BMW Motorrad

The Ultimate
Riding Machine

Operating instructions

HP Race Calibration Kit 2

Welcome to BMW

The BMW Motorrad HP Race Calibration software makes it possible to adjust a number of engine control and traction control functions. This means that modifications to the vehicle (e.g. exhaust system, tyres) or rider preferences can be taken into account in the setup. Use this User Guide to familiarise yourself with the software. If you have further questions, your authorised BMW Motorrad dealer will gladly provide advice and assistance.

We hope that your perusal of this manual will be enjoyable and instructive and that all your journeys will be pleasant and safe

BMW Motorrad.

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You can also consult the index at the end of this manual if you want to find a particular topic or item of information.

General instructions

Introduction

The following functions can be adapted:
- Injection
- Ignition
- DTC
- L-CON
- DDC
- ABS
- Shift assistant
- Pit-lane rpm limiter
- Fault memory
- Adaptation

The components you need are as follows:
- HP Race Calibration software DVD
- USB adapter cable
- HP Race Calibration enabling code

The first step is to have the function of the HP Race Calibration software activated in the control unit by an enabling code obtained for you by your authorised BMW Motorrad dealer.

Enabling the HP Race Calibration Kit software voids the motorcycle's homologation, the permit allowing it to be used on public roads. The vehicle is no longer approved for use on public roads.
Do not take the motorcycle out on public roads after the software has been enabled.◀

Enablement of the HP Race Calibration Kit software in the control unit and use in motorcycle racing render the motorcycle a high-performance product with a correspondingly short life expectancy. The machine no longer fulfils the life-expectancy requirements of a road-legal motorcycle. Thus, warranty is limited to freedom from faults in the material and the as-delivered condition of the factory new motorcycle or part.◀

With this BMW product you influence your motorcycle's on-board electronic systems to a very significant extent. Changing parameters to settings other than standard can lead to critical riding situations for which BMW Motorrad cannot provide safeguards.◀

If you decide that you want to go back to using the motorcycle on public roads, enabling of the HP Race Calibration function can be cancelled for this control unit with the BMW Motorrad diagnostic system.◀

The service intervals stated in the Rider's Manual apply to the standard motorcycle. Once the HP Race Calibration software has been enabled, the

maintenance intervals for the drive components have to be shortened accordingly in line with the higher levels of stress and strain and wear and tear.
BMW Motorrad recommends a maintenance interval of 5000 km (3100 mls).◄

Abbreviations and symbols

Indicates warnings that you must comply with for reasons of your safety and the safety of others, and to protect your product against damage.

Specific instructions on how to operate, control, adjust or look after items of equipment on the motorcycle.

◄	Indicates the end of an item of information.
•	Instruction.
»	Result of an activity.
➠	Reference to a page with more detailed information.
◁	Indicates the end of a passage relating to specific accessories or items of equipment.
	Tightening torque.
	Technical data.
DTC	Dynamic Traction Control.

Notes on use

The full scope of adaptation and modification for traction control is available only with the HP Race Power Kit. When used in combination with a standard control unit, the functionality differs from that available with the HP Race Power Kit as follows:
- The adaptation functions of the standard control unit for correction of tyre radius can act contrary to the modifications made in the HP Race Calibration Kit.
- With the standard control unit, deactivation of traction control by angle of heel (LeanAngleDTCon) is possibly only in the SLICK mode, subject to restriction.
On account of these constraints that apply when the HP Race Calibration Kit is used with the standard control unit, in individual cases unforeseen drawbacks can be encountered with traction control and therefore with the stability of the motorcycle.◄

The following, general tips regarding software handling serve to enhance safety and to facilitate the settings.

Keep parameters smooth
In the case of characteristic maps and characteristic curves harmonious characteristics must always be maintained. "Steps" or "corners" are discontinuities in the data that will produce unexpected and potentially dangerous sudden changes in the way your motorcycle behaves. The parameters must be continuous in the general 3D or 2D view.

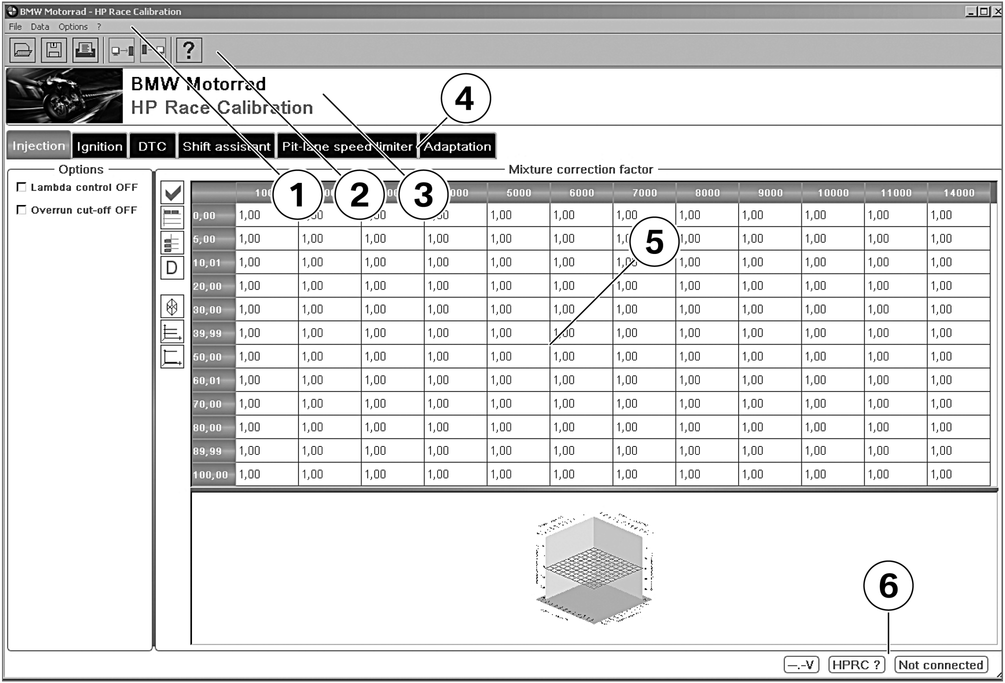
Proceed step-by-step
If an optimum value cannot be determined directly, step-by-step approximation makes sense. For example, a tyre circumference can be directly measured. Optimum data input for a characteristic correction map of the DTC can only be determined via small changes followed by a respective road test. Step-by-step approximation to the optimum from the safe, stable side with less wheel slip is recommended.

Saving and documenting the intermediate stages
It is recommended to save the data records on a regular base and to take notes regarding the respective results. This way it is always possible to return to a known set of circumstances and make comparisons that will help in drawing useful conclusions.

Actuality

The high safety and quality level of BMW motorcycles is ensured by continuous development work on design, equipment and accessories. Because of this, your motorcycle may differ from the information supplied in the Rider's Manual. Nor can BMW Motorrad entirely rule out errors and omissions. Thus, no claims can be derived from any information, figures or descriptions.

Operation


BMW Motorrad - HP Race Calibration
File Data Options ?
BMW Motorrad
HP Race Calibration
Injection
Ignition
DTC
Shift assistant
Pit-lane speed limiter
Adaptation
Options
Lambda control OFF
Overrun cut-off OFF
Mixture correction factor
5000 6000 7000 8000 9000 10000 11000 14000
0,00 5,00 10,01 20,00 30,00 39,99 50,00 60,01 70,00 80,00 89,99 100,00
1,00
1
2
3
4
5
6
–.-V
HPRC ?
Not connected

Working with HP Race Cali-bration

There are a number of areas in the graphical user interface of the HP Race Calibration software:

1 Menu bar
The menu bar provides access to all the functions, help and settings. The keyboard shortcuts, if any, are also explained.

2 Toolbar
The toolbar provides quick access to frequently used functions. The toolbar can be hidden by selecting "Options" from the symbol bar.

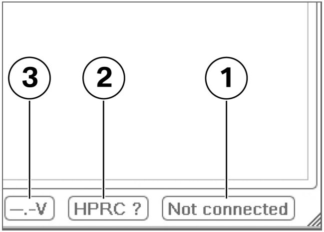
3 HP Race Calibration bar
You can hide this bar by selecting "Options" from the symbol bar. This bar displays the currently connected motorcycle.

4 Tab bar
Using the tab bar different subject areas can be selected.

5 Working area
The working area varies depending on the subject area you select. The subject area is selected in the tab bar above the working area.

6 Status area
The status area shows information about communication with the motorcycle.

Connection to the motorcycle

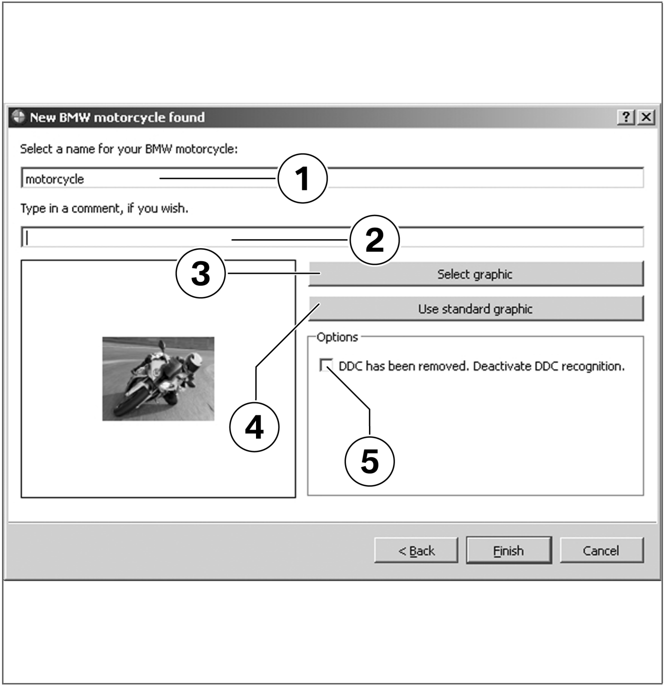


The data records can be adjusted without connection to the motorcycle. The connection does not have to be established until you are ready to transfer data from the computer to the motorcycle or to read data from the motorcycle.
Connection status **1**, status of enablement **2** in the engine control unit for the HP Race Calibration software and the circuit voltage **3** in the motorcycle's on-board electrical system all appear on screen in the status area.

Abbreviations

- **RCK1**: Functions of the BMW Motorrad HP Race Calibration Software (Version 1) are enabled in general.
- **RCK2**: Functions of the BMW Motorrad HP Race Calibration Software (Version 2) are enabled in general.
- **DTC**: Dynamic Traction Control is enabled.
- **DDC**: Dynamic Damping Control is installed.
- **RPKIT**: HP Race Power Kit is installed.
- **SASS**: Shift assistant is enabled.

Via options in the communication menu, the connection can be configured and, for example, the COM port selected. If a motorcycle is connected, it is unambiguously recognized using the VIN and stored in the software database. During the first connection a name must be assigned to the motorcycle. It is possible to add additional information such as descriptions and images to the motorcycle.

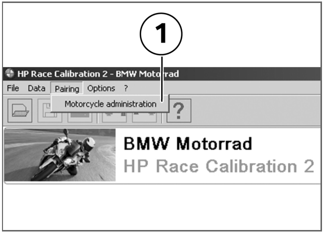


Motorcycle coupling

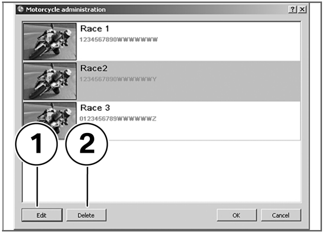
This process is referred to as coupling and should prevent unintentional loading of an incorrect data record into the motorcycle resulting in dangerous behaviour of the motorcycle.

- Assign motorcycle name **1**, enter comment **2**, select image **3** or use standard image **4**.
- Deactivate DDC detection **5** as needed.

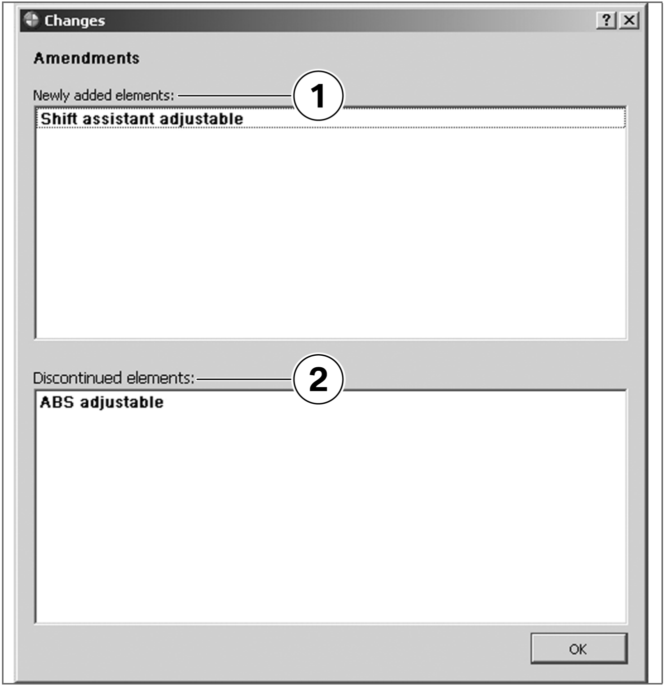
Motorcycle administration



Using the Motorcycle administration menu item **1** it is possible to manage the coupling settings.



The settings of known motorcycles can be edited via Edit **1** or removed from the database via Delete **2**.



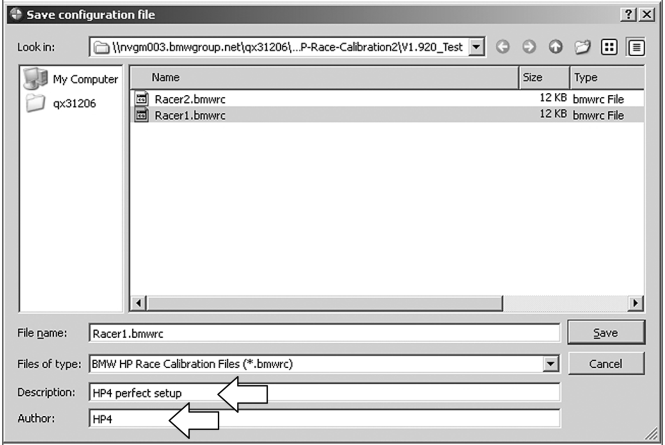
In the case of retrofits (e.g. of a shift assistant) the changed configuration is automatically detected and displayed in the BMW HP Race Calibration Kit. Added elements **1** enable the respective tab in the working area allowing them to be edited. Omitted elements **2** deactivate the respective tab in the working area. They cannot be further edited.

If an old data record is loaded after a new configuration, the changed elements are not copied and reset to the factory setting.◀

Load, save and print files

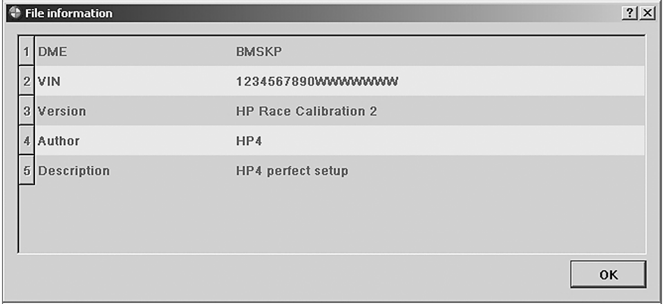
A data record can be saved in a file or loaded from a file. This enables you to administrate a library of data records and exchange records with other users. Access to the data-administration functions is via the menu or the toolbar. Note that you always load or save an entire data record.

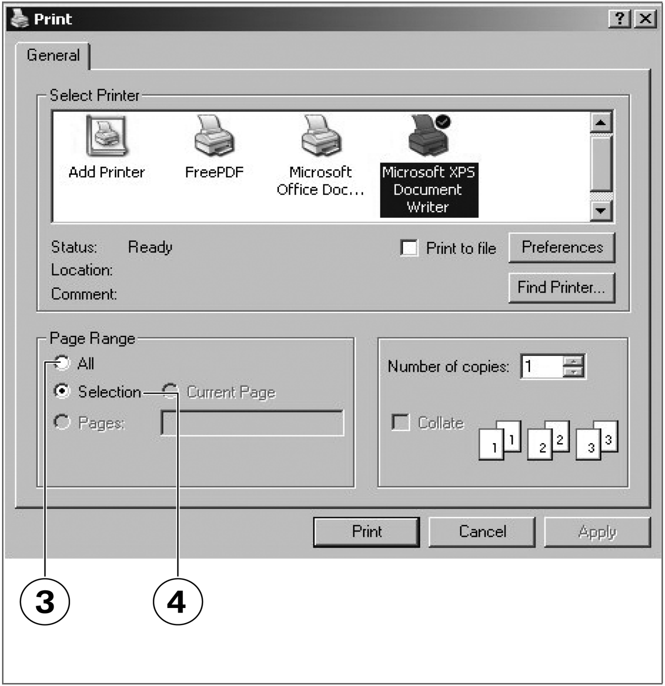
Load **1**.
Save as **2**.
Print **3**.



If the data record is saved, additional information **arrows** (author, small description) can be added.

The details regarding the current data record are displayed using the file information operating element.





Your options for printing the data are "All" **3** or "Current selection" **4** (currently selected characteristic curve or characteristic map).

▷ The 'Print' window appears in the language to which your operating system is set.◀

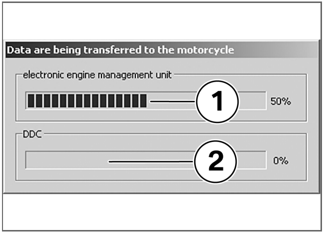
Data transfer

Writing data to the control unit 1

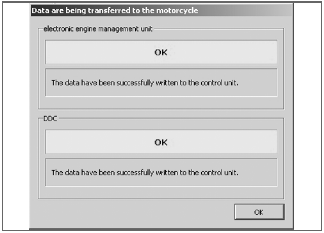
A data record becomes active in the control unit, as soon as it was transferred to the control unit. The data record remains in the control unit, until it is overwritten. A data record which may already be present in the control unit is overwritten in the process. In order to write data records into the control unit, this function must be respectively enabled by the authorised dealer. Changes made in the HP Race Calibration software are not active in the motorcycle until they have been written to the control unit. Note that the data record is always transmitted in its entirety.

Read data from control unit 2

You can also read the current data record from the motorcycle in the same way. When you do this the data record imported from the motorcycle overwrites the data record in the HP Race Calibration software. Note that under these circumstances too, the data record is always transmitted in its entirety. Access to the functions for reading and writing data records is via the menu or the toolbar. Reading and writing are possible only when the vehicle is connected to the computer by the USB adapter cable (the ignition must be ON and the engine OFF). The corresponding buttons are greyed and inactive unless all these preconditions are satisfied.



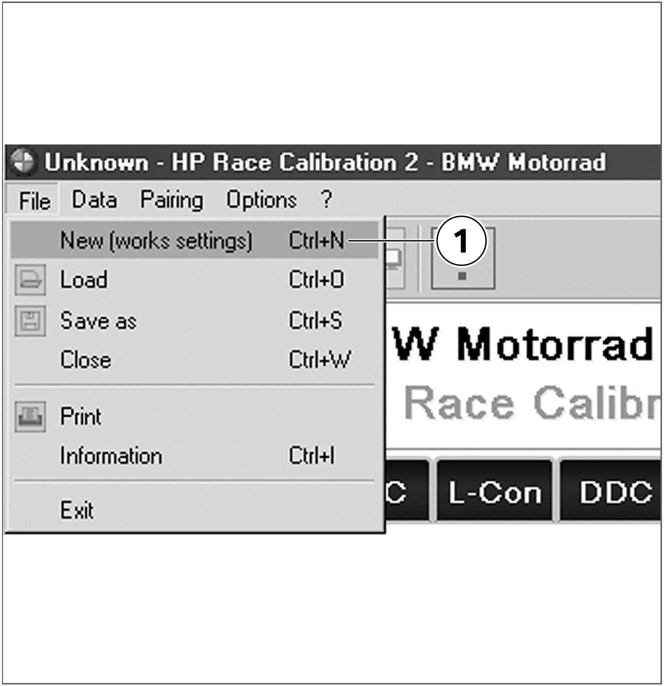
The progress bar **1** indicates the current transfer status. The transfer may take a few seconds. If the DDC is installed, the data for the DDC is transferred in addition to the data for the engine control unit. An additional progress bar **2** appears.



If the data was transferred successfully, "OK" is displayed in a dialogue window.
If the transfer failed, "Fault" is displayed. For example, if the data for the DDC was not completely transferred, the previous (old) DDC data is further used. The data for the engine control is successfully transferred and active. In most cases a loss of connection is the reason for a faulty transfer. In this case it must be checked whether the cable is correctly connected to the motorcycle and the PC. Next, the transfer is to be newly started.

Restoring factory setting

Restoring factory setting 1.
The menu also enables you to restore the factory settings for parameters changed beforehand using the HP Race Calibration software. Note that all the changes in the entire data record are cancelled in this way. In order to activate these factory settings in the motorcycle as well, the data must be written into the control unit.



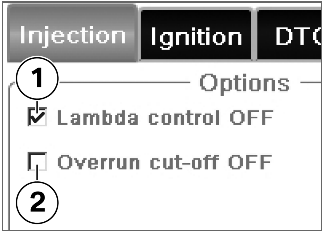
Function description

Editing data

A data record consists of a fixed number of editable parameters. These parameters represent a subset of the entire engine control and chassis and suspension control functions in the vehicle. Data changes can be seen immediately in the HP Race Calibration software. The changes are not actually implemented in the motorcycle's systems until you transfer the data from the computer to the control unit.

Options

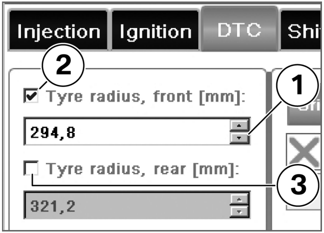
Options can be selected on the respective tab.



- Selection field **1** activated - Lambda control (switched off)
- Selection field **2** not activated - overrun fuel cutoff (switched on)

Characteristic values

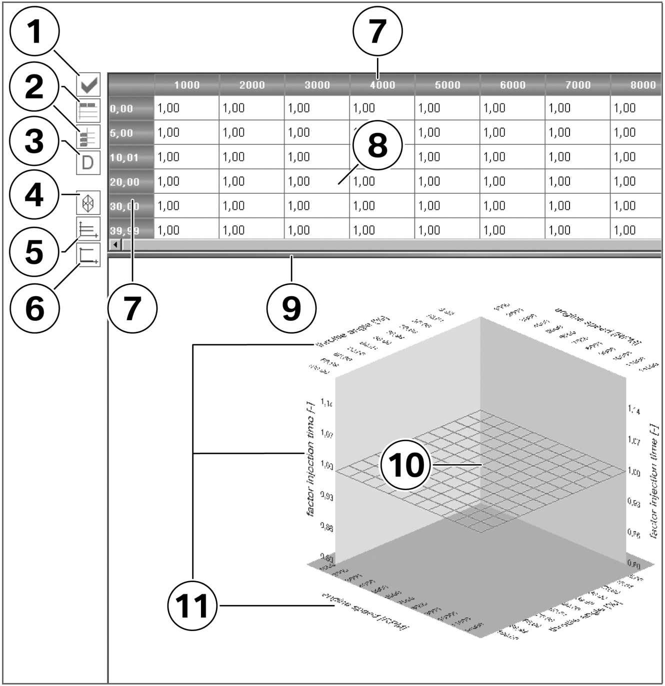
Activating this selection field activates a characteristic value, which can be adjusted using the numeric-entry field.



- Step up/down **1**
- Selection field **2** activated - entered value (is used)
- Selection field **3** not activated - factory setting (is used)

The system automatically substitutes a comma for a period to avoid confusion with the decimal separator. All your entries have to be within a permissible range and permissible step size.

If no characteristic value is activated, the motorcycle uses the factory settings.



Characteristic maps

Characteristic maps consist of a value table, a 3D view and different buttons.

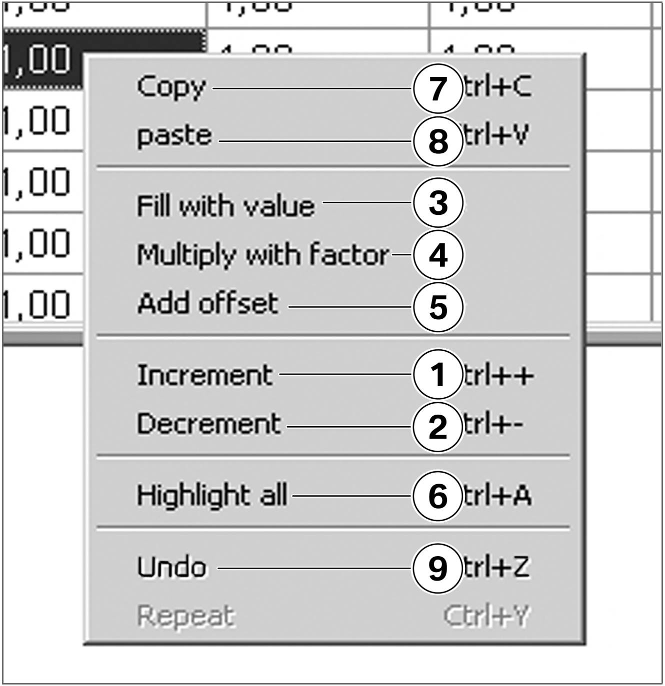
Characteristic maps must be activated. Toggling the red X to a green tick activates the characteristic map **1** and the numeric-entry fields then accept entries. If no characteristic map is activated, the motorcycle uses the factory settings.

A characteristic map consists of two axes **7** and a values table **8**. Each axis has an input value that corresponds to a variable you can influence in the motorcycle's ECU. The current values of the two input variables are used to calculate the point on the characteristic map at which the current operating point is located and this value is used to select the applicable value from the values table. Linear interpolation is applied if an input value does not correspond exactly to a value on the corresponding axis. The 3D view **10** shows you which input variables are represented by the axes of the characteristic map. For example, the map might show momentary values such as engine rpm.

When you want to make changes to the axes **7** you can open a node editor **2** in order to do so. You can make changes directly in the values table **8**.

You can click on button **3** to undo your changes to the values table.

The characteristic map is shown in graphic form in the 3D view **10**. Each axis has an axis name **11**. You can move the separating line **9** between the map and the values table **8** if you want to zoom the view. Use the left mouse button if you want to rotate the view. Clicking the right mouse button or clicking on button **4** restores the default view. If you want to optimise the 3D view **10** you can click on the "Axis limitation" button **5** to change the minimum/maximum values of the Z axis. This change affects only the 3D view; it has no effect on the data record as such. Clicking on the "Reset axis limitation" button **6** cancels axis limitation.



Characteristic maps

Use the mouse or the keyboard to highlight one or more cells and then make your changes. You can use the computer keyboard to key in digits. The system automatically substitutes a comma for a period to avoid confusion with the decimal separator. There are also a number of options for adjustment that you can access by opening the pop-up menu. The pop-up also lists the corresponding keyboard shortcuts.

You can increment **1** or decrement **2** the number in the cell. Once you have highlighted cells, moreover, you can apply common functions such as filling the cells with a value **3**, multiplying **4** or adding **5**.

You also have the option of highlighting **6** and using the computer's Clipboard to copy **7** and paste **8**.

This enables you to use other programs as editors to work with the data.

You can undo **9** entries.

The reset has no effect on the rest of the data record. All your entries have to be within a permissible range and permissible step size.

Characteristic curves

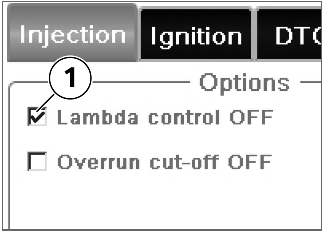
Characteristic curves are similar to characteristic maps in many ways. The difference is that they have only one input variable and consequently only one axis. This in turn means that the graphic view is two-dimensional. There are some characteristic curves that do not admit changes to the axis, because the input variable accepts only fixed values that are all defined on the default axis (DTC mode, for example).

Notes on retrofitting DTC

If the motorcycle to which the HP Race Calibration software is connected does not have DTC, the characteristic DTC variables are greyed out. During a transfer, the characteristic variables are transferred, however are inactive. This is to ensure that if DTC is retrofitted, the DTC factory settings are active.

Injection

Lambda control OFF

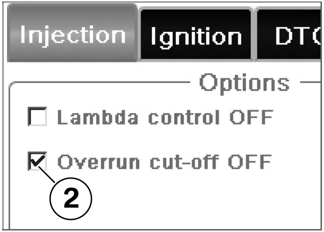


The lambda control system analyses the signals from the oxygen sensors fitted as standard in the exhaust system and corrects fuel injection timing in order to achieve a stoichiometric fuel/air ratio for combustion. If tick **1** is not set in the as-delivered condition, this only means that the as-delivered condition shall not be changed (lambda control is not necessarily active). Whether or not lambda control is active depends on the exhaust system mounted on the motorcycle. If the exhaust system includes the standard oxygen sensors, lambda control is active ex works. In this case only it can be deactivated. However, this is of practical assistance only if the air/fuel ratio should be varied in a way that changes it from the stoichiometric default. Injection timing can be changed in this way without lambda control intervening and cancelling out the changes.

Mixture correction factor

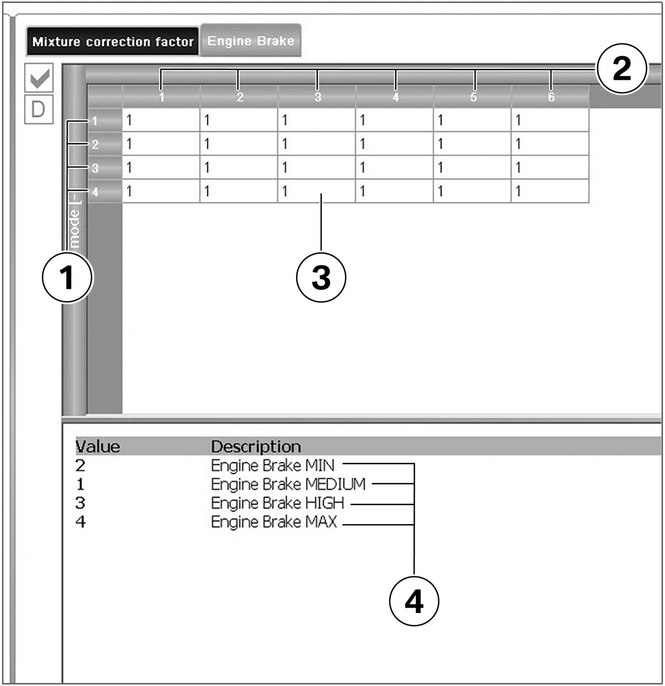
The "Mixture correction factor" characteristic map enables you to correct the injection times computed by the engine control. The engine control computes injection times that produce optimum combustion for the motorcycle's standard ex works setup. Various fuel/air ratios (lambda) for combustion are achieved in this way; these ratios depend on the engine's operating point. If modifications were applied to the motorcycle in a way that changes the amount of air inducted to the engine (e.g. exhaust system) or if a fuel/air ratio other than the ex works optimum should be used, the computed injection times can be multiplied by a factor using this characteristic map. Values greater than 1 prolong injection time and increase the volume of fuel injected, making the fuel/air mixture richer. Values less than 1 have the opposite effect. A value of 1 means no change to the injection times computed by the engine control. The correction factor can be stored in the characteristic map as a function of engine rpm and throttle-valve angle. It is to be considered that the air/fuel ratio has a very significant effect on engine behaviour (misfiring) and the temperatures of various components (e.g. pistons, exhaust valves). Particularly at high engine rpm and wide throttle-valve angles, it is advisable to make only such changes as compensate for changes to the volume of air inducted. A suitable technique for measuring excess oxygen (lambda) must be used in order to obtain an optimum air/fuel ratio. The correction factor is applied equally to all injection valves.

Overrun fuel cutoff OFF



You can deactivate overrun fuel cutoff by ticking the box in front of **2**. When the throttle twistgrip is snapped closed with the engine at high revs, the overrun fuel cutoff function completely stops the supply of fuel to the engine. Under these conditions combustion ceases and the inertia of the entire drive train serves to slow the motorcycle. Deactivating overrun fuel cutoff is practical if the deceleration of the motorcycle should be reduced when the throttle twistgrip is snapped closed. With the overrun fuel cutoff function deactivated fuel injection continues, with the engine receiving the amount of fuel that corresponds to the flow of inducted air. Under these circumstances it is possible to vary mixture control and ignition timing to influence combustion and consequently the way in which the motorcycle is slowed.

▷ In the case of some models, the overrun fuel cutoff function is generally deactivated in SLICK mode regardless of the settings in the software.◀



Engine braking torque

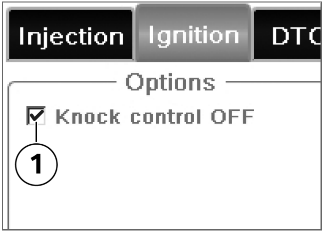
In Engine Brake the motorcycle's deceleration can be influenced in overrun fuel cut-off mode (throttle twistgrip closed). Depending on riding mode and gear 4 overrun air variants can be driven. The overrun effect and/or the deceleration of the variants can be obtained from the table in the tool. MIN means smallest deceleration and MAX largest deceleration.

Riding mode **1**, gear **2**, selected setting **3** and selection table **4**.

▷ Engine Brake is only active if overrun fuel cutoff function Off is activated.◀

Ignition

Knock control OFF



You can deactivate knock control by ticking the box in front of **1**. Knock control analyses the signals from the knock sensors and corrects the ignition timing to avoid knocking engine operation in the combustion process (see below). It can be deactivated in order to suppress interventions in the ignition timing output. Knock control intervenes only in circumstances in which knocking combustion occurs, however, so it is advisable not to deactivate it.

Deactivation of the knock control is not necessary to carry out interventions in the ignition output.

Ignition correction Offset

Using the characteristic map "Ignition correction Offset" the ignition point computed by the engine control is corrected. The fuel/air mixture inducted into the cylinders is ignited by the spark plugs to initiate combustion. The time of ignition is selected in such a way as to optimise as effectively as possible the conversion of the energy in the fuel into torque. Ignition timing is stated in crank angle degrees before compression dead centre. Drift away from the optimum leads to non-optimised combustion and thus to a reduction in torque. This can lead to major engine failure and can reduce the lifespan of the engine.

Depending on engine rpm and throttle valve angle the computed ignition timing can be corrected using this characteristic map by applying an Offset if changes where made to the motorcycle modifying the optimum ignition point (e.g. exhaust system) or if the optimum torque should be reduced. Like ignition timing, the ignition point is stated in crank angle degrees. The correction offset is applied equally to the ignition timing of all cylinders.
Values greater than 0 result in an earlier ignition point and increase the risk of knocking engine operation. Values smaller than 0 result in a later ignition point and act reducing starting from the optimum torque. A value of 0 means no change to the ignition timing computed by the engine control.
Advancing the ignition too far can lead to knocking combus-

tion at many operating points. Under these circumstances self-ignition occurs inside the combustion chamber in zones of the mixture not yet reached by the combustion triggered in the regular way by the spark plug. Extremely high pressure occur which quickly lead to destruction of engine components due to excessive temperatures and pressures. Late ignition timing increases the danger of overheating of exhaust valves and other components of the exhaust system. This too can result in severe damage to the engine. Particularly in circumstances involving high engine rpm and wide throttle-valve angles, it is advisable to exercise great caution and proceed only very gradually when making changes. As knock control interferes in the case of knocking combustion only, which must be absolutely avoided, it must remain active.

Ignition correction is used to influence the response behaviour and engine running at small throttle valve angles.

DTC

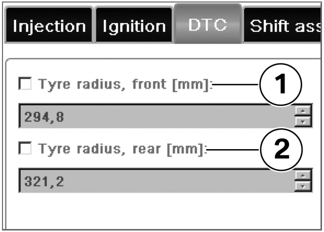
DTC sensors

The wheel speed signals from the ABS control unit are used for the DTC function and the angular rate sensor signals for calculating the heel angle. In order for the function to operate correctly it is important that the angular rate sensor is correctly positioned, that the wheel speed sensor rings are installed at the correct distance and that the sensor rings are free of damage. Damage to the sensor ring or radial or axial out-of-round can lead to signal disruptions. The front and rear sensor rings must each have 48 uniformly distributed flanks / teeth made of magnetic material and the same number of inter-tooth gaps. The angular rate sensor is installed with the connector pointing vertically down. The black baseplate faces to the rear, opposite the forward direction of travel. Deviations from the details above will result in measuring errors and even implausible heel angles.

Procedure for application

The first step is to determine the correct front and rear tyre radii. Then set the grip limit (GripLevel). Later on you can make finer distinctions in how traction control works and use a more aggressive setting. It can also be decided from the wheel speed curves whether the control intervention is based on a Wheelie or a skidding wheel. Using this information the activation angle (LeanAngleDTCon) of the DTC function can be increased to ensure that the Wheelie does not negatively reduce the engine performance. When it is time to fine-tune for the specifics of a given race course, the SlipCor Mod characteristic maps can be used to tweak the settings, using the information about heel angle and the speeds stored for the race course segments.

Tyre radii



In order to correctly compute the wheel speed, the radii of the front and rear tyres for straight-ahead driving have to be entered (front tyre radius **1** and rear tyre radius **2**).
The current tyre pressure must be considered when evaluat-

ing slip. It has an effect on tyre stiffness and consequently on actual rolling radius. You can check and, if necessary, correct the tyre-radius entries by letting the motorcycle roll forward in a straight line with the clutch lever pulled and without heeling the motorcycle away from the upright position. If the radii are correct the speed will be the same for the front wheel and the rear wheel (measured variables V_FRONT and V_REAR). Speed-related differences have to be allowed for or corrected in SlipCor Mod characteristic maps 1-4. A rear wheel tyre radius entry that is smaller by 1 % produces 1 % more slip across all riding modes.

▷ The described adjustments assume that a HP Race Power Kit is installed. If the HP Race Calibration Kit is used on a motorcycle with a standard control unit, the tyre radii should not be subsequently changed. Tyre-radius adaptation is active in the standard dataset and since it cancels the settings in certain riding situations the outcome can be unforeseen reactions by the motorcycle.◀

GripLevel

Grip limit

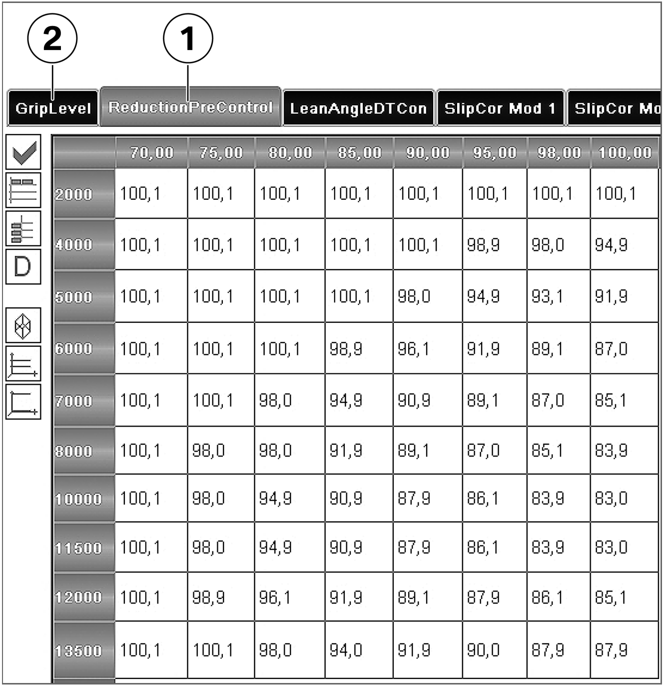
The coefficient of friction (grip) can be entered separately for each mode in the GripLevel characteristic curve. These 4 values are used exclusively for the next characteristic map, ReductionPreControl.
The recommended procedure to ascertain the grip limit is to start with an oversize rear-wheel radius (control intervenes earlier, because more slip is computed) and work gradually toward the limit of grip from the safe side. This entails gradually stepping down the value for the current mode in the GripLevel characteristic curve until the motorcycle starts to break away. Similarly, the heel angles should be reduced to low values in the LeanAngleDTCon characteristic curve.

▷ The described adjustments assume that a HP Race Power Kit is installed. If the HP Race Calibration Kit is used on a motorcycle with a standard control unit, changes in the LeanAngleDTCon table take effect only when SLICK mode is selected. Under certain circumstances wheelies are possible even at more extreme heel angles.◀

ReductionPreControl

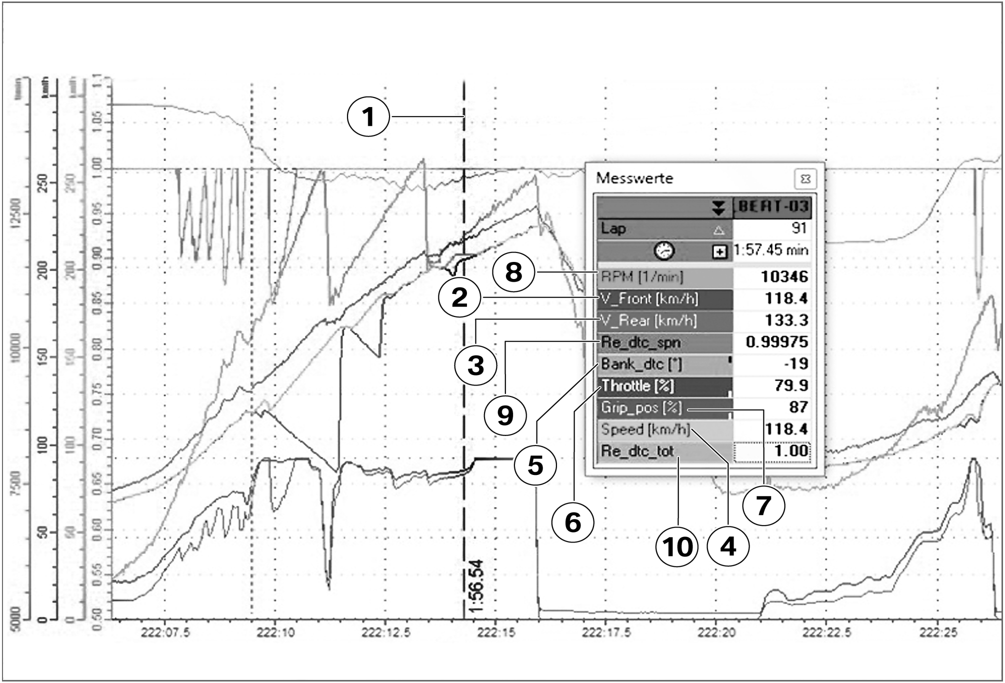
Torque precontrol

Torque precontrol calculates how close the motorcycle approaches to the limit dictated by the Kamm braking circle. In the ReductionPreControl **1** characteristic map you can influence torque reduction as a function of engine speed and utilisation of the applied coefficient of friction. The applied values are fully effective in 1st gear only. In gears 2-6 the values are reduced by the available relative overall gear ratio. In second gear the reduction value of the value table is multiplied by factor 1.27. In third gear it is multiplied by 1.53, in forth gear by 1.76, in fifth gear by 1.95 and in sixth gear by 2.10. The system interprets any value in excess of 100 as 100 % (maximum).
The factory settings are applied in such a way that



	70,00	75,00	80,00	85,00	90,00	95,00	98,00	100,00
2000	100,1	100,1	100,1	100,1	100,1	100,1	100,1	100,1
4000	100,1	100,1	100,1	100,1	100,1	98,9	98,0	94,9
5000	100,1	100,1	100,1	100,1	98,0	94,9	93,1	91,9
6000	100,1	100,1	100,1	98,9	96,1	91,9	89,1	87,0
7000	100,1	100,1	98,0	94,9	90,9	89,1	87,0	85,1
8000	100,1	98,0	98,0	91,9	89,1	87,0	85,1	83,9
10000	100,1	98,0	94,9	90,9	87,9	86,1	83,9	83,0
11500	100,1	98,0	94,9	90,9	87,9	86,1	83,9	83,0
12000	100,1	98,9	96,1	91,9	89,1	87,9	86,1	85,1
13500	100,1	100,1	98,0	94,0	91,9	90,0	87,9	87,9

with the sports silencer from the HP Race Power Kit, the acceleration behaviour for the full-load line is constant in 1st gear as of about 4000 rpm and with a maximum coefficient of friction. The advantage of precontrol is that slip control does not produce any unsteadiness in the chassis and suspension.
Precontrol can be deactivated as follows: In the GripLevel **2** characteristic curve, set all values to 1.95 (maximum) and use 100 for the entire ReductionPreControl **1** characteristic map.


Messwerte
Lap
91
1:57.45 min
RPM [1/min]
10346
V_Front [km/h]
118.4
V_Rear [km/h]
133.3
Re_dtc_spn
0.99975
Bank_dtc [°]
-19
Throttle [%]
79.9
Grip_pos [%]
87
Speed [km/h]
118.4
Re_dtc_tot
1.00
1:56.54
222:07.5
222:10
222:12.5
222:15
222:17.5
222:20
222:22.5
222:25
1
2
3
4
5
6
7
8
9
10

Measurement of the LeanAngleDTCon setting

The graphic shows an example of a data evaluation of the HP Race data logger.

The following variables are shown in the measurement:

- Time when shut-off limit reached (heel angle approx. 20°) **1**
- Front wheel speed **2**
- Rear wheel speed **3**
- Reference speed for the front wheel **4**
- Heel angle **5**
- Throttle valve angle **6**
- Throttle twistgrip angle **7**
- Engine rpm **8**
- Reduction from slip **9**
- Reduction from slip and pre-control **10**

LeanAngleDTCon
Heel angle for switch-off

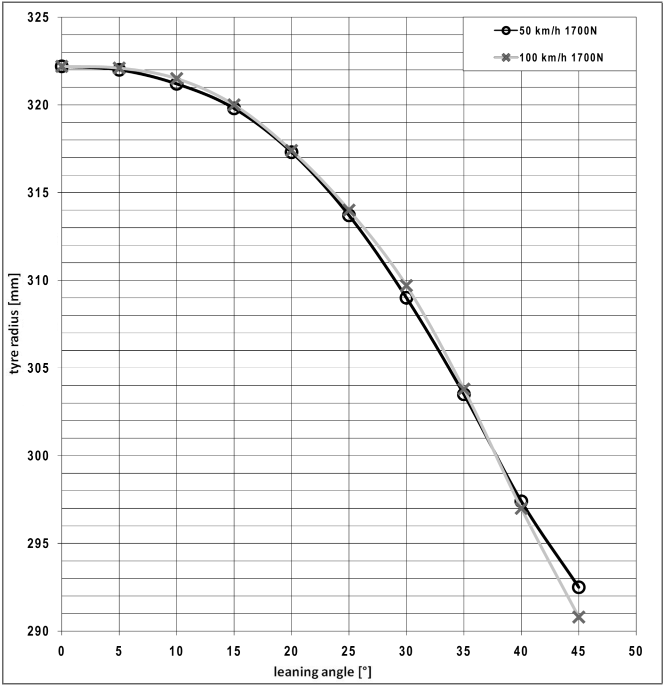
On a race course, traction control is needed only when the motorcycle is heeled over to an extreme heel angle. If the motorcycle is positioned upright, then only the front wheel tends to lift off (Wheelie). The ECU is deceived into computing circumferential slip that hinders forward propulsion. Consequently, the heel angle can be applied mode-depending in the characteristic curve LeanAngleDTCon, below which traction control is switched off. A new reference speed (measured variable Speed) is generated which differs from the real font wheel speed (measured variable V_Front). The maximum measured variable Speed is as large as the rear wheel speed (measured variable V_Rear).

At the beginning of the measurement, slip control and precontrol are both active at the apex of the curve. After the apex of the curve the rider accelerates again. Shortly after the cursor position the heel angle drops below the cut-off limit of the traction control. A reference speed is generated which corresponds to the specified acceleration for the rear wheel speed. Slip cannot be determined anymore. Shortly afterwards phases can be identified where the front wheel does not accelerate (it briefly lifts off). If the front wheel lifts off, the motorcycle already has sufficient grip not requiring traction control anymore.

SlipCor Mod 1-4

Slip correction

Wheel slip is calculated as follows: Initially the difference is calculated between front wheel speed (measured variable is Speed) and rear wheel speed (measured variable is V_Rear). Then a correction is applied, taking into account the difference in tyre rolling radii over heel angle (measured variable is Bank_dtc). Each mode (`RAIN` = 1, `SPORT` = 2, `RACE` = 3 and `SLICK` = 4) has its own characteristic map (SlipCor Mod 1-4). These characteristic maps allow for tyre contour as a function of heel angle and speed. The value obtained from the current SlipCor Mod characteristic map is subtracted from the difference in wheel speed. This corrected difference is divided by the speed of the front wheel gives the wheel slip used in the system. The system starts engine intervention when wheel slip reaches approximately 10 % of the computed value. The basic application is based on wheels fitted with Metzeler Racetec K3 and/or Pirelli Super Corsa tyres, tyre sizes front and rear 120/70-17 and 190/55-17.

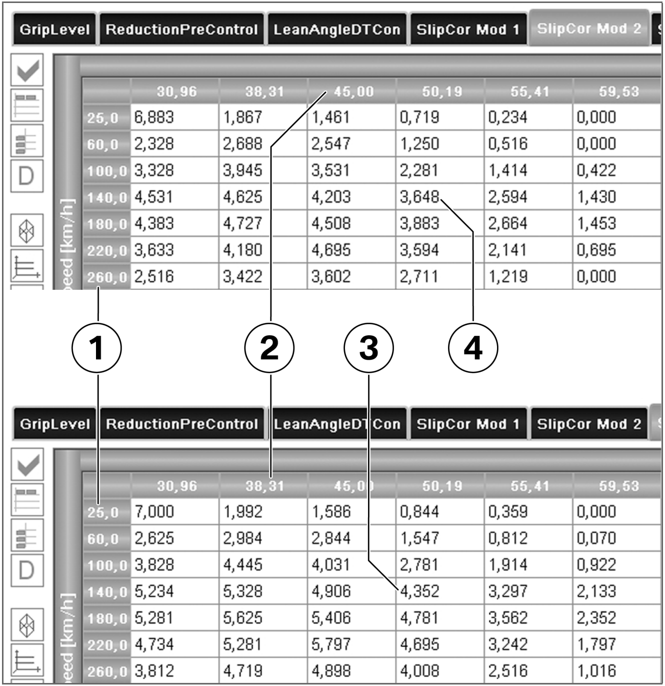


The diagram shows that the tyre radius of the front and rear wheels becomes smaller as the heel angle increases. Acceptable guideline values are a reduction of approximately 5 % in front wheel tyre radius and a reduction of approximately 10 % in rear wheel tyre radius when the motorcycle is heeled over to a 45° heel angle. Consequently, there is a difference of approximately 5 % between the speeds of the front and rear wheels (radius change with 1700 N at 50 km/h and 100 km/h for Metzeler Racetec K3 190/55-17).

This means that 5 km/h has to be entered in the characteristic map for a front wheel speed of 100 km/h and 2.5 km/h has to be entered for a front wheel speed of 50 km/h.

This difference between tyre radius for the front and rear wheels caused by the heel angle has to be subtracted from the target slip. This is done with SlipCor Mod characteristic maps 1-4, which can be applied depending on front wheel speed and heel angle.

The other SlipCor Mod characteristic maps can be used to create different settings for the corresponding riding modes. This means that you can use different settings for slip or react to tyre changes as wear increases while riding. You can step through the settings while the motorcycle is on the move (see the Rider's Manual for the S 1000 RR model and HP4).



	30,96	38,31	45,00	50,19	55,41	59,53
25,0	6,883	1,867	1,461	0,719	0,234	0,000
60,0	2,328	2,688	2,547	1,250	0,516	0,000
100,0	3,328	3,945	3,531	2,281	1,414	0,422
140,0	4,531	4,625	4,203	3,648	2,594	1,430
180,0	4,383	4,727	4,508	3,883	2,664	1,453
220,0	3,633	4,180	4,695	3,594	2,141	0,695
260,0	2,516	3,422	3,602	2,711	1,219	0,000

	30,96	38,31	45,00	50,19	55,41	59,53
25,0	7,000	1,992	1,586	0,844	0,359	0,000
60,0	2,625	2,984	2,844	1,547	0,812	0,070
100,0	3,828	4,445	4,031	2,781	1,914	0,922
140,0	5,234	5,328	4,906	4,352	3,297	2,133
180,0	5,281	5,625	5,406	4,781	3,562	2,352
220,0	4,734	5,281	5,797	4,695	3,242	1,797
260,0	3,812	4,719	4,898	4,008	2,516	1,016

In the characteristic map the speed **1** is indicated in km/h and the heel angle **2** in degree.

For example, if you want 1 % more slip with a SlipCor Mod characteristic map than with the preceding map, add 1 % of the value of the speed interpolation point to the original value to each value in the line (for all heel angles). The diagram below shows an example for a Metzeler Racetec K3 tyre with regard to the change in tyre radius in different modes and for different SlipCor Mod characteristic maps. Map **3** produces 1% more slip than map **4**.

TrqControl

Torque reduction

Starting from a calculated wheel slip of approx. 10 % a DTC intervention takes place. You can use the tyre radii to increase or decrease the level of slip for the various riding modes.

Diagram 1

- Measured variable Re_dtc_spn shows the percentage engine torque reduction and results from the characteristic curve TrqControl for torque reduction. A value of 1.0 corresponds to no reduction; a value of 0.0 corresponds to 100 % reduction (engine off). The characteristic curve for torque reduction enables you to influence torque reduction to suit race course conditions and tyre conditions. TrqControl is linear by default.

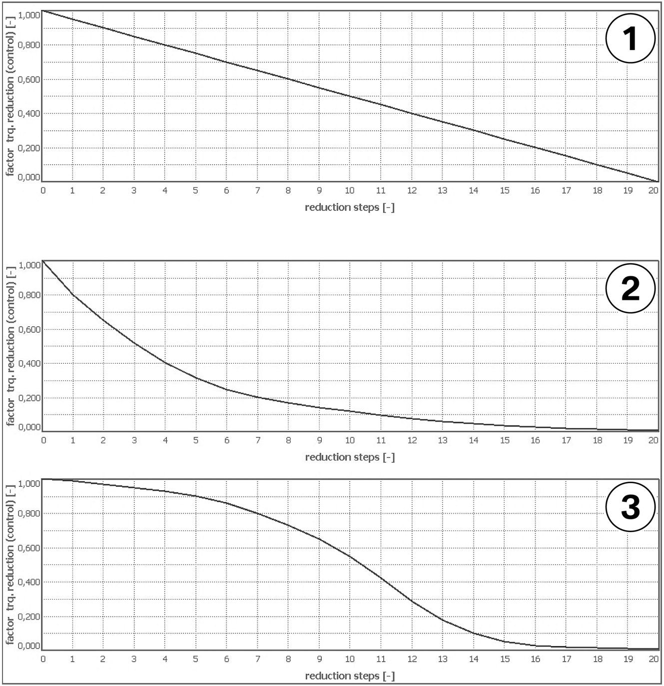


Diagram 2

- The downward gradient of the characteristic curve must be strictly monotonous. A tyre with a hard-wearing compound needs more torque reduction even at low reduction levels (falling degressively).

Diagram 3

- A tyre with a soft/wide limit zone needs less torque reduction at low reduction levels (falling progressively).

TrqIncrease

Torque increase

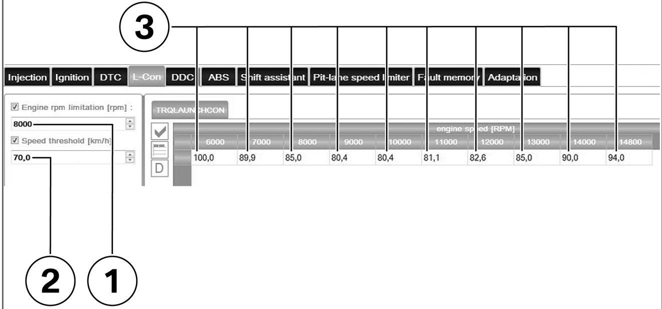
When rear wheel slip drops below the values applied in the SlipCor Mod characteristic maps, the engine torque is adjusted back again. The preset values can be changed in dependence on the speed with the TrqIncrease characteristic curve. A value over 1.0 accelerates the controlled torque reduction, while a value below 1.0 delays the controlled torque reduction.

Depending on the spring/damper settings, the controlled torque reduction can excite the motorcycle to vibrate. To separate the vibration frequencies of slip control, chassis and suspension as well as tyre system, it is advisable for example to reduce the controlled torque reduction (values less than 1.0). Entering an extremely small controlled torque reduction value will make the vehicle sluggish and slow to accelerate.

▷ The described adjustments assume that a HP Race Power Kit is installed. If the HP Race Calibration Kit is used on a motorcycle with a standard control unit, it must be considered that the standard data release in itself significantly damps controlled torque reduction above 8000 rpm. Consequently, a value of 1.0 is no longer neutral.◀

Characteristic curve DTC shift

In the case of the HP4 model, a rocker switch is located on the left-hand multifunction switch for operating the DTC, using which the target slip of the rear wheel can be corrected in the riding mode respectively enabled. There are 7 steps available in the + direction and 7 steps in the - direction. In the characteristic curve SlipOffset the individual steps can be stored with slip correction values. Steps - 7 to + 7 correspond to the display in the instrument cluster and are predefined in the system. If smaller values are entered, the traction control allows for more slip. Less control interventions mean more traction until the physical limit is achieved and less lateral stability of the tyre. Larger values allow for less slip, increase the lateral stability of the tyre with less traction and greater control interventions.

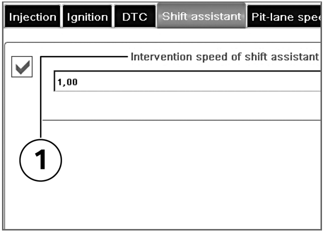


Launch control

Launch Control is used for maintaining a stable start rpm. Furthermore, the rear wheel torque should be reduced to the maximum which can be transferred. For this purpose, application variables engine rpm limitation **1** (maximum adjustable engine rpm) and the corresponding speed threshold (Speed threshold) **2**, up to which engine speed limiting is effective, are available. In the characteristic reduction curve TRQLAUNCHCON the engine torque reduction **3** is speed-dependently entered to ensure that the rear wheel torque reaches the desired maximum value in first gear. The engine torque is automatically increased for the second gear according to the gear step from first to second gear. As a result the same maximum torque is generated at the rear wheel as in first gear.

Launch Control is automatically deactivated when the third gear is reached or if a heel angle of 30° is exceeded.

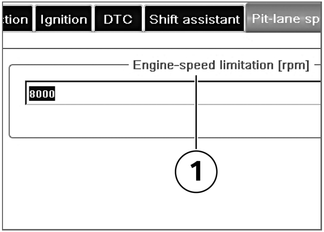
Shift assistant



The shift assistant allows upshifting of the gearbox without operating the clutch. While the engine torque reduction for initiating upshift using the shift assistant cannot be changed, the way in which engine torque is built up after the upshift can be influenced by changing the applicable factor "Intervention speed of shift assistant" **1**. Values greater than 1 mean that torque is built up more quickly, values less than 1 slow down the build-up of engine torque. A value of 1 means that torque build-up is in accordance with the factory settings.

The rate of torque build-up also has an effect on the drive train's reaction to load changes, and this in turn can result in unexpected reactions on the part of the vehicle.

Pit-lane speed limiter



This function enables the use of an rpm limiter that is active only in 1st gear and only when the starter button is pressed. Engine speed limiting **1** can be adjusted so that, for example, the motorcycle cannot be accelerated past the permissible limit in the pit lane as long as you stay in first gear. It is to be considered that changes to the transmission ratio or different tyres can produce different speed limits even though the setting is not changed. The alignment should be checked every time, changes of this nature are made. This setting cannot be higher than the ex works default setting for maximum engine speed limitation.

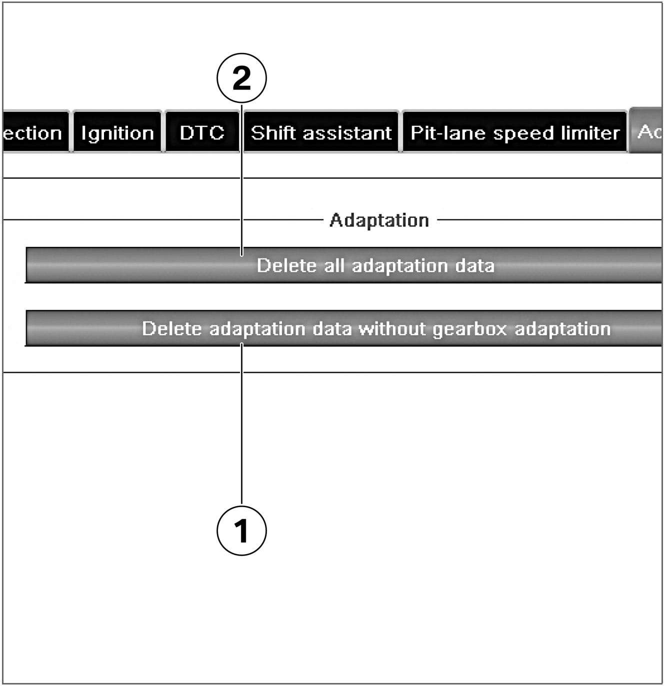
Adaptation

The engine control saves different settings, which are stored in the engine control unit and which are retained even when the battery is disconnected.

This applies to the following components:

- Throttle-valve assembly
- Exhaust system
- Airbox, air filter
- Basic engine (modifications relevant to the gas-change cycle)
- Gearbox potentiometer, shift lever sensor

The adaptation values have to be deleted if modifications affecting these components are made. This enables the engine control unit to save the values for the modified or new component.



The function of the shift assistant is not activated until you have ridden enough in all gears and the engine has idled for a sufficient length of time with the gearbox in neutral. You can delete the adaptation values in 2 stages: If the modifications do not affect the gearbox potentiometer and the shift lever sensor, the "Delete adaptation data without gearbox adaptation" function **1** is recommended. This means that the function of the shift assistant is immediately available again afterwards. If the modifications affect the gearbox potentiometer or the shift lever sensor, the "Delete all adaptation data" function **2** is recommended.

DDC

General information

The finally effective damping is adjusted in percent in the DDC control unit. Every data input in the RCK2 affects the factory setting in a relative manner. A factor from 0 % to 200 % can be adjusted. Thus, maximum twice the damping factor of the factory setting can be achieved. If the RCK2 is used, damping adjustment in the instrument cluster is not available anymore. As soon as a RCK2 function is used, this menu item cannot be selected anymore in the instrument cluster. The individualisation adjusted in the RCK2 applies instead.

At the spring strut it can be generally differentiated between rebound-stage and compression-stage damping. At the front forks this is only possible using a spring travel sensor not installed ex works. Complete damping (no differentiation between rebound-stage and compression-stage damping, see the operating instructions of the motorcycle as well) can be adjusted at the front in the factory. It is differentiated between riding mode and the DDC Setting.

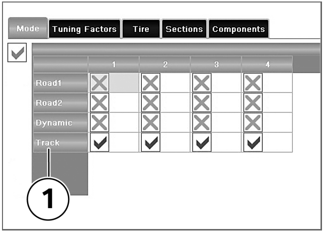
Sensible approach

- Select preferred DDC Setting on the specified course as basis Setting (e.g. TRACK).
- Individualise the basis Setting using the Tuning Factors (4 different alignments possible by switching the riding mode).
- Position the HP infrared transmitter (for HP Laptimer) on the pit wall (preferably in the direction of driving at the beginning of the pit wall). Using the HP Race Datenlogger determine and adjust the present course length (DDC Tracklenght) and permissible window width (Laptrigger tolerance) for the system.
- Develop meaningful nodes for section-depending damping and ensure that lap distance recording functions reliably.
- Observe the notes regarding the installation of the HP infrared transmitter under fault mode Sections.

Spring travel sensor for front forks

A connector is available at the wiring harness (see the operating instructions of the motorcycle), to which a suitable sensor can be connected. Theses accessories are not offered by BMW Motorrad. For further information please contact BMW HP Race Support (e-mail: hp-race-support@bmw-motorrad.com). The installation of a different sensor or a deviating sensor connection can result in faulty spring travel measurements. This may impact the system function as well. When installing the sensor it must be observed that the sensor must not restrict the spring travel of the front forks nor impact or block the steering movement (ensure freedom of movement of the front forks). The measured spring travels (at the spring strut and, if the sensor is installed, at the front forks) are outputted via the Controller Area Network (CAN) bus and can be recorded by the HP Race data logger (DDC_displacement_fr / DDC_displacement_rr). A zero point adjustment may be necessary.

Individual mode assignment



A DDC Setting can be assigned to every riding mode (selectable via the mode button on the vehicle). This setting is then the basis for further adjustments. In the case of race course riding, assigning DDC Setting Track **1** to every riding mode would make sense.

Tuning Factors

The basis Settings (selected in the "Mode" tab as needed) can be individually adjusted for every riding mode. In the case of individualised mode assignment ("Mode" tab) the adjustment basis is changed. In the case of the factory settings, the basis of riding mode 4 (SLICK) is DDC Setting TRACK. However, if a different DDC Setting was selected for riding mode 4 during mode assignment, the Tuning Factors adjusted here are applied to this deviating Setting. At the spring strut it can be differentiated between rebound and compression stage. At the front forks this differentiation is possible with an installed and connected spring travel sensor only. Values from 0 % to 200 % can be entered. If the Tuning Factors function is activated, the Sections function (section-depending damping) is automatically deactivated.

Application example:

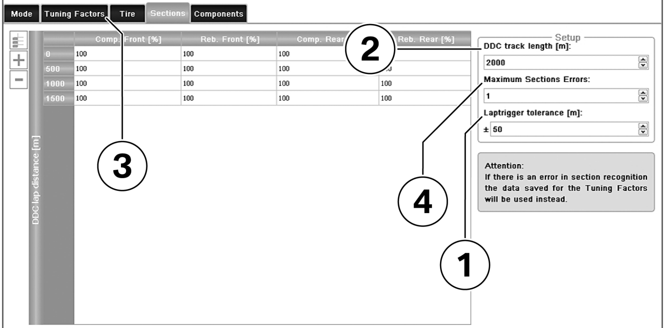
During a race with rider exchange, each rider can prepare 2 alignment settings, where one should be a rain alignment setting if possible. In this example – under dry conditions – the second driver would have to switch from riding mode RAIN to RACE in order to ride using his desired alignment setting. The following rider alignment settings can be adjusted (riding mode + corresponding DDC Setting):

- RAIN (Set TRACK) = Alignment setting for rider 1, dry
- SPORT (Set DYNAMIC) = Alignment setting for rider 1, wet
- RACE (Set TRACK) = Alignment setting for rider 2, dry
- SLICK (Set DYNAMIC) = Alignment setting for rider 2, wet

Tire

Damping can be changed on a course via the lap distance, which, for example, enables an individual adjustment per curve (Sections function). The lap distance is calculated based on the wheel speeds in the DDC control unit. To ensure as accurate calculations as possible, the contour of the tyre can be stored in the form of a quadratic formula. As a result, the vehicle speed can be corrected using the heel angle and the lap distance can be calculated more accurately. This correction is useful, if tyres different from the standard tyres are used. Data input is not absolutely necessary, as the lap distance recording accuracy is sufficient in the normal case.

▷ The data input of the Tire function exclusively affects the calculation of the lap distance in the DDC control unit. The RCK2 functionality of Dynamic Traction Control (DTC) is not affected. Here a separate data input must be stored.◀



Sections

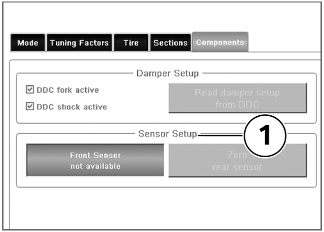
Up to 30 nodes are available, which can be distributed across the distance of the course. Every new node must have a larger value (in metres) than the previous node. A deviation of the measured lap distance from the nominal distance, which can for example be read out from the course specification, is probable. For this reason, data input should only take place after starting up this function. It is recommended to ride a few laps on the course in personal lines after the Tuning Operation "Use sections" were activated and parameter "DDC track length" was purposefully incremented. This is necessary, as the function stops distance recording, if the stored course length was exceeded. Furthermore, the measurement is to be evaluated using the HP Race data logger.

The "DDC_lap_distance" signal contains the lap distance recorded by the DDC control unit. This signal must be checked for plausibility. An adjustment of the tyre radius correction across the heel angle in the "Tire" tab may be necessary. Furthermore, the "Laptrigger" signal may be useful. If this signal was changed, a "Laptrigger" was received by the HP Laptimer. The DDC function Sections considers a "Laptrigger" as valid only if it occurs in the defined tolerance window (Laptrigger Tolerance). The race course can be divided into the desired sections. The corresponding lap distance nodes are to be obtained from the HP Race data logger recording. The sections are to be filled with factors from 0 % to 200 % according to your own wishes. These factors affect the respectively valid basis Setting in a relative manner. If individual mode assignment is used, the selected Setting is used as adjustment basis in the respective riding mode. Using the HP Laptimer the system identifies the start of a new lap. The lap distance is reset. The instrument cluster function, using which the lap time can be measured via push of a button, does not result in a reset of the DDC lap distance. The Laptrigger Tolerance parameter **1** contains the tolerance window for the "Laptrigger" signal. If 20 metres are input here, a Laptrigger signal is accepted starting from a lap distance of 20 metres prior to the entered DDC track length **2** up to a distance of 20 metres afterwards.

In the case of a fault in the lap detection it is switched to the setting of Tuning Factors **3**. As such a fault cannot be excluded, a suitable data input of the Tuning Factors **3** should be defined in the background. The DDC warning light in the instrument cluster displays the fault mode. Further information can be found under "Fault mode Sections".

Using the Maximum Sections Errors parameter **4** it can be adjusted, how many times the system should attempt to restart after a fault.

DDC components



Front forks and/or spring strut can be deactivated under Damper Setup. In the standard configuration (RCK not active) riding with only one of the two DDC components is not possible, as in this case the component still being installed is not activated anymore for safety reasons. For example, if the front forks must be replaced with a conventional part after a crash, it can be deactivated as DDC component. Spring strut activation can be further individualised in RCK2.

In the case of a possible spring strut removal, the rear spring travel sensor must be further correctly connected and installed, even if the spring strut is deactivated.

Under Sensor Setup **1** it is displayed whether a spring travel sensor is installed on the front forks (Front Sensor available). Furthermore, it is possible to adjust the rear sensor. This makes sense if the connection was previously changed via the sliding block. For correct calibration the rear wheel must be pulled into the rebound buffer of the spring strut.

⚠ Incorrect calibration can negatively impact the riding behaviour.

If the calibration using the RCK2 fails, the measured spring travel must be checked via suitable recording using a Datenlogger.◀

▷ By deactivating a component, the respective fault diagnostics is switched off as well. If a component is deactivated even though it is still installed, correct activation cannot be ensured anymore.◀

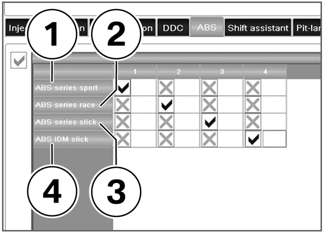
Relevant HP Race data logger signals

- **Laptrigger**: Every change in the signal value means that the instrument cluster detected a Laptrigger. The Sections function considers a Laptrigger in the tolerance range only.
- **DDC_lap_distance**: DDC lap distance (data input basis for the Funktion Sections)
- **DDC_sensor_fr_status**: Front spring travel sensor available (**0**: sensor not detected, **1**: sensor detected)

- **DDC_error_status**: DDC fault display (**0**: no fault, **1**: fault mode (warning light on))
- **DDC_rck_status**: RCK2 DDC display active (**0**: not active, **1**: active (adjustment in the instrument cluster not available))
- **DDC_displacement_fr**: Front spring travel (available only, if a sensor was retrofitted). A mechanical zero point calibration may be necessary.
- **DDC_displacement_rr**: Rear spring travel

ABS

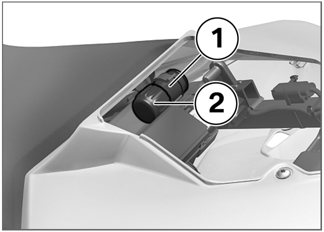
ABS



In the ABS section different riding modes can be assigned to different, predefined ABS Settings. The available Settings depend on the motorcycle type and the used ABS Software status. For example, the Settings differ by the deactivated ABS at the rear wheel on operation of the footbrake and by different variants of the rear wheel lift assistant. Setting "ABS Standard Sport" **1** is designed for maximum brake stability. Rear wheel lift detection and deceleration limiting are active. Setting "ABS Standard Race" **2** is designed for increased deceleration. Rear wheel lift detection is deactivated while deceleration limiting remains active. Setting "ABS Standard Slick" **3** is designed for increased deceleration similar to Race. Rear wheel lift detection is deactivated while deceleration limiting remains active. The ABS function while the footbrake is operated is deactivated. The rear wheel can be blocked. "ABS Slick IDM" **4** is designed for maximum deceleration under racing conditions. Rear wheel lift detection and deceleration limiting are not active. The ABS function while the footbrake is operated is deactivated. The rear wheel can be blocked.

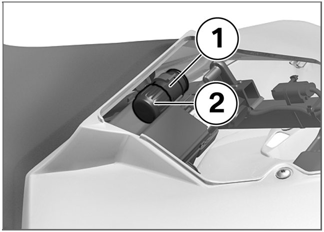
Connection

Connecting to the motorcycle



– Use the USB adapter cable to connect the computer to diagnosis connection **1** on the vehicle. Remove protective cap **2** beforehand. Communication does not commence until the ignition has been switched on.

Disconnecting from the motorcycle



– Change data using the HP Race Calibration software 2.

– Switch off the ignition.

– Disconnect the adapter cable from diagnosis connection **1** and reinstall protective cap **2**.

Installation

System requirements

• The BMW Motorrad HP Race Calibration software 2 can only be used if the tool is connected to a motorcycle (online) or an existing data record is loaded (offline).

• BMW Motorrad HP Race Calibration software 2 replaces the BMW Motorrad HP Race Calibration software.

– Operating system: MS Windows XP, MS Windows Vista, MS Windows 7

– Processor: Pentium or compatible

– Clock frequency: 2 GHz or higher

– RAM: 1 GB

– Hard disc: 100 MB free capacity

– Graphics adapter: with OpenGL support

– Ports: 1 x USB 2.0

Installing the interface drivers (FTDI)

After the HP Race Calibration software 2 is installed, the interface drivers must be installed.

Connect the interface cable supplied with the program to your PC's USB port and install the drivers with the file called `ftdiport.inf`.
The file is in the "FTDI_Driver_20600" directory on the installation DVD.

Driver settings

The path for checking or changing the driver configuration is as follows:
"Control panel", "System", "Device manager", "Ports (COM & LPT)" then double-click on `BMW HPRC USB Serial Port` to open the "Properties" window.

Select the "Connection settings" tab and click on "Extended".

Check that the following are set:

USB packet size:

– Receive: 64

– Send: 64

BM settings:

– Waiting time: 1

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Depending on the scope of equipment or accessories of your product from BMW Motorrad but also in the case of country-specific versions, deviations from the details described or illustrated in this booklet may occur. No claims will be entertained as a result of such discrepancies. Dimensions, weights, fuel consumption and performance data are quoted to the customary tolerances.

The right to modify designs, equipment and accessories is reserved.

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