PUMATRONIX

NEVADA

NEVADA

LEADER IN EVASION MANAGEMENT AT TOLL PLAZAS

Installation

Pumatronix Equipamentos Eletrônicos Ltda.

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Change History

Date	Revision	Updated content
11/2017	1.0	Initial Version
11/09/2018	2.0	Hardware review
11/16/2022	3.0	Format update; Firmware content update
07/02/2024	3.1	Privacy policy update; General review of document layout
09/13/2024	3.2	Update supplied components
03/20/2025	3.3	Updated Overview; Updated Frame Components; Added NEVADA Compact Frame; Updated Panoramic Image Capture Device Model; Updated Estimated Range; Updated and Added Diagrams; Updated Connection to Sensor Signals (SAD-664)
04/04/2025	3.4	Installation Diagram Update (SAD-796)

General View

NEVADA is a complete solution for non-metrological inspection of vehicles that commit the "Evading the toll without paying the fee" violation, specified in Article 209-A of the Brazilian Traffic Code. Composed of image capture and processing devices, illuminators, infrastructure devices and integrated software, which offers integration with systems such as ITSCAMPRO.

NEVADA is a system specially developed to monitor vehicles that have evaded toll stations of highway concessionaires. It is the leading system in the Brazilian market for this application. Regulated in accordance with DENATRAN Ordinance 179 and approved by INMETRO, it collects day and night images in an optimized and efficient manner, monitoring vehicles through automatic reading of their license plates and allowing management of the records made.

This system works automatically, requiring only a trigger to start the vehicle registration process, and the main functions performed by the NEVADA solution are:

- Automation of the toll evasion monitoring process;
- Identification of evasions with photo and license plate, sending the data to issue the infraction;
- Check valid TAGS for billing or fines;
- Issuance of flow reports, allowing the concessionaire to control billing;
- Capture of images, front, side and rear of vehicles and video recording;
- Provide clear images regardless of lighting and weather conditions;
- Integration with public bodies;
- Web system for consultation and screening;
- Programming video recording time;
- Dashboard with evasion profile, system and equipment data in real time.

Handling Risks

	**This equipment must be powered by a direct current (DC) source with a voltage between 9 and 32 VdC. Do not connect any of the inputs directly to the mains (AC)!**
	**Oxidation Risk: The electrical and signal connections made in the ITSCAM VIGIA+ harness and in the data network cable must be protected in a terminal box or similar structure to prevent oxidation of the connections and unwanted infiltration of liquids into the harness.**
	**This equipment may be accompanied by lenses, which are sensitive to mechanical impacts such as falls and extreme vibrations.**
	**Installation Location: In cases where it is not possible to meet the installation specifications, it is recommended to consult Pumatronix Technical Support.**
	**Damage to Vision: 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: Surge protectors and circuit breakers must meet the specifications indicated to ensure that the equipment has the necessary protection when connecting to the power supply. If not installed, the equipment may be damaged in the event of an electrical grid overload.**
	**Distribution of information: Content generated by NEVADA (captured images and data) is username and password protected. However, it is up to the system administrator to control which users have access to the information and the dissemination of the content.**

Models

Each lane monitored by NEVADA has one or more sets installed depending on the configuration and type of toll lane.

1) Optical Set contains the equipment responsible for acquiring front and rear images of vehicles and the road 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+ (S07L1IT1P)	Panoramic	640x480 p	NA**
ITSCAM VIGIA+ (S04L1IT1P)	Front or rear	1280x960 px	3 to 9 m (3.3-10mm)
ITSCAM VIGIA+ (S08L6IT1P)	Front or rear	1280x800 px	3 to 13 m (2.7-12mm)

*License plate characters remain legible in OCR reading within the estimated distance range, defined 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 for installing optical equipment with protection for connections and the hardware supervision mechanism:
    a. *NEVADA Frame or NEVADA Compact Frame;*
    b. Electrical devices of the frames;
    c. *Terminal box;*
    d. Panoramic Post;
    e. Rear Post;
    f. Front Post

Risk of Loss of Warranty: The parts that make up NEVADA must not be opened to perform repairs. All types of maintenance will be carried out by Pumatronix Technical Assistance.

The NEVADA system can be installed in all lanes of a toll station, automatic, semi-automatic or manual. The Local Processing Unit (ULP) is the component of the NEVADA Frame and the NEVADA Compact Frame that communicates with the Optical Sets of each lane with the function of processing images so that optical character recognition (OCR) of vehicle license plates can be performed. In addition to image processing, the ULP stores the files until synchronization with the NEVADA System software and therefore, the minimum specifications may vary according to the number of lanes that each unit serves:

Number of tracks	Processor type	Minimum specifications
2 (two) tracks	i3 or similar	4GB RAM and 32GB HD

To the server where the NEVADA System software will be installed, which receives all possible toll evasion violations events and allows the screening and processing of data.

Number of evasions/day	Operating System	CPU	Memory	Storage
1,000	Linux Ubuntu Server 20.04 or 22.04	9 cores	6 GB	1.5 TB
2,000		16 cores	7 GB	2.5 TB

Summary

1. Getting to Know the Product

The NEVADA solution consists of a set of equipment and software capable of monitoring the flow of vehicles in toll station 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;
- Gate to block the passage of vehicles (sized so that it does not cause physical or material damage if hit by a vehicle while closed);
- Vehicle detection sensors, which can be of the Optical Barrier and/or Inductive Loop type;
- Guardhouse at the toll station, so that the operator can carry out the manual collection process.

As can be seen in the image of the track, the installation of NEVADA generates minimal visual interference in the context of the toll station, as it is only necessary to install the three posts that accommodate the ITSCAM VIGIA+ capture devices, the ITSLUX illuminator (for capturing night images) and the terminal boxes, which house and protect the electrical and data connections, as well as the cabling.

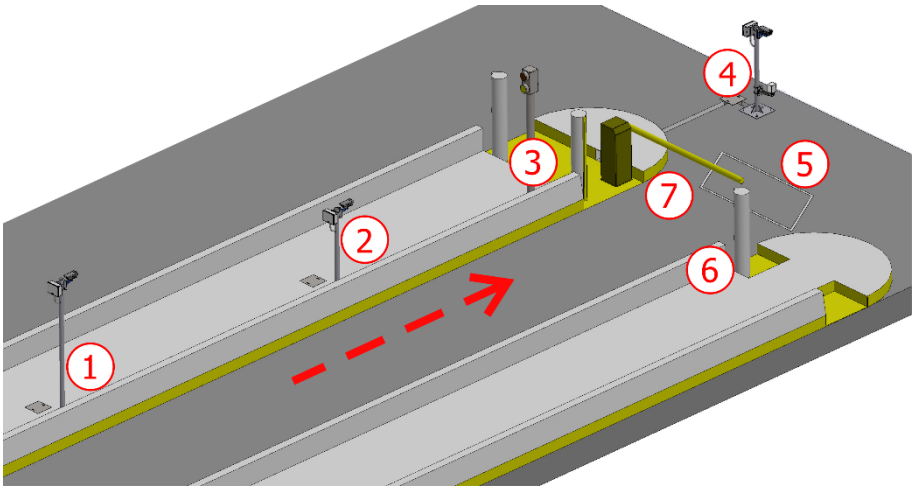


Figure 1 - NEVADA installed in an automatic toll lane (AVI): 1) Panoramic capture post, 2) Rear capture post, 3) Track traffic light, 4) Front capture post, 5) Track loop, 6) Track optical barrier, 7) Track gate

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

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

2. Information Generated

The NEVADA solution contains a module for managing toll evasion violations committed at monitoring points installed on toll station lanes. The NEVADA software is mainly responsible for compiling the data for the same record, generating a traffic violation report that can optionally contain the rear image, depending on the inspection body served:

Figure 2 - Traffic ticket generated by the NEVADA System

In addition to the configuration of the infraction notice, NEVADA can provide the following information:

- Search for stored records, with several filter options;
- Evasion Reports, with graphical information on the records made by period and the location on a map;
- Audit Report with all actions performed by users in the system;
- Report of records identified as evasive, containing the number of records for the same license plate, in the specified time interval;
- Video recorded while the vehicle passes through the monitored point;
- Registration and control of data from several toll stations with NEVADA monitoring;
- Reports with statistical data on violations committed by period;
- Equipment status, according to the profile of the connected user;
- Video captured in real time by equipment registered in NEVADA, for checks and adjustments;
- Images captured by ITSCAM VIGIA+ devices, which can be downloaded for better viewing.

Some *Filters* that can be used to search for records stored in the NEVADA database are presented on the screen in *Validation > Records*:

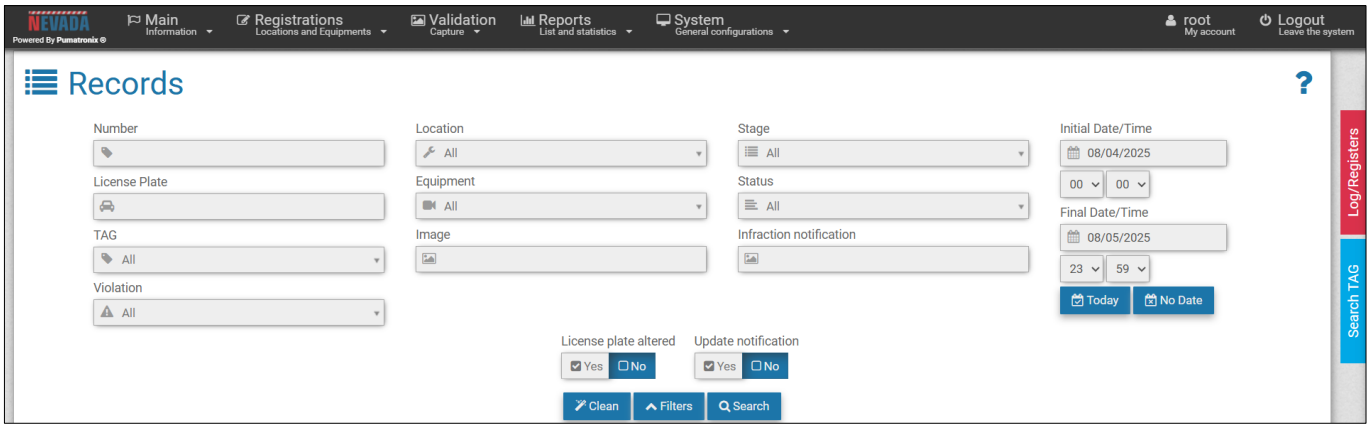


Figure 3 - Filters available when searching for records stored in NEVADA

Distribution of information: Content generated by NEVADA (captured images and data) is username and password protected. However, it is up to the system administrator to control which users have access to the information and the dissemination of the content.

NEVADA allows for enlarged viewing of captured images as well as downloading, facilitating registration validation. The quality of the images acquired by the ITSCAM VIGIA+ devices can be identified in the images:

Figure 4 - Examples of day and night images recorded by ITSCAM VIGIA+ Front

Figure 5 - Examples of daytime and nighttime images recorded by ITSCAM VIGIA+ Rear

Figure 6 - Examples of day and night images 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 required for integrating the ITSCAM 400 family with an application
	Installation and Maintenance Guide	Guide containing the information needed to install and maintain ITSCAM VIGIA+
ITSLUX	Product Manual	Manual with advanced settings for the ITSLUX image capture device
	Integration Manual	Programming and integration manual containing the information required for integrating the ITSCAM 600 with an application
	Installation and Maintenance Guide	Guide containing the information needed to install and maintain ITSLUX
NEVADA	Integration Manual	Programming and integration manual containing the information required to integrate NEVADA with an application
	Installation and Maintenance Guide	Guide containing the information needed to install and maintain NEVADA

4. Mechanical Specifications

For the track monitored by NEVADA, the Optical Set is required, with the equipment responsible for acquiring images of the track and the Infra Set with the elements for fixing the optical equipment, protecting the connections and controlling the hardware.

4.1. Optical Assembly

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

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

4.1.1. ITSCAM VIGIA+

The equipment responsible for photographic and video recording has 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 in NEVADA, according to the position in which it will be installed, as specified in Models.

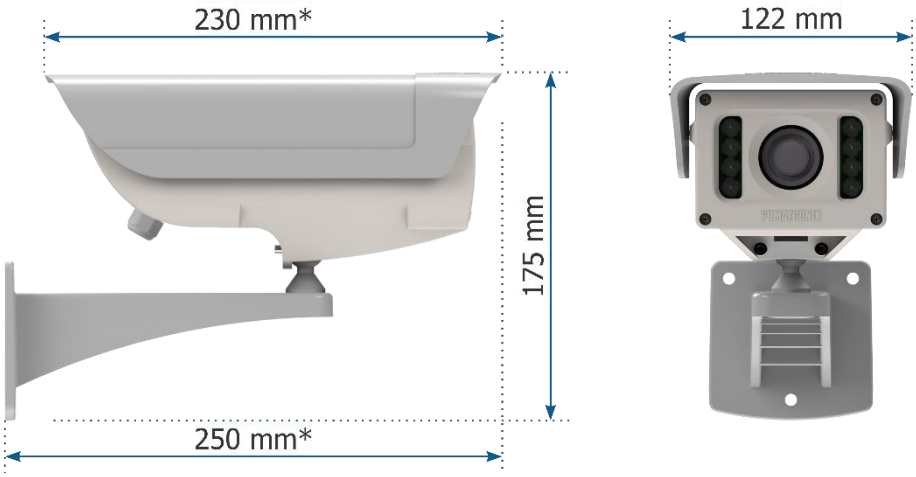


Figure 7 - ITSCAM VIGIA+ device dimensions

**Dimension considering the Sliding Tab in the initial position.*

- Material: Polycarbonate with UV protection
- Degree of Protection: IP67
- Fastening:
- VIGIA+ bracket, using 3 3/16” diameter screws (not included, as the length and type vary according to the application);

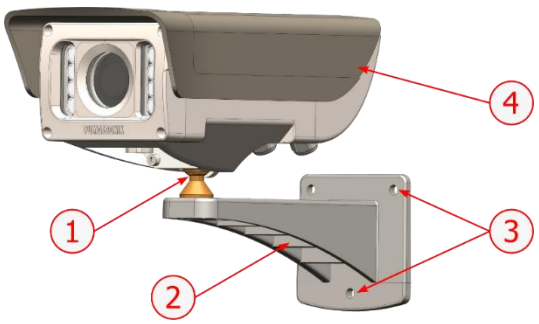


Figure 8 - Fastening the VIGIA+ Bracket: 1) Tilt adjustment of the VIGIA+ device; 2) VIGIA+ bracket; 3) Fastening points, using 3/16” screws; 4) Sliding flap, adjusted to the frame

- VIGIA+ fastener, together with the Reinforcement and 2 M4 Allen 3mm screws, allows the equipment to be fastened to the VIGIA+ Bracket sphere;

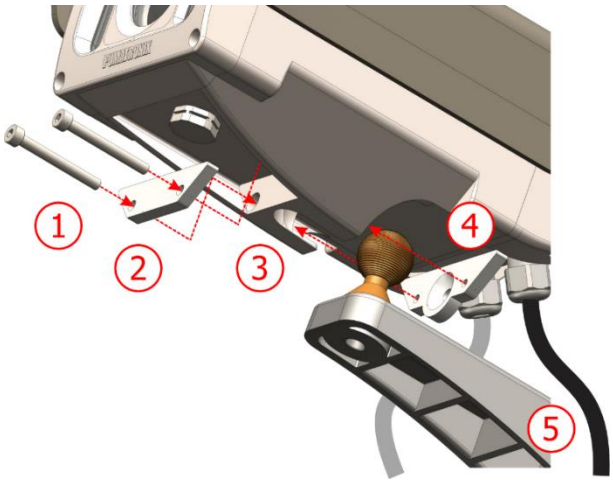


Figure 9 - VIGIA+ Fastening Assembly: 1) M4 Allen screws 3mm (2 units); 2) Reinforcement; 3) VIGIA+ cavity; 4) Fastener

- Interfaces: Ethernet connection and 12-way sleeve cable;
- Operating temperature: -10°C to 60°C;
- Weight: 955g;
- Mechanical Protection: Adjustable brim (protect lenses from direct sunlight);
- Lenses: Motorized, with infrared correction and variable focal length depending on the model and installation post;
- Illuminator: Infrared, integrated and with variable light power.

Damage to Vision: The illuminator integrated into the equipment emits thermal and light energy (not visible as 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 operating problems occur, send the product to Pumatronix Technical Assistance.

ITSCAM VIGIA+ assembly: Check the correct way to assemble the ITSCAM VIGIA+ set with the respective support, accessing the device's Installation and Maintenance Guide.

4.1.2. ITSLUX Illuminator

ITSLUX is an electronic light-emitting device that allows you to capture nighttime images. The light emission from this equipment occurs in a pulsed manner and is similar to that of a photographic flash with a lamp.

In NEVADA, ITSLUX is used to improve the display of vehicle details in nighttime images, being installed on a support that allows positioning adjustment in two directions.

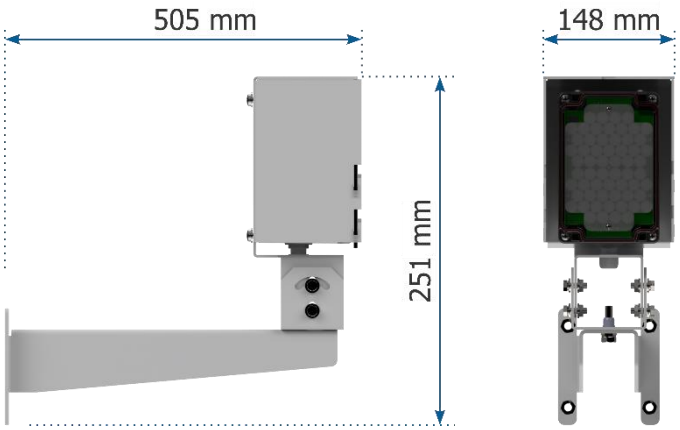


Figure 10 - ITSLUX dimensions with bracket

- Material: Polycarbonate;
- Degree of Protection: IP67;
- Fastening: ITSLUX NEVADA bracket with front protection acrylic, attached to the aluminum bracket;
- Interfaces: LED indicating operation, 6-ways 22 AWG sleeve cable (without shielding) and cover;

Figure 11 - ITSLUX Interface: 1) LED indicating operation; 2) 6-way sleeve cable

- Approximate weight: 472g (ITSLUX) + 1,250g (Bracket);
- Operating temperature: -10°C to 65°C.

Damage to Vision: The illuminators emit thermal and light energy (not 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.

ITSLUX assembly: Check the correct way to assemble the ITSLUX set with the corresponding bracket, accessing the device's Installation and Maintenance Guide.

4.2. Infra Set

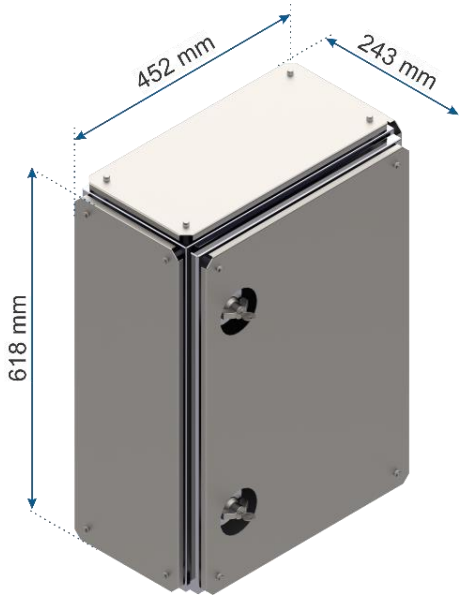
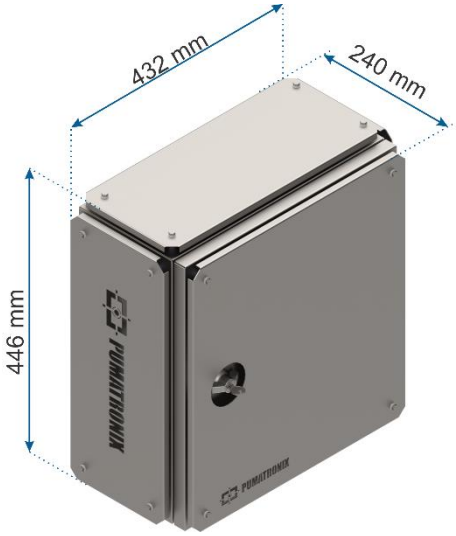
The Infra Set provides the infrastructure for the installation of the Optical Set equipment on the track and is composed of:

- NEVADA Frame or NEVADA Compact Frame;
- Electrical devices of the frames;

- Terminal box;
- Panoramic Post;
- Rear Post;
- Front Post

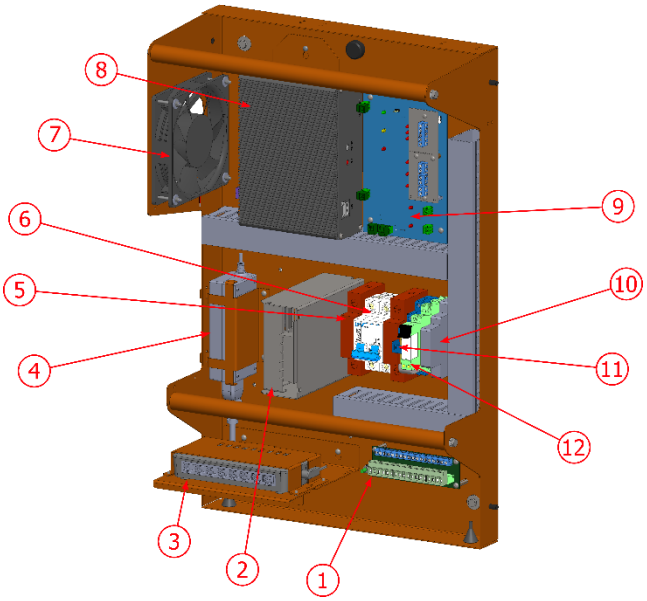
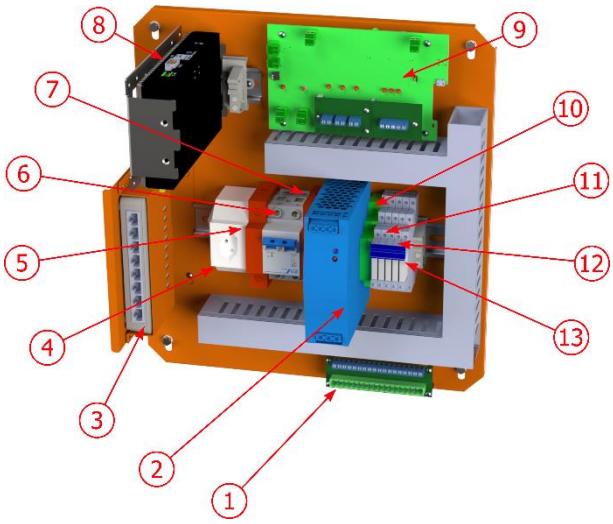
4.2.1. NEVADA Frame and NEVADA Compact Frame

The NEVADA Frame or NEVADA Compact Frame is responsible for storing and protecting Electrical Devices and connections from the elements. It comes with the attached bracket that allows for fastening to pole structures of varying shapes. The mechanical specifications of each can be compared in the table:

NEVADA Frame	NEVADA Compact Frame
 *Figure 12 – NEVADA Frame Dimensions*	 *Figure 13 - NEVADA Compact Frame Dimensions*
• Material: Steel with RAL 7032 painting; • IP Protection: IP65; • Fastening: Screwed to the upper and lower bracket; • Bracket: The support allows installation on flat surfaces (such as columns and walls) and posts with variable shapes; • Mechanical Protection: Thermal dissipation through Cooler (optional) and Deflectors; • Interfaces: It has two locks and a mechanism that keeps the door open during the maintenance process; • Connections: Sealtube at the base to protect the cable passage; • Operating temperature: -10°C to 60°C.	• Material: Galvanized AISI 1020 carbon steel; • IP Protection: IP66; • Fastening: Screwed to the upper and lower bracket; • Bracket: The support allows installation on flat surfaces (such as columns and walls) and posts with variable shapes; • Mechanical Protection: Heat dissipation through side plates; • Interfaces: Latch lock and mechanism that keeps the door open during the maintenance process; • Connections: Sealtube at the base to protect the cable passage; • Operating temperature: -10°C to 55°C.

4.2.2. Electrical Devices

Electrical Devices are arranged internally in the NEVADA Frame or NEVADA Compact Frame and support the operation of the NEVADA system. The Electrical Devices that act on the electrical protection mechanisms are fixed to the internal panel and are detailed in Electrical Specifications:

NEVADA Frame Electrical Devices	NEVADA Compact Frame Electrical Devices
	
1. General Connector 2. Power supply 3. Switch 4. ULP Power Supply 5. Surge Protector (220Vac Circuit, 2 units) 6. Circuit breaker 7. Cooler 8. ULP-Local Processing Unit with Hardkey 9. Surveillance Board 10. Surge Protector (24Vac Circuit) 11. Solid State Relay 12. Relay (24Vdc, 127Vac or 220Vac)	1. General Connector 2. Power supply 3. Switch 4. Brazilian standard plug according to ABNT NBR 14136, 10A 5. Surge Protector (220Vac Circuit) 6. Circuit breaker 7. Surge Protector (220Vac Circuit) 8. ULP-Local Processing Unit with Hardkey 9. Surveillance Board 10. Surge Protector (24Vac Circuit) 11. 24V Solid State Relay (3 units) 12. Relay 127 V 13. Relay 220 V

4.2.3. Terminal box;

The posts on which the 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 cage bracket with clamps and a protective cover.

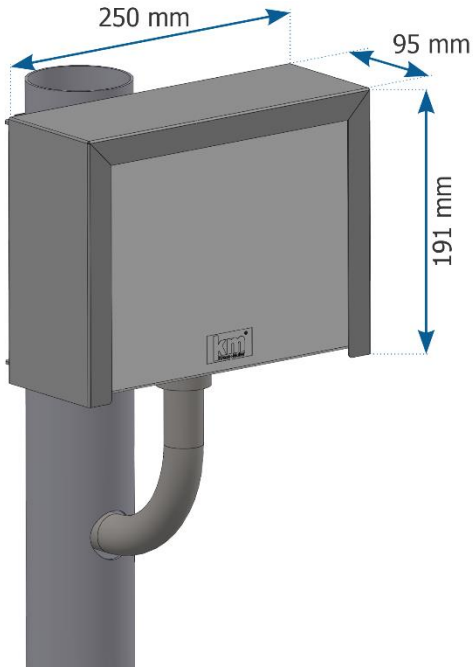


Figure 14 - Terminal box with protective cover on post

- Degree of Protection: IP55;
- Material: *Terminal box* in self-extinguishing thermoplastic (Polyamide 6.6) and protective cover in carbon steel 1020;
- Fixation: Screwed to a support attached to the post;
- Bracket: Cage-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.

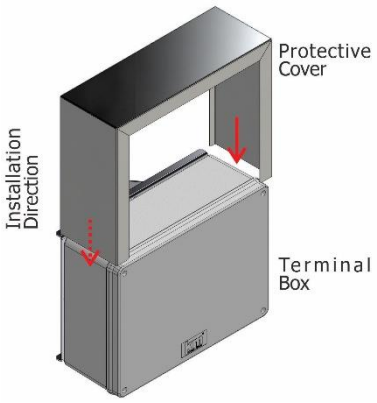


Figure 15 - Installing the Protective Cover on the terminal box

4.2.4. Panoramic Image Capture Post

The Panoramic Post receives the ITSCAM VIGIA+ Panoramic (to record the image of the track with the vehicle and the traffic light) and a terminal box (to connect the power supply and data network). It is possible to install the ITSLUX illuminator for operation in conjunction with the ITSCAM VIGIA+ Panoramic, to obtain clearer panoramic images at night.

Figure 16 - Panoramic Post with ITSCAM VIGIA+, ITSLUX (optional) and terminal box fastened

- Material: 3” (76.2mm) circular galvanized tube;
- Painting: Black (can be customized);
- Height: 2.5m from the surface;
- Fastening: Anchored base with 4 5/16” x 100 anchors bolts with stainless steel stud (Parabolt type) or 190mm anchor bolt;
- Interfaces: Holes for fitting conduits, passing cables and preventing internal water accumulation.

4.2.5. 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 the appropriate lighting) and a *terminal box* (protecting the electrical and data connections of the equipment).

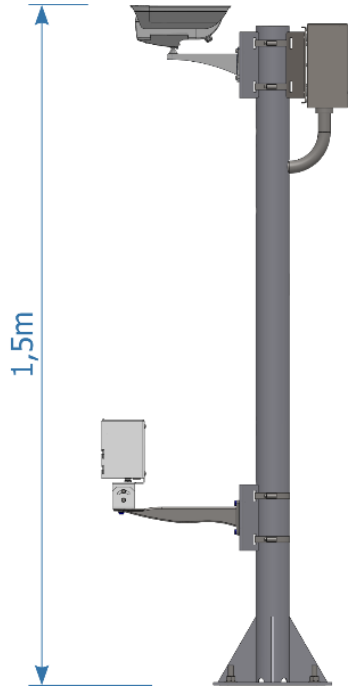


Figure 17 - Front Post with ITSCAM VIGIA+, ITSLUX and terminal box fastened

- Material: 3” (76.2mm) circular galvanized tube;
- Painting: Black (can be customized);
- Height: 1.5m from the surface;
- Fastening: Base anchored with 190mm anchor bolt and secured with nut and washer, or anchored with 4 5/16” x 100 anchor bolts with stainless steel stud (Parabolt type);
- Interfaces: Holes for fitting conduits, passing cables and preventing internal water accumulation.

4.2.6. Rear Image Capture Post

Capturing images of the rear of offending vehicles depends on the installation of a post that positions the ITSCAM VIGIA+ Rear at an appropriate distance from the location where the vehicle is usually located on the track. Its main features are the same as the front post, except for the absence of the lower hole.

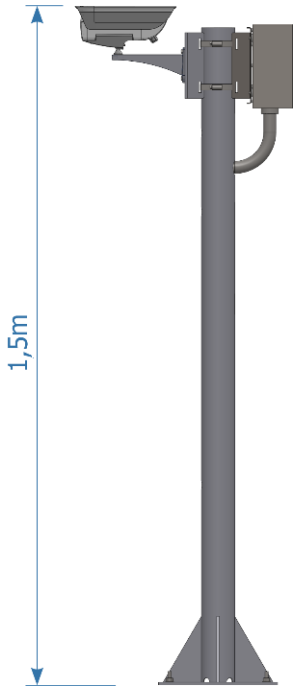


Figure 18 - Rear Post with ITSCAM VIGIA+ and terminal box fastened

5. Electrical Specifications

- Power supply: 127Vac or 220Vac;
- Connection: RJ-45 Ethernet connector;

The NEVADA Frame or NEVADA Compact Frame is responsible for supplying power to the track equipment and for interconnecting them to the sensor signals, as shown in the illustrative diagram:

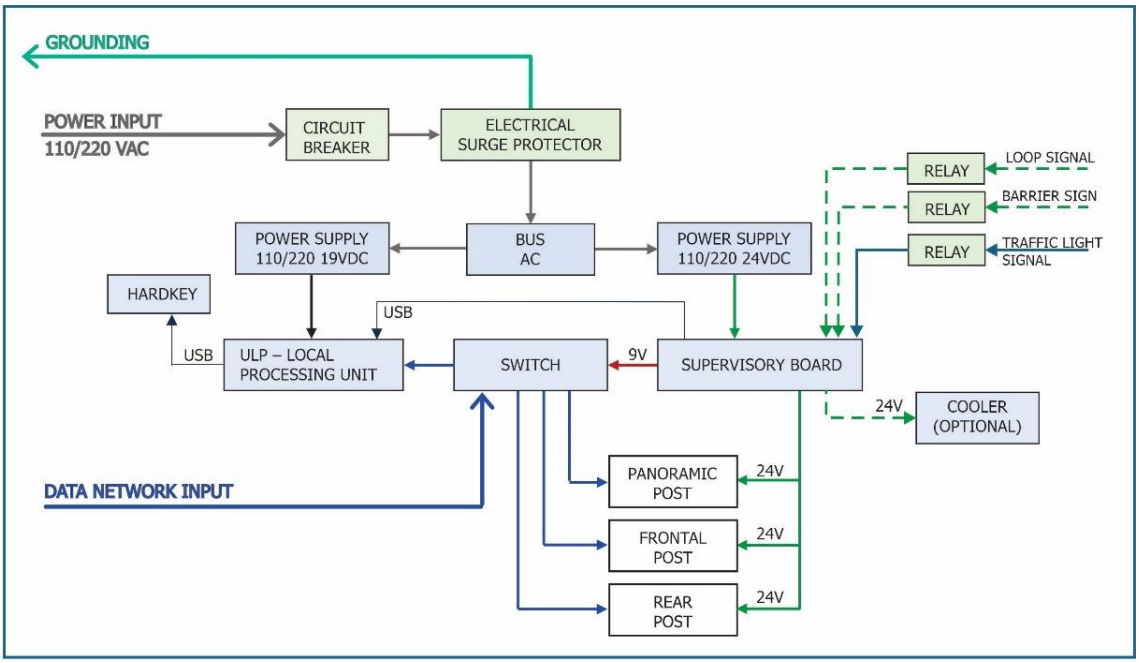


Figure 19 - Electrical Diagram of Connections in NEVADA Frame

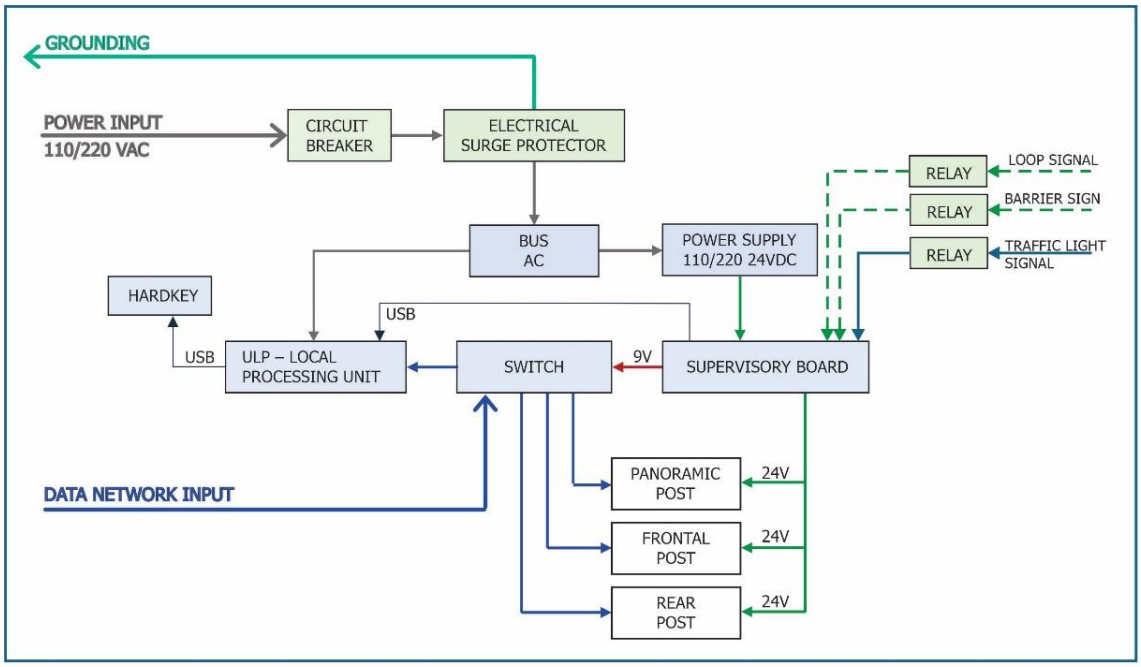


Figure 20 - Wiring Diagram on NEVADA Compact Frame

5.1. Surveillance Board

The Surveillance Board is the electronic component that provides secure communication with image capture equipment, receiving input and output signals.

The Surveillance Board connections to the Optical Set devices are detailed in the NEVADA Installation and Maintenance Guide.

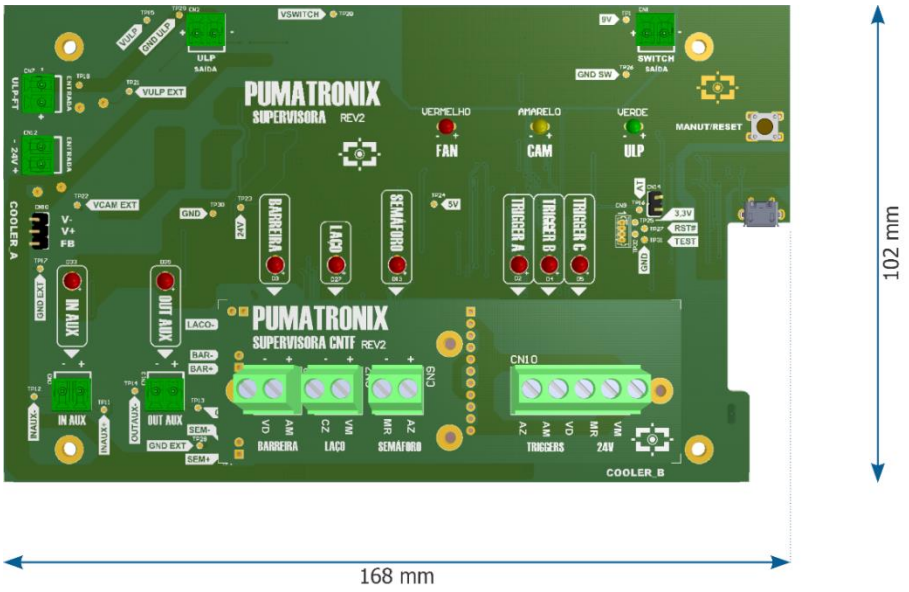


Figure 21 - Rev2 Surveillance Board Dimensions

- Interfaces:
- MAINTENANCE button for temporary suspension of monitoring activities to perform maintenance on the Optical Set equipment;
- LEDs indicating activation of track sensors;
- LEDs indicating the signals sent to ITSCAM VIGIA+ devices;
- LEDs indicating the monitored components (ULP, Cooler and Switch);
- Connections: Terminal type.
- Operating temperature: -10°C to 50°C.

5.1.1. Behavior of the Surveillance Board LEDs

The Rev2 Surveillance Board displays equipment supervision information through the LED interface. Each LED indicates the behavior of a specific component or equipment, as detailed in the table.

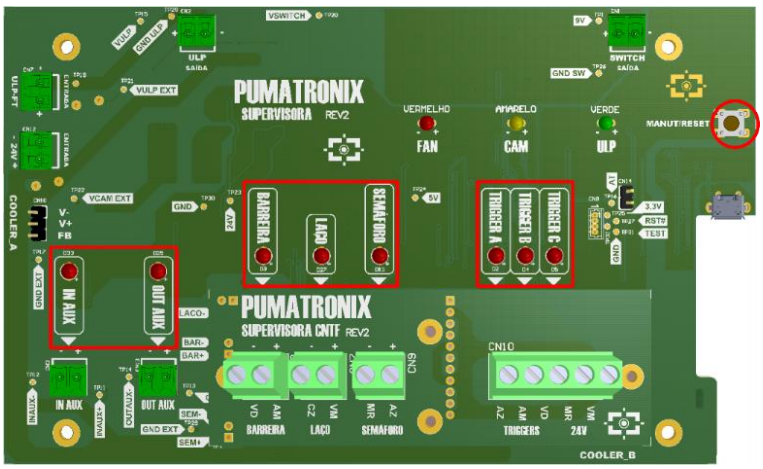


Figure 22 - Position of LEDs on Rev2 Surveillance Board

Interfaces	Behavior
MAINT/RESET Button	When pressing the Surveillance Board maintenance mode button, the board's surveillance status 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 flashing.
TRIGGER A, TRIGGER B and *TRIGGER C*	They indicate the sending of the signal to the trigger in ITSCAM, lighting up when sending.
BARRIER, LOOP and TRAFFIC LIGHT	They indicate the signals received from the track, according to the identification on the Surveillance Board. The respective LED is lit when the signal is received.
IN AUX	Indicates signal input, lighting up when received.
OUT AUX	Indicates the signal output, lighting up when it is sent.

5.2. Power Supply 110/220 – 24Vdc

The Power Supply is responsible for supplying voltage to the VIGIA+, ITSLUX, Switch and Surveillance Board devices.

Figure 23 - Mean Well Power Supply

- Interfaces: Vin, Vout and grounding
- Power: 120W
- Connections: Terminal type.
- Power supply: 85~264Vac (full range)
- Operating temperature: -20°C to 60°C.
- Protection: Overload
- Output: 24Vdc

5.3. Switch

The Switch is responsible for interconnecting the data network of the capture devices, Local Processing Unit (ULP) and the concessionaire. It provides always-available communication for data transmission. Regardless of whether the network equipment has different speeds, it provides communication without compromising speed. The model applied in the NEVADA Frame and NEVADA Compact Frame is the Switch with 8 Ports:

Figure 24 - 8 ports SWITCH

- Interfaces: 8 RJ-45 Ethernet ports (10/100Mbps);
- Power supply: Input 100-240Vac / 50-60Hz; Output 12Vdc / 0.5A;
- Operating Temperature: 0°C to 40°C.

5.4. Local Processing Unit (ULP)

The Local Processing Unit (ULP) is responsible for:

- acquisition of images captured by capture devices;
- identification of the license plate of the vehicle captured in the image through OCR (Optical Character Recognition) reading;
- video recording showing the moment in which the vehicle committed the traffic violation.

NEVADA Frame	NEVADA Compact Frame
 *Figure 25 - TECSYS Local Processing Unit (ULP)*	 *Figure 26 - JHCTECH Local Processing Unit (ULP)*
• Interface: Ethernet RJ-45 and USB; • Architecture: x86; • Power supply: Power supply with 110~220Vac input and 12Vdc output; • Operating temperature: -10°C to 50°C.	• Interface: Ethernet RJ-45 and USB; • Power supply: 9-36Vdc; • Operating temperature: -20ºC to 60ºC.

5.5. Hardkey

The Hardkey is a USB flash drive-like device that contains the NEVADA OCR software license. This means that vehicle license plate identification will only be performed if the Hardkey is connected to the Local Processing Unit (ULP).

Restriction of Use: Never disconnect the Hardkey from the Local Processing Unit (ULP) as this component is responsible for enabling the automatic reading of vehicle license plates in captured images.

5.6. Cooler (Optional)

The NEVADA Frame Cooler is an optional item and can be used to reduce the internal temperature of the frame structure, favoring the operation of the product in different environments.

Figure 27 – Cooler (Optional)

- Interface: Power/status connector connected to the Surveillance Board;
- Power supply: 24Vdc;
- Operating temperature: -10°C to 50°C.

5.7. Electrical Protection Devices

Among the Electrical Devices are those that offer protection in electrical connections, which are distinguished according to the model of the Frame, as indicated in the table:

Two-phase circuit breaker	
	The two-phase circuit breaker is designed to protect the NEVADA System against possible damage that surges and short circuits can cause, acting to shut down the entire system.
	• Type: Two-phase • Supported load: 10A

Surge Protector (220Vac Circuit)

The Surge Protector for electrical networks with operating voltage 127Vac or 220Vac is installed after the input circuit breaker and has the function of protecting the circuit elements against electrical voltage surges, generally caused by atmospheric overvoltages or by maneuvers in the electrical system.

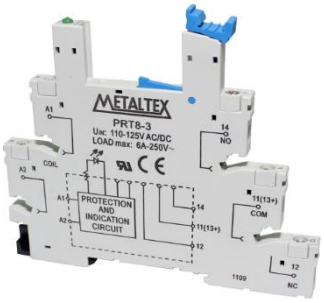
- Operating temperature: -40°C to +70°C.
- Maximum surge current: 15kA to 90kA

Surge Protector (24Vdc Circuit)

The Surge Protector for electrical networks is a protection component installed in the circuit after the input circuit breaker and with the function of protecting the circuit elements against electrical voltage surges.

- Operating temperature: -40°C to +70°C.
- Maximum discharge current: 10kAC
- Rated load current: 10 AC
- Maximum voltage 38Vdc

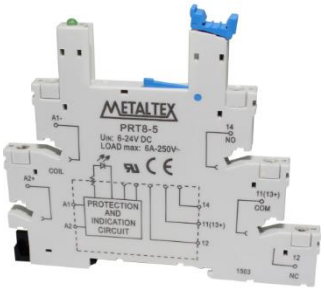
Electromechanical Relay 24Vdc, 127Vac or 220Vac



The 24Vdc, 127Vac or 220Vac Relay has the function of interconnecting and protecting the Traffic Light signal coming from the installation on the road with the NEVADA Frame or NEVADA Compact Frame.

- Input voltage (coil): 24Vdc, 127 or 220Vac (according to the traffic light signal)
- Output voltage: 127 or 220V (according to customer installations)
- Output: 6A

Solid State Relay



The Solid State Relay has the function of interconnecting and protecting the signals coming from the concessionaire's installation with the NEVADA Frame or NEVADA Compact Frame.

- Input voltage: 24Vdc
- Maximum switching voltage: 28Vdc
- Minimum load: 20 mA

5.8. Terminal box

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

- Surge Protector: Maximum operating voltage of 12V and withstand a maximum surge voltage of 5kA;
- Connection Board: connection to the Surveillance Board using the 8-ways sleeve cable to receive the barrier, traffic light and loop signals, low current with a maximum voltage of 24Vdc and the power supply for the ITSCAM VIGIA+ and ITSLUX 24Vdc 2A illuminators.

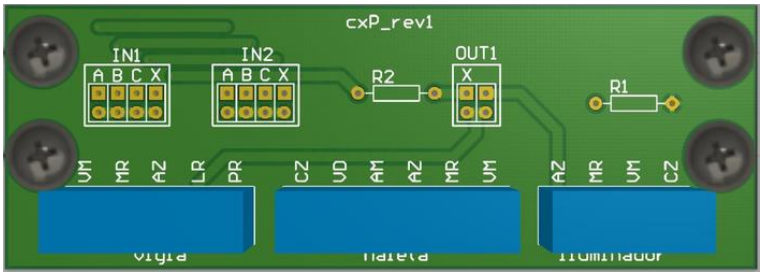


Figure 28 - Terminal Box Connection Plate

5.9. Connection with ITSCAM VIGIA+ Devices

In order for the Optical Set equipment to receive signals from the track sensors (Optical Barrier, Inductive Loop or Traffic Light), they must be connected to the NEVADA Frame or NEVADA Compact Frame using an 8-way sleeve cable, following the instructions in the NEVADA Installation Diagram on a track. The cable paths used are specified in the NEVADA Installation and Maintenance Guide.

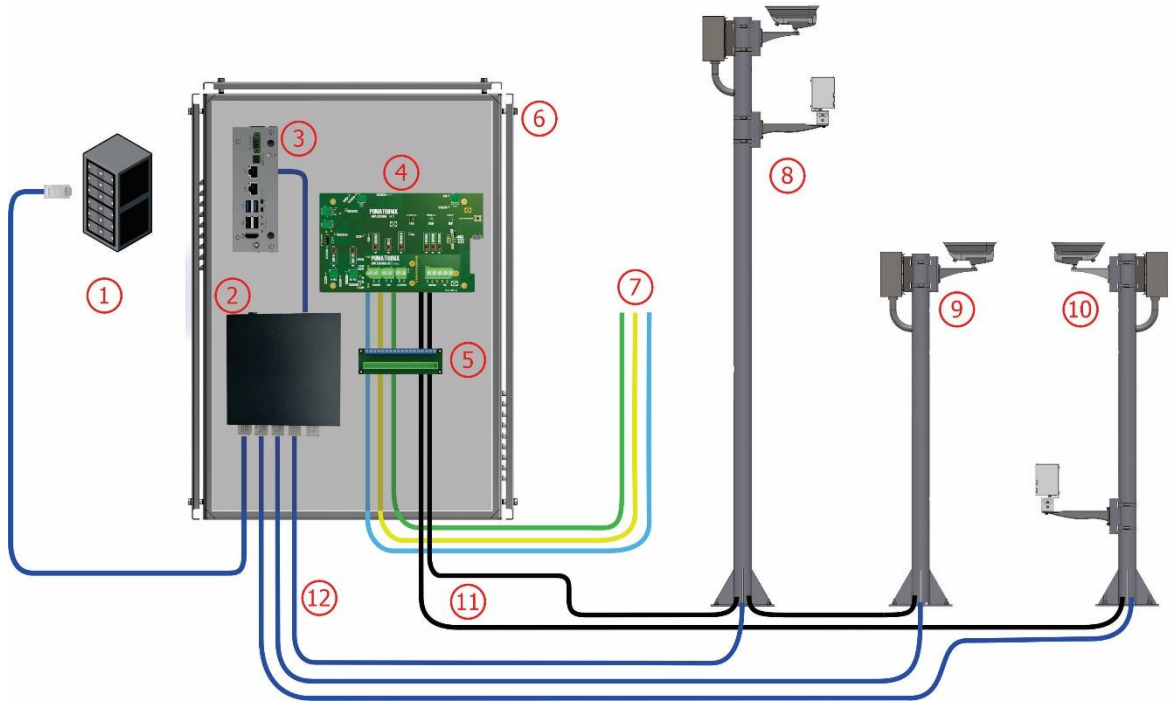


Figure 29 – NEVADA Installation Diagram on a Track: 1) Concessionaire network, 2) Switch, 3) ULP - Local Processing Unit, 4) Surveillance Board, 5) General Connector, 6) NEVADA Frame or NEVADA Compact Frame, 7) Signals from a Track sensor, 8) Panoramic Image Post, 9) Rear Image Post, 10) Front Image Post, 11) 8x22AWG shielded sleeve cable, 12) Furukawa External CAT-5E Cable

5.10. Connection with Sensor Signals

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

To receive the signals from the Inductive Loop, Optical Barrier and Traffic Light coming from the concessionaire's installation, it is necessary to use protection against possible electrical surges when connecting each concessionaire sensor to the NEVADA Frame or NEVADA Compact Frame.

The voltage of the concessionaire's mains must be considered when choosing the relay to interconnect the Traffic Light signal, present in the NEVADA Compact Frame:

- 24Vdc relay (PRZ-1D-D24): with 24Vdc input, electromechanical type;
- 127V METALTEX Relay (PN: PRZ-1R-110): for local network voltage of 127V, electromechanical type;
- 220V METALTEX Relay (PN: PRZ-1R-220): for local network voltage of 220V, electromechanical type.

5.10.1. Application of Sensor Signals

The Inductive Loop or Optical Barrier signals can be used to identify the start of a transaction. This signal comes to NEVADA to indicate that panoramic footage of the track should be recorded.

The charging scheme then processes the payment to the vehicle and activates the traffic light. At the beginning of the transaction, a vehicle passes with the red traffic light on. When payment is complete, the green light is switched on and the red light is switched off. If the traffic light does not change from red to green before the vehicle passes through the barrier, there was a problem with the transaction (manual or automatic payment).

Subsequently, 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.

5.11. Data Network Connection

NEVADA track equipment relies on the concessionaire's local network to communicate with the NEVADA System software and send logs. In this way, the ITSCAM VIGIA+ panel and devices must be on the same network as the concessionaire's equipment, connected through the Switch that makes up the NEVADA Frame and the NEVADA Compact Frame.

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 the Google Chrome browser and enter the provided IP address.

NEVADA IP	192.168.0.1
User	*root*
Password	*root*

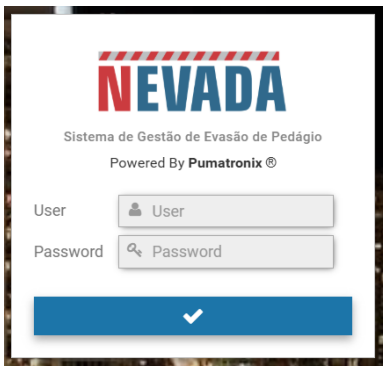


Figure 30 - NEVADA system login screen

6.1. Functionalities

The NEVADA system is operated through the NEVADA software interface, which allows, among other functions:

- register image capture devices that operate in the optimized and efficient collection of daytime and nighttime images of vehicles;
- automatically read plates, identifying the characters (OCR);
- store photos of the vehicle with the registration data.

NEVADA Software provides record management through the available functionalities listed and with the possibility of customization:

- Compilation of data in a log containing the captured images, the video of the vehicle passing by, the license plate read automatically, date and time of the violation, among other data;
- Integration between NEVADA systems, which allows communication of records from multiple tracks to the same NEVADA;
- Integration between TAG servers and NEVADA, which can be used as an auxiliary mechanism for identifying vehicles with automatic charging;
- Integration with the inspection body's server to send violations;
- Registration of violations of the Brazilian Traffic Code;
- Inclusion of a list of vehicle license plates that should not be ticketed (for example, official vehicles, dealership vehicles, firefighters, ambulances, etc.);
- Configuration of the record screening process, i.e., definition of the steps that a record must go through until it is considered a traffic violation;
- Possibility of performing automatic screening, with the definition of actions to be performed by the Bot user;
- Setting record discard patterns.

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

- Military Police of Paraná;

- Federal Highway Police;
- DETECTA System of Sao Paulo.

Communication protocols: The complete list of servers for integration is available in the Integration Manual and may vary depending on the version available.

NEVADA System Operation: See the Software Manual that presents the entire NEVADA system interface and the steps to customize screening and perform monitoring according to the desired specifications.

Distribution of information: Content generated by NEVADA (captured images and data) is username and password protected. However, it is up to the system administrator to control which users have access to the information and to disseminate the content with the version made available.

7. Licensing

The NEVADA Software license is a unique file associated with the hardware on which the system was installed. If it is necessary to install the system in another Processing Unit of the Concessionaire, a new license must be requested from Pumatronix Technical Support.

Changing the number of devices that can simultaneously connect to the NEVADA Software may generate additional license charges and must be requested via Technical Support or directly from the Pumatronix Sales team.

Figure 31 - Screen displayed when accessing the System > License menu

Please refer to the NEVADA Software manual for more information on licensing options.

Distribution of information: Content generated by NEVADA (captured images and data) is username and password protected. However, it is up to the system administrator to control which users have access to the information and the dissemination of the content.

8. Initial Setup

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

8.1. Installation Prerequisites

NEVADA requires the following resources to be installed and function correctly during operation:

- Electrical Network, for 127/220Vac power supply and 24Vdc availability;
- Connectivity (Data Network), for transmission of collected data, between the track and the NEVADA Frame or NEVADA Compact Frame;
- Posts for fixing ITSCAM VIGIA+ devices, ITSLUX illuminators and *Terminal Box*;
- Fixing infrastructure for the NEVADA Frame or NEVADA Compact Frame;
- Ducts for protecting connections, used in electrical installations and connections between devices and the NEVADA Frame or NEVADA Compact Frame.

8.1.1. Equipment Installation Location

The correct operation of NEVADA is directly related to the quality of the images that are captured, which is why the equipment has its lenses and illuminator sized for the specified standard distances. Variations in the values presented are tolerated, however the recognition results may be affected and it is advisable to contact Pumatronix technical support if it is not possible to meet the specifications.

The standard distances have as their origin point the position of the sensor that identifies the presence of the vehicle, that is, the Optical Barrier. From this sensor, the position of the posts is defined, and thus, the necessary infrastructure, such as the inspection box installed on the floor, close to the post. The distances required when installing the Infra Set are detailed in the Installation and Maintenance Guide. The recommended distances for installing image capture equipment can be found in the top view of the NEVADA deployment on a track:

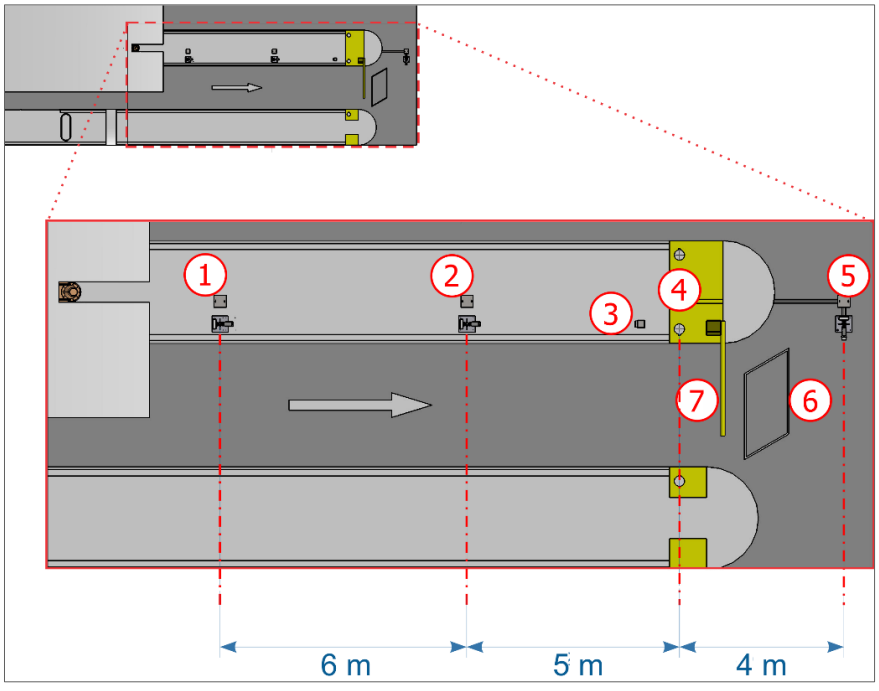


Figure 32 - Top view of the installation in an automatic collection track (AVI): 1) Panoramic capture post, 2) Rear capture post, 3) Track traffic light, 4) Track optical barrier, 5) Front capture post, 6) Track loop, 7) Track barrier

Considering the direction of the road where cars pass, the installation of the Inductive Loop after the gate is the model adopted in all images of the generic toll station track presented in this manual, however it is possible for the Inductive Loop to be installed before the gate.

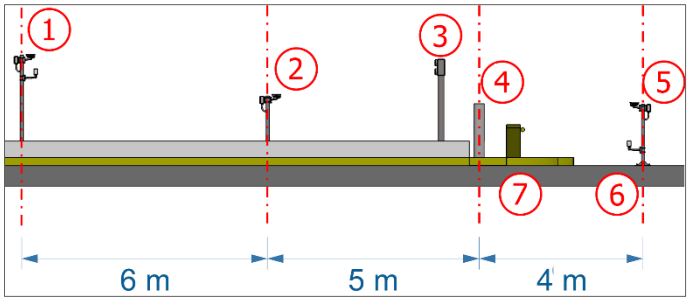


Figure 33 - Side view of the installation in an automatic toll track (AVI): 1) Panoramic capture post, 2) Rear capture post, 3) Track traffic light, 4) Track optical barrier, 5) Front capture post, 6) Track loop, 7) Track barrier

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

Front post positioning: The installation of the post that captures the frontal images of vehicles must be done in a region that does not interfere with the exit of vehicles from the toll lane area.

8.2. Necessary Conditions for Installation

After meeting the prerequisites for positioning the equipment on the track, check the configuration of the network to which the equipment will be connected and perform the necessary parameterization.

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

8.2.1. Network Interface Parameterization

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

Setup	Standard 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 the flash memory, however it is effectively applied after the equipment is restarted. 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 changes the IP address by mistake and loses connection with the device. Access to this recovery IP address is only available over a point-to-point connection to the appliance.

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 equipment's network interface (Ethernet), values other than the maintenance IP must be applied, as there will be no way to recover the connection in the event of loss of the configured IP address.

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

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

8.2.2. ITSCAM VIGIA+ positioning

To get the best performance from ITSCAM VIGIA+, it is recommended that it be installed parallel to the track and with little horizontal inclination. The location chosen for using NEVADA must allow the ITSCAM VIGIA+ to be positioned so that the images produced are free from regions covered by architectural structures, trees, vehicles on other lanes, among other elements. In situations where reflections such as sunlight occur, adjust the Sliding Tab to the best position that can prevent interference with image quality:

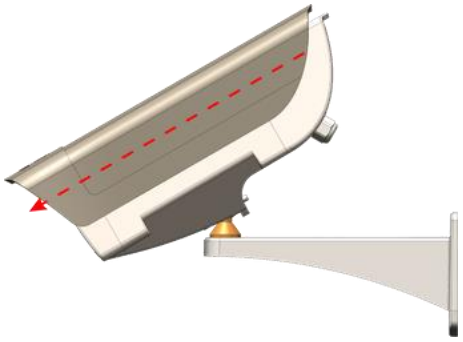


Figure 34 - Illustration of the direction of extension of the Sliding Flap

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

8.2.3. Image Framing Adjustments

For each image capture position, the framing of the ITSCAM VIGIA+ device is different. The Panoramic position aims to show the context of the violation committed, 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 vehicle's license plate. The requirements for framing the respective image are detailed in the Installation and Maintenance Guide.

The image framing must be done through the ITSCAM VIGIA+ Web interface, which allows you to view the image, offers Zoom and Focus adjustment options and advanced settings. For advanced information on adjustment options, refer to the ITSCAM VIGIA+ Product Manual.

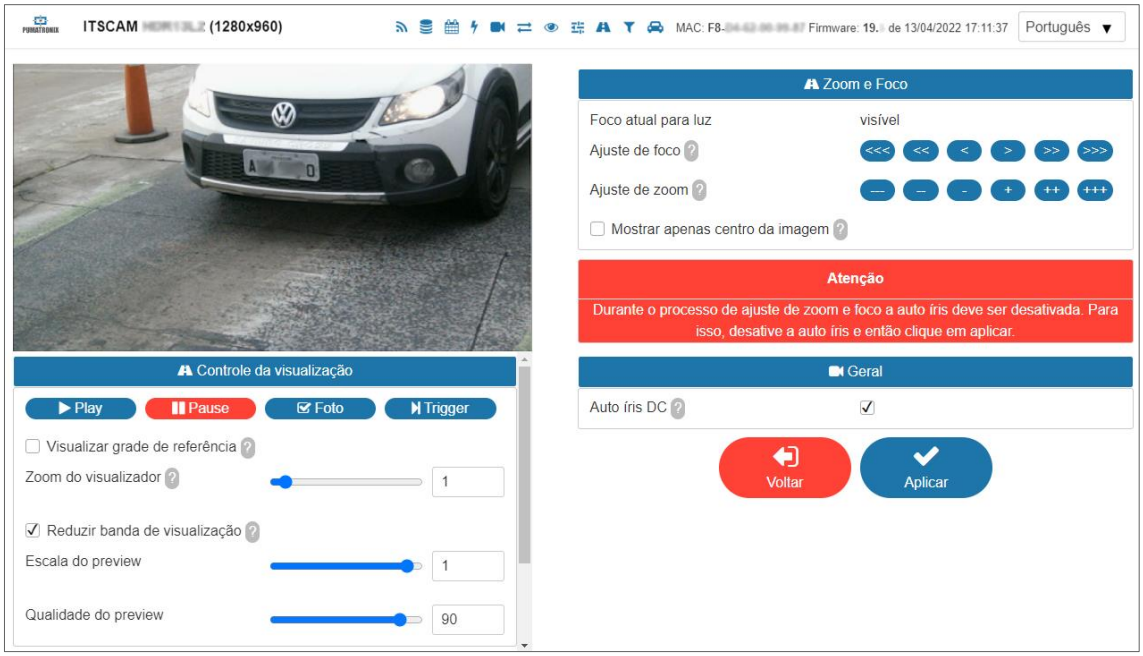


Figure 35 - ITSCAM VIGIA+ web interface screen with image preview and zoom and focus options

9. First Access

After installing the NEVADA system, with the equipment properly installed and powered, access to the NEVADA system interface can be done using an Auxiliary Configuration Equipment with the Google Chrome browser (version 85 or higher) installed. When entering the IP address in the browser address bar, the factory default username and password must be entered:

NEVADA IP	192.168.0.1
User	*root*
Password	*root*

The factory default network configuration uses DHCP. In order to connect to the network, the portable device must have a DHCP server. If necessary, configure the data network by following the steps outlined in the NEVADA Installation Guide before initial use of the system.

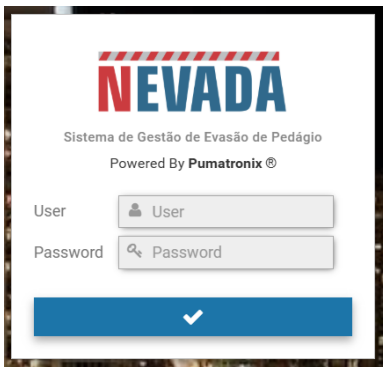


Figure 36 - NEVADA system login screen

The Pumatronix ITSCAM image capture device's web interface can be used to quickly check the equipment status and track images in real time. Each device can be accessed by entering the IP address of the respective device in a browser, from an Auxiliary Configuration Device connected to the same data network. Advanced configuration options are described in the Integration Manual for the respective device.

10. Care and Maintenance

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

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

11.1. Firmware Update

To perform the update, access the *System>System Maintenance* menu and in the Software Update option, insert or select the package files in the indicated area. Other maintenance options are presented in the NEVADA Integration Manual.

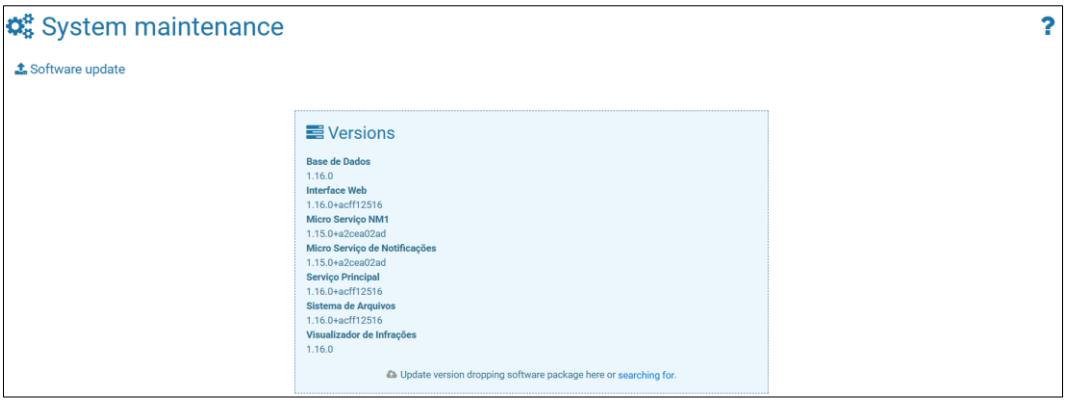


Figure 37 - NEVADA Software Screenshot in the System Maintenance Area

Perform the following steps to perform the Manual Update:

1) Download the new version files: Contact Technical Support on the Pumatronix website and download the firmware file received by email (which starts with the name sigaem and has the extension .swu);

2) With the help of an Auxiliary Configuration Equipment, access the Local Processing Unit (ULP) in the NEVADA Frame or NEVADA Compact Frame of the NEVADA system;
3) Access the System > System Maintenance menu;
4) In the Software Update field, install the update package by dragging the file to the Versions area or by clicking the link to browse for a saved file.

11.2. Preventive maintenance

Maintenance Interval: The maintenance procedures described in this manual have a suggested frequency, however, situations may arise in which activities must be carried out at shorter intervals.

11.2.1. Preventive Maintenance of ITSCAM VIGIA+

The ITSCAM VIGIA+ image capture and processing device must provide images that enable the identification of the violation and the reading of the license plate of the vehicle involved. However, if the external surface of the lenses is dirty, identification may be compromised. To maintain image quality, clean the lens acrylic every six months or whenever dirt is noticed when viewing images displayed through the software interface.

Figure 38 - Lens viewfinder position

To efficiently clean the external surface of the lenses, follow the steps below:

1) Spray lens cleaning liquid onto the surface of the lenses or water onto the glass of the protective case to remove excess dirt adhering to the surface;
2) Use a soft, lint-free cloth to remove dirt, moving the cloth in one direction only;
3) Use a dry cloth to finish cleaning and do not use force, as this could damage the surface.

Acrylic maintenance: Clean with non-abrasive materials and do not apply force when cleaning and drying the lenses as this could damage the acrylic.

11.2.2. Preventive Maintenance of the ITSCAM VIGIA+ Fastening Bracket

The ITSCAM VIGIA+ bracket has a sphere that allows the capture device to rotate freely, facilitating the correction of the position of the equipment on its bracket, with the aim of capturing images of vehicles, whether they are in the most varied positions. Accidental collisions with the equipment may occur, affecting its positioning. When analyzing the images and noting that there has been a change in position, loosen the screws indicated in red, reposition the equipment and tighten them again, so that the position of the ITSCAM VIGIA+ is not changed.

11.2.3. Preventive Maintenance of the ITSCAM VIGIA+ Protection Flap

The ITSCAM VIGIA+ Panoramic, Front and Rear devices must provide images that enable the identification of the violation and the reading of the license plate of the vehicle involved. Therefore, in addition to the equipment settings following the instructions in the ITSCAM VIGIA+ Product Manual, the mobile flap must be fully extended to block light rays that may fall directly on the lens and cause reflections in the captured images. Perform a biannual inspection of the flap positioning, as accidental collisions with the equipment may occur and it may become displaced.

Image characteristics: Depending on the lighting conditions and the incidence of sunlight, one or two of the exposures are dark or saturated, not allowing the distinction of details. A saturated image contains parts or all of the image light.

11.2.4. Preventive Maintenance of ITSLUX Illuminator

ITSLUX is responsible for enabling nighttime 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 support, which acts as protection against dust, dirt and even stones that may collide with the equipment. Check that the protective cover and ITSLUX itself are not dirty, as the light output may be impaired and the images may appear dark.

Cleaning acrylics: Clean with non-abrasive materials, such as a soft lint-free cloth, just dampened with water. In cases where there is a lot of accumulated dirt, you can use neutral detergent. After cleaning, wipe with a dry, non-abrasive cloth. When cleaning and drying the lenses, do not use force as this could damage the protective part and ITSLUX itself.

ITSLUX artificial lighting: When the ITSLUX cover is opaque or damaged, replace it following the step-by-step instructions presented in the Installation and Maintenance Guide.

11.2.5. Electrical Preventative Maintenance

The power supply voltage of the ITSCAM VIGIA+ located in the position furthest from the Surveillance Board must be measured preferably every six months, accessing the Terminal Box of the respective post. The measured voltage value must be at least 20V.

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

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

- Surveillance Board LED status;
- Presence of humidity at the Surveillance Board installation site;
- Presence of moisture in the Terminal Boxes.

11. General Warranty Conditions

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

The replacement of defective parts and execution of services arising from this Warranty will only be carried out at 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 accompanied by a Maintenance Form duly completed and without erasures and accompanied by the Invoice.

11.1. Situations in which the Product Loses its Warranty

1) Use of software/hardware not compatible with the specifications in the Manual;
2) Connecting the product to mains outside the standards established in the product manual and installations that present excessive voltage variation;
3) Infiltration of liquids from opening/closing the product;
4) Damage caused by natural agents (electrical discharge, flooding, sea spray, 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 tampering with security seals;
7) Show signs of opening and modification made by the Customer in areas 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 the transport and packaging of the product by the Customer in conditions incompatible with the same;
11) Misuse and in disagreement with the Instruction Manual.

12. Privacy Policy

In compliance with the General Data Protection Law (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.

The equipment does not collect, use or store personal information, whether sensitive or not, for its operation.

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


PUMATRONIX
www.pumatronix.com