Pumatronix Equipamentos Eletrônicos Ltda.

ITSCAM Vigia+ 4XX and Vigia+ HDR

USER MANUAL

Models: ITSCAM Vigia+ 400 to ITSCAM Vigia+ 421 and Vigia+ HDR

Traffic Control Device

Version 1.3 – January 2019

Index

This document provides technical information about ITSCAM. Integrators can connect to ITSCAM using its communication protocol (described at the end of the document). It is also available a dynamic library and development kit tool at www.pumatronix.com.br.

1. Overview

ITSCAM is a traffic control device that captures and processes images. The digital images are sent as BMP or JPEG files that flow through the network interface by TCP/IP protocol to servers that store them. Each equipment has an IP address that allows changing all settings remotely, at any time. The network interface also allows multiple device access by a same computer.

In analog capture technology, the photons that reach the image sensor are converted into analog voltage levels. The voltage level is digitalized to be processed and converted to analog video (NTSC or PAL), which is transmitted through a cable (with losses) to a capture card. Only after this stage, a computer can process and store the images. Each of these conversion steps means image quality loss.

ITSCAM digital technology improves image quality compared to analog systems. In digital technology, the photons are converted into analog levels and then converted into digital values. The digital values correspond to image pixels. In analog technology, there are three conversion steps, while in digital there is only one (Figure 1), mitigating quality loss.

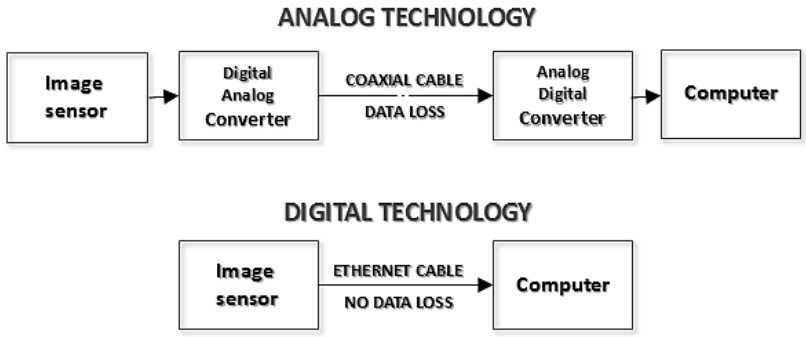


Figure 1 – Comparison of digital and analog image conversion steps

Another disadvantage of using analog devices for monitoring traffic is the difficulty of taking flash-synchronized pictures, because analog cameras do not have strobe outputs. ITSCAM provides an output for triggering a flash or an illuminator (as shown in Figure 2).

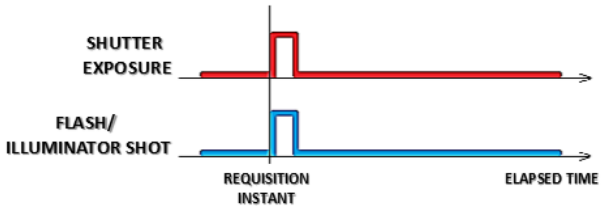


Figure 2 – Comparing diagram of shutter and output flash trigger with flash in Single Mode

To maximize illuminating devices efficiency, ITSCAM allows image capture delay after flash firing. It is useful because illuminating devices have a small delay until light reaches its peak. For this reason, you can configure the capture moment when the flash/illuminator is close to its peak of light emission. Figure 3 shows an example of this situation.

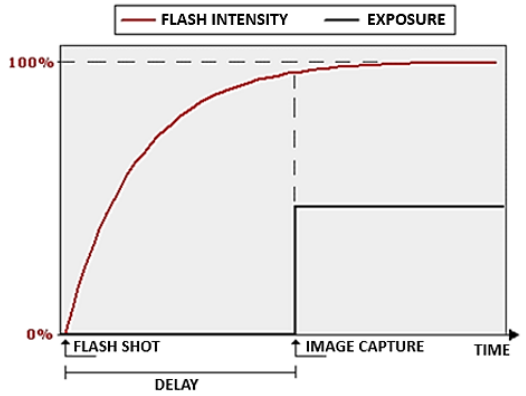


Figure 3 – When light reaches its peak, shutter fires

Another advantage of ITSCAM compared to analog systems is image resolution. ITSCAM uses global shutter technology for capturing images, thus they are non-interlaced (progressive scan). This means that ITSCAM captures all pixels in the image at the same instant. In analog video, there is a lag of 16 milliseconds between the capture of odd and even lines, making it impossible to use the both fields in images with moving objects, like in traffic control applications. The analog image real resolution is usually 640x240 pixels while ITSCAM available resolutions are on Table 1.

Table 1 – ITSCAM image resolution

Model	Resolution (pixels)
ITSCAM 401 and 403	800x600
ITSCAM 411 and 421	1280x720
Vigia+ HDR13xyz*	1280x960

*Product Vigia+ HDR13 can change based on lens model (x), embedded illumination (y) and additional hardware (z). See Table 3 for available variations.

The difference between analog and digital images is sensitive not only to the human eye, but also in Optical Character Recognition (OCR) algorithms. This amount of pixels based on resolution is shown in Figure 4.

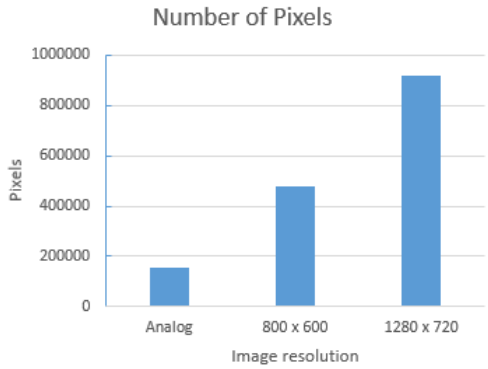


Figure 4 – Digital and analog amount of image pixels

Note that systems with larger image width as ITSCAM allows wider field of view with the same zoom used in analog images.

1.1. ITSCAM 4XX Vigia+ Models (Light and Lens Type)

Model*	Resolution (pixels)	Frames per second
ITSCAM Vigia+ 40X	800x600	50
ITSCAM Vigia+ 411	1280x720	30
ITSCAM Vigia+ 421		
Vigia+ HDR	1280x960	15

*Models without embedded illumination can have operating temperature extended from -10 to 75°C. This feature is shown with a letter "E" at the end of the product name, i.e. ITSCAM Vigia+ 411 DL1E

Vigia+ HDR has a label with features described as shown:

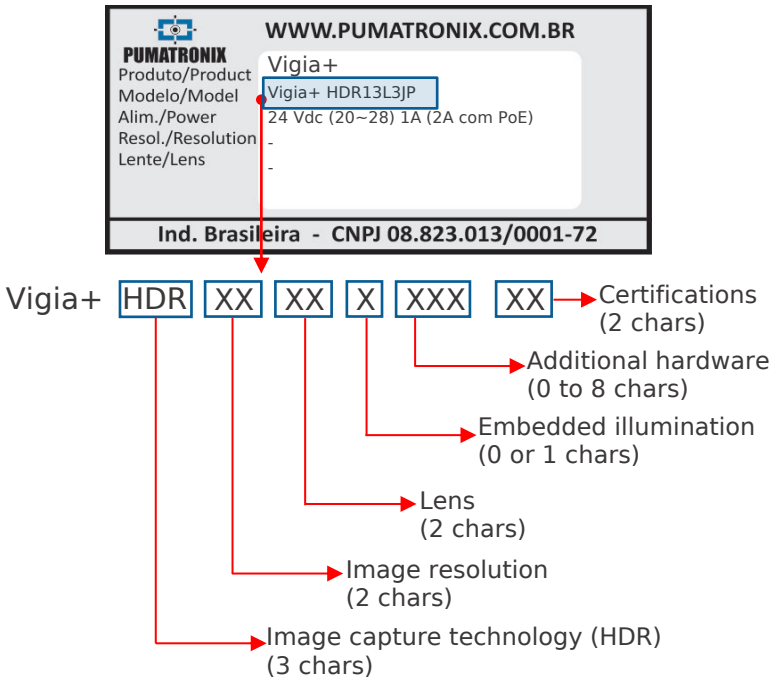


Image Resolution	Lens	Embedded Illumination	Additional Hardware
13: 1,3MP (1280x960px)	**L1**: 3-10mm **L2**: 9-22mm	**B**: White **I**: Infrared **M**: Mix **D**: Without illumination	**J**: Jidosha Light **P**: Power Over Ethernet **R**: RTC (Real Time Clock)

Some models are certified by international standards. In these cases, after the product model, characters *CX* are

inserted, with *X* indicating the type of certification that the product meets.

Product Certification
C1: CE
C2: FCC
C3: CE and FCC

The 403, 421 and HDRJ models have embedded OCR, that is, the equipment captures the images of the vehicles, performs the automatic identification of the vehicle plate characters and sends the image and the information through data network.

Choose ITSCAM 4XX Vigia+ model based on installation characteristics:

ITSCAM 4XX Vigia+ Illuminator	
White light (B)	Allows capturing color image at nighttime and better recognition for red vehicle plates
Hybrid light (M)	Has white and infrared embedded illuminator with independent firing. *Maximum distance device-object reduced to 6 meters*
Infrared light (I)	Illuminator shot cannot be noticed although images are black and white
Without Illuminator (D)	Has no embedded illuminator

ITSCAM 4XX Vigia+ Lens	
Short distance (L1)	Distance ITSCAM-vehicle from 2 to 4 meters (lens 3-10mm)
Long distance (L2)	Distance ITSCAM-vehicle from 4 to 8 meters (lens 9-22mm)

Respect capture distance to acquire images with appropriate light and focus: Embedded illuminator and lens cannot be changed

ITSCAM 4XX Vigia+ Serial Number is its MAC address. It cannot be altered and it is located at body bottom.

2. Risks

Water Infiltration and Humidity Risk: Follow Opening/Closing Instruction carefully. Use only specified cables and cable gland. Store ITSCAM in a dry ambient and without cable gland installed. Product warranty does not cover humidity problems and inappropriate installation/manipulation.

Electrical Shock Risk: Open ITSCAM 4XX Vigia+ may be opened only on specified points.

Vision Damage Risk: Embedded illuminator emits thermal and light energy (not visible in infrared models), so it is not recommended to look directly or using any optical device at ITSCAM 4XX Vigia+ front panel.

Send the equipment to Pumatronix Technical Assistance for maintenance.

3. Dimensions and Power Supply

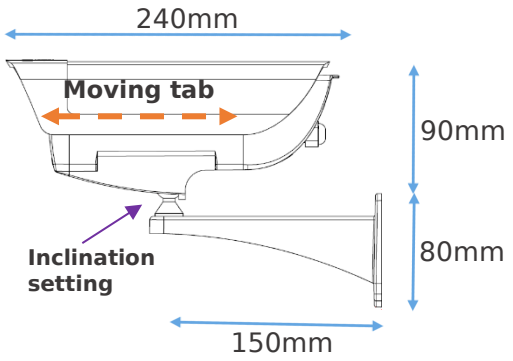
ITSCAM has suitable case for traffic control applications. Start using it by making physical installation, connecting power supply and Ethernet cable. ITSCAM motorized lens allows remote zoom and focus settings.

Articulated joint between body and support allows up to 45° of vertical offset to capture vehicles. ITSCAM has a moving tab to avoid light reflex.

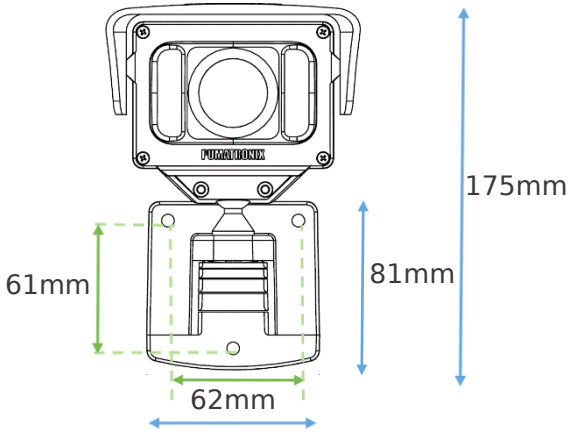
Weight	955g	
Case	Polycarbonate with IP67 protection	
Wire length	1 meter	
installation	3/16” screws (not included)	
Operation temperature	-10°C to 50°C	
Power supply	Power source 24 to 32Vdc and 1A	Power Over Ethernet (POE) 802.3af Standard

ITSCAM dimensions (millimeters):

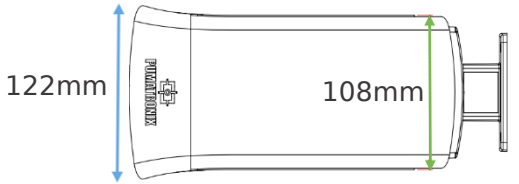
Side view



Front view



Top view



ITSCAM Vigia+ back lid is sealed and opening it implies on warranty loss.

ITSCAM Vigia+ has a multi wire cable for installation and Table 2 shows wire functionality.

Table 2 – ITSCAM Vigia+ connection description

Terminal	Signal	Description
1 Red	V+	Power supply
2 Brown	GND	Ground
3 Green	IN1+	Isolated positive input 1
4 Blue	IN1-	Isolated negative input 1
5 Light purple	RS232_RX2	RX RS232 2
6 White	RS232_TX2	TX RS232 2
7 Black and brown	Wiegand 0	Wiegand data low signal
8 Black and Red	Wiegand 1	Wiegand data high signal
9 Gray	IN2+	Isolated positive input 2
10 Black	IN2-	Isolated negative input 2
11 Orange	OUT1+	Isolated positive output 1
12 Yellow	OUT1-	Isolated negative output 1

Unused wires must be left unconnected

It is necessary to enclosure wires to avoid humidity exposure and oxidation.

ITSCAM Vigia+ second cable is Ethernet for externa use with RJ-45 connector, UV protection and **EIA/TIA-568A** standard.

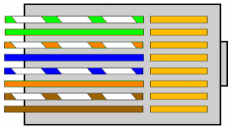
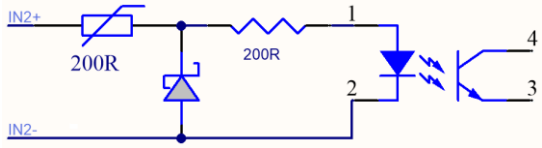
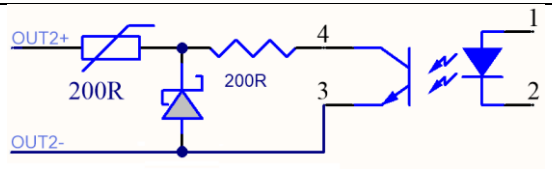


Figure 5 – Connector RJ-45 EIA/TIA-568A standard

200Ω resistors at the input and output circuits provide basic protection. However, the user must ensure that the current flowing in both output and input does not exceed 20mA. If necessary, additional resistors must be added to reduce current to acceptable levels. The circuit supports direct connection of 5Vdc power sources without needing additional resistors. Power source greater than 5Vdc requires additional resistors to limit current. Input and output signals are optically isolated and their corresponding circuits are:

Input	 Recommended current: 10mA Maximum current: 20mA

Output	 Maximum current: 30mA Maximum voltage: 28Vdc

4. Format of Transmitted Image

ITSCAM can transmit images in both "Photo" and "Video" mode, formatted as BMP or JPEG files. When transmitting JPEG image, ITSCAM adds an EXIF tag to the image, containing all its settings at the capture moment and additional data such as the recognized vehicle plate, if embedded OCR is available.

It is possible to choose image quality when using JPEG format. This parameter varies from 1 (with poor quality and high image data compression) to 100 (with all quality and minimal compression).

5. Light Sensibility

ITSCAM has high sensitivity to infrared light, which is ideal for using with flashes and illuminators. Figure 6 shows the graph of Sensitivity versus Light Wavelength for monochromatic image sensors. Figure 7 shows the same graph for day/night image sensors. Color sensor has 50% of its pixels sensitive to green light, 25% sensitive to red light and 25% sensitive to blue light, following Bayer Pattern. In the infrared region, all pixels have almost the same sensitivity.

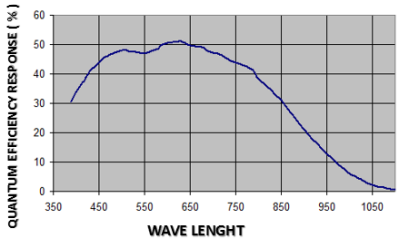


Figure 6 – Monochromatic sensor sensibility

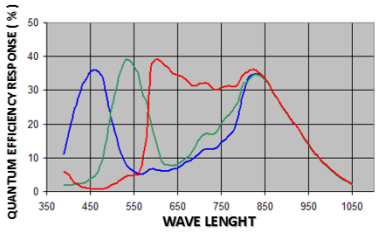


Figure 7 – RGB channel sensor sensibility

6. Image Capture Considerations

ITSCAM image capture principle is different from analog devices. In analog technology, images are continuously captured and, when there is a capture event, the frame has to

be acquired and digitalized. ITSCAM is better because it works on STAND BY, awaiting a command (via network or I/O) to capture a digital image and to deliver it with synchronized flash.

The application that communicates with ITSCAM does not need to request a video stream and freeze it to capture a frame because ITSCAM already does this internally.

ITSCAM has two commands for image capturing: “Video" and "Photo". The difference between them is mainly flash synchronization. Requesting images using “Video” command is faster because there is no need to synchronize light from a flash or an illuminator with the frame. If flash is on continuous mode, however, it will be activated at each frame and does not matter if it is transmitted or not. Pay attention to flash technical specifications before setting ITSCAM to continuous flash mode.

Otherwise, when using “Photo” command, ITSCAM waits for the next available frame, which will be flash-synchronized.

Image transmission time differs according to network infrastructure and the following factors:

- Network capacity;
- Processing power of host that receives ITSCAM data;
- Network card;
- Network traffic amount;
- Network peripherals such as *hubs* and *switches;*
- Long shutter length (greater than time to send frame).

ITSCAM processes an image request made by network or I/O the same way and instantly. It gets and stores the first available frame, then ITSCAM sends this frame as fast as network allows. This fact leads to acquisition rate (Table 5) and typical transmission rate (Table 3 for JPEG image format and

Table 4 for BMP image format).

Table 3 – ITSCAM Typical transmission rate for JPEG format (in frames per second)

Image	JPEG Format	
	ITSCAM Vigia+ Model	
	401 403	411 421
Color	35	10
Monochromatic	35	10

Table 4 – ITSCAM Typical transmission rate for BMP format (in frames per second)

Image	BMP Format	
	ITSCAM Vigia+ Model	
	401 403	411 421
Color	12	3
Monochromatic	33	6

Table 5 – ITSCAM Typical acquisition rate

Resolution	Internal acquisition rate
800 x 600	50fps
1280 x 720	30fps
1280 x 960	15fps

ITSCAM can capture a burst of images, which are stored in RAM and sequentially transmitted. These bursts can have from two to sixteen non-interlaced pictures, all flash synchronized. The delay between two consecutive images is

defined by ITSCAM internal frame rate; see Multiple Images per Requisition for more details.

7. ITSCAM Positioning

ITSCAM best performance occurs when it is positioned parallel to lane with little horizontal inclination. Also, avoid video occlusion by things like trees and vehicles from other lanes. Character height and distortion affect OCR recognition rate. Therefore, it is recommended to set zoom and focus in a way that plate character height is about 20 pixels. Character is recognizable if its height varies from 15 to 30 pixels.

7.1. ITSCAM for Toll, Parking Lot and Similar Situations

In this type of installation, vehicle speed is not high and ITSCAM position is usually close to the ground. The minimum recommended height is 1.5 meter and the distance between the facility and vehicle position should range from 2 to 10 meters. The minimum angle generated between the lens center and a line parallel to the ground should be 15° (as shown in Figure 8). ITSCAM can be placed on the sidewalk, but it is essential that plates are captured with maximum side angle of 30°, as shown Figure 9. However, it is recommended to position ITSCAM to capture images from 10° to 15° side angle.

Situations where the installation does not meet specifications may have low recognition rate and it is indicated to contact Pumatronix Technical Support.

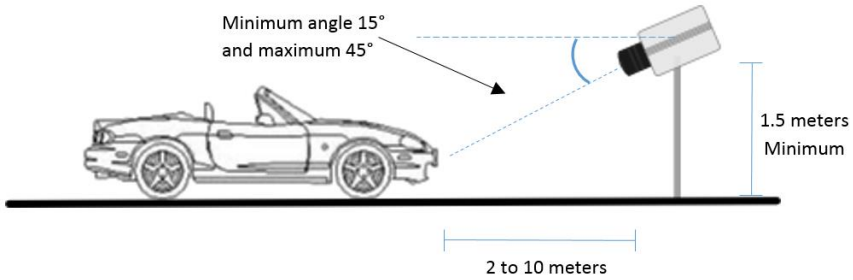


Figure 8 – ITSCAM installation for toll, parking lot and similar situations (side view)

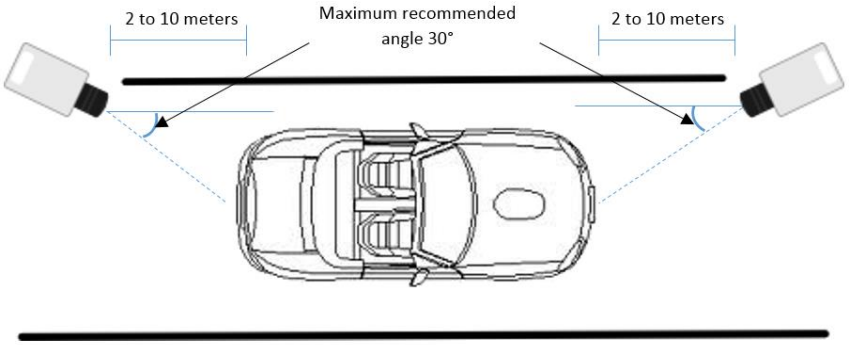


Figure 9 – ITSCAM installation for toll, parking lot and similar situations (top view)

8. ITSCAM Zoom and Focus Settings

Follow these steps for ITSCAM zoom and focus positioning:

- Disable trigger and applications that are requesting images;
- Watch real time images with Web interface or software available at www.pumatronix.com.br;
- Disable auto iris;
- Select zoom and focus that produce images with vehicle plate character height of 20 pixels;
- Save focus (if ITSCAM has motorized lens);
- Enable auto iris.

8.1. Night Focus Settings

- Disable trigger and applications that are requesting images;
- Watch real time images with Web interface or software available at www.pumatronix.com.br;
- Disable auto iris;
- Reduce maximum shutter and maximum gain to see only vehicle lights in Video mode
- Select zoom and focus that produce images (in Photo mode) with vehicle plate character height of 20 pixels;

- By requesting images in Photo mode, adjust maximum shutter and maximum gain to obtain the correct luminance
- Save focus (if ITSCAM has motorized lens);
- Enable auto iris;

9. ITSCAM Inputs and Outputs

9.1. Image Trigger – Input Signal

Image request can be done either by Ethernet interface or by an external signal applied at the ITSCAM inputs. When the requisition uses an input, the generated image can be BMP or JPEG. It is necessary to specify JPEG quality too. Via I/O it is possible to define whether the trigger will occur at the rising or falling or both edges of the pulse (two shots per pulse).

Configuration	Operation mode
1: Off	There is not camera I/O request or image detection

2: Rising edge	Images are sent when there is a rising edge on input
3: Falling edge	Images are sent when there is a falling edge on input
4: Rising and falling edge	Images are sent when there is a rising or falling edge on input
5: Approaching image	Capture is determined by digital image processing, when ITSCAM is positioned to capture the vehicle front plate
6: Departure image (fast)	Capture is determined by digital image processing, when ITSCAM is positioned to capture the vehicle rear plate
7: Departure image (slow)	Capture is determined by digital image processing, when ITSCAM is positioned to capture the vehicle rear license plate
8: Continuous	If OCR is disabled or unavailable, images are sent continuously, as fast as network allows. If OCR is enabled, ITSCAM captures images continuously but transmits only the ones which have a plate recognized
9: Periodic (Necessary enable NTP server)	Images are sent at each specific timestamp, regardless I/O signals and without processing the image content
10: High level	Images are sent continuously while I/O is high
11: Low level	Images are sent continuously while I/O is low
12: Rising edge and approaching	Options 2 and 5 combined

9.1.1. Virtual Trigger Description

Virtual Trigger can capture images of vehicles passing through the lane, using only image processing. ITSCAM4XX series Virtual Trigger is based on detecting vehicle movement by statistical analysis. This analysis determines which images are most likely to contain a vehicle with plate.

Comparing the current captured image with its previous frame shows two kinds of regions. One of them corresponds to regions with no significant luminance changes, which means a static region. The other region type has significant luminance differences and it has the moving object.

Another Virtual Trigger feature is the luminance histogram, because vehicle and asphalt populate separate regions of the histogram. However, it is not possible to determine values where these concentrations occur since it depends on lighting conditions and it changes according to the vehicle type and the asphalt itself. It is possible to make a correlation measure between the image and the background image histograms by estimating their standard deviation (Figure 10).

Regions with motion have an important characteristic known as edges. Image edges correspond to an abrupt change of pixel luminance, comparing with its vertical or horizontal neighbor pixel.

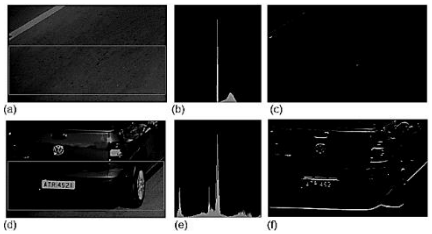


Figure 10 – Histograms of images with and without vehicle

Virtual trigger process begins with the application of smoothing filters that eliminate noise and leave the image more homogeneous. Then, it is extracted a horizontal image projection that is compared with former frame projections. Discontinuity points mean the presence of a moving object in the video. Successive analyzing of video discontinuities can determine movement direction. The movement flow allows monitoring of vehicle entrance and exit from the scene.

The algorithm keeps analyzing images with discontinuities by comparing them with historical data of image characteristics such as edge density and standard deviation. In addition, the algorithm continuously updates data. The capture happens only if comparison matches vehicle presence settings.

However, sun exposure builds object shade and it could cause late or early vehicle captures. To minimize this problem, the algorithm tries to differentiate the object from its shadow, what makes possible to delay or anticipate the catch. However, this algorithm does not avoid capturing object shadow projection from another lane.

For night situations, the procedure described above cannot identify the vehicle and asphalt without artificial lighting. Therefore, another algorithm captures the vehicles based on the position of headlights, which are presumed on, due to lack of lighting in the track (Figure 11). The algorithm seeks for high luminance regions and groups these pixels. The capture happens when some groups match headlight features.

ITSCAM performs the transition between day and night algorithms of digital image processing automatically. The switching takes place when the illumination level is below a certain threshold for a few consecutive frames.

Figure 11 – Night image example

9.2.Multiple Images per Requisition

ITSCAM can capture more than one image per requisition and this feature is available no matter how the requisition is

done (I/O, image processing or network). All captured images are flash synchronized and the time between frames varies according to ITSCAM frame rate (see Table 6).

It is possible to capture reflective and non-reflective plates by combining ITSCAM with multiple images per requisition and Pumatronix illuminators, which illuminate each photo with a different intensity. Thus, reflective plates do not become overexposed because the second image of the bust has low light. The amount of light used in the second capture depends on the illuminator model.

Table 6 – Time between frames and amount of frames per image requisition

Resolution	Time between frames	Amount of frames per requisition
800 x 600	20ms	1 to 16
1280 x 720	44ms	1 to 4

9.3.Read/Write Output Signal

ITSCAM output can be configured to act as a flash trigger or as an I/O signal. I/O signals can be used to activate devices such as gates, sirens and monitoring centrals.

9.4.Flash or Illuminator Firing

Each image acquisition can simultaneously activate the flash through the ITSCAM output. The flash firing can happen moments before shutter. This delay is useful when the flash light takes some time to reach its peak as shown in Figure 2 and Figure 3. The user must know flash/illuminator technical specifications to configure this parameter properly.

Configuration	Operation mode
Off	Flash firing never occurs
Single	Flash is instantly activated when requesting an image via "Photo" command
Single with delay	Flash fires before sensor exposure, according to configured delay (just for the "Photo" command)
Continuous	Flash fires in all ITSCAM internally captured frames. For this flash mode it is recommended to use a device that can fire several times per second
Auto	Flash fires only when the ambient is dark, avoiding shots during the day. This mode provides system energy savings
Auto with delay	Uses the same principle as *Auto*, but it uses the delay to optimize the lighting condition at shutter
Continuous on Night Mode	Flash fires in all ITSCAM internally captured frames, just when Night Mode is active

9.5.ITSCAM supported Servers

ITSCAM can communicate with many different types of servers, properly configured. Table 7 shows the supported servers and how the connection works using ITSCAM.

Table 7 – ITSCAM 4XX compatible servers

Server	ITSCAM interaction
FTP	Images are sent to a FTP server
ITSCAM PRO	ITSCAMPRO allows the receiving of images and vehicle plates (if ITSCAM has embedded OCR). ITSCAMPRO concentrates captures and can make reports (contact Pumatronix for more information about this software)
RTSP	Real Timing Streaming sever can be enabled to make ITSCAM send video by the link: rtsp://ITSCAM_IP_ADDRESS:PORT/mjpeg. If using server port is set to 554, which is RTSP default, the link turns to: rtsp://ITSCAM_IP_ADDRESS/mjpeg
Panoramic	Server for using NM1 system (contact Pumatronix for more information about this software)
Serial Port	ITSCAM creates a TCP server on specified port and all content that flows on serial port is redirected to the TCP server
NTP	Server to synchronize ITSCAM time
File	Internally stores up to 8192 images, with 55MB limit space. This server uses a specific protocol to retrieve the images and server port must be other than 50,000

9.5.1. ITSCAM File Server

ITSCAM can use up to 55MB of internal memory for image storage, when the server type is set to *File*. Communication port must be other 50,000 to allow images to be saved.

File server has a specific communication protocol (listed on Table 8). All commands are followed by a 16-bit CRC (as specified in CRC – Cyclic Redundancy Check). Further explanation of communication with ITSCAM is available in ITSCAM Command Pattern for Sending and Receiving Data.

Table 8 – Commands to manipulate ITSCAM stored images (in hexadecimal)

Command AA*h* 02*h* 01*h* 00*h* [CRC (2 Bytes)]	
Meaning: Request an ITSCAM stored image (chronological order not assured)	**Response:** AA*h* 02*h* 01*h* [image size (4 Bytes)][*image* (n Bytes)]
Command AA*h* 66*h* [CRC (2 Bytes)]	
Meaning: Exclude the image sent by *AAh 02h 01h 00h* command, releasing memory	**Response:** AA*h* 66*h* [00*h* (error) or 01*h* (success)]
Command AA*h* 83*h* [CRC (2 Bytes)]	
Meaning: Request free memory percentage	**Response:** AA*h* 83*h* [0 to 100% (1 Byte)]
Command AA*h* 86*h* [CRC (2 Bytes)]	
Meaning: Request amount of stored images	**Response:** AA*h* 86*h* [amount of images (2 Bytes)]

Retrieving images saved on ITSCAM memory requires a loop. In addition, it is necessary to check if new pictures were stored during download process. Figure 12 illustrates the steps to extract all images.

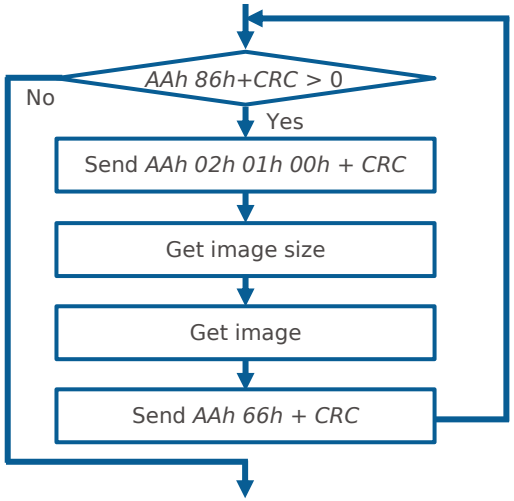


Figure 12 – ITSCAM image download for File server type

9.6.ITSCAM Network Settings

ITSCAM network settings are saved in flash memory and become valid only after ITSCAM reboots.

Configuration	Operation mode
MAC Address	ITSCAM MAC address cannot be changed
IP Address	Address to access ITSCAM. The default IP address is *192.168.0.254*. If changed, the new address is saved in flash memory and becomes the ITSCAM IP address after it reboots.
	ITSCAM has a second IP address (*192.168.254.254*), which is useful when IP address is unknown
Netmask	Defines ITSCAM network mask. When altered, it is saved on flash memory and becomes TSCAM network mask when it reboots
Gateway	IP address of an intermediate device that connects ITSCAM to other networks. When changed, the new gateway is saved in flash memory and becomes valid after ITSCAM reboots

9.6.1. Recover Access to ITSCAM

ITSCAM secondary IP address 192.168.254.254 is disabled when the primary IP address conflicts with it. This conflict occurs whenever the IP address 192.168.254.254 (which has network mask of 255.255.255.0) is on the same subnet as the primary IP address (see Table 9).

There is no way to recover the connection with ITSCAM in case of loss of primary configured IP address if this address conflicts with the secondary IP address.

Table 9 – Avoiding situations on ITSCAM network settings

Most common situations of primary and secondary IP address conflict
Primary ITSCAM address on *192.168.254.x* and netmask *255.255.255.0*
Primary ITSCAM address on *192.168.x.x* and netmask *255.255.0.0*
Primary ITSCAM address on *192.x.x.x* and netmask *255.0.0.0*
Netmask *0.0.0.0*

10. Image Rotation

ITSCAM 4XX Vigia+ allows its installation upside down, because images can be rotated 180°.

11. ITSCAM Adjusts to Produce Traffic Control Images

ITSCAM is designed to provide images for automatic recognition of vehicle license plates. To maximize recognition rates it is recommended to use ITSCAM with Multiple Images per Requisition feature enabled, because there are vehicles with reflective license plates and others with non-reflective plates.

ITSCAM Web interface can adjust ITSCAM settings. In addition, software available at www.pumatronix.com.br can change ITSCAM settings and save images.

Pay attention when changing certain parameters:

During daytime, change desired level

During nighttime, change gain and shutter

Adjust ITSCAM in a way that images show vehicle license plate characters perfectly, with background contrast. During night, when using multiple captures per request, ITSCAM parameters must produce images in which first shot allows recognition of non-reflective plates and the second capture allows recognition of reflective plates. A starting point to achieve images in these conditions is ITSCAM Default Settings.

Maximum gain	Adjust to minimize the noise of night images and display the reflective plate without overexposing it
Maximum Shutter	Adjust to capture night images without blurring
Desired Level (luminance)	Adjust to produce daytime images with good contrast and no saturation. It can be changed at specific day hours due to the sun's position
Auto iris	Must be enabled to allow ITSCAM to adjust auto iris lenses

11.1. Day/Night Mode

ITSCAM Day and Night mode can provide color images in daylight and black and white images at night (capturing infrared light). ITSCAM criteria (when operating in Automatic) to change between Day and Night mode are diagrammed in Figure 13. The opposite sequence happens for Night/Day transition.

Configuration	Operation mode
Manual	Provide images always in Day or Night format
Auto	Based on ambient light, ITSCAM chooses the black-and-white or color format. To use this option, gain and shutter parameters should be set to *Auto*. *Operating in Day (color) mode:* ITSCAM

	automatically switches to Night mode when shutter and gain reach their maximum value and luminance level reaches the specified value for transition. *Operating at Night (Black and white) mode:* ITSCAM automatically switches to Day mode when shutter reaches the specified percentage for transition

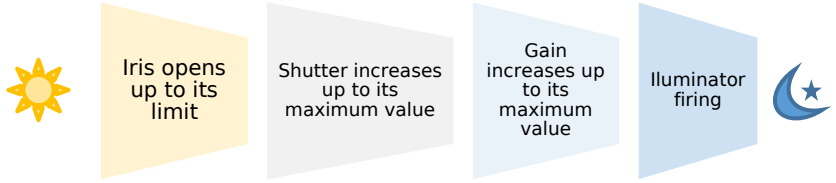


Figure 13 – ITSCAM adjust sequence for Day to Night mode transition. This sequence take place on reverse order for changing from Night to Day mode

11.2. Shutter (Image Sensor Light Exposure Time)

Shutter corresponds to the time that image sensor is exposed to light to form an image. High shutter values can produce blurred images. Table 10 shows typical correspondence between speed, ITSCAM resolution and Shutter.

Configuration	Operation mode
Manual	Keeps an specified value
Auto	Adjusts based on ambient conditions up to maximum specified limit

Table 10 – Default values for configuring ITSCAM shutter according to resolution and lane speed

Lane speed	Resolution	Estimated shutter
Up to 60 Km/h	800 x 600	30 to 60
	1280 x 720	22 to 44
More than 60 Km/h	800 x 600	15 to 30
	1280 x 720	11 to 22

Shutter values are set according to the ITSCAM resolution and vary from 1 (shortest exposure time) up to the maximum time each ITSCAM model supports (longer exposure), as shown in Table 11.

Table 11 – Maximum shutter allowed for ITSCAM according to its resolution and time of each shutter step (in microseconds)

Resolution	Maximum shutter	Shutter step in µs
800 x 600	600	31,25
1280 x 720	700	44,4

Table 12 shows the most common shutter values and its corresponding exposure time in seconds.

Table 12 – Shutter value and exposition time (in seconds)

Shutter	800 x 600 pixels	1280 x 720 pixels
1	1/ 32000	1/ 22522
2	1/ 16000	1/ 11261
3	1/ 10666	1/7507
5	1/6400	1/4504
10	1/3200	1/2252
15	1/2133	1/1501
20	1/1600	1/1126
30	1/1066	1/750

40	1/800	1/563
50	1/640	1/450
60	1/533	1/375

11.3. Gain (Electronic)

The electronic gain serves to make image brighter, improving the appearance of the image by emphasizing content. The gain should not be too high because noise increases too.

Minimum value	Maximum value
0 – without electronic gain	72

Configuration	Operation mode
Manual	Keeps an specified value
Auto	Adjusts based on ambient conditions up to maximum specified limit

11.4. Desired Level of Image Luminance

Desired luminance level defines the behavior of the gain and shutter, adjusting them to produce darker or brighter images. This parameter can be changed by the client application at specific times of the day to compensate sun position changes.

Minimum value	Maximum value
7	62
20 (with gamma enabled)	62

11.5. ITSCAM Current Level of Luminance

Current luminance level is a parameter supplied by ITSCAM that informs the image current lighting condition. When ITSCAM has automatic shutter and automatic gain, it will tend to maintain the current level of luminance to the desired level. To do so, ITSCAM adjusts shutter and gain values as needed, up to the maximum specified values.

During nighttime, usually adjusting shutter and gain to their maximum values will not make luminance level reach the desired level. In this case, ITSCAM needs to activate the flash. The recommended flash setting is "Auto" or "Auto with delay".

If the current luminance level is greater than the desired value, ITSCAM acts according to the type of lens (with or without auto iris).

Lens with disabled auto iris DC: First ITSCAM reduce gain and then shutter. It is possible that, at times with direct incidence of sunlight on the monitored object, even with the gain and shutter in the minimum values (0 for gain and 1 for shutter), the current luminance level still be higher than the desired level. In

such cases, it is recommended to slightly close lens iris, manually.

- **Lens with auto iris DC:** Available for ITSCAM310 and above. In this case, ITSCAM decreases the gain down to 0 and then shutter down to 7. If luminance level is not reached, ITSCAM adjusts lens iris opening.

11.6. Gamma

Gamma is an operation that produces a logarithmic response to pixel intensity in order to improve contrast and luminance. It may be useful to enhance images in which vehicle plate is in the shade.

ITSCAM image sensor reads the pixel value with 10-bit resolution. Therefore, sensor pixel values varies from 0 to 1023. In order to produce digital images in JPEG or BMP format, it is necessary to convert 10-bit values to 8-bit values according to selected gamma. Figure 14 shows an example of gamma conversion.

Minimum value	Maximum value
70	255

Configuration	Operation mode
Off	Pixel value conversion from 10 bits to 8 bits is linear
On	Pixel value conversion from 10 bits to 8 bits is logarithmic

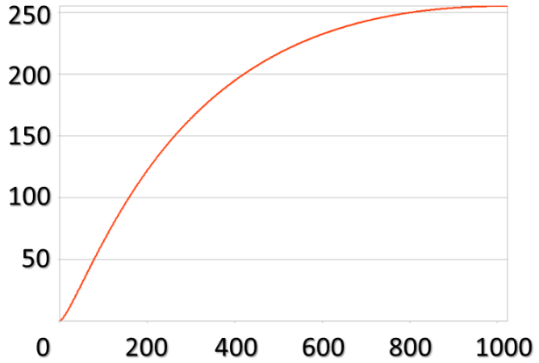


Figure 14 – Example of a gamma curve (Gamma value: 140). It converts sensor pixel value (that varies from 0 to 1023) in a logarithmic way to 8-bit value (that varies from 0 to 255)

11.7. White Balance

White balance makes color adjustments by changing red, green and blue image channels weight.

Minimum value	Maximum value
0 – ITSCAM automatically adjusts R, G and B values	255

Configuration	Operation mode
RGB chosen value	ITSCAM keeps specified value for each channel
Auto (value 0)	ITSCAM estimates RGB channel balance

11.8. Edge Sharpening

Edge sharpening is a digital filter for edge sharpening. Algorithms make the image edges noticeable, giving more contrast to the contours and giving the impression that the image has better focus. This feature improves the images visually, but since OCR algorithms perform similar processing, the activation of this parameter can reduce detection rate.

Configuration	Operation mode
0	Disable edge sharpening
1	1st order edge sharpening filter algorithm
2	2nd order edge sharpening filter algorithm
3	2nd order edge sharpening filter with smooth detection algorithm

11.9. Saturation

Saturation corresponds to color proportion in comparison to the average gray color, i.e., its minimum value corresponds to gray color and its maximum corresponds to pure color.

Minimum value	Maximum value
0	255

11.10. Brightness or Black Level

Brightness or black level corrects the image dark tones. The value set to this parameter is subtracted from all image pixels value. Therefore, when this parameter is set to the maximum value allowed, the resulting image is completely black.

Minimum value	Maximum value
0	255

11.11. Contrast or Digital Gain (%)

Contrast, or digital gain, corresponds to multiply by a factor all image pixels after its capture. It is not recommended to change this factor to values different from 100% (which corresponds to 1.00 multiplicative factor).

Changing this parameter can distort images because ITSCAM automatic adjustments are done before this multiplication.

Minimum value	Maximum value
0	255

Configuration	Operation mode
0	Multiply by 0 all pixels in the image - making the resulting image completely black
100	Multiply by 1 image pixels provided by ITSCAM – no image change
255	Multiply by 2.55 all image pixels

12. Differentiated Settings

In many environments, it is needed to specify daytime and nighttime settings, so ITSCAM can successfully operate in both DAY mode and NIGHT mode. Some parameters can have a second value that will overwrite the standard value during a specified mode (which can be Day or Night). Therefore, when ITSCAM operates in the specified mode, it will use the second value; otherwise it will use the standard value.

13. Configuring Regions of Interest for ITSCAM Auto-tuning

In situations where part of the image is under sun light incidence and part is in the shadow, the algorithm of auto-tuning will calculate an average of pixel values. It is possible that images of vehicles plates caught in the shadow region will have dark characters. The same applies to images of plates captured with direct sun light, because they might have overexposed characters.

To mitigate this situation, ITSCAM allows selecting the contribution of each region of the image during the execution of auto-tuning algorithm, which maintains the current level of luminance equivalent to the desired level. This contribution is proportional to the value specified for the region. Figure 15 shows an example of image regions.

Minimum value	Maximum value
0	15

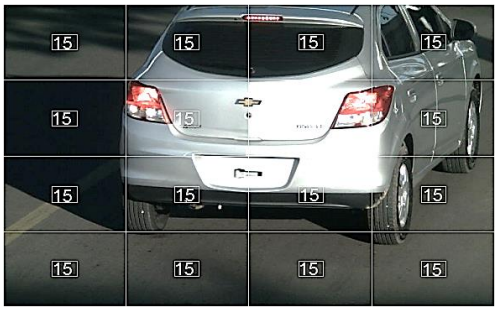


Figure 15 – Image showing regions of interest location and values

14. ITSCAM Configuration Using Java Technology

ITSCAM has a Web interface for configuration and displaying images. This interface is accessible by a Web Browser. Devices that communicate with ITSCAM need the updated version of Java SE Runtime Edition (JRE), available at http://java.com/download.

Web interface does not save images on disk because browser security policies do not allow this operation to be done by JAVA Applet. To save photos it is necessary to download and

use software that communicates with ITSCAM at www.pumatronix.com.br.

14.1. Access ITSCAM for the First Time

Web Interface is a tool to establish a connection between user and ITSCAM. To access ITSCAM for the first time, it is necessary a network in which ITSCAM default IP *192.168.0.254* is valid. So, it is needed a computer with an IP address of *192.168.0.x* and netmask *255.255.255.0*. This computer must have a browser with Java JRE installed. After accessing the URL http://192.168.0.254/java/index.html, inform:

User	admin
Password	123

On first access, it is possible to change ITSCAM network settings, but these changes will take effect only after ITSCAM reboots.

14.2. Access ITSCAM After Changing Default Network Configuration

Devices that have web browser and Java JRE can access ITSCAM. The procedure to access ITSCAM starts with typing the address *ITSCAM_IP/java/index.html* on the browser, followed by its configured user and password. In case of access lost, see Recover Access to ITSCAM.

14.3. General Tab of Web Interface

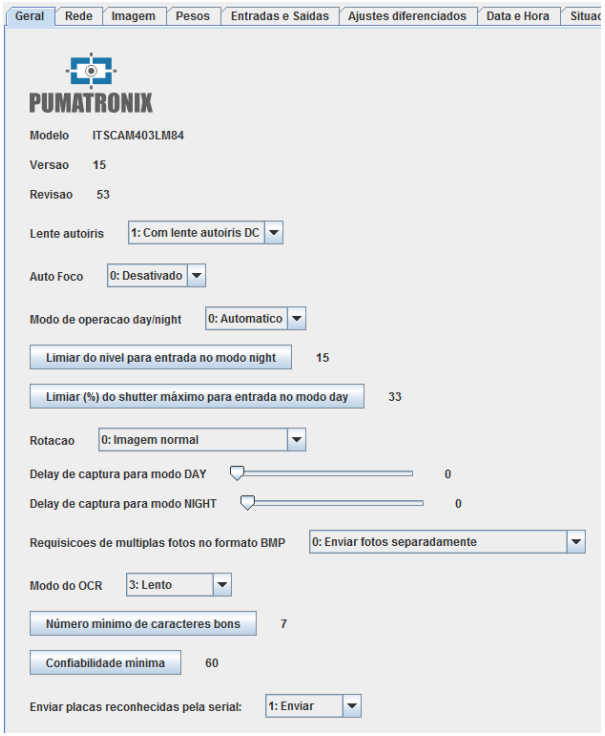


Figure 16 – General tab of ITSCAM Web interface

Configuration	Operation mode	Range
Model	Connected ITSCAM model	-
Version	Installed firmware version	-
Revision	Installed firmware revision	-
Auto iris lens	Compatible lens described at L. 0: ITSCAM without auto iris DC 1: ITSCAM with auto iris DC	0 to 1
Auto focus	Defines if ITSCAM will adjust focus after zooming	0 to 1
Day/Night Mode	0: Auto 1: Day 2: Night See Day/Night Mode	0 to 2
Threshold to Night mode	Set luminance value to ITSCAM change from Day to Night mode. See Day/Night Mode	5 to 40
Threshold (%) maximum shutter to Day mode	Set shutter percentage to ITSCAM change from Night to Day mode. See Shutter (Image Sensor Light Exposure Time)	0 to 100
Rotation	Rotate image 180°	-
Capture delay for Day mode	Just for multiple captures: 0: ITSCAM captures images one right after other 1 to 100: ITSCAM captures first image	0 to 100
Capture delay for Night mode		
	and drops the specified amount of frames between the next images of the burst	
Multiple requisition with BMP images	0: send each captured image (from multiple captures) in distinct files 1: join all BMP captured images in just one file	0 to 1
OCR mode (Verify if ITSCAM has this feature)	0: Off 1 to 4: ITSCAM OCR complexity. 1 uses less ITSCAM processing to read vehicle plate and it is faster than other modes. 4 mode applies more complex image processing, takes more time and recognizes more vehicle plates	0 to 4
Amount of valid characters	Minimal number of correct characters that a vehicle plate must have. If it is recognized with smaller reliability than specified, the character is replaced by “-“	0 to 7
Minimum character reliability	Similarity degree between the image character and another captured in perfect conditions	0 to 100

Send recognized plates via serial	Send recognized plate through ITSCAM serial connection	0 to 2

14.4. Network Tab of Web Interface

Figure 17 – Network tab of ITSCAM Web interface

Configuration	Operation mode	Range
MAC address	Show ITSCAM MAC address. It cannot be changed	-
IP address	Show and allow editing ITSCAM IP address. Reboot ITSCAM to apply changes	-
Netmask	Show and allow editing ITSCAM netmask. Reboot ITSCAM to apply changes	-
Gateway	Show and allow editing ITSCAM gateway. Reboot ITSCAM to apply changes	-
DNS Server	Show and allow editing ITSCAM DNS server. Reboot ITSCAM to apply changes	-
www password	ITSCAM Web interface password	-
Photo server	Specify where ITSCAM images will be stored	-
Server address	Server IP address that ITSCAM will send data	-
Server port	Server port that ITSCAM will send data	-
Send photos to ITSCAMPRO (server type)	0: send just one image 1: send all captures	0 to 1
Redundant server address	IP address of redundant server	-

	that is used on fault cases (valid only for FTP server)	
Redundant server port	FTP redundant server port number	-
FTP user	FTP server authentication user	-
FTP password	FTP server authentication password	-
FTP file	It must begin with "/" and it is specified as Table 13. Values can be truncated by inserting the number between "%" and character	-
FTP image resolution	0: send image with ITSCAM resolution 1: send image resized to 320x240 pixels	0 to 1

Table 13 – Symbols for FTP filename generation

Symbol	Filename correspondence
%u	Single identifier
%d	Day
%m	Month
%y	Year
%h	Hour
%n	Minute
%s	Second
%p	Vehicle plate
%i	ITSCAM IP address
%c	Image counter (restarts when ITSCAM reboots)
%v	Daylight saving – V for images on daylight saving and N for regular time
%a	ITSCAM that performed the capture MAC address

14.5. Serial Port Tab of Web Interface

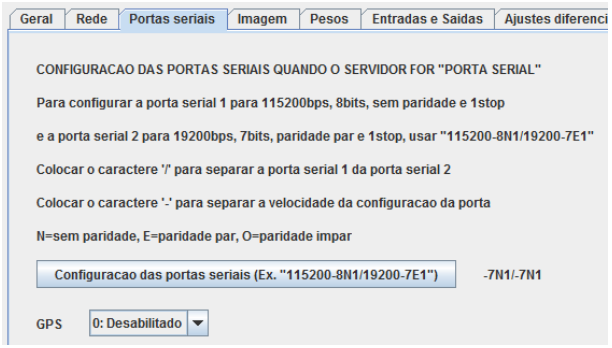


Figure 18 – Serial Port tab of ITSCAM Web interface

Configuration	Operation mode	Range
Serial port settings	Set ITSCAM serial port for connected equipment compatibility	-
GPS (see if feature is available)	0: Use serial interface as server 1: Set for GPS use 2: For image request trigger	0 to 2

14.6. Image Tab of Web Interface

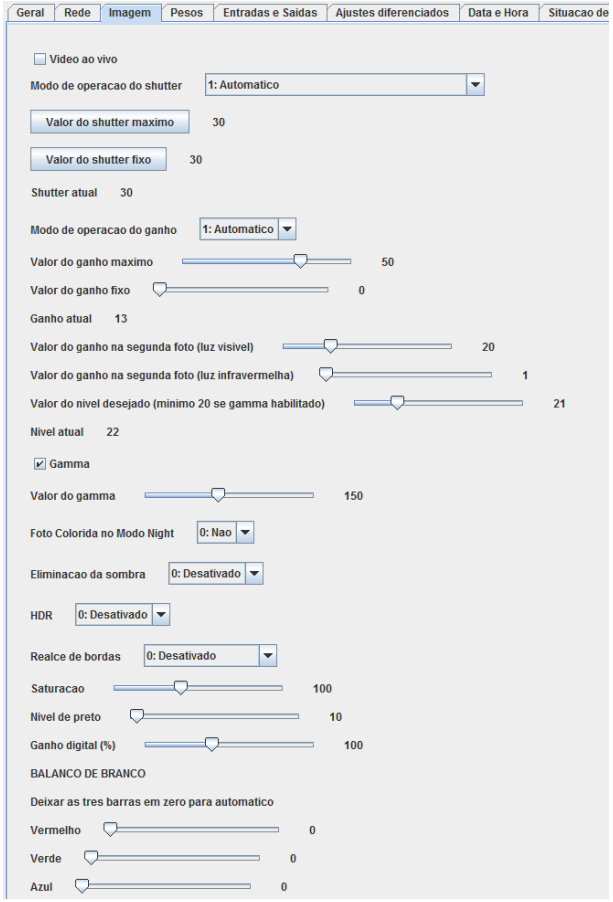


Figure 19 – Image tab of ITSCAM Web interface

Configuration	Operation mode	Range
Live video	Show real time video. For better frame rate, it is recommended to turn off applications that require ITSCAM images	-
Shutter	See Shutter (Image Sensor Light Exposure Time) 0: Keep ITSCAM shutter at the static value set (necessary set *Static shutter*) 1: Let ITSCAM establish the value (necessary set *Maximum shutter*) 2: Keep ITSCAM shutter at the static value during *Day* mode and let ITSCAM pick the best value for *Night* mode (necessary set *Maximum shutter* and *Static shutter*)	0 to 2
Maximum shutter	Maximum value ITSCAM reaches, when operating on Auto mode. See Shutter (Image Sensor Light Exposure Time)	1 to ITSCAM limit value
Static shutter	Shutter value ITSCAM keeps. See Shutter (Image Sensor Light Exposure Time)	1 to ITSCAM limit value
Current shutter	Shows ITSCAM current shutter	-
Gain	Artificially brightens captured	0 to 1

	images by improving their appearance (emphasizing content and noise). See Gain (Electronic). 0: Static (necessary set *Static gain*) 1: Auto (necessary set *Maximum gain*)	
Maximum gain	Maximum gain that ITSCAM uses while operating with *Auto gain*	0 to 72
Static gain	Gain value that ITSCAM keeps on Static mode	0 to 72
Current gain	Shows current ITSCAM gain	-
Gain on second photo (visible light)	*When using multiple captures:* Gain ITSCAM applies on second capture (just for visible light)	0 to 72
Gain on second photo (infrared light)	*When using multiple captures:* Gain ITSCAM applies on second capture (just for infrared light)	0 to 72
Desired level (at least 20 if gamma enabled)	Defines gain and shutter behavior to make image brighter or darker. High values produce brighter images	7 to 62
Current level	Shows current ITSCAM level	-
Gamma	Logarithmic curve that allows dark areas to become more visible *Unmarked:* make sensor response linearly *Marked:* apply basic logarithmic curve on pixel value. See Gamma	-
Gamma value	110: recommended for images where vehicle plate is in the shadow 150: default recommended value	70 to 255
Color photo in night mode	Force ITSCAM to capture color images at *Night* mode. It is not equivalent to force ITSCAM to operate always on *Day* mode	0 to 1
Shadow elimination	Remove shadows of night images that might appear near bright regions like car headlights	0 to 8
Edge sharpening	Sharpen edges and try to make image more focused. Enable this function is not recommended for OCR purposes. See Edge Sharpening	0 to 3
Saturation	Defines color intensities on the	0 to 255

	image (See Saturation). 0: minimal value (greyscale image) 100: recommended value 255: maximal saturation	
Black level	Adjust dark tones to avoid black turning grey 0: minimum value 3: recommended value for Night mode 10: recommended value for Day mode 255: maximum value	0 to 255
Digital gain (%)	After capturing image, ITSCAM applies a digital gain. It corresponds to multiply each pixel to selected value (See Contrast or Digital Gain (%)). 0: pixels multiplied by 0 (image turns black) 100: recommended value (pixels are multiplied by 1) 255: pixels are multiplied by 2.55	0 to 255
Red, Green and Blue	Adjusts image color channels R (red), G (green) and B (blue) 0: ITSCAM automatically	0 to 255

	estimates channel values	

14.7. Weights Tab of Web Interface

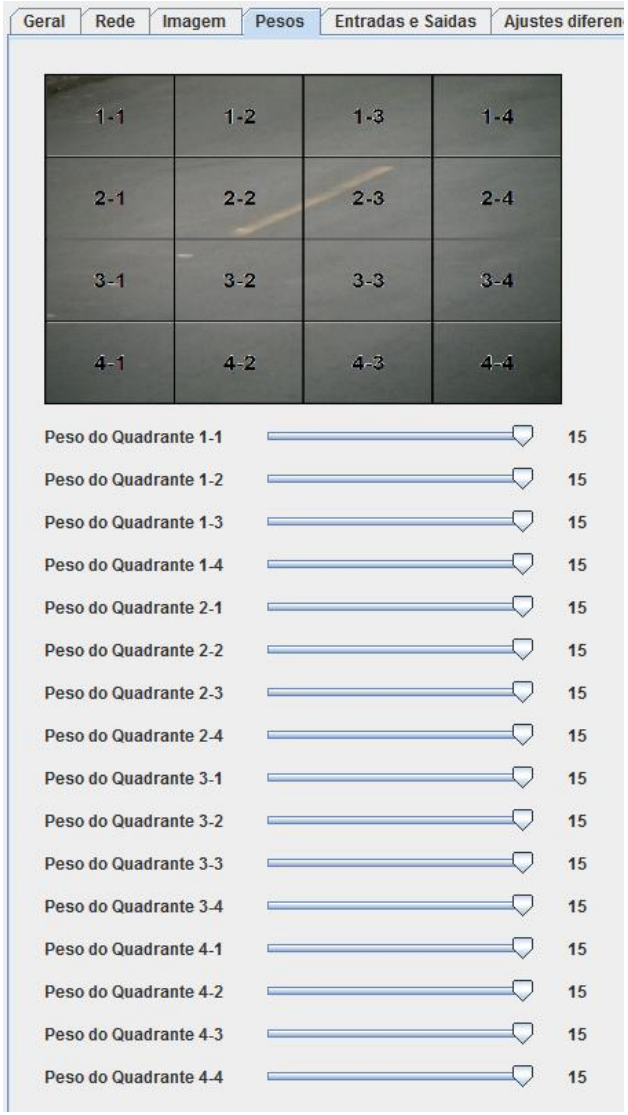


Figure 20 – Weights tab of ITSCAM Web interface

Configuration	Operation mode	Range
Quadrant weight n-m	In situations where part of the image is under direct sunlight and part is in shadow, image automatic tuning algorithm will hold an average of pixel values. Maybe, images captured with license plate in the shadow region will be dark. License plates captured in the sunny region will be overexposed. To mitigate this situation, it is possible to select each image region contribution on equipment auto-tuning. The algorithm serves to maintain the current level of brightness equivalent to the desired level. It is possible to modify the quadrant weights, to make some more important than others when ITSCAM calculates the luminance level. Region value can vary from 0 to 15 (maximum importance).	0 to 15

14.8. Input and Output Tab of Web Interface

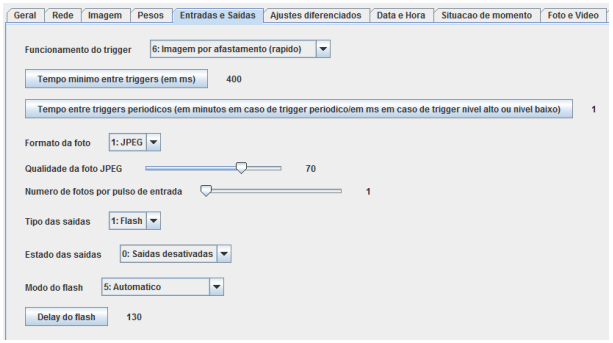


Figure 21 – Input and Output tab of ITSCAM Web interface

Configuration	Operation mode	Range
Trigger	Specify how images will be required. See Image Trigger – Input Signal	1 to 12
Minimum time between triggers (milliseconds)	Minimum amount of time between two I/O pulses. Pulses during this time are ignored	0 to 60000
Periodic time between triggers	*Periodic trigger enabled:* time in minutes between image requests *Trigger by level enabled:* time in milliseconds between image requests	0 to 60000
Photo format	ITSCAM image format on trigger	0 to 1
	modes. Embedded OCR requires JPEG format	
JPEG image quality	100: Better image quality (lossless)	0 to 100
Amount of images per requisition	Configure the amount of captures per request. Images will have 1 frame plus *Capture delay* difference. See Multiple Images per Requisition	1 to ITSCAM limit value
OUT1 operation	1: OUT1 is used for firing flash or illuminator 2: OUT1 is controlled by user application	1 to 2
Output status	0: OUT1 and OUT2 Off 1: OUT1 on and OUT2 Off 2: OUT1 Off and OUT2 On 3: OUT1 and OUT2 On If OUT1 is configured for firing flash or illuminator, the value selected for OUT1 is ignored	0 to 3
Flash mode	Each image request can activate flash by ITSCAM output. Activation can happen moments before shutter (time configured as *Flash delay*). See Flash or Illuminator Firing	1 to 7

Flash delay	Delay between flash fire and shutter. Steps have 0,4µs each	100 to 25000

14.9. Differentiated Settings Tab of Web Interface

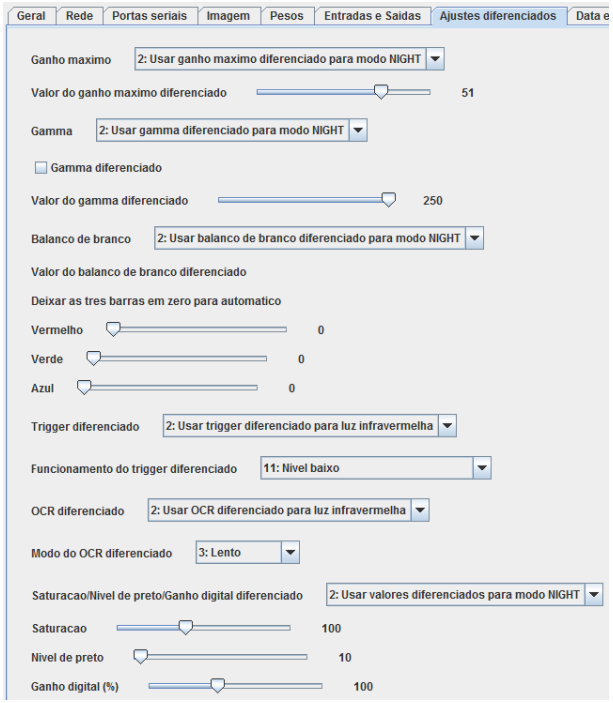


Figure 22 – Differentiated adjust tab of ITSCAM Web interface

Configuration	Operation mode	Range
Maximum gain	Enable or disable a second value for maximum gain. 0: Second value disabled 1: Second value enabled in Day mode 2: Second value enabled in Night mode	0 to 2
Maximum differentiated gain value	Value of the second maximum gain	0 to 72
Gamma	Configure differentiated gamma behavior	0 to 2
Differentiated Gamma	Mark to use differentiated gamma	-
Differentiated Gamma value	70: recommended value	70 to 255
White balance	White balance - Color channels R (red), G (green) and B (blue) influence	0 to 2
Red		0 to 255
Green		
Blue		
Differentiated trigger	Select differentiated trigger mode, based on light type	0 to 2
Differentiated trigger configuration	Specify trigger mode for differentiated value	1 to 12
Differentiated OCR	Select differentiated OCR mode, based on light type	0 to 2
Differentiated OCR mode	Specify OCR mode for differentiated value	0 to 4

Saturation	It is the color proportion in comparison to the average gray color, i.e., its minimum value corresponds to gray and its maximum is pure color 0: Grayscale image 100: recommended value 255: Fully colored	0 to 255
Brightness (black level)	Correct image black tones. The value set is subtracted from all image pixels. Therefore, its maximum value results in completely black image 0: pixel value without subtraction 3: recommended value for Night mode 10: recommended value for Day mode 255: Black image	0 to 255
Gain	Artificially lighten captured images by improving their appearance. 0: pixel value multiplied by 0 (black image) 100: recommended value (multiplied by 1) 255: Multiplied by 2.55	0 a 255

14.10. Date and Time Tab of Web Interface

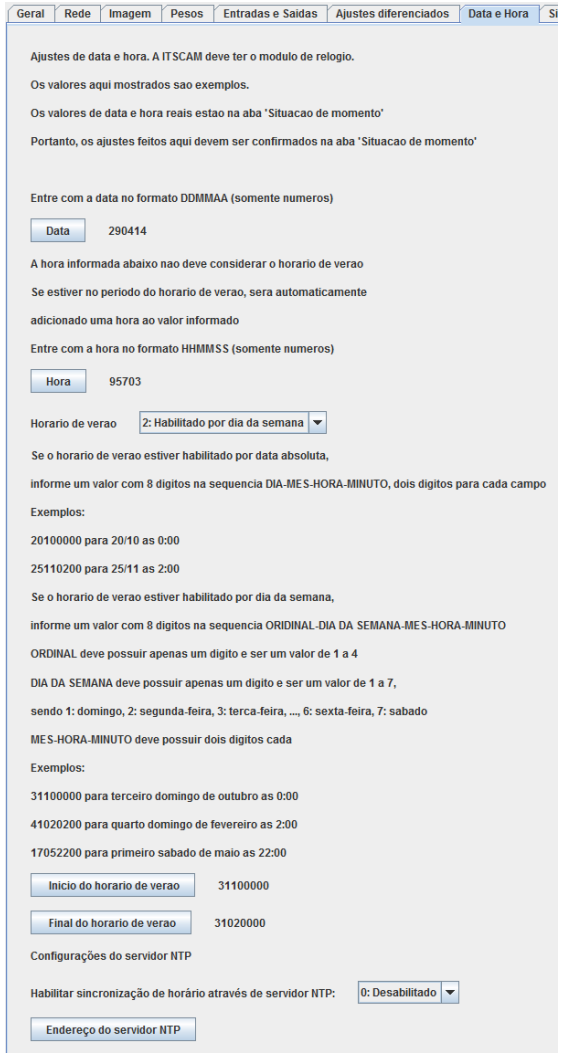


Figure 23 – Date and Time tab of ITSCAM Web interface

Configuration	Operation mode	Range
Date	Adjust date formatted as: DDMMYY	010101 to 311299
Time	Adjust time formatted as: HHMMSS (without daylight saving time)	000000 to 235959
Daylight saving	Specify when daylight saving is used	0 to 2
Beginning of daylight saving	Adjust date formatted as: Day-Month-Hour-Minute	-
End of daylight saving	Adjust date formatted as: Day-Month-Hour-Minute	-
Enable NTP server hour synchronization	Enable clock update by NTP server	0 to 1
NTP server Address	Address to clock update	-

14.11. Current Situation Tab of Web Interface

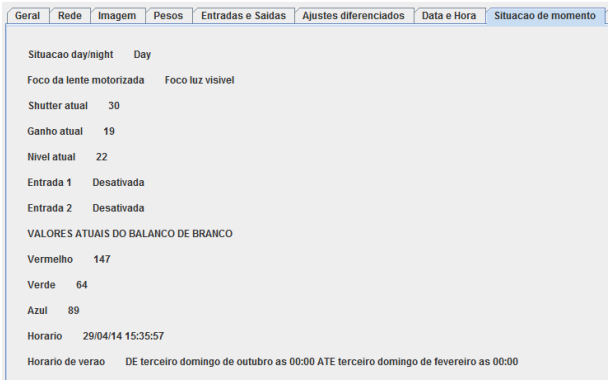


Figure 24 – Current situation of ITSCAM Web interface

This tab shows ITSCAM status.

14.12. Photo and Video Tab of Web Interface

There are zoom and focus buttons for remote setting.

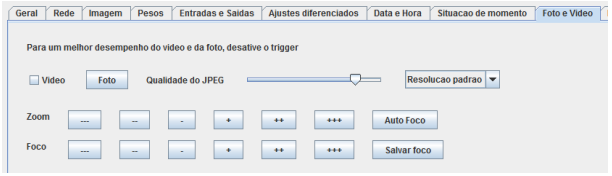


Figure 25 – Photo and Video Tab of ITSCAM Web Interface

Configuration	Operation mode	Range
Video	Real time image. For better performance, it is recommended to turn off software that also requires	-

	images and trigger functionality	
Photo	ITSCAM image request	-
JPEG quality	Higher values have low quality loss, when using “*Photo*” button	0 to 100
Default Resolution	Resolution to view images when using *Photo* button	ITSCAM available resolutions
Zoom	Zoom configuration. Amount of signals “+” and “-” determines steps. Available only in ITSCAM with motorized lens	Lens physical limit
Auto focus	Run ITSCAM auto focus process. Available only in ITSCAM with motorized lens	-
Focus	Allow setting focus. Available only in ITSCAM with motorized lens. It is necessary save day and night focus, because motorized lens does not correct infrared light perfectly	-
Save focus	Stores current ITSCAM focus configuration. This value is loaded when ITSCAM restarts.	-

14.13. Firmware Update Tab of Web Interface

Figure 26 – Firmware tab of ITSCAM Web interface

Configuration	Operation mode	Range
Firmware CRC	CRC is the last 4 digits in firmware filename, just before *“.frw”*	0000 to FFFF
Update firmware	Specifies firmware path. Update will occur just if *Firmware CRC* matches file value	-

15. Web Interface without Java

Since firmware version 16, there is a new interface without Java technology, compatible with browsers *Internet Explorer 11, Google Chrome 38, Firefox 21, Opera 25, Safari 8* and browser’s newer versions. Although, login is still necessary to access ITSCAM.

User	admin
Password	123

Interface header shows ITSCAM main information, as resolution, MAC address and current firmware (with version and build date). Pumatronix logo automatically redirects to its site and footer shows how to direct communicate with Pumatronix support. Detailed info and help about commands and settings are available over the sign ? and on this document.

15.1. Main Window of ITSCAM Web Interface without Java

After ITSCAM login, the main window shown looks like Figure 27.

Figure 27 – Main window of ITSCAM web interface for firmware version 16

Button	Meaning
Settings	Show ITSCAM parameters grouped by functionality
Downloads	Redirect to Pumatronix support page
Reboot	Send reboot command. It is necessary to wait about 30 seconds and reload page to retrieve connection with ITSCAM
Status	Show current ITSCAM image, parameter values, input and output status
Configuration File	Allows import and export a text file with all ITSCAM configuration. This file can be changed using a simple text editor. The importing process overwrites network (including IP address), servers, input and output, positioning (except zoom and focus), image settings and OCR configuration
Firmware update	Update ITSCAM firmware

15.2. ITSCAM Parameters on Web Interface Without Java

ITSCAM configurations are grouped by functionality, as shown in Figure 28. Some parameters require ITSCAM reboot and in such cases this information is displayed and reboot automatically occurs. After an ITSCAM reboot, browser page needs to be reloaded.

***Apply* button must be pressed to send changes to ITSCAM.**

Figure 28 – Configurations of ITSCAM web interface for firmware version 16

Button	Configurations
Network	Network Web interface access (need reboot to apply configurations)
Servers	ITSCAM supported servers NTP server GPS (need reboot to apply configurations)
Date and time	Date and time, including daylight saving
General	Test mode, rotation, auto iris, Day/Night mode
Inputs and Outputs	Capture firing (external trigger) – input Generated image
	Output
Image Settings	Image settings that can differ for visible and infrared light
Light Settings	Level, gain, shutter, etc.
Zoom and Focus	Zoom, Focus and Autofocus
Weights	Image region weights
OCR	ITSCAM with embedded OCR: OCR settings for visible and infrared light

16. ITSCAM Default Settings

Today, vehicles can have reflective or non-reflective license plates. The configuration of multiple exposures per request aims to increase recognition rate. Parameters values provided are the basis for installations using ITSCAM and ITSLUX illuminator.

Parameters that are not presented in this configuration depend on the application. Examples of these settings are network and image transmission server.

These settings are a starting point for equipment installation, although they may vary depending on the installation environment.

16.1. Default Settings for Web Interface with Java

Tab	Parameter	Recommended value
General	Auto iris	With DC auto iris lens
	Auto focus	Off

	Day/Night Mode	Auto
	Threshold to Night mode	15
	Threshold (%) maximum shutter to Day mode	33
	Rotation	According to installation
	Capture delay for Day mode	Check flash technical specification
	Capture delay for Night mode	Check flash technical specification
	Multiple requisition with BMP images	According to installation
	OCR mode	Verify if ITSCAM has this feature and what configuration best fits the application
	Minimum number of good characters	7
	Minimum reliability	60
	Send recognized plates via serial	According to installation
Image	Shutter	Auto
	Maximum shutter	Check suggested values on Shutter (Image Sensor Light Exposure Time)
	Gain	Auto
	Maximum gain	40 (adjust at night)
	Gain on second photo (visible light)	20
	Gain on second photo (infrared light)	0
	Desired level	20
	Gamma	On
	Gamma value	110
	Shadow Elimination	Off
	Edge sharpening	Off
	Saturation	100
	Black level	10
	Digital gain	100
	White balance	0 for all color channels

Input & Output	Trigger	According to installation
	Minimum time between triggers (microseconds)	According to installation
	Periodic time between triggers	According to installation
	Photo format	JPEG
	JPEG image quality	70
	Amount of images per requisition	2 to 4
	Output type	According to installation
	Output status	According to installation
	Flash mode	Auto
	Flash delay	Check flash technical specification
Diff. Settings	Differentiated Settings – Maximum gain	Use maximum differentiated gain for day mode
	Maximum gain value	50
	Differentiated gamma	Use differentiated gamma for Night mode
	Differentiated gamma value	0 and unmark gamma option
	Differentiated white balance	Do not use differentiated white balance
	Differentiated Trigger and OCR	According to installation

16.2. Default Settings for Web Interface without Java

Place	Parameter	Recommended value
Network	Network	According to installation
	Password protection on all HTTP protocol communication	Yes

Servers	Servers	According to installation
	Use Network Time Protocol - NTP	Marked
	NTP address	a.ntp.br
General	Mode	Auto
	Rotate image 180°	According to installation
	Auto Iris DC lens	Set
	Threshold for chaging from Day to Night Mode	15
	Threshold for changing from visible to infrared light	5
	Droped frames between multiple captures	0
	Maximum shutter for changing from Night to Day	33
	Threshold for changing from infrared to visible light	5
	Dropped frames between multiple captures	0
	Colored images on Night mode	Unmarked
Inputs and Outputs	Captures per pulse	2 to 4
	Minimum time between triggers	50
	Image format	JPEG
	Quality	70%
	Visible light trigger	According to installation
	Infrared light trigger	
	Outputs configured for	Fire illuminator/ flash
	Flash mode	Auto
	Autoflash fires on	Infrared light
	Delay do flash	0
Image Settings	Desired level	20
	Gain mode	Auto
	Shutter mode	Auto
	Maximum Shutter	**Resolution below 800x600:** Speed up to 60 km/h from 30 to 60 Speed over 60km/h from 15 to 30 **Resolution above 800x600:** Speed up to 60 km/h from 22 to 44 Speed over 60km/h from 11 to 22
	Edge Sharpening	Off
	Night shadow elimination	Off
	High Dynamic Range	Unmarked
Light Settings (Day)	Maximum gain	50
	2nd image gain	20
	Gamma	Logarithmic
	Logarithmic value	110
	Saturation	100
	Brightness	10
	Contrast	100
	White balance (red, green, blue)	0
Light Settings (Night)	Maximum gain (night adjustment)	40
	2nd image gain	0
	Gamma	Linear
	Saturation	100
	Brightness	3
	Contrast	100
	White balance (red, green, blue)	0
Weights	All windows	15
CCR	Amount of valid characters	7

	Minimum character reliability	60%
	Visible light OCR	Slow
	Infrared light OCR	Very slow
	Recognized plate	Not sent by serial port

17. Vehicle Counter

Vehicle counter function is available for ITSCAM 4XX series. This function allows selecting a tracking area and monitoring the number of vehicles that passed for a period.

Achieving optimum performance requires ITSCAM installed above the track center. This configuration makes traffic direction linear on the image, as shown in Figure 29, where ITSCAM is in a walkway crossing the highway.

Vehicle Counter has its own interface, available at www.pumatronix.com.br. Figure 30 shows an example of ITSCAM Vehicle Counter interface.

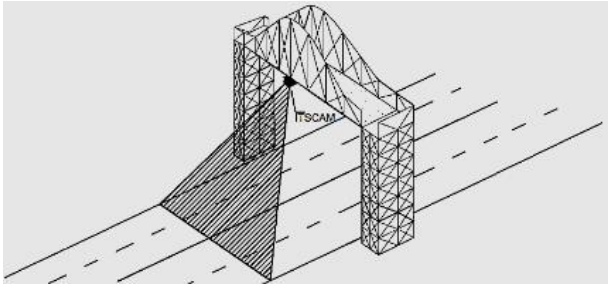


Figure 29 – ITSCAM installation maximizing Vehicle Counter results

The procedure for using the counter requires connecting with ITSCAM and selecting the counting region. After running the application, you must enter the ITSCAM IP address. Then you must mark the counting area with mouse or by entering rectangle region coordinates. The counter region is surrounded by a black rectangle. Counter result is shown in the upper right window. It is split by vehicle size: small (motorcycle and small vehicles), medium and large (truck, bus and similar) vehicles.

Figure 30 – ITSCAM Vehicle Counter Interface

18. Optical Character Recognition - OCR

ITSCAM 403 Vigia+ and ITSCAM 421 Vigia+ can recognize vehicle plates. The capture process happens whenever ITSCAM receives an image request in JPEG format by "Photo" or via I/O command. ITSCAM processes the vehicle plate recognition as soon as it makes the capture, and then it sends the image to the server. ITSCAM does not make plate recognitions if the capture is in BMP format or if it was requested by "Video" command.

After capturing the image, ITSCAM seeks objects similar to a license plate on the image. By locating each of these objects, the recognition algorithm tries to recognize letters and numbers. The identification result depends on the character minimal reliability. The read plate is inserted into the JPEG file on comment field, which is an EXIF tag.

Zoom and focus adjustments must be done in order to produce images in which the license plate characters have approximately 20-pixel height. However, character height can vary from 15 pixels to 30 pixels.

JPEG Marker Meaning	Meaning
FF D8	Image start
FF D9	Image end
FF FE	Comment field start, where recognition information is written

JPEG comment	Meaning
Ccx	Character x reliability
Plate	Vehicle read plate
ColorPlate	0: Bright plate with dark letters 1: Dark plate with bright letters
CoordPlate	Image rectangle coordinates of the region with vehicle plate

19. ITSCAM Communication Protocol Using Sockets

All commands described in this protocol are compatible with the latest ITSCAM firmware, available at

www.pumatronix.com.br. ITSCAM with an outdated firmware may not support some of the commands described.

ITSCAM communication is done via Ethernet interface using TCP and UDP/IP protocol. The port number used for communication with external equipment is 50000. Accordingly, the application developed to communicate with ITSCAM must use the same port in the TCP and UDP protocols.

The UDP protocol is used only for identification of connected devices on the network. It allows sending packets of the broadcast type, which are received by all devices. Then, ITSCAM sends its identification.

All ITSCAM commands use the TCP protocol. The unique exception is the identification command. Protocol establishes a peer to peer connection between the control device and the ITSCAM.

CRC code is used to safely receive and change ITSCAM settings. However, most of the replies sent by ITSCAM have no CRC.

The representation of values in hexadecimal receives an addition letter ***h*** at the end of the number.

19.1. ITSCAM Command Pattern for Sending and Receiving Data

The commands in this protocol have a header, additional parameters and CRC. Table 14 shows the structure of the protocol commands.

Table 14 – ITSCAM communication protocol pattern for using sockets

Header	Command	Parameters	CRC
1 Byte: *AAh*	1 Byte: Variable value	N Bytes: Variable value	2 Bytes

The header of the protocol (for both sending and receiving data) always corresponds to a single byte with value *AAh*. Possible commands are listed in Table 15 and range from *00h* to *FFh*. Depending on the nature of the command, it is necessary to send parameters. A CRC must be inserted at the end of the message. Generally, ITSCAM responses have the *AAh* header, the command and parameters (which vary according to the command type).

19.2. CRC – Cyclic Redundancy Check

ITSCAM requires a 16-bit CRC (2 bytes) in all the commands it receives to ensure its integrity. This CRC must be calculated as specified by CCITT-CRC, using the value *1021h* as polynomial generator.

To calculate CRC, all the bytes sent must be considered, which means Bytes from the header, the command and all

parameters. In commands that need integers greater than 1 Byte as a parameter, the first Byte is always the least significant. For the CRC, least significant byte should be transmitted first. The CRC is inserted at the end of the command and corresponds to the last two Bytes to be sent. The only exception to this rule occurs in the transmission of IP addresses, because the first Byte sent corresponds to the most significant Byte of the address.

An example of sending a request to ITSCAM that returns a picture without flash sync (Video command) in JPEG format and quality of 100% is "*AAh 01h 01h 64h FEh AAh*". *AAh* is the header, *01h* is video command, *01h* is JPEG format, *64h* is JPEG quality (100%) and *AAFEh* is the CRC of the message "*AAh 01h 01h 64h*". Since least significant byte of CRC must be transmitted first, the final command is:

AAh 01h 01h 64h FEh AAh

Another example is the request of a flash-synchronized picture (command PHOTO) in JPEG format and 80% quality compression. The header, command and its parameters is "AAh 02h 01h 50h", the CRC will be 8579h and ITSCAM should receive the following command (noting that the CRC and values greater than one byte must be transmitted with the least significant byte first):

AAh 02h 01h 50h 79h 85h

19.3. Protocol Description

Protocol commands are described in Table 15, which shows a column with the value in hexadecimal that references the command and another column with a brief explanation of the meaning. In addition to these columns, the table presents ITSCAM models that support the command, which parameters can be transmitted (with a brief explanation of its meaning). In the sample of transmission and reception columns, the CRC is symbolized by *[CRC (2)]* and should be calculated as CRC – Cyclic Redundancy Check. Still, the size in Bytes is given in parentheses and is always sent from the most significant Byte to the least significant.

Table 15 – ITSCAM communication protocol valid commands using sockets

Command	Meaning	Send format	Parameters	Response format
00h	This command must be broadcast using UDP protocol. Interfaces that are listening on the correct port and understand the command will send an identification packet. The default broadcast address is *255.255.255.255* and any packet sent to this address will be read by all network interfaces. All IP addresses received will be considered as a valid device that can be accessed.	AAh 00h [CRC(2)]		AAh 00h [ITSCAM IP(4)] [CRC(2)]
01h	Request frame without flash sync.	AAh 01h [format (1)] [quality(1)] [CRC(2)]	Format: 0: BMP picture/ 1: JPEG picture Quality: 0 to 100%	AAh 01h [format(1)] [size(4)] [data(*)] Format: 0: BMP/ 1: JPEG Size: in Bytes - little-endian Data: vector with image
02h	Request frame with flash sync (if flash enabled).	AAh 02h [format (1)] [quality(1)] [CRC(2)]	Format: 0: BMP picture/ 1: JPEG picture Quality: 0 a 100%	AAh 02h [format(1)] [size(4)] [data(*)] Format: 0: BMP/ 1: JPEG Size: in Bytes - little-endian Data: vector with image
04h	Command sent by ITSCAM to indicate trigger event	None, because this command is generated by ITSCAM to indicate a trigger event		AAh 04h [amount of pictures (1)] [CRC(2)]
0Fh	ITSCAM software restart. Reboot takes about 20 seconds.	AAh 0Fh [CRC(2)]		AAh 0Fh 01h The initialization routine is initiated as soon as the ITSCAM receives the command and response is sent only in firmware from version 14
10h	Request ITSCAM current configuration.	AAh 10h [CRC(2)]		AAh 10h [version(1)] [revision(1)] [flash mode (1)] [trigger mode(1)] [output type(1)] [output value (1)] [input value (1)] [flash delay (2)] Version and revision: from current firmware Flash mode: 1 off/ 2: single/ 3: continuous/ 4: single with delay/ 5: auto/ 6: auto with delay Trigger mode: 1: off/ 2: rising edge/ 3: falling edge/ 4: both edges/ 5: approaching by image/ 6: departing by image (quick)/ 7: departing by image (slow) / 8: continuous/ 9: periodic/ 10: high logic level/ 11: low logic level/ 12: rising edge and approaching

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
10h	Request ITSCAM current configuration (continuation).	AAh 10h [CRC(2)]		(Continuation) Output type: 0: flash/ 1: I/O Output and input value: 0: both off/ 1: output/input 1 On/ 2: output/input 2 On/ 3: both On Flash delay: moment before shutter that flash will be fired (steps with 0,4 microseconds)
13h	Set trigger operation mode.	AAh 13h [trigger mode (1)] [CRC(2)]	Trigger mode: 1: Off 2: Rising edge 3: Falling edge 4: Both edges 5: Approaching by image 6: Departing by image (quick) 7: Departing by image (slow) 8: Continuous 9: Periodic 10: High logic level 11: Low logic level 12: Rising edge and approaching	AAh 13h [status (1)] 0: Command not accepted 1: Command accepted
14h	Set output 1 configuration.	AAh 14h [output type (1)] [CRC(2)]	OUT1: 1: Fire flash or illuminator 2: OUT1 controlled by user application	AAh 14h [status (1)] 0: Command not accepted 1: Command accepted
15h	Set output value (when configured as I/O).	AAh 15h [output value (1)] [CRC(2)]	Output value: 0: Both outputs Off 1: Output 1 On 2: Output 2 On 3: Both outputs On	AAh 15h [status (1)] 0: Command not accepted 1: Command accepted
16h	Request input values.	AAh 16h [CRC(2)]		AAh 16h [level(1)] Level: 0: Both inputs Off/ 1: input 1 On/ 2: input 2 On/ 3: both inputs On
17h	Restore ITSCAM default configuration.	AAh 17h [CRC(2)]		AAh 17h [status (1)] 0: Command not accepted 1: Command accepted

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
18h	Set delay between flash firing and shutter.	AAh 18h [delay(2)] [CRC(2)]	Delay: Configured in steps of 0,4 µs, from 100 to 25000	AAh 18h [status (1)] 0: Command not accepted 1: Command accepted
1Bh	Set minimum period of time that ITSCAM waits to accept new image requisition made by I/Os.	AAh 1Bh [time(2)] [CRC(2)]	Time: 0 to 60000 miliseconds	AAh 1Bh [status (1)] 0: Command not accepted 1: Command accepted
1Ch	Request minimum period of time that ITSCAM waits to accept new image requisition made by I/Os.	AAh 1Ch [CRC(2)]		AAh 1Ch [time(2)] Time: 0 to 60000 in miliseconds
1Dh	Request ITSCAM model	AAh 1Dh [CRC(2)]		AAh 1Dh [model (2)] [lens(1)] Model: ITSCAM[model] (little-endian) Lens: 0 or 1: CS mount lens/ 2 or 3: Motorized
20h	Request network configuration: IP and MAC address, netmask and gateway.	AAh 20h [CRC(2)]		AAh 20h [mac(6)] [ip(4)] [mask(4)] [gateway(4)] Example: *AAh 20h 00h 50h C2h 8Ch 80h 01h 192 168 0 254 255 255 255 0 192 168 0 1* IP: 192.168.0.254 MAC: 00 50 C2 8C 80 01 Netmask: 255.255.255.0 Gateway: 192.168.0.1
21h	Set IP address.	AAh 21h [ip(4)] [CRC(2)]	Valid IP address	AAh 21h [status (1)] 0: Command not accepted 1: Command accepted
22h	Set netmask.	AAh 22h [mask(4)] [CRC(2)]	Valid netmask	AAh 22h [status (1)] 0: Command not accepted 1: Command accepted
23h	Set gateway.	AAh 23h [gateway(4)] [CRC(2)]	Valid gateway	AAh 23h [status (1)] 0: Command not accepted 1: Command accepted
30h	Require main ITSCAM image configurations.	AAh 30h [CRC(2)]		AAh 30h [hdr(1)] [shutter type(1)] [static shutter (2)] [maximum shutter(2)] [gain type(1)] [static gain (1)] [maximum gain (1)] [test mode(1)] [desired level (1)] [current level (1)] [current gain (1)]

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
30h	Require main ITSCAM image configurations (continuation).	AAh 30h [CRC(2)]		(Continuation) [current shutter (2)] [differentiated gain type (1)] [differentiated gain value (1)] [photo format via trigger(1)] [photo quality via trigger (1)] Hdr: 0: Off/ 1: On Shutter type: 0: Static / 1: Auto/ 2: Static on Day mode, Auto on Night mode Static, maximum and current shutter: 1 to ITSCAM model limit Gain type: 0: Static/ 1: Auto Static, maximum, current, differentiated gain: 0 to 72 Teste mode: 0: send captured image/ 1: send vertical pattern/ 2: send horizontal pattern / 3: send diagonal pattern Desired and current level: 7 to 62
30h	Require main ITSCAM image configurations (continuation).	AAh 30h [CRC(2)]		(Continuation) Differentiated gain type: 0: Off/ 1: enabled on Day mode/ 2: enabled on Night mode Photo format: 0: BMP/ 1: JPEG Photo quality: 0 to 100%
34h	Set shutter type that could be static or auto. When static, ITSCAM will use configured static value, otherwise ITSCAM will adjust shutter to match desired luminance level, up to maximum value specified.	AAh 34h [shutter type (1)] [CRC(2)]	Shutter type: 0: Static 1: Auto 2: Static on Day mode and Auto on Night mode	AAh 34h [status (1)] 0: Command not accepted 1: Command accepted
35h	Set static shutter.	AAh 35h [shutter (2)] [CRC(2)]	Static shutter: 1 to ITSCAM model limit	AAh 35h [status (1)] 0: Command not accepted 1: Command accepted
36h	Set maximum shutter. Auto shutter is limited by this value.	AAh 36h [maximum shutter (2)] [CRC(2)]	Maximum shutter: 1 to ITSCAM model limit	AAh 36h [status (1)] 0: Command not accepted 1: Command accepted

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
39h	Set electronic gain. Set to static, ITSCAM always adopts the value of static gain. Set to automatic, ITSCAM modifies its gain so that the luminance level reaches the desired value, respecting the maximum gain allowed.	AAh 39h [gain type (1)] [CRC(2)]	Gain type: 0: Static 1: Auto	AAh 39h [status (1)] 0: Command not accepted 1: Command accepted
3Ah	Set static electronic gain.	AAh 3Ah [static gain (1)] [CRC(2)]	Static gain: 0 to 72	AAh 3Ah [status (1)] 0: Command not accepted 1: Command accepted
3Bh	Set maximum electronic gain	AAh 3Bh [maximum gain (1)] [CRC(2)]	Maximum gain: 0 to 72	AAh 3Bh [status (1)] 0: Command not accepted 1: Command accepted
3Dh	Set desired level of image clarity. It is necessary that gain and shutter are set auto because ITSCAM changes these parameters to keep the image at the desired level.	AAh 3Dh [desired level (1)] [CRC(2)]	Desired level: from 7 to 62	AAh 3Dh [status (1)] 0: Command not accepted 1: Command accepted
3Fh	Set maximum gain. It is used because, in some situations, it is important that the maximum gain is different in Day and Night mode.	AAh 3Fh [maximum gain (1)] [CRC(2)]	Maximum gain: 0 to 72	AAh 3Fh [status (1)] 0: Command not accepted 1: Command accepted
40h	Set maximum differentiated configuration.	AAh 40h [maximum differentiated gain type (1)] [CRC(2)]	Maximum differentiated gain type: 0: Off 1: On for Day mode 2: On for Night mode	AAh 40h [status (1)] 0: Command not accepted 1: Command accepted
44h	Set photo format sent by I/O requisitions.	AAh 44h [format(1)] [CRC(2)]	Format: 0: BMP 1: JPEG	AAh 44h [status (1)] 0: Command not accepted 1: Command accepted
45h	Set JPEG image quality by I/O requisitions.	AAh 45h [quality(1)] [CRC(2)]	Quality: 0 a 100%	AAh 45h [status (1)] 0: Command not accepted 1: Command accepted

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
46h	Set the number of images captured by each photo request via network (command *02h*). Photos have the exact spacing of 1 frame, unless a delay is set between shots.	AAh 46h [photos(1)] [CRC(2)]	Photos: 1 to ITSCAM model limit	AAh 46h [status (1)] 0: Command not accepted 1: Command accepted
47h	Set the number of images captured by each photo request via I/O (command *02h*). Photos have the exact spacing of 1 frame, unless a delay is set between shots.	AAh 47h [photos(1)] [CRC(2)]	Photos: 1 to ITSCAM model limit	AAh 47h [status (1)] 0: Command not accepted 1: Command accepted
48h	Request the amount of photos send by network and by I/O, respectively.	AAh 48h [CRC(2)]		AAh 48h [network amount of photos (1)] [I/O amount of photos (1)] Amount of photos: 1 to ITSCAM model limit
4Ch	Set 180° rotation on image.	AAh 4Ch [rotation (1)] [CRC(2)]	Rotation: 0: No rotation 1: 180° rotation	AAh 4Ch [status (1)] 0: Command not accepted 1: Command accepted
4Dh	Request 180° rotation on images.	AAh 4Dh [CRC(2)]		AAh 4Dh [rotation(1)] Rotation: 0: No rotation/ 1: 180° rotation
4Eh	Set weights image to regions. These weights influence the calculation of the level of luminance of the image and is useful only when there are regions of static reflection or shadow.	AAh 4Eh [weights (16)] [CRC(2)] Example: *AAh 4Eh 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 [CRC(2)]*	Wights: 0 (no influence) to 15 (maximum influence) 16 values (4x4 image divisions matrix).	AAh 4Eh [status (1)] 0: Command not accepted 1: Command accepted
4Fh	Request assigned weights that influence the calculation of the level of luminance of the image.	AAh 4Fh [CRC(2)]		AAh 4Fh [weights (16)] Weights: 0 (no influence) to 15 (maximum). 16 values (4x4 image divisions matrix)

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
56h	Set image saturation (influences the intensity of the colors). Set Black Level (avoiding black to become gray). Set gain or contrast of the image (should keep this value 100 when gain and shutter are automatic, as this gain is applied after the shutter and the gain are adjusted by ITSCAM).	AAh 56h [saturation (1)] [black level (1)] [gain (1)] [CRC(2)]	Saturation: 0 (colorless image) to 255 (maximum intensity) Black level: 0 (lower level) to 255 (maximum level). Gain: 0 (lower contrast) to 255 (maximum).	AAh 56h [status (1)] 0: Command not accepted 1: Command accepted
57h	Request saturation, black level and gain values.	AAh 57h [CRC(2)]		AAh 57h [saturation (1)] [black level (1)] [gain (1)] All parameters return from 0 to 255
58h	Set white balance of red, green and blue components.	AAh 58h [red (1)] [green (1)] [blue (1)] [CRC(2)]	0: automatically adjusted 1 to 255: Component gain	AAh 58h [status (1)] 0: Command not accepted 1: Command accepted
59h	Request white balance of red, green and blue components.	AAh 59h [CRC(2)]		AAh 59h [red (1)] [green(1)] [blue(1)] All parameters return from 0 to 255
5Ah	Set image gamma, which means specify the logarithmic curve that allow amplify dark regions of the image to turn them more visible.	AAh 5Ah [gamma (1)] [CRC(2)]	Gamma: 0: Linear 1: Logarithmic default curve 70 to 255: Custom	AAh 5Ah [status (1)] 0: Command not accepted 1: Command accepted
5Bh	Request gamma configuration.	AAh 5Bh [CRC(2)]		AAh 5Bh [gamma (1)] Gamma: 0: Linear response/ 1: Logarithmic default curve/ 70 to 255: Custom curves
5Eh	Set focus position	AAh 5Eh [focus (2)] [CRC(2)]	Focus: 1 to 999: Focus objects on infinite 1000: Do not move lens 1001 to 1999: Focus near objects (steps count as the estimated value subtracted from 1000)	AAh 5Eh [status (1)] 0: Command not accepted 1: Command accepted

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
61h	Set edge sharpening, giving the impression of better focus. However, it harms OCR results.	AAh 61h [edges(1)] [CRC(2)]	edges: 0: Off 1: Algorithm with 1st order filter 2: Algorithm with 2nd order filter 3: Algorithm with 2nd order filter and smooth detection	AAh 61h [status (1)] 0: Command not accepted 1: Command accepted
62h	Request edge sharpening configuration.	AAh 62h [CRC(2)]		AAh 62h [edges (1)] Edges: 0: Off/ 1: Algorithm with 1st order filter/ 2: Algorithm with 2nd order filter/ 3: Algorithm with 2nd order filter and smooth detection
63h	Set configuration of color photos in Night mode. The pictures produced by ever ITSCAM always on Day mode are not equivalent to this command.	AAh 63h [photo (1)] [CRC(2)]	Foto: 0: Night mode with gray scale images 1: Night mode with color images	AAh 63h [status (1)] 0: Command not accepted 1: Command accepted
64h	Request configuration of color photos Night mode.	AAh 64h [CRC(2)]		AAh 64h [photo (1)] Photo: 0: Gray scale image/ 1: Color image
67h	Set differentiated gamma that changes gamma on Day or Night modes.	AAh 67h [type (1)] [gamma (1)] [CRC(2)]	Type: 0: Off 1: Enabled on Day mode with chosen values 2: Enabled on Night mode with chosen values Gamma: 0: Linear response 0: Linear response 1: Logarithmic default curve 70 to 255: Custom curves	AAh 67h [status (1)] 0: Command not accepted 1: Command accepted

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
68h	Request differentiated gamma value.	AAh 68h [CRC(2)]		AAh 68h [type (1)] [value (1)] [CRC(2)] Type: 0: Off/ 1: Enabled on Day mode with chosen values/ 2: Enabled on Night mode with chosen values Gamma: 0: Linear response/ 1: Logarithmic default curve/ 70 to 255: Custom curves
69h	Set differentiated white balance configurations on Day or Night mode because there are situations that need different values for day and night images.	AAh 69h [type (1)] [red (1)] [green (1)][blue (1)] [CRC(2)]	Type: 0: Off 1: Enabled on Day mode with chosen values 2: Enabled on Night mode with chosen values Components: 0: ITSCAM auto adjusts components 1 to 255: Component gain	AAh 69h [status (1)] 0: Command not accepted 1: Command accepted
6Ah	Request differentiated white balance configurations on Day or Night mode.	AAh 6Ah [CRC(2)]		AAh 6Ah [type (1)] [red (1)] [green (1)] [blue (1)] Type: 0: Without differentiated white balance/ 1: Differentiated White balance for Day mode/ 2: Differentiated White balance for Night mode Components return from 0 to 255
6Bh	Request current White balance configuration.	AAh 6Bh [CRC(2)]		AAh 6Bh [red (1)] [green (1)] [blue (1)] All parameters return from 0 to 255
6Ch	Set flash intensity on second shot.	AAh 6Ch [intensity (1)] [CRC(2)]	Intensity: 0 to 100% of first shot	AAh 6Ch [status (1)] 0: Command not accepted 1: Command accepted
6Dh	Request flash intensity on second shot.	AAh 6Dh [CRC(2)]		AAh 6Dh [intensity(1)] Intensity: 0 to 100% of first shot

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
6Eh	Set zoom position.	AAh 6Eh [zoom (2)] [CRC(2)]	Zoom: 1 to 999: Lens move to expand field of view 1000: Do not move lens 1001 to 1999: Lens move to narrow field of view (steps count as the estimated value subtracted from 1000)	AAh 6Eh [status (1)] 0: Command not accepted 1: Command accepted
6Fh	Save focus position.	AAh 6Fh [light (1)] [CRC(2)]	Light: 1: Save current focus position for visible light 2: Save current focus position for infrared light 50: clean zoom and focus settings and motorized lens do not move 101: Set lens on visible light saved position 102: Set lens on infrared light saved position	AAh 6Fh [status (1)] 0: Command not accepted 1: Command accepted
70h	Set delay (in frames) that ITSCAM waits to get consecutive photos inside a multiple image requisition on Day mode.	AAh 70h [delay (1)] [CRC(2)]	Delay: 0: Minimum 10: Maximum	AAh 70h [status (1)] 0: Command not accepted 1: Command accepted
71h	Request delay (in frames) that ITSCAM waits to get consecutive photos inside a multiple image requisition on Day mode.	AAh 71h [CRC(2)]		AAh 71h [delay(1)] Delay: 0 to 10 frames

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
72h	Set delay (in frames) that ITSCAM waits to get consecutive photos inside a multiple image requisition on Night mode.	AAh 72h [delay (1)] [CRC(2)]	Delay: 0: Minimum 10: Maximum	AAh 72h [status (1)] 0: Command not accepted 1: Command accepted
73h	Request delay (in frames) that ITSCAM waits to get consecutive photos inside a multiple image requisition on Night mode.	AAh 73h [CRC(2)]		AAh 73h [delay(1)] Delay: 0 to 10 frames
76h	Set absolute position of zoom, based on internal lens reference.	AAh 76h [zoom(4)] [CRC(2)]	Zoom: -1000 to 1000 (format int32)	AAh 76h [status(1)] 0: Command not accepted 1: Command accepted
77h	Request absolute position of zoom, based on internal lens reference.	AAh 77h [CRC(2)]		AAh 76h [zoom(4)] Zoom: -1000 to 1000 (format int32)
78h	Set absolute position of focus, based on internal lens reference.	AAh 78h [focus(4)] [CRC(2)]	Focus: -1000 to 1000 (format int32)	AAh 78h [status(1)] 0: Command not accepted 1: Command accepted
79h	Request absolute position of focus, based on internal lens reference.	AAh 79h [CRC(2)]		AAh 79h [focus(4)] Focus: -1000 to 1000 (format int32)
7Ah	Set gain on second photo (of multiple expositions), when predominant light is visible and ITSCAM takes 2 or 4 pictures per requisition. First picture has gain value.	AAh 7Ah [gain (1)] [CRC(2)]	Gain: 0 to 72	AAh 7Ah [status (1)] 0: Command not accepted 1: Command accepted
7Bh	Request gain on second photo (of multiple expositions), when predominant light is visible and ITSCAM takes 2 or 4 pictures per requisition.	AAh 7Bh [CRC(2)]		AAh 7Bh [gain (1)] Gain: 0 to 72
7Ch	multiple expositions), when predominant light is infrared and ITSCAM takes 2 or 4 pictures per requisition. First picture has gain value.	AAh 7Ch [gain (1)] [CRC(2)]	Gain: 0 a 72	AAh 7Ch [status (1)] 0: Command not accepted 1: Command accepted
7Dh	Request gain on second photo (of multiple expositions), when predominant light is infrared and ITSCAM takes 2 or 4 pictures per requisition.	AAh 7Dh [CRC(2)]		AAh 7Dh [gain (1)] Gain: 0 to 72
80h	Set auto iris DC control.	AAh 80h [auto iris (1)] [CRC(2)]	Auto iris: 0: Without control 1: With control	AAh 80h [status (1)] 0: Command not accepted 1: Command accepted

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
81h	Request auto iris DC configuration.	AAh 81h [CRC(2)]		AAh 81h [auto iris (1)] Auto iris: 0: Without control/ 1: With auto iris DC control
82h	Set ITSCAM operation mode based on light type.	AAh 82h [mode(1)] [CRC(2)]	Mode: 0: Auto 1: Day 2: Night	AAh 82h [status (1)] 0: Command not accepted 1: Command accepted
83h	Request ITSCAM Day/Night configuration.	AAh 83h [CRC(2)]		AAh 83h [mode(1)] Modo: 0: Auto/ 1: Day/ 2: Night
84h	Request current ITSCAM Day/Night configuration.	AAh 84h [CRC(2)]		AAh 84h [mode(1)] Mode: 0: Night/ 1: Day
88h	Set differentiated trigger configurations on Day or Night mode because there are situations that need different values for day and night images.	AAh 88h [type(1)] [CRC(2)]	Differentiated trigger: 0: Off 1: On for Day mode 2: On for Night mode	AAh 88h [status(1)] 0: Command not accepted 1: Command accepted
89h	Request differentiated trigger configuration.		AAh 89h [type(1)] Type: 0: No differentiated trigger/ 1: Differentiated trigger for Day mode/ 2: Differentiated trigger for Night mode	
8Ah	Set differentiated trigger value.	Trigger: Value from 1 to 12, as described in 13h	AAh 8Ah [status(1)] 0: Command not accepted 1: Command accepted	
8Bh	Request differentiated trigger value.	AAh 8Bh [CRC(2)]		AAh 8Bh [trigger(1)] Trigger: 1 to 12, as described on 13h command

Table 15 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Send format	Parameters	Response format
8Ch	Set differentiated OCR configurations on Day or Night mode because there are situations that need different values for day and night images (available only on models with embedded OCR).	AAh 8Ch [type(1)] [CRC(2)]	Type: 0: Off 1: On for Day mode 2: On for Night mode	AAh 8Ch [status(1)] 0: Command not accepted 1: Command accepted
8Dh	Request differentiated OCR type (available only on models with embedded OCR).	AAh 8Dh [CRC(2)]		AAh 8Dh [tipo(1)] Type: 0: No differentiated OCR/ 1: Differentiated OCR for Day mode/ 2: Differentiated OCR for Night mode
8Eh	Set differentiated OCR value (available only on models with embedded OCR).	AAh 8Eh [OCR(1)] [CRC(2)]	OCR: 0: Off 1: fast 2: normal 3: slow 4: ultra-slow	AAh 8Eh [status(1)] 0: Command not accepted 1: Command accepted
8Fh	Request differentiated trigger value.	AAh 8Fh [CRC(2)]		AAh 8Fh [ocr(1)] OCR: 0: Off/ 1: fast OCR / 2: normal OCR / 3: slow OCR / 4: ultra-slow OCR
D2h	Set ITSCAM OCR mode (available only on models with embedded OCR).	AAh D2h [OCR (1)] [CRC(2)]	OCR: 0: Off 1: fast 2: normal 3: slow 4: ultra-slow	AAh D2h [status (1)] 0: Command not accepted 1: Command accepted
D3h	Request ITSCAM OCR mode (available only on models with embedded OCR).	AAh D3h [CRC(2)]		AAh D3h [OCR(1)] OCR: 0: Off/ 1: fast OCR / 2: normal OCR / 3: slow OCR / 4: ultra-slow OCR

20.ITSCAM Communication Protocol Using HTTP

HTTP protocol is composed of eleven commands that allow: to request/change value of ITSCAM parameters configuration, to capture images and to restart the equipment.

- /api/config.cgi
- /api/configs.cgi
- /api/conexoes.cgi
- /api/conn.cgi
- /api/lastframe.cgi
- /api/logwatchdog.cgi
- /api/mjpegvideo.cgi
- /api/reboot.cgi
- /api/snapshot.cgi
- /api/trigger.cgi
- /api/watchdog.cgi

HTTP commands attach to ITSCAM a lower performance than a TCP socket connection on port 50000. High performance applications should use TCP Socket, as described on section

ITSCAM Communication Protocol Using Sockets). They can be made directly by using Dynamic Library (dll) or the C++ class for Linux. In www.pumatronix.com.br a development kit is available for download.

20.1. config.cgi Command

Config.cgi requests and updates ITSCAM settings. To view all settings in real time, send to ITSCAM the command:

```
http://(ITSCAM IP address)/api/config.cgi?tudo
```

This command returns all ITSCAM settings in the browser, with the variable name and the current value. At the same time, to list the value of a parameter of ITSCAM the word *tudo* must be replaced by variable name (as listed in the browser).

```
http://(ITSCAM IP address)/api/config.cgi?parametro
```

More than one parameter can be requested at the same time in a single CGI command by using the operator & among the variables. However, the maximum size of the query string must not exceed 500 characters.

```
http://(ITSCAM IP address)/api/config.cgi?parametro1&parametro2
```

With this command, it is possible to assign values to ITSCAM parameters. The command follows the same structure and at the end of the parameter name the equal sign must be inserted followed by the new value to be assigned. This update can be made to one or more parameters simultaneously, respecting the maximum size limit of 500 characters on the command line and using the & separator between the parameters, such as:

```
http://(ITSCAM IP address)/api/config.cgi?parametro1=10&
parametro2=40
```

After assigning a new value to a ITSCAM parameter, the response is the display of the parameter with the value that was assigned. Therefore, if a parameter update occurs with an invalid value, no update will occur and the function returns with the old values.

Table 18 displays all ITSCAM parameters that can be viewed and assigned, along with the limitations and/or values that can be assigned.

20.2. configs.cgi Command

Configs.cgi command displays the stored history of ITSCAM changed settings. Each change request has timestamp, parameter changed, old and assigned values, IP address that made the request and protocol type. Values assigned are listed in decimal and in hexadecimal format. The example shows Desired Level change:

```
[442329886 150102 030432 1] NIVEL_IMAGEM: 20 (14h) p/ 22 (16h)
(de 192.168.100.57:5047 [http])
```

20.3. conexoes.cgi Command

Conexoes.cgi lists the connections made with ITSCAM. Each connection is listed with the IP address of the device that connected, time that ITSCAM was on (in milliseconds) and the port used. The command that should be sent is:

```
http://(ITSCAM IP address)/api/conexoes.cgi
```

The result of an ITSCAM connection is:

```
Estabelecendo nova conexao em 192.168.0.123 em 248403828 ms.
Porta: 50263
```

20.4. conn.cgi Command

Conn.cgi returns HTTPS connections that were made in ITSCAM. You can list all connections like this:

```
http://(ITSCAM IP address)/api/conn.cgi
```

The result of this command, when there were no connections is:

```
Nenhuma conexao HTTP foi estabelecida ate agora (368589069 ms)
```

20.5. lastFrame.cgi Command

Lastframe.cgi returns the latest frame written on ITSCAM memory and can be run with:

```
http://(ITSCAM IP address)/api/lastframe.cgi
```

20.6. logwatchdog.cgi Command

Logwatchdog.cgi identifies what caused the last ITSCAM reboot forced by the watchdog. The command that should be sent is:

```
http://(ITSCAM IP address)/api/logwatchdog.cgi
```

An output sample of this log is displayed with the meaning of each field, indicated colorfully. The caption with the meaning of the colors is shown in Table 16.

```
[15220 000000 000000 0] cTx=1 cRx=-10 cOcr=0 FWD=2 wdRd=3000
TWD=15020 TTX=15220 TRX=2863311530 TPD=2863311530 TVD=15020
TPC=2863311530 TQD=2729093802 MST=0
```

Table 16 – Message caption of what is sent by logwatchdog.cgi command

Caption	
	Reboot timestamp
	Transmission status
	Reception status
	OCR status
	Reset reason
	Watchdog status
	Threads Timestamps
	Longer shipping package

20.7. mjpegvideo.cgi Command

mjpegvideo.cgi command sends an MJPEG stream with images captured by ITSCAM. To receive these images you must specify the quality, resolution and frame rate that would be sent. This command is influenced by the existing connection between the ITSCAM and the equipment that is requesting images. A list of possible settings is shown in Table 17. A sample of stream configuration and request follows:

```
http://(ITSCAM IP address)/api/mjpegvideo?Quality=80&Resolution
=320x 240&FrameRate=0
```

Table 17 – Possible values to configure mjpeg stream

Command	Limits
Quality	0: Lower quality and maximum compression 100: Better quality and less compression
Resolution	160x120 240x180 320x240 480x360 640x480
FrameRate (frames per second)	0: Maximum rate 1,2,3,5,6,10,15 or 30

Some browsers such as Internet Explorer have restrictions displaying video in MJPEG format, so images may not be displayed correctly.

20.8. reboot.cgi Command

reboot.cgi is the command that immediately resets ITSCAM.

In firmwares previous than version 14, no response is sent when this command is received by ITSCAM. However, in recent versions, a message stating that ITSCAM is restarting appears on the browser.

ITSCAM reboot process takes approximately 20 seconds to complete. So, communication with the device that sent the reset command can be restored. This command must be sent as follows:

```
http://(ITSCAM IP address)/api/reboot.cgi
```

20.9. snapshot.cgi Command

Snapshot.cgi command is used to request a JPEG photo. When ITSCAM is operating in Night mode and the flash is in "single mode" or "Auto mode", the photo posted by ITSCAM is synchronized with the flash. To use this command, you must determine the value of the quality of the images. The default value is 80% quality. The quality ranges from 0 to 100%, where 100 corresponds to an image with little compression and maximum quality. An example of using this command is:

```
http://(ITSCAM IP address)/api/snapshot.cgi?qualidade=100
```

20.10. trigger.cgi Command

Trigger.cgi operates similar to request photos, but when ITSCAM receives the request made by this script, the images are sent only when a trigger event occurs. This event can be generated by external equipment (such as inductive loops and light barriers) and by processing the captured images (virtual trigger).

To request images using this concept, ITSCAM must receive the command:

```
http://(ITSCAM IP address)/api/trigger.cgi
```

20.11. watchdog.cgi Command

Watchdog.cgi starts an external watchdog. This means that, if the ITSCAM does not receive this command again in 5 minutes, it restarts automatically. It is recommended to send this command to ITSCAM at every minute, as follows:

```
http://(ITSCAM IP address)/api/watchdog.cgi
```

20.12. Parameters Shown with http://(ITSCAM IP address)/api/config.cgi?tudo Command

Table 18 – ITSCAM parameters listed with http:///(ITSCAM IP address)/api/config.cgi?tudo command

Parameter	Description	Type	Possible values	Example
ArquivoFTP	Name pattern for files uploaded to the FTP server.	Read and write	Table 13 lists possible characters	/%i/%c.jpg
AutoIris	Auto iris configuration	Read and write	0: Without auto iris DC 1: With auto iris DC	1
BuffersLivres	Number of images stored internally that are still waiting to be transmitted	Read	0: No space to process new images 16: No images waiting for transmission	1
CountOcr	Parameters to error monitoring	Read	Integer value	90935
CountRx				-10
CountTx				0
ConfigPortaSerial	Serial port interface seetings	Read and write	String	300-7N1/1200-8N2
Data	ITSCAM current date	Read and write	Valid date as DDMMYY	160614
DataComp	Firmware compilation date	Read	Format DD/MM/YY HH:MM:SS	13/03/2014 15:14:40
DelayCapturaDay	Capture delay (in frames) between captures inside the multiple exposition requisition in Day mode	Read and write	0 to 100	0
DelayCapturaNight	Capture delay (in frames) between captures inside the multiple exposition requisition in Night mode	Read and write	0 to 100	0
DelayFlash	Delay between flash shot and shutter	Read and write	100 to 25000 (steps of 0,4µ seconds)	130
Dns	ITSCAM DNS address	Read and write	Valid DNS address	208.67.222.222
enableNtpServer	Synchronize ITSCAM time with NTP server	Read and write	0: Off 1: On	0
EnderecoServidor	IP address of the server that receives ITSCAM images	Read and write	Valid IP address	192.168.0.94
EnderecoServidorRedundante	Redundant IP address of the server that receives ITSCAM images	Read and write	Valid IP address	192.168.0.91
FiltroIO	Not implemented			
FinalHorarioVerao	Day light saving time end	Read and write	Valid date as Day-Month-Hour-Minute or Ordinal-Weekday-Month-Hour	31100000 (October 31at 00:00) or 11020000 (First February Sunday at 00:00)
Foco	Focus position of motorized lens	Read and write	0 to 1999	0

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
FocoDayNight	Current focus position of motorized lens	Write	1; Visible light focus 2: Infrared light focus 50: Clean focus setting (lens keep static)101: Positions lens on visible light focus stored 102: Positions lens on infrared light focus stored	0
FocoIR	Current motorized lens focus	Read	0: Visible light focus 1: Infrared light focus	0
FocoZoom	Auto focus operation when zoom is altered	Read and write	0: Off 1: On 2: Force auto focus adjust	0
FormatoTrigger	Image format when an I/O requisition occurs	Read and write	0: BMP 1: JPEG	1
FotoColorida	Color image on Night mode. This option is different from keeping ITSCAM always on Day mode	Read and write	0: Off 1: On	0
Gamma	Gamma value	Read and write	0: Off 1: On 70 to 255: Enabled with specified conversion	110
GammaDiurno	Gamma value on Day operation mode	Read and write	0: Off 1: On 70 to 255: Enabled with specified conversion	110
GammaNoturno	Gamma value on Night operation mode	Read and write	0: Off 1: On 70 to 255: Enabled with specified conversion	110
GanhoAtual	Current gain	Read	0 to 72	0
GanhoB	Gain for second photo on visible light	Read and write	0 to 72	19

Table 18 – ITSCAM parameters listed with http:///(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
GanhoC	Gain for second photo on infrared light	Read and write	0 to 72	15
GanhoFixo	Static gain	Read and write	0 to 72	0
GanhoMaximo	Maximum gain	Read and write	0 to 72	50
GanhoMaximoDiurno	Maximum gain on Day mode	Read and write	0 to 72	50
GanhoMaximoNoturno	Maximum gain on Night mode	Read and write	0 to 72	50
Gateway	ITSCAM Gateway	Read and write	Valid gateway	192.168.0.1
GPS	Define serial port 1 behavior	Read and write	0: Serial port as server 1: Serial port for GPS controlling 2: For image request trigger	0
Hdr	High Dynamic Range	Read and write	0: Off 1: On	0
Hora	Time	Read and write	Valid time as HHMMSS	95320
Horario	Current date and time	Read	Valid value as DD/MM/AA HH:MM:SS	16/06/14 09:53:20
HorarioVerao	Sets the operation of the daylight saving time	Read and write	0: Off 1: On (absolute date) 2: On (week days)	2
InicioHorarioVerao	Day light saving time start	Read and write	Valid date as Day-Month-Hour-Minute or Ordinal-Weekday-Month-Hour	31100000 (October 31at 00:00) or 11020000 (First February Sunday at 00:00)
Ip	ITSCAM IP address	Read and write	Valid IP address	192.168.0.213
IpServidor	Server IP address that stores ITSCAM images	Read and write	Valid IP address	0.0.0.0
IpServidorRedundante	Redundant server IP address that stores ITSCAM images	Read and write	Valid IP address	0.0.0.0
JuntaFotosBMP	Compress in a single BMP image all generated images of the request and then transmits only one file	Read and write	0: Send all images 1: Compress images	0
LenteMotorizada	Set if ITSCAM has motorized lens	Read	0: Does not have motorized lens 1: Has motorized lens	1

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
LimiarDayNight	Threshold for automatic change from Day mode to Night mode	Read and write	5 to 40	15
LimiarDayNightMotorizada	Threshold for automatic change from visible to infrared focus	Read and write	1 to 50	5
LimiarNightDay	Shutter percentage for changing from Night mode to Day mode	Read and write	0 to 100	33
LimiarNightDayMotorizada	Threshold for automatic change from infrared to visible focus	Read and write	1 to 50	5
Mac	ITSCAM MAC address	Read	Valid MAC address	F8-D4-62-00-10-D5
MaiorShutter	Maximi shutter ITSCAM can handle	Read	Positive integer value	2047
MascaraRede	ITSCAM netmask	Read and write	Valid netmask	255.255.255.0
MinimaProbPorCaracter	Minimum acceptable likelihood for a character to be considered as recognized	Read and write	0 to 100	60
MinimoCaracteresValidos	Minimum number of characters that must be recognized for the plate to be considered valid	Read and write	0 to 7	7
Modelo	String with ITSCAM Models	Read	ITSCAM400 to ITSCAM421	ITSCAM403LM84
ModoDayNight	Day/Night operation mode	Read and write	0: Auto 1: Always on Day mode 2: Always on Night mode	0
ModoFlash	Flash behavior	Read and write	1: Off 2: Unique mode 3: Unique mode with delay 4: Continuous mode 5: Auto 6: Auto with delay 7: Continuous on Night Mode	5
ModoFlashAuto	Auto flash behavior	Read and write	0: Fires only on Night mode 1: Fires on infrared light focus	1

Table 18 – ITSCAM parameters listed with http:///(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
ModoOCR	Embedded OCR behavior (when ITSCAM has this feature)	Read and write	0: Off 1: Fast 2: Normal 3: Slow 4: Ultra-slow	3
ModoOCRIR	Embedded OCR behavior when infrared light predominates (when ITSCAM has this feature)	Read and write	0: Off 1: Fast 2: Normal 3: Slow 4: Ultra-slow	3
ModoOCRVisivel	Embedded OCR behavior when visible light predominates (when ITSCAM has this feature)	Read and write	0: Off 1: Fast 2: Normal 3: Slow 4: Ultra-slow	3
ModoTeste	ITSCAM image send mode	Read	0: Image 1: Vertical pattern 2: Horizontal pattern 3: Diagonal pattern	0
NivelAtual	Current luminance level	Read	0 to 62	22
NivelAutomatico	Not implemented			
NivelDesejado	Desired image luminance level	Read and write	7 to 62 20 to 62 (with gamma on)	21
ntpServer	NTP server address	Read and write	Valid IP address or hostname	a.ntp.br
NumeroFotosIO	Amount of fotos per I/O requisition	Read and write	1 to ITSCAM limit value	2
NumeroFotosRede	Amount of fotos per network requisition	Read and write	1 to ITSCAM limit value	1
Password	Password to access Web interface	Read and write	Alphanumeric characters	123
PeriodicTriggerInterval	Interval (in minutes) between periodic captures, when using periodic trigger	Read and write	0 to 60000	1
PeriodoHorarioVerao	Time interval in which force daylight saving time	Read	Date	DE terceiro domingo de outubro as 00:00 ATE terceiro domingo de fevereiro as 00:00

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
Pesos1	Weights of the 1st image row regions. The rightmost region of the image corresponds to the least significant nibble	Read and write	0: Region with no influence 15: Maximum influence Each *nibble* can be from 0 to 65535	65535
Pesos2	Weights of the 2nd image row regions. The rightmost region of the image corresponds to the least significant nibble			
Pesos3	Weights of the 3rd image row regions. The rightmost region of the image corresponds to the least significant nibble			
Pesos4	Weights of the 4th image row regions. The rightmost region of the image corresponds to the least significant nibble			
PlacasSerial	Send recognized plate by serial port	Read and write	0: Does not send 1: Send plate	1
PorcentagemSegundoDisparo	Pumatronix illuminator intensity on second shot when capturing multiple photos per requisition. Check Illuminator technical specifications	Read and write	0 to 100	100
PortaServidor	ITSCAM server port	Read and write	Valid port	9000
PortaServidorRedundante	ITSCAM redundant server port	Read and write	Valid port	50000
QualidadeTrigger	JPEG image quality	Read and write	0: higher compression level and lower quality 100: higher quality	70
RealceBorda	Edge sharpening	Read and write	0: Off 1: 1st order filter 2: 2nd order filter 3: 2nd order filter with smooth detection	0
Resolucao	Equipment image resolution	Read	800x600, 1280x720	800x600
ResolucaoImagemFTP	FTP server image size	Read and write	0: ITSCAM resolution 1: 320x240 pixels	0
Revisao	ITSCAM firmware revision	Read	Do not apply	53

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
Rotacao	180° image rotation (only ITSCAM resolution 752x480 pixels)	Read and write	0: Regular image 1: Rotated image	0
Saturacao	Parameter with multiple variables per Byte: Saturation, black level and gain, respectively	Read and write	0 to 255 for each parameter 0 to 16777215	6556516
SaturacaoDiurno	Saturation during Day operation Parameter with multiple variables per Byte: Saturation, black level and gain, respectively	Read and write	0 to 255 for each parameter	6556516
SaturacaoNoturno	Saturation during Night operation Parameter with multiple variables per Byte: Saturation, black level and gain, respectively	Read and write	0 to 255 for each parameter	6556516
SenhaFTP	FTP user password	Read and write	Valid password	123
SenhaAPI	Uses password on all ITSCAM communication as reboot, read/set parameters, etc.	Read and write	0: Off 1: On	1
ShutterAtual	Current shutter	Read	Integer value	51
ShutterFixo	Static shutter	Read and write	1 to ITSCAM limit value	30
ShutterMaximo	Maximum shutter	Read and write	1 to ITSCAM limit value	60
SituacaoDayNight	Current Day/Night operation mode	Read	1: Day mode 2: Night mode	1
Sombra	Shadow removal algorithm for night images with spots near vehicle head lights	Read and write	0: Off 1 to 8: Available algorithms	0
TempoEntreTriggers	Time (in miliseconds) that ITSCAM waits after receiving a request to process another	Read and write	0 to 60000	400
TempoLigado, TempoPc, TempoPd, TempoQd, TempoRx, TempoTx, TempoVd, TempoWd	Debug counters that show ITSCAM timestamp of certain functionalities	Read	Integer value	-1E+09

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
TipoGammaDif	Differentiated gamma behavior	Read and write	0: Off 1: On for Day mode 2: On for Night mode	2
TipoGanhoDif	Differentiated gamma behavior	Read and write	0: Off 1: On for Day mode 2: On for Night mode	1
TipoOcrDif	Differentiated OCR behavior	Read and write	0: Off 1: On for visible light 2: On for infrared light	2
TipoSaida	Output configuration	Read and write	1: Flash 2: I/O	1
TipoSaturacaoDif	Differentiated saturation behavior	Read and write	0: Off 1: On for Day mode 2: On for Night mode	1
TipoServidor	ITSCAM server type	Read and write	0: None 1: FTP 2: ITSCAM PRO 3: RTSP 4: K32 5: Panoramic 6: Serial port	2
TipoShutter	Shutter configuration	Read and write	0: Static 1: Auto 2: Static on Day mode and auto on Night mode	1
TipoTriggerDif	Differentiated trigger behavior	Read and write	0: Off 1: On for visible light 2: On for infrared light	0
TipoWhiteBalanceDif	Differentiated white balance behavior	Read and write	0: Off 1: On for Day mode 2: On for Night mode	0
TodasFotosItscamPro	Amount of photos send to ITSCAM PRO per requisition	Read and write	0: Just one photo 1: All photos	0
TotalFotos	Maximum number of photos per requisition	Read	4 or 16	16

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
Trigger	Trigger behavior	Read and write	1: Off 2: Rising edge 3: Falling edge 4: Both edges 5: Approaching image 6: Departure image (fast) 7: Departure image (slow) 8: Continuous 9: Periodic (Necessary enable NTP server) 10: High logic level 11: Low logic level 12: Rising edge and approaching	6
TriggerIR	Trigger behavior on infrared light	Read and write		
TriggerVisivel	Trigger behavior on visible light	Read and write		
triggerEndPaddingAfastDiurno	Trigger by image paddings	Read and write	0 to 15	0
triggerEndPaddingAproxDiurno		Read and write	0 to 15	0
triggerEndPaddingNoturno		Read and write	0 to 30	15
triggerStartMotoPaddingNoturno		Read and write	0 to 50	30
triggerStartPaddingAfastDiurno		Read and write	0 to 30	0
triggerStartPaddingAproxDiurno		Read and write	0 to 30	0
triggerStartVeiculoPaddingNoturno		Read and write	0 to 30	10
UsuarioFTP	FTP user	Read and write	Valid user	admin
ValorEntrada1	Input 1status	Read	0: Input at level 0 1: Input at level 1	0
ValorEntrada2	Input 2 status	Read	0: Input at level 0 1: Input at level 1	0
ValorEntradas	Input status (in binary as input*2input1)*	Read	0: Both Off 1: Input 1 On 2: Input 2 On 3: Both On	0
ValorGammaDif	Differentiated gamma value	Read and write	0: Off 1: On 70 to 255: Enabled with specific conversion	70

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
ValorGanhoDif	Differentiated gain value	Read and write	0 to 72	50
ValorOcrDif	Differentiated OCR value	Read and write	0: Off 1: Fast 2: Normal 3: Slow 4: Ultra-slow	1
ValorSaida	Output status	Read and write	0: Both output Off 1: Output 1 On 2: Output 2 On 3: Both output On	0
ValorTriggerDif	Differentiated trigger value	Read and write	1: Off 2: Rising edge 3: Falling edge 4: Both edges 5: Approaching image 6: Departure image (fast) 7: Departure image (slow) 8: Continuous 9: Periodic (Necessary enable NTP server) 10: High logic level 11: Low logic level 12: Rising edge and approaching	1
ValorWhiteBalanceDif	Multiple parameter with differentiated white balance Split into Bytes that correspond to red, green and blue components	Read and write	0 to 255 for each component 0 to 16777215	0
Versao	ITSCAM firmware version	Read	-	15
WhiteBalance	Multiple parameter with white balance Split into Bytes that correspond to red, green and blue components	Read and write	0 to 255 for each component 0 to 16777215	0
WhiteBalanceAtual	Multiple parameter with current white balance Split into Bytes that correspond to red, green and blue components	Read	0 to 255 for each component 0 to 16777215	6439073

Table 18 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
WhiteBalanceDiurno	White balance for Day mode Multiple parameter with current white balance Split into Bytes that correspond to red, green and blue components	Read and write	0 to 255 for each component 0 to 16777215	0
WhiteBalanceNoturno	White balance for Night mode Multiple parameter with current white balance Split into Bytes that correspond to red, green and blue components	Read and write	0 to 255 for each component 0 to 16777215	0
Zoom	Motorized lens zoom value	Write	0 to 1999	500

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Datasheet ITSCAM Vigia+

Traffic Control Device

Models 400 to 421 and HDR

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