HEALTH TECHNICAL MEMORANDUM 2005

Building management systems
Management policy

1996

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About this publication

Health Technical Memoranda (HTMs) give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

They are applicable to new and existing sites, and are of use at various stages during the inception, design, construction, refurbishment and maintenance of a building.

Health Technical Memorandum 2005

HTM 2005 focuses on the:

a. legal and mandatory requirements;

b. design;

c. testing and commissioning;

d. operation and maintenance

of building management systems (BMS) in all types of healthcare premises.

It is published as four separate volumes, each addressing a specialist discipline:

- this volume – **Management policy** – 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. It summarises the technical aspects and concludes with guidance on the management of systems;

- **Design considerations** – outlines BMS technology and details the requirements and considerations that should be applied to the design, tendering and installation stages of the project;

- **Validation and verification** – gives general advice for ensuring that the installed equipment has been formally tested and certified as to contract. The importance of commissioning the completed installation is emphasised. Handover procedure, including the provision of documentation and training, is also set out;

- **Operational management** – provides information for those responsible for overseeing and operating day-to-day running and maintenance procedures. Coverage includes routine tests, planned preventive maintenance and trouble-shooting.

Guidance in this Health Technical Memorandum is complemented by the library of National Health Service Model Engineering Specifications (MES) and, where applicable, the Scottish and Northern Ireland supplements. Users of the guidance are advised to refer to the relevant specifications on “Building management systems”.

The contents of this Health Technical Memorandum in terms of management policy, operational policy and technical guidance are endorsed by:

a. the Welsh Office for NHS Wales;

b. the Health and Personal Social Services Management Executive in Northern Ireland;

c. the National Health Service in Scotland Estates Environment Forum.

References to legislation appearing in the main text of this guidance apply in England and Wales. Where references differ for Scotland and/or Northern Ireland, these are given as marginal notes.

Where appropriate, marginal notes are also used to amplify the text.

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:

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

This volume – 'Management policy' – 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

1.0 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.

Throughout this document, healthcare premises will include "social services premises" in Northern Ireland

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.

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

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.

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

When a BMS is specified, the NHS Model Engineering Specifications, with the appropriate supplements for Scotland and Northern Ireland, should be considered

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.

1.6 The commissioning of the 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.

2.0 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. Building Act 1984 and the Building Regulations 1991 (including Approved Documents);

d. Management of Health and Safety at Work Regulations 1992;

e. Provision and Use of Work Equipment Regulations 1992;

f. Manual Handling Operations Regulations 1992;

g. Workplace (Health, Safety and Welfare) Regulations 1992;

h. Personal Protective Equipment at Work (PPE) Regulations 1992;

j. Health and Safety (Display Screen Equipment) Regulations 1992;

k. Construction (Design and Management) Regulations 1994;

m. Electromagnetic Compatibility Regulations 1992;

n. Electromagnetic Compatibility (Amendment) Regulations 1994.

a. Health and Safety at Work (Northern Ireland) Order 1978;
b. Electricity at Work (Northern Ireland) Regulations 1991;
c. Building Regulations (Northern Ireland) 1994 and Technical Booklets; Building Standards (Scotland) Regulations 1990;
d. Management of Health and Safety at Work Regulations (Northern Ireland) 1992 and Management of Health and Safety at Work (Amendment) Regulations (Northern Ireland) 1994;
e. Provision and Use of Work Equipment Regulations (Northern Ireland) 1993 and Provision and Use of Work Equipment (Amendment) Regulations (Northern Ireland) 1995;
f. Manual Handling Operations Regulations (Northern Ireland) 1992;
g. Workplace (Health, Safety and Welfare) Regulations (Northern Ireland) 1993;
h. Personal Protective Equipment at Work Regulations (Northern Ireland) 1993;
j. Health and Safety (Display Screen Equipment) Regulations (Northern Ireland) 1992;
k. Construction (Design and Management) Regulations (Northern Ireland) 1995.

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 – NHS Estates;

d. Health Building Notes – NHS Estates;

e. Technical Standards (Scotland);

f. Health Technical Memoranda and Firecode – NHS Estates.

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

There are forthcoming CEN standards on BMS from CEN Technical Committee TC247

3.0 Functional overview

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 Safety Advice Bulletin SAB(94)49)

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**".

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:

- 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;
- the ability to receive plant alarms and abnormal conditions warnings which can be graded by degree of severity and required response;
- the ability to alter control parameters such as programmed occupancy times or control set-points;
- the ability to configure the system, including the outstations;
- the use of management software for energy monitoring and targeting and for maintenance planning;
- the ability to monitor all connected plant. Hard copy reports can be generated and printed.

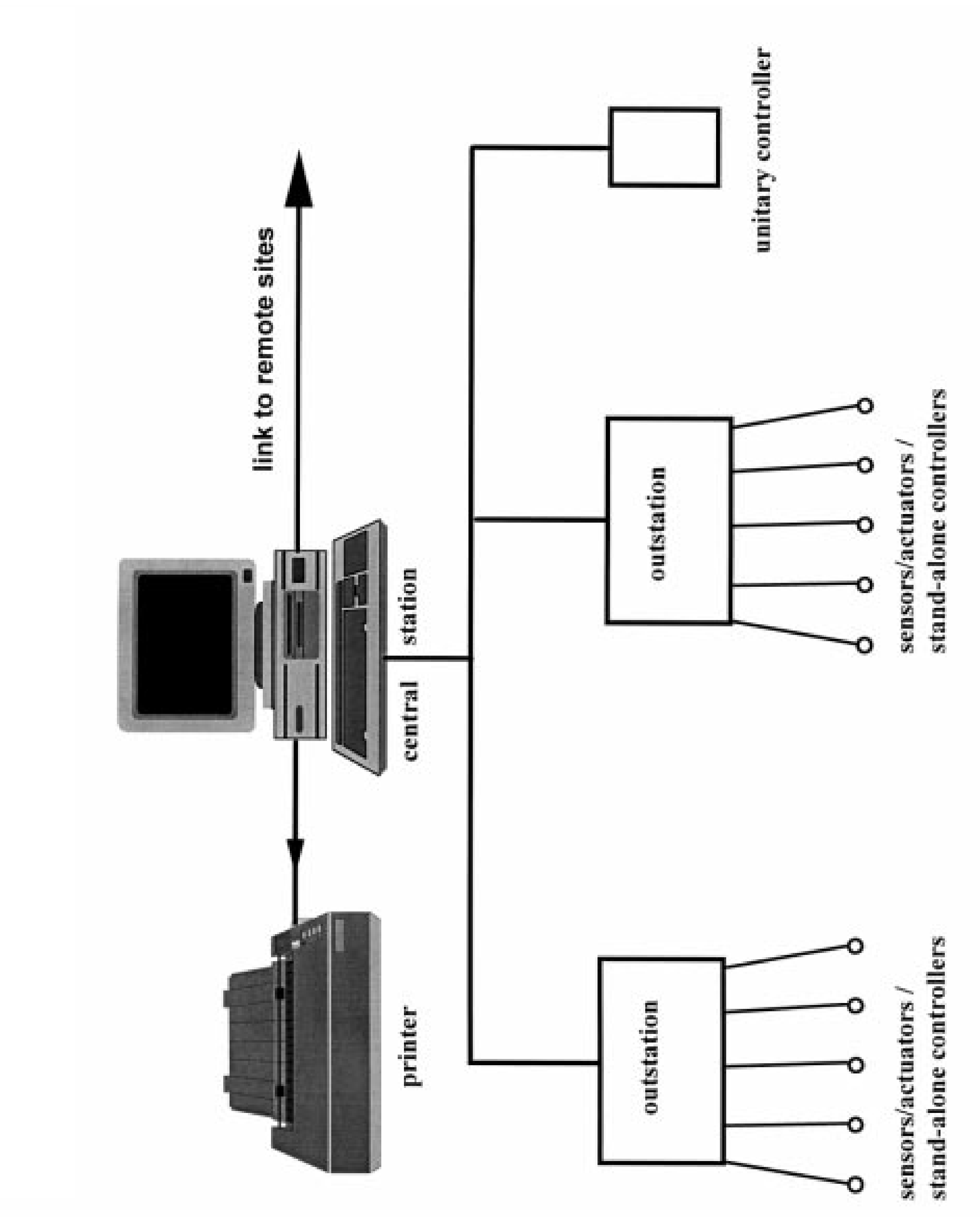

Figure 1 Building management system schematic

Outstation

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

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.

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:

- time/event schedules;
- optimisers;
- compensators;
- proportional, integral and derivative control;
- 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:

- heating;
- ventilation;
- air-conditioning;
- lighting;
- duty cycling;
- load shedding.

Potential benefits of a BMS

Improved monitoring alone may not necessarily save energy

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

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.

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:

- fire detection;
- security detection systems, including burglar alarms, closed circuit television (CCTV) and access control systems;
- telephone systems;
- vertical transport systems (lifts).

3.17 At present the BMS performs no control role when integrated with any of the above; it merely acts as a single user interface, linking 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.

4.0 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 building's 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 installed components (wiring, sensors and actuators) and checking of major sub-assemblies either on or off-site (control cabinets, configured control strategies and central station graphics slides);

b. commissioning of the complete system including checking alarms, interlocks and control loop tuning, and calibration of sensors and 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 his satisfaction. The handover procedure also includes the provision of all specified documentation including:

- record drawings;
- schematics;
- points lists;
- commissioning records;
- operating and maintenance manuals.

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.

5.0 Management action

General

5.1 The guidance contained in this HTM 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

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

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.

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 disrupution 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:

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

- if systems are implemented from a single supplier, there may not be the opportunity to select the "best" equipment for specific applications;
- by being tied to a single make of equipment, best value for money may not be realised;
- separate interfaces will be required if equipment is supplied by a number of different manufacturers.

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:

- high cost of engineering the gateway;
- loss of functionality;
- gateway maintenance and accommodation of protocol variations;
- 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.

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.

6.0 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 1988 (SI 1988/1222) apply.

Health and Safety (Training for Employment) Regulations (Northern Ireland) 1994

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 impose 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 implement, administer 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 HTM 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 HTM 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 HTM 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.

7.0 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 comprised of 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.

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2014 – Abatement of electrical interference. NHS Estates, HMSO 1993 (issued in 4 parts)

2015 – Bedhead services. NHS Estates, HMSO 1995 (issued in 3 parts)

2020 – Electrical safety code for low voltage systems (Escode – LV). NHS Estates, HMSO 1993 – new edition 1995 (issued in 2 parts)

2024 – Lifts. NHS Estates, HMSO 1995 (issued in 4 parts)

2025 – Ventilation in healthcare premises. NHS Estates, HMSO 1994 (issued in 4 parts)

2035 – Mains signalling. NHS Estates, HMSO 1996 (issued in 4 parts)

2050 – Risk management in the NHS estate. NHS Estates, HMSO 1994 (issued in 4 parts)

2055 – Telecommunications (telephone exchanges). NHS Estates, HMSO 1994 (issued in 4 parts)

Firecode publications

Firecode: directory of fire documents. Department of Health, HMSO 1987

Firecode: policy and principles. NHS Estates, HMSO 1994

Northern Ireland Firecode: Policy and Principles. HPSS/ME – HMSO 1994

Firecode: Nucleus fire precautions recommendations. Department of Health, HMSO 1989 (new edition in preparation – January 1997)

Firecode Health Technical Memoranda (HTMs)

81 – Fire precautions in new hospitals. NHS Estates, HMSO 1996

82 – Fire warning systems in hospitals (in preparation). NHS Estates (to be published by HMSO 1997)

83 – Fire safety in healthcare premises: general fire precautions. NHS Estates, HMSO 1994

Northern Ireland Firecode: Fire Safety in Residential Care Premises, HPSS/ME – HMSO 1995

85 – Fire precautions in existing hospitals. NHS Estates, HMSO 1994

86 – Fire risk assessment in hospitals. NHS Estates, HMSO 1994

Scottish Office publications

Health Service Building in Scotland (SHPN 1). Scottish Office, HMSO 1991

Scottish Hospital Technical Note 1: Post Commissioning Documentation for Health Buildings in Scotland. HMSO 1993

Fire Safety: New Health Buildings in Scotland. Scottish Home and Health Department, HMSO 1987

Firecode in Scotland: Policy and Principles. Scottish Office Home and Health Department, HMSO 1994

British Standards

BS 800: 1988 Specification for limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus. (Amd 6275, 6/90; Amd 6578, 6/91)

BS 4737 Intruder alarm systems.

BS 5445 Components of automatic fire detection systems.

BS EN 55011: 1991 Specification for limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.

BS EN 55015: 1993 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment. (Amd 7878, 7/93)

BS EN 50065 Specification for signalling on low-voltage electrical installations in the frequency range 3 kHz to 148.5 kHz.

BS EN 50065-1: 1992 General requirements, frequency bands and electromagnetic disturbances. (Amd 7950, 9/93)

BS 6238: 1982 (1993) Code of practice for performance monitoring of computer-based systems.

BS EN 60529: 1992 Specification for degrees of protection provided by enclosures (IP code). (Amd 7643, 7/93)

BS 7671: 1992 Requirements for Electrical Installations. IEE Wiring Regulations. Sixteenth edition. (Amd 8356, 01/95)

BS 7807: 1995 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.

BS EN ISO 9000 Quality management and quality assurance standards.

The European Standards Committee CEN TS247 on Controls for mechanical building services is currently preparing a series of standards for heating, ventilation and air-conditioning:

Systems structure and definition of terms

Equipment functionality

Equipment characteristics, test and verifications

Communications

Implementation guidelines

Miscellaneous publications

CIBSE commissioning codes:

Series C: Automatic control systems. Chartered Institute of Building Services Engineers (CIBSE), 1973.

CIBSE Guides:

Volume A: Design data. 5th edition, CIBSE, 1986.

Volume B: Installation and equipment data. 5th edition, CIBSE, 1986.

Volume C: Reference data. 5th edition, CIBSE, 1986.

Automatic controls and their implications for systems design (Application manual). CIBSE, 1985.

BSRIA publications:

Applications handbook volume 1: Guide to BEMS centre standard specification. Building Services Research and Information Association (BSRIA), 1990.

Applications handbook volume 2: Standard specification for BEMS version 3.1. BSRIA, 1990.

Commissioning of BEMS: a code of practice (AH 2/92). BSRIA, 1992.

BEMS performance testing (AG 2/94). BSRIA, 1994.

HVCA. Standard maintenance specification for mechanical services in buildings. Vol III: Control, energy and building management systems. SMG 90c. HVCA, 1992

Other publications in this series

(Given below are details of all Health Technical Memoranda available from HMSO. HTMs marked (*) are currently being revised, those marked (†) are out of print. Some HTMs in preparation at the time of publication of this HTM are also listed.)

1 Anti-static precautions: rubber, plastics and fabrics†
2 Anti-static precautions: flooring in anaesthetising areas (and data processing rooms), 1977.
3 –
4 –
6 Protection of condensate systems: filming amines†
2007 Electrical services: supply and distribution, 1993.
8 –
2009 Pneumatic air tube transport systems, 1995.
2010 Sterilizers, 1994, 1995, 1996.
2011 Emergency electrical services, 1993.
12 to 13 –
2014 Abatement of electrical interference, 1993.
2015 Bedhead services, 1994, 1995.
16 –
17 Health building engineering installations: commissioning and associated activities, 1978.
18 Facsimile telegraphy: possible applications in DGHs†
19 Facsimile telegraphy: the transmission of pathology reports within a hospital – a case study†
2020 Electrical safety code for low voltage systems, 1993.
2021 Electrical safety code for high voltage systems, 1993, 1994.
2022 Medical gas pipeline systems, 1994, 1996.
2023 Access and accommodation for engineering services, 1995.
2024 Lifts, 1995.
2025 Ventilation in healthcare premises, 1994.
26 Commissioning of oil, gas and dual fired boilers: with notes on design, operation and maintenance†
2027 Hot and cold water supply, storage and mains services, 1995.
28 to 29 –
2030 Washer-disinfectors, 1995.
2031 Steam supply for sterilization*
32 to 34 –
2035 Mains signalling, 1996.
36 to 39 –
2040 The control of legionellae in healthcare premises – a code of practice, 1993.
41 to 44 –
2045 Acoustics, 1996.
46 to 49 –
2050 Risk management in the NHS estate, 1994.
51 to 54 –
2055 Telecommunications (telephone exchanges), 1994.

Component Data Base (HTMs 54 to 80)

54.1 User manual, 1993.
55 Windows, 1989.
56 Partitions, 1989.
57 Internal glazing, 1995.
58 Internal doorsets, 1989.
59 Ironmongery†
60 Ceilings, 1989.
61 Flooring, 1995.
62 Demountable storage systems, 1989.
63 Fitted storage systems, 1989.
64 Sanitary assemblies, 1995.
65 Health signs*
66 Cubicle curtain track, 1989.
67 Laboratory fitting-out system, 1993.
68 Ducts and panel assemblies, 1993.
69 Protection, 1993.
70 Fixings, 1993.
71 Materials management modular system*
72 to 80 –

Firecode

81 Fire precautions in new hospitals, 1996.
82 Alarm and detection systems, 1989.
83 Fire safety in healthcare premises: general fire precautions, 1994.
85 Fire precautions in existing hospitals, 1994.
86 Fire risk assessment in hospitals, 1994.
87 Textiles and furniture, 1993.
88 Fire safety in health care premises: guide to fire precautions in NHS housing in the community for mentally handicapped/ill people, 1986.

Health Technical Memoranda published by HMSO can be purchased from HMSO bookshops in London (post orders to PO Box 276, SW8 5DT), Edinburgh, Belfast, Manchester, Cardiff, Birmingham and Bristol, or through good booksellers. HMSO provide a copy service for publications which are out of print; and a standing order service.

Enquiries about Health Technical Memoranda (but not orders) should be addressed to: NHS Estates, Department of Health, Publications Unit, 1 Trevelyan Square, Boar Lane, Leeds LS1 6AE.

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