Vicon Vantage Reference

Contents

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Advanced usage

Technical specifications

Regulatory and contact information

Index

| About this manual | Reference information | Advanced usage | Technical specifications | Regulatory information | Further resources |

About this manual

This manual provides reference, advanced usage, and technical specifications for the cameras, units, and supplies that make up a Vicon Vantage system.

It is intended for those who are using the Vicon Vantage 3D optical marker-based technology to track and analyze movement.

It is assumed that you have already read the **Vicon Vantage Quick Start Guide**, and have installed your Vicon Vantage system.

Note

Except where noted, references to **Vicon Lock+** and **Lock+** apply to all models of the Lock unit (both Vicon Lock and Vicon Lock+).

About Vicon Vantage documentation

The following documentation (online help and PDFs) is available for Vicon Vantage

Document	Description
Vicon Vantage Quick Start Guide	Provides basic system description and an overview of setting up your system.
	Supplied with your Vicon Vantage system as a printed booklet. Also available as a PDF from the **Downloads** page of the Vicon website.
Vicon Vantage Reference	(this document) Provides hardware data, and information on advanced usage, technical specs, and regulatory information.
	Supplied as a PDF, available from the **Downloads** page of the Vicon website.

Documents supplied in PDF format require Adobe Acrobat version 8.0 or later.

Be sure to check online for any updates to documents supplied with your product release.

Hardware reference

Find out more about the components of your Vicon Vantage system and how they fit together.

▌ Introducing Vicon Vantage systems

▌ Vicon Vantage cameras

▌ Vicon Lock+

▌ Vicon Vantage host PC

▌ Vicon Vantage system cables

▌ Vicon Vantage calibration device

▌ Vicon Vantage accessories

▌ Put together a simple Vicon Vantage system

Vicon Vantage Reference

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Introducing Vicon Vantage systems

A Vicon Vantage system is a suite of networked Vantage and/or Vicon Bonita Optical motion capture cameras, hardware devices (such as Bonita Video cameras, and Vicon Lock+ for synchronization of third-party devices), and software applications, which provide real-time and offline digital-optical motion capture data. The motion capture data can be applied to life sciences, animation, and engineering applications.

Vicon Vantage systems are flexible, expandable, and easy to integrate into your working environment. You can combine Vantage motion capture cameras with supported third-party devices (such as force plates, EMG, analog HD- and SD-compliant external video for genlocking and associated timecode sources) to create a system that meets your application requirements. This modular approach enables you to expand your Vicon Vantage system as needed.

Motion capture data from the Vicon Vantage cameras (V16, V8, and V5), Bonita Optical cameras, and the associated data from an optional Lock+ unit, connects through PoE+ switches to a Vantage host PC, which runs the required Vicon application software. Other third-party devices such as digital force plates, can connect directly to the host PC.

Vicon Vantage cameras can also be added to MX T-Series–Giganet systems with or without Lock+. However, note that if you are upgrading an existing MX T-Series–Giganet system that requires VESA Stereo genlocking, a Lock+ unit is required.

Important

A Vicon Vantage system runs on its own dedicated network, rather than being integrated into a general communications network.

The following topics list the major components of Vicon Vantage systems and describe example Vantage systems, showing how you can put together such systems, including Vicon Vantage cameras, networking PoE+ switches,

Vicon Vantage host PC, connecting cables, and application software, as well as supported external devices.

Note

Vantage cameras require PoE+ switches.
Vicon Lock+ and Vicon Bonita cameras require PoE+ or PoE switches.
Vicon Vantage host PC can use non-PoE, PoE, or PoE+ switches.

For more information, see:

▌ Overview of Vicon Vantage system components

▌ About the example Vicon Vantage systems

About this manual | Reference information | Advanced usage | Technical specifications | Regulatory information | Further resources

Introducing Vicon Vantage systems

Overview of Vicon Vantage system components

The major components of a Vicon Vantage motion capture system are:

▍ Vicon Vantage motion capture cameras

▍ Vicon Vantage networking PoE+ switches, which provide the power source and connectivity

▍ Vicon Vantage software to control the cameras, analyze and present the data

▍ Vicon Vantage host PC to run the software

A Vantage system also includes Vicon Vantage cables to connect the hardware devices, a Vantage calibration device (a Vicon Active Wand), and Vicon Vantage accessories.

You may also choose to include Bonita Video cameras; and, to support third-party devices such as force plates and accelerometers, a Vicon Lock+ (optional) for third-party devices. If your system requires multiple PoE+ switches (for example, if you need more than 12 Vicon Vantage cameras), it will also include a non-powered Gigabit switch.
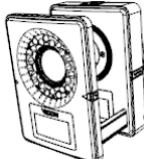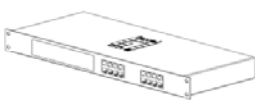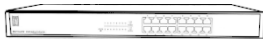
In each Vantage system, one Vicon Vantage master synchronization device provides synchronization to the rest of the system.

Note ──
Except where noted, references to Vicon Lock+ and Lock+ apply to all models of the Lock unit (at the time of publication, this includes Vicon Lock and Vicon Lock+).
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You can expand and upgrade your Vicon Vantage system as required. The Vantage system is compatible with T-Series cameras and their associated Giganets, so you can build on your existing investment.

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Introducing Vicon Vantage systems

The following table identifies commonly used components of Vicon Vantage systems.

Component	Description	Further information
	Vicon Vantage camera	Vicon Vantage motion capture cameras on page 14
	Vicon Bonita Optical camera	Vicon Vantage motion capture cameras on page 14 and the Vicon Bonita User Guide (PDF available from the Downloads page of the Vicon website).
	MX T-Series camera	The documentation supplied with your Vicon T-Series system.
	Vicon Bonita Video camera	PC Setup for Vicon Systems (PDFs available from the Downloads page of the Vicon website.) and Extend a Vicon Vantage system with more Vantage cameras, Vicon Lock+, and Bonita Video cameras on page 95.
	Vicon-supplied PoE+ switch (plugged into mains socket)	Vicon Vantage networking PoE+ switches on page 15. Note: Vantage cameras require PoE+ switches. Vicon Lock+ and Vicon Bonita cameras require PoE+ or PoE switches. Vicon Vantage host PC can use non-PoE, PoE, or PoE+ switches.
	Vicon-supplied non-powered Gigabit switch	Needed only if multiple PoE+ switches are used. See Extended Vicon Vantage system (add cameras and third-party devices) on page 21.

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Introducing Vicon Vantage systems

Component	Description	Further information
	Vicon Lock+ (plugged into PoE+)	Vicon Lock+ (optional) for third-party devices on page 17
	MX Giganet (plugged into mains socket)	Integrate MX T-Series components into a Vicon Vantage system on page 147
	Vicon Vantage host PC (with Vicon application software, Vicon Giganet Ethernet card and network Ethernet card)	Vicon Vantage host PC on page 16
	Vicon-supplied Cat 5e RJ-45 Ethernet cable.	Cables used to connect cameras to a PoE+ switch have a ferrite at the camera end. Cables used to connect a Lock+ to a PoE+ switch are shielded. Vicon Vantage system cables on page 16
	Lock+ to Giganet Link cable	Vicon Vantage system cables on page 16
	Lock+ to Lock+ Link cable	Vicon Vantage system cables on page 16
	Weidmüller connector cable for analog capture (force plates, etc)	Vicon Vantage system cables on page 16
	Vicon Vantage software download	Vicon Vantage software on page 16
	Vicon Vantage calibration device (Active Wand)	Vicon Vantage calibration device on page 17

Component	Description	Further information
	Vicon Vantage accessories motion capture accessories (such as markers) supplied by Vicon	Vicon Vantage accessories on page 17
Third-party devices (optional)	Third-party devices, such as accelerometers and force plates.	Vicon Lock+ (optional) for third-party devices on page 17

If your particular application requires a more complex configuration than is described in this book, contact Vicon Support (for information, see Contact Vicon on page 208).

Vicon Vantage motion capture cameras

Vicon offers a wide choice of motion capture cameras which feature multiple high-speed processors that perform real-time image processing.

You can include the following cameras in your Vicon Vantage system:

▌ Vantage V16, with a resolution of up to 16 megapixels (4096 x 4096) and capture speed of 120 fps

▌ Vantage V8, with a resolution of up to 8 megapixels (3328 x 2432) and capture speed of 260 fps

▌ Vantage V5, with a resolution of up to 5 megapixels (2432 x 2048) and capture speed of 420 fps

▌ All T-Series and Bonita cameras

For further details of Vantage cameras, see Vicon Vantage cameras on page 25 and Vicon Vantage camera technical specifications on page 161.

For details of T-Series cameras included in your Vicon Vantage system, see the Vicon T-Series documentation supplied with your cameras or download the required PDF from the Downloads page of the Vicon website.

Vicon Vantage networking PoE+ switches

Each Vicon Vantage camera, Bonita Optical camera, and the optional
Vicon Lock+ unit connect to one port of a PoE+ switch. Bonita Video cameras
can also be connected to a PoE+ switch, but occupy two ports. In addition:

▍ Each Vantage camera must connect to a port conforming to the IEEE
802.3at-2009 (25.5W PoE+) standard.

▍ Bonita cameras and Lock+ units can either connect to the same type of port
as the Vantage cameras or to a port of lesser standard conforming to IEEE
802.3 af (12.95W PoE). This connectivity through Vicon-supplied RJ-45
cables carries both Gigabit communications and power.

Note

In some legacy systems, Bonita cameras may be connected directly to a Giganet. For
information on connecting such a system, see Integrate MX T-Series components
into a Vicon Vantage system on page 147.

▍ The PoE+ switch also connects to the Vicon Vantage host PC running the
Vantage software that enables you to capture and analyze your data.

Note
No power is required on this particular port of the PoE+ switch.

The number of PoE+ switches required depends on the number of cameras to
be supported.

For examples of how to connect a PoE+ switch, see:

▍ Simple Vicon Vantage system (Vantage cameras only)

▍ Extended Vicon Vantage system (add cameras and third-party devices)

▍ Integrated Vicon Vantage system (with MX T-Series)

Vicon Vantage host PC

The Vicon Vantage host PC runs the Vicon motion capture software that analyzes and presents the data captured by the Vantage cameras.

This computer contains a dedicated Gigabit Ethernet port to enable the Vantage system to communicate with the installed Vicon application software. This port is in addition to any other network ports on the PC, for connecting it to the rest of your network.

Any Vicon motion capture and analysis software to be used with a Vicon Vantage system is installed on this Vicon Vantage host PC. For further details of this computer, see Vicon Vantage host PC on page 57.

Remote PCs may be used for other Vicon software or supported third-party applications.

Vicon Vantage software

Vicon Vantage supports the following versions of Vicon motion capture software for animation, life sciences, and engineering applications:

▍ Blade 3.2 and later

▍ Nexus 2.2 and later

▍ Tracker 3.1 and later

The motion capture software is installed on the Vicon Vantage host PC; for further details on the software, see Vicon software on Vicon Vantage host PC on page 62.

Vicon also provides a range of data visualization, analysis, and manipulation software (for details, see the **Software** link on the Vicon website).

Vicon Vantage cables

A combination of proprietary Vicon and commercially available cables is used to connect hardware devices in a Vicon Vantage system.

For further information, see Vicon Vantage system cables on page 63.

About this manual | Reference information | Advanced usage | Technical specifications | Regulatory information | Further resources

Introducing Vicon Vantage systems

Vicon Vantage calibration device

A Vicon proprietary calibration device is used to calibrate Vicon Vantage systems.

For further information, see Vicon Vantage calibration device on page 75.

Vicon Vantage accessories

Motion capture accessories such as Vicon retroreflective markers, marker-fixing tape, Micropore and Gaffer tape, and Velcro are available.

For further information, see Vicon Vantage accessories on page 83.

Vicon Lock+ (optional) for third-party devices

With the addition of a Vicon Lock+ unit to your Vicon Vantage system, you can directly include the following third-party devices:

▍ External analog peripheral devices, such as force plates, electromyography (EMG) equipment, and accelerometers

▍ External devices that require synchronization at a frequency that is related to the motion capture frame rate and/or a device that needs to know when a capture occurs

▍ External devices that need to start and stop the capture event, (Remote Start and Stop)

▍ External analog SD and HD broadcast composite video devices to which the Vicon Vantage system must synchronize

▍ External analog broadcast timecode devices for triggering capture and time-stamping captured data in accordance with LTC and VITC standards

▍ External VESA Stereo devices to which the Vicon Vantage system must synchronize

For more information on the role of Vicon Lock+ in a Vicon Vantage system, see Vicon Lock+ on page 49.

For more information on connecting third-party devices to a Vantage system, see Extend a Vicon Vantage system with analog capture devices on page 105.

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Introducing Vicon Vantage systems

For a list of currently tested and supported third-party devices, contact Vicon Support or your nearest agent or distributor (for details, see Contact Vicon on page 208).

Vicon Vantage master synchronization device

As shown in the following table, each Vantage system has one master device that provides synchronization to the rest of the system. The master is established automatically during system booting.

If the system includes	The master is
Vicon Lock+	Vicon Lock+
	Note that if Lock+ is added to a T-Series system, all Giganets become secondary units.
No Lock+	A camera (unless you have an integrated system that includes a Giganet, in which case the Giganet is the master)
Two Lock+ units	Lock+ with genlock source attached.
	If no genlock source is attached to either Lock+, one is automatically designated the master.

For more information on the role of a Vicon Lock in a Vantage system, see Vicon Lock+ in a Vicon Vantage system on page 50.

About the example Vicon Vantage systems

The following topics explain how to connect various example Vicon Vantage systems, from a basic system to a system where legacy components and Vantage components are combined:

▍ Simple Vicon Vantage system (Vantage cameras only)

▍ Extended Vicon Vantage system (add cameras and third-party devices) – includes Vicon Lock+ and Bonita Video cameras

▍ Integrated Vicon Vantage system (with MX T-Series)

Note

The above system configurations were current at the time of publication, but may now have been superseded. For up-to-date information, please visit the Vicon website, or contact Vicon Support.

In the diagrams in this manual, references to 'Optical data (Ethernet)' indicate the flow of positional data from Vicon cameras, as opposed to 'Video data (Ethernet)', which is used to indicate data from video cameras within a Vicon system. At no point are fiber optics referenced.

| About this manual | Reference information | Advanced usage | Technical specifications | Regulatory information | Further resources |

Introducing Vicon Vantage systems

Simple Vicon Vantage system (Vantage cameras only)

The simplest Vicon Vantage system consists of between 1–12 Vantage cameras, a PoE+ switch, and the Vicon Vantage host PC (for descriptions of these components, see Overview of Vicon Vantage system components on page 11).

The PoE+ switch provides power and data communication for the Vantage cameras. It also routes the Vicon sync (Ethernet sync and time stamp) from the master camera (selectable in your Vicon application software) to all attached secondary cameras. In addition, the PoE+ switch manages the data flow to the Vicon Vantage host PC. This PC runs the Vantage software that you use to process, visualize, and analyze your data.

The following diagram shows an example of a simple system.

Important

The ports on a PoE+ switch are divided into four sets, numbered 1–4, 5–8, 9–12 and 13–16. Each set of four ports can support up to three Vantage cameras (indicated by green check marks in the following illustration). The PC can connect to any of the remaining ports.
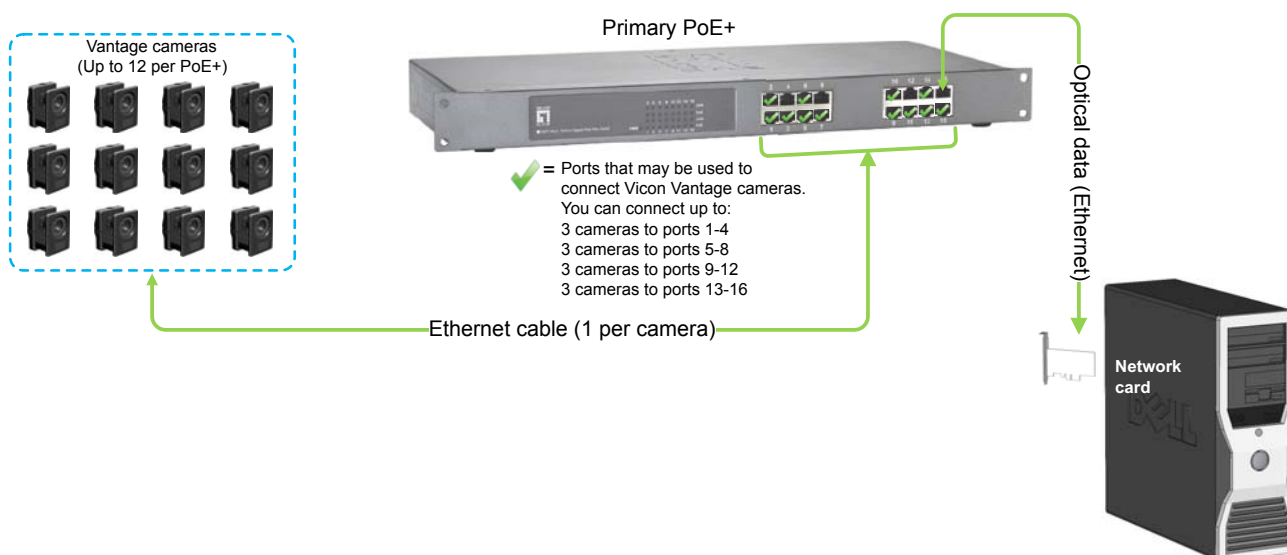
For further details on setting up a basic Vicon Vantage system, see Put together a simple Vicon Vantage system on page 85.

Extended Vicon Vantage system (add cameras and third-party devices)

An extended Vicon Vantage system consists of the basic system plus additional hardware, such as additional Vantage cameras, an additional PoE+ switch, a Vicon Lock+, and Bonita Video cameras.

Note

When a Vicon Lock+ is added to the system, it enables analog capture, synchronization of output devices, interfacing with remote triggering devices, and synchronization to genlock/timecode video sources, as well as VESA stereo video sources (for descriptions of these devices, see Overview of Vicon Vantage system components on page 11).

When extending your system, bear in mind the following points:

- You need one 16-port PoE+ switch for up to 12 Vicon Vantage cameras in your system.

- One port is used to connect to the Vicon Vantage host PC. The PoE+ switch that connects to the host PC is known as the primary PoE+ switch.

- The remaining three ports can be used to connect a Vicon Lock, one Bonita Video camera, and/or one or more Bonita Optical cameras, Note that:

  - A Lock+ or a Bonita Optical camera takes up one port of a PoE+ switch.

  - Each Bonita Video camera takes up two ports of a PoE+ switch.

- If you want to use more than 12 Vicon Vantage cameras, and/or the number of additional devices (such as Bonita cameras, Lock+, etc) require more than the three remaining available ports on the primary PoE+ switch, you must add a second PoE+ switch to your system.

- When you add a second PoE+ switch, one port is taken on each switch in connecting the two together. To eliminate the unwanted negotiation delay that is generated when two PoE+ switches are directly connected, you must add a non-powered Gigabit switch between the two PoE+ switches, as shown in the following diagram.

- In a system that contains multiple PoE+ switches, the sync master must be a camera or a Lock+ that is connected to the primary PoE+ switch.

The following diagram shows an example of an extended system.

Important

The ports on a PoE+ switch are divided into four sets, numbered 1–4, 5–8, 9–12 and 13–16. Each set of four ports can support up to three Vantage cameras (indicated by green check marks in the following illustration). The PC, Vicon Lock+, non-powered Gigabit switch and Bonita Video cameras can connect to any of the remaining ports.

Vantage cameras
(Up to 12 on primary PoE+)

Primary PoE+

Optical data (Ethernet)

= Ports that may be used to connect Vicon Vantage cameras.

Ethernet cable (1 per camera)

Vicon Lock+

Non-powered Gigabit switch

Third-party devices
(up to 64 channels)

Secondary PoE+

Host PC video

Host PC video

Vantage cameras
(Up to 11 on secondary PoE+)

2 Bonita Video cameras

Video data (Ethernet)
Video data (Ethernet)

Network card

Ethernet cable (1 per camera)

Integrated Vicon Vantage system (with MX T-Series)

An integrated Vicon Vantage system contains components from MX T-Series systems. You leave the old system as it was and connect the new Vantage system into one of the Gigabit Ethernet ports of the MX Giganet. The primary MX Giganet provides all data communications with any secondary MX Giganets and the new Vantage system. An example integrated Vantage system, with an MX Giganet and T-series cameras, is shown in the following diagram.

Important

The ports on a PoE+ switch divide into four sets, 1–4, 5–8, 9–12 and 13–16. Each set supports up to three Vantage cameras (indicated by green check marks in the following illustration). The PC, Giganet, and Vicon Lock+ connect to any of the remaining ports.
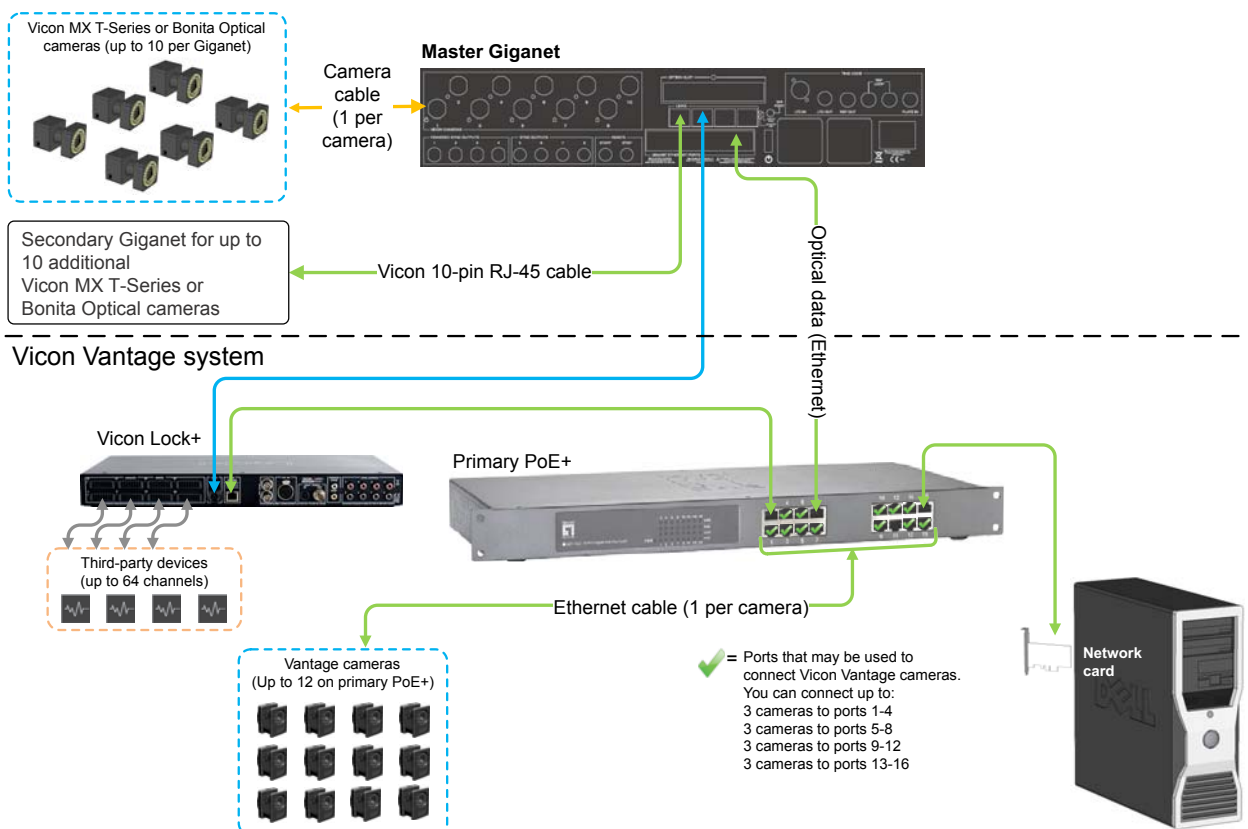
For details on setting up a Vicon Vantage system that is integrated with a MX T-Series system, see Integrate MX T-Series components into a Vicon Vantage system on page 147.

For further help with connecting large numbers of Vantage cameras into an MX T-Series/Giganet system, contact Vicon Support (see Contact Vicon on page 208).

Vicon Vantage cameras

The following topics describe the role of Vicon Vantage cameras in a Vantage system, list the available types of cameras, describe their physical structure (including lenses, controls and connectors, and associated strobe units) and explain their functional characteristics.

For more information, see:

▮ Vicon Vantage cameras in a Vantage system

▮ Vicon Vantage camera range

▮ Vicon Vantage camera controls and connectors

▮ Vicon Vantage camera strobe units

▮ Vicon Vantage camera lenses

For technical details of Vicon Vantage cameras, see Vicon Vantage camera technical specifications on page 161.

Caution

Vicon Vantage cameras contain no user-serviceable components. For all servicing, and any alterations, including lens or strobe change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

Vicon Vantage cameras in a Vantage system

Vicon Vantage cameras are purpose-designed motion capture cameras that use multiple high-speed processors to perform real-time proprietary image-processing. When Vicon cameras are set to their normal motion capture mode, they output the movement of Vicon markers, rather than the body to which the markers are attached. This is achieved with the combination of high-powered, narrow-band strobed illumination, retroreflective markers, and a corresponding filter that is tuned to the same wavelength as the strobe. However, to aid setup, Vicon cameras can also be set, one at any one time, to video preview mode. Video preview mode outputs a lower resolution image of the whole scene at approximately 30 fps (the exact rate is the closest multiple of the system frame period). When there is high ambient light, this can aid optimum setup.

Vicon markers are retroreflective spheres that reflect light from the camera strobe units back into the Vicon motion capture cameras. Vicon markers come in a range of sizes that are appropriate for different types of motion capture volumes. The markers are attached to a subject whose motion is to be captured. To obtain accurate results, you must position the markers on the subject at specific anatomical locations. These locations are defined in a Vicon Labeling Skeleton Template (VST) file for a generic type of capture subject or in a calibrated Vicon Labeling Skeleton (VSK) file for a specific capture subject. Your Vicon software documentation describes these files and how you attach markers to your subjects for motion capture in accordance with these files.

You position the cameras around the capture volume to ensure full coverage of the subjects whose motion you will be capturing. Data from at least two cameras is required to produce 3D reconstructions of the Vicon markers, so ensure that the placement and orientation of all cameras results in multiple

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage cameras

cameras aimed at the same region of the capture volume, as shown in the following diagram.
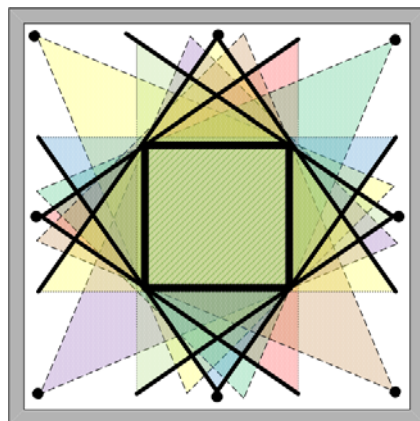
Camera positions will depend on your volume size, camera type, and camera lens. Remember to include height as well as width and depth in your volume calculations.

Depending on your capture requirements, you may choose to mount the cameras on tripods for floor-based cameras or on a clamp and truss on speed rails for raised cameras.

For more information, see also:

▍ Vicon Vantage accelerometer

▍ Vicon Vantage temperature sensors

▍ Vicon Vantage camera performance

Vicon Vantage accelerometer

Each camera is fitted with an accelerometer which has several purposes:

▌ Before the system is calibrated, you can tap the camera to alert the Vicon application software that you are setting up that particular camera. The software then responds accordingly.

▌ After the system has been calibrated, if the camera is accidentally knocked or bumped, an alert is sent to the Vicon application software so that you can take the appropriate action. You can change how hard the camera has to be knocked to cause it to report a bump by altering the Bump Detection Sensitivity control in the Vicon application software.

▌ The accelerometer also determines the orientation of the images in the OLED display.

Note the following limitations of bump detection:

▌ Bump detection is active only on calibrated cameras.

▌ Bump detection cannot detect movement that does not change the gravity vector, for example. slow translation with no rotation.

▌ Bump detection cannot detect movements that occur when the camera is not connected to a live system.

▌ The camera is detected as bumped when the reading from the accelerometer is sufficiently different from the last reading. Gradual changes (for example, a slipping camera mount) may not be detected until there is enough of a change to trigger a new notification.

Vicon Vantage temperature sensors

Electronic temperature sensors in the camera body and strobe relay information back to the Vicon application software. This lets the user of the software know when the system has stabilized and that the system is ready for calibrating. If a problem occurs due to overheating, which is caused by too high an ambient temperature, the Vicon application software can inform the user of a potential problem.

You can change the required temperature range in the Vicon application software.

Caution

To avoid overheating, ensure that the environment in which the cameras are used is well-ventilated.

Vicon Vantage camera performance

Vicon Vantage cameras evaluate an entire image in grayscale, rather than applying a black and white threshold. This provides more information and increases motion measurement accuracy over an equivalent resolution black and white camera. The Vicon Vantage cameras perform the majority of data processing. They generate grayscale blobs from the retro-reflective markers in the capture volume and then use centroid-fitting algorithms to determine their accurate centers, or collate the whole grayscale data if the markers are deemed to be merged. This camera data is sent to the Vicon application software for further processing and viewing. For details, see your Vicon software documentation.

A number of factors affect the overall performance of your Vantage system. These include camera resolution, number of cameras, capture rate, and number of markers/subjects captured. All of these factors impact the overall data rate of your system and may affect the specification required for your Vicon Vantage host PC. Understanding the expected data rate can also help to inform you whether a standard single Gigabit Ethernet connection is sufficient or whether a configuration that involves link aggregation may be preferable.

You can specify the required frame rate in your Vicon application software on the Vicon Vantage host PC. Your Vicon application software remembers this setting and re-applies it on power up or from reset. You can also configure the buffering of camera data at the time of capture. For details, see your Vicon software documentation.

For a comparison of the performance of the models in the Vicon Vantage range of cameras, see

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage cameras

Vicon Vantage camera range

Vicon Vantage systems can include any of the Vantage range of proprietary Vicon motion capture cameras: V16, V8, and V5, as well as Vicon Bonita Optical and/or Bonita Video cameras. Vantage cameras will also work with Vicon MX T-Series cameras.

The camera hardware design consists of a camera body, a strobe head unit, a lens, optical filter, and cable, as shown in the following image.
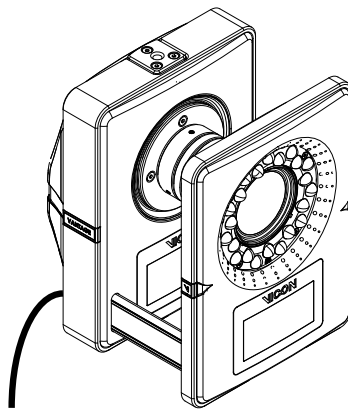
For more information, see:

▌ Vicon Vantage camera resolutions

▌ Vicon Vantage camera performance comparison

Vicon Vantage camera resolutions

A single hardware design is built with different types of sensors and lenses to create a range of cameras with different resolutions, as shown in the following table.

Camera	Lens	Resolution
V16	Vicon 18mm / 12.5mm	16 Megapixels
V8	1" C-Mount 12.5mm	8 Megapixels
V5	1" C-Mount 12.5mm / 2/3" C-Mount 8.5mm	5 Megapixels

All Vantage cameras are fitted with sensitive solid-state sensors and are purpose-built to provide high-speed, low-latency motion capture. Vicon applies stringent checks to its cameras for linearity, sensitivity, and absence of jitter.

Different types of strobe units can be attached to cameras to suit specific studio, laboratory, or research unit capture volumes. For further details, see Vicon Vantage camera strobe units on page 35.

Caution

The strobe unit is not user-serviceable. For all servicing, and any alterations, including lens or strobe change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

You can combine the various models of Vicon Vantage cameras within a single Vantage system to meet your application requirements for resolution and/or coverage. The V16 camera offers the highest resolution of the Vicon Vantage cameras. The V8 and V5 cameras can provide higher camera counts within a fixed budget, giving increased coverage.

Vicon Vantage camera performance comparison

Each Vicon Vantage camera is programmed with firmware to control its operation and to enable it to perform its own onboard grayscale processing. As all Vantage cameras use the same firmware, a mixture of Vantage cameras with different image sensors can be connected to and run on the same Vantage system. The Vantage system automatically recognizes cameras and their relevant characteristics when they are plugged in. A Vicon Vantage distributed architecture enables the camera software to be updated across the system network.

The following table illustrates the performance of each Vantage camera type. For full details, see Vicon Vantage camera technical specifications on page 161.

Model	V16	V8	V5
Sensor resolution H x V (pixels)	4096 x 4096	3328 x 2432	2432 x 2048
Sensor size H x V (mm)	18.43 H x 18.43 V 26.06 (diagonal)	14.8 H x 10.9 V 18.38 (diagonal)	10.94 H x 9.22 V 14.31 (diagonal)
Maximum frame rate (fps) at full resolution	120	260	420

Note

If you select a frame rate that is higher than the maximum listed in the table above, Vicon Vantage cameras can use windowing to provide the higher frame rate.

Vicon Vantage camera controls and connectors

This section describes the physical structure of Vicon Vantage cameras and their connection to a Vicon-supplied PoE+ switch.

For more information, see:

▍ Camera rear panel

▍ Camera lens mount

▍ Tripod mount

Camera rear panel

The following image shows the camera connection beneath the rear panel of a Vicon Vantage camera for connecting to a PoE+ switch.

Gigabit Ethernet port
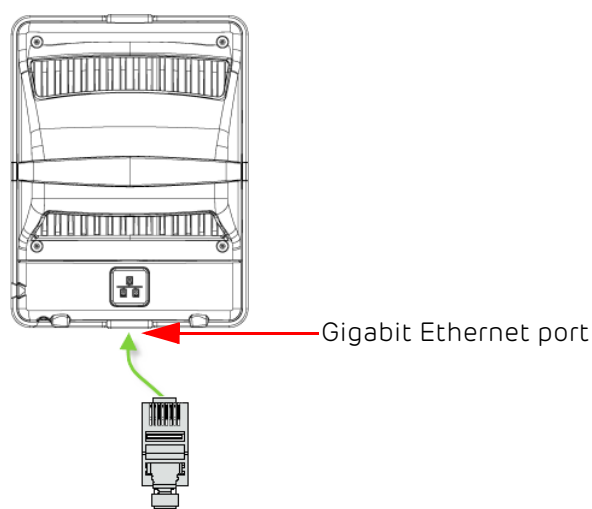
The following single connection point is beneath the rear panel:

▍ Gigabit Ethernet port

RJ-45 socket. Held in the housing mechanism, a Vicon-supplied Cat 5e RJ-45 Ethernet cable connects the Vicon Vantage camera to a PoE+ switch. The cable carries power, all data communications and sync.

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage cameras

Camera lens mount

Vicon Vantage cameras support two types of lens mount. One is the proprietary mount for the Vicon 18mm lens and the other is for the industry-standard C-mount lens.

Caution

Vicon Vantage camera lenses are not user-serviceable. For all servicing, and any alterations, including lens or strobe change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

Tripod mount

Both the underside and the top of the camera body contain mounting points, which have ¼"-20 UNC threaded holes. These are designed to match the common thread found on most tripod and wall mount fixing screws.

An optional mounting bracket that fits between the two mounting points is also available. This enables the camera to be mounted in various ways, for optimum positioning. It also provides a convenient way of handling the camera, avoiding touching the heat sinks, which may become warm during camera operation.

Mounting point

Mounting point
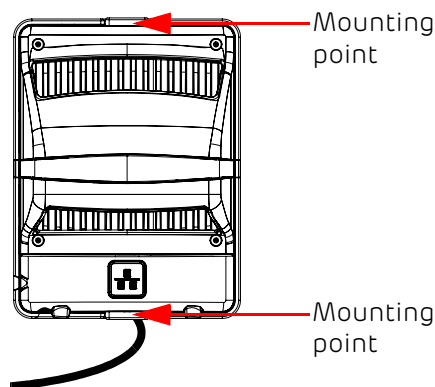
Caution

For safety and optimum performance, Vicon recommends that you use only stable tripods and wall mounts. For recommendations, contact your local Vicon office.

Vicon Vantage camera strobe units

The strobe unit on the front of a Vicon Vantage camera uses very powerful surface-mounted light-emitting diodes (LEDs) to illuminate the capture volume. The standard LEDs fitted to Vicon Vantage camera strobe units emit infrared (IR) light at 850nm. This is only slightly visible to the naked eye in very dark surroundings. For information about other LED wavelengths, please contact Vicon Sales or your nearest agent or distributor.

In your Vicon application software on the Vicon Vantage host PC, you can set each camera's strobe duration individually or set all the camera strobes together. From then on, your Vicon application software remembers these settings and re-applies them on power up or from reset.

Warning
Do not look directly at the source when an Infrared (IR) strobe unit is in operation.
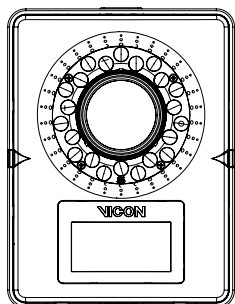
The strobe unit emits a powerful flash of light once per video frame at precisely the same time as the image sensor's global electronic shutter opens. This flash illuminates the retroreflective markers attached to the motion capture subject. The reflected light passes back through the lens and optical filter. The spectral characteristics of the filter ensure that only light with the same wavelength as the LEDs passes back into the camera.

In the camera, the lens collects the light and forms a focused image of the markers on the camera's image sensor plane. The camera electronically converts the pattern of light into data that ultimately represents the position

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

and radius of each marker in the image. For more information on the filters and lenses supplied, see Vicon Vantage camera lenses on page 42.

Tip

When the cameras are used outdoors, try to position the cameras to minimize the ambient light as the filter cannot distinguish ambient light of the same wavelength as that of the strobe.

To match and therefore optimize the field of view of the light from the LEDs to that of the lens and therefore the capture volume, secondary optics fit over the LEDs. Each LED effectively sits inside its own secondary lens. This converts the natural wider field of illumination of the LED to that of the fitted lens. In this way the same strobe can be optimized to different lenses through different secondary optics. For more information, see Field of View on page 43.

Caution

Neither secondary optics, the strobe unit mount, nor the strobe itself are user-serviceable. For all servicing, and any alterations, including lens or strobe change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

For more information, see:

▍ Strobe unit and camera status LEDs

▍ OLED display

Strobe unit and camera status LEDs

Two pairs of tri-color LEDS provide feedback on camera operation. One pair is situated on either side of the camera, and the second pair is situated on either side of the strobe. All four LEDs operate simultaneously, and display the same color at the same time. These status LEDs can be disabled through the Vicon application software.

Note

In certain camera modes and in certain system configurations, the status LEDs on the camera are automatically turned off to ensure maximum power is available to the strobe.

Status LED   Status LED
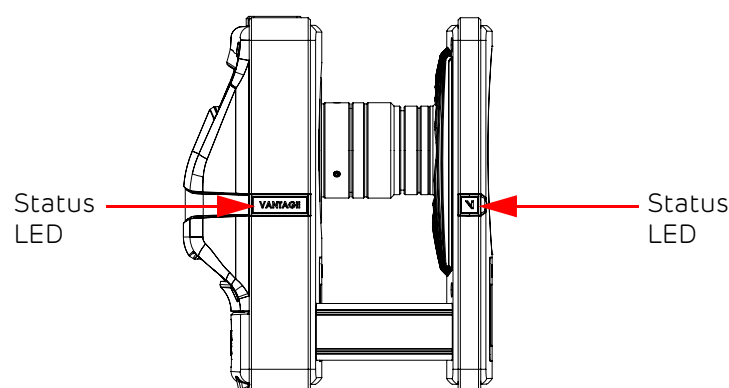
While the camera is booting, the OLED display shows the Vicon logo (unless a connected application causes it to display something else) and the status LED color changes from yellow during booting, to red when booting is complete.

Status LEDs

OLED display

When the cameras are communicating with Vicon application software, the status LEDs turn blue.
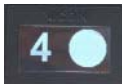
After the camera has booted, you can view the cameras' status by observing the status LEDs and the OLED display on each camera), and also by monitoring the cameras in the Vicon application software. For information on the significance of the status LEDs' colors in combination with the symbols on the OLED display, see OLED display on page 38.

OLED display

The OLED display comprises 128 x 64 alphanumeric characters, which, combined with the LED color, give information about the current camera status.

As shown in the following table, when the camera has booted, and unless the display has been disabled in the Vicon application software, the display shows the camera number. Other common display states are also shown.

Display	Description	Camera status
	Vicon logo	Booting
	Camera number	Booted
	Camera number and bumped icon	Bumped
	Camera number and disabled icon	Disabled
	Camera number and start calibration icon	Calibration started

Display	Description	Camera status
	Camera number and pie chart	Calibration in progress
	Camera number and complete pie chart	Calibration complete
	Display turned off in Vicon application software	NA

Additional information is available when you view the OLED display in combination with the color of the status LEDs. (Note that the status LED colors listed below are subject to change.)

Display	Status LED color	Status
	Blue	Enabled (default)
	Red	Not contributing
	Red (flashing)	Bumped

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage cameras

Display	Status LED color	Status
	Yellow	Disabled
	Magenta	Selected
	Off	Calibration (Wand count == 0) (The start calibration icon indicates that calibration has started.)
	Magenta (flashing, period decreases with wand count)	Calibration (0 < Wand count < Required wands) The pie chart indicates the fraction of the required wands that have been received from this camera.
	Green	Calibration (Wand count >= Required wands)

Display	Status LED color	Status
	Cyan	Automasking
	Off	Status LEDs disabled

The order of priority is from top of the above table (lowest) to bottom (highest), so that the LEDs for a camera that is both bumped and selected are magenta.

Unless accelerometry is switched off in the Vicon application software, the image on the display rotates based on the orientation of the camera.

Vicon Vantage camera lenses

The function of the camera lens is to collect reflected light from a scene and to form a focused image on the camera's sensor plane. The type of lens that will provide optimum performance for a particular application depends on factors such as the field of view (FOV), image circle, aperture and depth of field, and any lens filter fitted. For descriptions of these, see Camera lens characteristics below.

The proprietary Vicon lenses designed for Vicon Vantage cameras have been custom-built for motion capture. They have a large image circle to ensure that the entire image—not just the center—is evenly illuminated. Other C-Mount lenses recommended for Vantage cameras have been selected based on this criteria for image format size suitable for high-resolution sensors.

Other commercially available lenses are not necessarily designed to work with high resolution cameras; they tend to have a limited resolving power, and are more suitable for sensors with a resolution of less than two megapixels. As a result, when capturing with markers close together, the lens can have difficulty resolving the gap between the markers, causing merging even when the focus is optimal. For further details of Vantage camera lens specifications, see Vicon Vantage camera technical specifications on page 161.

Caution
The lens is not user-serviceable. For all servicing, and any alterations, including lens change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

Camera lens characteristics

The following topics describe the factors to consider in choosing a lens type:

- Field of View
- Image circle
- Aperture and depth of field
- Camera lens filters

Field of View

The most important factor in determining the lens to use with a Vicon Vantage camera is the total area that the camera can see, using a given lens. This is called the Field of View (FOV).

The scene that comprises the FOV has horizontal width (H) and vertical height (V). Knowing the distance (L) between the camera and a plane that defines the total FOV helps to select the type of lens to meet a particular application.

Lenses are described in terms of their focal length (f), defined as the distance in millimeters that the center of the lens must be from the sensor plane surface to project a sharp image on the sensor. The focal length of a lens is often given on the body of the lens or around the surround of the glass element at the front of the lens as well as in the lens documentation and packaging.

The focal length determines the angle of view (AOV) through the lens, as shown in the following diagram:
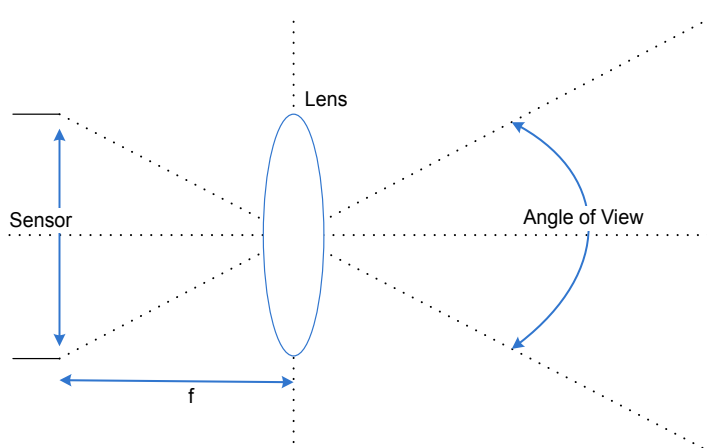
Normally, the AOV is calculated based on the known focal length and sensor size. This in turn determines the FOV, based on the distance (L) to the object being captured, as shown in the following diagram.
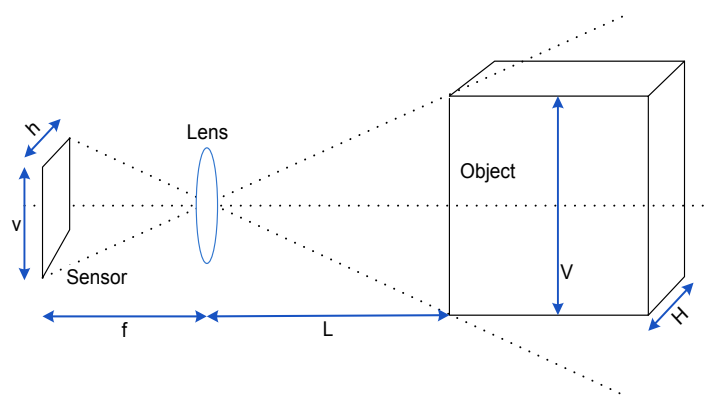
The sensor area used for capturing data through each Vicon Vantage camera determines the maximum FOV available for a particular combination of camera and lens. The area of the sensor is determined by its horizontal width (h) and vertical height (v).

The capture frame rate for each Vicon Vantage camera can be configured in the Vicon application software. The configured frame rate will also affect the field of view. Higher camera frame rates may make windowing of the sensor necessary, such that the sensor area used for capture is reduced in comparison to lower camera frame rates. For full details, see Vicon Vantage camera technical specifications on page 161.

Image circle

Another characteristic of the camera sensor is the image circle. This is the sharp circular image that the camera lens casts onto the sensor, as shown in the following image.
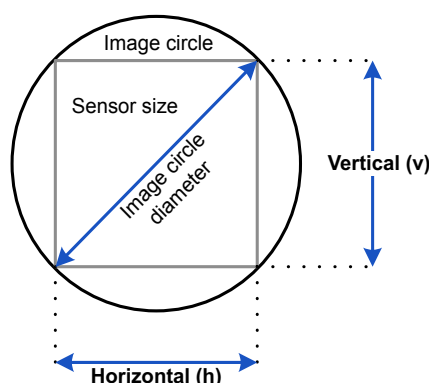
The diameter of this image circle is the maximum area of usable quality image that the lens can produce. Most lenses produce their best image at the center of the lens, dropping off in performance towards the outer extremes of the lens. This results in a gradual darkening towards the edges of the image, known as vignetting. Vignetting gets worse for wider angle lenses and for wider open apertures, but the area at which vignetting starts to occur depends on the lens.

Thus, for optimum performance, the image circle projected should be larger than the sensor area used by the camera. This ensures that the entire sensor is utilized and eliminates the fall-off of light that occurs towards the edge of the image circle. If the image circle of a lens is too small for the sensor size, then the camera image around the edges and corners is lost. Vicon Vantage cameras are fitted with lenses that have an appropriately sized image circle for the sensor.

Caution

Vicon Vantage camera lenses are not user-serviceable. For all servicing, and any alterations, including lens or strobe change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

The relationship between image circle (sensor size) and lens defines two of the most important optical properties: Field of View and Angle of View.

The following table gives the formulae used to calculate the angle of view (AOV) and field of view (FOV) for camera and lens combinations. These formulae require the dimensions of the sensor area used for each of the Vantage cameras at different frequencies.

Horizontal AOV (°)	Vertical AOV (°)	Horizontal FOV Width H (m)	Vertical FOV Height V (m)
$2 \times \tan^{-1}(h/2f)$	$2 \times \tan^{-1}(v/2f)$	$h \times L/f$	$v \times L/f$

where:

f = focal length of the lens (mm)

h = horizontal width of sensor (mm)

v = vertical height of sensor (mm)

L = distance from the lens to the object (m)

For sensor size details, see Vicon Vantage camera range on page 30.

As an example, consider a Vantage V16 camera with an 18mm lens operating at 120fps at a distance of 9m from the target markers. Given the V16 sensor size (18.43mm (H), 18.43mm (V)), you would calculate:

Horizontal AOV:	$2 \times \tan^{-1}(18.43/(2 * 18)) = 54.22°$
Vertical AOV:	$2 \times \tan^{-1}(18.43/(2 * 18)) = 54.22°$
Horizontal FOV at 9m:	$0.0183 \times (9/0.018) = 9.15$ m
Vertical FOV at 9m:	$0.0183 \times (9/0.018) = 9.15$ m

Important

These formulae take into account only the optical components of the camera and lens, thus they calculate the maximum possible theoretical Field of View from this combination. Poor illumination of the volume by camera strobes, less than optimal aperture or gain settings, or poor marker surface quality might all reduce the FOV in which a camera can recognize a marker below this maximum theoretical level.

When using these formulae, note that for frame rates above the full-resolution rates given for Vantage cameras in Vicon Vantage camera performance comparison on page 32, the sensor area is reduced due to windowing, as described in Field of View on page 43.

Aperture and depth of field

Another significant factor in choosing a lens type is the aperture (also known as the f-stop value, f-number, and F#).

The aperture is the ratio of the focal length of the lens to the diameter of the lens opening, which determines the amount of light that can pass through the lens. Smaller f-stop values (e.g. f2, f2.8) represent wider apertures that allow more light to pass through, while larger f-stop values (e.g. f11, f16, f22) represent narrower apertures that allow less light to pass through. Typically, faster lenses have larger diameter optics that can pass more light.

Each f-stop value changes the lens opening from the next f-stop by a factor of 2. For example, decreasing the aperture from f11 to f8 allows twice as much light to pass through. Increasing the aperture from f11 to f16 allows half as much light to pass through.

The aperture and magnification affect the depth of field, that is, the portion of the image that has sharp focus. Immediately surrounding this area, there is a region in which the image remains in focus. Outside of this area, moving towards or away from the lens, the focus becomes progressively less sharp and the image appears out of focus. Thus, as the aperture and focal length decrease, the depth of field increases. Conversely, as the aperture and focal length increase, the depth of field decreases.

Camera lens filters

To optimize the performance of the Vantage cameras, each lens is fitted with an optical filter that attenuates wavelengths of light other than the narrow passband required to pass the light emitted by the light-emitting diodes (LEDs) from the Vantage strobe unit and reflected back from the markers to the camera.

Tip
When the cameras are used outdoors, try to position the cameras to minimize the ambient light as the filter cannot distinguish ambient light of the same wavelength as that of the strobe.

Vicon Lock+

The following topics describe the role of the Vicon Lock+ in a Vicon Vantage system and its physical structure (including controls and connectors), and explain its functional characteristics.

The following topics are covered:

▌ Vicon Lock+ in a Vicon Vantage system

▌ Vicon Lock+ front panel

▌ Vicon Lock+ rear panel

For a brief introduction to Vicon Lock+ and instructions on setting up a Lock+ for the first time, see the PDF **Vicon Lock+ Quick Start Guide**, which is supplied with Vicon Lock+ and available from the **Downloads** page of the Vicon website.

Vicon Lock+ in a Vicon Vantage system

Both Vicon Vantage and Bonita cameras can synchronize themselves over their Ethernet network. Vicon Lock+ provides additional synchronization in systems that use Vicon Vantage and Vicon Bonita capture cameras. The Lock+ unit can synchronize all Vicon cameras as well as being able to synchronize to external sources itself, and also to provide synchronization to other third-party devices.

A Lock+ provides the following functionality in a Vicon Vantage system:

▐ Supplies synchronization to connected Vicon Vantage and Bonita cameras.

▐ Provides the interface between the Vicon system and third-party analog sources for capture, such as force plates, electromyography (EMG) equipment, and other analog devices.

▐ Provides synchronization/trigger out functionality for up to eight third-party peripheral devices.

▐ Provides the interface to external hardware to allow remote data capture by the Vicon system.

▐ Synchronizes to external industry-standard video sources as used by the broadcast industry.

▐ Triggers capture and timestamps captured data in accordance with the input timecode, LTC and VITC.

▐ Synchronizes to VESA Stereo source signals used in stereoscopic vision systems.

▐ Provides synchronization to Vicon MX T-Series–Giganet systems.

▐ Synchronizes or locks to another Lock+.

Important

Synchronization and remote triggering functionality are application-dependent. For details of supported functionality, see your Vicon application software documentation.

Systems that require Lock+ functionality generally only require one Lock+ unit. However, if additional functionality is required, you can add a further unit.

When connecting a second Lock+:

▮ If possible, connect both devices to the primary PoE+ switch.

▮ If one Lock+ connects to a broadcast genlock or VESA genlock device, this is the primary Lock+ and must connect to the primary PoE+ switch.

▮ If neither one of the Lock+ units is connected to a genlock source, both must connect to the primary PoE+ switch.

The Lock+ unit connects to the Vicon system in the same way as a Vicon camera, via PoE to the PoE+ switch. All data, power, and camera synchronization are carried over this Gigabit Ethernet interface. The unit does not function over 100 baseT PoE. For more information, see Extended Vicon Vantage system (add cameras and third-party devices) on page 21.

Important

Use only Vicon-supplied, shielded Cat 5e RJ-45 Ethernet cable to connect the Lock+ to a PoE+ switch.

In any system that contains a Lock+, the Lock+ is automatically made the sync master by the system application software. This is also the case when connecting to an MX T-Series–Giganet system. Lock+ can also synchronize with other video systems.

The Lock+ unit is 1U high and can be rack-, wall-, or floor-mounted and stacked either horizontally or vertically. The unit contains no convection fans, but it should still be sited so that it is not overheated by other external equipment.

Vicon Lock+ front panel

The following illustration shows the front panel of a Lock+ unit:

The Vicon logo illuminates to indicate that it is receiving power via PoE. When the unit is switched on, the color changes to reflect the state of the boot cycle:

Color	Status
Red	Booting
Green	Booted but not connected
Blue	Communicating with software
Cyan	Lock+ selected in software

The unit contains no switch, so to turn off the power, either disconnect the RJ-45 Ethernet cable or switch off the connected PoE+ switch.

Vicon Lock+ rear panel

The rear panel of the Vicon Lock+ contains all the connectivity to third-party peripherals, PoE, and for synchronizing to other Lock+ and MX Giganet units. The following illustration shows the Lock+ rear panel connectors.
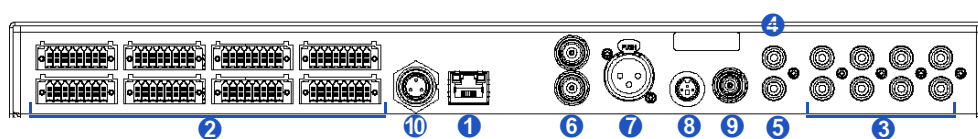
Note

In Vicon Vantage documentation, the terms socket and plug are used for female and male connectors respectively.

Lock+ rear panel connectors

For information on all interfacing cables, see Vicon Vantage system cables on page 63.

PoE Gigabit connector

The Gigabit Ethernet Port 8-pin RJ-45 socket ❶ connects to an appropriate Vicon-supplied PoE (Power over Ethernet) or PoE+ switch that is also connected to Vicon Vantage/Bonita cameras and the Vicon Host PC directly, or through further switches. For more information, see About the example Vicon Vantage systems on page 19.

Important

Use only Vicon-supplied, shielded Cat 5e RJ-45 Ethernet cable to connect the Lock+ to a PoE+ switch.

As well as carrying all the communications to the appropriate Vicon software, the Lock+ unit also receives its power over the same connections. Additionally, this port also transmits synchronization and time-stamping through special Ethernet packets to all other connected Vicon peripherals.

Analog input connectors

Vicon Lock+ provides 64 channels of analog signal capture ❷ , made up from eight separate connectors, each carrying eight signals. (The older model, Vicon Lock, provides 32 channels, made up from four connectors.) Each connector can be portioned to connect to individual force plates. Each connector contains 16 individual connections, eight signal and their eight respective grounds.

Data from third-party devices such as force plates, electromyography (EMG) equipment, potentiometers, and accelerometers can be captured and synchronized to the video capture data. The connectors supplied are used to interface to these third-party devices. Pre-configured cables can also be supplied separately for the more common force plate interfaces (for more information on suitable cables, see Vicon Vantage system cables on page 63).

For more information on including analog capture devices in your Vicon Vantage system, see Extend a Vicon Vantage system with analog capture devices on page 105. For information on configuring your system for analog data capture, see the documentation for your Vicon software.

Sync output connectors

Eight RCA sockets ❸ provide sync outputs to external third-party devices for synchronizing to the Vicon Vantage system.

Each sync output consists of a configurable TTL-type drive signal which is set up through the appropriate Vicon application software. Each output can be configured individually.

There are two signal types, one for repetitive signals and one for the duration of capture. A typical signal configuration for a repetitive signal allows for a signal at frame rate or multiples and sub-multiples of the Vantage system capture frame rate to be set up. A duration event allows the signal to be active during the capture period. Both signal type setups allow for a delay of up to one frame to be programmed and the setting of the polarity of the signal. The mark space ratio can be set with the former type. For more information, see Extend a Vicon Vantage system with synchronized output devices on page 111.

Remote start/stop connectors

To trigger capture by the Vicon Vantage system from a remote control device, you must configure your Vicon Vantage software to use the device connected to the Remote Start and Stop sockets; for details on doing this, see the documentation for your Vicon software. For details on enabling third-party

remote devices to trigger your Vicon system, see Extend a Vicon Vantage system with remote triggering devices on page 131.

▌ Remote start This RCA socket ❹ provides the external input for the start of capture, which can be activated by momentarily connecting this input to ground through either a mechanical or electronic switch. Capture is started on the first frame boundary after this event is detected.

▌ Remote stop This RCA socket ❺ provides the external input for stopping capture, which can be activated by momentarily connecting this input to ground through either a mechanical or electronic switch. Capture is stopped on the first frame boundary after this event is detected.

Genlock and timecode connectors

For details on using external Genlock and Timecode devices to synchronize your Vicon Vantage system to an external video system, see Extend a Vicon Vantage system with genlock/timecode devices on page 135.

▌ Ref Loop (Composite Video) Two BNC sockets ❻ provide loop-through connection to an external composite video signal, which may carry VITC (Vertical Interval Timecode) thus allowing genlocking. This video source is usually referred to as the house reference or the master video source. This connection allows Lock+ to synchronize to analog SD (standard definition) bi-level and analog HD (high definition) tri-sync video sources. Note that VITC is only supported by the former.

Important

If the Vicon Lock+ is the only device, or the last device in the chain, the Ref Loop connection that is not being used for signal output must be terminated using a 75 Ω (ohm) terminator.

▌ LTC In The XLR socket ❼ provides the balanced input for LTC (Longitudinal Time Code) to the Lock+.

The timecode is only valid when it is correctly frame-aligned to the accompanying analog SD or HD composite video signal.

▌ VESA Stereo In The 3-way, mini-DIN socket ❽ provides the input to the VESA Stereo In signal. When selected as the genlock source by the appropriate Vicon software, the Lock+ unit locks to this signal.

▌ VESA Stereo Out Reserved for future use ❾ .

For details on using external VESA Stereo signal to synchronize your Vicon Vantage system to an external video system, see Extend a Vicon Vantage system with VESA Stereo on page 143.

Link Input/Output (IO) connectors

Vicon System Connector - Link The Link socket ❿ provides a dedicated output signal to synchronize MX T-Series–Giganet systems to a Lock+. Alternatively, as well as being able to be made an output it can also be made to be an input under software control. Configured this way, it then enables another Lock+ to be connected to it, thus creating further functionality:

▌ When connecting to an MX T-Series–Giganet system, the appropriate Vicon software will make the Lock+ unit the master for the combined system. Any legacy reference video input signal should be transferred to the Lock+ unit. The master sends the Vicon Ethernet sync and timestamp packet once per frame to all Vicon peripherals attached to that network.

▌ When expanding a Lock+ system with a further Lock+ unit, the Lock+ with a reference video signal or VESA input signal will be made the sync master by the appropriate Vicon software. In this case the software will control which unit is master and which one is secondary. The secondary unit does not transmit the Vicon Ethernet sync and timestamp packet when acting in this mode.

Vicon Vantage host PC

The following topics describe the role of the Vicon Vantage host PC in a Vicon Vantage system and describes the ports used to enable communications between the Vicon software installed on this PC and other components in the Vantage system.

For more information, see:

▌ Vicon Vantage host PC in a Vantage system

▌ Vicon Vantage host PC connectors

▌ Vicon software on Vicon Vantage host PC

Vicon Vantage host PC in a Vantage system

The Vicon Vantage host PC receives data from your Vantage system and runs the Vicon motion capture and analysis software. If your Vantage system includes more than one PoE+ switch, the PoE+ switch connected to the Vicon Vantage host PC is the primary switch. Depending on your system configuration, you may also install additional Vicon hardware, Vicon application software or third-party applications on the same PC or on other, remote PCs in a distributed system. Vicon software is licensed on the Vicon Vantage host PC.

The computer used as the Vicon Vantage host PC in your Vicon Vantage system may be supplied by Vicon, or it may be one that you provide yourself. If you are providing your own PC, the computer specification depends upon your Vantage system and your application requirements. Processor speed and memory are the most important factors for system performance. Hard drive speed and RAM requirements are greater for high camera-count or high marker-count applications. A high-quality graphics card is required for any PC on which you have installed visualization software that makes high graphics demands. For details on minimum requirements for the Vicon Vantage host PC for your Vicon application software, visit the Vicon website, or contact Vicon Support.

Important

In all cases, Vicon application software requires a PC with an Intel processor. Because Intel processors are used in Vicon development and testing, Vicon applications are optimized for this processor type.

Vicon Vantage host PC connectors

This section describes the connectors on your Vicon Vantage host PC that you use to connect to other components in your Vicon Vantage system. It does not cover standard connectors for your mouse, keyboard, speakers, etc. The following image shows an example Vicon Vantage host PC; the location of connectors depends on your PC. For details, see the documentation supplied with your PC.
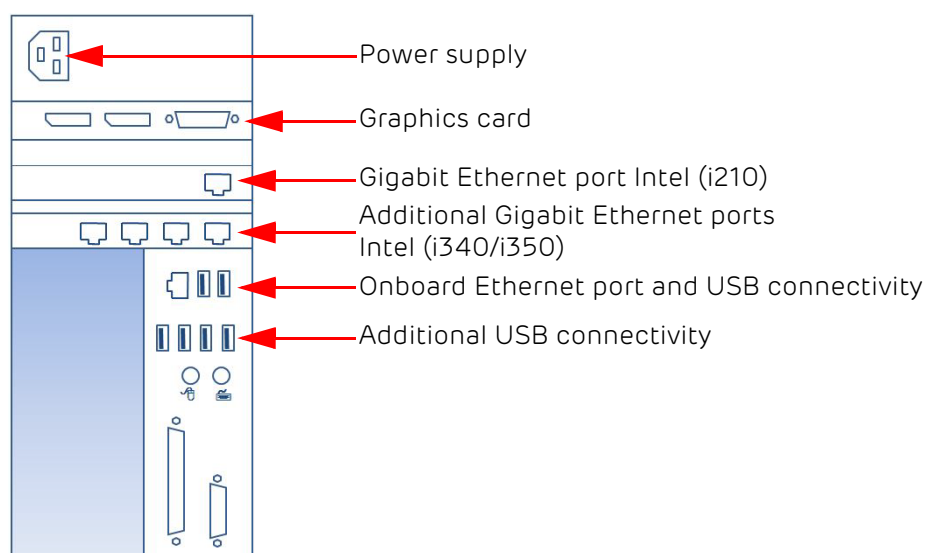
You will typically use the following connectors on your Vicon Vantage host PC:

▎ Vicon Vantage system network port

▎ Additional network ports

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage host PC

Vicon Vantage system network port

A Vicon Vantage system runs on its own dedicated network, rather than being integrated into a general communications network. This Vantage system network uses Gigabit Ethernet communications, so the Vicon Vantage host PC requires an appropriate network adapter card.

Vicon Vantage systems require at least a Gigabit Ethernet card, supporting data transfer rates up to 1000 Mbps. To attain the high-performance of which Vicon Vantage systems are capable, you should use a PCIe network card. This is because most embedded network cards built into PC motherboards cannot manage the network traffic involved when performing measurements at high frame rates with analog at high speed, or capturing high marker counts with many cameras.

You will use this Vantage system network port to connect the Vicon Vantage host PC to the primary PoE+, which controls the data flow between the Vicon Vantage host PC and other devices in the Vantage system.

You must configure this network adapter card for the Vicon Vantage system. To do this, disable all protocols other than Internet Protocol Version 4 (TCP/IPv4) for this network adapter card. Then use the following IP address settings for this network adapter card:

▎ IP address: 192.168.10.1

▎ Subnet mask: 255.255.255.0

▎ Default gateway: Leave blank

After setting the IP address, reboot the Vicon Vantage host PC. When the system is booted, an IP address in the range 192.168.10.10 to 192.168.10.254 is assigned to each camera via DHCP (Dynamic Host Configuration Protocol), which centrally manages the assignment of IP addresses.

The Vicon Vantage system maintains an internal connection map, which uniquely identifies each IP address with a particular camera. This makes it possible for you to plug active cameras into different ports on the rear of the PoE+ switch without having to recalibrate the cameras. Vicon DHCP will not interact with the DHCP on the local network. This IP address range does not go through routers, so Vicon data and communications traffic do not affect Internet or other network communications.

Data is streamed from the camera to the Vicon Vantage host PC as User Datagram Protocol (UDP) packets. Commands are sent via Telnet to individual cameras or broadcast to all cameras using a proprietary protocol.

If you have installed a PCIe card for this Vantage system network, you must increase the Receive Buffers parameter for each card to its maximum setting to optimize its performance when your Vicon Vantage system is running under high network load.

For more information on configuring network ports for Vicon Vantage systems and Vicon video devices, as well as details of recommended network cards and instructions on setting the Receive Buffers parameter, see the latest recommendations on the Vicon website, and the PDF **PC Setup for Vicon Systems**, which you can obtain from the Downloads page on the Vicon website.

Tip
If you obtained your Vicon Vantage host PC from Vicon, an appropriate network card will already have been installed, the IP address set, and this parameter optimized.

Additional network ports

In addition to the Vicon Vantage system network card, if you need to make any of the following optional connections, you will need to install additional Ethernet network cards in the Vicon Vantage host PC:

▍ Local area network (LAN): A separate, dedicated Ethernet port is required to connect the Vicon Vantage host PC to your LAN.

▍ Bonita Video cameras: A separate, dedicated Ethernet port is required to connect Bonita Video cameras.

▍ Link aggregation (if required): Link aggregation is required only for systems that include a large number of cameras.

As the Vantage system is independent of your communications network, no guidance is offered for LAN network cards.

For secondary PoE+ switches or video cameras, to attain the high performance of which Vicon Vantage systems are capable, Vicon recommends that you use a PCIe network card rather than the embedded network card that may be built into the PC motherboard.

When you have installed any PCIe network cards, you must increase the Receive Buffers parameter for each card to its maximum setting to optimize its performance when your Vicon Vantage system is running under high network load. For details on recommended network cards and instructions on setting the Receive Buffers parameter, see the latest recommendations on the Vicon website, and the PDF PC Setup for Vicon Systems, which you can obtain from the Downloads page on the Vicon website

Vicon software on Vicon Vantage host PC

You install your Vicon motion capture and analysis application software on the Vicon Vantage host PC. Vicon produces software for various applications including those in the life sciences, entertainment, and engineering fields. Vicon's software platforms for processing and capturing data include Vicon Nexus, Vicon Blade and Vicon Tracker.

If you have implemented a distributed Vicon Vantage system architecture or client-server application, you may also have this Vicon motion capture and analysis software, or other Vicon or third-party data visualization, analysis, or manipulation software on a remote PC.

For further details on these Vicon software applications, including the versions providing support for specific Vicon Vantage hardware components, see the Vicon Web site. For details on configuring Vicon Vantage cameras and data capture and processing through these Vicon software applications, see your Vicon software documentation.

Note

Vicon software is licensed on the Vicon Vantage host PC. For details of the software licensing method, see the documentation supplied with your Vicon software.

Vicon Vantage system cables

The following topics describe the cables used to connect hardware components in a Vicon Vantage system.

For more information, see:

▍ About Vicon Vantage cables in a Vantage system

▍ Vicon Vantage system cable descriptions

▍ Simple Vicon Vantage system cables

▍ Extended Vicon Vantage system cables

▍ Integrated Vicon Vantage system cables

▍ Vicon Vantage cable order information

About Vicon Vantage cables in a Vantage system

A number of cables are supplied with Vicon Vantage systems to connect Vantage hardware components. The majority of these are network cables (RJ-45 connectors joined by Cat5e cable), which carry the power, all the communication data, and synchronization.

Important

Where Ethernet cable is required, use only Vicon-supplied cable. Vicon-supplied cables that connect cameras to a PoE+ switch include a ferrite at the camera end, and those that connect a Lock+ to a PoE+ switch are suitably shielded.

For details of the cables supplied with your Vicon Vantage system, see the bill of materials accompanying your product shipment. If any cables are missing on receipt, or if you require additional cables later, please contact Vicon or your nearest agent or distributor.

Note the following cable requirements for various Vantage systems:

▌ Systems containing a Vicon Lock+ include the eight Weidmüller connectors necessary to connect the Lock+ to third-party analog capture devices.

▌ Systems containing two Lock+ units require a Lock+-to-Lock+ Link cable.

▌ Systems supporting T-Series cameras with a Giganet require an additional Lock+-to-Giganet Link cable.

Depending on your Vantage system components, you may also require commercially available cables to connect a Lock+ to third-party devices.

Such cables may be:

▌ Created by you:

– To connect the provided Weidmüller connectors to the analog source connector

– For remote triggering devices

▌ Obtained from video specialist distributors (such as for timecode, video devices such as broadcast and VESA Stereo video)

Vicon Vantage system cable descriptions

The following topics describe the cables you will need for various types of Vicon Vantage system. It does not describe all the cables supplied with MX T-Series systems; it is assumed that any MX T-Series system cameras and Giganets are already connected with the originally supplied cables.

▌ Simple Vicon Vantage system cables

▌ Extended Vicon Vantage system cables

▌ Integrated Vicon Vantage system cables

For descriptions and uses of MX T-Series cables, see the documentation supplied with your Vicon MX T-Series system.

Vicon
Vantage
Reference

| About this manual | Reference information | Advanced usage | Technical specifications | Regulatory information | Further resources |

Vicon Vantage system cables

Simple Vicon Vantage system cables
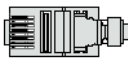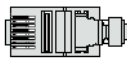
The following table lists the cables that are used in a simple Vicon Vantage system. For details of this type of system, see Simple Vicon Vantage system (Vantage cameras only) on page 20.

You can use the following information to identify the correct cables and connection points to use when setting up your Vantage system.
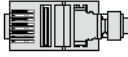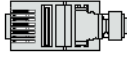
Important

Where Ethernet cable is required, use only Vicon-supplied cable.

Vicon Vantage camera to PoE+ cable

Cable name/Part no.	Vantage camera end	PoE+ end	Description
Vantage camera to PoE+ RJ-45 Ethernet cable (snagless) Vicon part no: BEH011AA-30 (30 m) and BEH011AA-50 (50 m)	8-pin RJ-45 plug	8-pin RJ-45 plug	A Vicon-supplied RJ-45 Standard 1000Base-T Gigabit Ethernet network cable. Includes a ferrite at the camera end.

Vicon Vantage host PC to PoE+ cable

Cable name/Part no.	Host PC end	PoE+ end	Description
Host PC to PoE+ RJ-45 Ethernet cable (Cat 5e) Vicon part no: 0470600	8-pin RJ-45 plug	8-pin RJ-45 plug	A Vicon-supplied RJ-45 Standard 1000Base-T Gigabit Ethernet network cable.

For information on cable lengths, see Vicon Vantage cable order information on page 73.

Extended Vicon Vantage system cables

The following table lists the cables that can be used in an extended Vicon Vantage system and that are in addition to those described in Simple Vicon Vantage system cables on page 66.
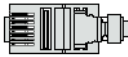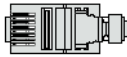
You can use this information to identify the correct cables and connection points to use when setting up your Vantage system to include third-party devices such as analog capture devices, synchronized output devices, remote triggering devices, and genlock/timecode video devices.

For details of this type of system, see Extended Vicon Vantage system (add cameras and third-party devices) on page 21.
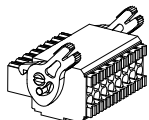
Important

Where Ethernet cable is required, use only Vicon-supplied cable.

Vicon Lock+ to PoE+ cable

Cable name/Part no.	Vicon Lock end	PoE+ end	Description
Lock+ to PoE+ RJ-45 cable (Cat 5e) Vicon part no: 0470600	8-pin RJ-45 plug (plugs into PoE socket)	8-pin RJ-45 plug	A Vicon-supplied, shielded RJ-45 Standard 1000Base-T Gigabit Ethernet network cable.

Vicon Lock+ to third-party devices cables

Cable name/Part no.	Vicon Lock end	Third-party device end	Description
OMNIMATE Signal connector (3.5mm) cable: Vicon part no: BEH007A D-25-M (for AMTI Gen5, MSA-6 and OPT-SC amplifiers) BEH008A D-15-M (for Kistler 9865B amplifiers) BEH009A D-37-M (for Kistler 5233A2 amplifiers) BEH012A D-15-M (for Bertec amplifiers)	Weidmüller connector (plugs into Analog Input (8 channels) x8)	Device dependent	Enables cables to connect to the 64 channels of analog capture. Each individual connector allows for eight connections to eight analog sources with their associated grounds. A force plate can connect through one connector. For information on how to make the connection, see Extend a Vicon Vantage system with analog capture devices on page 105.
Phono (RCA) cable (plus device-dependent plug)	RCA phono plug (plugs into Sync Out (GPO) x8)	Device dependent	Enables connection to third-party devices that require synchronization or triggering.
Phono (RCA) cable (plus device-dependent plug)	RCA phono plug (plugs into Remote Control In Start and Stop x2)	Device dependent	Enables connection to third-party devices that can trigger (start and stop) capture.

Cable name/Part no.	Vicon Lock end	Third-party device end	Description
BNC cable	BNC – 75 Ω (ohm) (plugs into Broadcast Sync (VITC) In)	BNC – 75 Ω (ohm)	Enables connection to an external analog video source for genlocking to. Analog SD bi-sync video may also carry VITC timecode in.
Male to Female XLR cable	XLR plug (male) (plugs into LTC (Timecode) balanced In)	XLR plug (female)	Enables the connection of balanced LTC – In. Note that for correct operation, a synchronized video signal must accompany this signal.
VESA Stereo In cable Manufacturer: CUI Inc Part no: MD-30 CP-2030-ND (Digi-Key part no.) VESA standard IEC-1076-4-105 stereoscopic connection type	3-pin mini-DIN (plugs into VESA Sync In)	Device dependent	Enables the connection of VESA Stereo devices for genlocking.

Lock+ to Lock+ cable

If you want to use an additional Lock+ in your Vicon Vantage system, you also need the following cable:

Cable name/Part no.	Vicon Lock+ end	Vicon Lock+ end	Description
Lock+ to Lock+ synchronizing cable Vicon part no: BEH010A	3-pin plug (plugs into Link Input/Output)	3-pin plug (plugs into Link Input/Output)	Proprietary cable for synchronizing an additional Lock+. Mini cord connector with 3 male contacts.

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage system cables

Integrated Vicon Vantage system cables

The following tables describe the cables (additional to those listed in Simple Vicon Vantage system cables on page 66) for connecting hardware components in an integrated Vantage system. You can use this information to identify the correct cables and connection points to use when setting up your Vantage system to integrate components from MX T-Series systems.

For details on this type of system, see Integrated Vicon Vantage system (with MX T-Series) on page 23.
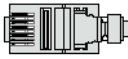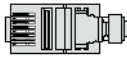
Important

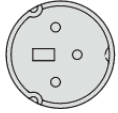Where Ethernet cable is required, use only Vicon-supplied cable.

Vicon Lock+ to MX Giganet cable

Cable name/Part no.	Vicon Lock+ end	MX Giganet end	Description
Lock+ to Giganet synchronizing cable Vicon part no: BEH004A (1m) BEH005A (20m) BEH006A – 4-pair (1m)	3-pin plug (plugs into Link Input/Output)	10-pin RJ-45 plug	Vicon-supplied cable for synchronizing an MX T-Series Giganet system.

Vicon Lock+ to PoE+ cable

Cable name/Part no.	Vicon Lock end	PoE+ end	Description
Lock+ to PoE+ RJ-45 cable (Cat 5e) Vicon part no: 0470600	8-pin RJ-45 plug (plugs into PoE socket)	8-pin RJ-45 plug	A Vicon-supplied, shielded RJ-45 Standard 1000Base-T Gigabit Ethernet network cable.

When you integrate Vicon T-Series cameras and hardware into a Vantage system, you use cables from your existing architecture. For descriptions and uses of these other cables, see the Vicon T-Series documentation supplied with this system.

Vicon Vantage cable order information

The following table lists the Vicon cables used in Vicon Vantage systems, and provides their product order codes and lengths. Use these details to obtain additional Vicon cables from Vicon or your nearest agent or distributor.

Cable description	Product order code	Length
Host PC to PoE+ and Lock+ to PoE+ RJ-45 cable (Cat 5e)	0470600	5m
Vantage camera to PoE+ RJ-45 cable (snagless) with ferrite	BEH011AA-30	30m
	BEH011AA-50	50m
Lock+ to Lock+ synchronizing cable	BEH010A	1m
OMNIMATE Signal connector (3.5mm) cable – for analog capture (force plates, etc)	BEH007A D-25-M (for AMTI Gen5, MSA-6 and OPT-SC amplifiers)	1.5m
	BEH008A D-15-M (for Kistler 9865B amplifiers)	1.5m
	BEH009A D-37-M (for Kistler 5233A2 amplifiers)	1.5m
	BEH012A D-15-M (for Bertec amplifiers)	1.5m
Lock+ to Giganet synchronizing cable	BEH004A	1m
	BEH005A	20m[1]
	BEH006A	1m (4-pair)

1. Do not leave this cable coiled when it is in use, as it may cause interference.

Note
The above product order codes are correct at the time of publication, but for the most up-to-date information, please refer to the latest revision of the current Vicon price list.

About this manual

Reference information

Advanced usage

Technical specifications

Regulatory information

Further resources

Vicon Vantage system cables

Vicon Vantage calibration device

The following topics describe the Vicon Vantage calibration device (Active Wand) used to prepare your Vicon Vantage system for motion capture.

▌ About the Vicon Vantage calibration device

▌ Calibration process

About the Vicon Vantage calibration device

You use the Vicon Vantage calibration device (Active Wand) to calibrate both optical and reference video cameras in your Vantage system. Calibration enables the Vicon Vantage cameras to capture the subject's movements throughout the volume. You use the Active Wand in your capture volume to identify the volume origin and axes, so the virtual cameras and volume in your Vicon application software reflect the positions of the cameras in relation to the capture volume and to one another.

The Active Wand is an electronic motion capture calibration device that contains five pairs of LEDs, as shown in the following illustration and described in the table below.
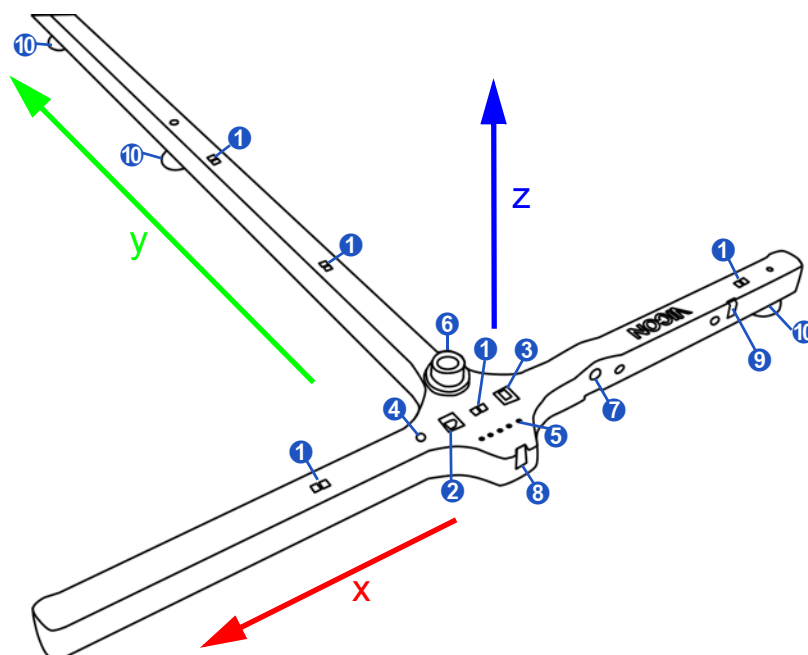
Key	Part	Description
❶	Pairs of LEDs	Used to calibrate both optical and reference video cameras. As some reference video cameras do not have strobes, the LEDs in the Active Wand make it easier to identify and locate markers from reference video images.
❷	On/Off switch	Power switch

Key	Part	Description
❸	LED mode switch	Enables you to change between Strobe and Continuous mode. Use Strobe mode whenever possible. In some cases, Continuous mode may give better results (for details, see the **Active Wand User Guide** PDF).
❹	Intensity adjustment screw	Enables you to change the brightness of the LEDs.
❺	Battery charge indicator LEDs	Indicates the amount of charge left in the battery.
❻	Bubble level	Enables you to check the bubbles when adjusting the feet to ensure device is flat on the floor.
❼	Battery charger connection	Enables you to charge the battery by plugging the supplied Active Wand charger into this socket.
❽	Camera strobe sensor	A photodiode detects the strobes from the cameras, enabling the Active Wand to synchronize to the cameras.
❾	NIR On/Off switch	Enables you to turn on/off the NIR LEDs on NIR wands or IR LEDs on IR wands.
❿	Adjustable feet	Enable you to position the wand flat on the floor when setting the volume origin by turning the adjuster screw for each foot.

In addition to the above features, the following features are also available, but are not illustrated:

▮ Handle: Hold this end when performing a wand wave. Also contains the battery. For information on charging and replacing the battery, see the **Active Wand User Guide** PDF, which is available from the **Downloads** page of the Vicon website.

▮ Pivot screw (center underside): Align the adjustable feet with this fixed point when setting the volume origin. To enable the Active Wand to lie level, you may need to change the position of the pivot screw from the default position to the alternative position on the wand's arm.

▮ Force plate alignment guides (can be fitted along the lengths of the wand): If you are placing the wand at the global origin while setting the volume origin, screw each alignment plate into the relevant set of holes and align the guides with the edge of a force plate.

This single calibration device is used for both dynamic calibration and setting the volume origin, as described in Calibration process on page 79.

Vicon Vantage calibration device

For further details about the Active Wand, see the **Active Wand User Guide** PDF, which is available from the **Downloads** page of the Vicon website.

Tip
The Active Wand is the instrument used to define system accuracy. To ensure continued accuracy, please take care of it and store it safely when not in use.

Calibration process

Vicon system performance depends on the accuracy with which the cameras and the capture volume are calibrated during a two-stage system calibration process:

▍ Camera calibration

▍ Setting the volume origin

Both stages of the system calibration process depend on the Vicon application software knowing the dimensions and relative marker positions of a specified calibration device. This definition of a calibration device is contained in a Vicon Labeling Skeleton (VSK) file. When you configure the calibration process in your Vicon application software, you load its VSK file.

The following sections provide a general overview of the calibration process. For details on calibrating your Vicon cameras and the capture volume, see the **Vicon Vantage Quick Start Guide** and the documentation for your Vicon application software.

Important

To calibrate your Vicon Vantage system, you must have a calibration device definition file (VSK) that matches your device. By default, only Vicon Active Wand definitions are pre-installed in the software. To use legacy or custom calibration devices, you must import a definition file that fully describes your device into your Vicon application software.

| About this manual | Reference information | Advanced usage | Technical specifications | Regulatory information | Further resources |

Vicon Vantage calibration device

Camera calibration

During camera calibration, the Vicon application software calculates the physical position and orientation of each Vicon camera in the capture volume based on the movement of a calibration wand. This stage calculates internal (focal length and image distortion) and external (position and orientation) camera parameters in two simultaneous phases:

▍ Linearization phase

The optical distortion of the camera lenses and any other non-linearity in the system are measured, and a correction matrix is calculated. Corrections are applied to every frame of data subsequently acquired by each camera.

▍ Photogrammetric calibration phase

The physical locations and orientations of the cameras are calculated, referring to a user-defined set of coordinates.

The objective of this stage is to describe the capture volume to the Vicon Vantage system.

To calibrate the Vicon Vantage cameras:

1. Turn on the Active Wand.

2. If necessary, move the **LED Mode** switch to **Strobe** mode.

    The LEDs begin to flash.

3. Place the Active Wand in the capture volume where it is visible to the Vicon cameras.

    When the LEDs appear to stop flashing, the Active Wand is synchronized to the cameras.

4. Wave the calibration wand throughout the empty capture volume, ensuring that the LEDs on the wand are visible to the cameras, until sufficient wand frames are spread evenly across the field of view for each camera.

    The Vantage camera display and your Vicon application software provide feedback to help you determine when enough wand data has been acquired to calibrate each camera. For details, see the documentation for your Vicon software.

Setting the volume origin

In setting the volume origin, the Vicon application software measures the position of a calibration device in the capture volume and sets the global coordinate system.

The objective of setting the volume origin is to set the global coordinate system so that subjects are displayed the right way up and so that you can change the way data is visualized in the Vicon application software workspace. Place the calibration device flat on the floor to identify the coordinates of the global origin (0,0,0), which represents the center of the capture volume, and the global axes (X,Y,Z), which represent the horizontal and vertical axes of the capture volume.

If you are using force plates, choose one of the force plate corners to be the position of the origin of the global coordinate system. This enables your force plates and the Vicon capture volume to share a common coordinate system. To do this, attach the supplied force plate alignment guides to the Vicon Vantage calibration device. The alignment guides ensure that you place the Vantage calibration device on the same position on top of one of the force plate corners each time you perform a calibration.

If you are not using force plates, adjust the feet of the Vantage calibration device to ensure that they are all flat on the floor. Start with the handle and adjust the foot between the fixed foot and the hand grip, and then adjust the other foot until the bubble in the spirit level is in the center. Next, on the top edge of the wand, adjust the foot on the left end until the bubble in the spirit level is in the center. To adjust the feet, first loosen the locking nut next to the metal frame and then turn the screw left to lower the calibration device or right to raise it. Then tighten the locking nuts to fix the feet in position.

Next place the Vantage calibration device either on top of the force plates or flat on the floor in the center of the capture volume in the field of view of at least three cameras. Position the left corner of the calibration device where you would like the volume origin to be and in the orientation that you would like the horizontal X and Y axes to be (for details of the Vicon Vantage calibration device, see About the Vicon Vantage calibration device on page 76). The

calibration process will calculate the vertical Z axis from the positions of the X and Y axes, as shown in the following image.
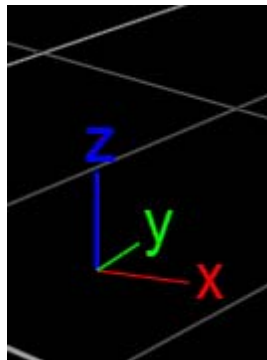
Vicon Vantage accessories

Vicon Vantage accessories are motion capture consumables that you will use and replace as required.

The following table lists the accessories available for Vicon Vantage systems.

Accessory	Description
Retroreflective paint	Applies directly to miniature subjects that are too small to have markers attached.
Scissors	Cuts tape.
Tape	
Marker-fixing tape	Secures markers directly to a subject's skin. This double-sided tape is specially designed to adhere well to human skin without creating an allergic reaction. It can only be used once. The tape does not perform well if the skin becomes very wet with sweat. Under these circumstances, Vicon Motion Systems recommends the use of medical grade elastic strips.
Micropore tape	Temporarily secures smaller markers to fingers. Some studios cut a small hole in a strip to poke the marker through, then wrap the remainder of the tape around a finger.
Gaffer tape	Secures marker bases to objects or props, and enables you to mark out the edges and origin of the capture volume in the lab or studio to help capture subjects visually identify the perimeter.
Tweezers	Enables you to carefully apply markers to avoid transfer of fingerprints and smudges to the retroreflective markers.

Accessory	Description
Velcro roll/strips/dots	Secures marker bases to objects or props. Many studios keep these on props and then add/detach markers as required.
Vicon retroreflective markers in various sizes, such as: 3.0 mm, 4.0 mm, 6.4 mm, 9.5 mm, 14.0 mm, and 25.0 mm	Smaller markers are typically used for facial, finger, or small object/prop capture. Larger markers are typically used for general body or object/prop capture. Additional marker sizes may be available.
Vicon PECS suit	3x3 Motion Capture Suit, including hat, gloves, and booties
Vicon Rigid Bodies in three kits: Full body kit; Hands and head kit; Object kit	Enable you to track and measure people and objects using a set of fixed, accurate markers. The markers are easy to apply and comfortable to wear, providing six-degrees-of-freedom tracking of human body segments or objects. Compatible with Vicon Tracker. For more information, see the Vicon Rigid Bodies User Guide PDF or visit the Vicon website.
Vicon Apex	A precise, robust, hand-held tracking tool that enables users to interact intuitively with virtual objects in a 3D environment, For more information, see the Vicon Apex User Guide PDF or visit the Vicon website.

The actual number and type of accessories supplied depend upon the specific Vicon application you have ordered.

Important

For details of the type and number of items supplied with your Vicon Vantage system, see the bill of materials accompanying your product shipment. If any items are missing on receipt, or if you require additional accessories later, please contact Vicon or your nearest agent or distributor.

Put together a simple Vicon Vantage system

The following topics describe how to put together a Vicon Vantage system, based on the simple system described in Simple Vicon Vantage system (Vantage cameras only) on page 20.

For more information, see:

▮ About simple Vicon Vantage systems

▮ Put together the Vicon Vantage hardware

▮ Set up the software

When you have set up a simple Vicon Vantage system with Vantage cameras, a PoE+ switch and a Vicon Vantage host PC, you can:

▮ Extend the system to include additional Vantage cameras with secondary PoE+ switches; add Bonita Video cameras; and add a Vicon Lock+ to include supported third-party devices such as analog capture devices, synchronized output devices, remote triggering devices, genlock/timecode video devices, and VESA Stereo video devices.

▮ Integrate MX T-Series cameras and Giganets into your new Vantage system.

For details of the Vicon MX T-Series components and third-party devices that you can integrate in your Vicon Vantage system, see Integrate MX T-Series components into a Vicon Vantage system on page 147.

About simple Vicon Vantage systems

A simple Vicon Vantage system consists of a primary PoE+ switch, up to 12 Vantage cameras, and a Vicon Vantage host PC, as shown in the following illustration. For details of these elements, see Overview of Vicon Vantage system components on page 11.

Vantage cameras (Up to 12 per PoE+)

Primary PoE+

Optical data (Ethernet)

✔ = Ports that may be used to connect Vicon Vantage cameras. You can connect up to:
3 cameras to ports 1-4
3 cameras to ports 5-8
3 cameras to ports 9-12
3 cameras to ports 13-16

Ethernet cable (1 per camera)

Network card
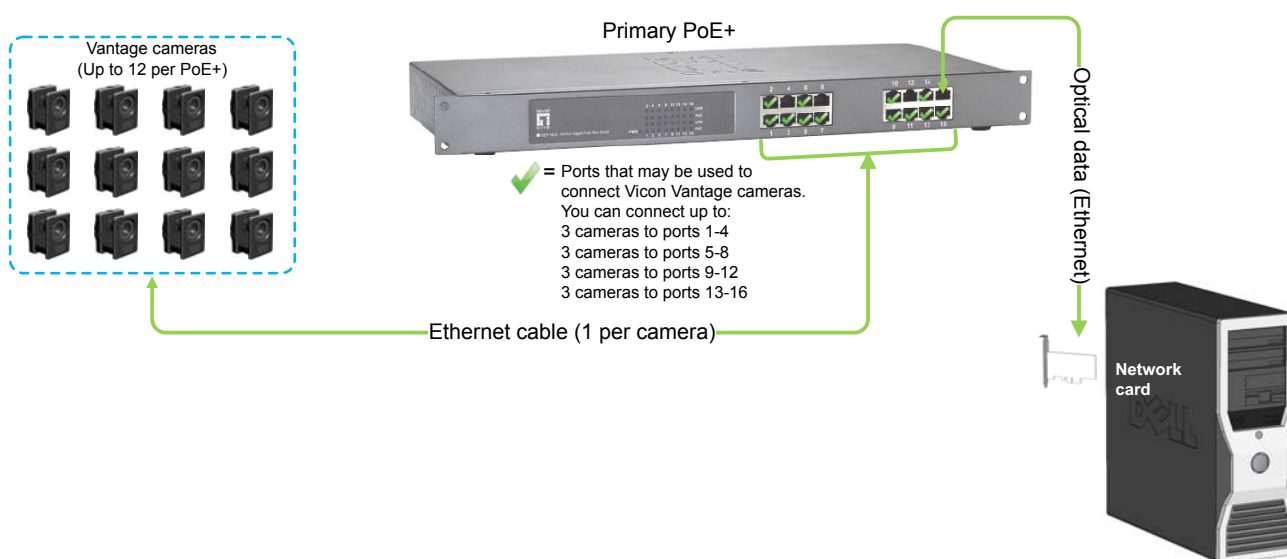
For instructions on setting up a simple Vantage system, see the Vicon Vantage Quick Start guide. A printed version of this guide is included in your product box. For your convenience, the steps described in the Quick Start guide are briefly outlined in the following topics.

▌ Put together the Vicon Vantage hardware

▌ Set up the software

Put together the Vicon Vantage hardware

The first step in putting together a Vicon Vantage system is to set up your hardware. Gather the hardware components, supplies, downloaded Vicon application software installer, and documentation for your Vicon Vantage system. For details of the components supplied with your particular system, see the Bill of Materials that accompanied the shipment.

Assemble and connect the Vantage hardware components:

1. For each Vantage camera, assemble the head block and connect the camera and base plate to it.

2. Mount the Vantage camera and head block assemblies on tripods or on a clamp and truss on a speed rail, and then position them around the capture volume.

3. For each Vantage camera, plug one end of a Vicon-supplied Cat 5e RJ-45 Ethernet cable (the end furthest away from the ferrite) into one of the available RJ-45 sockets in the PoE+ switch. Although there are 16 sockets in total, remember that:

   ▍ One socket is required to connect to the Vicon Vantage host PC.

   ▍ Each set of four ports on the PoE+ switch can support up to three Vantage cameras. The remaining ports can support any of the other Vicon components required in your system, such as Vicon Vantage host PC, Vicon Lock, Vicon Bonita Video cameras, or a non-powered Gigabit

Ethernet switch (only needed if your system requires multiple PoE+ switches).
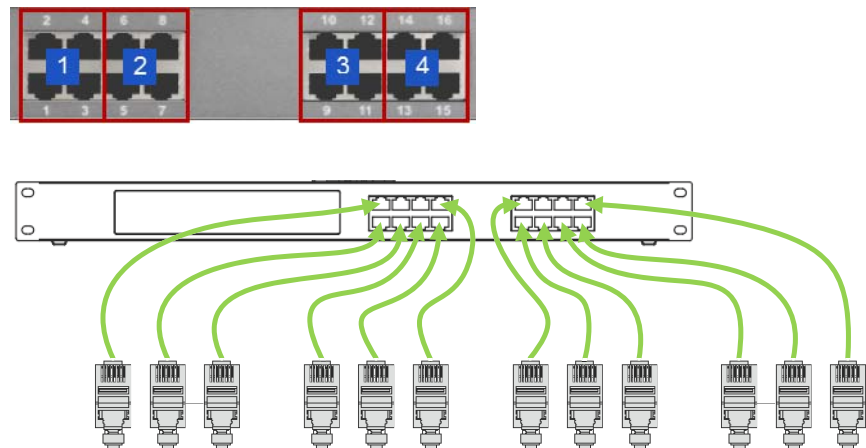
4. Plug the other end of the Ethernet cable (the end with the ferrite) into the RJ-45 socket on the rear of each Vantage camera.
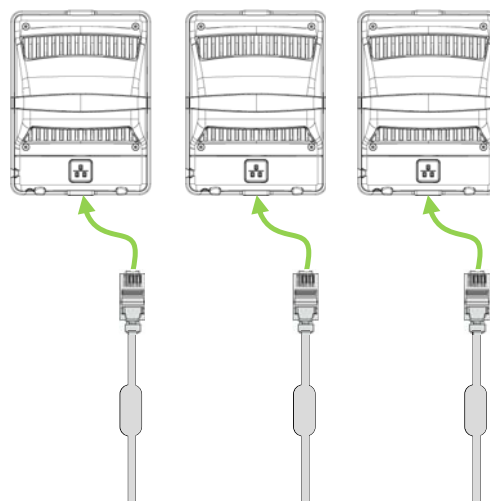
5. Plug one end of the Vicon Vantage host PC cable into one of the remaining sockets in the PoE+ switch.
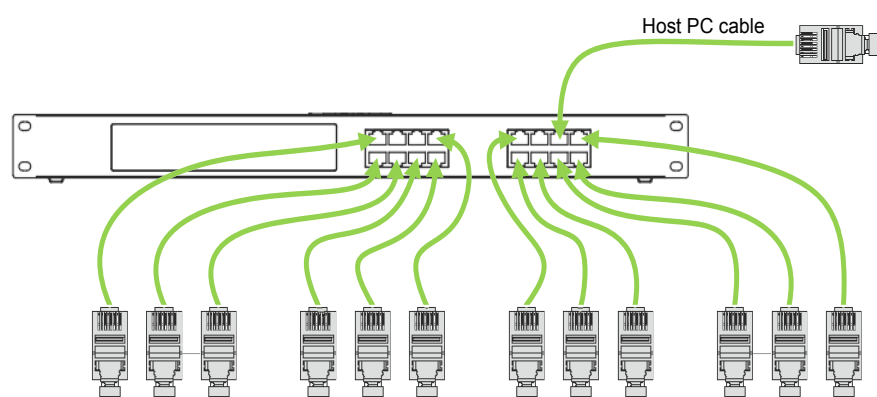
Host PC cable

6. Plug the other end of the cable into the PCIe network Gigabit Ethernet port for the Vantage system network on the rear of the Vicon Vantage host PC (for details, see Vicon Vantage system network port on page 60).
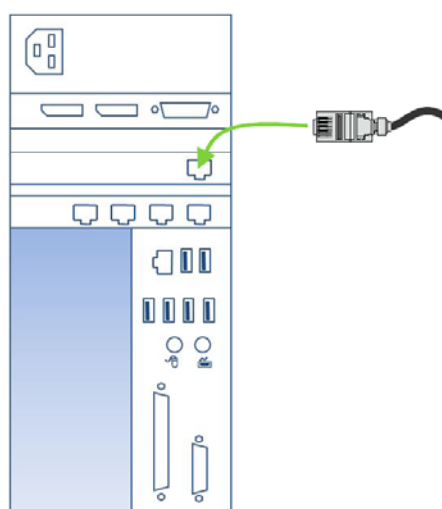
For details on the Vicon Vantage host PC cable, see Vicon Vantage system cable descriptions on page 65.

7. Switch on the Vicon Vantage host PC, and allow it to boot up.

8. Switch on the PoE+ unit.

Set up the software

After you have put together the Vicon Vantage hardware, you install, configure, and start your Vicon application software.

Note

If you bought your Vicon Vantage host PC from Vicon, the software is installed for you. You do not need to install the software again. You can check that the Vicon software folders and icons have been added to the standard locations on the Windows desktop or Start menu.

To set up the software:

1. Run the downloaded Vicon application software installer.

    After your Vicon application software has been installed, program folders and icons are added to the standard Windows locations, according to the installation options you selected.

2. Activate the software license. For information on how to do this, see the installation and licensing instructions supplied with your Vicon application software.

3. On the Vicon Vantage host PC, configure the Vicon Vantage system IP address:

    ▍ **IP address:** 192.168.10.1

    ▍ **Subnet mask:** 255.255.254.0

    ▍ **Default gateway:** Leave blank

    For detailed instructions on configuring your PC network card, including how to change the Jumbo Packet setting to its maximum value and other necessary steps, see the Vicon PDF PC setup for Vicon systems.

4. Start the Vicon application software.

    The application software splash screen is displayed.

About this manual

Reference information

Advanced usage

Technical specifications

Regulatory information

Further resources

Put together a simple Vicon Vantage system

5. To start real-time streaming of data from the Vantage cameras, connect the Vicon application software to the Vantage system:

▌ Blade On the **Studio Activities** tab, in the **Go Live** group, click the **Connect** button. When the system is connected, the main Blade button at the top left of the window turns red.

▌ Nexus and Tracker In the **Resources** pane, click the **Go Live** button. When the system is connected, the button label changes to **Go Offline** and the camera icon changes color.

About this manual	Reference information	Advanced usage	Technical specifications	Regulatory information	Further resources

Put together a simple Vicon Vantage system

Advanced usage

Find out how to extend the basic Vicon Vantage system described in Put together a simple Vicon Vantage system on page 85.

▐ Extend a Vicon Vantage system with more Vantage cameras, Vicon Lock+, and Bonita Video cameras

▐ Extend a Vicon Vantage system with analog capture devices

▐ Extend a Vicon Vantage system with synchronized output devices

▐ Extend a Vicon Vantage system with remote triggering devices

▐ Extend a Vicon Vantage system with genlock/timecode devices

▐ Extend a Vicon Vantage system with VESA Stereo

▐ Integrate MX T-Series components into a Vicon Vantage system

▐ Focus a Vicon Vantage camera lens

Extend a Vicon Vantage system with more Vantage cameras, Vicon Lock+, and Bonita Video cameras

The following topics explain how to connect additional PoE+ switches to scale your Vicon Vantage system to add Vantage cameras, Vicon Lock+ and Vicon Bonita Video cameras to the simple system described in Put together a simple Vicon Vantage system on page 85.

▍ Understand when additional PoE+ switches are required

▍ Add more Vicon Vantage cameras with secondary PoE+ switches

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with more Vantage cameras, Vicon Lock+, and Bonita Video

Understand when additional PoE+ switches are required

If your motion capture application requires more than 12 Vicon Vantage cameras, you must add one or more additional PoE+ switches.

A Vicon Vantage camera, Lock+, and the Vicon Vantage host PC each connect to one Ethernet port on the PoE+ switch. This connection to the Vantage host PC carries all the control data as well as all the motion capture data from the cameras. Bonita Video data is routed separately.

Each Bonita Video camera requires two ports on the PoE+ switch:

▎ One port powers the camera and carries the video data back to the PoE+ switch.

▎ Because the data load can reach 95% of the total Gigabit bandwidth at high frame rates, you must allocate a second port to carry this video data back to an additional Ethernet port on the host PC.

For more information, see Vicon Vantage host PC on page 57 and the PDF PC Setup for Vicon Systems, available on the Vicon website, which explain how video data is routed correctly through the PoE+ switch. Note that the ports connected to host PC ports do not draw any power.

The following table shows the number of 16-port PoE+ switches required to support various example systems.

Vantage camera	Lock+ unit	Bonita Video cameras	Total PoE+ ports	PoE+ units	Non-powered switch	See
1–12	0	0	2–13	1	0	Simple Vicon Vantage system on page 98.
13–24	0	0	16–27	2	1	Simple Vicon Vantage system with additional cameras on page 99.
13–24	1	0	17–28	2	1	Vicon Vantage system with additional cameras and Vicon Lock+ on page 100.
13–24	2	0	18–29	2	1	Vicon Vantage system with additional cameras and two Vicon Lock+ units on page 101.
13–23	0	2	20–30	2	1	Vicon Vantage system with Bonita Video cameras on page 102.
13–23	1	2	21–31	2	1	
25–36	1	2	35–45	3	1	Vicon Vantage system with three PoE+ switches on page 103.

For information on integrating an MX T-Series system with a Vicon Vantage system, see Integrate MX T-Series components into a Vicon Vantage system on page 147

Add more Vicon Vantage cameras with secondary PoE+ switches

The PoE+ switch connected to the Vicon Vantage host PC is referred to as the primary PoE+ and is directly connected to the assigned sync master. Additional PoE+ switches (referred to as secondary PoE+ switches) are connected to a non-powered Gigabit switch, which is connected to the primary PoE+ switch.

Caution

Do not daisy-chain secondary PoE+ switches through other secondary PoE+ switches, as this routes too much data through the final destination port of the primary PoE+ switch.

Simple Vicon Vantage system

The following diagram shows a simple Vicon Vantage system supporting up to 12 Vantage cameras. The Vantage application automatically selects one of the cameras to be sync master, causing it to transmit an Ethernet sync packet and timestamp once per frame.
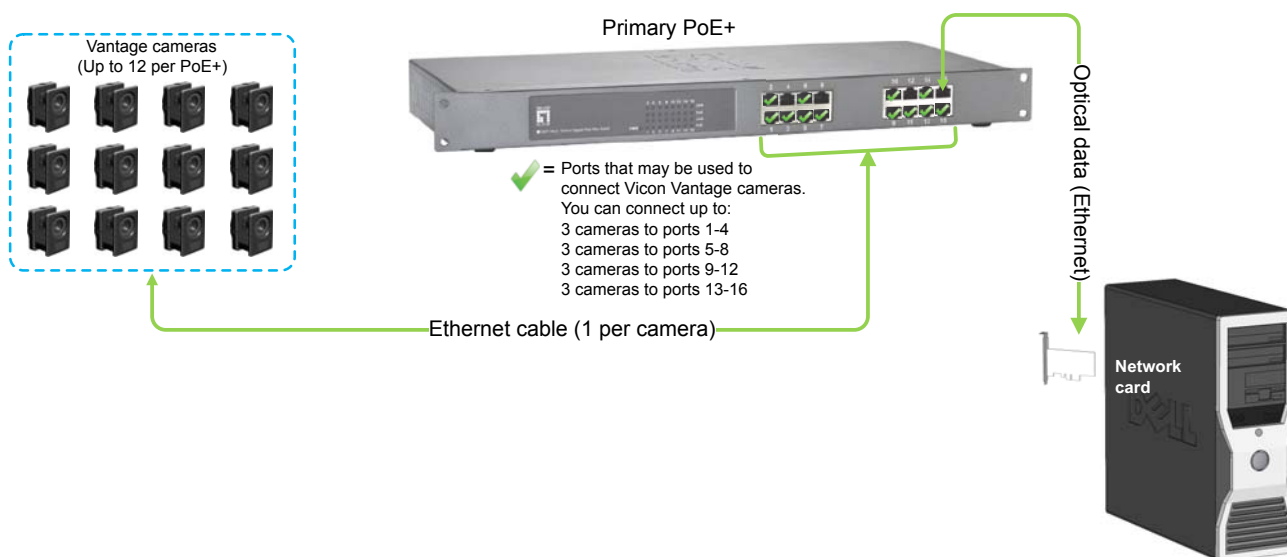
Vantage cameras
(Up to 12 per PoE+)

Primary PoE+

Optical data (Ethernet)

✔ = Ports that may be used to connect Vicon Vantage cameras. You can connect up to:
3 cameras to ports 1-4
3 cameras to ports 5-8
3 cameras to ports 9-12
3 cameras to ports 13-16

Ethernet cable (1 per camera)

Network card

Simple Vicon Vantage system with additional cameras

The following diagram shows a further 12 Vicon Vantage cameras added to the above system with one more PoE+ switch.

Primary PoE+

Vantage cameras
(Up to 12 on primary PoE+)

✓ = Ports that may be used to
connect Vicon Vantage cameras.
You can connect up to:
3 cameras to ports 1-4
3 cameras to ports 5-8
3 cameras to ports 9-12
3 cameras to ports 13-16

Optical data (Ethernet)

Ethernet cable (1 per camera)

Non-powered Gigabit switch

Secondary PoE+

Network card

Vantage cameras
(Up to 12 on secondary PoE+)

Ethernet cable (1 per camera)

In a system that requires more than one PoE+ switch, you must ensure that:

▌ The master camera (the one that outputs the Vicon Ethernet sync packet) is attached to the master PoE+ switch, which is connected to the Host PC (as described in Add more Vicon Vantage cameras with secondary PoE+ switches on page 98).

▌ To ensure correct synchronization of your system when multiple PoE+ switches are used, you must either add a Lock+ to the primary PoE+ switch,

or ensure that a camera connected to the primary PoE+ switch is selected in the Vicon application software to be synchronization master.

▍ The PoE+ switches are not connected directly to each other but are connected through a non-powered Gigabit switch, as shown in the diagram.

Vicon Vantage system with additional cameras and Vicon Lock+

The following diagram shows a Vicon Lock+ added to the primary PoE+ switch.
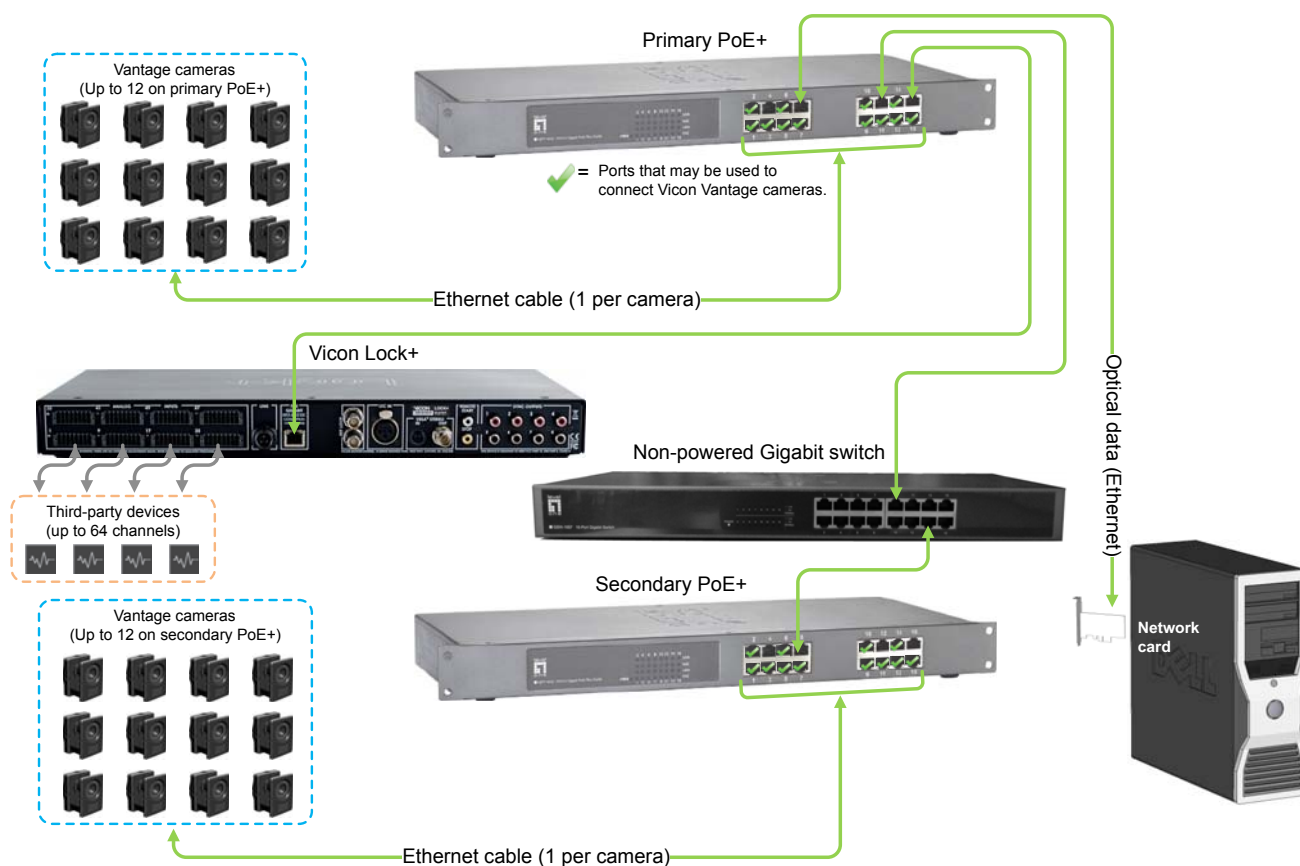
Lock+ is made sync master and is connected directly to the primary PoE+ switch.

Vicon Vantage system with additional cameras and two Vicon Lock+ units

The following diagram shows two Lock+ units added to the primary PoE+ switch.

Vantage cameras
(Up to 12 on primary PoE+)

Primary PoE+

✔ = Ports that may be used to connect Vicon Vantage cameras.

Optical data (Ethernet)

Ethernet cable (1 per camera)

Vicon Lock+

Third-party devices
(up to 64 channels)

Non-powered Gigabit switch

Network card

Vicon Lock+

Vantage cameras
(Up to 12 on secondary PoE+)

Third-party devices
(up to 64 channels)

Secondary PoE+

Ethernet cable (1 per camera)

Two Lock+ units are added to the primary PoE+ switch. Connecting a genlock source such as **Reference Video In** or **VESA Stereo In** will determine which Lock+ is sync master. If both sources are to be used, connect them both to the same Lock+.

Vicon Vantage system with Bonita Video cameras

The following diagram shows two Bonita Video cameras added to the extended Vantage system.
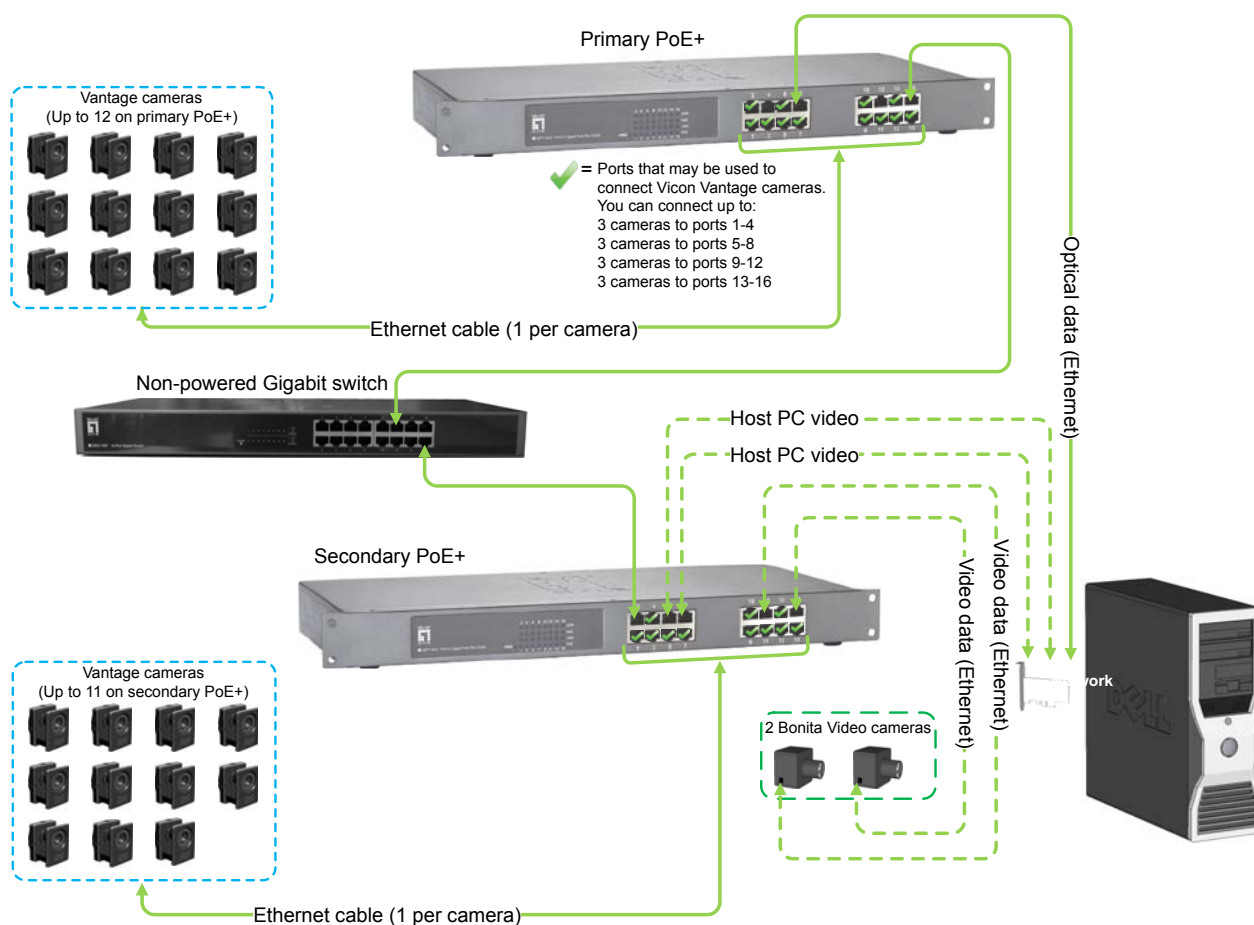
The Bonita video cameras are added to the secondary PoE+ switch so they do not add to the bandwidth of the interconnection to the primary PoE+ switch.

Vicon Vantage system with three PoE+ switches

The following diagram shows a system requiring three PoE+ switches and a Lock+.
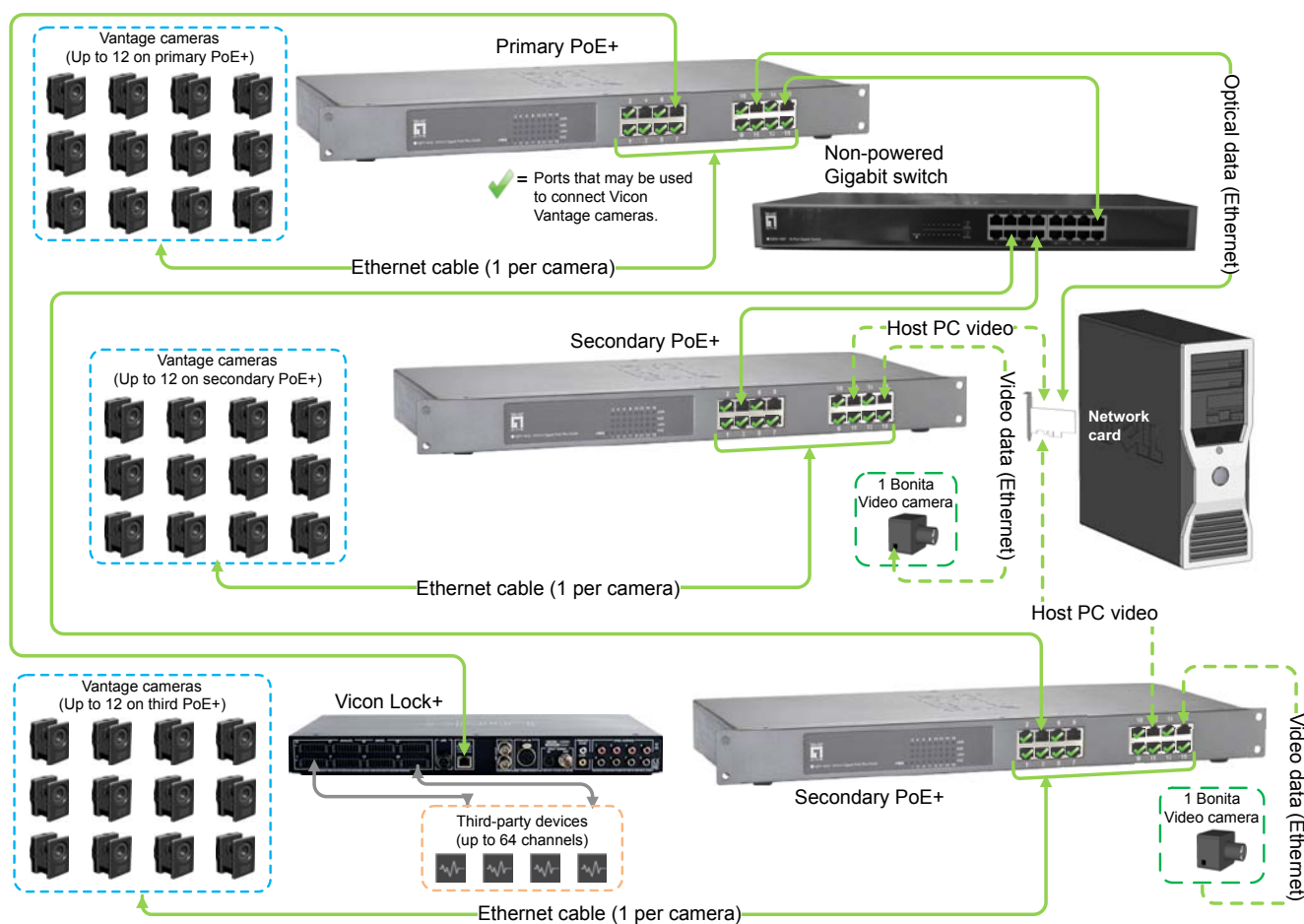
The number of Vantage cameras feeding into the primary PoE+ switch has been 'balanced' by adding a Bonita video camera to each of the secondary PoE+ switches.

Extend a Vicon Vantage system with more Vantage cameras, Vicon Lock+, and Bonita Video

Extend a Vicon Vantage system with analog capture devices

The following topics cover how to connect supported third-party analog capture devices, such as force plates, electromyography (EMG) equipment, potentiometers, and accelerometers, to your Vicon Vantage system.

▌ About analog to digital converter (ADC) functionality

▌ Analog ADC sockets and pin allocation

▌ Connect analog devices to a Vicon Lock+

About analog to digital converter (ADC) functionality

To capture data from third-party devices, such as force plates and electromyography (EMG) equipment, to a Vicon Vantage system, your Vantage system must include a Vicon Lock+, which provides analog to digital converter (ADC) functionality.

Vicon Lock+ supports the capture of up to 64 analog channels. You can extend the number of analog channels in your Vicon Vantage system by adding a further Lock+ (see Vicon Vantage system with additional cameras and two Vicon Lock+ units on page 101).

The ADC captures up to 64 separate inputs for generating 16-bit offset binary conversions from the analog sources. The input impedance is 1 MΩ (ohm). The data sampling frequency is common to all channels; you can set the sampling rate to be a multiple of the camera base rate up to 192,000 samples/second (192 KHz). The capture frequency you can specify depends on the total number of channels to be sampled, as shown in the following table.

No. of channels available	Max. capture frequency (KHz)	Allocated channel input no.
64	3	1–64
32	6	1–32
16	12	1–16
8	24	1–8
4	48	1–4
2	96	1–2
1	192	1

As illustrated in the above table, increasing the sample rate above 3 KHz automatically reduces the number of channels available for capturing. Irrespective of the sampling rate selected, there is always a fixed 5.2uS timing offset (one period of 192KHz) between physically adjacent channels.

Important

When sampling at capture frequencies greater than 3KHz, the upper channels can no longer be sampled, so the remaining channels to be sampled must be justified to the first channel positions (that is, they must begin at the first channel).

Each channel has a programmable gain, which can be set to +/- 10 volts, +/- 5 volts, +/- 2.5 volts, or +/- 1.25 volts. This gain (or indeed attenuation) automatically scales the input signal to the actual dynamic range of the ADC sampling device (which is +/- 2.5 volts) thus guaranteeing the best signal-to-noise ratio. For details on specifying these settings, see your Vicon software documentation.

Analog ADC sockets and pin allocation

To connect supported third-party analog devices into a Vicon Vantage system via a Vicon Lock+, you use the supplied Weidmüller connectors. For instructions on using the connectors, see Connect analog devices to a Vicon Lock+ on page 109.

As shown in the following image, in a Lock+, the 64 channels of analog signal capture are made up from eight separate connectors.
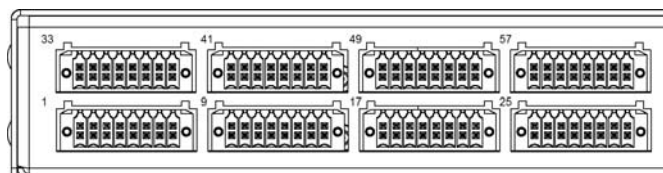
Each connector can be portioned to connect to individual force plates. Each connector contains 16 individual connections, eight signal and their eight respective grounds:
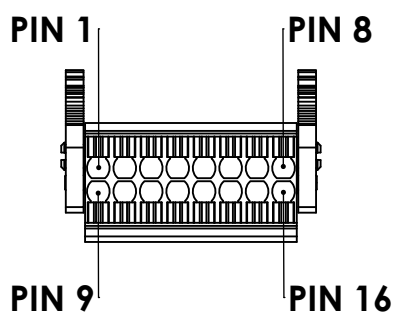
Note that the pins are assigned as follows:

▮ Pins 1–8 (top row): Ground

▮ Pins 9–16 (bottom row): Signal inputs

In this diagram, the bottom of the image represents the wire side of the connector.

Tip

For each socket, the duplicate pin numbers do not correlate with the analog channel input. That is, on connector one (leftmost), pin 9 is channel 1, pin 16 is channel 8. On connector four (rightmost), pin 9 is channel 25, pin 16 is channel 32.

For the more common force plate interfaces, you can also obtain pre-configured cables from Vicon (see Vicon Vantage cable order information on page 73).

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with analog capture devices

Connect analog devices to a Vicon Lock+

The Weidmüller connectors enable you to connect third-party devices for capturing analog data, such as force plates and accelerometers to a Vicon Lock+.

When inserting flexible wire cables into a connector or extracting them from a connector, use a slotted screwdriver as shown in the following illustration.
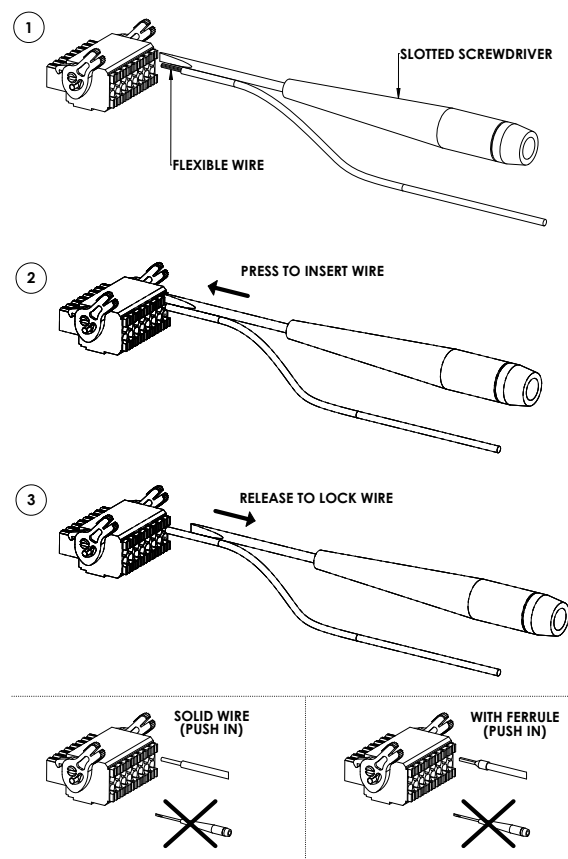
If your cables are rigid (solid wire or ferrule), you do not need to use a screwdriver and can push the ends of the cables into the required connector.

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Extend a Vicon Vantage system with analog capture devices

Extend a Vicon Vantage system with synchronized output devices

The following topics explain how to connect and synchronize third-party devices with output from your Vicon Vantage system.

▮ Understand synchronization output functionality

▮ System events and synchronization output signals

▮ Synchronization output (GPO) configuration files

▮ Include a synchronized device

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with synchronized output devices

Understand synchronization output functionality

The **Sync Output** sockets on the rear panel of a Vicon Lock+ can output synchronization signals that can be used by supported third-party devices, such as reference video cameras. With this functionality, you can synchronize all Vicon Vantage and supported third-party devices in your Vicon Vantage system to the master system frame rate. Some third-party devices do not run at as high a speed as the Vicon optical cameras, so you can specify what fraction or multiple of the master frame rate will be used for connected devices. You can also use these output signals to trigger third-party devices based on Vantage system events.

To activate the synchronization output signals, you must specify a synchronization configuration file (GPO) in your Vicon application software. You will need to know what type of output signal your third-party device expects, so that you can activate the required signal type.

The following topics explain what you need to know to synchronize your external device with the Vicon Vantage system:

▌ System events and synchronization output signals
▌ Synchronization output (GPO) configuration files

System events and synchronization output signals

You can configure a Vicon Lock+ to output a particular synchronization signal for a third-party device connected to one or more of the eight **Sync Output** sockets on the rear of the Vicon Lock+, based on Vantage system events. Vantage system events relevant to GPO are identified in the following table.

System event	Description
Start System	Synchronously start data flow from Vicon hardware devices.
	This Vicon System event can be used to activate the GPO file using the GPO StartEvent **MXDVStart**. For details, see StartEvent section on page 126.
Start Capture	Start capture with the Vantage cameras and any optional third-party devices, such as reference video cameras.
	This Vicon System event can be used to activate the GPO file using the GPO StartEvent **StartCapture**. For details, see StartEvent section on page 126.
Stop Capture	Stop capture with the Vantage cameras and any optional third-party devices, such as reference video cameras.
	This Vicon System event can be used to activate the GPO file using the GPO StopEvent **StopCapture**. For details, see StopEvent section on page 126.
Stop System	Stop data flow from Vicon hardware devices (either to resynchronize or shut down the system).
	This Vicon System event can be used to activate the GPO file using the GPO StopEvent **MXDVStop**. For details, see StopEvent section on page 126.

When one of these system events occurs, the specified General Purpose Output (GPO) configuration file is activated, and the defined synchronization signal is produced (for details, see Synchronization output (GPO) configuration files on page 115). The devices connected to these sockets can then respond to the synchronization signal (for details of the type of signal expected to trigger an action, see the documentation for your device).

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with synchronized output devices

The types of synchronization signal that can be produced are described in the following table.

Signal Type	Description
Duration (event-based)	A single signal that is either on or off. When on, the signal can either stay high or low.
	This signal changes state based on a specified event and then changes state back based on another specified event, independent of frames or times.
Repeating (frame based)	Repetitive signal that can be locked to a frame-based (synchronous) period. This signal uses rectangular waves with a mark-space ratio determined by the settings in the GPO file.
	Frame-based periods will have their edges referenced to frame boundaries with any offsets from these specified in the GPO file.
	The pulse period for frame-based signals can be set as either a multiple or fraction of the frame length and for time-based signals in microseconds or clock ticks.
	This signal type can be used to synchronously align supported devices that respond to a clock pulse.

Synchronization output (GPO) configuration files

A General Purpose Output (GPO) configuration file specifies the characteristics of a synchronization signal to be output from the **Sync Outputs** sockets on the rear panel of the Vicon Lock+.

In your Vicon application software, you specify the GPO configuration file that you want to use:

▊ Supplied GPO file

The GPO files supplied with your Vicon application software specify the relationship of the frame rate of a connected device with that of Vantage cameras. For details, see Supplied synchronization configuration (GPO) files on page 115.

▊ Custom GPO file

You can write a GPO file to specify the type of signal to have the Vicon Lock+ produce when a specified Vantage system event occurs. For details, see Custom synchronization (GPO) files on page 117.

Your connected device can then perform the action it is defined to do on receipt of that type of signal (for details, see the documentation supplied with your device).

For details on specifying a GPO file, see your Vicon software documentation.

Supplied synchronization configuration (GPO) files

Some synchronization configuration files may be supplied with your Vicon application software. For example, the GPO files supplied with Vicon Nexus are used to synchronize the frame rates of connected reference video cameras to the frame rate used by the Vantage system as shown in the following table. For

details on the installation location of these files, see your Vicon Nexus documentation.

Synchronization configuration file	Description
Duration signals	
Duration.gpo	On a StartCapture event, the synchronization output latches high for the duration of the capture. On a StopCapture event, the output latches low.For details, see StartEvent section and StopEvent section on page 126.
	This GPO file is used to synchronize supported third-party devices connected to your Vantage system.
SyncDuration.gpo	On an MXDVStart event the synchronization output latches high until an MXDVStop event is received. For details, see StartEvent section and StopEvent section on page 126.
	This GPO file is for use with ZeroWire Digital devices.
Repeating signals	
DV_Double.gpo	On an MXDVStart event produces two high and two low pulses for each Vicon frame. The pulse period is one-half of a Vicon frame, and the pulse width is one-quarter of a Vicon frame. For details, see StartEvent section on page 126 and PulsePeriod section on page 128.
	This GPO file is used to align reference video cameras with Vantage cameras at twice the Vicon Vantage system frame rate.
DV_Half.gpo	On an MXDVStart event sends a high pulse followed by a low pulse on every other Vicon frame. The pulse period is two Vicon frames, and the pulse width is one Vicon frame. For details, see StartEvent section on page 126 and PulsePeriod section on page 128.
	This GPO file is used to align reference video cameras with Vantage cameras at half the Vicon Vantage system frame rate.

VICON | Vicon Vantage Reference

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Extend a Vicon Vantage system with synchronized output devices

Synchronization configuration file	Description
DV_Normal.gpo	On an MXDVStart event sends a high pulse followed by a low pulse within every Vicon frame. The pulse period is one Vicon frame, and the pulse width is one-half of a Vicon frame. For details, see StartEvent section on page 126 and PulsePeriod section on page 128.
	This GPO file is used to synchronize reference video cameras to the Vicon Vantage system at the same frequency as the Vantage cameras.
DV_Quarter.gpo	On an MXDVStart event sends a high pulse followed by a low pulse on every fourth Vicon Vantage system frame. The pulse period is four Vicon frames, and the pulse width is two Vicon frames. For details, see StartEvent section on page 126 and PulsePeriod section on page 128.
	This GPO file is used to align reference video cameras with Vantage cameras at one-quarter of the Vicon Vantage system frame rate.

Custom synchronization (GPO) files

You can write your own GPO file to specify the type of synchronization signal to be output from the **Sync Output** sockets for a specified Vantage system event.

The following sections illustrate the two types of synchronization signals that can be output and show how you can specify each in a GPO file:

▎ Custom GPO file for a fixed duration synchronization signal

▎ Custom GPO file for a repeating synchronization signal

The examples use wave form diagrams to illustrate the signal characteristics and provide cross-references to the relevant GPO file syntax sections.

Custom GPO file for a fixed duration synchronization signal

The following diagram illustrates the characteristics of a fixed duration synchronization signal and a custom GPO file that would generate this signal.

Note that timing offsets are taken from the frame boundaries (indicated by green④ and red⑦ lines) and are measured in 27MHz increments (ticks).
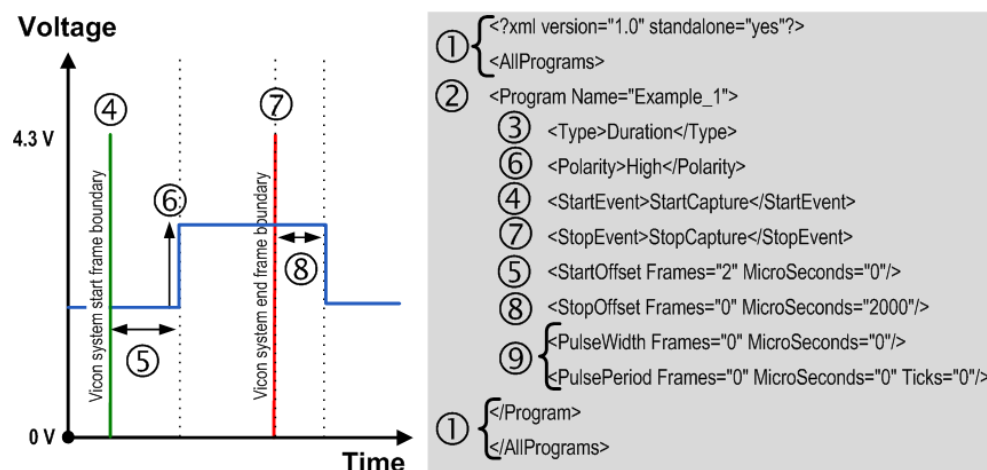
where:

1   are lines of code required to maintain full XML conformity for starting and ending a program. For details, see XML header and AllPrograms section on page 123.

2   are lines of code required to maintain full XML conformity. Note that Vicon software uses the GPO filename rather this program name. In this example, the Program Name is Example_1. For details, see Program Name section on page 124.

3   specifies the type of synchronization signal the GPO is to produce. In this example, it is a signal with a defined start and stop rather than a repeating signal. For details, see Type section on page 124.

4   is the system event that has been defined to start the GPO program.In this example, it sets the signal to be active referenced to the start of capture. For details, StartEvent section on page 126.

5   is the amount of time to wait after the start event has occurred before sending the signal to its specified polarity. In this example, it sets the delay of signal activation to two frames after the start of capture. For details, see StartOffset section on page 127.

6   is the direction the synchronization signal moves when started. In this example, it sets the signal to start low, go high on activation, and then reset low on completion. For details, see Polarity section on page 125.

7   is the event that has been defined to end the GPO program. In this example, it sets the signal to stop being active referenced to the end of capture. For details, see StopEvent section on page 126.

8   is the stop offset to be applied in the GPO file. In this example, it resets the signal 2 milliseconds (2000 microseconds) after the end of capture. For details, see StopOffset section on page 127.

9   are the length and frequency of the signal to be produced. In this example, they are set to 0 (zero) as they are not required for duration signals. For details, see PulseWidth section and PulsePeriod section on page 128.

Custom GPO file for a repeating synchronization signal

The following diagram illustrates a custom GPO file that sends a repetitive signal from the time the system becomes synchronized after boot up. The signal is not locked to the video frame rate but to time and is, therefore, described as asynchronous. For examples of synchronous signals refer to the supplied GPO files (DV_*.gpo). For details, see Supplied synchronization configuration (GPO) files on page 115.

The repeating synchronization signal GPO file described here will be active until the system reboots or is resynchronized. After resynchronization, the GPO will restart in the same way it does after system boot.

Note that timing offsets are taken from the frame boundaries (indicated by green④ and red⑦ lines) and are measured in 27MHz increments (ticks).
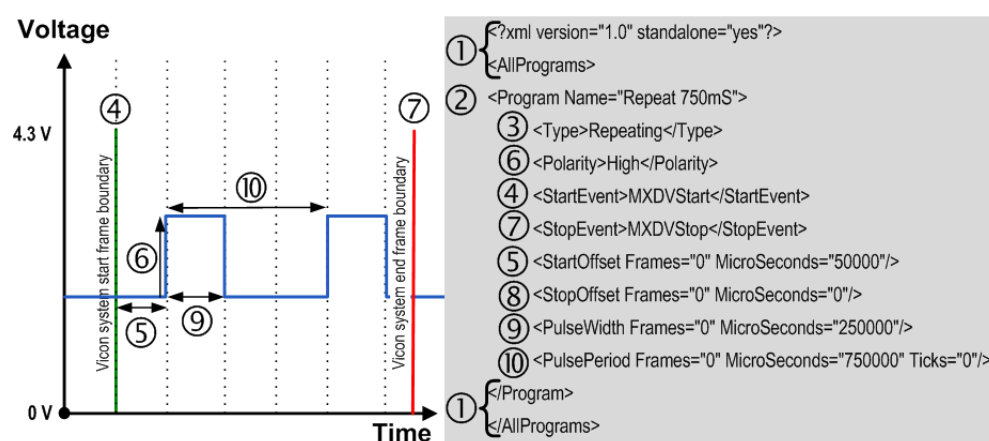
where:

1   are lines of code required to maintain full XML conformity for starting and ending a program. For details, see XML header and AllPrograms section on page 123.

2   are lines of code required to maintain full XML conformity. Note that Vicon software uses the GPO filename rather this program name. In this example, the Program Name is Repeat 750mS. For details, see Program Name section on page 124.

3   specifies the type of synchronization signal the GPO is to produce. In this example, it is a repeating signal that will be active as long as the system is running and is not booting up, resynchronizing, or shutting down, rather than a duration signal. For details, see Type section on page 124.

4   is the system event based on which you want to start the GPO program. In this example, the signal is set to start as soon as the system has finished synchronizing after it has booted up. For details, StartEvent section on page 126.

5   is the amount of time to wait after the start event has occurred before sending the signal to its specified polarity. In this example, it sets the delay of signal activation to 50 milliseconds (50000 microseconds) after the start event. For details, see StartOffset section on page 127.

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with synchronized output devices

6   is the direction the synchronization signal moves when started. In this example, it sets it to start low and go high when active. For details, see Polarity section on page 125.

7   is the event that has been defined to end the GPO program. In this example, it is set to the system suspending dataflow pending either a resynchronization being performed or the software shutting down. For details, see StopEvent section on page 126.

8   is the stop offset to be applied in the GPO file. In this example, it sets the stop offset to zero. For details, see StopOffset section on page 127.

9   is the width of the active part of the signal. In this example, it sets it to 0.25 seconds (250000 microseconds). For details, see PulseWidth section on page 128.

10   is the period between two pulse signals. In this example, it sets the cycle period of the signal to 0.75 seconds (750000 microseconds). The ratio of 0.75 to 0.25 means that the rectangular waveform produced will have a 3:1 (33 1/3%) mark-space ratio. Also by defining the cycle period in terms of seconds instead of frames, the signal is asynchronous with respect to the system frequency. For details, see PulsePeriod section on page 128.

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with synchronized output devices

Synchronization configuration (GPO) file format

General Purpose Output (GPO) configuration files are written in eXtensible Markup Language (XML) file format. These XML files are used to store structured information and to enclose or encapsulate information so that it can be passed between different computing systems. As in any XML file, GPO file sections are delimited with start and end section tags, and subsections are nested beneath main sections to reflect their hierarchical relationship, for example:

```
<XML header>
<SectionStart>
<SubsectionStart ATTRIBUTE="value">
    <Keyword>Value</Keyword>
    <Keyword ATTRIBUTE="value"/>
</SubsectionEnd>
</SectionEnd>
```

The GPO file can be viewed in most Web browsers or standard text editors like any other XML file. You may find it helpful to view the examples in Custom synchronization (GPO) files on page 117 or one of the sample GPO files provided with your Vicon application software while you read this description of the general format and content of a GPO file. You are assumed to have a basic understanding of the use and presentation of XML files.

Synchronization configuration (GPO) file structure

The full structure of a GPO file is outlined below:

```
<?xml version="1.0" standalone="yes"?>
<AllPrograms>
<Program Name="gpo_name">
    <Type>signal_type</Type>
    <Polarity>signal_direction</Polarity>
    <StartEvent>gpo_start</StartEvent>
    <StopEvent>gpo_stop</StopEvent>
    <StartOffset Frames="" MicroSeconds=""/>
    <StopOffset Frames="" MicroSeconds=""/>
    <PulseWidth Frames="" MicroSeconds=""/>
    <PulsePeriod Frames="" MicroSeconds="" Ticks=""/>
</Program>
</AllPrograms>
```

XML header

The header `<?xml version="1.0" standalone="yes"?>` is essential for the file to be recognized as XML format by Vicon applications and other XML file viewing packages. You must include this section at the top of your GPO file.

AllPrograms section

The program start and end section tags `<AllPrograms>` and `</AllPrograms>` delimit the details of the synchronization signal to be sent. You must include the start section immediately after the XML header and the end section at the end of your GPO file.

Each option in a given section within the `<AllPrograms>` section consists of a keyword and a single value or one or more `ATTRIBUTE="value"` pairs, which are written in the following ways in an XML file:

```
<Keyword>value</Keyword>
<Keyword ATTRIBUTE="value"/>
```

The `Keyword` identifies the element with which the Vicon application is to be concerned, the `ATTRIBUTE` is a characteristic of the specified keyword, and the `value` is the actual data that the Vicon application is to use. For most options, you must specify the value required for your specific implementation of the GPO file. To help you understand how to construct these definitions in your GPO file, when giving the syntax for a section, the following information includes the `Keyword` and any `ATTRIBUTE` words, and describes the type of data you must supply for the `value`.

Program Name section

The syntax for the Program Name section is:

```
<Program Name="gpo_name">
```

where:

`gpo_name`	is the name for your GPO program.

> **Tip**
> The base of the GPO file name is used as the program display name in your Vicon application software. Therefore, Vicon recommends that you use the file name base as the GPO program name. For example, the sample GPO program **Duration.gpo**, has the display name `Duration` in the Vicon application software.

Type section

The syntax for the Type section is:

```
<Type>signal_type</Type>
```

where:

`signal-type`	specifies the type of synchronization signal the Vicon Lock+ is to produce, one of:

`Duration`	A single signal that lasts from a given start event until a given stop event.
`Repeating`	A repetitive pulse signal that begins on a given start event and ends on a given stop event.
`Start`	A type of duration signal that occurs on a given start event; no signal occurs on a given stop event.
`StartStop`	A type of duration signal that occurs on a given start event and then again on a given stop event.
`Stop`	A type of duration signal that occurs on a given stop event; no signal occurs on a start event.

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with synchronized output devices

Polarity section

The syntax for the Polarity section is:

```
<Polarity>signal_direction</Polarity>
```

where:

`signal_direction`	specifies the direction the synchronization signal is to start and then move when the GPO file is activated:	
	`High`	Starts low (0 V) and moves high (5 V).
		For a duration signal type, the signal latches high until the start event occurs, whereupon the signal starts with a positive-going edge. When the stop event occurs, the signal is latched low. For details, see StartEvent section and StopEvent section on page 126.
		For a repeating signal type, the signal starts its repetitive cycle in this direction.
	`Low`	Starts high (5 V) and moves low (0 V).
		For a duration signal type, the signal latches low until the start event occurs, when the signal starts with a negative-going edge. When the stop event occurs, the signal is latched low. For details, see StartEvent section and StopEvent section on page 126.
		For a repeating signal type, the signal starts its repetitive cycle in this direction.

VICON | Vicon Vantage Reference

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

StartEvent section

The syntax for the StartEvent section is:

`<StartEvent>gpo_start</StartEvent>`

where:

`gpo_start`	specifies the Vantage system event that activates the GPO file:

`StartCapture`   The Start Capture event.

`MXDVStart`   The Start System event.

For details of these events, see System events and synchronization output signals on page 113.

Important

The `StartCapture` event type does not synchronize reference video cameras or the ZeroWire EMG system. Use the `MXDVStart` event to synchronize such external devices.

StopEvent section

The syntax for this StopEvent section is:

`<StopEvent>gpo_stop</StopEvent>`

where:

`gpo_stop`	specifies the Vantage system event that stops the GPO file:

`StopCapture`   The Stop Capture event.

`MXDVStop`   The Stop System event

For details of these events, see System events and synchronization output signals on page 113.

StartOffset section

The syntax for the StartOffset section is:

```
<StartOffset Frames="" MicroSeconds=""/>
```

where:

StartOffset   specifies how long to wait after the start event (see StartEvent section on page 126) has occurred before sending the signal to its desired polarity:

     Frames   A specified number of frames.

     MicroSeconds   A specified number of microseconds

Important

If you specify both Frames and MicroSeconds, the two values are added together to determine the offset. The maximum time-based offset you can define is 65 milliseconds (16 bits times microseconds). Frame-based offsets are unlimited.

StopOffset section

The syntax for the StopOffset section is:

```
<StopOffset Frames="" MicroSeconds=""/>
```

where:

StopOffset   specifies how long to wait after the stop event (see StopEvent section on page 126) has occurred before sending the signal to its desired polarity:

     Frames   A specified number of frames

     MicroSeconds   A specified number of microseconds.

Important

If you specify both Frames and MicroSeconds, the two values are added together to determine the offset. The maximum time-based offset you can define is 65 milliseconds (16 bits times microseconds). Frame-based offsets are unlimited.

PulseWidth section

The syntax for the PulseWidth section is:

```
<PulseWidth Frames="" MicroSeconds=""/>
```

where:

PulseWidth   specifies the fixed duration of the pulse for a repeating synchronization signal as either one or the sum of both the following:

Frames   The number of frames the pulse signal is to last.

MicroSeconds   The number of microseconds the pulse signal is to last.

Important

If you specify both `Frames` and `MicroSeconds`, the two values are added together to determine the pulse width; however, you are recommended to use either `Frames` and `MicroSeconds` rather than adding these values.

PulsePeriod section

The syntax for the PulsePeriod section is:

```
<PulsePeriod Frames="" MicroSeconds="" Ticks=""/>
```

where:

PulsePeriod   specifies the total period of the pulse for a repeating synchronization signal, that is, the time from one rising edge to the next rising edge, as either one or the sum of two or more of the following values converted to 27 Mhz:

Frames   The number of frames after which the pulse is to be repeated.

MicroSeconds   The number of microseconds after which the pulse is to be repeated.

Extend a Vicon Vantage system with synchronized output devices

| `Ticks`	The number of 27 Mhz clock ticks of the Vantage timing reference after which the pulse is to be repeated.

Important

If you specify `Frames`, `MicroSeconds`, and `Ticks`, all values are added together to determine the offset; however, you are recommended to add either `MicroSeconds` or `Ticks` to frames rather than adding all three values.

Include a synchronized device

You can include supported third-party devices whose operation is to be synchronized with your Vicon Vantage system, such as reference video cameras.

To include third-party synchronized devices in a Vantage system:

1. Plug one end of your synchronized device cable into one of the Sync Output sockets on the rear of a Vicon Lock+.
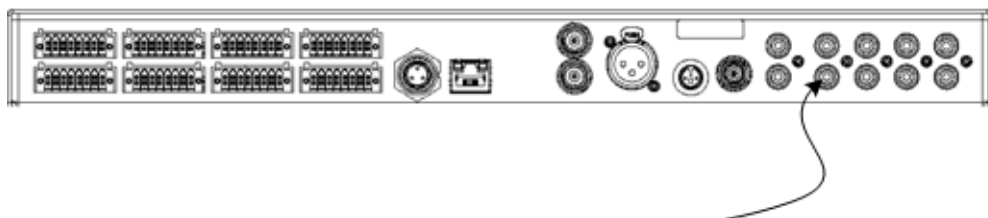
2. Plug the other end of the cable into the appropriate socket in your synchronized device.

3. To manage the synchronization of your external devices, or to trigger your external devices based on Vantage system events, identify an appropriate GPO configuration file supplied with your Vicon application software, or create a GPO file of your own. For details on these, see Supplied synchronization configuration (GPO) files on page 115 and Custom synchronization (GPO) files on page 117.

4. In the Vicon application software, specify this GPO configuration file for your external device. For details on doing this, see your Vicon software documentation.

For details on these connectors, see Lock+ rear panel connectors on page 53. For details on the synchronized device cable, see Extended Vicon Vantage system cables on page 67.

Extend a Vicon Vantage system with remote triggering devices

The following topics explain how to connect external devices to a Vicon Lock+ to remotely trigger capture by your Vicon Vantage system.

▍ Understand remote functionality
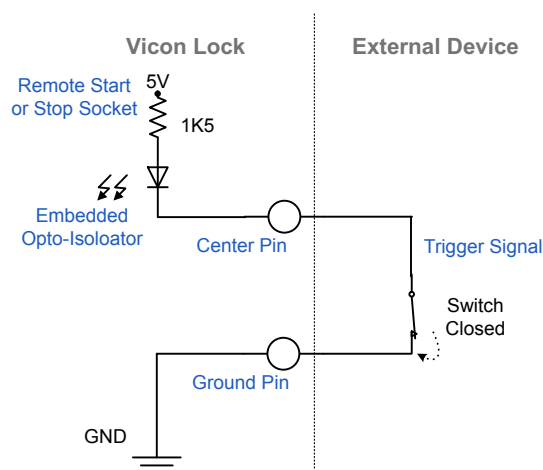
▍ Include a remote triggering device

Understand remote functionality

You can remotely trigger the Vicon Vantage system to capture data based on input signals that a Vicon Lock+ receives from a supported third-party device that is connected to the **Remote Start** or **Stop** sockets.

Before you can remotely start or stop your Vantage system, you must first arm it for capture and activate the start/stop functionality in your Vicon application software. For details, see your Vicon application software documentation.

You must create your own cable to plug into the **Remote Start** or **Stop** sockets in the rear of a Vicon Lock+, using RCA plugs. To activate the start or stop trigger, you must force the pin to the outer GND (that is, short circuit it) in the **Remote Start** or **Stop** socket. You can do this with a relay that you can connect to a photosensor, or wire to a foot pressure switch.

The following diagram illustrates how this relay would force the center pin to GND to send an input signal to the Vicon Lock+ to start or stop the capture. As illustrated, the Remote Start and Stop functions can be activated either by plugging in a standard TTL gate-to-ground signal or by using a simple mechanical switch, normally open, wired across the pin and ground of the RCA plug.

The following table shows the TTL settings to which your external switch must pull the **Remote Start** or **Stop** input pins in order to trigger the remote capture.

Input Signal		Trigger Action
Remote Start	Remote Stop	
High	High	Signal held high until the pin in pulled to GND. This is also the default system setting when no device is connected.
Low	High	Remote Start pin is pulled to GND and capture starts at next video frame.
High	Low	Remote Stop pin is pulled to GND and capture stops at the next video frame.
Low	Low	Undefined (do not use).

For details on the circuitry involved and electrical specifications for the connector, contact Vicon Support (for details, see Contact Vicon on page 208).

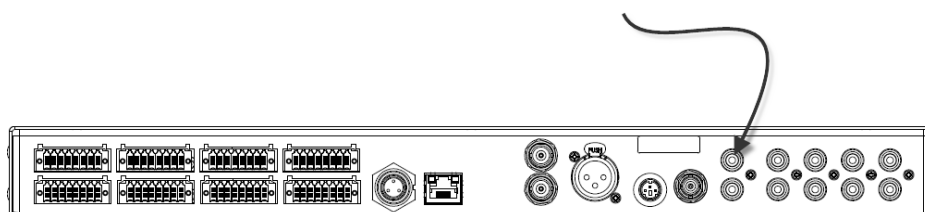# Include a remote triggering device

You can include supported third-party devices to trigger your Vicon Vantage system to start capture, stop capture, or both. You can also have the Vicon Lock+ trigger the external device. You must obtain your own cable to plug into the **Remote Start** or **Stop** connectors on the rear of the Lock+ and into your remote triggering device (for details, see Understand remote functionality on page 132).

Tip

You can configure in your Vicon application software a buffer to capture for a specified amount of time before the start is triggered (for details, see your software documentation). The data from that buffer is added to your raw data (X2D) file.
You can also configure the software to stop capture after a specified duration, rather than using a remote stop trigger.

To include remote triggering devices in a Vantage system:

1. For a device to remotely trigger capture to start, plug your device cable into the **Remote Control Input Start** connector on the rear of a Vicon Lock+.

2. For a device to remotely trigger capture to stop, plug your device cable into the **Remote Control Input Stop** input connector on the rear of a Vicon Lock+.
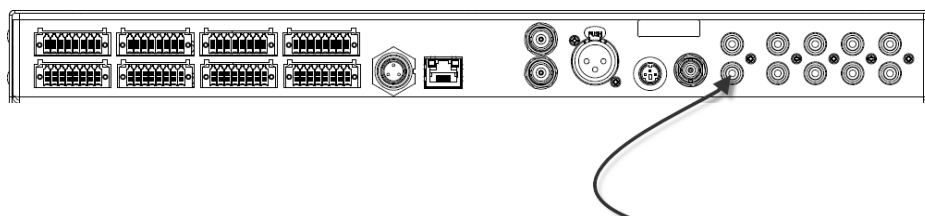
3. Plug the other end of your device cable into your remote triggering device.

For details on these connectors, see Lock+ rear panel connectors on page 53.

Extend a Vicon Vantage system with genlock/timecode devices

The following topics describe how to connect external EBU/SMPTE SD and HD analog video sources for genlocking to your Vicon Vantage system, with or without associated timecode.

▍ Understand Vicon Vantage genlock functionality

▍ Understand Vicon Vantage timecode functionality

▍ Include a genlock and/or timecode device

Understand Vicon Vantage genlock functionality

This topic describes genlock functionality provided by a Vicon Vantage system when you connect external video sources to a Vicon Lock+.

From the Vicon application software on the Vicon Vantage host PC, you can configure the Vicon Lock+ to genlock to an external PAL, SECAM, NTSC, or HD video source that is connected to one of the **Ref Loop** sockets. Genlock synchronizes the Lock+ and hence the Vantage cameras to the frame rate of the incoming video signal.

This also allows uplocking (running at a higher multiple of frame rate) from lower-speed broadcast cameras to Vicon's higher-speed motion capture cameras, where necessary.

The genlock source controls the master timing of Lock+ and the frame rate. The number of lines per frame has no significance other than locking the clock. You can enable genlock functionality in your Vicon application software.

If no external video source is connected, the primary Lock+ unit still provides master synchronization by 'free running'.

You can also synchronize VESA Stereo sources. For more information, see Extend a Vicon Vantage system with VESA Stereo on page 143.

Note
Genlock can be used without timecode.

Caution
Video from a non time-base corrected source may cause high levels of jitter, which prevents reliable synchronization.

The signal quality and hence Lock+ performance is affected if the loop is not correctly terminated. If the Vicon Lock+ is the only device or the last device in the chain, a 75 Ω (ohm) terminator must be attached to the other Ref loop video BNC connector.

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with genlock/timecode devices

Understand Vicon Vantage timecode functionality

This topic describes the timecode functionality that is available when you connect external video sources to a Vicon Lock+.

Timecode is a time stamp that can be present in video or audio signals to provide timing information (i.e. time and frame number reference). Within a 24-hour period, each frame has its own unique timecode. You can configure the Vicon Lock+ to trigger from a connected video source containing embedded VITC (Vertical Interval Timecode) or a video source in conjunction with LTC (Longitudinal Timecode). You do this using the Vicon application software on the Vicon Vantage host PC.

The following table shows the international SD and HD video formats supported by Vicon Vantage systems.

Format	Description	Variant supported
EBU (European Broadcasting Union): Based on cameras operating at a multiple of 25 Hz. In Vicon documentation, the term EBU is used interchangeably with the following terms:		
PAL (Phase Alternating Line)	The color standard used in Europe, except France.	PAL 50 2:1 (Interlaced)
SECAM (Sequential Couleur avec Mémoire)	The color standard used in France, the Middle East, and most of Eastern Europe.	SECAM 50 2:1 (Interlaced)
CCIR (Consultative Committee for International Radio)	The black and white standard.	2:1 (interlaced)
SMPTE (Society of Motion Picture & Television Engineers): Based on cameras operating at a multiple of 29.97 Hz. In Vicon documentation, the term SMPTE is used interchangeably with the following terms:		
NTSC (National Television System Committee)	The color standard used in the United States.	NTSC 59.94 2:1 (Interlaced)
EIA (Electronic Industry Association)	The black and white standard.	2:1 (interlaced)

Format	Description	Variant supported
HD (High Definition film): Based on cameras operating at a multiple of 24 fps, 23.98 fps, or 30 fps.		
24 fps	Cameras operating at a multiple of 24 fps	1920 x 1080 24 1:1 (Progressive)
23.98 fps	Cameras operating at a multiple of 23.98 fps	1920 x 1080 23.98 1:1 (Progressive)
30 fps	Cameras operating at a multiple of 30 fps	1920 x 1080 30 1:1 (Progressive)

Vicon Lock+ does not use any color sub-carrier if present. For each of the EBU and SMPTE formats, Vicon Lock+ supports the use of both LTC and VITC forms of timecode:

▮ LTC signal characteristics are compatible with standard audio channels so that they can be recorded onto audio tracks or to an audio track on video. Lock+ units are intended to be used with industry-standard balanced signals which are terminated in 600 Ω (ohm). LTC frame rates supported are 30, 29.97, 25, 24 and 23.98 fps.

▮ VITC is encoded directly into spare lines in the vertical interval of the analog SD video signal.

For the analog HD formats, which inherently do not support VITC, LTC timecode must be used in conjunction with the synchronized genlock source.

The Vicon Lock+ can take the timecode from a LTC source connected to the LTC In socket, and timestamp the associated synchronized video signal connected to the Ref Loop Input. It can also take the timecode from a Ref Loop Input itself, if it has embedded VITC, which may be the case with SD analog video. You can select the timecode source in your Vicon application software.

Within a 24-hour period, each video frame has an associated timecode which is encoded in hours, minutes, and seconds, along with a sequential frame number.

Standard timecode format is:

```
hh:mm:ss:ff
```

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with genlock/timecode devices

where:

hh	=	hours	00–23
mm	=	minutes	00–59
ss	=	seconds	00–59
ff	=	frames	00–23 for HD (FILM)
			00–24 for EBU (PAL/SECAM)
			00–29 for SMPTE (NTSC) and HD (30)

For NTSC, the separator character changes between a colon (:) for non-drop frames and a semicolon (;) for drop frames.

The Vicon Vantage system reads the sequential timecode from the selected timecode source and subsequently timestamps the Vicon raw (X2D) data, along with any reference Bonita video, with that of the external timecode. This can then be used to locate a precise reference point for editing your data.

Timecode triggering

From the Vicon application software on the Vicon Vantage host PC, you can configure Timecode triggering to automatically cause the Vicon Lock+ to start and/or stop data capture based on the timecode.

You can set the data capture start time to the required timecode and trigger the capture process to that particular timecode number. Vicon Lock+ then starts the capture when the specified timecode is reached.

About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources

Extend a Vicon Vantage system with genlock/timecode devices

Include a genlock and/or timecode device

You can include in your Vicon Vantage system supported third-party external video devices that provide HD- and SD-compliant genlock and timecode to an external PAL, SECAM, NTSC, or HD video standard.

For information on genlock and timecode support, see Understand Vicon Vantage genlock functionality on page 136 and Understand Vicon Vantage timecode functionality on page 137.

You can include such devices to synchronize your Vicon Vantage system using genlock (a third-party device acts as the master video-timing generator).

If no external video sources are connected (including a VESA Stereo source), Vicon Lock+ acts as the synchronization master for the Vicon Vantage system by controlling its own reference clock. For details on genlock support, see Understand Vicon Vantage genlock functionality on page 136.

To timestamp your Vantage system with external timecode, you must have a genlock device connected to the system. You can use a single genlock/timecode video source with its embedded VITC, or a synchronized video source with an associated LTC source. You will need specialist cables to connect these third-party devices to the Vicon Lock+. For details, see Vicon Vantage system cable descriptions on page 65.

The connections you use depend on whether you are using a separate timecode device:

▍   Connect a genlock source with embedded VITC timecode

▍   Connect a genlock source with a separate LTC timecode

For details on Vicon Lock+ connectors, see Lock+ rear panel connectors on page 53. For details on genlock and timecode cables, see Vicon Vantage system cable descriptions on page 65. For details on connectors on your genlock/timecode device, see the documentation supplied by the device manufacturer.

About this
manual

Hardware
reference

Advanced
usage

Technical
specifications

Regulatory
information

Further
resources

Connect a genlock source with embedded VITC timecode

The following steps describe how to connect a genlock source with embedded VITC to your Vicon Vantage system.

To include a genlock source with embedded VITC timecode:

1. Plug the end of your video cable from your external video source with its embedded VITC signal into one of the two Video Reference Input BNC sockets.
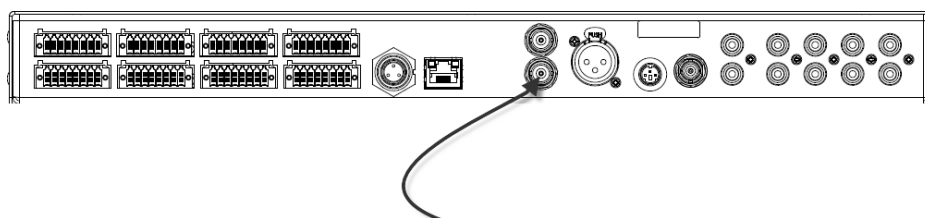

2. Depending on whether the Vicon Lock+ is the terminal device or not, connect the other BNC connector appropriately:

  ▍ If a Vicon Lock+ is the only or end device in the chain, place a 75 Ω (ohm) terminator on the other BNC connector.

  ▍ If a Lock+ is mid-chain, connect the other BNC connector to the next device.

Important

Always makes sure the chain is ultimately terminated in 75 Ω (ohm).

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with genlock/timecode devices

Connect a genlock source with a separate LTC timecode

The following steps explain how to connect a genlock source with a separate LTC timecode to your Vicon Vantage system.

To include a genlock source with a separate LTC timecode:

1. Plug the end of your video cable from your external video source into one of the two Video Reference Input BNC sockets.
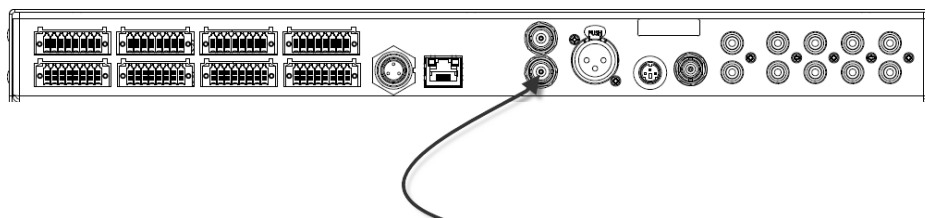
2. Depending on whether the Vicon Lock+ is the terminal device or not, connect the other BNC connector appropriately:

    ▌ If a Vicon Lock+ is the only or end device in the chain, place a 75 Ω (ohm) terminator on the other BNC connector.

    ▌ If a Lock+ is mid-chain, connect the other BNC connector to the next device.

    #### Important
    Always makes sure the chain is ultimately terminated in 75 Ω (ohm).

3. Plug the male LTC XLR connector from your external timecode device into the LTC In.
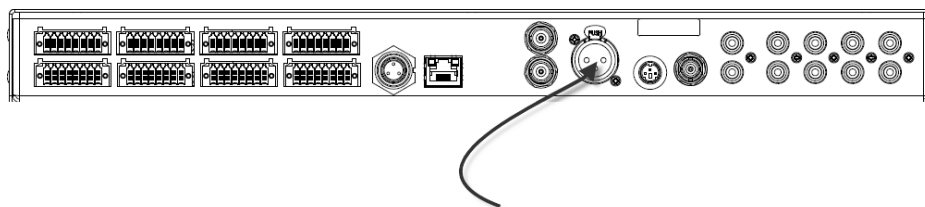
Extend a Vicon Vantage system with VESA Stereo

The following topics describe how to connect an external VESA Stereo source for genlocking to and/or syncing an external VESA Stereo device.

▍ Understand VESA Stereo

▍ Include a VESA Stereo source to genlock

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Extend a Vicon Vantage system with VESA Stereo

Understand VESA Stereo

VESA Stereo is a way to synchronize displays with stereoscopic 3D glasses for visualization systems. For certain types of stereoscopic glasses, particularly those that synchronize using IR light, it is important to match the timing of the Vicon system to the 3D signal using the VESA Stereo In on the Lock+.

Note ────────────────────────────────

Vicon Blade 3.2, Vicon Nexus 2.2, Vicon Tracker 3.1 and later versions support this interface.

LCD shuttered glasses are used to view the stereo monitor with the aid of the VESA Stereo signal. This signal allows the image to be displayed in one eye while blanking the other eye on one frame. The selection is then reversed on the next frame. One combination is allowed when the signal is low and the other when high. This 'tricks' the brain into combining the two images from slightly different perspective points into one 3D image.

Vicon Lock+ can genlock to this VESA Stereo signal, thus synchronizing the system. The VESA Stereo signal runs at half the frame rate of the monitor being used to view the image. Therefore a 60 fps VESA Stereo square wave allows 60 left-hand and 60 right-hand images per second and consequently genlocks the Lock+ system to 120 fps. The Vicon Vantage camera can run at this fundamental frame rate or at higher harmonics such as 240 fps.

Lock+ can synchronize to the fundamental frame rates of 50 and 60 fps and is controlled by the Vicon application software.

Include a VESA Stereo source to genlock

Connect the VESA Stereo signal from a video source, such as a graphics card, which supports this feature, to the VESA Stereo In connector.
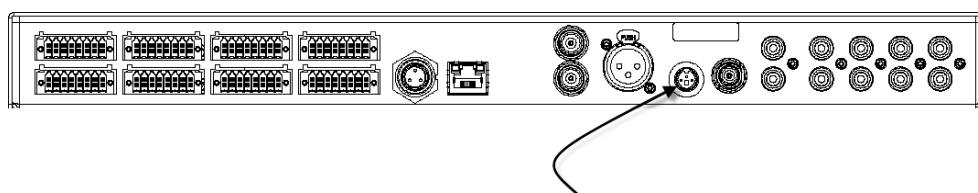
Using the VESA Stereo signal to genlock the Vicon Vantage system offers benefits such as enabling you to eliminate optical interference between illuminating sources, for example, Vicon camera strobes and third-party devices within the system.

You can use your Vicon application software to phase-shift the time when the camera strobes turn on for each frame, with respect to the incoming VESA Stereo signal. This enables the strobe to be turned on at a different time from that of other potentially interfering sources. For example, you could offset the synchronizing pulse used by IR LCD shuttered glasses, or the Vicon Apex hand-tracking tool. For information on how to do this, search for **VESA Offset** in the online help of your Vicon application software.

The Vicon Apex uses photodiodes to synchronize its own LEDs to those of the camera strobes. Systems that are free-running (not genlocked, as described above) have inherent problems with the interfering signal from the IR LCD shuttered glasses' sync illumination. This requires the Apex device to be set to Continuous illumination mode, which results in shorter battery life and dimmer illumination, with a shorter viewing distance.

If you genlock the system, you can set the Apex device to Strobe mode, enabling it to operate with a greater viewing distance.

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Extend a Vicon Vantage system with VESA Stereo

Integrate MX T-Series components into a Vicon Vantage system

The following topics explain how to integrate components of Vicon MX T-Series systems into your Vicon Vantage system.

For more information, see:

▍ Understand integrated Vicon Vantage systems

▍ Integrate an MX T-Series system without Vicon Lock+

▍ Integrate an MX T-Series system with Vicon Lock+

Understand integrated Vicon Vantage systems

If you are integrating components from a Vicon MX T-Series system into a Vicon Vantage system, it is assumed that your MX T-Series cameras are already set up and connected to MX Giganet unit(s). It also assumed that you have already set up your Vantage cameras and PoE+, as described in Put together a simple Vicon Vantage system on page 85 or Extend a Vicon Vantage system with more Vantage cameras, Vicon Lock+, and Bonita Video cameras on page 95.

The way in which the MX T-Series system is connected to the Vantage system depends upon whether you are adding a Vicon Lock+ unit with your Vantage cameras:

▎ If you are adding only Vantage cameras, the existing T-Series system stays intact and the additional Vantage cameras and associated PoE+ switches are added in the same way as if you were adding more Giganets to the system. For more information, see Integrate an MX T-Series system without Vicon Lock+ on page 149.

▎ If you are also adding a Lock+ unit, you must make the changes described in Integrate an MX T-Series system with Vicon Lock+ on page 150.

Important
When the integrated system requires a Lock+ unit, you may need to transfer any broadcast video reference signal and any associated LTC-In signal from the primary Giganet to the Lock+.

Integrate an MX T-Series system without Vicon Lock+

The following information describes how to integrate an MX Giganet unit into a Vicon Vantage system.

To integrate a T-Series system into a Vicon Vantage system without a Lock+:

▸ Connect one port of the primary PoE+ switch in the Vantage system into one of the Ethernet ports of the primary Giganet.

In the following diagram, the primary PoE+ switch is connected to a Gigabit Ethernet port on the master Giganet.

Vicon MX T-Series system

Vicon MX T-Series or Bonita Optical cameras (up to 10 per Giganet)

Camera cable (1 per camera)

Master Giganet (master set in Nexus)

Optical data (Ethernet)

Network card

Secondary Giganet for up to 10 additional Vicon MX T-Series or Bonita Optical cameras

Vicon proprietary 10-pin RJ-45 cable

Vicon Vantage system

Primary PoE+

Ethernet cable (1 per camera)

= Ports that may be used to connect Vicon Vantage cameras. You can connect up to:
3 cameras to ports 1-4
3 cameras to ports 5-8
3 cameras to ports 9-12
3 cameras to ports 13-16

Vantage cameras (Up to 12 on primary PoE+)

VICON | Vicon
Vantage
Reference

About this manual	Hardware reference	**Advanced usage**	Technical specifications	Regulatory information	Further resources

Integrate MX T-Series components into a Vicon Vantage system

The primary Giganet is the sync master and hence outputs the Vicon sync data (Ethernet sync and time stamping).

Data flows from the cameras, through their respective Giganets, through the primary Giganet to the host PC.

The Vicon sync packets travel in the opposite direction, with only accompanying light control data. This causes known deterministic switcher delay without jitter and possible packet loss. The Vantage PoE+ switch acts as a Giganet in this respect too.

Integrate an MX T-Series system with Vicon Lock+

If you want to add VESA Stereo synchronization functionality to an MX T-Series system, you must add a Vicon Lock+ unit. You can also add further Vicon Vantage cameras at the same time.

In mixed systems of this type, the Lock+ unit is automatically made sync master by the Vicon software. In this case, both analog data and Vicon sync travel in the same direction initially. This is not problematic as Lock+ implicitly manages the analog data transfer and Vicon sync data. Because Lock+ controls the system timing, it knows when it must transmit the sync packet and therefore when there is time to transmit the analog data outside of this period.

The Vantage Link to Giganet Link connection (shown in blue in the following diagram) is necessary to maintain correct Giganet synchronization to Lock+.

Giganets and Lock+ units do not use Vicon sync packets for synchronization. All Link ports use a Vicon proprietary signal for synchronization.

Vicon MX T-Series system

Vicon MX T-Series or Bonita Optical cameras (up to 10 per Giganet)

Camera cable (1 per camera)

Master Giganet

Secondary Giganet for up to 10 additional Vicon MX T-Series or Bonita Optical cameras

Vicon 10-pin RJ-45 cable

Optical data (Ethernet)

Vicon Vantage system

Vicon Lock+

Primary PoE+

Third-party devices (up to 64 channels)

Ethernet cable (1 per camera)

Vantage cameras (Up to 12 on primary PoE+)

Network card

= Ports that may be used to connect Vicon Vantage cameras. You can connect up to:
3 cameras to ports 1-4
3 cameras to ports 5-8
3 cameras to ports 9-12
3 cameras to ports 13-16

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Focus a Vicon Vantage camera lens

The following topics explain how to focus a Vicon Vantage camera lens.

▐ Understand lens focus methods

▐ Adjust camera lens focus with front focus ring

▐ Check camera lens focus

Understand lens focus methods

Vicon Vantage cameras are in focus when the images of markers seen by the camera at a distance representative of the capture distance (that is, the distance between subject and camera) are clear and sharp. The degree of focus of the lens on a Vantage camera can be controlled by altering two characteristics of the lens:

▍ Front (or forward) focus

This is set by adjusting the focus ring at the front of the lens. This type of adjustment is typically made when initially configuring and subsequently checking your cameras for capture.

This procedure is described in Adjust camera lens focus with front focus ring on page 155.

▍ Back focus

This is set by adjusting the position of the entire lens closer to or further away from the camera sensor along the axis of the lens. This sets the distance between the rear lens element and the sensor. This type of adjustment is required only to ensure that the lens focus ring matches what is actually in focus. Vicon makes this adjustment when initially setting the camera up.

Caution
As back focusing is a delicate operation, it must be performed by qualified and experienced persons only. For this reason, if you require a change in the back focus of your cameras, please contact Vicon Support.

You can see the results in real time while you are focusing the camera by viewing the marker images in your Vicon application software. For example, in Nexus and Tracker, you can view the camera data in a **Camera** view pane; in Blade, you can view it in a **Capture** workspace.

Adjust camera lens focus with front focus ring

You can sharpen the camera lens focus by adjusting the focus ring at the front of the lens.

You can see the results while you are focusing the camera by viewing the marker images in your Vicon application software. For example, in Blade, you can view the camera data in a **Capture** workspace. In Nexus and Tracker, you can view the camera data in a **Camera** view pane. The following procedure briefly describes how to view the live camera data in your Vicon application software. For full details of the software steps, see the documentation for your Vicon application software.

To adjust camera lens focus with the front focus ring:

1. Mount the camera on a tripod within reach of the Vicon Vantage host PC on which the Vicon application software is installed.

2. Ensure that you can view the camera data from the Vicon application software on the Vicon Vantage host PC. For details on doing this, see the documentation for your Vicon application software.

3. Place a selection of markers of the type you will use during motion capture central to the camera Field of View and at a distance from the camera representative of the capture distance, for example, some in the middle of the capture volume and some at a greater distance from the camera.

4. Ensure that the lens aperture is at its most open setting, that is, it is set to the lowest numerical value on the aperture ring.

   This lets more light into the camera and minimizes the depth of field (for details, see Aperture and depth of field on page 47).

5. In the Vicon software, check the marker images from this camera (for details, see Check camera lens focus on page 157).

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Focus a Vicon Vantage camera lens

6. In the Vicon software, observe the sharpness of the image of the markers; slowly adjust the front focus ring of the camera lens until the markers appear in sharp focus in the software, as shown in the following illustration.
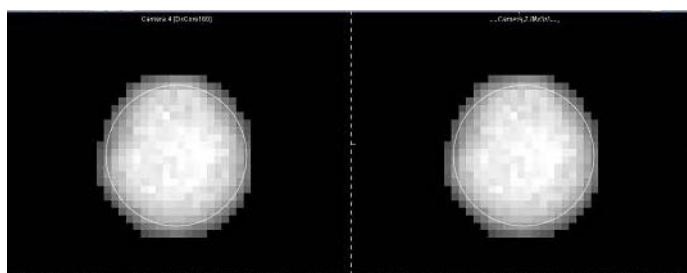
7. In the Vicon software, zoom out and check that other markers of interest distributed around the volume are also in focus.

8. When focusing is complete, if your lens has screws for locking the focus ring, turn them to ensure the focus stays at the desired level.

    Caution

    To avoid damaging the rings, do not over-tighten the locking screws.

9.   Return the Vicon software to the default capture settings (for details, see Check camera lens focus on page 157).

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Focus a Vicon Vantage camera lens

Check camera lens focus

You can check the focus of your camera in your Vicon application software as you adjust it. To optimize your focusing, adjust your camera settings to get clear, bright images of the markers.

The following topics provide a summary of the procedure in each software application:

▍ Check camera lens focus in Vicon Blade

▍ Check camera lens focus in Vicon Nexus and Vicon Tracker

For further details, see your Vicon application software documentation.

Check camera lens focus in Vicon Blade

You can check the image of the markers from the camera you are focusing in real time in Vicon Blade.

To adjust camera settings for checking camera focus in Blade:

1. With Blade in Live mode, on the **Studio Activities** tab, in the **Camera Control** group, click in the Grayscale mode list and select **All Data**.

2. In the **Capture** view for the relevant camera, click the **Show Settings** button on the toolbar to display the **Settings** sliders and then pull the **Strobe Intensity** slider up to its maximum level.

3. Right-click and drag in the **Capture** workspace to zoom in on the target marker pair.

4. If the image of the markers is not bright enough to allow confidence in the level of focus achieved, increase the intensity of the grayscale from the camera. To do this, in the **Capture** view, pull the **Gain** slider up to a level above 1.

5. In the **Capture** view, observe the sharpness of the image of the two markers.

6. After focusing the lens, return Blade to its default capture settings. On the **Studio Activities** tab, in the **Camera Control** group, click in the Grayscale mode list and select **Automatic**.

Check camera lens focus in Vicon Nexus and Vicon Tracker

You can check the image of the markers from the camera you are focusing in real time in Vicon Nexus and Vicon Tracker.

To adjust camera settings for checking camera focus in Nexus:

1. In the **View** pane, select the **Camera** view type.

2. In the **Resources** pane, ensure **Live** mode is activated (ie that **Connected** is displayed).

3. On the **System** tab, in the **Resources** list expand the **Vicon Cameras** node and select the required Vantage camera.

4. In the **Properties** pane at the bottom of the **System Resources** tab, go to the **Settings** section and set **Grayscale Mode** to **All**.

5. Right-click and drag in the **Camera** view pane to zoom in on the target marker pair.

6. If the image of the markers is not bright enough to allow confidence in the level of focus achieved, increase the intensity of the grayscale from the camera. To do this, in the **Properties** pane, ensure **Advanced** properties are displayed and in the **Settings** section, increase the value for **Gain** to a level above x1.

7. In the **Camera** view pane, observe the sharpness of the image of the markers.

8. After focusing the lens, return the Vicon application software to its default capture settings. In the **Properties** pane at the bottom of the **System Resources** tab, set **Grayscale Mode** to **Auto**.

Technical specifications

Find out about the technical details of the Vicon Vantage cameras and Vicon Lock+.

▊ Vicon Vantage camera technical specifications

▊ Vicon Lock+ technical specifications

Vicon Vantage camera technical specifications

The following topics provide technical specifications for Vicon Vantage cameras, including their lenses and strobe units.

For more information, see:

▌ About Vicon Vantage camera specifications

▌ V16 camera specifications

▌ V8 camera specifications

▌ V5 camera specifications

▌ Vicon Vantage cameras lens specifications

▌ Vicon Vantage cameras strobe unit specifications

About Vicon Vantage camera specifications

The following sections provide technical specifications and performance indicators for the different types of Vicon Vantage cameras:

▌ V16 camera specifications

▌ V8 camera specifications

▌ V5 camera specifications

▌ Vicon Vantage cameras lens specifications

▌ Vicon Vantage cameras strobe unit specifications

For information about using Vantage cameras in a Vicon system, see Vicon Vantage cameras on page 25.

V16 camera specifications

The following table provides technical specifications and performance indicators for the V16 camera. Superscripted numbers indicate additional information provided in the Table notes on page 166.

Component	Specification
Performance	
Maximum frame rate (fps) at full resolution	120[1]
Maximum frame rate (fps) at partial scan	2,000[1]
Frame rates (fps)	30–2,000
Sensor	
Sensor type	CMOS
Sensor resolution (pixels)	4096 H x 4096 V
Number of pixels	16,777,216
Pixel size	4.5 microns x 4.5 microns
Optical format	~4/3"
Physical sensor size (mm)	18.43 mm (H) x 18.43 mm (V), 26.06 mm (Diagonal)
Shutter type	Global shutter[2]
Aspect ratio	1:1
On camera processing	
256 shades and grayscale processing	Yes[3]
Grayscale depth	8-bit
Sub pixel resolution	1,048,576 x 1,048,576 (1/256 pixel resolution)
On-board processors	3 processors
On-camera masking	Yes[4]
In-camera dynamic large blob eliminator	Yes[5]
Software masking	Yes

Component	Specification
Auto masking	Yes
On-camera thresholding	Yes
Threshold grid size (tiles)	256 x 256
Threshold grid tile dimensions (pixels)	16 x 16
Camera output modes	5[6]
Full frame preview output	Yes[7]
Strobe/Ringlight	
Types available	850 nm (Infrared (IR))
Number of LEDs	22
Cover type available	Secondary Optics (Standard factory fit)
Strobe electronics	Integrated, software reprogrammable and controlled
Adjustable illumination	Yes
Adjustable levels	1,000 (software controlled)
View angle (Set by secondary optics)	56° or 70°
Physical	
Camera housing	Complex mold custom die-cast aluminum
Camera body dimensions	166.2 mm (H) x 125 mm (W) x 134.1 mm (D)
Weight (including strobe, excluding lens)	1.6 kg
Number of mount points	2
Camera mount fixing bracket	Optional
Camera architecture	
Software and firmware upgradable	Yes

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage camera technical specifications

Component	Specification
Upgrade methods	Through the Vicon application software. Firmware files can be placed on the Vicon Vantage host PC using any standard transmission method (e.g. FTP, e-mail, CD, USB stick). The files are then uploaded from the Vicon Vantage host PC to the Vantage system hardware through the **Reprogram Firmware** option in the software.
Connector	A single RJ-45 connector to the PoE+ switch.
Cabling	Cat5e (Gigabit Ethernet with power and sync over Ethernet)
Power supply	48V, 24 Watts max Conforms to IEEE 802.3at-2009 (25.5W) standard.
Maximum number of cameras supported per PoE+ switch	Switch-dependent (see Understand when additional PoE+ switches are required on page 96).
Lens type supported	Proprietary Vicon 18 mm and 12.5 mm focal length.
Plug and play compatibility	Yes
Mixed camera system compatibility	Interoperable with all Bonita Optical and Video and all MX T-Series cameras
System connectivity/ communication	Gigabit Ethernet
Communication status indicators	Yes
Camera number indicator / information display	Yes
Camera status indicators	On camera and strobe unit and in software
Knock detection indicator	Yes
Tap for Select notification	Yes
IP addressable	Yes
IP reconfigurable	Yes
Cooling	Advanced thermal design

Component	Specification
Environmental regulations	
RoHS compliant	Yes

Table notes

1. Increased frame rates: Selecting a frame rate greater than full resolution automatically reduces image size by windowing. This keeps the pixel rate the same by transmitting a greater number of smaller images per second. You specify the capture frame rate of the Vantage cameras in the Vicon application software. Vantage cameras are capable of capturing up to a maximum of 2,000 fps, but the actual frame rate you can specify depends on the Vicon application software you are using. For details, see your Vicon software documentation. Above 120 fps the amount of light emitted per frame is linearly reduced. The light emitted per frame at 240 fps is half that output per frame at 120 fps. (The total strobed light output remains the same).

2. Shuttering: The global shutter overcomes the negative effects of using rolling shutters for motion capture.

3. Full marker grayscale: Marker centers are calculated based on every pixel of grayscale available for the marker, not just the detected marker edges. An on-camera circularity test ensures merged or partially occluded markers which need high-level processing are sent in full grayscale to the Vicon Vantage host PC.

4. On-camera masking: This removes areas of the sensor where undesirable static light sources are recorded, for example strobes from other cameras.

5. Blob elimination: Camera firmware automatically removes undesirable image data including both large blobs (e.g. sunlight reflections) and/or an unusually large number of blobs.

6. Output modes: Automatic (centers for circular markers, grayscale for overlapping/partially occluded markers), Centers Only, Grayscale Only, Centers/Grayscale, and Preview (the entire sensor image).

7. Preview mode: The full image is lightly filtered, decimated and transmitted to the Vantage host at 30 fps. This reduces the quantity of preview video data to a level that can be transmitted over Gigabit Ethernet to the Vicon Vantage host PC. Only one camera at a time is allowed to be sent in Preview mode as it requires most of the system bandwidth to transmit this one signal.

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

V8 camera specifications

The following table provides technical specifications and performance indicators for the V8 camera. Superscripted numbers indicate additional information provided in the Table notes on page 170.

Component	Specification
Performance	
Maximum frame rate (fps) at full resolution	260[1]
Maximum frame rate (fps) at partial scan	2,000[1]
Frame rates (fps)	30–2,000
Sensor	
Sensor type	CMOS
Sensor resolution (pixels)	3328 H x 2432 V
Number of pixels	8,067,072
Pixel size	4.5 microns x 4.5 microns
Physical sensor size (mm)	14.8 mm (H) x 10.9 mm (V), 18.38 mm (Diagonal)
Optical format	1"
Shutter type	Global shutter[2]
Aspect ratio	1:1
On camera processing	
256 shades and grayscale processing	Yes[3]
Grayscale depth	8-bit
Sub pixel resolution	851,968 x 620,544 (1/256 pixel resolution)
On-board processors	3 processors
On-camera masking	Yes[4]
In-camera dynamic large blob eliminator	Yes[5]
Software masking	Yes

Component	Specification
Auto masking	Yes
On-camera thresholding	Yes
Threshold grid size (tiles)	208 x 152
Threshold grid tile dimensions (pixels)	16 x 16
Camera output modes	5[6]
Full frame preview output	Yes[7]
Strobe/Ringlight	
Types available	850 nm (Infrared (IR))
Number of LEDs	22
Cover type available	Secondary optics (standard factory fit)
Strobe electronics	Integrated, software reprogrammable and controlled
Adjustable illumination	Yes
Adjustable levels	1,000 (software controlled)
View angle (Set by secondary optics)	70°
Physical	
Camera housing	Complex mold custom die-cast aluminum
Camera body dimensions	166.2 mm (H) x 125 mm (W) x 134.1 mm (D)
Weight (including strobe, excluding lens)	1.6 kg
Number of mount points	2
Camera mount fixing bracket	Optional
Camera architecture	
Software and firmware upgradable	Yes

Component	Specification
Upgrade methods	Through the Vicon application software. Firmware files can be placed on the Vicon Vantage host PC using any standard transmission method (e.g. FTP, e-mail, CD, USB stick). The files are then uploaded from the Vicon Vantage host PC to the Vantage system hardware through the **Reprogram Firmware** option in the software.
Connector	A single RJ-45 connector to the PoE+ switch
Cabling	Cat5e (Gigabit Ethernet with power and sync over Ethernet)
Power supply	48V, 24 Watts max Conforms to IEEE 802.3at-2009 (25.5W) standard.
Maximum number of cameras supported per PoE+ switch	Switch-dependent (see Understand when additional PoE+ switches are required on page 96)
Lens type supported	Ricoh Pentax 12.5 mm focal length
Plug and play compatibility	Yes
Mixed camera system compatibility	Interoperable with all Bonita Optical and Video and all MX T-Series cameras
System connectivity/ communication	Gigabit Ethernet
Communication status indicators	Yes
Camera number indicator / information display	Yes
Camera status indicators	On camera and strobe unit and in software
Knock Detection indicator	Yes
Tap for Select notification	Yes
IP addressable	Yes
IP reconfigurable	Yes
Cooling	Advanced thermal design

Component	Specification
Environmental regulations	
RoHS compliant	Yes

Table notes

1. Increased frame rates: Selecting a frame rate greater than full resolution automatically reduces image size by windowing. This keeps the pixel rate the same by transmitting a greater number of smaller images per second. You specify the capture frame rate of the Vantage cameras in the Vicon application software. Vantage cameras are capable of capturing up to a maximum of 2,000 fps, but the actual frame rate you can specify depends on the Vicon application software you are using. For details, see your Vicon software documentation. Above 120 fps the amount of light emitted per frame is linearly reduced. The light emitted per frame at 240 fps is half that output per frame at 120 fps. (The total strobed light output remains the same).
2. Shuttering: The global shutter overcomes the negative effects of using rolling shutters for motion capture.
3. Full marker grayscale: Marker centers are calculated based on every pixel of grayscale available for the marker, not just the detected marker edges. An on-camera circularity test ensures merged or partially occluded markers which need high-level processing are sent in full grayscale to the Vicon Vantage host PC.
4. On-camera masking: This removes areas of the sensor where undesirable static light sources are recorded, for example strobes from other cameras.
5. Blob elimination: Camera firmware automatically removes undesirable image data including both large blobs (e.g. sunlight reflections) and/or an unusually large number of blobs.
6. Output modes: Automatic (centers for circular markers, grayscale for overlapping/ partially occluded markers), Centers Only, Grayscale Only, Centers/Grayscale, and Preview (the entire sensor image).
7. Preview mode: The full image is lightly filtered, decimated and transmitted to the Vantage host at 30 fps. This reduces the quantity of preview video data to a level that can be transmitted over Gigabit Ethernet to the Vicon Vantage host PC. Only one camera at a time is allowed to be sent in Preview mode as it requires most of the system bandwidth to transmit this one signal.

V5 camera specifications

The following table provides technical specifications and performance indicators for the V5 camera. Superscripted numbers indicate additional information provided in the Table notes on page 174.

Component	Specification
Performance	
Maximum frame rate (fps) at full resolution	420[1]
Maximum frame rate (fps) at partial scan	2,000[1]
Frame rates (fps)	30–2,000
Sensor	
Sensor type	CMOS
Sensor resolution (pixels)	2432 H x 2048 V
Number of pixels	4,980,736
Pixel size	4.5 microns x 4.5 microns
Physical sensor size (mm)	10.94 mm (H) x 9.22 mm (V), 14.31 mm (Diagonal)
Optical format	2/3" and 1"
Shutter type	Global shutter[2]
Aspect ratio	1:1
On camera processing	
256 shades and grayscale processing	Yes[3]
Grayscale depth	8-bit
Sub pixel resolution	1,048,576 x 1,048,576 (1/256 pixel resolution)
On-board processors	3 processors
On-camera masking	Yes[4]
In-camera dynamic large blob eliminator	Yes[5]
Software masking	Yes

Component	Specification
Auto masking	Yes
On-camera thresholding	Yes
Threshold grid size (tiles)	152 x 128
Threshold grid tile dimensions (pixels)	16 x 16
Camera output modes	5[6]
Full frame preview output	Yes[7]
Strobe/Ringlight	
Types available	850 nm (Infrared (IR))
Number of LEDs	22
Cover type available	Secondary optics (standard factory fit)
Strobe electronics	Integrated, software reprogrammable and controlled
Adjustable illumination	Yes
Adjustable levels	1,000 (software controlled)
View angle (Set by secondary optics)	56° or 70°
Physical	
Camera housing	Complex mold custom die-cast aluminum
Camera body dimensions	166.2 mm (H) x 125 mm (W) x 134.1 mm (D)
Weight (including strobe, excluding lens)	1.6 kg
Number of mount points	2
Camera mount fixing bracket	Optional
Camera architecture	
Software and firmware upgradable	Yes

Component	Specification
Upgrade methods	Through the Vicon application software. Firmware files can be placed on the Vicon Vantage host PC using any standard transmission method (e.g. FTP, e-mail, CD, USB stick). The files are then uploaded from the Vicon Vantage host PC to the Vantage system hardware through the **Reprogram Firmware** option in the software.
Connector	A single RJ-45 connector to the PoE+ switch.
Cabling	Cat5e (Gigabit Ethernet with power and sync over Ethernet)
Power supply	48V, 24 Watts max Conforms to IEEE 802.3at-2009 (25.5W) standard.
Maximum number of cameras supported per PoE+ switch	Switch-dependent (see Understand when additional PoE+ switches are required on page 96)
Lens type supported	Ricoh Pentax 12.5 mm and 8.5 mm focal length.
Plug and play compatibility	Yes
Mixed camera system compatibility	Interoperable with all Bonita Optical and Video and all MX T-Series cameras
System connectivity/ communication	Gigabit Ethernet
Communication status indicators	Yes
Camera number indicator / information display	Yes
Camera status indicators	On camera and strobe unit and in software
Knock detection indicator	Yes
Tap for Select notification	Yes
IP addressable	Yes
IP reconfigurable	Yes
Cooling	Advanced thermal design

Component	Specification
Environmental regulations	
RoHS compliant	Yes

Table notes

1. **Increased frame rates:** Selecting a frame rate greater than full resolution automatically reduces image size by windowing. This keeps the pixel rate the same by transmitting a greater number of smaller images per second. You specify the capture frame rate of the Vantage cameras in the Vicon application software. Vantage cameras are capable of capturing up to a maximum of 2,000 fps, but the actual frame rate you can specify depends on the Vicon application software you are using. For details, see your Vicon software documentation. Above 120 fps the amount of light emitted per frame is linearly reduced. The light emitted per frame at 240 fps is half that output per frame at 120 fps. (The total strobed light output remains the same).
2. **Shuttering:** The global shutter overcomes the negative effects of using rolling shutters for motion capture.
3. **Full marker grayscale:** Marker centers are calculated based on every pixel of grayscale available for the marker, not just the detected marker edges. An on-camera circularity test ensures merged or partially occluded markers which need high-level processing are sent in full grayscale to the Vicon Vantage host PC.
4. **On-camera masking:** This removes areas of the sensor where undesirable static light sources are recorded, for example strobes from other cameras.
5. **Blob elimination:** Camera firmware automatically removes undesirable image data including both large blobs (e.g. sunlight reflections) and/or an unusually large number of blobs.
6. **Output modes:** Automatic (centers for circular markers, grayscale for overlapping/partially occluded markers), Centers Only, Grayscale Only, Centers/Grayscale, and Preview (the entire sensor image).
7. **Preview mode:** The full image is lightly filtered, decimated and transmitted to the Vantage host at 30 fps. This reduces the quantity of preview video data to a level that can be transmitted over Gigabit Ethernet to the Vicon Vantage host PC. Only one camera at a time is allowed to be sent in Preview mode as it requires most of the system bandwidth to transmit this one signal.

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Vicon Vantage camera technical specifications

Vicon Vantage cameras lens specifications

This topic provides technical specifications for the different types of lenses that are used in Vicon Vantage cameras. For details of specific lenses, contact Vicon or your nearest agent or distributor.

Vantage cameras are fitted with lenses suitable for the system use you specified on ordering. The lens fitted to the camera is determined by various factors, including the focal length, which defines the Field of View (FOV), and the aperture range. The latter affects the amount of light seen by the image sensor and also governs the depth of field, the distance from the camera where the image is in focus.

Caution

The camera lens is not user-serviceable. For all servicing and any alterations, including lens or strobe change, you must return the camera to Vicon. Any attempt by you or any third-party to alter or repair a Vantage camera may invalidate its warranty.

Lenses used in Vicon Vantage cameras

The following table shows the lenses fitted to Vantage cameras.

Lens	Image format size	Vicon Vantage camera		
		V16	V8	V5
Vicon 18 mm	4/3"	x		
Vicon 12.5 mm	4/3"	x		
Ricoh Pentax 12.5 mm	1"		x	x
Ricoh Pentax 8.5 mm	2/3"			x

About this manual | Hardware reference | Advanced usage | **Technical specifications** | Regulatory information | Further resources

Camera lens specifications

The following tables provide technical specifications for the physical characteristics of the lenses available for V16, V8, and V5 cameras.

▍ Vicon 18 mm lens specification

▍ Vicon 12.5 mm lens specification

▍ Ricoh Pentax 12.5 mm lens specification

▍ Ricoh Pentax 8.5 mm lens specification

For a summary of the lenses that are fitted to a particular Vicon Vantage camera, see Lenses used in Vicon Vantage cameras on page 175. For Angle of View details for these lenses, see Angle of view information for Vicon Vantage cameras on page 178.

Vicon 18 mm lens specification

This lens is used with the V16.

Component	Specification
Focal Length	18 mm
Format	Proprietary Vicon ~4/3"
Aperture (f-stop) range	2–16
Dimensions	51 mm (diameter) x 75 mm (length)
Weight	0.28 Kg

Vicon 12.5 mm lens specification

This lens is used with the V16.

Component	Specification
Focal Length	12.5 mm
Format	C-mount 4/3"
Aperture (f-stop) range	2.0–22
Dimensions	48 mm (diameter) x 67 mm (length)
Weight	0.23 Kg

Ricoh Pentax 12.5 mm lens specification

This lens is used with the V8 and V5.

Component	Specification
Focal Length	12.5 mm
Format	C-mount 1"
Aperture (f-stop) range	1.4–Closed
Dimensions	42 mm (diameter) x 58 mm (length)
Weight	0.135 Kg

Ricoh Pentax 8.5 mm lens specification

This lens is used with the V5.

Component	Specification
Focal Length	8.5 mm
Format	C-mount 2/3"
Aperture (f-stop) range	1.5 to fully closed
Dimensions	42 mm (diameter) x 40 mm (length)
Weight	0.12 Kg

Angle of view information for Vicon Vantage cameras

The following table gives information on the Angle of View at full resolution for the V16, V8, and V5 cameras. For details on Angle of View and Field of View (FOV), see Camera lens characteristics on page 42.

Important

The Angle of View examples are specific to the referenced camera type. As is shown in the table, the angle of view changes if the lens is attached to a different camera type.

Lens type	V16	V8	V5
Vicon 18 mm	54.22 x 54.22 deg		
Vicon 12.5 mm	72.8 x 72.8 deg		
Ricoh Pentax 12.5 mm		61.36 x 47.15 deg	47.28 x 40.47 deg
Ricoh Pentax 8.5 mm			65.54 x 56.93 deg

Vicon Vantage cameras strobe unit specifications

This topic provides technical specifications for the Infrared strobe unit that is available for the Vicon Vantage cameras (V16, V8, V5):

▌ Camera strobe (shutter) durations

▌ Infrared strobe specifications

All Vantage strobe units use surface-mounted LEDs, have a built-in temperature sensor, and are fitted with dedicated secondary optics to match the fitted lens.

Camera strobe (shutter) durations

The following table shows camera strobe duration for different specifications:

Maximum duration	Specification
1 ms	at 120 Hz progressive
0.5 ms	at 240 Hz progressive
0.25 ms	at 480 Hz progressive
0.125 ms	at 960 Hz progressive

The strobe light-ring emits light once per video frame and is precisely aligned with the global shutter of the image sensor. The duration is controlled in the camera's strobe settings in your Vicon application software. The strobe intensity, which controls the duration of the light being emitted, can be adjusted in 1/1000 increments from zero through to the maximum allowed. When increasing the strobe intensity, remember that very fast motion produces more motion blur, so you may have to compromise between lens aperture and strobe intensity settings.

The total power drawn from the PoE+ source is the sum of the power drawn by the strobe and the camera itself. At a constant strobe intensity setting, the strobe power taken is proportional to the frame rate. Up to 120 fps, the strobe duration can be adjusted from zero to the maximum of 1 mS. In order not to

exceed the allowable total maximum power taken, the strobe duration is automatically reduced as shown in the above table.

Note

At frame rates above 120 fps, there will be a corresponding fall in light output and therefore a possible reduction in the distance that markers will be seen.

Infrared strobe specifications

The following table provides technical specifications and performance indicators for Vicon Vantage Infrared (IR) strobe units.

Component	Specification
Strobe active source (AlGaAs LEDs)	22
Wavelength	850 nm
Strobe viewing angle (to half luminous intensity). Set by secondary optics	56° and 70°
Time averaged radiance (in mW.mm-2.sr-1 per array)	128.89[1]
Time averaged irradiance (in W.m-2)	50.69[1]
Maximum power consumption (per camera)	24 W (when running at 120 fps at maximum strobe setting)
RoHS compliant	Yes

1. Given the following assumptions:
   Ideal overlap of radiation characteristics of array diodes
   IEC 62471-1 classification distance is 200mm
   Ambient temperature is 25 degrees C.
   Low visual stimulus at 850nm
   Calculation is for >1000 seconds.

Vicon Lock+ technical specifications

The following table provides technical specifications for the Lock+ unit.

Component	Specification
1U dimensions	
Height	44.5 mm (1 RU)
Width	445 mm
Depth	200 mm
Weight	1.6 kg
Power supply ratings (Power over Ethernet – PoE)	
Input voltage	48V DC nominal. Conforms to IEEE 802.3 af
Input current	166 mA DC nominal
Power	7 W nominal
Fuse	No externally accessed fuses
Input connector	RJ-45
Maximum length	100 m
Environmental regulations	
RoHS compliant	Yes

Regulatory and contact information

View the regulatory, safety, and warranty information relating to Vicon Vantage systems. Find out how to contact Vicon for further help with your Vicon Vantage system.

▎ Regulatory, safety, and warranty information

▎ Further resources

Regulatory, safety, and warranty information

The following topics provide important and required consumer information on how Vicon Vantage hardware complies with regulatory standards, including product recycling. The certification that Vicon Vantage systems have achieved for meeting stated international standards is included. You can also find regulatory notices and incident report forms to complete in the event of an adverse event involving the use of Vicon Vantage systems in the United Kingdom and the United States of America.

Guidance on the safe operation of your Vicon Vantage system, as well as information regarding the system warranty, is also provided.

For more information, see:

▌ Radio and television interference

▌ Environmental regulations (European Union customers)

▌ CE Declaration of Conformity (Vicon Vantage cameras)

▌ Product configurations and software options (Vicon Vantage cameras)

▌ CE Declaration of Conformity (Vicon Lock+)

▌ Product configurations and software options (Vicon Lock+)

▌ ISO 13485: 2003/13485:2012 Certificate of Approval

▌ MDD 93/42/EEC Production Quality Assurance certificate

▌ ISO 9001:2008 Certificate of Approval

▌ Medical device adverse event reporting

▌ Safety information

▌ Warranty information

Radio and television interference

The following topics contain information concerning compliance with regulations of radio and television interference:

▮ For United States of America customers

▮ For Canadian customers

For United States of America customers

Federal Communications Commission (FCC) Part 15 Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules (CFR 47:Part 15:B:2013). These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Vicon Motion Systems Ltd is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For Canadian customers

Conformity to the Canadian Interference-Causing Equipment Regulations

This Class A digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations ICES-003:2004.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada ICES-003:2004.

Environmental regulations (European Union customers)

This section lists the directives that apply to Vicon Vantage systems.

Important
This information applies only to European Union member states.

Vicon meets these European Commission directives concerning waste electrical and electronic equipment:

▌ Directives 2002/95/EC and 2011/65/EU (for details, see Restriction of the use of certain hazardous substances in electrical and electronic equipment – RoHS and recast (RoHS 2)).

▌ REACH Declaration of Conformity

▌ Directive 2202/96/EC (for details, see Waste Electrical and Electronic Equipment (WEEE)).

Restriction of the use of certain hazardous substances in electrical and electronic equipment – RoHS and recast (RoHS 2)

This equipment is fully RoHS- and RoHS 2- compliant. RoHS Directive 2002/95/EC provides that new electrical and electronic equipment put on the market for the first time from 1 July 2006 should not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB), or polybrominated diphenyl ethers (PBDE). The European Union Directive 2011/65/EU provides that new electrical and electronic equipment put on the market for the first time from 3rd January 2014 shall not contain more than permitted levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB), or polybrominated diphenyl ethers (PBDE; PentaBDE, OctaBDE; DecaBDE), Mercury (Hg).

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Regulatory, safety, and warranty information

REACH Declaration of Conformity

Vicon Motion Systems Ltd is a manufacturer of electronic hardware. We are therefore considered a "downstream user" as far as the REACH document is concerned. Vicon Motion Systems Ltd is therefore not obligated to register with the European Agency for Chemicals 'ECHA'.

Products sold by Vicon Motion Systems Ltd are "articles" as defined in REACH (Article 3 Definitions). Moreover and under normal and reasonably foreseeable circumstances of application, the articles supplied shall not release any substance. For that, Vicon Motion Systems Ltd is neither obligatory for registration nor for the creation of material safety data sheets.

In order to assure our customers of the continual supply of reliable and safe products, we ensure that our suppliers fulfill all requirements regarding chemical substances and prepared materials.

Waste Electrical and Electronic Equipment (WEEE)

The use of the symbol as a marking on the equipment, accessories or literature indicates that this product and its electronic accessories (e.g. USB cable) may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product.

Household users should contact either the retailer where they purchased this device, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchasing contract. This device and its electronic accessories should not be mixed with other commercial waste for disposal.

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Regulatory, safety, and warranty information

CE Declaration of Conformity (Vicon Vantage cameras)

CE 0088

Declaration of Conformity

*Medical Devices Directive 93/42/EEC as amended by
EU Council Directive 2007/47/EC of 5th September 2007.
Electromagnetic Compatibility to EMC Directive 2004/108/EC.
Electrical Safety to Low Voltage Directive 2006/95/EC.*

We, Vicon Motion Systems Limited
Unit 14 Minns Estate
Oxford OX2 0JB
United Kingdom

declare that the VICON VANTAGE Cameras manufactured by VICON MOTION SYSTEMS LIMITED meets ANNEX V and VII Section 5 of the Medical Devices Directive 93/42/EEC as amended by Directive 2007/47/EC in that the Quality Management System has been approved by Lloyd's Register Quality Assurance, a notified body of the European Union (Reg No. 0088) for the manufacture and support of the aforementioned CLASS 1(m) Medical device. Product configurations and software options (Vicon Vantage cameras) overleaf detail the product configurations and software options that conform to the metrological requirements of the Directive.

VICON MOTION SYSTEMS LIMITED has tested and demonstrated that all products of its own manufacture meet 2004/108/EC:

Electromagnetic Compatibility to:
EN60601-1-2:2007

General Requirements for Safety to:
Vantage Cameras EN60601-1:2006 + A12:2014

Network Hub UL60950–1, 2nd Edition

Thomas Shannon, TD PhD FIE (Aust), CPEng (Biomed.)
Director of Compliance

1st April 2016

Not for use in an operating theater, anesthetic gas environment, or oxygen-rich environments. Not for use where there is a risk of compromising the essential performance of medical electrical equipment. Not suitable for use in high magnetic flux, ionizing radiation, dust ingress, high vibration, sterile, or life- or safety-critical environments.

Product configurations and software options (Vicon Vantage cameras)

This page provides information relating to the CE Declaration of Conformity (Vicon Vantage cameras) on page 190.

Conformity of the Metrological Performance of CLASS 1 Products Manufactured in Accordance with Annex V and VII, Section 5 of the Medical Devices Directive 93/42/EEC of 14th June 1993. As amended by EU Council Directive 2007/47/EC of 5th September 2007.

We, Vicon Motion Systems Limited
Unit 14 Minns Estate
Oxford OX2 0JB
United Kingdom

declare that the VICON VANTAGE Cameras manufactured by VICON MOTION SYSTEMS LIMITED have been tested prior to shipment and meet the following metrological performance:

Measurement criteria

▍ Supporting software Blade 3.2 or later, Nexus 2.2 or later, and Tracker 3.1 or later.

▍ Resolution of the distance between the centers of two static 14 mm spherical markers located within a volume no less than 4 m x 4 m x 1.5 m to within 1 mm Mean; 1 mm Standard Deviation; sample size no less than 1,000.

Regulatory, safety, and warranty information

CE Declaration of Conformity (Vicon Lock+)

CE 0088

Declaration of Conformity

*Medical Devices Directive 93/42/EEC as amended by
EU Council Directive 2007/47/EC of 5th September 2007 and
Electromagnetic Compatibility to EMC Directive 2004/108/EC.*

We, Vicon Motion Systems Limited
Unit 14 Minns Business Park
Oxford OX2 0JB, United Kingdom

Declare that the VICON SAT Interfaces (supplied as Lock and Lock+) manufactured by VICON MOTION SYSTEMS LIMITED meets ANNEX V and VII Section 5 of the Medical Devices Directive 93/42/EEC in that the Quality Management System has been approved by Lloyd's Register Quality Assurance, a notified body of the European Union (Reg No. 0088) for the manufacture and support of the aforementioned CLASS 1(m) Medical device. Product configurations and software options (Vicon Lock+) below detail the product configurations and software options that conform to the metrological requirements of the Directive.

VICON MOTION SYSTEMS LIMITED has tested and demonstrated that all products of its own manufacture meet 2004/108/EC:

Electromagnetic Compatibility to:
EN60601-1-2:2007

General Requirements for Safety to:
EN60601-1:2006 + A1:2013

Thomas Shannon TD PhD FIE (Aust) CPEng (Biomed.)
Director of Compliance

1 April 2016

Not for use in an operating theatre anaesthetic gas or oxygen-rich environments. Not for use where there is a risk of compromising the essential performance of medical electrical equipment. Not suitable for use in high magnetic flux, ionising radiation, sterile, or life- or safety-critical environments.

Product configurations and software options (Vicon Lock+)

This page provides information relating to the CE Declaration of Conformity (Vicon Lock+) on page 192.

Conformity of the Metrological Performance of CLASS 1 Products Manufactured in Accordance with Annex VII, Section 5 of the Medical Devices Directive 93/42/EEC of the 14th June 1993.

We, Vicon Motion Systems Limited
Unit 14 Minns Estate,
Oxford OX2 0JB,
United Kingdom

declare that the VICON SAT Interface (supplied as Lock and Lock +) manufactured by VICON MOTION SYSTEMS LIMITED has been tested prior to shipment and meets the following metrological performance:

Measurement Criteria

- Supporting software: Blade 3.2 or later, Nexus 2.2 or later, Tracker 3.1 or later.

Analogue Digital Conversion

- Resolution to ± 10 mV mean and ± 10 mV (1 Standard Deviation).

Synchronization

- Difference within one video frame.

ISO 13485: 2003/13485:2012 Certificate of Approval

Lloyd's Register LRQA

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Vicon Motion Systems Ltd t/a Vicon
14 Minns Business Park, West Way,
Oxford
United Kingdom

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 13485:2003
EN ISO 13485:2012

The Quality Management System is applicable to:

Design, manufacture and support of motion capture
systems for life science applications, including
development of related software.

This certificate forms part of the approval identified by certificate number LRQ 4003146

Approval
Certificate No: LRQ 4003146/C

Original Approval: 17 August 2007

Current Certificate: 17 August 2015

Certificate Expiry: 16 August 2018

Issued by: Lloyd's Register Quality Assurance Limited

UKAS
MANAGEMENT SYSTEMS
001

1 Trinity Park, Bickenhill Lane, Birmingham, B37 7ES, United Kingdom

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About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Regulatory, safety, and warranty information

MDD 93/42/EEC Production Quality Assurance certificate

Lloyd's Register LRQA

EC CERTIFICATE – PRODUCTION QUALITY ASSURANCE

In accordance with the requirements of the Medical Devices Directive 93/42/EEC and the Medical Devices Regulations 2002, UK Statutory Instrument 2002 No. 618

This is to certify that the Quality Management System of:

Vicon Motion Systems Ltd t/a Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

has been assessed against the requirements of Annex V of the Medical Devices Directive 93/42/EEC, and the Medical Devices Regulations 2002 and conforms to the requirements for the products shown on the attached schedule.

Approval is subject to the maintenance of the quality system in accordance with the requirements of the above Directive and Regulations.

Authorisation is hereby given to use the LRQA Notified Body Registration Number in accordance with the requirements of the specified Directives/Regulations in relation to the products as identified above.

Certificate No:	LRQ 4003146/B
Original Approval:	17 August 2006
Current Certificate:	17 August 2015
Certificate Expiry:	16 August 2018

LRQA Notified Body Number 0088

Issued by: Lloyd's Register Quality Assurance Limited

1 Trinity Park, Bickenhill Lane, Birmingham B37 7ES, United Kingdom

Lloyd's Register
LRQA

**EC CERTIFICATE – PRODUCTION QUALITY ASSURANCE
CERTIFICATE LRQ 4003146/B SCHEDULE**

**In accordance with the requirements of the Medical Devices
Directive 93/42/EEC and the Medical Devices Regulations 2002, UK
Statutory Instrument 2002 No. 618**

**Vicon Motion Systems Ltd t/a Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom**

Class I Measuring Products
Vicon MX+ System
ViconT-Series System
Vicon Vantage System

Schedule Issue: 01

Date of Schedule Issue: 17 August 2015

LRQA Notified Body Number 0088

Issued by: Lloyd's Register Quality Assurance Limited

Page 1 of 1

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VICON | Vicon Vantage Reference

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

ISO 9001:2008 Certificate of Approval

Lloyd's Register LRQA

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

**Vicon Motion Systems Ltd t/a Vicon
14 Minns Business Park, West Way,
Oxford
United Kingdom**

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

**Design, manufacture and support of motion capture
systems. Development of software for motion
capture systems, measurement and analysis
of three-dimensional structures.**

This certificate is valid only in association with the certificate schedule bearing the same
number on which the locations applicable to this approval are listed.

This certificate forms part of the approval identified by certificate number LRQ 4003146

Approval
Certificate No: LRQ 4003146/A

Original Approval:	17 August 2006
Current Certificate:	17 August 2015
Certificate Expiry:	16 August 2018

Issued by: Lloyd's Register Quality Assurance Limited

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Lloyd's Register
LRQA

CERTIFICATE SCHEDULE

**Vicon Motion Systems Ltd t/a Vicon
14 Minns Business Park, West Way,
Oxford
United Kingdom**

Locations
7388 S Revere Parkway,
Suite 901,
Centennial CO 80112,
Colorado,
USA

Activities
Configuration, sales and support of
motion capture systems; including
development of related software.

Approval
Certificate No: LRQ 4003146/A

Original Approval:	17 August 2006
Current Certificate:	17 August 2015
Certificate Expiry:	16 August 2018

Page 1 of 1

UKAS
MANAGEMENT
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Medical device adverse event reporting

Use the appropriate information and form to report any adverse events involving Vicon Vantage systems:

▮ MHRA adverse incident reporting (UK)

▮ FDA MedWatch adverse event reporting program (US)

Should an adverse event occur, the appropriate form is to be completed and forwarded within one working day to Vicon Motion Systems Limited at one of the following addresses.

Oxford
14 Minns Business Park, West Way
Oxford OX2 0JB
UK

Tel: +44 (0)1865 261800
Fax: +44 (0)1865 240527

Denver
7388 S. Revere Parkway, Suite 901
Centennial, CO 80112
USA

Tel: +1 (303) 799 8686
Fax: +1 (303) 799 8690

Los Angeles
5419 McConnell Avenue
Los Angeles, CA 90066
USA

Tel: +1 (303) 799 8686
Fax: +1 (310) 388 3200

Singapore
8 Cross Street # 11-00
PWC Building,
Singapore 048424

Tel: +65 6400 3500

MHRA adverse incident reporting (UK)

The information in this section covers the reporting of incidents involving medical devices to the UK Medicines and Healthcare products Regulatory Agency (MHRA).

Important

Notice to Agents: For inclusion in all Vicon systems supplied from the United Kingdom for use outside of the United States of America (for supply and use in the US, see FDA MedWatch adverse event reporting program (US) on page 202).

The master Medicines and Healthcare products Regulatory Agency (MHRA) file is located at Vicon Motion Systems Limited. Should an adverse event occur, an MHRA Adverse Incident Report is to be completed and forwarded within one working day to Vicon Motion Systems Limited (see Medical device adverse event reporting on page 199).

The MHRA is a UK government agency which is responsible for ensuring that medicines and medical devices work, and are acceptably safe. Use the procedure specified to report an adverse incident involving a medical device.

Full information and guidance on reporting Adverse Incidents is available on the MHRA Yellow Card website. For details on reporting requirements, contact the MHRA:

Medicines and Healthcare products Regulatory Agency
151 Buckingham Palace Road
Victoria, London SW1W 9SZ
UK

Tel: +44 (0)20 3080 6000
Fax: +44 (0)20 3118 9803
Web: www.mhra.gov.uk

Tip

For additional information and guidance, refer to the latest revision of MEDDEV 2.12-1 on The European Commission Web site
(http://ec.europa.eu/health/medical-devices/files/meddev/2_12_1_ol_en.pdf).

About this manual	Hardware reference	Advanced usage	Technical specifications	Regulatory information	Further resources

Regulatory, safety, and warranty information

MHRA adverse incident report form

You report adverse incidents on the MHRA web site (MHRA Yellow Card website). You can either report the problem online or use a printed version of the MHRA Adverse Incident Report, which is also available from the web site.

Important

If you have any difficulty obtaining the MHRA Adverse Incident Report, contact Vicon Support immediately to receive the form.

To complete the MHRA Adverse Incident Report Form:

1. On the MHRA web site (MHRA Yellow Card website), click the **Devices** button.

2. Complete the subsequent parts of the form, including an email address to which your own printer-friendly version of the report can be sent. Remember to complete the **Email copy of report to** field with Vicon's email address.

3. Finish completing all sections of the report (you must complete all entries flagged with a red asterisk) and submit the form online.

4. If you want to work with a printed copy, retrieve the printer-friendly copy from your email. If required, you can print and fax the form to the nearest Vicon office (see Medical device adverse event reporting on page 199).

Tip

In section **Type of device**, select **General Report Form / All other devices** and on the next page, in the **Type of device** field, specify your Vicon system and device.

FDA MedWatch adverse event reporting program (US)

This section covers the reporting of incidents to the US Department of Health & Human Services.

Important

For inclusion in all Vicon systems supplied to the United States of America (for supply and use outside the US, see MHRA adverse incident reporting (UK) on page 200).

The master Medical Device Reporting (MDR) file is located at Vicon Motion Systems Limited. Should an adverse event occur, MEDWATCH Form FDA 3500A is to be completed and forwarded within one working day to Vicon Motion Systems Limited (see Medical device adverse event reporting on page 199).

Department of Health & Human Services,
US Food and Drug Administration

Medical Device Reporting System—Reportable Events

Code of Federal Regulations
Title 21, Volume 8
Revised as of April 1, 2014
Cite: 21CFG803.50

Under 803.50(a) device user facilities and manufacturers must report deaths and serious injuries that a device has or may have caused or contributed to. Should such an event occur, please complete the form specified in this section and forward it in accordance with the applicable regulations and time limits to your nearest Vicon office (see Medical device adverse event reporting on page 199).

FDA Adverse Event Report form

You can obtain the FDA Adverse Event Report form (MEDWATCH form FDA 3500A) from the FDA's MedWatch Adverse Event Reporting program on their web site (https://www.accessdata.fda.gov/scripts/medwatch/). The form can be completed online or printed out.

Important

To download a PDF of the form, click the **Download Forms** link at the bottom of the page. If you have any difficulty obtaining the FDA Adverse Event Report Form, contact Vicon Support immediately to receive the form.

To complete the FDA Adverse Event Report form:

▎ Online: Either complete the online MedWatch Voluntary Report or complete the PDF form, save it, and then e-mail it to support@vicon.com. Include "Adverse Event Report" in your e-mail subject line.

▎ Print: Print out the form, fill it in, and then fax it to the nearest Vicon office (see Medical device adverse event reporting on page 199).

Tip

Section C. Suspect Product(s) is not applicable to Vicon systems. For further guidance on completing the form, see the instructions contained in the PDF form.

Safety information

To avoid introducing a safety hazard and possibly damaging the system, please ensure that an adequate and good-quality alternating current (AC) power source is available. Please refer to the ratings statement on the rear of the relevant Vicon-supplied PoE+ switch for guidance. Also ensure that any computers and peripheral devices are set to be electrically rated to operate with the AC power available in your location.

When working with Vicon Vantage systems, observe these safety precautions:

▍ To prevent electric shock, plug all system components into properly grounded power sources. These cables must be equipped with three-prong plugs to ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a cable.

▍ Ensure nothing rests on the system cables and that cables are not located where they can be stepped on or tripped over.

▍ Do not spill food or liquids onto any electrical component of the system. If any component gets wet, immediately contact Vicon Motion Systems or your nearest agent or distributor for advice.

▍ Do not push any objects into the slots of any unit of the system. Doing so can cause fire or electric shock by shorting out internal components.

▍ Keep all system components away from radiators and heat sources, and do not block cooling vents. Avoid placing loose papers beneath components. Do not place any components on closed-in units or on a bed, chair, etc.

▍ Replace fuses with the same type and rating for continued fire protection.

▍ Do not use outside, near water, in an environment exposed to anesthetic or other explosive gases, or in mobile applications.

▍ Use only hypoallergenic tape to affix Vicon markers to a subject's skin. Vicon supplies specially designed marker fixing tape; medical grade elastic strips are also suitable.

▍ Do not apply any products containing latex to the subject while using the Vicon system. Vicon products do not contain latex.

▍ Do not look directly at the source when a Near Infrared (NIR) or Infrared (IR) strobe unit is in operation and note the following warnings.

Caution

Although it is theoretically possible for a strobe single fault condition to fully on to occur when an operator's eyes are within 100 mm of the Light Emitting Diodes for longer than 17 seconds, the likelihood of any such failure resulting in an emission of light that exceeds the Maximum Permissible Exposure defined by standard EN 62471:2008 to infrared light is extremely unlikely in practice, due to the design of the product.

Warning

Under abnormal usage conditions, the Maximum Permissible Exposure defined by standard EN 62471:2008 to infrared light may be exceeded if your eyes are within 100 mm of the Light Emitting Diodes for longer than 400 seconds.

Warranty information

The warranty for your Vicon Vantage system begins after installation.

For full details on warranty scope and conditions, refer to the Vicon Terms and Conditions of supply for your Vicon Vantage system.

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Regulatory, safety, and warranty information

Further resources

To obtain further support for your Vicon Vantage system, see the following resources:

▌ Contact Vicon

Vicon
Vantage
Reference

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

Further resources

Contact Vicon

In addition to the documentation and the information on the Vicon Support web pages, the following resources are also available:

Denver, CO

Vicon Denver
7388 S. Revere Parkway Suite 901
Centennial
CO 80112
USA

T:303.799.8686
F:303.799.8690
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Index

VICON | Vicon Vantage Reference

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |

VICON | Vicon Vantage Reference

| About this manual | Hardware reference | Advanced usage | Technical specifications | Regulatory information | Further resources |