Reference Manual

MAINTENANCE TECHNICIAN

Technical Training

BMW GROUP
Technical Training

Maintenance Technician

BMW of North America, LLC
Technical Training
ST1451
6/1/20

Information Status: **June 01, 2020**

Course Code: **ST1451 Maintenance Technician**

The information contained in the training course materials is solely intended for participants in this training course conducted by BMW Group Technical Training Centers, or BMW Group Contract Training Facilities.

This training manual or any attached publication is not intended to be a complete and all inclusive source for repair and maintenance data. It is only part of a training information system designed to assure that uniform procedures and information are presented to all participants.

For changes/additions to the technical data, repair procedures, please refer to the current information issued by BMW of North America, LLC, Technical Service Department.

This information is available by accessing TIS at www.dealerspeed.com.

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Maintenance Technician

Model: All

Production: All

OBJECTIVES

After completion of this module you will be able to:

- Identify and understand repair orders.
- Understand BMW Group practices and procedures.
- Correctly perform maintenance on BMW Group vehicles.

Introduction

Proper service and maintenance of BMW Group vehicles is crucial to maintaining the quality and performance that is expected from the BMW Group.

On board sensors continuously monitor the status of individual wear-and-tear parts and vehicle fluids. Together, with the onboard maintenance system known as Condition Based Service, the vehicle displays when maintenance is due.

When servicing a BMW Group vehicle, the technician not only needs to determine what services are due, but also know how to perform them in an efficient and proper manner.

Ensuring that the service is done right the first time is paramount. This includes performing the services indicated, as well as general inspection of the vehicle resulting in appropriate additional service recommendations. In addition to servicing the vehicle, the technician is also responsible for completing the relevant paperwork, such as the service checklist and multi-point inspection sheet.

The following information will provide, in detail, how to recognize when service is due and the steps to take in order to perform the service. Following theses steps will ensure that all BMW Group vehicles are properly maintained and continually provide the customer with the driving experience that has come to define the BMW Group.

Creating a Personal Process

In order to be an effective technician, you must develop habits that result in quality work that is performed efficiently. Quality that meets BMW Group's standards, your dealership's requirements and your clients' expectations results in improved customer satisfaction, increased customer retention and improved earnings.

It is not enough to simply produce quality work; it must delivered in a timely manner. The clients' expectations are initially determined by the service advisor. Meeting or exceeding these expectations is the role of the technician and the entire service department. Being mindful of the clients' time will result in improved customer satisfaction, increased customer retention and improved earnings.

By developing good work habits, you are able to consistently provide efficient, high-quality work. These habits are your personal process.

You personal process may consist of:

- Reviewing the repair order
- Performing a visual inspection
- Test driving the vehicle
- Performing a multi-point inspection (MPI)
- Creating estimates for customer concerns and recommended services
- Performing maintenance and repairs
- Verifying repairs and checking the quality of your work

Reviewing the Repair Order

When you receive your repair order, it is important to review it in order to complete the repairs in the most efficient manner possible. Before addressing the client's concerns:

- Confirm that the VIN on the repair order matches the vehicle.
- Confirm the mileage on the repair order reflects the actual mileage displayed by the instrument cluster.
- Confirm the services on the repair order are consistent with the age and mileage of the vehicle.
- Determine whether services to be performed are covered by a warranty, maintenance program or are "customer pay".

Example repair order

Verify the correct mileage

Verify the correct VIN

Verify the service required

Verify the service is covered under warranty

BMW of North America
250 Chestnut Ridge Road
Woodcliff Lake, NJ 07677
Phone: 201-307-4013

SERVICE DEPARTMENT HOURS
6:30 a.m. to 5:00 p.m.
Monday - Thursday
6:30 a.m. to 6:00 p.m. - Friday
8:00 a.m. to 12:00 p.m. - Saturday

R/O Open Date	R/O Number
5/9/16	1001975/1
R/O Close Date	Status
5/9/16	Pre-Invoice
Mileage In	Mileage Out
10124	10127
Service Advisor	
Zdravko Miric	

Miric, Zdravko
250 Chestnut Ridge Road
Woodcliff Lake, NJ 07677

Work Phone	Vehicle Identification Number	
	WBA8B3C59G K384233	
Home Phone	Delivery Date	In-Service Date
	8/31/2015	10/12/2015

Year	Make	Series	Model	Color	Body	License Number
2016	BMW	F30	340i Sedan	Melbourne Red Metallic	4DR SEDAN	

JOB NUMBER	DESCRIPTION OF SERVICE	JOB TYPE
#1 -	CLIENT CONCERN: PERFORM STANDARD SCOPE SERVICE	Warranty

CAUSE: STANDARD SCOPE DUE PER CBS

DC# 85 99 05 01 MP

CORRECTION: PERFORMED STANDARD SCOPE SERVICE. VERIFIED OPERATION OF PARKING BRAKE.

REVIEWED CHECK CONTROL MESSAGES. CHECKED INDICATOR AND WARNING LIGHTS.

VERIFIED SUNROOF OPERATION.

LINE # 1

ON May 9 10:38AM

OFF May 9 10:50AM

JOB NUMBER	DESCRIPTION OF SERVICE	JOB TYPE
#2 -	CLIENT CONCERN: PERFORM OIL CHANGE SERVICE	Warranty

CAUSE: OIL SERVICE DUE PER CBS

DC# 85 99 00 91 MP

CORRECTION: CHANGED OIL AND FILTER. REFILLED WITH 6.5L 0W-20 SYNTHETIC OIL.

TOPPED OFF ALL FLUIDS. RESET SERVICE INDICATOR. TEST DROVE 3 MILES.

LINE # 2

ON May 9 10:51AM

OFF May 9 11:15AM

JOB NUMBER	DESCRIPTION OF SERVICE	JOB TYPE
#3 -	CLIENT CONCERN: EXTERIOR LIGHT IS INOPERATIVE	Warranty

CAUSE: DRIVER SIDE PARKING LAMP BULB BURNED OUT

DC# 63 12 18 12 00

CORRECTION: VERIFIED CONCERN. INSPECTED AND FOUND DRIVERS SIDE PARKING LAMP

BULB BURNED OUT. REMOVED AND REPLACED BULB. VERIFIED OPERATION.

CONCERN CORRECTED.

LINE # 3

ON May 9 11:16AM

OFF May 9 11:22AM

Performing a Visual Inspection

Having reviewed the repair order, a visual inspection or “walk-around” should be performed on the vehicle. A walk-around inspection may reveal damage not noted during service reception. Additional recommended services to be “upsold” may also be noted during the walk-around.

Best practices for performing the visual inspection:

- Inspect the body of the vehicle for damage and loose or missing parts and bring to the attention of the service advisor prior to working on the vehicle.
- Inspect the wheels and tires for signs of impact, curb rash or other damage and recommend repairs as appropriate to ensure safe operation of the vehicle.
- Inspect all lights on the vehicle for physical damage and recommend repairs as appropriate to ensure safe, legal operation of the vehicle.
- Inspect wiper blades for wear and damage.
- Inspect the windshield for chips, cracks or other damage. Refer to the latest service information regarding performing glass repairs.
- Review the check control messages in the instrument cluster or CID to alert you to possible concerns that may need to be addressed.

Test Driving the Vehicle

After performing a walk-around inspection of the vehicle, it is time to decide if a test drive is necessary prior to performing repairs. Every vehicle and situation is different, with many variables to consider before test driving a vehicle. The information below is solely intended as a guide. Experience and good judgement are paramount.

It is not recommended to test drive the vehicle if doing so will endanger the driver or anyone else on the road. If damage will result to the vehicle from operation (e.g., severely low engine oil level resulting in damage to the engine, transmission, etc.) then a test drive is prohibited!

With regard to performing maintenance services as a Maintenance Technician, a test drive prior to performing repairs is recommended:

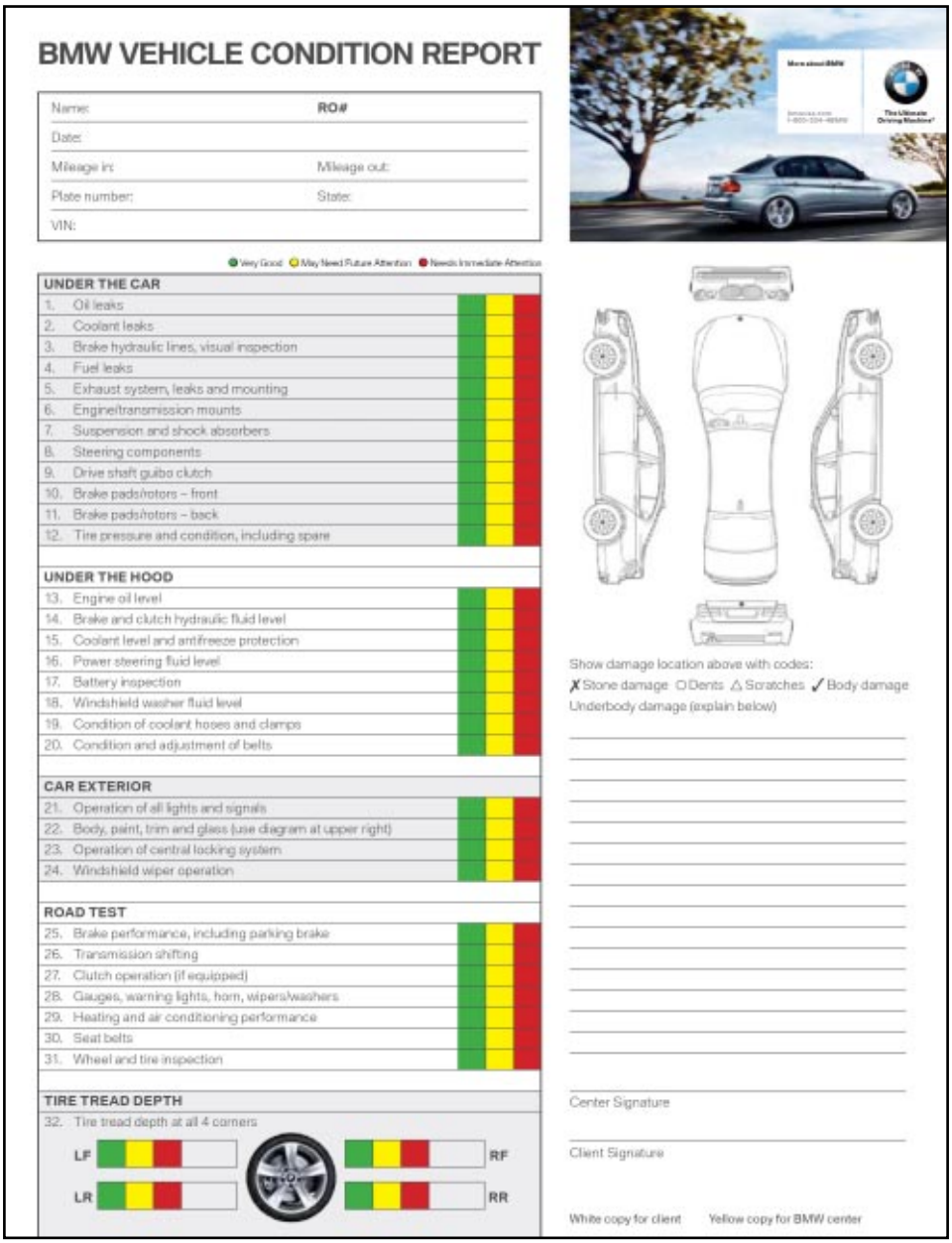
- To bring the engine oil to operating temperature prior to performing an oil service.
- As part of a multi-point inspection (MPI) to identify potential concerns that may require further investigation when the vehicle is in the workshop.
- As one of the tasks in the Vehicle Check service.
- As part of the CPO Inspection process.

Multi-point Inspections

While individual dealer procedures will vary, it is considered a “best practice” to perform a Multi-point Inspection (MPI) on every vehicle. MPI are recorded on a paper checklist or electronically via a third-party solution chosen by your dealership.

It is recommended to perform the MPI before beginning repairs or servicing the vehicle. Issues found during the inspection can be brought to the attention of the customer before work begins on the vehicle to allow the customer to make an accurate, informed decision about the estimated cost of repairs and the expected time the repairs will take to perform.

Example Multi-point Inspection



BMW VEHICLE CONDITION REPORT

Name: RO#
Date:
Mileage in: Mileage out:
Plate number: State:
VIN:

Very Good · May Need Future Attention · Needs Immediate Attention

UNDER THE CAR	
1.	Oil leaks
2.	Coolant leaks
3.	Brake hydraulic lines, visual inspection
4.	Fuel leaks
5.	Exhaust system, leaks and mounting
6.	Engine/transmission mounts
7.	Suspension and shock absorbers
8.	Steering components
9.	Drive shaft guibo clutch
10.	Brake pads/rotors – front
11.	Brake pads/rotors – back
12.	Tire pressure and condition, including spare
UNDER THE HOOD	
13.	Engine oil level
14.	Brake and clutch hydraulic fluid level
15.	Coolant level and antifreeze protection
16.	Power steering fluid level
17.	Battery inspection
18.	Windshield washer fluid level
19.	Condition of coolant hoses and clamps
20.	Condition and adjustment of belts
CAR EXTERIOR	
21.	Operation of all lights and signals
22.	Body, paint, trim and glass (use diagram at upper right)
23.	Operation of central locking system
24.	Windshield wiper operation
ROAD TEST	
25.	Brake performance, including parking brake
26.	Transmission shifting
27.	Clutch operation (if equipped)
28.	Gauges, warning lights, horn, wipers/washers
29.	Heating and air conditioning performance
30.	Seat belts
31.	Wheel and tire inspection
TIRE TREAD DEPTH	
32.	Tire tread depth at all 4 corners

LF RF LR RR

Show damage location above with codes:
✗ Stone damage ○ Dents △ Scratches ✓ Body damage
Underbody damage (explain below)

Center Signature

Client Signature

White copy for client Yellow copy for BMW center

Creating Estimates

Having performed an MPI, it is recommended to create an estimate for any suggested repairs prior to servicing the vehicle. Individual dealer procedures and systems will vary. Some dealerships require the service advisor to create the estimate, while others may rely on the parts department. In many dealerships, creating an estimate is the role of the service technician. Finally, an estimate may be the responsibility of all three roles, with each contributing based on their expertise.

Covering the many different platforms for creating estimates is beyond the scope of this reference manual. Follow the procedures as per your dealership.

Performing Maintenance and Repairs

Performing Maintenance

With the estimate submitted and approved, the Maintenance Technician can now begin work on the vehicle. As always, the latest repair instructions, Service Information and resources from ISTA, TIS & AIR should be followed to service the vehicle in accordance with BMW Group's guidelines.

Documenting Service

While servicing the vehicle is a very important aspect of your role as a Maintenance Technician, it is only part of your responsibilities. Documenting service and repairs in the form of Service Maintenance Checklists, QC1 and CPO Inspection forms are an integral function of your daily duties. This information is required per the Warranty Policy and Procedures Manual, which can be found on CenterNet. Warranty claims without this documentation are subject to debit.

Verifying Repairs and Quality-Checking

After servicing a vehicle, it is of utmost importance to verify the work you performed was completed correctly and thoroughly. Doing so will result in increased customer satisfaction and loyalty. Forgetting to complete these tasks will give the appearance of sloppy, careless work which will inevitably result in lower CSI scores. Take pride in servicing each vehicle.

There are 5 questions you should ask yourself to ensure the job has been completed:

- Did I address all Concerns?
- Did I top off all Fluids?
- Did I reset Tire Pressure?
- Did I reset Service Lights?
- Did I inspect vehicle for Cleanliness?

Did I address all Concerns?
Take a few moments to look over both your work and the repair order to ensure you fully addressed the customer's concerns. Has each job on the repair order been completed? Have you completed all your notes in the Cause/Complaint/Correction section of the repair order? Have you filled out all supporting documentation, such as Service Maintenance Checklists, QC1 and CPO Inspection forms?

Did I top off all Fluids?
Topping off all fluids, whether a vehicle is in for service, diagnosis or simply replacing wiper blades is critical for every vehicle. Windshield washer fluid, power steering fluid (if applicable), engine oil, etc. should be topped off whenever a vehicle is in the shop as a complimentary service to the customer.

Engine oil Top-up services may be reimbursed under the terms of the Maintenance Program when it is "active." Refer to SI B01 16 15 or SI M01 05 15 for detailed information.

Did I reset Tire Pressure?
Every vehicle that visits the service department should have the tire pressures checked and corrected, if necessary. The tire pressure monitoring system (TPMS) should also be reset every time tire pressures are adjusted. It is a best practice to reset the TPMS on every vehicle before leaving the workshop to test drive.

Did I reset Service Lights?
After performing a service, the service indicator must be reset. As simple as this aspect of the service is, it is among the most overlooked tasks. A customer who has left the dealership and must make a return trip to reset the service indicator will be inconvenienced, at best. It is a best practice to develop a habit of resetting the service indicator after completing each service.

Did I inspect vehicle for Cleanliness?
Before driving the vehicle out of the shop, take a few moments to inspect all areas of the vehicle you contacted. While it is best to prevent soiling the vehicle with dirty hands, parts or tools, it may happen occasionally. Wipe down or clean the vehicle of all traces of dirt, oil or contamination. Inspect the areas of the vehicle where you were working for tools that you may have left behind. Remove any leaves from under the hood or in the microfilter compartments. Clean any oil that may have dripped on to the engine or underboy covers.

The 5 Questions of QC

- Did I inspect vehicle for Cleanliness?
- Did I top off all Fluids?
- Did I reset Tire Pressure?
- Did I reset Service Lights?
- Did I address all Concerns?

NOTES

Repair Orders

The repair order is a legal document containing a multitude of information. It may be a physical sheet of paper and/or an electronic copy. Within the repair order is a set of instructions for the technician. Each set of instructions is referred to as a “job” or “line.”

Included with each repair order are the DCSnet Warranty Vehicle History and the key read from the BMW Key Reader application.

Understanding the Repair Order

The repair order is organized in to different groups of information, much of which is relevant to the technician. The sections of a typical repair order are described below.

Dealership Identification
The name, address and contact information for the dealership is found here.

Repair Order Details
The identification number for the repair order can be found here, as well as the date the repair order was created, the date it was closed and the name of the person who generated the repair order.

Customer Contact Information
The name of the company or owner of the vehicle, as well as their contact information is found here.

Vehicle Data
Details about the vehicle, such as the model, model year, type of drivetrain, exterior color and license plate are found in this location.

Job Number
This will either be a letter or number, depending on the dealer management system (DMS) used, to identify each set of instructions for the technician to perform.

Customer Concern
In most cases, a service advisor will interpret the customer’s concerns and record this information as a set of instructions for the technician servicing the vehicle.

Job Type
This describes which party, whether customer, warranty or dealership, is responsible for payment for each job on the repair order.

Legal Disclaimer
This section will vary from dealership to dealership, but will generally describe legal details such as agreements to pay for services rendered, how soon after completion of services a vehicle must be picked up, as well as how to seek resolution in the event of disputes. Consent to test drive a vehicle for diagnostic or quality control purposes is also found here.

Total Bill for Services
This section is a summary of the charges for the services rendered. The information is separated for each type of charge: labor, parts, deductible, sublet, shop supplies, hazardous materials, taxes, etc. An itemized break down of charges is typically found within each job.

Customer Signature
This is where the customer signs the repair order, consenting to the information described in the legal disclaimer section.

Index	Explanation
1	Dealership identification
2	Repair order details
3	Customer contact information
4	Vehicle data
5	Job or line number
6	Customer concern
7	Job type
8	Legal disclaimer
9	Customer signature
10	Total bill for services

Example repair order

BMW of North America
250 Chestnut Ridge Road
Woodcliff Lake, NJ 07677
Phone: 201-307-4013 (1)

SERVICE DEPARTMENT HOURS
6:30 a.m. to 6:00 p.m.
Monday - Thursday
6:30 a.m. to 6:00 p.m. - Friday
8:00 a.m. to 12:00 p.m. - Saturday

R/O Open Date	R/O Number
7/8/16	1001975/1
R/O Close Date	**Status**
7/8/16	Pre-Invoice
Mileage In	**Mileage Out**
10124	
Service Advisor	
Ken Ramsey	

(2)

Miric, Zdravko
250 Chestnut Ridge Road
Woodcliff Lake, NJ 07677 (3)

Work Phone	Vehicle Identification Number	
201-555-5555	5UXKR6C57G 0J80711	
Home Phone	**Delivery Date**	**In-Service Date**
201-555-5556	9/28/2015	11/20/2015

Year	Make	Series	Model	Color	Body	License Number
2016	BMW	F15	X5 xDr50i	Carbon Black Metallic	4DR SAV	BMWROX

(4)

JOB NUMBER		DESCRIPTION OF SERVICE	JOB TYPE
(5) #1	-	CLIENT CONCERN: Perform Standard Scope service (6)	Warranty (7)
#2	-	CLIENT CONCERN: Perform Oil change service	Warranty
#3	-	CLIENT CONCERN: Exterior light is inoperative	Warranty
#4	-	CLIENT CONCERN: Perform tire rotation service	Customer Pay
#5	-	CLIENT CONCERN: Perform Multi-Point inspection	Internal
#6	-	CLIENT CONCERN:	
#7	-	CLIENT CONCERN:	

Legal Disclaimer (8)

This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership. This section is a legal disclaimer. This information will vary at each dealership.

NO RETURN ON ELECTRICAL OR SAFETY ITEMS OR SPECIAL ORDERS.

(9) x *Joe Customer*

LABOR	
PARTS	
DEDUCTIBLE	
SUBLET	
SHOP SUPPLIES	
HAZARDOUS MATERIALS	
SALE TAX OR TAX I.D.	
SPECIAL ORDER DEPOSIT	
DISCOUNTS	
TOTAL DUE	

(10)

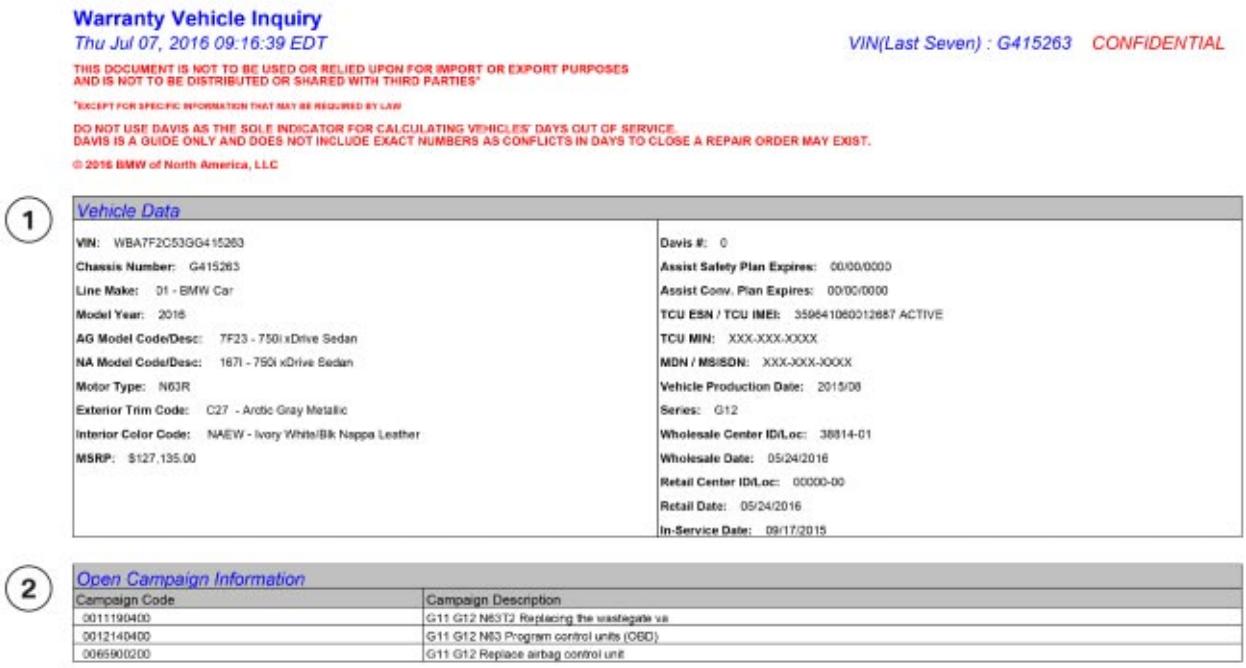
DCSnet Warranty Vehicle History

The DCSnet Warranty Vehicle History is organized by VIN and consists of:

- Vehicle data
- Open campaigns
- Options installed
- Customer information
- Status of warranty and maintenance programs
- Eligible warranty and maintenance program extensions
- Repair history claims

The vehicle history can be viewed by logging in to DCSnet and selecting from the Service Menu.

Example DCSnet warranty vehicle history



Warranty Vehicle Inquiry

Thu Jul 07, 2016 09:16:39 EDT

VIN(Last Seven) : G415263 CONFIDENTIAL

THIS DOCUMENT IS NOT TO BE USED OR RELIED UPON FOR IMPORT OR EXPORT PURPOSES AND IS NOT TO BE DISTRIBUTED OR SHARED WITH THIRD PARTIES*

*EXCEPT FOR SPECIFIC INFORMATION THAT MAY BE REQUIRED BY LAW

DO NOT USE DAVIS AS THE SOLE INDICATOR FOR CALCULATING VEHICLES' DAYS OUT OF SERVICE.
DAVIS IS A GUIDE ONLY AND DOES NOT INCLUDE EXACT NUMBERS AS CONFLICTS IN DAYS TO CLOSE A REPAIR ORDER MAY EXIST.

1

Vehicle Data

VIN: WBA7F2C53GG415263	**Davis #:** 0
Chassis Number: G415263	**Assist Safety Plan Expires:** 00/00/0000
Line Make: 01 - BMW Car	**Assist Conv. Plan Expires:** 00/00/0000
Model Year: 2016	**TCU ESN / TCU IMEI:** 359641060312887 ACTIVE
AG Model Code/Desc: 7F23 - 750i xDrive Sedan	**TCU MIN:** XXX-XXX-XXXX
NA Model Code/Desc: 1671 - 750i xDrive Sedan	**MDN / MSISDN:** XXX-XXX-XXXX
Motor Type: N63R	**Vehicle Production Date:** 2015/08
Exterior Trim Code: C27 - Arctic Gray Metallic	**Series:** G12
Interior Color Code: NAEW - Ivory White/Blk Nappa Leather	**Wholesale Center ID/Loc:** 38814-01
MSRP: $127,135.00	**Wholesale Date:** 05/24/2016
	Retail Center ID/Loc: 00000-00
	Retail Date: 05/24/2016
	In-Service Date: 09/17/2015

2

Open Campaign Information

Campaign Code	Campaign Description
0011190400	G11 G12 N63T2 Replacing the wastegate va
0012140400	G11 G12 N63 Program control units (OBD)
0065900200	G11 G12 Replace airbag control unit

Index	Explanation
1	Vehicle Data
2	Open Campaign Information

Vehicle Data

The VIN, model year, model code, engine type, color codes, MSRP, DAVIS number (**DA**ys **V**ehicle **I**n **S**ervice), status of BMW Assist account, vehicle production date, chassis engineering designation, wholesale and retail centers, and dates the vehicle was wholesaled, retailed and registered in-service can be found in this section.

Open Campaign Information

Campaigns are identified by a unique campaign code. In this section you will find a table of open campaigns, service actions and recalls for the vehicle. A brief description of the campaign can be found here as well. Using AIR or TIS, detailed information regarding the instructions of the campaign can be found.

Example DCSnet warranty vehicle history continued

3

Option Information

Code	Description	Code	Description
0ZDB	Driver Assistance Plus	0ZDT	Driver Assistance Plus II
0ZEC	Executive Package	0ZID	Interior Design Package
0ZLU	Luxury Seating Pk w/ Cold Wthr	0ZRE	Rear Executive Lounge Seating
07GZ	Executive Lounge Seating	07S5	Interior Design Package
024N	20" Light alloy wheels	02VB	Tire pressure monitor
02VH	Integral Active Steering	02XL	Wood inlay steering wheel
0300	Space-saver spare	0322	Comfort Access keyless entry
03AG	Rear view camera	03DS	Display Key
0407	Panoramic Sky Lounge LED Roof	0441	Smoker's package
04AX	Chestnut Wood Trim w/ inlay	04NM	Ambient Air Package
04UR	Ambiance lighting	0502	Retractable headlight washers
0552	Icon Adaptive LED Headlights	05A1	LED Fog Lights
05AC	Automatic high beams	05AP	Decoding for no-dazzle hgh bm
0609	Navigation system	0610	Head-up Display
0650	In-dash CD player	0655	Satellite radio w/1 year sub.
06AC	BMW Assist eCall	06AE	BMW TeleServices
06AK	BMW Online and BMW Apps	06AM	Advanced RTTI
06AN	Concierge Services	06AP	Remote Services
06F1	Bowers & Wilkins sound system	06NW	Wireless Charging
06U8	Gesture Control	06UK	NightVision w/pedest detection
06WB	Dynamic Digital Cluster	06WD	WiFi Horspot
0640	Increased top speed limiter	08KL	Oil Chg 10,000 mls/12 months
08S4	Variable Light Decoding	08TN	Daytime driving lights
0925	Shipping package	0997	PRODUCT TRAINING SUPPLY
09AA	Transport protection	0ZTM	Tier 2

4

Customer Information

Name (First/Last): BMW Financial S ervices USA
Address: 300 Chesnut Ridge Road
Woodcliff Lake NJ 07677-3002 UNITED STATES

Index	Explanation
3	Option Information
4	Customer Information

Option Information

Equipped options are found in this section. The option codes and a short description are listed. This list is not comprehensive. For a complete list of option codes, please use AIR.

Customer Information

The name and address of the owner are found here. It is important to confirm the correct owner is listed so he/she may receive federally-mandated correspondence about issues such as recalls.

Example DCSnet warranty vehicle history continued

5

Warranty/Maintenance Programs/Contract Services(Administered by BMW NA)

Type	Warr/Program Codes/Desc	Contract Number/Status	Eff Date	Enroll Date	No Coverage As Of	Exp Age (Mth)	Exp Odometer (Miles)	Current Age (Mth)	Retail Center	Center Name	Vendor Code Used	Contract Holder (First/Last)
	New Vehicle Limited Warranty	0000000 ACTIVE	09/17/2015		09/17/2019	48	50,000	10				
MP	0000000168 - MP 48 MO/050K MLS	0000000 ACTIVE	09/17/2015	09/17/2015	09/17/2019	48	50,000	10	00800		MP	

6

ELIGIBLE Contract/Service Program Information (Optional programs only, CPO eligibility not provided)

Type	Program Code/Desc	Wholesale Price	MSRP	Deductible	Vendor Code Used
MP	0000000202 - MP REFRESH 48M/50K	N/A	700.00	.00	MP
MP	0000000200 - MP 12 MO / 25K MLS	N/A	1240.00	.00	MP
MP	0000000184 - MP 24 MO/50K MLS	N/A	2495.00	.00	MP
MP	0000000206 - MP 36 MO/75K MLS	N/A	3529.00	.00	MP
ESC	0000000071 - ESC PT+ 60M/70K Mls	N/A	2205.00	50.00	PT
ESC	0000000074 - ESC GD 60M/70K Mls	N/A	3279.00	50.00	GD
ESC	0000000080 - ESC PT+ 60M/100K MLS	N/A	2440.00	50.00	PT
ESC	0000000083 - ESC GD 60M/100K Mls	N/A	3670.00	50.00	GD
ESC	0000000089 - ESC PT+ 72M/70K Mls	N/A	2606.00	50.00	PT
ESC	0000000092 - ESC GD 72M/70K Mls	N/A	3949.00	50.00	GD
ESC	0000000098 - ESC PT+ 72M/100K Mls	N/A	2900.00	50.00	PT
ESC	0000000101 - ESC GD 72M/100K Mls	N/A	4440.00	50.00	GD
ESC	0000000107 - ESC PT+ 84M/70K Mls	N/A	2960.00	50.00	PT
ESC	0000000110 - ESC GD 84M/70K Mls	N/A	4540.00	50.00	GD
ESC	0000000116 - ESC PT+ 84M/100K Mls	N/A	3500.00	50.00	PT
ESC	0000000119 - ESC GD 84M/100K Mls	N/A	5440.00	50.00	GD
ESC	0000000300 - ESC PL 60M/70K MLS	N/A	3680.00	50.00	PP
ESC	0000000303 - ESCPL 60M/100MLS	N/A	4130.00	50.00	PP
ESC	0000000306 - ESC PL 72M/70K MLS	N/A	4451.00	50.00	PP
ESC	0000000309 - ESC PL 72M/100K MLS	N/A	5020.00	50.00	PP
ESC	0000000312 - ESC PL 84M/70K MLS	N/A	5130.00	50.00	PP
ESC	0000000315 - ESC PL 84M/100K	N/A	6170.00	50.00	PP
Disclaimer:	The Eligible Contract indicators do not necessarily mean that the vehicle/vehicle owner is currently eligible for the indicated contracts. The Eligible Contract indicators are only suggestions to the dealer, based on the latest data to which BMW has access about the vehicle. For actual enrollment of the vehicle in any of the optional programs, please use the Vehicle Contract System.				

Index	Explanation
5	Warranty and Maintenance Programs
6	Eligible Contract and Extensions

Warranty and Maintenance Programs

The status of the new vehicle warranty, maintenance program and Certified Pre-Owned (CPO) warranty can be found here. This information is useful to determine whether or not warranty coverage is active.

Eligible Contract and Extensions

This section lists optional program coverage which may be eligible for purchase should a customer wish to extend their vehicle warranty or maintenance program.

Example DCSnet warranty vehicle history continued

7

Repair History (Claims)

Center ID	Location ID	Claim Number	Claim Date	Repair Order #	Repair Order Date	Repair Entry Date	Davis #	Mileage	Defect Code	Description
36760	01	888580	12/01/2015	15198	11/24/2015	12/01/2015	0	17	6550053300	Rear display optical distortion
36760	01	883190	11/04/2015	14790	10/30/2015	11/04/2015	0	11	0066140100	G11 G12 Rework or replace display key
36760	01	883180	11/04/2015	14790	10/30/2015	11/04/2015	0	11	0066150100	G11 G12 Replace ACC sensor
36760	01	883170	11/04/2015	14790	10/30/2015	11/04/2015	0	11	0084460100	G11 G12 Rework or replace charger (wireless charging)
36760	01	883160	11/04/2015	14790	10/30/2015	11/04/2015	0	11	0061240400	G11 G12 Program control units and Touch Command (quality measures)
36760	01	883150	11/04/2015	14790	10/30/2015	11/04/2015	0	11	0052730100	G12 VDC delivery stoppage ¿ repair the crash lock on the rear console
36760	01	883140	11/04/2015	14790	10/30/2015	11/04/2015	0	11	0032270200	G11 G12 Replace steering column control unit
36760	01	877400	09/18/2015	14124	09/16/2015	09/18/2015	0	6	11999877BV	QCI SPOT DELIVERY
96311	01	546280	09/18/2015	627869	09/16/2015	09/18/2015	0	2	0012040400	G11 G12 Program control units (wastegate actuator, ISTA/P 3.56.4)

Index	Explanation
7	Repair History (Claims)

Repair History (Claims)

Claims submitted to BMW NA for repairs under the new vehicle warranty and CPO programs are listed here. Additionally, maintenance performed under the maintenance program are recorded. Claims are listed in chronological order. The center where the repairs were performed, as well as the date of service, repair order number, DAVIS, mileage and a brief description of repairs can be found here.

This information is very useful to confirm that a vehicle has been maintained per BMW NA recommendations. It is also helpful to review this information to prevent performing duplicate work if a service has already been performed, such as at a different service center.

It is also important to be aware of DAVIS. The DAVIS is the number of days a vehicle has been at the dealership for repairs. A vehicle with a high DAVIS number may be subject to a “buy-back” or “lemon law” situation. The number of days in service and criteria to be “bought back” will vary from state-to-state. A disclaimer at the beginning of the Vehicle History Inquiry mentions that the DAVIS is not the sole indicator to determine a vehicle’s days out of service.

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Key Reader and CBS Checklists

There are two sections to the key reader report:

- Key data
- Service sheet

Key Data

The key data section is organized by subsections which contain:

- Vehicle details
- Key read timestamp
- Errors
- Service data (CBS)
- Dynamic vehicle data
- Check Control messages
- Software integration
- Technical campaigns

Vehicle Details

Details about the VIN, model, engine type, etc are found here.

Key Read Timestamp

The key read timestamp contains data about the vehicle's mileage at the time the information was stored in the key. The date the key was last updated by the vehicle, as well as the time the key was physically read by the key reader is displayed here. The key identification (number 1, 2...) is also listed.

Errors

Errors and alerts are found here. These are meant to highlight information on the key reader report, such as stored Check Control messages, open technical campaigns, or potential repeat visits.

Service Data (CBS)

Each maintenance service is indicated here. This section displays the service status, the current service counter, estimated date or mileage the service will be due and the included range.

Service Task

This is a brief description of the service.

Service Status
This displays the status of a service: not due, recommended, due or overdue.

Service counter
The service counter is a number which represents how many times a service has been performed. The service counter starts with “1” indicating the first time the vehicle was fitted or filled with a maintenance item from the factory. When a service is performed and the service indicator is reset, the counter increases by 1.

Some services are considered “connected services” and do not display a value for the service counter, e.g. microfilters and spark plugs. These service items are paired with another maintenance item, such as the oil service, and are to be performed when the service counter reaches a specified number.

For example, spark plugs may be paired with every fourth oil service. Each time the oil service counter reaches a multiple of 4, the spark plugs will be displayed as “due.”

The service counter intervals for connected services will vary between models. Detailed information can be found in the applicable “New Vehicle Preparation and Maintenance Requirements” service information bulletin on TIS or AIR.

Due in
This column displays when a service is estimated to be due. It may be shown in miles, a date, or a combination of the two depending on the service.

Included range
The included range is a value displayed in days or miles, as appropriate, which permits services to be performed before they are “due” if they fall within the specified range. This is to help minimize return workshop visits and increase customer satisfaction. Detailed information can be found in SI B01 06 13.

Dynamic Vehicle Data
Information about the status of various vehicle systems is displayed here, such as the current fuel level, engine coolant temperature, ambient temperature and battery voltage. The information presented will vary between models.

Check Control Messages
The most recent check control messages are displayed here.

Software Integration

This section indicates the vehicle's software integration level (software version).

Integration plant
This is the software version when the vehicle was produced.

I-Level HO
This is the current software version of the vehicle.

New integration level available
This indicates whether there is new software available for the vehicle.

Navigation
The software version of the currently installed navigation maps are listed here.
If updated maps are available, this will also be indicated.

Technical Campaigns

If there are open service actions or recalls, they will be listed here by defect code.
A brief description is also provided.

NOTES

Example key data section of key reader report

BMW Service

Key data

Vehicle identification number	WBA7F2C55GG415202	**Mileage (key)**	21 mi
Model designation	750LiX N63 7F23	**Avg. distance (8 weeks)**	n.a. mi
Series / Engine type	G12 / N63R	**Read date**	Aug 11, 2016 8:24 A.M.
Color	C27 arktis-grau Brillanteffekt	**Last key update**	Aug 10, 2016 9:55 A.M.
		Origin	KeyReader
Production date	Aug 11, 2015	**Key number**	1
Date of first registration	Sep 10, 2015	**State inspection due**	
		Emission inspection date	
		TeleServices status	Red

1

2

Errors

3

! CC messages
! Technical campaigns
! Repeat visit?

Service data (CBS)

4

Sel*	Service task	Service status	Service counter	Due in	Include range
	Standard scope		0	---	n.a. mi
	Front Brake		1	198,839 mi	
	Rear Brake		1	198,839 mi	
	Engine oil		1	9.2016 / 9,321 mi	2,001 mi
	Microfilter (consider further additional job(s) if appropriate)			---	
	Spark plugs			---	
	Intake silencer			---	
	Vehicle check		1	9.2017 / 37,282 mi	2,001 mi
	Brake fluid		1	8.2018	112 Days

* shows the CBS items at the time of printing; these may differ from the service tasks that have actually been performed.

Dynamic vehicle data

5

Fuel level	7 US.liq.gal	**Battery voltage**	14.46 V
Coolant temperature	93 °F		
Air temperature	76 °F		
Engine oil status	passive measurement is OK		

Check Control messages

Total distance	State	Code	Short message	Full message
20 mi	active	00955	Tire pressure notification.	Tire pressure notification: You can continue driving. Tire pressure is slightly lowered. Inflate tires at your convenience. See Owner's Manual for more inf
20 mi	active	00034		

Software integration

Integration level	
Integration plant	S15A-15-07-504
I-Level HO	S15A-15-07-503
New integration level available	Yes

Navigation disk	
Last data DVD used in the vehicle:	Road Map NORTH AMERICA EVO 2015-3+
Associated with function change:	No
Software update required in the navigation system	No

Technical campaigns

State	Special defect code	Description
open	10011190400	G11 G12 N63T2 Replacing the wastegate valve controller; programming the control units
open	10012070400	G12 Check engine ground connection and rework if necessary
open	10012140400	G11 G12 N63 Program control units (OBD)
open	10027080100	G11 G12 N63 Replacing the transfer box dust boot
open	10032270200	G11 G12 Replace steering column control unit
open	10052710100	G12 Replace crash lock, rear centre armrest
open	10052720100	G11 G12 Check rear massage seat and rework if necessary

Index	Explanation
1	Vehicle details
2	Key read timestamp
3	Errors
4	Service data (CBS)
5	Dynamic vehicle data
6	Check Control messages
7	Software integration
8	Technical campaigns

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Service Sheet

The service sheet (also referred to as the Service Maintenance checklist) is printed by Service Reception when maintenance services are to be performed. A completed copy of the checklist is required to be signed and attached to the repair order hard copy. If the Key Reader function is unavailable, two copies of the substitute Service Maintenance checklist must be used to document the required service.

Identification

This section of the service sheet identifies the customer, VIN, model and repair order.

Maintenance Checklist

An itemized list of tasks to perform for each service is listed here. Care should be taken to complete the document in an accurate, tidy and professional manner. If an item listed does not apply to the particular vehicle, the abbreviation “N/A” should be written beside the check box.

Signature

By signing where indicated, the technician guarantees that the services were carried out conscientiously and thoroughly.

Vehicle Check Tasks

When performing a vehicle check service, an additional sheet is provided to record tire tread depth, brake pad life, and other tasks.

Example service sheet

BMW Service

Service sheet

Customer	.....	**Order number**	.....
Customer number	.....	**Registration number**	.....
VIN	WBA7F2C55GG415202	**Model Designation**	750LI XD 7F23
Mileage (key)	21 mi	**Series / Motor Type**	G12 / N63R

1

Service - standard scope

- ☐ Check 'check control' messages
- ☐ If necessary, check sliding roof guide tracks for contamination If necessary clean, check parking brake function
- ☐ Check indicator and warning lights
- ☐ Function check of parking brake without roller dynamo meter

Service, front brakes

- ☐ Change brake pads, clean brake shafts
- ☐ Brake discs: check surface and thickness .(replace if necessary)(1) (can already be recommended before reaching the wear limit)
- ☐ Enter scope of maintenance in electronic service history
- ☐ Resetting service display in acc. with factory specifications

2

Service, rear brakes

- ☐ Brake discs: check surface and thickness .(replace if necessary)(1) (can already be recommended before reaching the wear limit)
- ☐ Resetting service display in acc. with factory specifications
- ☐ Parking brake function check on brake test stand
- ☐ Enter scope of maintenance in electronic service history
- ☐ Change brake pads, clean brake shafts

Engine oil service (10 l)

- ☐ Enter scope of maintenance in electronic service history
- ☐ At every 2nd engine oil change; Radio remote control: Change battery
- ☐ Changing engine oil and oil filter. We recommend BMW high-performance synthetic oil 5W-30.

Microfilter service

- ☐ Automatic air conditioning: change microfilter

Spark plug service

- ☐ Replacing spark plugs

Service - air filter element

Service, vehicle check

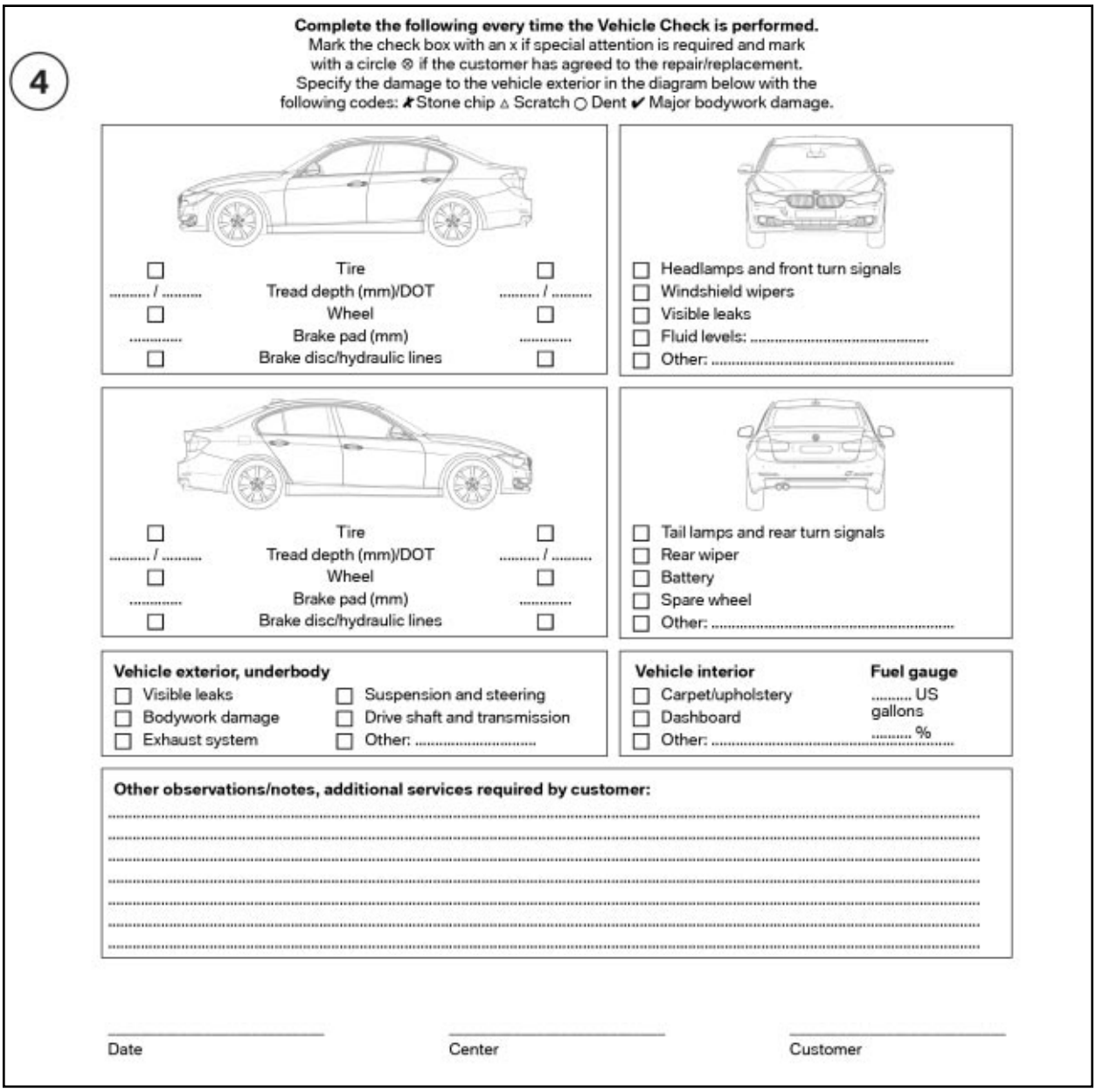
- ☐ Seat belts: Check condition of the seat belt strap, func. of autom. reel, seat belt locking reel, seat belt buckle, seat belt clip & clasp for damage
- ☐ Steering components: check for play, tightness and damage
- ☐ Check the lighting system: Adjust headlight as needed (1), function of front and rear lighting, license plate lighting
- ☐ UNDERFLOOR:
- ☐ Check instrument/inscription lighting, passenger compartment / luggage compartment / glove box lighting
- ☐ If applicable: Check spare wheel condition and tyre pressure.
- ☐ ENGINE COMPARTMENT:
- ☐ Enter scope of maintenance in electronic service history
- ☐ Check for warning triangle, high-visibility jacket and first aid box Check first aid box expiration date and observe country-specific regulations
- ☐ PASSENGER COMPARTMENT:
- ☐ TEST DRIVE:
- ☐ Brake lines and connections: Check for tightness, damage and correct position
- ☐ Checking horn, headlight flasher and hazard warning system
- ☐ Vehicle underbody incl. all visible parts: Check for damage, correct position, corrosion and tightness
- ☐ Check windscreen wipe and car wash for function and settings
- ☐ If applicable: hydraulic oil reservoir: Check oil level, troubleshoot incorrect fluid level (1) and notify customer.
- ☐ Checking road safety (test drive): Brakes, steering, shock absorbers, gearbox
- ☐ Tyres: Check tread depth, wear pattern, external condition and inflation pressure; correct inflation pressure if necessary
- ☐ Initialising Run Flat Indicator
- ☐ If installed: BMW Mobility System: Checking expiry date on sealant bottle. Replacing sealant bottle if necessary

* shows the CBS items at the time of printing; these may differ from the service tasks that have actually been performed.

Check the current series status improvements, and where applicable, arrange implementation.
We guarantee that the service stipulated by BMW Group has been carried out conscientiously and thoroughly.

3

Authorized Servicing dealer	Technician	Master technician / workshop foreman	Date



Index	Explanation
1	Identification
2	Maintenance checklist
3	Signature
4	Vehicle Check tasks

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Determining Maintenance

Key Reader

Using the Key Reader, Service Reception uses the data stored in the vehicle key to provide the following benefits:

- Accelerate and facilitate service consultation.
- Routine tasks, such as collecting vehicle data, will be minimized.
- After accessing the data stored in the vehicle's key, service and maintenance requirements are determined for the individual vehicle (CBS).
- A customized service maintenance list will be printed out for specific operations.

The Key Reader facilitates and accelerates service reception. As soon as the key is inserted, the vehicle's maintenance data, VIN, and mileage are displayed at the client advisor's desk. It obtains this information by reading the vehicle data from the vehicle keys.

The Service Acceptance Module (SAM) software displays and prints this vehicle data via a personal computer with installed Key Reader. The reader accesses the stored vehicle data and the information is displayed on screen depending on the vehicle and model.

Service Reception prints key read data and service sheets. The service sheets are completed by the technician who services the vehicle.

Remote Key Read

It is also possible for Service Reception to perform a Remote Key Read (RKR) for vehicles equipped with option code 6AE BMW / MINI TeleServices to expedite the customer write-up process. The RKR is performed in advance of vehicle arrival. If the vehicle arrives within 48 hours of the RKR, the repair order can be generated based on the services due at the time of the RKR. Should the vehicle arrive more than 48 hours after the RKR, a physical key read must be performed to determine required services/campaigns.

In either situation, a physical key read is required, however, the customer need not be present during this.

Condition Based Service (CBS)

Service Interval Indicator systems (SIA III and SIA IV) determine oil service intervals based on fuel consumption. The instrument cluster calculates the service interval utilizing the Fuel Consumption (ti) signal provided by the DME. Detailed information on SIA systems can be found in the ST050 Technical System Archive reference manual.

Condition Based Service (CBS), a further development of SIA, strikes a compromise between too-frequent maintenance and too-rigid service intervals which call for the replacement of maintenance items that may still have substantial useful life left. The objective of CBS is to indicate maintenance services based on individual vehicle usage.

Principle of Operation

Usage-dependent maintenance of select wear-and-tear items is detected by physical and virtual sensors. This means that, in cases where the wear is not measured directly, the service due date will be determined by using additional variables such as mileage, vehicle performance, temperature, etc.

Sensors built into certain components and control module algorithms take even more detailed account of the various conditions of vehicle use. The remaining times for selected maintenance tasks as well as any dates for State and/or Emissions Inspections (determined by the state in which the vehicle is registered) are individually displayed.

CBS determines the current and future maintenance requirements. The current status of service items determined by CBS are shown in the Control Display. This data can also be read from the vehicle key by using the Key Reader, as the vehicle's current service status is automatically saved in the ignition key every time the key is used.

Two sensors detect the following wear conditions:

- Engine oil (sensor)
- Front and rear brake linings

The instrument cluster collects the values from the wear detection control modules and manages the internally-defined service repair schedule. Data exchange is carried out on the bus systems.

Engine Oil

Oil Service Intervals

BMW Group vehicles' CBS computes the optimal maintenance requirements based not only upon the accumulated mileage, but also taking into account important factors related to fuel consumption such as high or low engine speeds and short or long trips. Such computations can result in variations from the hard coded mile interval (e.g.12,000 miles) and correspondingly, when an engine oil service will actually display "Recommended" or "Due."

Engine Oil Condition

The condition of the engine oil is detected by the oil condition sensor in N-designation engines. Oil level and temperature are also analyzed.

The engine oil condition sensor is monitored by the DME and is mounted in the oil pan.

The DME contains an algorithm for evaluating the service due date. The following parameters are considered in the calculation:

- The correct oil grade is installed
- Oil level
- Oil temperature
- Engine load
- Fuel consumption (ti signal)
- Mileage
- Date (time elapsed since last oil change)

The remaining life to the next service is forwarded from the DME to the instrument cluster by a bus message when the ignition is switched "ON." When the "engine oil" service is due, it is shown in the instrument cluster or the Control Display.

Microfilter State of Wear

The air intake section of the air conditioning system includes a microfilter or microfilters, depending on the vehicle. Vehicles equipped with IHKS systems receive standard microfilters, while IHKA systems receive carbon activated microfilters.

The condition of the microfilter is detected by the IHKA control module. It does not include a physical sensor to measure the level of contamination in the microfilter.

The IHKA uses an algorithm to calculate this from the following parameters:

- Ambient air temperature
- Rain sensor signal
- Heating use
- Air recirculation settings
- Driving speed
- Fan speed
- Mileage
- Date (time elapsed since the last oil change)

The remaining life to the next service is forwarded by the IHKA control module to the instrument cluster by a bus message when the ignition is switched "ON." When microfilter service is due, it is shown in the instrument cluster or the Control Display.

Front and Rear Brake Linings State of Wear

The brake lining state of wear on the front and rear axle is determined by 1- or 2-stage brake lining wear sensors, depending on the vehicle. These are located on the left front and right rear brake pads.

Single Stage Sensors

Using a calculation model, the DSC identifies the thickness of the brake pads in order to determine the mileage remaining until service is required for CBS. The single stage brake pad wear sensors serve as an additional monitor of the calculation of the thickness of the brake pad. Once the conductor path in the sensor is worn through, approximately 5% of the brake pad remains. The control module recognizes an open circuit and turns on the brake pad warning light.

Dual Stage Sensors

On vehicles equipped with 2-stage brake pad wear sensors, the first stage (reference point for the calculation) of the wear indicator is activated when the thickness of the lining is 6 mm, and the second when it is worn to 4 mm.

The 2-stage brake pad wear sensors are monitored by the DSC control module for continuous calculation of the brake pad wear. A resistor is integrated in the second stage. As the stages wear through (the circuit opens), the electrical resistance at the connections of the sensor changes.

The DSC module measures the resistance through the different stages of wear and calculates the approximate remaining brake pad life from the following parameters:

- Wheel speed
- Brake pressure
- Braking frequency
- Brake disc temperature
- Braking time
- Mileage (travel distance)

The remaining life of the brake lining on the front and rear axles is stored in the DSC control module when the ignition is switched “OFF” and is used as the starting value the next time the vehicle is started.

The remaining distance to the next service is forwarded by the DSC control module to the instrument cluster by a bus message when the ignition is switched "ON." The "Front or Rear brake linings" service due date is displayed in the instrument cluster or the Control Display.

Simultaneous replacement of the instrument cluster and DME must be avoided whenever possible, otherwise all current oil maintenance schedule data will be lost. The values will then have to be inserted manually in each control module.

Internal Calculation of CBS Service Items

For some maintenance services, sensors are not needed by the Condition Based Service. Maintenance services that are calculated and managed internally by the instrument cluster are:

- Brake fluid
- Visual and functional checks (vehicle check)
- Coolant (model-specific)
- Official State Safety and/or Emissions Inspections
- Spark plugs

The maintenance of these items is performed at fixed intervals. The residual wear or the remaining time to next service is calculated by the instrument cluster using the travel/time parameters of: mileage, current date and internal distance counter.
When a service item is due, it is shown in the instrument cluster or the Control Display.

Battery down times (battery cut off by the distribution switch) also stop the trip distance counter which leads to longer time based service intervals. This will disrupt the CBS volumes for engine oil, microfilter, brake fluid and coolant.

To correct this, the internal counter status must be reset using ISTA. The wear dependent items internally calculated by the instrument cluster are stored in the instrument cluster and in a second control module for redundancy.

The internal distance counter plays a particular role. Unlike the Time/Date, this counter cannot be set by the driver.

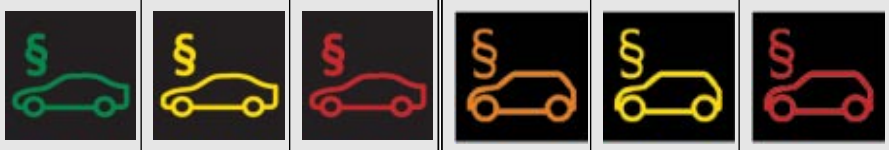
CBS Displays in the Instrument Cluster

The CBS display comprises the following two separate displays:

- A colored symbol in the upper display
  - Green/Orange for normal
  - Yellow for service due
  - Red for service overdue
- Information on remaining distance and/or due date in the lower display.

You will find further information on the CBS displays in the following chart.

CBS Symbols

Symbols BMW/MINI	Description
	Engine Oil
	Front Brakes
	Rear Brakes
	Brake Fluid
	Vehicle Check
	General Inspection
	Exhaust-gas Test

Key Data Update

In certain cases the CBS data is incorrect when performing a key read. This is because the Condition Based Service Data has not been transferred to the key prior to the key data being read. Typically, this occurs when the spare key is being used. In order to correct the key data, it must be manually updated. The following steps will outline how to perform a manual update of the CBS data to the remote.

All F Series Vehicles

1. Sit in the vehicle and close the driver's door.
2. Press and hold the central lock button inside for approximately 5 seconds.

For all vehicles with the Lock/Unlock button on the door:

Press the lock button to perform the key update.

3. Push the start/stop button once to activate KL-15.
4. Continue holding the lock button for approximately 5 seconds after pressing the start/stop button.
5. Release the lock button and hold the remote control against the right-hand side of the steering column, pointing toward the key symbol.
6. "Updating key data" will be displayed in the instrument cluster as soon as the key was recognized.

7. Once "Updating key data" messages have switched off and **a gong tone sounds**, the key data update has been completed.
8. Repeat the procedure for any additional remote keys.

The brake pedal must not be pressed during this procedure!

All G Series Vehicles

1. Sit in the vehicle and close the driver's door.
2. Place the vehicle in "residing mode" by pressing the start/stop button once.
3. Press and hold the **unlock** button on the drivers door.

4. Press the start/stop button 3 times within 1 second
   (Engine light displayed PAD/KL-15 now active).

5. Release the **unlock** button on the drivers door.

6. Now hold the display/standard key up to the steering column.

Back side of the remote key must be placed on key symbol (not front edge).

7. Wait for CC message to display "transferring key data".

8. Transfer of data is complete when a gong sounds and CC message is displayed.

E60, E61, E63, E64 (from 9/05), E9x, E7x, E8x

1. Sit in the vehicle, close the driver's door, **fasten the safety belt** and do not press the brake pedal.

2. Insert the remote key into the key holder.

3. Press and hold the central lock button **(in the center of the dash panel)** in the unlock position, and then press the start/stop button (to activate KL-15) while continuing to hold the unlock button.

E90

E60

4. Continue holding the unlock button for approximately 10 seconds after pressing the start/stop button. A gong will sound to indicate that the transfer process is complete.
5. Remove the remote key from the holder.
6. Repeat the procedure for any additional remote keys.

The brake pedal must not be pressed during this procedure!

E60, E61, E63, E64 (pre-9/05 vehicles)

1. Sit in the vehicle, close drivers door, **fasten safety belt and do not press the brake pedal.**

2. Insert the remote key and turn the ignition to position 1 (KL-R).
3. Press and hold the central lock button located between the center vents.
4. Switch the ignition to position 2 (KL-15) while continuing to hold the central lock button.
5. Continue holding the unlock button for approximately 10 seconds after pressing the start/stop button. A gong will sound to indicate that the transfer process is complete.
6. Remove the key from the ignition.
7. Repeat the procedure for any additional keys.

E65 and E66

1. Sit in the vehicle, close the driver's door, **fasten the safety belt** and insert the remote control into the key slot.

2. Press and hold the central lock button in the unlock position. While holding the central lock button, press the start/stop button once to activate KL-15.
3. Continue holding the unlock button for approximately 10 seconds after pressing the start/stop button. A gong will sound to indicate that the transfer process is complete.
4. Repeat the procedure for any additional remote keys.

MINI - R Series

1. Insert key into key slot in dash.
2. Press and hold the Center-Lock button and use the start/stop button to select “Terminal 15 ON”, wait 10 seconds and then release Center-Lock button.
3. When the key data is updated a gong will sound.

MINI - F Series

1. Sit in the vehicle.
2. Press and hold the Center-Lock/unlock (#1) button for 5 seconds.
3. Press the start/stop button and release.
4. Wait another 3 seconds and release the Central-Lock/unlock button.
5. Hold the front edge of the key directly onto the key symbol on the steering column and keep it there.
6. The “Updating service data” CC confirmation appears.

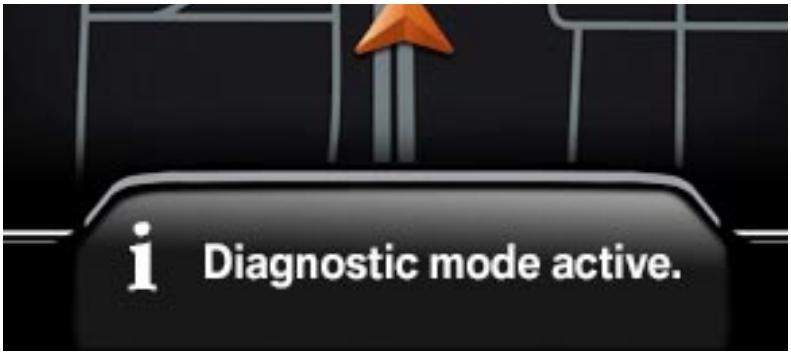
CBS Reset

The CBS Reset procedure provides resetting of the individual Condition Based Service items. The items that require a reset depend on the individual vehicle usage. When one or more service and maintenance items has been performed, these items must be reset. The reset procedure can be carried out via the instrument cluster or ISID.

All G Series Vehicles

Depending on the vehicle (e.g.,G01 X3, G20 3 Series), there may be a fully digital instrument cluster installed. This instrument cluster does not have a trip reset button. If the cluster does have a trip reset button, refer to the F series vehicles for the reset procedure. The following procedure is for vehicles **without** a trip reset button on the cluster.

To begin a reset procedure, press the Start/Stop button quickly 3 times, to turn the ignition to PAD mode. Do NOT start the vehicle for this process.



Wait a few seconds until the other indicator lights have gone out. Next, press and hold the BC button on the turn signal/high beam stalk until the first service job appears in the display.

It is possible to scroll through the different service items, by releasing the BC button and pressing it again until the desired service is reached.

If a reset is possible, the display in the instrument cluster will read “Reset Possible”. Once on the desired service indicator that is to be reset, press and hold the BC button again for 15 seconds.

Confirm the “Reset?” text by pressing the BC button again for 15 seconds.

The status of the reset is indicated in the display by a progress bar and in text as “Reset in progress”.

The reset of the service is completed when the status reads “Reset Successful”.

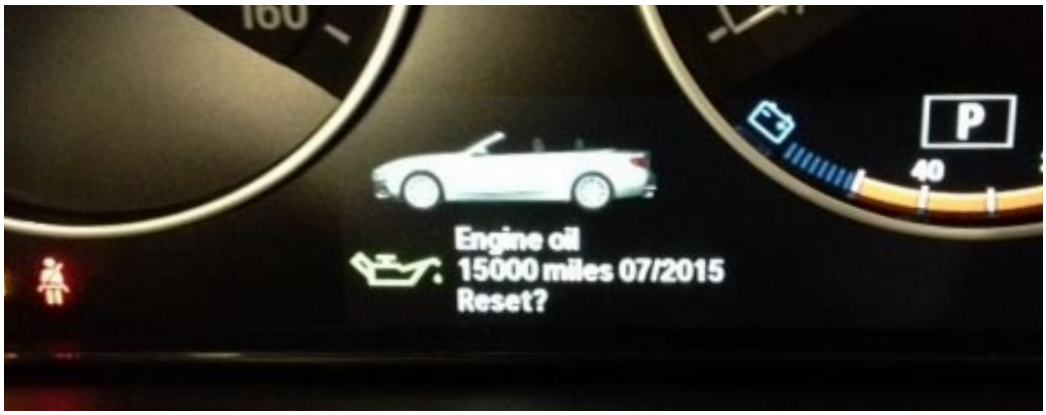
All F Series Vehicles
To begin a reset procedure, press the Start/Stop button, to turn the vehicle on.
Do NOT start the vehicle for this process.

Wait a few seconds until the other indicator lights have gone out. Next, press and hold the reset button on the lower left side of the instrument cluster until the first service job appears in the display.

It is possible to scroll through the different service items, by releasing the button and pressing it again until the desired service is reached.

If a reset is possible, the display in the instrument cluster will read “Reset Possible”. Once on the desired service indicator that is to be reset, press and hold the button again for 3 seconds.

Confirm the reset procedure by releasing the button and then pressing it again for 3 seconds.



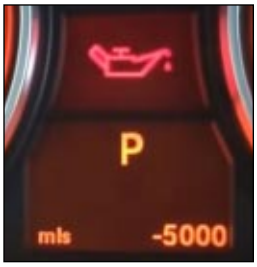
The status of the reset is indicated in the display by a progress bar and in text as “Reset in progress”.

The reset of the service is completed when the status reads “Reset Successful”.

E90, E91, E92, E93

To begin a reset procedure, insert the remote key and press the Start/Stop button, to turn the vehicle on. Do NOT start the vehicle for this process.

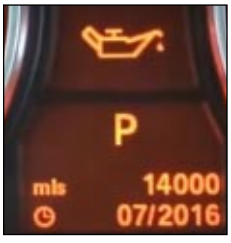
Wait a few seconds until the other indicator lights have gone out. Next, press and hold the reset button on the lower left side of the instrument cluster. A yellow triangle warning light will appear until the first service job appears in the display.



It is possible to scroll through the different service items, by releasing the cluster button and using the scroll feature on the BC stalk until the desired service is reached.

Press and release the BC button when the desired service has been reached.
The word “RESET” will appear on the display.

Press and hold the BC button on the desired service to reset. The reset takes place when the clock appears next to the “RESET” display. The reset is then complete.



E60, E61, E63, E64

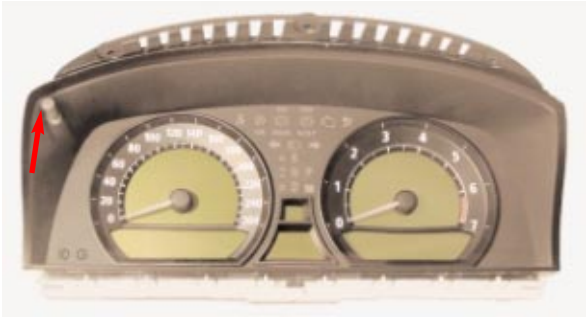
CBS reset on these vehicles is all done by using the lower left button on the instrument cluster. Follow the same procedures as done on E90.

You can scroll through the different services by pressing and releasing the instrument cluster button. When on the desired service, press and hold the instrument cluster button to initiate the reset.

E65, E66

To begin a reset procedure, insert the remote key and press the Start/Stop button, to turn the vehicle on. Do NOT start the vehicle for this process.

Wait a few seconds until the other indicator lights have gone out. Next, press and hold the reset button on the upper left side of the instrument cluster.



The service menu appears in the speedometer and tachometer.

The service menu can be scrolled through by pressing and releasing the reset button.

Once the desired item for service is to be reset, press and hold the reset button.

Press and hold the reset button again once the sub menu is active to reset the service.

To exit the service menu, scroll to the BACK selection on the display and hold the reset button.

Switch on KL.15 position.

Press and hold the trip reset button for approximately 10 seconds until the 1st maintenance service appears in the LCD display.

The upper display (#2) in the tachometer is lit up by a symbol (e.g. an oil can symbol for an oil change).

The lower display shows the time (#3) or distance (#1) remaining until the next service (e.g. 14,000 miles).

Scroll through the services by pressing the on-board computer button.

To reset, press and hold the on-board computer button until the word “RESET” appears in the lower display.

Repeat this procedure for every service that is to be reset.

MINI - F Series

With the vehicle off, press the start/stop toggle switch once.

Press and hold the trip reset button until the 1st maintenance service appears in the LCD display.

Scroll through the services by pressing the trip reset button.

To reset, press and hold the trip reset button until “RESET?” is displayed.

Press and hold the trip reset button again until a loading bar is displayed.
Once the loading bar finishes the reset will be complete.

A CBS reset will not be completed if “Reset Impossible” is displayed below the maintenance item.

Wiper Service Mode

On F and G series vehicles it is necessary to place the wipers in service mode prior to removing the wiper blades.

To do this follow the steps listed below:

- Activate the vehicle the vehicle by pressing the start/stop button.
- Deactivate the vehicle by pressing the start/stop again within 3 seconds.
- Press and hold the wiper stalk in the up position (press down for G series).

After holding the wiper stalk, the wipers will activate and then come to a stop in the up position. At this point you can release the wiper stalk and replace the wiper blades.

Electronic Oil Monitoring

Electronic oil monitoring replaces (or supplements) the conventional dipstick in modern BMW engines. On B-designation (and some updated N-designation) engines, the oil level sensor replaces the oil condition sensor.

Oil Level Sensor

The oil level sensor uses ultrasonic measurement to determine the engine oil level.

The oil level sensor measures the following variables:

- Oil level
- Engine oil temperature (not for all engines)

Function of the Oil Level Sensor

The oil level sensor is installed in the oil sump and is accessed from below.
The purpose of the oil level sensor is to perform an oil level check.

The oil level sensor consists of the evaluation electronics and a measuring tube, which contains engine oil. Additionally, some engines utilize a temperature sensor.

The evaluation electronics transmit ultrasonic pulses. These ultrasonic pulses are reflected (echo impulse) where the engine oil level meets the air in the sump.
The evaluation electronics receive and amplify these reflected pulses and convert them to a digital signal.

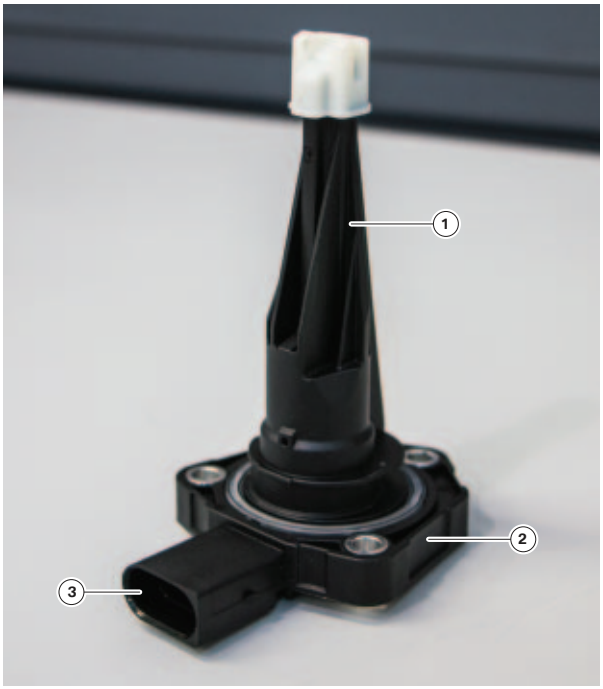
The distance traveled by the ultrasonic pulses determines the travel time from the evaluation electronics to the oil-to-air transition point (oil level) and back to the evaluation electronics. The evaluation electronics calculate the oil level based on the travel time of the ultrasonic pulses.

Changes in the engine oil (e.g. aged, dirty oil) and engine oil temperature influence the travel time of the ultrasonic pulses. The evaluation electronics compensate for this when calculating the engine oil level.

The ultrasonic pulses are transmitted to the engine control module by the evaluation electronics in the form of a pulse-width-modulated signal.

Electrical Connector

The oil level sensor is connected via a three-pin plug to the engine control module.
It is supplied with terminal 15 and terminal 31. The third pin is responsible for sending a PWM signal with information about the oil level (and temperature, if applicable) to the appropriate control modules.



Engine oil level sensor

Index	Explanation
1	Measuring tube
2	Oil level sensor
3	Three pin plug connection

Faults/Evaluation

If the oil level sensor fails, the following will occur:

- A fault is entered in the engine control unit.
- The engine control unit calculates substitute data for the engine oil service.

The fault code entry “oil level below minimum” indicates that the engine oil level is too low. This is not an indication that the oil level sensor is faulty.

Electronic Oil Level Indicator

The oil level is measured in two stages:

- Static oil level measurement while the vehicle is stationary
- Dynamic oil level measurement during vehicle operation

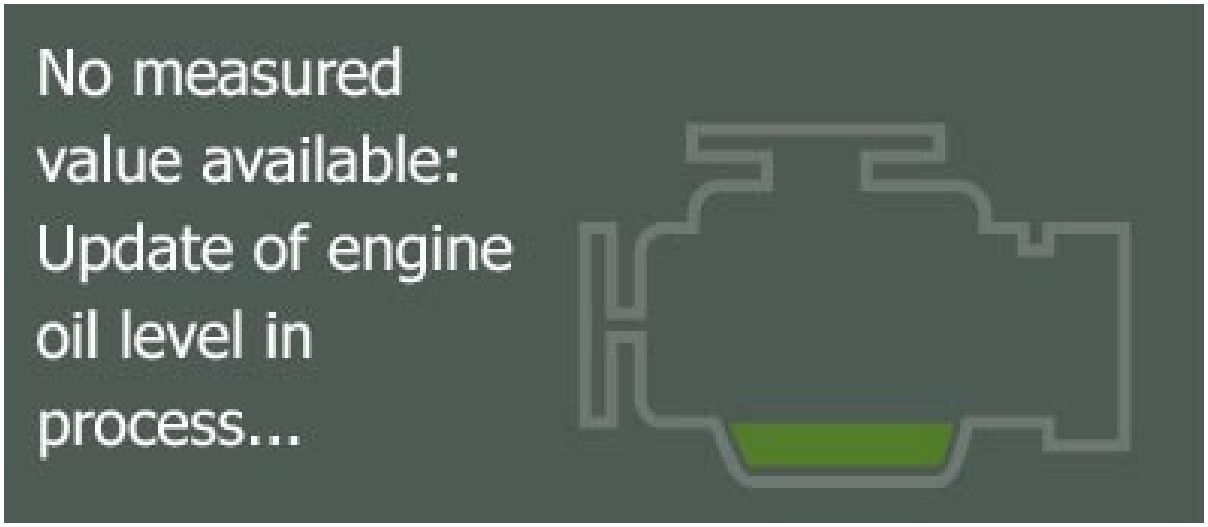
Static Oil Level Measurement at Engine OFF

This is only a reference measurement as the oil condition sensor (OZS) is flooded when the engine is turned off and can only detect the minimum oil level. The oil level is measured correctly only when the engine is running (see Dynamic oil level measurement).

After switching on the ignition, the static oil level measurement provides the driver with the opportunity of checking whether there is sufficient engine oil for safely and reliably starting the engine.

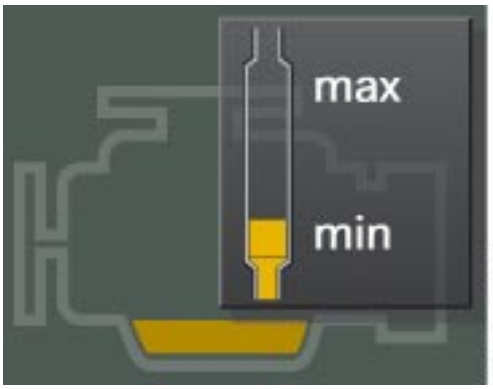
1. It is important that the vehicle is parked horizontally otherwise the oil level measurement may be incorrect.
2. Select on-board computer function "Service" -> "Oil level".

If there is sufficient oil to safely start the engine, a graphic appears in the CID in the form of an engine with a green oil sump.



If the oil level is close to minimum, the graphic appears with a yellow oil sump and an oil dipstick that represents the low oil level in yellow.

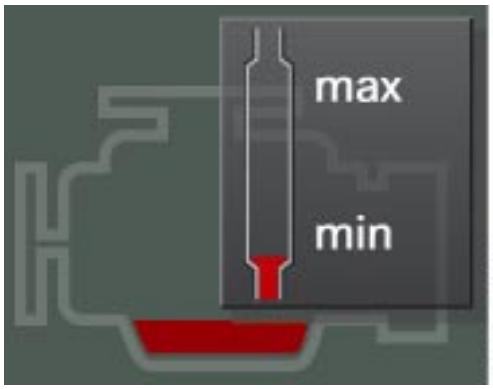
A top-up request +1 liter additionally appears as a text message. The display will not change if less than 1 liter of oil is topped up. MAX is indicated only after topping up a quantity of 1 liter.



If the oil level drops below minimum, the graphic appears with a red oil sump and an oil dipstick that represents the low oil level in red.

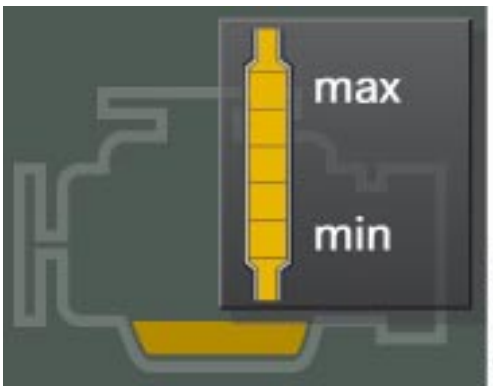
A top-up request +1 liter will additionally appear as a text message.

The display will not change if less than 1 liter of oil is topped up. MAX is indicated only after topping up a quantity of 1 liter.



If the oil level is above maximum, the graphic appears with a yellow oil sump and an oil dipstick that represents the high oil level in yellow.

A text message is also displayed for the driver.

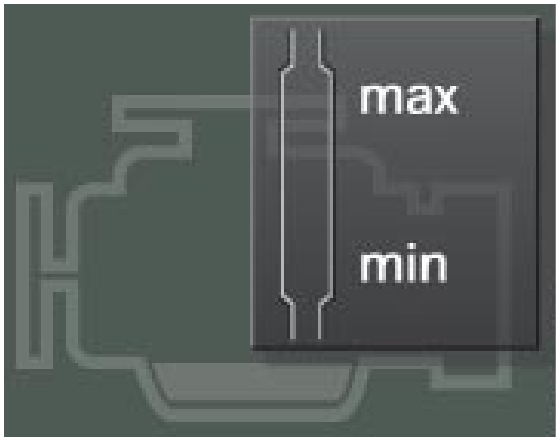


Dynamic Oil Level Measurement During Vehicle Operation

Always perform the dynamic oil level measurement (approximately 5 minutes driving time) after an oil change. The oil level could be misinterpreted as the oil level last stored is initially displayed after an oil change.

No oil level is initially stored after replacing or reprogramming the engine control unit. "Oil level below min" is therefore displayed. The correct oil level is indicated after running the engine for approximately 5 minutes.

1. Start engine.
2. Select on-board computer function - “Check oil level".
3. The oil level is measured. A clock symbol may appear while the level measurement is running. The clock symbol appears for up to 50 seconds after starting the engine when there is no measured value or the long-term value last stored is not within the tolerance range of the currently measured oil level.



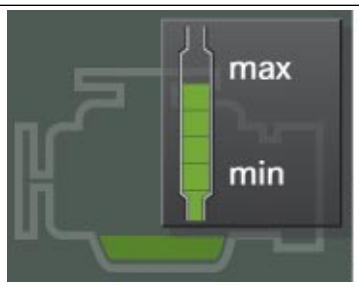
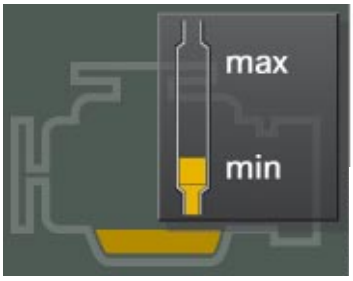
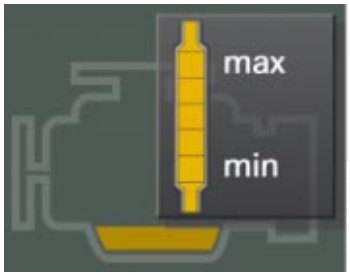
Dynamic oil level measurement begins when the following values are reached:

- Engine temperature > 60 °C
- Engine speed > 1000 rpm
- Transverse and longitudinal acceleration < 4-5 m/s2.

  The transverse acceleration signal is supplied by the DSC. The longitudinal acceleration is calculated from the speed and time factors.
- Change in inclination of the vehicle < 5% after covering a distance of approximately 200 m. The inclination value is detected by the ambient pressure sensor in the DME.

On reaching this value, the oil level indicator is updated approximately 5 minutes after starting vehicle operation. The oil level is then continuously measured. The indicator is updated at 20 minute intervals. The "Check oil level" menu in connection with the dynamic oil level measurement is exited while driving (vehicle speed > 0) approximately 15 seconds after the oil level is displayed.

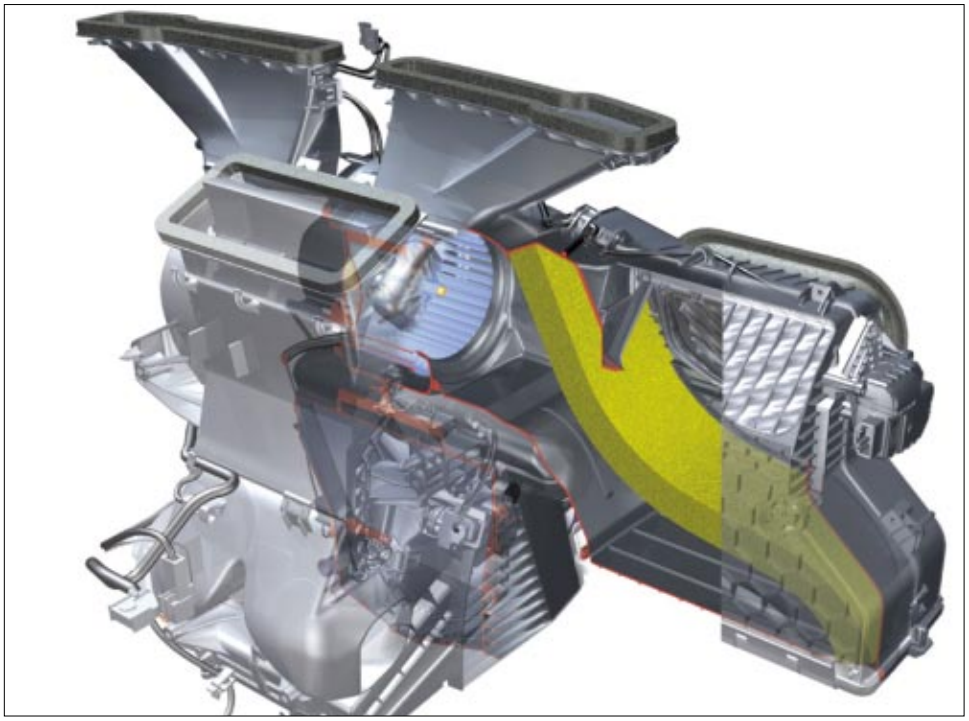
Display Options

Significance	Remark	Display
Oil OK with engine stationary	The oil level appears in the CID in the form of a graphic together with the "OK" message, indicating that the oil level is in the safe operating range.	
Oil level OK at idle speed	The oil level appears in the CID in the form of a graphic together with the "OK" message, indicating that the oil level is in the safe operating range. A further graphic showing a dipstick appears above the displayed graphic. It shows the oil level in green.	
Oil level too low	The oil level appears in the CID in the form of a graphic together with the request to top up with 1 liter of oil. If the oil is not topped up, this request is repeatedly indicated until the minimum oil level is exceeded.	
Oil level too high	The oil level appears in the CID in the form of a graphic together with the indication that the maximum oil level has been exceeded. The excess engine oil must be extracted in the workshop down to the maximum limit. If no oil is extracted, this request will be repeated until the oil level drops below the maximum limit. This represents an advantage that extends beyond the user friendliness of the monitoring system. Over filling of the engine that can cause leaks is indicated as a warning in the instrument cluster.	
Service	There is a problem with the measurement system if SERVICE appears in the display. In this case, the oil level is forecast from the oil consumption last measured and shown in the display. It is not necessary to immediately visit a workshop. The remaining kilometers are shown in the service menu. In the event of the instrument cluster failing, the oil level can also be read out with the diagnosis tester.	

Cabin Air Filters

Fresh Air/Recirculating Air Filter

While many earlier generation (E- and F- series) vehicles were equipped with microfilters installed in the engine compartment, most modern BMW and MINI cars have microfilters installed in the passenger compartment.



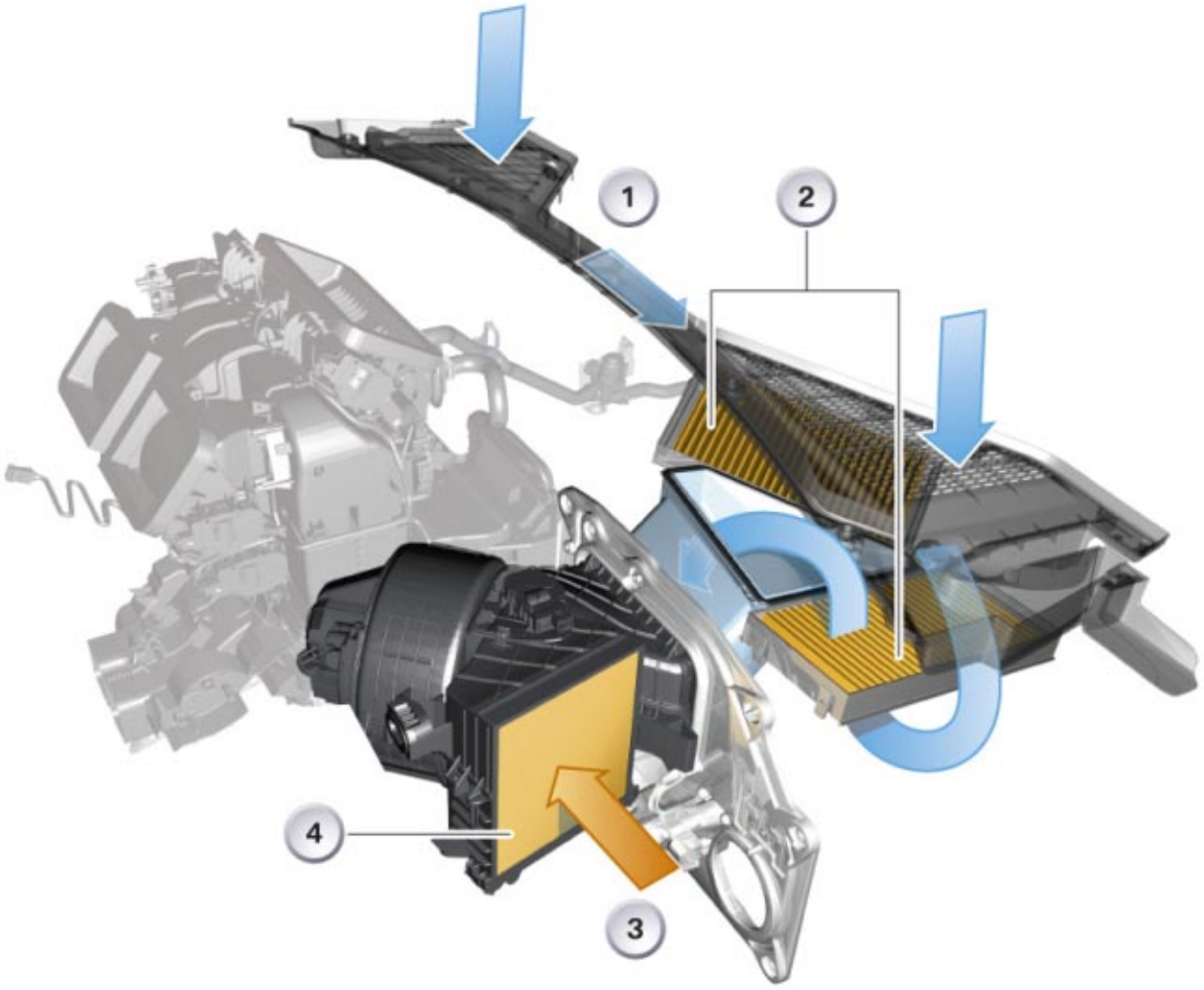
R56 microfilter location

In the E70 and F15, fresh air is drawn in via two filter elements in the intake area in front of the bulkhead. The recirculated air is drawn in at the side by the blower via separate recirculating air filters.

Fresh Air Filtering

A particulate filter or a micro/activated charcoal "combination filter" is also used on the E70 and F15 fresh air intake. The particulate filter (also referred to as a microfilter) removes dust, pollen, soot and other dirt from the fresh air that is needed to control the climate of the vehicle. The adsorption filter (activated charcoal filter) has the job of removing the pollutants (hydrocarbons, acidic gasses) that mainly occur in high concentrations under smog conditions from the fresh air that is needed to control the climate in the vehicle.

E70 Fresh Air & Recirculating Air Filters depicted (F15 is similar)



Index	Explanation	Index	Explanation
1	IHKA fresh air intake	3	IHKA recirculated air intake
2	IHKA fresh air filter	4	IHKA recirculated air filter

Recirculated Air Filtering

A new type of honeycomb filter is used in the recirculated air intake. These versions of fresh air particulate filters can also be used for filtering recirculated air, but are used for cleaning the air in the passenger compartment.

All filters are electrostatically charged during manufacturing and have the characteristic of attracting particles and holding them in, therefore cleaning the air.

The performance figures of an adsorption filter are initial pressure loss, particle separation, dust storage capacity, gas adsorption (such as n-butanes, sulfur dioxide, toluene) and are independent of the filter surface and the air-mass flow.

In order to be able to cope with customer specific filter usage and associated change interval increases and reductions, the filter change intervals have not been stored in the CBS (Condition Based Service) system.

The filter change intervals can be found in the relevant service literature.

Once the cover has been removed from the bulkhead, the filter can be easily replaced or cleaned. The filter change is indicated via the CBS.

The wear level of the microfilter is monitored by the IHKA control unit.

To do this, the control unit uses a calculation model (algorithm) to simulate the condition of the microfilter from the following factors:

- Outside temperature
- Signal from rain/light sensor (IHKA only, otherwise default value)
- Signal from solar sensor (IHKA only)
- Blower voltage
- Air conditions (recognized from frequent or infrequent use of air recirculation)
- Vehicle road speed
- Service interval display (SIA) timer

The IHKA control unit forwards the following data to the cluster via the K-CAN:

- Odometer reading
- Microfilter availability in percent
- Time remaining until next service

A/C Quick Check

- Note ambient humidity
- Note ambient temperature
- Note refrigerant type (R-134a, R-1234yf)
- Close all windows and doors
- Engine Speed = 1500-2000 RPM
- Blower Volume = Medium Speed
- Temperature Wheel = “Max Cold”
- “Snowflake” Button = A/C On
- Test conditions > 3 minutes
- Center vent discharge = 20°F
  less than the ambient temperature

Engine Coolant

The cooling system contains a special liquid called coolant, or “antifreeze,” which circulates through the engine and the radiator. The coolant picks up heat from the engine and transports it to the radiator, where it is dissipated to outside air. Some of the hot coolant can also be circulated through the heater core, where it can warm the air being blown into the passenger compartment.

The antifreeze concentration should be 50%, throughout the year. In addition, the coolant should be drained and refilled according to the recommendations in the BMW Operating Fluids Specifications, Group 17.

The cooling system does not need any additives besides a reputable brand of ethylene glycol antifreeze with corrosion inhibitors that are nitrite and amino-acid free and compatible with aluminum radiators. Antifreeze other than the type specified by BMW/MINI for aluminum radiators may cause corrosion of the cooling system, which can lead to engine overheating and damage.

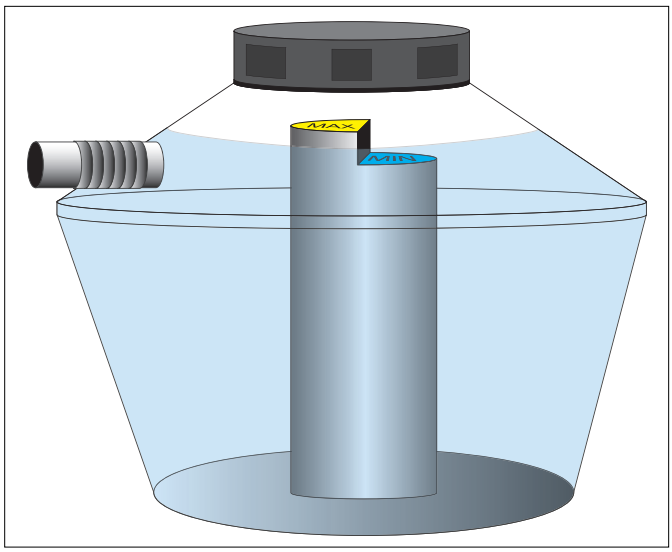
Coolant Recovery Tank

As coolant is heated it expands and gains volume, this fluid expansion is contained in the coolant recovery tank or expansion tank. Generally constructed out of plastic, this reservoir catches and holds the coolant as the engine warms, stores it until the engine cools and the suction generated by the contraction of the coolant pulls it back into the system.

Coolant Level Check

Coolant level can be checked by observing that the fill line is between a minimum and a maximum (Cold) marker and filling according to specifications. A measuring device or sensor is generally provided to indicate coolant level depending on the model.

- Perform filling operation slowly. Pour coolant into expansion tank up to MAX mark.
- Start engine and run at idle speed for approx. one minute (cap open). Then adjust coolant level to MAX.
- Close cap and run engine up to operating temperature until main thermostat opens. Check cooling circuit and drain plug for leaks.



The engine must be cooled down before the coolant level is checked. Coolant temperature must not exceed 30°C. If ambient temperature is above 30°C, allow engine to cool down to ambient temperature.

Check coolant level and adjust to MAX.

Before filling:

- Turn on ignition
- Set blower to low level
- Set heating controller to maximum temperature

This ensures that the heater valves are fully opened and the auxiliary water pump starts.

Do not fill the coolant expansion tank over MAX level as overfilling will cause the coolant to overflow and the auxiliary water pump must deliver coolant in order to ensure full venting!

Electric Pump System Bleeding Procedure
Due to this coolant pump, a special filling and bleeding procedure must be implemented for servicing (see current repair instructions):

Fill coolant expansion vessel to bottom of filler neck with specified coolant.
Replace cap on coolant expansion tank.

Do not remove cap from coolant expansion tank during the bleeding sequence.

1. Connect battery charger.
2. Switch on ignition.
3. Set heater to maximum temperature (set to "Automatic"), turn fan to lowest setting.
4. Depress accelerator to maximum for 10 seconds. The engine must not be started.
5. The bleeding sequence has been started by depressing the accelerator and takes about 12 minutes (The electric coolant pump has been activated and switches off automatically after about 12 minutes).
6. Afterwards, fill coolant expansion tank to 250 ml above "Max" (Observe service instructions specific to vehicle).
7. Check cooling system for leaks.
8. If the bleeding sequence has to be repeated (e.g. if there are leaks in the cooling system), allow DME to reset completely (remove key from ignition for about 3 minutes), then repeat procedure from step 3.

Services for Diesel Engines

SCR Introduction

The abbreviation SCR stands for **S**elective **C**atalytic **R**eduction. This is currently the most effective system for the reduction of nitrogen oxides in the exhaust gas.

This system is model-specific and is now being used for all current BMW diesel engines in USA as well as in other markets. It is necessary to comply with the EURO 6 exhaust emission standards (in Europe) as well with the US EPA and CARB emission regulations. Although the new US market diesels are certified to the more stringent ULEV II (California) standard in some states the requirement is still Tier 2, Bin 5 (LEV II). Compliance with these regulations has been possible by combining SCR the already known emission systems such as NSC (NOx storage catalytic converter), EGR (low-pressure exhaust gas recirculation) and DPF (diesel particulate filter) and the internal engine measures. Therefore the requirements of the CARB and EURO 6 exhaust emission standards are also fulfilled in the cold-start phase, when the SCR system is not yet operational.

BMW already has experience with the SCR system as it has been used in the BMW diesel fuel models in the US market since 2008. MINI does not offer a diesel variant in the US.

The special feature of the SCR system is the additional use of the urea/water mixture, a supply of which is stored and carried in the vehicle. This urea/water mixture is generally known under the brand name **“AdBlue®”** and also referred to as **Diesel Exhaust Fluid (DEF)**.

The system is managed at BMW under the marketing name **“BMW BluePerformance”**.

Supply of the Urea/water Mixture

An adequate supply of urea/water mixture is required for the proper operation of the Selective Catalytic Reduction (SCR) system. Furthermore, this medium must be stored in the vehicle and made available as quickly as it is necessary under all ambient conditions.

For this purpose there are two tanks (except F10) installed in the vehicles.

Tank 1 is refered to as the **“active tank”**, because this tank is heated and has the pump installed that is supplying the metering valve with the urea/water mixture. It is heated to ensure that there is always urea/water mixture available under all temperature conditions.

Tank 2 is called the **“passive tank”** and this one is not heated and will be used to supply tank 1 with fluid after a certain amount has been used (300 ml) from tank 1.

Urea/water tank and filler location

Vehicle	Tank volume Active tank/ passive tank	Position of filler neck
E90	7.5 L / 12.8 L	In the rear bumper on the left side
E70	5.6 L / 15.9 L	In the engine compartment
F10	15 L / No passive tank	Next to fuel filler cap
F15	13.7 L / 15.3 L	In the engine compartment
F30	8.7 L / 9.4 L	Next to the fuel filler cap
F31	8.7 L / 9.4 L	Next to the fuel filler cap

Urea/water Mixture

The diesel exhaust fluid (DEF) is a urea-water solution which acts as carrier for the ammonia that is used to reduce the nitrogen oxides (NOx) in the exhaust gas. In order to protect people and the environment against ammonia and in order to make it more manageable for transportation and tank processes it is available in a liquid urea form for use in the SCR system.

The recommended urea/water mixture is AdBlue®. The naming rights of AdBlue® are owned by VDA (German Association of the Automotive Industry). AdBlue® is a high-purity, water-clear, synthetically manufactured solution consisting of 32.5% urea with the balance (67.5%) being water. The urea-water solution used must correspond to this standard.

The recommended urea-water solution must meet certain standards for quality which are set forth in accordance with the DIN 70070/AUS32.

AdBlue® trademark

The urea/water mixture used (AdBlue®) must in any case be of this standard.

Hazard and Health

The urea/water mixture (AdBlue®) is not poisonous. It is an aqueous solution which poses no special risks. It is not a hazardous substance and it is not a dangerous medium which is readily apparent after reviewing the Material Safety Data (MSDS) sheets.

The urea-water solution is not toxic. If small amounts of the product come in contact with the skin while handling the urea-water solution it is sufficient to simply rinse it off with ample water. In this way, the possibility of any ill effects on human health are ruled out.

The urea-water solution can be broken down by microbes and is therefore easily degradable. The urea-water solution poses a minimum risk to water and soil. Refer to local laws regarding handling and disposal requirements.

If, when handling the urea/water mixture (AdBlue®), traces of the product come into contact with the skin, it is sufficient to wash it off with lots of water. An impairment of human health in this way is practically impossible.

Decomposability and Disposal

The urea/water mixture (AdBlue®) can be used by microbes and is therefore very easily decomposable. From the urea/water mixture (AdBlue®) there is a very small danger for water and soil. In Germany the urea/water mixture (AdBlue®) is in the lowest water danger class (WGK 1). Thanks to its outstanding decomposability, small amounts of spilled urea/water mixture (AdBlue®) can be washed into the sewage system with lots of water without any problems.

Storage and Durability

In order to prevent quality impairments due to impurities and a high inspection effort the urea/water mixture (AdBlue®) can only be stored in designated storage and container systems.

As the urea/water mixture (AdBlue®) becomes solid at -11 °C/12.2 °F (frozen) and decomposes more quickly at temperatures above 25 °C (77 °F) storage and container systems are to be set up in such a way that a temperature range of 30 °C to -11 °C (86 °F to 12.2 °F) can be guaranteed.

If the recommended storage temperature of maximum 25 °C (77 °F) is kept then the urea/water mixture (AdBlue®) fulfills the requirements of the DIN 70070 standard for at least 12 months after its manufacture. If its recommended storage temperature is exceeded then this period is reduced. If the urea/water mixture (AdBlue®) cools to under -11 °C (12.2 °F) it becomes solid. Upon heating the frozen urea/water mixture (AdBlue®) becomes liquid again and can be used again as normal without any loss of quality.

The urea/water mixture (AdBlue®) is normally odorless. If an unpleasant odor (strong smell of ammonia) occurs then this suggests old medium.

Direct ultraviolet radiation is to be avoided.

Material Tolerance

The contact of urea/water mixture (AdBlue®) with copper and zinc as well as their alloys and aluminum is to be urgently avoided as it leads to corrosion. Stainless steels and most plastics are no problem whatsoever.

For further information in relation to handling, first aid, storage and disposal, please consult the safety data sheet of the manufacturer.

Refilling

The SCR system is generally maintenance-free. The service requirements are solely limited to refilling the urea/water mixture (AdBlue®).

The refilling of active and passive tanks with urea/water mixture (AdBlue®) can either be carried out in Service or by the customer themselves.

Refilling on an incline of up to 5° in any direction is permitted. Ninety percent of the maximum possible refilling is still achieved.

The volume of the urea/water mixture (AdBlue®) tank is set out in such a way that a large range is possible. This means that the "normal" refilling takes place in a relatively long cycle so that the re filling can ideally take place in a second Service.

Should the urea/water mixture (AdBlue®) reserve not last until the next workshop visit a certain amount can also be refilled. A special bottle can be used for this that is screwed onto the fluid filler neck. The special bottle, also known as the “KRUSE bottle”, guarantees filling without the danger of overfilling, overflowing or spraying in the engine compartment or on the paint surface.

Refilling using the KRUSE bottle is also possible via the urea/water mixture (AdBlue®) filler connection in the fuel filler flap as this bottle also runs dry at an angle of about 30°.

KRUSE refill bottles with a content of 0.5 US gallons can be ordered from the Electronic Parts Catalog (the current part numbers are set out in the Electronic Parts Catalog).

Special KRUSE bottle for urea/water mixture (AdBlue®)

In the case of an inducement with "no start in ---" a minimum of 2 bottles (approx. 4 Liters) is required to get a refill detection and reset the countdown. At the beginning of the inducement (999 mls left) one bottle is enough to get a refill detection.

Refilling in Service
For refilling in Service 10 liter canisters are available, which are used in conjunction with a special tool (the current special tool part numbers are set out in the Aftersales Assistance Portal).

The filling hose that was used for SCR 1 is still usable for SCR 2. **(This filling hose (next picture) is sold at Daimler in Europe) VERIFY use in US.)**

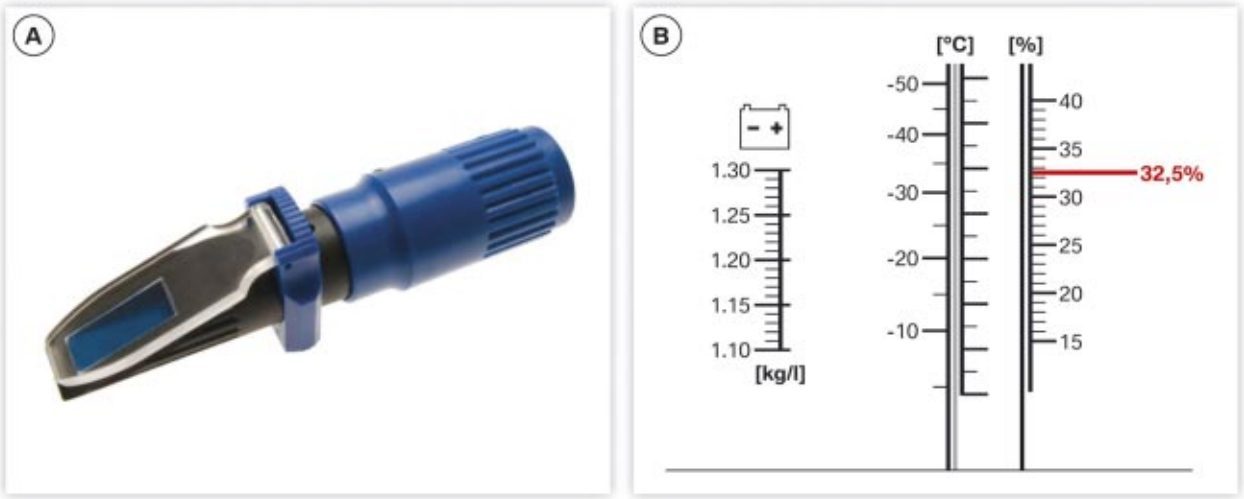
Once the system is fully drained two canisters are required. Via the workshop system ISTA it can be checked whether both tanks, active tank and passive tank, were filled completely.

Refill canisters with a content of 10 liters can be ordered from the Electronic Parts Catalog (the current part numbers are set out in the Electronic Parts Catalog).

Never refill the system from the canister without the special tools. Damage to components may occur due to overfilling and spillage (especially in the engine compartment) where various materials are very sensitive to the corrosive properties of the urea/water mixture.

Checking the Urea/water Mixture (AdBlue®) Concentrate

The quality check of the urea/water mixture (AdBlue®) is performed using a refractometer, which determines the urea concentration (the current special tool part numbers are set out in the Aftersales Assistance Portal). Using the enclosed pipette a drop of the medium to be tested is placed on the prism and the lid closed. The values are shown on the relevant scale using the light/dark boundary in the eyepiece



Index	Explanation
A	Refractometer
B	Scales (battery acid density/coolant frost protection/urea/water mixture (AdBlue®))

Evaluation of the Urea/water Mixture (AdBlue®) Concentrate

- At values lower than 31.8 percent by weight, proper functioning of the urea/water mixture (AdBlue®) can no longer be guaranteed. Therefore, this must be replaced (for example, urea/water mixture (AdBlue®) aged by UV irradiation).
- The values are within the tolerance for values displayed between 31.8 and 33.3 percent in weight.
- Values higher than 33.3 percent in weight indicate a leak in the SCR system (for example if a proportion of water in the urea/water mixture (AdBlue®) has evaporated).

Urea/water mixture (AdBlue®) which has been drawn off cannot be reused without a check. Long storage times and the influence of high temperatures and UV light have a subtle effect on the decomposition of the urea/water mixture (AdBlue®).

Evacuating the Urea/water mixture (AdBlue®)

If it is necessary to draw off the urea/water mixture (AdBlue®) within the frame work of maintenance measures or repair measures or in the case of an excessive aging, this must be done using suitable tools. **It is not possible to drain the system as draining ports are not provided.**

It is not possible to drain the system!!!

The new systems do not have a draining provision as E70. In order to drain the new system it is necessary to remove the filler pipe and drain through the filler nipple on the active tank. The passive tank can be drained through the transfer connection. The drained urea/water mixture (AdBlue®) must be collected in a suitable plastic tank. The pump must be purged with water after each use and cleaned. The safety data sheet must be observed for handling and disposal.

Compatibility with Other Materials

Components of the SCR system are incompatible with materials with a mineral oil base. It therefore must be assured that the components of the SCR system do not come into contact with these. In the event of uncertainties whether SCR system components came into contact with materials with a mineral oil base or SCR system components were filled with materials with a mineral oil base, there are test strips available to check the rest of the materials with a mineral oil base in the urea/water mixture (AdBlue®).

In the event that these materials have been verified and components of the SCR system were damaged as a result, the SCR system must be completely replaced.Special tools and other tools used in Service must be kept far away from materials containing a mineral oil base when handling the urea/water mixture (AdBlue®). This applies, in particular, for special tools and tools which are used for filling and draining the urea/water mixture (AdBlue®).

The following chart explains the possible system warnings and fault scenarios for the US market:

Index	Explanation	Symbol	Check Control Message	Explanation
Stage 1	Reserve < 1000 mls		Exhaust Fluid/ AdBlue Reserve	Exhaust Fluid/AdBlue Reserve. Pay attention to left over range. Driving is still possible. Add Exhaust Fluid/AdBlue soon. See owners manual.
Stage 2	Exhaust Fluid/ AdBlue Total Range < 200 mls		Add Exhaust Fluid/AdBlue	Exhaust Fluid/AdBlue at Minimum. Pay attention to range left. Fill Exhaust Fluid/AdBlue. immediately or engine will not start.
Stage 3	Exhaust Fluid/ AdBlue Range < 0 mls		Refill Exhaust Fluid/AdBlue	Refill Exhaust Fluid/AdBlue. Engine restart may not be possible. Refill Exhaust Fluid/AdBlue asap. See owners manual.
Stage 4	Exhaust Fluid/ AdBlue Wrong Medium		Exhaust Fluid/ AdBlue Wrong Medium Filled	Exhaust Fluid/AdBlue Wrong Medium. Exhaust Fluid/AdBlue wrong fluid filled. Pay attention to range left. At 0 miles range, engine restart may be impossible. Get system checked by BMW Service Department.
Stage 5	Exhaust Fluid/ AdBlue System Fault		Exhaust Fluid/ AdBlue System No Start in 0 Miles	Exhaust Fluid/AdBlue System. Exhaust fluid system fault, Engine start impossible. Get system checked by BMW Service Department.

Run-flat Tire Technology

Run Flat Tire (RFT) technology has been in development by the tire industry for many years. An RFT tire allows the driver to continue safely in the event of a tire puncture or complete loss or tire pressure. The sidewalls on an RFT tire are specially reinforced to support the vehicle with zero air pressure.

The RFT tire design maximizes safety and allows the driver to maintain vehicle control in the event of sudden or slow air pressure loss. This also eliminates the need for the driver to changes tires in unsafe situations. Therefore, the spare tire and jacking equipment can be deleted from some vehicles.

The first U.S. model BMW to be equipped with RFT technology was the E52 (Z8). The Z4, which has standard RFT, takes advantage of the reduced space requirement. Many current model BMW vehicles have standard RFT or they are available as an option.

RFT Operation

If a slow or sudden pressure loss occurs in a RFT, mobility is maintained due to the additional high temperature rubber reinforcements that strengthen the side wall.

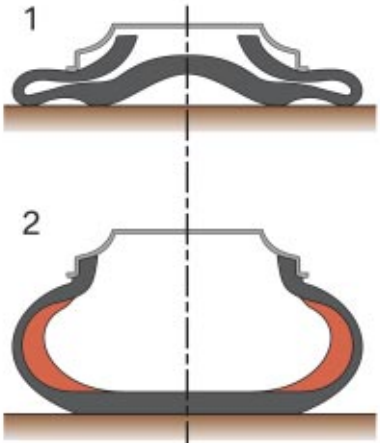
These reinforcements prevent side wall damage when the tire is deflated and also provide support during extreme loads. In addition, the special wheel for the RFT tires “grips” the tire to maintain sufficient steering, braking and accelerating power.

RFT Design

In the illustration to the right shows a comparison between a standard tire and one equipped with RFT self supporting technology.

Both tires have zero pressure. The non-RFT design (1) shows that the sidewalls will be completely collapsed providing no support.

The RFT design (2), shows that the side walls will maintain limited support for the vehicle to allow the driver to get to a safe area for a tire replacement or repair.



Tire Manufacturer Information

All “Run-flat” tires, regardless of brand, must carry a specific designation to indicate that the tire is a “Run-flat” system component. Therefore, the tires will have an “RSC” icon on the sidewall.

Most of today's BMW and MINI models are fitted with the Run-flat System Component (RSC) package on as standard equipment.

The BMW Group has put together a safety package with the aim of avoiding tire related accidents and the risk involved with changing a tire in dangerous situations (e.g. by the side of the road, at night, in wet conditions, tunnels or road construction sites).

The BMW/MINI runflat safety system:

- Warns the driver in good time of imminent tire pressure loss so that countermeasures can be taken.
- Allows the journey to be continued for a defined distance even in the event of complete loss of tire pressure.
- Keeps the tire safely on the rim even in the event of sudden tire pressure loss at high speed.

The system consists of the RSC tires, rims with EH2+ contour and the electronic tire pressure monitoring system (TPMS).

These "self-supporting tires" incorporate reinforced side walls, additional strip inserts and heat resistant rubber compounds. This design makes it possible to continue the journey (even when completely depressurized) for a limited distance at a maximum speed of 50 mph.

When driving with a run flat tire with no pressure, the standard VDC automatically distributes the vehicle weight over the remaining wheels so as to relieve the load on the depressurized tire with the aim of achieving the highest possible range for continued operation.

Refer to the owners manual for the maximum driving range after puncture or deflation occurs. ABS, ASC and DSC remain fully operational even in the event of complete tire pressure loss.

Due to the characteristics of the self-supporting tire design, a tire which is under inflated may not appear to be low on air pressure. Therefore, always verify actual air pressure with a tire gauge. Do not assume that the tire is properly inflated. Check the tire inflation placard in the driver's side door jamb area for correct inflation pressures.

The chart below is a breakdown of the various internal designations from the individual tire manufacturers:

Tire Manufacturer	Abbreviation/Acronym	Definition
Bridgestone	RFT	**R**un **F**lat **T**ire
Continental	SSR	**S**elf **S**upporting **R**un-flat
Dunlop	DSST	**D**unlop **S**elf **S**upporting **T**echnology
Goodyear	EMT	**E**xtended **M**obility **T**echnology
Michelin	ZP	**Z**ero **P**ressure
Pirelli	PTM	**P**irelli **T**otal **M**obility

Wheel Construction

The wheel design must compatible with the RFT system. A self-supporting tire must be capable of gripping the rim to keep the tire beads intact. The wheels used must be of the “double-hump” design.

The “double-hump” design features 2 raised areas on the rim to help retain the tire bead.

These are referred to as EH2 wheels as opposed to the previous “H2” wheels. Standard H2 wheels will accept RFT designed tires but may not retain the tire properly in the event of a failure. This would render the safety features of the RFT system useless.

When the Run-flat tire is at zero pressure. The vehicle can be driven up to 100 miles at a maximum speed of 50 miles per hour. Always refer to the vehicle Owner’s Manual for specific guidelines.

“EH2” Wheel

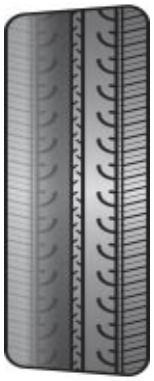
Tire Inspection

Always inspect the tires for any signs of irregular wear or damage.
Below you will see different examples of irregular tire wear patterns:

Over Inflation

Under Inflation

Feathered Wear



Camber Wear

Patchy Wear

Tire Damage

Any exterior damage to the tire should also be noted when servicing the vehicle. Most damage, such a as a bubble in the sidewall, must be noted and the tire replaced. Below is an example of a bubble in the sidewall.

Tread Depth

Tire tread depth should be inspected at every time the vehicle is in the workshop. A tread depth gauge is the best way to check the life of the tire tread.

The minimum tread depth measurement will differ depending on the type of inspection being performed and the state where the vehicle is operated. As a general rule, when performing a multi-point inspection, tires should be replaced at 2/32". CPO Inspections require a minimum tread depth of 3 mm, as measured from the top of the tread wear indicators.

Wheel Electronics

Each wheel is equipped with a wheel electronics module. The wheel electronics module is installed directly to the air filling valve on the interior lip of the wheel. The wheel electronics module specifically monitors the individual wheel for which it is installed and will notify the driver as a Check Control Message if there is fault or if the tire pressure is too low. Care must be taken if replacing a tire so that the wheel electronics module is not damaged. If a wheel electronics module needs to be replaced ensure that the proper one is reinstalled and the TPMS is reset.

- Service life of battery is roughly 7.5 years.
- A TPMS fault message displays when the battery is defective or fully discharged.
- Replace if tire puncture sealant has been used.
- Do NOT apply solvents or cleaning agents or clean with compressed air.
- To clean, simply wipe down with a clean cloth.

Index	Explanation
1	Data Matrix Code
2	Wheel electronics part number
3	FCC ID = approval for wireless operation
4	Wheel electronics ID
5	Transmission frequency (433 MHz)
6	Pressure sensor
7	Production date of wheel electronics
8	Tightening torque
9	Width across flats of union nut

Tire Pressure Monitoring Systems

According to numerous studies and statistical analysis, many vehicles on the roads today are driving with under-inflated tires. First and foremost, this a safety issue which could ultimately result in catastrophic tire failure (a.k.a. “blowout”). Many "blow-outs" can be traced back to preliminary damage from puncture or a slow loss in tire pressure.

In addition to safety issues, under-inflated tires can cause a reduction in fuel economy and overall tire life. Studies by tire manufacturers have shown that tire life can be reduced by 50% when the tires are under-inflated by as little as 20%.

Therefore the overall consequences of improperly inflated tires include:

- Increased tire wear resulting in decreased tire service life
- Impaired vehicle handling
- Reduction in safety for the vehicle occupants
- Reduced fuel economy

Since most tire pressure loss occurs gradually, the driver does not usually perceive the reduced tire pressure. Therefore various systems have been developed to aid the driver by monitoring tire pressure loss and report this information to the driver.

The intent of this training module is to include all systems which monitor tire pressure loss. The first U.S. model BMW to utilize this technology was the E39 M5. Various systems have been in use since that time on some models.

Government legislation mandates that all light vehicles sold in the U.S.
must have a “Tire Pressure Monitoring System” or TPMS as of 2007 model year.

TREAD Act

In 2000, there was much media attention surrounding tire safety issues. The leading tire manufacturers were involved with many law suits regarding catastrophic tire failures. These well publicized incidents involved injury and fatalities.

In response to these issues, the U.S. Congress enacted legislation entitled the "Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act in November of 2000.

The TREAD Act encompasses many aspects of tire industry issues. The act includes items such as tire labeling requirements, tire testing standards, information on tire safety related recalls etc. There are also provisions for issues on child safety restraints.

However, the focus of this training module is to train technicians about Tire Pressure Monitoring Systems (TPMS). TPM systems are also one of the primary components of the TREAD Act. TPM systems allow early detection of tire pressure loss which is not usually detected by the driver until vehicle handling and safety is affected.

The National Highway Traffic Safety Administration (NHTSA) is the government agency responsible for the creation and enforcement of the mandates of the TREAD Act. Initially, NHTSA approved the installation of "Indirect" TPM systems.

Indirect TPM systems monitor tire pressure "indirectly" by monitoring the rotational speed of the tire via the wheel speed sensors. The ABS/DSC system can then detect pressure loss by comparing wheel speed information between all 4 tires. Any loss in tire pressure would result in a change in tire diameter and therefore a change in rotational speed.

Direct TPM systems monitor tire pressure directly by using pressure sensors at each wheel which report tire pressure and temperature information to relevant vehicle systems. Tire pressure loss is then reported to the driver via an illuminated warning symbol. Direct TPM systems also offer the capability of monitoring tire pressure when the vehicle is at a standstill. Indirect systems must be driven in order to collect sufficient data to detect tire pressure loss.

As per NHTSA guidelines, passenger cars and light trucks must have a TPM system which is capable of detecting a 25% pressure loss in one or more tires within 20 minutes installed via a specific timeline from 2005. By 2007, all auto manufacturers must be in 100% compliance.

Aside from the obvious safety benefits, Direct TPM systems will also assist the driver by maintaining fuel economy and extending tire life.

This training module will help the technician to diagnose and repair both "Indirect" and "Direct" TPM systems. The first step in the diagnosis of the these systems is identification. The following text shows some tips on identifying these systems.

System Identification and Terminology

In order to accurately diagnose TPM systems, the system must be properly identified. These systems have had numerous acronyms which are used to describe the various systems. For the purposes of this training module, the systems will be broken down into two basic configurations. These are as follows:

- **Systems which monitor wheel speed** - These **"Indirect"**systems will be referred to as Flat Tire Monitoring systems or FTM. FTM systems take advantage of components already installed in the vehicle. The wheel speed sensors, which are already an input to the DSC control unit, are used to monitor wheel speed. When a tire starts to deflate, the overall diameter changes. This affects the rotational speed, which is picked up by the DSC module. The DSC module contains software for the purpose of calculating the speed changes and reporting the pressure loss to the driver via an illuminated indicator or symbol. The only additional components which are installed is the switch for system initialization. Early generation systems used a module which received wheel speed input from the DSC module.
- **Systems which monitor actual tire pressure** - These **"Direct"** systems will be referred to as Tire Pressure Monitoring Systems or TPM systems. TPM systems use wireless sensors which are part of the tire valve stem. These sensors monitor actual tire pressure and send this information to a module via multiple antennas. These systems are preferred due to the fact that the actual tire pressure is monitored rather than by variations in tire rotational speeds.

There is a simple way to identify the difference between the two systems. On systems which monitor actual tire pressure, the tire valve stem is threaded and has a "hex head" on the valve stem. The systems which monitor wheel speed have conventional rubber valve stems.

TPM System

"Threaded" valve stem on vehicles, which monitor actual tire pressure.

FTM System

"Rubber" valve stem on vehicles, which monitor wheel speed.

Flat Tire Monitoring Systems

FTM systems are “indirect” systems which were first used on U.S. models with the introduction of the E39 M5 in 2000. Since that time, FTM systems have been included on most other models including the 7 Series.

There have been numerous abbreviations and terminology used to describe FTM systems in the past. However, FTM will be used from this point forward to describe those systems which “indirectly” monitor tire pressure loss through wheel speed detection.

Some of the past abbreviations include:

- **RDW** - is derived from the German term “**R**eifen **D**ruck **W**arnung” which means Tire Pressure Warning. This term was used to describe some of the early systems used on the E39 M5, E46 M3 and R50/53 MINI Cooper.
- **RPA** - comes from the German words “**R**eifen **P**annen **A**nzeige” which translates to Tire Failure (Puncture) Indicator. This abbreviation is most closely associated with the E85, E60 and E46 (from 2001).
- **DDS** - This an English based abbreviation for **D**eflation **D**etection **S**ystem. This term is occasionally found when using the diagnostic equipment such as the DISplus/GT-1.
- **DWS** - This is also an English abbreviation for the system used on the Z8 (E52) and it stands for **D**unlop **W**arning **S**ystem.

Regardless of the terminology used, the most important concept to understand is the difference between the Direct and Indirect systems.

FTM System Overview

FTM Systems (Indirect monitoring systems)					
Series	**Chassis**	**Option/Date**	**System Design**	**Deflation Warning**	**System Reset (initialization)**
MINI	**R50/53**	Standard from 3/02	System integrated into DSC	Yellow telltale + gong	RDW Reset Button
3 Series	**E46**	Option from 9/03	System integrated into DSC	Yellow telltale + gong	RPA Reset Button
3 Series	**E46 M3**	Standard from SOP	System integrated into DSC	Yellow telltale + gong	RPA Reset Button
3 Series	**E46 (ix)**	Option from 9/01	System uses separate control unit	Yellow telltale + gong	RPA Reset Button
3 Series	**E90/E91**	Standard from SOP	System integrated into DSC	Yellow telltale + gong	RPA Reset via Stalk Switch or Controller
5 Series	**E39 (M5)**	Standard	System uses separate control unit	Yellow telltale + gong	RPA Reset Button
5 Series	**E60/E61**	Standard	System integrated into DSC	Yellow telltale + gong and CC Message	Soft Key Reset via CID Menu and Controller
6 Series	**E63/E64**	Standard	System integrated into DSC	Yellow telltale + gong and CC Message	Soft Key Reset via CID Menu and Controller
7 Series	**E65/E66**	Optional from 9/02 Standard from 12/03	System integrated into CIM	Yellow telltale + gong and CC Message	Soft Key Reset via CID Menu and Controller
Z4	**E85**	Standard	System integrated into DSC	Yellow telltale + gong	RPA Reset Button
SAV	**E53**	Standard from 4/04	System integrated into DSC	Yellow telltale + gong	RPA Reset Button
SAV	**E83**	Standard	System integrated into DSC	Yellow telltale + gong	RPA Reset Button

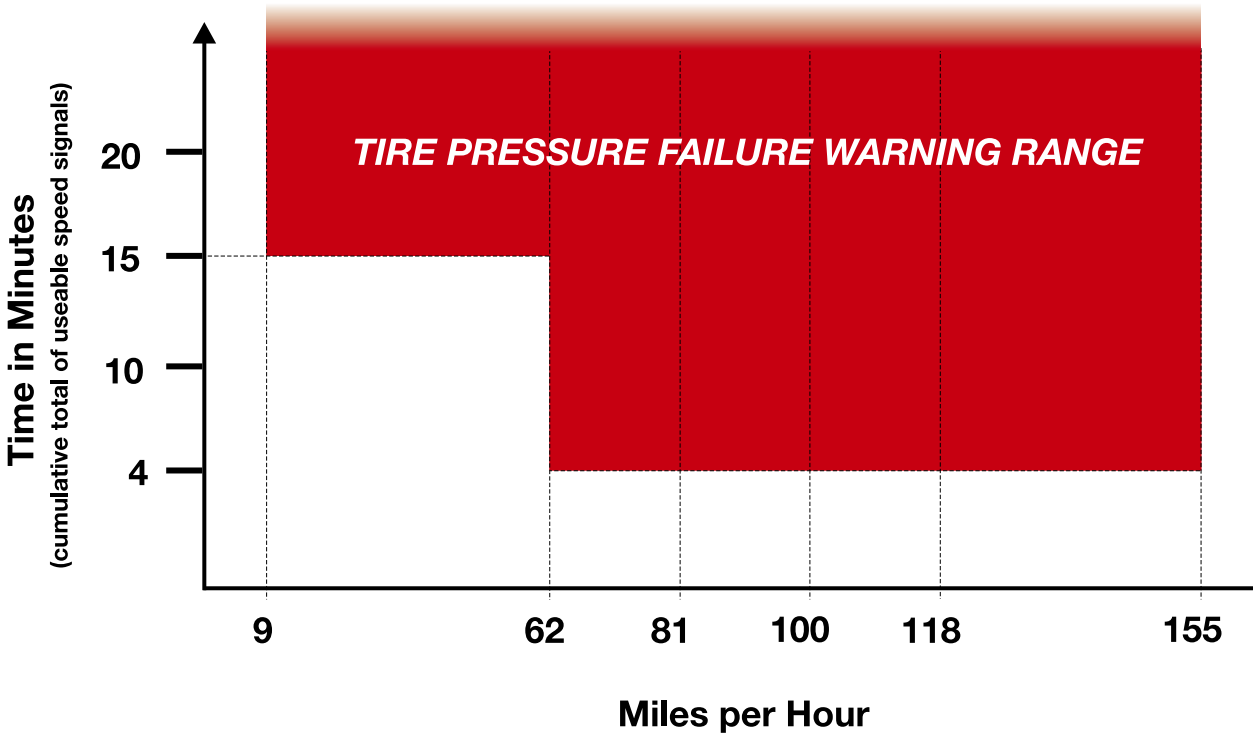
FTM System Operation

The FTM system is designed to inform the driver of a loss in tire pressure. Rather than monitor actual tire pressure (as direct systems do), the rolling circumference is calculated from the wheel speed signals. When a tire loses pressure, the circumference decreases which corresponds to an increase in wheel speed. The wheel speeds are compared with one another for the purpose of determining rotational irregularities.

A difference in wheel speed is recognized as a pressure loss. The FTM system can inform the driver after a short drive if there is a possible under-inflated tire. Depending upon the vehicle, the driver is warned via an indicator light in the cluster or by a check control message. A gong will sometimes accompany the warning light as an additional method of alerting the driver.

When pressure loss from the tire is gradual, the driver may not perceive a problem until the vehicle handling is compromised. The condition is made difficult to visually detect when “Run-flat” tires are used. This is due to the additional sidewall stiffness which can “mask” an under-inflation situation. The FTM system can alert the driver in advance of any pressure loss in the tires.

The FTM system will detect a drop in pressure below about 30 % ± 10 % of the initial value. The FTM indicator and warning light indicates a drop in tire pressure. The FTM system will indicate this after just a short distance. Usually, after a few minutes, from a certain minimum speed (e.g. 25 km/h) up to the permissible top speed.



During the reset process, the set tire pressure is taken as the initial value for the current set of tires. If all 4 tires lose pressure at the same rate, the wheel speeds will also change at the same rate. The RPA is unable to detect a uniform drop in pressure in all tires (e.g. due to diffusion = natural loss of air from all 4 tires).

Tire Pressure Placard Location

As per BMW Group guidelines, the tire pressure should be checked regularly. The owner's manual states at least twice a month and prior to any long trips. Tire pressure information can be found on the tire pressure placard on the b-pillar. There are also tire pressure charts in the owner's manual as well.

The overall responsibility for the maintenance of correct tire pressure resides with the driver at all times.

Spare Tire

When using the "space saver" type spare tire, be aware that the FTM system will not operate properly due to the reduced overall diameter of the spare tire. Have the tire repaired as soon as possible to ensure a high level of driving safety.

System Functions

The Run-flat Indicator (RPA) comprises the following functions:

- Self-test
- Reset (Initialization)
- Detects drop in tire pressure
- Visual and acoustic warning

Self Test

The RPA performs a self-test when terminal 15 is switched ON. A fault in the RPA is indicated by the RPA indicator and warning light and by a symbol in the LC display.

System Reset

Reset is started manually (e.g. by pressing the RPA button). Then (after the journey has started), Initialization will run as a fully automatic calibration sequence. In other words, the circumference of individual tires are recorded and evaluated.

To allow a drop in tire pressure to be detected, the system considers different speed ranges and driving situations. Taking account of the driving situation means that the system has to be primed for each speed range individually.

From 09/2004, these speed ranges and driving situations have been combined into 3 calibration ranges. This means greater clarity for output via the BMW diagnostic equipment.

The reset (initialization) phase lasts approximately 5 to 15 minutes for the individual speed ranges. The end of the reset phase is not indicated.

Detects Drop in Tire Pressure

The RPA records the wheel speeds using the wheel-speed sensors from the DSC. The RPA compares the speeds of the individual wheels and computes an average speed. In this way the RPA is able to detect a loss of tire pressure. (In the event of a tire losing pressure, the tire rolling circumference of the affected tire is also reduced.)

Visual and Acoustic Warning

A drop in pressure in one tire of approximately 30% ± 10% from the initial value is indicated by the RPA indicator and warning light. In addition, an acoustic signal sounds.

Signal Output

Depending on the model concerned, either via the instrument cluster, M-ASK or CCC.

In the event of a DSC malfunction, the FTM system will also register a malfunction. This is due to the fact that the wheel speed sensors are monitored by both the DSC and FTM systems.

Special Conditions for System Function

The following operating conditions may cause a delay in the warning being given in the event of a drop in tire pressure:

- Heavy braking.
- Rapid acceleration.
- High rate of lateral acceleration.
- Cornering (in a tight corner).
- Vehicle speed dropping below a minimum speed. (The RPA only responds when a certain minimum speed has been reached.)
- Large difference in slip (between axles or between wheel on one side of vehicle).
- Initialization not being completed in current speed range (see "Controls").
- Winter conditions.

The following operating conditions may cause a delay in the warning being given in the event of a drop in tire pressure:

- Driving with snow chains fitted.

Driving with snow chains may impair the correct function of the RPA. The system will work as normal again after the snow chains have been removed and the vehicle is driven for a few minutes. (The reset process will not need to be repeated.)

Do not perform reset (initialization) when snow chains are fitted. The reset process will be affected by the irregularities caused by the snow chains.

Old or Worn Tires

Only install tires with the same tread depth. Avoid fitting tires with greatly different tread depth (from approximately 2 millimeters) on one axle. The different diameters mean that the correct operation of the FTM system is no longer guaranteed.

In the following cases, the system will not emit a warning despite a drop in tire pressure being detected:

- The same amount of pressure is lost in 2 or more tires.
- Drops in tire pressures caused by diffusion and affecting all 4 tires equally.
- If a tire is damaged with a sudden loss of all pressure (tire blowout, warning is given too late).

System Reset

The FTM system is reset using the following control elements depending upon vehicle and optional equipment:

- FTM button (all early vehicles w/o CCC or E9X).
- On-board computer button on turn-signal/main-beam switch (E90/91/E92 w/o CCC).
- With iDrive in the Central Information Display (CID) with the controller (all with CCC/NAV).

It is important to always perform a system reset immediately after correcting the tire pressure, especially if a tire is changed or the wheels are interchanged. Only check tire pressures when the tires are cold.

Set the tires to the correct pressure before performing Initialization. During Initialization, the set tire pressure is taken as the initial value for the current set of wheels.

Correct the tire pressures when the tires are cold to prevent the data recorded from being affected by temperature.

The maintenance of tire pressure is the responsibility of the driver.

Check tire pressures regularly, at least twice a month and before embarking on lengthy journeys. During reset, the set tire pressure is taken as the initial value for the current set of tires.

The FTM should be reset during the following scenarios:

- If tire pressure is changed (tire pressure is corrected or reset).
- If the position of the tires is changed (change of axles, wheels), even if the tire pressure is not changed.
- If a tire is changed or the wheels are interchanged (e.g. old tires for new tires, summer tires for winter tires, etc.).

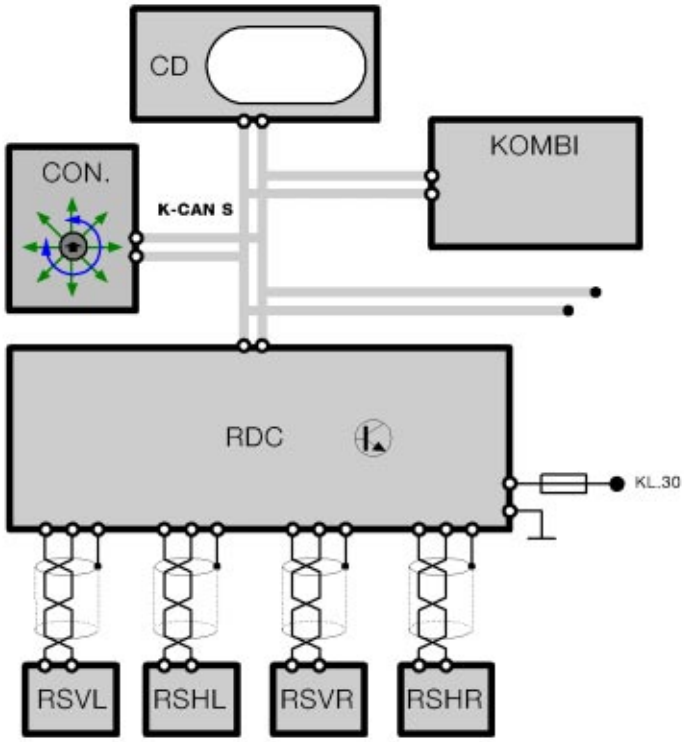
TPM Systems (up to 2003 production)

TPM systems are “direct”systems which monitor actual tire pressure. The first BMW to use the “direct” system was the early production E65/E66. The system was then referred to as Tire Pressure Control or RDC. The E46 also received an optional version of the RDC type system which was available up to 8/03 production.

The system is capable of monitoring actual tire pressure when the vehicle is stationary or when being driven. There are transmitters which are part of the valve stem assembly. These transmitters send signals to the RDC control unit via antennas mounted in the wheel well area.

When the system detects pressure loss, the driver is warned via a Check Control message and an acoustic warning (gong).

RDC Input / Output Diagram



The TPM system on these pages were installed on the E65/E66 and E46 vehicles as options until 2003 production. The newer (NHTSA mandated) TPM systems from 3/2006 are covered on page 90 “TPMS System (from 9/05)”.

TPM System Operation

During monitoring, the RDC control module takes the measured temperature and pressure readings to determine a target pressure value.

If the tire being monitored falls below the required level by 0.2 bar for more than 8 minutes, a Check Control Message appears in the instrument cluster after the car is started. The driver is prompted to check tire pressure.

Autumn Warning

If the tire temperature is 20 degrees Celsius lower for 14 days than the previously measured temperature during the last initialization, the RDC system will also prompt the driver to check tire pressures.

Check Control Message displayed in the Cluster	Message displayed in Control Display
Check tire pressures! 	"Check tire pressure!" Check tire inflation pressure; refer to owner's manual or inflation chart.

When the RDC menu on the control display is activated, the car is shown with the tires highlighted in yellow. The tire pressures must be adjusted and an initialization carried out.

Tire Failure Warning

After the temperature calculation, if the monitored tire falls below the specified pressure of 0.4 bar, a CC message will appear on the instrument cluster with an audible warning tone. These warnings will also be set if the monitored tire pressure falls by more than 16%. A corresponding CC message will also be shown on the Control Display.

Check Control Message displayed in the Cluster	Message displayed in Control Display
Flat tire! Stop vehicle carefully. 	Left front tire is flat, refer to owner's manual or contact BMW roadside assistance.

When the RDC menu on the control display is activated, the car is shown with the defective tire in red. In the case of a spare tire failure, all of the tires are shown in red.

Once the tire pressures are restored to the setpoint in the RDC control unit, the tires will return to green in the control display. The CC message is also withdrawn.

System Reset

After the tires are replaced, rotated or if their inflation pressures are adjusted, then the wheel transmitter modules must be initialized (reset) using the RDC function in the “Settings” menu of the Control Display.

During initialization the following processes are performed:

- Individual wheel recognition (Identification of wheel transmitter modules).
- Wheel position assignment.
- Plausibility check (setpoint pressures checked).
- Adoption of setpoint pressures as specified pressures.

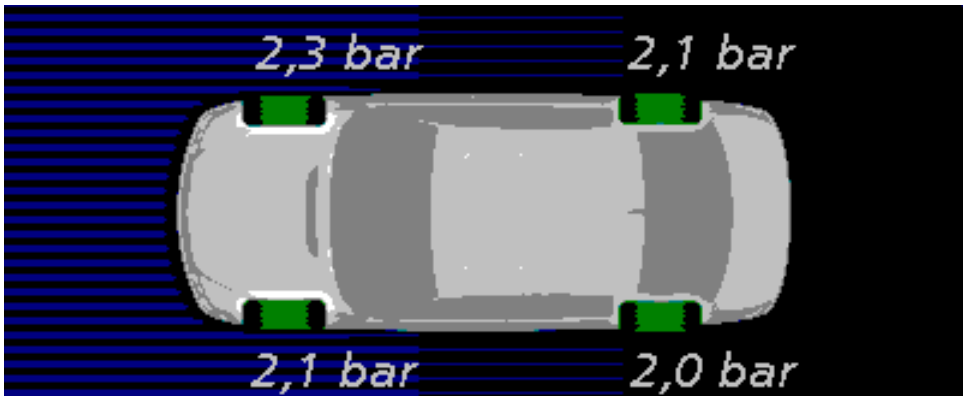
The RDC (TPM) system then learns the wheel transmitter module position.

The minimum air pressure accepted by the TPM system on during reset is 1.7 bar (or 24.7 psi). If the tire pressures deviate more than 0.4 bar (6 psi) per axle the reset process is rejected after a plausibility check.

1.3 bar is the lowest pressure detected by the wheel transmitter module. At that point, a tire failure warning will always be issued.

Complete reset procedure can take up to 30 minutes. Only the actual driving time over 6 km/h is taken into account. During initialization, the CC message “Initializing RDC” is displayed on the Instrument Cluster.

When the initialization from the Control Display is activated, the wheels appear black and the pressures are not shown. Once initialization is complete, the tires of the car on the graphic turn green and pressure values are shown for each tire.



TPM Systems (from 9/05)

As per the TREAD act guidelines, future tire pressure monitoring systems on BMW vehicles will be of the “direct” type. However, there will be some design changes from the first generation “direct” systems. This new system can also be referred to as the “trigger” type system. This is due to the use of trigger transmitter modules which will be explained in more detail later in this section.

The first models to receive the new systems were the 5, 6 and 7 series from March of 2006. The 3 series (E90,91,92) as well as the M5 and M6 are equipped with the direct system as well. The Z4 balanced out the module line in October 2006. To be in compliance with the new NHTSA regulations, all new models produced from September of 2007 use the new system.

The main function of the system is to monitor the tire pressure during vehicle operation. The most important auxiliary function of the system is the option of independently detecting the wheels (vehicle's wheels) mounted on the vehicle and their position.

The control unit obtains the radio telegrams from the electronic wheel electronic modules which are controlled via the trigger transmitters. The system recognizes the vehicle's own wheels and the mounting position of the wheels by evaluating the trigger location as well as statistical evaluation of the received information. The control unit checks the individual system components.

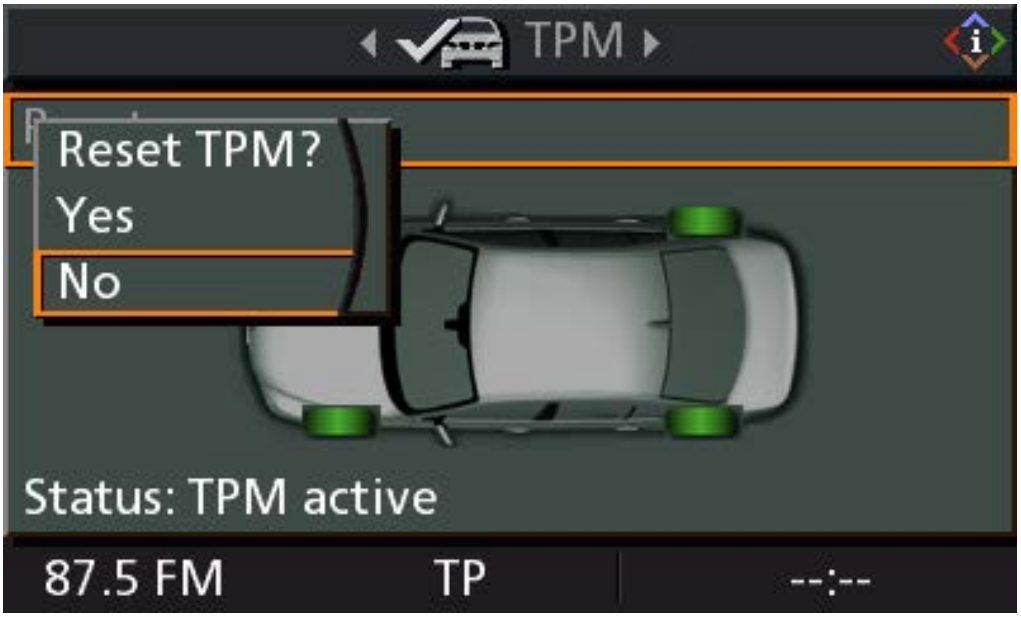
The spare wheel is not monitored as the electronic wheel module does not transmit telegrams when stationary (except for the specified post-run phase).

Control Display

On vehicle equipped with a control display, the tire status is indicated in the TPM menu. The tire pressure status is indicated by the color of the tires in the graphic. The colors are as follows:

- Green - Tire pressure is OK and matches the learned tire pressure.
- Yellow - There is a flat tire or a major drop in tire pressure has been detected.
- All wheels yellow - There is a flat tire or major tire pressure loss in several tires.
- Gray - The system cannot detect a flat tire due to a system malfunction or the system is currently in reset mode. Also, any RF interference from other devices can cause this situation.

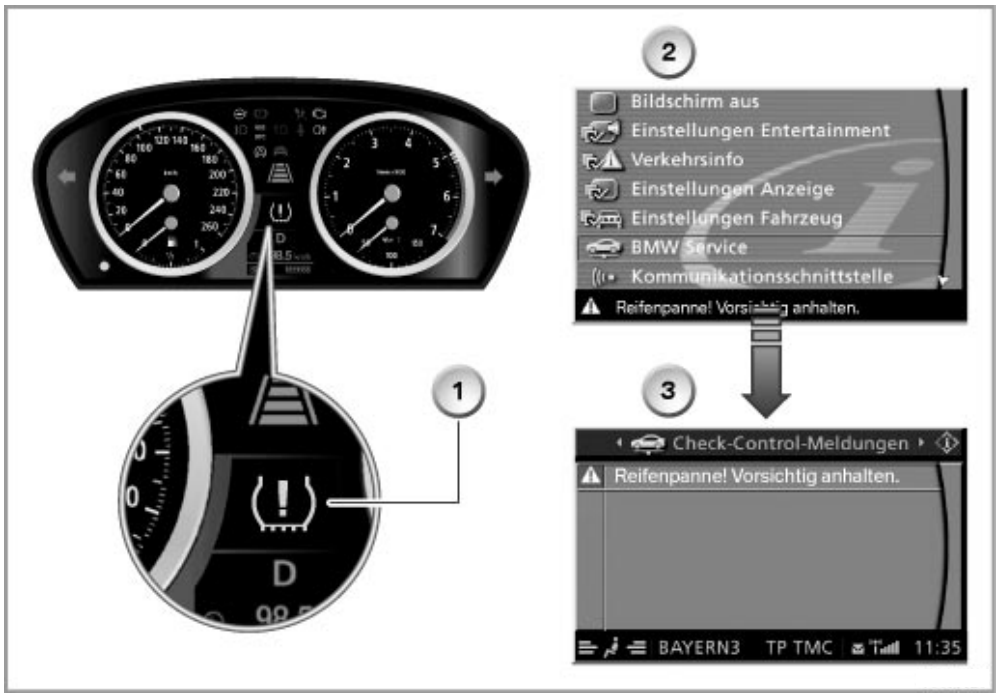
The system reset is also performed using the controller.



Instrument Cluster

The TPM indicator is located in the instrument cluster. The indicator is yellow and alerts the driver to the CC message in the control display. Also, any system malfunction is indicated by a flashing yellow indicator followed by a continuous illumination.

When this occurs, the tires in the control display will be shown in gray.



Index	Explanation	Index	Explanation
1	TPM warning indicator (yellow)	3	CC Message
2	Vehicle setting menu		

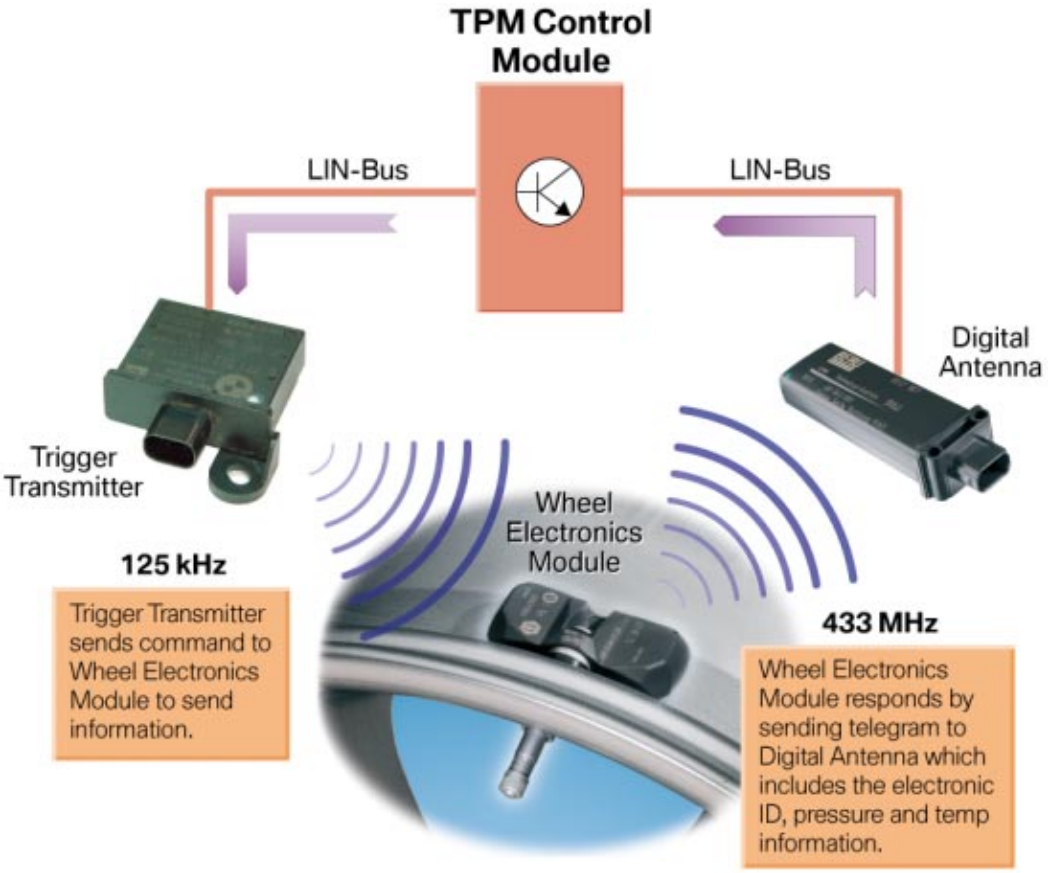
System Operation

The primary responsibility of the new TPM system is to monitor tire pressure and warn the driver of impending flat tire situations. This new TPM system is referred to as the "trigger type" system due to the trigger transmitters installed at all four wheel well areas.

This system differs from the past "direct" systems in a few areas. There is only one centrally located digital receiving antenna. This antenna receives input from all 4 of the wheel electronics modules (5 if the vehicle has a full size spare) located in each tire and wheel assembly. The central digital receiving antenna is connected to the TPM control unit via the LIN-Bus.

The wheel electronics modules will transmit information when prompted by signals from the trigger transmitters. The trigger transmitters communicate to the wheel electronics over the 125 KHz frequency.

In contrast to the past wheel electronics module, the new design has the capability of bi-directional communication. In other words, the wheel electronics not only transmit information but receive information and commands from the trigger transmitter modules.



The wheel electronics from the previous system will not work on the new system.

Control Display Screens

One Tire with Reduced Pressure

The yellow indicator lamp in the instrument cluster is switched on permanently and an audible indication (gong) is additionally sounded as soon as a tire undershoots one of the previously specified warning limits. If the vehicle is equipped with the corresponding option, the test "Low Tire" is additionally shown together with the position in the cluster. If the vehicle is equipped with an control display (MMI), the affected tire is indicated in yellow. The unaffected wheels retain their green color.

The "Low Tire" status means that driving safety is no longer ensured. The driver is requested to stop and check the condition of the tire. It is the responsibility of the driver to decide whether he can continue the journey at low speed to the next repair workshop or whether an on-site repair is necessary.

Workshop Hints

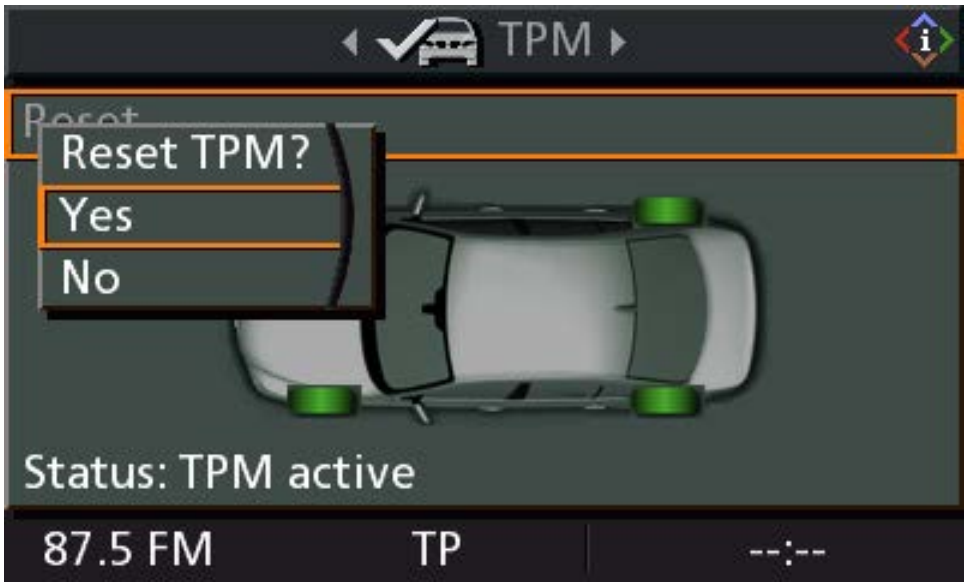
System Reset (Initialization)

The TPM system should be reset whenever any changes are made to the tire and wheel assemblies. For example, if a tire is replaced or if the tires are rotated for service. Also, the system should be reset whenever any repairs are made to the TPM system.

The driver of the vehicle is solely responsible for maintaining the correct tire pressure when in use. As per recommendations, the tire pressure should be checked 2 times per month.

Before system reset (initialization), the technician (or driver) should set the tire pressure to the specified pressure (as dictated by the tire pressure placard in the b-pillar). These pressures are a cold specification and should be set as such.

Depending on the vehicle, the system reset can be carried out via a button or via the controller (on vehicles with a control display i.e 5, 6 and 7 series).

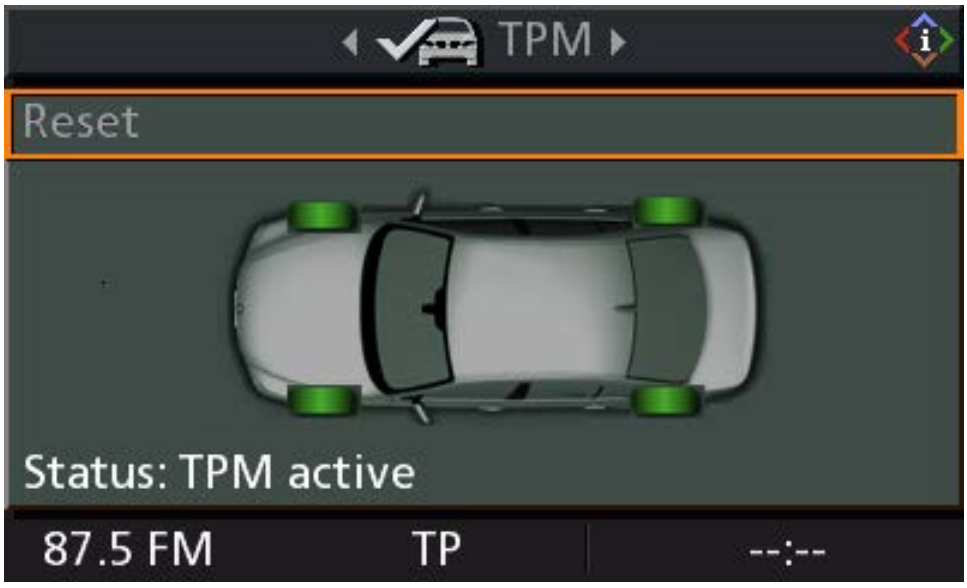


Once the reset mode is initiated, the vehicle must be driven in order to complete the process. This is to ensure that there is no RAF interference or erroneous signals from other vehicles which use similar TPM system components.

During this period, the control display will show the message “Status: Resetting TPM”. The tires on the control display will be gray in color until the process in complete. This should take only a few minutes.

When the reset is complete, the yellow TPM indicator will go out. The tire pressure and temperature values are stored in conjunction with the ID of the wheel electronics. Therefore, the wheel position is stored in the TPM control unit.

In order for the reset procedure to be completed, the tires must be at the minimum allowable pressure which is approximately 1.4 bar (20 psi) to 1.6 bar (23 psi). If the tire pressure is too low, the system will not complete the reset procedure. When complete, the control display will switch to “Status” TPM active” and the tires will switch to green.



New target pressures are adopted solely by way of initialization. If a wheel is exchanged and the system is not re-initialized, the newly mounted wheels will be “taught-in” and monitored to the previous target pressures.

Reset Procedure

The reset procedure is performed with KL15 ON. The engine can be OFF or ON, but do not drive off. Depending on the vehicle, the FTM is reset as follows:

Vehicles with RPA/RDW Button

Press and hold the RPA/RDW button until the RPA indicator and warning light lights up yellow for a few seconds. Then drive the vehicle through various speed ranges for at least 15 minutes.

Vehicles with BC Button (on-board computer function)

In the on-board computer function select "RPA" and "INIT" (LC display) with the rocker switch on the turn-signal/main-beam switch. Press the BC button to confirm.

Press and hold the BC button for approximately 5 seconds, until a box with a tick appears behind the "INIT" display. Then drive the vehicle through various speed ranges for at least 15 minutes.

Vehicles with Central Information Display

Initialization is performed via the Central Information Display (CID) and controller.

- Select "RPA/FTM" in the "Settings" menu and confirm.
- Select "Set" and confirm.
- Then drive the vehicle through various speed ranges for at least 15 minutes. The end of the Initialization phase is not indicated.

Preconditions for Activation

The flat tire indicator is automatically activated when terminal 15 is switched ON. The FTM cannot be switched off manually.

Flat Tire Indication

A flat tire is indicated as follows:

- E53, E83, E85, R50 - Yellow FTM indicator and warning light without acoustic signal.
- E60, E61, E63, E64, E65, E66, E90, E91 - Yellow FTM indicator and warning light with acoustic signal.

An FTM system failure is indicated by a yellow FTM indicator and warning light without an acoustic signal.

TPM Systems (from 3/11)

The next generation of BMW tire pressure monitoring systems was introduced to the US market with the launch of the F25 X3 SAV.

Operating Principle

The direct measuring system consists of the TPM control unit with integrated reception antenna and four wheel electronics. It was possible to reduce the number of components and cost of the system by integrating the reception antenna in the TPM control unit.

The four wheel electronics transmit the tire pressure and temperature to the TPM control unit via radio communication (433 MHz). Once the wheel electronics have been woken up, (vehicle speed > 20 km/h / 12 mph), a total of 25 telegrams are transmitted once at two second intervals. Providing the pressure has not dropped, individual telegrams are then sent every 18 seconds from the wheel electronics to the TPM control unit. As a prerequisite for the wheel electronics to go to sleep, the wheel must be at a standstill for more than five minutes.

Resetting the Tire Pressure Values

The tire pressure values are reset via the instrument panel or Central Information Display CID. The TPM text message appears, or the permanent TPM indicator light lights up, in the instrument panel when the teach-in process starts.

Teach-in Process

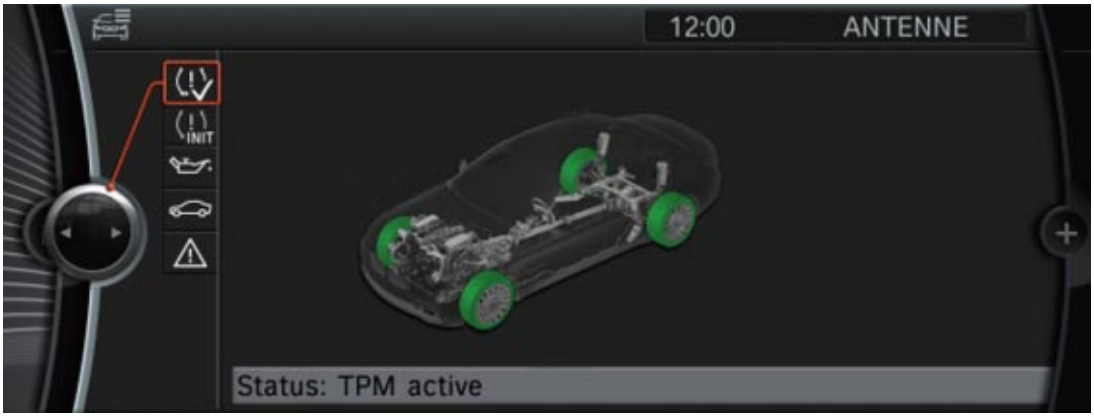
During the teach-in process, the wheel electronics identification numbers (ID) are transmitted to the TPM control unit. The TPM control unit can identify the wheel position of the corresponding wheel electronics via the identification numbers once the teach-in process is complete.

Two acceleration sensors are installed in each of the wheel electronics in order to be able to determine their positions. The acceleration sensors determine the wheel's direction of rotation. This means that right/left differentiation of the wheel electronics positions at the vehicle is possible.

The high frequency signals received are evaluated in order to determine whether the wheel electronics are at the front or rear axle. The TPM control unit with integrated receiver is mounted in the outer area of the luggage compartment well above the rear axle. The level of the signals received by the TPM control unit from the wheels on the rear axle is higher than the level of signals sent by the wheel electronics on the front axle. This means it is possible to determine whether the wheel electronics are at the front or rear of the vehicle.

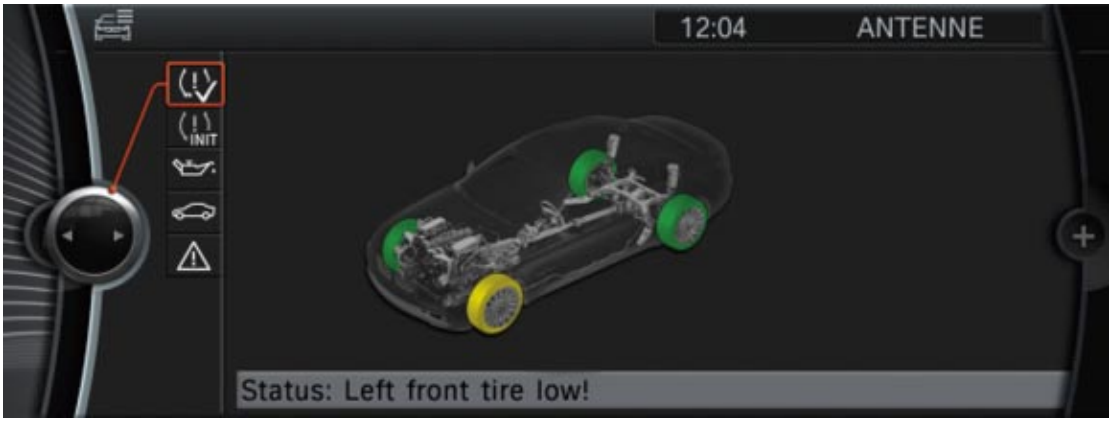
The entire teach-in process takes between roughly one and twelve minutes at the most. The following factors influence the duration:

- The current mode of the wheel electronics (awake/gone to sleep).
- The condition of the road (e.g. cobbles).
- The TPM control unit already knows what the ID's of the wheel electronics are.



F25 TPM, Teach-in Process Complete

Once the teach-in process is complete, the TPM text message or solid TPM indicator light are cancelled. The green tire symbols subsequently appear in the CID.



F25 TPM Pressure Drop

Once the teach-in process is complete, the wheel electronics send the pressure, temperature and also the identification numbers of the tires to the TPM control unit at regular intervals when driving.

If a pressure change of > 20 kPa (0.2 bar, 2.9 psi) is identified within two successive pressure measurements, the wheel electronics for the relevant wheel immediately assumes a fast transmitting mode. It then sends information to the control unit at one-second intervals. If the pressure drop is higher than 25%, the TPM text message "Tire Low" appears.

Service Information

Teach-in Process

The wheel electronics must be taught in under the following circumstances:

- The tire pressure has been changed
- A tire has been changed
- Wheels are replaced axle-wise

The driver can start the teach-in process via the Central Information Display (CID) and the controller. For more information, refer to the vehicle Owner's manual.

Service Life of Batteries for Wheel Electronics

The service life of the batteries installed in the wheel electronics is roughly 7.5 years. The current value of the service life counter in the batteries of the wheel electronics can be read out via the diagnosis system.

If the battery is fully discharged or defective, an TPM fault message is displayed.

Remove & Install Wheel Electronics

The following points must be observed when removing/installing the wheel electronics of the tire pressure control (TPM):

- Do not use high pressure cleaners to clean wheel rim with the wheel electronics installed when the tire has been removed.
- Replace the wheel electronics if tire sealant has been used.
- Clean the valve and valve seat thoroughly before installing the wheel electronics.
- Do not apply solvents or cleaning agents to the wheel electronics, or clean them with compressed air.
- To clean the wheel electronics, simply wipe down with a clean cloth.

TPM System (from 9/13)

The Tire pressure monitoring system (TPMS) has been updated yet again for 2014 model year vehicles. The new system eliminates components by utilizing existing ones to perform new tasks and enhances the life of the tire pressures sensor batteries.

The latest TPMS function is now integrated into the DSC control unit. Therefore a separate TPMS control module is no longer used.

Tire pressure and air temperature are calculated by each of the wheel electronics and forwarded via radio signals.

These radio signals are received by the Remote Control Receiver (FBD) and sent to the Dynamic Stability Control (DSC) control unit via the Flex Ray Bus signal from the Body Domain Controller (BDC). The evaluation of the tire pressures takes place in the DSC.

This system is installed in vehicles from the Start Of Production 9/2013.

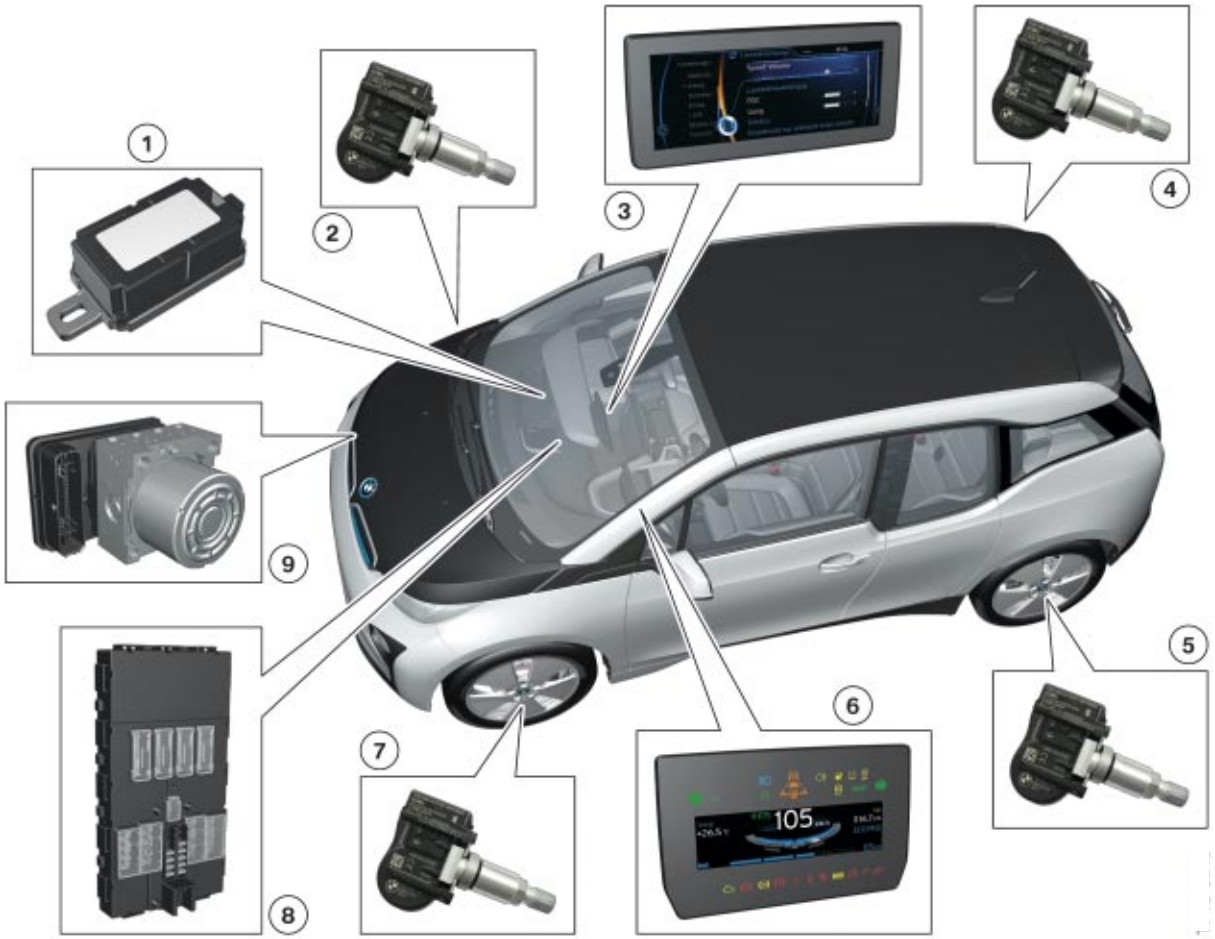
The following vehicles were initially equipped with the new TPMS:

- F15 X5
- I01 i3
- I12 i8
- F8x M3 Sedan, M4 Coupe, Convertible

As of 03/2014 the following vehicles were also equipped with the new system as part of this rolling change:

- F22 2 Series Coupe
- F3x 3 Series Sedan, Touring, GT
- F32 4 Series Coupe, F33 Convertible
- F36 Gran Coupe

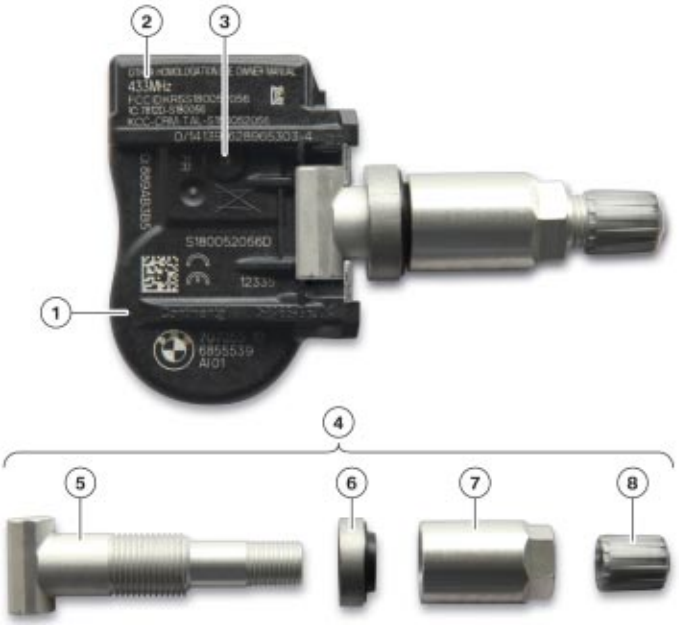
Overview of tire pressure monitoring system (TPMS)



Index	Explanation
1	Remote Control Receiver (FBD)
2	Tire pressure sensor, front right
3	Central Information Display (CID)
4	Tire pressure sensor, rear right
5	Tire pressure sensor, rear left
6	Instrument panel (KOMBI)
7	Tire pressure sensor, front left
8	Body Domain Controller (BDC)
9	Dynamic Stability Control (DSC)

Tire pressure monitoring is a system for monitoring the actual pressure of all four wheels. The latest version of TPMS was introduced with the F15 and used in the I01 and I12. It is integrated into the DSC control unit (9). This means that separate TPMS control unit is not required.

The tire pressures and temperatures of the air in the tires are calculated by the tire pressure sensors (2, 4, 5, 7) at all four wheels and are forwarded via radio signals. The radio signals from the tire pressure sensor are received by the Remote Control Receiver (1) and sent to the DSC control unit via Flex Ray Bus signal from the Body Domain Controller (8). The evaluation function of the tire pressures takes place in the DSC control unit. The tire pressures can be displayed via the Central Information Display. Warnings due to insufficient tire pressure are output via the CID or KOMBI (6).



Tire pressure sensor with repair kit

Index	Explanation
1	Tire pressure sensor
2	Indication of transmitting frequency
3	Pressure sensor
4	Repair kit
5	Valve unit
6	Sealing ring
7	Union nut
8	Valve cap

The tire pressure sensor consists of a pressure and temperature sensor, the radio transmitter, a timer, a battery, the acceleration sensor and the valve unit (5) with sealing ring (6), union nut (7) and valve cap (8). The tire pressure sensors send messages at defined intervals via radio signals to the remote control receiver (FBD). One message contains several data logs with information on the identification number (ID) of the tire pressure sensor, the current tire pressure, the temperature of the air in the tire and the battery status. As the ID numbers are different, the system can differentiate between the various tire pressure sensors.

The tire pressure sensor is located inside the tire. The battery status of the tire pressure sensor should therefore be determined with the assistance of the diagnosis system ISTA before each tire change. If it is likely that the service life of the tire will exceed the service life of the battery, the tire pressure sensor must also be replaced.

The tire pressure sensor used by BMW up till now cannot be used in this new system. A new version of the tire pressure sensor is installed. Therefore when replacing the tire pressure sensor on this new system, make sure that the correct version of the sensor is installed.

If the valve unit is leaking, a repair kit (4) is available in Service. This eliminates the high cost involved in replacing the complete pressure sensor.

Before fitting the tire, check that the battery capacity of the tire pressure sensor is sufficient. The TPMS will malfunction if the incorrect version of the tire pressure sensor is installed.

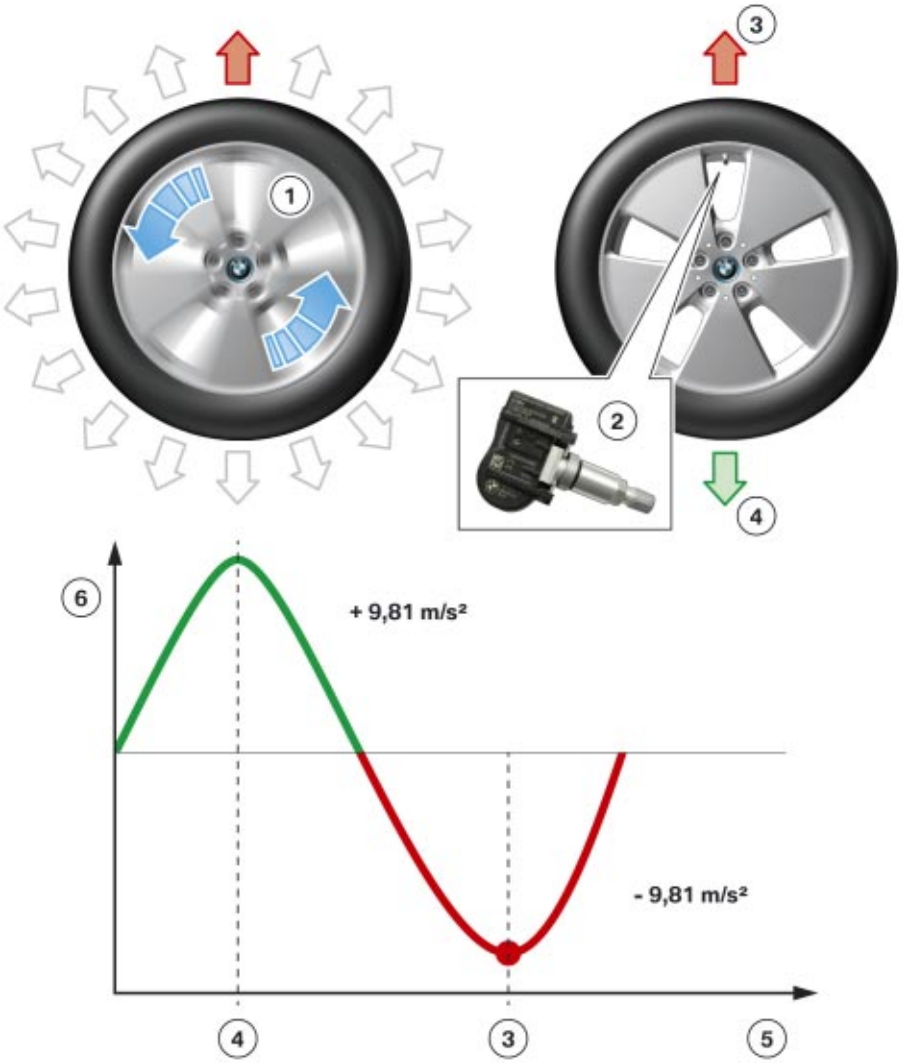
Notes for Service

The service life of the batteries of the tire pressure sensor is roughly 10 years or 330,000 km (186,411 miles). The current value of the service live counter is stated in years and months and can be read out with the help of the diagnosis system.

When removing/installing the tire pressure sensor, the following points must be observed:

- When fitting the tire, make sure the sensor is in the correct position as specified in the repair instructions.
- Do not use high pressure cleaners to clean the wheel rim with integrated tire pressure sensor when the tire has been removed.
- Replace the tire pressure sensor if tire sealant has been used.
- Clean the valve and valve seat thoroughly before installing the tire pressure sensor.
- Do not use solvents or detergents on the tire pressure sensor.
- Do not blow out the tire pressure sensor with compressed air.
- To clean the tire pressure sensor, simply wipe down with a clean cloth.

Rotation detection of the tire pressure sensor



Index	Explanation
1	Rotating wheel
2	12 o'clock position of tire pressure sensor
3	Force resulting from acceleration in opposition to gravitational acceleration
4	Force resulting from acceleration in the same direction as the gravitational acceleration
5	Wheel rotation in degrees
6	Force resulting from acceleration

If a body is set in rotational motion (rotation is movement of a body around its own axis), forces arise due to the inertia. The axis of rotation, from where the acceleration and therefore the resulting force acts in all directions, lies at the center of the body. Based on this principle, the tire pressure sensor can determine whether the wheel is stationary or turning (1).

The tire pressure sensor can be in the following modes:

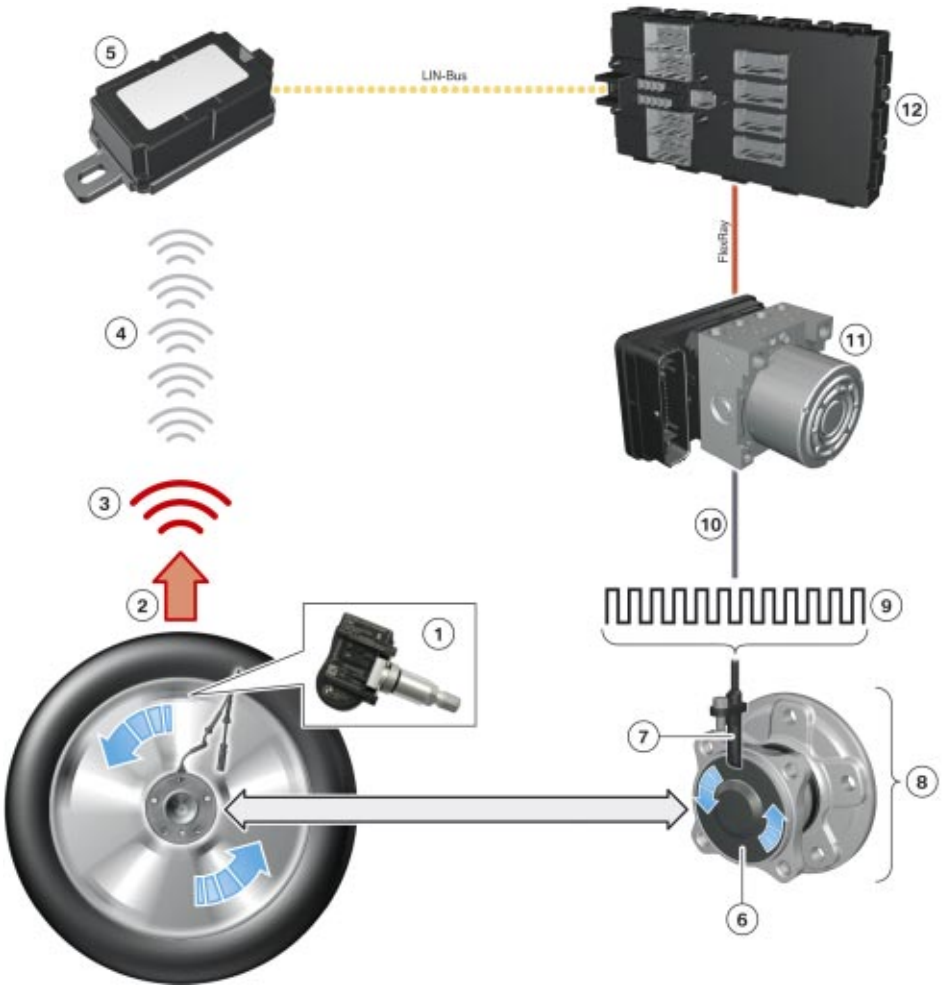
- Sleep mode
- Standby mode
- Teach-in mode

An acceleration sensor is incorporated into each tire pressure sensor. If the acceleration sensor detects a stationary wheel, the tire pressure sensor switches to sleep mode. Messages are not sent to the remote control receiver (FBD) in sleep mode. this increases the service life of the batteries.

As soon as the vehicle starts moving, forces begin to act on the tire pressure sensor. These forces increase as a speed of roughly 30 km/h (18.6 mph) is exceeded. The force is high enough to be captured by the acceleration sensor of the tire pressure sensor. The tire pressure sensors change to standby or teach-in mode and start transmitting at a defined interval.

The 12 o'clock position of the tire pressure sensor (2) can be determined in addition to the wheel rotation. An alternating force acts on the tire pressure sensor at the turning wheel. In the bottom valve position, the rotational movement of the wheel accelerates the tire pressure sensor towards the geocenter. The gravitational acceleration acts with 9.81 m/s² in the same direction which increases the force (4) acting on the tire pressure sensor. In the top valve position, the tire pressure sensor is accelerated away from the geocenter. The gravitational acceleration acts with 9.81 m/s² in the opposite direction, which reduces the force (3) acting on the tire pressure sensor. This effect means that the acceleration sensor in the tire pressure sensor can capture the force that is directed upwards (3). If the tire pressure sensors are in teach-in mode, the precise 12 o'clock position of the tire pressure sensor (2) is required.

Operating principle of wheel assignment



Index	Explanation
1	12 o'clock position of tire pressure sensor
2	Force resulting from acceleration in opposition to gravitational acceleration
3	Message
4	Transmission path
5	Remote control receiver (FBD)
6	Multi-pole sensor gear for ABS sensor
7	Wheel speed sensor
8	Wheel bearing unit
9	Wheel speed signal
10	Wheel speed sensor line
11	DSC control unit
12	Body Domain Controller (BDC)

For the measured tire pressures to be displayed at the Central Information Display (CID), the TPMS must have successfully completed a wheel assignment with the assistance of a teach-in operation.

The teach-in operation comprises the following two phases:

- Checking and storing the ID numbers of the tire pressure sensors assigned to the vehicle. Once the ID numbers have been successfully stored, the system is capable of issuing warnings. **However, tire pressures still cannot be displayed.**
- Determine and store the various installation positions of the tire pressure sensors. Once the installation position has been successfully stored, the system is capable of issuing warnings and displaying tire pressures via the CID.

The teach-in operation starts automatically when the journey starts providing a standstill period of 8 min has been exceeded and cannot be influenced manually. The DSC control unit (11) launches a program as soon as the teach-in operation is active and serves to assign the wheels to the tire pressure sensors. In doing so, the wheel speed signals (9) from the wheel speed sensors (7) are compared with the messages (3) sent from the tire pressure sensor. As both signals are only available during the journey, this process must be performed dynamically. It is not possible to enter teach-in mode when the vehicle is at a standstill.

Each of the four wheel speed sensors (7) is connected to the DSC control unit via a hard-wire connection. This connection is generally referred to as a wheel speed sensor line (10). Each wheel speed sensor line connection with the DSC control unit is different. The different connections are referred to as channels. Each channel is assigned to the installation position of one of the four wheel bearing units.

The channels are differentiated as follows:

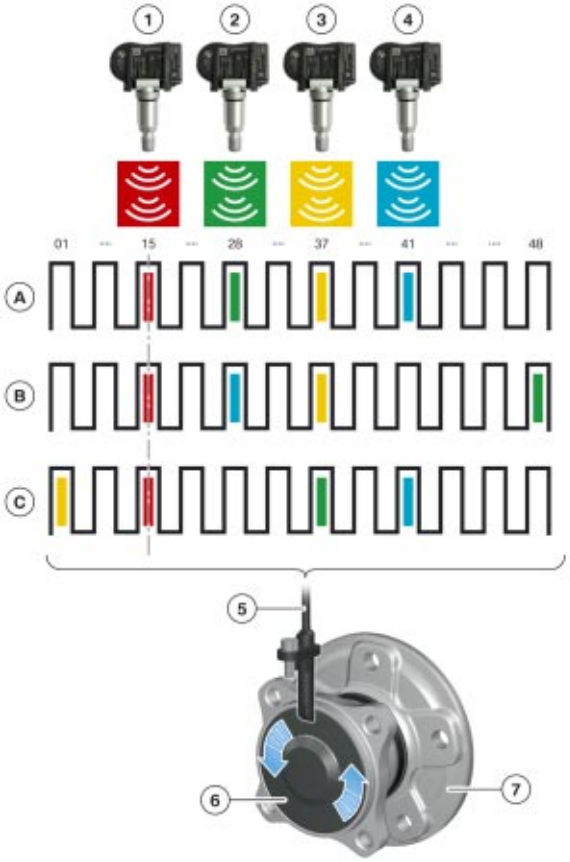
- Front axle on left
- Front axle on right
- Rear axle on left
- Rear axle on right

As each of the wheel speed signals are only imported via the channel assigned to them, the DSC control unit knows the installation location of the wheel bearing unit (8).

The four wheel bearing units are permanently bolted to the four wheels. If the wheels now turn at different wheel speeds (9) during cornering, the DSC control unit can determine the wheel speed and installation position of the four wheels based on the channel assignment.

The four different messages (3) from the tire pressure sensor must now be assigned to the appropriate wheel speed signal (9) and therefore to the correct wheel. In teach-in mode, the messages (3) are only sent from the tire pressure sensors at a defined interval in the 12 o'clock position. This means that, although the four messages (3) are transmitted at different times, each wheel always transmits in the same position (12 o'clock). As a result, the following correlations exist between the wheel speed (9) and messages:

Assignment of a tire pressure sensor



Index	Explanation
A	A Assignment of increments during the first message
B	Assignment of increments during the second message
C	Assignment of increments during the third message
1	Tire pressure sensor with ID 1
2	Tire pressure sensor with ID 2
3	Tire pressure sensor with ID 3
4	Tire pressure sensor with ID 4
5	Wheel speed sensor
6	Multi-pole sensor gear for ABS sensor
7	Wheel bearing unit front right

The multi-pole sensor gear of the ABS sensor (6) is subdivided into 48 increments. The DSC control unit can use the number of increments to determine the number of wheel rotations. The first increment is randomly specified at the start of a journey. The DSC control unit now counts each subsequent increment. The wheel has turned exactly one revolution once 48 increments have been counted.

In teach-in mode, the messages transmitted are assigned an increment from between 1 and 48. After the start of the journey, the DSC control unit receives one message from each of the tire pressure sensors at staggered time intervals. The message and increment are assigned to one another if they arrive at the same time. An example of three successive increment assignments for a wheel (A, B, C) is shown in the previous graphic. This process runs simultaneously for all four wheels. However, to simplify the illustration, only the wheel at the right front wheel bearing unit (7) is considered.

A maximum of 40 messages are transmitted in teach-in mode. The assignment must subsequently be complete. Of the 40 messages in total only 3 are shown in this example.

Assignment of increments during the first message (A):

- Tire pressure sensor with ID 1 transmits at increment 15
- Tire pressure sensor with ID 2 transmits at increment 28
- Tire pressure sensor with ID 3 transmits at increment 37
- Tire pressure sensor with ID 4 transmits at increment 41

Assignment of increments during the second message (B):

- Tire pressure sensor with ID 1 transmits at increment 15
- Tire pressure sensor with ID 2 transmits at increment 48
- Tire pressure sensor with ID 3 transmits at increment 37
- Tire pressure sensor with ID 4 transmits at increment 28

Following evaluation of the three increment assignments (A, B, C) it is noticeable that only the tire pressure sensor with ID 1 is always transmitting at the same increment. The messages of the other three tire pressure sensors are each being transmitted at different increments.

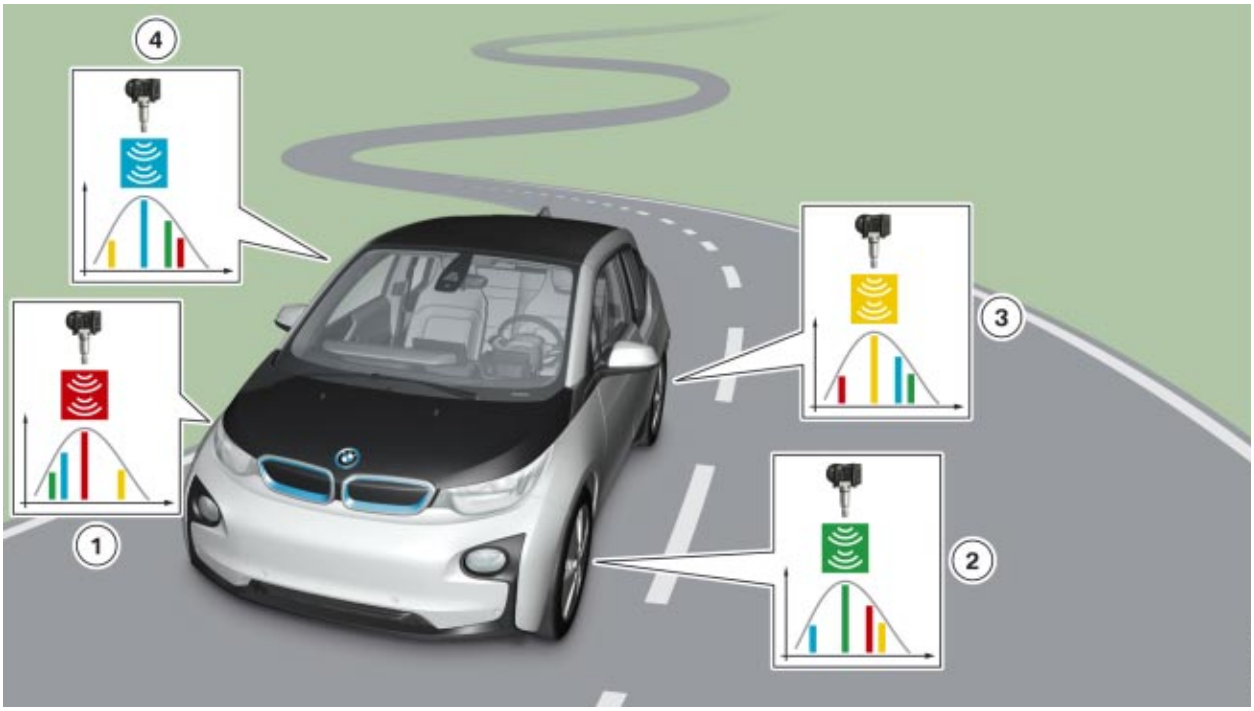
The IDs are shifting to the increments for the following reasons:

- Differences in speed during cornering.
- Slip of wheels during straight-ahead driving and cornering.

If a tire pressure sensor always sends at the same increment, this means it has a fixed mechanical connection with the wheel bearing unit of the wheel speed sensor. If a change in speed or slip occurs at the wheel it therefore has no effect. In our example, the tire pressure sensor with ID 1 (1) has a fixed connection with the front right wheel bearing unit (7).

The wheel assignment for the tire pressure sensor with the ID 1 is complete as the installation location front right has been identified.

Tire pressure sensor teach-in process



The above graphic shows an example of a completed teach-in process.

Index	Explanation
1	Tire pressure sensor with ID 1
2	Tire pressure sensor with ID 2
3	Tire pressure sensor with ID 3
4	Tire pressure sensor with ID 4

It was possible to assign the tire pressure sensor as follows:

- Tire pressure sensor ID 1 to front axle right
- Tire pressure sensor ID 2 to front axle left
- Tire pressure sensor ID 3 to rear axle left
- Tire pressure sensor ID 4 to rear axle right

It is possible to speed up the teach-in process by driving a winding road. This is because there is a much greater difference between wheel speeds during cornering when compared to straight-ahead driving.

During the teach-in process, the vehicle must be driven for a few minutes at a speed higher than 30 km/h (18.6 mph).

Faults in the tire pressure sensor of other vehicles are avoided as this process takes place dynamically during the journey.

The tire pressures can be displayed in the CID as soon as the wheel assignment of all tire pressure sensors is complete.

Transmission Cycles of the Tire Pressure Sensors

The tire pressure sensor can be in three different modes. Sleep mode, teach-in mode or standby mode. The tire pressure sensors transmit their messages at different time intervals in teach-in and standby mode.

To ensure that the wheel assignment works, a message is transmitted in teach-in mode at 16 s intervals when the tire pressure sensors are at 12 o'clock position. How long the teach-in mode lasts depends on a number of factors.

Factors influencing the duration of teach-in mode:

- Tire pressure sensor IDs already identified
- Tire pressure sensor IDs still unidentified
- Route
- Speed

Teach-in mode may therefore last from a few seconds up to 10 minutes at the most. The tire pressure sensors then switch to standby mode and transmit a message at 64 s intervals in any position. Standby mode remains active until the tire pressure sensors switch to sleep mode. The reduced transmission frequency in standby mode increases the battery service life of the tire pressure sensors while the high transmission frequency in teach-in mode ensures that the wheels are quickly assigned.

The different modes of the tire pressure sensors can only be influenced to a limited extent. The following factors affect the modes.

Influences on the modes:

- When the wheel is stationary the tire pressure sensor switches to sleep mode.
- Following a standstill period of > 8 min, the tire pressure sensors begin transmitting in teach-in mode when the journey starts.
- Once teach-in mode has been successfully completed, or following a standstill period of < 8 min, the tire pressure sensors transmit in standby mode when the journey starts.

In order to rule out user errors, the TPMS operates fully automatically. Only the tire pressure initialization must be performed by the user manually. This gives rise to the following special aspects in Service.

As soon as the vehicle is stopped, the TPMS is locked for 8 min in total. The positions of the tire pressure sensors are therefore permanently stored in the DSC control unit and cannot be changed. This prevents a teach-in process from being started each time the vehicle stops. As a wheel change within 8 min is highly unlikely, the tire pressure sensors transmit in standby mode once the journey starts. The tire pressures displayed are based on the wheel assignments most recently taught in. New tire pressure sensors with unknown identification numbers are not taken into consideration and cannot be taught in with this system status.

If the standstill period is greater than 8 min, the positions of the wheels may have changed or new wheels with different tire pressure sensors may have been installed. If the system was not to respond to this state, a possible consequence would be that a puncture could not be detected or that the warning would be based on incorrect installation position. For this reason, following a standstill period of > 8 min, the tire pressure sensors transmit in teach-in mode at a driving speed of roughly 30 km/h (18.6 mph). Parallel to this, the DSC control unit starts the wheel assignment program. It takes less time to teach-in an ID of the tire pressure sensor that is already known thatn it would to teach-in a new unknown ID.

Note: When changing a wheel with this TPMS, make sure that the vehicle is stationary for at least 8 minutes before initializing the tire pressures.

Functional Prerequisites

To ensure that the TPMS issues a correct warning in the event of a pressure drop, an initialization with the tire pressures set correctly must be performed manually.

Prerequisites for an initialization are:

- All four wheels equipped with correct version of the tire pressure sensor
- Sufficient energy in the batteries of the tire pressure sensors
- Prescribed tire pressures at all four wheels

An initialization can be started at any time. However, it is only performed upon completion of the wheel assignment by the TPMS.

The following threshold values are stored in the system:

- Initialization threshold: when the minimum pressure of 2.0 bar is undercut during initialization the “Tire pressure too low” warning is issued
- First warning threshold value with a pressure drop of 20% compared to the initialized nominal pressure
- Second warning threshold when 1.6 bar is undercut

Initializing the Tire Pressure Monitoring System (TPMS)

The TPMS is initialized via the iDrive menu.

The tire pressures must be initialized if:

- The tire pressures have been changed
- A tire change has been carried out
- The tire pressure sensor has been exchanged

The initialization ends with a journey that can be interrupted at any time. When the journey continues, the process is automatically resumed. In order to complete it, a speed of more than 30 km/h (18.6 mph) must be attained. If no measuring results are available, the wheels in the Central Information Display will be grey. A progress bar appears in the CID during the initialization process. Once the initialization has been completed successfully, all four wheels will be displayed in green with the corresponding tire pressures.

To ensure the system works reliably, an initialization must be performed following each wheel change or tire pressure adjustment.

Digital Voltage-Ohm Meter

The ability to measure voltage, current flow, and resistance is important in the diagnosing of electrical problems. Without the results of these measurements troubleshooting in an electrical system is a futile process.

The instrument most commonly used to make electrical measurements is called the Digital Voltage-Ohm Meter (DVOM).

Basic DVOM's are capable of measuring:

- AC Voltage
- DC Voltage
- Millivolts
- Resistance
- Conductance
- Capacitance
- Continuity
- Diode Test
- Amps/Milliamps
- Microamps

Advanced DVOM's add:

- Frequency
- RPM
- Temperature
- Duty Cycle
- Pulse Width

The DVOM provides for a method of accurate measurements.

Even though accurate measurements are the key to electrical diagnosis, the following four factors determine the effectiveness of the measurements:

- Accuracy of the measuring instrument.
- Correct installation in the circuit of the measuring instrument.
- Ability of the Technician to read the instrument.
- Skill of the Technician in interpreting the results.

As it is clearly seen, only one of the factors depends on the DVOM (e.g. accuracy), the rest will always depend on the ability of the technician to read and interpret the results.

Choosing a DVOM

A good choice of a DVOM is the IMIB, as the measuring system of each contains a highly accurate DVOM.

Choosing a handheld DVOM from a reputable manufacturer, however, leaves the shop IMIB free to perform other tasks that a DVOM can not do (e.g. Retrieval of fault codes, Oscilloscope, etc.).

In choosing a DVOM several factors need to be considered, one of which is impedance.

Impedance is the combined resistance to current created by the resistance, capacitance and inductance of the meter. Impedance is measured in 'Ohms per Volt'.

Meters with the highest 'Ohms per Volt' impedance are the most accurate. More importantly using a meter with high impedance will not cause damage to sensitive electronic circuitry.

When a Meter is connected across a circuit to measure voltage, it must be connected in parallel. This adds parallel resistance. The total resistance in a parallel circuit is less than the lowest resistance in that circuit (Ohms Law). Using a Meter with low impedance will reduce the total resistance of the circuit and allow more current to flow.

A meter with low impedance can draw enough current to cause inaccurate measurement, voltage drops or damage sensitive electronic circuit boards. A high impedance meter will draw little current and insure accurate readings.

Using older type meters with low impedance values (20,000 to 30,000 ohms-per-volt) can damage modern electronic circuits and components or give inaccurate readings.

Test lights should be avoided for the same reason. They lower the total resistance of the circuit and cause increased current flow.

Other factors in choosing the proper DVOM are:

- Cost
- Features

Basic DVOM's are available reasonably priced. These basic models may be more than sufficient for use in BMW Group Centers, given the availability of the IMIB for advanced measurement and scope functions.

Advanced features and price go hand in hand. The more features added the higher the cost. Some of those features may be worth the increase in cost (e.g. frequency, duty cycle and pulse width). Other features may not (e.g. oscilloscope, graphing).

Choose a DVOM wisely based on personal preference and cost. Like many other tools it is valuable in the diagnosis and repair of our vehicles. Experience has shown if the technician is not comfortable with the DVOM or confident in the results of the measurements, the DVOM will not be used.

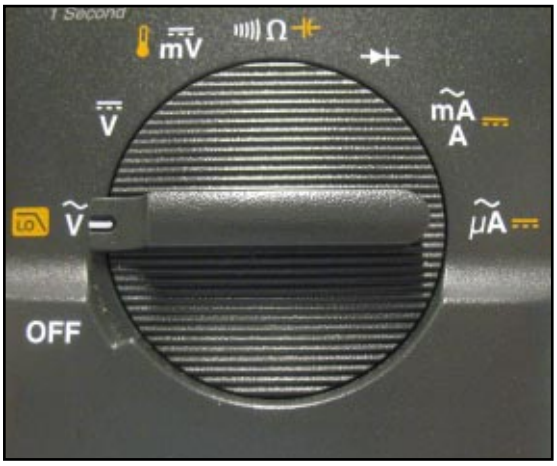
Considering the technology in BMW/MINI automobiles, diagnosing with a quality DVOM certainly makes repairing the problem correctly and expediently a more manageable task.

DVOM Functions

(FLUKE 87 V used as an example)

Function Selector Rotary Switch

Power to the meter is turned off.



Volts AC

Measures AC Voltage
Ranges: 600.0 mV, 6.000 V,
60.00 V, 600.0 V, and 1000 V

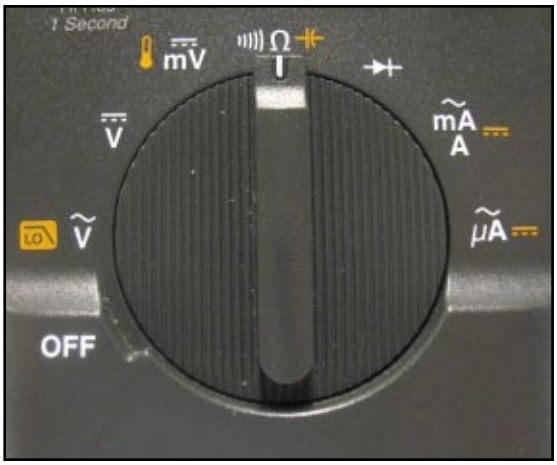
Volts DC, RPM

Measures DC Voltage
Ranges: 600.0 mV 6.000 V,
60.00 V, 600.0 V, and 1000 V

mV / Temperature

Measures DC Millivolts
Range: 600.0 mV;
–328.0 °F to 1994.0 °F

Function Selector Rotary Switch (Cont.)



Continuity / Ohms / Capacitance

Measures Continuity and Ohms.
Ranges: 600.0 Ω, 6.000 kΩ, 60.00 kΩ, 600.0 kΩ, 6.000 MΩ, and 50.00MΩ; 10.00 nF, 100.0 nF,1.000 μF, 10.00 μF, 100.0 μF, and 9999 μF

Diode Test

Test diode operation.
Range: 3.000V

Milliamp or Amps AC / DC

Measures DC Milliamps or amps.
Ranges: 60.00 mA, 400.0 mA, 6000 mA, and 10 A

Microamps or Amps AC / DC

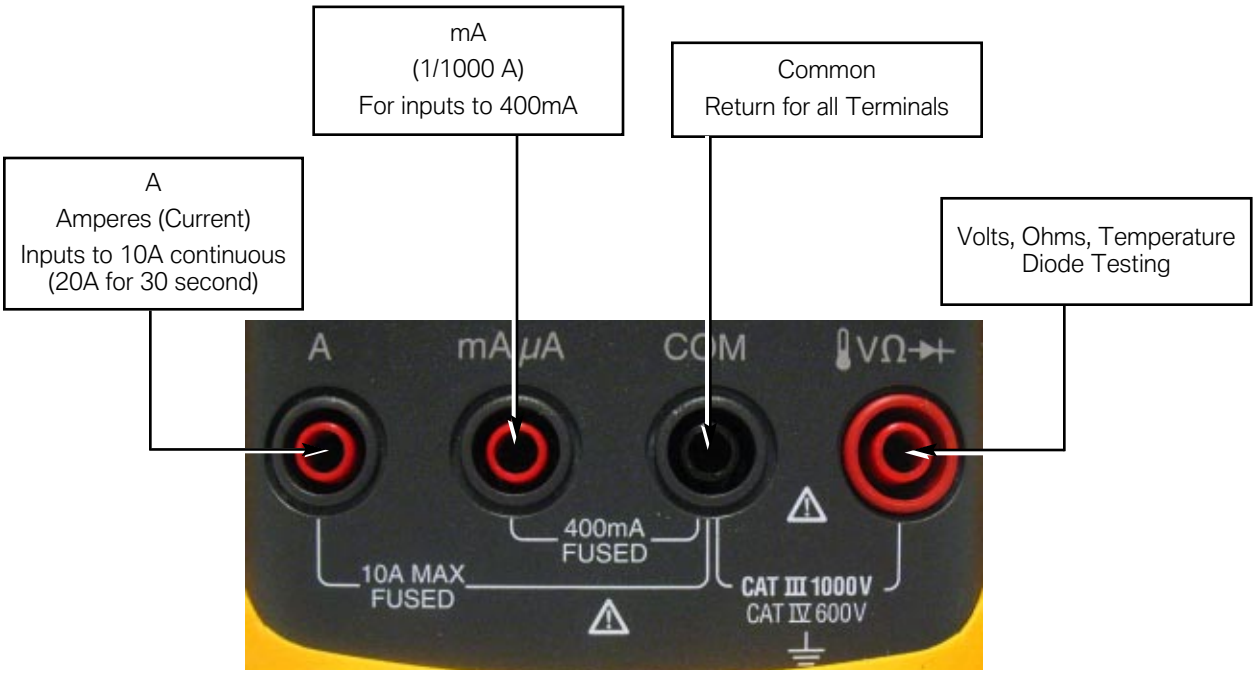
Measures AC Milliamp or amps
Ranges: 600.0 μA, 6000 μA, and 10 A

Push Button Functions

Button	Switch Position	Function
	Ω ⊣⊢ mV V mA / A µA **Power-up**	Selects capacitance Selects temperature Selects AC low pass filter function Switches between DC and AC current Switches between DC and AC current Disables automatic power-off feature (Meter normally powers off in 30 minutes). The Meter reads "PoFF" until the "yellow" button is released.
	Any switch position **Power-up**	Starts recording of minimum and maximum values. Steps the display through MAX, MIN, AVG (average), and present readings. Cancels MIN MAX (hold for 1 second). Enables the Meter's calibration mode and prompts for a password. The Meter reads "CAL" and enters calibration mode.
	Any switch position mV **Power-up**	Switches between the ranges available for the selected function. To return to autoranging, hold the button down for 1 second. Switches between °C and °F. Enables the Meter's smoothing feature. The Meter reads "S___" until the range button is released.

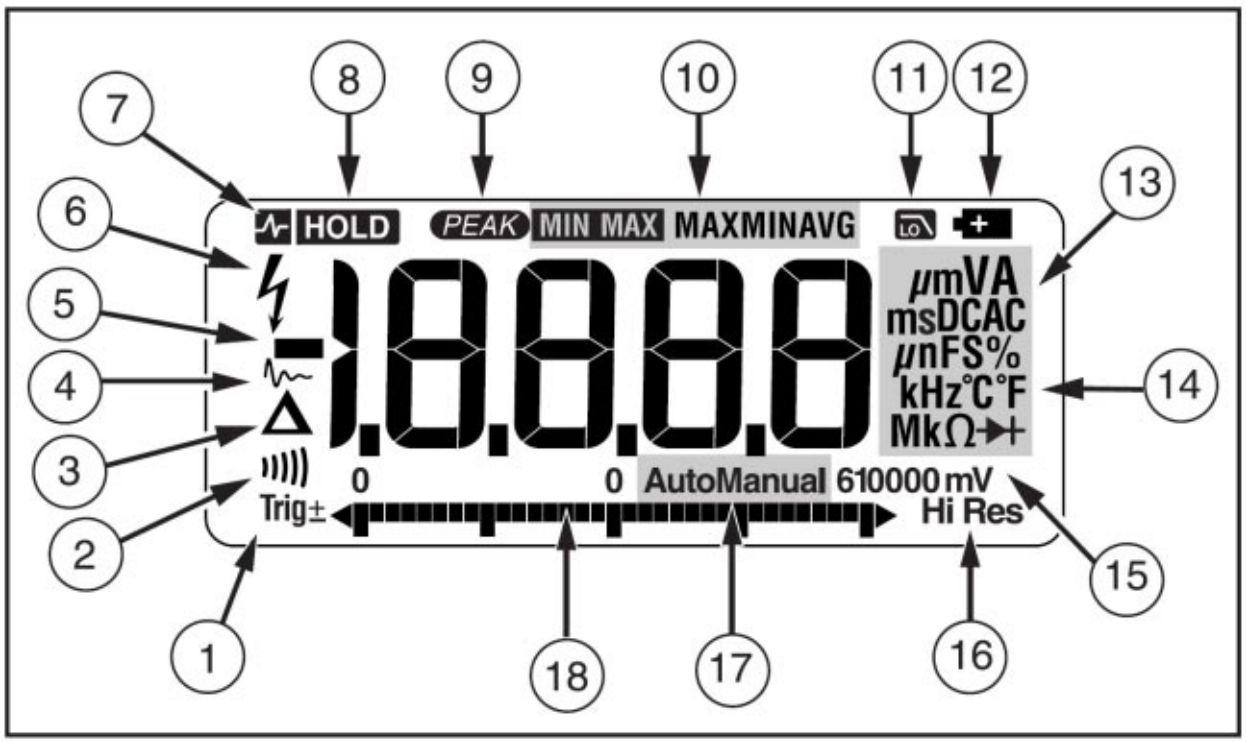
Button	Switch Position	Function
	Any switch position MIN MAX recording Frequency counter **Power-up**	AutoHOLD (formerly TouchHold) captures the present reading on the display. When a new, stable reading is detected, the Meter beeps and displays the new reading. Stops and starts recording without erasing recorded values. Stops and starts the frequency counter. Turns on all LCD segments.
	Any switch position	Turns the backlight on, makes it brighter, and turns it off. Hold down for one second to enter the HiRes digit mode, 4-1/2 digit mode. The “HiRes” icon appears on the display. To return to the 3-1/2 digit mode, hold down for one second. HiRes=19,999 counts.
	Continuity MIN MAX recording Hz, Duty Cycle **Power-up**	Turns the continuity beeper on and off Switches between Peak (250 µs) and Normal (100 ms) response times. Toggles the meter to trigger on positive or negative slope. Disables the beeper for all functions. The Meter reads “bEEP” until the button is released.
	Any switch position **Power-up**	Stores the present reading as a reference for subsequent readings. The display is zeroed, and the stored reading is subtracted from all subsequent readings. Enables zoom mode for the bar graph. The Meter reads “2rEL” until the relative button is released.
	Any switch position except diode test **Power-up**	Press for frequency measurements. Starts the frequency counter. Press again to enter duty cycle mode. Enables the Meter’s high impedance mode when the mV DC function is used. The Meter reads “Hi2” until the button is released.

Input Terminals



NOTES

Display



Index	Feature	Indication
1	±	Polarity indicator for the analog bar graph.
	Trig ±	Positive or negative slope indicator for Hz/duty cycle triggering.
2	)))))	The continuity beeper is on.

Index	Feature	Indication
3		Relative (REL) mode is active.
4		Smoothing is active.
5		Indicates negative readings. In relative mode, this sign indicates that the present input is less than the stored reference.
6		Indicates the presence of a high voltage input. Appears if the input voltage is 30 V or greater (ac or dc). Also appears in low pass filter mode. Also appears in cal, Hz, and duty cycle modes.
7		AutoHOLD is active.
8		Display Hold is active.
9		Indicates the Meter is in Peak Min Max mode and the response time is 250 µs.
10		Indicators for minimum-maximum recording mode.
11		Low pass filter mode.
12		The battery is low.  **To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears!**

Index	Feature	Indication
13	A, µA, mA	Amperes (amps), Microamp, Milliamp
	V, mV	Volts, Millivolts
	µF, nF	Microfarad, Nanofarad
	nS	Nanosiemens
	%	Percent. Used for duty cycle measurements.
	Ω, MΩ, kΩ	Ohm, Megohm, Kilohm
	Hz, kHz	Hertz, Kilohertz
	AC DC	Alternating current, direct current
14	°C, °F	Degrees Celsius, Degrees Fahrenheit
15	610000 mV	Displays selected range
16	HiRes	The Meter is in high resolution (Hi Res) mode. HiRes=19,999
17	Auto	The Meter is in autorange mode and automatically selects the range with the best resolution.
	Manual	The Meter is in manual range mode.

Index	Feature	Indication
18		The number of segments is relative to the full-scale value of the selected range. In normal operation 0 (zero) is on the left. The polarity indicator at the left of the graph indicates the polarity of the input. The graph does not operate with the capacitance, frequency counter functions, temperature, or peak min max. For more information, see “Bar Graph”. The bar graph also has a zoom function, as described under "Zoom Mode".
--		Overload condition is detected.

Error Messages	
bAtt	Replace the battery immediately.
diSC	In the capacitance function, too much electrical charge is present on the capacitor being tested.
EEPr Err	Invalid EEPROM data. Have Meter serviced.
CAL Err	⚠ Invalid calibration data. Calibrate Meter.
LEAd	Test lead alert. Displayed when the test leads are in the **A** or **mA/µA** terminal and the selected rotary switch position does not correspond to the terminal being used.

Infinity Display

While most displays of DVOMs are standard (i.e. mV means millivolt, mA means milliamp) the display or symbol for infinity or open circuit can be confusing. A display of 0 Ω indicates no or little resistance. It means the circuit or portion of the circuit being measured has continuity or is complete. A reading of OL means the circuit is open or not complete, the resistance is said to be “INFINITY”. Some meters may use the symbol B for Infinity. Be aware of which reading the meter being used will give for infinity or open circuit.

Display on Fluke 87 V

Using the DVOM

Voltage Testing

The voltmeter (DVOM) must be connected in parallel with the load or circuit.

The DVOM has a high resistance and taps off a small amount of current.

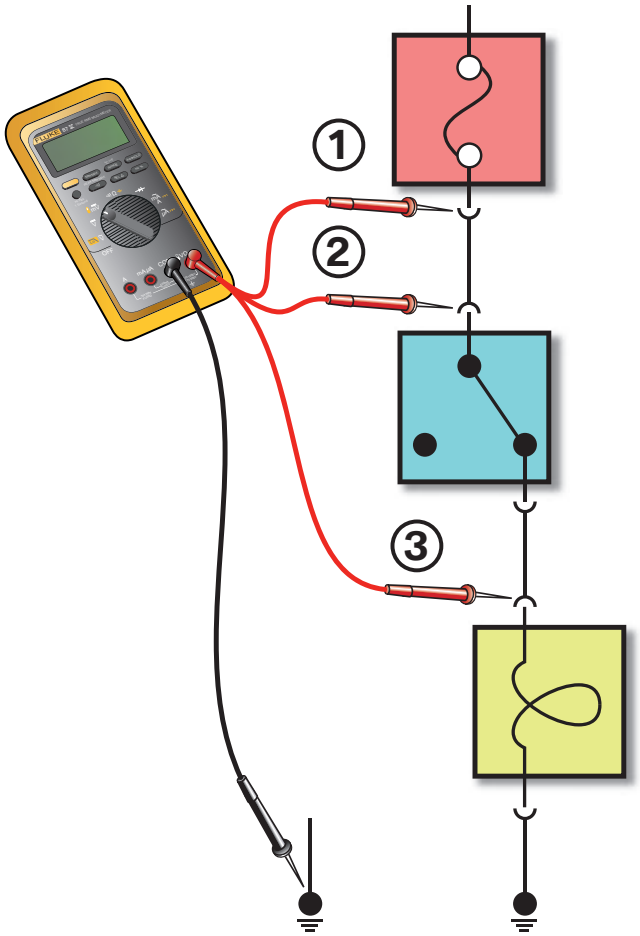
A voltmeter must be used with the current on and with the correct polarity.

The red lead should be connected to the B+ side of the circuit and the black lead to the B- side of the circuit.

If the leads are reversed the reading will be a negative number.

- Select proper function and range of DVOM.
- Connect (-) lead of meter to battery B- or known good ground.
- Connect (+) lead of meter to test circuit.

DVOM will indicate supply or available voltage at that point.



Typical Application of Voltage Testing

- Checking Power Supply.
- Charging System.
- Complete Basic Circuits.
- Control Module Functions (Input/Output).

Measure at different points checking for change or interruption in the voltage supply.

Voltage Drop Testing

Voltage Drop Tests determine the resistance of an active circuit, a circuit with current flowing.

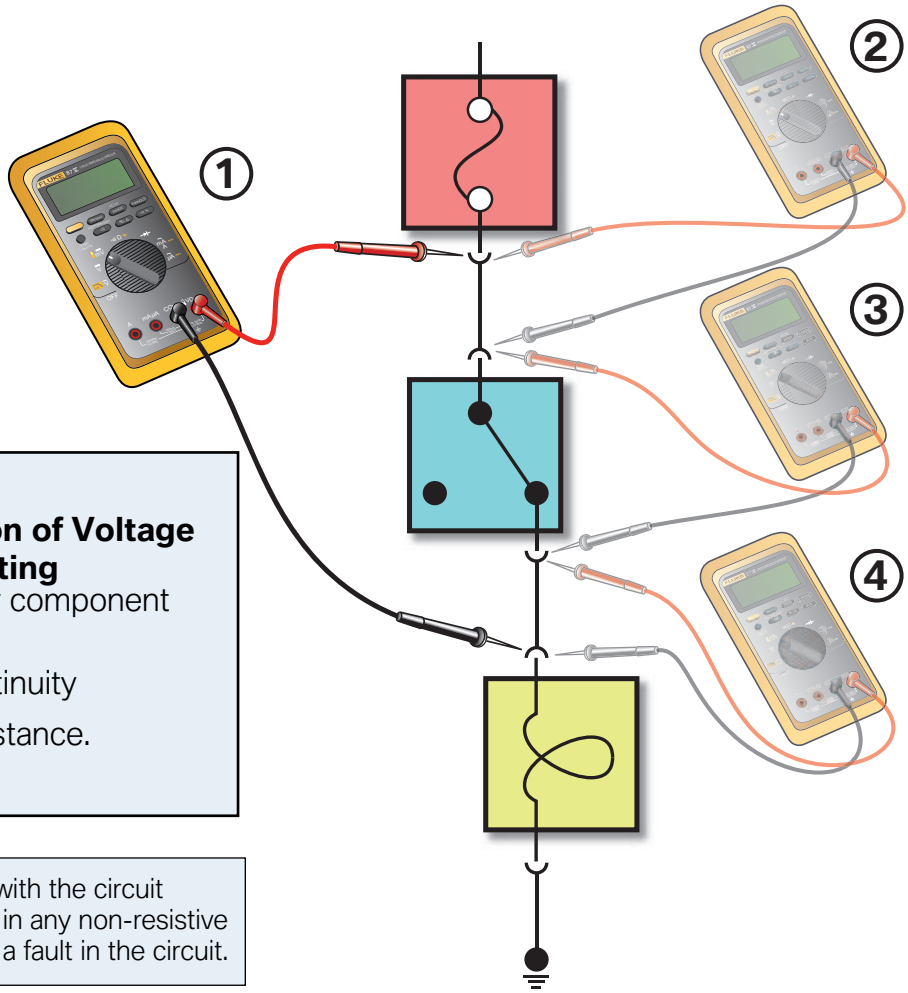
Voltage drop tests are preferred over simple resistance measurements because the power source is not removed from the circuit.

By measuring the voltage on both sides of a load, the amount of voltage consumed by the load is measured.

The voltage drops of each part of a series circuit added together must equal the power supply for that circuit while it is active.

- Select proper function and range of DVOM.
- Connect (+) lead to the B+ side of the circuit or component being tested.
- Connect (-) lead to the B- side of the circuit or component.

DVOM display will indicate the voltage drop in the circuit tested between the DVOM leads.



Typical Application of Voltage Drop Testing

- Determine proper component operation.
- Active circuit continuity
- Active circuit resistance.

As a “Dynamic” test with the circuit operational, a voltage drop in any non-resistive part of the circuit indicates a fault in the circuit.

Power Supply and Monitoring

The power supply of most current BMW Group vehicles is a combination of hardware and software that ensures the necessary power for all the vehicle systems.

Essentially it can be divided into two major functions:

- Energy management
- Power management

The energy management system ensures that sufficient starter motor current is always available and monitors the vehicle even when the engine is off. Energy management includes all the components in the vehicle that generate, store and consume energy. The data for the energy management is distributed across a number of control modules.

Power management is a subsystem of the energy management. The power management is run by the engine control module Digital Engine Electronics or Digital Diesel Electronics (DME or DDE). While the vehicle is being driven, the power management regulates the power output of the alternator as well as the battery charging.

Due to the amount of onboard electronics, current vehicles can have two batteries installed.

Index	Explanation	Index	Explanation
1	Engine	5	Junction box
2	Alternator	6	Electrical load/consumers
3	Intelligent battery terminal	7	Engine management - power management
4	Battery		

A vehicle's electrical system basically consists of an energy storage device (battery), an energy generator (alternator) and a large number of electrical loads (electrical/electronic devices). Electrical energy is taken from the battery in order to start the engine via the starter (electric load). Once the engine is running, the alternator supplies current which, in the ideal case, is sufficient to supply all electric loads and charge the battery. If the current requirement of the connected electrical loads is higher than the current supplied by the alternator, the system voltage will drop to the level of the battery voltage and the battery will be discharged.

The task of the vehicle electrical system is to provide electrical energy for the vehicle and all its functions. Priority is given to maintaining the starting capability of the vehicle. The purpose of the energy management system is to ensure and balance the energy in the vehicle under all operating conditions.

The main component of every energy management system is the power management software in the engine control unit (DME/DDE). The task of the power management software is to control the flow of energy in the vehicle.

The alternator is designed to supply current to all electrical loads and charge the battery. If the alternator is not able to supply sufficient current to the electrical loads the additional current requirement is taken from the battery.

Electrical Load/Consumer Deactivation

The loads/consumers can be categorized as follows:

- Comfort loads/consumers (heated window, seat heating, steering wheel heating).
  - These loads/consumers switch off automatically after engine "OFF" and can be activated again after the vehicle has been restarted.
- Stationary loads/consumers required by law (side lights, hazard warning lights, must be operational after engine "OFF" for a specific length of time).
  - Legally required stationary loads/consumers are not switched off even on reaching the start capability limit of the battery.
- Other stationary loads/consumers (independent heating, independent ventilation, central information display, telephone, telematic services).
  - Other stationary loads/consumers can be switched on after engine "OFF." The comfort electric loads/consumers switch off automatically on reaching the start capability limit of the battery. Switch-off is requested by the DME in the form of a CAN message.
- System-related after-running loads/consumers (electric radiator fan).
  - System-related after-running loads/consumers can maintain operation for a defined period of time.

Closed-circuit Current Diagnosis

A fault code is stored in the DME/DDE when the battery current exceeds a defined value during the vehicle rest phase.

Battery Charge Management

There are two "counters" in the power management module. One counter is responsible for the battery charge and the other for the battery discharge level. The State of Charge (SoC) of the battery is formed by the difference between the charge acceptance and draw levels. The power management module receives the corresponding data from the IBS via the BSD line.

The power management module calculates the current SoC value on restarting of the vehicle.

Battery - State of Health

When the vehicle is started, the battery terminal voltage and the starting current of the starter are measured by the IBS.

The starting current and voltage dip determined during the start phase are transferred via the BSD line to the DME/DDE. From this data, the power management module calculates the State of Health (SoH) of the battery.

Data Transfer to the IBS

The following data are transferred via the BSD line (or LIN-Bus depending on model) to the IBS before the DME goes into sleep mode:

- State of Charge of the battery (SoC)
- Outside temperature
- Available discharge level
- Terminal 15 wake-up enable
- Terminal 15 wake-up disable
- DME close

Transport Mode

The batteries in vehicles coming off the production line are adequately charged so that SoC > 80% (SoC = “State of Charge”). However, since several days or weeks can pass between the time the vehicle comes off the production line and when it is delivered to the customer, the battery will have discharged to a greater or lesser degree. Therefore, every battery must be charged according to the recharging calendar.

The F01/F02 is the first model on which it is possible to display the charge level of the battery when the new car is being transported. When production or transport mode is activated, a Check Control message is generated that provides a quick indication of the battery condition.

If the SOC has dropped to less than 35%, the indication continues to be displayed on the instrument cluster until the battery is replaced and a change of battery is registered.

Indication of Battery Condition

Battery condition	Display on instrument cluster	Audible signal	Action
Battery condition OK. SoC 60% to 100%		No sound	No action necessary.
Battery is discharged. SoC 35% to 60%		No sound	Charge battery.
Battery charge level is very low. SoC less than 35%		Double gong	Replace battery.

When transport mode is reset, there is no indication on the instrument cluster of the battery charge level.

If the vehicle is delivered with the red Check Control message “Battery charge level very low” active, it is essential that the low battery charge is recorded as transport damage on the delivery note.

In such cases, the test module “Energy diagnosis” must be carried out to establish the cause. Replace the battery before handing over the vehicle to the customer and register the change of battery using the service function.

If a vehicle is delivered with the yellow Check Control message “Charge battery”, this should also be recorded on the delivery note. The battery must then be charged once and an energy diagnosis carried out.

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