THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

Property Services Design Standards and Guidelines

Section 7
Building Management System (BMS)

Version 1.0

BMS

Document Control Information

Team Name:	Design Standards Steering Group	**Published date:**	18 October 2019
Document version:	1.0	**Revision date:**	Annually

Document Control

Version	Review Date	Authorised by	Description
1.0	18 October 2019	Design Standards Steering Group	Initial version of manual.
	February 2020		(Either note which sections have changed or 'annual review – no changes')

Feedback

If you spot an error in this document, or you have a suggestion on how we can improve the document, please tell us about it by printing, completing and emailing the form in Appendix A to us at PSTechServices@auckland.ac.nz.

7 Building Management System (BMS)

Table of Contents

List of Tables

List of Figures

No table of figures entries found.

7.1 Introduction

Introduction

This section shall be specifically read in conjunction with *Section 1 About this Document* and *Section 2 Project and Building Works Requirements* of the University's Property Services Design Standards and Guidelines.

7.1.1 Purpose

The purpose of this section is to outline the requirements around the Building Management System (BMS).

7.2 Abbreviations and Definitions

BMS abbreviations

Table 1: BMS abbreviations

Abbreviation	Description
AHU	Air handling unit
DALI	Digital Addressable Lighting Interface
FCU	Fan coil unit
FM	Facilities Management
VAV	Variable air volume
VRF	Variable refrigerant flow

7.3 General Requirements

7.3.1 General

- All proposed Building Management Systems (BMS) shall be direct digital control using the latest Siemens Desigo control architecture and technology.
- The University's incumbent BMS service provider shall be engaged directly to the main contractor to provide BMS engineering, programming, testing and commissioning, graphics and interface, and controls hardware, and devices compatible with the University's site wide BMS and their standards and requirements.
- All proposed BMS controls shall connect to Facilities Management (FM) BMS head end via a University ethernet connection provided by the University.
- Provisions for a local front end on development sites are **not** required.
- In the event University FM staff require on-site BMS access, this shall be achieved over the site's wireless network. Similarly, third party BMS access shall be provided via web-based interface.
- All BMS graphics shall be to the current University standard.
- All building services plant under BMS monitoring and control shall be graphically represented with dynamic schematics and schedules as appropriate on the University head end.

7.4 Design Requirements

7.4.1 Design approach

The University expects consultants and designers to provide designs that meet the project briefs.

Priorities that consultants and designers must consider in their designs include:

- Providing controls and strategies to meet the required environmental conditions
- Designing a dynamic BMS system to allow for individual nuances
- Taking a long-term balanced view of capital costs, energy costs, maintenance costs and longevity
- Designing systems that are adaptable for changes because educational and research progress at rapid rates so the usage of buildings and areas within buildings can change several times within the life of a building.
- **For new buildings**, delivering a system that will provide good and reliable functional outcomes, adopting sensible sustainable practices and maximizing The University's owning costs on energy and maintenance.
- **For existing buildings and small system additions**, building ability, minimising disruptions, neat and tidy integrating of systems and reticulation of services within the application and without compromising this standard.
- **When existing systems are present in buildings**, expanding the system type through the building to ensure consistency in buildings and maintainability.

7.4.2 Design inputs and process

The University expects consultants and designers to proactively inform, advise and contribute to the design process.

In particular, consider these aspects:

- Control logic - The consultant must provide specific logic on the operation of the systems. This advice is to be formed through the design of the equipment being controlled and the overarching system operational description and should be done in conjunction with the incumbent BMS provider.
- Siemens CAS library algorithms shall be used for all plant control as these have been tested for best practice and energy efficiency.
- Schematic diagrams - The consultant must provide detailed schematics of the proposed mechanical systems showing all sensors, meters and controlled devices.
- Location and quantity of sensors in a space to allow for accurate and reliable space sensing. Single sensors in large volume areas have proven to be inappropriate.
- For critical environments such as animal houses, special laboratories, clean rooms, etc. the stable operation of systems and/or other refrigeration systems are crucial. System redundancy must be considered on a case by case basis for backup power to controls, fail safe control operation alarm configurations and redundant controller/sensor installations.

7.5 Control Requirements

7.5.1 Introduction

These sections contain technical requirements on equipment, materials and installations which consultants and designers are required to adhere to.

Consultants are required to ensure the project specifications do not contain any information or requirements that conflict with this document.

7.5.2 Products

All products used in the installation shall be new, currently under manufacture, and shall be available in standard off the shelf products. Written approval from the University is required to install any new BMS products that are not commercially available.

Spare parts shall be available for at least 10 years after completion of the contract in relation to BMS installation.

The BMS system to be used at the University is the Siemens Desigo system.

All BMS equipment listed below is to be supplied and configured by the incumbent service provider.

The equipment shall be selected as follows:

Plant Type	Controllers
Main plant control	Siemens PXC modular controllers with modular TXIO modules for input and output.
Zone control	Siemens DXR controllers. These may be either TCP/IP or MSTP based depending on the structure of the building and network capability. MSTP based systems shall be connected via a PXCG3 router.
Lighting control	Siemens PXC3 controllers or directly by the local zone DXR controller.
Variable Speed Drives (VSDs)	Siemens G120P
Metering	Electrical: Siemens PAC3100 or PAC2200 Water: Siemens WFx30, wired MBUS Gas: Elster QAe with onboard wired MBUS Energy: Onicon heat meters Refer to *Section 3 Utilities Connections and Energy Management* of the *University's PS Design Guidelines and Standards* for details.
Gas detection systems	QEL MCONTROLLER System QEL Q5 Sensors
UPS systems	Riello connected via SMTP to the BMS Refer to *Section 5-a UPS* of the *University's PS Design Guidelines and Standards* for details.

7.5.3 Graphics

All graphics shall be completed to the University standard. Generally, this includes:

Section	Requirement
General	• All graphics shall use Maximo numbers for all plant. • Standard symbols must be used
Campus overview pages	• A list of campuses with links
Building overview pages	• A list of floorplans • A list of main plant and overviews • A picture of the building • A link to the Main page and sector overviews. • A link to the functional description for the building.
Plant pages	• A link to the building overview • A link to the appropriate section of the functional description • Fire signal status • Plant operating mode status • Schematic of the plant • All supplies to be labelled with destination plant • Plant setpoints • Plant location • Links to areas served by the plant
Zone overview pages	• A link to the building overview • A list of zones (VAV, FCU, VRF etc.) • Links to floorplans ad schedules • Links to related AHUs
Floorplan pages	• A link to the building overview • Switchable layers for the AHU legend and Lighting control • Room numbers • Links to plant serving the floor
Miscellaneous fan/plant pages	• A link to the building overview • A link to the appropriate section of the functional description • Details of each fan including Maximo number, location, control strategy

7.5.4 Alarms

- Alarms are prioritised by FM staff.
- Alarm priorities will vary depending on the severity of the fault and the nature of the building and associated plant. In the event of specialist equipment or particularly complex systems being part of the installation, alarm requirements should be discussed with members of the University's FM team as soon as possible.
- Alarms are directed to the appropriate recipient based on time of day and priority.
- Alarms are sent by email and / or text message via the University's Data Squirt system.
- Newly handed over buildings should have no active alarms.

7.5.5 Trending

Trending will be decided on a case by case basis but as a minimum the following will be configured:

Point type	Trend method
Main plant analogue values Supply temperature etc	15 minute polled trend
Main plant digital / multistate values Fan status etc.	Change of value trend
Meters	15 minute polled trend

7.5.6 BMS mechanical services control

All mechanical controls shall be native Siemens PXC with this requirement:

- 25% spare space in the panel shall be allowed for expansion.
- For general mechanical control strategies, refer to *7.6 Mechanical Control Strategies* on page 12.

7.5.7 BMS lighting control

All lighting controls shall be native Siemens TRA.

No third-party systems via an interface are acceptable.

These functions are required:

- For detailed lighting control strategies, refer to 7.7 *Lighting control strategies* on page 14.
- Light fittings shall be DALI.
- Presence detectors and pushbuttons shall be Siemens PL-Link.

7.6 Mechanical Control Strategies

7.6.1 General

- Controlled plant shall have status monitoring via a pressure switch, current switch, contactor status etc.
- Main plant filters shall be monitored with a pressure sensor
- VSDs shall be Siemens G120P and be controlled and monitored via high level interface
- Main plant actuators (valves, dampers etc.) shall be 0-10V controlled
- Zone plant actuators may be 3 point controlled.

7.6.2 Hardware Requirements

- Auto/Off/Manual switches shall be provided on all main plant items. These shall be monitored by the BMS via two digital inputs:
  - Off
  - Manual.

7.6.3 Software Strategies

- Siemens CAS libraries shall be used wherever possible
- Energy saving strategies shall be implemented from the CAS library. (Night Cooling, Temperature and Air Quality Demand Control, Summer/Winter Compensation)
- VAV AHU pressure control setpoint shall be reset based on zone volume
- Generally, room setpoints are 20°C for heating and 22°C for cooling.

Time Schedules and Calendar Functions

- The use of time schedules should be minimised for each building.
- Specific items of plant that are likely to have very different time settings to the rest of the building should have their own, dedicated time controls.
- Bookable spaces shall have their own time schedule to enable the system. When the schedule is active, presence detectors will enable the plant to run.
- Exceptions are used to adjust bookable hours based on inputs from the University's scheduling system.
- A BACnet Calendar for each BACnet site contains all the public holidays and shutdown periods. This calendar is applied to all schedules that need to be disabled during these periods.

Heating Systems

- Main heating systems are generally only run during the "Winter" period.
- This period is decided by dates entered by FM and outside temperature.
- Heating systems must be run only when there is demand from the field.
- To maximise condensing efficiency heating hot water setpoints shall be reset by either outside temperature or valve positions in the field.

Cooling Systems

- Cooling systems must be run only when there is demand from the field
- Chilled water setpoints shall be reset by valve positions in the field.
- Condensing water setpoints shall be reset to match chiller load and efficiency potential.

Control Zones

- Temperature control zones shall be arranged and sized to reflect the impact of changing perimeter loads as the solar gain varies during the day.
- Internal areas shall not be in the same control zone as a perimeter area.

7.7 Lighting control strategies

Introduction

The lighting control system is designed to provide adequate lighting to the occupants while using the minimum electricity.

7.7.1 General rules

- Refer to section *5-b Lighting Guide* of PS Design Standards and Guidelines.
- Standard Siemens CAS library lighting control strategies are to be used wherever possible.
- Presence detector time delays must be set to the minimum value acceptable by the users. This can be as low as 2 minutes for corridors.
- Adequate numbers of presence detectors must be installed to properly cover the space.
- Light levels should be tested and set on the controls, so the light fittings are run at the lowest setting possible while maintaining the required lux levels.

Hardware

Hardware used for lighting controls is to be as follows:

- Siemens PXC3 lighting controllers
- Siemens UP220 pushbutton interface at each door with a momentary pushbutton to toggle the lights.
- Siemens UP258 presence detectors in the ceiling
- DALI light fittings
- Either:
  - Lectern Touch Screen (supplied by LESU) with volt free contacts to the lighting control system, or
  - Siemens UP220 pushbutton interfaces at the board with multiple scene pushbuttons
- PDL 600 series momentary mechs are to be supplied and fitted by the electrical contractor. These must be engraved with the function of the button as follows:
  - Lights for General rooms
  - Welcome for Seminar rooms
  - Off for Seminar rooms
  - Teach for Seminar rooms
  - Quality for Seminar rooms
  - Ex Quality for Seminar rooms
- Installation must be to the Siemens installation standards
- Auto/Off/Manual switches shall be provided for each PXC3 controller. These shall be monitored by the BMS via two digital inputs:
  - Off
  - Manual.

7.7.2 Pushbutton offices

In these rooms the lighting is controlled by a pushbutton.

Daytime Operation

- On entering the room, the user presses the button at the door. This toggles the lights on.
- On leaving the room, the user presses the button at the door. This toggles the lights off.
- The user can dim the lights up or down by holding the button at the door.
- At the end of the day schedule the lights will flicker as a warning and then switch off.

After-hours Operation

- On entering the room, the user presses the button at the door. This toggles the lights on.
- On leaving the room, the user presses the button at the door. This toggles the lights off.
- Where enabled, if the user wants to dim the lights up or down they hold down the button at the door.
- After 2 hours the lights will flicker as a warning and then switch off.

7.7.3 Pushbutton and Presence Controlled Offices Type 1

In these rooms the lighting is controlled by a pushbutton and also a presence detector. The presence detector is used to ensure the lights will switch off if the user leaves the room.

Daytime Operation

- On entering the room, the user presses the button at the door. This toggles the lights on.
- On leaving the room, the user presses the button at the door. This toggles the lights off.
- Where enabled, if the user wants to dim the lights up or down they hold down the button at the door.
- When presence is no longer detected (for a period) the lights will dim slowly as a warning and then switch off.
- At the end of the day schedule the lights will flicker as a warning and then switch off.

After-hours Operation

- On entering the room, the user presses the button at the door. This toggles the lights on.
- On leaving the room, the user presses the button at the door. This toggles the lights off.
- If the user wants to dim the lights up or down they hold down the button at the door.

- After 2 hours the lights will flicker as a warning and then switch off.
- When presence is no longer detected (for a period) the lights will dim slowly as a warning and then switch off.

7.7.4 Pushbutton and Presence Controlled Offices Type 2

In these rooms the lighting is controlled by a pushbutton and also a presence detector. The presence detector is used to switch the lights on and also ensure that if the user leaves the room the lights will switch off.

Daytime Operation

- On entering the room, the user presses the button at the door. This toggles the lights on.
- On leaving the room, the user presses the button at the door. This toggles the lights off.
- Where enabled, should the user wish to dim the lights up or down they can hold the button at the door.
- When presence is no longer detected (for a period) the lights will dim slowly as a warning and then switch off.
- At the end of the day schedule the lights will flicker as a warning and then switch off.

After-hours Operation

- On entering the room, the user presses the button at the door. This toggles the lights on.
- On leaving the room, the user presses the button at the door. This toggles the lights off.
- If the user wants to dim the lights up or down they hold down the button at the door.
- After 2 hours the lights will flicker as a warning and then switch off.
- When presence is no longer detected (for a period) the lights will dim slowly as a warning and then switch off.

7.7.5 Corridors

In these rooms the lighting is controlled by presence detectors. After hours the lights are set to a reduced level to save power.

Daytime Operation

- On entering the room, the user triggers the presence detectors and the lights switch on.
- When presence is no longer detected (for a period) the lights will flicker as a warning and then switch off.

After-hours Operation

- On entering the room, the user triggers the presence detectors and the lights switch on at a reduced level.
- When presence is no longer detected (for a period) the lights will dim slowly as a warning and then switch off.

Special sections of corridors

- These areas, such as entries, intersections etc., will have a brighter level during after-hours operation.

7.7.6 Daylight Harvesting Operation

Where rooms have an abundance of external lighting available external or internal light level sensors can be used to dim the artificial lights.

Internal Light Level Sensor Operation

- Presence detectors in the room perform double duty as light level sensors, detecting reflected light from the room surfaces.
- The lights are dimmed up and down to maintain light levels at a setpoint.

External Light Level Sensor Operation

- An outdoor light level sensor provides information on how much light is available from the windows.
- The lights are dimmed up and down in a linear manner based on these light levels.
- Rows of lights further from the window are be dimmed appropriately based on their distance from the window.

7.7.7 Lecture Theatres and Seminar Rooms

In these rooms the lectern has either a touch screen, or pushbuttons on the wall that interface with the lighting controls to select scenes and control the lights.

Light fittings

- Main room
- Front Row (where installed)
- Board (1-3 sets depending on board layout).

Operation

- On entering the room, the user presses the **Welcome** button at the door. This triggers the Welcome scene.
- On leaving the room, the user presses the **Off** button at the door. This triggers the Off scene.
- If no Presence is detected for 30 minutes and the off scene is not active, the Off scene is triggered.
- The Touch Screen or Scene pushbuttons at the board can select any of the Scenes, toggle the board lights and enable an Exam mode.
- **In Exam mode** the presence detectors and scene selectors are disabled.

Scenes

Scene	Main	Front	Board	Notes
Welcome	On	On	On	All lights on Student bench light level of 300-1200 lux
Off	20 lux	Off	Off	After 2 minutes all lights go off
Teach	200-800 lux	0%	Off	
Quality	40-200 lux	0%	Off	
Extra Quality	10-45 lux	0%	Off	

Appendix A Feedback Form

We love hearing from you. Please take a few moments to let us know how we can improve the *Property Services Design Standards and Guidelines*.

1.	**Name:**			
2.	Contact Details: (in case we need clarification)			
Complete this section if you have found a typo / formatting error. (If possible, attach a photo of the error)				
3.	Section No:		Page No/s:	
	Description of error:			
Complete this section if you have a suggestion about content.				
4.	Section No:		Page No/s: (if applicable)	
	Suggestion/s:			
Complete this section if you have any other suggestions for improvement.				
5.	Suggestion/s:			
6.	Email your feedback to PSTechServices@auckland.ac.nz			
Thanks for your feedback!				

Appendix B Index