SLOVENSKI STANDARD
oSIST prEN 17690-1:2022

01-september-2022

Sestavni deli za krmilno zanko BAC - Senzorji - 1. del: Senzorji za sobno temperaturo

Components for BAC Control Loop - Sensors - Part 1: Room temperature sensors

Komponenten für BAC-Regelkreis - Sensoren - Teil 1: Raumtemperaturfühler

Composants d'une boucle de régulation - Capteurs - Partie 1: Capteurs de température

Ta slovenski standard je istoveten z: **prEN 17690-1**

ICS:

17.200.20	Instrumenti za merjenje temperature	Temperature-measuring instruments
91.140.10	Sistemi centralnega ogrevanja	Central heating systems

oSIST prEN 17690-1:2022 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 17690-1

June 2022

ICS 17.200.20; 91.140.10

English Version

Components for BAC Control Loop - Sensors - Part 1: Room temperature sensors

Composants d'une boucle de régulation - Capteurs - Partie 1: Capteurs de température

Komponenten für BAC-Regelkreis - Sensoren - Teil 1: Raumtemperaturfühler

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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 17690-1:2022) has been prepared by Technical Committee CEN/TC 247 “Building Automation and Controls”, the secretariat of which is held by SNV.

This document is currently submitted to the CEN Enquiry.

This document is part of a series of standards on Components of Building Automation and Control loop. A list of all parts in a series can be found on the CEN website.

Introduction

Various EU Directives and National Regulations regarding energy saving and energy performance of buildings require proof of energy efficiency.

BAC standards and Technical Reports (mainly EN ISO 52120-1, CEN ISO/TR 52120-2, EN 15500-1 and CEN/TR 15500-2) show the impact of building automation on the energy performance of buildings.

Characteristics like Control Accuracy of Control Loops, BAC functions and BAC Strategies are important parts specifying the energy performance. To ensure the performance of a control loop, the quality of all elements in the control loop need to fulfil specific requirements.

A set of standards and the appropriate Technical Report (CEN/prTR 17689-1, *Quality and Performance Assessment of the components for BAC Control Loop — Umbrella Document*) will cover the requirements of the control loop elements (sensors, valves and actuators used in building automation control loops). Classifications and test methodologies for these components will be described. The set of standards allow the market to select appropriate components achieving a desired quality of a control loop.

This document provides requirements of room temperature sensors to ensure overall quality and performance of the BAC Control Loop.

1 Scope

This document specifies requirements and test methods for room temperature sensors used to control the room temperature.

This document covers wall mounted and flush mounted room temperature sensors.

The following aspects are not covered by this document:

— Pendulum temperature sensors

— Ceiling mounted temperature sensor

— Extract air temperature sensors

NOTE The measured value available at the output of the sensor is influenced by the place where the sensor device is located and factors such as air velocity, wall temperature, self/waste heating of the device and the air temperature. The perceived temperature, which is important for the well-being of a person, depends among other factors on air temperature, temperature of the surrounding walls and air flow rate as indicated in EN ISO 7730.

The temperature sensor element can be combined with other sensors in one device. This document only deals with the room temperature sensing of this devices. Other sensors are not covered except of their influence on the room temperature sensing (e.g. self-heating).

This document specifies sensor characteristics contributing to the determination of the control accuracy of individual zone controller according to EN 15500-1.

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.

EN 60730-1, *Automatic electrical controls for household and similar use - Part 1: General requirements*

EN 215, *Thermostatic radiator valves - Requirements and test methods*

EN 60529, *Degrees of protection provided by enclosures (IP Code)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
measuring range
range of measured values for a measurand in which defined or agreed error limits are not exceeded

Note 1 to entry: The output or indication range (e.g. display) can be the same as the measuring range, but this is not always the case. If the indication range is larger than the measuring range, larger or undefined error limits shall be considered.

3.2
time constant t_{63}
time the sensor needs after a temperature step to reach 63,2% of the temperature step range

3.3
sensor accuracy
deviation of the measured room temperature of the sensor to the room temperature within the operation range

3.4
wall coupling
ratio for the influence of the wall temperature on the measured temperature of the sensor

3.5
turbulence degree
value characterizing the dimension of the turbulence of an air flow which superposes a principal direction according to EN 215

3.6
waste heat
total heat produced inside the device independent on the heat source

3.7
active sensor
sensor producing a change in some active electrical quantity such as voltage as a result of temperature measurement

Note 1 to entry: Active sensor could be analogue or digital.

Note 2 to entry: Active sensors analogue generates a signal like electrical current or voltage in response to the measured room temperature and require an external power source to operate.

Note 3 to entry: Active sensors digital deliver the measured value as defined by the communication protocol and they can be powered by the communication interface or an external power source.

Note 4 to entry: Wireless sensors are included.

3.8
passive sensor
sensor producing a change in some passive electrical quantity such as resistance as a result of temperature measurement

3.9
room temperature
operative temperature in the occupied zone

Note 1 to entry: For operative temperature see EN ISO 7730.

3.10
measured room temperature
temperature measured by the sensor inside the sensor device at the place where it is located in the room

Note 1 to entry: The measured temperature depends on the air temperature, radiation from surrounding surfaces and heat conductivity from the wall on which the sensor device is mounted.

Note 2 to entry: The amount of heat by radiation and convection resulting in the measured temperature need not to be equivalent to the operative temperature.

4 Symbols, units and abbreviations

Table 1 — Symbols and units

Symbol	Name of Quantity	Unit
f	factor	-
k	coefficient	%
I	current	A
P	power	W
q	volume flow	m^3/h
T	thermodynamic temperature	K
t	time, period of time	s
u	velocity	m/s
ν	kinematic viscosity	m^2/s
t_{63}	time constant	min
δ	thickness	m
ϑ	celsius temperature	°C
Δ	delta (difference) prefix to be combined with symbols	

Table 2 — Subscripts

Subscript	Explanation
corr	correction
ccs	centre of cross section
cots	complete test section
ipc	inrush peak current
ppc	periodic peak current
S	sensor

Subscript	Explanation
Su	power supply
W	wall
0	base, reference
step	temperature step for time constant
tvar	temperature variation
airvel	air velocity
psup	power supply

Table 3 — Abbreviations

Abbreviation	Explanation
AC	alternate current
DC	direct current
AHU	air handling unit
SELV	safety extra-low voltage
DUT	device under test

5 Room temperature sensor device

The room temperature sensor devices according to this document consist of a sensing element and a housing with or without internal electronics.

In this document room temperature sensor device and room temperature sensor are used as equivalent. For the sensing element, the term room temperature sensor element is used.

It can be combined with other sensor elements (e.g. CO_2, relative humidity) or control elements (e.g. room controller) in the same housing. The other elements are not part of this document except of their influence on the room temperature sensing (e.g. self-heating).

The sensor output signal can be active analogue (e.g. voltage/current), active digital (e.g. communication bus incl. wireless) or passive (e.g. resistive).

6 Requirements

6.1 Electrical requirements

6.1.1 Electromagnetic compatibility

Room temperature sensors shall meet the requirements of EN 60730-1, for use in residential, commerce, light industrial and industrial environments.

6.1.2 Degree of protection

Room temperature sensors shall comply with protection degree of housing: IP30 according to EN 60529.

6.2 Declarations by the manufacturer

6.2.1 General

In the following part, several useful declarations of characteristics are listed.

If they are declared by the manufacturer, they shall be measured as described in Clause 8 or according to the referenced standard.

NOTE Variants of room temperature sensor devices can be grouped according to their physical behaviour, design or measurement behaviour.

Declarations can be made for groups of sensors. In this case, the specific values or characteristics of single products can differ but shall be within the specified range. (Better than specified values).

6.2.2 Protection class

Protection class defines the level against electric shock e.g. protection class: III according to the definition for class III in EN 60730-1.

6.2.3 Measuring range

The manufacturer shall declare the measuring range of the sensor device, e.g. from 0°C to 50°C.

6.2.4 Sensor (device) accuracy

The accuracy of the sensor device depends on various factors, as for example:

— accuracy of the sensing element

— accuracy and resolution of the AC/DC conversion

— numerical errors in the signal conversion

— accuracy and resolution of the DC/AC conversion

— electrical influence of supply voltage

— electrical influence of the attached controlling element (burden, ….)

— over speaking (cross influences) of signal outputs

— noises on the output signal itself

— resolution of a communication bus or protocol

— waste heat effects

The manufacturer shall declare the accuracy at a reference temperature in a certain range.

For example, the following information may be declared as described in Table 3:

Table 3 — Example of accuracy declaration

Characteristics	Value(s)	Unit
accuracy of sensing element	20°C or 25°C	±*x* K
accuracy of sensing element in the range of	15°C to 35°C	±*y* K

The following additional information may be declared by the manufacturer:

— impact of temperature variation;

— impact of air speed variation;

— impact of power supply variation.

6.2.5 Time constant t_{63}

The time constant t_{63} is the time in minutes until the temperature sensor reading (output signal converted into a temperature value) shows 63,2 % of the temperature step. It shall be declared in minutes with a maximum of one digit after the decimal point.

Table 4 shows example of declaration of time constant t_{63}.

Table 4 — Example of declaration for Time constant τ

Type of declaration	Value(s)	Unit
by product	17,6 or < 19	min
by range of products	< 19	min

6.2.6 Wall coupling coefficient k_W

The wall coupling coefficient k_W in percent determines the influence of the wall temperature on the measured room temperature.

Table 5 shows example of declaration of wall coupling k_W.

Table 5 — Example of declaration for wall coupling k_W

Type of declaration	Value(s)	Unit
by product	approximately 45	%
by range of products	35 to 50	%

6.2.7 Self-heating compensation

The manufacturer may declare the self-heating compensation, e.g. default compensation of 0,5 K.

NOTE The self-heating compensation used by the manufacturer is an indication about possible measurement deviations, caused by other boundary conditions than those assumed by the manufacturer.