

Spectra Precision Laser Range

Handy Tips & Advice



Spectra LL100N, Spectra HV101, Spectra LL300N, Spectra LL300S, Spectra HV302, Spectra HV302G & Spectra GL422N

INTRODUCTION

Thank you for purchasing a Spectra Precision Rotary Laser Level Kit from Laser Levels Online. These instructions are intended to provide some handy tips and advice and the general basics of using Spectra Lasers. For full instructions, please see the individual product manuals.

For any more information, or if the laser requires calibration or repair; then please contact our Service Department by Telephone: **08000 869 769** or Email: **sales@laser-level.co.uk**

Tough, Simple & Reliable

There's a reason Spectra Precision Laser is the strongest name in the industry. We invented the industry. From day one, we have pioneered every major development in laser positioning for construction. That's why you'll find our products on more job sites around the world than any other brand.

For more than 50 years, Spectra Precision has been an innovation leader in the construction industry worldwide. We understand what our customers need on the job every day, because we have always made communication and listening to our customers, a top priority. We also employ the best engineers and technical specialists we can find to ensure that our reputation for innovation and quality never fades. This company focus: communication and innovation, is why we bring new technologies to the market in easy-to-use, highly efficient products designed with the commercial construction market-foremost in mind.

We believe in technological quality, precision, and competitiveness. We believe in work well done. Spectra Precision products are reliable and long-lasting, with an excellent Return on Investment value.

SAFETY

Read the individual products safety instructions before attempting to operate this Laser Level Kit. Keep these handy tips and advice in a safe place or store in the Laser's carry case for future reference.

- Do not remove warning labels from the product.



WARNING

Never look into the laser beam or direct it to the eyes of other people. Always operate the Laser Level in a way that prevents the beam from getting into people's eyes. Using Spectra Lasers differently than described in the product user guides, may result in unsafe operation.

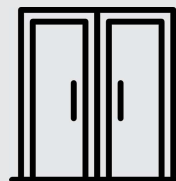
INSTRUCTIONS

Horizontal Levelling (All Spectra Laser Levels)



WARNING

Never operate Laser in front of glazing or any shiny surfaces!
See page 24 for further details.



The following general guidance is applicable to: Spectra **LL100N**, Spectra **HV101**, Spectra **LL300N**, Spectra **LL300S**, Spectra **HV302**, Spectra **HV302G** & Spectra **GL422N**.



1. Position Laser

Place the Laser Level on a firm, generally level surface or screw onto the 5/8" thread of the surveying tripod. You do not need to independently level the surface or tripod, but it does need to be within ± 5 deg of true horizontal.



2. Power On

Press the **ON/OFF** button once and the Laser Level will power on and begin automatically self-levelling horizontally. This process takes around 15-20 seconds. When the levelling process is complete, the laser beam will start spinning at 600rpm, indicating a level datum.

No other button needs to be pressed for the laser to self level.



3. Pick Up The Levels

Clamp the Detector onto the front face of the measuring staff and face towards the Laser. If you are above the horizontal datum, a down arrow will be shown. Below the horizontal datum an up arrow will be shown and when you are completely level or on the same datum, a horizontal line will be shown on the display. There is also a corresponding audible tone for high / low and level.



4. Read The Levels

When you have established the horizontal datum, you can then use the mm scale on the rear of the measuring staff (which is zero mm at ground level) to either measure a uniform distance down or a uniform distance up, to then set your base level, deck level, ground level etc.

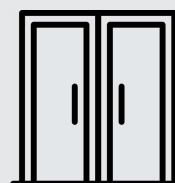
INSTRUCTIONS

Vertical Levelling (HV101, HV302, HV302G, GL422N)



WARNING

Never operate Laser in front of glazing or any shiny surfaces!
See page 24 for further details.



The following general guidance is **only** applicable to: Spectra **HV101**, Spectra **HV302**, Spectra **HV302G** & Spectra **GL422N**.



1. Position Laser

Place the the Laser Level on the rear lay-down mount on a firm, generally level surface. The mount is located on the opposing side of the keypad.

You do not need to independently level the surface but it does need to be within ± 5 deg of true horizontal.



2. Power On

Press the **ON/OFF** button once and the Laser Level will power on and begin automatically self-levelling vertically. This process takes around 15-20 seconds.

When the levelling process is complete, the laser will start spinning at 600rpm, indicating a vertically level datum.

No other button needs to be pressed for the laser to self level.



3. Pick Up The Vertical

Turn the Detector onto it's side (landscape mode) and face towards the Laser. The up and down arrows used for horizontal levelling will then become left and right arrows. The Detector will accurately pinpoint the vertical datum and the arrows on screen will indicate which direction to go. When in alignment, it will display a vertical black line. You can then walk forward of your position continually marking the datum. This method can be

used instead of a string line or to align a datum on the vertical. e.g. I-section steels, fence posts, timber frame structures, racking etc.

INSTRUCTIONS

90° Squaring (HV101, HV302, HV302G)

The following general guidance is **only** applicable to:
Spectra **HV101**, Spectra **HV302** & Spectra **HV302G**.



1. Position Laser & Power On

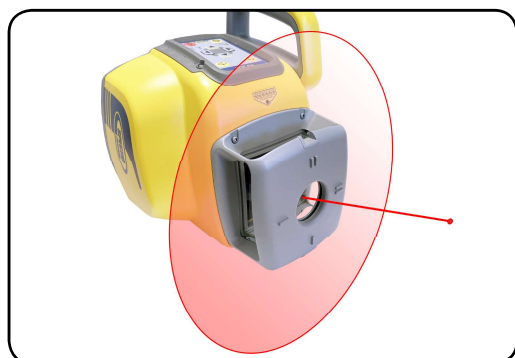
Take the Laser Level off the tripod and lay on a firm surface, at ground level on the rear lay-down mount. The mount is located on the opposing side of the keypad. The laser should be placed over your intended corner point. Then press the **ON/OFF** button once to turn on the level and wait for the laser to self-level before pressing the manual override button once.



2. Pick Up The Vertical

With the Laser prism now spinning (like the wheel of a car), turn the Detector onto it's side (landscape mode) and face towards the Laser. The up and down arrows used for horizontal levelling will then become left and right arrows. The Detector will accurately pinpoint the vertical datum and the arrows on screen will indicate which direction to go. When in alignment it will display a vertical black line. You can then walk up to 250m

forward of your position continually marking the datum. When this is complete, you will have marked out the first part of the 90° and you can now return to the laser to begin setting out the second part.



3. Pick Up The Laser Dot

The second part of the 90° is achieved by marking the position of the red laser dot that is fired from the centre of the lighthouse.

The laser dot cannot be picked up with your detector.

You need a target plate. Our recommendation is to use a small piece of around 300mm long white contriplus board, 6-9" wide or similar. Using a black marker pen, draw a vertical line down the middle of the board. The white

surface is an ideal target to "pick-up" the red dot at distance, even in bright sunlight. Hold the end face of the target board down onto the ground, align the dot onto the black line and mark the position accordingly at appropriate intervals. **This has set 90 degree squaring.** If you had an aerial or top down view, you would see a perfectly set out "L" shape or corner without using a Set Square or 3/4/5 Triangle calculation.

User Tip

Please see page **15** for a more in depth guide to 90° Squaring.

CHARGING & BATTERIES

The Spectra range is divided into two groups. Alkaline only Laser Levels which run on 2 x Type "D" Alkaline Batteries and Rechargeable Laser Levels which either run on a 5,000mAh or 10,000mAh Rechargeable battery pack. Only the Spectra **LL300N**, **LL300S**, **HV302**, **HV302G** & **GL422N** rechargeable lasers are supplied with the Spectra SMC62 Worldwide Charger 6.2V.

Spectra SMC62 Worldwide Charger 6.2V



This is the Genuine Spectra Precision® Plug-in Mains Charger 6.2V for WORLDWIDE use. All plug adapters (UK, US/CAN, EU & AUS/NZ) are included. (This Charger is NOT recommended for use with any other equipment).

The 6.2 Volt 700mA charger (Input 100-240V AC 50-60Hz Output DC 6.2V, 700mA, centre pin + polarity Double insulated CE mark) is for indoor use only. If the charger becomes damaged, stop using immediately and purchase a replacement. ***Never use a generic charger with this laser.***

- The general procedure to adopt is to use the laser during the day & charge-up overnight. You cannot damage the system by "over-charging" the batteries.
- When the Charger is plugged into a mains electric socket, it's LED illuminates GREEN.
- Plug the charger into the charging port located on the side wall of the laser.
- It remains green when plugged into the laser. It never flashes nor changes colour when operating correctly.



IMPORTANT

When the plug is connected into the laser's charging socket, there is **NO indication** on the keypad of the laser or on the charger to confirm charging is in progress. This is applicable to all Spectra Rotary lasers and is **NORMAL**.

- The laser's battery LED indicator only slowly flashes RED when the battery is low power and requires charging.
- The Mains Charger will charge most batteries in around 6-8 hours. It takes 4 to 5 charge/discharge cycles for these battery packs to reach their maximum capacity.

CHARGING & BATTERIES (CONTINUED)

LL300N (Rechargeable Battery Pack)

- The Spectra LL300N is powered by the Spectra Precision **SBP5** 5,000mAH NiMH rechargeable battery pack which will be pre-installed in the base of the laser.
- The battery pack contains 4 x 1.2V NiMH 5,000mAH rechargeable batteries. ***This battery pack must never be opened.***
- Prior to first use, we recommend that you fully charge the battery pack for around 7-8 hours.
- The battery pack will give around 50 hours of continuous use.
- **Important:** Do **NOT** allow battery to go completely flat before recharging.

Rechargeable Battery Pack Removal Procedure

- Turn the laser over.
- Twist the central battery latch through 90 degrees to remove the battery cover, noting its orientation. No tool is required for removal; its just finger-tight.
- Withdraw the battery pack.
- ***NEVER remove the individual cells from the black battery cradle.***

Refitting Rechargeable Battery Pack Procedure

- Refitting is the opposite to the above procedure and the battery pack will only fit into the laser's body, one way round.
- An important safety feature on these Spectra lasers only allows the Charger to operate when the rechargeable battery pack is fitted.

CHARGING & BATTERIES (CONTINUED 2)

LL300S, HV302, HV302G, GL422N (Rechargeable Battery Pack)

- The Spectra LL300S, HV302, HV302G and GL422N are all powered by the Spectra Precision **SBP10** 10,000mAH NiMH rechargeable battery pack which will be pre-installed in the base of the laser.
- The battery pack contains 4 x 1.2V NiMH 10,000mAH rechargeable batteries. ***This battery pack must never be opened.***
- Prior to first use, we recommend that you fully charge the battery pack for around 7-8 hours.
- The LL300S & HV302 battery pack will give around **45** hours of continuous use.
- The HV302G battery pack will give around **30** hours of continuous use.
- The GL422N battery pack will give around **35** hours of continuous use.
- **Important:** Do **NOT** allow battery to go completely flat before recharging.

Rechargeable Battery Pack Removal Procedure

- Turn the laser over.
- Twist the central battery latch through 90 degrees to remove the battery cover, noting its orientation. No tool is required for removal; its just finger-tight.
- Withdraw the battery pack.
- ***NEVER remove the individual cells from the black battery cradle.***

Refitting Rechargeable Battery Pack Procedure

- Refitting is the opposite to the above procedure and the battery pack will only fit into the laser's body, one way round.
- An important safety feature on these Spectra lasers only allows the Charger to operate when the rechargeable battery pack is fitted.

CHARGING & BATTERIES (CONTINUED 3)

LL300N, LL300S, HV302, HV302G, GL422N (Alkaline Batteries)



Non-rechargeable alkaline batteries being fitted.

Although the Spectra LL300N, LL300S, HV302, HV302G and GL422N Lasers are intended to run using a rechargeable battery pack, it is also possible to use 4 x type "D" Alkaline batteries instead. This is a useful backup power source if the rechargeable battery pack has not been charged.

Rechargeable Battery Pack Removal Procedure

- Turn the laser over.
- Twist the central battery latch through 90 degrees to remove the battery cover, noting its orientation. No tool is required for removal; its just finger-tight.
- Withdraw the rechargeable battery pack and place to one side.
- ***NEVER remove the individual cells from the black battery cradle.***

Alkaline Batteries Fitting Procedure

- Insert 4 x type "D" (D/LR20 1.5V) alkaline batteries with correct polarity, **into the laser itself.**



IMPORTANT

Under no circumstances fit alkaline batteries into the black battery cradle. Place the loose type "D" batteries into the laser itself.

- Refit the grey battery cover, ensuring the correct orientation.
- The laser is now ready to use.
- An important safety feature on these Spectra lasers is that it only allows the Charger to operate when the rechargeable battery pack is fitted.

CHARGING & BATTERIES (CONTINUED 4)

LL100N & HV101 (Alkaline Batteries)

- The Spectra LL100N & Spectra HV101 are powered by 2 x 1.5v type “D” alkaline batteries which will be pre-installed.
- 2 x 1.5v type “D” alkaline batteries will give around 50 hours of continuous use.
- When required, open the bottom battery compartment and fit 2 x 1.5v type “D” alkaline replacement batteries, taking care to ensure correct polarity.
- Type “D” alkaline batteries are readily available from all good hardware stores / supermarkets. Although it is recommended you use a good brand of battery for best results.
- It is also possible to use 2 x type “D” rechargeable batteries instead. However, as there is no charging option for these lasers, the batteries would need to be manually removed and charged in a stand-alone charger.

RC601UK REMOTE CONTROL

Optional Extra - not included as standard

LL100N, HV101, LL300N

The Spectra **RC601UK** Infrared Remote Control enables the user to remotely (up to 30m), adjust the following settings: Rotational speed, Scan angle & position, Manual Override (for single or dual-axis grade/slope control). ***It cannot be used to turn the Laser ON or OFF (a feature not available on any Spectra laser level system).***

It is compatible with the Spectra LL100N, Spectra HV101 & Spectra LL300N only.

However, not all remote functions are available on all models of laser.



www.laser-level.co.uk/rc601uk

RC601UK REMOTE CONTROL (CONTINUED)

Power Supply & Battery Replacement

- The RC601UK is powered by 1 x 9v PP3 alkaline battery which will be pre-installed.
- When required, unscrew the rear battery compartment and fit 1 x 9v PP3 alkaline replacement battery, taking care to ensure correct polarity.

HV101

The following general guidance is **only** applicable to: Spectra **HV101**.

Rotational Speed Control

- Press the Rotational Speed Control button on the face of the laser or on the remote to cycle through the 4 rotational speeds.
- The rotational speeds are Zero (Stop Dot), 50, 200, 600rpm.
- For Indoor work, we suggest using slower speeds, where the laser beam is easier to see by eye; but for Outdoor Groundworks – run the HV101 at its maximum speed of 600rpm; which gives the best working range when used with the supplied Laser Detector.
- The default rotational mode is 600rpm when the laser self levels after being turned on.

Scan Mode

- Press the Scan Mode button on the face of the laser or on the remote to cycle through the 6 scan modes. Each mode adjusts the angle of the beam.
- The scan modes allows the user to set a Stop Dot, 3°, 8°, 45°, 90° & 180° Line
- The scan mode is typically only used indoors and enables the user to see the beam better in a specific position.
- ***The Detector cannot pickup the Laser beam when in scan mode.***
- Pressing the Rotational Speed Control button once will turn off scan mode and return the laser to rotating at 600rpm.

RC601UK REMOTE CONTROL (CONTINUED 2)

LL100N, HV101 & LL300N

The following general guidance is applicable to: Spectra **LL100N, HV101 & LL300N**.

Manual Override

- Press the Manual Override button on the remote once and the self levelling system will be turned off. The Laser will continue to rotate but the laser will no longer be outputting a level datum.
- This mode is typically enabled when the laser is being used to do Gradients and Slopes (See Gradients & Slopes section on page **17** for further details).
- Pressing the Manual Override button once more will turn the self levelling system back on. The Laser head will stop and adjust to a level datum and then begin rotating at 600rpm. The laser is now running in self levelling mode once more.

Up / Down / Left & Right Arrows

- When the LL100N, HV101 or LL300N is in manual mode (Self levelling system has been turned off), the Up / Down / Left & Right arrows are used to tilt the laser prism in either the X or Y axis to set a progressive fall or gradient. (See Gradients & Slopes section on page **17** for further details).

Grading

- The LL100N, HV101 & LL300N are all DUAL GRADE facility laser levels when using the Remote Control. This means that they can be switched to "Manual" (to override the self levelling system) allowing the user to set a grade (incline/slope) in the X axis only, Y axis only or both together. The maximum settable slope is an approx. fall of 1m over 10m.
- For X & Y alignment, please see the case markings on the TOP of the laser head where sights point in the direction of the axis being set.

RC601UK REMOTE CONTROL (CONTINUED 3)

LL100N, HV101 & LL300N

The following general guidance is applicable to: Spectra **LL100N, HV101 & LL300N**.

Setting Single Axis Slope

- This example sets a grade in the X axis.
- Press the ON/OFF button once and the Laser will power on and begin automatically self-levelling.
- Press the Manual Override button on the remote once and the self levelling system will be turned off & the red HI / MAN LED illuminates and begins flashing.
- Using the black **Left & Right** Arrow buttons on the remote, set the % slope (fall) required - as measured on your staff.
- When complete, press the Manual Override button once more and this will turn the self levelling system back on. The Laser head will stop and adjust to a level datum and then begin rotating at 600rpm. The laser is now running in self levelling mode once more.

Setting Y Axis Slope

- This example sets a grade in the Y axis.
- Press the ON/OFF button once and the Laser will power on and begin automatically self-levelling.
- Press the Manual Override button on the remote once and the self levelling system will be turned off & the red HI / MAN LED illuminates and begins flashing.
- Using the yellow **Up & Down** Arrow buttons on either the face of the laser or on the remote, set the % slope (fall) required - as measured on your staff.
- When complete, press the Manual Override button once more and this will turn the self levelling system back on. The Laser head will stop and adjust to a level datum and then begin rotating at 600rpm. The laser is now running in self levelling mode once more.

Setting Both X & Y Axis Slopes (Dual Grade)

- Proceed as above, but use all four Arrow buttons on the remote - as required.

HOW TO SET 90° SQUARING

Working Example

The following general guidance is **only** applicable to:
Spectra **HV101**, Spectra **HV302**, Spectra **HV302G**.

The following description in this guide, explains the general principles of setting-out 90 degree squaring when using the Spectra Laser Level. It speeds up the classic 3/4/5 triangle method, giving better accuracy and alignment over much longer distances.

Equipment

You will need the Laser Level, the laser detector (receiver), a target plate and preferably a remote control. You do **not** need a tripod or staff.

(Without a remote control; having another person to assist you, is useful.)

Site Conditions

There are many different work site scenarios. As an example, we are assuming that you have laid a concrete pad or completed your strip foundations (footings) and are ready to set out in one corner, 90 degree (squaring) for brickwork, blocks or timber framing, over a datum *mark*.

Procedure

Place the Laser Level in “*lay-down*” over your corner datum *mark*, on the concrete surface & switch ON. Wait for it to auto (self) level, then press the Manual Override button. As this procedure is using “alignment” rather than “levelling” it is more convenient to use the laser in its Manual mode.

Next, remove the bracket from your laser detector. Switch the detector ON and lay it on its SIDE over a distant mark along one side of the concrete slab or strip footing. The pick-up window must be facing the rotating beam of the laser level. Using the left/right arrow buttons on the remote control, direct the spinning beam to receive a continuous audible tone on the detector. This has aligned the laser beam exactly on the distant mark.

Next, observe the laser dot projecting from the rotating prism. This is now parallel with the concrete slab or footings along the other axis. Laser prisms are optically cut to split one laser beam - to accurately set 90 degrees. ie. Rotating beam in one axis and laser dot in the other, setting squaring.

The laser dot **cannot** be picked up with your detector. You need a target plate.

Our recommendation is to use a small piece of around 300mm long white contiplas board, 6- 9 ins wide or similar. Using a black marker pen, draw a vertical line down the middle of the board. The white surface is an ideal target to “pick-up” the red dot at distance, even in bright sunlight. Hold the end face of the target board down onto the concrete footings, align the dot onto the black line and mark the concrete accordingly at appropriate intervals.

This has set 90 degree squaring.

HOW TO SET 90° SQUARING

Working Example (Continued)

The following general guidance is **only** applicable to:
Spectra **HV101**, Spectra **HV302**, Spectra **HV302G**.

User Tip

Do not mount the Laser Level in “lay-down” on a surveying tripod. It must be positioned directly onto the working surface. If mounted on a tripod, it can potentially introduce an error or inaccuracy to the 90 degree squaring procedure.

Dot axis alignment:

Depending on your make/model of laser level, most have a light house cover over the prism with glass windows. When setting the laser dot axis, the depth of this cover (usually around 20-40mm) prevents you from running your line back to the datum *mark*. So simply mark two positions say 100mm & 1m away from the laser level & strike a line back under the laser's cover to the datum *mark* to give the intersection of both axis.

HOW TO SET SLOPES (FALLS/GRADES)

Working Example (Requires RC601UK Remote Control)

The following description in this guide, explains the general principles of setting a Slope (Fall/Grade) when using a Spectra Rotary Laser Level with the Spectra RC601UK Remote Control.

Equipment

You will need the Laser Level, a surveying tripod, measuring staff (rod) with mm scale and a laser detector/receiver. You will also need the remote control or if you have arrow keys on the laser keypad those can be used instead. ***If your Laser Level does not have arrow keys on the Laser keypad, you will also need a remote control as you cannot set a gradient and slope without this.***

Site Conditions

There are many different work site scenarios. As an example, we are assuming that you are outside on a site with a clear field of view and planning to set drainage falls.

All above ground and below ground drainage pipes should be laid to an adequate gradient. The fall in a pipe is defined as the vertical height by which the pipe drops over a known distance. e.g. a 2.5% gradient is a fall of 1m over 40m or 1:40. (1 in 40).

Typically, surface water or foul water drainage pipes are set between 1:40 to 1:80.

If a gradient is too steep i.e. steeper than 1 in 40, the liquid may run faster than the solids in a foul water pipe thus leaving the solids stranded, which could then block the pipe. Conversely, if a gradient is not steep enough (usually less than 1 in 110), then the pipe may still block, if the solids slow down and become stranded.

Procedure

Place the Laser Level horizontally on the surveying tripod, switch it ON and allow it to auto (self) level. Note the X-axis / Y-axis markings on the top cover of the laser.

Setting a 1:40 gradient: Position the measuring staff at 10m away from the tripod, held vertically and move the laser detector (receiver) along the staff to find the set level position, usually by giving a continuous audible tone. By proportion, a 1m fall at 40m is only 250mm at 10m, so carefully noting the set level dimension on the rear of the staff, move the detector **down** by 250mm and clamp tight.

Using the remote control (from the staff location) or a colleague at the laser, press the Manual Override button and have the axis to be adjusted facing the measuring staff.

Hold the “down arrow” button on the remote control or laser’s keypad, to slope the laser beam down the measuring staff until it gives a continuous tone again, having found set level on the detector. **This has now set a 1:40 fall.**

Return the laser detector to the original set level dimension on the staff.

Dig out ground & lower staff until the laser detector picks up the laser beam again.

HOW TO SET SLOPES (FALLS/GRADES)

Working Example (Continued)

Important note: All “grade facility” rotary lasers revert back to the auto (self) level condition if switched **Off** without retaining the gradient set. So its recommended to complete the ground-works before switching the laser Off.

Once this 1:40 fall is set, the User can use this inclined laser beam as a datum to set the depth of either the crown of the drainage pipe or the Invert level, anywhere in range of the laser – along that same axis.

Invert level of a pipe – is the level taken from the bottom of the inside of the pipe.

Crown of a pipe – is the Invert level plus the internal diameter of the pipe plus the pipe wall thickness. It may be necessary to use this in calculations when level measurements are taken from the crown of a pipe.

Manhole / Access Chambers:

A manhole or access chamber is required to gain access to a drainage system for un-blocking, cleaning, rodding or inspection. (Land drainage systems excluded). They can be manufactured in PVC, masonry or pre-cast concrete.

When setting appropriate drainage gradients it is important to allow for the depth down to either the crown of the pipe (or the Invert level) from ground level, when using these manholes.

Dual Grading:

A rotary laser level with dual grading facility can be used for setting out driveways, car-parks or areas with slopes (falls) in BOTH the X & Y axis.

The same procedure is adopted as above for drainage runs, except a second step in the process is undertaken to set the laser to a fall in the other axis, to complete the dual grade setting-out.

Cut & Fill Machine control work:

If slopes of more than 10% (1:10) are required, which is outside the range of electronic adjustment of the rotary laser’s prism; then simply switch the laser to Manual & fit a “Laser Grade Adapter” between the top face of the tripod & the base of the laser. Then set the required slope. Search our website for more details.

GRADIENT CONVERSION CHART

GL422N Only

Grade	%	Grade	%	Grade	%	Grade	%	Grade	%
1:10	= 10.000	1:50	= 2.000	1:90	= 1.112	1:250	= 0.400	1:750	= 0.134
1:11	= 9.090	1:51	= 1.960	1:91	= 1.098	1:255	= 0.392	1:775	= 0.130
1:12	= 8.334	1:52	= 1.924	1:92	= 1.086	1:260	= 0.384	1:800	= 0.126
1:13	= 7.692	1:53	= 1.886	1:93	= 1.076	1:265	= 0.378	1:825	= 0.122
1:14	= 7.142	1:54	= 1.852	1:94	= 1.064	1:270	= 0.370	1:850	= 0.118
1:15	= 6.668	1:55	= 1.818	1:95	= 1.052	1:275	= 0.364	1:875	= 0.114
1:16	= 6.250	1:56	= 1.786	1:96	= 1.042	1:280	= 0.358	1:900	= 0.112
1:17	= 5.882	1:57	= 1.754	1:97	= 1.030	1:285	= 0.350	1:925	= 0.108
1:18	= 5.556	1:58	= 1.724	1:98	= 1.020	1:290	= 0.344	1:950	= 0.106
1:19	= 5.264	1:59	= 1.694	1:99	= 1.010	1:295	= 0.338	1:975	= 0.102
1:20	= 5.000	1:60	= 1.666	1:100	= 1.000	1:300	= 0.334	1:1000	= 0.100
1:21	= 4.762	1:61	= 1.640	1:105	= 0.952	1:310	= 0.332		
1:22	= 4.546	1:62	= 1.612	1:110	= 0.910	1:320	= 0.312		
1:23	= 4.348	1:63	= 1.588	1:115	= 0.870	1:330	= 0.304		
1:24	= 4.166	1:64	= 1.562	1:120	= 0.834	1:340	= 0.294		
1:25	= 4.000	1:65	= 1.538	1:125	= 0.800	1:350	= 0.286		
1:26	= 3.846	1:66	= 1.516	1:130	= 0.770	1:360	= 0.278		
1:27	= 3.704	1:67	= 1.492	1:135	= 0.740	1:370	= 0.270		
1:28	= 3.572	1:68	= 1.470	1:140	= 0.714	1:380	= 0.264		
1:29	= 3.448	1:69	= 1.450	1:145	= 0.690	1:390	= 0.256		
1:30	= 3.334	1:70	= 1.428	1:150	= 0.666	1:400	= 0.250		
1:31	= 3.226	1:71	= 1.408	1:155	= 0.646	1:410	= 0.244		
1:32	= 3.126	1:72	= 1.388	1:160	= 0.626	1:420	= 0.238		
1:33	= 3.030	1:73	= 1.370	1:165	= 0.606	1:430	= 0.232		
1:34	= 2.942	1:74	= 1.352	1:170	= 0.588	1:440	= 0.228		
1:35	= 2.858	1:75	= 1.334	1:175	= 0.572	1:450	= 0.222		
1:36	= 2.778	1:76	= 1.316	1:180	= 0.556	1:460	= 0.218		
1:37	= 2.702	1:77	= 1.298	1:185	= 0.540	1:470	= 0.212		
1:38	= 2.632	1:78	= 1.282	1:190	= 0.526	1:480	= 0.208		
1:39	= 2.564	1:79	= 1.266	1:195	= 0.512	1:490	= 0.204		
1:40	= 2.500	1:80	= 1.250	1:200	= 0.500	1:500	= 0.200		
1:41	= 2.438	1:81	= 1.234	1:205	= 0.488	1:525	= 0.190		
1:42	= 2.380	1:82	= 1.220	1:210	= 0.476	1:550	= 0.182		
1:43	= 2.326	1:83	= 1.204	1:215	= 0.466	1:575	= 0.174		
1:44	= 2.272	1:84	= 1.190	1:220	= 0.454	1:600	= 0.166		
1:45	= 2.222	1:85	= 1.176	1:225	= 0.444	1:625	= 0.160		
1:46	= 2.174	1:86	= 1.162	1:230	= 0.434	1:650	= 0.154		
1:47	= 2.128	1:87	= 1.150	1:235	= 0.426	1:675	= 0.148		
1:48	= 2.084	1:88	= 1.136	1:240	= 0.416	1:700	= 0.142		
1:49	= 2.040	1:89	= 1.124	1:245	= 0.408	1:725	= 0.138		

Formula:

$\frac{\text{Distance in height}}{\text{Distance}} \times 100 = \text{Percentage Grade}$

Example: Find 1 in 19.5

$= \frac{1}{19.5} \times 100 = \mathbf{5.128\%}$

HOW TO SET SLOPES (FALLS/GRADES)

Working Example 2 (when you do NOT know the % grade to set)

Use diagrams in conjunction with written example on page 21.

Diagram 1

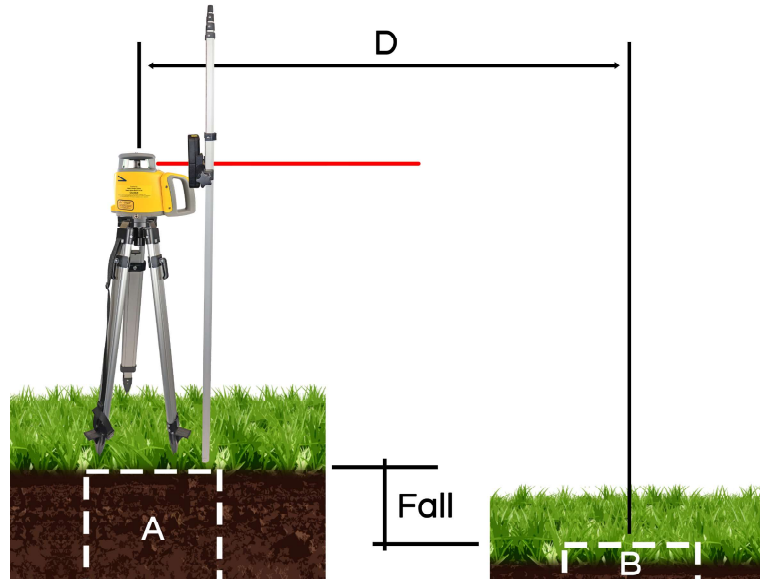


Diagram 2

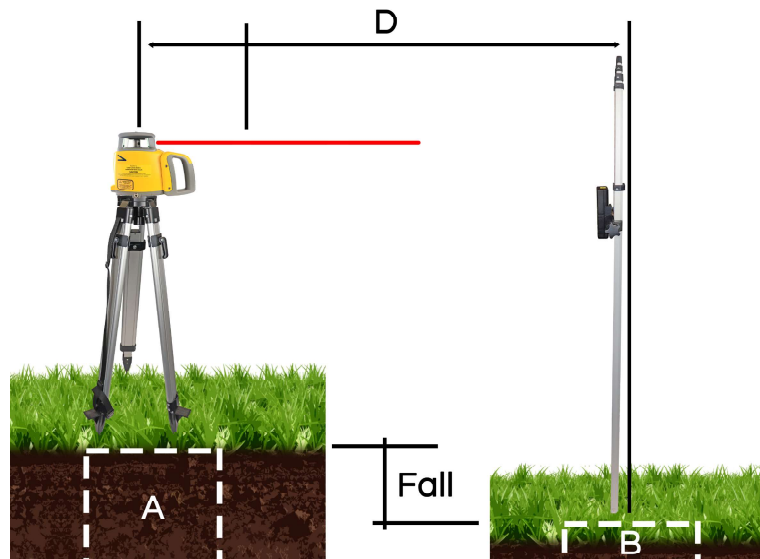
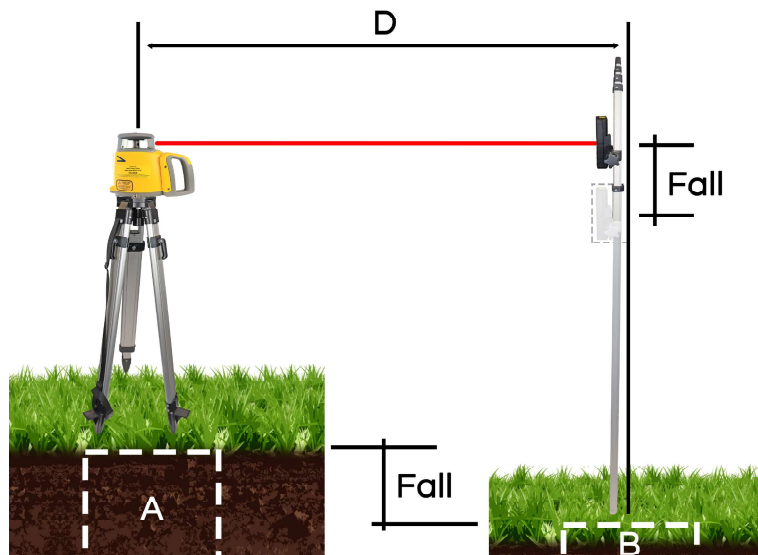


Diagram 3



HOW TO SET SLOPES (FALLS/GRADES)

Working Example 2 (when you do NOT know the % grade to set)

The following description explains the general principles of setting a Slope (Fall/Grade) using your Spectra laser, when you do NOT know the % grade to set.

Equipment

You will need the Spectra laser level, its remote control, a surveying tripod, measuring staff (rod) with mm scale and a laser detector/receiver.

Site Conditions

There are many different work site scenarios. As an example, we are assuming that you are outside, on a site with a clear field of view and planning to set drainage falls.

See Diagram 1

A is a manhole cover with surveying tripod and attached Spectra laser level.

B is a second manhole cover at a lower position, located at distance of “**D**” apart and by a fall of “**F**”.

The planned sitework is to set a slope on the laser level to assist in digging a drainage channel to join **A** to **B**.

Procedure

First measure distance “**D**”.

Next, attach the laser level on the surveying tripod, switch it ON and allow it to auto (self) level.

The tripod height is unimportant. Face keypad (Y axis) towards cover **B**.

Position your extended measuring staff on the ground next to the laser & clamp the detector to pick-up the rotating beam to give a continuous tone on the detector.

Note & record the mm height from the scale on the measuring staff.

To determine & set fall F:

Before moving position from cover **A**, press the laser’s Manual Override button to disable the auto (self) levelling. On the LL100N, this is only found on the remote.

Do NOT un-clamp detector. Move position and place extended measuring staff over the centre of cover **B**, holding it vertically (**see diagram 2**). Un-clamp detector and move it up the measuring staff to pick-up the laser beam with a continuous tone. (**see diagram 3**). Record the new height value. The site Fall “**F**” is this value minus the value taken before at cover **A**.

Return the detector down to the lower position again & clamp tight. See diagram 2.

HOW TO SET SLOPES (FALLS/GRADES)

Working Example 2 (when you do NOT know the % grade to set)

Models LL100N & LL300N:

To make the next adjustment, use the RC601UK infra-red remote control if distance “D” is less than 20m. If “D” is more than 20m, a colleague must assist you using the remote control, being within 20m of the laser level.

Hold the UP arrow button on the remote control to move the laser beam down the measuring staff until a continuous tone is heard. **The laser is now set at the desired Fall.**

Model HV101:

To make the next adjustment, use the RC601UK infra-red remote control if distance “D” is less than 20m; or a colleague at the laser, if “D” is more than 20m.

Hold the UP arrow button to move the laser beam down the measuring staff until a continuous tone is heard. **The laser is now set at the desired Fall.**

Models LL300S, HV302, HV302G & GL422N:

To make the next adjustment, use the RC402N radio remote control if distance “D” is less than 100m; or a colleague at the laser, if “D” is more than 100m.

Hold the UP arrow button to move the laser beam down the measuring staff until a continuous tone is heard. **The laser is now set at the desired Fall.**

Important note: If the laser is switched off and on again, this value is lost; as the laser reverts back to auto level.

Keep the detector clamped in place on the measuring staff & by moving between covers **A & B**, keeping a continuous tone on the detector, the ground can be cut away at the base of the staff, following the grade set by the laser level.

Obviously, allowance must be made for the actual depth of the pipes’ exit & entry positions in each manhole.

Grade Ratio:

As an example, if distance “D” is 30m (30,000mm) & fall “F” is 375mm, the formula shown below determines the Grade ratio:

Distance “D” in mm / Fall “F” in mm = Grade ratio.
i.e. 30,000/375 = **80**

A **1:80** Grade (fall) is used typically for a foul drain run.

CHECKING THE CALIBRATION

Controlled Test

If you believe the Spectra Laser is not giving accurate datums (after ensuring you have completely ruled out refraction of the laser beam explained on page **24**), please carry out the following controlled test in your office, or another indoor location.

- Position the Laser Level on its tripod in the **middle** of your office, garage, workshop etc... somewhere where you have space (10m or similar).
- Ensure there is no glazing or reflective surfaces in line of sight of the laser beam. This is to prevent the Refraction of the laser beam (See Refraction Issues section on page **24** for further details).
- Turn off all the lights and press the **ON/OFF** button once and the Laser Level will power on and begin automatically self-levelling horizontally.
- **No other button needs to be pressed for the laser to self level.**
- This self levelling process takes around 15-20 seconds and then the prism will start spinning and will project a laser beam 360 degrees around the room.
- With the laser level keypad facing your chest (towards you) walk to the left hand wall and mark the position of the laser beam on the wall.
- With the laser level keypad facing your chest (towards you) walk to the right hand wall and mark the position of the laser beam on the wall.
- Walk back to the laser and carefully twist the laser level round so the laser keypad now faces the left wall.
- **Be extremely careful not to overly disturb the laser when twisting it round to the point the tripod position moves or is kicked.**
- The laser will momentarily stop and re-start when turned round. This is normal. The laser will then self level again and project a laser beam 360 degrees around the room.
- Walk to the datum marks on both the left and right wall. You should see that the beam is hitting these marks.
- **If it is hitting the datum marks then the laser is operating correctly.**

If it's not hitting the datum mark's...

(and you have 100% ruled out Refraction and have not pressed Manual override)

Please contact the Service Department: **08000 869 769** who will be able to advise how to send it for repair / calibration.

REFRACTION ISSUES

Product types: All Rotary and Cross line laser levels

Although there will always be the 0.1% of products that develop a fault, 99.9% of the technical enquiries we receive relating to “incorrect levels”, “random positions”, “out-of-level” or “Detector not picking up the beam correctly” transpire to being Refraction of the laser beam.

Laser levelling equipment is used by many different industries in various work-site environments. Users should be aware of the possibility of refraction problems, when using this type of equipment.

“Refraction” is the phenomenon where light is transmitted but moves direction when it passes from one medium to another e.g. through air then glass or water. This is why a pond of water appears shallower than it actually is or when you shine a torch at a window and the beam bounces off to another position. In the same way, this refraction can affect the correct setting-out, when using laser beams.

An easy example to understand is if, for example, a rotary laser is operated with a double-glazed window behind it. The true level position can be refracted and the deviation can be appreciable, even over small distances. In some instances, a double beam position can occur and the wrong level marked.

Our advice is to be aware of this and take appropriate care when setting out with your laser level, **both** indoor & outdoors.

A simple *fix* (if the laser cannot be moved or lowered) is to position a simple brown cardboard cover over the laser level on the side towards the refraction surface.

The following surfaces can potentially be problematic:

All glazing - single, double or treble glazed units. Patio / Bi-fold glass doors etc.

Glazed office partitioning.

Vehicle or Site Plant - glass windows & windscreens. (Curved windows are the worst)

Panel van sides - wet surfaces.

Mirrors & mirrored surfaces.

Stainless steel, shiny aluminum panels & reflective Celotex panels

Water – fountains, water displays, rivers, dams and weirs etc.

In addition, please be aware of the effects of amber & green warning beacons on plant & equipment. This “strobe effect” is a known problem and can affect all types of laser detectors to give erratic readings.

Our main advice is just to be site-aware when using laser levelling equipment, to ensure the reliable and accurate setting-out of your jobs.

It's also important to understand that refraction of the beam, occurs with all lasers regardless of cost and or brand purchased.

■ TROUBLE SHOOTING

Error	Cause & Solution
Will Not Power On (All Laser Levels)	<p><u>Check Batteries</u></p> <p>Often lasers are sent to Service Centres with the following User battery mistakes:</p> <p>Standard batteries that are dead / Rechargeable batteries that are flat and need charging and Polarity errors i.e. batteries of either type that have been fitted incorrectly. Always double-check. It's well worth trying another set of new batteries and do not mix different types nor mix old batteries with new. Sometimes even new sealed batteries are faulty, so always try two sets.</p> <p>Bare in mind that new lasers with rechargeable batteries will not have been fully charged. Follow the User Manual to give them a full charge, before assuming the laser is defective.</p>
Not Charging (LL300N, LL300S, HV302, HV302G, GL422N, Only)	<p><u>Incorrect Charger</u></p> <p>It's common for Service Centres to receive lasers in for repair with either no charger or the wrong charger. Using a non-original charger can cause serious damage to the batteries, internal charge circuit or the laser itself. We always recommend contacting us to purchase the correct OEM charger, if yours has been mislaid. Do not risk buying an often cheaper equivalent to find it causes problems. Its false economy.</p> <p>Ensure that all users are aware of which batteries are fitted so that in error, a charger is not plugged into a laser level fitted with standard batteries, which could cause serious damage.</p>
Random Or Incorrect Levels (All Laser Levels)	<p><u>Site Refraction</u></p> <p>Not every user is aware that laser levels, both Rotary and Line lasers can be affected by reflective surfaces on the work site. Customers report to the Service Centre that the detector (laser receiver) is faulty because it is picking up the laser beam in random positions. 99.9% of the time this is due to site Refraction. It's too easy to conclude the laser is faulty rather than understanding what site conditions can cause this phenomenon. However, it is very easy to eliminate the problem by making sure that laser beam reflections cannot be bounced back to the detector. As an example, if your site has large glass windows (Bi-fold doors / UPVC Windows) make sure you set-up the laser level so that when you hold the detector, the glass is behind you and the detector, so it cannot reflect on to it. Basically look out for & position your laser, being aware of all reflective surfaces like glass and shiny wet surfaces. It is also important to understand that the laser has a range of 500m diameter and spins 360 degrees. As such the refraction can be being caused by something outside the boundaries of your location.</p>

■ TROUBLE SHOOTING (CONTINUED)

Error	Cause & Solution
Laser Will Not Self-Level (All Laser Levels)	<p><u>Outside Levelling Range Or Impact Damage</u></p> <p>If the Laser Level is positioned outside of it's self levelling range of ± 5 degrees the rotating laser prism will tilt over to one side (to try and locate a level position) and then time-out.</p> <p>Re-position the Laser Level so that it is within ± 5 degrees of level and try again.</p> <p>If it's within ± 5 degrees of level and the prism remains tilted over to one side, turn the laser OFF and On again and try again. If the laser will still not self level, it may have received an impact which has affected the self levelling system.</p> <p>Please contact the Service Department: 08000 869 769 who will be able to how to send it for repair.</p>
Laser Not Holding It's Charge (LL300N, LL300S, HV302, HV302G, GL422N, Only)	<p><u>Battery Issue</u></p> <p>Check the battery pack. The battery pack may require charging or need to be replaced due to age and/or a high number of charging cycles.</p> <p>Check the battery compartment for signs of damage and ensure that the compartment is clean and that the battery terminals are not corroded.</p>
Detector Not Detecting The Laser Beam (All Laser Levels)	<p><u>Multiple Causes</u></p> <p>Check the batteries in the detector. They may be low and need replacing.</p> <p>Check the Laser Level is spinning and producing a visible laser beam. You will be able to see the beam on your hands when placed in front of the protective lighthouse.</p> <p>Check the line of sight and ensure there is no obstructions.</p> <p>Check that the laser level and detector are within the operating range. If you are too close to the laser it may not pickup the beam. You need to be at least 3m away.</p> <p>Check that the protective lighthouse glass is clean and free of dust and dirt at all times.</p>
Laser Will Not Power Off (All Laser Levels)	<p><u>Poor Storage Conditions</u></p> <p>If the Spectra Laser will not turn OFF, it is typically due to poor storage (stored away wet, stored in a cold unheated building or vehicle) etc. which has caused internal condensation to build up and affect the main circuit board.</p> <p>Safely dry the Laser and accessories out thoroughly and try again. If this does not resolve the issue, please contact the Service Department: 08000 869 769 who will be able to advise how to sending it for repair.</p>

CARE & MAINTENANCE

Protecting the Spectra Laser Level Kit

- Your Spectra Laser Level is precision levelling equipment and should be treated as such. Always handle with care and transport within the carry case provided.
- Always turn the laser level off when transporting or moving around the job site.
- Ensure the laser & accessories are clean and dry before storing in the case.
- If wet, dry well before storing and store the case and contents at room temperature. Failure to do so may void warranty.
- ***NEVER store the Spectra Laser Level Kit in a van, car or an unheated location (workshop / shed / garage / lockup etc.) overnight. The Spectra Laser Level Kit is designed to work in cold and wet conditions but it's the storage of the product when not in use that is critical. Keeping it in a secure heated building increases the usable life of the product and reduces the possibility of theft.***
- When the laser level is not in use or is being stored long term, it is highly recommended to remove the batteries or battery pack from the base of the laser as well as the batteries in the remote control and detector.
- Ensure the protective lighthouse glass is clean and free of dust and dirt at all times.
- Only use the supplied charger with the laser. The charger is for indoor use only. If the charger becomes damaged, stop using immediately and purchase a replacement. ***Never use a generic charger with this laser.***
- Always check the accuracy of the laser level before precision levelling is attempted. Failure to do so may result in inaccurate levels. See page **23** for further details.
- If the Laser Level has received a heavy impact or has been dropped, please ensure the calibration is checked.
- There are no user serviceable parts inside the Laser Level. Warranty void if tampered.

MAGNETIC MACHINE DETECTORS

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