PUMATRONIX

VTR600

HIGH PROCESSING, CONNECTIVITY AND EMBEDDED SOFTWARE

Product

Pumatronix Equipamentos Eletrônicos Ltda.

Rua Bartolomeu Lourenço de Gusmão, 1970. Curitiba, Brasil

Visit our website https://www.pumatronix.com

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Change History

Date	Revision	Content updated
12/13/2023	1.0	Initial Version
04/17/2024	1.1.0	Updating VTR600 Device Images; Digital Signature and Encryption Update for firmware version 1.6.0
06/12/2024	1.1.1	Update of Classifier specifications; Update of the ITSCAMPRO Mobile interface in version 2.12.0
07/10/2024	1.2.0	SD Card Storage Update; License plate recognition update
26/07/2024	1.3.0	Network Interfaces Update; IP Protection Update

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Overview

In a scenario where crime demands swift and effective responses, Pumatronix stands out with the VTR600, a solution that combines Internet of Things (IoT) and Artificial Intelligence to revolutionize law enforcement operations, redefining the fight against crime and providing security to citizens. Designed for application in public safety actions such as electronic fencing, police operations, and fiscal operations.

The VTR600 reads moving vehicle license plates, enabling immediate identification of vehicles with circulation restrictions, stolen, or associated with criminal activities, issuing instant alerts directed to tablets, cell phones, and in-vehicle multimedia systems. Advanced connectivity with Gigabit network interfaces, GPS, Wi-Fi and 4G ensures efficient communication in any operational context. Its integration with public safety systems ensures effective cooperation among entities, strengthening crimefighting operations, resulting in safer and higher-quality urban environments for citizens.

Being a state-of-the-art device, it is designed to offer total security and integrity to captured data. Equipped with a Digital Signature, this technology guarantees that the information received by the end user can be validated and in the event of an attempt to change or manipulate the data, it will be promptly identified, providing absolute confidence in the authenticity of the information.

Furthermore, the VTR600 has data encryption that can be used as an additional layer of protection, for accessing the device and sending data to servers, which ensure that only authorized recipients have access to the images. This security measure prevents unauthorized individuals from intercepting or viewing information, maintaining the privacy and confidentiality of data at all times.

The VTR600 offers a powerful image capture and processing engine and the flexibility to incorporate custom software, allowing adaptation to specific project needs. With a 2.3MP global shutter sensor, the VTR600 provides detailed vehicle classification, including type, make, model, and color. Its ability to capture images at speeds of up to 150km/h, day or night, synchronized with hardware flash, demonstrates its performance in challenging situations, providing accurate vehicle plate readings.

The VTR600's video capture technology includes a video encoder that supports H.264, H.265 and MJPEG formats. Additionally, the VTR600 features an open platform that allows video capture and processing directly on the device, eliminating the need for computers and routers. The VTR600 was designed for installation outside the vehicle and can be used in various climatic conditions. Its resistant metal structure provides excellent heat dissipation, while simultaneous processing of up to 3 tracks and vehicles parked parallel and diagonally, synchronization with hardware Flash and low power consumption guarantee superior performance in various applications. The ability to delimit specific areas of interest with the ROI (Region of Interest) function further expands the possibilities for motion detection by the algorithm.

With technical support throughout the country and the possibility of configuration and installation by a specialized technical team, the Pumatronix VTR600 is the definitive choice for your needs for reading license plates on the go. Consult your vendor to learn more about how this solution can streamline your operations and improve security in your environment.

Figure 1 – VTR600

Handling Risks

⚠️	**The VTR600 was designed to operate at 12Vdc and can be directly connected to the vehicle's battery or plugged into the cigarette lighter socket. Do not connect any of the inputs directly to the electrical grid (AC)!**
⚠️	**This equipment may come with lenses that are sensitive to mechanical impacts such as falls and extreme vibrations.**
⚠️	**Installation Location: In cases where it's not possible to meet installation specifications, it's recommended to consult Pumatronix's Technical Support.**

Models

Available Models	Resolution	Lens Type	Estimated range * (in meters)
VTR600 (S09L9IW1N1AJ)	1920x1200px	Fixed 6 mm	3 to 15m

* The estimated range is defined based on the selected lens and identifies the distance range within which vehicle plate characters remain legible in OCR reading.

Image sensors	Lens	Integrated Lighting	Antennas	Network Interfaces	Optionals
S09: CMOS 1920x1200px	**L9**: Fixed 6 mm	**I**: Infrared	**W1**: Wi-Fi/4G External antennas and integrated GPS	**N1**: Has 1 Network Interface	**A**: Digital Signature (TPM1.0)
					J: LPR Embedded

⚠️ **Digital Signature Functionality: The VTR600 has high security with Digital Signature and data encryption, guaranteeing the integrity and confidentiality of captured information. More information can be obtained through Technical Support.**

Summary

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1. Getting to Know the Product

The VTR600 line of image capture and processing devices was developed to read moving vehicle license plates and allows for the identification of vehicles with circulation restrictions, stolen, or suspected of involvement in criminal activities when integrated into security systems. The VTR600's 2.3 MP image sensor enables the capture and processing of images for up to three lanes forward (left, center and right), in addition to capturing and image processing of vehicles parked parallel and diagonally to the left and right. The sensor is combined with a set of fixed 6 mm lenses.

The quality and level of detail in the images captured by the VTR600 under ambient and artificial lighting are a result of additional functionalities alongside the optical assembly (image sensor with lenses) and an integrated illuminator of 16 LEDs. Multiple Exposures can be captured for each photo request made to the equipment. This functionality captures and processes more than one sequential image, with automatic variation of capture parameters.

All images captured by the VTR600 pass through the Quad-Core processor with neural network accelerator, which scans them for vehicles. Identification extends to distinguishing between motorcycles, cars, trucks and buses, in addition to reading characteristics such as brand, model and color. This function is called *Classifier*, which can be carried out with high precision, detecting vehicles even in situations where the license plate is absent or with little distinction between characters. Along with identifying the vehicle type in the *Classifier*, it is possible to define regions that operate the Virtual Loop in the image (Virtual trigger regions). In addition to characterizing the vehicle present in the image, automatic license plate recognition is available for the old Brazilian standard and Mercosur (OCR). Consult Pumatronix Commercial for OCR availability in other Mercosur countries.
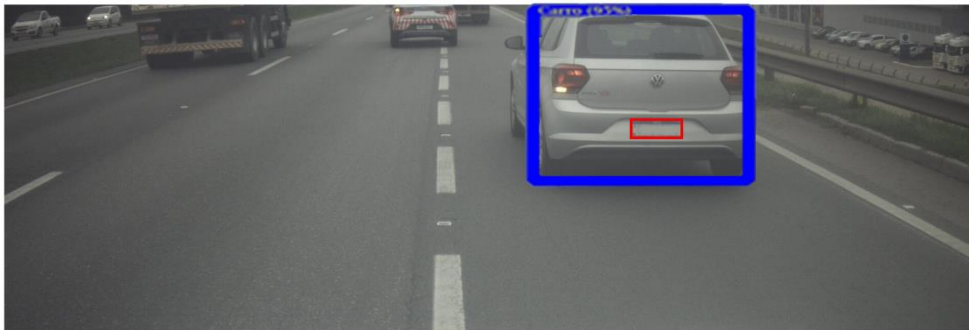

Figure 2 - Live image preview with Classifier function enabled

The VTR600 captures images of up to three lanes and vehicles parked parallel and diagonally in JPEG format and automatically provides the characters of Brazilian vehicle license plates (in the old standard and Mercosur). The license plates read in the images, the type of vehicle captured and information about the equipment configuration are stored within the image files, in the JPEG field intended for storing comments. The quality of the generated JPEG files is adjustable and the images can be overlaid with a caption with configurable content in each Profile. For each photo request, sequential captures can be sent with changes to the capture parameters (Multiple Exposures). The captured captures can be viewed through the interface on the Snapshot and Trigger screens, which present the user with the image's metadata, such as data on the type of vehicle (whether Car, Motorcycle, Bus or Truck), the make, model and color of the vehicle. vehicle identified by the Classifier and the license plates identified in OCR Recognition.

The redirection of images captured by the VTR600 can be done via a wired data network (using the Gigabit Ethernet port), via a Wi-Fi network or using 4G mobile data networks. Using the communication interfaces,

the VTR600 images can be sent automatically via the equipment's Web Interface or applications can connect using the REST API Client, the FTP protocol (File Transfer Protocol), the ITSCAMPRO server, the LINCE server and APIs that allow integration with systems from security agencies such as PM-PR, PRF (SPIA), PM-MG (Helios), Detecta-SP and Cortex.

Furthermore, monitoring of equipment operation and captures can be done in real time through the Web Interface or the ITSCAMPRO Móvel plugin, which presents data from captures made through the interface in Record Report format, detailed in Software Specifications . The video with the captured images is available in MJPEG, H.264 or H.265 format with adjustable quality, in addition to the live preview available in a floating window, which can be moved or minimized and which optionally displays only the images from the captures taken, with the possibility of adjusting zoom and focus for the current profile.

Information about the Current Status is available on the home screen, which displays equipment data, such as the Device ID (or Serial Number), installed versions, the performance status of the CPU, memory and storage and GPS.

2. Additional Documentation

Product	Link	Description
Docker	https://docs.docker.com	Documents with instructions for using Docker
Docker Engine API	https://docs.docker.com/engine/api/	API documentation for interacting with the Docker daemon
VTR600	Installation and Maintenance Guide	Guide containing the information necessary to install and maintain the VTR600
VTR600	Integration Manual	Programming and integration manual containing the necessary information for integrating the VTR600 with an application
ITSCAMPRO Mobile	Product Manual	ITSCAMPRO Mobile software manual

3. Generated Information

The VTR600 line captures images of up to three lanes in JPEG format and automatically provides the characters of Brazilian vehicle plates (both the old and Mercosur standards). Plates read in the images, captured vehicle types, and equipment configuration information are stored within the image files in the JPEG comment field. The quality of the generated JPEG files is adjustable, and the images can receive an overlay of a caption with configurable content in each Profile. For each photo request, sequential captures can be sent with changes to the capture parameters (*Multiple Exposures*). The captured captures can be viewed through the interface on the Snapshot and Trigger screens, which present the user with the image's metadata, such as data on the type of vehicle (whether Car, Motorcycle, Bus or Truck), the make, model and color of the vehicle. vehicle identified by the *Classifier* and the license plates identified in OCR Recognition.

Redirecting images captured by the VTR600 can be done via wired data network (using the Gigabit Ethernet port), Wi-Fi network, or utilizing 4G mobile data networks. Using the communication interfaces, VTR600

images can be sent automatically via the equipment's Web Interface or applications can connect using the REST API Client, the FTP protocol (File Transfer Protocol), the ITSCAMPRO server, the LINCE server and APIs that allow integration with systems of security agencies such as PM-PR, PRF (SPIA), PM-MG (Helios), Detecta-SP and Cortex.

Furthermore, monitoring the operation of the equipment and captures can be done in real time through the ITSCAMPRO Mobile application and the Web Interface. The video with the capture images is available in MJPEG, H.264 or H.265 format with quality adjustable, in addition to the live view available in a floating window, which can be moved or minimized and which optionally displays only the images from the captures taken, with the possibility of adjusting zoom and focus for the current profile.

Information about the Current State is provided on the home screen which displays equipment data, such as Device ID (or Serial Number), installed versions and the performance status of the CPU, memory and storage and GPS.

4. Mechanical Specifications

- Material: Aluminum and polycarbonate;
- IP Protection: IP67;
- Mounting: Fixed base on the vehicle's roof using magnets and a 60 cm Safety Cable, which should be attached to the vehicle's rack, providing greater stability in mounting.

Figure 3 – Fixing the VTR600: 1) base magnets, 2) safety wire rope
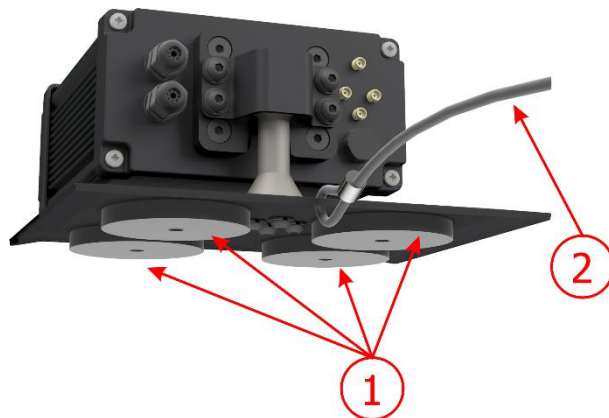
⚠️ **The Safety Wire Rope must remain attached to the vehicle's rack as an additional safety measure for securing the VTR600 to the roof and additionally ensuring greater stability for image capture framing. Periodically check if the cable is properly secured to the vehicle's rack.**

- Interfaces: The VTR600 presents the available connectors on the rear panel:
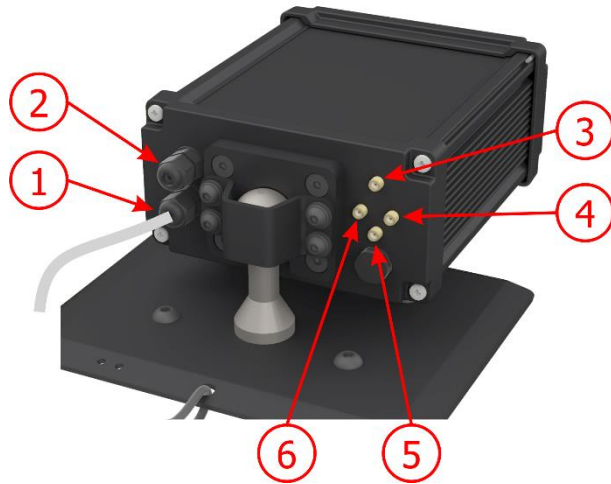
Figure 4 - Interfaces available on the VTR600

	Interface	**Specifications**
1	Sleeve Cable	power connector, IOS
2	Gigabit Ethernet	conector RJ-45 (indicated EIA/TIA-568A standard)
3	4G Antenna	
4	MOV Antenna	
5	GPS Antenna	male SMA connector
6	Wi-Fi Antenna	

- Temperature: -10 to 65 °C with relative humidity of 5 to 95% and without condensation;
- Weight:

Model	**Weight**
VTR600 (S09L9IN1W1AJ)	3500g*

- Dimensions:

Front View	**Side View**
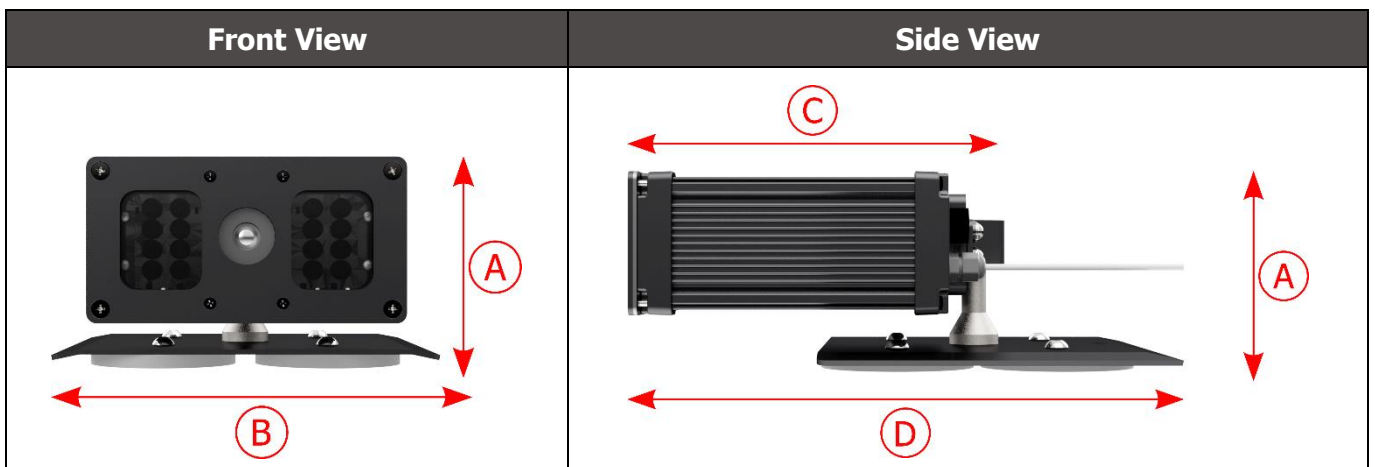
	A) Height	**B) Width**	**C) Device length**	**D) Overall length (device + base)**

Dimensions in millimeters	112*	156	216	300

*Using connected antennas, the total height with support can reach 144 mm.

5. Electrical Specifications

- Power Supply: Fonte 9~14,4 Vdc (Nominal 12V);
- Maximum input current: 2 A (with trigger) 0.7 A (without trigger)
- Typical power: 24 W (with trigger) and 8 W (without trigger);
- Maximum power: 30 W (with trigger) and 10 W (without trigger);
- Protection against reverse polarity: 45 V with a quick response of 2 µs to reverse polarity (ISO 7637-2);
- Protection against overvoltage (máx.): 28 V em 10/1000 µs (IEC 61000-4-5:2014);
- Protection against electrostatic discharge (DC power): ±30 kV per contact - Level B (IEC 61000-4-2/AEC Q100-002) and ±30 kV by air (IEC 61000-4-2/AEC Q100-002);
- Protection against fast electrical transients (EFT) (DC power): peak direct current at 10/1000 µs up to 53.3 A ±5% (ISO 7637 and IEC 61000-4-4);
- Protection against inrush current: 8 A in 2 seconds (IEC 63129:2020).

VTR600 Interfaces	Electrical Specifications
2 bidirectional ports (input or output)	Digital with 3.75 kV isolation, bidirectional, and individually programmable by users (maximum current 50 mA, maximum voltage 28 Vdc, and impedance of 10 kΩ)
1 Gigabit Ethernet port	Dielectric isolation of 5 kVAC, protection against electrostatic discharge of ±30 kV per contact - Level B (IEC 61000-4-2) and ±30 kV in the air (IEC 61000-4-2), EFT for peak direct current in 5/50 ns up to 40 A ±5% (IEC 61000-4-4), and protection against surge current of 4 A (tP = 8/20 µs) (IEC 61000-4-5)
WiFi	Protection against electrostatic discharge ±8 kV per contact (IEC 61000-4-2) and ±15 kV in the air (IEC 61000-4-2) for the high-gain external antenna (2.45 GHz ISM, U-NII, Wi-Fi, WLAN Whip, 2.4~2.5 GHz 2.8 dBi)
4G	Protection against electrostatic discharge ±8 kV per contact (IEC 61000-4-2) and ±15 kV in the air (IEC 61000-4-2) for straight external high-gain antennas (850 MHz, 900 MHz, 1.8 GHz, 1.9 GHz, 2.1 GHz CDMA, DCS, EDGE, GPRS, GSM, HSPA, PCS, UMTS, WCDMA, 824~960 MHz, 1.71~2.17 GHz 1.42 dBi, 1.91 dBi, 2.51 dBi, 3.23 dBi, 2.89 dBi) (Certifications: GCF, FCC, ANATEL, NCC, RCM, CE)
GPS	Qualcomm® IZat ™ Gen8C Lite Multi-constellation Glonass, BeiDou/Compass, Galileo, and QZSS, with an external active antenna of 1.57~1.58 GHz 2 dBic

Interface	Connectivity Specifications
1 Gigabit Ethernet port	10/100/1000 tri-speed
WiFi	IEEE 802.11 standard b/g/n 2.4 GHz bands, with UDP transfer rate of 46 Mbps and TCP/IP of 28 Mbps
4G	LTE-FDD/LTE-TDD in bands:

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	LTE FDD: B1/B2/B3/B4/B5/B7/B8/B28 LTE-TDD: B40
IoT M2M	Supported with a rate of 150 Mbps downlink and 50 Mbps uplink
e-Sim	Communication with mobile networks with e-Sim

Component	Image Processing Specifications
CPU	Quad-core ARM™ A53 (1.2 GHz, support ARMv8 andNEON)
RAM memory	16 Gb LPDDR4 (2100 Mbps e 1050 MHz)
Image sensors	Global Shutter 2.3 MP (1920x1200 px), with Day/Night mode (generates color images during the day and monochrome at night) Physical size of the sensor: 1/2.6" External | Internal frame rate: 30fps Minimum shutter of 48 µs and maximum of 30000 µs (or 30 milliseconds)
Internal storage	Available up to 4GB (with the total being 16 GB)
SD Card Storage	32 GB or 128 GB
Watchdog	in hardware with a period of 50 seconds

Electrical connections

Figure 5 – VTR600 power and signal connector (6-way sleeve cable)

Pin	Color	Description
1	Brown	VIN-
2	Red	VIN+
3	Green	IO3+
4	Yellow	IO3-
5	Grey	IO4+
6	Blue	IO4-

The power supply for the VTR600 is through the sleeve cable connection with a power source in the vehicle infrastructure. It is possible to use the vehicle's battery, or a plug connected to the cigarette lighter, and in each case, the installation is customized according to the car model:
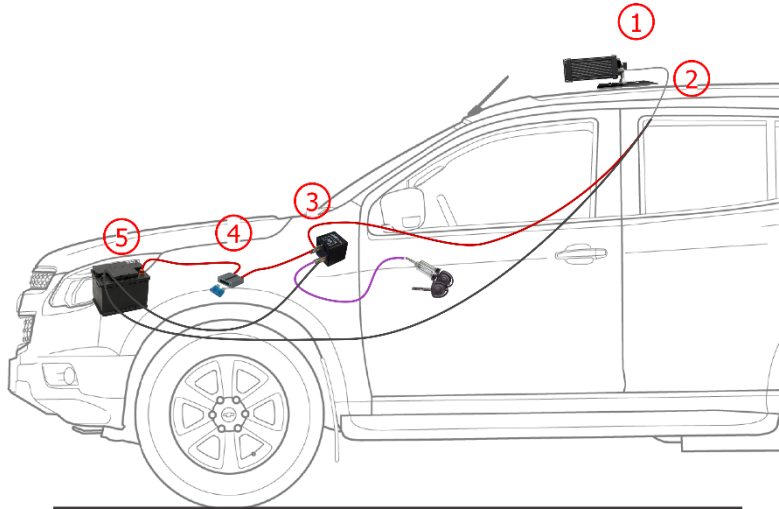

Figure 6 - Installation model using the vehicle battery for power: 1) VTR600 fixed to the vehicle roof, 2) 6-way sleeve cable 12Vdc, 3) Auxiliary relay connected to the vehicle's ignition key, 4) Fuse, 5) Vehicle battery
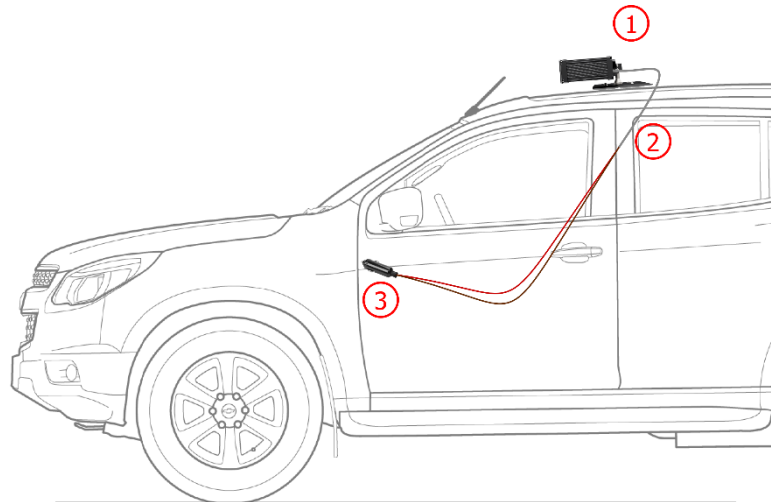

Figure 7 - Installation model using the vehicle's cigarette lighter for power: 1) VTR600 fixed to the vehicle roof, 2) 6-way sleeve cable 12Vdc, 3) Plug connected to the vehicle's cigarette lighter

Ethernet Connection

The VTR600 enables communication with other devices using the TCP/IP protocol. For such connection, the equipment provides a Gigabit Ethernet port (RJ-45 connector). It is recommended to use the EIA/TIA-568A standard for connections.
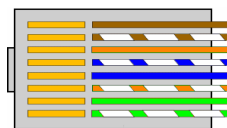

Figure 8 - RJ-45 Connector, EIA/TIA-568A Standard

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Antenna Connections

The images captured by the VTR600 may include geolocation, provided by the integrated GPS in the equipment. Wi-Fi and 4G signals can be amplified using an external antenna with an SMA connector (male connector, with a central pin).
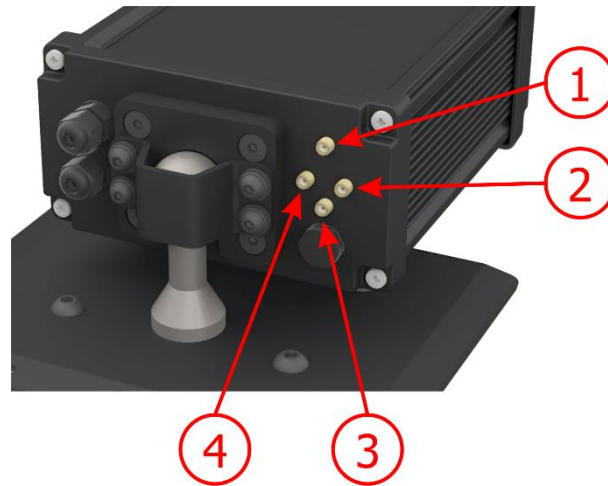

Figure 9 – Antenna Connection Points* on the VTR600

1	4G Antenna
2	MOV Antenna
3	GPS Antenna
4	Wi-Fi Antenna

* The antennas are provided for connection. In non-standard installation locations where the antenna is not effective for the application, contact Pumatronix support.

> ⚠ **4G Technologies Specification: Contact Pumatronix Technical Support for using the VTR600 in other countries.**

6.   Software Specifications

The data generated by the VTR600 is stored and made available through a plugin installed on the device. The plugin used by default for the VTR600 is ITSCAMPRO Móvel.

Access to the VTR600

The VTR600 device can be accessed via the Web interface to evaluate the generated images and make settings such as Network, OCR and Trigger, for example. Access to the interface requires the following information:

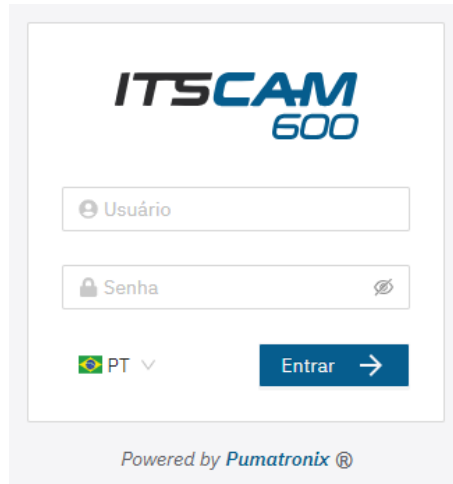|	
User	*admin*
Password	*1234*

Figure 10 - VTR600 access screen

Multiple Users

The VTR600 allows greater control of access and changes to the equipment, as when multiple users are created with remote and simultaneous access, the activity of each one can be tracked in the system logs. Users have an Administrator or Operator access profile, with the permissions characteristic of each profile, detailed in the VTR600 device Integration Manual.

Access to the ITSCAMPRO Mobile Plugin

The ITSCAMPRO Mobile plugin is installed on the VTR600 in the factory process and allows access to data extracted from image captures, in Record Report format. Access can be done via port 9080 by default, indicating the default plugin access address 192.168.0.254:9080 and providing the requested data:

User	*admin*
Password	*admin*
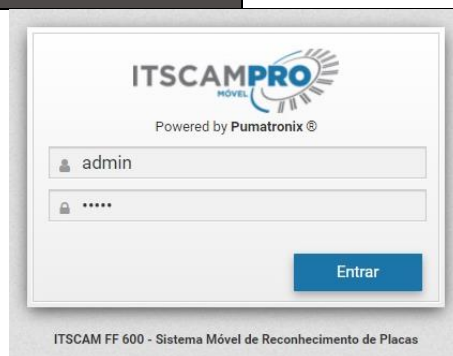
Figure 11 - ITSCAMPRO Mobile software access screen

Image Capture Architecture

To meet the requirements of Intelligent Transportation Systems (ITS), the VTR600 offers various functionalities associated with image acquisition. These functionalities constitute a general architecture and can be disabled by accessing the equipment's Configuration *Profiles*. The process of image acquisition starts with the image request method (*Trigger*). This request can be made by configuring the trigger to capture

a software-driven image. The activation can be at a *Constant* time interval or when the equipment identifies movement in the image (motion trigger), enabling the *Motion Detector* functionality.

After defining the VTR600 image capture flow, the *Multiple Exposures* functionality can be enabled on request. This technology allows you to configure two to eight sequential images, with variation in capture parameters for each request.

Identification of the license plate of vehicles present in the image can be done by enabling OCR processing, available for recognizing license plates from different countries. To increase reading accuracy, the *Majority Vote* functionality can be enabled.

The functionality that promotes more complete recognition of vehicles in images is the *Classifier*, responsible for identifying the type of vehicle detected in the image, in addition to the characteristics of the brand, model and color.

Motion Detector

The definition of movement between two consecutive VTR600 images depends on the configured variation parameter, which considers for the Motion Detector a time interval between shots (triggers) and a variation Threshold required to be activated. Additionally, it allows you to specify a Region of interest, which defines which portion of the image the movement will be evaluated in, which corresponds to a polygon with four vertices, drawn on the visualization image.

Classifier

The VTR600 can analyze captured images in real-time and assess the content within the images. The aim is to distinguish motorcycles, cars, trucks, and buses from images that display only the track. This analysis has a classification certainty level, considering image samples used for generating this analytic. It's essential to specify the correct type of installation, as the VTR600 can capture up to 3 lanes of the road simultaneously. From two tracks onwards, the *Panoramic* scenario must be chosen. The VTR600 can also be used to capture vehicles parked parallel and diagonally to the left and right.

The *Classifier's Enable object tracking* option allows you to define regions that operate the Virtual Loop (Virtual Trigger Regions), by configuring the direction in which vehicles travel in each lane of the road, with capacity for up to four loops.

When enabling *Vehicle Characteristics Reading*, the *Classifier* processes the reading of vehicle characteristics such as make, model and color, in addition to other enabled options, which can increase processing time.

Multiple Exposures

The *Multiple Exposures* feature of the VTR600 generates two to eight sequential images per capture request. This functionality can increase accuracy in automatically identifying license plates and identify vehicles that might have been partially obscured during the initial image capture. The configurable settings include:

- Flash intensity, always corresponding to a percentage of the initial flash;
- Image sensor exposure time (*Shutter*), creating images with varying amounts of captured light;
- Digital post-processing (*Gain*), allowing for lightening or darkening of images.

Therefore, the varied Gain, Shutter and Flash adjustments in each of the exposures allow, for example, that in the first capture the non-reflective plates are clearly visualized and in the second capture, adjusting the weak flash, allows the reflective plates to present better visualization, by preventing them from becoming saturated in the image.

OCR

The VTR600 can recognize vehicle plates from Brazil (in both Brazilian and Mercosul standards), Argentina, Chile, Mexico, Paraguay, Uruguay, and across the entire Southern Cone simultaneously. When enabled, recognition occurs across all captured images. Depending on the vehicle flow and processing demands on the VTR600, the number of *processing Threads* can be adjusted. It's important to define a *Processing Timeout* to discard images where plate reading wasn't feasible. The effort spent on plate identification can be set in the *Processing Mode*.

The OCR allows defining a Region of Interest (ROI) in the image to reduce processing in regions where plate identification isn't required. The ROI visualization image can assess the size of plate characters by configuring the enabled grid size, overlaid on the image display.

Majority Vote

The Majority Vote is a functionality applied to the results of the automatic reading stage of vehicle plate characters (OCR) and/or *Classifier*. This analytics determines which character sequence best describes the captured vehicle plate in the image. The algorithm compares the *Reliability* of identifying each character, based on the character image in perfect reading conditions. This analysis can be performed either on the set of Multiple Exposures images or using sequential images. You can configure parameters such as *Maximum different characters* and *Minimum interval between recognitions of identical plates*. During a vehicle's passage through the region monitored by the VTR600, multiple images of the same vehicle can be captured for processing. However, you can enable the option to *Send only the exposure with the best recognition*, discarding the other images.

Automatic Transition between Image Profiles

The VTR600 allows you to register up to four sets of equipment configurations, called *Profiles*. These settings correspond to image adjustments, framing (zoom and focus) and transition conditions between registered profiles. Switching between profiles is automatic when a time and/or Image *Level* value is reached, so that ideal image quality is obtained in any lighting situation. It is recommended to use one profile for shots with ambient light (daytime) and another for shots with artificial lighting (nighttime). Consult the Integration Manual and Product Manual for technical information on these technologies.

Information security

The Digital Signature and Data Encryption are the security mechanisms for the information generated by the VTR600 device. Digital Signature technology ensures that the information received by the end user can be validated and in the event of an attempt to change or manipulate the data, it will be promptly identified. Data encryption ensures that only authorized recipients have access to images, preventing unauthorized individuals from intercepting or viewing the information.

Digital signature

To sign the images, there is a software asymmetric encryption mechanism in which it is possible to generate a key automatically, or provide a signature key in PEM or P12 format.

When the VTR600 converts the captured image to JPEG format, the "hash" of that image is calculated using the SHA-256 algorithm. This "hash" is then signed by the RSA algorithm with a 1024, 2048 or 4096 bit key. In the final image, which will be transmitted over the network, the following fields are attached to the image:

- Sign: RSA signature of the hash;
- ExponentRSA: exponent used in the signature calculation;
- ModuloRSA: module used to check the signature;
- Sha256: SHA-256 hash of the image.

To ensure high security, the exponent used is always 65537.

This data is attached, in text format, to the comments field of the JPEG image, defined in the "FF FE" marker in accordance with the ISO/IEC 10918 specification. To check the signature, the following procedure must be carried out:

1) Remove texts referring to Sign, ExponentRSA, ModuloRSA and hash (Sha256) from the comments field;
2) Calculate the hash of the image with the text specified in "a" removed;
3) Extract the hash from the signature (Sign field) considering the exponent (ExponentRSA) and the module (ModuloRSA);
4) Compare the hash obtained in "b" with the hash obtained in "c". If the comparison obtained the same hash for both cases, the image is authentic. Otherwise, the image has been tampered with.

Cryptography

Encryption is the security mechanism that can be configured to access the device and send data to servers through secure protocols, such as https, FTPS and SFTP, responsible for data security when TLS/SSL encryption is applied. This technology ensures that only authorized recipients have access to images, maintaining the confidentiality of data generated by the VTR600 device.

Records Report

When accessing the ITSCAMPRO Mobile software interface, in the Report > Records Report menu, it is possible to retrieve the data from the stored records, using the filter options. The results are presented in report format, based on the application of filter criteria in the search, detailed in the ITSCAMPRO Móvel software manual.
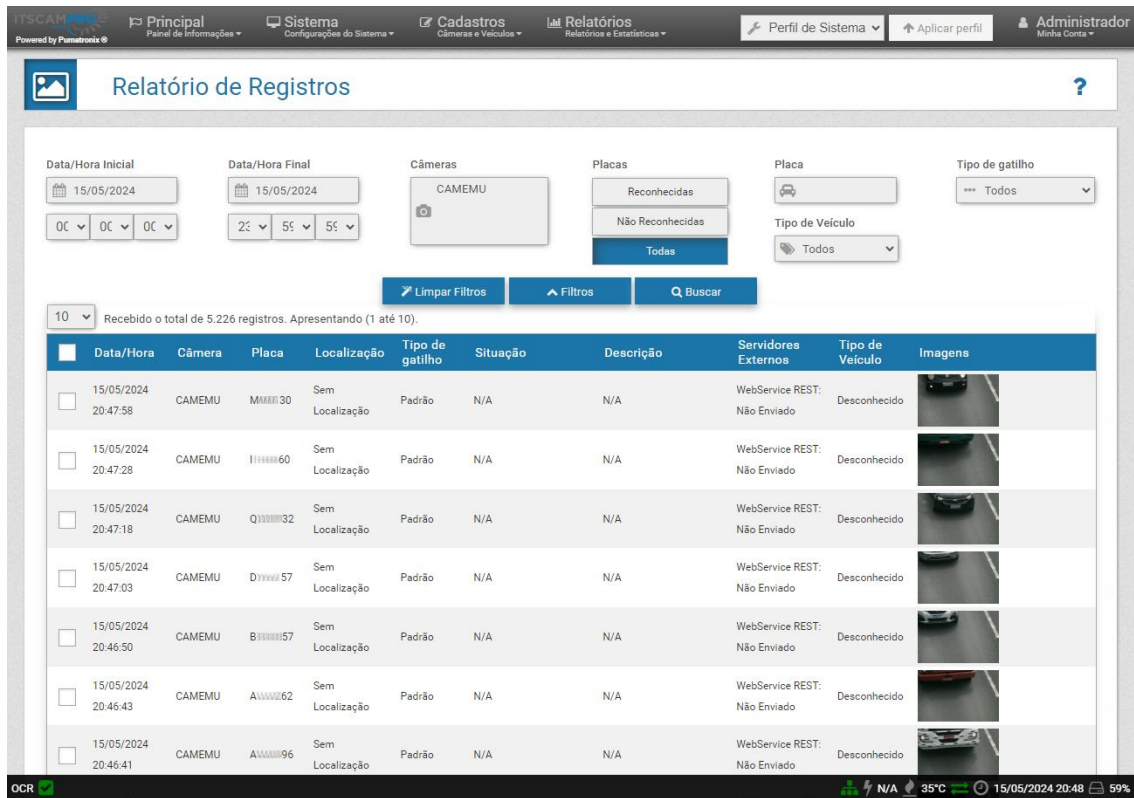
Figure 12 - ITSCAMPRO Mobile Records Report Screen

The Actions available for records are *Export selected records (in CSV format)*, *Export selected records (with images)* in ZIP format or *Remove selected records*.

Detailed Registry Information

When accessing images from the Record Report, the record details are displayed in tabs and contain the data obtained from the capture:

- Sequence of captured images, which can be enlarged or viewed in full screen or copied (by clicking on the download button next to them);
- Registration number generated in ITSCAMPRO Móvel;
- Vehicle license plate read automatically. If the user has permission to change the plate, an edit button is displayed next to it;
- Temporal information about image acquisition (date and time of capture);
- Spatial information (equipment identification and geographic location, when the map is enabled);
- Option to delete the record, if the user has permission;
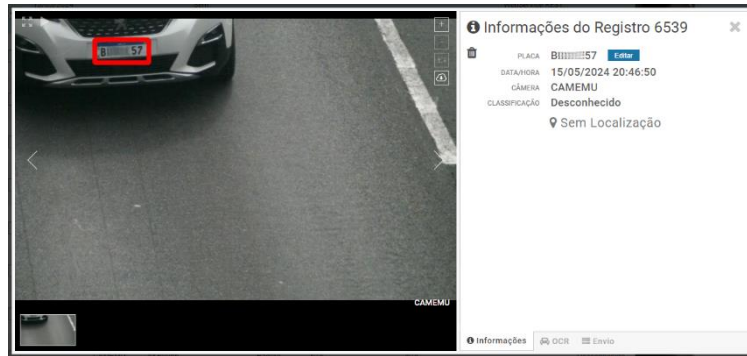- Vehicle details (category).

Figure 13 - Registration Information Screen home tab

Information about the OCR processed for registration can be obtained in the OCR tab and refers to:

- the time spent on the recognition process;
- the background color shown on the plate;
- the type of license plate, which can be motorcycle or not;
- the country of origin of the plate;
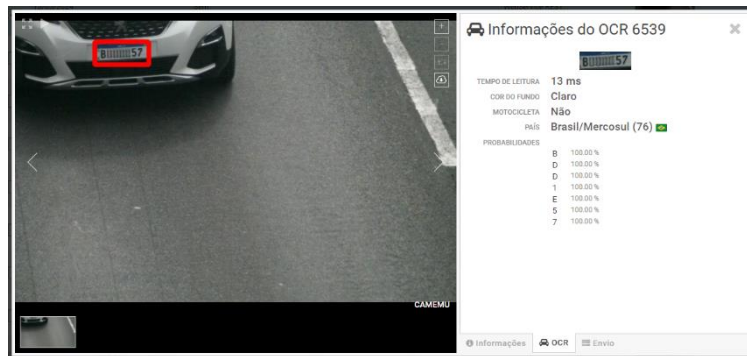- the OCR hit probability for each character identified.

Figure 14 - Registration Information Screen OCR tab

In the Send tab it is possible to check the status of sending records to each of the servers enabled in the system:
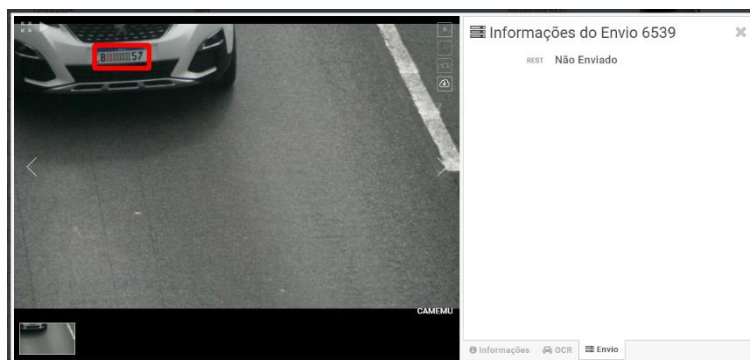

Figure 15 - Registration Information Screen Shipping tab

Available Integrations

The VTR600 can send captured images to vehicle storage and monitoring centers in the ways described:

Server	VTR600 Integration
FTP	The FTP server makes it possible to receive images captured by the VTR600
ITSCAMPRO	The ITSCAMPRO type server is used to send images and plates read by the embedded OCR. ITSCAMPRO is an application that concentrates images and signs. Various types of reports can be viewed and generated (consult Pumatronix for more information about the application)
Lince	The Lince server is Pumatronix's cloud SaaS platform, ideal for concentrating large numbers of devices and implementing electronic imaging fencing
WebService REST	Integration of ITSCAMPRO Móvel with systems that use Web Service REST architecture.
PM-PR*	Integration of ITSCAMPRO Móvel with the Paraná Military Police system
PM-MG*	Integration of ITSCAMPRO Móvel with the Military Police system of Minas Gerais PM-MG
Detecta-SP*	Integration of ITSCAMPRO Móvel with the Detecta-SP system
SPIA PRF*	Integration of ITSCAMPRO Móvel with the PRF (Federal Highway Police) system

* Integration with the PM-PR, PM-MG, Detecta-SP and SPIA-PRF systems is for specific use in Brazil and depends on license release on the VTR600.

Plugin installation

The processing capacity and infrastructure of the VTR600 enable the execution of applications embedded in the device's virtualized environment. Docker is the virtualization technology used, allowing the execution of third-party applications in an isolated environment using containers.

⚠️ **The plugin added to the interface will be available using an SD Card formatted with ext4 connected to the VTR600, intended for storing data generated by the plugin**

Access to the plugin uses a specific port for each type. Installing plugins requires the respective license and the *.tar* file installed in the system through the interface:
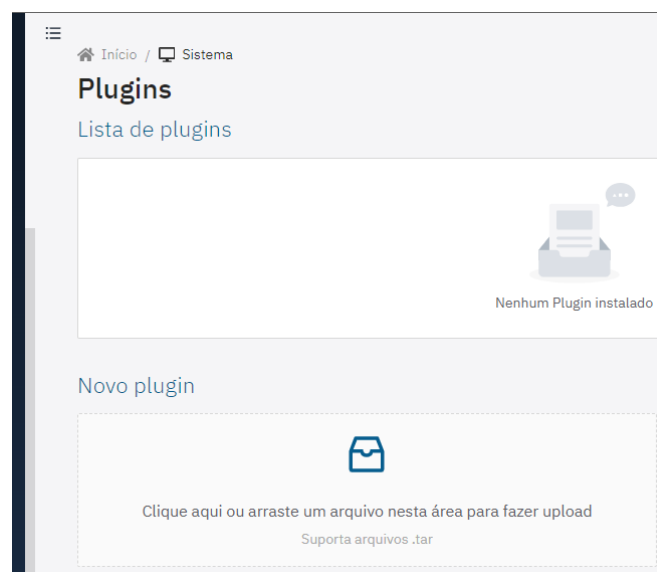

Figure 16 – VTR600 Web Interface in plugin installation

7. Licensing

The VTR600 license covers the hardware of the image capture and processing device, with automatic recognition of vehicle plates in images (OCR) in both the old Brazilian standard and Mercosul, along with the functionalities presented in this manual. New functionalities and bug fixes are provided in new firmware versions, made available by Pumatronix Technical Support.

8. Initial Setup

Installation Prerequisites

Conditions at the monitoring site, prior to installation, are essential for the equipment's operation.

Equipment Installation Location

The VTR600 series can be installed on the roof of any vehicle, with the ability to adjust the frame to capture up to three lanes and vehicles parked parallel and diagonally to the right and to the left. When installing, the necessary frame for the image should be considered, taking the vehicle's hood as the lower limit and the sky as the upper limit, as indicated in the image:
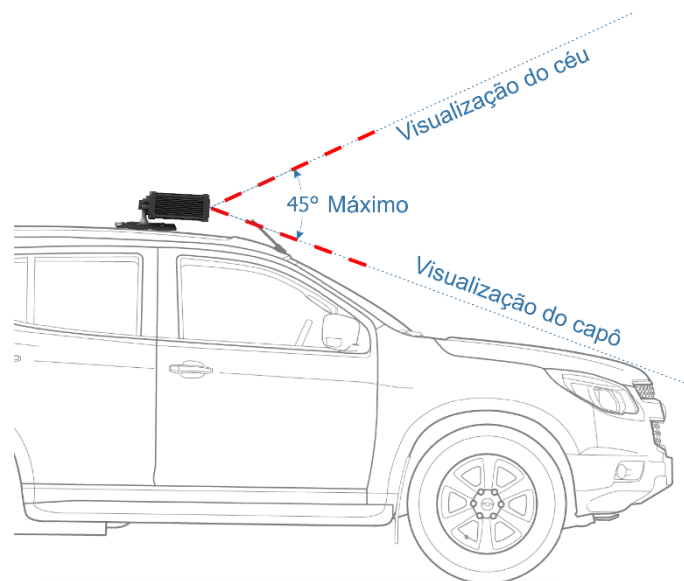

Figure 17 – Illustration of the Ideal Angle and Enframe Limits

During installation, the maximum vertical tilt angle of 45 degrees must be respected. Applying a larger angle results in significant image distortions, leading to a reduction in the automatic recognition rate of captured vehicle license plates.

Required Infrastructure

- Vehicle power source (battery or cigarette lighter);
- Data network connectivity near the equipment (based on the chosen mode);
- Security cable attached to the vehicle rack;

- Availability of an *Auxiliary Configuration Equipment* (for framing conference and image adjustments), with the Google Chrome browser (version 85 or higher) installed.

Required Installation Conditions

Refer to the Installation and Maintenance Guide on how to make the necessary connections.

> ⚠️ **Installation Location: In cases where meeting installation specifications is not feasible, it is recommended to consult Pumatronix's Technical Support.**

Parameterization of the Network Interface

Ethernet Port Configuration	Default value
IP Address	192.168.0.254
Maintenance IP address	192.168.254.254
Netmask	255.255.255.0

> ⚠️ **Check in the Wi-Fi Network Configuration how to set up the Wi-Fi and 4G network interfaces as they are disabled in the equipment's factory default settings.**

In situations where the VTR600 network configuration differs from the default, it is recommended to change the settings prior to the physical installation of the equipment on-site. The altered network configuration is saved in the flash memory but is effectively applied after the equipment is restarted. When the change is made through the Web interface, the reboot is automatic after confirming the alteration.

The VTR600 has a recovery IP address (192.168.254.254) for cases where the user mistakenly changes the IP address and loses connection with the device. The use of this IP address for access recovery is available only in a point-to-point connection with the equipment when connected to the Ethernet port.

> ⚠️ **The maintenance IP address of the VTR600 (192.168.254.254) is disabled when the primary IP address conflicts with it. Therefore, when manually configuring the equipment's network interface (Ethernet), different values from the maintenance IP should be applied as there won't be a way to recover the connection in extraordinary situations of primary IP loss.**

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

- Primary IP of VTR600 in the range 192.168.254.x and netmask 255.255.255.0
- Primary IP of VTR600 in the range 192.168.x.x and netmask 255.255.0.0
- Primary IP of VTR600 in the range 192.x.x.x and netmask 255.0.0.0
- Net mask defined as 0.0.0.0

Wi-Fi Network Configuration

⚠️ **VTR600 Connectivity: The Wi-Fi and 4G network interfaces are disabled in the equipment's factory default settings.**

1) Access the device's web interface with the credentials registered in the network interface parameterization;
2) Go to Equipment > Network in the Wi-Fi tab;
3) Select the Station (STA) operation mode to connect to an existing Wi-Fi network;
4) Click on the SSID field, and the available nearby Wi-Fi networks for connection will be listed for selection;
5) Choose the Authentication Protocol to be used: Open (no authentication), WEP, or WPA/WPA2 PSK;
6) Enter the password for access to the selected Wi-Fi network;
7) Click on the Apply button at the top of the page to validate the entered data.

Select the Access Point (AP) operation mode only when you want the device to be used as an access point to an available Wi-Fi network:

1) Enter the identification data (SSID), Country, Channel, and Authentication Protocol to be applied in distributing the Wi-Fi connection;
2) Enter the IP Address and Subnet Mask of the DHCP Server determining the address range for devices connecting to the Access Point.

⚠️ **Use a DHCP server IP address different from the one applied for accessing the VTR600 device and different from the maintenance IP to avoid conflicts and network malfunctions.**

4G Mobile Network Configuration

Some mobile internet providers require manual network data configuration:

1) Access the device's web interface with the credentials registered in the network interface parameterization;
2) Go to Equipment > Network in the Mobile tab;
3) Click Enable, and the configuration fields will be visible;
4) Enter personalized data whenever necessary to configure the carrier's information. By default, the information is:
   a. APN: http://[operator name].com.br;
   b. User: [operator name];
   c. Password: [operator name];
5) Click Apply to save the network settings.

9. First Access to the VTR600 Device

The VTR600 Web interface can be used to quickly check the equipment status and the area being captured in images. However, the equipment must be powered on, following the Electrical Specifications. An *Auxiliary*

Configuration Equipment (for framing verification and image adjustments) with the Google Chrome browser (version 85 or higher) installed should be used.

Additionally, the *Auxiliary Configuration Equipment* must be on the same data network as the VTR600 (with a network configuration compatible with the one set on the VTR600). If a point-to-point connection is used, access to the VTR600 can be made via the maintenance IP address 192.168.254.254. When entering the VTR600's IP address in the address bar of the *Auxiliary Configuration Equipment's* browser, the following should be provided:

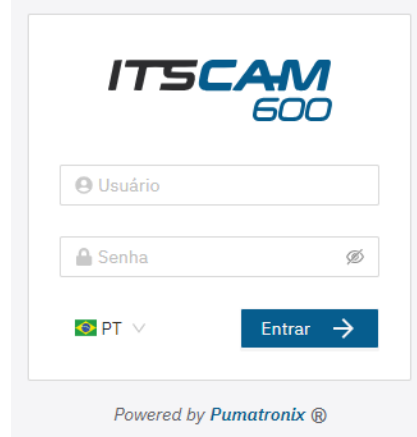| User	admin
Password	1234

Figure 18 - VTR600 access screen

10. First Access to the ITSCAMPRO Mobile Plugin

The ITSCAMPRO Mobile plugin web interface is used to extract the data captured by the VTR600. It must be accessed from an Auxiliary Configuration Equipment, connected to the same data network as the VTR600 device, via the external access address or by devices that have the Android/iOS application installed.

The default address for accessing the plugin is 192.168.0.254:9080. If a point-to-point connection is used, access to the VTR600 can be done via the maintenance IP address 192.168.254.254:9080, through ETH1.

To access the system, the Google Chrome browser (version 85 or higher) must be used, typing the IP address provided in the navigation bar and then the user credentials. However, on first access, it is recommended to create other users and restrict the use of the administrator account. To access for the first time, use the factory default data on the login screen:

User	admin
Password	admin

Figure 19 - ITSCAMPRO Mobile software access screen

11. Care and Maintenance

Some precautions are necessary to ensure the product's performance and extend its lifespan.

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

Firmware Update

Pumatronix periodically releases updates* for the VTR600, including defect corrections and new functionalities, available through contacting Technical Support on the Pumatronix website. The equipment update process requires an *Auxiliary Configuration Equipment* to connect to the device and can be directly performed through its web interface using one of the following web browsers:

- Microsoft Edge 109 or higher;
- Google Chrome version 38 or higher;
- Firefox version 21 or higher;
- Opera 25 or higher;
- Safari 8 or higher.

The VTR600 firmware update requires some security measures during the procedure to prevent file corruption and device malfunction:

1) Keep the VTR600 device inactive during the update process, ensuring it is not requested by any service or other equipment on the network where it's installed;
2) Ensure the VTR600 device remains powered on during the update, taking necessary steps to prevent it from restarting or shutting down;

Request the firmware file by filling out the form available on the Technical Support menu on the Pumatronix website:

Figure 20 – Online Firmware Request Form

If you have any questions, please contact Technical Support at suporte@pumatronix.com or WhatsApp +55 (41) 9203-8327.

* Pumatronix will provide versions with bug fixes or security improvements for up to 3 years after the product has been discontinued and removed from the portfolio.

VTR600 Firmware Update via Web Interface

1) Download the firmware file received by email (which starts with the name vtr600 and has the extension .swu) on the Configuration Auxiliary Equipment that will be used to connect to the VTR600;
2) Connect the Configuration Auxiliary Equipment to the same data network as the VTR600;
3) Open the Configuration Auxiliary Equipment browser;
4) Enter the IP address of the VTR600 (the default IP address is 192.168.0.254 and point-to-point connections can be made using the address 192.168.254.254);
5) Enter username and password;
6) Access the System menu > VTR600 Web Interface Update

7) Select or drag the firmware file (the update starts automatically and occurs in three stages, which are signaled by the progress bar);
8) Monitor the Upload reaching 100%, and then the Installation, making sure that the device is not restarted or turned off and that it is not being requested by any service or other equipment on the network during the process. This security is necessary when performing this procedure to prevent the update from corrupting the firmware and causing the equipment to stop working;
9) Check the SWUPDATE successful! message. which indicates the completion of the installation
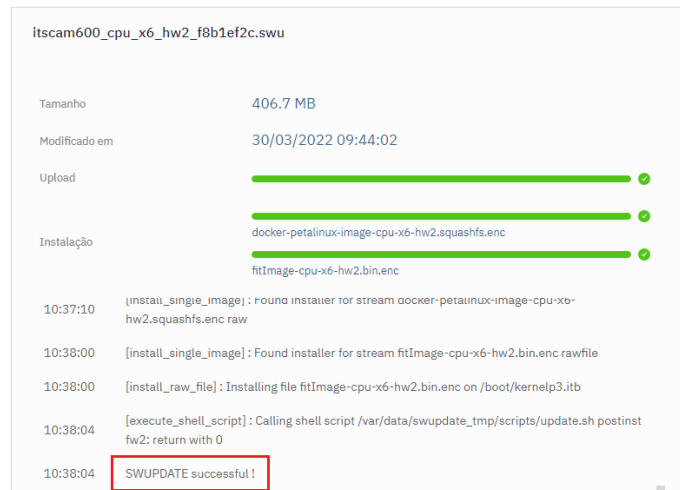
10) Click on the Restart VTR600 button;
11) Wait for the equipment to restart so that the new firmware changes are applied;
12) Finish the update procedure by checking the firmware version indicated in the top bar of the page.

ITSCAMPRO Mobile Plugin Update

The VTR600 has the ITSCAMPRO Mobile software plugin integrated into the SD card, which provides the user with a friendly and simple to operate interface. Updating to the most current version allows you to take advantage of updates and new features. The plugin update process takes place following the steps:

1) Download the firmware file received by email (which starts with the name itscampromovel and has the .tar extension) onto the Configuration Auxiliary Equipment that will be used to connect to the VTR600;
2) Connect the Configuration Auxiliary Equipment to the same data network as the VTR600;
3) Open the Configuration Auxiliary Equipment browser;
4) Enter the IP address of the VTR600 (the default IP address is 192.168.0.254 and point-to-point connections can be made using the address 192.168.254.254);
5) Access the System > Plugins menu of the VTR600 web interface;
6) Select the Stop function for the current plugin at the bottom of the page;
7) Click on Remove current plugin;
8) Start the installation process of the new version of the plugin by inserting the respective file in the area;

9) Open Sistema_Plugins3.jpg

- 80(privada) → 9080(publica);
- 2000 → 2000;
- 2005 → 2005;
- 10000 → 10000;

Revision 1.3.0

10) Click Install;
11) Wait the necessary time for the entire shipping and installation process to be completed. Depending on the network situation, it may take up to 15 minutes for the entire process to be completed;
12) Force the plugin to start by clicking the Start button;
13) Check after this first initialization that the plugin is automatically initialized when accessing the VTR600 device system.

Updating Analytical Licenses

The licenses for the image analytics libraries, *Classifier*, and OCR can be updated directly through the web interface. Upon receiving the .lic file provided by Technical Support, access the *System menu > Licenses* in the interface and drag it to the indicated area:
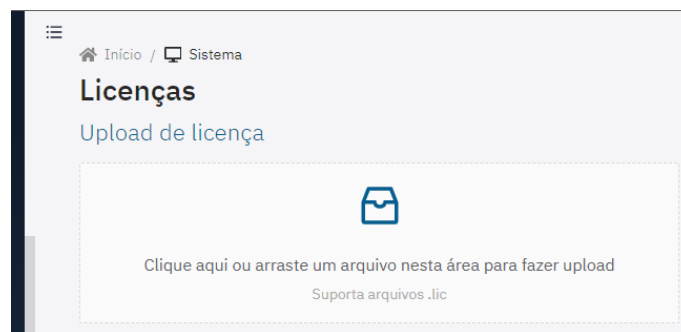

Figure 21 – VTR600 Web Interface for License Update

Preventive Maintenance of the VTR600 Device

The VTR600 image capture and processing device should deliver artifact-free images. However, if the external surface of the lenses or protective casing accumulates dirt, perform the cleaning procedure:

1) Spray lens cleaning liquid onto the lens surface or water onto the protective casing glass to remove adhered dirt excess;
2) Use a soft, non-abrasive cloth to remove the dirt, moving the cloth in a single direction;
3) Finish by wiping with a dry cloth and avoid using excessive force to prevent surface damage.

12. General Warranty Conditions

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

Replacement of defective parts and the execution of services arising from this Warranty will only be carried out at Pumatronix's Authorized Technical Assistance or by a third party expressly indicated by them, where the product should 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 an Invoice.

Situations in which the Product loses its warranty

1) Use of software/hardware not compatible with the specifications in the Manual;
2) Connection of the product to the mains outside the standards established in the product manual and installations that present excessive voltage variation;
3) Infiltration of liquids from the opening/closing of the product;
4) Damage caused by natural agents (electric discharge, flood, sea spray, excessive exposure to climatic 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 moisture and/or dust;
6) Show signs of tampering with security seals;
7) Present opening and modification signals made by the Customer in product locations not authorized by Pumatronix;
8) Damage caused by accidents/falls/vandalism;
9) Display tampered and/or removed serial number;
10) Damage arising from the transport and packaging of the product by the Customer under conditions incompatible with it;
11) Misuse and in disagreement with the Instruction Manual.

13. Privacy Policy

In accordance with the General Data Protection Law (LGPD) - Law No. 13.709, of August 14, 2018, this product has programmable functions for the capture and processing of images that may infringe the LGPD when used, together with other equipment, to capture personal data.

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

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 the sole decision of the user or purchaser of the product.

PUMATRONIX

www.pumatronix.com