Pumatronix Equipamentos Eletrônicos Ltda.

ITSCAM 4XX, HDR and CCD

USER MANUAL

Models: ITSCAM 400 to ITSCAM 421, HDR and CCD

Traffic Control Device

Firmware 19.2.0

Version 3.28_December 2020

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This document aims to provide technical information, in addition to detailing the principles of operation and installation of devices of ITSCAM line. A communication protocol allows integrators to develop software that communicates with ITSCAM. This protocol is described at the end of this document. The dynamic library, a development kit, and additional information are available at www.pumatronix.com.

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 plate. 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.

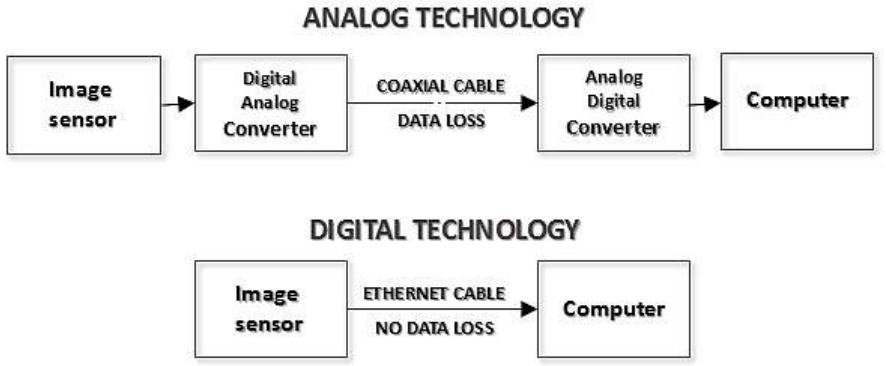


Figure 1 – Comparison of digital and analog image conversion steps

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

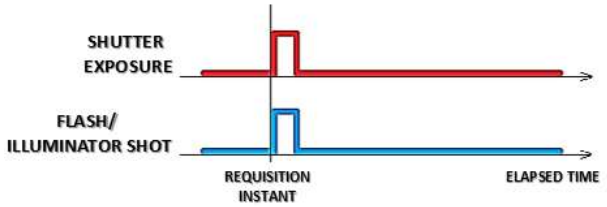


Figure 2 – Comparing diagram of shutter and output flash trigger with flash in Single Mode

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.

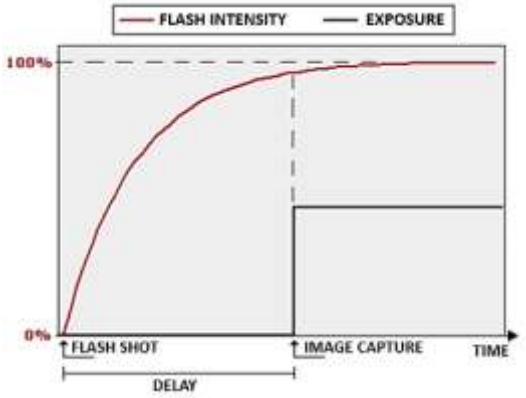


Figure 3 – When light reaches its peak, shutter fires

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 available resolutions of ITSCAM are on Table 1.

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

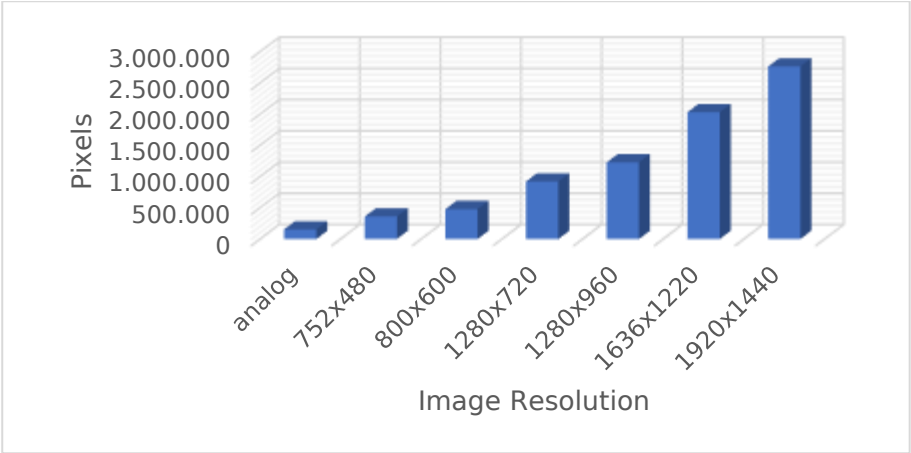


Figure 4 – Digital and analog amount of image pixels

Note that systems with larger image width as ITSCAM, also allows wider field of view with the same zoom used in analog images. This way, information loss is minimized at the edges, such as vehicles between lanes.

Table 1 – ITSCAM image resolution

Model	Resolution (pixels)
ITSCAM 400 a 403	752x480
	800x600
ITSCAM 410 a 421*	1280x720
	1280x960**
	1920x1440
HDR13	1280x960
CCD13	1280x960
HDR20	1636x1220

* ITSCAM 410 to 421 can provide interpolated images with 2048x1536 pixels (3MP)

** Models with 1280x960 pixels can generate images with resolution 1024x768 pixels without interpolation

ITSCAM CCD and HDR models are named with a code that each character represents a functionality, as presented on Table 2.

Table 2 – ITSCAM HDR and CCD specification details

Image resolution	Lens	Embedded light*	Additional hardware
03: 0,3MP (640x480px) **13**: 1,3MP (1280x960px) **20**: 2,1MP (1636×1220px)	**CS**: CS Mount **C1**: Theia 1.8-3mm (SL183) **C2**: Theia 9-40mm (SL940A) **C3**: Senko 7.5-50mm (MSV7X7515D) **C4**: Senko 2.8-12mm (TV4X2812D) **C5**: Senko 7.5-50mm (TV7X7513D) **C6**: Senko 10-50mm (MHV5X1020D) **C8:** Pumatronix 2.7-13.5mm **C9:** Pumatronix 8-40mm **L3**: 4,7-47mm **L4**: 4,7-84mm (unavailable for 2MP)	**B:** White **I:** Infrared **M:** Mixed **D:** No LEDs	**A**: Digital Signature (TPM1.0) **G**: GPS **J**: Jidosha Light **P**: Power Over Ethernet **R**: RTC (Real Time Clock)

*Models with embedded light have polycarbonate case, IP67 protection and are called ITSCAM Vigia+ or Vigia+

Some ITSCAM models are certified by international standards. In these cases, after the product model, two CX characters are inserted, with X indicating the type of certification that the product meets (Table 3).

Table 3 – ITSCAM international certifications

Product certification
C1: CE
C2: FCC
C3: CE e FCC

Figure 5 shows an ITSCAM label with the specifications entered in the product model code.

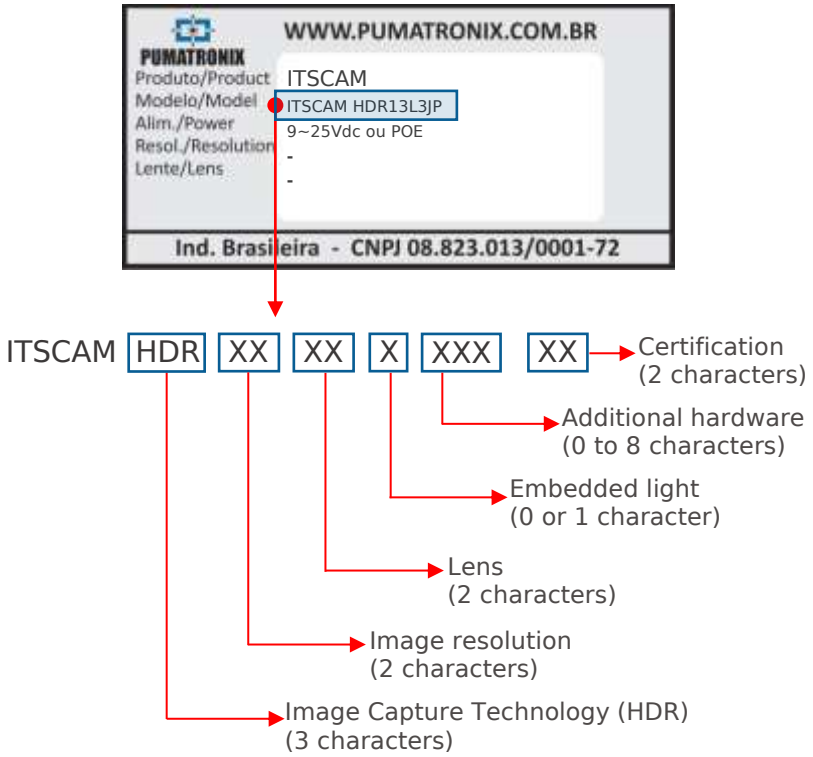


Figure 5 – Product naming description

2. Dimensions and Power Supply

Power supply	9 to 25Vdc
Energy consumption	5W

ITSCAM operating temperature is -10˚C to +70˚C.

When ITSCAM has manual lens, depth and weight must be updated with lens specifications. Auto Iris connector is not considered on dimensioning.

Dimensions (in mm)				
Model	**Height**	**Width**	**Depth**	**Weight**
CS Mount lens	57*	72**	93 + lens	250g + lens
Motorized lens	57*	72	163	400g
Motorized lens HDR13 e CCD13	57*	72	148	400g

* ITSCAM bracket attaches to ITSCAM bottom and makes its height exceed in 7mm.
** Auto iris lens connector must be plugged to ITSCAM side panel, making it slightly wider. This connector usually is 8mm wide, but actual size depends on the lens manufacturer.
*** Approximate lens weight is 70g and may increase according to the resolution used.

Back panel has two connectors: Ethernet for data communication and Microfit connector Molex 43025-1600 (datasheet available at www.molex.com) as shown in Figure 6. Pin functionalities are on Table 4.

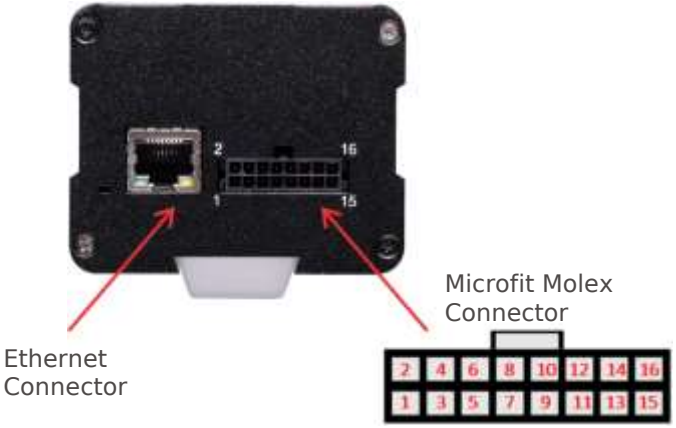


Figure 6 – ITSCAM 4XX connectors

Table 4 – Microfit 16-pin connector description (ITSCAM 4XX)

Terminal	Signal	Description
1	RS232_RX1	RX RS232 1
2	RS232_TX1	TX RS232 1
3	GND (RS232_1)	GND RS232 1
4 Purple	RS232_TX2	TX RS232 2
5 White	RS232_RX2	RX RS232 2
6	GND (RS232_2)	GND RS232 2
7	IN2+	Isolated positive input 2
8	IN2-	Isolated negative input 2
9	OUT2+	Isolated positive output 2
10	OUT2-	Isolated negative output 2
11 Green	IN1+	Isolated positive input 1
12 Blue	IN1-	Isolated negative input 1
13 Orange	OUT1+	Isolated positive output 1
14 Yellow	OUT1-	Isolated negative output 1
15 Brown	GND	Ground
16 Red	V+	Power supply 9 to 25Vdc

A connection example of ITSCAM with ITSLUX/SUPERLUX/ GREENLUX/WHITELUX is on Figure 7.

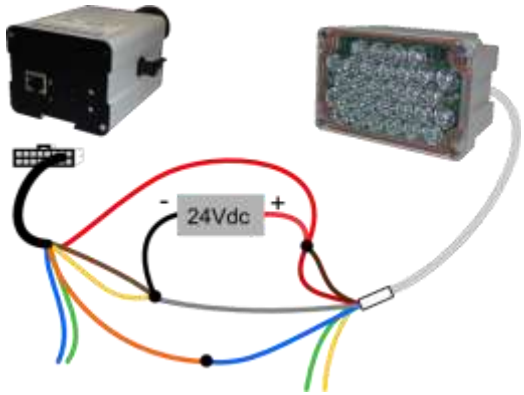


Figure 7 – Connection example of ITSCAM with ITSLUX

Input and output signals are optically isolated and their corresponding circuits are shown in Figure 8.

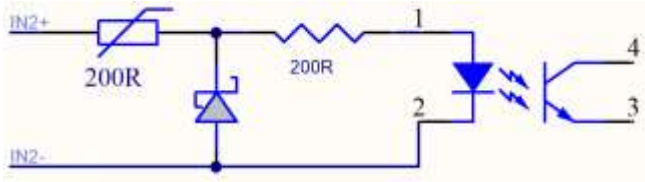
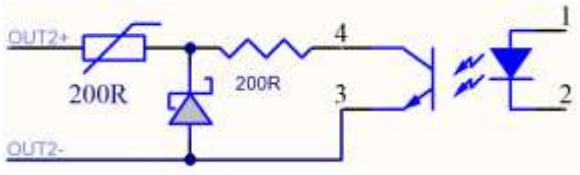
Input	 Recommended current: 10mA Maximum current: 20mA
Output	 Maximum current: 30mA Maximum voltage: 28Vdc

Figure 8 – Isolated input and output circuits

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.

Oxidation Hazard: Electrical and signal connections made to the harness and data cable should be protected in a junction box or similar structure to prevent oxidation of connections and unwanted liquid infiltration into the harness.

2.1. Power Over Ethernet - POE

ITSCAM powered over Ethernet connection works according to IEEE 802.3af standard. ITSCAM POE Microfit connector pinout is show in Table 5.

Table 5 – ITSCAM 4XX POE Terminals

Terminal	Signal	Description
1	RS232_RX1	RX RS232 1 *
2	RS232_TX1	TX RS232 1 *
3	GND (RS232_1)	GND RS232 1 *
4	RS232_TX2	TX RS232 2 *
5	RS232_RX2	RX RS232 2 *
6	GND (RS232_2)	GND RS232 2 *
7	IN2+	Isolated input 2 positive terminal
8	IN2-	Isolated input 2 negative terminal
9	OUT2+	Isolated output 2 positive terminal
10	OUT2-	Isolated output 2 negative terminal
11 – Green	IN1+	Isolated input 1 positive terminal
12 – Blue	IN1-	Isolated input 1 negative terminal
13 – Orange	OUT1+	Isolated output 1 positive terminal

14 – Yellow	OUT1-	Isolated output 1 negative terminal
15 Brown	GND	Ground *
16 Red	V+	Power supply 9 to 25Vdc *

* Pieces from the first production lot of ITSCAM POE did not have RS-232 and power supply pins. Contact Pumatronix for more information.

Figure 9 shows how to connect ITSCAM POE with ITSLUX.

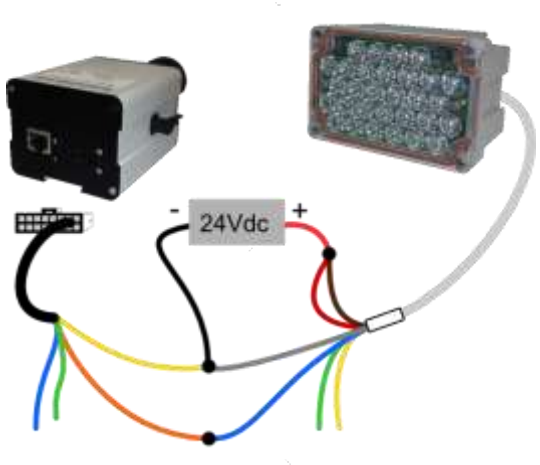


Figure 9 – Connection example of ITSCAM POE with ITSLUX

Oxidation Hazard: Electrical and signal connections made on the ITSCAM harness and data cable should be protected in a junction box or similar structure to prevent oxidation of connections and unwanted liquid infiltration into the harness.

3. Format of Transmitted Images

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).

4. Lens

ITSCAM accepts CS mount lens without auto iris or with DC Auto Iris. Furthermore, lens should be compatible image sensor size. 1920x1440 and 1636x1220 pixel-resolution models requires lens compatible with 1/1.8" sensors and other resolutions (752x480, 800x600, 1280x720 and 1280x960) with 1/3” sensor size.

4.1. Light Sensibility

ITSCAM has high sensitivity to infrared light, which is ideal for using with flashes and illuminators. Figure 10 shows the graph of Sensitivity versus Light Wavelength for monochromatic image sensors. Figure 11 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.

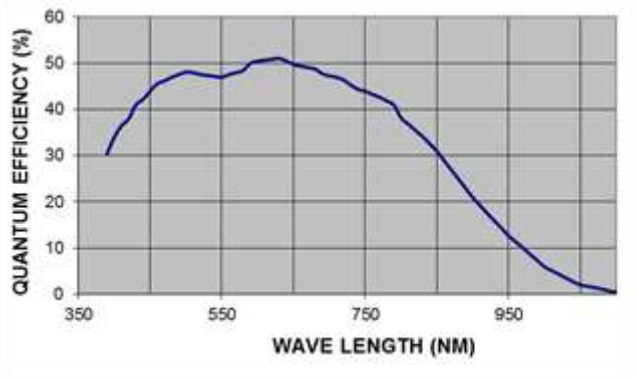


Figure 10 – Monochromatic sensor sensibility

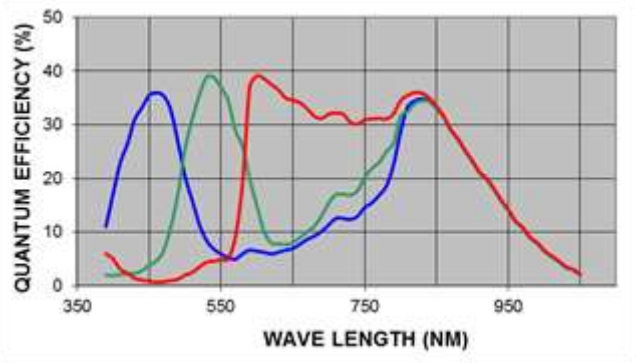


Figure 11 – RGB channel sensor sensibility

5. 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 8) and typical transmission rate (Table 6 for JPEG image format and
Table 7 for BMP image format).

Table 6 – ITSCAM Typical transmission rate for JPEG format (in frames per second)

Image	JPEG Format				
	ITSCAM Model				
	400 402	401 403	410	411 421 HDR CCD	HDR20
Color	--	35	--	10	5
Monochromatic	35	35	10	10	5

Table 7 – ITSCAM Typical transmission rate for BMP format (in frames per second)

Image	BMP Format				
	ITSCAM Model				
	400 402	401 403	410	411 421 HDR CCD	HDR20
Color	--	12	--	3	1
Monochromatic	23	33	6	6	1

Table 8 – ITSCAM Typical acquisition rate

Resolution	Internal acquisition rate
752x480	60fps
640x480	54fps
800x600	50fps
1280x720	30fps
1280x960 (HDR13)	30fps
1280x960 (CCD13)	24fps
1280x960 (ITSCAM 411/421)	22,5fps
1636x1220 (HDR20)	14,98fps
1920x1440	10fps

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).

6. 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.

6.1. 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 6 meters.

The minimum angle between the lens center and a line parallel to the ground should be 15° (as shown in Figure 12). ITSCAM can be placed on the sidewalk, but it is essential that plates are captured with maximum side angle of 30°, as shown Figure 13.

However, it is recommended to position ITSCAM to capture images from 10° to 15° lateral angle.

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

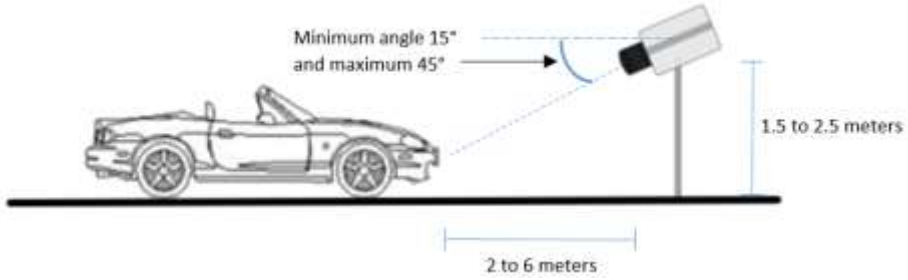


Figure 12 – ITSCAM installation for toll, parking lot and similar situations (side view)

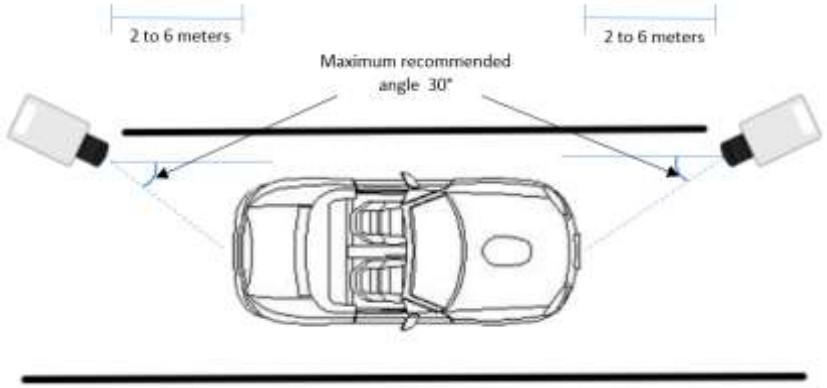


Figure 13 – ITSCAM installation for toll, parking lot and similar situations (top view)

6.2. ITSCAM Installation for Traffic Control

ITSCAM can be installed for traffic control on structures with a minimum height of 3.5 meters and maximum of 6 meters. The minimum angle of 15° between the lens center and a line parallel to the ground can be reached by positioning zoom and focus so that the license plate is visible and captured at a distance from 8 to 30 meters from ITSCAM (as illustrated in Figure 14). The vehicle plate maximum horizontal angle must be 30°, although it is suggested to keep ITSCAM with horizontal angle from 10° to 15°, as shown in Figure 15.

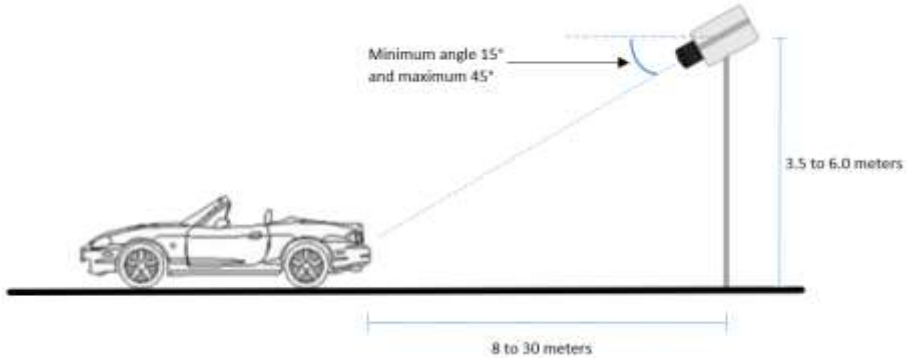


Figure 14 – ITSCAM installation for traffic control (side view)

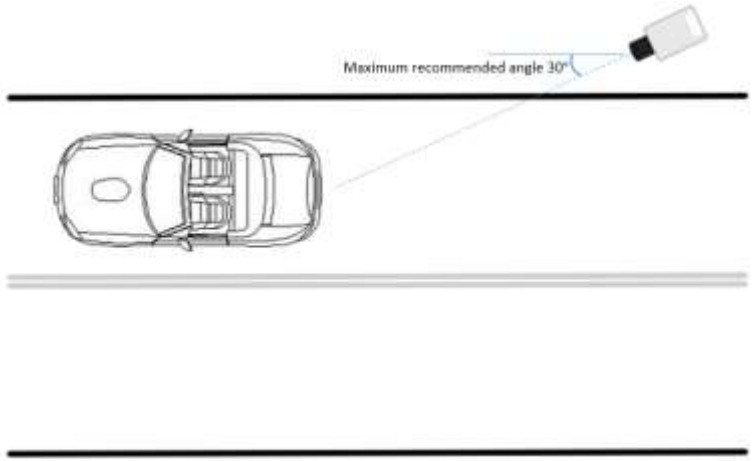


Figure 15 – ITSCAM installation for traffic control (top view)

Installing ITSCAM without following the reported distances compromises the quality of the captures and reduces OCR rate. If installation requisites are not meet, consult the Pumatronix Technical Support for specific instructions.

6.3. ITSCAM Bracket

ITSCAM has a bracket that allows its attachment to a case or tripod by using one or two ¼" screws. There is also a hole for tripod anti-rotation pin, as shown in Figure 16. The bracket location at ITSCAM can be changed by using the rail where it is located.

Changing bracket location requires untightening the screws that attach it to ITSCAM body, moving it to the desired position, tightening the screws uniformly and putting the equipment in the structure. Bracket may disassemble if moved out of ITSCAM body. Screws must be tightened uniformly, so images will not seem to be horizontally rotated when ITSCAM is leveled properly.

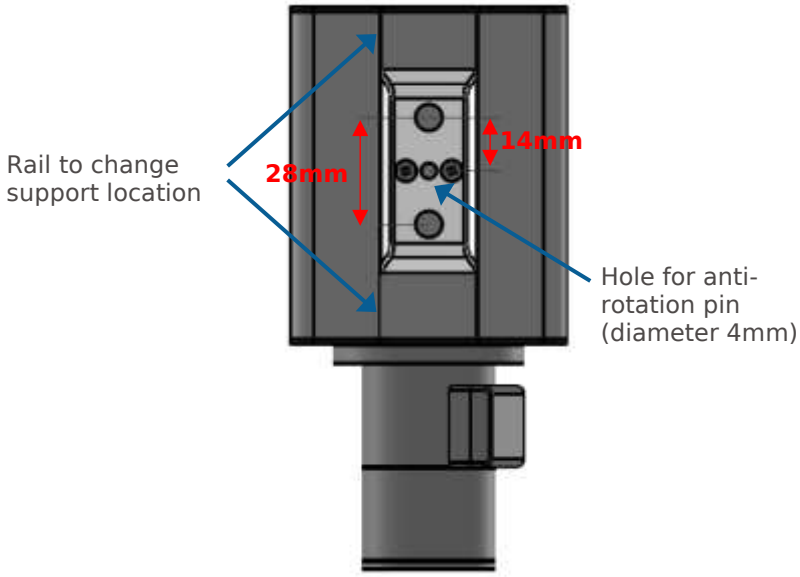


Figure 16 – Bracket specifications

Figure 17 shows all ITSCAM bracket parts and how to join them. If it disconnects to the equipment, put parts together as image shows.

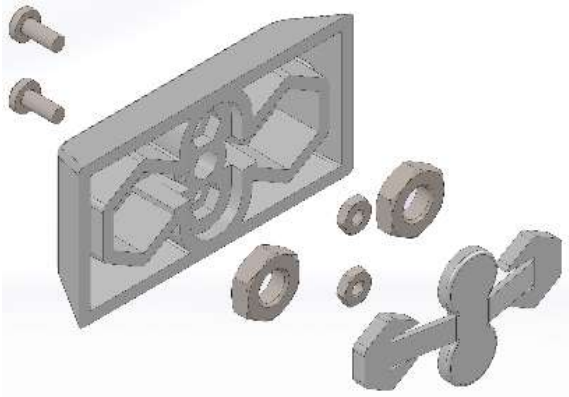


Figure 17 – ITSCAM bracket assembly

ITSCAM has a previous bracket model that uses only one ¼" screw.

6.4. 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;
- Disable auto iris (if ITSCAM has this feature);
- 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.

When fastening lens screws, put just enough pressure on the screw. Otherwise, lens can be damaged.

ITSCAM LM84 has option of saving focus for day situation and another focus for night situation. The reason is that these lenses have no infrared light correction and the presence of infrared light changes image focus.

6.4.1. 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;
- Disable auto iris (if ITSCAM has this feature);
- 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.

7. ITSCAM Inputs and Outputs

7.1. 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).

Vehicle detection methods by imaging are not available in ITSCAM model 411 with resolutions of 1280x960 and 1920x1440 pixels.

Configuration	Operation mode
1: Off	There is not 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: High level and approaching	Options 2 and 5 combined
13: Motion detector	Captures will be sent whenever the Motion Detector identifies variation in the image.
14: Start-motion detector	A single capture will be sent as soon as the Motion Detector identifies variation in the image.
15: End-motion detector	A single capture will be sent as soon as the Motion Detector stops identifying variation in the image.

7.1.1. Virtual Trigger Description

Virtual Trigger can capture images of vehicles passing through the lane, using only image processing. ITSCAM 4XX 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 18).

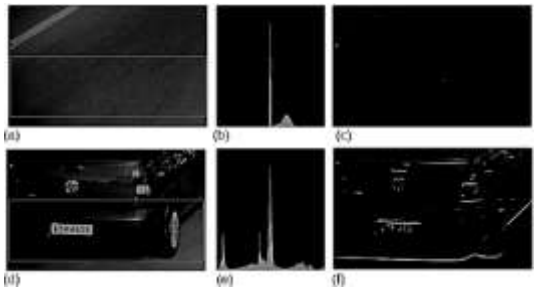


Figure 18 – Histograms of images with and without vehicle

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.

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 19). The algorithm seeks for high luminance regions and groups these pixels. The capture happens when some groups match headlight features.

Figure 19 – Night image example

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.

7.2. 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 9).

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 9 – Time between frames and number of frames per image requisition

Resolution	Time between frames	Number of frames per requisition
752x480	16ms	1 to 16
800x600	20ms	
1280x720	33ms	
640x480	18,5ms	1 to 4
1280x960	44ms	
1280x960 (HDR)	33,3ms	
1280x960 (CCD)	41,6ms	

1636x1220 (HDR20)	66,75ms	
1920x1440	100ms	1 to 2

7.3. 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.

7.4. 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 (Night) /OFF(Day)	Flash fires in all ITSCAM internally captured frames, just when Night Mode is active

7.5. ITSCAM supported Servers

ITSCAM can communicate with many different types of servers, properly configured. Table 10 shows the supported servers and how the connection works using ITSCAM.

Table 10 – ITSCAM 4XX compatible servers

Server	ITSCAM interaction
FTP	Images are sent to an 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
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

7.6. GPS

ITSCAM can provide images with embedded location coordinates from a GPS that is connected to the Serial Port 1. Some ITSCAM have embedded GPS working at 4800 bps, 8 data bits, no parity and 1 stop bit (*8N1)*.

7.7. 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

7.7.1. 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 11).

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 11 – 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*

8. ITSCAM Test Mode

ITSCAM test mode sends vertical, horizontal e diagonal patterns instead of the captured image. This mode is useful for testing features that do not depend on the image. It is available only on ITSCAM with resolution 752 x 480 pixels.

9. Image Rotation

ITSCAM with 800x600, 1280x720, 1280x960, 1636x1220 and 1920x1440 resolution, allows its installation upside down, because images can be rotated 180°.

10. 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. Settings can be done at ITSCAM Web interface. In addition, software available at www.pumatronix.com can be used to change ITSCAM settings and save images.

Pay attention on the correct time to change 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

10.1. Day/Night Mode

ITSCAM 302, ITSCAM 312, ITSCAM 401, ITSCAM 403, ITSCAM 411, ITSCAM 421, HDR and CCD operate in Day mode when capturing images with only visible light. Capturing images with infrared light occurs only while the equipment is operating in Night mode. The switching between these operating modes is done based on the amount of ambient light available.

Day and Night change depends on a component called Exchanger. This electronic component has an internal mechanism that performs the positioning of a filter that prevents the passage of infrared light. This filter is positioned between the light input and the image sensor.

To maintain image homogeneity throughout the day and night, ITSCAM performs a combined adjustment of Auto Iris, Shutter (Image Sensor Exposure Time), and Gain (after digital processing of captured images). These settings are combined and generate the result of Level in the image. When Auto Iris, Shutter and Gain reach the specified limit values, the equipment changes the operating mode to Day or Night.

However, up to version 17 of ITSCAM firmware, switching between Day and Night modes was done based on the value of the Image Level. This value should be below specified value for change to take place. This change was not equivalent to returning to Day mode. Changing from Night to Day mode was done with Shutter value used by ITSCAM. When this value reached the specified percentage, operation mode changes.

In firmware version 18, there was a change in Day/Night mode dynamics. ITSCAM remains controlling Auto Iris, Shutter and Gain, but uses the same percentage criterion to switch between modes. This change created two new variables (cgi commands) and, when upgrading the device to the latest firmware version, the default percentage parameters are adopted. The suggested setting for these parameters is 50% of the desired level to occur the transition to Night mode and 90% of the level desired to occur the transition to Day mode.

After performing ITSCAM firmware update, verify that the Day and Night mode transitions are correct. Do not hesitate to contact Pumatronix Technical Support to resolve questions and improve the mode settings.

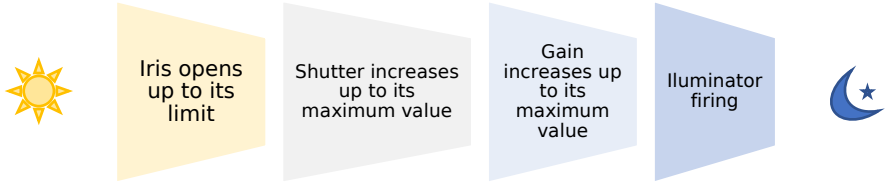


Figure 20 – ITSCAM adjustment sequence from Day to Night mode transition. This sequence take place on reverse order for changing from Night to Day mode

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

10.2. 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 12 shows typical correspondence between speed, ITSCAM resolution and Shutter.

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

Table 12 – Default values for configuring ITSCAM shutter according to resolution and lane speed

Lane speed	Resolution	Estimated shutter
Up to 60 Km/h	640x480	30 to 60
	752x480	
	800x600	
	1280x720	22 to 44
	1280x960	
	1636x1220	
	1920x1440	
More than 60 Km/h	640x480	15 to 30
	752x480	
	800x600	
	1280x720	11 to 22
	1280x960	
	1636x1220	
	1920x1440	

Shutter exposure time values are set according to ITSCAM resolution, defined by integers, ranging from 1 (shortest exposure time) to the maximum value that each ITSCAM model supports (longer exposure time), as shown in Table 13. Table 14 shows the most common shutter values and the exposure time in seconds for each ITSCAM resolution.

Table 13 – Maximum shutter allowed for ITSCAM according to its resolution and time of each shutter step (in microseconds)

Resolution	Maximum shutter	Shutter step in µs
640x480	450	19,97
752x480	2047	33,84
800x600	600	31,25
1280x720	700	44,4
1280x960	1000	44,4
1920x1440	1000	65,72
HDR (1280x960)	900	34,39
CCD (1280x960)	900	34,39
1636x1220 (HDR20)	1100	53,33

Table 14 – Relation between the set shutter value and the exposure time for each resolution of the ITSCAM (in seconds)

Shutter	640x480	752x480	800x600	1280x720 or 1280x960
1	1/50075	1/ 29550	1/ 32000	1/ 22522
2	1/25037	1/ 14775	1/ 16000	1/ 11261
3	1/16691	1/9850	1/ 10666	1/7507
5	1/10015	1/5910	1/6400	1/4504
10	1/5007	1/2955	1/3200	1/2252
15	1/3338	1/1970	1/2133	1/1501
20	1/2503	1/1477	1/1600	1/1126
30	1/1669	1/985	1/1066	1/750
40	1/1252	1/738	1/800	1/563
50	1/1001	1/591	1/640	1/450
60	1/835	1/492	1/533	1/375
Shutter	**1280x960 HDR**	**1280x720 CCD**	**1920x1440**	**1636x1220**
1	1/29078	1/29078	1/ 15216	1/18751
2	1/14539	1/14539	1/7608	1/9375
3	1/9692	1/9692	1/5072	1/6250
5	1/5815	1/5815	1/3043	1/3750
10	1/2907	1/2907	1/1521	1/1875
15	1/1938	1/1938	1/1014	1/1250
20	1/1453	1/1453	1/760	1/937
30	1/969	1/969	1/507	1/625
40	1/726	1/726	1/380	1/468
50	1/581	1/581	1/304	1/375
60	1/484	1/484	1/253	1/312

10.3. 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 a specified value
Auto	Adjusts based on ambient conditions up to maximum specified limit

10.4. 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

10.5. 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 without auto iris DC (or when auto iris disabled):** 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 ITSCAM 310 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.

10.6. High Dynamic Range (HDR) – Regular Contrast

High Dynamic Range details saturated and dark regions in the same image. ITSCAM changes pixel values of these regions to intermediate values. This occurs through the activation of a logarithmic response of pixel intensity, based on the amount of received light. This configuration is available on ITSCAM models with 752x480 pixels resolution and on ITSCAM HDR.

HDR Day or *HDR Night* are applied respectively in the current operating modes, when enabled. To balance with *Gamma* setting, it is suggested to use *Logarithmic Gamma* with a value of 180. Disabled, generates linear response of pixels.

Configuration	Operation mode
Off	Pixel response to received light is linear, with 55dB range
On	Pixel response to received light is logarithmic, with 110dB range

10.7. 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

10.8. 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 vary 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 21 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

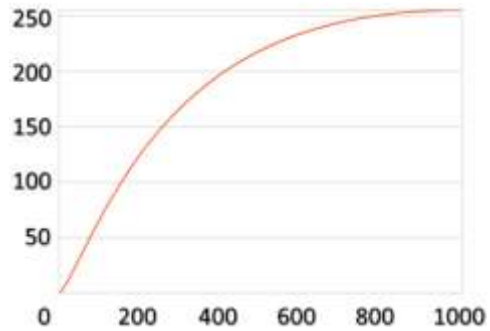


Figure 21 – Example of a gamma curve (Gamma value: 140). It converts sensor pixel value (that varies from 0 to 1023) in a logarithmic way to 8-bit value (that varies from 0 to 255)

10.9. 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. This setting is available in models ITSCAM 4XX series.

Minimum value	Maximum value
0	255

10.10. 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. This setting is available in ITSCAM 4XX series.

Minimum value	Maximum value
0	255

10.11. 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. This setting is available in ITSCAM 4XX series.

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

10.12. 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. Differentiated Settings

In many environments, it is needed to specify daytime and night time settings, so ITSCAM can successfully operate in both DAY and NIGHT modes. 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.

12. 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 22 shows an example of image regions.

Minimum value	Maximum value
0	15

Figure 22 – Image showing regions of interest location and values

13. ITSCAM First Access

The Web Interface is a tool for establishing the connection between ITSCAM and the user. To access ITSCAM for the first time, it is necessary to connect it to a network where its default IP address 192.168.0.254 is valid. The computer should have IP address 192.168.0.x and mask 255.255.255.0.

From the browser of this computer it is necessary to enter the default IP address of ITSCAM and to inform:

User	admin
Password	123

It is possible to change ITSCAM network settings on first access, although it will take effect after ITSCAM restart. ITSCAM with firmware version inferior to 15.X need Java JRE and the address 192.168.0.254/java/index.html must be used.

14. Access ITSCAM After Changes on Network Settings

ITSCAM can be accessed by devices with a web browser and Java JRE. To access the equipment, its respective IP address must be entered on the browser, and in the sequence User and Password.

In case of in case of loss of access, consult Recover Access to ITSCAM.

15. Web Interface for Firmware 16.X to 17.X

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, which shows all direct communication channels with Pumatronix support.

Detailed info and help about commands and settings are available over the sign ? and on this document.

After ITSCAM login, the main window shown looks like Figure 23.

Figure 23 – Main window of ITSCAM web interface for firmware version 16.X to 17.X

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 P.S.: If the *DisableFrwUp* parameter has been set, the option to update Firmware is unavailable.

15.1. ITSCAM Settings

ITSCAM configurations are grouped by functionality, as shown in Figure 24. 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 24 – Configurations of ITSCAM web interface for firmware version 16.X to 17.X

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.Web Interface for Firmware 18.X

Firmware version 18, 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

The ITSCAM web interface home screen is shown in Figure 25. On the left side is the fixed ITSCAM Image Control Panel Display and the Current Situation (that displays the current values of the Operation Mode, Shutter, Gain and Level). On the right side are the buttons of the initial menu to make the adjustments in the equipment.

In the upper right corner of the screen is the option to select the page display language. You can choose between Portuguese, English, Spanish and French.

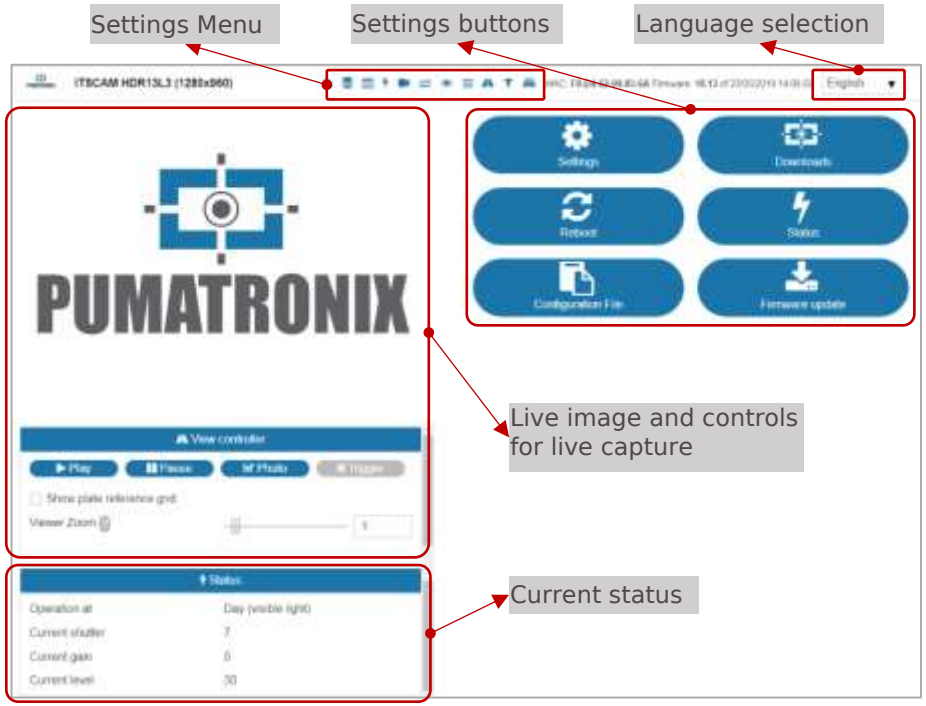


Figure 25 – ITSCAM web interface for firmware version 18.X

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

16.1. ITSCAM Settings

Figure 26 shows the Settings screen with the available options. All settings options are always available for quick access in the top bar of the screen.

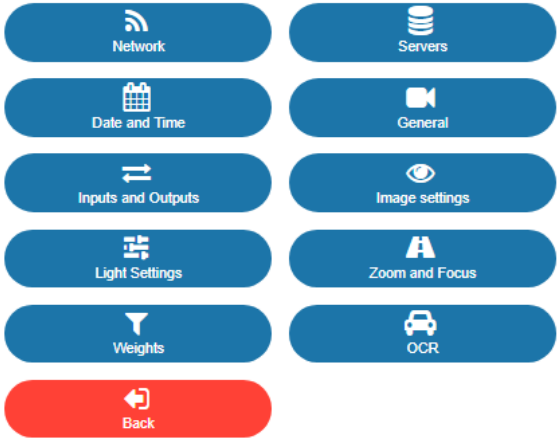


Figure 26 – ITSCAM Web Interface settings for firmware version 18.X

To perform the automatic vehicle license plate reading, it is necessary to update ITSCAM network configuration (Figure 27), define which images will be processed, enter the OCR and MAP processing settings, when available. The zoom and focus adjustment can be done at any time in the settings process, but it is mandatory. The indicated image parameters for ITSCAM are listed in Default Settings for Web Interface (Firmware 18.X).

When finalizing each configuration, to validate the information it is necessary to click the Apply button: 

By clicking on the section heading, or the relative blue bar, the contents of this section are minimized. Click again to access the fields.

16.2. Network Settings

Figure 27 – Network Settings at ITSCAM Web interface

Configuration	Operation mode	Range
MAC Address	Informs ITSCAM MAC address, that cannot be changed	Valid address
IP Address	The default IP address is 192.168.0.254 with network mask 255.255.255.0. The static IP 192.168.254.254 is always enabled and can be used as a recovery address in case of incorrect network configuration. Use 0.0.0.0 to enable automatic IP address assignment (DHCP). ITSCAM must be rebooted to apply configurations.	Valid Configuration
Netmask	Show and allow editing ITSCAM netmask. ITSCAM must be rebooted to apply configurations.	

Gateway	Show and allow editing ITSCAM gateway. ITSCAM must be rebooted to apply configurations.	
DNS server	Informs and lets you change the DNS server. ITSCAM must be rebooted to apply configurations.	
IP Address 2	Informs and allows you to change the secondary IP address of the machine, provided it is not on the same subnet as the recovery IP address 192.168.254.254, it can be used for access. ITSCAM must be rebooted to apply configurations.	Valid Configuration
Netmask 2	Informs and lets you change the netmask of the secondary IP address. ITSCAM must be rebooted to apply configurations.	
User	Informs the *user* that is accessing the machine.	-
Password for web access	For greater security, it is recommended to assign a password to the user *admin*. The factory default password is *123*. ITSCAM must be rebooted to apply configurations.	0 to 8 alphanumeric characters
Password protection on all HTTP protocol communication	Web interface is password protected, though the communication by HTTP protocol can be protected or not. Some operations that can be protected by password are: reboot, viewing and changing settings and image request.	Yes; No

16.3. Servers Settings

Figure 28 – Servers Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Server for image and data	Communication with the following types of servers is possible: - *FTP*: Equipment connects via FTP with one of the servers available for sending images; - *ITSCAMPRO*: Equipment connects to an ITSCAMPRO server to send images; - *RTSP*: Hardware enables a Real Time Streaming Protocol (RTSP)	None; FTP; ITSCAMPRO; RTSP; Serial Port

	server that displays images captured by ITSCAM; - *Serial Port*: Equipment becomes a TCP server on the specified ports and retransmits the data from the serial ports to the TCP socket and vice versa.	
Resolution	Resolution that images will be transmitted on the configured server (in pixels).	Original; 800x600; 640x480; 400x300; 320x240; 240x180; 160x120
Enable mosaic	Join four imagens on unique picture	Enabled; Disabled
Use Puma Protocol crop	Send only image region of interest as photo	Enabled; Disabled
Enable authentication in Pumatronix Protocol	Protects the communication with a password	Enabled; Disabled
Serial port 1 configured as	Serial port 1 interface can be used as a server (but Server for Image must be set as Serial Port), the controller of integrated GPS or working as external trigger (receiving the capture request signal). ITSCAM must be rebooted to apply configurations.	server; embedded GPS controller; image trigger
Baud rate	Serial port speed is measured by the number of bits transmitted per second (bps). ITSCAM must be rebooted to apply configurations.	300; 1200; 2400; 4800; 9600; 14400; 19200; 28800; 38400; 57600; 115200; 230400
Data bits	Number of data bits of a transmission. The packet refers to a single byte transfer, including start / end bits, data bits, and parity. ITSCAM must be rebooted to apply configurations.	7; 8
Parity	It is a simple form of error checking that is used in serial communication. ITSCAM must be rebooted to apply configurations.	none; odd; even
Stop bits	Used to signal the end of communication for a single packet. They indicate the end of transmission, but also give computers some margin of error in clock speeds. ITSCAM must be rebooted to apply configurations.	1; 2
Use Network Time Protocol - NTP	Enables time updating via Network Time Protocol (NTP) server.	Enabled; Disabled
NTP address	Network Time Protocol (NTP) address for updating ITSCAM time. A DNS server must be set up.	Valid IP Address or *Hostname*

16.3.1. FTP Server

Figure 29 – FTP Server Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Address	IP address or URL (if URL is used, it is necessary to configure DNS server).	Valid IP Address or *Hostname*
Port	Server Port that receives the information collected by ITSCAM.	1 to 65535
IP address (Redundant server)	Redundant server IP address in case of failure on communication with the main server (valid for FTP server only). If URL is used, it is necessary to configure DNS server).	Valid IP Address
Port (Redundant server)	Redundant server port (valid for FTP server only).	1 to 65535
User	User for FTP server authentication.	Alphanumeric characters
Password	Password for FTP server authentication.	Alphanumeric characters
Sent image	*At full resolution*: sends image with ITSCAM resolution *320x240 pixels*: Resizes images to 320x240 pixels before sending to the server.	at full resolution; 320x240 pixels
Image name format	The file name may have the symbols listed on Table 15, that are overwritten by the ITSCAM.	Alphanumeric characters

Table 15 – Symbols for File Name Generation Using FTP Server

Symbol	File Name Representation
%u	Unique identifier
%d	Day
%m	Month
%y	Year
%h	Hour
%n	Minute
%s	Second
%p	Vehicle plate
%i	IP address of the equipment that originated the capture
%c	Photo counter (reset at restart)
%v	Daylight Saving Time - V for daylight saving time and N for normal time
%a	MAC address of the equipment that performed the capture.

* Numbers can be used to truncate values (such as '%4u').

Software version 19.1.5 adds a process that monitors the FTP server. This process has access to the watchdog and forces a restart of the equipment, in case communication with FTP server has been interrupted. To activate this functionality, the dgi command *WDServerCheck = 1* must be sent, however it is necessary to have a product version with hardware in revision 6 or with an external hardware watchdog connected to output 2. In cases where the watchdog is external to output 2, the command ForceWDIO2 = 1 must also be configured via cgi. Pumatronix Technical Support can assist in identifying the hardware version.

16.3.2. ITSCAMPRO Server

Figure 30 – ITSCAMPRO Server Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Address	IP address or URL (if URL is used, it is necessary to configure DNS server).	Valid IP Address
Port	Server Port that receives the information collected by ITSCAM.	1 to 65535
Send to ITSCAMPRO	Number of photos per vehicle sent to ITSCAMPRO.	One image per request; all images

16.3.3. RTSP Server

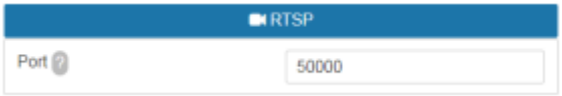


Figure 31 – RTSP Server Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Porta	To access the images via RTSP protocol, it is necessary to configure a valid port and in the receiving application enter the link: rtsp://EQUIPMENT_IP/Port/mjpeg. If default port 554 is chosen, the link corresponds to: rtsp://EQUIPMENT_IP/mjpeg.	1 to 79; 81 to 49999; 50001 to 65535; except ports in use by other services

16.3.4. Serial Port Server

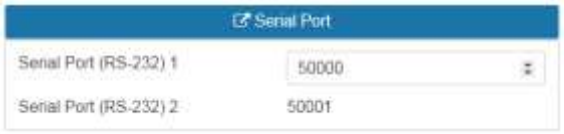


Figure 32 – Serial Port Server Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Serial Port (RS-232) 1	Server Port that receives the information collected by ITSCAM.	1 to 78; 81 to 49998; 50001 to 65534; except ports in use by other services
Serial Port (RS-232) 2	Server Port that receives the information collected by ITSCAM.	Consecutive value chosen at port 1

16.4. Date and Time Settings

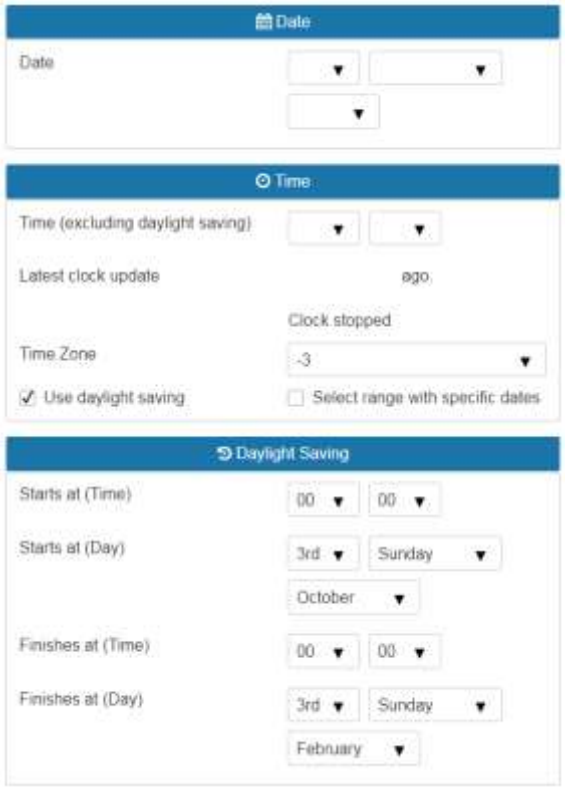


Figure 33 – Date and Time Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Date	Specify selecting day, month and year.	Valid day, month and year
Time (excluding daylight saving time)	Specifies the time. ITSCAM adds daylight saving time automatically.	24 hours
Time Zone	Specify the time relative to Universal Coordinated Time (UTC).	-12 to +12
Use daylight saving	When checked, allows to configure the daylight-saving time period.	Enabled; Disabled
Select range with specific dates	When checked, allows to specify the date of start and finish of daylight-saving time period.	Date and Time
Starts at / Finishes at	Daylight Saving Time start and end settings.	Date and Time

16.5. General Settings

Figure 34 – General Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Rotate image 180°	This feature rotates the image by 180°, allowing ceiling installation.	Enabled; Disabled

Auto Iris DC lenses	Auto Iris allows an additional light control and should be disabled only during the focus process.	Enabled; Disabled
Mode	Day or Night mode operation. ITSCAM can provide color images at daytime and black and white images at nighttime. This is because there is a filter that lets only infrared light pass through at night.	Auto; Always Day; Always Night; Day/Night set by IN2; Day/Night set by IN1
Day / Night Transition Algorithm	When using Day mode, infrared lighting is filtered and colors reproduced in the image remain unchanged. When in Night mode images are processed with the influence of infrared light, and so that no color distortion occurs, they are displayed in black and white. For the Night mode color photo option, color information is incorporated into images, which may not reflect the actual color of objects in the scene due to infrared illumination.	Enabled; Disabled
Colored images on Night mode	During Day mode, the lens has an infrared filter so that it does not affect the image colors. When in Night mode, the images are rendered in infrared and the device extracts only the brightness of the photo. By enabling use of color photos in Night mode, both color and infrared information are used in images and this can affect the actual color of the objects in the image.	Enabled; Disabled
Desired level	The desired level defines the gain and shutter behavior of the image sensor (shutter), adjusting them to produce darker or brighter images.	7 to 62
Day to Night	Operating in Auto Mode: Change from Day to Night happens only when the current level falls below	0 to 100
	the specified threshold (percentage of the Desired level). Usually this value is less than the threshold from Night to Day mode.	
Night to Day	Operating in Auto mode: Change from Night to Day happens only when current level stays above this threshold (percentage of the Desired level).	0 to 100
Visible to IR	Motorized lens has two focus settings, one for visible light and other for infrared. In order to avoid excessive exchanges at the glooming time during the end of the day, it is established a threshold (percentage of the Desired level) where the equipment switches to Night mode and continues with the focus for visible light.	0 to 100
IR to Visible	Motorized lens has two focus settings, one for visible light and other for infrared. In order to avoid excessive exchanges in early morning, it is established a threshold (percentage of the Desired level) where the equipment switches to Day mode and continues with the focus for infrared light.	0 to 100
Global label (Image)	Enables printing a label on the top of the image. The text in the label may be black or white.	Disabled; White text; Black text
Global label (Video)		
Global label text (image)	Text to be printed on equipment photo captures, which can be formatted to display equipment and capture information through tags, similar to C-string formatting. Note that, unlike C, this field does not support character length formatting or other modifiers.Table	Alphanumeric characters
Global label text (video)		

	16 indicates how to configure fields to be displayed in label.	

Table 16 - Symbols for setting fields that will be shown in label

Symbol	Substitution
%p	Plate (up to 7 characters) (only for image global label)
%y	Year (2 digits)
%m	Month (2 digits)
%d	Day (2 digits)
%h	Time (2 digits)
%n	Minute (2 digits)
%s	Second (2 digits)
%v	Daylight Saving Time ('V'/'N')

* Example: %p-y/%m/%d-%v
Possible response: ABC1234-20/03/20-N.

16.6. Inputs and Outputs Settings

OCR processing is performed on all images captured by ITSCAM. However, there are situations where the vehicles flow is low and the images that are captured have no distinction. To optimize the processing of these images without variation in content, a mechanism called Motion Detector was implemented in ITSCAM.

16.6.1. Inputs and Filters

Figure 35 – Inputs Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Captures per pulse (Day or Night)	Sets the number of photos that will be captured at each request (Multiple Exposures). Photos will	1 to ITSCAM model limit

	be spaced 1 frame plus Capture Delay. It is indicated to use more than one image per request to identify reflective and non-reflective plates in adverse conditions. Multiple exposures per vehicle generate images of the same vehicle with different configurations.	
Minimum time between triggers (milliseconds)	Time that equipment waits to process a new input signal. This time starts counting after receiving the request.	0 to 60000
Captured image format	It is recommended to use the JPEG format so that the transmission of images via protocol occurs faster and maintains quality.	BMP; JPEG
Quality	Quality of uploaded JPEG images.	0 to 100
Respect illuminator protection time	After the flash is triggered, the illuminator needs a break time so as not to overload the LEDs and stabilize the voltage. The illuminators have protection circuits that, if the flash is requested during this time, it is not triggered, causing the captured photo not to be correctly illuminated. By activating this option, ITSCAM automatically calculates the rest time from various parameters such as shutter times, number of shots and illuminator model. If any photo request does not respect this timeout, ITSCAM ignores the request. Note however that this option does not prevent captures with large number of shots and shutter time, which means that in these cases the last shots can be taken without sufficient lighting.	Enabled; Disabled
Visible light trigger	Trigger type used when ITSCAM is operating in Day mode.	Off; Rising edge;
Infrared trigger	Trigger type used when ITSCAM is operating in Night mode.	Falling edge; Rising and Falling edge; Approaching image; Departure image (fast); Departure image (slow); Continuous; Periodic; High Level; Low Level; High Level and Approaching; Motion detector; Start-motion detector; End-motion detector.
Execute motion analysis	Allows you to enable motion calculation in the trigger photo stream. Photos captured in the web interface and photo requests by the protocol of port 50000 will not be affected by the filter. The calculation result is added to the JPEG comment.	Enabled; Disabled
Filter behavior	If motion filter analysis is enabled, it is possible to discard images that are considered without motion. Thus, if this option is enabled, all images that have motion lower than the configured threshold will be discarded.	Do not discard; Select only those with movement; Select only the beginning of movement; Select only the end of movement
Threshold	The motion detector serves to prevent the capture of identical images and the excessive image processing. The lower the threshold value, the more	1 to 254

	sensitive the motion detector will be. The default value is 5.	
Use ROI	Specify whether a *Region of Interest* will be used to calculate the range of motion and process the OCR. This region may be different or equal to the one specified for OCR.	Disabled; Use movement filter ROI; Use OCR ROI
Region of Interest (ROI)	The Region of Interest in the image is for enabling Motion Detector only in the selected region and reducing image processing. It is recommended to use regions of interest to remove sidewalks and parts of the image that do not compose the track. The region you choose should be a four-point polygon that is marked over the image in the Preview control region.	Select region; Without region
Input 1 (IN1)	Status da entrada	On; Off
Input 2 (IN2)	Status da entrada	On; Off
Synchronism mode	Up to firmware version 18.6, the sync made by the *sinc* and *sincdt* counters matched the number of frames after a transition on an input. Since frame rate may differ for different ITSCAM models, compensation should be made to compare *sinc* and *sincdt* values between devices. Firmware from version 17 has the *TSinc* and *TSincDT* counters representing the time in milliseconds.	Controlled by IN1; Controlled by IN2; Controlled by IN1, when IN2=0; Controlled by IN1, when IN2=1; Controlled by IN2, when IN1=0; Controlled by IN2, when IN1=1;
Synchronism mode (DT)		

16.6.2. Outputs

Figure 36 – Outputs Filters Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Outputs configured for	ITSCAM outputs can be triggered by protocol commands or by the web interface, when interest. If it is necessary to control equipment and activate ITSLUX, the illuminator can be activated via ITSCAM serial port.	Fire illuminator/ flash; equipment control
Flash mode	The flash can be triggered using the *delay* option, which activates	Off; Single;

	the flash just before capturing the image, thus taking advantage of the maximum brightness the illuminator can provide. In *automatic* mode, the illuminator is not activated during the day, generating energy savings for the system. Mode: - *Off*: Flash is never activated; - *Single mode*: Flash activated for photos only; Flash is instantly activated when an image is requested with the command - *Continuous*: Flash activated in all frames (including video). Recommended for LED illuminators only; - *Single mode with delay*: Flash fires before the image is captured ("Photo" command only); - *Automatic*: Flash is enabled only in Night mode; - *Automatic with delay*: Uses the same principle as Auto Flash, but delay is used to optimize lighting at capture time; - *Continuous (Night)/OFF (Day)*: Flash fires continuously only while in Night mode.	Continuous; Single with delay; Automatic; Automatic with delay; Continuous (Night)/OFF (Day)
Flash surveillance	Illuminators send information about their working status through the serial in every shot. This diagnosis contains possible electrical problems such as internal short circuit, the voltage level of the capacitors, if there are burnt LEDs, etc. When enabled, such information appears on the WEB interface and in the comments of the photos taken, when using JPEG photo output.	Off; Enabled; Enabled and fires with serial port 2
Autoflash fires on	Configures illuminator behavior, that can be activated whenever the exchanger is not filtering infrared light (Night mode operation) or when the equipment detects that the light levels are low and infrared light predominates.	Night mode; infrared light
Flash delay (µs)	Equipment delay between the illuminator trigger and the image sensor exposure. This delay allows you to align the image capture with the flash at its peak of light emission, to take advantage of the best illumination that the illuminator offers. Using Pumatronix illuminators: There is a real delay of 50µs until the effective emission of light, which only influences shutter captures below 250µs. The small shutter can be fixed by inserting a delay of 130 steps before capturing the image, so that the light peak can be used. Situations with shutter greater than 250µs do not require the flash delay.	0 to 25000
Flash power in first shot Flash power in second shot	Percentage of ITSLUX intensity when *Multiple Exposures* are captured. Check illuminator technical specifications.	0 to 100
Illuminator model	Inform the model of illuminator used, or none/others if it is not a Pumatronix model.	None/others;
Flash output	Changes the voltage level of the ITSCAM output. This setting is lost when the equipment is reset or restarted. Check the Dimensions and Power Supply section to connect only equipment compatible with the IO circuit.	Activate output 1; Activate output 2
On Time (ms) Off Time (ms)	A pulse oscillator can be configured at ITSCAM output 2 or	1 to 3600000

	M. This is done by specifying how long it will be On and OFF.	
Period	Indicates the time interval until the trigger sequence repeats.	Calculated by ITSCAM
Duty cycle	The ratio of time on to time off (%)	Calculated by ITSCAM
Output	Enable Output 2 and/or Enable Output M	Enabled; Disabled

16.7. Image Settings

Figure 37 – Image Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Desired level	The level of clarity desired in the picture can be achieved with gain, shutter and iris adjustments. These settings must be enabled for automatic operation, and will use the *Desired Level* value as a base. If the current brightness level is lower than desired, ITSCAM follows the sequence of adjustments, starting at the iris, moving to the shutter and finally gaining until the desired level is reached. In case the current clarity level is greater than the desired level, the ITSCAM performs the reverse sequence until the desired level is reached.	7 to 62
Current level	Displays current ITSCAM level	7 to 62
Gain mode	The gain has the function of digitally lighten the captured images. However, the content and noise are emphasized and for this reason the gain should not be too high. It can be kept fixed or automatically changed by the equipment, which respects the limit specified in Maximum gain.	Static; Auto
Static gain	Gain value which is kept constant when the equipment operates in Static Gain mode.	0 to 72
Shutter mode	The shutter corresponds to the time the image sensor will be exposed for image formation. Very high shutter values generate blurred motion images. The value set in *Static Shutter* can be used or can be changed automatically by the equipment. There is also the option to operate with a fixed value when in Day mode and automatic when in Night mode.	Static; Auto; Static (Day); Auto (Night)
Static shutter	Equipment operates constantly with the same specified shutter	Varies by ITSCAM model

	value when in *Static* mode. A higher value allows image sensor larger light exposure. Therefore, the suggested configuration is on Table 12.	
Current shutter	Displays current ITSCAM shutter.	
Edge Sharpening	Apply a digital filter for image edge sharpening. The algorithms make the image edges noticeable, giving more contrast to the contours and pretending that image focus is better. This feature improves images visually, but enabling it can reduce detection rate. It happens because detection algorithms perform similar processing.	Off; 1st order Filter; 2nd order Filter; 2nd order Filter (smooth)
High Dynamic Range - HDR	High Dynamic Range lets detail visualization of saturated and dark regions in the same image.	Enabled; Disabled
Enable custom shutter Day mode	Advanced customizations change the shutter behavior of *Multiple Exposures*. To change these settings, at least 2 exposures must be selected. In traditional mode, *Multiple Exposures* are already optimized for most cases, so you do not need to change this setting. Contact technical support to assess the need and for more information about this feature.	Enabled; Disabled
Second exposition Day	Shutter value.	Varies by ITSCAM model
Enable custom shutter Night mode	Advanced customizations change the behavior of the Multiple Exposure shutter. To change such settings, at least 2 exposures must be selected. In traditional mode, Multiple Exposures are optimized for most cases and you do not need to change this setting. Contact Technical Support to evaluate the need for this setting.	Enabled; Disabled
Second, third and fourth exposition Night	Shutter value.	Varies by ITSCAM model

16.8. Light Settings

Figure 38 – PART A - Light Settings at ITSCAM Web interface

Figure 39 – PART B - Light Settings at ITSCAM Web interface

Firmware version 18.X and above changed ITSCAM switching mode between Day and Night Modes.

Configuration	Operation mode	Range
Captures per pulse (Day or Night)	It is better to use more than one capture per pulse to identify reflective and non-reflective plates in adverse conditions. Multiple exposures per vehicle generate images of the same vehicle with different configurations.	1 to 4
Current shutter	Shutter value.	Varies by ITSCAM model
Maximum shutter (Day or Night)	Maximum shutter value that the equipment uses when it is configured to operate with an automatic shutter. The higher the value, the longer image sensor exposure.	Varies by ITSCAM model
Current gain	Gain value	0 to 72
Global gain	In Day mode and automatic gain, it defines the maximum gain that can be reached by the level adjustment algorithm	0 to 72
Gain for plates in shadow	Gain for plates in shadow or objects in the image dark regions.	0 to 72
Gain for reflective plates	Value of the gain used in the second picture when in multi-exposure mode for infrared light.	0 to 72
Gamma	The gamma defines how the values of the pixels of the image sensor are correlated to the digital image with the predominance of visible light. In *linear* mode (gamma = 0), the value of each pixel is directly proportional to the amount of light that is captured by the sensor. In *quadratic* mode (gamma between 1 and 69) and *logarithmic* (gamma between 70 and 255) the amount of light undergoes a transformation that can improve the quality of the image generated in low light conditions, shadows or night shots.	Linear; Logarithmic; Quadratic
Logarithmic value	110: Suggested value for images with vehicle license plate in shadow 150: Suggested value under normal capture conditions	0 to 255
Saturation	Saturation corresponds to the color proportion in comparison to the average gray color, i.e., in its minimum the image turns gray and in its maximum the image shows only the pure color. When this value is kept at 0 the resulting image is displayed in grayscale.	0 to 255

Brightness (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 the maximum value allowed, the resulting image is completely black.	0 to 255
Contrast (digital gain)	Contrast, also known as digital gain, corresponds to multiply by a factor all image pixels after its capture. It is recommended to let this feature as 100 (which corresponds to factor 1.00 and it does not change captured image)	0 to 255
High Dynamic Range – HDR Day High Dynamic Range – HDR Night	The *High Dynamic Range (HDR)* aims to compensate for very dark or saturated image areas, bringing them to an intermediate value. It can be enabled in the current *Day* or *Night* operating mode. When enabling, to balance the contrast, apply *Logarithmic Gamma* setting with value 180.	Enabled; Disabled
White balance Red Green Blue	White balance corresponds to color setting by changing red, green and blue image channels influence. It is recommended to let all components as 0, so equipment automatically chooses its values.	0 to 255

16.9. Zoom and Focus Settings

Auto Iris must be disabled during zoom and focus adjustment. To do this, disable the auto iris and then click apply.

It is possible to visualize live the changes that are made in the equipment (Figure 40) by clicking the Play button and the Pause button (at left side of the browser window). *Photo* button requests an image with flash, if illuminator is set and needs to be triggered. The *Trigger* function displays the image resulting from the next trigger made by ITSCAM, which may be induced by an installed sensor, such as an inductive loop or optical barrier, or by processing images to identify a vehicle passing.

Requesting images through the interface *Trigger* button requires the following settings to operate correctly: *Servers* must be set to *None*; o *Number of captures per pulse* should be *1* and *Visible Light Trigger* and / or *Infrared Light Trigger* should be set to the desired vehicle detection type.

By clicking this button, ITSCAM's response takes time to detect a vehicle in the image.

Zoom and Focus adjustment can be done automatically using the *Perform Autofocus* button.

Test Mode lets you configure ITSCAM to send vertical, horizontal, and diagonal patterns in the image instead of the captured image for testing non-image-dependent functionality. This feature is only available on ITSCAM models with 752x480 pixel resolution.

By selecting *Mode* as *Automatic*, the switching between Day and Night Mode will be done automatically. However, you need to configure how this switching occurs in *Lighting Change* in the *General* option of the *Settings* menu.

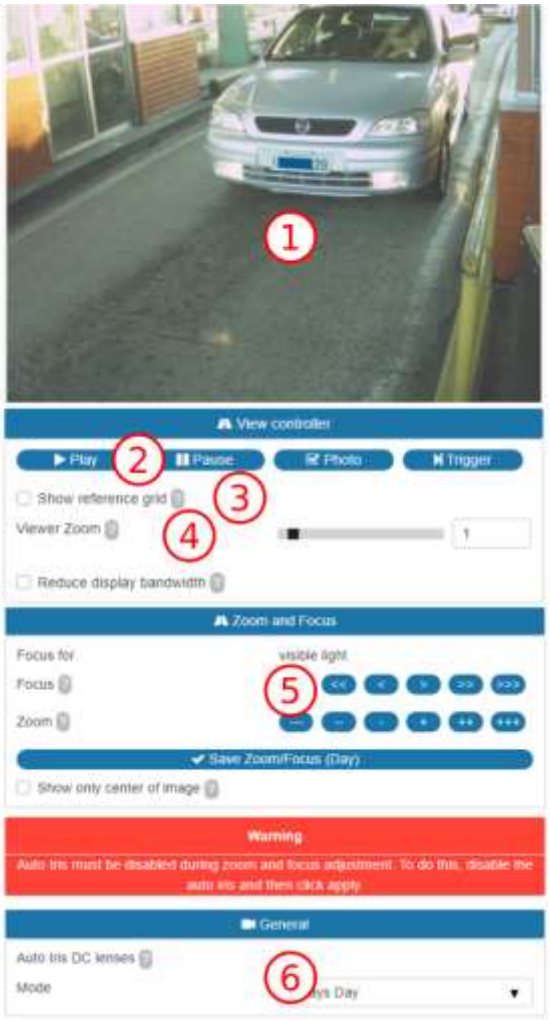


Figure 40 – Zoom and Focus Settings at ITSCAM Web interface

The numbered and highlighted commands in Figure 40 have the following meaning:

Index	Meaning
1 - Capture Screen	Display of live video and captured image. Changes made are displayed on this screen.
2 - Controls (*Play* / *Pause* / *Photo* / *Trigger*)	Allows viewing of the live video or paralyzes the video at the desired point (by clicking *Pause*). By clicking on *Photo* the image will be displayed and on the *Trigger* button the images generated with each trigger are displayed. *
3 – *Show plate reference grid*	Facilitates height adjustment of vehicle license plate character. The ideal height of the board characters will be ACHIEVED when they are fully inserted within one of the grid rectangles.
4 – *Viewer Zoom*	Allows to zoom in or out on the image reproduced by ITSCAM, which helps in identifying the plate OCR.
5 – Focus and Zoom adjustment	Allows you to increase or decrease the adjustment in multiples of 2, 20 or 200 lens steps.
6 – *Auto Iris DC lenses*	Enables auto iris control by ITSCAM. Keep this option off only during Zoom and Focus adjustment.

* Requesting images through T*rigger* button requires the following settings to operate correctly: *Servers* must be set to None; o *Number of captures per pulse* should be *1* and *Visible Light Trigger* and / or *Infrared Light Trigger* should be set to the desired vehicle detection type.

16.10. Weights

Figure 41 – Weights Settings at ITSCAM Web interface

Weight adjustment on *View controller* is available only when zoom is equal to 1.

Configuration	Operation mode	Range
In each of the 16 regions	In situations where part of the image is under direct sunlight and part is in shadow, the automatic image tuning algorithm will hold an average of pixel values. Possibly, images captured with the 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 the contribution of each image region on equipment auto-tuning. The algorithm serves to maintain the current level of brightness equivalent to the image Desired level. Changing region index, its contribution to the desired level will not be equivalent.	0 to 15

16.11. OCR

Automation of license plate identification uses OCR (Optical Character Recognition) algorithms to infer the letters and numbers contained in license plate images. This image analysis can be performed at a processing center or locally.

To auto-read license plates it is necessary to update the ITSCAM network configuration (Figure 27), define which images will be processed (Figure 35) and enter OCR and MAP processing settings, when available (Figure 42). It is required to settle Zoom and focus (Figure 40), and it can be done at any time during the setup process.

- **Option with OCR *Disabled* or *Local Only*:**

Processing performed at the installation site can be performed by the equipment itself that captures the images, that is, ITSCAM has embedded OCR. In this case, the photo is transmitted after identification with the plate read in the comment of JPEG file.

- ***MAP Only* OCR option:**

There are ITSCAM models that does not perform OCR, in this case a connection to an OCR processing center is required. It can be a server/computer that receives the images or the auxiliary processor MAP (Processing Accelerator Module) installed next to the capture device, which analyzes the images and returns the recognized plate to ITSCAM. MAP uses the same open communication protocol as ITSCAM 4XX. This equipment receives the data network connection that the monitoring system uses and the ITSCAM data connection.

- **Option to process OCR in *MAP / Local*:**

In this configuration OCR is processed preferentially in the MAP, but if communication is lost, ITSCAM takes over the processing and images are still available with OCR.

In the option where OCR processing is performed by MAP, information about it should be configured at *Settings* > *OCR* in ITSCAM web interface. The *IP Address* and *Port* assigned to MAP must be replicated in the ITSCAM configuration. After filling in, to save your changes, click the *Apply* button to continue. To test

ITSCAM connection with MAP is required to capture the image of a valid license plate. *OCR server status* reports the health of MAP that can be: *Undefined*, *Disabled*, *Connected*, *Unsupported Country*, *Invalid ROI*, *Invalid License*, *License Expired*, *Failed to Connect*, *Server Disconnected*, *Queued Timeout*, *Queue Full*, *Failed to Send to Server*, and *Connection Limit*. The *Current OCR server* indicates whether the Primary or Secondary equipment is performing OCR.

Figure 42 – PART A - OCR Settings at ITSCAM Web interface

Figure 43 – PART B - OCR Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Region of Interest	Using this feature, the system will check for vehicle plates only in the indicated area. It is indicated using a region of interest to	Select region (and define the 4 points in the image);

	remove sidewalks and no-road areas. The selected region must be a polygon with four points, that are marked over the image showed at *View Controller* (see Figure 46).	Without region
Vehicle plate type	OCR algorithm search in the images to find the plate numbers and letters pattern. Although, vehicles and motorcycles plates are different. For example, in front facilities motorcycles plates are not captured. Thus, it can be configured the type of plate for just *Car*.	Car; Motorcycle; All
OCR Country	For OCR processing of vehicle license plates from countries other than Brazil, please contact Pumatronix Technical Support. ITSCAM with embedded OCR perform processing for Brazil plates only.	Brazil; Argentina; Chile; Mexico; Paraguay; Uruguay; Netherlands; France; Colombia
Timeout (milliseconds)	OCR algorithm searches for the license plate in the image and stops as soon as it finds the plate. However, images having plates with hidden characters or no plates, make the algorithm continues to seek up till specified timeout is reached.	0 to 100
OCR Mode	Specifies the used OCR profile. The slower profiles, the greater the chances to find a license plate. If disabled, the algorithm will not be executed.	Off; Fast; Normal; Slow; Very slow
Maximum allowed characters with low reliability	For a plate to be valid, a number of characters can be identified with low reliability. Characters identified with lower reliability than the minimum value set are represented by the character “- “.	0 to 6
Minimum character reliability	Minimum percentage of OCR reliability considering the degree of similarity between the letter identified in the processing and a letter in perfect capture conditions. It is recommended to maintain the factory default of 85% minimum reliability. Characters identified with lower reliability than the minimum value set are represented by the character “- “.	0 to 100
Minimum character height	Specifies the minimum acceptable character height (in pixels). This value is by default 9 and should not be greater than the '*Maximum character height*' value;	9 to 120
Maximum character height	This specifies the maximum acceptable character height (in pixels). This value is by default 60 and should not be greater than the '*Minimum character height*' value.	9 to 200
Average character height	OCR performs better over a given character height range. By specifying the average character height, it can improve recognition rates of OCR algorithm.	9 to 150
Plate slant angle (°)	To improve the efficiency of OCR, you need to adjust the angle of inclination of the plates, which cause an "italic" effect. To adjust the value, take a picture with a plate in the definitive position and enable the *Plate reference grid* and the *Preview angle correction* options. Adjust the tilt and rotation value until the board is aligned with the grid.	-15 a 15
Plate angle (°)	To improve the efficiency of OCR, you need to adjust the angle of rotation of the plates.	-15 a 15

	To adjust the value, take a photo with a plate in the definitive position and enable the *Plate reference grid* and the *Preview angle correction* options. Adjust the tilt and rotation value until the board is aligned with the grid.	
Preview angle correction	Allows viewing of inclination and rotation set angles.	Enabled; Disabled

Figure 44 – ITSCAM Web interface with a Region of Interest (ROI) set. The OCR algorithm will search for plates placed in the ROI.

Figure 45 – PART C - OCR Settings at ITSCAM Web interface

Configuration	Operation mode	Range
Send plates recognized through the serial port (RS-232)	Sets the format of the message that will be sent when performing an acknowledgment.	Do not send; Send in the traditional way (plate only); Send ID to converter Wiegand 26;

		Send in a custom form
Serial port used for sending recognized plates	Select port	serial port 1; serial port 2
Serial message format	The byte sequence sent by the serial, when a plate identification occurs, is formatted according to this field, similarly to the formatting of strings in C. Note that unlike FTP, the output can be configured to have unreadable characters. Table 18 indicates the fields that can be exported in the message. Also, it can be sent to ITSCAM a CSV list with board pairs and IDs for use with Wiegand 26 converters (contact Support for more information).	String
List of plates Stores a relationship between plates and IDs	The list of plates is used to identify a set of plates using only 24 bits, making it possible to send via Wiegand 26 through a serial converter. The file sent by this interface must be in CSV format with 2 columns: plate (ASCII, up to 7 characters) and ID (decimal ASCII, between 0 and 16777215), separated by commas, with new line separating lines. When a list is loaded, plates that are not in it are not forwarded. To forward plates out of the list, the first line of the table must have the "*" (only one asterisk). The ID of this line is the ID forwarded from these plates.	CSV file
Enable majority vote	When OCR is performed on *Multiple Exposures*, the resulting plate considers the detection result with greater reliability for each character.	Enabled; Disabled
Mode of delivery via Pumatronix Protocol	This option makes it possible to make *Multiple Exposures*, run OCR and choose the best photo for sending via Pumatronix Protocol.	Send all photos; Send only the one with better recognition
Maximum number of different characters	It is the maximum number of different characters tolerated to consider two plates as equal and should contribute to the final vote.	0 to 7
Timeout for event generation	It is the maximum time waited (after the last recognition) to generate an event. This time is in seconds.	0 to 10
Timeout for plates in the recognized list	It is the time (in seconds) that must be elapsed for an already sent plate to be treated as a new event.	0 to 600
Minimum number of elements in the event	It is the minimum number of elements (requests) necessary to compose an event. If the event timeout occurs and this number is not reached, the event is discarded.	1 to 2
Maximum number of elements in the event	It is the maximum number of elements (requests) in an event. If the maximum number has been reached, the event will be generated even if the timeout has not been reached.	1 to 2
Majority vote on protocol photo request	Enabling the majority vote for all photo requests from Pumatronix protocol	Enabled; Disabled
Serial port 1 configured as	Serial port 1 interface can be used as a server (but *Server for image and data* must be set as *Serial Port*), for controlling the integrated GPS or working as external trigger (receiving the capture request signal). ITSCAM must be rebooted to apply configurations.	server; embedded GPS controller; image trigger

Baud rate	Serial port speed is measured by the number of bits transmitted per second (bps). ITSCAM must be rebooted to apply configurations.	300; 1200; 2400; 4800; 9600; 14400; 19200; 28800; 38400; 57600; 115200; 230400
Data bits	Number of data bits of a transmission. The packet refers to a single byte transfer, including start / end bits, data bits, and parity. ITSCAM must be rebooted to apply configurations.	7; 8
Parity	It is a simple form of error checking that is used in serial communication. ITSCAM must be rebooted to apply configurations.	none; odd; even
Stop bits	Used to signal the end of communication for a single packet. They indicate the end of transmission, but also give computers some margin of error in clock speeds. ITSCAM must be rebooted to apply configurations.	1; 2

Table 17 - Symbols for generation of messages sent by the Serial Port

Symbol	File Name Representation
%F	ASCII decimal plate equivalent (see footer)
%E	Equivalent hexadecimal ASCII ID
%e	Binary equivalent ID
%D	ASCII Day
%d	Binary day (1 byte)
%M	ASCII Month
%m	Binary month (1 byte)
%Y	ASCII Year
%y	Binary year (1 byte, decade and unit only)
%H	ASCII Hour
%h	Binary hour (1 byte)
%N	ASCII Minute
%n	Binary minute (1 byte)
%S	ASCII Second
%s	Binary Second (1 byte)
%V	Daylight savings time ASCII (V/N)
%v	Binary daylight savings time (1/0) (1 byte)
%P	ASCII original plate
%p	Converts ASCII plate characters to their decimal value
%I	IP in ASCII
%i	Binary IP (4 bytes, local address first)
%T	ASCII message counter
%t	Binary message counter (4 bytes, little endian)
%A	MAC in ASCII
%a	MAC binary (6 bytes, vendor first)
%c	CRC16/XMODEM binary (2 bytes)
%C	CRC16/XMODEM hexadecimal (4 bytes)
\n	New line (0xA0)
\r	Carriage return (0x0D)
\0	Null Character (0x00)
\\	Backslash (0x5C)
\t	Tab (0x09)
\NNN	Equivalent Octal Character
\xNN	Equivalent Hexadecimal Character

* It can be specified a fixed size for a field, which will be filled with spaces or truncated accordingly.
An exclamation (!) Reverses the field byte order.
A dash (-) added before that number determines whether the alignment will be done to the left.
It is still possible to determine another hexadecimal character in place of space. For example:
%\x00-4e -> Print the equivalent ID, fixed size at 4, left-aligned, with the remainder of the bytes filled by zero (0x00)
%016I -> Print IP in ASCII (4 decimals separated by dot) in 16 bytes, right-aligned, filling in the remaining spaces with ASCII '0' (0x30).

17. 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.

17.1. Default Settings for Web Interface (Firmware 12.X to 15.X)

	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
General	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
	HDR	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

17.2. Default Settings for Web Interface (Firmware 16.X to 17.X)

	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	Test mode	Captured image
	Mode	Auto
	Rotate image 180°	According to installation
	Auto Iris DC lens	Enabled
	Threshold for changing from Day to Night Mode	15
	Threshold for changing from visible to infrared light	5
	Dropped frames between multiple captures	0
General	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: 30 to 60 Speed over 60 km/h: 15 to 30
	Maximum Shutter **(Resolution above 800x600)**	Speed up to 60 km/h: 22 to 44 Speed over 60 km/h: 11 to 22
	Edge Sharpening	Disabled
	Night shadow elimination	Disabled
	High Dynamic Range	Disabled
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
OCR	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

17.3. Default Settings for Web Interface (Firmware 18.X)

	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	Enabled
	NTP address	a.ntp.br

General	Auto Iris DC lens	Enabled
	Mode	Auto
	Day / Night Transition Algorithm	Counter
	Colored images on Night mode	Disabled
	Desired level	20
	Day to Night	50
	Night to Day	90
Inputs and Outputs	Captures per pulse	2 to 4
	Minimum time between triggers	50
	Image format	JPEG
	Quality	70%
	Dropped frames between multiple captures (daytime)	0
	Dropped frames between multiple captures (nighttime)	0
	Visible light trigger	According to installation
	Infrared light trigger	
	Flash mode	Auto
	Use ROI	Disabled
	Outputs configured for	Fire illuminator/flash
	Flash mode	Automatic
	Flash surveillance	Enabled
	Autoflash fires on	Infrared light
	Delay do flash	Check flash technical specifications. For ITSLUX use 0.
	Flash power in second shot	100%
Image Settings	Desired level	20
	Gain mode	Auto
	Shutter mode	Auto
	Static Shutter **(Resolution below 800x600)**	Speed up to 60 km/h: 30 to 60 Speed over 60 km/h: 15 to 30

Image Settings	Static Shutter **(Resolution above 800x600)**	Speed up to 60 km/h: 22 to 44 Speed over 60 km/h: 11 to 22
	Edge Sharpening	Off
	Night shadow elimination	Off
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	ITSCAM HDR Gamma = Quadratic Value= 13 Other ITSCAMs: Gamma = Linear Value = 110
	Logarithmic value	
	Brightness	3
	Contrast	100
	White balance (red, green, blue)	0
Weights	All windows	15
OCR	OCR Server	MAP (if available)
	Region of interest	Select region: (use to remove regions as sidewalks and places that are not lane); Do not use region: (clear configuration)
	Vehicle plate type	All
OCR	OCR Country	Brazil
	Timeout	4500
	OCR Mode (visible and infrared)	Very slow
	Minimum character reliability	50
	Plate slant angle	0° **
	Plate angle	0° **
	Preview angle correction	Enabled
	Send plates recognized	Do not send through serial

* The region of interest (ROI) is used to define the region in which the motion detection algorithm will be executed.
** This setting must be modified by experienced users or with the assistance of Pumatronix Technical Support.

18. Vehicle Counter

Vehicle counter function is available for ITSCAM. This function allows selecting a tracking area and monitoring the number of vehicles that passed by 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 46, where ITSCAM is in a walkway crossing the highway.

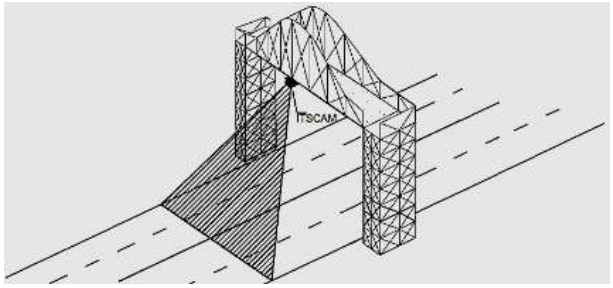


Figure 46 – ITSCAM installation maximizing Vehicle Counter results

Vehicle Counter has its own interface, available at www.pumatronix.com. Figure 47 shows an example of ITSCAM Vehicle Counter interface.

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 47 – ITSCAM Vehicle Counter Interface

19.Optical Character Recognition - OCR

ITSCAM 402, ITSCAM 403, ITSCAM 421, HDR and CCD with OCR 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.

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

20. Send by RS-232 Wiegand 26 Compatible

ITSCAM models that have the functionality of license plate location and recognition can communicate with Wiegand type controllers, which are very common in parking lots. In this type of communication, a license plate list is used to identify a set of vehicles using only 24 bits. The supported model is Wiegand 26 through a serial converter. For this functionality to work correctly, the *List of Plates* must be loaded into ITSCAM memory.

Serial Port Usage: As in previous versions of ITSCAM, connecting an user to a serial port via the *Serial Server,* interrupts all messages exchanged through that serial port, including GPS, photo request with or without label, and sending plates. Such functionality will be kept so as not to disturb the configuration of equipment (which is the purpose of such feature). The transmission of these messages via serial does not interfere on the reception of messages of other functionalities (GPS, photo with or without label).

20.1. List of Plates File

to make it possible the use of RS-232 port on devices that support Wiegand 26 protocol, it must be created a file containing the plate information and its identifier. This file containing the list is sent to ITSCAM and for each new vehicle identification the list is consulted.

The list file can be sent using web interface, which has a content validator, or by *cgi* command. This file must be CSV (separated by comma, semicolon or tab (0x09)), containing one plate per line, formatted in two columns: plate (ASCII, 1 to 7 alphanumeric characters) and id (ASCII decimal, between 0 and 16777215). To forward plates out of the list, the first row of the table must have the plate * (only an asterisk) and the id. This value is sent by the equipment whenever an unlisted plate is recognized. In web interface processing, characters are converted to uppercase. The quotation marks and spaces are removed before forwarding the list. Other columns and rows with empty columns are ignored.

Cases when importing the list using Web Interface will fail:

- Plate has no alphanumeric characters;
- Id specified out of range;
- There are invalid characters;
- There are duplicates.

In case of failure, the interface will point to the wrong line and will not load. In case of success, when list loading is completed, the interface will show the number of rows loaded.

If list loading is by POST command to *api/platelistid.cgi*, the file must have only 2 columns, all values must contain only alphanumeric characters (between 'A' to 'Z' and '0' to '9', except first line), without spaces, and be separated by commas. Rows should be ordered in increasing order, using plate as a key. The ASCII characters value is used to do this sorting and only 100,000 license plates are supported. List sorting influences processing speed because the algorithm uses the binary search method for the plates in the list. In addition, partial plates can be identified by selecting at least one low probability character from the OCR menu, so the search can infer the closest plate in the list.

The list in the machine can be obtained as a text file, using the *Export List* option.

Remove list of plates: “Remove List” button can be used from the web interface or an empty file when uploaded will remove it.

21. Digital Signature

ITSCAM that has the suffix "-AD" in the model name digitally signs transmitted images. They are signed when requested in JPEG format, regardless of whether the request came via network or external trigger.

To sign the images, ITSCAM uses ATMEL AT97SC3204 chip, fully compatible with version 1.2 of the Trusted Platform Module (TPM) specification made by the Trusted Computing Group (TCG).

This device uses an asymmetric encryption mechanism by hardware, which contains a protected internal memory for private key storage.

At the time ITSCAM converts the captured image to the JPEG format, the hash of that image is calculated using the SHA-1 or SHA-256 algorithm. This *hash* is then signed by the RSA algorithm with a 1024 or 2048-bit key.

Final image that will be transmitted has the fields:

- Sha256: Image Hash SHA-256
- Sha1: Image Hash SHA-1
- Sign: Hash RSA signature
- ExpoenteRSA: exponent used in calculating the signature
- ModuloRSA: module used for signature conferencing

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

This data is appended, in text format, to the comment field of the JPEG image, defined in the marker "FF FE" according to ISO / IEC 10918. To verify the signature, the following procedure must be performed:

a) Remove the texts referring to the hash (Sha1 or Sha256), Sign, ExpoenteRSA and ModuloRSA from the comment field;

b) Calculate the hash of the image with the specified text in "a" removed;

c) Extract the hash from the signature (Sign field) considering the exponent (ExpoenteRSA) and the module (ModuloRSA)

d) Compare the obtained hash in "b" with the obtained hash in "c".

When comparing in step "d" gets the same hash for both cases, the image is authentic. Otherwise, there was an adulteration in the image.

22. ITSCAM Communication Protocol Using Sockets

All commands described in this protocol are compatible with the latest ITSCAM firmware, available at www.pumatronix.com. ITSCAM with an outdated firmware may not support some of the commands described.

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

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

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

22.1. ITSCAM Command Pattern for Sending and Receiving Data

The commands in this protocol have a header, additional parameters and CRC. Table 18 shows the structure of the protocol commands.

Table 18 – 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 protocol (for both sending and receiving data) always corresponds to a single byte with value *AAh*. Possible commands are listed in Table 19 and range from *00h* to *FFh*. Depending on the nature of the command, it is necessary to send parameters. The 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).

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*". In this word, which is 4 bytes long, CRC must be calculated, which will be AAFEh. The application requesting the image must send a 6-byte word to ITSCAM:

```
AAh 01h 01h 64h FEh AAh
```

For CRC, the least significant byte must always be sent first, so the fifth byte of the example is *FEh* and the sixth byte is *AAh*.

Another example is the request of a flash-synchronized picture (command *02h* from protocol). This example will request an image in JPEG format with quality 80%. The word with the command and its parameters is "*AAh 02h 01h 50h*", the CRC will be *8579h* and ITSCAM should receive the following command (*noting that CRC and values larger than one Byte must be transmitted with the least significant Byte first*):

```
AAh 02h 01h 50h 79h 85h
```

22.2. CRC – Cyclic Redundancy Check

ITSCAM requires a 16-bit CRC (2 bytes) in all 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.

22.3. Protocol Description

Protocol commands are described in Table 19, which shows a column with the value in hexadecimal that references the command and another column with a brief explanation of its meaning. In addition to these columns, the table presents ITSCAM models that support the command, which parameters can or must 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.

Table 19 – ITSCAM communication protocol valid commands using sockets

Command	Meaning	Compatible models	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.	All models	AAh 00h [CRC(2)]		AAh 00h [ITSCAM IP(4)] [CRC(2)]
01h	Request frame without flash sync.	All models	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 Note: The format can be used as a photo identifier as the answer always repeats the number entered in the request.
02h	Request frame with flash sync (if flash enabled).	All models	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 Note: The format can be used as a photo identifier as the answer always repeats the number entered in the request.
04h	Command sent by ITSCAM to indicate trigger event	All models	None, because this command is generated by ITSCAM to indicate a trigger event		AAh 04h [amount of pictures (1)] [CRC(2)]
0Ch	Command to export RSA public key	AD models	AAh 0Ch [CRC(2)]		AAh 0Ch [key(*)] key: public key as text. Size 256Bytes to RSA 1024 or 512 for RSA 2048

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
0Fh	ITSCAM software restart. Reboot takes about 20 seconds.	All models starting at ITSCAM 4XX (only in firmware from version 14)	AAh 0Fh [CRC(2)]		AAh 0Fh 01h Response sent only on firmwares from version 14 onwards
10h	Request ITSCAM current configuration.	All models	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 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)

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
13h	Set trigger operation mode.	All models	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.	All models	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).	All models	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.	All models starting at ITSCAM 4XX	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.	All models	AAh 17h [CRC(2)]		AAh 17h [status (1)] 0: Command not accepted 1: Command accepted
18h	Set delay between flash firing and shutter.	All models	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.	All models starting at ITSCAM 4XX	AAh 1Bh [time(2)] [CRC(2)]	Time: 0 to 60000 miliseconds	AAh 1Bh [status (1)] 0: Command not accepted 1: Command accepted

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
1Ch	Request minimum period of time ITSCAM waits to accept new image requisition made by I/Os.	All models starting at ITSCAM 4XX	AAh 1Ch [CRC(2)]		AAh 1Ch [time(2)] Time: 0 to 60000 in milliseconds
1Dh	Request ITSCAM model	All models starting at ITSCAM 4XX	AAh 1Dh [CRC(2)]		AAh 1Dh [model (3)] Model: ITSCAM[model] (little-endian) 400: itscam400/ 401: itscam401/ 411: itscam411/ 431: itscam_ccd13cs/ 491: itscam_hdr13cs/ 501: itscam_hdr20cs/ 65938: itscam402/ 65939: itscam403/ 65957: itscam421/ 65967: itscam_ccd13csj/ 66027: itscam_hdr13csj/ 131472: itscam400lm84/ 131473: itscam401lm84/ 131483: itscam411lm84/ 131523: itscam401lm47/ 131553: itscam_ccd13l3/ 131613: itscam_hdr13l3/ 197010: itscam402lm84/ 197011: itscam403lm84/ 197029: itscam421em84/ 197089: itscam_ccd13l3j/ 197149: itscam_hdr13l3j/ 262545: itscam401_800x600/ 262555: itscam411_1280x720/ 328083: itscam403_800x600/ 328101: itscam421_1280x720/ 393617: itscam401lm84_800x600/ 459155: itscam403lm84_800x600/ 524699: itscam411_1920x1440/ 655761: itscam401_752x480_vigia/ 655791: itscam_ccd13l2/ 655851: itscam_hdr13l2/ 721327: itscam_ccd13l2j/ 721387: itscam_hdr13l2j/ 917905: itscam401_vigia/ 917915: itscam411_vigia_1280x720 (continues)

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
1Dh	Request ITSCAM model	All models starting at ITSCAM 4XX	AAh 1Dh [CRC(2)]		983443: itscam403_vigia/ 983461: itscam421_vigia_1280x720
20h	Request network configuration: IP and MAC address, netmask and gateway.	All models	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.	All models	AAh 21h [ip(4)] [CRC(2)]	Valid IP address	AAh 21h [status (1)] 0: Command not accepted 1: Command accepted
22h	Set netmask.	All models	AAh 22h [mask(4)] [CRC(2)]	Valid netmask	AAh 22h [status (1)] 0: Command not accepted 1: Command accepted
23h	Set gateway.	All models	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.	All models	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)] [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 Static, maximum and current shutter: 1 to ITSCAM model limit Gain type: 0: Static/ 1: Auto; Static, maximum, current (continues)

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
30h	Require main ITSCAM image configurations.	All models	AAh 30h [CRC(2)]		differentiated gain: 0 to 72 Test mode: 0: send captured image/ 1: send vertical pattern/ 2: send horizontal pattern / 3: send diagonal pattern Desired and current level: 7 to 62 Differentiated gain type: 0: Off/ 1: enabled on Day mode/ 2: enabled on Night mode Format: 0: BMP/ 1: JPEG; Photo quality: 0 to 100%
33h	Assign the High Dynamic Range - HDR logarithmic gain applied to the image, which aims to compensate for very dark or saturated areas of image, bringing them to an intermediate value. Disabled generates linear pixel response.	All models	AAh 33h [hdr(1)] [CRC(2)]	Hdr: 0: Off 1: On	AAh 33h [status (1)] 0: Command not accepted 1: Command accepted
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.	All models	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.	All models	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.	All models	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
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.	All models	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.	All models	AAh 3Ah [static gain (1)] [CRC(2)]	Static gain: 0 to 72	AAh 3Ah [status (1)] 0: Command not accepted 1: Command accepted

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
3Bh	Set maximum electronic gain	All models	AAh 3Bh [maximum gain (1)] [CRC(2)]	Maximum gain: 0 to 72	AAh 3Bh [status (1)] 0: Command not accepted 1: Command accepted
3Ch	Set ITSCAM test mode.	ITSCAM with resolution 752x480 pixels	AAh 3Ch [mode(1)] [CRC(2)]	Mode: 0: Send captured image 1: Send vertical pattern 2: Send horizontal pattern 3: Send diagonal pattern	AAh 3Ch [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.	All models	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 40h [maximum differentiated gain type (1)] [CRC(2)]	Maximum differentiated gain type: 0: Off 1: On differentiated gain for Day mode 2: On differentiated gain for Night mode	AAh 40h [status (1)] 0: Command not accepted 1: Command accepted
44h	Set photo format sent by I/O requisitions.	All models	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.	All models	AAh 45h [quality(1)] [CRC(2)]	Quality: 0 a 100%	AAh 45h [status (1)] 0: Command not accepted 1: Command accepted
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.	All models	AAh 46h [number of 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.	All models	AAh 47h [number of photos(1)] [CRC(2)]	Photos: 1 to ITSCAM model limit	AAh 47h [status (1)] 0: Command not accepted 1: Command accepted

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
48h	Request the number of photos send by network and by I/O, respectively.	All models	AAh 48h [CRC(2)]		AAh 48h [network number of photos (1)] [I/O number of photos (1)] Number of photos: 1 to ITSCAM model limit
4Ch	Set 180° rotation on image.	All models	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.	All models	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 image luminance and is useful only when there are regions of static reflection or shadow.	All models	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 inlfuence the calculation of the level of luminance of the image.	All models	AAh 4Fh [CRC(2)]		AAh 4Fh [weights (16)] Weights: 0 (no influence) to 15 (maximum). 16 values (4x4 image divisions matrix)
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).	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 58h [red (1)] [green (1)] [blue (1)] [CRC(2)]	0: ITSCAM automatically adjusts White balance 1 a 255: Component gain	AAh 58h [status (1)] 0: Command not accepted 1: Command accepted

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
59h	Request white balance of red, green and blue components.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 5Ah [gamma (1)] [CRC(2)]	Gamma: 0: Linear response 1: Logarithmic default curve 70 to 255: Custom curves	AAh 5Ah [status (1)] 0: Command not accepted 1: Command accepted
5Bh	Request gamma configuration.	All models starting at ITSCAM 4XX	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	ITSCAM LM	AAh 5Eh [focus (2)] [CRC(2)]	Focus: 1 to 999: Lens move to focus objects on infinite 1000: Do not move lens 1001 to 1999: Lens move to focus near objects (steps count as the estimated value subtracted from 1000)	AAh 5Eh [status (1)] 0: Command not accepted 1: Command accepted
61h	Set edge sharpening, giving the impression of better focus. However, it harms OCR results.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	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 colored photos in Night mode. The pictures produced by ever ITSCAM always on Day mode are not equivalent to this command.	All models starting at ITSCAM 4XX	AAh 63h [photo (1)] [CRC(2)]	Foto: 0: Night mode with gray scale photos 1: Colored photos on Night mode	AAh 63h [status (1)] 0: Command not accepted 1: Command accepted

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
64h	Request configuration of color photos Night mode.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	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 1: Logarithmic default curve 70 to 255: Custom curves	AAh 67h [status (1)] 0: Command not accepted 1: Command accepted
68h	Request differentiated gamma value.	All models starting at ITSCAM 4XX	AAh 68h [CRC(2)]		AAh 68h [gamma(1)] 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.	All models starting at ITSCAM 4XX	AAh 69h [type (1)] [red (1)] [green (1)][blue (1)] [CRC(2)]	Type: 0: Off 1: Enabled on Day mode 2: Enabled on Night mode Components: 0: ITSCAM auto adjusts values 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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 6Bh [CRC(2)]		AAh 6Bh [red (1)] [green (1)] [blue (1)] All parameters return from 0 to 255

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
6Ch	Set flash intensity on second shot.	All models from ITSCAM 4XX series, except for resolution 752x480 pixels	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.	All models from ITSCAM 4XX series, except for resolution 752x480 pixels	AAh 6Dh [CRC(2)]		AAh 6Dh [intensity(1)] Intensity: 0 to 100% of first shot
6Eh	Set zoom position.	ITSCAM LM	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.	ITSCAM LM	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 71h [CRC(2)]		AAh 71h [delay(1)] Delay: 0 to 10 frames

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 73h [CRC(2)]		AAh 73h [delay(1)] Delay: 0 to 10 frames
76h	Set absolute position of zoom, based on internal lens reference.	ITSCAM LM	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.	ITSCAM LM	AAh 77h [CRC(2)]		AAh 77h [zoom(4)] Zoom: -1000 to 1000 (format int32)
78h	Set absolute position of focus, based on internal lens reference.	ITSCAM LM	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.	ITSCAM LM	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 7Dh [CRC(2)]		AAh 7Dh [gain (1)] Gain: 0 to 72

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	Send format	Parameters	Response format
80h	Set auto iris DC.	All from ITSCAM 310 model	AAh 80h [auto iris (1)] [CRC(2)]	Auto iris: 0: Without control 1: With auto iris DC control	AAh 80h [status (1)] 0: Command not accepted 1: Command accepted
81h	Request auto iris DC configuration.	All from ITSCAM 310 model	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.	All from ITSCAM 310 model	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.	All from ITSCAM 310 model	AAh 83h [CRC(2)]		AAh 83h [mode(1)] Modo: 0: Auto/ 1: Day/ 2: Night
84h	Request current ITSCAM Day/Night configuration.	All from ITSCAM 310 model	AAh 84h [CRC(2)]		AAh 84h [mode(1)] Mode: 0: Night/ 1: Day
D2h	Set ITSCAM OCR mode.	ITSCAM 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.	ITSCAM 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
88h	Set differentiated trigger configurations on Day or Night mode because there are situations that need different values for day and night images.	All models starting at ITSCAM 4XX	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.	All models starting at ITSCAM 4XX	AAh 89h [CRC(2)]		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.	All models starting at ITSCAM 4XX	AAh 8Ah [trigger(1)] [CRC(2)]	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.	All models starting at ITSCAM 4XX	AAh 8Bh [CRC(2)]		AAh 8Bh [trigger(1)] Trigger: 1 to 12, as described on 13h

Table 19 – ITSCAM communication protocol valid commands using sockets (Continuation)

Command	Meaning	Compatible models	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.	ITSCAM 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.	ITSCAM with embedded OCR	AAh 8Dh [CRC(2)]		AAh 8Dh [type(1)] Type: 0: No differentiated OCR/ 1: Differentiated OCR for Day mode/ 2: Differentiated OCR for Night mode
8Eh	Set differentiated OCR value.	ITSCAM 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.	ITSCAM with embedded OCR	AAh 8Fh [CRC(2)]		AAh 8Fh [ocr(1)] OCR: 0: Off/ 1: fast OCR / 2: normal OCR / 3: slow OCR / 4: ultra-slow OCR

23. 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 a development kit is available for download.

23.1. 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 22 displays all ITSCAM parameters that can be viewed and assigned, along with the limitations and/or values that can be assigned.

23.2. 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])
```

23.3. 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
```

23.4. 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)
```

23.5. 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
```

23.6. 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 20.

```
[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 20 – 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

23.7. 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 21. A sample of stream configuration and request follows:

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

Table 21 – 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 752x480 (only ITSCAM 400/401/403) 1280x960 (only ITSCAM 410/411/421)
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.

23.8. plateidlist.cgi Command

The *plateidlist.cgi* command is used to manipulate the list of cards stored in ITSCAM for use with the Wiegand 26 protocol. When sent to the equipment without parameters, returns the list that is currently in use, in CSV format. The *write* parameter is used in POST request and is intended to specify the loading mode of the list on the device:

Parameter	Function
0	Saves to volatile memory only, not to use internal FLASH
1	Saves to flash if 1 hour has passed since last save, to reduce FLASH usage. If 1 hour has not yet passed, it updates the list in volatile memory and saves it later when 1 hour has elapsed
2	Force save to FLASH

The *plate* and *serial* parameters can be used in this *cgi* to assist in the debug process, as *plate* is the field used to simulate a plate recognition and should contain a string of up to 7 characters, representing the desired board; the *serial* field indicates the serial port to which the plate should be sent, that is, the values 1 or 2 can be assigned. In addition to sending the plate chosen by the specified serial, it returns a *cgi* command containing the plate, hexadecimal values of the bytes sent and the string sent. Passing 0 for the *serial* parameter, the return is only via CGI.

This command should be sent as follows:

```
http://(ip da ITSCAM)/api/plateidlist.cgi
```

23.9. 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
```

23.10. 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
```

23.11. 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
```

23.12. 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
```

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

Table 22 – 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 15 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
ConfigPortaSerial	Serial port interface settings	Read and write	String	300-7N1/1200-8N2
CountOcr	Parameters to error monitoring	Read	Integer value	90935
CountRx				-10
CountTx				0
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
DirIOVigia	Vigia+ input and output setting	Read and write	0 to 255	188
DisableFrwUp	Disables the firmware upgrade option and can no longer upgrade as this action is irreversible	Read and write	Firmware update will be disabled if send value 6271155477	6271155477
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			

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
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
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

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
GanhoB	Gain for second photo on visible light	Read and write	0 to 72	19
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
GlobalInterruptDisable	Variable used for debugging			
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
HasOcrRoi	Set Region of Interest use	Read and write	0: Off 1: On	0
Hdr	HDR (High Dynamic Range) operation mode on ITSCAM 4XX and CCD models	Read and write	0: Off 1: On	0
HdrFpga	HDR (High Dynamic Range) operation mode on ITSCAM HDR models	Read and write	0: Off 1: On	0
HdrNight	HDR (*High Dynamic Range*) operating mode on ITSCAM 4XX and CCD models, when in Night mode	Read and write	0: Off 1: On	0
HdrFpgaNight	HDR (*High Dynamic Range*) operating mode on ITSCAM HDR models, when in Night mode	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
Identificador	Variable used for debugging			
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)

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
IOVigia	Vigia+ input and output settings	Read and write	0 to 255	255
Ip	ITSCAM IP address	Read and write	Valid IP address	192.168.0.213
Ip2	Secondary 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
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
LimiarPercentDayNight	Threshold for automatic change from Day to Night mode	Read and write	0 to 100	50
LimiarPercentDayNightMotorizada	Threshold for automatic change for lens focus from visible to infrared	Read and write	0 to 100	20
LimiarPercentNightDay	Threshold for automatic change from Night to Day mode	Read and write	0 to 100	90
LimiarPercentNightDayMotorizada	Threshold for automatic change for lens focus from infrared to visible	Read and write	0 to 100	30
LimTM	Movement detector threshold	Read and write	0 to 50	5
Mac	ITSCAM MAC address	Read	Valid MAC address	F8-D4-62-00-10-D5
MaiorShutter	Maximum shutter ITSCAM can handle	Read	Positive integer value	2047
MapHabilitado	Set MAP to process OCR	Read and write	0: Off 1: On	0

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
MapIp	IP address to access MAP	Read and write	Valid IP address	192.168.0.253
MapIp2	Secondary IP address to access MAP	Read and write	Valid IP address	192.168.0.254
MapPorta	MAP communication port	Read and write	1 to 65535	50000
MapPorta2	Secondary MAP communication port	Read and write	1 to 65535	50001
MapSt	MAP status	Read	-1: Undefined -2: Disabled 0: Connected 5: Not supported country 7: Invalid ROI 16: Invalid license 17: Expired license 100: Connection failure 101: Disconnected server 102: Queue timeout 103 or 108: Full queue 105: Send server failure 213: connection limit	0
MapUsd	MAP in use	Read	-1: Undefined 0: Main 1: Secondary	0
MascaraRede	ITSCAM netmask	Read and write	Valid netmask	255.255.255.0
MascaraRede2	Secondary ITSCAM netmask	Read and write	Valid netmask	255.255.255.0
MaxLowProbChars	Maximum number of low probability characters	Read and write	0 to 6	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	ITSCAM models	ITSCAM403LM84

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
ModoDayNight	Day/Night operation mode	Read and write	0: Auto	ModoDayNight
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
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		3
ModoOCRVisivel	Embedded OCR behavior when visible light predominates (when ITSCAM has this feature)	Read and write		3
ModoTarjaVideo	Selection of displaying mode of label text on video frame	Read and write	0: Off 1: White text 2: Black text	1
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 (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
OcrAngle	Plate character's rotation angle	Read and write	-15 to 15	0
OcrCountry	OCR country	Read and write	1: Brazil 4: Chile	1
OcrSlant	Plate character's inclination angle	Read and write	-15 to 15	0

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
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
Pesos1, Pesos2, Pesos3 and Pesos4	Weights of the 1st, 2nd, 3rd and 4th image row regions, respectively. 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
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
RebootNeeded	Show if reboot is needed to apply settings	Read	0: No 1: Yes	0
Resolucao	Equipment image resolution	Read	752x480, 800x600, 1280x720, 1280x960, 1636x1220 and 1920x1440	752x480

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
ResolucaoImagemFTP	FTP server image size	Read and write	0: ITSCAM resolution 1: 320x240 pixels	0
Revisao	ITSCAM firmware revision	Read	Do not apply	53
RoiOCR	OCR ROI 4 points coordinates	Read and write	Pixel coordinates	0,0,0,0,0,0,0,0
RoiTM	Motion Detection ROI 4 points coordinates	Read and write	Pixel coordinates	0,0,0,0,0,0,0,0
RoiTMMode	Motion Detection ROI setting	Read and write	0: No ROI 1: Use OCR ROI 2: Use Motion detection ROI	0
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
SenhaAPI	Uses password on all ITSCAM communication as reboot, read/set parameters, etc.	Read and write	0: Off 1: On	1
SenhaFTP	FTP user password	Read and write	Valid password	123
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
Sincronismo	Variable used for debugging			
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
StatusFirmware	Debug variable			
StatusSupervisao	ITSLUX surveillance answer	Read	0 to 255	0

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
StringTarjaGlobal	Setting of text that will be displayed on image's global label	Read and write	String (Table 16 contains the list of possible characters)	%p-y/%m/%d-%v
StringTarjaVideo	Setting of text that will be displayed on video's global label	Read and write		%p-y/%m/%d-%v
SupervisaoIluminador	Enable writing on JPEG comment illuminator status, need surveillance wires connected and uses serial port	Read and write	0: Disabled 1: Enabled 2; Enabled and shooting by serial port	1
TempoEntreTriggers	Time (in milliseconds) 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 46541564
TimeoutOCR	Timeout to OCR search for vehicle plate on the image	Read and write	0 to 10000	4500
TipoGammaDif	Differentiated gamma behavior	Read and write	0: Off 1: On for Day mode 2: On for Night mode	2
TipoGanho	Definition of gain operation	Read and write	0: Static 1: Automatic	1
TipoGanhoDif	Differentiated gain behavior	Read and write	0: Off 1: On for Day mode 2: On for Night mode	1
TipoOCR	OCR Configuration	Read and write	0: Disabled 1: Fast 2: Normal 3: Slow 4: Very slow	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

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
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	Number 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
TransicaoMotorizadaIO	Lens focus transition	Read and write	0: By thresholds 1: By IN2 2: By IN1	0
Trigger	Trigger behavior	Read and write	1: Off 2: Rising edge 3: Falling edge 4: Both edges 5: Approaching image 6: Departure (fast) 7: Departure (slow) 8: Continuous 9: Periodic (need NTP) 10: High logic level 11: Low logic level 12: Rising edge and approaching	6
TriggerIR	Trigger behavior on infrared light			
TriggerVisivel	Trigger behavior on visible light			

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
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
TZ	Timezone	Read and write	-12 to 12	-3
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 *input2input1)*	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
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
ValorSaturacaoDif	Definition of differentiated saturation	Read and write	0 to 255 for each parameter 0 to 16777215 in total	0

Table 22 – ITSCAM parameters listed with http://(ITSCAM IP address)/api/config.cgi?tudo command (Continuation)

Parameter	Description	Type	Possible values	Example
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	White balance is a multiple parameter containing 1 Byte to represent: Red, Green and Blue (respectively)	Read and write	0 to 255 for each component 0 to 16777215	0
WhiteBalanceAtual				
WhiteBalanceDiurno				
WhiteBalanceNoturno				
Zoom	Motorized lens zoom value	Write	0 to 1999	500

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Datasheet ITSCAM

Traffic Control Device

Models 400 to 421, HDR and CCD

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