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Building automation and control systems - Control applications

Systeme der Gebäudeautomation - Steuerungsanwendung

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35.240.67	Uporabniške rešitve IT v gradbeništvu	IT applications in building and construction industry
91.140.01	Napeljave v stavbah na splošno	Installations in buildings in general

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English Version

Building automation and control systems - Control applications

Systeme der Gebäudeautomation - Steuerungsanwendung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 247.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17609:2020) has been prepared by Technical Committee CEN/TC 247 “Building Automation, Controls and Building Management” the secretariat of which is held by SNV.

This document is currently submitted to the CEN Enquiry.

Introduction

Buildings are built and operated serving a specific purpose, e.g. as an office workspace, a manufacturing floor, or a data centre. In each case, the usage of the space requires specific environmental conditions, e.g. temperature, light level or air quality, which is provided.

On the other hand, there is an increasing demand for reducing the energy used to provide the environmental conditions for a given space.

Energy efficiency requirements cannot be fulfilled by optimizing the primary systems of a building alone. A holistic view on the building and especially on the automation systems for lighting, solar protection and HVAC in the room is the basis for optimizing the energy efficiency of buildings. This requires integration of the room automation, controls and management systems from the design phase through installation and commissioning to the building operation.

The planning process for the technical infrastructure of a building and its spaces includes several steps starting with a rough set of requirements. With each step in the planning process the design becomes more detailed. Basic design choices made in the first step allow for a budget estimate. These choices may be documented as depicted in Figure 1.

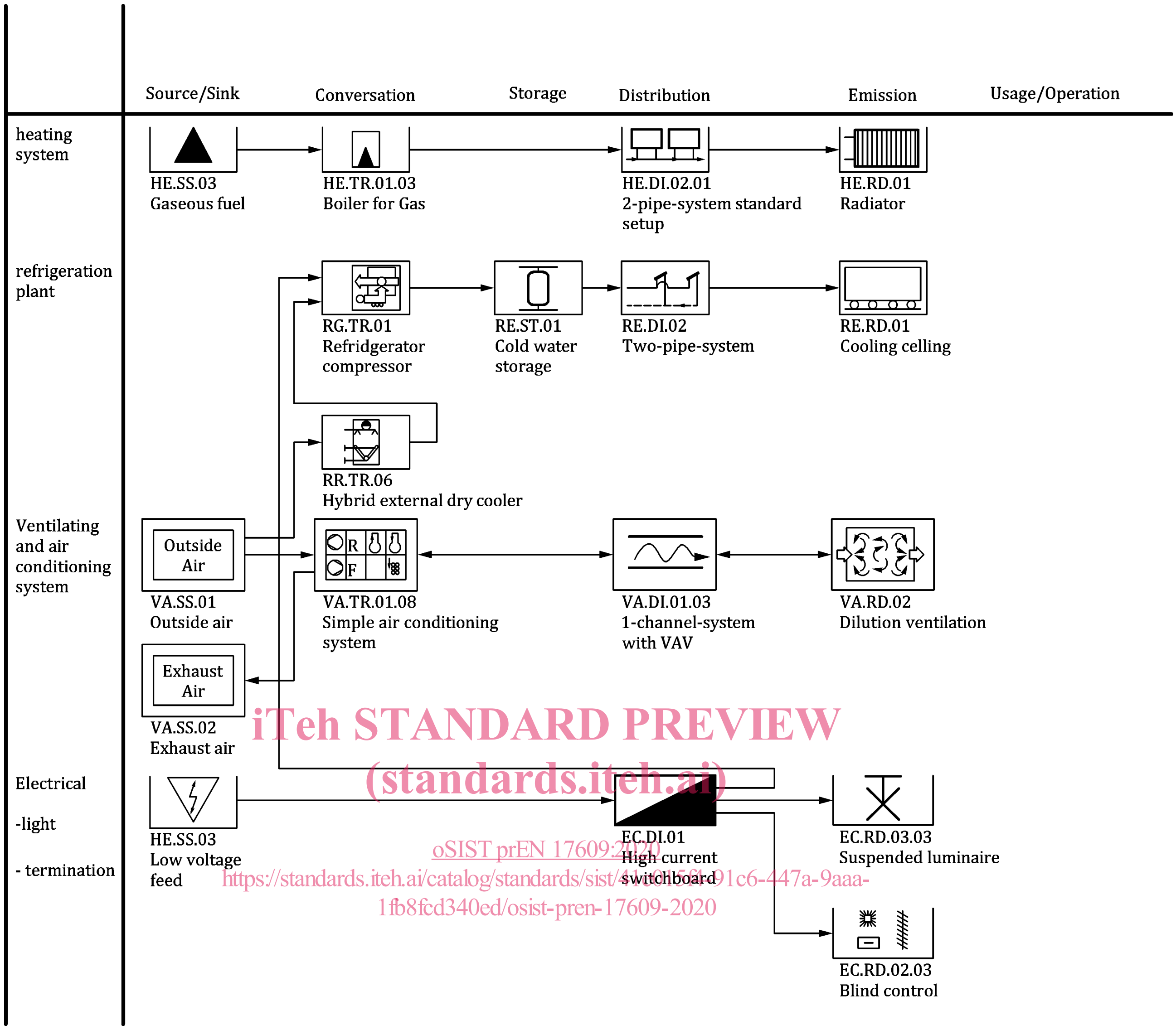

Figure 1 — Example for documentation of design choices for technical infrastructure of a building (Source: draft for SIA-410:2011)

Figure 1 shows the equipment for the different technical building disciplines (heating, cooling, ventilation, lighting, solar protection) in the space including the equipment required to fulfil the energy demand associated with the respective disciplines. The schema depicts source/sink, conversion, storage, distribution, and emission elements and their interconnections in a simple manner. This is a high-level view on the mechanical and electrical equipment. It does not yet include the automation requirements associated with the equipment.

In a further planning step, the control functions (BAC functions) associated with the technical infrastructure equipment of a building are added as depicted in Figure 2.

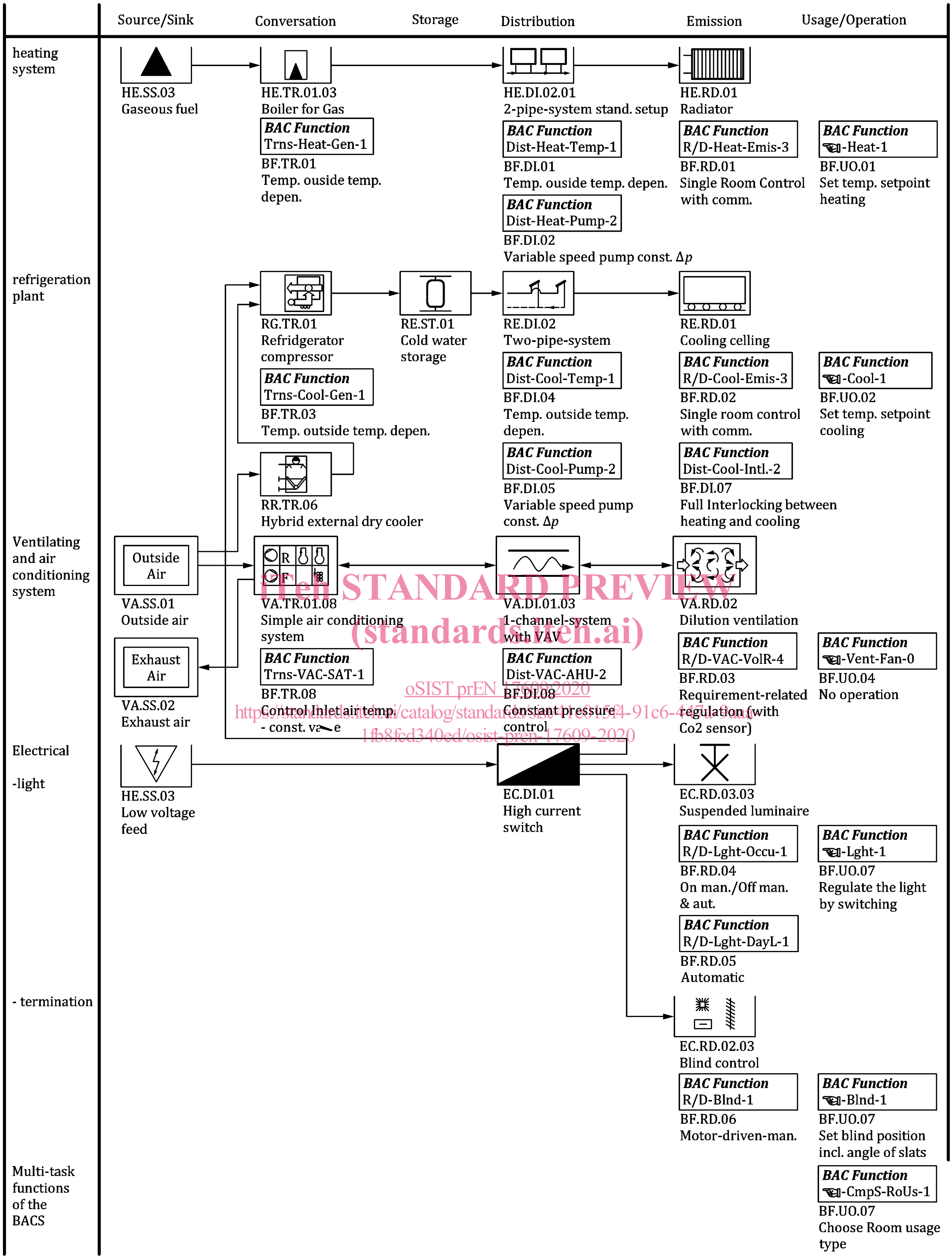

Figure 2 — Example for documentation of design choices for technical infrastructure and associated control functions of a building (Source: draft for SIA-410:2011)

The column “usage/operation” contains control functions required for user interaction with the technical building infrastructure in the space and/or for super-ordinated (e.g. building-wide) functions and requirements.

Although the schema presented above provides a description of the equipment and the associated control functions it still is a high-level view. It is reasonably detailed for budgetary estimate purposes but not detailed enough to serve as a requirement specification.

Whereas the control functions are determined by the technical building equipment and the user operation interface, the sophistication of these control functions is determined by the desired level of energy efficiency of a building or comfort and operational requirements. Hence, both views, the desired level of energy efficiency of a building and the comfort and operational requirements, have to be considered and documented such that this documentation serves as a requirement specification for building control applications (heating, cooling, ventilation, lighting, solar protection) in a space.

Building control functions may be associated with a specific zone, a room, a building segment, or the whole building.

Clause 5 of this document provides a method to transfer energy performance, comfort, and operational requirements as defined in prEN ISO 52120-1:2020 into a more detailed specification of building automation functions.

High-quality building automation and control contributes to the reduction of the energy use for heating, domestic hot water, cooling, ventilation, solar protection, and lighting, using minimal energy for the BAC and TBM equipment. Thus, high-quality building automation and control has a positive contribution to the energy performance of a building.

Several types of contributions of building automation and control on the energy performance of a building are distinguished:

a) The energy usage for heating, domestic hot water, cooling, ventilation, solar protection, and lighting is influenced by the automation functions of **separate single systems.**

Single systems may be controlled separately, e.g. the heating system by the room temperature feedback control or the electrical lighting system by the day light control.

b) The energy usage for heating, domestic hot water, cooling, ventilation, solar protection, and lighting is influenced by the **coordination** between automated functions of separate single systems.

NOTE 1 E.g. coordination of room automation functions for heating, cooling and blind systems.

c) The energy usage for heating, domestic hot water, cooling, ventilation, solar protection, and lighting is influenced by the **interaction** via information links between room automation and **control of primary systems.**

NOTE 2 E.g. pressure control in an air distribution network using demand information from the room automation.

d) The energy usage for heating, domestic hot water, cooling, ventilation, solar protection, and lighting is influenced by the **interaction** over information links between automation functions and **superordinate functions.**

NOTE 3 These are functions for the centralized adaptation and optimization of the BAC system and TBM functions. For example, automated monitoring, recording and reporting room temperatures, allowing detection of unnecessary energy use for heating during unoccupied periods.

e) The energy usage for heating, domestic hot water, cooling, ventilation and lighting is influenced indirectly by the **display and user operation functions in the space or building**.

NOTE 4 Individual adjustment of comfort levels has an impact on the energy usage. Natural ventilation by manual operation of windows has an influence on the energy efficiency.

f) The **energy usage for BAC and TBM equipment** is dependent on the installed automation system including the types of sensors, actuators and controllers.

NOTE 5 The energy usage of building automation equipment is generally small compared to the energy savings generated by applying the building automation.

Integrated building automation is characterized by the presence of at least one of the contribution types b to d listed above.

The energy use for heating, domestic hot water, cooling, ventilation, solar protection, and lighting, as considered in the contribution types a to e is mainly dependent on the **functionality** of the building automation and control system. The energy use for BAC and TBM equipment, as considered in contribution type f, is dependent on the **hardware** of the building automation system.

Refer to prEN ISO 52120-1:2020, Table 4, for a list of functions contributing to achieve the desired level of energy performance. Whereas prEN ISO 52120-1:2020 only provides a very brief description of the functionality, Clause 5 contains a more detailed description.

NOTE 6 Application of automated control improves the energy performance of buildings. Clause 5 of this document covers automated control applications only. Any manual or non-automated control listed in prEN ISO 52120-1:2020, Table 4, is not covered in this document.

For the purpose of clarity, each sub-clause in Clause 5 contains a reference in square brackets to the corresponding entry in Table 4 of prEN ISO 52120-1:2020 directly after the sub-clause heading.

The more detailed description includes information about mandatory and optional inputs as well as mandatory and optional outputs for the control function. The control function is not described in detail but rather is a “black box” as the actual implementation may be project or manufacturer specific.

Figure 3 provides an informative schematic view with the function (box), mandatory (blue) and optional (grey) inputs and mandatory (blue) and optional (grey) outputs. The informative schematic drawing also shows if inputs may be controlled, e.g. by manual operation or by a schedule and if output values are associated e.g. with an alarm or a trend.

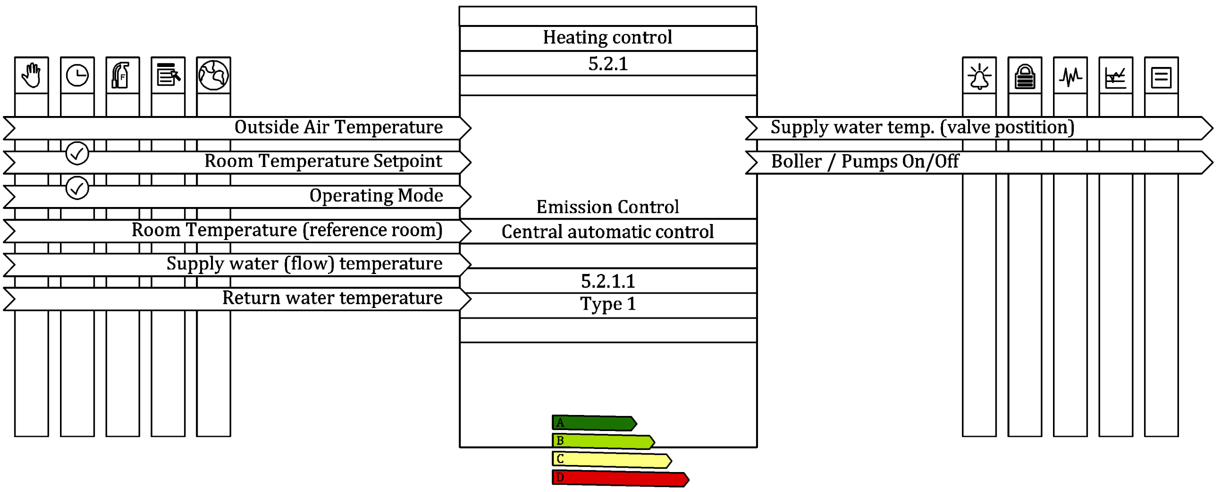

Figure 3 — Informative depiction of control application scheme for Heating control – Emission control – Type 1: Central automatic control

Clause 5 contains in each sub-clause a brief description of the control function itself, the target of the function, different operating modes, where applicable, and a description of the inputs and outputs of the function. Optionally, parameters and implementation equipment may be described.

For some of these functions more than one version is described, covering different technological implementations.

The result of applying Clause 5 is a collection of building automation control function blocks. This does not yet depict how these blocks work in detail or how they are linked to each other. A more detailed control scheme description can be provided using the function blocks described in Clause 6.

Clause 6 of this document provides function blocks, which can be used to describe building control functions in more detail independent of a specific building control system or vendor.

Applications can be described by a combination of sensor input, actuator output, user interaction, and control and monitoring functions. Certain functions in a room (e.g. presence detection) may be shared by two or more applications. A common set of function blocks covering sensor input, actuator output, user interaction, and control functions for the different applications in a room serves as the basis for describing integrated room automation, controls and management systems.

Any automation system consists of input, control and output functionality.

Using a typical example, Figure 4 shows the relationship between sensor, display/operation, control and actuator functions. Information exchanged between functions is provided from outputs to inputs. Physical inputs and outputs are presented as an example in the figure. As some functions may require parameters these are also depicted in each function block.

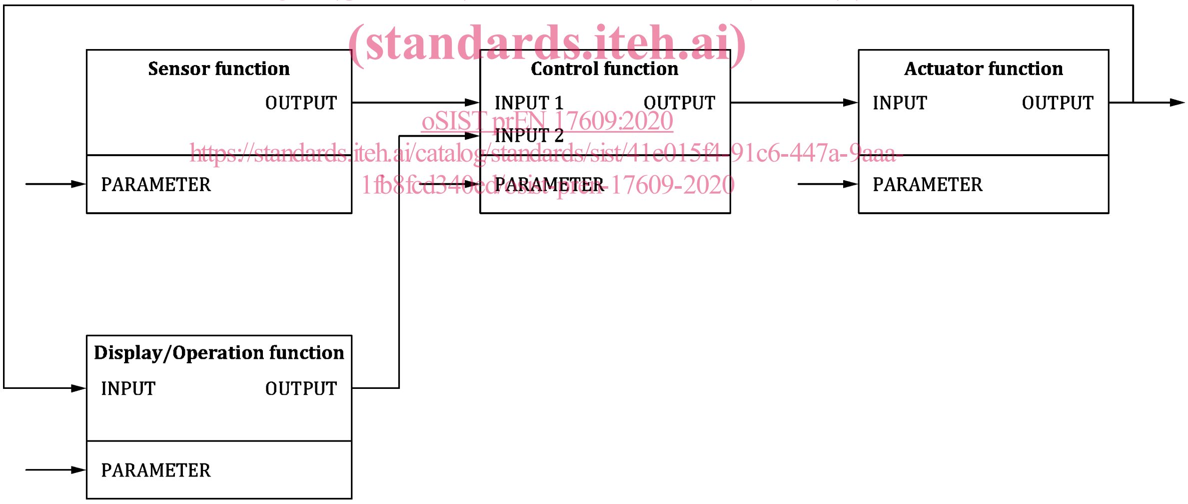

Figure 4 — Relationship of Integrated Room Automation functions (typical example)

The generalized description format for functions includes a brief description of the function, of the physical input(s), of the logical input(s) expected from other functions, of the logical output(s) provided to other functions, and of the physical output(s). In addition, parameters are listed that are required to more precisely define the function for a specific project.

In the context of Integrated Room Automation, input functionality is assigned to sensor functions and display and operation functions. A sensor function typically includes a physical input (e.g. a temperature sensor as depicted in Figure 4) and provides a logical output (OUTPUT of the Sensor function block in Figure 4) for use by other functions. A display and operation function includes physical inputs or outputs depending on its functionality and provides logical inputs for display purposes and logical outputs for use by other functions (Display and Operation function block in Figure 4).

In the context of Integrated Room Automation, control functionality as depicted in Figure 4 is assigned to specific control functions with one or more logical inputs (INPUT 1 and INPUT 2 of the Control function block in Figure 4) and at least one logical output (OUTPUT of the Control function block in Figure 4). Control functions are not directly associated with physical inputs or outputs.

In the context of Integrated Room Automation actuator functionality is assigned to specific actuator functions. An actuator function typically includes a physical output (controlling the valve in Figure 4) and provides a logical input (INPUT of the Actuator function in Figure 4) and logical output. This logical output could be used as a feedback status information.

The description of the functions blocks follows this uniform scheme:

— Short description of the function;

— Physical Input(s);

— Logical Input(s);

— Logical Output(s);

— Physical Output(s);

— Parameters (optional).

The list of functions may be extended where necessary.

1 Scope

This part of the standard specifies control applications and function blocks focusing on but not limited to lighting, solar protection and HVAC applications.

It describes how energy performance, comfort, and operational requirements of buildings are translated into functional specifications for integrated plant and room control.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN ISO 52120-1:2020, *Energy Performance of Buildings - Energy performance of buildings - Part 1: Impact of Building Automation, Controls and Building Management - Modules M10-4,5,6,7,8,9,10*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN ISO 52120-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
building part

one or more rooms horizontally and/or vertically positioned with a joint perimeter typically determined by walls or floors

Note 1 to entry: A horizontal building part may be a floor. A vertical building part may be a building wing or side, e.g. North side or West wing. A building part may be a part of another building part (e.g. West wing – floor 2) and contains at least one room.

3.2
display function
presentation of information coming from an actuator, control, monitoring or sensor function in a visible format understandable by a human user

Note 1 to entry: Information may be displayed in text form (e.g. 18 °C, 100 %) or in a graphical form (e.g. light blue for cool, bar graph).

3.3
energy efficiency
ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

EXAMPLE Efficiency conversion energy; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate.

Note 1 to entry: Both input and output need to be clearly specified in quantity and quality. Additionally, they need to be measurable.

[SOURCE: prEN ISO 52120-1:2020]

3.4
integrated building automation
smart control of lighting, solar protection, heating/ventilation/air conditioning devices and systems in a building providing the desired comfort level with maximum energy efficiency

Note 1 to entry: Smart control may also encompass access control via information links from those devices and systems to other building control devices and systems.

3.5
integrated room automation
smart control of lighting, solar protection, heating/ventilation/air conditioning devices and systems in a room providing the desired comfort level with maximum energy efficiency

Note 1 to entry: Smart control may also encompass access control via information links from those devices and systems to other room control devices and systems.

3.6
logical input
interface of a function receiving data from an output of another function

3.7
logical output
interface of a function sending data to an input of another function

3.8
operation function
means for input of information by a human user intended for use by an actuator, control, monitoring or display function

Note 1 to entry: Operation of e.g. a wall switch, touch panel area may be used as input.

3.9
plant
equipment for generation of hot or cold water and/or conditioned air

3.10
room
one or more zones with a joint perimeter typically determined by walls or other types of partitions

Note 1 to entry: Typically, a room is a part of a building segment.

3.11
room automation
control of one or more lighting, solar protection, and/or heating/ventilation/air conditioning in a room providing the desired comfort levels of these separate applications

3.12
smart control
coordination between all control disciplines providing optimal balance of energy-efficiency, comfort, low life-cycle cost, ease of operation, engineering, and maintenance

Note 1 to entry: The implementation of the coordination may be achieved via logical information exchange and/or simply via physics. In the latter case coordination is relying on the synchronization of different disciplines during the design phase.

3.13
solar protection
means for reducing heat losses at night and for controlling the impact of solar radiation on the temperature in a space and/or on the visual comfort of an occupant of a space

Note 1 to entry: The impact of solar radiation on the temperature can lead to an undesired (in summer) or a desired (in winter) temperature rise.

3.14
space
complete building, building part, room, or zone

3.15
superordinate control
building control functions situated on a supervisory system overseeing automation functions and aggregating information spanning across a building, a campus, or several locations

3.16
zone
smallest space determined by the minimum technical infrastructure required to operate that space

Note 1 to entry: The minimum technical infrastructure may be a heating radiator, ventilation outlet, or other mechanical or electrical equipment element.

3.17
technical building management
TBM
process(es) and services related to operation and management of buildings and technical building system through the interrelationships between the different disciplines and trades

Note 1 to entry: The disciplines and trades comprise all technical building services for the purpose of optimized maintenance and energy consumption.

EXAMPLE Optimization of buildings through interrelationships ranging from heating, ventilation and air conditioning (HVAC) to lighting and day lighting to life safety and security to electric power systems and energy monitoring and metering; to its services, including communications and maintenance and to its management.

[SOURCE: prEN ISO 52120-1:2020]

4 Abbreviations

Abbreviation	**Description**
BAC	Building Automation and Control
BACS	Building Automation and Control System
TBM	Technical Building Management