CSI 2010 Specification for: FLIR PT-Series AI Cameras

Notes to Specifier:

1. **This CSI 2010-compliant specification is designed to allow the specifier to specify Teledyne FLIR or similar products for any type of project. Specifier can easily customize this specification to his/her needs.**
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PART 1 - GENERAL

1.1. Summary

A. Requirement

1. A multi-sensor pan/tilt imager with both a 4K visible camera and a Thermal imager with a high degree of pointing accuracy and the ability to reliably operate 24/7 in all weather and geographic conditions.

B. Device

1. An outdoor multi-sensor pan/tilt system capable of producing simultaneous 4K visible and VGA thermal images in the long wave infrared band for installation into a fully operational Digital Video System. Section Contents and Related Specification References

C. This Specification may be part of a larger Security System project. ***[If so, utilize the appropriate specification sections below.]*** Refer to the appropriate CSI 2010 Specification Sections as referenced below: ***[Delete any sections not for coordination to this work.]***

1. 000000 – Procurement and Contracting Requirements (Division 0)
2. 010000 – General Requirements (Division 1)
3. 020000 – Existing Conditions (Division 2)
4. 080000 – Openings (Doors, Door Hardware and other Openings) (Division 8)
5. 101400 – Signage (Division 10)
6. 111200 – Parking Control Equipment (Division 11)
7. 142000 – Elevators (Division 14)
8. 250000 – Integrated Automation Systems (Division 25)
9. 260000 – Electrical (Division 26)
10. 270000 – Communications (Division 27)
    a. 271000 – Data Communications Network Equipment (including Firewalls, Routers, Codecs, Switches and Access Points)
    b. 272200 – Data Communications Hardware (including Servers, Storage, Workstations, Printers, etc.)
    c. 273000 – Voice Communications
11. 280000 – General Security System Specification (Division 28)
    a. Section 280800 – Commissioning of Electronic Safety and Security
    b. Section 281000 – Electronic Access Control and Intrusion Detection
    c. Section 281600 – Intrusion Detection
    d. Section 281619 – Intrusion Detection Remote Devices and Sensors
    e. Section 282000 – Electronic Surveillance
    f. Section 282300 – Video Surveillance
    g. Section 282313 – Video Surveillance Control and Management Systems
    h. Section 282316 – Video Surveillance Monitoring and Supervisory Interfaces
    i. Section 282323 – Video Surveillance Systems Infrastructure
    j. Section 282329 – Video Surveillance Remote Devices and Sensor

1.2. Drawings and Specifications:

A. Drawings:

1. Drawings delivered with these Specifications show device locations, and may show conduits, details, device schedules and single-line or detailed schematics.

B. Specifications: The Specifications describe the Scope of Work including:

1. Section 1 – System Descriptions, all items to be delivered and installed and all services to be performed.

2. Section 2 – Products, describes acceptable products.

3. Section 3 – Execution, describes the standards and practices to be used by the installer for this work.

1.3. Project Background and Site Conditions:

A. See Section 282313 – Video Surveillance Control and Management Systems

1.4. Product Description:

A. Provide a quantity of Outdoor Multi-Sensor Pan/Tilt Systems as shown on the associated Purchase Order or Bill of Quantities.

1.5. Submittals:

A. See Section 013300 – Submittal Procedures

B. *PT-Series AI Camera Quick Connect Guide*

C. *PT-Series AI Camera Installation and User Guide*

1.6. Delivery, Storage and Handling

A. ***[Fill in Submittal Requirements for this work here or delete this paragraph and include the paragraph below if this is part of a complete system.]***

B. See Section 016000 – Product Requirements

1.7. Quality Assurance:

A. Manufacturer:

1. Minimum 10 years' experience in manufacturing and designing IP Thermal Video Surveillance Systems.

2. ISO 9001:2015 certification

B. Installer:

1. Minimum 2 years' experience in installing IP Thermal Video Surveillance Systems.

2. All camera installation, configuration and commissioning shall be performed by technicians fully authorized by manufacturer.

1.8. Applicable Codes and Standards:

A. Thermal Camera
1. Electromagnetic Compatibility: CE (EN 61000-6-4:2007+ A1:2011, EN 50130-4:2011 + A1:2014); FCC 47 CFR Part 15, Subpart B, Class A, tested according to ANSI C63.4:2009 within CISPR 22:2008 Class A limits
2. Environmental: IP66; IEC 60068-2-1:2007; IEC 60068-2-2:2007; IEC 60068-2-27:2008; ISTA-1A; MIL-STD-810G method 505.5, 507.5, 509.5, 514.6, and 521.3
3. Material: RoHS Directive 2011/65/EU; WEEE 2012/19/EU

4. ONVIF 2.3 Profile S, G, T

B. Environmental: (FROM DATASHEET)

1. IP Rating (Dust & Water Ingress): IP66
2. Corrosion: MIL-STD-810H, Method 509.8, section 2.3.8.1
3. Shock: IEC 60068-2-27
4. Vibe: IEC 60068-2-64
5. Vandalism: IK10 (except windows)
6. Surge Immunity: EN 50130-4:2011 + A1:2014
7. Surge / Lightning Protection: TVS 6000 V Lightning protection, surge protection, voltage transient protection
8. Wiper / Washer: Built-in / Optional accessory

C. Electromagnetic Compatibility: CE; FCC Part 15, Subpart B

D. Enclosure: NEMA 4X

E. Material: RoHS; WEEE

F. Safety: IEC 62368

G. ONVIF Profiles S, G, & T

1.9. Warranty:

A. ***[Fill in specific services for this work here or delete this paragraph and include the paragraph below if this is part of a complete system.]***

B. Manufacturer’s standard warranty will cover three years for components and ten years for the thermal sensor.

PART 2 - PRODUCTS

2.1. Acceptable Manufacturer and Model:

A. Acceptable Manufacturers:

1. FLIR Models: FLIR PT-Series AI Camera

B. Substitutions Allowed: None

2.2. General Product Description:

A. An Outdoor Multi-Sensor Pan/Tilt System consisting of a Thermal Security Camera and a Visible Light (Day/Night) 4K Color Camera (PT-Series AI Camera).

2.3. Detailed Product Description:

A. Basic Description:

1. The Outdoor Multi-Sensor Pan/Tilt System shall consist of (1) a Thermal Security Camera with multiple lens options of various fixed fields of view, or a true 4x thermal zoom lens, and (2) a Visible Light (Day/Night) 4K Color Camera with an auto-focus 25x zoom lens.

2. The Outdoor Multi-Sensor Pan/Tilt System shall provide four independent IP network streams (channels): two streams for the thermal camera and two streams for 4K visible light camera. These two streams will be user-selectable H.264, H.265 or M-JPEG.

3. The Thermal Security Camera and a Visible Light Camera shall be integrated onto a high-performance pan/tilt drive and rated for outdoor installations. The pan drive shall be capable of true 360° rotation and allow for slow movements down to 0.1°/second and fast movements up to 60°/second. The tilt drive shall be capable of +/-90° movement and allow for slow movements down to 0.1°/second and fast movements up to 30°/second.

4. The Outdoor Multi-Sensor Pan/Tilt System shall be furnished in an IP66-rated outdoor enclosure with a mounting base. The mounting base shall provide four holes for mounting to a pedestal or wall mount. All cable connections shall be made inside of the enclosure. The enclosure shall be provided with liquid-tight sealed cable gland fittings for the video, Ethernet, serial and power cables.

5. The Outdoor Multi-Sensor Pan/Tilt System enclosure shall include grounding and surge protection. A separate Earth ground connection shall be made inside the enclosure to a designated grounding lug. The Earth ground conductor may be run as part of the power cable bundle.

6. The Outdoor Multi-Sensor Pan/Tilt System shall feature an IP network interface, built-in Ethernet port, built-in web browser interface/server for device set-up, configuration and control.

7. From a computer or other device, the Outdoor Multi-Sensor Pan/Tilt System shall support set-up, configuration and control as follows:
    a. Support a standard web browser interface.
    b. Support for third-party systems using a Software Development Kit (SDK) and a Common Gateway Interface (CGI) Application Programming Interface (API).
    c. Configuration settings shall include settings for the video CODEC, cameras sensors settings, etc.
    d. Support for IPV4, HTTP, Bonjour, UPnP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, ICMP, IGMP, DHCP, ARP, and SCP.
    e. Field software upgrades shall be distributable across the network.
    f. The Outdoor Multi-Sensor Pan/Tilt System shall be ONVIF-compliant.
    g. Support a configuration tool for device discovery, IP setup, firmware upgrade, and credential changes.
8. The Outdoor Multi-Sensor Pan/Tilt System shall provide an IP network interface that is based on open standards to ensure compatibility with a wide range of third-party video players and Video Management Systems (VMSs), such as, but not limited to, FLIR UVMS, Milestone, Genetec, and ONSSI.
9. The Outdoor Multi-Sensor Pan/Tilt System shall support built-in Edge AI video analytics. Supported features shall include:
    a. Hand-off from a fixed camera to the Outdoor Multi-Sensor Pan/Tilt System utilizing FLIR analytics.
    b. Object detection on presets
10. The Outdoor Multi-Sensor Pan/Tilt System shall support slew-to-cue input from external FLIR and/or third-party intrusion systems, including radars.
11. The Thermal Security Camera shall not depend on any visible or invisible (infrared) illumination or image intensifier to “see”, i.e. produce images. The Thermal Security Camera shall be totally passive and not produce any energy or emit light in any bandwidth. The Thermal Security Camera shall allow the user to clearly identify images in the total absence of light.
12. The Thermal Security Camera shall allow the user to see through smoke and light fog and to view the thermal patterns and contrast in the scene.
13. The Thermal Security Camera shall utilize a sun-safe Vanadium Oxide (VOx) uncooled microbolometer responding in the LWIR (Long Wave Infrared) spectral range of 7.5 – 13.5 µm.
14. The visual camera shall include a wiper for visual window and support an optional wash system connected to the camera’s dry outputs. The camera’s web interface shall include settings and controls for the wiper and the optional wash system.
15. The Thermal Security Camera shall not utilize shutters to prevent damage from the sun, but rather it shall provide uninterrupted video which is required for security installations.
16. The Thermal Security Camera shall not utilize dynamic apertures to protect the image sensor because these mechanisms reduce the camera’s performance and sensitivity for an extended period of time, which is not acceptable for security installations. The Thermal Security Camera shall include a lens or window that is temperature-controlled to prevent dew, frost, and ice accumulation.
17. The Thermal Security Camera shall provide athermal optics that automatically adjust to ambient temperature changes, and therefore do not require re-adjustment and/or thermal refocusing.
18. The Thermal Security Camera shall not be susceptible to “image blooming” caused by bright lights as are image intensifiers and visible spectrum cameras.

19. The Thermal Security Camera shall be a ruggedized IP66 industrial enclosure.
20. The Thermal Security Camera shall be factory configured with one of the following fixed or continuous zoom anti-reflection coated Germanium lenses with the Field of View (FOV), focal length, and aperture as indicated:

Model	FOV	Focal Length	F#
PT-644 AI	44°×36°	13 mm	1.0
PT-625 AI	25°×18°	25 mm	1.1
PT-617 AI	17°×14°	35 mm	1.1
PT-612 AI	12°×10°	50 mm	1.2
PT-608 AI	8.6°×6.6°	75 mm	1.1
PT-606 AI	6.2°×5.0°	100mm	1.6
PT-606z AI	Continuous zoom 24° to 6°	26-105 mm	1.6

21. The Thermal Security Camera image sensor shall provide a NETD of <25mK @ 25c F# 1.0. The NETD (Noise Equivalent Temperature Difference) is the measure of the smallest object temperature that can be detected by the thermal image sensor relative to the system noise. The measurement is usually quantified as an mK value. This is the most common Figure of Merit of a thermal imaging system and a true measurement of the thermal camera's sensitivity.
22. The Thermal Security Camera shall include Auto Digital Detail Enhancement (Auto DDE), which is an advanced non-linear image processing algorithm that increases the probability of detection of low contrast images. The Auto DDE shall enhance the image detail to match the total dynamic range of the original image allowing details to be visible to the user even in scenes with low or high thermal contrast. The Auto DDE function shall be fully automatic and require no input or adjustment from the user.
23. The Thermal Security Camera shall utilize Flat-Field Correction (FFC), which is a set of compensation factors for each pixel. FFC shall enable the following features and benefits:
    a. Eliminate the need for FPA (Focal Plane Array) temperature stabilization.
    b. Allow for near instantaneous camera turn-on.
    c. Reduced system complexity and power consumption.
    d. Allow for a wider operating temperature range.
24. The Thermal Security Camera shall include Automatic Gain Control (AGC) circuitry to compensate for scene variations, improve image quality by avoiding saturation and distortion, and to balance signal levels prior to display to maximize image quality.
25. The Thermal Security Camera shall feature both White-Hot and Black-Hot operating modes. In the White-Hot (default) mode warmer images will be displayed in white or lighter shades than cooler or background areas. In the Black-Hot mode warmer objects will be displayed as black or dark gray compared to cooler objects. Ten Color Palettes shall also be available.
26. The Color Daylight Camera shall be provided with a 4K CMOS imager with a 25x optical zoom lens, automatic IR Cut filter, and an integral image stabilization feature.
27. The Pan/Tilt Mechanism shall be high-performance and provide continuous 360° pan motion at a rate of 0.1° to 60°/second, and tilt motion of +90° to -90° at a rate of 0.1° to 30°/second.
28. A security site planning tool shall be available online to assist in selection of the correct cameras and designing the video surveillance system. The tool shall utilize Google Maps to allow the user to place cameras on the site and simulate the actual field of view of any camera to visually see the difference between each camera/ lens

combination for detection, recognition and identification. The tool must also allow for image upload and overlay to allow for accurate determination of the camera locations when Google Maps is not sufficient. The tool shall be available at http://raven.flirops.com/.

B. The camera shall support the following additional functionalities:

1. Perform scheduled actions. The unit will perform actions on a specific date or time or on a recurring basis over a defined time period according to a predefined schedule.

2. Perform automatic responses to a pre-defined triggering event during a defined monitoring period. For example, sending notification emails.

3. Utilize the unit's relay outputs to control external devices, including one dedicated to supporting external infrared (IR) LED illumination.

4. Provide onboard storage (SoE) for video and snapshots.

1.2. The Outdoor Multi-Sensor Pan/Tilt Camera System shall meet the following specifications: (FROM PT AI CAMERA)

A. General Technical requirements:
1. Digital Video Outputs
a. Digital:
i. Each sensor shall have 2 streams of either the following stream formats: H.264, H265, and/or MJPEG
ii. Streaming Resolutions shall be user configurable to:
1) Thermal: VGA (640 × 512) and QVGA (320 × 240)
2) Visible:4k (3840x2160), 1080p (1,920x1080), 720p (1,280x720) or VGA (640 × 480)
iii. User-definable frame rate: 1-30 fps @ MJPEG; 1-30 fps @ H.264/H.265
iv. Two concurrent streams: H.264, H.265 and MJPEG
v. Bit Rate: H: 264/H.265: Restricted VBR and CBR (10kbps-4Mbps)
2. Networking
a. Security
i. The thermal camera must support three levels of user accounts;
1) Admin
2) Expert
3) User
ii. The Web Configuration tool must allow for IP Whitelists
b. Services and protocols: IPV4, HTTP, Bonjour, UPnP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, ICMP, IGMP, DHCP, ARP, SCP
c. Video: RTP/RTSP Unicast/Multicast
d. Alarms and commands: TCP/IP, HTTP

B. The Thermal Security Camera shall meet the following minimum requirements:
1. Long-life, Uncooled Vanadium Oxide Microbolometer Sensor (imager)
2. Array Format (NTSC): 640 x 512 pixel array
3. Pixel Pitch: 17µm
4. Spectral Response (LWIR): 7.5µm to 13.5µm
5. Sensitivity (NEDT): <25mK @ 25c F# 1.0
6. Focus Range: Athermalized, Focus-Free
7. Thermal Frame Rate: 30Hz/8.3Hz
8. Image Polarity: White Hot/Black Hot

9. Gain Control: Automatic Gain Control (AGC)
10. Image Processing: Auto Digital Detail Enhancement (Auto DDE)

C. The Color Daylight Camera shall meet the following minimum requirements:
1. Sensor Type: 1/1.8-type STARVIS™2 CMOS Sensor 8.4M pixels
2. Sensor Illumination: Backlight Compensation
3. Sensitivity: Color 0.028 lux @ F1.6 with AGC ON @ 1/30s
4. Noise Reduction: Yes
5. WDR: 120db
6. F/#: F1.6 – F4.8
7. Lens Field of View: 59° (wide end) to 2.36° (tele end)
8. Focal Length: 6.5mm – 162.5mm
9. Zoom: 25x Optical Zoom

D. The Pan/Tilt Mechanism shall meet the following minimum requirements:
1. Pan Angle Speed: Continuous 360°; 0.1° to 60°/sec
2. Tilt Angle Speed: +90° to -90°; 0.1° to 30°/sec
3. Programmable Presets: 256

E. Electrical
1. Input Voltage:
   a. 24 VDC nominal (21-30VDC)
2. Power Consumption:
   a. 24 VDC: 65W max. without heater, 195W max. with heater
3. Inrush Current:
   a. <14A in 4ms for DC power supply

F. Mechanical
1. Lens Heater: Thermostatically controlled
2. Enclosure Rating: IP66
3. Weight: ~37 lbs. (16.8 kg) configuration-dependent
4. Dimensions: 13.7 × 18.4 × 13” (348 × 467 × 330 mm)

G. Communication
1. 10/100Mpbs Ethernet
2. Nexus SDK
3. Nexus CGI commands
4. ONVIF Profile S, G, T

H. Video Analytics

Optimal video analytics (VA) classification distances are based on the VA configuration DNN AI or Fusion AI with High or Ultra Motion Sensitivity;

- **Fusion AI** detects Upright and Discreet human intrusions at short, medium to long range distances. Upright human intrusions denote vertical movements such as standing, walking, running. Discreet human intrusions denote movements such as crawling, rolling or camouflaged actions. Fusion AI is not recommended for heavy traffic scenes or scenes with dynamic vehicle activity.

- **DNN AI** detects Upright non-discreet human intrusions. Upright human intrusions denote vertical movements such as standing, walking, running.

- **Vehicle detection** is limited to cars, vans, trucks and trailers up to 15m size.

VA classification distances represent the maximum distance to accurately classify intrusions in Day and Night on the Thermal spectrum measured under the following controlled conditions and site setup policy, in order to achieve >95-99% detection accuracy rate (DAR). Appropriate animal filter (object size) filter settings and masking levels 2 or 3 should be applied to achieve <5% nuisance alarm rate (NAR) and false alarm rate (FAR):

- ❖ Camera is installed on a stable fixed pole at a height of 20 ft ~ 6 meters
- ❖ Mounting orientation (tilt) is at horizon level close to top of the scene
- ❖ Georeference setting for VA Calibration is setup correctly and the calibration verified at closest and farthest of area or FOV such that detection human boxes correctly represent the typical height of a human at different distances
- ❖ The Region of Interest within the FOV of the camera has a clear line of sight, flat ground surface terrain with no tall grass or sloping surfaces.
- ❖ Detection region starts at 5 meters from the fence line or boundary from where the intrusion can start
- ❖ Static scenery/ objects such as walls, fences, trees and tree branches, that can occlude target detection is masked using Masking Level 2 or 3.
- ❖ Vehicle classification is reliable at distances up to 200m when using Fusion AI configuration.

Thermal VA

Model	DNN Upright	Fusion AI high Upright	Fusion AI Ultra Upright	Fusion AI High Discreet	Fusion AI Ultra Discreet	DNN Vehicle
PT-644	100	150	170	70	85	60
PT-625	180	230	260	120	140	100
PT-617	250	310	350	150	170	150
PT-612	350	410	450	200	240	200
PT-608	500	570	650	300	350	300
PT-606	580	650	730	380	430	380
PT-606z	603	676	759	395	447	395

Visual VA

Model	DNN Upright	Fusion AI high Upright	Fusion AI Ultra Upright	Fusion AI High Discreet	Fusion AI Ultra Discreet	DNN Vehicle
PT-644	90	110	120	60	70	120
PT-625	170	190	210	110	130	180
PT-617	240	270	300	150	170	250
PT-612	350	380	420	200	230	300
PT-608	450	500	530	280	310	400

Model	DNN Upright	Fusion AI high Upright	Fusion AI Ultra Upright	Fusion AI High Discreet	Fusion AI Ultra Discreet	DNN Vehicle
PT-606	530	580	610	320	350	480
PT-606z	551	603	634	333	364	499

Optimal *human* detection, recognition, and identification distances ***without VA*** (Johnson's Criteria):

	Detection		Recognition		Identification	
Model	m	ft	m	ft	m	ft
PT-644	417	1368.1	104	341.2	52	170.6
PT-625	734	2408.1	183	600.4	92	301.8
PT-617	1079	3540	270	885.8	135	442.9
PT-612	1528	5013.1	382	1253.3	191	626.6
PT-608	2236	7335.9	559	1834	279	915.3
PT-606	2941	9648.8	735	2411.4	368	1207.3
PT-606z	3120	10236.1	780	2559.0	390	1278.5

Optimal *vehicle* detection, recognition, and identification distances ***without VA*** (Johnson's Criteria):

	Detection		Recognition		Identification	
Model	m	ft	m	ft	m	ft
PT-644	1278	4192.9	319	1046.6	160	524.9
PT-625	2249	7378.5	562	1843.8	281	921.9
PT-617	3307	10849.6	827	2713.2	413	1355
PT-612	4686	15373.8	1171	3841.8	586	1922.5
PT-608	6857	22496.4	1714	5623.3	857	2811.6
PT-606	9020	29592.8	2255	7398.2	1127	3697.5
PT-606z	9470	31069.2	2370	7775.5	1180	387.3

The distances above reflect cameras configured with the indicated lenses, and assume:

i. Optimal performance

ii. Clear weather and thermal contrast

iii. Human critical dimension is 0.75m (29.5")

iv. Vehicle critical dimension is 2.3m (7.5')

v. Pixels for detection under optimal conditions: 1.5

vi. Pixels for recognition under optimal conditions: 6

vii. Pixels for identification under optimal conditions: 12

viii. Other assumptions apply

a. Dynamic Detail Enhancement (DDE)

b. Automatic Gain Control (AGC)

2. **Visible Light Imager** Specifications: (FROM DATASHEET)

a. Sensor Resolution: 4K 2160p (3840×2160)

b. Sensitivity:

i. Color: 0.028 Lux (F1.6, AGC On, 30 FPS)

c. Optical characteristics for each model:

Model	**FOV**	**Focal Length**	**F#**
PT-644 AI	44°×36°	13 mm	1.0
PT-625 AI	25°×18°	25 mm	1.1
PT-617 AI	17°×14°	35 mm	1.1
PT-612 AI	12°×10°	50 mm	1.2
PT-608 AI	8.6°×6.6°	75 mm	1.1
PT-606 AI	6.2°×5.0°	100mm	1.6
PT-606z AI	Continuous zoom 24° to 6°	26-105 mm	1.6

d. Optimal video analytics (VA) classification distances measured at Optimal Daylight conditions: based on the VA configuration DNN AI or Fusion AI with High or Ultra Motion Sensitivity

- **Fusion AI** detects Upright and Discreet human intrusions at short, medium to long range distances. Upright human intrusions denote vertical movements such as standing, walking, running. Discreet human intrusions denote movements such as crawling, rolling, camouflaged actions. Fusion AI is not recommended for heavy traffic scenes or scenes with dynamic vehicle activity.

- **DNN AI** detects Upright non-discreet human intrusions. Upright human intrusions denote vertical movements such as standing, walking, running.

- **Vehicle detection** is limited to cars, vans, trucks and trailers up to 15m size

VA classification distances represent the maximum distance to classify in optimal Daylight for the Visible spectrum measured under the following controlled conditions and site setup policy, in order to achieve >95-99% detection accuracy rate (DAR). Appropriate animal filter (object size) filter settings and masking levels 2 or 3 should be applied to achieve <5% nuisance alarm rate (NAR) and false alarm rate (FAR):

- ❖ Camera is installed on a stable fixed pole at a height of 20 ft ~ 6 meters
- ❖ Mounting orientation (tilt) is at horizon level close to top of the scene
- ❖ Georeference setting for VA Calibration is setup correctly and the calibration verified at closest and farthest of area or FOV such that detection human boxes correctly represent the typical height of a human at different distances
- ❖ The Region of Interest within the FOV of the camera has a clear line of sight, flat ground surface terrain with no tall grass or sloping surfaces
- ❖ Detection region starts at 5 meters from the fence line or boundary from where the intrusion can start
- ❖ Static scenery/ objects such as walls, fences, trees and tree branches, that can occlude target detection is masked using Level 2 or 3 Masking
- ❖ Vehicle detection limited to cars, vans, trucks and trailers up to 15m size
- ❖ Vehicle classification is reliable at distances up to 200m when using Fusion AI configuration.

e. White Balance: Auto / ATW / One Push / Manual

f. Noise Reduction:

   i. 2DNR (0-100)

   ii. 3DNR (0-100)

g. Night Mode:

   i. Color (day)

   ii. B/W (night)

   iii. Auto, with separate night-to-day and day-to-night thresholds, and adjustable switch time (Slow, Normal or Fast)

3. Video:

   a. The camera shall provide user-configurable H.265 / H.264 / M-JPEG video compression simultaneously on up to four digital streams.

b. Resolution shall be scalable on each stream, which can be set to unicast or multicast.

i. Primary streams:

- Thermal: VGA (640 × 512)
- Visible: 4K (3840 × 2160) (only available with H.265 / H.264 compression), 1080p (1920 × 1080), 720p (1280 × 720) & VGA (640 × 480)

ii. Secondary streams:

- Thermal: VGA (640 × 512)
- Visible: 1080p (1920 × 1080), 720p (1280 × 720) & VGA (640 × 480)

c. User-Definable Frame Rate: 5-30 fps

d. User-Definable Bit Rate for H.265 / H.264: Restricted VBR and CBR (100kbps-12Mbps)

4. Audio:

a. G.711 audio compression

b. Digital audio output

5. Digital Input / Output (I / O):

a. Input: two (2) dry alarm contacts

b. Output: two (2) relay contacts 1A max at 30VDC

c. Each input and output individually user-configurable between normally open and normally closed via the camera's browser-based interface

6. Network:

a. Ethernet: RJ45 100/1000 Mbps

b. Supported Services and Protocols: IPV4, HTTP, HTTPS, UPnP, DNS, NTP, RTSP, TCP, UDP, ICMP, IGMP, DHCP, ARP, SNMP

c. Cybersecurity:

i. IEEE 802.1X

ii. TLS / HTTPS

iii. User authentication

iv. Access control via firewall

v. User credentials with policy enforcement

vi. Digest authentication

vii. IP address filtering

7. Connections and Interfaces:

    a. Network: RJ45

    b. Power Input:

        i. 24 VDC: Through dedicated terminal block

    c. MicroSD Card Slot: Up to 1TB on a Class 10 microSD/microSDHC/microSDXC card (minimum 8GB)

8. Software:

    a. Integrated web server

    b. Discovery Network Assistant (DNA) tool to discover and configure the camera's IP addressing and DNS server settings; set device properties and user credentials; set the TV system (PAL/NTSC); upgrade the camera's firmware; reset defaults; reboot the analytics firmware; and display camera properties.

9. Environmental:
    a. Operating Temperature Range: -40°C to 70°C (-40°F to 158°F) cold start
    b. Storage Temperature Range: -55°C to 85°C (-67°F to 185°F)
    c. Humidity: 0-95% relative humidity
    d. Icing, fogging, and frosting provisions: Anti-icing provided, Anti-fogging and Anti-frosting provided with all models
    e. Humidity tolerance: per MIL-STD-810G method 507.5 procedure 2
    f. Salt fog tolerance: No damage caused exposure to salt fog per MIL-STD-810H, Method 509.8, section 2.3.8.1.
    g. Protection for dust and water: System sealed to IP66
    h. Vibration tolerance: per MIL-STD-810G "Transportation"
    i. Shock tolerance: per ISTA 1A

10. Compliance and Certifications:

    a. USA: FCC Part 15 (subpart B)

    b. International: CE Marked, EN 50130-4, RoHS, NEMA 4X, WEEE

    c. Emission: EN 61000-6-3:2021 EN 55032:2015 + AC:2+ A11:2020,

    d. Immunity: EN 50130-4:2011+A1:2014

    e. RoHS: EN 63000:2018

PART 3 - EXECUTION

1.1. Examination:

A. See Section 282313 – Video Surveillance Control and Management Systems

1.2. Installation:

A. See Section 282313 – Video Surveillance Control and Management Systems

1.3. Preparation:

A. See Section 282313 – Video Surveillance Control and Management Systems

1.4. Quality Control:

A. See Section 282313 – Video Surveillance Control and Management Systems

1.5. Testing and Commissioning:

A. See Section 282313 – Video Surveillance Control and Management Systems

1.6. Handing Over:

A. See Section 282313 – Video Surveillance Control and Management Systems

--- End of Specifications ---