PUMATRONIX

ITSCAM 400

CAPTURING IMAGES OF VEHICLES AT VARIOUS SPEEDS, DURING THE NIGHT AND DAY

Product

Pumatronix Equipamentos Eletrônicos Ltda.

Rua Bartolomeu Lourenço de Gusmão, 1970. Curitiba, Brazil

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

Please send feedback on this document to suporte@pumatronix.com

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

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

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

Change History

Date	Revision	Content updated
10/17/2017	1.0	Initial Version
02/16/2022	4.0	Updating the format and content of the Manual
06/03/2022	4.1	Q Protocol, Ethernet Connection Specifications, respective firmware data, Mosaic
08/09/2022	4.2	OCR configuration steps; Updating nomenclatures; Vin specification
19/09/2023	4.3	Updating of device images; update steps of Pumatronix Software; CS model length update

Overview

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

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

Examples of these technologies are Intelligent Transport Systems (ITS), in which Pumatronix products are used, such as the ITSCAM 400 line. The devices of this line capture images of vehicles for traffic management, enforcement, Smart City Applications, mobility systems and applications that demand capture of images whose minimum distance from the application is greater than 2 meters, using a sensor of global shutter image:

Figure 1 - ITSCAM 400 Line with CS Mount Lenses

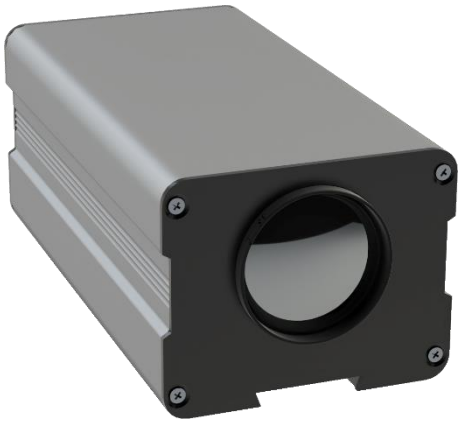


Figure 2 - ITSCAM 400 Line with Motorized Lenses

Handling Risks

	**This equipment must be powered by a source of direct current (DC) with voltage between 9 to 32 Vdc. Do not connect any of the inputs directly to the mains (AC)!**
	**Risk of Oxidation: The electrical and signal connections made in the ITSCAM 400 bundle and in the data network cable must be protected in a terminal box or similar structure to prevent oxidation of the connections and unwanted infiltration of liquids into the bundle.**
	**This equipment may be accompanied by lenses, which are sensitive to mechanical impacts such as drops and extreme vibrations.**
	**Installation Location: In cases where it is not possible to meet installation specifications, it is recommended to consult Pumatronix's Technical Support.**

Models

The ITSCAM 400 image capture and processing devices are available in the ITSCAM 401 and ITSCAM 411 model lines. The composition of each model allows the modification of the sensor, lens and optional items considering the specific possibilities for each line.

The ITSCAM 401 model has the color sensor that can be combined with a fixed type of lens set (CS Mount standard), without options.

In the ITSCAM 411 model line, the sensor is combined with a set of lenses, which can be of the fixed type (CS Mount standard) or motorized, in addition to the optional Digital Signature.

The technical characteristics of the ITSCAM 401 and ITSCAM 411 models can be identified in the designator in parentheses, indicating the components of the model.

Models available	Resolution	Lens Type	Estimated range (in meters) *
ITSCAM 401 (S01L0)	752x480px	CS Mount Manual	5 to 20m (9-40mm) **
ITSCAM 401 (S01L0A)			
ITSCAM 411 (S04L0)	1280x960px	CS Mount Manual	8 to 35m (9-40mm) **
ITSCAM 411 (S04L0A)			
ITSCAM 411 (S04L3)		Built-in Motorized	4 to 45m
ITSCAM 411 (S04L3A)			
ITSCAM 411 (S05L0)	1280x960px HDR	CS Mount Manual	8 to 35m (9-40mm) **
ITSCAM 411 (S06L0)	1636x1220px HDR		9 to 37m (10-50mm) ***
ITSCAM 411 (S06L0A)			

*Estimated range is defined according to the lens selected and identifies at what distance the license plate characters remain readable for LPR feature. For models with a motorized lens, the lens cannot be modified. For CS Mount type lenses, the lens models shown are for reference only for the respective range.

**For the model it is recommended to use the Theia SL940A 9-40mm lens.

***For models with S06 sensor, it is recommended to use IDAX VISION 10-50mm lens with a C adapter ring to CS Mount (included).

Image sensors (ITSCAM 401 and ITSCAM 411)	Lens	Optional
S01: Colorful CMOS 752x480px	**L0**: Manual lens, CS Mount type	**A**: Digital Signature (TPM1.0)
S04: CCD 1280x960px*	**L3**: 4,7-47mm	
S05: CCD HDR 1280x960px*		
S06: CCD HDR 1636X1220px		

*The 1280x960 pixel model can generate 1024x768 pixel resolution images.

Some models of ITSCAM 400 are certified by international standards that regulate the operation of electronic devices. In these cases, the technical characteristics designator presents three characters CIx, with **x** indicating the type of certification that the product meets:

Código	Product Certification
CI1	CE
CI2	FCC
CI3	CE e FCC

Table of Contents

1. Knowing the Product

The ITSCAM 400 line of image capture and processing devices was developed for traffic management, enforcement, Smart City Applications, mobility systems and applications that require image capture whose minimum distance from the application is greater than 2 meters.

Lenses and Image Sensors

The ITSCAM 400 device can be selected with an internal motorized lens (with software controllable zoom and focus), or a standard CS Mount fixed lens. The model of equipment that receives fixed lenses has an Iris DC control output that allows electronically controlling the iris if the lens supports it. The lenses used must be compatible with the image sensor sizes used, considering:

Sensor Code	Resolution	Size (in inches)
S01 (CMOS)	752x480px	1/3"
S04 (CCD)	1280x960px	
S05 (CCD HDR)	1280x960px	
S06 (CCD HDR)	1636X1220px	1/1,8"

The ITSCAM 400's image sensors have high sensitivity to infrared light, ideal for use with flashes and dim illuminators, with light invisible to the human eye. See Sensitivity of Sensors to Light for sensor specifications about the supported wavelength range.

The focal length varies according to the lens used and refers to the distance between the optical center of a lens and the plane of focus, measured in mm (millimeters), with the angle of view being more "open" for smaller values.

Inputs and Outputs

The ITSCAM 400 hardware has a total of 4 input and output ports (IOs), being 2 input ports for installing external sensors, which identify the moment of capturing the images (trigger) and 2 output ports that can control the artificial lighting (flash), usually triggered automatically in low light situations. In situations where the application of external sensors is unfeasible, the ITSCAM 400 device can be configured to generate trigger events from image analysis, by enabling software triggering (Virtual Trigger).

Data Transmission over the Network

When the ITSCAM 400 receives an image capture request, either by triggering an external trigger or by software, the flash synchronism occurs, and the next generated frame will be made available by the network. The captured images are transmitted digitally (in BMP or JPEG format) through the network interface, using the TCP/IP protocol. The transmission time of images captured by the ITSCAM 400 varies depending on the network infrastructure conditions. The transmission capacity of the network to which the ITSCAM 400 is connected can be affected by the following factors:

- Processing capacity of the equipment that receives the data;
- Quality of the network card of the equipment that receives the data;
- Traffic volume of the network to which the ITSCAM 400 is connected;
- Quality of peripherals connected to the network (hubs, switches, routers, etc.).

The table below shows typical image transmission rates over the network in JPEG and BMP formats. Upon receiving a request for image capture (via the network or via I/O), the ITSCAM 400 prepares the image and stores it in RAM immediately, being transmitted according to the availability of the network.

Table 2 - Typical transmission rates (in frames per second) for images in JPEG and BMP format

Type of JPEG Image	ITSCAM 401	ITSCAM 411
Colorful	35	10
Monochrome	35	10
Type of BMP Image	**ITSCAM 401**	**ITSCAM 411**
Colorful	12	3
Monochrome	33	6

The ITSCAM 400's internal image capture rate is constant, with the value corresponding to the sensor resolution, which have the following speeds:

Table 3 – ITSCAM 400 acquisition rates

Sensor Code	Resolution	Internal acquisition rate
S01 (CMOS)	752x480px	60fps
S05 (CCD HDR)	1280x960px	30fps
S04 (CCD)	1280x960px	24fps
S06 (CCD HDR)	1636X1220px	14,98fps

Format of Transmitted Images

The image can be transmitted, either in *Photo* or *Video* mode, in BMP or JPEG formats. In both formats, the ITSCAM 400 transmits an image that includes the header of the respective format. In the case of JPEG images, the settings of the ITSCAM 400 at the time of capture and additional data, such as the license plate of the vehicle in case of embedded OCR, are also attached within the image.

Additionally, the quality of the JPEG image can be selected, setting between 1 (worst quality – highest compression) and 100 (best quality – least compression).

Supported Servers

The ITSCAM 400 can communicate with different types of servers if they are correctly configured. Each server has its own characteristics when connecting to the ITSCAM 400:

Server	Interaction with the ITSCAM 400
FTP	The equipment connects via FTP with one of the servers available for sending images
ITSCAMPRO	By configuring the ITSCAM 400 to communicate with the ITSCAMPRO solution, it is possible to send images and the plates read by the embedded OCR. ITSCAMPRO is an application that concentrates the images and plates sent by the ITSCAM 400, allowing visualization and generation of different types of reports (contact Pumatronix for more information about the application)

Server	Interaction with the ITSCAM 400
RTSP*	The Real Time Streaming server can receive the images captured by the ITSCAM 400 through the link rtsp://ITSCAM IP:PORT/mjpeg. If the default port 554 is specified, the link becomes rtsp://ITSCAM IP/mjpeg
Porta Serial	It creates a TCP server on the ITSCAM 400 on the specified ports and causes all messages that travel through the ITSCAM 400's serial port to be redirected to the port that has been configured in the TCP protocol
Q Protocol	Configures ITSCAM 400 to communicate with systems that use equipment that supports Protocol Q, which sends the vehicle pass-through log

*ITSCAM 400 implements an MJPEG stream that operates independently of the server that is configured. This stream can be composed of images not synchronized with the lighting, as well as illuminated images.

Digital Signature

Some ITSCAM 400 models sign the images they transmit digitally. Images are signed when requested in JPEG format, regardless of whether the request came via network or an external trigger. The hardware asymmetric encryption mechanism contains a protected internal memory for storing private keys.

2. Additional Documentation

Product	Link	Description
ITSLUX	Product Manual	Manual containing the technical specifications of the ITSLUX product
ITSCAM VIGIA+	Product Manual	Manual containing the technical specifications of the ITSCAM VIGIA+ product
ITSCAM 400	Installation and Maintenance Guide	Guide containing the information necessary to install and maintain the ITSCAM 400
ITSCAM 400	Integration Manual	Programming and Integration Manual containing the information necessary for the integration of ITSCAM 400 with an application

3. Generated Information

Figure 3 – Example of image generated by ITSCAM 400

The ITSCAM 400 line is composed of image capture and processing devices that are transmitted digitally (in BMP or JPEG format) through the network interface, through the TCP/IP protocol. Each ITSCAM 400 has an IP address, which allows you to remotely configure all its settings. The network interface also allows multiple devices to be accessed by the same machine, without overloading or compromising capture, switching and synchronization time.

The ITSCAM 400's digital technology improves image quality over analog systems. In digital technology, photons are converted to an analog level and then digitized. These digital values correspond to image pixels and with fewer conversion steps, image quality losses are reduced.

The ITSCAM 400 series devices use non-interlaced (progressive scan) global shutter image sensors to capture images. This means that all image pixels are captured at the same instant and it is possible to capture images with moving objects. Generally, the real resolution of analog images is 640x240 pixels, while the ITSCAM 400 provides all the resolutions shown in the graphic. This difference in the number of pixels is sensitive not only to the human eye, but also to automatic license plate recognition (LPR) algorithms, as illustrated:

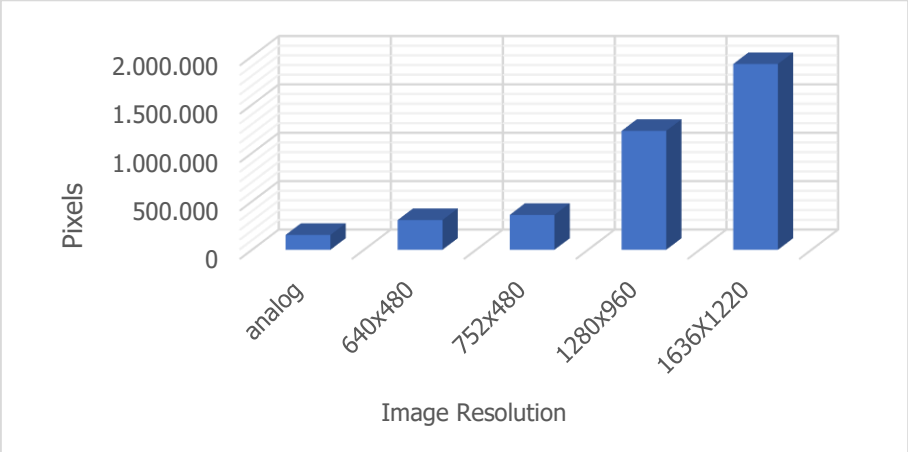


Figure 4 - Comparison between the actual number of pixels of analog and digital images

With the ITSCAM 400, the greater number of pixels available in the width of the image also allows, with the same zoom used in analog images, a greater field of view of the image can be achieved. Thus, information loss at the edges, such as vehicles between lanes, is minimized. Starting with firmware version 19, all ITSCAM 400 models can generate cropped images and some other reduced (scaled) resolutions, as identified in the table:

Sensor and Effective Pixels	Reduced Resolutions
S01: Colorful 752x480px CMOS	640x480, 480x360, 320x240, 240x180, 160x120
S04: CCD 1280x960px	800x600, 640x480, 480x360, 320x240, 240x180, 160x120
S05: CCD HDR 1280x960px	
S06: CCD HDR 1636X1220px	800x600, 640x480, 480x360, 320x240

*The 1280x960 pixel model can generate 1024x768 pixel resolution images.

JPEG Comments

The JPEG format is a block-based image storage format. Blocks start with a tag that is always composed of 0xFF and a second byte. Some examples are:

0xFF 0xD8: Start of image

0xFF 0xD9: End of image

0xFF 0xE8: Image information such as data size and formatting

0xFF 0xDA: Start of compressed image

0xFF 0xFE: Comments in text format

The file is always formatted in such a way that, for example, 0xFFDA only appears once in the file (to indicate the beginning of the compressed image data). Therefore, Pumatronix uses the image comments tag to store generated metadata for each capture. This field (commonly referred to as Comments or Image Comments) can be found in the image by looking for bytes 0xFF and 0xFE. As comments are placed at the end of the image, it is suggested to search for the marker starting at the end of the file. Then, following JPEG standards, the data is formatted as follows:

Comment tag		Size of comments (counting this field, in Big Endian)		Comment string, ending in 0x00
0xFF	0xFE	LSB	MSB	string [length-2]

As the comments consist of a C string ending '\0', it is possible to use some function like *strcpy*, 2 bytes after the tag to extract it. The string is composed of a sequence of "key=value;" (semicolon separating key and value sets).

JPEG comment example:

DataComp=24/06/202121:14:36;FwV=v19.2.5;FwD=so800x600,LENTE_MOTORIZADA_SENKO,JIDOSHA,JIDOSHA_LIGHT,SENSOR_BAYER,HW_VIGIA,MEMORIA_EXTENDIDA;FotoColorida=0;Sombra=0;Hdr=0;Gamma=90;TipoShutter=0;ShutterFixo=600;ShutterMaximoDay=600;ShutterMaximoNight=600;TipoGanho=0;GanhoFixo=20;GanhoB=0;GanhoC=0;GanhoMaximo=0;ModoTeste=0;NivelDesejado=20;NivelAutomatico=0;FormatoTrigger=1;QualidadeTrigger=80;NumeroFotosRede=1;NumeroFotosIODay=1;NumeroFotosIONight=1;DelayFlash=130;ModoFlash=2;ModoFlashAuto=0;flash_out=1;SupervisaoIluminador=0;Revisao=2;Versao=19;TipoSaida=1;Trigger=1;Rotacao=0;TipoGanhoDif=0;ValorGanhoDif=0;TipoGammaDif=0;ValorGammaDif=90;TipoWhiteBalanceDif=0;ValorWhiteBalanceDif=0;TipoTriggerDif=0;ValorTriggerDif=1;TipoSaturacaoDif=1;ValorSaturacaoDif=6555748;RealceBorda=0;Modelo=ITSCAM403_VIGIA;Resolucao=800x600;AutoIris=1;DayNightAlgorithm=0;ModoDayNight=1;PorcentagemPrimeiroDisparo=100;PorcentagemSegundoDisparo=100;DelayCapturaDay=0;DelayCapturaNight=0;Sincronismo=0;SincronismoDt=4;TodasFotosItscamPro=1;JuntaFotosBMP=0;GPS=0;ModoOCR=0;TipoOcrDif=0;ValorOcrDif=0;MaxLowProbChars=0;MinimaProbPorCaracter=80;TipoOCR=3;TimeoutOCR=4000;JidoshaLightVersion=3.9.0;JidoshaLightSHA1=1479289519f1cb1944c73aec22dc0c9a4a8e887b;OcrAngle=0.000000;OcrSlant=0.000000;OcrMinCharHeight=9;OcrMaxCharHeight=60;OcrAvgCharHeight=17;OcrGoodCharProb=80;LimiarPercentNightDay=90;LimiarPercentDayNight=50;LimiarPercentNightDayMotorizada=30;LimiarPercentDayNightMotorizada=20;TransicaoMotorizadaIO=0;PlacasSerial=0;PlacasSerialIface=2;enableNtpServer=0;ntpServer=http://ntp.br;triggerStartVeiculoPaddingNoturno=0;triggerStartMotoPaddingNoturno=0;triggerEndPaddingNoturno=0;triggerStartPaddingAproxDiurno=0;triggerEndPaddingAproxDiurno=0;triggerStartPaddingAfastDiurno=0;triggerEndPaddingAfastDiurno=0;statusFirmwareRecebido=0;LimTM=0;RoiTM=0,0,0,0,0,0,0,0;RoiTMMode=0;MapHabilitado=0;MapIp=10.9.0.1;MapPorta=51000;MapIp2=0.0.0.0;MapPorta2=51001;ocrCountry=1;tipoIluminador=0;usarProtecaoIluminador=0;VmEnable=0;ShutterMaximo=600;NumeroFotosIO=1;QualidadeReal=80;TSinc=-215699032;TSincDT=-215699032;TempoCaptura=-1931784260;TempoLigado=-1931784199;ShutterAtual=600;GanhoAtual=20;NivelAtual=0;WhiteBalanceAtual=4210752;SituacaoDayNight=1;FocoIR=0;Horario=;Entrada1=0;Entrada2=0;EntradaUsada=0;IndiceFoto=1;IOVigia=255;OCRUsado=0;Contagem=1;Cc0=0.0000;PosC0=0x0,0x0;Cc1=0.0000;PosC1=0x0,0x0;Cc2=0.0000;PosC2=0x0,0x0;Cc3=0.0000;PosC3=0x0,0x0;Cc4=0.0000;PosC4=0x0,0x0;Cc5=0.0000;PosC5=0x0,0x0;Cc6=0.0000;PosC6=0x0,0x0;Placa=;CorPlaca=0;CoordPlaca=0x0,0x0;OCRTotalTime=0;OCRRem=0;OCRRemRet=0;OCRLoc=0;OCRLocRet=0;OCRRemVersion=0.0.0;OCRRemSHA1=;MeanTM=0;StdTM=0;RoiOCR=0,0,0,0,0,0,0,0;Borda=1

JPEG Image Comment	Meaning
Ccx	X character reliability
Placa	Vehicle license plate read
CorPlaca	0: Light plate with dark letters 1: Dark plate with light letters
CoordPlaca	Coordinates of the rectangle that contains the plate identified in the image

Automatic License Plate Recognition

Vehicle license plate location and recognition functionality is possible through an OCR server (MAP or PC) that offers better image analysis processing. The main functionality of this OCR server is to recognize Brazilian and Mercosur license plates from images using a software library. For OCR processing of vehicle license plates from countries other than Brazil, please contact Pumatronix technical support.

For a better recognition index, it is recommended to adjust the equipment to capture the license plate of the vehicles in the center of the images and with the height of the letters and numbers of 20 pixels when the resolution is up to 752x480px and 25 pixels for higher resolutions, from 1280X720px to 1636X1220px.

Whenever an image in JPEG format is requested via the *Photo* command or via I/O, the ITSCAM 400 captures the frame, performs license plate recognition, and transmits the image. This functionality is not performed if the request is made by the *Video* command or if the requested image is configured for BMP format.

After capturing the image, the ITSCAM 400 seeks to identify objects like a license plate. When locating each of these objects, the recognition algorithm seeks to identify letters and numbers. The identification result depends on the minimum reliability that the character presents. The read license plate is inserted within the JPEG stream itself, in the comments field.

Sending by RS-232 Compatible com Wiegand 26

The ITSCAM 400 models that have the functionality of locating and recognizing vehicle license plates can communicate with *Wiegand* controllers, 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, it is necessary to load the Plates List into the ITSCAM 400's memory and carry out the steps to configure the connections.

As in previous versions of the ITSCAM 400, connecting a user to a serial port, via the Serial Server, interrupts all messages exchanged through that serial port, including GPS, photo request with or without stripe, and plate sending. Such functionality will be maintained so as not to disturb the equipment configuration (which is the purpose of this feature). The transmission of these messages via serial does not interfere with the reception of messages from other functionalities (GPS, photo with or without a stripe).

License Plate List File

For the RS-232 port to be used in equipment that supports the Wiegand 26 protocol, a file must be created containing the information on the plates and their respective identifier. This file containing the list is sent to ITSCAM 400 and with each new vehicle identification, the list is consulted.

Sending the file with the list can be done using the 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). The CSV file pattern follows the example:

ABC1234,321

ZZZ4444,456

XYZ9876,99

To forward plates outside the list, the first row of the table must contain the plate * (just an asterisk) and the id. This value is sent by the equipment whenever an unlisted plate is recognized. When processing the web interface, characters are converted to uppercase. The quotes and spaces are removed before forwarding the list. Other columns and rows with empty columns are ignored. Cases in which importing the list using the Web Interface will fail:

- The license plate does not have alphanumeric characters;

- Specified ID out of range;
- Invalid characters exist;
- There are duplicates.

In cases of failure, the interface will point to the wrong line and not load. In cases of success, at the end of the list loading, the interface will show the number of loaded lines.

If the list is loaded 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. The lines must be sorted in ascending order, using the plate as a key. The ASCII character value is used to do this sorting and only 100,000 license plates are supported. The ordering of the list influences the processing speed, as 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 in the OCR menu, so the search can infer the closest plate in the list.

The verification of the list that is in the equipment can be obtained in the form of a text file, using the option of Export List. To remove the plate list, use the *Remove List* button on the web interface or upload an empty file.

Geographic Location - GPS

Some ITSCAM 400 models can provide images with the location coordinates embedded, requiring only an external GPS antenna on Serial Port 1. In this case, serial port 1 must be configured to control integrated GPS and the serial settings must be: speed 4800bps, 8 bits in protocol, no parity and with 1 stop bit or 4800-8N1.

All ITSCAM 400 models that allow the use of integrated GPS will be discontinued.

Vehicle Counting Function

The ITSCAM 400 can be used as a Vehicle Counter. This function allows to select a region of the track to survey the number of vehicles that circulated during a set period.

To obtain optimal performance from this function, the ITSCAM 400 must be installed above the center of the road, so that the traffic direction occurs linearly under the coverage of the ITSCAM 400, as shown in the figure. In this illustration the ITSCAM 400 is installed under a footbridge that crosses the highway.

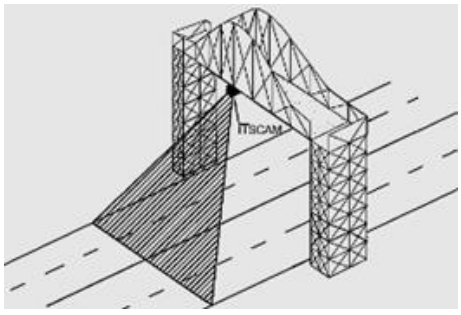


Figure 5 - Installation of the ITSCAM 400 to maximize the results of using the Vehicle Counter function

The Vehicle Counter function has its own interface (Figure 6), available at www.pumatronix.com, in the *Customer Area > Technical Support*. The procedure for using the counter requires connecting to the ITSCAM 400, demarcating the counting region, and checking or restarting the count:

1) Run the application and enter the IP address of the ITSCAM 400 which you want to count and establish the connection;
2) Define an area in the image that should detect the passing of the vehicle and add the total value of the count. To determine this counting region, simply select a region of the image with the mouse or enter the coordinates of the area in the image at the top of the screen;
3) Once the selection is made, the outline of the region in dark color will signal the selected area;
4) The result can be visualized by vehicle size, with a breakdown of the types of vehicles accounted for as small (motorcycles, small vehicles), medium (medium-sized vehicles) and large (trucks, buses and similar).

Figure 6 - ITSCAM 400 Vehicle Counter Interface

4. Mechanical Specifications

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

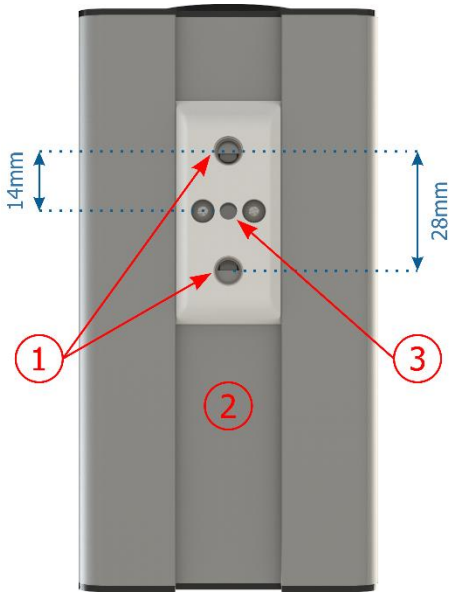


Figure 7 - Attachment Mechanism specifications: 1) Thread for ¼" screws; 2) Rail for changing the attachment point; 3) Ø4mm hole for guide pin

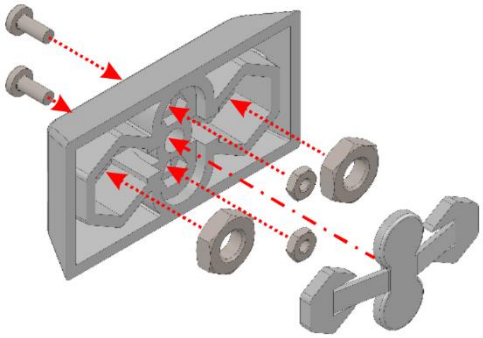


Figure 8 - Assembly of the Attachment Mechanism components installed in ITSCAM 400

- Interfaces:

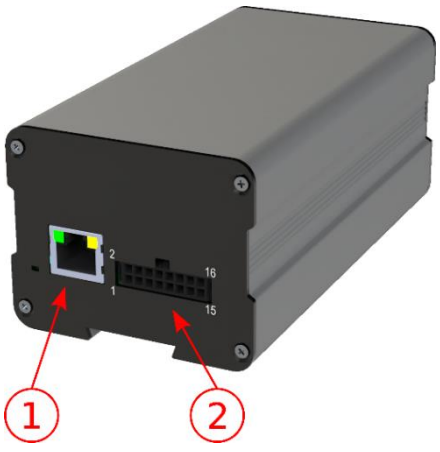
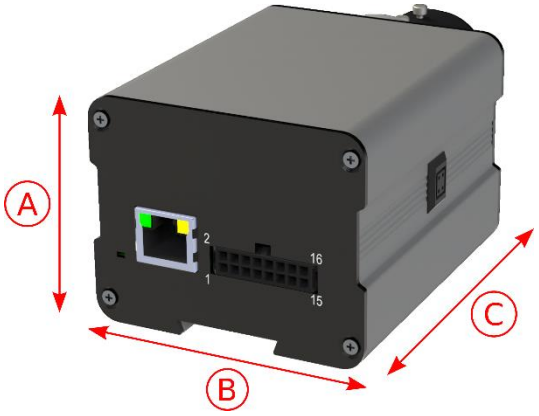


Figure 9 - Connections available on the device: 1) Ethernet; 2) 16-way Microfit (power connector, IOs, RS-232)

- Temperature: -10 a +70˚C;
- Dimensions and Weight: When the ITSCAM 400 does not have a motorized lens, the lenses used change the depth and the total weight. The *Auto Iris* connector is not considered in the dimensions, which are presented in millimeters:



Model	A) Height	B) Width	C) Depth	Weight
Manual lens	58*	72**	94 + lens	250g + lens***
Motorized lens	58*	72	141	350g

* *Attachment Mechanism* fits on the bottom of ITSCAM 400 and has an excess height of 7mm.

** The *Auto Iris* connector, which fits on the side of the ITSCAM 400, is approximately 8mm wide, depending on the lens manufacturer.

*** Approximate lens weight is 70g and may increase depending on the resolution used.

Sensitivity of Sensors to Light

The ITSCAM 400 has high sensitivity to infrared light, ideal for use with flashes and dim illuminators, with light invisible to the human eye. Below are the Sensitivity vs. Wavelength graphs for the image sensors of the monochromatic and *Day/Night* versions, representing approximate values for all sensor models in force. Remembering that in the color sensor 50% of the pixels are green, 25% are red and 25% are blue, according to the Bayer standard. Each color has specific sensitivity, according to the wavelengths. However, in the infrared region the colors have practically coincident sensitivity curves.

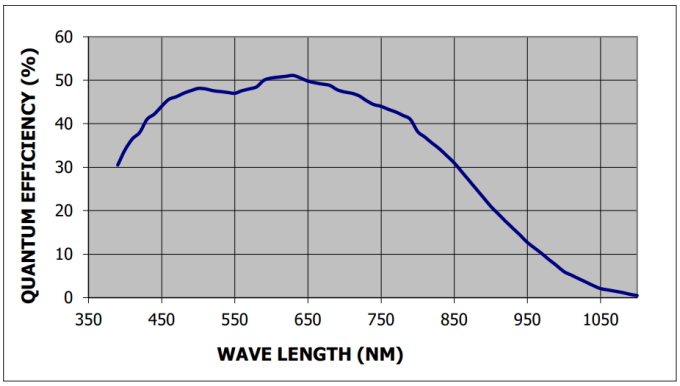


Figure 10 - Sensitivity of the monochrome sensor

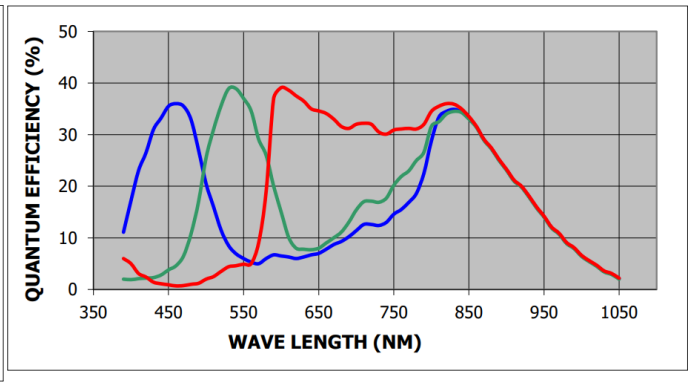


Figure 11 - Sensitivity of red, green, and blue colors in the color sensor

5. Electrical Specifications

- Power supply: 12 Vdc or 24 Vdc;
- Maximum power consumed: 6W
- Reverse polarity protection: 28 V;

- Overvoltage protection (maximum): 28 V;
- Overcurrent protection: 0.5 A;
- Inrush current protection: 1.1 A.

Electrical Connections

On the rear panel there are two connectors: Ethernet for data communication and Microfit 16-way Molex 43025-1600 (datasheet available at www.molex.com). Electrical connections are made at the Microfit connector terminals, according to the specifications:

Figure 12 - Terminals of ITSCAM 400 Signal and Power Connector (Microfit)

Terminal/Color	Signal	Description
1 – Green + White	RS232_RX1	RX RS232 1*
2 – Purple + White	RS232_TX1	TX RS232 1*
3 – Black + White	GND(RS232_1)	GND RS232 1*
4 – Purple	RS232_TX2	TX RS232 2*
5 – White	RS232_RX2	RX RS232 2*
6 – Brown + White	GND(RS232_2)	GND RS232 2*
7 – Grey	IN2+	Positive Terminal of Isolated Input 2
8 – Black	IN2-	Negative Terminal of Isolated Input 2
9 – Red + White	OUT2+	Positive Terminal of Isolated Output 2
10 – Blue + White	OUT2-	Negative Terminal of Isolated Output 2
11 – Green	IN1+	Positive Terminal of Isolated Input 1
12 – Blue	IN1-	Negative Terminal of Isolated Input 1
13 – Orange	OUT1+	Positive Terminal of Isolated Output 1
14 – Yellow	OUT1-	Negative Terminal of Isolated Output 1
15 – Brown	GND	Ground
16 – Red	Vin	Positive Voltage of 12 Vdc or 24 Vdc

The input and output signals are optically isolated, and the circuits are shown in the figure:

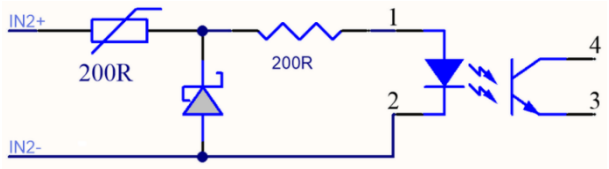
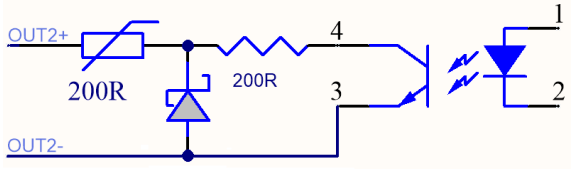
Input	Output
	
Recommended current: 10mA Maximum supported current: 20mA	Maximum current supported: 30mA Maximum voltage supported: 28Vdc

Figure 13 - ITSCAM 400 isolated input/output signal circuit

The 200ohm resistors at the input and output are intended to provide basic circuit protection. However, it is up to the user to ensure that the current flowing both at the output and at the input does not exceed **20mA**. Additional resistors must be inserted to reduce currents above the established limit. The circuit is dimensioned so that the equipment can be connected to 5Vdc voltage sources without the need for an additional resistor, in the same way for the triggering signal of the ITSLUX illuminator. Voltages above 5Vdc require additional resistors to limit the current:

Source voltage	Additional resistor indicated
12Vdc	470ohms
24Vdc	1000ohms

Risk of Oxidation: The electrical and signal connections made in the ITSCAM 400 bundle and in the data network cable must be protected in a terminal box or similar structures to avoid oxidation of the connections and unwanted infiltration of liquids in the bundle.

Output Signal Status Selection

The equipment's output ports can be configured to trigger the illuminator's flash or to remotely activate equipment via I/O signal, such as gates, sirens, and monitoring centers. The configuration process is done by software, using the equipment's web interface or the communication protocol.

Flash or Illuminator Shot

When using the illuminator devices in conjunction with the ITSCAM 400, the flash trigger output can be synchronized with the sensor exposure for image capture. To maximize the efficiency of these illuminators, it is possible that this flash firing occurs a few moments before the capture, applying the *Delay* function. This function allows you to set a delay in the exposure of the image sensor in relation to the flash triggering, to wait until the flash reaches its peak of light emission. As a result, the image is generated with the greatest amount of light provided by the illuminator, as illustrated by the graph of the intensity of the flash over time, after its activation, and the *Delay* in the exposure of the image sensor:

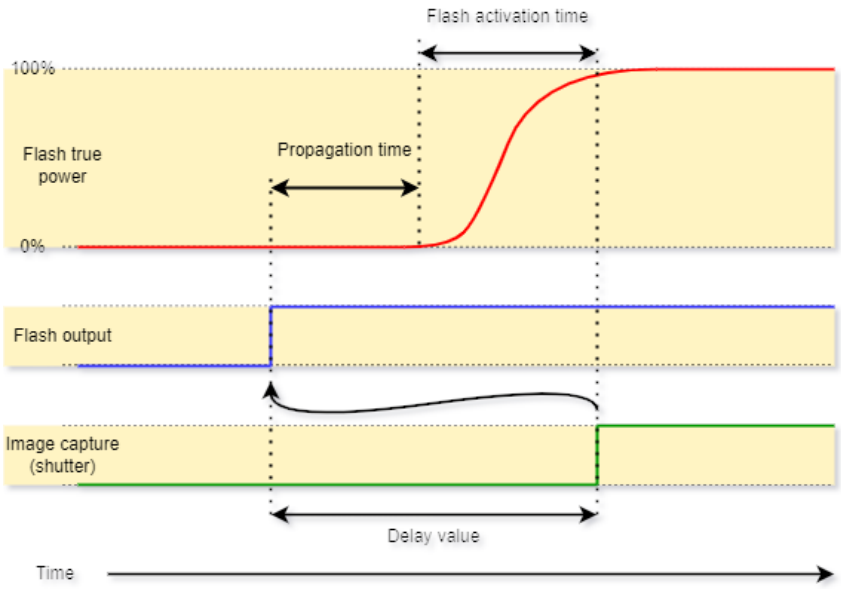


Figure 14 - Moment of Shutter activation after flash intensification

Each flash model reaches its peak light output at a certain time after shooting. For this reason, it is necessary to consult the technical specifications of the equipment for the correct configuration of the time that the ITSCAM 400 device must wait to perform the exposure of the image sensor. The available settings for the flash mode and what they operate are described:

Setup	Operating mode
Off	The flash never activates
Single	The flash is instantly activated when an image is requested
Single with delay	The flash is triggered moments before the Shutter exposure, according to the time set (only for the "Photo" command)
Continuous	The flash activates on all frames captured internally by the device. This mode is only recommended for illuminators without rest time, such as ITSLUX Video (ITSLUX W6032-V or W6075-V). Indicated for Illuminator testing only, as the Illuminator fires without any image request
Automatic	Flash is activated only when the environment is dark, in Night mode, avoiding shooting during the day. It generates energy savings for the system
Automatic with delay	Uses the same principle as Auto flash, but delay is used to optimize lighting at the time of capture
Continuous (Night) / OFF (Day)	Flash fires on all frames captured internally by the device when the ITSCAM 400 is operating in Night mode only. In Day mode the illuminator is not activated

Ethernet Connection

The ITSCAM 400 allows communication with other devices using the TCP/IP protocol. For this connection, the equipment offers a Fast Ethernet port with RJ45 connector, which follows the ANSI/TIA-568 T568B standard on the connections.

Fast Ethernet connection speed is up to 100 Mbit/s with auto negotiation, compliant with IEEE 802.3u standard.

6. Software Specifications

The ITSCAM 400 has a Web interface for evaluating the generated images and performing configurations. Accessing the interface requires entering the standard access data:

User	**admin**
Password	123

The features presented in this manual refer to firmware 19.3.1, with more information and details specified in the ITSCAM 400 Integration Manual.

Image Capture Architecture

The request for a photo can occur either through the Ethernet interface or from a signal on the input port of the ITSCAM 400, using, for example, external sensors. The events that can be configured to trigger the image capture are:

Setup	Operating mode
1: Off	No requests made via I/O
2: Rising edge	Images are sent when there is a rising edge on the I/O
3: Falling edge	Images are sent when there is a falling edge on the I/O
4: Rising and falling edges	Images are sent when there is a rising edge or falling edge on the I/O
5: Approaching image	The detection of the moment to perform the capture is determined by digital image processing (*Virtual Trigger*) when the positioning of the ITSCAM 400 captures the vehicle's faceplate first. It generates captures while detecting an approaching object or vehicle
6: Departure image (fast) 7: Departure image (slow)	In this trigger mode, the detection of the moment to perform the capture is determined by digital image processing. When the ITSCAM 400 detects that an object or vehicle is moving from the bottom up in the image (distance) images of the vehicle are captured and OCR is processed (when enabled). This trigger can generate more than one event for each pass depending on the frame and speed of the object in the image.
8: Continuous	Embedded OCR Disabled or Not Available: Send images continuously OCR Enabled: Capture images continuously, but send only those with recognized plate
9: Periodic	Captures are sent spaced by the specified time interval, regardless of an external signal of vehicle presence in the I/Os and image analysis processing (*Virtual Trigger*), like *Low Level*, but with an interval specified in minutes. Need to enable NTP server
10: High level	Generate captures at regular intervals while the input 1 signal is at high level considering the *Pulse Duration* specified in milliseconds

Setup	Operating mode
11: Low level	Generate captures at regular intervals while the input 1 signal is at high level considering the *Pulse Duration* specified in milliseconds
12: Rising edge and approaching image	It generates a capture when imaging an approaching object or vehicle and simultaneously there is a *Rising Edge* at input 1, whichever comes first
13: Motion Detector	Captures will be sent whenever the *Motion Detector* identifies variation in the image
14: Start-motion detector	Only a single capture will be sent once the *Motion Detector* starts to identify variation in the image
15: End-motion detector	Only a single capture will be sent once the *Motion Detector* stops to identify variation in the image. In conjunction with region of interest (ROI) positioning it can detect a vehicle departure

Virtual Trigger

In situations where the application of external sensors is not feasible, the ITSCAM 400 device can be configured to generate the trigger events by software from the analysis of the images. The *Virtual Trigger* corresponds to the vehicle detection process using only the statistical analysis of the images that determines which images detected by the ITSCAM 400 device are more likely to contain a vehicle with a license plate.

The events that can be configured to trigger the image capture by *Virtual Trigger* are *Approaching image, Departure image, Rising Edge and Approaching* or *Motion Detector*. In these, the images will be processed so that the algorithm can detect the presence of a vehicle and then perform the capture.

Imaging vehicle detection methods are **not** available on the ITSCAM 411 model with 1280x960 resolution.

Motion Detector

The *Virtual Trigger* can be activated with the *Motion Detector*, which consists of optimizing the processing of images without variation in content, necessary in situations where the flow of vehicles is low and the images that are captured are not distinct.

The variation parameter is defined by the *Motion Detector Threshold*, which sets the sensitivity for motion between two consecutive ITSCAM 400 images. In addition to this sensitivity, an ROI (*Region of Interest*) can be specified for the images in which the movement will be evaluated, to restrict the search for license plates only in the demarcated portion of the image. It is recommended to use a region of interest to remove sidewalks and regions that are not part of the track. This region corresponds to a polygon with four vertices, which is drawn over the preview image generated by the device

Multiple Exposures

The ITSCAM 400's *Multiple Exposure* functionality is the generation of two to four sequential images per request by configuring the number of *Captures per Pulse* through the interface. This functionality can increase the success rate in the automatic identification of license plates and identify vehicles that had some type of concealment at the time of capturing the first image. The settings that may vary are:

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

- The exposure time of the image sensor (*Shutter*), generating images with variation in the amount of light captured;
- Digital post-processing (*Gain*), which allows to lighten or darken the images.

When using *Multiple Exposures* (or photos), the first capture allows the non-reflective plates to be clearly visualized and the second capture will be performed with weak flash, which allows reflective plates to not be saturated and present a better view:

Figure 15 - Multiple Exposures at daytime

Figure 16 - Multiple Exposures at night

In both the network trigger and the I/O trigger, bursts of 2 to 4 images can be captured from a single request. All images of this burst are captured with the illuminator's flash shooting. The minimum interval between frames varies according to the frame rate of the ITSCAM 400 models, however it can be configured:

Table 1 - Time between frames and number of frames per capture

Resolution	Time between frames*	Number of frames per request
752x480px	16ms	1 to 4
1280x960px	41,6ms	
1636X1220px	66,75ms	

*The variation in the time interval between frames occurs due to the longer time required for the equipment to perform internal operations such as OCR, JPEG conversion and others.

Majority Vote

When OCR is performed on *Multiple Exposures* or using sequential images with *Majority Vote* enabled, the reading results are combined to identify with greater reliability which vehicle plate detected and the photos of the set will present the same OCR result.

The *Majority Vote* is a functionality applied to the results of the automatic character reading step on vehicle license plates (OCR). This analytics defines which sequence of characters best describes the license plate of the vehicle captured in the image. The algorithm compares the reliability of identification of each character, based on the image of the character in perfect reading conditions. This analysis can be done only on the set of images from the *Multiple Exposures* or using sequential images. Just configure the

parameters of *Maximum number of different characters* and *Timeout for plates in the recognized list*. During the passage of the vehicle through the region monitored by the ITSCAM 400, several images of the same vehicle can be captured for processing. However, the option to *Send only the one with the best recognition* can be enabled and the other images will be discarded.

After reading the OCR with the information of the best card identified, additionally there is the option to group all the photos generated in *Multiple Exposures* into a single jpeg file, enabling the functionality of the *Mosaic*.

Day or *Night* Operating Mode

The ITSCAM 401 and ITSCAM 411 models in Day Mode is capturing images in visible light only. The capture of images using infrared light occurs only if equipment is operating in Night mode. The transition between these operating modes uses the amount of lighting available in the environment to detect the best operating mode for current situation.

The correct operation for these *Day* and *Night* modes relies on a component named *Exchanger*. This electronic component has an internal mechanism that performs the positioning of a filter which prevents the passage of infrared light, allowing only visible light passthrough during daytime. This filter is located between the light input and the image sensor.

In order to maintain images with the lightness level throughout daytime and nighttime, the ITSCAM 400 performs a combined adjustment of *Iris*, *Shutter* (exposure period of image sensor) and *Gain* (digital post-processing of captured images). These adjustments are combined to reach the configured lightness *Level* in the image. When *Shutter* and *Gain* reach the specified limit values and the ITSCAM 400 is not able to reach the desired image *Level*, the equipment's operating mode must be changed to *Day* or *Night*.

For all firmware version 18 or newest, the automatic *Day* and *Night* mode feature had a large change on ITSCAM 400. The ITSCAM 400 remains controlling *Iris*, *Shutter* and *Gain*, but uses two different percentage criteria to switch between modes. After this change we have two new variables (Common Gateway Interface – CGI commands) and, when updating the equipment from an oldest firmware version, the default parameters are adopted with same percentage for both configurations. The recommended setting for these parameters is 50% of the desired *Level* for transition to *Night* mode and 90% of the desired *Level* for transition to *Day* mode.

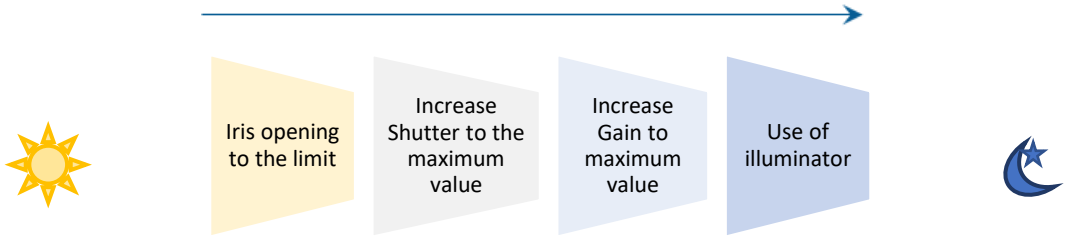


Figure 17 - Sequence of adjustments performed by the ITSCAM 400 in the transition from Day to Night modes

This procedure is performed in reverse order for transition from *Night* mode to *Day* mode.

Setup	Operating mode
Manual	It always provides images in the specified *Day* or *Night* format or according to the input signal.
Automatic	Operating in *Day* mode: when the Current *Level* remains below the transition threshold for approximately 60 seconds the ITSCAM 400 switches to *Night* mode operation. Operating in *Night* mode: when the Current *Level* remains above the transition threshold for about 60 seconds the ITSCAM 400 switches to *Day* mode.

Digital Signature

To sign the images, the ITSCAM 400 uses the ATMEL AT97SC3204 chip, fully compliant with version 1.2 of the TCG (Trusted Computing Group) specification for TPM (Trusted Platform Modules).

The hardware asymmetric encryption mechanism contains a protected internal memory for storing private keys. When the ITSCAM 400 converts the captured image into 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.

In the final image, which will be transmitted over the network, the fields below are appended to the image:

- Sha256: Image Hash SHA-256;
- Sha1: Image Hash SHA-1;
- Sign: RSA hash signature;
- RSA Exponent: exponent used in the signature calculation;
- RSA Module: module used for checking the signature.

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

This data is appended, in text format, to the JPEG image comment field, defined in the "FF FE" marker as per the ISO/IEC 10918 specification. Perform the following procedure to check the signature:

1) Remove the text referring to the hash (Sha1 or Sha256), Sign, RSA Exponent and RSA Module from the comment field;
2) Calculate the hash of the image with the text specified in "a" removed;
3) Extract the hash from the signature (Sign field) considering the exponent (RSA Exponent) and the module (RSA Module);
4) Compare the hash obtained in "b" with the hash obtained in "c";
5) If step "4" obtained the same hash for both cases, the image is authentic. Otherwise, the image has been tampered with.

7. Licensing

The ITSCAM 400 license includes the hardware for the image capture and processing device, in addition to the features presented in this manual. New features and bug fixes are made available in new firmware versions by Technical Support, through the Pumatronix website.

8. Initial Setup

Installation Prerequisites

ITSCAM 400 Positioning

To extract the best performance from the ITSCAM 400, it is recommended that its installation be made parallel to the track and with little horizontal inclination. Covering parts of the image by objects such as trees or vehicles from other lanes should be avoided.

The zoom and focus adjustment aim to produce images in which the characters on the license plate are approximately 20 pixels high. However, the height of the characters can vary from 15 pixels to 30 pixels, and the best recognition rates correspond to the height of 20 pixels.

In traffic enforcement applications, the ITSCAM 400 can be installed on poles or gantries with a minimum height of 3.5 meters and a maximum height of 6 meters. The minimum vertical angle of 15° and the maximum of 45° between the center of the lens and a line parallel to the ground must be respected, adjusting zoom and focus for the best visibility of the license plate. The distance from the ITSCAM 400 to the vehicle crossing point varies in the CS Mount manual ITSCAM 400 models, depending on the lens applied. On the motorized lens models ITSCAM 411 (S04L3) and ITSCAM 411 (S04L3A), the applied distance varies from 4.5 to 45 meters.

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

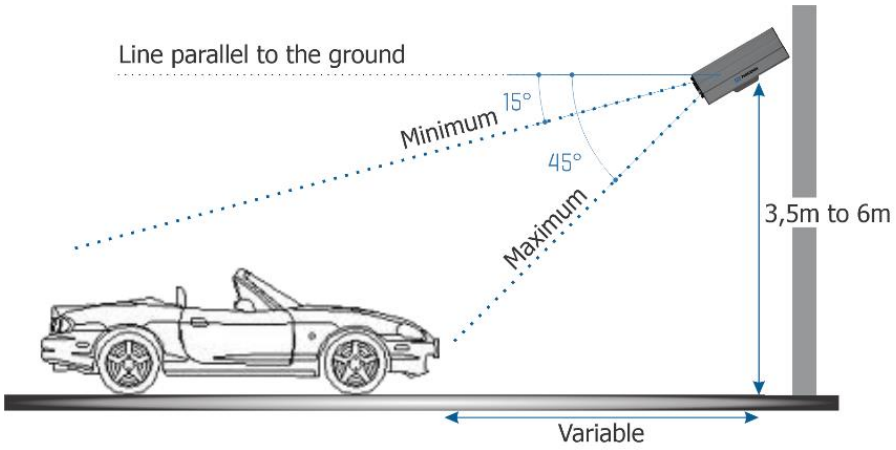


Figure 18 - Side View of the Installation

The captured license plate must present a maximum horizontal angle of 30° in relation to the side of the road:

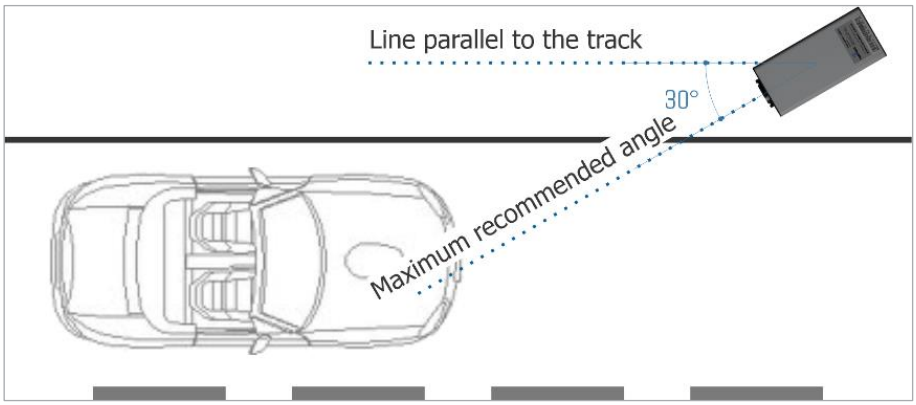


Figure 19 - Top View of the Installation

Installing the ITSCAM 400 without following the reported distances compromises the quality of captured images and reduces OCR recognition. If the requirements cannot be met at the installation site, it is recommended to consult Pumatronix Technical Support.

Settings for LPR (License Plate Recognition)

For the ITSCAM 400 to automatically read vehicle license plates, when starting the equipment, make the following settings:

1) Update the ITSCAM 400 network configuration;
2) Define the format and quality of captured images;
3) Adjust OCR and MAP processing settings when available;
4) Adjust zoom and focus, which can be done at any time during the configuration process, but it is mandatory. The image parameters indicated for the ITSCAM 400 are listed in Integration Manual.

Required Installation Conditions

After meeting the prerequisites for positioning the ITSCAM 400, check the configuration of the network where the equipment will be installed and enter the necessary parameterization.

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

Network Interface Parameterization

If the application that uses the ITSCAM 400 presents a network configuration different from the equipment's factory default, it is recommended to change the network setting before installing it on the local network. The ITSCAM 400's default network setting is:

Setup	Default Value
IP Address	192.168.0.254
Maintenance IP address	192.168.254.254
Netmask	255.255.255.0

The changed network configuration is saved in flash memory, however it is effectively applied after the device is restarted. When the change is made through the web interface, this restart is automatic after confirming the change.

The ITSCAM 400 has a recovery IP address (192.168.254.254) in case the user mistakenly changes the IP address and loses connection to the device. Access to this recovery IP address is only available over a point-to-point connection to the device.

The ITSCAM 400 maintenance IP address (192.168.254.254) is disabled when the primary IP address conflicts with it. Therefore, when manually configuring the equipment's network interface (Ethernet), different values of the maintenance IP should be applied, as there will be no way to recover the connection in case of loss of the configured IP address.

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

- ITSCAM 400's primary IP in the range 192.168.254.x and netmask 255.255.255.0;
- ITSCAM 400's primary IP in the range 192.168.xx and netmask 255.255.0.0;
- ITSCAM 400's primary IP in the range 192.xxx and netmask 255.0.0.0;
- Netmask set to 0.0.0.0.

9. First Access

The ITSCAM 400's web interface can be used to quickly check the status of the equipment and monitor the images in real time. However, the equipment must be energized, following the Electrical Specifications. An auxiliary device with the Google Chrome browser (version 85 or higher) installed must be used and the auxiliary device must be on the same data network as the ITSCAM 400 (with a network configuration compatible with that performed on the ITSCAM 400).

If a point-to-point connection is used, the ITSCAM 400 can be accessed via the maintenance IP address 192.168.254.254. When entering the ITSCAM 400's IP address in the address bar of the auxiliary device's browser, it must be informed:

User	**admin**
Password	123

10. Care and Maintenance

Some cares are needed to ensure the performance of the product and prolong its useful life.

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

Firmware Upgrading

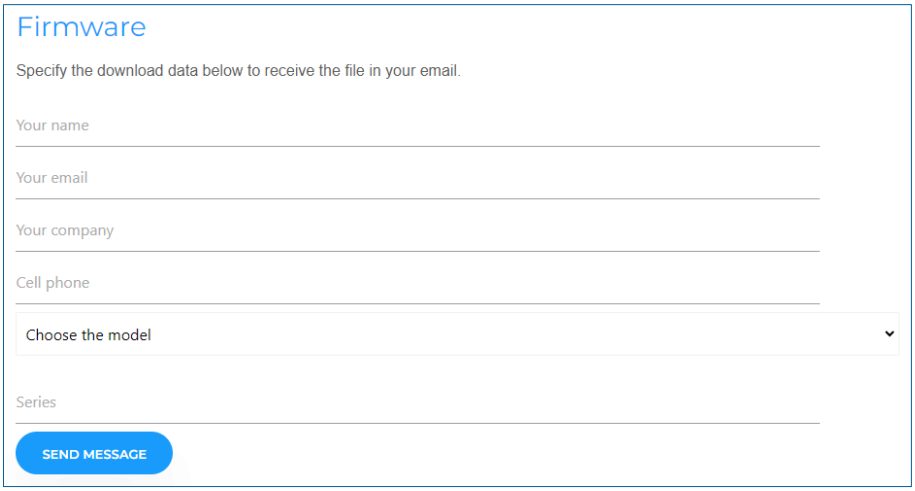
Pumatronix periodically provides updates for the ITSCAM 400 with defect corrections and functionality additions, by contacting Technical Support on the Pumatronix website. The update process requires an auxiliary device to connect to the equipment and can be done by specific update software available from Pumatronix, or directly through its web interface using one of the installed web browsers:

- Internet Explorer 11 or higher;
- Google Chrome version 38 or higher;
- Firefox version 21 or higher;

- Opera 25 or higher;
- Safari 8 or higher.

Updating the ITSCAM 400 firmware requires some security measures during the procedure, to prevent the file from being corrupted and the ITSCAM 400 device stop working:

1) Keep the ITSCAM 400 device inactive during the update process, ensuring that it is not required by any service or other equipment on the network where it is installed;
2) Keep the ITSCAM 400 device always on during the execution of the update, taking the necessary measures to prevent it from being restarted or turned off;
3) Request the firmware file by filling out the form available in the Technical Support menu on the Pumatronix website:



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

ITSCAM 400 Update via Web Interface

1) Download the firmware file received by email on the auxiliary device that will be used to connect to the ITSCAM 400;
2) Connect the auxiliary device to the same data network as the ITSCAM400;
3) Open a browser of auxiliary device to access the ITSCAM 400 web interface;
4) Enter the IP address of the ITSCAM 400 (the default IP address is 192.168.0.254 and point-to-point connections can be made via the address 192.168.254.254);
5) Access with *User* and *Password*;
6) Access the *Firmware Update* menu;
7) Select the saved firmware file;
8) Click on *Send* and track the *Firmware sending Progress* until it reaches 100%, making sure that it is **not** restarted or shut down and that it is **not** being requested by any service or other equipment on the network during the sending. This security is necessary when performing this procedure to prevent the update from corrupting the firmware and the equipment stop working;
9) Click on *Restart* button, waiting for the equipment to restart to apply the new firmware changes;
10) Finish the update procedure by checking the firmware version indicated on the top bar of the page.

ITSCAM 400 Update with Pumatronix Software (ITSUPDATE)

1) Download the firmware file available on the auxiliary device that will be used to access the ITSCAM 400 web interface;

2) Connect the auxiliary device to the same data network as the ITSCAM400;
3) Open the ITSUPDATE update software, available for download from www.pumatronix.com;
4) Select ITSCAM in *Type of equipment*;
5) Enter the IP address of the ITSCAM 400 in *Device address*;
6) Enter the path to the *Firmware file*;
7) Enter the last 4 digits of the file name (presented after the "_" symbol and before the .frw file extension);
8) Click *Update* and track the *Firmware sending Progress* until it reaches 100%, making sure that it is **not** restarted or shut down and that it is **not** being requested by any service or other equipment on the network during the sending. This security is necessary when performing this procedure to prevent the update from corrupting the firmware and the equipment stop working;
9) Click on *Restart* button, waiting for the equipment to restart to apply the new firmware changes;
10) Click the *Update* button on the web page, waiting for the new firmware changes to be updated and applied to the device;
11) Finish the update procedure by checking the firmware version indicated on the top bar of the page.

Preventative Maintenance

The ITSCAM 400 image capture and processing device must provide artifact-free images. However, if the external surface of the lenses or the protective case shows any dirt, the cleaning procedure must be performed:

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

11. General Conditions of the Warranty

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

The replacement of defective parts and the performance of services resulting from this Warranty will only be carried out at the Authorized Technical Assistance of Pumatronix or a third party expressly indicated by it, where the product must be delivered for repair.

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

Situations in which the Product Loses the Warranty

1) Use of software/hardware not compatible with the Manual's specifications;
2) Connection of the product to the electrical network outside the standards established in the product manual and installations that present excessive voltage variation;
3) Infiltration of liquids from the opening/closing of the product;

4) Damage caused by natural agents (electrical discharge, flooding, sea air, excessive exposure to climatic variations, among other factors) or excessive exposure to heat (beyond the limits established in the Manual);
5) Use of the product in environments subject to corrosive gases, with excessive humidity and/or dust;
6) Show signs of tampering with security seals;
7) Showing signs of opening and modification made by the Customer in product locations not authorized by Pumatronix;
8) Damage caused by accidents/falls/vandalism;
9) Display tampered and/or removed serial number;
10) Damage resulting from the transport and packaging of the product by the Customer in incompatible conditions;
11) Misuse and in disagreement with the Instruction Manual.

Privacy Policy

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

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


PUMATRONIX
www.pumatronix.com