

# VAISALA

## USER'S GUIDE

### Vaisala Radiosonde RS41-SGM



PUBLISHED BY

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# CHAPTER 1

## GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

### About This Manual

This manual provides information for operating Vaisala Radiosonde RS41-SGM. For information on the sounding software, see the appropriate sounding system documentation.

### Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information: This chapter provides general notes for the manual and the product.
- Chapter 2, Product Overview: This chapter introduces the features and advantages of the radiosonde.
- Chapter 3, Operation: This chapter contains information that is needed to operate this product.
- Chapter 4, Storage and Transportation: This chapter provides information for the transport and storage of the product.

- Chapter 5, Technical Support: This chapter presents information about the failure report and radiosonde warranty.
- Appendix A, Replacing Radiosonde Batteries: This appendix provides information on replacing radiosonde batteries.
- Appendix B, Safety Instructions for Balloon Operators: This appendix contains safe and proper instructions for handling radiosonde balloons.
- Appendix C: This appendix contains the warranty text for the radiosonde.

## Version Information

**Table 1** Manual Versions

Manual Code	Description
M211752EN-B	December 2015. Updated information on preparing the radiosonde.
M211752EN-A	March 2015. First version of this manual.

## Related Manuals

**Table 2** Related Manuals

Manual Code	Manual Name
DOC231720	Vaisala RS41 Unwinder Quick Guide
M211069EN	Vaisala MARWIN Sounding System MW32 User's Guide
M210977EN	Vaisala MARWIN Sounding System MW32 Technical Reference
M210978EN	Vaisala MARWIN Sounding System MW32 Maintenance Manual
-	Vaisala DigiCORA Sounding System MW41 Online Help, available in the Vaisala Sounding System MW41 web user interface.
M211415EN	Vaisala DigiCORA Sounding System MW41 Technical Reference

Visit [www.vaisala.com/RS41](http://www.vaisala.com/RS41) to watch a short video on how to use the RS41 unwinder.

## Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

**WARNING**

Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

**CAUTION**

Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

**NOTE**

Note highlights important information on using the product.

## Product-Related Safety Precautions

**WARNING**

Conduct soundings in a safe environment and in accordance with all applicable restrictions and regulations.

**WARNING**

Do not use the radiosonde in an area with power lines or other obstructions overhead. Make sure that you check the area for such obstructions before using the radiosonde.

**WARNING**

Do not use the radiosonde without consultation and cooperation with local and other applicable aviation authorities.

**WARNING**

Vaisala recommends the use of a parachute even if it is not required by applicable regulations.

**CAUTION**

Do not modify the unit. Improper modification can damage the product or lead to malfunction.

**CAUTION**

Do not use the radiosonde for any purpose other than for soundings.

## ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. It is possible to damage the product, however, by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench.
- When an ESD workbench is not available, ground yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either of the above precautions, touch a conductive part of the equipment chassis with your other hand before touching ESD sensitive components.
- Always hold component boards by the edges and avoid touching the component contacts.

## Lithium Battery-Related Precautions

**CAUTION**

Do not place the lithium battery in fire or apply heat to the battery.

Do not pierce the battery with nails, strike the battery with a hammer, step on the battery, or otherwise damage the outer casing.

Do not subject the battery pack to strong impacts or shocks.

Do not expose the battery to water or salt water, or allow the battery to get wet.

Do not disassemble or modify the battery. The battery contains safety and protection devices which, if damaged, may cause the battery to generate heat, rupture or ignite.

Do not leave the battery in direct sunlight, or use or store the battery inside cars in hot weather. Doing so may cause the battery to generate heat, rupture, or ignite. Using the battery in this manner may also result in shortened life expectancy and loss of performance.

Never short circuit, reverse polarity, disassemble, damage, or heat the battery over 100 °C (212 °F). If an exposed lithium battery does not start on fire, it will burn even more violently if it comes into contact with water or even moisture in the air.

**DO NOT SPILL WATER ON A BURNING BATTERY.** A fire extinguisher must be used.

## Recycling



Recycle all applicable material.



Dispose of batteries and the unit according to statutory regulations.  
Do not dispose of with regular household refuse.

## Regulatory Compliances

Vaisala Radiosonde RS41-SGM complies with the following performance and environmental test standards:

- 2004/108/EC Electromagnetic Compliance:  
EN 61000-4-2, EN 61000-4-3 and EN 55022 / EN 302 054-2
- ERM Electromagnetic Compatibility and Radio Spectrum Matters:  
ETSI EN 302054-1 and ETSI EN 302054-2
- RoHS compliance: RoHS Directive (2011/65/EC)



## Trademarks

DigiCORA<sup>®</sup> and MARWIN<sup>®</sup> are registered trademarks of Vaisala Oyj.

## CHAPTER 2

# PRODUCT OVERVIEW

This chapter introduces the features and advantages of the radiosonde.

## Introduction to Vaisala Radiosonde RS41-SGM

Vaisala Radiosonde RS41-SGM offers excellent data availability and accuracy of humidity, temperature, pressure, and wind measurement. The radiosonde is fast and stable with individual, SI-standard traceable calibration.

The radiosonde temperature sensor utilizes linear resistive platinum technology. The small size of the sensor results in low solar radiation error and guarantees fast response. Wind data, height and pressure are derived from Vaisala Radiosonde RS41 GPS data combined with differential corrected GPS data from the ground equipment.

Robust design, Physical Zero Humidity Check and In-built Functional Temperature Check ensure reliable performance in every situation. The radiosonde is also easy to use. For example, there is no need for the user to connect the batteries to the radiosonde to activate it. The radiosonde is automatically activated when placed on the ground check device. To make it easier to check the status of the radiosonde, the radiosonde has LED light indicators visible on the cover.

Radiosonde RS41-SGM features radio silence, which means that the radiosonde can be launched in radio silence up to a specified height. All data is recorded also during the radio silence and, when the radio silence ends, transmitted to the ground equipment. All transmitted data is

encrypted, and surface observations can be obtained directly from the radiosonde.

See [Figure 1](#) on page 14 for an illustration of RS41 with unwinder.



**Figure 1** Vaisala Radiosonde RS41-SGM with Unwinder

- 1 = Sensor boom
- 2 = Power switch
- 3 = Additional sensor interface connector
- 4 = Antenna
- 5 = LED light
- 6 = Unwinder
- 7 = Unwinder stick



## Unwinder

The unwinder is specifically designed for use with Radiosonde RS41-SGM. The unwinder is installed to the radiosonde so that it bends the sensor boom to the correct sounding position, ensuring repeatable results in the soundings. See [Figure 2 on page 15](#) for an illustration of the unwinder.

**Table 3 Unwinder Properties**

Material of the string	Non-UV treated polypropylene
Tenacity	<115 N
Length of the string	55 m
Unwinder weight with stick	24 g



**Figure 2 Unwinder**

## Packing

For easy transport, Radiosonde RS41-SGM is delivered in small packages containing three radiosondes and three unwinders.



**Figure 3** RS41-SGM Radiosondes and Unwinders in a Delivery Package

## CHAPTER 3

# OPERATION

This chapter contains information that is needed to operate this product.

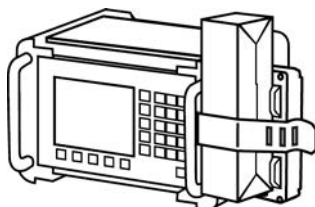
## Preparing the Sounding

It is essential that you carry out the pre-launch steps as instructed and always in the same way. The workorder for a sounding is listed below. See the following sections for details.

1. Unpack and fill the balloon. Prepare the optional sounding accessories.
2. Unpack the radiosonde and the unwinder. Attach the unwinder to the balloon. See RS41 Unwinder Quick Guide for illustrations.
3. Prepare the radiosonde with the ground check device.

### NOTE

When RS41-SGM is prepared outdoors with Ground Check Device MWH322, Vaisala recommends that the radiosonde is prepared in its cardboard package to provide extra protection for the radiosonde sensor. Remove the folio bag before the preparations.



4. Attach the radiosonde to the unwinder.
5. Launch the radiosonde balloon.
6. Monitor the sounding with the sounding system. See the sounding system documentation for more information.

## Preparing the Radiosonde Balloon

### **WARNING**

Read the safety instructions in Appendix B [Safety Instructions for Balloon Operators on page 49](#) before proceeding. Normally the balloon-lifting gas (hydrogen or helium) is supplied in gas bottles, but hydrogen can also be produced with a hydrogen generator. Carefully study the operation and safety instructions for the gas bottle facilities or the hydrogen generator.

Take extreme caution when handling the inflated balloon.

## Handling the Balloon

### **WARNING**

It is recommended that the balloon be prepared in a balloon-filling shed. The balloon-filling shed must be well ventilated so that possible gas leaks do not remain inside the shed, even in situations when there is no electricity.

### **CAUTION**

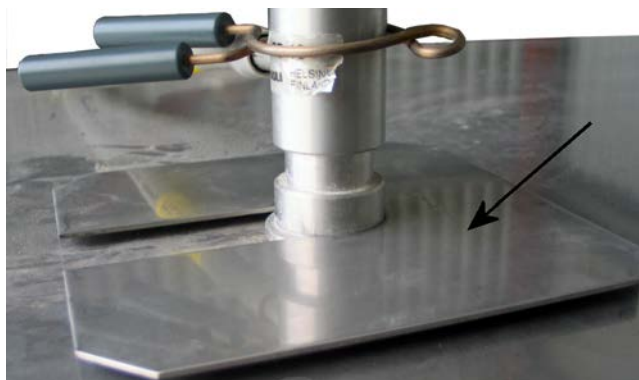
When handling the balloon, use protective gloves to avoid damaging the balloon surface. Even minor grease stains can damage the balloon, causing premature balloon burst.

Open the balloon package carefully. To avoid damaging the balloon, do not use a knife or other sharp objects to open the package.

Check visually that the balloon is structurally sound and has no perforations or other apparent defects in the nozzle section.

## Filling the Balloon

1. Connect the side tube of the filling balance to the pressure reducing valve on the gas cylinder (or hydrogen generator) with a flexible plastic hose.
2. Select the nozzle which best fits into the neck of the balloon.
3. Load the additional weights that are needed to obtain the required lift, for example, Vaisala Filling Balance FB13 weights.



**Figure 4** Loading Weights onto the Gas Nozzle

4. Secure the neck of the balloon to the balance nozzle with a clamp. Look out for sharp objects near the filling balance so that no damage is caused to the relaxed balloon.



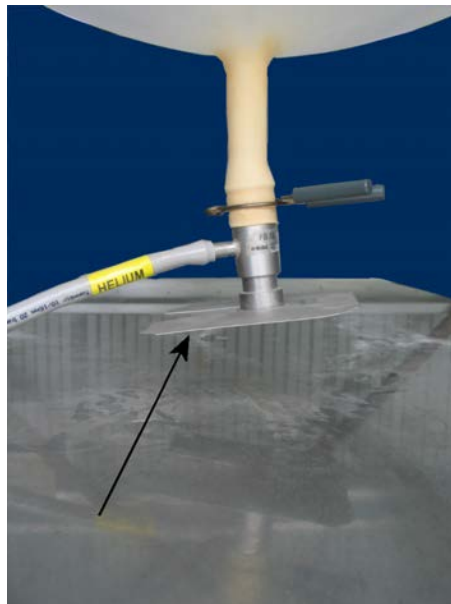
**Figure 5** Balloon Neck Secured with a Clamp

5. Turn on the gas from the pressure reducing valve. Let the gas flow slowly into the balloon. Do not leave the balloon-filling shed while inflating the balloon. Follow the balloon manufacturer's instructions when inflating the balloon.



**Figure 6 Filling the Balloon**

6. When the balloon is sufficiently filled, in other words, the balloon just raises the gas nozzle, close the gas valve.

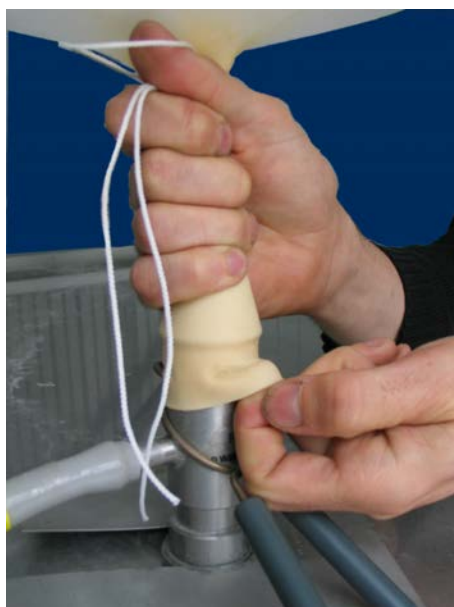


**Figure 7 Balloon Raises the Weight and Nozzle**

7. Before removing the balloon from the gass nozzle, tie the neck of the balloon tightly above the balance nozzle with approximately 0.5 m (2 ft) bit of string. Remove the balloon from the gas nozzle.



**Figure 8** Tying the Balloon Neck



**Figure 9** Removing the Balloon from the Gas Nozzle

8. Fold the neck of the balloon over and secure firmly. Cut off any extra string. [Figure 10 on page 22](#) shows an example of a secured balloon neck. In the figure, the balloon is attached to a balloon holder hook.



**Figure 10 Balloon Neck Tied Firmly**

9. When the balloon is ready, make sure it does not touch anything. Hold the inflated balloon by the neck.

## Preparing Optional Sounding Accessories

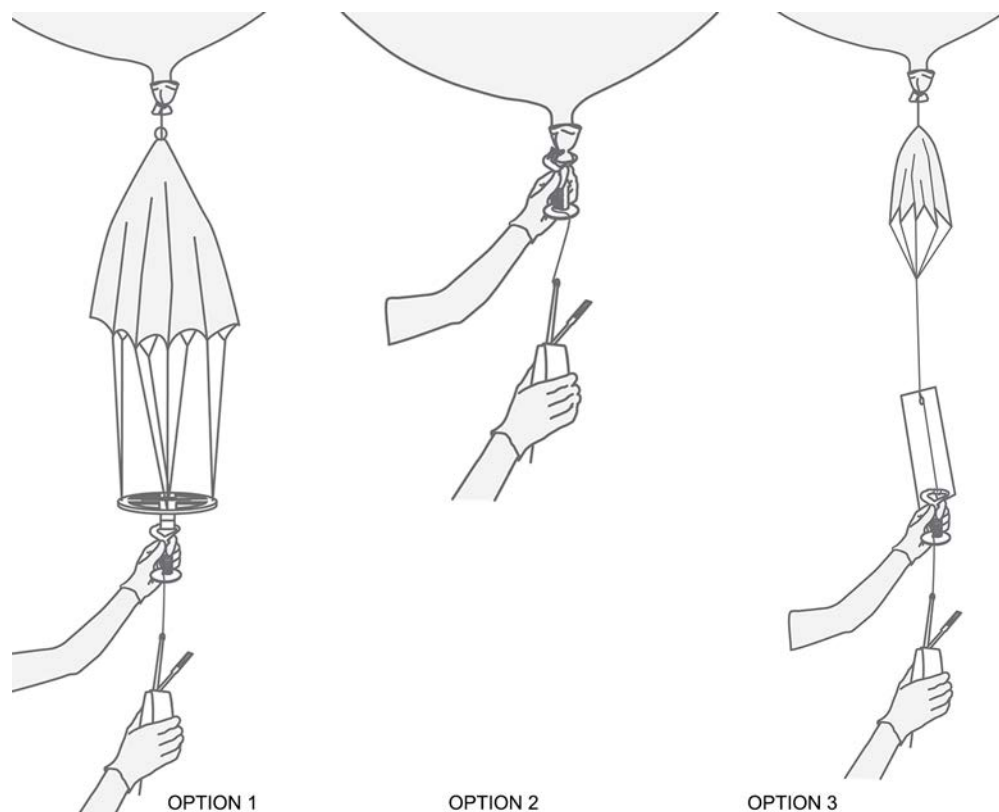
The unwinder is designed to be attached directly to the folded balloon neck, but in case you cannot attach the unwinder to the balloon, the unwinder can also be used with optional sounding accessories which provide the necessary support during the sounding. The sounding accessories are needed to restrict the movement of the unwinder. In this section, optional sounding accessories refer to a hanger board or a parachute.

The unwinder must always be attached to a relatively firm support. The support must not let the unwinder twist freely, or otherwise the suspension string might unwind at too high a speed and the radiosonde hit the ground during the launch. However, the unwinder must be able to swing slightly during the sounding.

Similar to the balloon, the unwinder and the optional sounding accessories must be prepared before launching the radiosonde.

See [Figure 11 on page 23](#) for an illustration of the different options.





**Figure 11 Radiosonde RS41 Optional Accessories**

**CAUTION**

The strength of all the strings used during soundings must not exceed 23 kp (230 N). Knots in the strings weaken the strength to the minimum of 45 % of the original string strength. This results in a string strength of 10 kp (100 N) which is sufficient for soundings with Radiosonde RS41.

Attach all optional sounding accessories next to the balloon, otherwise they disturb the measuring environment of the radiosonde and no proper temperature and humidity measurements can be made.

Visit [www.vaisala.com/RS41](http://www.vaisala.com/RS41) to watch short videos on how to make a hanger board and how to attach the unwinder to the hanger board, and how to attach the unwinder to the parachute.

## Totex Parachute 5710-5

The recommended parachute is Totex type 5710-5 (Vaisala code 15045). See option 1 in [Figure 11 on page 23](#).

Totex parachute 5710-5 has an elastic ribbon loop below the spreader. Attach the unwinder to the loop by pushing the hook out the other side in the same fashion as with the folded balloon neck.

## Non-Totex Parachute

If you are using a parachute that has no firm objects to prevent the unwinder from twisting, use a hanger board. The hanger board provides more stability during the sounding. See option 3 in [Figure 11 on page 23](#).

### Making a Hanger Board

The string used with the hanger board must have a diameter of  $> 1.5$  mm and the strength must be 250 ... 350 N.

See the steps below for instructions on how to make a hanger board out of the radiosonde cardboard package. See also the video in [www.vaisala.com/RS41](http://www.vaisala.com/RS41).

You need the radiosonde cardboard package, scissors, and some string.

1. Cut the radiosonde cardboard package to one whole piece that is big enough to make a hanger board.
2. Make one hole at one end of the hanger board, four holes at the other. Make the four holes so that two holes are on top of each other.
3. Tie a string on the unwinder hook.
4. Thread the string through the four holes so that the unwinder is firmly attached to the other end of the hanger board.
5. Pull the same string through the hole at the other end of the hanger board and attach the string to the parachute. The string now runs across the hanger board.

## Preparing RS41 Unwinder

When you perform a sounding with no optional accessories, the radiosonde unwinder is attached directly to the balloon. See option 2 in [Figure 11 on page 23](#).

Visit [www.vaisala.com/RS41](http://www.vaisala.com/RS41) to watch a short video on how to attach the unwinder to the balloon.

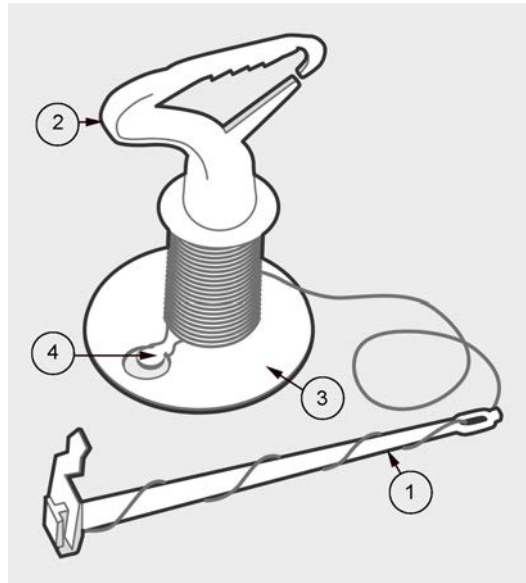
**NOTE**

It is very important to prepare the unwinder carefully, following the instructions below. Correct handling of the unwinder ensures a successful sounding.

## Detaching Unwinder Stick

To start using the RS41 unwinder, first detach the unwinder stick (number 1 in [Figure 12 on page 26](#)) from the unwinder body. The stick is attached between two plastic clips in the unwinder hook (number 2). Detach the stick from between the plastic clips and pull it out from the unwinder bottom plate (3).

If the unwinder stick is tightly attached to the bottom plate, it is a good idea to slightly twist the unwinder stick before pulling it out. When you pull the unwinder stick out, make sure that the string unwinds and that it is not tangled.



**Figure 12** RS41 Unwinder

**Table 4** RS41 Unwinder Parts

The numbers refer to <a href="#">Figure 12 on page 26</a> :		
1	=	Unwinder stick
2	=	Unwinder hook
3	=	Unwinder bottom plate
4	=	Unwinder clip

## Handling the Unwinder String

In the unwinder body, the unwinder string runs under a round plastic clip (number 4 in [Figure 12 on page 26](#)) on the bottom plate. This will keep the string attached to the unwinder, and the radiosonde attached to the balloon.

To prevent the string from getting tangled in the clip during the sounding, make sure the round plastic clip is level with the unwinder bottom plate. If the lip is bent, bend it gently back to level position. See [Figure 13 on page 27](#).



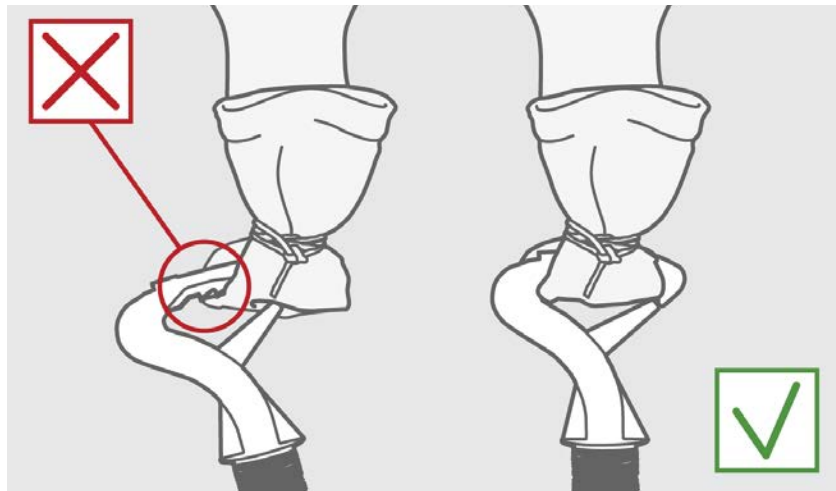
**Figure 13** Unwinder Clip Is Level with the Bottom Plate

## Attaching the Unwinder to the Balloon

Follow the steps and figures below to attach and align the unwinder correctly when it is attached directly to the balloon.

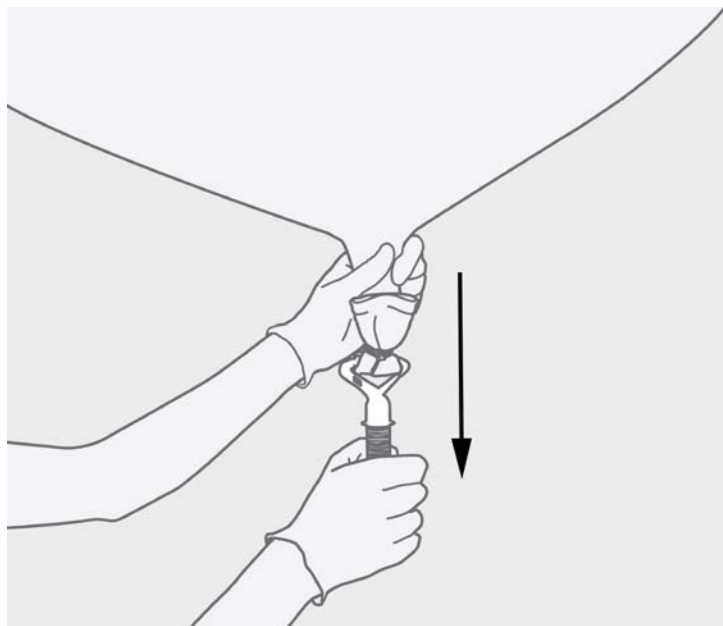
The unwinder must be attached firmly, so that it is not able to twist freely, or the suspension string might unwind at too high a speed and the radiosonde hit the ground during the launch. However, the unwinder must be able to swing slightly during the sounding.

- Pass the unwinder hook through the loop created by the tied balloon neck.
- Make sure the hook comes out the other side as shown in [Figure 14 on page 28](#). The unwinder is now firmly attached to the balloon.



**Figure 14 Unwinder Attached to the Balloon Neck**

- Align the unwinder so that it points directly downwards from the balloon neck, as illustrated in [Figure 15 on page 28](#).



**Figure 15 Unwinder Aligned with the Balloon Neck**

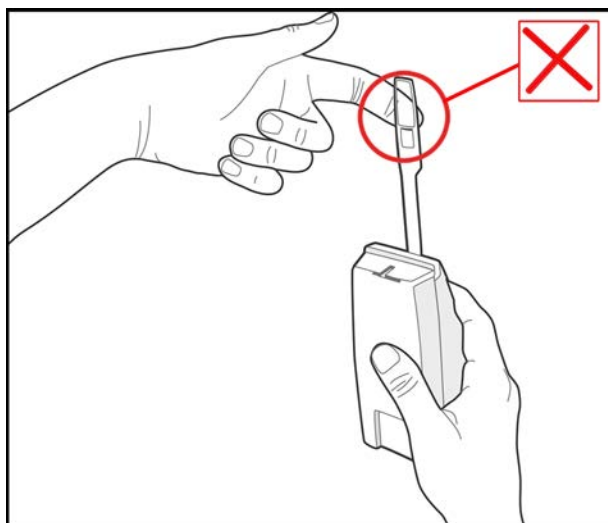
**CAUTION**

Align the unwinder so that it points downwards from the balloon neck.

## Preparing the Radiosonde

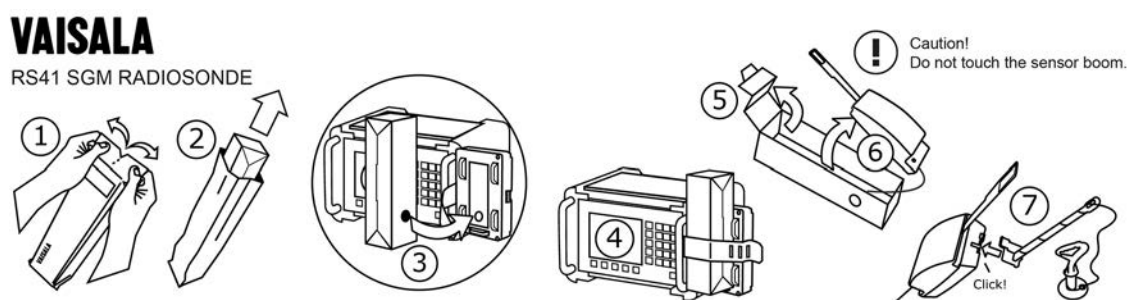
**CAUTION**

Do not touch the radiosonde sensors, they are fragile and can be easily contaminated.

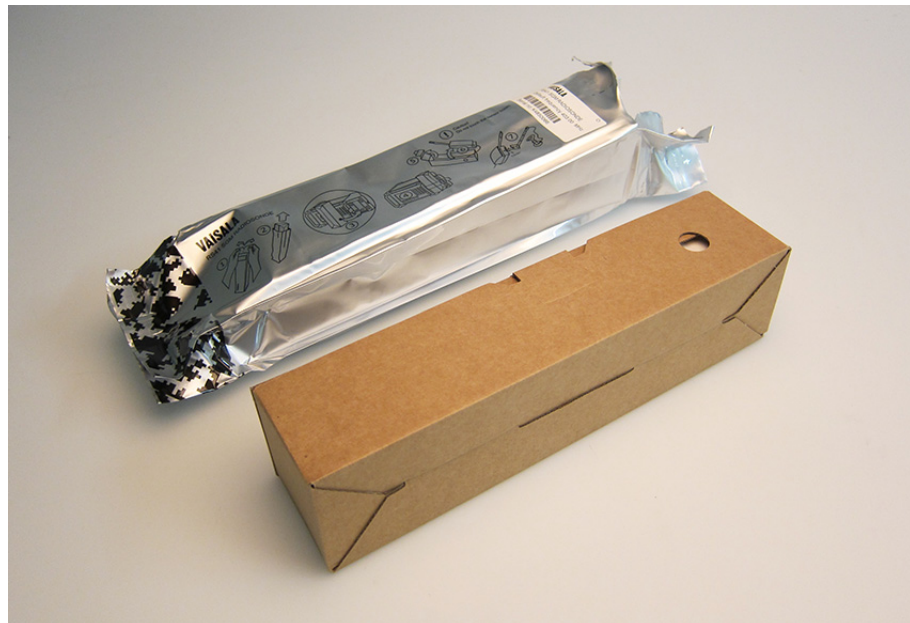


**Figure 16 Do Not Touch the Radiosonde Sensors**

1. Open the radiosonde package and follow the instructions printed on the folio bag to prepare the radiosonde. [Figure 17 on page 29](#) provides an example of the instructions.

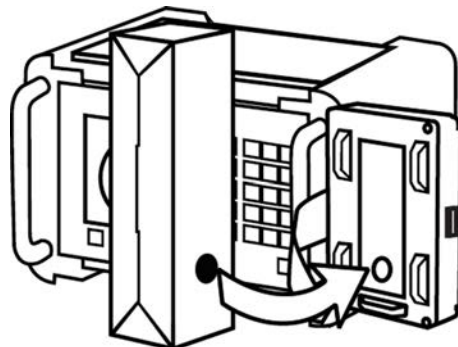


**Figure 17 Instructions for Preparing the Radiosonde Printed on the Folio Bag**



**Figure 18 Radiosonde RS41-SGM Package Removed from the Folio Bag**

2. Place the radiosonde on the ground check device. Check the markings on the cardboard box and the device for the correct placement of the radiosonde.

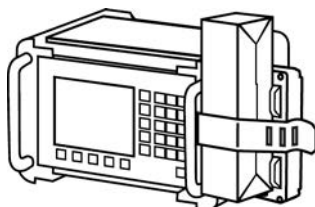


**Figure 19 Placing Radiosonde RS41-SGM on MWH322**



**NOTE**

When RS41-SGM is prepared outdoors with Ground Check Device MWH322, Vaisala recommends that the radiosonde is prepared in its cardboard package to provide extra protection for the radiosonde sensor. Remove the folio bag before the preparations.



3. Pull the strap over the radiosonde. The radiosonde is switched on automatically.

The sounding software automatically detects the radiosonde and begins the sounding preparations.

4. During the radiosonde pre-flight preparation phase, several steps are carried out. These consist of ground check procedures for sensors, as well as optional features for setting the radiosonde in-flight operation parameters, such as a timer for turning the radiosonde power off after a desired time or altitude.

For RS41-SGM, you can also define a trigger for radio silence height and/or time. This trigger sets the height and/or the time after which the radio silence ends and the radiosonde starts transmitting data.

During the radio silence, RS41-SGM buffers sounding data without transmitting it. When the trigger you have set is met, the radiosonde starts transmitting the buffered data first, and then continues with real-time sounding data.

5. After the ground check is finished, the sounding software indicates the results with a message. Remove the radiosonde from the ground check device.

Before you launch the radiosonde, you can return to the preparation phase by releasing the strap around the radiosonde. The sounding software automatically returns to the ground check phase.

If there is any delay in starting the sounding, for example, if you must wait before launching the sounding balloon, you can switch the radiosonde off by pressing the power switch. When you are ready to launch the balloon, switch the radiosonde back on.

## Launching the Radiosonde

If you have prepared the radiosonde in its cardboard box, remove the radiosonde from the box when the ground check is finished. Open the cover and lift up the flap at the end of the box.



**Figure 20** Removing the Radiosonde from the Cardboard Box

## Checking the LED Light

After preparing radiosonde RS41-SGM for the sounding, check the radiosonde GPS reception by checking the LED light on the radiosonde cover. When the green LED is lit steadily, the radiosonde is ready for the release. The LED light will switch off automatically after the launch. See [Table 5 on page 33](#) for more detailed information on RS41-SGM LED light.

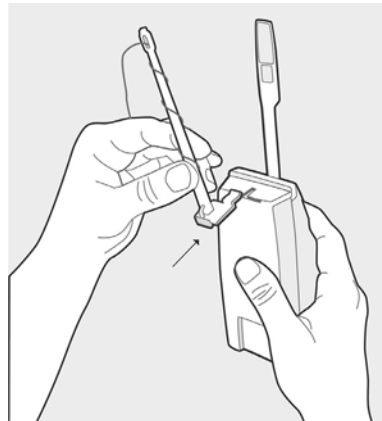
**Table 5 RS41 LED Lights**

Green LED is blinking.	When the green LED light is blinking, the reconditioning of the humidity sensor and sensor checks are in progress and/or the radiosonde is not receiving GPS signal. To receive the GPS signal, take the radiosonde outside with line of sight to GPS satellites.
Green LED is steadily lit.	<ol style="list-style-type: none"> <li>1. The radiosonde is ready and works fine, determined by the radiosonde self diagnostics. The self diagnostics cover, for example, temperature and humidity sensors, as well as GPS.</li> <li>2. GPS satellites are detected. Once GPS signal has been found after radiosonde start up, the LED light becomes steady green. The LED light may start blinking again due to possible GPS blind spots (for example, inside a balloon shelter), indicating that the radiosonde should be taken outside with line of sight to GPS satellites before launch.</li> <li>3. The steady green LED light indicates that the telemetry from RS41 is working.</li> </ol>
Red LED is lit.	Error. Check the sounding software for any error messages. For possible battery replacement, see <a href="#">Appendix A Replacing Radiosonde Batteries on page 41</a> .

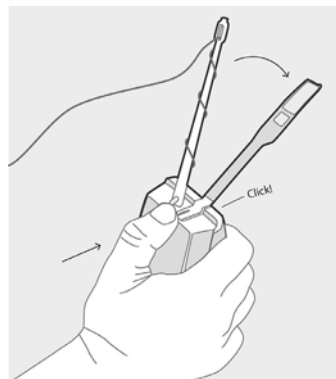
## Preparing RS41 Sensor Boom

Before launching the radiosonde, bend the sensor boom to the correct sounding position using the unwinder stick. This also attaches the radiosonde to the unwinder and the balloon.

Push the unwinder stick to its position at the end of the radiosonde. As you push, the unwinder stick pushes the sensor boom to the bent position and the unwinder snap lock clicks into place. Make sure that the unwinder is firmly attached to the radiosonde. See [Figure 21 on page 34](#) and [Figure 22 on page 34](#).



**Figure 21** Pushing the Unwinder to Place



**Figure 22** Unwinder Stick Locking into Place

If necessary, push the unwinder stick in two places: hold the radiosonde in your left hand and push the stick with your thumb as shown in [Figure 22 on page 34](#). Use your right hand thumb to push the stem of the stick against the edge of the radiosonde.

## CHAPTER 4

# STORAGE AND TRANSPORTATION

This chapter provides information for the transport and storage of the product.

## Storage

Radiosondes must be stored and used properly in accordance with applicable instructions, the User's Guide, and specifications issued by Vaisala.

Proper storage conditions must fulfill the following requirements:

Radiosondes must be kept in their original packaging (unopened vacuum envelopes) in a dry, ventilated indoor storage space, and within the following key environmental limits (ref. IEC 60721-3-1 class 1K2):

- Temperature +5 °C to +40 °C
- Relative humidity below 85%

### **CAUTION**

The suspension string is not resistant to prolonged exposure to sunlight. Store the unwinders in their original unopened packages.

# Transportation

Vaisala radiosondes must be transported in their original shipping packages. These packages are designed and built to survive and protect their contents in the environmental conditions described herein with the terminology and standards per standard: IEC 60721-3-2. The transportation of radiosondes requires climatic conditions 2K2 and mechanical conditions 2M1 of this standard:

- Transportation in weather-protected conditions.
- Transportation using conventional means (car, truck, and/or aircraft), with free fall not exceeding 0.25 m in any circumstances.
- Following additional markings on packaging.

## Transporting RS41 Radiosondes with Lithium Batteries

RS41 radiosondes with lithium batteries are classified as:

- UN 3091 Lithium metal batteries contained in equipment

Consignments must be packed, labeled, and documented according to the IATA packing instructions.

When transporting the radiosondes with lithium batteries, take the following requirements into account:

- The package must display a lithium battery handling label, see [Figure 23 on page 37](#) for an example. The original radiosonde shipping package must be used for transport, and it already has the lithium battery handling label.
- The consignment must include a document indicating the lithium content, describing proper handling and procedures for damaged packages, and a telephone number for additional information. The original radiosonde consignment includes a **SHIPPER'S DECLARATION FOR ARTICLES NOT REGULATED AS DANGEROUS GOODS**, which should be reused for this purpose after updating the appropriate information.



**Figure 23** Lithium Battery Handling Label

**NOTE**

If the lithium battery is faulty, do not transport it.





## CHAPTER 5

# TECHNICAL SUPPORT

This chapter presents information about technical support.

## Product Returns

If the product is found faulty, follow the instructions below to speed up the process and to avoid extra costs to you.

1. Read the radiosonde warranty information.
2. Contact Vaisala technical support via e-mail or fax and request for RMA (Return Material Authorization) and shipping instructions.
3. Proceed as instructed by Vaisala technical support and provide the failure report as requested.

**NOTE**

RMA must always be requested from Vaisala technical support before returning any faulty material.

## Technical Support

For technical questions, contact the Vaisala technical support:

E-mail [helpdesk@vaisala.com](mailto:helpdesk@vaisala.com)

Fax +358 9 8949 2790



## APPENDIX A

# REPLACING RADIOSONDE BATTERIES

This appendix provides information on replacing the radiosonde batteries.

**NOTE**

Note that inserting or replacing radiosonde batteries is not part of the normal operation of the radiosonde. It is only needed in a possible error situation indicated by the radiosonde or the ground equipment.

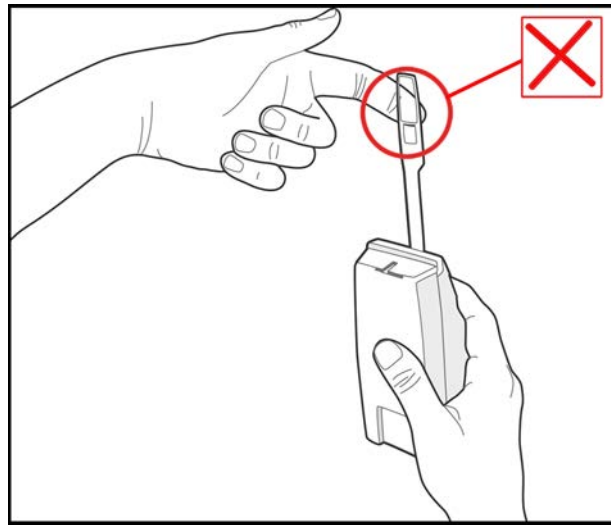
The radiosonde uses two lithium batteries which have power for approximately five hours.

If the radiosonde LED light indicator is red and MW41 sounding system gives a warning on low battery capacity during the radiosonde ground check, you must replace the radiosonde batteries.

To replace the batteries, follow the steps below. You can use, for example, a small screwdriver to open the radiosonde cover.

**CAUTION**

Do not touch the radiosonde sensors, they are fragile and can be easily contaminated. Handle the radiosonde carefully and do not let the sensors touch anything while changing the batteries.



**Figure 24 Do Not Touch the Radiosonde Sensors**

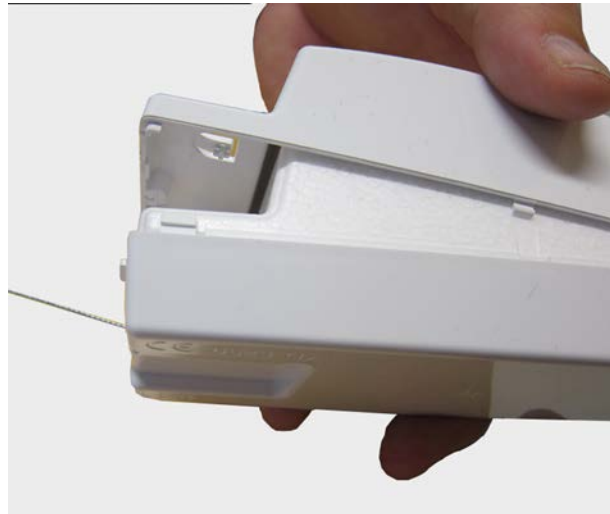
1. Loosen the radiosonde cover by placing the tip of the screwdriver to the small slots at the antenna end of the radiosonde and twist the screwdriver carefully. See [Figure 25 on page 42](#) for an example. At the same time, slightly press the sides of the bottom half of the radiosonde to loosen the snap locks. See [Figure 26 on page 43](#).

**CAUTION**

Be careful not to accidentally touch the pins in the additional sensor interface connector with the screwdriver, you might short circuit the radiosonde.

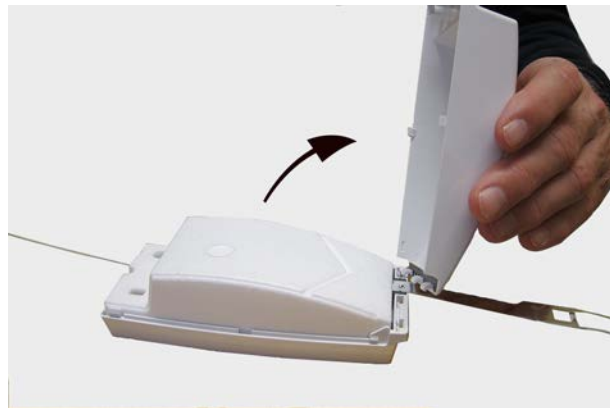


**Figure 25 Opening the Radiosonde Cover**



**Figure 26** Opening the Snap Locks

2. Open the radiosonde cover by lifting the antenna end first and remove the styrofoam case from inside the radiosonde.

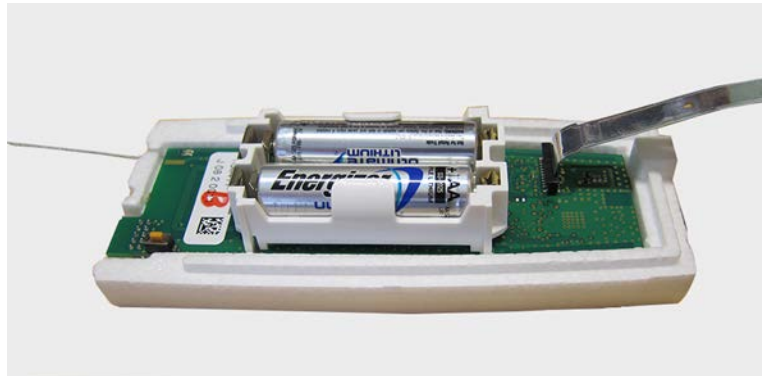


**Figure 27** Opening the Radiosonde Cover

3. The battery holder is inside the styrofoam case, on top of a Printed Circuit Board (PCB). To make the changing of batteries easier, you can remove the PCB board and the battery holder from inside the radiosonde bottom cover, but be careful not to touch the PCB.

**CAUTION**

Do not touch the PCB board. You might deliver electrostatic discharge and damage the radiosonde.

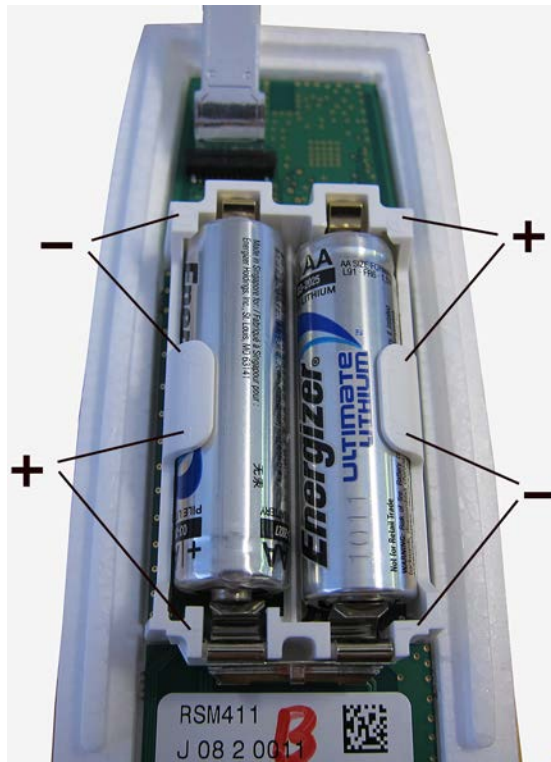


**Figure 28** RS41 Batteries in the Battery Holder

4. Remove the old batteries from the battery holder.
5. Before placing the new batteries, check the battery polarity symbols on the radiosonde battery holder carefully. See [Figure 29 on page 45](#) for an illustration of RS41 battery holder polarity symbols.

**CAUTION**

Make sure to check the battery polarity symbols in the battery holder carefully and to place the new batteries correctly. Placing both battery poles in the wrong direction damages the radiosonde. Placing one battery pole in the wrong direction prevents the radiosonde from working.



**Figure 29** RS41 Battery Holder Polarity Symbols

6. When placing the new batteries, it is easier to insert the batteries by first pushing them against the spring clips, circled in [Figure 30](#) on [page 46](#).

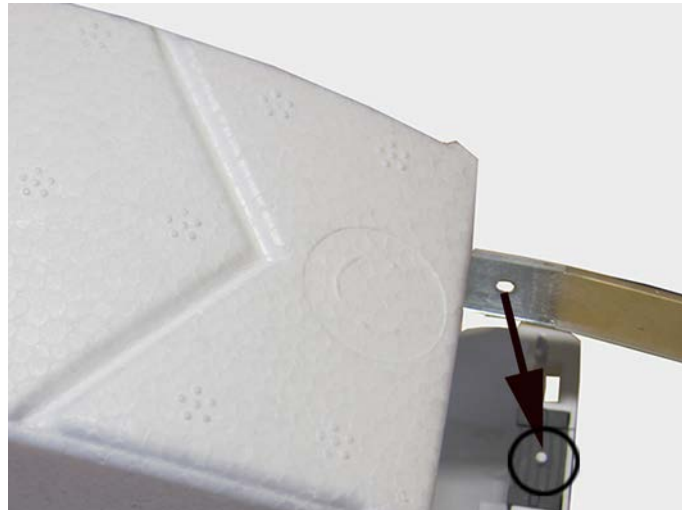


**Figure 30** RS41 Battery Holder Spring Clip

7. Put the battery holder and the PCB board back inside the styrofoam bottom case and put the styrofoam cover back on.

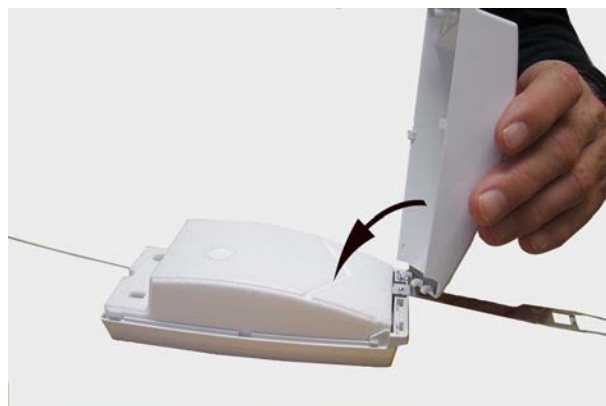


8. Put the styrofoam case back inside the radiosonde bottom cover. Check the positioning of the sensor boom: Make sure the small hole at the stem of the sensor boom meets the white pin on the edge of the radiosonde cover. Use your thumb to push the stem of the sensor boom, if necessary, but do not touch the sensors.



**Figure 31 Placing Radiosonde Sensor Boom**

9. Replace the radiosonde cover by first attaching the three hooks at the sensor end of the radiosonde and then setting the rest of the cover down.



**Figure 32 Replacing Radiosonde Cover**

10. Snap the radiosonde covers together and make sure that the three snap locks on both sides of the radiosonde are locked. Check all the seams to make sure that the radiosonde covers are tightly attached.



**Figure 33 Snapping Radiosonde Covers Together**

11. Even after changing the batteries, the radiosonde LED light indicator remains red and the sounding software gives a warning on low battery capacity and a short sounding time. However, if these are the only warnings you get, you can start a sounding after changing the batteries and the radiosonde works as usual.

**NOTE**

The radiosonde LED light indicator remains red and the sounding software gives a warning on low battery capacity after replacing the batteries. However, if these are the only warnings you get, you can start a sounding after changing the batteries.

## APPENDIX B

# SAFETY INSTRUCTIONS FOR BALLOON OPERATORS

This appendix contains details of safe and proper balloon preparation.

Photocopy these instructions and place the list in clear view in the balloon-filling shed and in the sounding compartment.

1. No smoking or naked flame allowed.
2. If possible, avoid wearing clothing made of nylon or other synthetic fibers to prevent a build-up of static charges. Do not wear shoes with rubber soles.
3. Wear protective glasses.
4. Regularly check that the gas tube fits securely to the gas cylinder or generator nozzle and to the balloon inflation nozzle.
5. Take care to prevent a gas leak in the shed when interrupting inflation to replace a gas cylinder.
6. Never use a repaired balloon.
7. Should a leak develop in the balloon during inflation, do not let gas escape from the balloon inside the shed if possible. Instead, release the defective balloon without load. It is not advisable to deflate the balloon, even outside the shed.
8. Do not touch the balloon with bare hands except when holding it by the neck. Wear soft cotton gloves.
9. Ensure that there are no pointed objects in the shed. Nails, hooks, hinges, padlocks, etc., are dangerous as they might scratch the

inflated balloon. The balloon film is only 0.05 ... 0.1 mm thick upon launch; the slightest scratch could cause the balloon to burst prematurely.

10. Keep the doors of the shed shut while inflating the balloon on a windy day. However, ensure that the shed is properly ventilated.
11. No unauthorized person shall be allowed admittance to the shed while the hydrogen generator is in operation or balloon inflation is going on.
12. Ensure that all tools and other implements not essential for balloon inflation have been removed from the shed.
13. Do not take any electrical devices (cell phone etc.) to the balloon filling shed or close to the balloon inflated with hydrogen. Safe distance when outdoors is typically 1.5 meters.
14. Always keep the radiosonde at least 50 cm below the level of the gas nozzle and the inflated balloon, and at least 1.5 meters away from the gas cylinder/hydrogen generator, connectors, and tubing. Avoid taking the radiosonde inside the balloon filling shed, if possible.
15. Follow all regulations concerning hydrogen safety.

<b>WARNING</b>	New operator! Carefully study the instructions for using the hydrogen generator and for the correct method of inflation.
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## APPENDIX C

# **RADIOSONDE WARRANTY**

This appendix contains the warranty for Vaisala Radiosonde RS41.



This document is an integral part of "General conditions of sale of Vaisala Oyj, Ref. DOC223573-A 2011-07-01". In case of discrepancy, the provisions of the Vaisala radiosonde warranty prevails.

## Vaisala Radiosonde RS41 Warranty

Vaisala repairs or, at its discretion, replaces any Vaisala Radiosonde RS41 that is proven, with reasonable satisfaction, to have failed within 13 months of shipment by reason of faulty materials or workmanship, under the following conditions and provided that radiosonde is transported, stored and used properly in accordance with applicable instructions and manuals issued by Vaisala.

### Storage Conditions

Vaisala Radiosonde RS41 shall be stored indoors in its original unopened vacuum envelope within the following environmental limits:

- temperature +5 °C to +40 °C
- relative humidity below 85 %

### Transportation and Handling

Radiosondes shall be transported in the original shipping packaging, which is designed and built to survive and protect the contents in the environmental conditions specified in standard IEC 60721-3-2: climatic conditions of class 2K2, and mechanical conditions of class 2M1 of the standard are applied. Instructions on the packaging for transportation and handling shall be followed.

### Criteria for Radiosonde Failures

Pre-flight failures under warranty:

- Radiosonde fails during the sounding preparation
- Ground check with RI41 exceeds one of the following limits:
  - T: Gross error detected (OK/not OK,  $\pm 3$  °C, stable indoor conditions)
  - U:  $\pm 2$  % RH (at RS41 generated physical zero humidity, stable indoor conditions)
- Ground check of radiosonde's pressure sensor exceeds the following limit:
  - P:  $\pm 3$  hPa (against precision barometer, e.g., Vaisala RI41-B)

In-flight failures below altitude of 100 hPa under warranty:

- Radiosonde stops transmitting one or more parameters
- Radiosonde transmits clearly erroneous data
- There is a continuous telemetry link failure exceeding 2 minutes

Early termination of sounding caused by balloon burst, user error, or any external cause, e.g., icing, is not covered by this warranty.

### Making Warranty Claims

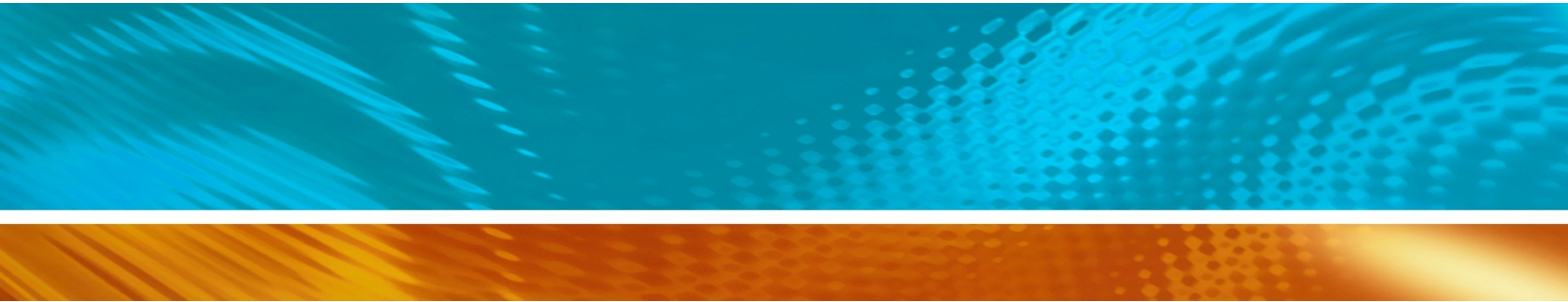
A failure report shall be provided for each failed radiosonde stating the radiosonde serial number, a description of the failure, and sounding site and date. A template provided by Vaisala should be used for this.

A radiosonde found defect prior to launch shall be returned to the Vaisala office as instructed by Vaisala Helpdesk.

Failure report of an in-flight failure shall be accompanied by sounding data file and preferably with the sounding quality report (generated by MW41 sounding system).

Failure report, the quality report and any radiosonde failed prior to launch shall be sent to Vaisala within 180 days after the failure or within a year from extremely remote or shipborne stations.

When returning radiosondes that contain lithium batteries, refer to the shipping instructions in the applicable radiosonde User's Guide.



[www.vaisala.com](http://www.vaisala.com)

