

PiCUS Tree Inspection Technology

PiCUS Calliper Version 3



Digital calliper
for precise geometry detection

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PiCUS Calliper Version 3

User's Manual

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1. Abbreviations

BT Bluetooth

DC Direct current

°C Degree Celsius

°F Degree Fahrenheit

MP Measuring point. Each nail in the tree is a measuring point.

m/sec meter per second. Unit of speed of acoustic waves

PCA3 PiCUS Calliper Version 3

PRHD PiCUS Radio Hammer with Display. Can only be used with PiCUS 3.

USB Universal Serial Bus.

2. Introduction

2.1. Field of application

The PiCUS Calliper is an instrument for measuring distances. It is mainly used for triangulation measurements that determine the coordinates of measuring points during tomography-scans on trees.

The PiCUS Calliper enables the user to accurately find the X/Y coordinates even of complex circumferences within a short time.

The PiCUS Calliper Version 3 can be assembled by the operator in two different sizes that cover the measuring range of:

- 0 to 1630 mm and
- 0 to 2150 mm



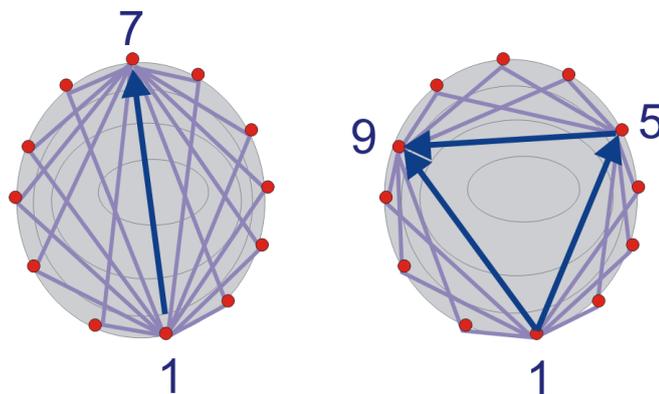
2.2. Working principles

The geometry of a tree at the measuring level of a tomography scan can be recorded precisely using a triangulation method. The measuring level is split into many triangles, the lengths of all sides of which are measured.

Each MP belongs to a triangle. Two MP are part of all the triangles in a measurement. The line between these two points is called the “baseline”. The position of the third corner of the triangle is calculated using the length of the sides.

Based on one or three baselines, the x/y positions of all MP can be calculated.

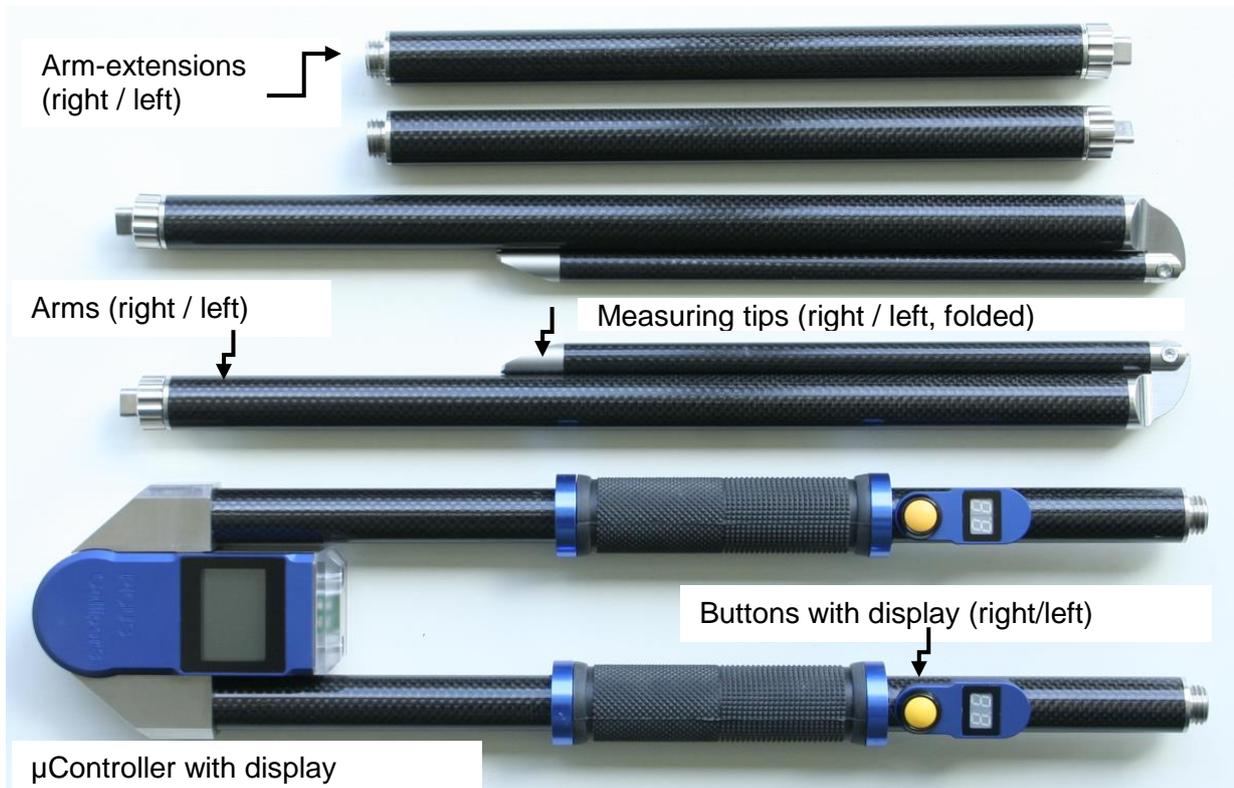
The sketch on the left displays the distances needed to be measured when using one baseline (dark blue) for 12 different MP. The sketch on the right shows the distances necessary for three baselines. The orientation of the baseline is indicated with an arrow.



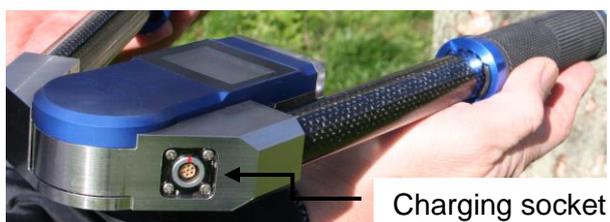
3. Manual

3.1. PCA3 components

PiCUS Calliper 3 consists of the parts shown. It can be assembled in two different sizes, depending on the working range required.

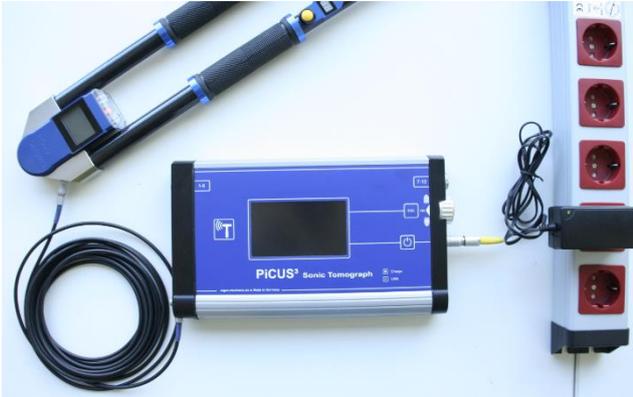


PiCUS Calliper in a working position:



3.2. Preparing to work

3.2.1. Charging the accumulators



Before you work with the calliper you will want to make sure that the device is fully charged.

Recharge the calliper by connecting the PRHD hammer cable of the PiCUS 3 unit to the calliper like shown in the photo. If an extra calliper power supply is supplied it can be connected directly to the socket.

The green light switches off when the accumulator is fully charged. This may take up to 3 hours.

Note: The temperature of the calliper and of the ambient air during the charging process must range from + 5°C (41°F) to +30°C (86°F). Do not charge the calliper when the temperature of the inside accumulator is 0°C (32°F) or lower.

3.2.2. Selecting the working range

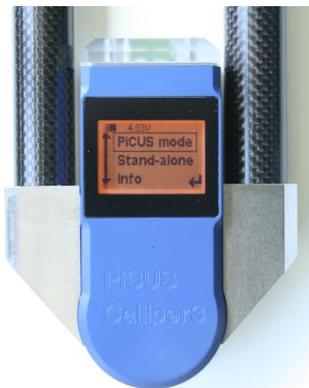
The calliper can be assembled in a short (left photo) or long (right photo) version. The short setup covers a working range from 0 to 1630mm, the long version from 0 to 2150mm.

The calliper detects the length of the arms automatically when it is turned on. If the arms are mounted AFTER the calliper was turned on then it does NOT recognize the length of the arms!



To bring the calliper tips into a working position, just twist them until the lock in.

3.2.3. How to turn the calliper on and select the operating mode



Press the button on the left arm for more than 3 seconds to turn the calliper on.

The first screen asks to select the operating mode. The left button scrolls through the options the right button selects the mode.

„PiCUS mode“: Measuring positions of MP for tomography scans (standard working mode).

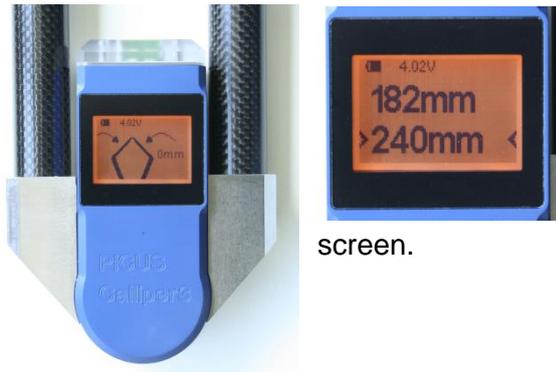
„Stand-alone“: Measuring distances autarkical. No PC or PiCUS is unit connected.

„Info“: Display of the Bluetooth address and firmware version of the calliper.

This Bluetooth address must be entered into the PiCUS 3 or Treetric 3 in order to configure the connection.

Calliper must be turned off and turned on again to switch to a new operating mode.

Operating mode „Stand alone“



The zero point of the internal angular sensor must be set in all measuring modes every time the calliper is turned on. To do so the tips are moved together by using very gentle force. Pushing either button sets the zero mark. Now the calliper is ready to measure distances. Pushing a button saves the distance in the second line of the

screen.

Operating mode „PiCUS mode“

In this operating mode the calliper is waiting for a Bluetooth connection to a PC or PiCUS 3 after the zero mark is set.

Once the Bluetooth connection is established the distances to be measured are shown in the display. The MP numbers to touch with the arms are also shown in the displays in the arms. The flashing of a number signals the standard orientation of that MP in relation to the current base line.

3.2.4. Configuration of the Bluetooth connection

The calliper is connected to the PC or PiCUS 3 (TreeTronic 3) through a serial Bluetooth connection. The configuration of that BT COM port must be done only once.

Configuration of the PC - Bluetooth COM Port

1. Turn calliper on and bring it to „PiCUS mode“.
2. Turn on PC and turn on Bluetooth. The Bluetooth icon  is shown in the task bar (in most PC/Windows versions).
3. PC: Add new Bluetooth device: either through the Bluetoothmanager (Right-click on ) or through the window „Devices and Printers“
4. The calliper is shown like this: “PiCUS Calliper 16B7“. The number at the end is showing the last digits of the Bluetooth address and varies from Calliper to Calliper. Click “proceed” and enter the pairing code: “0000“ (four times number zero).
5. The installation of the driver may take some moments and afterwards the calliper is shown in the device list.
6. Identify COM port number: right-click on the calliper icon → Menu → properties → tab „services“. The number of the COM port is shown as serial Anschluss SPP (Serial port profile). Note that number.
7. Start PiCUS Q7x program.
PiCUS PC Program: “Configuration” → “COM settings” → tab “PiCUS Calliper”
8. Enter the COM Port number. Clicking on the (still) red COM icon opens the COM port. The icon turns green if succeeded. Click on „Test calliper“ to test the connection.
9. Close window with „OK“.

Note: The COM port must have been created by the windows operating system BEFORE (!) the PiCUS program COM configuration window can be opened. Otherwise the COM port is not shown in the list.

3.2.5. How to turn the calliper OFF

To turn off the calliper, press the left button for several seconds. There is an automatic shut-down function that will switch off the calliper if no buttons are pressed or communication commands sent after several minutes.

Please do not turn off the calliper while the Bluetooth connection to a PC is still active. Because some Bluetooth-adapters on PCs do not function well in this situation, you will want to first terminate the Bluetooth connection on your PC before you turn off the calliper.

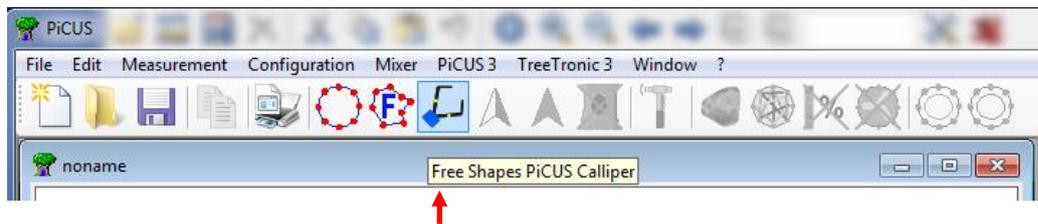
3.3. Calliper and PiCUS PC program

3.3.1. Workflow of a triangulation measurement in the PiCUS PC software

Note: The dialogue “Free shapes calliper” can be used in all cases, even when the electronic PiCUS Calliper is NOT available. The dialogue function will suggest the recommended distances to be measured and these distances can also be entered or changed by hand.

The COM port of the calliper must be set (see previous chapter) BEFORE you open the “Free shapes calliper” window.

1. Open a new PiCUS file.
2. Main menu → “Measuring” → “Change geometry” → “Free shapes Calliper” or click the calliper icon.



3. Enter data

Baseline | Distance | Graphic | Nails and Bark | Laser1 | Extra

Circumference at level of tomography: mm

u = 459 cm / 4.59 m
d = 146 cm / 1.46 m

recommended number of measuring points: 417 mm

radio 1 Baseline A->B

radio 3 Baselines A->B, A->C, B->C

Basepoints
A < B !!!

Sketch:

North at measuring point:

Position of measuring point 1:

Level of measurement (above ground): [cm]

- Enter the circumference at the measuring level (in mm). The program suggests an optimal number of measuring points (MP).
- Enter the actual number of MP placed on the tree. The theoretical distance between MP is also shown.
- Select the number of baselines. The choice depends on the size of the tree and calliper and on the shape of the measuring level. Try to use the one-baseline-method. However, both methods yield similar results.
- Select the base-points. Make sure that the calliper is able to reach those points.
- Enter the “Level of measurement” in cm. This is important for 3-D measurements.
- Click “Continue” to view the distances to be measured. Changes can be made by clicking on “new values”.

- View the card "Distance" to see all distances that need to be measured.
- Make sure the calliper is still on and in "PiCUS mode".
- Click on the (still) red COM port icon. The COM port will open – Icon turns green - and the first distance to measure is send to the calliper.

Baseline		Distance		Graphic
from	to	L/R	value [mm]	
1	6	-	0	
1	5	R	0	
1	4	R	0	
1	3	R	0	
1	2	R	0	
6	2	*	0	
6	3	*	0	
6	4	*	0	
6	5	*	0	
1	7	L	0	
1	8	L	0	
1	9	L	0	
1	10	L	0	
6	11	*	0	
6	10	*	0	
6	9	*	0	
6	8	*	0	
6	7	*	0	

Legend

- Columns "from" and "to" specify endpoints of the distances to be measured.
- Column "L/R" specifies the position of the "to" point in relation to the base line:
 - "R" means: MP is situated to the *right* of the baseline the MP belongs to.
 - "L": means: MP is *left* of the baseline.
 - Left-click in this column changes the orientation
 - "L!" and "R!" indicate that the "to" point does not have a standard orientation
 - "-": This line is a base line
 - "*": The orientation of the "to" point was already specified
- Column "value": distance in unit [mm].
- "Automatic correction" compensates for small errors made during measurements.

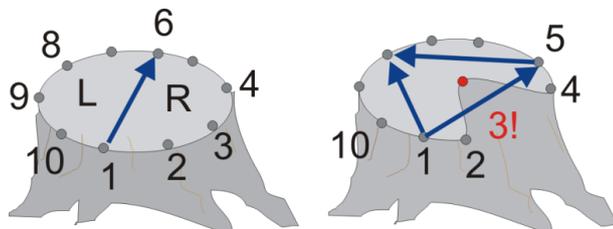
How to find the correct orientation of measuring points?

An orientation needs to be entered for all non-base points (points situated to the left or right of a baseline).

Example: the baseline runs from point 1 → to point 6 like shown in sketch A. The orientation of point 3 needs to be entered. In image A, MP 3 is situated to the right of the baseline, which is the "standard" orientation. An "R" is shown in the table.

In image B, MP 3 is situated to the left of the baseline 1→5, which is not the standard orientation. Thus, the right number will flash on the calliper but you have to push the left (not flashing) button to select the left orientation.

In the program the non-standard orientation will be indicated with an exclamation mark. Click on the cell in the column "R/L" to change the orientation. If a point is not in the standard orientation, a "!" is shown in this column as well.



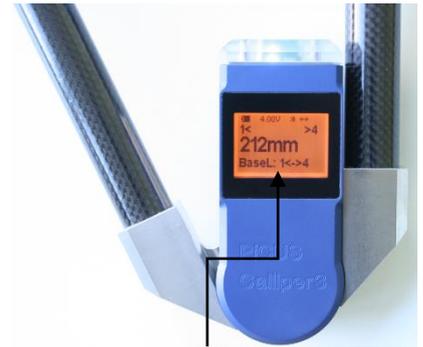
Baseline		Distance		Graphic
from	to	L/R	value [mm]	
1	6	-	1245	
1	5	R	911	
1	4	L!	890	
1	3	R	503	
1	2	R	435	

Orientation of MP: sketch A (one baseline)

Sketch B (three base-lines)

Table

7. Move the tips of the calliper to both points (in the photo 1 and 4) and press any button. Data is then transferred to the computer. Line 1-4 is a baseline. No orientation must be considered.
8. In case the line is not a baseline the orientation is to be considered following the above explanations. The standard orientation is indicated by a flashing number next to the buttons. If no orientation is required the numbers do not flash.
9. After obtaining all distances, the shape of the tree is shown on the PC screen. The message "OK" appears on the display of the calliper.
10. Close the Bluetooth connection in the PC window before the calliper is turned off.



Display of the baseline, here MP 1–4.

3.3.2. Changing values by hand

If you want to change a value by hand during or after measurements, proceed as follows:

1. Left-click on the value that you wish to change.
2. Change the value. Click on a "*" field in the table afterwards to accept the new value.
3. Click on "Calculate" to calculate and show the new tree geometry.

The orientation of a MP can be changed as well:

1. Left-click in a cell of the "L/R" column will change the orientation of that MP.
2. Click on calculate ("=") will re-calculate the image.

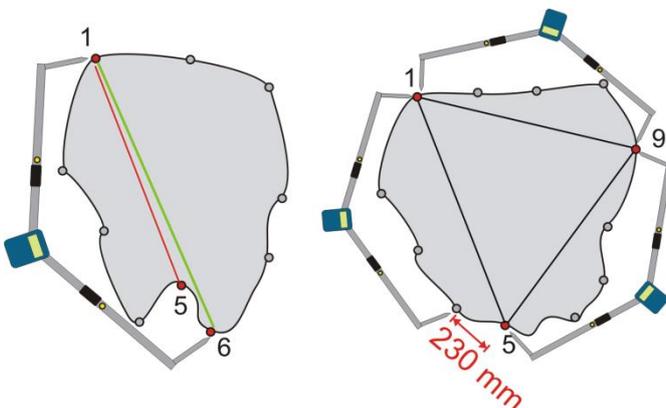
3.3.3. Repeating measurements with the PiCUS Calliper

If you want to re-measure (with calliper) some values after the measurements have been taken, proceed as follows:

1. Turn on the PiCUS Calliper and select the "PiCUS mode". Establish that there is a connection to the PC.
2. Click on the field of the table you wish to measure again.
3. Change the value to 0 (Zero). Click on a "*" field of the table to finish your typing.
4. Click on "Begin again". The program then searches for the first zero value in the table and transmits the measuring command to the calliper.
5. Carry out the measurement as usual. After all distances have been received, the shape is calculated and shown.

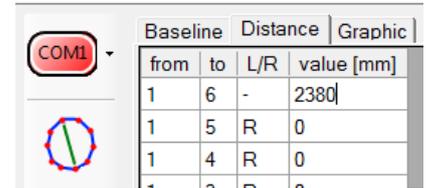
3.3.4. Calliper too small for the tree

If the calliper is too small for a particular tree or if the tips of the calliper cannot reach certain MP because of the tree geometry, you first need to check if the problem can be solved by selecting different base points. The image on the left shows such a situation. In this case the program suggests using base-points 1 and 5, but MP 5 is difficult to reach. One solution is to change the baseline to 1 – 6 (green line). Alternatively, three baselines could be used.



If the calliper is not large enough to measure a distance, the value can be estimated as follows. (The image on the right illustrates the situation.)

1. Transmit the maximal value to the computer (~ 2150 mm).
2. Estimate the length of the remaining distance by using a measuring tape or ruler. In our example it is 230 mm.
3. Left-click in the table on the field "1-5". Add the values you have (2150 mm and 230 mm) and type in the sum (2380). Click on "Calculate" ("=").



Baseline		Distance		Graphic
from	to	L/R	value [mm]	
1	6	-	2380	
1	5	R	0	
1	4	R	0	

3.3.5. Error messages

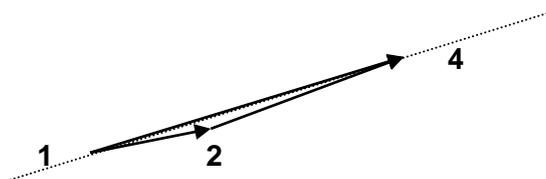
When taking measurements with the PiCUS Calliper, the following error message may appear:



This message tells us that the program is unable to calculate a triangle using the distances measured (in this case a triangle with points 1, 2 and 4). While working with the calliper in this situation you should keep an eye on the PC screen.

In geometry the sum of two sides of a triangle must be greater than the third side. In a formula this can be expressed as: $a+b>c$; $a+c>b$; and $c+b>a$, where a, b and c indicate the three sides of a triangle.

This case may occur if all three points are situated very close to a line:



To avoid this error, repeat the measurement of the given distances (in this case 1-4, 1-2 and 2-4). If the message still appears, you should try to change the values slightly by hand. A small difference from the real value is not so very important for the tomogram calculation.

Note: The option "Automatic correction" suppresses this error message. "Automatic correction" is also applied when a button is accidentally pushed - and these errors will not be detected. Be sure to check the tree shape after measurements to avoid such errors.

4. Technical data and handling notes

4.1. Calibration

The PiCUS calliper 3 does not require any calibration like previous versions. However, zero point setting at every start of the calliper must be done with care.

4.2. Maintenance

The PiCUS calliper must be maintained by *argus electronic gmbh* in Rostock, Germany. The device does not contain any parts that can be maintained by the user. If the device or any parts of it should be opened by a person not authorized by the manufacturer, all warranty claims are void.

4.3. Changing the accumulators

The LithimIon accumulator of the calliper unit can be recharged roughly 500 to 800 times. When an accumulator needs to be replaced, the calliper must be shipped to *argus electronic gmbh* in Germany.

4.4. Shipping the PiCUS Calliper

To ship the PiCUS Calliper via parcel services, you **MUST include** lots of crumpled newspapers (or similar packaging materials) **IN THE calliper** case! This is to avoid damage caused by vibrations or bumps during transport. Be sure to close the box firmly before shipping.

4.5. Technical data

Weight:	1.8 kg
Maximum span width:	1630 / 2150 mm
PiCUS Sonic Tomograph software version required:	“Q73.03” or higher
PiCUS 3 Firmware:	Version 19 or higher
TreeTronic 3 Firmware:	Version 6 or higher
Accuracy:	+/- 5 mm (at constant pressure of tips)
Power supply charging unit:	100 – 240 V~ (AC), 50 Hz
Accumulator:	Li-Ion Accumulator
Accumulator capacity:	approx. 24 hours (at 20°C), operation with Bluetooth connection and display on. Capacity is lower at colder temperatures.
Self-discharging:	<1% per week Accumulator batteries age and their capacity becomes lower over time and after a number of charges or discharges. The accumulators can be charged / discharged up to 500 times.
Storage:	Between +5°C and +35°C. (41°F – 95°F) Please do not store the calliper with the accumulators fully emptied. Charge the accumulators BEFORE storing to approx. 3,7 Volt to keep them in better condition. Recharge the calliper before next use.
Charging Temperature:	+ 5°C (41°F) to +30°C (86°F). Do not charge the calliper when the temperature of the inside accumulator is 0°C (32°F) or lower.
Accumulator shut down voltage:	approx.: 3,2V. Do avoid deep discharging of the accumulator.
Charge-end-voltage:	4,1 - 4,2 Volt
Charging time:	approx. 2-3 hours
Operating temperature:	0°C to 40°C (32°F – 104°F)
Humidity:	Electronic devices can be damage by humidity. The PiCUS Calliper is NOT waterproof. Do not store it in damp conditions. Do not work with it in heavy rains, although you can use it in very light rain or in the mist.
Date:	29 April 2015

Note: All technical parameters are subject to change without notice.

5. Disclaimer

The PiCUS Calliper is an instrument for measuring distances. Inappropriate application can lead to damage to the device itself and/or to the object you are examining. Please read this manual carefully before using the PiCUS Calliper.

Although every effort has been undertaken to present the results of measurements as accurately as possible, we cannot guarantee the accuracy of the measurements. Any conclusions about the status of trees examined are the exclusive responsibility of the user. Neither the manufacturer nor the distributor of the PiCUS® Calliper can be held liable for any conclusions based on measurements taken with the PiCUS® Calliper. We recommend attending one of the training courses offered by the distributor or held at a certified institution in your country.

The PiCUS Calliper is a supplementary tool, designed to be used in conjunction with the PiCUS Sonic Tomograph unit. It can be used to measure the shape of a tree at the level measurements are taken.

The PiCUS Calliper contains various sensitive components. It should be maintained only by *argus electronic gmbh*. The customer or operator may only open the device to change the accumulator. If the device is opened for any other purposes or is opened by unauthorized persons, all warranty claims are voided. The company *argus electronic gmbh* cannot assume any risk for damage in transit.

6. Manufacturer

The Picus Calliper has been developed and manufactured by:

argus electronic gmbh
Erich-Schlesinger-Straße 49d
18059 Rostock
Germany

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The PiCUS Calliper version 2 won the German Lilienthal Design Award 2005 of the Federal State of Mecklenburg-Vorpommern, Germany.

