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Automatisch generierte Beschreibung

Video Management System A&E Specification

Construction Specifications Institute (CSI) edition

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| A&E Specification for Video Management System  Based on MOBOTIX HUB L3 (2021-R1) |
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| Prepared by: |
| MOBOTIX AG  17 May 2021 |

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Specifications

This Architectural and Engineering Specifications document utilizes MasterFormat™ Titles and Numbers April 2018 Edition and SectionFormat™/PageFormat™ December 2009 Edition standards by the Construction Specifications Institute (CSI).

This document specifies the architectural/engineering and bid criteria for a premises-based networked Video Management System (VMS) .

Notes to Specifier

1. Where several alternative parameters or specifications exist, or where the Specifier has the option of inserting text, such choices are presented in **bold red text**.
2. Explanatory notes and comments are presented in red hidden text.
3. Delete any item or paragraph that is not applicable to this project, renumber the paragraphs. Insert additional provisions as required for this project.

Document Disclaimer and Restrictions

Information in this document was current as of the time of publication, and subject to change without notice. For the most up-to-date information, visit <http://www.mobotix.com/>.

1. Section 28 23 00
   1. Video Management System

[**Specifier Note:** Delete Specifier Notes and unused optional items in red.]

* + 1. General
  1. Summary
     + - 1. *Section Includes:* Description, architectural and functional requirements, data security requirements, operational capabilities, and computer equipment requirements for a single or multi-site on-premises Video Management System (VMS) supporting an unrestricted number of users, devices, servers and sites.
         2. *Compliance:* System equipment and installation shall comply with all provisions and requirements of this specification as well as all applicable national, state and local codes and standards.
         3. Products Furnished **[or]** Supplied But Not Installed Under This Section.

[**SPECIFIER NOTE:** Delete this Article if not used. Replace “Furnished **[or]** Supplied” with either “Furnished” or “Supplied”, as which word to use is a matter of preference. Briefly list products that are only furnished/supplied by this section, but whose installation is specified in other sections. For example, these may be new products “installed by owner”.]

* + - * 1. Products Installed But Not Furnished **[or]** Supplied Under This Section.

[**SPECIFIER NOTE:** Delete this Article if not used. Replace “Furnished **[or]** Supplied” with either “Furnished” or “Supplied”, as which word to use is a matter of preference. Briefly list products that are only installed by this section but are furnished/installed under other sections. For example, these may be new products “furnished by owner”, or existing devices previously installed.]

* + - * 1. *Related Requirements*:

[**SPECIFIER NOTE:** Delete any item or paragraph not applicable in this Article . The purpose of Related Requirements is to briefly list other documents or sections in the Project Manual that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to documents or sections with specific information that the reader might expect to find in this document but are specified elsewhere (i.e. in a separate Project document).]

Section 27 00 00 Communications (Division 27).

Section 27 05 00 Common Work Results for Communications.  
[**SPECIFIER NOTE:** For general requirements that are common to more than one section in Division 27.]

Section 27 05 28 – Pathways for Communication Systems.

Section 27 10 00 – Structured Cabling.

Section 27 13 00 – Communications Backbone Cabling.

Section 27 15 00 – Communications Horizontal Cabling.

Section 28 00 00 Electronic Safety and Security (Division 28).

Section 28 05 00 – Common Work Results for Electronic Safety and Security. [**SPECIFIER NOTE:** For general requirements that are common to more than one section in Division 28.]

Section 28 08 00 Commissioning of Electronic Safety and Security.   
[**SPECIFIER NOTE:** For expanded requirements for commissioning, systems readiness checklists, and training.]

28 08 11 Testing for Baseline Performance Criteria.

* + - 1. References
         1. Trademarks Used in This Document:

*Apple*: Safari®

*Digital Living Network Alliance:* DLNA®

*Google*: Google Chrome™

*Intel:* Intel®, Core™, Xeon®

*Microsoft:* Microsoft®, Outlook®, Windows®, Active Directory®, Hyper-V®, SQL Server®, Microsoft Internet Explorer®

*NVIDIA:* NVIDIA®

*Mozilla*: Mozilla®, Firefox®

*VMware:* VMware®

* + - * 1. Abbreviations and Acronyms:

*ACC*: Advanced Audio Coding.

*AES*: Advanced Encryption Standard.

*API*: Application Programming Interface.

*CA*: Certificate Authority.

*DES*: Data Encryption Standard.

*DLNA*: Digital Living Network Alliance.

*EULA*: End User License Agreement.

*FIPS*: Federal Information Processing Standards.

*FPS*: Frames per Second.

*Full HD*: High Definition video resolution of 1920 x 1080 pixels.

*GB*: Gigabyte.

*GOP*: Group of Pictures.

*H.264/H.265*: Video compression formats.

*HD*: High Definition video resolution of 1280 x 720 pixels.

*HTML*: Hyper Text Markup Language.

*HTTPS*: Hyper Text Transfer Protocol Secure.

*I/O*: Input/Output.

*IP*: Internet Protocol.

*JPEG*: Joint Photographic Experts Group (image format).

*LAN*: Local Area Network.

*LPR*: License Plate Recognition.

*MPEG*: Moving Picture Experts Group (video format).

*NAS*: Network Attached Storage.

*NAT*: Network Address Translation.

*ONVIF*: Open Network Video Interface Forum.

*PTZ*: Pan-Tilt-Zoom.

*RTSP*: Real Time Streaming Protocol.

*SDK*: Software Development Kit.

*SVQR*: Scalable Video Quality Recording.

*UPnP*: Universal Plug and Play.

*UPS*: Uninterruptible Power Supply.

*VMS*: Video Management System.

*WAN*: Wide Area Network.

* + - * 1. Definitions:

*AAC Audio Codec*: Advanced Audio Coding is a proprietary audio coding standard for lossy digital audio compression.

*Active Media Storage:* High-performance media storage used for active video, audio and metadata recording.

*Application Programming Interface (API):* Set of clearly defined methods of communication between various software components.

*Archived Media Storage:* Secondary media storage used for storing video, audio and metadata beyond an initial retention period.

*Authentication:* Process that establishes the origin of information or determines an entity’s identity.

*Authorization:* Process that associates permission to access a resource or asset with a person and the person’s identifier(s) for the purpose of granting or denying access.

*Bit Rate:* Number of bits per time unit sent over a network.

*Contractor:* Firm selected by Owner and any of Contractor’s subcontractors, vendors, suppliers or fabricators, to perform work specified in these contract documents and supporting documentation. Contractor shall supply all equipment, labor, material and services necessary to complete the project construction in accordance with Contract Documents.

*Central Processing Unit (CPU):* General purpose electronic circuitry within a computer that carries out the instructions of a computer program, typically contained in a single integrated circuit chip.

*Digital Living Network Alliance:* Standards-making group for consumer electronics manufacturers establishing interoperability among consumer devices for picture and video display.

*Dwg-files*: Proprietarybinary file format used for storing two- and three- dimensional design data and metadata.

*Dxf-files*: CAD data file format developed by Autodeskfor enabling data interoperability between AutoCAD and other programs.

*Federal Information Processing Standards*: A set of U.S. government standards that define the critical security parameters that vendors must use for encryption before selling the software or hardware to U.S. government and regulated industries.

*G.711 Audio Codec*: ITU-T standard audio codec that provides toll-quality audio.

*G.726 Audio Codec*: ITU-T ADPCM speech codec standard covering the transmission of voice.

*Graphics Processing Unit (GPU):* Specialized electronic circuit designed to rapidly decode video, manipulate images and accelerate the creation of video images in a video frame buffer intended for output to a display device, much more efficiently than can be done by general purpose computer CPUs. GPUs are used in mobile phones, personal computers, workstations and game consoles.

*Group of Pictures (GOP):* In video coding, a group of pictures, or GOP structure, specifies the order in which intra- and inter-frames are arranged. The GOP is a collection of successive pictures within a coded video stream. Each coded video stream consists of successive GOPs, from which the visible frames are generated. Encountering a new GOP in a compressed video stream means that the decoder doesn't need any previous frames to decode the next ones and allows fast seeking through the video.

*Hardware Acceleration:* Use of computer hardware (such as a GPU) to perform some functions more efficiently than is possible in software running on a more general-purpose CPU.

*Kerberos:* Ticket-based network authentication protocol designed to provide strong authentication for client/server or server/server applications.

*Multi-site:* Reference to a VMS that spans multiple physical site locations.

*Open Network Video Interface Forum (ONVIF):* Global and open industry forum for the creation of standards for how IP-networked products within video surveillance and other physical security areas can communicate with each other.

*Pre-buffering:* Temporary storage of video and audiofor pre-recording.

*Pre-recording:* Automatically recording video and audio starting a specified number of seconds just before the event or time condition that initiated the recording.

*Post-recording:* Automatically continuing the recording of video and audio for a specified number of seconds after the end of the event or time condition that initiated the recording.

*PTZ Patrolling or PTZ Tour:* Automatically moving a camera through a specified series of preset PTZ positions, dwelling on those positions for a specified amount of time, and transitioning between the preset positions at a specified speed.

*Reseller:* Contractor authorized by manufacturer to furnish, install and maintain manufacturer’s VMS, who may be the primary contractor or a subcontractor for the provision of this project’s VMS.

*Universal Plug and Play (UPnP):* Set of networking protocols that permits networked devices, such as personal computers, printers, Internet gateways, Wi-Fi access points, IP video cameras and mobile devices to seamlessly discover each other's presence on the network and establish functional network services for data sharing and communications.

* + - 1. Submittals
         1. *Submission:* Submit under provisions of Section 01 30 00 - Administrative Requirements.
         2. *Product Data:* Provide manufacturer's data sheets and installation manuals on each product to be used, including:

Preparation instructions and recommendations.

Storage and handling requirements and recommendations.

Installation methods.

* + - * 1. *Shop Drawings:* Provide the following drawings.

Schematic of system components with physical space requirements.

System network topology diagram.

Connecting riser diagrams for all interfacing equipment.

List of all equipment with part numbers.

Locations for all components to be installed under this scope of work.

* + - 1. Closeout Submittals
         1. *As-Built Drawings:* Provide original shop drawings modified to reflect changes made to comply with installation/configuration requirements and actual field conditions.
         2. *Maintenance Contracts:* Submit a maintenance service agreement, including cost and services for a two-year period for Owner’s review.
         3. *Warranty Documentation:* Submit manufacturer’s standard VMS warranty.
      2. Quality Assurance

[**SPECIFIER NOTE**: Use this article to describe owner requirements for contractor experience, certifications and references. Delete if not applicable.]

* + - * 1. *Qualifications*:

Manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, material and services specified for this project for commercial, military or industrial use.

*Contractors / Installers*:

*Licensure:* Contractor or security sub-contractors shall be licensed to perform security installations in the state/region where the work is to be performed if so required.

*Experience:* Contractor or security sub-contractor shall have a minimum of three years of experience installing and servicing systems of similar scope and complexity**.**

* + - * 1. *References:* Contractor shall provide four current project references from clients with systems of similar scope and complexity which became operational in the past three years**.**

At least three references shall be utilizing the same system components, in a similar configuration as the proposed system.

References shall include a current point of contact, company or agency name, business address, telephone number, and if the contact agrees, include a basic system description and date of project completion. The owner reserves the option to visit the reference sites, with the site owner’s permission and representative, to verify the quality of installation and the reference’s level of satisfaction with the system.

* + - * 1. *Technician Certification:* Utilize only manufacturer-trained technicians to install, program, and service VMS equipment**.**

Ensure technicians have a minimum of five continuous years of technical experience in electronic security systems including IP networking and VMS solutions**.**

*Dealer Certification:* Provide evidence that installing service company is an authorized dealer in good standing for the product’s manufacturer, and that it meets the manufacturer’s technical certification requirements.

* + - 1. Delivery, Storage and Handling
         1. Deliver software installation packages via download directly from manufacturer’s web site
         2. Software installation packages must be digitally signed by the manufacturer.
      2. Site conditions
         1. *Ambient Conditions*:

[**SPECIFIER NOTE:** Identify site specific ambient conditions under which work must be performed such as bad lighting, obstacles, or extreme cold/heat that installers or equipment may have to deal with. Delete if not needed.]

* + - * 1. *Existing Conditions*:

[**SPECIFIER NOTE:** Identify site specific existing conditions. Such as the condition of existing work subject to reworking or modification. Delete if not needed.]

* + - 1. Warranty and Suppport
         1. *Manufacturer Warranty and Support*:

*Software Warranty*:

Manufacturer’s software warranty must be described in the manufacturer’s EULA for the product.

*Software Support*:

Provide free access to any software service updates or hot fixes released due to a material defect or error in the product.

Provide new device driver packs, multiple times per year, to extend support for additional devices without the need for a new version of the product.

Provide free access to self-paced interactive e-training.

*Software Updates and Upgrades*:

Make software upgrades available for a period of one year from activation of the software license. Coverage options shall include:

Free access to any new product versions for the purchased VMS software product.

100% credit on owners current VMS product when upgrading to a more advanced version of the same VMS product.

Case Management online tool for submitting and tracking technical cases.

Direct Access to technical support via e-mail and phone.

Prioritized handling of support phone call response times based upon criticality of issue, for questions submitted by email or that cannot be answered in initial phone call.

Additional years of software upgrades available for purchase separately.

* + 1. *Contractor Warranty*:
       1. Fully warrant parts, materials and labor for a minimum of one year from date of the final acceptance of the VMS, including wiring, software, hardware and third-party products, including:
          1. Provision of all new software service releases during the warranty period.
          2. Provision of all new device driver packs.
    2. *Maintenance and Service*:
       1. *General Requirements*:
          1. Provide all services required and equipment necessary to maintain VMS in an operational state as specified for one year from formal written acceptance of system.
          2. Provide all necessary material required for performing scheduled adjustments or other non-scheduled work.
          3. Minimize impacts on facility operations when performing scheduled adjustments or other non-scheduled work.
       2. *Description of Work:* Deployment of VMS includes installation and setup of new server hardware and software, plus any new and existing equipment specified in Article 2.1. OWNER-FURNISHED PRODUCTS.
       3. *Personnel:* Service personnel shall be certified in the maintenance and repair of the selected type of equipment and integrations, and qualified to accomplish all work promptly and satisfactorily.
       4. *Schedule of Work:* Work shall be performed during regular workweek working hours, as determined by the deployment facility’s locale, excluding federal/public holidays.
       5. *Emergency Service*:

[**SPECIFIER NOTE:** Use this article to describe owner requirements for Support Level Agreements (SLA). Delete if not applicable.]

* + - * 1. Provide Owner with an emergency service center telephone number. Emergency service center shall be staffed 24 hours a day, 365 days a year and be located within 60 miles/kilometers of the deployment facility.
        2. Be a stocking contractor of the manufacturer’s equipment.
        3. Owner shall initiate service calls whenever system is not functioning properly.
        4. *Service Response*:

Owner has sole authority for determining catastrophic and non-catastrophic system failures.

Catastrophic system failure is defined as any system failure that Owner determines will place a facility at increased risk.

For catastrophic system failures, provide same-day four-hour service response with continued status updates at least every four hours.

For non-catastrophic failures, provide service response within eight hours with continued status updates at least twice a week.

* + - 1. *Verification of Operation:* As part of scheduled adjustments and repairs, verify operation of system as demonstrated by performance verification testing.
    1. Products
       1. Owner-Furnished Products

[**SPECIFIER NOTE**: use this article to describe owner-furnished products to enable Contractor to correctly install and configure them for use with VMS. Delete if not applicable.]

* + - * 1. *New Products*:

[**SPECIFIER**: List new products furnished by owner, such as computers, cameras or other devices, or delete paragraph A.]

* + - * 1. *Existing Products*:

[**SPECIFIER**: List existing products/systems furnished by owner, such as cameras, computers and network infrastructure, or delete paragraph B.]

* + - 1. Manufacturer
         1. *Qualification*: Manufacturer shall have regularly produced, as one of the manufacturer's principal products, a VMS similar to that specified for this project for at least five years.
         2. *Substitution Limitations*: Product substitutions must conform to the functional requirements of this specifications document. System architectural differences are acceptable as long as functional requirements are met under the alternate architecture. Windows 32-bit applications shall not be substituted for 64-bit applications.
      2. Video Management System
         1. *Description:* Video surveillance management system (referred to as “system” or “VMS”) supporting an unrestricted number of users, devices, servers and sites, with options for central surveillance operations and mobile devices.
         2. *System Architecture:* The VMS shall consist of:

*Servers:* One or more VMS servers.

Physical or virtualized Windows servers.

Virtualized Windows servers, using:

Microsoft Hyper-V.

VMWare.

UPS provided to physical servers, network infrastructure and devices such as cameras.

*Server Software Components*: One or more software components by Manufacturer, or software components made by others as noted, per VMS server.

*Management Server:* Central service component of the VMS responsible for handling system configuration, distributing the configuration to other system components, such as recording server services, and for facilitating user authentication.

*Recording Server:* Service responsible for communications, recording and event handling for all devices (cameras, video and audio encoders, I/O modules, metadata sources, etc.), including:

Retrieving video, audio, metadata and I/O event streams from devices.

Recording video, audio and metadata.

Providing access to live and recorded video, audio and metadata.

Transmit live audio from operator’s microphone to one or more camera speakers or supported IP speakers.

Providing access to device status.

Triggering system and video events on device failures, events, etc.

Writes video streams, audio streams and their metadata to a high-performance media database.

Performing motion detection and generate smart search metadata.

*Event Server:* Service that handles various tasks related to events, alarms, maps and third-party integrations via the Software Development Kit (SDK).

*Log Server*: Service that writes all system, audit and rule-triggered log messages to database.

*Service Channel*:Service responsible for communicating the following:

Service and configuration messages to full viewing client.

*Mobile Server:* Service responsible for hosting the web client and for providing access to the VMS for web client and mobile client users.

*ONVIF Out:* Optional server, plus 64-bit plug-in for management client. This is to enable private-to-public video integration.

*DLNA Out*: Service to enable display of live video on any DLNA compliant TV or displays without the need for additional equipment.

*Microsoft SQL Server*:Microsoft database server service for the management server, event server and log server services.

*Microsoft Active Directory:* Active Directory is not required for single-site systems but is recommended for cyber security purposes.

*PC or Laptop Workstations:* One or more PCs or laptops for client software applications intended to run on Windows-based PCs and laptops.

*Management Client:* The administration interface for all parts of the VMS, designed to be run remotely from, for example, an administrator’s computer.

*Full Viewing Client:* Designed for day-to-day use by dedicated operators, to be run remotely on the operator’s computer. Full viewing client provides dedicated task-oriented tabs for Live Video, Video Playback, Search, plus dockable tabs for Alarm Monitor. Full viewing client supports definable keyboard and joystick button shortcuts for frequently-used actions, including window or camera selection.

*Web Client:* Browser-based application for the occasional or remote user that needs easy access to live video monitoring and audio listening with PTZ control including use of presets, and video and audio playback and export, with defined exports available for later usage or download.

*Tablets or Smartphones:* One or more tablets or smartphones using web client (see above) or mobile client.

*Mobile Client:* Native mobile app for smartphone or tablet users, for easy access to live and playback of cameras, and to activate system events and outputs. Additionally, for use as a remote recording device by using the mobile device’s built-in camera, whereby video from the device’s camera is streamed back to the VMS and recorded like a standard camera.

*Video Walls:* Optionally one or more video walls.

See Section 28 51 19.13 VIDEO WALL.

*Networks*:

*Multiple Network Segments*: The VMS must support network segmentation into separate device, server and internet-connected networks.

*Device Network:* Local network whose capacity and configuration are suitable for the level of video, audio and metadata data transmission established by the system design and its intended usage.

*Server Network:* Local network whose capacity and configuration are suitable for the level of video data transmission, systems integration, and user operations established by the system design and its intended usage.

*Internet-Connected Network*: Internet-connected network providing connection to remote VMS sites and private-to-public connection via ONVIF Out. This network is also used for remote user access via the mobile server.

*Network Traversal*:

Enable software clients to access recording server services from outside a NAT firewall, by the use of public addresses and port forwarding.

Provide Remote Connect Services that enable secure remote connections to devices across different types of private and public networks.

* + - * 1. *Multi-System Architectures:* Provide the following architecture option for multi-site deployments:

*Distributed Recording Server Services:* Intended for sites with stable network connections between the central site and any number of remote sites.

Management server at central site is providing user authentication and authorization for all distributed recording server services.

Each site has at least one recording server.

* + - 1. System Design Criteria
         1. *Scalability:* Provide component-based system architecture to support scaling of VMS from small systems (up to 100 devices) to very large systems (several thousand devices) for single-site or multi-site deployment, whereby:

*For Small Systems:* All software components can be installed on the same server if the server is able to handle the combined load.

*For Large Systems:* Software components can be installed on separate dedicated servers to scale and distribute the load.

* + - * 1. *Availability and High Performance:* Provide the following capabilities to ensure high VMS availability and performance.

Storage solution shall be configured with RAID10 for Live database and RAID5 or RAID6 for archive database.

* + - * 1. *Operating Systems:* Provide server and client software applications that are native 64‑bit Microsoft Windows applications.
        2. *Network Addressing:* Support both IPv4 and IPv6 addressing.
        3. *Video Standards:* Provide simultaneous live streaming and recording of video from IP cameras and IP video encoders without any software limitations on the number of cameras per recording server, with support for the following codecs and options:

*Codecs*:

H.264 and H.265

MPEG-4 and MPEG-4 ASP

MJPEG

MxPEG

*Options*:

Toggling between recording key frames only or full video stream for MPEG-4, H.264 and H.265 video.

Adjustable GOP length for MPEG-4, H.264 and H.265 video.

Toggle between recording full framerate from the camera and any lower FPS for MJPEG video.

* + - * 1. *Video De-Interlacing:* Provide live video views with an adaptive de-interlacing option, to improve the quality of interlaced video, based on the actual video content received, for example, to smooth area of an image where object lines would otherwise appear as jagged lines.
        2. *Audio Standards*: Provide simultaneous digital two-way audio streaming and recording of audio from IP speaker and IP microphone devices without any software limitations on the number of devices per recording server, with support for the following codecs and options:

*Codecs*:

AAC

G711

G726

*Options*:

Playback of audio files on rule.

* + - * 1. *DLNA Support:* Provide the ability to easily display live video from the installed cameras directly onto any modern consumer-grade TV supporting DLNA functionality.
        2. *Hardware Acceleration Full Viewing Client:* Provide the following hardware acceleration capabilities to offload full viewing client video processing from the computer CPU to dedicated hardware video processing capabilities:

*NVIDIA GPU:* Automatically detect and use all available NVIDIA GPUs, for hardware accelerated decoding, color correction, and scaling.

*Intel Quick Sync:* Automatically detect and use Intel Quick Sync Video GPU integrated into select Intel processors for hardware accelerated decoding, color correction, and scaling.

Provide the ability to use both NVIDIA and Intel GPUs at the same time and automatically load balance the requests for optimal performance.

Provide the ability to show which GPU is used to decode which stream.

* + - * 1. *Hardware Acceleration Recording Server:* Provide the following hardware acceleration capabilities to offload recording server video processing from the computer CPU to dedicated hardware video processing capabilities:

*Intel Quick Sync:* Automatically detect and use Intel Quick Sync Video GPU integrated into select Intel processors for hardware accelerated decoding to enable server-side motion detection.

* + - * 1. *Hardware Acceleration Mobile Server:* Provide the following hardware acceleration capabilities to offload mobile server video processing from the computer CPU to dedicated hardware video processing capabilities:

*NVIDIA GPU:* Automatically detect and use all available NVIDIA GPUs, for hardware accelerated decoding to enable adaptive transcoding.

*Intel Quick Sync:* Automatically detect and use Intel Quick Sync Video GPU integrated into select Intel processors for hardware accelerated decoding to enable adaptive transcoding.

Provide the ability to use both NVIDIA and Intel GPUs at the same time and automatically load balance the requests for optimal performance.

* + - * 1. *ONVIF Out Functionality:* Provide access to live and recorded video, and the ability to control pan-tilt-zoom cameras in compliance with the relevant ONVIF Profile G and Profiles S standards.
        2. *Camera-Independent Motion Detection:* Provide real-time, camera-independent motion detection with:

*Configurable Sensitivity:* Configurable and automatic motion-detection sensitivity per camera

*Searchable Metadata:* Searchable motion detection metadata created during motion detection.

*Exclusion Zones:* Multiple motion exclusion zones definable per camera to keep irrelevant motion from triggering recording.

* + - * 1. *PTZ Control Priorities*:

Provide 3 PTZ priority levels for control of rights between different operators and automatic scanning and patrolling schemes.

PTZ Scans and Patrols shall pause for higher-priority manual or event-based camera control, and resume after manual session timeout and completion of event camera control period.

* + - * 1. *Configurable Pre-Buffering:* Provide pre-buffering with variable buffer length, with the ability to place buffer on disk or in memory.
        2. *Device Video Quality Optimization:* Provide video quality optimized per available bandwidth, device screen resolution, and camera view window sizes in these clients:

*Full Viewing Client Optimization*:

Switch between all configured live video streams from the cameras to optimize bandwidth consumption and workstation performance.

Optimize viewing performance for remote viewing according to the available bandwidth and view layouts, maximizing video stream quality per display capabilities of defined views.

*Web Client and Mobile Client Optimization:* Optimize transcoding by capping video stream resolution and frame rate for transmission to web client and mobile client.

* + - * 1. *Multiple Language Support:* Provide support for multiple languages in these clients:

*Management Client User Interface:* American English, Chinese (Simplified), Chinese (Traditional), Danish, French, German, Italian, Japanese, Korean, Portuguese (Brazilian), Russian, Spanish, Swedish and Turkish.

*Management Client Built-In Help:* American English, Chinese (Simplified), French, German, Japanese, Korean and Portuguese (Brazil).

*Full Viewing Client, Web Client and Mobile Client User Interface:* American English, Arabic, Bulgarian, Chinese (Simplified), Chinese (Traditional), Croatian, Czech, Danish, Dutch, Farsi, Finnish, French, German, Hebrew, Hindi, Hungarian, Icelandic, Italian, Japanese, Korean, Norwegian (Bokmål), Polish, Portuguese (Brazilian), Russian, Serbian, Slovak, Spanish, Swedish, Thai and Turkish.

*Full Viewing Client Built-In Help:* American English, Arabic, Chinese (Simplified), Chinese (Traditional), Czech, Danish, Dutch, French, German, Italian, Japanese, Korean, Polish, Portuguese (Brazilian), Russian, Spanish, Swedish and Turkish.

*Web Client and Mobile Client Built-In Help*: American English, Danish and Japanese.

* + - * 1. *True Multi-Window Support:* Provide true multi-window support in full viewing client whereby secondary windows have full functionality and can be operated in independent mode or synchronized mode where they follow the control of the main window.
        2. *System Capacities:* Provide the following maximum capacities, constrained only by the physical performance capabilities of installed server hardware and network infrastructure:

Unrestricted devices.

Unrestricted client software users.

Unrestricted mobile devices.

Unrestricted client PCs or laptops.

Unrestricted servers.

Unrestricted sites.

Unrestricted system rules.

Unrestricted time profiles.

Three software client profiles.

Unrestricted media storage.

Recording rates of at least 30 FPS per camera, limited only by hardware capabilities.

* + - 1. System Security
         1. *Control and Information Security:* Provide the following data protection measures and user rights management capabilities in support of system confidentiality, integrity and availability:

*Data in Transit:*

HTTPS connections from devices to recording server that support HTTPS connections.

Encrypted communication between the recording server and services that retrieve streaming data using customer-provided CA digital certificates for connections to the recording server.

Encrypted communication between the management server and the recording server using customer-provided CA digital certificates.

HTTPS connections from recording server to VMS clients, SDK clients and services that support HTTPS connections.

*System Configuration Data*: Provide password protection of the system configuration backup.

*Off-Premises Live and Recorded Video in Transit*: HTTPS connections must use trusted CA certificates and support HTTPS connections from:

Mobile server to browser-based web client and mobile client app.

ONVIF Out to remote public systems.

*Data Integrity of Exported Video*:

Export video in database format that can only be viewed in the Full Viewing Client – Player.

Per-export password protection for playback.

256-bit AES encryption.

Digital sign exported media with SHA-2 algorithm to establish a means of detecting modification of exported video.

Full Viewing Client – Player’s Verify Signatures function to validate authenticity of exported video recording.

Option to prevent re-export of exported video.

*Digital Certificates:* Use of customer-provided CA digital certificates for connections to the mobile server.

*Data Access Control*: Provide:

User profiles restricting device access and video viewing, playback and export, including by day and time-of-day.

Timestamped audit log of who logged in, viewed live or recorded video, or exported video.

* + - * 1. *User Authentication*:

*Log-in Options:* Log-in authentication via:

Microsoft Active Directory.

Local Windows user accounts.

Basic user system account (username and password credentials).

Dual authentication, a.k.a. two-person rule, requiring two verified persons to gain access.

*Auto-Log-In:* Use of last used credentials for authentication, with Auto-log-in and auto-restore of camera views.

*Kerberos Authentication:* Providestrong authentication via Kerberos support.

* + - * 1. *User Rights Management:* Provide common and central detailed management of user rights across all user and programmatic (SDK) interfaces, using roles, users, and user groups:

*User Rights:* Define roles, add and delete users, manage permissions for roles, user groups and users, generate user rights management reports.

*Roles:* Defining roles establishes permissions (also called “rights”) that determine which system features may be accessed by users and groups. Provide the following security settings for roles:

*Role Info*:

*General:* Full viewing client profiles, dual authorization rights.

*Applications:* Login to full viewing client, web client and mobile client.

*Anonymous PTZ Sessions*: Enabling anonymous user information for PTZ sessions.

*Users and Groups*: Users and groups can be assigned to multiple roles.

*Overall System Permissions:* Globally allow or deny permissions for servers, devices and functions (such as manage, read, edit and delete).

*Specific System Permissions:* Allow permissions for specific individual devices and functions:

*Cameras:* Visibility, live view (within time profile), playback (within time profile), search sequences, smart search, export, manual recording, bookmark functions, AUX commands.

*Microphones and Speakers:* Visibility, listen to live audio (within time profile), playback audio (within time profile), search sequences, export, manual recording, bookmark functions.

*Inputs and Outputs:* Visibility, activation.

*PTZ Control:* Manual control, activate PTZ presets, PTZ priority, manage PTZ presets and patrolling.

*Speech:* Speak to speakers, speak priority.

*Remote Recordings:* Retrieve remote recordings.

*External Events:* Visibility, edit, delete, trigger.

*View Groups*: Visibility, edit, delete, operate.

*Servers:* Professional server access and authentication details.

*Matrix*: Visibility.

*Alarms:* Manage, view, disable alarms, receive notifications.

*SDK:* SDK plug-in permissions.

* + - * 1. *Client Authentication:* Provide management server authentication and authorization of connecting clients (full viewing client, management client and SDK clients) and use a session-limited access token for controlling access to the recording server.
        2. *System Hardening:* System hardening guide that:

Describes data security, network security and physical security measures and best practices for securing the installed VMS against cyber-attacks. This includes security considerations for the hardware and software of servers, clients and network device components of a video surveillance system.

Incorporates standards-based and best-practice-based security and privacy controls and maps them to each hardening recommendation.

* + - * 1. *GDPR-Ready Certification:* The VMS must have a EuroPriSe privacy seal.

The vendor shall provide comprehensive guides and templates to aid in configuring a GDPR compliant system.

* + - * 1. *FIPS 140-2 compliant mode*: The VMS has the ability to operate in a FIPS 140-2 compliant mode.
      1. Logging
         1. Provide logging of errors, warnings, system information, user activity, and logs about rules to a centralized database with time, date, and other related information. Logs provide multi-system support and configurable logging limits.

*System Logs:* Log all system related errors, warnings and system information, to be used for troubleshooting.

*Audit Logs:* Log user activity in client applications including, but not limited to, user system access, configuration changes and operator actions.

*Rule-Triggered Logs:* Log rules in which the system administrator has specified the “Make new log entry” action.

*Log Exporting:* Logs can be exported as comma-separated-values (.csv) files.

*Log Filtering:* Logs can be filtered based on time frame, source name, source type, user, user location, rule name, etc.

*Log-Related Options:* Settings can be changed about:

Log retention time.

Which levels (error, warning, and system information) are logged.

Log security.

* + - 1. System Functionality
         1. *Configuration Management*:

*Real-Time Configuration Change Application:* Immediately apply authorized changes of system configuration data for all sites, including, but not limited to licenses, devices, rules, schedules, users, maps, alarms, recording, client views, including while recording is in operation.

*Configuration Data Caching for Continued Operation:* Cached recording server configuration data shall ensure continuous operation of recording server during periods where the management server is inaccessible.

*Backup and Restore:* Built-in backup and restore support for manual system backup of all configuration data, including but not limited to:

All system configuration data.

Full device configuration data.

Maps.

Alarm settings and definitions.

Software client views.

User-defined rules and events. Defined video bookmarks.

*Configuration Reporting:* Provide complete or partial documentation of system configuration, including custom and site-specific free-text information, contractor’s notes and option for logo inclusion.

* + - * 1. *Application Workspace Optimization*:

Options for optimizing application workspaces in the management client software:

*Application Layout*: Rearranging layout via drag-and-drop.

Options for optimizing application workspaces in the full viewing client software:

*General*: Control general look and feel and navigation properties, such as color mode, camera title bar, grid sizes.

*Personal or Centrally Enforced*: Optimization can either be made as individual personalization managed by each operator, or centrally enforced using full viewing client profiles.

*View Layouts:* Availability of specific view layouts enforced using full viewing client profiles.

*Themes:* User interface color schemes enabling user choice of dark or light themes.

*Simple and Advanced Modes:* Optional simplified user interface with toggling between “Simple” and “Advanced” mode.

*Control Panes Availability*: Control availability of control panes and functions in live and playback tabs, and in setup mode.

*Timeline Information*: Control information included in timeline in playback tab.

*Export Behavior*: Control behavior and availability of export function.

*Keyboard and Joystick Setup*: Setup of keyboard short cuts and joystick controls.

*Alarm and Access Control Notifications*: Control behavior of alarms and access control notifications.

*Application Language*: Control application language.

*Advanced Application Settings*: Control advanced application settings such as use of hardware acceleration, videos diagnostics overlay and time zone settings.

* + - * 1. *Device Discovery and Management*:

Add Hardware wizard to automatically discover and upon approval add devices to system using Universal Plug and Play (UPnP) discovery, IP network range scanning, or manual device detection. User ability to perform initial setup of credentials on devices without factory default credentials detected. Must be supported for Axis, Bosch, Hanwha Techwin, and for ONVIF profile Q conformant devices.

Replace Hardware wizard for swift replacement of malfunctioning devices with preservation of configuration settings and recordings, including those for attached cameras, microphones, speakers, inputs, outputs and metadata devices.

Move Hardware wizard for moving devices and related devices from one recording server to another during runtime with no loss of settings, recordings, rules, permissions etc.

User ability to enable and disable devices for purposes of maintenance or temporary deactivation.

User ability to change the password of one or multiple devices based on a pre-configured time interval. Must be supported for Axis, Bosch, Canon, Hanwha Techwin, Hikvision, Panasonic, Sony and ONVIF-compliant devices.

For ONVIF Profile T & Q compliant devices. User ability to manage a VMS user account that communicates with a device. Add a user, list an existing user, and delete a user.

For ONVIF Profile T & Q compliant devices. User ability to manage network configuration. Change IP address, subnet mask, and default gateway.

* + - * 1. *Camera Image and Video Stream Management:* Adjustment of per-camera and per-video stream settings, with each camera allowed one or more streams for live viewing and one stream for recording, including an optional per-camera or per-camera-group preview window:

*Per Camera*:

*General Settings*: Change all camera specific general settings such as brightness, color level, compression, maximum bit rate, resolution and image rotation.

*Camera Video Stream Settings*: Define as many different streams as specific camera support. Change individual stream settings such as FPS, resolution, image quality, video encoding format and resolution.

*Per Camera Group*:

*General Settings*: Change all common camera specific generalsettings for the camera group such as brightness, color level, compression, maximum bit rate, resolution and image rotation.

*Camera Video Stream Settings*: Define as many different streams as specific camera support for the camera group. Change individual stream settings such as FPS, resolution, image quality, video encoding format and resolution.

One camera can be associated to multiple camera groups.

*Video Streams:* Define one camera video stream used for recording and one camera video stream to be used for live viewing.

*Recording*: Manage recording functionality including:

Related device recording.

Manual recording timer.

Pre-buffer use.

Recording framerate.

Media storage assignment.

Automatic retrieval of edge recordings.

*Fisheye Lens Viewing:* Capability for fisheye lens camera views provided through utilization of panomorph lens technology.

*Motion Detection*: Manage motion detection functionality including:

Motion sensitivity.

Processing all frames or keyframes only.

Generation of motion metadata for smart search.

Exclusion zones.

*Camera Events*: Define which camera events will be forwarded to the VMS.

*Client Settings*: Define client related functionality including:

Related devices.

Keyboard shortcut.

*Privacy Masks:* Permanent and liftable system-defined camera image privacy masks hide certain areas in the camera image for live view, recording, and video export.

*Permanent Masks:* Allow a system admin to mask areas in cameras at all times and for all users. Permanently masked areas cannot be revealed once recorded.

*Liftable Masks:* Allows a system admin to establish default mask areas in cameras at all times and for all users, but with the option to sufficiently privileged operators to temporarily remove the masks for authorized users if needed – such as during investigation.

*Masking Level:* When establishing a privacy mask, system admins may select a mask level on a scale between ‘light blur’ to ‘solid grey’.

* + - * 1. *PTZ Camera Control:* Camera-based and system-based PTZ camera control including the following capabilities.

*Camera PTZ preset positions:* Camera-based PTZ presets may be imported from the camera and renamed for use in system-based manual and automatic PTZ control.

*Automated Use of PTZ Presets:* Scheduled and event-based rules capability to move PTZ cameras to pre-set positions.

*System-Based PTZ Preset Positions:* System-based PTZ presets are definable for use in system-based manual and automatic PTZ control.

*PTZ Patrolling:* Multiple per-camera PTZ patrolling schemes may be defined with the following options:

Adjustable wait times between preset position changes.

Disabling of motion detection to avoid false detection alarms.

Multiple patrolling schedules per camera per day, with different schedule for days, nights and weekends.

* + - 1. Event and Alarm Management
         1. *Rules Engine:* Provide rules for automating of different aspects of the system, including camera control, system behavior and external devices, based on events or time profiles, or a combination of events and time profiles.

*Trigger Events:* Provide a Microsoft-Outlook-style configuration dialog where pre-defined and custom-defined events are used in rules to trigger actions.

*Event Categories:* Organize events into the following categories:

*Hardware:* Physical hardware devices connected to the system.

*Devices:* Certain functions and states of devices available via connected hardware devices.

*External:* Relating to VMS integrations.

*Recording Server: A*rchiving and database functions.

*Analytics:* From integrated analytics applications and systems.

*User-Defined:* Custom-configured events enabling users to manually trigger actions and events in the system.

*Start Actions:* Triggering events may initiate a wide set of system actions, including, but not limited to:

Control start and stop of recording, including scheduled and event-based recording.

Change camera stream properties.

PTZ camera preset positions and patrols.

Event-based notifications, including email notifications to single or multiple recipients with optional attachment of a camera still image or AVI video clip.

External system interactions.

Play pre-recorded audio.

Retrieve video and audio from edge storage devices.

Single rule allows for executing multiple system actions.

Rule actions shall be triggered by event, time interval or a combination of event and time.

Rules shall be optionally stopped by event or after a specified time.

Unrestricted number of rules.

* + - * 1. *Time Profiles:* Provide the following time profile functionality for use with profiles, rules and triggers:

Time profiles contain one, or more, single or recurring periods of time.

A single time period may span one or more days, defined by a starting date and time and an ending date and time.

A recurring period of time is defined as a time range with recurrence pattern and range:

Time range is a starting and ending time within a day.

Recurrence pattern may be Daily, Weekly, Monthly or Yearly.

Recurrent range is a starting and ending date, or a starting date with a duration in days.

Unrestricted number of time profiles.

* + - * 1. *Single-Point Event/Alarm Management:* Provide central management of all internal system alarms and external security alarms. Events are pre-defined or user-specified incidents on the VMS that can be set up to trigger an alarm, including analytics events and manual control actions. Event and alarm management capabilities shall include but not be limited to:

*Alarm Data Settings*:

Customizable alarm priorities, statuses and categories to enable alignment of the alarm handling workflow with existing workflows and security systems.

Optional sound notifications for different alarm priorities for notification of new incoming alarms.

Manage which alarm priorities trigger desktop notifications for alarms.

Manage which alarm data are shown in the Alarm Manager, including but not limited to:

ID.

Image.

Location.

Message.

Owner.

Priority Level.

Source.

State Level.

State Name.

Time.

Optional Reasons for Closing to be chosen when an alarm is closed.

Add audio files in wav-format to be used as alarm notification sounds.

Manage how long alarms instances are kept in the system before being automatically deleted.

*Alarm Configuration*:

User-definable alarm descriptions and work instructions.

Select triggering event and source.

Alarm time profiles specifying that response actions must take place within the specified time profile.

Select start and stop events specifying that response actions must take place within the specified event window.

Select a user defined event to be triggered if an alarm is not acknowledged within a defined time limit.

Association of alarms with one or more cameras, with automatic display of camera video in the alarm preview window, with a minimum of 15 cameras showing simultaneously in the alarm preview window.

Association of alarms to maps.

Association of initial alarm owner (individual user or group) and priority.

Association of alarm category.

Select user defined event to be triggered by the alarm.

Enable or disable desktop notifications for alarms.

*Alarm Manager*:

Alarm list with extensive sorting and filtering capabilities.

Instant preview of recorded video from primary and related cameras, at the time of the incident.

Thumbnail image from primary camera, at the time of the incident.

Alarm disabling option shall enable users to suppress alarms from a given device for a specified time period.

Alarm handling reports providing information about alarm inflow and alarm handling performance.

*Alarm Handling*:

Instant preview live video of primary camera.

Instant preview of recorded video from primary and related cameras, at the time of the incident.

Option to select any related cameras to be displayed in the live and playback view items.

Present the alarm work instructions.

Change priority and status of the alarm.

Alarm escalation with option to forward alarms to operators with appropriate skills to handle specific types of alarms.

Present time logged alarm activities.

Add time logged comments to the alarm incident.

Desktop notifications shall allow immediate access to alarm handling.

*Map Integration*:

Present incident location automatically on the map allowing operators to view and acknowledge active alarms.

All other map functionality must be available when viewing maps in the Alarm Manager.

*Smart Map integration*:

Present incident location automatically on the Smart Map allowing operators to view and acknowledge active alarms.

Cameras with active alarms shall be visualized when viewing the geographic location of search results in the Centralized Search workspace.

*Web Client*: Provide the following alarm list, alarm handling and investigation functionality:

*Alarm List*:

Alarm list with filtering capabilities:

All or personal alarms.

All or specific alarm states.

All or specific alarm priorities.

Thumbnail image from primary camera, at the time of the incident.

Click to handle alarm.

*Alarm Handling*:

Instant preview of recorded video from primary and related cameras, at the time of the incident. Available incoming audio for cameras that have related microphones.

Present the alarm work instructions.

Change priority and status of the alarm.

Alarm escalation with option to forward alarms to operators with appropriate skills to handle specific types of alarms.

*Mobile Client*: Provide the following alarm notification, alarm list, alarm handling and investigation functionality:

*Alarm Notification*: Receive alarm notifications using Push Notifications. Notifications include access to:

Video.

Alarm information.

Work instructions.

*Alarm List*:

Alarm list with filtering capabilities:

All or personal alarms.

All or specific alarm states.

All or specific alarm priorities.

Thumbnail image from primary camera, at the time of the incident.

Click to handle alarm.

*Alarm Handling*:

Instant preview of recorded video from primary and related cameras, at the time of the incident.

Present the alarm work instructions.

Change priority and status of the alarm.

Alarm escalation with option to forward alarms to operators with appropriate skills to handle specific types of alarms.

* + - 1. Video Processing and Viewing
         1. *Multiple Monitor Support*: Support multiple monitors where each monitor shall show multiple floating or full-screen windows for display of views or individual view items.
         2. *View Window Aspect Ratios:* Support multiple views optimized for 4:3 and 16:9 display settings in both landscape and portrait orientations.
         3. *Private or Shared Views:* Private views can only be access by the user who created them. Views may be shared generally and available to all roles or restricted to specific roles. Viewing of a content item in a shared view is subject to the viewer’s permissions relating to the content item.
         4. *View Groups:* View groups facilitate view navigation and simplify searching across multiple views by narrowing search scope.
         5. *View Layout Persistence*: Same view layout in both live and playback modes.
         6. *View Arrange and Restore:* Support simple drag-and-drop re-arrangement of cameras in views for optimized monitoring of incidents, including replacement of individual cameras with different cameras, with single-click restore of original view layout.
         7. *View Creation:* Views that display up to 100 view items including cameras, web pages, still images, text and interactive items. View capabilities include, but are not limited to:

*Camera View Item:* Live and recorded camera video displayed in resizable view windows, utilized in several workspaces within the application. Each camera view item contains the following:

*Video Status Indicator:* A round dot indicating one of four states:

*Green:* A connection to the camera is established.

*Red:* Video from the camera is being recorded.

*Yellow:* Playing back recorded video.

*Gray:* The video has not changed for more than two seconds.

*Motion Indicator:* An icon of a moving person that appears only when motion is detected since it was last cleared.

*Bounding-Box Display:* Display of metadata bounding boxes as provided by supported cameras and integrated analytics in live and playback views.

*Update on motion only:* Optimizes CPU use by allowing motion detection to control whether the image should be decoded and displayed.

*PTZ Camera View Item:* PTZ camera view item can be configured to provide virtual joystick camera control and PTZ navigation overlay buttons on the video image.

*Overlay Buttons:* Used to add manually controlled speakers, events, outputs, PTZ cameras and to start/stop recording.

*Camera Navigator:* User-defined views of specific sets of cameras in relation to each other, for example, according to floor plan, to enable visually tracking people and objects as they move from one camera’s field of view to another. Camera Navigator function provides an add-on to the Map with no special configuration needed.

*Carousel:* Allow a specific view item to automatically sequence rotate through pre-defined set of cameras that are not necessarily present in the view at the same time. Operators may select default or custom display times for each camera, and they are able to manually switch to the next or previous camera in the carousel list.

*Hotspot:* Global hotspot function shall allow users to work in detail with any camera selected from any view. Local hotspot function shall allow users to work in detail with a camera selected from the same view.

*HTML Page*: Show interactive HTML page.

*Image:* Show a still image.

*Matrix:* Shows live video from multiple cameras in any view layout with customizable rotation paths, remotely controlled by the computers sending matrix remote commands.

*Navigable Map Pages:* Static or active map pages may be used to provide a good overview of premises, and for switching between different views, such as map page displaying a floor plan.

*Text*: Add text.

*3rd party plug-ins*: Add 3rd party plug-ins to extend the behavior of full viewing client.

* + - * 1. *Live Video*: Views provide camera live viewing capabilities including, but not limited to:

*Live Viewing:* View live video of camera view items on the Live tab.

*Manual PTZ Control:* Manual PTZ control options:

Video overlaid PTZ control.

Joystick.

Virtual joystick function.

PTZ point-and-click control.

PTZ preset positions.

Overlay buttons to activate PTZ preset positions.

PTZ zoom to a defined rectangle.

Start, stop, and pause patrolling.

View who have PTZ control and time to automatic release, including anonymous users.

*Send Video to Destination*: Option to send current camera to the following destinations:

View item in an existing window.

New floating window.

*Digital Zoom:* Magnification of video to facilitate detail viewing.

*Bookmarks:* Create quick or detailed bookmarks, to facilitate incident review and documentation.

System generated headline for quick bookmark.

Optional headline and description information for detailed bookmark.

*Independent Video Playback*:

Playback of video in multiple camera view items, each on its own independent timeline.

Option to initiate playback mode and synchronizing playback timeline with current time in independent playback.

*Instant Change of Camera:* Drag-and-drop placement of a different camera in a camera view item, instantly changes the content to video from the new camera, according to the camera view item’s current timeline position.

*Centralized Search*: Initiate Centralized Search for the camera in a new window.

*Manual Recording*: Start and stop manual recording with automatic stop of recording after a configurable number of minutes.

* + - * 1. *Video Playback:* Views provide additional camera playback capabilities including, but not limited to:

*Playback:* Timesynchronizedplay back video of camera view items on the Playback tab.

*Navigation:* Advanced video navigation includes:

Forward and backwards playback at different speeds:

*Playback Speeds*: ¼x, ½x, 1x, 2x, 4x, 8x, 16x.

*Instant Realtime Speed*: Toggle 1x playback speed or selected playback speed.

Forward and backwards frame-by-frame.

Skip to next or previous recorded sequence.

Skip to beginning or end of recordings.

Jump to date/time.

*Timeline:* An overview of recorded sequences and bookmarks via integrated video timeline with time navigation and playback controls, including the following functionality:

*Timeline Video Playback:* Video from multiple camera view items integrated to a common video timeline, with common timeline control from any of the integrated camera view item.

*Single and Consolidated Timeline*: Two timelines with the first showing overview of selected camera view item and second showing a consolidated overview of all camera view items in the view.

*Timeline Period*: Select which period timeline covers.

5, 10, 20 minutes.

1, 2, 4, 8, 12, 16, 20 hours.

1, 2, 4 days.

1, 2, 4 weeks.

*Recorded Sequences Overview*: Recorded sequences of video and audio are shown in the timeline. The timeline displaying light-red to indicate recording, red for motion, light-green for incoming audio, and green for outgoing audio. If there are additional sources of data available, these are displayed as other colors.

*Bookmarks Overview*: Bookmarks are shown in the timeline with instant preview of the recorded video.

*Integrated Time Interval Selection*: Integrated function to select a time interval for export or video and audio retrieval from edge storage devices.

Visual selection on timeline.

Select start and end date/time.

Loop selected period on playback.

*Multi-Window Timeline*: Ability to use one timeline to control playback of cameras in multiple view windows.

*Recording Search:* Search listing of camera sequences or bookmarks.

*Preview*: Search results may be previewed.

*Print*: Print of still image from the selected video clip may be initiated.

*Export:* Export of selected video clips may be initiated, reducing time needed to prepare forensic video material.

* + - * 1. *Two-Way Audio:* Audio from cameras with built-in or attached microphones can be configured for listening. Camera built-in or attached speakers can be configured for use to talk to individuals near speakers. Additional capabilities include:

*Broadcast:* Broad announcements can be made by selecting the All Speakers option when talking.

*Lock to Selected Audio Devices:* Enables continued use of microphones and speakers from selected cameras, while viewing video from a different set of cameras. This enables, for example, informing an individual at risk about the safety status of nearby areas.

*Level Meter:* Level meter indicates the volume of the speaking operator’s voice, to indicate whether the operator is at a correct distance from the microphone.

* + - * 1. *Centralized Search:* Shall enable users to apply search categories and filters to find recording sequences, recordings with motion and bookmarks. From the search results, users shall be able to preview video and perform various actions, e.g. by exporting the search results or sending the search results to PDF. The search results shall be presented instantly as thumbnail images:

*Sequence Search:* Search in recording sequences on one or more cameras.

*Motion Search:* Search for sequences with motion, or Smart Search for motion in selected areas on one or more cameras.

*Bookmark Search:* Search for bookmark headlines or descriptions.

*Navigation:* Ability to jump to search results through a clickable timeline, or the ability to scroll through the search results.

*Preview:* Selected sequence previews with auto play and direct export support.

* + - * 1. *Video Export and Documentation:* Full viewing client options for video export and documentation include, but are not limited to:

*Snapshot:* Produce instant visual documentation of a camera by saving the camera image to a file.

*Print:* Produce instant visual documentation of a camera by sending it directly to a printer.

*Storyboarding:* The storyboarding function makes it possible to include video sequences from different or overlapping time intervals from different cameras in the one and the same export.

*Export Database Format:* Export in database format; including the standalone Full Viewing Client – Player application for simple instant viewing by authorities.

*Export Preview:* Review video just prior to export, with looped playback option.

*Export Other Formats:* Create evidence material in media player format (AVI files), MKV format, or still image format (JPEG images).

*Re-Export:* Re-Export allows an authorized individual to export a digitally signed selection from the original video exported. Option to disable re-export, during initial export to database format, prevents undesirable re-distribution of sensitive video recordings.

*Bulk Export:* In a single step, export in multiple formats to multiple destinations, including direct export to optical media, to ensure consistency across exported video sequences in various formats, and reduce human error possibilities.

*Export of Comments:* Two video formats support inclusion of comments in exported video:

*Database Format:* Include general and/or camera-specific comments to a video export file.

*Media Player Format:* Include comments as pre/post slides.

*Video Incident Report Printing:* Utilize still images rather than clips to print incident reports including images, surveillance details and free-text user comments.

* + - 1. Maps
         1. *Maps:* Provide multi-layered physical overview of surveillance video coverage, with interactive access to and control of the VMS and related devices, including the following elements:

*Map Images:* Illustrated maps or photographs. Supported image file formats are: BMP, GIF, JPEG, JPG, PNG, TIF, TIFF, and WMP.

*Camera Icons:* Indicate camera locations on the map. Fixed camera icons show camera view as colored angle radiating from the camera. PTZ camera icons show preset camera views as colored angles radiating from the camera.

*Live Preview:* Hover mouse pointer over camera icon to display a live preview in a resizable window.

*PTZ Preset Navigation:* Click on PTZ preset view zone moves camera to the preset position.

*Microphone Icons:* Microphone icons show microphone locations on the map.

*Live Listening:* Place mouse over microphone icon; press and hold left mouse button to listen to incoming audio from microphone.

*Speaker Icons:* Indicate speaker locations on the map.

*Live Speaking:* Place mouse over speaker icon; press and hold left mouse button to talk through speaker.

*Control Icons:* Icons to use for control of objects such as doors, gates, and lights.

*Hot Zones:* Hot zones to provide vertical navigation through a hierarchy of maps by clicking on a hot zone.

*Map Overview Window:* Navigable overview of map hierarchy set up in full viewing client.

*Map Image Updates:* When map images are replaced by an updated version of the map image of the same scale, map icons and other elements are kept in their original locations.

*Map Display Information:* Information display options include but are not limited to:

Real-time status monitoring indication from all system components including cameras, I/O devices and system servers.

Graphical visualization of the system status through color coding.

Hierarchical propagation of status indications to higher ordered maps.

Different levels of status indications available (alarm, warning and errors).

System performance data for cameras and servers including camera resolution, FPS, network use and disk space.

Ability to suppress status indications (such as alarms and operational status) for a given device.

Editable device names in map and map-specific names and references assignable to devices in Map, subject to user permissions.

* + - 1. Media Storage Management
         1. Provide multiple media storage containers definable with the following characteristics:

*Container:* Each container consists of a live database and optionally one archive database, with container-specific archiving scheme and retention times. Archive database can reside on the same disk as the live database or on secondary disk or network drive.

*Capacity:* Maximumrecording capacity shall be limited only by available disk space or configured container storage limit.

*Device Assignment:* Recording of each device is assigned to a specific storage container. The assigned storage container for a device or group of devices may be changed from one container to another.

*Archiving:* Recorded video data may be automatically moved from a container’s live database storage to its archived storage. Archived data is still online and available to client software.

*Maximum Recording Times:* Maximum recording times may be set for manual recordings, with VMS deleting older video to free up storage for newer video.

* + - * 1. *Edge Video Storage:* Provide utilization of camera-based storage including the following capabilities:

*Video and Audio Retrieval:* Retrieving video and audio recordings across low-bandwidth connections based on time profiles, events or manual requests.

*Video and Audio Consolidation:* Consolidating video and audio from multiple storage mechanisms:

Seamless merging of video and audio stored centrally in media database, and video and audio retrieved from associated camera edge storage, or from an interconnected system.

Optionally consolidate pre-event images recorded locally in camera or video encoder.

*Scalable Video Quality Recording (SVQR):* Capability to record high quality video using edge storage and record low quality video centrally, to minimize network bandwidth utilization, using the capabilities described above. High quality video can be retrieved when needed, on an event-driven, scheduled or manual basis.

* + - 1. Mobile Server
         1. *User Authentication:* Facilitate the following methods of user authentication:

*Basic Authentication:* Basic user VMS account.

*Windows Authentication:* ViaActive Directory or local Windows user account. Possible to use current Windows user to facilitate single sign-on.

* + - * 1. *Dynamic Bandwidth Optimization:* Optimize camera video stream from server to client to make optimum use of bandwidth.
        2. *Smart Connect:* Easy configuration of internet access to the mobile server by automatic configuration of firewalls and internet routers via UPnP, with verification of configuration and operation of internet connection, with option to email connection details to mobile client users. Includes automatic mobile server on LAN via UPnP.
      1. Web Client
         1. Provide the following browser-based capabilities:

*User Authentication*:

Require only username and password.

User authentication and authorization is handled by mobile server.

*Inherit System Views:* Automatically obtain the user’s private and shared views configuration from the system.

*All-Camera View:* Automatically generate a view for all cameras when no views are set up.

*Two-Way Audio:* Audio from cameras with built-in or attached microphones can be configured for listening. Camera built-in or attached speakers can be configured for use to talk to individuals near speakers. Audio playback shall be available for investigations, video exports and alarms. Additional capabilities include:

*Broadcast:* Broad announcements can be made by selecting a microphone icon on the view level when talking.

*Use the Push-to-talk (PTT) Feature:* Communicate via the VMS system, through a PC microphone and while watching live video from one camera, with people near a video camera with audio equipment. Push-to-talk (PTT) is also available in Actions.

*Live Video Monitoring:* View live video with PTZ control including use of presets, video playback, and triggering of camera-related outputs and events from within the camera’s view.

*Search:* Search function to find cameras, types of camera, cameras with related microphones, cameras with related speakers and camera views.

*Video Export:* Provide video export, with the option to preview and store exported video on the server, and make it available for later usage or download, for example, when a higher-bandwidth connection is in use.

*Still Image Export:* Provide camera view JPEG image export.

*Investigations*: Ability to export the recordings, download and share them with authorities at a later stage:

Create AVI, MKV or database export files.

Option to include audio in the export package.

Export on the server to avoid moving large video files back and forth.

Store video recordings for a period that is longer than the retention time.

Play back the recordings even if the recordings have already been deleted from the media database.

Only download needed files or save them for downloading when on a faster connection.

Preview exports on the server without downloading them.

*Secure Connection:* Connect to mobile server through trusted CA certificates for HTTPS encryption..

*Supported Browsers*:

Microsoft Internet Explorer

Microsoft Edge

Safari

Google Chrome

Mozilla Firefox

*Browser Plug-Ins or Extensions*: No plug-ins or extensions to be installed.

* + - 1. Mobile Client
         1. Provide the following native-app mobile client capabilities:

*User Authentication*:

Require only user name and password.

User authentication and authorization is handled by mobile server.

*Multiple Server Profiles:* Select between multiple server profiles to facilitate easily switching between sites or different connection addresses.

*Inherit System Views:* Automatically obtain the user’s private and shared views from the system to be use as camera lists.

*All-Camera View:* Automatically generate a view for all cameras when no views are set up.

*Two-Way Audio:* Audio from cameras with built-in or attached microphones can be configured for listening. Camera built-in or attached speakers can be configured for use to talk to individuals near speakers. Audio playback shall be available for investigations and alarms. Additional capabilities include:

*Use the Push-to-talk (PTT) Feature:* Communicate via the VMS system, through the microphone of the mobile device and while watching live video from one camera, with people near a video camera with audio equipment. Push-to-talk (PTT) is also available in access control.

*Full-Screen View:* Display cameras in full screen to take better advantage of the mobile device’s screen, with camera view navigation in full screen by swiping left or right.

*Pinch-To-Zoom:* Digital pinch-to-zoom shall enable mobile users to enlarge a part of the image for closer review and conduct detailed investigation of video.

*Picture-In-Picture*: Provide the following functionality for Picture-In-Picture:

Display a live picture-in-picture frame of the same camera when in playback mode.

The picture-in-picture shall be movable by dragging.

Double-tapping and will return to live view.

Hide live picture-in-picture frame.

*Search:* Search function to find cameras, types of camera, cameras with related microphones, cameras with related speakers, and camera views.

*Navigation:* Ability to navigate recorded video using a time picker and to adjust the start time by dragging a timeline scroller.

*Mobile Video Push:* Provide mobile client capability for mobile device users to use their mobile device cameras as cameras in the VMS, including the following characteristics.

*No Mobile Setup:* No mobile device setup shall be required for mobile video push. Provide central server-side configuration.

*Metadata Support:* Mobile users shall be able to include metadata in the video submitted.

*Audio*: Mobile users shall be able to include audio in the video submitted.

*Investigation*: Provide access to investigations created in the web client.

*Secure Connection:* Connect to Mobile server through trusted CA certificates for HTTPS encryption.

*Supported Mobile Operating Systems*:

Android

iOS

* + - 1. SDK-Based Integration
         1. Provide an SDK for integration with third-party systems including, but not limited to:

Seamless integration of video analytics algorithms and other third-party applications in full viewing client and management client.

Functionality for external applications to make changes to the system’s configuration.

Compatibility with Transact and Retail, which integrate video surveillance with automatic teller machines (ATM), point-of-sale (POS) and enterprise resource planning (ERP) systems for managing loss prevention and fraud.

Compatibility with LPR for automatic reading and tracking of vehicle license plates.

Event integration via a simple message-based socket communication interface enabling external applications to trigger events in the VMS.

Functionality for external applications to trigger user-defined events in the VMS.

* + - * 1. Implement the SDK via integration in the following system components:

Full viewing client.

Management client.

Event server.

* + - 1. Computer Equipment
         1. *Computer Requirements:* Consult with VMS manufacturer to determine current computer requirements appropriate for system design, intended use and desired level of performance. Optimize server computer count, and server application distribution across servers, to account for likely system expansion. The following are minimum requirements.

*Computer Running Management Server and Service Channel*:

*CPU:* Intel® Core™ i3 or better.

*RAM:* 8 GB or more.

*Network:* Ethernet 100 Mbit or better.

*Graphics Adapter:* Onboard GFX, AGP or PCI-Express, minimum 1024×768, 16-bit color or better.

*Hard Disk Space:* 50 GB free or more (depends on number of servers, devices, rules, and logging settings).

*Operating System*:

*For Individual Servers*:

Microsoft Windows 8.1 Pro (64 bit).

Microsoft Windows 8.1 Enterprise (64 bit).

Microsoft Windows 10 Pro (64 bit).

Microsoft Windows 10 Enterprise (64 bit).

Microsoft Windows 10 Enterprise LTSB (Long-Term Servicing Branch) 2016 (version 1607 or later).

Microsoft Windows 10 IoT Enterprise, version 1803 or later (64 bit), IoT Core.

Microsoft Windows Server 2012 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2012 R2 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2016 (64 bit): Essentials, Standard and Datacenter.

Microsoft Windows Server 2019 (64 bit): Essentials, Standard or Datacenter.

*Software*:

Microsoft .NET 4.7 Framework.

300 Cameras or less: SQL Server Express Edition.

For larger systems or to support frequent database backups, run a licensed version of Microsoft SQL Server on its own server.

*Computer Running Microsoft SQL Server (if not running Microsoft SQL Server Express Edition on Management Server computer)*:

*CPU:* Intel® Core™ i3 or better.

*RAM:* 8 GB or more.

*Network:* Ethernet 100 Mbit or better.

*Graphics Adapter:* Onboard GFX, AGP or PCI-Express, minimum 1024×768, 16-bit color or better.

*Hard Disk Space:* 100 GB free or more (depends on number of servers, devices, rules, and logging settings).

*Operating System*:

Microsoft Windows Server 2012 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2012 R2 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2016 (64 bit): Essentials, Standard and Datacenter.

*Software*:

Microsoft .NET 4.7 Framework.

*Microsoft SQL Server*:

Microsoft SQL Server 2012 SP1.

Microsoft SQL Server 2014.

Microsoft SQL Server 2016.

*Computer Running Recording Server, Event Server or Log Server*:

*CPU:* Intel® Core™ i3 or better.

*RAM:* 8 GB or more.

*Network:* Ethernet 100 Mbit or better.

*Graphics Adapter:* Onboard GFX, AGP or PCI-Express, minimum 1024×768, 16-bit color or better.

*Hard Disk Space:* 10 GB free or more (depends on number of devices and recording settings).

*Operating System*:

*For Individual Servers*:

Microsoft Windows 8.1 Pro (64 bit).

Microsoft Windows 8.1 Enterprise (64 bit).

Microsoft Windows 10 Pro (64 bit).

Microsoft Windows 10 Enterprise (64 bit).

Microsoft Windows Server 2012 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2012 R2 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2016 (64 bit): Essentials, Standard and Datacenter.

*Software:* Microsoft .NET 4.7 Framework.

*Computer Running Management Client*:

*CPU:* Intel® Core™ i3 or better.

*RAM:* 4 GB or more.

*Network:* Ethernet 100 Mbit or better.

*Graphics Adapter:* Onboard GFX, AGP or PCI-Express, minimum 1024×768, 16-bit color or better.

*Hard Disk Space:* 1 GB free or more.

*Operating System*:

Microsoft Windows 8.1 Pro (64 bit).

Microsoft Windows 8.1 Enterprise (64 bit).

Microsoft Windows 10 Pro (64 bit).

Microsoft Windows 10 Enterprise (64 bit).

Microsoft Windows Server 2012 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2012 R2 (64 bit): Standard and Datacenter.

Microsoft Windows Server 2016 (64 bit): Essentials, Standard and Datacenter.

*Software*:

Microsoft .NET 4.7 Framework.

DirectX 11 or newer.

*Computer Running Full Viewing Client or Accessing Remote Client*:

*CPU:* Intel® Core™ i3 or better.

*RAM:* 1 GB or more.

*Network:* Ethernet 100 Mbit or better.

*Graphics Adapter:* Onboard GFX, AGP or PCI-Express, minimum 1024×768, 16-bit color or better.

*Hard Disk Space:* 500 MB free or more.

*Operating System*:

Microsoft Windows 8.1 Pro.

Microsoft Windows 8.1 Enterprise.

Microsoft Windows 10 Pro.

Microsoft Windows 10 Enterprise.

Microsoft Windows 10 Enterprise LTSB (Long-Term Servicing Branch) 2016 (version 1607 or later).

Microsoft Windows 10 Enterprise, version 1803 or later (64 bit), IoT Core.

Microsoft Windows Server 2012: Standard and Datacenter.

Microsoft Windows Server 2012 R2: Standard and Datacenter.

Microsoft Windows Server 2016: Essentials, Standard and Datacenter.

Microsoft Windows Server 2019: Essentials, Standard and Datacenter.

*Software*:

Microsoft .NET 4.7 Framework.

DirectX 11.0 or newer.

* + - 1. Licensing
         1. *License Activation:* VMS shall offer easy-to-use automatic or manual online activation via the Internet and alternatively, offline activation via email and web for closed surveillance networks.
         2. *Server Base License*:

Require one mandatory server base license for installing the product.

Server base license shall permit the following deployments within the legal entity purchasing the base license:

Unrestricted number of management servers.

Unrestricted number of recording servers.

Unrestricted number of full viewing client, web client and mobile client applications.

* + - * 1. *Hardware Device License*:

Require one license per hardware IP address to connect:

Cameras.

Audio devices.

Video encoders.

Other devices.

Support an unlimited number of hardware device licenses.

* + - * 1. *License Overview Information:* License overview shall include add-on products.
        2. *License Administration:* Provide license information presenting the license use.
        3. *Changes Without Activation:* A “Changes without activation” function shall allow additions and replacements of limited number of devices without requiring license device activation or reactivation.
    1. Execution
       1. Examination
          1. *Verification of Conditions*:

Visit site and verify that site conditions are in agreement with design package. Report all changes to the site or conditions which will affect performance of the system to the Owner. Do not take any corrective action without written permission from the Owner.

*General*:

Verify that existing site conditions are acceptable for product installation in accordance with manufacturer’s instructions.

Verify that wire runs, related items, and conditions are ready to receive work of this Section.

*Cable and Wiring*:

Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

Examine roughing-in for LAN and control cable conduit systems to PCs and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

*LAN / WAN*:

Verify LAN connections for server and workstation computers.

Provide access to the internet for the mobile server.

*Power Connections*:

Verify power circuits which are existing or have been previously installed under other sections are acceptable for product installation in accordance with manufacturer’s instructions.

* + - 1. Preparation
         1. Review configurable features of the VMS with the Owner’s Representative and document the results of the meeting in the Project planning documents. The following configuration topics shall be resolved prior to configuring equipment and services:

Internet Service Provider, firewall, and IP schema for VMS devices.

Time server synchronization scheme for overall security system.

Plan for system testing, startup, and demonstration.

Acceptance test concept and, on approval, develop specifics of the test.

List of default user IDs and passwords (factory defaults) for VMS application, servers and workstations.

Prepare root certificate and necessary child certificates for secure connection between system components.

* + - * 1. Provide a schedule with a list of participants to attend monthly coordination and progress update meeting until job completion. Attendees shall include:

Owner’s Representative of Facilities Management, Information Services, Security Management.

Contractor Project Manager.

Manufacturer(s) Employed Representative.

Architect / Engineer / Security Consultant.

* + - * 1. At all coordination meetings with Owner’s Representative, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.
        2. Owner’s Representative and Owner shall assist in establishing procedural guidelines and in defining terminology and conditions unique to the Owner’s operation.
        3. Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the installation of the VMS.
        4. Coordinate Owner installation or update of workstation operating system software and web browser software to a version as specified by the VMS provider.
        5. Coordinate Owner-managed computer and network security practices as specified by the VMS provider.
      1. Installation
         1. Deploy VMS in accordance with manufacturer’s Deployment Best Practice Guide, including workstation and integration instructions and requirements.
         2. Collaborate with Owner’s Representative on the application of manufacturer’s hardening guide recommendations.
         3. Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the VMS installation.
         4. *Drawings and Diagrams*:

System devices identified on building drawings are intended to generally indicate areas where such devices are to be located. Determine final location of these devices in accordance with Owner’s requirements.

Riser diagrams are schematic and do not show every conduit, wire box, fitting, or other accessories. Provide such materials as necessary for a complete and functioning installation.

* + - * 1. Comply with manufacturer’s written data, including product technical bulletins, product catalog installation instructions and product carton installation instructions.
        2. All firmware in products shall be the latest and most up-to-date provided by the manufacturer, or of a version as specified by the provider of the VMS to ensure approved integration compatibility.
        3. Install, configure, and test VMS for complete and proper operation.
      1. Site Quality Control
         1. *Site Tests and Inspections*:

Submit documented test plan to Owner at least 14 days in advance of final acceptance test, inspection and check-off.

Perform acceptance reviews with Owner’s representative of device and system configurations and their documentation.

Perform final acceptance testing in the presence of Owner’s representative, executing a point by point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified, including response times for control actions and sequences, and rules-based actions. Tests shall demonstrate the functionality of each individual device control item, including as camera alarm outputs and control relays.

Conduct acceptance tests in presence of Owner’s representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center, and provide Owner’s Representative with written report of test results.

Specific tests shall be witnessed by Authorities Having Jurisdiction if necessary.

Consider VMS accepted only after all acceptance test items have been successfully checked-off.

Beneficial use of part or all of the system shall not be considered as acceptance.

As required to sufficiently demonstrate the VMS functionality, request the console operator on duty and his/her superior to perform certain daily operations using the VMS.

Complete all required training prior to initiation of the final acceptance test.

Inspect the installation of all field computers and devices.

Point out general neatness and quality of installation, test the full functionality of each individual device, and show that mounting, backbox and conduit meet compliance requirements.

Owner’s Representative shall, upon successful completion of the final acceptance test (or subsequent punch list retest), issue a letter of final acceptance.

Owner’s Representative retains right to suspend and/or terminate testing at any time when the system fails to perform as specified.

Collaborate with Owner’s Representative prior to start of testing, to establish criteria pass/fail criteria and classification of test execution problems, such as:

*Pass/fail:* Criteria determining what constitutes a test pass or failure.

*Suspension and resumption:* Criteria determining when testing must be suspended and resulted later.

*Show Stopper:* Stop test, fix problem and restart test from beginning.

*Major Problem:* Fix problem before test can be resumed or concluded.

*Minor Problem:* Add problem to “punch list”, complete test.

*Special Issue:* Investigate to determine which problem category above category applies.

If it becomes necessary to suspend testing or inspections, work diligently to complete/repair all outstanding items to the condition specified in Specification and as indicated on related drawings.

Supply Owner’s Representative with detailed completion schedule outlining phase by phase completion dates and a tentative date for a subsequent punch list retest.

During final acceptance test, make no adjustments, repairs or modifications to system without permission of Owner’s Representative.

* + - 1. Adjusting
         1. Perform field software changes after the initial programming session to “fine tune” operating parameters and sequence of operations based on any revisions to the Owner’s operating requirements.
         2. *Installer/Factory User Accounts*:

Remove all default, installer, or temporary user accounts and passwords used during installation that are not part of End-user’s final operational requirements.

Assign new passwords that are substantially different from factory default passwords to user accounts that match factory-default user accounts.

Apply appropriate measures from manufacturer’s system hardening guide.

* + - 1. Closeout Activities
         1. *Training*:

*General*:

Submit training plans and instructor qualifications to Owner’s Representative for approval.

Coordinate with Owner’s Representative to accommodate owner shift schedules to reduce impact to regular operations.

* + - * 1. Provide training as scheduled.
        2. Deliver printed or electronic reference materials that cover the entire training presentation.
      1. Protection
         1. Maintain strict site security during the installation of equipment and software.

*Equipment Rooms:* Lock and secure rooms housing accessible equipment that has been powered up.

*Dedicated Workstations:* Shut down, lock and secure rooms containing workstations during periods when a qualified operator in Contractor’s employ is not present.

* + - * 1. Protect installed work of other trades when working in the same location, protecting all completed work prior to acceptance by Owner, unless Owner has specifically relieved Contractor from this responsibility.
        2. *Incremental and As-built Configuration Backup*:

Perform full back-up of all configuration settings and system data from VMS at the completion of critical installation milestones, immediately prior to start of acceptance testing, and immediately after acceptance testing is completed.

Deliver instructions for restoration of the VMS backups upon completion of acceptance testing.

* + - 1. Maintenance
         1. Provide maintenance updates by VMS manufacturer per agreed schedule.

1. End of Section