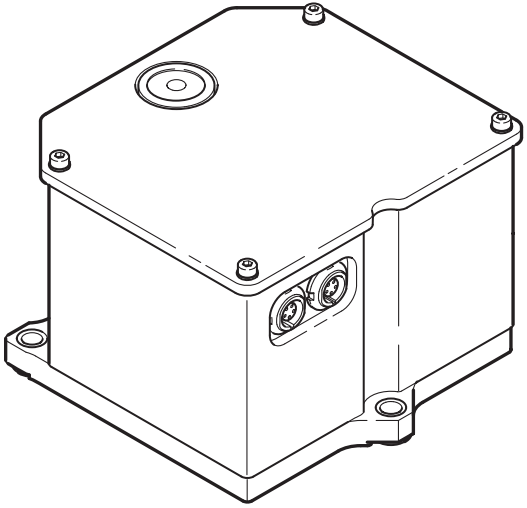
NIVEL200



Technical Reference Manual

Version 1.0
English

Leica Geosystems

Introduction

Purchase

Congratulations on the purchase of a NIVEL200 sensor.

To use the product in a permitted manner, please refer to the detailed safety directions in the User Manual.

Product identification

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

Legend of variables

A description of the variables used in this manual, including their valid ranges, are listed in the "Appendix B - Legend".

Index

The index is at the back of the manual.

Validity of this manual

This manual applies to all NIVEL200 sensors. 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. All manuals are also available in printed form except for the NIVEL200 Technical Reference Manual.

2 Overview

2.1 General

Description

The software for the NIVEL200 sensor can be customized to satisfy user requirements. Information on the commands is available in the NIVEL200 Technical Reference Manual.

Use

Commands are divided into five groups:

- Commands relating to communication. Refer to "3 Communication".
- Commands relating to the preparation of a measurement. Refer to "4 Prepare a Measurement".
- Commands relating to saving. Refer to "5 Storage of Parameters".
- Commands relating to the execution of a measurement. Refer to "6 Execute a Measurement".
- Commands relating to the calibration. Refer to "7 Check & Adjust".

2.2 Basic Commands

Request/Response protocol

A request/response protocol has the following characteristics:

- A NIVEL200 sensor will only transmit a response when it is requested to do so by the control computer.
- The communication protocol is structured into blocks.
- The protocol is devised such that it is insensitive to interference on the bus.

Overview of blocks

The NIVEL200 sensor commands consist of various blocks.
The blocks are:

block start - addressee - sender - information - block finish

- Each part of a block consists of one or several ASCII characters.
- Each block of information is transmitted as a single chain.

Description of all blocks

Block	Description	Character	Decimal	Length [bytes]
block start	The character <NUL> defines the bus electrically. The character <STX> marks the actual beginning of the block and causes every NIVEL200 sensor connected to the network to wait for the addressee.	<NUL> <STX>	22 2	2
addressee	Refer to "3 Communication"	xy	-	2

Block	Description	Character	Decimal	Length [bytes]
sender	Refer to "3 Communication"	xy	-	2
information	Command	" "	-	1 to 200
block finish	The character <ETX> followed by two characters ss, which represent the check sum, terminates every block transmitted.	<ETX> ss	3	3

With the NIVEL200 sensor the check sum is generated and transmitted, but not checked. It can therefore comprise of any character for example <CR>,<LF>.

Check sum

NIVEL200 sensor generates the check sum according to the following rule:

- The check sum is the 16 Bit sum of all the characters from the beginning of the addressee block to the last character of the information block.
- The two last characters are in hexadecimal notation and represent the highest and the lowest Byte of the 16 Bit check sum.

<STX> or <ETX> are not counted in the check sum.

Transmission

Transmission has the following characteristics:

- Data are transmitted in blocks.
- Each block is transmitted and handled as a single unit.
- When sending a START character, the unit reserves the bus.
- The END OF BLOCK character cancels the reservation.

2.3 Example Request/Response Protocol

Description	The address for the NIVEL200 sensor is 'N1'. The address for the control computer is 'C1'. It is assumed that the NIVEL200 sensor receives the signal of the X inclination.
Send syntax	The data block transmitted by the control computer has the following structure: Send: <22><2>N1C1 G X<3><13><10>
Return syntax	The data block transmitted by NIVEL200 sensor has the following structure: Return: <22><2>C1N1 X:+0.766<3><02hex><D1hex>

3 Communication

3.1 General

Overview of communication parameters

The communication parameters establish and control the communication between NIVEL200 sensor and the control computer.

The following communication parameters are available:

Parameter	Description
A	Indicates the device and group addresses.
B	Indicates the baud rate or the bus parameter mode.
D	Indicates the device number and current software version.
I	Indicates the device identifier.

Saving communication parameters

Should it be necessary to set a communication parameter the new value must be written into the memory. Refer to "5 Storage of Parameters".

3.2 Switching the Bus Parameter

Description

To change the communication parameters and save the new values in the memory, switch **B** must be set to ON.

This is a precaution against overprinting parameters by mistake.

Read

RS B

Call this command to read the bus parameter mode.

	Command
Send syntax	<SYN><STX>NxCx **RS B**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx sw<ETX>ss
Parameters	sw The bus parameter mode is either on or off.
Remarks	The default value for sw is OFF.
Example	Send: <22><2>N1C1 RS B<3><13><10> Return: <22><2>C1N1 ON<3><1><176>

Set

S B sw

Call this command to set the bus parameter mode.

	Command
Send syntax	<SYN><STX>NxCx **S B sw**<ETX><CR><LF>
Parameters	sw The bus parameter mode is either on or off.

	Command
Example	Send: <22><2>N1C1 S B ON<3><13><10> Enables the bus parameter write status.

It is possible to set the bus parameter either with the device address or the group addresses.

3.3 Addresses

Description

Parameter **A** contains 8 items of information:

Field	Description
Nx	Device address
1y 2y 3y 4y 5y 6y 7y	Group addresses

General

There are two different addresses for NIVEL200 sensors:

- Individual addresses
- General addresses

Individual address

Address		Description
Device	Nx	Every NIVEL200 sensor has a unique address consisting of the two characters **Nx**: • The first character is always N, the second character is alpha-numerical. • 36 individual addresses are available. A maximum of 32 NIVEL200 sensors can be connected to a data bus.

Address		Description
Group	ny	Every NIVEL200 sensor can have a unique group address consisting of the two characters **ny**: • A NIVEL200 sensor is assigned to a group by giving it an address within the group. • The first character is from 1 to 7, the second character is alphanumerical. • A NIVEL200 sensor can be removed from a group by assigning it to the group address n0. It then no longer responds to the group address.

General address

Address		Description
Device	N0	The address **N0** calls every NIVEL200 sensor in a network. • All NIVEL200 sensors are simultaneously called by the address N0 regardless of their individual address. • An unknown individual address can be found by using N0, to which it answers with its individual address Nx.
Group	10 20 30 40 50 60 70	The group addresses **10, 20, 30, 40, 50, 60 or 70** calls every NIVEL200 belongs to a group in a network. • All NIVEL200 sensors belonging to a group are simultaneously called by the group addresses n0 regardless of their individual address. • 0 defines that the NIVEL200 sensor does not belong to the corresponding group.

- The first character of a NIVEL200 sensor is always N.
- The x, y are variables. Refer to "Appendix B - Legend".
- 0 is a general address and general group address.

Examples of calling the sensor

There are the following possibilities of calling NIVEL200 sensors:

- Each NIVEL200 sensor in a network has a unique identifier and can be called individually.
- For certain instructions, for example RESET, it is of advantageous to be able to call all the NIVEL200 sensors at once.
- In more complicated applications involving several NIVEL200 sensors in a group, a group as a whole can be called.

Read

RB A

Call this command to read the current address.

	Command
Send syntax	<SYN><STX>NxCx **RB A**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx N**x** 1**y** 2**y** 3**y** 4**y** 5**y** 6**y** 7**y**<ETX>ss
Parameters	x NIVEL200 sensor and control computer parameter. From the characters 0 to 9 and the letters A to Z. y NIVEL200 sensor group address parameter. From the characters 0 to 9 and the letters A to Z.
Remarks	The default value of y is 0.
Example	Send: <22><2>N1C1 RB A<3><13><10> Return: <22><2>C1N1 N1 10 20 30 40 50 60 70<3><5><46>

Write the device address

WB A Nx

Call this command to write the device address.

	Command
Send syntax	<SYN><STX>NxCx **WB A Nx**<ETX><CR><LF>
Parameters	x NIVEL200 sensor device address. From the characters 0 to 9 and the letters A to Z.
Example	Send: <22><2>N1C1 WB A N3<3><13><10> The device address is set to N3.

Write the group address

WB A ny

Call this command to write the group address.

	Command
Send syntax	<SYN><STX>NxCx **WB A ny**<ETX><CR><LF>
Parameters	n NIVEL200 sensor group address parameter. From the characters 1 to 7. y NIVEL200 sensor group address parameter. From the characters 0 to 9 and the letters A to Z.
Example	Send: <22><2>N1C1 WB A 13<3><13><10> The group address is set to 13.

3.4 Baud Rates

Description

Parameter **B** contains two items of information:

- The currently set baud rate.
- The available baud rate settings.

Five baud rate settings

Baud rate	Abbreviation
1200	0
2400	1
9600	2
19200	3
38400	4

Baud rate numbers which are not available indicated with "-".

Read

RB B

Call this command to read the baud rate.

	Command
Send syntax	<SYN><STX>NxCx **RB B**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **b** 01234---<ETX>ss
Parameters	b The NIVEL200 sensor baud rate from 0 to 4.
Remarks	The default value for b is 2.

	Command
Example	Send: <22><2>N1C1 RB B<3><13><10> Return: <22><2>C1N1 2 01234---<3><2><230>

Write

WB B b

Call this command to write the baud rate.

	Command
Send syntax	<SYN><STX>NxCx **WB B b**<ETX><CR><LF>
Parameters	b The NIVEL200 sensor baud rate from 0 to 4.
Example	Send: <22><2>N1C1 WB B 3<3><13><10> The baud rate is set to 19200.

The new baud rate is active after a system reset. Refer to "8 System Reset".

3.5 Device Number and Software Version

Description

Parameter **D** contains two items of information:

- The serial number of the particular NIVEL200 sensor.
- The version of the firmware installed.

Parameter **D** absolutely identifies each individual NIVEL200 sensor.

Read

RB D

Call this command to read the serial number and firmware version.

	Command
Send syntax	<SYN><STX>NxCx **RB D**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx sn fn<ETX>ss
Parameters	sn The serial number. fn The firmware version.
Example	Send: <22><2>N1C1 RB D<3><13><10> Return: <22><2>C1N1 000005 1.0<3><2><231>

3.6 Device Identifier

Description

Parameter **I** is the device identifier, which can be defined by the user.

Parameter **I** can help to indicate each NIVEL200 sensor for example, its purpose or location.

Read

RB I

Call this command to read the device identifier.

	Command
Send syntax	<SYN><STX>NxCx **RB I**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **str**<ETX>ss
Parameters	str NIVEL200 sensor device identifier. Default value depends on sensor type.
Example	Send: <22><2>N1C1 RB I<3><13><10> Return: <22><2>C1N1 PYLON EAST<3><3><242>

Write

WB I str

Call this command to write the device identifier.

	Command
Send syntax	<SYN><STX>NxCx **WB I str**<ETX><CR><LF>
Parameters	str NIVEL200 sensor device identifier. Up to 11 ASCII characters.

	Command
Example	Send: <22><2>N1C1 WB I PYLON EAST<3><13><10> The device identifier is set to "PYLON EAST".

4 Prepare a Measurement

4.1 General

Overview

Parameter	Description
C	Indicates the compensation status.
M	Indicates the trigger mode.
N	Indicates number of measurement averages.

To prepare a measurement there is no switch required.

Saving measurement parameters

Should it be necessary to set a parameter preparing measurements the new value must be written into the memory. Refer to section "5 Storage of Parameters".

4.2 Compensation Status

Description

Parameter **C** switches the measure signal correction mode either ON or OFF.

This facility is useful for obtaining measured signals, which are largely in their original state and uncorrected (e.g. during readjustment).

Read

RS BC

Call this command to read the compensation status.

	Command
Send syntax	<SYN><STX>NxCx **RS C** <ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **c**<ETX>ss
Parameters	c The compensation status is either on or off.
Remarks	The default value of c is ON.
Example	Send: <22><2>N1C1 RS C<3><13><10> Return: <22><2>C1N1 ON<3><1><176>

Set

S C sw

Call this command to set the compensation status.

	Command
Send syntax	<SYN><STX>NxCx **S C sw**<ETX><CR><LF>
Parameters	c The compensation status is either ON or OFF.

	Command
Example	Send: <22><2>N1C1 OFF<3><1><238> The compensation status is switched OFF.

The X and Y signals are corrected as long as C is set to ON. With C set to OFF, the measured signals are not corrected and the raw values are transferred.

Please note that this command also switches the specified characteristics, i.e. the user must make all the necessary corrections. The linearity of the measured values is unaffected in the specified range.

4.3 Trigger Mode

Description

Parameter **M** switches the triggering operating mode.

- In the **CONT**inuous operating mode the actual measured value is transferred when requested.
- The triggering logic is enabled in the **PRE** operating mode. The instruction TT then causes the current value to be measured and saved. Refer to "6.6 Signal Acquisition".

Read

RS M

Call this command to read the triggering logic.

	Command
Send syntax	<SYN><STX>NxCx **RS M**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **t**<X>ss
Parameters	t The trigger mode is either CONT or PRE.
Remarks	The default value of t is CONT.
Example	Send: <22><2>N1C1 RS M<3><13><10> Return: <22><2>C1N1 PRE<3><2><71>

Set

S M t

Call this command to SET the triggering logic.

	Command
Send syntax	<SYN><STX>NxCx **S M t**<ETX><CR><LF>

	Command
Parameters	t The trigger mode is either CONT or PRE.
Example	<22><2>N1C1 S M PRE<3><13><10> The triggering logic is enabled.

4.4 Measurement Averages

Description

The index **N** shows how many measurements are taken to determine the mean inclinations in the X and Y axes.

Read

R N

Call this command to read the number of measurement average.

	Command
Send syntax	<SYN><STX>NxCx **R N**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx zzz<ETX>ss
Parameters	z The number of measurement averages from 001 to 128.
Remarks	The default value of measurement averages is 008.
Example	Send: <22><2>N1C1 R N<3><13><10> Return: <22><2>C1N1 008<3><1><171>

Set

W N zzz

Call this command to write the number of measurement average.

	Command
Send syntax	<SYN><STX>NxCx **W N** zzz<ETX><CR><LF>
Parameters	z The number of measurement averages from 001 to 128.

	Command
Example	Send: <22><2>N1C1 W N 002<3><13><10> The number of measurement averages is set to 2.

Please note that a high average number increases the response time of the NIVEL200 sensor.

5 Storage of Parameters

5.1 General

Overview

The following control instructions are available:

Parameter	Description
PD	Set default parameters
PR	Overprint parameters with values from the non-volatile memory
PS	Transfer parameters to the non-volatile memory

In order to change the adjustment or communication parameters and save the new values in the non-volatile memory, switch P (adjustment parameters) or switch B (communication parameters) must be set to 'ON'. This is a precaution against overprinting these parameter groups by mistake.

5.2 Default Parameters

Description

Command **PD** overwrites the current settings of the variable parameters and replaces them with the default values.

Set

PD

Call this command to reset the variable parameters by the default values.

	Command
Send syntax	<SYN><STX>NxCx **PD**<ETX><CR><LF>
Example	Send: <22><2>N1C1 PD<3><13><10> The command PD overwrites the current settings.

5.3 Restore the Last Set of Parameters

Description

Command **PR** overwrites the variable parameters by values from the non-volatile memory.

Set

PR

Call this command to overwrite the variable parameters by values from the non-volatile memory.

	Command
Send syntax	<SYN><STX>NxCx **PR**<ETX><CR><LF>
Example	Send: <22><2>N1C1 PR<3><13><10> The command PR overwrites the variable parameters by values form the non-volatile memory.

5.4 Transfer to the Non-Volatile Memory

Description

Command **PS** transfers the variable parameters to the non-volatile memory.

Set

PS

Call this command to transfer the variable parameters to the non-volatile memory.

	Command
Send syntax	<SYN><STX>NxCx **PS**<ETX><CR><LF>
Example	Send: <22><2>N1C1 PS<3><13><10> The command PS transfers the variable parameters to the non-volatile memory.

6 Execute a Measurement

6.1 General

Overview

NIVEL200 sensor generates three parameters, called signals and a status:

Parameter	Description
X, Y	Indicates the detected inclination.
T	Indicates the measured temperature.
A	Indicates the detected inclination and measured temperature.
P	Indicates the status.

Additional there are two measurement modes available.

The signals are not stored.

Specification

Signals	Unit	Resolution
X	mrad	0.001
Y	mrad	0.001
T	°C	0.1
P	string	-

Refer to "7 Check & Adjust".

6.2 Inclination

Description

The parameter **X** and **Y** represent the inclinations.

The NIVEL200 sensor detects inclinations at a rate of once a second. Before being displayed, these values are then corrected according to the correction factors.

Read inclinations-cross value X

G X

Call this command to get the inclinations-cross value X.

	Command
Send syntax	<SYN><STX>NxCx **G X**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **X:vz.zzz**<ETX>ss
Parameters	Refer to NIVEL200 User Manual.
Example	Send: <22><2>N1C1 G X<3><13><10> Return: <22><2>C1N1 X:-0.082<3><2><202>

Read inclinations-length value Y

G Y

Call this command to get the inclinations-length value Y.

	Command
Send syntax	<SYN><STX>NxCx **G Y**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **Y:vz.zzz**<ETX>ss
Parameters	Refer to NIVEL200 User Manual.
Example	Send: <22><2>N1C1 G Y<3><13><10> Return: <22><2>C1N1 Y:+0.292<3><2><204>

6.3 Temperature

Description

The temperature inside the NIVEL200 sensor is measured every 10 seconds and the signal is directly accessible.

Read

G T

Call this command to get the temperature value.

	Command
Send syntax	<SYN><STX>NxCx **G T**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **T: vz.z**<ETX>ss
Parameters	Refer to NIVEL200 User Manual.
Example	Send: <22><2>N1C1 G T<3><13><10> Return: <22><2>C1N1 T:+24.2<3><2><146>

6.4 Inclination and Temperature

Description

This command is a combination from "6.2 Inclination" and "6.3 Temperature".

Read

G A

Call this command to get the inclinations and temperature signals together.

	Command
Send syntax	<SYN><STX>NxCx **G A**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **X:vz.zzz Y:vz.zzz T:vz.zz**<ETX>ss
Parameters	Refer to "6.2 Inclination" and "6.3 Temperature"
Example	Send: <22><2>N1C1 G A<3><13><10> Return: <22><2>C1N1 X:-0.084 Y:+0.296 T:+24.4<3><6><74>

6.5 Operating Range

Description

The status of the NIVEL200 sensor is given by the string

- 'OK' (correct) or
- 'F' (incorrect).

Read

G P

Call this command to get the status of the NIVEL200 sensor.

	Command
Send syntax	<SYN><STX>NxCx **G P**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **r**<ETX>ss
Parameters	p The operating range is OK or F.
Example	Send: <22><2>N1C1 G P<3><13><10> Return: <22><2>C1N1 OK<3><1><173>

6.6 Signal Acquisition

Measurement modes

There are two measurement modes available for the NIVEL200 sensor:

Mode	Mode
Continuous	• The actual measured value is transferred when requested. After each scan the mean of the last N measurements is calculated and displayed. • Indicates the continuous operating mode. • The triggering mode is disabled in the CONT mode.
Triggered	• In the triggered mode NIVEL200 sensor waits for an instruction before measuring. • Indicates the status of the control logic in the trigger operating mode. • The triggering logic is enabled in the PRE operating mode.

Trigger mode

To prepare a measurement in the trigger mode refer to "4.3 Trigger Mode".

Read

R TS

Call this command to read the trigger status.

	Command
Send syntax	<SYN><STX>NxCx **R TS**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **ts**<ETX>ss
Parameters	ts The trigger status is A, S, SM or OFF.

	Command
Remarks	The trigger status is set as default to OFF. Refer to "Appendix B Legend of Variables".
Example	Send: <22><2>N1C1 R TS<3><13><10> Return: <22><2>C1N1 OFF<3><1><238>

Trigger measurement

TT

Call this command to measure the current value.

	Command
Send syntax	<SYN><STX>NxCx TT<ETX><CR><LF>
Example	Send: <22><2>N1C1 TT<3><13><10> The current value will be measured and saved.

The instruction TT causes the current value to be measured and saved. It can then be requested any number of times until a new trigger signal results in a new measurement. This procedure makes it possible for several inclination NIVEL200 sensors to measure at the same time and then to be queried later in sequence.

7 Check & Adjust

7.1 Overview

Adjustment parameters

There are three adjustment parameters:

Parameter	Description
OX	Offset in the X axis
OY	Offset in the Y axis
OT	Temperature measurement offset

Saving adjustment parameters

Should it be necessary to set a adjustment parameter the new value must be written into the memory. Refer to "5 Storage of Parameters".

To avoid rounding errors all corrections are calculated internally with a resolution of more than five decimal places. Only the final result is rounded to four significant decimal places.

7.2 Parameter Write Status

Description

Switch **P** enables the adjustment parameters to be changed. Parameters cannot be changed whilst P is OFF. With **P** set to ON they can be changed and saved in the non-volatile memory.

Read

RS P

Call this command to read the parameter write status.

	Command
Send syntax	<SYN><STX>NxCx **RS P**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **sw**<ETX>ss
Parameters	sw The parameter write status is either on or off.
Remarks	The default value for sw is OFF.
Example	Send: <22><2>N1C1 RS P<3><13><10> Return: <22><2>C1N1 OFF<3><1><238>

Set

S P sw

Call this command to set the parameter write status either on or off.

	Command
Send syntax	<SYN><STX>NxCx **S P sw**<ETX><CR><LF>
Parameters	The parameter write status is either on or off.
Example	Send: <22><2>N1C1 S P ON<3><13><10> Enables the parameter write status.

☞

In order to change the adjustment parameters and save the new values in the non-volatile memory, switch **P** must be set to ON. This is a precaution against overprinting these parameter group by mistake.

7.3 Inclinations Offset

Description

These functions allow you to adjust the offset or zero point of the NIVEL200 sensor.

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

Refer to NIVEL200 User Manual "4.2 Offset Adjustment" for more information on requirements and step-by-step procedures.

Read the X-tilting offset

RP OX

Call this command to read the X-tilting offset.

	Command
Send syntax	<SYN><STX>NxCx **RP OX**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **vz.zzzz**<ETX>ss
Parameters	vz.zzzz The X-tilting offset. Refer to "Appendix B Legend of Variables".
Example	Send: <22><2>N1C1 RP OX<3><13><10> Return: <22><2>C1N1 +0.0000<3><2><92>

Write the X-tilting offset

WP OX

Call this command to write the X-tilting offset.

	Command
Send syntax	<SYN><STX>NxCx **WP OX vz.zzzz**<ETX><CR><LF>

	Command
Remarks	vz.zzzz The X-tilting offset. Refer to "Appendix B Legend of Variables".
Example	Send: <22><2>N1C1 WP OX +0.0020<3><13><10> The inclination-cross value X is re-adjusted.

Read the Y-tilting offset

RP OY

Call this command to read the Y-tilting offset.

	Command
Send syntax	<SYN><STX>NxCx **RP OY**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **vz.zzzz**<ETX>ss
Parameters	vz.zzzz The Y-tilting offset. Refer to "Appendix B Legend of Variables".
Example	Send: <22><2>N1C1 RP OY<3><13><10> Return: <22><2>C1N1 +0.0000<3><2><92>

Write the Y-tilting offset

WP OY

Call this command to write the Y-tilting offset.

	Command
Send syntax	<SYN><STX>NxCx **WP OY vz.zzzz**<ETX><CR><LF>
Remarks	vz.zzzz The Y-tilting offset. Refer to "Appendix B Legend of Variables".

	Command
Example	Send: <22><2>N1C1 WP OY -0.0020<3><13><10> The inclination-length value Y is re-adjusted.

7.4 Temperature Offset

Description

These function allows you to adjust the temperature offset.

Read

RP OT

Call this command to read the temperature offset.

	Command
Send syntax	<SYN><STX>NxCx **RP OT**<ETX><CR><LF>
Return syntax	<SYN><STX>CxNx **vz.z**<ETX>ss
Parameters	vz.z The temperature offset. Refer to "Appendix B Legend of Variables".
Example	Send: <22><2>N1C1 RP OT<3><13><10> Return: <22><2>C1N1 +0.0<3><1><204>

Write

WP OT

Call this command to write the temperature offset.

	Command
Send syntax	<SYN><STX>NxCx **WP OT vz.z**<ETX><CR><LF>
Remarks	vz.z The Y-tilting offset. Refer to "Appendix B Legend of Variables".
Example	Send: <22><2>N1C1 WP OT +2.0<3><13><10> The temperature value T is re-adjusted.

7.5 Adjustment of the Circular Level

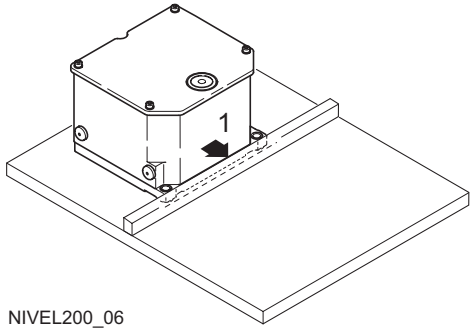
Description

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

Requirements

A plane-parallel plate with flatness within 0.01 mm.

Adjustment step-by-step

Step	Description
1.	Position the NIVEL200 sensor on a plane-parallel plate.  NIVEL200_06
☞	The bubble of the circular level must be centered. If it extends beyond the circle, use an allen key to centre it.
2.	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.
3.	Repeat the adjustment procedure if the bubble does not stay centered.
☞	After the adjustment, no screw should be left loose.

8 System Reset

Description

The NIVEL200 sensor is returned to its normal state upon switching on. All incompletely executed instructions and measurements being carried out are aborted, except the baud rate, which is retained and does not return to its switch-on value. The status of the NIVEL200 sensor is otherwise identical to that when switching on.

Reset

RES SYS

Call this command to reset the system.

	Command
Send syntax	<SYN><STX>NxCx **RES SYS**<ETX><CR><LF>
Example	Send: <22><2>N1C1 RES SYS<3><13><10>

9 Instructions For Writing a Control Program

Requirements

A user can write a control program provided that the following equipment and programming knowledge is available:

- a computer with a serial interface
- a programming language which permits a serial interface to be programmed
- a sufficient knowledge of the programming language, enabling program iterative loops, conditional branches and the interface control.

Summary of programming principles

Principles	Description
1. (Only RS485)	In order to set up a system with several NIVEL200 sensors, each NIVEL200 sensor must first be assigned its own unique address. This requires that each NIVEL200 sensor be connected individually to the computer. This avoids any risk of two NIVEL200 sensors in the system having the same address and being unable to be differentiated. Refer to "3.3 Addresses".
2. (Only RS485)	Since several NIVEL200 sensors are connected to the bus, it can never be guaranteed that a data block reaches its destination. It is therefore good programming practice to check every instruction, which changes a parameter, and to repeat it if necessary.

Principles	Description
3. (Only RS485)	Although possible, it is not recommended to send a request for a parameter or a value to a general address. In such a case NIVEL200 sensor would endeavor to avoid a collision but the possibility exists for several of them to start transmitting simultaneously. Their responses would then be corrupted. The computer would then have to repeat the request. Refer to "6.6 Signal Acquisition".
4.	The time required by NIVEL200 sensor to generate a response is 100 ms to 2 s depending on the instruction and the parameter values. It is necessary to wait until an instruction has been received following every request for a measured value or a parameter. The best way of doing this depends on the programming language being used.
5.	Whilst one instruction is being processed, NIVEL200 sensor is able to receive another one. This is normally sufficient to enable a complete sequence of instructions to be processed. Some instructions, however, require longer to process (for example 'RES SYS' about 1 s, 'G A' about 2 s). A corresponding waiting time must therefore be included after these instructions.
6.	It is not advisable to send further instructions after requesting a parameter or a value before the response has been received, or the waiting time given in Point 4 has expired. Failing to do this might result in a bus collision, i.e. the instruction could collide with the response from the NIVEL200 sensor to the previous request.

Angular units

The NIVEL200 sensors measured values X and Y are in mrad (0.001 rad). The following factors convert the measured values to other angular units:

cc	"	mrad	µrad
1	0.324	1.570796E-3	1.570796
3.08641975	1	4.848136E-3	4.848136
636.61977	206.2648062	1	1000
0.63661977	0.206264806	0.001	1

360° = 400 gon = 6400 mil = 6.283185... rad

Appendix A List of Instructions

A.1 Complete List

Complete List of Instructions

Command	Description
G A	Get all values
G P	Get posicon signal
G T	Get T value
G X	Get X value
G Y	Get Y value
PD	Parameter default
PR	Parameter restore
PS	Parameter save
R N	Read number
R TS	Read trigger status
RB A	Read addresses
RB B	Read baud rates
RB D	Read device number
RB I	Read device identifier
RES SYS	System reset
RP OT	Read temperature off-set

Command	Description
RP OX	Read X off-set
RP OY	Read Y off-set
RS B	Read bus parameter mode
RS C	Read compensation status
RS M	Read trigger mode
RS P	Read parameter write status
S B sw	Set bus parameter write on/off
S C sw	Set compensation on/off
S M t	Set trigger mode cont/pre
S P sw	Set parameter write on/off
TT	Trigger
W N zzz	Write number
WB A ny	Write group address
WB A Nx	Write device address
WB B b	Write baud rate
WB I str	Write device identifier
WP OT vz.z	Write temperature off-set
WP OX vz.zzzz	Write X off-set
WP OY vz.zzzz	Write Y off-set

A.2 List According to Function

Communication

Command	Description
RB A	Read addresses
RB B	Read baud rates
RB D	Read device number
RB I	Read device identifier
RS B	Read bus parameter mode
S B sw	Set bus parameter write on/off
WB A ny	Write group address
WB A Nx	Write device address
WB B b	Write baud rate
WB I str	Write device identifier

Prepare a Measurement

Command	Description
R N	Read number
RS C	Read compensation status
RS M	Read trigger mode
S C sw	Set compensation on/off
S M t	Set trigger mode cont/pre
W N zzz	Write number

Non-volatile storage of parameter

Command	Description
PD	Parameter default
PR	Parameter restore
PS	Parameter save

Execute a Measurement

Command	Description
G A	Get all values
G P	Get posicon signal
G T	Get T value
G X	Get X value
G Y	Get Y value
R TS	Read trigger status
TT	Trigger

Adjustment

Command	Description
RP OT	Read temperature off-set
RP OX	Read X off-set
RP OY	Read Y off-set
RS P	Read parameter write status
S P sw	Set parameter write on/off

Command	Description
WP OT vz.z	Write temperature off-set
WP OX vz.zzzz	Write X off-set
WP OY vz.zzzz	Write Y off-set

Exception handling

Command	Description
RES SYS	System reset

Appendix B Legend of Variables

Variables chart

Abbreviation	Description	Value
b	Baud rate code	0|1|2|3|4
fn	Firmware version	Up to 8 Bytes
n	Group No.	1|2|3|4|5|6|7
p	Operating range	OK ¦ F
sn	Serial No.	zzzzzz
str	Printable ASCII characters	Up to 11 Bytes
sw	Switches	ON I OFF
t	Trigger mode	CONT I PRE
ts	Trigger status	A I S I SM I OFF A = armed, trigger ready S = saved, measurement completed and value saved SM = multiple trigger, several trigger signals received without read request OFF =operation mode CONT for continuous measurement
v	Sign	+ I -
x	Device No.	0|1|2…8|9|A|B…X|Y|Z

Abbreviation	Description	Value
y	Group No.	0|1|2…8|9|A|B…X|Y|Z
z	Number	0|1|2|3|4|5|6|7|8|9

Appendix C ASCII Table

ASCII character chart, part 1/3

Value decimal	hex	Character	Value decimal	hex	Character	Value decimal	hex	Character
0	00	NUL	16	10	DLE	32	20	space
1	01	SOH	17	11	DC1	33	21	!
2	02	STX	18	12	DC2	34	22	"
3	03	ETX	19	13	DC3	35	23	#
4	04	EOT	20	14	DC4	36	24	$
5	05	ENQ	21	15	NAK	37	25	%
6	06	ACK	22	16	SYN	38	26	´
7	07	BEL	23	17	ETB	39	27	&
8	08	BS	24	18	CAN	40	28	(
9	09	HAT	25	19	EM	41	29	)
10	0A	LF	26	1A	SUB	42	2A	*
11	0B	VT	27	1B	ESC	43	2B	+
12	0C	FF	28	1C	FS	44	2C	,
13	0D	CR	29	1D	GS	45	2D	-
14	0E	SOH	30	1E	RS	46	2E	.
15	0F	SI	31	1F	US	47	2F	/

ASCII character chart, part 2/3

Value decimal	hex	Character	Value decimal	hex	Character	Value decimal	hex	Character
48	30	0	66	42	B	84	54	T
49	31	1	67	43	C	85	55	U
50	32	2	68	44	D	86	56	V
51	33	3	69	45	E	87	57	W
52	34	4	70	46	F	88	58	X
53	35	5	71	47	G	89	59	Y
54	36	6	72	48	H	90	5A	U
55	37	7	73	49	I	91	5B	[
56	38	8	74	4A	J	92	5C	\
57	39	9	75	4B	K	93	5D	]
58	3A	:	76	4C	L	94	5E	^
59	3B	;	77	4D	M	95	5F	_
60	3C	<	78	4E	N	96	60	`
61	3D	=	79	4F	O	97	61	a
62	3E	>	80	50	P	98	62	b
63	3F	?	81	51	Q	99	63	c
64	40	@	82	52	R	100	64	d
65	41	A	83	53	S	101	65	e

ASCII character chart, part 3/3

Value decimal	hex	Character
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w

Value decimal	hex	Character
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	|
125	7D	}
126	7E	~
127	7F	DEL

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