



**WHEEL BALANCER «MAXI PM»**

**St. Petersburg 2015**

## INDEX

	<b>page</b>
1. General	2
2. Main Technical Specifications	2
3. Operation, Transportation and Storage Conditions	3
4. Contents of Delivery	3
5. Installation Requirements	3
6. Safety Requirements	4
7. Commissioning	4
8. Keyboard and Main Operating Screen	5
9. Mounting a Wheel on a Spindle	6
10. Entering the Wheel Dimensions	8
11. Modes ALU1-ALU5, St.	10
12. Wheel Balancing	11
13. Program «SPLIT» for Balancing Weight Separation	13
15. Program «OPT»	14
16. Program «FOUR OPERATORS»	15
17. Machine Parameter Setup	16
18. Calibration	18
19. Calibration of the measuring channel	19
20. Residual unbalance assessment	20
21. «TEST» Mode	20
22. Displaying the Machine Information	21
23. Maintenance Service	22
24. Certificate of Acceptance	23
25. Initial Calibration Certificate	23
26. Warranty	23
27. Calibration Procedure	24
Contact Information	26

## 1. General

1.1. The Wheel Balancer (further referred as WB) is a high-precision machine with a microprocessor based information processing and control.

1.2. The WB provides for one cycle normal/static balance check and the calculation of corrective weights mass and positioning along the two correction planes (on an inner and outer sides of a wheel-rim).

1.3. The machine has two modes of operation:

Car mode (Mode 1): balancing the wheels weighing up to 65 kg (cars, minibuses and light trucks such as «GAZelle»).

Truck mode (Mode 2): balancing the wheels weighing up to 200 kg (truck wheels).

The wheels weighing over 65 kg must be balanced only using truck balancing mode (Mode 2), because operating rotation velocity of the wheel in Mode 1 is much greater and spinning of heavier wheels to the mode 1 speed can damage the spindle assembly. The software of this machine provides for automatic recognition of the wheel size and automatic selection of the correct mode.

1.4. Computer unit is based on an ultramodern high performance industrial microprocessor.

1.5. For the display of the information the WB is equipped with a SVGA monitor with a high quality 3D graphics

1.6. The machine has a program «SPLIT» for balancing weights application behind wheel spokes and a program «OPT» for optimal positioning of a tire on a disc.

1.7. Only specially trained personnel, familiarized with this instruction manual, may operate or perform any work on the WB.

## 2. Main Technical Specifications.

	Car mode	Truck mode
- accuracy, g.	1	1
- measuring range, g.	0-150	0-450
- tolerance with unbalance for 1 correction plane no more than (g) (where M - measured load weight)	$\pm(3+0,1 M)$	$\pm(3+0,1 M)$
- angular unbalance position tolerance, angle grad, no more than	$\pm 6$	$\pm 6$
- Wheels parameters:		
• Rim diameter, inch (mm) for manual input up to 30(762)	9(229)-28(711)	9(229)-28(711)
• Rim width inch (mm)	15(381)-20(508)	15(381)-20(508)
• Max. wheel weight, kg	70	200
- Power consumption, W, no more than	800	
- Dimensions:		
• without the hood	1250x620x1050 (h)	
• with the hood	1360x1360x1375	
- Machine weight, kg, no more than	130	

### **3. Operation, Transportation and Storage Conditions.**

3.1. Normal operating conditions UHL 4.2 according to GOST 1515069:

- ambient temperature: +10 +35 °C,
- relative humidity, no more than 80% at 25 °C.

3.2. Storage conditions in accordance with GOST 1515069, group 2.

Ambient temperature: - 50 to +40 °C

3.3. Transportation conditions in accordance with GOST 1515069, group 5.

Ambient temperature: - 50 to +50°C

### **4. Contents of Delivery**

4.1. Balancing machine	1 pcs.
4.2. Wheel guard (locker)	1 pcs.
4.3. Small cone	1 pcs.
4.4 Large cone	1 pcs.
4.5 Threaded shaft TP 40x3	1 pcs.
4.6 Clamping nut with bushing	1 pcs.
4.7 Elongated nut bushing	1 pcs.
4.8 Flange (cup) nut with rubber ring	1 pcs.
4.9 Conical spring	1 pcs.
4.10. Special pliers	1 pcs.
4.11. Measurement caliper	1 pcs.
4.12. Tool set for heavy truck wheel mounting (steel disc (2 pcs), dural disc (1 pcs), pins (5 pcs), pin nuts (5 pcs))	1 pcs.
4.13. Pneumatic dolly for heavy wheels mounting	1 pcs.
4.14. LCD monitor	1 pcs.
4.15. Truck wheel assembly	1 pcs.
4.16. Compressor Fiac Apolo 50	1 pcs.
4.17. Surge protector SVEN Optima Base Black	1 pcs.
4.18. Operation manual	1 pcs.

### **5. Installation Requirements.**

5.1. After transportation or storage at below 0°C temperatures the WB needs to be kept in original packaging at room temperature for at least 2 hours before commissioning.

5.2. The WB should be placed on a flat concrete surface or foundation bed with all its support feet touching the base. Horizontal deviation of the base should not be more than 10mm per 1m. The use of rubber pads or any other elastic elements for the installation of the WB is prohibited. Vibration level at the place of installation must be minimal. Vibration or resonating frequencies within 1 to 10 Hz are not allowed. The WB should be bolted solidly to the base with hold-down bolts. It is prohibited to place the WB near the heating sources, which can overheat WB parts, or electromagnetic sources, which can lead to decrease in measurement accuracy.

For normal transportation and mounting of truck wheels, the WB must has an even and clear area of no less than 11,5 around it.

5.4. During transportation and mounting of the WB it is prohibited to exert any force on a spindle.

5.5. The power supply must be free of any large high-frequency, impulse or switching interferences, such as the ones produced by welding machines or heavy duty equipment, using common circuitry.

**IMPORTANT!** Failure to comply with requirements mentioned in subparagraphs 5.3 and 5.5 can lead to malfunctions of the WB, which are not covered by the manufacturer's warranty.

## 6. Safety Requirements.

6.1. The housing of the WB must be properly grounded.

6.2. Operating the machine with an open power supply unit is prohibited.

**IMPORTANT!** Opening the WB power supply unit cover is allowed only after 1,5-2 minutes after power has been turned off.

6.3. Prior to starting the machine and until its full stoppage, the wheel must be covered with the wheel guard.

6.4. For emergency stop of the WB, press the button «STOP».

## 7. Commissioning.

7.1. After transportation or storage at below 0°C temperatures the WB needs to be kept in original packaging at room temperature for at least 2 hours before commissioning.

Area where the machine is to be installed should be equipped with the three-pin plug socket with its side contact connected to the ground bus. For normal operation of the WB, the power line voltage range should be within 220V ±10%.

7.2. The room, where the WB will be used, should be clean. To avoid excessive accumulation of the dirt on the monitor, the dust content of the air should be kept at a minimum.

**IMPORTANT!** Excessive pollution of the monitor may decrease its service life.

7.3. Connect the power-supply cord to the power source.

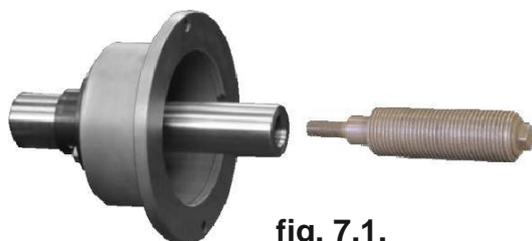


fig. 7.1.

7.4. Place the threaded stud on the shaft (fig. 7.1). All mating surfaces must be cleaned with a clean piece of cloth moistened with petrol or petroleum spirit prior to assembling. Any amount of dirt on the mating surfaces of the spindle or the threaded stud can lead to unacceptably low accuracy of the measurements.

To provide for an easy dismantling of the threaded stud, if it will ever need to be replaced, apply some consistent grease on its mating surfaces after cleaning. Tighten the threaded stud with the tightening torque of 35 Nm.

7.5. To provide for the safety of the personnel, prior to starting the WB, make sure the power source is correctly connected and properly grounded.

**IMPORTANT!** Operating the equipment without the proper grounding is prohibited!

7.6. Install the wheel guard, fixing its frame on the axle.

7.7. Position the monitor on the housing stand and attach it with the screws (included), placing them into the provided holes. Connect the power and VGA cables to the monitor, passing it through the holes in the stand first.

## 8. Keyboard and Main Operating Screen.

8.1. This WB model has a keyboard with 11 buttons placed in two rows (fig. 8.1.). The upper row has 7 buttons, numbered 1 through 7. These buttons have different functionalities, which are indicated by the buttons located on the bottom of the screen. Four buttons from the bottom row have fixed functionalities: button «MENU» - is used for starting the mode «MENU», button «ENTER» -for inputting various parameters into the memory, button «START» - for starting the shaft rotation, button «STOP» - for exiting the modes and returning to the main operational screen and also for the emergency stop of the WB shaft.



fig. 8.1

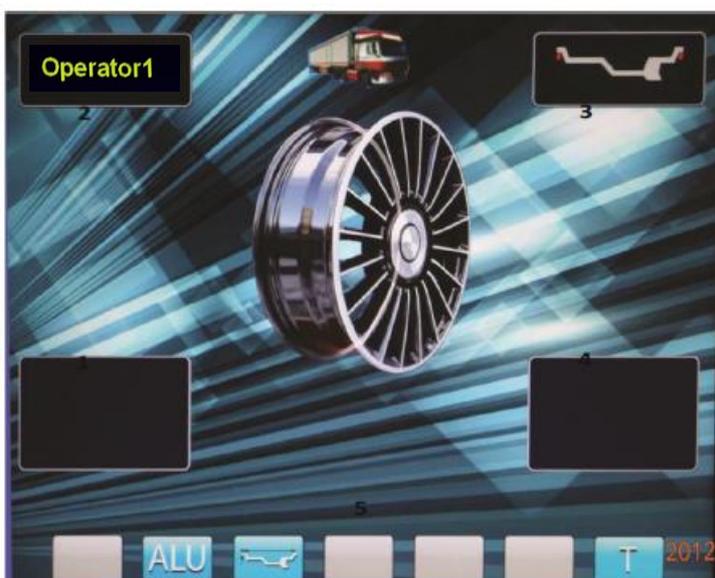


fig. 8.2.

8.2. For starting the WB put the power switch, located on the left side housing panel, in position 1.

*Note:* Monitor power turns on when the WB main power switch is turned ON, provided that the monitor switch is already in a turned-on position. If the monitor does not show anything and the indicator is not on, after the WB has been switched on, press the power on button on the monitor.

8.3. After the WB has been powered up, the monitor displays brand-name startup screen, which changes to the main operational mode screen in a few seconds. (fig. 8.2).

Windows 1 and 4 display unbalance figures for internal and external correction planes.

Window 2 displays the operator's name.

Window 3 displays the scheme for positioning of the corrective (balancing) weights.

Window 5 displays the functionalities of the 7 buttons on the keyboard: ALU – for selection of the balancing weights positioning scheme for wheels with aluminum rims; button «A, d, b».- for control and correction of the balanced wheel dimensions; button «T» - for starting the braking device.

## 9. Mounting a Wheel on a Spindle.

9.1. Prior to being mounted, the wheel should be cleaned from dirt.

9.2. The wheel is being fixed on the shaft by its central bore with the use of the cones and the quick release nut with threaded sliding blocks. Depending on the configuration of the disc, the cone can be placed on the outer side of the disc (option "a"), or on the inner side (option "b") (fig. 9.1)

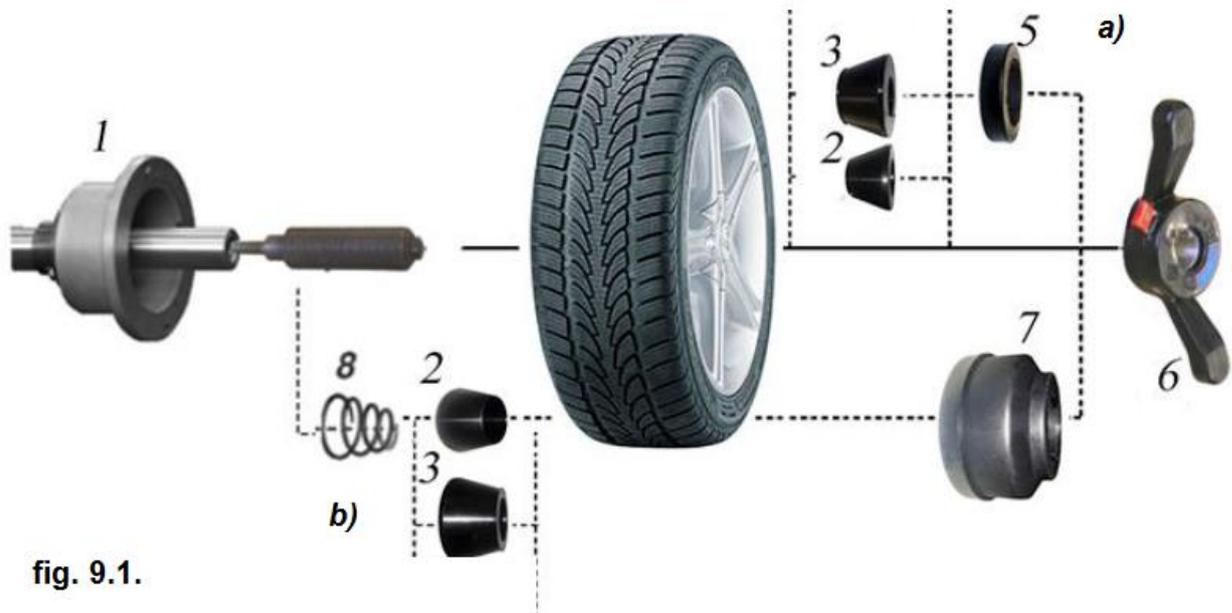


fig. 9.1.

The figure is showing the following:

- 1 working part of the WB shaft
- 2, 3, - small and large cones. The necessary cone is selected depending on the diameter of the disc's center bore.
- 5 nut bushing
- 6 clamping nut
- 7 flange (cup) nut with rubber ring
- 8 conical spring

To place the cones on the inner side of the rim, at first place the conical spring (8), which creates the centering force, on the shaft. Replace the bushing (5) with a flange (7) on the nut (6).

The precision of balancing largely depends on the accurate placement of the wheel on the WB shaft. Perform the clamping of the wheel on the WB shaft with great care, and make sure the front surface of the wheel rim is clean and tightly fitted against the shaft flange. Working surfaces of the shaft and cones must be clean and free of indentations.

**IMPORTANT!** Do not tighten the nut with the wheel being fixed, because the wheels weight dislocates the wheel from its vertical position in respect to the shaft. Also the cone, when centering the wheel, enters the discs bore and clamps the wheel to the shaft flange, thus creating frictional forces, which inhibit the correct centering of the wheel. Tighten the nut gradually, turning the wheel in the process.

For the correct centering of the wheel do the following:

1. advance the nut and tighten it a little,
2. spin the wheel 0,5-1 turn and tighten the nut a little bit more,
3. spin the wheel once more 0,5-1 turn and tighten the nut fully home.

To average the forces, dislocating the wheel from its upright position in respect to the WB shaft, tighten the nut gradually, turning it only the portion of the full turn at a time rotating the wheel on the shaft in the process.

The working parts of the shaft, flange, cone set and the nut should be maintained in clean condition, regularly wiped with the piece of cloth, moistened with lubricating mineral oil for cleaning and creating the oil film on the surfaces. Protect parts from impacts, which may cause deformations and indentations, affecting the centering of the wheel on the shaft.

9.3. Heavy truck wheels are mounted using pin plate adapters, clamping the wheels by its clamping holes.

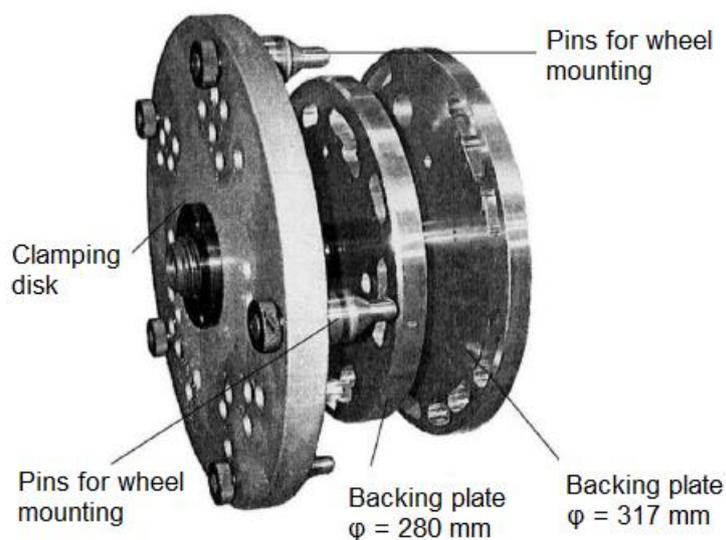


Fig. 9.2.

To mount the heavy wheels, use the dolly, equipped with the lifting device. Place the wheel on the dolly and secure it with the rope, located in its upper part. Use the hook of rope to hook the wheel by the edge of the rim, release the clamping screw, stretch the rope tight and secure it with the clamping screw. For wheels with the outer diameter less than 850 mm place the supporting tray on the forks of a dolly.

Pin plate adapter consists of a clamping disc and two changeable backing plates (fig. 9.2.).

Clamping disc has holes for 3, 4 or 5 pins for placing wheels with discs having 6, 8 or 10 clamping holes. The schemes of pins locations, in terms of quantity and radial positioning, are marked with numbers 1 and 8.

Backing plates have shaped holes for unobstructed passage of the clamping disc pins through the holes of the wheels rim. The 280 mm backing plate has holes marked with numbers 1, 2, 6 and 7. The 317 mm backing plate has holes marked with numbers 3, 5 and 8. For placing pins into the clamping disc holes marked with number 4 the 317 mm backing plate is used and the tips of the pins extend beyond the backing plate edges.

Before mounting the wheels, prepare the pin plate adapter. Use a ruler to measure the distances between the centers of the neighboring wheel clamping holes. Then, using the table, determine the number of the hole for placing the pin on the adapter.

Number of holes (num. of pins)	Distances between centers of used neighboring holes (mm)	Hole Nr	Hole centers circle diameters (mm)
6(3)	102,5	1	205
6(3)	111,2	7	224,4
6(3)	122,5	2	245
8(4)	105,2	3	275
8(4)	109,1	8	285
10(5)	69,6	6	225
10(5)	88,2	5	285,6
10(5)	103,5	4	335

Place 3, 4 or 5 pins, depending on the number of holes in the rim (6, 8 or 10) into the holes of the clamping disc, marked with respective numbers. Select the backing plate with the holes having the same numbers. Place the backing plate on to the WB shaft all the way until it fits tightly against the shaft flange. Set the lifting device so the center bore of the wheel is aligned with the WB shaft. Bring the wheel, placed on the dolly, to the stand and place it on to the shaft until the rim is pressed against the backing plate. Place the clamping disc on the shaft and slide its pins through the clamping holes of the rim. Fix the wheel slightly tightening the nut on the clamping disc. Lower the hooks of the dolly and roll it away. Slowly spinning the wheel, tighten the nut gradually. The wheel should make two full turns before the nut is tightened fully home. This is very important for the centering of the heavy wheel on the shaft of the WB.

## 10. Entering the Wheel Dimensions.

10.1. For correct calculation of the corrective weights mass on the inner and outer sides of the wheel, it is important to accurately enter the wheel dimensions: diameter and width of the disc (parameters d and b), as well as the distance from the WB frame to the inner side of the disc (parameter A).

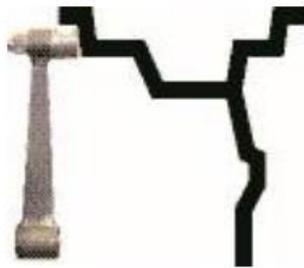


fig. 10.1.

When the WB is powered on, the parameters «d» and «b» are set to the values kept in the memory of the WB. It can be controlled by pressing the button «A, d, b» (number 3 on the figure 10.2).

Initial values for «d» and «b» parameters can be changed at customer's request. This procedure is described further below. Newly entered parameters are deleted when the WB is powered off and must be entered again when the WB is turned on



fig. 10.2.

10.2. This WB model is equipped with the device, allowing automatic input of the diameter («d») of the wheel and the distance («A»). To accomplish this, you need to use a handle to pull out a gauge from the housing of the WB, place the pin on the end of the handle against the position of the corrective weights placement on the inner side of the disc (fig. 10.1) and hold the gauge in this position until the audio signal goes off. After that, the gauge can be returned to the original position. The screen will switch from the main operating mode to the screen for input of the dimensions (fig 10.2).

The top left window displays the entered distance «A», the distance to the plane of balancing weights positions on the inner side of the wheel rim (in mm).

The top right window shows entered value for the rim diameter.

**Note:** The diameter provided by the rim manufacturer shows the diameter for a tire. With the help of a gauge you can enter the diameter for spring-loaded weights placement (fig. 10.1), which is bigger than the diameter used for a tire by about 1 inch. Thus, the diameter entered by the means of a gauge will be greater than the rim/tire diameter provided by the rim manufacturer.

The bottom window shows the width of the wheel rim.

This mode has a function for entering the width of the rim and also for the correction of the rim's diameter and the distance from the WB frame to the wheel, if it is required (buttons «-» and «+»). Buttons «-» and «+», used for correcting the diameter and distance values, are enabled by the «A, d, b» button (button 3 on the fig. 10.2). The corrected value is highlighted in red. The button «A, d, b» allows to switch from the main operating mode screen to the screen for input of the dimensions.

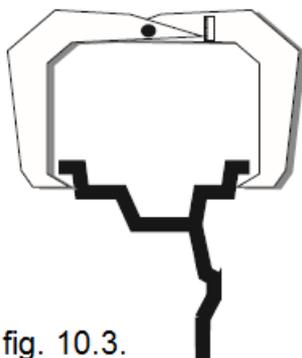


fig. 10.3.

Button «inch/mm» allows for switching between inches and millimeters when entering the values for the diameter and the width of the rim.

Button «STOP» is used for returning to the main operating mode screen.

10.3. The rim's width is normally indicated on its markings. If the markings are missing or hard to read, the width can be measured with a special instrument – measurement caliper (fig. 10.3.).

**Note:** Keep in mind, the width parameter provided by the rim manufacturer shows the diameter for the tire. The real width in the positions of the weights will be larger by the value of the thickness of the rim wall times two.

If the read or measured value of the width of the rim differs from the one shown in the bottom window (fig. 10.2), buttons «-» and «+» will help you to enter the correct value.

10.4. If, for any reason, the automatic input of «A» and «d» parameters is difficult or impossible, there is a manual option available for entering of those parameters.

To enter the parameters manually, press the «A, d, b» button once, buttons «-» and «+» will be activated for the input of the parameters. The value in the diameter window is highlighted in red. Using «-» and «+» buttons, set the required diameter. After 2-3 seconds, buttons «-» and «+» return to the width input mode.

10.5. Keep in mind, errors made while entering the parameters will lead to the error in the division of the total unbalance to the unbalances along inner and outer sides of the wheel. In this case, the added weight on one side will change the unbalance number on the other side; moreover, the projection of the values of the unbalance from one side to the other will also lead to the error in determination of the unbalance location.

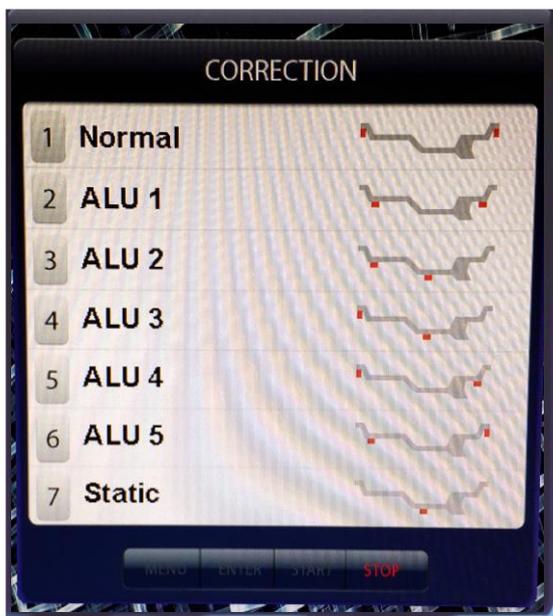
The larger the unbalance, the larger will be the cross-effect. After the first balancing cycle, such errors cause some residual unbalance figures, which can be eliminated during the subsequent cycles.

So, all the measurements and entering of the parameters «A» and «b» should be done very carefully. Parameter «A» is measured to the center point of the mass of the weights on the inner plane and parameter «b» is measured from the mass of the weights on the inner plane to the center point of the mass of the weights on the outer plane.

10.6. The permissible error of the automatic diameter input device is 1 inch. After the automatic input of the diameter (cl. 10.2.) check the entered value in the respected window, and correct it if necessary (refer to clause 10.4.).

Keep in mind that the error in entering the diameter only leads to the relative error in the determination of the corrective weights masses, and it is decreasing with the increase of the rim's diameter. For example, for the diameter of the rim equal to 13 inches the error of 1 inch gives the error in determining the corrective weights masses is 7,5%, that is, 50 gr error in determining the corrective weights mass gives 3,75 gr error. But with the diameter of the rim equal to 20 inches the error will be only 5% or 2,5 gr.

## 11. Modes ALU1-ALU5, St.



11.1. For balancing light alloy wheels, the weights are placed in the positions that are different from the ones used for adding the standard slip-on spring-loaded weights. The programs «ALU1-ALU5» are used for this purpose. These programs allow getting the accurate measurements of corrective weights masses when they are being placed in non-standard positions. The dimensions are entered in the same manner, as with the standard spring-loaded weights (clauses.10.2-10.4).

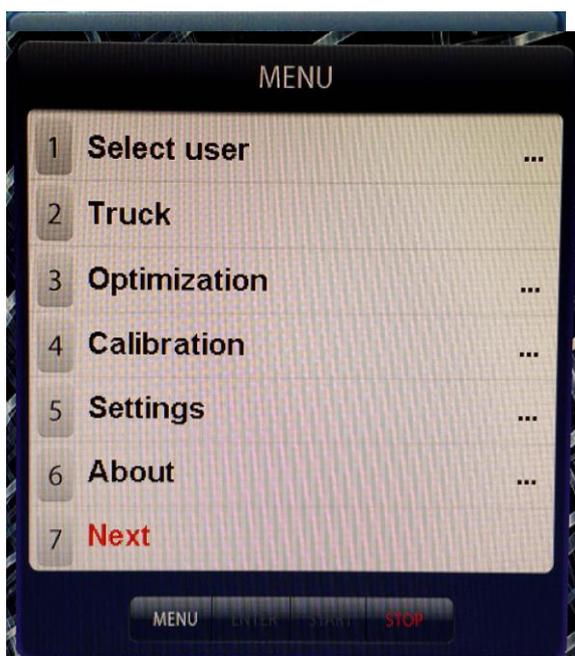
11.2. To select a weight positioning scheme in the programs «ALU1-ALU5» you will need to press the button «ALU» on main operating mode screen. It will open the window for weight positioning schemes marked with numbers (fig. 11.1.). To select the required scheme, press the top row button on the keyboard with the corresponding number. Selected weight positioning scheme will appear in the window 3 of the main operating mode screen (fig. 10.2).

## 12. Wheel Balancing.

### 12.1. Measuring the unbalance.

Measuring of the unbalance is done in the following sequence.

12.1.1. Power up the WB. The machine has two balancing modes: Mode 1 - for cars and light trucks, with wheels weighing under 65 kg, and Mode 2 – for wheels up to 200 kg. Switching between modes is done in the following way: press the button «MENU». The window MENU will appear on the screen (fig. 12.1). Select the option 2 and select the desired mode «Car» or «Truck», by pressing the button 2 in the top row of the keyboard. The main operating mode screen will display the image of a car or truck. When the WB is powered up, it can automatically enter one of the modes (1 or 2). It is set by the user and will be described further below.



The WB software has a function of automatic recognition of the type of the wheel (car or truck) and automatic selection of the correct mode. This function has a step-by-step sensitivity adjustment and can be turned off by setting the respective (refer to «Machine Parameter Setup»).

12.1.2. Get the wheel ready for being mounted on the WB:

- clean it from dirt,
- remove all previously added weights , large stones or other foreign objects from the tire tread.

12.1.3. Установите на вал СБ балансируемое колесо в соответствии с разделом 9.

12.1.4. Enter the dimensions of the wheel as per chapter 10.

12.1.5. Если необходимо, выберите программу ALU в соответствии с разделом 11.

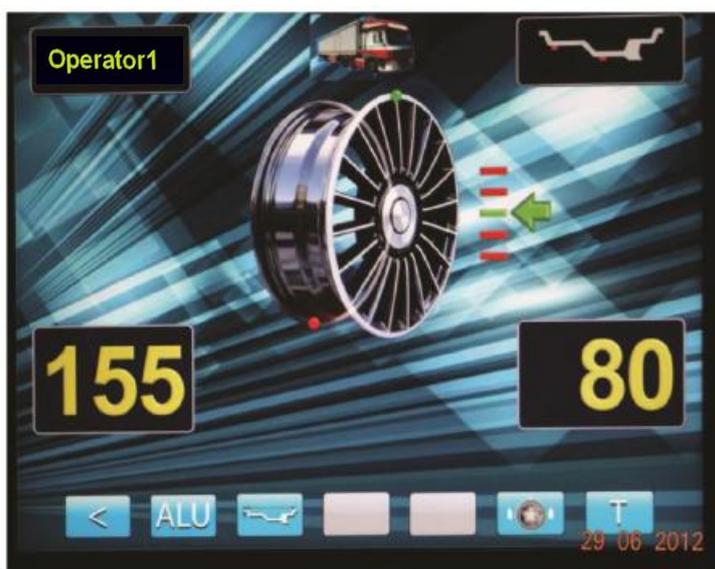


fig. 12.2

12.1.6. Start the WB by pressing the button «START». The image of the wheel disc on the main working mode screen will start to rotate. After the measurement cycle is complete the braking device will stop the WB shaft. Windows 1 and 4 will display the value for the mass of the balancing weights and the image of the disk will show two red dots in the places where the weights should be added. (fig. 12.2.).

12.1.7. If, after the WB has been started, you notice, that the dimensions were entered incorrectly or the wrong balancing program was selected (ALU, St), reenter the parameters and the results will be automatically recalculated.

12.2. The program for measuring of the unbalance is set not to count the unbalance of less than 8 gr in mode 1 for any correction plane. In this case, the windows 1 and 4 show the message «OK». Minimum unbalance to be shown in the windows 1 and 4 is 8 gr. Unbalance greater than 8 gr will be rounded off to the nearest multiple of 5 gr, i.e. the unbalance values of 9, 10, 11 and 12 gr will be shown as 10, the unbalance values 13, 14, 15, 16 and 17 gr - as 15 and so on. To view the unrounded value or the value under 8 gr, press the button «<<». The value of the minimal unbalance, displayed in windows 1 and 4 can be changed within the range of 0 and 15.

In the mode 2 the value of the minimal unbalance can be changed within the range of 0 and 100. And the values are rounded to the nearest values in increments of 25 gr.

**IMPORTANT!** Balancing of wheels heavier than 65 kg in the Mode 1 is prohibited!

The WB software has a function of automatic recognition of the type of the wheel (car or truck) and automatic selection of the correct mode.

12.3. Placement of the corrective weights.

12.3.1. This balancer is equipped with a function that automatically brings the wheel in the correct position for placement of the corrective weights. The wheel is positioned in such a way, that the weight is being placed on the top – on the vertical line from the center of the shaft (12 o'clock position). The program is set in such a way, that after the measuring cycle the wheel can be positioned either along the correction plane, where the unbalance is at the maximum, or along the left (inner) or right (outer) plane. Adjustment of the wheel position is done with the use of the parameter «Positioning» (refer to the chapter «Machine Parameter Setup»). The switching between the correction planes is done by the button «Position».

Raise the wheel guard. The correction plane, on which the weight needs to be placed, is marked by a green dot, showing where to add the balancing weight on the image of the disc, and also by the scale with green arrow, appearing on the left or on the right of the disc image.

12.3.2. Select the corrective weight with the mass equal to the figures on the unbalance indicators in the plane, in which the image of the dot and the arrow is in green, and place the weight on this plane «at 12 o'clock position».

12.3.3. The WB is design to allow for weight placement directly on the shaft of the machine, but to prolong the life of the WB do not subject it to the high impact forces while adding the weights. It is recommended to perform the final hammering of the corrective weights after dismounting the wheel from the WB shaft.

12.3.4. With unbalance of 100 gr on both sides of the wheel in the Mode 1, or over 300 gr in the Mode 2, can create the saturation of the WB measuring channel, which can lead to additional errors. For measurement values higher than 100 gr in the Mode 1 (or 300 gr in the Mode 2) for any plane, it is recommended to compensate such a big unbalance with a weight, accounting for 70-80% of the WB measurements, and then, in the next cycle, perform the final balancing of the wheel.

12.4. Sometimes, when the already balanced wheel is turned on the shaft or balanced wheel is placed back on the shaft, the unbalance measurement value is not equal to «0». This may not be the result of an error in measurements, but there may be a mismatch in wheel weight distribution relative to its axes of rotation between the previous measurement and the current measurement, i.e. during these two measurement cycles the wheel had different positions relative to the WB shaft. The errors in measurements may also be caused by dirt, foreign objects on the flange face or the disc, ovality and other defects of the center bore, wear, defects of the working surfaces of the shaft and cones, high radial and face run-out of the flange face and shaft due to

deformations caused by an application of excessive loads or forces.

It should be noted, that difference in unbalance measurements described above (when the position of the wheel relative to the WB shaft has been changed) is approximately twice as large the actual value of the final unbalance. This is due to the portion of the balancing weights, compensating incorrect wheel positioning, is combined with the unbalance caused by the defects described above.

So the difference in measurements of up to 15 gr (20 gr for heavier wheels) should be considered acceptable. In the Mode 2 the values may be greater.

If, after the wheel has been balanced, there is a vibration on the steering wheel during driving, it may have been caused by the unbalance of the brake wheels, drums or other parts rotating along with the wheel. Very often the reason is excessively large permissible error limits and the wear on the hub, center bore or clamping holes of the wheel. The other reason for vibration may be the defects of the disc or the tire, ovality or the wobble of the wheel, dead stroke in the suspension and steering mechanism.

After the wheel has been balanced any final unbalance can be eliminated with the use of a finishing balancing machine, which will compensate the final unbalance of all the rotating parts directly on the axle of a car.

### 13. Program «SPLIT» for Balancing Weight Separation.



fig. 13.1

13.1. The program «SPLIT» is used for balancing the wheels with high quality discs made from light alloys to preserve the exterior appearance of the wheel by placing the invisible weights behind the disc's spokes.

The program «SPLIT» can only be used for the schemes when the outer unbalance correction plane is located behind the spokes of the disc, i.e. for «ALU 2R» and «ALU 3R» modes. The program allows splitting the value of the balancing weights in two parts in such a way, that both of them end up in the position behind the spokes.

13.2. Prior to using the program «SPLIT», the wheel should be mounted on the machine, the parameters entered and the programs «ALU 2R» and «ALU 3R» selected.

13.3 After the WB has been started and the unbalance measurement results acquired, the operator evaluates the need to split the weight on the right side of the rim. If the position of the balancing weight placement will be behind the spokes, the program «SPLIT» will help to split it and place it behind the spokes.

13.4 Move the next right spoke, relative to the place of the balancing weight positioning, vertically (12 o'clock position) and press the «SPLIT» button. The main operating mode screen will display the yellow dot for the positioning of the first part of the balancing weight. Then move the next left spoke relative to the place of the balancing weight positioning vertically (12 o'clock position) and press the «SPLIT» button. The main operating mode screen will show the yellow dot for the positioning of the second part of the balancing weight (fig. 13.1.).

Now, the balancing weight on the right side of the disc is split in two parts behind two neighboring spokes and you can start adding the balancing weights.

13.5 Perform the placement of the balancing weights according to the method described in clauses 12.3.2 and 12.3.3.

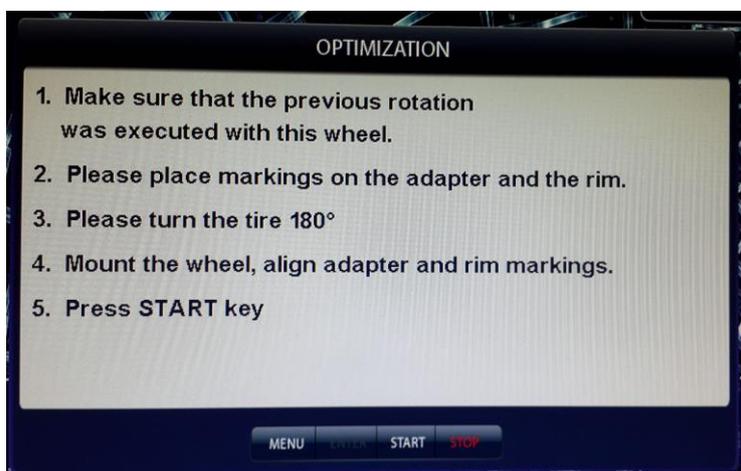
13.6 Start the WB to check the balancing results. If the values are not equal to zero, perform the necessary corrections.

13.7. Press «SPLIT» button to exit the program.

#### 14. Program «OPT».

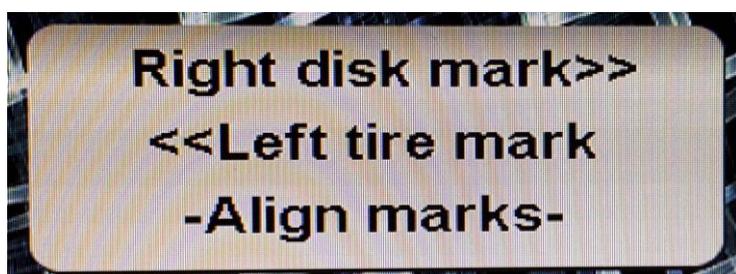
14.1 The «OPT» program provides the optimal positioning of the tire on the disc in terms of minimal static unbalance of the wheel. Also it reduces the mass and the quantity of the balancing weights needed for wheel balancing, as well as minimizes the residual wheel eccentricity. The «OPT» program is recommended for use when static unbalance of the wheel is greater than 30 gr.

14.2 To enter the «OPT» program press button «MENU». The screen will display the window shown in the fig. 12.1. Then select the option «Optimization» by pressing the button «3». The screen will display window shown in fig. 14.1. Follow the directions on the screen.



14.3 After completing the instructions in item 5 (fig. 14.1) you will see the following window on the monitor – (fig. 14.2). The value of the static unbalance will be displayed on the indicator 1 and the indicator 4 will display the value of the unbalance you will get after the completion of the «OPT» program. Put the, markings on the tire according to the instructions in the clause 2 of the window on the fig. 14.1.

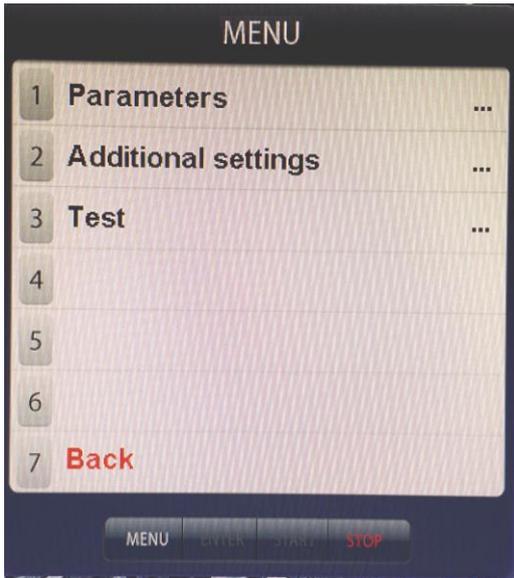
14.4. Dismount the wheel from the WB shaft and place it on the tire fitting machine. Turn the tire relative to the disc so the markings align.



14.5 Put the wheel back on the shaft of the WB and align the wheel disk based on the markings made in procedure described in clause 14.1. Start the WB and balance the wheel as described in the chapter 12.

14.6 Press the «STOP» button to exit the «OPT» program

## 16. Program «FOUR OPERATORS»

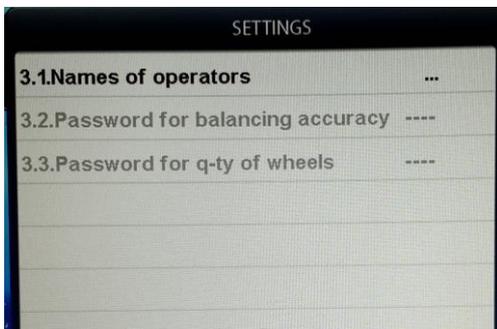


16.1. Very often there are multiple operators working in the tire fitting area, servicing the vehicles with different types of tires. It would be very convenient not to have to enter the new wheel dimensions every time and the switch between the different types of wheels could be done simply by switching the name of the operator. Besides this, the operator can choose any combination of options from the MENU «SETTINGS», and it will be saved under the name of this operator. This function is available with the program «FOUR OPERATORS».

16.2. En

tering the operator.

16.2.1. Press the button «MENU». The window MENU will appear on the screen (fig. 12.1). Press button 7 «Next» - the monitor will display the second page of the MENU screen (fig. 16.1).



Select «Additional settings» by pressing the button 2. The menu «SETTINGS» will appear on the screen (fig. 16.2.). Press the button 1 «Names of operators» - the screen will display the window «SELECT USER» with the list of the operators (fig. 16.3).

16.2.2. Press the button for the required operator. If the number has no name the word «Operator» will be deleted and in this space you can enter the name of the operator. The name can be entered using buttons «↑» and «↓». (UP and DOWN). Pressing of this buttons displays the sequential list of Cyrillic and Latin alphabet letters and numbers from 0 to 9. After the name has been entered, press the «ENTER» button and the name will be recorded. If this number already had a name of the operator assigned to it, enter a new name and press «ENTER».

After the operators name has been recorded, press the «STOP» button to return to the main operating mode screen.

16.3. Retrieving the operator and recording its settings.

16.3.1. Press the button «MENU». The window MENU will appear on the screen. Press the button 1 «Select a user». The screen will display the window «SELECT USER» with the list of the operators. (fig. 16.3).

16.3.2. Press the button for the required operator. The program will switch to the main operating mode screen and the operator's name will be displayed in the window 2 (fig. 8.2).

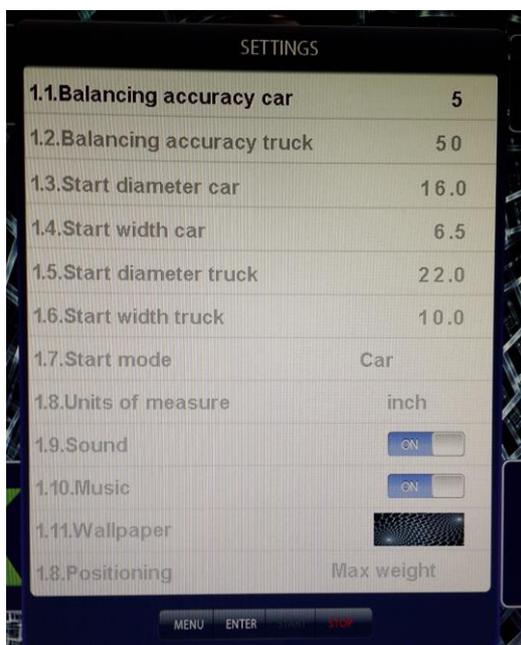
16.3.3. To record settings for this operator, select them as described in the chapter 17 «Machine Parameter Setup» and press the button «ENTER». Now the selected settings for this particular operator are recorded in the machines memory.

The sizes of the wheel and the weight positioning scheme, entered by this operator, will be

kept until the other values are entered.

**Note:** The sizes of the wheel and the weight positioning scheme, entered by the operator, will not be saved when the machine is powered down.

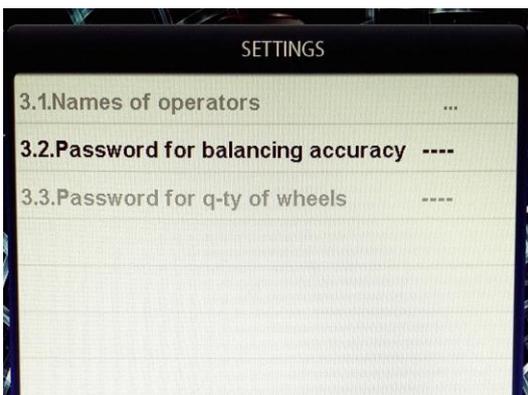
## 17. Machine Parameter Setup.



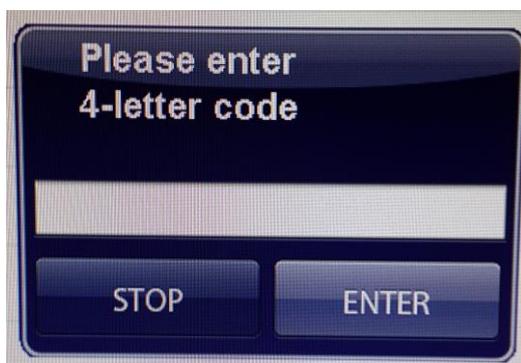
The software of the WB contains the whole set of parameters, allowing to make the machine as much user friendly and make sure it meets all needs of the customers. To set the parameters press the «MENU» button. The window MENU will appear on the screen (fig. 12.1). Press the button 5 «Settings». The monitor will display the parameter setting window (fig. 17.1).

17.1. Parameter 1.1 and 1.2 "Balancing accuracy car" and "Balancing accuracy truck" sets the minimal unbalance value in car and truck modes, displayed in windows 1 and 4 (refer to clause 12.2.). To change it, use the buttons «↑» and «↓» to select the required parameter (highlighted in color). Set the required value using buttons «+» or «-». Press the button «ENTER» to return to the mode MENU, press the button «STOP» to return to the main operating mode screen.

**IMPORTANT!** If the technical manager wants to restrict the change of the parameter 1.1 «Balancing accuracy» by the operators, a password can be set on this option.



To add a password press the button «MENU», then press the button 7 «Next» to get to the second MENU page. Select option 2 «Additional settings» by pressing number 2. Using button «↓», select the option «Password for balancing accuracy» and press button «+». The screen will display the window. Enter the four figure code and press «ENTER». From now on, the machine will ask to enter the code if someone wants to change this parameter.



To change the code, select the option «Password for balancing accuracy» and press the «+» button. The window (fig. 17.2) will display the request «Please enter 4-letter old code». Enter the old code and press «ENTER». The window (fig. 17.3) will display the request « Please enter 4-letter new code». Enter the new code and press «ENTER». If you press the button «STOP» when entering the new code, the password option on the setting the parameter «Balancing accuracy» will be removed.

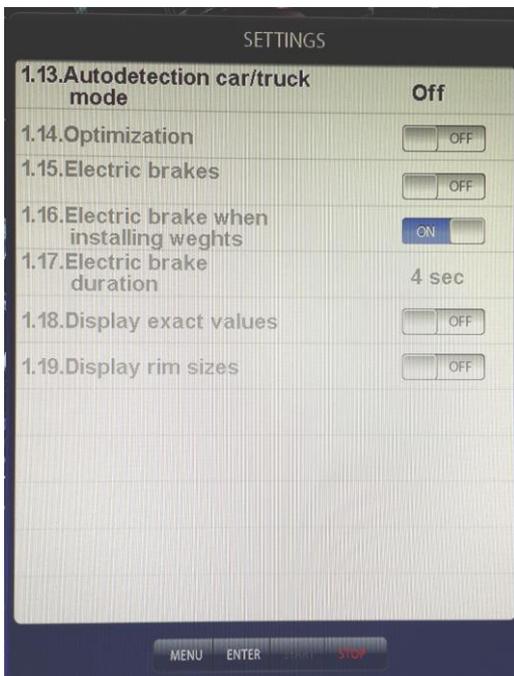
17.2. Setting the initial values for diameter and width of the wheel's disk, on the startup of the WB for car and truck modes (refer to clause 10.1.) is done, using the following parameters: 1.3 «Start diameter car», 1.4 «Start width car», 1.5 «Start diameter truck», 1.6 «Start width truck». To change the value, select the required parameter using buttons «↑» and «↓» and set the required value using buttons «+» and «-». Press «ENTER» to save the parameter and «STOP» to

return to the main operating mode.

Setting the units of measurement for the diameter and the width (inches or mm) - parameter 1.8 «Units of measure». Select the parameter using buttons «↑» and «↓» and choose the required units of measurement using buttons «+» and «-». Press «ENTER» to save the value and «STOP» to return to the main operating mode screen.

17.3. To set the selection of car or truck mode on the powering up of the WB, use the parameter 1.7. To select the parameter use buttons «↑» and «↓», to change the setting use buttons «+» and «-». Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.

17.4. The WB software contains several phrases accompanying main operations, for example, entering of the geometrical dimensions placement mode with the use of a gauge etc. The audio can be turned off. Select parameter 1.9 «Sound» using buttons «↑» and «↓», set its value to «OFF» using buttons «+» or «-». Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.



17.5. Parameter 1.10 «Music». If the parameter «Music» is set to «ON», when you turn the power on, you hear the music playing. To change this option choose the parameter 1.10, using buttons «↑» and «↓», and set it to «OFF», using buttons «+» or «-». Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.

17.6. Parameter 1.11 «Wallpaper». The WB software has several screen background options, which can be changed by the user. To change the background select the parameter 1.11 using buttons «↑» and «↓» and set the desired background, using buttons «+» or «-» (the background sample will appear on the line). Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.

17.7. Adjusted positioning by plane - parameter 1.12 «Positioning». To change this option choose the parameter 1.12, using buttons «↑» and «↓» and set its

value using buttons «+» or «-»:

- initial plane specific positioning to rectify maximum unbalance
- left (inner) plane specific positioning
- right (outer) plane specific positioning
- initial positioning is turned off (pressing the button «Position» turns the option ON).

Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.

The second page of the parameter setup screen (fig. 17.4.). Use button 5 to swap pages.

17.8. Parameter 1.13 «Autodetection car/truck mode». This parameter has two values: «19» and «OFF». Number 19 stands for sensitivity level of the wheel type identification channel (car or truck). The sensitivity level is to be corrected while in operation, so the WB can correctly identify the type of the wheel. If the parameter is set to «OFF», the auto determination of the mode is turned off.

17.9. The program for minimization of the residual static unbalances - parameter - 1.14 «Optimization».

If this option is not available due to the setting of the minimum unbalance in windows 1 and 4 (refer to clause 17.1.1), and the masses of the corrective weights are divisible by 5, there

may be some residual unbalance left, after the wheel has been balanced.

When the program for minimization of the residual static unbalances is turned on, the mass and positioning of the corrective weights are calculated in order to get the minimal residual static unbalance.

To turn this program on, select the parameter 1.14 using buttons «↑» and «↓» and set its value using buttons «+» or «-». Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.

17.10. Parameter 1.15 «Electric brakes». After the measurement cycle has been completed the machine stops the wheel. To reduce the braking time the braking electromagnet can be used. To change the setting of this parameter select the option 1.15, using buttons «↑» and «↓», and set its value using buttons «+» or «-». Press «ENTER» to save the setting and «STOP» to return to the main operating mode screen.

17.11. Parameters 1.16 " Electric brake when installing weights" and 1.17 "Electric brake duration". If the parameter 1.16 is set to «ON», when the wheel is in the position for weight placement for one of the planes, this position is being fixed by the electromagnetic braking device. The duration of electromagnetic braking device engagement can be regulated by setting the parameter 1.17 to the specific value (within the range of 2 - 8 sec).

17.12. Parameter 1.18 " Display exact values ". If this parameter is set to «ON», the windows with unrounded unbalance values for inner and outer sides of the wheel will appear on the screen next to the windows 1 and 4.

Changing of the parameter and recording of the new value is done the same way as for other parameters..

Press «STOP» to return to the main operating mode screen.

17.13. Parameter 1.19 " Display rim sizes ". If this parameter is set to «ON» , the screen displays the small window, showing the values for inputted wheel dimensions.

## 18. Calibration.

For wheel unbalance measurement the WB has a main measuring channel and secondary measuring channels:

- measuring the distance to the wheel;
- measuring the diameter of the rim;

All mentioned channels are calibrated separately.

18.1. Calibration of channels for measuring the distance to the wheel and diameter of the rim.

18.1.1. Calibration of channels for measuring the distance and diameter.

To evaluate the inaccuracies in measurement of the distance, pull out the gauge and press the side surface of its handle against the back end of the shaft flange, as shown on the fig. 18.1.

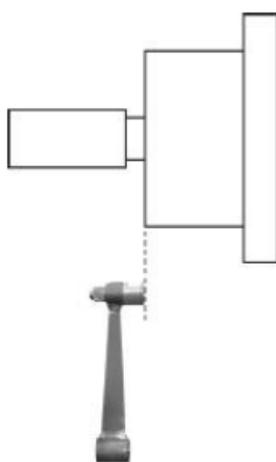


fig. 18.1.

The screen for input of the dimensions will display the value for the distance (refer to fig. 10.2).

If the distance is not equal to  $117 \pm 5$  mm, the distance input device needs to be calibrated.

Press the button «MENU». In the window MENU select the option «Calibration» by pressing the button 5 in the top row of the keyboard. The window «CALIBRATION» will open. Select option 3 «Distance calibration» by pressing button 3 in the top row of the keyboard. This will open the window «DISTANCE CALIBRATION» (fig. 18. 3). Pull out the gauge and press

the side surface of its handle against the back end of the shaft flange, as shown on the fig. 18.1 and press the button «ENTER». The item 2 «Insert the distance handle into the position 1 and press ENTER button» in the window «DISTANCE CALIBRATION» will be highlighted.

**Note:** If you only wish to calibrate the distance measuring channel and skip calibrating the diameter measuring channel, you need to quit the «DISTANCE CALIBRATION» menu by pressing the button «START». The message «parameters recorded» will appear and the monitor will display the main operating mode screen.

#### 18.1.2. The calibration of the disc diameter measuring channel.

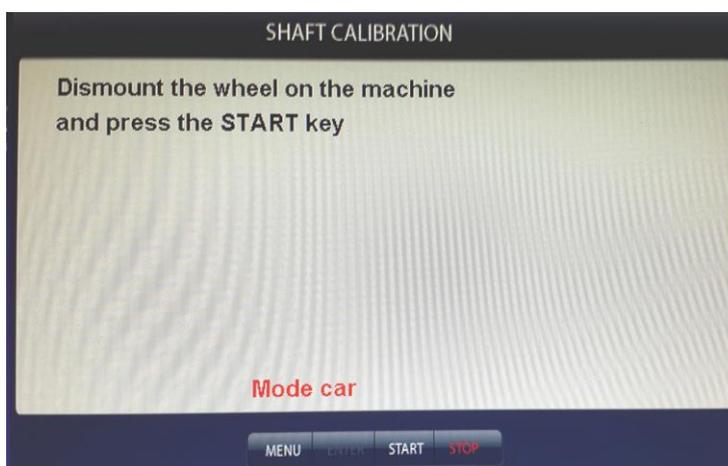
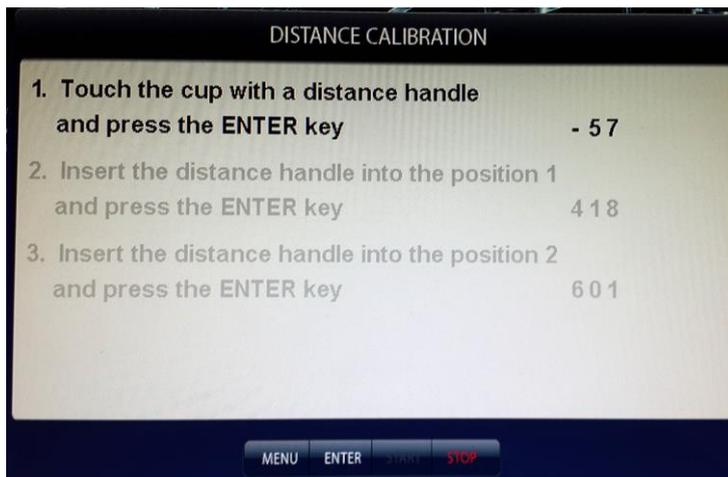
Place the diameter calibration sampler, so its notch (fork) is pressed against the smaller diameter of the cup behind the back end, with the sampler plane pressed against the back of the cup. Insert the tip of the gauge handle into the lower hole of the sampler and press «ENTER».

The item 3 «Insert the distance handle into the position 2 and press ENTER button» in the window «DISTANCE CALIBRATION» will be highlighted. Follow the directions in the item 3. The message «Parameters recorded» will appear. Press the button «STOP» to return to the main operating mode screen.

**Note:** The figures in the windows are conditional (fig. 18.3.).

### 19. Calibration of the measuring channel.

If you have any doubt as of the accuracy of the corrective weights masses measurements, you can perform calibration of the WB unbalance measuring channel.



19.1. The calibration of unbalance measuring channel for car and truck modes is performed separately.

19.2. Set the required balancing mode (1 or 2) and enter the calibration program by pressing the button «MENU». Select the item 1 «Main calibration» by pressing the button «1» in the top row of the keyboard on the MENU screen. The window «MAIN CALIBRATION» will appear (fig. 19.1).

19.3. As per item 1 of this window, place an average size assembled wheel on the shaft of the WB (with unbalance on both sides of no more than 25 gr for Mode 1 and no more than 75 gr for Mode 2).

19.4. Enter the dimensions of the wheel.

**IMPORTANT!** If the dimensions are entered incorrectly, the results of the calibration will also be incorrect, as well as the all following measurements.

19.5. Start the WB by pressing the button «START». After the first cycle in the window

highlights the second item: «Place the 75gr weight on the external plane and press the START button» for the Mode 1 and «Place the 300gr weight on the external plane and press the START button» for the Mode 2.

19.6. Place the weight with the mass measured in advance and equal to  $75 \pm 0,5$  gr for Mode 1 and  $300 \pm 1$  gr for Mode 2 on the outer side of the wheel. Start the WB.

19.7. After second calibration cycle is completed, the screen will display the changing numbers and the message «CALIBRATION IS COMPLETE» will appear.

## 20. Residual unbalance assessment

To determine the need for shaft residual unbalance assessment procedure set the required balancing mode (1 or 2). Set the average dimensions:

	For Mode 1	For Mode 2
diameter	13 inches	22,5 inches
distance within	3,5 3,7	3,0
width	5,0 inches	10 inches.

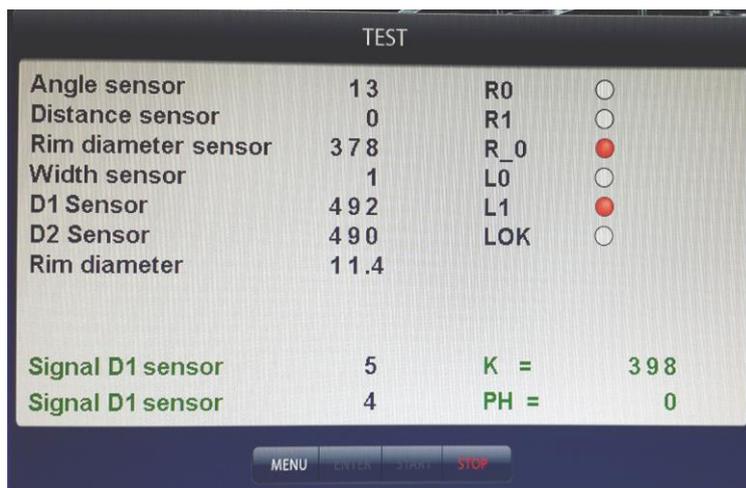
Do not place any parts of a wheel on the WB. Start the WB. If, after the WB has stopped, the values in the windows 1 and 4 will be greater than 2 units for Mode 1 and 10 units for Mode 2, there is a need to perform the shaft residual unbalance assessment procedure. This procedure is performed separately for modes 1 and 2.

20.1. Set the required balancing mode.

20.2. Press the button «MENU». Select the item 2 «Shaft balancing» by pressing the button «2» in the top row of the keyboard. The window «SHAFT BALANCING» will open (fig. 20.1.).

20.3. Do not place any parts of a wheel on the WB. Start the WB. After the measurement cycle is complete the screen will display the message «SHAFT BALANCING IS COMPLETE».

## 21. «TEST» Mode.



Press the button «MENU». Select the item 7 «Next» by pressing the button 7 in the top row of the keyboard on the MENU screen. The second MENU screen will open (refer to fig. 16.1). Select item 3 «Test» by pressing the button 3 in the top row of the keyboard. The window TEST will open (fig. 21.1.).

In the line «Angle sensor» there will be a number, changing from 0 to 143 for each one turn of the shaft.

The indicators R0 and R1 must blink steadily with the steady rotation of the shaft. (fig. 21.1.) The indicator R\_0 should give out 1 flash for one turn of the shaft. В строке Датчик угла отображается число, изменяющееся от 0 до 143 за 1 оборот вала. Индикаторы R0 и

The line «Distance sensor» display the value, changing by 50-60 units with the extension of

the gauge.

The line «Rim diameter sensor» displays the number, steadily changing with the turning of the gauge handle for entering of the distance.

The line «Rim width sensor» displays the number, steadily changing with the turning of the gauge handle for entering of the width (if the gauge handle for entering of the width is available).

Sensor D1 and sensor D2 represent the average levels of signals from the sensors and should fluctuate around the value of 500. Lines «Signal D1 sensor» and «Signal D2 sensor» display sensor signal values after the measuring cycle.

«K» and «PH» are the internal parameters.

All values on the fig. 21.1 have an illustrative purpose only.

To leave the TEST mode press the button «STOP».

## 22. Displaying the Number of Balanced Wheels.



The screenshot shows a screen titled 'ABOUT' with the following data:

Soft. ver.	V8.12	
	Nr.wheels	Nr.starts
Storm	000000	000006
Operator2	000000	000000
Operator3	000000	000000
Operator4	000000	000000
Total	000000	000006

At the bottom of the screen, there are three buttons: 'MENU', 'ENTER', and 'STOP'.

Press the button «MENU». Select the item 7 «Next» by pressing the button 7 in the top row of the keyboard on the MENU screen. The second MENU screen will open (refer to fig. 16.1). Select the item 2 «Additional settings» by pressing the button 2. The following window will open – fig. 22.1. The window shows the software version information (top left) and the number of wheels balanced by each operator (first column). The second column contains the number of starts, performed by each operator.

**IMPORTANT!** If the technical manager wants to restrict the viewing of the number of balanced wheels by the operators, a password can

be set on this option.

To set the password, press the button «MENU». Press the button 7 «Next» to go to the second MENU page. Select the item 2 «Additional settings» by pressing the button 2 (fig. 17.2). Select option «Password of q-ty of wheels» using button «↓», then press the button «+» to open the next window. Enter the 4 digit code and press «ENTER». Now, to view the number of balanced wheels there will be a request to enter the code.

To change the code, select the option «Password for balancing accuracy» and press the «+» button. The window will display the request « Please enter 4-letter old code». Enter the old code and press «ENTER». The window will display the request « Please enter 4-letter new code». Enter the new code and press «ENTER». If you press the button «STOP» when entering the new code, the password option on the viewing of the information about the number of balanced wheels will be removed.

## 23. Maintenance Service.

23.1. To function normally during the entire operating life the WB requires regular servicing. The frequency of maintenance service depends on the working and environmental conditions, as well as the operating rate.

Recommended types and time intervals of maintenance operation:

- daily maintenance
- quarterly cleaning
- belt tension adjustment and brake unit clearance check –as required.

Before opening for maintenance, the WB should be disconnected from the power source.

### 23.2. Daily maintenance.

After the completion of each work day clean the housing of WB from any dirt and dust. Wipe the working parts of the spindle, flange, stud and the clamping set with the piece of cloth moistened with mineral oil.

**IMPORTANT!** Every day, during the working process, keep the mounting faces of the spindle, stud, cones and the adapter for truck wheels mounting clean and wipe it with the piece of cloth moistened with mineral oil when required, to avoid early wear and mechanical failures.

### 23.3. Cleaning the WB.

Every three month the dust and wear products of the transmission and brake unit, which accumulate on the interior of the WB, should be removed. The cleaning must be performed with the use of a vacuum cleaner. Air blasting cleaning of the WB interior may cause some conducting particles to get into the sensor circuits and electronic components and is strictly prohibited.

During cleaning pay special attention to the optoelectronic sensors on the devices for entering the distance and measuring the spindle rotational angle. The circle with the dark and light bands on the front end of the spindle sheave and the measuring scale with the same bands on the distance entering gauge need to be wiped with a dry or slightly damp soft cloth. Never use organic solvents! The optoelectronic sensors elements should be cleaned with a clean soft brush.

If there is a reason to suspect that the distance or angle measurements are faulty, carefully disassemble the optoelectronic sensors and thoroughly wipe the surfaces of light-emitting and photo diodes with the soft piece of cloth moistened in alcohol, after which place them back.

**IMPORTANT!** When reassembling the optoelectronic sensors make sure to provide for the clearance of at least 0,8-1,2 mm between the light-reflective surface with the dark and light bands and the faces of the photocells on the optical sensor board. This applies especially to distance entering sensors, because if the clearance is less than 0,8 mm, there is a possibility of scratching of the light-reflecting band because of the lost motion play off a measuring scale guide bar.

23.4. Adjust belt tension by moving the motor support assembly. With normal tension on application of a force of 0,8-1,0 kg, the belt deflection should be 15-20 mm.

**Note:** If there is a squeaking sound, this problem can be solved by applying special purpose grease, used for solving the squeaking problem with car alternator belts and is sold in auto parts stores.

23.5. To adjust the clearance between the electric magnet and the brake disk; ease off two bolts that hold electric magnet bracket. Pull back the bracket, set the clearance within 1-1,5 mm and tighten the bracket bolts.

#### **24. Certificate of Acceptance.**

Balancing stand Maxi, manufacturing number \_\_\_\_\_

Complies with Technical Specifications 4577001946081482006 and ready for operation.

Production Date « \_\_\_\_ » \_\_\_\_\_ 201\_\_.

Head of the Enterprise \_\_\_\_\_

stamp here

#### **25. Initial Calibration Certificate.**

stamp here

Control measuring device verification officer \_\_\_\_\_

« \_\_\_\_ » \_\_\_\_\_ 201\_\_ .

#### **26. Warranty.**

Manufacturer warrants compliance of products with the requirements of the present Specifications subject to adherence to the operation, transportation and storage conditions. Claims are not accepted for the WB with defects caused by the user, the WB with deviations from the assigned parameters, which can be remedied by the adjustments provided in this instruction manual.

Product warranty period – 1 (one) year from the date of the shipment to the customer, but no more than 18 months from the Production Date.

Date of the shipment « \_\_\_\_ » \_\_\_\_\_ 201\_\_ .

Signature \_\_\_\_\_ stamp here.

## 27. Calibration Procedure.

The following calibration procedure is applied to balancing machines manufactured by «STORMBALANS» LLC, St. Petersburg in accordance to Technical Specifications 4577-001-30645255-2011. This calibration procedure establishes the methods for initial and periodical calibrations of this equipment.

The interval between calibrations – 1 year.

### 1. Calibration Stages And Instruments.

1.2. The calibration procedure should include the stages, described in the Table 1.

**Table 1**

Stage	Paragraph number	Calibration Instruments, accessory equipment and technical characteristics	Stages of	
			Inicial calibration	Periodical calibration
Visual inspection	5.1	Visually	yes	yes
Testing	5.2	Car wheel assembly	yes	yes
Software validation	5.3		yes	yes
Determination of the metrological characteristics: - determination of the zero drift; - determination of the absolute error while measuring the unbalance mass for one correction plane; - determination of the absolute error while measuring the angular position of the unbalance mass	5.4	Weigh-scales in accordance with GOST P 53228-08 with scale capacity of 300 gr and accuracy readability of 0,1 gr. Car wheel assembly. Weights 25, 50, 75, 100, 150 and 200 gr $\pm$ 0,5gr.	yes	yes

To ensure the required accuracy of measurements, it is admissible to use the calibration instruments and accessory equipment not listed in Table 1, provided it has valid certificates.

### 2. Safety Requirements.

- 2.1. It is strictly prohibited to work on the machine with its housing covers removed.
- 2.2. The WB housing must be properly grounded.
- 2.3. Touching rotating parts of the WB before full stop is strictly prohibited.
- 2.4. From the start of the WB and until its full stop the wheel must be covered with wheel guard (if supplied).
- 2.5. The calibration procedure must be performed only in the presence of the operator, responsible for operating of this machine.

### **3. Calibration Conditions.**

The following conditions must be observed while performing the calibration procedure: the room temperature -  $20 (\pm 10) ^\circ\text{C}$ ; the changes in room temperature should be no more than  $2 ^\circ\text{C}$  per hour; relative humidity  $65 (\pm 15) \%$ .

### **4. Preparation for Calibration.**

4.1. Prior to carrying out the calibration procedure all the requirements for correct installation and connection of the WB must be performed.

4.2. All the maintenance and calibration procedures must be performed in accordance with this Operation Manual.

### **5. Carrying Out Of the Calibration.**

5.1. Visual inspection. The visual inspection should establish the following:

- the machine has no visible damage;
- all operating controls function normally;
- working surfaces of the shaft and clamping devices are free of indentations and scoring marks.

5.2. Testing.

5.2.1. Perform the test start of the WB in accordance with this Operation Manual. After the measurement cycle is complete the display must show the values for the unbalance mass and its angular position.

5.3. Software validation.

5.3.1. After the machine is started, press the button «MENU». Select the item 6 «About» by pressing the button 6 in the top row of the keyboard on the MENU screen. The software version number will be displayed in the top left corner of the screen (fig. 22.1). The software version number should match the one, indicated in the machine description.

5.4. Determination of the metrological characteristics.

5.4.1. Determination of the zero drift.

Mount the wheel and balance it in accordance with this Operation Manual, so the resulted residual balance values are equal to zero or do not exceed 1 gr. Then, start the WB and, after the stop, record the readout on the indicators for the corrective weights for inner and outer planes of the wheel. Repeat the measurements twice more. Calculate the average value of the readouts. The zero drift (the average of the unbalance mass) for each wheel plane should not exceed  $\pm 3$  gr.

5.4.2. Determination of the absolute error while measuring the unbalance mass for one correction plane.

Verify the masses of the control weights with nominal values of 25, 50, 75, 100, 150 and 200 gr. The mass of the control weights should be verified using weigh-scales with a scale interval equal to 0,1 gr. Actual masses of the control weights should not differ from the nominal values by more than 0,5 gr..

Place the control weight with the mass of 25 gr on the outer plane of the wheel. Perform the measurement of unbalance for outer and inner planes of the wheel three times. Record unrounded values.

Place the control weight with the mass of 25 gr on the inner plane of the wheel. Perform the measurement of unbalance for outer and inner planes of the wheel three times.

The mass of unbalance should be the average value of all the measurements.

The same procedure should be done with weights with a mass of 50, 75, 100, 150 and 200 gr.

Unbalance measuring error for the plane with added control weight is calculated based on the following formula:

$$DM_i = |Mp_i - M_k|,$$

where  $Mp_i$  – the value of unbalance, measured by the WB.

$M_k$  – the mass of the control weight (actual mass of unbalance value). Absolute zero drift error is determined for a plane with no weight added.

Obtained values must not exceed  $\pm(3+0,1M_k)$ .

5.4.3. Determination of the absolute error while measuring the angular position of the unbalance mass.

Place the control weight with the mass of 200 gr on the inner plane of the wheel.

Determine the location for placement of the balancing weight. Measure the distance from the control weight's center of balance to the vertical line going through the center of the spindle axle with a ruler (0 – 300 mm GOST 427). Perform this procedure no less than three times.

Unbalance mass angular position measuring error is calculated based on the following formula:

$$a = 114,6 L_{cp}/D,$$

where  $L_{cp}$  – is the average value of the distance from the control weight's center of balance to the vertical line going through the center of the spindle axle (in mm);

$D$  – the diameter of the wheel disc (in mm).

The same measurements are done with the appropriate control weight placed on the inner lip of the calibration disc.

Unbalance mass angular position measuring error must not exceed  $\pm 5^\circ$ .

## 6. Calibration Results Certification

6.1. Positive results of the initial calibration is recorded in the machine data sheet with the date of the calibration authenticated by the stamp of the verification officer.

6.2. Positive results of the periodical calibration is certified by the Calibration Certificate.

6.3. The balancer failed to meet the requirements of this method are rejected and not approved for use. The certificate is nullified. The certificate of unserviceability, with the reasons for rejection listed, is issued in accordance with Regulation «PR 50.2.006-94» - « Procedure for calibration of measurement equipment».

**The "STORM" Company**  
**www.stormbalance.com**  
**Tel/fax: + 7 (904) 332-18-15**  
**E-mail: export@stormbalance.com**