PUMATRONIX

ITSCAM 600

HIGH PROCESSING POWER, CONNECTIVITY AND EMBEDDED SOFTWARE

Product

Pumatronix Equipamentos Eletrônicos Ltda.

Rua Bartolomeu Lourenço de Gusmão, 1970. Curitiba, Brazil

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

Send comments about this document by email suporte@pumatronix.com

Information contained in this document is subject to change without notice.

Pumatronix reserves the right to modify or improve this material without obligation to notify such changes or improvements.

Pumatronix grants permission to download and print this document, provided that the electronic or physical copy of this document contains the full text. Any changes to this content are strictly prohibited.

Change History

Date	Revision	Updated content
10/21/2020	0.6.0	Initial Version
04/11/2024	2.0	Inclusion of ITSCAM 600 FHD models corresponding to software version 1.7.1; Digital Signature and Encryption Update
10/30/2024	2.1	Inclusion of new models; Update of image sensors; Addition of the Classification option to all models; Addition of models with S12 sensor
11/27/2024	2.2	Digital Signature Description
01/22/2025	2.3	Inclusion of changes to the S12 sensor and L5 lens; Inclusion of Anatel approval
04/14/2025	2.4	Update of available model code; Indication of network interface code in Models; SAD-792
05/26/2025	2.5	Added code for ITSCAM 600 FHD LM AD IOT model (SAD-844)

General View

The ITSCAM 600 Family offers a powerful image processing engine and the flexibility to embed custom software, allowing adaptation to specific project needs. Additionally, it provides connectivity via cables, Wi-Fi or mobile data to ensure seamless communication in any scenario.

Our latest technology allows authorities, technicians and urban managers to interact in real time, transforming the management of city infrastructure. This results in safer and higher quality urban environments for citizens, while enabling agile and effective actions to promote the sustainable growth of smart cities.

The ITSCAM 600 is a low-power equipment, making it a viable option for solar power, demonstrating our commitment to sustainability. This versatility is reflected in applications ranging from traffic control and urban mobility systems to public and private security monitoring, customs areas, parking and access control, as well as highway concessionaires.

Figure 1 - ITSCAM 600 Series with CS Mount lenses

Figure 2 - ITSCAM 600 Series with motorized lenses

Figure 3 - ITSCAM 600 FHD Series with CS Mount lenses

Figure 4 - ITSCAM 600 FHD Series with motorized lenses

Being a state-of-the-art device, it is designed to offer total security and integrity to the captured data. Equipped with Digital Signature, this 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, providing absolute confidence in the authenticity of the information.

In addition to this security applied to the information generated, the ITSCAM 600 Family has Data Encryption, which can be used as an additional layer of protection when accessing the device and sending data to servers, which ensures that only authorized recipients have access to the images. This security

measure prevents unauthorized individuals from intercepting or viewing information, maintaining data privacy and confidentiality at all times.

The ITSCAM 600's video capture technology includes a video encoder that supports H.264, H.265 and MJPEG formats, plus a 2MP global shutter sensor with HDR sensor or 2.3MP global shutter sensor on FHD models, optimized to minimize the negative effects of poor lighting and ensure sharper nighttime images. The result is superior image quality, even in challenging weather conditions, providing accurate license plate reading.

Additionally, the ITSCAM 600 Family features an open platform that enables video capture and processing directly on the device, eliminating the need for computers and routers. Its sturdy metal frame provides excellent heat dissipation, while simultaneous processing of up to 3 tracks, hardware Flash synchronization and low power consumption ensure superior performance in a variety of applications. The ability to delimit specific areas of interest with the ROI (Region of Interest) function further expands the algorithm's motion detection possibilities.

With the flexibility of lens choices, Pumatronix offers a choice of CS external lens models as well as LM motorized lens models, all equipped with a Global Shutter CMOS sensor for blur-free images. In this way, the system is capable of capturing images of vehicles at speeds of up to 180 km/h in models with the 2MP sensor and up to 200 km/h in models with the 2.3MP sensor, providing accurate readings in high-speed scenarios.

With nationwide technical support and the possibility of configuration and installation by a specialized technical team, the Pumatronix ITSCAM 600 is the definitive choice for your high-speed license plate reading needs. Consult your salesperson to learn more about how this solution can streamline your operations and improve security in your environment.

Handling Risks

ANATEL	**Anatel Approval No. 06943-24-10157.** **Resolution 680 – ACT 14448:** **This equipment is not entitled to protection against harmful interference and must not cause interference in duly authorized systems. For more information, see the ANATEL website http://www.gov.br/anatel.**
	**This equipment must be powered by a direct current (DC) source with a voltage between 9 and 32 VdC. Do not connect any of the inputs directly to the power grid (AC)!**
	**Oxidation Risk: Electrical and data connections must be protected in a junction box or similar structure to prevent oxidation of the connections and unwanted infiltration of liquids into the cable.**
	**This equipment may be accompanied by lenses, which are sensitive to mechanical impacts such as falls and extreme vibrations.**
	**Installation Location: In cases where it is not possible to meet the installation specifications, it is recommended to consult Pumatronix Technical Support.**

Models

Available models	Resolution	Lens Type	Estimated range (in meters)*
ITSCAM 600 CS (S06L0AJP)	1636x1220px HDR	CS Mount Manual	9 to 32 m (10-50mm)
ITSCAM 600 CS AD IOT (S06L0W1AJP)			
ITSCAM 600 LM (S06L5AJP)		Integrated motorized	10 to 37m (15-55mm)
ITSCAM 600 LM AD IOT (S06L5W1AJP)			
ITSCAM 600 FHD CS AD IOT (S09L0W1N2AJP)	1920x1200px	CS Mount Manual	4 to 45 m (9-40mm) 9 to 32 m (10-50mm)
ITSCAM 600 FHD LM (S09L3N2AJP)		Integrated motorized	4 to 45m (4,7-47mm)
ITSCAM 600 FHD LM AD IOT (S09L3W1N1AJP, S09L3W1N2AJP)			
ITSCAM 600 LM (S12L5AJP)	2688x2005px Color HDR	Integrated motorized	10 to 37m (15-55mm)
ITSCAM 600 LM AD IOT (S12L5W1AJP)			

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

Illuminator Installation: When using an illuminator in conjunction with the ITSCAM 600 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	Network Interface	Optionals
S06: CCD 1636x1220px HDR **S09**: CMOS 1920x1200px **S12**: CCD 2688x2005px Color HDR	**L0**: CS Mount Manual Lens: • LC1: 10-50mm 8MP 1/1.7” • LC3: 9-40mm SL940a **L3**: 4,7-47mm **L5**: 15-55 mm	**W1**: Wi-Fi/4G/3G External antennas and integrated GPS	**N1:** 1 Network Interface **N2:** 2 Network Interfaces	**A**: Digital Signature **J**: Embedded LPR **P**: POE Power

Digital Signature Functionality: The ITSCAM 600 has high security with Digital Signature and Data Encryption, ensuring the integrity and confidentiality of the captured information. Further information can be obtained through Technical Support.

Summary

1. Getting to Know the Product

The ITSCAM 600 line of image capture and processing devices was developed for traffic management, inspection, Smart City Applications, mobility systems, parking and applications that require image capture. The ITSCAM 600's 2MP image sensor enables the capture and processing of images from up to two lanes of runway and the ITSCAM 600 FHD's 2.3MP image sensor enables the capture and processing of images from up to three lanes of runway. 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 irises of the DC and P-Iris models.

The quality and level of detail of images captured with ambient and artificial lighting comes from additional features to the optical assembly (image sensor with lenses) of the ITSCAM 600. In models with a 2MP image sensor, there is a proprietary HDR (High Dynamic Range) algorithm to highlight details in very dark and very light regions of images. Multiple Exposures can be captured for each photo request made to the equipment. This feature captures and processes more than one sequential image, with automatic variation of capture parameters.

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

Figure 5 - Examples of daytime images captured with the ITSCAM 600

Figure 6 – Example of night images captured with the ITSCAM 600

The ITSCAM 600 hardware has 4 input or output ports (IOs) for installing external sensors, which identify the moment of image capture (trigger). Additionally, these IOs can control artificial lighting (flash), which is usually activated automatically in low light situations. However, the ITSCAM 600 can capture images without the need for external sensors, enabling capture activation via software (Motion Detector).

All images captured by the ITSCAM 600 pass through the Quad-Core processor with neural network accelerator, which scans them in search of vehicles. Identification extends to the distinction between motorcycle, car, truck and bus. This function is called Classifier, which can be performed with high precision, detecting vehicles even in situations where the license plate is missing or where the characters are not clearly distinguishable. Along with identifying the vehicle type in the Classifier, it is possible to define regions

that operate the Virtual Lasso in the image (Virtual Trigger Regions). In addition to the characterization of the vehicle present in the image, automatic character recognition (OCR) of vehicles is available, for the old Brazilian standard and Mercosul (OCR). Consult Pumatronix Sales for availability of OCR recognition for other Mercosur countries.

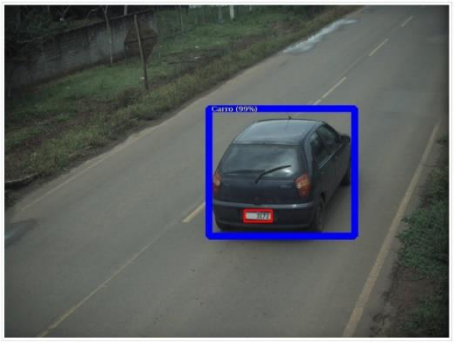


Figure 7 - CLASSIFIER identifies a car

Figure 8 - CLASSIFIER identifies a truck

Figure 9 - CLASSIFIER identifies a bus

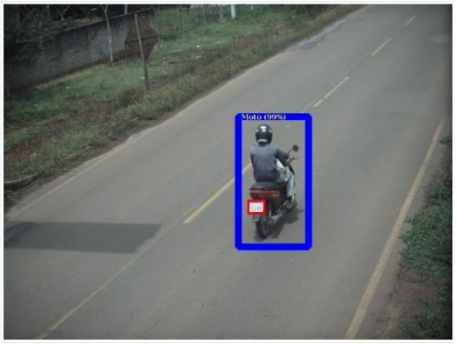


Figure 10 - CLASSIFIER identifies a motorcycle

The ITSCAM 600 delivers photos in JPEG format with a resolution of 1636 x 1220 pixels and the ITSCAM 600 FHD delivers photos in JPEG format with a resolution of 1920 x 1200 pixels. Within these files, the comments field is filled with data relating to each capture, containing the coordinates of the image location, the recognized plates, the type of vehicle identified and the instantaneous equipment settings.

The ITSCAM 600 line provides 2 Gigabit Ethernet ports (the ITSCAM 600 CS and ITSCAM 600 CS AD IOT models only have the ETH1 network interface) to facilitate connectivity at monitoring points and allow remote and simultaneous access by multiple users. Access can be via the equipment's Web Interface or applications can connect using the REST API, FTP (File Transfer Protocol), the ITSCAMPRO server or the Lince(R) platform. Access to the equipment is managed by specifying the network Firewall rules or by specifying Routes. The commands available via the REST API are detailed in the ITSCAM 600 Integration Manual.

The ITSCAM 600 CS AD IOT, ITSCAM 600 LM AD IOT, ITSCAM 600 FHD CS AD IOT and ITSCAM 600 FHD 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. Images captured by these ITSCAM models can be automatically georeferenced, as long as an external antenna for receiving the GPS signal is connected.

2. Information Generated

The ITSCAM 600 line captures images of up to three tracks in JPEG format and automatically provides the characters of Brazilian vehicle license plates (in the old and Mercosur standards). 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 captures obtained can be viewed through the interface on the Snapshot and Trigger screens, which present the user with the image metadata, such as data on the type of vehicle (whether Car, Motorcycle, Bus or Truck), the make, model and color of the vehicle identified by the Classifier and the license plates identified in the OCR Recognition.

The redirection of images captured by the ITSCAM 600 can be done via a wired data network (using independent Gigabit Ethernet ports), via Wi-Fi network or using 4G and 3G mobile data networks. Using the communication interfaces, images from the ITSCAM 600 can be sent automatically via the equipment's Web Interface or applications can connect using the REST API Client, the FTP (File Transfer Protocol), the ITSCAMPRO server or the LINCE server.

Furthermore, monitoring of equipment operation and captures can be done in real time with the Web Interface. The video with the captured images is available in MJPEG, H.264 or H.265 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 displays equipment data, such as the Device ID (or Serial Number), installed versions, CPU, memory and storage performance status, GPS and Inputs and Outputs.

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 necessary information to install and maintain the ITSCAM 600
	Integration Manual	Programming and integration manual containing the information required for integrating the ITSCAM 600 with an application
ITSLUX	Product Manual	Manual containing the technical specifications of the ITSLUX product

4. Mechanical Specifications

- Material: Aluminum and polycarbonate;
- IP Protection: IP40 (requires protective housing for outdoor use);
- Fastening: Fastening mechanism located at the bottom of the device

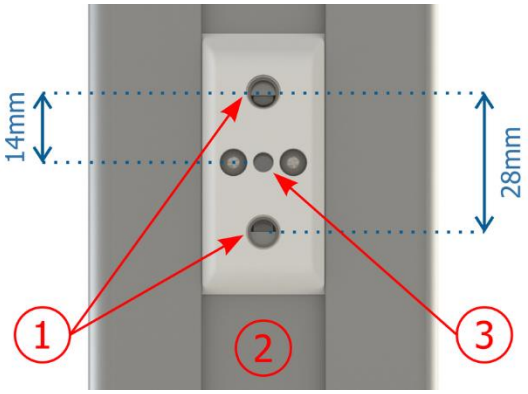


Figure 11 - Fastening Mechanism Specifications: 1) Thread for ¼" screws; 2) Track for changing the fastening point; 3) Ø4mm hole for guide pin

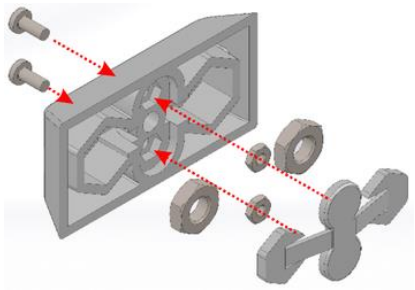


Figure 12 - Assembling the fastener components installed on the ITSCAM 600

- Interfaces: The ITSCAM 600 features the following connectors available on the rear panel:

Figure 13 - ITSCAM 600 line interfaces (may vary depending on the model)

Interfaces		Specifications
1	Microfit	power connector, IOs, RS-232, RS-485
2	Auto Íris	connector for lenses with DC and P-Iris type iris
3	POWER	status LED

Interfaces		Specifications
4	SD BOOT	Reset Button
5	SD CARD	for microSD 2.0 card
6	USB HOST	2.0 (host)
7	ETH-1 and ETH-2*	RJ-45 connector (EIA/TIA-568A standard recommended)
8	SIM CARD	nano SIM connector (12.3 x 8.8 x 0.67 mm)
9	Antenna MOV	SMA male connector
10	Antenna GPS**	
11	Antenna Wi-Fi**	
12	Antenna 3G/4G**	

*ITSCAM 600 CS and ITSCAM 600 CS AD IOT models only have the ETH1 network interface.

**Available only on models ITSCAM 600 CS AD IOT, ITSCAM 600 LM AD IOT, ITSCAM 600 FHD CS AD IOT and ITSCAM 600 FHD LM AD IOT.

- Ambient Operating Temperature:
  - DC power supply: -10 to 65 °C with 5 to 95% relative humidity and non-condensing (tests performed in accordance with IEC 60068-2-2);
  - Power via PoE source: -10 to 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
ITSCAM 600 FHD CS AD IOT (S09L0W1N1AJP)	589 g + lens weight*
ITSCAM 600 FHD LM (S09L3N2AJP)	752 g
ITSCAM 600 FHD LM AD IOT (S09L3W1N1AJP, S09L3W1N2AJP)	795 g
ITSCAM 600 LM (S12L5AJP)	835 g
ITSCAM 600 LM AD IOT (S2L5W1AJP)	875 g

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

- Dimensions:
  - The ITSCAM 600 CS and ITSCAM 600 CS AD IOT models use CS Mount lenses and have the same dimensions, with the total length depending on the lens model chosen.

Figure 14 – ITSCAM 600 CS and ITSCAM 600 CS AD IOT

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

- The ITSCAM 600 LM and ITSCAM 600 LM AD IOT models feature integrated motorized lenses with a focal length of 15-55 mm and a filter to control the entry of infrared light.

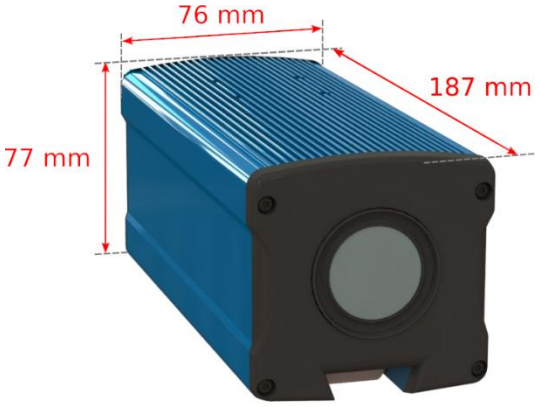


Figure 15 – ITSCAM 600 LM and ITSCAM 600 LM AD IOT

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

- The ITSCAM 600 FHD CS AD IOT model uses a CS Mount lens, with the total length depending on the lens model chosen.

Figure 16 – ITSCAM 600 FHD CS IOT

*Using connected antennas, the total length can reach 136mm.

- The ITSCAM 600 FHD LM and ITSCAM 600 FHD LM AD IOT models feature integrated motorized lenses with a focal length of 4.7-47mm and a filter to control the incoming infrared light.

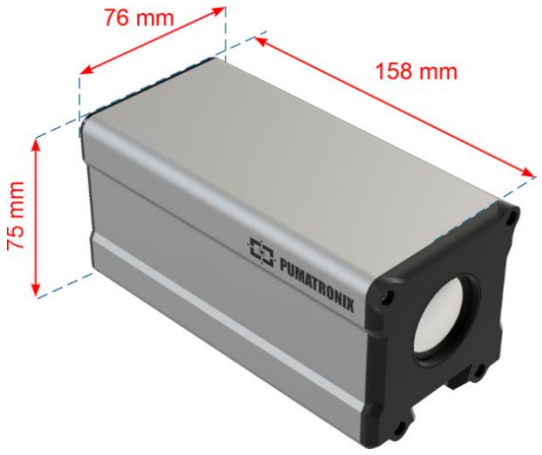


Figure 17 – ITSCAM 600 FHD LM and ITSCAM 600 FHD LM AD IOT

*Using connected antennas, the total length can reach 182mm.

5. Electrical Specifications

- Power supply: Power over Ethernet - PoE 802.3af (Power 12.95 W/48 V) or with 9~32 Vdc source (recommended 12 Vdc ±20% or 24 Vdc ±20%);
- Minimum consumption: 700 mA (12 V) and 400 mA (24 V);
- Maximum consumption: 1 A (12V) and 500 mA (24V);
- Minimum power: 10 W;
- Maximum power: 12 W;
- Typical power on ITSCAM 600 LM, ITSCAM 600 CS and ITSCAM 600 FHD LM models: 7 W (models without RF interface for communication);
- Typical power in models ITSCAM 600 LM AD IOT, ITSCAM 600 CS AD IOT, ITSCAM 600 FHD CS AD IOT and ITSCAM 600 FHD LM AD IOT: 8.5 W (models with RF interface for communication);
- Reverse polarity protection: 45 V with fast 2 µs response to reverse polarity (ISO 7637-2);
- Overvoltage protection (max.): 36.7 V at 10/1000 µs (IEC 61000-4-5:2014);
- Electrostatic discharge protection (DC power): ±30 kV by contact - Level B (IEC 61000-4-2/AEC Q100-002) and ±30 kV by air (IEC 61000-4-2/AEC Q100-002);
- Electrical Fast Transient (EFT) protection (DC power): 10/1000 µs forward current peak up to 53.3 A ±5% (ISO 7637 and IEC 61000-4-4);
- Inrush current protection: 8 A in 2 seconds (IEC 63129:2020).

Interfaces of the ITSCAM 600	Electrical Specifications
2 Gigabit Ethernet ports*	5 kVAC dielectric isolation, ±30 kV electrostatic discharge protection by contact - Level B (IEC 61000-4-2) and ±30 kV through air (IEC 61000-4-2), EFT for forward current peak in 5/50 ns up to 40 A ±5 % (IEC 61000-4-4) and surge current protection of 4 A (tP = 8/20 µs) (IEC 61000-4-5)
USB 2.0 port (host)	Protection against electrostatic discharge of ±8 kV by contact (IEC 61000-4-2) and ±15 kV by air (IEC 61000-4-2).

Interfaces of the ITSCAM 600	Electrical Specifications
4 inputs/outputs (IOs on Microfit connector)	User-programmable bidirectional 3.75 kV isolation digital (maximum current 50 mA, maximum voltage 28 Vdc and 10 kΩ impedance)
RS-485/422 Serial Port (Microfit connector)	2 Half Duplex ports with electrostatic discharge protection of ±8 kV by contact (IEC 61000-4-2) and ±15 kV by air (IEC 61000-4-2)
RS-232 EIA/TIA Serial Port (Microfit connector)	2 ports with a maximum transmission rate of 115,200 kbps and protection against electrostatic discharge of ±8 kV by contact (IEC 61000-4-2) and ±15 kV by air (IEC 61000-4-2)
External storage	Protection against electrostatic discharge of ±8 kV by contact (IEC 61000-4-2) and ±15 kV by air (IEC 61000-4-2);
Wi-Fi**	ESD protection ±8 kV by contact (IEC 61000-4-2) and ±15 kV by air (IEC 61000-4-2) and 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**	ESD protection ±8 kV by contact (IEC 61000-4-2) and ±15 kV in air (IEC 61000-4-2) and external high-gain straight 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**	Qualcomm® IZat™ Gen8C Lite Multi-constellation Glonass, BeiDou/Compass, Galileo and QZSS, with 1.57~1.58 GHz 2 dBic external active antenna

Interfaces	Connectivity Specifications
2 Gigabit Ethernet ports*	10/100/1000 tri-speed
External storage (SD Card)	microSD 2.0 card with support up to 128 GB
Wi-Fi**	IEEE 802.11 b/g/n 2.4 GHz band standard, with 46 Mbps UDP and 28 Mbps TCP/IP transfer rates
4G and 3G**	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 (models with CS Mount lens)	Supports lenses with DC and P-Iris type iris (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)

Component	Image Processing Specifications
2MP image sensor (ITSCAM 600 CS, ITSCAM 600 CS AD IOT, ITSCAM 600 LM and ITSCAM 600 LM AD IOT models)	2 MP Global Shutter (1636x1220 px), with proprietary HDR technology and Day/Night mode (generates color images during the day and monochrome images at night) Physical size of the sensor: 1/1.18” Internal Frame Rate: 15 fps Minimum shutter of 80 µs and maximum of 64000 µs (or 64 ms)
2.3 MP image sensor (ITSCAM 600 FHD CS AD IOT, ITSCAM 600 FHD LM and ITSCAM 600 FHD LM AD IOT models)	2.3 MP Global Shutter (1920x1200 px), with Day/Night mode (generates color images during the day and monochrome images at night) Physical size of the sensor: 1/2.6” Internal Frame Rate: 30 fps Minimum shutter of 48 µs and maximum of 30000 µs (or 30 ms)
5.3MP image sensor (ITSCAM 600 LM and ITSCAM 600 LM AD IOT models)	5.3 MP Global Shutter (2688x2005 px), with Day/Night mode (generates color images during the day and monochrome images at night) Physical size of the sensor: 1/1.8” Frame rate: 25 fps Minimum shutter of 80 µs and maximum of 64000 µs (or 64 ms)
Internal storage	Up to 8 GB available for user data (total 16 GB)
SD Card Storage	Micro SD 2.0 card supports up to 128GB
Watchdog	in hardware with a period of 50 seconds

*ITSCAM 600 CS and ITSCAM 600 CS AD IOT models have only one network interface.

**Available only on models ITSCAM 600 CS AD IOT, ITSCAM 600 LM AD IOT, ITSCAM 600 FHD CS AD IOT and ITSCAM 600 FHD LM AD IOT.

Anatel Approval No. 06943-24-10157.
Resolution 680 – ACT 14448:
This equipment is not entitled to protection against harmful interference and must not cause interference in duly authorized systems. For more information, see the ANATEL website http://www.gov.br/anatel.

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

5.1. Electrical Connections

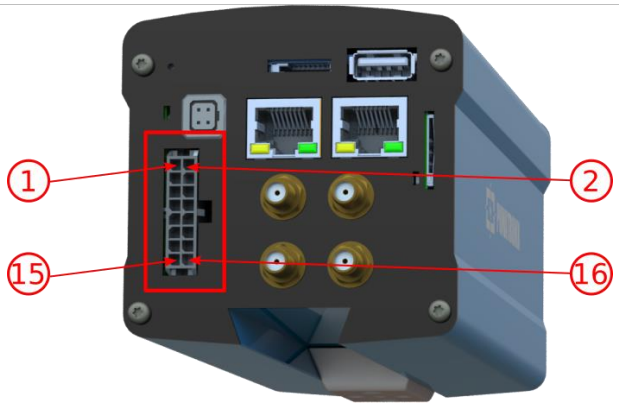


Figure 18 – ITSCAM 600 Power and Signal Connector (Microfit)

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	Gray	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

5.1.1. Triggering on IOs

The ITSCAM 600 has 4 connections that can be used as inputs or outputs, with IO1 and IO2 dedicated to controlling the activation of the illuminator and IO3 and IO4 available for the installation of external sensors, such as loops and light barriers, which identify the moment of image capture (trigger). The configuration process is done via 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.

IO Specification: Maximum supported current of 50 mA and maximum supported voltage of 28 Vdc, however, it is recommended to activate the circuit with 10 mA.

5.2. Ethernet Connection

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

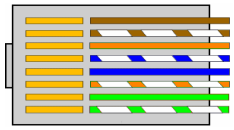


Figure 19 - EIA/TIA-568A standard RJ-45 connector

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

5.3. Antenna Connection

Images captured by the ITSCAM 600 can display geolocation, provided 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 and 3G/4G signals can be amplified using an external antenna, with an SMA type connector (male connector, i.e. with a central pin).

The connectors for the Wi-Fi and 3G/4G signal antennas are only available on the ITSCAM 600 models named ITSCAM 600 CS AD IOT (S06L0W1AJP), ITSCAM 600 LM AD IOT (S06L5W1AJP), ITSCAM 600 FHD CS AD IOT (S09L0W1N1AJP) and ITSCAM 600 FHD LM AD IOT (S09L3W1N1AJP, S09L3W1N2AJP) (for more information, see the model list). The silkscreen on the rear panel of the equipment helps to identify the connectors for the antennas:

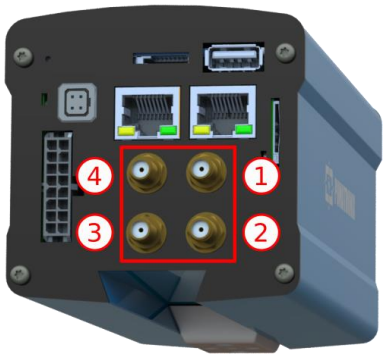


Figure 20 – SMA connectors for antennas (there may be variations depending on the model)

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

*In non-standard installation locations where the antenna is not effective in the application, contact Pumatronix support.

4G and 3G Technology Specification: Please 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 making configurations. Access to the interface requires the following information username and password, considering the factory default data on First Access.

6.1. Image Capture Architecture

To meet Intelligent Transportation Systems (ITS) applications, the ITSCAM 600 has several functionalities associated with image acquisition. These features make up a general architecture and can be disabled by accessing the equipment's Configuration Profiles. The image acquisition process begins with the image request form (Trigger). This request can be made through external sensors, connected to one or more ports of the ITSCAM 600 (IOs configured as Inputs). When configuring the ports, you can specify that the capture trigger will be performed by edge (rising, falling or both) or level (high and low).

There is an alternative to using external sensors connected to the ITSCAM 600 inputs, which is the trigger configuration for capturing an image triggered by software. In this case, the triggering can be at a constant time interval or when the equipment identifies movement in the image (motion trigger), enabling the Motion Detector functionality.

Once the ITSCAM 600 image capture workflow has been defined, the Multiple Exposures on Demand functionality can be enabled. This technology allows you to configure two to eight sequential images, with variations in capture parameters for each request.

The identification of the license plates of vehicles present in the image can be done by enabling OCR processing, available for recognizing the characters of license plates from different countries. To increase reading accuracy, the Majority Vote functionality can be enabled. The feature that promotes more complete recognition of vehicles in images is the Classifier, responsible for identifying the type of vehicle detected in the image.

6.1.1. Motion Detector

The definition of movement between two consecutive images of the ITSCAM 600 depends on the configured variation parameter, which considers for the Motion Detector a minimum time interval between triggers and a variation threshold necessary for it to be activated. Additionally, it allows you to specify a Region of Interest, which defines the portion of the image in which the movement will be evaluated, which corresponds to a polygon with four vertices, drawn on the visualization image.

6.1.2. Classifier

The ITSCAM 600 is capable of analyzing captured images in real time and evaluating the content present in the images. This analysis aims to distinguish motorcycles, cars, trucks and buses from images that only show the road. This analysis has a degree of classification certainty, considering image samples that were used to generate this analysis. It is important to inform the correct type of installation, as the ITSCAM 600

can be used to capture two or three tracks simultaneously, depending on the model applied. From two tracks, the Panorama setting must be chosen. 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.

6.1.3. Multiple Exposures

The ITSCAM 600's Multiple Exposure functionality generates two to eight sequential images per capture request. This feature can increase the accuracy rate in the automatic identification of license plates and identify vehicles that were obscured in some way when the first image was captured. The settings that may vary are:

- The intensity of the Flash, always corresponding to a percentage of the initial trigger. This option is available for the Pumatronix ITSLUX line of illuminators, designed to deliver the best results with *Multiple Exposures*;
- 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.

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

6.1.4. OCR

The ITSCAM 600 can recognize license plates from Brazil (in the 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 vehicle flow and the processing required by the ITSCAM 600, the number of processing threads can be changed. It is important to define a processing time limit to discard images in which it was not possible to read the license plate. The effort spent on plate identification can be set in Processing Mode.

OCR allows you to define a ROI (Region of Interest) in the image with the aim of reducing the processing of regions of the image where you do not want to find a license plate. In the ROI preview image, the size of the plate characters can be evaluated, using the grid with configurable size, superimposed on the image preview, as a reference.

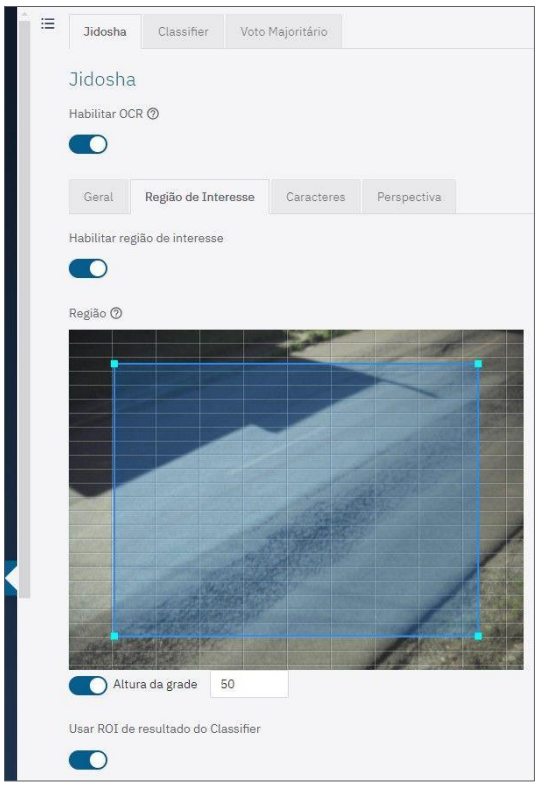


Figure 21 – Web interface for configuring the OCR ROI (Region of Interest)

6.1.5. Majority Vote

Majority Vote is a functionality applied to the results of the automatic reading stage of vehicle license plate characters (OCR) and/or the *Classifier*. This analytics defines which sequence of characters best describes the license plate of the vehicle captured in the image. The algorithm compares the identification reliability 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 *Multiple Exposures* or using sequential images.

6.1.6. Automatic Transition between Picture Profiles

The ITSCAM 600 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 specific time and/or Picture *Level* value is reached, so that you can achieve optimal picture quality in any lighting situation. It is recommended to use one profile for captures with ambient light (daytime) and another for captures with artificial lighting (nighttime). See the Integration Manual for suggested settings for a profile's *Transitions*.

6.2. Information Security

Digital Signature and Data Encryption are the security mechanisms for information generated by devices in the ITSCAM 600 family. Digital Signature technology allows information received by the end user to 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.

6.2.1. Digital Signature

The ITSCAM 600 and ITSCAM 600 FHD intelligent capture devices have the ability to sign all images that are captured by the device. The digital signature mechanism employs asymmetric cryptography, using a public key in PEM or P12 formats.

The public key can be generated internally by the ITSCAM device using a random seed mechanism or it can be generated externally and sent to the capture device via the GUI or M2M API.

When the key is generated by ITSCAM, this process is done first in RAM and only the public key is then sent to the client in the web interface. The toilet goes directly into the database.

If the key is generated externally, the storage process follows a similar procedure. The user only sends the public key to the device, and this content, after format validation, is stored directly in the database from RAM memory.

The key is stored compressed in a Redis database that resides on the device's eMMC. Since eMMC is memory soldered inside the device, then the only way to compromise the key would be to physically remove the chip, find the Redis database file, and explore that file to locate the compressed key.

6.2.2. Encryption

Encryption is the security mechanism that can be configured to access the device and send data to servers using secure protocols, such as https, FTPS and SFTP, which are responsible for data security when TLS/SSL encryption is applied. This technology ensures that only authorized recipients have access to the images, maintaining the confidentiality of the data generated by the ITSCAM 600 family devices.

6.3. Plugin Installation

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

The plugin added to the interface will be available using an SD Card formatted through the interface and connected to the ITSCAM 600, which is intended to store the data generated by the plugin.

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

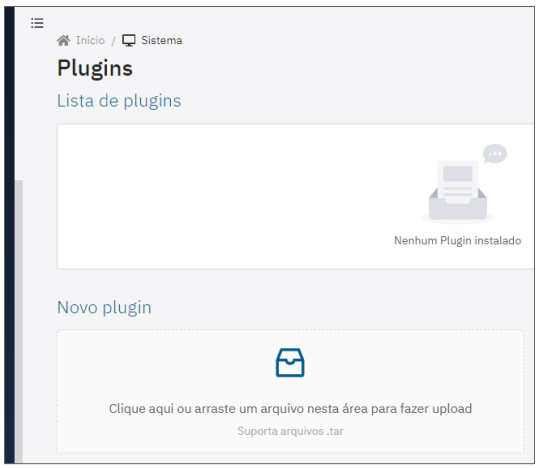


Figure 22 – Web interface for installing plugins

7. Licensing

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

8. Initial Setup

8.1. Installation Prerequisites

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

8.1.1. Installation Location of the Equipment

To get the best performance from the ITSCAM 600, it is recommended that it be installed parallel to the track and with little horizontal inclination. Avoid covering parts of the image with objects such as trees or vehicles in other lanes.

The zoom and focus adjustment aims to produce images in which the vehicle license plate characters are approximately 20 pixels high. However, character height can vary from 15 pixels to 30 pixels, with the best recognition rates corresponding to a height of 20 pixels.

The ITSCAM 600 line can be installed in urban and highway environments, and the framing can be adjusted to capture up to three lanes of the road. When installing on the highway, the minimum height limits specified for the location must be respected, as well as the maximum vertical inclination angle of 45°. Larger angles of vertical inclination generate significant deformations in the images, which implies a reduction in the automatic recognition rate of the plates detected in the images. The distance from the ITSCAM 600 to the vehicle crossing point varies in models with CS Mount lenses, depending on the lens used. In models with motorized lens, the applied distance varies from 10 to 50 meters. In night operations, this distance varies depending on the illuminator model applied.

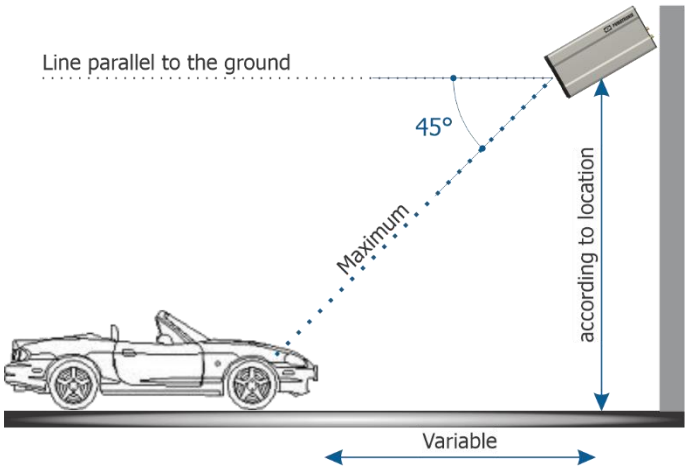


Figure 23 - Side view of the installation

Illuminator Installation: When using an illuminator in conjunction with the ITSCAM 600 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.

Attention must be paid to restrictions on positioning equipment in vehicle circulation areas if the ITSCAM 600 is installed on a side structure. When choosing this type of installation, the equipment must be located as close and safe as possible 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 caught in the furthest lane is done by large vehicles traveling in the closest lane.

Installing the ITSCAM 600 without following the distances indicated compromises the quality of the captured images and reduces OCR recognition. If the requirements cannot be met at the installation site, it is recommended to consult Pumatronix Technical Support.

8.1.2. Necessary Infrastructure

At the location where the equipment is fixed, there must be:

- Power supply point in accordance with Electrical Specifications, close to the equipment installation point;
- Connectivity to a data network close to the equipment installation point (based on the chosen modality);
- Sheltered location for cable splices, for example a junction box, close to the equipment installation point;
- Drilling for fastening the protection box support;
- Appropriate screws for fastening the ITSCAM 600 protection box at the installation site;
- Availability of Auxiliary Configuration Equipment (for checking framing and image adjustments), with the Google Chrome browser (version 85 or higher) installed.

8.2. Necessary Conditions for Installation

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

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

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

8.2.1. Network Interface Parameterization

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

*ITSCAM 600 CS and ITSCAM 600 CS AD IOT models only have the ETH1 network interface.

Connectivity of ITSCAM 600 CS AD IOT (S06L0W1AJP), ITSCAM 600 LM AD IOT (S06L5W1AJP), ITSCAM 600 FHD CS AD IOT (S09L0W1N1AJP) e ITSCAM 600 FHD LM AD IOT (S09L3W1N1AJP, S09L3W1N2AJP): Check the Wi-Fi Network Configuration to see how to configure the Wi-Fi, 4G and 3G network interfaces as they are disabled in the equipment's factory default settings.

In situations where the ITSCAM 600 network configuration is different from the standard, it is recommended to change the settings prior to physically installing the equipment on site. The changed network configuration is saved in the flash memory, however it is effectively applied after the equipment is restarted. When the change is made via the web interface, the restart is automatic after the change is confirmed.

The ITSCAM 600 has a recovery IP address (192.168.254.254) for cases where the user changes the IP address by mistake 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 maintenance IP address (192.168.254.254) is disabled when the primary IP address conflicts with it. Therefore, when manually configuring the equipment's network interface (Ethernet), values other than the maintenance IP must be applied, as there will be no way to recover the connection in extraordinary situations where the primary IP is lost.

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

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

8.2.2. Wi-Fi Network Configuration

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

1) Access the device's web interface with the data registered in the network interface parameterization;

2) Access the Equipment > Network menu in the Wi-Fi tab;
3) Select Station (STA) Operating 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 you have validated the data entered.

Select Access Point (AP) Operating 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 that will be applied when distributing the Wi-Fi connection;
2) Enter the IP Address and Subnet Mask of the DHCP Server determining the address range for the devices that connect to the Access point.

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

8.2.3. 3G or 4G Mobile Network Configuration

Some mobile internet operators require manual configuration of network data:

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

8.2.4. Installation Infrastructure

1) Fit the ITSCAM 600 into the protective housing bracket, leaving the lenses as close as possible to the bracket glass;
2) Respecting the positioning distances of the ITSCAM 600 (as indicated in Equipment Installation Location), secure the protective box. When fixed to the ceiling (upside down) it is possible to configure the equipment to rotate the image 180º via the web interface;
3) Adjust the positioning of the protection box so that images of the region where the vehicles travel are captured. If necessary, it is possible to crop the image, selecting only the region of interest (ROI) of the image in which the vehicles are actually visible for generating the images. In this option, the conversion time to JPEG is improved and does not affect Streams or live viewing;
4) Connect the Microfit connector harness to the ITSCAM 600, if DC power or equipment IOs are used:

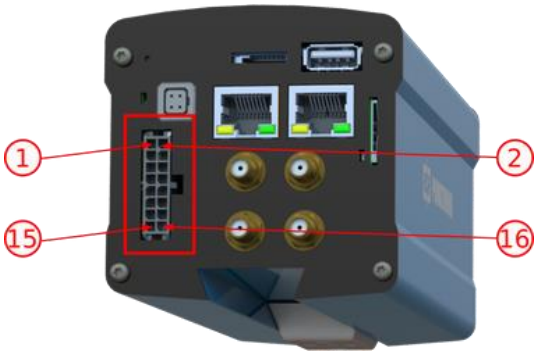


Figure 24 - ITSCAM 600 Power and Signal Connector (Microfit)

8.3. First Access

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

Furthermore, the Auxiliary Configuration Equipment must be on the same data network as the ITSCAM 600 (with a network configuration compatible with that performed on the ITSCAM 600). If a point-to-point connection is used, access to the ITSCAM 600 can be done via the maintenance IP address 192.168.254.254. When typing the IP address of the ITSCAM 600 in the address bar of the Auxiliary Configuration Equipment browser, the following information must be provided:

User	*admin*
Password	*1234*

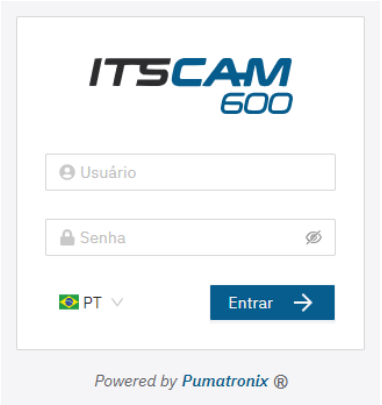


Figure 25 - Access screen

9. Care and Maintenance

Some care is necessary to ensure the product's performance and extend its useful life.

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

9.1. Firmware Update

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

- Microsoft Edge 109 or higher;
- Google Chrome version 85 or higher;
- Firefox version 21 or higher;
- Opera 25 or higher;
- Safari 8 or higher.

Updating the ITSCAM 600 firmware requires some safety measures during the procedure, in order to prevent the file from being corrupted and the ITSCAM 600 device from stopping 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 in which it is installed;
2) Keep the ITSCAM 600 device powered on at all times while the update is running, 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:

Figure 26 – Firmware Request Form

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

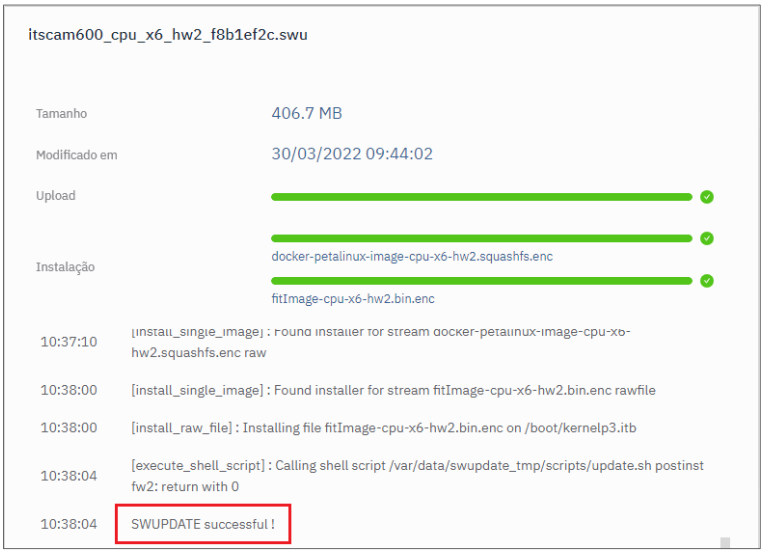
*Pumatronix will provide bug fixes or security enhancements for up to 3 years after the product is discontinued and removed from the portfolio.

9.1.1. ITSCAM 600 Firmware Update via Web Interface

1) Download the firmware file received by email (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 the Auxiliary Configuration Equipment browser;
4) Enter the IP address of the ITSCAM 600 (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 the System > ITSCAM 600 Web Interface Update menu

7) Select or drag the firmware file (the update starts automatically and takes place in three stages, which are signaled by the progress bar);
8) Watch for 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 causing the equipment to stop working;
9) Check the SWUPDATE successful! message indicating that the installation is complete.



10) Click the Restart ITSCAM 600 button;
11) Wait for the equipment to restart so that the new firmware changes are applied;
12) Complete the update procedure by checking the firmware version indicated in the top bar of the page.

9.2. (Restricted Procedure) ITSCAM 600 Recovery by Factory Reset

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

The ITSCAM 600 recovery procedure requires an SD card with 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 on the ITSCAM 600;
7) Release the RESET button when the status LED is green;
8) Check the status LED flashing red, which indicates that the recovery process is in progress;
9) Check the status LED blinking 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.

9.3. Analytics License Update

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

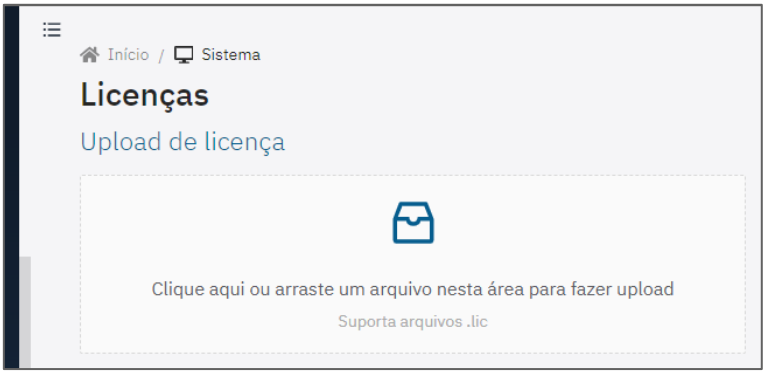


Figure 27 – Web interface for updating licenses

9.4. Preventive maintenance

The ITSCAM 600 image capture and processing device must provide artifact-free images. However, if the external surface of the lenses or protective case is dirty, the following cleaning procedure must be carried out:

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

10. General Warranty 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 execution of services arising from this Warranty will only be carried out at Pumatronix Authorized Technical Assistance or a third party expressly indicated by it, where the product must be delivered for repair.

This Warranty will only be valid if the product is accompanied by a Maintenance Form duly completed and without erasures and accompanied by an Invoice.

10.1. Situations in which the Product Loses its Warranty

1) Use of software/hardware not compatible with the specifications in the Manual;
2) Connecting the product to the power grid outside the standards established in the product manual and installations that present excessive voltage variation;
3) Infiltration of liquids from opening/closing the product;
4) Damage caused by natural agents (electrical discharge, flooding, sea spray, excessive exposure to climate variations, among other factors) or excessive exposure to heat (beyond the limits established in the Manual);
5) Use of the product in environments subject to corrosive gases, with excessive humidity and/or dust;
6) Show signs of tampering with security seals;
7) Show signs of opening and modification made by the Customer in areas of the product not authorized by Pumatronix;
8) Damage caused by accidents/falls/vandalism;
9) Display tampered and/or removed serial number;
10) Damage resulting from the transport and packaging of the product by the Customer in conditions incompatible with the same;
11) Misuse and in disagreement with the Instruction Manual.

11. Privacy Policy

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

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

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


PUMATRONIX
www.pumatronix.com