

General Notice

Digital levels
NA2002/NA3003 V3.2

Staff Overview

Standard Staffs
GNLE4C/GBNL4C

Invar-Coded Staffs
GPCL2/GPCL3

SURVEYORS-EXPRESS™

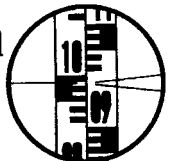
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General Notice



This user manual contains important safety directions (chapter 1) as well as instructions for setting up the instrument and operating it. Read carefully through the user manual before you switch on the instruments.

Product identification

The instrument model is indicated on the housing of your unit, and the serial number on the underside. Enter this information in your user manual, and always refer to it when you need to contact your agency or service workshop.

Type: _____

Serial number: _____

Meaning of symbols

The symbols used in this user manual have the following meanings:

**DANGER:**

Indicates an imminently-hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING:**

Indicates a potentially-hazardous situation which, if not avoided, could result in death or serious injury

**CAUTION:**

Indicates a potentially-hazardous situation which, if not avoided, may result in minor or moderate injury and/or appreciable material, financial and environmental damage. The symbol is also used to alert against unsafe practices.



Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically-correct and efficient manner.

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1. Using the instrument and staff

Surveying instruments are only fully productive if they are carefully handled, kept clean, and used such that the chosen surveying method is matched to the attributes of the instrument concerned. The instruction manual belongs with the instrument: please read it to obtain full benefit of the instrumentation.

1.1. Care and storage

Cleaning and drying: The telescope lens and ocular should be handled with extreme care. Before cleaning the glass, blow away any dust. Never touch the glass with your fingers. To clean, use a clean, soft cloth. Breathing on the lens before cleaning is allowed. If necessary, damp the cloth using pure alcohol.

Storage: Always unpack damp or wet instruments as soon as you get back from the field. Dry out and clean the instrument, the transport case, foam inserts and accessories. Only pack the instrument when fully dry.

If working in extremely cold temperatures never bring the instrument into the warm, but instead store it in a protected area at outside temperature. In this way you will hinder the build-up of condensation on the lens and inside the instrument which would have otherwise occurred when you took the instrument from warm quarters into the cold outside temperatures when work resumed.

Cable and connectors: Connectors should not be allowed to become dirty or wet. Dirty cable connectors should always be rinsed with pure alcohol and left to dry.

1.2. Test before use

Before beginning any fieldwork the instrument should be tested and adjusted according to the user manual (two-peg test and bull's-eye level). It is also recommended to do this after use, after long pauses and after lengthy travelling.

Also test the correct adjustment of the staff bull's-eye level. The staff can be positioned in the vertical by using an previously adjusted level.

1.3. Temperature adjustment

When there is a large temperature difference between the instrument and the surrounding air, leave the instrument to stand until it has reached the

temperature of the air. As a rule of thumb it takes roughly one minute to change 1°C, i.e. for a 20°C temperature difference you should leave the instrument to stand for 20 minutes. For high-precision levelling it is nevertheless highly recommended to leave the instrument to stand for double this time.

1.4. Transport and shipping

When transporting the instrument via land, sea or air, it is necessary to pack the instrument in such a way as to be shock-proof. Whenever possible, use the correct Leica transport case.

Whenever sending the instrument as freight (e.g. post, rail or air freight), pack the instrument in the Leica transport case and pack that in the original freight carton in which the instrument was delivered. Only empty (discharged) batteries should be included in the instrument or case on safety grounds. Charged batteries should always be taken in personal hand baggage.

1.5. Dangers when working with a staff in the vicinity of electrical installations



For your own safety read and follow the following instructions:

Whenever working with a staff in the vicinity of electrical installations (e.g. electric railways, high-tension cables, transmitters, etc.) there is always a danger of deadly electric shock. This danger is independent of what material the staff is made from: conductive (e.g. aluminium or steel) or non-conductive (e.g. wood or plastic).

If the work in or near such installations is necessary, every precaution must be taken, the permission from the responsible safety officer received, and any instruction strictly adhered to.

2. The equipment

2.1. The tripod

For simple levelling you should use either the standard tripod GST20, or the lighter GST05/GST05L, all having adjustable legs. For high-precision levelling in level terrain, the tripod GST40 can increase the stability of the instrument due to its rigid legs.

The tripods GST20/GST40 have a protective cap, in whose underside is stored the Allen key used to tighten the tripod screws.

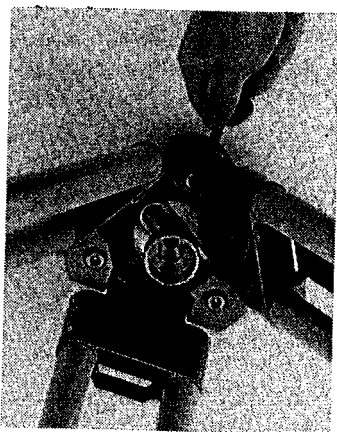


Figure 1 Checking and securing the tripod screws

The individual tripods legs should never be loose in their sockets but should always be held tight. If necessary, tighten the Allen screw above and between each pair of supports.

The clamping force of each joint of the tripod head can also be regulated (see figure). If the tripod, with its legs open, is lifted from the ground by the tripod head, the legs should all remain just open at their original positions. All three legs should slide uniformly.

You should control the firm seating of the leg tips once on a while. If the tips wobble, tighten the fixing screw slightly.

2.2. The level

2.2.1. Setting-up the instrument

When setting up the tripod, the legs should be firmly trodden down onto the ground. At the same time you should make sure that the top of the tripod remains reasonably level and that the eyepiece will be at the observer's eye-level.

The instrument is then placed on to the tripod and tightly fixed using the central fixing screw.

The instrument must never be left loose on top of the tripod.

Therefore:

- if you place the instrument on the tripod you should **immediately** screw it into place;
- whenever you unscrew the instrument from the tripod you should **immediately** remove it from the same.

2.2.2. Levelling and centring

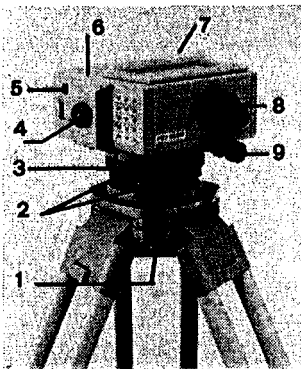


Figure 2 NA2002/NA3000 Front view

- 1 Central fixing screw
- 2 Tripod screws
- 3 Horizontal circle
- 4 Telescope eyepiece
- 5 Bull's-eye level, viewed from user's side
- 6 Bull's-eye level, viewed from above
- 7 Aiming sight
- 8 Focusing drive
- 9 Endless horizontal drive

Levelling the instrument

By adjusting the tripod screws (2), place the bubble of the bull's-eye level (5) in the middle of the centring circle. The tripod screws should no longer be adjusted. The bull's-eye level should be checked throughout the surveying process (to control if the instrument has been inadvertently moved).

Centring over a point in the ground

If you ever have to centre the instrument over a point, e.g. if you need to take horizontal angle measurements, use the plumb bob found in the tripod pocket. Insert the plumb bob socket into the central fixing screw (1) from underneath and fully tighten to the right. Set-out the tripod such that the top remains approximately level and the plumb bob hangs down vertically over the ground. Now tread the leg tips into the ground in such a way that the centring remains within 1 to 2cm of the point. Now release the central fixing screw and shift the instrument until the plumb bob is once again directly above the point, and tighten the fixing screw again.

2.2.3. Focusing the reticule

The observer should make sure that the cross-hair reticule is correctly and sharply focused. For each person, this is different.

To focus the reticule you must first aim the telescope towards an evenly lit, bright surface. Turn the eyepiece ring ((4), page 5) until the reticule appears very dark. By slightly turning the ring first in one direction, then the other, find the average position for the optimal sharpness. The respective number on the dioptre scale is your personal adjustment figure to which other instruments may be correctly adjusted before commencing work.

To check, look through the telescope and move your head slightly from side to side, top to bottom: the reticule should no longer appear to move relative to the staff, i.e. it is free from parallax.

2.2.4. Targeting and focusing

Aiming at the staff

Looking through the aiming sight ((7) page 5), turn the instrument by hand around its vertical axis until the staff is coarsely lined-up. Next, by looking through the telescope, focus on the staff and perform the fine aiming at the staff centre using the endless horizontal drive ((9) page 5).

Focusing

The view through the telescope, i.e. the aimed-at staff, is focused sharply using the focusing drive ((8) page 5).

3. Taking the measurement

3.1. Reading the staff and distance measurement by eye

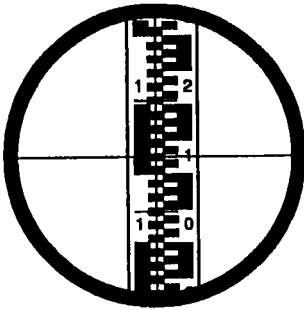


Figure 3 Optically reading the staff

Aim the reticule at the cm-divisions of the staff. Before taking a measurement, make sure that the instrument is levelled-up by glancing at the bull's-eye level. The reading is taken from where the horizontal hair of the reticule crosses the scale. The metre and decimetre values are taken directly from the figures, and the centimetres from the number of complete red and white fields above the next-lowest decimetre line. The millimetres are judged by eye from the bisected centimetre field. Because the staff image is upright, the values increase from bottom to top.

Example in figure 3.

Height reading = 112.6cm

Distance:

Reading above = 120.5cm

Reading below = 105.6cm

Distance = 14.9m

Optical distance measurement

The *horizontal* distance between instrument and staff can be found using the two *stadia hairs* found on the vertical crosshair (see figure above). The part of the staff found between these two stadia hairs is equal to 1/100 of the distance (accuracy 1:500). The staff should be read at the upper and lower marks (in cm) - the difference, when multiplied by 100, gives the horizontal distance in metres.

The reading can be simplified by turning the foot-screw nearest to the telescope axis until the lower distance mark coincides with a decimetre line. You can now read the difference in cm directly from the upper mark. You save time by not having to read two unrounded values and having to calculate the difference.

3.2. Measuring against the light

When measuring against the light (also by electronic measurement) you can shield the telescope objective with a hand.

3.3. Wind / Vibration

Strong winds or ground vibrations can start the compensator of automatic levels oscillating, and the picture through the telescope begins to tremble. You can stop the vibration by firmly holding the top of the tripod legs. The aiming is not influenced because the compensator automatic levels again.

3.4. Angle measurement

The horizontal circle ((3) page 5) can be turned to any direction by hand to read 0.0 or any other value when reading horizontal angles or setting-out.

If you are using the staff as the signal pole for your horizontal angle measurements, it is most accurate to aim the vertical cross-hair at the centre of the centimetre divisions.

4. The levelling

4.1. Line levelling

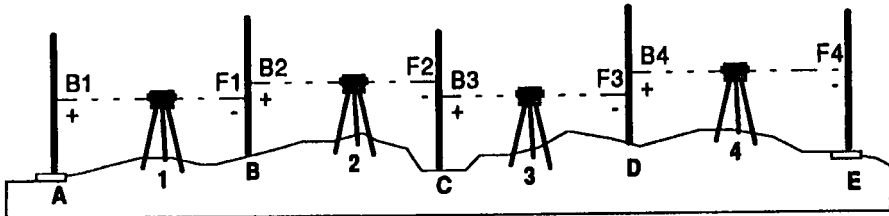


Figure 4 Line levelling between A and E

To measure the height difference between two points, e.g. A and E, you must choose intermediate points placed between 40m and 50m apart (20-25m with precise levelling).

From the first instrument position the measurement B_1 is taken to the staff at position A ($B_1 =$ Backsight from position 1). After a successful measurement has been taken, the staff is carried passed the instrument. As the staffman is doing this he counts how many paces it took him to reach the level. He uses this figure again to position the staff at roughly the same distance from the level on the other side. The observer now aims the telescope at the staff at position B and measures the foresight, B_1 . The observer now carries the level past position B to station 2. He chooses his position such that the next pair of back- and fore- sights can be made at roughly the same distance. The staffman now turns the staff carefully around so that the staff divisions face once more toward the instrument. The measurements B_2 and F_2 now follow. The measurements all the way to E are performed in much the same way.

By choosing the same distances for each pair of back- and fore- sights it is possible to eliminate certain instrument adjustment errors. For more precise measurements, the rule described should be used.

The height difference between A and B is obtained from the difference $(B_1 - F_1)$, from B to C from $(B_2 - F_2)$, etc., and all with a positive sign so long as the height increases. The total height difference between A and E (ΔH) is the same as all of the differences $(B_i - F_i)$. It is also the same as the difference between the sum of all B minus the sum of all F. Therefore, $\Delta H = \Sigma(B_i - F_i) = \Sigma(B_i) - \Sigma(F_i)$. The second equation is used to test the arithmetic.

To protect from coarse errors (or blunders) take care to measure in both directions when line levelling (double levelling), i.e. in our example from A to E (fore) and then from E back to A (back).

In sunny weather you should protect the instrument and staff with a parasol if you wish to obtain more accurate results.

The ground under the staff should be firm enough such that during the measurement the staff does not sink or move. After the instrument has been moved the staff must be turned towards it again. It is necessary to watch carefully that the ground plate does not slip nor lean away.

If a line levelling has to be performed across a wide river or valley with over-dimensioned aiming distances the requirement for equal aiming distances cannot be easily upheld. Apart from this, the reading of the staff over great distances is made difficult, if not impossible.

In these cases you should use a theodolite instead of a level. By reciprocal and simultaneous measurements of small vertical angles to special targets, it is possible to perform the surveying more quickly and accurately.

4.2. Area levelling

This term should be interpreted as the measurement of many points in the terrain, from just one, central station. The instrument horizon is so chosen that the highest point can still be surveyed.

If you are surveying a large area it is perhaps easier to use a regular grid. In this way the X/Y-position of terrain points can be easily reconstructed.

If you are making a local height map then the instrument horizon can be given any figure, e.g. 10m. The height of each surveyed point is thus found by subtracting the staff reading from the instrument height (10m).

In other circumstances, when the surveyed points have to be tied into a fixed point network, the heights (above mean sea level) must be first obtained by line levelling from a fixed point in the surrounding area, or by direct backsights to such a point.

Unlike line-levelling, where the aiming points are roughly the same distance from the instrument, in area levelling the individual distances can be very different. Because of this, and in view of the required accuracy and use to which

the survey results are put, any instrument-collimation error, or the influence of the earth's curvature, must be taken into account.

The instrument-collimation error can be controlled by taking control measurements to a fixed reference point before, (during,) and after the surveying. The readings must remain constant.

When surveying in bright sunlight it is recommended to place the tripod and instrument under the shadow of a parasol, especially if they are to remain stationary for a considerable amount of time.

4.3. Precision levelling

The following section covers only general rules and notes. They are by no means complete. Country-specific regulations must also be followed.

A general note:

- When turning a staff on a change point towards the level it must be turned whilst still on the ground plate. Lifting and lowering again to the ground plate should be avoided.
- At midday under intense sunshine the problem of refraction is particularly noticeable, whereby the measurements can be falsified. Avoid taking measurements at this time of day. Care should also be taken when aiming over asphalt surfaces or car roofs due to the refraction generated.
- Temperature affects the staff scale. For precise measurements the **temperature of the staff** should be taken and used for corrections. For more information consult section 5 concerning the Invar-coded staff.

Particular attention should be paid to the avoidance of systematic errors:

- To compensate for possible residual errors in the automatic compensation you should centre the bubble within the bull's-eye level alternately in one direction then the other (fore- and back- sight), etc.. If you are working simultaneously with two staffs you get the correct sequence if you always aim the instrument for levelling-up towards the same staffman.

- **By always using the same aiming distance** for forward- and back-sights you can eliminate most of the collimation errors, earth curvature and atmospheric refraction.
To keep the aiming distances balance to within a few decimetres it is recommended to determine the instrument and staff positions, using a measuring tape, beforehand.
From the digital level it is also possible to measure a distance for checking out the other functions.
- If with simple line-levelling two Invar-staffs are simultaneously used (i.e. alternately), then the **difference of the staff zero-point errors** must be taken into consideration. The zero-point difference plays no effect if the surveying is ended by aiming at the same staff it was started with. From this requirement you should always use an even number of stations.
- A systematic error is generated if **the staff or tripod sinks into the ground**, in that a misclosure can be found in the forward- and back-measurements (absolute value of the rises is larger than of the falls). This type of error can be minimised by firmly treading the tripod legs and the ground plate into the ground. What is important is that during the changing of positions, the height of the tripod or staff does not change. On asphalt surfaces it is better to use a ground plate with a large supporting area.
- **Vertical positioning of the Invar-coded staff**
It is imperative that the staff also stands exactly vertical. If a staff stands somewhat inclined in the direction of the instrument, even with the digital measurement system a systematic error will result. Make sure that the bull's-eye level has been correctly adjusted.

Measuring at the ends of a staff (with coded staffs):

For the highest accuracy the complete vertical field of view through the telescope should be covered by the staff (image processing with the maximum amount of code information). When aiming at the ends of a staff this requirement can no longer be upheld because the code reaches to half way across the field of view (at least).

The 1% rule can be used as a rule of thumb: reduce the effective staff length on top and on the bottom by 1% of the distance to the staff. In this way the field of view should be 80% full of the coded staff.

Example for a 3m Invar staff:

Distance = 10m: Max. staff reading = 2.90m (3m - 10cm)

Min. staff reading = 0.10m

Distance = 20m: Max. staff reading = 2.80m (3m - 20cm)
Min. staff reading = 0.20m

etc.

Target distance:

Just as with optical levelling, the distance to the target (staff) should not be more than 25-30m. On gradients (greater than 4%) it is recommended not to aim at the lowest 30-50cm of the staff due to the extreme refraction which can be encountered so close to the ground.

Parasol:

The instrument and tripod should never be directly exposed to sunshine. Always use a parasol in such circumstances!

Double measurements:

As previously performed with optical levels, double measurements (BFFB BFFB ...) serve to cover reading errors and the control of staff- and instrument-movements (sinking) during the measurements.

As the 'human' reading error is no longer a problem with digital levels, double measurement could be necessary just because of the problem of sinking. Because the time it takes to perform a measurement using a digital level is so much shorter than with an optical level, the problem of sinking does not carry so much weight, so that when measuring on firm ground it can be negligible and double measurement need not be performed.

5. Safety directions

The following directions should enable the person responsible for the NA2002/3003, and the person who actually uses the instrument, to anticipate and avoid operational hazard.

The person responsible for the instrument (see section 5.3, "Responsibilities") must ensure that all users (see section 5.3, "Responsibilities") understand these directions and adhere to them.

5.1. Intended use of instrument

5.1.1 Permitted uses

The NA2002/3003 digital levels are designed and suitable for the following applications, within the limits of their intended conditions of use:

- Measuring heights and distances on staffs, with or without recording of the results.

5.1.2 Prohibited uses

- Activation of the digital level without instruction.
- Activation outside the range of conditions for which the instrument is intended (see section 5.2 "Limits to use").
- Deactivation of safety systems and removal of hazard notices.
- Opening of the product by using tools (e.g. screwdriver), unless this is specifically permitted for certain functions.
- Modification or conversion of the product.
- Activation after misappropriation.
- Use of accessories from other manufacturers without the express approval of Leica.
- Aiming directly into the sun.
- Inadequate safeguards at the site.



WARNING: Prohibited use can lead to injury, malfunction and damage. It is the task of the person responsible for the instrument to inform the user about hazards and how to counteract them.

The NA2002/3003 digital levels are not to be operated until the user has been instructed how to work with them.

5.2. Limits to use

Refer to the technical data in chapter 2, section 15.

Environment:

Suitable for use in an atmosphere appropriate for permanent human habitation (no protection in an aggressive or explosive environment). Use in rain is permissible for limited periods.

5.3. Responsibilities

- Responsibilities of the manufacturer of the original equipment
LEICA AG, CH-9435 Heerbrugg (hereinafter referred to as LEICA):
LEICA is responsible for supplying the product, including the user manual and original accessories, in a completely-safe condition.

- Responsibilities of the manufacturers of non-LEICA accessories:



The manufacturers of non-LEICA accessories for the NA2002/3003 digital levels 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 product.

- Responsibilities of the person in charge of the instrument:



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

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

- To understand the safety instructions on the product and the instructions in the user manual.
- To be familiar with local regulations relating to accident prevention.
- To inform LEICA immediately if the equipment becomes unsafe.

5.4. Hazards in use

5.4.1 Main hazards in use



WARNING: The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or prohibited 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 instrument.



CAUTION: Watch out for erroneous distance measurements if the instrument is defective or if it has been dropped or has been misused or modified.

Precautions:

Periodically carry out test measurements and perform the field adjustments indicated in the user manual, particularly after the instrument has been subjected to abnormal use and before and after important measurements.



DANGER: Because of the risk of electrocution, it is very dangerous to use staffs in the vicinity of electrical installations such as power cables or electric railways.

Precautions:

Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.



WARNING: By surveying during a thunderstorm you are at risk from lightning.

Precautions:

Do not carry out field surveys during thunderstorms.



WARNING: Inadequate safeguarding of the survey site can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

Always ensure that the survey site is adequately safeguarded. Adhere to the regulations governing accident prevention and road traffic.



WARNING: If computers intended for 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 our instruments.



CAUTION: Be careful when pointing a digital level towards the sun, because the telescope functions as a burning glass and can injure your eyes or damage the internal components of the instrument.

Precautions:

Try to avoid pointing the telescope directly at the sun.



CAUTION: If the accessories attached to the instrument are not properly secured, and the equipment is subjected to mechanical shock (blows, falling etc.), the equipment may be damaged or people may sustain injury.

Precautions:

When setting up the equipment, make sure that the accessories (e.g. tripod, staff, strut, battery, connecting cables) are correctly adapted, fitted, secured and locked in position. Avoid subjecting the equipment to mechanical shock.



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

Precautions:

Before dispatching or disposing of your equipment, discharge the battery, either by running the instrument in AUTO-OFF mode until it displays "off", or by means of the GKL23 charger.



CAUTION: A strut-supported vertical staff can be blown over by a strong gust of wind, possibly causing injury or damage.

Precautions:

Never leave a strut-supported staff unattended.



WARNING: If the equipment 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 equipment 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:

Dispose of the equipment appropriately in accordance with the regulations in force in your country. Always prevent access to the equipment by unauthorized personnel.

5.4.2 Electromagnetic acceptability

The term "electromagnetic acceptability" is taken to mean the capability of the instrument 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 digital levels meet the strict regulations and standards which are in force in this respect, LEICA 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 digital level is used in conjunction with accessories from other manufacturers (field computers, personal computers, walkie-talkies, non-standard cables, external batteries etc.)

Precautions:

Use only the equipment and accessories recommended by LEICA. When combined with digital levels, they meet the strict requirements stipulated by the guidelines and standards. When using computers and walkie-talkies, pay attention to the information about electromagnetic acceptability provided by the manufacturer.



CAUTION: Disturbances caused by electromagnetic radiation can result in the tolerance limits for measurements being exceeded.

Although the digital levels meet the strict regulations and standards which are in force in this connection, LEICA cannot completely exclude the possibility that the digital level may be disturbed by very intense electromagnetic radiation, for instance near radio transmitters, diesel generators, or high-tension power cables. Check the plausibility of results obtained under these conditions.



WARNING: If a digital level is operated with connecting cables attached at only one of their two ends (e.g. external supply cables, interface cables), the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other instruments may be impaired.

Precautions:

While the digital level is in use, connecting cables (e.g. instrument to external battery, instrument to computer) must be connected at both ends.

5.4.3 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 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 for compliance could void the user's authority to operate the equipment.

Product labelling:

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

5.5. Important user directions or addenda



Take care when measuring through windows, or if there are several reflecting objects in the field of view. Incorrect readings may result.



If the connecting cable or the REC-module is removed during the measurement procedure, data may be lost.
Do not remove the connecting cable or the REC-module until you have switched off the instrument.

5.5.1 Addendum to section 1.1: "Care and storage"



Respect the temperature limits when storing the instrument, particularly in summer if the instrument is inside a vehicle.



Keep the contacts of the REC-module clean and dry.
If the contacts become dirty, clean them with pure alcohol and leave them to dry.

5.5.2 Addendum to section 1.4: "Transport and shipping"



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

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

NA2002 NA3003

User Manual

SW Version 3.2



This user manual contains important safety directions (section 1) as well as instructions for setting up the instrument and operating it. Read carefully through the user manual before you switch on the instruments.

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- A PROG functions: Measurement and service programs**
- B SET functions**
- C-1/2 Stack register for BFFB**
- D-1 Number of decimal places in display of NA3003 (NA2002)**
- D-2 Storage formats: Number of digits in column 6 of data word**
- E Main abbreviations used in displays**

1 Introduction

1.1 What is new? What is different? A comparison with Version 3.0

You can quickly see here below the differences between the new software and the previous Version 3.0 software, and where to find more information about them in the manual.

SW-Version 3.2	NA3003	NA2002
<i>New or expanded functions</i>		
Additional measuring modes in SET MEASURE: - <u>Mean</u> : The mean is taken as previously. - <u>Mean on</u> : The mean is taken with automatic termination when the required standard deviation of the mean value is attained, and with an outlier test. - <u>Median</u> : The result is expressed as the median (central) value together with its band width. Description in sections 5.1.3 and 8.2.	X X X	X X X
Two levels of system accuracy, standard and enhanced, can be selected with the SET function. The standard accuracy is that already obtainable. The time for measuring with enhanced accuracy is about two seconds longer. Description in section 5.1.1.	X	-
The integration time of a measurement can be lengthened. Times between three and nine seconds can be selected with the SET function. Description in section 5.1.2.	X	-
An additional two-peg test, which covers two methods at the same time: - First station in the middle, the second near to a staff - First station in the middle, the second beyond the staffs Description in section 7.1.	X	X
Individual collimation error can be entered manually (SET function). Description in section 7.1.2.	X	X