



GRL 350 HV | RC 4 Professional

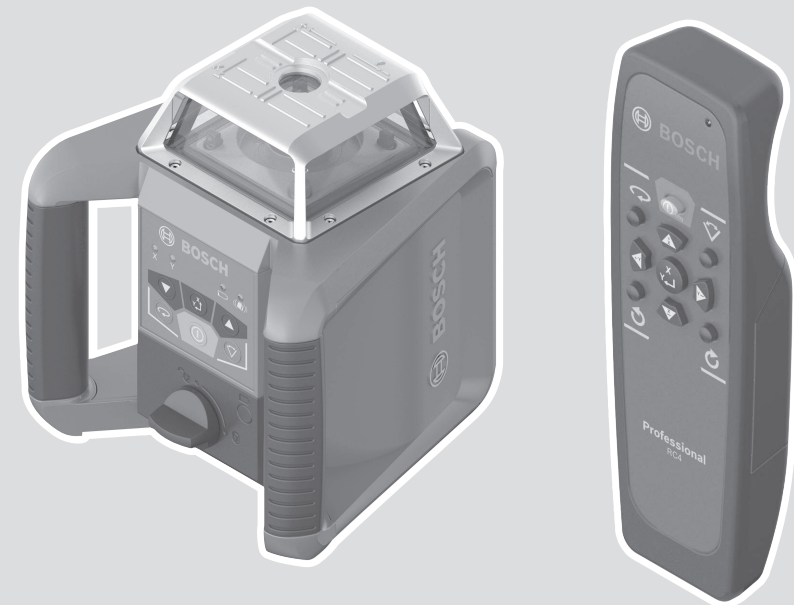
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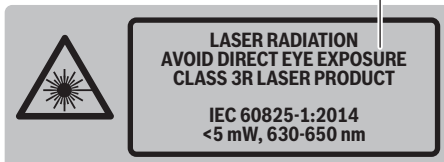
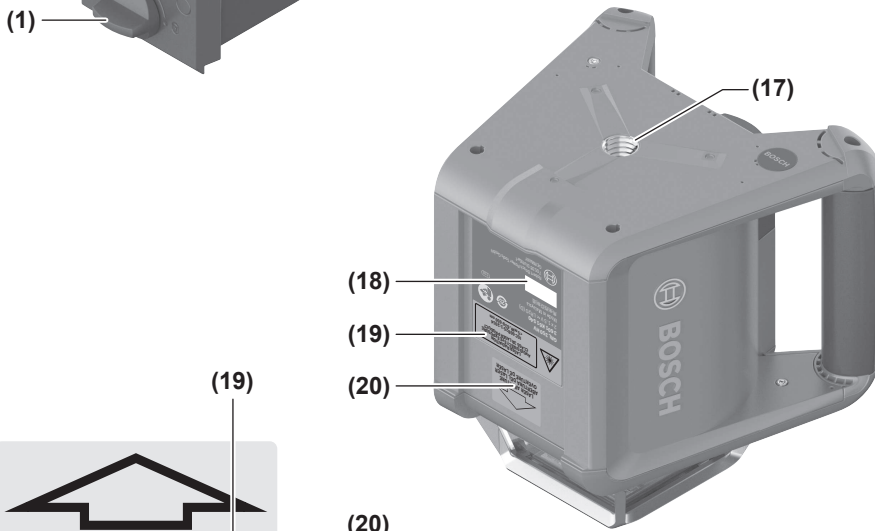
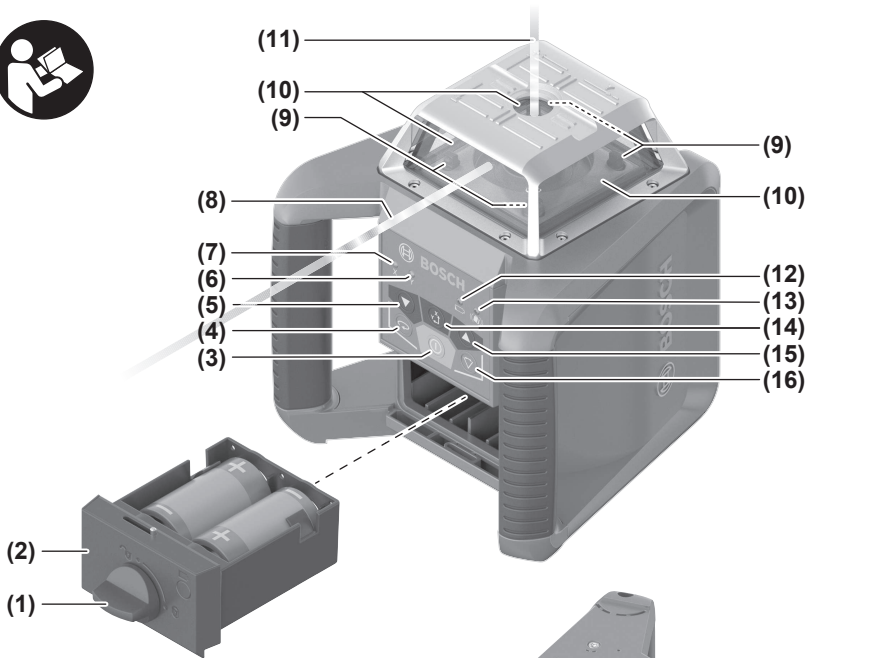
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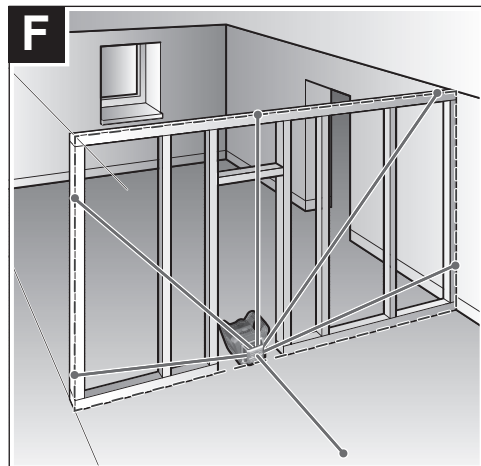
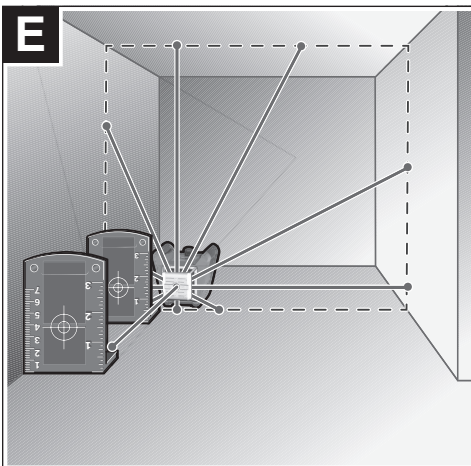
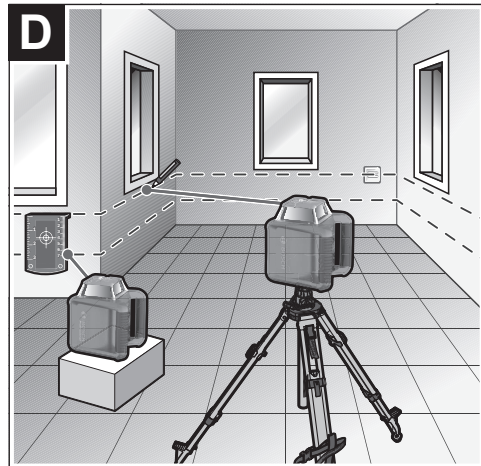
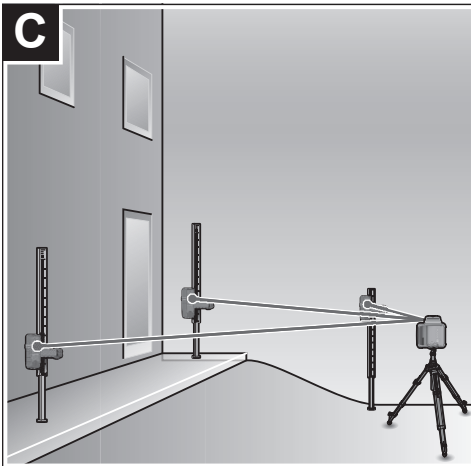
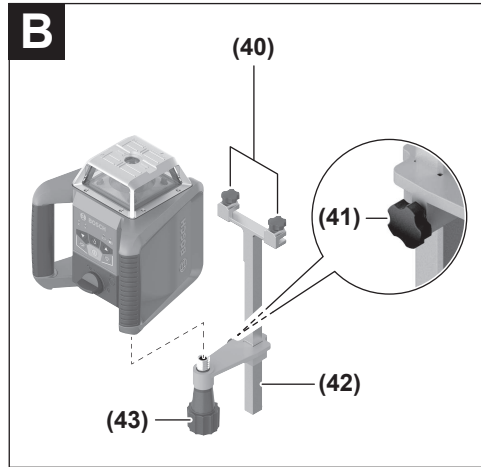
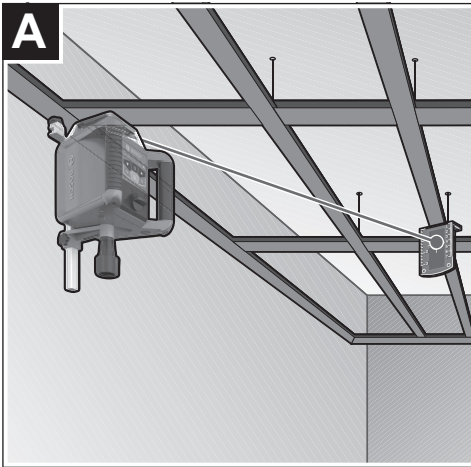


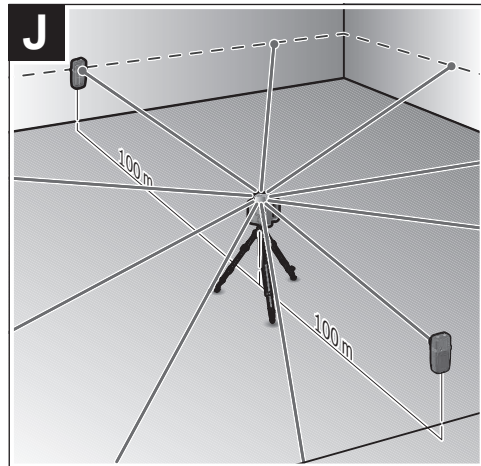
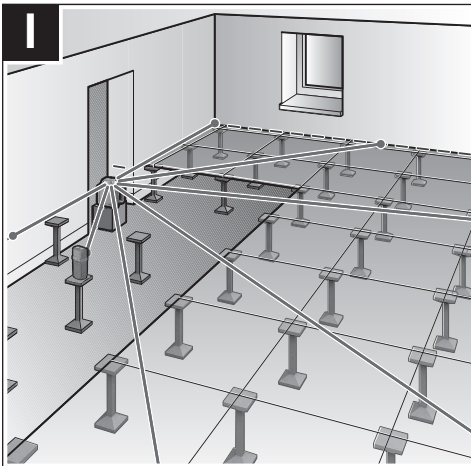
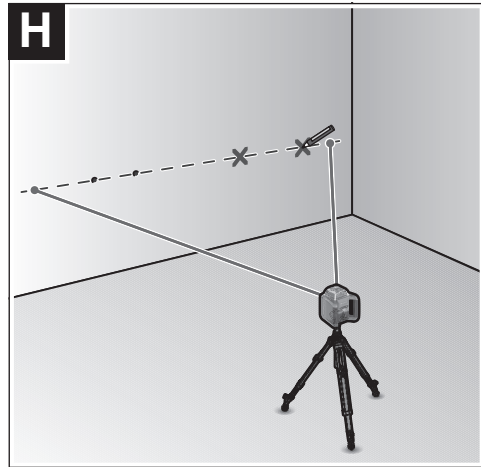
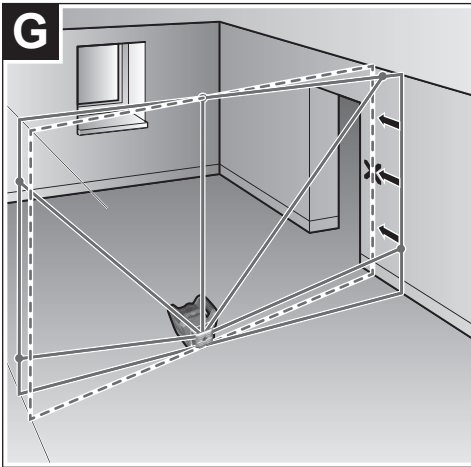
- en Original instructions
- zh 正本使用说明书
- zh 原始使用說明書
- ko 사용 설명서 원본
- th หนังสือคู่มือการใช้งานฉบับต้นแบบ
- id Petunjuk-Petunjuk untuk Penggunaan Orisinal
- vi Bản gốc hướng dẫn sử dụng

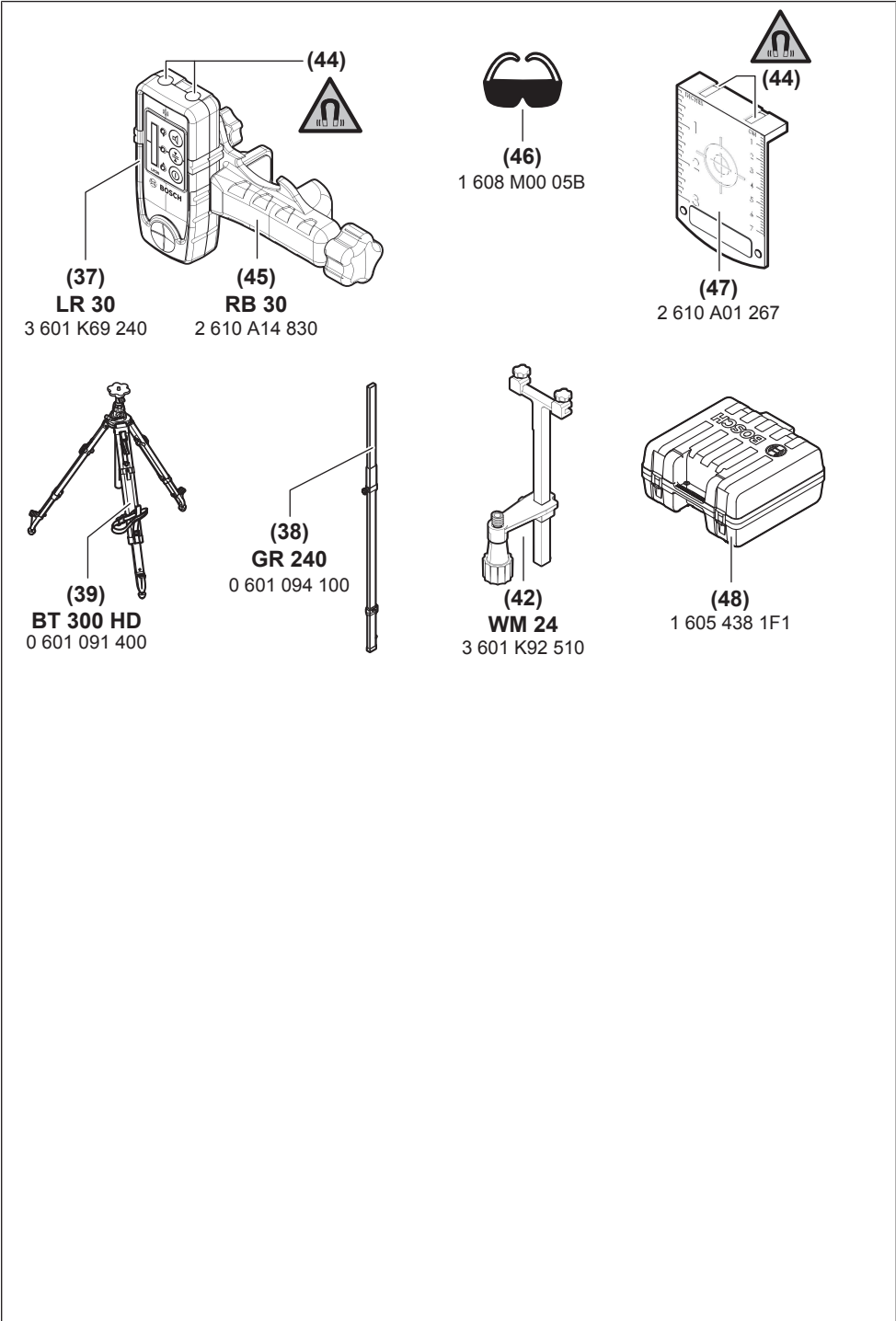


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English

Safety instructions for rotary lasers



All instructions must be read and observed in order for the measuring tool to function safely. The safeguards integrated into the measuring tool may be compromised if the measuring tool is not used in accordance with these instructions. Never make warning signs on the measuring tool unrecognisable. **SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE AND INCLUDE THEM WITH THE MEASURING TOOL WHEN TRANSFERRING IT TO A THIRD PARTY.**

- ▶ The measuring tool is delivered with a laser warning sign (marked in the illustration of the measuring tool on the graphics page).
- ▶ If the text of the laser warning label is not in your national language, stick the provided warning label in your national language over it before operating for the first time.
- ▶ The laser exit holes on the measuring tool are marked with warning labels. Take note of their position when using the measuring tool.
- ▶ If the text of these labels is not in your national language, stick the provided warning label in your national language over it before operating for the first time.
- ▶ **Warning!** If operating or adjustment devices other than those specified here are used or other procedures are carried out, this can lead to dangerous exposure to radiation.
- ▶ Do not make any modifications to the laser equipment.



Do not direct the laser beam at persons or animals and do not stare into the laser beam yourself. This measuring tool generates laser class 3R laser radiation according to EN 60825-1. Looking into the laser beam directly can cause eye injuries – even from far away.

- ▶ Do not use the laser goggles as protective goggles. The laser goggles make the laser beam easier to see; they do not protect you against laser radiation.
- ▶ Do not use the laser goggles as sunglasses or while driving. The laser goggles do not provide full UV protection and impair your ability to see colours.
- ▶ Have the measuring tool serviced only by a qualified specialist using only original replacement parts. This will ensure that the safety of the measuring tool is maintained.
- ▶ Do not let children use the laser measuring tool unsupervised. They could accidentally dazzle someone.

- ▶ Avoid laser beam reflections on smooth surfaces such as windows or mirrors. Even the reflected laser beam can cause eye injuries.
- ▶ The measuring tool should only be operated by people who have experience in using laser tools. According to EN 60825-1, this includes knowledge of the biological impact of the laser on eyes and skin as well as the correct application of laser safety guidelines to prevent hazards.
- ▶ Do not use the measuring tool in explosive atmospheres which contain flammable liquids, gases or dust. Sparks may be produced inside the measuring tool, which can ignite dust or fumes.
- ▶ Always position the measuring tool such that the laser beams travel far above or below eye level. This ensures that no eye injuries are caused.
- ▶ Mark out the area where the measuring tool is being used with suitable laser warning signs. This will prevent people who are not using the measuring tool from entering the danger zone.
- ▶ Do not store the measuring tool in places which can be accessed by unauthorised individuals. People who are unfamiliar with the operation of the measuring tool may cause harm to themselves or others.
- ▶ Comply with any applicable national regulations when using a laser from laser class 3R. Failure to comply with these regulations may cause injuries.
- ▶ Ensure that the laser radiation area is guarded or screened. Restricting the laser radiation to controlled areas prevents eye injuries being caused to people who are not using the laser measuring tool.
- ▶ Never leave the measuring tool unattended when switched on, and ensure the measuring tool is switched off after use. Others may be dazzled by the laser beam.
- ▶ Do not use any optical instruments such as binoculars or magnifying glasses to view the radiation source. Doing so can damage your eyes.



Keep the magnetic accessories away from implants and other medical devices, e.g. pacemakers or insulin pumps. The magnets in the accessories generate a field that can impair the function of implants and medical devices.

- ▶ Keep the magnetic accessories away from magnetic data storage media and magnetically-sensitive devices. The effect of the magnets in the accessories can lead to irreversible data loss.

Safety Instructions For Remote Controls



All instructions must be read and observed. The safeguards integrated into the remote control may be compromised if the remote control is not used in accordance with these

instructions. STORE THESE INSTRUCTIONS IN A SAFE PLACE.

- ▶ **Have the remote control repaired only through a qualified repair person and only using identical replacement parts.** This will ensure that the safety of the remote control is maintained.
- ▶ **Do not operate the remote control in explosive atmospheres, such as in the presence of flammable liquids, gases or dusts.** Sparks can be created in the remote control which may ignite the dust or fumes.

Product Description and Specifications

Please observe the illustrations at the beginning of this operating manual.

Intended Use

Rotary laser

The measuring tool is intended for establishing and checking exactly horizontal height profiles, vertical lines, alignments and plumb points.

The measuring tool is suitable for indoor and outdoor use.

Remote control

The remote control is intended for controlling the **Bosch** rotary lasers via infrared.

The remote control is suitable for indoor and outdoor use.

Product Features

The numbering of the product features refers to the illustration of the measuring tool and remote control on the graphics pages.

Rotary Laser

- (1) Battery compartment locking mechanism^{A)}
- (2) Battery compartment^{A)}
- (3) On/off button
- (4) Rotational operation button
- (5) Slope button down
- (6) Y-axis status indicator
- (7) X-axis status indicator
- (8) Variable laser beam
- (9) Sensor for remote control
- (10) Laser beam outlet aperture
- (11) Plumb point up
- (12) Battery warning
- (13) Shock-warning function indicator
- (14) Manual operation button
- (15) Slope button up
- (16) Line operation button
- (17) 5/8" tripod mount

- (18) Serial number
- (19) Laser warning label
- (20) Label laser aperture

A) **Accessories shown or described are not included with the product as standard. You can find the complete selection of accessories in our accessories range.**

Remote Control

- (21) Remote control^{A)}
- (22) Slope button X-
- (23) Button for anticlockwise rotation
- (24) Slope button Y+
- (25) Slope button X+
- (26) Rotational operation button
- (27) Infrared beam outlet aperture
- (28) Signal transmission indicator
- (29) Sleep mode button (standby)
- (30) Line operation button
- (31) Manual operation button
- (32) Slope button Y-
- (33) Button for clockwise rotation
- (34) Serial number
- (35) Battery compartment cover locking mechanism
- (36) Battery compartment cover

A) **Accessories shown or described are not included with the product as standard. You can find the complete selection of accessories in our accessories range.**

Accessories/replacement parts

- (37) Laser receiver^{A)}
- (38) Measuring rod^{A)}
- (39) Tripod^{A)}
- (40) Fastening screw for wall mount^{A)}
- (41) Alignment unit bolt^{A)}
- (42) Wall mount/alignment unit^{A)}
- (43) 5/8" screw for wall mount^{A)}
- (44) Magnet^{A)}
- (45) Laser receiver holder^{A)}
- (46) Laser viewing glasses^{A)}
- (47) Laser target plate^{A)}
- (48) Case^{A)}

A) **Accessories shown or described are not included with the product as standard. You can find the complete selection of accessories in our accessories range.**

Technical data

Rotary laser	GRL 350 HV
Article number	3 601 K61 S..
Working range (diameter) ^{A)} / ^{B)}	

Rotary laser	GRL 350 HV
– without laser receiver, approx.	60 m
– with laser receiver approx.	350 m
Levelling accuracy ^{A)C)}	
– horizontal	± 1.5 mm/30 m
– vertical	± 3 mm/30 m
Typical self-levelling range	± 8 % (± 4.6°)
Typical levelling time	30 s
Rotation speed	0/150/300/600 min ⁻¹
Aperture angle for line operation	10/25/50°
Slope range for manual operation	± 8 %
Operating temperature	– 10 °C to + 50 °C
Storage temperature	– 20 °C to + 70 °C
Max. altitude	2000 m
Relative air humidity max.	90 %
Pollution degree according to IEC 61010-1	2 ^{D)}
Laser class	3R
Laser type	630–650 nm, < 5 mW
Divergence	0.4 mrad (full angle)
Tripod mount, horizontal	5/8"-11
Non-rechargeable batteries (alkaline manganese)	2 × 1.5 V LR20 (D)
Approx. operating time	30 h
Weight according to EPTA-Procedure 01:2014	1.8 kg
Dimensions (length × width × height)	187 × 182 × 170 mm
Protection rating (excluding battery compartment)	IP 56 (protection against dust ingress and water jets)

A) At 20 °C

B) The working range may be reduced by unfavourable environmental conditions (e.g. direct sunlight).

C) Along the axes

D) Only non-conductive deposits occur, whereby occasional temporary conductivity caused by condensation is expected.

The serial number (18) on the type plate is used to clearly identify your measuring tool.

Remote control	RC 4
Article number	3 601 K69 S..
Working range ^{A)}	30 m
Operating temperature	– 10 °C to + 50 °C
Storage temperature	– 20 °C to + 70 °C
Max. altitude	2000 m
Relative air humidity max.	90 %

Remote control	RC 4
Pollution degree according to IEC 61010-1	2 ^{B)}
Non-rechargeable batteries (alkaline manganese)	2 × 1.5 V LR6 (AA)
Weight according to EPTA-Procedure 01:2014	0.11

A) The working range may be reduced by unfavourable environmental conditions (e.g. direct sunlight).

B) Only non-conductive deposits occur, whereby occasional temporary conductivity caused by condensation is expected.

For clear identification of your remote control, see the serial number (34) on the type plate.

Assembly

Remote Control Power Supply

Using alkali-manganese batteries is recommended to operate the remote control.

To open the battery compartment cover (36), press on the locking mechanism (35) and remove the battery compartment cover. Insert the batteries.


When inserting the batteries, ensure that the polarity is correct according to the illustration on the inside of the battery compartment.

Always replace all the batteries at the same time. Only use batteries from the same manufacturer and which have the same capacity.


► **Remove the batteries from the remote control when not using it for longer periods.** The batteries can corrode and self-discharge during prolonged storage in the remote control.

Measuring Tool Power Supply

It is recommended that you use alkaline manganese batteries to operate the measuring tool.

To remove the battery compartment (2), turn the locking mechanism (1) to position . Pull the battery compartment out of the measuring tool and insert the batteries.

When inserting the batteries, ensure that the polarity is correct according to the illustration on the inside of the battery compartment.

Slide the battery compartment (2) into the measuring tool and turn the locking mechanism (1) to position .

If the batteries become weak, the battery warning (12) will light up red. The measuring tool can be operated for approx. two more hours.

If the battery warning (12) flashes red, the measuring tool will automatically switch itself off after five minutes.

Always replace all the batteries at the same time. Only use batteries from the same manufacturer and which have the same capacity.

► **Take the batteries out of the measuring tool when you are not using it for a prolonged period of time.** The bat-

teries can corrode and self-discharge during prolonged storage in the measuring tool.

Operation

- ▶ **Protect the measuring tool and remote control against moisture and direct sunlight.**
- ▶ **Do not expose the measuring tool or remote control to any extreme temperatures or variations in temperature.** For example, do not leave them in a car for extended periods of time. In case of large variations in temperature, allow the measuring tool and the remote control to adjust to the ambient temperature before putting them into operation. Before continuing work with the measuring tool, always perform an accuracy check (see "Accuracy Check of the Measuring Tool", page 14). The precision of the measuring tool may be compromised if exposed to extreme temperatures or fluctuations in temperature.
- ▶ **Avoid substantial knocks to the measuring tool and avoid dropping it.** Always carry out an accuracy check before continuing work if the measuring tool has been subjected to severe external influences (see "Accuracy Check of the Measuring Tool", page 14).
- ▶ **Take care if the laser grid is broken by the measuring tool falling over.** You may cut yourself on the broken edges of the grid.

Starting Operation of the Remote Control

When pressing the operating controls, it is possible to bring the measuring tool out of its level position, so that the rotation is briefly interrupted. This effect is avoided when using the remote control.

The remote control will only work if it is fitted with batteries that are sufficiently charged.

Set up the measuring tool in such a manner that the signals of the remote control can directly reach one of the sensors (9). If the remote control cannot be pointed directly at a sensor, the working range will be reduced. By reflecting the signal (e.g. against walls), the working range can be improved even for indirect signals.

After pressing a button on the remote control, the signal transmission indicator (28) will light up, indicating that a signal has been sent out.

It is not possible to switch the measuring tool on/off with the remote control.

Starting Operation of the rotary laser

- ▶ **Keep the work area free from obstacles that could reflect or obstruct the laser beam. For example, cover any reflective or shiny surfaces. Do not measure through panes of glass or similar materials.** The measurements may be distorted by a reflected or obstructed laser beam.

Setting up the measuring tool



Horizontal position



Vertical position

Position the measuring tool on a stable surface in the horizontal or vertical position, mount it on the tripod (39) or on the wall mount (42) with the alignment unit.

Due to its high levelling accuracy, the measuring tool is very sensitive to knocks and vibrations and changes in position. Take care, therefore, that the measuring tool is stable to avoid interruptions to the operation caused by releveling.

Switching On and Off

Note: After the first time the tool is started up and before beginning work, you should always perform an accuracy check (see "Accuracy Check of the Measuring Tool", page 14).

To **switch on** the measuring tool, press the on/off button (3). All indicators will quickly flash red (3 ×/s). The measuring tool emits the variable laser beam (8) and the upwards plumb point (11) from the outlet apertures (10).

- ▶ **Do not direct the laser beam at persons or animals and do not stare into the laser beam yourself (even from a distance).**

The measuring tool immediately starts automatic levelling. During levelling, the X-axis (7) and Y-axis (6) status indicators flash green and the laser flashes in point operation. The measuring tool is levelled as soon as the X-axis (7) and Y-axis (6) status displays light up green continuously and the laser lights up continuously. After levelling is completed, the measuring tool automatically starts in rotational operation.

- ▶ **Never leave the measuring tool unattended when switched on, and ensure the measuring tool is switched off after use.** Others may be blinded by the laser beam.

To **switch off** the measuring tool, press the on/off button (3) until all indicators turn off.

Sleep Mode (Standby)

During breaks from work, you can set the measuring tool to sleep mode using the remote control (21). This saves all the settings and the shock-warning function remains activated.

To **switch on** sleep mode, press the sleep mode button (29) on the remote control. All indicators on the measuring tool will flash slowly (1 ×/s).

To **switch off** sleep mode, press the sleep mode button (29) again. You can also end sleep mode by briefly pressing the on/off button (3) on the measuring tool.

Operating Modes

Path of X and Y axes

The path of the X and Y axes is marked on the housing above the rotation head.

Operating Modes Overview

All three operating modes are possible with the measuring tool in horizontal and vertical position.



Rotational operation

Rotational operation is especially recommended when using the laser receiver. It is possible to select between different rotational speeds.



Line operation

In this operating mode, the variable laser beam moves within a defined aperture angle. This increases the visibility of the laser beam in comparison to rotational operation. You can select between different aperture angles.



Point operation

In this operating mode, the best visibility of the variable laser beam can be reached. For example, it is used to easily project heights or to check building lines.

Line and point operation are not suitable for use with the laser receiver (37).



Rotational operation/point operation

Each time after switching on, the measuring tool is in rotational operation mode with standard rotational speed (300 min⁻¹).

To switch from line operation to rotational or point operation, press the rotational operation button (4) or the rotational operation button (26) on the remote control.

To change the rotational speed, press the rotational operation button (4) or rotational operation button (26) on the remote control until the required speed is reached. The rotational speed is gradually increased each time after pressing the button. After the highest speed setting, the measuring tool switches to point operation after brief post-pulsation. Pressing the rotational operation button takes you back to rotational operation with the lowest rotational speed.

When working with the laser receiver, the highest rotational speed should be set. When not working with the laser receiver, reduce the rotational speed for improved visibility of the laser beam and use the laser goggles (46).



Line mode

To switch to line operation, press the line operation button (16) or the line operation button (30) on the remote control.

To change the aperture angle, press the line operation button (16) or the line operation button (30) on the remote control until the required operating mode is achieved. The aperture angle is gradually increased each time it is pressed; at the same time, the rotational speed is increased with each setting.

Note: Due to inertia, it is possible for the laser to slightly move beyond the end point of the laser line.

Functions

Turning the Line/Point in a Horizontal Position within the Rotational Plane

When the measuring tool is in a horizontal position, the laser line or the laser point can be positioned within the rotational plane of the laser. Rotation is possible by 360°.

To rotate anticlockwise, press the slope button down (5) on the measuring tool or the button for anticlockwise rotation (23) on the remote control.

To rotate clockwise, press the slope button up (15) on the measuring tool or the button for clockwise rotation (33) on the remote control.

Turning the Rotational Plane When In the Vertical Position

When the measuring tool is in the vertical position, it is possible to rotate the laser point, laser line or rotational plane around the X-axis for easy sighting out or parallel alignment in a range of ±8 %.

To rotate anticlockwise, press the slope button down (5) on the measuring tool or the button for anticlockwise rotation (23) on the remote control.

To rotate clockwise, press the slope button up (15) on the measuring tool or the button for clockwise rotation (33) on the remote control.

Automatic levelling

Overview

After switching on, the measuring tool checks the horizontal and vertical position and automatically levels out any unevenness within the self-levelling range of approx. ±8 % (±4.6°).

During levelling, the X-axis (7) and Y-axis (6) status indicators flash green and the laser flashes in point operation.

The measuring tool is levelled as soon as the X-axis (7) and Y-axis (6) status displays light up green continuously and the laser lights up continuously. After levelling is completed, the measuring tool automatically starts in rotational operation.

When the measuring tool is out-of-level by more than 8 % after switching it on or after a position change, levelling is no longer possible. If this is the case, the X-axis (7) and Y-axis (6) status indicators will flash red, the rotor will be stopped and the laser will be switched off.

Switch the measuring tool off, position it as level (horizontal position) or perpendicular as possible (vertical position) and switch it on again.

Position Changes

When the measuring tool is levelled in, it continuously checks the horizontal and vertical position. Re-levelling is automatically performed if there are any position changes.

Minimal position changes are levelled out without interrupting the operation. This automatically compensates subsoil ground vibrations or weather influences.

For **larger position changes**, the rotation of the laser beam will be stopped and the laser beam will be stopped in order to avoid incorrect measurements during the levelling process. The X-axis (7) and Y-axis (6) status indicators will flash green. The shock-warning function will be actuated, if required.

The measuring tool will automatically detect the horizontal or vertical position. To **change between the horizontal and the vertical position**, switch the measuring tool off, reposition it and switch it on again.

Shock-warning function

The measuring tool has a shock-warning function. After position changes or shock to the measuring tool, or in case of ground vibrations, it keeps the measuring tool from levelling in at changed positions, and thus prevents errors caused by a change in the measuring tool's position.

Activating the shock warning: The shock-warning function is switched on by default. It is activated approximately one minute after the measuring tool has been switched on.

Shock warning actuated: If the position of the measuring tool is changed or a severe knock is registered, the shock warning will be actuated. The laser will stop rotating and the laser beams will flash. At the same time, the shock-warning indicator (13) and the X-axis (7) and Y-axis (6) status indicators will flash red. The current operating mode is stored.

When the shock-warning function has actuated, briefly press the on/off button (3). The shock-warning function is restarted and the measuring tool starts the levelling. As soon as the measuring tool is levelled (the X-axis (7) and Y-axis (6) status indicators will light up continuously), it will start up in the saved operating mode.

Now check the position of the laser beam at a reference point and, if necessary, correct the height or alignment of the measuring tool.

Switching off the shock-warning function: To switch the shock-warning function off or on, briefly press the on/off button (3) once or, when the shock warning has actuated (shock-warning indicator (13) flashes red), twice. When the shock-warning function is switched off, the shock-warning indicator (13) will light up red continuously.

If the shock-warning function has been switched on, it will be activated after approximately one minute.

Note: The shock-warning function cannot be switched on or off or restarted with the remote control.



Inclined operation in a single axis/manual operation

The automatic levelling of the measuring tool can be switched off (manual operation):

- in the horizontal position for both axes independently of each other,
- in the vertical position for the X-axis (the Y-axis cannot be levelled in the vertical position).

It is possible to set up the measuring tool at any inclination in manual operation mode. The axes can also be tilted independently of each other in a range of $\pm 8\%$ on the measuring tool.

Selecting the axis: To start the manual operation or select the axis to be tilted, press the manual operation button (14) on the measuring tool or the manual operation button (31) on the remote control. You can see on the X-axis (7) or Y-axis (6) status indicators which axis is no longer level and can be tilted.

Press the manual operation button	 X-axis status		 Y-axis status			
	Green	Red	Green	Red		
1 × (in the horizontal position)		*	Inclined operation in a single axis, axis adjustable	●		Axis levelled
1 × (in the vertical position)		*	Inclined operation in a single axis, axis adjustable	–		Axis cannot be levelled
2 ×	●		Axis levelled		*	Inclined operation in a single axis, axis adjustable
3 ×		*	Manual operation, axis adjustable		●	Manual operation
4 ×		●	Manual operation		*	Manual operation, axis adjustable
5 × (in the horizontal position)	*/●		Axis is levelled in/is level	*/●		Axis is levelled in/is level

Press the manual operation button	X-axis status		Y-axis status	
	Green	Red	Green	Red
5 × (in the vertical position)	* / ●	Axis is levelled in/is level	-	Axis cannot be levelled

● Indicator lit up continuously

* Indicator flashing

- Indicator gone out

Tilting the axis: The slope of an axis in slope operation or manual operation can be altered within five seconds of selecting the axis (as long as the relevant status indicator of the axis is flashing red). If the status indicator lights up red continuously, the slope has been determined. To alter the slope, press the manual operation button (14) on the measuring tool or the manual operation button (31) on the remote control again until the status indicator of the required axis flashes red.

You can alter the slope of an adjustable axis as follows:

- On the measuring tool: Press the slope button down (5) to tilt the adjustable axis in a "-" direction. Press the slope button up (15) to tilt the adjustable axis in a "+" direction.
- With the remote control: Press the slope button X+ (25) or the slope button X- (22) to tilt the X-axis in a "+" direction or "-" direction. Press the slope button Y+ (24) or the slope button Y- (32) to tilt the Y-axis in a "+" direction or "-" direction.

Accuracy Check of the Measuring Tool

The following tasks should be performed only by well-trained and qualified persons. The legalities with regard to performing an accuracy check or calibration of a measuring tool must be known.

Influences on Accuracy

The largest influence is exerted by the ambient temperature. In particular, temperature differences that occur from the ground upwards can refract the laser beam.

Since the temperature stratification is greatest at ground level, you should always mount the measuring tool on a tripod for measuring distances of 20 m or more. In addition, position the measuring tool in the centre of the work surface, wherever this is possible.

The deviations have an impact on measuring distances of approx. 20 m or more, and at 100 m the deviation can easily be two to four times larger than that at 20 m.

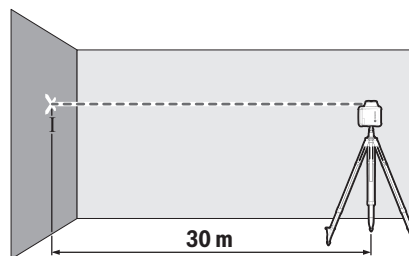
In addition to external influences, device-specific influences (e.g. falls or heavy impacts) can also lead to deviations. For this reason, check the levelling accuracy each time before beginning work.

If the measuring tool exceeds the maximum deviation for the measuring procedures described below, perform a calibration (see "Calibrating the measuring tool", page 15) or have the measuring tool checked by a **Bosch** customer service agent.

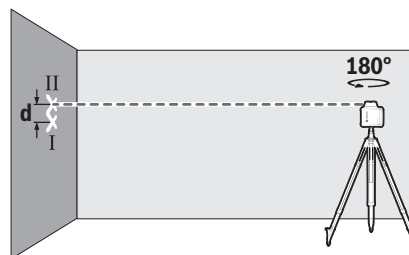
Checking the levelling accuracy in a horizontal position

For a reliable and precise result, it is recommended that you check there is a free measuring distance of 30 m on firm ground in front of a wall. Carry out a complete measuring procedure for each of the two axes.

- Mount the measuring tool in a horizontal position 30 m from the wall on a tripod, or place it on a firm, level surface. Switch on the measuring tool.



- Once levelling is complete, mark the centre of the laser beam on the wall (point I).



- Rotate the measuring tool 180° without changing its position. Allow it to level in and mark the centre point of the laser beam on the wall (point II). Note that point II should preferably be positioned vertically above or below point I. The discrepancy **d** between the two marked points I and II on the wall reveals the actual height deviation of the measuring tool for the axis being measured.

Repeat the measuring process for the other axis. To do this, turn the measuring tool through 90° before beginning the measurement.

The maximum permitted deviation on the 30 m measuring distance is as follows:

30 m × ±0.05 mm/m = ±1.5 mm. The discrepancy **d** between points I and II must therefore amount to no more than **3 mm** for each of the two measuring processes.

Calibrating the measuring tool

The following tasks should be performed only by well-trained and qualified persons. The legalities with regard to performing an accuracy check or calibration of a measuring tool must be known.

- ▶ **Perform calibration of the measuring tool with extreme precision or have the measuring tool checked by a Bosch customer service agent.** Inaccurate calibration leads to incorrect measuring results.
- ▶ **Only start the calibration if you have to perform a calibration of the measuring tool.** As soon as the measuring tool is in calibration mode, you must perform the calibration meticulously to the end in order to ensure that no incorrect measuring results are produced afterwards.

Check the levelling accuracy after every calibration (see "Accuracy Check of the Measuring Tool", page 14). If the deviation is outside the maximum permitted limits, have the measuring tool checked by a **Bosch** customer service agent. Always calibrate all axes (X-axis, Y-axis and Z-axis).

Note: If the X-axis (7) or Y-axis (6) status indicator flashes red during calibration, this indicates that the deviation is outside the maximum permitted range. If this is the case, press the manual operation button (14) to exit calibration mode without saving the settings. The X-axis (7) and Y-axis (6) status indicators will then flash red at 3 ×/s to indicate calibration errors.

Restart the calibration. If the error occurs again, have the measuring tool checked by a **Bosch** customer service agent.

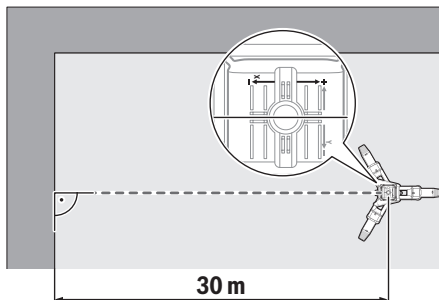
X-axis and Y-axis Calibration

For calibration, you will need a free measuring distance of **30 m** on firm ground in front of a wall.

If required (e.g. in poor lighting conditions), you can use a laser receiver (37) to mark the laser beam. When using the laser receiver, take care that it is aligned vertically on the wall, as otherwise the marks are offset with respect to the laser beam. With laser receivers with an adjustable reception accuracy, you can set the reception accuracy depending on the required calibration accuracy (see the operating instructions for the laser receiver).

Mounting and aligning the measuring tool for calibration:

Mount the measuring tool in the horizontal position **30 m** from the wall on the tripod (39) (recommended) or position it on a firm, level surface.



Align the measuring tool so that the X-axis indicator imprinted on the measuring tool is at right angles to the wall.

Starting calibration:

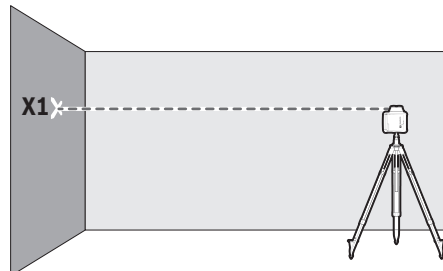
The measuring tool must be switched off when calibration starts.

Press and hold the manual operation button (14) on the measuring tool and then also briefly press the on/off button (3). Release the slope button only when the X-axis status indicator (7) and the shock-warning function indicator (13) flash red (both at 2 ×/s).

The measuring tool is switched on in calibration mode for the X-axis.

X-axis calibration:

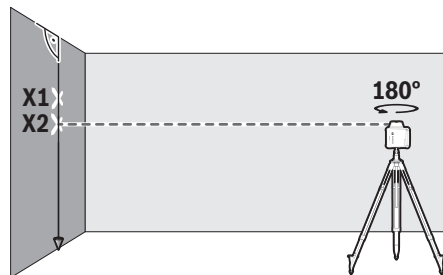
Ensure that the measuring tool is aligned with the X-axis at right angles to the wall. Wait until the measuring tool is levelled in and rotational operation has started.



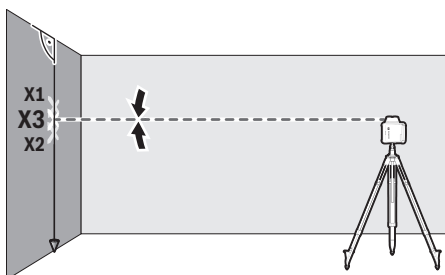
Mark the height of the laser beam on the wall as height **X1**. To do this, you may need to use the laser receiver (37).

Turn the measuring tool through **180°** without adjusting the height and position of the measuring tool.

Wait until the measuring tool is levelled in and rotational operation has started.



Mark the height of the laser beam on the wall as height **X2**. To do this, you may need to use the laser receiver (37). Note that height **X2** should preferably be positioned vertically above or below height **X1**.



Determine the exact centre point between the marked heights **X1** and **X2** and mark this on the wall as height **X3**. Align the variable laser beam (**8**) using the down (**5**) and up (**15**) slope buttons so that it hits height **X3** as accurately as possible. To do this, you may need to use the laser receiver (**37**).

Save the calibration of the X-axis by pressing the manual operation button (**14**). As confirmation, the X-axis status indicator (**7**) will flash green six times.

Y-axis calibration:

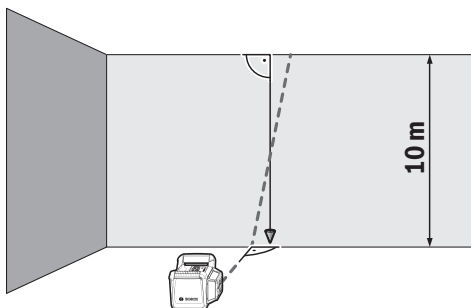
After calibration of the X-axis, the measuring tool automatically switches to calibration mode for the Y-axis. The Y-axis status indicator (**6**) flashes green and the shock-warning function indicator (**13**) flashes red (both at $2 \times/s$).

Turn the measuring tool through 90° so that the Y-axis indicator imprinted on the measuring tool is at right angles to the wall. Then calibrate as described for the X-axis.

If the calibration of the Y-axis has been saved, the Y-axis status indicator (**6**) will flash green six times. Calibration mode will be ended automatically.

Z-axis Calibration

A free measuring distance on firm ground in front of a **10 m** wall is required for the calibration. Fix a plumb line to the wall.

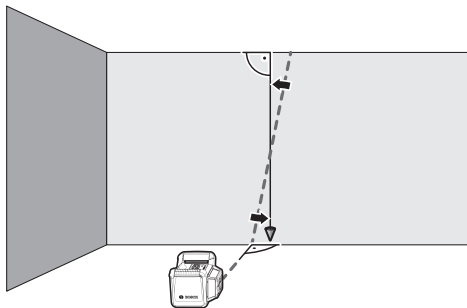


Position the measuring tool in a vertical position on a firm, level surface. Switch the measuring tool on and allow it to level in. Align the measuring tool so that the variable laser beam contacts the wall at right angles and cuts through the plumb line. Switch the measuring tool off.

To start calibration mode, press and hold the manual operation button (**14**) and then also briefly press the on/off button (**3**). Release the slope button only when the X-axis status

indicator (**7**) flashes green and the shock-warning function indicator (**13**) flashes red (both at $2 \times/s$).

The measuring tool is switched on in calibration mode for the Z-axis. Wait until the measuring tool is levelled in and rotational operation has started.



Align the variable laser beam so that it runs as parallel as possible to the plumb line. To do this, press the down (**5**) or up (**15**) slope buttons.

If it is not possible to align the laser beam in parallel to the plumb line, align the measuring tool to the wall more precisely and start the calibration process again.

If the laser beam is aligned in parallel, save the calibration by pressing the manual operation button (**14**). As confirmation, the X-axis status indicator (**7**) will flash green six times.

The calibration of the Z-axis will be saved and calibration mode automatically ended.

Working Advice

► **Only the centre of the laser point or laser line must be used for marking.** The size of the laser point/the width of the laser line changes depending on the distance.

Working with the Laser Target Plate (see figure A)

The laser target plate (**47**) improves visibility of the laser beam in unfavourable conditions and at greater distances.

The reflective half of the laser target plate (**47**) improves visibility of the laser line. The transparent half enables the laser line to be seen from behind the laser target plate.

Working with the Tripod (Accessory)

A tripod offers a stable, height-adjustable support surface for measuring. Place the measuring tool with the 5/8" tripod mount (**17**) on the thread of the tripod (**39**). Tighten the measuring tool using the locking screw of the tripod.

On a tripod featuring a measuring scale on its extender, you can set the height deviation straight away.

Roughly align the tripod before switching on the measuring tool.

Working with the WM 24 wall mount (accessory) (see figure B)

The measuring tool can be secured to the wall using the wall mount with the alignment unit (**42**). Using the wall mount is recommended, e.g. when working above the maximum ex-

tension height of tripods, or when working on unstable surfaces without a tripod.

Fasten the wall mount **(42)** with the fastening screws **(40)** to a suitable strip of wall. Fit the wall mount as perpendicular as possible to the wall and ensure it is mounted so that it is stable.

Screw the 5/8" screw **(43)** of the wall mount into the tripod mount **(17)** of the measuring tool.

The alignment unit can be used to move the mounted measuring tool vertically in a range of approx. 23 cm. To do this, loosen the screw **(41)** on the alignment unit, slide the measuring tool into the required position and retighten the screw **(41)**.

Working with the Laser Receiver (accessory)

Use the laser receiver **(37)** to improve detection of the laser lines in adverse lighting conditions (bright environment, direct sunlight) and over greater distances.

For rotary lasers with multiple operating modes, select the horizontal or vertical operation with the highest rotational speed.

Before working with the laser receiver, read and observe the laser receiver operating instructions.

Working with the measuring rod (accessory) (see figure C)

To check levels or apply slopes, it is recommended to use the measuring rod **(38)** together with the laser receiver.

A relative measuring scale is incorporated at the top of the measuring rod **(38)**. You can preselect its zero at the bottom on the extender. This enables you to read deviations from the target height straight away.

Laser Goggles (Accessory)

The laser goggles filter out ambient light. This makes the light of the laser appear brighter to the eye.

- ▶ **Do not use the laser goggles as protective goggles.** The laser goggles make the laser beam easier to see; they do not protect you against laser radiation.
- ▶ **Do not use the laser goggles as sunglasses or while driving.** The laser goggles do not provide full UV protection and impair your ability to see colours.

Example applications

Projecting/checking heights (see figure D)

Position the measuring tool in the horizontal position on a firm support or mount it on a tripod **(39)** (accessory).

Working with a tripod: Set the laser beam at the required height. Project or check the height at the target location.

Working without a tripod: Determine the height difference between the laser beam and the height at the reference point using the laser target plate **(47)**. Project or check the height difference measured at the target location.

Parallel Alignment of Upwards Plumb Point/Projecting Right Angles (see figure E)

When right angles are to be projected or partition walls are to be aligned, the upwards plumb point **(11)** must be aligned

in parallel, meaning at the same distance to a reference line (e.g. a wall).

For this, set up the measuring tool in the vertical position and position it in such a manner that the upwards plumb point runs approximately parallel to the reference line.

For the exact positioning, measure the clearance between the upwards plumb point and reference line directly on the measuring tool using the laser target plate **(47)**. Measure the clearance between the upwards plumb point and reference line again as far away as possible from the measuring tool. Align the upwards plumb point in such a manner that it has the same clearance to the reference line as when measured directly at the measuring tool.

The right angle to the upwards plumb point **(11)** is indicated by the variable laser beam **(8)**.

Indicating a perpendicular/vertical plane (see figure F)

To indicate a perpendicular or a vertical plane, set up the measuring tool in the vertical position. When the vertical plane is supposed to run at a right angle to a reference line (e.g. a wall), align the upwards plumb point **(11)** with this reference line.

The perpendicular plane is indicated by the variable laser beam **(8)**.

Aligning a Perpendicular/Vertical plane (see figure G)

To align the vertical laser line or the rotational plane against a reference point on a wall, set up the measuring tool in the vertical position, and roughly align the laser line or the rotational plane with the reference point. For precise alignment with the reference point, turn the rotational plane around the Y-axis (see "Turning the Rotational Plane When In the Vertical Position", page 12).

Working without the Laser Receiver (see figure H)

Under favourable light conditions (dark environment) and for short distances, it is possible to work without the laser receiver. For improved visibility of the laser beam, either select line operation or point operation and rotate the laser beam to the target location.

Working with the Laser Receiver (see figure I)

In unfavourable lighting conditions (bright environment, direct sunlight) and for larger distances, use the laser receiver to improve detection of the laser beam **(37)**. When working with the laser receiver, select rotational operation with the highest rotational speed.

Measuring over Long Distances (see figure J)

When measuring over long distances, the laser receiver **(37)** must be used to find the laser beam. In order to reduce interferences, the measuring tool should always be set up in the centre of the work surface and on a tripod.



Working outdoors (see figure K)

The laser receiver **(37)** should always be used when working outdoors.

When working on unstable ground, mount the measuring tool on the tripod **(39)**. Always work with the shock-warning function activated in order to avoid faulty measurements in case of ground movements or shocks to the measuring tool.

Overview of Indications

	Laser beam	Rotation of the laser beam ^{A)}	X		Y		Z	
			Green	Red	Green	Red	Red	Red
Switching on the measuring tool (1 s self-check)				3 ×/s		3 ×/s	3 ×/s	3 ×/s
Sleep mode	○	○		1 ×/s		1 ×/s	1 ×/s	1 ×/s
Levelling								
Levelling in	*	○	*		*			
Re-levelling	○	○	*		*			
Self-levelling range exceeded				*		*		
Measuring tool ready for operation, both axes levelled in	●	●	●		●			
Shock warning								
Shock warning actuated	*	○		*		*		*
Shock-warning function switched off								●
Battery voltage								
Battery voltage low							●	
Batteries drained							*	
Slope operation/manual operation								
X-axis slope adjustable Y-axis levelled in	○	○		*	●			
X-axis manual Y-axis levelled in	●	●		●	●			
X-axis levelled in Y-axis slope adjustable	○	○	●			*		
X-axis levelled in Y-axis manual	●	●	●			●		
X-axis slope adjustable Y-axis manual	○	○		*		●		
X-axis slope manual Y-axis slope adjustable	○	○		●		*		
X-axis manual Y-axis manual	●	●		●		●		
Calibration								
X-axis calibration mode (in the horizontal position)			2 ×/s					2 ×/s
X-axis calibration saved			* (6 ×)					
Y-axis calibration mode					2 ×/s			2 ×/s
Y-axis calibration saved					* (6 ×)			
Z-axis calibration mode (in the vertical position)			2 ×/s					2 ×/s
Z-axis calibration saved			* (6 ×)					
Error during X-axis or Z-axis calibration				*				
Error during Y-axis calibration						*		

	Laser beam	Rotation of the laser beam ^{A)}	X		Y			
			Green	Red	Green	Red		

Reset

Restart required; switch the measuring tool off and on again using the on/off button **(3)**.

3 ×/s

3 ×/s

A) For line and rotational operation

●: Continuous operation

*: flashing

2 ×/s: Flashing frequency (e.g. twice per second)

o: Function stopped

Maintenance and Service

Maintenance and Cleaning

Keep the measuring tool and the remote control clean at all times.

Do not immerse the measuring tool and remote control into water or other fluids.

Wipe off any dirt using a damp, soft cloth. Do not use any detergents or solvents.

In particular, regularly clean the surfaces at the outlet aperture of the laser on the measuring tool and make sure to check for any lint.

Only store and transport the measuring tool in the case **(48)**. If the measuring tool needs to be repaired, send it off in the case **(48)**.

After-Sales Service and Application Service

Our after-sales service responds to your questions concerning maintenance and repair of your product as well as spare parts. You can find explosion drawings and information on spare parts at: www.bosch-pt.com

The Bosch product use advice team will be happy to help you with any questions about our products and their accessories.

In all correspondence and spare parts orders, please always include the 10-digit article number given on the nameplate of the product.

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Disposal

Electrical and electronic equipment, batteries, accessories and packaging should be sorted for environmentally friendly recycling.



Do not dispose of electrical and electronic equipment and batteries in the household waste!

中文

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- ▶ 本测量仪交付时带有一块激光警戒牌（在测量仪示意图的图形页中标记）。
- ▶ 如果激光警戒牌的文字并非贵国语言，则在第一次使用前，将随附的贵国语言的贴纸贴在警戒牌上。
- ▶ 测量仪上的激光发射口用一个警戒牌标记。在使用测量仪时注意其位置。
- ▶ 如果其警戒牌的文字并非贵国语言，使用仪器之前，先把附带的以贵国语言书写的贴纸贴在警戒牌上。
- ▶ 小心 - 如果使用了与此处指定的操作或校准设备不同的设备，或执行了不同的过程方法，可能会导致危险的光束泄露。
- ▶ 请不要对激光装置进行任何更改。



不要将激光束指向人或动物，请勿直视激光束。根据EN 60825-1，本测量仪可以产生激光等级为3R的激光束。直视激光束，即使距离更远，眼睛也会受到伤害。

- ▶ 激光视镜不得用作护目镜。激光视镜用于更好地识别激光束；然而对激光束并没有防护作用。
- ▶ 激光视镜不得用作太阳镜或在道路交通中使用。激光视镜并不能完全防护紫外线，还会干扰对色彩的感知。

- ▶ 仅允许由具备资质的专业人员使用原装备件修理测量仪。如此才能够确保测量仪的安全性能。
- ▶ 不得让儿童在无人看管的情况下使用激光测量仪。可能意外地让人炫目。
- ▶ 避免激光束反射到光滑的表面，比如窗户或镜子。反射的激光也可能伤害眼睛。
- ▶ 仅允许由熟悉激光设备的人员操作测量仪。根据EN 60825-1，包括有关激光对眼睛和皮肤的生物影响以及正确使用激光防护装置来避免危害的知识。
- ▶ 请勿在有易燃液体、气体或粉尘的潜在爆炸性环境中使用测量仪。测量仪器内可能产生火花并点燃粉尘和气体。
- ▶ 放置测量仪，使激光束始终高于或低于视平线。这样可以确保不会伤害眼睛。
- ▶ 通过合适的激光警戒牌来标记测量仪的使用范围。这样可以避免与工作无关的人进入危险区域。
- ▶ 切勿将测量仪存放在未经授权人员可以进入的地方。如果不熟悉测量仪器的操作方式，可能伤害操作者本身以及他人。
- ▶ 使用激光等级为3R的激光器时，请遵守相应的国家标准。如果未遵循这些规章可能导致伤害。
- ▶ 确保保护或屏蔽激光辐射区域。看管或屏蔽好激光的投射范围可以避免激光伤害未参与工作者的眼睛。
- ▶ 测量仪接通后应有人看管，使用后应关闭。激光可能会让旁人炫目。
- ▶ 请勿使用望远镜或放大镜之类的聚光仪器观察辐射源。可能会损伤您的眼睛。



不要将磁性附件靠近植入物和其他医疗设备，例如心脏起搏器或胰岛素泵。附件的磁性会产生磁场，这可能对植入物或医疗设备的功能产生不利影响。

- ▶ 让磁性附件远离磁性数据媒体和对磁性敏感的设备。附件的磁性作用可能会导致不可逆的数据丢失。

遥控器安全规章



必须阅读并遵守所有说明。如果不按照提供的说明使用遥控器，可能会影响集成在遥控器中的保护功能。请妥善保存这些说明。

- ▶ 仅允许由具备资质的专业人员使用原装备件修理遥控器。从而确保遥控器的安全性。
- ▶ 不得在含有易燃液体、气体或粉尘的易爆环境中使用遥控器。遥控器内可能产生能点燃粉尘和气体的火花。

产品和性能说明

请注意本使用说明书开头部分的图示。

按照规定使用

旋转激光仪

本测量仪器是用来测量和检查精准水平的高度梯度、垂直线、列线和下对点的。

本测量仪适合在室内和室外使用。

遥控器

遥控器用于通过红外线控制Bosch旋转激光仪。

遥控器适合在户内、户外使用。

插图上的机件

图示部件的编号对应于图形页上的测量仪和遥控器图形。

旋转激光仪

- (1) 电池盒的固定扳扣^{A)}
- (2) 电池盒^{A)}
- (3) 电源开关
- (4) 旋转模式按键
- (5) 向下倾斜按键
- (6) Y轴状态指示灯
- (7) X轴状态指示灯
- (8) 可变激光束
- (9) 遥控器传感器
- (10) 激光束发射口
- (11) 上对点
- (12) 电池电量警告标志
- (13) 震动警告功能显示
- (14) 手动模式按键
- (15) 向上倾斜按键
- (16) 直线模式按键
- (17) 5/8英寸三脚架接头
- (18) 序列号
- (19) 激光警戒牌
- (20) 激光发射口警戒牌

A) 图表或说明上提到的附件，并不包含在基本的供货范围中。本公司的附件清单中有完整的附件供应项目。

遥控器

- (21) 遥控器^{A)}
- (22) X-倾斜按键
- (23) 逆时针旋转按键
- (24) Y+倾斜按键
- (25) X+倾斜按键
- (26) 旋转模式按键
- (27) 红外线射线发射口
- (28) 信号发送指示灯
- (29) 睡眠模式（待机）按键
- (30) 直线模式按键
- (31) 手动模式按键

- (32) Y-倾斜按键
- (33) 顺时针旋转按键
- (34) 序列号
- (35) 电池盒盖的固定扳扣
- (36) 电池盒盖

A) 图表或说明上提到的附件，并不包含在基本的供货范围中。本公司的附件清单中有完整的附件供应项目。

附件/配件

- (37) 激光接收器^{A)}
- (38) 测杆^{A)}
- (39) 三脚架^{A)}
- (40) 墙架固定螺栓^{A)}
- (41) 对准单元上的螺栓^{A)}
- (42) 墙架/对准单元^{A)}
- (43) 墙架的5/8英寸螺栓^{A)}
- (44) 磁铁^{A)}
- (45) 激光接收器支座^{A)}
- (46) 激光护目镜^{A)}
- (47) 激光靶^{A)}
- (48) 箱子^{A)}

A) 图表或说明上提到的附件，并不包含在基本的供货范围中。本公司的附件清单中有完整的附件供应项目。

技术参数

旋转激光仪	GRL 350 HV
物品代码	3 601 K61 S..
工作范围（直径） ^{A)B)}	
- 无激光接收器约	60米
- 带激光接收器约	350米
找平准确性 ^{A)C)}	
- 水平	±1.5毫米/30米
- 垂直	±3毫米/30米
一般自调平范围	±8% (±4.6度)
一般找平时间	30秒
旋转速度	0/150/300/600转/分钟
直线模式时的开口角度	10/25/50度
手动模式下的倾斜范围	±8%
工作温度	-10摄氏度至+50摄氏度
仓储温度	-20摄氏度至+70摄氏度
基准高度以上的最大使用高度	2000米
最大相对湿度	90%
脏污程度符合 IEC 61010-1	2 ^{D)}
激光等级	3R
激光种类	630-650纳米, < 5毫瓦
发散角	0.4毫弧度 (全角)

旋转激光仪		GRL 350 HV
水平三脚架接口		5/8英寸-11
电池 (碱-锰)		2 × 1.5伏LR20 (D)
运行时间大约		30小时
重量符合 EPTA-Procedure 01:2014		1.8公斤
尺寸 (长 × 宽 × 高)		187 × 182 × 170毫米
防护类型 (电池盒除外)		IP 56 (防尘、防溅)

- A) 在 20 摄氏度时
B) 工作范围可能会因为环境条件不利 (比如阳光直射) 而缩小。
C) 沿着轴
D) 仅出现非导电性污染, 不过有时会因凝结而暂时具备导电性。

型号铭牌上的序列号(18)是测量仪唯一的识别码。

遥控器		RC 4
物品代码		3 601 K69 S..
工作范围 ^{A)}		30米
工作温度		-10摄氏度至+50摄氏度
仓储温度		-20摄氏度至+70摄氏度
基准高度以上的最大使用高度		2000米
最大相对湿度		90 %
脏污程度符合 IEC 61010-1		2 ^{B)}
电池 (碱-锰)		2 × 1.5伏LR6 (AA)
重量符合 EPTA-Procedure 01:2014		0.11

- A) 工作范围可能会因为环境条件不利 (比如阳光直射) 而缩小。
B) 仅出现非导电性污染, 不过有时会因凝结而暂时具备导电性。

型号铭牌上的序列号(34)是您的遥控器的唯一识别号。

安装

遥控器的供电

建议在遥控器中使用碱性电池。

按下固定扳扣(35)以打开电池盒盖(36), 然后取下电池盒盖。装入电池。

根据电池盒内部的图示, 注意电极是否正确。务必同时更换所有的电池。请使用同一制造厂商所生产的相同容量电池。

- ▶ **长时间不使用时, 应将电池从遥控器中取出。** 电池长时间存放在遥控器中可能会腐蚀以及自行放电。

测量仪电源

建议使用碱性电池运行测量仪。

如需取下电池盒(2), 请将固定扳扣(1)旋转到位置 ②。将电池盒从测量仪中拉出, 然后装入电池。

根据电池盒内部的图示, 注意电极是否正确。

将电池盒(2)推入测量仪, 然后将固定扳扣(1)旋转到位置 ③。

如果电池电量低, 则电池电量警告标志(12)亮起红光。测量仪还可以再运行约2小时。

如果电池电量警告标志(12)闪红光, 测量仪将在5分钟后自动关闭。

务必同时更换所有的电池。请使用同一制造厂商所生产的相同容量电池。

- ▶ **长时间不使用时, 请将电池从测量仪中取出。** 在长时间存放于测量仪中的情况下, 蓄电池可能会腐蚀以及自行放电。

工作

- ▶ **避免测量仪和遥控器受潮或受阳光直射。**
- ▶ **请勿在极端温度或温度波动较大的情况下使用测量仪和遥控器。** 比如, 不可以长时间搁置在汽车中。温度波动较大的情况下, 使用测量仪和遥控器之前先使其温度稳定下来。在继续使用测量仪操作前应先通过(参见“测量仪精度检查”, 页 27)检查精度。在极端温度或温度波动较大的情况下, 测量仪的精度可能会受到影响。
- ▶ **避免让测量仪发生剧烈碰撞或将其跌落。** 测量仪受到强烈的外部作用之后, 在重新使用前务必进行精度检查(参见“测量仪精度检查”, 页 27)。
- ▶ **请小心激光盒会因测量仪坠落而断裂。** 盒子的断裂边缘可能会造成割伤。

操作遥控器

如果您在仪器找平时按下操作按键, 会中断找平过程, 并导致仪器瞬间停止转动。使用遥控器便可以避免发生上述情况。

只要电池电压充足, 遥控器就可以使用。

放置测量仪时确保遥控器的信号能直达一个传感器(9)。如果遥控器无法直接对准传感器, 请缩小工作范围。可以通过反射信号(比如墙壁)再次改善可达范围, 即使是间接信号。

按压遥控器上的某个按键, 信号发送指示灯(28)亮起, 表示信号已发出。

无法使用遥控器接通/关闭测量仪器。

旋转激光仪的调试

- ▶ **使工作范围远离可能反射或阻碍激光束的障碍物。** 盖住比如反光或有光泽的表面。请勿透过玻璃板或类似材料进行测量。反射或被阻碍的激光束可能会使测量结果失真。

放置测量仪



水平位置



垂直位置

将测量仪水平或垂直地放置在一个稳定的底板上，然后用对准单元将其安装到三脚架(39)或墙架(42)上。

由于仪器的找平准确性极高，所以对于震动和移位非常敏感。因此务必确实地固定好测量仪，以避免因为重新找平而必须中断测量。

接通/关闭

提示：首次调试后以及每次操作前，请通过(参见“测量仪精度检查”，页 27)检查精度。

如要**接通**测量仪，请按压电源开关(3)。所有指示灯快速闪烁红光(每秒3次)。测量仪从发射口(10)发出可变激光束(8)以及对点(11)。

▶ **不得将激光束对准人或动物，也请勿直视激光束，即使和激光束相距甚远也不可以做上述动作。**

此时测量仪马上进行自动调平。在调平过程中，X轴状态指示灯(7)和Y轴状态指示灯(6)闪绿光，激光器以点模式闪烁。

一旦X轴状态指示灯(7)和Y轴状态指示灯(6)持续亮起绿光且激光器持续亮起，表示测量仪已调平。调平结束后，测量仪自动处于旋转模式中。

▶ **测量仪接通后应有人看管，使用后应关闭。**激光可能会让旁人炫目。

如要**关闭**测量仪，请按住电源开关(3)，直至所有指示灯都熄灭。

睡眠模式(待机)

工作间歇期间可借助遥控器(21)将测量仪调到睡眠模式。此时会保存所有设置，震动警告功能保持激活状态。

如要**接通**睡眠模式，请按压遥控器上的睡眠模式按键(29)。测量仪上的所有指示灯缓慢闪烁(每秒1次)。

如要**关闭**睡眠模式，请重新按压睡眠模式按键(29)。也可以短促按压测量仪上的电源开关(3)来退出睡眠模式。

运行模式

X轴和Y轴的走向

X轴和Y轴的走向已在旋转头上方的壳体上标出。

运行模式概览

在测量仪的水平 and 垂直位置都可以使用所有3种运行模式。



旋转模式

使用激光接收器时，特别推荐旋转模式。您可以选择不同的旋转速度。



直线模式

在这种运行模式下，可变激光束在受限的开口角度中移动。因此激光束的辨识程度比旋转模式更高。您可以选择不同的开口角度。



点模式

在这种运行模式下可达到可变激光束的最佳辨识程度。这种模式用于例如轻松传输高度或检查对齐状况。

直线模式和点模式不适合使用激光接收器(37)。



旋转模式/点模式

每次接通后，测量仪都通过旋转模式以标准旋转速度(300转/分钟)运行。

如要从直线模式切换到旋转模式或点模式，请按压遥控器上的旋转模式按键(4)或旋转模式按键(26)。更改旋转速度时，请多次按压遥控器的旋转模式按键(4)或旋转模式按键(26)，直至达到所需的速度。每按压一次，旋转速度就升高一档。达到最高速度后，测量仪会在短促振动后切换到点模式。重新按压旋转模式按键以最低旋转速度返回至旋转模式。使用激光接收器时必须选择最高的旋转速度。在不使用激光接收器进行操作时，请降低旋转速度以提高激光束的辨识程度并使用激光辨识镜(46)。



直线模式

如要切换到直线模式，请按压遥控器上的直线模式按键(16)或直线模式按键(30)。

更改开口角度时，请多次按压遥控器的直线模式按键(16)或直线模式按键(30)，直至达到所需的运行模式。开口角度随着按压逐步增大，同时提高旋转速度。

提示：由于惯性，激光可能会略微摆过激光线的端点。

功能

在水平位置转动旋转面内的线/点

可以在测量仪的水平位置定位激光器在旋转面内的激光线或激光点。可以旋转360°。

如要逆时针旋转，请按压测量仪上的向下倾斜按键(5)或遥控器上的逆时针旋转按键(23)。

如要顺时针旋转，请按压测量仪上的向下倾斜按键(15)或遥控器上的顺时针旋转按键(33)。

在垂直位置转动旋转面

可以在测量仪的垂直位置绕X轴转动激光点、激光线或旋转面，以便在 $\pm 8\%$ 的范围内简单对齐或平行对齐。

如要逆时针旋转，请按压测量仪上的向下倾斜按键(5)或遥控器上的逆时针旋转按键(23)。

如要顺时针旋转，请按压测量仪上的向下倾斜按键(15)或遥控器上的顺时针旋转按键(33)。

自动找平功能

概要

接通后，测量仪会检查水平位置或垂直位置，并在约 $\pm 8\%$ ($\pm 4.6^\circ$)的自调平范围内自动找平。

在调平过程中，X轴状态指示灯(7)和Y轴状态指示灯(6)闪绿光，激光器以点模式闪烁。

一旦X轴状态指示灯(7)和Y轴状态指示灯(6)持续亮起绿光且激光器持续亮起，表示测量仪已调平。调平结束后，测量仪自动处于旋转模式中。

如果测量仪在接通或更改位置后倾斜大于 8% ，则无法再找平。在这种情况下，X轴状态指示灯(7)和Y轴状态指示灯(6)闪红光，转子停下，激光器关闭。关闭测量仪，尽可能水平（水平位置）或垂直（垂直位置）地定位测量仪，然后重新接通。

位置变化

找平完毕后，测量仪仍然会随时检查水平或垂直的状况。如果平衡状况改变了，仪器会再度自动找平。

在不中断操作的情况下，补偿最小位置变化。这样就能自动补偿底垫的振动或天气的影响。

对于较大的位置变化，为避免在调平过程中错误测量，请停止转动激光束并关闭激光器。X轴状态指示灯(7)和Y轴状态指示灯(6)闪绿光。必要时触发震动警告功能。

测量仪自动识别水平位置或垂直位置。关闭测量仪，重新定位，然后将其再次接通以在水平位置和垂直位置之间切换。

震动警告功能

测量仪拥有震动警告功能。当位置变化或测量仪振动或底垫振动时，请避免在变化后的位置进行调平，以防因测量仪移动而发生错误。

激活震动警告功能：震动警告功能默认处于接通状态。接通测量仪约1分钟后就会激活。

震动警告功能已触发：如果测量仪的位置变化或检测到强烈的震动，就会触发震动警告功能：激光器停止旋转，激光束闪烁。同时，震动警告功能指示灯(13)和X轴状态指示灯(7)及Y轴状态指示灯(6)闪红光。当前运行模式被存储。

请在震动警告功能触发后短促按压电源开关(3)。接着仪器便会重新启动震动警告功能并开始找平。一旦调平了测量仪（X轴状态指示灯(7)和Y轴状态指示灯(6)持续亮起），就开始以保存的运行模式运行。现在借助参考点检查激光束的位置并在必要时修正测量仪的高度或方向。

关闭震动警告功能：如要关闭或接通震动警告功能，请短促按压一次电源开关(3)或在震动警告功能触发的情况下（震动警告功能指示灯(13)闪红光）短促按压两次。震动警告功能关闭后，震动警告功能指示灯(13)持续亮起红光。

如果震动警告功能已接通，则其约在1分钟后激活。

提示：无法通过遥控器接通或关闭或重启震动警告功能。

单轴倾斜模式/手动模式

可以关闭测量仪的自动找平功能（手动模式）：

- 在水平位置适用于两个轴，彼此独立，
- 在垂直位置适用于X轴（Y轴在垂直位置不可调平）。

在手动模式下，可以将测量仪安放在任意倾斜位置。而且，各轴在测量仪上倾斜 $\pm 8\%$ ，相互独立。

选择轴：如要启动手动模式或选择要倾斜的轴，请按压测量仪上的手动模式按键(14)或遥控器上的手动模式按键(31)。可以根据X轴状态指示灯(7)或Y轴状态指示灯(6)识别出哪根轴无法再调平和倾斜。

按压手动模式按键	X轴状态		Y轴状态		
	绿色	红色	绿色	红色	
1× (在水平位置)		*	●		轴已调平
1× (在垂直位置)		*	-		轴无法调平
2×	●			*	单轴倾斜模式，轴可调
3×		*		●	手动模式
4×		●		*	手动模式，轴可调
5× (在水平位置)	* / ●		* / ●		轴正在调平/已调平

按压手动模式按键



X轴状态



Y轴状态

绿色 红色

绿色 红色

5× (在垂直位置)

* / ●

轴正在调平/已调平

-

轴无法调平

● 指示灯持续亮起

* 指示灯闪烁

- 指示灯熄灭

倾斜轴：可在选择轴后的5秒钟内更改倾斜模式或手动模式下轴的倾斜度（只要相关状态指示灯闪红光）。如果状态指示灯持续亮起红光，则表示倾斜度已确定。如要更改倾斜度，请重新多次按压测量仪上的手动模式按键(14)或遥控器上的手动模式按键(31)，直至所需轴的状态指示灯闪红光。

可如下更改某根可调节轴的倾斜度：

- 在测量仪上：按压向下倾斜按键(5)，将可调节的轴朝“-”方向倾斜。
按压向上倾斜按键(15)，将可调节的轴朝“+”方向倾斜。
- 使用遥控器：按压X+倾斜按键(25)或X-倾斜按键(22)，将X轴朝“+”方向或“-”方向倾斜。
按压Y+倾斜按键(24)或Y-倾斜按键(32)，将Y轴朝“+”方向或“-”方向倾斜。

测量仪精度检查

后续操作仅允许由训练有素的专业人员执行。必须熟悉执行精度检查或测量仪校准方面的法律规定。

影响精度的因素

操作环境的温度是最大的影响因素。尤其是由地面往上延伸的渐进式温度差异可能会转移激光束。

由于接近地面的温度积层最大，所有当测量距离超过20米时最好把仪器安装在三脚架上。另外，尽可能把测量仪摆在测量场所的中央。

如果未架设好仪器，大约从距离20米处起便会产生误差。而在100米处的误差可能是在20米处的误差的二到四倍。

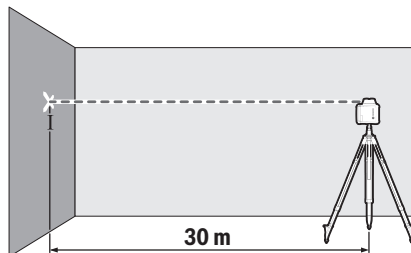
除了外部影响，对设备特殊的影响（例如掉落或强烈撞击）也会导致出现偏差。因此，每次工作前都要检查校准准确性。

如果测量仪在下面所述的某个测量回合中超过最大偏差，请通过（参见“校准测量仪”，页27）进行校准或委托Bosch客户服务部门检查测量仪。

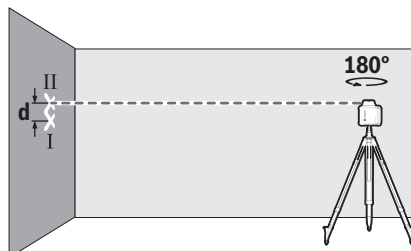
检查水平位置的找平准确性

为获得可靠准确的结果，建议检查墙壁前稳固的地面上是否有一段无障碍物的30米长的测量距离。请为两根轴分别执行一次完整的测量过程。

- 将测量仪水平地安装在距离墙壁30米远的三脚架上，或者将其放在稳固、平坦的底垫上。接通测量仪。



- 完成调平后在墙壁上标记激光束的中心（点I）。



- 将测量仪旋转180°，不要改变位置。找平，然后在墙壁上标记激光束的中心（点II）。注意，点II尽可能地在点I的上方或下方垂直。

墙上标记的点I和点II之间的差值d就是所测轴测量仪的实际高度差。

请为其他轴重复该测量过程。开始该测量过程前，将测量仪旋转90°。

在30米的测量距离内允许的最大偏差为：

$30\text{米} \times \pm 0.05\text{毫米/米} = \pm 1.5\text{毫米}$ 。就是说，点I和点II之间的差值d在每个测量过程中最大允许为3毫米。

校准测量仪

后续操作仅允许由训练有素的专业人员执行。必须熟悉执行精度检查或测量仪校准方面的法律规定。

▶ **请极其准确地校准测量仪或让Bosch客户服务人员对测量仪进行检查。**校准不准确可能会导致错误的测量结果。

▶ **当您必须对测量仪进行校准时才能启动校准。**一旦测量仪处于校准模式，您就必须极其准确地将校准进行到底，以免之后产生错误的测量结果。

每次校准后请检查找平准确性（参见“测量仪精度检查”，页27）。如果偏差超出所允许的最大数值，则请委托Bosch客户服务部门检查测量仪。始终校准所有轴（X轴、Y轴和Z轴）。

提示：如果X轴状态指示灯(7)或Y轴状态指示灯(8)在校准过程中闪红光，则表示偏差超出所允许的最大范围。这时，请按压手动模式按键(14)，以便在不保存设置的情况下离开校准模式。然后X轴状态指

指示灯(7)和Y轴状态指示灯(6)每秒闪3次红光，以显示错误的校准。

请重新开始校准。如果错误仍然存在，请委托Bosch客户服务部门检查测量仪。

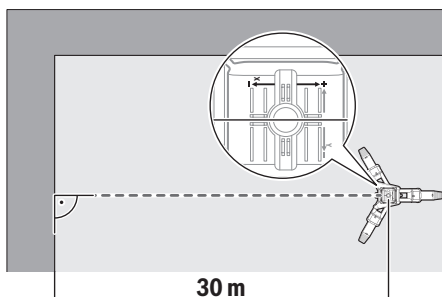
校准X轴和Y轴

要进行校准，需要在墙壁前稳固的地面上找一段无障碍物的30米长的测量距离。

根据需求（比如能见度差时），可以使用激光接收器(37)来标记激光束。使用激光接收器时请确保其垂直于墙壁对齐，否则标记偏离激光束。对于接收精度可调节的激光接收器，可根据所需的校准精度调节接收精度（为此请注意激光接收器使用说明）。

为校准而安装和对齐测量仪：

将测量仪水平地安装在距离墙壁30米远的三脚架(39)（推荐）上，或者将其放置在稳固、平坦的底垫上。



对准测量仪，使测量仪上X轴指示灯与墙壁成直角。

开始校准：

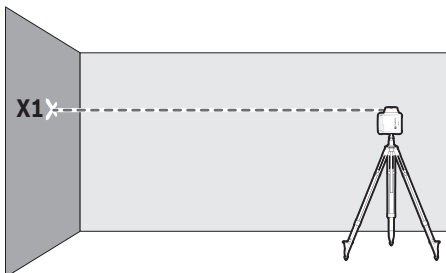
开始校准时测量仪必须已关闭。

按住测量仪上的手动模式按键(14)，还要短促按压电源开关(3)。当X轴状态指示灯(7)闪绿灯且震动警告功能指示灯(13)闪红光（各每秒2次）时，才松开倾斜设置按键。

测量仪在X轴校准模式下接通。

校准X轴：

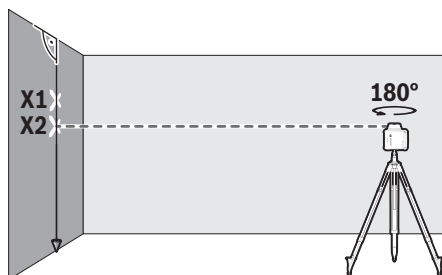
请确保测量仪及X轴与墙壁成直角。请等待，直至测量仪调平且旋转测量启动。



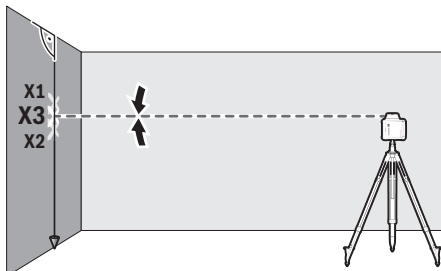
请在墙壁上将激光束的高度标记为高度X1。根据需求，请使用激光接收器(37)。

将测量仪旋转180°，不要改变测量仪的高度和位置。

请等待，直至测量仪调平且旋转测量启动。



请在墙壁上将激光束的高度标记为高度X2。根据需求，请使用激光接收器(37)。确保高度X2尽可能地垂直于高度X1的上方或下方。



请计算出所标记高度X1和X2之间的精确中点，并将其在墙壁上标记为高度X3。

借助向下倾斜按键(5)或向上倾斜按键(15)对齐可变的激光束(8)，使其正好与高度X3重合。根据需求，请使用激光接收器(37)。

请通过按压手动模式按键(14)的方式保存X轴的校准。X轴状态指示灯(7)闪烁6次绿光以确认。

校准Y轴：

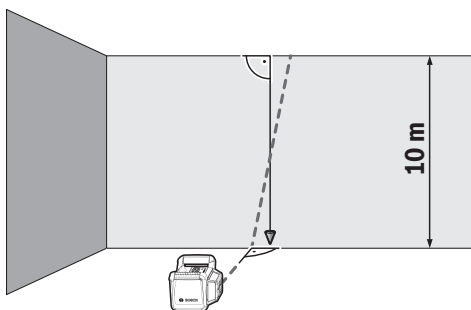
X轴校准后，测量仪自动切换到Y轴校准模式。Y轴状态指示灯(6)闪绿灯，震动警告功能指示灯(13)闪红光（各每秒2次）。

将测量仪旋转90°，使测量仪上Y轴指示灯与墙壁成直角。然后像X轴那样进行校准。

当保存Y轴的校准时，Y轴状态指示灯(6)闪6次绿光。自动退出校准模式。

校准Z轴

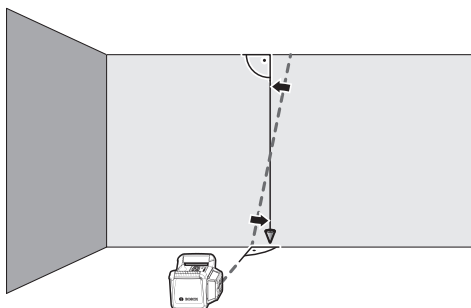
要进行校准，需要在10米高的墙壁前的稳固地面上找到一段无障碍物的测量距离。将铅垂线固定在墙壁上。



将测量仪垂直地放在稳固、平坦的底垫上。接通测量仪，使其调平。对准测量仪，使可变的激光束与墙壁成直角并与铅垂线相交。关闭探测仪。

如要启动校准模式，请按住手动模式按键(14)，然后还要短促按压电源开关(3)。当X轴状态指示灯(7)闪绿光且震动警告功能指示灯(13)闪红光（各每秒2次）时，才松开倾斜设置按键。

测量仪在Z轴校准模式下接通。请等待，直至测量仪调平且旋转测量启动。



对准可变激光束，使其尽可能地平行于铅垂线。为此按压向下倾斜按键(5)或向上倾斜按键(15)。

如果无法平行于铅垂线对准激光束，则将测量仪更精准地对准墙壁，然后重新启动校准过程。

如果激光束已平行对齐，则按压手动模式按键(14)以保存校准。X轴状态指示灯(7)闪烁6次绿光以确认。

Z轴校准已保存，自动退出校准模式。

工作提示

- ▶ 仅使用激光点或激光线中心来标记。激光点的大小或激光线段的宽度会随著距离而改变。

使用激光靶操作 (见图片A)

在条件不佳和距离较远时，激光靶(47)可以改善激光束的可见性。

反光的那半激光靶(47)可以改善激光线的可见性，通过透明的那半可以在激光靶的背面看到激光线。

三脚架的使用 (附件)

三脚架提供稳定且高度可调的测量底座。将测量仪用5/8英寸三脚架接头(17)安装在三脚架(39)的螺柱上。使用三脚架的固定螺栓拧紧测量仪。

对于伸缩部位上带刻度的三脚架，可以直接调节高度偏差。

在开动测量仪之前，先大略地调整好三脚架的位置。

使用墙架WM 24 (附件) 进行操作 (参见插图B)

可以借助带对齐单元(42)的墙架将测量仪固定在墙壁上。当在三脚架伸缩部位高度以上进行操作时或不通过三脚架在不稳固的底垫上进行操作时，推荐使用墙架。

将墙架(42)用固定螺栓(40)拧到板条上。将墙架尽可能垂直地安装到墙壁上，并确保牢固固定。

将墙架的5/8英寸螺栓(43)拧入测量仪上的三脚架接头(17)。

借助对齐单元可以将安装的测量仪在约23厘米的高度范围内移动。为此松开对齐单元上的螺栓(41)，将测量仪移动到所需的位置，然后再次拧紧螺栓(41)。

使用激光接收器 (附件) 进行操作

在光线不佳（周围环境明亮，阳光直射）且距离更远的情况下使用激光接收器(37)以更好地找到激光线。

针对具备多种运行模式的旋转激光仪，请选择带最高旋转速度的水平或垂直模式。

使用激光接收器时必须阅读和遵循接收器的使用说明书。

使用测量杆 (附件) 进行操作 (参见插图C)

建议将测量杆(38)与激光接收器一起使用以检查平整度或绘制斜度。

测量杆(38)上方有一个相对刻度。您可以使用标杆下部的伸缩部位调整零位高度。这样您就可以直接读取和给定高度比较后的偏差值。

激光辨识镜 (附件)

激光辨识镜会过滤周围环境的光线。因此激光束会显得更亮。

- ▶ 激光视镜不得用作护目镜。激光视镜用于更好地识别激光束；然而对激光束并没有防护作用。
- ▶ 激光视镜不得用作太阳镜或在道路交通中使用。激光视镜并不能完全防护紫外线，还会干扰对色彩的感知。

工作范例

传输/检查高度 (参见插图D)

将测量仪水平地放在稳固的底板上或安装在三脚架(39) (附件) 上。

使用三脚架操作：把激光调整在需要的高度上。将高度传输到目标位置，或在目标位置检查高度。

不使用三脚架进行操作：请借助激光靶(47)确定激光束和参考点高度之间的高度差。将高度传输到目标位置，或在目标位置检查测出的高度差。

平行对齐上对点/绘制直角 (参见插图E)

如要绘制直角或对齐中间墙壁，必须平行对齐上对点(11)，也就是至参考直线（比如墙壁）的距离相同。

为此，将测量仪垂直放置并进行定位，使上对点平行于参考直线。

为精确定位，请借助激光靶(47)直接通过测量仪测量上对点和参考直线之间的距离。请在距离测量仪尽可能远地距离重新测量上对点和参考直线之间的距离。对齐上对点，使其至参考直线的距离相同，就像直接通过测量仪进行测量一样。

通过可变激光束(8)显示至上对点(11)的直角。

显示垂直面 (参见插图F)

要显示垂直面，请将测量仪调到垂直位置。如果垂直面与参考直线（比如墙壁）成直角，请将上对点(11)对准该参考直线。

通过可变激光束(8)显示垂直线。

对齐垂直面 (参见插图G)

要把垂直激光线或旋转激光面对准墙上的参考点时，先将测量仪器架设在垂直的位置，让激光线或旋转激光面粗略地对准参考点。为精确对齐参考点，将旋转面绕Y轴旋转(参见“在垂直位置转动旋转面”，页 26)。

不使用激光接收器进行操作 (参见插图H)

在有利测量的照明状况下（昏暗的环境），或者当测量的距离很近时，操作仪器时可以不使用激光接收器。为了获得更好的激光束辨识程度，请选择直线模式或点模式，然后将激光束旋转至目标位置。

使用激光接收器进行操作 (参见插图I)

在光线不佳（周围环境明亮，阳光直射）且距离更远的情况下使用激光接收器(37)以更好地找到激光束。使用激光接收器时必须选择旋转模式并选择最高的旋转速度。

以远距离测量 (参见插图J)

远距离测量时，必须使用激光接收器(37)以找到激光束。为了尽可能排除干扰，要把测量仪摆在测量场所的中央，并且将测量仪固定在三脚架上。

在户外操作 (参见插图K)

在户外操作时应始终使用激光接收器(37)。在不稳定的地面上进行操作时应将测量仪安装到三脚架(39)上。只能在震动警告功能激活时进行操作，以防地面移动或测量仪震动时错误测量。

指示灯一览

	激光束	激光束旋转 ^{A)}	X		Y		红色	红色
			绿色	红色	绿色	红色		
接通测量仪 (1秒钟自动测试)				每秒3次		每秒3次	每秒3次	每秒3次
睡眠模式	○	○		每秒1次		每秒1次	每秒1次	每秒1次
调平								
调平	*	○	*		*			
重新找平	○	○	*		*			
超过自动找平范围				*		*		
测量仪准备就绪，两根轴均已调平	●	●	●		●			
震动警告功能								
震动警告功能已触发	*	○		*		*		*
震动警告功能已关闭								●
电池电压								
电池电压低							●	
电池没电了							*	
倾斜模式/手动模式								
X轴倾斜度可调节 Y轴已调平	○	○		*	●			
X轴手动 Y轴已调平	●	●		●	●			
X轴已调平 Y轴倾斜度可调	○	○	●			*		
X轴已调平 Y轴手动	●	●	●			●		

	激光束	激光束旋 转 ^{A)}	X		Y			
			绿色	红色	绿色	红色	红色	红色
X轴倾斜度可调	○	○		*		●		
Y轴手动								
X轴手动	○	○		●		*		
Y轴倾斜度可调								
X轴手动	●	●		●		●		
Y轴手动								
校准								
X轴校准模式 (在水平位置)			每秒 2次					每秒 2次
X轴校准已保存			* (6次)					
Y轴校准模式					每秒 2次			每秒 2次
Y轴校准已保存					* (6次)			
Z轴校准模式 (在垂直位置)			每秒 2次					每秒 2次
Z轴校准已保存			* (6次)					
X轴或Z轴校准过程中出错				*				
Y轴校准过程中出错						*		
复位								
需要重启, 请通过电源开关(3) 关闭测量仪, 然后重新接通。				每秒 3次		每秒 3次		

A) 在直线模式和旋转模式时

●: 持续模式

* 闪烁

每秒2次: 闪烁频率 (比如每秒2次)

○: 功能已停止

维修和服务

维护和清洁

测量仪和遥控器必须随时保持清洁。

不要将测量仪和遥控器放入水或其他液体中。

使用潮湿, 柔软的布擦除仪器上的污垢。切勿使用任何清洁剂或溶剂。

务必定期清洁测量仪上的激光发射口, 清洁时不可在出口残留绒毛。

只能使用箱子(48)存储和运输测量仪。

需要维修时, 请将测量仪装入箱子(48)邮寄。

客户服务和应用咨询

本公司顾客服务处负责回答有关本公司产品的修理、维护和备件的问题。备件的展开图纸和信息也可查看: www.bosch-pt.com
博世应用咨询团队乐于就我们的产品及其附件问题提供帮助。

询问和订购备件时, 务必提供机器铭牌上标示的10位数物品代码。

香港和澳门特别行政区

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废弃处理

应对电动设备、充电电池/电池、附件和包装进行环保的回收利用。



不可以把电动设备和充电电池/电池丢入生活垃圾中!

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr ⁶⁺)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
外壳的金属部分	X	○	○	○	○	○
外壳的非金属部分 (包括玻璃)	○	○	○	○	○	○
组合印刷电路板	X	○	○	○	○	○
附件 ^{A)}	X	○	○	○	○	○
碱性电池系统	○	○	○	○	○	○
充电电池系统 ^{B)}	X	○	○	○	○	○
键盘	○	○	○	○	○	○
显示器 ^{C)}	○	○	○	○	○	○
激光模块 ^{D)}	X	○	○	○	○	○
内部连接电缆	○	○	○	○	○	○

A) 适用于采用附件的产品

B) 适用于采用充电电池供电的产品

C) 适用于采用显示器的产品

D) 适用于采用激光模块的产品

本表是按照SJ/T 11364的规定编制

○: 表示该有害物质在该部件所有物质材料中的含量均在GB/T 26572规定的限量要求以下。

X: 表示该有害物质至少在该部件的某一物质材料中的含量超出GB/T 26572规定的限量要求, 且目前业界没有成熟的替代方案, 符合欧盟RoHS指令环保要求。

产品环保使用期限内的使用条件参见产品说明书。

繁體中文**旋轉雷射水平儀的安全注意事項**

為確保能夠安全地使用本測量工具, 您必須完整詳讀本說明書並確實遵照其內容。若未依照現有之說明內容使用測量工具, 測量工具內部所設置的防護措施可能無法發揮應有功效。謹慎對待測量工具上的警告標示, 絕對不可讓它模糊不清而無法辨識。請妥善保存說明書, 將測量工具轉交給他人時應一併附上本說明書。

- ▶ 本測量工具出貨時皆有附掛雷射警示牌 (即測量工具詳解圖中的標示處)。
- ▶ 雷射警示牌上的內容若不是以貴國語言書寫, 則請於第一次使用前將隨附的當地語言說明貼紙貼覆於其上。
- ▶ 測量工具上已標出附帶警示牌的雷射出口。使用測量工具時請留意其位置。

- ▶ 隨附警示牌上的內容若不是以貴國語言書寫, 則請於第一次使用前將隨附的當地語言說明貼紙貼覆於其上。

- ▶ 小心 - 若是使用非此處指明的操作設備或校正設備, 或是未遵照說明的操作方式, 可能使您暴露於危險的雷射光照射環境之下。

- ▶ 請勿對本雷射裝備進行任何改造。



請勿將雷射光束對準人員或動物, 您本人亦不可直視雷射光束。此測量工具所發出的雷射光屬於 3R 級雷射並且符合 EN 60825-1 之規範。若直視雷射光束, 即使相隔很遠的距離亦可能導致眼睛受傷。

- ▶ 請勿將雷射眼鏡當作護目鏡使用。雷射眼鏡是用來讓您看清楚雷射光束; 但它對於雷射光照射並沒有保護作用。
- ▶ 請勿將雷射眼鏡當作護目鏡使用, 或在道路上行進間使用。雷射眼鏡無法完全阻隔紫外線, 而且還會降低您對於色差的感知能力。

- ▶ 本測量工具僅可交由合格的專業技師以原廠替換零件進行維修。如此才能夠確保本測量工具的安全性。
- ▶ 不可放任兒童在無人監督之下使用本雷射測量工具。他們可能會不小心對他人眼睛產生眩光
- ▶ 請您避免雷射光束從窗戶或鏡子等這類光滑表面反射。反射的雷射也可能傷害眼睛。
- ▶ 本測量工具僅可交由熟稔雷射裝置的人員操作。除此之外，根據 EN 60825-1 該人員也應充份瞭解雷射會對所有生物的眼睛、皮膚造成何種影響，並掌握該如何正確使用雷射護具以免造成任何危害。
- ▶ 請不要在存有易燃液體、氣體或粉塵等易爆環境下操作本測量工具。測量工具內部產生的火花會點燃粉塵或氣體。
- ▶ 架設本測量工具時，請務必讓雷射光束遠離眼睛高度，高低不拘。這樣可以確保眼睛不會傷害。
- ▶ 請在預備使用測量工具的區域擺放恰當的雷射警示牌，做為標示。這樣可以避免與工作無關的人進入危險區域。
- ▶ 請勿將測量工具存放在他人未經許可便能擅自取用的地點。如果不熟悉測量工具的操作方式，可能危害操作者本身以及他人。
- ▶ 使用具有 3R 級雷射的裝置時，請您遵照所在國目前施行的相關法規。如果未遵循這些法規可能導致人員受傷。
- ▶ 雷射的投射範圍應要做好人員管控或屏蔽措施。管控或屏蔽好雷射的投射範圍可以避免雷射傷害未參與工作者的眼睛。
- ▶ 不可放任啟動的測量工具無人看管，使用完畢後請關閉測量工具電源。雷射可能會對旁人的眼睛產生眩光。
- ▶ 請勿使用望遠鏡或放大鏡等聚光儀器或透過此類儀器視察雷射光源。您的眼睛可能因此受傷。



磁性配件不得接近植入裝置以及諸如心律調節器或胰島素幫浦等其他醫療器材。配件磁鐵形成的磁場可能干擾植入裝置或醫療器材運作。

- ▶ 請讓磁性配件遠離磁性資料儲存裝置和易受磁場干擾的高靈敏器材。配件之磁鐵所形成的磁場可能造成無法挽救的資料遺失。

遙控器安全注意事項



您必須完整詳讀本說明書並確實遵照其內容。若未依照現有之說明內容使用遙控器，遙控器內部所設置的防護措施可能無法發揮應有功效。請妥善保存本說明書。

- ▶ 本遙控器僅可交由合格的專業技師以原廠替換零件進行維修。如此才能夠確保本遙控器的安全性。
- ▶ 請不要在存有易燃液體、氣體或粉塵等易爆環境下操作本遙控器。遙控器內可能產生火花並點燃粉塵和氣體。

產品和功率描述

請留意操作說明書中最前面的圖示。

依規定使用機器

旋轉式雷射測量儀

本測量工具是用來測量和檢查平行線段、垂直線段、對齊線段和鉛垂點。

本測量工具可同時適用於室內及戶外應用。

遙控器

遙控器可讓您透過紅外線來操控 **Bosch** 旋轉式雷射測量儀。

本遙控器可同時適用於室內及戶外應用。

插圖上的機件

機件編號供您對照測量工具和遙控器詳解圖上的編號。

旋轉式雷射測量儀

- (1) 電池盒鎖扣^{A)}
- (2) 電池盒^{A)}
- (3) 電源按鈕
- (4) 旋轉模式按鈕
- (5) 向下傾斜按鈕
- (6) Y 軸狀態指示器
- (7) X 軸狀態指示器
- (8) 可變雷射光束
- (9) 遙控器感應器
- (10) 雷射光束射出口
- (11) 向上鉛垂點
- (12) 電量警示燈
- (13) 震動警告功能指示器
- (14) 手動模式按鈕
- (15) 向上傾斜按鈕
- (16) 線形模式按鈕
- (17) 5/8" 三腳架固定座
- (18) 序號
- (19) 雷射警示牌
- (20) 雷射射出口警示牌

A) 圖表或說明上提到的配件，並不包含在基本的供貨範圍中。本公司的配件清單中有完整的配件供應項目。

遙控器

- (21) 遙控器^{A)}
- (22) X- 傾斜按鈕
- (23) 逆時針旋轉按鈕
- (24) Y+ 傾斜按鈕
- (25) X+ 傾斜按鈕
- (26) 旋轉模式按鈕
- (27) 紅外線輻射射出口

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- (28) 訊號傳送指示器
- (29) 休眠模式按鈕 (待機)
- (30) 線形模式按鈕
- (31) 手動模式按鈕
- (32) Y- 傾斜按鈕
- (33) 順時針旋轉按鈕
- (34) 序號
- (35) 電池盒蓋鎖扣
- (36) 電池盒蓋

A) 圖表或說明上提到的配件，並不包含在基本的供貨範圍中。本公司的配件清單中有完整的配件供應項目。

配件/備用零件

- (37) 雷射接收器^{A)}
- (38) 測量標竿^{A)}
- (39) 三腳架^{A)}
- (40) 掛牆托架的固定螺栓^{A)}
- (41) 校正器上的螺栓^{A)}
- (42) 掛牆托架/校正器^{A)}
- (43) 掛牆托架的 5/8" 螺栓^{A)}
- (44) 磁鐵^{A)}
- (45) 雷射接收器托架^{A)}
- (46) 雷射辨識鏡^{A)}
- (47) 雷射標靶^{A)}
- (48) 提箱^{A)}

A) 圖表或說明上提到的配件，並不包含在基本的供貨範圍中。本公司的配件清單中有完整的配件供應項目。

技術性數據

旋轉式雷射測量儀	GRL 350 HV
產品機號	3 601 K61 S..
工作範圍 (直徑) ^{A)B)}	
- 無雷射接收器約	60 m
- 使用雷射接收器約	350 m
調平精準度 ^{A)C)}	
- 水平	±1.5 mm/30 m
- 垂直	±3 mm/30 m
自動調平範圍標準值	±8% (±4.6°)
調平耗時標準值	30 秒
旋轉速度	0/150/300/600 次 / 分
線段模式時的開口角度	10/25/50°
手動模式下的傾斜範圍	±8%
操作溫度	-10°C ... +50°C
儲藏溫度	-20°C ... +70°C
從基準點高度算起的最大可測量高度	2000 m
空氣相對濕度最大值	90%

旋轉式雷射測量儀	GRL 350 HV
依照 IEC 61010-1，污染等級為	2 ^{D)}
雷射等級	3R
雷射種類	630–650 nm, < 5 mW
光束發散角	0.4 mrad (全角度)
三腳架固定座 (水平)	5/8"-11
拋棄式電池 (鹼-錳)	2 × 1.5 VLR20 (D)
連續工作時間約略值	30 小時
重量符合 EPTA-Procedure 01:2014	1.8 kg
尺寸 (長 × 寬 × 高)	187 × 182 × 170 mm
防護等級 (不含電池盒)	IP 56 (防塵、防潑水設計)

A) 溫度為 20 °C

B) 工作範圍在不利的環境條件下 (例如陽光直射)，工作範圍將縮小。

C) 沿軸線

D) 只產生非導電性污染，但應預期偶爾因水氣凝結而導致暫時性導電。

從產品銘牌的序號 (18) 即可確定您的測量工具機型。

遙控器	RC 4
產品機號	3 601 K69 S..
工作範圍 ^{A)}	30 m
操作溫度	-10°C ... +50°C
儲藏溫度	-20°C ... +70°C
從基準點高度算起的最大可測量高度	2000 m
空氣相對濕度最大值	90%
依照 IEC 61010-1，污染等級為	2 ^{B)}
拋棄式電池 (鹼-錳)	2 × 1.5 VLR6 (AA)
重量符合 EPTA-Procedure 01:2014	0.11

A) 工作範圍在不利的環境條件下 (例如陽光直射)，工作範圍將縮小。

B) 只產生非導電性污染，但應預期偶爾因水氣凝結而導致暫時性導電。

從產品銘牌的序號 (34) 即可確定您的遙控器類型。

安裝

遙控器的供電

建議使用鹼錳電池來驅動本遙控器。

若要打開電池盒蓋 (36)，請按壓鎖扣 (35) 並取下電池盒蓋。裝入電池。


此時請您注意是否有依照電池盒內側上的電極標示正確放入。

務必同時更換所有的電池。請使用同一製造廠商，容量相同的電池。

- ▶ **長時間不使用時，請將取出遙控器中的電池。**遙控器中的電池可能因長時間存放不使用而自行放電。

測量工具的電源供應

建議使用鹼錳電池來驅動本測量工具。

若要取出電池盒 (2)，請將鎖扣 (1) 旋轉至  位置。將電池盒從測量工具中抽出，然後裝入電池。此時請您注意是否有依照電池盒內側上的電極標示正確放入。

將電池盒 (2) 推回測量工具內，並將鎖扣 (1) 旋轉至  位置。

電池快沒電時，電量警示燈 (12) 將亮起。測量工具還能繼續運作約 2 小時。

電量警示燈 (12) 開始呈紅色閃爍時，表示測量工具將在 5 分鐘後自動關機。

務必同時更換所有的電池。請使用同一製造廠商，容量相同的電池。

- ▶ **長時間不使用時，請將測量工具裡的電池取出。**電池可能因長時間存放於測量工具中不使用而自行放電。

操作

- ▶ **妥善保護測量工具和遙控器，切勿受潮並應避免陽光直射。**
- ▶ **勿讓測量工具和遙控器暴露於極端溫度或溫度劇烈變化的環境。**例如請勿將它長時間放在車內。測量工具和遙控器歷經較大溫度起伏時，請先讓其回溫後再使用。一律要先進行精準度檢查，才能繼續使用測量工具(參見「測量工具精準度檢查」，頁 37)。
- ▶ **如果測量工具曝露在極端溫度下或溫差較大的環境中，會影響儀器的測量準確度。**
- ▶ **測量工具須避免猛力碰撞或翻倒。**測量工具遭受外力衝擊後，一律必須先檢查其精準度，確認後才能繼續使用(參見「測量工具精準度檢查」，頁 37)。
- ▶ **雷射光管若是因測量工具翻倒而破裂時，請您要小心。**您可能因破碎而形成的尖銳利邊而割傷自己。

操作遙控器

如果您在測量工具調平時按下操作按鍵，會中斷調平過程，並導致儀器瞬間停止轉動。只要使用遙控器就可避免這種情形。

只要裝入的電池具有足夠電壓，遙控器即能保持在待機狀態。

架設測量工具時，請將遙控器對準其中一個感應器 (9) 以便能夠直線傳送訊號。如果遙控器無法正對感應器，將導致其工作範圍縮小。以非直射訊號來說，透過訊號反射 (例如在牆面上) 亦可改善其作用範圍。

按下遙控器的按鈕後，訊號傳送指示器 (28) 隨即亮起，上隨即出現代表已傳送訊號的燈號。

無法用遙控器關閉測量工具的電源。

操作旋轉式雷射測量儀

- ▶ **工作區域不得留有可能會反射或阻擋雷射光束的障礙物。請將反光或平滑發光的表面蓋住。請勿以穿透過玻璃板或類似材質的方式進行測量。**經反射或被阻擋的雷射光束可能會造成測量結果產生誤差。

架設測量工具



橫擺



直擺

您可將測量工具以橫擺或直擺的方式置於穩固平面上，將它安裝在三腳架 (39) 上，或將它裝在具有校正器的掛牆托架 (42) 上。

由於測量工具的調平精準度極高，所以對於震動和移位非常敏感。因此務必確實地固定好測量工具，以避免因為重新調平而必須中斷測量。

啟動/關閉

提示：第一次使用完畢後以及每次作業前，請您進行精準度檢查(參見「測量工具精準度檢查」，頁 37)。

若要啟動測量工具，請按一下電源按鈕 (3)。所有指示器呈紅色快速閃爍狀態 (每秒 3 次)。測量工具從射出口 (10) 發射出一道可變雷射光束 (8) 以及向上鉛垂點 (11)。

- ▶ **雷射光束不可以對準人或動物，操作人本身也不要直視光束，即使和光束相距甚遠也不可以做上述動作。**

此時測量工具馬上進行自動調平。調平期間，X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 呈綠色閃爍狀態，進入點形模式後雷射線也會閃爍。

當 X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 一改為持續亮起綠燈色且雷射也持續亮起時，表示測量工具完成調平。當調平的工作結束後，測量工具會自動進入旋轉模式。

- ▶ **不可放任啟動的測量工具無人看管，使用完畢後請關閉測量工具電源。**雷射可能會對旁人的眼睛產生眩光。

若要關閉測量工具，請按住電源按鈕 (3) 直到所有指示器熄滅。

休眠模式 (待機)

工作休息期間，您可利用遙控器 (21) 讓測量工具進入休眠模式。此時將儲存所有設定且震動警告功能保持開啟。

若要開啟休眠模式，按一下遙控器上的休眠模式按鈕 (29)。測量工具上的所有指示器慢速閃爍 (每秒 1 次)。

若要關閉休眠模式，請再按一次休眠模式按鈕 (29)。短按一下測量工具上的電源按鈕 (3) 也可以結束休眠模式。

操作模式

X 軸及 Y 軸線條

X 軸及 Y 軸線條標示在外殼上的旋轉鈕上方。

操作模式概覽

測量工具橫擺和直擺都能使用所有 3 個操作模式。



旋轉模式

特別建議在使用雷射接收器時採用旋轉模式。您可以選擇不同的旋轉速度。



線形模式

在此操作模式下，可變雷射光束能夠在限定的開口角度內。因此其雷射辨識程度會優於旋轉式模式。您可以選擇不同的開口角度。



點形模式

在此操作模式下，最能看清楚可變雷射光束。舉例來說，它可讓您輕鬆移植高度或用來檢查是否對齊。

線形模式和點形模式不適合使用雷射接收器 (37)。



旋轉模式 / 點形模式

每次啟動時，測量工具都是設為旋轉模式以及標準旋轉速度 (300 rpm)。

若要從線形模式切換至旋轉模式或點形模式，請按一下遙控器的旋轉模式按鈕 (4) 或旋轉模式按鈕 (26)。

若要變更旋轉速度，請反覆按壓遙控器的旋轉模式按鈕 (4) 或旋轉模式按鈕 (26)，直到設為所需轉速。每按一下即可分段提升旋轉速度。進入最高轉速設定後，測量工具會短暫振動後進入點形模式。再按一下旋轉模式按鈕即可返回旋轉模式並設為最低旋轉速度。

使用雷射接收器時必須選擇最高旋轉速度。作業時若不使用雷射接收器，請調降旋轉速度並使用雷射辨識鏡，以提高雷射光束 (46) 的能見度。



線形模式

按一下遙控器的線形模式按鈕 (16) 或線形模式按鈕 (30) 以便切換至線形模式。

若要變更開口角度，請反覆按壓遙控器的線形模式按鈕 (16) 或線形模式按鈕 (30)，直到設為所需操作模式。每按一下就會開口角度分段加大，系統會同時隨著每一次加大角度而加快旋轉速度。

提示：由於慣性運動的緣故，雷射可能會稍微晃動至超出雷射標線末端。

功能

在橫擺狀態下，將雷射標線 / 雷射點旋轉至旋轉平面內

測量工具橫擺時，您可將雷射標線或雷射點定位於雷射的旋轉平面之內。可 360° 旋轉。

若要逆時針旋轉，請按一下測量工具上的向下傾斜按鈕 (5) 或遙控器上的逆時針旋轉按鈕 (23)。

若要順時針旋轉，請按一下測量工具上的向上傾斜按鈕 (15) 或遙控器上的順時針旋轉按鈕 (33)。

在直擺狀態下，轉動旋轉平面

測量工具直擺時，您可在 $\pm 8\%$ 的範圍內，沿 X 軸旋轉雷射點、雷射標線或旋轉平面，輕鬆使它們對齊或呈平行狀。

若要逆時針旋轉，請按一下測量工具上的向下傾斜按鈕 (5) 或遙控器上的逆時針旋轉按鈕 (23)。

若要順時針旋轉，請按一下測量工具上的向上傾斜按鈕 (15) 或遙控器上的順時針旋轉按鈕 (33)。

自動調平功能

概要

啟動後，測量工具將確認是處於水平位置還是垂直位置，並在 $\pm 8\%$ ($\pm 4.6^\circ$) 的自動調平範圍內自動調整。

調平期間，X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 呈綠色閃爍狀態，進入點形模式後雷射線也會閃爍。

當 X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 一改為持續亮起綠色且雷射也持續亮起時，表示測量工具完成調平。當調平的工作結束後，測量工具會自動進入旋轉模式。

測量工具啟動後或變更擺放位置後，若其跑偏超過 8%，將無法再進行調平。發生這種情況時，X 軸狀態指示器 (7) 和 Y 軸 (6) 將呈紅色閃爍狀態，旋轉部件停止運作並關閉雷射。

請關閉測量工具，將它放置在儘可能水平位置 (橫擺) 或垂直位置 (直擺) 上，然後再將它重新啟動。

擺放位置變化

測量工具完成調平後，會持續檢查其水平位置或垂直位置。如果擺放位置改變了，將再度自動重新調平。

針對最小幅度的擺放位置變化，將不會中斷運作，直接自動補平。若是基座晃動或受到天氣的影響，將自動補償。

針對較大幅度的擺放位置變化，為避免執行調平時發生誤測，將停止雷射光束旋轉並關閉雷射。X 軸狀態指示器 (7) 和 Y 軸 (6) 呈綠色閃爍狀態。必要時將觸發震動警告功能。

測量工具會自動偵測現在是橫擺或直擺。想要變成橫擺或直擺時，請關閉測量工具，將它擺放至新位置，然後再重新啟動。

震動警告功能

本測量工具具有震動警告功能。此項功能可在測量工具變更擺放方式或發生晃動時，或是基座震動

時，避免在不同位置上進行調平，進而防止因測量工具移位而發生錯誤。

啟用震動警告：震動警告功能預設為開啟。它將在測量工具啟動 1 分鐘後啟用。

震動警告已觸發：如果測量工具捕捉到變換位置或大幅晃動，那麼將觸發震動警告：雷射將停止旋轉且雷射光束轉為閃爍狀態。在此同時，震動警告指示器 (13) 以及 X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 也會呈紅色閃爍。將儲存目前所使用的操作模式。

已觸發震動警告時，請短按一下電源按鈕 (3)。此時儀器會重新啟動震動警告功能，並開始調平。當測量工具一完成調平 (X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 持續亮起) 後，即立刻以之前儲存的操作模式啟動。

現在，請您檢查某一基準點上的雷射光束位置，必要時請修正高度或測量工具的方位。

關閉震動警告功能：若要關閉或開啟震動警告功能，請短按一下電源按鈕 (3)；或者若是在已觸發震動警告 (震動警告指示器 (13) 呈紅色閃爍) 下，則

請短按兩下。震動警告關閉時，震動警告指示器 (13) 將呈紅色持續亮起。

震動警告功能之前若開啟，則將在約 1 分鐘啟用。

提示：無法利用遙控器開啟或關閉或重新啟動震動警告功能。

單軸傾斜模式 / 手動模式

測量工具的自動調平功能可以關掉 (手動模式)：

- 橫擺時兩軸各自獨立，
 - 直擺時適用於 X 軸 (直擺時 Y 軸無法調平)。
- 處於手動模式時，可將測量工具架設成任意傾斜角度。此外，測量工具上的軸線可在 $\pm 8\%$ 範圍內各自調成不同傾斜度。

選擇軸：若要啟動手動模式或選擇欲傾斜的軸，請按一下測量工具上的手動模式按鈕 (14) 或遙控器上的手動模式按鈕 (31)。您可以從 X 軸狀態指示器 (7) 或 Y 軸狀態指示器 (6) 上辨認哪一軸無法再調平以及哪一軸可以傾斜。

按一下手動模式 按鈕	X 軸狀態		Y 軸狀態		
	綠色	紅色	綠色	紅色	
1 個 (橫擺時)		*	●		軸已完成調平
1 個 (直擺時)		*	-		軸無法調平
2 個	●			*	單軸傾斜模式，可設定軸
3 個		*		●	手動模式
4 個		●		*	手動模式，可設定軸
5 個 (橫擺時)	* / ●		* / ●		軸正在調平 / 已完成調平
5 個 (直擺時)	* / ●		-		軸無法調平

● 指示器持續亮起

* 指示器閃爍

- 指示器熄滅

軸傾斜：在傾斜模式或手動模式下可在選好軸後的 5 秒內變更該軸的傾斜度 (只要該軸的狀態指示器呈紅色閃爍)。狀態指示器持續亮起紅燈時，表示已調好傾斜。為能變更傾斜度，請反覆按壓測量工具上的手動模式按鈕 (14) 或遙控器上的手動模式按鈕 (31)，直到所需軸的狀態指示器呈紅色閃爍。

您可按以下方式變更可調軸的傾斜度：

- 在測量工具上：按壓向下傾斜按鈕 (5)，可調軸即往「-」方向傾斜。
按一下向上傾斜按鈕 (15)，可調軸即往「+」方向傾斜。
- 使用遙控器：按一下 X+ 傾斜按鈕 (25) 或 X- 傾斜按鈕 (22)，X 軸即往「+」方向或「-」方向傾斜。
按一下 Y+ 傾斜按鈕 (24) 或 Y- 傾斜按鈕 (32)，Y 軸即往「+」方向或「-」方向傾斜。

測量工具精準度檢查

以下作業應由受過充份訓練的合格人員來執行。必須知道執行精準度檢查或校正測量工具時的慣用方式。

影響精度的因素

操作環境的溫度是最大的影響因素。尤其是由地面往上延伸的漸進式溫度差異可能會使雷射光束改變方向。

靠近地面的位置其溫度分層變化最大，因此當測量距離超過 20 m 以上，一律應將本測量工具安裝在三腳架上。此外，請您將測量工具儘量架設在作業區的中央。

如果未架設好儀器，大約從距離 20 m 處起便會產生誤差。而在 100 m 處的誤差可能是在 20 m 處的誤差的二到四倍。

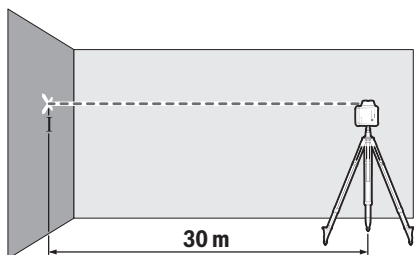
除了外在因素，發生偏差的原因亦可能來自機器本身 (例如機器曾翻倒或受到猛力撞擊)。因此，每次開始工作之前，請您先進行調平精準度檢查。

如果測量工具在下述任一測量程序中超出最大偏差，則請您進行校正(參見「校正測量工具」，頁 38)或將測量工具交由 **Bosch** 客戶服務中心檢查。

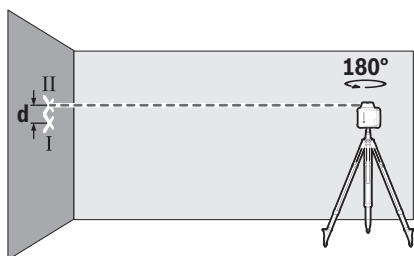
在橫擺狀態下檢查調平精準度

為能取得可靠精準的測量結果，建議您在牆前的穩固地面上找出一段無障礙物、長度 **30 m** 的測量距離。兩軸都要分別進行一次完整的測量流程。

- 測量工具以橫擺方式安裝在與牆面相距 **30 m** 的位置，此時您可將它裝在三腳架上或直接放置在穩固的平坦基座上。啟動測量工具。



- 完成調平後，請在牆上標出雷射光束的中心位置 (I 點)。



- 將測量工具旋轉 **180°**，但不用再改變其位置。讓測量工具進行調平，接著再到牆面上標出雷射光束的中心點 (II 點)。請注意 II 點應儘可能與 I 點呈一垂直線，可能位於 I 點之上或之下。

牆面上標出的 I 與 II 兩點相差的高度 **d** 即是測量工具之受測軸的實際高度偏差。

請對另一軸重複此測量流程。其方法是：在開始測量流程之前，請先將測量工具旋轉 **90°**。

測量距離為 **30 m** 時的最大容許偏差：

$30 \text{ m} \times \pm 0.05 \text{ mm/m} = \pm 1.5 \text{ mm}$ 。在兩次測量流程中，I 和 II 兩點之間相差的距離 **d** 都不能超過 **3 mm**。

校正測量工具

以下作業應由受過充份訓練的合格人員來執行。必須知道執行精準度檢查或校正測量工具時的慣用方式。

- ▶ 請校正測量工具，以確保其絕對精準；或是將它送交 **Bosch** 顧客服務處進一步檢修。若未精準校正，便無法獲取正確的測量結果。

- ▶ 測量工具僅在有校正之必要時，才需進行校正作業。測量工具一進入校正模式後，必須正確完成校正作業，使其絕對精準，這樣才能確保後續取得的測量結果正確無誤。

每次校正後請檢查調平精準度(參見「測量工具精準度檢查」，頁 37)。偏差若超出最大容許值，請將測量工具交由 **Bosch** 客戶服務中心進行檢查。

所有軸一律都要校正 (X 軸、Y 軸和 Z 軸)。

提示：X 軸狀態指示器 (7) 或 Y 軸狀態指示器 (6) 若在校正期間呈紅色閃爍，表示偏差已落在最大容許範圍之外。發生這種情況時，請按一下手動模式按鈕 (14)，以便直接退出校正模式並且不儲存設定。然後 X 軸狀態指示器 (7) 和 Y 軸狀態指示器 (6) 會每秒閃爍 3 次紅燈，藉此告知您校正作業發生問題。

請重新啟動校正作業。如果再次出現相同錯誤，則請將測量工具交由 **Bosch** 客戶服務中心進行檢查。

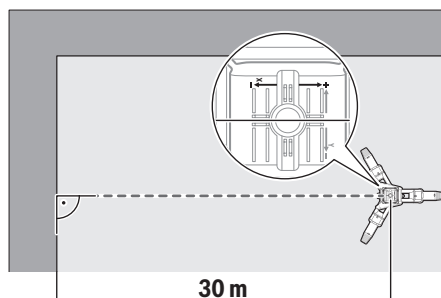
校正 X 軸和 Y 軸

為了進行校正作業，您必須在牆前的穩固地面上找出一段無障礙物、長度 **30 m** 的測量距離。

標示雷射光束時，可視需要 (例如在不利照明條件之下) 使用雷射接收器 (37)。使用雷射接收器時，請您小心注意要讓它垂直於牆面上，否則無法準確標示出雷射光束。雷射接收器若可設定接收準確度，則您可依所需之校正準確度調整接收準確度 (此時請您遵循雷射接收器操作說明書)。

安裝和調整測量工具位置以便進行校正：

以橫擺方式將測量工具安裝在距離牆面 **30 m** 的位置上，此時您可將它安裝在三腳架 (39) (建議) 上或直接放置在穩固的平坦基座上。



調整測量工具位置，使測量工具上印刻的 X 軸指示器與牆面呈直角。

啟動校正作業：

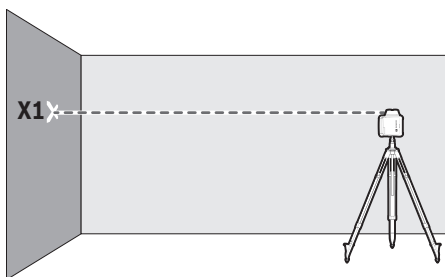
必須關閉測量工具，才能啟動校正作業。

將測量工具上的手動模式按鈕 (14) 按住不放，並且再短按一下電源按鈕 (3)。如果 X 軸狀態指示器 (7) 呈色綠色閃爍且震動警告功能指示器 (13) 呈紅色閃爍 (每秒 2 次)，先放開傾斜設定按鈕。

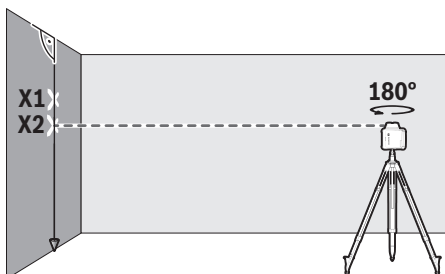
測量工具隨即以 X 軸校正模式啟動。

校正 X 軸：

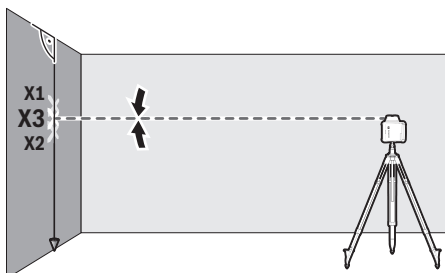
請確認測量工具的 X 軸已調整成與牆面呈直角。稍候片刻，讓測量工具完成調平並啟動旋轉模式。



在牆上標出雷射光束的高度，此即為 **X1** 高度。此時，請您視需要使用雷射接收器 (37)。
將測量工具旋轉 180°，但不用再改變測量工具的高度和位置。
稍候片刻，讓測量工具完成調平並啟動旋轉模式。



在牆上標出雷射光束的高度，此即為 **X2** 高度。此時，請您視需要使用雷射接收器 (37)。請注意：**X2** 高度應儘可能位於 **X1** 的正上方或正下方。



請找出所標示之 **X1** 高度及 **X2** 高度之間的正中間位置，然後在牆上將它標為 **X3** 高度。
利用向下傾斜按鈕 (5) 或向上傾斜按鈕 (15)，調整可變雷射光束 (8)，使其高度儘可能正好對準 **X3** 高度。此時，請您視需要使用雷射接收器 (37)。
按一下手動模式按鈕 (14)，以便儲存 X 軸校正結果。X 軸狀態指示器 (7) 將呈綠色並閃爍 6 次，以示確認。

校正 Y 軸：

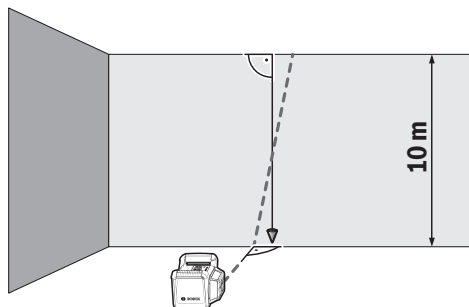
完成 X 軸校正之後，測量工具將自動切換至 Y 軸校正模式。Y 軸狀態指示器 (6) 隨即呈綠色閃爍狀態，而震動警告功能指示器 (13) 則是呈紅色閃爍 (每秒 2 次)。

將測量工具旋轉 90°，使測量工具上印刻的 Y 軸指示器與牆面呈直角。接下來請您比照 X 軸的方式進行校正。

儲存好 Y 軸校正後，Y 軸狀態指示器 (6) 將呈綠色並閃爍 6 次。校正模式隨即自動結束。

校正 Z 軸

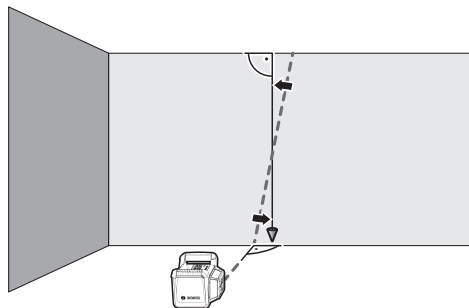
請到高度 10 m 牆面前，在穩固地面上找出一段無障礙的測量距離。在牆上固定一條鉛垂線。



以直擺方式將測量工具放置在穩固的平坦基座上。啟動測量工具，然後讓它進行水平面調整。調整測量工具位置，使可變雷射光束呈直角落於牆面上並且與鉛垂線相交。關閉測量工具。

若要啟動校正模式，請按住手動模式按鈕 (14) 不放，並且再短按一下電源按鈕 (3)。如果 X 軸狀態指示器 (7) 呈綠色閃爍且震動警告功能指示器 (13) 呈紅色閃爍 (每秒 2 次)，先放開傾斜設定按鈕。

測量工具隨即以 Z 軸校正模式啟動。稍候片刻，讓測量工具完成調平並啟動旋轉模式。



調整可變雷射光束的位置，使其儘可能與鉛垂線平行。若要這樣做，請按壓向下傾斜按鈕 (5) 或向上傾斜按鈕 (15)。

若無法將雷射光束調成與鉛垂線平行，則請測量工具調得更與牆面對齊，然後再重頭開始執行校正程序。

將雷射光束調成平行之後，按一下手動模式按鈕 (14)，即可儲存校正結果。X 軸狀態指示器 (7) 將呈綠色並閃爍 6 次，以示確認。

已儲存好 Z 軸校正並自動結束校正模式。

作業注意事項

- ▶ 一律只能標示雷射點/雷射標線的中心位置。雷射點的大小或雷射線段的寬度會隨著距離而改變。

使用雷射靶進行測量 (請參考圖 A)

雷射標靶 (47) 可增強雷射光束在不利條件下以及距離較長時的能見度。

雷射標靶 (47) 有一半具反射作用，它可增強雷射標線的能見度，另一半則是可透光，讓您從雷射標靶背面也能看清楚雷射標線。

使用三腳架 (配件) 進行測量

三腳架可為您提供一個可調整高度的穩固測量基座。透過 5/8" 三腳架固定座 (17)，將測量工具安裝至三腳架 (39) 的螺紋孔上。利用三腳架的止付螺絲，將測量工具旋緊固定。

三腳架的伸縮部位上若有尺寸刻度，即可直接調整高度落差。

在啟動測量工具之前，先大略地調整好三腳架的位置。

使用掛牆托架 WM 24 進行作業 (配件) (請參考圖 B)

您可利用具有校正器的掛牆托架 (42) 測量工具固定於牆上。如果作業位置高於三腳架伸縮部位的高度，或是在不穩固的基座上作業又無三腳架時等情況下，建議您使用掛牆托架。

使用固定螺絲 (40) 將掛牆托架 (42) 旋緊固定在木條上。安裝掛牆托架時，應該使它儘量在牆面上垂直，並請注意固定要確實牢靠。

將掛牆托架的 5/8" 螺絲 (43) 鎖到測量工具在三腳架固定座 (17) 中。

已裝上的測量工具可在校正器的輔助之下在 23 cm 的範圍內調整高度。其做法是：鬆開校正器上的螺絲 (41)，將測量工具滑移至所需位置，然後再將螺絲 (41) 重新旋緊。

使用雷射接收器進行作業 (配件)

在不利照明條件之下 (周圍環境明亮、陽光直射) 且距離又較遠時，為能更容易捕捉雷射標線，請使用雷射接收器 (37)。

旋轉式雷射測量儀若是具有多種操作模式，請選擇水平模式或垂直模式，並旋轉速度調至最高。

使用雷射接收器時必須詳讀並遵循接收器的使用說明書。

使用測量標竿 (配件) 進行測量 (請參考圖 C)

若要檢查平整度或轉移坡度，建議使用測量標竿 (38) 並搭配雷射接收器。

測量標竿 (38) 的上部標有相對尺寸刻度。您可以使用下部的伸縮部位預調零位高度。這樣您可以直接讀取標準高度的偏差值。

雷射視鏡 (配件)

雷射視鏡可過濾掉周圍環境的光線。因此，您的眼睛看到雷射光時會覺得較亮。

▶ **請勿將雷射眼鏡當作護目鏡使用。**雷射眼鏡是用來讓您看清楚雷射光束；但它對於雷射光照射並沒有保護作用。

▶ **請勿將雷射眼鏡當作護目鏡使用，或在道路上行進間使用。**雷射眼鏡無法完全阻隔紫外線，而且還會降低您對於色差的感知能力。

操作範例**移植/檢查高度 (請參考圖 D)**

以橫擺方式將本測量工具放置在一個穩固的基座上，或將它安裝在三腳架 (39) (配件) 上。

使用三腳架作為：把雷射光束調至所需高度上。移植或檢查目標地點的高度。

作業時不使用三腳架：藉助雷射標靶 (47)，確認出雷射光束與基準點高度之間的高度差距。把測量出來的高度差距轉載到目標地點，或在目標地點上檢查高度差距。

向上鉛垂點平行調整/轉移直角 (請參考圖 E)

若要轉移直角或對齊隔間牆，您必須平行調整向上鉛垂點 (11)，也就是與參考線 (例如牆面) 等距。其做法是：將測量工具架設成直擺方式，並調整其位置使向上鉛垂點大致與參考線平行。

為確保定位準確，請您利用雷射標靶 (47) 直接在測量工具上測量向上鉛垂點與參考線之間的距離。接著到距離測量工具比較遠的地方，再度測量向上鉛垂點與參考線的距離。調整向上鉛垂點的位置，使它與參考線之間相隔您之前直接在測量工具上測得的距離。

可變雷射光束 (8) 將為您顯示與向上鉛垂點 (11) 呈直角的位置。

直立面/垂直平面指示器 (請參考圖 F)

若要顯示直立面，請以直擺方式架設測量工具。如果垂直平面與參考線 (例如牆面) 呈直角，那麼請您將向上鉛垂點 (11) 對齊參考線。

直立面是以可變雷射光束 (8) 顯示。

調整直立面/垂直平面 (請參考圖 G)

若要將某一基準點上的垂直雷射標線或旋轉平面對齊牆面，請以直擺方式架設測量工具，並將雷射標線或旋轉平面大致對準基準點。若欲精確對準在基準點上，請沿 Y 軸轉動旋轉平面 (參見「在直擺狀態下，轉動旋轉平面」，頁 36)。

作業時不使用雷射接收器 (請參考圖 H)

在有利照明條件之下 (周圍環境昏暗) 且距離又較短時，您作業時可不必使用雷射接收器。為提高雷射光束的能見度，請您選用線形模式，或者選用點形模式並將雷射光束旋轉至對準目標地點。

作業時使用雷射接收器 (請參考圖 I)

在不利照明條件之下 (周圍環境明亮、陽光直射) 且距離又較遠時，為能更容易捕捉雷射光束，請使用雷射接收器 (37)。使用雷射接收器時，必須選擇旋轉模式並且使用最高轉速。

遠距離測量 (請參考圖 J)

進行遠距離測量時，必須使用雷射接收器 (37) 以便捕捉雷射光束。為了降低干擾，一律應將測量工具架設在工作平面的正中央以及三腳架上。

戶外作業 (請參考圖 C)

在戶外作業時，一律要使用雷射接收器 (37)。

在不穩固的地面上作業時，請您將測量工具安裝在三腳架 (39) 上。作業時一律啟用震動警告功能，以

防止萬一測量工具在地面上滑動或發生晃動時導致誤測。

指示器一覽表

	雷射光束	雷射光束旋轉 ^{A)}	X		Y		紅色	紅色
			綠色	紅色	綠色	紅色		
啟動測量儀 (1 秒鐘自我檢測)				每秒 3 次		每秒 3 次	每秒 3 次	每秒 3 次
休眠模式	○	○		每秒 1 次		每秒 1 次	每秒 1 次	每秒 1 次
調平								
調平	*	○	*		*			
重新調平	○	○	*		*			
超過自動調平範圍				*		*		
測量工具已準備就緒，兩軸都已完成調平	●	●	●		●			
震動警告								
震動警告已觸發	*	○		*		*		*
震動警告關閉								●
電池電壓								
電池電壓過低							●	
電池耗盡							*	
傾斜模式/手動模式								
X 軸可調傾斜度 Y 軸已完成調平	○	○		*	●			
X 軸手動 Y 軸已完成調平	●	●		●	●			
X 軸已完成調平 Y 軸可調傾斜度	○	○	●			*		
X 軸已完成調平 Y 軸手動	●	●	●			●		
X 軸可調傾斜度 Y 軸手動	○	○		*		●		
X 軸手動 Y 軸可調傾斜度	○	○		●		*		
X 軸手動 Y 軸手動	●	●		●		●		
校正								
X 軸校正模式 (橫擺)				每秒 2 次				每秒 2 次
X 軸校正已儲存				*				
Y 軸校正模式						每秒 2 次		每秒 2 次
Y 軸校正已儲存						*		

	雷射光束	雷射光束 旋轉 ^{A)}	X		Y		Z	
			綠色	紅色	綠色	紅色	紅色	紅色
Z 軸校正模式 (直擺)			每秒 2 次					每秒 2 次
Z 軸校正已儲存			* (6 個)					
校正 X 軸或 Z 軸時發生錯誤				*				
校正 Y 軸時發生錯誤						*		
重設								
如有必要請重新啟動，請利用電源按鈕 (3) 將測量工具關閉後再重新啟動。				每秒 3 次		每秒 3 次		

A) 在線形模式和旋轉模式下

● : 連續旋轉

* 閃爍

每秒 2 次 : 閃爍頻率 (範例)

○ : 功能已停止

維修和服務

維修和清潔

測量工具與遙控器應隨時保持乾淨。

測量工具與遙控器嚴禁沉入水中或其他任何液體中。

使用柔軟濕布擦除儀器上的污垢。切勿使用清潔劑或溶液。

務必定期清潔測量工具上的雷射射出口，清潔時射出口不可殘留毛絮。

儲放和搬運測量工具時，一定要將它放進箱 (48) 內。

如需送修，請將測量工具放入提箱 (48) 後，再轉交給相關單位。

顧客服務處和顧客諮詢中心

本公司顧客服務處負責回答有關本公司產品的維修、維護和備用零件的問題。以下的網頁中有分解圖和備用零件相關資料：www.bosch-pt.com

如果對本公司產品及其配件有任何疑問，博世應用諮詢小組很樂意為您提供協助。

當您需要諮詢或訂購備用零件時，請務必提供本產品型號銘牌上 10 位數的產品機號。

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한국어

회전 레이저 레벨기 관련 안전 수칙



측정공구의 안전한 사용을 위해 모든 수칙들을 숙지하고 이에 유의하여 작업하시기 바랍니다. 측정공구를 해당 지침에 따라 사용하지 않으면, 측정공구에 내장되어 있는 안전장치에 안 좋은 영향을 미칠 수 있습니다. 측정공구의 경고판을 절대로 가려서는 안 됩니다. 안전 수칙을 잘 보관하고 공구 양도 시 측정공구와 함께 전달하십시오.

▶ 본 측정공구는 레이저 경고 스티커가 함께 공급됩니다(그림에 측정공구의 주요 명칭 표시).

- ▶ 처음 사용하기 전에 함께 공급되는 한국어로 된 레이저 경고 스티커를 독문 경고판 위에 붙이십시오.
- ▶ 측정공구에 레이저 발사구가 경고 스티커와 함께 표시되어 있습니다. 측정공구 사용 시 공구 위치에 유의하십시오.
- ▶ 처음 사용하기 전에 함께 공급되는 한국어로 된 해당 스티커를 독문 경고판 위에 붙이십시오.
- ▶ 주의 - 여기에 제시된 조작 장치 또는 조정 장치 외의 용도로 사용하거나 다른 방식으로 작업을 진행하는 경우, 광선으로 인해 폭발될 위험이 있습니다.
- ▶ 레이저 장치를 개조하지 마십시오.



레이저 광선을 사람이나 동물에게 비추거나, 직접적으로 광선을 보지 마십시오. 본 측정공구는 유럽 표준 EN 60825-1에 따른 레이저 등급 3R의 광선을 만들어 냅니다. 레이저빔 안으로 직접 들여다 보면 먼 먼 거리에서라도 눈에 손상을 입을 수 있습니다.

- ▶ 레이저 보안경을 일반 보안경으로 사용하지 마십시오. 레이저 보안경은 레이저 광선을 보다 잘 감지하지만, 그렇다고 해서 레이저 광선으로부터 보호해주는 것은 아닙니다.
- ▶ 레이저 보안경을 선글라스 용도 또는 도로에서 사용하지 마십시오. 레이저 보안경은 자외선을 완벽하게 차단하지 못하며, 색상 분별력을 떨어뜨립니다.
- ▶ 측정공구의 수리는 해당 자격을 갖춘 전문 인력에게 맡기고, 수리 정비 시 순정 부품만 사용하십시오. 이 경우에만 측정공구의 안전성을 오래 유지할 수 있습니다.
- ▶ 어린이가 무감독 상태로 레이저 측정공구를 사용하는 일이 없도록 하십시오. 의도치 않게 사람의 눈이 부시게 할 수 있습니다.
- ▶ 창문이나 거울 등 매끄러운 표면에 레이저빔이 반사되지 않도록 하십시오. 또한 반사된 레이저빔으로 인해 눈이 손상될 수 있습니다.
- ▶ 측정공구는 반드시 측정기기의 사용법을 잘 아는 사람만 사용해야 합니다. EN 60825-1에 따라 레이저가 눈과 피부에 미치는 생물학적 작용을 알고, 위험을 방지하기 위해 레이저 안전장치를 사용할 수 있어야 합니다.
- ▶ 가연성 유체나 가스 혹은 분진 등 폭발 위험이 있는 곳에서 측정공구를 사용하지 마십시오. 측정공구에 분진이나 증기를 접화하는 스파크가 생길 수 있습니다.
- ▶ 항상 레이저빔이 눈 높이 이상이나 이하로 지나가도록 측정공구를 설치하십시오. 그렇게 하면 눈이 손상되는 것을 예방할 수 있습니다.
- ▶ 적당한 레이저 경고판을 사용하여 측정공구를 사용하는 범위를 표시하십시오. 그렇게 하면 작업과 관계 없는 사람이 위험한 범위로 오는 것을 방지할 수 있습니다.
- ▶ 작업과 관계 없는 사람이 드나드는 곳에 측정공구를 보관하지 마십시오. 측정공구를 제대로 사

용하지 못하는 사람이 자신과 다른 사람을 다치게 할 수 있습니다.

- ▶ 레이저 등급 3R인 측정공구를 사용할 때 적용되는 국내 규정을 준수하십시오. 이러한 규정을 준수하지 않으면 상해를 입을 수 있습니다.
- ▶ 레이저빔이 발사되는 부위를 지키거나 차단하도록 하십시오. 레이저빔 발사를 특정한 범위로 제한하면 작업과 관계 없는 사람의 눈이 다치게 되는 것을 예방할 수 있습니다.
- ▶ 측정공구가 켜져 있는 상태에서 자리를 비우지 말고, 사용 후에는 측정공구의 스위치를 끄십시오. 레이저빔으로 인해 다른 사람의 눈을 일시적으로 안 보이게 할 수 있습니다.
- ▶ 방사선원을 관찰하기 위해 쌍안경 또는 확대경과 같이 광학식으로 초점이 모아지는 도구를 사용하지 마십시오. 이로 인해 눈이 손상될 수 있습니다.



자성 액세서리를 심장 박동 조절장치 또는 인슐린 펌프와 같은 삽입물 및 기타 의학 기기 근처로 가져오지 마십시오. 액세서리의 자석으로 인해 자기장이 형성되어 삽입물 또는 의학 기기의 기능에 장애를 일으킬 수 있습니다.

- ▶ 자성 액세서리를 자기 데이터 매체나 자력에 예민한 기기에서 멀리 두십시오. 액세서리의 자석으로 인해 데이터가 손실되어 복구되지 않을 수 있습니다.

리모컨 관련 안전 수칙



제시된 모든 지침을 숙지하고 이를 준수해야 합니다. 리모컨을 해당 지침에 따라 사용하지 않으면, 리모컨에 내장되어 있는 안전장치에 안 좋은 영향을 미칠 수 있습니다. 본 설명서를 잘 보관하시기 바랍니다.

- ▶ 리모컨의 수리는 해당 자격을 갖춘 전문 인력에게 맡기고, 수리 정비 시 순정 부품만 사용하십시오. 이 경우에만 리모컨의 안전성을 오래 유지할 수 있습니다.
- ▶ 가연성 액체, 기체 또는 분진이 존재하는 폭발 위험이 있는 환경에서는 리모컨을 이용해 작업하지 마십시오. 리모컨에 분진이나 증기에 접화하는 불꽃이 생길 수 있습니다.

제품 및 성능 설명

사용 설명서 앞 부분에 제시된 그림을 확인하십시오.

규정에 따른 사용

회전 레이저

본 측정공구는 정확히 수직인 높이나 직선의 거리, 기준선 및 연추점을 계산하고 확인하는 데 사용해야 합니다.

측정공구는 실내 및 실외에서 모두 사용할 수 있습니다.

리모컨

리모컨은 적외선으로 **Bosch** 회전 레이저를 제어하기 위한 용도로 사용됩니다.

본 리모컨은 실내 및 야외에서 모두 사용 가능합니다.

제품의 주요 명칭

그림의 부품에 매겨진 번호는 그래픽 페이지의 측정 공구 및 리모컨 그림에 해당됩니다.

회전 레이저

- (1) 배터리 케이스 잠금쇠^{A)}
- (2) 배터리 케이스^{A)}
- (3) 전원 버튼
- (4) 회전 모드 버튼
- (5) 하향 경사 버튼
- (6) Y축 상태 표시기
- (7) X축 상태 표시기
- (8) 가변 레이저빔
- (9) 리모컨 센서
- (10) 레이저빔 발사구
- (11) 상향 수직점
- (12) 배터리 경고 표시
- (13) 충격 경고 기능 표시기
- (14) 수동 모드 버튼
- (15) 상향 경사 버튼
- (16) 라인 모드 버튼
- (17) 삼각대 연결 부위 5/8"
- (18) 일련 번호
- (19) 레이저 경고판
- (20) 발사구 레이저 경고판

A) 도면이나 설명서에 나와있는 액세서리는 표준 공급부품에 속하지 않습니다. 전체 액세서리는 저희 액세서리 프로그램을 참고하십시오.

리모컨

- (21) 리모컨^{A)}
- (22) X- 경사 버튼
- (23) 시계 반대 방향 회전 버튼
- (24) Y+ 경사 버튼
- (25) X+ 경사 버튼
- (26) 회전 모드 버튼
- (27) 적외선 발사구
- (28) 신호 송신 표시기
- (29) 휴지 모드(스탠바이) 버튼
- (30) 라인 모드 버튼
- (31) 수동 모드 버튼
- (32) Y- 경사 버튼
- (33) 시계 방향 회전 버튼
- (34) 일련 번호

(35) 배터리 케이스 덮개 잠금쇠

(36) 배터리 케이스 덮개

A) 도면이나 설명서에 나와있는 액세서리는 표준 공급부품에 속하지 않습니다. 전체 액세서리는 저희 액세서리 프로그램을 참고하십시오.

액세서리/부품

- (37) 레이저 수광기^{A)}
- (38) 측량 막대^{A)}
- (39) 삼각대^{A)}
- (40) 벽면 홀더의 고정 나사^{A)}
- (41) 조준장치의 나사^{A)}
- (42) 벽면 홀더/조준장치^{A)}
- (43) 벽면 홀더의 5/8" 나사^{A)}
- (44) 자석^{A)}
- (45) 레이저 수광기 홀더^{A)}
- (46) 레이저용 안경^{A)}
- (47) 레이저 표적판^{A)}
- (48) 케이스^{A)}

A) 도면이나 설명서에 나와있는 액세서리는 표준 공급부품에 속하지 않습니다. 전체 액세서리는 저희 액세서리 프로그램을 참고하십시오.

제품 사양

회전 레이저	GRL 350 HV
제품 번호	3 601 K61 S..
작업 범위 (직경) ^{A)B)}	
- 레이저 수광기 없이 작업할 경우, 약	60 m
- 레이저 수광기를 사용하여 작업할 경우, 약	350 m
레벨링 정확도 ^{A)C)}	
- 수평	±1.5 mm/30 m
- 수직	±3 mm/30 m
레벨링 범위, 평균	±8 % (±4.6°)
레벨링 시간, 평균	30 초
회전 속도	0/150/300/600 min ⁻¹
라인 모드에서 구경 각도	10/25/50°
수동 모드에서 경사 범위	±8 %
작동 온도	-10 °C ... +50 °C
보관 온도	-20 °C ... +70 °C
기준 높이를 초과한 최대 사용 높이	2000 m
상대 습도 최대	90 %
IEC 61010-1에 따른 오염도	2 ^{D)}
레이저 등급	3R
레이저 유형	630-650 nm, < 5 mW
편차	0.4 mrad (전체 각도)
수평 삼각대 연결 부위	5/8"-11

회전 레이저	GRL 350 HV
배터리(알칼리 망간)	2 × 1.5 VLR20 (D)
작동 시간, 약	30 시간
EPTA-Procedure 01:2014에 따른중량	1.8 kg
치수(길이 × 폭 × 높이)	187 × 182 × 170 mm
보호 유형(배터리 케이스 제외)	IP 56(먼지 및 분무수 침투 방지)

- A) 20 °C일 경우
 - B) 직사광선 등의 불리한 환경 조건에서는 작업 범위가 줄어들 수 있습니다.
 - C) 축을 따라서
 - D) 비전도성 오염만 발생하지만, 가끔씩 이슬이 맺히면 임시로 전도성이 생기기도 합니다.
- 측정공구를 확실하게 구분할 수 있도록 타입 표시판에 일련 번호(18)가 적혀 있습니다.

리모컨	RC 4
제품 번호	3 601 K69 S..
작업 범위 ^{A)}	30 m
작동 온도	-10 °C ... +50 °C
보관 온도	-20 °C ... +70 °C
기준 높이를 초과한 최대 사용 높이	2000 m
상대 습도 최대	90 %
IEC 61010-1에 따른 오염도	2 ^{B)}
배터리(알칼리 망간)	2 × 1.5 VLR6 (AA)
EPTA-Procedure 01:2014에 따른중량	0.11

- A) 직사광선 등의 불리한 환경 조건에서는 작업 범위가 줄어들 수 있습니다.
 - B) 비전도성 오염만 발생하지만, 가끔씩 이슬이 맺히면 임시로 전도성이 생기기도 합니다.
- 리모컨을 확실하게 구분할 수 있도록 타입 표시판에 일련 번호(34)가 적혀 있습니다.

조립

리모컨의 전원 공급

리모컨 작동에는 알칼리 망간 배터리를 사용할 것을 권장합니다.

배터리 케이스 덮개 (36)를 열려면 잠금쇠 (35)를 누른 뒤 배터리 케이스 덮개를 분리하십시오. 배터리를 끼우십시오.

이때 전극이 배터리 케이스 안쪽에 나와있는 것처럼 올바르게 끼워야 합니다.

모든 배터리는 항상 동시에 교체하십시오. 한 제조사의 용량이 동일한 배터리로만 사용하십시오.

- ▶ **오랜 기간 사용하지 않을 경우 리모컨의 배터리를 빼두십시오.** 리모컨에 배터리를 오래 두면 부식되고 방전될 수 있습니다.

측정공구 전원 공급

측정공구 작동에는 알칼리 망간 배터리를 사용할 것을 권장합니다.

배터리 케이스 덮개 (2)를 분리하려면 잠금쇠 (1)를 위치로 돌리십시오. 측정공구에서 배터리 케이스 덮개를 당긴 후 배터리를 끼우십시오.

이때 전극이 배터리 케이스 안쪽에 나와있는 것처럼 올바르게 끼워야 합니다.

배터리 케이스 (2)를 측정공구에 끼우고, 잠금쇠 (1)를 위치로 돌리십시오.

배터리가 약해지면, 배터리 경고 표시 (12)가 적색으로 점등됩니다. 측정공구는 대략 2 시간 정도 더 작동 가능합니다.

배터리 경고 표시 (12)가 적색으로 깜박이면, 측정공구가 5 분 후에 자동으로 꺼집니다.

모든 배터리는 항상 동시에 교체하십시오. 한 제조사의 용량이 동일한 배터리로만 사용하십시오.

- ▶ **오랜 기간 사용하지 않을 경우 측정공구의 배터리를 빼두십시오.** 배터리를 측정공구에 오래 두면 부식되고 방전될 수 있습니다.

작동

- ▶ **측정공구 및 리모컨이 물에 젖거나 직사광선에 노출되지 않도록 하십시오.**

- ▶ **극한의 온도 또는 온도 변화가 심한 환경에 측정공구 및 리모컨을 노출시키지 마십시오.** 예를 들어 장시간 차량 안에 기기를 두지 마십시오. 온도 변화가 심한 경우 측정공구 및 리모컨을 작동시키기 전에 먼저 온도에 적응할 수 있게 하십시오. 측정공구를 이용하여 계속 작업하기 전에 항상 정확도를 점검해야 합니다 (참조 „측정공구의 정확도 점검“, 페이지 48).

극심한 온도에서나 온도 변화가 심한 환경에서 사용하면 측정공구의 정확도가 떨어질 수 있습니다.

- ▶ **측정공구가 외부와 세계 부딪히거나 떨어지지 않도록 주의하십시오.** 측정공구에 외부 영향이 심하게 가해진 후에는 계속 작업하기 전에 항상 정확도를 점검해야 합니다 (참조 „측정공구의 정확도 점검“, 페이지 48).

- ▶ **측정공구가 넘어지면서 레이저 케이스가 파손된 경우, 조심하십시오.** 케이스의 파손된 모서리로 인해 다칠 수 있습니다.

리모컨 시동

조작 버튼을 누르면 측정공구가 레벨링 중에 벗어나 회전이 잠시 중단될 수 있습니다. 리모컨을 사용하면 이러한 경우를 방지할 수 있습니다.

배터리가 삽입되어 있는 동안 배터리에 남아 있는 전압이 충분하면, 리모컨은 항상 작동할 수 있습니다.

리모컨 신호가 센서 (9) 중 하나에 바로 도달할 수 있도록 측정공구를 세우십시오. 리모컨을 바로 센서에 맞춰 조준할 수 없는 경우, 작업 범위가 줄어들거나, (벽면 등에서) 신호 반사가 이루어져 간접적인

신호에서도 신호 도달 범위가 더 넓어질 수 있습니다.

리모컨에 있는 버튼을 누르면, 신호 송신 표시기 (28) 가 점등되어 신호가 송신되었음을 나타냅니다.

측정공구의 전원은 리모컨으로 켜거나 끌 수 없습니다.

회전 레이저 레벨기 시동

▶ 레이저빔을 반사하거나 방해할 수 있는 장애물을 작업 영역 가까이 두지 마십시오. 반사되는 표면 또는 광택이 나는 표면 등은 가려주십시오. 유리판 또는 이와 유사한 소재를 관통하여 측정하지 마십시오. 레이저빔이 반사되거나 방해 받아 측정 결과가 부정확할 수 있습니다.

측정공구 설치하기



수평 위치



수직 위치

측정공구를 수평 또는 수직 위치로 안정적인 받침대에 세우고, 삼각대 (39) 또는 벽면 홀더 (42) 에 조준장치와 함께 장착하십시오.

레벨링 정확도가 높기 때문에 측정공구가 진동이나 위치 변경에 아주 민감하게 반응합니다. 그러므로 다시 레벨링을 진행하여 작동이 중단되지 않도록 하려면, 측정공구가 안정된 위치에 있도록 하십시오.

전원 스위치 작동

지침: 첫 시동 후 작업을 시작하기 전에 항상 정확도를 점검하십시오 (참조 „측정공구의 정확도 점검“, 페이지 48).

측정공구의 전원을 켜려면 전원 버튼 (3) 을 누르십시오. 전체 표시기가 빠른 주기 (초당 3회)로 적색으로 깜박입니다. 측정공구에서 가변 레이저빔 (8) 을 내보내고, 발사구 (10) 에서 상향 수직점 (11) 을 발사합니다.

▶ 레이저빔이 사람이나 동물에 향하지 않도록 하고, 먼 거리에서라도 레이저빔 안을 들여다 보지 마십시오.

측정공구가 즉시 자동 레벨링을 하기 시작합니다. 레벨링이 진행되는 도중에는 X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 녹색으로 깜박이고, 레이저가 포인트 모드에서 깜박입니다.

X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 계속 녹색으로 점등되고 레이저가 계속 점등되면, 측정공구가 레벨링되었음을 나타냅니다. 레벨링 작업을 마치고 나면 측정공구가 자동으로 회전 모드가 됩니다.

▶ 측정공구가 켜져 있는 상태에서 자리를 비우지 말고, 사용 후에는 측정공구의 스위치를 끄십시오. 레이저빔으로 인해 다른 사람의 눈이 부실 수 있습니다.

측정공구의 전원을 끄려면 전원 버튼 (3) 을 누르십시오.

휴지 모드(스탠바이)

작업을 중지한 경우 리모컨 (21) 을 이용해 측정공구를 휴지 모드로 전환할 수 있습니다. 모든 설정 내역이 저장되며, 충격 경고 기능은 활성화된 상태로 그대로 유지됩니다.

휴지 모드를 켜려면 리모컨에서 휴지 모드 버튼 (29) 을 누르십시오. 측정공구의 전체 표시기가 느린 주기(초당 1회)로 깜박입니다.

휴지 모드를 끄려면 휴지 모드 버튼 (29) 을 누르십시오. 측정공구의 전원 버튼 (3) 을 짧게 눌러서도 휴지 모드를 종료할 수 있습니다.

작동 모드

X축 및 Y축의 경로

X축 및 Y축은 하우징의 회전 헤드 위쪽에 표시되어 있습니다.

작동 모드 개요

측정공구의 수평 및 수직 위치에서 3가지 작동 모드를 모두 실행할 수 있습니다.



회전 모드

회전 작동 모드는 특히 레이저 수광기 사용 시 권장합니다. 다양한 회전 속도 중에서 선택할 수 있습니다.



라인 모드

이 작동 모드에서는 가변 레이저빔이 제한된 구경 각도로 움직입니다. 그렇기 때문에 레이저빔이 회전 작동 모드에 비해 더 잘 보입니다. 다양한 구경 각도 중에서 선택할 수 있습니다.



포인트 모드

이 작동 모드에서는 가변 레이저빔이 아주 잘 보입니다. 간단하게 높이를 측정하거나 일직선 정렬 여부를 검사하는 데 사용하면 좋습니다.

라인 모드 및 포인트 모드는 레이저 수광기 (37) 를 이용하는 경우에는 적합하지 않습니다.



회전 모드/포인트 모드

전원을 켜면 항상 측정공구는 표준 회전 속도 (300 min⁻¹)가 적용된 회전 모드에 있습니다.

라인 모드에서 회전 모드 또는 포인트 모드로 전환하려면, 회전 모드 버튼 (4) 또는 리모컨의 회전 모드 버튼 (26) 을 누르십시오.

회전 속도를 변경하려면, 원하는 속도에 도달할 때까지 회전 모드 버튼 (4) 또는 리모컨의 회전 모드 버튼 (26) 을 누르십시오. 버튼을 누를 때마다 회전 속도가 단계적으로 높아집니다. 가장 높은 속도 단계를 넘어가면 측정공구는 잠시 후 포인트 모드로

전환됩니다. 회전 모드 버튼을 다시 한번 누르면, 가장 낮은 속도가 적용된 회전 모드로 되돌아갑니다. 레이저 수광기를 사용하여 작업할 경우, 최고 회전 속도를 선택해야 합니다. 레이저 수광기 없이 작업하는 경우, 레이저빔의 시야 확보를 개선할 수 있도록 회전 속도를 줄이고, 레이저 보안경 (46) 을 사용하십시오.

▽ 라인 모드

라인 모드로 전환하려면, 라인 모드 버튼 (16) 또는 리모컨의 라인 모드 버튼 (30) 을 누르십시오. 구경 각도를 변경하려면, 원하는 작동 모드가 나올 때까지 라인 모드 버튼 (16) 또는 리모컨의 라인 모드 버튼 (30) 을 누르십시오. 버튼을 누를 때마다 구경 각도가 단계적으로 커지는 동시에 모든 단계에서 회전 속도가 높아집니다.

지침: 관성으로 인해 레이저가 레이저 라인의 종료 지점을 넘어갈 수 있습니다.

기능

회전 평면 내에서 수평 위치의 라인/포인트 회전시키기

측정공구의 수평 위치에서 레이저 라인 또는 레이저 포인트를 레이저의 회전 평면 내에 위치시킬 수 있습니다. 360° 회전이 가능합니다.

시계 반대 방향으로 돌리려면, 측정공구의 하향 경사 버튼 (5) 또는 리모컨의 시계 반대 방향 버튼 (23) 을 누르십시오.

시계 방향으로 돌리려면, 측정공구의 상향 경사 버튼 (15) 또는 리모컨의 시계 방향 버튼 (33) 을 누르십시오.

수직 위치에서 회전 평면 회전시키기

측정공구의 수직 위치에서 레이저 포인트, 레이저 라인 또는 회전 평면을 $\pm 8\%$ 범위 내에서 간편한 일직선 정렬 또는 평행 조준을 위해 X축 주변을 회전시킬 수 있습니다.

시계 반대 방향으로 돌리려면, 측정공구의 하향 경사 버튼 (5) 또는 리모컨의 시계 반대 방향 버튼 (23) 을 누르십시오.

시계 방향으로 돌리려면, 측정공구의 상향 경사 버튼 (15) 또는 리모컨의 시계 방향 버튼 (33) 을 누르십시오.

자동 레벨링 기능

요약

전원을 켜면 측정공구는 수평 또는 수직 위치를 점검하고, 약 $\pm 8\%$ ($\pm 4.6^\circ$) 범위 내에서 수평도가 맞지 않는 부분을 자동으로 보정합니다.

레벨링이 진행되는 도중에는 X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 녹색으로 깜박이고, 레이저가 포인트 모드에서 깜박입니다.

X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 계속 녹색으로 점등되고 레이저가 계속 점등되면, 측정공구가 레벨링되었음을 나타냅니다. 레벨링 작업을 마치고 나면 측정공구가 자동으로 회전 모드가 됩니다.

전원을 켜 후 또는 위치를 변경한 후 측정공구가 8% 넘게 기울어진 경우, 더 이상 레벨링을 진행할 수 없습니다. 이 경우, X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 적색으로 깜박이고, 로터는 정지되며 레이저의 전원이 꺼집니다. 측정공구의 전원을 끄고, 공구를 최대한 수평(수평 위치) 또는 수직(수직 위치)으로 위치시킨 후 전원을 다시 켜십시오.

위치 변경

측정공구는 레벨링 진행 후, 항상 수평과 수직 위치를 확인합니다. 위치가 바뀌면 자동으로 다시 레벨링됩니다.

최소 위치 변경이 진행되면 공구의 작동 중단 없이 보정됩니다. 이에 따라 바닥면의 진동 또는 기상 영향은 자동으로 보상됩니다.

과도한 위치 변경이 진행되면 측정 오류를 피할 수 있도록 레벨링 과정이 진행되는 동안 레이저빔의 회전이 정지되고, 레이저의 전원이 꺼집니다. X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 녹색으로 깜박입니다. 경우에 따라 충격 경고 기능이 작동됩니다.

측정공구는 수평 위치 또는 수직 위치를 자동으로 감지합니다. **수평 위치와 수직 위치를 전환하려면** 측정공구의 전원을 끄고, 공구의 위치를 바꾼 후 다시 전원을 켜십시오.

⚡ 충격 경고 기능

측정공구에 충격 경고 기능이 있습니다. 이 기능은 위치 변경을 하거나 측정공구에 충격이 있는 경우 또는 바닥면이 진동하는 경우 변경된 위치에서 레벨링을 진행하여 측정공구의 이동으로 인해 오류가 발생하는 일이 없도록 해줍니다.

충격 경고 활성화: 기본적으로 충격 경고 기능이 켜져 있습니다. 이 기능은 측정공구의 전원을 켜 후 1 분 정도 지나면 활성화됩니다.

충격 경고 작동됨: 측정공구의 위치가 바뀌거나 강한 충격이 등록되면, 충격 경고가 작동됩니다: 레이저가 회전을 멈추고 레이저빔이 깜박입니다. 동시에 충격 경고 표시기 (13) 와 X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 적색으로 깜박입니다. 현재 작동 모드가 저장됩니다.

충격 경고가 작동하면 전원 버튼 (3) 을 짧게 누르십시오. 충격 경고 기능이 다시 작동하며 측정공구가 레벨링을 시작합니다. 측정공구가 레벨링을 마치면(X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 계속 점등됨), 저장된 작동 모드로 작동되기 시작합니다.

이제 기준점에서 레이저빔의 위치를 점검하고, 필요에 따라 높이 또는 측정공구의 조준 상태를 보정하십시오.

충격 경고 기능 끄기: 충격 경고 기능을 끄거나 켜려면 전원 버튼 (3) 을 한번 짧게 누르거나 충격 경고가 작동된 상태(충격 경고 표시기 (13) 적색으로 깜박임)를 두번 짧게 누르십시오. 충격 경고가 꺼진 상태에서 충격 경고 표시기 (13) 는 계속 적색으로 점등됩니다.

충격 경고 기능이 켜졌다면, 1 분 정도 지난 후 기능이 활성화됩니다.

지침: 리모컨을 이용해서는 충격 경고 기능을 켜고 끌 수 있으며, 새로 시작할 수 없습니다.

1축 경사 모드/수동 모드

측정공구의 자동 레벨링 기능을 끌 수 있습니다(수동 모드):

- 두 축의 수평 위치에서 개별적으로,
- X축의 수직 위치에서(Y축은 수직 위치에서 레벨링 불가능).

수동 모드에서 측정공구를 임의의 경사 위치에 세울 수 있습니다. 그 외에도 축을 측정공구의 ± 8 % 범위에서 서로 독립적으로 기울일 수 있습니다.

축 선택: 수동 모드를 시작하거나 기울여야 할 축을 선택하려면, 측정공구의 수동 모드 버튼 (14) 또는 리모컨의 수동 모드 (31) 를 누르십시오. X축 상태 표시기 (7) 또는 Y축 상태 표시기 (6) 에서 어떤 축을 레벨링할 수 없는지, 기울일 수 없는지 확인할 수 있습니다.

수동 모드 버튼 누르기	X축 상태		Y축 상태	
	녹색	적색	녹색	적색
1회 (수평 위치에서)		*	●	
1회 (수직 위치에서)		*	-	
2회	●			*
3회		*		●
4회		●		*
5회 (수평 위치에서)	*/●		*/●	
5회 (수직 위치에서)	*/●		-	

● 표시기 계속 점등

* 표시기 깜박임

- 표시기 꺼짐

축 기울이기: 경사 모드에서 또는 수동 모드에서 축 기울이기에는 축을 선택한 후 5 초 이내에 변경할 수 있습니다(축의 해당 상태 표시기가 적색으로 깜박이는 경우만). 상태 표시기가 계속 적색으로 점등되면, 경사가 정해진 것을 나타냅니다. 경사를 변경할 수 있도록, 원하는 축의 상태 표시기가 적색으로 깜박일 때까지 측정공구의 수동 모드 버튼 (14) 또는 리모컨의 수동 모드 (31) 를 누르십시오.

조정 가능한 축의 경사는 다음과 같이 변경할 수 있습니다:

- 측정공구에서: 하향 경사 버튼 (5) 을 누르면, 조정 가능한 축이 "-" 방향으로 기울어집니다. 상향 경사 버튼 (15) 을 누르면, 조정 가능한 축이 "+" 방향으로 기울어집니다.
- 리모컨에서: 경사 버튼 X+ (25) 또는 경사 버튼 X- (22) 을 누르면, X축이 "+" 방향 또는 "-" 방향으로 기울어집니다. 경사 버튼 Y+ (24) 또는 경사 버튼 Y- (32) 을 누르면, Y축이 "+" 방향 또는 "-" 방향으로 기울어집니다.

측정공구의 정확도 점검

다음에 제시된 작업은 관련 교육을 이수하고 자격을 갖춘 사람만 진행할 수 있습니다. 측정공구의 정확

도 점검 또는 캘리브레이션 진행 시 해당 규칙을 알고 있어야 합니다.

정확도에 미치는 영향

가장 큰 영향을 미치는 것은 주위 온도입니다. 특히 바닥에서 위로 가면서 달라지는 온도로 인해 레이저 빔이 굴절될 수 있습니다.

바닥 가까이에서 온도 변화가 가장 심하므로 20 m 이상의 거리를 측정할 경우 반드시 측정공구를 삼각대에 조립하여 사용해야 합니다. 또한 가능하면 측정공구를 작업 표면의 중심에 세우십시오.

편차는 측정 거리 약 20 m 이상의 경우부터 생기는 데, 측정 거리 100 m 경우 대개 20 m 거리의 편차보다 2배에서 4배까지 이를 수 있습니다.

외부 요인 외에도 장비에 따른 요인(예: 전복 또는 충격의 강도)에 따라 차이가 있을 수 있습니다. 따라서 작업을 시작하기 전마다 레벨링 정확도를 점검하십시오.

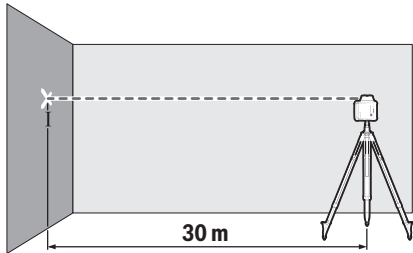
다음에 기술된 측정 진행 중에 측정공구가 최대 편차를 초과하면, (참조 „측정공구 캘리브레이션“, 페이지 49)을 통해 측정공구를 보정을 진행하거나 Bosch 고객 서비스 센터에서 점검을 받으십시오.

수평 위치에서 레벨링 정확도 점검하기

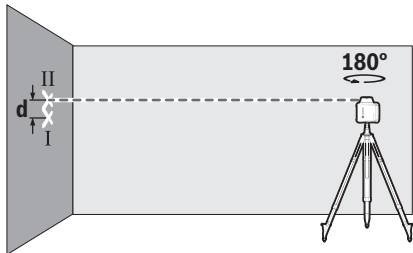
신뢰성 높고 정확한 결과를 얻으려면, 벽 앞에 단단한 바닥이 있는 30 m 구간의 빈 공간에서 점검하는

것이 좋습니다. 두 축에서 각각 한번씩 처음부터 끝까지 측정을 하십시오.

- 벽에서 수평으로 30 m 떨어진 거리에 삼각대에 측정공구를 조립하거나 단단하고 평평한 바닥에 놓으십시오. 측정공구의 전원을 켜십시오.



- 레벨링한 후 벽에서 레이저빔의 중간 지점을 표시하십시오(지점 I).



- 위치를 변경할 필요 없이 측정공구를 180° 회전시킵니다. 레벨링한 후 벽에서 레이저빔의 중간 지점을 표시하십시오(지점 II). 지점 II가 최대한 지점 I의 수직 위 또는 아래에 위치하는지 확인하십시오.

벽에 표시된 두 지점 I 및 II의 간격 **d**로 인해 측정된 축에 대해 측정공구의 실제 높이 편차가 생깁니다. 다른 축에서도 측정 과정을 반복하십시오. 이를 위해 측정 과정을 시작하기 전에 측정공구를 90° 회전시키십시오.

측정구간 30 m에서 허용되는 최대 편차는 다음과 같습니다:

$30\text{ m} \times \pm 0.05\text{ mm/m} = \pm 1.5\text{ mm}$. 두 번의 측정 과정을 진행할 때 모두 지점 I과 II 사이의 간격 **d**는 최대 3 mm입니다.

측정공구 캘리브레이션

다음에 제시된 작업은 관련 교육을 이수하고 자격을 갖춘 사람만 진행할 수 있습니다. 측정공구의 정확도 점검 또는 캘리브레이션 진행 시 해당 규칙을 알고 있어야 합니다.

- ▶ **최대한 정확하게 측정공구의 검교정을 진행하거나 Bosch 고객 서비스 센터에서 점검을 받으십시오.** 검교정이 부정확하게 진행되면 측정결과가 잘못 나올 수 있습니다.
- ▶ **측정공구의 검교정을 진행해야 하는 경우, 검교정만 시작하십시오.** 측정공구가 검교정 모드에 있으면, 마지막까지 최대한 정확하게 검교정을

진행해야 이후에 잘못된 측정 결과가 발생하지 않습니다.

캘리브레이션 후 레벨링 정확도를 점검하십시오

(참조 „측정공구의 정확도 점검“, 페이지 48). 편차가 허용되는 최대 수준의 값을 벗어나면, 측정공구를 **Bosch** 서비스 센터에서 점검 받으십시오.

항상 모든 축(X축, Y축 및 Z축)을 캘리브레이션하십시오.

지침: 캘리브레이션하는 동안 X축 상태 표시기 (7) 또는 Y축 상태 표시기 (6) 이 적색으로 깜박이면, 편차가 허용되는 최대 범위를 벗어난 것입니다. 이 경우 수동 모드 버튼 (14) 을 누르면, 설정 내역이 저장되지 않은 채로 캘리브레이션 모드를 끝냅니다. 그리고 나서 캘리브레이션에서 오류가 있음을 나타내기 위해 X축 상태 표시기 (7) 및 Y축 상태 표시기 (6) 가 초당 3회 적색으로 깜박입니다. 캘리브레이션을 다시 시작하십시오. 오류가 다시 발생하면, 측정공구를 **Bosch** 서비스 센터에서 점검 받으십시오.

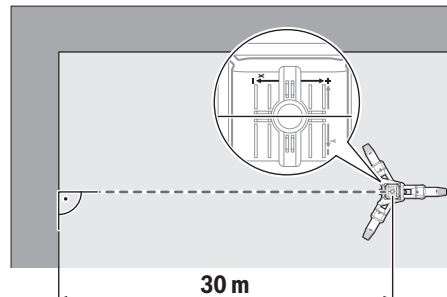
X축 및 Y축 캘리브레이션

캘리브레이션을 진행하려면 벽 앞에 단단한 바닥이 있는 30 m 구간의 빈 공간이 필요합니다.

(시야 확보가 힘든 경우와 같이) 필요에 따라 레이저빔 표시를 위해 레이저 수광기 (37) 를 이용하십시오. 레이저 수광기 사용 시 수광기가 벽에 수직으로 조준되어 있는지 세심하게 확인하십시오. 그렇지 않으면 해당 표시가 레이저빔 맞은편에 옮겨집니다. 수신 정확도 조절이 가능한 레이저 수광기의 경우, 원하는 캘리브레이션 정확도에 따라 설정할 수 있습니다(레이저 수광기의 사용 설명서 참조).

캘리브레이션을 위해 측정공구 설치 및 조준:

벽에서 수평으로 30 m 떨어진 거리에 삼각대 (39) 에 측정공구를 조립하거나 단단하고 평평한 바닥에 놓으십시오.



측정공구에서 암인 처리된 X축 표시기가 벽에 직각으로 세워지도록 측정공구를 맞추십시오.

캘리브레이션 시작:

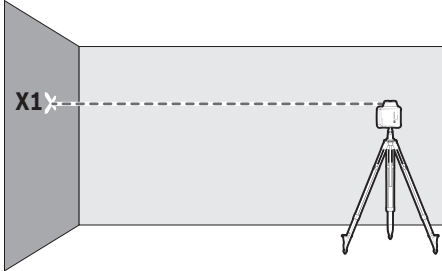
캘리브레이션을 시작하려면 측정공구의 전원이 꺼져 있어야 합니다.

측정공구의 수동 모드 버튼 (14) 을 누르고 있는 상태에서 추가로 전원 버튼 (3) 을 누르십시오. X축 상태 표시기 (7) 가 녹색으로 깜박이고, 충격 경고 기능 표시기 (13) 가 적색으로 깜박일 경우(각각 초당 2회)에만, 경사 설정 버튼에서 손을 떼십시오.

측정공구는 X축 캘리브레이션 모드에서 전원이 켜져 있습니다.

X축 캘리브레이션:

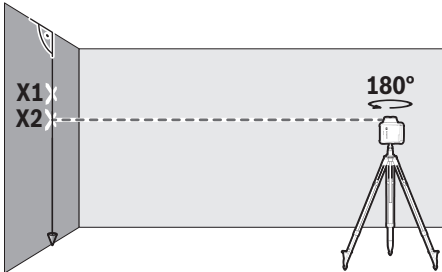
X축이 있는 측정공구가 벽에 직각으로 조준되어 있는지 확인하십시오. 측정공구가 레벨링되고, 회전 모드가 시작될 때까지 기다리십시오.



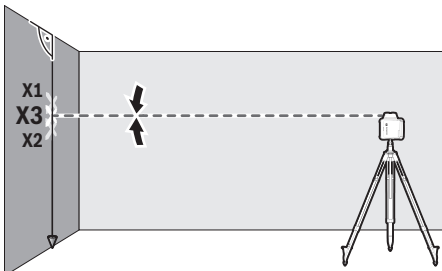
레이저빔의 높이를 벽에 높이 **X1**로 표시하십시오. 이를 위해 필요한 경우 레이저 수광기 (37)를 사용하십시오.

측정공구의 높이 및 위치를 변경할 필요 없이 측정공구를 180° 회전시키십시오.

측정공구가 레벨링되고, 회전 모드가 시작될 때까지 기다리십시오.



레이저빔의 높이를 벽에 높이 **X2**로 표시하십시오. 이를 위해 필요한 경우 레이저 수광기 (37)를 사용하십시오. 높이 **X2**가 최대한 높이 **X1**의 수직 위 또는 아래에 위치하는지 확인하십시오.



표시된 높이 **X1**과 **X2** 사이에서 중간 지점을 정확하게 확인하고, 벽에 높이 **X3**로 표시하십시오.

가변 레이저빔 (8)을 하향 경사 버튼 (5) 또는 상향 경사 버튼 (15)을 눌러 레이저빔이 최대한 정확하게 높이 **X3**에 오도록 조준하십시오. 이를 위해 필요한 경우 레이저 수광기 (37)를 사용하십시오.

수동 모드 버튼 (14)을 눌러 X축의 캘리브레이션을 저장하십시오. 확인을 위해 X축 상태 표시기 (7)가 녹색으로 6회 깜박입니다.

Y축 캘리브레이션:

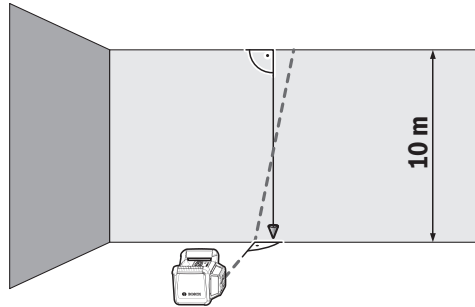
측정공구는 X축 캘리브레이션 후 자동으로 Y축 캘리브레이션 모드로 전환됩니다. Y축 상태 표시기 (6)가 녹색으로 깜박이고, 충격 경고 기능 표시기 (13)가 적색으로 깜박입니다(각각 초당 2회).

측정공구에서 압인 처리된 Y축 표시기가 벽에 직각으로 세워지도록 측정공구를 90° 회전시키십시오. 이후 X축에 기술된 내용과 같이 캘리브레이션을 진행하십시오.

Y축 캘리브레이션이 진행되면, Y축 상태 표시기 (6)가 녹색으로 6회 깜박입니다. 캘리브레이션 모드가 자동으로 종료됩니다.

Z축 캘리브레이션

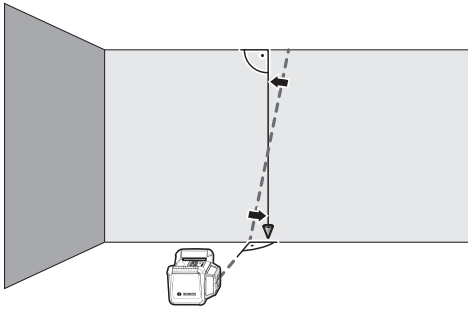
캘리브레이션을 진행하려면, 10 m 높이의 벽 앞에 단단한 바닥이 있는 빈 공간이 필요합니다. 벽에 다림줄을 고정시키십시오.



측정공구를 평평하고 단단한 바닥 위에 수직으로 세우십시오. 측정공구의 전원을 켜고 레벨링을 진행하십시오. 가변 레이저빔이 벽에 직각으로 하고 다림줄과 겹치도록 측정공구를 조준하십시오. 측정공구의 전원을 끄십시오.

캘리브레이션 모드를 시작하려면, 수동 모드 버튼 (14)을 누르고 있는 상태에서 추가로 전원 버튼 (3)을 누르십시오. X축 상태 표시기 (7)가 녹색으로 깜박이고, 충격 경고 기능 표시기 (13)가 적색으로 깜박일 경우(각각 초당 2회)에만, 경사 설정 버튼에서 손을 떼십시오.

측정공구는 Z축 캘리브레이션 모드에서 전원이 켜져 있습니다. 측정공구가 레벨링되고, 회전 모드가 시작될 때까지 기다리십시오.



레이저빔이 다림줄과 최대한 평행을 이루도록 가변 레이저빔을 조준하십시오. 이를 위해 하향 경사 버튼 (5) 또는 상향 경사 버튼 (15) 을 누르십시오.

레이저빔을 다림줄과 평행하게 조준하는 것이 불가능한 경우, 측정공구를 더 정밀하게 벽에 조준한 후 캘리브레이션 과정을 다시 시작하십시오.

레이저빔이 평행하게 조준되었으면, 수동 모드 버튼 (14) 을 눌러 캘리브레이션을 저장하십시오. 확인을 위해 X축 상태 표시기 (7) 가 녹색으로 6회 깜박입니다.

Z축의 캘리브레이션이 저장되고, 캘리브레이션 모드가 자동으로 종료됩니다.

사용 방법

- ▶ 레이저 포인트 또는 레이저 라인 중심점은 표시 용도에만 사용하십시오. 레이저 포인트의 크기 또는 레이저 라인의 폭은 거리에 따라 달라집니다.

레이저 표적판으로 작업하기(그림 A 참조)

레이저 표적판 (47) 은 불리한 조건에서 그리고 거리가 많이 떨어진 곳에서 레이저빔의 가시성을 높여줍니다.

레이저 표적판 (47) 의 절반은 반사면이고, 절반은 투명하여 레이저 표적판의 뒷면을 통해서도 식별할 수 있어 레이저 라인의 가시성을 높여줍니다.

삼각대(액세서리)를 이용해 작업하기

삼각대를 사용하여 높이를 조정하며, 안정적으로 측정할 수 있습니다. 5/8" 삼각대 연결 부위 (17) 와 함께 측정공구를 삼각대 (39) 의 나사부 위에 놓습니다. 측정공구를 삼각대 고정 나사로 고정하십시오.

빠는 부분에 측정 눈금이 있는 삼각대의 경우 높이 편차를 직접 설정할 수 있습니다.

측정공구의 전원을 켜기 전에 대략 삼각대의 방향을 맞추십시오.

벽면 홀더 WM 24(액세서리)를 이용한 작업 (그림 B 참조)

조준장치 (42) 가 있는 벽면 홀더를 이용해 측정공구를 벽에 고정할 수 있습니다. 삼각대를 최대로 빼낼 수 있는 높이를 넘어가는 작업을 하거나 또는 삼각대 없이 불안정한 바닥에서 작업하는 경우, 벽면 홀더를 사용할 것을 권장합니다.

벽면 홀더 (42) 를 고정 나사 (40) 를 이용해 막대에 체결하십시오. 벽면 홀더를 벽에 최대한 수직으로 조립한 후, 안정적으로 고정되었는지 확인하십시오. 벽면 홀더의 5/8" 나사 (43) 를 측정공구의 삼각대 연결 부위 (17) 에 체결하십시오.

조준장치를 이용하여 조립된 측정공구를 23 cm 정도의 높이에서 이동할 수 있습니다. 이를 위해 조준장치에서 나사 (41) 를 풀고, 측정공구를 원하는 작업 위치로 이동시킨 후, 나사 (41) 를 다시 돌려 조이십시오.

레이저 수광기(액세서리)를 이용해 작업하기

조명 상태(밝은 환경, 직사광선)가 좋지 않고 거리가 많이 떨어져 있는 경우, 레이저 라인을 잘 감지할 수 있도록 레이저 수광기 (37) 를 사용하십시오.

회전 레이저에 작동 모드가 여러 개인 경우 회전 속도가 가장 높은 수평 및 수직 작동 모드를 선택하십시오.

레이저 수광기를 사용하여 작업할 경우 해당 사용 설명서를 잘 읽고 준수하십시오.

측량 막대(액세서리)를 이용한 작업(그림 C 참조)

수평도를 점검하거나 기울기를 적용하는 작업에는 레이저 수광기와 함께 측량 막대 (38) 사용을 권장합니다.

측량 막대 (38) 의 상부에 상대적인 측량 눈금이 표시되어 있습니다. 이 0의 높이를 하부의 빠른 부위에서 설정할 수 있습니다. 이렇게 하면 기준 높이에서 벗어나는 편차를 직접 읽을 수 있습니다.

레이저용 안경(액세서리)

레이저용 안경은 주변 조명을 걸러냅니다. 이를 통해 레이저의 빛이 더 밝게 보입니다.

- ▶ 레이저 보안경을 일반 보안경으로 사용하지 마십시오. 레이저 보안경은 레이저 광선을 보다 잘 감지하지만, 그렇다고 해서 레이저 광선으로부터 보호해주는 것은 아닙니다.

- ▶ 레이저 보안경을 선글라스 용도 또는 도로에서 사용하지 마십시오. 레이저 보안경은 자외선을 완벽하게 차단하지 못하며, 색상 분별력을 떨어뜨립니다.

작업 실례

높이 전송하기/확인하기(그림 D 참조)

측정공구를 수평의 고정된 받침대 위에 놓거나 삼각대 (39) (액세서리)에 조립하십시오.

삼각대를 사용하여 작업할 경우: 레이저빔을 원하는 높이로 맞춥니다. 목표 지점을 확인하고 검사하십시오.

삼각대 없이 작업할 경우: 레이저 표적판 (47) 을 이용하여 레이저빔과 기준점 높이 간의 높이 차이를 측정하십시오. 목표 지점에서 측정된 높이 차이를 표시하거나 확인하십시오.

상향 수직점 평행으로 조준하기/직각 적용하기 (그림 E 참조)

직각을 적용하거나 중간 벽면을 조준해야 하는 경우, 상향 수직점 (11) 을 평행으로, 즉 기준선(예: 벽)에 동일한 간격으로 맞추십시오.

이를 위해 측정공구를 수직으로 세우고, 상향 수직 점이 기준선에 나란히 오도록 위치시키십시오.

정확한 위치 설정을 위해 레이저 표적판 (47) 을 이용해 측정공구에서 직접 상향 수직점과 기준선 사이의 간격을 측정하십시오. 상향 수직점과 기준선 사이의 간격을 측정공구에서 최대한의 간격을 두고 다시 측정하십시오. 상향 수직점과 기준선 사이의 간격이 측정공구에서 직접 측정할 때와 동일한 간격을 유지하도록 상향 수직점을 맞추십시오.

상향 수직점 (11) 에 대한 직각이 가변 레이저 빔 (8) 을 통해 표시됩니다.

수직 평면 표시하기(그림 F 참조)

연직선이나 수직 평면을 표시하려면 측정공구를 수직 위치로 두십시오. 수직 평면이 기준선(예: 벽)에 직각으로 위치해야 한다면, 해당 기준선에서 상향 수직점 (11) 을 맞추십시오.

수직 평면이 가변 레이저빔 (8) 을 통해 표시됩니다.

수직 평면 조준하기(그림 G 참조)

벽에 있는 기준점에 선 레이저빔이나 회전 평면을 수직으로 맞추려면 측정공구를 수직으로 세우고 선 레이저빔이나 회전 평면을 대략 기준점에 맞추십시오. 기준점에서 정확한 조준을 위해 회전 평면을 Y 축 주위로 돌리십시오 (참조 „수직 위치에서 회전 평면 회전시키기“, 페이지 47).

레이저 수광기 없이 작업하기(그림 H 참조)

조명 상태가 양호하고 (주위가 어두운 경우) 단거리를 측정할 경우 레이저 수광기 없이도 작업이 가능합니다. 레이저빔이 더 잘 보일 수 있도록 라인 모드를 선택하거나, 또는 포인트 모드를 선택하여 레이저빔을 목표 지점으로 돌리십시오.

레이저 수광기를 이용해 작업하기(그림 I 참조)

조명 상태(밝은 환경, 직사광선)가 좋지 않고 거리가 많이 떨어져 있는 경우, 레이저빔을 잘 감지할 수 있도록 레이저 수광기 (37) 를 사용하십시오. 레이저 수광기를 사용하여 작업할 때 최고 회전 속도로 회전 작동을 선택하십시오.

거리가 많이 떨어진 곳 측정하기(그림 J 참조)

거리가 많이 떨어진 곳을 측정하는 경우, 레이저빔을 찾을 수 있도록 레이저 수광기 (37) 를 사용해야 합니다. 장애 요소를 감소하려면 측정공구를 항상 작업 표면의 중심에 맞추거나 삼각대에 세우는 것이 좋습니다.

외부 영역에서 작업하기(그림 C 참조)

외부 영역에서는 항상 레이저 수광기 (37) 를 사용해야 합니다.

불안정한 바닥에서 작업할 경우 측정공구를 삼각대 (39) 에 장착하십시오. 바닥에 진동이 있거나 측정공구가 흔들려 오류 측정이 생기는 것을 방지하기 위해 충격 경고 기능이 켜져 있는지 확인하십시오.

표시기 개요

	레이저빔 레이저빔 회전 ^{A)}		X		Y		회전	
	녹색	적색	녹색	적색	적색	적색	적색	적색
측정공구 스위치 켜기(1 초 자체 테스트)				초당 3회		초당 3회	초당 3회	초당 3회
휴지 모드	○	○		초당 1회		초당 1회	초당 1회	초당 1회
레벨링								
레벨링	*	○	*		*			
사후 레벨링	○	○	*		*			
자동 레벨링 범위 초과				*		*		
측정공구 작동 준비된 상태, 두 축 모두 레벨링됨	●	●	●		●			
충격 경고								
충격 경고 발생	*	○		*		*		*
충격 경고 꺼진 상태								●
배터리 전압								
배터리 전압이 낮음							●	
배터리가 방전되었습니다							*	
경사 모드/수동 모드								
X축 경사 조정 가능	○	○		*	●			
Y축 레벨링됨								
X축 수동	●	●		●	●			
Y축 레벨링됨								

	레이저빔 레이저빔 회전 ^{A)}		X		Y		Z	
	녹색	적색	녹색	적색	녹색	적색	녹색	적색
X축 레벨링됨 Y축 경사 조정 가능	○	○	●			*		
X축 레벨링됨 Y축 수동	●	●	●			●		
X축 경사 조정 가능 Y축 수동	○	○		*		●		
X축 수동 Y축 경사 조정 가능	○	○		●		*		
X축 수동 Y축 수동	●	●	●			●		
캘리브레이션								
X축 캘리브레이션 모드(수평 위치에서)				초당 2회				초당 2회
X축 캘리브레이션 저장됨				* (6회)				
Y축 캘리브레이션 모드						초당 2회		초당 2회
Y축 캘리브레이션 저장됨						* (6회)		
Z축 캘리브레이션 모드(수직 위치에서)				초당 2회				초당 2회
Z축 캘리브레이션 저장됨				* (6회)				
X축 또는 Z축 캘리브레이션 도중 오류					*			
Y축 캘리브레이션 도중 오류							*	
리셋								
재시작해야 합니다. 전원 버튼 (3)을 눌러 측정공구를 꺾다가 켜십시오.				초당 3회		초당 3회		

A) 라인 모드 및 회전 모드에서

●: 연속 작동

* 감박임

초당 2회: 점멸 주파수(예: 1초에 2회)

○: 기능 정지됨

보수 정비 및 서비스

보수 정비 및 유지

측정공구 및 리모컨을 항상 깨끗이 유지하십시오. 측정공구 및 리모컨을 물이나 다른 액체에 넣지 마십시오.

물기있는 부드러운 천으로 오염된 부위를 깨끗이 닦으십시오. 세척제 또는 용제를 사용하지 마십시오.

측정공구에서 특히 레이저빔 발사구 표면을 정기적으로 깨끗이하고 보푸라기가 없도록 하십시오.

측정공구를 항상 함께 공급되는 운반 케이스 (48)에 넣어 보관하거나 운반하십시오.

수리해야 할 경우 측정공구를 운반 케이스 (48)에 넣어 보내십시오.

AS 센터 및 사용 문의

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처리

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ไทย

คำแนะนำเพื่อความปลอดภัยสำหรับเลเซอร์ที่กำลังหมุน



ส่งเครื่องมือวัดให้ช่างผู้เชี่ยวชาญตรวจสอบและไขอะไหล่เปลี่ยนของแท้เท่านั้น หากไม่ใช่เครื่องมือวัดตามคำแนะนำเหล่านี้

ระบบป้องกันเบ็ดเสร็จในเครื่องมือวัดอาจได้รับผลกระทบ อย่าทำให้ป้ายเตือนที่อยู่บนเครื่องมือวัดนี้ลบลือน เก็บรักษาคำแนะนำเหล่านี้ไว้ให้ดี และหากเครื่องมือวัดนี้ถูกส่งต่อไปยังผู้อื่น ให้ส่งมอบคำแนะนำเหล่านี้ไปด้วย

- ▶ เครื่องมือวัดนี้จัดส่งมาพร้อมป้ายเตือนแสงเลเซอร์ (แสดงในหน้าภาพประกอบของเครื่องมือวัด)
- ▶ หากข้อความของป้ายเตือนแสงเลเซอร์ไม่ได้เป็นภาษาของท่าน ให้ติดสติ๊กเกอร์ที่จัดส่งมาที่พิมพ์เป็นภาษาของท่านทับลงบนข้อความก่อนใช้งานครั้งแรก
- ▶ บนเครื่องมือวัดจะมีป้ายเตือนแสดงให้เห็นช่องเปิดของเลเซอร์ ให้คำนึงถึงตำแหน่งนี้เมื่อใช้เครื่องมือวัด
- ▶ หากข้อความของป้ายเตือนดังกล่าวไม่ได้เป็นภาษาของท่าน ให้ติดสติ๊กเกอร์ที่จัดส่งมาที่พิมพ์เป็นภาษาของท่านทับลงบนข้อความก่อนใช้งานครั้งแรก
- ▶ ข้อควรระวัง - การใช้อุปกรณ์ทำงานหรืออุปกรณ์ปรับเปลี่ยนอื่นๆ นอกเหนือไปจากที่ระบุไว้ในที่นี้ หรือการใช้วิธีการอื่นๆ อาจนำไปสู่การสัมผัสกับรังสีอันตรายได้
- ▶ อย่าทำการเปลี่ยนแปลงใดๆ ที่อุปกรณ์เลเซอร์



อย่าเล็งลำแสงเลเซอร์ไปยังคนหรือสัตว์ และตัวท่านเองอย่าจ้องมองเข้าไปในลำแสงเลเซอร์ เครื่องมือวัดนี้ผลิตรังสีเลเซอร์ระดับ 3R ตามมาตรฐาน EN 60825-1 การจ้องมองโดยตรงเข้าไปในลำแสงเลเซอร์ - แม้จากระยะไกล - สามารถทำให้ดวงตาเสียหายได้

- ▶ **อย่าใช้แว่นสำหรับมองแสงเลเซอร์เป็นแว่นนิรภัย** แว่นสำหรับมองแสงเลเซอร์ใช้สำหรับมองลำแสงเลเซอร์ให้เห็นชัดเจนยิ่งขึ้น แต่ไม่ได้ช่วยป้องกันรังสีเลเซอร์
- ▶ **อย่าใช้แว่นสำหรับมองแสงเลเซอร์เป็นแว่นกันแดดหรือใส่ซันบรอนด์** แว่นสำหรับมองแสงเลเซอร์ไม่สามารถป้องกันรังสีอัลตราไวโอเล็ต (UV) ได้อย่างสมบูรณ์ และยังคงความสามารถในการมองเห็นสี
- ▶ **ส่งเครื่องมือวัดให้ช่างผู้เชี่ยวชาญตรวจสอบและไขอะไหล่เปลี่ยนของแท้เท่านั้น** ทั้งนี้เพื่อให้มั่นใจได้ว่าจะสามารถใช้งานเครื่องมือวัดได้อย่างปลอดภัยเสมอ
- ▶ **อย่าให้เด็กใช้เครื่องมือวัดด้วยเลเซอร์โดยไม่ควบคุมดูแล** เด็กๆ อาจทำให้คนตาพร่าโดยไม่ตั้งใจ
- ▶ **หลีกเลี่ยงการสะท้อนของลำแสงเลเซอร์บนพื้นผิวที่ราบเรียบ เช่น หน้าต่างหรือกระจก** ลำแสงเลเซอร์ที่สะท้อนอาจทำให้ดวงตาเสียหายได้ด้วย
- ▶ **ควรให้บุคคลที่คุ้นเคยกับการจัดการอุปกรณ์เลเซอร์เป็นผู้ใช้เครื่องมือวัดเท่านั้น** ตามมาตรฐาน EN 60825-1 นอกเหนือจากสิ่งอื่นแล้วยังครอบคลุมถึงความรู้เกี่ยวกับผลกระทบทางชีวภาพของเลเซอร์ตาดตาและผิวหนัง ตลอดจนการใช้อุปกรณ์ป้องกันเลเซอร์อย่างถูกต้องเพื่อหลีกเลี่ยงอันตราย
- ▶ **อย่าใช้เครื่องมือวัดในสภาพแวดล้อมที่เสี่ยงต่อการระเบิด** ซึ่งเป็นที่ที่มีของเหลว แก๊ส หรือฝุ่นที่ติดไฟได้ในเครื่องมือวัดสามารถเกิดประกายไฟซึ่งอาจจุดฝุ่นละอองหรือไอระเหยให้ติดไฟได้
- ▶ **ตั้งเครื่องมือวัดในลักษณะให้ลำแสงเลเซอร์วิ่งเหนือกว่าหรือต่ำกว่าระดับสายตาเสมอ** ในลักษณะนี้จะแน่ใจได้ว่า จะไม่เกิดความเสียหายกับดวงตา
- ▶ **ระบุบริเวณที่ใช้เครื่องมือวัดด้วยป้ายเตือนเลเซอร์ที่เหมาะสม** ในลักษณะนี้จะช่วยป้องกันไม่ให้บุคคลที่ไม่เกี่ยวข้องเข้าไปในเขตอันตรายนี้ได้
- ▶ **อย่าเก็บเครื่องมือวัดในสถานที่ที่บุคคลที่ไม่ได้รับอนุญาตสามารถเข้าถึงได้** บุคคลที่ไม่คุ้นเคยกับการทำงานของเครื่องมือวัดอาจทำให้เกิดอันตรายแก่ตนเองและผู้อื่นได้
- ▶ **เมื่อใช้เครื่องมือเลเซอร์ที่มีเลเซอร์ระดับ 3R ให้ปฏิบัติตามกฎระเบียบของประเทศที่เป็นไปได้ว่าจะมีอยู่** การไม่ปฏิบัติตามกฎระเบียบเหล่านี้อาจทำให้บาดเจ็บได้
- ▶ **ตรวจสอบให้แน่ใจว่าบริเวณรังสีเลเซอร์ได้รับการคุ้มกันหรือเฝ้าระวัง** การจำกัดรังสีเลเซอร์ในพื้นที่ควบคุมจะป้องกันไม่ให้อันตรายของบุคคลที่ไม่มีเกี่ยวข้องได้รับความเสียหาย

- ▶ **อย่าวางเครื่องมือวัดที่เปิดสวิตช์ทิ้งไว้โดยไม่มีผู้ดูแล และปิดสวิตช์เครื่องมือวัดเมื่อเลิกใช้งาน** คนอื่นอาจตาพร่าจากแสงเลเซอร์ได้
- ▶ **อย่าใช้อุปกรณ์รวมแสง เช่น กล้องส่องทางไกล หรือแว่นขยาย เพื่อสังเกตแหล่งกำเนิดรังสี** ท่านอาจทำใหดวงตาของท่านเสียหายได้



ต้องกันอุปกรณ์ประกอบที่มีคุณสมบัติเป็นแม่เหล็กให้ห่างจากวัตถุปลูกถ่ายในร่างกายและอุปกรณ์ทางการแพทย์อื่นๆ เครื่องปรับจังหวะการเต้นของหัวใจด้วยไฟฟ้าหรือมีอินซูลินแม่เหล็กของอุปกรณ์ประกอบจะสร้างสนามแม่เหล็กซึ่งสามารถทำให้วัตถุปลูกถ่ายในร่างกายและอุปกรณ์ทางการแพทย์อื่นๆ ทำงานบกพร่องได้

- ▶ **ต้องกันอุปกรณ์ประกอบที่มีคุณสมบัติเป็นแม่เหล็กให้ห่างจากสื่อข้อมูลที่มีคุณสมบัติเป็นแม่เหล็กและอุปกรณ์ที่ไวต่อแรงดึงดูดแม่เหล็ก** แม่เหล็กของอุปกรณ์ประกอบสามารถทำให้ข้อมูลสูญหายอย่างเรียกกลับไม่ได้

คำเตือนเพื่อความปลอดภัยสำหรับรีโมทคอนโทรล



ต้องอ่านและปฏิบัติตามคำแนะนำทั้งหมด หากไม่ใช้เครื่องควบคุมระยะไกลตามคำแนะนำต่อไป ระบบป้องกันเบ็ดเสร็จในเครื่องควบคุมระยะไกลอาจได้รับผลกระทบ เก็บรักษาคำแนะนำเหล่านี้สำหรับใช้อ้างอิงในภายหลัง

- ▶ **ส่งเครื่องควบคุมระยะไกลให้ช่างผู้เชี่ยวชาญซ่อมแซมและใช้อะไหล่แท้เท่านั้น** ทั้งนี้เพื่อใหมั่นใจได้ว่าเครื่องควบคุมระยะไกลยังคงมีความปลอดภัยอยู่
- ▶ **อย่าใช้เครื่องควบคุมระยะไกลในสภาพแวดล้อมที่เสี่ยงต่อการคิดระเบิดซึ่งเป็นที่ที่มีของเหลว แก๊ส หรือฝุ่นที่ติดไฟได้** ในเครื่องควบคุมระยะไกลอาจเกิดประกายไฟที่สามารถจุดฝุ่นหรือไอระเหยให้ลุกไหม้ได้

รายละเอียดผลิตภัณฑ์และข้อมูลจำเพาะ

กรุณาดูภาพประกอบในส่วนหน้าของคู่มือการใช้งาน

ประโยชน์การใช้งานของเครื่อง

เลเซอร์แบบหมุน

เครื่องมือวัดนี้ใช้สำหรับกำหนดและตรวจสอบการไล่ระดับ ความสูงในแนวนอน เส้นแนวตั้ง เส้นปรับแนว และจุดตั้งอย่างแม่นยำ

เครื่องมือวัดนี้เหมาะสำหรับใช้งานทั้งภายในและภายนอกอาคาร

เครื่องควบคุมระยะไกล

เครื่องควบคุมระยะไกลมีไว้สำหรับควบคุมเลเซอร์แบบหมุน **Bosch**

เครื่องควบคุมระยะไกลเหมาะสำหรับใช้งานภายในและภายนอกอาคาร

ส่วนประกอบที่แสดงภาพ

เลขของส่วนประกอบผลิตภัณฑ์อ้างอิงถึงส่วนประกอบของเครื่องมือวัดและรีโมทคอนโทรลที่แสดงในหน้าภาพประกอบ

เลเซอร์แบบหมุน

- (1) ตัวล็อกช่องใส่แบตเตอรี่^{A)}
- (2) ช่องใส่แบตเตอรี่^{A)}
- (3) มุมเปิด/ปิด
- (4) มุมการทำงานแบบหมุนรอบ
- (5) มุมเอียงเดิหน้า
- (6) แถบแสดงสถานะแกน Y
- (7) แถบแสดงสถานะแกน X
- (8) ลำแสงเลเซอร์ที่เปลี่ยนแปลงได้
- (9) เซ็นเซอร์สำหรับรีโมทคอนโทรล
- (10) ช่องทางออกลำแสงเลเซอร์
- (11) จุดเชื่อมต่อทางด้านบน
- (12) ไฟเตือนแบตเตอรี่
- (13) แถบแสดงฟังก์ชันการเตือนแรงกระแทก (shock-warning)
- (14) มุมการทำงานแบบหมุนแนว
- (15) มุมเอียงขึ้น
- (16) มุมการทำงานแบบเส้น
- (17) ช่องประกอบของขาตั้งแบบสามขาขนาด 5/8"
- (18) หมายเลขเครื่อง
- (19) ป้ายเตือนแสงเลเซอร์

- (20) ป้ายเตือนช่องทางออกลำแสงเลเซอร์
- A) อุปกรณ์ประกอบที่แสดงภาพหรืออธิบายไม่รวมอยู่ในการจัดส่งมาตรฐาน
กรุณาดูอุปกรณ์ประกอบทั้งหมดในรายการแสดงอุปกรณ์ประกอบของเรา

เครื่องควบคุมระยะไกล

- (21) รีโมทคอนโทรล^{A)}
- (22) ปุ่มเอียง X-
- (23) ปุ่มหมุนทวนเข็มนาฬิกา
- (24) ปุ่มเอียง Y+
- (25) ปุ่มเอียง X+
- (26) ปุ่มการทำงานแบบหมุนรอบ
- (27) ช่องทางออกรังสีอินฟราเรด
- (28) แถบแสดงผลการส่งสัญญาณ
- (29) ปุ่มโหมดนิ่ง (สแตนด์บาย)
- (30) ปุ่มการทำงานแบบเส้น
- (31) ปุ่มการทำงานแบบแมนนวล
- (32) ปุ่มเอียง Y-
- (33) ปุ่มหมุนตามเข็มนาฬิกา
- (34) หมายเลขเครื่อง
- (35) ตัวล็อกฝาช่องใส่แบตเตอรี่
- (36) ฝาช่องใส่แบตเตอรี่
- A) อุปกรณ์ประกอบที่แสดงภาพหรืออธิบายไม่รวมอยู่ในการจัดส่งมาตรฐาน
กรุณาดูอุปกรณ์ประกอบทั้งหมดในรายการแสดงอุปกรณ์ประกอบของเรา

อุปกรณ์ประกอบ/อะไหล่

- (37) อุปกรณ์รับแสงเลเซอร์^{A)}
- (38) ระดับวัด^{A)}
- (39) ขาดังแบบสามขา^{A)}
- (40) สกรูยึดบนผนัง^{A)}
- (41) สกรูที่ชุดจัดตำแหน่ง^{A)}
- (42) ตัวยึดผนัง/ชุดจัดตำแหน่ง^{A)}
- (43) 5/8"-สกรูยึดบนผนัง^{A)}
- (44) แม่เหล็ก^{A)}
- (45) ด้ามจับอุปกรณ์รับแสงเลเซอร์^{A)}
- (46) แวนตาสำหรับมองแสงเลเซอร์^{A)}

- (47) แผ่นเป้าหมายเลเซอร์^{A)}

- (48) กาลังเก็บ^{A)}

- A) อุปกรณ์ประกอบที่แสดงภาพหรืออธิบายไม่รวมอยู่ในการจัดส่งมาตรฐาน
กรุณาดูอุปกรณ์ประกอบทั้งหมดในรายการแสดงอุปกรณ์ประกอบของเรา

ข้อมูลทางเทคนิค

เลเซอร์แบบหมุน	GRL 350 HV
หมายเลขสินค้า	3 601 K61 S..
ช่วงการทำงาน (รัศมี) ^{A)B)}	
- ไม่ใช้อุปกรณ์รับแสงเลเซอร์ ประมาณ	60 ม.
- ใช้อุปกรณ์รับแสงเลเซอร์ ประมาณ	350 ม.
ความแม่นยำการทำระดับ ^{A)C)}	
- แนวนอน	±1.5 มม./30 ม.
- แนวตั้ง	±3 มม./30 ม.
ย่านการทำระดับอัตโนมัติ ปกติ	±8% (±4.6°)
ระยะเวลาทำระดับ ปกติ	30 วินาที
ความเร็วรอบหมุน	0/150/300/600 นาที ⁻¹
มุมทางผ่านแสง สำหรับการ ทำงานแบบเส้น	10/25/50°
ช่วงการเอียงในการทำงานด้วย มือ	±8%
อุณหภูมิใช้งาน	-10°C ... +50°C
อุณหภูมิเก็บรักษา	-20°C ... +70°C
ความสูงใช้งานเหนือระดับอ้างอิง สูงสุด	2000 ม.
ความชื้นสัมพัทธ์ สูงสุด	90%
ระดับมลพิษตาม IEC 61010-1	2 ^{D)}
ระดับเลเซอร์	3R
ชนิดเลเซอร์	630-650 นาโนเมตร, < 5 มิลลิวัตต์
การบานออกของลำแสง	0.4 mrad (มุมเต็ม)
ช่องประกอบของขา ตั้งแบบสามขาแนวนอน	5/8"-11
แบตเตอรี่ (อัลคาไลน์-แมงกานีส)	2 × 1.5 V LR20 (D)
ระยะเวลาทำงาน ประมาณ	30 ชม.

เลขอะแบบหมุน	GRL 350 HV
น้ำหนักตามระเบียบการ EPTA-Procedure 01:2014	1.8 กก.
ขนาด (ความยาว x ความกว้าง x ความสูง)	187 x 182 x 170 มม.
ระดับการป้องกัน (ยกเว้นแบตเตอรี่)	IP 56 (ป้องกันฝุ่นและน้ำกระเซ็น)

- A) ที่ 20 °C
- B) ยานการทำงานอาจลดลงหากมีสภาวะแวดล้อมที่ไม่เหมาะสม (ต.ย. เช่น แสงอาทิตย์ส่องโดยตรง)
- C) ตามแนวนอน
- D) เกิดขึ้นเฉพาะมลพิษที่ไม่นำไฟฟ้า ยกเว้นบางครั้งนำไฟฟ้าได้ชั่วคราวที่มีสาเหตุจากการกลับตัวที่ได้คาดว่าจะเป็น
- สำหรับการระบุเครื่องมือวัดของท่านอย่างชัดเจน กรุณาดูหมายเลขเครื่อง (18) บนแผ่นป้ายรุ่น

เครื่องควบคุมระยะไกล	RC 4
หมายเลขสินค้า	3 601 K69 S..
ช่วงการใช้งาน ^{A)}	30 ม.
อุณหภูมิใช้งาน	-10 °C ... +50 °C
อุณหภูมิเก็บรักษา	-20 °C ... +70 °C
ความสูงใช้งานเหนือระดับอ้างอิงสูงสุด	2000 ม.
ความชื้นสัมพัทธ์ สูงสุด	90 %
ระดับมลพิษตาม IEC 61010-1	2 ^{B)}
แบตเตอรี่ (อัลคาไลน์-แมงกานีส)	2 x 1.5 V LRG6 (AA)
น้ำหนักตามระเบียบการ EPTA-Procedure 01:2014	0.11

- A) ยานการทำงานอาจลดลงหากมีสภาวะแวดล้อมที่ไม่เหมาะสม (ต.ย. เช่น แสงอาทิตย์ส่องโดยตรง)
- B) เกิดขึ้นเฉพาะมลพิษที่ไม่นำไฟฟ้า ยกเว้นบางครั้งนำไฟฟ้าได้ชั่วคราวที่มีสาเหตุจากการกลับตัวที่ได้คาดว่าจะเป็น
- หมายเลขเครื่อง (34) บนแผ่นป้ายรุ่นมีไว้เพื่อระบุโมทคอนโทรลของท่าน

การติดตั้ง

แหล่งจ่ายไฟฟ้าของเครื่องควบคุมระยะไกล

สำหรับการใช้งานรีโมทคอนโทรลของท่าน ขอแนะนำให้ใช้แบตเตอรี่อัลคาไลน์แมงกานีส

เปิดฝาช่องใส่แบตเตอรี่ (36) โดยกดบนตัวล็อก (35) และถอดฝาช่องใส่แบตเตอรี่ออก ใส่แบตเตอรี่เข้าไป

ขณะใส่แบตเตอรี่ต้องดูให้ขั้วแบตเตอรี่อยู่ในตำแหน่งที่ถูกต้องตามที่กำหนดไว้ที่ด้านในช่องใส่แบตเตอรี่

เปลี่ยนแบตเตอรี่ทุกก้อนพร้อมกันเสมอ โดยใช้แบตเตอรี่จากผู้ผลิตรายเดียวกันทั้งหมดและมีความจุเท่ากันทุกก้อน

- ▶ **เมื่อไม่ใช้งานเครื่องควบคุมระยะไกลเป็นเวลานาน ต้องถอดแบตเตอรี่ออก** แบตเตอรี่สามารถกักกร่อนในระหว่างเก็บรักษาในรีโมทคอนโทรลเป็นเวลานาน และปล่อยประจุออกเองได้

แหล่งจ่ายพลังงาน เครื่องมือวัด

สำหรับการใช้งานเครื่องมือวัด ขอแนะนำให้ใช้แบตเตอรี่อัลคาไลน์แมงกานีส

เมื่อต้องการถอดช่องใส่แบตเตอรี่ (2) ให้หมุนตัวล็อก (1) ไปที่ตำแหน่ง ๒ ดึงช่องใส่แบตเตอรี่ออกจากเครื่องมือวัดและใส่แบตเตอรี่

ขณะใส่แบตเตอรี่ต้องดูให้ขั้วแบตเตอรี่อยู่ในตำแหน่งที่ถูกต้องตามที่กำหนดไว้ที่ด้านในช่องใส่แบตเตอรี่

เลื่อนช่องใส่แบตเตอรี่ (2) เข้าในเครื่องมือวัดและหมุนตัวล็อก (1) ไปที่ตำแหน่ง ๑

หากแบตเตอรี่อ่อน ไฟแสดงสถานะแบตเตอรี่ (12) และแสงสว่างสีแดง เครื่องมือวัดยังคงสามารถใช้งานได้ประมาณ 2 นาที

หากไฟแสดงสถานะแบตเตอรี่ (12) กระพริบสีแดง เครื่องมือวัดจะปิดสวิทช์โดยอัตโนมัติหลังจากผ่านไป 5 นาที

เปลี่ยนแบตเตอรี่ทุกก้อนพร้อมกันเสมอ โดยใช้แบตเตอรี่จากผู้ผลิตรายเดียวกันทั้งหมดและมีความจุเท่ากันทุกก้อน

- ▶ **เมื่อไม่ใช้งานเครื่องมือวัดเป็นเวลานาน ต้องถอดแบตเตอรี่ออก** แบตเตอรี่ในเครื่องมือวัดอาจกักกร่อนในระหว่างเก็บรักษาเป็นเวลานาน และปล่อยประจุออกเองได้

การปฏิบัติงาน

- ▶ ปกป้องเครื่องมือวัดและเครื่องควบคุมระยะไกลจากความชื้น และแสงแดดส่องโดยตรง

▶ **อย่าให้เครื่องมือวัดและเครื่องควบคุมระยะไกลได้รับอุณหภูมิที่สูงมากหรือรับอุณหภูมิที่เปลี่ยนแปลงมาก** ต.ย. เช่น อยาปล่อยให้เครื่องมือวัดในรถยนต์เป็นเวลานาน ในกรณี que อุณหภูมิมีการเปลี่ยนแปลงมาก ต้องปล่อยให้เครื่องมือวัดและเครื่องควบคุมระยะไกลปรับตัวเข้ากับอุณหภูมิรอบด้านก่อนใช้งาน ตรวจสอบความแม่นยำก่อนดำเนินการต่อด้วยเครื่องมือวัด (ดู "การตรวจสอบความแม่นยำของเครื่องมือวัด", หน้า 61)

ในกรณีที่ได้รับอุณหภูมิที่สูงมากหรือรับอุณหภูมิที่เปลี่ยนแปลงมาก เครื่องมือวัดอาจมีความแม่นยำน้อยลง

- ▶ **หลีกเลี่ยงอย่าให้เครื่องมือวัดตกหล่นหรือถูกกระทบอย่างรุนแรง** เมื่อเครื่องมือวัดถูกกระทบจากภายนอกอย่างรุนแรง ขอแนะนำให้ทำการตรวจสอบความแม่นยำทุกครั้งก่อนนำมาใช้งานต่อ (ดู "การตรวจสอบความแม่นยำของเครื่องมือวัด", หน้า 61)
- ▶ **ระวังหากแรงเลเซอร์ชำรุดเนื่องจากเครื่องมือวัดแตกหักเนื่องจากตกหล่น** คุณอาจได้รับบาดเจ็บจากการถูกบาดได้ที่ขอบแตกของกรง

การเริ่มต้นปฏิบัติงานของเครื่องควบคุมระยะไกล

เมื่อกดปุ่มควบคุมการทำงาน เครื่องมือวัดอาจเคลื่อนจากระดับตำแหน่งของมัน ทำให้การหมุนถูกขัดจังหวะชั่วคราว ซึ่งสามารถหลีกเลี่ยงได้โดยใช้รีโมทคอนโทรล

รีโมทคอนโทรลยังคงทำงานหากแบตเตอรี่ที่มีประจุไฟฟ้าเพียงพอ

ตั้งค่าเครื่องมือวัดเพื่อให้สัญญาณจากรีโมทควบคุมเข้าถึงเซ็นเซอร์ตัวใดตัวหนึ่งในทิศทางตรง หากไม่สามารถชี้รีโมทคอนโทรลไปที่เซ็นเซอร์ (9) ในทิศทางตรง หากไม่สามารถชี้รีโมทคอนโทรลไปที่เซ็นเซอร์ได้โดยตรง พื้นที่การทำงานจะลดลง ด้วยการสะท้อนสัญญาณ (เช่น บนผนัง) สามารถปรับปรุงช่วงได้ด้วยมีสัญญาณอ้อมเช่นกัน

หลังจากกดปุ่มบนตัวควบคุมระยะไกลไฟแสดงสถานะการส่งสัญญาณ (28) จะสว่างขึ้นเพื่อระบุว่ามีการส่งสัญญาณแล้วไม่สามารถทำการเปิดหรือปิดสวิทช์การทำงานเครื่องมือวัดได้ด้วยรีโมทคอนโทรล

การเปิดใช้งานเลเซอร์แบบหมุน

- ▶ **เสียงไม่ให้พื้นที่ทำงานมีสิ่งกีดขวาง ซึ่งอาจส่งผลกระทบต่อการทำงานหรือกีดขวางลำแสงเลเซอร์ปิดคลุมพื้นผิวสะท้อนแสงหรือเงาวาววัดผ่านบานกระจกหรือวัสดุที่คล้ายกันนี้** แสงสะท้อนหรือลำแสงเลเซอร์ที่สะท้อนอาจส่งผลกระทบต่อการทำงานวัดเคลื่อนได้

การตั้งเครื่องมือวัด



ตำแหน่งแนวนอน



ตำแหน่งแนวตั้ง

วางเครื่องมือวัดบนพื้นผิวที่มั่นคงในแนวนอนหรือแนวตั้งติดตั้งบนขาตั้งแบบสามขา (39) หรือบนตัวยึดผนัง (42) ด้วยชุดจัดตำแหน่ง

เนื่องจากเครื่องมือมีความแม่นยำในการปรับระดับสูง เครื่องมือวัดจึงไวต่อการตรวจจับแรงกระแทกและการเปลี่ยนแปลงตำแหน่ง ดังนั้นจึงควรตรวจสอบให้แน่ใจว่า เครื่องมือวัดอยู่ในตำแหน่งที่มั่นคง เพื่อหลีกเลี่ยงการหยุดชะงักในการทำงานเนื่องจากการปรับใหม่

การเปิด-ปิดเครื่อง

หมายเหตุ: ตรวจสอบความแม่นยำก่อนเริ่มการทำงานทุกครั้ง โดยทำผ่าน (ดู "การตรวจสอบความแม่นยำของเครื่องมือวัด", หน้า 61)

เปิดสวิทช์ เครื่องมือวัดโดยกดปุ่มเปิด-ปิด (3) จะแสดงผลทั้งหมดจะกะพริบเป็นสีแดงอย่างรวดเร็ว (3x/s) เครื่องมือวัดปล่อยเส้นเลเซอร์ (8) พร้อมจุดเชื่อมชิ้นทางตามบน (11) ออกมาจากช่องทางออก (10)

- ▶ **อย่าส่องลำแสงเลเซอร์ไปยังคนหรือสัตว์ และอย่าจ้องมองลำแสงเลเซอร์แม้จะอยู่ในระยะไกล**

เครื่องมือวัดเริ่มต้นทำงานระดับโดยอัตโนมัติทันที ในขณะที่ปรับแถบแสดงสถานะแกน X (7) และแกน Y (6) จะกะพริบสีเขียวและเลเซอร์กะพริบในจุดทำงาน

เครื่องมือวัดได้รับการปรับระดับแล้วทันทีที่แถบแสดงสถานะแกน X (7) และแกน Y (6) สว่างสว่างสีเขียวอย่างต่อเนื่องและเลเซอร์ส่องสว่างต่อเนื่อง หลังจากการปรับระดับเสร็จสมบูรณ์แล้ว เครื่องมือวัดจะเริ่มต้นทำงานโดยอัตโนมัติใหม่ตามการหมุน

- ▶ **อย่าวางเครื่องมือวัดที่เปิดสวิทช์ทิ้งไว้โดยไม่มีผู้ดูแล และให้ปิดสวิทช์เครื่องมือวัดเมื่อเลิกใช้งาน** คนอื่นอาจตาพร่าจากแสงเลเซอร์ได้

ปิดสวิทช์ เครื่องมือวัดด้วยการกดปุ่มเปิด-ปิด (3) ค้างไว้จนกว่าไฟแสดงทั้งหมดดับลง

โหมดนิ่ง (สแตนด์บาย)

คุณสามารถปรับเครื่องมือวัดให้อยู่ในโหมดนิ่งได้ด้วยรีโมทคอนโทรล (21) การตั้งค่าทั้งหมดจะถูกบันทึกและฟังก์ชันการเตือนการกระแทกยังคงเปิดใช้งานอยู่

เปิดสวิทช์ โหมดนิ่งได้โดยกดปุ่มโหมดนิ่ง (29) ที่รีโมทคอนโทรล จะแสดงผลทั้งหมดที่เครื่องมือวัดจะกะพริบเป็นสีแดงอย่างช้าๆ (1x/s)

ปิดสวิทช์ โหมดนิ่งโดยกดปุ่มโหมดนิ่ง (29) ใหม่อีกครั้ง ท่านสามารถออกจากโหมดนิ่งได้โดยกดปุ่มเปิด-ปิด (3) ที่เครื่องมือวัด

รูปแบบการทำงาน

เส้นกราฟของแกน X และ Y

เส้นกราฟของแกน X และ Y จะทำเครื่องหมายไว้เหนือหัวหมุนที่ตัวเรือน

การอธิบายโดยสรุปของโหมดทำงาน

สามารถใช้โหมดการทำงานทั้ง 3 โหมดในแนวนอนและแนวตั้งของเครื่องมือวัด



แนะนำให้ใช้โหมดการหมุนโดยเฉพาะเมื่อใช้ตัวรับเลเซอร์ สามารถเลือกความเร็วในการหมุนได้แตกต่างกัน



โหมดเส้น
ในโหมดการทำงานนี้ ลำแสงเลเซอร์ต่างๆ จะเคลื่อนที่โดยมีมุมเปิดอย่างจำกัด ในลักษณะนี้จะมองเห็นลำแสงเลเซอร์ได้ชัดเจนเมื่อเทียบกับการทำงานแบบหมุนรอบ สามารถเลือกมุมทางผ่านแสงได้หลากหลาย



โหมดจุด
ในโหมดนี้จะสามารถมองเห็นลำแสงเลเซอร์ต่างๆ ได้ชัดเจนที่สุด ซึ่งเหมาะสำหรับสำหรับการรังสีความสูงได้อย่างง่ายดาย

โหมดเส้นและโหมดจุดเหมาะสำหรับการใช้งานกับเครื่องรับเลเซอร์ (37)



โหมดหมุน/โหมดจุด

หลังจากเปิดสวิตช์แต่ละครั้ง เครื่องมือวัดจะอยู่ในโหมดการหมุนด้วยความเร็วการหมุนมาตรฐาน (300 min^{-1}) หากต้องการเปลี่ยนจากโหมดเส้นเป็นโหมดจุด ให้กดปุ่มโหมดหมุน (4) หรือปุ่มโหมดหมุน (26) บนรีโมทคอนโทรล หากต้องการเปลี่ยนแปลงความเร็วในการหมุน ให้กดปุ่มโหมดหมุนหลายๆ ครั้ง (4) หรือปุ่มโหมดหมุน (26) บนรีโมทคอนโทรลจนได้ความเร็วที่ต้องการ ความเร็วที่ต้องการ ความเร็วการหมุนจะค่อยๆ เพิ่มขึ้นเมื่อกดแต่ละครั้ง หลังจากถึงระดับความเร็วสูงสุดเครื่องมือวัดจะสลับไปยังตำแหน่งการทำงานหลังจากหมุนสู่โหมดจุด กดปุ่มโหมดหมุนอีกครั้งเพื่อกลับสู่โหมดการหมุนด้วยความเร็วในการหมุนต่ำสุด ในการดำเนินงานกับเครื่องรับเลเซอร์ ควรเลือกความเร็วในการหมุนสูงสุด เมื่อทำงานโดยใช้ตัวรับเลเซอร์ ให้ลดความเร็วในการหมุนและสวมใส่แว่นตาสำหรับแสงเลเซอร์โดยเฉพาะเพื่อให้มองเห็นลำแสงเลเซอร์ (46) ได้อย่างชัดเจน



การทำงานแบบเส้น

หากต้องการเปลี่ยนเป็นโหมดเส้น ให้กดปุ่มโหมดเส้น (16) หรือปุ่มโหมดเส้น (30) บนรีโมทคอนโทรล

หากต้องการเปลี่ยนแปลงมุมเปิด ให้กดปุ่มโหมดเส้นหลายๆ ครั้ง (16) หรือปุ่มโหมดเส้น (30) บนรีโมทคอนโทรลจนได้โหมดที่ต้องการ มุมเปิดจะเพิ่มกว้างขึ้นตามระดับเมื่อกดแต่ละครั้ง ขณะเดียวกันความเร็วการหมุนจะค่อยๆ เพิ่มขึ้นตามระดับ

หมายเหตุ: เนื่องจากมีความหน่วง เลเซอร์อาจหลุดออกจากเหนือจุดสิ้นสุดของเส้นเลเซอร์ออกมาได้

ฟังก์ชัน

หมุนเส้น/จุดที่ตำแหน่งในแนวนอนภายในระนาบการหมุน

คุณสามารถจัดตำแหน่งในแนวนอนของเครื่องมือวัดอาจ เส้นเลเซอร์หรือจุดเซอร์ภายในระนาบการหมุนของเลเซอร์ สามารถหมุน 360° ได้

ในการหมุนทวนเข็มนาฬิกา ให้กดปุ่มเอียง (5) ที่เครื่องมือวัด หรือปุ่มหมุนทวนเข็มนาฬิกา (23) บนรีโมทคอนโทรล

ในการหมุนตามเข็มนาฬิกา ให้กดปุ่มเอียง (15) ที่เครื่องมือวัด หรือปุ่มหมุนตามเข็มนาฬิกา (33) บนรีโมทคอนโทรล

หมุนระนาบการหมุน ณ ตำแหน่งในแนวดิ่ง

ณ ตำแหน่งในแนวดิ่งเครื่องมือวัด คุณสามารถหมุนจุดเลเซอร์ เส้นเลเซอร์หรือระนาบการหมุนสำหรับการจัดตำแหน่งอย่างง่ายหรือการจัดตำแหน่งแบบขนานในช่วง $\pm 8\%$ รอบแกน X

ในการหมุนทวนเข็มนาฬิกา ให้กดปุ่มเอียง (5) ที่เครื่องมือวัด หรือปุ่มหมุนทวนเข็มนาฬิกา (23) บนรีโมทคอนโทรล

ในการหมุนตามเข็มนาฬิกา ให้กดปุ่มเอียง (15) ที่เครื่องมือวัด หรือปุ่มหมุนตามเข็มนาฬิกา (33) บนรีโมทคอนโทรล

การชำระระดับอัตโนมัติ

การอธิบายโดยสรุป

หลังจากเปิดสวิตช์เครื่องมือวัดตรวจสอบตำแหน่งแนวนอนหรือแนวตั้งและชดเชยความไม่สม่ำเสมอโดยอัตโนมัติภายในช่วงการปรับระดับตัวเองประมาณ $\pm 8\%$ ($\pm 4.6^\circ$)

ในขณะปรับ แถบแสดงสถานะแกน X (7) และแกน Y (6)

จะกะพริบสีเขียวและเลเซอร์กะพริบในจุดทำงาน

เครื่องมือวัดได้รับการปรับระดับแล้ว ทั้งนี้ที่แถบแสดงสถานะแกน X (7) และแกน Y (6) สว่างสว่างสีเขียวอย่างต่อเนื่องและเลเซอร์ส่องสว่างต่อเนื่อง หลังจากการปรับระดับเสร็จสมบูรณ์แล้ว เครื่องมือวัดจะเริ่มต้นทำงานโดยอัตโนมัติในโหมดการหมุน

หากเครื่องมือวัดไม่ตรงหลังจากเปิดสวิตช์หรือหลังจากเปลี่ยนตำแหน่งมากกว่า 8% จะไม่สามารถปรับระดับได้อีก

ต่อไป ในกรณีนี้ แถบแสดงสถานะแกน X (7) และแกน Y (6) จะกะพริบสีแดง โรเตอร์จะหยุดและเลเซอร์จะปิดสนิท

ปิดสนิทเครื่องมือวัด จัดตำแหน่งให้อยู่ในแนวนอนมากที่สุด (ตำแหน่งในแนวนอน) และในแนวตั้ง (ตำแหน่งในแนวตั้ง) และเปิดสนิทใหม่อีกครั้ง

การเปลี่ยนแปลงตำแหน่ง

หากเครื่องมือวัดได้รับการปรับระดับแล้ว ตรวจสอบตำแหน่งแนวนอนหรือแนวตั้งอย่างต่อเนื่อง

เครื่องจะทำการระดับซ้ำโดยอัตโนมัติเมื่อได้เปลี่ยนตำแหน่ง

การเปลี่ยนแปลงตำแหน่งเล็กน้อย ได้รับความชัดเจนโดยไม่มีขีดจำกัดการทำงาน สิ่งนี้จะชัดเจนการสั่นสะเทือนบนพื้นผิวหรือผลกระทบของสภาพอากาศโดยอัตโนมัติ

สำหรับการเปลี่ยนแปลงตำแหน่งเล็กน้อย เพื่อหลีกเลี่ยงการตรวจวัดที่ไม่ถูกต้องในระหว่างกระบวนการปรับ ระดับการหมุนของลำแสงเลเซอร์จะหยุดและเลเซอร์จะดับไป แถบแสดงสถานะแกน X (7) และแกน Y (6) จะกะพริบสีเขียว ฟังก์ชันการเตือนการกระแทกอาจถูกกระตุ้นให้ทำงาน

เครื่องมือวัดตรวจจับตำแหน่งในแนวตั้งและแนวนอนโดยอัตโนมัติ ในการสลับระหว่างตำแหน่งแนวนอนและแนวตั้ง ปิด ปิดสนิทเครื่องมือวัด จัดตำแหน่งและเปิดสนิทอีกครั้ง

⚡ ฟังก์ชันการเตือนแรงกระแทก (shock-warning)

เครื่องมือวัดมีฟังก์ชันเตือนการกระแทก ในกรณีที่มีการเปลี่ยนแปลงตำแหน่งหรือการสั่นสะเทือนของเครื่องมือวัดหรือการสั่นสะเทือนของพื้นผิว ฟังก์ชันนี้จะป้องกันการปรับระดับในตำแหน่งที่เปลี่ยนแปลงไปและทำให้เกิดข้อผิดพลาดเนื่องจากมีความคลาดเคลื่อนเครื่องมือวัด

เปิดใช้งานฟังก์ชันเตือนการกระแทก: ฟังก์ชันการเตือนการสั่นสะเทือนจะเปิดใช้งานตามปกติ ประมาณ 1 นาทีหลังจากเปิดสนิทเครื่องมือวัด

ฟังก์ชันเตือนการกระแทกเริ่มทำงาน: หากตำแหน่งของเครื่องมือวัดเปลี่ยนแปลงหรือมีการสั่นสะเทือนรุนแรง สัญญาณเตือนการกระแทกจะเริ่มทำงาน: การหมุนของเลเซอร์จะหยุดลงและลำแสงเลเซอร์จะกะพริบ ในเวลาเดียวกันฟังก์ชันเตือนการกระแทก (13) และแถบแสดงสถานะแกน X (7) และแกน Y (6) จะกะพริบสีแดง โหมดการทำงานปัจจุบันจะได้รับการบันทึก

เมื่อฟังก์ชันเตือนการกระแทกเริ่มทำงาน ให้อดปุ่มเปิด-ปิด (3) ชั่วครู่ ฟังก์ชันการ

เตือนแรงกระแทกจะสแตร์ทใหม่อีกครั้ง และเครื่องมือวัดเริ่มทำการระดับ ทันทีที่เครื่องมือวัดได้รับการปรับระดับแล้ว (แถบแสดงสถานะแกน X (7) และแกน Y (6) สว่างสว่างสีเขียวอย่างต่อเนื่อง) และเครื่องมือจะทำงานใหม่ทันทีที่บันทึกไว้

ตรวจสอบตำแหน่งของลำแสงเลเซอร์ที่จุดอ้างอิงและแก้ไขความสูงหรือการปรับแนวของเครื่องมือวัดหากจำเป็น

ปิดใช้งานฟังก์ชันเตือนการกระแทก: ปิดฟังก์ชันเตือนการกระแทกได้โดยกดปุ่มเปิด-ปิด (3) แล้วปล่อย และกดปุ่มสองครั้งหากฟังก์ชันเตือนการกระแทกถูกกระตุ้นให้ทำงาน (แถบแสดงฟังก์ชันเตือนการกระแทก (13) จะกะพริบสีแดง) หากฟังก์ชันเตือนการกระแทกปิดใช้งาน แถบแสดงฟังก์ชันเตือนการกระแทก (13) สว่างสว่างสีแดงอย่างต่อเนื่อง

หากฟังก์ชันเตือนการกระแทกเปิดใช้งานอยู่ ฟังก์ชันจะเริ่มทำงานประมาณ 1 นาทีให้หลัง

หมายเหตุ: ไม่สามารถเปิดหรือปิดฟังก์ชันฟังก์ชันเตือนการกระแทกหรือรีเซ็ตด้วยรีโมทคอนโทรล

⊗ โหมดการเอียง/ปุ่มการทำงานแบบแมนนวล แขนเดียว

สามารถปิดการปรับระดับอัตโนมัติของเครื่องมือวัดได้ (โหมดแมนนวล):

- ที่ตำแหน่งในแนวนอนสำหรับทั้งสองแกนแยกกัน
- ที่ตำแหน่งในแนวตั้งสำหรับแกน X (ไม่สามารถปรับระดับแกน Y ที่ตำแหน่งในแนวตั้งได้)

ในโหมดแมนนวล สามารถตั้งเครื่องมือวัดในตำแหน่งใดก็ได้ตามต้องการ นอกจากนี้แกนสามารถเอียงได้อย่างอิสระจากกันในช่วง $\pm 8^\circ$ ที่เครื่องมือวัด

เลือกแกน: เลือกโหมดแมนนวลหรือเลือกแกนที่ต้องการเอียง ให้อดปุ่มโหมด (14) ที่เครื่องมือวัดปุ่มโหมดแมนนวล (31) บนรีโมทคอนโทรล ที่แถบแสดงสถานะแกน X (7) และแกน Y (6) คุณสามารถดูได้ว่าแกนใดที่ไม่ได้ปรับระดับแล้วและแกนใดสามารถเอียงได้

กดปุ่มการทำงานแบบแมนนวล	☀️ X		สถานะแกน X	☀️ Y		สถานะแกน Y
	สีเขียว	สีแดง		สีเขียว	สีแดง	
1x (ที่ตำแหน่งในแนวนอน)		*	โหมดการเอียงแบบแกนเดียว, สามารถปรับแกนได้	●		ปรับแกน

กคปุ่มการทำงานแบบแมนนวล	☀️ สถานะแกน X		☀️ สถานะแกน Y		
	สีเขียว	สีแดง	สีเขียว	สีแดง	
1x (ที่ตำแหน่งในแนวตั้ง)		*	-		ไม่สามารถปรับแกนได้
2x	●			*	โหมดการเอียงแบบแกนเดียว, สามารถปรับแกนได้
3x		*		●	โหมดแมนนวล
4x		●		*	โหมดแมนนวล, สามารถปรับแกนได้
5x (ที่ตำแหน่งในแนวอน)	* / ●		* / ●		แกนจะถูกปรับระดับ/ได้รับการปรับระดับแล้ว
5x (ที่ตำแหน่งในแนวตั้ง)	* / ●		-		ไม่สามารถปรับแกนได้

● แถบแสดงจะส่องสว่างต่อเนื่อง

* แถบแสดงกะพริบ

- แถบแสดงดับไป

เอียงแกน: สามารถเปลี่ยนแปลงความเอียงของแกนในโหมดเอียงหรือโหมดแมนนวลได้ภายใน 5 วินาทีหลังจากเลือกแกน (นานเท่าที่แถบที่เกี่ยวข้องแสดงให้เห็นว่าแกนกะพริบสีแดง) หากแถบแสดงสีแดงสว่างขึ้นอย่างต่อเนื่อง หมายความว่า การเอียงได้รับการปรับแล้ว สามารถเปลี่ยนความเอียงได้ โดยกดปุ่มโหมดแมนนวล (14) ที่เครื่องมือวัด หรือปุ่มโหมดแมนนวล (31) ที่รีโมทคอนโทรลซ้ำๆ จนกระทั่งแถบแสดงสถานะแกนที่ต้องการกะพริบสีแดง

คุณสามารถปรับความเอียงของแกนที่ปรับได้ดังต่อไปนี้:

- ที่เครื่องมือวัด: กดปุ่มเอียงลง (5) เพื่อเอียงแกนปรับในทิศทาง "-"
กดปุ่มเอียงขึ้น (15) เพื่อเอียงแกนปรับในทิศทาง "+"
- ใช้อุปกรณ์รีโมท: กดปุ่มเอียง X+ (25) และปุ่มเอียง X (22) เพื่อเอียงแกน X ในทิศทาง "+" และ "-"
กดปุ่มเอียง Y+ (24) และปุ่มเอียง Y- (32) เพื่อเอียงแกน Y ในทิศทาง "+" และ "-"

การตรวจสอบความแม่นยำของเครื่องมือวัด

ต้องปฏิบัติตามต่างๆ ในภายหลังโดยผู้ผ่านการฝึกอบรมและมีคุณสมบัติเท่านั้น การตรวจสอบความถูกต้องแม่นยำหรือการสอบเทียบของเครื่องมือวัดต้องเป็นไปตามกฎระเบียบที่กำหนดไว้

ผลกระทบต่อความแม่นยำ

อุณหภูมิรอบตัวมีผลต่อความแม่นยำมากที่สุด โดยเฉพาะอย่างยิ่งความแตกต่างของอุณหภูมิจากพื้นขึ้นไป ที่ระดับสูงกว่าสามารถเบี่ยงเบนค่าแสงเลเซอร์ได้

เนื่องจากบริเวณใกล้พื้นมีการผันผวนของชั้นอุณหภูมิมากที่สุด ดังนั้นเมื่อระยะทางวัดไกลกว่า 20 ม. จึงควรประกอบเครื่องมือวัดเข้ากับขาตั้งแบบสามขาเสมอ หากเป็นไปได้ให้ตั้งเครื่องมือวัดไว้กลางพื้นที่ทำงานด้วย

อาจมีความคลาดเคลื่อนตั้งแต่ระยะการวัดประมาณ 20 ม. และสามารถคลาดเคลื่อนได้ถึงสี่เท่าจาก 20 ม. ที่ระยะ 100 ม.

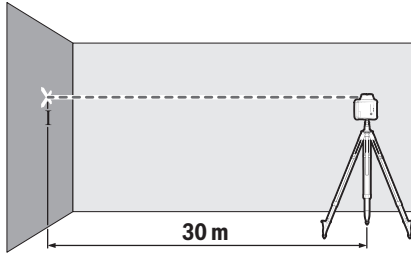
นอกจากสาเหตุและปัจจัยจากภายนอกแล้ว สาเหตุและปัจจัยเฉพาะตัวอุปกรณ์เอง (ต. ย. เช่น การตกหล่น หรือการกระแทกอย่างรุนแรง) อาจนำไปสู่การเบี่ยงเบนได้ด้วย ดังนั้นให้ตรวจสอบความแม่นยำการที่าระดับทุกครั้งก่อนเริ่มทำงาน

หากเครื่องมือวัดเกินค่าคลาดเคลื่อนสูงสุดระหว่างการดำเนินการวัดตามคำอธิบายต่อไปนี้ ให้ดำเนินการสอบเทียบโดย (ดู "ปรับเทียบเครื่องมือวัด", หน้า 62) หรือนำเครื่องมือวัดเข้ารับการตรวจสอบโดยฝ่ายบริการลูกค้าที่ **Bosch**

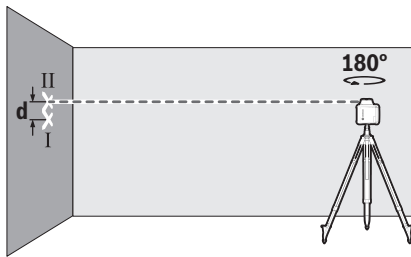
ตรวจสอบความแม่นยำในการปรับระดับที่ตำแหน่งในแนวอน

เพื่อผลลัพธ์ที่นำเชื่อถือและถูกต้องขอแนะนำให้ตรวจสอบระยะการวัด โดยให้มีระยะ 30 ม. บนพื้นผิวที่มั่นคงหนาแน่น ดำเนินการวัดให้เสร็จสิ้นสมบูรณ์สำหรับแกนทั้งสอง

- ติดตั้งเครื่องมือวัดในตำแหน่งในแนวนอน หรือขาตั้งแบบสามขา หรือวางเครื่องลงบนพื้นผิวที่มั่นคงและราบเสมอกัน ในระยะห่างจากผนัง **30 ม.** เปิดสวิตช์เครื่องมือวัด



- หลังจากปรับระดับเสร็จแล้ว ให้ทำเครื่องหมายตรงกลางลำแสงเลเซอร์บนผนัง (จุด I)



- หมุนเครื่องมือวัดไป 180° โดยไม่เปลี่ยนตำแหน่ง ปล่อยให้เครื่องมือวัดหาระดับและทำเครื่องหมายที่กึ่งกลางของลำแสงเลเซอร์บนผนัง A (จุด II) รัศมีครึ่งวงให้จุด II อยู่ในแนวตรงเหนือหรือใต้จุด I เท่าที่จะทำได้

ความต่าง **d** ของจุดเครื่องหมายทั้งสอง I และ II บนผนัง A แสดงความเบี่ยงเบนความสูงที่แท้จริงของเครื่องมือวัด

ดำเนินการชดเชยการวัดนี้ซ้ำสำหรับแกนอื่นๆ หมุนเครื่องมือวัด 90° ก่อนเริ่มกระบวนการวัด

ที่ระยะวัด **30 ม.** ความเบี่ยงเบนสูงสุดที่อนุญาตคือ:

30 ม. $\times \pm 0.05$ มม./ม. = ± 1.5 มม. ดังนั้นความต่าง **d** ระหว่างจุด I และ II ในกระบวนการวัดทั้งสองแต่ละครั้งต้องไม่เกิน **3 มม.**

ปรับเทียบเครื่องมือวัด

ต้องปฏิบัติตามต่างๆ ในภายหลังโดยผู้ผ่านการฝึกอบรมและมีคุณสมบัติเท่านั้น การตรวจสอบความถูกต้องแม่นยำหรือการสอบเทียบของเครื่องมือวัดต้องเป็นไปตามกฎระเบียบที่กำหนดไว้

- ▶ ทำการสอบเทียบเครื่องมือวัดอย่างแม่นยำที่สุดหรือส่งเครื่องมือวัดไปตรวจสอบที่ศูนย์บริการหลังการขาย **Bosch** การสอบเทียบที่ไม่แม่นยำจะนำไปสู่การวัดที่ไม่ถูกต้อง

- ▶ เริ่มทำการสอบเทียบเฉพาะเมื่อท่านจำเป็นต้องทำการสอบเทียบเครื่องมือวัดเท่านั้น พื้นที่ที่เครื่องมือวัดอยู่ในโหมดการสอบเทียบท่านจะต้องดำเนินการสอบเทียบอย่างแม่นยำจนจบสิ้น ทั้งนี้เพื่อไม่ให้เกิดผลการวัดที่ไม่ถูกต้องในภายหลัง

การตรวจสอบความแม่นยำในการปรับระดับหลังจาก

ดำเนินการสอบเทียบทุกครั้ง (ดู "การตรวจสอบความแม่นยำของเครื่องมือวัด", หน้า 61) หากค่าคลาดเคลื่อนอยู่นอกเหนือค่าสูงสุดที่อนุญาต ให้ส่งเครื่องมือวัดไปตรวจสอบที่ศูนย์บริการลูกค้า **Bosch**

ดำเนินการสอบเทียบทุกแกน (แกน X, Y และ Z)

หมายเหตุ: หากในระหว่างการสอบเทียบ แถบแสดงสถานะแกน X (7) หรือแถบแสดงสถานะแกน Y (6) กะพริบสีแดง หมายความว่าค่าคลาดเคลื่อนอยู่นอกเหนือค่าสูงสุดที่อนุญาต ในกรณีนี้กดปุ่มโหมดแมนนวล (14) เพื่อออกจากโหมดสอบเทียบโดยไม่บันทึกการตั้งค่า จากนั้นแถบแสดงสถานะแกน X (7) และแกน Y (6) จะกะพริบสีแดง $3 \times/s$ เพื่อระบุการสอบเทียบที่ไม่ถูกต้องเริ่มการสอบเทียบอีกครั้ง เริ่มทำการสอบเทียบใหม่ หากเกิดความผิดพลาดขึ้นอีกครั้ง ให้ส่งเครื่องมือวัดไปตรวจสอบที่ศูนย์บริการลูกค้า **Bosch**

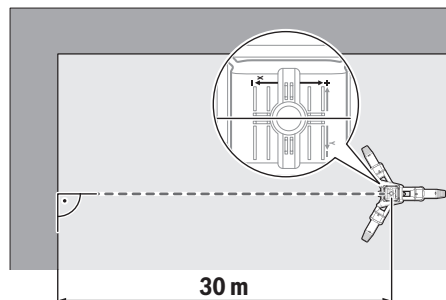
สอบเทียบแกน X แกน Y

สำหรับการสอบเทียบ ต้องใช้ระยะทางวัดว่างเปล่า **30 ม.** บนพื้นผิวที่มั่นคงขวางหน้าผนัง

ในบางกรณี (เช่น ทัศนวิสัยไม่ดี) คุณสามารถใช้เครื่องรับเลเซอร์ (37) เพื่อทำเครื่องหมายลำแสงเลเซอร์ได้ เมื่อใช้ตัวรับเลเซอร์ ตรวจสอบให้แน่ใจว่าได้รับแนวที่ตั้งฉากกับผนัง ไม่เช่นนั้นเครื่องหมายจะคลาดเคลื่อนไปจากลำแสงเลเซอร์ สำหรับเครื่องรับเลเซอร์ที่มีความแม่นยำในการรับสัญญาณที่ปรับได้ คุณสามารถตั้งค่าความแม่นยำในการรับได้โดยขึ้นอยู่กับความแม่นยำในการสอบเทียบที่ต้องการ (โปรดดูคู่มือการใช้งานสำหรับเครื่องรับเลเซอร์)

ติดตั้งและปรับตำแหน่งเครื่องมือวัดสำหรับการสอบเทียบ:

ติดตั้งเครื่องมือวัดที่ตำแหน่งในแนวนอนในระยะห่างจากผนัง **30 ม.** หรือขาตั้งแบบสามขา (39) (แนะนำให้ใช้) หรือวางเครื่องลงบนพื้นผิวที่มั่นคงและราบเสมอกัน



จัดแนวเครื่องมือวัดเพื่อให้แถบแสดงตัวคูณที่แกน X บนเครื่องมือวัดอยู่ในมุมที่เหมาะสมกับผนัง

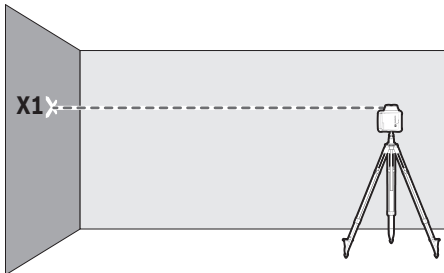
เริ่มต้นการสอบเทียบ:

เครื่องมือวัดจะต้องปิดสวิตช์อยู่เพื่อเริ่มการสอบเทียบ กดปุ่มโหมดแมนนวล (14) ที่เครื่องมือวัดค้างไว้ และกดปุ่มเปิด / ปิด (3) สั้นๆ อย่าย่ำปล่อยปุ่มปรับความลาดเอียงจนกว่าแถบแสดงสถานะแกน X (7) ส่องสว่างสีเขียว และฟังก์ชันเตือนการกระแทก (13) กะพริบเป็นสีแดง (2x/s แต่ละครั้ง)

เครื่องมือวัดเปิดอยู่ในโหมดการสอบเทียบสำหรับแกน X

การสอบเทียบแกน X:

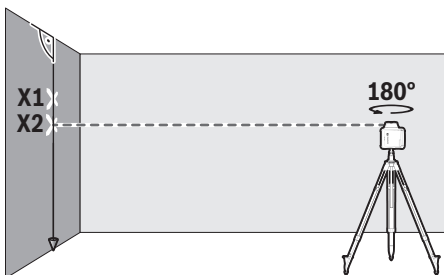
ตรวจสอบให้แน่ใจว่าเครื่องมือวัดสอดคล้องกับแกน X ซึ่งตั้งฉากกับผนัง รองจนกระทั่งเครื่องมือวัดระดับแล้วโหมดการหมุนจะเริ่มขึ้น



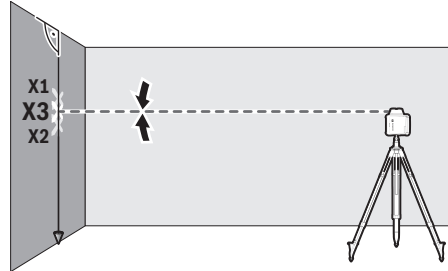
ทำเครื่องหมายความสูงของลำแสงเลเซอร์บนผนังเป็นความสูง X1 หากจำเป็นให้ใช้ตัววัดเลเซอร์ (37)

หมุนเครื่องมือวัดไป 180° โดยไม่เปลี่ยนแปลงตำแหน่งเครื่องมือวัด

รองจนกระทั่งเครื่องมือวัดระดับแล้วโหมดการหมุนจะเริ่มขึ้น



ทำเครื่องหมายความสูงของลำแสงเลเซอร์บนผนังเป็นความสูง X2 หากจำเป็นให้ใช้ตัววัดเลเซอร์ (37) ตรวจสอบให้แน่ใจว่าความสูง X2 ตั้งตรงสูงกว่าหรือต่ำกว่าความสูง X1



กำหนดกึ่งกลางระหว่างความสูงที่ทำเครื่องหมาย X1 และ X2 และทำเครื่องหมายเป็นความสูง X3 บนผนัง

จัดแนวลำแสงเลเซอร์ (8) ขึ้นด้วยมุมเอียง (5) และลง (15) เพื่อให้ระดับความสูง X3 แม่นยำที่สุดเท่าที่จะทำได้ หากจำเป็นให้ใช้ตัววัดเลเซอร์ (37)

บันทึกการสอบเทียบแกน X โดยกดปุ่มโหมดแมนนวล (14) ระบบจะยืนยันการปรับโดยที่แถบแสดงสถานะแกน X (7) กะพริบสีเขียว 6 ครั้ง

การสอบเทียบแกน Y:

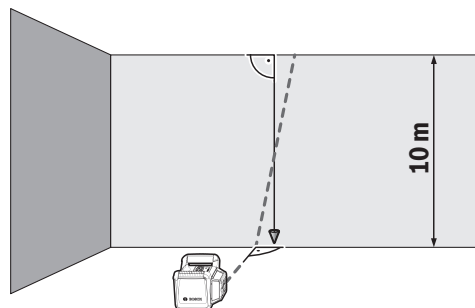
หลังจากสอบเทียบแกน X เครื่องมือวัดจะเปลี่ยนสู่โหมดสอบเทียบสำหรับแกน Y โดยอัตโนมัติ แถบแสดงสถานะแกน Y (6) กะพริบสีเขียว แบแสดงฟังก์ชันเตือนการกระแทก (13) กะพริบสีแดง (2x/s แต่ละครั้ง)

จัดแนวเครื่องมือวัด 90° เพื่อให้แถบแสดงตัวคูณที่แกน X บนเครื่องมือวัดอยู่ในมุมที่เหมาะสมกับผนัง ดำเนินการสอบเทียบตามคำอธิบายสำหรับแกน X

หากการสอบเทียบแกน Y ได้รับการบันทึกแล้วแถบแสดงสถานะแกน Y (6) จะกะพริบสีเขียว 6 ครั้ง โหมดสอบเทียบจะสิ้นสุดลงโดยอัตโนมัติ

การสอบเทียบแกน Z

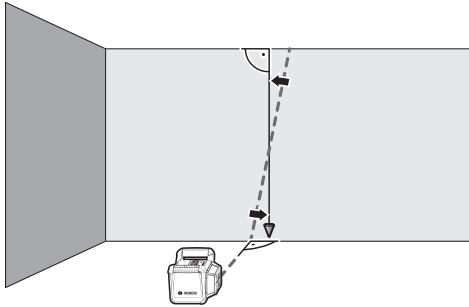
สำหรับการสอบเทียบบนพื้นผิวที่มั่นคง ต้องใช้ระยะทางวัด 10 ม. ข้างหน้าผนัง ติดตั้งสายตั้งบนผนัง



ตั้งเครื่องมือวัดที่ตำแหน่งในแนวตั้งบนพื้นผิวที่ราบเรียบมั่นคง เปิดสวิตช์เครื่องมือวัดและให้เครื่องมือปรับระดับ จัดแนวเครื่องมือวัดเพื่อให้ลำแสงเลเซอร์ชนกับผนังตรงมุมฉากและติดกับสายตั้ง ปิดสวิตช์เครื่องมือวัด

เริ่มต้นการสอบเทียบโดยกดปุ่มโหมดแมนนวล (14) ค้างไว้ และจากนั้นกดปุ่มเปิด-ปิด (3) แล้วปล่อย อย่าวปล่อยปุ่มปรับ ความลาดเอียงจนกว่าแถบแสดงสถานะแกน X (7) ส่องสว่างสีเขียว และฟังก์ชันเตือนการกระแทก (13) กะพริบเป็นสีแดง ($2 \times/s$ แต่ละครั้ง)

เครื่องมือวัดเปิดอยู่ในโหมดการสอบเทียบสำหรับแกน Z รอจนกระทั่งเครื่องมือวัดระดับแล้วโหมดการหมุนจะเริ่มขึ้น



จัดแนวลำแสงเลเซอร์แบบปรับได้เพื่อให้นานกับลูกตั้งมากที่สุด กดปุ่มเอียงขึ้น (5) หรือลง (15)

หากไม่สามารถจัดแนวลำแสงเลเซอร์ขนานกับแนวสายตั้งได้ ให้ปรับเครื่องมือวัดให้ตรงกับฟังก์ชันแล้วเริ่มกระบวนการสอบเทียบอีกครั้ง

หากลำแสงเลเซอร์อยู่ในแนวขนานให้บันทึกการสอบเทียบโดยกดปุ่มโหมดแมนนวล (14) ระบบจะยืนยันการปรับโดยที่แถบแสดงสถานะแกน X (7) กะพริบสีเขียว 6 ครั้ง

การสอบเทียบแกน Z ถูกบันทึกและโหมดการสอบเทียบจะสิ้นสุดลงโดยอัตโนมัติ

ข้อแนะนำในการทำงาน

▶ **ห้าเครื่องหมายตรงจุดเลเซอร์หรือเส้นเลเซอร์เสมอ** ขนาดของจุดเลเซอร์และความกว้างของเส้นเลเซอร์เปลี่ยนแปลงตามระยะทาง

การทำงานกับแผ่นเป้าหมายเลเซอร์ (รูปภาพประกอบ A)

แผ่นเป้าหมายเลเซอร์ (47) ช่วยให้เห็นลำแสงเลเซอร์ได้ดียิ่งขึ้นในสถานะที่ไม่เหมาะสมและในระยะทางไกลๆ

ส่วนสะท้อนกลับของแผ่นเป้าหมายเลเซอร์ (47) ช่วยให้เห็นเส้นเลเซอร์ได้ดียิ่งขึ้น เนื่องจากมีส่วนโปร่งใส จึงสามารถมองเห็นเส้นเลเซอร์จากทางด้านหลังของแผ่นเป้าหมายเลเซอร์ได้ด้วย

การทำงานกับขาตั้งแบบสามขา (อุปกรณ์ประกอบ)

ขาตั้งแบบสามขาช่วยให้สามารถทำการวัดได้อย่างมั่นคงและปรับความสูงได้ สวมเครื่องมือวัดที่มีช่องประกอบของขาตั้งแบบสามขาขนาด 5/8" (17) เข้าบนเกลียวของขาตั้งแบบ

สามขา (39) ยึดเครื่องมือวัดโดยขันสลกรูล็อกของขาตั้งแบบสามขาเข้าให้แน่น

ด้วยขาตั้งที่มีสเกลบนส่วนขยาย คุณสามารถตั้งค่าความสูงชัดเจนได้โดยตรง

ปรับขาตั้งแบบสามขาอย่างคร่าวๆ ก่อนเปิดสวิตช์เครื่องมือวัด

การทำงานกับหรือบนตัวยึดผนัง WM 24 (อุปกรณ์ประกอบ) (รูปภาพประกอบ B)

คุณสามารถยึดเครื่องมือวัดบนผนังโดยใช้โดยใช้ตัวยึดผนังพร้อมอุปกรณ์ปรับแนว (42) และนำไปใช้ด้วยยึดติดผนัง เช่น เมื่อสำหรับการดำเนินงานที่สูงกว่าขาตั้ง หรือเมื่อดำเนินงานบนพื้นผิวที่ไม่มั่นคงและไม่มีความขัง

ขันสลกรูยึดผนัง (42) เข้ากับแถบโดยใช้สลกรูยึด (40) บนแถบให้แน่น ติดตั้งตัวยึดผนังบนผนังให้ตั้งตรงมากที่สุดเท่าที่จะทำได้

ขันสลกรูขนาด 5/8" (43) ของฉากยึดผนังเข้ากับขาตั้ง (17) ที่เครื่องมือวัด

สามารถใช้อุปกรณ์ปรับแนวเลื่อนเครื่องมือวัดในช่วงความสูงประมาณ 23 ซม. คลายสลกรู (41) ที่อุปกรณ์ปรับ เลื่อนเครื่องมือวัดไปยังตำแหน่งที่ต้องการ และหมุนสลกรู (41) ให้แน่นอีกครั้ง

การทำงานกับอุปกรณ์รับแสงเลเซอร์ (อุปกรณ์ประกอบ)

ในสถานะแสงที่ไม่เหมาะสม (สภาพแวดล้อมที่สว่างจ้า แสงแดดส่องตรง) และสำหรับระยะทางไกลๆ ให้ใช้อุปกรณ์รับแสงเลเซอร์ (37) เพื่อจะได้ค้นหาเส้นเลเซอร์ได้ง่ายขึ้น

สำหรับเลเซอร์หมุนที่มีหลายโหมดให้เลือกโหมดการทำงานในแนวนอนหรือแนวตั้งที่ความเร็วการหมุนสูงสุด

ก่อนใช้อุปกรณ์รับแสงเลเซอร์ ต้องอ่านและปฏิบัติตามหนังสือคู่มือการใช้งานอุปกรณ์รับแสงเลเซอร์

การทำงานกับแท่งสำหรับวัด (อุปกรณ์ประกอบ) (รูปภาพประกอบ C)

ขอแนะนำให้ใช้แท่งวัด (38) ร่วมกับอุปกรณ์รับแสงเลเซอร์เพื่อตรวจสอบความเรียบหรือการไล่ระดับสี

สเกลสัมผัสจะระบุอยู่บนแท่งวัด (38) คุณสามารถเลือกความสูงเป็นศูนย์ได้ที่ด้านล่างส่วนตั้ง เพื่อช่วยให้สามารถอ่านค่าคลาดเคลื่อนจากความสูงเป้าหมายได้โดยตรง

แว่นสำหรับมองแสงเลเซอร์ (อุปกรณ์ประกอบ)

แว่นสำหรับมองแสงเลเซอร์ช่วยกรองสถานะแสงภายนอกออกไป ทำให้ตามองเห็นแสงเลเซอร์ได้ชัดเจนยิ่งขึ้น

▶ **อย่าใช้แว่นสำหรับมองแสงเลเซอร์เป็นแว่นนิรภัย** แว่นสำหรับมองแสงเลเซอร์ใช้สำหรับมองลำแสงเลเซอร์ให้เห็นชัดเจนยิ่งขึ้น แต่ไม่ได้ช่วยป้องกันรังสีเลเซอร์

▶ **อย่าใช้แว่นสำหรับมองแสงเลเซอร์เป็นแว่นกันแดดหรือใส่ขั้วรถยนต์** แว่นสำหรับมองแสงเลเซอร์ไม่สามารถ

ป้องกันรังสีอัลตราไวโอเล็ต (UV) ได้อย่างสมบูรณ์ และ
ยังลดความสามารถในการมองเห็นสี

ตัวอย่างการปฏิบัติงาน

คัดลอก/ตรวจสอบความสูง (รูปภาพประกอบ D)

วางเครื่องมือวัดที่ตำแหน่งในแนวนอนบนพื้นที่ยื่นคองและรวม
เสมอกันหรือติดตั้งเครื่องมือบนขาตั้ง (39) (อุปกรณ์
ประกอบ)

การทำงานบนขาตั้ง: จัดแนวลำแสงเลเซอร์ให้อยู่ในระดับ
ความสูงที่ต้องการ คัดลอกหรือตรวจสอบความสูงที่จุดเป้าหมาย

การทำงานโดยไม่มีขาตั้ง: ใช้แผ่นเป้าหมายเลเซอร์เพื่อ
กำหนดความแตกต่างของความสูงระหว่างลำแสงเลเซอร์และ
ความสูงที่จุดอ้างอิง (47) ช่วยคัดลอกหรือตรวจสอบความ
ต่างความสูงที่วัดได้ที่สถานที่ตั้งเป้าหมาย

**จัดตำแหน่งจุดตั้งชั้นในแนวนอน/ไข่มุมขวา (รูปภาพ
ประกอบ E)**

หากต้องใส่มุมฉากหรือต้องจัดผนังคั่น จุดเชื่อม (11) จะต้อง
ขนานกันขึ้นทางด้านบน นั่นหมายความว่าต้องจัดตำแหน่งที่
ระยะห่างเดียวกันจากบรรทัดอ้างอิง (เช่น ผนัง)

ตั้งเครื่องมือวัดที่ตำแหน่งในแนวตั้งและจัดตำแหน่งให้จุด
เชื่อมขนานกับเส้นอ้างอิงโดยประมาณ

สำหรับการจัดตำแหน่งที่แม่นยำ ให้วัดระยะทางระหว่างจุดที่
จุดเชื่อมชั้นด้านบนและเส้นอ้างอิงโดยตรงที่เครื่องมือวัดโดย
ใช้แผ่นเป้าหมายเลเซอร์ (47) วัดระยะห่างระหว่างจุดเชื่อม
ชั้นด้านบนและเส้นอ้างอิงใหม่อีกครั้งที่ระยะห่างที่สุดที่เป็นไป
ได้จากเครื่องมือวัด จัดตำแหน่งจุดเชื่อมต่อให้อยู่ในระยะห่าง
จากเส้นอ้างอิงเหมือนกับเมื่อวัดค่าโดยตรงที่เครื่องมือวัด
มุมขวาของจุดเชื่อมชั้นด้านบน (11) จะระบุด้วยลำแสง
เลเซอร์แบบปรับได้ (8)

แสดงระนาบแนวตั้ง/แนวตั้ง (รูปภาพประกอบ F)

หากต้องการแสดงระนาบแนวตั้งหรือแนวตั้งให้ตั้งค่าเครื่อง
มือวัดในตำแหน่งในแนวตั้ง หากระนาบแนวตั้งเป็นมุมฉากกับ

เส้นอ้างอิง (เช่น ผนัง) ให้จัดตำแหน่งจุดเชื่อมชั้นด้าน
บน (11) กับบรรทัดอ้างอิงนี้

จะแสดงแนวตั้งด้วยลำแสงเลเซอร์แบบปรับได้ (8)

จัดระนาบแนวตั้ง/แนวตั้ง (รูปภาพประกอบ G)

ในการจัดแนวเส้นเลเซอร์แนวตั้งหรือระนาบการหมุนกับจุด
อ้างอิงบนผนัง ให้ตั้งเครื่องมือวัดในตำแหน่งในแนวตั้งและจัด
แนวเส้นเลเซอร์หรือระนาบการหมุนโดยประมาณกับจุดอ้างอิง
สำหรับการจัดตำแหน่งที่แม่นยำพร้อมจุดอ้างอิง ให้หมุน
ระนาบการหมุนรอบแกน Y (ดู "หมุนระนาบการหมุน ณ
ตำแหน่งในแนวตั้ง", หน้า 59)

**การทำงานโดยไม่มีอุปกรณ์รับแสงเลเซอร์ (รูปภาพ
ประกอบ H)**

ในสภาพแสงที่เหมาะสม (สภาพแวดล้อมที่มีมืด) และในระยะ
ทางสั้น ๆ คุณสามารถทำงานได้โดยไม่ต้องใช้อุปกรณ์รับแสง
เลเซอร์ เพื่อการมองเห็นลำแสงเลเซอร์ที่ดีที่สุด ให้เลือกโหมด
เส้นหรือเลือกโหมดจุดและเปลี่ยนลำแสงเลเซอร์ไปยังปลาย
ทาง

การทำงานด้วยอุปกรณ์รับแสงเลเซอร์ (รูปภาพประกอบ I)

ในสภาวะแสงที่ไม่เหมาะสม (สภาพแวดล้อมที่สว่างจ้า
แสงแดดส่องตรง) และสำหรับระยะทางไกลๆ ให้ใช้อุปกรณ์
รับแสงเลเซอร์ (37) เพื่อจะได้ค้นหาลำแสงเลเซอร์ได้ง่ายขึ้น
เมื่อทำงานกับเครื่องรับเลเซอร์ ให้เลือกโหมดการหมุนด้วย
ความเร็วการหมุนสูงสุด

การวัดระยะไกล (รูปภาพประกอบ J)

เมื่อทำการวัดระยะไกลต้องใช้อุปกรณ์รับแสงเลเซอร์ (37)
เพื่อค้นหาลำแสงเลเซอร์ เพื่อลดสัญญาณรบกวน คุณควรวาง
เครื่องมือวัดไว้ที่กึ่งตรงกลางของพื้นผิวงานและบนขาตั้ง

การทำงานกลางแจ้ง (รูปภาพประกอบ C)

ควรใช้อุปกรณ์รับแสงเลเซอร์ (37) ในการทำงานกลางแจ้ง
เสมอ

เมื่อทำงานบนพื้นที่ไม่ปลอดภัยให้ตัดเครื่องมือวัดบนขา
ตั้ง (39) ดำเนินงานเมื่อฟังก์ชันแจ้งเตือนการกระแทกเปิดใช้
งานอยู่เท่านั้น เพื่อหลีกเลี่ยงการวัดที่ไม่ถูกต้องเมื่อมีการ
เคลื่อนไหวนบนพื้นตั้งหรือมีสิ่งสะท้อนที่เครื่องมือวัด

การอธิบายโดยสรุปของสัญญาณบอกสถานะ

	ลำแสงเลเซอร์	การหมุน ลำแสง เลเซอร์ ⁽¹⁾	X		Y		Z	
			สีเขียว	สีแดง	สีเขียว	สีแดง	สีแดง	สีแดง
เครื่องมือวัดเปิดสวิตซ์ (ทดสอบตัวเอง 1 วินาที)				3x/s		3x/s	3x/s	3x/s
โหมดนิ่ง	o	o	1x/s		1x/s	1x/s	1x/s	

	ลำแสงเลเซอร์ ออร์	การหมุน ลำแสง เลเซอร์ ^{A)}	X		Y			
			สีเขียว	สีแดง	สีเขียว	สีแดง	สีแดง	สีแดง
การทำระดับ								
การปรับระดับ	*	○	*		*			
การปรับระดับใหม่	○	○	*		*			
ออกนอกย่านการทำระดับอัตโนมัติ				*		*		
เครื่องมือวัดพร้อมทำงาน, ปรับระดับทั้งสองแกน	●	●	●		●			
ฟังก์ชันเตือนการกระแทก								
การเตือนแรงกระแทกปล่อยใช้งานกลไก	*	○		*		*		*
ฟังก์ชันเตือนการกระแทกปิดสวิทช์อยู่								●
แรงดันไฟแบตเตอรี่								
แรงดันไฟแบตเตอรี่อ่อน							●	
แบตเตอรี่หมดประจุ							*	
โหมดการเอียง/ปฏิกิริยาการทำงานแบบแมนนวล								
ความเอียงของแกน X ปรับได้ ปรับแกน Y แล้ว	○	○		*	●			
ปรับแกน X ด้วยตนเอง ปรับแกน Y แล้ว	●	●		●	●			
ปรับแกน X แล้ว ความเอียงของแกน Y ปรับได้	○	○	●			*		
ปรับแกน X แล้ว ปรับแกน Y ด้วยตนเอง	●	●	●			●		
ความเอียงของแกน X ปรับได้ ปรับแกน Y ด้วยตนเอง	○	○		*		●		
ปรับแกน X ด้วยตนเอง ความเอียงของแกน Y ปรับได้	○	○		●		*		
ปรับแกน X ด้วยตนเอง ปรับแกน Y ด้วยตนเอง	●	●		●		●		
การสอบเทียบ								
โหมดการสอบเทียบแกน X (ที่ตำแหน่งในแนวนอน)				2x/s				2x/s
บันทึกการสอบเทียบแกน X แล้ว				* (6x)				
โหมดการสอบเทียบแกน Y						2x/s		2x/s
บันทึกการสอบเทียบแกน Y แล้ว						* (6x)		
โหมดการสอบเทียบแกน Z (ที่ตำแหน่งในแนวนอน)				2x/s				2x/s

	ลำแสงเลเซอร์	การหมุนลำแสงเลเซอร์ ^{A)}	X		Y			
			สีเขียว	สีแดง	สีเขียว	สีแดง	สีแดง	สีแดง
บันทึกการสอบเทียบแกน Z แล้ว			*					
			(6x)					
ข้อผิดพลาดในระหว่างการสอบเทียบแกน X และ Z				*				
ข้อผิดพลาดในระหว่างการสอบเทียบแกน Y						*		
รีเซ็ต								
ต้องรีเซ็ตารท์ เปิดและปิดสวิทช์เครื่องมือวัดด้วยปุ่มเปิด-ปิด (3)				3x/s		3x/s		

A) สำหรับโหมดเส้นและโหมดหมุน

● โหมดการทำงานต่อเนื่อง

* กะพริบ

2x/s: ความถี่ในการกะพริบ (เช่น สองครั้งภายในหนึ่งนาที)

o: พิงก์ซ์หยุด

การบำรุงรักษาและบริการ

การบำรุงรักษาและการทำความสะอาด

รักษาเครื่องมือวัดและรีโมทคอนโทรลสะอาดตลอดเวลา

อย่าจุ่มเครื่องมือวัดและรีโมทคอนโทรลลงในน้ำหรือของเหลวอื่นๆ

เช็ดสิ่งสกปรกออกด้วยผ้านุ่มที่เปียกหมาดๆอย่าใช้สารซักฟอกหรือตัวทำละลาย

ทำความสะอาดเครื่องมือวัด โดยเฉพาะพื้น

ผิวตรงช่องทางออกลำแสงเลเซอร์เป็นประจำ และเอาใจใส่อย่าให้ขูดขีด

เก็บรักษาและขนย้ายเครื่องมือวัดโดยบรรจุลงในทึบ (48) เท่านั้น

สำหรับการซ่อมแซม ต้องส่งเครื่องมือวัดโดยบรรจุลงในทึบ (48) เท่านั้น

การบริการหลังการขายและการให้คำปรึกษาการใช้งาน

ศูนย์บริการหลังการขายของเรายินดีตอบคำถามของท่านที่เกี่ยวกับการบำรุงรักษาและการซ่อมแซมผลิตภัณฑ์รวมทั้งเรื่องอะไหล่ ภาพเขียนแบบการประกอบและข้อมูลเกี่ยวกับอะไหล่ กรุณาดูใน: www.bosch-pt.com ทีมงานที่ปรึกษาของ บอช ยินดีให้ข้อมูลเกี่ยวกับผลิตภัณฑ์ของเราและอุปกรณ์ประกอบต่างๆ

เมื่อต้องการสอบถามและสั่งซื้ออะไหล่ กรุณาแจ้งหมายเลขสินค้า 10 หลักบนแผ่นป้ายรุ่นของผลิตภัณฑ์ทุกครั้ง

ไทย

ไทย บริษัท โรเบิร์ต บอช จำกัด

เอพวายุไอ เซ็นเตอร์ อาคาร 1 ชั้น 5

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ศูนย์บริการซ่อมและฝึกอบรม บอช

อาคาร ลาซาลทาวเวอร์ ชั้น G ห้องเลขที่ 2

บ้านเลขที่ 10/11 หมู่ 16

ถนนศรีนครินทร์ ตำบลบางแก้ว อำเภอบางพลี

จังหวัดสมุทรปราการ 10540

ประเทศไทย

โทรศัพท์ 02 7587555

โทรสาร 02 7587525

การกำจัดขยะ

อุปกรณ์ไฟฟ้า, แบตเตอรี่แพ็ค/แบตเตอรี่, อุปกรณ์ประกอบ และที่บ่อ ต้องนำไปแยกประเภทวัสดุเพื่อนำกลับมาใช้ใหม่โดยไม่ทำลายสภาพแวดล้อม



อย่าทิ้งอุปกรณ์ไฟฟ้าและแบตเตอรี่แพ็ค/แบตเตอรี่ลงในขยะบ้าน!

Bahasa Indonesia

Petunjuk keselamatan untuk laser putar



Petunjuk lengkap ini harus dibaca dan diperhatikan agar tidak terjadi bahaya dan Anda dapat bekerja dengan aman saat menggunakan alat ukur ini. Apabila alat

ukur tidak digunakan sesuai dengan petunjuk yang disertakan, keamanan alat ukur dapat terganggu. Janganlah sekali-kali menutupi atau melepas label keselamatan kerja yang ada pada alat ukur ini. **SIMPAN PETUNJUK INI DENGAN BAIK DAN BERIKAN KEPADA PEMILIK ALAT UKUR BERIKUTNYA.**

- ▶ Alat pengukur dikirim dengan tanda peringatan laser (ditandai dengan ilustrasi alat pengukur di halaman grafis).
- ▶ Jika teks pada tanda peringatan laser tidak tertulis dalam bahasa negara Anda, tempelkan label yang tersedia dalam bahasa negara Anda di atas label berbahasa Inggris sebelum Anda menggunakan alat untuk pertama kalinya.
- ▶ Lubang outlet laser ditandai dengan label peringatan pada alat ukur. Perhatikan posisi lubang outlet laser saat menggunakan alat ukur.
- ▶ Jika teks pada tanda peringatan tidak tertulis dalam bahasa negara Anda, tempelkan label yang tersedia dalam bahasa negara Anda di atas label tersebut sebelum Anda menggunakan alat untuk pertama kalinya.
- ▶ Perhatian – jika perangkat pengoperasian atau perangkat pengaturan atau prosedur lain selain yang dituliskan di sini digunakan, hal ini dapat menyebabkan terjadinya paparan radiasi yang berbahaya.

- ▶ Jangan mengubah peralatan laser.



Jangan melihat sinar laser ataupun mengarahkannya kepada orang lain atau hewan. Alat ukur ini menghasilkan radiasi laser dengan kelas laser 3R menurut EN 60825-1. Pandangan langsung ke arah sinar laser – bahkan dari jarak yang lebih jauh – dapat merusak mata.

- ▶ Jangan gunakan kacamata pelihat laser sebagai kacamata pelindung. Kacamata pelihat laser disediakan agar dapat mendeteksi laser dengan lebih baik, namun tidak melindungi dari sinar laser.
- ▶ Jangan gunakan kacamata pelihat laser sebagai sunglasses atau di jalan raya. Kacamata pelihat laser tidak menawarkan perlindungan penuh terhadap sinar UV dan mengurangi persepsi warna.
- ▶ Perbaiki alat ukur hanya di teknisi ahli resmi dan gunakan hanya suku cadang asli. Dengan demikian, keselamatan kerja dengan alat ukur ini selalu terjamin.

- ▶ Jangan biarkan anak-anak menggunakan alat ukur laser tanpa pengawasan. Anda dapat secara tidak sengaja membuat orang menjadi buta.
- ▶ Hindari pantulan sinar laser pada permukaan yang halus seperti jendela atau cermin. Sinar laser yang terpantul juga dapat merusak mata.
- ▶ Alat ukur sebaiknya dioperasikan oleh orang-orang yang terbiasa menggunakan perangkat laser. Menurut EN 60825-1 tercantum di dalamnya antara lain pengetahuan mengenai efek biologis dari laser terhadap mata dan kulit serta penggunaan pelindung laser yang benar guna mencegah risiko bahaya.
- ▶ Jangan mengoperasikan alat ukur di area yang berpotensi meledak yang di dalamnya terdapat cairan, gas, atau serbuk yang dapat terbakar. Di dalam alat pengukur dapat terjadi bunga api, yang lalu menyulut debu atau uap.
- ▶ Selalu letakkan alat ukur sedemikian rupa agar sinar laser memancar jauh di atas atau di bawah tinggi mata. Dengan begitu, dapat dipastikan tidak ada kerusakan mata.
- ▶ Tandai area tempat alat ukur digunakan dengan tanda peringatan laser. Dengan demikian, orang-orang lain yang tidak mengetahui tentang pekerjaan dengan alat ukur, tidak mendekati bidang yang membahayakan.
- ▶ Jangan menyimpan alat ukur di tempat yang dapat diakses oleh orang yang tidak berwenang. Orang-orang yang tidak memahami cara penggunaan alat ukur dengan aman dapat melukai diri sendiri atau orang lain.
- ▶ Perhatikan peraturan umum saat menggunakan laser dengan kelas laser 3R. Terdapat risiko cedera apabila Anda tidak mematuhi peraturan ini.
- ▶ Pastikan area sinar laser aman atau terlindung. Jika penyinaran laser terbatas pada bidang-bidang yang diawasi, hal tersebut dapat mencegah cedera mata pada orang lain yang tidak mengetahui bahwa alat ukur sedang digunakan.
- ▶ Jangan biarkan alat ukur yang aktif berada di luar pengawasan dan matikan alat ukur setelah digunakan. Sinar laser dapat menyilaukan mata orang lain.
- ▶ Jangan gunakan alat optik seperti teropong atau kaca pembesar untuk mengamati sumber radiasi. Hal tersebut dapat merusak mata.



Jauhkan aksesoris magnetis dari alat implan dan perangkat medis semacamnya, seperti misalnya alat pacu jantung atau pompa insulin. Magnet pada aksesoris menciptakan medan yang dapat memengaruhi fungsi alat implan atau perangkat medis.

- ▶ Jauhkan aksesoris magnetis dari media penyimpanan data magnetis dan perangkat yang sensitif terhadap magnet. Daya magnet pada aksesoris dapat mengakibatkan data-data hilang secara permanen.

Petunjuk keselamatan untuk remote control



Semua petunjuk harus dibaca dan diperhatikan. Perlindungan yang terintegrasi dalam remote control dapat terganggu apabila remote control tidak digunakan sesuai petunjuk yang disertakan. **SIMPAN PETUNJUK INI DENGAN BAIK.**

- ▶ Perbaiki remote control hanya boleh dilakukan oleh teknisi ahli resmi dan hanya gunakan suku cadang asli. Dengan demikian, keamanan penggunaan remote control selalu terjamin.
- ▶ Jangan bekerja menggunakan remote control di lokasi yang berpotensi mudah terjadi ledakan yang terdapat debu, gas dan cairan yang dapat terbakar. Di dalam remote control dapat terjadi percikan yang dapat menyulut debu atau uap.

Spesifikasi produk dan performa

Perhatikan ilustrasi yang terdapat pada bagian depan panduan pengoperasian.

Tujuan penggunaan

Laser rotasi

Alat pengukur ini cocok untuk menentukan dan memeriksa ketinggian garis yang mendatar, garis yang tegak lurus, garis pedoman dan titik-titik tegak lurus dengan saksama.

Alat ukur ditujukan untuk digunakan di dalam maupun di luar ruangan.

Remote control

Remote control cocok untuk mengontrol laser putar **Bosch** melalui inframerah.

Remote control ini cocok untuk digunakan di dalam maupun di luar ruangan.

Ilustrasi komponen

Penomoran dari bagian-bagian perkakas yang digambarkan mengacu pada gambar alat pengukur dan remote control pada halaman grafik.

Laser rotasi

- (1) Penguncian kompartemen baterai^{A)}
- (2) Kompartemen baterai^{A)}
- (3) Tombol on/off
- (4) Tombol mode rotasi
- (5) Tombol kemiringan ke bawah
- (6) Indikator status sumbu Y
- (7) Indikator status sumbu X
- (8) Sinar laser variabel
- (9) Sensor untuk remote control
- (10) Outlet sinar laser

- (11) Titik tegak lurus ke atas
 - (12) Peringatan baterai
 - (13) Indikator fungsi shock-warning
 - (14) Tombol pengoperasian manual
 - (15) Tombol kemiringan ke atas
 - (16) Tombol mode garis
 - (17) Dudukan tripod 5/8"
 - (18) Nomor seri
 - (19) Label peringatan laser
 - (20) Label peringatan outlet laser
- A) Aksesori yang ada pada gambar atau yang dijelaskan tidak termasuk dalam lingkup pengiriman standar. Semua aksesori yang ada dapat Anda lihat dalam program aksesori kami.

Remote control

- (21) Remote control^{A)}
- (22) Tombol kemiringan X-
- (23) Tombol memutar berlawanan arah jarum jam
- (24) Tombol kemiringan Y+
- (25) Tombol kemiringan X+
- (26) Tombol mode rotasi
- (27) Outlet radiasi inframerah
- (28) Indikator transmisi sinyal
- (29) Tombol mode senyap (standby)
- (30) Tombol mode garis
- (31) Tombol pengoperasian manual
- (32) Tombol kemiringan Y-
- (33) Tombol memutar searah jarum jam
- (34) Nomor seri
- (35) Penguncian tutup kompartemen baterai
- (36) Tutup kompartemen baterai

A) Aksesori yang ada pada gambar atau yang dijelaskan tidak termasuk dalam lingkup pengiriman standar. Semua aksesori yang ada dapat Anda lihat dalam program aksesori kami.

Aksesori/suku cadang

- (37) Penerima laser^{A)}
- (38) Penggaris^{A)}
- (39) Tripod^{A)}
- (40) Sekrup pengencang penahan dinding^{A)}
- (41) Sekrup pada unit penyejajaran^{A)}
- (42) Penahan dinding/unit penyejajaran^{A)}
- (43) Sekrup 5/8" pada penahan dinding^{A)}
- (44) Magnet^{A)}
- (45) Penopang penerima laser^{A)}
- (46) Kacamata laser^{A)}
- (47) Reflektor sinar laser^{A)}

(48) Koper^{A)}

- A) Aksesoris yang ada pada gambar atau yang dijelaskan tidak termasuk dalam lingkup pengiriman standar. Semua aksesoris yang ada dapat Anda lihat dalam program aksesoris kami.

Data teknis

Laser rotasi	GRL 350 HV
Nomor seri	3 601 K61 S..
Area kerja (diameter) ^{A)B)}	
– tanpa penerima laser sekitar	60 m
– dengan penerima laser sekitar	350 m
Akurasi perataan ^{A)C)}	
– horizontal	± 1,5 mm/30 m
– vertikal	± 3 mm/30 m
Area perataan otomatis khusus	± 8% (± 4,6°)
Waktu perataan khusus	30 detik
Kecepatan rotasi	0/150/300/600 min ⁻¹
Sudut bukaan pada mode garis	10/25/50°
Area kemiringan pada pengoperasian manual	± 8%
Suhu pengoperasian	-10°C ... +50°C
Suhu penyimpanan	-20°C ... +70°C
Tinggi penggunaan maks. di atas tinggi acuan	2000 m
Kelembapan relatif maks.	90%
Tingkat polusi sesuai dengan IEC 61010-1	2 ^{D)}
Kelas laser	3R
Jenis laser	630–650 nm, < 5 mW
Divergensi	0,4 mrad (sudut penuh)
Dudukan tripod horizontal	5/8"-11
Baterai (alkali)	2 × 1,5 V LR20 (D)
Durasi pengoperasian sekitar	30 jam
Berat sesuai dengan EPTA-Procedure 01:2014	1,8 kg
Dimensi (panjang × lebar × tinggi)	187 × 182 × 170 mm
Jenis perlindungan (selain kompartemen baterai)	IP 56 (terlindung dari debu dan percikan air)

A) pada 20 °C

B) Area kerja dapat berkurang akibat keadaan lingkungan yang tidak menguntungkan (seperti sinar matahari langsung).

C) sepanjang poros

D) Hanya polusi nonkonduktif yang terjadi, namun terkadang muncul konduktivitas sementara yang disebabkan oleh kondensasi.

Untuk mengidentifikasi alat ukur secara jelas terdapat nomor seri **(18)** pada label tipe.

Remote control	RC 4
Nomor seri	3 601 K69 S..
Area kerja ^{A)}	30 m
Suhu pengoperasian	-10°C ... +50°C
Suhu penyimpanan	-20°C ... +70°C
Tinggi penggunaan maks. di atas tinggi acuan	2000 m
Kelembapan relatif maks.	90%
Tingkat polusi sesuai dengan IEC 61010-1	2 ^{B)}
Baterai (alkali)	2 × 1,5 V LR6 (AA)
Berat sesuai dengan EPTA-Procedure 01:2014	0,11

A) Area kerja dapat berkurang akibat keadaan lingkungan yang tidak menguntungkan (seperti sinar matahari langsung).

B) Hanya polusi nonkonduktif yang terjadi, namun terkadang muncul konduktivitas sementara yang disebabkan oleh kondensasi.

Terdapat nomor seri **(34)** pada label tipe untuk mengidentifikasi remote control secara jelas.

Cara memasang**Suplai daya remote control**

Untuk pengoperasian remote control disarankan memakai baterai alkali.

Untuk membuka tutup kompartemen baterai **(36)**, tekan pengunci **(35)** dan lepaskan tutup kompartemen baterai. Masukkan baterai.


Pastikan baterai terpasang pada posisi kutub yang benar sesuai gambar di dalam kompartemen baterai.

Selalu ganti semua baterai sekaligus. Hanya gunakan baterai dari produsen yang dan dengan kapasitas yang sama.


► **Keluarkan baterai dari remote control apabila tidak digunakan untuk waktu yang lama.** Jika baterai berada dalam remote control untuk waktu yang lama, baterai dapat berkarat dan daya baterai akan habis dengan sendirinya.

Suplai daya alat ukur

Untuk pengoperasian alat ukur disarankan memakai baterai mangani alkali.

Untuk melepas kompartemen baterai **(2)**, putar pengunci **(1)** ke posisi . Tarik kompartemen baterai ke luar dari alat pengukur lalu pasang baterai.

Pastikan baterai terpasang pada posisi kutub yang benar sesuai gambar di dalam kompartemen baterai.

Dorong kompartemen baterai **(2)** ke dalam alat pengukur lalu putar pengunci **(1)** ke posisi .

Jika baterai lemah, peringatan baterai **(12)** akan menyala merah. Alat pengukur masih dapat dioperasikan sekitar 2 jam.

Jika peringatan baterai **(12)** berkedip merah, alat pengukur akan nonaktif secara otomatis setelah 5 menit.

Selalu ganti semua baterai sekaligus. Hanya gunakan baterai dari produsen dan dengan kapasitas yang sama.

- **Keluarkan baterai dari alat pengukur jika tidak digunakan dalam waktu yang lama.** Jika baterai disimpan di dalam alat pengukur untuk waktu yang lama, baterai dapat berkarat dan dayanya akan habis dengan sendirinya.

Penggunaan

- **Lindungi alat pengukur dan remote control dari kelembapan dan sinar matahari langsung.**
- **Jauhkan alat pengukur dan remote control dari suhu atau perubahan suhu yang ekstrem.** Jangan biarkan alat pengukur dan remote control berada terlalu lama di dalam kendaraan. Biarkan alat pengukur dan remote control menyesuaikan suhu lingkungan apabila terjadi perubahan suhu yang drastis sebelum dioperasikan. Sebelum melanjutkan pekerjaan dengan alat pengukur, selalu lakukan pemeriksaan akurasi melalui (lihat „Pemeriksaan keakuratan alat ukur“, Halaman 74). Pada suhu yang ekstrem atau terjadi perubahan suhu yang drastis, ketepatan alat ukur dapat terganggu.
- **Hindari guncangan atau benturan yang keras pada alat ukur.** Apabila setelah terjadi pengaruh eksternal yang kuat pada alat ukur, disarankan untuk memeriksa akurasi alat ukur sebelum digunakan kembali (lihat „Pemeriksaan keakuratan alat ukur“, Halaman 74).
- **Berhati-hatilah jika kotak laser (laser cage) rusak akibat alat pengukur terjatuh.** Tepi patahan kotak laser dapat melukai Anda.

Pengoperasian remote control

Jika tombol kontrol pada alat pengukur ditekan, alat pengukur dapat keluar dari perataan sehingga rotasi akan berhenti sesaat. Hindiri efek yang ditimbulkan dengan menggunakan remote control.

Selama baterai yang dipasang memiliki tegangan yang cukup, remote control akan selalu siap dioperasikan.

Atur alat pengukur sehingga sinyal remote control mencapai salah satu sensor (9) ke arah secara langsung. Jika remote control tidak diarahkan secara langsung ke sensor, area kerja akan menyempit. Dengan refleksi sinyal (misalnya pada dinding), rentang juga dapat kembali diperbaiki pada sinyal tidak langsung.

Setelah tombol pada remote control ditekan, lampu indikator transmisi sinyal (28) akan menunjukkan bahwa sinyal telah ditransmisikan.

Alat pengukur tidak dapat dihidupkan/dimatikan dengan remote control.

Pengoperasian laser rotasi

- **Jauhkan area kerja dari penghalang yang dapat memantulkan atau menghalangi sinar laser. Tutupi permukaan yang reflektif atau mengkilap. Jangan mengukur melalui panel kaca atau material yang**

serupa. Hasil pengukuran dapat terdistorsi akibat sinar laser yang dipantulkan atau dihalangi.

Mengatur alat pengukur



Posisi horizontal



Posisi vertikal

Atur alat pengukur pada permukaan yang stabil dalam posisi horizontal atau vertikal, pasang pada tripod (39) atau pada penahan dinding (42) dengan unit penyejajaran.

Karena akurasi perataan yang tinggi, alat pengukur sangat peka terhadap getaran dan perubahan posisi. Karena itu pastikan bahwa posisi alat pengukur dalam keadaan stabil agar alat pengukur terhindar dari gangguan karena harus melakukan perataan ulang.

Menghidupkan/mematikan

Catatan: Setelah pengoperasian pertama kali serta setiap sebelum mulai pengerjaan, lakukan pemeriksaan akurasi melalui (lihat „Pemeriksaan keakuratan alat ukur“, Halaman 74).

Untuk **menghidupkan** alat pengukur, tekan tombol on/off (3). Semua indikator berkedip merah dengan cepat (3×/dtk). Alat pengukur mengeluarkan sinar laser variabel (8) serta titik tegak lurus ke atas (11) dari outlet sinar laser (10).

- **Jangan mengarahkan sinar laser pada orang lain atau binatang dan jangan melihat ke sinar laser, juga tidak dari jarak jauh.**

Alat pengukur segera memulai perataan otomatis. Selama perataan, indikator status sumbu X (7) dan sumbu Y (6) akan berkedip hijau dan sinar laser akan berkedip pada mode titik.

Alat pengukur melakukan perataan secara otomatis begitu indikator status sumbu X (7) dan sumbu Y (6) menyala hijau dan sinar laser menyala secara terus-menerus. Setelah perataan selesai, alat pengukur akan mulai secara otomatis pada mode rotasi.

- **Jangan biarkan alat ukur yang aktif berada di luar pengawasan dan matikan alat ukur setelah digunakan.** Sinar laser dapat menyilaukan mata orang lain.

Untuk **mematikan** alat pengukur, tekan tombol on/off (3) beberapa kali hingga semua indikator menghilang.

Mode senyap (standby)

Saat jeda kerja, alat pengukur dapat digerakkan dalam mode senyap menggunakan remote control (21). Semua pengaturan akan disimpan dan fungsi shock-warning akan tetap aktif.

Untuk **mengaktifkan** mode senyap, tekan tombol mode senyap (29) pada remote control. Semua indikator pada alat pengukur akan berkedip lambat (1×/dtk).

Untuk **menonaktifkan** mode senyap, tekan lagi tombol mode senyap **(29)**. Mode senyap juga dapat diakhiri dengan menekan singkat tombol on/off **(3)** pada alat pengukur.

Mode pengoperasian

Pergerakan sumbu X dan Y

Pergerakan sumbu X dan Y ditandai melalui kepala rotasi pada housing.

Ikhtisar mode pengoperasian

Ketiga mode pengoperasian dapat dilakukan dalam posisi horizontal dan vertikal alat pengukur.



Mode rotasi

Mode rotasi sangat direkomendasikan untuk digunakan pada penerima laser. Beberapa kecepatan rotasi yang berbeda dapat dipilih.



Mode garis

Pada mode pengoperasian ini, sinar laser variabel akan bergerak dalam sudut bukaan yang terbatas. Dengan demikian, sinar laser tampak lebih jelas dibandingkan dengan mode rotasi. Anda dapat memilih antara beberapa sudut bukaan yang berbeda.



Mode titik

Dalam mode pengoperasian ini, sinar laser akan tampak paling jelas. Mode ini digunakan untuk mengirim ketinggian dengan mudah atau untuk memeriksa kesejajaran.

Mode garis dan mode titik tidak cocok untuk digunakan dengan penerima laser **(37)**.



Mode rotasi/mode titik

Setelah setiap dihidupkan, alat pengukur berada dalam mode rotasi dengan kecepatan rotasi standar (300 min^{-1}). Untuk mengganti mode garis ke mode rotasi atau mode titik, tekan tombol mode rotasi **(4)** atau tombol mode rotasi **(26)** pada remote control.

Untuk mengubah kecepatan rotasi, tekan beberapa kali tombol mode rotasi **(4)** atau tombol mode rotasi **(26)** pada remote control hingga kecepatan yang diinginkan tercapai. Kecepatan rotasi ditingkatkan secara bertahap setiap kali ditekan. Setelah tingkat kecepatan yang tertinggi tercapai, alat pengukur akan beralih ke mode titik setelah berbunyi singkat. Menekan ulang tombol mode rotasi akan mengembalikan ke mode rotasi dengan kecepatan rotasi terendah.

Pada pengoperasian dengan penerima laser, Anda harus memilih kecepatan rotasi yang paling tinggi. Pada pengoperasian tanpa penerima laser, kurangi kecepatan putaran untuk visibilitas sinar laser yang lebih baik dan gunakan kacamata laser **(46)**.



Mode garis

Tekan tombol mode garis **(16)** atau tombol mode garis **(30)** pada remote control untuk mengganti ke mode garis.

Untuk mengubah sudut bukaan, tekan beberapa kali tombol mode garis **(16)** atau tombol mode garis **(30)** pada remote control hingga mode pengoperasian yang diinginkan tercapai. Sudut bukaan akan diperbesar secara bertahap setiap kali ditekan, kecepatan putaran akan meningkat secara bersamaan pada setiap tahapan.

Catatan: Berdasarkan inersia, laser dapat berayun sedikit ke titik akhir garis laser.

Fungsi

Memutar garis/titik pada posisi horizontal dalam bidang rotasi

Pada posisi horizontal alat pengukur, garis laser atau titik laser dapat diposisikan dalam bidang rotasi laser. Putaran dapat dilakukan sebesar 360° .

Untuk memutar berlawanan arah jarum jam, tekan tombol kemiringan ke bawah **(5)** pada alat pengukur atau tombol untuk memutar berlawanan arah jarum jam **(23)** pada remote control.

Untuk memutar searah jarum jam, tekan tombol kemiringan ke atas **(15)** pada alat pengukur atau tombol untuk memutar searah jarum jam **(33)** pada remote control.

Memutar bidang rotasi pada posisi vertikal

Pada posisi vertikal alat pengukur, titik laser, garis laser atau bidang rotasi dapat diputar untuk disejajarkan dengan mudah atau untuk diarahkan secara paralel dalam rentang $\pm 8\%$ di sekeliling sumbu X.

Untuk memutar berlawanan arah jarum jam, tekan tombol kemiringan ke bawah **(5)** pada alat pengukur atau tombol untuk memutar berlawanan arah jarum jam **(23)** pada remote control.

Untuk memutar searah jarum jam, tekan tombol kemiringan ke atas **(15)** pada alat pengukur atau tombol untuk memutar searah jarum jam **(33)** pada remote control.

Perataan otomatis

Ikhtisar

Setelah dihidupkan, alat pengukur akan memeriksa posisi horizontal atau vertikal dan menyeimbangkan ketidakrataaan di dalam rentang perataan otomatis mulai sekitar $\pm 8\%$ ($\pm 4,6^\circ$) secara otomatis.

Selama perataan, indikator status sumbu X **(7)** dan sumbu Y **(6)** akan berkedip hijau dan sinar laser akan berkedip pada mode titik.

Alat pengukur melakukan perataan secara otomatis begitu indikator status sumbu X **(7)** dan sumbu Y **(6)** menyala hijau dan sinar laser menyala secara terus-menerus. Setelah perataan selesai, alat pengukur akan mulai secara otomatis pada mode rotasi.

Jika alat pengukur berada pada posisi miring setelah dihidupkan atau setelah posisi diubah lebih dari 8% , perataan tidak lagi dapat dilakukan. Pada situasi tersebut,

indikator status sumbu X (7) dan sumbu Y (6) akan berkedip merah, rotor berhenti dan laser dinonaktifkan.

Matikan alat pengukur, posisikan secara mendatar (posisi horizontal) atau secara tegak lurus (posisi vertikal) dan hidupkan lagi.

Pengubahan posisi

Jika alat pengukur melakukan perataan, alat akan memeriksa posisi horizontal atau vertikal secara konstan. Jika posisi berubah, alat pengukur melakukan perataan ulang secara otomatis.

Perubahan posisi minimal diimbangi tanpa menghentikan pengoperasian. Hal ini akan mengimbangi getaran di atas permukaan atau pengaruh cuaca.

Pada **perubahan posisi yang lebih besar**, putaran sinar laser akan berhenti dan laser akan dinonaktifkan untuk mencegah kegagalan pengukuran selama proses perataan. Indikator status sumbu X (7) dan sumbu Y (6) berkedip hijau. Fungsi shock-warning mungkin dapat terpicu.

Alat pengukur mengenali posisi horizontal atau vertikal secara otomatis. Untuk **mengubah antara posisi horizontal dan vertikal**, matikan alat pengukur, posisikan ulang dan hidupkan lagi.

Fungsi shock-warning

Alat pengukur memiliki sebuah fungsi shock-warning. Saat posisi diubah atau terdapat getaran pada alat pengukur atau getaran pada permukaan, fungsi ini akan mencegah perataan pada posisi yang telah diubah yang menyebabkan kesalahan akibat bergesernya alat pengukur.

Mengaktifkan shock-warning: Fungsi shock-warning diaktifkan secara default. Fungsi akan aktif sekitar 1 menit setelah alat pengukur dihidupkan.

Shock-warning terpicu: Jika posisi alat pengukur diubah atau tercatat getaran yang kencang, shock-warning akan terpicu. Putaran laser akan berhenti dan sinar laser berkedip. Indikator shock-warning (13) serta indikator status sumbu X (7) dan sumbu Y (6) akan berkedip merah secara bersamaan. Mode pengoperasian saat ini akan disimpan.

Tekan singkat tombol on/off (3) saat shock-warning terpicu. Fungsi shock-warning dimulai ulang dan alat pengukur

memulai perataan. Begitu dilakukan perataan pada alat pengukur (indikator status sumbu X (7) dan sumbu Y (6) menyala terus-menerus), fungsi akan dimulai pada mode pengoperasian yang disimpan.

Kini, periksa posisi sinar laser pada titik referensi dan perbaiki ketinggian atau arah alat pengukur jika perlu.

Menonaktifkan fungsi shock-warning: Untuk menonaktifkan atau mengaktifkan fungsi shock-warning, tekan sekali secara singkat tombol on/off (3) atau dua kali secara singkat saat shock-warning terpicu (indikator shock-warning (13) berkedip merah). Jika shock-warning telah dinonaktifkan, indikator shock-warning (13) akan menyala merah secara terus-menerus.

Jika fungsi shock-warning telah diaktifkan, fungsi akan aktif setelah sekitar 1 menit.

Catatan: Fungsi shock-warning tidak dapat diaktifkan, dinonaktifkan maupun dimulai ulang menggunakan remote control.

Pengoperasian kemiringan satu sumbu/ pengoperasian manual

Perataan otomatis pada alat pengukur dapat dinonaktifkan (pengoperasian manual):

- pada posisi horizontal, kedua sumbu tidak saling bergantung,
- pada posisi vertikal untuk sumbu X (sumbu Y tidak dapat dilakukan perataan pada posisi vertikal).

Pada pengoperasian manual, posisi alat pengukur dapat diatur dalam posisi miring mana pun. Selain itu, sumbu dapat dimiringkan tanpa harus saling bergantung dalam rentang mulai $\pm 8\%$ pada alat pengukur.

Memilih sumbu: Untuk memulai pengoperasian manual atau memilih sumbu yang miring, tekan tombol pengoperasian manual (14) pada alat pengukur atau tombol pengoperasian manual (31) pada remote control. Pada indikator status sumbu X (7) atau sumbu Y (6) dapat dideteksi sumbu mana yang tidak lagi dilakukan perataan atau tidak dapat dimiringkan.

Menekan tombol pengoperasian manual	Status sumbu X			Status sumbu Y	
	hijau	merah		hijau	merah
1x (pada posisi horizontal)		*	pengoperasian kemiringan satu sumbu, sumbu dapat diatur	●	sumbu dilakukan perataan
1x (pada posisi vertikal)		*	pengoperasian kemiringan satu sumbu, sumbu dapat diatur	-	sumbu tidak dapat dilakukan perataan
2x	●		sumbu dilakukan perataan		* pengoperasian kemiringan satu sumbu, sumbu dapat diatur
3x		*	pengoperasian manual, sumbu dapat diatur	●	pengoperasian manual

Memekan tombol pengoperasian manual	Status sumbu X		Status sumbu Y		
	hijau	merah	hijau	merah	
4x		●		*	pengoperasian manual, sumbu dapat diatur
5x (pada posisi horizontal)	*/●		*/●		sumbu dilakukan perataan/telah dilakukan perataan
5x (pada posisi vertikal)	*/●		-		sumbu tidak dapat dilakukan perataan

● Indikator menyala terus-menerus

* Indikator berkedip

- Indikator menghilang

Memiringkan sumbu: Kemiringan sumbu dalam pengoperasian kemiringan atau pengoperasian manual dapat diubah dalam kurun waktu 5 detik setelah sumbu dipilih (selama indikator status sumbu terkait berkedip merah). Jika indikator status terus menyala merah, kemiringan telah ditentukan. Agar kemiringan dapat diubah, tekan lagi tombol pengoperasian manual (14) pada alat pengukur atau tombol pengoperasian manual (31) pada remote control beberapa kali hingga indikator status sumbu yang diinginkan berkedip merah.

Kemiringan sumbu yang dapat diatur dapat diubah sebagai berikut:

- Pada alat pengukur: Tekan tombol kemiringan ke bawah (5) untuk memiringkan sumbu yang dapat diatur ke arah "-".
Tekan tombol kemiringan ke atas (15) untuk memiringkan sumbu yang dapat diatur ke arah "+".
- Dengan remote control: Tekan tombol kemiringan X+ (25) atau tombol kemiringan X- (22) untuk memiringkan sumbu X ke arah "+" atau ke arah "-".
Tekan tombol kemiringan Y+ (24) atau tombol kemiringan Y- (32) untuk memiringkan sumbu Y ke arah "+" atau ke arah "-".

Pemeriksaan keakuratan alat ukur

Pengoperasian berikut hanya boleh dilakukan oleh orang yang terlatih dan berkualifikasi. Legalitas saat melaksanakan pemeriksaan akurasi atau kalibrasi alat pengukur harus dikenali.

Pengaruh terhadap ketelitian

Suhu sekitar memberikan pengaruh terbesar. Khususnya perbedaan suhu dari tanah ke atas dapat mempengaruhi sinar laser.

Berhubung perbedaan dari lapisan-lapisan suhu di dekat tanah paling besar, alat ukur mulai jarak pengukuran sebesar 20 m sebaiknya selalu dipasang pada tripod. Selain itu alat ukur sebaiknya dipasang di bagian tengah permukaan kerja.

Selisih akan berpengaruh pada jarak pengukuran sekitar 20 m dan pada jarak 100 m dapat berjumlah dua hingga empat kali lipat dari selisih pada jarak 20 m.

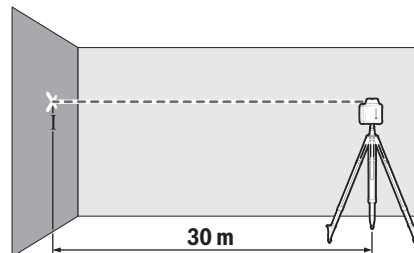
Selain pengaruh dari luar, pengaruh khusus perangkat juga dapat menyebabkan kerusakan (seperti misalnya benturan atau guncangan keras). Oleh karena itu, periksa ketepatan levelling terlebih dahulu sebelum memulai proses.

Jika alat pengukur harus melampaui selisih maksimal pada proses pengukuran yang dijelaskan berikut, lakukan kalibrasi melalui (lihat „Mengkalibrasi alat pengukur“, Halaman 75) atau periksa alat pengukur di layanan pelanggan **Bosch**.

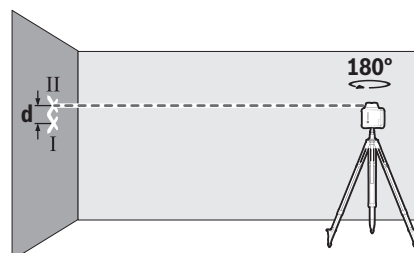
Memeriksa akurasi perataan pada posisi horizontal

Untuk hasil yang reliabel dan tepat, pemeriksaan disarankan dilakukan pada jarak ukur bebas sebesar 30 m di atas permukaan yang stabil pada dinding. Lakukan proses pengukuran yang lengkap pada kedua sumbu.

- Pasang alat pengukur pada posisi horizontal 30 m dari dinding pada tripod, atau letakkan pada permukaan yang stabil dan rata. Hidupkan alat pengukur.



- Tandai bagian tengah sinar laser pada dinding (titik I) setelah perataan selesai.



- Putar alat pengukur sebesar 180° tanpa mengubah posisinya. Biarkan alat pengukur melakukan perataan dan tandai pusat titik sinar laser pada dinding (titik II).

Pastikan titik II terletak vertikal di atas atau di bawah titik I.

Selisih **d** dari kedua titik I dan II yang ditandai pada dinding memberikan selisih ketinggian alat pengukur yang sebenarnya untuk sumbu yang diukur.

Ulangi proses pengukuran pada sumbu lainnya. Putar alat pengukur sebesar 90° sebelum memulai proses pengukuran. Pada jarak ukur **30 m**, selisih maksimal yang diperbolehkan adalah sebesar:

$30 \text{ m} \times \pm 0,05 \text{ mm/m} = \pm 1,5 \text{ mm}$. Selisih **d** antara titik I dan II hanya diperbolehkan maksimal sebesar **3 mm** pada setiap proses pengukuran.

Mengkalibrasi alat pengukur

Pengoperasian berikut hanya boleh dilakukan oleh orang yang terlatih dan berkualifikasi. Legalitas saat melaksanakan pemeriksaan akurasi atau kalibrasi alat pengukur harus dikenali.

- ▶ **Lakukan kalibrasi alat pengukur secara cermat atau lakukan pemeriksaan alat pengukur di layanan pelanggan Bosch.** Kalibrasi yang tidak tepat dapat menyebabkan kesalahan hasil pengukuran.
- ▶ **Hanya jalankan kalibrasi jika kalibrasi alat pengukur perlu dilakukan.** Begitu alat pengukur berada dalam mode kalibrasi, kalibrasi harus dilakukan secara cermat hingga selesai agar tidak terjadi kesalahan pengukuran sesudahnya.

Periksa akurasi perataan setiap setelah dikalibrasi (lihat „Pemeriksaan keakuratan alat ukur“, Halaman 74). Jika selisih berada di luar nilai maksimal yang diperbolehkan, periksa alat pengukur di layanan pelanggan **Bosch**.

Selalu kalibrasikan semua sumbu (sumbu X, Y dan Z).

Catatan: Jika indikator status sumbu X (**7**) atau indikator status sumbu Y (**6**) berkedip merah selama kalibrasi, terdapat selisih di luar rentang maksimal yang diperbolehkan. Pada situasi tersebut, tekan tombol pengoperasian manual (**14**) untuk keluar dari mode kalibrasi tanpa menyimpan pengaturan. Selanjutnya, indikator status sumbu X (**7**) dan sumbu Y (**6**) berkedip merah 3×/dtk untuk menampilkan kesalahan kalibrasi.

Mulai ulang kalibrasi. Jika kesalahan masih terjadi, lakukan pemeriksaan alat pengukur di layanan pelanggan **Bosch**.

Kalibrasi sumbu X dan Y

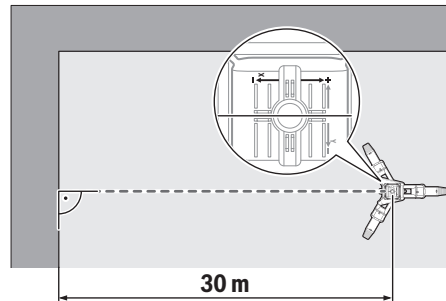
Untuk kalibrasi, diperlukan jarak ukur bebas sebesar **30 m** di atas permukaan yang stabil pada dinding.

Jika perlu (misalnya jika kondisi visibilitas kurang baik), penerima laser (**37**) dapat digunakan untuk menandai sinar laser. Saat menggunakan penerima laser, pastikan dengan saksama penerima laser telah diatur secara vertikal pada dinding, karena jika tidak, tanda akan tergeser terhadap sinar laser. Pada penerima laser dengan akurasi penerimaan yang dapat diatur, akurasi penerimaan dapat diatur terlepas dari akurasi kalibrasi yang diinginkan (perhatikan panduan pengoperasian penerima laser).

Memasang dan mengatur alat pengukur untuk kalibrasi:

Pasang alat pengukur dalam posisi horizontal **30 m** dari

dinding pada tripod (**39**) (disarankan) atau letakkan pada permukaan yang stabil dan rata.



Atur alat pengukur sedemikian rupa sehingga indikator sumbu X yang tertera pada alat pengukur tegak lurus pada dinding.

Memulai kalibrasi:

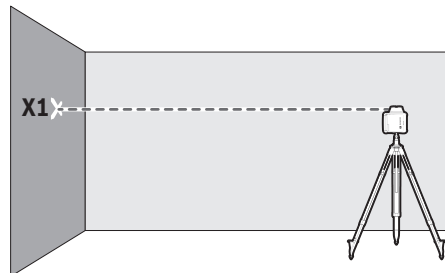
Untuk memulai kalibrasi, alat pengukur harus dimatikan.

Tekan dan tahan tombol pengoperasian manual (**14**) pada alat pengukur dan tekan singkat tombol on/off (**3**). Lepaskan tombol pengaturan kemiringan begitu indikator status sumbu X (**7**) berkedip hijau dan indikator fungsi shock-warning (**13**) berkedip merah (masing-masing 2×/dtk).

Alat pengukur telah dihidupkan dalam mode kalibrasi untuk sumbu X.

Kalibrasi sumbu X:

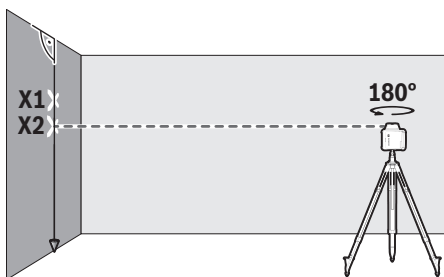
Pastikan alat pengukur dengan sumbu X telah diatur secara tegak lurus ke dinding. Tunggu hingga alat pengukur melakukan perataan dan mode rotasi dimulai.



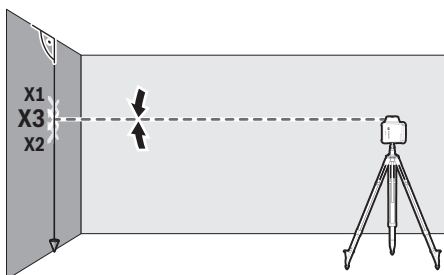
Tandai ketinggian sinar laser pada dinding sebagai ketinggian **X1**. Jika perlu, gunakan penerima laser (**37**).

Putar alat pengukur sebesar 180° tanpa mengubah ketinggian dan posisi alat pengukur.

Tunggu hingga alat pengukur melakukan perataan dan mode rotasi dimulai.



Tandai ketinggian sinar laser pada dinding sebagai ketinggian **X2**. Jika perlu, gunakan penerima laser (**37**). Pastikan ketinggian **X2** berada dalam posisi setegak mungkin di atas atau di bawah ketinggian **X1**.



Tentukan titik tengah yang tepat di antara ketinggian **X1** dan **X2** yang ditandai dan tandai sebagai ketinggian **X3** pada dinding.

Atur sinar laser variabel (**8**) menggunakan tombol kemiringan ke bawah (**5**) atau ke atas (**15**) sehingga menyentuh ketinggian **X3** seakurat mungkin. Jika perlu, gunakan penerima laser (**37**).

Simpan kalibrasi sumbu X dengan cara menekan tombol pengoperasian manual (**14**). Untuk mengonfirmasi, indikator status sumbu X (**7**) akan berkedip hijau 6 kali.

Kalibrasi sumbu Y:

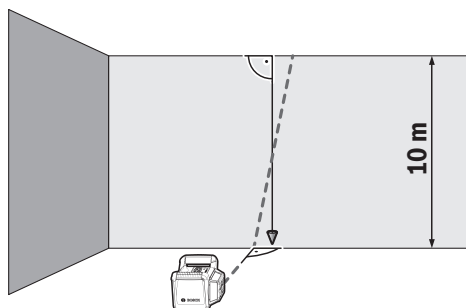
Setelah kalibrasi sumbu X, alat pengukur akan beralih secara otomatis ke mode kalibrasi untuk sumbu Y. Indikator status sumbu Y (**6**) berkedip hijau, indikator fungsi shock-warning (**13**) berkedip merah (masing-masing 2×/dtk).

Putar alat pengukur sebesar 90° sehingga indikator sumbu Y yang tertera pada alat pengukur tegak lurus pada dinding. Lalu, lakukan kalibrasi seperti yang telah dijelaskan pada sumbu X.

Jika kalibrasi sumbu Y disimpan, indikator status sumbu Y (**6**) akan berkedip hijau 6 kali. Mode kalibrasi akan berakhir secara otomatis.

Kalibrasi sumbu Z

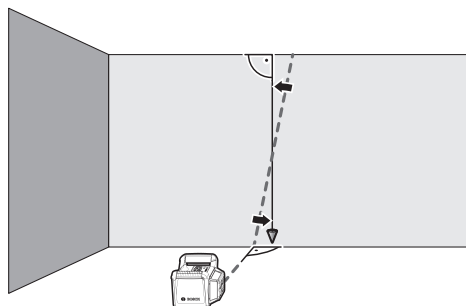
Untuk kalibrasi, diperlukan jarak ukur bebas di atas permukaan yang stabil pada dinding setinggi 10 m. Kencangkan tali lut pada dinding.



Letakkan alat pengukur dalam posisi vertikal di atas permukaan yang stabil dan rata. Hidupkan alat pengukur dan lakukan perataan. Atur alat pengukur sedemikian rupa sehingga sinar laser variabel mengarah ke dinding secara tegak lurus dan memotong tali lut. Matikan alat pengukur.

Untuk memulai mode kalibrasi, tekan dan tahan tombol pengoperasian manual (**14**) dan tekan singkat tombol on/off (**3**). Lepaskan tombol pengaturan kemiringan begitu indikator status sumbu X (**7**) berkedip hijau dan indikator fungsi shock-warning (**13**) berkedip merah (masing-masing 2×/dtk).

Alat pengukur telah dihidupkan dalam mode kalibrasi untuk sumbu Z. Tunggu hingga alat pengukur melakukan perataan dan mode rotasi dimulai.



Atur sinar laser variabel sedemikian rupa sehingga berada paralel mungkin terhadap tali lut. Tekan tombol kemiringan ke bawah (**5**) atau ke atas (**15**).

Jika tidak memungkinkan untuk mengatur sinar laser secara paralel ke tali lut, maka atur alat pengukur dengan lebih tepat ke dinding dan mulai lagi proses kalibrasi.

Jika sinar laser telah diatur secara paralel, selanjutnya simpan kalibrasi dengan cara menekan tombol pengoperasian manual (**14**). Untuk mengonfirmasi, indikator status sumbu X (**7**) akan berkedip hijau 6 kali.

Kalibrasi sumbu Z telah disimpan dan mode kalibrasi berakhir secara otomatis.

Petunjuk pemakaian

- **Selalu hanya gunakan bagian tengah titik laser atau garis laser untuk menandai.** Besarnya titik laser atau

lebarnya garis laser berubah sesuai dengan perubahan jarak.

Bekerja dengan reflektor (alat pemantulan) (lihat gambar A)

Reflektor (alat pemantulan) **(47)** meningkatkan visibilitas sinar laser dalam kondisi yang tidak menguntungkan dan jarak yang lebih besar.

Setengah reflektif pada reflektor (alat pemantulan) **(47)** meningkatkan visibilitas garis laser, garis laser juga dapat terlihat melalui bagian yang transparan dari bagian belakang reflektor (alat pemantulan).

Bekerja dengan tripod (aksesori)

Tripod memberi posisi pengukuran yang stabil dan ketinggian yang dapat diatur. Atur alat pengukur dengan dudukan tripod 5/8" **(17)** ke ulir tripod **(39)**. Kencangkan alat pengukur dengan baut pengencang tripod.

Pada tripod dengan skala ukur pada perpanjangan rambu ukur, offset ketinggian dapat diatur secara langsung.

Atur tripod sebelum menghidupkan alat ukur.

Pengoperasian dengan penahan dinding WM 24 (aksesori) (lihat gambar B)

Alat pengukur dapat dikencangkan ke dinding menggunakan penahan dinding dengan unit penyejajaran **(42)**.

Penggunaan penahan dinding direkomendasikan misalnya saat bekerja di atas ketinggian perpanjangan rambu ukur tripod atau saat bekerja di atas permukaan yang tidak stabil dan tanpa tripod.

Kencangkan penahan dinding **(42)** pada strip menggunakan sekrup pengencang **(40)**. Pasang penahan dinding severtikal mungkin pada dinding dan pastikan terpasang stabil.

Pasang sekrup 5/8" **(43)** penahan dinding ke dudukan tripod **(17)** pada alat pengukur.

Dengan menggunakan unit penyejajaran, alat pengukur yang terpasang dapat digeser di rentang ketinggian sekitar 23 cm. Lepaskan sekrup **(41)** pada unit penyejajaran, geser alat pengukur ke posisi yang diinginkan dan kencangkan kembali sekrup **(41)**.

Pengoperasian dengan penerima laser (aksesori)

Gunakan penerima laser **(37)** pada kondisi pencahayaan yang kurang baik (keadaan sekitar yang terlalu terang, paparan sinar matahari langsung) dan pada jarak yang lebar agar garis laser dapat terdeteksi dengan lebih baik.

Untuk laser putar dengan beberapa mode pengoperasian, pilih pengoperasian horizontal atau vertikal dengan kecepatan rotasi tertinggi.

Pada pengoperasian dengan penerima laser, baca dan perhatikan petunjuk penggunaan penerima laser.

Pengoperasian dengan penggaris (aksesori) (lihat gambar C)

Untuk memeriksa kerataan atau untuk membuat gradien, disarankan untuk menggunakan penggaris **(38)** bersama dengan penerima laser.

Skala ukur relatif disesuaikan pada penggaris **(38)**. Ketinggian nolnya dapat diatur sebelumnya pada

perpanjangan rambu ukur. Dengan demikian, selisih ketinggian yang ditargetkan dapat dibaca secara langsung.

Kacamata laser (aksesori)

Kacamata laser berfungsi menyaring sinar yang berada di sekitar. Dengan demikian, sinar laser akan terlihat lebih terang untuk mata.

► **Jangan gunakan kacamata pelihat laser sebagai kacamata pelindung.** Kacamata pelihat laser disediakan agar dapat mendeteksi laser dengan lebih baik, namun tidak melindungi dari sinar laser.

► **Jangan gunakan kacamata pelihat laser sebagai sunglasses atau di jalan raya.** Kacamata pelihat laser tidak menawarkan perlindungan penuh terhadap sinar UV dan mengurangi persepsi warna.

Contoh penggunaan

Memeriksa/mengirim ketinggian (lihat gambar D)

Atur alat pengukur pada posisi horizontal ke permukaan yang stabil atau pasang ke tripod **(39)** (aksesori).

Pengoperasian dengan tripod: Atur sinar laser pada ketinggian yang diinginkan. Kirimkan atau periksa ketinggian pada lokasi yang ditargetkan.

Pengoperasian tanpa tripod: Tentukan selisih ketinggian antara sinar laser dan ketinggian pada titik referensi dengan reflektor sinar laser **(47)**. Kirimkan atau periksa selisih ketinggian yang diukur pada lokasi yang ditargetkan.

Mengatur titik tegak lurus ke atas secara paralel/ mengaplikasikan sudut kanan (lihat gambar E)

Jika sudut kanan diaplikasikan atau dinding partisi perlu diatur, titik tegak lurus ke atas **(11)** harus diatur secara paralel, yakni dalam jarak yang sama ke garis referensi (misalnya dinding).

Atur alat pengukur ke posisi vertikal dan posisikan sedemikian rupa sehingga titik tegak lurus bergerak ke atas secara paralel ke titik referensi.

Untuk pengaturan posisi yang tepat, ukur jarak antara titik tegak lurus ke atas dan garis referensi langsung pada alat pengukur dengan menggunakan reflektor sinar laser **(47)**. Ukur lagi jarak antara titik tegak lurus ke atas dan garis referensi dalam jarak yang selebar mungkin dari alat pengukur. Atur titik tegak lurus ke atas sedemikian rupa sehingga titik ukur memiliki jarak yang sama ke garis referensi seperti pengukuran langsung pada alat pengukur. Sudut kanan ke titik tegak lurus ke atas **(11)** ditampilkan melalui sinar laser variabel **(8)**.

Menampilkan permukaan horizontal/vertikal (lihat gambar F)

Untuk menampilkan permukaan horizontal atau vertikal, atur alat pengukur ke posisi vertikal. Jika permukaan vertikal perlu bergerak pada sudut kanan ke garis referensi (misalnya dinding), atur titik tegak lurus ke atas **(11)** pada garis referensi.

Permukaan vertikal akan ditampilkan melalui sinar laser variabel **(8)**.

Mengatur permukaan tegak lurus/vertikal (lihat gambar G)

Untuk mengatur garis laser vertikal atau permukaan rotasi pada titik referensi di dinding, atur alat pengukur pada posisi vertikal dan atur garis laser atau permukaan rotasi secara kasar ke titik referensi. Untuk mengatur dengan tepat pada titik referensi, putar permukaan rotasi di sekeliling sumbu Y (lihat „Memutar bidang rotasi pada posisi vertikal“, Halaman 72).

Pengoperasian tanpa penerima laser (lihat gambar H)

Pengguna dapat bekerja tanpa penerima laser pada kondisi pencahayaan yang menguntungkan (keadaan sekitar gelap) dan pada jarak yang dekat. Untuk visibilitas sinar laser yang lebih baik, pilih mode garis atau pilih mode titik dan putar sinar laser pada lokasi yang ditargetkan.

Pengoperasian dengan penerima laser (lihat gambar I)

Gunakan penerima laser (37) pada kondisi pencahayaan yang tidak menguntungkan (keadaan sekitar yang terang,

paparan sinar matahari langsung) dan pada jarak yang lebar agar sinar laser dapat terdeteksi dengan lebih baik. Pada pengoperasian dengan penerima laser, pilih mode rotasi dengan kecepatan rotasi paling tinggi.

Mengukur pada jarak yang lebar (lihat gambar J)

Saat mengukur pada jarak yang lebar, penerima laser (37) harus digunakan agar sinar laser dapat terdeteksi dengan lebih baik. Untuk mengurangi gangguan, alat pengukur harus selalu berada di tengah permukaan kerja dan di atas tripod.

Pengoperasian di luar ruangan (lihat gambar K)

Penerima laser (37) harus selalu digunakan saat bekerja di luar ruangan.

Pasang alat pengukur pada tripod (39) saat bekerja di permukaan yang tidak stabil. Bekerjalah hanya dengan fungsi shock-warning yang diaktifkan untuk mencegah kesalahan pengukuran saat permukaan bergerak atau alat pengukur bergetar.

Ikhtisar indikator

	Sinar laser	Rotasi sinar laser ^{A)}	X		Y		merah	merah
			hijau	merah	hijau	merah		
Menghidupkan alat pengukur (1 detik uji otomatis)				3×/dtk		3×/dtk	3×/dtk	3×/dtk
Mode senyap	○	○		1×/dtk		1×/dtk	1×/dtk	1×/dtk
Perataan								
Perataan	*	○	*		*			
Perataan ulang	○	○	*		*			
Batas perataan otomatis terlampaui				*		*		
Alat pengukur siap dioperasikan, kedua sumbu dilakukan perataan	●	●	●		●			
Shock-warning								
Shock-warning terpicu	*	○		*		*		*
Shock-warning dinonaktifkan								●
Tegangan baterai								
Tegangan baterai rendah							●	
Baterai kosong							*	
Pengoperasian kemiringan/pengoperasian manual								
Kemiringan sumbu X dapat diatur sumbu Y dilakukan perataan	○	○		*	●			
sumbu X manual sumbu Y dilakukan perataan	●	●		●	●			
Sumbu X dilakukan perataan Kemiringan sumbu Y dapat diatur	○	○	●			*		
Sumbu X dilakukan perataan sumbu Y manual	●	●	●			●		
Kemiringan sumbu X dapat diatur Sumbu Y manual	○	○		*		●		

	Sinar laser	Rotasi sinar laser ^{A)}	X		Y			
			hijau	merah	hijau	merah	merah	merah
Sumbu X manual Kemiringan sumbu Y dapat diatur	○	○		●		*		
Sumbu X manual Sumbu Y manual	●	●		●		●		
Kalibrasi								
Mode kalibrasi sumbu X (pada posisi horizontal)			2×/dtk					2×/dtk
Kalibrasi sumbu X disimpan			* (6×)					
Mode kalibrasi sumbu Y					2×/dtk			2×/dtk
Kalibrasi sumbu Y disimpan					* (6×)			
Mode kalibrasi sumbu Z (pada posisi vertikal)			2×/dtk					2×/dtk
Kalibrasi sumbu Z disimpan			* (6×)					
Kesalahan selama mengkalibrasi sumbu X atau Z				*				
Kesalahan selama mengkalibrasi sumbu Y						*		
Reset								
Start ulang diperlukan, matikan alat pengukur dengan tombol on/off (3) lalu hidupkan lagi.				3×/dtk		3×/dtk		

A) pada mode garis dan mode rotasi

●: Beroperasi secara kontinu

* berkedip

2×/dtk: Frekuensi kedipan (misalnya dua kali dalam satu detik)

○: Fungsi berhenti

Perawatan dan servis

Perawatan dan pembersihan

Jaga kebersihan alat pengukur dan remote control.

Jangan memasukkan alat pengukur dan remote control ke dalam air atau cairan lainnya.

Jika alat kotor, bersihkan dengan lap yang lembut dan lembap. Jangan gunakan bahan pembersih atau zat pelarut.

Bersihkan alat pengukur secara berkala terutama permukaan outlet sinar laser dan pastikan terbebas dari kain serat.

Pindahkan dan simpan alat pengukur hanya di dalam koper **(48)**.

Masukkan alat pengukur di dalam koper **(48)** jika hendak direparasi.

Layanan pelanggan dan konsultasi penggunaan

Layanan pelanggan Bosch menjawab semua pertanyaan Anda tentang reparasi dan perawatan serta tentang suku cadang produk ini. Gambaran teknis (exploded view) dan

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Tim konsultasi penggunaan Bosch akan membantu Anda menjawab pertanyaan seputar produk kami beserta aksesorinya.

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Cara membuang

Perangkat listrik, baterai, aksesoris dan pembungkus harus disortir untuk pendauran ulang yang ramah lingkungan.



Jangan membuang perangkat listrik atau baterai bersama dengan sampah rumah tangga!

Tiếng Việt

Hướng dẫn an toàn cho laser xoay



Phải đọc và chú ý mọi hướng dẫn để đảm bảo an toàn và không bị nguy hiểm khi làm việc với dụng cụ đo.

Khi sử dụng dụng cụ đo không phù hợp với các hướng dẫn ở trên, các

thiết bị bảo vệ được tích hợp trong dụng cụ đo có thể bị suy giảm. Không bao giờ được làm cho các dấu hiệu cảnh báo trên dụng cụ đo không thể đọc được. **HÃY BẢO QUẢN CẨN THẬN CÁC HƯỚNG DẪN NÀY VÀ ĐƯA KÈM THEO KHI BẠN CHUYỂN GIAO DỤNG CỤ ĐO.**

- ▶ Máy đo được dán nhãn cảnh báo laser (được đánh dấu trong mô tả máy đo ở trang đồ thị).
- ▶ Nếu văn bản của nhãn cảnh báo laser không theo ngôn ngữ của bạn, hãy dán chống nhãn dính được cung cấp kèm theo bằng ngôn ngữ của nước bạn lên trên trước khi sử dụng lần đầu tiên.
- ▶ Trên dụng cụ đo có đánh dấu các lỗ thoát Laser với nhãn cảnh báo. Lưu ý vị trí của chúng khi sử dụng dụng cụ đo.
- ▶ Nếu văn bản của nhãn cảnh báo có liên quan không theo ngôn ngữ của bạn, hãy dán chống nhãn dính được cung cấp kèm theo bằng ngôn ngữ của nước bạn lên trên trước khi sử dụng lần đầu tiên.
- ▶ Thận trọng - nếu những thiết bị khác ngoài thiết bị hiệu chỉnh hoặc thiết bị điều khiển được nêu ở đây được sử dụng hoặc các phương pháp khác được tiến hành, có thể dẫn đến phơi nhiễm phóng xạ nguy hiểm.
- ▶ Không thực hiện bất kỳ thay đổi nào ở thiết bị laser.



Không được hướng tia laser vào người hoặc động vật và không được nhìn vào tia laser. Dụng cụ đo này phát ra tia laser hạng 3R theo tiêu chuẩn EN 60825-1. Nhìn trực tiếp trong chùm tia laser – kể cả ở khoảng cách xa – có thể gây hại mắt.

- ▶ Không sử dụng kính nhìn tia laze làm kính bảo vệ. Kính nhìn tia laze dùng để nhận biết tốt hơn tia laze; tuy nhiên nó không bảo vệ khỏi tia laze.
- ▶ Không sử dụng kính nhìn tia laze làm kính mát hoặc trong giao thông đường bộ. Kính nhìn tia laze không chống UV hoàn toàn và giảm thiểu thụ cảm màu sắc.
- ▶ Chỉ để người có chuyên môn được đào tạo sửa dụng cụ đo và chỉ dùng các phụ tùng gốc để sửa chữa. Điều này đảm bảo cho sự an toàn của dụng cụ đo được giữ nguyên.
- ▶ Không để trẻ em sử dụng dụng cụ đo laser khi không có người lớn giám sát. Bạn có thể vô tình làm lóa mắt người khác.
- ▶ Tránh các phản xạ của tia laser lên các bề mặt phẳng nhẵn như cửa sổ hoặc gương. Luồng laze phản chiếu cũng có thể làm tổn thương mắt.
- ▶ Dụng cụ đo chỉ được điều khiển bởi những người thành thạo với các thiết bị laser. Theo EN 60825-1 trong đó bao gồm kiến thức về tác dụng sinh học của laser lên mắt và da cũng như việc sử dụng đúng cách cấu bảo vệ laser để ngăn ngừa nguy hiểm.
- ▶ Không làm việc với dụng cụ đo trong môi trường dễ nổ, mà trong đó có chất lỏng, khí ga hoặc bụi dễ cháy. Các tia lửa có thể hình thành trong dụng cụ đo và có khả năng làm rác cháy hay ngùn khói.
- ▶ Luôn đặt dụng cụ đo sao cho chùm tia laser ở bên trên hoặc bên dưới chiều cao mắt. Điều này bảo đảm sẽ không xảy ra việc gây tổn thương cho mắt.
- ▶ Hãy đánh dấu vùng, mà trong đó dụng cụ đo được sử dụng, bằng các dấu hiệu cảnh báo laser phù hợp. Điều này ngăn ngừa những người không liên quan tiếp cận khu vực nguy hiểm.
- ▶ Không cất dụng cụ đo ở những nơi, mà người ngoài có thể tiếp cận. Những người không biết rõ cách sử dụng dụng cụ đo có thể gây nguy hại cho chính họ và những người khác.
- ▶ Khi sử dụng Laser có hạng 3R, hãy tuân thủ các quy định của quốc gia. Không tuân theo các qui định này có thể dẫn đến thương tật.
- ▶ Đảm bảo rằng vùng của tia laser được che chắn và được theo dõi. Ngưỡng giới hạn bức xạ laze đối với các khu vực được kiểm soát ngăn ngừa sự gây tổn thương mắt cho người không liên quan.
- ▶ Không cho phép dụng cụ đo đang bật một cách không kiểm soát và hãy tắt dụng cụ đo sau khi sử dụng. Tia Laser có thể chiếu vào những người khác.
- ▶ Không sử dụng các dụng cụ thu thập quang học như ống nhòm hoặc thấu kính để quan

sát nguồn phóng xạ. Bạn có thể gây hỏng mắt mình.



Không để phụ kiện từ tính ở gần mô cây và các thiết bị y tế khác, ví dụ như máy trợ tim hoặc bơm insulin.
Từ tính của phụ kiện có thể tạo ra một trường ảnh hưởng xấu đến chức năng của mô cây hoặc các thiết bị y tế.

- ▶ **Để phụ kiện từ tính tránh xa các phương tiện nhớ từ tính và các thiết bị nhạy từ.** Ảnh hưởng của từ tính của phụ kiện có thể gây ra mất dữ liệu không phục hồi được.

Các hướng dẫn an toàn cho điều khiển từ xa



Đọc và tuân thủ tất cả các hướng dẫn. Khi sử dụng thiết bị điều khiển từ xa không phù hợp với các hướng dẫn ở trên, các thiết bị bảo vệ được tích hợp trong thiết bị điều khiển từ xa có thể bị suy giảm. **HÃY BẢO QUẢN CÁC HƯỚNG DẪN NÀY MỘT CÁCH CẨN THẬN.**

- ▶ **Chỉ để người có chuyên môn được đào tạo sửa thiết bị điều khiển từ xa và chỉ dùng các phụ tùng gốc để sửa chữa.** Điều này đảm bảo cho sự an toàn của thiết bị điều khiển từ xa được giữ nguyên.
- ▶ **Không làm việc với thiết bị điều khiển từ xa trong môi trường dễ nổ, mà trông đó có chất lỏng, khí ga hoặc bụi dễ cháy.** Các tia lửa bắn ra từ bộ điều khiển từ xa có thể gây cháy rác hay gây khói.

Mô Tả Sản Phẩm và Đặc Tính Kỹ Thuật

Xin lưu ý các hình minh hoạt trong phần trước của hướng dẫn vận hành.

Sử dụng đúng cách

Máy Đo Cao Trình Laze Xoay

Dụng cụ đo được thiết kế để xác định và kiểm tra độ chính xác của các vách ngăn nằm ngang, các đường thẳng đứng, vạch đường chỉ định thi công xây dựng và các điểm ứng dây dọi.

Dụng cụ đo phù hợp để sử dụng trong vùng bên ngoài và bên trong.

Thiết bị điều khiển từ xa

Điều khiển từ xa được thiết kế để điều khiển laser Bosch xoay bằng tia hồng ngoại.

Thiết bị điều khiển từ xa phù hợp để sử dụng trong vùng bên ngoài và bên trong.

Các bộ phận được minh họa

Sự đánh số các bộ phận được minh họa là để tham khảo hình minh họa của dụng cụ đo và điều khiển từ xa trên trang hình ảnh.

Máy Đo Cao Trình Laze Xoay

- (1) Khóa ngăn chứa pin^{A)}
- (2) Ngăn chứa pin^{A)}
- (3) Phím Bật/tắt
- (4) Nút chế độ vận hành xoay
- (5) Nút nghiêng xuống
- (6) Hiển thị trạng thái trực Y
- (7) Hiển thị trạng thái trực X
- (8) Luồng laze biến đổi
- (9) Cảm biến cho điều khiển từ xa
- (10) Cửa chiếu luồng Laser
- (11) Điểm chuẩn lên trên
- (12) Đèn báo dung lượng pin thấp
- (13) Hiển thị chức năng cảnh báo va chạm
- (14) Nút vận hành thủ công
- (15) Nút nghiêng lên
- (16) Nút Chế độ vận hành thẳng
- (17) Điểm nhận giá đỡ ba chân 5/8"
- (18) Mã seri sản xuất
- (19) Nhãn cảnh báo laze
- (20) Biển cảnh báo cửa chiếu Laser

^{A)} **Phụ tùng được trình bày hay mô tả không phải là một phần của tiêu chuẩn hàng hóa được giao kèm theo sản phẩm.** Bạn có thể tham khảo tổng thể các loại phụ tùng, phụ kiện trong chương trình phụ tùng của chúng tôi.

Thiết bị điều khiển từ xa

- (21) Điều khiển từ xa^{A)}
- (22) Nút nghiêng X-
- (23) Vận nút ngược chiếu kim đồng hồ
- (24) Nút nghiêng Y+
- (25) Nút nghiêng X+
- (26) Nút chế độ vận hành xoay
- (27) Cửa chiếu tia hồng ngoại
- (28) Hiển thị phát tín hiệu
- (29) Nút chế độ tĩnh (Chế độ chờ)
- (30) Nút Chế độ vận hành thẳng
- (31) Nút vận hành thủ công
- (32) Nút nghiêng Y-
- (33) Vận nút theo chiều kim đồng hồ
- (34) Mã seri sản xuất
- (35) Lẫy cài nắp đậy pin

(36) Nắp dây pin

- A) **Phụ tùng được trình bày hay mô tả không phải là một phần của tiêu chuẩn hàng hóa được giao kèm theo sản phẩm. Bạn có thể tham khảo tổng thể các loại phụ tùng, phụ kiện trong chương trình phụ tùng của chúng tôi.**

Phụ kiện/Phụ tùng thay thế

- (37)** Bộ thu laser^{A)}
(38) Thanh đo^{A)}
(39) Giá đỡ ba chân^{A)}
(40) Vít cố định của giá gắn tường^{A)}
(41) Vít ở đơn vị căn chỉnh^{A)}
(42) Giá gắn tường/đơn vị căn chỉnh^{A)}
(43) Vít 5/8" của giá gắn tường^{A)}
(44) Nam châm^{A)}
(45) Giá đỡ bộ thu laser^{A)}
(46) Kính nhìn laser^{A)}
(47) Bảng đối tượng của tia laser^{A)}
(48) Cốp xe^{A)}

- A) **Phụ tùng được trình bày hay mô tả không phải là một phần của tiêu chuẩn hàng hóa được giao kèm theo sản phẩm. Bạn có thể tham khảo tổng thể các loại phụ tùng, phụ kiện trong chương trình phụ tùng của chúng tôi.**

Thông số kỹ thuật

Máy Đo Cao Trình Laze Xoay	GRL 350 HV
Mã số máy	3 601 K61 S..
Phạm vi làm việc (đường kính) ^{A)B)}	
– không có thiết bị thu laze, khoảng	60 m
– có thiết bị thu laze, khoảng	350 m
Cốt thủy chuẩn chính xác ^{A)C)}	
– nằm ngang	±1,5 mm/30 m
– thẳng đứng	±3 mm/30 m
Phạm vi tự lấy cốt tiêu biểu	±8 % (±4,6°)
Thời gian lấy cốt thủy chuẩn tiêu biểu	30 s
Tốc độ xoay	0/150/300/600 min ⁻¹
Góc mở ở chế độ vận hành thẳng	10/25/50°
Khoảng nghiêng ở chế độ vận hành thủ công	±8 %
Nhiệt độ hoạt động	-10 °C ... +50 °C
Nhiệt độ lưu kho	-20 °C ... +70 °C
Chiều cao ứng dụng tối đa qua chiều cao tham chiếu	2000 m

Máy Đo Cao Trình Laze Xoay	GRL 350 HV
Độ ẩm không khí tương đối tối đa	90 %
Mức độ bắn theo IEC 61010-1	2 ^{D)}
Cấp độ Laser	3R
Loại Laser	630-650 nm, < 5 mW
Phân kỳ	0,4 mrad (góc đáy)
Điểm nhận giá đỡ ba chân theo chiều ngang	5/8"-11
Pin (kiềm-mangan)	2 × 1,5 V LR20 (D)
Thời gian vận hành khoảng	30 h
Trọng lượng theo Qui trình EPTA-Procedure 01:2014	1,8 kg
Kích thước (chiều dài × rộng × cao)	187 × 182 × 170 mm
Mức độ bảo vệ (không kể khoang chứa pin)	IP 56 (được bảo vệ chống bụi và tia nước)

- A) ở 20 °C
 B) Phạm vi làm việc có thể được giảm thông qua các điều kiện môi trường không thuận lợi (ví dụ như tia mặt trời chiếu trực tiếp).
 C) đọc theo các trục
 D) Chỉ có chất bắn không dẫn xuất hiện, nhưng đôi khi độ dẫn điện tạm thời gây ra do ngưng tụ.
 Số xêri (18) đều được ghi trên nhãn mác, để dễ dàng nhận dạng loại máy đo.

Thiết bị điều khiển từ xa	RC 4
Mã số máy	3 601 K69 S..
Phạm vi làm việc ^{A)}	30 m
Nhiệt độ hoạt động	-10 °C ... +50 °C
Nhiệt độ lưu kho	-20 °C ... +70 °C
Chiều cao ứng dụng tối đa qua chiều cao tham chiếu	2000 m
Độ ẩm không khí tương đối tối đa.	90 %
Mức độ bắn theo IEC 61010-1	2 ^{B)}
Pin (kiềm-mangan)	2 × 1,5 V LR6 (AA)
Trọng lượng theo Qui trình EPTA-Procedure 01:2014	0,11

- A) Phạm vi làm việc có thể được giảm thông qua các điều kiện môi trường không thuận lợi (ví dụ như tia mặt trời chiếu trực tiếp).
 B) Chỉ có chất bắn không dẫn xuất hiện, nhưng đôi khi độ dẫn điện tạm thời gây ra do ngưng tụ.
 Số seri (34) ghi trên nhãn mác, để dễ dàng nhận dạng điều khiển từ xa.

Sự lắp vào

Nguồn Điện Năng của Bộ Điều Khiển Từ Xa

Khuyến nghị sử dụng các pin kiềm mangan để vận hành điều khiển từ xa.

Để mở nắp đây pin (36) bạn hãy nhấn lên khóa (35) và tháo nắp đây pin ra. Lắp pin vào.


Xin hãy lưu ý lắp tương ứng đúng cực pin như được thể hiện mặt trong ngăn chứa pin.

Luôn luôn thay tất cả pin cùng một lần. Chỉ sử dụng pin cùng một hiệu và có cùng một điện dung.


- ▶ **Tháo pin ra khỏi thiết bị điều khiển từ xa nếu bạn không muốn sử dụng thiết bị trong thời gian dài.** Pin có thể hư mòn sau thời gian bảo quản lâu trong điều khiển từ xa và tự xả điện.

Nguồn năng lượng cho dụng cụ đo

Khuyến nghị sử dụng các pin kiềm mangan để vận hành dụng cụ đo.

Để tháo ngăn chứa pin (2) hãy vặn cơ cấu khóa (1) vào vị trí . Kéo ngăn chứa pin ra khỏi dụng cụ đo và đặt pin vào.

Xin hãy lưu ý lắp tương ứng đúng cực pin như được thể hiện mặt trong ngăn chứa pin.

Hãy đẩy ngăn chứa pin (2) vào dụng cụ đo và vặn cơ cấu khóa (1) vào vị trí .

Nếu pin yếu, cảnh báo pin (12) sẽ sáng màu đỏ. Dụng cụ đo còn có thể được vận hành khoảng 2 h.

Nếu cảnh báo pin nhấp nháy (12) màu đỏ, dụng cụ đo sẽ tự ngắt sau 5 phút.

Luôn luôn thay tất cả pin cùng một lần. Chỉ sử dụng pin cùng một hiệu và có cùng một điện dung.

- ▶ **Tháo ắc quy ra khỏi dụng cụ đo nếu bạn không muốn sử dụng thiết bị trong thời gian dài.** Pin có thể hư mòn sau thời gian bảo quản lâu trong dụng cụ đo và tự xả điện.

Vận Hành

- ▶ **Bảo vệ dụng cụ đo và thiết bị điều khiển từ xa tránh khỏi ẩm ướt và không để bức xạ mặt trời chiếu trực tiếp vào.**

- ▶ **Không cho dụng cụ đo và thiết bị điều khiển từ xa tiếp xúc với nhiệt độ khác nghiệt hoặc dao động nhiệt độ.** Không để nó trong chế độ tự động quá lâu. Điều chỉnh nhiệt độ cho dụng cụ đo và thiết bị điều khiển từ xa khi có sự dao động nhiệt độ lớn, trước khi bạn đưa nó vào vận hành. Luôn tiến hành kiểm tra độ chính xác trước khi làm việc tiếp với dụng cụ đo (xem „Kiểm tra độ chính xác của dụng cụ đo“, Trang 86).

Trong trường hợp ở trạng thái nhiệt độ cực độ hay nhiệt độ thay đổi thái quá, sự chính xác của dụng cụ đo có thể bị hư hỏng.

- ▶ **Tránh va chạm mạnh hoặc làm rơi dụng cụ đo.** Sau khi có tác động mạnh từ bên ngoài lên dụng cụ đo, cần tiến hành kiểm tra độ chính xác trước khi tiếp tục (xem „Kiểm tra độ chính xác của dụng cụ đo“, Trang 86).

- ▶ **Hãy cẩn thận, nếu buồng laser bị vỡ do dụng cụ đo bị rơi.** Bạn có thể bị cắt do các cạnh vỡ của buồng này.

Bắt Đầu Vận Hành bộ Điều Khiển Từ xa

Khi nhấn nút điều khiển, dụng cụ đo có thể bị thoát khỏi chế độ đo độ cao, do đó chế độ xoay dừng lại nhanh. Bằng cách sử dụng điều khiển từ xa, sẽ tránh được điều này.

Miễn là sử dụng pin có đủ điện thế, thiết bị điều khiển từ xa sẵn sàng hoạt động.

Đặt dụng cụ đo sao cho tín hiệu của điều khiển từ xa có thể đến thẳng một trong các cảm biến (9).

Nếu không thể nhắm thiết bị điều khiển từ xa trực tiếp vào cảm biến, hãy giảm diện tích làm việc. Do có phản xạ tín hiệu (ví dụ như tường nhà), cũng có thể cải thiện phạm vi bằng tín hiệu gián tiếp.

Sau khi nhấn nút trên điều khiển từ xa, đèn của hiển thị phát tín hiệu (28) sẽ cho biết tín hiệu đã được phát.

Không thể bật/tắt dụng cụ đo bằng điều khiển từ xa.

Bắt Đầu Vận Hành Máy Đo Cao Trình Laze Xoay

- ▶ **Giữ khu vực làm việc tránh xa các chướng ngại vật có thể phản xạ hoặc cản trở tia laser. Che các bề mặt phản chiếu hoặc sáng bóng. Không đo qua tấm kính hoặc vật liệu tương tự.** Các kết quả đo có thể bị làm sai lệch do tia laser bị phản xạ hoặc bị ngăn cản.

Lắp dụng cụ đo



Tư thế ngang



Tư thế dọc

Bạn hãy đặt dụng cụ đo lên một mặt nền cố định, nằm ngang hoặc nằm dọc, lắp nó lên giá ba chân (39) hoặc giá gắn tường (42) với đơn vị cân chỉnh.

Do vì độ chính xác của cốt thủy chuẩn cao, dụng cụ đo rất nhạy phản ứng với sự rung chuyển của mặt đất và sự thay đổi vị trí. Vì thế, hãy lưu ý đến sự vững chắc, ổn định của vị trí đặt dụng cụ đo để tránh sự cố bị gián đoạn do việc lập lại cốt thủy chuẩn.

Bật Mở và Tắt

Hướng dẫn: Luôn tiến hành kiểm tra độ chính xác trước khi vận hành lần đầu cũng như trước khi bắt đầu công việc (xem „Kiểm tra độ chính xác của dụng cụ đo“, Trang 86).

Để **bật** dụng cụ đo, bạn hãy ấn phím bật/tắt (3). Tất cả hiển thị nhấp nháy theo nhịp nhanh (3×/s) đó. Dụng cụ đo gửi tia laser biến đổi (8) cũng như tia chuẩn hướng lên trên (11) từ các cửa chiếu (10).

► **Không được chiếu luồng laser vào con người hay động vật và không được tự chính bạn nhìn vào luồng laser, ngay cả khi từ một khoảng cách lớn.**

Dụng cụ đo ngay đó bắt đầu cân mực thủy chuẩn tự động. Trong lúc đo độ cao, hiển thị trạng thái trục X (7) và trục Y (6) sẽ nhấp nháy xanh lá và laser nhấp nháy trong chế độ điểm.

Dụng cụ đo được cân bằng, ngay khi các hiển thị trạng thái trục X (7) và trục Y (6) sáng màu xanh lá liên tục và laser tiếp tục sáng. Sau khi hoàn tất việc cân mực thủy chuẩn, dụng cụ đo tự động bắt đầu hoạt động xoay vòng.

► **Không cho phép dụng cụ đo đang bật một cách không kiểm soát và hãy tắt dụng cụ đo sau khi sử dụng.** Tia Laser có thể chiếu vào những người khác.

Để **tắt** dụng cụ đo, bạn hãy ấn nút bật/tắt (3), cho đến khi tất cả hiển thị tắt.

Chế độ tĩnh (Chế độ chờ)

Trong lúc tạm dừng làm việc, bạn có thể đặt dụng cụ đo nhờ điều khiển từ xa (21) vào chế độ tĩnh. Khi đó, tất cả cài đặt được lưu lại và chức năng cảnh báo va chạm vẫn được kích hoạt.

Để **bật** chế độ tĩnh, bạn hãy nhấn nút chế độ tĩnh (29) trên điều khiển từ xa. Tất cả hiển thị trên dụng cụ đo nhấp nháy theo nhịp chậm (1×/s).

Để **tắt** chế độ tĩnh, bạn hãy nhấn lại nút chế độ tĩnh (29). Bạn cũng có thể kết thúc chế độ tĩnh bằng cách nhấn nhanh nút bật/tắt (3) trên dụng cụ đo.

Chế độ hoạt động

Lịch sử trục X và Y

Lịch sử trục X và Y được đánh dấu bằng núm xoay trên vỏ.

Tổng quan các chế độ vận hành

Có thể thực hiện tất cả 3 chế độ vận hành theo chiều ngang và chiều dọc của dụng cụ đo.



Chế độ xoay

Chế độ xoay được khuyến nghị đặc biệt khi dùng bộ thu laser. Bạn có thể chọn trong số các tốc độ xoay khác nhau.



Chế độ vận hành thẳng

Trong chế độ vận hành, tia laser biến đổi được di chuyển trong góc mở giới hạn. Do đó, độ rõ của tia laser được tăng cao so với chế độ xoay. Bạn có thể chọn trong số nhiều góc mở khác nhau.



Chế độ vận hành điểm

Trong chế độ vận hành này, độ rõ tốt nhất của tia laser biến đổi sẽ đạt được. Ví dụ, nó được dùng để truyền độ cao hoặc kiểm tra các dòng một cách đơn giản.

Chế độ vận hành điểm và chế độ vận hành thẳng không phù hợp để sử dụng với bộ thu laser (37).



Chế độ xoay/chế độ vận hành điểm

Sau khi bật, dụng cụ đo nằm ở chế độ xoay với tốc độ xoay tiêu chuẩn (300 min⁻¹).

Để chuyển chế độ vận hành thẳng sang chế độ xoay hoặc chế độ điểm, hãy nhấn nút chế độ xoay (4) hoặc die nút chế độ xoay (26) của điều khiển từ xa.

Để thay đổi tốc độ xoay, hãy nhấn nút chế độ vận hành xoay (4) hoặc nút chế độ vận hành xoay (26) của điều khiển từ xa liên tục, cho đến khi đạt tốc độ mong muốn. Tốc độ xoay được tăng theo cấp mỗi lần nhấn. Sau cấp tốc độ cao nhất, dụng cụ đo chuyển sang chế độ vận hành điểm sau khi dao động thêm trong thời gian ngắn. Nhấn lại nút chế độ vận hành xoay sẽ trở về chế độ vận hành xoay với tốc độ xoay thấp nhất.

Khi làm việc với bộ thu laser, bạn cần chọn tốc độ xoay cao nhất. Khi làm việc mà không có bộ thu laser, hãy giảm tốc độ xoay và sử dụng kính nhìn laser để có tầm nhìn tốt hơn (46).



Chế độ vận hành thẳng

Để chuyển sang chế độ vận hành thẳng, hãy nhấn nút chế độ vận hành thẳng (16) hoặc nút chế độ vận hành thẳng (30) của điều khiển từ xa.

Để thay đổi góc mở, hãy nhấn nút chế độ vận hành thẳng (16) hoặc nút chế độ vận hành thẳng (30) của điều khiển từ xa liên tục, cho đến khi đạt chế độ vận hành mong muốn. Góc mở được mở rộng theo cấp mỗi lần nhấn, đồng thời tốc độ xoay được tăng theo cấp.

Hướng dẫn: Do quán tính, mà laser có thể xoay nhẹ bên trên điểm cuối của vạch laser.

Chức năng

Xoay vạch/điểm ở tư thế ngang trong mặt phẳng xoay

Ở tư thế ngang của dụng cụ đo, bạn có thể định vị vạch laser hoặc điểm laser trong mặt phẳng xoay của laser. Có thể xoay 360°.

Để xoay ngược chiều kim đồng hồ, hãy nhấn nút nghiêng xuống (5) trên dụng cụ đo hoặc nút xoay ngược chiều kim đồng hồ (23) ở điều khiển từ xa. Để xoay theo chiều kim đồng hồ, hãy nhấn nút nghiêng lên (15) trên dụng cụ đo hoặc nút xoay theo chiều kim đồng hồ (33) ở điều khiển từ xa.

Xoay mặt phẳng xoay ở tư thế dọc

Ở tư thế dọc của dụng cụ đo, bạn có thể xoay điểm laser, vạch laser hoặc mặt phẳng xoay để nắn thẳng đơn giản hoặc căn chỉnh song song trong khoảng $\pm 8\%$ quanh trục X.

Để xoay ngược chiều kim đồng hồ, hãy nhấn nút nghiêng xuống (5) trên dụng cụ đo hoặc nút xoay ngược chiều kim đồng hồ (23) ở điều khiển từ xa.

Để xoay theo chiều kim đồng hồ, hãy nhấn nút nghiêng lên (15) trên dụng cụ đo hoặc nút xoay theo chiều kim đồng hồ (33) ở điều khiển từ xa.

Lấy Cốt Thủy Chuẩn Tự Động

Tổng quan

Sau khi bật, dụng cụ đo sẽ tự động kiểm tra tư thế ngang hoặc dọc và căn chỉnh bằng phẳng trong phạm vi tự cân bằng từ $\pm 8\%$ ($\pm 4,6^\circ$).

Trong lúc đo độ cao, hiển thị trạng thái trục X (7) và trục Y (6) sẽ nhấp nháy xanh lá và laser nhấp nháy trong chế độ điểm.

Dụng cụ đo được cân bằng, ngay khi các hiển thị trạng thái trục X (7) và trục Y (6) sáng màu xanh lá liên tục và laser tiếp tục sáng. Sau khi hoàn tất việc cân mực thủy chuẩn, dụng cụ đo tự động bắt đầu hoạt động xoay vòng.

Nếu dụng cụ đo bị xiên hơn 8% sau khi bật hoặc sau khi thay đổi tư thế, việc cân bằng không thể thực hiện được. Trong trường hợp này, các hiển thị trạng thái trục X (7) và trục Y (6) sẽ nhấp nháy đỏ, rô-tô dừng lại và laser được tắt.

Tắt dụng cụ đo, định vị dụng cụ theo chiều ngang (Tư thế ngang) hoặc dọc (Tư thế dọc) hết mức có thể và bật lại dụng cụ.

Những thay đổi về tư thế

Nếu dụng cụ đo được cân bằng, nó sẽ kiểm tra tư thế ngang hoặc dọc. Sự tự động cân mực thủy chuẩn lặp lại xảy ra sau khi vị trí bị thay đổi.

Những thay đổi tối thiểu về tư thế được cân bằng mà không cản ngưng chế độ vận hành. Rung lắc nền hoặc ảnh hưởng của thời tiết sẽ được bù tự động.

Đối với **những thay đổi lớn về tư thế** việc xoay tia laser được dừng và laser được tắt để tránh lỗi do trong quá trình đo thủy chuẩn. Hiển thị trạng thái trục X (7) và trục Y (6) nhấp nháy màu xanh lá cây. Chức năng cảnh báo và chạm được kích hoạt nếu cần.

Dụng cụ đo tự động phát hiện tư thế ngang hoặc dọc. Để **chuyển đổi giữa tư thế ngang và dọc** hãy tắt dụng cụ đo, định vị lại nó và bật lại.

Chức Năng Cảnh Báo Va Chạm

Dụng cụ đo có một chức năng cảnh báo va chạm. Nó ngăn sự cân bằng trong vị trí được thay đổi và ngăn lỗi do dịch chuyển dụng cụ đo khi có thay đổi về tư thế hoặc có rung lắc dụng cụ đo hoặc khi rung động nền.

Kích hoạt cảnh báo va chạm: Chức năng cảnh báo va chạm được bật theo tiêu chuẩn. Nó được kích hoạt 1 phút sau khi bật dụng cụ đo.

Cảnh báo va chạm được kích hoạt: Nếu tư thế của dụng cụ đo bị thay đổi hoặc rung lắc mạnh được ghi lại, cảnh báo va chạm sẽ được kích hoạt: Xoay laser được dừng lại và tia laser nhấp nháy. Đồng thời, hiển thị cảnh báo va chạm (13) nhấp nháy cũng như hiển thị trạng thái trục X (7) và trục Y (6) nhấp nháy màu đỏ. Chế độ vận hành hiện tại được lưu.

Hãy nhấn nhanh nút bật/tắt (3) khi cảnh báo va chạm được kích hoạt. Chức năng cảnh báo va chạm được khởi động lại và dụng cụ đo bắt đầu cân mực thủy chuẩn. Ngay khi dụng cụ đo được cân bằng (các hiển thị trạng thái của trục X (7) và trục Y (6) sáng liên tục), nó sẽ khởi động trong chế độ vận hành đã lưu.

Giờ hãy kiểm tra vị trí của tia laser ở điểm tham chiếu và chỉnh chiều cao hoặc căn chỉnh dụng cụ đo nếu cần.

Tắt chức năng cảnh báo va chạm: Để tắt hoặc bật chức năng cảnh báo va chạm, hãy nhấn nút Bật/tắt (3) nhanh một lần hoặc khi cảnh báo va chạm được kích hoạt (hiển thị cảnh báo va chạm (13) nhấp nháy màu đỏ) thì nhấn nhanh hai lần. Khi cảnh báo va chạm được tắt, hiển thị cảnh báo va chạm (13) sáng đỏ liên tục.

Nếu chức năng cảnh báo va chạm được bật, nó sẽ được kích hoạt sau khoảng 1 phút.

Hướng dẫn: Bằng điều khiển từ xa chức năng cảnh báo va chạm không thể bật hoặc tắt hay khởi động lại.

Chế độ nghiêng/vận hành thủ công đơn trục

Lấy cốt thủy chuẩn tự động của dụng cụ đo có thể được ngắt (chế độ vận hành thủ công):

- ở tư thế ngang cho cả hai trục mà không phụ thuộc vào nhau,
- ở tư thế dọc của trục X (trục Y không thể đo thủy chuẩn ở tư thế dọc).

Ở chế độ vận hành thủ công, có thể lắp dụng cụ đo ở tư thế nghiêng bất kỳ. Ngoài ra, các trục có thể được nghiêng mà không phụ thuộc vào nhau trong khoảng $\pm 8\%$ trên dụng cụ đo.

Chọn trục: Để khởi động chế độ vận hành thủ công hoặc chọn trục cân nghiêng, hãy nhấn nút chế độ vận hành thủ công (14) trên dụng cụ đo hoặc nút chế độ vận hành thủ công (31) trên điều

khuyến từ xa. Trên hiển thị trạng thái trực X (7) hoặc

trực Y (6) có thể phát hiện trực nào không được do thủy chuẩn nữa và trực nào có thể nghiêng.

Nhấn nút chế độ vận hành thủ công	Trạng thái Trực X		Trạng thái Trực Y		
	màu xanh lá	màu đỏ	màu xanh lá	màu đỏ	
1x (ở tư thế ngang)		*	●		Trực được đo thủy chuẩn
1x (ở tư thế dọc)		*	–		Trực không thể đo thủy chuẩn
2x	●			*	chế độ nghiêng đơn trực, trực có thể điều chỉnh
3x		*		●	chế độ vận hành thủ công, trực có thể điều chỉnh
4x		●		*	chế độ vận hành thủ công, trực có thể điều chỉnh
5x (ở tư thế ngang)	*/●		*/●		Trực được cân bằng/được đo thủy chuẩn
5x (ở tư thế dọc)	*/●		–		Trực không thể đo thủy chuẩn

● Hiển thị sáng liên tục

* Hiển thị nhấp nháy

– Hiển thị tắt

Nghiêng trực: Độ nghiêng của trực trong chế độ nghiêng hoặc chế độ vận hành thủ công có thể được thay đổi trong vòng 5 s sau khi chọn trực (miễn là hiển thị trạng thái liên quan của trực nhấp nháy đỏ). Nếu hiển thị trạng thái sáng liên tục màu đỏ, độ nghiêng được xác định. Để có thể thay đổi độ nghiêng, hãy nhấn lại nút chế độ vận hành thủ công (14) trên dụng cụ đo hoặc nút chế độ vận hành thủ công (31) trên điều khiển từ xa liên tục cho đến khi hiển thị trạng thái của trực mong muốn nhấp nháy đỏ.

Bạn có thể thay đổi độ nghiêng của trực có thể điều chỉnh như sau:

- Trên dụng cụ đo: Hãy nhấn nút nghiêng xuống (5), để nghiêng trực có thể điều chỉnh theo hướng "–".
Hãy nhấn nút nghiêng lên (15), để nghiêng trực có thể điều chỉnh theo hướng "+".
- Bằng điều khiển từ xa: Nhấn nút nghiêng X+ (25) hoặc nút nghiêng X– (22), để nghiêng trực X theo hướng "+", hoặc hướng "–".
Nhấn nút nghiêng Y+ (24) hoặc nút nghiêng Y– (32), để nghiêng trực Y theo hướng "+", hoặc hướng "–".

Kiểm tra độ chính xác của dụng cụ đo

Các công việc sau đây chỉ được thực hiện bởi nhân viên có trình độ và được đào tạo tốt. Phải xác định tính hợp pháp khi tiến hành kiểm tra độ chính xác hoặc hiệu chỉnh dụng cụ đo.

Những Ảnh Hưởng Đến độ Chính xác

Nhiệt độ chung quanh có ảnh hưởng lớn nhất. Đặc biệt là sự sai biệt của nhiệt độ xảy ra từ mặt đất hướng lên có thể làm lệch hướng luồng laze.

Bởi vì sự khác biệt lớn nhất của các tầng nhiệt độ là ở nơi gần mặt đất, nên luôn luôn lắp dụng cụ đo lên giá đỡ khi khoảng cách đo nằm ngoài tầm 20 m. Nếu có thể, cũng nên đặt dụng cụ đo vào chính giữa khu vực làm việc.

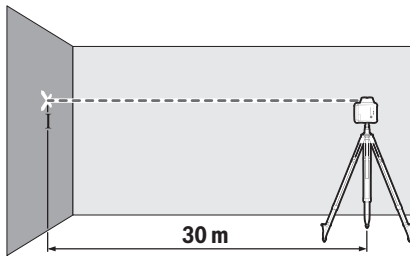
Sự lệch hướng có vai trò trong một khoảng cách đo vượt ngoài khoảng 20 m và ở khoảng cách 100 m có thể dễ dàng đạt đến hai hay bốn lần sự lệch hướng 20 m.

Bên cạnh các tác động ngoài, các tác động ảnh hưởng trực tiếp tới thiết bị (như rơi hoặc va đập mạnh) có thể gây ra các sai lệch. Do đó, hãy kiểm tra mức độ chính xác trước khi bắt đầu công việc. Nếu dụng cụ đo vượt quá độ sai lệch tối đa ở một trong các chu kỳ đo đã mô tả sau đây, bạn hãy tiến hành hiệu chỉnh (xem „Hiệu chỉnh dụng cụ đo“, Trang 87) hoặc cho kiểm tra dụng cụ đo tại dịch vụ khách hàng **Bosch**.

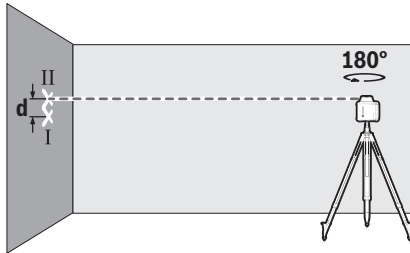
Kiểm tra cốt thủy chuẩn chính xác ở tư thế ngang

Để có kết quả hợp lệ và chính xác, việc kiểm tra được khuyến nghị trên một đoạn đo thoáng khoảng 30 m trên nền cứng trước một bức tường. Hãy tiến hành quá trình đo hoàn chỉnh cho cả hai trực.

- Lắp đặt dụng cụ đo ở tư thế dọc cách 30 m so với tường trên giá ba chân hoặc đặt trên nền cứng và bằng phẳng. Bật công tắc cho máy hoạt động.



- Hãy đánh dấu tâm của điểm laser trên tường (Điểm I) sau khi kết thúc đo thủy chuẩn.



- Xoay dụng cụ đo 180° mà không thay đổi vị trí. Hãy để dụng cụ tự cân bằng và đánh dấu tâm của tia laser trên tường (Điểm II). Lưu ý sao cho điểm II nằm ngang thẳng trên hoặc dưới điểm I càng tốt.

Sự chênh lệch **d** của cả hai điểm đã đánh dấu I và II trên tường dẫn đến lệch chiều cao thực tế của dụng cụ đo cho trực đã đo.

Hãy lặp lại quy trình đo cho các trục khác. Hãy xoay dụng cụ đo 90° trước khi bắt đầu quá trình đo.

Trên quãng đo 30 m độ lệch tối đa cho phép là: $30 \text{ m} \times \pm 0,05 \text{ mm/m} = \pm 1,5 \text{ mm}$. Chênh lệch **d** giữa điểm I và II được phép cao nhất là 3 mm ở một trong hai quá trình đo.

Hiệu chỉnh dụng cụ đo

Các công việc sau đây chỉ được thực hiện bởi nhân viên có trình độ và được đào tạo tốt. Phải xác định tính hợp pháp khi tiến hành kiểm tra độ chính xác hoặc hiệu chỉnh dụng cụ đo.

- ▶ **Hãy tiến hành hiệu chỉnh dụng cụ đo thật chính xác hoặc kiểm tra dụng cụ đo tại bộ phận Bosch dịch vụ khách hàng.** Hiệu chỉnh không chính xác dẫn đến kết quả đo sai.
- ▶ **Chỉ khởi động hiệu chỉnh, nếu bạn phải tiến hành hiệu chỉnh dụng cụ đo.** Ngay khi dụng cụ đo ở chế độ hiệu chỉnh, bạn phải tiến hành hiệu chỉnh cực chính xác đến khi kết thúc, để không tạo ra kết quả đo không chính xác.

Hãy kiểm tra cốt thủy chuẩn chính xác sau mỗi lần hiệu chỉnh (xem „Kiểm tra độ chính xác của dụng cụ đo“, Trang 86). Nếu sai lệch nằm ngoài

khoảng giá trị tối đa cho phép, hãy kiểm tra dụng cụ đo tại bộ phận dịch vụ khách hàng **Bosch**.

Luôn hiệu chỉnh tất cả trục (Trục X, Y và Z).

Hướng dẫn: Nếu hiển thị trạng thái Trục X (7) hoặc die hiển thị trạng thái Trục Y (6) nhấp nháy màu đỏ trong khi hiệu chỉnh, độ sai lệch sẽ nằm ngoài khoảng tối đa cho phép. Trong trường hợp này, hãy nhấn nút chế độ vận hành thủ công (14), để thoát chế độ hiệu chỉnh mà không lưu các cài đặt. Sau đó, các hiển thị trạng thái Trục X (7) và Trục Y (6) 3×/s nhấp nháy đỏ, để hiển thị hiệu chỉnh lỗi.

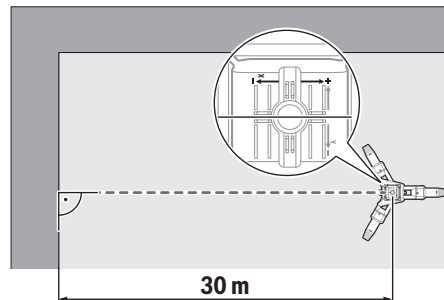
Hãy khởi động lại hiệu chỉnh. Nếu lỗi vẫn xuất hiện, hãy kiểm tra dụng cụ đo tại bộ phận dịch vụ khách hàng **Bosch**.

Hiệu chỉnh trục X và Y

Để hiệu chỉnh, bạn cần một đoạn đo thoáng khoảng 30 m trên nền cứng trước một bức tường. Nếu cần (ví dụ do điều kiện tầm nhìn kém) bạn có thể sử dụng bộ thu laser (37) để đánh dấu tia laser. Khi sử dụng bộ thu laser hãy đảm bảo rằng nó được căn chỉnh dọc trên tường, nếu không các vạch dấu bị dịch chuyển so với tia laser. Đối với bộ thu laser có độ thu nhận chính xác điều chỉnh được, bạn có thể điều chỉnh độ thu nhận chính xác phụ thuộc vào độ chính xác hiệu chỉnh mong muốn (hãy lưu ý hướng dẫn vận hành của bộ thu laser).

Lắp và căn chỉnh dụng cụ đo để hiệu chỉnh:

Hãy lắp dụng cụ đo theo tư thế ngang cách 30 m so với tường trên giá ba chân (39) (được khuyến dùng) hoặc đặt trên nền cứng, bằng phẳng.



So chỉnh dụng cụ đo sao cho hiển thị trục X được đập nổi nằm trên dụng cụ đo vuông góc với tường.

Khởi động hiệu chỉnh:

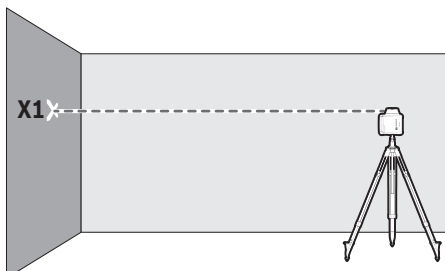
Để khởi động hiệu chỉnh, dụng cụ đo phải được tắt.

Nhấn giữ nút chế độ vận hành thủ công (14) trên dụng cụ đo và nhấn nhanh nút Bật/tắt (3). Hãy nhả nút điều chỉnh độ nghiêng, nếu hiển thị trạng thái trục X (7) nhấp nháy màu xanh lá cây và hiển thị chức năng cảnh báo va chạm (13) nhấp nháy đỏ (tương ứng 2×/s).

Dụng cụ đo được bật trong chế độ hiệu chỉnh cho trục X.

Hiệu chỉnh trục X:

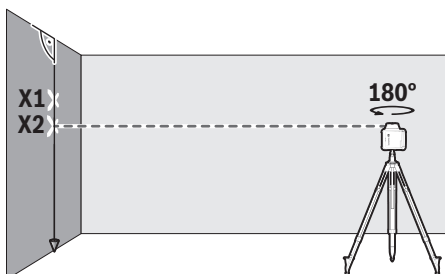
Hãy đảm bảo rằng dụng cụ đo có trục X được căn chỉnh vuông góc với tường. Hãy đợi, cho đến khi dụng cụ đo được cân bằng và chế độ xoay khởi động.



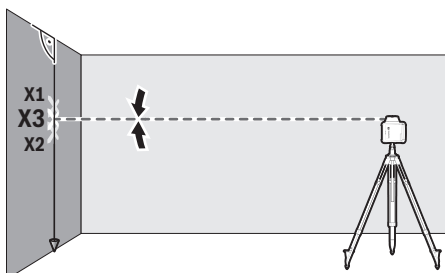
Hãy đánh dấu chiều cao của tia laser trên tường làm chiều cao **X1**. Hãy sử dụng bộ thu laser theo nhu cầu (37).

Xoay dụng cụ đo 180° mà không thay đổi chiều cao và vị trí của dụng cụ đo.

Hãy đợi, cho đến khi dụng cụ đo được cân bằng và chế độ xoay khởi động.



Hãy đánh dấu chiều cao của tia laser trên tường làm chiều cao **X2**. Hãy sử dụng bộ thu laser theo nhu cầu (37). Đảm bảo rằng chiều cao **X2** cao hơn hoặc thấp hơn chiều cao **X1** theo chiều dọc hết mức có thể.



Hãy xác định tâm chính xác giữa chiều cao đã đánh dấu **X1** và **X2** và đánh dấu chúng làm chiều cao **X3** trên tường.

Hãy căn chỉnh tia laser biến đổi (8) nhờ nút nghiêng xuống (5) hoặc lên (15) sao cho chiều cao **X3** chính xác hết mức có thể. Hãy sử dụng bộ thu laser theo nhu cầu (37).

Hãy lưu hiệu chỉnh trục X, bằng cách nhấn nút chế độ vận hành thủ công (14). Để xác nhận, hiển thị trạng thái trục X (7) sẽ nhấp nháy màu xanh lá cây 6 lần.

Hiệu chỉnh trục Y:

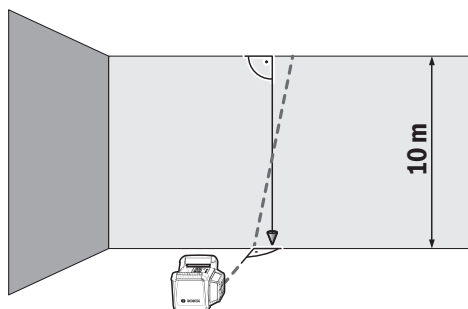
Sau khi hiệu chỉnh trục X, dụng cụ đo tự động chuyển sang chế độ hiệu chỉnh cho trục Y. Hiển thị trạng thái trục Y (6) nhấp nháy màu xanh lá, hiển thị chức năng cảnh báo va chạm (13) nhấp nháy màu đỏ (tương ứng 2x/s).

Hãy xoay dụng cụ đo 90° sao cho hiển thị trục Y được đập nổi nằm trên dụng cụ đo vuông góc với tường. Sau đó hãy tiến hành hiệu chỉnh như được mô tả ở trục X.

Nếu hiệu chỉnh trục Y được lưu, hiển thị trạng thái Trục Y (6) sẽ nhấp nháy màu xanh lá 6 lần. Chế độ hiệu chỉnh được kết thúc tự động.

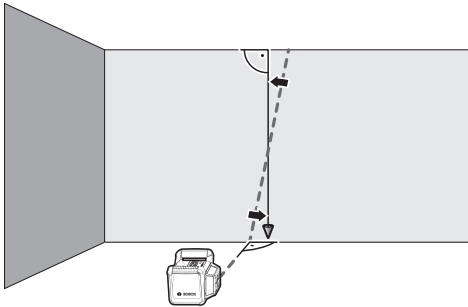
Hiệu chỉnh trục Z

Để hiệu chỉnh, bạn cần một đoạn đo thoáng trên nền cứng trước tường cao 10 m. Gắn dây dọi vào tường.



Hãy đặt dụng cụ đo ở tư thế dọc trên nền cứng, bằng phẳng. Bật máy đo và để nó cân bằng. Hãy căn chỉnh dụng cụ đo sao cho tia laser biến đổi vuông góc với tường và cắt dây dọi. Tắt dụng cụ đo.

Để khởi động chế độ hiệu chỉnh, hãy nhấn giữ nút chế độ vận hành thủ công (14) và sau đó nhấn nhanh nút Bật/tắt (3). Hãy nhả nút điều chỉnh độ nghiêng, nếu hiển thị trạng thái trục X (7) nhấp nháy màu xanh lá cây và hiển thị chức năng cảnh báo va chạm (13) nhấp nháy đỏ (tương ứng 2x/s). Dụng cụ đo được bật trong chế độ hiệu chỉnh cho trục Z. Hãy đợi, cho đến khi dụng cụ đo được cân bằng và chế độ xoay khởi động.



Hãy căn chỉnh tia laser biến đổi sao cho nó chạy song song với dây dọi hết mức có thể. Hãy nhấn nút nghiêng xuống (5) hoặc lên (15).

Nếu không thể thực hiện, hãy căn chỉnh tia laser song song với dây dọi, sau đó căn chỉnh dụng cụ đo chính xác so với tường và khởi động lại quá trình hiệu chỉnh.

Nếu tia laser được căn chỉnh song song, bạn hãy lưu hiệu chỉnh, bằng cách nhấn nút chế độ vận hành thủ công (14). Để xác nhận, hiển thị trạng thái trục X (7) sẽ nhấp nháy màu xanh lá cây 6 lần. Hiệu chỉnh trục Z được lưu lại và chế độ hiệu chỉnh được kết thúc tự động.

Hướng Dẫn Sử Dụng

► **Chỉ luôn sử dụng tâm của điểm laser hoặc tia laser để đánh dấu.** Kích thước của tiêu điểm laser cũng như bề rộng của tia laser thay đổi theo khoảng cách.

Sử dụng cùng với tấm cọc tiêu laser A)

Bảng đích laser (47) cải thiện độ rõ của tia laser ở những điều kiện không phù hợp và ở khoảng cách lớn.

Nửa phản chiếu của bảng đích laser (47) cải thiện độ rõ của tia laser, thông qua nửa trong suốt, tia laser của mặt sau bảng đích laser cũng có thể được phát hiện.

Sử dụng giá đỡ ba chân (phụ kiện)

Giá đỡ ba chân cung cấp khả năng đo ổn định và linh hoạt. Đặt máy đo với điểm nhận giá đỡ ba chân 5/8" (17) lên ren của giá đỡ ba chân (39). Siết chặt dụng cụ đo bằng vít định vị của giá đỡ ba chân.

Đối với giá ba chân có thang đo trên thanh nâng, bạn có thể điều chỉnh trực tiếp độ lệch chiều cao.

Điều chỉnh sơ giá đỡ trước khi cho dụng cụ đo hoạt động.

Làm việc với giá gắn tường WM 24 (Phụ kiện) (xem hình B)

Bạn có thể gắn dụng cụ đo trên tường nhờ giá gắn tường có đơn vị căn chỉnh (42). Việc sử dụng giá gắn tường được khuyến nghị, ví dụ khi làm các công việc phía trên chiều cao thanh nâng của giá

ba chân, hoặc khi làm việc trên nền không ổn định và không có giá ba chân.

Hãy siết chặt giá gắn tường (42) bằng vít cố định (40) trên một thanh. Hãy lắp giá gắn tường vuông góc trên tường hết mức có thể và lưu ý độ khít chặt.

Hãy vặn vít 5/8" (43) của giá gắn tường vào điểm nhận giá ba chân (17) trên dụng cụ đo.

Bằng bộ ngắm chuẩn, bạn có thể đẩy dụng cụ đo đã lắp vào một vùng khoảng 23 cm theo chiều cao. Nới lỏng vít (41) tại bộ ngắm chuẩn, hãy đẩy dụng cụ đo vào vị trí mong muốn, và vật chặt vít lại (41).

Làm việc với bộ thu laser (Phụ kiện)

Khi điều kiện ánh sáng không thuận lợi (vùng xung quanh sáng, ánh nắng mặt trời trực tiếp) và khoảng cách xa, bạn hãy sử dụng bộ thu laser để phát hiện tia laser tốt hơn (37).

Đối với các laser xoay với nhiều chế độ vận hành hãy chọn vận hành ngang hoặc dọc với tốc độ xoay cao nhất.

Trước khi làm việc với thiết bị thu laser, hãy đọc và tuân theo các hướng dẫn sử dụng thiết bị thu laser.

Làm việc với thanh đo (Phụ kiện) (xem hình C)

Để kiểm tra độ bằng phẳng hoặc áp dụng độ dốc, cần sử dụng thanh đo (38) cùng với bộ thu laser.

Trên thanh đo (38) đặt một thang đo tương đối ở bên trên. Chiều cao bằng không của thước có thể chỉnh đặt trước ở bên dưới thanh nâng. Cách này cho phép đọc trực tiếp sự lệch hướng từ một chiều cao đã định rõ.

Kính nhìn laser (phụ kiện)

Kính nhìn laser sẽ lọc nguồn ánh sáng xung quanh. Do đó ánh sáng của laser sẽ sáng hơn đối với mắt.

► **Không sử dụng kính nhìn tia laser làm kính bảo vệ.** Kính nhìn tia laser dùng để nhận biết tốt hơn tia laser; tuy nhiên nó không bảo vệ khỏi tia laser.

► **Không sử dụng kính nhìn tia laser làm kính mát hoặc trong giao thông đường bộ.** Kính nhìn tia laser không chống UV hoàn toàn và giảm thiểu thụ cảm màu sắc.

Công việc theo Thí dụ

Truyền/kiểm tra chiều cao (xem Hình D)

Hãy đặt dụng cụ đo ở tư thế ngang trên nền cứng hoặc lắp trên giá ba chân (39) (phụ tùng).

Làm việc với giá đỡ: Đồng chỉnh luồng laser đến chiều cao theo yêu cầu. Truyền hay kiểm tra chiều cao đo tại địa điểm mục tiêu.

Làm việc mà không có giá ba chân: Hãy xác định độ sai lệch chiều cao giữa tia laser và chiều cao trên điểm tham chiếu nhờ cọc tiêu laser tấm (47). Chiều hay kiểm tra sự sai biệt chiều cao đo tại địa điểm mục tiêu.

Căn chỉnh điểm chuẩn lên trên song song/áp dụng góc bên phải (xem hình E)

Nếu căn áp dụng góc bên phải hoặc căn chỉnh tường giữa, bạn phải căn chỉnh điểm chuẩn lên trên (11) song song, tức là ở khoảng cách đều nhau tới đường tham chiếu (ví dụ tường).

Muốn vậy, hãy lắp dụng cụ đo ở tư thế dọc và định vị sao cho điểm chuẩn hướng lên trên chạy song song với đường tham chiếu.

Hãy đo khoảng cách giữa điểm chuẩn hướng lên trên và đường tham chiếu ngay trên dụng cụ đo nhờ cọc tiêu laser tẩm để định vị chính xác (47). Hãy đo khoảng cách giữa điểm chuẩn hướng lên trên và đường tham chiếu ở khoảng cách lớn so với dụng cụ đo. Hãy căn chỉnh điểm chuẩn sao cho nó có cùng khoảng cách với đường tham chiếu, như khi đo trực tiếp trên dụng cụ đo.

Góc bên phải so với điểm chuẩn hướng lên trên (11) được hiển thị bằng tia laser biến đổi (8).

Hiển thị mặt phẳng vuông góc/dọc (xem hình F)

Để hiển thị một đường vuông góc hoặc mặt phẳng dọc, hãy lắp dụng cụ đo ở tư thế dọc. Nếu mặt phẳng dọc ở góc phải chạy tới đường tham chiếu (ví dụ tường), bạn hãy căn chỉnh điểm chuẩn lên trên (11) ở đường tham chiếu này.

Đường vuông góc được hiển thị bằng tia laser biến đổi (8).

Căn chỉnh đường vuông góc/mặt phẳng dọc (xem hình G)

Để căn chỉnh vạch laser vuông góc hoặc các mặt phẳng xoay trên một điểm tham chiếu ở tường, hãy

lắp dụng cụ đo ở tư thế dọc và căn chỉnh vạch laser hoặc mặt phẳng xoay lên điểm tham chiếu. Để căn chỉnh chính xác lên điểm tham chiếu, hãy xoay mặt phẳng xoay quanh trục Y (xem „Xoay mặt phẳng xoay ở tư thế dọc“, Trang 85).

Làm việc mà không có bộ thu laser (xem hình H)

Khi điều kiện ánh sáng tốt (vùng xung quanh tối) và ở khoảng cách ngắn, bạn có thể làm việc mà không cần bộ thu laser. Để nhìn rõ hơn tia laser, hãy chọn chế độ vận hành thẳng hoặc chọn chế độ vận hành điểm và xoay tia laser tới vị trí đích.

Làm việc với bộ thu laser (xem hình I)

Khi điều kiện ánh sáng không thuận lợi (vùng xung quanh sáng, ánh nắng mặt trời trực tiếp) và khoảng cách xa, bạn hãy sử dụng bộ thu laser để phát hiện vạch laser tốt hơn (37). Hãy chọn chế độ xoay với tốc độ xoay cao nhất khi sử dụng bộ thu laser.

Đo các khoảng cách lớn (xem hình J)





Khi đo các khoảng cách lớn, bộ thu laser phải được sử dụng (37) để phát hiện tia laser. Để giảm ảnh hưởng của nhiễu, bạn cần lắp dụng cụ đo ở giữa khu vực làm việc và trên giá ba chân.

Làm việc ở khu vực bên ngoài (xem Hình C)

Ở khu vực bên ngoài, luôn sử dụng bộ thu laser (37).

Hãy lắp dụng cụ đo trên giá ba chân khi làm việc trên sàn không chắc chắn (39). Chỉ làm việc khi chức năng cảnh báo va chạm được kích hoạt, để tránh đo lỗi khi sàn di chuyển hoặc khi có rung lắc dụng cụ đo.

Các Chỉ Dẫn Khái Quát

	Luồng laser	Xoay tia laser ^{A)}	   					
			màu xanh lá	màu đỏ	màu xanh lá	màu đỏ	màu đỏ	màu đỏ
Mở máy dụng cụ đo (tự kiểm soát 1 giây)				3x/s		3x/s	3x/s	3x/s
Chế độ tĩnh	○	○		1x/s		1x/s	1x/s	1x/s
Đo thủy chuẩn								
Cân bằng	*	○	*		*			
Đo thủy chuẩn lại	○	○	*		*			
Phạm vi tự cân mức thủy chuẩn vượt quá				*		*		
Dụng cụ đo sẵn sàng vận hành, cả hai trục được cân bằng	●	●	●		●			
Sự cảnh báo va chạm								
Sự cảnh báo va chạm khởi hoạt	*	○		*		*		*
Cảnh báo va chạm tắt								●
Điện áp ắc quy								

	Luồng laze	Xoay tia laser ^{A)}	X		Y		Z	
			màu xanh lá	màu đỏ	màu xanh lá	màu đỏ	màu đỏ	màu đỏ
Điện áp ắc quy thấp								●
Hết pin								*
Chế độ nghiêng/vận hành thủ công								
Độ nghiêng trục X điều chỉnh được Trục Y được cân bằng	○	○		*	●			
Trục X điều khiển bằng tay Trục Y được cân bằng	●	●		●	●			
Trục X được cân bằng Độ nghiêng Trục Y điều chỉnh được	○	○	●			*		
Trục X được cân bằng Trục Y điều khiển bằng tay	●	●	●			●		
Độ nghiêng trục X điều chỉnh được Trục Y điều khiển bằng tay	○	○		*		●		
Trục X điều khiển bằng tay Độ nghiêng Trục Y điều chỉnh được	○	○		●		*		
Trục X điều khiển bằng tay Trục Y điều khiển bằng tay	●	●		●		●		
Hiệu chuẩn								
Chế độ hiệu chỉnh Trục X (ở tư thế ngang)			2x/s					2x/s
Hiệu chỉnh trục X được lưu			* (6x)					
Hiệu chỉnh trục Y					2x/s			2x/s
Hiệu chỉnh trục Y được lưu					* (6x)			
Chế độ hiệu chỉnh Trục Z (ở tư thế đọc)			2x/s					2x/s
Hiệu chỉnh trục Z được lưu			* (6x)					
Các lỗi trong khi hiệu chỉnh trục X hoặc Z				*				
Các lỗi trong khi hiệu chỉnh trục Y						*		
Reset								
Cần khởi động lại, hãy tắt và bật lại dụng cụ đo bằng nút bật/tắt (3).				3x/s		3x/s		

A) ở chế độ vận hành thẳng và chế độ xoay

●: Chế độ vận hành liên tục

* nhấp nháy

2x/s: Tần số nhấp nháy (ví dụ hai lần trong một giây)

○: Chức năng dừng

Bảo Dưỡng và Bảo Quản

Bảo Dưỡng Và Làm Sạch

Hãy giữ dụng cụ đo và điều khiển từ xa luôn sạch sẽ.

Không được nhúng dụng cụ đo và điều khiển từ xa vào nước hoặc các chất lỏng khác.

Lau sạch bụi bẩn bằng một mảnh vải mềm và ẩm. Không được sử dụng chất tẩy rửa.

Thường xuyên lau sạch bề mặt các cửa chiếu laze trên dụng cụ đo một cách kỹ lưỡng, và lưu ý đến các tưa vải hay sợi chỉ.

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