

## G01K

### MEASURING TEMPERATURE; MEASURING QUANTITY OF HEAT; THERMALLY-SENSITIVE ELEMENTS NOT OTHERWISE PROVIDED FOR (radiation pyrometry [G01J 5/00](#))

#### Definition statement

*This place covers:*

A detailed description of the subject matter appropriate for the subclass [G01K](#) is possible only at the main-group level.

Provisions that are valid at a general level (e.g. of a kind appropriate to more than one of the main groups) are provided in the sections that follow.

The user is otherwise referred to the definitions for the individual main groups of [G01K](#) which follow hereafter. The following listing is intended to assist the user:

Apparatus or methods for measuring temperature, i.e. thermometers. The following types of thermometers are therefore covered, the list being non exhaustive:

- thermometers giving results other than momentary value of temperature;
- thermometers based on the expansion or contraction of a material;
- thermometers based on the use of electric or magnetic elements directly sensitive to heat;
- thermometers based on movements caused by redistribution of weight, e.g. tilting thermometer;
- thermometers based on other physical or chemical changes.

Testing or calibrating of thermometers.

Apparatus or methods for measuring quantity of heat, i.e. calorimeters.

Testing or calibrating of calorimeters.

Thermally-sensitive elements not otherwise provided for.

#### Relationships with other classification places

Subclass [G01K](#) covers temperature measurements where there is direct physical contact between sensor and object and environment. Temperature sensing by radiation pyrometry (based on, e.g., infrared radiation emitted from the object) is classified in [G01J](#).

When temperature measurements are used for the investigation of material properties (e.g. flaw detection), that subject matter falls under the scope of [G01N 25/00](#).

For subject matter relating to sensing temperature changes for compensating measurements of other variables or for compensating readings of instruments for variations in temperature, see [G01D](#) or relevant subclass for variable measured.

#### References

##### Limiting references

*This place does not cover:*

Radiation pyrometry	<a href="#">G01J 5/00</a>
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**Application-oriented references**

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Measuring temperature of human body parts for diagnostic purposes	<a href="#">A61B 5/01</a>
Heat-sensitive devices for control of fire-fighting equipment	<a href="#">A62C 37/00</a>
Control or measuring devices, e.g. for temperature of metal, in the art of manufacture of metal sheets, wires, rods, tubes or profiles	<a href="#">B21C 31/00</a>
Arrangement of indicating or measuring devices, e.g. for temperature or viscosity of the fused mass, in the art of casting of metals	<a href="#">B22D 2/00</a>
Measuring, controlling or regulating of temperature in injection moulding	<a href="#">B29C 45/78</a>
Heat-sensitive sheets for use in thermography	<a href="#">B41M 5/00</a>
Measuring temperature specially adapted to boreholes or wells	<a href="#">E21B 47/06</a>
Arrangements of temperature sensing elements for regulating or controlling in gas turbines	<a href="#">F01D 17/08</a>
Indicating devices concerning coolant temperature, in the art of cooling of machines, engines, or internal-combustion engines	<a href="#">F01P 11/16</a>
Use of thermally-sensitive elements in systems controlling or regulating combustion	<a href="#">F23N 5/02</a> - <a href="#">F23N 5/14</a>
Flow measurement by thermal means	<a href="#">G01F 1/68</a>
Investigating or analysing materials by use of thermal means, e.g. by calorimetry	<a href="#">G01N 25/00</a> , <a href="#">G01N 25/20</a>
Meteorology; Indication of human comfort	<a href="#">G01W 1/00</a> , <a href="#">G01W 1/17</a>
Temperature control	<a href="#">G05D 23/00</a>
Fire alarms	<a href="#">G08B 17/00</a> - <a href="#">G08B 19/00</a>
Structural combination of nuclear reactor elements with sensitive instruments for measuring temperature	<a href="#">G21C 17/112</a>
Temperature sensing in car batteries	<a href="#">H01M 10/48</a>
Thermally-sensitive members for thermally-actuated switches	<a href="#">H10N 15/00</a>

**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

Thermometer holders specially adapted to veterinary purposes	<a href="#">A61D 13/00</a>
Ambient temperature regulation specially adapted to passengers or goods spaces in vehicles	<a href="#">B60H 1/00</a>
Heating in general	<a href="#">F24B</a> , <a href="#">F24C</a> , <a href="#">F24D</a>
Sensing temperature changes for compensating measurements of other variables or for compensating readings of instruments for variations in temperature	<a href="#">G01D</a>
Bimetallic elements	<a href="#">G12B 1/02</a>
Compensating for the effects of temperature on instruments	<a href="#">G12B 7/00</a>
Thermistors, i.e. thermo-resistors	<a href="#">H01C 7/00</a> - <a href="#">H01C 7/04</a>
Electrolytic temperature-sensitive devices	<a href="#">H01G 9/21</a>
Peltier elements	<a href="#">H01L 23/38</a>

Semiconductor or solid-state thermoelectric or thermomagnetic devices	<a href="#">H10N 10/00</a> , <a href="#">H10N 15/00</a>
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## Special rules of classification

For the following application fields, the following appropriate additional information is obligatory (also check the scheme for the groups):

Airconditioning: Indexing code [G01K 2201/00](#)

Cryogenics: Indexing code [G01K 2203/00](#)

Vehicle motors: Indexing code [G01K 2205/00](#)

Household appliances (e.g. cooking): Indexing code [G01K 2207/00](#)

Further, the following general technical details are also obligatory as additional information using the following classes:

Thermometers based on nanotechnology: Indexing code [G01K 2211/00](#)

Spatial (2D) mapping of temperature: Indexing code [G01K 2213/00](#)

Details or special adaptations concerning the sensor power supply: Indexing code [G01K 2215/00](#)

Dedicated Analog to Digital Converters for temperature sensors: Indexing code [G01K 2217/00](#)

## Glossary of terms

*In this place, the following terms or expressions are used with the meaning indicated:*

Thermometer	Includes thermally-sensitive elements not provided for in other subclasses.
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## Synonyms and Keywords

*In patent documents, the following abbreviations are often used:*

PTAT	Proportional To Absolute Temperature
CTAT	Complementary To Absolute Temperature
NTC/PTC	Negative/Positive Temperature Coefficient
RTD	Resistance Temperature Detector
3-wire / 4-wire RTD's	Resistive temperature detectors with additional lead wire for compensation purposes
OTDR	Optical Time Domain Reflectometry
FBG	Fiber Bragg Grating
SAW/BAW	Surface/Bulk Acoustic Wave
HVAC	Heating Ventilation Air Conditioning
TAT/SAT	Total/Static Air Temperature (in aircrafts)

## G01K 1/00

**Details of thermometers not specially adapted for particular types of thermometer (circuits for reducing thermal inertia [G01K 7/42](#))**

### Definition statement

*This place covers:*

Indicating and recording of temperature.

Protective devices and casings.

Support and fastening of thermometers.

Conducting heat from an object to the sensor.

Compensation, e.g., for ambient temperature or pressure.

### References

#### Limiting references

*This place does not cover:*

Temperature calculation based on spatial modelling	<a href="#">G01K 7/427</a>
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#### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Remote temperature indication for medical applications	<a href="#">A61B 5/0008</a>
Mounting of thermocouples for injection moulding	<a href="#">B29C 45/1782</a>

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Compensation of undesired influences per se	<a href="#">G01D 3/0365</a>
Sensor housings in general	<a href="#">G01D 11/245</a>
Casings for pressure sensors	<a href="#">G01L 19/14</a>
Indicating of human comfort	<a href="#">G01W 1/17</a>
Remote indication per se	<a href="#">G08C</a>

### Synonyms and Keywords

*In patent documents, the following abbreviations are often used:*

ZHF	Zero Heat Flux
ZHF Sensor	Measures core body temperature by attaching a first sensor to the body surface and a second sensor at a distance. Once the first and second temperatures are the same (i.e. there is zero heat flux), they are assumed to correspond to core temperature. Also known as ZHF sensors or "fox probes".

Thermowell	A closed-end tube designed to protect a temperature sensor from harsh process conditions as in <a href="#">G01K 1/08</a> .
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## G01K 1/02

**Means for indicating or recording specially adapted for thermometers**

### References

#### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Temperature indicating arrangements in hand irons internally heated by electricity	<a href="#">D06F 75/26</a>
Displaying temperature data in connection with air-conditioning, air-humidification, ventilation or use of air currents for screening	<a href="#">F24F 11/523</a>

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Indicating measured values, in general	<a href="#">G01D 7/00</a>
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## G01K 1/022

**for recording**

### References

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Recording measured values, in general	<a href="#">G01D 9/00</a>
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## G01K 1/026

**{arrangements for monitoring a plurality of temperatures, e.g. by multiplexing}**

### Special rules of classification

If a temperature profile is recorded, Indexing code [G01K 2213/00](#) is obligatory as additional information.

## G01K 1/08

**Protective devices, e.g. casings**

### Definition statement

*This place covers:*

Protective devices for preventing both chemical attack and heat overloading.

Protective devices that are vibration resistant.

## G01K 1/14

### Supports; Fastening devices; Arrangements for mounting thermometers in particular locations

#### References

##### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Arrangements for detecting or measuring washing liquid temperature for washing machines	<a href="#">D06F 34/24</a>
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#### Special rules of classification

To clarify difference between [G01K 1/14](#) and [G01K 13/00](#): In general [G01K 13/00](#) concerns internal adaptation of the sensor, [G01K 1/14](#) concerns mounting of an existing sensor.

## G01K 1/143

### for measuring surface temperatures

#### Definition statement

*This place covers:*

The measurement of a representative temperature of solid, extended objects, e.g. pipes, vessels, containers, requiring that the geometry of the temperature sensor be suitably matched to the solid, extended object to be measured.

For example, an apparatus for measuring the temperature of a fluid flowing in a tube by measuring the temperature of the outer surface of the tube would be classified in this group.

Another example would be the geometric adaptation of a temperature sensor to measure the temperature of an electric cable carrying current.

#### Relationships with other classification places

Classification in this group requires that the geometry of the temperature sensor assembly be compatible with the object being measured. Instead, the subject matter of [G01K 1/16](#) is rather directed at arrangements that can optimise the heat conduction between the probe part of the temperature sensor and the temperature transducer part of that sensor, without the need to take into account the geometry of the object that is being measured.

#### Special rules of classification

If a pipe wall temperature is measured as a reference of flowing fluid temperature inside the pipe, also classify in [G01K 13/02](#).

## G01K 1/146

### {arrangements for moving thermometers to or from a measuring position}

#### Definition statement

*This place covers:*

Automated systems moving the thermometer to and from the measurement position.

**Special rules of classification**

Thermometers fixed or removed manually are placed in [G01K 1/14](#).

**G01K 1/16****Special arrangements for conducting heat from the object to the sensitive element****Definition statement**

*This place covers:*

Preventing heat leakage.

Preventing heat from electronics to affect sensor temperature.

**G01K 1/165**

**{for application in zero heat flux sensors}**

**Special rules of classification**

See US 3,933,045 as an example of a ZHF probe. If heat flux is measured, and based on this measurement temperature is calculated then the document should be classified in [G01K 7/427](#) and not in [G01K 1/165](#).

**G01K 1/18**

**for reducing thermal inertia**

**Definition statement**

*This place covers:*

Preheating of the measurement object.

Creating additional thermal inertia.

**G01K 1/20**

**Compensating for effects of temperature changes other than those to be measured, e.g. changes in ambient temperature**

**Definition statement**

*This place covers:*

Compensation for optical radiation.

**G01K 3/00**

**Thermometers giving results other than momentary value of temperature  
([G01K 7/42](#) takes precedence)**

**Definition statement**

*This place covers:*

Thermometers that are integrating or differentiating temperature over time or over space.

Thermometers that indicate crossing of a predetermined (threshold) temperature.

## References

### Limiting references

*This place does not cover:*

Circuits for predicting the stationary value of temperature	<a href="#">G01K 7/42</a>
Temperature calculation based on spatial modeling, e.g. spatial inter- or extrapolation	<a href="#">G01K 7/427</a>
Threshold indicators based on material phase change (e.g. melting)	<a href="#">G01K 11/06</a>
Threshold indicators based on thermochromes	<a href="#">G01K 11/12</a>

### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Indication of incorrect storage conditions	<a href="#">B65D 79/02</a>
Labels that change in response to external conditions	<a href="#">G09F 3/0291</a>

### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Measurement of temperature profiles	<a href="#">G01K 1/026</a> , <a href="#">G01K 11/32</a>
Measuring temperature using thermoelectric elements	<a href="#">G01K 7/02</a>
Time-temperature integrators for non-biological materials	<a href="#">G01N 31/229</a>
Time integrating devices	<a href="#">G04F 1/06</a>
Fire detection	<a href="#">G08B 17/00</a>
Emergency protective devices responsive to temperature	<a href="#">H02H 5/04</a>
Thermally actuated switches	<a href="#">H10N 15/00</a>

## Special rules of classification

### Further details of subgroups:

[G01K 3/005](#):

This group is really limited to circuit arrangements.

[G01K 3/04](#):

This groups contains the Time Temperature Integrators.

[G01K 3/08](#):

If the difference of temperature values is between the hot and the cold junction of a thermocouple, [G01K 7/02](#) is given and not [G01K 3/08](#).

[G01K 3/14](#):

This group also comprises determination of temperature maximum and of temperature gradients. In case of determination of the location of a hotspot, Indexing Code [G01K 2003/145](#) is obligatory as additional information.



## Synonyms and Keywords

In patent documents, the following abbreviations are often used:

TTI	Time Temperature Integrator: Devices used, e.g. to monitor the cold-chain of a perishable such as food, blood samples. Based on a chemical process, diffusion process, capillary process or a shape memory material that changes over time, resulting in a change of color or shape. The speed of the process underlying a TTI is temperature-dependent. The color/shape of a TTI at any moment is a measure of the integral of temperature over time.
Arrhenius curve	Curve representing the development of bacteria. TTI's are often designed to match an Arrhenius curve.

## G01K 5/00

**Measuring temperature based on the expansion or contraction of a material**  
**([G01K 9/00](#) takes precedence; giving other than momentary value of temperature [G01K 3/00](#))**

### Definition statement

*This place covers:*

Thermometers where the expanding/contracting material is either a liquid (i.e. the traditional capillary thermometers), a gas or a solid.

### References

#### Limiting references

*This place does not cover:*

Thermometers giving results other than momentary value of temperature	<a href="#">G01K 3/00</a>
Tilting thermometers	<a href="#">G01K 9/00</a>

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Thermometers giving results other than momentary value of temperatures	<a href="#">G01K 3/00</a>
Temperature based upon vapour arising from a liquid	<a href="#">G01K 11/02</a>
Temperature based upon vapour arising from a liquid where liquid is contained in a hollow body having parts which are displaceable under pressure	<a href="#">G01K 11/04</a>
Shape Memory elements per se	<a href="#">F03G 7/0614</a>
Pressure measuring devices in general	<a href="#">G01L</a>
Compound/bimetallic strips per se	<a href="#">G12B 1/02</a>
Thermally actuated switches	<a href="#">H01H</a>
Thermally actuated switches with extendable rods	<a href="#">H01H 37/48</a>

### Special rules of classification

Further details of groups:

[G01K 5/02:](#)

If the liquid is contained in a hollow body having parts which are deformable or displaceable under the pressure developed by the material, [G01K 5/32](#) is given and not [G01K 5/02](#).

[G01K 5/14:](#)

If the liquid column is displaced for maximum or minimum indication, [G01K 5/20](#) is given and not [G01K 5/14](#).

[G01K 5/20:](#)

[G01K 5/22](#) takes precedence.

[G01K 5/28:](#)

If the gas is contained in a hollow body having parts which are deformable or displaceable under the pressure developed by the material, [G01K 5/32](#) is given and not [G01K 5/28](#).

[G01K 5/32:](#)

If the pressure is developed by evaporation [G01K 11/04](#) is given and not [G01K 5/32](#).

[G01K 5/32:](#)

[G01K 5/36](#) and [G01K 5/42](#) take precedence.

[G01K 5/486:](#)

This group contains the Shape Memory Alloys SMA's and the Shape Memory Polymers SMP's. They are sometimes used as Time-Temperature Integrators TTI's, in which case also [G01K 3/04](#) is to be assigned.

[G01K 5/486:](#)

[G01K 5/62](#) takes precedence.

## Synonyms and Keywords

*In patent documents, the following abbreviations are often used:*

Shape memory materials	A group of materials that can return to some previously defined shape or size when subjected to the appropriate thermal procedure. That is, shape memory alloys can be plastically deformed at some relatively low temperature and, upon exposure to some higher temperature, will return to their original shape. Examples are SMA and SMP (see below).
SMA	Shape Memory Alloy
SMP	Shape Memory Polymer

## G01K 7/00

**Measuring temperature based on the use of electric or magnetic elements directly sensitive to heat (giving results other than momentary value of temperature [G01K 3/00](#)) {; Power supply therefor, e.g. using thermoelectric elements}**

### Definition statement

*This place covers:*

Diode thermometers, thermocouples, resistive temperature sensors (such as thermistors) and capacitive temperature sensors.

Thermometers based on thermal noise, resonant frequencies, magnetic elements and gas ionization.

Circuits for predicting stationary temperature and for spatial inter- and extrapolation

### References

#### Limiting references

*This place does not cover:*

Giving results other than momentary value of temperature	<a href="#">G01K 3/00</a>
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#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Zero Heat Flux sensors or "fox probes"	<a href="#">G01K 1/165</a>
Surface (or Bulk) Acoustic Wave Sensors	<a href="#">G01K 11/265</a>
Measuring electric or magnetic variables	<a href="#">G01R</a>
Testing or monitoring of circuits in sensors systems	<a href="#">G01R 31/2829</a>
Open/short circuit determination per se	<a href="#">G01R 31/54</a>
Resistive elements for temperature control	<a href="#">G05D 23/24</a>
Producing voltage/current as function of temperature	<a href="#">G05F 3/225</a>
Bandgap reference voltage sources	<a href="#">G05F 3/30</a>
Thermal management of data processing equipment	<a href="#">G06F 1/206</a>
Digital storage with means to avoid temperature influence	<a href="#">G11C 7/04</a>
Resistive elements per se	<a href="#">H01C</a>
Terminals for resistive temperature sensors	<a href="#">H01C 1/1406</a> , <a href="#">H01C 1/1413</a>
Thermistors per se	<a href="#">H01C 7/008</a> , <a href="#">H01C 7/02</a> , <a href="#">H01C 7/04</a>
Capacitors with temperature dependent dielectric per se	<a href="#">H01G 7/04</a>
Cooling arrangements in electronic devices using the Peltier effect	<a href="#">H01L 23/38</a>
Temperature measurement in car batteries (often done by extrapolation/ modeling)	<a href="#">H01M 10/486</a>
Connectors per se	<a href="#">H01R</a>

Stabilizing oscillators by generating a temperature dependent oscillation signal	<a href="#">H03L 1/027</a>
Ohmic resistance heating	<a href="#">H05B 3/00</a>
Heating or cooling of PCB's	<a href="#">H05K 1/0201</a>
Thermoelectric devices per se	<a href="#">H10N 10/10</a>
Thermomagnetic devices per se	<a href="#">H10N 15/00</a>

### Special rules of classification

If temperature is measured using electric or magnetic components already present in the system to be measured, the class Indexing code [G01K 2217/00](#) is obligatory as additional information.

#### Further details of subgroups:

[G01K 7/01](#):

Temperature measurement based on the temperature dependent current through a diode or a PNP transistor with base and collector short circuited. [G01K 7/02](#), [G01K 7/16](#) and [G01K 7/30](#) take precedence.

[G01K 7/021](#):

[G01K 7/026](#), [G01K 7/12](#) and [G01K 7/14](#) take precedence.

[G01K 7/026](#):

This group also contains arrangements for signalling wrong or reversed connection of thermocouples.

[G01K 7/028](#):

For thermocouples based on nanotechnology, [G01K 2211/00](#) is obligatory as additional information.

[G01K 7/16](#):

If one of the following two elements is present, the indicated classes as additional information are obligatory (next to the appropriate group under [G01K 7/16](#)):

Specially adapted connectors for resistive temperature detectors: [G01K 2007/163](#)

Electrical time domain reflectometry (see for example DE102006022363):

[G01K 2007/166](#).

[G01K 7/18](#), [G01K 7/22](#):

[G01K 7/26](#) takes precedence.

[G01K 7/186](#); [G01K 7/226](#):

For RTD sensors based on nanotechnology Indexing code [G01K 2211/00](#) is obligatory as additional information.

[G01K 7/203](#), [G01K 7/245](#):

These groups also contain measurement of decay time, when the resistive temperature sensor is in an RC circuit.

[G01K 7/32](#):

[G01K 7/203](#) and [G01K 7/245](#) take precedence. [G01K 7/32](#) also comprises:

piezoelectric oscillators

electric oscillators (e.g. ring oscillators)

tuning forks

[G01K 7/42](#):

This group comprises modelling in the time domain. Modelling in the spatial domain is for [G01K 7/427](#).

[G01K 7/427](#):

This group comprises:

Spatial inter- and extrapolation

General modelling, where temperature is calculated based on, e.g., heat flux measurement

Dummy objects used for estimating the temperature of real objects, in which case the class Indexing Code [G01K 2007/422](#) is obligatory as additional information

### Synonyms and Keywords

*In patent documents, the following abbreviations are often used:*

Curie temperature	the temperature at which the magnetic properties of a substance change from ferromagnetic to paramagnetic
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## G01K 7/02

using thermoelectric elements, e.g. thermocouples

### References

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Thermoelectric or thermomagnetic devices per se	<a href="#">H10N 10/00</a> , <a href="#">H10N 15/00</a>
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## G01K 7/16

using resistive elements (resistive elements per se [H01C](#), [H01L](#))

### References

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Resistive elements per se	<a href="#">H01C</a> , <a href="#">H10D 1/40</a> , <a href="#">H10K 10/10</a>
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## G01K 9/00

Measuring temperature based on movements caused by redistribution of weight, e.g. tilting thermometer (not giving momentary value of temperature [G01K 3/00](#))

### Definition statement

*This place covers:*

The somewhat exotic "tilting thermometers"; an example can be found in FR405419.

### References

#### Limiting references

*This place does not cover:*

Thermometers giving results other than momentary value of temperature	<a href="#">G01K 3/00</a>
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## G01K 11/00

Measuring temperature based upon physical or chemical changes not covered by groups [G01K 3/00](#), [G01K 5/00](#), [G01K 7/00](#) or [G01K 9/00](#)

### Definition statement

*This place covers:*

Temperature measurement based on:

- microwaves or millimeter waves emitted by an object
- phase change (e.g. melting) of materials
- color change of materials (e.g. thermochromes)
- thermoluminescence or fluorescence
- acoustic effects
- the effect of a material on radiation (e.g. gamma radiation)
- changes in transmission in optical fibers
- measuring temperature by temperature sensitive (optical) refractive index

### References

#### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Temperature measurement in boreholes (often by using optical fibers as in <a href="#">G01K 11/32</a> )	<a href="#">E21B 47/07</a>
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#### References out of a residual place

*Examples of places in relation to which this place is residual:*

Details of thermometers not specially adapted for particular types of thermometer	<a href="#">G01K 3/00</a>
Measuring temperature based on the expansion or contraction of a material	<a href="#">G01K 5/00</a>

Measuring temperature based on the use of electric or magnetic elements directly sensitive to heat	<a href="#">G01K 7/00</a>
Measuring temperature based on movements caused by redistribution of weight, e.g. tilting thermometer	<a href="#">G01K 9/00</a>

### **Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

Heat sensitive sheets for use in thermography	<a href="#">B41M 5/00</a>
Thermosensitive paints (relevant for <a href="#">G01K 11/12</a> ) per se	<a href="#">C09D 5/26</a>
Tenebrescent compositions	<a href="#">C09K 9/00</a>
Liquid crystal compositions	<a href="#">C09K 19/00</a>
Optical fiber sensors per se	<a href="#">G01D 5/268</a> , <a href="#">G01D 5/353</a>
FBG's for stress measurement	<a href="#">G01L 1/246</a>
Pressure sensors with optical fibers	<a href="#">G01L 11/025</a>
Optical Time Domain Reflectometry (relevant for <a href="#">G01K 11/32</a> ) OTDR for general testing of optical fibers	<a href="#">G01M 11/3109</a>
Measuring density in general	<a href="#">G01N 9/00</a>
Determining freezing or melting point (relevant for <a href="#">G01K 11/06</a> ) of a substance	<a href="#">G01N 25/04</a>
Mm-waves (relevant for <a href="#">G01K 11/006</a> ) for detecting hidden objects	<a href="#">G01V 8/005</a>
Bragg gratings (relevant for <a href="#">G01K 11/3206</a> ) per se	<a href="#">G02B 6/02076</a>
Electro-optic liquid crystals	<a href="#">G02F 1/13</a>

### **Special rules of classification**

#### **Further details of subgroups:**

#### [G01K 11/006](#):

The methods in this class are mainly passive (i.e. measurement of radiation emitted by the object itself). [G01K 17/003](#) takes precedence.

#### [G01K 11/20](#):

This group also comprises temperature measurement by fluorescence ([G01K 11/3213](#) takes precedence).

#### [G01K 11/265](#):

Bulk acoustic wave sensors are also in this group.

#### [G01K 11/30](#):

These methods, in the shorter wavelength region of the electromagnetic spectrum, are mostly active methods (i.e. there is an external source irradiating the measurement object).

#### [G01K 11/32](#):

The following symbols should be used to distinguish between systems based on Brillouin and Raman scattering respectively:

Brillouin: [G01K 11/322](#)

Raman: [G01K 11/324](#)

[G01K 11/3206](#):

This group also comprises measuring temperature at the end of an optical fiber using other means than fluorescence. The sensors used in this group are often also used for pressure measurement, in which case circulation to [G01L 1/246](#) is obligatory.

## Synonyms and Keywords

*In patent documents, the following abbreviations are often used:*

DTS	Distributed Temperature Sensor
OTDR	Optical Time Domain Reflectometry
OFDR	Optical Frequency Domain Reflectometry
FBG	Fiber Bragg Grating

## G01K 11/165

### of organic liquid crystals

## References

### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Liquid crystal materials	<a href="#">C09K 19/00</a>
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## G01K 13/00

### Thermometers specially adapted for specific purposes

## Definition statement

*This place covers:*

Adaption of thermometers:

- for clinical purposes
- for cryogenic purposes
- for measuring moving fluids (gas or liquid)
- for measuring moving solid bodies
- combined with sampling devices (e.g. for molten metal)

## Relationships with other classification places

When temperature is measured in order to provide compensation for the impact of a temperature or a variation of temperature on a measurement, variable, signal or technological effect, classification is made in the place that is applicable to that measurement, variable, signal or technological effect, e.g. [G01D 3/028](#), [G01G 23/48](#), [G01L 19/04](#), [G12B 7/00](#), [H01G 5/017](#), [H03F 1/30](#). Additional classification in [G01K](#) would be justifiable if such compensation required that a temperature-measuring instrument or circuit be modified or that temperature measurements be processed in a new way.



## References

### Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Patient garments with monitoring equipment	<a href="#">A41D 13/1281</a>
Recording temperature data for clinical diagnosis	<a href="#">A61B 5/0008</a>
Diagnostic temperature sensing	<a href="#">A61B 5/01</a>
Temperature mapping of body parts	<a href="#">A61B 5/015</a>
Baby bottles with temperature sensors	<a href="#">A61J 9/02</a>
Temperature measurement in rolling mills	<a href="#">B21B 38/006</a>
Measurement of metal bath temperature	<a href="#">B22D 11/182</a> , <a href="#">B22D 11/202</a> , <a href="#">B22D 2/006</a>
Temperature regulation for vehicle airco and HVAC	<a href="#">B60H 1/00878</a>
Determining when the hardening temperature has been reached by measurement of magnetic or electrical properties in the treatment of metals or alloys	<a href="#">C21D 1/54</a>
Arrangements for detecting or measuring liquid temperature in washing machines, washer-dryers or laundry dryers	<a href="#">D06F 34/24</a>
Arrangements for detecting or measuring temperature of the drying air in washer-dryers or laundry dryers	<a href="#">D06F 34/26</a>
Measuring temperature in boreholes or wells	<a href="#">E21B 47/07</a>
Temperature sensing elements in gas turbines	<a href="#">F01D 17/085</a>
Temperature sensing in exhaust gases of combustion engines	<a href="#">F02D 41/1446</a>
Sensors specially adapted for exhaust gas recirculation systems, for determining temperature	<a href="#">F02M 26/47</a>
Prevention of heat overload in bearings	<a href="#">F16C 17/24</a>
Air temperature sensors in air conditioning systems	<a href="#">F24F 2110/10</a>
Frost detectors for fridges	<a href="#">F25D 21/02</a>
Temperature monitoring in heat treatment chambers (industrial furnaces, ovens)	<a href="#">F27D 21/0014</a>
Flow measurement by thermal means	<a href="#">G01F 1/68</a>
Temperature sensing on integrated circuits	<a href="#">G01R 31/2891</a>
Car battery state of charge	<a href="#">G01R 31/392</a>
Temperature monitoring in nuclear reactors	<a href="#">G21C 17/112</a>
Temperature monitoring of semiconductor wafers during manufacturing	<a href="#">H01L 21/67248</a>
Devices for sensing temperature or actuated thereby structurally associated with dynamo-electric machines	<a href="#">H02K 11/25</a>
In arrangements for regulating or controlling electric motors, appropriate for both AC and DC, determining the temperature of the motor or of the drive	<a href="#">H02P 29/60</a>

### Informative references

Attention is drawn to the following places, which may be of interest for search:

Processes for controlling fuel cells or fuel cell systems characterised by the detection or assessment of temperature or ambient temperature	<a href="#">H01M 8/0432</a>
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### Special rules of classification

#### Further details of subgroups:

##### [G01K 13/00](#):

This group also comprises adaptations of specific objects for thermometric purposes. In general, [G01K 13/00](#) concerns internal adaptation of the sensor and [G01K 1/14](#) concerns mounting of an existing sensor. For specific application fields there is a dedicated Indexing Code [G01K](#) "2000" series that is obligatory as additional information. Reference is made to the special rules of classification at the subclass [G01K](#) level.

##### [G01K 13/02](#)

If pipe wall temperature is measured as a reference of flowing fluid temperature inside the pipe, also classify in [G01K 1/143](#). The following classes are obligatory:

- Moving gas: [G01K 13/024](#)
- Moving liquid: [G01K 13/026](#)

##### [G01K 13/08](#):

This group comprises temperature measurement of bearings. When the result of the temperature measurement is used to prevent heat overload in bearings, then also circulate to [F16C 17/24](#).

##### [G01K 13/10](#):

This group comprises, e.g., temperature measurement in grain containers (silos). If temperature is measured by special arrangements for conducting heat from the object to the sensitive heat element both [G01K 13/10](#) and [G01K 1/16](#) are obligatory.

##### [G01K 13/20](#):

This group comprises measurement of human or animal temperature. Temperature prediction aspects (e.g. prediction of stationary value of temperature) are found in [G01K 7/42](#), and in this case both [G01K 13/20](#) and [G01K 7/42](#) are obligatory.

### Synonyms and Keywords

In patent documents, the following abbreviations are often used:

HVAC	Heating Ventilation Air Conditioning
Total Air Temperature	Total Air Temperature (TAT) is the air temperature as measured by a temperature probe on an aircraft. It is greater than the static (ambient) air temperature because of the heating that occurs as air moving past the aircraft is slowed down

## G01K 13/20

### Clinical contact thermometers for use with humans or animals

#### Definition statement

*This place covers:*

Instruments, including their constructional details, that measure the temperature of human beings or animals and that operate in direct contact with the human being or animal. These instruments are specially adapted to measure the temperature around the point of homeostasis of the human being or animal. Therefore, they could be operable only for a single species or a small number of species. In addition, a clinical thermometer may be adapted to suit the morphology of a given species or small number of species.

For example, the normal human body temperature is around 37 °C, and the medically dangerous condition of hyperpyrexia occurs around 41.5 °C, so that clinical thermometers need not be capable of measuring temperatures above 45 °C. A lower limit for the applicability of clinical thermometers in human beings would be set by medically-induced hypothermia, which is kept above 30 °C to avoid serious complications. Therefore, a clinical thermometer for use on human beings would not be designed to operate out of the range 30 °C-45 °C.

#### Relationships with other classification places

[A61B 5/01](#) covers the medical-diagnosis aspect of temperature measurements of human beings or animals, like mapping the temperature of a body part, whereas [G01K 13/20](#) covers hardware, circuits and processes that improve the suitability of temperature-measuring technology for use on humans or animals, but that do not provide per se a medical diagnosis. That is, what is covered in [G01K 13/20](#) is ultimately destined to be used for medical diagnosis, but does not per se determine a specific medical condition, this latter type of improvement belonging to [A61B 5/01](#). Stated differently, [G01K 13/20](#) covers adaptations that make temperature measuring more suited to human beings or animals, whereas [A61B 5/01](#) provides a precise medical answer that is inferred from temperature measurements.

#### Glossary of terms

*In this place, the following terms or expressions are used with the meaning indicated:*

clinical thermometer	Temperature-measuring instrument designed to operate around the homeostasis point of a human being or animal
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## G01K 15/00

### Testing or calibrating of thermometers

#### References

##### Limiting references

*This place does not cover:*

Arrangements with respect to the cold junction of thermocouples	<a href="#">G01K 7/12</a>
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##### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Failure detection of sensors in combustion engines	<a href="#">F02D 41/222</a>
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## Special rules of classification

### Further details of subgroups:

#### [G01K 15/00](#):

This group comprises testing or verification of the temperature sensor, to investigate whether calibration is necessary. If the document is purely about testing or purely about calibration, it should be classified in one of the groups [G01K 15/007](#) or [G01K 15/005](#) and not in [G01K 15/00](#).

#### [G01K 15/007](#):

This group comprises verification for proper functioning (i.e. testing) and estimation of expected life-time. Testing could be either in-line (i.e. during operation) or off-line.

#### [G01K 15/002](#):

This group comprises the eutectics, peritectics, triple point cells, etc. defining a temperature reference point used for calibration. This class should be given together with [G01K 15/00](#) or [G01K 15/005](#).

## G01K 17/00

**Measuring quantity of heat (measuring temperature by calorimetry [G01K 3/00](#) - [G01K 11/00](#); specially adapted for measuring thermal properties of materials, e.g. specific heat, heat of combustion [G01N](#))**

### Definition statement

*This place covers:*

(Micro)calorimeters.

Measuring heat in (domestic) radiation systems.

Heating cost allocation.

Testing of heat pipes.

### References

#### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Microreactors / "lab-on-a-chip" systems	<a href="#">B01J 19/0093</a>
Counting of domestic energy consumption	<a href="#">F24D 19/1048</a>
Same as above for domestic hot water	<a href="#">F24D 19/1063</a>
Same as above for combi-kettles	<a href="#">F24D 19/1081</a>
Utility meters	<a href="#">G01D 4/00</a>
Measuring quantity of heat specially adapted for measuring thermal properties of materials	<a href="#">G01N</a>
Investigating materials and chemical reactions by thermal means	<a href="#">G01N 25/48</a>

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Measuring quantity of heat in order to calculate temperature	<a href="#">G01K 7/427</a>
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## Special rules of classification

### Further details of subgroups:

#### G01K 17/00:

For classification: also circulate to [G01N 25/48](#) if applicable (i.e. if material investigation as such is relevant). This group further also comprises testing of heat pipes.

#### G01K 17/06 and groups:

This group comprises measurement of domestic energy consumption. Circulate to [F24D 19/00](#) and/or [G01D 4/00](#) if applicable. [G01K 17/02](#) and [G01K 17/04](#) take precedence.

#### G01K 17/20:

This group also comprises determination of so called U-value, R-value or K-value of a building.

## Synonyms and Keywords

*In patent documents, the following abbreviations are often used:*

U-value, K-value	Overall heat transfer coefficient. Represents a measure of thermal insulation of a building
R-value	Reciprocal of the U-value