

Replacement of RDC sensor batteries

All BMW models equipped with RDC, 2008 onward

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Introduction and rationale

Electronic tyre-pressure monitoring was first introduced for mainstream automotive use in 1986 by Porsche, who fitted the system to the 959.

From approximately 2008, certain BMW motorcycles became available with *Reifen-Druck Control* (hereafter RDC, German for 'tyre-pressure monitoring') as a factory-fitted optional accessory.

RDC is a system whereby prevailing air pressure in the motorcycle's front and rear tyres is monitored in real time, with current pressure readings being relayed to the motorcycle's digital display for perusal and, where necessary, action by the rider.

The system consists of a radio receiver (typically located underneath or underneath and behind the rear seat), data uplink to the motorcycle's ZFE-High control unit, and software programming which allows the system to interface with the motorcycle's digital display. Air-pressure data is transmitted to the receiver by a small battery-powered sensor mounted inside each wheel.

These sensors consist of an air-filling channel (which is also used as the mounting to secure the unit to the wheel rim) moulded to a plastic housing containing a pressure-sensing cell. The pressure-sensing cell is linked by internal circuitry to a radio-frequency transmitter. To avoid unnecessary battery drain, each sensor is activated by a built-in centrifugal switch which allows the transmitter to activate only when vehicle speed exceeds approximately 30 Km/h. To avoid RF interference, each set of two sensors is 'keyed' to a particular motorcycle.

By all accounts, the RDC sensors are reliable and long-lived. However, on motorcycles which cover higher mileages and/or have led longer-than-average service lives, the lithium batteries with which the sensors are equipped can become exhausted, causing the affected sensor to stop transmitting tyre-pressure data. Where this occurs, a 'blank' reading is registered on the digital display for the affected sensor, a relevant warning symbol appears on the digital LCD display, and the Master Caution light illuminates in yellow.

Since the sensors are ostensibly un-repairable, bringing an RDC system which has malfunctioned because of an exhausted sensor battery back to operating condition would mean replacing the affected sensor unit with a new one via the BMW dealer network, at considerable expense.

However, the sensors utilize a relatively inexpensive lithium battery which is easily obtainable and relatively easily replaceable. This makes it cheap and straightforward to bring a 'dead' sensor back to full operating condition.

This document illustrates the procedure whereby a failed sensor battery can be removed from the affected sensor and replaced with a new battery, thus eliminating the need to purchase a replacement RDC sensor.

The procedure is applicable to all BMW motorcycles utilizing the RDC system.

In all cases, the wheel containing the affected sensor will have to be removed from the motorcycle, and the tyre removed from the wheel in order to effect battery replacement. Please refer to the appropriate Haynes, Clymer or

BMW factory workshop manual for the relevant BMW model in order to accomplish wheel removal, as the appropriate procedures are not described here.

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Equipment List

- Suitable tools to remove and replace the affected wheel.
- In the case of an affected front wheel, suitable tools to remove and replace the brake calipers.
- Use of a hydraulic tyre changer.
- 12mm open-ended / ringset wrench.
- 1mm or 1.5mm flat screwdriver for electronics.
- 3mm flat screwdriver.
- Soldering iron.

Consumables List

- 1 000-grit sandpaper.
- Low-temperature resin-core solder.
- High-quality acid-free silicone sealant (Bostik Gasket Maker or a high-quality branded equivalent is recommended).
- 1x lithium-based CR2032 battery per affected sensor.

Procedure

Diagnosis of RDC pressure sensor condition

Verify operation of the motorcycle's RDC system as follows:

1. Take the motorcycle for a short test ride, exceeding an indicated 35 Km/h for at least ten seconds. Do not exceed an indicated 45 Km/h. The display is not able to show tyre pressure readings unless the motorcycle is moving at 30 Km/h or more. This is normal and to be expected.
2. While riding, operate the relevant *TRIP* or *INFO* button on the left-hand switchgear until the *RDC* or *RDC P* readout appears on the digital display (Figure 1 below).
A 2010-2013 R1200GS digital display is represented in the figures below. Digital displays on other BMW models and/or manufactured at other times may present RDC information in a different format.

Note: By default, the left-hand RDC reading denotes the motorcycle's front tyre pressure. The right-hand RDC reading denotes the motorcycle's rear tyre pressure.

3. If both RDC sensors are operational, the display will change from two blank readings (Figure 1) to two valid sensor readings (Figure 2) within a few hundred metres under normal conditions.



Figure 1



Figure 2

Note: If the RDC readouts only appear after several minutes, this may indicate sub-par battery voltage. In this case, the batteries will have to be examined as per the procedures below.

4. If an RDC sensor is non-functional, the display may momentarily change from two blank readings to one valid reading (Figure 3). However, if the motorcycle's secondary electronics system cannot establish contact with the 'blank' sensor within a few kilometres, the display may revert to two blank readings, the tyre-pressure warning symbol (⚠) will appear on the display (Figure 4), and the Master Caution light will illuminate in yellow. This condition persists for as long as contact cannot be established with the sensor.



Figure 3



Figure 4

Notes: By default, BMW motorcycles sold in non-metric territories display RDC information in PSI (Pounds per square inch). Using BMW diagnostic equipment, BMW digital displays can be configured to display information in Metric or Imperial format, depending on rider preference.

Removing the RDC sensor from the wheel

1. Remove the affected wheel from the motorcycle.
2. Remove the valve cap from the wheel's inflation valve. Using a suitable valve-core removal tool, remove the valve core from the valve to deflate the tyre completely.
3. Take the wheel to a local tyre-fitment centre. Have the centre remove the tyre from the rim using a hydraulic tyre-changer.

Cautions: By default, RDC-equipped BMW wheels carry a decal informing tyre-change personnel of the location of the sensor.

Regardless of whether or not the decal is in place, any person removing the tyre from the wheel must be informed that the RDC sensor is located inside the rim, at the same relative point as the inflation valve. If tyre-removal personnel are unaware of the presence of the sensor, it could easily be damaged or destroyed.

To avoid the possibility of damage to the sensor and/or wheel rim, do not attempt to remove or re-install tyres using makeshift methods. Modern tyre beads need to be displaced from the rim using greater force and precision than can be applied without highly specialized tools.

4. Holding the RDC sensor body securely in one hand, use a 12mm open-ended wrench to remove the sensor's securing collar from the threaded shaft.

Caution: To avoid damage to the sensor and/or the threaded shaft, hold the sensor body securely in one hand as the securing collar is removed.

5. Gently pull the sensor away from the wheel rim in a straight line.

Dismantling the RDC sensor and replacing the sensor battery

1. Carefully inspect the black rubber sealing ring at the bottom of the threaded shaft (Red arrow, Figure 5). If the sealing ring is in less than optimal condition, do not attempt to repair it. Instead, replace it with a genuine BMW part (included in *Repair Kit*, BMW part number 36 31 7 694 420).



Figure 5

2. Place the RDC sensor on a suitable work surface (such as a rubber car floor mat) with the threaded shaft facing upward.
3. Using a 3mm flat screwdriver, carefully prise the epoxy 'potting' out of the sensor. Remove as much of the potting as possible until the battery is fully exposed on all sides (Figure 6).



Figure 6

Caution: To avoid damage to the underlying sensor electronics, only remove as much

potting as necessary to expose the battery.

4. Using a 2mm or 3mm flat screwdriver, carefully prise up the battery until it protrudes from the casing at a 45-degree angle (Figure 7).
5. Set the electronic multimeter to the 10 volt DC scale. Holding the positive and negative probes of the multimeter to the relevant battery terminals, check the battery output reading:
 - a. If a nominal voltage reading (between 2.7 and 3 volts) is recorded, the battery is serviceable and does not need to be replaced. Proceed to step 21 below.
 - b. If the voltage reading is less than 1.8 volts, the battery is unserviceable and must be replaced.

Tip: If both the front and rear RDC sensors have been in service for the same amount of time, it is good practice to change the batteries in both RDC sensors at once. This will negate the need to perform a battery replacement on the opposite wheel at a later stage.

6. Note that each contact tab is secured to its relevant battery terminal by two very small spot-welds (Blue arrows, figure 7). Thus, the tabs cannot be disconnected from the battery terminals using a soldering iron. If the battery is to be replaced, use a 1mm or 1.5mm flat screwdriver for electronics to carefully break contact between the lower contact tab (Red arrow, figure 8) and the battery negative terminal. Repeat this step between the upper contact tab (Green arrow, figure 8) and the battery positive terminal.

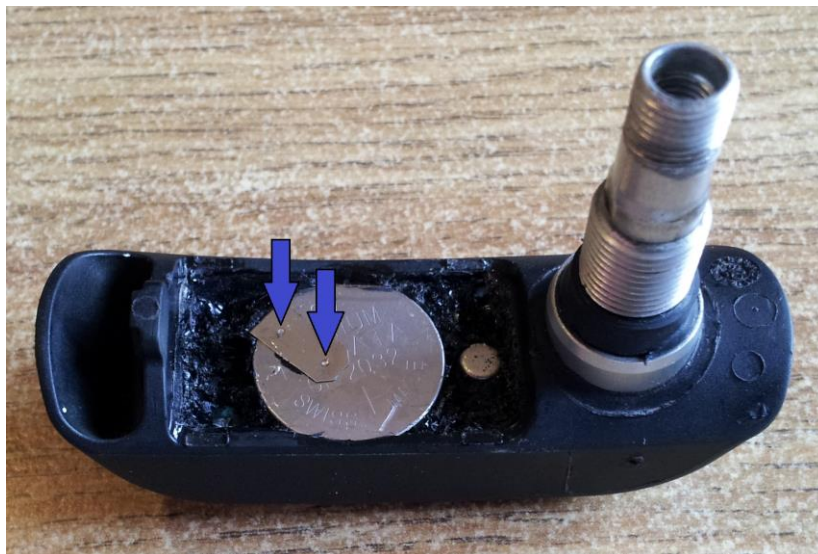


Figure 7

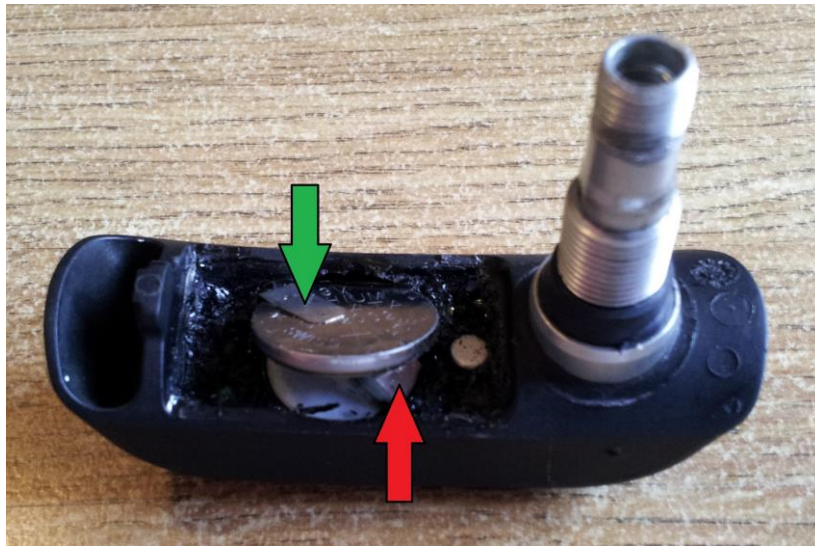


Figure 8

7. Carefully lift up the upper electrical contact tab. Remove the battery.
8. Replace the unserviceable battery with a lithium-based CR2032 battery (Figure 9). Good brand names include Maxell, Sanyo, Renata and Energizer.



Figure 9

Tip: CR2032 batteries are commonly used in wristwatches, garage-door remote controls and computer motherboards. They are available from watch-repair outlets, electronics- and hobby-supply stores, computer-supply stores and good hardware stores.

9. Slightly roughen the contact area of the positive terminal using 1 000-grit or finer abrasive paper.
10. Insert the replacement battery into the RDC sensor with the battery's positive terminal facing upward.
11. At this point, the help of an assistant will be needed. Carefully re-solder the positive-terminal electrical contact tab using the following procedure:
 - a. Apply a bead of low-temperature solder to the tip of the heated soldering iron.

Warnings: Do not hold the soldering iron in contact with the battery for longer than necessary to melt the solder. The battery contains lithium metal, which may expand with enough force to burst the battery casing.

Lithium is pyrophoric and hydrophoric (it oxidizes rapidly and may spontaneously combust in air, and will spontaneously combust if exposed to water).

If the battery contents are exposed to air, cover the battery immediately with dry sand or clean engine oil. Do not attempt to extinguish a lithium fire with water: it will burn violently and may explode.

- b. Using the soldering iron, person A must heat the electrical contact tab for approximately three seconds whilst applying a modest but even coating of solder to the tab.
 - c. Using the soldering iron, person A must heat the contact tab area of the positive terminal for approximately three seconds, whilst applying a modest but even coating of solder to the terminal.
 - d. Allow the battery to cool for at least one minute.
 - e. Person B must now use a small screwdriver to press the electrical contact tab onto the positive terminal of the battery.
 - f. At this point, person A should *momentarily* heat the point at which the electrical contact tab makes contact with the battery, applying a *small* amount of additional solder to join the electrical contact tab to the battery.
 - g. Allow the soldered assembly to cool for five minutes.
12. Ensure that the battery is firmly seated in the sensor housing. Re-pot the battery in place using a high-quality acid-free silicone sealant (Figure 10). Use just enough sealant to cover the battery completely. There is no need to 'over-do' the job, as the battery will be held securely in place by centrifugal force when the wheel is turning. Use of excessive sealant may cause wheel-balance issues.



Figure 10

Caution: Do not use water-based acrylic sealants or acid-based silicone sealants to re-pot the battery. Such sealants can corrode electronic circuits, possibly damaging the RDC sensor beyond repair. Acid-based sealants may also cause damage to the tyre carcass.

13. Allow 24 hours for the sealant to cure completely before re-installing the RDC sensor to the wheel.

Note: If the RDC sensor removed in step 8 is being replaced with one not originally used on the motorcycle, the motorcycle must be taken to a BMW Motorrad dealer upon installation of the new RDC sensor for the new sensor to be synchronized with the motorcycle's RDC system.

If this is not done, the motorcycle will not recognize signals from the new RDC sensor, and the RDC display will remain blank.

Re-installing the RDC sensor to the wheel

1. Lubricate the RDC sensor's black rubber seal using a *small* amount of red rubber grease.
2. Gently re-install the RDC sensor to the wheel rim by pushing the threaded shaft through the mounting hole in a straight line.
3. Holding the sensor body securely in one hand, use a 12mm open-ended wrench to install and secure the sensor's securing collar to the threaded shaft.

Caution: To avoid damage to the sensor and/or the threaded shaft, hold the sensor body securely in one hand as the securing collar is installed.

4. Using a suitable valve-core removal tool, re-install the valve core to the tyre inflation valve.
5. Take the wheel to a local tyre-fitment centre. Have the tyre re-installed to the rim using a hydraulic tyre-changer. Ensure that the wheel/tyre assembly is balanced at this time.

Caution: If the tyre is unidirectional, ensure that the tyre is mounted for rotation in the correct direction.

6. Inflate the tyre to the correct cold pressure.
7. Re-install the valve cap.

Confirming that the RDC system is operational

1. Take the motorcycle for a short test ride. During the ride, be sure to exceed an indicated 35 Km/h for at least ten seconds.
2. Operate the relevant *TRIP* or *INFO* button on the left-hand switchgear until the *RDC* or *RDC P* readout appears on the digital display (Figure 11).
3. If both RDC sensors are operational, the display will change from two blank readings (Figure 11) to two valid sensor readings (Figure 12) within a few hundred metres.

Note: The display is not able to show tyre pressure readings unless the motorcycle is moving at 30 Km/h or more. This is normal and to be expected.



Figure 11



Figure 12

4. If the motorcycle's secondary electronics have not received signals from one or both RDC sensors for an extended period of time, the digital display may persist in showing blank readings. If this happens, perform a battery reset as follows:
 - a. Switch off the motorcycle's ignition.
 - b. Disconnect the negative terminal of the motorcycle's battery. Leave the terminal disconnected for approximately five minutes before securely re-connecting it.
 - c. On all motorcycles not equipped with fly-by-wire throttle, perform a throttle-position sensor reset as follows:
 - i. With the motorcycle's ignition turned on, twist the throttle from idle to full throttle and back. Pause for two or three seconds. Repeat this step once or twice.
 - ii. Switch off the ignition. Remove the key from the ignition and leave the motorcycle to stand for approximately one minute.
 - d. In the unlikely event that the display still persists in showing blank readings, the RDC sensors may need to be re-synchronized to the motorcycle's secondary electronics. In such cases, seek advice from a BMW Motorrad dealer.