FLUKE®

421D
Distance Meter

Users Manual

September 2009
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Distance Meter

Introduction

Carefully read the Safety Instructions and the User Manual before using this product.

How to Contact Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-443-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-3434-0181
- Singapore: +65-738-5655
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at www.fluke.com.

To register your product, visit http://register.fluke.com.

To view, print, or download the latest manual supplement, visit http://us.fluke.com/usen/support/manuals.

Use of the instrument

Permitted use

- Measuring distances
- Computing functions, e. g. areas and volumes
- Measuring tilts

Prohibited use

- Using the instrument without instruction
- Using outside the stated limits
- Deactivation of safety systems and removal of explanatory and hazard labels
- Opening of the equipment by using tools (screwdrivers, etc.), as far as not specifically permitted for certain cases
- Carrying out modification or conversion of the product

- Use of accessories from other manufacturers without the express approval of Fluke
- Deliberate or irresponsible behavior on scaffolding, when using ladders, when measuring near machines which are running, or near parts of machines or installations which are unprotected
- Aiming directly into the sun
- Pointing the laser directly at people or animals in light or dark conditions.
- Inadequate safeguards at the surveying site (for example, when measuring on roads, construction sites, etc.)

Limits of use

Note

See section "Technical Data".

The Fluke 421D is designed for use in areas permanently habitable by humans, do not use the product in explosion hazardous areas or in aggressive environments.

Areas of responsibility

Responsibilities of the manufacturer (Fluke)

Fluke is responsible for supplying the product, including the User Manual and original accessories, in a completely safe condition.

Responsibilities of the manufacturer of non-Fluke accessories

The manufacturers of non-Fluke accessories for the 421D are responsible for developing, implementing and communicating safety concepts for their products. They are also responsible for the effectiveness of these safety concepts in combination with Fluke equipment.

Responsibilities of the person in charge of the instrument

⚠ Warning

The person responsible for the instrument must ensure that the equipment is used in accordance with the instructions. This person is also accountable for the deployment of personnel and for their training and for the safety of the equipment when in use.

The person in charge of the instrument has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual.
- To be familiar with local safety regulations relating to accident prevention.
- To inform Fluke immediately if the equipment becomes unsafe.

Hazards in use

⚠ Caution

Watch out for erroneous distance measurements if the instrument is defective or if it has been dropped or has been misused or modified.

Precautions

Carry out periodic test measurements. Particularly after the instrument has been subject to abnormal use, and before, during and after important measurements.

Make sure the 421D optics is kept clean and that there is no mechanical damage to the bumpers.

⚠ Caution

In using the instrument for distance measurements or for positioning moving objects (for example, cranes, building equipment, platforms, etc.) unforeseen events may cause erroneous measurements.

Only use this product as a measuring sensor, not as a control device. Your system must be configured and operated in such a way, that in case of an erroneous measurement, malfunction of the device or power failure due to installed safety measures (for example, safety limit switch), it is assured that no damage will occur.

⚠ Warning

Flat batteries must not be disposed of with household waste. Care for the environment and take them to the collection points provided in accordance with national or local regulations.

The product must not be disposed of with household waste.

Dispose of the product appropriately in accordance with the national regulations in force in your country.

Always prevent access to the product by unauthorized personnel.

Product specific treatment and waste management information can be downloaded from the Fluke home page at http://www.fluke.com or received from your Fluke dealer.

Safety Instructions

Symbols

The symbols used in the Safety Instructions have the following meanings:

⚠ Warning

Indicates a potentially hazardous situation or an unintended use which, if not avoided, will result in death or serious injury.

⚠ Caution

Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor injury and/or in appreciable material, financial and environmental damage.

Symbol	Description
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.
	Warning. Laser
	Risk of Danger. Important information. See Manual.
CE	Conforms to European Union directives.

Note

Important paragraphs which must be adhered to in practice as they enabled the product to be used in a technically correct and efficient manner.

Electromagnetic Compatibility (EMC)

The term "electromagnetic compatibility" is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic interference to other equipment.

⚠ Warning

The 421D conforms to the most stringent requirements of the relevant standards and regulations. Yet, the possibility of it causing interference in other devices cannot be totally excluded.

⚠ Caution

Never attempt to repair the product yourself. In case of damage, contact Fluke (www.fluke.com).

FCC statement (U.S.A only)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

⚠ Warning

Changes or modifications not expressly approved by Fluke for compliance could void the user's authority to operate the equipment.

Laser classification

Integrated distance meter

The 421D produces a visible laser beam which emerges from the front of the instrument.

It is a Class 2 laser product in accordance with:

- IEC60825-1 : 2007 "Radiation safety of laser products"

Laser Class 2 products:

Do not stare into the laser beam or direct it towards other people unnecessarily. Eye protection is normally afforded by aversion responses including the blink reflex.

⚠ Warning

Do not look directly into the beam with optical aids. Looking directly into the beam with optical aids (for example, binoculars, telescopes) can be hazardous.

⚠ Caution

Looking into the laser beam may be hazardous to the eyes.

Do not look into the laser beam. Make sure the laser is aimed above or below eye level. (particularly with fixed installations, in machines, etc.)

Start-up

Inserting/replacing batteries

See figure {**A**}

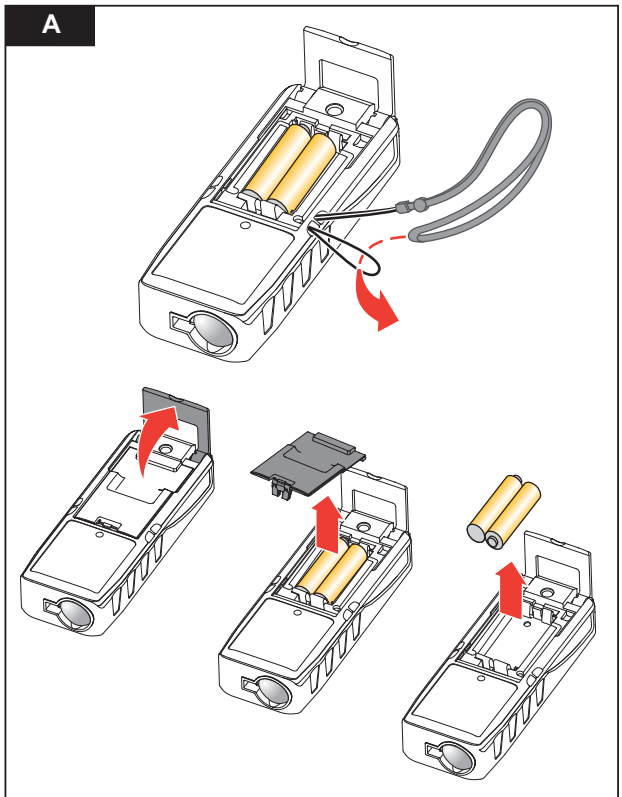
1. Remove battery compartment lid and attach handstrap.
2. Insert two AAA (LR3) batteries, observing correct polarity.
3. Close the battery compartment again. Replace the batteries when the symbol ▯ flashes permanently in the display.

Note

Use alkaline batteries only.

Note

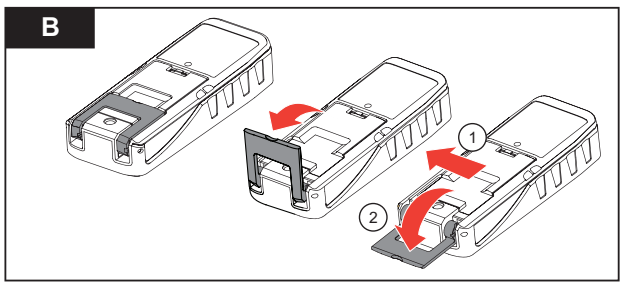
Remove the batteries before any long period of non-use to avoid the danger of corrosion.



Changing the reference point (multifunctional endpiece)

See figure {**B**}.

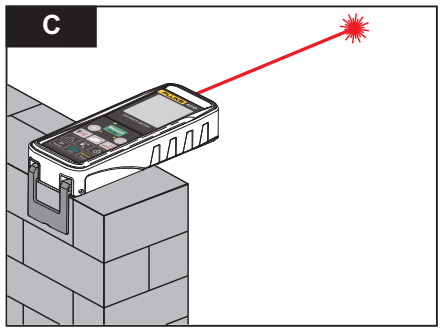
B



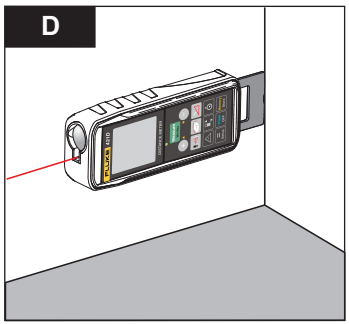
The instrument can be adapted for the following measuring situations:

- For measurements from an edge, fold out the positioning bracket until it first locks in place. See figure {**C**}.

C



- For measurements from a corner, open the positioning bracket until it locks in place, then push the positioning bracket lightly to the right to fold it out fully. See figure {**D**}.

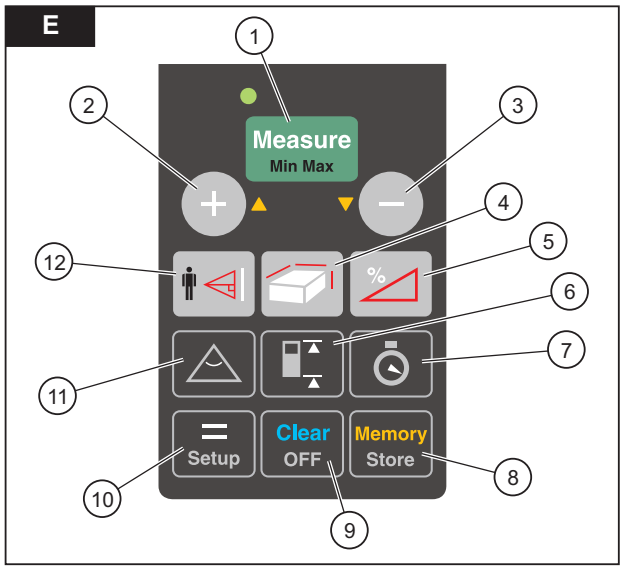


A built-in sensor automatically detects the orientation of the positioning bracket and adjusts the zero point of the instrument accordingly.

Keypad

See figure {**E**}:

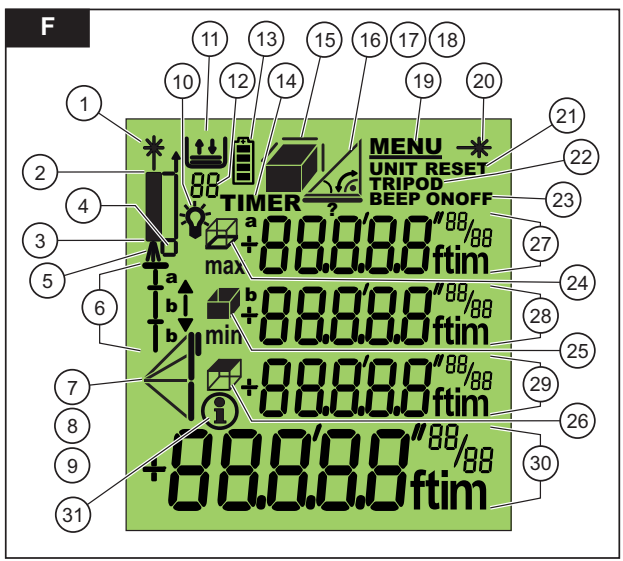
1. Measure/Min Max/Power On
2. Plus (+)/Scroll up
3. Minus (-)/Scroll down
4. Area/volume
5. Tilt function/Stake out
6. Reference
7. Timer
8. Memory
9. Clear/off
10. Setup/mem/equal
11. Room corner/triangle angles
12. Indirect measurement (Pythagoras)



Display

See figure {**F**}

1. Laser active
2. Reference (front)
3. Reference (rear)
4. Reference (corner stop)
5. Measuring with the tripod
6. Stake out function
7. Single Pythagorean measurement
8. Double Pythagorean measurement
9. Double (partial height) measurement
10. Illumination
11. Save constant value, call up constant value
12. Historical memory, call up values
13. Battery status
14. Timer
15. Area/volume
16. Tilt
17. Horizontal distance measurement using tilt
18. Room corner angle function
19. Menu
20. Continuous laser
21. Reset
22. Reference (tripod)
23. Beep
24. Circumference
25. Wall area
26. Ceiling area
27. Intermediate line 1
28. Intermediate line 2
29. Intermediate line 3
30. Summary line
31. Message code indicator



Menu functions

Settings

The menu allows settings to be altered and permanently stored. After switching off the device or replacing the batteries the settings are stored.

Navigation in the menu

The menu allows settings to be made at the user level. The instrument can be specifically configured to your personal requirements.

General description

Measure Min Max button (**long** press) brings up the **MENU**, the set units and the symbol **UNIT** are displayed.

Measure Min Max button (**short** press) pages through each menu item. See figure {**G**}.

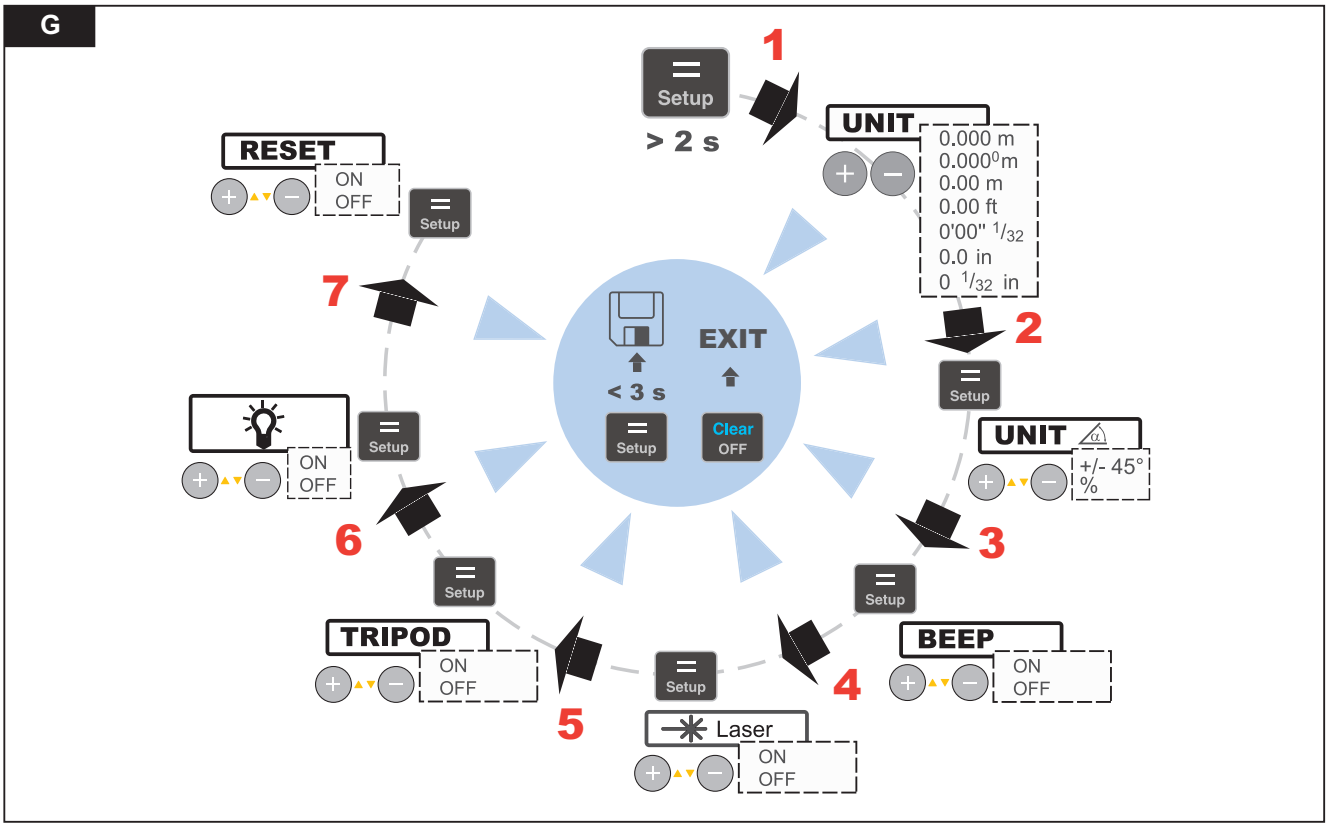
⊕ or ⊖ button to make changes in menu items.

Measure Min Max button (**short** press) brings up the next menu item.

A long press on the Measure Min Max button in the menu confirms the new settings made in the submenu items.

Pressing the Clear OFF button (**short** press) in the menu allows you to quit the settings function without saving.

G


1
Setup
> 2 s
UNIT
0.000 m
0.000 m
0.00 m
0.00 ft
0'00" 1/32
0.0 in
0 1/32 in
2
Setup
UNIT
+/- 45°
%
3
Setup
BEEP
ON
OFF
4
Setup
Laser
ON
OFF
5
Setup
TRIPOD
ON
OFF
6
Setup
ON
OFF
7
Setup
RESET
ON
OFF
EXIT
< 3 s
Setup
Clear
OFF

Setting the unit for distance measurements

The following units can be set:

Menu #	Distance	Area	Volume
1.1	0.000 m	0.000 m^2	0.000 m^3
1.2	0.000^0 m	0.000 m^2	0.000 m^3
1.3	0.00 m	0.000 m^2	0.000 m^3
1.4	0.00 ft	0.00 ft^2	0.00 ft^3
1.5	0'00" 1/32	0.00 ft^2	0.00 ft^3
1.6	0.0 in	0.00 ft^2	0.00 ft^3
1.7	0 1/32 in	0.00 ft^2	0.00 ft^3

Setting the unit for tilt measurements

The following units can be set for tilt measurements:

Menu #	Units for tilt
2.1	+/- 0.0°
2.2	0.00%

Beep (BEEP)

You can switch the beep on or off.

Menu #	Beep function
3.1	On
3.2	Off

Continuous laser (→✳)

You can switch the continuous laser function on or off.

Menu #	Continuous laser function
4.1	On
4.2	Off

With the continuous laser function set on, each press of the button Measure Min Max triggers a measurement. The laser automatically switches off after 15 minutes.

Measuring with the tripod (TRIPOD)

The reference must be appropriately adjusted in order to be able to take correct measurements with a tripod. To do this select the **TRIPOD** symbol in this menu item. You can switch the reference on the tripod on or off. The setting can be seen on the display.

Menu #	Measuring with tripod function
5.1	On
5.2	Off

Display - keypad illumination (☼)

Automatic illumination of the display and the keypad can be switched on or off.

Menu #	Illumination function
6.1	On
6.2	Off

Reset - returning the instrument to the factory settings (RESET)

The instrument has a **RESET** function. When you select the menu function **RESET** and confirm, the instrument defaults to the factory settings.

Menu #	Reset function
7.1	On
7.2	Off

A reset returns the following values to their factory settings:

- Reference (rear)
- Display illumination (ON)
- Beep (ON)
- Unit (m(mm))
- Stack and memory are erased

Note

All customized settings and stored values are also lost.

Operation

Switching on and off

Measure Min Max Switches on the instrument and laser. The display shows the battery symbol until the next button is pressed.

Clear OFF Pressing this button for longer switches the instrument off.

The instrument switches off automatically after six minutes of inactivity.

CLEAR button

Clear OFF The last action is cancelled. While making area or volume measurements, each single measurement can be deleted and remeasured in series.

Display / keypad illumination

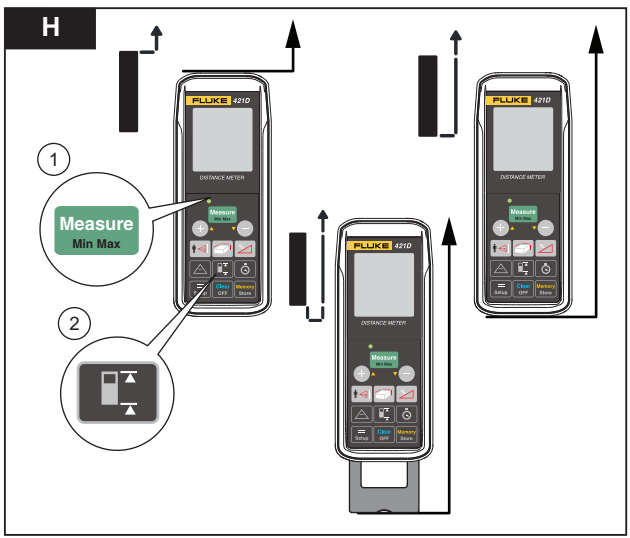
The instrument has a sensor that automatically switches the display and keypad illumination on or off in response to lighting conditions.

Reference setting

The default reference setting is from the rear of the instrument. A special beep sounds whenever the reference setting is changed.

Press this button (**short** press) to take the next measurement from the front edge.

After a measurement the reference returns automatically to the default setting (rear reference). See figure {**H**}.



Press this button (**long** press) to set the reference to the front. Does not return to default (rear) reference.

Press this button, the rear reference is set again.

Measuring

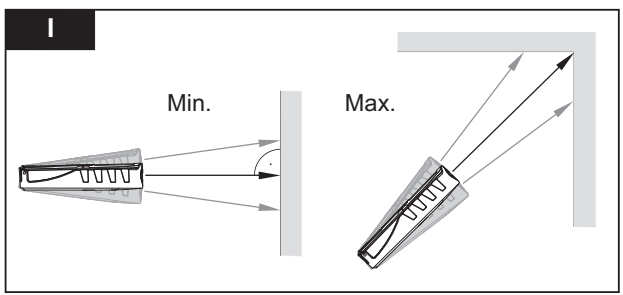
Single distance measurement

Measure Min Max Press to activate the laser. Press again to trigger the distance measurement.

The result is displayed immediately.

Minimum/maximum measurement

This function allows the user to measure the minimum or maximum distance from a fixed measuring point. It can also be used as to determine spacings. See figure {**I**}.



It is commonly used to measure room diagonals (maximum values) or horizontal distances (minimum values).

Measure Min Max Press and hold down this button until you hear a beep. Then slowly sweep the laser back and forth and up and down over the desired target point - (for example, into the corner of a room).

Measure Min Max Press to stop continuous measurement. The values for maximum and minimum distances are shown in the display as well as the last measured value in the summary line.

Functions

Addition / subtraction

Distance measuring

⊕ The next measurement is added to the previous one.

⊖ The next measurement is subtracted from the previous one.

This process can be repeated as required. Setup Press this key to display result. The result is always shown in the summary line with the previous value in the second line.

Clear OFF The last step is cancelled.

Area

Press **once**. The symbol appears in the display.

Measure Min Max Press this button to take the first length measurement (for example, length).

Measure Min Max Press it again to take the second length measurement (for example, width).

The result is displayed in the summary line.

Press the button (**long** press) to calculate the circumference.

Volume

Press this button **twice**. The symbol appears in the display.

Measure Min Max Press this button to take the first length measurement (for example, length).

Measure Min Max Press this button to take the second length measurement (for example, width).

Measure Min Max Press this button to take the third length measurement (for example, height). The value is shown in the second line.

The volume then appears in the summary line.

Press the button (**long** press) to display additional room information such as ceiling/floor area, surface area of the walls, circumference.

- Ceiling/floor area
- Wall area
- Circumference

Tilt measurement

Note

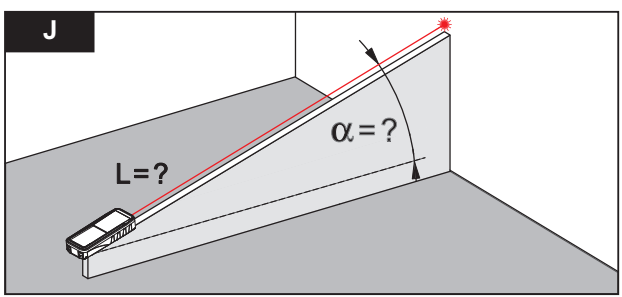
The inclination sensor measures tilts between ±45°.

Note

During tilt measurement the instrument should be held without a transverse tilt (±10°).

Press this button **once** to activate the tilt sensor. The ∠symbol appears in the display. The tilt is continuously shown as ° or % depending on the setting.

Measure Min Max Press to measure the inclination and the distance. See figure {**J**}.



Tilt sensor calibration

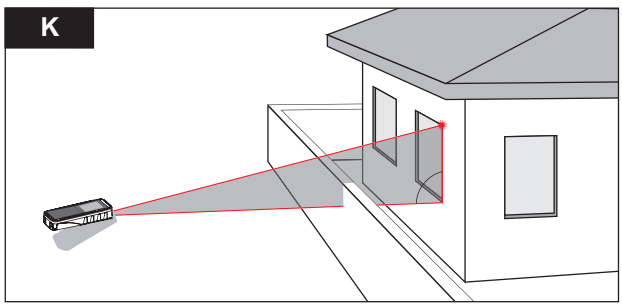
The user can calibrate the device's tilt sensor. The angle sensor is switched on by pressing the once. Then two measurements are taken on a flat surface. The first measurement is taken and a note is made of the measured angle **a**. The device is then turned through exactly 180 °, the second measurement is taken and a note is made of the measured angle **b**. The value **x** to which the device must be corrected is calculated as follows:

x = -(a+b)/2

The calibration mode is then entered by pressing keys Clear OFF and the both at the same time for 2 seconds. The correction value x can be entered here using the ⊕ and ⊖ keys. The entered value is stored and implemented by pressing the Setup key.

Indirect horizontal distance

This function allows the user to determine a horizontal distance even when the line-of-sight is blocked by an object or obstacle. See figure {**K**}.



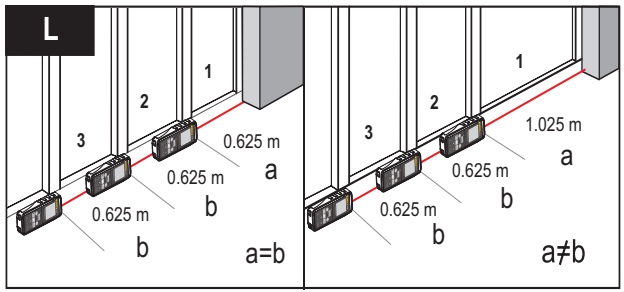
Press this button **twice** and the following symbol appears in the display ◿.

Measure Min Max Press this button to measure tilt and diagonal distance. The summary line displays the result as the direct horizontal distance.

Stake out function

Two different distances (a and b) can be entered into the instrument and can then be used to mark off defined measured lengths, for example, in the construction of wooden frames.

See figure {**L**}.



Entering stake out distances:

Press this button **three times** and the stake out function symbol appears in the display.

The value (a) and the corresponding intermediate line flash.

By using ⊕ and ⊖, you can adjust the values (first a and then b) to suit the desired stake out distances. Holding the buttons down increases the rate of change of the values.

Once the desired value (a) has been reached it can be confirmed with the Setup button.

The value (b) and the intermediate line flashes (the defined value (a) is automatically adopted). Value (b) can be entered using ⊕ and ⊖.

The defined value (b) is confirmed with the Setup button and starts the stake out laser measurement.

The display shows required stake out distance in the summary line between the stake out point (first a and then b) and the instrument (rear reference).

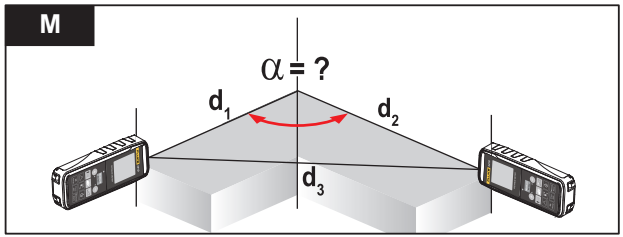
If the 421D is then moved slowly along the stake out line the displayed distance decreases. The instrument starts to beep at a distance of 0.1 m from the next stake out point.

The arrows in the display indicate in which direction the 421D needs to be moved in order to achieve the defined distance (either a or b). As soon as the stake out point is reached the beep changes and the arrows in the display disappear.

The function can be stopped at any time by pressing the Clear OFF button.

Room corner angle function

The angles in a triangle can be calculated by measuring the three sides. This function can be used e. g. to check a right-angled room corner. See figure {**M**}.



Press this button and the room corner symbol appears in the display ∠.

Mark the reference points to the right and left (d1/d2) of the angle to be measured.

Measure Min Max Press this button to measure the first (short) side of the triangle (d1 or d2).

Measure Min Max Press this button to measure the second (short) side of the triangle (d1 or d2).

Measure Min Max Press this button to measure the third (long) side of the triangle (d3).

The result is displayed in the summary line as the room corner angle.

Indirect measurement

The instrument can calculate distances using Pythagoras' theorem.

Note

Make sure you adhere to the prescribed sequence of measurement:

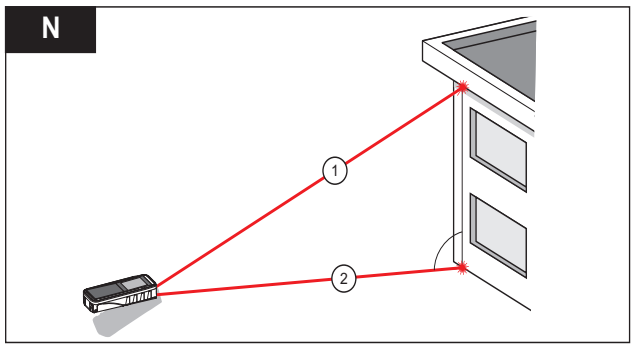
- *All target points must be in a horizontal or vertical plane.*
- *The best results are achieved when the instrument is rotated about a fixed point (for example, with the positioning bracket fully folded out and the instrument placed on a wall).*
- *The minimum/maximum function can be used -see explanation in "Measuring -> Minimum/maximum measurement". The minimum value must be used for measurements at right angles to the target; the maximum distance for all other measurements.*

Note

Make sure that the first measurement and the distance to be measured are at right angles. Use the Minimum/maximum function, as explained in "Measuring -> Minimum/maximum measurement".

Indirect measurement - determining a distance using 2 auxilliary measurements

See figure {**N**}.



For example, for measuring building heights or widths. It is helpful to use a tripod when measuring heights that require the measurement of two or three measurements.

Press this button **once**, the display shows ⦟.

The laser is switched on.

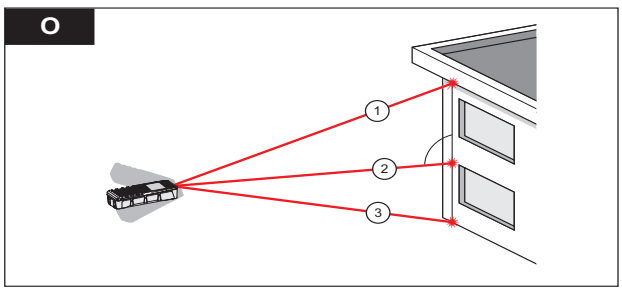
Measure Min Max Aim at the upper point (1) and trigger the measurement. After the first measurement the value is adopted. Keep the instrument as horizontal as possible.

Measure Min Max Press and hold down this button to trigger continuous measurement, sweep the laser back and forth and up and down over the ideal horizontal target point.

Measure Min Max Press to stop continuous measurement (2). The result is displayed in the summary line, the partial results in the secondary line.

Indirect Measurement - determining a distance using 3 measurements

See figure {**O**}.



Press this button **twice**; the display shows the following symbol ◁. The laser is switched on.

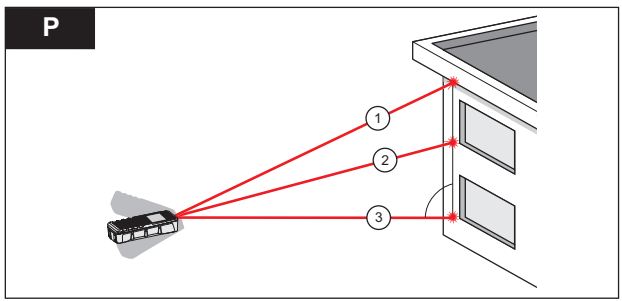
Measure Min Max Aim at the upper point (1) and trigger the measurement. After the first measurement the value is adopted. Keep the instrument as horizontal as possible.

Measure Min Max Press and hold down this button to trigger continuous measurement, sweep the laser up and down over the ideal horizontal target point.

Measure Min Max Press to stop continuous measurement (2). The value is adopted. Aim at the lower point and Measure Min Max press this button to trigger the measurement (3). The result is displayed in the summary line, the partial results in the secondary lines.

Indirect measurement - determining a chain value using 3 measurements

See figure {**P**}.



fig_p.eps

For example, determining the height between point 1 and point 2 using three target points.

Press this button **three** times; the display shows the following symbol ◿. The laser is switched on.

Aim at the upper point (1).

Measure Min Max Press this button and trigger the measurement. After the first measurement the value is adopted. The display flashes (2).

Measure Min Max Triggers the measurement. After the second measurement the value is adopted. The display flashes (3). Keep the instrument as horizontal as possible.

Measure Min Max Press and hold down this button to trigger continuous measurement. Sweep the laser up and down over the ideal horizontal target point.

Measure Min Max Press this button to end continuous measurement. The result is displayed in the summary line, the partial results in the secondary lines.

Storage of constants/historical storage

Storage of a constant

You can store and recall a frequently used value for example, height of a room. Measure the desired distance, press and hold the Memory Store button until the device beeps to confirm storage.

Recalling the constant

Memory Store Press this button **once** to recall the constant and make it available for further calculations by pressing button Setup .

Historical storage

Memory Store Press this button **twice** and the previous 20 results (measurements or calculated results) are shown in reverse order.

The ⊕ and ⊖ buttons can be used for navigation.

Memory Store Press this button to use a result from the summary line for further calculations.

Pressing the Memory Store and Clear OFF buttons at the same time erases all the values in historical storage.

Timer (self-triggering)

Press this button to set a 5-second time delay.

or

Press and hold down this button until the desired time delay is reached (max. 60 seconds).

Press Measure Min Max to begin the timer. The remaining seconds until measurement (for example, 59, 58, 57...) are displayed in a countdown. The last 5 seconds are counted down with a beep. After the last beep the measurement is taken and the value is displayed.

Note

The timer can be used for all measurements.

Appendix

Message codes

All message codes are displayed with either ⓘ or "Error". The following errors can be corrected:

ⓘ	Cause	Remedy
156	Transverse tilt greater than 10°	Hold the instrument without any transverse Tilt
160	Main tilt direction, angle too high (>45°)	Measure angle up to max. ±45°
204	Calculation error	Repeat procedure
252	Temperature too high	Cool down instrument
253	Temperature too low	Warm up instrument
255	Receiver signal too weak, measurement time too long, distance >100 m	Use target plate
256	Received signal too strong	Target too reflective (use target plate)
257	Wrong measurement, background brightness too high	Darken target (measure in different lighting conditions)
260	Laser beam interrupted	Repeat measurement

Error	Cause	Remedy
Error	Hardware error	Switch on/off the device several times. If the symbol still appears, then your instrument is defective. Please call your dealer for assistance.

Technical data

Distance measurements: Measuring accuracy up to 10 m (2 σ, standard deviation)	typically: ± 1.5 mm* (± 1/16 in*)
Power Range Technology™: Range (use target plate from about 80m)	0.05 m to 100 m
Smallest unit displayed	0.1 mm
Distance measurement	√
Minimum/maximum measurement, Continuous measurement	√
Area/volume calculation of room data	√
Addition / subtraction	√
Indirect measurement using Pythagoras	√
Tilt measurements: Tilt sensor: Accuracy (2 σ, standard deviation) - to laser beam - to the housing	 ± 0.3° ± 0.3°
Indirect measurement using tilt sensor (direct horizontal distance)	√
Angle measurement using tilt sensor(± 45°)	√

General: Laser class	II
Laser type	635 nm, < 1 mW
∅ laser point (at distances)	6 / 30 / 60 mm (10 / 50 / 100 m)
Automatic laser switch-off	after 3 min
Automatic instrument switchoff	after 6 min
Display illumination	√
Keypad illumination	√
Multifunctional endpiece	√
Timer (self-triggering)	√
Save constant value	√
Historical storage (20 values)	√
Tripod thread	√
Battery life, Type AAA, 2 x 1.5 V NEDA 24A/IEC LR03	up to 5 000 measurements
Protection against splashes and dust	IP 54, dust-proof, splash-proof

Dimensions	125 x 45 x 25 mm
Weight (with batteries)	110 g
Temperature range: Storage Operation	 -25 °C to +70°C (13 °F to +158 °F) -10 °C to +50 °C (14 °F to +122 °F)
Maximum altitude	3500 m (AMSL)
Maximum relative humidity	85% at 20 °F to 120 °F (-7 °C to 50 °C)
Pollution degree	2
Safety	CAN/CSA-C22.2 No. 61010-1-04, UL Std. No. 61010-1 (2nd Edition), ISA-82.02.01, IEC Standard No. 61010-1:2001, and EN60825-1:2007 (Class II)
EMC	61326-1:2006
*maximum deviation occurs under unfavorable conditions such as bright sunlight or when measuring to poorly reflecting or very rough surfaces. Measuring accuracy between 10 m and 30 m may deteriorate to approx. ± 0.025 mm/m, for distances above 30 m to ± 0.1 mm/m.	

Measuring conditions

Measuring range

The range is limited to 100 m.

At night or dusk and if the target is in shadow the measuring range without target plate is increased.

Use a target plate to increase the measurement range during daylight or if the target has poor reflection properties.

Target surfaces

Measuring errors can occur when measuring toward colorless liquids (for example, water) or dust free glass, Styrofoam or similar semi-permeable surfaces.

Aiming at high gloss surfaces may deflect the laser beam and lead to measurement errors.

Against non-reflective and dark surfaces the measuring time may increase.

Care and Cleaning

Do not immerse the instrument in water. Wipe off dirt with a damp, soft cloth. Do not use aggressive cleaning agents or solutions. Handle the instrument as you would a telescope or camera.