Origin Setup and Maintenance Guide

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Check status of product name (Origin) as regards TM - so far not TM'd (not included on TM page of PDF template)

This is mainly for internal users or more technical external users, so title changed from 'User Guide' to more accurately reflect purpose.

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About this guide

This guide provides information on system setup and maintenance for operators of the Origin system from Vicon.

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Introducing the Origin system

The following topics provide an introduction to the Origin system:

- Origin system components (see page 6)
- Pulsar status LEDs and button (see page 8)
- Using the Pulsar button (see page 9)
- Battery run time (see page 10)

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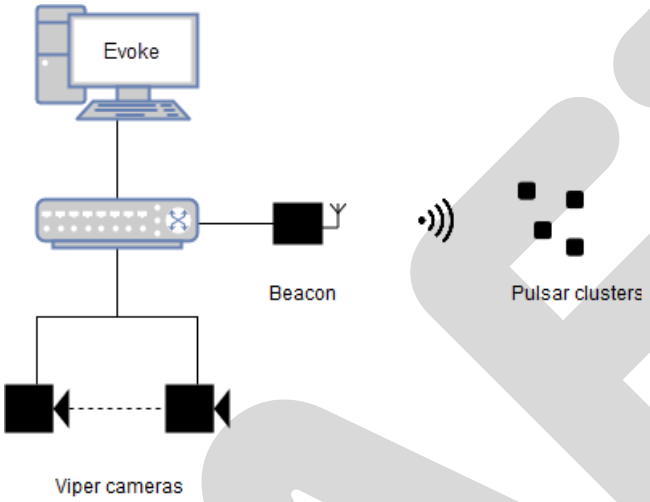
Origin system components

The Origin system comprises the following components:



Component	Description
PC running Vicon Evoke software	Spec/requirements TBC Evoke is the Vicon app that controls Vicon devices and outputs object poses via the DataStream SDK.
Viper cameras	Approved description to come - with RGB status LED, IR positioning LED, temperature sensors and accelerometer.
PoE switch	Spec/requirements TBC
Ethernet cabling	Standard RJ-45 terminated Cat5e cable
Vicon Beacon wireless synchronization unit	Vicon master synchronization unit whose main function is to receive the Vicon Ethernet synchronization pulse from the PoE+ and broadcast this wirelessly to Pulsar clusters. It broadcasts the sync signal over Ethernet for the cameras and over the radio at 2.4 GHz for the clusters. This ensures the cluster LEDs are on only during the camera exposure period, maximizing power efficiency.

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Component	Description
Pulsar clusters	Synchronized active tracking objects containing eight LEDs that can be configured in unique LED patterns to allow for tracking by the Evoke software. The clusters are battery-operated and rechargeable through a standard micro-USB connection.
Micro-USB charger cable	Standard micro-USB cable?

Note that an additional app (TBC) is required to control Evoke and connected Vicon devices.

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Pulsar status LEDs and button

LED status	Description
Green on	Pulsar battery is charging*
Green off	Pulsar battery is fully charged
Red on	Pulsar battery low (<=20%)
Red off	Pulsar battery has charge (>20%)
Blue off	Radio disabled
Blue on	Pulsar paired to Beacon
Blue on → Blue off (slow pulsing)	Pulsar on and paired but not receiving comms from Beacon (will be in continuous mode)
Blue on → Blue off (fast pulsing)	Pulsar on but not paired (will be in continuous mode)
Red on → Red off → Blue on → Blue off → Green on → Green off	Boot sequence
Red on → Red off → Blue on → Blue off → Green on → Green off (sequence repeating)	Cluster selected in software

* To ensure the charge indication LEDs are visible, the cluster automatically switches on when plugged into the charger.

Available user commands:

- Status LEDs can be disabled.
- Enable/disable selection of Pulsar.

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Using the Pulsar button

To	Do this
Turn on cluster	On a cluster that is turned off, give the button a single short press.
Turn off cluster	On cluster that is turned on, press the button for 2 seconds.*
Reboot cluster (retains settings)	On cluster that is turned on, press the button for 10 seconds.*
Unpair cluster from Beacon	During the 10-second period **after booting only**, double-press the button.

* Can be disabled in software to prevent accidental use.

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Battery run time

The following measurements have been performed with multiple prototype units that are representative of final production hardware. They are presented here to assist Dreamscape in specifying the number of units to provide for their setup. However, the final numbers stated in released documentation may differ once extended testing has been complete. Leave in for now?****

Condition	LED power setting	Run time	Estimated run time after 500 charge cycles
Running continuously	75%	14h	8h
50:50 duty cycle IR LEDs on/off (radio and status LEDs still on)	75%	20h	12h
50:50 duty cycle IR LEDs on/off (radio and status LEDs still on)	100%	18h	11h

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Setting up an Origin system

To set up your Origin system, complete the following procedures:

- Start Evoke and load tracking objects (see page 12)
- Turn on Beacon, check status and set pairing mode (see page 13)
- Turn on clusters and pair with a Beacon (see page 14)

Important
Before you begin, ensure Beacon is connected to a powered PoE switch and that this switch is connected to the host PC, which runs Evoke.

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Start Evoke and load tracking objects

1. Start Evoke.
2. On the **Object** tab, click the **Import Active Object** button.
3. In the <name?> dialog box, select the number of objects required (up to a maximum of 56 for Pulsar).
   Evoke generates the requested number of objects, assigning each a unique pattern of markers.
4. Ensure objects are appropriately named (e.g. Green_Hand_L), so they can be easily matched with clusters. (Is it obvious how to rename objects?)

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Turn on Beacon, check status and set pairing mode

1. Ensure Beacon is connected to a powered PoE switch and that this switch is connected to the host PC running Evoke.
   In Evoke, on the **System** tab, notice that in the **Connectivity** section a Beacon entry is displayed.
2. Ensure that the Beacon connection status is green.
   If a radio error flag is displayed, Beacon was unable to find a clear radio channel. This may be because other devices are transmitting at 2.4 GHz and are interferring with the sync signal (e.g. mobile phones or Wi-Fi routers).
3. On the **System** tab, select Beacon and in the Properties pane? set the **Pairing Mode**:
   - **Auto** Enables unpaired clusters to pair to this Beacon.
   - **Whitelist** Enables you to select specific clusters to pair.

   Only one connected Beacon can be in pairing mode at a time (Beacons in adjacent volumes may also be in pairing mode, but this is not recommended).

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Turn on clusters and pair with a Beacon

1. On the cluster, press the power button to turn it on. (Note that it is easiest to match physical labels with entries in the **System** tab if you turn on clusters one at a time.)
   The cluster automatically searches for a radio channel with a Beacon pairing broadcast. It records the radio channel for communication with this Beacon. This record persists when the cluster is turned off.
   In Evoke, on the **System** tab, in the **Active Cluster** section, a Cluster entry is displayed.
2. Ensure that the cluster connection status is **blue** (connected but not programmed with a marker pattern).
   <img>
   Note that the cluster battery level is indicated by status icon.
   <img>
   If any other icon is displayed, see Cluster error icons (see page 15) to troubleshoot possible issues.
3. Assign a tracking object (LED pattern) to the cluster. To do this, on the **System** tab, select a cluster and from the **Pattern** drop-down menu, choose the corresponding object pattern.
   Note that a cluster can be assigned a pattern from any object, but to avoid confusion it is best to label clusters according to their intended location (e.g. Green_Hand_L or Red_Backpack_Top) and name objects accordingly.
   When you have assigned a pattern to the cluster:
   - The pattern error icon clears from cluster entry.
   - The cluster connection status turns **green** (active with LEDs turned on).
4. To confirm that the object is tracked and labeled correctly, check that in the **3D Scene** view, the object model is drawn and its label matches the associated cluster(s).
5. When you have paired all the clusters, turn off pairing mode. To do this, on the **System** tab select Beacon and set **Pairing Mode** to **Off**.
   Cluster settings are stored in the System file (by default located at *C:\Users\Public\Documents\Vicon\Evoke1.0\LastRun*<username>*\LastRun.System*). Object settings are stored in the Subjects file (by default located at *C:\Users\Public\Documents\Vicon\Evoke1.0\LastRun*<username>*\LastRun.Subjects*). Settings are auto-saved on exit.

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- To disable a cluster, on the **System** tab, select the cluster and clear the **Enabled** check box.
  The cluster connection status turns **yellow**. The marker LEDs turn off, to reduce power consumption when not in active use. Move to where relevant

Cluster error icons

On the **System** tab, in the **Active Cluster** section, cluster error icons indicate the status of the cluster: <add images>

Error	Meaning
Hardware error	A physical problem has been reported by the cluster.
Radio error	Evoke is not receiving status updates from the cluster.
Pattern error	The cluster has not been assigned a pattern, or multiple enabled devices are using the same pattern.

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Preparing Origin for a live experience

Before using clusters in a live experience, make the following checks:

1. Ensure clusters are paired with a Beacon in the volume (see Setting up an Origin system (see page 11)).
2. Ensure that the Beacon is enabled. This is shown by the following indicators:
   - On the **System** tab, the **Connectivity** section displays a Beacon entry.
   - Beacon connection status is green.
   - Beacon error flags are clear.
   - On the **System** tab, select Beacon and then select the **Enabled** checkbox. (ensure the Enabled checkbox is selected?)
3. Turn on the clusters and check their status in Evoke:
   - Cluster entries appear on the System tab, in the **Active Cluster** section.
   - Cluster connection status is green for all clusters.
   - Battery levels are sufficient for the experience.
   - Error flags are clear.
   - Objects are tracked and labeled in the **3D Scene**.

Disable Beacon features (optional):

- Set **Pairing Mode** to **Off**
  This removes the pairing flag from the Beacon sync broadcast, which prevents any unpaired clusters trying to connect to it.

Start camera calibration auto heal session:

- This tells the automatic camera calibration repair mechanism to start collecting data.
  For successful calibration repair, objects must be tracked in the volume, and all cameras must see some data at some point during the session.

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Maintaining an Origin system

For information about maintaining your Origin system, see the following topics:

- Replace a failed cluster (see page 18)
- Unpair a cluster (see page 19)
- Monitor status (see page 20)
- Install in multiple volumes (see page 21)
- Manage object groups for gear up/gear down (see page 22)

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Replace a failed cluster

Depending on the failure mode, the affected cluster may show as disconnected (red X icon) on the **System** tab, or it may show error icons.

To replace a cluster:

1. Turn off the failed cluster using the power button.
2. Ensure that the replacement cluster is paired with the Beacon in the volume.
3. Replace the failed cluster with the replacement cluster and turn on the replacement.

To assign the pattern from the failed cluster:

1. Ensure the replacement cluster is displayed in the **System** tab with a **blue** connection status icon (connected but not programmed with a marker pattern).
2. On the **System** tab, select it and from the **Pattern** drop-down list, choose the pattern matching the device location.
   Note that unassigned patterns or patterns assigned to a disconnected device are displayed at the top of the list.
   Check that the connection status turns **green** (active and programmed with a marker pattern).

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Unpair a cluster

You can unpair a cluster from a Beacon within Evoke if it is currently connected. To do this:

1. Ensure that the current Beacon is not in pairing mode at this point, or the cluster will reconnect to it.
2. On the **System** tab, right-click the cluster and from the context menu, choose the **Unpair** option.
   The cluster pairing channel is cleared, so it immediately enters pairing mode to search for a new Beacon.
   - The Beacon clears its record of the cluster.
   - The cluster entry is cleared from the **System** tab.

If the cluster is not connected to a Beacon, you can unpair it using the multi-function button on the cluster. To do this:

1. Hold the power button for 4 seconds (TBC) then release.
   The cluster reboots and starts a flash sequence to indicate that it can be unpaired for 10 seconds.
2. Press the button twice to unpair the cluster.
   It automatically returns to pairing mode, searching for Beacons in pairing mode.

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Monitor status

The Live API <xref to Live API doc> provides functionality for querying device status and registering for callbacks on value changes. This can be used to monitor battery levels or cluster error flags.

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Install in multiple volumes

Between 4 and 10 Beacons can share the same radio space, depending on the number of other devices on 2.4 GHz nearby (for example, Wi-Fi routers and mobile phones).

To prevent clusters pairing with the wrong Beacon, set only one Beacon to pairing mode at a time.

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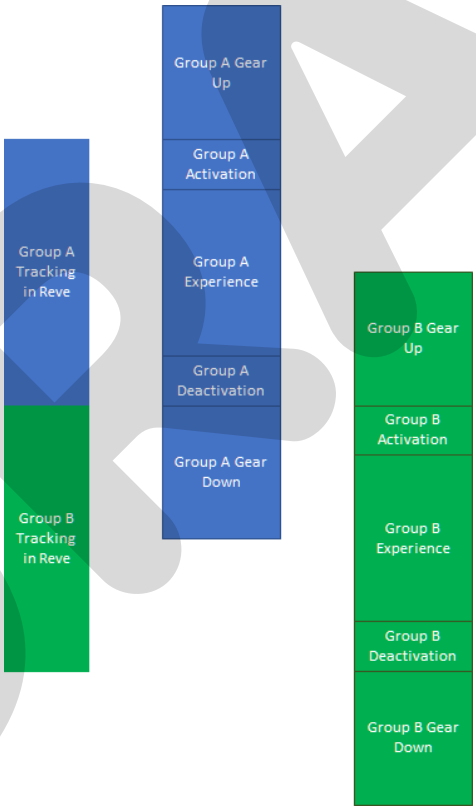
Manage object groups for gear up/gear down

Maximizing volume uptime requires overlapping groups of participants, so that one group is gearing up/down while another is going through the experience.

The number of patterns required for two groups of participants may exceed the maximum number of unique patterns. In this case, the operator must manage enabling and disabling groups of devices.

In Evoke, a single set of objects is loaded and the operator manages which cluster devices are assigned to the objects.

The Live API <XREF> provides access to devices for easier management of device groups.



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1. Gear up
   a. Enable group clusters:
      - On **System** tab, select clusters in group and select the **Enabled** check box.
   b. Check cluster statuses are **green** and error flags are clear.
   c. Participants move to calibration area.
   d. Check that all objects are tracking well.
2. Experience
   a. Send **Start Experience** command.
   b. Participants move into volume and experience begins.
   c. Experience ends.
   d. Send **Stop Experience** command.
3. Gear down
   a. Participants move to calibration area.
   b. Disable group clusters:
      - On **System** tab, select clusters in group and clear the **Enabled** check box.

It is assumed that there are four areas involved:

- Gear up/gear down area for Group A
- Gear up/gear down area for Group B
- Calibration area for group activation/deactivation and tracking checks
- Tracking volume (where experience takes place)

In the gear-up/gear down areas, the clusters must be able to connect to the Beacon, enabling the software to monitor status and battery level. Connectivity depends on the physical layout and distance from the Beacon.

The calibration area must be adjacent to the main tracking volume, both for seamless tracking and for good radio connectivity.

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Hardware specifications for Origin systems

See the following specifications:

- Viper camera specification (see page 25)
- Cluster specification (see page 27)
- Beacon specification (see page 28)
- Charger specification (see page 29)

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Viper camera specification

The following table provides technical specifications and performance indicators for Vicon Viper cameras.

Component	Specification
Resolution	2.2 MP 2048 * 1088
Frame rate (minimum)	30 fps
Frame rate (full frame)	240 fps
Sensor diagonal	12.75 mm
Pixel shutter type	Global shutter
Pixel size	5.5 µm square
Lens	Tamron 6.5 mm fixed
Effective FOV (H x V)	81.8 x 49.4
Optical filter	Long-pass wavelength matched dye filter
Maximum temperature	35°C [1] (see page 26)
Minimum temperature	-5°C [1] (see page 26)
Maximum humidity	TBC
Maximum power consumption	6 W
Connectivity	Single RJ-45 connection for Cat6 cabling. Carries power and data and conforms to IEEE 802.3af-2003 (15.4W) standard.
Weight	277 g
Camera external dimensions	H x W x D: 80 x 80 x 75 mm

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1. **Operating temperature**: While Vicon cameras may operate outside the given limits, these are the temperatures to which Vicon has tested the cameras. If the cameras are operated outside of these limits, image quality may be degraded, the external surface temperatures may exceed the relevant safety limits, and any failures are not covered under warranty.

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Cluster specification

Component	Specification
Power	Internal 3.7 V nominal lithium polymer battery (fixed)
IR wavelength	850 nm
Distinct LED patterns in use	24 (min), 56 (aim)
Patterning	5 LEDs on of 8 fitted
LEDs for status indication	Battery (Green) Radio (Blue) Sensor failure (Red)
Physical multifunction switch	Power, sleep, pairing, reboot
Run time	10 hrs (min)
Charge interface	USB micro-B receptacle
Recharge time to 80%	1 hr (max)
Recharge time to 100%	3 hr (max)
Range (optical)	To suit 7 x 7 x 3 m volume
Range (RF)	To suit 7 x 7 x 3 m volume
IP rating	IP50 (min)

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Beacon specification

Component	Specification
Power	Power over Ethernet (PoE) class TBD device
Number of clusters per Beacon	24 (min), 56 (aim)
Number of Beacons per volume	1
Number of Beacons operating simultaneously in adjacent volumes	4 (min), 10 (aim)*
Sync frequency	240 fps (max)
RF frequency band	2.4 GHz
Range (RF)	To suit 7 x 7 x 3 m volume (min)

*Depending on RF spectrum occupancy at site check

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Charger specification

USB cable charging from off-the-shelf charger.

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Origin system safety and regulatory information

When final, move to Regulatory space and link as far as poss.

The terms “device” or “wireless device” used in this section refer to your Beacon Model MSU1 and sets of Pulsar LED Cluster Model P1 wearable products.

Read this information before using your device.

- Pulsar radio and television interference regulatory information (see page 31)
- Pulsar environmental regulations (European customers) (see page 35)
- CE Declaration of Conformity (Vicon Pulsar) (see page 38)
- CE Declaration of Conformity (Vicon Viper) (see page 39)
- Specific Absorption Rate (SAR) certification (see page 40)
- Other important safety information (see page 41)

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Radio and television interference regulatory information

This topic contains information concerning compliance with regulations of radio and television interference.

- For United States of America customers (see page 31)
- For Canadian customers (see page 32)
- For Australian and New Zealand customers (see page 33)
- For Japanese customers (see page 34)

For United States of America customers

Federal Communications Commission (FCC) Part 15 Information

Pursuant to part 15.21 of the FCC Rules, you are cautioned that changes or modifications not expressly approved by Vicon Motion Systems Ltd could void your authority to operate the device. This device complies with part 15 of the FCC Rules. Operation is subject to the 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.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15(c) of the FCC CFR47 rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency (RF) energy and, if not used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular application. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

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FCC Notice and Cautions

The device may cause TV or radio interference if used in close proximity to receiving equipment. The FCC can require you to stop using the equipment if such interference cannot be eliminated.

Cautions: Any changes or modifications to your device not expressly approved by Vicon Motions Systems Ltd could void your warranty for this equipment and void your authority to operate this equipment. Only use approved batteries. The use of any unauthorized accessories may be dangerous and void the device warranty if said accessories cause damage or a defect to the device. Although your device is quite sturdy, it is a complex piece of equipment and can be broken. Avoid dropping, hitting, bending or sitting on it.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The published FCC IDs are **Beacon** DMR-VICMSU1 and **Pulsar LED Clusters** DMR-VICP1.

For Canadian customers

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada.

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Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The published COMPANY NUMBER and UPN NUMBER are:

Beacon 11323A VICMSU1 and **Pulsar LED Clusters** 11323A -VICP1.

For Australian and New Zealand customers

The product complies with the requirements of the relevant Australian Communications and Media Authority Standards made under the following Notices:

- *Radiocommunications (Compliance Labelling - Devices) Notice 2014* made under section 182 of the *Radiocommunications Act 1992*;
- *Radiocommunications Labelling (Electromagnetic Compatibility) Notice 2008* made under section 182 of the *Radiocommunications Act 1992*;
- *Radiocommunications (Compliance Labelling – Electromagnetic Radiation) Notice 2014* made under section 182 of the *Radiocommunications Act 1992*.

Supplier's declaration of conformity available upon request.

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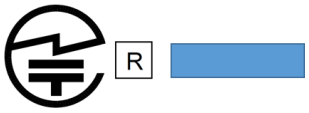
For Japanese customers



Conformity Assessment Body (CAB ID 205) with respect to the Japan/EU MRA, declares that the VICON Pulsar System wearable product and supporting equipment complies with the Certification by Type of the Ordinance Concerning Technical Regulations Conformity Certification, etc. of Specified Radio Equipment (MPT Ordinance No. 37 of 1981).

Category of the Specified Radio Equipment Article 2, Paragraph 1, Item (19).

Class of Emission F1D

Frequency 2402 MHz–2480 MHz

Antenna Power ****** mW/MHz

Antenna Gain 1.5 dBi (cluster), 2.0 dBi (Beacon)

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Environmental regulations (European customers)

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

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) (see page 35)).
- REACH Declaration of Conformity (see page 35)
- Directive 2202/96/EC (for details, see Waste Electrical and Electronic Equipment (WEEE) (see page 36)).

Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment –RoHS and Recast (RoHS 2)

This device is fully RoHS (2002/95/EC provides that new electrical and electronic equipment put on the market for the first time from 1 July 2006) and RoHS 2-compliant. The European Union Directive 2011/65/EU[1] 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).

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

1 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011L0065

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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)
(Applicable in the European Union and other European countries with separate collection systems)

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 their 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.

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Correct disposal of batteries in this device
(Applicable in the European Union and other European countries with separate battery systems)

The use of the symbol as a marking on the battery, manual or packaging indicates that the battery in this device should not be disposed of with other household waste at the end of their working life. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. If batteries are not properly disposed of, these substances can cause harm to human health or the environment.

To protect natural resources, and to promote material reuse, please separate batteries form other types of waste and recycle them through your local, free battery return system.

The rechargeable battery incorporated in this device is not user replaceable. For information on its replacement please contact Vicon Motion Systems Ltd.

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CE Declaration of Conformity (Vicon Pulsar)

CE Declaration of Conformity

(Radio Equipment Directive 2014/53/EU)

We, Vicon Motion Systems Ltd
Unit 6, Oxford Industrial Park
Yarnton, Oxfordshire, OX5 1QU
UNITED KINGDOM

declare under our sole responsibility that the product

VICON Beacon Model MSU1
VICON Pulsar LED Clusters Model P1

to which the declaration relates, is in conformity with the following standards and/or other normative documents.

SAFETY[1]	EN 60601-1:2006/A12: 2014 Latex Free RF Exposure Evaluation RED 2014/53/EU Article 3(1)(a)
EMC	EN61236:2013; ETSI EN301 489-17 V2.2.1:2012 using the common technical requirements of ETSI EN301 489-1 V2.1.1
RADIO	ETSI EN300 328 V2.1.1 (2016-11) Covering wide band transmission systems; data transmission equipment operating in the 2.4 GHz ISM band

We hereby declare that all essential radio test suites have been carried out and that the above named product is in conformity to all the essential requirements of Directive 1999/5/EC. The technical documentation is kept at Vicon Motion Systems Ltd, Unit 6, Oxford Industrial Park, Yarnton, Oxfordshire, OX5 1QU, UNITED KINGDOM that will be made available on request.

T.M.L. Shannon, TD, PhD, FIE (Aust.), CPEng (Biomed.)
Director

3rd September 2018

1. Risk analysis performed under ISO14971:2012 in compliance with Medical Devices Directive 93/42/EEC applied as amended by EU Council Directive 2007/47/EC of 5th September 2007 as the product is wearable.

Not a medical device. 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, ionizing radiation, sterile, or life- or safety-critical environments.

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CE Declaration of Conformity (Vicon Viper)

When final, if MDD compliant, move to Hardware regulatory section and link instead

CE Declaration of Conformity

Electromagnetic Compatibility to EMC Directive 2004/108/EC
Electrical Safety to Low Voltage Directive 2006/95/EC.

We, Vicon Motion Systems Limited
Unit 6 Oxford Industrial Estate
Yarnton OX5 1QU
UNITED KINGDOM

declare that the VICON Viper Cameras manufactured by VICON MOTION SYSTEMS LIMITED have been tested and demonstrated that all products of its own manufacture meet 2004/108/EC:

Electromagnetic Compatibility to:
EN60601-1-2:2015

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

Network Hub UL60950-1, 2nd Edition

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Thomas Shannon TD PhD FIE (Aust) CPEng (Biomed.)

Director

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Specific Absorption Rate (SAR) certification

For United States of American Customers (FCC)

For Standalone SAR exclusion consideration, when SAR Exclusion Threshold requirement in KDB 447498 is satisfied, standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required. At 2480 MHz, equivalent isotropically radiated power of the devices is 3.9 mW, which will be less than the SAR Exclusion Threshold (95.54 mW). For further information, please see clause 4.3 of KDB 447498 D01 General RF Exposure Guidance.

This device has been granted authorization to be used in the United States for all equipment exhibiting DMR IMUAP1.

For Canadian Customers (ISED)

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance. At 2440 MHz, equivalent isotropically radiated power of the device is 4.1 mW, which will be less than the SAR Exclusion Threshold at distances of between ≥5 and ≤ 10 mm of 4-7 mW respectively at 2450 MHz. The minimum distance between the cluster aerial and the underside is 6.69 mm. The Beacon emissions are assessed as presenting a negligible risk. For further information, please see clause 2.5.1 of RSS-102 Issue 5 March 2015.

This device has been granted authorisation to be used in Canada for all equipment exhibiting 11323A-IMUAP1.

For European Union Customers (RED)

Minimum safe distance for RF exposure, based on the *Reference Levels for General Public exposure of EU Council Recommendation (1999/519/EC)* of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) was calculated:

Frequency (MHz)	EIRP (dBm)	Limit (W/m2)	Minimum safe distance (m)
2480	6.8	10	0.0062

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Other important safety information

- Only qualified personnel should service the device. Faulty service may be dangerous and may invalidate any warranty applicable to the device.
- Do not store or carry flammable liquids, gases, or explosive materials in the same compartments as the device, its parts, or accessories.
- For vehicles equipped with an air bag, remember that an airbag inflates with great force. Do not place objects, including portable wireless equipment near or in the area over the air bag or in the airbag deployment area. If the wireless device is within the deployment area as an air bag inflates, serious injury could result.
- Switch off the device off before boarding an aircraft. The use of wireless devices in aircraft is illegal and may be dangerous to the aircraft's operation. Check with appropriate authorities before using any function of the device while on an aircraft.
- The primary responsibility of every driver is the safe operation of his or her vehicle. Do not engage in any activity while driving a moving vehicle which may take your eyes off the road or become absorbed in any activity that your ability to concentrate on the act of driving becomes impaired.
- Failure to observe these instructions may lead to the suspension or denial of network services, or legal action, or both.

Battery use and safety

- The battery in this device is not intended to be replaced by the consumer. If you believe the battery is damaged or needs to be replaced, return the device for inspection and replacement.
- Do not let the device or battery come in contact with liquids. Liquids can get into the device's circuits, leading to corrosion. Even when the device appears dry and appears to operate normally, the circuit could slowly corrode and pose a safety hazard.
- Do not place the device in or near a heat source. Excessive heating can damage the device and battery and could cause the device or the battery to explode. Do not dry a wet or damp device with an appliance or heat source such as a microwave oven, hair dryer, iron, or radiator. Avoid leaving your device in your vehicle in high temperatures.
- Do not dispose of the device or battery in a fire. The device or battery may explode when overheated.
- Avoid dropping the device. Dropping the device, especially on a hard surface, can potentially cause damage. If you suspect damage to the device or battery, return it for inspection.

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- Never use any battery that is damaged in any way.
- **Warning.** Use of a non-manufacturer approved batteries may present a risk of fire, leakage, or other hazard. Manufacturer warranty does not cover damage to the device caused by non-approved batteries.
- Do not use incompatible batteries and chargers. If using a powered USB Hub always ensure that you use the manufacturer's approved or recommended power source. Some websites and second-hand dealers not associated with reputable manufacturers and carriers, might be selling incompatible or even counterfeit batteries and chargers. Please refer to Vicon Motion Systems Ltd for advice. Misuse or use of incompatible batteries and chargers could result in damage to the device and a possible risk of fire, explosion, or leakage, leading to serious injuries, damage to your device, or other serious hazard.

Operating environment

- Avoid temperature below 0°C/ 32°F or above 37°C/99°F.
- Do not expose your device to dust, dirt, or sand.
- Remember to follow any special regulations in force in any area, and always switch your device off whenever it is forbidden to use it, or when it may cause interference or danger. When connecting the device or any accessory to another device, read its user's guide for detailed safety instructions. Do not connect incompatible products.
- **Implantable medical devices**. A minimum separation of 6 inches (15.3 mm) should be maintained between the device and an implantable medical device, such as a pacemaker or implantable defibrillator, to avoid potential interference by the device.
  The wearable device uses neodymium magnets to provide an easy connection to supporting strap holders. The operation of heart pacemakers will be affected by the close proximity of a magnet. Magnets can set a pacemaker working in a way that is not suitable for the pacemaker user and that might affect their health. This change will stop when the magnet is removed. The background to this is that magnets are used to put pacemakers into a mode of working that does not respond to the patient's own heart rhythm. Pacemaker clinics use magnets to change the working of the pacemaker, to see how it is operating. Each pacemaker manufacturer uses the 'magnet response' of a pacemaker in a different way, so it is impossible to be more precise than the above statement. Some manufacturers have a response that makes the pacemaker pace the heart at 100 beats-per-minute or faster. The pacemaker will not usually synchronize with the natural heart beat when

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a magnet is applied. It is theoretically possible to trigger a life-threatening heart rhythm by doing so.

- Persons who have such implantable medical devices:
    - Should ALWAYS keep the device more than 6 inches (15.3 mm) from their implantable medical device when the device is turned ON;
    - Should not carry the device in a breast pocket;
    - Should immediately turn the device OFF if there is any reason to suspect that interference is taking place;
    - Should read and follow the directions from the manufacturer of your implantable medical device. If you have any questions about using your wireless device and/or using magnets with an implantable medical device, consult your health care provider.

- **Other medical devices.** If you use any other personal medical devices, consult the manufacturer of your device to determine if it is adequately shielded from external RF energy. Your physician may be able to assist you in obtaining this information. Immediately turn the device OFF if there is any reason to suspect that interference is taking place.
- Switch your wireless device off in health care facilities when any regulation posted in these areas instructs you to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.
- **Vehicles.** RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles. Check with the manufacturer or its representative regarding using your wireless device in a motor vehicle. You should also consult the manufacturer of any equipment that has been added to your vehicle. Immediately turn the device OFF if there is any reason to suspect that interference is taking place.
- **Posted facilities.** Switch your device off in any facility where posted notices require you to do so.
- **Potentially explosive environments.** Switch your wireless device off when in any area with a potential explosive atmosphere and obey all signs and instructions. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death. Users are advised to switch the wireless device off while at a refueling point (service station).
  Users are reminded of the need to observe restrictions on the use of radio equipment in fuel depots (fuel storage and distribution areas),

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chemical plants or where blasting operations are in progress. Areas with a potentially explosive atmosphere are often but not always, clearly marked. They include below deck on boats, chemical transfer or storage facilities, vehicles using liquefied petroleum gas (such as propane or butane), areas where the air contains chemicals or particles, such as grain, dust, metal powders or anesthetic gases, and other areas where you would normally be advised to turn off your vehicle engine. Vehicles using liquefied petroleum gas (such as propane or butane) must comply with the National Fire Protection Standard (NFPA-58). For a copy of this standard, contact the National Fire Protection Association.

- **High magnetic flux environments.** The device contains ferrous components so may constitute a physical projectile hazard if brought into high magnetic flux environments such as found within Magnetic Resonance Imaging (MRI) facilities.
- **Securing straps**. Securing straps are **Latex Free**, manufactured using **Neoprene** or polychloroprene. *Allergic* reaction to neoprene is generally ascribed to the accelerants used to manufacture the man-made rubber, specifically thiourea compounds and mercaptobenzothiazole (MBT). Symptoms of *neoprene*-related allergic contact dermatitis (ACD) include itching, skin eruptions, swelling, and hemorrhages into the skin. If you experience an ACD, please immediately desist from using the straps.
- **Allergies to Nickel** Neodymium magnets are nickel-plated. Nickel is a metal which can cause an allergic reaction in some people who are exposed to long-term contact with objects that release nickel. As a precaution, avoid long-term contact with nickel-plated magnets and totally avoid contact with nickel-plated materials if you already have a nickel allergy. How much or little it takes to trigger a nickel allergy is debatable and changes from person to person.

Restricting children's access to your device

- Your device is not a toy. Do not allow children to play with it because they could hurt themselves and others or damage the device.
- Keep the device and all its parts and accessories out of reach of small children.
- Children (aged 16 years or younger) should NEVER be allowed to play with NEODYMIUM magnets if they break free from the device. Even relatively small magnets can cause blood blisters and cuts and tiny magnets can cause serious injury if swallowed.

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- If more than one magnet is swallowed, they can attract each other through the walls of the intestines, get stuck and pinch the digestive tract causing major swelling and even life-threatening injuries requiring surgery. Always keep any free neodymium magnets out of the reach of children.

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