Scottish Health Technical Memorandum 2005

(Part 1 of 4)

Overview and management responsibilities

Building management systems

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Executive summary

A building management system (BMS) is a computer-based centralised procedure that helps to manage, control and monitor certain engineering services within a building or a group of buildings. Such a system ensures efficiency and cost-effectiveness in terms of labour and energy costs, and provides a safe and more comfortable environment for building occupants.

The BMS has evolved from being a simple supervisory control to a totally integrated computerised control and monitoring system.

Some of the advantages of a BMS are as follows:

a. simple operation with routine and repetitive functions programmed for automatic response;
b. reduced operator training time through on-screen instructions and supporting graphic display;
c. faster and better response to occupant needs;
d. reduced energy costs through centralised control and energy management programmes;
e. better management of the facility through historical records, maintenance programmes and automatic alarm reporting;
f. improved operation through software and hardware integration of multiple sub-systems, for example direct digital control, security and access and lighting controls.

This part, 'Overview and management responsibilities', outlines the overall responsibility of chief executives and managers of healthcare premises, and details their legal and mandatory obligations in installing and operating a reliable, efficient and economic BMS.

Management responsibilities in terms of compliance with statutory instruments are summarised in Chapter 2. Technical aspects are described very briefly, concluding with guidance on the management of systems. The technology and potential benefits of a BMS are described in Chapter 3, 'Functional overview'. A synopsis of testing and inspection, together with an outline on commissioning and handover procedures, is included in Chapter 4.

Chapter 5 draws the attention of management to BMS applications and advice is given on selection of maintenance contractors and training.

Chapters 6 and 7 deal with selected staff functions and definitions respectively.

Contents

1. Scope

1.1 A building management system (BMS) is a management tool for the effective control of building engineering services, and can be applied equally to new and existing buildings.

1.2 A BMS can be used to manage the environmental conditions of all types of building. In healthcare premises, a BMS is particularly valuable in maintaining suitable conditions in critical areas, for example operating departments, intensive care units, isolation suites, pharmacies and sterile supply departments. A BMS provides alarm communication networks for the building services plant.

1.3 A properly installed and maintained BMS operated by fully trained staff offers considerable opportunities for “energy management”. A BMS can support separate software packages for energy monitoring and targeting.

NOTE: Other areas that can be monitored and targeted include water consumption, sewage and waste disposal.

1.4 A further use of the BMS is to help to establish the basis of the site’s planned preventive maintenance operations.

1.5 A BMS should be specified with care and detail, focusing on the functionality and required performance of the systems under control. The specification should detail the commissioning and handover requirements. When a BMS is specified, especially if it is replacing existing controls, consideration should be given to the appropriate level of user control.

NOTE: When a BMS is specified, the NHS Model Engineering Specifications, with appropriate supplements for Scotland should be considered.

1.6 The commissioning of a BMS should be fully documented to ensure that all aspects of the system meet the specification. Adequate resources should be allocated to ensure satisfactory commissioning procedures are met.

1.7 To continue to meet specified environmental conditions and increase energy efficiency, a BMS should be regularly maintained and its performance tested.

1.8 It is important that BMS operators and maintenance staff receive adequate training.

1.9 The sophistication of building services in healthcare premises is increasing, and therefore BMS controls should be designed, installed, operated and maintained to standards that will enable the controls to fulfil the desired functions reliably and safely.

2. Management responsibilities

2.1 It is incumbent on management to ensure that their BMS installations comply with all the statutory regulations applicable to a BMS on their premises. Other functional guidance in terms of standards and codes of practice should also be noted.

Statutory requirements

2.2 Safety regulations are as laid down in the:

a. Health and Safety at Work etc (HSW) Act 1974;
b. Electricity at Work Regulations 1989;
c. The Building Standards (Scotland) Regulations 1990 (as amended);
d. Management of Health and Safety at Work Regulations 1999;
e. Provision and Use of Work Equipment Regulations 1998;
f. Manual Handling Operations Regulations 1992;
g. Workplace (Health, Safety and Welfare) Regulations 1992;
h. Personal Protective Equipment at Work (PPE) Regulations 1992;
i. Health and Safety (Display Screen Equipment) Regulations 1992;
j. Construction (Design and Management) Regulations 1994;
k. Electromagnetic Compatibility Regulations 1992;
l. Electromagnetic Compatibility (Amendment) Regulations 1994.

Functional guidance

2.3 Guidance is as laid down in:

a. British Standards and Codes of Practice;
b. Health and Safety Executive Guidance;
c. NHS Model Engineering Specifications;
d. Scottish Health Technical Memoranda (SHTM);
e. Scottish Hospital Planning Notes (SHPN);
f. Scottish Hospital Technical Notes (SHTN);
g. Scottish Health Guidance Notes (SHGN);
h. NHS in Scotland – Firecode;
i. Health Building Notes and Health Technical Memoranda;
j. The Technical Standards for compliance with the Building Standards (Scotland) Regulations 1998 (as amended).

For further details please refer to the 'References' section at the end of this document.

3. Functional overview

Introduction

3.1 A BMS controls the plant and equipment creating the internal environment in healthcare premises. It typically consists of a **central station** connected via a communications network to a number of **outstations** (see Figure 1). Control actions can be determined by either the central station or outstations. The latter can operate independently of the network if necessary, hence the term "**distributed intelligence**".

NOTE: The extent and geography of the site will determine the choice of the equipment and communications network to be used. Links from the central station to remote outstations can be achieved by, for example, hard wire, modem or radio communication. However, it is critical to ensure that sensitive medical electrical equipment is not affected by radio communication interference. (Refer to the HEEU report 'Electromagnetic Compatibility of Medical devices with Mobile Communications' issued 9/5/97).

BMS technology

Central station

3.2 The central station of a BMS is usually a personal computer-based system which provides a user interface with the BMS by means of schedules or graphical schematics. These are dynamically updated with monitored values. The central station of a BMS provides:

a. the ability to establish trend logs of various monitored parameters such as sensor values or control outputs. This feature can be invaluable when investigating the performance of plant;

b. the ability to receive plant alarms and abnormal conditions warnings which can be graded by degree of severity and required response;

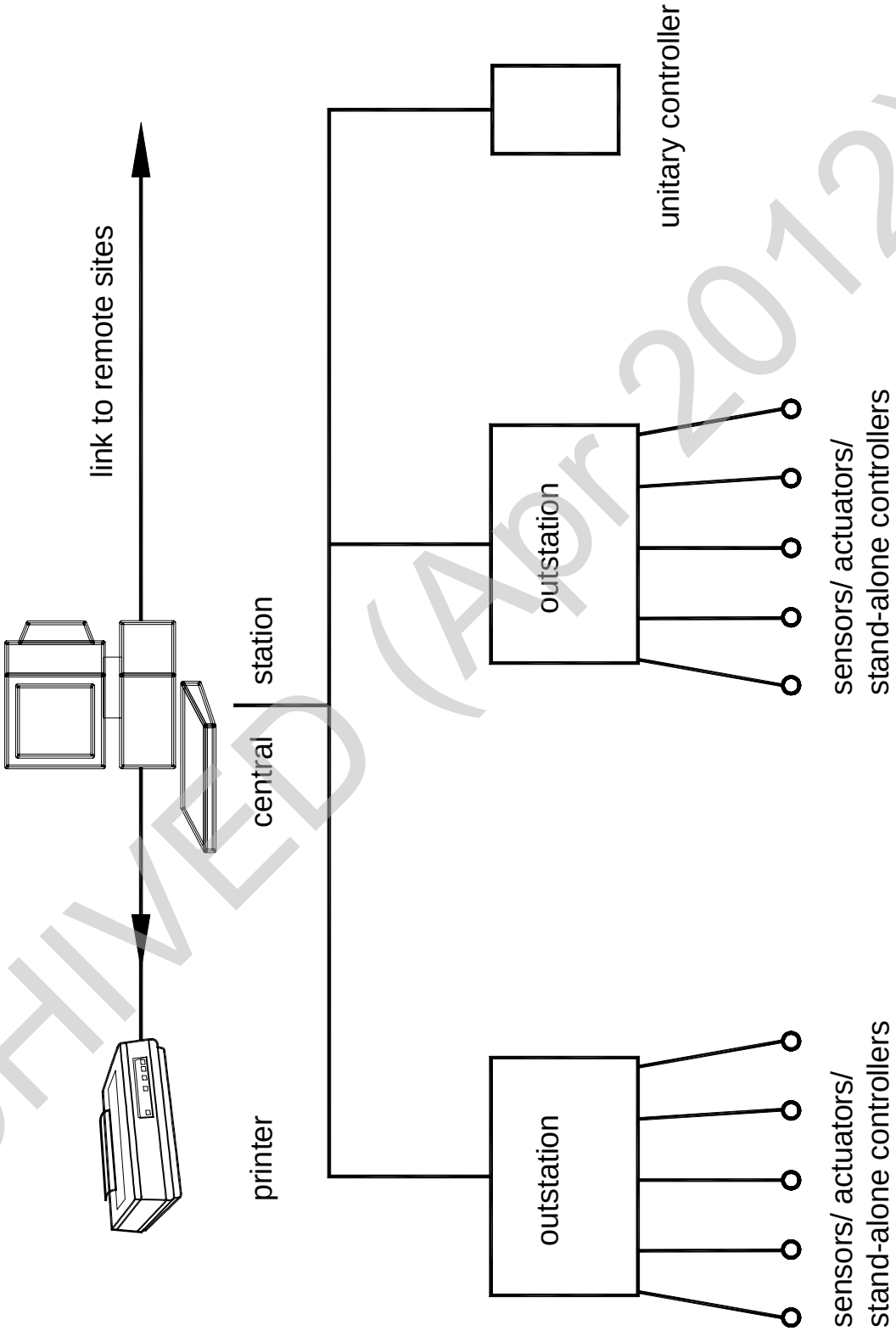
c. the ability to alter control parameters such as programmed occupancy times or control set-points;

d. the ability to configure the system, including the outstations;

e. the use of management software for energy monitoring and targeting and for maintenance planning;

f. the ability to monitor all connected plant. Hard copy reports can be generated and printed.

Figure 1: Building management system schematic



Outstation

3.3 An outstation is a microprocessor device which uses programmable software to perform control functions. The outstation software provides control ”blocks” which can be arranged (configured) to provide a control strategy. Once configured, the outstation is able to hold the control logic.

NOTE: One or more outstations may be used to control the engineering services plant in a particular building.

3.4 A number of inputs and outputs are connected to each outstation. Inputs include on/off status of plant and data from sensors measuring temperature, humidity, pressure, velocity, etc. Outputs include on/off signals to plant along with control signals to actuators for valves and dampers, etc.

3.5 Outstations are connected to a communications network. This enables data to be shared between outstations and provides a means of accessing and monitoring the system from a single point.

Unitary controllers

3.6 These are small outstations generally dedicated to one item of plant and are connected to the communications network.

Control functions

3.7 Control functions available for configuration depend on the make of outstation and typically include:

a. time/event schedules;
b. optimisers;
c. compensators;
d. proportional, integral and derivative control;
e. logic functions.

3.8 These various functions can be configured together to provide a tailored control strategy to suit the plant and environment in question. Typical control applications include:

a. heating;
b. ventilation;
c. air-conditioning;
d. lighting;
e. duty cycling;
f. load shedding.

Potential benefits of a BMS

3.9 To maximise the energy-saving potential of a BMS, its ability to control plant should be fully exploited.

NOTE: Improved monitoring alone may not necessarily save energy.

3.10 A BMS can provide enhanced control of environmental conditions. This is achieved by the flexibility in configuration of programmes which can be tailored to provide optimum control solutions. The ability to record or log measured or calculated parameters over time provides a powerful auditing tool which can be used to check and refine the control settings.

3.11 The logging facility is invaluable for energy auditing and checking the control of an item of plant or space condition. A permanent record can be made of environmental conditions through the use of logs.

3.12 A BMS can be configured such that any monitored parameter can signal an alarm once a predetermined value has been exceeded. The type of abnormal condition can be specified, as can the nature of the associated alarm and required response. This facility gives the BMS a fault detection capability which can be extended to other hospital equipment, for example fume cupboards, freezers and lifts.

NOTE: It is essential to ensure that the BMS interface with “lifts” processors is restricted to monitoring only. Any possibility of the BMS influencing the lift’s controls must be eliminated.

3.13 A BMS can be configured to log the hours run by a particular item of plant and the number of starts. This data and other information collected by a maintenance management software package can be used to schedule plant maintenance. Messages from the BMS can also be used to initiate repair and maintenance instructions.

3.14 Improved monitoring and control of plant with a BMS improves the life of the plant, reduces maintenance costs and enables better use of existing engineering labour resources.

3.15 Proprietary software for monitoring and targeting can be installed at the central station. This software can be a powerful tool in an energy-saving campaign as it not only provides an analysis of energy use, but also highlights energy wastage and deviations from set targets.

3.16 A BMS can provide a central monitoring facility for a range of related systems such as:

a. fire detection;

b. security detection systems, including burglar alarms, closed circuit television (CCTV) and access control systems;

c. telephone systems;

d. vertical transport systems (lifts).

3.17 At present a BMS performs no control role when integrated with any of the above; it merely acts as a single user interface, monitoring autonomous systems. There needs to be a clear technical break (isolation) between fire alarm/protection systems and the BMS to ensure the absolute integrity of the fire alarm system. The level of integration is restricted at present due to current standards and the advice of fire prevention and building control officers. It is also essential that the BMS interface with “lifts” processors is restricted to monitoring only. Any possibility of the BMS influencing the lift’s controls must be eliminated.

4. Testing and inspection criteria

General

4.1 Management should be aware of the importance of thorough and complete commissioning of an installed BMS before it is formally handed over and put into use. Since the BMS contributes to safe and comfortable environmental conditions for the buildings' occupants, it is essential that the system is fully commissioned.

4.2 When a BMS installation is part of a larger project, the commissioning of the BMS is one of the last tasks in the construction process. If the project over-runs, the programmed resources tend to be compressed. This can result in a poorly commissioned BMS which is ineffective, energy-inefficient, and which can suffer from false alarms, resulting in complaints from the occupants. Much time, cost and effort will then be expended to resolve the problems.

Commissioning

4.3 Commissioning describes the testing and inspection of an installed BMS to ensure it is working and able to meet specified requirements (normally contained within the specification). Commissioning incorporates several stages:

a. pre-commissioning checks of the components:
   (i) wiring;
   (ii) sensors and actuators;
   (iii) major sub-assemblies (either on or off site);
   (iv) control cabinets;
   (v) configured control strategies;
   (vi) central station graphics slides;

b. commissioning of the application software;

c. commissioning of the complete system including:
   (i) checking alarms;
   (ii) checking interlocks;
   (iii) control loop tuning;
   (iv) calibration of sensors;
   (v) performance tests to check the ability of the system to meet specified environmental performance parameters.

4.4 The commissioning of a BMS should only begin once the plant to be controlled has been fully tested and approved for work. Commissioning should be undertaken by a BMS specialist.

Specification

4.5 The specification should ensure that the BMS is commissioned properly by the application of a commissioning procedure and the relevant code of practice. The completion of commissioning record sheets should be specified as a means of verification.

Commissioning documentation

4.6 Record sheets should be completed to verify that items are commissioned and to create a permanent record for future reference. Variations should be noted and drawings and other documentation updated during the commissioning process to create a set of “as-installed” records.

Handover procedures

4.7 Handover requirements should be detailed in the specification. The client should witness the demonstration of various aspects of the BMS to their satisfaction. The handover procedure also includes the provision of all specified documentation including:

a. record drawings;
b. schematics;
c. points lists;
d. commissioning records;
e. operating and maintenance manuals.

NOTE: For this purpose, the client needs to be informed and should have already received some training. Involvement in the commissioning process of client’s key staff can consolidate his informed status.

Fine tuning

4.8 During the first year of operation the performance of a BMS will need to be optimised through a process of fine tuning. This is partly because the BMS may have been commissioned before the building was occupied, and invariably set points and other items will need adjusting.

5. Management summary

General

5.1 The guidance contained in this SHTM is not intended to be applied retrospectively; however, there is an obligation to review existing installations and ensure that they are of a satisfactory standard. The guidance should be applied in full to new installations and major refurbishment of existing installations.

5.2 Management should be aware of the range and type of building engineering services controlled by a BMS, as this will provide an understanding of the importance of the system.

5.3 To have a reliable and efficient BMS, management should ensure that the specification, commissioning, handover, maintenance and operation are to a high and appropriate standard.

Application considerations

5.4 Management should conduct a feasibility study before specifying BMS control. In a new building the size and complexity of the plant will dictate whether a BMS is suitable. An additional factor is the existence of a BMS on the site and the desire to connect new buildings to the system.

NOTE: A BMS is not always the most cost-effective control solution.

5.5 The replacement of an existing control system with a BMS should be subject to a “value for money” and “cost/benefit” analysis. Where this is the case, the replacement may be justified by other benefits, such as plant and alarm monitoring. Often, a BMS can interface with an existing effective control system, thus reducing overall cost. Where a BMS is to be installed into an existing building, every effort should be made to minimise disruption to existing plant operation.

5.6 For a BMS to function effectively, data must be transferred around the system and, in many cases, to and from other systems. To provide a means for the transfer of data, communication protocols are required. These protocols permit the physical connection, transfer and interpretation of data.

5.7 Major BMS companies often implement different communication protocols, with the result that equipment from different manufacturers may not communicate directly. This can present several problems, including:

a. if systems are implemented from a single supplier, there may not be the opportunity to select the “best” equipment for specific applications;

b. by being tied to a single make of equipment, best value for money may not be realised;

c. separate interfaces will be required if equipment is supplied by a number of different manufacturers.

NOTE: Competitive tendering can be achieved through the use of systems houses (controls companies that market, design and install control equipment from several different BMS companies) or by requiring the tender to include for additional BMS equipment to be index-linked over a specific number of years.

5.8 The formulation of standardised protocols is the subject of protracted discussions within international bodies. A partial solution to the problems of transferring data between different systems is to use a gateway. Essentially, a gateway can be thought of as a “black box” which is placed between dissimilar systems to give a degree of interconnection and to enable a certain amount of interaction. However, the use of gateways presents several potential problems, such as:

a. high cost of engineering the gateway;

b. loss of functionality;

c. gateway maintenance and accommodation of protocol variations;

d. contractual issues, that is, who has ultimate responsibility for the gateway?

Functional objectives

5.9 Management should ensure that the relevant parties receive a sound briefing on all the BMS functional objectives.

5.10 The system should be commissioned thoroughly to ensure that the BMS is installed and operating according to the functional objectives. Adequate resources should be allocated to the commissioning process to ensure that all aspects are covered.

Maintenance contracts

5.11 The safe and reliable operation of the BMS should be ensured by regular maintenance and performance checking. A maintenance schedule should be

followed and records kept of all activities. Maintenance work should be undertaken by experienced and competent persons.

5.12 Initial maintenance is particularly important. Responsibility for this can be focused effectively by including the initial 12 months' maintenance in the supply contract. If maintenance is to be provided by the supplier/installer, it will be advantageous to detail the costs in the initial tenders.

NOTE:

a. This approach should reduce the potential for disputes during the contract defects liability period;

b. Maintenance arrangements should commence at handover.

5.13 Third-party software for energy monitoring and targeting, and for planned preventive maintenance, can run on the central station computer. Any faults and failures of the BMS can affect the performance of these software packages.

5.14 A BMS can control critical building services plant, so it is necessary that a high quality breakdown support service is available at all times. It is the responsibility of management to specify the required emergency and breakdown response. The contractor should be experienced, reliable and able to meet specified emergency response requirements.

5.15 Management is responsible for the provision of contracts with suitably qualified contractors to provide a regular maintenance service and high-quality breakdown support.

5.16 A strict quality assurance procedure should be enforced to ensure that documentation is continuously updated to record changes made to the BMS.

Training of personnel

5.17 Management should provide adequate training for personnel responsible for the operation and maintenance of the BMS to enable them to undertake their designated tasks. Management should be aware that competent and enthusiastic BMS operators help to maximise the potential of a BMS operation. To prevent mishandling of the system, access to the BMS should be password-protected and limited to authorised users by a hierarchical procedure.

BMS ownership

5.18 It is a management responsibility to ensure that the standards applied during the design and installation of a BMS are not reduced during the operation and maintenance of the equipment.

5.19 Clear lines of managerial responsibility should be in place so that no doubt exists as to who is responsible for the correct operation and maintenance of the equipment. A periodic review of the management systems should take place in order to ensure that the agreed standards are being maintained.

5.20 It is essential that the concept of ownership of the BMS is cultivated to enable the user to realise the full potential of the system.

BMS drawbacks

5.21 A BMS can either fail completely or not realise its full potential and benefits, often through causes other than the equipment itself.

5.22 Most common causes of failure include:

a. imposing a BMS onto poor or unreliable plant;

b. insufficient attention given at the pre-contract stage to the definition and understanding of system requirement;

c. ambiguous lines of responsibility regarding the users of the system and cover arrangements for absence;

d. inappropriate staff selection, for example staff who are computer-literate but lack plant knowledge;

e. poor commissioning or subsequent maintenance;

f. lack of facility for future expansion.

6. Designated staff functions

6.1 Only trained and competent persons should be appointed by management to operate and maintain the BMS.

6.2 **Management**: the owner, occupier, employer, general manager, chief executive or other person who is accountable for the premises and is responsible for issuing or implementing a general policy statement under the HSW Act 1974.

6.3 **Employer**: any person or body who:

a. employs one or more individuals under a contract of employment or apprenticeship;

b. provides training under the schemes to which the Health and Safety (Training for Employment) Regulations 1990 (SI 1990/1380) apply.

6.4 **Designated person (electrical)**: an individual who has overall authority and responsibility for the premises containing the electrical supply and distribution system and who has a duty under the HSW Act 1974 to prepare and issue a general policy statement on health and safety at work, including the organisation and arrangements for carrying out that policy. This person should not be the authorising engineer.

6.5 **Duty holder**: a person on whom the Electricity at Work Regulations 1989 imposes a duty in connection with safety.

6.6 **Authorising engineer (low voltage)**: a chartered engineer or incorporated electrical engineer with appropriate experience and possessing the necessary degree of independence from local management who is appointed in writing by management to advise on and monitor the safety arrangements for the low voltage electrical supply and distribution systems of that organisation to ensure compliance with the Electricity at Work Regulations 1989, and to assess the suitability and appointment of candidates in writing to be authorised persons (see SHTM 2020; *Electrical safety code for low voltage systems*).

6.7 **Authorised person (LV – electrical)**: an individual possessing adequate technical knowledge and having received appropriate training, appointed in writing by the authorising engineer (LV) to be responsible for the practical implementation and operation of management's safety policy and procedures on defined electrical systems (see SHTM 2020).

6.8 **Competent person (LV – electrical)**: an individual who, in the opinion of an authorised person, has sufficient technical knowledge and experience to prevent danger while carrying out work on defined electrical systems (see SHTM 2020).

6.9 **Commissioning specialist (BMS)**: an individual or organisation authorised to carry out commissioning, validation and routine testing of a BMS.

6.10 **Maintenance person (BMS)**: a member of the maintenance staff, BMS manufacturer or maintenance organisation employed by management to carry out maintenance duties on a BMS.

6.11 **BMS operator**: any authorised individual who operates a BMS.

7. Definitions

Actuator: an electromechanical device that positions control devices (such as valves or dampers) in relation to a supplied control signal.

Alarm: the annunciation of an event that the system operator needs to be aware of.

Analogue: pertaining to data that consists of continuously variable quantities.

BAS – building automation system: synonymous with BMS.

BEMS – building and energy management system: synonymous with BMS.

BMS – building management system: a system comprising electronic equipment and software with the prime function of controlling and monitoring the operation of building services within a building, including heating, air-conditioning, lighting, and other energy-using areas.

BMS contractor: the organisation responsible for the supply and/or installation of the BMS. The contractor may be either the manufacturer or a systems house. It is often the case that the BMS contractor will commission the BMS.

Bus: a means of connecting a number of different devices, sensors, controllers, outstations, etc. to act as a means of data exchange.

Central station: the primary point of access to a BMS; the usual point from which all operations are supervised.

Client: the individual or group of individuals ultimately responsible for paying for and using the BMS.

Commissioning: the advancement of an installed system to working order to specified requirements.

Commissioning specialist: the individual responsible for the commissioning of the BMS. He/she may be employed by the BMS contractor or a specialist commissioning company.

Communications network: a system of linking together outstations and a central station to enable the exchange of data. Usually a dedicated cable system, but radio or mains-borne signalling may be used.

Compensator: a control device whose control function is to either:

a. reduce heat supply with decreasing building heat load; or

b. reduce cooling energy supply with decreasing building cooling load, in response to outside and (sometimes) inside temperatures.

Completion: the state of being finished in its entirety, according to the specification, ready for use by the owner.

Configuration software: software (in the form of "building blocks") resident in an outstation which can be configured to create different control strategies.

Control function: a term used to describe a specific, discrete form of control, for example compensation, optimisation, etc. These can be linked together in a control strategy.

Control loop: proportional, or proportional + integral, or proportional + integral + derivative control strategy where the output is related to a function of the input signal.

Control strategy: a description of the engineered scheme to control a particular item of plant or perform a series of control functions.

Data: a representation of information or instruction in a formalised manner suitable for communication, interpretation, or processing by humans or computer.

Derivative control: a control algorithm in which the control output signal is proportional to the rate of change of the controlled variable.

Direct digital control (DDC): a term used to define products that are based on microprocessor control.

Distributed intelligence: a description of a system where data processing and control is carried out at outstations, not at a central point.

Duty cycling: a control function that rotates the use of items of plant so that each item undergoes equal usage.

EMS – energy management system: synonymous with BMS.

Field device: the controls that are placed in the field level, that is, switches, sensors, actuators, etc.

Gateway: software written to enable data to be exchanged between two different communications protocols.

Handover: the transfer of ownership of all or part of a building or system, usually to the client.

Integral control: a control algorithm in which the output signal is proportional to the integral of the error.

Load cycling: a control method where management of plant energy demand is achieved by means of fixed on/off periods of operation.

Load shedding: the function of switching off electrical equipment if the load exceeds a limit. This function therefore reduces the risk of maximum demand penalty charges.

Optimiser: a control device whose function is to vary the daily on and off times of heating, ventilation and air-conditioning (HVAC) plant in order to produce an acceptable environment with lowest energy usage.

Outstation: a device to which sensors and actuators are connected, capable of controlling and monitoring building services functions. It also has the facility to exchange information throughout the BMS network.

Performance tests: tests carried out to demonstrate that the system functions according to specification.

Point: a physical source or destination for data in the form of analogue or digital signals.

Pre-commissioning checks: systematic checking of a completed installation to establish its suitability for commissioning.

Proportional control: a control algorithm in which the output signal is proportional to the error in the controlled variable.

Proportional and integral control: a control algorithm in which the output signal is proportional to the error plus the integral of the error in the controlled variable.

Proportional and integral and derivative control: a control algorithm in which the output signal is proportional to the error plus the integral of the error and the rate of change of the controlled variable.

Protocol: a set of rules governing information flow in a communication system.

Sensor: a hardware device which measures, and provides to a control strategy, a value representing a physical quantity (for example temperature, pressure etc.); or activates a switch to indicate that a preset value has been reached.

Soft point: a point that can be referenced as if it were a monitoring or control point in a BMS, although it has no associated physical location. It may have a set value or be the result of a given calculation or algorithm.

Stand-alone control: during normal operation, an item of equipment which can operate normally when isolated from the remainder of the system.

Testing: the evaluation of the performance of a commissioned installation tested against the specification.

Witnessing: the observation (by the client or his/her representative) of tests and checks of BMS hardware and operation prior to completion.

References

NOTE:
Where there is a requirement to address a listed reference, care should be taken to ensure that all amendments following the date of issue are included.

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
Acts and Regulations				
	The Building (Scotland) Act	HMSO	1959	
	Clean Air Act	HMSO	1993	
	Electricity Act	HMSO	1989	
	Health and Safety at Work etc Act	HMSO	1974	
	Registered Establishments (Scotland) Act	HMSO	1998	
	The Water (Scotland) Act	HMSO	1980	
SI 2179 & 187	The Building Standards (Scotland) Regulations (as amended)	HMSO	1990	
	The Building Standards (Scotland) Regulations: Technical Standards Guidance	HMSO	1998	
SI 2092	Carriage of Dangerous Goods (Classification, Packaging & Labelling) and Use of Transportable Pressure Receptacles Regulations	HMSO	1996	
SI 1460	Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP2)	HMSO	1997	
SI 3140	Construction (Design and Management) Regulations	HMSO	1994	
SI 437	Control of Substances Hazardous to Health Regulations (COSHH)	HMSO	1999	
SI 635	Electricity at Work Regulations	HMSO	1989	
SI 1057	Electricity Supply Regulations (as amended)	HMSO	1988 (amd 1994)	
SI 2372	Electromagnetic Compatibility Regulations (as amended)	HMSO	1992	
SI 2451	Gas Safety (Installation and Use) Regulations	HMSO	1998	
SI 917	Health & Safety (First Aid) Regulations	HMSO	1981	
SI 682	Health & Safety (Information for Employees) Regulations	HMSO	1989	

Publication ID	Title	Publisher	Date	Notes
SI 2792	Health and Safety (Display Screen Equipment) Regulations	HMSO	1992	
SI 341	Health and Safety (Safety Signs and Signals) Regulations	HMSO	1996	
SI 1380	Health and Safety (Training for Employment) Regulations	HMSO	1990	
SI 2307	Lifting Operations and Lifting Equipment Regulations (LOLER)	HMSO	1998	
SI 3242	Management of Health and Safety at Work Regulations	HMSO	1999	
SI 2793	Manual Handling Operations Regulations	HMSO	1992	
SI 1790	Noise at Work Regulations	HMSO	1989	
SI 3139	Personal Protective Equipment (EC Directive) Regulations (as amended)	HMSO	1992	
SI 2966	Personal Protective Equipment at Work (PPE) Regulations	HMSO	1992	
SI 128	Pressure Systems Safety Regulations (PSSR)	HMSO	2000	
SI 2306	Provision and Use of Work Equipment Regulations (PUWER)	HMSO	1998	
SI 3163	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)	HMSO	1995	
SI 3004	Workplace (Health, Safety and Welfare) Regulations	HMSO	1992	
British Standards				
BS 4737	**Intruder alarm systems**	BSI Standards		
BS 5445	**Components of automatic fire detection systems**	BSI Standards		
BS 6238	**Code of practice for performance monitoring of computer-based systems**	BSI Standards	1982	
BS 7671	**Requirements for electrical installations. IEE wiring regulations**	BSI Standards	1992	16th edition
BS 7807	**Code of practice for design, installation and servicing of integrated systems incorporating detection and alarm systems and/or security systems for buildings other than dwellings**	BSI Standards	1995	
BS EN 55011	**Specification for limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment**	BSI Standards	1998	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS EN 55014-1	**Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus. Emission. Product family standard**	BSI Standards	1997	
BS EN 55014-2	**Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus. Immunity. Product family standard**	BSI Standards	1997	
BS EN 55015	**Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment**	BSI Standards	1996	
BS EN 50065-1	**Specification for signalling on low-voltage electrical installations in the frequency range 3 kHz to 148.5 kHz. General requirements, frequency bands and electromagnetic disturbances.**	BSI Standards	1992	
BS EN 60529	**Specification for degrees of protection provided by enclosures (IP code)**	BSI Standards	1992	
BS EN ISO 9000	**Quality management and quality assurance standards**	BSI Standards		
Scottish Health Technical Guidance				
SHTM 2007	Electrical services: supply and distribution	P&EFEx	2001	
SHTM 2011	Emergency electrical services	P&EFEx	2001	
SHTM 2014	Abatement of electrical interference	P&EFEx	2001	
SHTM 2015	Bedhead Services	P&EFEx	2001	
SHTM 2020	Electrical safety code for low voltage systems (Escode – LV)	P&EFEx	2001	
SHTM 2024	Lifts	P&EFEx	2001	
SHTM 2025	Ventilation in healthcare premises	P&EFEx	2001	
SHTM 2035	Mains Signalling	P&EFEx	2001	
SHPN 1	Health service building in Scotland	HMSO	1991	
SHPN 2	Hospital briefing and operational policy	HMSO	1993	
SHPN 48	Telecommunications	HMSO	1997	
SHTN 1	Post commissioning documentation for health buildings in Scotland	HMSO	1993	
SHTN 4	General Purposes Estates and Functions Model Safety Permit-to-Work Systems	P&EFEx	1997	
	NHS in Scotland – PROCODE	P&EFEx	2001	Version 1.1

Publication ID	Title	Publisher	Date	Notes
NHS in Scotland Fire Safety Management				
SHTM 81	Fire precautions in new hospitals	P&EFEx	1999	CD-ROM
SHTM 82	Alarm and detection systems	P&EFEx	1999	CD-ROM
SHTM 83	Fire safety in healthcare premises	P&EFEx	1999	CD-ROM
SHTM 84	Fire safety in NHS residential care properties	P&EFEx	1999	CD-ROM
SHTM 85	Fire precautions in existing hospitals	P&EFEx	1999	CD-ROM
SHTM 86	Fire risk assessment in hospitals	P&EFEx	1999	CD-ROM
SHTM 87	Textiles and furniture	P&EFEx	1999	CD-ROM
SFPN 3	Escape bed lifts	P&EFEx	1999	CD-ROM
SFPN 4	Hospital main kitchens	P&EFEx	1999	CD-ROM
SFPN 5	Commercial enterprises on hospital premises	P&EFEx	1999	CD-ROM
SFPN 6	Arson prevention and control in NHS healthcare premises	P&EFEx	1999	CD-ROM
SFPN 7	Fire precautions in patient hotels	P&EFEx	1999	CD-ROM
SFPN 10	Laboratories on hospital premises	P&EFEx	1999	CD-ROM
UK Health Technical Guidance				
EH 40	HSE Occupational Exposure limits	HSE	Annual	
MES	Model Engineering Specifications	NHS Estates	1997	As required
C54	Model Engineering Specification – Building Management Systems	NHS Estates	1997	
HTM 2050	Risk management in the NHS estate	HMSO	1999	
HTM 2055	Telecommunications (Telephone exchanges)	HMSO	1994	Use with caution – See SHPN 48
	HSE programmable electronic systems in safety related applications	HSE	1987	
Miscellaneous				
PM5	HSE Guidance Note; Automatically controlled steam and hot water boilers	HSE		
	HSE programmable electronic systems in safety related applications	HSE	1987	
	CIBSE commissioning codes: Series C: Automatic control systems	CIBSE	1973	

Publication ID	Title	Publisher	Date	Notes
	CIBSE guides:	CIBSE		
GVA	Volume A: Environmental Design		1999	
GVBS	Volume B: Installation and equipment data		1986	5th edition
GVC	Volume C: Reference data		1986	5th edition
AM1	Automatic controls and their implications for systems design (Application manual)		1985	
GVH	CIBSE Guide GVH: Building control systems	CIBSE	2000	
BAH01/01	Applications handbook volume 1: Guide to BEMS centre standard specification	BSRIA	1990	
BAH01/02	Applications handbook volume 2: Standard specification for BEMS version 3.1	BSRIA	1990	
AH2/92	Commissioning of BEMS: a code of practice	BSRIA	1992	
AG2/94	BEMS performance testing	BSRIA	1992	
SMG 90c	Standard maintenance specification for mechanical services in buildings. Vol. III: control, energy and building management systems.	HVCA	1992	
9/5/97	Electromagnetic compatibility of medical devices with mobile communications	EEF	1997	