



EN



Ташев-Галвинг ООД
www.tashev-galving.com

Digital Theodolite **DT-2, DT-5, DT-5L**

*Thank you for purchasing Nivel System digital theodolite.
For best use of purchased instrument ,
please carefully read the manual and keep it in safe place,
to use this manual in the future.*

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INFORMATION FOR THE EU MEMBER COUNTRIES:

The symbol drawn below indicates that this product may not be treated as an ordinary household waste. By storing the product properly you will prevent negative effects on the environment and human health. To get more details about the storage and recycling of this product, please contact the relevant dealer where you purchased the product.





ATTENTION

In case of working in industrial area or near electrical installation operation of the instrument can be disturbed by electromagnetic field. In this case please check before use correctness of instrument operation.

GENERAL USING NOTES

1. Do not aim the instrument at the sun

Aiming instrument at the sun can cause serious eye damage and also damage the instrument. To avoid this problem, please use sun filters.

2. Do not immerse instrument in water

The instrument complies with IPX6 and it is resistant to rain and snow.

3. Setting the instrument on tripod

If it's possible the instrument should be set on a wooden tripod (such as. Nivel System SWW8).

In case of using metal tripod vibrations may occur and affects the measurement accuracy.

4. Tribach installation

Inaccurate installation of tribach affects the measurement accuracy.

Please check the tribach leveling screws. Screw connecting tribach with instrument must be locked, and safety screw must be screwed.

5. Protect instrument against shock

While transporting you instrument you must take all reasonable steps to minimize the risk of exposure to shock. Strong shocks can cause erroneous measurements.

6. Moving the instrument

Always carry the instrument by the handle.

7. Strong heating of the instrument

Do not expose the instrument to strong heat for longer than it is necessary.

8. Battery charge level

Before use check the battery level.

WARNING SUBTITLES

To encourage to safe use of the instrument and to prevent potential dangers to which operator may be exposed and damage to objects in the environment, in the manual you will find the inscriptions which are placed on the instrument.

It is suggested to anyone to familiar with the meaning of the following title and icons before reading the chapter. "PRECAUTIONS" and further text.

Subtitle	Meaning
WARNING	Ignoring this subtitle may cause death or disability.
CAUTION	Ignoring this subtitle may cause body or surrounding objects damage

- The injury means: burns, injury, electric shock, etc..
- The objects are defined as: buildings, furniture, equipment, etc.

PRECAUTIONS

WARNING
<ul style="list-style-type: none">• Aiming instrument at the sun can cause serious eye damage. Do not aim instrument directly at the sun.• Danger which could damage your eye or cause blindness<ul style="list-style-type: none">1) Never look into the laser plummet light source2) Dismantling or fixing the instrument can be done only by authorized Nivel System service (TPI service)• Theodolite is not immune to explosions. Avoid working in areas where gas explosions can happen.

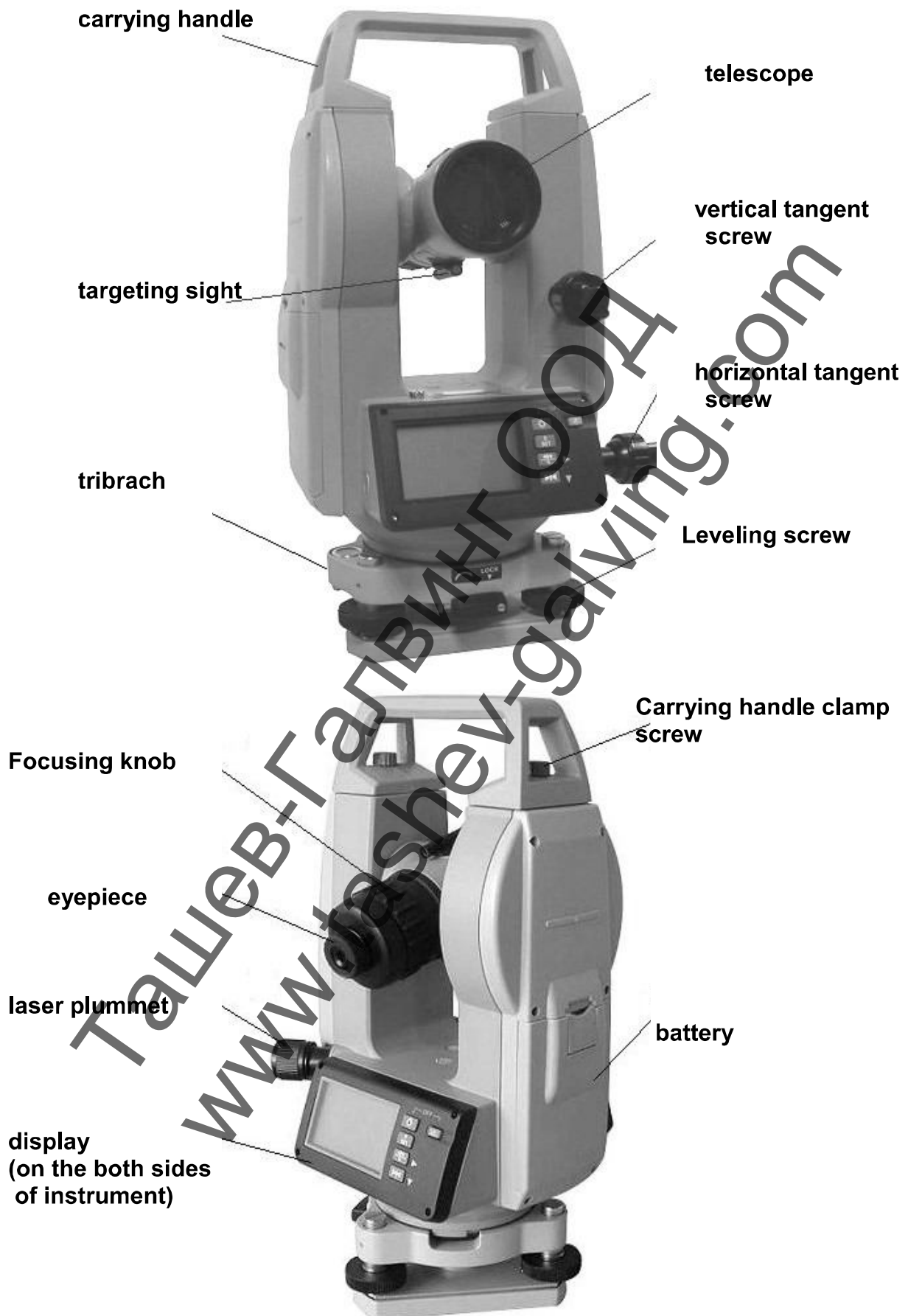
WARNING
<ul style="list-style-type: none">• There is a danger of electric current leakage if you will plug in the plug into the electric socket with wet hands. Never do it with wet hands• There is a danger of electric current leakage and electric shock if you will use the charger in humid room. Do not use the charger in humid room, charger is not waterproof.• There is a danger of hurting yourself while falling the instrument to the ground. Firmly tighten the clamping lever of tribrach for safe mounting the instrument on a tripod.• There is a danger in the situation of the instrument package roll-over. Do not sit on the package during the transportation of the instrument.

FACTORY EQUIPMENT

1. The instrument (with lens cover) 1 pc.
2. Transport box 1 pc.
3. Battery 1 pc.
4. Charger 1 pc.
5. Flannel cloth 1 pc.
6. Manual 1 pc.

(Check if you have the full instrument equipment)

NAMES AND FUNCTIONS



1. DISPLAY AND FUNCTION BUTTONS

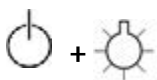
3.1 Function buttons



ON switch



ON/OFF switch of display backlight and laser plummet



Holding button press - instrument OFF

OSET

Reset of horizontal angle reading



Vertical angle unit



Hold of horizontal angle reading

1.2 Symbols on display



- % slope measurement in percentage
- G angle measurement unit – grades
- ... Battery charge level
- RL Choosing the direction of increasing values of reading of horizontal angle (Right/Left)
- V Vertical angle
- H Horizontal angle

2. BASIC SETTINGS

Instrument has a lot of functions. To set it for different types of observations please change the basic settings of the instrument.

Angle units:

Degrees, minutes, seconds (360 degrees in whole wheel) (**default**)

Grades (400 in whole wheel)

Miles (6400 in whole wheel)

Setting „0” for vertical angle

Horizontal angle „0” in level (90 degrees in zenith)

Zenithal length: „0” in zenith (90 degrees in level) (**default**)

Automatic turn off

30 minutes (**default**) or none

Minimal displayed unit

1” (**default**) or 5”



Compensator

Turned ON (**default**) or OFF

Sound signal while going through 0, 90, 180, 270 degrees

ON or OFF (**default**)

Changing the settings

Press and at  the same time turn on the instrument. Hold  button for about 3 sec. and release the button. Instrument will go into basic settings mode.

Press to go to  /  next position in menu.

Press to   change the settings.

When all basic settings are properly set please press [0SET] to escape to measurement menu

Settings order:

1. Signal sound of full angle:



„NO BEEP” means no sound. Changing to „90 BEEP” turns on the sound alarm while going through 90, 180 and 270 degrees.

2. Angle units



Available settings:

UNITA - 360°

UNITB – 400 grades

UNITC – 6400 miles

3. Horizontal/zenith angle



ZEN=0 zenith angles (90° in level)

ZEN=90 horizontal angles (0° in level)

4. Auto turn OFF



NO OFF Auto turning OFF - OFF

30 OFF Auto turning OFF after 30 minutes

5. Minimum display unit



DSP 1 minimum display unit is 1"
DSP 5 minimum display unit is 5"

6. Compensator ON/OFF



VTILT ON Compensator ON
VTILT OFF Compensator OFF

For finish and save basic settings, press [0SET]. In other case settings won't change.

3. Preparing for measurement

Setting the instrument

Mount instrument on a tripod. Center and accurately level the instrument. Please use the tripod with 5/8" screw and 11 threads per inch such as wooden Nivel System SWW8 tripod.

Leveling and centering the instrument

1. Setting tripod

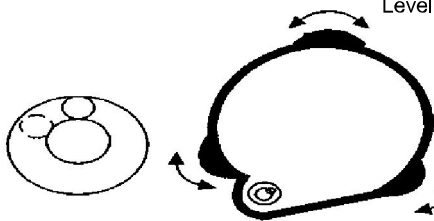
Expand legs on proper height and fix the blocking screws.

2. Mounting instrument on a tripod

Carefully place the instrument on tripod head. With unfixed mount screw move the instrument so that the weight plumb bob will be at the point. Tighten the mounting screw.

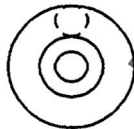
3. Coarse leveling the instrument by using the circular vial

- ① Turning A and B leveling screws move circular vial bubble to the line, which is perpendicular to line going through A i B leveling screws and also going through the center of circular vial.



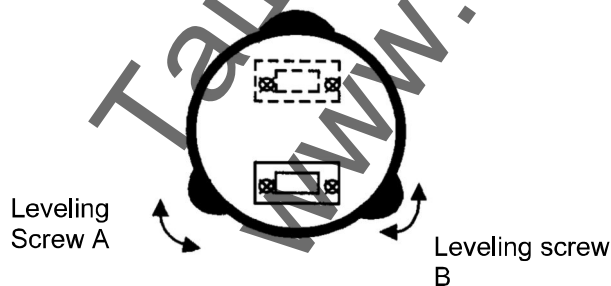
- ② Turning leveling screw C move the bubble to the center of circular vial.

Levelling screw A

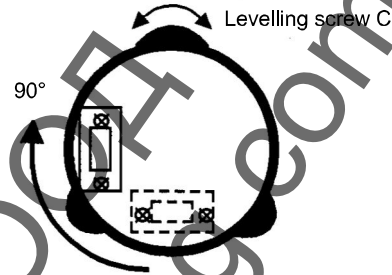


4. Leveling using the tubular vial

- ① Release the locking screw of horizontal wheel and turn instrument to make axis of tubular vial parallel to line connecting the A and B leveling screws. Using A and B leveling screws center the bubble of tubular vial.



- ② Turn the instrument 90° (100 grades) around vertical axis of the instrument and move the tubular vial bubble to center using the C leveling screw.



- ③ Repeat the procedure ① and ② after each turn of instrument by 90°. Check if the tubular vial bubble is in the center in all 4 instrument placements

5. Final leveling of the instrument

Accurately fix the tripod mounting screw. Level the instrument as described in ④. Turn the instrument to any angle and check if bubbles of vials are in the center position...

Instrument power

Instrument is powered by 3.7 V, 1400 mAh battery

For replacing battery please turn off the instrument, push the battery socket door button and pull out the battery. For inserting battery please put the battery in socket and push the top of battery socket to instrument.

Battery charge indicator

Fully charged battery can power the instrument for 15-20 working hours. Battery charge indicator is placed in right bottom corner of the display. Every part of the indicator is about 4h of working time.

■■■■ and ■■ tells us about a lot energy for working

■ indicates that there is energy for about 2h of working



■ – blinks and disappears – from this moment instrument can work only for about 20 minutes. Please finish your work and replace the battery.

Battery charging

Battery can be charged by a special charger. Charger must be plugged into 230V power source, next please remove the battery from the instrument and place it into the charger. Red light indicates of charging battery. Charging end will be indicated by a green light. After appearing of a green light you can disconnect the battery from the charger, and put the charger into transport box

Turning the instrument ON/OFF

To turn ON the instrument please press  button and hold it until whole symbols appear. Instrument is ON.

To turn OFF the instrument, please press in the same time  +  buttons, hold them until you'll see [OFF]. Instrument is OFF.

Aiming

- Adjusting the crosshair:
Turn the telescope and point it on the bright background, turn the crosshair focusing knob to make the crosshair clearly visible.
- Aiming:
 - Use target sight to coarsely aim on the object
 - Turn around the instrument and using the tangent screws precisely aim on the object
 - If while turning left, right, up or down the crosshair moves relative to the target, you need to turn the focusing knob on telescope until both images will overlap

4. ANGLE MEASUREMENTS

Telescope position

First (normal) telescope position tells us that vertical wheel is placed on left side of telescope when the observer looks through the ocular.

Second (upside-down) telescope position tells us that vertical wheel is placed on the right side of the telescope when the observer looks through the ocular.

Readings from both telescope positions (first and second) allows to eliminate the systematic errors while measurement. While measuring the angle you need to make the observation in one telescope position, then turn the instrument 180 degrees, aim on the object and make the reading again.

Setting „0” for horizontal angle

Aim the telescope onto the object, press [0SET] button – reading of the horizontal wheel will be 0.

Warning: [0SET] sets only the value for horizontal wheel

Horizontal and vertical angle measurements

Settings

For changing the way of horizontal angle measurement from left to right please press



When you choose R (right), turn the alidade clockwise for increasing the value of angle.

When you choose L (left), turn the alidade counter clockwise for increasing the value of angle

Vertical angle measurement settings

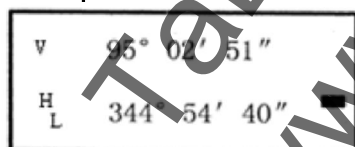
There are 2 ways of measuring the vertical angle: vertical and zenith. Zenith angle is default. For changing the settings please go to point 4.

Measurement

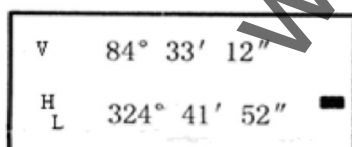
Aim onto the reference object (A) using the crosshair, press [0SET]. Choose L, turn the alidade clockwise. Target on to the measuring object (B).

The angle between those objects will be displayed on the display.

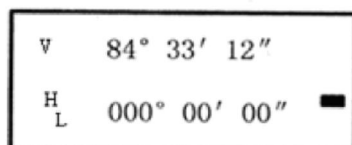
Example:



Aim on A



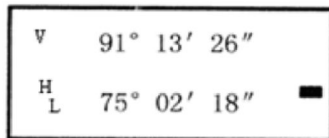
Press [0SET]



Top: vertical angle A

Bottom: horizontal angle set on 0

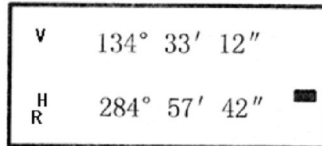
Confirm or change the way of measuring the horizontal angle, aim on B



Top: vertical angle B

Bottom: horizontal angle (L) between A and B

Press button, chose R, turn the telescope counter clockwise, aim on A, press [0SET]. Value of the angle will be. Next, aim on B.



Top: vertical angle B

Bottom: horizontal angle (R) between A and B

Next turn the telescope 180 degree for measuring the point one again in second telescope position.

Horizontal angle value hold

To hold for a while the value of displayed horizontal angle please press

, signs L, R and H will start to blink and value of the horizontal angle won't change, even during the turning of the instrument.

For release the hold, press once again.

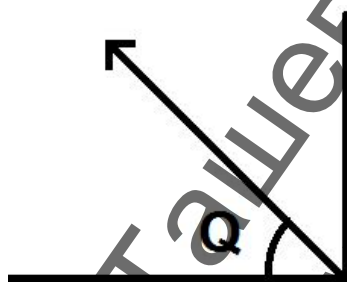
Warning: hold function only holds horizontal wheel

90 degrees angle stakeout

Aim on the first object and press [0SET]. Turn the instrument until you'll hear the sound, while displaying the value for example. 89° 59' 20". Next using the horizontal tangent screw set the value of the angle to 90° 00' 00". Stakeout of 180 i 270 degree angle is similar.

Warning: sound alarm will works only if it's enabled (go to: chapter 4).

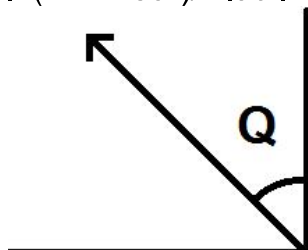
Horizontal and zenith angle measurement



Horizontal angle

$$Q = (L \pm 180^\circ - R) / 2$$

$$I = (L + R - 180^\circ) / 2 \text{ lub } I = (L + R - 540^\circ) / 2$$

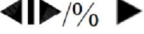


Zenith angle
 $Q = (L + 360^\circ - R) / 2$
 $I = (L + R - 360^\circ) / 2$

If value $|I| \geq 10''$, you need to calibrate your instrument.

Percentage values

Horizontal angle can be displayed using the percentage values. Value of slope can be displayed only for values smaller than 45° . In other case the instrument won't display the value of slope.

Press for 2 seconds  until you'll hear 2 sound signals. On the display you will see values of slopes in %.

5. DISTANCE MEASUREMENTS



Instrument allows coarse measurement of distance using the telescope crosshair. The accuracy of this measurement is about $0.4\%L$, where L is distance to the target.

Place the instrument over the point A, on point B place the leveling staff.

Next make the reading of distance between points on a leveling staff by telescope crosshair

Distance between A and B is coarsely $L = a * 100$.

6. WORKING WITH LASER BEAM (only DT-5L model)

Turn on the theodolite and press  twice - laser is on (laser beam is emitted) – aim the beam on to the target, make the measurement. For turning off the laser beam please press  twice – laser will be turned off.

8. CHECKING AND CALIBRATION

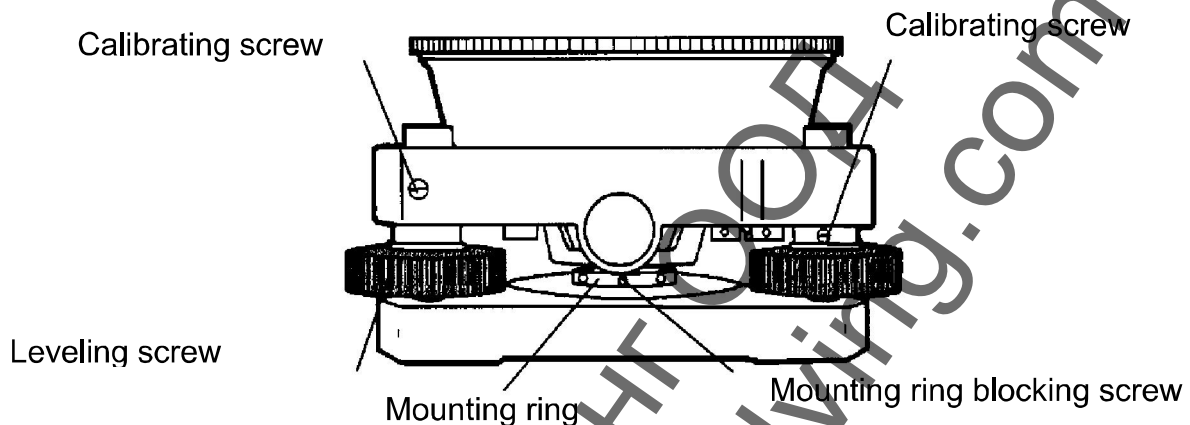
• Calibration order

1. Accurately set the ocular of the telescope before checking, which needs the aiming through the telescope. Remember about accurate set the focus and completely remove the parallax.
2. Do the calibration using the manual written below. Save the order because each patch independently of each other. Patches made in wrong order can even break the effect of the last calibration.
3. Each calibration end with accurate tighten the calibration screws (do not tighten the screws too much because you can break the thread, break the screw or brake the other parts of the instrument)
4. Accurately tighten every connection screw at the end of calibration.
5. After finishing the calibration, check the instrument again to confirm that the calibration has been done properly.

• Notes about the tribrach

Remember that measurement accuracy of horizontal angles can be much smaller if the tribrach is not installed well.

1. If one of the screws loosen up or if aiming axis is not stable because of loosen up calibrating screws, please use the screwdriver to tighten the screws placed in two places on every of leveling screw.
2. If there are any backlash between leveling screws and the tribrach base, loose the screw in mounting ring and tighten up the mounting ring using the calibration needle.

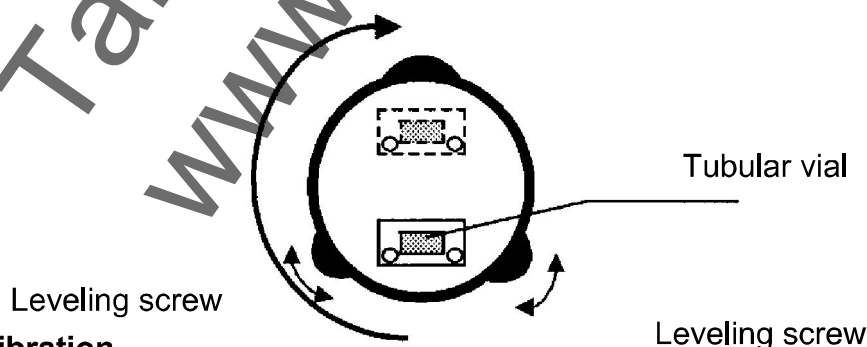


8.1 Checking and calibrating the tubular vial

Calibration is necessary if tubular vial axis is not perpendicular to vertical axis of the instrument.

• Checking

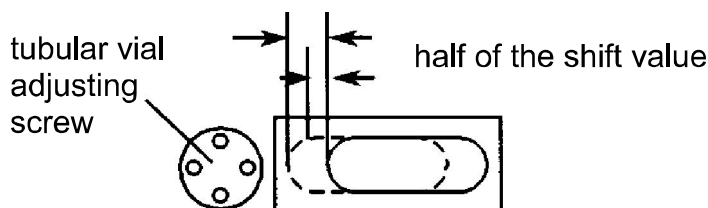
1. Set the tubular vial parallel to line connecting the two leveling screws, for example A and B. Using these two screws move the bubble of tubular vial to the center.
2. Turn around the instrument 180° or 200 grades around the vertical axis and check if tubular vial bubble do not move from the center. If the bubble is still in the center, calibration is not necessary. If bubble moves make the actions written below.



• Calibration

1. Turning the tubular vial adjusting screw using the calibration needle move the bubble into center direction but only of the half of the shift value.
2. Using the leveling screws move the bubble to the center of tubular vial.

3. Turn the instrument 180° or 200 grades to go back to last placement. If the bubble is in the center position the calibration is over. If it's not you need to repeat the procedure once again.



8.2 Checking and calibrating the circular vial

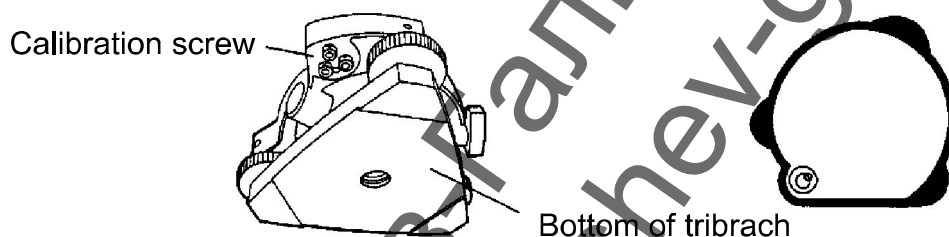
Calibration is necessary if the axis of the circular vial is not perpendicular to vertical axis.

• Checking

Using the tubular vial accurately level the instrument. If the bubble of the circular vial is in the center – calibration is not necessary. In other case do the calibration as written below.

• Calibration

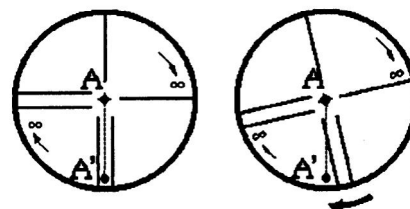
Move the bubble of circular vial to center position by turning one of three calibrating screws using calibration needle.



8.3 Checking and calibration of vertical line of crosshair

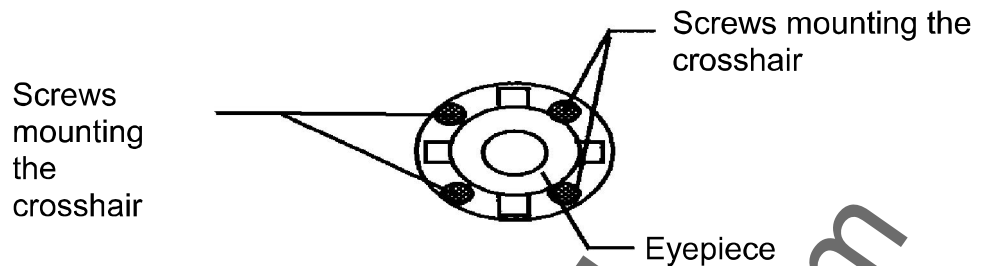
• Checking

1. Mount and level the instrument on tripod.
2. Aim the telescope on to the well visible target (A), placed in distance 50m minimum and precisely aim the crosshair lines on target (A). Tighten up all holding screws
3. Using the vertical tangent screw move the telescope in vertical and check if point A is moving parallelly to vertical line of crosshair.
4. If the point is moving on vertical line it means that the vertical line of crosshair is placed in plane perpendicular to horizontal axis (calibration is not necessary)
5. If the point is moving from the vertical line of crosshair, like the telescope was inclined in vertical, do the procedure written below.



- **Calibrating**

1. In the counter clockwise direction unscrew the cap covering the mounting screws of the crosshair.



1. Loosen up all 4 screws using the screwdriver equipped with factory equipment (count the turns) and turn the whole eyepiece to cover the vertical line of the crosshair with the point A. Fix the crosshair mounting screws by turning the same amount of turns as while loosening up.
2. Check once again and if point A is moving towards the crosshair line in whole length it means that another calibration is not necessary.

Warning: Calibration „Instrument collimation” (chapter 8.4), „Calibration of zero place of vertical wheel” (chapter 8.6) do only after ending the calibration written above.

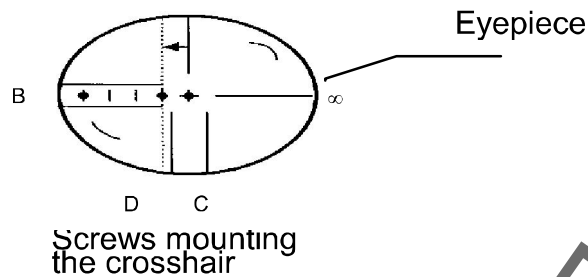
8.4 Instrument collimation

Collimation is necessary if target axis of the instrument is not perpendicular to turning horizontal axis of telescope.

- **Checking**

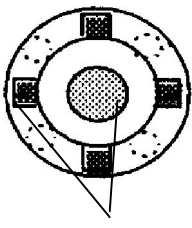
1. Place the instrument in a place where you can find a good visibility to 50, 60m on the both sides of the instrument.
2. Level accurately the instrument using the tubular vial.
3. Aim to the point A placed in distance about 50m.
4. Loosen up the holding screw of horizontal wheel and turn the telescope 180 degrees or 200 grades around the horizontal axis to aim the opposed direction.
5. Aim on to the point B, which is placed in the same distance as point A and tighten up the holding screw of vertical wheel.
6. Loosen up only the holding screw of horizontal wheel and turn the telescope 180 degrees or 200 grades around the vertical axis. Aim once again to point A and tighten up the holding screw of horizontal wheel.

7. Loosen up only the holding screw of vertical wheel and turn the telescope 180 degrees or 200 grades around the horizontal axis. Aim to point C which should cover the point B
8. If points B and C doesn't cover, perform the calibration written below.



• Calibration

1. Unmount the cap of the crosshair screws.
2. Find point D placed between points B and C and distanced from point C of $\frac{1}{4}$ distance between points B and C. Value of shift is because that the visible error between points B and C is 4 times larger than the right error because during the check procedure telescope was turned twice.
3. Move the vertical line of crosshair and make the coincidence with point D making the turning of left or right screw mounting the plate of crosshair using the calibration needle. After finishing the calibration check the instrument once again. If points B and C do not cover, it means that instrument doesn't has the collimation error. In other case please do the calibration process.



- Notes:
- 1) Because the placement of crosshair is fixed by mounting screws on the right and left side, that's why plate with crosshair will move only after loosening the screw placed on the side in which it will be moved and after tightening up the screw on opposite side. After finishing the moving please tighten up all screws.
 - 2) After finishing the calibration written above you need to perform next calibration, chapter 8.6 „Calibration of zero place of vertical wheel”

8.5 Checking and calibrating the laser plummet

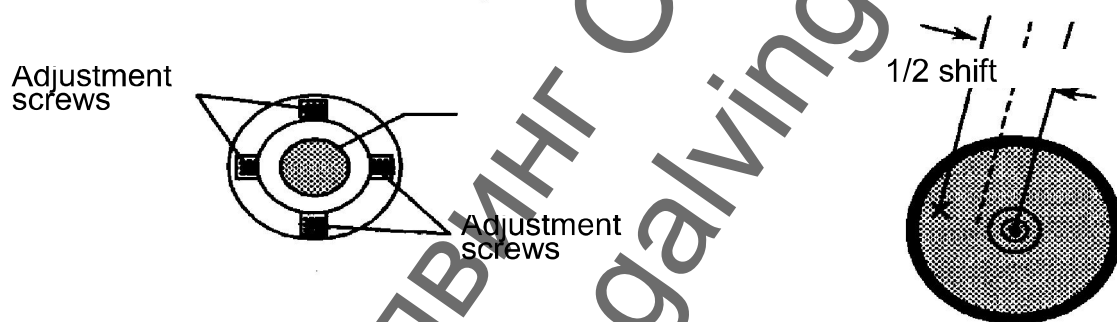
Calibration is necessary if axis of the laser plummet do not cover the vertical axis of the instrument

- **Checking**

1. Cover the laser plummet with point.
2. Turn instrument 180° and observe the dot of laser plummet. If the laser plummet dot is covering the point all the time, calibration is not necessary. In other case perform the calibration written below.

- **Calibration**

1. Unmounts the cover of laser plummet mounting screws. Move the laser plummet dot in the direction of point for about half of shift value using laser plummet calibration screws



1. Using adjustment screws place the dot on the point.
2. Once again turn the instrument 180°. If the laser dot covers with point, another calibration is not necessary, in other case repeat the calibration process.

Note: 1) Because the placement of crosshair is fixed by mounting screws on the right and left side, that's why plate with crosshair will move only after loosening the screw placed on the side in which it will be moved and after tightening up the screw on opposite side. After finishing the moving please tighten up all screws.

8.6 Calibrating of zero place of vertical wheel

If while measurement of vertical angle to point A in I and II telescope position sum of angles is different than 360 degrees you need to perform calibration. Half of difference between the given value and 360 degrees is setting the zero place error. Because the accurate of setting the zero place is correspondent to accuracy of determining of coordinates, that's why calibration must be performed very accurately.

Checking

Level the instrument and power it up. Aim it to a reference point (A) in first telescope position and make the reading of vertical error (L)

Then turn the instrument 180 degrees and make the reading on point A once again (R). If zenith angles are set up then the difference of readings should be $I = (L + R - 360^\circ) / 2$

If vertical angles are set up then the difference of readings should be $I = (L + R - 180^\circ) / 2$ or $(L + R - 540^\circ) / 2$

If $|I| \geq 10''$, you need to calibrate the zero place of vertical wheel.

Calibration

After leveling the instrument press [0SET] + $\leftarrow \rightarrow / \% \rightarrow$ + \odot . When all sign will be displayed, release \odot , after 3 signal signs release the rest of buttons. On the display you will see:



In first telescope position aim well on to good visible and stable object A, placed on the same height like instrument. Then press $\leftarrow \rightarrow / \% \rightarrow$ button to display FACE-2. Turn the instrument 180°. Aim on the target A and press $\leftarrow \rightarrow / \% \rightarrow$. Calibration of zero place of vertical wheel is over.

Now recheck the error of the zero place. If error occurs, repeat the procedure. If the calibration do not works, send the instrument to service.

8.7 Vertical wheel compensator

Checking

Level accurately the instrument. Set the telescope in direction one of leveling screws (M), hold the horizontal wheel. Turn on the instrument, aim at object A and hold the vertical wheel. Instrument will show the reading of the vertical wheel. Turn the leveling screw M in one direction until you see "TILT" (instrument out of compensator range). Next turn the screw in opposite direction. If the angle is not changing step by step, the compensator is damaged.

Calibrating

Instrument must be sent to service for fixing the compensator.

9. Technical Specifications

Telescope	View	Straight
	Magnification	30x
	Lens diameter	45 mm
	Field of view	1°30'
	Shortest focal length	1,3 m
	Distance scale	100
	Resolution	3"
Angle measurement	Measurement method	Absolute
	Minimal reading	1", 5"
	Accuracy	2" (DT-2), 5" (DT-5)
	Units	Degrees, grades, miles
	Display	2 x LCD
Compensator	Tilt sensor	Automatic compensation of vertical wheel
	Working range	±3'
Plummet		Laser
Accuracy of tubular vial		30"/2 mm
Accuracy of circular vial		8"/2 mm
Temperature working range		-25°C do +50°C
Power	Battery	Lithium
	Voltage	3.7 V
Instrument weight	5 kg	
Dimensions	190mm x 155 mm x 345 mm	

10. ERROR MESSAGES

If instrument displays „TILT” message, it means that instrument compensator is out of range and you need to level the instrument. If it doesn't help please contact local dealer and send the instrument to service.

If error messages occurs, you need to carefully check the instrument settings and make the calibration. If it doesn't help please contact local dealer and send the instrument to service.

11. FREE EXTENDED WARRANTY- 24 months

To use the free warranty extension to 24 months, the instrument must be registered within three months from the date of purchase. Registration is done via a form on the web: <http://www.tpi.com.pl/rejestracja-gwarancji>

Ташев-Галвинг ООП
www.tashev-galving.com

Ташев-Галвинг ООД
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Nivel System – service, support

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