CSI 2010 Specification for:
FLIR FH-Series R Dual-Spectrum 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.**
2. **The specification is not proprietary to Teledyne FLIR. Any suitable brand can be specified using this specification.**
3. **Teledyne FLIR has placed Text Boxes such as this in bold to alert the specifier of important information. Delete all Text Boxes after editing.**
4. **Teledyne FLIR has also placed edit prompts "[ ]" throughout the specification to prompt the specifier to add or modify information relative to the paragraph at hand. Delete all Edit Prompts "[ ]" after editing.**
5. **Delete this section after editing this document.**

Teledyne Confidential; Commercially Sensitive Business Data

PART 1 - GENERAL

1.1. Summary

A. This Specification is for a fixed dual-spectrum security camera with radiometry and embedded video analytics (FH-Series R) for installation into a fully operational Digital Video System. This Specification is part of a larger project which may be covered in one or more of the Specification Sections listed below.

1.2. Section Contents and Related Specification References

A. 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 Sensors

1.3. Drawings and Specifications:

A. Drawings:

1. ***[Include this paragraph if Drawings were included.]*** Drawings delivered with these Specifications show device locations, and may show conduits, details, device schedules and single-line or detailed schematics.

2. ***[Include this paragraph if Drawings were not included.]*** Drawings are not included. See the descriptive narratives in Articles 1.5 and 1.7 below.

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.

1.4. Project Background and Site Conditions:

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

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

1.5. Product Description:

A. Provide a quantity of fixed dual-spectrum security cameras with radiometry and embedded video analytics (FH-Series R) as shown on the associated Purchase Order or Bill of Quantities.

1.6. Submittals:

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 013300 – Submittal Procedures

C. *FH-Series Camera Quick Install Guide*

D. *FH-Series Camera Installation and User Guide*

1.7. 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

1.8. Quality Assurance:

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. Manufacturer:

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

2. ISO 9001:2008 certification

C. Installer:

1. Minimum 5 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.

1.9. Applicable Codes and Standards:

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

B. Environmental:

1. IP Rating (Dust & Water Ingress): IP66 & IP67

2. Corrosion: MIL-STD 810G, 1000 hr salt spray

3. Shock: IEC 60068-2-27

4. Vibe: IEC 60068-2-64

5. Vandalism: IK10 (except windows)

6. Surge Immunity on AC Power Lines and on Signal Lines: EN 50130- 4

7. Surge / Lightning Protection: TVS 6000 V Lightning protection, surge protection, voltage transient protection

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

D. Enclosure: NEMA 4X

E. Material: RoHS; WEEE

F. Safety: IEC 62368

G. ONVIF Profiles S, G, & T

1.10. 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: ***[Teledyne FLIR and/or name acceptable alternative manufacturers here, or indicate to submit all for review.]***

B. Models: ***[FLIR dual-spectrum model FH-Series R and/or name acceptable alternative models here, or indicate to submit all for review.]***

2.2. General Product Description:

A. A dual-spectrum video surveillance system consisting of a fixed dual-spectrum security camera with radiometry and embedded video analytics (FH-Series R).

2.3. Detailed Product Description:

A. Basic Description:

1. The camera shall operate either as a standalone, fixed dual-spectrum security camera or as part of an integrated network or DVR configuration. There shall be no need for additional hardware or software to perform the video analytics.

2. The camera shall consist of (1) a thermal sensor with multiple lens options of various fixed fields of view and (2) a 4K visible light sensor with multiple auto-focus lens options of various levels of optical zoom and fields of view corresponding to the thermal sensor lens.

3. The camera shall include radiometry that provides rapid visual verification and detection of hot spots in early fire detection applications.

4. The camera shall provide the capability to filter out false radiometry alarms caused by vehicle exhaust pipes by actively detecting and masking vehicles.

5. The camera shall include onboard video analytics that incorporates, provides, and supports:

   a. Convolutional neural networks (CNN) technology

   b. Intrusion and loitering detection

   c. Human and vehicle classification for detected objects

   d. Separate configuration for the visible video and for the thermal video

   e. High probability of intelligent video detection while maintaining a low false alarm rate

   f. Geotracking of detected targets in GPS coordinates

   g. Pairing with compatible FLIR Security PTZ cameras

   h. Hand-off to ioi PTZ Tracker

6. The thermal sensor lens shall be coated with anti-reflection germanium.

7. The camera shall digitally encode images into compressed video and stream it over IP via its Ethernet cable connection. For example, to video management systems (VMSs).

8. The camera shall provide four independent IP network video streams: two streams for thermal video and two streams for visible video.

9. The camera shall provide analog video outputs.

10. Field software upgrades shall be distributable across the network.

11. Video from the thermal sensor shall allow the user to view images, thermal patterns, and contrast despite smoke, low light, light fog, and haze.

12. The camera imagers shall be passive and not produce any energy or emit light in any bandwidth.

13. The thermal sensor shall include athermalized optics that automatically adjust to ambient temperature changes, and therefore do not require re-adjustment and/or thermal refocusing.

14. The thermal sensor shall not be susceptible to “image blooming” that results from brightly lit objects that appear as intense glows that might hide nearby detail and might blind the camera by flooding the scene with light.

15. The thermal sensor shall utilize automatic flat-field correction (FFC) to compensate for temperature variations and eliminate the need for focal plane array (FPA) temperature stabilization.

16. The video from the thermal sensor shall feature the following colorization modes: WhiteHot, BlackHot, Rainbow, Rainbow-Invert, Contrast, Contrast-Invert, IronBow2, IronBow2-Invert, Arctic, Arctic-Invert, IceFire, and IceFire-Invert. For example, in the default WhiteHot mode, warmer objects and areas appear in white or lighter shades of gray than cooler objects and areas. In BlackHot mode, warmer objects and areas appear as black or dark gray compared to cooler objects and areas.

17. The camera shall include a browser-based interface for remote operation and configuration without requiring the use of a VMS.

18. The camera shall be compatible with 3rd party Network Video Management Software (NVMS), digital video displays, and recording devices.

19. The camera shall support overlaying on-screen display information onto the encoded video.

20. Setup and Configuration:

    a. Single-handedly install and set up one or more cameras without requiring another person’s assistance.

    b. It shall be possible to configure the camera’s sensors via its browser-based interface.

    c. It shall be possible to configure the camera’s analytic capabilities via its browser-based interface.

21. The camera shall include two dry contacts for alarm input and two relay contacts for output. These contacts shall be configurable as normally open or normally closed

22. The camera shall include onboard heaters and fans for defogging, de-icing, and temperature control. The camera shall support automatic and manual heater and fan control via the browser-based interface.

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 24VAC power for up to two supported third-party external IR LED illuminators.

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

6. Nexus CGI digest authentication.

7. Strong password enforcement.

8. IEEE 802.1X authentication (EAP-TLS) support.

9. Firewall with options to individually block or allow RTSP, UPnP, Nexus Discovery, Nexus SDK, TRK, ICMP, and SNMP services and their default ports.

10. TLS control and HTTPS redirect support.

2.4. The camera shall meet the following specifications:

A. Basic Camera Specifications:

The following models are available:

Model	Thermal FOV (H x W)	Thermal Focal Length	F/#	Pixel Pitch
FH-369 R	69° × 56°	9 mm	F1.4	34 µm
FH-324 R	24° × 18°	13 mm	F1.0	34 µm
FH-313 R	13° × 10°	25 mm	F1.1	17 µm
FH-669 R	69° × 56°	9 mm	F1.4	17 µm
FH-644 R	44° × 36°	13 mm	F1.0	17 µm
FH-625 R	25° × 18°	25 mm	F1.1	17 µm
FH-617 R	17° × 14°	35 mm	F1.1	17 µm

1. **Thermal Imager / Processor** Specifications:

    a. Uncooled Vanadium Oxide Microbolometer Sensor (imager)

    b. Spectral Range: 7.5 to 13.5 µm

    c. Sensitivity (NEdT): <35mK @ 25°C (77°F) F1.0

    d. Array Format: 320 × 256 (FH-3xx models) or 640x512 (FH-6xx models)

    e. Each model is available in two sensor options: 8.3 fps and user-switchable 25 or 30 fps. The 8.3 fps models are easier to export. An export license is not required.

    f. 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

        - **Isotherm-specific color palette** will limit the Video Analytics intrusion detection functions. User can select the color palette the camera uses to indicate detected levels of thermal energy. WhiteHot and BlackHot are gray-scale palettes; other palettes assign different colors to different temperatures. When VA is enabled for thermal video on the Video Analytics Page for FH-Series R, the camera automatically uses the WhiteHot color palette. When isotherm is enabled and the camera is using an isotherm-specific color palette for the thermal video, VA is unable to function as intended.

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.

Model	DNN AI	Fusion AI High	Fusion AI Ultra	Fusion AI High	Fusion AI Ultra	DNN AI
	Upright Human (m)	Upright Human (m)	Upright Human (m)	Discreet Human (m)	Discreet Human (m)	Vehicle (m)
FH-669 R	60	90	100	50	60	50
FH-644 R	100	150	170	70	85	60
FH-625 R	180	230	260	120	140	100
FH-617 R	250	310	350	150	170	150

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

Model	Detection		Recognition		Identification	
	[m]	[ft]	[m]	[ft]	[m]	[ft]
FH-369 R	133	436.4	33	108.3	17	55.8
FH-324 R	382	1253.3	95	311.7	48	157.5
FH-313 R	705	2313	176	577.4	88	288.7
FH-669 R	266	872.7	66	216.5	33	108.3
FH-644 R	417	1368.2	104	341.2	52	170.6
FH-625 R	734	2408.1	183	600.4	92	301.9
FH-617 R	1079	3540.2	270	885.9	135	442.9

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

Model	Detection		Recognition		Identification	
	[m]	[ft]	[m]	[ft]	[m]	[ft]
FH-369 R	407	1335.3	102	334.6	51	167.3
FH-324 R	1171	3841.9	293	961.3	146	479.0
FH-313 R	2163	7096.5	541	1774.9	270	885.8
FH-669 R	815	2673.9	203	666.0	102	334.6
FH-644 R	1278	4192.9	319	1046.6	160	524.9
FH-625 R	2249	7378.6	561	1840.6	282	925.2
FH-617 R	3307	10849.7	827	2713.3	413	1355.0

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

- Optimal performance
- Clear weather and thermal contrast
- Human critical dimension is 0.75m (29.5")
- Vehicle critical dimension is 2.3m (7.5')
- Pixels for detection under optimal conditions: 1.5
- Pixels for recognition under optimal conditions: 6
- Pixels for identification under optimal conditions: 12
- Other assumptions apply

i. Dynamic Detail Enhancement (DDE)

j. Automatic Gain Control (AGC)

2. **Visible Light Imager** Specifications:

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

b. Sensitivity:

   i. Color: 0.25 Lux (F1.6, AGC On, 30 FPS)

   ii. B/W: 0.10 Lux (F1.6, AGC On, 30 FPS)

c. Optical characteristics for each model:

Model	Default FOV	Focal Length	F/#
FH-369 R	98° × 55°	3.6-10mm	F1.5-2.8
FH-324 R	34° × 19°	9-22mm	F1.4-1.7
FH-313 R	18° × 10°	13-55 mm	F1.6-2.2
FH-669 R	98° × 55°	3.6-10mm	F1.5-2.8
FH-644 R	63° × 35°	3.6-10mm	F1.5-2.8
FH-625 R	36° × 20°	9-22mm	F1.4-1.7
FH-617 R	24° × 14°	13-55 mm	F1.6-2.2

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

e. Noise Reduction:

   i. ColorNR Off / On (3 levels)

   ii. 2DNR (0-100)

   iii. 3DNR (0-100)

f. 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)

g. Wide Dynamic Range:

   i. Digital Wide Dynamic Range (dWDR): Off / On (3 levels)

   ii. True (Shutter) Wide Dynamic Range: Off / On (2x / 3x)

h. Exposure Modes: Full Auto / Manual / Shutter Priority / Flickerless / Manual

i. Backlight Compensation Off / On (6 options)

3. Temperature Measurement

    a. Measurement Accuracy

        - Target below 100°C (212°F): ± 5°C (±9°F) accuracy
        - Target below 150°C (302°F): ± 5% accuracy
        - Target above 150°C (302°F): ± 15% accuracy

        Measured at 25°C ambient temperature. Inaccuracy can be greater at extreme temperatures.

    b. Object Temperature Range

        - High Gain Mode: 0°C to +160°C (32°F to 320°F)
        - Low Gain Mode: 0°C to +380°C (32°F to 716°F)

4. 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), QVGA (320 × 256)
        - 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), QVGA (320 × 256)
        - 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)

5. Audio:

    a. Line-level analog audio input

    b. Analog-to-digital conversion

    c. G.711 audio compression

    d. Digital audio output

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

    a. Input: two (2) dry alarm contacts

b. Output: two (2) relay contacts 1A max at 24VAC / 30VDC

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

d. One output dedicated to supporting third-party external infrared (IR) LED illumination

7. 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

B. Electrical:

1. Input Voltage: PoE 802.3bt; 12 VDC (±10%); 24 VDC (±10%); 24 VAC (±10%)

2. Power Consumption

a. Nominal: 15W

b. 12 VDC with heaters enabled: 48W

c. All other input voltages with heaters enabled: 70W

C. Connections:

1. Network: RJ45

2. Power Input:

a. 12 VDC: Through dedicated terminal block

b. 24 VDC / VAC: Through dedicated terminal block

c. PoE: Through RJ45 connection

3. Power Output:

a. 24 VAC x 2 (maximum 4.2A total): Through dedicated terminal blocks

3. microSD Card Slot: Up to 512GB on a Class 10 microSD/microSDHC/microSDXC card (minimum 8GB)

4. Audio In / Out: Through terminal block

5. Alarm In / Alarm Out: Through terminal block

D. Physical and Mechanical:

1. Dimensions, with sunshield: 233 x 124 x 313 mm / 9.2 x 4.9 x 12.3 in. (W x H x D)

2. Unit Weight: 11.3 lbs / 5.1 kg

E. Software:

1. Integrated web server

2. 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.

F. Environmental:

1. IP Rating (Dust & Water Ingress): IP66, IP67

2. Enclosure: NEMA 4X

3. Operating Temperature Range:

a. -40°C to 70°C (PoE 70W class 8 or 24V AC / DC)

b. -20°C to 70°C (PoE 50W class 6 or 12 VDC)

4. Storage Temperature Range: -55°C to 85°C

5. Corrosion: MIL-STD 810G, 1000hr salt spray

6. Humidity: 0-95% relative

7. Shock: IEC 60068-2-27

8. Vibration: IEC 60068-2-64

9. Vandalism: IK10 (except windows)

10. Surge Immunity on AC Power Lines: EN 50130-4

11. Surge Immunity on Signal Lines: EN 50130-4

12. Surge / Lightning Protection: TVS 6000V lightning protection, surge protection, voltage transient protection

G. Other Certifications:

1. USA: FCC Part 15 (subpart B, class A)

2. International: CE Marked, EN 50130-4, RoHS, NEMA 4X, WEEE, IEC 62368

H. Optional Accessories:

1. 421-0086-00: Illuminator mount bracket for FH-Series cameras
2. 421-0087-00: Wall mount adapter for FH-Series cameras
3. 500-1116-00: Large pole adapter assembly for pole diameter ⌀ 150-230 mm (6-9")
4. 500-1119-00: Corner mount assembly
5. 500-1120-00: Pedestal mount assembly
6. 500-1121-00: Small pole adapter assembly for pole diameter ⌀ 65-110 mm (2.6-4.3")

2.5. Required System Elements to Complete a Workable System

1. Digital Video Software or Video System See Section 282313 – Video Surveillance Control and Management Systems

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 ---