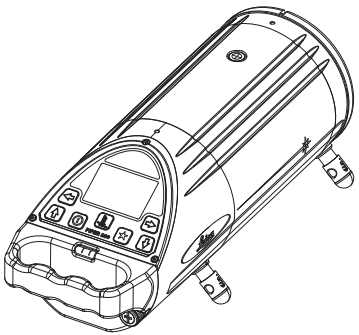
Leica Piper 100/200



User Manual
Version 5.0
English

- when it has to be **right**

Leica Geosystems

Introduction

Purchase

Congratulations on the purchase of a Leica Pipe Laser product.

This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to 1 Safety Directions for further information.

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

The content of this document is subject to change without prior notice. Ensure that the product is used in accordance with the latest version of this document.

Product identification

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

Always refer to this information when you need to contact your agency or Leica Geosystems authorised service centre.

Validity of this manual

This manual applies to the Piper 100/200 lasers. Differences between the models are marked and described.

Models

This manual covers the following Piper Laser models:

- Piper 100 - Red beam pipe laser
- Piper 100 (Class 2M) - Red beam pipe laser (Laser Class 2M)
- Piper 100G/3 - Green beam pipe laser
- Piper 100G/2 (Class 2M) - Green beam pipe laser (Laser Class 2M)
- Piper 200 - Red beam pipe laser with the Alignmaster™ feature
- Piper 200G - Green beam pipe laser with the Alignmaster™ feature

Trademarks

Available documentation

Name	Description/Format		
Leica Piper 100/200 User Manual	All instructions required in order to operate the product to a basic level are contained in the User Manual. Provides an overview of the product together with technical data and safety directions.	✓	✓

Refer to the following resources for all Piper 100/200 documentation:

- the Leica Piper CD
- https://myworld.leica-geosystems.com

myWorld

https://myworld.leica-geosystems.com offers a wide range of services, information and training material.

With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you.

Service	Description
myProducts	Add all products that you and your company own and explore your world of Leica Geosystems: View detailed information on your products and update your products with the latest software and keep up-to-date with the latest documentation.
myService	View the current service status and full service history of your products in Leica Geosystems service centres. Access detailed information on the services performed and download your latest calibration certificates and service reports.
mySupport	Create new support requests for your products that will be answered by your local Leica Geosystems Support Team. View the complete history of your support requests and view detailed information on each request in case you want to refer to previous support requests.

Service	Description
myLearning	Welcome to the home of Leica Geosystems online learning! There are numerous online courses – available to all customers with products that have valid CCPs (Customer Care Packages).
myTrustedServices	Add your subscriptions and manage users for Leica Geosystems Trusted Services, the secure software services, that assist you to optimise your workflow and increase your efficiency.
mySmartNet	HxGN SmartNet is the GNSS correction service built on the world's largest reference station network, enabling GNSS-capable devices to quickly determine precise positions in the range of one to two centimetre accuracy. The service is provided 24/7 by a highly-available infrastructure and professional support team with more than 10 years of experience reliably delivering the service.
myDownloads	Downloads of software, manuals, tools, training material and news for Leica Geosystems products.

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1 Safety Directions

1.1 General

Description

The following directions 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.

About warning messages

Warning messages are an essential part of the safety concept of the instrument. They appear wherever hazards or hazardous situations can occur.

Warning messages...

- make the user alert about direct and indirect hazards concerning the use of the product.
- contain general rules of behaviour.

For the users' safety, all safety instructions and safety messages shall be strictly observed and followed! Therefore, the manual must always be available to all persons performing any tasks described here.

DANGER, **WARNING**, **CAUTION** and **NOTICE** are standardised signal words for identifying levels of hazards and risks related to personal injury and property damage. For your safety, it is important to read and fully understand the following table with the different signal words and their definitions! Supplementary

safety information symbols may be placed within a warning message as well as supplementary text.

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.
NOTICE	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in 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.

1.2 Definition of Use

Intended use

- The instrument projects a collimated beam of laser light for the purposes of alignment of gravity flow pipelines
- 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

Reasonably foreseeable misuse

- Use of the product without instruction
- Use outside of the intended use and limits
- Disabling safety systems
- Removal of hazard notices
- Opening the product using tools, for example screwdriver, unless this is permitted for certain functions
- Modification or conversion of the product
- Use after misappropriation
- Use of products with recognisable damage or defects
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems
- Inadequate safeguards at the working site
- Deliberate dazzling of third parties
- Deliberate laser exposure to third parties

1.3 Limits of Use

Environment

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

⚠WARNING

Working in hazardous areas, or close to electrical installations or similar situations

Life Risk.

Precautions:

- ▸ Local safety authorities and safety experts must be contacted by the person responsible for the product before working in such conditions.

1.4 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 safe condition.

Person responsible for the product

The person responsible for the product has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual
- To ensure that it is used in accordance with the instructions
- To be familiar with local regulations relating to safety and accident prevention
- To inform Leica Geosystems immediately if the product and the application become unsafe
- To ensure that the national laws, regulations and conditions for the operation of the product are respected

1.5 Lifetime Manufacturer's Warranty

1.5.1 Piper 100/200

Description

Lifetime Manufacturer's Warranty

Warranty coverage for the entire usage time of the product under PROTECT according to Leica Geosystems International Limited Warranty and PROTECT General Terms & Conditions set out under www.leica-geosystems.com/protect. Free charge repair or replacement of all products or any parts under PROTECT that suffer defects as a result of faults in materials or manufacturing.

2 Years No Costs

Additional services should the product under PROTECT become defective and require servicing under normal conditions of use, as described in the user manual, at no additional charge.

1.6 Hazards of Use

⚠WARNING

Distraction or loss of attention

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.

⚠ WARNING

Inadequate securing of the working site

This can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

- Always ensure that the working site is adequately secured.
- Adhere to the regulations governing safety, accident prevention and road traffic.

⚠ CAUTION

Not properly secured accessories

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 can sustain injury.

Precautions:

- When setting up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position.
- Avoid subjecting the product to mechanical stress.

NOTICE

Instrument out of level

When the instrument is out of level this can result in erroneous measurements.

Precautions:

- Always level the instrument before carrying out a measurement, particularly when the instrument or the tripod has been moved or received some other kind of impact.
- Carry out a circular level test. If necessary, adjust the circular level.

⚠ WARNING

Improperly repaired equipment

Risk of injuries to users and equipment destruction due to lack of repair knowledge.

Precautions:

- Only authorised Leica Geosystems Service Centres are entitled to repair these products.

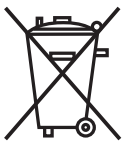
⚠WARNING

Improper disposal

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

- The product does include parts of Beryllium inside. Any modification of some internal parts can release Beryllium dust or fragments, creating a health hazard.

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 unauthorised personnel.

Product-specific treatment and waste management information can be received from your Leica Geosystems distributor.

NOTICE

Dropping, misusing, modifying, storing the product for long periods or transporting the product

Watch out for erroneous measurement results.

Precautions:

- Periodically carry out test measurements and perform the field adjustments indicated in the User Manual, particularly after the product has been subjected to abnormal use as well as before and after important measurements.

⚠ **CAUTION**

No original or authorised accessories

The correct functioning of the system is not guaranteed.

Precautions:

- Use only original and authorised accessories for the Piper 100/200 system.

⚠WARNING

Inappropriate mechanical influences to batteries

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 it, discharge the batteries by 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

Using charger inside a driving vehilce

This can lead to dangerous situations which may result in damage or personal injury.

Precautions:

- If it can be avoided, do not use the charger inside a driving vehicle.
- If it is necessary to use the charger inside a driving vehicle: Ensure that the charger is properly secured against sudden movements, such as acceleration, braking, or steering movements.

⚠WARNING

Exposure of batteries to high mechanical stress, high ambient temperatures or immersion into fluids

This can cause leakage, fire or explosion of the batteries.

Precautions:

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

⚠WARNING

Short circuit of battery terminals

If battery terminals are short circuited e.g. by coming in contact with jewellery, keys, metallised paper or other metals, the battery can overheat and cause injury or fire, for example by storing or transporting in pockets.

Precautions:

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

⚠WARNING

Short circuit of battery terminals

Risk of fire, electric shock and damage.

Precautions:

- Do not open the battery housing.
- Keep away any metallic or wet objects from the battery terminals.

⚠WARNING

Battery pack of the signal transmitter may get hot after prolonged use.

Risk of burning injuries.

Precautions:

- Avoid touching the hot battery pack.
- Allow the battery pack to cool down before removing it.

⚠WARNING

Overheating hazard

If the ventilation slots are covered while the product is being used, the product can overheat and cause injury or fire.

Precautions:

- Make sure that the ventilation slots are not covered by any objects while the product is being used.

For the AC/DC power supply and the battery charger:

⚠WARNING

Electric shock due to use under wet and severe conditions

If unit becomes wet it may cause you to receive an electric shock.

Precautions:

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

- Protect the product against humidity.

For the AC/DC power supply and the battery charger:

⚠ WARNING

Unauthorised opening of 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 authorised service centres are entitled to repair these products.

⚠ WARNING

Improperly repaired equipment

Risk of injuries to flight crew and passengers and equipment destruction due to lack of repair knowledge.

Precautions:

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

⚠ CAUTION

Opening of the Piper 100/200 by non-trained personnel

Opening the Piper 100/200 without appropriate training may result in injuries or damage.

Precautions:

- Opening the Piper 100/200 for service purposes is only allowed if a Piper 100/200 Service and Maintenance training course given by Leica Geosystems AG has been completed.

⚠ CAUTION

Before any cleaning procedure, ensure that the instrument is switched off and the battery has been removed.

1.7 Laser Classification

1.7.1 General

General

The following chapters provide instructions and training information about laser safety according to international standard IEC 60825-1 (2014-05) and technical report IEC TR 60825-14 (2004-02). The information enables the person responsible for the product and the person who actually uses the equipment, to anticipate and avoid operational hazards.

☞ According to IEC TR 60825-14 (2004-02), products 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.

☞ National laws and local regulations could impose more stringent instructions for the safe use of lasers than IEC 60825-1 (2014-05) and IEC TR 60825-14 (2004-02).

1.7.2 Piper 100 (Class 3R)

General

The pipe laser built into the product produces a visible laser beam which emerges from the front window.

The laser product described in this section is classified as laser class 3R in accordance with:

- IEC 60825-1 (2014-05): “Safety of laser products”

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
b) inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value
Wavelength	635 nm
Maximum average radiant power	< 4.8 mW cw
Beam divergence	0.03 mrad

⚠ CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- Prevent direct eye exposure to the beam.
- Do not direct the beam at other people.

⚠CAUTION

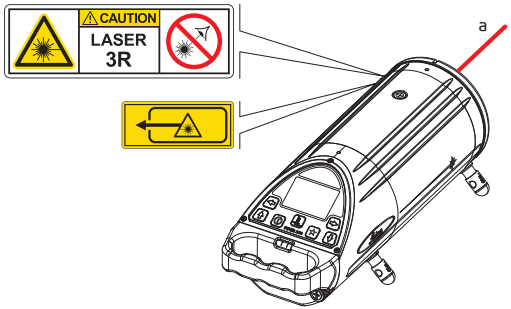
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



a Laser beam

1.7.3 Piper 100 (Class 2M)

General

The pipe laser built into the product produces a visible laser beam which emerges from the front window.

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

- IEC 60825-1 (2014-05): “Safety of laser products”

These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions.

Description	Value
Wavelength	635 nm
Maximum average radiant power	< 1.2 mW cw
Beam divergence	0.06 mrad

⚠ CAUTION

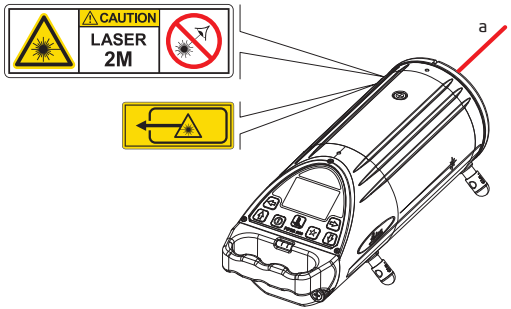
Class 2 laser product

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

Precautions:

- Avoid staring into the beam or viewing it through optical instruments.
- Avoid pointing the beam at other people or at animals.

Labelling



a Laser beam

1.7.4 Piper 100G/3 (Class 3R)

General

The pipe laser built into the product produces a visible laser beam which emerges from the front window.

The laser product described in this section is classified as laser class 3R in accordance with:

- IEC 60825-1 (2014-05): “Safety of laser products”

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
b) inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value
Wavelength	520 nm
Maximum average radiant power	< 5.0 mW cw
Beam divergence	0.02 mrad

⚠ CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- Prevent direct eye exposure to the beam.
- Do not direct the beam at other people.

⚠ CAUTION

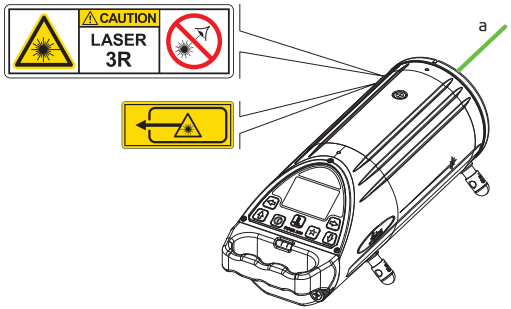
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



a Laser beam

1.7.5 Piper 100G/2 (Class 2M)

General

The pipe laser built into the product produces a visible laser beam which emerges from the front window.

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

- IEC 60825-1 (2014-05): “Safety of laser products”

These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions.

Description	Value
Wavelength	520 nm
Maximum average radiant power	< 1.2 mW cw
Beam Divergence	0.02 mrad

⚠ CAUTION

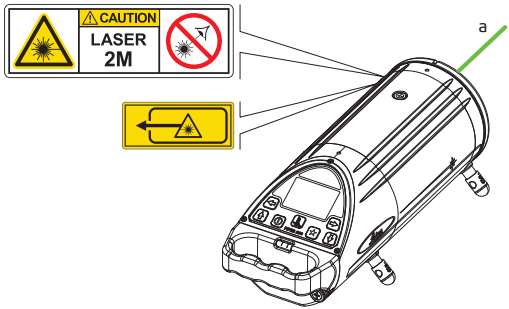
Class 2 laser product

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

Precautions:

- Avoid staring into the beam or viewing it through optical instruments.
- Avoid pointing the beam at other people or at animals.

Labelling



a Laser beam

1.7.6 Piper 200 (Class 3R)

General

The pipe laser built into the product produces a visible laser beam which emerges from the front window.

The laser product described in this section is classified as laser class 3R in accordance with:

- IEC 60825-1 (2014-05): “Safety of laser products”

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
b) inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value
Wavelength	635 nm
Maximum average radiant power	< 4.8 mW cw
Beam divergence	0.03 mrad

⚠ CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- Prevent direct eye exposure to the beam.
- Do not direct the beam at other people.

⚠ CAUTION

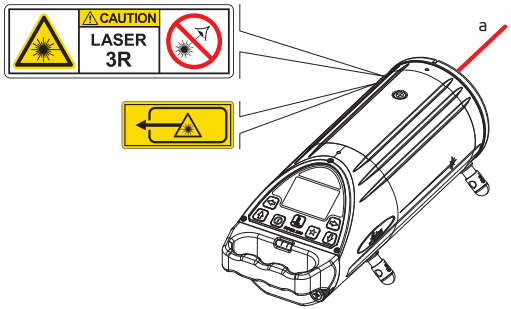
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



a Laser beam

1.7.7 Piper 200G (Class 3R)

General

The pipe laser built into the product produces a visible laser beam which emerges from the front window.

The laser product described in this section is classified as laser class 3R in accordance with:

- IEC 60825-1 (2014-05): “Safety of laser products”

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
b) inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value
Wavelength	520 nm
Maximum average radiant power	< 5.0 mW cw
Beam divergence	0.02 mrad

⚠ CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- Prevent direct eye exposure to the beam.
- Do not direct the beam at other people.

⚠ CAUTION

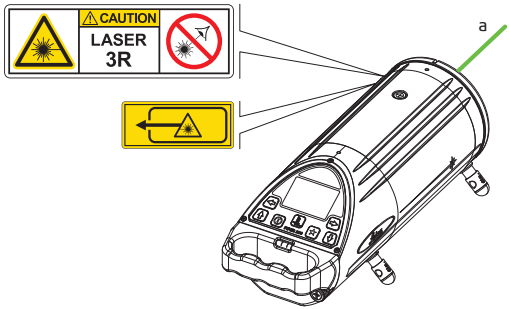
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



a Laser beam

1.8 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

Electromagnetic radiation can cause disturbances in other equipment.

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.

⚠ CAUTION

Use of the product with accessories from other manufacturers. For example field computers, personal computers or other electronic equipment, non-standard cables or external batteries

This may cause disturbances in other equipment.

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, two-way radios or other electronic equipment, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

⚠ CAUTION

Intense electromagnetic radiation. For example, near radio transmitters, transponders, two-way radios or diesel generators

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that function of the product may be disturbed in such an electromagnetic environment.

Precautions:

- ▸ Check the plausibility of results obtained under these conditions.

1.9 FCC Statement, Applicable in U.S.

☞ The greyed paragraph below is only applicable for products without radio.

⚠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 radio 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.

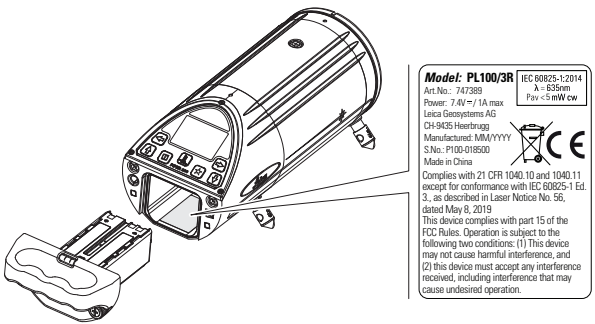
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- 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.

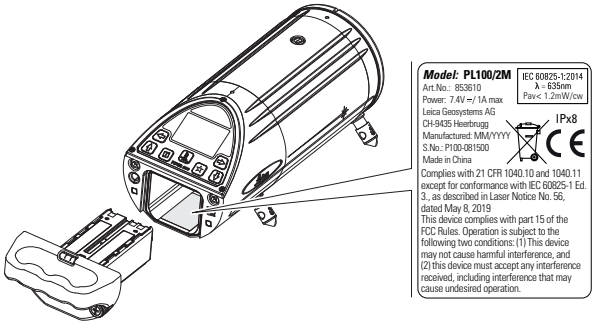
⚠CAUTION

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

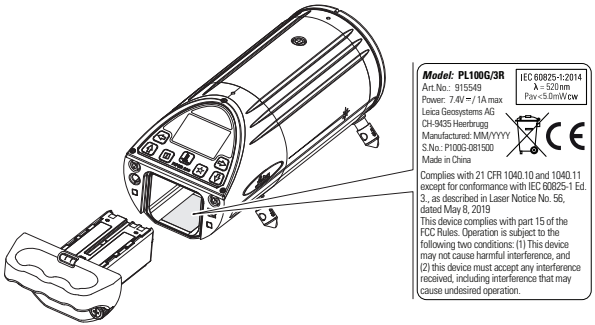
Labelling Piper 100 (Class 3R)



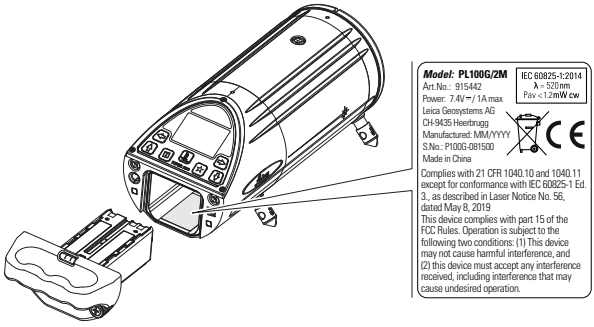
Labelling Piper 100 (Class 2M)



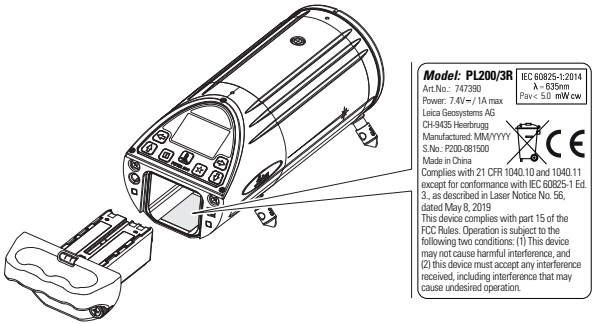
Labelling Piper 100G/3 (Class 3R)



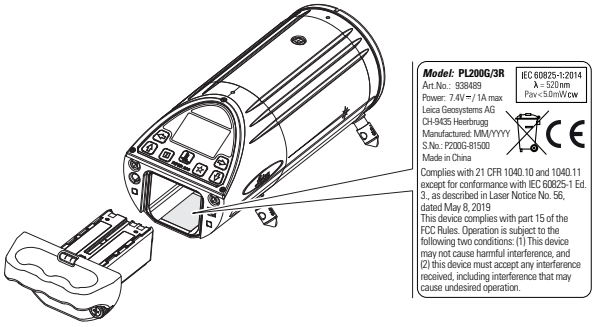
Labelling Piper 100G/2 (Class 2M)



Labelling Piper 200 (Class 3R)



Labelling Piper 200G (Class 3R)



2 Care and Transport

2.1 Transport

Transport in the field

When transporting the equipment in the field, always make sure that you

- either carry the product in its original container,
- or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.

Transport in a road vehicle

Never carry the product loose in a road vehicle, as it can be affected by shock and vibration. Always carry the product in its container and secure it.

For products for which no container is available use the original packaging or its equivalent.

Shipping

When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging, container and cardboard box, or its equivalent, to protect against shock and vibration.

Shipping, transport of batteries

When transporting or shipping batteries, the person responsible for 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.

Field adjustment

Exposing the product to high mechanical forces, for example through frequent transport or rough handling, or storing the product for a long time may cause deviations and a decrease in the measurement accuracy. Periodically carry out test measurements and perform the field adjustments indicated in the User Manual before using the product.

2.2 Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to 3 Technical Data for information about temperature limits.

Li-Ion batteries

- Remove batteries from the product and the charger before storing.
- After storage recharge batteries before using.
- Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use.
- A storage temperature range of 0 °C to +30 °C / +32 °F to +86 °F in a dry environment is recommended to minimize self-discharging of the battery
- At the recommended storage temperature range, batteries containing a 40% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged

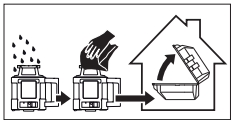
2.3 Cleaning and Drying

Product and accessories

- Blow dust off lenses and prisms.
- 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 40 °C /104 °F and clean them. Remove the battery cover and dry the battery compartment. 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.

3 Technical Data

3.1 General Technical Data of the Product

Operating range

Operating range		Value
Piper 100/200		200 m/650 ft
Remote Control	Front:	up to 150 m/500 ft
	Back:	up to 10 m/35 ft

Self-levelling accuracy of Piper 100/200

Type	Value
Self-levelling accuracy*	±1.6 mm at 30 m / ±1/16" at 100 ft
Line Movement	6 m at 30 m/ 20 ft at 100 ft

* Self-levelling accuracy is defined at 25 °C/77 °F.

Ranges of Piper 100/200

Type	Value
Grade range	-10% to +25%

Type	Value
Self-levelling range	-15% to +30%

Dimensions

Piper 100/200

Dimensions (diameter x length)	96 mm x 267mm/ 3.9″ x 10.5″

Weight

Piper 100/200

Weight	2.0kg/4.4lbs

Internal battery for Piper 100/200

Type	Operating times at 20°C*
Lithium-Ion (Li-Ion Pack)	up to 40 h

* Operating times are dependent upon environmental conditions.

Charging the Li-Ion battery pack takes a maximum of four hours.

Environmental specifications for Piper 100/200

Temperature

Type	Operating temperature [°C]/[°F]	Storage temperature [°C]/[°F]
Instrument	-20 to +50/-4 to +122	-40 to +70/-40 to +158
Battery	-20 to +55/-4 to +131	-20 to +30/-4 to +68
Charger and AC/DC power supply	±0 to +40/+32 to +104	-20 to +30/-4 to +68

Type	Protection against water, dust and sand
Instrument	IPx8 (IEC 60529) Dust tight Protected against continuous immersion in water
Battery	IP54 (IEC 60592) Dust protected Protection against splashing water from any direction
Charger and AC/DC power supply	IPX0 (IEC 60592) Only operate in dry environments, for example in buildings and vehicles.

Type	Humidity
Instrument	max 95% non-condensing
Battery and charger	max 95% non-condensing
AC/DC power supply	max 95% non-condensing

Type	Limits of use
Instrument and battery	Indoor and outdoor use Working altitude: unlimited
Charger and AC/DC power supply	Indoor use only Working altitude: ≤2000 m

Lithium-Ion charger

Type	Value
Type	Li-Ion battery charger
Input voltage	12 V / 24 V
Output voltage	18 V / 2 A max.

Lithium-Ion battery pack

Type	Value
Type	Li-Ion battery pack
Input voltage	7.4 V DC
Input current	3.8 Ah
Charge time	4 h (max.) at 20 °C

3.2 Conformity to National Regulations

Conformity to national regulations

For products without radio transmitter or receiver:

- FCC Part 15 (applicable in US)

CE

- Hereby, Leica Geosystems AG declares that the product/s is/are in compliance with the essential requirements and other relevant provisions of the applicable European Directives.
  The full text of the EU declaration of conformity is available at the following Internet address:
  http://www.leica-geosystems.com/ce.

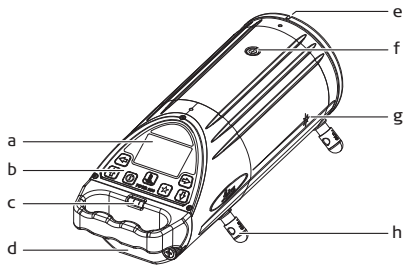
4 Description of the System

4.1 Features

Precision	Engineered and designed to maintain its accuracy over time and temperature, the Piper projects a beam up to 200 m (650 ft).
Versatility	Powered by a rechargeable Lithium-Ion battery, the Piper is the smallest, professional pipe laser ever made. When sitting level the Piper can self-level over its entire grade range, or can be placed inside the pipe for second day setups. In the manhole, in the pipe, or over the top, the Piper can work for you.
Intelligence	The cross-axis compensation function maintains the grade accuracy regardless of the roll of the laser up to three degrees. The Alignmaster™ feature (Piper 200) seeks and locates the target automatically for easy second day setups.
Precision	Waterproof, shock and temperature tested, the Piper is built “construction tough” with a metal housing and shock absorbing bumper around the front window.

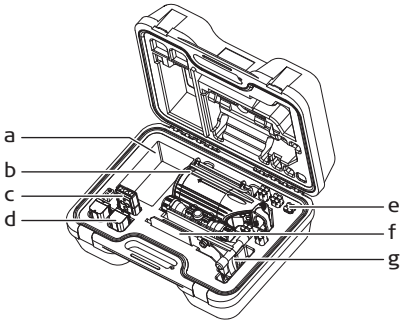
4.2 Components

Piper components



a	LCD display
b	Switch buttons
c	Handle and level vial
d	Battery compartment
e	Stringline notch
f	Lighted pivot point (top)
g	Pivot point (side)
h	Self-centring feet

Case components



a Accessory compartment
b Piper*
c Remote control
d Spare Batteries
e Self-centring feet
f User manual
g Target assembly

* Piper shown with optional scope assembly

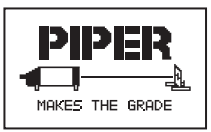
5 Basic Operation

Starting up

1. Press the POWER button to turn the Piper on.

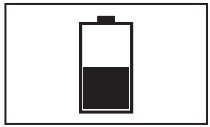
2. When the Piper is first turned on the Leica Start-up Screen is displayed with the serial number of the laser.

3. Next, the Piper Screen will be displayed.

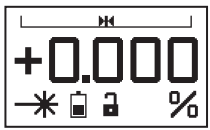


Or the Customer Name Screen if it has been programmed by your dealer.

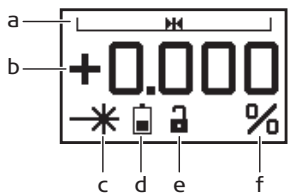
4. Finally, the Battery Status Screen will be displayed as a large battery.



5. When the start-up screens are completed, the Main Operating Screen will be displayed and work can begin.

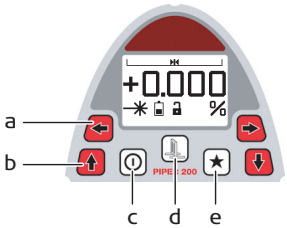


LCD Display



a	Line movement indication
b	Plus / minus grade value
c	Beam emission indicator
d	Battery status indicator
e	Line and grade lock indicator
f	Percent (per mill)

Switch buttons

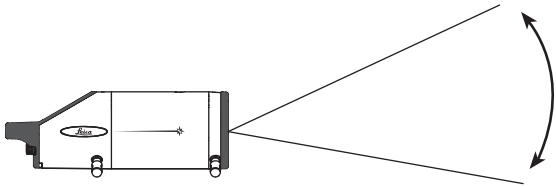


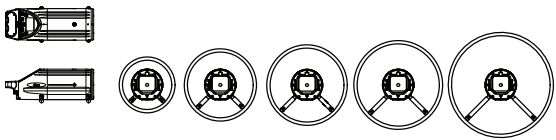
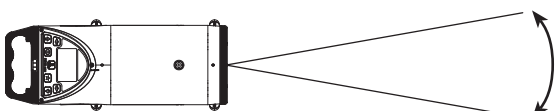
a Left and Right Line buttons
b Up and Down Grade buttons
c Power button
d Alignmaster button, Piper 200 only
e Star button, used in combination with the Grade buttons for large grade changes

Basic requirements

Refer to the information that follows when setting up and operating the Piper.

To set up for a specific application, refer to **Standard Setup Procedures**. You must always define the following three variables in any application.

Variable	Description
Grade	The amount of rise and fall over the distance of the pipe to be laid. Set the grade by entering the percentage of grade to the Piper display. 

Variable	Description
Elevation	The distance from the invert of the pipe to the laser beam. Set the distance by attaching the self-centring feet for the pipe size to be laid (the 150 mm, six inch feet are standard, all other sizes are optional) or by adjusting the height of the Piper on the Trivet Mount Assembly. 
Line	The position of the laser beam relative to the centreline of the pipe to be laid. Set the line by aligning the laser beam with the next manhole. 

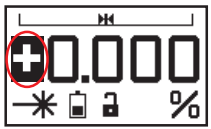
Entering Grade

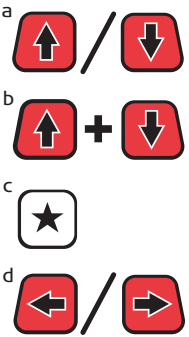
To change grade:

1. Press the UP or DOWN arrow button (a). The speed at which the grade changes will increase as the button is held.

To enter grade:

2. Press and release the STAR button (c). The plus/minus sign will appear as a reverse image.
3. Press the LEFT or RIGHT arrow button (d) to move the cursor (reverse image) to the desired digit.
4. Press the UP or DOWN arrow button (a) to change the plus/minus sign or the value of the individual digit.
5. Press STAR (c) again to exit when the desired grade is displayed or wait ten seconds and the screen will automatically return to the main operating screen.





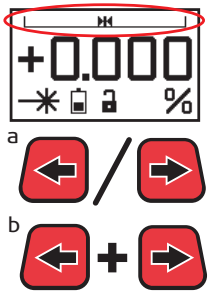
☞ To reset the grade to zero, press both, the UP and DOWN arrow buttons (b), at the same time.

Changing Line

To change the line position:

1. Press the LEFT or RIGHT arrow button (a) to move the beam to the required position. The speed at which the line moves will increase as the button is held.

☞ To reset the line to the centre position, press both, the LEFT and RIGHT arrow buttons (b), at the same time.



The current line position is indicated at the top of the display.

Icon	Description
⏭	Line centred

Icon	Description
	Line position left or right of centre
	Left line limit
	Right line limit

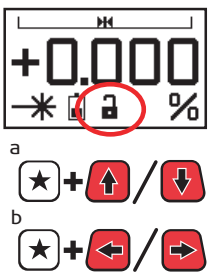
Line and Grade Lock

To lock the grade position:

1. Press and hold the STAR button.
2. Then press the UP or DOWN arrow button (a) to lock the grade at the current value.

To lock the line position:

3. Press and hold the STAR button.
4. Then press the LEFT or RIGHT arrow button (b) to lock the line at the current position.



☞ To unlock grade or line repeat the same procedure.

The current status is indicated at the bottom, centre of the display.

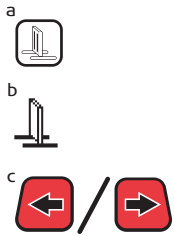
Icon	Description
	Grade and Line unlocked
	Grade locked
	Line locked
	Grade and Line locked

Alignmaster (Piper 200 only)

Alignmaster is a function of the Piper 200 models only.

When the ALIGNMASTER button (a) is pressed, the Piper will begin a search routine to find located and stop on the target. This function is normally used for second day setups to quickly find the beam in the previous day's work.

Procedure for using Alignmaster:



1.	Position the target assembly in the end of the last piece of pipe with the two reflective strips on the inside of the pipe, facing the laser.
2.	Roughly align the laser beam in the pipe to the target assembly.
3.	Press the ALIGNMASTER button (a). When pressed the laser will scan left and right until the target is found. While searching, the main operating screen is replaced with a blinking target (b) indicating that Alignmaster is working.
4.	If the search routine is successful, the target will remain on the screen for an additonal five seconds (not blinking).
5.	The beam can now be fine-positioned to the centre of the target using the LEFT or RIGHT arrow button (c) on the laser or the remote control.
☞	The Alignmaster routine can be interrupted at any time by pressing the ALIGNMASTER button a second time. The line position will return to its original position.

Troubleshooting:

Icon	Description
	If the Alignmaster function cannot find the target, a question mark will appear next to the target (d) to indicate “target not found”. This screen will appear for two minutes or until another button is pressed. The line position will then return to its original position.
	If the ambient light conditions are too bright for the Alignmaster function to operate properly, the target will be shown with a question mark and a sun icon.

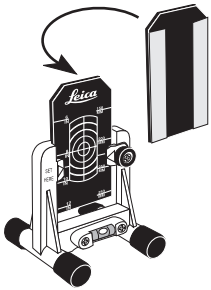
☞ When the ALIGNMASTER button is pressed the beam will appear to dim. This is normal. The beam is actually pulsing at a very rapid rate to better control the recognition of the target.

☞ Alignmaster is designed to work at distances greater than 10 m (30 ft). Demonstrations or usage at shorter distances may not find the target.

Setting up the Target Assembly

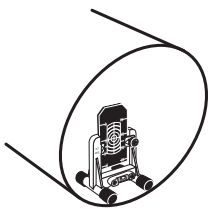
The red Target Assembly (725858) and the blue Target Assembly (915443) include the small target insert.

1. Slide the required Target Insert into the Target Assembly.



2. Loosen the locking knob and insert the target with the printed side of the target on the same side as the level vial.

3. Place the target into the end of the pipe. The reflective strips should be facing the laser, towards the inside of the pipe.



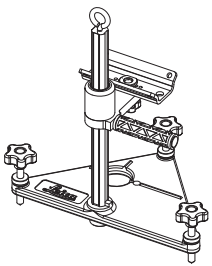
4. Adjust the Target in the pipe until the bubble is centred in the level vial.

5. Observe the Target. Adjust the pipe so that the laser beam is centred on the cross-hairs.

Setting up the Trivet Assembly and Mounting Bracket

The Leica Geosystems AG Trivet Assembly (746158) includes the mounting bracket that is attached to the bottom of the laser.

1. Remove the four feet from the Piper, then attach the mounting plate by re-installing the feet.



2. Attach the Piper with the mounting bracket to the Trivet Assembly and secure by tightening the 5/8 "-11 knob and stud assembly to the bracket.

3. **Set the line.** Place the Trivet Assembly in a way that the Piper is aligned with the pipe to be laid. Turn the knobs on the Trivet plate until the bubble is centred in the Piper's cross-axis level vial. Tighten the brass lock nuts to lock the feet in place.

4. **Set the grade.** Enter the required grade to the Piper (see **Entering Grade** for further information). The Piper can self-level over its entire grade range. It is not necessary to tip the laser to achieve grade.

5. **Set the elevation.** Loosen the handle on the mounting bracket. Slide the bracket and laser up or down until the desired elevation is achieved. The slide bracket is made of a special material to ensure smooth movement. Tighten the handle to lock the elevation in place.

Typical Second Day Setup

The following is a brief description of a typical second day setup.

1. Press the POWER button to turn the unit on.
2. Set the Grade. The Piper remembers the last-used grade from the previous day.
   Check the display to ensure that the grade has not been changed.
3. Set the Elevation. Place the Piper where it was the previous day.
   Rotate the Piper until the bubble in the cross-axis level vial is centred.
4. When placing the Piper in the pipe, ensure that the proper feet are attached and that the cross-axis bubble is centred.
5. Set the line. Follow the line of the pipe laid the previous day.
6. Place the target assembly in the last piece of the pipe laid and adjust it in a way that the bubble is centred in the level vial.
7. Adjust the line of the laser beam using either the LEFT and RIGHT buttons on the Piper or on the remote control.
   Press the button until the laser beam is centred on the target

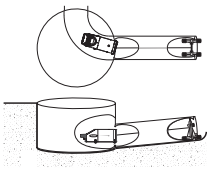
8. For Piper 200 use the Alignmaster feature.
Press the ALIGNMASTER button on the Piper or on the remote control to scan and locate the target.
Use the LEFT and RIGHT buttons to fine-adjust the beam to the centre cross-hairs of the target.

6 Standard Setup Procedures

Pre-Poured Inverts

The pre-poured invert must be set at the correct elevation and on the correct line position.

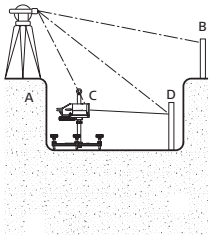
1. **Set the grade.** Enter the required grade for the pipe to be laid in the display of the Piper.
2. **Set the elevation.** Attach the required size feet to the Piper. The Piper comes standard with 150 mm (6 inches) feet, and offers optional feet for 200, 225, 250 and 300 mm (8, 9, 10, and 12 inches) pipes.
3. **Set the line.** Place the Piper in the invert and adjust the beam so it is in-line with the next manhole.



Open Trench (Transit)

In the open trench a transit is used to align the laser beam to the next manhole.

1. **Set the grade.** Enter the required grade for the pipe to be laid in the display of the Piper.



2. **Set the Piper on the centreline of the pipe to be laid.** Locate the line for the laser beam.
   a) Locate Point A. Place the transit in a way that it is behind the Piper and in line with the centreline of the pipe to be laid.
   b) Locate Point B. Look through the transit and lock it on-line with the next man-hole point.
   c) Locate Point C. Tilt the transit down to see the Piper. Move the Piper until the pivot point on the top of the Piper is in line with the centreline of the pipe to be laid.

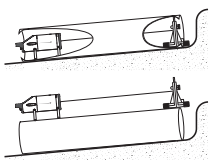
3. **Set the elevation.** Move the Piper up or down on the (optional) trivet until the required height is set. Choose the most convenient method for determining the cut-to-invert distance.

4. **Set the line.** Locate Point D. Using the transit, place a new stake approximately 5 m (15 ft) in front of the Piper. Look through the transit and move the beam using the LEFT and RIGHT buttons on the remote control until the beam hits the stake and intersects with the transit's cross-hairs.

In or On Top of the Pipe

☞ Place the Piper on top of the pipe when the beam cannot pass through the pipe, for example, when it is filled with water.

1. **Set the grade.** Enter the required grade for the pipe to be laid in the display of the Piper.



2. **Set the elevation.** If the Piper is going to be placed inside the pipe, attach the required size feet to the Piper. The Piper comes standard with 150 mm (6 inches) feet, and offers optional feet for 200, 225, 250 and 300 mm (8, 9, 10, and 12 inches) pipes.

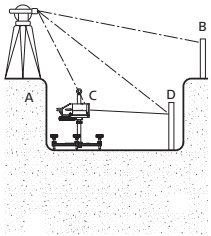
3. **Set the line.** Place the Piper in or on the pipe and adjust the beam so that it is in line with the next manhole.

Open Trench (Stringline)

☞ This procedure is the best for shorter runs of pipe, typically those less that 90 m (300 ft).

1. **Set the grade.** Enter the required grade for the pipe to be laid in the display of the Piper.

2. **Set the elevation.** Move the Piper up or down on the (optional) trivet until the required height is set. Choose the most convenient method for determining the cut-to-invert distance.

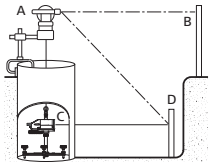


3. **Set the line.** Locate the line for the laser beam.
   a) Locate Point A. Place a range rod at the centre of the next manhole point. The rod must be plumb.
   b) Locate Point B. Attach a stringline to the slot in the top of the Piper's front bumper. Move the Piper until it is in line with the centreline of the pipe to be laid.
   c) Locate Point C. Stand behind the Piper, close one eye, and hold up the stringline. Align the stringline with the range rod. Look down and align a new stake approximately 5 m (15 ft) in front of the Piper. Use the LEFT and RIGHT arrow buttons on the remote control to move the beam until it hits the stake and intersects with the stringline.

Manhole

1. **Set the grade.** Enter the required grade for the pipe to be laid in the display of the Piper.

2. **Set the elevation.** Place the Piper in the manhole. Move the Piper up or down on the (optional) trivet until the required height is set. Choose the most convenient method for determining the cut-to-invert distance.



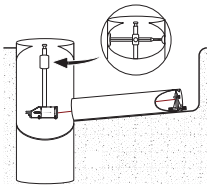
3. **Set the line.** Locate the line for the laser beam.
   a) Locate Point A. Place a transit over the centre of the manhole.
   b) Locate Point B. Look through the transit and lock it on-line with the next manhole point.
   c) Locate Point C. Hang a plumb bob from the transit. Move the Piper until the tip of the plumb bob is directly over the pivot point on the top of the Piper.
   d) Locate Point D. Tilt the transit down and use it to align a new stake approximately 5 m (15 ft) in front of the Piper. Look through the transit and move the beam using the LEFT and RIGHT buttons on the remote control until the beam hits the stake and intersects with the transit's cross-hairs.

Drop Manhole

The trivet pole or the complete trivet assembly is designed to attach directly to a drop manhole T-bar assembly using a 5/8 "-11 mount.

1. **Set the grade.** Enter the required grade for the pipe to be laid in the display of the Piper.

2. **Set the elevation.** Lower the pre-assembled Drop Manhole Assembly and Piper into the manhole until the T-bar is approximately 150 to 300 mm (6 to 12 inches) above or below the pipe. Ensure that the T-bar is level and perpendicular to the pipe. Tighten the wing nut on the T-bar to secure it in the manhole. Move the Piper up or down on the adjustable pole until the beam is approximately at the required elevation.

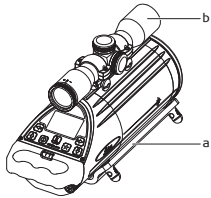


3. **Set the line.** Adjust the beam so that it is in line with the next manhole.

Over the Top

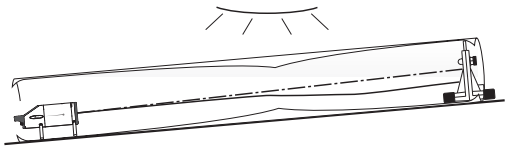
The Over-the-Top Mount Assembly consists of a Scope and a mounting bracket for attaching the Piper to a tripod.

1.	Remove the four feet from the Piper, then attach the mounting plate (a) by re-installing the feet.
2.	Attach the Scope and mount (b) to the top of the Piper using the two screws and hex driver supplied with the scope.
3.	Attach the Piper to the tripod and tighten it securely
4.	Set the cross-hairs of the scope on a target and then adjust the beam to the target using the LEFT and RIGHT arrow buttons on the Piper or on the remote control.



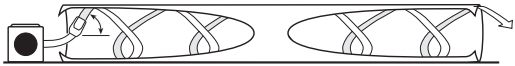
7 Refraction

Impacts due to refraction



- Refraction happens when layers of air with varying degrees of temperature and humidity deflect light as it passes through it.
- Layers of air in a sewer pipe can refract a laser beam, causing it to bend downward or produce a “dancing” effect as the beam passes through to the target.
- Refraction is especially noticeable during hot or humid weather, but may also occur in extrremely cold conditions when warm air from a newly opened trench mixes with the colder air.
- In these conditions, Leica Geosystems strongly recommends the use of a blower assembly to reduce or eliminnate the effects of refraction. A blower mixes the different layers of air temperature and density inside a sewer pipe, thereby creating a uniform medium for the laser beam to pass through.

Counteractive measures



1. Connect the blower to a power source, normally a 12 V battery.
2. Position the blower. Make sure that the air intake for the blower is not blocked. If possible, position the blower in a way that the temperature of the air it draws in is approximately the same as the air inside the pipe.
3. Determine whether to attach the nozzle to the end of the blower. If the pipe is less than or equal to 250 mm (10 inches), use the nozzle. If the pipe is greater than 250 mm (10 inches), you do not need the nozzle.
4. Use clamps to attach the blower hose at the beginning of the pipe where the laser is located. Position the end of the hose at a 60° angle to force the air to swirl as it travels through the pipe.
5. Apply power to the blower and let it operate.

☞ Allow the blower to operate for at least 10 minutes before aligning the next pipe.

8 Accessories

8.1 Target Assembly

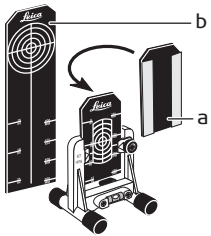
General Description

The Target Assembly provides a visual reference for locating the laser beam and aligning the pipe.

The target inserts have a special holographic material applied to them that enhances the beam visibility even in bright light conditions.

The reverse side of each of the targets has two retro-reflective strips. These strips are used with the Alignmaster feature (Piper 200 only). When the ALIGNMASTER button is pressed, the beam scans from side to side and until it detects the reflective strips then stops between the them. See also: **Alignmaster (Piper200 only)**

Component Description



The two target inserts have markings on them for centring the cross-hairs in the centre of various sizes of pipe. The small target insert is standard with the target assembly. The large target insert is sold as an optional accessory.

a) Small Target Insert – 150, 200, 225, 250 and 300 mm (6, 8, 9, 10, and 12 inches)
b) Large Target Insert – 400, 450, 500 and 550 mm (15, 18 and 21 inches)

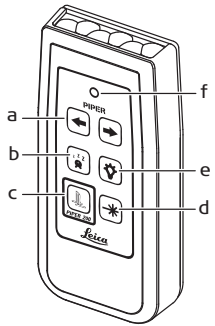
8.2 Remote Control

General Description

The Remote Control Assembly communicates with the Piper via infrared signals, and is used to adjust line and other functions.

The remote control unit is powered by a 9 V type battery. The battery can only be accessed by removing the four screws and the back cover of the remote control.

Component Description



a Left and Right Line Buttons – Are used for initial alignment and to centre the beam in the pipe for second day setups.

b Alignmaster Button, Piper 200 only – Starts the scanning process to locate and lock on the target for second day setups.

c Sleep or Standby Button – Causes the Piper to switch to stand-by mode with only the display showing the sleeping Piper icon. The Piper will stay in stand-by mode for up to 72 hours, after which it will shut off completely.

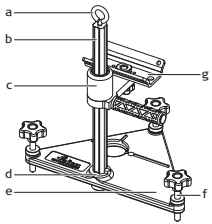
d Strobe Button – Causes the Piper beam to strobe or flash very rapidly and thereby creating a brighter beam for viewing of the target.

e Pivot Light Button – Cause the pivot point light to turn on for better visibility when setting up the Piper in the manhole.

f Sending LED – Flashes to indicate that the remote control is sending a signal to the Piper.

8.3 Trivet Assembly

Component Description



a Eye Bolt – For lowering the trivet into a manhole.

b Trivet Post – The scales on the pole can be read from the top of the post down to the centre of the beam on the left side, and from the bottom of the knob (below post) up to the centre of the beam.

c Slider Support Assembly – Includes the locking handle for height adjustment. The top edge equals the centre of the beam.

d Knob and Stud – Attaches the post to the base.

e Trivet Base – Large and heavy for better stability.

f Leveling Foot Assembly (3) – For leveling the Piper and locking in place.

g Mounting Bracket – Attaches to the Piper with the Piper feet.

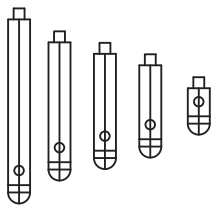
8.4 Self-Centring Feet

General Description

Combined with the Target Assembly, the Self-Centring Feet allow the operator to align the beam down the centreline of the pipe.

Component Description

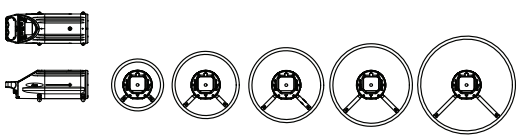
The Piper comes standard with 150 mm (6 inches) feet.



Optional Self-Centring Feet for:

- 200 mm (8 inches) pipes
- 225 mm (9 inches) pipes
- 250 mm (10 inches) pipes
- 300 mm (12 inches) pipes

☞ For 100 mm (4 inches) pipes remove the feet completely.



8.5 Lithium-Ion Battery

General Description

The Piper is powered by a Lithium-Ion Battery. The battery must be removed to be charged.

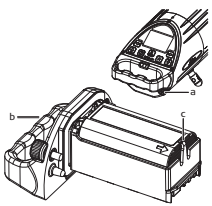
☞ There is no external charge connection in order to prevent the use of external power in a possibly dangerous pipelaying environment.

☞ Use the Leica Geosystems battery and charger recommended by Leica Geosystems to ensure the instrument functioning correctly.

☞ Follow the instructions received with your charging unit to ensure proper charging of the battery.

Removing the battery

1. To remove the battery, loosen the two locking screws (a) below the rear handle and slide the Handle and Battery Assembly (b) out of the rear of the Piper.

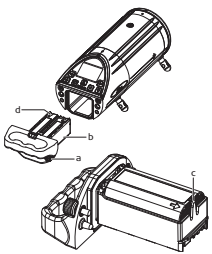


2. The battery sits in a holder that is part of the handle assembly. Turn the Handle and Battery Assembly upside-down.

3. Release the small tab (c), and press the battery upwards to remove the battery from the holder.

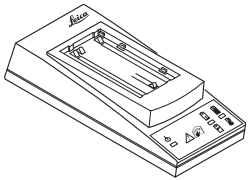
Installing the battery

1. To install the battery, loosen the two locking screws (a) below the rear handle and pull out the Handle and Battery Assembly (b).



2. The battery sits in a holder that is part of the handle assembly. Turn the Handle and Battery Assembly upside-down.
3. Press the battery into the holder until the small tab (c) locks the battery in place.
4. Turn the Handle and Battery Assembly over and slide the it into the rear of the Piper. The gold contacts (d) should be facing up as shown.
5. Tighten the two locking screws (a) firmly to ensure a good, watertight sealing.

Charging the battery



Primary Use / Charging

- 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.
- For new batteries or batteries that have been stored for a long time (> three months), it is sufficient to make only one charge/discharge cycle.
- For Li-Ion batteries, a single discharging and charging cycle is sufficient. We recommend carrying out the process when the battery capacity indicated on the charger or on a Leica Geosystems product deviates significantly form the actual battery capacity available.
- The permissible temperature range for charging is between 0 °C to + 40 °C (+ 32 °F to + 104 °F). For optimal charging we recommend charging the batteries at a low ambient temperature of + 10°C to + 20 °C (+ 50 °F to + 68 °F) 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.

Operation / Discharging

- The batteries can be operated from - 20 °C to + 55 °C (- 4 °F to + 131 °F).
- Low operating temperatures reduce the capacity that can be drawn; very high operating temperatures reduce the service life of the battery.

9 Accuracy Adjustment

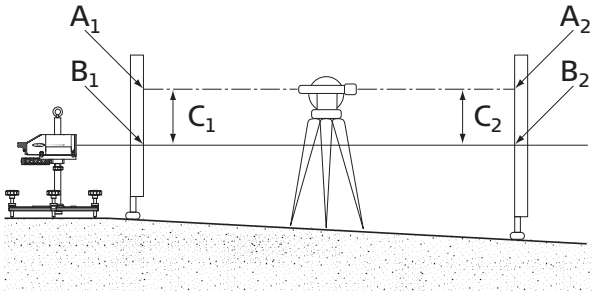
Adjusting Accuracy

☞ 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 Piper 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 authorised service centre 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 only be performed by a qualified individual that understands basic adjustment principles.

☞ This procedure is easier when performed with two people, on a relatively flat surface and when using a trivet assembly. Refer to the illustration below.



Checking Level Accuracy

1.	Set up the Piper on the trivet assembly, level the Piper with the trivet feet, and set the grade counter to 0.000 %. See also: **Setting up the Trivet Assembly and Mounting Bracket** **Entering Grade**
2.	Set up a transit or automatic level as shown in the illustration approximately 30 m (100 ft) from the Piper.
3.	Take grade readings approximately 30 m (100 ft) on either side of the transit. These readings become A1 and A2.

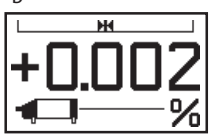
4.	Stand at the grade rod and note where the laser beam strikes the rod. Take readings B1 and B2.
5.	Subtract B1 from A1 to determine C1, and B2 from A2 to determine C2.
☞	If C1 and C2 are the same, the Piper is adjusted. If C1 and C2 are **not** the same, continue with the accuracy adjustment procedure.

Accessing the Adjustment Screen

1.	If power is ON, turn it OFF.
2.	Press and hold the DOWN and RIGHT arrow buttons, then press the POWER button (a) to turn the unit on and enter the adjustment mode/screen.
3.	The adjustment screen will appear as illustrated (b).

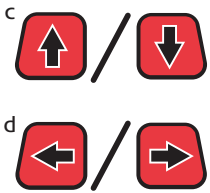
a

b



Adjusting Level Accuracy

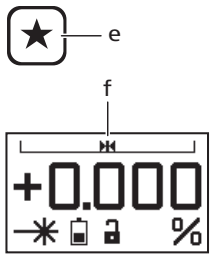
1. When the accuracy of the Piper has been checked, and the amount of error is known, then the beam position is adjusted using the UP and DOWN arrow buttons (c) to increment the counter and move the beam to the desired position.
   Each count represents approximately two arc seconds. Therefore, five counts of the counter is approximately equal to 1.6 mm at 30 m (1/16 inches at 100 feet).



2. The Piper icon will blink to indicate that the unit has not reached the level position.
   Use the LEFT or RIGHT arrow buttons (d) in order to move the line during the procedure.

Exiting the Adjustment Screen

1. Press the STAR Button (e) to accept, save, store the adjustment activity, and return to the main operating screen (f).

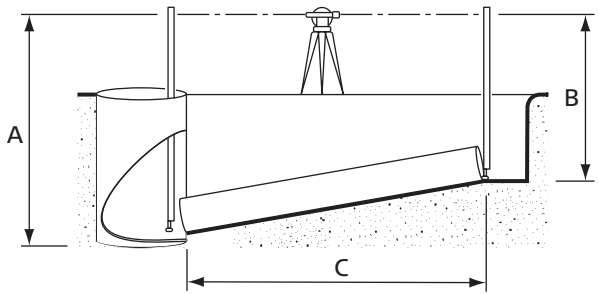


☞ Pressing the POWER button at any time before completing the procedure will turn off the unit, and will revert to previous adjustment information.

10 Checking Line and Grade

Checking Line and Grade

Line and Grade should be checked after the first 7.5 to 15 m (25 to 50 ft) of pipe is laid to ensure the pipe is at the proper grade and line.



Checking Line and Grade

1.	Set up a transit or automatic level as shown in the illustration.
2.	Take grade readings at the ends of the pipe using a grade rod.

☞ The grade readings must be taken from the same relative position in the pipe.
The illustration shows the readings being taken from the invert of the pipe.

Determine the actual grade of the pipe

1.	Subtract distance B from distance A to determine the inclination of the pipe.
2.	Measure the horizontal distance (C) of the pipe.
3.	Divide the rise distance (A - B) by the horizontal distance (C), and then multiply this value by 100 to determine the percent of grade.

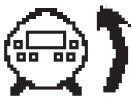
Compare the measured grade to the grade dialed in the Piper

1.	Compare the measured grade to the grade shown on the display of the Piper. If they are equal, the pipe is at the proper grade.
2.	If they are **not** equal, repeat the procedure to ensure that you did not make a mistake.

3. If they are still not equal, check the accuracy of the Piper and the instrument being used.
See also: **Adjusting Accuracy**

11 Troubleshooting

Troubleshooting

Display item	Symptom	Possible Reasons and Solutions
	Roll icon	Indicates that the Piper is in a position where its cross-axis level vial is not level. Reposition the Piper in the direction of the arrow until the vial is centred.
	Servo limit	Indicates that the Piper is in a position where it cannot achieve the entered grade. Reposition the Piper in the direction of the arrow until the unit can level itself.
	Temperature limit	Indicates that the Piper is in an environment where it cannot operate without causing damage to the laser. Most often this happens due to direct sunlight. Shade the unit.
	Empty battery	Indicates that the Piper's battery requires recharging. Remove and replace or recharge the battery. The Piper uses an intelligent battery system that indicates the remaining battery charge on the main operating screen.

Display item	Symptom	Possible Reasons and Solutions
	Sleeping Piper icon	Indicates that the Piper has been placed in standby mode using the remote control. Press any button to reactivate the Piper.
	Line and Grade will not change	Line and Grade may have been locked. Press the STAR button, then a Line or Grade button to unlock. See also: **Line and Grade Lock** Or Line or Grade may have reached their furthest limit. Line limits are indicated by the icon at the top of the display. Grade limits are from -10 % to +25 %.

Display item	Symptom	Possible Reasons and Solutions
	Target and question mark icon	Indicates that the Alignmaster function (Piper 200) cannot find the target. • The target is missing or not positioned properly. Ensure that the reflective tapes are towards the Piper. Reposition and try again. • The laser beam may be blocked. Check for obstructions and try again. • The target is too far from the Piper for Alignmaster to find the target. If possible, move the target closer to the Piper and try again. • The Piper may be positioned in a way that the target is outside of the physical limits of the Alignmaster seek area. Reposition the Piper and try again.
	Target, question mark and sun icon	Indicates that the Piper is in light conditions too bright for the Alignmaster function to find the target. Try shading to reduce the affects of the sun.

Display item	Symptom	Possible Reasons and Solutions
	Beam is not hitting the centre of the target	• The Piper or the Target has not been set up properly or has been moved. Check and try again. • The Piper has not been correctly adjusted to grade. Check and try again. • The pipe or water in the pipe is reflecting the beam. If possible, drain the pipe and try again. • Conditions inside the pipe are refracting the beam. See **Refraction** for remedy. • The Piper is out of adjustment. Perform an accuracy check. See also: **Accuracy Adjustment**
	Remote Control is not working	• Line movement may be locked. • the remote control unit is too far from the Piper to activate the desired function. Move closer and try again. • The battery of the remote control may be low. Replace the battery and try again.

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Original text

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- when it has to be **right**

Leica Geosystems