VECTOR
VECTOR-Z

Technical Brief

VYSIONICS
Intelligent Traffic Solutions

Introduction

VECTOR is a fully self-contained compact intelligent camera incorporating ANPR monochrome and colour context day/night camera modules, onboard processing and communication interfaces.

In normal operation, VECTOR automatically reads number plates and captures plate and context images. ANPR data and associated images are buffered in non-volatile local storage and then transmitted to remote servers. High capacity local internal storage is available in a range of capacities, ensuring that data is preserved for later transmission in the event of a communication link outage.

Two variants are available:

- **VECTOR** with fixed range lenses
- **VECTOR-Z** with motorised zoom lenses

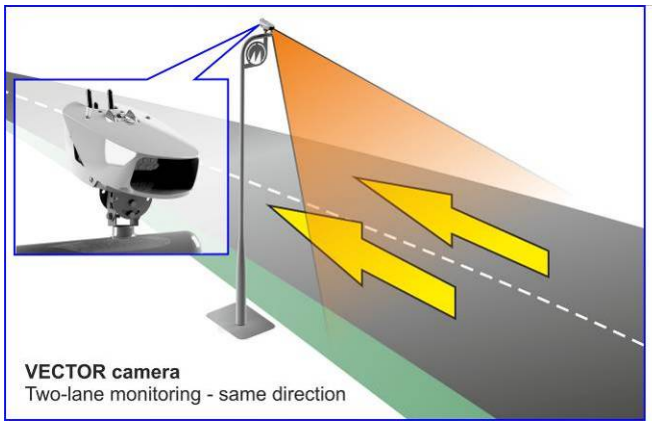
Features common to all VECTOR variants:

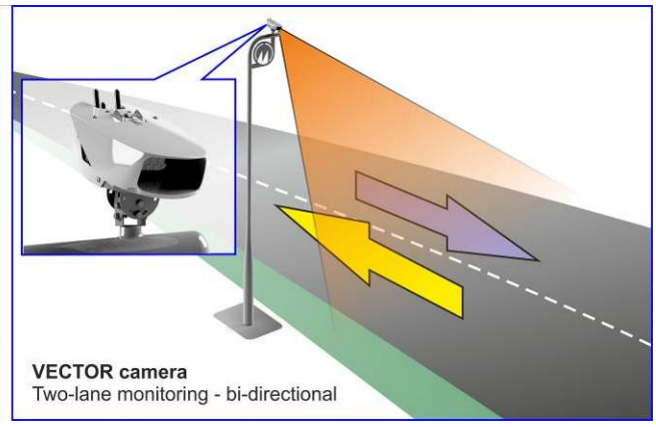
- High resolution camera sensors for both ANPR and colour context (overview image) cameras offering twin lane monitoring capability
- Compact and light in weight: 2.9kg excluding mounting bracket
- Low power consumption: 48VDC using 25W typically
- Robust die-cast aluminium construction sealed to IP67 rating
- Integrated synchronised pulsed IR illumination from 16 individually lensed 850nm LEDs
    - Near invisible to the naked eye
- Integrated GPS module
- Integrated 3G / 4G modem and WLAN module as standard (either module can be deleted by special request at time of order)
    - LAN communication available from column box
    - ADSL Broadband connection via LAN connection
- Analogue video output available from BNC in column box for either ANPR or colour context camera
    - Useful for ground-truthing or analogue recording
- Integrated forward and rear facing light sensors for improved image exposure control
- Integrated compass and accelerometer detects camera orientation and movement

VECTOR-Z features additional to VECTOR:

- Integrated remote control motorised zoom lenses for ANPR and colour context cameras, for added flexibility and simplified installation
- Remote control motorised focus for ANPR and colour context cameras
- Higher resolution camera sensors for ANPR and colour context cameras.

VECTOR can monitor one or two lanes simultaneously, and can monitor twin lanes where traffic flow is in the same direction or bi-directional, as shown below.





Optics and operating range

VECTOR contains a high resolution monochrome CMOS sensor for ANPR and a high resolution colour CMOS sensor for colour context images. The colour sensor incorporates a software controlled day/night IR cut filter switcher. This can be disabled to provide night-time colour images under white illumination, where required. VECTOR-Z also includes a switchable IR bandpass filter.

A range of lens options is available for VECTOR to suit different operating ranges (object distance from the camera) as per the table below. Operating range must be specified at the time of order. VECTOR-Z includes remote control 15-50mm motorised zoon lenses as standard.

VECTOR				VECTOR-Z	
ANPR Camera				***ANPR Camera***	
Specification	**Range**	**Notes**		**Specification**	**Notes**
50mm	30m	Specify at time of order		15 - 50mm motorised zoom	Remote control focus
35mm	21m				
25mm	15m				
Context Camera - Overview				***Context Camera - Overview***	
Specification	**Range**	**Notes**		**Specification**	**Notes**
10mm - 40mm varifocal		Matches all ANPR lenses. Matching range configured during manufacture		15 - 50mm motorised zoom	Remote control focus

Mechanical construction

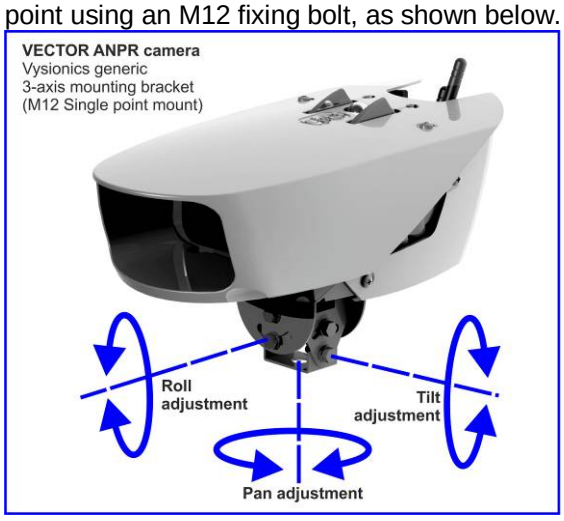
VECTOR uses an IP67 die-cast aluminium enclosure. Key heat-generating internal components are thermally linked to the enclosure, which is externally finned underneath and at the sides to dissipate heat. The camera module assembly and illuminator assembly sit behind an anti-reflective toughened glass window. Dimensioned views of VECTOR are shown on the specification pages.

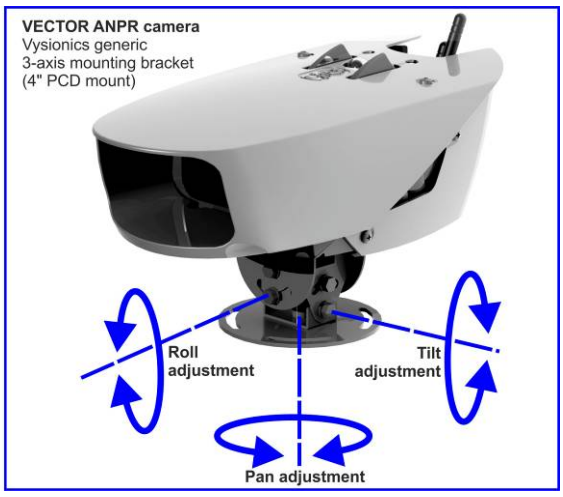
The VECTOR is optionally fitted with an injection-moulded polycarbonate sunshield, which provides protection against solar heat gain, stray non-axial light, road spray, rain and snow. A rear sunshield may also be fitted. Front and rear sunshields are available in a range of colours, which should be specified at the time of order. Other colours are available to special order but are subject to a setup surcharge. Standard available colours:

- Dusty Grey RAL7037
- Jet Black RAL9005
- Traffic Yellow RAL1023 (typically reserved for SPECS or other enforcement applications)

Installation

Standard mounting brackets are available to suit either standard CCTV 4" PCD mounts or a single mounting point using an M12 fixing bolt, as shown below.





VECTOR is compact, light in weight and has minimal wind deflection due to its small cross-sectional side and frontal area. It therefore offers a wide range of installation options including:

- Standard CCTV columns, including passively safe columns, tilt-down columns or lowering trolley head columns.
- Existing infrastructure such as lighting columns, buildings, signage gantries and overbridges, using appropriate industry standard brackets.

A single power / data cable connects each VECTOR to a breakout box, which offers additional connectivity including a LAN connection to the VECTOR and analogue video output via BNC connector inside the box. Two standard breakout boxes are available:

- Mains power input (90 - 264VAC) breakout junction box with integrated 48VDC output PSU, intended for installation inside a column.
- Compact 48VDC power input breakout junction box, which can be externally mounted, e.g. on a camera bracket arm or gantry.

VECTOR's low power consumption also enables it to be used in a number of temporary deployment methodologies, including inside vehicles or on rapid deployment platforms. In such applications, VECTOR can run from local power sources such as battery power, combined with power top-up from a range of power sources such as conventional generators, solar panels, wind turbines and fuel cells.

Communication interfaces

VECTOR offers the following communication interfaces for connection to public or private network infrastructure:

- 4G*/3G/GPRS/GSM WAN connection via an internal modem to the mobile telephone network, supporting the HSUPA or HSPA+ standard which is essential to provide adequate upload bandwidth
    - ** 4G not supported by all variants*
- WLAN (WiFi) connection via an internal module. Useful for linking cameras wirelessly (e.g. across roads) so that one 3G connection can serve multiple ANPR units, and also for maintenance purposes. Some applications also benefit from the ability to download data to a nearby vehicle without the need physically to access equipment.
- Wired network LAN connection via an RJ45 LAN port inside the breakout junction box. Useful for wired camera connection during configuration / maintenance, or for permanent wired connection to an ADSL Broadband link or existing LAN, such as the Highways Agency's NRTS network.

Communication protocols and data transmission

VECTOR supports ANPR industry standards such as UTMC, BOF, BOF2 and FTP, and is tested to be fully NAAS / NASP compliant.

VECTOR provides inbuilt Virtual Private Network (VPN) features. IPsec tunnels may be initiated directly from the camera to routers or SSL connections, reducing the need for third party equipment at the roadside.

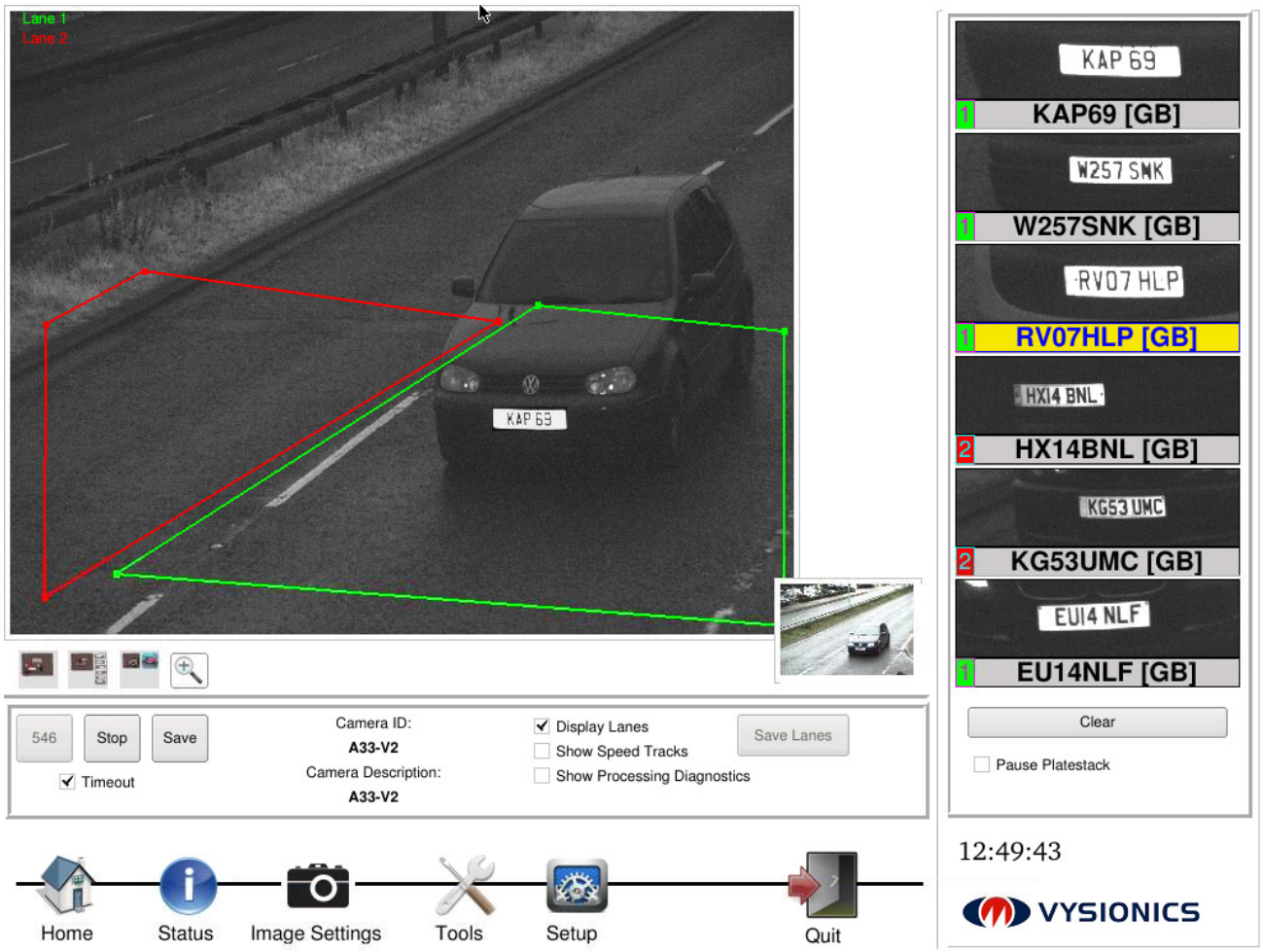
Data packet content is configurable for each application and may include some or all of:

- XML metadata
- Context camera Overview image - JPEG
- ANPR camera image - JPEG
- ANPR camera Plate Patch image - JPEG
- Video clip - MPEG 4 or Motion JPEG

Data can be securely encrypted, for instance using HTTPS for BOF and UTMC. VECTOR is fitted with an internal tamper detect switch which can be configured to provide further data security upon unauthorised access into the camera unit case, if required.

Configuration

VECTOR has a user-friendly Graphical User Interface (GUI) as shown below, enabling straightforward and clear camera configuration. The GUI can be securely accessed via LAN, WAN and WLAN interfaces.



VECTOR configuration is facilitated by choosing from a range of preset "Profiles" covering applications such as:

- General ANPR monitoring
- Police ANPR monitoring
- Journey Time monitoring
- Car Park monitoring
- User Access control
- Bus Lane Enforcement
- Average Speed Enforcement (as part of a SPECS3 VECTOR Enforcement system)

Once the profile is selected, VECTOR's configuration can be edited to suit specific implementations. The edited Profile can then be saved and re-used as a template for additional VECTORs, offering further productivity benefits and reducing engineering time and resource required on site during the installation phase.

VECTOR-Z software control features additional to VECTOR:

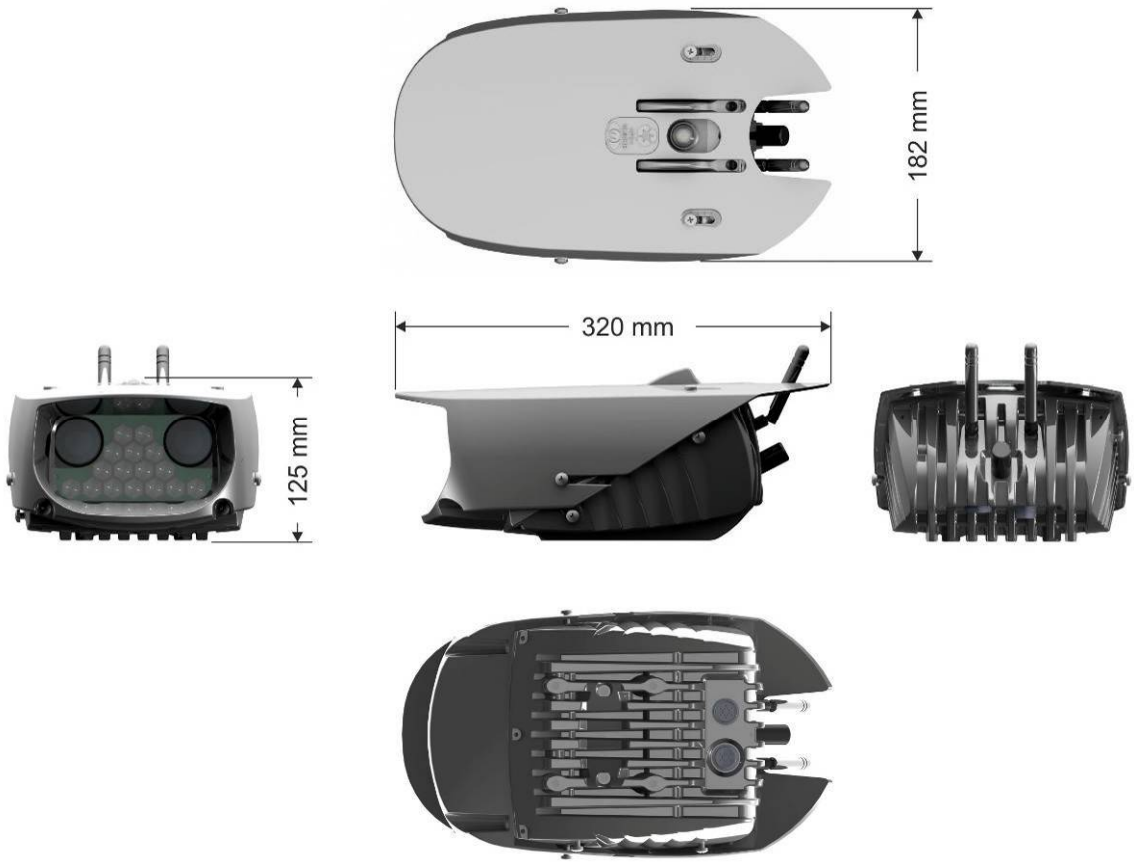
- Remote control motorised zoom for installation flexibility
- Remote control focus for focus fine-tune, including "auto-focus" function
- Switchable IR bandpass filter - e.g. to read non retro-reflective number plates

Specification

Dimensions	• Without sunshield: Height: 125mm, Width: 168mm, Length: 192mm • With sunshield: Height: 125mm, Width: 182mm, Length: 320- 340mm
Weight	2.9kg (excluding mounting bracket)
Power	48VDC nominal, 25W typical consumption (Mains power input to column box: 230VAC nominal, range: 90 - 264VAC)
Ingress protection	IP67
Operating temperature	-10ºC to +50ºC (80% humidity above +20 ºC)
Storage temperature	-25ºC to +70ºC (low humidity)
Optics	Clear IR-permissive front window, toughened glass, anti-reflective coated both sides
Illumination	Integrated IR illumination from 16 individually lensed 850nm LEDs
Monochrome IR camera (ANPR capture)	Monochrome 1/1.8" CMOS sensor, equipped with IR narrow pass filter and C/CS lens mount • *VECTOR:* 1280(H)x1024(V) pixels • *VECTOR-Z:* 1600(H)x1024(V) pixels
Colour context camera (Overview capture)	Colour 1/1.8" CMOS sensor, equipped with switchable day/night IR-cut filter and C/CS lens mount • *VECTOR:* 1280(H)x1024(V) pixels • *VECTOR-Z:* 1600(H)x1024(V) pixels
Lens (ANPR camera)	• VECTOR: 50mm, 35mm, 25mm fixed iris options available • VECTOR-Z: 15-50mm remote zoom, focus and iris module under software control
Lens (context camera)	• VECTOR: Varifocal 12-40mm with auto iris under software control • VECTOR-Z: 15-50mm remote zoom, focus and iris module under software control
Filter (ANPR camera)	• VECTOR: fixed IR bandpass filter • VECTOR-Z: software controlled / remote switchable IR bandpass filter
Filter (context camera)	• VECTOR: software controlled / remote switchable IR cut day / night filter • VECTOR-Z: software controlled / remote switchable IR cut day / night filter
Onboard sensors	• Internal temperature • Forward and rear facing ambient light sensors (IR and visible light ranges) • Three axis accelerometer / magnetometer
Onboard processor	Qseven processor board equipped with AMD T40E dual core processor
Operating system	Linux
Clock sources	• Primary: integrated GPS module with PPS signal • Secondary: integrated clock with high precision crystal, regularly synchronised to GPS time source
Onboard storage	• MicroSD card for operating system • SATA Disk-on-Module DOM for data storage - up to 128GB capacity to be specified at time of order
Communications	• Wired LAN 10/100 baseT Ethernet connection via primary camera connector • 4G*/3G/GPRS/GSM via internal wireless module to externally mounted or remote antenna (* Some variants) • WLAN (WiFi) connection (optional)
Connectivity	• Primary connector (14 way female) o Power o LAN connection o Video out o RS485 • Secondary connector (14 way male) - normally unused o USB o RS485
Security	Tamper detection inside enclosure and / or column box can automatically trigger SMS alert, or email alerts (in conjunction with *VECTOR Manager* software).

Dimensions

VECTOR camera dimensions – with sunshield



Note

This document contains the latest information available at the time of preparation.

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VECTOR-Z

Traffic technology solutions to improve roads, journeys and communities

VECTOR-Z Applications

VECTOR-Z further builds on the capabilities of the proven VECTOR platform, in applications such as:

- Re-locatable ANPR
- Civil Enforcement
- Tolling
- Journey Time Measurement
- Access Control
- Security Cordons
- Parking Management

VECTOR–Z sees even more.

High resolution and superior motorised zoom lenses result in our most powerful and flexible ANPR camera ever.

VECTOR-Z offers a more flexible, enhanced version of the VECTOR ANPR camera, through the addition of two motorised zoom lenses, remote control focus and high resolution sensors. This means that the camera benefits from the reliable VECTOR platform and number plate reading software, whilst allowing it to be deployed more flexibly and rapidly. The motorised lenses allow different operating distances and fields of view to be quickly set up and focussed, whilst the high resolution ensures excellent images over a wide field of view.

VECTOR-Z auto-detects vehicles as they pass through the field of view, interrogating every image captured by the camera. Vehicle number plates are tracked through the field of view, covering two full width lanes of traffic and even traffic travelling in opposite directions simultaneously.

Integrated Intelligent ANPR Camera

For each number plate capture, a record is created for the vehicle comprising of data and images. Data includes the Vehicle Registration Number (VRN), read confidence, time, date, country identifier and camera location..

The images include a plate patch and one of more overview or scene images. Images can be compressed and sent in small file sizes to reduce data usage, particularly when using mobile or cellular communications.

Data can be encrypted using the latest standards, stored locally, in case of communications failure, and/or sent with the plate patch via a wide range of communications media. The corresponding overview image for vehicles of interest can then be transmitted on demand.

VECTOR-Z Ease of Use

Jenoptik have designed VECTOR-Z to be as simple to install, configure and operate as possible. Combined with the cameras technical capability, this delivers powerful solutions that can be rapidly implemented.

Installation: The VECTOR-Z can be mounted on a wide variety of fixtures, from traffic signals and street lighting columns to gantries and bridges. VECTOR-Z can operate with a wide angular offset, allowing installation some distance away from the monitored lane. A range of mounting fixtures, including a 3 axis adjustable bracket allows the camera to be rapidly installed and prepared for operation. A single cable is used for power, data and video, with no requirement for an additional roadside cabinet.

Configuration: VECTOR-Z can be simply configured through a simple to use Graphical User Interface (GUI), which leads an installer through the key stages needed to make a camera operational. There is no need to programme complex routines; the step-by-step GUI gets the camera working, fast.

Operation: Once VECTOR-Z is powered up and capturing data, it will automatically monitor its performance and the environment around it. Adjustments will automatically be made if ambient lighting is too high or low, or if it is moving too much through vibration. When plate reads fall below a threshold value, an alert can be sent to the operator. Remote monitoring via WLAN, 3G or ADSL allows the camera to be viewed without the need for physical access. **In short VECTOR –Z provides intelligent operation.**

Day/Night Mode - When lighting levels drop below a set threshold, VECTOR-Z can automatically switch to 'night' mode if required. This optimises the camera for low light conditions, allowing clear monochrome images to be captured. A wide range of illumination types can be used.

VECTOR-Z can be configured to read characters in the formats issued by almost all countries, with software licenses available for countries with known number plate syntaxes, including more challenging number plates such as Arabic and Cyrillic. The IR filter can be automatically removed in countries or applications where non-retro reflective plates are used.

VECTOR-Z works in all weather and lighting conditions and is able to read plates at high vehicle speeds, so is suitable for use where vehicles are stationary or travelling on high speed roads.

VECTOR-Z read rates have been tested in the most challenging ANPR applications and it has achieved the UK's NASP standard.

VECTOR Specification

ANPR Monochrome Camera & Overview Day/ Night Mode Camera
Resolution: 1600H 1200V
Lens to Object (options): 10m- 30m variable motorised zoom
Field of View: Full two lane coverage
Main Features
Illumination: Controlled pulse infra-red LED, 850mm
Processor & Memory: DualCore 1Ghz, 2Gb RAM, 4Gb SD boot media, 2/4/8/16Gb (option) flash storage media
Communications: Ethernet, HSPA (3G), 4G LTE, GPRS, SMS, IEEE802.11b/g/n (WiFi) , GPS clock, GPS location, tamper switch, x2 input, x2 output, analogue video feed for ground truthing
Physical: 3.5kg, 190mm x 160mm x 100mm, metal casting, 3 axis adjustable stainless steel bracket
Environmental: IP67, -10°C to +50°C operational temperature range
Electrical: 48 V DC to camera, 90-240V AC to column box PSU, 25W typical power consumption

Graphical User Interface - The VECTOR-Z ANPR GUI allows for rapid, effective configuration of the camera set-up. This intuitive interface guides both new and experienced users through the optimum setup configuration for the camera.

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