Operating Instructions

Universal-Laser UL-89L

Uncompromising versatility

Congratulations on your new GEO laser

This operating instructions contain enclosed in addition to information on how to use the laser **important safety information**.

Please note: First read the safety instructions on the supplement page **1 - 3** and then the operating instructions carefully before using the laser.

1. Description

1.1 Function

The automatic universal laser UL-89L is a multifunction laser with inclination setting for horizontal and vertical use capable of electronic self-levelling over three axes. It emits a laser beam, which turns into a light plane as it rotates.
Another laser beam is available exactly square to it.
The operation is made at the laser or optionally with the wireless control FB-10. The rotating laser beam in the Y axis is locked by the locking receiver FE-53 and the plumb beam in the Y and X axes by the FE-61.

1.2 Inclination Symbol

Enables clear inclination assignment.
The +/- and X/Y symbols indicate the inclination. The + ranges are light and the - ranges dark.
The symbol also shows the inclination and its change relative to the centre axis.

1.3 Charging Socket

Behind the dust guard cap.

1.4 Keyboard

Clear layout. User-friendly, self-explanatory keys.

1.5 Robust Light Metal Housing

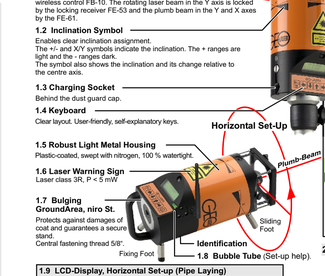
Plastic-coated, swept with nitrogen, 100 % watertight.

1.6 Laser Warning Sign

Laser class 3R, P < 5 mW

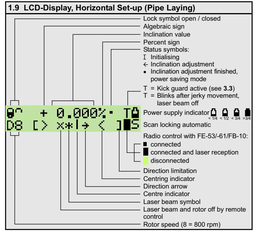
1.7 Bulging GroundArea, niro St.

Protects against damages of coat and guarantees a secure stand.
Central fastening thread 5/8".



1.8 Bubble Tube (Set-up help).

1.9 LCD-Display, Horizontal Set-up (Pipe Laying)



Vertical Set-Up

1.10 Optical sight

for quick alignment of the inclination axis.

1.11 Box Level in rotor head for plumb-down function.

1.12 Rotor Head

Rotor speed adjustable from 200 - 1000 rpm.

1.13 Manual Rotor Setting

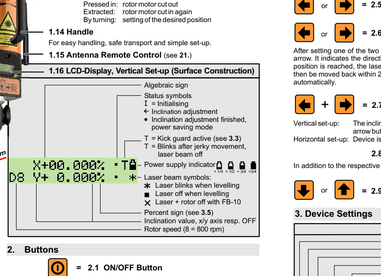
Pressed in: rotor motor cut out
Extracted: rotor motor cut in again
By turning: setting of the desired position

1.14 Handle

For easy handling, safe transport and simple set-up.

1.15 Antenna Remote Control (see 21.)

1.16 LCD-Display, Vertical Set-up (Surface Construction)



2. Buttons

= 2.1 ON/OFF Button

The device is switched on by pressing this button. The device and company data are then shown, followed by the operating display with the last settings without button lock. The device is then levelled and referenced on the zero point automatically. After the levelling phase the laser beam and laser beam symbol stop blinking. If this does not happen, the device must be moved into the levelling range by tilting it forwards. The display illumination switches off after approx. 30 seconds automatically. The illumination is switched on again by pressing the ON/OFF button shortly.
To switch off the device, press the ON/OFF button until "Auf Wiedersehen !" appears.

= 2.2 Arrow Buttons - Release Select - Set - Confirm

When setting-up vertically, the X inclination setting, the y inclination setting and the rotor setting, when setting-up horizontally the lock symbol and the rotor speed are selected and released one after the other by pressing the MENU/OK button.
The respectively activated point blinks.
If, after setting the speed, the button is pressed again or a time of about 25 seconds passes, the adjustment guard is reactivated automatically. This means: the arrow buttons do not work.

= 2.3 Lock-, Rotor Speed- and X Inclination Setting

Pressing the arrow buttons briefly changes the inclination value by 0.001 %.
The value is changed with increasing speed if the button is kept pressed.

= 2.4 X Inclination Setting to Zero

The inclination value is set to 0.000 % by pressing the two arrow buttons at the same time.

= 2.5 Y Inclination Setting (Vertical set-up)

= 2.6 Direction Setting (Horizontal set-up)

After setting one of the two arrow buttons the laser beam symbol changes to an arrow. It indicates the direction of movement and the current position. When end position is reached, the laser beam and limitation symbol blink. The setting must then be moved back within 2.5 minutes. If this is not done, the laser is switched off automatically.

= 2.7 Y Inclination Setting to Zero or Direction Centering

Vertical set-up: The inclination value is set to 0.000 % by pressing the arrow buttons at the same time.
Horizontal set-up: Device is automatically centred in middle position.

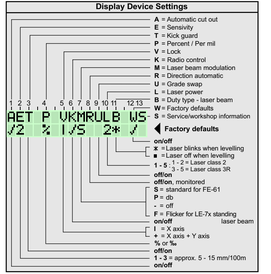
2.8 Quick Setting

In addition to the respective arrow button also press the ON/OFF button.

= 2.9 Grade swap: minus or plus (to activate see 3.9)

3. Device Settings

Display Device Settings



Check or Change Device Settings

= Select Indication of Factory Defaults

Keep the button pressed until the adjustment menu is shown.

= Select Letter

The selected letter blinks.

= Change Settings

= Back to Operating Display

or automatically after 25 seconds.

3.1 Switch ON/OFF Automatic Levelling

Vertical Set-Up:
= Automatic levelling switched on.
These are the factory defaults. They are always activated when switching-on the laser.

= Automatic self-levelling cutted out in X and Y axis.
On the display appears behind the **X** and **Y OFF**.
Now the X and Y axes can be selected and set by the arrow buttons.

Horizontal Set-Up:
= Automatic self-levelling switched on in X axis.
These are the factory defaults. They are always activated when switching-on the laser.

= Automatic self-levelling switched off.
On the display appears **OFF %**.

3.2 Sensitivity Setting (Wind/Vibration)

The self-levelling function corrects even the smallest deviation.
Additionally the laser beam and the laser beam symbol at the operating mode display blink when the limit values of step 1 to 3 are exceeded, i. e. by influence of wind and/or vibration.
1 = 0.005 % no effect
2 = 0.010 % weak effect (factory defaults)
3 = 0.015 % stronger effect

3.3 Kick Guard (Automatic Laser Beam Cut-Out)

= Kick guard switched on. It is only active after 30 sec. Then a **T** appears in front of the battery symbol at the operating mode display.
This means the laser is switched off automatically as a precautionary measure in the event of a jerky movement (bump). The **T** then begins to blink. The laser must be switched on again by pressing briefly the ON-button and the positioning must be checked and corrected if necessary.

= Factory defaults: Kick guard switched off.
When the automatic is switched off in X and Y axes, it is not possible to activate the kick guard.

3.4 Inclination value display in % or ‰

Select between % or ‰ indicator.
= factory defaults

3.5 Lock Function only when Setting-up Horizontally

= Settings unlocked (factory defaults).

= Inclination setting locked.

= Inclination and direction setting locked.
Now direction control is not possible.

3.6 Radio Control On/Off

Is required for the operation with the remote control FB-10 or locking receiver FE-53/-61.
= off (energy-saving mode)
= on (factory defaults)

3.7 Laser Beam Modulation Mode

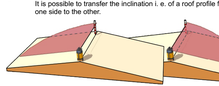
= Standard modulation for FE-61 (factory defaults)
= db
= Modulation off
= Flickering for LE-7x stationary beam

3.8 Monitoring of Locking Automatic

When using the locking receivers FE-53/-61 the automatic locking can be monitored. The laser beam switches off when the laser or radio contact is interrupted for more than 3 min.
It can be switched on again by briefly pressing the laser ON button.
= off (factory defaults)
= on

3.9 Grade swap

It is possible to transfer the inclination i. e. of a roof profile from one side to the other.



= on. When setting the inclination, + or - can be selected and then inverted.
= off (factory default)

Please note: Setting only possible in a range of ± 5 %.

3.10 Laser Power

The laser power can be regulated in 5 steps from approx. 0.5 mW to < 2.6 mW.
Up to a range of approx. 200 m step 2 = < 1 mW is recommended.
= < 2.6 mW (factory defaults)

3.11 Operation Mode Laser Beam

= Laser beam and laser beam symbol at the operating mode display blink when levelling (factory defaults).
= Laser beam is off when levelling.
However the symbol blinks at the operating mode display.

3.12 Factory defaults

= All set to factory defaults.

3.13 Service/Workshop Notice

First off all a phone no. for service/help appears. Then authorized personnel can put in a numerical code to come to the adjustment mode.

4. Pipe Laying Made Easy

Mount device over the point of reference in such a way that the bubble tube is levelled in. Adjust the inclination and align the laser beam to the point of aim. After that join pipe after pipe and align each end to the target.

4.1. Set-up

The laser can be set up centrically or at a constant distance above the pipe invert. Suitable legs, tripods and fastening systems are available for this.

Note: If the diameter indicated on the legs does not correspond with the pipe diameter, the target has to be set up directly in front of the laser and must be adjusted to the correct height ignoring the diameter marking.

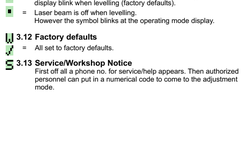
5. Transfer Possibilities

5.1 Axis Transfer with the Alignment Line

5.2 Axis Transfer by Bearing over the Plumb Line

1. Set up laser over the axis.
2. Look over the plumb line and align it to the alignment rod.
3. Look over the plumb line to the laser beam and align the laser in the direction.

5.3 Height Transfer



6. Locking Automatic (see 19.)

in the Y axis in combination with the locking receiver FE-53. Laser and receiver correspond via radio circuit.
By pressing the button of laser or receiver the laser starts to search for the receiver. As soon as the rotating laser beam hits the receiver, it is directed to the center and fixed there.
On the laser display an alternating direction arrow appears and on the receiver the LEDs are blinking alternately.
Accuracy: to +/- 0.5 mm/100 m.

6.1 Operation

Set-up laser and receiver over the line axis, switch on both, switch off Y axis and set the rotor speed to 800 rpm. As soon as the radio control is connected, the system starts to operate.
The FE-53 can be mounted either on the left or on the right side of the laser. Because of reasons of functionality, the keyboards of both devices must be on the same side.

6.2 Display Locking Automatic (Horizontal Set-Up)

6.3 Scan Mode

It can be started either at receiver or at laser. After its activation the laser scans and finds the receiver automatically.

Start scan at laser:

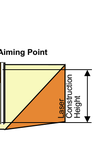
Menu OK = 3 x = **S** blinks

= Scan starts.
The ◆ indicates the control direction on the display.

Note: A radio communication with the FE-53 is provided, indicated by the symbol "■" on the LCD display (see 1.9).

7. Inclination Measurement Parallel to Ground

Even if the inclination is unknown, it can simply be adapted to the ground.



7.1. Operating Instructions

Mount laser above the reference point and align the Y inclination axis to the aiming point. Adjust banking in the X axis.
Measure laser construction height with the locking receiver FE-53 and a levelling rod. Transfer this height to the aiming point.
Release the automatic scan with the A button of the receiver.
The light plane is now automatically directed within typically 2 min./max. 5 min. to the centre of the receiver and locked there.
The LEDs at the FE-53 are blinking alternately. On the display **OFF** and the approx. inclination value are shown alternately.
Now the FE-53 can be removed abruptly off the laser light plane and switched off. After approx. 30 seconds the exact inclination value is shown on the display and automatically locked. The % symbol is blinking.
Alternatively the FE-53 can be mounted permanently to realize a long-term fixing of the laser light plane.

Please note: Never operate the remote control or inclination setting at the laser in this mode because by this the laser light plane is moved. Precondition is an established radio link to the FE-53, indicated by the symbol on the LCD display.

7.2 Display Inclination Measurement (Vertical Laser Set-up)

8. Adjustment Checking

8.1 Horizontal Light Plane (Vertical Set-Up)

Set-up the laser upright and mark laser beam in the height of the required measuring distance. Turn laser device on the tripod by 180°, mark once again. If the adjustment is perfect, the first mark does not deviate from the second one. Turn device by 90°, repeat this process.

8.2 Horizontal Plumb Beam (Horizontal Set-Up/Pipe Laying)

Although the laser is adjusted precisely by the manufacturer, jolts and strong vibrations can lead to maladjustment. The laser should therefore be checked before use:

1. Select a measuring area of approx. 40 m that is as horizontal as possible and set up the laser with the counter at 0.000%.
2. Set up two control points, one directly in front of the laser and the other in a distance of approx. 40 m, and measure the distance to the centre of the laser beam **"a"** and **"b"**.
3. Set up the laser behind the second measuring point and repeat the measuring process in reverse direction, this means measure **"A"** and **"B"**.
4. If the adjustment is correct, A - a = B - b. This means, the laser beam of the first installation is parallel to the second one.

8.3 Adjustment

The laser can be adjusted in the field without having to open the device. For safety reasons, however, adjustment should only be carried out by authorized personnel. See the special adjustment instructions in the appendix.
If the adjustment is incorrect, please contact your specialist dealer.

9. Power Supply

7.4 V DC internal lithium ion rechargeable battery or 12 V DC external rechargeable battery via connection cable 0117.02.

10. Battery Charging

- Carry out charging only with the power and charging unit, type NE-80 or a 12 V DC external rechargeable battery via connection cable 0117.02.
- Keep charger dry and only use in rooms.
- For charging take the laser out of the transport case.
- Permissible charging temperature 0°C to + 40°C, as best + 10°C to + 25°C.
- After approx. 5 hours the charging time is finished. The display dies down or the battery symbol shows a full battery.
- Low ambient temperatures reduce the running time, high temperatures reduce the battery life.
- Damaged batteries must be disposed.

11. Radio Control

1. The serial numbers of the laser, FE-53/-61 and FB-10 must correspond with each other.
2. Simultaneous operation of FE-53/-61 and FB-10 is not possible.

12.Troubleshooting

1. No laser beam - check battery charge.
2. Low range - clean laser beam exit window.
3. Laser beam blinks slowly - move device into the levelling range by tilting forwards.
4. Laser beam not banking around blink slowly - reset laser from the limitation. If the errors of points 3 and 4 are not corrected within 2.5 minutes, the device is switched off automatically.
5. Laser switched off automatically (kick guard or distortion automatic monitoring) - Switch on laser beam by pressing the ON button shortly.

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German Quality Product

CE Certified

GEO - partner of the construction industry for 50 years

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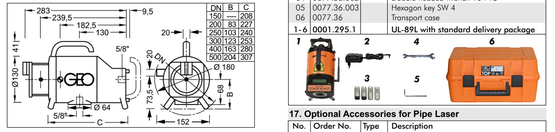
13. Maintenance

The laser requires no special maintenance. Keep the electrical connections clean. Do not clean with water spray. Clean glass parts with a soft, clean cloth. Store dry. Always transport the laser in its original case.

14. Dimensional Sketch



	DN	B	C
	150	—	208
	200	80	227
	250	103	240
	300	121	253
	400	163	280
	500	204	307

15. Technical Specifications

Laser class/Laser type:	3R, < 5 mW/diode, visible red, 635 nm
Range depending on circumstances and receiver:	to 250 m, Ø 500 m
Inclination range:	X axis - 5 % to + 20 %
Inclination range:	hz. mounting by tilting forward, X axis - +10 % to + 20 %
Inclination range/direction setting range:	Y axis - 5 % to + 5 %
Inclination range with rotation of device:	X axis ± 20 % / Y axis ± 5 %
Self-levelling range:	over the complete inclination range with 3 legs
Reading precision:	0,001 %
Permissible deviation:	± 5 mm/100 m
Speed adjustment:	from 200 - 1000 rpm
Locking automatic laser light plane:	up to 250 m with receiver FE-53
Locking automatic plumb beam:	up to 100 m with receiver FE-61
Operating time with 7.4 V DC Li Ion rechargable battery:	to 27 hours
External power supply:	11 to 14 V DC with cable 0117.02
Low battery cut-out:	yes
Watertight:	to 0.35 m
Temperature range:	- 10° C to + 50° C
Dimensions/weight:	Ø 130 mm, length 295 mm/3.6 kg
Working distance ratio control:	up to 350 m
The range is reduced by obstacles in the way of the radio signal.	
Frequency range:	2.4 Ghz ISM Band
Transmission power :	< 100 mW (EIRP)

Conformity with national regulations:
GEO-Feinmechanik GmbH herewith declares that the devices UL-89L, FB-10, FE-53 and FE-61 conform to the fundamental requirements and other relevant regulations of directive 1999/5/EG.
The declaration of conformity can be found at the following address: http://www.geo-laser.de. In countries with national regulations that are not covered by European directives the operator must himself check the provisions and permits for use.
The permit for use is only valid for use with antenna of up to 3 dBi.

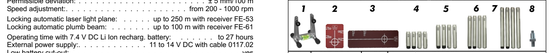
Guarantee:	24 months
CE:	certified

16. Standard Delivery Package

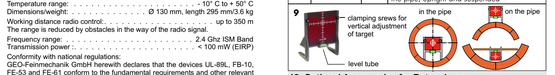
No.	Order No.	Type	Description
01	0001.295	UL-89L	Universal laser
02	0037.18	NE-80	Power supply/Battery charger
03	0019.07		Leg set DN 200 (2 x sliding leg/ 2 x fixing leg)
04	0077.36.002		Double headed wrench 10 + 13
05	0077.36.003		Hexagon key SW 4
06	0077.36		Transport case
1 - 6	0001.295.1		UL-89L with standard delivery package

17. Optional Accessories for Pipe Laser

No.	Order No.	Type	Description
01	0016.07	KL-04	Target frame
02	0016.07.002		Plexi target DN 150 - 300
03	0016.07.003		Plexi target DN 400 - 500
04	0019.08		Leg set DN 250 (2 x sliding leg/ 2 x fixing leg)
05	0019.09		Leg set DN 300 (2 x sliding leg/ 2 x fixing leg)
06	0019.10		Leg set DN 400 (2 x sliding leg/ 2 x fixing leg)
07	0019.11		Leg set DN 500 (2 x sliding leg/ 2 x fixing leg)
08	0019.90		Leg adapter for mounting with 3 legs
1-8	0127.01.1	KL-AU	Pipe laying equipment for UL-89L



09	0017.04.1	KL-05	Target from DN 500, suitable on and in the pipe, upright and suspended



18. Optional Accessories for Rotary Laser

09	1035.29		Lightning 2 laser receiver
10	1035.27	Storm	Laser receiver with digital data display
11	0009.39.1	LE-72	Laser receiver with digital data display
12	0009.36.1	FE-53	Lockng receiver for laser light plane
13	0009.70.1	FE-61	Locking receiver for plumb beam
14	0026.07	FB-10	Two-way radio control
15	0045.04	DS-80	Rotation axis

19. Locking and Measuring Receiver FE-53 Functions

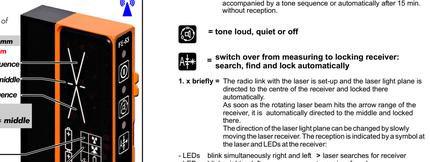
19.1 Measuring Receiver

The laser receiver type FE-53 receives the rotating laser beam and indicates its position to the light plane by way of three LEDs and various signal tones.

19.2 Locking Receiver for the X Inclinatin Axis

It directs the rotating laser beam over the whole inclination range automatically to the centre position of the receiver and locks it there.
Accuracy to ± 1mm/100 m.

19.3 Receiver Description



The FE-53 can be mounted either on the left or on the right side of the laser. Because of reasons of functionality, the keyboards of both devices must be on the same side.

19.4 Control Principle

19.5 Operation

= switch on/off

1. x briefly = Measuring receiver with an accuracy of +/- 1 mm.
Move FE-53 towards the light plane until the reception of the light plane is indicated by LED and signal tone.
To reach the desired accuracy move the FE-53 in arrow direction:
Accuracy: One LED blinks in the middle = +/- 1 mm

2. x briefly = Measuring receiver with an accuracy of +/- 0.1 mm
Accuracy: Two LED's blink alternately = +/- 0.1 mm

3. x briefly = Back to measuring receiver with an accuracy of +/- 1 mm.

1 x long = Switch off
Press button until the LED of the operating mode display flashes accompanied by a tone sequence or automatically after 15 min. without reception.

= tone loud, quiet or off

= switch over from measuring to locking receiver: search, find and lock automatically

1. x briefly = The radio link with the laser is set-up and the laser light plane is directed to the centre of the receiver and locked there automatically.
As soon as the rotating laser beam hits the arrow range of the receiver, it is automatically directed to the middle and locked there.
The direction of the laser light plane can be changed by slowly moving the laser receiver. The reception is indicated by a symbol at the laser and LEDs at the receiver:

- LEDs blink simultaneously right and left > laser searches for receiver
- LED blinks right or left > receiver found
- LEDs blink alternately right and left > setting finished: centre found and locked

2. x briefly = laser searches for the receiver again.

Switch off receiver to switch off the locking function.

19.8 Outstanding Technical Specifications:

Range depending on ambient conditions:	2 to 250 m
Distance to illuminants and high-voltage power lines:	> 1.5 m
Accuracy direction automatic:	to ± 1 mm/100 m
Accuracy laser receiver:	± 1 mm or ± 0.1 mm
Reception range/-angle:	85 mm / > 100°
Rotor speed:	600 - 1000 rpm
Signal tone:	loud, quiet or off
Power supply:	2 x round cell/AA (battery or rech. battery)
Current consumption:	approx. 100 mA (operating time to 25 hours)
Housing:	watertight, except battery cover
Dimensions / weight:	140 x 100 x 32 mm / 0.52 kg
Frequency range:	2.4 Ghz ISM Band
Transmission power :	< 100 mW (EIRP)

Conformity with national regulations:
GEO-Feinmechanik GmbH herewith declares that the FE-53 conform to the fundamental requirements and other relevant regulations of Directive 1999/5/EG.
The declaration of conformity can be found at the following address: http://www.geo-laser.de. In countries with national regulations that are not covered by European directives the operator must himself check the provisions and permits for use.
The permit for use is only valid for use with antenna of up to 3 dBi.

Guarantee:	24 months
CE:	certified

20. Locking and Measuring Receiver FE-61 Functions

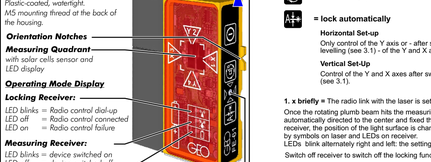
20.1 Measuring Receiver

The laser receiver FE-61 receives a stationary or rotating plumb laser beam and indicates its position to the light plane by way of 2 LEDs.

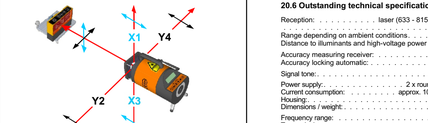
20.2 Locking Receiver for the Plumb-Axis

It automatically directs the stationary or rotating plumb laser beam to the centre position of the laser beam and locks it there. Accuracy to ± 1mm/100 m.

20.3 Receiver Description



20.4 Control Principle



20.5 Operation

= switch on

1. x briefly = switch on: The FE-61 works as measuring receiver.
Switch on the FE-61 and move it to the laser light plane until the reception of the light plane is indicated by LEDs and signal tones.
To receive the required accuracy, move the FE-61 in arrow direction.

1. x long = switch off
Keep the button pressed until the LED of the operating mode display lights accompanied by a tone sequence or automatically after 15 min. without receipt.

= tone loud, quiet or off

= lock automatically

Horizontal Set-up
Only control of the Y axis or - after switch-off of the automatic levelling (see 3.1) - of the Y and X axes.

Vertical Set-Up
Control of the Y and X axes after switch-off of automatic levelling (see 3.1).

1. x briefly = The radio link with the laser is set up
Once the rotating plumb beam hits the measuring quadrant of the receiver it is automatically directed to the center and fixed there. By slowly moving the laser receiver, the position of the light surface is changed. The reception is indicated by symbols on laser and LEDs on receiver.
LEDs blink alternately right and left: the setting phase is completed.
Switch off receiver to switch off the locking function.

Remote Control

It is possible to adjust manually the direction and height of the laser with the FE-611.
To activate the remote control when turning on the receiver press the power button until the remote LED flashes.
The slide (Y axis) can be adjusted with the keys next to the LED.
Switch to the height (X axis) by briefly pressing the power button.
The remote control LED blinks faster.
Now the height can be adjusted using the buttons next to the LED.

Press briefly to return to the measuring receiver function.

20.6 Outstanding technical specifications:

Reception:	laser (633 - 815 nm homogeneous beam profile)
	Ø von 5 - 20 mm, 0.8 - 2 mW
Range depending on ambient conditions:	2 to 100 m
Distance to illuminants and high-voltage power lines:	> 1.5 m
Accuracy measuring receiver:	to ± 0.1 mm
Accuracy locking automatic:	to ± 1 mm/100 m
Signal tone:	loud, quiet or off
Power supply:	2 x round cell/AA (battery or rech. battery)
Current consumption:	approx. 100 mA (operating time to 20 hours)
Housing:	watertight, except battery cover
Dimensions / weight:	140 x 100 x 32 mm / 0.52 kg
Frequency range:	2.4 Ghz ISM Band
Transmission power :	< 100 mW (EIRP)

Conformity with national regulations:
GEO-Feinmechanik GmbH herewith declares that the FE-61 conforms to the fundamental requirements and other relevant regulations of directive 1999/5/EG.

The declaration of conformity can be found at the following address: http://www.geo-laser.de. In countries with national regulations that are not covered by European directives the operator must himself check the provisions and permits for use.
The permit for use is only valid for use with antenna of up to 3 dBi.

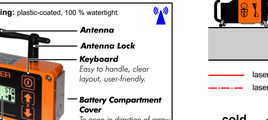
Guarantee:	24 months
CE:	certified

21. Wireless Control FB-10

21.1 Functional Description

The remote control FB-10 allows a wireless operation of GEO lasers with radio module. Laser and receiver have the same keyboards, operating mode displays, radio transmitters and receivers.
Range while visual contact up to 350 m.

21.2 Device Description



21.3 Button Description (see 2.)

Apart from the ON button, the functions correspond to those of the keyboard and display of the laser.

Note: It is not possible to switch on the laser and the radio transmission and to switch off the laser by the FB-10.

= ON only FB-10

1 x short = ON: The message "Try to connect .. Please wait .." appears
Activate wireless remote control connects to the GEO laser within approx. 20 seconds.

1. x long = laser beam + rotor switched off (stand-by mode)
2. x long = laser beam + rotor switched on again
Note: Press the button until the desired symbol ✻ or ✕ appears.

OFF = Auto off after approx. two minutes if no button pressed.

15.4 Error Messages:

"Connection Lost!": Communication between laser and remote control interrupted - establish visual contact with the laser or reduce the distance to the laser.
Activate wireless remote control in the menu of the GEO laser (see instructions for use of laser).

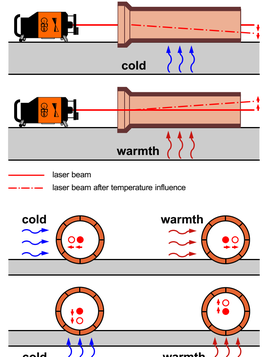
"BATTERY LOW": Replace batteries soon.
The LCD light stays off to save power.

"BATTERY EMPTY!": The batteries must be replaced immediately.

Note: The radio transmission can be switched off either in the second menu level of the laser or of the remote control. A renewed switch-on of the radio transmission is possible only at the laser.

22. Refraction Effects: Example Pipe Laying

The laser beam is deflected to cold air.
It is deformed and moved by atmospheric turbulences.



Countermeasures:

Do not keep tubes in direct insolation. Store tubes in the shadow or cover them with a canvas.

Align the pipe in the ditch immediately. If the laser beam is deformed by temperature influences and/or in movement, define the centre by averaging.