

INTELLIGENT SECURITY SYSTEMS SPECIFICATION

A. Substation security systems

The service provider is required to provide security services and solutions for various Eskom substations in the Cape Coastal Cluster (Eastern Cape and Western Cape) as detailed below.

The service provider(s) shall ensure that all equipment and systems supplied are fully compatible and integratable with the existing CathexisVision platform currently utilised within the Cluster.

All material and items used need to be in accordance with the specifications listed in the end.

1. Perimeter fence

- a) Install the optical fiber on the perimeter fence.
- b) Deploy panoramic or PTZ cameras along the perimeter fence and link them to the perimeter fence optical fiber.
- c) Deploy bullet cameras for intrusion detection in areas where fences are frequently overturned

2. Gates

- a) Deploy bullet cameras at the gates for real time monitoring

3. Substation control room

- a) Install HD network dome cameras inside the substation control room.

4. Battery room

- a) Install dome cameras in the battery room for intrusion detection.

5. Fibre sensing

The perimeter fence fiber sensing system needs to include the optic fiber sensing equipment and servers

6. *CCTV*

CCTV needs to be supported by network video recorder.

7. *CCTV backhaul*

CCTV backhaul needs to include various switches to access cameras, to aggregate traffic and to access serves. The firewall needs to be included.

8. *Video consultation*

Video consultation needs to include access wireless terminals

Storage for all recordings needs to be for at least 30 days.

B. CNCs, Complexes and Warehouses

The service provider is required to provide security services and solutions for various Eskom Customer Network Centres, Complexes and Warehouses in the Cape Coastal Cluster (Eastern Cape and Western Cape) as detailed below.

All material and items used need to be in accordance with the specifications listed in the end.

1. *Perimeter fence*

- a) Install the optical fiber on the perimeter fence.
- b) Deploy panoramic or PTZ cameras along the perimeter fence and link them to the perimeter fence optical fiber.
- c) Deploy bullet cameras for intrusion detection in areas where fences are frequently overturned.

2. *Gates*

- a) Deploy bullet cameras at the gates for real time monitoring

3. *Warehouse (internal)*

- a) Install PTZ cameras, dome cameras and bullet cameras inside the warehouse.

4. *Fibre sensing*

The perimeter fence fiber sensing system needs to include the optic fiber sensing equipment and servers

5. *CCTV*

CCTV needs to be supported by network video recorder.

6. *CCTV backhaul*

CCTV backhaul needs to include various switches to access cameras and access points, to aggregate traffic and to access serves. The firewall needs to be included.

7. *Video consultation*

Video consultation needs to include access wireless terminals

Storage for all recordings needs to be for at least 30 days.

C. Operation Centre

The service provider is required to provide and equip the security operation centres in the Cape Coastal Cluster (Eastern Cape and Western Cape) as detailed below.

All material and items used need to be in accordance with the specifications listed in the end. (The service provider needs to discuss with Eskom the requirements and specifications for additional material and items not listed in the end.)

The security operation centre should be equipped with the facilities below.

1. *Digital twin*

- a) Provide digital twin (3D) for the whole substation and equipment.
- b) Provide unified display of all information in one dashboard.

- c) Provide digital-physical linkage
- d) Interface with asset management and equipment control system.

2. Intelligent algorithm platform

- a) Provide equipment defect identification
- b) Provide equipment status identification
- c) Provide equipment safety identification
- d) Provide human behaviour identification

3. Consultation server

- a) Provide real-time video
- b) Provide multi-terminal access
- c) Provide multi-party collaboration
- d) Provide video Graffiti and Screen sharing
- e) Provide terminal real time interaction
- f) Provide record retention and traceability
- g) Provide platform openness

4. Private video cloud

- a) Periodically back up data from the substation and warehouse to the O&M center.

D. Substation plant monitoring system

The service provider is required to provide substation transformer monitoring services and solutions for various Eskom substations in the Cape Coastal Cluster (Eastern Cape and Western Cape) as detailed below.

All material and items used need to be in accordance with the specifications listed in the end.

1. Transformer monitoring

- d) Install thermal imaging Pan-Tilt camera for temperature measurement of the main body, cable connectors, insulating bushings, etc.

- e) Install visible light Pan-Tilt camera for readings of oil temperature gauge, winding temperature gauge, oil level gauge, main transformer breather, etc.

2. Substation control room

- b) Install HD Network dome cameras to monitor indicator lights, meters, switches, etc.

These dome cameras need to also be installed and positioned to monitor the environment (smoke, open fire, etc.) and personnel behaviour (during operating, etc.)

3. Battery room

- d) Install explosion-proof bullet cameras in the battery room for temperature monitoring (point, line and surface) on the battery body and cable joints.

4. CCTV

CCTV needs to be supported by network video recorder.

5. CCTV backhaul

CCTV backhaul needs to include various switches to access cameras, to aggregate traffic and to access serves. The firewall needs to be included.

6. Video consultation

Video consultation needs to include access wireless terminals

Storage for all recordings needs to be for at least 30 days.

E. Video consultation

The service provider is required to provide video consultation solution and service in the Cape Coastal Cluster (Eastern Cape and Western Cape) as detailed below.

All material and items used need to be in accordance with the specifications listed in the end. (The service provider needs to discuss with Eskom the requirements and specifications for additional material and items not listed in the end.)

1. Terminals

Use smart helmets, dome cameras, and bullet cameras as terminals.

2. Network

Use Wi-Fi, LTE/4G, MTN or Vodacom APN for networking.

3. Hardware infrastructure

The hardware infrastructure should consist of the following:

- a) Virtualization
- b) Container
- c) Cluster
- d) Computing
- e) Storage

4. Software abilities

The software used should have the following abilities:

- a) Smart device access
- b) Real time video
- c) Multi-party collaboration

F. Warranty

The material and items used, and work performed to provide the security system solution need to be warranted for a period of at least two (2) years.

Distributed Fiber-Optic vibration detection system

The distributed fiber-optic vibration detection system should be designed for 24-hour perimeter protection of small campuses like substations and data centers, featuring advanced sensing technology and low false positive rates. It should offer comprehensive detection capabilities with a maximum measurement distance of 5 km and a fast event identification time of under 5 seconds.

Features:

- 1) The system should detect vibrations caused by intruders, such as climbing or cutting fences, and report them instantly.
- 2) The system should integrate with surveillance cameras for visual verification, enabling security staff to view live, zoomed-in video of the alarm location.
- 3) The system should have optical Digital Signal Processing (oDSP) algorithms and an integrated judgment mechanism, that filters out environmental noise like wind, rain, or small animals.

- 4) The fiber cables on the fence should be passive (maintenance-free and easy to deploy).
- 5) The system should handle harsh weather conditions, including heavy rain and strong winds

Specifications (*Distributed fiber-optic vibration detection device*)

Description	Quantity
Installation mode	In a 19-inch rack
Dimensions (H x W x D)	88.1 mm x 442 mm x 220 mm
Number of channels	1
Maximum one-channel measurement fence distance	5 metres
Event identification time of a single port	≤ 5 seconds
False positive rate	≤ 1 time/km/day
False negative rate	< 1%
Positioning accuracy	≤ 5 metre
Operating temperature	-5°C to +45°C
Relative humidity	5% to 85%
Power supply	230 V AC
Power consumption	≤ 95 W

NCE (server)

Features:

- 1) Network Cloud Engine (NCE) is the component of the intelligent network and security solutions, and it should be designed to deliver automated, secure, and intelligent infrastructure management.
- 2) It should integrate management, control, analysis, and AI functions.
- 3) It should translate application intent into network configurations, providing full-lifecycle management (deployment, provisioning, and maintenance).
- 4) It should integrate network management with security policies and IoT expansion.

SAE (server)

Features:

- 1) SAE (Secure Access Service Edge/SAE authentication) is the component of the intelligent network and security solutions, and it should be designed to deliver automated, secure, and intelligent infrastructure management.
- 2) SAE should be applied in the context of security protocols within WPA3 wireless standards.
- 3) WPA3-SAE should be utilised for advanced wireless security.

CCTV System

The system should consist of an intelligent Network Video Recorder (NVR), PTZ camera and Dome camera.

Features:

NVR

- 1) The intelligent Network Video Recorder (NVR) should be designed to be compact for edge AI applications.
- 2) It should utilize AI-powered computing to provide advanced video analytics and high-performance storage for intelligent substation scenarios.
- 3) It should support up to 32 TOPS (Trillions of Operations Per Second) of computing power to run complex, concurrent algorithms, such as face recognition, behaviour analysis, and vehicle recognition.
- 4) It should support up to 128 channels of video access (512 Mbit/s) and provides intelligent analysis for up to 16 channels, or up to 64 channels of image analysis (depending on the specific model).
- 5) It should feature SafeVideo technology, which ensures data is still readable and writable even if multiple hard disks fail simultaneously.

- 6) It should be 3U embedded, quiet desktop-level or cabinet-mountable server with hot-swappable hard disks for easy maintenance.
- 7) It should use an embedded Linux system for 24/7 stability, optimized for security.

NVR Specification

Description		Quantity
Access and bandwidth		Supports up to 64-channel network video access. Video input bandwidth is 320 Mbit/s (160 Mbit/s when intelligent services are enabled).
Storage & Reliability		Hybrid storage for video and images. Features SafeVideo technology, ensuring data readability in scenarios with hard disk failures (RAID 5). Data Safe ensures dual backup of key system data.
Intelligence		Supports algorithm plug-in integration, including target analysis, person analysis, vehicle analysis, behavior analysis, and smart tracking
Processor & Operating System		Embedded Linux OS with a high-performance 8-core CPU.
External Ports	Networking	2 x 10/100/1000 Mbit/s Ethernet ports
	USB	3 x USB ports (2 x USB 2.0 on front, 1 x USB 3.0 on rear)
	Audio	1 x RCA input, 1 x RCA output
	Alarm	16 alarm-in ports and 4 alarm-out ports
	Video Out	Dual HDMI (one 4K, one 1080p) and one VGA port
Chassis & Power	Chassis	2U or 3U
	Power Supply	100–240 V AC, 900 W (max.)
Operating temperature		Operating temperature ranges from –10°C to +55°C
Video Formats		H.264, H.265, and MJPEG
Management		Local Display Unit (LDU) or client/server (iClient) management
Storage Support		Compatible with 4 TB, 6 TB, 8 TB, 10 TB, or 16 TB enterprise-level disks

PTZ Camera (for perimeter) specification

Description		Quantity
Image sensor		Dual 1/1.8" CMOS sensors
Resolution		4MP (2560 x 1440 pixels) for both lenses
Lenses	Prime Lens	F1.0 wide aperture for panoramic awareness
	Zoom Lens	5.5mm to 220mm (40x optical zoom) with F1.8 to F3.8 aperture
Illumination		IR range up to 200m; white light illumination up to 30m
Minimum Illumination		Color 0.0003 lux; B/W 0 lux with IR enabled
Computing Power		4 TOPS
Intelligence Features		Supports omni-data structuring, behavior analysis (tripwire, intrusion), target/body detection, and crowd flow analysis
ISP Performance		AI ISP-based video stream noise reduction and Super Wide Dynamic Range (WDR) of 120 dB
PTZ Movement		360° continuous pan and -10° to +90° tilt
Protection Rating		IP66 (weatherproof), IK10 (vandal-resistant), and 6 kV surge protection
Operating Range		-40°C to +60°C temperature; 5% to 95% humidity
Power Supply		24V AC or PoE (IEEE 802.3bt)
Power Consumption		Maximum 56.7 W; typical 17.6 W
Local Storage		MicroSD slot supporting up to 256 GB
I/O Ports		4 alarm inputs, 2 alarm outputs, 1 audio line-in/mic-in, and 1 audio line-out

Dome Camera specification

Description	Quantity
Image Sensor	1/2.7" 5MP CMOS sensor with a resolution of 2880(H) x 1620(V)
Focal Length	2.8–12mm manual zoom lens

Aperture	F1.3 (Wide) to F2.4 (Tele)
Field of View	Horizontal range from 32°C (Tele) to 95°C (Wide)
Night Vision	Infrared (IR) range up to 30 metres using 850nm wavelength
Dynamic Range	120 dB Super Wide Dynamic Range (WDR) for clear images in high-contrast light
Computing Power	1 TOPS (Tera Operations Per Second)
Target Detection	Supports target detection, person detection, and target attribute recognition
Behaviour Analysis	Detects fast movement, tripwire crossing, intrusion, area entry/exit, and loitering
Crowd Analysis	Provides queue length monitoring, head counting, and crowd flow statistics
Compression	Uses SuperCoding technology to reduce bit rates by up to 50%
Memory	1.0 GB DDR3 RAM and 512.0 MB SPI NAND Flash
Architecture	Software-defined architecture allowing algorithm loading and upgrades
Adaptation	Supports backlight and overcast adaptation modes
Durability	Typically supports IP67 (weatherproof) and IK10 (vandal-resistant) ratings

Access Switch specification

Description	Quantity
Downlink Ports	24/48 x 10/100/1000BASE-T or 10GE SFP+
Uplink Ports	4 x 10GE SFP+ or 40GE/100GE QSFP+
Switching Capacity	Up to 2.4 Tbit/s (S6730), ranging up to 12.8 Tbps on high-end aggregation
PoE Support	Supports PoE (802.3af), PoE+ (802.3at), and 90W PoE++ (802.3bt)
Performance	1.2GHz or higher CPUs with 2GB RAM / 1GB Flash

Software & Intelligence	Supporting VXLAN, telemetry, and automated network management
Intelligent Stacking (iStack)	Allows multiple switches to function as a single logical unit
Reliability	Supports 50 ms protection switching using SEP or ERPS protocols
Operating Temperature	Typically –5°C to +50°C

Core Switch specification

Description	Quantity
VXLAN	Supports full-stack VXLAN for highly virtualized, automated networks
Intelligent O&M	Features iPCA (Packet Conservation Algorithm) for measuring network quality, pinpointing faults within minutes
IPv6	Native support for SRv6 and high-performance IPv6 service processing
Port density	400GE/100GE
Switching capacity	14.4 Tbit/s per slot
Reliability	M-LAG (Multichassis Link Aggregation Group) ensures sub-millisecond failover

TOR Switch specification

Description	Quantity
Network Virtualization	Supports VXLAN routing and bridging and BGP-EVPN for building elastic cloud fabrics
Reliability	M-LAG and iStack
Intelligent O&M	Telemetry for real-time monitoring and sFlow/NetStream for deep traffic analysis

Firewall specification

Description	Quantity
Threat Defense	AI-powered Detection Engine (CDE) identifies unknown ransomware/threats and provides 95% detection accuracy
Performance	Built-in hardware acceleration engines (NP) enable optimized forwarding, IPS, and IPsec processing, ensuring high throughput
Throughput & Scaling	Ranging from 10 Gbit/s to 4 Tbit/s depending on the model
Application Control	Identifies and controls over 6,000 applications (e.g., SQL injection, XSS) and supports application-layer defense
Capacity	High concurrent session support, with up to 960 million sessions
Reliability	Supports 99.9% availability, featuring redundant power modules and hot-swappable components
AI-Powered Detection	Protects against unknown and evasive threats using machine learning
Unified Management	Integrates IPS, anti-DDoS, and URL filtering into a single management platform, reducing OPEX
VPN Support	Supports high-availability IPsec VPN and SSL VPN
Encrypted Traffic	Capable of detecting threats within encrypted traffic without requiring full decryption

Outdoor access point (AP) specification

Description	Quantity
Wi-Fi Standard	Wi-Fi 6 (802.11ax)
Data Rates	At least 1.775Gbps (2x2 MIMO)

Radios	Simultaneous 2.4 GHz and 5 GHz (or 6 GHz) radios
Environmental Protection	IP68-rated for waterproofing and dustproofing
Operating temperature	-40°C to +65°C
Surge Protection	Up to 6kV or 6 kA surge protection on Ethernet ports
Antennas	Built-in smart antennas or external antenna options for optimized coverage
Interfaces	Gigabit Ethernet (GE) electrical ports and SFP optical ports for long-distance uplink
Deployment	Supports Fit, Fat, and Cloud management modes

Thermal imaging pan-tilt camera (for transformer monitoring) specifications

Description	Quantity
<i>Thermal imaging</i>	
Detector Type	Uncooled VOx (Vanadium Oxide) IR focal plane detector
Resolution	640 x 512
Thermal Pixel Spacing	12 µm
Thermal Lens Focal Length	25 mm
Temperature Measurement Range	-20°C to +550°C
Temperature Measurement Accuracy	±2°C or ±2% of range
Detection Distance	3m to 30m
<i>Visible light camera (dual spectrum)</i>	
Image Sensor	1/1.8" Progressive Scan CMOS
Resolution	5MP (2880 x 1620)
Optical Zoom	32x
Focal Length	5–160mm
Min Illumination	Color: 0.005 lux; B/W: 0.0025 lux (F1.2)
<i>Pan-Tilt-Zoom (PTZ) Capabilities</i>	
Rotation Angle	Pan: 0°–360° (continuous), Tilt: -90°–90°
Rotation Speed	Pan: 0.1–80°/s (manual) Tilt: 0.1–60°/s (manual)
Preset Positions	512
Park Action	Supported
<i>Intelligence and Security</i>	
AI TOPS	2.5 TOPS (used for object recognition and intelligent analysis)

Thermal Functions	Hot/cold spot tracking and temperature analysis
Video Encoding	H.265 / H.264 / MJPEG
Structure and Environment	
Protection Rating	IP66
Vandal Resistance	IK10
Operating Temperature	-40°C to +60°C
Power Supply	AC24V & PoE

Visible light pan-tilt camera (for transformer monitoring) specifications

Description	Quantity
Camera & Imaging	
Sensor	1/1.8" Progressive Scan CMOS sensor
Resolution	5MP (2880 × 1620) resolution
Zoom	32x optical zoom and 16x digital zoom
Focal Length	5 mm to 160 mm
Minimum Illumination	Color: 0.005 lux (F1.2); B/W: 0.0025 lux (F1.2)
WDR	Physical WDR 120 dB
Illumination Distance	100m for LED supplementary lighting
PTZ (Pan/Tilt/Zoom) Performance	
Pan Range	0°–360° continuous rotation
Tilt Range	-90° to +90° (auto-flip)
Pan Speed	0.1°–240°/s (manual); 100°/s (preset)
Tilt Speed	0.1°–160°/s (manual); 60°/s (preset)
Presets	Supports up to 512 preset positions
AI & Intelligence	
Computing Power	2.5 TOPS (Trillion Operations Per Second)
Intelligent Functionality	Supports intelligent video analytics, including behavioral analysis, crowd density detection, and object classification
Video & Audio	
Video Encoding	H.265/H.264/MJPEG
Frame Rate	Up to 5MP@30fps
Audio	Built-in audio input and output interfaces
Durability & Physical	
Protection Rating	IP66 for weather resistance
Impact Resistance	IK10 rating
Power Supply	AC24V and PoE (Power over Ethernet)

HD Network Dome Camera (for control room monitoring) specification

Description	Quantity
Imaging System	1/1.8" CMOS sensor, 4MP resolution
Dual-Lens Design	Supports both a panoramic view and detailed zoom capture
Optical Zoom	40x optical zoom lens (5.4–216 mm) and a wide-angle prime lens (5 mm)
AI Computing Power	2 TOPS (Trillion Operations Per Second)
Intelligent Analysis	Supports automatic tracking, behavior analysis, crowd flow analysis, object classification (motor vehicle, non-motorized vehicle, and pedestrian), vehicle recognition, traffic flow statistics, and parking violation detection
Image Quality	120 dB Super Wide Dynamic Range (WDR), backlight adaptation, and overcast adaptation
PTZ & Stabilization	Built-in six-axis gyroscope for image stabilization and built-in electronic compass/accelerometer for real-time PTZ direction tracking
Infrared Range	Supports infrared (IR) for night vision with a distance of up to 200 meters
Security/Storage	Supports MicroSD card storage (max capacity not explicitly listed, but supports secure encrypted storage)
Environmental Protection	IP66-rated protection
Operating Conditions	-40°C to +60°C operating temperature range
Power Supply	AC24V; PoE (IEEE 802.3bt)
Omni-data Structuring	Extracts features from pedestrian, motor vehicle, and non-motorized vehicle images for intelligent search
Algorithm Upgrades	Supports online loading and upgrading of AI algorithms
Fog Detection	Uses deep learning algorithms for agglomerate fog detection

Panoramic camera specification

Description	Quantity
ROM	
Image sensor	Panorama camera: 1/1.8" 2-megapixel CMOS sensor; PTZ dome camera: 1/1.8" 4-megapixel CMOS sensor
Resolution	Panorama camera: 16 megapixel; PTZ dome camera: 4-megapixel
Maximum resolution	8192 (H) x 1800 (V)
ROM	Panorama camera: 8 GB; PTZ dome camera: 8 GB
Memory	Panorama camera: 4 GB; PTZ dome camera: 2 GB
Scanning mode	Progressive scan
Electronic shutter	Automatic, manual, or 1/100,000s to 1/3s
Minimum illumination	Panorama camera: 0.0005 lux @ F1.0 (color mode); 0.0002 lux @ F1.0 (B/W mode) PTZ dome camera: 0.001 lux @ F1.4 (color mode); 0.0005 lux (B/W mode); 0 lux (illuminator enabled)
SNR	> 56 dB
Maximum radiation distance	Panorama camera: N/A PTZ dome camera: ≥ 400 m
Illuminator	7 PCS (infrared LED)
Lens	
Lens type	Panorama camera: prime lens PTZ dome camera: zoom lens
Focal length	Panorama camera: 2.8 mm PTZ dome camera: 5.5 mm to 220 mm
Max f-number	Panorama camera: F1.0 PTZ dome camera: F1.4

Angle of view (AoV)	Panorama camera: 360° (horizontal); 111° (vertical) PTZ dome camera: 2.2°–61.8° (horizontal); 1.3°–36.3° (vertical); 2.4°–69.2° (diagonal)
Iris type	Panorama camera: fixed iris PTZ dome camera: automatic iris
Iris control mode	Panorama camera: N/A PTZ dome camera: P-iris
Minimum object distance	Panorama camera: 1.4 m PTZ dome camera: 0.5–2 m
Lens DORI distance	
Panorama camera	Detection: 57.9 m
	Observation: 23.2 m
	Recognition: 11.6 m
	Identification: 5.8 m
PTZ dome camera	Detection: 3030 m
	Observation: 1204 m
	Recognition: 606 m
	Identification: 303 m
PTZ	
Pan/Tilt range	Pan: 0° to 360° Tilt: –11° to +90°; automatic rotation: 180°
Manual control speed	Pan: 240°/s Tilt: 100°/s
Speed adjustment on the long-focus lens	Supported
Positioning error	Vertical: 0.05° Horizontal: 0.05°
Automatic positioning calibration	Supported
Remote lens reset	Supported
Remote PTZ reset	Supported
Maximum number of preset positions	300
Automatic tour	8 (a maximum of 32 preset positions for each tour) <i>It supports up to 8 automatic tours, with each tour containing a maximum of 32 individual preset positions</i>
Automatic tracking	5 <i>The system has capacity to configure and store up to 5 simultaneous automatic tracking rules or paths</i>
Automatic linear scan	5 <i>The camera allows operators to configure and save 5 linear scan paths</i>
Power-off memory	Supported

Actions during off-peak hours	Preset position rotation, tracking, tour, and linear scan
Scheduled tasks	Preset position rotation, tracking, tour, and linear scan
3D positioning	Supported
PTZ rotation limit	Supported
Azimuth display	Supported
Information display	Supported
Time display	Supported
PTZ restart	Supported
AI	
IVS (perimeter detection)	Tripwire crossing detection, intrusion detection, and parking detection
Video	
Video compression format	H.265, H.264, H.264H, H.264B, and MJPEG (supports only secondary streams)
Intelligent encoding	H.264 H.265
Video frame rate	Panorama camera: Primary stream: 8192 x 1800 @ 1–25 fps Secondary stream: 2048 x 452 @ 1–25 fps Third stream: 3840 x 832 @ 1–25 fps PTZ dome camera: Primary stream: 2560 x 1440 @ 1–25 fps; secondary stream: 704 x 576 @ 1–25 fps Third stream: 1920 x 1080 @ 1–25 fps
Resolution	Panorama camera: Primary stream: 8192 x 1800, 7680 x 1680, 5760 x 1264, 4096 x 900 Secondary stream: 2048 x 452 Third stream: 3840 x 832, 2560 x 560 PTZ dome camera: Primary stream: 2560 x 1440, 1920 x 1080, 1280 x 960, 1280 x 720 Secondary stream: 704 x 576, 640 x 480, and 352 x 288 Third stream: 1920 x 1080, 1280 x 960, 1280 x 720
Bit rate control	CBR/VBR
Video bit rate	Panorama camera: 112 kbit/s to 37227 kbit/s (H.264) or 44 kbit/s to 22546 kbit/s (H.265)

	PTZ dome camera: 512 kbit/s to 13056 kbit/s (H.264) or 204 kbit/s to 7936 kbit/s (H.265)
Backlight compensation (BLC)	Supported
Highlight compensation (HLC)	Supported
Wide dynamic range (WDR)	Panorama camera: N/A PTZ dome camera: 120 dB
Scene adaptation (SSA)	Supported
White balance	Automatic, natural light, streetlamp, outdoor, manual, and custom area
Gain control	Automatic or manual
Noise reduction	3D noise reduction
Motion detection	Enable/Disable (a maximum of four rectangular areas)
Default bit rate at the default resolution	Panorama camera: 6144 kbit/s (8192 x 1800) PTZ dome camera: 6144 kbit/s (2560 x 1440)
Region of Interest (ROI)	Panorama camera: supported (4 ROIs) PTZ dome camera: supported (8 ROIs)
Image stabilization	Panorama camera: N/A PTZ dome camera: electronic image stabilization
Defogging	Panorama camera: N/A PTZ dome camera: optical defogging
Image rotation	Panorama camera: N/A PTZ dome camera: supported
Privacy mask area	Panorama camera: 4 PTZ dome camera: 24 (8 for each preset position)
Audio	
Audio port	Supported
Audio compression format	PCM (default), G.711a, G.711Mu, G.726, G.723, G.711a
Audio sampling rate	8 kHz; 16 kHz; 32 kHz; 48 kHz; 64 kHz
Port	
RS-485	One (baud rate range: 1200 bit/s to 115,200 bit/s)
Audio-in port	2 (wiring terminal)
Audio-out port	2 (wiring terminal)
Alarm-in port	7 (3–5 V DC, 5 mA)
Alarm-out port	3 (30 V DC, 1000 mA/50 V AC, 500 mA)
Analog-out port	1 (CVBS output: BNC)
Network	

Network port	RJ45 (10/100/1000 Mbit/s)
SDK and API	Supported
Network protocol	IPv4, IPv6, HTTP, TCP, UDP, ARP, RTP, RTSP, RTCP, RTMP, SMTP, FTP, SFTP, DHCP, DNS, DDNS, QoS, UPnP, NTP, multicast, ICMP, IGMP, NFS, SAMBA, PPPoE, SNMP
Network security	Stream encryption; firmware encryption; configuration encryption; Digest authentication; WSSE; account lock; security log; IP/MAC address filtering; X.509 certificate generation and import; syslog; HTTPS; 802.1X; trusted boot; trusted execution; trusted upgrade
Access protocol	ONVIF (Profile S/Profile G/Profile T), CGI, P2P
Maximum number of concurrent video viewing channels	20 (total bandwidth: 400 Mbit/s)
Storage	FTP; SFTP; microSD card (up to 512 GB); NAS
Environment	
Operating temperature	–40°C to +70°C
Operating humidity	≤ 95%
IP rating	IP66

Outdoor access switch specification

Description	Quantity
Performance	Up to 176 Gbps switching capacity
Port Options	Available with 8, 16, 24, or 48 Downlink GE ports, plus 2 GE SFP or 4 10GE SFP+ uplink ports
PoE Capability	Supports PoE+ (802.3at)
Industrial Hardened	IP40 protection
Operating temperature	–40°C to +70°C
Reliability	Supports 1+1 redundant power supply input and stack capability
Management	Intelligent network O&M with Telemetry and iMaster NCE-CampusInsight for rapid fault detection
Networking	Supports advanced features like ERPS (20ms fast protection) and various Layer 3 protocols

Access switch specification

Description	Quantity
Model Variants	Available in 24 and 48-port configurations
Downlink Ports	Support for 24/48 x 100M/1/2.5G Base-T or high-speed 100M/1/2.5/5/10G Base-T auto-sensing ports
Uplink Ports	4 x 1/10/25GE SFP28 ports and 2 x 40/100GE QSFP28 ports (40GE can split to 4x10GE; 100GE can split to 4x25GE)
PoE Capability	Supports PoE++ (90W) on many models, facilitating direct power for high-demand APs
Switching Capacity	Up to 2.4 Tbps
Power Supply	Pluggable power modules, supporting 1+1 or N+1 redundancy, with AC/DC power options
Virtualization	Supports VXLAN and BGP EVPN for creating converged, virtualized campus networks
Security	MACsec support on all ports provides end-to-end (E2E) encryption for high-security environments
Operating Temp	-5°C to +45°C

Bullet camera specifications

Description	Quantity
Computing Power	2.5 TOPS (Trillions of Operations Per Second)
Imaging Sensor	1/1.8" sensor
Lens	2.8-12mm focal length
Resolution	Can be upgraded to 4MP, 6MP, or 8MP via licensing
AI Capabilities	Supports behavior analysis, crowd flow analysis, target detection, person detection, object classification (motor

	vehicles, non-motorized vehicles, pedestrians), and license plate recognition
Wide Dynamic Range (WDR)	130 dB super WDR for balanced lighting in high-contrast environments
Noise Reduction	AI HNR (HoloWits Noise Reduction) for improved low-light color performance
Encoding	SuperCoding2.0, which reduces bit rates by up to 60% compared to standard H.265
Memory	2.0 GB LPDDR4x
Storage	NAND FLASH 512.0 MB