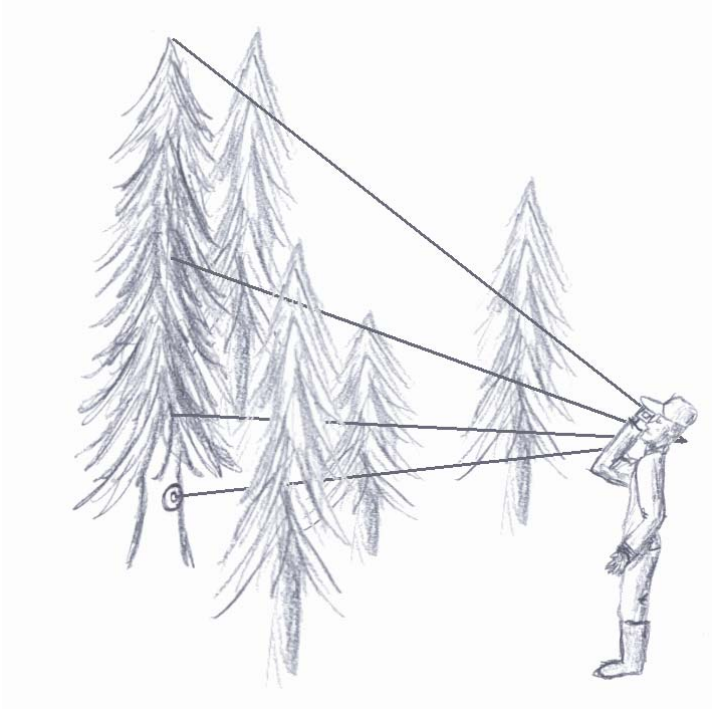# Users Guide
Vertex III V1.5
and Transponder T3

Users Guide
Vertex III and
Transponder T3

2007-04-27

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Contents

Vertex III

Functions and Construction

Congratulations to your choice of height measurer! The Vertex III is the markets most modern instruments, carefully tested and approved to be your reliable companion for years to come.

The Vertex III is primarily designed to measure the height of standing objects, and most often trees. The instrument can also be used to measure distance, horizontal distance, angle and inclination. The Vertex instrument has with its ultrasonic measuring technique proved to be especially useful in dense terrains with thick undergrowth, where conventional methods such as measuring tapes, laser instruments and mechanical height measurers are difficult to use.

To define a reference point in a secure and reliable way, the Vertex III works with the transponder T3. The Vertex III communicates with the transponder. This communication eliminates in an efficient way any mix-ups of signals from other instruments or places (echoes). A measuring operation will not in any significant way be disturbed by objects in between the Vertex III and the Transponder T3. The reference point, i.e. the T3, is used as a sight mark for height measuring and can be placed at optional height, where visibility is the best in for example thick vegetation. The reference point height is set in a special menu in the Vertex instrument and automatically added to the measured height.

The Vertex III uses ultrasound to measure distances. Unlike for example measuring tapes and laser instruments, ultrasound can be used also when there is no free aim to the reference point. The ultrasound will not pass through an obstacle, but looks for the shortest way around it.

Heights are calculated trigonometrically using the variables contained when measuring angle and distance. The Vertex III automatically assumes that the measuring object is perpendicularly positioned to the ground.

With the Vertex III, an unlimited number of heights per object can be measured. The instrument display can show the 4 lastly measured heights per object at a time.

When using a relaskopic method to measure, an in-built BAF function (Basal Area Factor) can be used for the Vertex III instrument to control the minimum diameter for trees. The function is useful when some trees in an area are covered by other, making the decision whether to include the tree or to exclude it from the area difficult. By simply measuring the distance between the tree and the plot centre, the Vertex III can calculate the minimum diameter the tree should have in order to be included into the counting.

Data can be sent through IR or and results can be stored and processed in for example the Digitech Professional caliper, other PC or handheld computer.

Description

Keys

Signal element

Display

Battery lid

Aim

IR

Lense

Temperature giver

Loudspeaker/microphone
Ultrasound
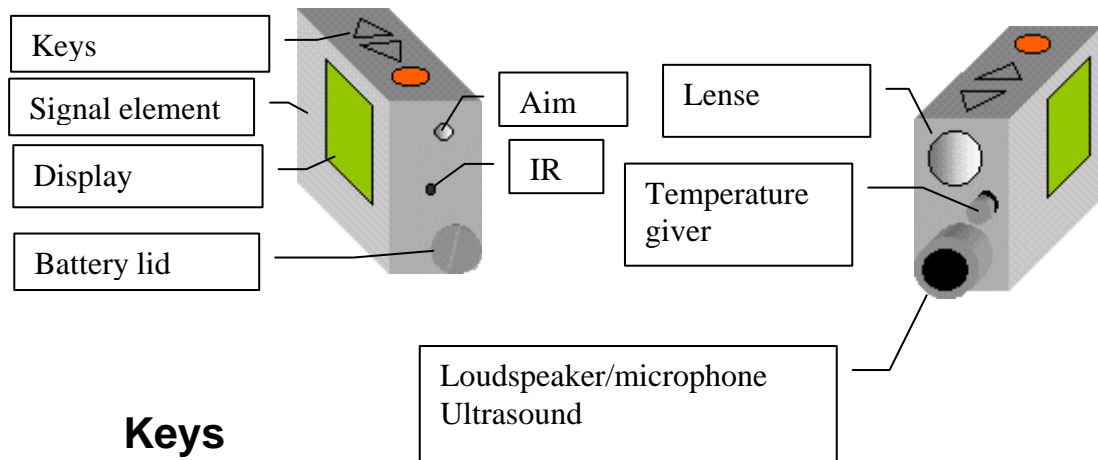
Keys

The Vertex III has three keys: Two arrow keys and one ON key.
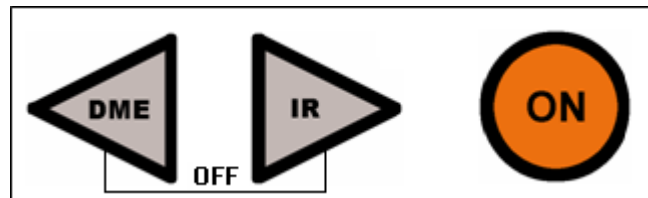
Function of the Arrow Keys

Use the arrow keys primarily to scroll through the menu and to change the settings in the SETUP menu. By pressing down both arrow keys at the same time, the Vertex III is turned off. Automatic turnoff time is set to approximately 25 sec.

When the Vertex III is turned off, the DME position can be activated with left arrow key. The Vertex III turns into a distance measurer.
Right arrow key (IR) is used to transmit data through IR (Infrared light). Data can only be sent after having made a measuring.

The ON Key Function

The ON key is used to start the Vertex III, to confirm a value and as a trigger when measuring heights and angles.

Red Cross Aim

The red dot cross hair sight simplifies spotting the target and holding the instrument straight when measuring heights, for best possible accuracy.

For best possible visibility, the light can be adjusted with the left arrow key when aiming.

Loud Speakers

The Vertex III is equipped with a built-in signal that will beep when an angle or a height has been registered.

Battery

The Vertex III uses an alkaline or a rechargeable battery of 1,5 V AA. The battery is placed under the battery cap, plus pole + down.

The remaining battery tension is featured as an icon in the display of the Vertex III.

A battery will in normal cases last for weeks or even months.
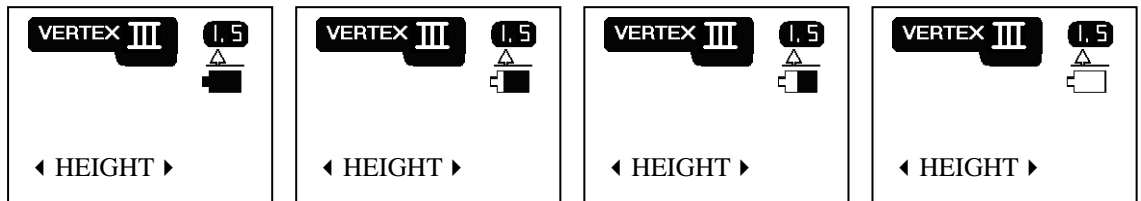
Battery full	Battery satisfactory	Battery tension low	Battery empty
Battery>1.2v	1.1V< Battery<1.2V	1.0V< Battery<1.1V	Battery<1.0V

Menu Overview

VERTEX III 1.5	VERTEX III 1.5	VERTEX III 1.5	VERTEX III 1.5	VERTEX III 1.5	VERTEX III 1.5
◄ HEIGHT ►	◄ ANGLE ►	◄ SETUP ►	◄ CALIBRATE ►	◄ CONTRAST ►	◄ BLUETOOTH ►

HEIGHT

M.DIST   34.5

23ºC	74ºC
DEG	-17.9
GRAD	-19.9
%	-32.4

SD	34.5
HD	32.3
DEG	-17.9
H1	29.5

ANGLE

23ºC	74ºC
DEG	-17.9
GRAD	-19.9
%	-32.4

SETUP

METRIC	DEG
P.OFFSET	0.3
T.HEIGHT	1.3
M.DIST	034.5

CALIBRATE

DME
23ºC
74ºC

10.00M

CONTRAST

CONTRAST 48

BLUETOOTH

CODE ► 12345
BLUETOOTH ► ON

Important Facts on your Vertex III Instrument

The Vertex III uses ultra sonic signals to determine distances. Humidity, air pressure, surrounding noise and, above all, the temperature can affect the range and extension of the ultra sonic signals. The Vertex III has a built-in temperature sensor that automatically compensates for the divergence caused by variations in temperature.

In some cases, distances of 50 meters/yds and greater can be measured without problems, and in other cases, the maximum distance can be shorter than 30 meters/yds.

To increase and optimize the measuring accuracy, the instrument should be calibrated on a regular basis. When calibrating, it is of utmost importance that the instrument has been given enough time to stabilize at ambient temperature.

If, for example, the instrument is carried in an inner pocket, it can take up to 10 minutes before it has adjusted to current outdoor temperature. The measurement inaccuracy pending on temperature is app. 2 cm/C°.

An example: Your inner pocket holds +15 C°/59F. Outdoor air temperature is -5 C°/23F. The measurement result will show 10,40 m/34 ft and not the correct 10,00 m/32.8 ft.

The measuring fault can be made permanent if the instrument is calibrated before reaching the correct current temperature.

-Check your instrument daily and recalibrate if necessary
-Do not touch the temperature sensor at the front of the instrument (the metal knob between the sight and the loudspeaker)
-Never calibrate the instrument before it has reached ambient temperature

When measuring heights, it is important to hold the instrument as straight as possible.
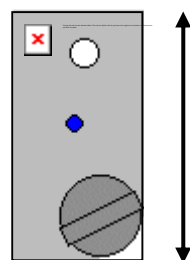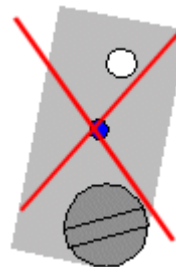
Correct   **Wrong**
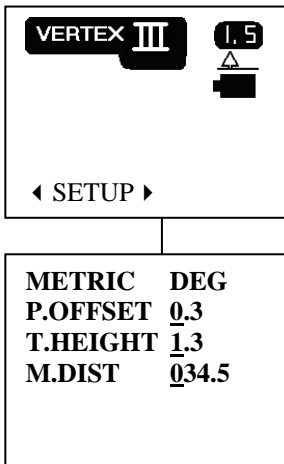
The trigonometric functions calculate the height based on two (2) angles and one (1) distance. The distance can be measured manually with a tape, or automatically by using the T3 transponder. If using a tape, the distance has to be input in the Vertex before starting (angle-) and height measuring.

Settings

```
VERTEX III   1.5

◄ SETUP ►
```

```
METRIC    DEG
P.OFFSET  0.3
T.HEIGHT  1.3
M.DIST    034.5
```

SETUP

All settings to measure heights, distances and angles and BAF Factors are made in the SETUP menu. Choose between metric or feet, degrees or percentage, pivot offset, transponder height and manual distance.

Start the Vertex III by pressing ON. Press any of the arrow keys and ON to go to settings. Step to the parameter using ON and change values with the arrow keys.

METRIC/FEET

Choose if height and distance values should be featured in **METRIC or FEET**. Shift with the arrow keys and confirm your choice with ON.

DEG/GRAD/%

Select Angle unit as Deg (degrees 0.360), GRAD (gradients 0..400) or % (percentage) by pressing the arrow keys. Confirm by pressing ON.

P.OFFSET (Pivot Offset)

Change the value with the arrow keys and confirm your choice with ON. The value is shown in Metric/Feet
The "Pivot offset" is equal to the distance between the front side of the instrument to the aimed point where the prolonging of the sight line from the transponder and the top of the tree coincide.
The imagined point is located somewhere behind your neck and the value should in normal cases be set to 0,3 m (1.0 feet).
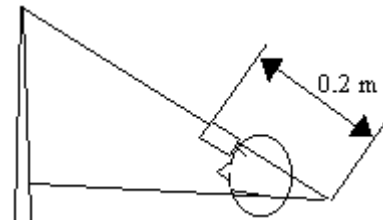
Since the Vertex III will presume that the transponder T3 is placed directly under the aimed height of the measuring object (when the object is equal to a tree), a half of the objects diameter should be added to the Pivot Offset. This compensates for the diminishment of the tree top. When measuring tree heights, it is recommended to add half the average diameter in the area, for improved accuracy.

T.HEIGHT (Transponder height)

Change the value with the arrow keys and confirm with ON. The value is set in metric/feet. **T.HEIGHT** is the height where the transponder is set, the reference height for the measuring unit. The Vertex III adds the preset T HEIGHT to the measured height. Normal breast height value is set to 1,3 m (4.5 ft).

M.DIST (Manual distance)

This function is useful when <u>measuring without the transponder</u>. Change value with the arrow keys and confirm with the ON key. The value is shown in metric or feet. **M. DIST** is the manual distance to the reference point on the object where the height is measured. Make sure that the **T.HEIGHT** is correctly set, i.e. the height to the chosen reference point.
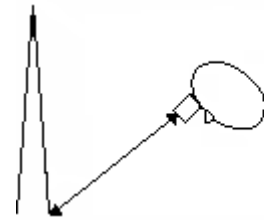
DME DIAMETER MEASURING
BAF 5

BAF Basal Area Factor

Working with relaskopes or prism can sometimes offer difficulties when in the forest some trees cover others. The poor sighting can prevent a correct diameter measuring. With the Vertex built in BAF function, the minimum tree diameter for trees to be included can be featured.

By measuring the distance from the tree to the plot centre with the Vertex III the instrument can calculate the minimum diameter for a tree to be included in the plot.
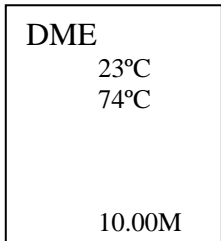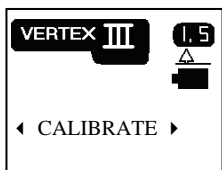
These BAF factors are available in the Vertex III:

0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9 (m2/ha)

or

5, 10, 15, 20, 25, 30, 35, 40, 45, 50 (ft2/acre)

The Vertex III can compensate for an inclination in the terrain when calculating the minimum diameter, see next chapter.

CALIBRATE

Use a measuring tape to measure the exact distance of 10.0 m (32,8 feet) between the transponder and the Vertex front.

DME
  23ºC
  74ºC

  10.00M

Press ON to start the Vertex instrument. Step in the menu to **CALIBRATE** and press ON. The instrument will calibrate to 10 m and automatically turn off when ready.

It is important to give the instrument approximately 10 minutes to set to the correct temperature before calibrating.

DISPLAY

Set the display contrast for best possible visibility using the arrow keys.
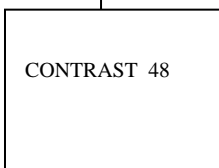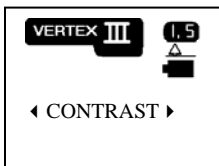
CONTRAST 48

CONTRAST

Start the instrument with ON. Step to CONTRAST and press ON. Change the contrast with the arrow keys for best possible visibility.
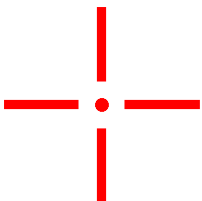
CROSS HAIR SIGHT

Change the light in the cross sight by looking into the sight when measuring and using arrow keys to increase or decrease the light intensity.

If the sun (back-light) makes it difficult to see, use both eyes when aiming, and put a finger in front of the sight.

How to Use the Vertex III

HEIGHT

Height measuring can be performed in different ways depending on type of surroundings and operation. Heights, distance and angles can be transferred to for example the Digitech Professional Caliper or other computer device for storage/processing with IR by pressing right arrow key. For height measuring, the 3 last measured heights with angle and distance can be transferred.

```
┌──────────────────────┐
│  VERTEX III    1.5   │
│                  △   │
│                  ▬    │
│                      │
│  ◄ HEIGHT ►          │
└──────────────────────┘
┌──────────────────────┐
│                      │
│                      │
│  M.DIST    34.5      │
└──────────────────────┘
┌──────────────────────┐
│  23ºC      74ºC      │
│  DEG      -17.9      │
│  GRAD     -19.9      │
│  %        -32.4      │
└──────────────────────┘
┌──────────────────────┐
│  SD        34.5      │
│  HD        32.3      │
│  DEG      -17.9      │
│  H1        29.5      │
└──────────────────────┘
```
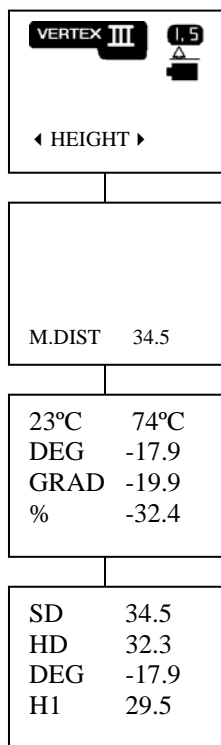
Height measuring with transponder

Start the transponder T3 and place it on/towards the object to measure. *Note that the transponder should be placed at the T.HEIGHT /(transponder height) that has been set in the settings menu.* Walk a suitable distance from the object – for optimal result accuracy, a distance equal to the approximate height.

1. Press ON to start the Vertex and aim at the transponder. Keep pressing ON until the cross hair sight goes out momentarily. Now release ON. The Vertex has measured the distance, the angle and the horizontal distance to the transponder.

2. Aim at the height to measure with the sight cross blinking. Press ON until the cross hair disappears. The first height is locked and displayed. Repeat until all heights on the object are measured.

Height Measuring without the Transponder

Height measuring without the transponder can be performed in two ways, both using manual distance (M.DIST). *Note that aiming must be made on the same height as the preset T.HEIGHT.*

1. Press ON to start the Vertex III and **HEIGHT** is displayed.

2. A quick press on ON and **M.DIST** is featured. Change this value if incorrect, using the arrow keys. Press ON when the value is set and the angle window is featured.

3. Aim at the height that T.HEIGHT is set to and press ON until sight cross disappears. Release ON. The Vertex displays the angle and the horizontal distance to T.HEIGHT.

4. Aim at the height you wish to measure with the cross hair blinking. Keep pressing ON until the cross disappears. The first height is displayed. Repeat until all heights on the object are measured (see above).

Height measuring from horizontal line

Height measuring from a fixed distance and 0-set reference angle is a useful function to measure for example power line heights.

1. Press ON to start the Vertex and **HEIGHT** is displayed.

2. Press ON and **M.DIST** is featured. Change this value with the arrow keys and press ON when the correct distance is reached. Press right arrow key and ON at the same time to zero-set the angle.

3. Aim at the height of the object, with the cross hair sight blinking. Push and press ON until the cross disappears. The first height is locked and displayed. Repeat for more heights (see above). Note that the T.HEIGHT is added to the measured height over the horizontal line. The T.HEIGHT can, for example, be set at the operator's eye height.

ANGLE ►

23ºC   74ºC
DEG   -17.9
GRAD -19.9
%   -32.4
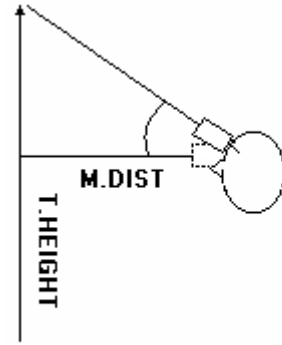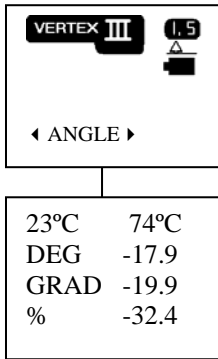
Inclination (ANGLE)

The Vertex III is an excellent instrument to measure inclination and angles in the terrain.

1. Start the Vertex III with the ON key and step with the arrow keys in the menu to **ANGLE.** Press the ON key.

2. The ANGLE window is displayed. Aim where you need to measure the angle. Press and keep ON pressed until the red aim cross goes out. Read the measured value in the display.

The angle is presented in DEG (degrees 0.360), GRAD (degrees 0..400) and percentage.

Note that the angle should be measured with the cross hair sight. This implies that it is not possible to use the outside of the Vertex III to measure an angle of, for example a flat table surface.

Distance Measuring (DME)

DME
        23ºC
        74ºC

        10.00M
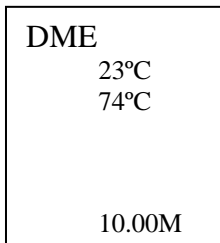
To measure a distance, press the DME key (left arrow key) when the Vertex III is turned off. The result, the distance between the Vertex III and the transponder T3, is presented in the Vertex display. Data can be transmitted through IR by pressing the IR key.

Distance Measuring with the Adapter for 360 Degrees

With the adapter, the ultrasound is spread and it is possible to measure from any direction. This is particularly useful when working in circular sample plots, where the distance from the plot centre to objects within a defined circle should be measured.

Note that the ultrasound has to travel approximately 1 inch (2,5cm) extra in these cases and that the distance reading should be made from the upper part of the display frame on the Vertex III instrument when Vertex is calibrated as in page 13.

Horizontal Distance measuring (DME)

The Vertex can be used as a horizontal distance measurer (DME). The display text will rotate 90º to simplify reading the results when measuring horizontal distances.

1. Press ON to start the Vertex and go with the arrow keys to **ANGLE** and push ON.

2. Aim at the point where you need to know the angle. Push and press the ON until the red cross goes out.

3. To measure a distance, now push the left arrow key. The Vertex III presents the horizontal distance in the display.

> **DME arrow key –
> trigger for
> distance
> measuring**
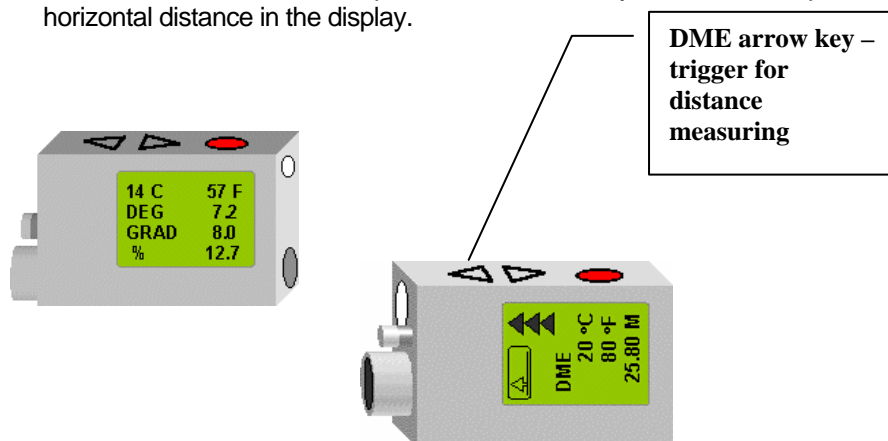
```
DME
        23ºC
        74ºC

   ∅      23.5
        15.54M
```

BAF – Smallest Diameter

Working in dense forest with relaskopes or prism can sometimes offer difficulties and accurate diameter estimation hard to make.

When using a relaskopic method to measure, an in-built BAF function can be used for the Vertex III instrument to control the minimum diameter for trees. The function is useful when some trees in an area are covered by other, making the decision whether to include the tree or to exclude it from the area difficult. By simply measuring the distance between the tree and the plot centre, the Vertex III can calculate the minimum diameter the tree should have in order to be included into the counting.

Basal Area Factors: 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9 (m2/ha)

or: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 (ft2/acre)

Diameters in leaning terrain

The Vertex III can compensate the calculated minimum diameter also when the terrain is leaning. Measure the angle from the tree to the plot centre. Activate the distance measuring function by pressing the DME key (left arrow key).

The horizontal distance and the calculated minimum diameter is presented in the display.
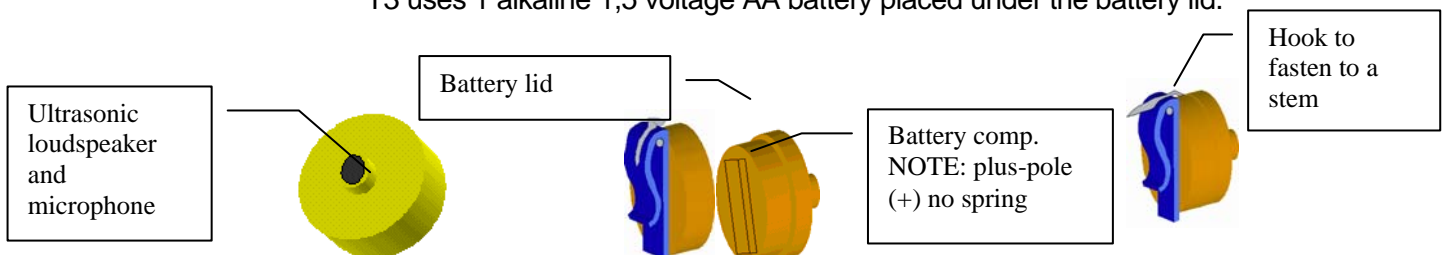
Transponder T3

The T3 transponder is an ultrasonic transmitter/receiver that communicates with the Vertex III instrument. The T3 transponder can be used both for direct measuring (60º), and in 360º when used with the "360 adapter" – for example when working in circular sample plots.

The T3 is equipped with an audible signal that tells if the transponder is activated or not.

The T3 has no switch and the Vertex and/or DME is used as a remote control to turn off and on. When turned on, the T3 Transponder stays activated for app. 20 minutes.

T3 uses 1 alkaline 1,5 voltage AA battery placed under the battery lid.

Ultrasonic loudspeaker and microphone

Battery lid

Battery comp. NOTE: plus-pole (+) no spring

Hook to fasten to a stem

To measure in a 360° circle with the transponder, the T3 is attached to the adapter. The adapter spreads and receives the ultrasound in a full circle. The adapter can be mounted onto the custom plot center staff.
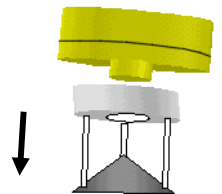
How to use the T3 Transponder

To perform any of the operations described below, keep the measuring unit loudspeaker towards the T3 loudspeaker.

1-2 cm
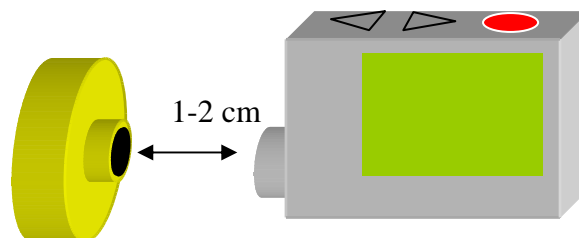
Function	
Turn on	Press meas.unit DME ◁ trigger until 2 signals beep
Turn off	Press meas.unit DME ◁ trigger until 4 signals beep (transponder)

IR

Heights can be sent through IR to the Digitech Professional caliper or to a special made IR receiver that can be placed in a serial port (RS232).

Note that the Vertex III has to be positioned within 10 cm/4" to the receiving device for a transmission to be successful.

Ex. Sending data to the Digitech Professional caliper

Sign Format IR

When sending data through IR every sign is transmitted with a parity bit added, if the number of bits in the sign is uneven. The parity bit is used to control that the sign has been received correctly, and has to be removed. When transmitting data with IR, baud 1200bps, 7 data bits and even parity and 1 stop bit are used. A special made receiver for handheld computers and PC can be ordered separately.

Data Format

Data from the Vertex III is sent serially as text acc. to below:

The data packet contains a total of 40 signs.

1 0000 [LF][EOL]
2 0000 [LF][EOL]
3 0000 [LF][EOL]
4 0000 [LF][EOL]
5 +000 [LF][EOL]   (Negative angle replaces '+'with '-')

LF=Linefeed (ASCII 13)
EOL=End of line (ASCII 10)

Height Measuring

Line 1:   1st height (dm alt. feet X 10)
Line 2:   2nd height (dm alt. feet X 10)
Line 3:   3rd height (dm alt. feet X 10)
Line 4:   Horizontal distance to the object (dm x 10 alt. ft X10)
Line 5:   Angle to the object (centesimal gradients X10)

Distance Measuring

Line 1:   Distance to transponder (cm alt feet X 10)
Line 2:   0000
Line 3:   0000
Line 4:   0000
Line 5:   Angle to the object (centesimal degree X10)

*If the angle (line 5) has a larger or smaller value than zero (0) the distance will be the calculated horizontal distance.

Technical specification

Vertex III	
Size	80 x 50 x 30 mm
Weight	160 g (incl. battery)
Battery	1 x 1,5 AA alkaline
Temperature	-15° - 45° C
Ultra sonic frequency	25 kHz
Height	0-999 m
Resolution height	0,1 m
Angles	-55° .. 85° degrees
Resolution Angle	0,1
Distance with aimed transponder	30 m or better
Distance with 360° adapter	20 m or better
Resolution distance	0.01 m
Accuracy distance	1% or better
Bluetooth	No

T3 Transponder	
Size:	Diameter 70 mm
Weight:	85 g (Incl. battery)
Battery:	1,5V AA alkaline
Current:	1.0 mA

Fault Detection

Problem	Cause	What to do
No distance shown in display	Transponder turned off Poor battery in transponder Disturbing noise in surroundings Incorrect transponder type	Start the transponder Change battery Measure from other spot or manually Change transponder type
Unstable distance value	Disturbing noise in surroundings Incorrect transponder type	Measure from other spot or manually Change transponder type
Incorrect distance value	Poor calibration Disturbing noise in surroundings	Calibrate Measure from other spot or manually
Cross hair will not go out	Transponder turned off Poor battery in transponder Disturbing noise in surroundings Incorrect transponder type Too large angle towards measuring object	Start the transponder Change battery Measure from other spot or manually Change transponder type Increase distance to measuring object
Measuring unit will not start	Poor batteries Batteries put in incorrectly	Change batteries Turn batteries to right position
Transponder will not start	Poor batteries	Change battery
No measuring values are presented	Transponder turned off Poor battery in transponder Disturbing noise in surroundings Incorrect transponder type Too large angle towards measuring object. Instrument not held steady No horizontal reference	Start the transponder Change battery Measure from other spot or manually Change transponder type Increase distance to measuring object Attempt to hold unit steady Shake the measuring unit cautiously
Incorrect/unrealistic values	Disturbing noise in surroundings Measuring unit held unsteady	Measure from other spot or manually Attempt to hold unit steady

Quick Start Guide

Height measuring when using the transponder

1. Start the transponder and place it on the object to measure.

2. Press ON. Aim towards the transponder and press ON until the cross hair sight goes out.

3. Aim towards the height to measure. Press ON until the cross hair sight goes out.

Repeat for taking another height.

Height measuring without using the transponder

1. Press ON. **HEIGHT** is displayed. Press ON and **M.DIST** is displayed. Change **M.DIST** or use the current value if accurate.

2. Aim towards the height measuring point (T.HEIGHT). Press ON until the cross hair sight goes out.

3. Aim towards the height to measure. Press ON until the cross hair sight goes out.

Repeat for taking another height.

Height measuring horizontally

1. Press ON. **HEIGHT** is displayed. Press ON and **M.DIST** is displayed. Change **M.DIST** or use the current value if accurate and press ON.

2. The angle window is displayed. Press left arrow and ON. Height measuring position is featured.

3. Aim towards the height to measure. Press ON until the cross hair sight goes out.

Repeat for taking another height.

ANGLE Measuring

1. Start the Vertex with ON and use the arrow keys to reach **ANGLE.** Press ON.

2. Sight towards the point where the angle to measure is located. Press ON until the cross hair sight goes out.

DISTANCE Measuring (DME)

1. Start the transponder and place it on the object to where the required distance to be measured is.

2. Press left arrow key and read the value measured.

Turn on and turn off the transponder T3

On
Keep the Vertex loudspeaker towards the transponder.
Press left arrow key until two short signals are heard from the transponder.

Off
Keep the Vertex loudspeaker towards the transponder.

Press the left arrow key until 4 short signals goes off from the transponder.