



# EXCELSENSE



## ToughCam-1000™

User Manual, V2.0



# Table of Contents

<b>Table of Contents</b>	<b>1</b>
<b>Overview</b>	<b>3</b>
<b>Important Safety Instructions</b>	<b>3</b>
Warning	3
Caution	4
<b>Compliance</b>	<b>5</b>
Electromagnetic Compliance Information	5
USA	5
Canada	5
Europe	5
Australia/New Zealand	5
<b>Specifications</b>	<b>6</b>
<b>Ordering Options</b>	<b>7</b>
<b>Accessories List</b>	<b>8</b>
External Harness Options	8
Power Supply Options	10
Mounting Options	10
<b>System Installation</b>	<b>11</b>
Configuration Selection	11
Network Configuration A-1	11
Option 1	11
Option 2	12
Network Configuration A-2	12
Option 1	13
Option 2	13
<b>Interfacing the ToughCam-1000™</b>	<b>13</b>
Powering the ToughCam-1000™	13
PoE Power Source	14
Triggering the ToughCam-1000™	15
Remote Manual Trigger using Web Interface	15
Automatic Trigger	16
Cleaning the ToughCam-1000™ Lens	16
<b>Technical Information</b>	<b>17</b>
Network Camera	17
Factory-Setting Parameters	17
Interfacing with the ToughCam-1000™	17



Finding the Camera on the Network	17
Web Interface	17
ExcelSense Camera Configuration Tool (EST Camera App)	17
ONVIF Device Manager Tool	18
API Interface	18
3rd-Party Software Integration	18
Live View Page	18
Optical Module Settings Configuration	19
ToughCam-1000™ Thermal Regulation	19
Accessories	19
ToughCam-1000™ Standard Bracket	19
Sealed Inline RJ45 Coupler	22
ToughCam-1000™ Dimensions	23

## Overview

The ToughCam-1000™ is a rugged IP camera, suitable for many applications. It is built using the same rugged design principles as our ToughEye™ line of self cleaning cameras.

## Important Safety Instructions

### Warning

1. This is an ITE class A device. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
2. This is an **IEEE 802.3af** compliant device equipped with **Layer 1 (hardware interface)** PoE detection and classification hardware. Only connect to IEEE 802.3af compliant power sourcing equipment (PSE) devices, with sufficient power budget to deliver up to 15.4W. Failure to meet these requirements may cause faults that can lead to permanent damage to the ToughCam-1000™'s internal electronics.
3. All electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations. Electrical power is not to be applied to conductors at any point during this process.
4. Connecting the ToughCam-1000™ cable incorrectly poses a risk of injury due to electric shock to the user, and can damage the device.
5. Damaged or faulty cable connections may leave electrical conductors bare and/or short-circuited. Extra care must be taken during cable installation in order to avoid this scenario. In such a circumstance, do not attempt to handle conductors before removing power.
6. The ToughCam-1000™ lens is made with hardened glass. The user should take necessary precautions when handling the system. If excessive, direct force is induced, the glass may break, causing system failure and potential injury to the user.

 **Caution**

1. Alterations or modifications carried out without appropriate authorization may invalidate the user's right to operate the equipment.
2. When powering the device, the power sourcing equipment (PSE) must be compliant with the IEEE802.3af standard.
3. Only use fully-compatible cabling, as recommended by ExcelSense representatives, to connect ToughCam-1000™ cameras in your application. Failure to do this may cause unintended behaviour and permanent damage.
4. This device is not compatible with ToughEye-3100™ cabling. If replacing a ToughEye-3100™ product with this device, new cabling or an appropriate ExcelSense adapter cable must be used with this device. Consult your ExcelSense representative for more information.
5. Do not attempt to disassemble ToughCam-1000™ in order to access internal components. Consult ExcelSense for technical support as required.
6. Never face the ToughCam-1000™ directly towards the sun or any bright or reflective light, which may cause smear on the picture and possible damage to the CCD.
7. Do not remove the ToughCam-1000™ label containing P/N and S/N information for warranty service.
8. Never expose ToughCam-1000™ to conditions outside those specified in the *Specifications* section. Doing this can cause permanent damage to the device.
9. Damaged ToughCam-1000™ equipment must be replaced through an ExcelSense representative. Failure to do this may cause incompatibilities and permanent damage to the system.
10. Follow the cleaning procedure outlined in *Cleaning ToughCam-1000™* to avoid scratching the lens.

# Compliance

## Electromagnetic Compliance Information

### USA

The ToughCam-1000™ and its custom peripheral hardware, produced and sold by ExcelSense Technologies, have been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) for a Class A device, pursuant to part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Please follow the recommended installation guidelines as expressed in this manual when installing this device and its peripherals and cabling. Any changes or modifications made to the recommended system architecture or installation instructions could result in electromagnetic non-compliance, and so may void the authority granted to the user by the FCC to operate this equipment.

### Canada

This Class A digital apparatus complies with CAN ICES-3. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

### Europe

This digital equipment fulfills the requirements for RF emissions according to the Class A limit of CISPR 32 / EN 55032.

### Australia/New Zealand

This digital equipment fulfills the requirements for RF emissions according to the Class A limit of AS/NZS CISPR 32.

# Specifications

## CAMERA

Image Sensor	2.1 MP
Effective Pixels	1920 (H) x 1080 (V)
Horizontal FoV	Approx. 20°, 60°, 80°, 100°, 125°
Min Illumination	Color: 0.001 Lux @ (F1.2, AGC ON) B/W: 0.0001 Lux @ (F1.2, AGC ON)
Wide Dynamic Range	True WDR (>120dB)
IP Video	H.265 (1920x1080)   H.264 (1920x1080)   MJPEG (1280x720)
Streaming Capability	Stream 1: 1920×1080/1280×720 @50/60fps Stream 2: D1/VGA/640×360/CIF/QVGA @25/30fps Stream 3: VGA/CIF/QVGA @25/30fps
Network	IPv4/IPv6, 802.1x, HTTP, HTTPS, TCP/IP, UDP/IP, RTSP, DHCP, NTP, RTCP/RTP, PPPoE, SMTP, DNS, UPnP, FTP, ARP, SNMP
ONVIF	Profile S, Profile G
Recording (Loaded onboard storage variant only)	128GB max storage - Continuous, Motion, Pre/Post Alarm

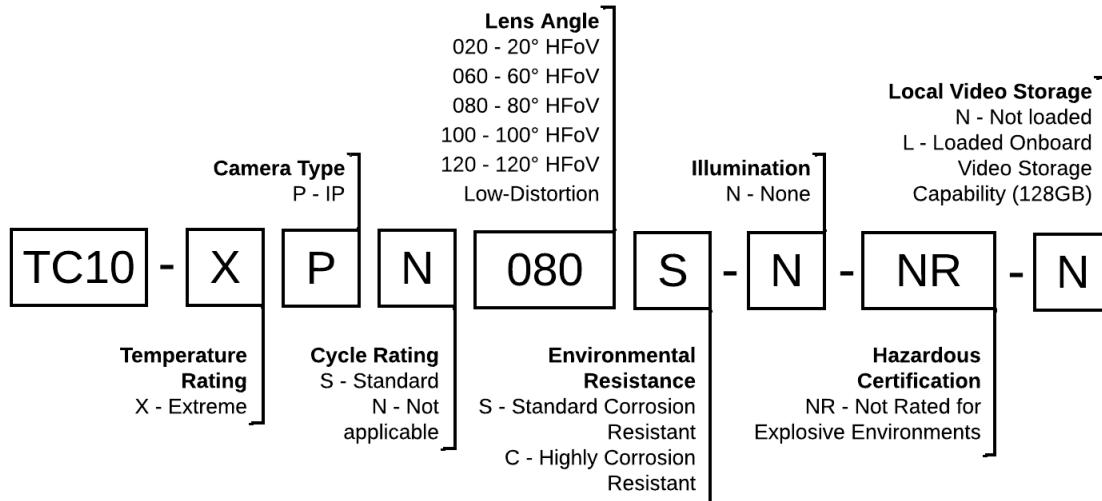
## GENERAL

Dimensions	68mm dia x 126mm [2.677in x 4.962in]
Weight	0.65kg [1.433lb] - 1.1kg [2.425lb] with Bracket and Sunshield
Power	PoE (IEEE802.3af/at, Class 4)
Thermal	-40°C to 60°C (operation and storage)
IP Rating	Designed to IP69
Vibration	11g

## ELECTRICAL

Parameter	Min	Typ	Max
Input Voltage (Active PoE), $V_{IN}$	36V		57V
Power Consumption, $P_{IN}$	4W (Idle)		10.5W (Heating)
Max Cable Length <sup>2</sup> , $L_{MAX}$			100m

## Ordering Options



**TC10** - ToughCam-1000™ camera

### Environmental Resistance

**S** - Standard Corrosion Resistant

**C** - Highly Corrosion Resistant

### Temperature Rating

**X** - Extreme: -40°C to 60°C

### Illumination

**N** - No Illumination

### Camera Type

**P** - IP: IP Camera

### Hazardous Locations Certification

**NR** - Not Rated for Explosive Environments

### Lens Angle (customization available)

020 - Approx. 20° Horizontal FoV

060 - Approx. 60° Horizontal FoV

080 - Approx. 80° Horizontal FoV

100 - Approx. 100° Horizontal FoV

120 - Approx. 120° Horizontal FoV

(Low-Distortion Lens option)

### Local Video Storage





**N** - Not Loaded

**L** - Loaded Onboard Video Storage Capability (128GB)








# Accessories List

## External Harness Options




The following table lists standard cables available. Detailed drawings for each cable harness shown below are available [here](#). Note that if a variant is required that cannot be found in this table, please contact an ExcelSense representative.

<b>RJ45 Adapter Cable [AC17-RJ45-K]</b>	<p>The RJ45 adapter kit provides a waterproof RJ-45 connection using the IP67 inline coupler, which accepts an RJ-45 plug. When connected to a IEEE802.3at compliant PSE (e.g. PoE+ injector or switch), it is the simplest way to power and operate the camera.</p>	
<b>RJ45 Adapter Cable, 90deg Downward Camera-side Overmold [AC17R1-RJ45-K]</b>	<p>This cable is compatible with TE-1700.</p>	
<b>M12 X-coded Adapter Cable, with 90-deg M12 Overmold, Clocked SW [AC17-M12XR2-xxM-IP]</b>	<p>The M12 adapter cables enable TC-1000 connection to a panel-mount X-coded M12 female receptacle. This cabling is compatible with the IP output of the camera.</p>	
<b>M12 X-coded Adapter Cable, with 90-deg M12 Overmold Clocked SW, and 90deg Downward Camera-side Overmold [AC17R1-M12XR2-xxM-IP]</b>	<p>This cable is compatible with TE-1700.</p>	

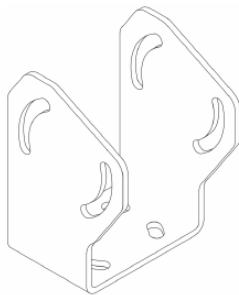
The following harnesses are also compatible with ToughCam-1000™, however they have additional wires and cables within the harness which, although not used in ToughCam-1000™, allow for compatibility with other products such as the ToughEye-1700™ products.

<b>Main Cable - IP</b> <b>[MC17-SC-xxM-X-IP]</b>	<p>Main cable can be used in all ToughCam-1000 installations. The IP cable includes a shielded Cat-5e cable for 10/100 Base-T signal transmission.</p> <p>The dual-output cable includes a 75-ohm coaxial cable for CVBS transmission. This cable is recommended if compatibility with the TE-1700 camera's analog video feed is desired (note: TC-1000 does not have an analog video output).</p> <p>This cable is compatible with TE-1700.</p> <p>Available in: <b>10m, 20m, 30m, 40m</b> lengths</p>	
<b>Main Cable - Dual Output</b> <b>[MC17-SC-xxM-X-DU]</b>		
<b>Extension Cable - IP</b> <b>[EC17-DC-xxM-X-IP]</b>	<p>Extension cables can be used to increase the length of existing cables.</p> <p>This cable is compatible with TE-1700.</p> <p>Available in: <b>3m, 10m</b> lengths</p>	
<b>Extension Cable - Dual Output</b> <b>[EC17-DC-xxM-X-DU]</b>		
<b>Extension Cable - Dual Output, 90deg TC10 connector overmold (downward)</b> <b>[EC17R1-DC-xxM-X-DU]</b>		
<b>Extension Cable - IP, 90deg TC10 connector overmold (downward)</b> <b>[EC17R1-DC-xxM-X-IP]</b>		
<b>Programming Adapter, IP Output</b> <b>[PA-TE17-USB-A]</b>	<p>Programming adapter is used to modify configurable device parameters, retrieve cleaning cycle data, and update internal microcontroller firmware. Suitable for inline connection to TC-1000.</p> <p>This cable is compatible with TE-1700.</p>	

## Power Supply Options

Part Number	Description	Preview	Datasheet
INJ-POE-S	Commercial-grade PoE+ injector, ideal for areas protected from the environment, and benchtop testing and demonstration, Input:100-240V AC		<a href="#">TPE-115GI (v2.1)</a>
INJ-POE-N	Industrial-grade PoE+ injector, with integrated DIN-rail mount. Suitable for field deployment with a wide temperature range: -40C to 65C. Input: 10-30 VDC		<a href="#">POE-24</a>
INJ-POE-N48	Industrial-grade PoE+ injector, with integrated DIN-rail mount. Suitable for field deployment with a wide temperature range: -40C to 75C. Input: 48-56 VDC		<a href="#">TI-IG30 (v1.0R)</a>

## Mounting Options



MB - TC10 - S

Standard mounting bracket. Suitable for installations requiring +15° to -60° down camera orientations. The MB-TC10-S comes standard with the ToughCam-1000™.

# System Installation

## Configuration Selection

The ToughCam-1000™ IP camera supports a network video stream, which provides simple connections, high resolution video, and accessibility from any device connected to the same network.

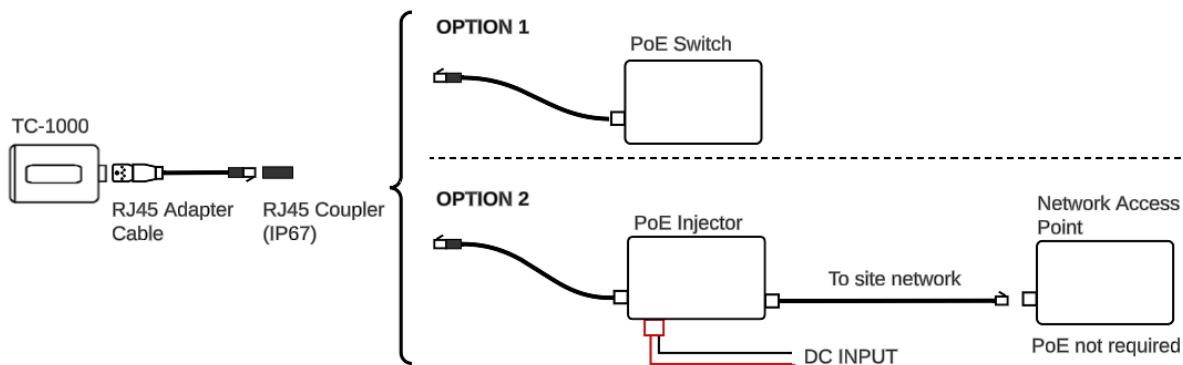
It is important to note that IP video has inherent latency due to video compression. The ToughCam-1000™ latency is rated at approximately **172ms** and **137ms** for Gen1 and Gen2 sensor module equipped units, respectively.

**Note:** IP camera video latency has been thoroughly analyzed and characterized under carefully constructed experiments using the ToughEye-1700™ product. The detailed experiment reports for each generation sensor module can be found [here](#).

Below are the recommended installations for the ToughCam-1000™.

### Network Configuration A-1

This configuration allows any shielded Cat-5e cable to be used to power and communicate with the ToughCam-1000™ camera. No custom cabling is required to be routed, as the Cat-5e cable plugs into the custom short adapter cable for plug and play functionality.



System Diagram using RJ45 Adapter Cable

#### Option 1

This option is the simplest configuration shown in the figure above and uses an endspan IEEE802.3af (PoE) compliant power sourcing equipment (PSE) to provide power to the camera through the same shielded Cat-5e cable used for data transmission.

## Option 2

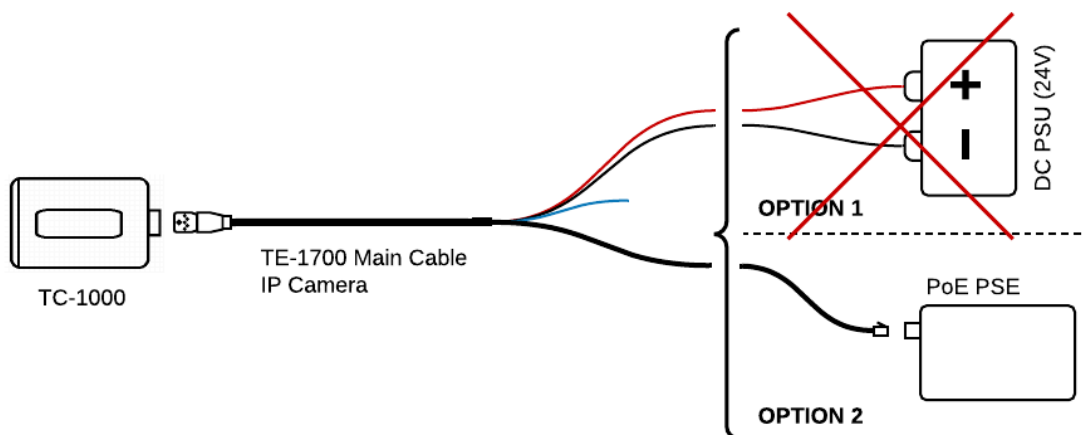
This option is optimal for applications with existing network switches that are not IEEE802.3af compliant. In this configuration, a midspan PoE injector can be used (see *Accessories* section earlier in this document for ordering information) in-line between the switch and the camera as shown above. The injector accepts a 12~24VDC input and supplies PoE power to the camera while also transmitting the data signals.

This configuration is designed to be simple to install and configure:

1. From an IEEE 802.3af compliant PoE PSE (power sourcing equipment) - either an endspan switch or midspan injector - route a shielded Cat-5e or better cable to the ToughCam-1000™. Ensure the routed cable is appropriately rated for your application (temperature, ingress protection, ruggedness, etc).
2. Once the cable has been routed to within 1m of the camera, it can be plugged into the waterproof Cat-5e adapter. For details on usage of the Cat-5e adapter please refer to section *Sealed In-line RJ45 Coupler*.
3. The PoE Adapter Cable [AC17-RJ45] can now be plugged into the ToughCam-1000™ camera.

## Network Configuration A-2

In this configuration, a ToughEye-1700™ IP or dual-output series cable can be used to power and interface with the ToughCam-1000™ camera. This is because the ToughCam-1000™ IP camera is fully compatible with the IP camera terminations within the ToughEye-1700™ cabling. However, it is important to note that the ToughCam-1000™ does not accept a DC input supply, as it solely relies on **PoE power** (see *Powering The ToughCam™*). The recommended installation is shown below.



*System Diagram using IP style Main Cable*

This configuration allows for a seamless transition between ToughEye-1700™ and ToughCam-1000™ IP cameras without the need to re-route the main cable. **Note:** *It is highly recommended that the cable be installed into an electrical cabinet via an appropriately sized cable gland. The TE-1700 IP style main cable jacket is 12mm (0.47") in diameter.*

#### Option 1

- Originally designed for use with the ToughEye-1700™ self-cleaning camera, the TE-1700 Main Cable includes DC input leads - coloured red and black and labeled “24V” and “0V”, respectively - which cannot be used to power ToughCam-1000™.

#### Option 2

- In this option, a PoE or higher compliant (IEEE 802.3af/at) PSE is used to power the camera, making the connection much cleaner.
- Connect the main cable's RJ45 connector into the PSE's PoE output port, and route the main cable to the *ToughCam-1000™* camera. If an extension cable is used, it should be connected in-line between the main cable and the camera. **Note:** *Care should be taken to properly secure routed cables. Use of conduit, cable clamps or appropriately rated cable ties is recommended.*
- Carefully and cleanly cut, insulate, and secure the spare red, black, and blue wires as they are not used in this configuration.

## Interfacing the ToughCam-1000™

### Powering the ToughCam-1000™

**Important Note:** *As per rule 2-024(2) of the Canadian Electrical Code Part I, ToughCam-1000™ does not require approval in order to be installed. However, it must be connected to a Class 2 output, as permitted by the Canadian Electrical Code Part I. (See rule 16-222 and relevant appendices).*

**WARNING:** *This is an IEEE 802.3af compliant device equipped with Layer 1 (hardware interface) PoE detection and classification hardware. If using power-over-ethernet, only connect to IEEE 802.3af compliant power sourcing equipment (PSE) devices with all software-layer (e.g. LLDP, CDP, etc.) communications disabled on the port, which should be preset to deliver up to 15.4W of guaranteed power as per the IEEE 802.3af standard. Failure to meet these requirements may cause faults that can lead to permanent damage to the ToughCam-1000™'s internal electronics.*

## PoE Power Source

When powering the device using the PoE protocol, an appropriate shielded Cat-5e or better cabling solution is required (see *Network Configurations A-1* and *A-2*). Aside from selecting the correct cabling, it is critical to ensure the Power Sourcing Equipment (PSE) is IEEE 802.3af compliant. Be sure that the PSE has all software-layer auto-detection capabilities disabled on the port, and that it is confirmed to be capable of delivering up to 15.4W of power as per the IEEE 802.3af standard.

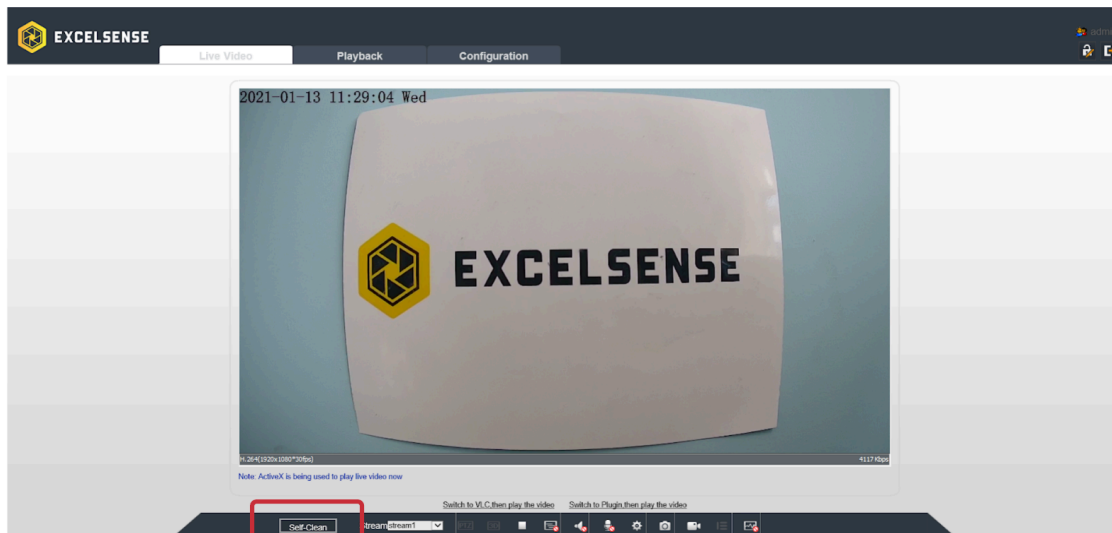
**Note:** *Care should be taken to properly secure routed cables. Use of conduit, cable clamps or appropriately rated cable ties is recommended. Added conduits or protective sleeves may oversize the effective cable OD with respect to the in-line coupler's gland.*

## Triggering the ToughCam-1000™

Note that the ToughCam-1000™ **does not** have Self-Cleaning capabilities. Within the web interface, certain features and settings pertaining to self-cleaning will have no functionality when using ToughCam-1000™, as they are intended to interface with supported ToughEye™ series cameras. Similarly, the trigger wire on the compatible main cable will have no effect (see *ToughCam-1000™ Main Cables* section).

### Remote Manual Trigger using Web Interface

As seen below, the ToughCam-1000™ web interface shows the Self-Clean button on the live view page, although it has no effect since ToughCam-1000™ does not support Self-Cleaning.

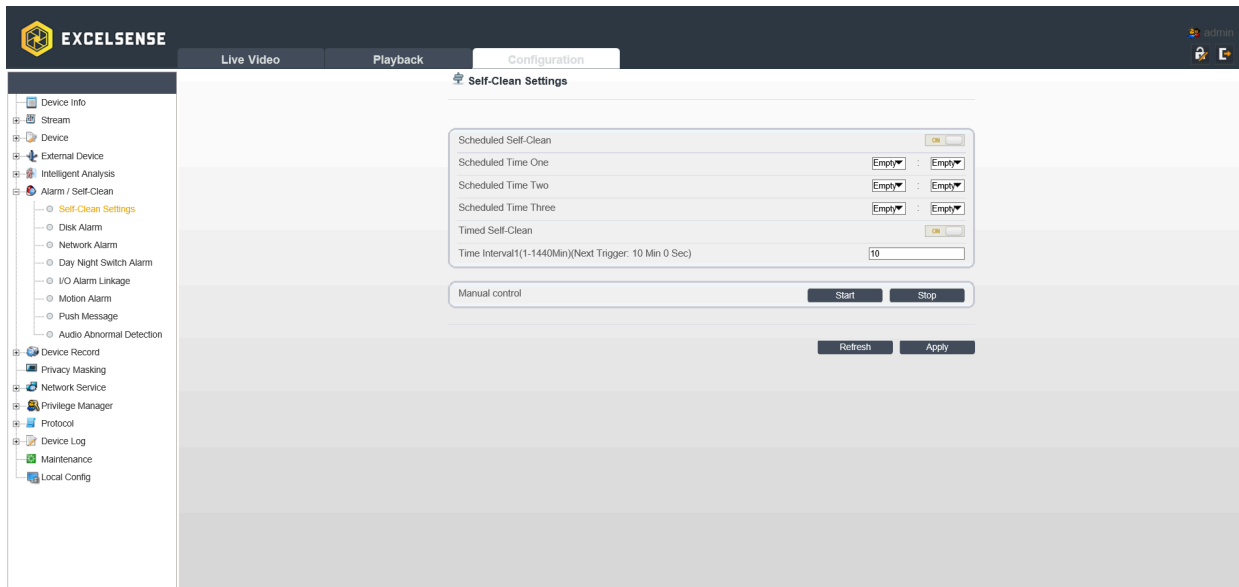


**Self-Clean Button**

*Camera Module Web Interface Live View Page*

## Automatic Trigger

The ToughCam-1000™ camera web interface also displays several automatic self-clean trigger options which have **no effect** when applied to ToughCam-1000™. Both the *Timed Self-Clean* and *Scheduled Self-Clean* trigger methods may be enabled simultaneously on supported ToughEye™ series cameras.



Web Interface Self-Clean Settings Page

## Cleaning the ToughCam-1000™ Lens

The recommended cleaning procedure is to gently spray off the lens with a hose or bottle to remove abrasive particles. A microfibre cloth may be used to complete the cleaning process, lightly wiping off any remaining contaminants.

# Technical Information

## Network Camera

### Factory-Setting Parameters

IP Settings	Login Credentials	Main Stream Settings
IP Address: 192.168.0.120 Subnet Mask: 255.255.255.0 Default Gateway: 192.168.0.1	Username: admin Password: admin	Video Encode Type: H.265 Resolution: 1920 x 1080 Frame Rate: 30 fps

### Interfacing with the ToughCam-1000™

#### Finding the Camera on the Network

A useful tool to find the camera on the local network is the Tools application (available [here](#)). This tool searches active online devices within your subnet and displays the information of the devices. You can also modify basic network information of the devices with this software.

#### Web Interface

The camera's web interface exposes all of the camera's features to the user. It is primarily used for streaming the live view or modifying camera settings.

Refer to the available web interface manuals [here](#) for detailed information regarding the web interface. Use the table below to identify the appropriate manual.

Optical Sensor Module	TC-1000 Serial Number Range	Web Interface Manual
1st Gen	1000799 and lower	<a href="#">1st Gen Manual</a>
2nd Gen	1000800 and higher	<a href="#">2nd Gen Manual</a>

#### ExcelSense Camera Configuration Tool (EST Camera App)

ExcelSense has released a dedicated camera configuration desktop application, compatible with Windows-based operating systems. This tool can be used to retrieve and configure various camera settings including video stream settings, image sensor settings, network settings (IP

address, ports), and more. The installer is available for download [here](#), and the relevant documentation can be found [here](#).

### ONVIF Device Manager Tool

The ONVIF Device Manager Tool provides an alternative option for modifying camera settings and accessing the live video stream of the camera. It is a Windows-based application which communicates with the camera through the ONVIF protocol. The tool's installer (.msi file) is available for download [here](#).

### API Interface

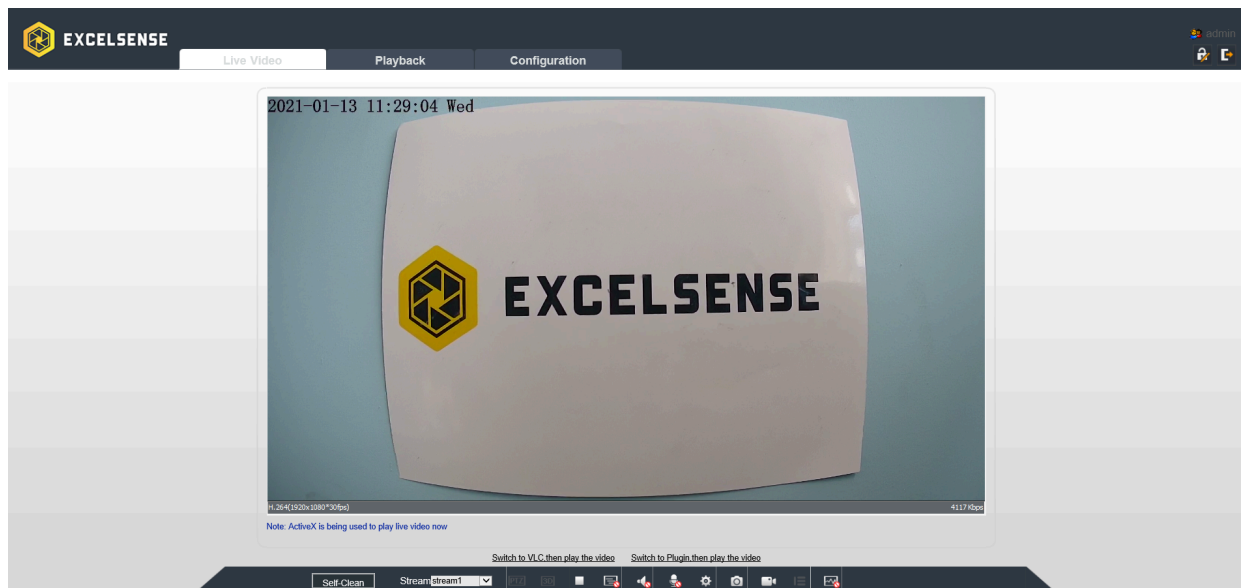
The ToughCam-1000™ is equipped with an accessible API that can be used to query and set a variety of camera settings, including stream, image, and shutter settings. Please refer to the **IP Camera API Documentation**, found [here](#), for detailed information.

### 3rd-Party Software Integration

The ToughCam-1000™ IP camera can be integrated with 3rd-party IP camera software, as the camera is ONVIF Profile S and G compliant. It is important to note that full integration cannot be confirmed with all 3rd-party software platforms (i.e. camera features and settings are not guaranteed to be accessible or configurable), therefore it is recommended to use the camera's native IE browser interface or one of the other options mentioned in this section to access and modify camera settings.

### Live View Page

The main page where live view can be streamed, snapshots and recordings can be taken, etc. Note that the Self-Clean action is not applicable to ToughCam-1000™.



*Web Interface Live View Page*

## Optical Module Settings Configuration

For detailed information accessing and modifying all available optical module features and settings on the ToughCam-1000™ product, please refer to either the relevant web interface manual, found [here](#), or the ExcelSense configuration application documentation, found [here](#).

## ToughCam-1000™ Thermal Regulation

ToughCam-1000™ is equipped with a thermal control system running on its integrated control module. This enables the device to be used in extremely cold temperatures as low as -40°C.

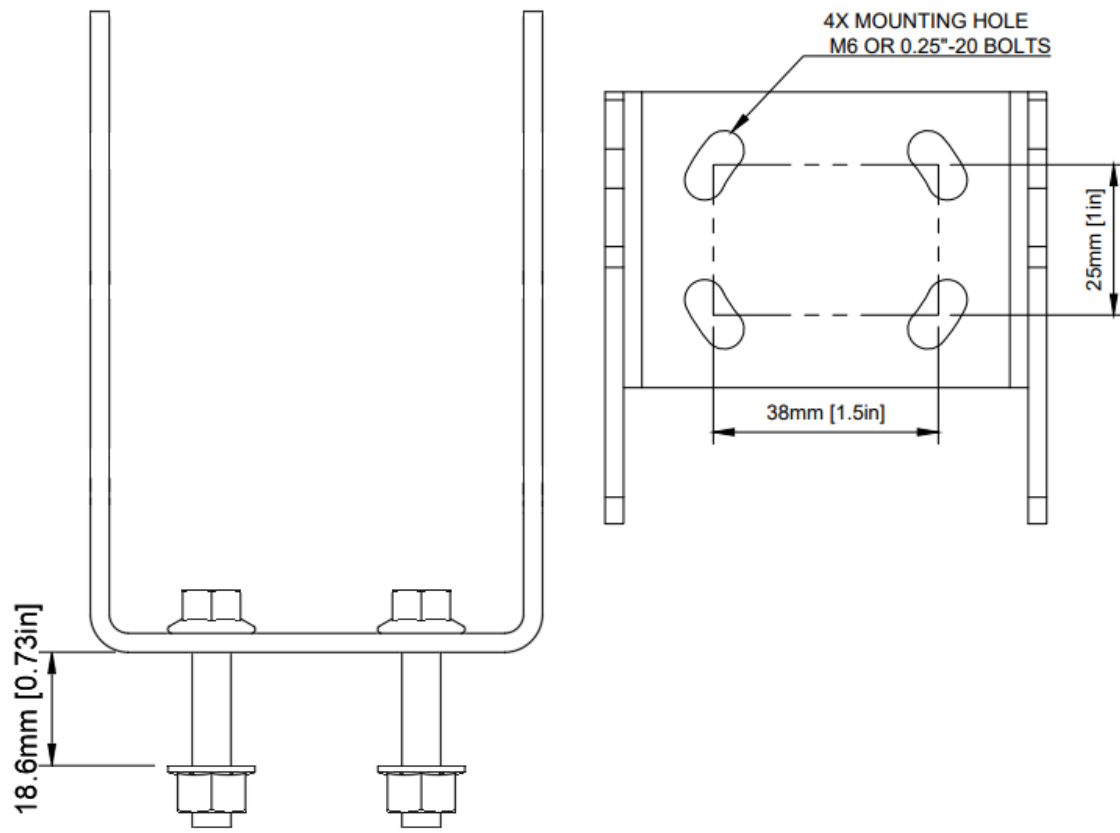
The thermal subsystem aims to maintain the internal temperature at an optimal level. During cold startup, the internal optical subsystem will be disabled until it has reached a temperature of -5°C. The front glass will continue to heat until it reaches a temperature of +5°C. This is done to ensure ice build-up on the lens has been properly melted prior to operation.

## Accessories

The following sections outline the specifications, sizes, and other relevant information for critical accessories.

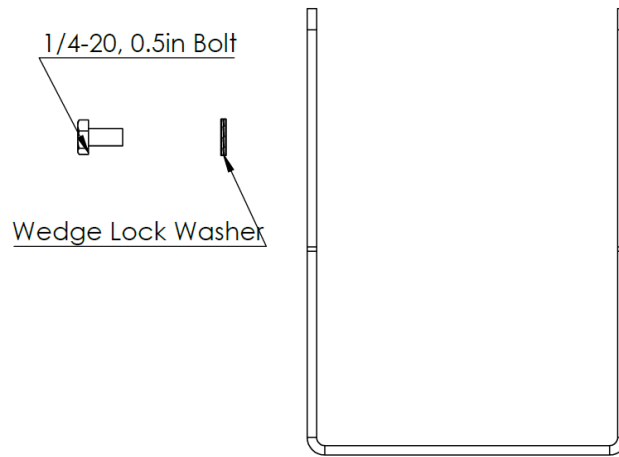
### ToughCam-1000™ Standard Bracket

The ToughCam-1000™ Standard Bracket [MB-TC10-S] is included as the default bracket in most ToughCam-1000™ installations. The bracket should first be mounted to a suitable horizontal support with sufficient strength. The camera ships with high strength, 1/4"-20, 1.25" long bolts, suitable for mounting to plates up to 0.625" thick. If mounted to a thicker support, suitable Grade 8 bolts should be sourced. The standard bolt and nyloc can be installed using 9/16" wrenches or sockets. When using supplied Grade 8 bolts, they should be torqued to 8.8 ft-lbs.



*Mounting pattern and bolt details*

With the bracket mounted the camera can be installed. Start by placing the camera within the bracket and loosely attaching it at all 4 mounting points. Be sure to use the included wedge lock washers:



*Camera bolt installation ordering*

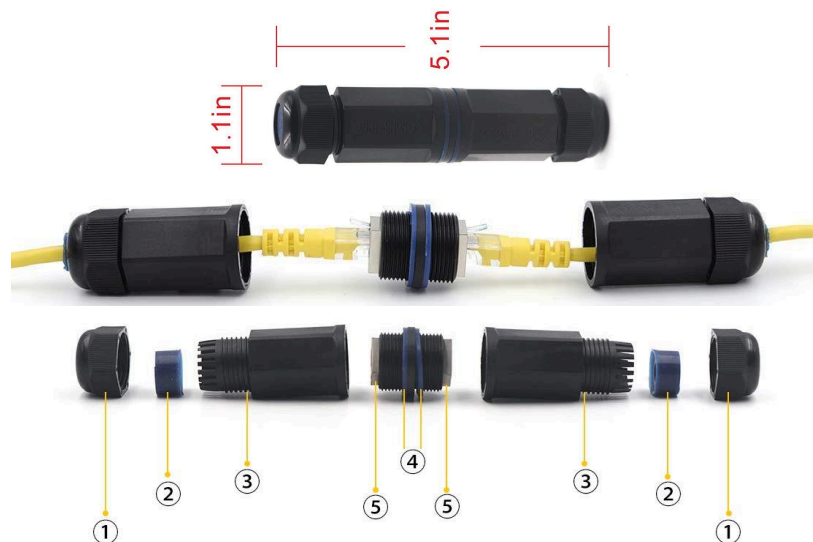
Rotate the camera to the desired orientation. Note that the standard bracket accommodates mounting angles from 0° (horizontal) to down by 80°. With the camera at the desired orientation, tighten the bolts using a 7/16" wrench or socket. Bolts should be torqued to 8.8 ft-lb (11.9Nm) to ensure they do not slip under vibration.

## Sealed Inline RJ45 Coupler

The sealed in-line RJ45 female-to-female coupler is included in the PoE adapter cable kit [AC17-RJ45] to achieve an IP67 network cable connection.

With reference to the diagram below, to install the coupler perform the following steps on either side:

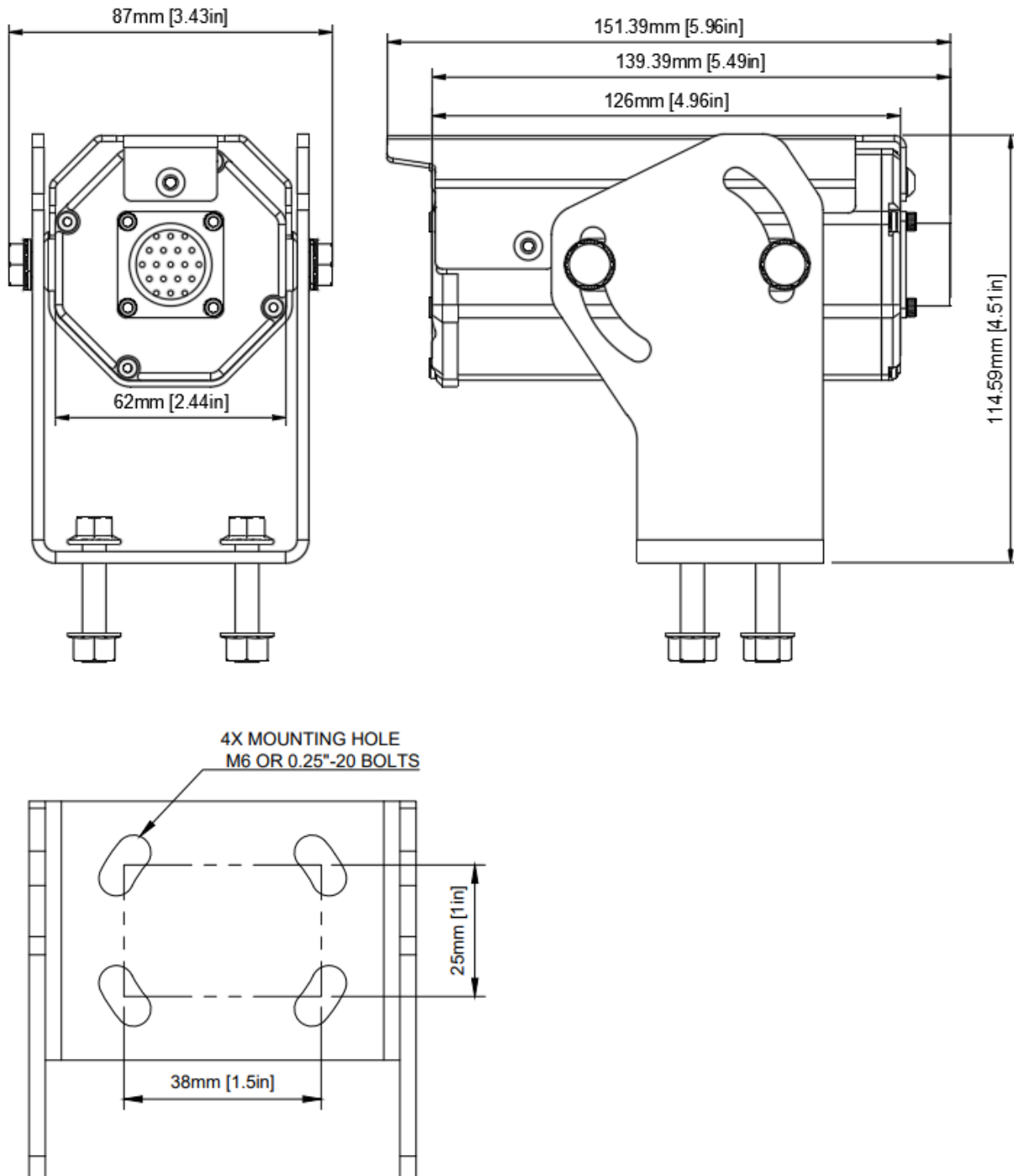
1. Loosen the cable gland nut (1) and unscrew the waterproof connector (3) from the middle RJ45 coupler (4/5)
2. Insert the shielded Cat-5e RJ45, through the nut, apron and connector (1, 2, 3) and into the female coupler (4)
3. Tighten both the connector (3) and gland nut (1) to achieve a fully water-tight seal



- |                        |                         |
|------------------------|-------------------------|
| ① Waterproof nuts      | ④ Waterproof gasket     |
| ② Waterproof apron     | ⑤ Shielded RJ45 Coupler |
| ③ Waterproof connector |                         |

*Sealed In-line RJ45 Coupler*

## ToughCam-1000™ Dimensions



*ToughCam-1000™ Mechanical Dimensions*