

3rd Generation

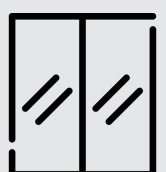
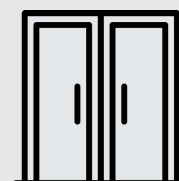
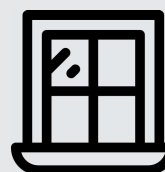
Fukuda FRE-203XR

User Guide



WARNING

Never operate Laser in front of glazing or any shiny surfaces!
See page **25** for further details.



KEY INFORMATION

Specification

Brand	Fukuda
Product Type	Rotating Laser Level
Levelling Type	Fully Self Levelling
Detector Range	Up to 500m Diameter (250m either side of Laser)
Accuracy	±2.8mm at 30m (100ft)
Beam Colour	Red Beam
Beam Type	Rotating Dot
Levelling Axis	Horizontal & Vertical Levelling
Facilities	90° Squaring, Scan, Plumb (Up), Plumb (Down)
Usage	Indoor & Outdoor
Battery	Li-Ion Rechargeable Battery Packs (8,000mAh)
Runtime	Up to 60 hours per Battery. 2 Batteries included (120 hours runtime total)
Slope / Gradient	Dual Grade using Keypad or included Remote Control
Mounting Thread	5/8" Standard Surveying
Laser Rating	Class 2
Durability	Excellent
IP Rating	IP66 - Dust tight / Protected against powerful jets of water
Warranty	Automatic 3 Year Warranty



1st Generation (2019 - Summer 2023)



2nd Generation (July 2023 - December 2024)



NEW 3^d Generation

INTRODUCTION

Thank you for purchasing the Fukuda FRE-203XR RED beam rotary laser kit. These instructions are intended to explain the general basics of operating this equipment. Please read them carefully.

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**

Overview

The Fukuda FRE-203XR is accurate, well-featured and competitively priced. It replaces the extremely reliable Fukuda FRE-301R, to which it shares many of its internal components. It builds upon this foundation to incorporate many new features and improvements. This is currently the only model in the Fukuda range which is extremely robust, having a drop-test specification of 1 metre onto concrete. The top glass "lighthouse" is protected by a metal die-cast cover whilst a robust roll cage adds increased durability.

It's a professional laser level kit from the Fukuda Laser Company. They are specialists in their field of laser level manufacture & certified to ISO-9001.

The FRE-203XR quickly auto levels to set horizontals, verticals and 90-degree site squaring. An invaluable feature.

In addition, this laser can be switched to Manual mode where the spinning beam can set a grade (fall) in the X-axis, Y-axis or both together (dual grade). You can only grade match with this system and not key in a value, however, it will set up to a 1:10 (10%) grade.

SAFETY

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

- Do not remove warning labels from the product.
- The FRE-203XR is a class 2 laser product (<1 mW; 635nm)



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 the FRE-203XR differently than described in the user guide, may result in unsafe operation.

WHAT'S INCLUDED IN THE KIT

The Fukuda FRE-203XR Kit includes the following items. Your contents may vary if the kit was customised at point-of-purchase to upgrade or remove items.



Fukuda FRE-203XR

Horizontal, Vertical, 90° Squaring
& Dual Grade



RLR100Plus Detector

Laser Detector / Receiver
With Staff Mounting Clamp



RC203X Remote Control

Infrared Remote Control For
Setting Gradients & Slopes



Battery Packs & Charger

Rechargeable Li-Ion Battery (pre-
installed in base of laser), Spare
Battery & USB-C Charger



Red Target & Glasses

Red Laser Target & Red Laser
Enhancement Glasses



Tripod & Staff

Surveying Tripod &
Measuring Staff



Carry Case

Foam Lined Carry Case

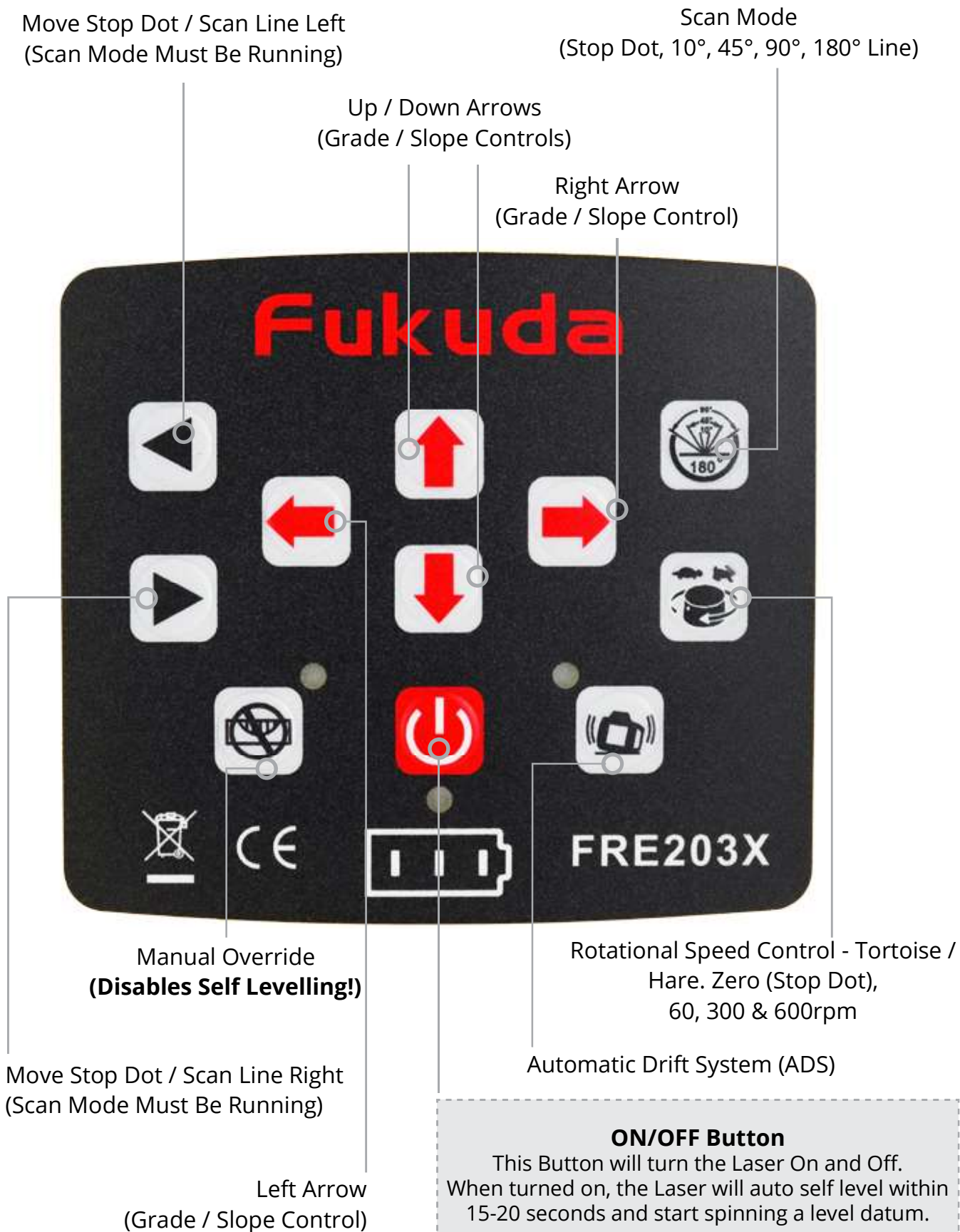
LASER OVERVIEW



LASER OVERVIEW (CONTINUED)



KEY PAD OVERVIEW



ON/OFF Button
This Button will turn the Laser On and Off. When turned on, the Laser will auto self level within 15-20 seconds and start spinning a level datum.
No other button needs to be pressed for the laser to self level.

REMOTE CONTROL OVERVIEW

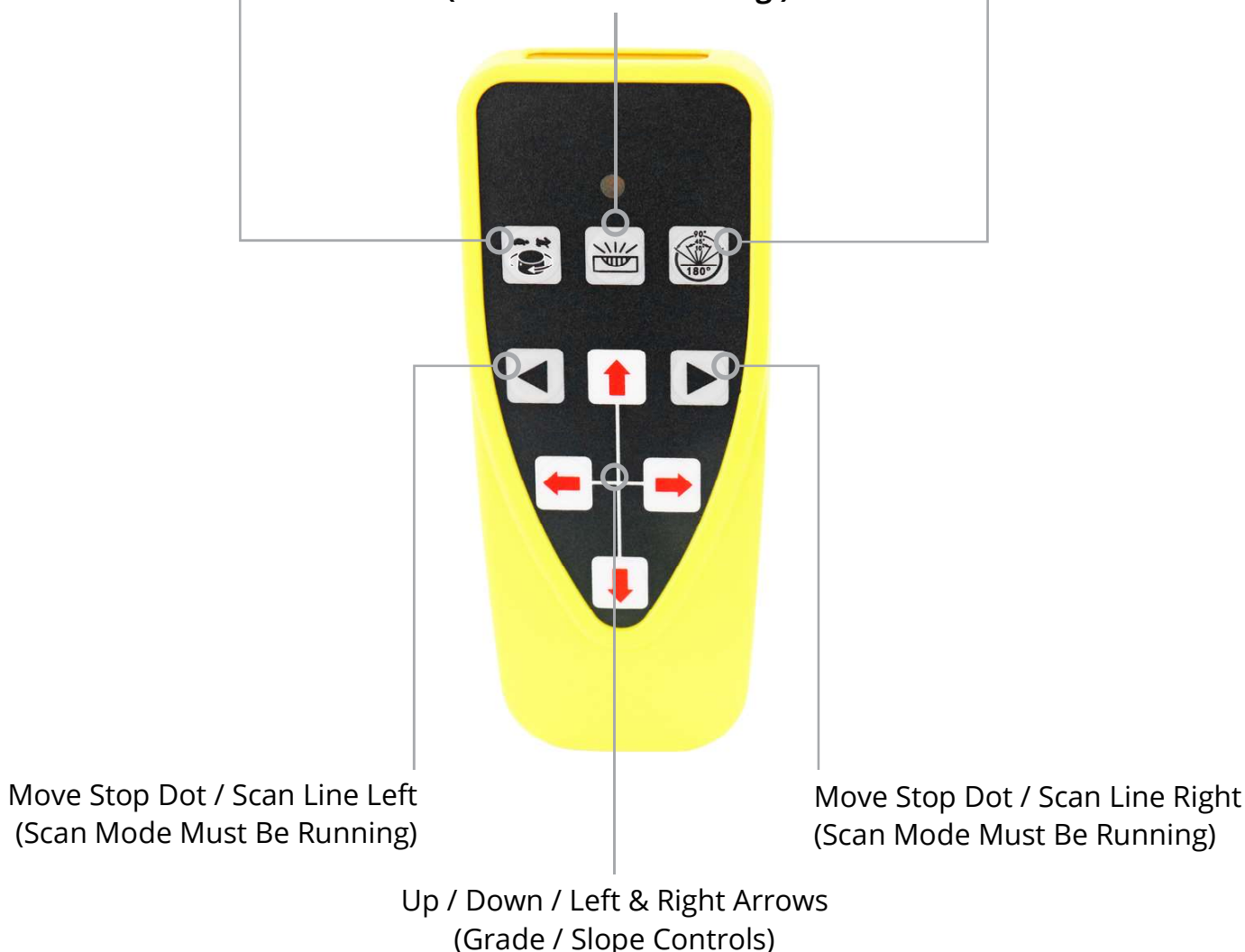
The Fukuda RC203X Infrared Remote Control enables the user to remotely (up to 20m), adjust the following settings: Rotational speed, Scan angle & position, Manual Override (for single or dual-axis grade/slope control). ***It cannot be used to turn the Laser ON or OFF (a feature not available on any Fukuda laser level system).***

TIP - it is often better to use the Remote Control rather than the FRE-203XR's keypad, to avoid disturbing the laser's sensitive self levelling mechanism.

Rotational Speed Control - Tortoise/Hare.
Zero (Stop Dot), 60, 300 & 600rpm

Scan Mode
(Stop Dot, 10°, 45°, 90°, 180° Line)

Manual Override
(Disables Self Levelling!)

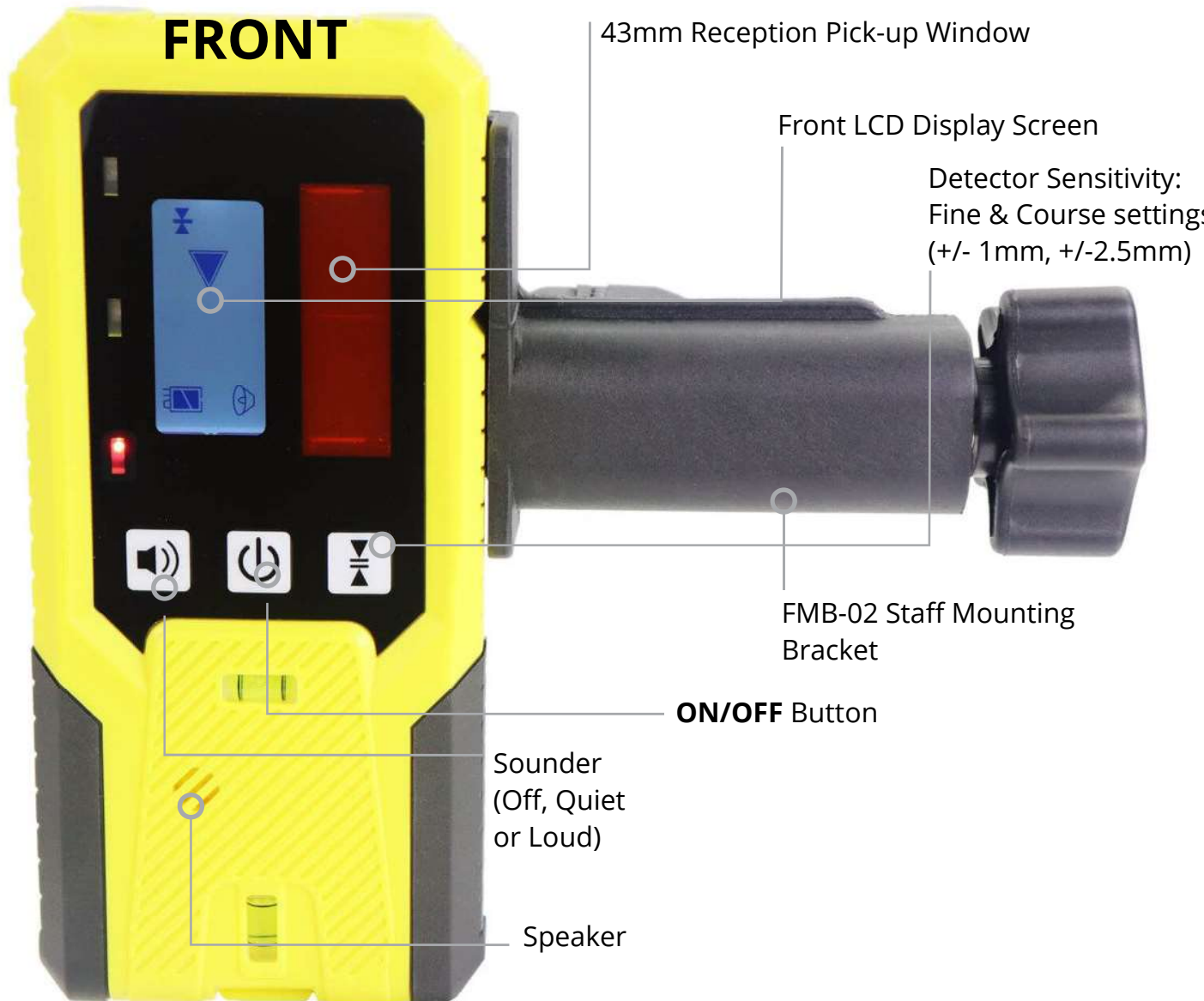


Power Supply & Battery Replacement

- The RC203X remote is powered by 2 x AAA alkaline batteries which will be pre-installed.
- When required, open the rear battery compartment and fit 2 x AAA alkaline replacement batteries, taking care to ensure correct polarity.

LASER DETECTOR OVERVIEW

The FRE-203XR Kit is available with either the standard RLR100plus Detector or the upgraded RLR200D Detector with mm/inch display. The overview below shows the standard RLR100plus.



Power Supply & Battery Replacement

- The RLR100plus Detector is powered by 4 x 1.5v AAA alkaline batteries which will be pre-installed.
- When required, open the rear battery compartment and fit 1 x 9v PP3 alkaline replacement battery, taking care to ensure correct polarity.

LASER DETECTOR OVERVIEW (CONTINUED)



Using The Detector

- Press the **ON/OFF** button once and the RLR100plus will power on.
- 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. 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.

CHARGING & BATTERIES

The Fukuda FRE-203XR is supplied with 2 x Li-Ion high capacity (8,000mAh) rechargeable batteries and a USB mains charger with USB type C cable. **There is no provision for operating this laser level on standard alkaline batteries or FRE-203XR batteries from previous generations which have a different voltage and are not Lithium.**

Laser Charging

Please read these Instructions thoroughly and comply with battery safety requirements whilst charging this laser level. Failure to follow this advice may result in personal injury, fire or property damage, if the batteries are charged improperly.

- Never substitute batteries for other types. Always use those provided with the laser.
- Always use the supplied USB mains charger and USB type "C" cable provided.
- Each charge time is about **4** hrs. The best charging temperature is 0 – 20 deg C.
- If the Li-ion batteries are not used for an extended time, it is recommended to charge them for at least 6 hrs, once every 3 months.
- The Lithium battery pack can either be charged in or out of the Laser Level.
- When charging the battery OUT of the laser, the LED indicators on the battery itself, flash green in sequence. When fully charged, all three indicators are solid green.
- When charging the battery IN the laser, the LED battery indicators on the keypad flash green in sequence. When fully charged, all three indicators are solid green.

Battery Safety

- Do not short circuit. Short circuits may cause fire or injury.
- Do not disassemble or modify the battery in any way.
- Keep the battery away from children and pets.
- Never charge or store these batteries in a vehicle. Extreme temperatures may cause fire.
- Do not carry or store batteries together with other metal objects.
- Immediately discontinue using these batteries if they become abnormally hot, emit an unusual smell, change in colour / shape or appear different in any way. Please contact us to replace it.

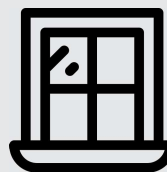
INSTRUCTIONS

Horizontal Levelling



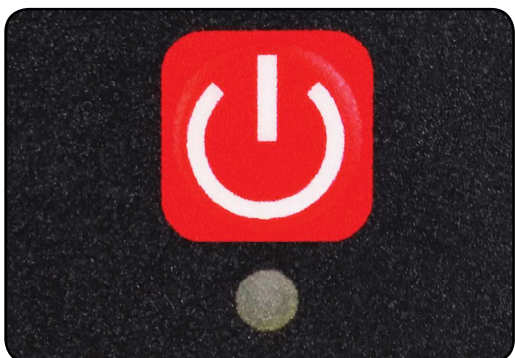
WARNING

Never operate Laser in front of glazing or any shiny surfaces!
See page 25 for further details.



1. Position Laser

Place the FRE-203XR 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 FRE-203XR 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 and LED indicators.



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.

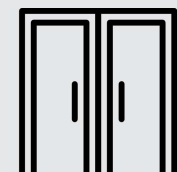
INSTRUCTIONS

Vertical Levelling



WARNING

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See page 25 for further details.



1. Position Laser

Place the the FRE-203XR 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 FRE-203XR 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.

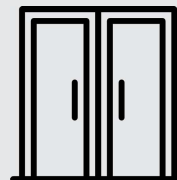
INSTRUCTIONS

90° Squaring



WARNING

Never operate Laser in front of glazing or any shiny surfaces! See page 25 for further details.



1. Position Laser & Power On

Take the FRE-203XR 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 contiplus 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 23 for a more in depth guide to 90° Squaring.

USING THE LASER

Power On



- Press the ON/OFF button once and the FRE-203XR will power on and begin automatically self-levelling. This process takes around 15-20 seconds. When the levelling process is complete, the laser will start spinning at 600rpm, indicating a level datum.

Power Off



- Press the OFF button once and the FRE-203XR will power off.
- If the Laser has been put into grade mode, scan or the rotational speed set at zero, switching off the laser and turning it back on again will automatically return the laser to the default fully self levelled state, running at 600rpm.

Rotational Speed Control - Tortoise/Hare



- 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), 60rpm, 300rpm & 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 FRE-203XR 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 5 scan modes. Each mode adjusts the angle of the beam.
- The scan modes allows the user to set a Stop Dot, 10°, 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.

■ USING THE LASER (CONTINUED)

Rotate Stop Dot / Scan Line (Left or Right)



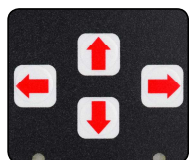
- When the FRE-203XR is in Scan mode or set at 0rpm, the Rotate Stop Dot / Scan Line Left and Right buttons can be pressed to rotate the position of the laser prism either clockwise or counter clockwise.
- This is useful to position the stop dot or line on a specific point in the room.

Manual Override



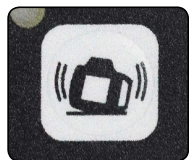
- Press the Manual Override button on the face of the laser or on the remote once and the self levelling system will be turned off. The Laser will continue to rotate but the laser will no longer be outputting a level datum.
- This mode is typically enabled when the laser is being used to do Gradients and Slopes (See Gradients & Slopes section on page **18** 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 FRE-203XR 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 **18** for further details).

Automatic Drift System (ADS)



- If the FRE-203XR is running in self levelling mode, press the Automatic Drift System (ADS) button on the face of the laser to turn on the Automatic Drift System.
- Once activated the green LED will flash slowly. ADS is now ON.
- If for example, the FRE-203XR is knocked or caught by a gust of wind, the laser prism will stop rotating and the green ADS LED will flash quickly to show an alarm condition. Check that your datums have not altered and if all is ok; press the ADS button again & the laser will reset to AUTO level. This function is used to alert users that the laser has been disturbed. If this mode has not been turned on and the laser is disturbed, it is possible that although a level datum will be continue to be produced it may be at a different height than before.
- ***The ADS function cannot be activated when in manual mode doing Gradients or Slopes.***

■ USING THE LASER (CONTINUED 2)

Grading

- The FRE-203XR is a DUAL GRADE facility laser level. This means that the FRE-203XR 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.

Setting Single Axis Slope

- This example sets a grade in the X axis.
- Press the ON/OFF button once and the FRE-203XR will power on and begin automatically self-levelling.
- Press the Manual Override button on the face of the laser or on the remote once and the self levelling system will be turned off & the green LED illuminates.
- Using the red **Left & Right** 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 Y Axis Slope

- This example sets a grade in the Y axis.
- Press the ON/OFF button once and the FRE-203XR will power on and begin automatically self-levelling.
- Press the Manual Override button on the face of the laser or on the remote once and the self levelling system will be turned off & the green LED illuminates.
- Using the red **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 red Arrow buttons - as required.

HOW TO SET SLOPES (FALLS/GRADES)

Working Example 1

The following description in this guide, explains the general principles of setting a Slope (Fall/Grade) when using the FRE-203XR.

Equipment

You will need the FRE-203XR laser level, a surveying tripod, measuring staff (rod) with mm scale and a laser detector/receiver. Its not essential but having the remote control for the laser level is preferable. (Without a remote control, having another person to assist you, is essential).

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 FRE-203XR 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.

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.

HOW TO SET SLOPES (FALLS/GRADES)

Working Example 1 (Continued)

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.

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

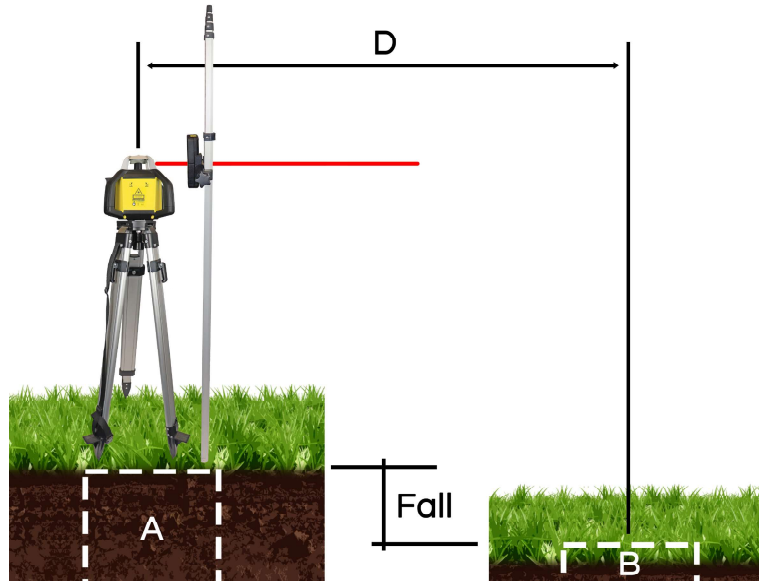


Diagram 2

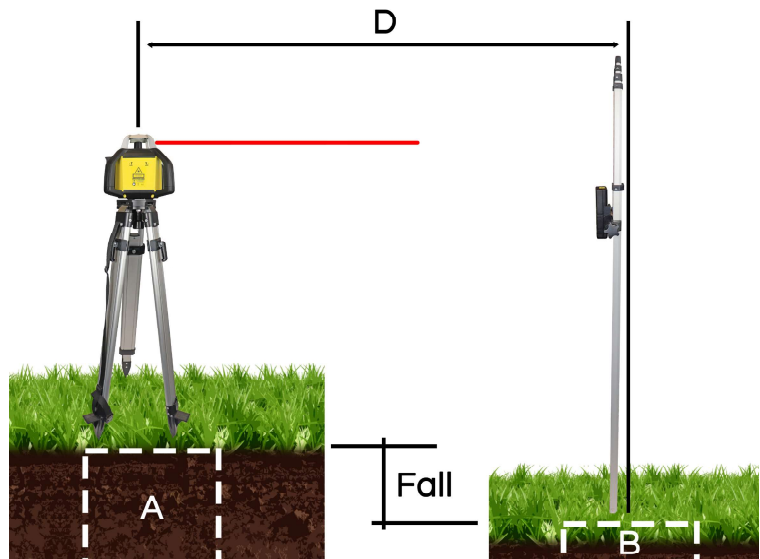
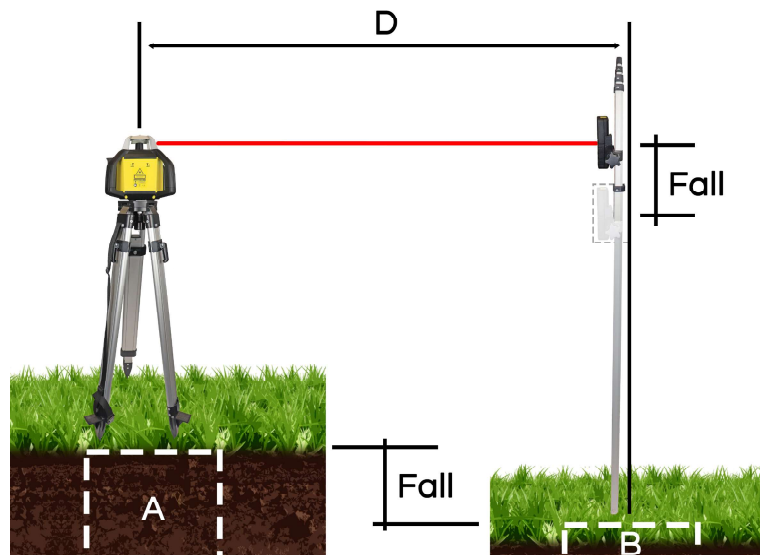


Diagram 3



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 the FRE-203XR, when you do NOT know the grade to set.

Equipment

You will need the FRE-203XR 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 FRE-203XR laser level.

B is a second manhole cover at a lower position, located the 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 FRE-203XR 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 red rotating beam with a continuous tone on the detector.

Note & record the mm height from 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.

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.

To make the next adjustment, use the 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.

HOW TO SET SLOPES (FALLS/GRADES)

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

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.

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 20m (20,000mm) & fall "**F**" is 250mm, the formula shown below determines the Grade ratio:

Distance "**D**" in mm / Fall "**F**" in mm = Grade ratio.
i.e. 20,000/250 = **80**

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

HOW TO SET 90° SQUARING

Working Example

The following description in this guide, explains the general principles of setting-out 90 degree squaring when using the FRE-203XR. It speeds up the classic 3/4/5 triangle method, giving better accuracy and alignment over much longer distances.

Equipment

You will need the FRE-203XR 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 FRE-203XR 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 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 contriplas 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.

User Tip

Do not mount the FRE-203XR 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.

CHECKING THE CALIBRATION

Controlled Test

If you believe the FRE-203XR is not giving accurate datums (after ensuring you have completely ruled out refraction of the laser beam explained on page **25**), please carry out the following controlled test in your office, or another indoor location.

- Position the FRE-203XR laser on it's 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 **25** for further details).
- Turn off all the lights and press the **ON/OFF** button once and the FRE-203XR 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 red 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 red 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

Getting “incorrect levels”, “random positions” or “out-of-level” faults?

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 be **Refraction** and both the Laser Level and Detector are in fact working perfectly.

Not every User is aware that laser levels, both Rotary and Line lasers can be affected by reflective surfaces on the worksite. Customers report to the Service Centre that the detector (laser receiver) is faulty because it is picking up the laser beam in random positions. Terms like “incorrect levels”, “random positions”, “out-of-level” or “Detector not picking up the beam correctly” are used. Refraction is simply physics and will occur regardless of brand and how much money was spent.

“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 when you shine a torch at a window 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.

Another quick way to tell Refraction is happening (and not that the Laser or Detector is faulty) is if you are getting multiple positions on the Detector i.e. a datum above and below where you believe the true datum to be.

If hypothetically the Laser level was not self-levelling correctly, it would then obviously give a datum which is incorrect. ***However, the key to this is that the datum it projects will always be the same. For example always 2mm low. A Self-levelling laser (even if it was out of calibration) would never give multiple levels at the same time. The self-levelling mechanism just doesn't work that way.***

It is also easy to forget that the laser has in many instances a 500m range with a 360-degree coverage. **We routinely hear the statement “I am in the middle of nowhere - and there is nothing around me”. To then find the Excavator or Van is parked 10m behind the user with a huge glass windscreen.** The cause of the refraction also may not be on your site but the neighbouring property, across the street or in the next field.

It's too easy to conclude the laser is faulty rather than understanding what site conditions can cause this phenomenon.

To establish the cause of the issue and to troubleshoot the problem, your best option is to carry out a controlled test as explained on page 24.

REFRACTION ISSUES

Continued...

Additionally you can also do a quick check on-site by getting the Laser off the Tripod and putting it on a firm surface (paving slab or on a block) down at ground level. Typically in this position, you are below the position of any glazing, or shiny/reflective surfaces. Then go about 5-6m from the Laser and pick up the beam. You should then find the Detector is picking up the beam correctly. You can then continue to move further and further away. Again, you will typically find the Detector is operating normally. Don't be tempted at the start to go too close to Laser e.g. 30cm as all Detectors will struggle to give a true reading at this distance as they are intended to work at long range and going too close might seem like a good test, but is actually the opposite.

When you have established the Laser and Detector are operating correctly, you can eliminate the problem of Refraction by making sure that laser beam reflections cannot be bounced back to the detector. As an example, if your site has large glass 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.

If it is not viable to temporarily re-locate the Laser you can try masking some of the Lasers output windows (so that the beam is only output in the direction you are working). Although each Laser Level is slightly different, most typically have a "light house" at the top which has 4 glass windows which are arranged Front, Back, Left & Right. If as an example, you are positioned directly in front of the window above the Lasers keypad you can use some brown cardboard to mask / block the Back, Left & Right windows allowing the laser beam to only be omitted from the Front glass directly to your location. This will then prevent the Laser beam from travelling out of the rear window, hitting an object behind and travelling back to your position but at a lower position.

Basically lookout for & position your laser, being aware of all reflective surfaces like glass and shiny wet surfaces.

■ TROUBLE SHOOTING

Error	Cause & Solution
Will Not Power On	<u>Check Batteries</u> Often lasers are sent to Service Centres with the following User battery mistakes: 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. 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.
Not Charging	<u>Incorrect Charger</u> 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. 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.
Random Or Incorrect Levels	<u>Site Refraction</u> 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.

■ TROUBLE SHOOTING (CONTINUED)

Error	Cause & Solution
Laser Will Not Self-Level	<u>Outside Levelling Range Or Impact Damage</u> If the FRE-203XR 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. Re-position the FRE-203XR so that is is within ± 5 degrees of level and try again. 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. Please contact the Service Department: 08000 869 769 who will be able to how to send it for repair.
Laser Not Holding It's Charge	<u>Battery Issue</u> 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. Check the battery compartment for signs of damage and ensure that the compartment is clean and that the battery terminals are not corroded.
Detector Not Detecting The Laser Beam	<u>Multiple Causes</u> Check the batteries in the detector. They may be low and need replacing. Check the FRE-203XR is spinning and producing a visible red beam. You will be able to see the beam on your hands when placed in front of the protective lighthouse. Check the line of sight and ensure there is no obstructions. 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. Check that the protective lighthouse glass is clean and free of dust and dirt at all times.
Laser Will Not Power Off	<u>Poor Storage Conditions</u> If the FRE-203XR 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. 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.

CARE & MAINTENANCE

Protecting The FRE-203XR Kit

- The Fukuda FRE-203XR 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 Fukuda FRE-203XR Kit in a van, car or an unheated location (workshop / shed / garage / lockup etc.) overnight. The Fukuda FRE-203XR 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 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 USB-C UK 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 **24** for further details.
- If the FRE-203XR has received a heavy impact or has been dropped, please ensure the calibration is checked.
- There are no user serviceable parts inside the FRE-203XR. Warranty void if tampered.

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