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WÖHLER

Operation manual
Indoor Air Quality Meter

Wöhler KM 410

Best.-Nr. 22718 – 2013-03-07

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1 General Information

1.1 Operation Manual Information

This operation manual allows you to safely work with the Wöhler KM 410 IAQ Meter. Please keep this manual for your information.

The Wöhler KM 410 IAQ Meter 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 meter.

NOTE!
Useful information

1.3 Intended Use

The meter verifies HVAC system performance and air ventilation control. It measures the CO_2 level, the air temperature and the relative humidity. Furthermore it determines the CO content, the dew point and the wet bulb temperature.

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1.4 Components

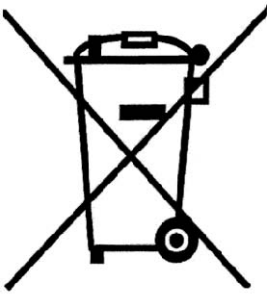
Device	Components
Wöhler KM 410 IAQ Instrument	IAQ Instrument
	4 AA batteries
	USB Data Cable
	PC-Software
	Plastic case

1.5 Transport

! ATTENTION!
Improper transport can harm the instrument.

Always transport the meter in the provided carrying case in order to prevent damage.

1.6 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.

1.7 Direction

Wöhler Messgeräte Kehrgeräte GmbH
Schützenstr. 41
33181 Bad Wünnenberg
Tel.: +49 2953 73-100
Fax: +49 2953 7396-100
E-Mail: mgkg@woehler.com

2 Technical Data

CO_2 - Measurement

Description	Data
Range	0 – 5.000 ppm
Resolution	1 ppm
Accuracy	± 30 ppm ± 5 % of reading
Warm up phase	30 seconds
Reaction	< 30 seconds
Measuring principle	NDIR (non-dispersive infrared) Waveguide technology CO_2 sensor

CO - Measurement

Description	Data
Range	0 – 1.000 ppm
Resolution	1 ppm
Accuracy	± 10 ppm when <100 ppm ± 10 % when 101-500 ppm ± 20 % when >500 ppm
Reaction	< 60 seconds

Temperature

Description	Data
Range	-20 °C to +60 °C (-5 – 140 °F)
Resolution	0.1 °C (0.1 °F)
Accuracy	0.5 °C (± 0.9 °F)

Relative Humidity

Description	Data
Range	0.1 – 99.9 % rh
Resolution	0.1 % rh
Accuracy	± 3 % when 10 – 90 % rh and 25°C, ±5 % with other rh - values and 25°C

General technical data

Description	Data
Operating temperature	0 °C … + 50°C
Storage temperature	-20 °C … + +60 °C 10 – 90 % rh non condensing
Power supply	4 AA batteries or DC Adapter 9 V (not included in the delivery).
Working time	ca. 24 hours
Connection to the PC	USB-port
Size	205 mm x 60 mm x 56 mm
Weight	200 g
Memory	6.000 series of measurement: CO_2, temp., rh, CO Log rate: 1 s … 4h49m59s
Log rate	1 s to 4 h 49 min 59 s
Audible CO warning alarm	

3 Component explanation

Fig. 1: Overview

Component Explanation

1 Battery case (rear of the instrument)
2 DC Adaptor connection
3 USB port
4 Sensors with protection cap
5 Vent slots (rear of the instrument)

3.1 Key assignments

Key name	Function
ON/OFF SET	-Turns on and off the meter - Enters setup mode while meter is off. - Sets as non-sleep mode with HOLD .
START ESC	Exits setup or recall mode. - to exit a menu and - to start and stop automatic logging.
MODE RECALL	- Press to switch between the measuring modes. - Hold this key pressed to enter the memory recall mode.
HOLD ▲	- HOLD function: Freezes the current readings - Cancels data hold function - In the SETUP menu: Selects unit or decreases the value
MEM ▼	- Manual record of the reading - In the SETUP menu: Selects unit or decreases the value
Min/Max/AVG	- Activates MIN, MAX, TWA, STEL function - Saves and finishes settings
ON/OFF + START + MEM	Enter calibration mode

3.2 LCD display

Fig. 2: LCD Display

Upper display: CO_2, CO, temp., dew point, wet bulb reading
Lower display: Date and time (alternating)

Icon	Significance
HOLD	Readings are frozen unchanged.
MIN	Minimum reading
Max	Maximum reading
AVG	Weighted average
B	Low battery indicator
CAL	In calibration status
CO_2	Carbon dioxide reading
CO	Carbon monoxide reading
TA	Air temperature
WBT	Wet bulb temperature
°C/°F	Celsius/Fahrenheit of temperature
%rh	relative humidity
ppm	CO_2 level or CO level in ppm
REC	manual/automatic data logging
RECALL	Recall of saved information

EN

4 Getting started

The meter is powered by either 4 AA batteries or a DC adaptor 9 V.

4.1 Installing the batteries

- Install 4 AA batteries into the battery compartment on the rear and make sure that they are in correct polarity and good contact.

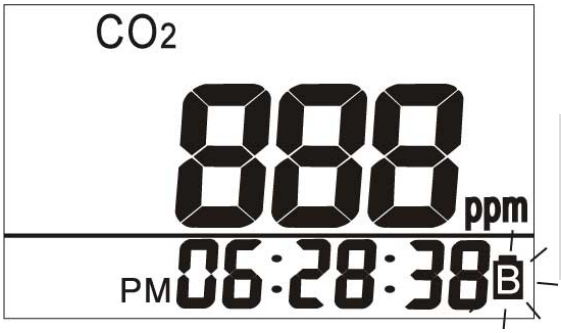


Fig. 3: Display with low battery indicator

When battery voltage gets low, a low battery indicator will appear on the LCD.

ATTENTION!
The CO_2 sensor cannot work normally under low voltage.

Replace with fresh batteries or connect with the DC adaptor.

4.2 Working with the DC adaptor

- Connect the meter to the power outlet via the DC adaptor 9 V (not included in the delivery, see accessories) see fig. 1, part 2.

When the adaptor is used, the power supply from the batteries is cut off automatically.

ATTENTION!
The adaptor cannot be used as a battery charger.

WARNING!
Risk of electrical shock!

Never touch the power supply with wet hands!

Protect the power supply against water and moisture!

Do not unplug the recharger by pulling the cable!

Do not use the power supply when the voltage requirements of the recharger and the supply do not match!

5 Operation

ATTENTION!
Before working with the meter for the first time, perform a CO_2 calibration in fresh outdoor air, see chapter 12.1.

5.1 Switching the meter on and off

Fig. 4: After switching on

- Press the ON/OFF-key to turn the meter on and off.

The meter emits a short beep and performs a 30 seconds countdown.

Fig. 5: Readings

After the warmup phase it emits another beep and the actual reading is shown in the display.

EN

5.2 Measuring

After the warm-up-phase the meter starts measuring.

Fig. 6: Readings

NOTE!
The measured value (CO_2, CO etc.) selected before the meter was switched off will be displayed, see chapter 5.2.1

The readings are updated every second.

In the lower part of the screen, date and time are displayed in turns.

If the operating environment changes (ex. from high to low temperature), it will take 30 seconds until the correct CO_2 readings are indicated and 30 minutes, until the correct relative humidity readings are indicated.

NOTE!
NOTE! During the CO_2-measurement do not hold the meter close to faces, because the exhalation can affect the CO_2 level.

5.2.1 Selecting the measuring mode

- Press MODE to select the measuring mode.

By pressing MODE repeatedly the display switches from one measuring mode to another. The following modes are displayed.

CO_2 (carbon dioxide), DP (dew point), WBT (wet bulb temperature), TA (air temperature), %rH (relative humidity), CO (carbon monoxide).

Fig. 7: Measuring mode "Air temperature"

5.3 Data Hold

Fig. 8: Hold Function

- In normal measuring mode, press HOLD to freeze the readings.

The HOLD icon will flash on the left top of the LCD.

- Press HOLD again to cancel the hold function.

NOTE!
The HOLD function is disabled in the MIN/MAX/AVG Mode.

5.4 MIN, MAX, STEL, TWA

Fig. 9: CO_2 reading

Fig. 10: maximum CO_2 value

- In normal measuring mode, press M/AVG to see the minimum value (MIN) in the selected mode.
- Each press of M/AVG displays MIN, MAX, STEL, TWA, current value in sequence.

STEL: Weighted average of readings during the last 15 minutes.

TWA: Weighted average of readings during the last 8 hours.

- Press START/ESC to bring up the measuring menu again.

In the MAX, MIN, STEL, TAW modes and in the current value mode, the display shows the corresponding readings in the main display and the accumulated time of how long this mode is active. The longest possible interval is 18 hours.

NOTE!
Distinguishing between the display of the normal mode and the current review is possible by checking the time display format: In normal display the date and time is displayed in turns. In the current review, the time displayed is the accumulated time of how long the min/max mode is active.

NOTE!
HOLD, MANUALLY RECORD and RECALL are disabled in the MIN/MAX mode.

When the user has selected MIN or MAX, the display will show the minimum value or the maximum value of the selected measuring mode (CO, CO_2).

STEL and TWA mode (weighted average)

When the STEL or the TWA mode has been selected, the meter will show the weighted average of the readings during the last 15 minutes or the last 8 hours.

When the meter is turned on for less than 15 minutes (8 hours) the STEL value (TWA value) will be the weighted average of readings taken since the meter was switched on.

It takes at least 5 minutes to calculate STEL and TWA. The display shows "----" during the first 5 minutes after having the meter switched on.

The STEL and TWA values are updated every 5 minutes.

- Press START/ESC to return to the normal measurement mode.

6 Manual Recording

Fig. 11: Data record n° 20

The meter can record and recall 99 data records.

- In normal measuring mode or in HOLD-mode, press MEM to record the values.

The main display and the REC icon will flash about 3 seconds now. The main display shows the memory serial number (at most 99 records).

Each memory contains all parameters (CO_2, CO, TA …%rh), not only the selected parameter shown in the display.

NOTE!
The user can also press HOLD to freeze the reading before manually recording the data. This will make sense, if the reading changes quickly.

NOTE!
The manually recording function is disabled in the min/max mode.

6.1 Recall saved information

Fig. 12: Data record n° 23

Fig. 13: Showing the CO_2 value of data record 23

- In the normal measuring mode or in the HOLD mode, press the MODE/RECALL key for more than 2 seconds until the recall icon flashes.
- The memory serial number of the last record appears first and the reading appears after that.
- Press HOLD/▲ or MEM/▼ to scroll the records.
- Again the memory serial number of the record appears first and the reading after that. (see Abb. 13 and Abb. 14).

Fig. 14: Showing the CO value of data record 23

- Press MODE/RECALL to switch between the different readings of the record.

The date and time displayed in the memory recall mode is the recording time of this memory.

- Press START/ESC to escape the memory recall mode and to bring up the measuring mode again.

7 Data Logging

Fig. 15: Data Logging

NOTE!
Data logging should be done with the DC adaptor connected, to conserve the batteries. When the DC adaptor is used, it will cut off the power supply from the batteries.

The meter can automatically record readings of CO_2, CO, temperature and humidity for long time environment monitoring. The memory capacity is 6.000 records with all values measured at a certain time, thus 24.000 readings.

The user can set up a sampling rate from 1 second to 4:59:59 hours (see chapter 11.4).

- After the sampling rate is selected, press START/ESC for two seconds in the normal measuring mode.

The REC icon flashes to indicate the logging status. The LCS main display shows the real time value. In the lower part of the screen, date and time are displayed in turns.

- To terminate the data logging, press the START/ESC key for two seconds, until the REC icon stops flashing.

NOTE!
When the user presses START/ESC to start the logging again, the previous logging records will be overwritten. Export the Logged records to the PC to save them (see chapter 14).

- Press MODE/RECALL to switch between the different readings of the record. This is even possible during the logging process.

NOTE!
During the logging process, MIN/MAX/AVG, manual record, hold and recall functions are disabled. During the logging process, the meter cannot be switched off.

8 Backlight

- Press any key to activate the backlight for 10 seconds.

9 Alarm

The meter features audible alarm to give warnings when CO concentration exceeds the limit. For setting the alarm threshold see chapter 11.2.

- Press any key to stop the alarm beep (except the ON/OFF key).

The alarm beep stops when the CO value falls below the set value.

10 Auto Power Off

The meter turns off automatically after 20 minutes of inactivity.

To override the function, press ON/OFF and HOLD for 2 seconds until "n" appears on screen.

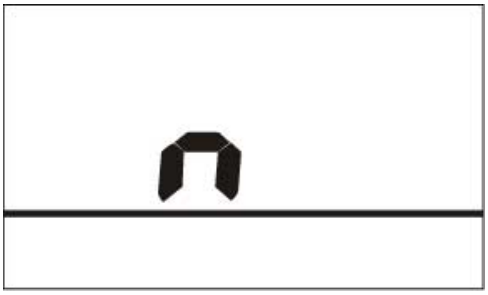


Fig. 16: Deactivation of the auto power off function

NOTE!
The Auto Power Off Function will be disabled during the calibration mode.

11 Settings

- When the meter is off, hold down the ON/OFF key for more than 1 second to enter the setup mode.
- Press HOLD to switch from one setup mode to the next one (from P10 to P20 etc.). Press the M/AVG key to go to the parameter that you want to change. Press HOLD/▲ or M▼ to select.
- In P10 to P60 mode press START/ESC to escape and enter the measuring mode.

In the different modes of the Wöhler KM 410, different parameters can be set.

Mode	**Parameter**
P10	delete stored data
P20	enter the CO alarm threshold
P30	select the temperature unit
P40	set the sampling rate of data logging
P 50	enter the air pressure
P60	select the time format as 12 hours or 24 hours date and time

11.1 P10 Delete stored data

When the setup mode is activated, P10 and "CLr" will appear first.

- Press M/AVG to delete all stored data. "yes" or "no" will appear on screen, see Abb. 18

Fig. 17: Setup - Delete all records, Display 1

Fig. 18: Setup - Delete all records, Display 2

- Press HOLD/▲or MEM/▼ to choose NO (do not delete) and YES (delete).
- Press M/AVG to confirm.
- Press START/ESC to escape and return to P10.

11.2 P20 Setting the CO Alarm Threshold

When the setup mode is activated, press HOLD. P20 and "AlAr" will appear.

- Press M/AVG to go into P21 for setting the CO alarm threshold.
- The current set value will be blinking.
- Press HOLD/▲ to increase the value or MEM/▼ to decrease. Each press tunes 5 ppm.
- Press M/AVG to save the settings or press START/ESC to return to the P20 mode without saving.

Fig. 19: Setup - Setting the CO Alarm Threshold

11.3 P30 Selection of the temperature unit

Fig. 20: Setup - Selection of the temperature unit

When entering the setup mode press HOLD several times, to bring up the P30 mode for the selection of the temperature unit. "Unit" and P30 will appear in the display.

- Press M/AVG to select the temperature unit.
- The current set and P 31 will appear on screen.
- Press HOLD/▲or MEM/▼ to choose °C (do not delete) or °F.
- Press M/AVG to save the settings or press START/ESC to return to the P30 mode without saving.

11.4 P40 Setting the sampling rate

Fig. 21: Setup - Setting the sampling rate

Fig. 22: Setup - Setting the sampling rate

When entering the setup mode press HOLD several times, to bring up the P40 mode. The user can set a sampling rate from 1 second to 4 hours 59 minutes and 59 seconds.

- Press M/AVG to bring up the setting mode. The hour digits will blink.
- Press HOLD/▲ to increase the value or MEM/▼ to decrease.
- Press M/AVG to save the settings and bring up the mode for setting the minutes.
- Proceed the same way when setting the seconds.
- Press M/AVG to save the settings and to return to the P40 mode.

11.5 P50 Pressure compensation

Fig. 23: Setup - air pressure, Display 1

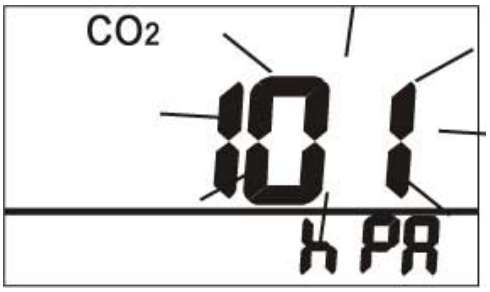


Fig. 24: Setup - air pressure, Display 2

When entering the setup mode press HOLD several times, to bring up the P50 mode. "PrES" and P50 will appear in the display.

- Press M/AVG to set the pressure compensation value for the CO_2 measurement.
- The current set will flash. The barometric pressure unit is kilopascal (kpa).
- Press HOLD/▲ to increase the value or MEM/▼ to decrease.
- Press M/AVG to save the settings and to return to the P50 mode.
- Press START/ESC to bring up the measuring menu again.

11.6 P60 Date and time

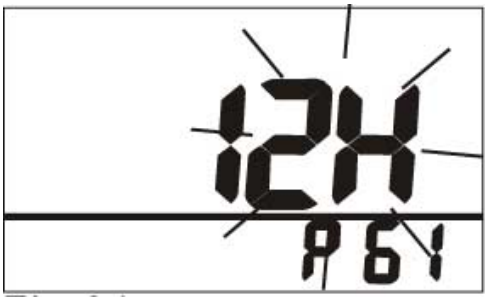


Fig. 25: Select time format as 24 hours or 12 hours format

Fig. 26: Set the sampling rate of data logging

When entering the setup mode press HOLD several times, to bring up the P60 mode. "rtC" and P60 will appear in the display.

- Press M/AVG to bring up the mode for setting the time format as 12 hours or 24 hours.
- Press HOLD/▲ or MEM/▼ to change the format.
- Press M/AVG to save the settings and enter the real time clock setting.
- Press HOLD/▲ or MEM/▼ to change the selected parameters and press M/AVG to save the settings and go to the next parameters. The sequence is: Year - month - day - hour - minute - second

12 Calibration

The meter is calibrated at standard 400 ppm CO_2 concentration in factory. It is suggested to do manual calibration regularly to maintain good accuracy. It takes about 10 minutes to calibrate the meter.

! ATTENTION!
After a long time usage or under special conditions, return the meter to the factory for standard calibration.

- The manual calibration is suggested to be done in fresh outdoor air that is well ventilated and in sunny weather. Switch the meter off and place it in the calibration site.
- First press START/ESC and MEM/▼, then also ON/OFF/SET simultaneously for 3 seconds to turn on the meter and enter the calibration mode.

Three calibration menus are available: CO_2, relative humidity, CO

12.1 CO_2-Calibration

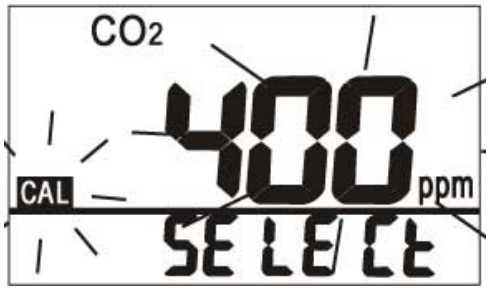


Fig. 27: CO_2-calibration

Press HOLD/▲ or MEM/▼ to enter the CO_2 calibration mode.

400 ppm and the "CAL" icon are blinking.

- Press M/AVG to start the calibration.

Wait about 10 minutes until the blinking stops and the calibration is completed automatically.

To abort the calibration, turn off the meter at any time.

! ATTENTION!
Do not calibrate the meter in the air with unknown CO_2 concentration. Otherwise, it will be calibrated as 400 ppm by default. This will lead to inaccurate measurements.

! ATTENTION!
Ensure that the battery voltage is sufficient.

12.2 Relative Humidity Calibration

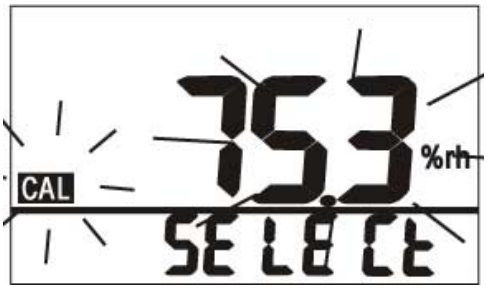


Fig. 28: RH Calibration

The relative humidity calibration has to be done with a 33% and a 75% salt solution. The ambient condition is recommended to be at 25°C and stable humidity (better to be close to the calibration value). To abort the calibration, turn off the meter at any time.

! ATTENTION!
Never do the relative humidity calibration without calibration salt, otherwise the meter will be harmed. You will find the calibration set in the chapter accessories.

12.2.1 33% Calibration

Plug the sensor probe into the 33% salt bottle.

- First press START/ESC and MEM/▼, then also ON/OFF/SET simultaneously for 3 seconds to turn on the meter and enter the calibration mode.
- Press M/AVG to select the 33% calibration mode.

The "CAL" icon and the calibration value (32,8 % at 25 °C) are blinking.

- Press M/AVG to start the calibration.

The meter is now calibrating. Wait about 60 minutes until the blinking stops and the calibration is completed automatically.

To abort the calibration, turn off the meter at any time.

12.2.2 75% Calibration

Plug the sensor probe into the 75% salt bottle.

- First press START/ESC and MEM/▼, then also ON/OFF/SET simultaneously for 3 seconds to turn on the meter and enter the calibration mode.
- Press HOLD/▲ to select the 75% calibration mode.
- Press M/AVG to start the calibration.

The "CAL" icon and the calibration value (75,3 % at 25 °C) are blinking.

The meter is now calibrating. Wait about 60 minutes until the blinking stops and the calibration is completed automatically.

- To abort the calibration, turn off the meter at any time.

12.3 CO Calibration

Fig. 29: CO Calibration

- First press START/ESC and MEM/▼, then also ON/OFF/SET simultaneously for 3 seconds to turn on the meter and enter the calibration mode.
- Press HOLD/▲ or MEM/▼ to enter the CO_2 calibration mode (0 ppm or 400 ppm).

0 ppm or 400 ppm and the "CAL" icon are blinking.

- Press M/AVG to start the calibration.

Wait about 10 minutes until the blinking stops and the calibration is completed automatically.

To abort the calibration, turn off the meter at any time.

! ATTENTION!
Do not calibrate the meter in the air with unknown CO concentration. Otherwise, it will be calibrated as 0 or 400 ppm by default. This will lead to inaccurate measurements.

! ATTENTION!
Ensure that the battery voltage is sufficient.

13 Failures

Failure	Possible reason	Solution
The meter cannot be switched on.	Batteries are empty.	Check whether the batteries are in good contact or correct polarity or whether the adaptor is well plugged. If necessary change the batteries.
	The ON OFF key has not been well pressed.	Keep the ON/OFF key pressed for a second.
The current readings do not appear.	Check whether the data hold function is activated.	If the HOLD icon blinks at the left top, press HOLD to deactivate the HOLD function.
Slow Response	Check whether the air flow channels on the rear were blocked.	If necessary clean the air flow channels.
Error messages	**Significance**	
E01	The CO_2 sensor is out of order. Retry CO_2 calibration.	
E02	The value is under range.	
E03	The value is over range.	
E04	The original data error results in this error (DP, WB).	
E07	Battery voltage is too low for the CO_2 measurement. Change batteries or connect the adaptor.	
E11	Retry humidity calibration.	
E17	Retry humidity calibration.	
E31	The temperature sensor is damaged.	
E34	The humidity sensor is damaged.	

14 Analyzing the data with the PC

The data saved by the Wöhler KM 410 can be transferred to the PC and evaluated with the Wöhler Indoor Air Quality Software.

- Connect the meter to the PC with the USB câble included in the delivery.
- Follow the instructions of the software manual.

15 CO_2 levels and guide lines

Technische Regel für Arbeitsstätten Lüftung ASR A3.6/Januar 2012
(**German Technical workplace regulation: ventilation ASR** A3.6/january 2012, Germany):
No remedial action will be necessary, if the CO_2 concentration [ml/m^3] or [ppm] does not exceed 1000.

NIOSH recommendations (National Institute for Occupational Safety and Health):

250 - 350 ppm:	normal outdoor ambient concentrations
1000 ppm	indicates inadequate ventilation: complaints such as headaches, fatigue and eye/throat irritation will be more widespread. 1000 ppm should be used as an upper limit for indoor levels.

ASHRAE Standard 62-1989 (American Society of Heating, Refrigerating and Air-Conditioning Engineers):

Upper CO_2 limit for indoor levels: 1000 ppm

OSHA (Occupational Safety and Health Administration): 5000 ppm

Time weighted average over five 8-hour work days should not exceed 5000 ppm.

Germany, Japan, Australia, UK: 5000 ppm

Time weighted average over 8 hours should not exceed 5000 ppm.

16 Warranty and Service

16.1 Warranty

Each Wöhler KM 410 will be tested in all functions and will leave our factory only after extensive quality control testing.

If used properly, the warranty period for the Wöhler KM 410 will be twelve month from the date of sale. Batteries are not covered by this warranty.

This warranty does not cover the freight and packing costs when the device is sent to the factory for repair.

Service by non authorized personnel or making modifications to the analyzer voids any warranty.

16.2 Service

Wöhler has built our reputation on excellence in customer service. Therefore, of course, we are readily available to assist you after the warranty period ends.

- Send us the device and we will repair it and return it to you with our package service.
- Immediate help is provided by our technical staff over the telephone.

17 Accessories

Calibration Set Wöhler IR Hygrotemp 24	Order no. 6605
Power Supply KM 410 (for data logging)	Order no. 4281

18 Declaration of conformity

The product

product name: IAQ Instrument
model number: Wöhler KM 410

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:

EN 61326-12006:
(CISPR11, IEC/EN 61000-3-2 (2006), IEC/EN 61000-3-3 (1995+A1:2001 + A2:2005)
(IEC/EN61000-4-2 (1995+A1:1998+A2:2001)/-3 (2006)/-4(2004)/-5(2006)
/-6 (1996+A1:2

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