WÖHLER

Operation Manual
Moisture Meter for Wood and Building Materials

EN

Wöhler HBF 420

Best.-Nr. 22736 – 2015-03-31

Contents

1 General Information

1.1 Operation Manual Information

This operation manual allows to work safely with the Wöhler HBF 420. Please keep this manual for your information.

The Wöhler HBF 420 should be employed by professionals for its intended use only.

Liability is void for any damages caused by not following this manual.

1.2 Notes

WARNING!
Not following this warning can cause injury or death.

ATTENTION!
Not following this note can cause permanent damage to the device.

NOTE!
Useful information

1.3 Intended Use

Use the meter for the determination of moisture humidity, especially for the following applications:

- Fuel technology: Wood evaluation considering the combustion
- Building diagnostic: Damage analysis, leak indication
- Building work: preparatory measurements before adding coatings, floor coverings etc.

1.4 Components

Device	Components
HBF 420	Meter
	2 replacement needles for resistance measurements
	4 x 1.5 AAA size battery
	Leather bag

1.5 Storage and transport

WARNING!
The sharp tips of the measurement needles at the base of the instrument represent a risk of injury if due care and attention is not exercised.

Always transport and store the meter with the protection cap in the leather bag.

- Store it at a dry place.
- Take the batteries from the meter when not using it for a certain time.

1.6 Safety information

WARNING!
Risk of death by electric shock - do not allow the tips of the measurement needles or the surface probe at the top of the instrument to come into contact with live parts.

WARNING!
Do not use the meter in close proximity to devices that are sensitive to high frequencies (e.g. medical instruments).

1.7 Information on disposal

Electronic equipment does not belong into domestic waste, but must be disposed in accordance with the applicable statutory provisions.

You may hand in any defective batteries taken out of the unit to our company as well as to recycling places of public disposal systems or to selling points of new batteries or storage batteries.

1.8 Direction

Wöhler Messgeräte Kehrgeräte GmbH

Schützenstr. 41

33181 Bad Wünnenberg

Tel.: +49 2953 73-100
Fax: +49 2953 73-250
E-Mail: mgkg@woehler.com

2 Technical Data

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Resistance measurements (wood)

Description	Data
Range	0 to 40% 10 % to 35 % (tested)
Needle length (electrodes)	12 mm
Distance between the needles (electrodes)	25 mm
Correction facility	for 10 groups of wood
Temperature compen-sation	Material temperature
Accuracy, according to VDI Guideline 4206, sheet 4	Currant state: ± 40 % of the refer-ence value (wood) ± 5 % of the value of the test facility Desired status: ± 40 % of the refer-ence value (wood) ± 5 % of the reference value of the test standard

Dielectric measurement

Description	Data
Display	four digits
Penetration depth of the dielectric probe	approx. 3 to 4 cm
Correction facility for the material	20 codes

Features

Description	Data
Alarm	three-colored LEDs (green, yellow, red) adjustable limit values

Other data

Description	Data
Environmental conditi-ons	5 … +40 °C < 90% rh (non con-densing)
Size	165 x 62 x 26 mm
Weight	175 g (without battery)

3 Component Explanation

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3.1 Device

Fig. 1: Overview

Component Explanation

1 Protective cap, top, with contact points for calibration check 25%.

2 Dielectric probe (not visible here)

3 Needles (electrodes) for resistance measurement

4 LC display

5 Three-colored alarm LED

6 Jack connection to the Wöhler Wood Moisture Probe

7 Battery compartment (rear of the instrument)

8 Protective cap, bottom, with contact points for calibration check 18 %.

9 Replacement needles for the resistance measurement (replacement for part 3)

10 Protection for replacement needles

3.2 Keypad

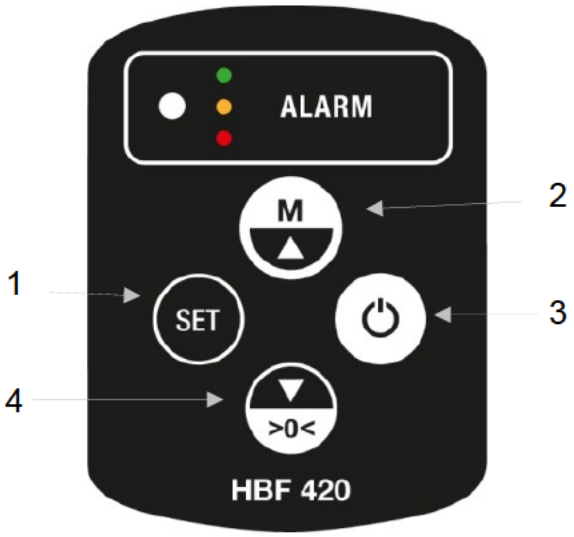

Fig. 2: Keypad

Component Explanation

1 Set key: Settings / confirm settings
2 M/▲: Measuring / upward
3 ON/OFF-key / Escape
4 ▼/<0>: downward / zeroing

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3.3 Display and Keys

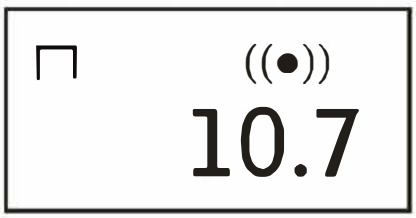

Fig. 3: Dielectric measurement

A square at the top of the display with the opening facing downwards and the symbol ((•)) show that the measuring mode "dielectric measurement" has been chosen. Underneath the measured humidity is indicated in digits.

Fig. 4: Measuring mode "dielectric measurement"

A square with the opening facing downwards at the bottom of the display and the symbol ((•)) show that the measuring mode "resistance measurement" has been chosen. Underneath the measured wood humidity (u) in % is indicated.

3.4 Function

The Wöhler HBF 420 offers two different measurement modes:

- With the dielectric measurement moisture profiles of building material can be done:

The probe for dielectric measurements at the top of the moisture meter facilitates rapid detection of moisture in all kinds of building materials through an uncomplicated method of measured data acquisition. In addition, it is quickly possible to gain an overview and localize critical points by creating a quasi two-dimensional moisture profile. This is where assigning material codes enables an informed judgment of different materials to be made.

- Electrical resistance measurement for determining the wood moisture precisely:

The resistance measurement uses the needles at the base of the instrument. In order to obtain an exact measurement, the respective material is considered by entering the appropriate code.

As the relative humidity depends on the material temperature, the meter will automatically perform a temperature compensation on the basis of the temperature value entered by the user.

In both measuring modes the two optical alarm limits help to evaluate the moisture content, e.g. when performing general measurements.

4 Device

NOTE!
In the following, the numbers (1) to (4), which are placed in brackets behind the key-names, will always refer to figure 2.

4.1 Switching on

- Press the ON/OFF key (3) to switch on the meter.

At once the meter will be ready to operate.

It is in the hold mode now.

The alarm indication shines green.

- To switch off the meter, keep the "On/Off" key (3) depressed for two seconds.

4.2 Entering the material temperature

- The user can enter the temperature of the measurement material into the meter. As the measured value depends on the material temperature, the meter will perform an automatic temperature compensation on the basis of the temperature entered by the user.

☞ *NOTE!*
Temperatures from -60 °C to +60 °C can be entered.

- To enter the temperature value into the meter follow the steps below (see short manual at the end of this manual):
- Measure the material temperature, e.g. with the Wöhler IR Temp 210 (see accessories).
- Switch on the Wöhler HBF 420 and press the Set key (1).
- The temperature value, that was entered last, will appear on screen.
- Increase or reduce the value with the up and down keys (2 and 4).
- Press the Set key (1) to confirm. The menu to select the measuring mode appears on screen.
- (If you do not want to change the measuring mode, press the ON/OFF key (3) instead of confirming).

4.3 Selecting the measuring mode

As the Wöhler HBF 420 offers two measuring modes, you have to select the measuring probe (see chapter 3.4). Proceed as follows:

- After having switched on the meter press the Set key (1) twice to bring up the menu for selecting the measuring mode.

> ☞ *HINWEIS!*
> *Having pressed the Set key once, wait until the temperature value is displayed, until you press the Set-key a second time.*

- "PB" (Probe) and the respective symbol for the dielectric measurement and the resistance measurement will be displayed.

Fig. 5: Dielectric measurement

- Press the upper center key (2), to select the dielectric measuring mode (measurement with probe at the top of the device).

In the top of the display ((•)) and a square with the opening facing downwards will appear.

Fig. 6: Resistance measurement

- Press the lower center key (4), to select the resistance measuring mode (measurement with needles).

At the bottom of the display a square with the opening facing downwards will appear.

- Press the Set key (1) to confirm.

> ☞ *NOTE!*
> *If you switch off the meter and switch it on again, the meter is in the measuring mode selected before it had been switched off.*

You are now in the menu to select the material codes.

(If you do not want to change the measuring mode, press the ON/OFF key (3) instead of confirming).

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4.4 Selecting the material code

The measured moisture content of materials depends on the type of material and other factors.

4.4.1 Material code resistance measurements (needles/electrodes)

For resistance measurements, 10 different material codes 'Cd00' to 'Cd09' can be assigned on the moisture meter in conjunction with the following table of material codes:

NOTE!
The specifications are based on a standardization of types of wood. Possible inaccuracies cannot be excluded.

Material code table

Cd	Material
00	Oak, pine, walnut (American)
01	Douglas fir, meranti (white)
02	Beech, spruce, walnut (European), larch, sweet chestnut, silver fir
03	Lime wood, elm
04	Teak
05	Afrormosia, ebony
06	Guarea
07	Cherry, birch, walnut
08	not assigned
09	Wall, concrete

4.4.2 Material code for dielectric measurements

For the dielectric measurement, the material codes 0 - 20 can be chosen.

The material code for measurements with the dielectric probe is selected based on the bulk density of the material to be measured; it should be noted that with increasing bulk density, the material code to be selected also increases.

1. The codes 'Cd05' to 'Cd10' are suitable for taking measurements of wood (bulk density approx. 400 to 600 kg/m^3).
2. The codes 'Cd15' to 'Cd18' are suitable for taking measurements of brickwork, floor screed and concrete (bulk density approx. 1600 to 2200 kg/m^3).

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4.4.3 Material code of unknown materials

In order to classify unknown materials more exactly, it is possible to determine the moisture in the material by means of a drying test. The appropriate code for the material measured is the one whose setting on the instrument leads most closely to the result indicated by the drying test. If no drying test is done, we recommend to measure unknown wood materials with Cd00, though the measurement may not be precise in this case.

4.4.4 Entering the material code

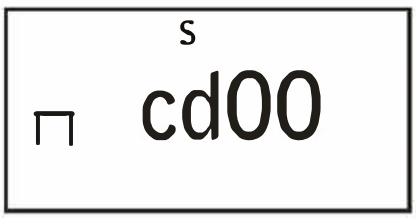

Fig. 7: Entering the material code

- After having switched on the meter press the Set key (1) three times to bring up the menu for selecting the material code.

HINWEIS!
After having pressed the Set-key wait approx. 2 seconds before you press it again.

"cd00" and a small "s" as well as the symbols for the selected measuring modes will appear on screen.

NOTE!
The correct measuring mode must be selected before entering the material code (see chapter 4.3).

- Enter the correspondent material code with the up and down keys (2 and 4).
- Press the Set key (1) to confirm.

You are now in the menu to enter the alarm threshold values.

4.5 Alarm threshold

Two alarm thresholds can be set on the instrument to facilitate rapid assessment of the moisture content of the material. The setting is displayed on a 3 -colored LED (see fig. 1, part 5).

The following statuses are possible:

1. Indicated value < AI1:	green
2. Indicated value ≥ AI1 and < AI2:	yellow
3. Indicated value ≥ AI2	red

NOTE!
The visual alarm makes it possible to quickly detect critical areas, in particular when taking moisture profile measurements using the dielectric probe.

4.5.1 Setting the alarm threshold

- After switching on the meter press the Set key (1) four times to bring up the menu for setting the alarm threshold.

HINWEIS!
After having pressed the Set-key. wait approx. 2 seconds before you press it again.

"AI 1" and subsequently the setting for the lower alarm threshold relating to the relative humidity will be displayed. Furthermore the symbols of the chosen measurement mode will appear (see chapter 3.3).

- Enter the value for the lower alarm threshold with the up and down keys (2 and 4).
- Press the Set key (1) to confirm.
- "Al 2" and subsequently the setting for the upper alarm threshold relating to the relative humidity will be displayed.
- Enter the value for the upper alarm threshold with the up and down keys (2 and 4).
- Press the Set key (1) to confirm.
- The meter will return to the menu for entering the material temperature.
- Press the ON/OFF/Escape key (3) to bring up the hold-mode again.
- Press the M key (2) to bring up the measuring-mode.

4.6 Zero point calibration

The instrument zero point should be calibrated before each measurement.

- To do so, hold the Wöhler HBF 420 in the air without allowing it to come into contact with any material.

NOTE!
When taking dielectric measurements, ensure that you hold the probe at least 15 cm away from any material during the zero point calibration and that you hold only the lower part of the instrument in your hand.

Then press **(>o<)** key in normal measurement mode. The Wöhler HBF 420 automatically sets and displays the zero point.

5 Measuring

ATTENTION!
Before starting the measurement, check that the needles/electrodes are not bent. If the electrodes are bent, the distance will not be 25 mm any more, so that the measurement result may not be correct. In this case exchange the electrodes, see chapter 8 „Maintenance“.

- Switch on the meter. It is in the hold mode now.
- Press Set key (1) and enter the material temperature (see chapter 4.4).
- Press Set key (1) and select the measuring mode (resistance measurement or dielectric measurement), see chapter 4.3.
- Press Set key (1), enter the material code and confirm with the Set key (1), see chapter 4.4.
- Press the ON/OFF/Escape-key (3) to close the settings menu and to bring up the hold-mode again.
- Depending on the chosen measurement mode bring the probe for the dielectric measurement or the electrodes for the resistance measurement into the measuring position, see chapter 5.1 and 5.2.
- **Press the M key (2) to bring up the measuring-mode and hold the key pressed during the measurement.**
- As soon as you release the M key, the meter will enter the hold mode again and show the last measured value.

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5.1 Resistance measurements (wood)

The resistance measurement uses the needles/electrodes at the base of the instrument. The meter will automatically determine the wood moisture *u*. This is the water mass m_w bound in the fuel and related to the absolute dry fuel mass m_B according to equation (1):

$$u = \frac{m_w}{m_B} \cdot 100\% \qquad \text{Equation 1}$$

Explanation:

u = wood moisture

m_w = water mass bound in the wood

m_B = absolute dry fuel mass

NOTE!
According to the above equation the wood moisture may be higher than 100 %.

The wood moisture must not be confused with the water content. The water content is the water mass related to the total mass of fuel and water (wet basis).

$$w = \frac{m_w}{m_B + m_w} \cdot 100\ \% \qquad \text{Equation 2}$$

Explanation:

w = water content

m_w = water mass bound to wood

m_B = absolute dry fuel mass

The wood moisture can be converted to the water content as follows:

$$w = \frac{u}{1+u} \cdot 100\% \qquad \text{Equation 3}$$

Explanation:

w = water content

u = wood moisture

Performing the resistance measurement

To perform a resistance measurement, follow the steps below (see short manual at the end of this manual):

- Switch on the meter, select the measurement mode "resistance measurement", enter the material code and perform the zero calibration.
- Split the wood log in the middle and perform the measurement immediately after that at the inside part of the log.
- The electrodes should penetrate into the wood approx. 6 mm.

ATTENTION!
Only if possible without applying force.

NOTE!
Measurements taken of wood are to be performed diagonally to the direction of the fibres; in other words, a line drawn between the measurement needles would dissect the fibre of the wood.

- To perform a measurement, keep the M-key (3) pressed.

Average value

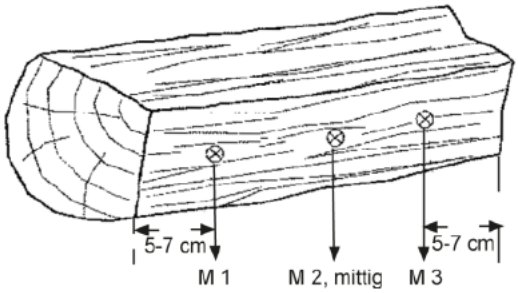

Fig. 8: Situation of the measurement points at the log

In general the wood moisture should be measured at three different points (see adjacent figure). After that, the user has to calculate the average. Please note the following points when performing the measurement:

NOTE!
Chose a measuring point without any knobs, resin or fissures.

- Do not measure at the front side or at the exterior side of the split log.

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Amongst other factors, the following should be observed:

- Depending on the type of wood, higher degrees of inaccuracy should be expected when wood moisture levels are above approx. 35 - 40 %.
- The wood to be measured should have a temperature of 0°C to 30 °C.
- High static charges in the material to be measured can lead to erroneous measurements and possibly damage the meter. Suitable earthing arrangements can resolve the matter.

5.1.1 Resistance measurements with the wood moisture probe

The result of the resistance measurement will be more exact, when the wood measurement probe is used, because the needles of the probe can be inserted more deeply into the wood, so that humidity can even be measured in the wood-inside.

- Switch on the Wöhler HBF 420, select the material code and perform the zero point calibration. After that connect the meter to the Wood Moisture Probe as follows:
- Connect the two plugs of the lower part of the cable to the jacks of the isolator of the Wöhler Wood Moisture Probe. For the resistance measurement it does not matter which jack is connected to which plug.

Fig. 9: Connecting the cable to the Wood Moisture Probe

Fig. 10: Connecting the cable to the Wöhler HBF 420

- Connect the plug at the other end of the cable to the upper jack of the Wöhler HBF 420. Perform the measurement as described in chapter 5.1.
- The result will be shown in the display.

5.2 Dielectric measurement

Fig. 11: Dielectric measurement

Non-destructive measurements taken with the dielectric probe at the top of the Wöhler HBF 420 are informative measurements for orientation purposes; the displayed values do not represent exact measurement results.

The measurement is ideal for detecting critical moist points in building materials or for creating a moisture profile. Due to the fast functioning measurement value display, it is possible to take measurements with the dielectric probe at many different points on the surface in quick succession. Thus, critical points can be recognized immediately and further targeted measures undertaken, such as taking a sample of the material for later analysis.

- Switch on the meter, enter the material temperature, select the measurement mode "dielectric measurement", enter the material code and perform the zero calibration (see chapter 4).
- Press the Escape key (3) to close the settings menu and the M key (2) to bring up the measuring mode.
- Hold the white probe at the top of the meter against the surface to be measured. While measuring, the whole probe-area must have contact to the surface.

NOTE!
In doing so, hold only the lower part of the instrument to ensure that your hand affects the measurement results as little as possible. Maintain a distance of approx. 10 - 15 cm to the wall / ceiling corners.

- To perform the measurement, keep the M key (3) pressed.

The Wöhler HBF 420 will establish a mean level of moisture which is calculated from the water content of various penetrated layers and provide a reading in digits on the display.

If the material code has been correctly selected taking the bulk density into consideration, the following values can be used as an indicator for orientation purposes based on a normal drying process of mineral construction material.

1.	Indicated value 0.0 ... 5.0:	dry
2.	Indicated value 5.1 ... 9.9:	normal
3.	Indicated value 10.0 and higher	moist

NOTE!

Amongst other factors, the following should be observed:

The measurement result can be distorted by underground metal (electrical cables, structural steel, etc.)

The material should have a sufficient thickness to accommodate the penetration depth.

Water is generally not distributed evenly in building materials; therefore measurements should be taken at several different points and, if necessary, weighted mean values determined.

6 Calibration check

You can easily check the calibration of the meter with the aid of the two calibration points on the two protection caps. Depending on the protection cap, an 18 % or a 25 % humidity calibration check can be done.

- Switch on the meter and enter the wood temperature 20 °C.
- Select "resistance measurement" (see chapter 4.1).
- Select material code Cd00 (see chapter 4.2).
- Press the M key (2) to enter the measuring mode.
- Connect the needles of the Wöhler HBF 420 or the Wöhler Wood Moisture Probe to the points.
- Keep the the M button (2) pressed for four seconds. The value indicated in the display should be u = 18 or u = 25 depending on which protection cap was used. If the indicated value differs more than ± 0.90 or ± 1.25 respectively, we recommend to send us the device for calibration.

7 Changing the batteries

If the battery voltage gets too low, the battery symbol is displayed and the display contrast becomes weaker. The battery should be replaced.

- To do so open the battery compartment at the rear of the instrument, remove the old batteries and replace it with 4 new batteries 1.5 V, AAA. Observe the right polarity.

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8 Maintenance and care

Proper operation of the Wöhler HBF 420 requires regular control of the electrodes. (see chapter 5.1, resistance measurement). The lifetime of the electrodes depends on the treatment of the meter and on the hardness of the wood. The user himself can change the electrodes. The following maintenance work has to be done.

8.1 Maintenance work

Interval	Maintenance work
Regularly	Control the distance between the electrodes (25 mm)
When the electrodes are damaged or broken	Broken or damaged needles can be exchanged by the needle-kit delivered with the device (see fig. 3.1, part 9) Loosen the damaged needles with an appropriate tool (gripper, screw wrench or ring wrench). Replace the damaged needles by the needle-kit and fix the new needles with the tool. ATTENTION! The tips of the needles are very sharp. Therefore the needle-kit should always be protected by the protection sponge.
In case of pollution	Only clean the meter with a soft cloth if necessary. Make sure that no water can penetrate into the meter.

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10 Accessories

Wood moisture probe

Wöhler Wood moisture probe	Order no. 2522

Measuring the material temperature

Wöhler IR Temp 219 Infrared Thermometer	Order no. 6612

10.1 Declaration of conformity

The product

product name: Moisture Meter for Wood and Building Materials
model number: Wöhler HBF 420

complies with the key safety requirements set down in the guidelines of the Council for the Harmonization of the Legal Requirements of the Member States in relation to the electromagnetic compatibility (2004/108/EG).
The following standards were availed of to evaluate the product in respect of the electromagnetic compatibility:

DIN EN 55011 (04/2011) high frequency interference
DIN EN 61326-1 (10/2006) interference immunity
DIN EN 61000-4-2 (12/2009) discharging of static electricity
DIN EN 61000-4-3 electromagnetic HF field

11 Short Manual : Settings

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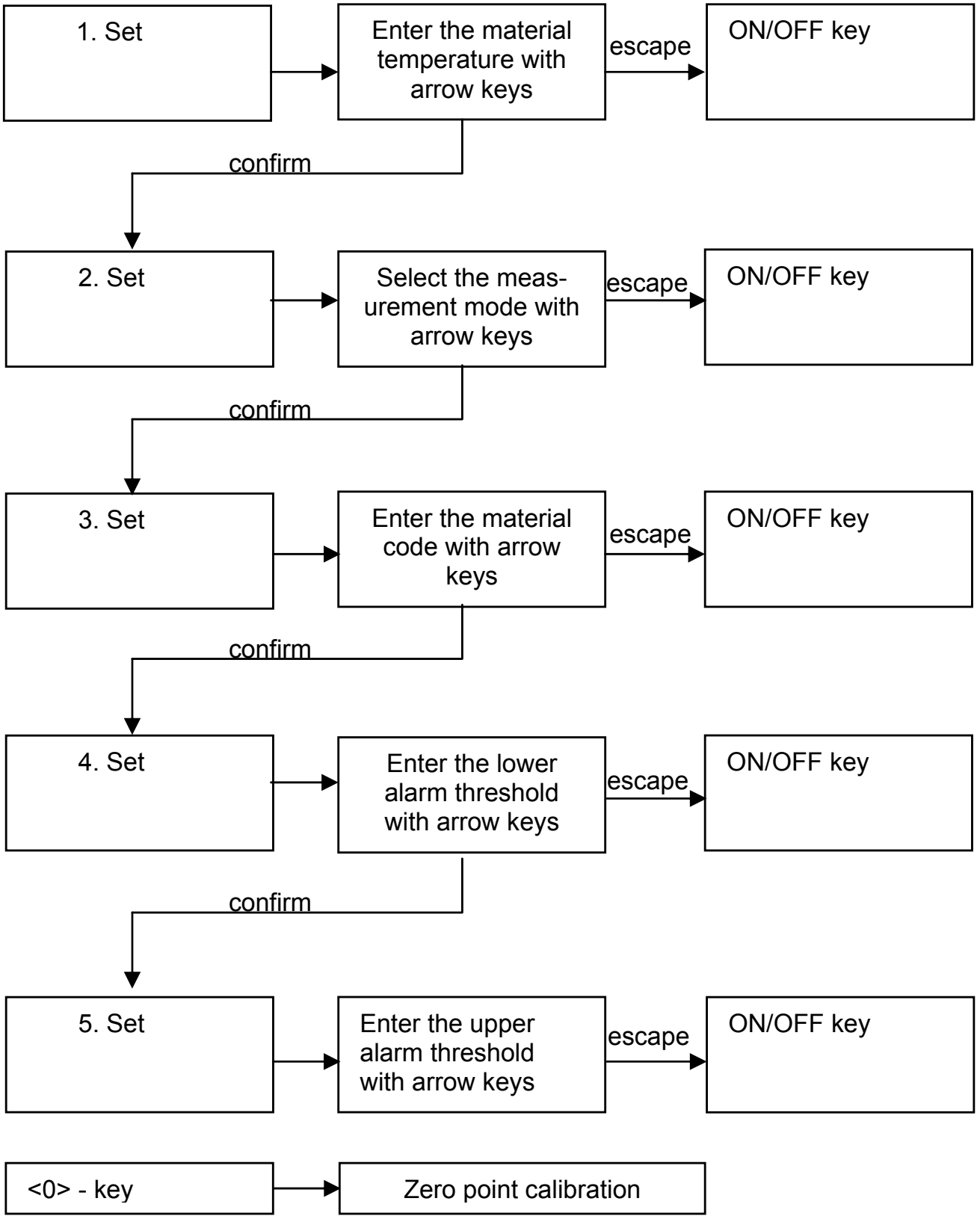

12 Short manual "Measuring"