SISTEMA NEVADA
Product Manual

PUMATRONIX

Pumatronix Equipamentos Eletrônicos Ltda.

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Change History

Date	Revision	Updated Content
11/2017	1.0	Starter Version
11/09/2018	2.0	Hardware Overhaul
11/16/2022	3.0	Format update; Firmware content update

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Overview

The continuous increase of the population in urban areas implies great challenges in the public management of cities. Intelligent services that use Information and Communication Technologies (ICT) are becoming increasingly relevant in helping to monitor, control, and make efficient and quick decisions to solve problems inherent to the large concentration of people, such as mobility and traffic safety, energy efficiency, public safety, and supply control, among others.

The concept called Smart Cities is a worldwide trend that classifies the strategic use of infrastructure and services from the application of ICT solutions in urban planning and management, bringing results to the social and economic needs of a city. Thus, the use of Information Technology allows cities to develop economically while improving the quality of life of their inhabitants by generating efficiency in urban operations.

Examples of these technologies are Intelligent Transportation Systems (ITS), in which Pumatronix products, such as the NEVADA system, are used. These systems monitor vehicles by automatically reading their license plates. The process of vehicle monitoring modernization requires analysis of a large volume of images, which is why the automation of the vehicle license plate identification was developed. This automation uses OCR (Optical Character Recognition) algorithms to infer the letters and numbers contained in license plates images.

NEVADA is composed of ITSCAM VIGIA+ image capturing and processing devices, which perform OCR reading of the license plate of vehicles that commit the violation "Evading a toll road without paying the fare", specified in Article 209 of the Brazilian Traffic Code. This identification is done by collecting day and night images at the toll stations, in an optimized and aware manner, allowing the management of the records made. This system works automatically, requiring only a trigger to start the vehicle registration process.

Handling Risks

This equipment must be powered from a direct current (DC) source with a voltage between 9 to 32 Vdc. Do not connect any of the inputs directly to the mains (AC)!

Oxidation Risk: The electrical and signal connections made to ITSCAM 400 harness and data network cable must be protected in a *Terminal Box* or similar structure to prevent oxidation of the connections and unwanted ingress of liquids into the harness.

This equipment may be accompanied by lenses, which are sensitive to mechanical impacts such as drops and extreme vibrations.

Installation Place: In cases where it is not possible to meet the installation specifications, it is recommended to consult Pumatronix Technical Support.

Vision Damage: The illuminators emit thermal and light energy (non-visible in infrared models), so it is not recommended to look directly at the LEDs. It is also not recommended to use any optical instrument to look directly at the LEDs.

Power Supply Safety: The surge protectors and the circuit breaker must have the indicated specifications, to ensure that the equipment has the necessary protection in the power connection. If they are not installed, the equipment can be damaged when the power grid is overloaded.

Information Distribution: The content generated by NEVADA (captured images and data) is user and password protected. However, it is up to the system administrator to control the users that have access to the information and content disclosure.

Models

Each lane monitored by NEVADA has the sets installed with the necessary items for the product correct functioning:

1) The *Optical Set* contains the equipment responsible for acquiring front and rear images of the vehicles and lane surroundings (panoramic), indicating the act of toll evasion without payment:
    a. ITSCAM VIGIA+ Panoramic;
    b. ITSCAM VIGIA+ Rear;
    c. ITSCAM VIGIA+ Front;
    d. ITSLUX Illuminator.

Available Models	Position	Resolution	Estimated Range (in meters) *
ITSCAM VIGIA+ (S07L1DT2P)	Panoramic	640x480 px	NA**
ITSCAM VIGIA+ (S04L1IT1P)	Front or Rear	1280x960 px	3 to 9 m (3.3-10mm)
ITSCAM VIGIA+ (S08L6IT1P)	Front or Rear	1280x800 px	4 to 11 m (3.2-10mm)

*The license plate characters remain readable in the OCR reading within the distance range of the estimated range, set according to the lens applied to the model.

**The model with 640x480 px resolution (S07 sensor) is used only in panoramic monitoring, without OCR reading.

2) *Infra Set* provides the infrastructure to install the optical equipment with the protection for the connections and the hardware supervision mechanism:
    a. Supervisor Board;
    b. Terminal Box;
    c. Panoramic Post;
    d. Rear Post;
    e. Front Post.

⚠️ **Warranty Loss Risk: The parts that make up the NEVADA should not be opened to perform repairs. All types of maintenance will be performed by Pumatronix Technical Assistance.**

The NEVADA system can be installed in all toll station lanes, both automatic and manual. The Processing Unit is the equipment that processes license plate characters optical recognition of the vehicles detected as violators by NEVADA, so it must be connected to the station data network. This unit is responsible for receiving and storing the data collected by the ITSCAM VIGIA+ devices and must have the following minimum specifications according to the lanes number served:

Number of Lanes	Processor Type	Minimum Specifications
2 (two) lanes	i3 or similar	4GB RAM and 32GB HD
4 (four) lanes	i5 or similar	4GB RAM and 64GB HD

The following minimum specifications must be met for the server where the Triage System will be installed, according to the volume of evasions:

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Number of Evasions/Day	Operating System	CPU	Memory	Storage
1,000	Linux Ubuntu Server 14.04, 18.04 or 20.04	9 cores	6GB	1.5TB
2,000		16 cores	7GB	2.5TB

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Summary

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1.   Getting to Know the Product

The NEVADA solution consists of an equipment and software set capable of monitoring the flow of vehicles in toll stations lanes that use both the AVI (automatic vehicle identification) collection mechanism and manual collection. Among the basic elements that characterize a monitored lane are:

- *Traffic light* indicating vehicle release;
- *Barrier* to block the passage of vehicles (dimensioned so that it does not cause physical and material damage, should it be hit by a vehicle while it is closed);
- Vehicle detection sensors, which can be of the *Optical Barrier* and/or *Inductive Loop* type;
- An existing *Guardhouse* at the toll station, so that the operator can perform the manual collection process.

As can be seen in the lane image, the NEVADA installation generates minimal visual interference in the context of the toll station, since it is only necessary to install the three posts that accommodate the ITSCAM VIGIA+ capture devices, the ITSLUX illuminator (for nighttime image capture), and the *Terminal Boxes*, which house and protect the electrical and data connections, as well as the cabling.
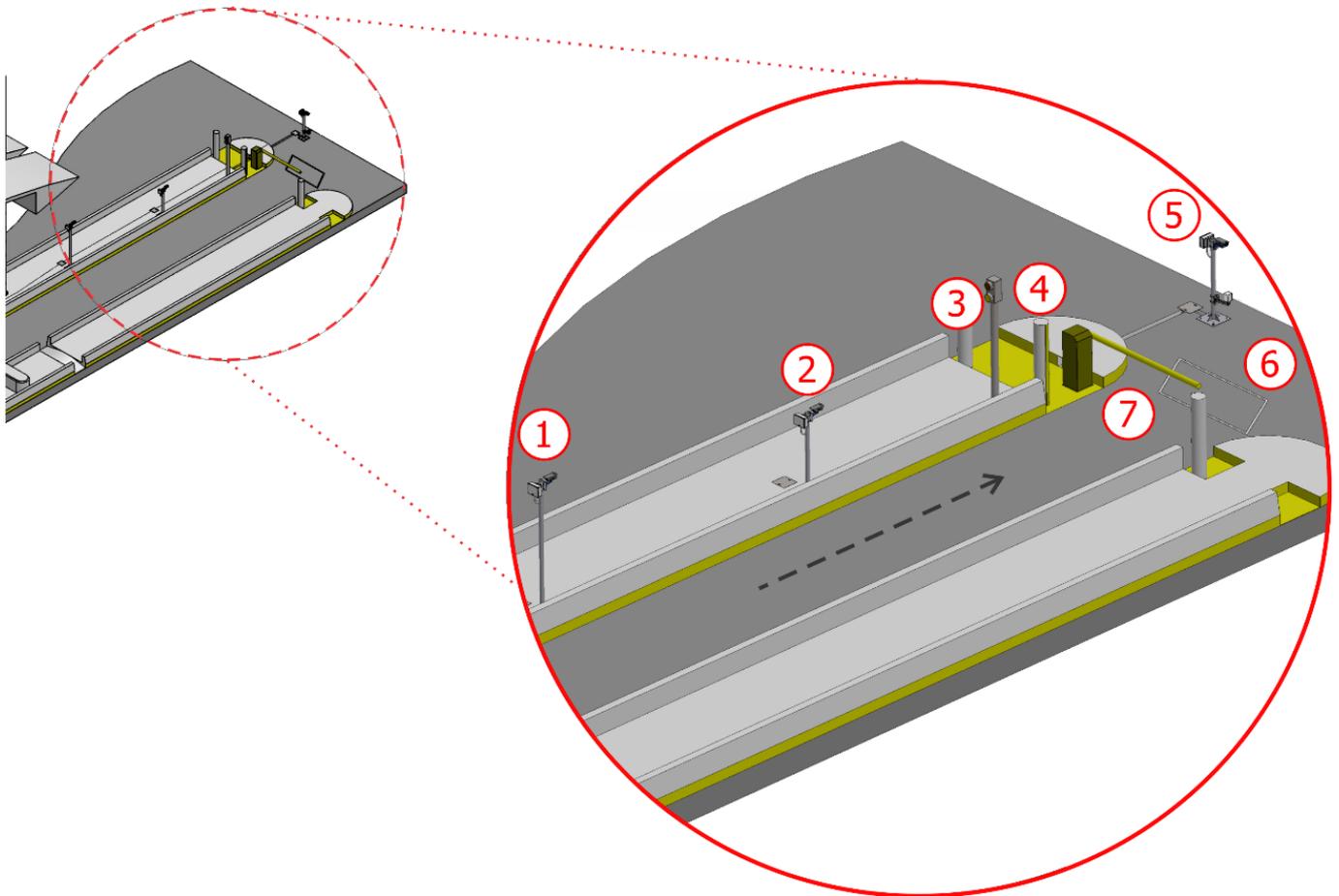
Figure 1 - NEVADA installed in an automatic charging lane (AVI): 1) Panoramic capture post, 2) Rear capture post, 3) Lane Traffic light, 4) Lane Optical Barrier, 5) Front capture post, 6) Lane loop, 7) Lane barrier

The visual impact of installing the system is small when all the benefits of its use are evaluated, such as automated inspection and the return of the revenue lost with vehicles that pass through the station without paying their taxes.

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To implement the system, it must first be planned in which lanes of the toll station the monitoring will be carried out. The resources needed for installation and connection to the lane signals are presented under Initial Setup and detailed in the Installation and Maintenance Guide.

2. Generated Information

The NEVADA solution contains a module for managing toll evasion infractions committed at the monitoring points installed in the lanes of the toll stations. The NEVADA software is mainly responsible for compiling the data for the same record, generating an infraction notice that can optionally contain the rear image, according to the inspection agency served:

Figure 2 - Infraction Notice generated by NEVADA System

In addition to infraction notice configuration, NEVADA can make the following information available:

- Stored *Records* search, with several filter options;
- *Evasion Reports*, with graphical information of records per period and location on a map;
- Reports on all actions performed by the users in the system;

- Records reports identified as evaders, containing the quantity of records for the same license plate, in the specified time interval;
- Video recorded during the vehicle's passage in the monitored point;
- Registration and data control of several toll stations with NEVADA monitoring;
- Statistical data reports of infractions committed per period;
- Equipment status, according to connected user's profile;
- Video captured in real time by the equipment registered at NEVADA, for verifications and adjustments;
- Images captured by the ITSCAM VIGIA+ devices, which can be downloaded for better viewing.

Some *Filters* that can be used when searching for records stored in the NEVADA database are presented on the screen under *Validation > Records*:
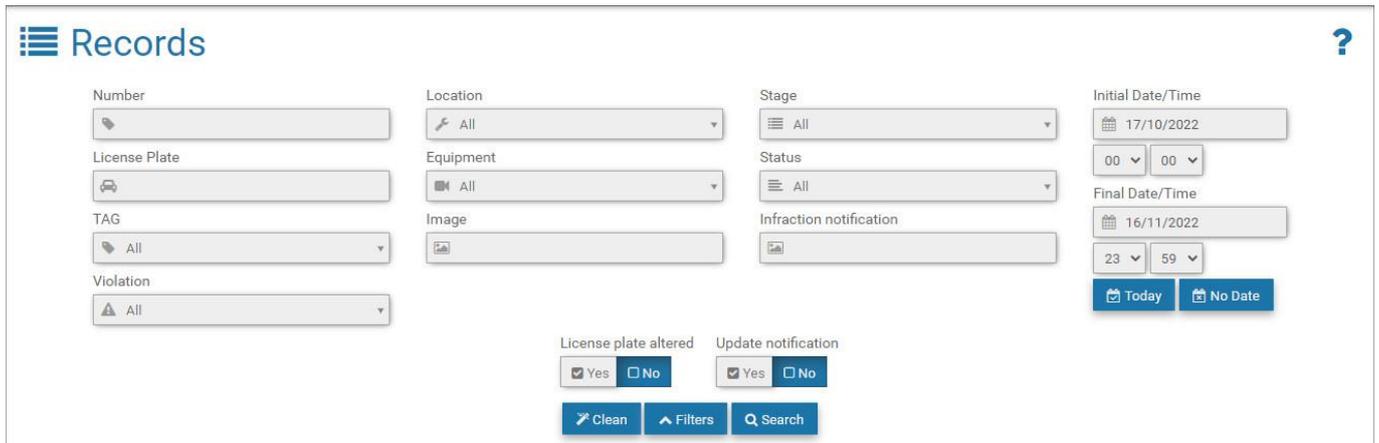
Figure 3 - Filters available in the search for records stored at NEVADA

Information Distribution: The content generated by NEVADA (captured images and data) is user and password protected. However, it is up to the system administrator to control the users that have access to the information and content disclosure.

NEVADA allows captured images enlarged views as well as downloading, making it easy to validate the registration. The quality of the images acquired by the ITSCAM VIGIA+ devices can be identified in the images:

Figure 4 - Day and night images examples recorded by ITSCAM VIGIA+ Front

Figure 5 - Day and night images examples recorded by ITSCAM VIGIA+ Rear

Figure 6 - Day and night images examples recorded by ITSCAM VIGIA+ Panoramic

3. Additional Documentation

Product	Link	Description
ITSCAM VIGIA+	Product Manual	Manual with advanced settings for the ITSCAM VIGIA+ image capture device
	Integration Manual	Programming and integration manual containing the information needed to integrate the ITSCAM 400 family with an application
	Installation and Maintenance Guide	Guide containing the information needed to perform ITSCAM VIGIA+ installation and maintenance
ITSLUX	Product Manual	Manual with ITSLUX image capture device advanced configurations
	Integration Manual	Programming and integration manual containing the necessary information for integrating the ITSCAM 600 with an application
	Installation and Maintenance Guide	Guide containing the information needed to perform ITSLUX installation and maintenance

| NEVADA | Integration Manual | Programming and integration manual containing the necessary information for integrating NEVADA with an application |
| | Installation and Maintenance Guide | Guide containing the information needed to perform NEVADA installation and maintenance |

4. Mechanical Specifications

For the lane monitored by NEVADA, the *Optical Set* is required, with the equipment responsible for the lane image acquisition, and the *Infra Set* with the elements for fixing the optical equipment, protecting the connections, and controlling the hardware.

The NEVADA system installed in a toll station has its operation controlled by the Processing Unit, which has the main function of optically recognizing the license plates characters of the vehicles detected as violators by NEVADA, with the specifications detailed in Models. Through the Processing Unit used by NEVADA it is possible to process and manage the records from several automatic type lanes or with manual fee collection.

Optical Set

The *Optical Set* corresponds to the equipment responsible for image acquisition:

- ITSCAM VIGIA+ Panoramic with optional ITSLUX illuminator;
- ITSCAM VIGIA+ Front with ITSLUX illuminator;
- ITSCAM VIGIA+ Rear.

ITSCAM VIGIA+

The equipment responsible for the photographic and video registration have the same technical specifications, except for the focal length of the lenses, which vary according to the resolution of the equipment. Different models of the ITSCAM VIGIA+ image capture device can be selected for operation on the NEVADA, according to the position where it will be installed, as specified in Models.
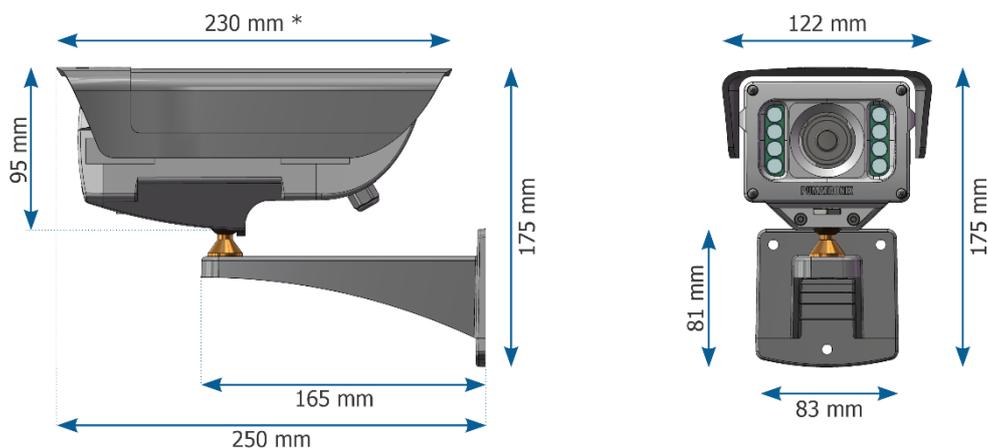

Figure 7 - ITSCAM VIGIA+ Dimensions

- Protection Degree: IP67
- Material: Polycarbonate with UV protection
- Fixation: 3/16" diameter screws

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- Support: With 360° movement in all axes (positioning/tilting adjustment)
- Mechanical Protection: Adjustable flap (protect the lenses from direct sunlight)
- Interfaces: IP and Opto-coupled I/O
- Connections: RJ-45 and multi-way cable
- Power supply: 24 to 32Vdc (1A) or Power Over Ethernet (PoE) Standard 802.3af
- Operating temperature: -10 °C to 50 °C
- Lenses: Motorized, with infrared correction and focal length according to the model applied
- Illuminator: Infrared, integrated and with variable light power

⚠️ **Vision Damage: The illuminator integrated in the equipment emits thermal and luminous energy (not visible because it is infrared lighting), so it is not recommended to look directly at the LEDs. It is also not recommended to use any optical instrument to look directly at the LEDs. If malfunctions occur, send the product to Pumatronix Technical Assistance.**

⚠️ **ITSCAM VIGIA+ Assembly: Check the correct way to mount the ITSCAM VIGIA+ set with its support by accessing the device's Installation and Maintenance Guide.**

ITSLUX Illuminator

ITSLUX is a light emitting electronic device that allows nighttime image capture. The light emission of this equipment occurs in a pulsed form and is similar to that of a photographic flash lamp.

In NEVADA, ITSLUX is used to enhance the display of vehicle details in nighttime images, and is mounted on a bracket that allows for two-way positioning adjustment.
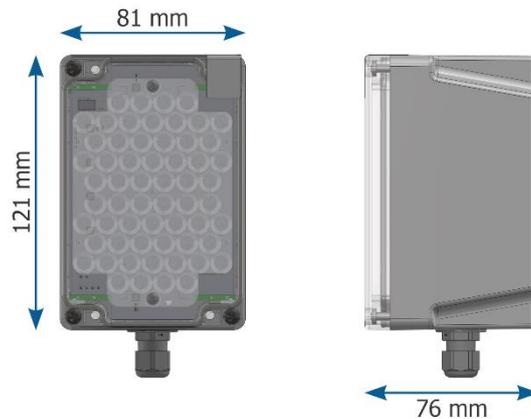
Figure 8 - ITSLUX Illuminator Dimensions

- Protection Degree: IP67
- Material: Polycarbonate with UV protection
- Fixation: Screws 4.8x13mm
- Support: Containing 2 directions for positioning adjustment
- Protection: Against overheating
- Interfaces: LED indicating operation, triggering and product status
- Connections: Multi-way cable
- Power supply: 24 to 32Vdc (1A)
- Operating temperature: -10°C to 60°C
- Lighting: Infrared with variable light power

> ⚠️ **Vision Damage:** The illuminators emit thermal and light energy (nonvisible in infrared models), so it is not recommended to look directly at the LEDs. It is also not recommended to use any optical instrument to look directly at the LEDs.

> ⚠️ **ITSLUX Assembly:** Check the correct way to mount the ITSLUX set with its bracket by accessing the device's Installation and Maintenance Guide.

Infra Set

Infra Set offers the infrastructure for the *Optical Set* 's equipment installation in the lane and is composed of the *Supervisor Board*, the *posts*, and the *Terminal Boxes*. The accessories used for installation are detailed in the NEVADA Installation and Maintenance Guide. The cabling that must be purchased varies in length, depending on the existing distances in the installation.

Supervisor Board

The *Supervisor Board* is the electronic component that provides the secure communication with the image capture equipment, receiving the signals from the lane and sending them to the connected image capture devices, and must be installed in an existing Command Board for the lane.

Through the *Supervisor Board* interface, information is received on the operation of the input and output signals, detailed in Electrical Specifications. The connection of the *Supervisor Board* to the *Optical Set* is detailed and can be accessed in NEVADA's Installation and Maintenance Guide.
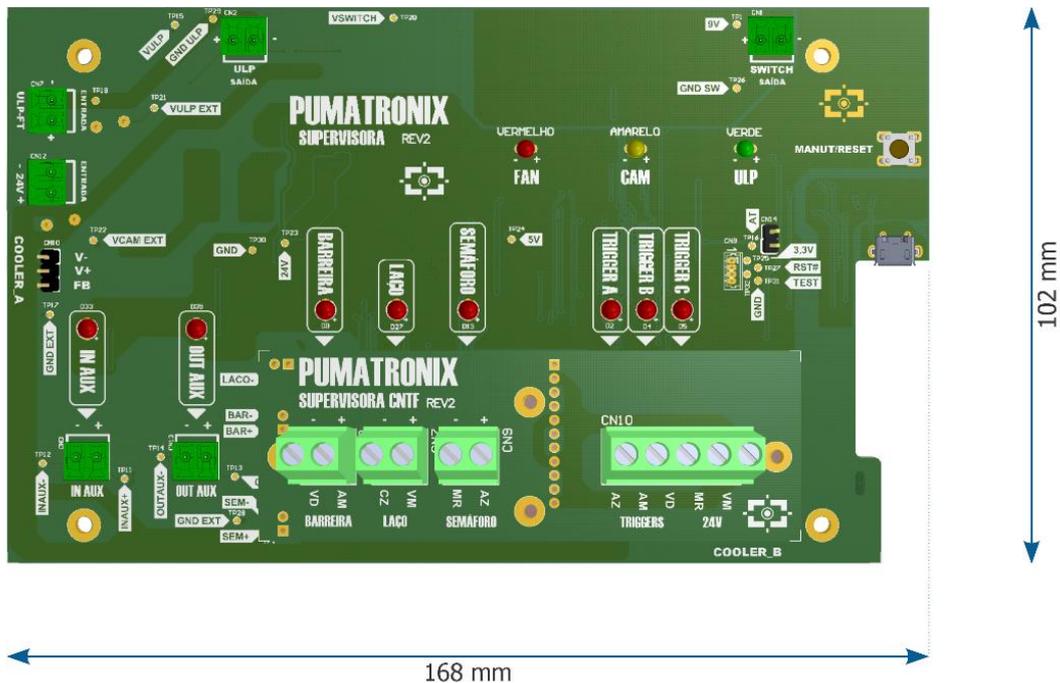

Figure 9 - Rev2 Supervisor Board Dimensions

- Interfaces:
  - MANUT button for temporary suspension monitoring activities to perform maintenance on the *Optical Set* equipment;
  - LEDs indicating lane sensors activation;
  - LEDs indicating signals sent to the ITSCAM VIGIA+ devices, LEDs indicating the auxiliary input and output;

  ○ Connections: Terminal type.
• Operating temperature: -10°C to 50°C

Terminal Box

The posts on which ITSCAM VIGIA+ are installed have a *Terminal Box* to protect the electrical and data connections. The *Terminal Box* model presented is used on the Front post, with the use of a cell-type support with clamps and the protective cover.
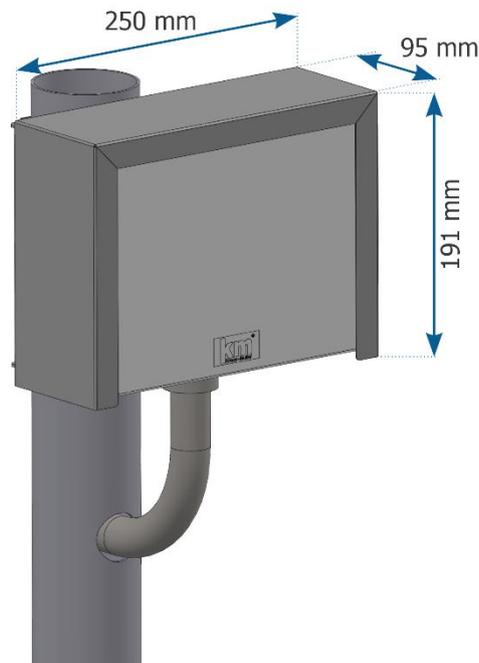
Figure 10 - Terminal Box with protective cover on post

• Protection Degree: IP55
• Material: *Terminal Box* in self-extinguishing thermoplastic (Polyamide 6.6) and Protective Cover in 1020 carbon steel
• Fixation: Bolted to a bracket attached to the post
• Support: Cell type with clamps
• Mechanical Protection: Protective Cover

Sealing: Every *Terminal Box* has an additional protection called a *Protective Cover*, which protects the box and increases the degree of protection against liquid infiltration. This Protective Cover must be kept permanently installed in the *Terminal Box*, except in situations where it is necessary to open it to perform a maintenance procedure.
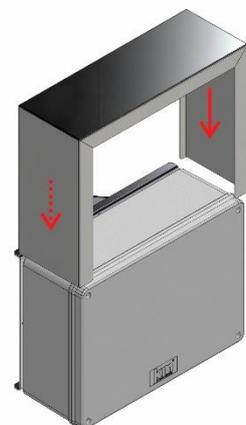
Panoramic Image Capture Post

The Panoramic Post receives the ITSCAM VIGIA+ Panoramic (for recording the lane image with the vehicle and the traffic light) and a *Terminal Box* (for connecting the power and data network). It is possible to install the ITSLUX illuminator for operation in conjunction with the ITSCAM VIGIA+ Panorama, for sharper panoramic images at night.

Figure 11 - Panoramic Post with ITSCAM VIGIA+, ITSLUX (optional) and Terminal Box attached

- Material: 3" (76.2mm) galvanized circular pipe
- Painting: Black (can be customized)
- Height: 2.5m from the surface
- Fixation: Base with four 5/16" x 100 Anchor bolts with stainless steel clamp (Parabolt type) or 190mm Anchor bolt
- Interfaces: Holes for conduit fitting, cable passage, and to avoid internal water accumulation

Front Image Capture Post

The post that allows the capture of frontal images is called Frontal and accommodates the ITSCAM VIGIA+ Frontal, an ITSLUX illuminator (for capturing night images with proper lighting) and a *Terminal Box* (protecting the equipment's electrical and data connections).
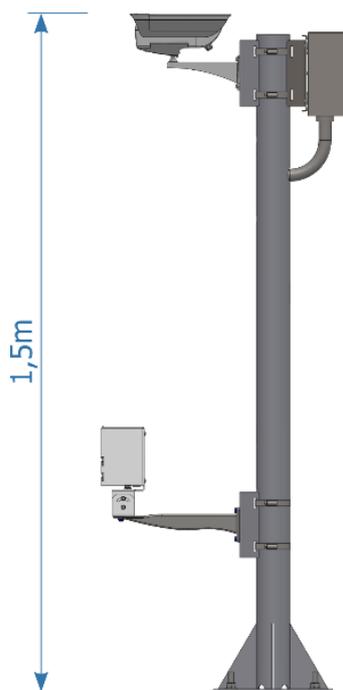
Figure 12 - Front Post with ITSCAM VIGIA+, ITSLUX and Terminal Box attached

- Material: 3" (76.2mm) galvanized circular pipe
- Painting: Black (can be customized)
- Height: 1.5m from the surface
- Fixation: Base plumbed in 190mm anchor bolt and secured with nut and washer, or plumbed with 4 Anchor bolts 5/16" x 100 with stainless steel clamp (Parabolt type)
- Interfaces: Holes for conduit fitting, cable passage, and to avoid internal water accumulation

Rear Image Capture Post

The images capture from the rear of offending vehicles depends on the installation of a post that positions the ITSCAM VIGIA+ Rear with adequate distance from where the vehicle usually is on the lane. Its main characteristics are the same as those of the front post, except for the absence of the bottom hole.
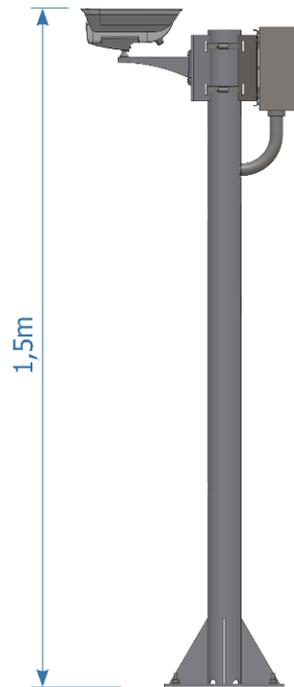
Figure 13 - Rear Post with ITSCAM VIGIA+ and Terminal Box attached

5. Electrical Specifications

- Power supply: 127Vac or 220Vac

The *Supervisor Board* is responsible for supplying power to the lane devices and for connecting them to the sensor signals, as shown in the illustrative diagram:
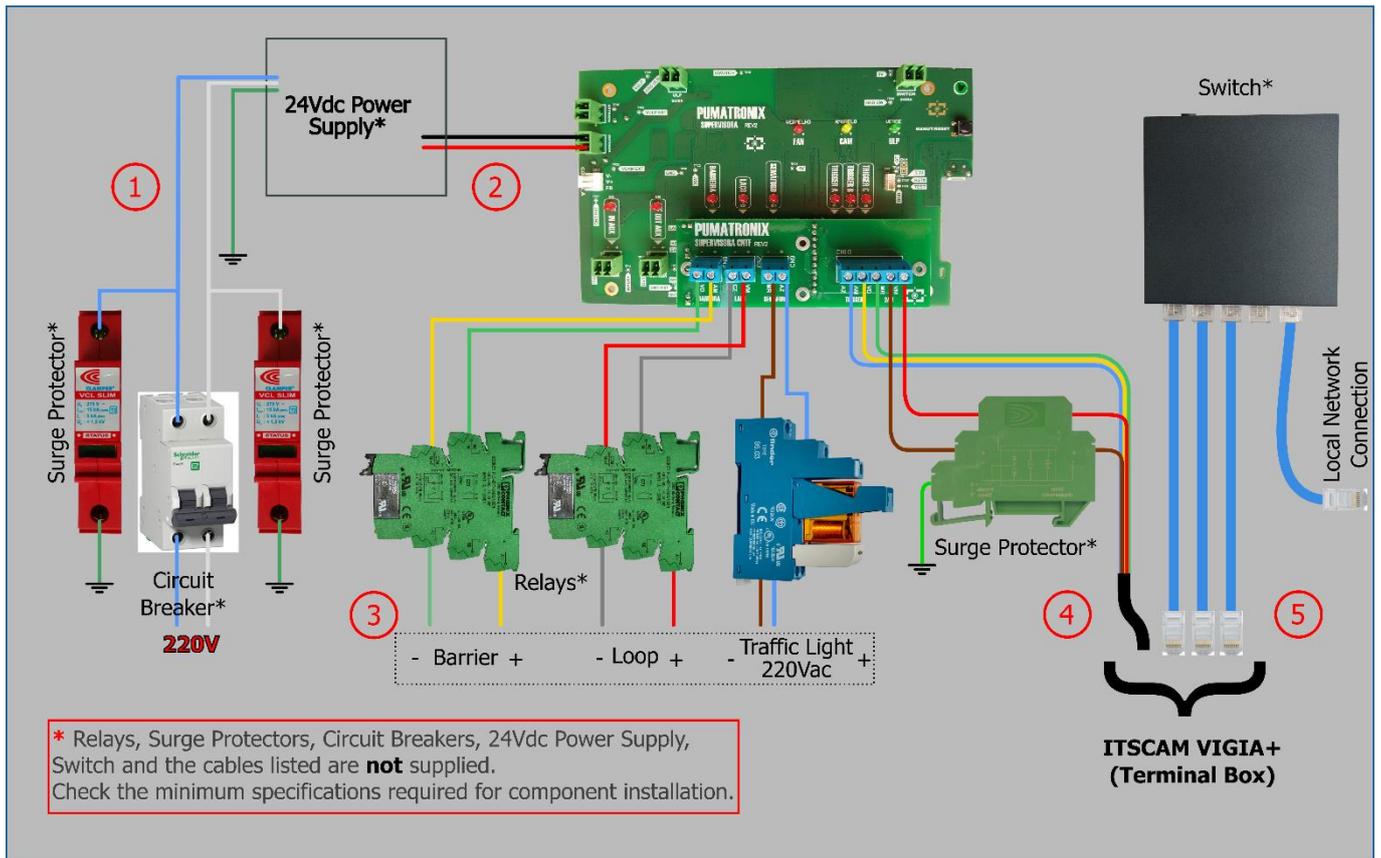
Figure 14 - Connection diagram with the Supervisor Board (when 220 Vac Traffic light)

The numbered cables in the diagram must be used for connections to the *Supervisor Board*, supplied with the minimum specifications indicated:

1) Power connection: 1 Pp type 3-way 0.75 cable;
2) Power supply connection: 1 2-way cable;
3) Connection with lane sensor: 1 2-way cable (for each sensor);
4) Connection with ITSCAM VIGIA+: 1 shielded 8x22AWG multi-way cable;
5) Data connection: 3 Furukawa External CAT-5E cables (one for each ITSCAM VIGIA+).

The *Terminal Box* connects the *Optical Set* devices with the following electrical specifications:

- Surge Protector: 12V maximum operating voltage and withstands a maximum surge voltage of 5kA;
- Connections Board: connection to the *Supervisor Board* using 8-way multi-way cable to receive the barrier, traffic light, and loop signals, low current with a maximum voltage of 24Vdc and the power supply to the ITSCAM VIGIA+ and ITSLUX illuminators of 24Vdc 2A.
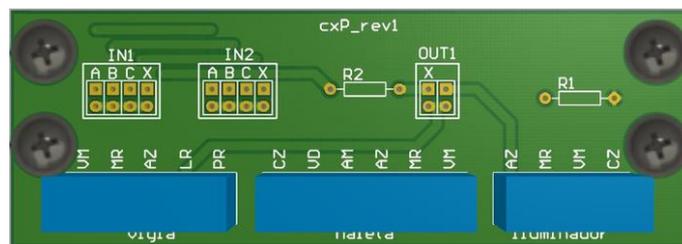
Figure 15 - Terminal Box Connections Plate

Power Connection

To provide electrical power to the equipment installed on the lane, the *Supervisor Board* must be connected to an *AC/DC Power Supply*, which is not supplied and must be purchased with the following minimum specifications:

- Interfaces: Vin, Vout and grounding;
- Connections: Terminal type;
- Power supply: 85~264Vac (full range);
- Operating temperature: 20 °C to 70 °C; Protection: Overload; Output: 24Vdc.

The grounding point should be obtained at the place closest to the NEVADA Command Board, as it serves to discharge electrical surges that may occur in the equipment.

To protect the circuit elements from possible damage that electrical voltage surges and short circuits can cause, electrical devices should be installed in the *Supervisor Board* power connection, connected to the power supply. These items are not supplied and must be purchased to specification:

- 1 (one) Surge Protector for DC source, with operating voltage 24Vdc to 38Vdc. It must support a maximum current of 10A and withstand a maximum surge voltage of 4kV;
- 1 (one) DC Surge Protector, with operating voltage from 24Vdc to 38Vdc. It must withstand a maximum current of 10A and withstand a maximum surge voltage of 10kA;
- 2 (two) Surge Protectors for the electrical network, with 127Vac or 220Vac operating voltage. It must withstand the maximum surge current from 15kA to 90kA;
- 1 (one) two-phase circuit breaker, acting in the shutting down of the whole set. It must be of the two-phase type and support the load of 10A.

> ⚠️ **Power Supply Safety: The surge protectors and circuit breaker used must meet the indicated specifications, ensuring that the equipment has the necessary protection in the power connection. If they are not installed, the equipment can be damaged when the power grid is overloaded.**

Connection with ITSCAM VIGIA+ Devices

For the *Optical Set* equipment to receive the signals from the lane sensors (*Optical Barrier*, *Inductive Loop*, or *Traffic Light*), they must be connected to the *Supervisor Board* using an 8-way multi-way cable. This cable is not supplied and the 8x22AWG model must be purchased with variable length and considering the distances applied in the installation, following what is indicated in the lane Installation Diagram. The cable routes used are specified in the NEVADA Installation and Maintenance Guide.
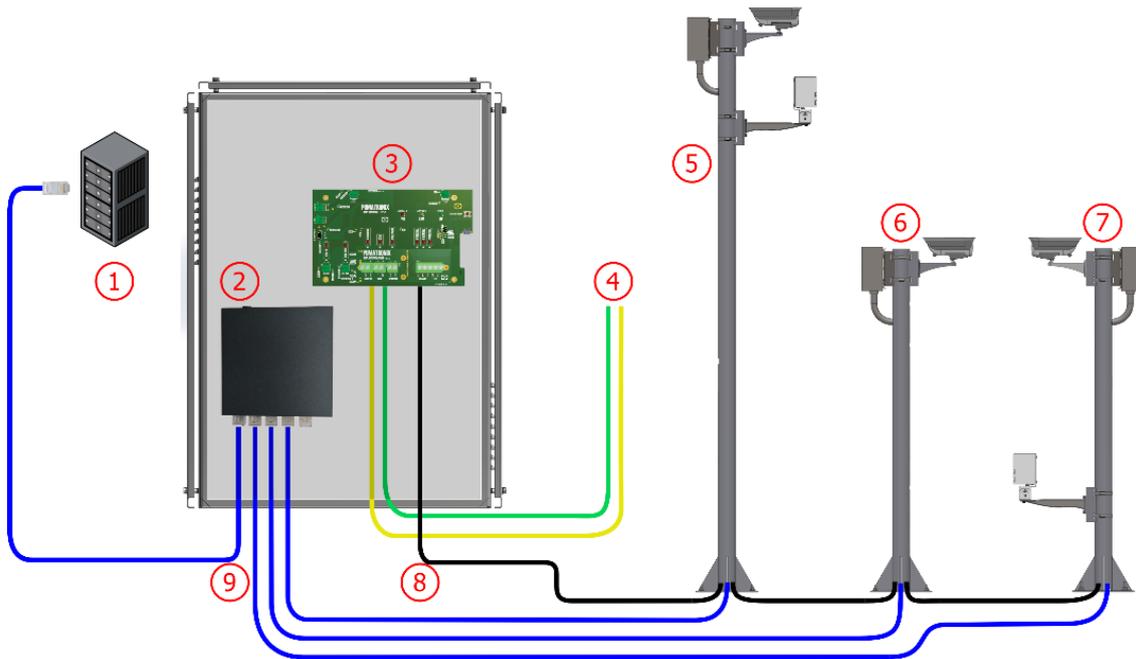
Figure 16 - Diagram of NEVADA installation on a lane: 1) Lane Processing Unit, 2) Switch, 3) Supervisor Board on the Command Board, 4) Signals from a Lane sensor, 5) Panoramic Imaging Post, 6) Rear Imaging Post, 7) Front Imaging Post, 8) Shielded 8x22AWG multi-way cable, 9) Furukawa External CAT-5E cable

Connection to Sensor Signals

Each lane has a characteristic electrical installation, which can lead to different formats of the sensor signals that identify the presence of the vehicle. However, the NEVADA can be installed in these locations, because it has requirements in the format of the received signal, with the possibility of the traffic light signal being 24Vdc, 127Vac, or 220Vac.

In order to receive the *Inductive Loop*, *Optical Barrier*, and *Traffic Light* signals from the utility installation, it is necessary to install protection against possible electrical surges. The signals must be electrically isolated by installing relays at the connection of each utility sensor to the *Supervisor Board*. These relays are not supplied and must be purchased with the indicated characteristics:

- 2 (two) Phoenix solid-state 24Vdc relays: to interconnect the *Inductive Loop* and *Optical Barrier* signals, with 24Vdc input.

The utility power grid voltage must be considered when choosing the relay to interconnect the *Traffic Light* signal, which can be:

- 1 (one) Phoenix 24Vdc solid state relay (PN 2900358): with 24Vdc input;
- 1 (one) Finder Relay 127V (PN 40.61.8.110.0000): for local network voltage at 127V, electromechanical type;
- 1 (one) 220V Finder Relay (PN 48.61.8.230.0060 spa): for local network voltage at 220V, electromechanical type.

Sensor Signal Application

Inductive Loop or *Optical Barrier* signals can be used to identify a transaction start. This signal arrives at the NEVADA to indicate that panoramic footage of the lane should be recorded.

Then the collection scheme processes the payment for the vehicle and triggers the traffic light. At the start of the transaction, a vehicle passes with the red *Traffic Light* on. When the payment is completed, the green light is lit and the red light is turned off. If the *traffic light* does not change from red to green before the vehicle passes through the barrier, there was a problem in the transaction (manual or automatic payment).

Next, the passage through the barrier is confirmed by the *Optical Barrier* sensor or the *Inductive Loop* on the lane, and then the toll evasion violation is characterized and NEVADA compiles the evidence and saves it.

Data Network Connection

The existing data network at the toll station must be used for communication between the equipment. ITSCAM VIGIA+ devices installed on a monitored lane must be connected to the same network as the Processing Unit in order to send the records. For this connection it is necessary to use a *Switch,* which must power the image capture devices (PoE power). This equipment is not supplied and must be purchased with the minimum required specifications:

- Interfaces: RJ-45 ports (10/100Mbps)
- Power supply: 9Vdc (850mA)
- Power over Ethernet (PoE) function: IEEE 802.3af standard compliant.

The minimum specifications indicated for the *Switch* should be used, as it transmits multiple data packets at the same time and has the ability to increase the performance of the wireless network, keeping communication available at all times. This is an advantage for use in networks with high data traffic, such as when applying NEVADA to multiple toll station lanes.

⚠️ **PoE power**: **The Switch used must support Power over Ethernet (PoE) to automatically supply power to ITSCAM VIGIA+ devices, compatible with the IEEE 802.3af standard.**

Supervisor Board LED Behavior

The *Supervisor Board* Rev2 presents the information about the supervision of the equipment through the LED interface. Each LED indicates the behavior of a specific component or piece of equipment, as detailed in the table.
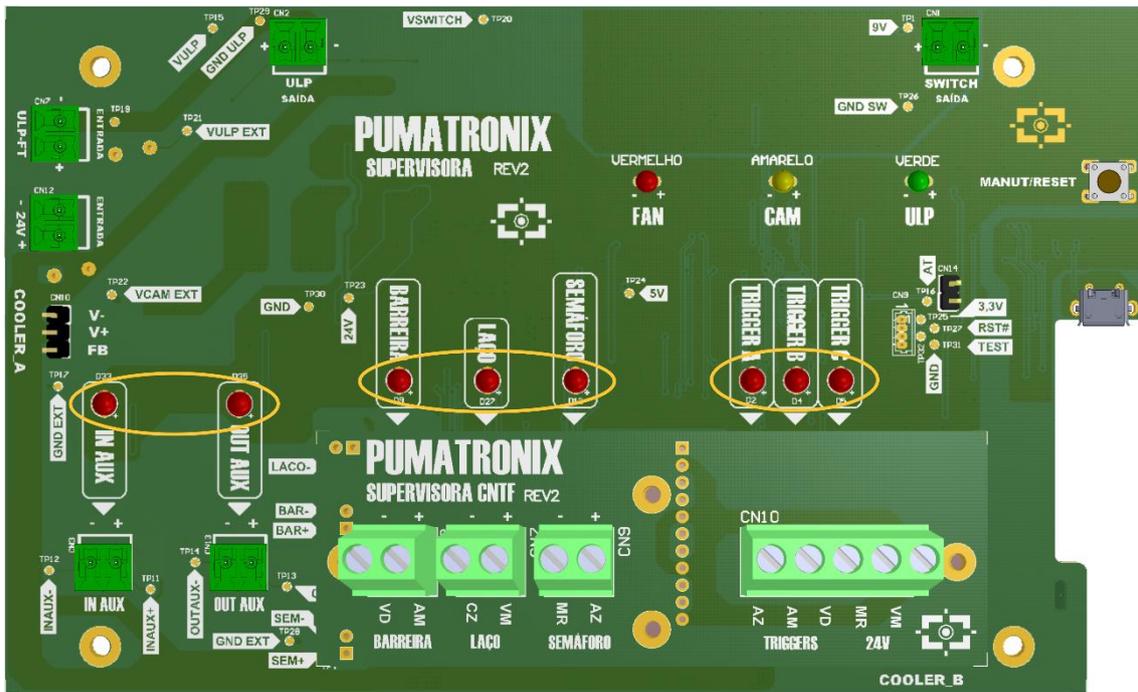
Figure 17 - Position of the LEDs on the Rev2 Supervisor Board

Interface	Behavior
Button *MANUT/RESET*	When the maintenance mode button on the *Supervisor Board* is pressed, the supervision state of the board is temporarily turned off, for 10 minutes. In this mode, the connected equipment can be accessed to perform some quick maintenance within the time limit, in which the green LED named ULP remains blinking.
TRIGGER A, TRIGGER B and TRIGGER C	They indicate that the signal is being sent to the trigger, and light up when sent.
BARREIRA, LAÇO and *SEMÁFORO*	They indicate the lane signals, as identified on the *Supervisor Board*. The respective LED is lit when the signal is received.
IN AUX	Indicates the input signal originating from the utility, illuminating when received.
OUT AUX	Indicates the output of the signal to the utility, lighting up when it is sent.

6.   Software Specifications

To access the NEVADA software, first confirm that the components are properly installed and powered, and then the first access can be performed using the factory default login. To do this, open your Google Chrome browser and type in the IP address provided. Next, the interface provides the fields to enter the factory default user name and password:

NEVADA IP	192.168.0.1
User	*root*
Password	*root*

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Features

The operation of the NEVADA system is performed through the NEVADA software interface, which allows among other functions:

- to register the image capture devices that operate in the optimal and efficient collection of day and night vehicle images;
- to automatically read license plates, identifying the characters (OCR);
- to store the vehicle photos with the registration data.

NEVADA software provides records management through the available functionalities listed and with the possibility of customization:

- Compiling the data into a record containing the captured images, the vehicle passing video, the automatically read license plate, violation date and time, among other data;
- Integration between NEVADA systems, which allows the communication of the logs from several lanes to the same NEVADA;
- Integration between the TAG servers and NEVADA, which can be used as an auxiliary mechanism to identify vehicles with automatic charging;
- Integration with the enforcement agency's server for sending an infraction;
- Registration of violations to the Brazilian Traffic Code;
- Inclusion of a list of license plates of vehicles that should not be fined (for example official vehicles, utility vehicles, firemen, ambulances, etc.);
- Setting up the record screening process, i.e., defining the steps a record must go through before it is considered a traffic violation;
- Possibility of performing automatic sorting, with the definition of actions to be performed by the *Bot* user;
- Configuration of record discard patterns.

The NEVADA software uses the ITSCAMPRO server to store the files and through communication protocols, which use REST Web service architecture, allows integration with external servers, as an example:

- Paraná Military Police;
- Federal Highway Police;
- DETECTA system of São Paulo.

⚠️ **Communication Protocols:** The complete list of servers for integration is available in the Software Manual and may vary according to the version made available.

⚠️ **NEVADA System Operation:** Refer to the Software Manual that presents the entire NEVADA system interface and the steps to customize the screening and perform the monitoring according to the desired specifics.

⚠️ **Information Distribution:** The content generated by NEVADA (captured images and data) is user and password protected. However, it is up to the system administrator to control the users who have access to the information and the content disclosure with the version made available.

7. Licensing

The NEVADA Software license is a single file and associated with the hardware on which the system was installed. If it is necessary to make the installation in another processing unit, a new license must be requested to Pumatronix Technical Support.

Changing the amount of equipment that can simultaneously connect to the NEVADA software can generate additional license fees and must be requested via Technical Support or directly to the Pumatronix Commercial team.

Figure 18 - Screen displayed when accessing the System > License menu

⚠️ **See the NEVADA Software manual for more information about licensing options.**

⚠️ **Information Distribution:** The content generated by NEVADA (captured images and data) is user and password protected. However, it is up to the system administrator to control the users that have access to the information and content disclosure.

8. Initial Setup

For NEVADA installation it is essential that the toll station existing infrastructure meets the minimum requirements listed.

Installation Pre-Requirements

On the lanes where NEVADA monitoring is desired, the *Infra Set*, the *Optical Set*, and the power supply to the system with the necessary signals must be installed, as well as the possibility of communicating the equipment using the toll station data network.

The conditions at the monitoring site, prior to installation, are indispensable for the operation of the equipment. In general, NEVADA requires the following features from the toll location, detailed in the Installation and Maintenance Guide:

- *Cable Protection Tubing*, for installation protection;
- *Appropriate location on the Command Board*, sufficient to house the *Supervisor Board* and all components used for electrical and data connection;
- *AC 127 or 220Volts power* supply, to be connected to an AC-DC source, which provides 24Vdc for NEVADA's equipment;
- *Cables*, to make the power connections, the lane sensors, with the ITSCAM VIGIA+ and the data network;
- *Surge Protector, Circuit Breaker and Relay*, to protect the circuit elements against damage by the occurrence of electrical surges;
- *Signals* from the sensors that identify the presence of a vehicle in the road (which must connect to the *Supervisor Board*);
- *Data Communication Network*, for transmission of the collected data, between the lane and the Processing Unit;
- *PoE Switch* (IEEE 802.3af standard), to power and connect ITSCAM VIGIA+ devices to the data network.

Equipment Installation Location

The correct functioning of NEVADA is directly related to the quality of the images that are captured, so the equipment has its lenses and illuminator sized for the specified standard distances. Variations from the values shown are tolerated, however recognition results can be affected and it is advisable to contact Pumatronix technical support when it is not possible to meet the specifications.

The standard distances have as origin point the position of the sensor that identifies the presence of the vehicle, that is, the *Optical Barrier*. From this sensor is defined the posts position, and thus the necessary infrastructure, such as the inspection box installed on the floor near to the post. The distances required when installing the *Infra Set* are detailed in the Installation and Maintenance Guide. The recommended distances for installing the image capture equipment can be seen in the top view of the NEVADA deployment on a lane:
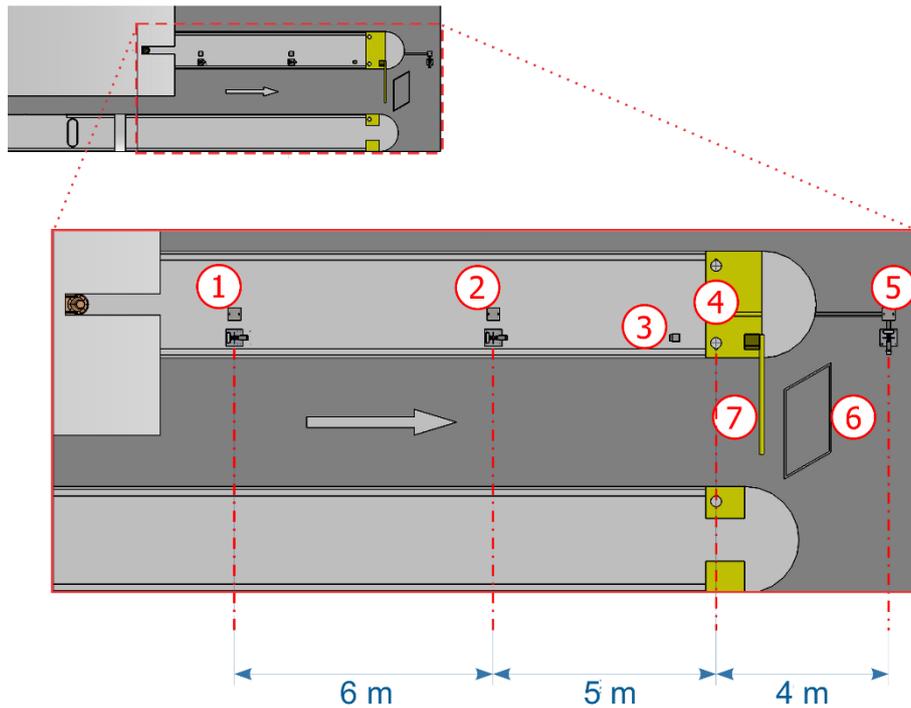
Figure 19 - Top view of the installation in an automatic charging lane (AVI): 1) Panoramic capture post,
2) Rear capture post, 3) Lane Traffic light, 4) Lane optical barrier, 5) Front capture post, 6) Lane loop,
7) Lane Barrier

Considering the direction of the car passing lane, the installation of the *Inductive Loop* after the barrier is the model adopted in all images of the generic toll station lane presented in this manual, but it is possible that the *Inductive Loop* is installed before the barrier.
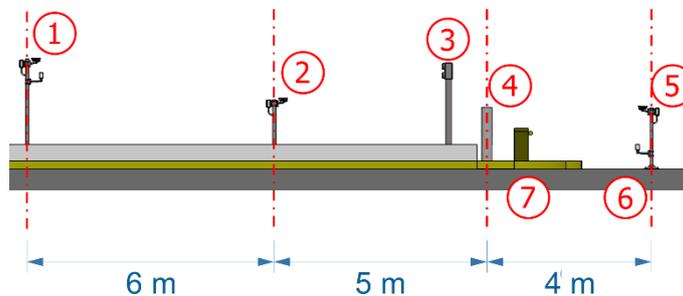
Figure 20 - Side view of the installation in an automatic charging lane (AVI): 1) Panoramic capture post, 2) Rear capture post, 3) Traffic light in the lane, 4) Lane optical barrier, 5) Front capture post, 6) Lane loop, 7) Lane barrier

Lane Sides Alignment: During installation, it is important to observe the alignment on the sides of the lane, so that a safe spacing is maintained for large vehicles to be able to move around normally. Likewise, the chosen location must allow operators to safely maintain the system.

Front Post Positioning: The installation of the post that captures the frontal images of the vehicles must be done in a region that does not interfere with the vehicles leaving the lane charging area.

Installation Required Conditions

After the prerequisites for positioning the equipment on the lane have been met, check the network configuration where the equipment will be connected and perform the necessary parameterization.

Check in the Installation and Maintenance Guide how to make the necessary connections.

⚠️ **Installation Place: In cases where it is not possible to meet the installation specifications, it is recommended to consult Pumatronix Technical Support.**

Network Interface Parameterization

If the application that uses ITSCAM VIGIA+ has a network configuration different from the equipment's factory default, it is recommended to change the network configuration prior to installation on the local network. The ITSCAM VIGIA+ factory default network configuration is:

ETH1 Port Configuration	Default Value
IP address	192.168.0.254
Maintenance IP address	192.168.254.254
Netmask	255.255.255.0

The changed network configuration is saved in flash memory, however it is effectively applied after restarting the device. When the change is made via the Web interface, this restart is automatic after the change is confirmed.

ITSCAM VIGIA+ has a recovery IP address (192.168.254.254) for cases where the user mistakenly changes the IP address and loses connection to the device. Access to this recovery IP address is only available on a point-to-point connection to the equipment.

⚠️ **The ITSCAM VIGIA+ maintenance IP address (192.168.254.254) is disabled when the primary IP address conflicts with it. Therefore, when manually configuring the network interface (Ethernet) of the equipment, values other than the maintenance IP must be applied, because there will be no way to recover the connection in case of loss of the configured IP address.**

The most common primary and maintenance IP address conflict situations are:

- Primary IP of the ITSCAM 600 in the range 192.168.254.x and netmask 255.255.255.0
- Primary IP of the ITSCAM 600 in the range 192.168.x.x and netmask 255.255.0.0
- Primary IP of the ITSCAM 600 in the range 192.x.x.x and netmask 255.0.0.0
- Netmask set to 0.0.0.0

ITSCAM VIGIA+ Positioning

To extract the best performance from the ITSCAM VIGIA+ it is recommended that it be installed parallel to the lane and with a low horizontal slope. The location chosen to use NEVADA must allow the ITSCAM VIGIA+ to be positioned in such a way that the images produced are free of regions covered by architectural structures, trees, vehicles from other lanes, among other elements. In situations of reflections such as sunlight, adjust the *Sliding Flap* to the best position that can prevent interference with image quality:
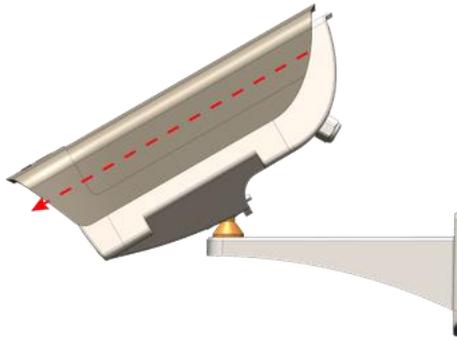
Figure 21 - Sliding Flap Extension Direction Illustration

The function of the ITSCAM VIGIA+ device (capturing front, rear or panoramic images) requires specific positioning and framing adjustments. This ITSCAM VIGIA+ position adjustment can be done on the spherical stand and by viewing the images through the device's web interface, following the guidelines presented in the Installation and Maintenance Guide.

Image Framing Adjustments

For each image capture position, the framing of the ITSCAM VIGIA+ device is differentiated. In the *Panoramic* position it has the objective of showing the context of the committed violation, displaying in a single image all the elements that allow the evasion to be characterized. The *Front* and *Rear* positions are responsible for performing OCR to identify the license plate. The requirements for the respective image frame are detailed in the Installation and Maintenance Guide.

The framing of the image must be done through ITSCAM VIGIA+'s Web interface, which allows viewing the image, offers Zoom and Focus adjustment options, and advanced settings. For advanced information on the adjustment options, please refer to the ITSCAM VIGIA+ Product Manual.
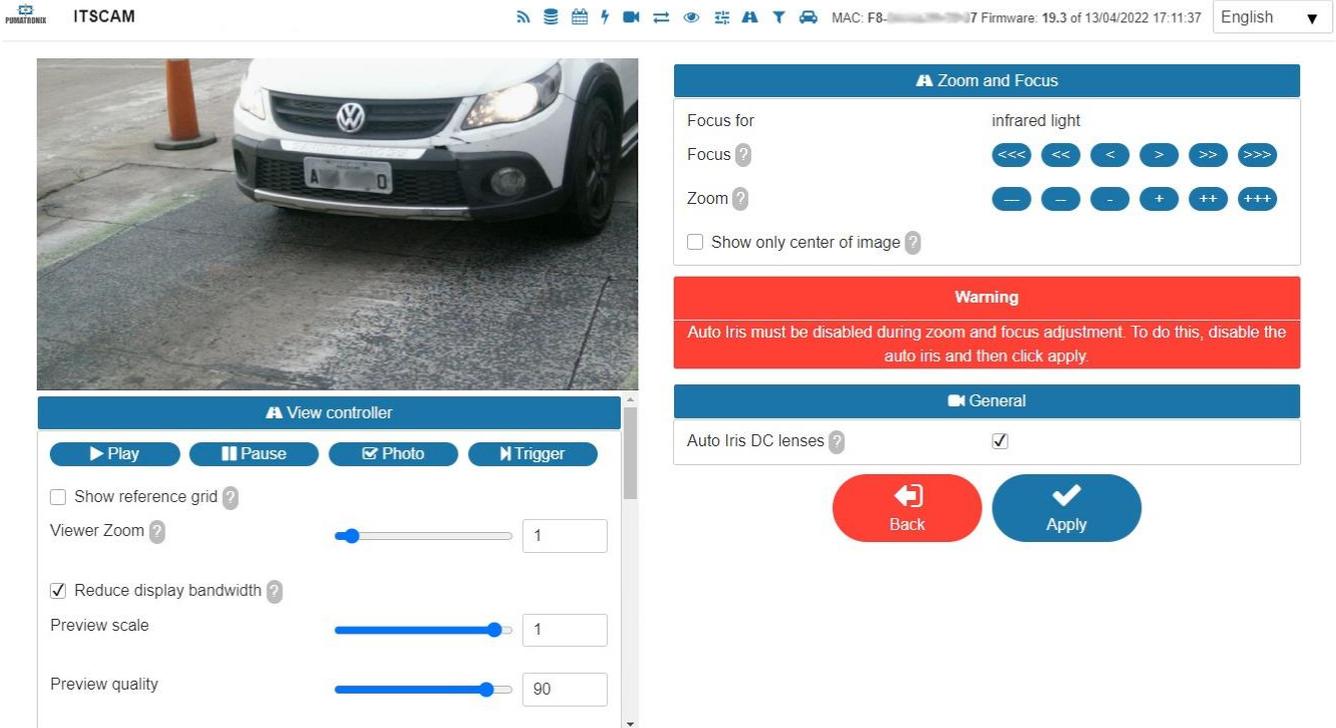
Figure 22 - ITSCAM VIGIA+ web interface screen shot with the image preview and zoom and focus options

9. First Access

The first access to NEVADA can be performed after the equipment has been installed on the monitored lane and after the connections between the lane and the toll station processing center, and between the equipment on each post, have been checked. All connections are detailed in the Installation and Maintenance Guide**.**

When the power supply and all connections are confirmed, it is possible to access the NEVADA Software interface using a *Configuration Helper* with Google Chrome browser (version 85 or higher) installed, connecting to the same data network as the equipment. For this, the factory default data is critical on first access:

NEVADA IP	192.168.0.1
User	*root*
Password	*root*

The Pumatronix image capture device has advanced settings available in the equipment's web interface, which can be accessed by entering the hardware's IP address in a browser from a device connected to the same data network. Advanced configuration options are described in the ITSCAM VIGIA+ Product Manual.

10. Care and Maintenance

⚠️ **Product Risks: The use of the product presents risks, which are presented in the Handling Risks section.**

Some care is needed to protect the equipment, as it reduces the probability of failure or degradation of its operation. The steps listed for preventive maintenance do not replace the recommended guidelines in the Installation and Maintenance Guide.

Firmware Upgrade

Version 1.8.1 of the NEVADA software is compatible with versions 1.2.0 and higher. For upgrades from versions prior to 1.2.0, technical support should be contacted so that the upgrade can be performed in an assisted manner.

Version 1.8.1 of the NEVADA Software can be installed on any server running Ubuntu Server 14.04. However, migration of the NEVADA database from MySQL to Oracle should be done following Technical Support's guidelines.

To perform the update, go to menu *System>System Maintenance* and, under *Software Update*, insert or select the package files in the indicated area. The other maintenance options are presented in the NEVADA Integration Manual.

⚙️ System maintenance   ?

⬆ Software update

≡ Versions

Base de Dados
1.8.1
Interface Web
1.8.1
Micro Serviço NM1
1.8.1
Micro Serviço de Notificações
1.8.1
Serviço Principal
1.8.1
Sistema de Arquivos
1.8.1
Visualizador de Infrações
1.8.1

☁ Update version dropping software package here or searching for.

Figure 23 - NEVADA Software's screen in the System Maintenance area

Preventive Maintenance

⚠️ **Maintenance Interval: The maintenance procedures described in this manual have a suggested frequency, however there may be situations in which the activities must be performed at shorter time intervals.**

ITSCAM VIGIA+ Preventive Maintenance

The ITSCAM VIGIA+ image capture and processing device in Panoramic, Front or Rear position must provide images that allow the identification of the infraction and the reading of the involved vehicle's license plate, thus providing images without artifacts. However, if the outer surface of the lens or the protective case is dirty, the cleaning procedure should be performed:

1) Spray lens cleaning fluid on the lens surface or water on the glass of the housing, so that you can remove the excess dirt adhering to the surface;
2) Use a soft, lint-free cloth to remove the dirt, moving the cloth in one direction only;
3) Use a dry cloth to finish cleaning and do not use force, as this can damage the surface.

ITSCAM VIGIA+ Fixation Bracket Preventive Maintenance

The ITSCAM VIGIA+ support has a sphere that makes it possible to freely rotate the capture device, facilitating the correction of the equipment's position in its support, in order to capture images of vehicles, with them in the most varied positions. Accidental collisions with the equipment can occur, affecting its positioning. When analyzing the images and verifying that there was a change in the position, loosen the screws indicated in red, reposition the equipment and screw them again, so that the ITSCAM VIGIA+ position is not changed.

ITSCAM VIGIA+ Protection Flap Preventive Maintenance

The ITSCAM VIGIA+ Panoramic, Front and Rear devices must provide images that allow the act of infringement identification and the license plate reading of the vehicle involved. Therefore, in addition to the equipment settings following the instructions in the ITSCAM VIGIA+ Product Manual, the movable flap must be fully extended to block light rays that can fall directly on the lens and cause reflections on the captured images. Perform a semi-annual inspection of the flap positioning, because accidental collisions with the equipment can occur and the flap can be dislodged.

⚠️ **Image Characteristics:** Depending on the lighting conditions and sun ray's incidence, one or two of the exposures become dark or saturated, not allowing details to be distinguished. A saturated image contains parts or the whole of the clear image

ITSLUX Illuminator Preventive Maintenance

ITSLUX is responsible for allowing night images with a higher level of detail of the offending vehicles. Every month and after rain, confirm that the illuminator is aligned with the vehicle's capture point, which is the optical barrier.

There is an acrylic cover on the ITSLUX stand, which works as protection against dust, dirt, and even stones that might collide with the equipment. Make sure that the protective cover and the ITSLUX itself are not dirty, because the light output can be impaired and the images will be dark.

> ⚠️ **Acrylics Cleaning: Clean with non-abrasive materials, such as soft cloth that does not shed fibers, only dampened with water. In cases where a lot of dirt has accumulated, neutral detergent can be used. After cleaning, wipe with a dry, also non-abrasive cloth. When cleaning and drying the lenses, do not use force as it can damage the lens hood and ITSLUX itself.**

> ⚠️ **ITSLUX Artificial Lighting: When the ITSLUX cover is opaque or damaged, replace it following the step-by-step instructions in the Installation and Maintenance Guide.**

Preventive Electrical Maintenance

The supply voltage of the ITSCAM VIGIA+ located at the position furthest from the *Supervisor Board* should be measured preferably every six months by accessing the *Terminal Box* of the respective post. The value of the measured voltage must be at least **20V**.

> ⚠️ ***Terminal Box* Maintenance: Whenever opening or closing the passage box, care must be taken not to damage the closing mechanism and the Protective Cover must be used.**

Among the measurements in the electrical installations, preferably at monthly intervals should be checked:

- LEDs on the *Supervisor Board* Status;
- Presence of humidity at the *Supervisor Board* installation site;
- Presence of humidity in the *Terminal Box*es.

11. General Warranty Conditions

Pumatronix guarantees the product against any defect in material or manufacturing process for the period of 1 year from the invoice issue date, provided that, at the discretion of its authorized technicians, a defect is found under normal use conditions.

The replacement of defective parts and execution of services resulting from this warranty will only be carried out at the Pumatronix Authorized Technical Assistance or a third party expressly indicated by it, where the product must be delivered for repair.

This Warranty will only be valid if the product is followed by the *Maintenance Form* properly filled out and without erasures and accompanied by the Invoice.

Loss of Warranty Situations

1) Use of software/hardware not compatible with the specifications in the Manual;

2) Connecting the product to the mains outside the standards established in the product's manual and installations that present excessive voltage variation;

3) Liquids infiltration from opening/closing the product;

4) Damage caused by natural agents (electric discharge, flood, sea fog, excessive exposure to climate variations, among other factors) or excessive exposure to heat (beyond the limits established in the Manual);

5) Use of the product in environments subject to corrosive gases, with excessive humidity and/or dust;

6) Show signs of security seal tampering;

7) Show signs of opening and modification made by the Customer in places of the product not authorized by Pumatronix;

8) Damage caused by accidents/falls/vandalism;

9) Display tampered and/or removed serial number;

10) Damage resulting from transportation and packaging of the product by the Customer in conditions incompatible with it;

11) Misuse and in disagreement with the Instruction Manual.

12. Privacy Policy

In compliance with the General Data Protection Act (LGPD) - Law No. 13,709 of August 14, 2018, this product has programmable functions for capturing and processing images that may violate the LGPD when used, in conjunction with other equipment, to capture personal data.

Pumatronix is not responsible for the purposes, use and treatment of the images captured, and the control of the information and forms of operation of the product are of the exclusive decision of the user or purchaser of the product.

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