



ITSCAM 600

HIGH PROCESSING, CONNECTIVITY AND EMBEDDED SOFTWARE

| Product

Pumatronix Equipamentos Eletrônicos Ltda.

Rua Bartolomeu Lourenço de Gusmão, 1970. Curitiba, Brazil

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Change History

Date	Revision	Content updated
10/21/2020	0.6.0	Initial Version
07/08/2022	1.0	Updating the format; Firmware content update
11/23/2022	1.1	Operating temperature update
01/23/2024	1.2	Maximum reading speed update

Overview

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

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

Examples of these technologies are Intelligent Transport Systems (ITS), in which Pumatronix products are used, such as ITSCAM 600 line. Devices in this line capture images of vehicles with speeds of up to 180km/h during the day and night, using a global shutter image sensor.



Figure 1 - ITSCAM 600 Line with CS Mount Lenses



Figure 2 - ITSCAM 600 Line with motorized lenses

Handling Risks



The ITSCAM 600 CS AD IOT (S06L0W1AJP) and ITSCAM 600 LM AD IOT (S06L5W1AJP) models contain the EC25-AUFA-512-STD plate and ATWILC3000-MR110UA Anatel homologation code 06239-18-07968/0142417-03464.



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



Risk of Oxidation: The electrical and data connections must be protected in a junction box or similar structure to avoid oxidation of the connections and unwanted liquids infiltration in the cable.



This equipment may have lenses included, which are sensitive to mechanical impacts such as drops and extreme vibrations.



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

Models

Available models	Resolution	Lens Type	Estimated reach (in meters)*
ITSCAM 600 CS (S06L0AJP)	1636x1220px HDR	Manual CS Mount	9 to 32m (10-50mm) **
ITSCAM 600 CS AD IOT (S06L0W1AJP)			
ITSCAM 600 LM (S06L5AJP)		Motorized integrated	10 to 37m
ITSCAM 600 LM AD IOT (S06L5W1AJP)			

*Estimated range is defined according to the lens selected and identifies at what distance the license plate characters remain readable in the OCR reading. When the device is used in conjunction with the illuminator, the range may be limited to the applied model. For models with a motorized lens, the lens cannot be modified. For CS Mount type lenses, the lens models shown are for reference only for the respective range.

**For this estimated range it is recommended to use the Idax Vision 10-50mm lens (PN: ID1050AHR)



Illuminator Installation: When using an illuminator in conjunction with the ITSCAM 400 device, check the product specifications for the minimum and maximum distance that must be observed in relation to the position of the object to be illuminated.

Image sensors	Lens	Antennas	Optional
S06: CCD HDR 1636X1220px	L0: CS Mount type manual lens	W1: Wi-Fi, 4G/3G External antennas and built-in GPS	A: Digital Signature (TPM1.0)
	L5: 13-55 mm		J: LPR Embedded
			P: POE Power



Digital Signature Functionality: The encryption of data that travels in ITSCAM 600 is in the specification validation process. Further details can be provided by Pumatronix Technical Support.

Summary

1.	Knowing the Product	7
2.	Generated Information	8
3.	Additional Documentation	9
4.	Mechanical Specifications	10
5.	Electrical Specifications	13
	Electrical Connections	15
	Trigger on IO	15
	Ethernet Connection	16
	Antenna Connection	16
6.	Software Specifications	17
	Image Capture Architecture	17
	Motion Detector	18
	Classifier	18
	Multiple Exposures	18
	OCR	18
	Automatic Transition Between Image Profiles	19
	Plugin Installation	19
7.	Licensing	20
8.	Initial setting	20
	Installation Prerequisites	20
	Equipment Installation Location	20
	Required Infrastructure	21
	Required Installation Conditions	21
	Network Interface Parameterization	22
	Wi-fi Network Setup	22
	3G or 4G Mobile Network Setup	23
	Installation Infrastructure	23
9.	First access	24
10.	Care and Maintenance	24
	Firmware Update	25

ITSCAM 600 Firmware Update via Web Interface.....	25
(Restricted Procedure) Recovery of ITSCAM 600 by Factory Reset.....	26
Updating Analytics Licenses	27
Preventive Maintenance of ITSCAM Device	27
11. Warranty General Conditions.....	27
Situations in which the Product Loses the Warranty	28
Privacy Policy.....	28

1. Knowing the Product

The ITSCAM 600 line of image capture and processing devices was developed for traffic management, enforcement, Smart City Applications, mobility systems, parking lots and applications that require image capture. The ITSCAM 600's 2MP image sensor allows for up to two range image capture and processing. The sensor is combined with a set of lenses, which can be motorized or fixed (CS Mount standard). In models that support fixed lenses, there are circuits that detect and control the iris of the DC and P-Iris models.

The quality and level of detail of the images captured with ambient and artificial lighting of the ITSCAM 600 comes from additional functionalities to the optical set (image sensor with lenses). There is a proprietary HDR (High Dynamic Range) algorithm to bring out the details of very dark and very light regions of images. *Multiple Exposures* can be captured for each photo request made to the device. This functionality captures and processes more than one sequential image, with automatic variation of capture parameters.

The ITSCAM 600 maintains the standardization of images, even when there are significant variations in lighting conditions. This is made possible by toggling the image setup *Profiles*. Profile changes are made by the equipment, based on image level and time.

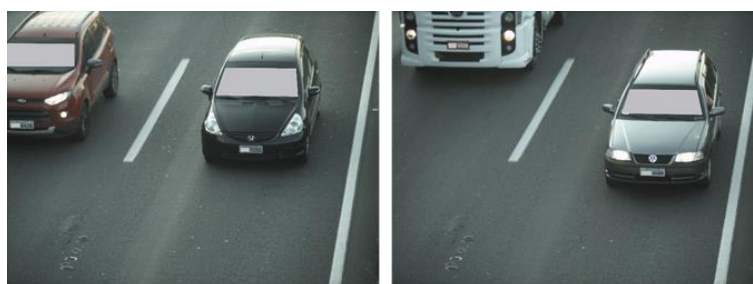


Figure 3 - Examples of daytime images captured with ITSCAM 600



Figure 4 - Example of night images captured with ITSCAM 600

The ITSCAM 600 hardware has 4 input or output ports (IOs) for the installation of external sensors, which identify the moment of capturing the images (*trigger*). Additionally, these IOs can control artificial lighting (flash), which is usually triggered automatically in low-light situations. However, the ITSCAM 600 can capture images without the need for external sensors, enabling software triggering (Virtual Trigger).

All images captured by the ITSCAM 600 pass through the Zynq® UltraScale+ EV processor, which scans them for vehicles. The identification extends to the distinction between *motorcycle, car, truck and bus*. This function is called *Classifier*, which can be performed with high precision by detecting vehicles even in situations where the license plate is absent or with little distinction of characters. In addition to the characterization of the vehicle present in the image, automatic *recognition* of vehicle license plates is available, for the old Brazilian standard and Mercosur (OCR).



Figure 5 - Live image preview with Classifier enabled

The ITSCAM 600 delivers photos in JPEG format with a resolution of 1636 x 1220 pixels. Within these files, the comments field is filled with data referring to each capture, containing the coordinates of the image location, the recognized license plates, the type of vehicle identified and the instantaneous settings of the equipment.

The ITSCAM 600 line provides 2 Gigabit Ethernet ports to facilitate connectivity at monitoring points and allow remote and simultaneous access by multiple users. Access can be via the device's Web Interface or applications can be connected using the REST API and the FTP (File Transfer Protocol) protocol or the ITSCAMPRO server. The management of access to the equipment is done by specifying the firewall rules of the network or even specifying the Routes.

The ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT feature additional connectivity features. 4G and 3G cellular mobile technologies are available for connection to the equipment, as well as Wi-Fi and IoT M2M communication. The images captured by these ITSCAM models can be automatically georeferenced, as long as an external antenna for receiving the GPS signal is connected.

2. Generated Information

The ITSCAM 600 line captures images of up to two tracks in JPEG format and automatically makes available the characters of Brazilian license plates (in the old and Mercosur standard). 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 subtitle with configurable content in each *Profile*. For each photo request, sequential captures can be sent with changes in capture parameters (*Multiple Exposures*). The data of the type of vehicle identified by the *Classifier* and the plates identified in the *OCR Recognition* are additionally delivered through the interface using the *Snapshot* function, which displays the captured image and all the metadata of the image.

The redirection of images captured by the ITSCAM 600 can be done via a wired data network (using the 2 independent Gigabit Ethernet ports), a Wi-Fi network or using 4G and 3G mobile data networks. Using the

communication interfaces, ITSCAM 600 images can be automatically uploaded to FTP and ITSCAMPRO servers.

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

Information about the *Current Status* is available on the home screen, which presents the equipment data, such as Device ID (or Serial Number), GPS, versions installed and the 4 Inputs and Outputs ports.

3. 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
ITSCAM 600	Installation and Maintenance Guide	Guide containing the information necessary to install and maintain the ITSCAM 600
ITSCAM 600	Integration Manual	Programming and Integration Manual containing the information necessary for the integration of ITSCAM 600 with an application

4. Mechanical Specifications

- Material: Aluminum and polycarbonate;
- IP protection: IP40 (requires enclosure for outdoor use);
- Fixation:

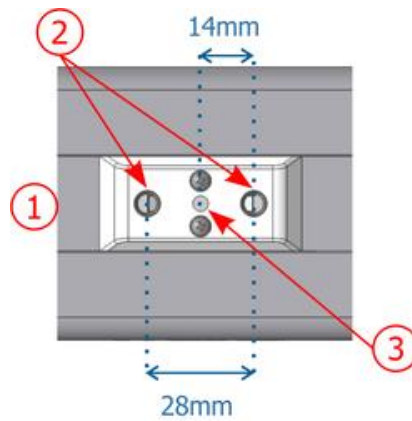


Figure 6 - ITSCAM 600 securing mechanism: 1) Rail for changing the fixing point; 2) Thread for screws 1/4"; 3) Ø4 mm hole for guide pin

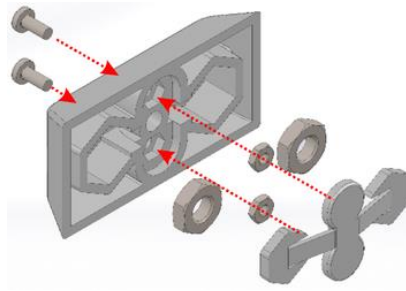


Figure 7 - Mounting of fastener components installed on ITSCAM 600

- Interfaces:

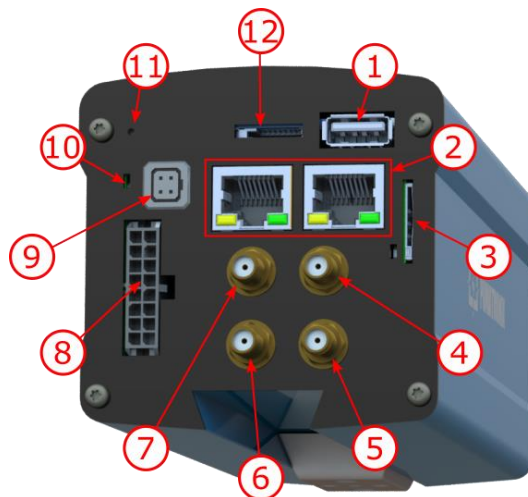


Figure 8 - ITSCAM 600 CS AD IOT (S06L0W1AJP) Interfaces

The ITSCAM 600 features the connectors available on the rear panel:

Interface		Specifications
1	USB	2.0 (host)
2	2 Gigabit Ethernet	RJ-45 connector (EIA/TIA-568A standard)
3	SIM CARD	connector for nano SIM (12,3 x 8,8 x 0,67 mm)
4	MOV antenna	SMA macho connector
5	GPS antenna	
6	WIFI antenna	
7	3G/4G antenna	
8	Microfit	power connector, IOs, RS-232, RS-485
9	Auto Iris	connector for lenses with DC e P-Iris type
10	POWER	status LED
11	SD BOOT	reset button
12	SD CARD	for microSD 2.0 card

- Temperature:
 - DC: -10 a 65 °C with 5 to 95% relative humidity and non-condensing (tests performed in accordance with IEC 60068-2-2);
 - PoE: -10 a 55 °C.

- Weight:

Model	Weight
ITSCAM 600 CS (S06L0AJP)	535 g + lens weight*
ITSCAM 600 CS AD IOT (S06L0W1AJP)	575 g + lens weight*
ITSCAM 600 LM (S06L5AJP)	835 g
ITSCAM 600 LM AD IOT (S06L5W1AJP)	875 g

*The lens model compatible with ITSCAM 600 CS and provided by Pumatronix (8-40mm focal length) weighs approximately 340g.

- Dimensions:

The ITSCAM 600 CS and ITSCAM 600 CS AD IOT versions use CS Mount type lenses and have the same dimensions, the total length being dependent on the lens model chosen.

*Using connected antennas, the total length can reach 144 mm.



Figure 9 - ITSCAM 600 CS and ITSCAM 600 CS AD

The ITSCAM 600 LM and ITSCAM 600 LM AD IOT models feature integrated motorized lens with a focal length of 13-55 mm and a filter to control the incoming infrared light.

*Using connected antennas, the total length can reach 211 mm.

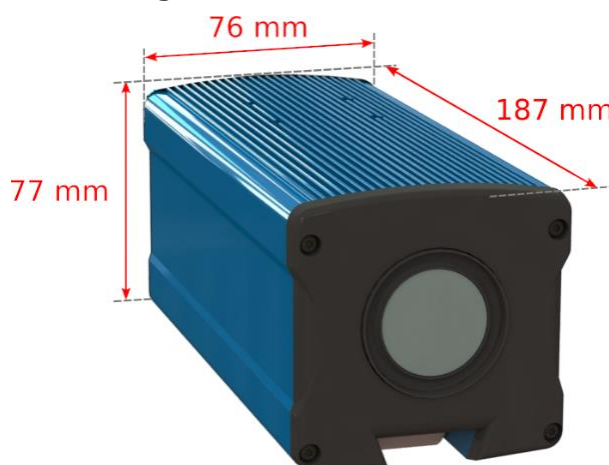


Figure 10 - ITSCAM 600 LM and ITSCAM 600 LM AD IOT

5. Electrical Specifications

- Power supply: Power over Ethernet - PoE 802.3af (Potência 12.95 W/48 V) or with source 9~32 Vdc (recommended 12 Vdc $\pm 20\%$ or 24 Vdc $\pm 20\%$);
- Typical power on ITSCAM 600 LM e ITSCAM 600 CS models: 7 W (models without interface for communication);
- Typical power on ITSCAM 600 LM AD IOT and ITSCAM 600 CS AD IOT models: 8.5 W (models with RF interface for communication);
- Maximum power: 12 W;
- Reverse polarity protection: 45 V de 2 μ s fast response to reverse polarity (ISO 7637-2);
- Overvoltage protection (máx.): 36.7 V at 10/1000 μ s (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 through air (IEC 61000-4-2/AEC Q100-002);
- Fast electrical transients (EFT) protection (DC power): direct peak current at 10/1000 μ s up to 53.3 A $\pm 5\%$ (ISO 7637 e IEC 61000-4-4);
- Inrush current protection: 8 A in 2 seconds (IEC 63129:2020).

ITSCAM 600 Interfaces	Electrical Specifications
2 Gigabit Ethernet ports	5 kVAC dielectric insulation, electrostatic discharge protection of ± 30 kV per contact - Level B (IEC 61000-4-2) and ± 30 kV through air (IEC 61000-4-2), EFT for direct peak current in 5/50 ns up to 40 A $\pm 5\%$ (IEC 61000-4-4) and 4 A surge current protection (tP = 8/20 μ s) (IEC 61000-4-5)
USB 2.0 port (host)	Protection against electrostatic discharge of ± 8 kV per contact (IEC 61000-4-2) and ± 15 kV through air (IEC 61000-4-2)
4 inputs/outputs (IOs on Microfit connector)	Digital with 3.75 kV bidirectional isolation programmed by users (maximum current 50 mA, maximum voltage 28 Vdc and impedance of 10 k Ω)
RS-485/422 Serial Port (Microfit connector)	2 Half Duplex ports with electrostatic discharge protection of ± 8 kV per contact (IEC 61000-4-2) and ± 15 kV through air (IEC 61000-4-2)
RS-232 EIA/TIA Serial Port (Microfit connector)	2 ports with a maximum baud rate of 115,200 kbps and electrostatic discharge protection of ± 8 kV per contact (IEC 61000-4-2) and ± 15 kV through air (IEC 61000-4-2)
External storage	Electrostatic discharge protection of ± 8 kV per contact (IEC 61000-4-2) and ± 15 kV through air (IEC 61000-4-2)
WiFi (on ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT models)	Electrostatic discharge protection of ± 8 kV per contact (IEC 61000-4-2) and ± 15 kV through air (IEC 61000-4-2) and the external high-gain antenna (2.45 GHz ISM, U-NII, Wi-Fi, WLAN Whip, 2.4~2.5 GHz 2.8 dBi)
4G and 3G (on ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT models)	Electrostatic discharge protection of ± 8 kV per contact (IEC 61000-4-2) and ± 15 kV through air (IEC 61000-4-2) and high-gain straight external 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) (Certificates: GCF, FCC, ANATEL, NCC, RCM, CE)
GPS (on ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT models)	Qualcomm® IZat™ Gen8C Lite Multi-constellation Glonass, BeiDou/Compass, Galileo and QZSS, with external active antenna of 1.57~1.58 GHz 2 dBi

Interface	Connectivity Specifications
2 Gigabit Ethernet ports	10/100/1000 tri-speed
External storage (SD card)	microSD 2.0 card support up to 128GB
Wi-Fi (on ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT models)	Standard IEEE 802.11 b/g/n 2.4 GHz bands, with UDP transfer rate of 46 Mbps and TCP/IP of 28 Mbps
4G e 3G (on ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT models)	LTE-FDD/LTE-TDD/WCDMA/GSM technologies in the bands: LTE FDD: B1/B2/B3/B4/B5/B7/B8/B28, LTE-TDD: B40, WCDMA: B1/B2/B5/B8, GSM/EDGE: Quad band
IoT M2M	Supported with 150 Mbps downlink and 50 Mbps uplink rate
SIM card	Communication with mobile networks with nano SIM card
Iris control (ITSCAM 600 CS e ITSCAM 600 CS AD IOT)	Supports lenses with DC and P-Iris type (with automatic model detection)

Component	Image Processing Specifications
CPU	Quad-core ARM™ A53 (1.2 GHz, ARMv8 and NEON support)
RAM memory	16 Gb LPDDR4 (2100 Mbps and 1050 MHz)
Image sensor	2 MP Global Shutter (1636x1220 px), with proprietary HDR technology and Day/Night mode (generates color or monochrome images)
Internal storage	Available up to 4GB (with a total of 16 GB)
Sd card storage	32 GB
Watchdog	in hardware with a period of 50 seconds



The ITSCAM 600 CS AD IOT (S06L0W1AJP) and ITSCAM 600 LM AD IOT (S06L5W1AJP) models contain the EC25-AUFA-512-STD plate and ATWILC3000-MR110UA Anatel homologation code 06239-18-07968/0142417-03464.



Risk of Oxidation: The electrical and data connections must be protected in a junction box or similar structure to avoid oxidation of the connections and unwanted liquids infiltration in the cable.

Electrical Connections

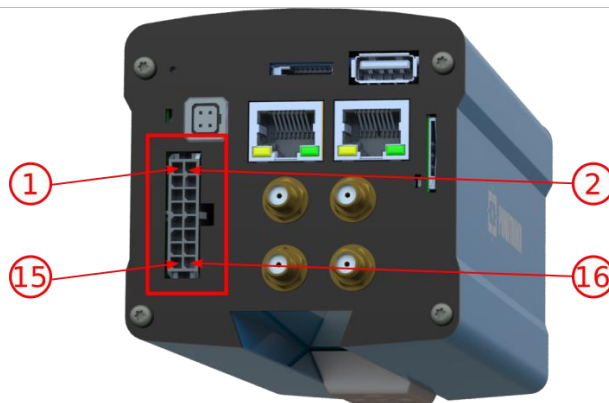


Figure 11 - ITSCAM 600 Microfit Power and Signal Connector

Pin	Color	Description
1	green with white	RX RS-232
2	purple with white	TX RS-232
3	black with white	GND RS-232
4	Purple	A RS-485
5	White	B RS-485
6	brown with white	GND RS-485
7	Grey	I/O 4 +
8	Black	I/O 4 -
9	red with white	I/O 3 +
10	blue with white	I/O 3 -
11	Green	I/O 2 +
12	Blue	I/O 2 -
13	Orange	I/O 1 +
14	Yellow	I/O 1 -
15	Brown	Negative (GND)
16	Red	Power supply 9~32 Vdc

Trigger on IO

The ITSCAM 600 has 4 connections that can be used as inputs or outputs, IO1 and IO2 are dedicated to controlling the activation of the illuminator and IO3 and IO4 are available for installing external sensors, such as loops and light barriers. The configuration process is done by software, using the equipment's web interface or the communication protocol. ITSCAM 600 ports configured as *Input* can be sensitized by: *Rising Edge, Falling Edge, High Level* and *Low Level*.



IOs specification: Maximum supported current of 50 mA and maximum supported voltage of 28 Vdc, however circuit activation with 10 mA is indicated.

Ethernet Connection

The ITSCAM 600 allows communication with other devices using the TCP/IP protocol. For this connection, the equipment provides two Gigabit Ethernet ports (RJ-45 connector). It is recommended to use the EIA/TIA-568A standard in the connections.

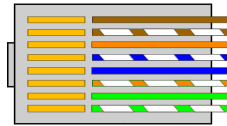


Figure 12 - EIA/TIA-568A Standard RJ-45 Connector



ETH2 Ethernet Network Interface: The second network interface of the ITSCAM 600 is disabled in the equipment's default configuration.

Antenna Connection

The images captured by the ITSCAM 600 can show the geolocation, made available by the GPS integrated into the equipment. However, an external antenna must be connected to the enclosure in which the ITSCAM 600 is to be installed. Wi-Fi, 4G and 3G signals can be amplified using an external antenna, with an SMA type connector (male connector, that is, with a central pin).

Connectors for antennas for Wi-Fi, 4G and 3G signals are only available on ITSCAM 600 models named ITSCAM 600 CS AD IOT (S06L0W1AJP) and ITSCAM 600 LM AD IOT (S06L5W1AJP) (for more information, see the [model list](#)). The screen printing on the equipment's rear panel helps to identify the connectors for the antennas:

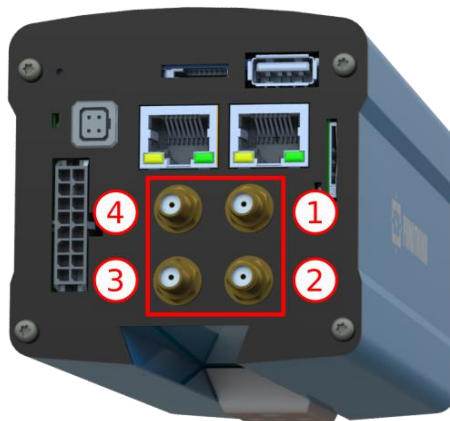


Figure 13 - SMA connectors for ITSCAM 600 CS AD IOT and ITSCAM 600 LM AD IOT antennas*

1	MOV antenna	3	WIFI antenna
2	GPS antenna	4	4G/3G antenna

*The indicated models have the antennas for connection. In non-standard installation locations where the antenna is not effective in the application, contact Pumatronix support.




4G and 3G Technology Specification: Consult Pumatronix Technical Support for use of the ITSCAM 600 in other countries.



6. Software Specifications

The ITSCAM 600 has a Web interface for evaluating the generated images and performing configurations. Access to the interface requires that be informed:

User	admin
Senha	1234

ITSCAM600

 admin

 1234 

Entrar →

Image Capture Architecture

To meet Intelligent Transport Systems (ITS) applications, the ITSCAM 600 has several features associated with image acquisition. These functionalities make up a general architecture and can be disabled by accessing the equipment *Profiles* settings. The image acquisition process begins with the image request form (*Trigger*). This request can be made through external sensors, connected to one or more ITSCAM 600 ports (IOs configured as Inputs). In the port's configuration, it can be informed that the capture trigger will be done by edge (up, down or both) or level (high and low).

There is an alternative to using external sensors connected to the inputs of the ITSCAM 600, which is to configure the Trigger for software activation. In this case, the activation can be at a constant time interval or when the equipment identifies movement in the image (Trigger by *Motion*). Choosing *Motion* Trigger enables the *Motion Detector* functionality. Another feature that improves the classification of vehicles present in the images is the *Classifier*, which analyzes the images and returns the type of vehicle.

Once the ITSCAM 600 image capture stream has been defined, the functionality *Multiple Exposures* on demand can be enabled. This technology allows configuring from two to eight sequential images, with variation in the capture parameters for each request.

The identification of the license plate of the vehicles present in the image can be done by enabling the OCR functionality, available for several countries. To increase the reading accuracy, the *Majority Vote* functionality can be enabled.

Motion Detector

The definition of motion between two consecutive images of ITSCAM 600 depends on the configured variation parameter. In addition to this sensitivity, can be specified the *ROI* (Image Region of Interest) in which the motion will be evaluated. This region corresponds to a polygon with four vertices, which is drawn over a preview image. The selected region is shaded over the preview. This image to draw the region is displayed after enabling the option to use *Region of Interest*.

Classifier

The ITSCAM 600 is able to analyze the captured images in real time and evaluate the content present in the images. This analysis aims to distinguish motorcycles, cars, trucks and buses from images that only show the track. This analysis has a degree of classification certainty, considering image samples that were used to generate this analytical. It is important to inform the correct type of installation, as the ITSCAM 600 can be used to capture two or one tracks simultaneously. In the case of two lanes, the *Panoramic Scenario* must be chosen. The *Enable object tracking* option of *Classifier* allows to define the *Virtual Trigger Regions* that operate by configuring the direction that vehicles travel in each lane of the track (up to four lanes).

Multiple Exposures

The ITSCAM 600's *Multiple Exposures* functionality generates two to eight sequential images per capture request. This functionality can increase the success rate in the automatic identification of license plates and identify vehicles that had some type of cover-up at the time of capturing the first image. The settings that may vary are:

- The *Flash* intensity, always corresponding to a percentage of the initial fire. This option is available for the Pumatronix ITSLUX line of illuminators;
- The exposure time of the image sensor (*Shutter*), generating images with variation in the amount of light captured;
- Digital post-processing (*Gain*), which allows you to lighten or darken images.

OCR

The ITSCAM 600 can recognize license plates from Brazil (Brazilian and Mercosur standard), Argentina, Chile, Mexico, Paraguay, Uruguay and the entire Southern Cone simultaneously. When enabled, recognition is performed on all captured images. Depending on the vehicles flow and the processing required by ITSCAM 600, the number of *Processing threads* can be changed. It is important to set a *Recognition Timeout*, to discard images that could not be read from the plate. The effort spent on plate identification can be set in *Processing Mode*.

OCR allows to define an *ROI* (Region of Interest) on the image in order to reduce the processing of image regions where no plate is to be found. In the ROI preview image, the character size of the plates can be evaluated, configuring the size of the enabled grid, superimposed on the image preview.

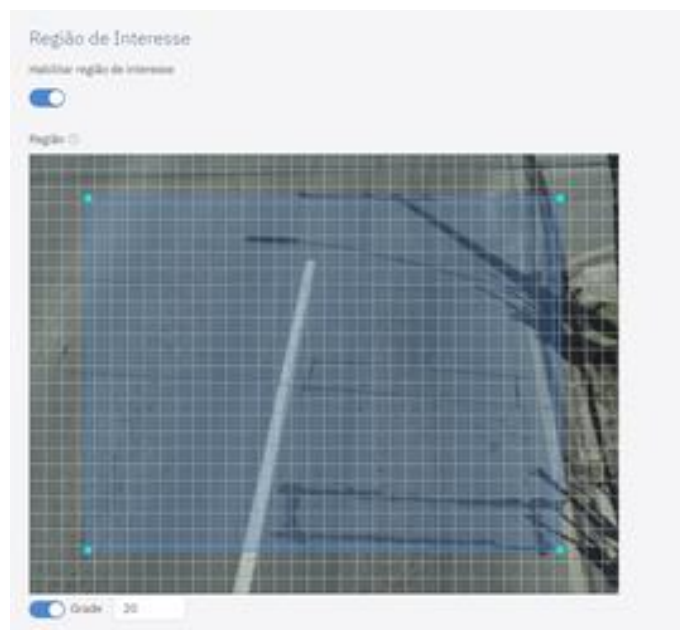


Figure 14 - ITSCAM 600 web interface for OCR Region of Interest (ROI) configuration

Majority Voting

The *Majority Voting* is a functionality applied to the results of the automatic character reading step of vehicle license plates (OCR) and/or *Classifier*. This analytics defines which sequence of characters best describes the license plate of the vehicle captured in the image. The algorithm compares the *Reliability* of identification of each character, based on the image of the character in perfect reading conditions. This analysis can be done only on the set of images from the *Multiple Exposures* or using sequential images. Just configure the parameters of *Maximum different characters* and *Same-plate recognition debounce*. During the passage of the vehicle through the region monitored by the ITSCAM 600, several images of the same vehicle can be captured for processing. However, the option to *Send only the exposure with the best recognition* can be enabled and the other images will be discarded.

Automatic Transition Between Image Profiles

The ITSCAM 600 allows registering 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. Changing between profiles is automatic when a time and/or *Image Level* value is reached, for optimal image quality 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). See the Integration Manual for suggested settings for a profile's *Transitions*.

Plugin Installation

The ITSCAM 600's processing power and infrastructure make it possible to run embedded applications in the device's virtualized environment. *Docker* is the virtualization technology used, which allows the execution of the third-party application in an isolated environment using a *container*.



The plugin added to the interface will be available using an SD Card formatted with ext4 connected to the ITSCAM 600, which has the purpose of storing the data generated by the plugin.

Plugin access uses a specific port for each type. Plugin installation requires the respective license and the .tar file installed on the system through the interface:

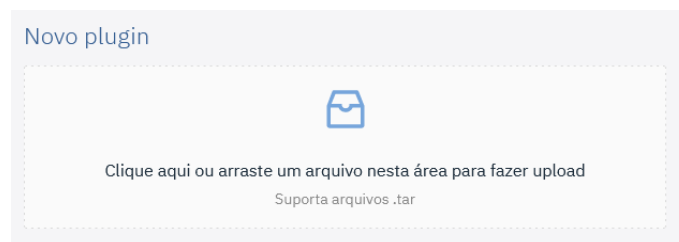


Figure 15 - ITSCAM 600 Web Interface for Plugin Installation

7. Licensing

The ITSCAM 600 license includes the hardware of the image capture and processing device, with automatic and on-board recognition of the vehicles license plate present in images (OCR) in the old Brazilian and Mercosur standard, in addition to the features presented in this manual. New features and bug fixes are available in new firmware versions, made available by Pumatronix Technical Support.

8. Initial setting

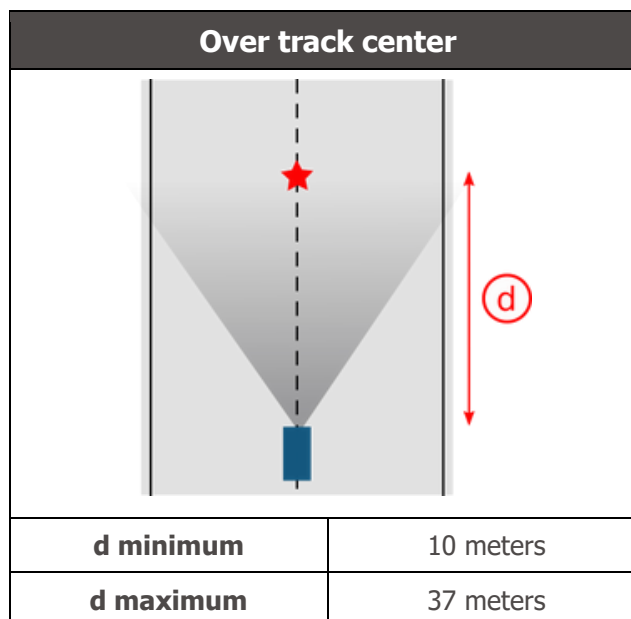
Installation Prerequisites

The conditions at the monitoring site, prior to installation, are essential for equipment operation.

Equipment Installation Location

The ITSCAM 600 line can be installed in urban and road environments, and it is possible to adjust the framing to capture one or two lanes of the track. When installing on the road, the minimum height limits specified for the site must be respected, as well as the maximum angle of vertical inclination of 45°. Larger angles of vertical inclination generate significant deformations in the images, which implies a reduction in the rate of automatic recognition of vehicles license plates captured in images.

For the installation of ITSCAM 600 models with motorized lens [ITSCAM 600 LM (S06L5AJP) and ITSCAM 600 LM AD IOT (S06L5W1AJP)] the linear distance between the equipment and the image center must be considered when positioning the equipment on the road. The installation diagram for capturing two-lane images indicates the ideal equipment position in relation to the monitored road:



ITSCAM 600 Installation Suggestion: The suggested information are based on the focal length of ITSCAM 600 motorized lenses and Pumatronix ITSLUX illuminators. Installations outside the recommended standard can be made, but the rates of automatic recognition of vehicle license plates may be affected. In case of doubt or installation situation different from the one presented, consult Pumatronix Technical Support

Attention to equipment positioning restrictions in vehicle circulation areas must be maintained if the ITSCAM 600 is installed on a side structure. When choosing this type of installation, the equipment must be located at the closest and safest distance from the road. The height of the equipment must take into account the maximum vertical angle of 45° and the possibility of concealment. This concealment of vehicles captured in the farthest lane is done by large vehicles traveling in the closest lane.

Required Infrastructure

- DC power point (if powering with DC Source and not PoE is defined) close to the equipment installation point;
- Data network connectivity close to the equipment installation point (based on the chosen mode);
- Sheltered location for cable splices, for example junction box, close to the equipment installation point;
- Drilling for fixing the protection box bracket;
- Appropriate screws for fixing the ITSCAM 600 protection box at the installation site;
- 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

In order to extract the best performance from the ITSCAM 600, the installation should be carried out with little horizontal inclination and avoiding the covering of parts of the image by objects such as trees or vehicles from other lanes.

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



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

Network Interface Parameterization

The ITSCAM 600 has two network interfaces: *ETH1* and *ETH2*. In the factory default configuration, the first network interface (ETH1) has the configuration shown and the second network interface (ETH2) is disabled:

ETH1 Port Configuration	Standard value
IP address	192.168.0.254
Maintenance IP address	192.168.254.254
Netmask	255.255.255.0



Connectivity of Models ITSCAM 600 CS AD IOT (S06L0W1AJP) and ITSCAM 600 LM AD IOT (S06L5W1AJP): Check in *Wi-Fi Network* setting how to configure the *Wi-Fi*, *4G* and *3G* network interfaces as they are disabled in the default settings of equipment factory.

In situations where the ITSCAM 600's network configuration is different from the standard one, it is recommended to change the configurations prior to the physical installation of equipment on site. The changed network configuration is saved in flash memory, however it is effectively applied after the device is restarted. When the change is made through the web interface, the restart is automatic, after the change is confirmed.

The ITSCAM 600 has a recovery IP address (192.168.254.254) in case the user mistakenly changes the IP address and loses connection to the device. The use of this IP address for access recovery is only available in a point-to-point connection with the equipment, when connected to the ETH1 port.



The ITSCAM 600's 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), different values of the maintenance IP must be applied, as there will be no way to recover the connection in extraordinary situations where the primary IP is lost

The most common primary and maintenance IP address conflict situations 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 netmask 255.0.0.0
- Netmask set to 0.0.0.0

Wi-fi Network Setup



ITSCAM FF 600 Connectivity: The *Wi-Fi*, *4G* and *3G* network interfaces are disabled by default in the equipment's factory settings

- 1) Access the device's web interface with data registered in the network interface parameterization;
- 2) Access the menu *Equipment > Network* on 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 nearby Wi-Fi networks available for connection are listed for selection;
- 5) Select the Authentication Protocol to be used: *Open* (no authentication), *WEP* or *WPA/WPA2 PSK*;
- 6) Enter the password to access the selected Wi-Fi network;
- 7) Click the *Apply* button at the top of the page when validating the entered data.

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

- 1) Enter the identification data (*SSID*), the *Country*, the *Channel* and the *Authentication* Protocol that will be applied in the distribution of the Wi-Fi connection;
- 2) Enter the *IP Address* and *Subnet Mask* of the *DHCP Server* determining the address range for the equipment that will connect to the *Access point*.



Use an IP address for the DHCP server that is different from the one applied for accessing the ITSCAM 600 device in order to avoid conflicts and malfunctions in the data network.

3G or 4G Mobile Network Setup

Some mobile internet operators require manual network data setup:

- 1) Access the device's web interface with the data registered in the network interface parameterization;
- 2) Access the menu *Equipment > Network* in the *Mobile* tab;
- 3) Click *Enable* and the configuration fields will be visible;
- 4) Enter data when customized or for *Claro* operator manually:
 - a. APN: <http://claro.com.br>;
 - b. Username: *claro*;
 - c. Password: *claro*;
- 5) Click *Apply* to save the network settings.

Installation Infrastructure

- 1) Fit the ITSCAM 600 into the protective case support, leaving the lens as close as possible to the case glass;
- 2) Respecting the distances of ITSCAM 600 positioning (as indicated in the [Equipment Location](#)), fix the protection box. When fixed on the ceiling (upside down) it is possible to configure the equipment to *Rotate the image by 180°* through the web interface;
- 3) Adjust the protection box positioning so that images are captured from the region where vehicles travel. If necessary, it is possible to crop the image, selecting only the image region of interest (ROI) in which the vehicles are effectively visible for image generation. In this option, the time to convert to JPEG is improved and does not affect *Streams* or *Live Feed*;
- 4) Connect the Microfit connector harness to the ITSCAM 600, if DC power or equipment IOs are used:

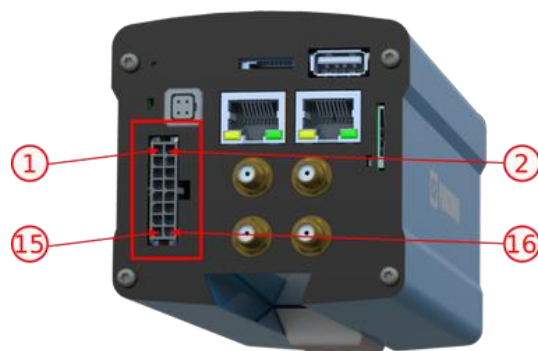


Figure 16 - ITSCAM 600 Microfit Power and Signal Connector

9. First access

The ITSCAM 600's web interface can be used to quickly check the equipment status and the location being captured in images. However, the equipment must be energized, following the [Electrical Specifications](#). An *Auxiliary Configuration Equipment* must be used (for framing conference and image adjustments) with the Google Chrome browser (version 85 or higher) installed.

In addition, the *Auxiliary Configuration Equipment* must be on the same data network on the ITSCAM 600 (with a network configuration compatible with that performed in ITSCAM 600). If a point-to-point connection is used, the ITSCAM 600 can be accessed via the maintenance IP address `192.168.254.254`. When typing the ITSCAM 600 IP address in the address bar of the *Auxiliary Configuration Equipment*'s browser, it must be informed:

Username	<code>admin</code>
Password	<code>1234</code>

ITSCAM600

 admin

 1234 

Entrar →

10. Care and Maintenance

Some care is necessary to ensure the performance of the product and prolong its useful life.



Product Risks: The use of the product presents risks, which are listed in the [Handling Risks](#) section.

Firmware Update

Pumatronix periodically provides updates for the ITSCAM 600 with defect corrections and functionality additions, by contacting Technical Support on the Pumatronix website. The equipment update process requires an *Auxiliary Configuration Equipment* to connect to the equipment and can be done directly through its web interface using one of the web browsers:

- Internet Explorer 11 or higher;
- Google Chrome versão 38 or higher;
- Firefox versão 21 or higher;
- Opera 25 or higher;
- Safari 8 or higher.

Updating the ITSCAM 600 firmware requires some security measures during the procedure, in order to prevent the file from being corrupted and the ITSCAM 600 device stop working:

- 1) Keep the ITSCAM 600 device inactive during the update process, ensuring that it is not required by any service or other equipment on the network where it is installed;
- 2) Keep the ITSCAM 600 device always on during the execution of the update, taking the necessary measures to prevent it from being restarted or turned off;

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



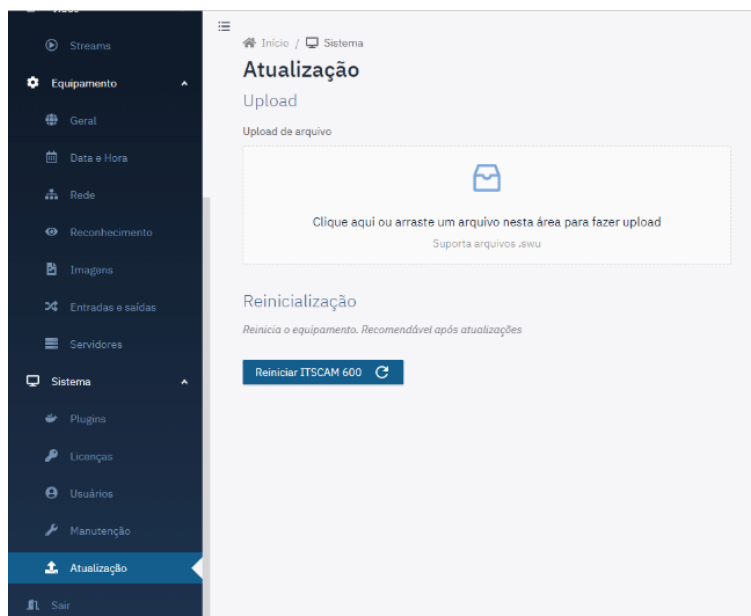
The screenshot shows a web form titled "Firmwares" with the instruction "Especifique abaixo os dados para download para receber o arquivo em seu e-mail." The form contains several input fields: "Seu nome", "Seu email", "Sua empresa", "Celular", "Escolha o modelo" (a dropdown menu), and "Série". At the bottom of the form is a blue button labeled "ENVIAR MENSAGEM".

Figure 17 - Firmware Request Form

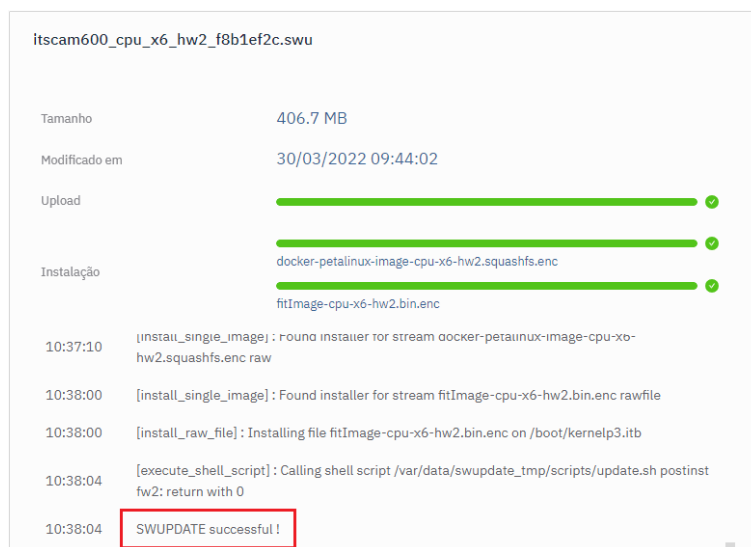
If you have any questions, please contact Technical Support at suporte@pumatronix.com.

ITSCAM 600 Firmware Update via Web Interface

- 1) Download the firmware file received by e-mail (which starts with the name *itscam600* and has the extension *.swu*) on the *Auxiliary Configuration Equipment* that will be used to connect to the ITSCAM 600;
- 2) Connect the *Auxiliary Configuration Equipment* to the same data network as the ITSCAM 600;
- 3) Open browser at *Auxiliary Configuration Equipment*;
- 4) Enter the ITSCAM 600 IP address (the default IP address is 192.168.0.254 and point-to-point connections can be made via the address 192.168.254.254);
- 5) Enter username and password;
- 6) Go to *System > Software Update* menu at ITSCAM 600 Web Interface



- 7) Select or drag the firmware file (the update starts automatically and takes place in three steps, which are signaled by the progress bar);
- 8) Follow the *Upload* to reach 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 the equipment stop working;
- 9) Check the *SWUPDATE successful!* which indicates completion of the installation



- 10) Click on the *Reboot ITSCAM 600* button;
- 11) Wait for the equipment to be restarted for the new firmware changes to be applied;
- 12) Finish the update procedure by checking the firmware version indicated on the top bar of the page.

(Restricted Procedure) Recovery of ITSCAM 600 by Factory Reset



Information Loss: All files, images and settings stored on ITSCAM 600 are lost when performing the Recovery procedure.

The ITSCAM 600 recovery procedure requires an SD card that has a minimum capacity of 4 GB and that can be formatted.

- 1) Download the ITSCAM 600 recovery file (file with *.tar* extension), (contact Pumatronix Technical Support to access the file);
- 2) Format the SD card using FAT32;
- 3) Unzip the recovery file to the formatted SD card;
- 4) Disconnect the ITSCAM 600 from the power supply;
- 5) Insert the SD card into the ITSCAM 600;
- 6) Keeping the *RESET* button pressed, power up the ITSCAM 600;
- 7) Release the *RESET* button when the status LED is green;
- 8) Check the status LED flashing red, which indicates the recovery process is in progress;
- 9) Check the status LED flashes green, which indicates that the recovery is complete;
- 10) Turn off the ITSCAM 600;
- 11) Remove the SD card from the slot and turn the device back on.

Updating Analytics Licenses

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



Figure 18 – ITSCAM 600 web interface for updating licenses

Preventive Maintenance of ITSCAM Device

The ITSCAM 600 image capture and processing device must provide artifact-free images. However, if the lenses external surface or protective case shows any dirt, the cleaning procedure must be performed:

- 1) Spray lens cleaning liquid on the lens surface or water on the protective case glass so that excess dirt adhered to the surface can be removed;
- 2) Use a soft, lint-free cloth to remove dirt, moving the cloth in one direction only.
- 3) Pass a dry cloth after to finish cleaning and do not use force, as it is possible to damage the surface;

11. Warranty General Conditions

Pumatronix guarantees 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 the performance of services resulting from this Warranty will only be carried out at the Authorized Technical Assistance of Pumatronix 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 an Invoice.

Situations in which the Product Loses the Warranty

- 1) Use of software/hardware not compatible with the Manual's specifications;
- 2) Connection of the product to the electrical network 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 (electrical discharge, flooding, sea air, 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 humidity and/or dust;
- 6) Show signs of tampering with security seals;
- 7) Showing signs of opening and modification 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 resulting from the transport and packaging of the product by the Customer in incompatible conditions;
- 11) Misuse and in disagreement with the Instruction Manual.

Privacy Policy

In compliance with the Brazilian General Data Protection Act (LGPD) - Law No. 13.709 of August 14, 2018, this product has programmable functions for capturing and processing images that may violate the LGPD when used in conjunction with other equipment to capture personal data.

Pumatronix is not responsible for the purposes, use and handling of images captured, whereas control over product information and forms of operation are solely the responsibility of the product user or buyer.





www.pumatronix.com

