DIRECTORATE OF ESTATES

PROCEDURE AND INFORMATION MANUAL

EPM PM26 – Standard CCTV Specification

Document Originated:	January 2017	**By:**	Mark Hobday
Issue Number:	01	**Number of pages:**	29
Approved by EMG:		**Status:**	Working Document
Last revised:	January 2021	**By:**	Paul Greenlees & John Ashton, Sandra Davidson
Next revision:	January 2022	**By:**	TBA

Table of Contents

CCTV UPGRADE SPECIFICATION

1. INSTRUCTIONS TO CCTV CONTRACTORS

1.1 Background

The University of Manchester, has numerous buildings spread over a large area. The campus is split into 2 distinct sections; the North and Oxford Road campus, separated by the A57M/A635M Mancunion Way motorway. The campus has extensive open areas and leisure facilities including bars, restaurants, a museum and art gallery.

The University has a substantial Video Management System (VMS) consisting of a Milestone XProtect Corporate CCTV system which is monitored in a dedicated CCTV control room (the PCR) within the Harold Hankins building on Oxford Road campus. This system is used predominantly to provide proactive monitoring of external areas of both the North and Oxford Road campus, and the interconnecting safe walkway. The system was installed in late 2017. External fixed, panoramic and PTZ cameras connected to this system are recorded on servers provided and managed by the University IT department. The majority of these cameras are connected via the University's IT infrastructure, although a small quantity utilise legacy cabling converted to be IP bearing. In addition, numerous departmental internal CCTV systems, often utilising legacy Dedicated Micros Sprite Network Video recorders are located within the individual department buildings. These departmental buildings are not managed or proactively monitored by the University Security Services; however, recorded footage can be reviewed by Security Services if required, via a dedicated NetVu client located in the PCR.

The propose of this document is twofold:

i. To ensure compatibility with the Milestone system for any legacy CCTV systems or components that require replacement.

ii. To ensure compatibility with the Milestone system for any CCTV systems deployed as part of new building construction on the campus.

This document will provide an Operational Requirement for CCTV camera coverage and associated performance, and for recording systems deployed under either of the above scenarios.

For new construction projects it is intended that this generic specification document will be incorporated into the project tender documents in addition to any project specific CCTV specification produced.

1.2 Scope of Works.

It will be the responsibility of the CCTV contractor to supply, install and commission the CCTV equipment to provide a fully integrated solution in line with the individual project requirements and this generic CCTV technical specification.

The exact scope of works will be dictated by the individual project requirements but will typically consist of the following elements:

- Supply, install, configure and test local Milestone XProtect Smart Client products.
- Manage the changeover from any existing system to the new systems with minimal downtime to any existing CCTV provision.

- Supply and install IP CCTV cameras, masts & bracketry, XProtect licenses, PSUs transmission equipment and associated local cables, for new CCTV locations.
- Remove redundant CCTV equipment where upgrading existing systems and return associated equipment to the University for re-use or disposal.
- Provision of comprehensive Method Statements and site-specific risk assessments, detailing the works processes.
- Site surveys during the works to identify extent of existing provisions and services if re-use is planned.
- Liaison with the Design and Management Team throughout the project
- Liaison with the relevant IT department to co-ordinate communication and server requirements throughout the project.
- Commission the systems and demonstrate functionality
- Provide operational documentation for the new systems
- Train the client in the use of the system.

The contract shall provide for all elements to provide a fully functional CCTV system at the site (within the limitations of the individual project), with monitoring from the PCR for external cameras and local monitoring of internal cameras. This local monitoring shall be detailed in the individual project specification.

Certain associated elements may be provided to the CCTV contractor, by others; typically, data, power, cabling and/or containment, and buildersworks. Where applicable these shall be detailed in the individual project specification.

The CCTV contractor shall identify all such elements within their tender return, to allow these to be priced by others. Any items omitted will be deemed to be the responsibility of the CCTV contractor to provide.

2. GENERAL REQUIREMENTS

2.1 Design Aim

This specification defines the works necessary to provide additional CCTV monitoring of The University of Manchester campus and buildings, via expansion and additions to the existing networked Video Management System (VMS) including the capacity to record all cameras for a specified period, at the specified image quality and refresh rates.

The design aim is to achieve the following:

- A consistent CCTV operational requirement
- Standardisation on CCTV cameras and associated equipment.
- Flexible recording and monitoring solution with capability to accommodate IP cameras.
- High quality images of designated areas of the campus at a resolution sufficient to meet operational requirements including, where applicable, to assist with incident management and investigation.
- Robust evidence and archiving facilities
- Enhanced incident and event search facilities
- Flexible upgrade capability.
- Adhere to the network and security design standardisation using a secure and logically segmented implementation approach.

In summary, the design aim is to provide a monitoring and review system to cater for all cameras, which can be deployed in a flexible manner to suit the needs of the University Security Services and the individual building/department initiating the works.

2.2 CCTV network

Generally, cameras will connect to recording and review facilities via a segregated network. This shall provide new network connectivity to all upgraded and new camera locations using Virtual Routing and Forwarding (VRF) facilities. Networks shall provide segregation between incoming cameras streams and outgoing viewing streams within the VRF to the PCR or local review and recording facilities.

This manner in which this network is provided shall adhere the CCTV network design and will be detailed in the individual project specific documentation. In all cases, the CCTV contractor shall allow for sufficient liaison with the project IT provider, and relevant University IT department to clearly co-ordinate the project requirements. This shall include agreement on software and license loading, patching of firmware updates, support and initial IT governance, security and PEN testing.

The CCTV contractor shall liaise with the client network providers to ensure that camera images are free of any network based interference and have acceptable control latency (typically >600Ms at the PCR).

2.3 Works by others.

The extent of works by others may include network cabling, containment, power and associated builders works, and will be detailed within the individual project specification. The CCTV contractor shall detail their exact requirements within their tender return. Any omissions will be deemed to be the CCTV contractor’s responsibility to provide.

2.4 Liaison with the client's representative

The need to liaise constantly with the client's project, security and IT representatives during the entire works period cannot be stressed strongly enough.

The client **must** be kept informed of the impending work activities to ensure no essential systems are compromised. The CCTV contractor shall allow in his costs for this **on-going** exchange of information with the client, and for compliance with client procedures, including risk assessment, method statement and local permit to work requirements.

2.5 Factory Tests and Inspections

Any requirement for factory testing will be detailed within the individual project specification.

2.6 Site Commissioning and Witness Testing

A comprehensive Site Witness Testing Schedule relevant to the works shall be produced by the CCTV contractor, for approval by the client's representative, and shall be submitted a minimum of two weeks in advance of the test date. The documents shall cover the verification of all system functions and facilities sufficient to demonstrate the correct installation and operation of the system provided under the project, as a whole. Covering both night and daytime tests as applicable to the system components, the document shall include a section on operational tests, designed to verify the operation of all aspects of the system.

The test document shall be thorough in its testing and recording, and shall effectively demonstrate all performance and operational aspects to the satisfaction of the project manager, and shall naturally include the verification of the overall control functionality.

To conduct the tests, the CCTV contractor shall provide suitable personnel and test equipment as necessary, such that he may carry out tests and demonstrations in accordance with the test schedule for the client's representative and others to witness. In the case of CCTV testing, the CCTV contractor is also required to demonstrate the resolution, etc. of the new camera units.

The client shall nominate a representative be present at the tests to witness the actions, verify the results and signify or not his satisfaction of each aspect of the system.

Before the testing, the system shall have been fully commissioned by the Security Contractor, and checked against the agreed Site Witness Testing Schedule with results recorded, such that the tests can reasonably be expected to proceed without delays due to wiring errors, poor equipment adjustment and errors within the test schedules themselves.

Abortive or unsuccessful tests shall be at the cost of the Security Contractor. Similarly, costs incurred due to the inability of the CCTV contractor to make or complete a test, having given the required notice, shall be charged to the Security Contractor.

Witness Tests shall include, but not be limited to:

Physical Checks:

Provision of equipment against specification

Verification of use of any specified components/systems

Quality of installation, wiring, cabling and cable/unit identification for elements provided by the CCTV contractor.

Qualitive Checks (new CCTV cameras):

Verification of required fields of view

Image resolution day & night (Rotakin testing or equal approved) pre-VMS

Day/night focus

Infra Red illumination field (where applicable)

Operational Checks (Local control equipment and at PCR, as required):

Camera selection – manually and via maps

Camera control including pre-positions

Display and review functionality

Image resolution

File size and compression confirmation

Refresh rate confirmation

Storage confirmation

Disc failure reporting

Archive functionality

Evidential signature

Playback resolution

Motion search functionality

Network based vulnerability scans and/or penetration tests are required prior to acceptance into service

Additional training where required

2.7 Documentation

The CCTV contractor shall include for the production of a set of documents for the new and upgraded elements of the system. All documentation shall be in electronic format, in the form of a series of pdf document with hyperlinks between documents. The exact format is to be agreed with the CCTV contractor, client and main contractor.

No additional documentation is required for retained equipment or cabling where these have not been modified by the project. However, schematic diagrams and revised cable and wiring schedules shall be provided to record any changes to existing cabling and control/display equipment associated with the incorporation of the new devices and control systems.

Measurements of newly installed cables, additional/modified containment, additional power supplies, equipment types, locations and serial numbers shall be recorded and included in the documentation package. Full details and operating instructions for any equipment or systems provided under the contract shall be provided. Re-used mains circuits shall be retested in accordance with legislative requirements for modified circuits and test results included in the documentation package.

Installation drawings detailing all intended device locations, cable routes, power sources, etc. shall be provided for approval before installation of the system equipment. Such drawings shall be later incorporated in the final Maintenance Manuals for record purposes.

Installation drawings shall be submitted to the project manager for comment by the Design Team, with final review and approval by the client's representative.

The documentation is part of the extent of supply of the security works, and the works as a whole shall not be deemed complete until complete documentation to the required standard is provided and accepted.

2.7.1 O & M Manuals

O/M manuals shall comprise Manufacturers' standard documentation logically integrated by a purpose drawn Block Diagram. A schedule of new systems, equipment types, serial numbers and equipment locations shall be included. All Site testing documents and post-installation measurements for cables shall be included also.

The Maintenance Manuals shall be fully detailed concerning all connection schedules (wires and cables) and technical information of major system components such that any NACOSS approved Company can successfully carry out system modifications and maintenance, both regular and emergency.

At least one copy of the complete final version of the O&M Manual shall be in the possession of the Client at completion in order to comply with Health and Safety Regulations.

2.7.2 Operator Manuals

Operator Handbooks shall be provided where necessary as a guide to the everyday operation of the various stand-alone sub-systems that are included in the scope of works. It shall describe the system concepts and its control and displays only in such detail as is necessary for non-technical Operators to gain sufficient knowledge to efficiently understand and use the systems.

2.7.3 'As-Fitted' Drawings

Installation drawings detailing new and relocated system components and their locations, new and revised cable routes, cable identifications, location of power sources, etc. shall be provided and incorporated in the final Maintenance Manuals for record purposes

All drawings shall be produced using AutoCAD or approved equivalent. Drawings in pdf format shall be included in the O/Ms and shall also be issued in AutoCad format for inclusion in the client's own records.

3 CCTV OPERATIONAL REQUIREMENT

The general minimum Operational Requirement for The University of Manchester CCTV system is as follows unless modified in the individual project specification:

- PTZ cameras - The system should be able to provide the specified live and recorded images when operator controlled to view scenes of interest at the building line, in all reasonably expected lighting conditions.

- Fixed & panoramic cameras – The system should be able to provide the specified live and recorded images at the target position specified for the fixed camera, in all reasonably expected lighting conditions.

- Support for remote viewing of images via client PCs using a dedicated VMS client, browser and mobile devices.

The CCTV contractor shall design, supply, install and commission a system capable of meeting the above operational requirement.

Resolution levels used throughout this document shall be as follows:

- **Identification level** shall be nominally a minimum of 150 ppm at the target position
- **Recognition level** shall be nominally a minimum of 100 ppm at the target position
- **Overview level** shall be nominally a minimum of 50 ppm at the target position.

In all cases the ppm level should be seen as a minimum guidance only, and it is the CCTV contractor's responsibility to design and demonstrate a system that provide images that are fit-for purpose, including considering all contributory factors should as lighting levels, compression and camera settings (WDR, BLC etc) as applicable to the individual camera locations and which can impact on the produced image quality.

Details of individual coverage requirements follow:

3.1 External CCTV coverage

The general concept for external CCTV coverage will be as follows:

3.1.1 **Overview coverage** of all external aspects of a building using fixed or panoramic cameras. Cameras should provide sufficient quality images to provide recognition level performance at 25m from the camera location under all reasonably expected lighting conditions. 100% coverage of the external faces of a building is not required; however, it should not be possible to approach a building without passing through the field of view of a fixed/panoramic external camera.

3.1.2 **Detailed coverage** using PTZ cameras under PCR operator control, using a combination of new and where applicable existing camera locations. PTZ cameras should provide evidential quality (minimum 150ppm) of individuals when steered and zoomed by operators, in all reasonably applicable lighting conditions.

The CCTV contractor shall in all cases engage with the University Security Services when determining all external CCTV requirements, as any design should consider existing locations which may already provide some of the above individual project/building coverage requirements via cameras currently in place on adjacent buildings.

All external cameras provided under a project shall be configured so that they can be proactively monitored by PCR security operatives on a 24/7 basis on the Milestone VMS. PCR security operatives will at all times have priority of PTZ control over any local building level review/monitoring/control facility provided under the individual project.

External CCTV cameras shall be recorded on the main system VMS recordings servers which shall be expanded as required (in terms of storage, licensing, processing power and resilience) to suit the additional requirements for the individual project. The CCTV contractor shall engage with the University IT department to determine the exact expansion requirement, based on information regarding external camera quantities, bandwidth and storage calculations provided by the CCTV contractor. Additional server and storage requirements will be procured by the University IT department; however, the costs for such expansion shall be borne by the individual building / CCTV project.

The CCTV contractor shall provide all additional Milestone software and device licenses.

3.2 Internal CCTV coverage

The general concept for internal CCTV coverage will be as follows:

3.2.1 **Main entrances.** All building main entrances shall be provided with fixed CCTV coverage that views the entire width of the door opening. For double doors this shall include both leaves. For multiple adjacent doors such as rotary doors with side doors, this shall include all doors routinely opened for entry. It is acceptable for a single camera to provide coverage of multiple adjacent doors, as long as the full opening width and minimum resolution parameters are maintained at each door. Cameras should provide identification level live and recorded images of all individuals entering the building.

3.2.2 **Fire escapes.** Fire escapes shall not routinely be provided with dedicated CCTV coverage unless high risk areas. The CCTV contractor shall seek guidance from the University Security Services on such locations within any new construction or upgrade project involving CCTV. For high risk areas, where CCTV for fire escapes is deemed to be a requirement, then the specifications for main entrances shall apply as section 3.2.1

3.2.3 **Reception areas.** Reception areas shall be provided with overview level CCTV coverage of the full reception area. In addition, if the area includes a manned reception desk, this shall also be provided with identification level coverage of anyone interacting with staff at the desk.

3.2.4 **Computer clusters.** These areas shall be provided with full CCTV coverage of the whole of the room, providing evidential level recorded images throughout. If selecting 360’ roof mount cameras these should be de-warped and presented as 4 x 90’ views using a Milestone certified plugin as required.

3.2.5 **Café areas.** These areas shall be provided with full overview level CCTV coverage of the whole of the room. If selecting 360’ roof mount cameras these should be de-warped and presented as 4 x 90’ views using a Milestone certified plugin as required. The installation will not position cameras that will enable them to capture images of card data and or PIN transactions.

3.2.6 **Front of house/Foyers/Lobbies/Congregation areas.** These areas shall be provided with overview level CCTV coverage of the full area.

3.2.7 **Cash handling/ATM areas.** These areas shall be provided with overview level CCTV coverage of the area. Again the installation will not position cameras that will enable them to capture images of card data and or PIN transactions.

3.2.8 **High risk Areas**. This will typically consist of CAT3 laboratories, and IT server rooms. In all cases, the Universities Security Services should be consulted for guidance. Generally, the requirement will be for fixed evidential level CCTV coverage of the entrance door with fixed overview coverage throughout the remainder of the room.

3.2.9 **Museums and Galleries**. These may have additional requirements such as compliance with the Government Indemnity Scheme (GIS), in addition to those of the University Security Services, and external guidance should be sought as to any particular specifications for such locations.

Items 3.2.5 and 3.2.7 shall be in accordance with the Payment Card Industry Data Security Standards (PCI DSS), the PCI Operational Group can provide guidance on this.

All internal cameras provided under a project shall be configured so that they are not normally proactively monitored by PCR security operatives but are available for incident review on the Milestone VMS.

Internal CCTV cameras shall **not** be recorded on the main external CCTV system Milestone VMS recordings servers; instead, the CCTV contractor shall provide local Milestone Husky Network Video Recorders (NVRs), sized to provide 31 days recording of all connected cameras at 12fps. The CCTV contractor shall provide design calculations within their tender return to demonstrate compliance with this requirement – see section 4.4 for further details.

4 EQUIPMENT PARTICULARS

4.1 General

The following sections describe the detailed requirements for items to be supplied and/or upgraded as within this scope of works.

Section 4.3 describes the specification of field equipment items to be provided within this project specification. Section 4.4 describes the specification of control and monitoring equipment.

4.2 Performance criteria

Image fields of view will be assessed against the standard Home Office Scientific Development Branch (HOSDB) test target which provides a means of standard measurement of target heights and image resolution. The Rotakin is a man shaped target. 100%R is achieved when the target is placed so that it stands from top to bottom of the viewing screen, 25%R when it only fills ¼ of the screen height etc.

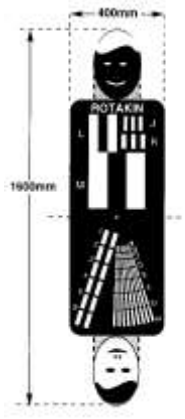

Fig 1 – HOSDB Rotakin test target

The following guidelines are advised for differing surveillance requirements:

Control and Monitor…….Not less than 5%R

Detection……...Not less than 10%R

Recognition……...Not less than 50%R

Identification…….Not less than 120%R

Thus for identification of an individual that person must occupy approx 120% of the image screen height. However, the above figures are for monitoring and recording review of standard definition systems.

High definition (HD) systems can provide identification level recordings at considerably lower target height than the standard definition Rotakin values above, and as such, the following definitions will apply to HD camera performance:

- **Identification level** shall be nominally a minimum of 150 ppm at the target position
- **Recognition level** shall be nominally a minimum of 100 ppm at the target position
- **Overview level** shall be nominally a minimum of 50 ppm at the target position.

4.3 Field equipment

The following section details the requirements for cameras to be provided as part of any campus CCTV project.

It should be remembered that this specification was produced in 2017 and over time, many of the camera models indicated in the following sections will become obsolete and be replaced within the manufacturer's portfolio with newer variants. In such cases, the manufacturers direct replacement model shall be considered an acceptable alternative. If no such model exists, an alternate should be proposed, with preference for products from the Axis range of cameras. In all cases, performance criteria within this section of the document should be considered the minimum acceptable level of performance, and all deviations due to equipment obsolescence should have a rationale provided by the CCTV contractor explaining the reason for the deviation and the performance implications when compared with the devices specified in section 4.3, particularly with respect to resolution, low light capability, dynamic range, bandwidth and warranty. Compatibility with Milestone XProtect Corporate shall be maintained at all times.

It should be noted that all external cameras will be capable and configured to be proactively monitored by University security staff at the PCR, whilst internal cameras can be monitored or displayed locally to suit the department and individual project needs and as detailed in the individual project specific documentation. This monitoring should be via dedicated PCs or Milestone 'Huskys' connected to an isolated CCTV network segment. Recordings and live images from internal cameras shall also be available at the PCR but these shall be configured to be in a separate group from external cameras which are proactively monitored as a matter of course.

4.3.1 External HD PTZ cameras

All cameras are to be mounted within camera housings suitable for the installed environment. External cameras shall be provided with heaters and the CCTV contractor shall allow for any associated hardware required such as brackets, PSUs, mid-spans etc. All camera enclosures shall be tamper resistant and require special tools to gain access to camera aiming facilities and installation fixings. All power and communications cabling shall be concealed. All camera housings shall be low voltage devices, preferably supporting PoE. Where the requirement for housing heaters leads to the need for a separate PSU and an associated 240v supply is required, the CCTV contractor shall advise this within their tender return so that it can be provided by others. Any omissions will be deemed to be the CCTV contractor's responsibility.

Camera housings are to be mounted in positions providing maximum protection from vandalism and/or tampering.

Cameras shall support Electronic Image Stabilisation and auto tracking.

Cameras shall be provided with local storage, typically 64Gb SD cards to provide a short term buffer should network connection be temporarily lost.

PTZ cameras shall meet the following minimum specification:

Image sensor 1/3" Progressive Scan CMOS
Lens 4.4–132 mm, F1.4–4.6, Horizontal field of view: 63.4˚– 2.3˚ Vertical field of view: 34.3˚–1.3˚ Autofocus, auto-iris
Day and night Automatically removable infrared-cut filter
Minimum illumination
Color: 0.2 lux at 30 IRE F1.4 **B/W:** 0.02 lux at 30 IRE F1.4
Color: 0.3 lux at 50 IRE F1.4 **B/W:** 0.04 lux at 50 IRE F1.4
Pan/Tilt/Zoom Pan: 360° endless, 0.05°–700°/s Tilt: +20 to -90°, 0.05°–500°/s

Zoom: 30x Optical, 12x Digital, Total 360x zoom Nadir flip, 256 preset positions, Tour recording, Guard tour, Control queue, On-screen directional indicator, Set new pan 0°,
Adjustable zoom speed, Speed Dry (Q6115)
Video compression
H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles Motion JPEG
Resolutions 1920x1080p (HDTV 1080p) to 320x180
Frame rate Minimum 12 fps
Video streaming Multiple, individually configurable streams in H.264 and Motion
JPEG Controllable frame rate and bandwidth VBR/MBR H.264
Image settings Compression, Color, Brightness, Sharpness, White balance, Exposure control, Exposure zones, Rotation, Backlight compensation, Fine tuning of behavior at low light, Electronic Image Stabilization (EIS), Defogging, Manual shutter time, Text
and image overlay, Image freeze on PTZ WDR – Dynamic Capture: 115 dB 32 individual 3D privacy masks
Network Security Password protection, IP address filtering, HTTPSa encryption,
IEEE 802.1Xa network access control, Digest authentication, User access log, Centralized Certificate Management
Supported protocols
IPv4/v6, HTTP, HTTPSa, SSL/TLSa, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnPTM, SNMP v1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, SFTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, NTCIP
Application Programming Interface
Open API for software integration, ONVIF Profile S
Analytics Video motion detection, Active Gatekeeper, Shock detection, Autotracking
Event triggers Detectors: Live Stream Accessed, Motion Detection, Shock Detection
Hardware: Network, Temperature Input Signal: Manual Trigger, Virtual Inputs
PTZ: Autotracking, Error, Moving, Preset Reached, Ready Storage: Disruption, Recording System: System Ready Time: Recurrence, Use Schedule
Event actions Overlay text, PTZ preset, guard tour, video recording to edge storage, autotracking, day/night mode, pre- and post-alarm video buffering, send SNMP Trap
File upload via FTP, SFTP, HTTP, HTTPS, and email, Notification via email, HTTP, HTTPS, and TCP
Operating conditions -20 °C to 50 °C (4 °F to 122 °F)
Approvals EN 55022 Class A, EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 55024, EN 50121-4, IEC 62236-4, FCC Part 15 Subpart B Class A, ICES-003 Class A, VCCI Class A, RCM AS/NZS CISPR22 Class A, KCC KN22 Class A, KN24, IEC/EN/UL 60950-1, IEC/EN/UL 60950-22, IEC/EN 62262 IK08,
IEC/EN 60529 IP66, NEMA 250 Type 4X, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-78, IEC 60068-2-14, IEC 60068-2-6, IEC 60068-2-27, ISO4892-2
Warranty 3-year warranty

External HD PTZ cameras shall be either Axis Q6045E or Q6115E or agreed equivalent.

4.3.2 External HD fixed cameras

All cameras are to be mounted within camera housings suitable for the installed environment. External cameras shall be provided with heaters and the CCTV contractor shall allow for any associated hardware required such as brackets, PSUs, mid-spans etc. All camera enclosures shall be tamper resistant and require special tools to gain access to camera aiming facilities and installation fixings. All power and communications cabling shall be concealed. All camera housings shall be low voltage devices, preferably supporting PoE. Where the requirement for housing heaters leads to the need for a separate PSU and an associated 240v supply is required, the CCTV contractor shall advise this within their tender return so that it can be provided by others. Any omissions will be deemed to be the CCTV contractor's responsibility.

Camera housings are to be mounted in positions providing maximum protection from vandalism and/or tampering.

Cameras shall be provided with local storage, typically 64Gb SD cards to provide a short term buffer should network connection be temporarily lost.

Fixed (static) cameras shall meet the following minimum specification:

Image sensor Progressive scan CMOS 1/3.2"
Lens 3.3–9.8 mm, F1.6 Horizontal angle of view 35˚ – 109˚ Varifocal, Autofocus, Remote focus and zoom, P-Iris control, IR corrected
Day and night Automatically removable infrared-cut filter
Minimum illumination: Color: 0.35 lux at F1.6 **B/W:** 0.07 lux at F1.6
Video Compression H.264 High, Main and Baseline profiles (MPEG-4 Part 10/AVC)
Motion JPEG
Resolutions Varies from 1080p to 4K as detailed in section 8 for the individual locations.
Frame rate 12 fps minimum
Video streaming Multiple, individually configurable streams in H.264 and Motion JPEG, Controllable frame rate and bandwidth, VBR/MBR H.264
Image settings Manual shutter time, Compression, Color, Brightness, Sharpness,
White balance, Exposure control, Exposure zones, Backlight compensation, Fine tuning of behavior at low light, Text and image overlay, Privacy masks
Wide Dynamic Range-Dynamic Contrast Rotation: 0°, 180°
Pan/Tilt/Zoom Digital PTZ
Network Security Password protection, IP address filtering, HTTPS encryption, IEEE 802.1Xa network access control, Digest authentication, User access log
Supported protocols IPv4/v6, HTTP, HTTPSa, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnPTM, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, SFTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH
Application Programming Interface Open API for software integration,
Analytics Video motion detection
Event triggers Detectors: Day/Night Mode, Live Stream Accessed Tampering Hardware: Network, Temperature Input Signal: Manual Trigger, Virtual Inputs Storage: Disruption, Recording System: System Ready
Time: Use Schedule, Recurrences

Event actions File upload: FTP, SFTP, HTTP, HTTPS network share and email Notification: email, HTTP, HTTPS and TCP and SNMP trap External output activation
Video recording to edge storage Pre- and post-alarm video buffering PTZ preset, Overlay text
Operating conditions -30 °C to 50 °C (-22 °F to 122 °F) Humidity 10–100% RH (condensing)
Approvals EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 55024, FCC Part 15 Subpart B Class A, ICES-003 Class A, VCCI Class A, RCM AS/NZS CISPR 22 Class A, KCC KN22 Class B, KN24, IEC/EN/UL 60950-1,
IEC/EN/UL 60950-22, IEC/EN 60529 IP66, NEMA 250 type 4X, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-27 EN 55022 Class B
Warranty 3-year warranty

External HD fixed cameras shall be Axis P14 series or agreed equivalent, as required to provide the necessary resolution for the individual location.

4.3.3 External HD panoramic cameras

All cameras are to be mounted within camera housings suitable for the installed environment. External cameras shall be provided with heaters and the CCTV contractor shall allow for any associated hardware required such as brackets, PSUs, mid-spans etc. All camera enclosures shall be tamper resistant and require special tools to gain access to camera aiming facilities and installation fixings. All power and communications cabling shall be concealed.

All camera housings shall be low voltage devices, preferably supporting PoE. Where the requirement for housing heaters leads to the need for a separate PSU and an associated 240v supply is required, the CCTV contractor shall advise this within their tender return so that it can be provided by others. Any omissions will be deemed to be the CCTV contractor's responsibility.

Camera housings are to be mounted in positions providing maximum protection from vandalism and/or tampering. Where this is not possible protection cages and/or vandal proof fixings are to be provided for external cameras.

Panoramic cameras shall meet the following minimum specification:

Image sensor 3 x 1/1.8" progressive scan CMOS
Lens 3 x lenses, fixed focus, 5.0 mm, F2.8, Combined horizontal angle of view: 180°
Day and night Automatically removable infrared-cut filter
Minimum illumination: Color: 0.3 lux, F2.8 **B/W:** 0.06 lux, F2.8
Video compression H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles
Motion JPEG
Resolutions 3 x (2560x1920 to 480x270) (Q3708)
Frame rate Minimum 12 fps
Video streaming Multiple, individually configurable streams in H.264 and Motion
JPEG, Controllable frame rate and bandwidth, VBR/CBR H.264, Axis' Zipstream technology in H.264 (Q3708)
Image settings Compression, Color, Brightness, Sharpness, Contrast, White balance, Exposure control, Exposure zones, Fine tuning of behavior at low light, Text and image overlay, Privacy mask, Capture alignment WDR – forensic capture: Up to 110 dB depending on scene (Q3708)

Network Security Password protection, IP address filtering, HTTPSa encryption,
IEEE 802.1Xa network access control, Digest authentication, User access log, Centralized Certificate Management
Supported protocols IPv4/v6, HTTP, HTTPSa, SSL/TLSa, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnPTM, SNMP v1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP (Q3708)
Application Programming Interface Open API for software integration, ONVIF Profile S
Analytics Video Motion Detection, Active tampering alarm
Event triggers Analytics, Edge storage events
Event actions File upload: FTP, SFTP, HTTP, HTTPS, network share and email
Notification: email, HTTP, HTTPS, TCP and SNMP trap, Video recording to edge storage, Pre- and post-alarm video buffering, Overlay text
Operating conditions -40 °C to 55 °C (-40 °F to 131 °F), Humidity 10–100% RH (condensing)
Approvals EN 55022 Class A, EN 50121-4, IEC62236-4, EN 61000-3-2, EN 61000-3-3, EN 55024, EN 61000-6-1, EN 61000-6-2, FCC Part 15 Subpart B Class A, ICES-003 Class A, VCCI Class A, RCM AS/NZS CISPR 22 Class A, KCC KN32 Class A, KN35, IEC/EN/UL 60950-1, IEC/EN/UL 60950-22, EN 50581, IEC/EN 60529 IP66, NEMA 250 Type 4X, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-30, IEC 60068-2-78, IEC/EN 62262 IK10
Warranty 3-year warranty

External HD panoramic cameras shall be either Axis Q3708-PVE or Q6000-E or agreed equivalent.

4.3.4 Internal HD fixed cameras

All cameras are to be mounted within camera housings suitable for the installed environment. The CCTV contractor shall allow for any associated hardware required such as brackets, PSUs, mid-spans etc. All camera enclosures shall be tamper resistant and require special tools to gain access to camera aiming facilities and installation fixings. All power and communications cabling shall be concealed. All camera housings shall be low voltage devices, preferably supporting PoE. Where the requirement for housing heaters leads to the need for a separate PSU and an associated 240v supply is required, the CCTV contractor shall advise this within their tender return so that it can be provided by others. Any omissions will be deemed to be the CCTV contractor's responsibility.

Camera housings are to be mounted in positions providing maximum protection from vandalism and/or tampering.

Cameras shall be provided with local storage, typically 64Gb SD cards to provide a short term buffer should network connection be temporarily lost.

Fixed (static) cameras shall meet the following minimum specification:

Image sensor Varies with camera selected for location.
Lens Varifocal, Autofocus, Remote focus and zoom, P-Iris control, IR corrected
Day and night Automatically removable infrared-cut filter
Minimum illumination: Color: 0.16 lux at F1.4 50IRE **B/W:** 0.03 lux at F1.4 50 IRE
Video Compression H.264 High, Main and Baseline profiles (MPEG-4 Part 10/AVC)
Motion JPEG

Resolutions Varies from 1080p to 4K as detailed for the individual locations.
Frame rate 12 fps minimum
Video streaming Multiple, individually configurable streams in H.264 and Motion JPEG, Controllable frame rate and bandwidth, VBR/MBR H.264
Image settings Compression, Color, Brightness, Sharpness, White balance, Exposure control, Exposure zones, Backlight compensation, Fine tuning of behavior at different light levels, Text and image overlay, Privacy masks, WDR forensic capture.
Pan/Tilt/Zoom Digital PTZ, preset positions
Network Security Password protection, IP address filtering, HTTPSa encryption,
IEEE 802.1Xa network access control, Digest authentication, User access log
Supported protocols IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, SFTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, LLDP
Application Programming Interface Open API for software integration,
Analytics Video motion detection, active tampering.
Event triggers Analytics, edge storage devices, virtual inputs through API.
Event actions Record video: SD card and network share, Upload of images or video clips: FTP, SFTP, HTTP, HTTPS, network share and email Pre- and post-alarm video or image buffering for recording or upload. Notification: email, HTTP, HTTPS, TCP and SNMP trap. Overlay text
Memory 512 MB RAM, 256 MB Flash
Power Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 3, max 10.2 W, typical 6.1 W
Connectors RJ45 10BASE-T/100BASE-TX PoE
IR illumination Models available with Optimized IR with power-efficient, long-life 850 nm IR LEDs with adjustable illumination intensity. Range of reach 30 m (100 ft) or more depending on scene
Storage Support for microSD/microSDHC/microSDXC card
Support for SD card encryption
Support for recording to network-attached storage (NAS)
Operating conditions 0 °C to 50 °C (32 °F to 122 °F. Humidity 10 to 85% RH (non-condensing)
Approvals **EMC**
EN 55022 Class B, EN 61000-6-1, EN 61000-6-2, EN 55024, EN 50121-4, IEC 62236-4, FCC Part 15 Subpart B Class A and B,
ICES-003 Class B, VCCI Class B, RCM AS/NZS CISPR 22 Class B,
KCC KN22 Class B, KN24
Safety
IEC/EN/UL 60950-1, IEC/EN 62471
Environment
IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-14
IEC 60068-2-6 (vibration), IEC 60068-2-27 (shock),
IEC 60068-2-78, IEC/EN 60529 IP52, IEC/EN 62262 IK08
Warranty 3-year warranty

Internal HD fixed cameras shall be Axis P32 series or agreed equivalent, as required to provide the necessary resolution for the individual location. Some locations may require variants with integral IR illumination.

4.3.5 Internal HD 360’ cameras

All cameras are to be mounted within camera housings suitable for the installed environment. The CCTV contractor shall allow for any associated hardware required such as brackets, PSUs, mid-spans etc. All camera enclosures shall be tamper resistant and require special tools to gain access to camera aiming facilities and installation fixings. All power and communications cabling shall be concealed.

All camera housings shall be low voltage devices, preferably supporting PoE. Where the requirement for housing heaters leads to the need for a separate PSU and an associated 240v supply is required, the CCTV contractor shall advise this within their tender return so that it can be provided by others. Any omissions will be deemed to be the CCTV contractor’s responsibility.

Camera housings are to be mounted in positions providing maximum protection from vandalism and/or tampering. Where this is not possible protection cages and/or vandal proof fixings are to be provided for external cameras.

Internal 360’ cameras shall meet the following minimum specification:

Image sensor 12 MP, 1/1.7” progressive scan RGB CMOS
Lens F2.8, Fixed iris, Fixed focus, 1.65 mm, Horizontal field of view: 185°, Vertical field of view: 185°
Minimum illumination: 0.35 lux at 50 IRE F2.8
Shutter time 1/25000 s to 1/2 s
Camera angle adjustment Rotation ±180°
Video compression H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles
Motion JPEG
Resolutions 360° overview: 2880x2880 to 480x480
Panorama: 2560x720 to 640x240
Double Panorama: 2560x1440 to 480x360
Quad view: 2560x1440 to 480x360
View area: 2048x1152 to 480x360
Corner left or right: 1920x720 to 640x240
Double Corner: 1920x1440 to 480x360
Corridor: 2560x1440 to 640x360
Frame rate Minimum 12 fps
Video streaming Multiple, individually configurable streams in H.264 and Motion
JPEG, Controllable frame rate and bandwidth, VBR/CBR H.264, Axis' Zipstream technology in H.264
Multi-view streaming
360° overview. Dewarped panorama, corridor, corner and quad views. Two individually cropped out and dewarped view areas. The 360° overview can be streamed simultaneously with two view areas or one other dewarped view.
Image settings Compression, Color, Brightness, Sharpness, Contrast, White balance, Exposure control, Exposure zones, WDR – dynamic contrast, noise reduction, rotation: 0°, 180°, text and image overlay, privacy masks, mirroring of images
Pan/Tilt/Zoom Digital PTZ of view areas, preset positions, guard tour, digital tilt of panorama, and quad views
Network Security Password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, Digest authentication, User access log, Centralized Certificate Management

Supported protocols IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMP v1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, HDMI 1.4b
Application Programming Interface Open API for software integration, ONVIF Profile S & G
Analytics Video Motion Detection, Active tampering alarm
Event triggers Analytics, Edge storage events
Event actions Record video: SD card and network share, Upload of images or video clips: FTP, SFTP, HTTP, HTTPS, network share and email, Pre- and post-alarm video or image buffering for recording or Upload Notification: email, HTTP, HTTPS, TCP and SNMP trap, Overlay text
Memory 1024 MB RAM, 256 MB Flash
Power Power over Ethernet (PoE) IEEE 802.3af/802.3at Type 1 Class 2 Typical 5.6 W, max 6.49 W
Connectors RJ45 10BASE-T/100BASE-TX PoE HDMI Type Db
Storage Support for microSD/microSDHC/microSDXC card, Support for recording to dedicated network-attached storage (NAS)
Operating conditions 0 °C to 40 °C (32 °F to 104 °F), Humidity 10–85% RH (non-condensing)
Approvals

EMC EN 55024, EN 55032 Class A, EN 61000-6-1, EN 61000-6-2, FCC Part 15 Subpart B Class A, ICES-003 Class A, VCCI Class A, RCM AS/NZS CISPR 22 Class A, KCC KN32 Class A, KN35
Safety IEC/EN/UL 62368-1
Environment IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-14, IEC 60068-2-27, IEC 60068-2-78

Warranty 3-year warranty

Internal 360’ cameras shall be Axis M3048-P or agreed equivalent.

4.3.6 SD encoders.

Where CCTV upgrade requirements dictate the recording of analogue cameras, such as where an existing Sprite Unit has failed and requires replacement, then encoders meeting the following specification shall be provided by the CCTV contractor.

The CCTV contractor shall provide sufficient encoders to connect the existing SD cameras into the system. These shall be configured to record at the camera’s full native resolution (or 720 x 576) and at 12 fps.

Encoders shall be provided with local storage, typically SD cards to provide a short term buffer should network connection be temporarily lost.

Encoders shall meet the following minimum specification:

Video compression H.264 (MPEG-4 Part 10/AVC) Baseline and Main Profile Motion JPEG
Resolutions 176x120 to 720x576, 176x120 to 1536x1152 for quad view
Frame rate 12 fps minimum
Video streaming One individually configured H.264 and one Motion JPEG stream
per channel at full frame rate, More streams if identical or limited in frame rate/resolution, Controllable frame rate and bandwidth, VBR/CBR H.264
Image settings Compression, Color, Brightness, Contrast, Aspect ratio correction,

Mirroring of images, Text and image overlay, Privacy mask, Enhanced deinterlace filter, Video termination, Anti-aliasing, Temporal noise filtering, Rotation: 90°, 180°, 270°
Pan/Tilt/Zoom Wide range of analog PTZ cameras supported , Support for one PTZ driver in each group of 4 channels, 100 presets/camera, Guard tour, PTZ control queue
Supports Windows compatible joysticks
Security Password protection, IP address filtering, HTTPSa encryption, IEEE 802.1Xa network access control, Digest authentication, User access log
Supported protocols IPv4/v6, HTTP, HTTPSa, IEEE 802.1Xa, QoS Layer 3 DiffServ, FTP, SMTP, Bonjour, UPnP™, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS
Application Programming Interface Open API for software integration**,** ONVIF Profile S
Intelligent video Video motion detection, Active tampering alarm
Event triggers Intelligent video, Video loss
Event actions File upload: FTP, HTTP, network share and email Notification: email, HTTP and TCP Video recording to edge storage, Pre- and post-alarm video buffering
PTZ preset
Operating conditions 0 °C to 50 °C (32 °F to 122 °F) Humidity 20–80% RH (non-condensing)
Approvals EN 55022 Class B, EN 61000-3-2, EN 61000-3-3, EN 55024, EN 61000-6-1, EN 61000-6-2, FCC Part 15 Subpart B Class B, ICES-003 Class B, VCCI Class B, C-tick AS/NZS CISPR 22 Class B, KCC KN22 Class B, KN24, IEC/EN/UL 60950-1
Warranty 1-year warranty

SD encoders shall be either Axis M7011, M7014 or M7016 or agreed equivalent, to the capacity required.

4.4 Control equipment requirements

The control and recording equipment requirements will be dictated by the individual project. Recording can be accomplished using a combination of expansion of the existing campus external CCTV servers (for external cameras), and Milestone hardware recorders such as Husky NVR units for internal cameras.

In all cases, the recording device for internal cameras shall be located at the local building and the system shall be designed with due consideration for reliability and availability requirements dictated by the individual project requirement. External cameras, which will be proactively monitored by the University Security Services at the PCR, shall be recorded on the central Milestone XProtect Corporate CCTV system recording servers, which shall be expanded to cater for the individual project CCTV requirements. This expansion will be carried out by the University IT department; however, the costs for the expansion will be borne by the individual project, and the project CCTV contractor shall allow for detailed engagement with the University IT department to determine the required system expansion and network requirements, so that the IT department can cost the required measures and advise the individual project of the budget requirements.

The University has standardised on the Milestone XProtect Corporate Video Management System and any products provided must be compatible with this VMS.

4.4.1 Servers, workstations and network equipment

4.4.1.1 Server expansion

Where the individual project is to include the provision or upgrade of external cameras, these shall be recorded by the existing campus wide Milestone recording servers. This will necessitate expansion of this recording facility and shall consider storage, licensing, processing power and resilience requirements to suit the additions for the individual project. The CCTV contractor shall engage with the University IT department to determine the exact expansion requirement, based on external camera quantities, bandwidth and storage calculations provided by the CCTV contractor. Additional server and storage requirements will be procured by the University IT department; however, the costs for such expansion shall be borne by the individual building / CCTV project.

Any servers, storage and workstation hardware provided by the University IT department will be issued already configured with the required operating systems including anti-virus software. The CCTV contractor shall provide all other hardware and software, including Milestone licences, and carry out all site loading, configuration, and testing to provide a fully functional IP video management system to meet the individual project requirements.

The CCTV contractor shall allow for all Milestone and third party software and licences required to provide for a fully functional VMS, and the loading and site configuration of these, onto the provided hardware.

The CCTV contractor shall allow for full liaison with the University IT department to develop the expansion requirement for the project and to complete IT governance including any resilience and cyber security testing of measures provided by the CCTV contractor under the individual project.

The CCTV contractor shall provide design calculations showing the server expansion requirements for their proposal. Details of the current server configuration shall be provided by the University IT department to allow the CCTV contractor to determine the baseline for the expansion calculations. This will evolve over time as more external cameras are added to the system; however, the original server configurations provided in late 2017 consist of the following, which are advised for information purposes only below:

Management server (1 off)

This server is virtualised and runs the Milestone XProtect Corporate service, logging servers, event servers, service channels, and SQL database, although this last will require to be migrated to a separate server once the camera counts exceeds 300 cameras.

- CPU: Intel Xeon E3-1220 v3
- RAM: 12 GB
- Network: Ethernet 1000 Mbit
- Graphics Adapter: Onboard GFX, AGP or PCI-Express, minimum 1024 x 768, 16-bit color
- Hard Disk Space: 2 x 300GB+ HDD, 10K RPM (SATA/SAS) - OS / Application / SQL DB and Transaction Logs RAID 1
- Operating System: Microsoft® Windows® Server 2012 R2 (64 bit): Standard and Datacenter
- Software: Microsoft® .NET 3.5 SP1 and .NET 4.5.1 Framework

Primary recording servers (2 off)

These physical servers run the camera recording archives and stream live and recorded images to viewing clients. Each server supports 50% of the campus cameras.

- CPU: 2 x Intel Xeon E5-2620 v3
- RAM: 8 GB
- Network: 3 x Ethernet 1000 Mbit
- Graphics Adapter: Onboard GFX, AGP or PCI-Express, minimum 1024 x 768, 16-bit color
- Hard Disk Space
    - Rec. Server Disk Throughput Total (ea): 236 MB/Sec
    - Estimated IOPS – 1886
    - Recording server total video storage 155Tb
    - ***OS and Application Volume - Disk Configuration:*** 2 x 300GB Minimum - SATA or SAS RAID 1
    - ***Live Database Disk Configuration:*** 12 x 15K RPM 450 GB RAID1/RAID 10
    - ***Archive Database Disk Configuration:*** 32 x 7.2k RPM 6TB RAID 5
- Operating System: Microsoft® Windows® Server 2012 R2 (64 bit): Standard and Datacenter
- Software: Microsoft® .NET 3.5 SP1 and .NET 4.5.1 Framework

Failover recording server (1 off)

This physical server acts as a cold standby recording server maintaining live streams and providing 4 days of failback recording should either primary recording server fail. The server is a cold standby unit, capable of supporting either primary server and should be operational within a minute of a primary server failing as it is constantly powered and monitoring each primary server.

- CPU: 2 x Intel Xeon E5-2620 v3
- RAM: 8 GB
- Network: 3 x Ethernet 1000 Mbit
- Graphics Adapter: Onboard GFX, AGP or PCI-Express, minimum 1024 x 768, 16-bit color
- Hard Disk Space
    - Recording server total video storage approx. 23Tb for 4 days.
    - ***OS and Application Volume - Disk Configuration:*** 2 x 300GB Minimum - SATA or SAS RAID 1
    - ***Database Disk Configuration:*** 8 x 5.4k RPM 4TB RAID 5
- Operating System: Microsoft® Windows® Server 2012 R2 (64 bit): Standard and Datacenter
- Software: Microsoft® .NET 3.5 SP1 and .NET 4.5.1 Framework

4.4.1.2 Client workstations

Where the individual project determines the requirement for local viewing/review facilities this may be accomplished using the Milestone XProtect Smart Client or via the XProtect web client on new or existing client workstations and displays.

Where this requires the provision of new client machines under the individual project, these shall be provided by the University IT department, to ensure

compatibility with the University network and connectivity within the CCTV VRF. The CCTV contractor shall allow for liaison with the IT department to advise the workstation and display requirements so that they can be procured correctly. This shall include operating system and anti-virus implications.

The machines will be provided to the CCTV contractor already loaded with the agreed OS and anti-virus software. The CCTV contractor shall allow for the provision and loading/configuration of all other software, including Milestone client software, and allow for sufficient testing to confirm University IT governance and cyber security requirements have been met.

The CCTV contractor shall supply all other necessary equipment to provide a fully functional IP CCTV system including:

- Any signal conversion equipment.
- All stream, device and third party licenses.
- Any bracketry or mounting hardware.

The CCTV contractor shall include for the design, supply (unless detailed to the contrary), installation and commissioning of all equipment to provide a fully operational CCTV system.

The CCTV contractor shall confirm all relevant CCTV requirements to the IT department to allow for the procurement of suitable VMS clients machines.

The CCTV contractor shall include for all stream, camera, operating system and third-party software licenses required to provide a fully functional solution. The CCTV contractor shall state within their tender response, the ongoing future support and software licensing costs. A copy of all software licenses and software discs/files shall be included in the O&M manuals. All software is to be registered to the client.

4.4.1.3 Network equipment

Cameras, recorders and client PCs will communicate using a VRF segregated network using the universities' IT infrastructure. All network switches/routers that shall reside on this network will be provided by the University IT department; however, the costs for these switches/routers and any modifications and expansion to the network to cater for the individual CCTV project requirement, will be borne by the project in question.

The CCTV contractor shall allow for liaison with the IT department to advise the project requirements so that they can be procured correctly and shall allow for sufficient testing to confirm University IT governance and cyber security requirements have been met.

The only exemption to the above shall be where the CCTV design requires the provision of additional equipment for conversion of existing cables to be IP bearing (such as when converting an existing fibre to an outlying camera position). In such cases the required signal conversion equipment shall be provided by the CCTV contractor as it may be more specialist to the CCTV industry than IT industry, and the CCTV contractor is likely to have the greater experience in selecting the appropriate product.

4.4.2 Local recording devices.

Internal cameras shall be recorded locally within the individual building, using Milestone Husky series Network Video Recording (NVR) devices. This shall apply equally to new build construction and when replacing an existing DVR/NVR (such as a Dedicated Micros Sprite) that has failed.

Milestone Husky is a range of Network Video Recorders NVR preloaded with XProtect Professional software with a variety of form factors, camera numbers and storage capacities. There are IP-only models and hybrid models to allow easy connection of legacy analog cameras alongside IP cameras.

When selecting the appropriate model for the individual project, the CCTV contractor shall consider the following key parameters required for the Husky NVRs:

- Compatibility with Milestone XProtect Corporate Edition VMS.
- Support for centralised management of multiple recording servers. All Husky units shall be able to be configured from the campus wide CCTV system central management server, and shall report common system alarms, such as disc faults, to the PCR operators.
- Support for Raid 5.
- Sized to suit the individual project requirements based on all associated cameras continuously recording 24/7/365 at 12 fps at full resolution.
- Simultaneous 12fps live viewing.
- Shall utilise drives specifically designed for continuous CCTV read/write access such as Western Digital Purple Drives.
- Failover capability.
- Support for Milestone Interconnect and Federated Architecture.

The CCTV contractor shall provide design calculations demonstrating the parameters utilised to arrive at selection of the proposed Husky NVR model.

The CCTV contractor shall supply all other necessary equipment to provide a fully functional IP CCTV system including:

- Any signal conversion equipment.
- All stream, device and third-party licenses.
- Any bracketry or mounting hardware.

The CCTV contractor shall include for the design, supply (unless detailed to the contrary), installation and commissioning of all equipment to provide a fully operational CCTV system.

The CCTV contractor shall allow for liaison with the IT department and shall allow for sufficient testing to confirm University IT governance and cyber security requirements have been met.

The CCTV contractor shall include for all stream, camera, operating system and third party software licenses required to provide a fully functional system. The CCTV contractor shall state within their tender response, the ongoing future support and software licensing costs. A copy of all software licenses and software discs/files shall be included in the O&M manuals. All software is to be registered to the University.

4.4.3 Local displays.

These will be determined by the individual building project and may consist of direct connections to the Husky NVR units or local review/display clients. In all cases, the CCTV contractor shall undertake a Privacy Impact Assessment of any permanent displays and shall liaise with the University Security Services as to privacy implications and local review capabilities, permissions and hierarchy of controls.

Where local displays are required, these shall be a commercial device designed for continuous operation.

The CCTV contractor shall include all cabling, fixings, interfaces and ancillary equipment.

Existing supplies shall be re-used, or new provided by others as detailed in the individual project specification. The CCTV contractor shall survey and advise their requirements within their tender return. Omissions will be deemed to be the responsibility of the CCTV contractor.

4.4.4 Local client workstations

The requirement for these will be determined by the individual building project and in consultation with the University Security Services. In such cases the facility may consist of local review/display clients using XProtect Smart client software or the XProtect Web client, as detailed within the individual project specifications.

Where so specified, the CCTV contractor shall configure and commission the appropriate client onto workstation(s) provided by the University IT department. The CCTV contractor may provide a PTZ joystick controller as indicated in the individual project specification.

The workstation must be able to provide review, export, camera control and alarm acceptance facilities as indicated in the individual project specification.

The use of said workstation will permit simultaneous viewing and control to an agreed hierarchy.

The local video management system may incorporate support for all of the following functionality, although these may be limited as indicated in the individual project specification:

- IP Cameras with integral encoders
- Pan Tilt Zoom (PTZ) digital cameras with integral encoders
- Analogue cameras (fixed and PTZ) with transmitters/encoders
- Choice of video resolutions ranging from SIF to 4K
- Transmit live H.264 Video
- Receivers/decoders
- Receive live H.264 Video
- Networked Video Recorders (VMSs)
- Record and play back h.2564 Video and Audio

- Physical alarm (PIRs, contact) and virtual alarm (VMD, video analytics and system fault) handling.

The local workstation will be responsible for virtual matrix operation including live video, PTZ control, playback, alarm management, sequences, guard tours and salvos. All users will be required to log into the workstation individually using windows authentication in line with University Security Services and IT and technical standards policies. A system administrator assigns user privileges as well as configuring and maintaining the system.

The contractor shall allow for creating graphics (maps) depicting the location of all new, upgraded and additional cameras both on the existing PCR clients and on any local clients indicated in the individual project specification.

The video management system shall support the following functionality on the client workstation, although the level of availability of certain functions may be limited, or omitted, locally as directed by the University Security Services:

- Live video
- PTZ control
- Virtual Matrix
- Video review
- Incident Export
- Recording
- Recording Redundancy
- Alarms
- Monitoring and Diagnostics
- Bandwidth Control

The CCTV contractor shall allow for continuous dialogue with the University Security Services to agree and deploy the required level of local controls and functionality.

4.5 System configuration

The CCTV contractor shall allow for the following standard configurations, and any additional requirements as detailed within the individual project specifications.

The CCTV contractor shall configure the system for global time synchronisation from University hosted NTP server.

The CCTV contractor shall configure the system to monitor its recording and system discs and advise the PCR operator of disc failures and other significant system failures/events. This shall extend to internal cameras and local building NVRs.

The CCTV contractor shall configure the system including additions to the XProtect VMS, Husky NVRs and local clients as follows:

Logons

- Individual password protected logons per user created under the individual project.

Streams/image quality

- Live viewing stream: H.264 with minimal compression at 12fps, native full camera resolution and a GoP value that assures 1 I frame per second.
- Recording stream: H.264 with minimal compression at 12fps, native full camera resolution and a GoP value that assures 1 I frame per second
- Recording: 24/7/365 recording with 31 days retention, calculations shall assume activity 16 hours per day.

Camera selection

- Camera selection via a pick list at the PCR and locally as specified by the individual project requirements
- Camera selection via graphic maps at the PCR and locally as specified by the individual project requirements
- Ability to display 'Pushed' video from smart devices using the Milestone App.

PTZ control (both existing and new cameras)

- PTZ control using a mouse
- PTZ control using a hardware joystick at the PCR and locally as specified by the individual project requirements

Pre-position control

- Selection via a pick list at the PCR and locally as specified by the individual project requirements
- Selection via clicking an area within a graphic map at the PCR and locally as specified by the individual project requirements

Alarm reporting

- System alarm reporting at the PCR and locally as specified by the individual project requirements
- Disc monitoring and failure reporting at the PCR and locally as specified by the individual project requirements

Movement detection

- Movement in an active zone within a camera field of view will cause the associated time to be colour highlighted in the recording timeline, to aid searching for events.
- Out of hours auto tracking.

Audio

- Audio support is not required at this time.

Graphic maps

- Multi level maps including:
    - Modifications to existing North Campus overview for external cameras

- Modifications to existing Oxford Road campus overview for external cameras
- Building internal cameras – 1 map for each floor containing CCTV