

Control Philosophy.

General.

The Heating, Hot water Services and Ventilation control systems will be installed employing a Building Management System (BMS) PC, printer and software is to be installed into a location to be agreed with the client. This will provide for centralised control and monitoring. The BMS terminal will also allow for alarm reports to be generated and routed through the most appropriate channels.

The BMS shall be a Trend based BMS system.

The BMS shall provide the user with a full range of graphics to permit the operator to identify the operating status of the plant together with the necessary data to create energy use reports. a P.C. Shall be provided for this purpose which shall operate the Trend IQ Vision operating software.

The BMS shall operate via a dedicated communication network to provide communications between the control panels and the location of the operator's terminal.

Where LTHW systems are installed adequate frost-protection shall be provided by the BMS outside of normal operating times making use of first, second and third stage frost protection regimes.

The Phase 1 BMS scheme currently provides for the BMS requirements for the FACE/TECH and Library Buildings.

The FACE/TECH Building has 6no. Main control panels with 5no. satellite control panel allowed for and the points schedules which represent the various input and output devices have been included as an appendix within this document.

The Library Building has 2 control panels allowed for and the points schedules which represent the various input and output devices have been included as an appendix within this document.

MCC1 FACE/TECH Building BP101-First Floor Plantroom

1.01 Main Boiler Plant.

The four heating boilers shall be sequenced to operate to maintain a substantially constant 82-degree C flow temperature. An immersion temperature detector located in the common boiler flow header shall monitor the common boiler flow temperature and enable the minimum number of boilers necessary to maintain the required conditions. The sequence of operation of the boilers is determined by the BMS, the boilers should be automatically rotated on an hours run basis.

A further immersion temperature detector shall be installed in the common boiler return to monitor the system return temperature.

A CHP unit installed in the boiler return circuit shall operate as required to maintain a maximum return water temperature to the boiler system. The BMS shall monitor the inlet and

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outlet temperature to the CHP units and shall also generate an alarm status should a fault alarm occur on the unit. Additional status information shall be provided on the BMS graphics to represent that status of the unit. Volt free contacts shall be available on the BMS unit to achieve this.

If the boiler return water temperature falls below a pre-set temperature on the return water temperature detector, the heating boiler and pumps will turn on until this set point is exceeded, additional protection against frost damage is provided by an external temperature detector, which shall operate the pumps during periods when the external temperature falls below the temperature at which there is a possibility of frost damage.

A LTHW pressurisation unit shall maintain the system pressure, and in the event that the systems pressure falls outside of normal parameters the heating system shall be shut down until normal condition have been restored. Should such a shutdown occur the BMS shall generate an appropriate alarm.

1.02 Boiler Primary Pumps.

The pumps shall operate as required when each individual boiler operates. In the event that a flow fail alarm occurs, the BMS shall raise an alarm on the BMS. This interlock shall also be used to prevent the operation of that boiler until adequate flow has been established.

Following the operation of the boilers, at any time, the pumps shall continue to operate to ensure that sufficient heat is dissipated to prevent nuisance operation of the boiler 'high limit' thermostats. An immersion detector located in the common boiler flow header shall maintain the heating pumps operation until such time that the flow water temperature falls below a set value.

1.03 LTHW Secondary Pumps.

The Boiler plant serves 3 heating circuits for the following: -

- Zone No.1 V.T Heating circuit providing heating to the radiator system throughout the building.
- Zone No.2 C.T Heating circuit providing heating to the AHU's within the building.
- Zone No.3 C.T Heating circuit providing heating to the DHWS Calorifiers within the building.

The pumps will operate in the manner outlined below.

To permit the operation of the pumps, On/Off/Auto switches are fitted to the control panel fascia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the pump is On continuously.

When the On/Off/Auto switch is in the Off position, the pumps are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the pumps operate Automatically under the dictates of the BMS.

The control system shall rotate the operation of the pumps on a regular basis (as required by the

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client) to ensure that both pumps benefit from equal run times as this will prevent the 'off line' pump from seizing due to lack of use.

Should the duty pump fail the standby pump shall automatically be enabled to maintain circulation. A fault lamp on the control panel shall identify when a fault has occurred to alert the maintenance staff to the need for remedial action.

1.04 Optimisation Heating.

The Building is principally heated by means of a combination of both ceiling mounted radiant panels and radiators, although there is a limited amount of underfloor heating which serves the reception and Atrium area. All three systems are served by the variable temperature circuit.

In general, the radiant panels are to be controlled by means of the BMS. Black Bulb temperature detectors shall be installed in each zone where radiant panels are installed and the BMS shall position the control valve so as to maintain a substantially constant space temperature.

Various space temperature detectors shall be positioned throughout the building to represent those areas where radiators have been installed

Additional space temperature detectors will be installed on the ground floor area to provide control over the underfloor heating, and the BMS shall provide control over the underfloor manifold valves to maintain conditions.

The operating period of the heating system is determined by the Optimisation control module within the BMS controller, which by monitoring the internal temperature, external temperature and historical data can adjust the start and stop times of the heating system according to the pre-heat and heat dissipation requirements.

The Optimiser enables both heating boilers, main boiler primary pumps and the relevant variable temperature heating pumps.

The space temperature detectors will monitor the actual space temperature and when the temperature falls below a given frost temperature set point, the heating will remain on until this set point has been exceeded.

Additional protection against frost damage is provided by an external temperature detector, which shall operate the pumps during periods when the external temperature falls below the temperature at which there is a possibility of frost damage.

1.05 Hot water Services.

There are 2 No. HWS Calorifiers are to be installed to provide for the hot water services required.

The Hot Water Services (HWS) calorifiers are to be served by a dedicated pair of the constant temperature heating pumps.

Immersion temperature detectors located in the calorifiers shall monitor the cylinder temperature and the BMS shall provide a control output to position a 3 port diverting valve in

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order to maintain the correct set value. A further high limit thermostat will operate should the measured value exceed a high temperature limit. This shall create a high temperature alarm within the BMS and cause the 3 port valve to close.

The valves shall remain closed and the alarm shall remain active until the high limit thermostat is manually reset by means of the reset button located on the device itself. It will be necessary for the temperature within the cylinder to have fallen below the high limit setpoint to allow the reset to be operated,

1.06 Hot water Services Pump.

Secondary circulation shall be maintained by a secondary pump. To permit the operation of the pump, an On/Off/Auto rotary switch is fitted to the control panel fascia to allow the following mode of operation: -

When the switch is in the On position, the pump is On continuously.

When the switch is in the Off position, the pump is Off continuously.

And when the switch is in the Auto position, the pump operates automatically under the dictates of the BMS.

An additional HWS Destratification pump will now be installed on each HWS calorifier. The HWS Destratification Pumps will operate when the HWS time schedule is active. A CT Switch will be mounted in the control panel to monitor the pump for failure.

To permit the operation of the pump, an On/Off/Auto rotary switch is fitted to the control panel fascia to allow the following mode of operation: -

When the switch is in the On position, the pump is On continuously.

When the switch is in the Off position, the pump is Off continuously.

And when the switch is in the Auto position, the pump operates automatically under the dictates of the BMS.

1.07 Air Handling Units.

MCCP1 will directly control the following AHU:

- AHU No.6 - B016B/B016D/B016A/B015A/B014/B013/B012B/

The ventilation unit shall operate as follows: -

The ventilation plant is to be controlled by the BMS on a fixed time basis; provision shall be made to allow the time schedules to be altered to meet any changes in the routine operation of the plant.

To permit the operation of the AHU, On/Off/Auto switches are fitted to the control panel fascia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the Supply and/or Extract Fan is On continuously.

When the On/Off/Auto switch is in the Off position, the Supply and/or Extract Fan are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the Supply and/or Extract Fan operate Automatically under the dictates of the BMS.

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Inlet and out dampers supplied with the unit shall open as the BMS enables the unit and once they dampers have attained the open position, as proved by the integral end switches the supply and extract fans shall operate.

The unit includes both supply and extract fans which are powered from the MCCP via frequency inverters. The supply and extract fan will be set to run at a fixed speed as set at commissioning.

Across the supply and extract fan section, a differential pressure switch shall be installed and monitored via the BMS. When the BMS enables the AHU an alarm will be raised if a differential pressure switch is not activated, which highlights a air flow failure. In addition to this air flow differential pressure switch, the inverter will be monitored for fault status.

The unit also includes a frost battery, heater battery, and a plate heat exchanger.

The heater battery shall be controlled by modulating the 3 port control valves installed on the battery. The valves shall be positioned in sequence with the plate heat exchanger bypass damper to maintain a substantially constant return air temperature (adjustable).

A further detector installed in the supply duct shall act as a low limit device and shall prevent the discharge temperature falling below a low limit setpoint (adjustable) to prevent a draft effect.

A duct frost capillary temperature thermostat after the heater battery will hold off the supply fan until the off-coil temperature is above a frost temperature setpoint, which prevents the frost heater battery from freezing.

The bag and panel filters installed in the inlet section and outlet section shall be complete with differential pressure switches. As the differential pressure increases across the filters, due to the filters becoming soiled, the switches shall operate to indicate that the filters require changing by generating an alarm on the BMS.

1.08 Heat Recovery Units HRU

There are a number of Heat Recovery Units (HRU) installed throughout the building, all of these are to be enabled only by the BMS on a time schedule.

The fault output, provided by the manufacturer, shall also be monitored by the BMS and in the event of a fault occurring an alarm shall be generated on the BMS front end.

All the Heat Recovery Units shall be supplied complete with integral controls

A combined Temperature and Carbon Dioxide (T&CO²) sensor shall be installed in each area where the ventilation is provided via a HRU. The T&CO² Sensor will be added to the BMS Sensor network and all values will be visible on the BMS front end.

There will be no Hand/Off/Auto switches on the BMS panels for the HRU's.

1.09 Safety

The main building fire alarm shall also be monitored, and in the event that the main block zone is activated the plant shall be shut down until such time that the alarm is reset.

A safety cut off button, fire alarm monitoring and heating boilers thermal links & gas detection system will shut off the control panel and the gas solenoid valve will close should either be activated.

Safety cut off buttons shall be installed within all the plant areas. On activation, they shall shut down the associated plant.

1.10 Metering

The main utilities shall be monitored (gas, water and electricity). The consumption of these utilities shall be recorded by the BMS.

Metering devices are to be supplied to monitor the following circuits: -

- Main incoming boundary water meter.
- Main incoming water meter.
- Cold water main LTHW Pressurisation Unit.
- Boosted cold water main to HWS Plant.
- Boosted cold water main to CAT5 Plant.
- Boosted cold water main to Rain Water Harvesting Plant.
- Main gas meter.
- Main gas meter to BLT101 1st. Floor Plantroom Boiler Supply.
- Main gas meter to BLT101 1st. Floor Plantroom CHP Supply.
- Main gas meter to A012A Café/Store Supply.
- Main gas meter to AP-205 2nd. Floor Environmental Science.
- Main electricity supply.
- Power & Lighting Distribution Boards electricity sub-meters.

The BMS shall monitor the boundary water supply and the usage within each building. An alarm shall be generated in the event that the combined consumption is inconsistent with the total volume as measured at the boundary meter.

All meters are provided by others.

1.11 VRF Units

The BMS shall provide a BACnet interface to allow the VRF central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. *Number and location of data points to be confirmed by the AC Specialist.*

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1.12 Breathing Buildings

The BMS shall provide a modbus interface to allow the Breathing Building central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status.

1.13 Fire Alarm System

The BMS shall provide a BACnet interface to allow the Fire Alarm System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and locations of data points to be confirmed by the Fire Alarm Specialist.

1.14 Security Detection System

The BMS shall provide a BACnet interface to allow the Security Detection System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and locations of data points to be confirmed by the Security Specialist.

1.15 Door Access Control System

The BMS shall provide a BACnet interface to allow the Door Access Control System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and locations of data points to be confirmed by the Door Access Specialist.

1.16 DALI Lighting Control

The BMS shall provide a BACnet interface to allow the DALI Lighting Control System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and locations of data points to be confirmed by the Lighting Specialist.

1.17 UPS System

The BMS shall monitor the UPS system via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

1.18 CHP System

The BMS shall monitor the CHP system via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

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1.19 CAT 5 Cold Water Booster Set

The BMS shall monitor the CAT 5 Coldwater booster set via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

1.20 Rain Water Re-Cycling Unit

The BMS shall monitor the Rain water re-cycling unit via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

1.21 Vehicle Exhaust System Monitoring

The BMS shall monitor the various vehicle exhaust system units via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall generate an alarm which will be visible on the front end.

Carbon Monoxide detectors installed within each space shall be monitored via the BMS and the data logged. In the event that the CO levels within any of the monitored spaces exceed a maximum limit an alarm shall be generated by the BMS.

1.22 Surge Protection

The BMS shall monitor the surge protection unit via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

1.23 Communications and I.T. Rooms

Space temperature detectors shall be installed in locations where temperature control is necessary to maintain the operation of I.T. Equipment. The detectors shall continuously monitor the temperature and provide an alarm as the temperature rises above the expected set-point.

1.24 Major Leak Detection

The BMS shall monitor both the boundary and main building water meters. Should there be a discrepancy between the two recorded values an alarm shall be generated by the BMS to indicate that a significant leak has occurred between the two meters.

1.25 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

1.00 MCC1 - FACE Main Panel Points Schedule.

Main Boiler Plant.	AI	DI	AO	DO
Outside temperature detector	1			
Common boiler flow temperature detector	1			
Common boiler return temperature detector	1			
Heating boilers enable			4	
Heating boilers fault		4		
Fire alarm signal		1		
Gas detection system alarm		1		
Safety circuit		1		
Sub Total	3	7	4	0

CHP Unit.	AI	DI	AO	DO
Flow temperature detector	1			1
Return temperature detector	1			1
Unit status		2		2
Unit system monitoring via bacnet interface				
Sub Total	2	2		4

Boilers Primary Heating Pumps.	AI	DI	AO	DO
Pumps enable				2
Water flow proved		1		
Sub Total	0	1	0	2

Zone No.1 V.T. Heating Pumps Radiator Circuit.	AI	DI	AO	DO
Pumps enable				2
Water flow proved		1		
Sub Total	0	1	0	2

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Zone No.1 Compensation Heating Radiator Circuit.	AI	DI	AO	DO
Flow temperature detector	1			
Return temperature detector	1			
Space temperature detector	16			
Control valve signal			1	
Sub Total	18	0	1	0

Zone No.2 C.T. Heating Pumps (AHU's).	AI	DI	AO	DO
Flow temperature detector	1			
Return temperature detector	1			
Pumps enable				2
Water flow proved		1		
Sub Total	2	1		2

Zone No.3 C.T. Heating Pumps (DHWS Primary).	AI	DI	AO	DO
Flow temperature detector	1			
Return temperature detector	1			
Pumps enable				2
Water flow proved		1		
Sub Total	2	1		2

LTHW Pressurisation Unit.	AI	DI	AO	DO
Fault status		1		
Sub Total	0	1	0	0

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AHU No.6	AI	DI	AO	DO
Supply & Extract fan enable/control/status		2	2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Frost battery control			1	
Frost coil off coil temperature detector	1			
Recoup Damper			1	
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	10	5	2

Rainwater Re-Cycling Unit	AI	DI	AO	DO
Units status		5		
Sub Total	0	5	0	0

Surge Protection	AI	DI	AO	DO
Unit status.		2		
Sub Total	0	2	0	0

CAT 5 Cold Water Booster Set	AI	DI	AO	DO
Unit status.		2		
Sub Total	0	2	0	0

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Meters.	AI	DI	AO	DO
Main electricity meter via modbus				
Electricity sub-meters via modbus 30 No.				
Major leak detection system boundary meter (by others)		1		
Major leak detection system internal meter (by others)		1		
Booster water rainwater top up meter		1		
Cold water main LTHW Pressurisation Unit		1		
Cold water main HWS		1		
Cold water main CAT5 Unit		1		
Main gas meter		1		
Main gas meter to BLT101 1st. Floor plantroom boilers		1		
Main gas meter to BLT101 1st. Floor plantroom CHP		1		
Main gas meter to AP-201 2nd. Floor Environmental		1		
Sub Total	0	10	0	0

Domestic Hot Water System 2 No. Calorifiers	AI	DI	AO	DO
Calorifier temperature	2			
Secondary pump enable				1
Calorifier valve control			2	
Calorifier high limit thermostat status		2		
Secondary flow temperature detector - Sentinal	4			
HWS Calorifier Destratification Pumps		2		2
Sub Total	6	4	2	3

Breathing Buildings Natural Ventilation Interface	AI	DI	AO	DO
Unit system monitoring via Modbus Interface				
Sub Total	0	0	0	0

Lighting Control System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

Security Detection System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

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Door Access Control System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

UPS System	AI	DI	AO	DO
Unit status/alarm		5		
Sub Total	0	5	0	0

MVHR	AI	DI	AO	DO
Units enable/status		26		21
Sub Total	0	26	0	21

Radiant Panels Zones	AI	DI	AO	DO
Space temperature detectors	27			
Zone valve control			27	
Sub Total	27	0	27	0

Vehicle Exhaust System Monitoring	AI	DI	AO	DO
Space Carbon Monoxide detectors	17			
Specialist exhaust extract system status		17		
Sub Total	17	17	0	0

Cooling /Refrigeration System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

Communications Room Cooling Units	AI	DI	AO	DO
Units status		2		
Space temperature detector	2			
Sub Total	2	2	0	0

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MCC1 - Main Panel Points Summary.

	AI	DI	AO	DO
Main Boiler Plant.	3	7	4	0
CHP Unit	2	2	0	4
Boiler Primary Heating Pumps	0	1	0	2
Zone No.1 V.T. Heating Pumps.	0	1	0	2
Zone No.1 Compensation Heating.	18	0	1	0
Zone No.2 C.T. Heating Pumps.	2	1	0	2
Zone No.3 C.T. Heating Pumps.	2	1	0	2
LTHW Pressurisation Unit.	0	1	0	0
Air Handling Unit No.6	3	10	5	2
Rainwater Re-Cycling Unit	0	5	0	0
Surge Protection	0	2	0	0
Cold Water Storage Tank	2	4	0	1
Cold Water Booster Set	0	2	0	0
CAT 5 Cold Water Booster Set	0	2	0	0
Meters.	0	11	0	0
Domestic Hot Water System 2 No. Calorifiers	6	4	2	3
Breathing Buildings Natural Ventilation Interface	0	0	0	0
Lighting Control System Interface	0	0	0	0
Security Detection System Interface	0	0	0	0
Door Access Control System Interface	0	0	0	0
UPS System	0	0	0	0
MVHR	0	36	0	21
Radiant Panels Zones	27	0	0	27
Vehicle Exhaust System Monitoring	17	17	0	0
Cooling /Refrigeration System Interface	0	0	0	0
Communications Room Cooling Units	2	2	0	0
Grand Total	98	146	23	86

MCC2 FACE/TECH Building Roof Plant Enclosure

2.01 Air Handling Units.

On the roof of F&T/FACE Building 5no. AHU shall be installed.
These are as follows:

- AHU No.2 1st. & 2nd. Floor Various Mechanical Ventilation Areas.
- AHU No.3 Ground Floor A007/A012/A005/A001/A011/AP005.
- AHU No.4 1st. 2nd. & 3rd. Floor Core Toilet & Cleaner Areas.
- AHU No.5 A122/A123/A221/A201.
- AHU No.10 A318-320/A325/A316a/A317-317a/A310-311/A314/A303-307.

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Due to external conditions and maintenance of the AHU's MCCP2 shall be installed with 5no. satellite controllers which will control the AHU's.

The Rooftop panel shall be broken down as follows:

- MCCP2 – Main Control Panel – This panel houses the inverters for all AHUs and provides power to the satellite controllers. This panel comes complete with a double door and houses the Hand/Off/Auto switches for the 5no. AHU's.
- MCCP2a – AHU No. 02 – This dedicated controller/panel shall enable and control the AHU No.2 including time schedules. The AHU Supply and Extract signals will be relayed back to MCCP2 to enable the control circuit for the AHU and enable the dampers and inverter.
- MCCP2b – AHU No. 03 – This dedicated controller/panel shall enable and control the AHU No.3 including time schedules. The AHU Supply and Extract signals will be relayed back to MCCP2 to enable the control circuit for the AHU and enable the dampers and inverter.
- MCCP2c – AHU No. 04 – This dedicated controller/panel shall enable and control the AHU No.4 including time schedules. The AHU Supply and Extract signals will be relayed back to MCCP2 to enable the control circuit for the AHU and enable the dampers and inverter.
- MCCP2d – AHU No. 05 – This dedicated controller/panel shall enable and control the AHU No.5 including time schedules. The AHU Supply and Extract signals will be relayed back to MCCP2 to enable the control circuit for the AHU and enable the dampers and inverter.
- MCCP2e – AHU No. 10 – This dedicated controller/panel shall enable and control the AHU No.10 including time schedules. The AHU Supply and Extract signals will be relayed back to MCCP2 to enable the control circuit for the AHU and enable the dampers and inverter.

In the situation of a device failure on the AHU, the satellite control panel can be isolated enabling the replacement of any device without the lose of any other AHU.

If MCCP2 is isolated all the AHU's will be isolated as per usual.

The ventilation unit shall operate as follows: -

The ventilation plant is to be controlled by the BMS on a fixed time basis; provision shall be made to allow the time schedules to be altered to meet any changes in the routine operation of the plant.

To permit the operation of the AHU, On/Off/Auto switches are fitted to the control panel facia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the Supply and/or Extract Fan is On continuously.

When the On/Off/Auto switch is in the Off position, the Supply and/or Extract Fan are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the Supply and/or Extract Fan operate Automatically under the dictates of the BMS.

Inlet and out dampers supplied with the unit shall open as the BMS enables the unit and once they dampers have attained the open position, as proved by the integral end switches the supply

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and extract fans shall operate.

The unit includes both supply and extract fans which are powered from the MCCP via frequency inverters. The supply and extract fan will be set to run at a fixed speed as set at commissioning.

Across the supply and extract fan section, a differential pressure switch shall be installed and monitored via the BMS. When the BMS enables the AHU an alarm will be raised if a differential pressure switch is not activated, which highlights a air flow failure. In addition to this air flow differential pressure switch, the inverter will be monitored for fault status.

The unit also includes a frost battery, heater battery, and a plate heat exchanger.

The heater battery shall be controlled by modulating the 3 port control valves installed on the battery. The valves shall be positioned in sequence with the plate heat exchanger bypass damper to maintain a substantially constant return air temperature (adjustable).

A further detector installed in the supply duct shall act as a low limit device and shall prevent the discharge temperature falling below a low limit setpoint (adjustable) to prevent a draft effect.

A duct frost capillary temperature thermostat after the heater battery will hold off the supply fan until the off-coil temperature is above a frost temperature setpoint, which prevents the frost heater battery from freezing.

The bag and panel filters installed in the inlet section and outlet section shall be complete with differential pressure switches. As the differential pressure increases across the filters, due to the filters becoming soiled, the switches shall operate to indicate that the filters require changing by generating an alarm on the BMS.

2.02 Safety

The main building fire alarm shall also be monitored, and in the event that the main block zone is activated the plant shall be shut down until such time that the alarm is reset.

A safety cut off button, fire alarm monitoring shall be installed within all the roof exit area. On activation, they shall shut down the associated plant.

2.03 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

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MCC2 - FACE Points Schedule.

Inverter Faults	AI	DI	AO	DO
AHU No.2 Supply & Extract Inverter Faults		2		
AHU No.3 Supply & Extract Inverter Faults		2		
AHU No.4 Supply & Extract Inverter Faults		2		
AHU No.5 Supply & Extract Inverter Faults		2		
AHU No.10 Supply & Extract Inverter Faults		2		
Sub Total	0	10	0	0

MCC2a – AHU No.2

AHU No.2	AI	DI	AO	DO
Supply & Extract fan enable/control			2	
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	8	5	0

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MCC2b – AHU No.3

AHU No.3	AI	DI	AO	DO
Supply & Extract fan enable/control			2	
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	8	5	0

MCC2c – AHU No.4

AHU No.4	AI	DI	AO	DO
Supply & Extract fan enable/control			2	
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	8	5	0

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MCC2d – AHU No.5

AHU No.5	AI	DI	AO	DO
Supply & Extract fan enable/control			2	
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	8	5	0

MCC2e – AHU No.10

AHU No.10	AI	DI	AO	DO
Supply & Extract fan enable/control			2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	8	5	2

MCC2 & Satellite Panels - Points Summary.

	AI	DI	AO	DO
Inverter Faults	0	10	0	0
MCCP 2a - AHU No.2	3	8	5	2
MCCP 2b - AHU No.3	3	8	5	2
MCCP 2c - AHU No.4	3	8	5	2
MCCP 2d - AHU No.5	3	8	5	2
MCCP 2e - AHU No.10	3	8	5	2
Grand Total	15	50	25	10

MCC3 FACE/TECH Building Roof Pod Plant Enclosure

3.01 Air Handling Units.

On the roof of F&T/FACE Building, AHU No. 7 & 8 shall be install in a roof plantroom, pod. A dedicated controller and control panel will enable These are as follows:

- AHU No.7 B10C/BO10F/B010D/- Change Area 01/02/03.
- AHU No.8 B010E/B010A/B010B/ - spraying/Cutting/Pre-Preg.

The ventilation unit shall operate as follows: -

The ventilation plant is to be controlled by the BMS on a fixed time basis; provision shall be made to allow the time schedules to be altered to meet any changes in the routine operation of the plant.

To permit the operation of the AHU, On/Off/Auto switches are fitted to the control panel facia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the Supply and/or Extract Fan is On continuously.

When the On/Off/Auto switch is in the Off position, the Supply and/or Extract Fan are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the Supply and/or Extract Fan operate Automatically under the dictates of the BMS.

Inlet and out dampers supplied with the unit shall open as the BMS enables the unit and once they dampers have attained the open position, as proved by the integral end switches the supply and extract fans shall operate.

The unit includes both supply and extract fans which are powered from the MCCP via frequency inverters. The supply and extract fan will be set to run at a fixed speed as set at commissioning.

Across the supply and extract fan section, a differential pressure switch shall be installed and monitored via the BMS. When the BMS enables the AHU an alarm will be raised if a differential pressure switch is not activated, which highlights a air flow failure. In addition to this air flow differential pressure switch, the inverter will be monitored for fault status.

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The unit also includes a frost battery, heater battery, and a plate heat exchanger.

The heater battery shall be controlled by modulating the 3 port control valves installed on the battery. The valves shall be positioned in sequence with the plate heat exchanger bypass damper to maintain a substantially constant return air temperature (adjustable).

A further detector installed in the supply duct shall act as a low limit device and shall prevent the discharge temperature falling below a low limit setpoint (adjustable) to prevent a draft effect.

A duct frost capillary temperature thermostat after the heater battery will hold off the supply fan until the off-coil temperature is above a frost temperature setpoint, which prevents the frost heater battery from freezing.

The bag and panel filters installed in the inlet section and outlet section shall be complete with differential pressure switches. As the differential pressure increases across the filters, due to the filters becoming soiled, the switches shall operate to indicate that the filters require changing by generating an alarm on the BMS.

3.02 Safety

The main building fire alarm shall also be monitored, and in the event that the main block zone is activated the plant shall be shut down until such time that the alarm is reset.

A safety cut off button, fire alarm monitoring shall be installed within all the roof pod area. On activation, they shall shut down the associated plant.

3.03 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

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MCC3 – AHU No.7 & AHU No.8

AHU No.7	AI	DI	AO	DO
Supply & Extract fan enable/control		2	2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	10	5	2

AHU No.8	AI	DI	AO	DO
Supply & Extract fan enable/control		2	2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	10	5	2

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MCC3 - Points Summary.

	AI	DI	AO	DO
AHU No. 7	3	8	5	2
AHU No. 8	3	8	5	2
Grand Total	6	16	10	4

MCC4 FACE/TECH Building Roof Pod Plant Enclosure

4.01 Air Handling Units.

On the roof of F&T/FACE Building, AHU No. 9 shall be install in a roof plantroom, pod.
A dedicated controller and control panel will enable These are as follows:

- AHU No.9 B002/B002A/B005/B004A/B008/B009 – Materials Testing/Technicians x2, PPE , W.C's.

The ventilation unit shall operate as follows: -

The ventilation plant is to be controlled by the BMS on a fixed time basis; provision shall be made to allow the time schedules to be altered to meet any changes in the routine operation of the plant.

To permit the operation of the AHU, On/Off/Auto switches are fitted to the control panel facia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the Supply and/or Extract Fan is On continuously.

When the On/Off/Auto switch is in the Off position, the Supply and/or Extract Fan are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the Supply and/or Extract Fan operate Automatically under the dictates of the BMS.

Inlet and out dampers supplied with the unit shall open as the BMS enables the unit and once they dampers have attained the open position, as proved by the integral end switches the supply and extract fans shall operate.

The unit includes both supply and extract fans which are powered from the MCCP via frequency inverters. The supply and extract fan will be set to run at a fixed speed as set at commissioning.

Across the supply and extract fan section, a differential pressure switch shall be installed and monitored via the BMS. When the BMS enables the AHU an alarm will be raised if a differential pressure switch is not activated, which highlights a air flow failure. In addition to this air flow differential pressure switch, the inverter will be monitored for fault status.

The unit also includes a frost battery, heater battery, and a plate heat exchanger.

The heater battery shall be controlled by modulating the 3 port control valves installed on the

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battery. The valves shall be positioned in sequence with the plate heat exchanger bypass damper to maintain a substantially constant return air temperature (adjustable).

A further detector installed in the supply duct shall act as a low limit device and shall prevent the discharge temperature falling below a low limit setpoint (adjustable) to prevent a draft effect.

A duct frost capillary temperature thermostat after the heater battery will hold off the supply fan until the off-coil temperature is above a frost temperature setpoint, which prevents the frost heater battery from freezing.

The bag and panel filters installed in the inlet section and outlet section shall be complete with differential pressure switches. As the differential pressure increases across the filters, due to the filters becoming soiled, the switches shall operate to indicate that the filters require changing by generating an alarm on the BMS.

4.02 Heat Recovery Units HRU

Heat Recovery Unit No.1 (HRU) shall be installed in the roof pod, this to be enabled only by the BMS on a time schedule.

The fault output, provided by the manufacturer, shall also be monitored by the BMS and in the event of a fault occurring an alarm shall be generated on the BMS front end.

All the Heat Recovery Units shall be supplied complete with integral controls

A combined Temperature and Carbon Dioxide (T&CO²) sensor shall be installed in the area where the ventilation is provided via a HRU. The T&CO² Sensor will be added to the BMS Sensor network and all values will be visible on the BMS front end.

There will be no Hand/Off/Auto switches on the BMS panels for the HRU's.

4.03 Safety

The main building fire alarm shall also be monitored, and in the event that the main block zone is activated the plant shall be shut down until such time that the alarm is reset.

A safety cut off button, fire alarm monitoring shall be installed within all the roof pod area. On activation, they shall shut down the associated plant.

4.04 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

MCC4 – AHU No.9

AHU No.9	AI	DI	AO	DO
Supply & Extract fan enable/control		2	2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	10	5	2

HRU 01	AI	DI	AO	DO
Enable				1
Fault		1		
Sub Total	0	1	0	1

MCC3 - Points Summary.

	AI	DI	AO	DO
AHU No. 9	3	8	5	2
HRU No.1	0	1	0	1
Grand Total	3	9	6	3

MCC5 FACE/TECH Building Ground Floor Electrical Cupboard**5.01 Air Handling Units.**

AHU No.1 shall be install in a ceiling void area above the WC's.
A dedicated controller and control panel will enable These are as follows:

- AHU No.1 Ground Floor W.C/AW004/AW005/AW006/

The ventilation unit shall operate as follows: -

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The ventilation plant is to be controlled by the BMS on a fixed time basis; provision shall be made to allow the time schedules to be altered to meet any changes in the routine operation of the plant.

To permit the operation of the AHU, On/Off/Auto switches are fitted to the control panel fascia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the Supply and/or Extract Fan is On continuously.

When the On/Off/Auto switch is in the Off position, the Supply and/or Extract Fan are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the Supply and/or Extract Fan operate Automatically under the dictates of the BMS.

Inlet and out dampers supplied with the unit shall open as the BMS enables the unit and once they dampers have attained the open position, as proved by the integral end switches the supply and extract fans shall operate.

The unit includes both supply and extract fans which are powered from the MCCP via frequency inverters. The supply and extract fan will be set to run at a fixed speed as set at commissioning.

Across the supply and extract fan section, a differential pressure switch shall be installed and monitored via the BMS. When the BMS enables the AHU an alarm will be raised if a differential pressure switch is not activated, which highlights a air flow failure. In addition to this air flow differential pressure switch, the inverter will be monitored for fault status.

The unit also includes a frost battery, heater battery, and a plate heat exchanger.

The heater battery shall be controlled by modulating the 3 port control valves installed on the battery. The valves shall be positioned in sequence with the plate heat exchanger bypass damper to maintain a substantially constant return air temperature (adjustable).

A further detector installed in the supply duct shall act as a low limit device and shall prevent the discharge temperature falling below a low limit setpoint (adjustable) to prevent a draft effect.

A duct frost capillary temperature thermostat after the heater battery will hold off the supply fan until the off-coil temperature is above a frost temperature setpoint, which prevents the frost heater battery from freezing.

The bag and panel filters installed in the inlet section and outlet section shall be complete with differential pressure switches. As the differential pressure increases across the filters, due to the filters becoming soiled, the switches shall operate to indicate that the filters require changing by generating an alarm on the BMS.

5.02 Metering

The gas meter to the Café and also a selection of remote DB's shall be monitored from MCCP5.

Metering devices are to be supplied to monitor the following circuits: -

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- Main gas meter to A012A Café/Store Supply.
- Power & Lighting Distribution Boards electricity sub-meters.

All meters are provided by others.

5.03 Underfloor Heating

An underfloor heating system shall be installed on the Ground Floor core area.

3no. Manifolds are provided and installed by the Underfloor heating specialist complete with controls.

The BMS will interface to these controls via a dedicated controller with all I/O interfaced to the Trend BMS.

A screed temperature sensor will monitor the screed temperature. If the temperature of the screed rises above a setpoint, 29°C, the manifold will shut all loops and an alarm will be raised on the BMS.

5.04 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

MCC5 – AHU No.1

AHU No.1	AI	DI	AO	DO
Supply & Extract fan enable/control		2	2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper Control			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	10	5	2

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Underfloor Heating	AI	DI	AO	DO
Zone space temperature/control & high limit status	3	3		3
Sub Total	3	3	0	3

Metering	AI	DI	AO	DO
Gas meter to A012A Café/Store Supply.		1		
Electricity Meters (Remote DB's)				
Sub Total	0	1	0	0

MCC5 - Points Summary.

	AI	DI	AO	DO
AHU No. 1	3	8	5	2
Underfloor Heating	3	3	0	3
Metering	0	1	0	0
Grand Total	3	9	5	2

MCC6 FACE/TECH Building CWS Booster and GRP Tank

6.01 Cold Water Booster Set

The BMS shall monitor the Coldwater booster set via a locally installed controller via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm. Power to the unit is via a local DB and not from the BMS panel.

6.02 Cold Water Storage Tank

The BMS shall monitor the various cold-water storage tank temperature shall be monitored via the BMS and the data logged. In the event that the water temperature level within the tank exceeds a maximum limit an alarm shall be generated by the BMS.

The tank water level shall be monitored via level switches shall allow the high & low levels. In the event of an alarm occurring, the BMS shall general an alarm.

6.03 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

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Cold Water Storage Tank	AI	DI	AO	DO
Tank temperature	2			
Tank high level alarm		2		
Tank low level alarm		2		
Drain solenoid control				1
Sub Total	2	4	0	1

Cold Water Booster Set	AI	DI	AO	DO
Unit status.		2		
Sub Total	0	2	0	0

MCC6 - Points Summary.

	AI	DI	AO	DO
Cold Water Storage Tank	2	4	0	1
Cold Water Booster Set0	0	2	0	0
Grand Total	2	6	0	1

MCC1 Library Building Ground Floor Plantroom

7.01 Main Boiler Plant.

The three heating boilers shall be sequenced to operate to maintain a substantially constant 82-degree C flow temperature. An immersion temperature detector located in the common boiler flow header shall monitor the common boiler flow temperature and enable the minimum number of boilers necessary to maintain the required conditions. The sequence of operation of the boilers is determined by the BMS, the boilers should be automatically rotated on an hours run basis.

A further immersion temperature detector shall be installed in the common boiler return to monitor the system return temperature.

If the boiler return water temperature falls below a pre-set temperature on the return water temperature detector, the heating boiler and pumps will turn on until this set point is exceeded, additional protection against frost damage is provided by an external temperature detector, which shall operate the pumps during periods when the external temperature falls below the temperature at which there is a possibility of frost damage.

A LTHW pressurisation unit shall maintain the system pressure, and in the event that the systems pressure falls outside of normal parameters the heating system shall be shut down until normal condition have been restored. Should such a shutdown occur the BMS shall generate an appropriate alarm.

7.02 LTHW Secondary Pumps.

The Boiler plant serves 3 heating circuits for the following: -

- Zone No.1 V.T Heating circuit providing heating to the radiator system throughout the building.
- Zone No.2 C.T Heating circuit providing heating to the AHU's within the building.
- Zone No.3 C.T Heating circuit providing heating to the DHWS Calorifiers within the building.

The pumps will operate in the manner outlined below.

To permit the operation of the pumps, On/Off/Auto switches are fitted to the control panel fascia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the pump is On continuously.

When the On/Off/Auto switch is in the Off position, the pumps are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the pumps operate Automatically under the dictates of the BMS.

The control system shall rotate the operation of the pumps on a regular basis (as required by the client) to ensure that both pumps benefit from equal run times as this will prevent the 'off line' pump from seizing due to lack of use.

Should the duty pump fail the standby pump shall automatically be enabled to maintain circulation. A fault lamp on the control panel shall identify when a fault has occurred to alert the maintenance staff to the need for remedial action.

7.03 Optimisation Heating.

The Building is principally heated by means of radiators, which are served by the variable temperature circuit.

Various space temperature detectors shall be positioned throughout the building to represent those areas where radiators have been installed

The operating period of the heating system is determined by the Optimisation control module within the BMS controller, which by monitoring the internal temperature, external temperature and historical data can adjust the start and stop times of the heating system according to the pre-heat and heat dissipation requirements.

The Optimiser enables both heating boilers, main boiler primary pumps and the relevant variable temperature heating pumps.

The space temperature detectors will monitor the actual space temperature and when the temperature falls below a given frost temperature set point, the heating will remain on until this set point has been exceeded.

Additional protection against frost damage is provided by an external temperature detector,

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which shall operate the pumps during periods when the external temperature falls below the temperature at which there is a possibility of frost damage.

7.04 Hot water Services.

There is 1 No. HWS Calorifiers are to be installed to provide for the hot water services required.

The Hot Water Services (HWS) calorifiers are to be served by a dedicated pair of the constant temperature heating pumps.

Immersion temperature detectors located in the calorifiers shall monitor the cylinder temperature and the BMS shall provide a control output to position a 3 port diverting valve in order to maintain the correct set value. A further high limit thermostat will operate should the measured value exceed a high temperature limit. This shall create a high temperature alarm within the BMS and cause the 3 port valve to close.

The valves shall remain closed and the alarm shall remain active when the high limit thermostat is manually reset by means of the reset button located on the device itself. It will be necessary for the temperature within the cylinder to have fallen below the high limit setpoint to allow the reset to be operated,

7.05 Hot water Services Pump.

Secondary circulation shall be maintained by a secondary pump. To permit the operation of the pump, an On/Off/Auto rotary switch is fitted to the control panel facia to allow the following mode of operation: -

When the switch is in the On position, the pump is On continuously.

When the switch is in the Off position, the pump is Off continuously.

And when the switch is in the Auto position, the pump operates automatically under the dictates of the BMS.

An additional HWS Destratification pump will now be installed on the HWS calorifier. The HWS Destratification Pump will operate when the HWS time schedule is active. A CT Switch will be mounted in the control panel to monitor the pump for failure.

To permit the operation of the pump, an On/Off/Auto rotary switch is fitted to the control panel facia to allow the following mode of operation: -

When the switch is in the On position, the pump is On continuously.

When the switch is in the Off position, the pump is Off continuously.

And when the switch is in the Auto position, the pump operates automatically under the dictates of the BMS.

7.06 Safety

The main building fire alarm shall also be monitored, and in the event that the main block zone is activated the plant shall be shut down until such time that the alarm is reset.

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A safety cut off button, fire alarm monitoring and heating boilers thermal links & gas detection system will shut off the control panel and the gas solenoid valve will close should either be activated.

Safety cut off buttons shall be installed within all the plant areas. ON activation, they shall shut down the associated plant.

7.07 Metering

The main utilities shall be monitored (gas, water and electricity). The consumption of these utilities shall be recorded by the BMS.

Metering devices are to be supplied to monitor the following circuits: -

- Main incoming boundary water meter.
- Main incoming water meter.
- Cold water main LTHW Pressurisation Unit.
- Boosted cold water main to HWS Plant.
- Boosted cold water main to Rain Water Harvesting Plant.
- Main gas meter.
- Main electricity supply.
- Power & Lighting Distribution Boards electricity sub-meters.

The BMS shall monitor the boundary water supply and the usage within each building. An alarm shall be generated in the event that the combined consumption is inconsistent with the total volume as measured at the boundary meter.

7.08 VRF Units

The BMS shall provide a BACnet interface to allow the VRF central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and location of data points to be confirmed by the AC Specialist.

7.09 Fire Alarm System

The BMS shall provide a BACnet interface to allow the Fire Alarm System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and location of data points to be confirmed by the Fire Alarm Specialist.

7.10 Security Detection System

The BMS shall provide a BACnet interface to allow the Security Detection System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT

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Network. Number and location of data points to be confirmed by the Security Specialist.

7.11 Door Access Control System

The BMS shall provide a BACnet interface to allow the Door Access Control System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and location of data points to be confirmed by the Door Access Specialist.

7.12 DALI Lighting Control

The BMS shall provide a BACnet interface to allow the DALI Lighting Control System central controller (supplied by the manufacturer) to sit on the BMS network and give the user access to time schedules, set-points and alarm status. The BMS will interface to this system via the site IT Network. Number and location of data points to be confirmed by the Lighting Specialist.

7.13 UPS System

The BMS shall monitor the UPS system via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

7.14 Cold Water Booster Set

The BMS shall monitor the Coldwater booster set via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

7.15 Rain Water Re-Cycling Unit

The BMS shall monitor the Rain water re-cycling unit via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

7.16 Cold Water Storage Tank

The BMS shall monitor the various cold-water storage tank temperature shall be monitored via the BMS and the data logged. In the event that the water temperature level within the tank exceeds a maximum limit an alarm shall be generated by the BMS.

The tank water level shall be monitored via level switches shall allow the high & low levels. In the event of an alarm occurring, the BMS shall general an alarm.

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7.17 Surge Protection

The BMS shall monitor the surge protection unit via volt free contacts which will be provided by the manufacturer which shall allow the fault and general status of the equipment to be monitored. In the event of an alarm occurring, the BMS shall general an alarm.

7.18 Communications and I.T. Rooms

Space temperature detectors shall be installed in locations where temperature control is necessary to maintain the operation of I.T. Equipment. The detectors shall continuously monitor the temperature and provide an alarm as the temperature rises above the expected set-point.

7.19 Major Leak Detection

The BMS shall monitor both the boundary and main building water meters. Should there be a discrepancy between the two recorded values an alarm shall be generated by the BMS to indicate that a significant leak has occurred between the two meters.

7.20 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

MCC1 - Library Main Panel Points Schedule.

Main Boiler Plant.	AI	DI	AO	DO
Outside temperature detector	1			
Common boiler flow temperature detector	1			
Common boiler return temperature detector	1			
Heating boilers enable			3	
Heating boilers fault		3		
Fire alarm signal		1		
Gas detection system alarm		1		
Safety circuit		1		
Sub Total	3	6	3	0

Zone No.1 V.T. Heating Pumps Radiator Circuit.	AI	DI	AO	DO
Pumps enable				2
Water flow proved		1		
Sub Total	0	1	0	2

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Zone No.1 Compensation Heating Radiator Circuit.	AI	DI	AO	DO
Flow temperature detector	1			
Return temperature detector	1			
Space temperature detector	12			
Control valve signal			1	
Sub Total	14	0	1	0

Zone No.2 C.T. Heating Pumps (AHU's).	AI	DI	AO	DO
Flow temperature detector	1			
Return temperature detector	1			
Pumps enable				2
Water flow proved		1		
Sub Total	2	1	0	2

Zone No.3 C.T. Heating Pumps (DHWS Primary).	AI	DI	AO	DO
Flow temperature detector	1			
Return temperature detector	1			
Pumps enable				2
Water flow proved		1		
Sub Total	2	1	0	2

LTHW Pressurisation Unit.	AI	DI	AO	DO
Fault status		1		
Sub Total	0	1	0	0

Rainwater Re-Cycling Unit	AI	DI	AO	DO
Units status		5		
Sub Total	0	5	0	0

Surge Protection	AI	DI	AO	DO
Unit status.		2		
Sub Total	0	2	0	0

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Cold Water Storage Tank	AI	DI	AO	DO
Tank temperature	2			
Tank high level alarm		2		
Tank low level alarm		2		
Drain solenoid control				1
Sub Total	2	4	0	1

Cold Water Booster Set	AI	DI	AO	DO
Unit status.		2		
Sub Total	0	2	0	0

Meters.	AI	DI	AO	DO
Main electricity meter via modbus				
Electricity sub-meters via modbus 30 No.				
Major leak detection system boundary meter (by others)		1		
Major leak detection system internal meter (by others)		1		
Booster water rainwater top up meter		1		
Cold water main LTHW Pressurisation Unit		1		
Cold water main HWS		1		
Main gas meter		1		
	0	6	0	0

Domestic Hot Water System 1 No. Calorifiers	AI	DI	AO	DO
Calorifier temperature	1			
Secondary pump enable				1
Calorifier valve control			1	
Calorifier high limit thermostat status		1		
Secondary flow temperature detector - Sentinal	2			
HWS Calorifier De-Stratification Pump		1		1
	3	2	1	2

Lighting Control System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

Security Detection System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
	0	0	0	0

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Door Access Control System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

UPS System	AI	DI	AO	DO
Unit status/alarm		5		
Sub Total	0	5	0	0

Cooling /Refrigeration System Interface	AI	DI	AO	DO
Unit system monitoring via bacnet interface				
Sub Total	0	0	0	0

Communications Room Cooling Units	AI	DI	AO	DO
Units status		4		
Space temperature detector	4			
Sub Total	4	4	0	0

MCC1 - Main Panel Points Summary.

	AI	DI	AO	DO
Main Boiler Plant.	3	6	0	3
Zone No.1 V.T. Heating Pumps Radiator Circuit.	0	1	0	2
Zone No.1 Compensation Heating Radiator Circuit.	14	0	1	0
Zone No.2 C.T. Heating Pumps (AHU's).	2	1	0	2
Zone No.3 C.T. Heating Pumps (DHWS Primary).	2	1	0	2
LTHW Pressurisation Unit.	0	1	0	0
Rainwater Re-Cycling Unit	0	5	0	0
Surge Protection	0	2	0	0
Cold Water Storage Tank	2	4	0	1
Cold Water Booster Set	0	2	0	0
Meters.	0	6	0	0
Domestic Hot Water System 1 No. Calorifiers	3	2	1	2
Lighting Control System Interface	0	0	0	0
Security Detection System Interface	0	0	0	0
Door Access Control System Interface	0	0	0	0
UPS System	0	5	0	0
Cooling /Refrigeration System Interface	0	0	0	0
Communications Room Cooling Units	4	4	0	0

MCC2 Library Building Second Floor Plantroom

8.01 Air Handling Units.

The following will be controlled from MCC2 installed on the Roof Plant Enclosure of the FACE Building. The following plant shall be directly controlled by the BMS. All other AHU/Ventilation equipment will be supplied complete with integral controllers, and will only be monitored by means of the BMS in terms of fault status and time control.

- AHU No.2 General Areas.

The ventilation unit shall operate as follows: -

The ventilation plant is to be controlled by the BMS on a fixed time basis; provision shall be made to allow the time schedules to be altered to meet any changes in the routine operation of the plant.

To permit the operation of the AHU, On/Off/Auto switches are fitted to the control panel facia to allow the following mode of operation: -

When the On/Off/Auto switch is in the On position, the Supply and/or Extract Fan is On continuously.

When the On/Off/Auto switch is in the Off position, the Supply and/or Extract Fan are Off continuously.

And when the On/Off/Auto switch is in the Auto position; the Supply and/or Extract Fan operate Automatically under the dictates of the BMS.

Inlet and out dampers supplied with the unit shall open as the BMS enables the unit and once they dampers have attained the open position, as proved by the integral end switches the supply and extract fans shall operate.

The unit includes both supply and extract fans which are powered from the MCCP via frequency inverters. The supply and extract fan will be set to run at a fixed speed as set at commissioning.

Across the supply and extract fan section, a differential pressure switch shall be installed and monitored via the BMS. When the BMS enables the AHU an alarm will be raised if a differential pressure switch is not activated, which highlights a air flow failure. In addition to this air flow differential pressure switch, the inverter will be monitored for fault status.

The unit also includes a frost battery, heater battery, and a plate heat exchanger.

The heater battery shall be controlled by modulating the 3 port control valves installed on the battery. The valves shall be positioned in sequence with the plate heat exchanger bypass damper to maintain a substantially constant return air temperature (adjustable).

A further detector installed in the supply duct shall act as a low limit device and shall prevent

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the discharge temperature falling below a low limit setpoint (adjustable) to prevent a draft effect.

A duct frost capillary temperature thermostat after the heater battery will hold off the supply fan until the off-coil temperature is above a frost temperature setpoint, which prevents the frost heater battery from freezing.

The bag and panel filters installed in the inlet section and outlet section shall be complete with differential pressure switches. As the differential pressure increases across the filters, due to the filters becoming soiled, the switches shall operate to indicate that the filters require changing by generating an alarm on the BMS.

8.02 Heat Recovery Units HRU

There is one Heat Recovery Unit (HRU) installed on the second floor. This is to be enabled by the BMS. The fault output, provided by the manufacturer, shall also be monitored by the BMS and in the event of a fault occurring an alarm shall be generated on the BMS front end.

The Heat Recovery Unit shall be supplied complete with integral controls.

8.03 Safety

The main building fire alarm shall also be monitored, and in the event that the main block zone is activated the plant shall be shut down until such time that the alarm is reset.

A safety cut off button, fire alarm monitoring shall be installed within all the plant areas. ON activation, they shall shut down the associated plant.

8.04 Point List

The above narrative should be read in conjunction with the BMS Points schedule below.

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MCC2 - Library Points Schedule.

AHU No.2	AI	DI	AO	DO
Supply & Extract fan enable/control/status		2	2	2
Supply fan air flow proved		1		
Extract fan air flow proved		1		
Fan hold off frost thermostat		1		
Inlet damper control/status		1		
Outlet damper control/status		1		
Recoup Damper			1	
Frost battery control			1	
Frost battery off coil duct temperature	1			
Heater battery control			1	
Panel filter status		1		
Bag filter status		1		
Return air filter status		1		
Supply air temperature detector	1			
Return air temperature detector	1			
Sub Total	3	10	5	2

MVHR Unit	AI	DI	AO	DO
Units enable/status		1		1
Sub Total	0	1	0	1

General Services	AI	DI	AO	DO
Lift alarm status		2		
Disabled systems alarms		3		
Sub Total	0	5	0	0

MCC2 - Points Summary.

	AI	DI	AO	DO
AHU No.2	3	10	5	3
Roof Mounted NVHR	0	1	0	1
General Services	0	5	0	0
Grand Total	3	16	5	4

9.00 Firemans override key switch

A fireman's override switch shall be installed in the main entrance to both the F&T/FACE

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Building and the Library.

Upon activation of the fire alarm, all AHU's controlled via the BMS will shut down. When the fire alarm is activated the Fireman's Switch will become active.

The key switch shall have On/Off/Extract Only selection with the Switch in the Off position during normal operation.

When the fireman selects the On Position, Supply and Extract Fan's on the AHU will be enabled.

When the fireman selects the Extract Only Position, only the extract fans associated with the AHU's will be enabled.