testo 400 · testo 650 · testo 950

Instruction manual

en

Contents

CE

The conformity certificate confirms that the instruments meet **2004/108/EEC** guidelines**.**

Dear Customer

You have made the right decision by choosing a measuring instrument from Testo. Thousands of customers buy our high standard products every year. There are at least 7 good reasons for doing so:

1) Cost - performance ratio. Reliable quality at a fair price.
2) Extended warranty times of up to 3 years - depending on instrument.
3) We have the ideal solutions for your measuring tasks based on our expert experience gained over 40 years.
4) Our high quality standard is confirmed by the ISO 9001 certificate.
5) Of course, our instruments carry the CE symbol required by the EU.
6) Calibration certificates for all relevant parameters. Seminars, advice and calibration on location.
7) Our after-sales service. Ask for more details.

Your measuring instrument is a flexible, future-oriented system whose range of operations and software can vary according to installation.

Once the instrument is switched on, you will receive information on the type of instrument installed, the serial number as well as information on the current software version in the instrument. Additional information on our service points, for example, can be printed (See page 16).
The instruction manual describes the maximum available range of functions in the **testo 400**. **testo 650** and **testo 950** have limited derived functions in relation to the probes which can be connected and the parameters which can be analysed - See table:

Parameter	testo 400	testo 650	testo 950
Temperature °C	x	x	x
Humidity %RH	x	x	-
Pressure hPa ... bar	x	x	-
Velocity m/s, m^3/h	x	-	-
Gas CO	x	x	x
Gas CO_2	x	x	x
rpm	x	x	x
Voltage V	x	x	x
Current I	x	x	x
WBGT °C	x	-	-
NET °C	x	-	-

testo 650 and **testo 950** can also be subsequently upgraded to include the full range of functions of **testo 400**.
We will also continue to make branch-specific and user-specific software updates for these instruments available to you. All you need to do is register yourself as a user so that we can inform you directly via NEWS.

This documentation describes the Software Version 2.0.

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Update on disk

Please read prior to operation

Do not measure on live parts.

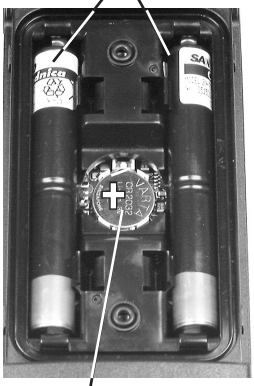
Observe admissible storage and transport temperature as well as the operating temperature (e.g. protect measuring instrument from direct sunlight).

Turn off the instrument when changing configurations (e.g. changing the probe) because the characteristic values specific to the probe are only read by the instrument when switched on. The V24 cable (barcode pen or PC connection) can be plugged in at any time. If a PC cable is connected, a simultaneous print command is not possible.

Ensure that contacts are correct in probes with plug-on head. Tighten the sleeve in the probe handle until the limit stop is reached.

The warranty is no longer valid if the instrument is opened, in the case of inexpert handling or use of force.

Testo rechargeable battery



Button cell - stores the contents of the memory if the rechargeable batteries are empty or if the battery is changed.

Putting in batteries

Unscrew the back of the measuring instrument. Place the **button cell** (Part no.: 0515.0028) in the opened battery compartment with the **"+" pole** on **top** and put in the batteries or the Testo rechargeable batteries (Part no. 0554.0196). **Observe polarization!** Close battery compartment.

You will find further information on alternative power supply, recharging mode, battery quality, recharging in the "Power supply" chapter. Refer to the index.

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Power supply

First measurement

A quick introduction is provided by the instrument and system descriptions on pages 6-9.

This symbol stands for further information . Look for the adequate word in the keyword context, further informations are available on the indicated page.

Note: *The measuring instrument should be switched off before connecting a probe.*

Once a probe has been attached and the measuring instrument has been switched on, you will immediately receive current readings. In the case of new instruments, you should update or define the data saved in the instrument:

Configuration

- ⇛ Date/Time:
- ⇛ Auto Off:
- ⇛ Units:
- ⇛ Type of printer used (the set printer must be activated separately).

Some things can only be set via the PC software (see Ordering data):

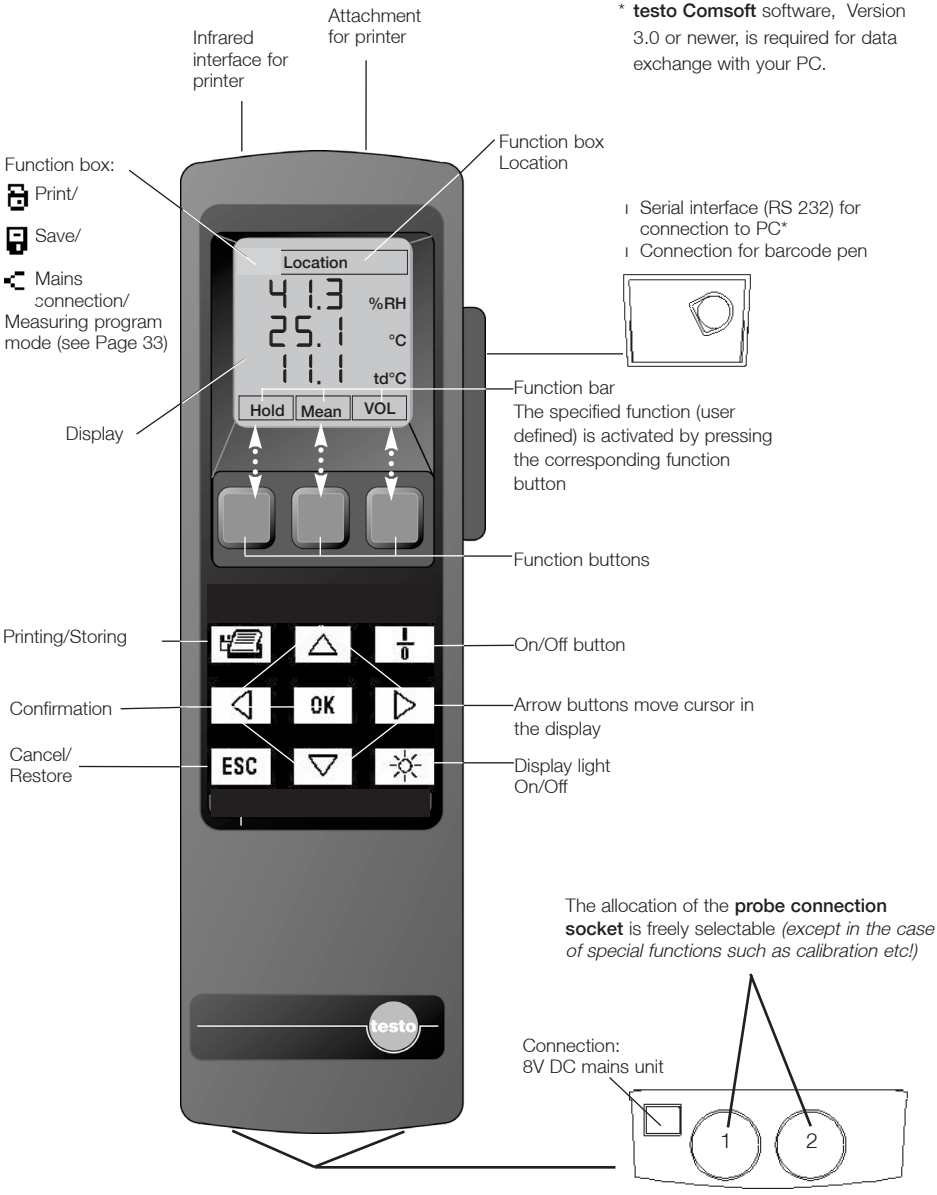
- ⇛ Info (additional information on the chosen measurement location)
- ⇛ Your address.

Function buttons
Function fields
Allocation options

The function buttons can be assigned once a probe is connected: Press ◁ until such time that the corresponding function field is shown inversely and then press OK. A list appears in the display containing the allocation options available for the respective function buttons when a certain probe is connected. Select the function required via △ or ▽ and allocate to function button by pressing OK (multiple allocation is not possible).

You can get to the other two function buttons via ◁ or ▷. If none of the functions fields are inversed once ◁ or ▷ is pressed, then **current data measurement** is activated.

Description of instrument



5 function fields are set up around the data display which provide information on additional functions during measurement. In order to set up these functions which can be activated directly, leave the measurement window by pressing ◁ or ▷. The current measurement is then interrupted. The activated function field is shown in white with a black background (inversed).

The △ and ▽ buttons switch between the options stored for this field. OK shows all the options available in an additional window which can then be selected.

The target location for the measured data is shown at the top left, if transmission is activated via the button. The data is then stored in the memory or printed.

The measuring location is shown at the top right facilitating the allocation of the data to the measuring location during printing and analysis.

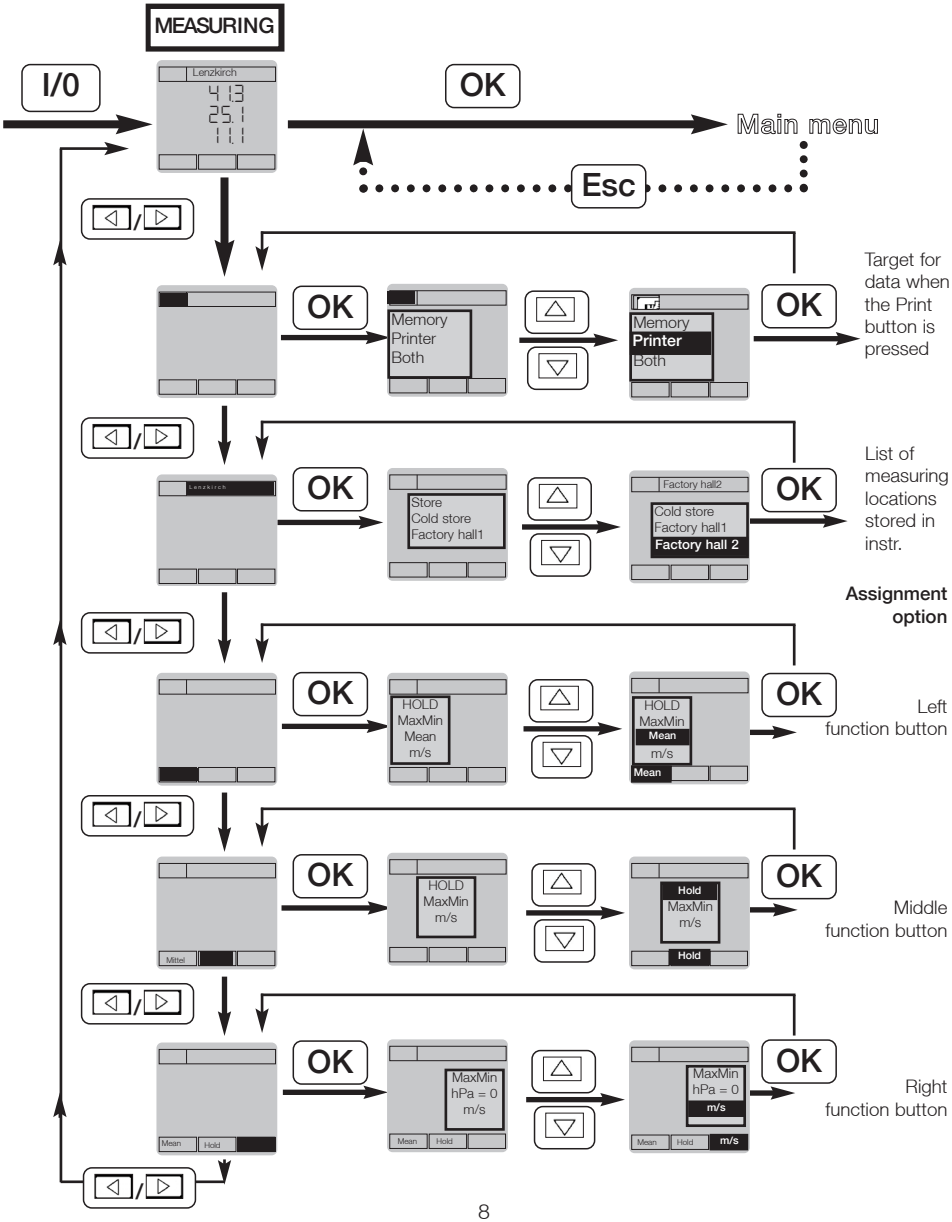
Below are the 3 currently available functions. The meaning changes depending on the menu. The description in the display also changes accordingly. Not all of the function buttons are allocated in every menu or with every probe.

If none of the function fields are inversed after pressing ◁ or ▷ this means that **current data measurement** is activated.

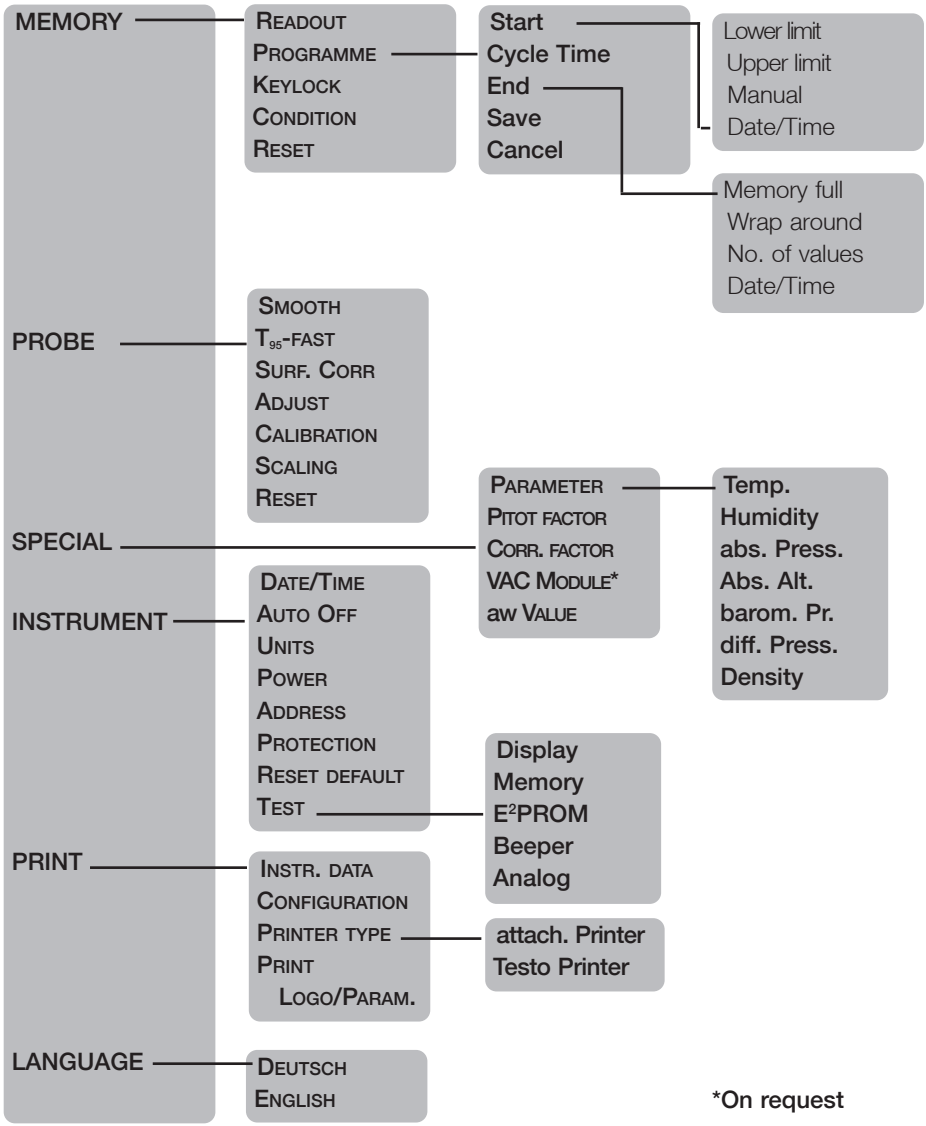
The OK button takes you from the measured value display to the **main menu**. Otherwise OK activates the selected function or confirms the contents of the selected window.

By pressing ESC, selected processes or functions can be cancelled or you can leave submenus. The ESC always takes you back to the menu window until the main menu or the activated data display appears.

Function fields

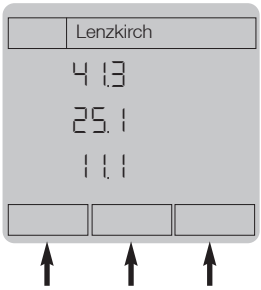


Main menu



*On request

Allocation options of function buttons



Allocation options of function buttons:

HOLD
MAX/MIN
MEAN
VOL
hPa=0
hPa
m/s
Turb.
(blank)
CO=0
Start/Stop
T_{95}
0.1 - 0.01
0-->0.0
Delta T
Delta P
aw value
NET
Send

Hold freezes the last current reading on the display.

MAXMIN shows the largest/smallest display value since switching on. If there is more than one value, all of the display values are stored separately and analysed.

Mean for calculating mean value. This function is available for all parameters.

Continue extends the mean calculation by an additional set measurement duration within the same log.

New measures a new mean in a new log.

End interrupts calculation of the mean value.

Vol extends the display with the "m^3/h" channel (volume flow) when a velocity probe is connected. The diameter of the channel, two side lengths or the area can be given as the parameters. The duct dimensions are individually saved and processed for every measurement location.

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Standard volume flow

hPa=0 carries out a zero-point calibration when the pressure probe is connected.

m/s "m/s" extends the display by the velocity value calculated from pressure when a differential pressure probe is connected.

hPa "hPa" deactivates this channel.

Turb. calculates degree of turbulence when a comfort level probe (0628.0009) is connected.

The function button is deactivated.

CO=0 repeats the zero-point calibration if a CO probe is connected.

Allocation options of function buttons

Start starts a measurement program.

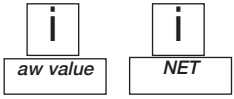
Stop stops a measurement program.

T95 uses the constants stored in **PROBE - T95 FAST** (also depending on location) to extrapolate the change in reading to the expected final value when a temperature probe is connected. The function is particularly suited to slow temperature probes. The constants are measured via PC software.

0.1 - 0.01 switches resolution when a temperature probe is connected (only for Pt100 or adjusted thermcouple probes) and facilitates with these probes measurements ≥ +300° C and ≤ -100°C with a resolution of 0.1 ° C and measurements ≤ +300° C and ≥ -100°C with a 0.01 ° C resolution.

Delta T Calculates the difference between two displayed temperature values if two temperature probes are connected.

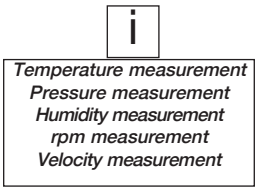
Delta P Calculates the difference from the two pressure values, if two pressure probes (0638.1740, 0638.1840 or 0638.1940) are connected.



aw-value aw value measurement (water activity)

NET Calculates NET climate index

Send Sends current readings in ASCII format with unit to a connected PC via connection cable 0554.0178 using the RS232 interface. The values can be displayed, printed and saved using the HyperTerminal program, for example.



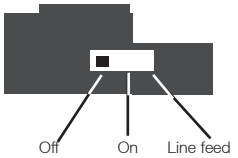
Not all of the function buttons are allocated in every menu or with every probe.
The meaning can change depending on the menu. The description in the display changes accordingly.

Attachable printer
Part no. 0554.0570

The **testo 400/650/950** instruments have an interface for connecting the attachable printer. Press ① to release the lock.

The switch on the left side of the printer has the following 3 functions:

left:	Off switch
middle:	On switch
right:	Line feed.



In the OFF mode, move the switch to line feed and if you keep this position the character set stored in the printer will be printed as a **test print**.

Changing batteries

Observe polarity marked in the battery section when putting in batteries (4 x 1.5 V alkaline or corresponding rechargeable batteries). Rechargeable batteries must be charged outside the printer e.g. using the Testo recharger 0554.0110 (incl. 4 standard rechargeable batteries).

Changing the paper

The paper section is at the top of the printer. Position the paper as shown in diagram.

Note: *The paper is thermal paper which means that only one side can be printed. Therefore ensure that the paper is inserted properly.*

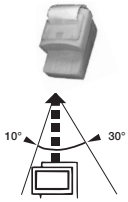
Move slide switch to “Line feed” position so that the paper can run through.

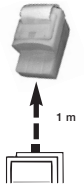
Note: The printer is not powered via the hand-held instrument, therefore it must always be switched on and off separately.
After approx. 8 minutes inactivity the printer goes into a power-save mode to save the battery. Switch the printer off and then on again to reactivate it.
Even in the power-save mode the printer uses up energy. The printer should be switched off when not in use for longer periods of time.

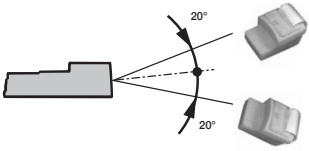
Attachable printer
Part no. 0554.0570

Data transfer

The attachable printer has a powerful bi-directional **infrared interface** with data buffer in the printer. Once the button is pressed**,** the data is transferred in the matter of seconds. The line of transmission should be kept free of obstacles until the instrument has confirmed transmission.

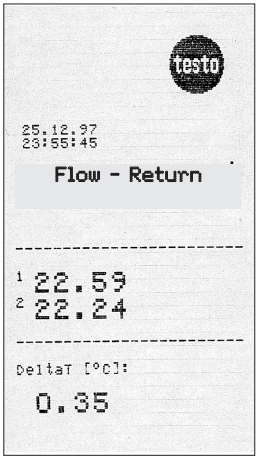






Note: If printing large amounts of text
- more than 1 m text -
we recommend you to attach the printer to the measuring instrument.

Printout:



Printer
Printing logs

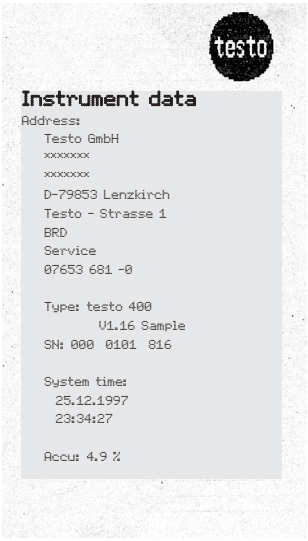
Empty page

Error message	Possible causes	Error elimination
Instrument error 072304EF00	Numerous! ← Note number!	Contact our service department
Memory error Memory not available	No memory space available	Erase memory
Memory error Meas. program is active	Measurement program was set up and is currently measuring	Cancel meas. program or wait until finished
Printer error or printer is not printing	No connection to printer	Check plug-in connection or infrared transmission line
	Printer is switched off	Switch on printer
	Printer batteries are empty	Change batteries in printer
	Printer in power-save mode	Switch printer off and then on again
	Printer symbol top left is not activated in display.	Activate printer symbol
	Wrong printer selected in main menu.	Correct under PRINT - PRINTER TYPE
++++ or - - - -	Extreme application conditions (very strong currents near the measuring instrument)	Wait until disturbance disappears
Change lithium battery	No or very low Li battery in instrument	ESC, replace battery if necessary
Self-test error	Li battery was put in incorrectly	
- - - - - -	Probe unavailable	
+ - + - + -	Outside measuring range	
- + + + + -	Upper limit in measuring range	
+ - - - - +	Lower limit in measuring range	

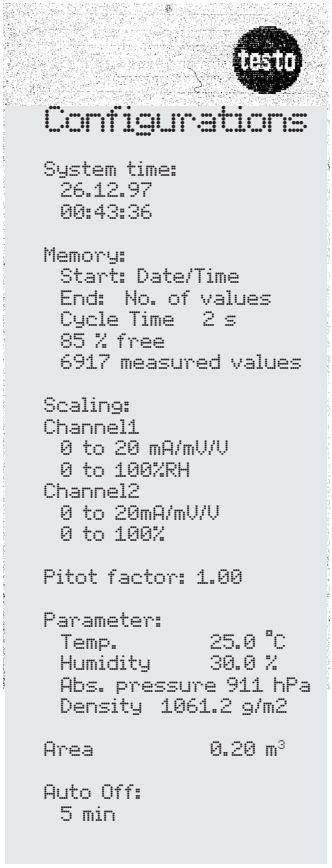
If we were unable to answer your question, please contact your distributor or Testo Customer Service. For contact data, see back of this document or web page www.testo.com/service-contact

You can reset your units to the factory settings via **INSTRUMENT - RESET DEFAULT** or **PROBE - RESET**.
Current instrument data and settings can be printed via **PRINT - INSTRUMENT DATA** and **PRINT - CONFIGURATIONS**.

Instrument data



Configurations



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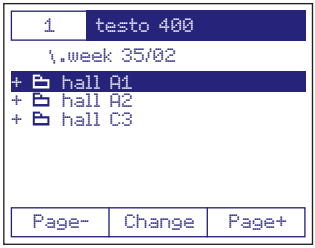
Adjustment

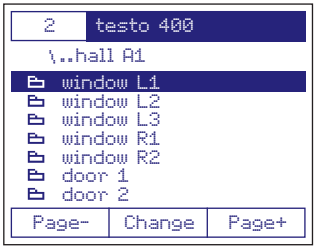
The proof value of the data measured is determined by the time, allocation of a location and other conditions during the measurement. (Where, when, how and in what conditions was the measurement carried out?).
For example, **23.4 °C** is a measured value without reference and meaning. An actual value has been taken completely out of its context. Additions such as 13.4.97/ 8:30 a.m./ cold store, incubator or living room/ 17 °C connect the actual value with the desired value and this can be assessed years later.

The values measured in the measuring instruments of the **testo 400/650/950** series are constantly accompanied by a **location** (top right in display). This information as well as date and time appear as additional information in all of the printouts and in the PC files.

The location is selected in situ from a list stored in the measurement instrument:

Measurement menu → ◁ ▷





Page+/**Page-** use to scroll through a long list of locations.
It is best to use the **testo 400** module for **testo Comsoft** software (from Version 3.0) to process the list.
You can also modify the list directly in the instrument:
LOCATION function box **- Change** function button.

Select with OK :

- **New folder:** You can also set up a folder to structure the locations.
  The layout is in a tree structure corresponding to **testo Comsoft** software.
  5 hierarchical levels (folders and sub-folders) can be set up.
- **New location:** A new location can be set up (see below about entering characters).
- **Copy:** You can change a saved location and save as a new location. The original location will be retained. This is ideal for numbering locations e.g. Hall 1, Hall 2,... (see below about entering characters).
- **Change:** You can change a stored location (see below about entering characters). The barcode number is retained after a new name has been saved.
- **Delete:** You can delete a location or folder from the list.
- **Info** (only for locations, not for folders)**:** shows additional, attached information on the location (entered via **testo Comsoft** software).

Entering characters via Alphabet/Digit box:

Change to the required characters using the arrow buttons, select with OK. Use → to select lower case letters and special characters. The folder (maximum 8 characters) or the location (maximum 15 characters) is copied into the list via the **Take over** button.

Working with the barcode

The barcode pen (No. 0554 0460) automates the allocation of measured data to a measuring location.

If a barcode label is attached on location (produced using Comfort software, **testo 400** module) this can be read in with the barcode pen. The measuring instrument searches for the location in the list to which these coded barcode numbers are allocated in the instrument memory. The location is then written in the top right corner of the display.

The barcode pen can be plugged in and out when the instrument is switched on. Attaching the barcode pen with the holder to the SoftCase (Accessory Part no. 0516.0401) makes handling easier.

The barcode pen can be attached to the RS-232 socket on the side of the measuring instrument. An audible signal follows.
If the signal does not sound, repeat the procedure. If the signal still does not sound this is an indication that the barcode pen is not working properly. Please contact our service department.
After the signal has sounded, the barcode pen then goes into the power-save mode. This is indicated by the pulsating laser diode.

Activate the barcode pen by holding the tip of the pen on a white surface e.g. the barcode label. The laser then goes into continuous operation.

Run the pen directly over the barcode sample. Correct transmission is confirmed by an audible signal. The selected location is then available.

If the barcode number on the label is not in the instrument list i.e. the read in barcode is unknown to the instrument, a new location is automatically allocated. The PC software then searches in the PC location data base to find out if this location already exists. If not, it is then set up.
If an unplanned location (without barcode) has to be measured, a name is set up in the function box **LOCATION** at **Change - New Location**. The instrument generates a provisional number. The final barcode number is then allocated in the PC software.

Task: - Repeated temperature measurement ② at 30 measuring points with a thermocouple probe
① specially adjusted to a Pt100 precision probe
- Printout with attachable printer ③

① **Adjusting ...**

a) a surface temperature probe e.g. 0614.9993 to a precision Pt100 immersion probe, e.g. 0628.0015:

The temperature probe marked with * in the Ordering data has its own integrated memory (EEPROM). Data on probes is saved here:
Main menu→ Probe - Adjustment (OFFSET correction)
- Surface correction (Gradient correction).

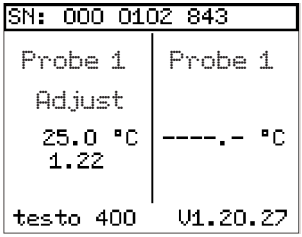
Connect both probes to the hand-held instrument. Connect the probe which is to be adjusted - only an **EEPROM probe** (See Ordering data: marked with *) can be used - to socket 1 on the left.

Switch on instrument. Switch to main menu with OK and adjust via **PROBE** - ADJUSTMENT. Immerse both probes in a bath at the future working temperature (at least 10 cm deep) and wait for a stable temperature display in both probes. Start adjustment in the menu (See display:"**Adjust**"). The differential temperature of the surface temperature probe to the Pt100 precision probe is stored here.

b) a probe with EEPROM using a separate precision measuring instrument:

Connect the probe to be adjusted to the left socket 1, switch on the instrument and confirm **PROBE-ADJUST** in the main menu with OK.
The measured actual temperature is on line 1. The required temperature is specified by the reference instrument.
Set the required temperature on line 2 using the cursor buttons.

The future displayed temperature values of this probe will be adjusted accordingly (=offset correction). This offset, compared with the factory calibration, appears in the display when the instrument is switched on:



Example:

Set required value: 25.0 °C
Offset correction: 1.22
Required value + offset correction = measured value following factory calibration = current value of probe: 26.22 °C.

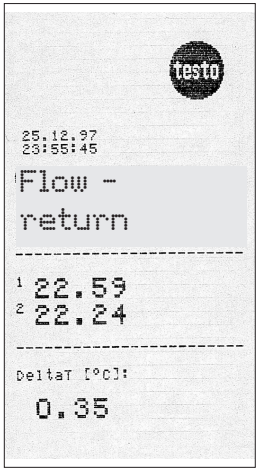
Optimum accuracy only applies in the environment of the calibration point. There may be deviations from the true desired value in other temperature ranges.

***Warning: If a probe is newly adjusted, the factory calibration data is deleted. You can retrieve the original values via* PROBE - RESET.**

② **Measurement:** Place the function display at the top left on the **Save** (= disk symbol) symbol.

Return to the measurement menu by pressing [ESC]. Switch off measuring instrument. Plug in the newly calibrated probe to the instrument on location and switch on. The probe socket is freely selectable. Select the **Location** function field via [◁] [▷] and set the required **location** with [▽].

Press the [🖶] button after every measurement and select the required **location** before the next measurement**.**



Example:
Log with attachable printer

A log is set up in the hand-held instrument memory each time the [🖶] button is pressed. The log includes the location, date and time, all additional information, set correction values... and can be printed under **PRINT - CONFIGURATION**.

③ **Printing** all of the measured data following completion of the measurement series: set the measuring location at top right. Call up the log in the **Main menu** under **MEMORY** - **READOUT** and print by pressing [🖶].

Note: The printer to be used when printing must be selected via the menu PRINT - PRINTER TYPE.

0.01 °C resolution for Pt100 and thermocouple probe

Pt100 probes are generally shown with a resolution of 0.01 °C. This resolution is possible for a reading of max. +299.99°C and min. 99.99°C. At temperatures outside this range, the symbol for a disconnected probe is (- - - -). If you wish to measure above +299.99 °C or below -99.99°C, you have to switch to a resolution of 0.1 °C beforehand: allocate “0.1...0.01” to function button and activate. The switch-over is only possible if a measurement program is not activated. It must otherwise be cancelled beforehand.

Switch thermocouple probe with EEPROM following adjustment to a 0.01 °C resolution.
The following also applies: maximum measured value = +299.99 °C
minimum measured value = -99.99°C

t_{95}, k factor, quick final value extrapolation

This function can only be used to the full when used with **testo Comsoft** software. It is particularly suited to slow temperture probes with a large thermal mass.

Measuring: During a test measurement, a jump in temperature is recorded with an EEPROM probe.

The time constant of probe under given conditions for quick final value extrapolation is determined and stored in the instrument via the automatic learning function available in the PC software.

You can set and change this value in the instrument (in main menu under **PROBE** - τ_{95} - **fast)**. With the help of the k factor a small change in temperature in the starting phase of a temperature jump is amplified and extrapolated to the expected final value.

k= 0:	Function without effect.
k=50.00	Maximum amplification possible

Depending on the probe, the optimum k value is between 0 and 50. If the set k value is too small for the probe, the display reacts too slowly to a temperature jump. If the k value is too big the displayed value overshoots.
(Please refer to the Comfort software instruction manual for more detailed information).

For quick measurements on location, assign one of the function buttons with t_{-95} and set the location required. Activate the function by pressing the function button (the measurement on location must correspond physically to the previous **practice measurement**). The function is deactivated by pressing the function button again.

Temperature measurement

Surface correction

Surface probes conduct heat from the surface being measured following the first contact. For this reason the measured result is lower than the true surface temperature without the probe (the opposite arises in the case of surfaces which are colder compared to the ambient temperature). This effect can be corrected with an addition in percentage of the measured value.

Data is input in the main menu under **PROBE** - **SURF CORR** and can be defined differently for probe socket 1 or 2 (maximum 30 %).

All of the temperature probes are corrected with the input values regardless of the chosen location. In EEPROM probes the corrected value is stored in the probe.

Globe thermometer

The globe thermometer 0554.0670 (D = 150 mm) is used to measure radiation temperature in accordance with ISO 7243, ISO 7726, DIN EN 27726, DIN 33403.

Inserting calculated parameters

When used with **testo 400/650**, the multi-function humidity probes from Testo (e.g. 0636.9740) show readings for relative humidity and the corresponding temperature after switch-on. Once OK is pressed one of the following parameters from a list can be added in the Main menu under **INSTRUMENT** - **UNITS** - **Humidity**:

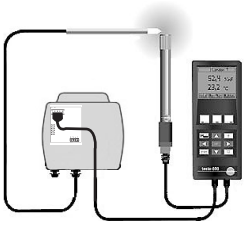
- dew point temperature (td °C)
- absolute humidity (g/m³)
- absolute humidity (g/kg)
  → if dependent on pressure please set the absolute pressure under **SPECIAL** - **PARAMETER** for correct pressure compensation.
- enthalpie (J/g or kJ/kg)
  → this variable is also dependent on pressure
- psychrometric wet-bulb temperature (PSYC °C)
- water vapour partial pressure (mbar)
- water level (V ppm, displayed unit in display: ppm): describes volume levels of water vapour in the complete sample gas.
  → Please adjust current pressure at **SPECIAL** - **PARAMETER - ABS. PRESS.**
- pressure dew point (tdat °C): to atmospheric dew point (1013mbar) of calculated dew point under pressure.
  → Please adjust duct pressure at **SPECIAL** - **PARAMETER - ABS. PRESS.** The instrument indicates atmospheric dew point td °C.

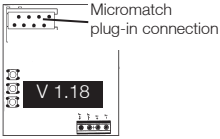
Following activation via OK an additional channel is generated in addition to %RH and ° C. This can be deactivated via **INSTRUMENT** - **UNITS** - **Humidity** - *Off*.

Calibration

The humidity probes 0636.9740 and 0636.9715 as well as 0635.1540 can be calibrated using the hand-held instrument (no buttons on probe). All other humidity probes are adjusted using buttons. *Please also consult the 0973.1820 Instruction manual on the 0554.0660 control and adjustment set.*

Confirm in the main menu with OK under **PROBES** - **CALIBRATION**. Place the humidity probe in the respective calibration container and start the calibration at the points (11.3%RH / LiCl or 75.3%RH / NaCl) by pressing the appropriate function button.
The required value, the current reading and the remaining calibration time are shown on the display. If the current reading is stable you can carry out the calibration ahead of time using the middle function button. Repeat the calibration at the second calibration point.
Note! PROBE - RESET cannot reverse calibration.





Calibrating testo hygrotest 600/650 with reference instrument
testo 650/400: Requirements:
- **testo 650** hand-held instrument or **testo 400**, V1.22 or newer
- Transmitter board from Version V 1.18 (visible on the largest IC component)
- Calibration connection cable (0409 0214)
- Connection cable for probes (0430.0143 or 0430.0145)
- Reference humidity temperature probe (0636 9741)

Connect transmitter to probe socket 1 and a reference probe to probe socket 2 in the instrument. The humidity and temperature value is adjusted to the reference probe via the menu item “Probe” - ”Probe adjustment”.
Humidity adjustment is deleted via ”Probe reset”. Temperature adjustment is retained.
Adaptation time: min. 30 minutes, at constant temperature.

Calibrating testo 608-H2 with reference instrument
testo 650/400: Requirements:
- **testo 650** or **testo 400**, V2.0 or newer
- Calibration connection cable (0699 4235 / 10)
- Connection cable for probes (0430.0143 or 0430.0145)
- Reference humidity temperature probe (0636 9741)

Remove battery from **testo 608-H2** battery compartment but do not disconnect.
Attach calibration cable to micromatch plug-in connection. Insert correctly.
Connect calibration cable to probe socket 1 of the **testo 650/400**.
Connect reference humidity temperature probe to the right probe socket of **testo 650/400**.
The humidity value is adjusted to the reference probe via the “Probe” - ”Probe adjustment” menu item.
Humidity adjustment is deleted via ”Probe reset”.
Adaptation time: min. 30 minutes, at constant temperature.

Material/building moisture cable,
Part no. 0636.0565

Description:
The building moisture cable 0636.0565 is suitable for qualitative measurements in the material/ building moisture sector. The measuring principle is based on resistance measurement.
By scaling, values between 100 and 0 are allocated to the resistance values making an assessment of the material/building moisture possible.

Note:
This probe is not suitable for measuring resistance in the same way as a multimeter.

Connecting to testo 400 or testo 650 reference instruments:
If the instrument is switched on with the 0636.0565 probe attached, the instrument shows the values in kΩ. The instrument measures the parallel connection between a 100 kΩ fixed resistor and the measurement resistance at both banana plugs.
Example: 100kΩ measurement resistance produces the display = 50 kΩ.

Scale the system in the "building moisture" application range as follows:

1. Press OK to go to the main menu.
2. Select "probe" - Confirm with OK.
3. Set "Scaling" - Confirm with OK.
4. Select channel: right connection socket = **Channel 2**
   left connection socket = **Channel 1**
   Confirm with OK.
5. Select "%" or "n" - Confirm with OK.
6. Adjust with arrow buttons:
   0 to 100 kΩ
   100 to 0 % or n

Effect: Short-circuit ➪ Display = 100.
High-value resistance at input ➪ Display = 0.

All of the values relevant for measuring building moisture lie inbetween:

100 to 66 WET
65 to 51 BUILDING MOISTURE
50 to 21 BUILDING DRYNESS
20 to 1 DRY
0 to 1 VERY DRY

Material moisture probe, Part no. 0636.0365

Description:
The humidity sensor works according to the principle of relative permittivity measurement. The high relative permittivity of water (approx. 80) is used to determine the moisture level. A high frequency, electrical field penetrates the material being measured. Depending on the moisture, a value is shown on the instrument display (not water level). This display value is different for every material. The water level has to measured using the “dry and weigh method”.

Measurement:
When measuring ensure that the probe is lying firmly on the material being measured.

Note:
The output signal of the probe cannot be checked to see if the probe is still working properly. If the contact is interrupted, the value in the display will remain at a value, depending on the scaling.

Connecting to testo 400 or testo 650 reference instruments :
1. Connect material moisture probe to channel 1 or channel 2.
2. Press OK to go to main menu.
3. Select “probe” - Confirm with OK.
4. Set “scaling” - Confirm with OK.
5. Select channel: right connection socket = **Channel 2**
   left connection socket = **Channel 1**
   Confirm with OK.
6. Select “%” - Confirm with OK.
7. Adjust using arrow buttons:
   1.50 to 3.50 V (zero point and gradient value)
   0000 to 0100

In order to produce greater measurement effects 0000 to 0200 or 0000 to 0300 can be set instead of 0000...0100.

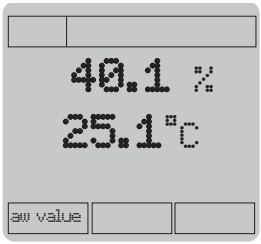
Note:
If dispersions occur when several probes are compared,
the scaling can also be individually modified.
To do this the measurement should first be carried out in the volt unit without scaling.
Measurement in air = **zero point** (instead of 1.5 V).
Measurement on metal = **gradient value** (instead of 3.5 V).
The individual zero point and gradient value can be input when scaling.

aw value measurement

The aw value (water activity) plays a decisive role fot the product quality and the growth of bacteria. Bacteria need high water activity (salmonella min. aw = 0.95). The amount of water is not important in this case, the degree of availability is more important.

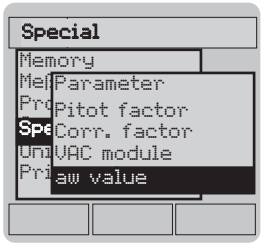
aw = 0 ➪ anhydrous substances
aw = 1 ➪ pure water

The reference temperature is always given because water activity depends on temperature.

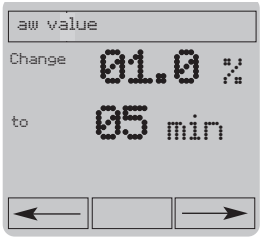


In order to measure the aw value you will need, in addition to the **testo 400**/**testo 650** measuring instrument, a highly accurate humidity probe and a measuring device (accessories).
It consists of a pressure tight measuring chamber which is filled with the goods to be measured. Fill the container half the minimum. The time of adjustment takes approx. 30 minutes at constant temperature depending on the goods to be measured. Contact your Testo dealer and ask for the detailed scientific paper.

A new function button is generated once a humidity probe is connected. This can only be assigned or is only visible in the display if **exactly one** humidity probe is connected (-Do not connect any more than 1 probe!-). Start the aw-value measurement by pressing this function button.

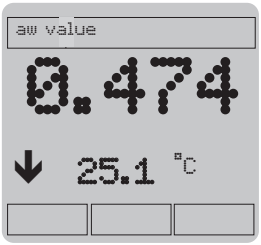


The aw value measurement is finished, if no changes occur within a defined period of time. Enter these values in the main menu under Special aw value.



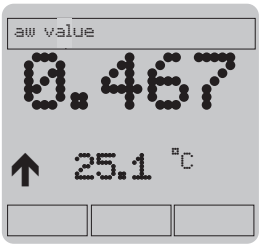
Input limits: 1.0 to 10.0 %RH and 1 to 60 min.
Standard setting 1.0 %RH, 5 min.

Move the cursor with → or ← to the number to be changed and change the number with △ / ▽ . Confirm the settings with OK.

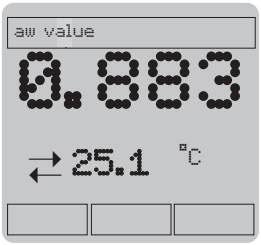


An arrow in the display indicates the trend of the aw values measured:

Falling trend



Rising trend



aw value stable: Measurement can be completed.

The aw value and the corresponding temperature are automatically saved in the “aw” class (depending on location).

supplies a printout for your documentation.

Task: Automatic storing of the humidity/temperature conditions in front of and behind an air heater together with two humidity probes, 100 values with printout of time dependency on an attachable printer.

Procedure:

1) Preliminary check: Is everything set up properly?

- **MEMORY** - **CONDITION?:** For example, you have "**Memory 500000 meas. values, 25 locations**". You can now store 20000 readings in one location.

  The free memory space is reduced as each location is added. Maximum 25 locations can be set up.

  The following applies to the above:
  At least 2 (probes) x 100 (no. of readings) x 3 (channels per probe) = 600 values must be free. If necessary, erase the memory under **MEMORY** - **RESET.**

Note:	***MEMORY** - **RESET** erases the data memory, the folders and locations are retained. The function box LOCATION - Change - **ERASE** erases the respective selected folder/location and the stored folders/locations and data.*

- Have the required locations been set up?

→ **Function box LOCATION** - **CHANGE -**
NEW LOCATION: Define location, e.g. "heater".

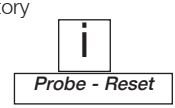
- Checking other configurations ...

→ **MEMORY - KEYLOCK:** The button panel can be locked if the instrument is not monitored during measuring: once the password (3 digits) has been entered all of the button functions are locked.
If the button panel is locked, the configurations can only be changed if the correct password is entered. (The button panel is unlocked by pressing any button + entering the password + activating the **Unlock** function button.

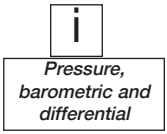
→ **INSTRUMENT - PROTECTION** functions like **MEMORY** - **KEYLOCK,** the lock limits access to the main menu.

→ **PROBE - SMOOTH:** off?
- Surf corr: 00 %? (for probe 1 and 2!)
- Adjustments: ok?
- Calibration: necessary?
- Scaling: ok?

If you are unsure, you can reverse all probe configurations to the factory settings via **PROBE** - **RESET**.



- **SPECIAL - PARAMETER:** Update altitude (**Abs. Alt.**) and pressure values (**barometric** and **differential pressure**) if a pressure-dependent humidity parameter (e.g. g/kg) is logged.



- **INSTRUMENT - DATE/TIME:** Current time?
- **AUTO OFF:** Off?
- **UNITS:** Humidity: g/kg?
- **POWER:** Sufficient?

- **PRINT - PRINTER TYPE:** Attachable printer?

2) Programming the measurement:

Call up the main menu with OK. Set up the measuring cycle and start and end conditions in the **MEMORY - PROGRAM** sub-menu**,** e.g. starting time 16:00, 05.01.1998.

Select the values with ◁ ▷. Increase or decrease values with △ or ▽.

Press OK to start. For example, the measuring cycle is defined with 30 s. The unit (h, min, s) can be changed with the function buttons. End with OK. Define the duration of automatic storing under the menu item "**End**": e.g. number of measured values. If "100" is input the measuring instrument stores 100 value sets per humidity probe (°C, %RH respectively and e.g. °C td depending on selection). The measurement takes 50 min (= 2 value sets per minute) and ends at 16:50.

The following sub-menus should be checked or set before storing:

PROGRAMME - START **- Lower limit/Upper limit**

A probe must be connected via which the program can be started . Auto-OFF to “OFF”. Input the required limit values.

Note: *Do not switch off the instrument after programming otherwise the starting criterium cannot be monitored.*

- Manual

Start the program on location by pressing the function button. The button is automatically allocated with “Start”.

- Date/Time

Does the program start at the specified time ?
(With measuring cycles greater than 2 min the instrument switches off if Auto-Off was activated → power-save mode. It is activated to start measuring).

Note: The starting time must lie in the future.

PROGRAMME - CYCLE TIME: determines the interval between two measurements. The time unit can be selected via the function buttons: s, min or h.

Note:
Some probes need a certain “Waking up” time. It is not possible to measure during this time. A counter going backwards is blended in. This is taken into consideration when automatic storage out of the sleep mode takes place (Auto OFF).
Probes which have to be zeroised after being switched on should be used for longterm logging in continuous operation, mode Auto-OFF (OFF).

PROGRAMME - **END** -

Memory Full
stops the program if the complete memory is full.
Wrap Around
Stores until storing has been interrupted by the the “Stop” function button (appears automatically in the function bar once the program has started). If the memory is full, the values stored at the start are overwritten. Therefore you always have the last possible values in the memory.
No. of Values
ends the program if the specified number of values in the memory has been reached.
Date/Time is only available with programmed starting criterium, date/time.

Store programming with the left function button.
The programmed memory function cannot be activated without “Save”.

Save: activates the input programming, the left function button is automatically allocated with “Start”, if necessary.
Erase: programming is erased.

When storing programs are activated you will be informed via the display (in the top left function field) about the progress in storing.

1. Program is active and is waiting for the starting criterium to be fulfilled:

Low limit:
High limit:
Manual:
Time start:

2. The program is running and is storing values.
appears along with a symbol from item 1.
When this symbol disappears, the program has finished and can be started again if necessary. **PRINT - INSTRUMENT DATA** and **PRINT** - **CONFIGURATIONS** produce a printout which can be used for checking purposes.

3. Measuring in accordance with the previous example

Plug in the humidity probes on location and switch on the measuring instrument.
Set the location (in this case "heater") at the top right of the display using the arrow buttons. Set the function display in the top left to **"Store symbol"** (disk symbol).

In the case of the following probes the instrument has to be switched on since the time until a reading is available is too long or the readings may be incorrect:

→ CO and pressure probe (10, 100 mbar)
(due to automatic initialisation when switched on)
→ CO_2

The instrument should be **switched off if measuring series > 2 min** (protects the battery).
The instrument switches on automatically to measure.

Switch on the instrument following automatic measuring. You will find the "Ambient air office 2" log "5:00 26.12.97" in the main menu under **MEMORY** - **READOUT** .
Confirm selection with OK.

Info and → contain further information on this log (max, min,...).
Using the Delete function button, a log can be deleted from the instrument memory. This button is only active if a program is not stored, if necessary the measuring program has to be deleted.

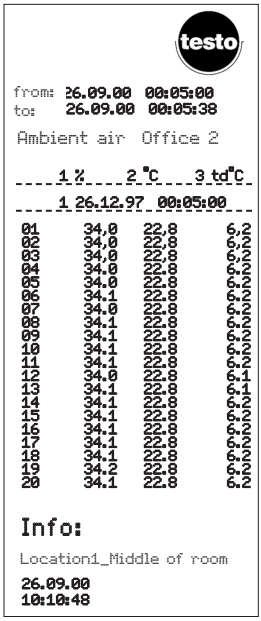
Confirm by pressing OK in **MEMORY -REORGANIZE**.

Then print via the button.
When printing out a measurement series you can choose whether you wish to print the series in table form or as a diagram.
If printed in table form all of the parameters (e.g. °C, %RH, td°C) are printed.
If printed in diagram form a maximum of 2 parameters can be included in one diagram. You are asked automatically in the display which parameters are to be shown in the diagram.

Select the first required parameter and confirm with OK .

*Sel*ect the second required parameter in the same way.

For the safe transmission of large amounts of data put on the attachable printer and switch on.



testo

from: 26.09.00 00:05:00
to: 26.09.00 00:05:38

Ambient air Office 2

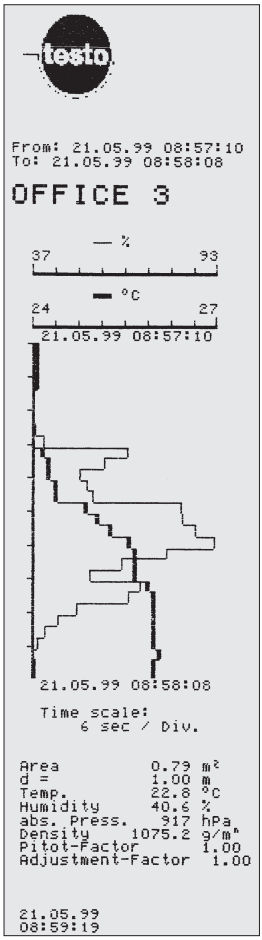
	1 %	2 °C	3 td°C
1	26.12.97	00:05:00	
01	34,0	22,8	6,2
02	34,0	22,8	6,2
03	34,0	22,8	6,2
04	34.0	22.8	6.2
05	34.0	22.8	6.2
06	34.1	22.8	6.2
07	34.0	22.8	6.2
08	34.1	22.8	6.2
09	34.1	22.8	6.2
10	34.1	22.8	6.2
11	34.1	22.8	6.2
12	34.0	22.8	6.1
13	34.1	22.8	6.1
14	34.1	22.8	6.2
15	34.1	22.8	6.2
16	34.1	22.8	6.2
17	34.1	22.8	6.2
18	34.1	22.8	6.2
19	34.2	22.8	6.2
20	34.1	22.8	6.2

Info:

Location1_Middle of room

26.09.00
10:10:48

Printout of a measurement series in table form



testo

From: 21.05.99 08:57:10
To: 21.05.99 08:58:08

OFFICE 3

— %
37 93

— °C
24 27

21.05.99 08:57:10

21.05.99 08:58:08

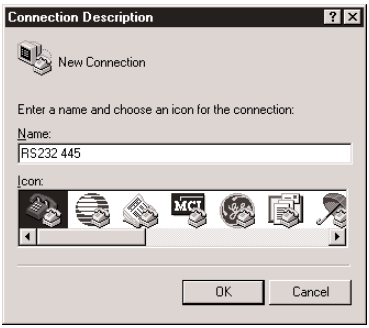
Time scale:
6 sec / Div.

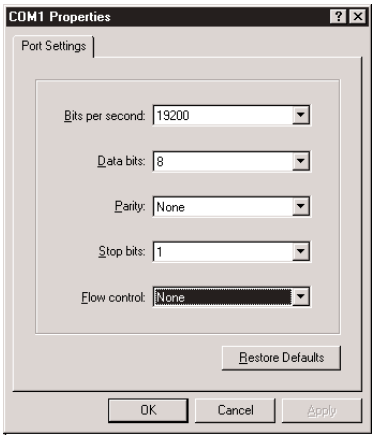
Area	0.79	m²
d =	1.00	m
Temp.	22.8	°C
Humidity	40.6	%
abs. Press.	917	hPa
Density	1075.2	g/m³
Pitot-Factor	1.00	
Adjustment-Factor	1.00	

21.05.99
08:59:19

Printout of a measurement series in diagram form

Function button “Send”





All current readings are transmitted to your PC as ASCII files including unit via the RS232 interface once the **Send** button is pressed. The data can be displayed, saved and printed using the HyperTerminal program.

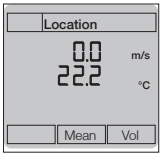
Thanks to this function, readings can be transmitted to a PC without having to start a measurement program. The data does not come in regular cycles but asynchronous i.e. each location comes with the date and time of the measurement. The time intervals between the different measurements can vary.

Calling up the HyperTerminal program:
Normally, you will find the program in “Programs” - “Accessories”. Once you have called up the program, you will have to enter a name for the connection (e.g. RS232 445), then you will have to define the COM interface, to which the interface is connected. The next step involves defining the COM interface settings. Select the following: 19200 bits/second, 8 data bits, no parity, 1 stop bit and no log.

Task: Measuring the volume flow in a duct with a 500 mm diameter and vane probe (Ø 16 mm), printout on attachable printer.

Procedure:

To measuring velocity connect the vane to the telescope and secure, then connect to the measuring instrument and switch on the instrument.



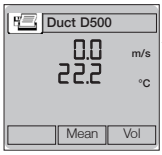
Assign the function buttons with **Mean** and **Vol.**.
To do this activate the function bars for the function buttons with ◁ ▷ and select the required function by pressing ▽.

Return to the measurement window via ◁ ▷ or **ESC**.

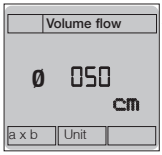
1.) Press **OK** to enter the main menu from where you can check or edit the measuring instrument configurations:

- **INSTRUMENT** - **DATE/TIME:** Current time?
- **PRINT** - **PRINTER TYPE:** Attachable printer?

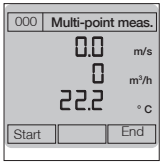
2.) Return to ***current measurement*** via **ESC**.



Select the print symbol in the top left function bar and the measuring location on the top right (e.g. "Duct D500) via ◁ ▷ and ▽ , or if not available set up with **CHANGE - NEW LOCATION**.
Reactivate the current measurement via ◁ ▷.



Activate volume flow calculation (see figure on left) via the **Vol.** function button and enter the correct duct dimensions (e.g. via the diameter function button → 50.00 cm; press **OK**).



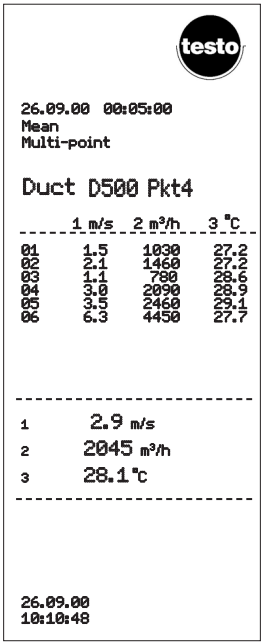
The instrument goes through a restart and the volume flow will now appear in the display.
In **DEVICE-UNITS** -Flow, instead of volume flow it is possible to activate the corresponding standard volume flow (reference to 1013 mbar, 0 °C) **-** marked by capital letters M3/h **-**.
The required information appears on the display.

Averaging is called up via Mean and multi-point measurement is selected.

While the vane is moved over the duct cross-section, each Start confirmation stores a single value.

The number of logged single values appears at the top left of the display. End calculates the arithmetic mean from these single values. This corresponds to the average velocity value and the volume flow in m^3/h.

New sets up a new log.
Continue extends the measurement series by a new “n x start” sequence.
Quit by pressing End.
Return to measurement menu by pressing End again.



Note: *Switching off volume flow calculation: Press* Vol. *and leave the next window by pressing* ESC.

Printing mean calculation
Press button to print out the whole mean calculation procedure (do not forget to switch on the printer).

Example: **Printout of a mean calculation with vane (incl. volume flow)**

Volume flow funnel

A volume flow funnel is required for calculating volume flow at a sucking opening (grid or button tool with dual wall clearance). The funnel opening must cover the grid fully (max. 200 x 200 mm with 0554.0400 or max. 350 x 350 mm with 0554.0410).

To measure, a volume probe (0635 1041 or 0635 9540) is placed in a hole in the funnel, positioned in the middle and aligned. The probe is snapped into the funnel´s handle. Connect the probe to the instrument and switch it on.

Allocate one of the 3 function buttons with the Vol. function and press this function button to allocate the third measurement duct with the volume flow unit (e.g. m^3/h).

Enter 8.82 cm as the diameter for the funnels with Part nos. 0554.0400 and 0554.0410.

Press the funnel firmly on the opening when measuring. You can either accept the displayed reading straightaway or you can calculate a timed mean if there are strong fluctuations in the readings.

Pitot tube and pressure probe

When measuring velocity with a Pitot tube, it is recommended to use the pressure probe 0638.1445 on account of its high accuracy level. The measuring range therefore extends to approx. 40 m/s. Velocity υ is calculated in the instrument from the difference in pressure ^{3} p in the Pitot tube using the following formula:

$$\upsilon\ [m/s] = S \times \sqrt{\frac{200000 \times {}^3p\ [hPa]}{rho\ [g/m^3]}}$$

To activate the conversion allocate one of the function buttons with “m/s”. To do this, a pressure probe must be connected. When this button is pressed, the display changes from pressure to velocity units and “hPa” is automatically allocated to the function button when the instrument is switched on (in this way you can return to the pressure display). The volume flow display (m^3/h) can only be activated if there are m/s units in the display.

Pitot tube factor “S” and density “rho” can be set in the main menu under **SPECIAL** - **PARAMETER** (enter rho) or **SPECIAL** - **PITOT-FACTOR** (enter S).

The Pitot tube factor for testo Pitot tubes is a constant 1.00 and does not need to be changed. If non-Testo Pitot tubes are used, ask the supplier for the Pitot tube factor and store it.

Density “rho”: setting parameters manually

Density can be entered directly in g/m³ under **SPECIAL** - **PARAMETER** (factory setting: 1293 g/m3).

When confirmed with **OK**, this value is used for the calculation, the individual variables are not taken into consideration.

Alternatively you can enter the variables which influence the air density at the point of measurement: temperature, relative humidity and absolute pressure.

Once input is confirmed with **OK** the density is automatically calculated from this variable. The result is as follows:

Absolute pressure is calculated from

- **Altitude (Absolute altitude)**
  The annual mean is 1013 mbar, the higher the location above sea level, the lower the pressure
- **Barometric pressure**
  This is independent of the annual average of 1013 mbar. Depending on the weather this pressure can differ from the annual average by approx. ±20 mbar (See barometer display on location).
- **Differential pressure**
  This is a reference to over or underpressure in the duct.

Note: The input of absolute pressure (only in hPa; it is not possible to switch to other parameters) also affects other parameters which are dependent on pressure. The pressure is compensated automatically in the following cases: humidity (g/kg, J/g), CO_2 and in all thermal probes!

Setting parameters automatically

If you have connected a temperature, humidity or absolute pressure probe their values are accepted directly if you confirm the displayed value via OK under **SPECIAL** - **PARAMETER** - **Temp., Humidity** or **Abs. pressure** .

Note: If you work with standard density as set in the factory, the measurement error during the velocity measurement can be as much as 10% of the measured value. If the parameters are not correctly adjusted the error can increase considerably.

The density should be checked from time to time or print out the set parameters in addition to the measured value:

Printing set parameters

You will get the following in the Main menu under **PRINT** - **CONFIGURATION**:

- Pitot factor
- Temperature
- Humidity
- Absolute pressure
- Density.

The set parameters are automatically printed every time. The Testo logo is also printed if the attachable printer (part no. 0554.0570) is connected. Automatic printing of logo and parameter can be switched on or off via **PRINT**-**PRINT LOGO/PARAMETER.**

Mean calculation options

The following selection appears once the Mean function button is pressed:

1. Timed
2. Multi-point
3. Timed/multi-point.
4. Timed/Graph.

See next page

Mean calculation options

Timed mean calculation

The duration of the measurement from which the mean is to be calculated must be input first for the timed mean calculation (1 to 60 s, or 1 to 60 min).

The current measured value appears after OK is pressed. Start and End are available as function buttons. Start starts a timed mean calculation for the specified duration (see time in top left of display). End interrupts the procedure. If Continue is pressed the mean calculation is extended by the values resulting from the longer lasting measurement. New opens a new log, the values measured up to now are not used. You can leave the mean calculation function by pressing End again.

Multi-point mean calculation

Each time the Start function button is pressed a value for the arithmetic mean calculation is stored. The value counter at the top left increases accordingly. End adds the measured values together and the end value is divided by the number of measured values. You can leave the mean calculation function by pressing End again.

If Continue is pressed new measured values are added to the old values (See value counter). New erases the values counter and opens a new log. The values are stored in the memory. You will find the calculated mean under Info.

Timed multi-point mean calculation

This function is a combination of the mean calculations described above: a multi-point arithmetic mean calculation in which the mean is calculated at each respective point over a specified length of time. The duration and the value counter are located in the top left corner of the display.

Timed, graphic mean calculation

This function takes the values measured over a period of up to 90 s and displays them in the form of a graph. Start and End control the process, Continue extends the procedure by an additional extended measurement. → switches to other measuring channels. End in this window closes the graph.

Measuring and printing degree of turbulence

If the 0628 0009 probe is connected it is possible to calculate the degree of turbulence for the velocity value in accordance with DIN EN 13779.

Allocate **Turb.** to one of the function buttons.

Similar to all other thermal probes the 0628.0009 probe is pressure-compensated in testo 400. For this reason set the current absolute pressure in the main menu under Special - Parameter. Alternatively the absolute altitude is sufficient in most cases. The standard value of 1013 or 0 mbar can be input in the case of barometric pressure and differential pressure.

Select the location and activate the printer.

Once the **Turb.** function button is pressed calculation of the degree of turbulence is started. The whole process takes 180 s. The degree of turbulence is shown in % based on the following formula:

$$\text{Turb} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\upsilon_i - \overline{\upsilon})^2}}{\overline{\upsilon}} \times 100$$

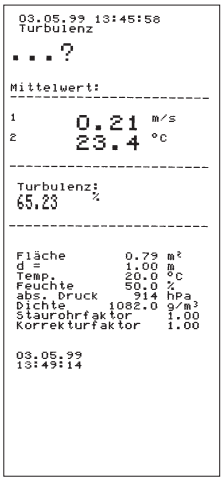
Continue and **Start** start a new measuring cycle.

End measures the degree of turbulence before the 180 s have elapsed.

End pressed while the results are displayed leads back to standard measuring.

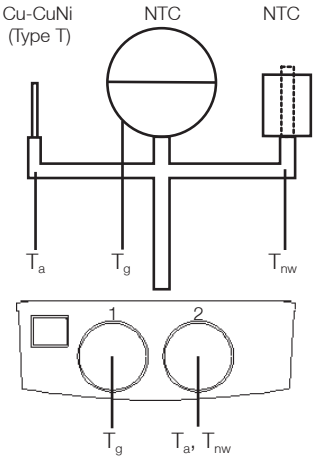
In the case of protocols saved in the memory, the degree of turbulence is found under **Info**.

Press the button while the results are being displayed and you will receive a printout of your measurement.



The WBGT (Wet Bulb Globe Temperature) climate index is determined using the WBGT probe in accordance with DIN 33403 and ISO 7243. The WBGT index is used to determine the maximum permissible exposure time at high-temperature workplaces (e.g. steel industry, foundries, glass industry or blast furnaces).

3 different temperatures have to be measured to calculate WBGT:
- Radiation temperature T_g
- Ambient temperature T_a
- Humidity temperature T_{nw} (temperature of a naturally ventilated psychrometer)

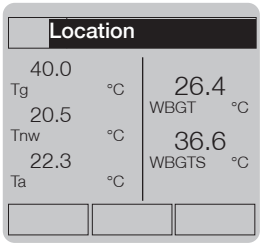


Note: Ensure that the water container to measure humidity temperature is sufficiently filled.

To carry out the measurement, connect the following:
Socket 1: Connection cable of globe thermometer (T_g)
Socket 2: Connection cable of ambient and humidity temperature probe (T_a, T_{nw})

Ensure that the specified instrument and cable temperatures are not exceeded. You should work with extension cables, particularly in the case of high radiation temperatures.

Switch on instrument: WBGT appears in the display



Calculate using the following formulae:

$WBGT = 0.7 \times T_{nw} + 0.3 \times T_g$

$WBGTS = 0.7 \times T_{nw} + 0.2 \times T_g + 0.1 \times T_a$
(with influence of solar radiation)

Downloading using testo Comsoft software
Duct assignment is as follows:

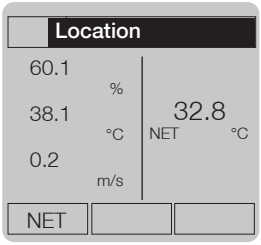
Duct:	K:1	K:2	K:3	K:4	K:5
Unit:	°C	°C	°C	°C	°C
Assignment:	T_g	T_{nw}	T_a	WBGT	WBGTS

The NET (Normal Effective Temperature) climate index is determined using the 3 function probe in accordance with DIN 33403. NET is used, for example, in the basic principles of the Professional Association for High-Temperature Work (G30), to assess the maximum time which can be spent working in extreme conditions (e.g. steel industry, foundries).
The following ambient variables are included in the calculation:
- Air temperature
- Air moisture
- Air flow

Connect the following to carry out the measurement:
Socket 1: 3 function probe (0635.1540)
Socket 2: **Do not connect probe!**

Switch on instrument.
Allocate “NET” to one of the function buttons.
Press “NET” to start measurement.

NET is shown in the display:



Generally, the following data applies to NET measurement:
Ambient temperature: 15-50°C
NET range: 5-37°C

Downloading using testo Comsoft software
Duct assignment is as follows:

Duct:	K:1	K:2	K:3	K:4
Unit:	%	°C	m/s	°C
Assignment:	Air moisture	Air temp.	Air flow	NET

Pressure measurement

Once a pressure probe has been connected and the measuring instrument has been switched on the pressure value is displayed with the unit set in the measuring instrument.

The display depends on the position of the pressure probe. Therefore the probe should be put into position before the measurement and initialise the display via the “hPa=0” function button (assignment of function buttons → Page 12).

→ **Changing the pressure unit:**

 , go to Main menu under **INSTRUMENT - UNITS - Pressure.** The following can be selected: hPa, inch water column, mbar, Pa, bar, psi and mm water column.

If the probe´s measuring range and unit are badly combined, the display can fluctuate to an extreme degree (e.g. 100 hPa probe and Pa unit with 0.01 resolution).

If the readings fluctuate to an extreme degree a smoothing of the values measured is recommended. Smoothing is activated under **PROBE - SMOOTH**, each separately for the two probe sockets. The number in the display stands for the level of smoothing, the middle function button contains the corresponding unit (this can be changed via the middle function button). For example “n =2 ... 10” stands for a sliding mean calculation of up to 10 measuring cycles. “sec = 2..10” stands for a sliding mean calculation of up to 10 seconds. “Off = 1” means original values, smoothing is deactivated.

rpm measurement

Using the 0640.0340 probe you can measure the rpm of shafts and rotating parts. The caliper is in the form of a mechanical sensor (cone) on the rotation axis. The running wheels show the rotational speed of the surface point in m/s or ft/min (Note! The unit shown is still rpm!)

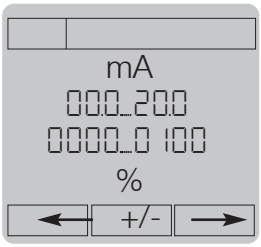
Note on running wheel:

Display in rpm. The displayed value corresponds to speed in mm/sec.

Example:
1000 rpm is displayed. This value is equal to a speed of 1000 mm/sec (1 m/s).

Current and voltage can be measured with the 0554.0007 probe.
Note! If 2 probes are connected the signals must refer to the same reference potential. A difference in potential is not permitted.
A different physical variable can be allocated to these signals in the main menu under **PROBE** - **SCALING** (See selection list). A separate configuration is possible for both probe connection sockets.

Scaling occurs once the channel and unit (confirm with OK) have been selected:
e.g.: 0 to 20 mA should later correspond to 0 to 100 %RH in the display.



The right and left function buttons select the values, ◁ or ▷ positions the cursor on the digit required, the digit is changed with △ and ▽. The middle function button changes the previous character. Scaling is confirmed by pressing OK.

Number of digits after decimal point:
None / one / two, can be set via function button "0-->0,0".

i
Function buttons

Barometric measurement

Barometric pressure has a yearly average of 1013 mbar above sea level. Depending on the current weather, this pressure can deviate by approx. ±20 mbar from the annual mean (high pressure and low pressure area).
Barometric pressure can be measured, saved and documented (on PC or as a printout on site) using the **testo 400** or **testo 650** measuring instrument together with the absolute pressure probe (Part no. 0638.1645).
Connect absolute pressure probe (part no. 0638.1645) to measuring instrument and switch on. The measuring instrument displays the current absolute pressure measured at your elevation (unit: hPa).
To attain the prevailing barometric pressure calculated above sea level, the following must be carried out:
1. Enter the elevation in metres above mean sea level in **SPECIAL-PARAMETER-Metres amsl**.
2. Allocate one of the 3 function buttons with the function BaromP (= barometric measurement).
3. Press BaromP function button.
The measuring instrument now displays barometric pressure (unit: hPaB).
To return to absolute pressure measurement, allocate one of the 3 function buttons with AbsP and confirm.

You can adjust the displayed value to a known reference value in **PROBE-ADJUST**. The adjustment results in a system accuracy of ±1 hPa for barometric pressure measurement in the reference value range. You can call your local weather station, for example, for the reference value.

Adjustment:
Use probe connection socket **1** for the adjustment!
Switch on instrument and wait until the measurement menu appears.
Press OK button.
Select “Probe” - “Adjust”
Enter reference value with the help of the arrow buttons.
Confirm with OK button.
Adjustment is reset via “Probe” - “Reset”.

Leak detection probe

Using the leak protection probe explosive and combustible gases and in particular natural and liquefied petroleum gas can be detected in the air, even in small concentrations e.g. it can be used to detect leaks in gas pipelines, containers or instruments.

The leak detection probe and measuring instrument should not be used in closed rooms or systems in which an explosive mixture of gases has developed. The use of other electrical instruments is not permitted.

Ensure that the concentration of gas does not exceed 20 % of the lower explosion limit of gas mixtures.

It is not possible to work with other probes simultaneously when operating the leak protection probe.

Duration of measurement with leak detection probe when batteries are fully recharged: max. 2 hours.

Remove leak detection probe immediately once the measurement is complete.

Never leave a leak detection probe plugged in when recharging a battery.

Procedure:

- Connect leak detection probe before switching on the measuring instrument.
- When the instrument is switched on the warm-up phase of the leak detection probe is started (approx. 10 seconds). Green LED, continuous tone.
- Ready to operate: Green LED is permanently on, continuous tone no longer sounds.
- Searching for leaks:
  - audible acoustic signal (ticking) if gas is flowing out, ticking becomes faster as the concentration increases.
  - if the 1st limit is exceeded (> 200 ppm) the yellow LED lights up.
  - if the 2nd limit is exceeded (> 1%) the red LED lights up, continuous tone

No further probe readings are shown in the display.

CO/CO_2 measurement

CO measurement

The connected 0632 1247 probe is initialised in the switch-on phase. For this reason the measuring instrument should only be switched on in a CO-free environment, otherwise the values subsequently measured may be too low!
For further initialisation in a switched on instrument, place the probe in a CO-free environment. Allocate one of the function buttons with CO=0 and then press this function.

Ambient CO measurement

Connect the probe before switching on the instrument.
The protective cap should be closed during the initialisation phase (otherwise the measurements may be incorrect).
The protection cap should only be opened for the duration of the measurement, close cap straight after measurement (mechanical protection of sensor and adherence to accuracies).
Cigarette smoke influences the measurement (min. 50 ppm).
A smoker´s breath influences the measurement by approx. 5 ppm).

Switch-on - Initialisation - Zeroising phase (60 s). The CO sniffer is zeroised during the zeroising phase.
- Open protective cap.
- Attach probe to shirt pocket for example. The direction from which the gas flows on the probe influences the accuracy of the measurement. Optimum measured results are reached by moving the probe gently back and forth. Frontal flow on the sensor leads to inaccurate readings.
- Close protective cap.

CO_2 measurement

The 0632.1240 probe measures concentrations from 0 to 1 vol % CO_2. The unit can be switched to ppm in the main menu under **INSTRUMENT - UNITS - Gas**.
The measuring principle is based on infrared absorption. Due to its sensors, the probe has a relatively high power consumption. Use mains unit and rechargeable batteries for long-term measurements.
Note! The correct reading appears after the instrument is switched on following a warm-up phase of 1 to 2 minutes.
If there are large changes in the concentrations, the probe will need 30 to 60 s in order to adapt to conditions. The adaptation time can be reduced by swaying the probe gently back and forth.

Keep the probe as far away as possible from your body in order to avoid the influence of the CO_2 in your breath.

The CO_2 value depends on the absolute air pressure. This effect is compensated in the instrument. Enter the correct absolute pressure of the measurement location in the main menu under **SPECIAL - PARAMETER** (refer to barometric measurement on page 43). The CO2 value is automatically compensated according to the specified absolute pressure.

i
Absolute pressure

Power supply

The instruments in the testo 400 series can be operated using the following:

- **4 standard batteries** (Type: Al/Mn round cell) incl. 1 Li button cell to store RAM data when changing batteries - parallel power supply via mains unit is also possible without damaging batteries.
- **4 standard rechargeabe batteries** (Type: round cell) incl. Li button cell - a mains unit can also be connected simultaneously. It is not possible to recharge the batteries in the instrument.
- **2 quickly rechargeable Testo battery rods** incl. Li button cell - the battery rods can be recharged via the mains unit in the instrument. Mains operation with empty rechargeable batteries is possible. ***It is normal that the mains unit heats up. It is protected from overheating by a thermal protection switch.***
- Power supplied solely via mains unit (without batteries/rechargeable batteries) is not recommended because if the power supply breaks down or the mains plug is pulled out during measurement, undefined switching modes for the instrument processor may occur.

The level of charge or battery quality can be queried in the main menu under **INSTRUMENT** - **POWER**:

Display when batteries/rechargeables are full: 6.0 to 6.4 V
First message if battery is getting low (symbol at top left): 4,8 V
The instrument switches off at 4.5 V. To recharge batteries: connect mains unit and switch off the instrument. The charging time is approx. 4 h. The "-C" symbol at the top left stands for the connected mains unit.

If the rechargeable batteries are totally discharged, it is possible that they may not be recognised and therefore not charged. If this happens, press the following button combination provided a mains unit is connected and the instrument is switched off ("Power" appears in the header): Press △ and ▽ simultaneously. Start up the instrument again after approx. 1 min. "Quick recharge" appears at the top of the display.

Ensure there are rechargeable batteries in the instrument, do not activate the charging current when the batteries are in place.

The following service lives result:

Instrument configuration	**Service life with 700 mAh rech. batt.**	**Service life with 2300 mAh battery**
testo 400 + 2 T/C probes	13 h	42 h
testo 400 + 100 mbar pressure probe	13 h	42 h
testo 400 + CO2 probe	3 h	>7 h
testo 400 + 3-function probe*	3 at 4 h at max. 5 m/s	
testo 400 + 2 3-function probes*	1.6 h at. 2 to 3 m/s	

Buffer capacity of Li button cell with empty batteries/rechargeable batteries: 20 to 27 days.
Power consumption of instrument (without probe) when measuring: approx. 40 mA.
Service life is at least halved if equipped with additional display illumination (approx. 60 mA).

* Thermal measurement in 3 function probes can be switched off in order to extend the lifetime.

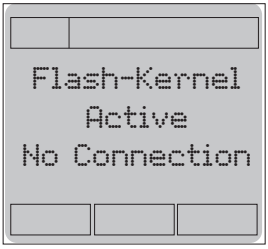
Notes: The given times refer to batteries/rechargeables with the capacities mentioned opposite. This standard data is supplied by the manufacturers. The values are subject to fabrication spreads - the storage times and storage temperatures also play a role.

Rechargeable batteries have to be charged and discharged regularly in order to retain their rated capacity. After not using the almost empty batteries they will only have a fraction of their capacity available..

If the system has not been used for a longer period of time (e.g. more than 4 weeks) remove all the batteries/rechargeable batteries from the instrument. Rechargeable batteries should be stored in a charged condition separately.

Update on disk

testo 650 and **testo 950** can be upgraded to have the full functions of **testo 400.** We will gradually introduce branch-specific and user-specific software updates for the instruments.
Please ask your Testo service department or Testo dealer.
A simple instrument update e. g. firmware V1.20 to V1.21 can be performed by you.
Remove the lithium battery, batteries/rechargeable batteries and mains unit from the measuring instrument. Reconnect the mains unit. At the same time keep the ▽ button on the instrument pressed. The following message appears :



Connect your measuring instrument with an interface lead to your PC. Place the disk in disk drive A:. Change to DOS input command (C:\). Type “A:\ <Enter> and then “Update” <Enter>.

All you have to do now is select the interface to which your Testo instrument is connected. A progress bar indicates how far the update is...

Once the update has been installed successfully, switch off the instrument and replace the batteries/rechargeable batteries.

Measuring data

Temperature

Pt100: measuring range		**-200 to +800 °C**
Resolution	- 99.9 to 300 °C:	0.01 °C
	Remaining range:	0.1 °C
Accuracy*		±0.1 °C (-49.9 to +99.9 °C)
		±0,1 °C + 0,1% of mv. (rem. range)
NiCr-Ni: measuring range		**-200 to +1370 °C**
Resolution		0.1 °C
Accuracy*		±0,3 °C + 0,1% of mv. (-200...+1370 °C)
PtRh-Pt: measuring range		**0 to +1760 °C**
Resolution		1 °C
Accuracy		±1.0 °C
FeCu-Ni: measuring range		-200 to +1000 °C
Resolution		0.1 °C
Accuracy*		±0.4 °C (-150 to +150 °C)
		±1 °C (rem. range)
Cu-CuNi: measuring range		**-40 to +350 °C**
(Type T) Resolution		0.1 °C
Accuracy*		±0.3 °C + 0,1% of mv.
NTC: measuring range		**-40 to 150 °C**
Resolution		0.1 °C
Accuracy*		±0.2 °C (-10 to 50 °C)
		±0.4 °C (rem. range)

Humidity measurement

Measuring range	**0 to 100 %RH**
Resolution	0.1 %RH
Accuracy*	See probe data

Pressure measurement

Measuring range	Resolution	Accuracy
±100 hPa	0.01 hPa	±0.1 hPa
±10 hPa	0.001 hPa	±0.01 hPa
2000 hPa	1 hPa	±2 hPa
10 bar	0.01 bar	±0.2 % of E type
30 bar	0.01 bar	±0.2 % of E type

*Accuracy ±1 Digit

*The accuracies refer to an ambient temperature of 0 to+30 °C.

rpm measurement

Measuring range:	**20 to 20 000 rpm**
Resolution:	1 rpm
Accuracy*	±1 digit

Velocity measurement

Vane probe: measuring range	**0 to 60 m/s**
Resolution for ø 60/100 mm	0.01 m/s
Resolution for remaining probes	0.1 m/s
Accuracy*	See probe data
Therm. probes.: measuring range	**0 to 20 m/s**
Resolution	0.01 m/s
Accuracy*	±0.01 m/s (0 to 1.99 m/s)
	±0.02 m/s (2 to 4.9 m/s)
	±0.04 m/s (5 to 20 m/s)

Current/voltage measurement

(with current/voltage cable 0554.0007)

Measuring range:	**0 to 20 mA**
Resolution:	0.01 mA
Accuracy*	±0.04 mA
Measuring range:	**0 to ±10 V**
Resolution:	0.01 V
Accuracy*	±0.01 V
Measuring range:	**0 to ±1 V**
Resolution:	1 mV
Accuracy*	±1 mV

Memory space	500 000 measured values
Power supply	ı AlMn LR06 battery/ rechargeable battery (type: round cell) ı or via 8 V mains unit
Battery lifetime	Cont. operation w. 2 T/C probes: 18 h
Operating temp.	0 to +50 °C (short-term 0 to +60°C)
Storage/transport temperature	-25 to +60 °C
Connection	DIN 8 pin plug
Weight	500 g (incl. rechargeable battery)
Other features	ı Automatic recognition of all connected probes ı Housing material: ABS

Attachable printer/ Testo printer CO/CO_2 probe/testo 400 Comfort software module

Attachable printer 0554.0570

Printer type	Infrared controlled thermal printer
Receiving radius	max. 1 m
Operating temperature	0 to +50 °C
Storage/transport temperature	-40 to +60 °C
Dimensions	115 x 78 x 77 mm
Weight	0.36 kg (incl. batteries)
Power supply	4 round cell batteries 1.5 V or NC rechargeable batteries

Testo printer 0554.0545

Printer type	infrared controlled thermal printer
Operating temperature	0 to +50 °C
Storage/transport temperature	-40 to +60 °C
Dimensions	150 x 88 x 50 mm
Weight	0.33 kg (incl. batteries)
Power supply	4 AA batteries 1.5 V or NC rechargeable batteries
Accessories	Spare paper, Part no. 0554.0569

CO/CO_2 probe

Measuring range CO_2	**0 to 1 vol% = 0 to 10,000 ppm**
Measuring range CO	**0 to 500 ppm**
Accuracy	See probe data
t_{90} with CO_2	ı 60 seconds
t_{90} with CO	Approx. 30 s
Max. operating temperature	+0 to +40 °C
Max. storage temperature	-20 to +50 °C
Warm-up time after switch-on	Approx. 1 minute
Max. operating pressure	800 to 1100 mbar (absolute pressure)
Factory calibration	Standardised at 1013 mbar (abs. alt.) and 25 ° C

testo 400 Comfort software module
Graphic data management in the modern user environment Windows. All of the instrument configurations can be activated via PC.

Functions	ı Convenient zoom functions ı Mathematical smoothing function ı Statistical calculation functions (average, variance...) ı Measurement location management in the PC ı Prints location labels (with barcode) ı Learning function for quick temp. extrapolation t_{90}-fast
Multi-window technology	Shows and analyses several data in different windows
Printing measured data	in the form of tables or graphs
Prerequisites	ı PC with operating system ı Microsoft Windows 98 or newer (if compatible) ı Microsoft Windows NT 4, Service pack 4, or newer (if compatible). ı Windows 2000 or newer (if compatible).
Other features	ı Mouse operation ı Colour overlays ı Freely selectable limit values

Warranty

Instrument	3 years
Probes	1 year

Measuring instruments, accessories

	Description	Part no.
Meas. instr.	**testo 950** temperature measuring instrument incl. batteries and Instruction manual	0563.9501
	testo 650 humidity measuring instrument incl. batteries and instruction manual	0563.6501
	testo 400 multi-function measuring instrument incl. batteries and Instruction manual	0563.4001
	Mass storage extension to 500,000 measured values	0554.9481
Software	Humidity/pressure module (upgrades 950 to 650)	0450.4002
	Velocity module (upgrades 650 to 400)	0450.4003
	Humidity/pressure/velocity module (upgrades 950 to 400)	0450.4004
	Please specify in which language the upgrade is required:	
	German	0450.9901
	English	0450.9902
	Comfort software 3	0554.0830
	Module update/Upgrade	On request
Accessories	Attachable printer	0554.0570
	Testo printer	0554 0545
	Printer paper for attachable printer/ desktop printer (6 rolls)X	0554.0569
	Barcode pen	0554.0460
	Barcode labels (300 off)	0554.0411
	Mains unit for instrument (European plug)	0554.0054
	Rechargeable set for instrument, selected for quick recharging	0554.0196
	Rechargeable set for printer with recharger	0554.0110
	SoftCase for testo 400/650/950	0516 0401
	SoftCase for attachable printer	0516.0411
	Instrument case, plastic for instrument/printer and 1 probe	0516.0300
	System case, plastic for instrument, probes and additional accessories	0516.0400
	System case, aluminium for instrument, probes and additional accessories	0516.0410
	Adhesive pockets for paper barcode labels	0554.0116
	RS232 cable to connect measuring instrument ↔ PC for data transfer	0409.0154
	Electrical isolation for RS 232 (Instrument ↔ PC)	0554.0006
	Li cell to store RAM data	0515.0028

NiCr–Ni surface probes for testo 950, 650, 400	Meas. range/Accuracy	t_{99} s	Connection cable	Part no.
Quick action surface probe with sprung thermocouple band Rated length = 150 m Probe tip Ø 10 mm	–200 to +300 °C short–term to +500 °C Class 2	3	Plug–in head Please order connection cable (Page 61)	**0604.0194** ***0614.0194****
Quick action surface probe with sprung thermocouple band Probe tip: bent at 90° angle Rated length = 49 mm, probe tip: Ø 10 mm	–200 to +300 °C Short–term to +500 °C Class 2	3		**0604.0994** ***0614.0994****
Robust surface probe, straight Rated length = 150 mm, probe tip: Ø4 mm	–200 to +600 °C Class 1	25		**0604.9993** ***0614.9993****
Robust surface probe, bent at 90°, for inaccessible places Rated length = 130 mm, probe tip: Ø 4 mm	–200 to +600 °C Class 1	25		**0604.9893** ***0614.9893****
Robust probe with sprung thermocouple band Rated length = 200 mm, probe tip: Ø 15 mm	–200 to +700 °C Class 2	3	PUR coiled cable	**0600.0394**
Pipe clamp probes for pipes with diameter of 2ý Spare measuring head	–60 to +130 °C Class 2	5	1.5 m PVC	**0600.4593** **0602.0092**
Magnetic probe for measurements on metal surfaces a) Adhesive force: approx. 20 N b) For higher temperatures, adhesive force: approx. 10 N	Class 2 –50 to +170 °C –50 to +400 °C		L =1.5 m Silicone Fibre glass	**0600.4793** **0600.4893**
Flat head probe with telescope (215 to 660 mm) for quick measurements at inaccessible points, measuring head: Ø 25mm, height: 12 mm	–50 to +250 °C Class 2	<3	1.8 m PVC	**0600.2394**
Miniature probe for measurements on electronic components, small motors…; rated length = 100 mm, probe tip: Ø 5 mm	–50 to +400 °C (short–term to +500 °C), Class 2	3	1.5 m PVC	**0600.1494**
Roller probe for surface meaurements on rollers and rotating drums, max. circumferential velocity 18 to 400 m/min, rated length = 274 mm, probe tip: Ø 33 mm	–50 to +240 °C Class 2		PUR coiled cable	**0600.5093**

Cu–CuNi probe for testo 950, 650, 400	–40 to +350°C Class 1			**On request**

NTC probe for testo 950, 650, 400				
Highly accurate probe for air and gas temperature measurements with bare, mechanically protected sensor	–40 to +130 °C to UNI–Kurve	60	PUR coiled cable	**0610.9714**

Pt100 surface probes for testo 950, 650, 400				
Robust surface probe Rated length = 150 mm, Ø of probe tip: 9 mm	–50 to +400 °C, Class B	40	Plug–in head Please order connection cable (p.61)	**0604.9973** ***0628.0018****
Velcro probe for pipes with max. Ø of 100 mm	–50 to +150 °C, Class B	40	1.6 m, PTEE ribbon cable	**0628.0019**

*** with EEPROM: • Measuring range limits are stored in the probe**
• Adjustment possible at 1 measuring point • Surface correction in surface probe can be adapted to measuring task

NiCr–Ni immersion/penetration probes for testo 950, 650, 400	Meas. range/Accuracy	t_{99} s	Connection cable	Part no.
Quick-action immersion/penetration probe Rated length = 150 mm, probe tip: Ø 3 mm	–200 to +400 °C Class 1	3	Plug–in head Please order connection cable (p. 61)	**0604.0293** ***0614.0293****
Super quick-action immersion/penetration probe for meas. in liquids; rated length = 150 mm, probe top: Ø 1.5 mm	–200 to +600 °C Class 1	1		**0604.0493** ***0614.0493****
Super quick-action immersion/penetration probe for high temperatures, rated length = 470 mm, probe tip: Ø 1.5 mm	–200 +1100 °C Class 1	1		**0604.0593** ***0614.0593****
Super quick-action immersion/penetration probe for measurements in gases and liquids with a thin tip low in mass; rated length = 150 mm, probe tip: Ø 0.5 mm	–200 to +600 °C Class 1	< 1		**0604.9794** ***0614.9794****
Robust immersion/penetration probe made of V4A steel, water-tight and oven-proof, e.g. for the food sector; rated length = 150 mm, probe tip: Ø 3 mm	–200 to +400 °C Class 1	3	1.5 m Silicone	**0600.2593**
Smelting probe for measurements in non-ferrous meltingbaths with exchangeable bent measuring tips. Lifetime of measuring tip: up to 500 measurements in aluminium melting baths	–200 to +1250 °C Class 1	60	1.5 m PVC	**0600.5993**
Spare measuring tip				**0363.1712**
Plug-in measuring tips for high temperatures, bendable. Please also order handle (see below).	All Class 1			
a)Outer casing: stainless steel 1.4541	–200 to +900 °C	3,5		**0600.5393**
b)Outer casing: stainless steel 1.4541	–200 to +900 °C	3,5		**0600.5493**
c)Outer casing: Inconel 2.4816	–200 to +1100°C	3,5		**0600.5793**
d)Outer casing: Inconel 2.4816	–200 to +1100°C	3,5		**0600.5893**
Handle for plug–in measuring tips			PUR coiled cable	**0600.5593**

Pt100 air probes for testo 950. 650, 400				
Standard air probe Rated length = 150 mm, Ø probe tip: 9 mm	–200 to +600 °C Class A	75	Plug–in head please order connection cable (p. 61)	**0604.9773**
Precision air probe Rated length = 150 mm, Ø probe tip 9 mm	–100 to +400 °C 1/10 Class B**	75	Plug–in head please order connection cable (p. 61)	***0628.0017****

**** 1/10 Class B (0 to +100 °C)**
1/5 Class B (rem. range)
to DIN IEC 751

*** with EEPROM: • Measuring range limits are stored in the probe**
• Adjustment possible at 1 measuring point • Surface correction in surface probe can be adapted to measuring task

Pt100 immersion/penetration probes for testo 950, 650, 400	Meas. range/Accuracy	t_{99} s	Connection cable	Part no.
Standard immersion/penetration probe Rated length = 200 mm, Ø probe tip: 3 mm	–200 to +400 °C Class A	20	Plug–in head please order connection cable (p. 61)	**0604.0273**
Precision immersion/penetration probe Rated length = 200 mm, Ø probe tip 3 mm	–100 to +400 °C 1/10 Class B**	30	Plug–in head please order connection cable (p. 61)	***0628.0015****
Protective glass for immersion/pen. probe 0604.0273 and 0628.0015				**0554.7072**
Flexible precision immersion probe Rated length = 1000 mm,	–100 to +400 °C 1/10 Class B**	80 in Wasser	Plug–in head please order connection cable (p. 61)	***0628.0016****
Robust probe with sharpened measuring tip, water-proof and oven-proof Rated length = 150 mm, Ø probe tip 3 mm	–200 to +600 °C Class A	30	1.5 m silicone	**0604.2573**

NiCr–Ni thermocouples for testo 950, 650, 400				
T/C made of fibre glass insulated thermal pipes Insulation: twin conductor, flat, oval, opposed and covered with fibre glass, both conductors are wrapped together with glass fibre and soaked with lacquer; wire: Ø 0.2 mm; outer: Ø 1 x 0.8 mm	Highest temp. +400 °C		Please order adapter 0600.1693	**0644.1109** Pack of 5
Adhesive thermocouple, base material: aluminium foil Is fixed at the measuring point using conventional adhesives or silicone heat paste, Part no. 0554.0004, Ø extension 2 x 0.2 mm, thickness 0.1 mm	Highest temp. +200 °C		Please order adapter 0600.1693	**0644.1607** Packung à 2 Stk.
Adapter to connect NiCr-Ni thermocouples and probes with open wire ends			0.3 m PVC	**0600.1693**

Other temperature probes for testo 950, 650, 400				
Globe thermometer to measure radiant heat, NTC sensor, Ø ball: approx. 150 mm Corresponds to following requirements: ISO 7243, ISO 7726, DIN EN 27726, DIN 33403.	0 to +120 °C ± 0.5 °C (0 to 50 °C) ± 1 °C (50 to 120 °C)		1.5 m	**0554.0670**
Infrared probe for non-contact temperature measurement on live, inaccessible and rotating parts	–18 to +260 °C	2	PUR coiled cable	**0600.0750**

Accessories for temperature probes				
Silicone heat paste (14g), Tmax = +260 °C				**0554.0004**

**** 1/10 Class B (0 to +100 °C)**
1/5 Class B (remaining range)
to DIN IEC 751

*** With EEPROM: • Measuring range limits are stored in the probe**
• Adjustment at 1 measuring point • Surface correction in surface probe can be adapted to measuring task

Add. probes for testo 950, 650, 400	Meas. range	Accuracy *	t_{99} s	Connection cable	Part no.
CO probe	0 to 500 ppm	±5 ppm (0 to 100 ppm) ±5 % of m.v. (rem. range)			**0632.1247**
CO_2 probe	0 to 1 vol. % CO_2 0 to 10,000 ppm CO_2	50 ppm ±2% of m.v. (0 to 5000 ppm) 100 ppm ±3% of m.v. (rem. range)			**0632.1240**
Leak detection probe					
Mechanical rpm probe with plug-in head.	20 to 20.000 rpm 0.33 to 333 Hz	±1 digit		Please order connection cable (p. 61)	**0640.0340**
Current/voltage cable (±1 V, ±10 V, 20 mA)	0 to 20mA/4 20mA 0 ± 1V/0 ± 10V	± 0.04 mA ± 0.001 V / ± 0.01 V			**0554.0007**
4...20mA-Interface for connection and intermittent power to transmitters	0/4...20mA	±0,04 mA		Plug–in head. Connection cable 0430 0143 or 0430 0145 requiredh	**0554.0528**

Humidity/temperature probes for air conditioning and ventilation sector for testo 650, 400					
Standard room conditions probe for measurements up to +70 °C Ø 12 mm (probe tip)	0 to 100 % RH (probe tip) –20 to +70 °C	± 2 % RH (2 to 98 % RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<12 at 2 m/s	Plug–in head Please order connection cable (p.61)	**0636.9740**
Duct humidity/temperature probe, telescopic extension can be connected, Ø12 mm	0 to 100 %RH (probe tip) –20 to +70 °C	± 2 %RH (2 to 98 % RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<12 at 2 m/s	3 m PUR	**0636.9715**
Telescope, length: 340 - 800 mm					**0430.9715**
Highly accurate reference humidity/temperature probe, Ø 21 mm	0 to 100 %RH (probe tip) –20 to +70 °C	± 1 % RH (2 to 98 % RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<12 at 2 m/s	Plug–in head Please order connection cable (p.61)	**0636.9741**
Flexible humidity probe with mini module for measurements, e.g. on material test rigs. Length of module cable: 1500 mm	0 to 100 %RH –20 to +125 °C	± 2 % RH (2 to 98 % RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	20	Plug–in head Please order connection cable (p.61)	**0628.0013**
Thin humidity probe incl. 4 plug-on protective caps for room climate measurements, measurements in exhaust air ducts and equilibrium moisture measurements.	0 to100 %RH –20 to +70 °C	±2 %RH (2 to 98%RH) ±0,4 °C (–10 to 50°C) ±0,5 °C (rem. range)	<15	Plug–in head Please order connection cable (p.61)	**0636.2130**

*** Accuracy data at rated temperature of +25 °C,**
Temperature coefficient: ±0.03 % / °C

Humidity/temperature probes for tough industrial applications for testo 650, 400					
	Measuring range	**Accuracy ***	**t_{99} s.**	**Connection cable**	**Part no.**
Sword probe for humidity/temperature measurement in stacked goods, rated length: 320 mm	0 to 100 %RH (probe tip) –20 to +70 °C	±2 %RH (2 to 98 %RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<12 at 2 m/s	Plug–in head please order connection cable (p. 61)	**0636.0340**
Robust humidity probe e.g. for measuring material compensation humidity or for measurements in extraction ducts, rated length: 300 mm, Ø 12 mm	0 to 100 %RH –20 to +120 °C	±2 %RH (2 to 98 %RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<30 at 2 m/s	Plug–in head please order connection cable (p. 61)	**0636.2140**
Robust high temp. probe for meas. up to +180 °C, rated length: 300 mm, Ø 12 mm	0 to 100 %RH –20 to +180 °C	±2 %RH (2 to 98 %RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<30 at 2 m/s	Plug–in head please order connection cable (p. 61)	**0628.0021**
Flexible humidity probe for measurements at inaccessible points.	0 to 100 %RH –20 to +180 °C	±2 %RH (2 to 98 %RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<30 at 2 m/s	Plug–in head please order connection cable (p. 61)	**0628.0022**
Standard pressure dew point probe for measurements in compressed air systems	0 to 100 %RH –30 to +50 °C t_{pd}	Pressure dew point meas. at rated temp. +25°C: ± 0.9 to >4 °C t_{pd} (5 to 40 °C)	1 to 5 min typically 2 min	Plug–in head please order connection cable (p. 61)	**0636.9840**
Precision dew point probe for measurements in compressed air systems	0 to 100 %RH –60 to +50 °C t_{pd}	Pressure dew point meas. at rated temp. +25°C: ± 0.8 to 4 °C t_{pd} (5 to 40 °C)	1 to 5 min typically 2 min	Plug–in head please order connection cable (p. 61)	**0636.9841**
Flexible humidity probe for measurements at inaccessible points	0 to 100 %RH –20 to +140 °C	±2 %RH (2 to 98 %RH) ± 0.4 °C (0 to 50 °C) ± 0.5 °C (rem. range)	<30 at 2 m/s	Plug–in head please order connection cable (p. 61)	**0628.0014**
Material moisture sensor		free scaling compasing measurement no water content			**0636.0365**
Material building moisture cable	0 to 100 KΩ = 100 to 0 %	100 to 66 wet ↓ 0 to 1 very dry			**0636.0565**

*** Accuracy data at rated temperature of +25 °C, Temperature coefficient: ± 0.03 % / °C**

Caps for all humidity probe types Ø 12 and 21 mm	Connection cable	Part no.
Metal protection cage, material: stainless steel V4A. Quick adjustment time, robust and temperature–proof. Application: for measuring air velocity <10 m/s.	Ø 21 mm Ø 12 mm	0554.0665 0554.0755
Wire mesh filter, material: stainless steel V4A. Quick adjustment time, protected from dirt and damage. Applications: meteorology, splashwater, condensation. **Insertable filter for metal protection cage and plastic cage.**	Ø 21 mm	0554.0667
Cap with wire mesh filter	Ø 12 mm	0554.0757
Teflon sintered filter, material: PTFE. Not affected by condensation, water–repellent, resistant to corrosive substances. Applications: compressed air measurements, **high humidity range** (continuous measurements), high velocities.	Ø 21 mm Ø 12 mm	0554.0666 0554.0756
Stainless steel sintered cap, material: stainless steel V2A. Highly robust, suitable for plunging, should be cleaned with compressed air, mechanical protection of sensor. Applications: large mechanical loads, high velocities.	Ø 21 mm Ø 12 mm	0554.0640 0554.0647
Surface adapter for humidity probe, Ø 12 mm		0628.0012

Accessories for humidity/temperature probe, 3–function probe and rpm probe	Part no.
Adapter for humidity probe 0636.XX60 and Pt100 probe 0605.XX73/XX72	0554.0454
Connection cable for probes with plug–in head, 1.5 m long, PUR coating material	0430.0143
Connection cable for probes with plug–in head, 5 m long, PUR coating material	0430.0145
Extension cable betweem plug–in cable and instrument, 5 m long, PUR coating material	0409.0063
Telecope for probes with plug–in head, can be extended to max. 1 m, cable: 2.5 m, PUR coating material	0430.0144
Control and adjustment set for humidity probe and 3–function probe	0554.0660
Adapter for humidity adjustment of 3–function probe 0635.1545, order with adjustment set	0554.0661
Control and storage humidity (33 %RH) for humidity probe and 3–function probe	0554.0636

Pressure probes for testo 650, 400	**Measuring method**	**Meas. range**	**Accuracy**	**Part no.**
Pressure probe for measuring air velocities and differential pressure	Diff.pressure Diff.pressure	±10 mbar ±100 mbar	± 0.03 mbar ±0.1 mbar (0 to 20 mbar)	**0638.1445** **0638.1545**
or absolute pressure	Absolute pressure	2000 mbar	± 0.5 % of m.v. (rem.) ± 5 mbar	**0638.1645**
Pressure probe, refrigerant–proof stainless steel, screw–in thread 7/16" UNF				
– Low pressure probe to 10 bar	Relative pressure probe	–1…+10 bar	±1% of f.v. Overload 25 bar	**0638.1741**
– High pressure probe to 30bar		–1…+30 bar	±1% of f.v. Overload 120 bar	**0638.1841**
– High pressure probe to 40bar		–1...+40 bar	±1% of f.v. Overload 120 bar	**0638.1941**
– High pressure probe to 100bar		–1...+100 bar	±1% of f.v. Overload 250 bar	**0638.2041**
– High pressure probe to 400bar		–1...+400 bar	±1% of f.v. Overload 600 bar	**0638.2141**
Pressure probe, measures differential pres–sure, in robust metal housing with impact protection, incl. magnet for attachment				
– Precision pressure probe 100Pa	Differential pressure probe	0…+100Pa	±(0.3Pa ±0.5% of mv) (0...+100Pa)	**0638.1347**
		0…+10hPa	±0.03hPa (0...10hPa)	**0638.1447**
– Pressure probe 10hPa		0…+100hPa	±0.5% of mv (+20... +100 hPa) ±0.3hPa (0...+20hPa)	**0638.1547**
– Pressure probe 100hPa				
Pressure probe, measures differential pres–sure, in robust metal housing with impact protection, quick closing coupling (M8 x 0.5), incl. magnet for attachment				
– Pressure probe 1000hPa	Differential pressure probe	0…+1000Pa	±1hPa (0...200hPa) 0.5% of mv (+200... +1000 hPa)	**0638.1647**
– Pressure probe 2000hPa		0…+2000Pa	±2hPa (0...400hPa) 0.5% of mv (+400... +2000 hPa)	**0638.1747**
– Pressure probe 2000hPa	Absolute pressure	0…+2000Pa	±5hPa (0...+2000hPa)	**0638.1847**

Accessories for pressure probes	**Part no.**
Magnetic holder for pressure probes 0638.1445 / 0638.1545 / 0638.1645	**0554.0225**
Connection cable for pressure probes 0638.1740, 0638.1840 and 0638.1940	**0409.0202**

Plug–in velocity probes for testo 400	Measuring range	Accuracy	Part no.
Vane probe, can be attached to handle or telescope Ø 12 mm, -30 to +140 °C*	0.6 to 20 m/s	± 0.2 m/s +2 % of m.v.	**0635.9443**
Vane/temperature probe, can be attached to handle or telescope, Ø 16 mm	0.4 to 60 m/s –30 to +140 °C *	± 0.2 m/s ±1 % of m.v.	**0635.9540**
Vane/temperature probe, can be attached to handle or telescope, Ø 25 mm	0.4 to 40 m/s –30 to +140 °C *	± 0.2 m/s ± 1 % of m.v.	**0635.9640**
Plug–in vane for integrating velocity measurement. Application range: –20 to +60 °C, can be bent by 90°, Ø 60 mm	0.25 to 20 m/s	± 0.1 m/s + 1.5 %of m.v.	**0635.9440**
Plug–in vane for integrating velocity measurement. Application range: –20 to +60 °C, can be bent by 90°, Ø 100 mm	0.2 to 15 m/s	± 0.1 m/s + 1.5 %of m.v.	**0635.9340**
Shell anemometer for meteorological wind measurement. Cable: 3 m.	0.7 to 30 m/s	± 0.3 m/s, ± 5 % of m.v.	**0635.9045**

***** with short–term measurements

Accessories for plug–in vane probes	Connection cable	Part no.
Telescope for plug–in vane probes/ length: max. 1 m/ extension on request/ connection cable for pressure probes 0638.1740 and 0638.1840	2.3 m silicone	**0430.0941**
Handle for plug–in vane probes	DIN round plug 1.5 m silicone	**0430.3545**
Swan neck, flexible connection between measuring probe and connection part		**0430.0001**
Magnetic probe holder for vane probes		**0554.0430**

Velocity probes with handle/telescope for testo 400	Measuring range	Accuracy	Part no.
Low cost, robust heated ball probe for measurements in the lower velocity range. With handle.	0 to 10 m/s –20 to +70 °C	0 to 10 m/s: ± (0.03 m/s + 5 % of m.v.)	**0635.1549** *(see note)*
Robust heated ball probe with handle and telescope (190 – 850 mm) for measurements in the lower velocity range.	0 to 10 m/s –20 to +70 °C	0 to 10 m/s: ± (0.03 m/s +5 % of m.v.)	**0635.1049** *(see note)*
Quick–reaction heated wire probe with telescope (160 – 760 mm) for measurements in the lower velocity range with direction recognition function	0 to 20 m/s –20 to +70 °C	0 to 20 m/s: ± (0.03 m/s +4 % of m.v.)	**0635.1041** *(see note)*
Thermal anemometer Ø 10 mm, with telescopic handle, measures air flow in lab fume cupboards to DIN EN 14175 (draft)	0…5 m/s 0…+50 °C	± (0.03 m/s ±4 % of m.v.) (0…5 m/s)	**0635.1047**
High temperature probe with handle for continuous measurements up to +350 °C / Ø 25 mm	0.6 to 20 m/s –40 to +350 °C	± 0.2 m/s ± 2 % of m.v.	**0635.6045**

Accessories for velocity probes		**Temp. max.**	**Ø**	**Length**	**Part no.**
Pitot tubes (longer versions on request)	a) Stainless steel	+600 °C	7 mm	500 mm	**0635.2045**
	b) Stainless steel	+600 °C	7 mm	350 mm	**0635.2145**
	c) Stainless steel	+600 °C	4 mm	300 mm	**0635.2245**
	d) Stainless steel	+600 °C	7 mm	1000 mm	**0635.2345**
Silicone hose to connect Pitot tube and pressure probe				5 m	**0554.0440**
Volume flow funnel for measuring the extraction power of extraction systems a) Measuring range: 20 to 400 m^3/h; funnel factor 22 b) Measuring range: 20 to 400 m^3/h; funnel factor 22 – In connection with 0635.1041 or 0635.9540.					**0554.0400** **0554.0410**

Additional probes for testo 400	**Measuring range**	**Accuracy**	**Part no.**
3 function probe for simultaneous measurement of temperature, humidity and velocity and for NET measurement. With plug–in head – please order plug–in head (See page 61).	0 to 10 m/s 0 to 100 %RH (probe tip) –20 to +70 °C	See 0635.1549 ± 2 %RH (2 to 98 %RH) ± 0.4 °C (0 to +50 °C) ± 0.5 °C (rem. range)	**0635.1540** *(see note)*
Comfort level probe for measuring turbulence levels, with telescope and stand. Fulfills the requirements of DIN EN 13779 and VDI 2080	0 to 5 m/s 0 to +50 °C	0 to 5 m/s ±(0.03 m/s ± 4 % of m.v.) ± 0.3 °C	**0628.0009** *(see note)*
WBGT probe incl. stand, in aluminium case	Range of application: 0…+100 °C	See sensor data CU–CuNi (Type T)/NTC: Seite 53	**0699.4239**

Note: During m/s calibration, thermal probes are adjusted to the annual mean air pressure of 1013 mbar on sea level.
The pressure dependency of the measurement can be compensated by setting the current absolute pressure in the main menu - SPECIAL - PARAMETER.
In the case of still air (v < 0.5 m/s) the temperature shown in the display increases slightly.

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