Webinar: ebro Measuring devices in the food industry
網絡研討會：ebro 食品行業的測量設備

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ebro Measuring devices in the food industry ebro
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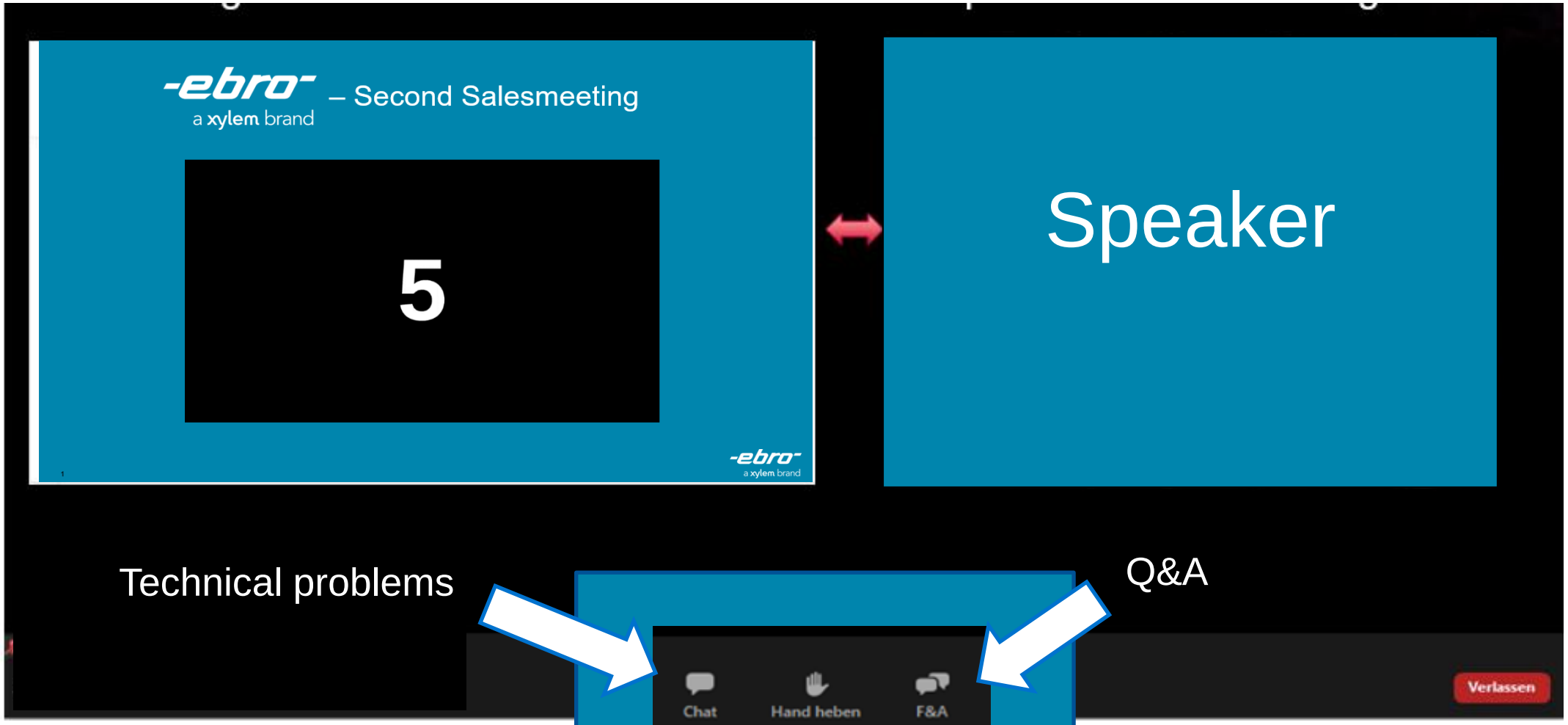
Information – LIVE Webinar via Zoom
信息 – 通過 Zoom 進行的現場網絡研討會

Presentation

Speaker



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Agenda 議程

- Why is temperature measuring important?為什麼溫度測量很重要？
- Coretemperature- or Surfacetemperature- measuring?核心溫度或表面溫度測量？
- Touch-sensitive- or contactless- Temperature measuring? 觸敏式或非接觸式溫度測量？
- Measure or record? 測量還是記錄？
- What accuracy and resolution and what is the difference?什麼精度和解析度，有什麼區別？
- Measure properly 適當地測量

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Survey調查

Where do you mainly use thermometer?
你主要在哪裡使用溫度計？

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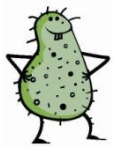
Why is temperature measuring important?為什麼溫度測量很重要？

One of the most important goals is to prevent the growth of microorganisms.
最重要的目標之一是防止微生物的生長。

- During the manufacturing process 在製造過程中
- During transportation 在運輸期間
- During storage 在儲存期間

Microorganisms double themselves within 30 minutes.
微生物在 30 分鐘內翻倍。

10.000



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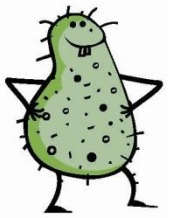

1 hour

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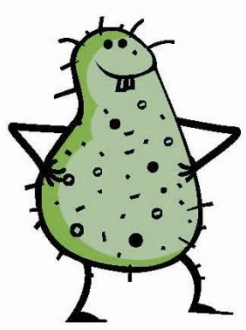

2 hour

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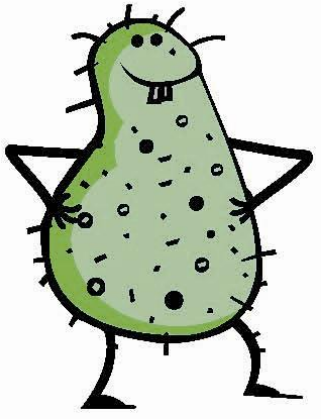

3 hour

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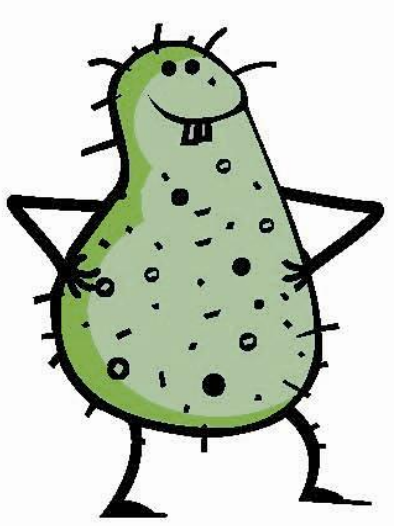

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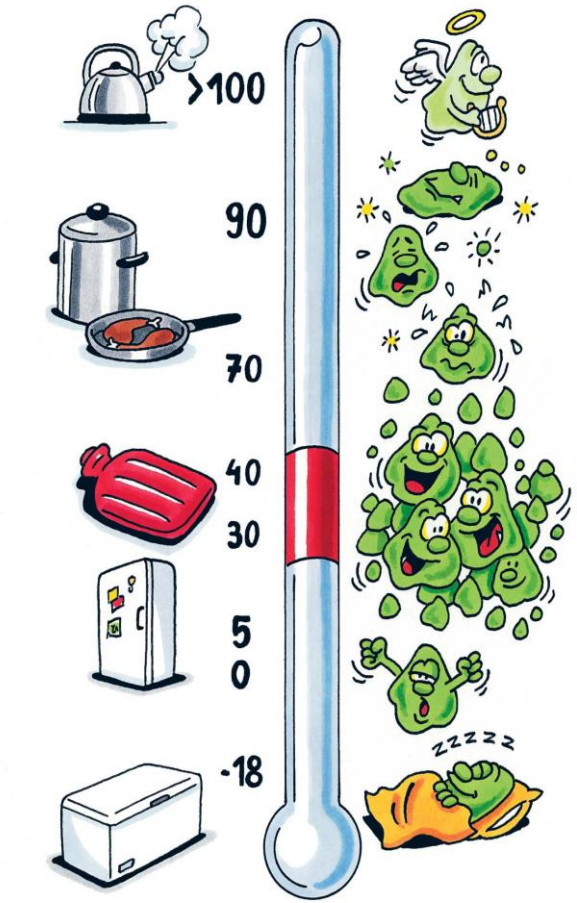
Why is temperature measuring important? 為什麼溫度測量很重要？



A sterilization process kills heat-resistant microorganism.
滅菌過程殺死耐熱微生物。

Pasteurization of food and beverages leads to a reduction of microorganism.食品和飲料的巴氏殺菌導致微生物減少。

Best growth conditions for microorganism.微生物的最佳生長條件。

Storage in a refrigerator or cold room leads to low growth of microorganism.儲存在冰箱或冷藏室會導致微生物生長緩慢。

In the freezer the microorganism survive, but they do not multiply.
微生物在冰箱中存活，但不會繁殖。

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Coretemperature- or Surfacetemperature- measuring?
核心溫度或表面溫度測量？

Both core temperature and surface temperature measurement with thermometers or temperature sensors require thermal contact with sufficient heat conduction between the sensor and the measured object (solid, liquid, gas).使用溫度計或溫度傳感器測量核心溫度和表面溫度都需要在傳感器和被測物體（固體、液體、氣體）之間進行充分熱傳導的熱接觸。

The reaction speed of the measurement also depends on this heat conduction.測量的反應速度也取決於這種熱傳導。

Media with low thermal conductivity are good heat insulators, so they do not transfer heat very well and the time required for heat measurement is correspondingly long.導熱係數低的介質是良好的熱絕緣體，因此傳熱效果不好，熱測量所需的時間也相應較長。

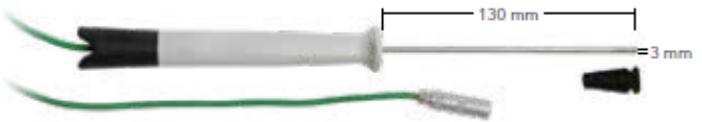
Media with good thermal conductivity are poor thermal insulators, transfer heat well and the time required for thermal measurement is low.導熱性好的介質是差的熱絕緣體，傳熱好，熱測量所需的時間短。

Coretemperature- or Surfacetemperature- measuring?
核心溫度或表面溫度測量？

Selection of the appropriate temperature sensors.選擇合適的溫度傳感器。

Blunt temperature probes are suitable for measurement in liquids and gases.鈍頭溫度探頭適用於液體和氣體中的測量。

Blunt temperature probes reduce the risk of injury.鈍的溫度探頭減少受傷的風險。



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Coretemperature- or Surfacetemperature- measuring?
核心溫度或表面溫度測量？

Selection of the appropriate temperature sensors.選擇合適的溫度傳感器。

Pointed temperature probes are mostly used for core temperature measurement of solid foods such as sausage, meat, cheese, bakery products, etc.尖頭溫度探頭多用於香腸、肉類、奶酪、烘焙產品等固體食品的核心溫度測量。

Measuring in liquids and gases are possible too.也可以測量液體和氣體。

Pointed temperature probes increase the risk of injury.尖頭溫度探頭會增加受傷的風險。

Coretemperature- or Surfacetemperature- measuring?
核心溫度或表面溫度測量？

Selection of the appropriate temperature sensors.
選擇合適的溫度傳感器。

Surface temperature probes are available in various designs, e.g.表面溫度探頭有多種設計可供選擇，例如

- Paddle probe for flat surfaces用於平面的槳式探頭
- All purpose surface sensor for heating plates, heating pipes, boilers etc.用於加熱板、加熱管、鍋爐等的通用表面傳感器。

- Angle probe for hard-to-reach surfaces用於難以觸及的表面的角度探頭
- Magnet- surface probe 磁面探頭

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Coretemperature- or Surfacetemperature- measuring?

核心溫度或表面溫度測量？

Selection of the appropriate temperature sensors.
選擇合適的溫度傳感器。

Temperature probes which are mounted directly on the measuring device enable one-hand operation.直接安裝在測量設備上的溫度探頭可以單手操作。

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Coretemperature- or Surfacetemperature- measuring?
核心溫度或表面溫度測量？

Selection of the appropriate temperature sensors.選擇合適的溫度傳感器。

Temperature probes that are mounted on the meter via a cable require two-handed operation.通過電纜安裝在儀表上的溫度探頭需要雙手操作。

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Touch-sensitive- or contactless- Temperature measuring?

觸敏式或非接觸式溫度測量？

In addition to contact-sensitive temperature measurement, the surface area of a substance can also be determined without contact by measuring thermal radiation, provided that the emissivity is known with sufficient accuracy.除了觸敏溫度測量，如果輻射率已知，物質的表面也可以通過測量熱輻射以非接觸方式進行偵測且具有足夠的準確性。

The measurement is done e.g. with a pyrometer or a thermographic camera.測量完成，例如用光學高溫計或熱像儀。

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Touch-sensitive- or contactless- Temperature measuring?

觸敏式或非接觸式溫度測量？

In the case of non-contact temperature measurement via thermal radiation, the following points can lead to measurement errors:在通過熱輻射進行非接觸式溫度測量的情況下，以下幾點可能會導致測量誤差：

- Different or unknown emissivities of the measured objects.
  被測物體的不同或未知發射率。
- Reflections of extraneous radiation from smooth surfaces.
  來自光滑表面的外來輻射反射。
- Self-radiation of the air between object and optics.
  物體和光學元件之間空氣的自我輻射。

已知發射率表

Table of certain known emissivities

材料發射率 Material Emissivity	發射率 Emission 8-14 µm
Aluminium, oxidised	0.2 - 0.4
Aluminium, blank	0.04
Lead, scraggly	0.4
Lead, oxidised	0.2 - 0.6
Iron, oxidised	0.5 - 0.9
Iron, polished	0.24
Iron, rusted	0.5 - 0.7
Copper, polished	0.03
Copper, oxidised	0.4 - 0.8
Inconel, oxidised	0.7 - 0.95
Inconel, polished	0.3 - 0.6
Asphalt	0.95
Concrete	0.95
Ice	0.98
Cement	0.8 - 0.95
Glass pane	0.85
Rubber	0.95
Limestone	0.98
Wood	0.9 - 0.95
Cork	0.7
Graphite	0.7 - 0.8
Ceramics	0.95
Gravel	0.95
Paper	0.95
Cloth	0.95
Sand	0.9
Snow	0.9
Potter's clay	0.95
Water	0.93

Touch-sensitive- or contactless- Temperature measuring?
觸敏式或非接觸式溫度測量？

Advantages and disadvantages of the different measurement methods.不同測量方法的優缺點

Contact- Measuring觸敏式測量	Contactless- Measuring非接觸式測量
Very high accuracy is possible 非常高的精度是可能的	Less accurate. Mostly > 1K 不太準確。大多> 1K
Low risk of measurement errors 測量錯誤風險低	isk of measurement errors is bigger 測量誤差的風險更大
Measurement takes time 測量需要時間	Very fast measurement 非常快速的測量
Contact or penetration of the probe can damage or even destroy the product.探針的接觸或穿透可能會損壞甚至毀壞產品。	Goods are not attacked 貨物不受攻擊
Possibility of core temperature as well as surface temperature measurement 核心溫度和表面溫度測量的可能性	Only measurement of surface temperature possible 只能測量表面溫度
Probe need to be cleaned between measurements to prevent cross contamination. 測量之間需要清潔探頭以防止交叉污染。	No risk of cross contamination 沒有交叉污染的風險

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Measure or record? 測量還是記錄？

With the measuring instruments described up to this point, physical measured variables, in this case temperature, are recorded selectively at one point in time. This means you record a single measured value and use it to check e.g.到此為止所描述使用測量儀器，在一個時間點選擇性地記錄物理測量變量，在這種情況下為溫度。這意味著您記錄單個測量值並使用它來檢查，例如

- Did the frozen goods arrive cold enough upon delivery?冷凍貨物在交貨時是否足夠冷?
- Is the food delivered hot enough?
  送來的食物夠熱嗎?
- Is the frying oil at the desired temperature?煎炸油是否處於所需溫度？
- Is the wine at the right temperature?酒的溫度是否合適?
- Is the smokehouse preheated to the correct temperature?
  燻製室是否預熱到正確的溫度？
- And so on.等等。

Measure or record? 測量還是記錄？

Sometimes, however, it is also necessary not only to record a single measured value, but to record data continuously, at a defined interval, over a certain period of time. Use cases are e.g.然而，有時不僅需要記錄單個測量值，而且還需要在特定時間段內以定義的時間間隔連續記錄數據。使用範例例如

- Production process where certain temperature ranges must be maintained over a certain period of time during smoking, cooking, frying, pasteurizing, etc.• 在燻製、烹飪、油炸、巴氏殺菌等過程中，必須在一定時間內保持一定溫度範圍的生產過程。
- Warehousing, where raw products, intermediate products or the finished product must be stored under defined temperature conditions.在倉儲，原材料、中間產品或成品必須在規定的溫度條件下儲存。
- Transports where the temperature must be monitored.必須監測溫度的運輸。

Here you would select a data logger.
在這裡，您將選擇一個數據記錄器。

Measure or record? 測量還是記錄？

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Data loggers record the temperature, or other physical parameters, at a defined interval of X seconds, minutes or hours over a certain period of time.
These data can then be analyzed on the computer and reports can be generated with which it can be proven that e.g.
數據記錄器在特定時間段內以 X 秒、分鐘或小時的定義間隔記錄溫度或其他物理參數。
然後可以在計算機上分析這些數據並生成報告，通過這些報告可以證明例如：

- The correct temperature was maintained during the manufacturing process.在製造過程中保持正確的溫度。
- The goods were stored under the correct temperature conditions.貨物存放在正確的溫度條件下。
- The goods were transported under the correct temperature conditions.貨物在正確的溫度條件下運輸。
- There was a homogeneous temperature distribution in the warehouse or other premises.倉庫或其他場所的溫度分佈均勻。

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What accuracy and resolution and what is the difference?
什麼精度和解析度，有什麼區別？

In the technical data of digital measuring instruments and data loggers, you often find information such as:在數字測量儀器和數據記錄器的技術數據中，您會經常找到以下信息：
Accuracy準確性: +/- 0.5 °C
Resolution解析度: 0.1 °C.
But what does that mean exactly and what is the difference.但這究竟意味著什麼，有什麼區別。

The resolution indicates what the display can show. Some devices have a display where only one decimal place can be specified, others have two or more decimal places.解析度指示顯示器可以顯示的內容。某些設備的顯示幕只能指定一個小數位，而其他設備則具有兩個或更多小數位。

Below are some examples of what can be displayed at given resolution.以下是在給定解析度下可以顯示的內容的一些示例。

Resolution 解析度	Display 顯示
0,5 °C	20,0 °C, 20,5 °C, 21,0 °C, 21,5 °C …
0,1 °C	20,0 °C, 20,1 °C, 20,2 °C, 20,3 °C …
0,05 °C	20,00 °C, 20,05 °C, 20,10 °C, 20,15 °C …
0,01 °C	20,00 °C, 20,01 °C, 20,02 °C, 20,03 °C …

What accuracy and resolution and what is the difference?
什麼精度和解析度，有什麼區別？

However, the accuracy of the measuring device has nothing to do with the resolution. For example, it is quite possible for an instrument to have a resolution of 0.1 °C, but only an accuracy of plus/minus (+/-) 0.5 °C.然而，測量設備的精度與解析度無關。例如，儀器很可能具有 0.1 °C 的分辨率，但精度僅為正/負 (+/-) 0.5 °C。

The accuracy indicates how far the measurement result may deviate from the actual temperature.精準度表示測量結果與實際溫度的偏差。
For a measuring device with an accuracy of +/- 0.5 °C and an object temperature of 20.0 °C, the display may therefore show numbers between 19.5 °C and 20.5 °C.因此，對於精度為 +/- 0.5 °C 且物體溫度為 20.0 °C 的測量設備，顯示屏可能會顯示介於 19.5 °C 和 20.5 °C 之間的數字。

In most cases, thermometers with a higher accuracy are used in laboratories, and of course also as reference instruments, while lower accuracies of +/- 0.5 °C, +/- 0.8 °C or +/- 1.0 °C are used in production and during storage and transport. The operator and thus mostly the quality management is responsible for defining the limits.在大多數情況下，精度較高的溫度計用於實驗室，當然也用作參考儀器，而精度較低的 +/- 0.5 °C、+/- 0.8 °C 或 +/- 1.0 °C 用於生產以及在儲存和運輸過程中。操作員和質量管理人員主要負責定義限值。

What accuracy and resolution and what is the difference?

什麼精度和解析度，有什麼區別？

Most companies today use quality assurance systems such as ISO 9000 ff, QS 9000, GxP, FDA, etc. which require test equipment monitoring and thus regular calibration of the test equipment to ensure the accuracy of the devices.當今大多數公司都使用質量保證體系，例如 ISO 9000 ff、QS 9000、GxP、FDA 等，這些體系需要對測試設備進行監控，因此需要對測試設備進行定期校準，以確保設備的準確性。

In most cases a distinction is made between:在大多數情況下，兩者之間存在區別：

- A calibration according to ISO 9000 ff. and
  根據 ISO 9000 ff 進行校準。和
- An accredited calibration according to DAkkS specifications in terms of DIN EN ISO 9001 and DIN EN ISO/IEC 17025.根據 DIN EN ISO 9001 和 DIN EN ISO/IEC 17025 的 DAkkS 規範進行的認可校準。

Xylem Analytics Germany GmbH

akkreditiert durch die / *accredited by the*

Deutsche Akkreditierungsstelle GmbH

als Kalibrierlaboratorium im / *as calibration laboratory in the*

Deutschen Kalibrierdienst

11220
D-K-20615-01-00
2018-11

Kalibrierschein / *Calibration certificate*

Kalibrierzeichen / *Calibration mark*

Gegenstand / *Object*

Hersteller / *Manufacturer* — Xylem Analytics Germany GmbH

Typ / *Type*

Fabrikat/Serien-Nr. / *Serial number*

Auftraggeber / *Customer* — Muster GmbH, Musterstraße 1, 9999 Musterstadt

Auftragsnummer / *Order No.* — Muster

Anzahl der Seiten des Kalibrierscheins / *Number of Pages of the certificate* — 3

Datum der Kalibrierung / *Date of calibration* — 21/11/2018

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21/11/2018

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Survey調查

Do you have your thermometers calibrated?

您的溫度計是否經過校準？

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Agenda 議程

- Why is temperature measuring important?為什麼溫度測量很重要？
- Coretemperature- or Surfacetemperature- measuring?核心溫度或表面溫度測量？
- Touch-sensitive- or contactless- Temperature measuring? 觸敏式或非接觸式溫度測量？
- Measure or record? 測量還是記錄？
- What accuracy and resolution and what is the difference?什麼精度和解析度，有什麼區別？
- Measure properly 適當地測量

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Measure correctly. 正確地測量 Optical with 應用光學 TLC + TFI

For optimum measurement results, the following should be considered:為獲得最佳測量結果，應考慮以下因素：

- Make sure that the lens is clean before measuring. Carefully remove dust or dirt with a lint-free soft cloth.測量前確保鏡頭清潔。用不起毛的軟布小心清除灰塵或污垢。

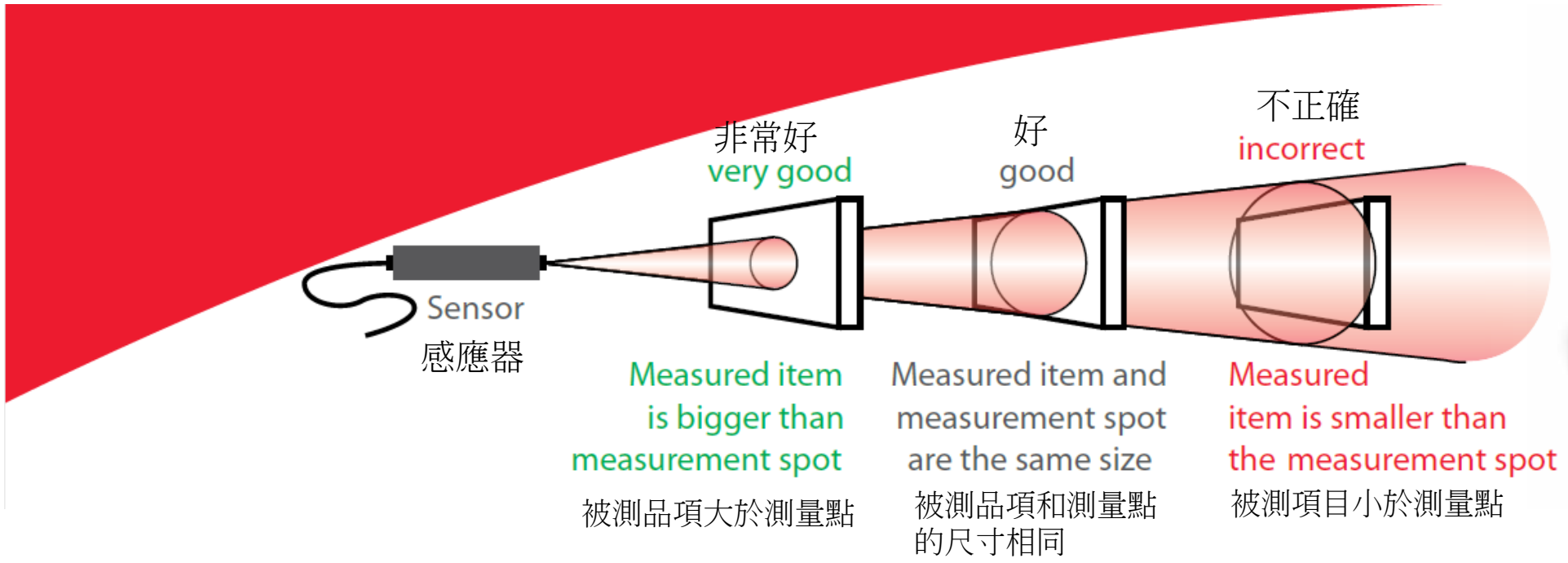
- The meter should acclimatize after being moved to a room with a different temperature.儀表移動到不同溫度的房間後應該適應環境。

- Make sure that the measurement takes place within the distance specified in the technical data.確保在技術數據中指定的距離內進行測量。

- Read the temperature after the indication on the display stabilized.在顯示屏上的指示穩定後讀取溫度。

Measure correctly. 正確地測量 Optical with 應用光學 TLC + TFI

Do not measure too far away 不要測量太遠



3 cm to 10 cm is a good measuring distance.3 公分到 10 公分是一個很好的測量距離。

Measure correctly. 正確地測量 Optical with 應用光學 TLC + TFI

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在金屬或有光澤的表面上測量會導致不正確的結果（例如優酪奶蓋）

Further measurement recommendations: 進一步的測量建議

Measure on metallic or shiny surfaces will cause incorrect results (e.g. yoghurt cover)

incorrect 不正確

correct 正確

Do not measure in locations where there may be space between packaging and the product

不要在包裝老化和產品之間可能有空間的位置進行測量

incorrect 不正確

correct 正確

The diameter of the entire measurement spot must always be on the measured item

整個測量點的直徑必須始終在被測品項上

incorrect 不正確

correct 正確

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Correct measurement. Core temperature with 正確測量。核心溫度使用型號TLC, TFX, TTX, TFE, TDC ...

Core temperature measurement with a needle is 用針頭測量核心溫度

- More accurate than an infrared measurement 比紅外測量更精確
- But not as fast as an infrared measurement.
  但不如紅外測量快。

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Correct measurement. Core temperature with 正確測量。核心溫度使用型號TLC, TFX, TTX, TFE, TDC ...

In order to achieve an optimum measurement result with the insertion probe, the following must be considered:為了使用插入式探頭獲得最佳測量結果，必須考慮以下因素：

The temperature sensor is located at the sensor tip. This is exactly where the temperature is measured. Make sure that the sensor tip is in the material to be measured and has not been pierced through the material to be measured. 溫度傳感器位於傳感器尖端。這是準確測量溫度的位置。確保傳感器尖端在待測材料中，並且沒有刺穿待測材料。

The probe must be brought into the product with at least 1/3 of the probe tube. In the case of small material to be measured, if possible, measure from the side. 探頭必須至少將探頭的1/3帶入產品中。在要測量小材料的情況下，如果可能的話，從側面測量。

Incorrect – the probe tip may not stick out of the measured good

Correct

Correct measurement. Core temperature with 正確測量。核心溫度使用型號TLC, TFX, TTX, TFE, TDC ...

In order to achieve an optimum measurement result with the penetration probe, the following must be considered: 為了以穿透探針達到最佳的測量結果，必須考慮以下幾點：

The probe must be inserted exactly into the material to be measured. Each hole drilled (e.g. in frozen goods) must be the same size as the diameter of the probe tube. As soon as there is a gap between the probe and the product to be measured, e.g. in the case of air packaging, the measurement result will be inaccurate.探針必須精確地插入要測量的材料中。鑽的每個孔（例如在冷凍貨物中）必須與探針管的直徑相同。一旦探頭和待測產品之間存在間隙，例如在空氣包裝的情況下，測量結果將不準確。

To achieve the best results, the temperature distribution in the measure material should be the same at every place. When measuring liquid samples such as soups, stir before measuring to ensure an accurate measurement.為了獲得最佳結果，測量材料中每個地方的溫度分佈應相同。測量湯等液體樣品時，請在測量前攪拌以確保測量準確。

Wait until the temperature reading is stable before ending the measurement. Do not forget to document the measurement, including date, time,measured material and measured value.等到溫度讀數穩定後再結束測量。不要忘記文件記錄測量結果，包括日期，時間，測量材料和測量值。

Disinfection of the probe before each measurement is absolutely necessary to prevent the risk of cross-contamination. 在每次測量之前對探針進行消毒是絕對必要的，以防止交叉污染的風險。

Questions when choosing the right measuring device 選擇正確測量設備時的問題

Important questions to ask when choosing the right thermometer or logger:選擇合適的溫度計或記錄器時要問的重要問題：

- What is the measuring range (or, what is the lowest and what is the highest temperature I need to measure)? 測量範圍為何（或者，我需要測量的最低溫度是多少，最高溫度是多少）？

- What accuracy is required? 精度需求為何?

- Should the core temperature (in the medium/material) or the surface temperature be measured? 應測量核心溫度（在介質/材料中）還是測量表面溫度？

- Is a thermometer or logger needed? 是否需要溫度計或記錄器？

- In which medium/material shall be measured?應在哪種介質/材料中測量？
  - Do I have to have a pointed probe to pierce the material? 我必須有一個尖頭探頭才能刺穿材料嗎？
  - Is a blunt probe sufficient that I can immerse in a liquid? 鈍探頭是否足以讓我浸入液體中？
  - Does the probe have to be specially protected because I have to measure in an aggressive medium such as an acid or an alkali? 探頭是否必須受到特殊保護，因為我必須在酸或鹼等腐蝕性介質中測量？
- Is a device for one-hand or two-hand operation preferred? 首選是單手還是雙手操作的設備？

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Juni 2022

Questions and Answers問題和解答

Welcome to send questions to
歡迎發送問題至:

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Note: 此文件中文翻譯的部分若有進一步疑問，請參考原文或洽詢大久生物科技。

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