

Leica Rugby 410/420 DG User Manual



Version 1.0
English

- when it has to be **right**

Leica
Geosystems

Introduction

Purchase

Congratulations on the purchase of a Rugby instrument.



This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "9 Safety Directions" for further information.

Read carefully through the User Manual before you switch on the product.

Trademarks

XBeePro is a registered trademark of Digi International. All other trademarks are the property of their respective owner.

Product identification

The model and the serial number of your product are indicated on the type plate.

Enter the model and serial number in your manual and always refer to this information when you need to contact your agency or Leica Geosystems authorized service workshop.

Type-Serial No.: 410- _____
 420- _____

Date of purchase: _____

Symbols

The symbols used in this manual have the following meanings:

Type	Description
 Danger	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 Warning	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
 Caution	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury and/or appreciable material, financial and environmental damage.
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

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The Rugby Grade laser is designed to serve your needs in a wide variety of applications.

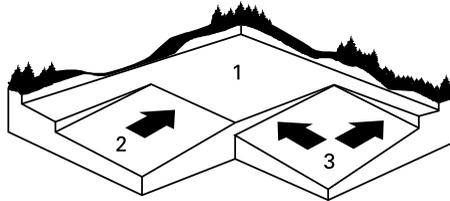
It is a proven tool for increased production with substantial reduction of labor, time and material costs. It can be used to accurately control land leveling, sloped or level grading, trenching, open cut mining, dredging, contouring of levees, general construction and excavation.

This manual contains operating and set-up procedures for common applications. Its purpose is to describe the features of the Rugby and how the Rugby operates. The manual is not intended to describe specific applications. Contact your local dealer or Leica Geosystems for information specific to your jobsite requirements.

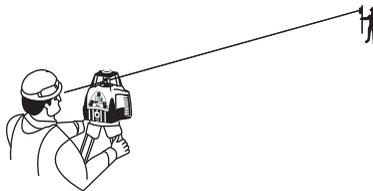
The Rugby Grade lasers are rugged, accurate and fully electronic with an operating range (diameter) of up to:

- Rugby 410DG: 2600 feet (800 meters)
- Rugby 420DG: 3600 feet (1100 meters)

The Rugby 410/420 DG is a dual grade laser and is capable of producing an accurate plane of laser light for applications that are level (1), single grade (2) or dual grade (3).



Alignment is as easy as sighting over the top of the Rugby to your control point using the integrated alignment sights or the optional sighting scope assembly. For increased accuracy, follow the procedure for "3.5 Precise Alignment of the Axes". For highest accuracy refer to the Axis Alignment application.





- a) **POWER Button** – Powers the Rugby on and off.
- b) **LCD Display** – Shows the grade setting for the X axis. The display shows also Beam Masking, Battery status, H.I. and Head Speed.
- c) **X/Y Button** – Press to set grade in the X- and Y-axis.
- d) **UP Arrow Button** – After pressing X/Y, press to increase the grade shown.
- e) **STAR Button** – Press to enter setup screens and the grade entry by digit screen.
- f) **DOWN Arrow Button** – After pressing X/Y, press to decrease the grade shown.
- g) **Circular Level Vial** – For initial setup reference.
- h) **12-volt input** – Charge the batteries or run the Rugby directly from 12-volts.
- i) **Dual Batteries** – The Rugby will run with one or two sets of batteries for maximum flexibility and battery life.
- j) **Raised alignment sights** and mounting plate for the optional sighting scope.
- k) **Easy grip handle** for carrying and setup.
- l) **Tripod mount** for attachment to a 5/8"-11 tripod.

3 Operation

3.1 Entering Grade

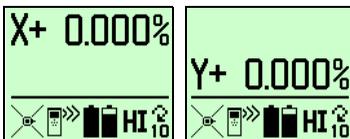
Direct Grade Entry



Press **POWER** to turn the Rugby on.



Press **X/Y** once to enter X-axis grade. Press **X/Y** again to enter Y-axis grade. The display will show the grade entry screens.



Use the **UP** or **DOWN** buttons to set the desired grade.



Press **X/Y** to exit.

Grade Entry by Digit



While in the grade entry screens, press the **STAR** button and a cursor will appear on the +/- sign.



Press the **STAR** button to move the cursor to the right.



Press the **UP** or **DOWN** buttons to change the sign or the digit that is highlighted.



Press **X/Y** to exit.

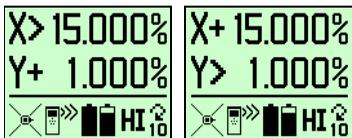
Grade Zero

The grade in either axis can quickly be set to zero by pressing both the Up and Down buttons simultaneously while in either grade entry mode. When changing grade using the direct entry method, the counter will always stop at zero. Release the button and press again to continue counting beyond zero.

Grade Capability

The Rugby 410/420 DG can have up to 15% grade simultaneously in both axes, or up to 25% in one axis.

Grades above 15% in one axis require that the cross axis grade be $\pm 1\%$ or lower. In this situation, if attempting to enter grades greater than 1% or 15%, a notice will appear on the screen when the button is pressed.



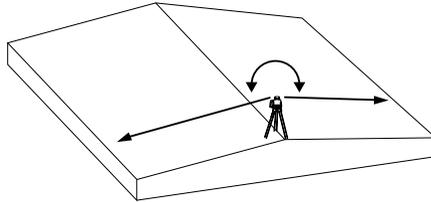


If no button is pressed, the display will revert to the main display after ten seconds.

Grade Swap

The grade in the X and Y axes can easily be swapped from positive to negative in the Grade Entry by Digit screen.

A typical application for this feature is road building. For example, with the Rugby setup on the crown of the road and with one axis aligned to the center line, the cross axis grade can be made to fall to the right or lefthand side simply by changing the +/- sign on the display.

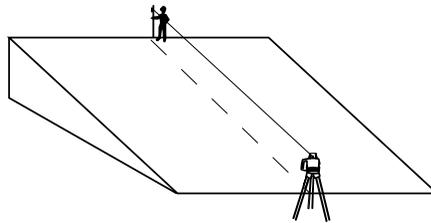


Grade Matching

In Direct Grade Entry mode the movement of the leveling mechanism moves at the same speed as the grade counters.

To match an existing slope, set up the laser over the known gradebreak (base) of the slope, and align the laser to the end of the slope with both control points parallel to the direction of grade.

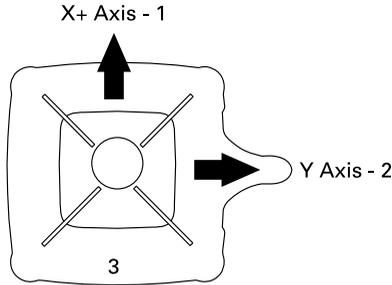
Adjust the Rod-Eye receiver on your grade rod for the elevation of the laser at the gradebreak next to the laser.



Move the grade rod to a point on the slope that is to be matched. Then, dial grade into the laser until the Rod-Eye indicates an on-grade reading. The percent of grade in the display is now equal to the grade being matched.

3.2

Identification of the Axes



1. **X+ Axis** - When positive grade is entered in the X-axis, grade will increase in this direction.
2. **Y+ Axis** - When positive grade is entered in the Y-axis, grade will increase in this direction.
3. **Front of Rugby** - See also axis labeling on the side of the laser and inside the top windows.

3.3

Slope - Percent of Grade

Slope

The change in elevation per unit of measure (foot, meter, etc.)

Percent of Grade

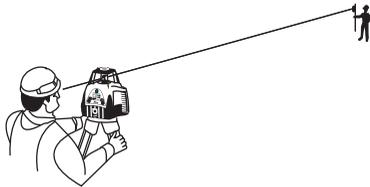
The change in elevation per 100 units of measure (feet, meters, etc.)

Calculating Percent of Grade from the Slope

Slope	=	0.0059
Conversion	=	0.0059×100
Percent of Grade	=	0.590%

3.4

Alignment of the Axes



When the desired grade is correctly set in the display, it is necessary to align the X and Y axes to the jobsite.

Ensure the circular level vial is positioned near the center of the circle for maximum self-leveling capability.

Ensure the Rugby is properly positioned over a control point.

As shown, the direction of the X-axis is seen from the front of the Rugby, sighting over the top of the Rugby.

Rotate the Rugby slightly until the sights are aligned with your second control point.

Once aligned, work can begin.



An optional sighting scope is also available.



For very accurate alignment, refer to the steps for Precise Alignment of the Axes.

3.5 Precise Alignment of the Axes

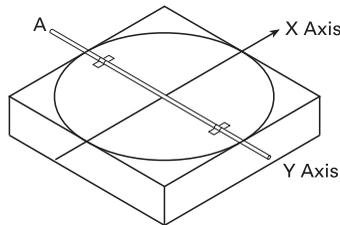
Under most conditions, the raised alignment marks on the top of the Rugby are adequate for alignment of the axes. However, for more precise alignment, use the following procedure.

Objective

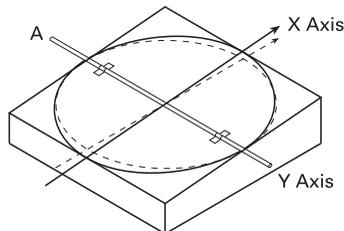
- To establish Point A on the Y-axis as a reference and take an elevation reading.
- To dial grade into the X-axis and then adjust the position of the laser until the original elevation at Point A is again found.

Procedure

1. With 0.000% grade in both axes, set up the Rugby directly over a grade stake and rough align the Y-axis to a second grade stake that we will call Point A.
2. Take an elevation reading at Point A using a Rod-Eye Receiver and a survey rod.



3. Enter +5.000% grade into the X-axis. When grade is entered in the X-axis, the Y-axis acts like a hinge or fulcrum.
4. With 5.000% in the X-axis, take a second reading at Point A.



Alignment

- If the second reading is equal to the first reading, the X-axis is aligned correctly.
- If the second reading is greater than the first reading, rotate the Rugby clockwise (to the right) until the two readings are the same.
- If the second reading is less than the first reading, rotate the Rugby counter-clockwise (to the left) until the two readings are the same.

The Axis Alignment Application is designed to precisely align the axis when grade accuracy is extremely important. For most applications, the traditional sighting method (using the sights on the laser, or using the optional sighting scope) is sufficient, but when precise grades are critical, it is important to have the axes accurately aligned. This Axis Alignment Application is only available on the Rugby 410/420 DG.

Preparation

How to use the Axis Alignment Application:

Power up the laser and enter the desired grade.
(For Example: X=+10.000% and Y=+2.000%).

To establish a proper laser position, make use of the sights on the top of the laser (or the optional scope) and adjust the laser on the tripod so that the axis you intend to precisely align is aimed at your second control point. We recommend using the X-axis when possible.

Using the optional remote control, the Axis Alignment procedure can be a one person operation. With-out the remote control, two people are needed to complete the set-up.

Be sure the remote control is 'enabled' if you intend to use it for this set-up. Refer to page 17 of this manual.

Step 1

Access the Axis Alignment Application (directly from the laser or via the remote control).

From the main operation screen:



Press the **STAR** button once.



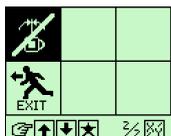
Press the **X/Y** button once.



Use the **UP / DOWN** buttons to toggle to the Axis Alignment Application.

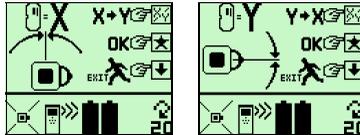


Press the **STAR** button once to start the application.



Step 2

- The X-Axis is automatically pre-selected as the axis to be precisely aligned. Press the **X/Y** button to change to the Y-axis if desired. During this process the cross-axis is automatically reset to 0.000% grade.
- The cross axis is at 0.000% grade when 'OK' is shown on the display.
- On the second control point adjust the Rod-Eye receiver on the grade rod and make sure it is located in the on-grade position on the axis selected (solid bar or solid tone). **This part of step 2 is very important.**
- When you're done press **STAR** to continue.

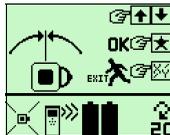


Once **STAR** is pressed, the cross axis grade will change from 0.000% to +5.000%.

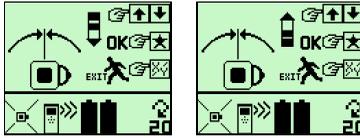
As a result the laser beam signal on the receiver will most likely change the elevation indication from the 'on-grade' position to either a 'high or low' position. This is because the Rugby is not mechanically aligned and the laser will no longer be giving an on grade signal. This is where the electronic Axis Alignment is used.

Step 3

Carefully watch the arrows (laser beam) on the receiver.

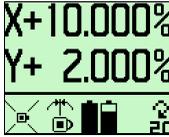


- Use the **UP / DOWN** buttons to move the laser beam once again on the center.
- Select between Speed 1, 2 or 3 which is available in both directions.
 - One push will start moving the beam in slow speed.
 - A second push will move the beam at medium speed.
 - A third push will move the beam at highest speed.
 - During this process an arrow symbol is shown. If the arrow symbol stops flashing the maximum limit is reached and the laser beam does not move anymore. (If the laser beam did not pass the 'on-grade' position on the receiver please consider re-orientating the laser instrument).
- To stop the laser beam movement press **STAR**.
- If the Rod-Eye receiver shows an UP arrow displayed, use the DOWN arrow on the remote control to return to 'on-grade'.
- If the Rod-Eye receiver shows a DOWN arrow, then use the UP arrow on the remote control to return to 'on-grade'.



Step 4

- Hold the receiver steady and watch the laser beam. When the on-grade signal is achieved, the laser is precisely aligned.
- Press the **STAR** button to apply the axis correction, to quit the application and return to the main menu.



Notes

- The X and Y-axis return now to the previously entered grade values. The alignment is electronically compensated; therefore the mechanical alignment of the laser may not be in alignment with the axes.
- In order to indicate that axis alignment is active, the axis alignment icon appears on the display instead of the remote icon.
- As a control watch the laser beam on your receiver, insure that it is still centered.

Important

- In order to reset the axis alignment correction, select the axis alignment dialog and press **STAR**.
- The axis alignment icon is not shown if the axis alignment correction is off.
- By turning off the instrument the axis alignment correction is turned off as well.
- HI alert is disabled during the axis alignment procedure.

Limits and Exceptions

- The X- or Y-axis must have less than -3.500% or 13.500% grade.
- The maximum angle of miss-orientation allowed is 5 degrees. (This represents an offside of 8.7m at 100m).
- The maximum working distance for axis alignment is limited to the operation of the remote control when used, or the sensor's ability to receive the laser signal when the remote is not used.

4 Setup

4.1 General Setup

Location

Make sure the location is clear of possible obstructions that may block or reflect the laser beam.

Make the most efficient use of the Rugby's operating radius. The Rugby can be placed in the center of the working area or to one side.

Make sure the ground is stable. Ground vibration and extremely windy conditions can affect the operation of the Rugby.

If working in very dusty conditions, place the Rugby up-wind. The dirt and will then be blown away from the Rugby and reduce interference.

Recommended Head Speeds

For surveying and manual machine control applications the typical head speed is 10 rps (600 rpm).

For automatic machine control applications it is recommended to use the highest head speed, 20 rps, to increase the frequency of updates.

When working at extended distances, decreasing the head speed (increasing the pulse time on the receiver) or changing the band width of the receiver to wide band can improve distance and performance.

Tripod Setup

Attach the Rugby securely to a tripod or laser trailer, or mount on a stable level surface.

Always check the tripod or trailer before beginning work.

Make sure all screws, bolts, and nuts are tight.

If your tripod has chains, they should be slightly loose to allow for thermal expansion during the day.

On extremely windy days, secure the tripod. Placing a sandbag on each leg can do this. (See also adjustment for setting the wind sensitivity of the Rugby.)

If using a tripod with a quick disconnect adapter, point the control lever into the wind. This places the locking mechanism also into the wind, and will provide better stability.

4.2 Setup Options

The Rugby has several setup options that are easily accessed and changed in the first setup screen.



From the main operating screen, Press **STAR** to access the setup screen.



Head Speed Selections –
5, 10, 15, 20 rps.



HI Function – Turns the H.I. function on and off.

Automatic, Manual or Manual with Grade.

Wind Sensitivity (1-5) – (1) for calm days, (3) for normal days, (5) for extremely windy days.

Beam Masking – Turns the beam off in the selected quadrants.

Changing the Setup Options

When entering the setup screen, the EXIT window will be highlighted. To change the setup options in this window the buttons are used in the following way:



Use the **STAR** button to select or deselect the setup parameters and exit the setup screen.



Use the **UP** and **DOWN** buttons to move the cursor or change the selected parameter.



Press the Star button and the cursor will become a thick border around the selected parameter. Once selected, use the Up and Down buttons to change the parameter.



Use the X/Y button to switch between the first and second page of the setup screen.



Beam masking requires using also the X/Y button.



With the beam masking option selected, press the X/Y button to turn the beam on or off in the selected quadrant.



Use the Up and Down buttons to move around the quadrants.



The quadrant will become solid and dark when selected for the beam to be masked (off) in the quadrant.



Select the **EXIT** window, then press the Star button to exit and return to the main display.



If no button is pressed, the display will revert to the main display after ten seconds.

Head Speeds

The Rugby can be set to any of four different head speeds – 5, 10, 15, or 20 rps. (300, 600, 900, 1200 rpm)

Select the head speed that provides the best performance for your application. The selected head speed is shown on the bottom, right corner of the main display screen.

H.I. (Height of Instrument)

The H.I. function is used to prevent elevation changes caused by movement of the tripod.

When the H.I. Alert function is activated, the self-leveling accuracy remains the same, but the self-leveling range of the Rugby is reduced. Movement of the Rugby beyond its self-leveling range will cause an "alert condition". The Rugby will stop rotating and the following screen will appear on the display:



Stop the "alert condition" by pressing the Star or Power button and reset the function.

Check carefully the setup and elevation of the unit to determine what has caused the alert condition. Adjust as required to the correct elevation.

The H.I. function can be turned on or off in the first setup screen.

When the H.I. function is turned on, the letters "HI" will appear in the bottom, right part of the display.

The H.I. function becomes active 30 seconds after the unit has completely leveled and the head starts rotating.



The H.I. function can be made to turn on automatically at power-up. This can be enabled in the second setup screen.

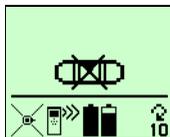
Automatic and Manual Mode



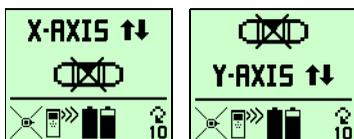
The Rugby will always turn on in automatic mode and will continuously self-level to maintain grade accuracy.

In manual mode the self-leveling function is turned off.

The display screen will show the following:

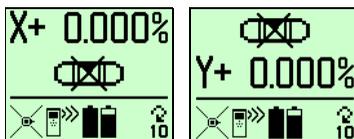


The X-axis slope can be changed using the X/Y and arrow buttons, but the amount of change is not shown in the display.



Manual Mode with Grade

In Manual Mode with Grade, the display will alternately show the grade entered for the X- and Y-axis and the crossed out level vial as shown here:



In this mode, grade can be entered into either axis. The Rugby will self-level to the grade input in the unit, then will lock into manual mode at this grade.

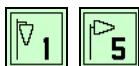


Once locked in manual mode the self-leveling function is turned off.

If it is desired to change the manual grade shown, a new grade can be entered (same as in automatic mode) and the Rugby will level to this new grade, then lock in manual mode.

Wind Sensitivity

The Wind Sensitivity setting allows the Rugby to operate in adverse environmental and windy conditions, while still ensuring maximum accuracy.



The sensitivity numbers can be set from 1 to 5. Select "1" for calm conditions. Select "5" for very windy conditions. Use the lowest setting for conditions present.

Beam Masking

Electronic Beam Masking allows the operator to turn off the laser beam in specific quadrants to prevent interference with other operations on the job.

Using the setup menu, the beam can be turned off in up to three selected quadrants.

When a quadrant is turned off, the space will appear dark.



The quadrants selected can be either diagonals of corners of the Rugby. This selection is made in the second setup screen.



The settings for beam masking are normally not saved when the Rugby is turned off. The Rugby can be made to save the mask settings in the second setup screen.

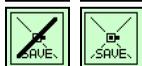
Additional setup options may be accessed in a second setup screen.



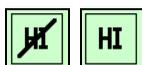
From the main operating screen, Press and hold the **UP** button, then press the **STAR** button to access the second level setup screen.



Selects beam masking at the diagonals or at the corners.



Allows the Rugby to always start up with no beam masking, or to save and start up with the last beam mask setting used.



Allows the Rugby to start up with the H.I. Alert automatically turned on, or turned off.



Allows the operator to disable the negative grade function of the Rugby. When disabled, negative grade cannot be entered in the grade displays.



The remote control is enabled only when a remote is to be used with the Rugby. It is normally off to conserve battery power.

Changing the Setup Options

When entering the setup screen, the EXIT window be highlighted.

To change the setup options in this window the buttons are used in the following way:



The **STAR** button is used to select or deselect the setup parameters.



The **UP** and **DOWN** buttons are used to move the cursor and change the parameters.



Press the **STAR** button and the cursor will become a thick border around the selected parameter. Once selected, use the UP and DOWN buttons to change the parameter.



Select the EXIT window, then press the **STAR** button to exit and return to the main display.



If no button is pressed, the display will revert to the main display after ten seconds.

5 Checking Level Accuracy



It is the responsibility of the user to follow operating instructions, and to periodically check the accuracy of the instrument and work as it progresses.



The Rugby is adjusted to the defined accuracy specification at the factory. It is recommended to check your laser for accuracy upon receipt and periodically thereafter to ensure accuracy is maintained. If your laser requires adjustment, contact your nearest authorized service center or adjust the laser using the following procedure.



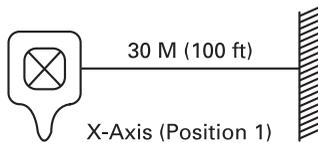
Do not enter this mode or attempt adjustment unless you plan to change the accuracy. Accuracy adjustment should be performed only by a qualified individual that understands basic adjustment principles.

5.1 Checking Level Accuracy

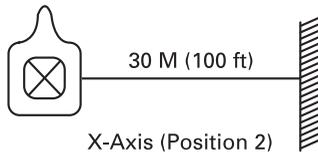
To check level accuracy of your Rugby, place the unit on a flat, level surface or tripod approximately 100 feet (30 meters) from a wall.

Checking the X-Axis

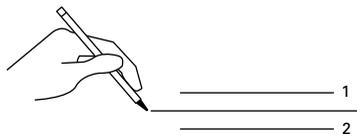
Align the X-axis so that it is square to the wall. Allow the unit to self-level completely (approximately one minute after the unit begins to rotate), and then, using your Rod-Eye receiver, mark the position of the beam (Position 1).



Rotate the Rugby 180°, allow it to self-level and then mark the opposite side of the X-axis (Position 2).



Mark the position half-way between the two marks. The X-axis is within its accuracy specification if the two marks are within $\pm 1/16''$ (± 1.5 mm) from center.



Checking the Y-Axis

Align the Y-axis by rotating the Rugby 90° so that the Y-axis is now square to the wall. Allow the unit to self-level completely, then check the Y-axis in the same way as above.

5.2

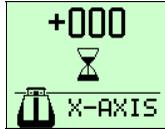
Adjusting Level Accuracy

To Enter Adjustment Mode

With the unit turned off, press and hold both the Up and Down buttons, then press the Power button to put the unit in adjustment mode.

X-Axis Accuracy Adjustment

If entered correctly, the X-axis adjustment screen will appear.



When entering the adjustment screen, a small hour glass will appear. Wait until the hour glass disappears before checking and changing the adjustment numbers.

Use the Up and Down arrows to change the number and move the beam to the half-way point between the positions marked for the X-Axis. Five counts in the display are equal to approximately 1/16" at 100 feet (1.5 mm at 30 meters).

Press the Star button to accept this position and accept the number in the display for the X-Axis.

Press the Star button again to move to the Y-Axis adjustment screen.

Y-Axis Accuracy Adjustment

If entered correctly, the Y-axis adjustment screen will appear.



Wait until the hour glass disappears before checking and changing the adjustment numbers.

Use the Up and Down arrows to change the number and move the beam to the half-way point between the positions marked for the Y-Axis.

Press the Star button to accept this position and accept the number in the display for the Y-Axis.

Press the Star button again to accept, save, store the adjustment activity, and to return to the main display screen.



After adjustment, always check your work.



Always check accuracy prior to critical applications. Repeated activation of the grade mechanism may result in accuracy variations up to ± 20 arc seconds.

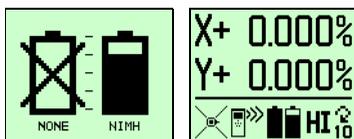


Pressing the power button at any time before completing the procedure will revert the accuracy to previously saved information.

The **unique battery solution** in the Rugby has two independent battery compartments that will accept various combinations of NiMH packs or individual D-cell batteries (2).



The **battery status** is displayed on power-up and as small icons on the main operating screen.



Install the NiMH batteries (1) as shown on the label of the pack. Install individual D-cell batteries (2) as shown on the battery door cover. The charge jack (3) is located on the laser above the locking knob of the battery door (4).

Charge time is approximately 4-5 hours.

The Rugby can also be run directly from a 12-volt source through the charge jack.

Charging / First Time Use

- The batteries must be charged prior to using it for the first time because it is delivered with an energy content as low as possible.
- The permissible temperature range for charging is between +32°F to +104°F (0°C to +40°C). For optimal charging we recommend charging the batteries at a low ambient temperature of +32°F to +68°F (0°C to +20°C) if possible.
- It is normal for the battery to become warm during charging. Using the chargers recommended by Leica Geosystems, it is not possible to charge the battery if the temperature is too high.
- For new batteries or batteries that have been stored for a long time (> three months), it is effectual to make 3 - 5 charge/discharge cycle.

Operation/ Discharging

- The batteries can be operated from -4°F to +122°F (-20°C to +50°C).
- Low operating temperatures reduce the capacity that can be drawn; very high operating temperatures reduce the service life of the battery.

6.2

The Sighting Scope

A sighting scope (739870) is available as an optional accessory for alignment of the axes and second day setups.

The scope is magnetically mounted to the top of the housing and once aligned has a repeatable accuracy of approximately $\pm 0.2^\circ$.



Alignment of the crosshairs

If using the scope for reference or second day setup, use the raised sights on the top of the laser to align your Rugby to a second control point.

The scope is roughly aligned at the factory. If a more precise alignment is desired, first align the Rugby to a second control point using the procedure for Precise Alignment of the Axes found in this manual.



A = Vertical crosshair alignment

The Rugby LR Remote Control (765668) is a full functioning, two-way remote control.



The LCD display and the grade and star buttons on the remote are the same as on the Rugby.



The Power button turns on only the remote. When pressed it will communicate with the Rugby to receive current information.

Once communication is established, the remote can be used to change grade and setup parameters on the laser.

If the remote is not within range or otherwise loses communication, the lost communication screen will be displayed.



It is important, to achieve specified distances, that the remote be used within the “line of sight” of the Rugby.

Press and hold the power button for 1.5 seconds to turn the remote off.



The Standby button will cause the Rugby to go into standby mode for up to 16 hours. After this time the Rugby will shut off and can only be turned on again at the laser.

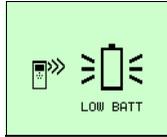
When in standby mode the display will show only a sleeping Rugby.

Pressing any button (except power) while the unit is in standby mode will cause the laser to return to normal operation.



Automatic Shut Off - To conserve battery power, the remote will automatically shut off after two minutes of non-use.

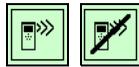
Low Battery – The remote will display a low battery screen when the batteries have reached a voltage where the remote can no longer communicate with the laser.



To replace the batteries, remove the bottom cover of the housing. Install as indicated on the side of the housing.

Before you can use the remote it is necessary to enable the remote capability on the laser.

To do this follow the instructions for entering and changing the setup in the second setup screen (page 17).

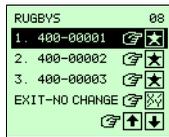


Change the remote symbol in the setup screen so that it no longer has a line through it.

When enabled, the remote symbol will appear on the bottom of the main display.

Programing the remote – To program the remote for your laser press and hold the **STAR** button, then press the **POWER** button.

The remote will search the immediate area for Rugby units with remote capability, and will identify these in the display.



To select your laser highlight the serial number and press the **STAR** button. The remote will connect to the selected laser.

To exit this screen without changing settings, highlight **EXIT - NO CHANGE** and press the **X/Y** button.

Remote Notes

Setting the shut-off timer – The remote is set from the factory to shut off after two minutes of not being used.

To change this shut-off time, enter the remote programming screen (just described) by pressing and holding the **STAR** button, then pressing the **POWER** button.



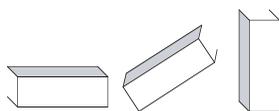
When the Rugby select screen is shown, press and hold the **STAND-BY** button for 1.5 seconds. The shut-off time will change between 120, 60, or 30 seconds each time the button is held.

Backlighting – The LCD backlighting is normally off to conserve battery power.



To backlight the display on the remote, press the power button a second time after the remote has been turned on.

Remote reception – The remote is an RF (radio frequency) device with an internal antenna. Always ensure that the remote is within the “line of sight” of the Rugby.



If the remote loses communication, hold the remote at a different angle to improve reception.

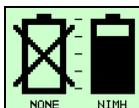
7 Troubleshooting

7.1 Display Screen Explanations



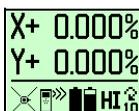
Leica Start-up Screen

- Can be programmed to display customer's name and address.



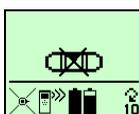
Battery Status Screen

- Displays on power-up
- Displays also when batteries are empty.



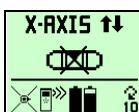
Automatic Mode

- Main Display Screen
- Unit automatically self-levels.



Manual Mode

- Unit will not self-level
- Grade can be changed with the grade/arrow buttons.



Manual Mode with Grade

- Unit will self-level to grades input, then lock in manual mode.
- Grade can be changed with the grade/arrow buttons.



Stand-by Mode

- Controlled by the stand-by button on the remote.
- Press the power button on the Rugby to turn off.



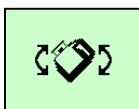
H.I. Alert Warning

- Unit has moved and elevation may have changed.
- Press Power or Star to reset H.I. function.
- Check unit's elevation and adjust if required.



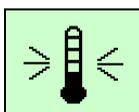
Servo Limit Warning

- Unit is not level
- Check setup and circular level vial.



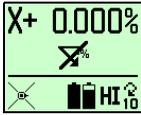
Tilt Warning

- Unit is tilted more than 30°.



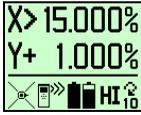
Temperature Warning

- Unit is too hot or cold to operate properly.
- Shade unit if too hot.
- Warm unit before continuing if too cold.



Negative Grade Disabled

- The ability to enter negative grade has been disabled in the second setup screen.



Grade greater than 15%

- If attempting to enter grades greater than 15%, the cross axis grade is limited to 1%.
- Four similar screens are possible.



Lost Communication

- The remote is out of range. Move closer.
 - The remote is not in the line of sight of the laser.
-

Whenever there are questions regarding your laser, check the basics first.

- Mode of operation - automatic, manual, manual with grade.
- Battery status
- Warning Screens - H.I., servo limit, temperature, adjustment.
- Head speed setting
- Beam mask setting

Symptom	Possible Causes and Solutions
No beam	<ul style="list-style-type: none"> • The Rugby beam is infrared (Rugby 410 DG only) and invisible to the human eye. • Check with a receiver to verify.
No self-leveling	<ul style="list-style-type: none"> • Check the basics above.
Cannot change grade	<ul style="list-style-type: none"> • Check the basics above. • Check the other axis. • Check operation in manual mode. • Check if at grade limit.
Loss of distance	<ul style="list-style-type: none"> • Check the window surfaces. • Check with a different receiver. • At extended distances, decreasing the head speed may improve performance.
Head rotates slowly	<ul style="list-style-type: none"> • Check the basics above. • In low battery mode the Rugby will rotate slowly (7 RPS) to trigger the laser low battery function on the RE Pro.
Grade stakes do not match the laser	<ul style="list-style-type: none"> • Check for proper alignment of the axes. • Check level accuracy of the laser. • Check the grade stakes to verify their accuracy or to determine if they have moved.
Beam masking not saved when laser is turned off	<ul style="list-style-type: none"> • Set up this preference in the second set-up screen.
Remote will not turn on	<ul style="list-style-type: none"> • Check and replace the batteries.
Remote will not communicate with the laser.	<ul style="list-style-type: none"> • Check that remote capability is enabled on the laser. (see small icon on the main display) • Check remote battery status. • Reduce distance and try again. • At longer distances, ensure the remote is in "line of sight" of the laser. • Reposition the remote at a different angle to improve the internal antenna reception.



If none of the above suggestions results in a solution, contact your local dealer or nearest authorized service center.

8 Care and Transport

8.1 Transport

Transport in the field	<p>When transporting the product in the field, always make sure that you:</p> <ul style="list-style-type: none">• Either carry the instrument in its original transport case• Or carry the tripod with its legs splayed across your shoulder, keeping the attached instrument upright.
Transport in a road vehicle	<p>Never carry the instrument loose in a road vehicle. It can be affected by shock and vibration. Always carry the product in its transport container and secure it.</p>
Shipping	<p>When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging transport container and cardboard box, or its equivalent, to protect against shock and vibration.</p>
Shipping, transport of batteries	<p>When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping, contact your local passenger or freight transport company.</p>
Field Adjustment	<p>After transport inspect the field adjustment parameters given in this user manual before using the product.</p>

8.2 Storage

Product	<p>Respect the temperature limits when storing the product, particularly in summer if the instrument is inside a vehicle. Refer to "Technical Data" for information about temperature limits.</p>
Field Adjustment	<p>After long periods of storage inspect the field adjustment parameters given in this user manual before using the product.</p>
Nickel-Metal Hydride and D-Cell Batteries	<ul style="list-style-type: none">• Refer to "10 Technical Data" for information about storage temperature range.• Fully charged NiMH batteries can be stored for a maximum of 180 days. NiMH batteries must then be recharged again.• Remove the batteries from the product for storage.• After storage, recharge the batteries before use.• Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use.

8.3

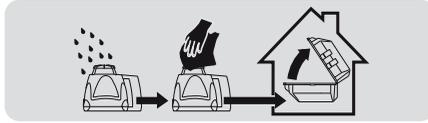
Cleaning and Drying

Product and Accessories

- Blow dust off optical parts.
 - Never touch the glass with your fingers.
 - Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol.
 - Do not use other liquids; these may attack the polymer components.
-

Damp Products

- Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater than 104°F / 40°C and clean them.
- Do not repack until everything is completely dry.
- Always close the transport container when using in the field.



Cables and Plugs

- Keep plugs clean and dry.
 - Blow away any dirt lodged in the plugs of the connecting cables
-

Connectors with Dust Cap

- Wet connectors must be completely dry before attaching the dust cap.
-

9 Safety Directions

9.1 General

The following directions should enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

9.2 Intended Use

Permitted use

- The product casts a horizontal laser plane or a laser beam for the purposes of alignment.
 - The product can be set up on its own baseplate or on a tripod.
 - The laser beam can be detected by means of a laser detector.
 - Remote control of product.
 - Data communication with external appliances.
-

Adverse use

- Use of the product without instruction.
 - Use outside of the intended limits.
 - Disabling safety systems.
 - Removal of hazard notices.
 - Opening the product using tools, for example screwdriver, unless this is specifically permitted for certain functions.
 - Modification or conversion of the product.
 - Use after misappropriation.
 - Use of products with obviously recognizable damages or defects.
 - Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.
 - Inadequate safeguards at the construction site (e.g. when using on or near roads).
 - Deliberate dazzling of third parties.
 - Controlling of machines, moving objects or similar monitoring application without additional control and safety installations.
-

Warning

Adverse use can lead to injury, malfunction, and material damage. It is the task of the person responsible for the equipment to inform the user about hazards and how to counteract them. The product is not to be used until the user has been instructed how to work with it.

9.3

Limits of Use

Environment

Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments.

Charger

Suitable for use in dry environment only and not under adverse conditions.



Danger

Local safety authorities and safety experts must be contacted before working in hazardous areas, or in close proximity to electrical installations or similar situations by the person in charge of the product.

9.4

Warranty

International Limited Warranty

This product is subject to the terms and conditions set out in the International Limited Warranty which you can download from the Leica Geosystems home page at <http://www.leica-geosystems.com/internationalwarranty> or collect from your Leica Geosystems distributor.

The foregoing warranty is exclusive and is in lieu of all other warranties, terms or conditions, express or implied, either in fact or by operation of law, statutory or otherwise, including warranties, terms or conditions of merchantability, fitness for a particular purpose, satisfactory quality and non-infringement, all of which are expressly disclaimed.

9.5

Responsibilities

Manufacturer of the product

Leica Geosystems AG, CH-9435 Heerbrugg, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the user manual and original accessories, in a completely-safe condition.

Manufacturers of non-Leica Geosystems accessories

The manufacturers of non Leica Geosystems accessories for the product are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Leica Geosystems product.

Person in charge of the product

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

- To understand the safety instructions on the product and the instructions in the user manual;
 - To be familiar with local regulations relating to accident prevention;
 - To inform Leica Geosystems immediately if the product and the application becomes unsafe.
 - To ensure that the national laws, regulations and conditions for the operation of radio transmitters are respected.
-



Warning

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

-
-  **Warning**
- The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial, and environmental consequences.
- Precautions:**
All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the product.
-
-  **Caution**
- Watch out for erroneous measurements if the product has been dropped or has been misused, modified, stored for long periods or transported.
- Precautions:**
Periodically carry out test measurements and perform the field adjustments indicated in the user manual, particularly after the instrument has been subjected to abnormal use and before and after important measurements.
-
-  **Danger**
- Because of the risk of electrocution, it is very dangerous to use grade rods and staffs in the vicinity of electrical installations such as power cables or electrical railways.
- Precautions:**
Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.
- 
-
-  **Warning**
- If the product is used with accessories, for example masts, staffs, poles, you may increase the risk of being struck by lightning.
- Precautions:**
Do not use the product in a thunderstorm.
-
-  **Warning**
- Inadequate securing of the work site can lead to dangerous situations, for example in traffic, on building sites, and at industrial installations.
- Precautions:**
Always ensure that the work site is adequately secured. Adhere to the regulations governing accident prevention and road traffic.
-
-  **Caution**
- If the accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people may sustain injury.
- Precautions:**
When setting-up the product, make sure that the accessories, for example tripod, tribrach, connecting cables, are correctly adapted, fitted, secured, and locked in position.
Avoid subjecting the equipment to mechanical stress.
-

**Caution:**

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

Precautions:

Before shipping the product or disposing of it, discharge the batteries by running the product until they are flat.

When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping contact your local passenger or freight transport company.

**Warning**

During dynamic applications, there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:

The person responsible for the product must make all users fully aware of the existing dangers.

**Danger****Operation of Charger:**

The product is not designed for use under wet and severe conditions. If unit becomes wet it may cause you to receive an electric shock.

Precautions:

Use the product only in dry environments, for example in buildings or vehicles. Protect the product against humidity. If the product becomes humid, it must not be used!

**Warning****Operation of Charger:**

If you open the product, either of the following actions may cause you to receive an electric shock

- Touching live components
- Using the product after incorrect attempts were made to carry out repairs.

Precautions:

Do not open the product. Only Leica Geosystems authorized service workshops are entitled to repair these products.

**Warning****Inserting and Removing the Batteries:**

Batteries not recommended by Leica Geosystems may be damaged if charged or discharged. They may burn and explode.

Precautions:

Only charge and discharge batteries recommended by Leica Geosystems.

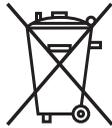
**Warning**

If the product is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.

- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorized persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.

Precautions:



The product must not be disposed with household waste. Dispose of the product appropriately in accordance with the national regulations in force in your country. Always prevent access to the product by unauthorized personnel.

Product specific treatment and waste management information can be downloaded from the Leica Geosystems home page at <http://www.leica-geosystems.com/treatment> or received from your Leica Geosystems dealer.

 **Warning**

Only Leica Geosystems authorized service workshops are entitled to repair these products.

 **Warning**

Using a battery charger not recommended by Leica Geosystems can destroy the batteries. This can cause fire or explosions.

Precautions:

Only use chargers recommended by Leica Geosystems to charge the batteries.

 **Warning**

High mechanical stress, high ambient temperatures or immersion into fluids can cause leakage, fire or explosions of the batteries.

Precautions:

Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.

 **Warning**

Short circuited battery terminals can overheat and cause injury or fire, for example by storing or transporting in pockets if battery terminals come in contact with jewelry, keys, metallized paper or other metals.

Precautions:

Make sure that the battery terminals do not come into contact with metallic objects.

General

The following directions (in accordance with the statement of the art - international standard IEC 60825-1 (2001-08; 2007-03) and IEC TR 60825-14 (2004-02) provide instruction and training information to the person responsible for the product and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.



Product classified as laser class 1, class 2 and class 3R do not require:

- Laser safety officer involvement
- Protective clothes and eyewear
- Special warning signs in the laser working area

If used and operated as defined in this user manual due to the low eye hazard level.



Products classified as laser class 2 or 3R may cause dazzle, flash-blindness and afterimages, particularly under low ambient light conditions.

Rugby 410 DG

The rotating laser produces an infrared laser beam which emerges from the rotating head.

The laser product described in this section, is classified as laser class 1 in accordance with:

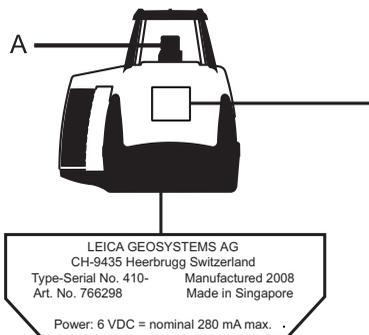
- IEC 60825-1 (2001-08): "Safety of laser products"
- EN 60825-1: 1994 + A11:1996 + A2:2001: "Safety of laser products"

Class 1 laser products

These products are safe under reasonable foreseeable conditions of operation and are not harmful to eyes provided that the products are used and maintained in accordance with this user manual.

Description	Value
Maximum radiant power (Rotating mode)	1.7 mW
Maximum radiant power per pulse	N/A
Pulse duration (effective)	N/A
Pulse repetition frequency	N/A
Beam divergence	0.2 mrad
Measurement uncertainty	+/- 5%

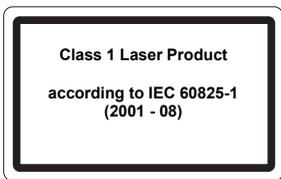
Labeling Class 1



 Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No 50, dated July 26, 2001.

This device contains a transmitter:
 FCC ID: OUR-XBEEPRO
 IC ID: 4214A-XBEEPRO
 ERP: <100mW

This device complies with part 15 of the FCC Rules
 Operation is subject to the following two condition
 (1) This device may not cause harmful interference
 and (2) this device must accept any interference
 received, including interference that may cause
 undesired operation.



A = Laser Beam

Rugby 420 DG

The rotating laser produces a visible red laser beam which emerges from the rotating head.

The laser product described in this section, is classified as laser class 2 in accordance with:

- IEC 60825-1 (2007-03): "Safety of laser products"
- EN 60825-1 (2007-10): "Safety of laser products"

Class 2 laser products

These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam.

Description	Value
Maximum peak radiant power	< 2.7 mW c.w.
Pulse duration (effective)	2.2, 1.1, 0.74, 0.56 ms
Pulse repetition frequency	5, 10, 15, 20 rps
Wavelength	620 - 690 nm

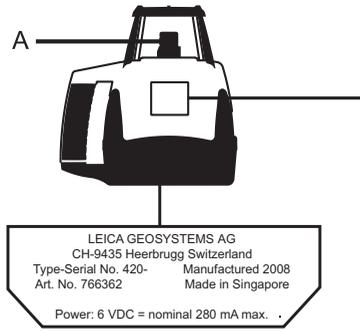
Warning

From a safety perspective class 2 laser products are not inherently safe for the eyes.

Precautions:

Avoid staring into the beam or pointing the beam at other people.

Labeling Class 2



 Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No 50, dated July 26, 2001.

This device contains a transmitter:
FCC ID: 0UR-XBEEPRO
IC ID: 4214A-XBEEPRO
ERP: <100mW

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.



Laser Radiation
Do not stare into beam
Class 2 Laser Product
according to IEC 60825-1
(2007 - 03)
Po 2.7mW
= 620 - 690mW

A = Laser Beam

9.8

Electromagnetic Compatibility (EMC)

Description

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

Warning

Electromagnetic radiation can cause disturbances in other equipment. Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

Caution

There is a risk that disturbances may be caused in other equipment if the product is used in conjunction with accessories from other manufacturers, for example field computers, personal computers, two-way radios, non-standard cables or external batteries.

Precautions:

Use only the equipment and accessories recommended by Leica Geosystems. When combined with the product, they meet the strict requirements stipulated by the guidelines and standards. When using computers and two-way radios, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

Caution

Disturbances caused by electromagnetic radiation can result in erroneous measurements.

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that the product may be disturbed by very intense electromagnetic radiation, for example near radio transmitters, two-way radios or diesel generators.

Precautions:

Check the plausibility of results obtained under these conditions.

 **Warning**

If the product is operated with connecting cables attached at only one of their two ends, for example external supply cables, interface cables, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired.

Precautions:

While the product is in use, connecting cables, for example product to external battery, product to computer, must be connected at both ends.

 **Warning**

Use of product with radio devices:

Electromagnetic radiation can cause disturbances in other equipment, in installations (e.g. medical ones such as pacemakers or hearing aids) and in aircraft. It can also affect humans and animals.

Precautions:

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed or that humans or animals may be affected.

- Do not operate the product in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
 - Do not operate the product near to medical equipment.
 - Do not operate the product in aircraft.
 - Do not operate the product for long periods with it immediately next to your body.
-

9.9

FCC Statement, Applicable in U.S.

 **Warning**

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

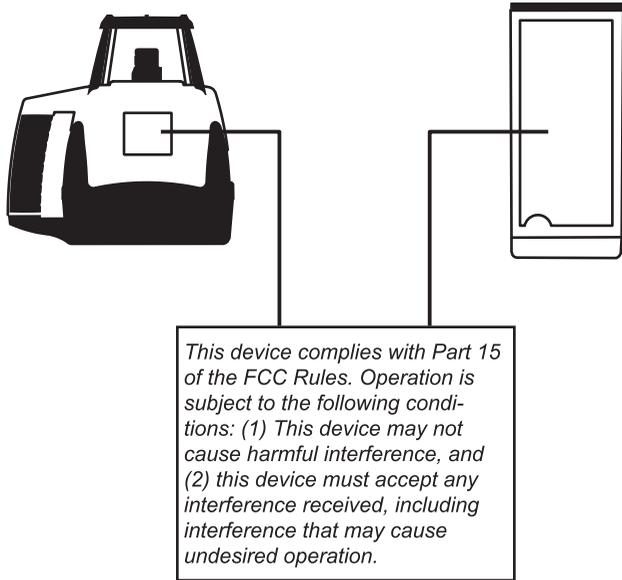
 **Warning**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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

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

**Labeling Rugby
410/420 DG and LR
Remote Control**



Conformity to National Regulations

- FCC Part 15 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the product Rugby 410/420 DG and LR Remote control is in compliance with the essential requirements and other relevant provisions of the applicable Europe Directive. The declaration of conformity may be consulted at <http://www.leica-geosystems.com/ce>.



Class 2 equipment according European Directive 1999/5/EC (R&TTE) for which following EU Member States apply restrictions on the placing on the market or on the putting into service or require authorization for use:

- France
 - Italy
 - Norway (if used in the geographical area within a radius of 20km from the centre of Ny-Ålesund)
- The conformity for countries with other national regulations not covered by the FCC part 15 or European directive 1999/5/EC has to be approved prior to use and operation.

Frequency range: 2405-2480 MHz
Transmission power: < 100 mW (e.i.r.p.)

Antenna

Rugby 410/420 DG: Whip Antenna
Remote: Chip Antenna

Specific Absorption Rate (SAR)

The product meets the limits for the maximum permissible exposure of the guidelines and standards, which are force in this respect. The product must be used with the recommended antenna. A separation distance of at least 20 centimeters should be kept between the antenna and the body of the user or nearby person within the intended application.

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Technical Data

Rugby 410/420 DG

Self-leveling accuracy*	±1/16" at 100' (1.5 mm at 30 meters)
Self-leveling range	± 5°
Grade Capability	-5% to +15% in either axis simultaneously up to +25% with up to ±1% in the cross axis
Head Speeds	5, 10, 15, 20 RPS
Operating Temperature	-4° to +122°F (-20° to +50°C)
Storage Temperature (without batteries)	-40° to +158°F (-40° to +70°C)
Storage Temperature (with batteries)	+32° to +68°F (0° to +20°C)
Battery Life**	65 hours (4-alkaline), 130 hours (8-alkaline) 50 hours (1-NiMH pack), 100 hours (2-NiMH packs)
Charging time	4.5 hours (approximate)
Dimensions (HWD)	10.4 x 10.2 x 7.92" (265 x 260 x 200 mm)
Weight without batteries	11.1 lbs. (5 kg)
Water resistance	Waterproof to IP57 Standard

Rugby 410 DG specific

Operating range	1300 ft (400 meters) radius
Laser Diode Type	780 nm (invisible)
Laser Classification	Class 1 IEC60825-1

Rugby 420 DG specific

Operating range	1800 ft (550 meters) radius
Laser Diode Type	635 nm (visible red laser)
Laser Classification	Class 2 IEC60825-1

Rugby LR Remote

Distance	750 ft (225 meters) typical radius
Battery type	Four AAA-alkaline batteries
Size	6.1 x 2.8 x 1.8" (155 x 70 x 45 mm)
Weight	14.4 oz. (410g)

* Accuracy defined at 77°F / 25°C.

** Battery life is dependent on many variables.

Total Quality Management: Our commitment to total customer satisfaction.



Leica Geosystems AG, Heerbrugg, Switzerland, has been certified as being equipped with a quality system which meets the International Standards of Quality Management and Quality Systems (ISO standard 9001) and Environmental Management Systems (ISO standard 14001).

Ask your local Leica Geosystems dealer for more information about our TQM program.

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Leica Geosystems AG

Heinrich-Wild-Strasse
CH-9435 Heerbrugg
Switzerland
Phone +41 71 727 31 31

www.leica-geosystems.com

- when it has to be **right**

Leica
Geosystems