

testing bench

 **DS[®]** Electronic Racing Products

Ref. DS-4101

INDEX

1. Presentation.....	1
2. Features	1-2-3
3. Sensors, connectors, controls and displays	3-4
4. Menu navigation and use	4-11
5. Protection	11
6. Contents downloading.....	11
7. FAQ	12-13
8. Warranty and Security.....	13-14-15

1. Presentation

Thank you for purchasing TESTING BENCH, with this product we have tried to group the whole series of sensors that can help us choose the best engine, best magnet and get the best balance of our vehicles for each type of competition. Thank you for purchasing the TESTING BENCH. With this product we have tried to group all series of sensors that could help us choose the best motor, the best magnet and to achieve the best balance of our vehicles for any type of race. Please take a moment to read this manual in order to know this testing bench features. If you still have any doubts please contact your usual vendor or directly DS Racing Products.

Sincerely, TESTING BENCH design team.

2. Features

The main TESTING BENCH features are:

- **Motor torque measurement**

Constantly backlit LCD screen visualises the actual voltage, amps and current RPM. Once realised the test, it shows the motor torque measure expressed in gr*cm

- **Motor RPM measurement at desired voltage**

Automatic measurement.

Manual measurement.

Constantly backlit LCD screen shows voltage, amps and current RPM.

Once realised the test, it shows the maximum reached RPM.

- **Wheels RPM measurement at desired voltage**

Automatic measurement.

Manual measurement.

Entering the gear and pinion teeth number shows motor RPM.

Constantly backlit LCD screen shows voltage, amps and current RPM.

Once realised the test, it shows the maximum reached RPM in wheels and motor.

- **Weight of the vehicle without magnetic attraction to track**

Weight of the frontal part of vehicle.

Weight of the back part of vehicle.

Total vehicle weight.

- **Weight of the vehicle including magnetic attraction to track**

Weight of the frontal part of vehicle.

Weight of the back part of vehicle.

Total vehicle weight.

- **Motor or magnet magnetic power measurement expressed in gauss**

Measurement of instantaneous magnetic power.

Measurement of the maximum magnetic power during 2,1 seconds.

Measurement of the absolute maximum magnetic power.

- **Calibration scales and magnetic sensor**

Basically used for the tare weight of the scales.

- **6 stations to realise the motor break in**

You can choose at each station times from 0 to 99 minutes and Voltages from 0 to 18 volts (obviously the output with 0 volts is to stop the engine for "x" minutes (0 to 99) before the next break in step).

- **Data transmission to the computer via USB or by DS wireless transmitter ***

- **Optional software to display and visualize the motor parameters, voltage, amps consumed, RPM.**

- **Resolution measures:**

Resolution engine revolutions: 20 RPM.

Resolution wheel revolutions: 40 rpm.

Resolution weight: +1 gr.

Resolution magnetic field: 4 Gauss.

Resolution voltage measures: 100 millivolts.

Resolution electric current measurements: 10 milliamps.

- **Manufacture features:**

- ROHS compiled.
- Made in PRC.

- **What contains the suitcase?**

- 1 x Testing Bench.
- 1 x encoder to measure revolutions of motors with axle 2mm.
- 1 x encoder to measure revolutions of motors with axle 1,5 mm.
- 1 x motor mount head diameter 6,4 mm. (Motors MABUCHI / Short Box/Long Box)
- 1 x motor mount head diameter 5mm (motors SLIM).
- 1 x motor mount head diameter 9mm (motors BISON).
- 1 x motor mount head diameter 6mm (motors SCX - PARMA).
- 4 x vehicle elevator for weight measurement without magnetic attraction.
- 2 x elevators to measure revolutions on wheels or motor running.
- 1 x key to set the motor to torque meter.
- 1 x set of bearings and sensor for revolutions measures on wheels + Adhesives indicators for the wheels.

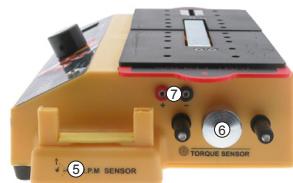
- 1 x power supply 8 amps 24 volts.
- 1 x set of motor wiring set.
- 1 x user's manual

* Wireless Transmitter and USB cable are sold separately.

3. Sensors, connectors, controls and displays.

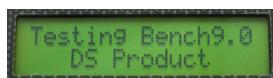
The TESTING BENCH has the following sensors, connectors, controls and displays:

1. Data output for PC.
2. DS-Wireless data output for wireless transmission to PC.
3. Units power input.
4. Hall sensor for magnetic effect.
5. Revolutions meter directly from the motor.
6. Motor torque meter.
7. Power point for motor feeding.
8. LCD screen 16 characters x 2 lines backlit.
9. Voltage output control towards the motor.
10. Menu navigation buttons (MODE - START - STOP - OK).
11. Connector for revolutions on wheels sensor.
12. Revolutions on wheels sensor.
13. Frontal scale.
14. Backside scale.
15. Ferromagnetic plate for magnetic attraction.
16. Conductive plates for contact with the brides of the guides.
17. Protector for scales (take out only to regulate weight and torque measures)

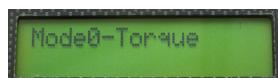


4. The navigation menu

Connect the power supply to 220V/110V power plug and connect the 5.5mm jack to the corresponding power point in TESTING BENCH and the LCD screen will be illuminates showing the following message:



and then



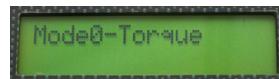


Using the following 4 buttons we can access all the menu options.

With the button **MODE** we're going through all the options and menus in each click.

Mode 0 - Torque

Press the button **MODE** till the following menu is visualised:



Used to perform a torque measurement, of the motor connected to the measurement axis.

Performing the measurement:

Remove the backside scale protection. Connect the motor to the metal motors mount to prevent the motor rotation during acceleration and join this conjunct to TORQUE SENSOR axis with the help of the key. Feed the engine respecting the polarity. Changes in the polarity provoke slightly different maximum torque values.

Press the button or directly press the button

The TESTING BENCH delivers the electric current to the motor in order to provoke an abrupt increase of the measure unit's revolutions for 2.4 seconds. The unit reads revolutions in every moment till the system stops itself.



Values during the acceleration



Values during stabilisation



Values during the deceleration.

Once the measurement is finished the result is showed

You can repeat the measure as many times as you want but note that each test produces an increase the motor temperature.

This temperature increase causes an increase in resistance increase in resistance and reduces its performance, every time reducing the measured torque maximum value.

Mode 1 - Motor Auto RpmMax

Press the button  till the following menu is visualised:



Automatically executes the measurement of maximum revolutions of the motor connected to the sensor. Must be used the appropriate motor mount according the type of motor and the necessary encoder for the motor axle diameter 2 mm or 1.5 mm. Place the conjunct on the bench for revolutions measurement.

Performing the measurement:

Set the mentioned conjunct to the RPM sensor bench.

Feed the motor respecting the polarity. Changes in the polarity provoke slightly different maximum revolutions values.

Press the button 



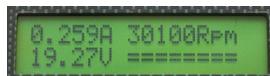
We recommend turning the voltage selection potentiometer to almost minimum in order not to deliver voltage higher than the nominal value of motor.

To start the measurement press the button 

The motor receives the voltage selected with the potentiometer "VOLTAGE" and the measuring unit begins to record the maximum revolutions value. The unit continuously reads revolutions till the system detects that there is no increase in revolutions. in this case the system understands that the revolutions maximum is reached and stops the motor feeding showing the result in the LCD.



Values during the acceleration.



Values during stabilisation.



Values during the deceleration.



Once the measurement is finished the result is displayed.

Mode 2 - Motor Manual RpmMax

Press the button  till the following menu is visualised:



Automatically executes the measurement of maximum revolutions of the motor connected to the RPM sensor. Must be used the appropriate motor mount according the type of motor and the necessary encoder for the motor axle diameter 2 mm or 1.5 mm. Place the conjunct on the bench for revolutions measurement.

Performing the measurement:

Set the mentioned conjunct to the RPM sensor and feed the motor respecting the polarity. Changes in the polarity provoke slightly different maximum revolutions values.

Press the button  *and then* 

The motor receives the voltage selected with the potentiometer "VOLTAGE" and the measuring unit begins to record the maximum revolutions value.



Values during the acceleration.



Values during stabilisation

The unit continuously reads revolutions till the user would press the button , then the motor feeding is stopped and the following message is displayed:



Once the measurement is finished the result is showed

Mode 3 - Wheel Auto RpmMax

Press the button till the following menu is visualised:



In order to measure automatically the maximum tractor wheels revolutions, use the sensor for measuring wheels revolutions + adhesives indicators for wheels and the elevator so that the wheels don't touch the scale base. We must enter the teeth number that have pinion and gear assembled in the vehicle and like this we will obtain both results - the revolutions on wheels and the real motor revolutions.

IMPORTANT: Maintain the protections of the placed scales to avoid damaging the loading cells.

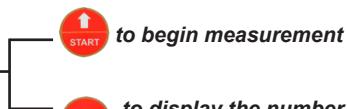


Performing the measurement:

Place the vehicle elevator so that the tractor wheels don't touch the ground. After this place the vehicle on the scale plate and on the elevator so that the current outlet braids make contact with the conductive plates. Place the adhesive on the wheel you wish to measure revolutions. Adjust the height of the revolutions sensor on wheels and plug it to the unit (it is very important to maintain a distance of 1 mm between the wheel and the sensor). To begin, we recommend turning the voltage selection potentiometer to almost minimum in order not to deliver voltage higher than the nominal value of motor.



Press the button



to begin measurement



Special sticker for wheels.

to display the number of teeth and again to enter the number of teeth.



Use buttons , and to validate.

Once we have the desired number of teeth, press  and the menu system shows the menu Mode3-Wheel Auto RpmMax, so we can precede the measurement.

Press  and then  to start the measurement.

The motor receives the voltage selected with the potentiometer "VOLTAGE" and the measuring unit begins to record the revolutions maximum value. The unit continuously reads revolutions till the system detects that there is no increase in revolutions. In this case the system understands that the revolutions maximum is reached and stops the motor feeding showing the result in the LCD.



Values during acceleration.



Values during stabilization.



Values during the deceleration.



Finalizada la medida se muestra el resultado y las revoluciones en rueda y en motor.

Mode 4 - Wheel Manual RpmMax

Press the  key until you see the following menu:



It makes a manual measurement of maximum revolutions in the traction wheels. In order to perform the measure should be used the sensor for measuring the revolutions on wheels + stickers for wheels and the lift so that the wheel of the vehicle won't touch the scale basis. We must enter the teeth number that have pinion and gear assembled in the vehicle and like this we will obtain both results - the revolutions on wheels and the real motor revolutions.

Performing the measurement:

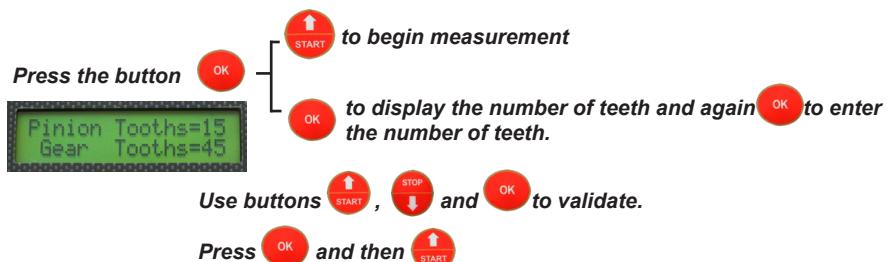
Place the vehicle elevator so that the traction wheels won't touch the ground.

After this place the vehicle on the scale plate and on the elevator, so that the braids that realise power point in track would contact the conductive plates.

Place the adhesive on the wheel you wish to measure revolutions. Adjust the height of the sensor of revolutions on wheel and plug to the unit (it is very important to maintain a maximum distance of 1 mm between the wheel and the sensor).



To begin, we recommend setting the voltage selection potentiometer to almost minimum in order not to deliver voltages higher than the nominal value of motor.



The equipment delivery to the motor voltage selected with the potentiometer "VOLTAGE and measurement equipment begins to record the maximum revolutions. The unit performs the reading of revolutions in each time step until the user press the button MODE, then it will stop supplying the engine and the LCD displays the following message:



Values during acceleration.



Values during stabilization.



Once the measurement is finished the result is displayed – motor revolutions and the revolutions on wheels.

Mode5 – Weight

Press the button MODE till the following menu is visualised:



Allows weighing the vehicle. The LCD display shows the weight values corresponding to both plates of the scale and also shows the sum of the both weight values.

There are two ways to weigh the vehicle:

- Weight without magnetic attraction
- Weight with magnetic attraction

To find out the magnetic power contributed by the motor and the magnets the two previous measures must be performed; we must deduct the weight measured without magnetic attraction from the weight with magnetic attraction and the result is the weight contributed by the magnetic attraction to track.

Performing the weight measurement without magnetic attraction:

Remove the protections from the scale and place on it 2 or more highest vehicle elevators so that the magnetic field doesn't influence the weight measurement. Press the button MODE until the LCD displays the option Mode 7-Calibrate Weight & Gauss.

Press the button OK

Calibration performed



Press the button MODE until the LCD displays the option Mode 5 - Weight.

Place the vehicle on elevators and press the button OK



W1 indicates the weight on the front scale, W2 indicates the weight on the back scale and W1 + W2 is the sum of the both weights. Take a note of these values.

Performing the weight measurement with magnetic attraction:

Remove the protections and the elevators from the scale and make a new calibration with mode7-Calibrate Weight & Gauss. Press the button  until the LCD displays the option Mode5-Weight.

Place the vehicle on the scale and press the button 



W1	W2	W1+W2
609r	2149r	2759r

W1 indicates the weight on the front scale; W2 indicates the weight on the back scale and W1 + W2 is the sum of the both weights. Take a note of these values. The difference between the previous weight and this one is the contribution of the magnetic attraction on the track

Mode 6 - Measure Gauss

Press the button  till the following menu is visualised:



Measures the magnetic field generated by any magnet or the motor magnet that drives the vehicle. The LCD screen shows various possibilities to read the magnetic field:

- Measure ValueMax (maximum magnetic field value measured).
- Measure Just-in time (magnetic field value at each instant).
- Measure 2sec max (maximum magnetic field value measured over 2.1 seconds).

In parallel with the magnetic field displays the output voltage for those who want to measure the engine magnetic field while it is running to the desired voltage. The symbol S shows the South Pole and N shows the North Pole, followed by the numerical value of the measured magnetic field expressed in Gauss.

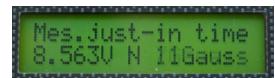
Performing the measurement:

Press the button  . The LCD display shows:



Pressing any of the buttons  or  alternates the measure system between the three types of magnetic field measurement.

The LCD screen shows the type of measurement we have selected and the output voltage we have selected. The value of the output voltage we can vary with the main potentiometer "VOLTAGE".



In order to perform the measurement we have to bring the magnet, motor or vehicle close to the area where the magnetic field sensor is located:



Mode 7 - Calibrate Weigth & Gauss

Press the button  till the following menu is visualised:



It serves to tare the scales and to calibrate the initial magnetic field value at which magnetic field measurements are made. It also serves to check the status for the loading cells and the magnetic sensor.

Completing the calibration:

Press the button 

The LCD displays the following message:



Calibration done.

Mode 8 - Break in 1 & 2 (stages)

Press the button  again to access the following menu:



It serves to program the first and second motor running stage. At each running stage introduce the desired running time from 1 to 99 minutes and the desired voltage from 0 to 18 volts.

Programming performing:

Press the button 

The following messages appear on the LCD display:



Use the buttons ,  *and*  *o validate*

All values are recorded in EEPROM memory, so always when you turn on the unit, the last values that have been recorded will be available. Automatically jumps to the next programming mode.

Mode 9 - Break in 3 & 4 (stages)

Press the button  again to access the following menu:



It serves to program the third and forth motor running stage. At each running stage introduce the desired running time from 1 to 99 minutes and the desired voltage from 0 to 18 volts. Adjusts data entry and performs in the same way as MODE 8 Break in 1 & 2 (stages).

Mode 10 - Break in 5 & 6 (stages)

Press the button  again to access the following menu:



It serves to program the fifth and sixth motor running stage. At each running stage introduce the desired running time from 1 to 99 minutes and the desired voltage from 0 to 18 volts. Adjusts data entry and performs in the same way as MODE 8 Break in 1 & 2 (stages).

Mode 11 - Break in Go 1 & 2 & 3 & 4 & 5 & 6

Press the button  again to access the following menu:



Allows to start all the running stages programmed. Connect the motor to the corresponding voltage outputs before starting the running.

Press the button 

The following messages appear on the LCD display:



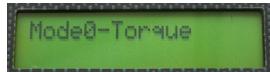
Press the button  and the running starts from the cycle number 1 at the time and voltage programmed till finish with the cycle 6, when the running cycle stops automatically.

Simultaneously will be displayed the cycle executed Run-P1 or P2 or P3 or P4 or P5 or P6 and the number of minutes and seconds remaining to complete the cycle.



And will leave us again at the same menu option Mode10-Break-in 1 & 2 & 3 & 4 & 5 & 6 (stages).

Press again the button  to access the initial menu and return to start the sequence of available menus with all the features described above:



5. Protections

TESTING BENCH has several hardware and software protections. The two scales have SAFETY TRAY protections that are the elements to protect the sensitive load cells located underneath each plate of the scale. When not using the equipment for measuring the weight, it is recommended to have them always in place in order to protect the load cells against shock or other effects that can cause malfunction of these highly sensitive sensors. Software protections are to prevent errors in cable connections to the engines, for example:

- If we wish to measure the revolutions or torque of the motor: if the sensor doesn't detect any rotation, the voltage output to the motor will be cut off and the following warning message will be displayed:

“ I read 0 Rpm's Check the electrical Connection ”

--If the system detects the consumption of more than 2 amps for a few seconds, the system will cut off the voltage output to prevent damages to the unit and the following warning message will be displayed:

“ Current>2Amperes Check the Mechanical Connection ”

6. Content Downloads

On the website www.ds-racingproducts.com you can download extras for your TESTING BENCH, please visit the website to discover these extras.

7. FAQ

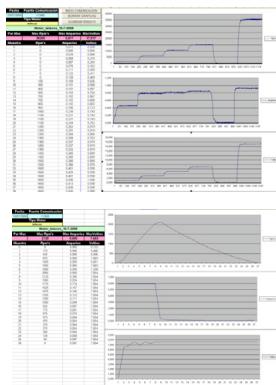
• What kind of curves or graphs are obtained by telemetry?

Graphs of revolutions can be obtained connecting the testing bench to the PC and are amps consumed and volts delivered by the voltage source during the motor running as the following figure shows.

You can perfectly see how increasing the voltage (the 3rd lower curve), the number of revolutions is increasing (the 1rst curve). You can see how during the running cycle the resting cycle can be obtained, o at a voltage of 0 volts, as this case.

The values obtained during a test of torque:

You can observe the acceleration curve at a maximum power and then the curve of motor deceleration and inertial mass.



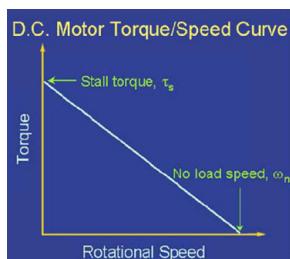
• How do I balance the weight of all four wheels?

With two scales of TESTING BENCH you can balance the weight of both front and rear axles. But if our colleague borrows us his TESTING BENCH, you can balance the weight of all four wheels independently, as if we have 4 scales, one for each tire.

• Why the motor torque measurement does not match with the motor label indicating revolutions, maximum torque and nominal voltage?

The measure of the maximum torque that indicates the motor label is at a locked rotor (Stall Torque) and according to this chart you can see that at this point there is no rotation of the motor axle. Let's remember that the formula for the effective power delivered by the motor is equal to motor torque multiplying by the angular velocity; if the angular velocity is zero, there is no current delivery. And as the torque is directly proportional to the current consumed, not surprisingly, to get the torque that figures on the motor label requires a current supply of up to 10 amps depending on motor model. The TESTING BENCH measures torque in more realistic motor usage conditions.

The TESTING BENCH measures the revolutions increase produced by motor when it's powered by 12 volts and with a maximum current of 6 amps circulating inside. (This current is limited by hardware. If this current were greater, the maximum torque would also be higher. As explained before, the torque is directly proportional to the consumed current). The torque measure is obtained by applying the formula that tells us that the torque is directly proportional to angular acceleration multiplied by the inertia of the entire system rotating. As the inertia of the whole system is known, there is only the angular acceleration that the system is able to obtain when an abrupt current increase is applied needs to be determined. Likewise the system measures the deceleration when we stop feeding the motor and like this the torque resistant to the friction bearings, etc. is quantified that makes the measure much more accurate.



• Why when making a consecutive torque measurement the result is diminishing?

The torque measurement can be repeated several times, but keep in mind that each test produces the rotor temperature increase. This increase in temperature causes an increase in the resistance of the thread of the rotor and as a direct result we have a reduction in motor performance. That is why the measured maximum torque every time may be diminishing. It is recommended to wait some time between consecutive measurements not to damage the enamel that covers the thread of the rotor.

8. Warranty

The TESTING BENCH unit covered under this waeranty has been manufactured in accordance with quality standards having passed the corresponding homologation tests for approval.

The unit has a legal warranty that runs for 1 year from the delivery date. In case of non-compliance of the unit, the right of substitution to the same or a price reduction may be exercised.

For this and in any case the invoice or a proof of delivery of the unit (*) must be kept and the form below should be filled out:

Purchased by : _____

Address : _____

City: _____

Province: _____ Zip : _____

Country: _____

Phone : _____

E-mail: _____

Serial number: _____

In the telephone number indicated below you will be informed of the procedure to follow when the repair is required or, in cases provided by law, the replacement of the unit. Tel.: 902 132 124 (international tel.: +34 93 804 0015).

Substitution of the unit or any of its parts because of the failure shall not implicate extension of the warranty.

The warranty does not cover the unit damages caused by its improper handling or treatment. The general conditions of the warranty are limited in case of inappropriate use of the unit, losing the warranty in the following cases:

- Permanent deformation of the loading cells for misuse and / or non-use of the SAFETY TRAY'S.
- Unit brake by beats or impacts to ground of the unit.
- Feeding by another power source than the supplied with the unit.

Failures caused by catastrophic causes (fire, flood, ..) atmospheric causes, beats and falls are also excluded from the warranty.

DS Racing Products reserves the right to enforce the warranty if the seals are missing or there are clear evidences of having been manipulated incorrectly, whether having obvious physical breakdowns, internal manipulation or being used outside the operating ranges.

(*) In any case, the terms and rights provided under this paragraph will be governed by the current law applicable all the time.

Security

IMPORTANT SAFETY INSTRUCTIONS

When used properly, this unit has been designed and manufactured to assure your personal safety. However, improper use can cause electric shock or fire hazard. Please read all safety and operating instructions carefully before use, and keep these instructions handy for future reference. Pay special attention to the warnings listed in these instructions.

- 1. - Water and Moisture.** - The unit should not be used near water, not even in a wet basement.
 - 2. - Ventilation.** - The unit should be situated so that its placement does not affect the correct ventilation.
 - 3. - Heat.** - The unit should be kept away from heat sources such as radiators or other appliances that emit heat.
 - 4. - Objects or liquids entry.** - Special attention should be paid so that no one object or not any liquid could fall through the gaps or vents of the unit.
 - 5. - Accessories.** - Do not use accessories other than those recommended by the manufacturer of the product.
 - 6. - Protection against lightning and power surge.** - Unplug the unit from the wall socket during thunderstorms, when you leave home or when you have it unused for long period of time. This will prevent possible damages due to lightning or power surges.
 - 7. - Overloading.** - Do not overload wall sockets, extension cords, or integral convenience receptacles as this can provoke fire or electric shock.
 - 8. - Damages requiring repair.** - The unit must be repaired by qualified service personnel when:
 - A. The power supply cord or plug has been damaged;
 - B. Objects or liquids have got inside the box;
 - C. The unit has been exposed to rain;
 - D. The unit has been dropped or the enclosure damaged;
 - E. The unit presents a significant alteration in functioning or doesn't operate normally.
 - 9. - Technical Service.** - Do not try to repair the unit with other methods than described in this user manual. Repair methods that are not indicated in these operating instructions should be left to qualified technical personnel.
- Warning:** To reduce the risk of electroshock, please do not remove the plates or the bottom cover. Inside the unit there are no parts reparable by user. Contact qualified personnel for inspection.
- 10. -** Use only the adapter included with the product. Using any other adapter will void the warranty.

11. - Unplug the power cable and transformer from the power source when the unit is not in use.

12. - Always carry the product inside its suitcase designed and made especially for this product.



This product bears the selective sorting symbol on waste electrical and electronic equipment (WEEE).

This means that this product must be handled pursuant to European Directive 2002/96/EC in order to be recycled or dismantled minimizing its impact on the environment.

For further information please contact your local or regional authorities.



Electronic products not included in the selective sorting process are potentially dangerous for the environment and human health due to the presence of hazardous substances.