

# BMW Motorsport

## Basic Setup



A basic setup is given by BMW Motorsport. You find mounting advices in the car documentation, Group 31 XX for front axle and 33 XX for rear axle.

The basic setup is tested by BMW Motorsport and should be adjusted after each service at the axle.

### Preperations:

The car has to be loaded with 60 litre fuel and 80kg at the drivers postion.  
(60kg at the seat and 20kg in the foot area)

**Adjust tyre pressure:** (Therefore you have to take the target pressure)

Frontaxle: 2,4 bar

Rear axle: 2,3 bar

### **Careful:**

The M235i Racing is delivered with Dunlop Slick 265/660-18.

The height of the car can in / decrease by using different dimensions.

### Adjusting on the wheeel load scale.

The balance is 52,1% - 52,3% on the front axle.

## Front axle setup:

Height:	112 mm (1)
Camber:	- 3.1° / -3,1° (=Scale)
Track:	-1 mm / -1mm
Rebound:	11 clicks open
Bump:	9 clicks open

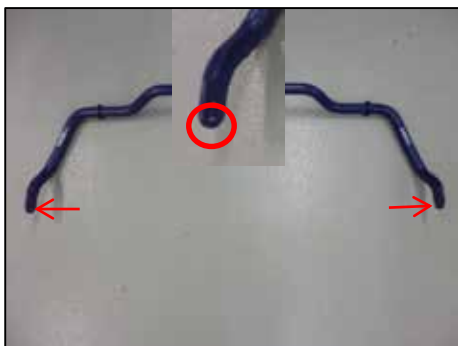
## Preperations and notes:

Check every part of the suspension before starting the adjustment. Load the vehicle as subscribed.

Adjust the vehicle height front and rear, near to the target data.

Start the adjustment of the vehicle on the rear of the vehicle. Adjustment of the camber cause huge affectments to the track, therefore start with adjusting the camber.

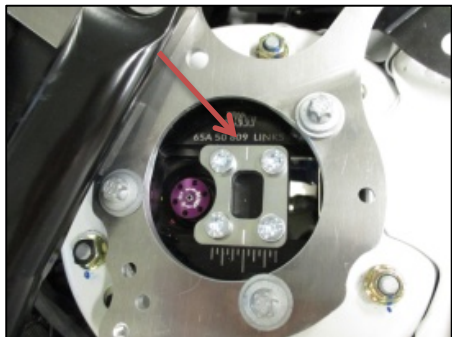
Take note that the roll bar of the front is mounted to the first holes. (Picture)



After the camber and track of the vehicle is adjusted, set the car to the target height and start with the meassurment of the wheel load scale. To get the car balanced 52.2% crosswards, adjust the height of the car in small steps.

## Adjusting of the front axle:

Loosen the four screws of the guide support. Move the plate to adjust the camber. Fasten the screws after the adjustment of the track.



Adjust the track on the track rod left and right.



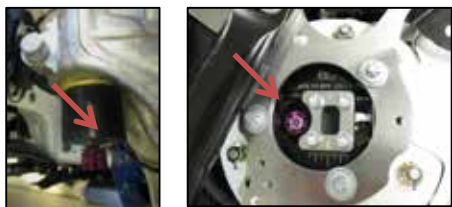
Tightening torque:

Camber plate guide support:	<b>30Nm</b>
Track rod end on track rod:	<b>32Nm</b>

Adjust the height at the damper with the KW special tool and fasten it well.



Adjust rebound on the lower side and the bump at the upper site for the front axle.



# BMW Motorsport Basic Setup



## Rear axle setup:

Height:	124 mm
Camber:	-2,6° / -2,6°
Track:	+3 mm / +3 mm
Rebound:	10 clicks open
Bump:	9 clicks open



## Adjusting the rear axle:

Adjust the track on the upper link.  
Adjust the camber on the lower link.

Tightening torque:

Track link:	<b>100Nm</b>
Camber link:	<b>165Nm</b>



Adjust the height on the rear damper by using the KW special tool. Fasten well afterwards.



Adjust the rebound on the upper side and bump on the lower side of the damper.



### Setup sheet Spec. 2016

Preparations	
Fuel filling [liter] [gal]	60 15,85
Load [kg] seat / foot well [lbs]	60 / 20 132 / 44
Tire pressure [bar] Front / Rear [psi]	2,4 / 2,3 34,8 / 33,4
Reference / Recommended Tire by <b>Dunlop</b>	265/660 - 18

FL – Item	Target
Tyre fillings [bar] [psi]	2,40 34,8
Rebound [Klicks]	11
Bump [Klicks]	9
Height [mm]	110
Toe [°]	-7
Camber [°]	-2,9
Anti Roll bar	Front hole

FR – Item	Target
Tyre fillings [bar] [psi]	2,40 34,8
Rebound [Klicks]	11
Bump [Klicks]	9
Height [mm]	110
Toe [°]	-7
Camber [°]	-2,9
Anti Roll bar	Front hole

RR – Item	Target
Tyre fillings [bar] [psi]	2,35 34,1
Rebound [Klicks]	10
Bump [Klicks]	9
Height [mm]	126
Toe [°]	+18
Camber [°]	-2,5
Rear wing	low

RL – Item	Target
Tyre fillings [bar] [psi]	2,35 34,1
Rebound [Klicks]	10
Bump [Klicks]	9
Height [mm]	126
Toe [°]	+18
Camber [°]	-2,5
Rear wing	low

# BMW Motorsport

## BMW M235i Racing Performance Book



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### **Statement of Non-liability.**

This performance Handbook suggest realistic solutions to racecar handling problems. The suggested solutions point the way and by implementing the suggestions from the next pages you should get unstuck. It will be a result of your own conscious decisions, therefore we disclaim responsibility for your actions and for accident.

The goal of car tuning is to be able to drive quickly and safely on the racetrack. The next pages explains - re-summed in different chapters - how to improve lap times and safety by improving racecar handling.

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### I. Driver

Handling problems, car or driver?

Many handling problems can be attributed to driver errors, especially for new or inexperienced drivers. It can be difficult without data logging to determine if a handling problem is Set-up or driver related.

Below is a list of clues where to look first when handling problems occurs:

- If a problem is inconsistent, it is likely driver related
- If a problem occurs at every similar type of track section, it is likely Set-up related
- If a problem is either on left or right turns only, it is likely Set-up related
- If a problem is at one turn only and not at any other similar turn, it is likely driver related



### **II. Tire pressure**

#### **Effect of tire pressure:**

The tire pressure in a tire has a big effect on tire traction. A specific tire on a given car with a given load will have only one correct tire pressure which should first be requested at the tire brand engineer for the specific used car. In practice it is a narrow range of pressure, within about 3 psi. If the pressure is outside of this range, the contact patch is deformed and not fully contacting the road surface.

#### **Setting tire pressures:**

- When the target pressure is p. ex. 28psi at hot conditions, then start with ~ 23psi and run a stint of min. 10 laps. Check the tire pressures all-around and adjust to the target value.
- Then take the adjusted tire set off the car and let cool down to ambient temperature for obtaining cold tire pressure values.

#### **Note:**

- Use always the tire temperature pressure sheet (pressure lookup table) and stick to the reference values of 20deg C.
- The attached tire pressure lookup table helps to determine cold pressures in each wheel when ambient temperatures are changing during the event.
- During every session should tire pressures and track surface / air temperature be monitored.
- When track gets ~10deg warmer, bleed ~0,72psi cold or ~1,16psi warm air pressure from the tire to avoid over pressures which results in less grip.
- Tire pressure gauges has to be re-calibrated from time to time to avoid wrong pressure settings. An on track tire service can always be asked for double checks at your tire pressure gauge or for some tire contact patch evaluations.

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### Trouble shooting:

- **Too much tire pressure**  
→ Sliding at slightest provocation, wheel spin, responds to quickly
- **Tire pressure too low**  
→ car feels unresponsive, rolls a lot, slow to take a set in corners
- Rear tire pressure ~2.9psi **higher than front** tire pressure gets over-steer
- Rear tire pressure ~2.9psi **lower than front** tire pressure gets under-steer

**Note:** Tire pressures to be Set-Up with the slower driver if using more than one driver per car



### **III. Tire temperature**

All racing and high-performance street car tires are designed to operate within an optimum temperature range when driving near or at the limits of the racecar.

- **If the tire temperature is too low**, the coefficient of friction will be too low and maximum traction will not be achieved.
- **If the tire tread is too hot**, traction will again be lost and the tire will wear more quickly.

The optimum tire temperature range for the specific car should be requested at the tire brand engineer. The tire temperature should be measured by a tire pyrometer with a needle probe and checked as close as possible to the tire steel construction. Measuring the temperature with a needle probe will be much more accurate as the surface might cool down when entering into the pit lane at lower speeds.

#### **Measuring temperatures:**

The tire temperature range will be measured at the outside, middle and inside area of the tire patch.

**Note:** The difference between the spots should be ~10°C., per ex. outside 60°C., middle 70°C. and inside 80°C.

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### Trouble shooting:

- Too much tire temperature and wear at the center of the tire  
→ too much tire pressure
- Mid temp. too height  
→ set less tire pressure
- Mid temp. too low  
→ set more tire pressure

**Note:** Tire wear check should be done with the tire brand engineer

### Wear check with the tire depth indicator:

- Too much tire wear inside → check camber or toe-out settings
- Too much tire wear outside → check camber or toe-in settings

### Tire graining:

- Could be a result of a “green track” (no rubber on tarmac, as beginning of the event)
- Tire compound not adapted to the track temperature

### Tire cleaning on track:

**Front:** Apply excessive steering angle (Zig-Zagging) which cleans the tire surface.

**Rear:** Wheel spin or increase tire pressure to clean the tire in the middle.



#### **IV. Brakes and straight line instability**

Every corner will be followed by a straight line which will end up in a braking zone.

##### **Straight line instability:**

- Too much rear wheel toe-out, either static due to incorrect set-up or dynamic due to bump steer or deflection steer
- Way too much front toe-in or toe-out
- Uneven front castor or trail settings
- Loose or broken chassis, suspension or suspension link mounting points
- Dead shock absorber

##### **Straight line instability under acceleration:**

- Malfunction of limited slip differential
- Not enough rear toe-in
- Deflection steer from rear chassis, suspension member or mounting point
- Dead rear shock absorber
- Way too uneven corner weights

##### **Straight line instability over bumps:**

- Too much front toe-in or toe-out
- Uneven front castor or trail settings
- Dead or uneven shock forces or incorrectly adjusted packers / bump rubbers
- Way too uneven corner weights
- Front anti roll bar too stiff

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### **Instability under hard braking, front end wanders:**

- Too much front brake bias
- Too much front damper rebound setting

### **Instability under hard braking, car wants to spin:**

- Too much rear brake bias
- Too much rear damper rebound setting
- Too much rear camber





### V. Dampers

The primary purpose of the shock absorbers is to dampen oscillations or vibrations. The shock has to keep the spring from bouncing beyond one full cycle. The shock absorbers has two jobs. First, it must control oscillations of the unsprung mass. Second, the shock absorber must control the sprung mass of the car. The spring does most of the work in bump travel, while the shock controls the return motion with rebound travel.

#### Damper settings:

- Low speed adjustments when car is rolling (corners)
- Height speed adjustments for bumps and Kerbs

**Note:** Bump gains traction and helps in braking

#### Too much bump

- harsh reaction to road surface irregularities
- Car slides rather than sticking
- Car doesn't put power down well
- Car responds too quickly, slides at slightest provocation

**Note:** Rebound helps the unloaded axle

#### Too much rebound

- wheels do not return quickly to road surface after displacement
- Inside wheel in a corner may be pulled off the road by the damper
- Car doesn't put power down well at exit of corners when road surface isn't extremely smooth
- Instability under hard braking, car wants to spin.



### **VI. Springs**

A spring, defined in terms of physics, stores energy. When a constant force is applied to a spring, it will store the energy of that force and return to its original shape when the force is no longer applied.

- Too much dive of the front while braking → harder spring needed
- Entry turn front more rolling than the rear → harder spring front needed
- Entry turn rear more rolling than the front → harder spring rear needed
- Rear no traction at all → softer spring rear needed

### **Bump rubbers / packers:**

**Note:** Check ride height at height speed if bump rubbers or packers are not on block (With tie-rod at the damper-rod).



### **VII. Corner over-steer**

#### **Entry-corner oversteer:**

- Front anti-roll-bar stiffer
- Rear ride height lower
- Front ride height higher  
(also if the car touches at the end of the main straight)
- Rear damper stiffer in re-bound
- Rear more Aero load  
(when issue happens in high speed corners > 4<sup>th</sup> gear)

#### **Mid-corner oversteer:**

- Rear more camber
- Front anti-roll-bar stiffer
- Rear more Aero load
- Rear softer springs

#### **Exit-corner oversteer:**

- Driver accelerate too early or too much
- Rear anti-roll-bar softer
- Rear damper softer in bump
- Front damper stiffer in re-bound
- Rear ride height lower
- Front ride height higher
- Rear more Aero load (when issue happens in high speed corners > 4<sup>th</sup> gear)

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### VIII. Corners under-steer

#### **Entry-corner understeer:**

- Driver trail-brakes too much (staying on brakes while turning in)
- Driver carries too much speed into the corner-entry
- Front anti-roll-bar softer
- Front ride height lower
- Rear ride height higher
- Front damper softer in bump
- Rear damper softer in re-bound
- Front more Aero load (when issue is at height speed corners > 4<sup>th</sup> gear)
- Rear less Aero load (when issue is at height speed corners > 4<sup>th</sup> gear)
- When the problem of the under-steer occurs when the tire temperature is too cold:
  - try more tire pressure to get them quicker at target temperature

#### **Mid-corner understeer:**

- Front more camber
- Rear less camber  
(check lap-times for double check if driver feels car better)
- Front anti-roll-bar softer
- Front spring softer

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### Exit-corner understeer:

- Driver accelerate too early (with still too much steering angle)
- Front ride height lower
- Rear ride height higher
- Front damper stiffer in re-bound
- Rear damper stiffer in bump
- Front anti-roll-bar softer

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### **IX. Wet conditions**

- Go to rain tires
- Rise front and rear up – Center of gravity rise (increase load transfer)
  - Adjust camber to initial Set-up
  - Adjust toe to initial Set-up
- Damper softer (Bump & rebound)
- More Aero where it is possible



### **X. Suspensions adjustments scans**

Every test-kilometer should be used to better understand the car, therefore prepare well your tests and generate always a run-plan where you write down what you want to test / to learn about the different suspension adjustments.

A Set-up scan can be achieved on the following adjustments at the front and at the rear:

- Wheel-Toe
- Wheel-Camber
- Tire pressure
- Car-Ride-height
- Anti-roll-bar

### **How to do:**

Start always with your base-line Set-up and run 7 laps on a new tire set

- Do a 1<sup>st</sup> change to a “positive” value and run 7 laps on a new tire set
- Do a 2<sup>nd</sup> change to a “negative” value and run 7 laps on a new tire set
- Go back to base-line Set-up and run 7 laps on a new tire set to evaluate any track improvement or downgrade comparing to the first base-line run

With this method you as an engineer and the driver will learn where to adjust to improve what kind of handling problem.





### **XI. Differential**

Cars need differentials between the driven wheels because the outside wheel in any cornering situation must travel on an arc of greater radius than the inside wheel so will have to turn more times.

The standard differential allows the wheels to have different speeds. When the wheel speed is very different, the car loses performance because all the torque is going to the unloaded wheel with more speed.

We need to minimize this difference between the wheels speed to improve the traction and the braking.

If the two driving wheels are locked together, the unloaded inside wheel will be forced to rotate at the same speed as the outside one (get less torque to reduce the speed), therefore we use a limited slip differential to adapt the difference of radii.

The idea behind the limited slip differential is to allow one wheel gets more torque than the other and to try to have the same wheel speeds.

#### **Note:**

- The outer wheel has always more load, so the outer wheel should have always more torque
- The diff. always load more torque in the outer wheel and less in the inner wheel
- More locking in the diff. means more torque difference between the outer and the inner wheel
- The angle of the ramps and the faces of the discs in contact give us the locking percentage
  - Less angle of the ramps, produces more locking torque
  - More faces of the discs in contact, produces more locking torque
- In a high locking diff. we can put much more torque in the outer wheel – that is the wheel with more grip and very little torque in the inner wheel – that is the wheel with less grip.
  - If we have little locking, we will have wheel spin and high difference wheel speed between both sides
  - If we have much locking, we will have the same speed in both sides and will be a problem in cornering

As the differential locking torque is improving the car handling on track, you should check the differential pre-load value at new condition and before every session.

When the pre-load changes too much during the season, this will get less differential locking torque, which could provoke inner wheel spins and result in entry-corner oversteer.



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## 00 11 Engine Oil Change



### Required parts:

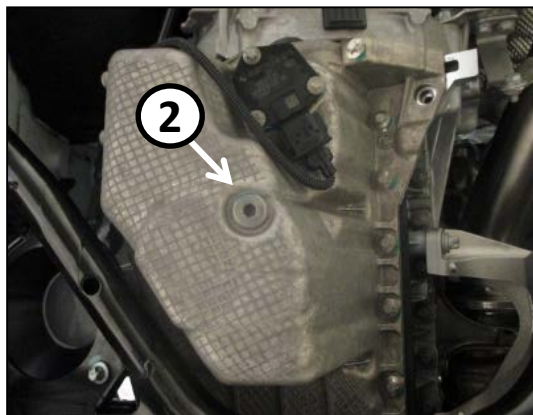
Quantity	Item number	Designation
1	8321 0398504	Engine oil SAE 0W-40 Longlife 04
1	1142 7566327	Engine oil filter with gasket

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## 00 11 Engine Oil Change



Notice: Risk of burning!



1. Only change engine oil when the engine is at operating temperature.
2. Turn off the engine and secure the vehicle against rolling away.
3. Open the oil filter cover (1).  
Attention: Warm oil may leak.
4. Lift the vehicle. (the vehicle must be level on the platform)
5. Have a suitable container ready.
6. Carefully open the oil drain plug and collect the emerging, hot oil. (2)
7. Drain the engine oil until the oil thread is complete broken.  
Approx. 15 min.
8. Close the oil drain plug.  
Tightening torque:  
**M16x20 20 Nm**  
Attention, the gasket must be replaced.

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## 00 11 Engine Oil Change



Notice: Risk of burning!



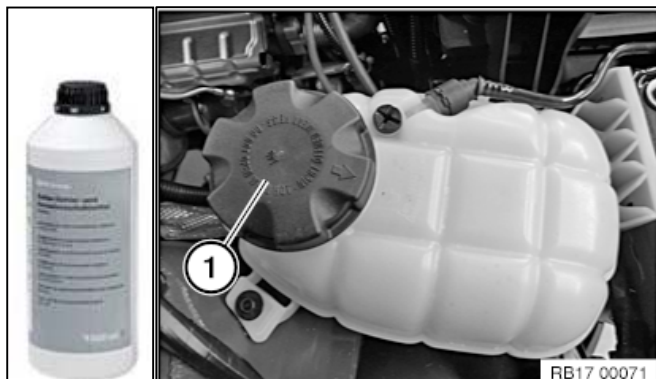
9. Lower the vehicle.
10. Replace oil filter with gasket.
11. Screw the oil filter cap to the housing.  
(3)  
tightening torque: **25 Nm**



12. Fill the engine with 7.0 l engine oil (4).  
Attention: Use specified engine oil.
13. Then check the engine oil level.

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## 00 17 Coolant Change



### Required parts:

Quantity	Partnumber	Description
8	8319 2211191	Coolant liquid
2	1153 7793373	Vent screw

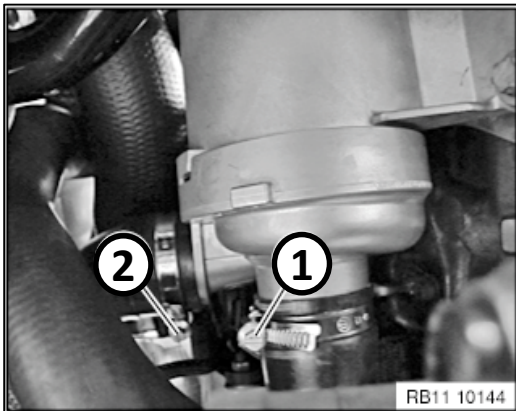
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## 00 17 Coolant Change



Notice: Risk of burning!

Attention: In case of contamination by engine oil, for example, the cooling system must be cleaned thoroughly.



### Draining the coolant:

1. Open the cap on the compensating reservoir
2. Remove the shear panel.
3. Loosen hose clamps (1) and (2). Remove the coolant hoses from the coolant pump and drain the coolant.
4. Notice: Observe the installation position of the hose clamps.

### Fill the cooling system.

1. Filling with 50% cooling agent and 50% distilled water.
2. Fill slowly.
3. Fill coolant up to the maximum level.





Notice: Risk of burning!

Attention: In case of contamination by engine oil, for example, the cooling system must be cleaned thoroughly.

### Fill the cooling system.

4. Close the compensating coolant reservoir.
5. Notice:  
Close the cap until the arrow markings are aligned.

### Refill the cooling system.

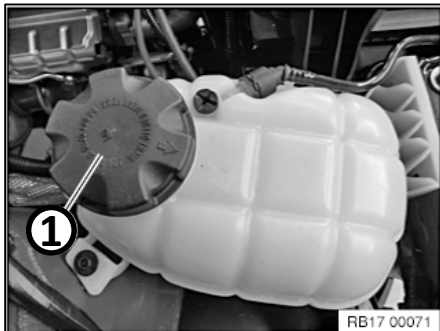
Notice: The following venting procedure is necessary after, e.g., replacing parts in the cooling system or when refilling the cooling system.

1. Fill the cooling system with a vacuum filling device.

### Vent the cooling system.

Boundary conditions:

- The cap stays open
- Connect the battery charger
- Switch-on the ignition
- Switch-on the dimmed headlights
- Turn the heater to maximum
- Turn fan to minimum





Notice: Risk of burning!

Attention: In case of contamination by engine oil, for example, the cooling system must be cleaned thoroughly.

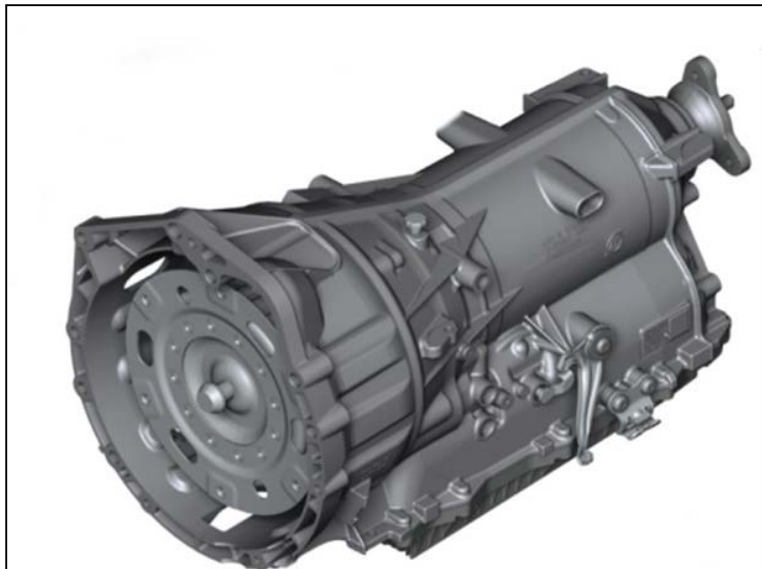


### Vent the cooling system.

1. Press the accelerator pedal all the way down for 10 seconds, the engine must not be started.
2. The venting procedure is started and takes about 12 min.  
The electronic water pump switches off automatically.
3. At the end, fill the coolant level as described on page 6.
4. Check the cooling system for leaks with suitable tool.
5. *If the procedure must be performed again, start with step 1 after first turning off the ignition for about 3 minutes, until the DME voltage is complete drained.*

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## 00 24 Transmission Oil Change



### Required parts:

Quantity	Partnumber	Description
9	8322 2305397	ATF 3 1l

# BMW Motorsport

## 00 24 Transmission Oil Change

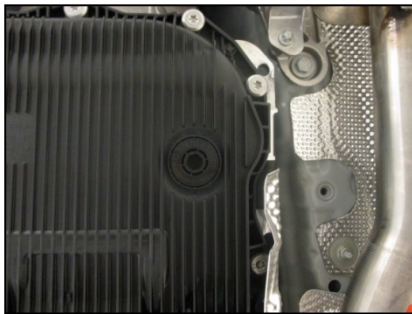


Notice:

- Risk of burning
- Avoid skin contact with transmission oil
- Ventilate the room sufficiently

### Drain the transmission oil:

1. Lift the vehicle and make sure it is level.
2. Open the transmission oil drain plug and collect the oil with a suitable container.  
Tightening torque **8 Nm**
3. Wait for about 5 minutes.



(Now fill the oil during the change, start the engine briefly and repeat the process several times to purge the system.)

### ➤ **Fill the transmission oil**

Bring the engine in gear position P to operating temperature.

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## 00 24 Transmission Oil Change



### Notice:

- Risk of burning
- Avoid skin contact with transmission oil
- Ventilate the room sufficiently

### Top off transmission oil.

Display the transmission temperature on the steering wheel:

Conditions to start: Transmission oil temperature 30 °C to 40 °C

Conditions to finish: Transmission oil temperature 40 °C to 50 °C

Open filler plug with running engine and gear in position P.

A: Oil is emerging from the hole in a thin string

=> Oil level is correct

B: Oil is emerging in large quantities

=> Wait until a thin string emerges

C: No oil emerges

=> Add prescribed transmission oil until the oil emerges as a thin string



Fasten the transmission filler screw.  
Tightening torque **35Nm**

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## 00 33 Differential Oil Change



### Required parts:

Quantity	Partnumber	Description
4	8322 2282583	CASTROL SAF XJ 75W140 500 ml
2	0711 9963300	Gasket A18x22 AL
2	0711 9963355	Gasket A22x27 AL

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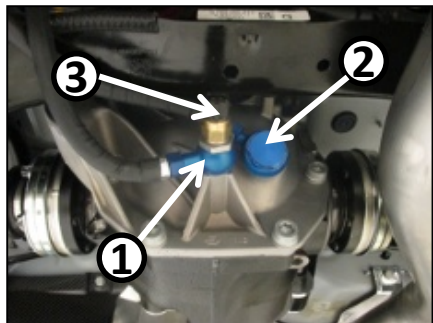
## 00 33 Differential Oil Change



Notice:

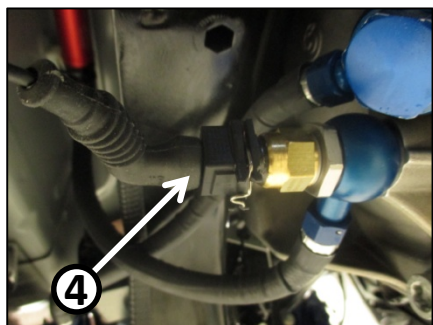
- Risk of burning
- Avoid skin contact with transmission oil
- Ventilate the room sufficiently

### Drain differential oil.



1. Open the drain screw (1).  
Capture the transmission oil with a suitable container.
2. Open the filler plug (2) for bleeding.
3. Let the transmission oil drain out.

### Fill differential oil



1. Loosen the temperature switch plug (3) (4).
2. Bridge the temperature switch plug (4), switch on ignition.
3. Place the suction line into the container and suck oil until the differential oil emerges from the drain hole.
4. Quickly install the suction line.  
Tightening torque **35 Nm**.
5. Fill the differential oil into the filler hole to the top and close quickly.  
Tightening torque M22 **60 Nm**.





**Requird parts:**

Quantity	Partnumber	Description
1	3410 8416725	Brake disc left (friction ring)
1	3410 8416726	Brake disc right (friction ring)
1	3410 8416729	Set of brake pads

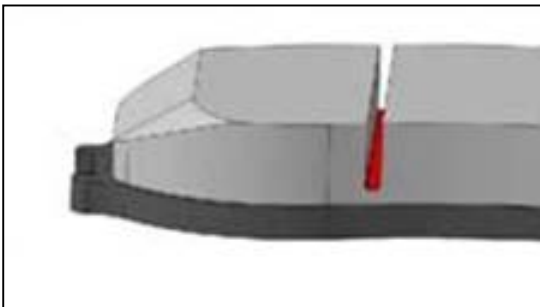


### Notice:

- It is always helpful to monitor the temperatures of the brake disc, pads and the brake caliper via the indicators.
- The built-in ABS components generate a control system during driving, for which the steerability of the vehicle should be maintained within the limit. The control range should be avoided to achieve an optimized braking distance and for less wear on the brake system.

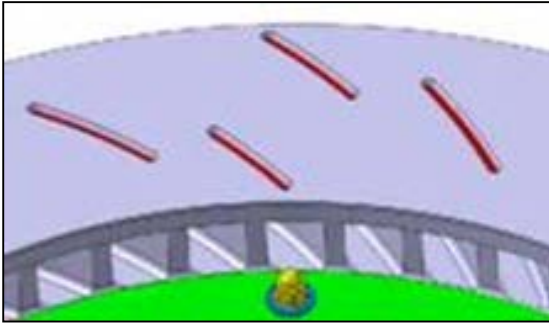
If the forces are too high and if the crash detection engages, the ABS is inactive.

Brake pad wear according to manufacturer data.  
(front axle)



1. The brake pads are considered worn when the brake pad surfaces with the area of the slot that is marked red is on the same level. If the wear differs between the inside and outside, the pads must also be replaced and the brake pistons in the saddle must be tested.
2. When using the ABS system, the pads should be replaced at 60-70% wear, because from this point on the braking performance of the surface is diminished, resulting in higher temperatures.

Brake disk wear according to manufacturer data. (front axle)



1. Cracks in the brake discs should not exceed 6.0 - be 8.0 mm. In addition, the cracks should not go beyond the friction surface.
2. The slots on the friction surface of the brake disc have a depth of 1.25 mm; the brake discs should be replaced if wear of 1.0 mm is observed. (Residual slot depth 0.25 mm)

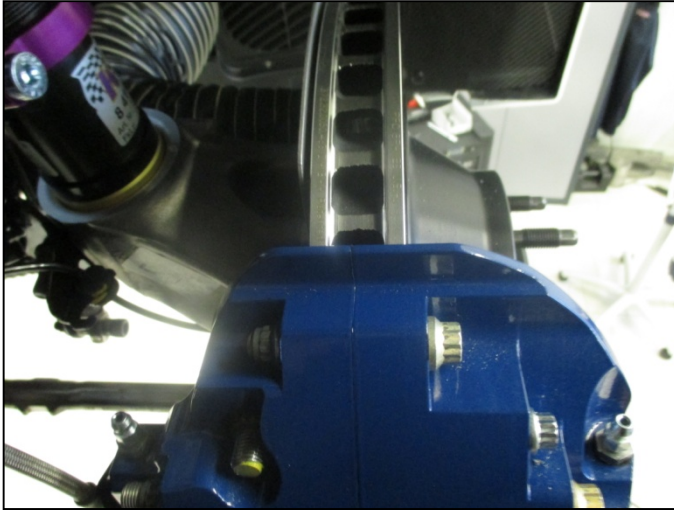
Replace brake discs. (Front axle)

The necessary steps for a brake disk change are described in the design documentation of the M235i Racing (grouping 34 10)

Brake pistons must be pushed back with a suitable tool for a multi-piston system.  
The system surface and brake caliper must be cleaned.

# BMW Motorsport

## 00 34 Brake Fluid Change



### Required parts:

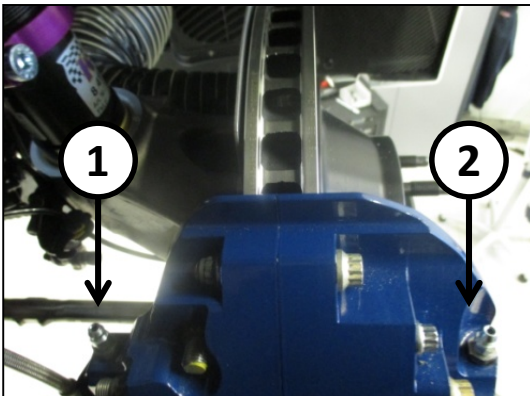
Quantity	Partnumber	Description
2	3430 2483651	CASTROL SRF 1LTR
1	3410 8416834	Bleeder nipple set 8 mm
1	3410 8416733	Brake caliper sealing kit (optional)

**Notice:**

➤ Avoid skin contact with the brake fluid

1. Position the fender cover and connect the brake bleeding unit.  
Operating pressure max. 2 bar.
2. Open the brake fluid bleeder screw on the brake caliper.  
Leave it open until the new brake fluid emerges.

This routine is carried out in the following order



1. rear right
2. rear left
3. front right, inside (1)  
front right, outside (2)
4. front left, inside  
front left, outside

**Notice:** The complete brake system can only be bled with an examiner of the BMW Group present.



The following components need to be continuously checked for leaks, firm seat and stability for the running-in check and thereafter.  
The torque values can be found in the documentation.

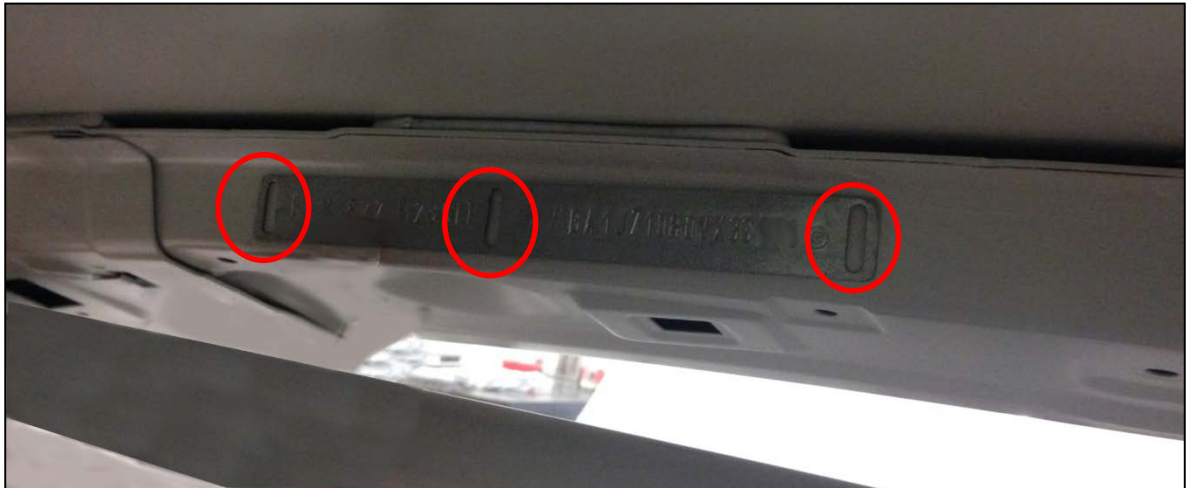
Inspection work - description of assemblies	
	Front axle with steering
	Rear axle with cooling
	Engine compartment with reinforcement
	Body with safety cage, seat and interior space
	Tank system
	Underbody
	Bodywork

## Mounting vehicle identification number.

BMW Motorsport´s delivered vehicle identification number has to be fixed to the vehicles body.

The prescribed location is the a-column cross strut. The badge has to be readable for the driver.

1. Remove in this area the lacquer from the chassis.
2. Clean the body thouroughly.



3. Welt the badge to the body on points shown in figure 1.
4. Clean the body in the area of the welding and the badge.
5. BMW Motorsport recommends a small layer of lacquer to protect against corrosion.



<b>Description</b>	<b>Page</b>
<a href="#">Fluids check</a>	
<a href="#">Engine and gear oil</a>	3
<a href="#">Fuel</a>	
<a href="#">Differential oil</a>	4
<a href="#">Coolant and windshield cleaner</a>	5
<a href="#">Brake fluids</a>	6
<a href="#">Service regulations</a>	7
<a href="#">Sealing</a>	8
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<a href="#">General vehicle electronics</a>	11
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<b>Description</b>	<b>Page</b>
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<a href="#">Fuel discharge</a>	35
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### **Note:**

Only BMW approved parts are to be used.

### **Engine oil.**

BMW SAE 5W-30 Longlife -04 // Shell SAE 0W-40 Helix Ultra

Filling quantity: 7.0 l

Warm up the engine. (oil temperature > 90°C).

Turn off the engine and open the oil fill cap. This will allow a pressure equalisation between riser pipe and crankcase. Let the engine cool down for about 2 minutes.

Verify the engine oil level with the oil dip stick. The recommended oil level of 7.0 l is reached at approximately 50% of the measuring scale. An overfill should be avoided.

### **Fuel.**

Filling quantity: about 85 Liter

Please note, only unleaded fuel ROZ98 is released by BMW Motorsport. Contact [teaminfo@bmw-motorsport.com](mailto:teaminfo@bmw-motorsport.com) with a full spec. sheet to check clearance for the fuel.

PWC: VP101 is checked at ATL. It is recommended to drain the complete fuel cell after running with VP101. The use is free for the race weekend.

### **Transmission oil.**

ATF 3+ (2 289 720)

Shell ATF-Oil L12108

Filling quantity: 8,5 l

Note: ATF3 is mixable with L12108. Do not cross other oils, otherwise the gearbox can be damaged.

Further information on the control of the oil level and oil change, may be found under the main documentation group 00 24 Service.

# BMW Motorsport

## Fluids check



### **Note:**

Only BMW approved parts are to be used.

### **Differential oil.**

SAF XJ 75W140 (2 282 583)

Filling quantity: 1,6 l including differential cooling.

The oil level can only be checked when properly refilled. For this matter, regard the main documentation group 00 33.



### **Note:**

Only BMW approved parts are to be used.

### **Coolant.**

Coolant shall be checked when the engine is at a standstill and cold.

The compensation reservoir, on the right side of the engine compartment, shows minimum and maximum level marks.



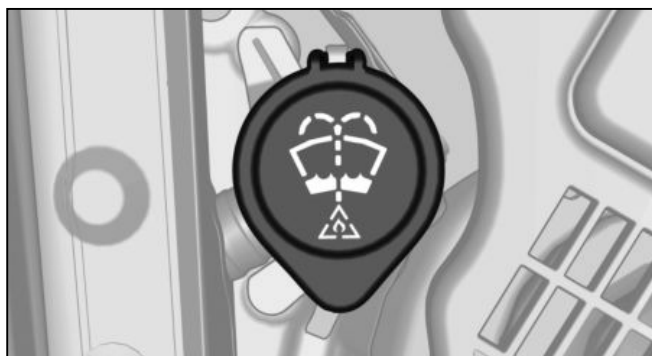
The cooling fluid consists of coolant and of distilled water. The mixing ration is 50%/50%.  
BMW part number: **83 19 2 211 191**

The coolant level is correct, when it lies between the minimum and the maximum mark.

Regard the main documentation group 0017 for further information on the coolant change.

### **Windshield cleaner.**

The windshield cleaner can be refilled on the right side of the engine compartment, behind the front strut support.



**Note:**

Only BMW approved parts are to be used.

**Brake fluids.**

CASTROL SRF

BMW part number: 83 10 2 483 651

Filling quantity: approx. 2l

The fluid level can be read off of the compensating reservoir, on the left of the engine compartment.

After changing the brake pads, you need to make sure that the level is always at a maximum.

Check the fluid level before each drive.

Careful: Also pay attention to the other reservoir for leak-tightness.





### Servicing.

**The noncompliance can lead to engine damages.**

**Before each drive you need to check the oil levels.**

Distance [km]	Max rotations [1/min]	Load [%]	Vmax [km/h]
0-400	3000	40	170
400-1000	4000	50	170

### Roll in Service.

After the first 1000km you need to have it serviced.

- Engine oil change
- Differential oil change and filter cleaning (SAF XJ)
- Brake fluids check
- Alignment measurement (see setup)
- Check screw connections according to the spreadsheet: (regard the document torques)
- Grease bolts with Molykote.



#### Audit work – Card description

Front axle and steering
Rear axle and cooling system , differential screw connections
Engine and engine compartment with reinforcement strut
Bodywork with safety cell, seat and interior
Fuel cell
Underfloor
Bodywork
Brake systems front and back

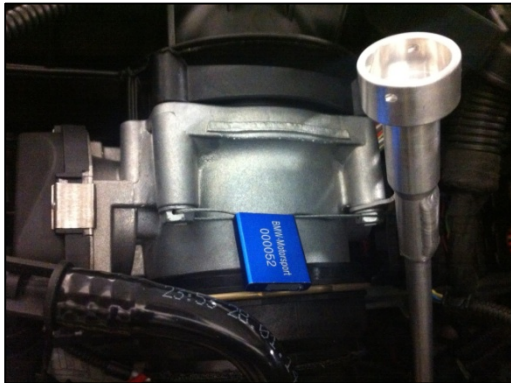
# BMW Motorsport

## Preservation of the competition



For a fair competition in the M235i Racing brand trophy, the drive train was sealed by BMW Motorsport and holograms were attached.

### Sealing.



1. Throttle



2. Intake Manifold



3. Valve cover



4.1 Turbocharger- Distribution



4.2 Turbocharger- Substitute



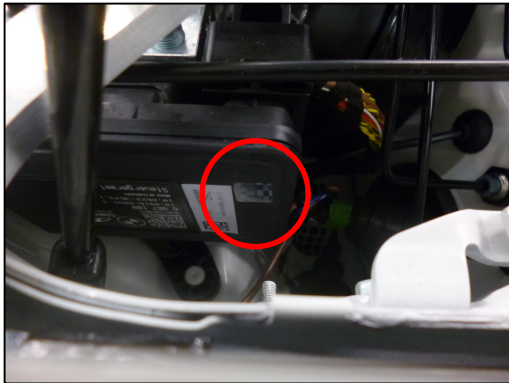
# BMW Motorsport

## Preservation of the competition



For a fair competition in the M235i Racing brand trophy, the drive train was sealed by BMW Motorsport and holograms were attached.

### Holograms.



1. Control unit ABS



2. Control unit engine



3. Boost pressure sensor „top“



4. Boost pressure sensor „bottom“



# BMW Motorsport

## Preservation of the competition



For a fair competition in the M235i Racing brand trophy, the drive train was sealed by BMW Motorsport and holograms were attached.

### Holograms new Spec.



1. Control unit ABS



2. Control unit engine



3. Boost pressure sensor „top“



4. Boost pressure sensor „bottom“



Necessary additional weights are to be attached in the passenger's foot area. Therefore use the fixing points of the passenger's seat.

You can order weights with the following parts numbers:

Part number	Description
8 416 906	COUNTERWEIGHT PLATES 1 KG
8 416 907	COUNTERWEIGHT PLATES 2 KG
8 416 908	COUNTERWEIGHT PLATES 5 KG
8 416 909	COUNTERWEIGHT PLATES 10 KG

### Vehicle battery.

A 12V 80Ah AGM battery is mounted in the vehicle.  
This battery has individually been attributed to the car.

### Battery change.

A battery change should be registered on occasion, by a M235i Racing specialist.

### Battery installation and removal.

We advise to first connect the positive pole before attaching the negative pole. The disconnection should follow in reversed order – first negative then positive.

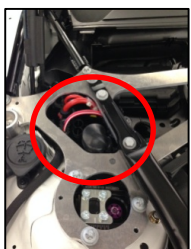
### Batterie care.

Should the vehicle stay unused for a longer while (approx. 30 days or longer), we recommend (to conserve the batterie) to disconnect the earth terminal. Then isolate the terminal until start up of the electrical system.

### General handling.

The vehicle is constructed like a serial model.  
Which means the batterie doesn't discharge increasingly. That is why we recommend, only to use the battery main switch (interior and exterior one) in the case of an emergency.

Please ensure, after connecting for example the logging equipment that the serial behavior is still given (sleep modus) and that their is no additional load on the battery in resting mode.



When working on the front end strut or the electronics in the engine compartment, the battery should be disconnected to avoid short circuit.



### General handling.

### ICM Handling.



The airbag inscription stands for the sensor technology of the serial model airbag systems. The system was omitted in the M235i Racing. The ICM control unit is still in use by the DSC and EPS Systems. Therefore make sure of a firm hold and avoid shocks to the system.

### Engine Start-Stop Button.



The engine may only be started and turned off with the start stop button. After startup, let the engine run for 30 seconds at idle speed. To start the engine, activate the brakes.

#### *Locked positions:*

Everything OFF -> SST press x1 = KL15 ON, press again KL15 OFF

Everything OFF -> SST press x1 = KL15 ON, press again + brake = Engine starts

Engine runs -> SST press x1 = Engine OFF – KL R active, press again KL15

When an emergency program is activated or if there is an error entry, then after turning the engine off, the ignition has also to be deactivated, so that the reason for the default can be controlled.

**Important, press the second time! Only then is a re-launch of the control unit possible once the ignition is reactivated.**

### Gear selector. Emergency lock.



#### **Gear selector (1)**

The activation of the brake pedal allows the selection of the driving programs D and R. The driving program D is for driving forward while the R program is for reverse driving.

**Careful:** An automatic driver mode is not available for the M235i Racing. You can switch gears with the pedals on the steering wheel or with the gear selector. (1)

### Parking lock and Safety release. (Gearbox)

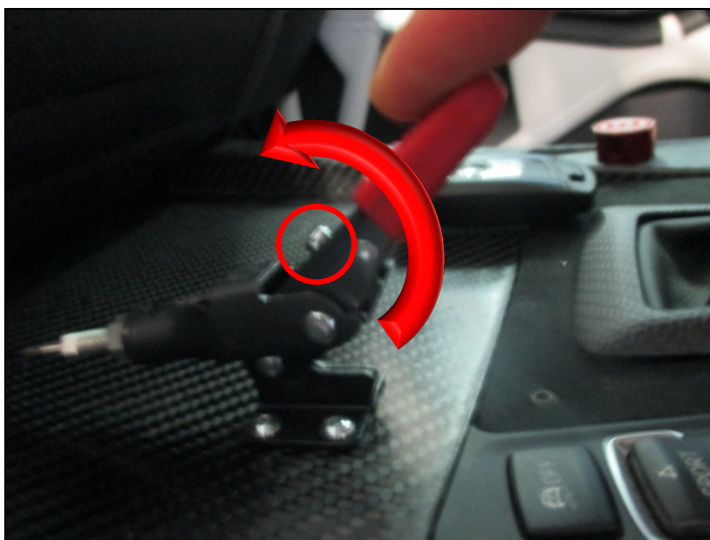
To unlock the Gearbox pull down the lever and at the same time push down the chrome button (Picture 1).



Unlocked – car could roll away

#### 1. Rollable

To secure the vehicle, push down the chrome button (Picture 2) and pull the lever to an upright position.



Locked – car can't roll away

#### 2. Secured





## Initialization window regulator.

### **Operating sequence initialization:**

#### **Erasing the initialization:**

Set your window to the lowest endposition.

Put the switch in the following position "Open tap mode" (second switch level) and press it for more than 15 but less than 25 seconds.

#### Note:

The erasing of the initialization was successful when the M/AUT - function and the jamming system are out of order.

#### **Resetting the initialization:**

Set your window to the highest endposition.

Put the switch in the following position " Close tap mode" (second switchlevel) and pull it towards you during the entire process.

#### Note:

The reset was successful when the M/AUT - function and the jamming system work flawlessly.

### Race - DSC.

The M235i Racing has an adapted Race– DSC.

When starting the engine, ensure that the warning lamp lights up on the instrument panel. When the system is activated the lamp will go out after a few seconds.



#### Boxrun.


When the vehicle is operated wheel-free, press the DSC button down long to deactivate DSC/ASC.

#### ABS. (Anti-Blockier-System)


The M235i Racing is equipped with a Race specific ABS. This function can not be deactivated.

#### DSC. (Dynamic-Stability-Control)

**Explanation: DSC allows a precise intervention in the brake- and engine management of your vehicle, when it recognizes slippage or higher yawing moments.**

Briefly activate the  - button to activate the „Dynamic Traction control“ (DTC). The display indicates TRACTION and the control lamp DSC OFF lights up.

While in the DTC Mode your vehicle allows a higher slippage, as well as a higher yawing moment.

Activate the  -button long enough to deactivate the DSC entirely. All security brake systems remain active.

**Indication:** Only use the M235i Racing, when the DSC is activated. The rocker switch with the lettering (Sport / ECO Pro) is disabled.

**Indication:** Before each drive, while the engine is running, steer the wheel from stop to stop, so that the steering angle, especially after a KL30 reset, can be reaquired.



### Extinguishing system.

The M235i Racing is equipped with a fire extinguishing system which complies with FIA standard.

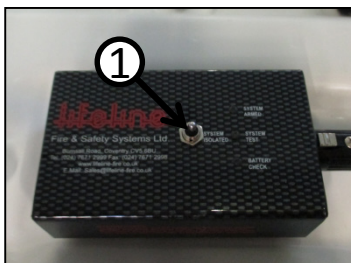


Before each drive verify the serial number, the durability and the pressure of the bottle.  
Before each drive you must check your battery and the entire system.

### Activate, check, deactivate.

You will find detailed information in the joined file:  
*Zero360FittingInstructions.pdf*.

#### Brief description:



The system can be checked at any time, no matter if the engine is running or not.

#### Battery Check

In order to do a „**battery check**“, the lever needs to be put in the position „battery check“ and the orange LED light needs to be checked. If the lamp lights up faintly or if it blinks, you immediatly need to change the 9V-Block.

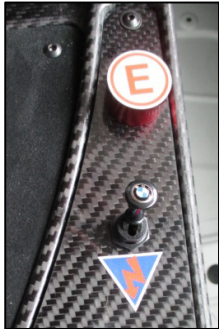
### System Test

When the lever is in the „**System Test**“ position, and the trigger is activated (on the inside of the vehicle and on the outside, near the windshield wipers) then the system can be checked with the green light. If the light doesn't light up, then the cabling needs to be checked immediatly.

Further information on the restauration and cabling can be found in the joined PDF.

Safety indications must be taken into account and applied.

### Extinguishing system activation



The selector switch position „**System armed**“ activates the system. When the system is active the red lamp lights up for „**System armed**“.  
Careful: There is no confirmation. Once the trigger is pressed the extinguishing procedure automatically starts in the passenger compartment and in the engine compartment.



The triggers are marked with an „E“ (Image1&2).

The jets are located in the passenger's compartment. They aim at the driver and at the driver's foot area. Additional jets are located in the engine compartment near the exhaust and the intake manifold.

## Seat position



The seat height and angle can be adjusted, within the grid, with the 4 screws.



Beneath the seat there is a lever, with which you can adjust the distance between the driver and the steering wheel/ pedals.

## Safety belt settings



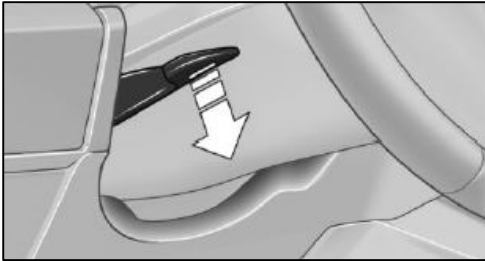
Open the harness. Adopt a sitting position and lock the straps of the central lock (3).

To secure the harness, simultaneously pull both hip straps tight (1). Then pull the shoulder straps tight (2).



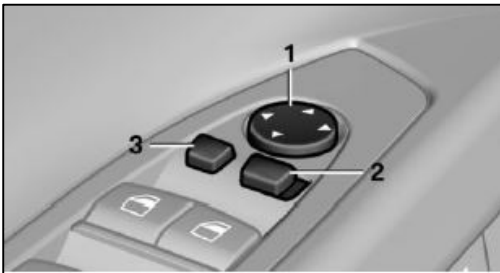
To unlock twist the strap lock!

### Steering wheel settings



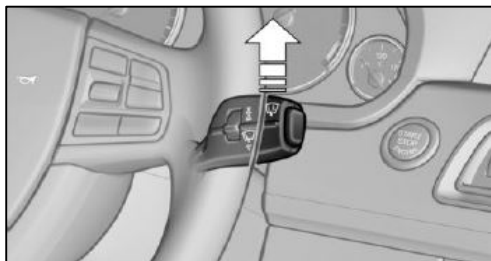
To set the steering wheel, pull the lever towards the bottom. After completing the setting; pull the lever up, to clock the settings.

### Side mirror's settings



- 1 = Settings
- 2 = Side mirrors left/right
- 3 = Fold up and down

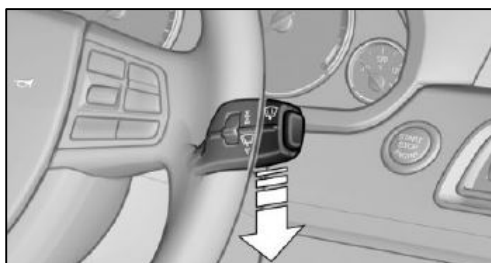
## Windshield wipers.



Switch on the wipers by pushing the lever up.

1x push = normal

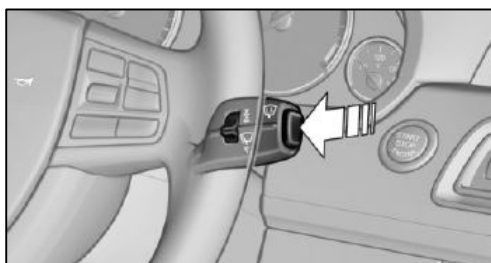
2x pushes = fast



pull down = brief wiping

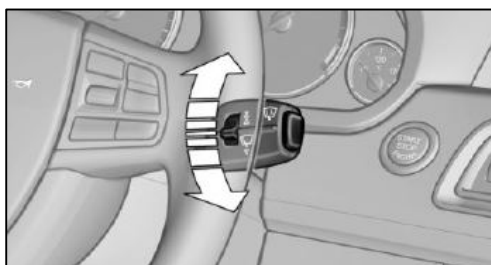
Turn off:

To turn off the windshield press the lever down.



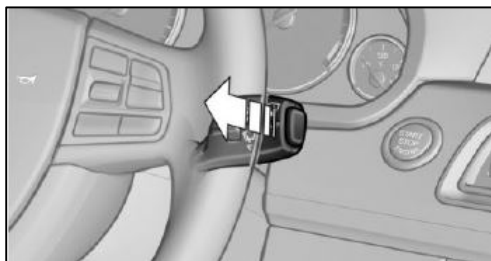
Intervall:

Press = activate/deactivate



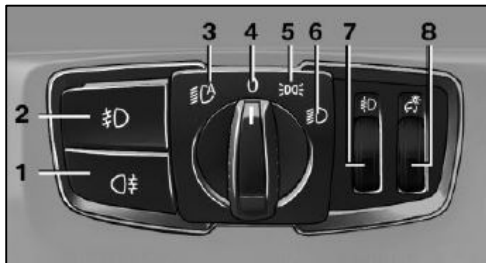
Twist knurling wheel to regulate the interval time or to adjust the sensitivity.

## Cleaning the windshield .



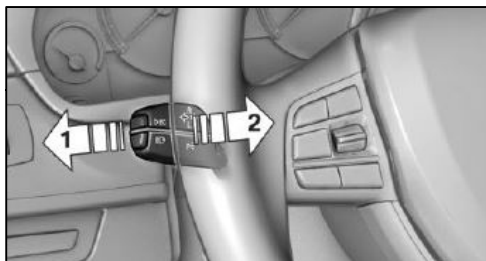
Pull the windshield lever towards you to clean the windshield.

### Light settings



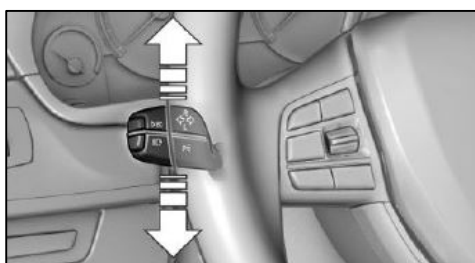
1	Rain lights
2	<i>Optional light package 24h</i>
3	Without function
4	Lights out, daytime running light
5	Parking light, daytime running light
6	Full beam assistant
7	Without function
8	Instrument lighting

### Full beam/ flasher



- 1 High beam headlights on
- 2 Headlight flasher

### Indicator



Activate lever above the pressure point.

For brief blinking activate lever above the pressure point.



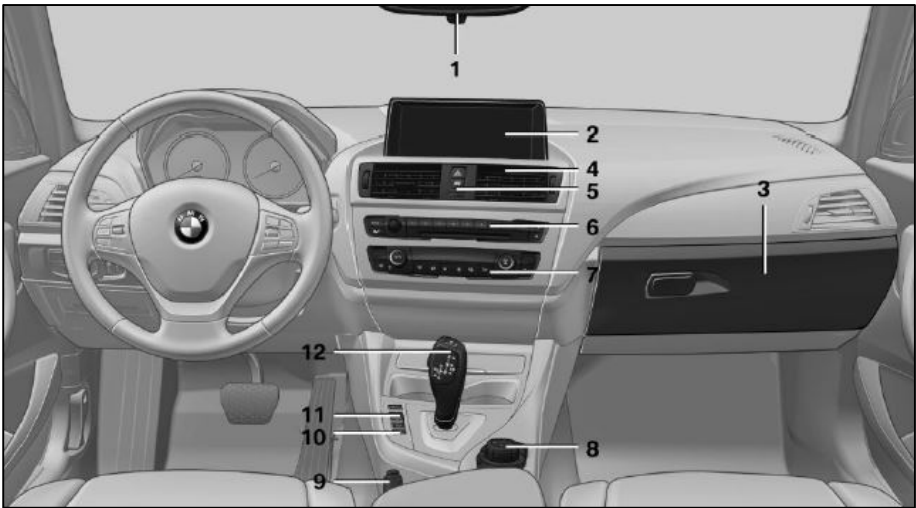
**Window regulator**





For manual opening/closing press/pull past pressure point.

For automatic function, press/pull past pressure point.

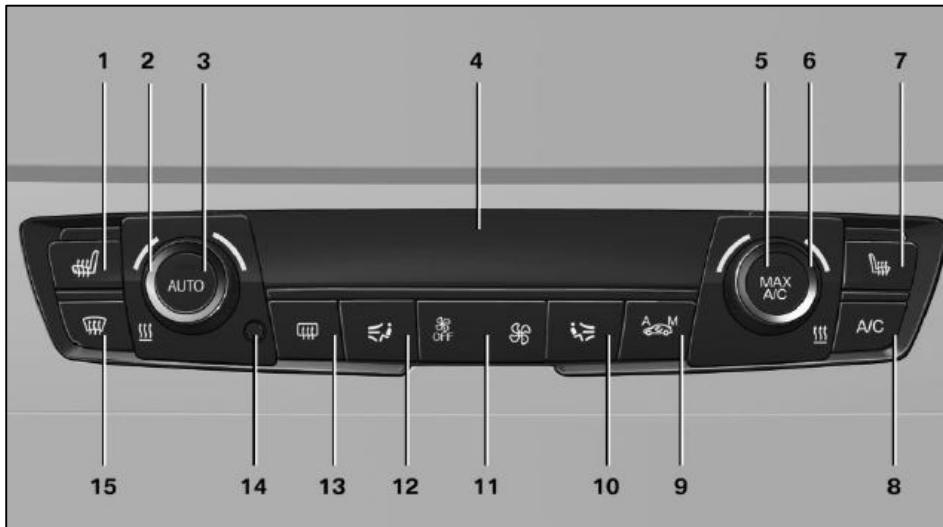
**Central console**



- |            |                              |   |
|------------|------------------------------|---|
| <u>4 =</u> | <u>Air outlets</u>           |   |
| <u>5 =</u> | <u>Hazard warning lights</u> |  |
|            | <u>Central locking</u>       |  |
| <u>7 =</u> | <u>Air ventilation</u>       |   |



### Blowers



**2 =** Air stream intensity

**4 =** Display

**9 =** Recirculation air-mode

**10 =** Air distribution, right

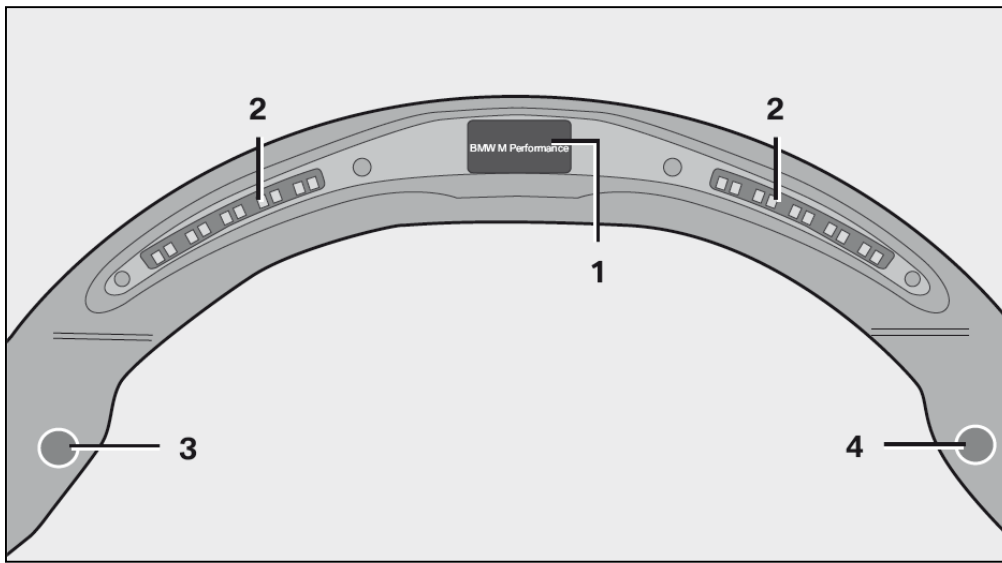
**11 =** Air flow intensitiy

**12 =** Air distribution, left

**15 =** Remove condensation (air stream on the windshields)



The M Performance steering wheel of the M235i Racing was conceptualized for the race sport requirements.  
The use of it is strictly forbidden on public roads.



Position	Description
1	Display
2	Shift lights
3	Left feeler, briefly activate (LK), long (LL)
4	Right feeler, briefly activate (RK), long (RL)

# BMW Motorsport

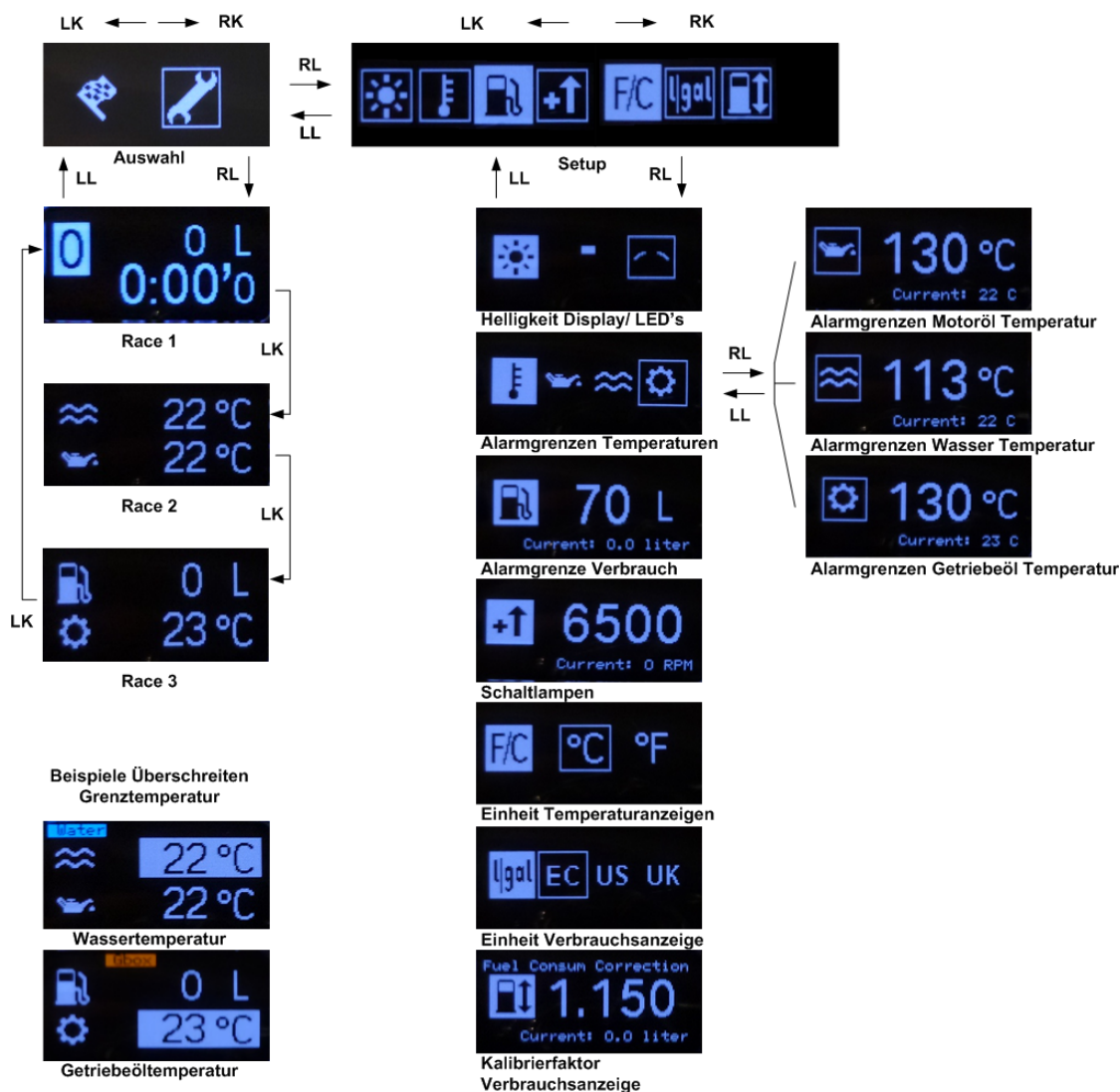
## M Performance Display



The M Performance steering wheel of the M235i Racing turns itself on automatically once Kl.15 is activated.

The display automatically switches to Race 1.

Once the battery is disconnected or the emergency stop switch is on the consumption calculation will systematically reset itself.





### Race Mode

The Race Mode is automatically active. To switch between the display pages, briefly activate the left feeler.

### Race Page 1

- Gear indicator
- Consumption indicator
- Lap time indicator

### Race Page 2

- Engine water temperature gauge
- Engine oil temperature gauge

### Race Page 3

- Consumption indicator
- Transmission temperature gauge

### Consumption indicator

The amount of injected fuel is added up. There is a calibration factor in the setup mode which can be used for the adaptation of the consumption.

Please customize the factor to your car. As support, the calculated consumption updates itself when the calibration factor is changed. The consumption indicator can be reset by activating both feelers simultaneously (> 2sec.; only at a standstill).

All shift LED lamps light up briefly for confirmation.

### How to calculate the factor:

Refuel to maximum fuel level and reset the consumption display to zero by pushing both buttons on the steering wheel for 3 seconds. Drive a whole test day without resetting the fuel consumption and note the refueled gas of the test day and summarize it.

Stored factor

$$\frac{\text{Stored factor}}{\text{Displayed consumption}} \times \text{used fuel} = \text{new factor}$$



### Lap time indicator

The lap time indicator is triggered when a beacon is passed.

After impulse recognition there is a downtime of 10 seconds, during which the laptime is shown to the driver. Then the display switches back to the actual lap time. By resetting the consumption indicator, the lap time indicator is also reset.

### Setup Mode

Switching to the setupmode is only possible when the vehicle is at a stand still.

Press the left feeler for more then two seconds.

By switching to the setup symbol and by activating the right feeler, the setup mode opens up.

To make installation changes you have to switch to the required symbol and activate the right feeler long.

Basically the following applies:

- **Right long**  
activates the submenu,
- **Right/Left briefly**  
Navigation in the submenu and adjust the values,
- **Left long**  
Saves the settings and exits the menu.



### Display when threshold is surpassed

Should one of the 4 values fall below the thresholds, a colour strip will light up and the display will automatically switch to the concerned page.

Color codes:

Blue	–	Water temperature
Red	–	Engine oil temperature
Orange	–	Transmission oil temperature
White	–	Consumption indicator

The display can freely be switched between the Race Pages. The color strips keep lighting up until the values fall below the thresholds.

### Gear shift indicator lights.

The threshold of the shift lights can be adapted in the setup mode. You can alternate the 100% threshold.

The LED switching operations are structured as follows:

LED 1 at 80% (green)

LED 2 at 85% (green)

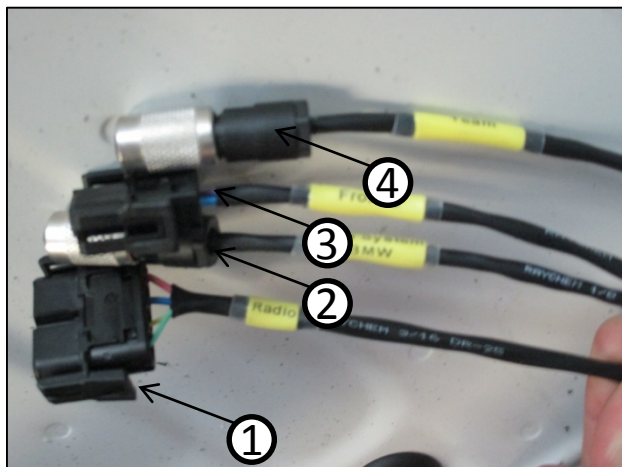
LED 3 at 90% (green)

LED 4 at 94% (red)

LED 5 at 97% (red)

Once the 100% threshold is reached, all LED's lamps light up red.

## Passenger's foot area



1 =	Radio
2 =	Data System BMW (connector-plug)
3 =	12 V (10A Fuse)
4 =	Data System Team (connector-plug)
+	Additionally through central console: 12V (20A Fuse)
+	Handbrake switch (for transmission adjustment)

### Configuration diagnostic connector (connector Typ 712 plug)

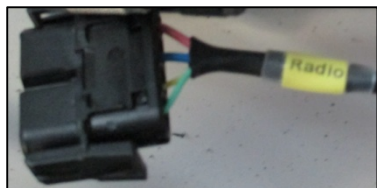
1- CAN H, 2 – CAN L, 3 – GND, 5 – On-board power supply

### ConfigurationV on board power supply; power outlets

1 – On-board power supply, 2 - GND

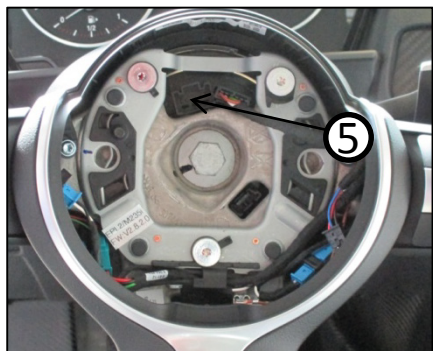
## Radio communication

**Plug passenger's foot area:** See above (1).



Configuration:

PIN1 = 12V  
PIN2 = Ground  
PIN3 = Feeler  
PIN4 = Feeler



**Steering wheel pinning:** See left (5)

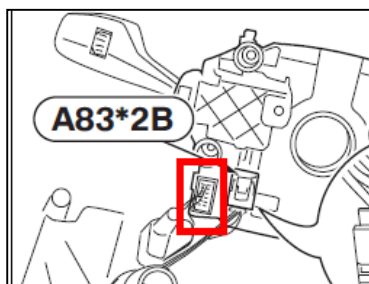
Configuration:

PIN5 = Feeler 1 (available)  
PIN6 = Feeler 1 (available)  
PIN3 = Feeler 2 (alternatively)  
PIN4 = Feeler 2 (alternatively)

Part number of the plugs:  
9 135 012 + 9 135 016



The delivered buttons (marked in red) cannot be used. But you can remove the buttons, and replace them with your own buttons.

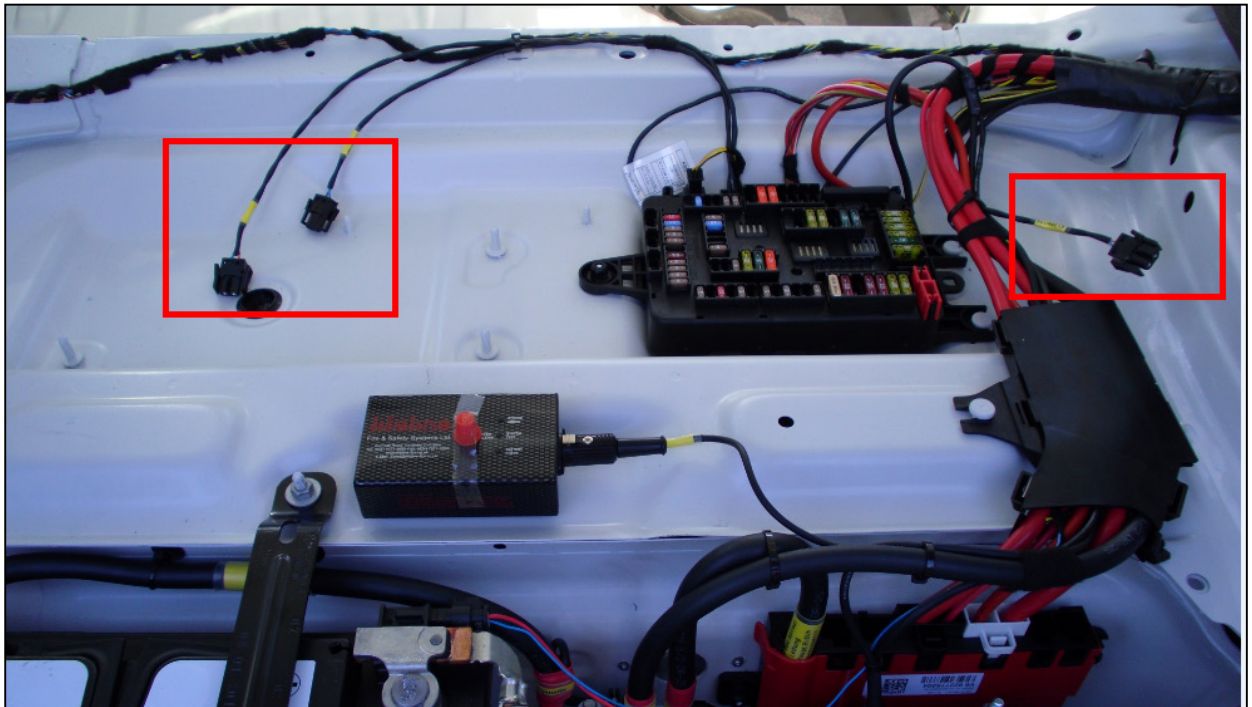


The second feeler (alternatively) can be recabled via PIN3 and PIN4 in the switch cluster of the steering column.



### On-board power supply outlets of the trunk

- 3 pieces/ 2.5mm System Power outlet/ each secured with 10A
- Pinning: 1- On-board power supply 12V, 2- GND

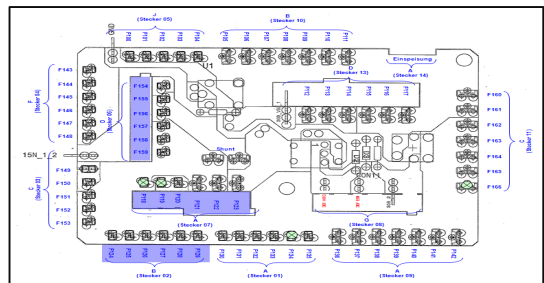
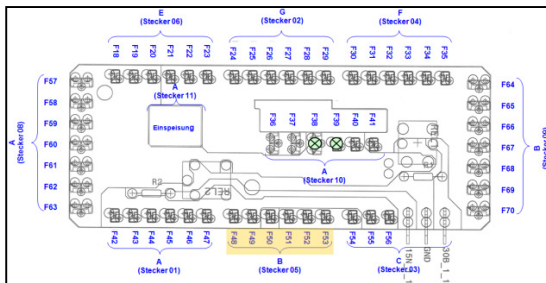




front



back



**You will find the configuration in the build up documentation 61 99.**

# BMW Motorsport

## Measurement data connector



The M235i Racing is equipped with a plug to connect an individual measurement technology (Data System Team).

With this port (passenger's foot area) the vehicle can be linked with a CAN- Bus and a power supply.

Make sure that no information is sent to the CAN Bus.

**Careful:** this can lead to a disfunctioning of the vehicle.

You require the cable connector „Binder Typ 712, 5polig“.

PIN configuration 1-CAN High, 2-CAN Low, 3-GND, 5- on-board power supply (max.3A).

Bezeichnung  
Bereich

Kabelstecker, Kabeldurchlass 3,5-5 mm  
M 9 Steckverbinder IP 67

Serie 712

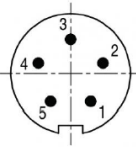
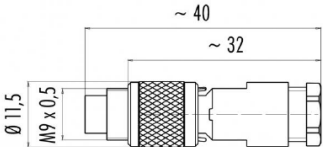

Polzahl  
Bestellnummer

5  
99 0413 00 05

Abbildung

Maßzeichnung

Polbild



	X	Y
1	1,00	-1,37
2	1,61	0,52
3	0,00	1,70
4	-1,61	0,52
5	-1,00	-1,37

### Mating plug System Team

Name	Typ		Faktor	Offset	Einheit	ID (hex)	Startbyte	Startbit	Länge [Bit]	Values	Description
Air_Press	Intel	Unsign.	2	598	mbar	3FB	0	0	8	600 ... 1106 hPa	Ambient pressure
Air_Temp	Intel	Unsign.	0.5	-40	°C	2CA	1	0	8	-40 ... 85 °C	Outside Temperature
Battery	Intel	Unsign.	15	0	mV	281	0	0	12	0 ... 60000 mV	Battery Voltage
Brake_State	Intel	Unsign.	1	0	-	173	7	0	6	Tabelle	Brake operation
Current_IBS	Intel	Unsign.	0.02	-200	A	1BA	3	0	16	-200 ... 1000 A	Current at the battery
FN_ABS	Intel	Unsign.	1	0	-	173	3	4	12	Tabelle	Function ABS
FN_ASC	Intel	Unsign.	1	0	-	173	5	0	12	Tabelle	Function ASC (Anti Schlupf Control)
Fuel_raw	Intel	Unsign.	1	0	µl	2C4	0	0	16	0 ... 65534 µl	Used fuel per cylinder
Gear	Intel	Unsign.	1	-4	-	3F9	6	0	4	Tabelle	Gear
Gear_Temp	Intel	Unsign.	1	-48	°C	39A	1	0	8	-40 ... 170 °C	Gearboxtemperature
Gyro	Intel	Unsign.	0.005	-163.84	°/s	19F	2	0	16	-163.84 ... 163.83 °/s	Yaw rate
Inline_Accel	Intel	Unsign.	0.002	-65	m/s²	199	2	0	16	-65 ... 65 m/s²	Longitudal acceleration
Lateral_Accel	Intel	Unsign.	0.002	-65	m/s²	19A	2	0	16	-65 ... 65 m/s²	Lateral acceleration
Oil_Temp	Intel	Unsign.	1	-48	°C	3F9	5	0	8	-48 ... 170 °C	Engine oil temperature
RPM	Intel	Unsign.	10	0	1/min	F3	1	4	12	0 ... 12000 1/min	Engine speed
Speed	Intel	Unsign.	0.015625	0	km/h	1A1	2	0	16	0 ... 350 km/h	Vehicle speed
Speed_FL	Intel	Unsign	0.015625	-511.984	rad/s	254	4	0	16	-400 ... 400 rad/s	Wheel Speed FR
Speed_FR	Intel	Unsign	0.015625	-511.984	rad/s	254	6	0	16	-400 ... 400 rad/s	Wheel Speed FL
Speed_RL	Intel	Unsign	0.015625	-511.984	rad/s	254	0	0	16	-400 ... 400 rad/s	Wheel Speed HR
Speed_RR	Intel	Unsign	0.015625	-511.984	rad/s	254	2	0	16	-400 ... 400 rad/s	Wheel Speed HL
Steering	Intel	Unsign.	0.04395	-1440.11	°	301	2	0	16	-1440.11 ... 1440.11 °	Steering angle
Throttle	Intel	Unsign.	0.025	0	%	D9	2	0	12	0 ... 100 %	Throttle accelerator
Water_Temp	Intel	Unsign.	1	-48	°C	3F9	4	0	8	-48 ... 144 °C	Engine water temperature

### CAN Protocol (500 kbaud)

### Fuel discharge switch

- Behind the driver's seat.
- While the vehicle is in use , the switch should always be in secure lock, with the cap locked.
- The Kl.15 must be turned on while defueling.

### Indication:

The hose should not be connected or disconnected while the pumps are working.



The clutch of the fuel discharger is located on the left side of the engine compartment, under the strut.



## Manufacturer BMW M235i Racing

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## Installed Components

### *Fuel Cell*

#### **ATL Technology Centre**

Denbigh Road  
Bletchley  
Milton Keynes  
MK1 1DF  
UK

**Email:** [atl@atltd.com](mailto:atl@atltd.com)

**Phone:** +44 (0)1908 351700

**Fax:** +44 (0)1908 351750

**Internet:** [www.atltd.com](http://www.atltd.com)

### *Fire Extinguisher*

#### **Lifeline Fire & Safety Systems**

Falkland Close,  
Charter Avenue Industrial Estate,  
Coventry,  
West Midlands,  
CV4 8AU

**Email:** [sales@lifeline-fire.co.uk](mailto:sales@lifeline-fire.co.uk)

**Tel:** +44 (0)24 7671 2999

**Fax:** +44 (0)24 7642 1322

**Internet:** [www.lifeline-fire.co.uk](http://www.lifeline-fire.co.uk)

# BMW Motorsport

## Contacts



### *Safety belt*

#### **SCHROTH Safety Products GmbH**

Vertrieb/Produktion/Kundenberatung

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59714 Arnsberg-Deutschland

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**Phone:** +49 (0)2932 / 9742-0

**Fax:** +49 (0)2932 / 9742-42

### *Tires*

#### **Goodyear Dunlop Tires Germany GmbH**

Dunlopstr. 2

63450 Hanau

**E-Mail:** [Info@dunlop.de](mailto:Info@dunlop.de)

**Telefon:** +49 (0)6181-68-01

**Fax:** +49 (0)6181-68-1283