

Симулятор СН

Технические характеристики

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1 General Information



Please read the user manual carefully and keep it for future reference. Please note that some components of the device and the described software may slightly differ from the illustrations in this manual.

This user manual is part of the equipment. It must always be kept close to the equipment so that it can be accessed quickly when needed.

This user manual must be read, understood and observed in all respects by all persons responsible for the equipment and all persons who work on it. This applies, in particular, to the chapter "Safety".

Editorial deadline: December 2020

This user manual is valid for the following versions of the equipment with the order numbers:

8349.SIM	8349.SIMC	8349.SIMCO
8350.SIM	8350.SIMC	8350.SIMCO

Date	Issue	Notes
December 2020	R1.0	Initial release

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The manual was prepared with due care. No liability is assumed for damages resulting from failure to observe the information contained in the manual.

1.1 Symbols used



Remarks for the smooth use of the equipment



Required action step

2 Safety

2.1 Standards and directives

The device is designed according to the recognized rules of technology and safety and is manufactured in series unchanged. The applied rules are listed in the currently valid declaration of conformity. Declarations of conformity can be downloaded from our homepage:

In Europe, the declaration of conformity is enclosed in the accompanying documents.

2.2 Description of the warnings

2.2.1 Description of the warning symbols

Symbol	Use
	Warning of a general hazard
	Warning of laser beam
	Warning of dangerous electrical voltage
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.2.2 Description of precautionary statements

	WARNING
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.	
	CAUTION
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.	
NOTICE	
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.	

2.3 Safety notes

 WARNING	
	The Cloud Height Simulator has no insulation against mains voltage. If there is an insulation fault in the external DC power supply, a dangerous voltage may be present at the simulator and there is a risk of electric shock, which can cause serious or fatal injuries. ⇒ The simulator may only be connected to the Cloud Height Simulator via a DC voltage supply in the range of 10VDC to 28VDC, which complies with the requirements of protection class III (SELV) (see Figure 1). ⇒ The DC power supply used must either be protected against any kind of humidity or meet an adequate IP degree of protection.
 CAUTION	
	The ceilometer to be checked emits invisible class 1M laser radiation from the opening at the top of the device. Viewing class 1M radiation with optical instruments can cause serious eye injuries. ⇒ Switch off the ceilometer when installing the simulator on top to prevent laser radiation from being reflected. ⇒ Under no circumstances should the laser beam be viewed directly with optical instruments (binoculars). ⇒ Avoid looking directly into the laser beam.



Figure 1 Symbol marking the protection class III (SELV).

Please also pay attention to the following additional safety instructions:

- Always carry the Cloud Height Simulator with a firm grip of both hands. The weight of the device can cause the device to slip out of your hand and cause injury. It's safest to transport it in its original packaging or an aluminum case.
- Always lock the angle adapter with the locking screw on the hood of the ceilometer before placing the Cloud Height Simulator on top.
- Always lift the Cloud Height Simulator with a firm grip of both hands onto the adapter in the laser outlet of the ceilometer.
- Do not operate the Cloud Height Simulator with a broken cover window; in this case send the device to G. Lufft GmbH for repair.
- The Cloud Height Simulator emits invisible near-infrared light, avoid looking directly into the simulator's lens openings for a long time.

Please also follow the safety instructions in the operating manual of the ceilometer, especially regarding laser safety.

2.4 Requirements for the personnel

- The Cloud Height Simulator may only be installed and commissioned by trained personnel who have received instructions in safety-related matters.
- Every person assigned to install and commission the Cloud Height Simulator must have read and understood the complete user manual. Furthermore, the person must be familiar with the operation of the ceilometer
- During all work on the equipment, personnel must not be overtired and must not be under the influence of alcohol, medicines or intoxicants. The personnel must have no physical limitations that temporarily or permanently restrict their attention and judgment.
- Maintenance work is not necessary with the Cloud Height Simulator.

2.5 Designated use

The operational safety of the Cloud Height Simulator is only guaranteed if used as designated in accordance with the instructions in this operating manual.

- The device may only be operated within the specified technical data.
- The device may only be used under the conditions and for the purposes for which it was designed.
- The device may not be modified or changed; operational safety and function are then no longer guaranteed.
- The Cloud Height Simulator is not approved for explosive areas.

The simulator complies with the requirements of IP68 protection class, which allows it to be used outdoors, even in the rain. It is important to ensure that the DC power supply used is either protected against any kind of moisture / wetness or meets a high degree of IP-protection.

3 Technical Data

3.1 Ordering information

Device variants for the CHM 15k	
Order number	Description
8350.SIM	CH-Simulator for the CHM 15k + connection cable 10m
8350.SIMC	CH-Simulator for the CHM 15k + aluminum case + tablet and connection cable 10m
8350.SIMCO	CH-Simulator for the CHM 15k + aluminum case + connection cable 10m
Device variants for the CHM 8k	
Order number	Description
8349.SIM	CH-Simulator for the CHM 8k + connection cable 10m
8349.SIMC	CH-Simulator for the CHM 8k + aluminum case + tablet and connection cable 10m
8349.SIMCO	CH-Simulator for the CHM 8k + aluminum case + connection cable 10m

Table 1 Variants of the device.

3.2 Technical data

Measurement parameters	
Adjustable cloud height range	100 m ... 14900 m / 328 ft ... 48883 ft
Adjustable cloud depth range	100 m ... 14900 m / 328 ft ... 48883 ft
Measurement parameter	Laser impulse frequency, LED temperature
Optical parameter	
Light sources	4 near-infrared LED (1x pulsed, 3x continuous)
Wavelength	CHM 8k: 940 nm CHM 15k: 1060 nm
Data interfaces	
Interfaces	Bluetooth (Required for communication via CH-Simulator-App) RS485 half-duplex, galvanically isolated
Protocol	UMB-binary
Electrical parameters	
Power supply	10...28VDC on device
Power consumption	approx. 3VA
Device safety	
Type of protection	IEC/ EN 60529:2000 IP 68
Protection class	None, only a class III (SELV) protected DC supply may be connected
Overvoltage category	none
Degree of pollution inside the IP68 housing	2
EMV	EN 61326 Class B (domestic)
Conformity	CE
Operating conditions	
Temperature range	-20 °C ... +40 °C
Rel. humidity	0 % – 95 % r.h. (non-condensing)
Maximum operation altitude	3000 m
Storage conditions	
Temperature range	-40 °C ... +60 °C
Rel. humidity	0 % – 95 % r.h. (non-condensing)

Dimensions	
Housing dimensions	W x H x L = 230 mm x 100 mm x 120 mm
Angle adapter	W x H x L = 330 mm x 90 mm x 211 mm
Packaging dimensions	Cardboard: W x H x L = 290 mm x 210 mm x 210 mm Aluminum case: W x H x L = 520 mm x 430 mm x 220 mm
Weight	
Cloud Height Simulator	1.7 kg
Angle adapter	3.2 kg
Aluminum case (tare weight)	4.3 kg

Table 2 Technical data.

4 Technical description

The Cloud Height Simulator allows to check the correct operation of Lufft ceilometers. The simulator detects the laser pulses emitted by the ceilometer and sends an optical signal back to the device after a certain period of time. The time span between the reception of the laser signal and the transmission of the response, as well as the signal duration of the response, simulates the backscatter signal of a cloud with a certain height and depth.

The time span and the signal duration of the optical signal can be adjusted in the simulator. Thus, clouds can be simulated at different heights and with different depths to check the correct detection by the ceilometer. In addition to preset cloud signals, the height and depth can be freely adjusted in the advanced mode. This mode also allows to add a background light component.

The simulator is delivered with an angle adapter which allows to optimize the signal strength of the optical signal emitted by the simulator on the detector of the ceilometer by tilting. This allows an extended check of the correct function of the detector in case of an error.

The results of the control measurements are available in the tested ceilometer. It can be received via data telegram on the RS485 interface or as a stored NetCDF file. Some data can be read out by the simulator itself, e.g. the repetition rate of the laser pulses. The measured data is displayed in the CH-Simulator-App or can be output alternatively via the UMB binary protocol.

4.1 Design of the Cloud Height Simulator

The Cloud Height Simulator has six lens apertures at the bottom, 5 of which are used (see Figure 2). The receiver is individually located on the left side. The four lenses on the right side emit the pulsed light and the continuous light. The supply cable is connected via the connector plug on the right side.

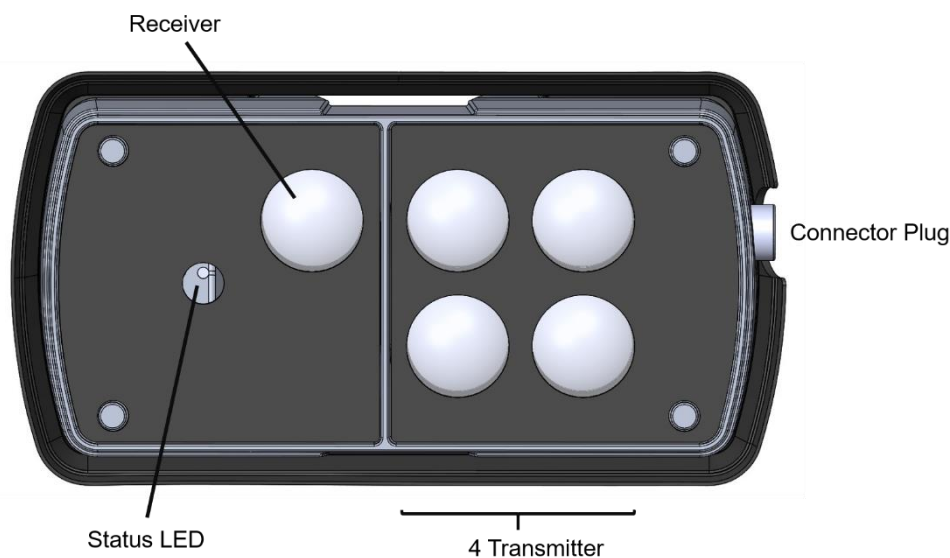


Figure 2 Components of the Cloud Height Simulator.

4.2 Connectors

On the housing of the Cloud Height Simulator there is an 8-pin connector plug. It is used to connect the supply voltage and the RS485 interface. A 10 m power cable with cig plug connector is included in the delivery. For the use of the RS485 interface an alternative cable is required, e.g. 8371.UK015. Please contact Lufft.

4.2.1 Connector plug and pin assignment

The position of the connector plug is shown in Figure 2. The plug itself is shown in Figure 3.



Figure 3 Connector plug (8-pin).

The pin assignment of the connector is defined by Figure 4 and the corresponding Table 3.



Figure 4 Pin assignment of the connector plug

Pin number	Wire color	Description
1	Rose	
2	Yellow	RS485_B (-)
3	Grey	
4	Red	
5	Green	RS485_A (+)
6	Blue	
7	White	GND
8	brown	+ VDC (10...28VDC)

Table 3 Pin assignment of the connector plug. Color scheme only valid for alternative connection cable, e.g. 8371.UK015, see above.

The simulator is powered by a 12 – 28 DC voltage.

The half-duplex 2-wire RS485 interface is electrically isolated and can be used for measurement retrieval and firmware updates.

4.2.2 Bluetooth-Connection

By default, a Bluetooth connection is used to communicate with the Cloud Height Simulator. The CH-Simulator-App can only communicate with the device via Bluetooth. To set up a Bluetooth connection, please first follow the instructions of the manufacturer of the device you want to connect to the simulator. Afterwards search for your Cloud Height Simulator in the Bluetooth settings. It can be recognized by the first two sections of its serial number.

The coupling code of the simulator is

- CHM 15k (8350.SIMx): **1503**
- CHM 8k (8349.SIMx): **2003**



The coupling code can be changed with the Lufft ConfigTool.Net. In order for the change to be accepted by the Cloud Height Simulator, the parameter "Configured" must be set to "No".

4.3 Scope of delivery

The scope of delivery includes for all sales versions:

- Cloud Height Simulator
- Angle adapter as support plate on the ceilometer
- Power cable with zig plug 10m
- In the EU: EU – Declaration of conformity
- Safety information
- USB-flash drive with user manual

Additionally, a tablet for control can be included (see Table 1).

At delivery the Cloud Height Simulator has the following settings:

Class ID: 12 (not changeable)
Device-ID: 1 (results in address C001h = 49153d)
Baud rate: 19200
RS485 Protocol: UMB binary
Cloud height 3000 m
Cloud depth 1000 m
Backlight all LEDs on

5 Commissioning

5.1 Installation of the Cloud Height Simulator

⚠ WARNING	
	The Cloud Height Simulator has no insulation against mains voltage. In case of an insulation fault of the external DC voltage supply, a dangerous voltage may be applied to the simulator and there is a risk of electric shock, which can cause severe or even fatal injuries. ⇒ The simulator may only be connected to the Cloud Height Simulator via a DC voltage supply in the range of 10VDC to 28VDC, which complies with the requirements of protection class III (SELV) (see Figure 1). ⇒ The DC power supply used must either be protected against any kind of humidity or meet an adequate IP degree of protection.

⚠ CAUTION	
	The ceilometer to be tested emits invisible Class 1M laser radiation from the opening at the top of the instrument. Viewing class 1M radiation with optical instruments can cause serious eye injuries. ⇒ Under no circumstances should the laser beam be viewed with optical instruments (binoculars). ⇒ Avoid looking directly into the laser beam. ⇒ Switch off the ceilometer when setting up the simulator so that no laser radiation can be reflected by it.

NOTICE	
Improper installation can lead to equipment damage. ⇒ The electrical connection of the Cloud Height Simulator may only be made using the supplied cable ⇒ The power supply must be suitable for the simulator (see safety instructions) ⇒ Carry only with both hands, preferably in the original packaging or aluminum case ⇒ Only lift with both hands onto the ceilometer	

The Cloud Height Simulator is placed on the outlet opening in the hood of the ceilometer using the angle adapter supplied. The following steps are necessary:

1. Remove the grip protection (edge protection profile) at the edge of the opening in the hood of the ceilometer, if this has not already been done. The grip protection is only needed for the transport of the ceilometer and should be removed after installation of the device.
2. Put on the angle adapter. The side marked with "Door" points to the front of the ceilometer where the housing door is located (see Figure 5). First insert the angle adapter at the front and push fully in, then press it down into the opening of the hood (see Figure 6).

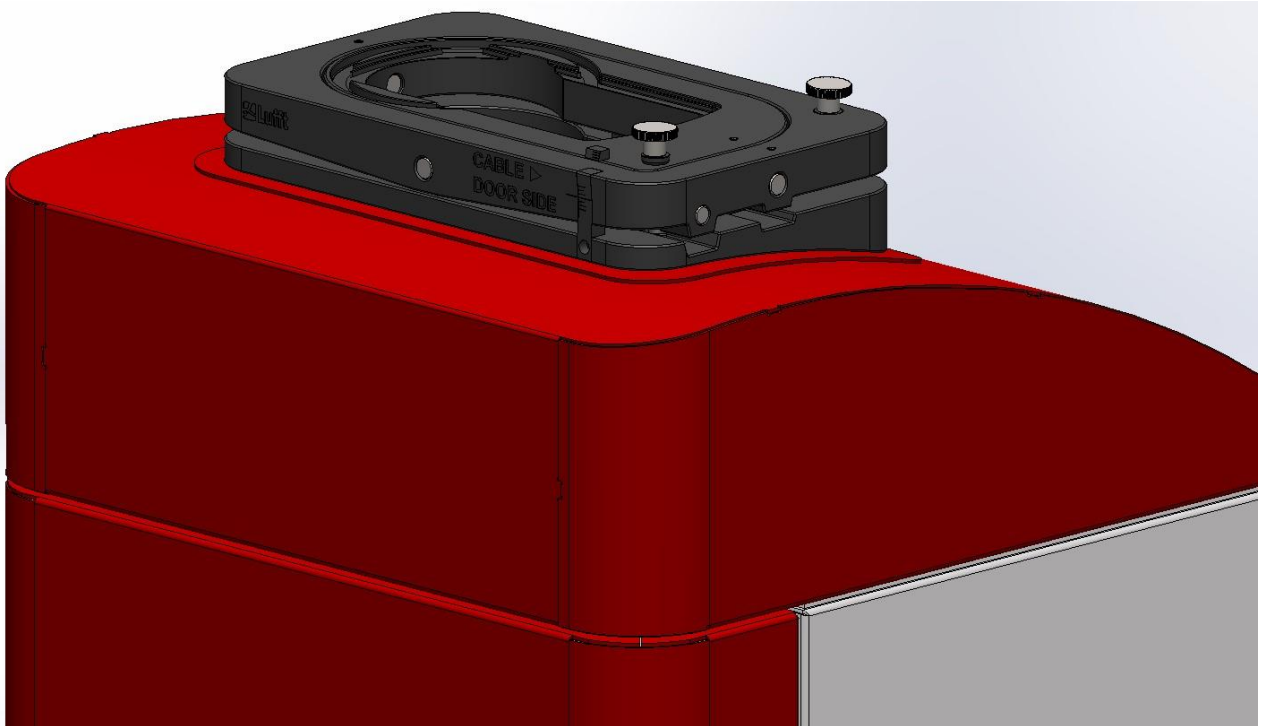


Figure 5 Alignment of the angle adapter to the ceilometer.

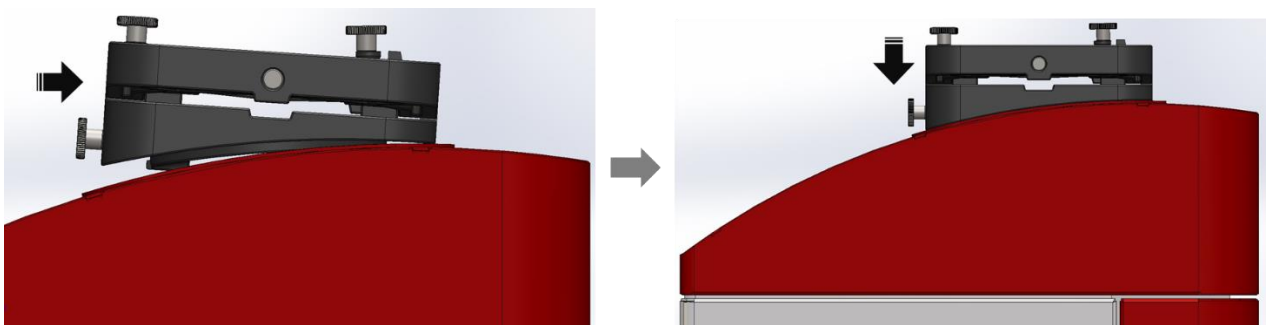


Figure 6 Placement of the angle adapter on the ceilometer.

3. There is a knurled screw at the back of the angle adapter with which the angle adapter must be securely clamped to the hood by turning it clockwise (see Figure 7).

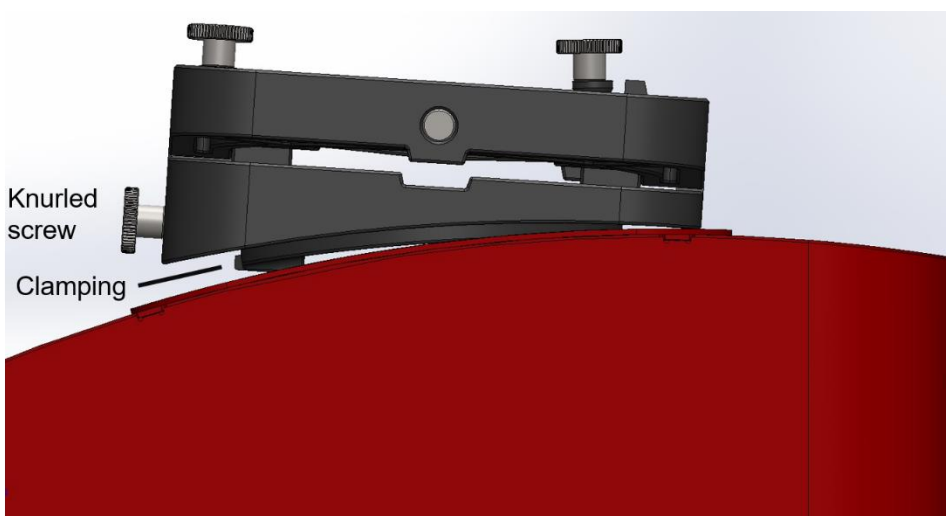


Figure 7 Fixing the angle adapter on the hood.

4. Plug in the connection cable and secure its connection by screwing in the securing at the plug. The Cloud Height Simulator has no on/off switch. As soon as the Cloud Height Simulator is supplied with power via the cable, the device starts and is ready for operation after a start time of about 10 seconds.

The LED on the front of the simulator next to the lenses shows the status of the simulator (see Table 4).

Color	Description
Green	Device status OK
Blue	Device status OK, active Bluetooth connection
Magenta	Firmware update active; the power supply must not be interrupted!
Red	There is a device error, see section 11.1
Flashing	Data transfer is taking place

Table 4 Status-LED.

- After a successful start put the Cloud Height Simulator on the angle adapter. Place the simulator so that the cable points to the right (Figure 8). This is indicated on the front of the angle adapter by the word "Cable" and the arrow.



Figure 8 Positioning of the simulator and connection of the supply cable.

5.2 Setting up communication

By default, the Cloud Height Simulator is controlled with the Android CH-Simulator-App. The communication is done via the Bluetooth interface. In addition, a cable bound serial RS485 interface is also available for communication with the device using the UMB binary protocol. For the communication via the serial interface the ConfigTool.Net from Lufft can be used.

5.2.1 Communication with the CH-Simulator-App via Bluetooth

Connect the Simulator via Bluetooth to your Android device as described in section 4.2.2. Open the CH-Simulator-App, which can be downloaded from the Android Play Store. Additionally, an APK is available on the Lufft homepage:

The start screen as shown in Figure 9 will appear. If no simulator is connected to the app yet, a red cross appears in the top right corner of the icon next to the gear wheel. To select a simulator paired via Bluetooth, click on this symbol and connect the desired simulator to the app by selecting it from the list that appears (see Figure 10).

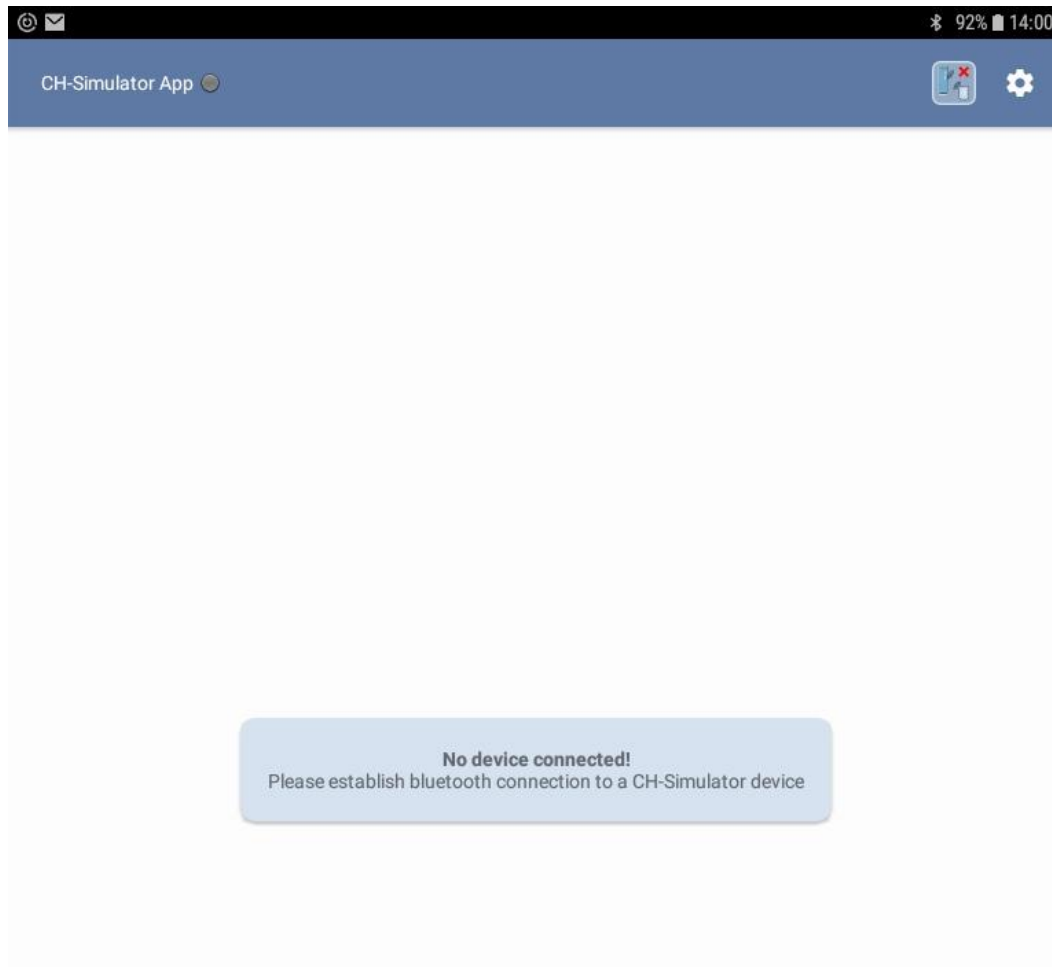


Figure 9 Start screen of the CH-Simulator-App.

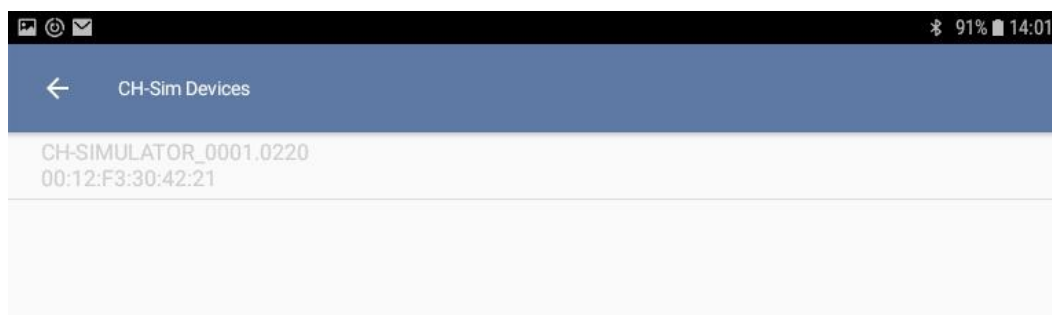


Figure 10 Selecting a simulator in the app.

After successfully connecting the Cloud Height Simulator, the CH-Simulator-App displays the device settings (see Figure 11). Here you can activate or deactivate the status LED and reset the current Bluetooth pairing. In addition, the simulator can be reset to the factory settings.

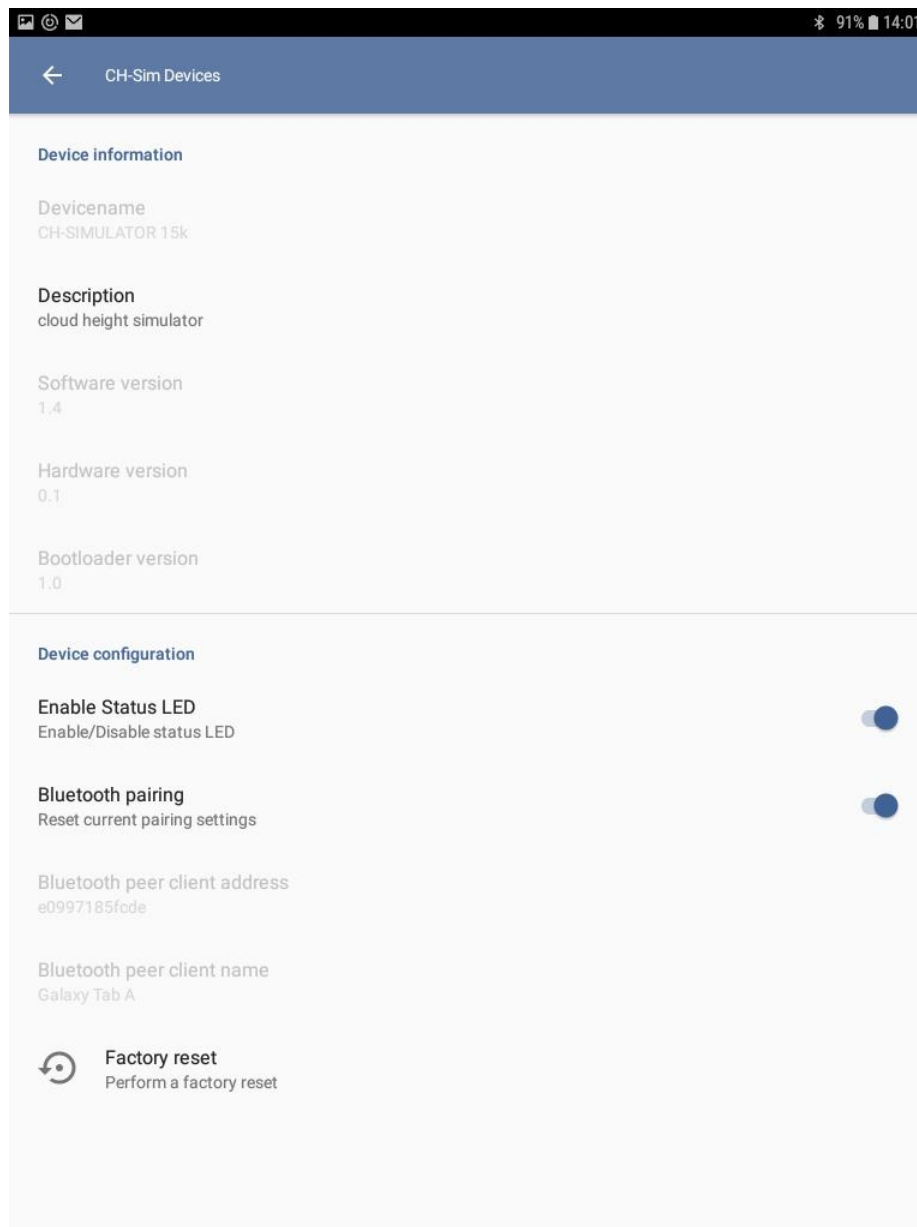


Figure 11 Device settings in the CH-Simulator-App.

5.2.2 Communication via the UMB binary protocol

Furthermore, the communication with the Cloud Height Simulator can be done via the UMB binary protocol. This is possible both via the wired RS485 interface (see section 4.2) and via the Bluetooth connection.

A comfortable way of communication via the UMB binary protocol is possible with the ConfigTool.Net from Lufft. This tool not only allows to make changes in the simulator settings and firmware updates, but also the recording of parameters measured by the simulator, e.g. the laser pulse repetition rate. Further information about the ConfigTool.Net and the UMB binary protocol can be downloaded from the Lufft website

To establish an UMB communication via Bluetooth, the COM port for communication must be known. Under Windows 10 the COM port can be looked up under "Further Bluetooth options" in the COM port settings. For communication, the outgoing port must be set in ConfigTool.Net (see Figure 12).

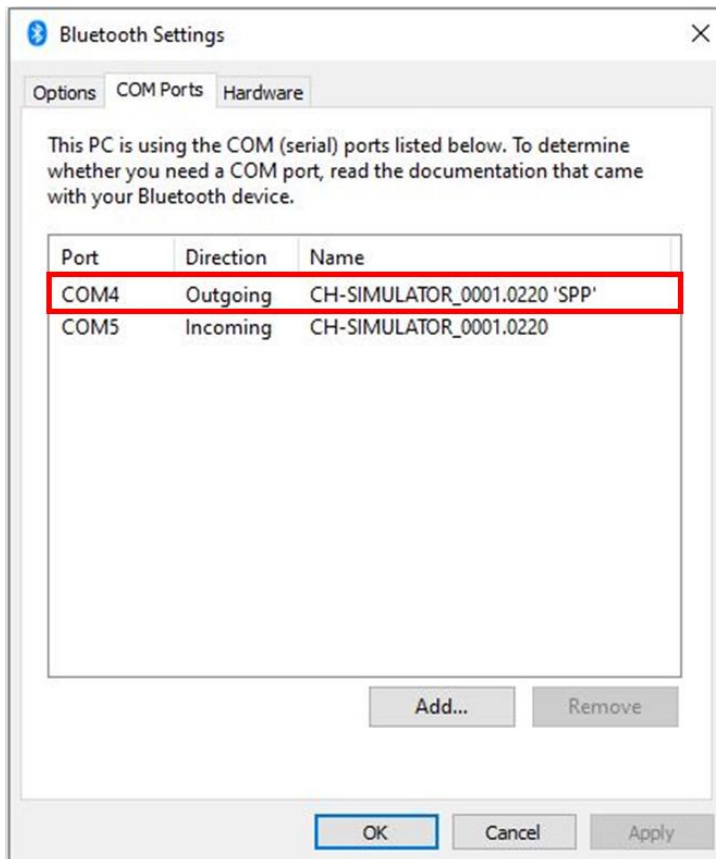


Figure 12 COM port for the UMB communication via Bluetooth.

6 Checking a Ceilometer with the Cloud Height Simulator

The verification of the correct function of a ceilometer with the Cloud Height Simulator is done by default with a set of pre-defined simulated clouds, which are selected via a menu in the CH-Simulator-App. In addition, an advanced mode is available, which allows free selection of the cloud height and depth and background light.

6.1 Preparations on the Ceilometer

NOTICE

Communication via the RS485 interface with raw data telegram (3) is not compatible with the TestMode for the CHM 8k. The amount of data to be transmitted is too large for the measuring period of 2 s and causes the interface to be blocked.

- ⇒ Before switching to TestMode, switch the ceilometer to one of the other data telegrams or use the LAN interface (transmission of the raw data telegram via LAN is possible).
- ⇒ If the communication fails, the device must be restarted or the user has to wait 1 hour until the TestMode switches off automatically, if access via the web interface is not possible.

After the successful start-up of the simulator (see chapter 5), the ceilometer must be prepared for the check as the next step. If the device is still switched off, connect it now to the power supply and wait for the boot process to finish. For a detailed description of the start-up of the ceilometer please refer to the manuals of the CHM 8k and CHM 15k.

As a next step switch the ceilometer into TestMode. This can be done either via the web interface or the RS485 interface.

Webinterface:

- (1) Login as Superuser (CHM 8k password: 8k-MHC; CHM 15k password: 15k-Nimbus)
- (2) In the web interface tab „Config System“ set the parameter “TestMode” to 1

RS485-Interface:

- (1) Activate the service-mode with the command
set<Space><RS485Number>:ServiceMode=1<CR><LF>
- (2) Activate the TestMode with the command
set<Space><RS485Number>:ChmTest=1<CR><LF>



The TestMode switches off automatically after one hour of operation to prevent accidental operation in this mode. The algorithm for cloud detection in TestMode does not apply distance correction to the measurement signal, because the Cloud Height Simulator is a constant light source and therefore does not require height-dependent correction. The algorithm cannot be used in normal operation of the ceilometer.

After switching on the TestMode of the ceilometer, a new NetCDF file with CHT instead of CHM in the filename is written. In the "Viewer" tab of the web interface, the "simulator intensity" is displayed in addition to the cloud heights, which corresponds to the signal strength of a simulated cloud in the height range of 3002 m to 3846 m (corresponds to cloud 4 in Table 5 and cloud 2 in Table 6). Furthermore, there are differences for the ceilometers CHM 8k and CHM 15k in the TestMode operation, as detailed below:

CHM 8k

- Recording of the measurement data is done with the minimum logging interval of 2s
- Switch to the cloud detection algorithm for simulated clouds to enable the detection of clouds over the entire height range

CHM 15k

- Modification of the averaging times of the cloud detection algorithm to enable a faster detection of the simulated clouds

When querying the boundary layer height (aerosol layer height) via telegrams, please note that this value is only contained in telegram 2, 3 and 4.

6.2 Check of the ceilometer

As soon as the simulator is correctly connected to the CH-Simulator-App as described in section 5.2, a cloud setting can be selected in the standard mode of the app via the menu selection. Figure 13 shows the corresponding menu in the app. To select a cloud, tap on the drop-down menu and select one of the clouds. The CHM 8k has 5 different cloud settings, the CHM 15k has 3 different cloud settings. The cloud settings are summarized in Table 5 and Table 6.

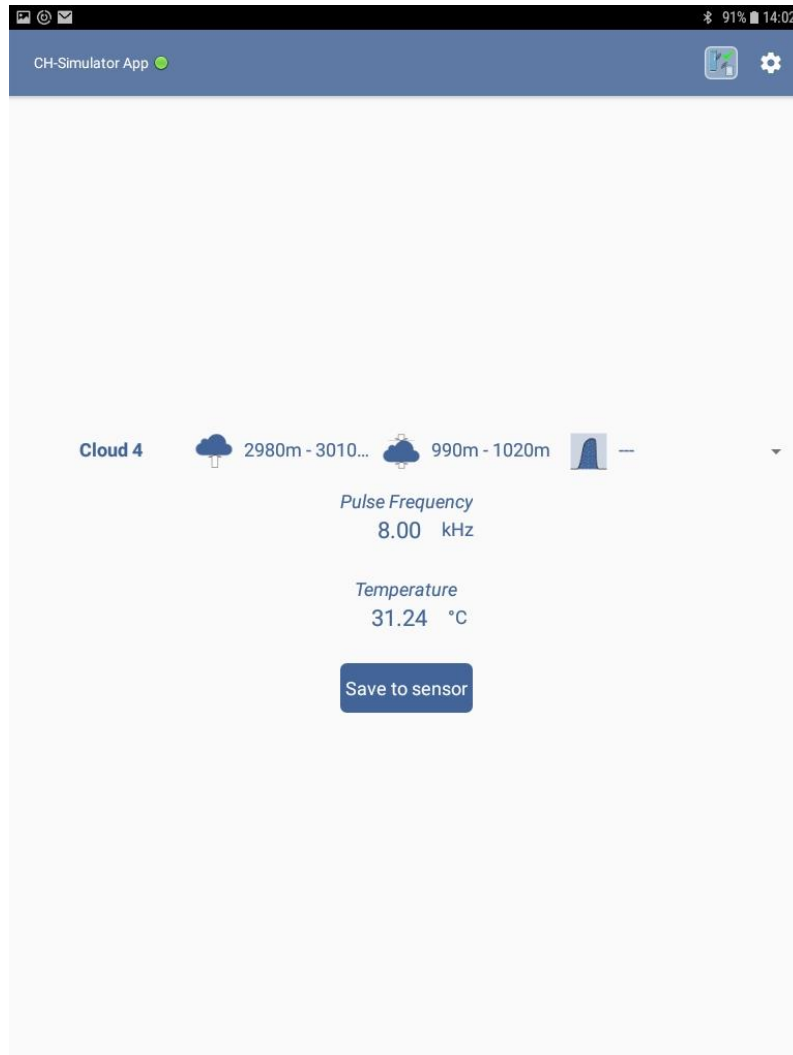


Figure 13 Selection of the clouds in standard mode.



The TestMode must be activated in the ceilometer to determine the clouds with the specified accuracy over the entire altitude range. On the CHM 8k ceilometer a firmware version 1.070 or higher must be installed for the test.

Proceed as follows for the check (steps 2 and 3 are only available when operating the ceilometer via the web interface):

- (1) Check in the CH-Simulator-App if a pulse rate is measured (CHM 8k: approx. 8 kHz; CHM 15k: variable, for new devices in the range 5 - 7 kHz). If no pulse rate is displayed, please check first that the simulator is correctly positioned and that there are no obstacles in the beam path between ceilometer and simulator. If the problem persists, please refer to section 11.1.
- (2) Set cloud 4 (2980 m – 3010 m) for checking a CHM 8k and cloud 2 (2980 m – 3015 m) for checking a CHM 15k.
- (3) In the web interface, in the "Viewer" tab, check if the displayed "simulator intensity" is greater than 100. If it is not, please refer to chapter 8.
- (4) Set the different clouds from the drop-down menu. After a changeover time of about 5s, the accuracy specified in the description of the app must be maintained for each cloud set (see also Table 5 and Table 6). The verification whether the ceilometer determines the clouds correctly can be done either

directly via the web interface or via the telegram or alternatively at a later time by checking the NetCDF data.

Cloud	Cloud height		Cloud depth		Back-ground light
	Unit meters	Unit feet	Unit meters	Unit feet	
1	80m - 110m	260ft – 360ft	190m - 220m	625ft – 725ft	On
2	480m - 510m	1575 – 1675ft	90m - 120m	295ft – 395ft	On
3	1480m - 1510m	4855ft – 4955ft	490m - 520m	1605ft – 1705ft	On
4	2980m - 3010m	9775ft – 9875ft	990m - 1020m	3245ft – 3345ft	On
5	7510m - 7540m	24640ft – 24740ft	465m - 495m	1525ft – 1625ft	On

Table 5 Pre-defined cloud settings for the CHM 8k.

Cloud	Cloud height		Cloud depth		Back-ground light
	Unit meters	Unit feet	Unit meters	Unit feet	
1	11970m - 12040m	39271ft – 39501ft	210m - 310m	688ft - 1018ft	Off
2	2980m - 3015m	9776ft - 9892ft	1000m - 1045m	3280ft - 3429ft	Off
PBL	PBL height				Back-ground light
	Unit meters	Unit feet			
3	584m/599m+/-30m	1916ft/1965ft+/-99ft			Off

Table 6 Pre-defined cloud settings for the CHM 15k.

6.3 Completion of the ceilometer check

After the desired check of the ceilometer with the simulator is done, the simulator can be removed again. To do so, take the simulator off the device and remove the power supply cable. Loosen the locking screw at the angle adjuster and take it off the device.

The TestMode of the ceilometer deactivates itself after one hour of operation, but it is recommended to deactivate the TestMode directly after the check. This can be done as described in section 6.1 via the web interface or with the following RS485 commands:

```
set<Space><RS485Number>:ServiceMode=1<CR><LF>
set<Space><RS485Number>:ChmTest=0<CR><LF>
set<Space><RS485Number>:ServiceMode=0<CR><LF>
```

7 Advanced Mode

Via the settings of the CH-Simulator App (see section 9.1) the advanced mode can be selected (see Figure 14), where cloud height and cloud depth can be freely selected over a large range. There are restrictions at the lower and upper limit. The sum of cloud height and cloud thickness must be at least 300 m and must not exceed 15000 m. In addition, the background light LEDs can be switched on or off individually in advanced mode. Please note that the brightness of BL1 and BL2 is much smaller than that of BL3 due to the alignment on the device.



Figure 14 Advanced mode of the CH-Simulator-App.



If the sum of cloud height and depth exceeds 6000 m, the step size for the cloud settings is increased to 100 m. In addition, there is a hardware-related jump in cloud height and depth. On average the cloud height is output 25 m higher and the cloud depth 25 m lower.

8 Optimization of signal strength

The signal strength of the light pulse, which the simulator generates on the detector of the ceilometer, can be optimized by adjusting the angle adapter. This step is only necessary for testing a ceilometer in exceptional cases. To optimize the signal strength, a connection to the cloud altimeter via web interface must be available.

The "simulator intensity" parameter displayed in the "Viewer" tab of the web interface when TestMode is activated corresponds to the signal strength of the optical signal emitted by the Cloud Height Simulator onto the receiver of the ceilometer. The signal strength is determined in the altitude range 3002 m to 3846 m, therefore cloud 4 (CHM 8k) or cloud 2 (CHM 15k) must be activated in the simulator, see section 6.2.

The signal strength depends on several factors:

Device specific brightness

The brightness of the light pulses emitted by the Cloud Height Simulator and arriving at the receiver of the ceilometer varies from simulator to simulator. In addition to the manufacturer-related differences in LED brightness, there are also differences in the central wavelength of the LEDs. The amount of light that can pass through the optical bandpass filter of the cloud altimeter varies from simulator to simulator.

Temperature

The brightness of the LEDs used in the simulator is temperature-dependent and decreases at higher temperatures. The change is caused by a decrease in LED efficiency and a shift in the central wavelength. Both are device-specific. The decrease in brightness compared to an initial temperature of 25°C is typically between 20% and 40% per 10°C temperature difference.

Alignment

The alignment of the simulator to the optical measuring unit in the ceilometer is decisive for the signal strength measured by the detector of the ceilometer. Production-related variations in the emission angle of the simulator are compensated for by means of the supplied angle adapter, ensuring compatibility with all ceilometers. The angle adapter is preset during the production of the Cloud Height Simulator.

The signal strength measured by a ceilometer during the test does not normally correspond to the maximum signal strength achievable with optimum alignment of the simulator to the measuring unit. This is not necessary for the cloud altimeter check described in chapter 6.

The angle adapter allows an extended check of the ceilometer. This is especially interesting for the analysis of a device defect and to determine whether there is a progressive aging of the device with decreasing sensitivity. For the extended test the parameter "simulator intensity" must be optimized by adjusting the angle adapter.

8.1 Angle adapter

With the angle adapter the alignment of the Cloud Height Simulator to the measuring unit of the ceilometer can be optimized by tilting it around two independent axes. Figure 15 shows how the simulator can be tilted around the two axes by turning knurled screws. A tilt in the short direction of the angle adapter (x-axis) is shown in the upper illustration, a tilt in the long direction (y-axis) in the lower illustration.

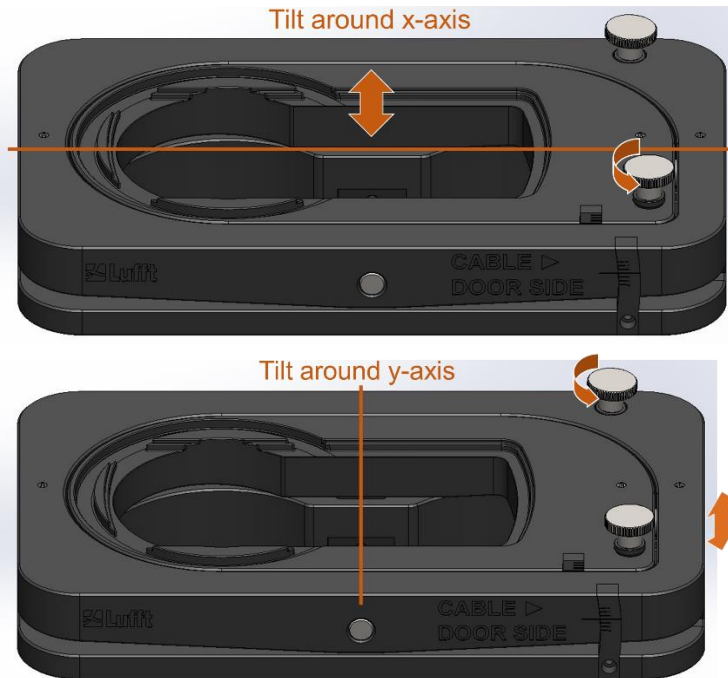


Figure 15 Alignment of the angle of both axis of the angle adapter.

The current angle setting can be read off from two scales (see Figure 16). The longer middle line indicates the zero position. The line above the middle long line corresponds to an angle of $+1^\circ$, the line below to an angle of -1° (see Figure 17).

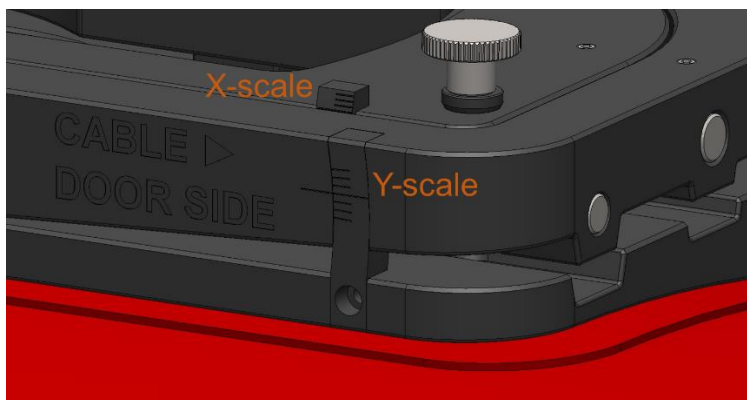


Figure 16 Scales to display the current angle setting.

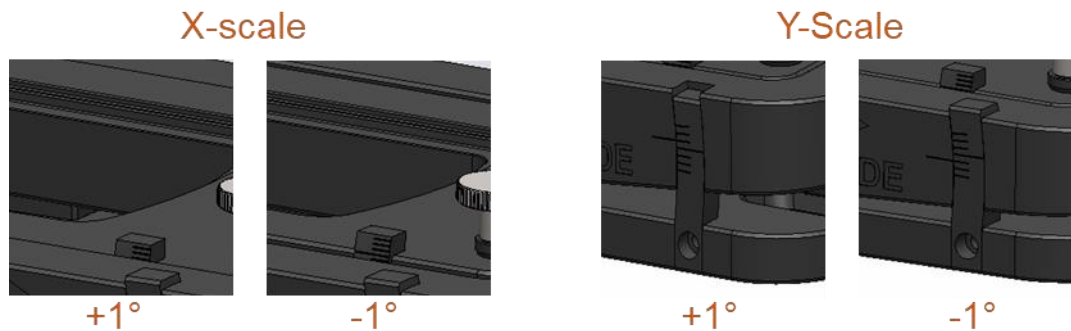


Figure 17 Reading the scales. The two left images show an angle setting of $\pm 1^\circ$ for the x-axis, the two right images show an angle setting of $\pm 1^\circ$ for the y-axis.

8.2 Recommended procedure for optimization

The light profile generated by the LEDs of a Cloud Height Simulator on the detector of the ceilometer is subject to production-related fluctuations and often has a secondary maximum in addition to the main maximum. Therefore, the following procedure is recommended to optimize the signal strength:

1. Let the simulator warm up/cool down to the ambient temperature, because the LED brightness changes with temperature. The temperature output by the CH-Simulator-App should change less than 1°C in 5 minutes before starting the optimization.
2. Adjust the x-axis over the whole available adjustment range of approx. 5° in 0.5° steps and read off the "simulator intensity". After the entire adjustment range has been run through, the angle at which the highest simulator intensity was measured is set.
3. Adjust the y-axis over the entire available adjustment range of approx. 5° in 0.5° steps and read off the "simulator intensity". After the entire adjustment range has been run through, the angle at which the highest simulator intensity was measured is set.
4. Carefully readjust the x-axis to the maximum value
5. Carefully readjust the y-axis to the maximum value



Especially at high outside temperatures, a sudden drop of the signal strength to 0 is possible, if the receiver of the simulator cannot detect the laser pulses for all angle settings. In this case, reverse the setting that caused the drop and continue the optimization without this angle range.

It is recommended to write down the angles of the maximum position found by the optimization for each ceilometer. Steps 2 and 3 of the optimization procedure can then be skipped during the next test if this maximum position is preset directly. The factory setting of the angle adapter can be found in the test protocol delivered with the instrument.

9 CH-Simulator-App

9.1 Configuration of the App

Open the CH-Simulator app on your Android device and check if there is a Bluetooth connection to the Cloud Height Simulator (see section 5.2.1). By selecting the settings via the gear symbol you can view further information about your CH-Simulator and the existing Bluetooth connection. You can also switch between the units feet and meters and select the advanced mode of the app. Figure 18 shows the app's settings options.

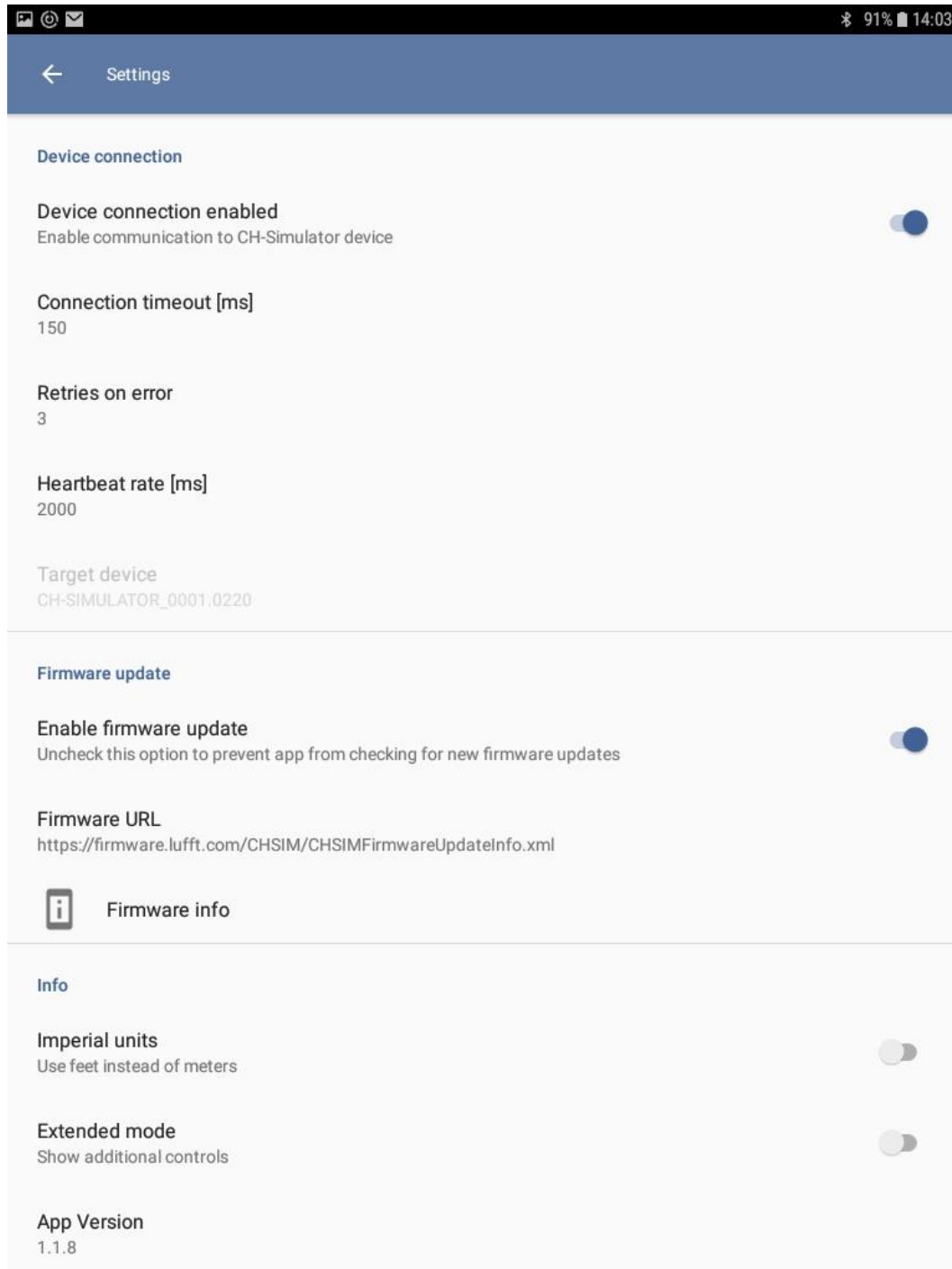


Figure 18 CH-Simulator-App settings.

The following settings can be made:

Device connection

In the device connection settings you can enable or disable the device connection and you can make settings for timeout and heartbeat interval. Changing these parameters is recommended for advanced users only.

Firmware update

In the firmware settings, the automatic firmware update can be enabled or disabled. If the update is activated, the latest firmware for the Cloud Height Simulator will be downloaded and saved locally if an internet connection is available. The field "Firmware URL" allows to change the web address used for this purpose. By pressing "Firmware info" information about the currently locally stored firmware version can be displayed. A description of the procedure for a firmware update follows in section 9.2.

Info

In the area Info you can change settings for the CH-Simulator-App. With the button "Imperial Units" you can choose between the units meter (switch off) and foot (switch on). After switching the unit, the app must be restarted for the change to take effect. You can also switch on the advanced mode, which allows you to freely set the cloud height and depth. After switching this setting, the app must be restarted.



Changes of the switches "Imperial Units" and "Advanced Mode" only become effective after a restart of the app.

9.2 Firmware update

To keep the sensor up to date, it is possible to update the firmware on site without having to send the sensor to the manufacturer. The settings for the firmware update are shown in Figure 18.

If the firmware update is activated in the settings, the latest firmware is downloaded from the specified Internet address and stored locally. In general, the web address preset in the app does not need to be changed.

When a connection to a Cloud Height Simulator is established, it is checked whether the firmware version of the simulator corresponds to the latest locally stored version. If the downloaded firmware is newer than the one on the connected simulator, the app offers to perform a firmware update. The firmware update runs automatically.

Notice

If the power supply is interrupted during a firmware update, the device may fail.

- ⇒ Guarantee a secure power supply during the update.
- ⇒ If the device fails, it must be sent in for repair.

10 Cleaning

If the glass panels of the transmitter and receiver are dirty, clean them with a damp, wrung out cloth. Then dry the glass panes with a dry, lint-free cloth.

Also remove dust and dirt on the housing.

Do not use solvents such as benzine, thinner, alcohol, kitchen cleaner, etc. to clean the simulator, as these agents may damage the housing and optical parts

If you use a chemical cleaning cloth, be sure to follow the instructions.

11 Faults, support, repair and disposal

11.1 Possible faults

Error description	Cause and remedy
After connecting the supply voltage the simulator does not react, the status LED remains off	• Disconnect and reconnect the supply voltage • Check supply voltage • If the defect remains, please contact Lufft for support
The status LED is green, but no Bluetooth connection is possible and the status LED is not blue during connection attempts	• Check the Bluetooth settings of the device you want to connect the simulator to • Decouple the simulator and recouple it with the device • Disable Bluetooth on other devices that are nearby • If the error persists, check whether the simulator is visible as a Bluetooth device on another device
The status LED indicates the correct operation of the device, but no RS485 connection is possible	• Check the correct wiring of the RS485 interface, if necessary swap yellow and green wire
The communication with the Cloud Height Simulator is working and the device is correctly installed, but no pulse rate is measured	• Check if the simulator is correctly positioned on the ceilometer, especially check the alignment (see Figure 8) • Check that the beam path between the ceilometer and the simulator is free of obstacles • Disconnect and reconnect supply voltage • Check LED temperature, if it is higher than 45°C, cancel the check and perform it at a later time when the operating temperature range is guaranteed, see Table 2 • Optimize the signal strength as described in chapter 8
The communication with the Cloud Height Simulator is working and the device measures a pulse frequency, but no clouds are displayed	• Disconnect and reconnect the power supply • Check LED temperature, if it is higher than 45°C, cancel the check and perform it at a later time when the operating temperature range is guaranteed, see Table 2 • Optimize the signal strength as described in chapter 8 • If the measured laser pulse frequency and "simulator intensity" remains 0 over the entire angular range, please contact Lufft for support
There is no change in the parameters "background_det" and "stddev" in the NetCDF file when the background light LEDs are switched on	• When the background light LEDs are switched on, the measured background light component changes (parameter background_det in NetCDF) and the detector noise increases (parameter stddev in NetCDF) • Due to design limitations, there is a significant change in background brightness only when LED 3 is switched on • If no change can be detected, disconnect and reconnect supply voltage • Check if the communication with the simulator works correctly • If the problem persists, please contact Lufft for support

12 Appendix

12.1 Cloud Height Simulator Hardware Version

Revision	Date of change	Changes	Comment
0.1	01.10.2020		First series version

Table 7 Hardware version.

12.2 Cloud Height Simulator Firmware Version

Firmware version	Description	Released
1.4	1. Detection CHM 8k or CHM 15k hardware 2. Reading the LED temperature 3. Parameter changes	Oct 2020

Table 8 Firmware version.

12.3 CH-Simulator-App Version

App version	Description	Released
1.1.8	1. Detection CHM 8k or CHM 15k hardware 2. Unit selection foot / meter 3. LED temperature display 4. Selecting the advanced mode by settings	Oct 2020

Table 9 CH-Simulator-App version.

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