EXCELSENSE

ToughEye-1700™

User Manual, *V2.1*

Table of Contents

Overview

Patented ClearSight™ technology actively and automatically clears the field of view of the camera without any regular maintenance. The technology is effective against oil, grease, mud, and various other industrial contaminants. ClearSight™ enables cameras to self-clean — in most cases, for several years — eliminating the need for access and regular maintenance.

The ToughEye-1700™ camera is equipped with ClearSight™ technology. The system requires nothing more than conventional electrical connections; its rugged, self-contained design eliminates the need for fluid tanks, hoses, compressors, and pumps.

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 device is compatible with power-over-ethernet plus (PoE+) power supply equipment (PSE) compliant with IEEE 802.3at through the hardware-layer (Layer 1) power negotiation method. If using power-over-ethernet, only connect to IEEE 802.3at compliant PSE devices with all software-layer (e.g. **LLDP, CDP**, etc.) communications **disabled** on the port, and ensure that the port is configured to deliver up to 30W of guaranteed power to the camera. Failure to meet these requirements may cause faults that can lead to permanent damage to the ToughEye-1700™'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 the installation and connection process.
4. Connecting the ToughEye-1700™ 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 ToughEye-1700™ 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. Refer to the ExcelSense Hardware Terms and Conditions, found here, for more information.
2. If powering the device using DC voltage, a Class 2 24VDC 3A power supply is recommended to ensure the best picture quality and stable operation. With its internal protection and regulation, ToughEye™ can be operated with an unregulated 24VDC power supply. In this scenario, voltage fluctuation limits will be dependent on setup. Refer to the *Electrical Specifications* section on ToughEye-1700™ operational limits.
3. If powering the device using power-over-ethernet (PoE), only connect to IEEE 802.3at compliant power sourcing equipment (PSE) devices with all software-layer (e.g. **LLDP, CDP**, etc.) communications **disabled** on the port, and ensure that the port is configured to deliver up to 30W of guaranteed power. Failure to meet these requirements may cause faults that can lead to permanent damage to the ToughEye-1700™'s internal electronics.
4. Only use fully-compatible cabling, as recommended by ExcelSense representatives, to connect ToughEye-1700™ cameras in your application. Failure to do this may cause unintended behaviour and permanent damage.
5. 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.
6. It is recommended that ToughEye-1700™ be used with the ExcelSense Analog Monitor when analog view is required. However, ToughEye-1700™ may be used with any analog monitor (NTSC or PAL) using a 75Ω impedance level coaxial cable.
7. Do not attempt to disassemble ToughEye-1700™ in order to access internal components. Consult ExcelSense for technical support as required.
8. Never face the ToughEye-1700™ directly towards the sun or any bright or reflective light, which may cause smear on the picture and possible damage to the image sensor.
9. Do not remove the ToughEye-1700™ label containing P/N and S/N information for warranty service.
10. Never expose ToughEye-1700™ to conditions outside those specified in the *Specifications* section. Doing this can cause permanent damage to the device.
11. Damaged ToughEye-1700™ equipment must be replaced through an ExcelSense representative. Failure to do this may cause incompatibilities and permanent damage to the system.
12. Always clean the ToughEye-1700™ lens by performing cleaning cycles (see *Triggering the ToughEye-1700*™ section for details). Do not clean the lens manually. ToughEye-1700™ may also be pressure washed as an alternative.

Compliance

Electromagnetic Compliance Information

USA

The ToughEye-1700™ 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.

CE Certification

ToughEye-1700™ conforms to the requirements of all applicable European Union directives, ensuring compliance with the CE marking. The CE marking affixed to this product signifies that it meets high safety, health, and environmental protection standards set out by the European Union.

Conditions of Conformity

1. ToughEye-1700™ complies with all applicable directives when powered through its DC port, with a DC voltage that is within the acceptable range of the camera as stated in the Electrical Specifications section.

2. ToughEye-1700™ has been tested and found to operate within specified limits for electromagnetic emissions and immunity, ensuring it does not interfere with other devices and is not unduly affected by external electromagnetic interference.

Declaration of Conformity

The official Declaration of Conformity can be found here.

Specifications

CAMERA

Image Sensor	2.1 MP
Effective Pixels	1920 (H) x 1080 (V)
FoV Options[1]	

Name	Hor. FoV	Ver. FoV
80°	80°	50°
90° Low-Distortion	90°	61°
100°	100°	67°
120° Low-Distortion	120°	84°

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 @ 25/30fps 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	128GB max storage - Continuous, Motion, Pre/Post Alarm
Analog Video (CVBS)	720x486 (NTSC), 720x576 (PAL)

GENERAL

Dimensions	102mm dia x 178mm [4in dia x 7 in]
Weight	3.0kg [6.5lb] - 4.3kg [9.5lb] with Bracket and Sunshield
Material / Finish	

Variant	Enclosure	Front Cap	Bracket	Sunshield
Standard Corrosion Resistant	6061 Aluminum, Type 2 Anodized	7075 Aluminum, Type 3 Anodized and Teflon Coated	316 Stainless Steel	304 Stainless Steel
Highly Corrosion Resistant	6061 Aluminum, Type 3 Anodized and Teflon Coated	7075 Aluminum, Type 3 Anodized and Teflon Coated		

[1] FoV values are approximate

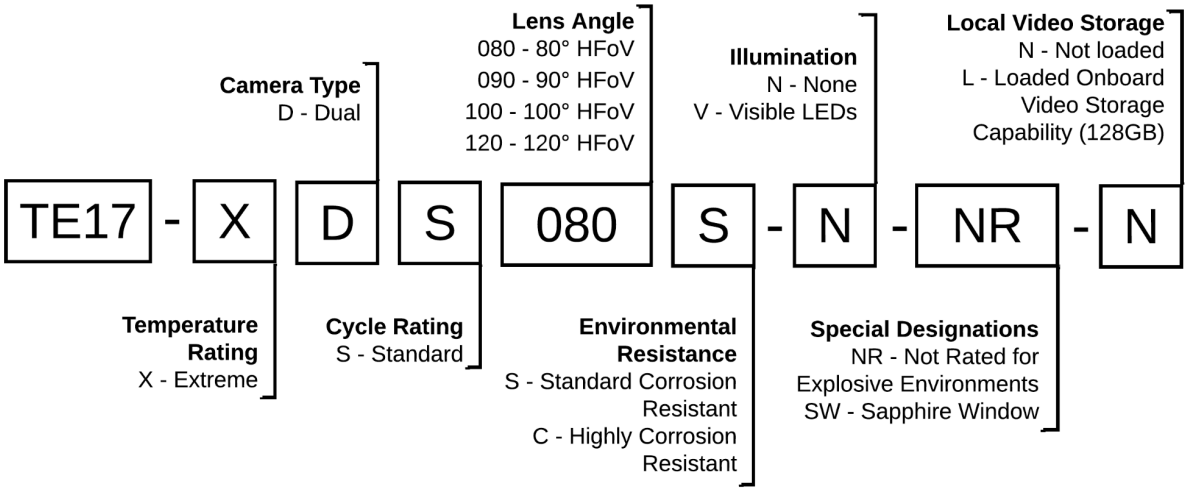
Power	18~32VDC or PoE+[2]
Clean Cycle	Automatic: Configurable Timer or Schedule-Based Manual: Network Command or Electrical Trigger
Thermal	-40°C to 60°C (operation and storage)
IP Rating	IP69
Vibration	11g (JIS-D-1601-1995)
Luminosity (Visible LED Variant)	1500 lumens (typical output at 20°C)
Max Lux	3800 lux (at distance of 30cm, typical output at 20°C)
Color Temperature	4000K
Certifications	FCC, IC, CE[3]

ELECTRICAL

Parameter	Min	Typ	Max
Input Voltage, V_{IN} (DC port)	18V	24V	32V
Input Voltage, V_{IN} (PoE+ port)	42.5V[4]		57V
Power Consumption, P_{IN}	5W (Idle)		25W (Heating)
Input Protection (DC port)[5]			
Clamping Voltage, V_C			116V
Peak-pulse Power, P_{PP}			6.4kW (28ms pulse duration)
Peak-pulse Current, I_{PP}			35A
Overvoltage Lockout, V_{OVLO}			
Engage lockout (rising)		33.3V	
Disengage lockout (falling)		33.0V	
Undervoltage Lockout, V_{UVLO}			
Engage lockout (falling)		17.0V	
Disengage lockout (rising)		19.0V	
Overcurrent Threshold, I_{OVC}			3A (internal PTC fuse)
Reverse-Polarity, V_{RVP}			[Pulse defined by ISO 7637-2]
Input Protection (PoE+ port)			
Input crow-bar protection (protects against external cabling surge events)			[Defined by: IEC 61000-4-5, TIA-968-A/B, ITU K.20/21 Enhanced Level]
Max Cable Length[2], L_{MAX}			40m (DC), 100m (PoE+)
Trigger Input, V_{TRIG}	0V / Open	0V (internal pull-down)	V_{IN}

[2] Compatible with IEEE 802.3at PSEs using hardware layer (layer 1) power class negotiation.
[3] When powered with DC voltage as per the ToughEye-1700™ Electrical Specifications.
[4] *PoE+ $V_{IN\ (min)}$ is 42.5V at the camera, as per IEEE 802.3at. The camera will engage its PoE undervoltage protection at 36V.*
[5] Tested as per ISO 16750-2. Designed for complete load isolation during damaging input conditions.

Ordering Options



TE17 - ToughEye-1700™ Self-Cleaning Camera

Temperature Rating
X - Extreme: -40ºC to 60ºC

Camera Type
D - Dual: IP / Analog Camera

Cycle Rating
S - Standard Cycle Rating 40,000 cycles

Lens Angle (customization available)
080 - Approx. 80° Horizontal FoV (Low-Distortion)
090 - Approx. 90° Horizontal FoV (Low-Distortion)[6]
100 - Approx. 100° Horizontal FoV
120 - Approx. 120° Horizontal FoV (Low-Distortion)[7]

Environmental Resistance
S - Standard Corrosion Resistant
C - Highly Corrosion Resistant

Illumination
N - None
V - Visible LEDs

Special Designations
NR - Not Rated for Explosive Environments
SW - Sapphire Window

Local Video Storage
N - Not Loaded
L - Loaded Onboard Video Storage Capability (128GB)

[6] Low-distortion 90° lens option currently not available for the Visible LED integrated option.
[7] Wide-angle variant of ToughEye-1700™; refer to the corresponding section in this manual. This lens angle variant is not available for the Visible LED integrated option.

Accessories

Compatible Harnesses

Summary Table

The following table lists standard cables available. If a variant is required that cannot be found in this table, please contact an ExcelSense representative.

Main Cable - IP **[MC17-SC-xxM-X-IP]**	Main cable can be used in all ToughEye-1700 installations. The analog cable includes a 75-ohm coaxial cable for CVBS transmission. The IP cable includes a shielded Cat-5e cable for 10/100 Base-T signal transmission. Available in: **10m, 20m, 30m, 40m** lengths	
Main Cable - Dual Output **[MC17-SC-xxM-X-DU]**		
Main Cable - Analog **[MC17-SC-xxM-X-AN]**		
Extension Cable - IP **[EC17-DC-xxM-X-IP]**	Extension cables can be used to increase the length of existing cables. Available in: **3m, 10m** lengths	
Extension Cable - Dual Output **[EC17-DC-xxM-X-DU]**		
Extension Cable - Analog **[EC17-DC-xxM-X-AN]**		
Extension Cable - Dual Output, 90deg TE17 connector overmold (downward) **[EC17R1-DC-xxM-X-DU]**		
Extension Cable - IP, 90deg TE17 connector overmold (downward) **[EC17R1-DC-xxM-X-IP]**		
Programming Adapter, IP Output **[PA-TE17-USB-A]**	Programming adapter is used to modify configurable device parameters, retrieve cleaning cycle data, and update internal microcontroller firmware. Suitable for inline connection to TE-1700	

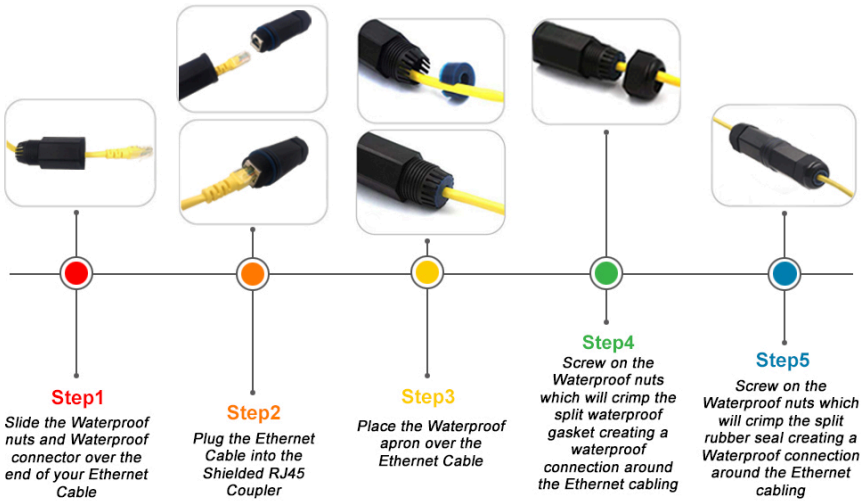
RJ45 Adapter Cable **[AC17-RJ45-K]**	The RJ45 adapter kit provides a waterproof RJ-45 connection using the IP67 inline coupler, which accepts an RJ-45 plug. When connected to a IEEE802.3at compliant PSE (e.g. PoE+ injector or switch), it is the simplest way to power and operate the camera.	
RJ45 Adapter Cable, 90deg Downward Camera-side Overmold **[AC17R1-RJ45-K]**		
M12 X-coded Adapter Cable, with 90-deg M12 Overmold, Clocked SW **[AC17-M12XR2-xxM-IP]**	The M12 adapter cables enable TE1700 connection to a panel-mount X-coded M12 female receptacle. This cabling is compatible with the IP output of the camera.	
M12 X-coded Adapter Cable, with 90-deg M12 Overmold Clocked SW, and 90deg Downward Camera-side Overmold **[AC17R1-M12XR2-xxM-IP]**		
TE3100 to TE1700 Adapter Cable, Dual Output **[AC17-TE31]**	The TE31 to TE17 adapter cable is suitable for adapting the TE17 camera to a TE31-style cabling system. It enables full functionality to the TE17, including DC input, PoE+ input, IP and CVBS outputs, self-clean trigger, and RS-232 communication.	
Analog Video Adapter Cable, GX12 to BNC **[AC-GX12-BNC]**	The standard video connector to BNC plug adapter cable is suitable for adapting the Standard Analog Monitor Kit [AM-4C-7IN-MB-S] to 3rd-party video hardware (e.g. DVR) which accept a 75-Ohm BNC connection.	

Harness Drawings

Detailed electrical drawings for each cable harness shown above are available here.

Cable Accessory Detail - 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 dust/water rated, network cable connection.



Power Supplies

Isolated DC-DC Power Supply and Conditioner Kit - 24VDC

Part Number	Description	Preview	Datasheet
PSU-24V-72W-X-K	Extreme-rated DC to DC isolated power supply and conditioner kit, 24V output, 72W, 9-36V input		AX081100BK

DC Source - 24VDC Supply

In applications where only AC power is available, the following AC-DC converter can be used to supply the ToughEye-1700™ and optionally an external monitor with 24VDC.

Part Number	Description	Preview	Datasheet

PSU-24V-120W-DIN	AC to DC power supply, 24V output, 120W, 110VAC to 260VAC		TIB 120-124

PoE+ Source - IEEE802.at Compliant PSE

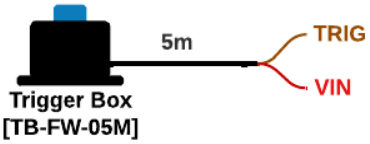
In applications where the PoE+ power method is preferred, it is important to ensure the correct PoE power source equipment (PSE) class level is selected. The ToughEye-1700™ is a class 4 powered device (PD), meaning it is rated to draw up to 25.5W, as per the IEEE802.at standard. For this device, a class 4 PSE compliant with the IEEE 802.3at standard using the hardware-layer power classification method, and rated to provide at least 30W to the ToughEye-1700™, is required. The recommended options are shown below.

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		TPE-115GI (v2.1)
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		POE-24
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		TI-IG30 (v1.0R)

Self-Cleaning Trigger Button Box

The ToughEye-1700™ can be triggered to clean its lens through many different ways, one of them being through the hardware trigger method. This method involves accessing the trigger, power, and ground signals of the electrical system in order to switch the trigger signal.

A simple way of accomplishing this is through the self-cleaning in-cab Trigger Button Box.

Part Number	Description	Preview
TB-FW-05M	Self-Cleaning in-cab trigger button, black aluminum with blue button, with mounting flange, IP65 rated, with 5m open-ended cable	

Video Monitor Kits

7” Standard Series 4ch Monitor Kit [AM-4C-7IN-S]

The Standard Monitor Kit features a rugged 4-channel 770 series monitor, which supports 12VDC and 24VDC systems. When connected to the ToughEye-1700™ analog video output connector, it produces a clear CVBS video.

Please refer to the Standard Monitor Kit Reference Manual here for more detailed technical information such as the recommended wiring diagram as well as ordering information.

7” Extreme Series 4ch Monitor Kit [AM-4C-7IN-X]

The Extreme Monitor Kit features a rugged 4-channel 970 series monitor, which supports 12VDC and 24VDC systems, has a -40°C ~ 70°C industrial temperature rating, and has 10G and 100G mechanical vibration and shock ratings respectively. When connected to the ToughEye-1700™ analog video output connector, it produces a clear CVBS video.

Please refer to the Extreme Monitor Kit Reference Manual here for more detailed technical information such as the recommended wiring diagram as well as ordering information.

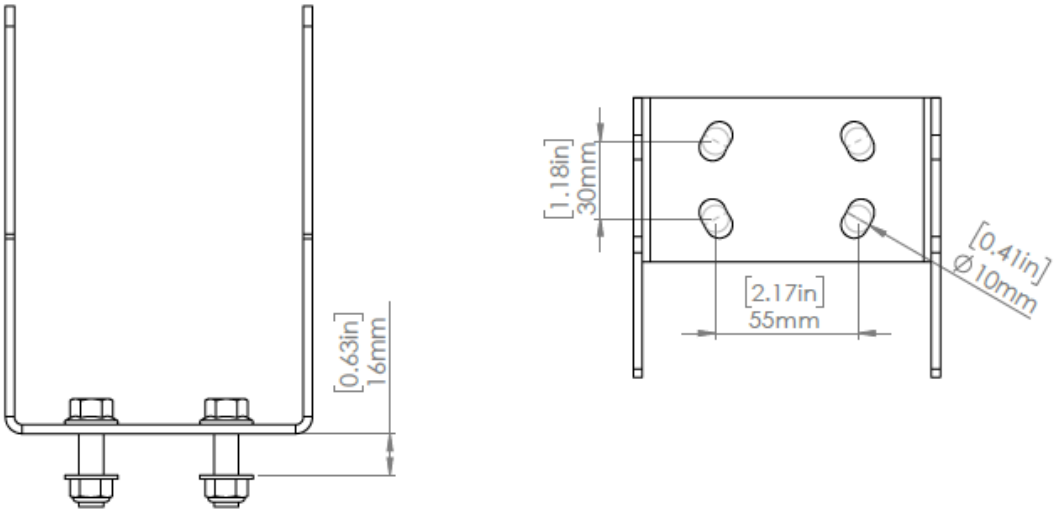
Mounting Accessories

The following accessories are available for mounting the ToughEye-1700™.

ToughEye-1700™ Standard Bracket

The ToughEye-1700™ Standard Bracket is included as it is the default bracket in most ToughEye-1700™ installations.

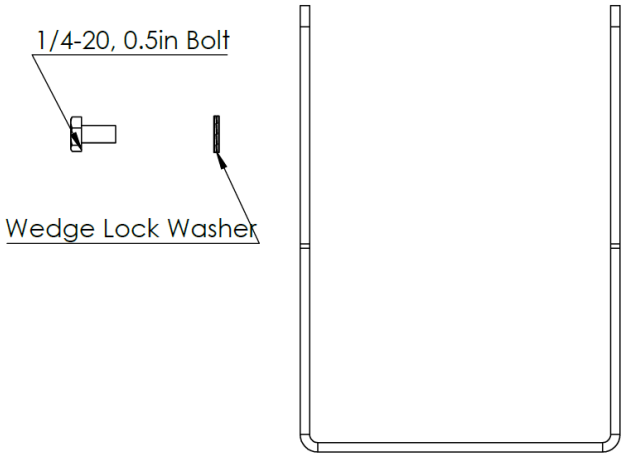
The bracket should first be mounted to a suitable horizontal support with sufficient strength. The camera ships with high strength, 3/8”-16, 1.25” long bolts, suitable for mounting to plates up to 0.625” thick. If mounted to a thicker support, suitable Grade 8 bolts should be sourced. The standard bolt and nylon insert lock-nut can be installed using 9/16” wrenches or sockets.



Mounting pattern and bolt details

If the camera is mounted to a vertical surface a horizontal bracket [MB-TE-WB] can first be welded to the vertical surface, in order to provide a suitable mounting point.

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:



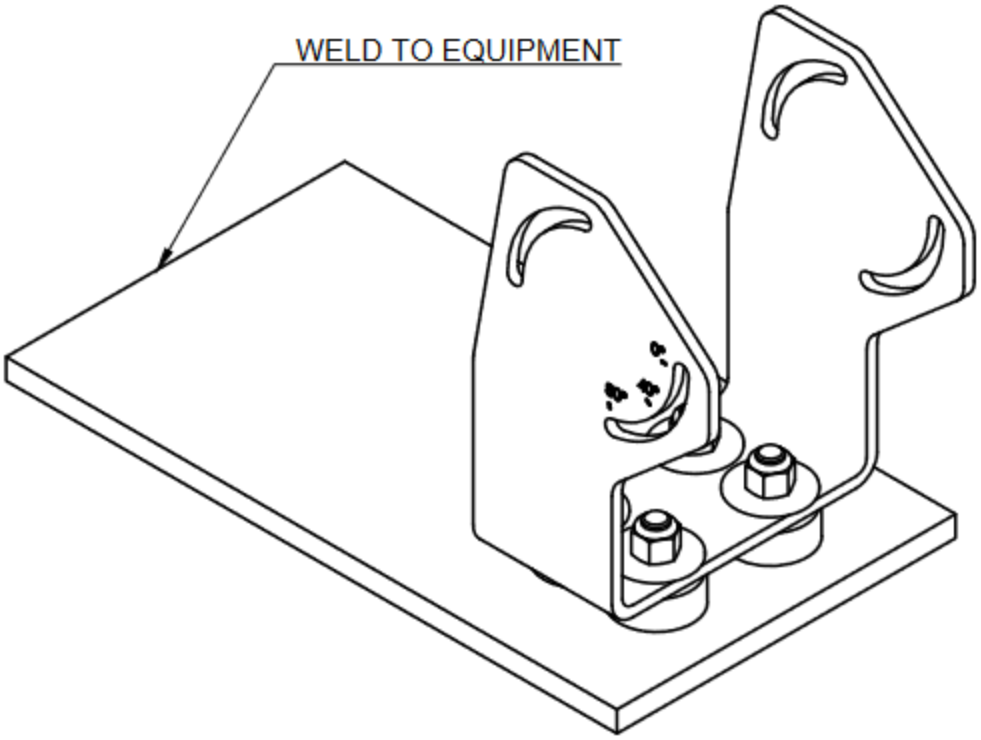
Camera bolt installation ordering

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 tightened to 8.5 Nm [6.3ft-lb].

Field Welding Bracket Options

Part Number	Description
MB-TE-WE	Field Welding Bracket, ToughEye Compatible. Suitable for welding to existing horizontal or vertical surfaces when bolting is not an option.
MB-TE-DW-K	Field Welding Bracket Damping Kit, ToughEye Compatible. Suitable for welding to existing horizontal or vertical surfaces in high-vibration applications.

The image below shows the MB-TE-DW-K kit with the standard ToughEye-1700™ bracket installed.



System Installation

Installation Best Practices

When installing the ToughEye-1700™, it is critical to follow the recommendations found in the Mechanical Installation Best Practices document, found here, to avoid premature failure of the camera.

Configuration Selection

IP Camera Configurations

The ToughEye-1700™ supports network and analog video streams. Selection of the appropriate stream is an important consideration.

The network stream provides simpler connections, higher resolution video, and accessibility to the stream from any device connected to the same network. We **recommend** using the **network** stream in the following scenarios:

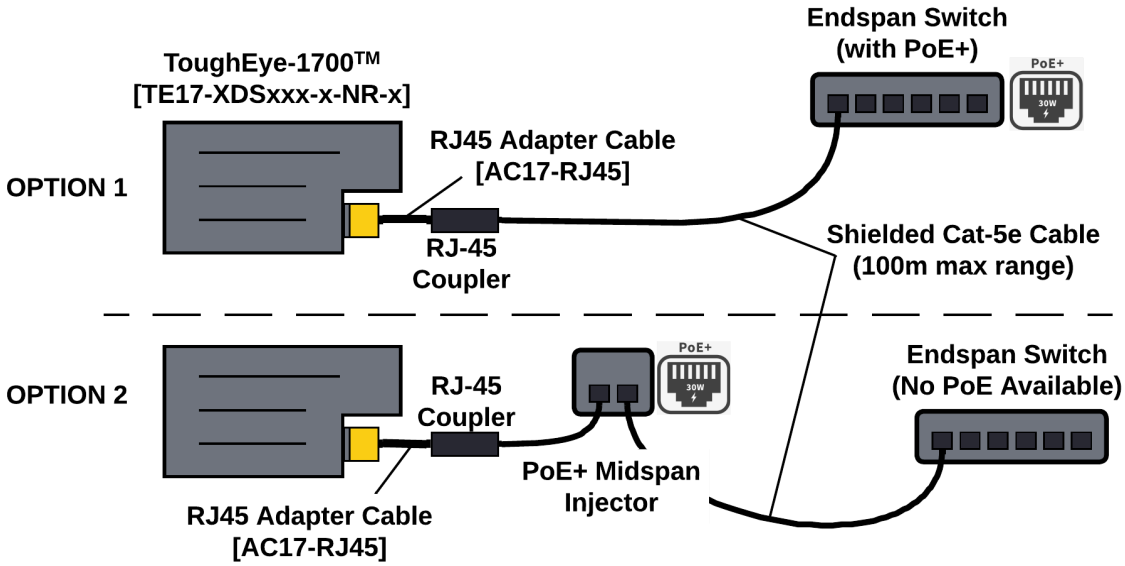
1. The stream must be viewed remotely | *See Network Configuration A-1*
2. The stream must be viewed on the equipment and an on-equipment display exists which is powered by a computer (ie. Panel PC or Dispatch system) | *See Network Configuration A-1*

It is important to note that IP video has inherent latency due to video compression. The ToughEye-1700™ latency is rated at **172ms** and **105ms** for Gen1 and Gen2 sensor module equipped units, respectively. Only in applications where this latency can be tolerated is the network stream recommended.

Note: *IP camera video latency has been thoroughly analyzed and characterized under carefully constructed experiments. The detailed experiment report for Gen1 can be found here, while Gen2's report is available here.*

Network Configuration A-1

This configuration allows any shielded (S/FTP) Cat6a cable to be used to power and communicate with the ToughEye-1700™ camera. No custom cabling is required to be routed, as the shielded Cat6a cable plugs into either the custom short adapter cable or the open end of the main cable for plug and play functionality. See below for connection diagrams.



Option 1

This option is the simplest configuration shown in the figure above and uses an endspan IEEE 802.3at (PoE+) compliant power sourcing equipment (PSE) to provide power to the camera through the same shielded (S/FTP) Cat6a cable used for data transmission.

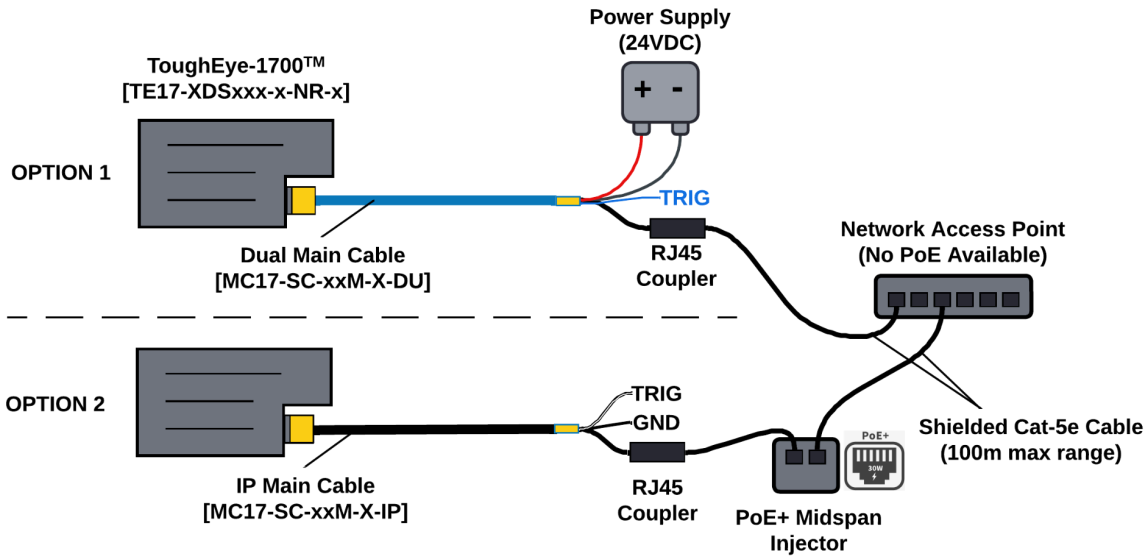
Option 2

This option is optimal for applications with existing network switches that are not IEEE 802.3at 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 or 110~260VAC input, depending on the model, 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 802.3at compliant PoE+ PSE (power sourcing equipment) - either an endspan switch or midspan injector - route a shielded (S/FTP) Cat6a or better cable to the ToughEye-1700™. 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 IP67 RJ45 coupler. For details on its usage, please refer to section *Sealed In-line RJ45 Coupler*.
3. The RJ45 Adapter Cable [AC17-RJ45] can now be plugged into the ToughEye-1700™ camera.

Network Configuration A-2



This configuration provides multiple options for powering the camera and triggering the self-cleaning action. ***Note:*** *It is highly recommended that the cable be installed into an electrical cabinet via an appropriately sized cable gland. The Dual-output style main cable jacket is 15mm in diameter.*

Option 1

- In this option, DC voltage is used to power the camera; refer to the *Powering the ToughEye-1700™* section for a detailed powering guide. Connect the positive and negative terminals to the appropriate wires using the wire labels as a guide. The MC17-SC-XXM-X-DU cable drawing can also be referenced.
- If the external trigger wire is being used in the application, connect the trigger, and ground wires to an appropriate switch circuit. Note that the internal opto-isolated trigger signal is pulled to the camera's ground. Refer to the *Triggering the ToughEye-1700™* section for triggering details.
- Route the main cable to the ToughEye-1700™ camera, or to an optional extension cable. 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.*

Option 2

- In this option, a PoE+ compliant (IEEE 802.3at) 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 ToughEye-1700™ 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.
- Note: if the hardware trigger feature is required for the application to initiate self-cleaning, then both the TRIG and GND wires are needed.

Analog Camera Configurations

The analog streams are lower resolution and more prone to noise, however, they can be connected to almost any new or existing analog monitor or DVR. We **recommend** using the **analog** stream in the following scenarios:

1. The stream must be viewed on the equipment, no existing display is installed, and all connections will be made in a harsh environment requiring IP6x | *See Analog Configuration B-1*
2. The stream must be viewed on the equipment, no existing display is installed, and the wiring connections can be made in an existing enclosed IP6x environment | *See Analog Configuration B-2*

Analog Configuration B-1

The monitor can be integrated into the ToughEye-1700™ analog camera system using the Standard Boost Box. This installation is recommended for applications requiring rugged, IP6x cables and connections. The monitor, however, should be mounted in an enclosed, protected environment. The trigger wire can be tied to an external switch to initiate cleaning cycles (see the *Manual Trigger* section). Alternatively, the camera can automatically initiate cleaning cycles which can be set based on a timer or scheduled at specific times throughout the day (see *Automatic Trigger* section).

Refer to the *Standard Boost Box Installation Diagram* section for further details on this configuration, including the recommended system diagram.

This configuration allows simple setup of an on-equipment monitor for use by equipment operators:

1. Select an appropriate installation location for the junction box. It is important to consider the positioning of the junction box such that both the monitor cable and the power cable can reach the box. Note that a 3m monitor extension cable is included as an accessory in the standard monitor kit.
2. Mount the box using 4 appropriately sized self-tapping or threaded fasteners.
   Note: *If using standard machine screws, an anti-vibration measure should be used (loctite, nylon insert lock-nuts or spring washers)*
3. Route an appropriately sized and selected power cable through the power port gland of the junction box and follow the wiring instructions found in the *Boost Box Internal Wiring Diagram* section. Properly tighten the gland using a wrench to achieve an IP67-rated seal at the interface. Connect the power and ground wires by following the instructions

found in the Boost-Box manual. Note that optionally a third signal can be routed in this cable for the self-cleaning trigger input of the camera. Connect the trigger wires according to your application requirements as defined in the *Triggering the ToughEye-1700*™ section.

4. Route the monitor cable through the monitor port gland of the junction box. Properly tighten the gland using a wrench to achieve an IP67-rated seal at the interface. Cut and splice the cable to expose the internal video signals, and connect them into the appropriate terminal blocks. ***Note:*** *Care should be taken to fully insulate any unused wire or shield braiding to prevent any short-circuits within the box.*
5. If a camera extension cable is required in the installation, connect the extension cable directly to the ToughEye-1700™ camera. Route the extension cable. ***Note:*** *Care should be taken to properly secure the extension cable. Use of conduit, cable clamps or appropriately rated cable ties is recommended*
6. If a camera extension cable was used, connect the main cable to the extension cable. If not, connect the main cable to the ToughEye-1700™ directly. Route the main cable from the ToughEye-1700™ to the junction box through the camera port gland. Properly tighten the gland using a wrench to achieve an IP67-rated seal at the interface. ***Note:*** *Care should be taken to properly secure the main cable. Use of conduit, cable clamps or appropriately rated cable ties is recommended*

Analog Configuration B-2

The analog monitor also comes as a plug-and-play cabling kit [AM-4C-7IN-MB-X], allowing direct connection to the ToughEye-1700™ analog [MC17-SC-xxM-X-AN] or dual-output [MC17-SC-xxM-X-DU] main cable without the use of a junction box. This configuration is recommended for dust-proof IP6x enclosed applications where cost and space minimization is required.

Refer to the *Extreme Series Monitor Kit* section of this document for further details on this configuration, including the link to the reference manual which contains the recommended system diagram.

Carefully follow the instructions below:

1. If there is no 24VDC power already available, route a power cable carrying 24VDC and GND (0V) through appropriate wire gauges into the enclosure through a dedicated opening.
2. After mounting the camera in the desired location, connect the main cable to the ToughEye-1700™.
3. Route the main cable to the IP6x enclosure. ***Note:*** *Care should be taken to properly secure the main cable. Use of conduit, cable clamps or appropriately rated cable ties is recommended.*
4. Carefully route the main cable through the dedicated opening in the enclosure.
5. Select an appropriate location for the analog monitor. Use the mounting kit to mount the monitor.
6. Route the monitor cable inside the enclosure through the dedicated monitor port opening.

7. With the power off, safely connect all power and trigger wires to their respective sources as shown above. Refer to the *Triggering the ToughEye-1700™* section for detailed self-clean triggering instructions.
8. The ToughEye-1700™'s composite (CVBS) analog stream can be interfaced through the 75Ω BNC connector at the main cable. Connect this male BNC connector to the mating female connector found on the analog monitor kit.
9. Finally, fully seal all openings in the enclosure through which cables have been routed. If glands are used, tighten the glands to an appropriate torque setting to achieve an IP67-rated seal at the interface.

Ground Loop Prevention in Mobile Vehicle Applications

Ground loops occur when the camera housing and the installation frame are bonded together in more than one place (e.g. at the switch cabinet and again at the camera mount), creating a closed path for low-frequency "equalizing" current. On electric-drive haul trucks for example, large AC drives and battery returns can make different parts of the chassis sit at slightly different potentials; the loop then carries current that can inject noise onto cable shields and disturb data/power. Effects include packet errors or drops, image artifacts, nuisance resets, and increased EMI susceptibility/emissions.

To avoid ground-loop problems, do one of the following (choose based on installation):

- Isolate the ToughEye-1700™ enclosure mechanically from the machine structure (insulated mounting hardware) so the camera housing is not DC-bonded to the frame. This breaks DC loop current while retaining high-frequency shielding along the cables/device enclosures.
- Or provide robust equipotential bonding (a short, wide, low-inmpedance bonding strap) between the relevant chassis locations so little equalizing current seeks the cable shield path. This is standard practice when a solid bonding network is available.

Important installer's note: *do not attempt to break the shield at the connectors. If equalizing currents are still an issue, couple the housing to the frame through an HF path that blocks DC, e.g. a safety-rated capacitor with bleed, so RF/ESD returns cleanly without creating a DC loop.*

Interfacing the ToughEye-1700™

Powering the ToughEye-1700™

Important Notes:

1. *As per rule 2-024(2) of the Canadian Electrical Code Part I, ToughEye-1700™ 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).

2. *This device is compatible with IEEE 802.3at compliant Class 4 PSEs which use the hardware power classification method. No software-layer PoE classification is available on this device. If powering the device using PoE, only IEEE 802.3at compliant power sourcing equipment (PSE) devices must be used. Additionally, all software-layer (e.g.* ***LLDP****,* ***CDP****, etc.) communications on the connecting port must be* ***disabled****,* ***two-event classification*** *be* ***enabled****, and the PSE must be capable of delivering up to* ***30W*** *of guaranteed power on the port. Failure to meet these requirements may cause PoE classification failure, which may lead to power instability during high-current drawing events such as self-cleaning.*
3. *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.*

PoE+ Power Source

When powering the device using the PoE+ protocol, a shielded (S/FTP) Cat6a or better cabling solution is recommended(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 802.3at (Class 4) compliant. This is commonly referred to as PoE+ and ensures that the camera receives the required wattage. Be sure that the PSE has all software-layer classification protocols disabled, two-event classification enabled, and the capability to deliver 30W to the device.

Refer to the *PoE+ Source* section within Accessories for a list of the recommended power supply options tested and verified to be fully compatible with the ToughEye-1700™.

DC Power Source

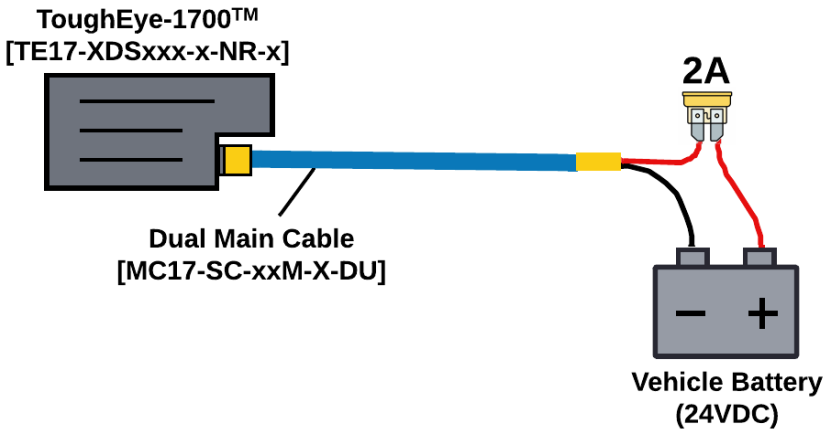
The ToughEye-1700™ internal circuitry has been optimized to withstand the harsh electrical conditions seen in the extreme applications they are utilized in. Key electrical tests/features include:

- Load-dump surge and spike immunity, as per ISO 7637-2 (Pulse 1, 2a, 2b, 3a, 3b) and ISO 16750-2 (Pulse 5a, 5b)
- Reverse-polarity surge and spike immunity, as per ISO 7637-2 (Pulse 1, 2a, 3a, 3b)
- Cold-crank immunity, as per ISO 7637-2 (Pulse 4)
- Overvoltage/undervoltage lockout
- Recoverable overcurrent protection against transient conditions with internal PTC fuse

Note: *Industrial surge and load-dump testing was conducted at a nationally accredited (IEC/ISO 17025) certifications laboratory. The resulting test report is available here.*

In applications where a DC power source is available within the recommended input range as defined in the *Electrical Specifications*, a suitable main cable (MC17 series) can be used to power the camera. Cabling details are available in the *Accessories* and *Cable Drawings* sections of this document.

For installations where the ToughEye-1700™ is powered directly by a battery, to prevent an overcurrent event caused by potential cable damage, a 2A fast-blow external in-line fuse is recommended to be used between the ToughEye-1700™ and the power source. When using the main cable, the **fuse** should be added **during installation**.

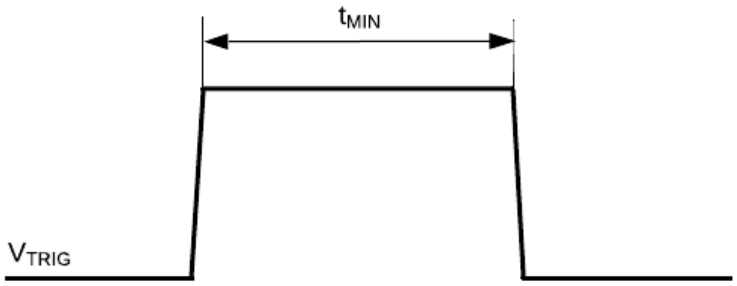


Triggering the ToughEye-1700™

The ToughEye-1700™ performs cleaning cycles in response to a trigger event. The triggering event method is an important consideration at the time of specifying your system topology. The decision is based on many factors, including availability of a digital switch, remote triggering requirements, and the general nature of the application. Below are the recommended options for triggering the device:

Manual Trigger

The manual trigger method is based on an external digital input (see *Electrical Specifications* for acceptable input voltage range). The device accepts a positive signal pulse as a trigger input and responds with a single, complete cleaning cycle, initiating its clean at the rising edge of the pulse. Only when the device has completed this cleaning cycle will it respond to subsequent trigger events. Note that due to its edge-sensitive triggering behaviour, the device will not perform multiple cleaning cycles if the trigger wire is held at a logic high state. The pulse sequence shown below will initiate a ToughEye-1700™ cleaning cycle.



Manual Trigger Pulse Diagram

	Logic Level	Trigger Voltage
Step 1	Logic Low	0V or Open
Step 2	Logic High	5V ~ V_{IN} (DC voltage)
Step 3	Logic Low	0V or Open

The recommended minimum hold time at a logic level state, t_{MIN}, is 0.5 seconds. Using this control, the ToughEye-1700™ can be configured for common use cases as seen below.

Manual Trigger when using PoE+

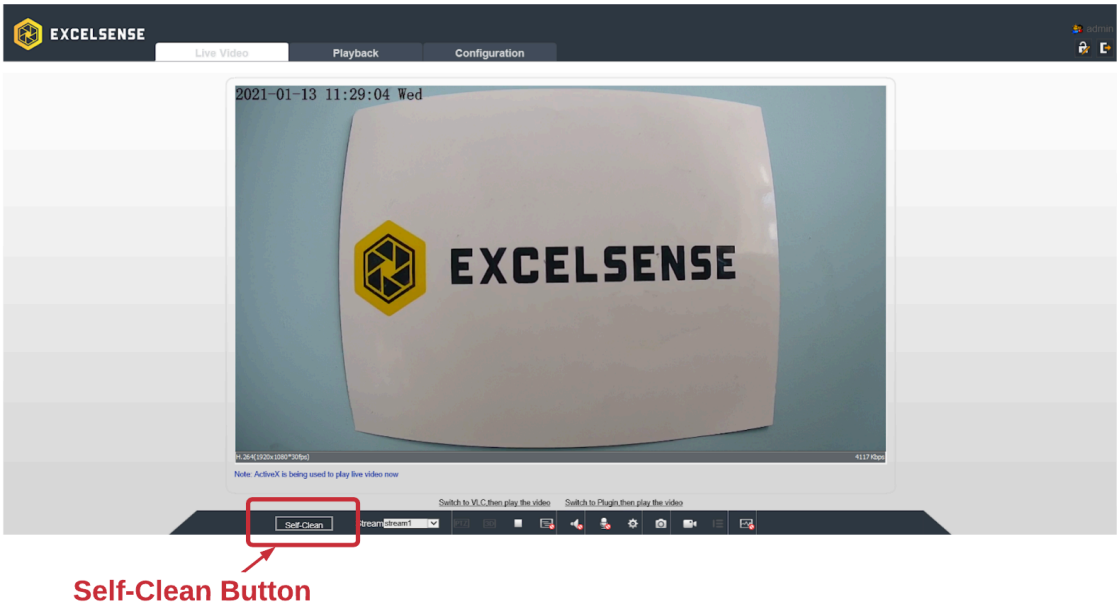
The manual trigger method can also be used when the ToughEye-1700™ is powered with PoE+. To access the necessary signal wires, a compatible MC17-series main cable must be used.

First ensure that the external trigger signal's reference level is the same as the camera's. This can be done by tying the trigger's reference signal to one of the black wires labelled "GND" or "0V" from the open end of the MC17 cable. The pulse diagram above can now be followed to initiate a cleaning cycle.

Remote Manual Trigger using Web Interface

In applications such as autonomous haulage or tele-operated machines where remote triggering is required, the ToughEye-1700™ camera web interface provides a convenient solution (see *Network Configuration A-1* system diagram).

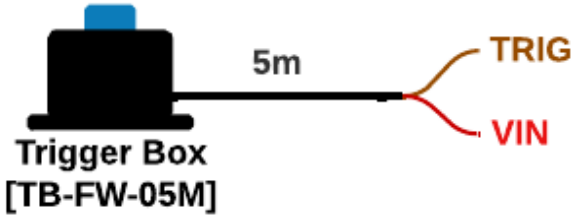
As seen below, a cleaning cycle can be triggered on-demand by clicking the Self-Clean button on the live view page of the camera, which can be found in the bottom-left section of the page.



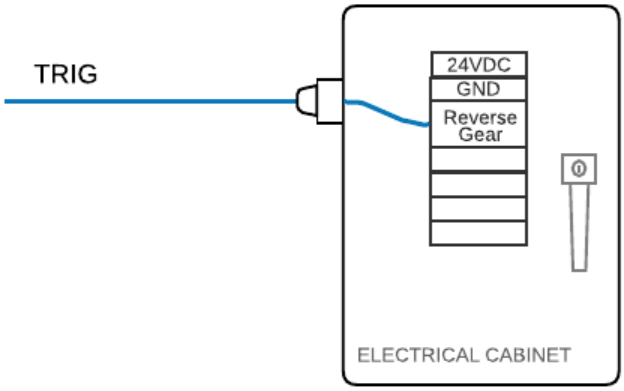
Camera Module Web Interface Live View Page

Manual Trigger using External Button

In manual trigger applications where on-demand vision is required, the trigger can be simply wired to a normally-open momentary button as shown below.



In applications such as vehicle rear camera installations, the trigger can be wired to seamlessly provide consistent clear rear vision when reversing. This is done by simply connecting the trigger wire to the reverse gear signal of the vehicle, as shown in the figure below. In this wiring configuration, the ToughEye-1700™ performs a cleaning cycle when the reverse gear is engaged (rising edge where TRIG goes from low to high). When the reverse gear is disengaged, the TRIG signal goes back to 0V and the device trigger is reset, and ready to activate a subsequent cleaning cycle upon another rising edge. With this behaviour, a clear view can be achieved every time the truck reverses and the backup camera is needed.



Automatic Trigger

The ToughEye-1700™ camera is equipped with several automatic self-clean trigger options for a wide range of applications. On the camera's web interface, navigate to Configuration > Self-Clean Settings and refer to the *Timed Self-Clean* and *Scheduled Self-Clean* sections below. Note that both trigger methods may be enabled simultaneously.

Refer to the latest Optical Module Web Interface Manual, found here, for further details about the features as well as instructions on how to enable them to suit your application.

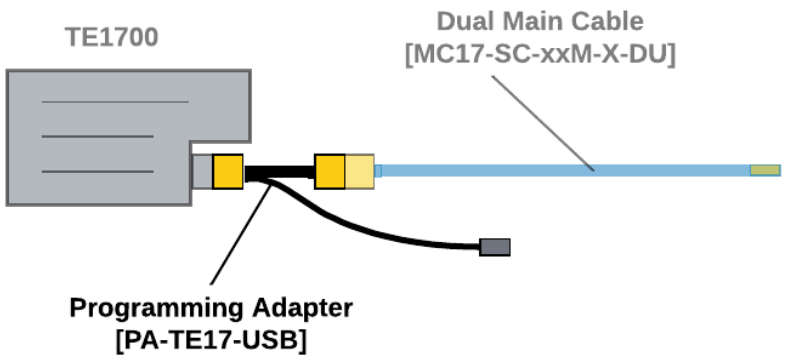
Controller Module Interface - RS-232

Description

The ToughEye-1700™ controller module can be interfaced in order to send and receive data as well as upload firmware to the controller.

Required Hardware

The controller module establishes communication with a client over the RS-232 hardware protocol. In order to achieve this communication, an appropriate ExcelSense cable must be used, such as a programming adapter or a dual-output main cable. A diagram illustrating the usage of the programming adapter cable is shown below. Please contact ExcelSense technical support for more information.



Note that although it is shown above being used with a dual-output main cable, the programming adapter can be used in conjunction with any ExcelSense cable currently powering the camera. This includes main cables (dual-output and IP-only) as well as short RJ-45 adapter cables.

Modbus-RTU Interface

The ToughEye-1700™ controller module utilizes the Modbus-RTU protocol, implemented over the RS-232 physical layer, to communicate with Modbus-RTU clients. This method of serial asynchronous communication can be used to retrieve self-clean, thermal, or system diagnostics data from the controller.

Documentation on the Modbus-RTU interface can be found here. For the purposes of demonstration and simple diagnostics, a sample Modbus-RTU client software is available for download here.

Firmware Upload - Controller Module

The RS-232 interface can be used to upload new firmware (.hex file) to the controller. Special care must be taken to prevent accidentally uploading the camera module firmware to the controller module; the controller accepts hex files only.

For detailed instructions on uploading firmware, please refer to the controller module upload guide, found here. Note that the controller module firmware is always a hexadecimal file (.hex extension); the latest available firmware file can be downloaded from here.

Technical Information

ToughEye-1700™ Thermal Variants

The ToughEye-1700™ has two thermal variants: the standard-thermal variant and the integrated high-power LED variant. Both variants are equivalent in the aspects of self-cleaning and optical module functionality and control, however they differ in their integrated thermal control algorithms.

Standard-Thermal Variant

The standard-thermal variant runs a closed-loop thermal control system on its integrated controller module in order to drive a resistive heating element such that the internal device thermal conditions are maintained in the desired operating range. This enables the device to be used in extremely cold temperatures as low as -40°C. During startup, the device's cleaning subsystem will be disabled until the system temperature has reached a minimum of 7°C. This is done to ensure any ice build-up on the lens has been properly melted prior to actuation. The thermal subsystem aims to maintain the internal temperature at an optimal level. The thermal subsystem is engaged when the temperature drops below 12°C.

Integrated High-Power LED Variant

Background

The ToughEye-1700™ camera with integrated high-power lighting provides clear vision with up to 3800 lux of illumination at a 30cm distance, making it ideal for monitoring in extremely dark environments.

The ToughEye-1700™ LED-integrated model effectively utilizes its high-power lighting as its primary heat source, enabling continuous full-rated illumination down to -40°C environments. Similar to the standard-thermal variant, the device's cleaning subsystem will be disabled until the system temperature has reached a minimum of 7°C.

LED Illumination - Default Behaviour

Integrated light variants of ToughEye-1700™ are designed to eliminate the risks of thermal runaway by utilizing their automatic active illumination control. This closed-loop control feature ensures that regardless of the ambient thermal conditions, the device will operate its LEDs in a thermally stable manner.

LED Power Mode - User Control

Cold-Temperature Environment Behaviour

An important consideration in employing the integrated-LED variant of ToughEye-1700™ is the expected behaviour in cold-temperature applications. In cold climates, the integrated LEDs double as a heater to raise the temperature to an operable level for the optical module and self-cleaning sub-system.

Normally-Disabled Toggle

Controller Firmware Compatibility

This feature is compatible for controller module firmware versions *"ClearSight1700-v3.1.0"* and newer, released with units shipped on or after March 29, 2023[8].

Description

This feature controls the power mode of the LEDs between two main modes:

1. ***Normal Mode:*** The LEDs will be set to their brightest level based on the ambient temperature conditions being sensed by the controller, resulting in the luminosity performance curves seen in the *Specifications* section below.

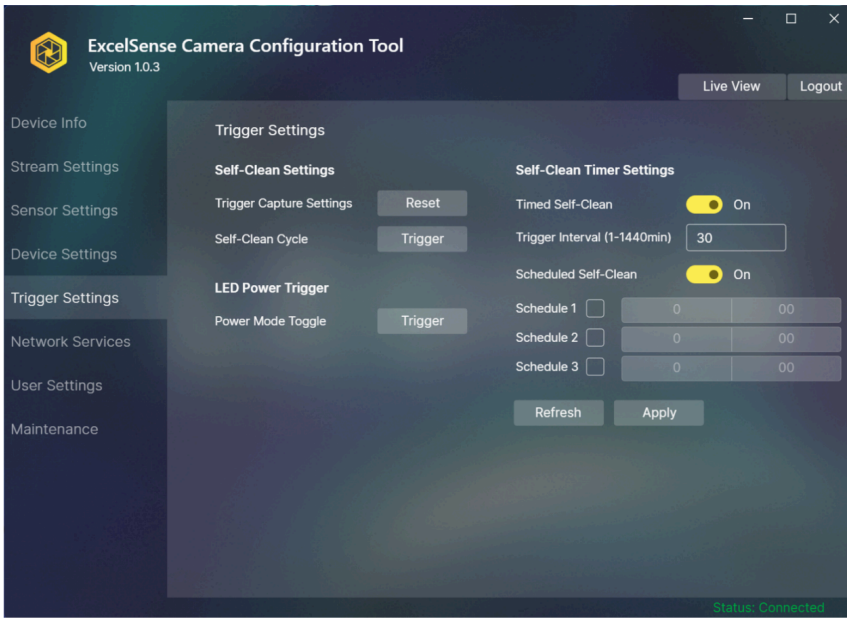
2. ***Normally-Disabled Mode:*** The LEDs will be set to their lowest brightness level possible based on the ambient temperature conditions sensed by the controller. In this mode, the controller, through heat generated by the integrated LEDs, aims to maintain a target internal temperature of around 15°C by adjusting LED luminosity. This mode ensures that all internal subsystems run by the controller, including self-cleaning, are kept at an operable temperature regardless of the ambient temperature of the application. In all applications where the temperature is greater than 25°C, the LEDs will always remain disabled.

Control

Toggling the power state of the LEDs can be controlled in the following ways:

2.1. ***ExcelSense Camera Configuration Tool (EST Camera App)***: The LED mode can be toggled using the app as shown below, by clicking the "Power Mode Toggle" in the LED Trigger section.

[8] To ensure the latest TE-1700 Controller Firmware is installed, contact ExcelSense Technical Support.



2.2. **Automated Set of API HTTP Requests:** This method involves sending successive HTTP requests to the server of the camera sensor module. See below for the appropriate sequence, assuming factory-default credentials and IP settings:

2.1. http://192.168.0.120/cgi-bin/param.cgi?userName=admin&password=admin&action=set&type=alarmOut&alarmOutID=1&alarmOutName=selfCleanTrigger&alarmMode=2&alarmValidSignal=1&alarmOutFrequency=5&alarmTime=1000

2.2. (Wait 2s)

2.3. http://192.168.0.120/cgi-bin/alarm.cgi?userName=admin&password=admin&action=manualControl&alarmOutID=1&controlFlag=1

2.4. (Wait 2s)

2.5. http://192.168.0.120/cgi-bin/param.cgi?userName=admin&password=admin&action=set&type=alarmOut&alarmOutID=1&alarmOutName=selfCleanTrigger&alarmMode=2&alarmValidSignal=1&alarmOutFrequency=5&alarmTime=300

When the power mode toggle command is successfully received by the controller module, the following actions will be performed:

1. The unit will attempt to perform a self-cleaning cycle. Note that this cleaning cycle will only be performed if the functionality is available based on the sensor and diagnostics readings by the controller. For example, a cycle will not be performed if the unit has already cycled in the previous minute, or if the controller detects a system error.
2. Upon receiving the command, the unit will toggle the LED power state from normally-powered to a custom off-state[9], and vice versa. The off-state results in the power-down of the LEDs in ambient temperatures above 15°C.

[9] Below 15°C ambient, the LEDs may remain powered to maintain an operable internal temperature.

a. ***Note:*** *the LEDs may slightly flicker for a brief period of time until the internal thermal subsystem has fully adjusted to the new power mode.*

Volatility Behaviour

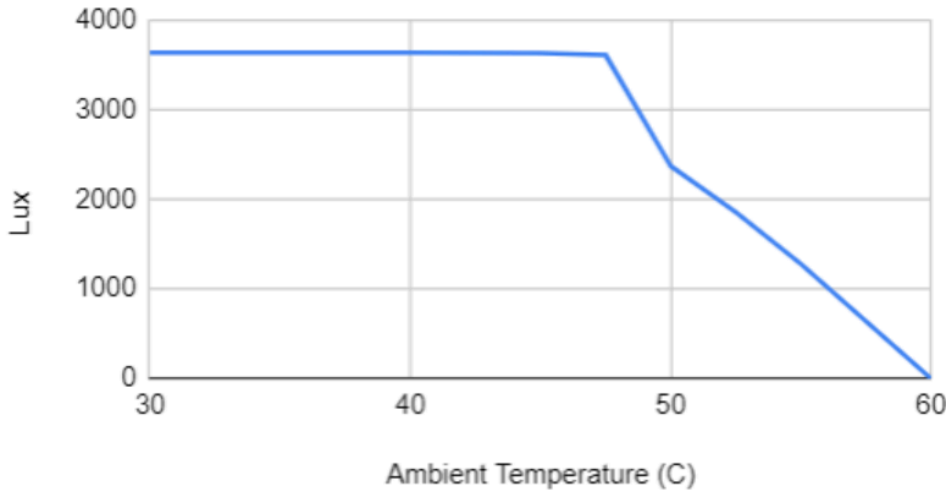
This feature behaves in a volatile manner for controller firmware versions prior to "*Clearsight1700-v3.3.0*". This means that after a power cycle or system reboot, the LED mode will revert back to the factory-default *Normal Mode*. The "*Clearsight1700-v3.3.0*" firmware version adds non-volatility to this feature, meaning the currently set LED mode will be maintained after a power cycle or reboot.

LED Specifications

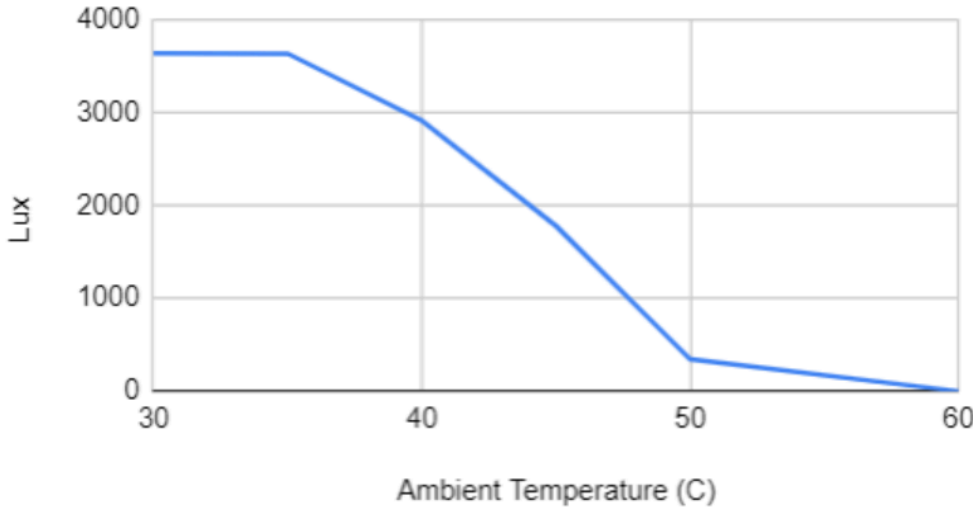
Active Illumination Control Curves

The active illumination control curves illustrate how the device will operate its integrated LEDs given the ambient thermal conditions. The figures below are based on empirical data in a controlled thermal environment, where the device was operated in the absence of direct solar loading.

DC Power Source



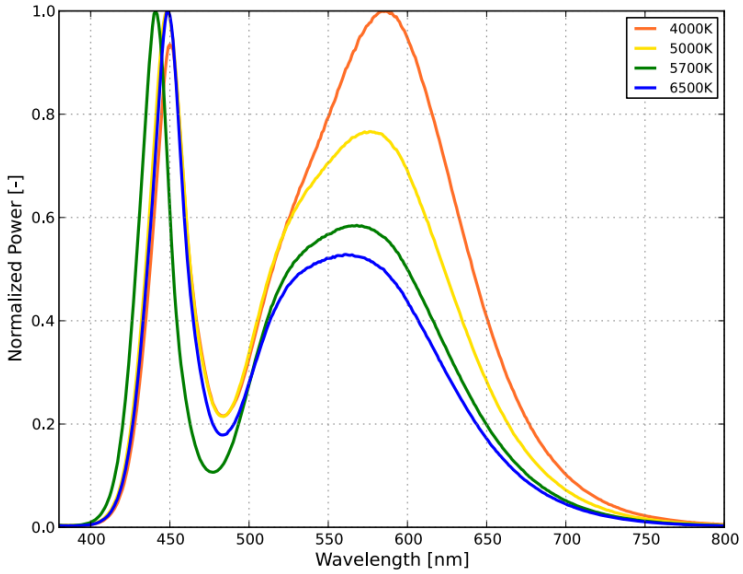
PoE+ Power Source



Note: *The data above was taken using a light measurement device at a distance of 30cm from the front of the unit.*

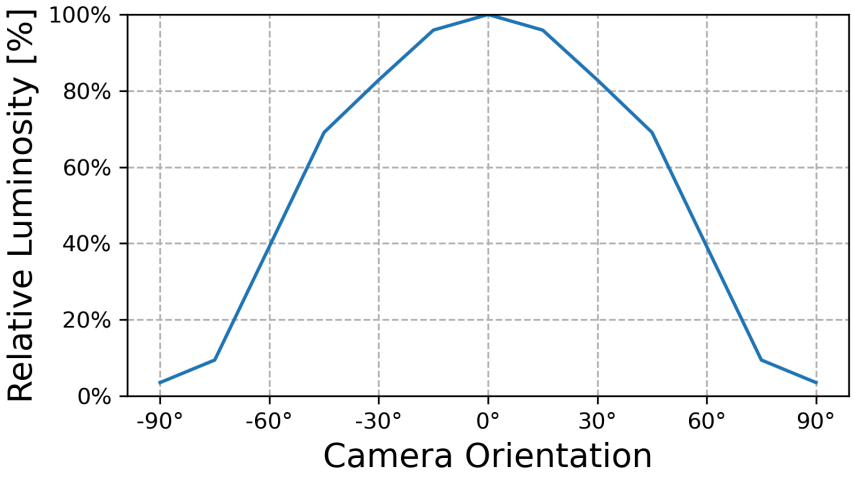
Spectral Distribution

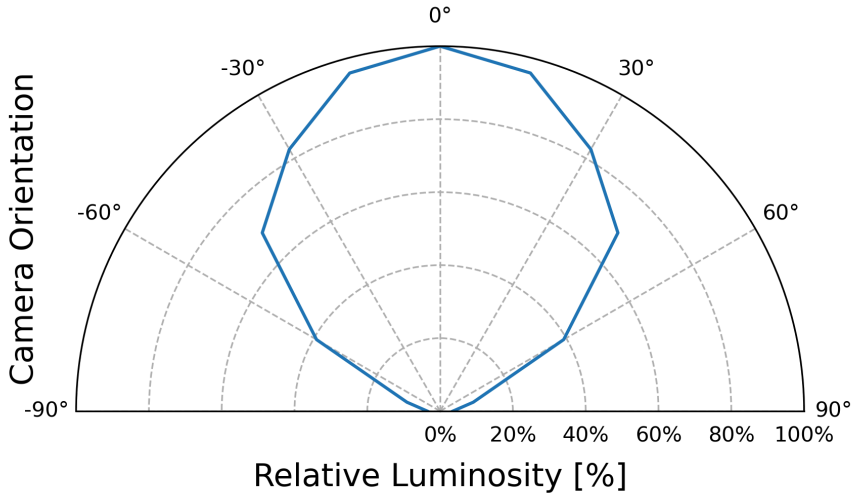
The device operates two integrated LED chipsets at a correlated colour temperature (CCT) of 4000K. The red plot in the figure below illustrates the spectral distribution of the LEDs.



Radiation Pattern Characteristization

The following figures are typical radiation patterns at full load, ambient temperature of 20°C, measured in a dark environment at a distance of 30cm.





ToughEye-1700™ Wide-Angle Variant

The ToughEye-1700™ wide-angle variant is a slightly modified version of the standard ToughEye-1700™ self-cleaning camera designed to provide a low-distortion, 120° horizontal field-of-view.

The precise field-of-view measurements based on the Gen 2 image sensor are listed below:

Horizontal FoV	Vertical FoV
119°	84°

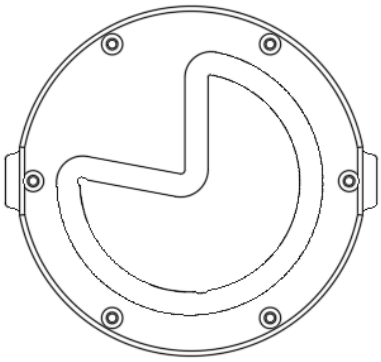
The wide-angle variant is applicable to the following products:

TE17-XDS-120x-N-xx-x

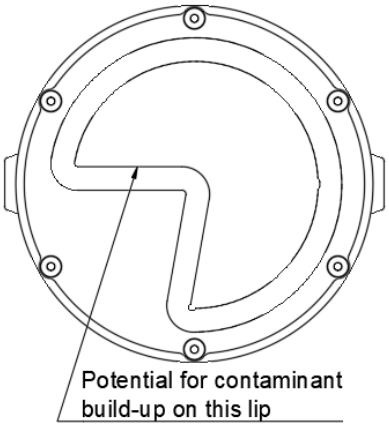
Note: *As indicated in the part number above, the wide-angle option is not available for the LED-integrated variant of ToughEye-1700™.*

The increased field of view is achieved by modifications to the internal and external design.

Most notably, the Front Cap is rotated counterclockwise 90°, and the lens now sits at the top middle of the glass. In this orientation, there is potential for contaminant build-up on the lip created by the cleaning quadrant, as indicated by the arrow in the right-most image below. This effect is more pronounced if the camera is pointing above horizontal. To avoid this, it is recommended to angle the camera pointing below horizontal if installation allows.



ToughEye-1700™ Standard



ToughEye-1700™ Wide-Angle Variant

Important Note: *For any build-up, avoid cleaning the contaminant off manually, as this may cause scratching or abrasive damage to the optical glass. Compressed air or a low pressure water stream is recommended to remove build-up. For full details on the recommendations, refer to the Manual Lens Cleaning section of the Mechanical Best Practices Document, found here.*

Additional external differences between the wide-angle variant and standard include:

- Bulkhead position: To accommodate the internal modifications, the bulkhead position is located on the middle-left of the Rear Cap. The pinout orientation remains unchanged.
- Mounting bracket holes: To accommodate the internal modifications, the rear mounting bracket bolt holes have shifted position. The original mounting bracket is still used, as the hole position change does not impact the axis of revolution.

See *ToughEye-1700™ Wide-Angle Variant Dimensions* below for further information.

Optical Module

Sensor Generation

Before proceeding further in this section, please refer to the table below to identify the correct sensor module in your product.

Product Family	Optical Sensor Module	Serial Number Range
ToughEye-1700™	1st Gen	1700999 and lower
	2nd Gen	1701000 and higher

Latency Specification

The specification of IP camera latency can be affected by a variety of external factors, including the latency-measuring processor, camera settings, hardware configuration, and network configuration and condition. ExcelSense rates the camera latency specification based on a standard, repeatable test method with well-defined control parameters. The latency information as well as the test conditions used to produce these results can be found here for 1st Gen and here for 2nd Gen sensor modules.

Web Interface

The configuration and operation of the optical module's network interface may vary depending on the specific application. Refer to the corresponding web manual based on the serial number of your product.

Optical Sensor Module	Serial Number Range	Web Interface Manual

1st Gen	1700999 and lower	1st Gen Manual
2nd Gen	1701000 and higher	2nd Gen Manual

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 retrieving and configuring 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.

Developer Interfaces

To support custom integrations and advanced control, our IP camera exposes two primary developer interfaces: an HTTP-based API/CGI and a comprehensive Software Development Kit (SDK).

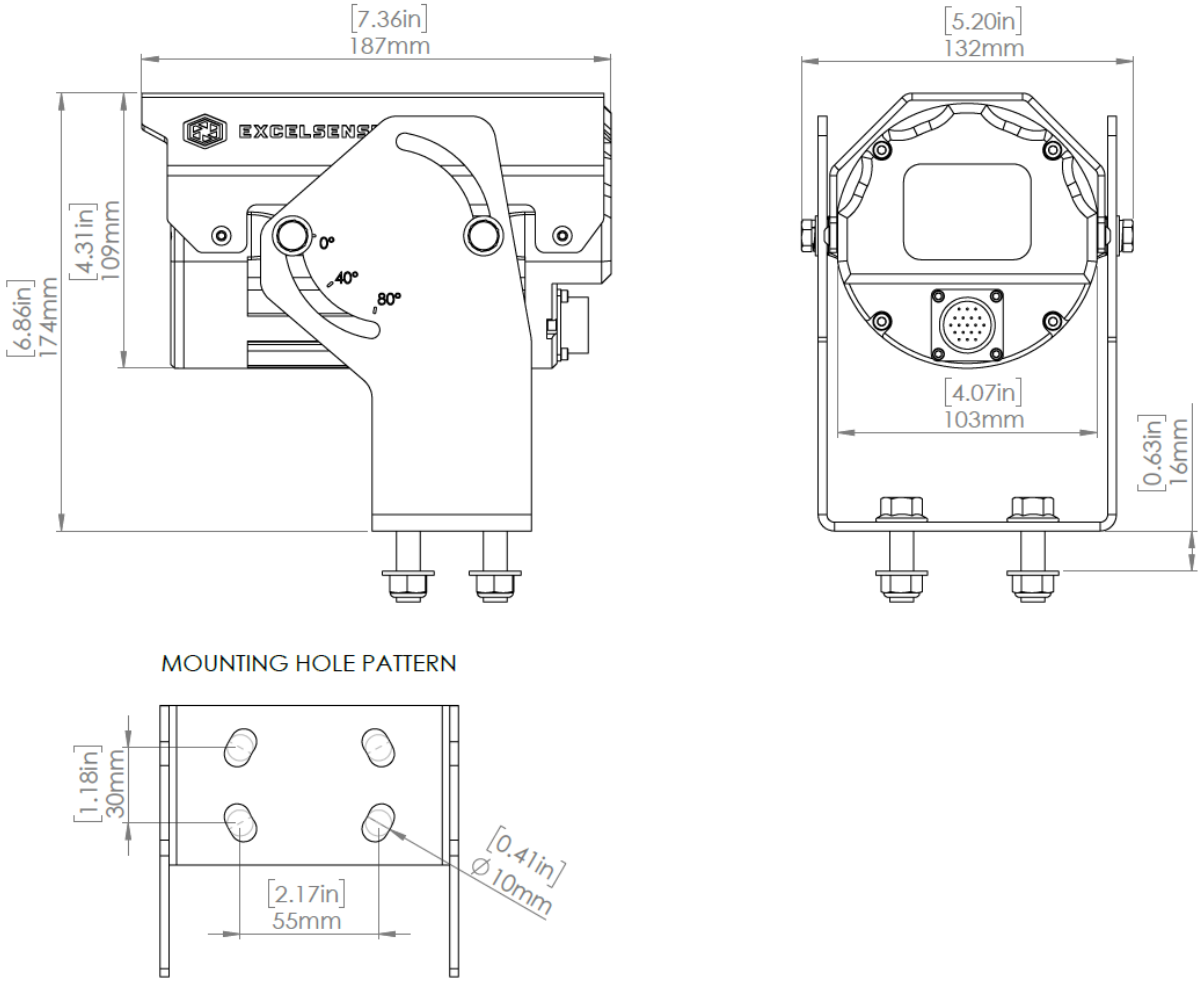
API/CGI Interface

The API/CGI interface allows developers to interact with the camera directly using standard HTTP requests. It is ideal for lightweight integrations, and can be used to trigger snapshots, configure device settings, and perform actions such as triggering a self-cleaning cycle from an external script. For a complete list of supported endpoints and commands, please refer to the relevant documentation here.

Software Development Kit (SDK)

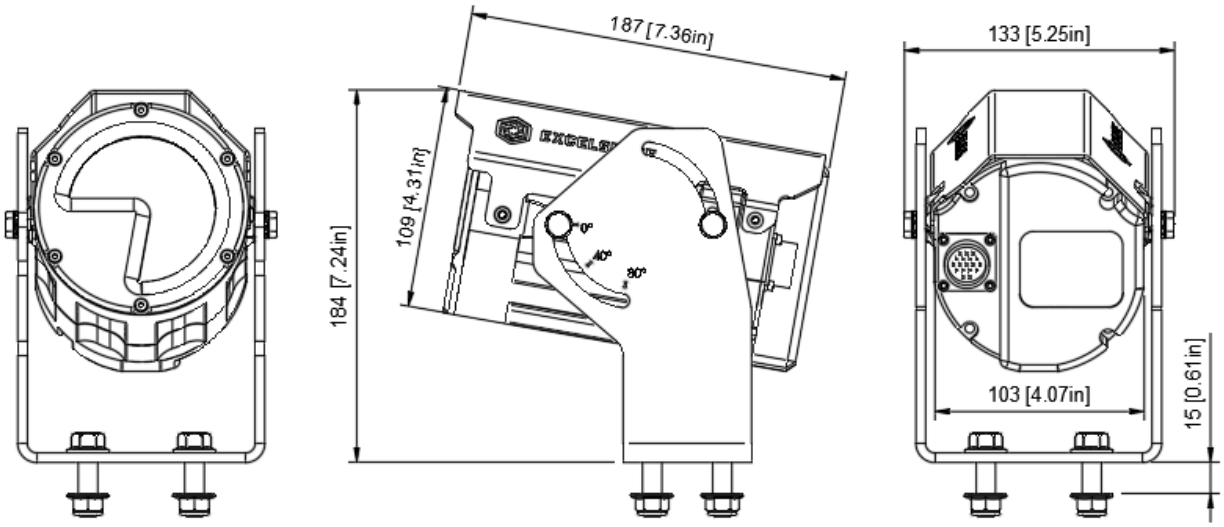
For deep system-level integration and custom application development, a robust SDK is exposed. The SDK provides the necessary libraries and tools for seamless video stream decoding, advanced event handling, and direct integration into third-party Video Management Systems (VMS) or proprietary software. To access code samples, libraries, and integration guides, please refer to the zipped contents available here.

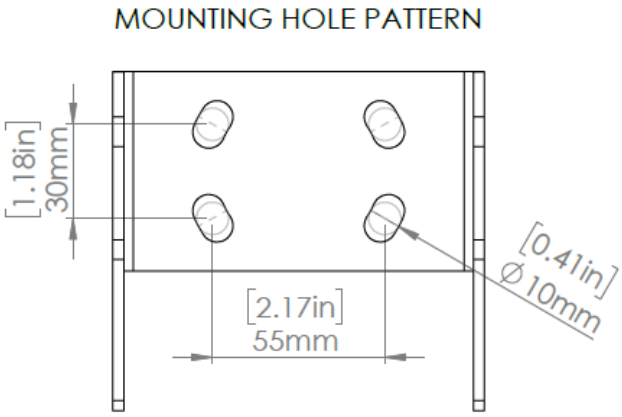
ToughEye-1700™ Dimensions



ToughEye-1700™ Mechanical Dimensions

ToughEye-1700™ Wide-Angle Variant Dimensions





ToughEye-1700™ Wide-Angle Variant Mechanical Dimensions

Legal and Licensing Notices

Open Source Software (OSS) Notice

This product contains software licensed under the GNU General Public License (GPL) and other open-source licenses. The open-source components are provided "as is," without any warranty of any kind, either expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

To obtain a complete machine-readable copy of the corresponding source code for the GPL-licensed components used in this device, please submit a written request to support@excelsensetechnologies.com. This offer is valid to anyone in receipt of this information for a period of three years from the date of original product distribution by ExcelSense Technologies.

Video Codec Patent Portfolio Notice

This product utilizes video compression technology governed by international patent portfolios. The following notices are provided in compliance with the End User License Agreements of the respective patent administrators.

AVC/H.264 Patent Portfolio Notice

THIS PRODUCT IS LICENSED UNDER THE AVC PATENT PORTFOLIO LICENSE FOR THE PERSONAL USE OF A CONSUMER OR OTHER USES IN WHICH IT DOES NOT RECEIVE REMUNERATION TO (i) ENCODE VIDEO IN COMPLIANCE WITH THE AVC STANDARD (“AVC VIDEO”) AND/OR (ii) DECODE AVC VIDEO THAT WAS ENCODED BY A CONSUMER ENGAGED IN A PERSONAL ACTIVITY AND/OR WAS OBTAINED FROM A VIDEO PROVIDER LICENSED TO PROVIDE AVC VIDEO. NO LICENSE IS GRANTED OR SHALL BE IMPLIED FOR ANY OTHER USE. ADDITIONAL INFORMATION MAY BE OBTAINED FROM MPEG LA, L.L.C. SEE HTTP://WWW.MPEGLA.COM.

HEVC/H.265 Patent Portfolio Notice

THIS PRODUCT IS SOLD WITH A LIMITED LICENSE AND IS AUTHORIZED TO BE USED ONLY IN CONNECTION WITH HEVC CONTENT THAT MEETS EACH OF THE THREE FOLLOWING QUALIFICATIONS: (1) HEVC CONTENT ONLY FOR PERSONAL USE; (2) HEVC CONTENT THAT IS NOT OFFERED FOR SALE; AND (3) HEVC CONTENT THAT IS CREATED BY THE OWNER OF THE PRODUCT. THIS PRODUCT MAY NOT BE USED IN CONNECTION WITH HEVC ENCODED CONTENT CREATED BY A THIRD PARTY, WHICH THE USER HAS ORDERED OR PURCHASED FROM A THIRD PARTY, UNLESS THE USER

IS SEPARATELY GRANTED RIGHTS TO USE THE PRODUCT WITH SUCH CONTENT BY A LICENSED SELLER OF THE CONTENT. YOUR USE OF THIS PRODUCT IN CONNECTION WITH HEVC ENCODED CONTENT IS DEEMED ACCEPTANCE OF THE LIMITED AUTHORITY TO USE AS NOTED ABOVE.