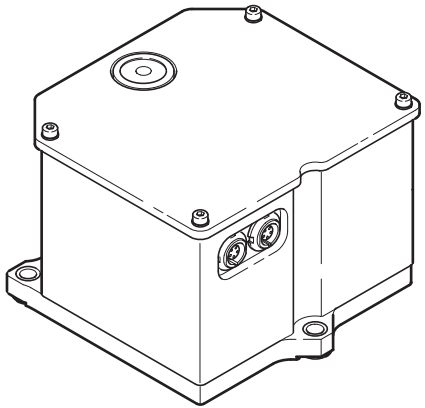
NIVEL200



User Manual

Version 1.0
English

Leica Geosystems

Introduction

Purchase

Congratulations on the purchase of a NIVEL200 sensor.

This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "7 Safety Directions" for further information. Read carefully through the User Manual before you switch on the product.

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.: _____

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.

Trademarks

- Windows is a registered trademark of Microsoft Corporation

All other trademarks are the property of their respective owners.

Table of Contents

In this manual

1 How to Use this Manual

It is recommended to set up the product, while reading through this manual.

Index

The index is at the back of the manual.

Validity of this manual

This manual applies to all NIVEL200 sensors (Nivel210 and Nivel220). Differences between the various models are marked and described.

Available documentation

Name of documentation	Description
NIVEL200 User Manual	All instructions required in order to operate the NIVEL200 sensor to a basic level are contained in this User Manual. Provides an overview of the sensor together with technical data and safety directions.
NIVEL200 Technical Reference Manual	Comprehensive guide to the NIVEL200 sensor. Included are detailed descriptions of special software/hardware settings and software/hardware components intended for technical specialists.

Format of the documentation

The NIVEL200 CD contains the entire documentation in electronic format. The NIVEL200 Technical Reference Manual is not available in printed form.

2 Description of the System

2.1 Overview

Description

The NIVEL200 sensor is a two-axis high precision inclination sensor for simultaneous measurement of inclination and direction of inclination. It operates according to an optoelectronic principle. The horizontal plane is a fluid level and the angle between this and the NIVEL200 sensor varies according to the inclination of the object being measured. The angle is registered by a patented electro optical system and converted to a digital output signal.

2.2 System Components

Main components

Component	Description
Inclination sensor	Simultaneous detection of angles of inclination in X and Y directions as well as the temperature.
NIVELTool	The office software including a series of functionality to support working with NIVEL200.

Sensor models

Component	Description
NIVEL210	Inclination sensor equipped with RS232 interface for single sensor monitoring applications
NIVEL220	Inclination sensor equipped with RS485 interface for multi sensor monitoring applications

Accessories

Additional equipment such as cable, supports and power supply are listed in the setup sections. Any further description of accessories is not part of the manual.

NIVELTool

Functionality	Description
Standard Functionality	Includes the data exchange between computer and sensor.
Extended Functionality	Includes the parameter settings and adjusting the sensor.

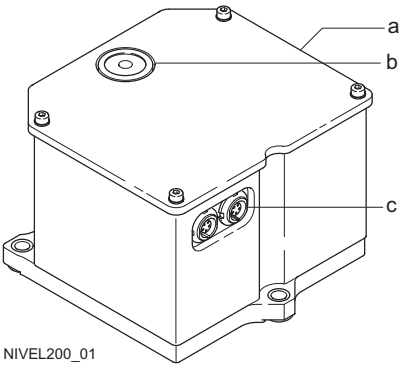
Supported operating systems:

- Windows® XP
- Windows® 2000.

3 Operation

3.1 Sensor Components

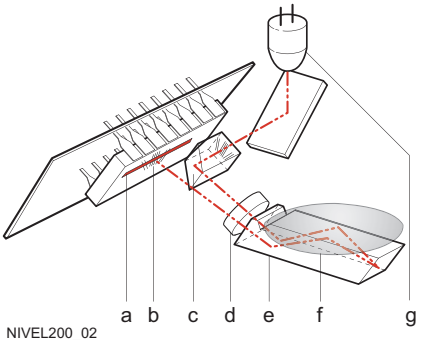
Sensor



NIVEL200_01

a) NIVEL200 housing
b) Circular level
c) Plugs

Sensor Components



a) CCD Array
b) Mapped line figure
c) Prism with line figure
d) System of lenses
e) Prism
f) Surface of fluid
g) Light Emitting Diode

Principle of operation

- The line figure (c) is located on a prism.
- This line figure is illuminated with a **L**ight **E**mitting **D**iode (g).
- The system of lenses (d) projects the illuminated line figure (c) through a prism (e) and the fluid surface (f) onto the CCD-Array (a).
- The surface of the fluid (f) remains horizontal irrespective of the inclination of the NIVEL200 sensor, so that the angle of inclination corresponds to the angle between the surface of the fluid and the base of the NIVEL200 sensor.

3.2 Preparation

Setup step-by-step

Step	Description
	• Do not drop or turn NIVEL200 sensor upside down shortly before the measurement. • The viscosity of the liquid takes some time to flow back to its correct level position. • During this time the values measured will not be stable.
1.	Use the circular level to be within its normal operating range.
2.	Mount the NIVEL200 sensor within its operation range.
	• The surface upon which the NIVEL200 sensor is mounted to must be properly machined. • The screws should be tightened to the same torque.
3.	Plug in the cables. Refer to "3.4 Setup of NIVEL210" Refer to "3.5 Setup of NIVEL220"
4.	Switch on the auxiliary supply.
5.	The warm-up time refer to "8 Technical Data".

Step	Description
☞	The time should be correspondingly prolonged, should the device have been at some other temperature than ambient initially.
☞	Avoid uneven heating and cooling during the measurement.

3.3 Configuration Utilities with NIVELTool

Description

NIVELTool allows the configuration of NIVEL200 sensors.

Each NIVEL200 sensor must be configured individually. NIVELTool does not support multiple NIVEL200 sensor communication.

Sensor settings

The following NIVEL200 sensor settings can be read and set:

- Specific NIVEL200 sensor name
- NIVEL200 sensor address
- NIVEL200 sensor port (read only)
- Internal average number (arithmetic mean function)

Selecting an option

Button	Description
Connect	Initializes a NIVEL200 sensor connection.
Read	Displays the current NIVEL200 sensor settings.
Write	Stores new settings in the NIVEL200 sensor memory.
Measure	Displays the current NIVEL200 sensor values in real-time.
Stop	Stops the real-time measure mode.

Connect

- While starting up, NIVELTool automatically searches for any connected NIVEL200 sensor on all available COM ports.
- Or use the **Connect** button to connect and configure a NIVEL200 sensor.
- As only one NIVEL200 sensor can be configured at the time, the first NIVEL200 sensor found will become the active NIVEL200 sensor.
- Full functionality within NIVELTool is available after a successful NIVEL200 sensor initialisation.

Read

Field	Description
Name	Displays the current specific NIVEL200 sensor name.
Port	Displays the COM port of the currently active NIVEL200 sensor.
Average	Displays the current average setting.
Address	Displays the current NIVEL200 sensor address.

Set

The following options for the NIVEL200 sensor can be configured:

Field	Description
Name	• Stores a NIVEL200 sensor specific name in the NIVEL200 sensor memory. • The entry of a name is optional. • The maximum number of characters is 11.
Average	• The NIVEL200 sensor offers the possibility to output the inclination values as an arithmetic mean. • The maximum average number is 128.
☞	A high average number increases the response time of NIVEL200 sensor.
Address	• The NIVEL200 sensor address is Nx. • Valid addresses range x: 0 to 9 and A to Z.
☞	For communication in a RS485 network it is necessary that NIVEL200 sensor has its individual address.

Measure

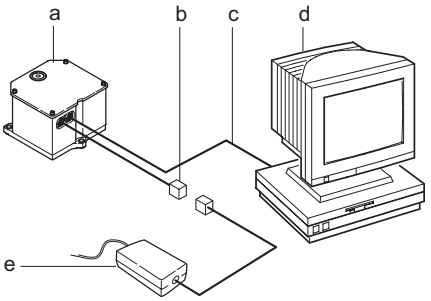
- Use the Measure button to start the real-time mode.
- Use the Stop button to end this mode.

3.4 Setup of NIVEL210

Description

This chapter describes a typical setup of NIVEL210 sensors.

Setup of a NIVEL210



NIVEL200_04

a) NIVEL210 RS232
b) Cable, Lemo 0 (male) - power supply cable Lemo 1 (female)
c) Cable, Lemo 0 (male) - PC
d) PC
e) Power supply

3.5 Setup of NIVEL220

Description

This chapter describes a typical setup of NIVEL220 sensors.

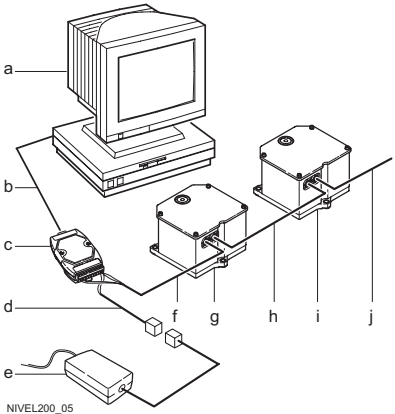
General information

Please only use cables supplied from Leica Geosystems when wiring the NIVEL200 system components.

- For the installation of the cables of the NIVEL200 sensors, the general rules for the installation of electrical wiring apply.
- Avoid sharp bends and lay the cable in large loops within the range of rotating or moving parts.
- When installing the cables, please observe the already existing installation of electric system.
- After having completed the installation, please drive through all possible positions in order to make sure that the cables are not touching, stretched or even squeezed by any moving parts.

Please consider that a well-planned and thoroughly carried out electric installation does not only protect the cables against damages, but also looks professional.

Setup of a NIVEL220



a) PC
b) Cable, Converter - PC
c) RS232 / RS485 bus converter
d) Cable, Lemo 1 (female) - Converter
e) Power supply
f) Cable, Converter - Lemo 0 (male)
g) NIVEL220 RS485
h) Cable, Lemo 0 (male) - Lemo 0 (male)
i) NIVEL220 RS485
j) Cable, Lemo 0 (male) - Lemo 0 (male)

Cable connection

In order to run the bus system properly it has to be terminated. This has to be done via the terminator resistor (see "Accessories" in this chapter).

From	to	Description	Product code / number	Pos.
PC	Converter	RS232 cable	-	b
Power supply	Converter	0.8 m cable, Lemo 1 (female) - 2 wires to terminal strip	GEV206 / 748488	d
Converter	NIVEL220	1.8 m, bus cable (RS485), Lemo 0 (male) - 4 wires to terminal strip	GEV207 / 748489	f
NIVEL220	NIVEL220	5.0 m cable, Lemo 0 (male) - Lemo 0 (male)	802906	h, j
NIVEL220	NIVEL220	20.0 m cable, Lemo 0 (male) - Lemo 0 (male)	802907	h, j

Accessories

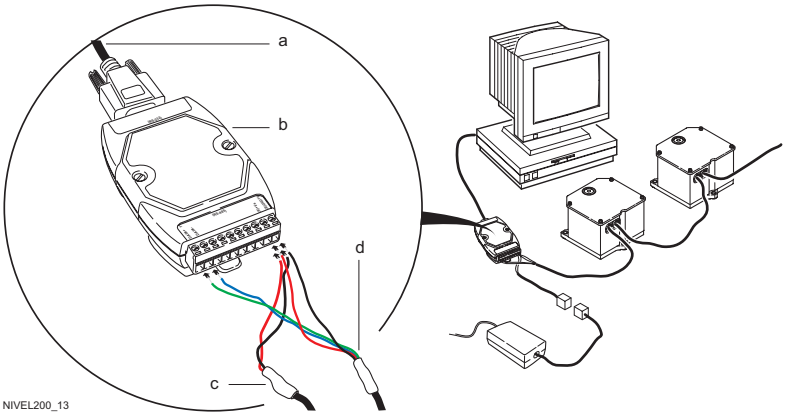
Article	Product code / number	Pos.
Power supply	722409	e
Terminator for RS485	575869	-

Recommended converter

Leica Geosystems **recommends** to use the following RS232 to RS485 converter:

Contact	Converter
http://www.icpdas.com	I-7520

Cabling of NIVEL220 sensor with I-7520 bus converter



a) Cable, Converter - PC
b) RS232 / RS485 bus converter
c) Cable, Lemo 1 - 2 wires to terminal strip
d) Cable, Lemo 0 - 4 wires to terminal strip

Cable, power supply to converter

Cable end	Name	Description	Direction
Red	+Vs	12 V power supply	In
Black	GND	Signal ground	-

Cable, NIVEL220 to converter

Cable end	Name	Description	Direction
Red	+Vs	12 V power supply	In
Black	GND	Signal ground	-
Green	Data +	RS485, receive data	In
Blue	Data -	RS485, transmit data	Out

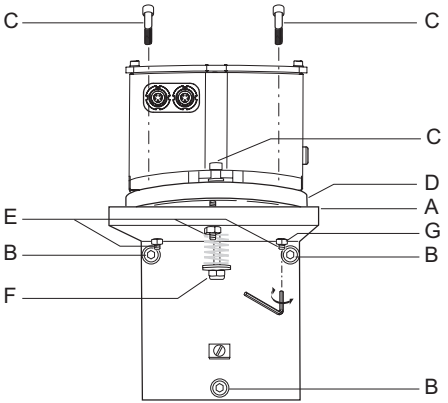
3.6 Mounting

Characteristics

- Non-corroding (stainless steel and galvanised components)
- Adapter flange rotates ± 150° (for common orientation of all sensors applied in setup)
- Each Wall Mount kit (Order No. 749031) comprises:
  - 1x steel assembly (chemical nickel-plated), including 1x angle profile, 1x turning flange with screw and spring for adjustment, 3x M5 ball pressure screws, 3x M4 sensor screws, cable tie fastener with screw)
  - 3x M6 brass plugs
  - 3x M6 screws
  - 3x M6 washer
  - 2x cable tie

Protect the NIVEL200 sensor from water or rain.

Installation picture



NIVEL200_14

Installation of wall mount step-by-step

Step	Description
1.	Drill three holes with Ø 8 mm for brass plugs M6, according to flange dimensions 95x80 mm.
☞	The overall tolerance for the mounting holes is ± 1.5 mm.

Step	Description
2.	Insert brass plugs into drilled holes and install wall mount (A) with 3x M6 screws and 3x M6 washer (B).
3.	If the wall does not have an even surface, use washers between mount and wall to avoid unnecessary tensions.
☞	Carefully use a hammer to relive possible tensions (stress) in the angle steel.
4.	Install NIVEL200 with 3x M4 screws (C) and rotate flange assembly (D) to align the sensor in the desired direction (for common X and Y direction of all sensors if required).
5.	Coarse level the sensor with the 3x M5 ball pressure screws (E) levelling screws until circular bubble is centred.
6.	Tighten the centre screw (F) of the flange assembly (1x M6 with spring).
7.	Connect Laptop or any data logger, which has appropriate NIVELTool software installed and power supply with the NIVEL200 as described in chapter "3.7 Power Supply".
8.	Start the software.
9.	Level the NIVEL200 close to zero values in X and Y direction (overall tolerance for X and Y to within 0.050 mrad of better).

Step	Description
☞	Secure the levelling 3x M5 ball pressure screws with nuts (G) to provide a safe long-term stability for the setup.

3.7 Power Supply

Description	Power for the NIVEL200 sensor must be supplied externally. The power is connected to the sensor using a LEMO cable.
Sensor auxiliary supply	The auxiliary supply voltage at the NIVEL200 sensor must be within the permissible range. Refer to "8 Technical Data".
☞	For the voltage drop along long supply cables take into account and, if necessary, correspondingly increase the voltage at the supply end.
☞	Use the Leica Geosystems power supply recommended by Leica Geosystems to ensure the correct functionality of the NIVEL200 sensor.

4 Check & Adjust

4.1 Overview

Description

Leica instruments are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, shock or stress can cause deviations and decrease the instrument accuracy.
It is therefore recommended to check and adjust the sensor from time to time. The procedures are guided and have to be followed carefully and precisely as described in the following chapters. Some other sensor errors and mechanical parts can be adjusted mechanically.

Electronic adjustment

The following instrument error can be checked and adjusted electronically:

- Offset error

Mechanical adjustment

The following instrument part can be adjusted mechanically:

- Circular level on NIVEL200 sensor

Precise measurements

To get precise measurements in the daily work, it is important:

- To check and adjust the instrument from time to time.
- To take high precision measurements during the check and adjust procedures.
- Refer to NIVEL200 Technical Reference Manual.

During the manufacturing process, the instrument errors are carefully determined and set to zero. As mentioned above, these errors can change and it is highly recommended to redetermine them in the following situations:

- Before the first use
- Before every high precision survey
- After rough or long transportations
- After long working periods
- After long storage periods
- If the temperature difference between current environment and the temperature at the last calibration is more than 20°C

4.2 Offset Adjustment

Description

This function allows you to adjust the offset or zero point of NIVEL200 sensors.

The original factory adjustment is overwritten with this adjustment process. A incorrect performed adjustment may cause the displayed inclination values of your NIVEL200 sensor to not correspond with the line of gravity.

Requirements

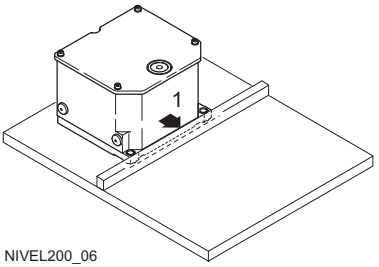
Requirements	Description
Horizontal plane plate	• The plane plate mounting should be free of inclination when loaded with the weight of the NIVEL200 sensor. • The plane plate should be free of deformations due to the NIVEL200 sensor weight. • The flatness of the plane plate should be within 0.001 mm within a diameter of about 200 mm. • The surface between the NIVEL200 sensor and plane plate should be free of dust particles. • Avoid thermal distortion of the NIVEL200 sensor or plane plate (Air draft, sunlight, heat sources).

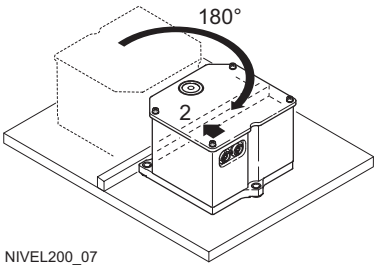
Requirements	Description
Steel straight edge or a triangle	A steel straight edge or a triangle used as reference edge.

Offset adjustment step-by-step

The following table explains the offset adjustment procedure:

Step	Description
	NIVEL200 sensor requires a warm-up time. Refer to "8 Technical Data". During the warm-up time, the measured values can differ from their adjusted values due to the varying thermal behavior of components as the internal temperature of the sensor rises.
1.	Press the **Corrections** button to enter the correction routine in the NIVEL-Tool software.

Step	Description
2.	Position the sensor along a straight edge or triangle.  NIVEL200_06
3.	Level the plane plate with the NIVEL200 circular level before determining the offset error.
4.	Wait for about 10 seconds.
5.	Press the **First** button to store the NIVEL200 sensor values of the inclination in the X and Y axes in position 1.

Step	Description
6.	Rotate the NIVEL200 sensor through 180°and position the NIVEL200 sensor along the straight edge.  NIVEL200_07
7.	Wait for about 10 seconds.
8.	Press the **Second** button to store the NIVEL200 sensor values of the inclination in the X and Y axes in position 2.
9.	Repeat step 3. to 8. several times to check the reliability of the results.
☞	Avoid uneven heating and cooling during the measurement.
10.	Press the **Save** button to store the displayed new offset parameters for X and Y in the NIVEL200 sensor memory.

4.3 Adjustment of the Circular Level

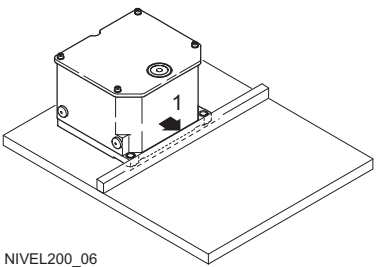
Description

The circular level on the NIVEL200 sensor can be adjusted mechanically if it is out of range.

Requirements

- A plane plate with flatness within 0.01mm.
- Carefully done Offset Adjustment. Refer to "4.2 Offset Adjustment".

Adjustment step-by-step

Step	Description
1.	Position the NIVEL200 sensor on a plane plate.  NIVEL200_06
2.	Level the plane plate with the NIVEL200 circular level before determining the offset error.

Step	Description
☞	The bubble of the circular level must be centered. If it extends beyond the circle, use an allen key to centre it.
3.	Adjust the circular level with the cylinder head screw on the bottom side within the working range. Use only two cylinder head screws to adjust the circular level.
4.	Repeat the adjustment procedure if the bubble does not stay centered.
☞	After the adjustment, no screw should be left loose.

5 Data Transfer

Description	Data Transfer allows the controlling of NIVEL200 sensors with special commands.
Standard application	A NIVEL200 sensor has to make two measurements, the inclinations in the X and Y axes, in order to fulfill its purpose. Additional information of the temperature inside the NIVEL200 sensor is also available. It is not necessary to know the Data Transfer, if it is only intended to use standard application software.
Accommodate to special applications	To accommodate special applications, NIVEL200 sensors operate within wide limits. Paying attention to the functional description is recommended for such cases. Refer to NIVEL200 Technical Reference Manual.

6 Care and Transport

6.1 Transport

Transport in the field	When transporting the equipment in the field, always make sure that you carry the product in its original transport container.
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 transport container and secure it.
Shipping	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.
Field adjustment	After transport inspect the field adjustment parameters given in this user manual before using the product.

6.2 Storage

Product	Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "8 Technical Data" for information about temperature limits.
Field adjustment	After long periods of storage inspect the field adjustment parameters given in this user manual before using the product.

6.3 Cleaning and Drying

Objective, eyepiece and prisms	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 / 108°F and clean them. Do not repack until everything is completely dry.
Cables and plugs	Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

7 Safety Directions

7.1 General

Description

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.

7.2 Intended Use

Permitted use

- Measuring inclinations.
- Computing by means of application software.

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 surveying site, for example when measuring on roads.

Warning

Adverse use can lead to injury, malfunction and 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 operated until the user has been instructed on how to work with it.

7.3 Limits of Use

Environment

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

⚠ 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.

7.4 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 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 product 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 safety and accident prevention.
- To inform Leica Geosystems immediately if the product and the application becomes unsafe.

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.

7.5 Software Licence Agreement

International Warranty

The International Warranty can be downloaded from the Leica Geosystems home page at http://www.leica-geosystems.com/internationalwarranty or received from your Leica Geosystems dealer.

Software Licence Agreement

This product contains software that is preinstalled on the product, or that is supplied to you on a data carrier medium, or that can be downloaded by you online pursuant to prior authorization from Leica Geosystems. Such software is protected by copyright and other laws and its use is defined and regulated by the Leica Geosystems Software Licence Agreement, which covers aspects such as, but not limited to, Scope of the Licence, Warranty, Intellectual Property Rights, Limitation of Liability, Exclusion of other Assurances, Governing Law and Place of Jurisdiction. Please make sure, that at any time you fully comply with the terms and conditions of the Leica Geosystems Software Licence Agreement.

Such agreement is provided together with all products and can also be found at the Leica Geosystems home page at http://www.leica-geosystems.com/swlicense or your Leica Geosystems dealer.

You must not install or use the software unless you have read and accepted the terms and conditions of the Leica Geosystems Software Licence Agreement. Instal-

lation or use of the software or any part thereof, is deemed to be an acceptance of all the terms and conditions of such licence agreement. If you do not agree to all or some of the terms of such licence agreement, you may not download, install or use the software and you must return the unused software together with its accompanying documentation and the purchase receipt to the dealer from whom you purchased the product within ten (10) days of purchase to obtain a full refund of the purchase price.

7.6 Hazards of 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 measurement results 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 product has been subjected to abnormal use and before and after important measurements.

Warning

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

Warning

If computers intended for use indoors are used in the field there is a danger of electric shock.

Precautions:

Adhere to the instructions given by the computer manufacturer with regard to field use in conjunction with Leica Geosystems products.

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 product to mechanical stress.

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.

7.7 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.

7.8 FCC Statement, Applicable in U.S.

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.

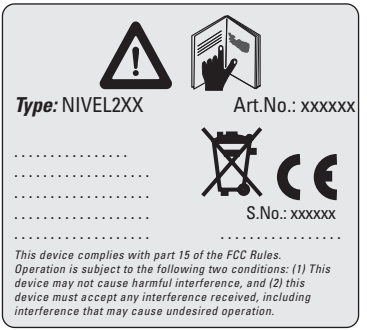
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- 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.

Warning

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

Labelling NIVEL200



NIVEL200_11

8 Technical Data

8.1 General Technical Data of the Instrument

Measuring range

Range	From		To	
	[mrad]	[cc]	[mrad]	[cc]
A	- 1.51	- 960	+ 1.51	+ 960
B	- 2.51	- 1600	+ 2.51	+ 1600
C	- 3.00	- 1900	+ 3.00	+ 1900

Resolution

[mrad]	[cc]
0.001	0.6

Zero-point stability

[mrad / °C]	[cc / °C]
< 0.00471	< 3

Equipoise error

[mrad]	[cc]
0.00204	1.3

Valid for temperature < +15°C.

Tilt angle accuracy

Range	Standard deviation	
	[mrad]	[cc]
A	± 0.0047	± 3
B	± 0.0141	± 9
C	± 0.0471	± 30

Other errors

Error	Value
Zero-point error	15cc
Directional error	< ± 1°
Orthogonal error	< ± 2°
Scaling error	0.5 %

After proper adjustment. Refer to "4 Check & Adjust".

Equipoise time

< 10 s

Warm-up time

< 20 minutes

Power supply voltage

Nominal voltage 12 V DC, voltage range 9 - 15 V DC

Power consumption

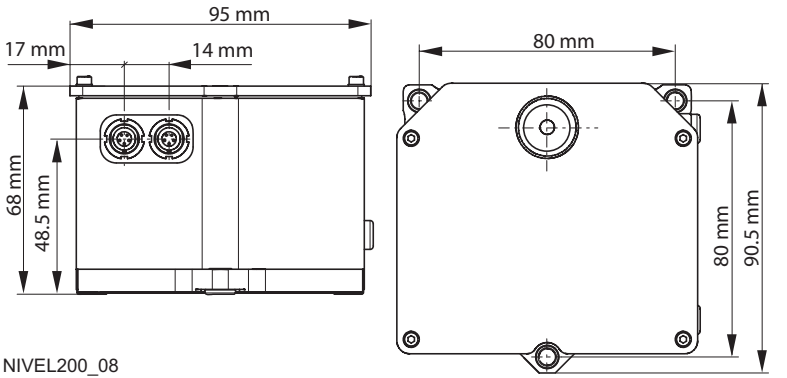
0.6 W
50 mA

Environmental Specifications

Type		Description
Temperature	Operating	-20 to +50 °C
	Storage	-40 to +70 °C
Protection	Against Water, Dust and Sand	IP50 (IEC 60529)
Humidity	Up to 95%	Non condensing The effects of condensation are to be effectively counteracted by periodically drying out the instrument.

8.2 Dimensions

Dimensions diagram

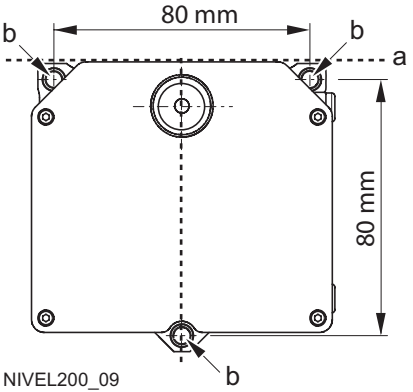


NIVEL200_08

Length [mm]	Width [mm]	Height [mm]
95	90.5	68

Weight 0.74 kg

Mounting dimensions



NIVEL200_09

a) Reference edge
b) Mounting holes

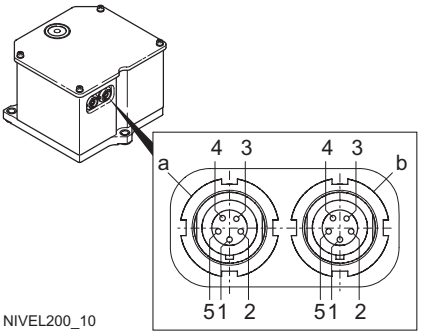
8.3 Interfaces

General

- The interface RS232 or RS485 is integrated in the NIVEL200 sensor. No other attachments or adaptors are necessary.
- The interface RS485 can communicate with the serial interface RS232 of the computer via an RS232/RS485 converter.

Interface	Description
RS232	NIVEL210 sensor is used in conjunction with computer for recording, displaying and storing X and Y directions and temperature.
RS485	Up to 32 NIVEL220 sensors can operate in the same network.

Ports at the NIVEL200



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Pin assignments for port RS232

Pin	Name	Description	Direction
1	-	Do not use	-
2	RxD	RS232, receive data	In
3	TxD	RS232, transmit data	Out
4	+ 12 V	12 V power supply	In
5	GND	Signal ground	-

Pin assignments for port RS485

Pin	Name	Description	Direction
1	-	Do not use	-
2	Data +	RS485, receive data	In
3	Data -	RS485, transmit data	Out
4	+ 12 V	12 V power supply	In
5	GND	Signal ground	-

Pin assignments for I-7520 bus converter

Pin	Name	Description	Direction
1	Data +	RS485, receive data	In
2	Data -	RS485, transmit data	Out
3-8	-	-	-
9	(R)+Vs	12 V power supply	In
10	(B)GND	Signal ground	-

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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).

Total Quality Management - Our commitment to total customer satisfaction.

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

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