Operating Instructions

for

Manual Humidity Precision Measuring Unit

Model: HND-F215

1. Contents

Manufactured and sold by:

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2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.
The instruction manuals on our website www.kobold.com are always for currently manufactured version of our products. Due to technical changes, the instruction manuals available online may not always correspond to the product version you have purchased. If you need an instruction manual that corresponds to the purchased product version, you can request it from us free of charge by email (info.de@kobold.com) in PDF format, specifying the relevant invoice number and serial number. If you wish, the operating instructions can also be sent to you by post in paper form against an applicable postage fee.

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EC-machine guidelines.

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition.
Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:
The standard delivery includes:

- Manual Humidity Precision Measuring Unit model: HND-F215

4. Regulation Use

Any use of the Manual Humidity Precision Measuring Unit, model: HND-F215, which exceeds the manufacturer's specification, may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

5. Operating Principle

The KOBOLD HND-F215 manual measuring unit allows for the measurement of gas humidity and gas temperature or the gas respectively water flow. Appropriate probes are available for both measuring applications (for more technical data, see subsequent pages). The device offers extensive functions, a high degree of accuracy, and decisive advantages in operation in order to support the user in determining the various measured quantities.
In addition to the standard basic functions like minimum/maximum value memory, hold function, dew-point calculation, or a calibration function for humidity measurement, the improved device design KOBOLD HND-F215 has a minimum/maximum alarm, adjustable alarm, a real-time clock, and logger function.

6. Electrical Connection

6.1 Mains operation

When using a power supply device please note that operating voltage has to be 10.5 to 12 V_{DC}. Do not apply over-voltage!! Cheap 12 V-power supply devices often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supply devices. Trouble-free operation is guaranteed by our power supply HND-Z002. Prior to connecting the plug power supply device with the mains supply make sure that the operating voltage stated at the power supply device is identical to the mains voltage.

- Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect plug and socket from soiling. Only use for the HND specified sensors. Connecting the instrument to others, may damaged the instrument and the probe.
- Switch off instrument to change sensors.
- When connecting the probe, the connector may not lock correctly. In such case take the plug not at the casing but at the buckling protection at the end of the plug. If the plug is entered correctly, it will slide in smoothly.
- To disconnect sensor/probe, the interface or the power supply devices do not pull at the cable but at the plug.

7. Operation

7.1 Safety Requirements

This device has been designed and tested in accordance with the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using the device.

1. Trouble-free operation and reliability of the device can only be guaranteed if the device is not subjected to any other climatic conditions than those stated under chapter 9. Technical Information.
2. If the device is transported from a cold to a warm environment condensation may cause in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.
3. If device is to be connected to other devices (e.g. via serial interface) the circuitry has to be designed most carefully. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.

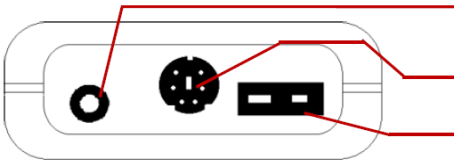
Warning: If device is operated with a defective mains power supply (short circuit from mains voltage to output voltage) this ma result in hazardous voltages at the device (e.g. sensor socket at interface).

4. If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting.
   Operator safety may be a risk if:
   - there is visible damage to the device
   - the device is not working as specified
   - the device has been stored under unsuitable conditions for a longer time.

   In case of doubt, please return device to manufacturer for repair or maintenance.

Warning: Do not use this product as safety or emergency stop device or in any other application where failure of the product could result in personal injury or material damage. Failure to comply with these instructions could result in serious injury and material damage.

7.2 Connections



Interface: Connection for electrical isolated interface adapter (accessories: HND-Z031, -Z032 or -Z033)
Connection for meas. Probes *)
Temperature input T2: Connection for NiCr-Ni-temperature probe (type K) for surface temperature measurements etc.

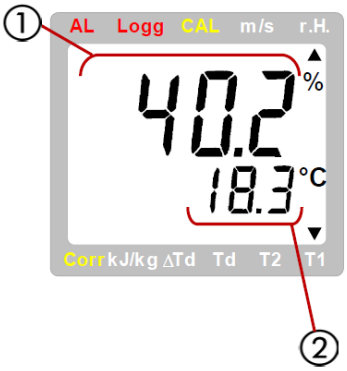
*The **mains socket** is located at the left side of the measuring instrument.*

*) The following sensor types can be connected to the connection socket:

-HND-FF31 (atmospheric humidity and temperature T1)
-HND-FF33 (flow speed air, 0.55..20m/s)
-HND-FF32 (flow speed water, 0.05..5m/s)

7.3 Displays

Depending on the measuring probes/sensors connected the following measuring results can be displayed:



HND-FF31
Main display:

①
- r.H.: relative atmospheric humidity in %

② **Secondary display:** possible views:
- T1: temperature of the HND-FF31
- Td: dew point temperature of air
- kJ/kg: enthalpy

with surface temperature probe at T2:
T2: surface temperature
ΔTd: dew point ratio = T2 - Td

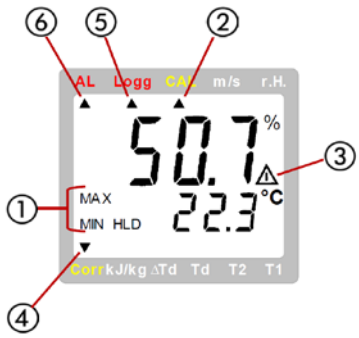
The desired secondary display view can be selected by pressing the -key.

HND-FF32 or HND-FF33:
Main display:

①
- **m/s**: flow rate

② **Secondary display:** possible views:
- **t.AVG**: time left till average flow value in seconds will be displayed
- with temperature probe at T2 and as soon as the averaging time has been reached: T2: temperature

Special display – elements



① **Min/Max/Hold**: shows if a min., max. or hold value is displayed in either the main or the secondary display.

② **CAL-arrow:** indicates that a humidity calibration is carried out at the moment.

③ **Warning triangle:** indicates a low battery, full logger storage, etc.

④ **Corr arrow**: indicates that correction factor is activated

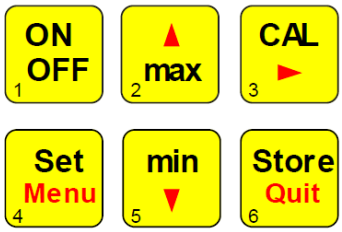
⑤ **Logger arrow:** indicates that the logger function is activated.

⑥ **Alarm arrow**: indicates an alarm

Messages at device startup:
The device will show some messages at the startup depended on the configuration and the connected sensor. Further information about the displays can be founded in the chapter “system and error messages” or by the display in the chapter “configuration”.

Note: The message display can be aborted by pressing any key (keys 2 - 6) after the segment test.

7.4 Push buttons



On/off key

in/max when taking measurements:
press shortly: min. or max. measuring value will be displayed
+
press for 1 sec.: the value shown will be deleted
up/down for configuration:
to enter values, and/or change settings

CAL: (for HND-FF31-measuring probe only)
press for 2 sec.: humidity calibration will be started
press for more than 10 sec.: reset of humidity calibration to factory calibration

Set/Menu:
press (Set) shortly: display changes between: T1,T2,Td, ΔTd,kJ/kg (if existing)
press (Menu) for 2 sec.: configuration menu is activated

Store/Quit:
Measurement: Hold current measuring value ('HLD' in display)
for flow measurements in the 'AVGHold' mode: start new measurement or handling of logger functions
Set/Menu: Acknowledge setting, return to measuring.

7.5 Instrument Configuration

Note: Some menu items will be shown depending on the actual device configuration (e.g. there are some items disabled when the logger contains data). Please note the hints by the menu items.

For configuration of the device press Set Menu -key for 2 seconds; the main menu of the configuration will be called up. Use key Set Menu to select a sub-menu; use the key CAL o actually go into the sub-menu selected and to change parameters.
Use the keys min and max to set the individual value for the parameter. Press the key Set Menu again to memorize the changes made and to change to the main menu. Use key Store Quit to leave the configuration.

'Read Logger': Read Out Logger Data (will be displayed only if data are memorized in the individual value logger mode)

CAL For more information please refer to the chapter 'data logger - how to display individual values'.

'Set Configuration': General Device Configurations

CAL Setting general configuration:
*Please note: the points marked by *1 will only be displayed if no data is stored in the logger.*

'AVG': Selection of Averaging Proceedings for Flow Measurement *1
(only HND-FF32/33)

max **Cont:** continuous averaging - the average value calculated from the measuring conducted during the averaging period will be displayed
min **Hold:** press key for averaging - flow measurements will be taken during the averaging period, then the average value will be calculated and displayed till the next flow measurement is started.

't.AVG': Setting of Averaging Period *1 (only with HND-FF32-FF33)

max **1 .. 30:** Time for averaging (in seconds) during flow measuring
min

'Unit': Selection of Temperature Unit °C /°F *1

max **°C**: All temperature values in degrees Celsius
min **°F**: All temperature values in degrees Fahrenheit

'Offset T1': Zero Displacement of Sensor Temperature T1 *1
(only with HND-FF31)

max **-10.0 °C...10.0 °C** The zero point of the measurement of channel 1 will be
-18.0 °F...18.0 °F: displaced by this value.
min **off**: Zero point displacement is deactivated (=0.0°)

'Offset T2': Zero Displacement of Temperature T2 *1

max **-10.0 °C...10.0 °C** or The zero point of the measurement of channel 1 will be displaced
min **-18.0 °F...18.0 °F**: by this value.
off: Zero point displacement is deactivated (=0.0°)

'Corr': Selection of Display Correction Factor *1

max / min

1.001...1.200: The temperature value (referring to 0 °C or. 32 °F) will be multiplied by this factor.

off: Factor is deactivated (=1.000)

'Power.off': Selection of Power-Off Delay

max / min

1...120: Power-off delay in minutes. Device will be automatically switched off as soon as this time has elapsed if no key is pressed/no interface communication takes place. (deactivated when cyclic logger is running)

off: automatic power-off function deactivated (continuous operation)

'Address': Selection of Base Address'

max / min

01, 11, 21, ..., 91: Base address for interface communication.

Using the interface converter HND-Z031 it is possible to connect several devices to a single interface. As a precondition the base addresses of all devices must not be identical. In case several devices are connected via one interface make sure to configurate the base addresses accordingly.

'Set Alarm': Alarm Settings

CAL

Settings for the alarm function:

*Please note: the points marked by *2 will only be displayed if the alarm functions 'on' or 'no'.So' have been selected.*

'Alarm': Selection of Alarm Function

max / min

off: Alarm off

no.So: Alarm on, the "AL" arrow will be displayed in case of alarm

on: Alarm on, in case of alarm the "AL" arrow will be displayed; in addition an audible alarm signal will be given.

'Alarm Input': Selection of Alarm Input *2

max / min

arrow points to the input channel

'Alarm Low': Setting of Min. Alarm *2

max / min

Setting of the display limit value triggering a min. alarm.

'Alarm High': Setting of Max. Alarm *2

max / min

Setting of the display limit value triggering a max . alarm

'Set Logger': Logger Settings (not possible if there are data in the logger memory)

CAL

Setting for the logger function:

'Function': Selection of Logger Function

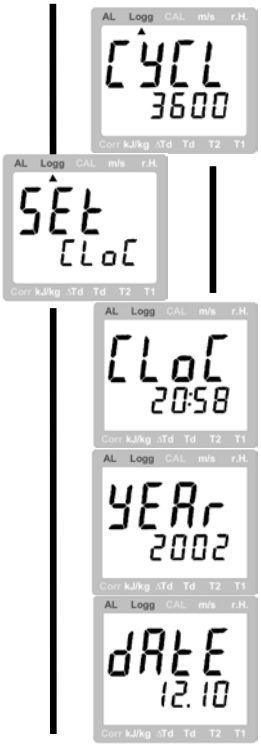
max / min

off: Logger function off (Use key 6 for Hold-function)

Stor: Individual value logger (Press key 6 to store an individual value set)

CYCL: Cyclic logger (Start by pressing key 6)

note: if function "AVG Hold" is chosen, the cyclic logger is not supported.



'Cycle Time': Setting of Cycle Time (only with Func = CYCL)
1 ... 3600: Cycle time in seconds giving the intervals between the logger data recordings

'Set Clock': Setting of the Real-Time Clock
Setting of the internal real-time clock:

'Clock': Set the Time

Setting of the time (hours : minutes)

'Year': Set the Year

Setting of the year.
Time span that can be set: 1997 ... 2100

'Date': Set the Date

Setting of the date (day. month)

7.6 Measurements Using the Combination Measuring Sensor HND-FF31

The HND-FF31 has been especially designed to carry out measurements of ambient temperature. All HND-FF31-probes are interchangeable without recalibration being required. The scope of supply includes one sensor to measure relative atmospheric humidity and another one to measure the ambient temperature T1.

rel. humidity r.H. [%]
Relative humidity measured in the tip of the probe. Resolution 0.1 %

Ambient temperature T1
Temperature measured in the tip of the probe. Resolution 0.1 °C or 0.1 °F.
Other values on display will be calculated by the measuring device (acc. to Mollier diagram).

Dew point temperature Td
Cold air cannot absorb as much steam as warm air. This means that the **relative** humidity increases as the temperature decreases. If 100 % have been reached, the air is saturated with steam; another decrease in temperature results in part of the steam condensing to water, becoming visible as fog or precipitation (dew). The dew point temperature indicates at which temperature a 100 % saturation would be reached and as of when "dew" can be expected.

Enthalpy h [kJ/kg]
Enthalpy refers to the energy content of air. This value always refers to dry air at 0 ° C. I.e. the energy content of air with a relative humidity of 0 % and 0 °C is 0kJ/kg. The warmer the air is, the higher the relative humidity, the higher the energy content. Therefore, more energy is required to heat up humid air than dry air.

All humidity and temperature values calculated from the measuring values refer to a standard atmospheric pressure of 1013 mbar. For measuring atmospheric air, the deviations do not have to be taken into account. When taking measurements in pressure vessels or under similar conditions, the values have to be corrected in accordance with a suitable correction table.

Additional Measurements with NiCr-Ni-Surface Probe at T2:

Surface temperature T2
The second temperature channel can amongst other things be used to take measurements of surface temperatures

Dew point distance ΔTd
This measurement refers to measurements of T1, T2 and relative atmospheric humidity.
The combination sensor is used to measure the ambient air, whose condition is issued to calculate the dew point Td. The surface sensor is used to measure surfaces within this ambient air, with .Td stating the temperature difference between those measurements and the dew point.
Example: measuring the ambient temperature results in a Td of 5 °C. As long as the surface-temperature (T2) of a window exceeds 5°C (ΔTd > 0 °C) the surface won't sweat! When T2 falls below 5 °C, (ΔTd < 0 °C) it will sweat.
Other examples for application: detection of 'humid corners', monitoring of heat exchangers, weather forecast etc.

7.7 Measurements Using the Flow Measuring Probes HND-FF32 a. HND-FF33

Two types of measuring probes are available for flow speed measurements:
Please note: - use **HND-FF32** to measure **water** flow
- use **HND-FF33** to measure **air** flow
Incorrect use will result in incorrect measurements!
Please observe max. measuring ranges for flow measurements!
-**HND-FF32**: 0.05 ... 5.00 m/s (water)
-**HND-FF33**: 0.55 ... 20.00 m/s (air)
Higher speeds may destroy the measuring head or may, at least, permanently influence measuring accuracy.
An arrow on the measuring head indicates the required flow direction.

Flow measuring probes are 'free-jet calibrated', i.e. the diameter of the flow channel has to be 5 times bigger than the diameter of the flow measuring head (= approx. 5 cm, otherwise measuring errors up to 40 %).
When evaluating the measuring results please also note that in a channel the flow speed is usually higher in the middle of the channel than at its edges. Therefore, use appropriate tables to calculate air flow by means of flow speed.

Averaging for Flow Measurements:
When taking flow measurements fluctuations tend to be quite high. To be able to display a stable measuring value two averaging functions have been integrated in the instrument.

Continuous Averaging
The average value displayed has been calculated from the past few measurements conducted during the averaging time set After the instrument has been switched on the time remaining till expiration of the averaging time will be displayed at the bottom line of the display. The min. and max. values memorized refer to the minimum and/or maximum average value displayed.

Average Hold
As soon as the HND-F215 instrument has been switched on the device starts calculating the average flow value during the averaging time. During measuring the **current measuring value** will be shown in the top line of the display while the bottom line shows the remaining measuring time. As soon as measurements have been completed the **average value** will be displayed and the device will switch to the HOLD mode. The min. and max. values memorized refer to the minimum and/or maximum measuring value established during averaging.
To start a new measuring series press the key "Store" (key 6).

Additional Measurements with any NiCr-Ni-Temperature Probe at T2:

Use temperature channel T2 to take measurements of medium temperature, for example. The value shown is not an average value.

7.8 Notes for Special Functions

Zero displacement ('Offset')
A zero displacement can be carried out for each of the two temperature channels T1 (HND-FF31 only) and T2:

displayed temperature = measured temperature - Offset

Standard setting: 'off' = 0.0°, i.e. no zero displacement will be carried out. The zero displacement is mainly used to compensate for sensor deviations. Unless 'off' is set, this value will be displayed shortly after the device is switched on; during operation it will be identified by means of the offset arrow in the display.

Display Correction Factor ('Corr')
This factor is applied to both sensor channels.

temperature displayed [°C] = temperature measured [°C] * Corr or
temperature displayed [°F] = (temperature measured [°F]-32 °F) * Corr + 32 °F

Standard setting: 'off' =1.000
This factor is used to compensate for losses of transfer in case of surface measurements, occurring if the object to be measured is extremely hot but will be cooled by lower ambient temperatures. The same can be true for sensors with a large mass. Unless 'off' is set, this value will be displayed shortly after the device is switched on; during operation it will be identified by means of the Corr-arrow in the display.

Base Address ('Adr.')
Using a interface converter it is possible to connect several instruments to a single interface. As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configurate the base addresses accordingly.
Channel 1 will be addressed by the base address set, channels 2 and 3 will have the following addresses.
(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23)

Alarm:
3 alarm settings are available: off (off), on with horn sound (on), on - no horn sound (no.So)
Depending on the sensors in use there is the choice of which channel is surveyed by the alarm function.
If the alarm function (on, no.So) has been activated, an audible alarm signal will be given with the following cases:

- values have fallen below/exceeded the lower/upper alarm limits in the channel to be monitored
- FE 9 and/or FE11 at the channel to be monitored
- low battery
- FE 7: In case of a system error the horn will be sounded regardless of the alarm setting even if alarm = off)

If one or more alarm settings have been fulfilled the "alarm" arrow will be shown in the display; in case of access via the interface the 'PRIO'-Flag will appear.

Real Time Clock:
The real time clock is required to put logger data in a time order. If necessary, please check the setting:
Setting via keys (p.r.t. configuration of the device): time (minutes. accurate), date, year.
Setting via interface: use suitable software (seconds - accurate) e.g. HND-Z034-software.
The clock setting menu will be started automatically when the device is switched on again after a battery change.

Data Logger:
As soon as key "Store" (key 6) is pressed and .**Func = Stor**. is chosen, a data set will be stored. The data stored can either be observed on the display (prt. "How to Display Individual Values" below), or be read into a PC via the interface.
When .**CYCL**. is set and the logger has been started using key "Store" (press for 2 seconds), data sets will be stored till the recording is either stopped or the logger memory is full. (not available with HND-FF… and "AVG Hold") The logger cycle time can be set. Use the interface to input the data stored into a PC.

If the logger contains already data, the connected kind of sensor (HND-FF31, HND-FF33, HND-FF32) must not be changed. In such case the instrument would display "Sens Erro". Functions like the read out of logger data or clear the memory are still accessible.

Storing of Individual Values: "Func Stor"
Data set that can be stored: 99
One data set consists of: measuring value channel 1 - 6 and time + date
Press "Store"-key to store current values. .St.XX. will be displayed for a short time, XX representing the number of the data set 1..99.

If the logger memory is full a warning will appear on the display:
(warning triangle permanently shown, cyclic display of "LoGG FuLL" and the current measuring value)

Upon pressing the "Store"-key (key 6) for 2 seconds the selection for deleting the logger memory will be displayed assumed that there are any logger data.

delete all data sets

delete data set recorded last

do not delete (= cancel procedure)

Use the keys "▲" (key 2) or "▼" (key 5) to make a selection. Use key "Quit" (key 6) to acknowledge selection.

How to display Individual Values:
Individual values can also be displayed without interface which is not possible with the cyclic logger function.
If there are data sets in the logger memory, the additional main menu .rEAd LoGG. will be offered upon call-up of the menu (press key "Set" (key 4) for 2 sec). When the "▶"-key (key 3) is pressed the last data set will be displayed. Use "▶"-key (key 3) to change over between the values of one data set (channel 1 - 6, date/time).
To change over from one data set to another use the keys "▲" (key 2) or "▼" (key 5).

Cyclic Logger Function: "Func CYCL"
Data sets that can be stored: 5400
One data set consists of: measuring value channel 1 - 6
The cycle time is set during "Device configuration".

Please Note: During long time recordings we suggest to use a mains adapter (HND-Z002).

Start logger recording:
Press "Store"-key (key 6) for 2 seconds to start recording. Then .St.XXXX. will be displayed for a short time for every logging; XXXX representing the number of the data set 1..5400.

If the logger memory is full a warning triangle will be shown on the display:
(warning triangle permanently shown, cyclic display of "LoGG FuLL" and the current measuring value)

Stop logger recording:
Press "Store"-key (key 6) for a short time to stop recording. You will then be asked to acknowledge again:

recording to be stopped

recording to be continued

Use the keys "▲" (key 2) or "▼" (key 5) to make your selection. Use "Quit"-key (key 6) to acknowledge your selection.

Please note: If you try to switch off the instrument in the cyclic recording mode you will be asked once again if the recording is to be stopped. The device can only be switched off after the recording has been stopped as the Auto-Power-Off-function is deactivated during recording.

Delete data in logger memory:
Press "Store"-key (key 6) for 2 seconds to display the selection for deleting data, if any, in the logger memory:

delete all data sets

do not delete (= cancel procedure

Use the keys "▲" (key 2) or "▼" (key 5) to make your selection. Use "Quit"-key (key 6) to acknowledge your selection.

7.9 The Serial Interface

All measuring and setting data of the device can be read and/or changed by means of the serial interface and a suitable electrically isolated interface adapter (HND-Z031, HND-Z032). In order to avoid transmission errors, there are several security checks implemented.
The following **standard software packages** are available for data transfer:

- **HND-Z034**: Software for temperature display and/or read out of logger data.
- **BUS-S20M:** 20-channel software to display the humidity (channel 1), the temperature. (channel 2, 3)

The following interface functions will be supported:

Channel						DLL-Code	Name/function
1	2	3	4	5	6		
x	x	x	x	x	x	0	Read nominal value
x	x	x	x	x	x	3	Read system status
x						12	Read ID number
1)	1)	1)	1)	1)	1)	22	Read min. alarm limit
1)	1)	1)	1)	1)	1)	23	Read max. alarm limit
2)						32	Read configuration flag
2)						160	Set configuration flag
x	x	x	x	x	x	199	Read meas. type in display
x	x	x	x	x	x	200	Read min. display range
x	x	x	x	x	x	201	Read max. display range
x	x	x	x	x	x	202	Read unit of display
x	x	x	x	x	x	204	Read decimal point of display
x						208	Read channel count
	x	x				216	Read offset correction
		x				218	Read corr. factor (1000..1200)
3)	3)	3)	3)	3)	3)	224	Read logger data (cyclic logger)
4)						225	Read logger cycle
5)						226	Set logger cycle
6)						227	Start logger recording
7)						228	Read count of logger data
7)						229	Read logger state
3)						231	Read logger stop time
x)						233	Read real-time clock
x						234	Set real-time clock
7)						236	Read logger size
x						240	Reset unit
x						254	Read program identification
8)						260	Read logger data (man. logger)

For HND-FF31
Channel 1: rel atmospheric humidity
Channel 2: temperature T1
Channel 3: temperature T2
Channel 4: dew point temperature Td
Channel 5: dew point distance .Td
Channel 6: enthalpy h

For HND-FF32/HND-FF33
Channel 1: flow speed
Channel 3: temperature T2
Channel 2, 4, 5, 6: not supported.

For NiCr-Ni (without HND-FF31/32/33)
Channel 3: temperature T2
Channel 1, 2, 4, 5, 6: not supported.
Logger handling still works with channel 1.

1) only when alarm is activated for referring channel
2) configuration flags: 50: 0 = logger off 1 = logger on
51: 0 = man. logger 1 = cyclic logger
3) only when logger function = CYCL, data present and logger stopped.
4) only when logger function = CYCL
5) only when logger function = CYCL and no data in memory
6) only when logger function = Stor, or logger function = CYCL and no data in memory
7) only when logger is activated (CYCL or Stor)
8) only when logger function = Stor and data in memory

7.10 How to Calibrate Meas. of Rel. Humidity Using HND-FF31

Due to the natural aging process of the polymer humidity sensor we recommend to calibrate the sensor at least once a year to ensure optimum measuring accuracy. For optimum recalibration and linearity check, please return device to manufacturer. Use integrated calibration function for 2-point on-site calibration.

Please note: Automatic temperature compensation during calibration

The rel. humidity to be found in the calibration equipment is quite often highly dependent on temperature. This dependence is automatically compensated for when calibrating with the integrated calibration equipment and automatic detection. In case you want to enter calibration values manually, make sure to enter the respective temperature with the values.

How to carry out calibration

Please note: the calibration is only possible, if the logger memory is empty.

Start calibration: press "CAL" (key 3) for 2 sec. (after more than 10 sec. the factory calibration will be set). The display prompts you to measure the first humidity value. Use "Set"-key (key 4) to stop calibration whenever you want to. In such a case the last calibration before this one will be used.

1) Selection automatic detection / manual input

Press "CAL"-key (key 3) for a short time to switch over between the various possibilities existing:

automatic detection (acceptable humidity variables see above)
Display will switch over between the acceptable variables.

manual input
If you want to use other humidity values than those provided in the automatic detection, please enter them here.
0 ... 100.0 %: input range for rel. atmospheric humidity.
(please note Watch out for 'Automatic temperature compensation during calibration')

2) Calibration point 1

Put sensor in suitable calibration equipment.
- As long as the individual values in the display for the automatic detection keep changing, a valid value could not be detected (humidity value measured may deviate from value set by manufacturer by approx. 10 %).
- In case of manual input, enter value here.
As soon as the display stops blinking and changing between values, a stable value has been detected and can be taken over by means of the "Store"-key (key 6). Then the next calibration step will be displayed.

3) Calibration point 2

Put sensor into suitable calibration equipment prepared for the second humidity value.
Precondition: If the first value was below 50 %, this value has to be over 50% or vice versa. Otherwise proceed as above. As soon as the display stops blinking and changing between values, the measuring value can be taken over by means of the "Store"-key (key 6) and the calibration has been completed.

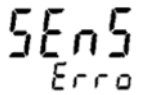
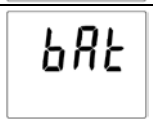
If error messages are displayed when calibrating the instrument, the old calibration keeps valid, the new calibration data are lost. Please refer to "Error and System Messages during HND-FF31 Calibration"

7.11 System and Error Messages

7.11.1 Messages at device startup

Message (display)	Description
segment test (8888 and all special sign"s/arrows)	
current time (CLOC xx:xx)	
identified sensor (HND-FF31, -FF32 or –FF33)	
temperature offset of the HND-FF31-sensor	only with HND-FF31 and adj. offset-value <> off
flow - averaging procedure (AVG Hold or AVG Cont)	only with HND-FF32, --FF33
flow - averaging period	only with HND-FF32, --FF33
temperature offset for NiCr-Ni-probe	only at adjusted offset-value <> off
display correction for NiCr-Ni-probe	only at adjusted corr-value <> off

7.12 System and Error Messages

Display	Description	Remedy
	no probe/sensor connected	connect probe/sensor
	probe/sensor damaged	probe/sensor defective -> return to manufacturer for repair
	after taking logger readings the sensor was changed	**reconnect the sensor used before or clear the logger memory** *recommendation: please keep sensor attached as long as the logger contains data.*
	Low battery voltage, device will only continue operation for a short time	replace battery
	Low battery voltage	replace battery
	If mains operation: wrong voltage	replace power supply, if fault continues to exist: device damaged
no display or **characters confused**	Battery voltage too low	replace battery
	If mains op.: power supply defective or wrong voltage/polarity	check/replace power supply
	System error	disconnect battery or power supply, wait for a short time, re-connect
	device defective	return to manufacturer for repair
Err. 1	Values exceeding measuring range	Check: are there any values exceeding the measuring range specified? ->meas. value too high
	Sensor/cable defective	-> replace
Err. 2	Values below measuring range	check: are there any values below the measuring range specified? ->meas. value too low
	Sensor/cable defective	-> replace
Err. 7	System fault	switch on again: if fault continues to exist, device is damaged -> return to manufacturer for repair
Err. 9	No probe/sensor existing or probe/sensor defective	connect probe/sensor probe/sensor damaged -> return to manufacturer for repair
Err. 11	Value cannot be calculated	One measuring variable required for calculation is missing (no sensor) or incorrect (overflow/underflow)

7.13 Error and System Messages during HND-FF31 Calibration

Display	Description	Remedy
Cal Err.1	Deviation too high (zero point)	correct humidity variable?
		no -> probe no longer within permissible tolerances, return to manufacturer for recalibration.
Cal Err.2	Difference point1-point2 too small	difference has to be at least 40% if values are entered manually select suitable values
Cal Err.3	Incorrect temperature	calibration is only permissible in the temp. range from 5 ... 40°C

8. Maintenance

When to replace battery

If ⚠ and ´bAt´ are shown in the lower display the battery has been used up and needs to be replaced. The device will, however, operate correctly for a certain time. If ´bAt´ is shown in the upper display the voltage is too low to operate the device; the battery has been completely used up.

Please note: The battery has to be taken out, when storing device above 50 °C. We recommend taking out battery if device is not used for a longer period of time.

9. Technical Information

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

10. Order Codes

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

11. Dimensions

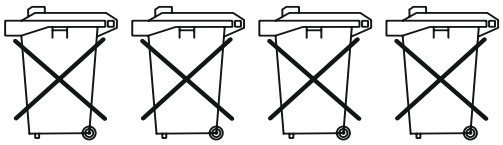
Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

12. Disposal

- **Note!**
    - Avoid environmental damage caused by media-contaminated parts
    - Dispose of the device and packaging in an environmentally friendly manner
    - Comply with applicable national and international disposal regulations and environmental regulations.
    -

- **Batteries**

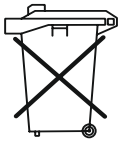
- Batteries containing pollutants are marked with a sign consisting of a crossed-out garbage can and the chemical symbol (Cd, Hg, Li or Pb) of the heavy metal that is decisive for the classification as containing pollutants:



Cd[1] Hg[2] Pb[3] Li[4]

1. „Cd" stands for cadmium
2. „Hg" stands for mercury
3. „Pb" stands for lead
4. „Li" stands for lithium

- **Electrical and electronic equipment**



13. EU Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Manual Humidity Precision Measuring Unit Model: HND-F215

to which this declaration relates is in conformity with the standards noted below:

EN 61326-1:2013
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

EN 50581:2012
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Also, the following EU guidelines are fulfilled:

2014/30/EU	Electromagnetic compatibility
2011/65/EU	**RoHS** (category 9)
2015/863/EU	Delegated Directive (RoHS III)

Hofheim, 23 Nov. 2021

H. Volz
General Manager

M. Wenzel
Proxy Holder

Appendix A: Sorts of wood

Select kind of wood you want to measure, enter number on the device, e.g. birch = h. 60

Identification	Number	Comment	Range
Group A	h. A	Wood-group A	0..82%
Group B	h. B	Wood-group B	1..95%
Group C	h. C	Wood-group C	2..107%
Group D	h. D	Wood-group D	3..121%
AS/NZS 1080.1	h. AS	Australian reference characteristic curve	4..91%
Group Spruce-Pine-Fir	h.402	Softwood-Group	6..99%
Fir, Picea abies Karst.	**h.460**	**applications in the glued timber construction, MPA certified**	**6..101%**
HND-F reference	.rEF	Internal reference for determining additional characteristic curves / calculation tables (without temperature-compensation)	

Abura	Hallea ciliata	h.2	7..50%
Afrormosia	Pericopsis elata	h.3	6..47%
Afzelia	Afzelia spp.	h.4	8..42%
Agba	Gossweilerodendron balsamiferum	h.426	6..64%
Albizia / Iatandza, New Guinea	Albizia falcatara	h.8	5..88%
Albizia / Iatandza, Solomon Island	Albizia falcatara	h.9	4..72%
Alder, Blush	Solanea australis	h.10	5..65%
Alder, Brown	Caldcluvia paniculosa	h.11	7..69%
Alder, Common	Alnus glutinosa	h.131	2..107%
Alder, Rose	Caldcluvia australiensis	h.12	6..71%
Alerce	Fitzroya cupressoides	h.13	7..61%
Amberoi	Pterocymbium beccarii	h.14	5..67%
Amoora, New Guinea	Amoora cucullata	h.15	3..94%
Andiroba	Carapa guianensis	h.16	5..59%
Antiaris, New Guinea	Antiaris toxicaria	h.7	6..83%
Apple, Black	Planachonella australis	h.17	7..62%
Ash Silvertop	Eucalyptus sieberi	h.27	2..90%
Ash, American	Fraxinus americana	h.132	5..79%
Ash, Bennet's	Flindersia bennettiana	h.18	6..76%
Ash, Crow's	Flindersia australis	h.19	7..69%
Ash, European	Fraxinus excelsior	h.133	7..56%
Ash, Hickory	Flindersia ifflaiana	h.20	6..71%
Ash, Japanese	Fraxinus mandshurica	h.134	4..79%
Ash, Red	Flindersia excelsa	h.21	5..67%
Ash, Scaly	Ganophyllum falcatum	h.22	5..90%
Ash, Silver (Northern)	Flindersia schottina	h.23	7..70%
Ash, Silver (Queensland)	Flindersia bourjotiana	h.24	6..88%
Ash, Silver (Southern)	Flindersia schottina	h.25	7..82%
Ash, Silver, New Guinea	Flindersia amboinensis	h.26	5..82%
Aspen, Hard	Acronychia laevis	h.28	5..66%
Ayan	Distemonanthus benthamianus	h.285	7..54%
Balau	Shorea laevis	h.31	4..54%
Balau, red	Shorea guiso	h.32	4..68%
Balsa	Ochroma pyramidale	h.33	4..91%
Basralocus / Angelique	Dicorynia guianensis	h.34	6..55%
Basswood	Tilia americana	h.228	4..85%
Basswood, Fijian	Endospermum macrophyllum	h.35	4..63%
Basswood, Malaysian	Endospermum malacense	h.36	5..116%
Basswood, New Guinea	Endospermum medullosum	h.37	5..76%
Basswood, Silver	Polyscias elegans	h.38	7..72%
Basswood, Solomon Island	Polyscias elegans	h.39	4..65%
Bean, Black	Castanosperum australe	h.40	6..87%
beech, damped	Fagus sylvatica	h.87	6..55%
beech, european -	Fagus sylvatica	h.86	5..85%
Beech, Myrtle	Nothofagus cunninghamii	h.41	6..76%
Beech, New Zeeland Red (hearted untreated)	Nothofagus fusca	h.42	7..87%
Beech, New Zeeland Red (sapwood boron)	Nothofagus fusca	h.43	2..97%
Beech, New Zeeland Red (sapwood untreated)	Nothofagus fusca	h.44	5..84%
Beech, Silky	Citronella moorei	h.45	8..66%
Beech, Silver	Nothofagus menziesii	h.46	8..58%
Beech, Silver (sapwood tanalith)	Nothofagus menziesii	h.47	6..76%
Beech, Silver (sapwood untreated)	Nothofagus menziesii	h.48	4..92%
Beech, Wau	Elmerrilla papuana	h.49	7..96%
Beech, White (Fiji)	Gmelina vitiensis	h.50	5..77%
Beech, White (Queensland)	Gmelina leichardtii	h.51	6..81%
Bintangor / Calophyllum, Fijian	Calophyllum leucocarpum	h.53	5..81%
Bintangor / Calophyllum, Malaysian	Calophyllum curtisii	h.54	6..76%
Bintangor / Calophyllum, New Guinea	Calophyllum papuanum	h.55	4..98%
Bintangor / Calophyllum, Phillipines	Calophyllum inophyllum	h.56	6..78%
Bintangor / Calophyllum, Solomon Islands	Calophyllum kajewskii	h.57	6..85%
Binuang	Octomeles sumatrana	h.130	5..73%
Birch, American	Betula lutea	h.59	7..72%
Birch, European	Betula pubescens	h.60	5..96%
Birch, White	Schizomeria ovata	h.58	7..75%
Bishop Wood (Fiji)	Bischofia javanica	h.61	5..73%
Blackbutt	Eucalyptus pilularis	h.62	4..92%
Blackbutt, Western Australia	Eucalyptus patens	h.63	6..88%
Blackwood	Acacia melanoxylon	h.64	6..75%
Bloodwood, Red	Corymbia gunmifera	h.66	7..78%
Bollywood	Litsea reticulata	h.67	5..78%
Bossime	Drypetes spp,	h.70	7..62%
Box Grey	Eucalyptus moluccana	h.75	8..73%
Box Grey Coast	Eucalyptus bosistoana	h.76	7..76%

Box, Black	Eucalyptus lafgiflorens	h.71	5..92%
Box, Brush (Location Unknown)	Lophostemon confertus	h.74	5..53%
Box, Brush (N.S.W.)	Lophostemon confertus	h.72	4..55%
Box, Brush (Queensland	Lophostemon confertus	h.73	7..46%
Box, Kanuka	Tristania laurina	h.77	6..78%
Boxwood, New Guinea	Xanthophyllum papuanum	h.78	5..69%
Boxwood, Yellow	Planchonella pholmaniana	h.79	7..62%
Brachychiton	Brachychiton carrthersii	h.80	5..55%
Bridelia	Bridelia minutiflora	h.81	5..103%
Brigalow	Acacia harpohylla	h.82	5..83%
Brownbarrel	Eucalyptus fastigata	h.83	5..80%
Bubinga	Guibourtia demeusii	h.84	7..70%
Buchanania	Buchanania arborescens	h.85	4..76%
Burckella, Solomon Island	Burckella obovata	h.88	4..59%
Butternut, Rose	Blepharocarya involucrigera	h.89	5..69%
Camphorwood, New Guinea	Cinnamomum spp,	h.90	6..74%
Campnosperma (Malaysia)	Campnosperma curtisii	h.91	8..95%
Campnosperma (Solomon Island)	Campnosperma kajewskii	h.92	3..78%
Cananga (Phillipines)	Canagium odoratum	h.93	7..62%
Canarium Solomon Island	Canarium salomonese	h.97	4..65%
Canarium, African	Canarium Scheinfurthii	h.94	7..80%
Canarium, Fijian	Canarium oleosum	h.95	5..77%
Canarium, New Guinea	Canarium vitiense	h.96	5..75%
Candlenut	Aleurites moluccana	h.98	0..168%
Carabeen, Yellow	Sloanea woollsii	h.99	6..67%
Cathormion, New Guinea	Cathormion umbellatum	h.100	4..56%
Cedar , Amercan	Cedrela odorata	h.102	8..67%
Cedar, incense	Calocedrus decurrens	h.65	5..96%
Cedar, White	Melia azedarach	h.101	7..86%
Cedar, Yellow	Chamaecyparsis nootkatensis	h.457	4..91%
Celtis, New Guinea	Celtis spp,	h.103	5..67%
Celtis, Solomon Island	Celtis philippinesis	h.104	4..56%
Cheesewood, White (Queensland) /Asian Alstonia	Alstonia scholaris	h.105	5..77%
Chengal (Malaysia)	Neobalanocarpus heimii	h.106	4..76%
Cherry, American	Prunus serotina	h.216	5..97%
Cherry, European	Prunus avium	h.217	7..68%
Cleistocalyx	Cleistocalyx mirtoides	h.107	5..85%
Coachwood	Ceratopetalum apetalum	h.108	4..84%
Coondoo, Blush	Planchonella laurifolia	h.109	6..60%
Cordia, New Guinea	Cordia dichotoma	h.110	5..51%
Corkwood, Grey	Erythrina vespertillio	h.111	6..57%
Courbaril	Hymenaea coubaril	h.112	7..53%
Cudgerie, Brown	Canarium australasicum	h.113	7..67%
Cupiuba	Goupia glabra	h.147	6..56%
Curupixá	Micropholis	h.114	6..52%
Cypress	Cupressus spp,	h.456	5..89%
Cypress, Northern	Callitris intratropica	h.115	6..78%
Cypress, Rottnest Island	Callitris preisii	h.116	7..80%
Cypress, White	Callitris glaucophylla	h.117	6..86%
Dakua, Salusalu (Fiji)	Decussocarpus vitiensis	h.118	6..83%
Dibetou/African walnut	Lovoa trichilioides	h.119	7..68%
Dillenia (Solomon Island)	Dillenia salomonese	h.120	4..65%
Doi (Fiji)	Alphitonia zizphoides	h.121	5..72%
Duabanga, New Guinea	Duabanga moluccana	h.124	4..72%
Ebony, african	Diospyros spp,	h.125	6..55%
Ekki	Lophira alata	h.29	4..73%
Elm, European	Ulmus spp,	h.374	7..51%
Elm, White	Ulmus americana	h.373	5..69%
Evodia, White	Melicope micrococca	h.135	5..60%
Figwood (Moreton Bay)	Ficus macrophylla	h.139	7..56%
Fir, alpine	Abies lasiocarpa	h.410	6..80%
Fir, amabilis	Abies amabilis	h.411	4..91%
Fir, Douglas	Pseudotsuga menziesii	h.122	5..91%
Fir, Douglas (New Zealand) (sapwood treated)	Pseudotsuga menziesii	h.140	6..73%
Fir, Douglas (New Zealand) (sapwood untreated)	Pseudotsuga menziesii	h.141	5..108%
Fir, Douglas (New Zealand) (truewood untreated)	Pseudotsuga menziesii	h.142	3..99%
Fir, grand	Abies grandis	h.412	4..91%
Fir, Spruce	Abies magnifica	h.413	5..97%
Fir, white / Fir, silver	Abies alba	h.414	5..93%
Fir, MPA	**Picea abies Karst.**	**h.460**	**6..101%**
Galip	Canarium indicum	h.143	5..64%
Garo-Garo	Matrixiodendron pschyclados	h.144	5..67%
Garuga	Garuga floribunda	h.145	6..53%
Goncalo Alvez	Astronium spp,	h.146	6..45%
Greenheart	Ocotea rodiaei	h.148	6..100%
Greenheart, Queensland	Endiandra compressa	h.149	7..82%
Guarea, black	Guarea cedrata	h.68	7..94%
Guarea, white	Guarea cedrata	h.69	9..67%
Guariuba	Clarisia racemosa	h.150	8..57%
Gum, Black	Nyssa sylvatica	h.162	7..76%
Gum, Blue, Sidney	Eucalyptus saligna	h.152	7..76%
Gum, Blue, Southern	Eucalyptus globulus	h.151	6..79%
Gum, Grey	Eucalyptus punctata	h.153	5..89%
Gum, Grey, Mountain	Eucalyptus cypellocarpa	h.154	6..79%
Gum, Maiden's	Eucalyptus maidenii	h.155	7..79%
Gum, Manna	Eucalyptus viminalis	h.156	4..80%
Gum, Mountain	Eucalyptus dalrympleana	h.157	3..89%
Gum, Pink	Eucalyptus fasciculosa	h.158	6..85%
Gum, Red, American	Liquidambar styraciflua	h.166	5..92%
Gum, Red, Forest	Eucalyptus tereticomis	h.159	7..82%
Gum, Red, River	Eucalyptus camaldulensis	h.160	7..94%
Gum, Rose / Gum, Saligna	Eucalyptus grandis	h.161	7..81%
Gum, Shining	Eucalyptus nitens	h.163	5..83%
Gum, Spotted (Victoria) (Lemon-Scented)	Corymbia spp,	h.164	4..72%
Gum, Sugar	Eucalyptus cladocalyx	h.165	6..79%
Gum, White Dunn's	Eucalyptus dunnii	h.167	4..72%
Gum, Yellow	Eucalyptus leucoxylon	h.168	7..73%

Handlewood, Grey	Aphanante phillipinensis	h.169	5..66%
Handlewood, White	Strebulus pendulinus	h.170	7..58%
Hardwood, Johnstone River	Bakhousia bancroftii	h.171	5..62%
Hemlock / Hemlock, Western	Tsuga heterophylla	h.172	8..54%
Hemlock, Chinesische	Tsuga chinensis	h.173	5..75%
Hevea	Hevea Brasiliensis	h.174	7..71%
Hickory	Carya spp.	h.175	6..69%
Hollywood, Yellow	Premna lignum-vitae	h.176	7..67%
Horizontal	Anodopetalum biglandulosum	h.177	7..84%
Incensewood	Pseudocarapa nitidula	h.178	8..58%
Iroko	Chlorophora excesla	h.179	7..46%
Ironbark, Grey	Eucalyptus drephanophylla	h.180	7..88%
Ironbark, Grey	Eucalyptus paniculata	h.181	5..86%
Ironbark, Red	Eucalyptus sideroxylon	h.182	8..79%
Ironbark, Red, Broad Leaved	Eucalyptus fibrosa	h.183	8..81%
Ironbark, Red, Narrow Leaved	Eucalyptus cerbra	h.184	5..86%
Jarrah	Eucalyptus marginata	h.185	5..92%
Jelutong	Dyera costulata	h.186	0..104%
Jequitibá	Cariniana spp,	h.187	5..64%
Kahikatea (New Zealand) (Boron)	Dacrycarpus docrydiodies	h.188	7..63%
Kahikatea (New Zealand) (Thanalith)	Dacrycarpus docrydiodies	h.189	6..73%
Kahikatea (New Zealand) (untreated)	Dacrycarpus docrydiodies	h.190	6..74%
Kamarere (Fiji)	Eucalyptus deglupta	h.191	5..66%
Kamarere (New Guinea)	Eucalyptus deglupta	h.192	5..83%
Kapur	Dryobalanops spp,	h.193	7..73%
Karri	Eucalyptus diversicolor	h.194	5..79%
Kauceti	Kermadecia vitiensis	h.200	4..57%
Kauri	Agathis australis, boroneensis	h.201	5..78%
Keledang	Artocarpus lanceifolius	h.202	0..132%
Kempas	Koomapassia excelsa	h.203	4..89%
Keranji (Malaysia)	Dialium platysepalum	h.204	5..51%
Keruing	Dipterocarpus spp,	h.205	6..64%
Kiso	Chisocheton schumannii	h.218	6..54%
Lacewood, Yellow	Polyalthia oblongifolia	h.219	5..68%
Laran	Anthocephalus chinensis	h.223	7..67%
Larch	Larix decidua	h.221	5..69%
Larch, American / Larch, Western	Larix occidentalis	h.220	5..98%
Larch, Japanese	Larix kaempferi	h.222	5..99%
Lauan, Red	Shorea negrosensis	h.224	5..62%
Leatherwood	Eucryphia lucida	h.225	6..79%
Lightwood	Acacia implexa	h.226	7..62%
Limba	Terminalia superba	h.227	6..56%
Lime, European	Tilia vulgaris	h.229	4..78%
Louro, Red	Ocotea rubra	h.231	5..76%
Macadamia	Floyda praealta	h.232	7..59%
Magnolia	Magnolia acuminata/grandiflora	h.233	6..88%
Mahogany, Brush	Geissos benthamii	h.242	7..57%
Mahogany, Miva	Dysoxylum muelleri	h.243	8..73%
Mahogany, New Guinea	Dysoxylum spp,	h.241	6..74%
Mahogany, Red	Eucalyptus botryoides	h.244	7..91%
Mahogany, Rose	Dysoxylum fraseranum	h.245	7..65%
Mahogany, Southern	Eucalyptus botryoides	h.246	5..82%
Mahogany, White	Eucalyptus acmenoides	h.247	6..93%
Mahogony Khaya	Khaya spp,	h.235	7..82%
Mahogony, American	Swietenia spp,	h.234	6..84%
Mahogony, Phillipines	Parashorea plicata	h.236	5..93%
Mahogony, Phillipines	Shorea almon	h.237	4..67%
Mahogony, Sapelli / Sapele	Entandrophragma cylindricum	h.238	5..99%
Mahogony, Sipo / Utile	Entradrophragma utilie	h.239	6..110%
Mahogony, Tiama / gedu nohor	Entadrophragma angolense	h.240	10..54%
Mako	Trischospermum richii	h.248	3..68%
Makoré	Thieghemmella africana	h.123	6..86%
Makorè	Thieghemella heckelii	h.249	7..80%
Malas	Homalium foetidum	h.250	5..72%
Malletwood	Rhodamnia argentea	h.251	5..68%
Malletwood, Brown	Rhodamnia rubescens	h.252	5..70%
Manggachapui	Hopea acuminata	h.253	6..87%
Mango	Mangifera minor	h.254	4..68%
Mango, Phillipines	Mangifera altissima	h.255	7..93%
Mangosteen (Fiji)	Garcinia myrtifolia	h.256	5..68%
Mangrove, Cedar	Xylocarpus australasicus	h.257	6..82%
Maniltoa (Fiji)	Maniltoa grandiflora	h.258	6..58%
Maniltoa (New Guinea)	Maniltoa pimenteliana	h.259	6..58%
Mansonia	Mansonia altissima	h.260	7..80%
Maple, New Guinea	Flindersia pimentelianan	h.261	6..87%
Maple, Queensland	Flindersia brayleyana	h.262	5..136%
Maple, Rose	Cryptocarya erythroxylon	h.263	6..64%
Maple, Scented	Flindersia laevicarpa	h.264	7..57%
Mararie	Pseudoweinwannia lanchanocarpa	h.265	8..75%
Marri	Eucalyptus calophylla	h.266	5..64%
Masiratu	Degeneria vitiensis	h.267	5..67%
Massandaruba	Manilkara kanosiensis	h.268	4..65%
Matai	Podocarpus spicatus	h.269	6..73%
Mengkulang	Heritiera spp,	h.270	5..67%
Meranti, Buik from 1999	Shorea platiclados	h.271	4..61%
Meranti, Dark Red	Shorea spp,	h.272	5..94%
Meranti, Nemesu from 1999	Shorea pauciflora	h.274	4..91%
Meranti, Seraya from 1999	Shura curtisii	h.275	5..62%
Meranti, Tembaga from 1999	Shorea leprosula	h.276	3..72%
Meranti, White	Shorea hypochra	h.277	4..94%
Meranti, Yellow	Shorea multiflora	h.273	0..111%
Merawan	Hopea sulcala	h.278	4..90%
Merbau	Intsia spp,	h.279	6..84%
Mersawa	Anisoptera laevis	h.280	4..96%
Messmate	Eucalyptus obliqua	h.281	8..75%
Moabi	Baillonella toxisperma	h.282	6..83%
Mora	Mora excelsa	h.283	5..59%
Moustiqaire	Cryptocarya spp,	h.284	4..77%
Musizi	Maesopsis eminii	h.286	7..94%
Neuburgia	Neuburgia collina	h.287	7..75%
Nutmeg (Fiji)	Myrstica spp,	h.290	5..74%

Nutmeg (New Guinea)	Myrstica buchneriana	h.291	5..78%
Nyatoh	Palaquium spp,	h.292	4..71%
Oak, European	Quercus robur L.,	h.126	4..87%
Oak, Japanese	Quercus spp,	h.127	4..91%
Oak, New Guinea	Castanopsis acuminatissima	h.293	4..90%
Oak, Red	Quercus spp,	h.128	5..91%
Oak, Silky, Fishtail	Neorites kevediana	h.294	3..59%
Oak, Silky, Northern	Cardwellia sublimia	h.295	5..83%
Oak, Silky, Red	Stenocarpus salignus	h.296	6..67%
Oak, Silky, Southern	Grevillea robusta	h.297	5..64%
Oak, Silky, White	Stenocarpus sinuatus	h.298	6..64%
Oak, Tasmanian	Eucalyptus regnans	h.299	7..87%
Oak, Tulip, Blush	Argyrodendron actinophyllum	h.300	6..60%
Oak, Tulip, Brown	Argyrodendron trifoliolatum	h.301	9..60%
Oak, Tulip, Red	Argyrodendron peralatum	h.302	9..87%
Oak, Tulip, White	Petrygota horsfieldii	h.303	5..69%
Oak, White-	Quercus spp,	h.129	5..81%
Obah	Eugenia spp,	h.304	5..66%
Obeche	Triplochiton scleroxylon	h.1	5..50%
Odoko	Scottellila coriancea	h.305	6..72%
Olive	Olea hochstetteri	h.306	7..80%
Olivillo	Atextoxicon puncttatum	h.307	5..70%
Opepe	Nauclea diderrichii	h.52	7..73%
Padauk, African	Pterocarpus soyauxii	h.308	4..79%
Palachonella, Fijian	Planchonella vitiensis	h.347	6..61%
Palachonella, New Guinea	Planchonella kaernbachiana	h.348	4..71%
Palachonella, New Guinea	Planchonella thyrsoidea	h.349	2..67%
Palachonella, Solomon Island	Planchonia papuana	h.350	4..57%
Paldao	Dracontomelum dao	h.309	4..86%
Panga Panga	Millettia stuhlmannii	h.312	6..45%
Papuacedrus	Papuacedrus papuana	h.314	6..88%
Parinari, Fijian	Oarinari insularum	h.315	4..78%
Penarahan	Myristica iners	h.316	6..94%
Peppermint, Broad-Leaved	Eucalyptus dives	h.317	6..94%
Peppermint, Narrow-Leaved	Eucalyptus australiana	h.318	8..76%
Peroba, White	Paratecoma peroba	h.319	7..60%
Persimmon	Diospyros pentamera	h.320	5..70%
Perupok (Malaysia)	Kokoona spp,	h.321	1..135%
Perupok (Malaysia)	Lophopetalum subovatum	h.322	8..98%
Pillarwood	Cassipourea malosano	h.323	4..79%
Pine / Pine, Stone	Pinus pinea	h.345	6..87%
Pine, Aleppo	Pinus halepensis	h.324	8..76%
Pine, Austrian	Pinus nigra	h.212	5..106%
Pine, Beneguet	Pinus kesya	h.325	8..104%
Pine, Black	Prumnoptys amarus	h.326	5..76%
Pine, Bunya	Pinus bidwillii	h.327	8..69%
Pine, Canary Island	Pinus canariensis	h.328	6..80%
Pine, Celery-Top	Phyllocladus aspenifolius	h.329	7..71%
Pine, Hoop	Araucaria cunninghamii	h.330	7..79%
Pine, Huon	Dacrydium franklinii	h.331	8..70%
Pine, King William	Athrotaxis selaginoides	h.332	7..67%
Pine, Klinki	Araucaria hunsteinii	h.333	4..91%
Pine, Loblolly-	Pinus taeda	h.209	5..91%
Pine, Longpole-	Pinus contorta	h.207	5..96%
Pine, Maritime	Pinus pinaster	h.334	8..74%
Pine, Parana Red	Araucaria angustifolia	h.335	6..39%
Pine, Parana White	Araucaria angustifolia	h.336	7..58%
Pine, Pitch-, american	Pinus palustris	h.211	6..65%
Pine, Pitch-, caribbean	Pinus caribaea	h.210	6..93%
Pine, Radiata	Pinus radiata	h.337	5..100%
Pine, Radiata (New Zealand) (sapwood aac)	Pinus radiata	h.338	7..78%
Pine, Radiata (New Zealand) (sapwood boliden)	Pinus radiata	h.339	6..85%
Pine, Radiata (New Zealand) (sapwood boron)	Pinus radiata	h.340	6..69%
Pine, Radiata (New Zealand) (sapwood tanalith)	Pinus radiata	h.341	5..73%
Pine, Radiata (New Zealand) (sapwoodt untreated)	Pinus radiata	h.342	5..91%
Pine, Red	Pinus resinosa	h.343	2..99%
Pine, Scotts	Pinus sylvestris L.	h.206	6..94%
Pine, Shortleaf	Pinus echinata	h.213	5..96%
Pine, Slash (Queensland)	Pinus elliottii	h.344	6..86%
Pine, Southern	Pinus echinata	h.214	5..97%
Pine, Southern, yellow / Pine, Ponderosa	Pinus ponderosa	h.208	5..96%
Pine, Sugar	Pinus lambertiana	h.215	4..97%
Pine, western white	Pinus monticola	h.406	5..98%
Pittosporum (Tasmania)	Pittosporum bicolor	h.346	4..82%
Planchonia	Pleiogynium timorense	h.351	5..73%
Pleiogynium / Podo	Podocarpus neriifolia	h.352	7..57%
Podocarp, Fijian	Decussocarpus vitiensis	h.353	6..79%
Podocarp, Red	Euroschinus falcata	h.354	6..83%
Poplar, Black	Populus nigra	h.313	4..91%
Poplar, Pink	Euroschinus falcata	h.355	6..67%
Quandong, Brown	Eurocarpus coorangooloo	h.356	5..75%
Quandong, Silver	Elaecarpus angustifolius	h.357	5..65%
Quandong, Solomon Island	Elaecarpus spaericus	h.358	3..67%
Qumu	Acacia Richii	h.359	5..67%
Raintree (Fiji)	Samanea saman	h.360	5..49%
Ramin	Gonystylus spp,	h.361	6..54%
Redwood / Sequoia	Sequoia sempervirens	h.362	5..88%
Rengas	Gluta spp,	h.363	4..85%
Resak (Malaysia)	Cotylelobium melanoxylon	h.364	3..94%
Rimu (non-truewood boron)	Dacrydium cupresinum	h.365	7..65%
Rimu (non-truewood tanalith)	Dacrydium cupresinum	h.366	7..65%
Rimu (non-truewood untreated)	Dacrydium cupresinum	h.367	8..69%
Rimu (truewood untreated)	Dacrydium cupresinum	h.368	8..44%
Robinia	Robinia pseudoacacia	h.369	2..72%
Roble Pellin	Nothofagus obliqua	h.370	6..72%

Rock maple	Acer saccharum	h.6	5..92%
Rosewood, Brasilian	Dalbergia nigra	h.311	5..58%
Rosewood, Indian	Dalbergia latifolia	h.310	4..91%
Rosewood, New Guinea	Pterocarpus indicus	h.371	5..66%
Rosewood, Phillippines	Pterocarpus indicus	h.372	10..54%
Sapupira	Hymenolobium excelsum	h.375	5..68%
Sasauria (Fiji)	Dysoxylum quercifolium	h.376	4..69%
Sassafras	Doryphora sassafras	h.377	6..70%
Sassafras, Southern	Atherospherma moschatum	h.378	7..66%
Satinash, Blush	Acmena Hemilampra	h.379	3..84%
Satinash, Grey	Syzygium gustavioides	h.380	5..82%
Satinash, New Guinea	Syzygium butterneranum	h.381	5..68%
Satinash, Rose	Syzygium francisii	h.382	5..59%
Satinay	Syncarpia hilii	h.383	4..92%
Satinbox	Phenbalium saquameum	h.384	5..92%
Satinheart, Green	Geijera salicifolia	h.385	8..51%
Satinwood, Tulip	Rhodosphaera rhodanthema	h.386	6..94%
Scentbark	Eucalyptus aromapholia	h.387	5..70%
Schizomeria, New Guinea	Schizomeria serrata	h.388	5..81%
Schizomeria, Solomon Island	Schizomeria serrata	h.389	4..60%
Sepetir	Sindora coriaceae	h.390	1..88%
Sheoak, Fijian Beach	Casuarina nodiflora	h.391	6..71%
Sheoak, River	Casuarina cunninghamiana	h.392	7..59%
Sheoak, Rose	Casuarina torulosa	h.393	8..58%
Sheoak, Western Australia	Allocasuarina fraserana	h.394	7..64%
Silkwood, Bolly	Cryptocarya ablata	h.395	8..53%
Silkwood, Silver	Flindersia acuminata	h.396	7..71%
Simpoh (Phillippines)	Dillenia philippinensis	h.397	5..86%
Sirus, White	Ailainthus peekelii	h.398	5..74%
Sirus, White	Ailainthus triphysa	h.399	7..70%
Sloanea	Sloanea spp,	h.400	5..77%
Spondias	Spondias mariana	h.401	4..72%
Spruce, European	Picea abies Karst.	h.136	6..101%
Spruce, Norway /Norway Spruce	Picea abies	h.137	6..105%
Spruce, Sitka	Picea sitchensis	h.138	5..98%
Sterculia, Brown	Sterculia spp,	h.230	4..91%
Stringybark, Brown	Eucalyptus capitellata	h.403	6..83%
Stringybark, Darwin	Eucalyptus tetrodonta	h.404	5..81%
Stringybark, Yellow	Eucalyptus muelleriana	h.405	9..77%
Suren	Toona cilata	h.407	6..103%
Sweet chestnut	Castanea sativa	h.199	2..107%
Sycamore	Acer pseudoplatanus	h.5	7..57%
Sycamore, Satin	Ceratopetalum succirubrum	h.408	7..63%
Tallowwood	Eucalyptus microcorsis	h.409	4..92%
Tatajuba	Bagassa guianesis	h.30	7..44%
Taun Maleisien	Pometia pinnata	h.195	0..105%
Taun New Guinea	Pometia pinnata	h.196	6..103%
Taun Phillipines	Pometia pinnata	h.197	7..99%
Taun Solomon Island	Pometia pinnata	h.198	4..70%
Tawa	Beilschmiedia tawa	h.415	8..51%
Tawa (sap & heart boron)	Beilschmiedia tawa	h.416	6..61%
Tawa (sap & heart untreated)	Beilschmiedia tawa	h.417	7..64%
Teak	Tectona grandis	h.418	6..80%
Terap	Artocarpus elasticus	h.419	2..169%
Terentang	Campnosperma brevipetiolata	h.420	5..77%
Terminalia Braun	Terminalia microcarpa	h.421	3..71%
Terminalia Gelb	Terminalia complanata	h.422	3..87%
Tetrameles	Tetrameles nudiflora	h.423	5..70%
Tingle, Red	Eucalyptus jacksonii	h.424	5..110%
Tingle, Yellow	Eucalyptus guilfolei	h.425	5..105%
Tornillo	Cedrelinga catenaeformis	h.427	5..71%
Totara	Podocarpus totara	h.428	7..63%
Touriga, Red	Calophyllum constatum	h.429	8..73%
Tristiropsis, New Guinea	Tristiropsis canarioides	h.430	6..70%
Tulipwood	Harpullia pendula	h.432	7..76%
Turat	Eucalyptus gomophocephala	h.431	7..71%
Turpentine	Syncarpia glomulifera	h.433	5..91%
Vaivai-Ni-Veikau	Serianthes myriadenia	h.434	5..61%
Vatica, Phillippines	Vatica, manggachopi	h.435	7..63%
Vitex, New Guinea	Vitex cofassus	h.436	5..78%
Vuga	Metrosideros collina	h.437	6..56%
Vutu	Barringtonia edulis	h.438	4..55%
Walnut, American	Juglans nigra	h.288	5..87%
Walnut, Blush	Beilschmiedia obtusifolia	h.439	8..64%
Walnut, European	Junglans regia	h.289	7..59%
Walnut, Queensland	Endiandra palmerstonii	h.440	6..101%
Walnut, Rose	Endiandra muelleri	h.441	3..78%
Walnut, White	Cryptocarya obovota	h.442	7..63%
Walnut, Yellow	Beilschmiedia bancroftii	h.443	5..66%
Wandoo	Eucalyptus wandoo	h.444	7..87%
Wattle, Hickory	Acacia penninervis	h.445	7..64%
Wattle, Silver	Acacia dealbata	h.446	7..73%
Wengé	Millettia laurentii	h.448	7..55%
Western Red Cedar	Thuja plicata	h.449	6..56%
Whitewood, American	Liriodendron tulipifera	h.447	5..99%
Woolybutt	Eucalyptus longifolia	h.450	7..80%
Yaka	Dacrydium nausoriensis/nidilum	h.451	6..69%
Yasi-Yasi I (Fiji)	Syzygium effusum	h.452	4..71%
Yasi-Yasi II (Fiji)	Syzygium spp,	h.453	5..82%
Yate	Eucalyptus cornuta	h.454	6..73%
Yertschuk	Eucalyptus considenia	h.455	7..88%

Appendix B: Additional materials

Select material you want to measure, enter number on the device, e.g. concrete b25 = b. 6

Measuring of building materials

Material	Number	Range	Moisture estimation
Concrete			
Concrete 200kg/m³ B15 (200 kg Concrete per 1m³ sand)	b. 5	0,7..3,3%	yes
Concrete 350kg/m³ B25 (350 kg Concrete per 1m³ sand)	b. 6	1,1..3,9%	yes
Concrete 500kg/m³ B35 (500 kg Concrete per 1m³ sand)	b. 7	1,4..3,7%	yes
gas-aerated concrete (Hebel)	b. 9	1,6..173,3%	yes
gas-aerated concrete (Ytong PPW4, gross density 0,55)	b. 27	1,6..53,6%	yes
Screed			
Anhydrit screed AE, AFE	b. 1	0,0..30,3%	yes
Ardurapid screed-concrete	b. 2	0,6..3,4%	no
Elastizell screed	b. 8	1,0..24,5%	yes
Screed-plaster	b. 11	0,4..9,4%	yes
Wood-concrete screed	b. 13	5,3..20,0%	yes
Screed-concrete ZE, ZFE without additives	b. 21	0,8..4,6%	yes
Screed-concrete ZE, ZFE with bitumen additives	b. 22	2,8..5,5%	yes
Screed-concrete ZE, ZFE with synthetic additives	b. 23	2,4..11,8%	yes
Miscellaneous			
Asbestos cement panels	b. 3	4,7..34,9%	no
Bricks clay bricks	b. 4	0,0..40,4%	no
Plaster	b. 10	0,3..77,7%	yes
Plaster synthetic	b. 12	18,2..60,8%	yes
On-wall plaster	b. 20	0,0..38,8%	no
Lime mortar KM 1:3	b. 14	0,4..40,4%	yes
Lime sand bricks (14 DF (200), gross density 1,9)	b. 28	0,1..12,5%	yes
Limestone	b. 15	0,4..29,5%	yes
MDF	b. 16	3,3..52,1%	yes
Cardboard	b. 17	9,8..136,7%	yes
Stone-timber	b. 18	10,5..18,3%	yes
Polystyrene	b. 25	3,9..50,3%	yes
soft-fibre-panel-wood, bitumen	b. 26	0,0..71,1%	yes
Concrete mortar ZM 1:3	b. 19	1,0..10,6%	yes
Concrete bounded fake boards	b. 24	3,3..33,2%	yes

The accuracy of measuring building materials depends on manufacturing and using. The used additives may vary from manufacturer to manufacturer, therefore deviating measure results may occur. The given measuring-range is the theoretically measurable range.

Estimation of additional materials

Following materials may be well estimated with the help of the device, but you won't reach such high accuracy than with materials listed in appendix A and B.

Material	Number	Comment
Hay, flax	h. 458	Injection probe HND-Z058
Straw, grain	h. 459	Injection probe HND-Z058
Cork	h. A	
Fibre board	h. C	
Wood fibre insulating wall panel	h. C	
Wood fibre hard disks	h. C	
Kauramin-fake boards	h. C	
Melamine-fake boards	h. A	
Paper	h. C	
Phenolic resin-fake boards	h. A	
Textiles	h. C (D)	