Reference Manual

F01 / F02
LIFE CYCLE IMPULSE

Technical Training

Reference Manual

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BMW
Technical Training

F01/F02 Life Cycle Impulse (LCI)

BMW of North America, LLC
Technical Training
ST1212
09/1/12

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Technical training.
Product information.

F01/F02 LCI Introduction

Edited for the U.S. market by:
BMW Group University
Technical Training
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BMW Service

General information

Symbols used

The following symbol/schematic diagram is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

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This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further deviations may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

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Information status: **May 2012**
VH-23/International Technical Training

F01/F02 LCI Introduction

Contents

F01/F02 LCI Introduction

1. Introduction

In July 2012, just three and a half years after the market introduction of the F01/F02, the model revision LCI (Life Cycle Impulse) will be available on the market. The LCI model introduces a new engine (N63 TU) and contains visible upgrades in the front and rear styling, as well as improvements in comfort and infotainment.

These improvements include:

- Adaptive LED headlights
- New rear seat entertainment system with 9" display screens
- Bang & Olufsen Surround Sound system
- Acoustic measures to reduce noise
- The suspension was enhanced to increase ride comfort.

The model range of the F01/F02 LCI comprises the following models:

F01	F02
BMW 740i	BMW 740Li
—	BMW 740Li xDrive
BMW 750i	BMW 750Li
BMW 750i xDrive	BMW 750Li xDrive
BMW 760i	BMW 760Li

F01/F02 LCI front and rear view

F01/F02 LCI Introduction

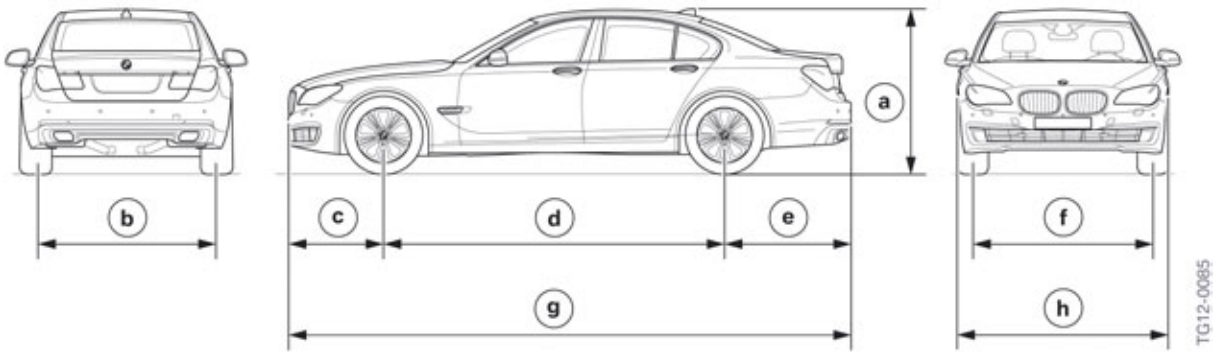
1. Introduction

F01 LCI side view

1.1. Further information

Only the new features and adaptations of the F01/F02 LCI are described in this document. Further information on topics not dealt with here can be found in the ST811 F01 Complete Vehicle " Introduction" training material available on TIS and ICP:

1.2. Vehicle dimensions



F01 LCI garage dimensions

The length of the F01 LCI and the F02 LCI was increased by 7 mm with the model revision. Although the wheelbase remains unchanged, the F01 LCI is 8 mm lower, the F02 LCI is 3 mm higher than previous model.

Index	Explanation		F01	F01 LCI	F02	F02 LCI
a	Rear track width, basic wheels	[mm]	1650	1650	1650	1650
b	Vehicle width with exterior mirror	[mm]	2134	2142	2134	2142
c	Front overhang	[mm]	864	866	864	866

F01/F02 LCI Introduction

1. Introduction

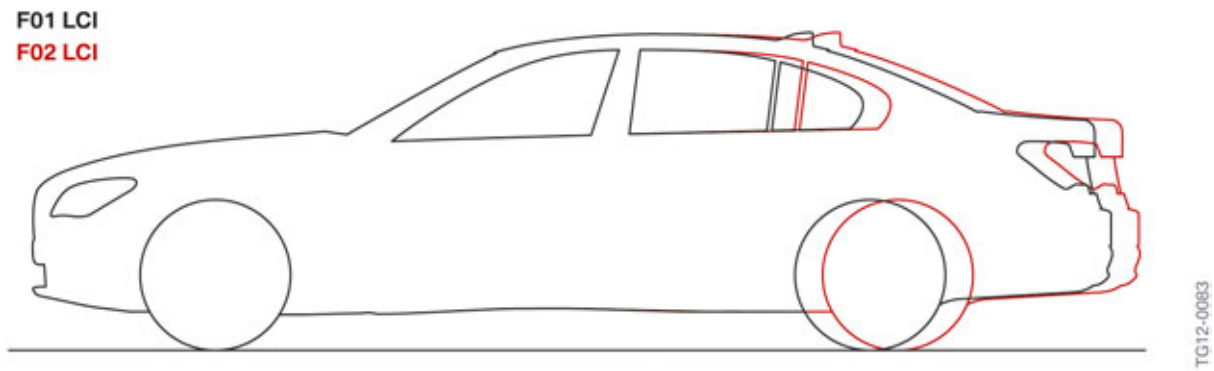
d	Wheelbase	[mm]	3070	3070	3210	3210
e	Rear overhang	[mm]	1138	1143	1138	1143
f	Vehicle length	[mm]	5072	5079	5212	5219
g	Vehicle height, empty	[mm]	1479	1471	1478	1481
h	Front track width, basic wheels	[mm]	1611	1611	1611	1611
i	Vehicle width excluding exterior mirrors	[mm]	1902	1902	1902	1902

1.2.1. Weights and load capacities

Weights as per DIN of the F01/F02 LCI in the European version and their load capacities are set out in the following table.

Vehicle	Transmission	Unladen weight [kg]	Payload [kg]
BMW 740i	Automatic transmission	1825	650
BMW 750i	Automatic transmission	1940	640
BMW 750i xDrive	Automatic transmission	2000	640
BMW 760i	Automatic transmission	2105	590
BMW 740Li	Automatic transmission	1845	650
BMW 740Li xDrive	Automatic transmission	2080	520
BMW 750Li	Automatic transmission	1960	640
BMW 750Li xDrive	Automatic transmission	2035	640
BMW 760Li	Automatic transmission	2175	575

1.3. Silhouette comparison

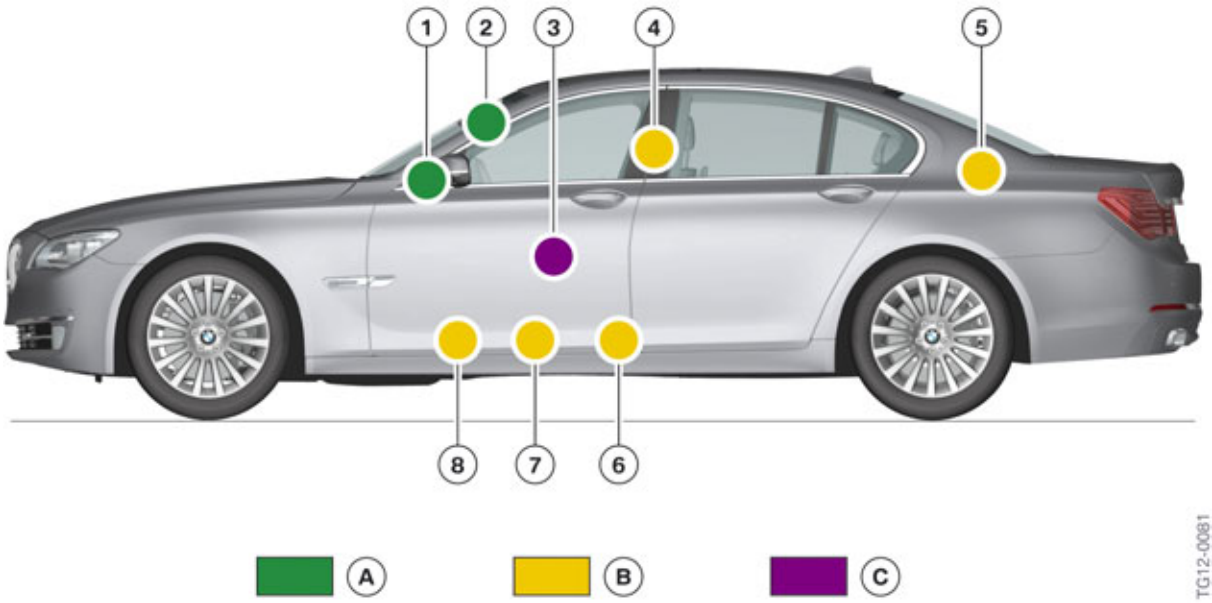


F01/F02 LCI silhouette comparison

F01/F02 LCI Introduction

2. Acoustic Measures

The background noise in the vehicle was able to be reduced significantly in different areas through the use of additional insulating materials. These areas are shown in the following graphic.



F01/F02 LCI measures to reduce noise

Index	Explanation
A	Wind noise measures
B	Rolling noise measures
C	General measures
1	Optimized mirror base and triangle
2	Optimized retaining trim
3	Door insulation
4	Sound insulation, B-pillar, top
5	Sound insulation, C-pillar
6	Sound insulation, B-pillar, bottom
7	Sound insulation, central base
8	Sound insulation, entrance

Openings at the B-pillar were insulated with sealing caps. To provide noise insulation, 10 mm absorbers are installed between the B-pillar panelling and body with 15 mm absorbers in the lower area.

Sound insulation is used between the central base and floor trim.

Absorbers are also used in the cavities of the C-pillars which help minimize rolling noises.

A 19 mm absorber is installed in the doors (in the area of the function carrier) to enhance noise insulation.

F01/F02 LCI Introduction

2. Acoustic Measures

F01/F02 LCI door insulation

Index	Explanation
1	Absorber

F01/F02 LCI Introduction

3. Exterior Trim

The exterior changes to the F01/F02 LCI include:

- Bi-xenon headlight with standard LED daytime driving lights
- Newly designed front and rear bumper cover
- Air curtain for improved air circulation and a reduction of the CO_2 emissions
- Modified exterior mirrors with integrated turn indicator
- New rear lights
- LED fog light (standard equipment 5A1)
- Adaptive LED headlight (optional equipment 552 except on BMW 760 models)

F01/F02 LCI design changes

Index	Explanation
1	Exterior mirror with integrated turn indicator
2	Adaptive LED headlight (optional equipment)
3	Modified radiator grill frame with new bridge distribution
4	New front bumper cover with air curtain
5	New rear lights
6	New rear bumper cover

F01/F02 LCI Introduction

4. Interior Equipment

Changes were also made to the interior compartment of the F01/F02 LCI:

- Chrome application at the frame of the central information display CID and at the cover of the cupholder
- Two additional upholstery color and three new decorative strips.

F01/F02 LCI center console

Index	Explanation
1	Chrome application

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F01/F02 LCI Powertrain and Chassis

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F01/F02 LCI Powertrain and Chassis

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F01/F02 LCI Powertrain and Chassis

1. Powertrain

1.1. Powertrain variants

F01/F02 LCI Powertrain

1.1.1. Models

The following models are available for the market introduction of the F01/F02 LCI:

F01	F02
BMW 740i	BMW 740Li
—	BMW 740LiH
—	BMW 740Li xDrive
BMW 750i	BMW 750Li
BMW 750i xDrive	BMW 750Li xDrive
BMW 760i	BMW 760Li

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Gasoline engines

BMW	740i 740Li 740LiH 740Li xDrive	750i 750i xDrive 750Li 750Li xDrive	760Li
Engine	N55B30O0	N63B44O1	N74B60U0
Automatic transmission	GA8HP45Z (*)	GA8HP70Z	GA8HP90Z

(*) The 740LiH ActiveHybrid uses the GA8P70HZ

1.1.2. Further information

The descriptions of the engines and the eight-speed automatic transmission can be found in the following training manuals:

- ST916 N55 engine training manual
- ST1209 N63TU engine training manual
- ST915 N74 engine training manual
- GA8HP automatic transmission (described in the ST116 F25 Complete Vehicle and in the “Powertrain” section).

Information regarding the engines can also be found in the following online web courses and training videos on ICP:

- VO916 N55 engine VOD
- VO915 N74 engine VOD
- OL1209 N63TU engine WBT

1.2. Engines

1.2.1. N55 engine

The N55 engine is the successor to the N54. Technical updates and modifications make it possible to use only one exhaust turbocharger instead of two. The technical data has remained virtually the same - with reduced costs and improved quality.

Highlights:

- TwinScroll exhaust turbocharger
- Air-gap-insulated exhaust manifold six in two; engine-proximate catalytic converter
- Direct fuel injection with central injector location, solenoid valve injectors
- 3rd generation Valvetronic

F01/F02 LCI Powertrain and Chassis

1. Powertrain

- Upstream Digital Engine Electronics (MEVD17.2 Bosch), integrated in air intake system, FlexRay-compatible
- Lightweight crankshaft
- Map-controlled oil pump
- Uniform single-belt drive across all model series
- Initial introduction in the F07, then cross-series introduction.

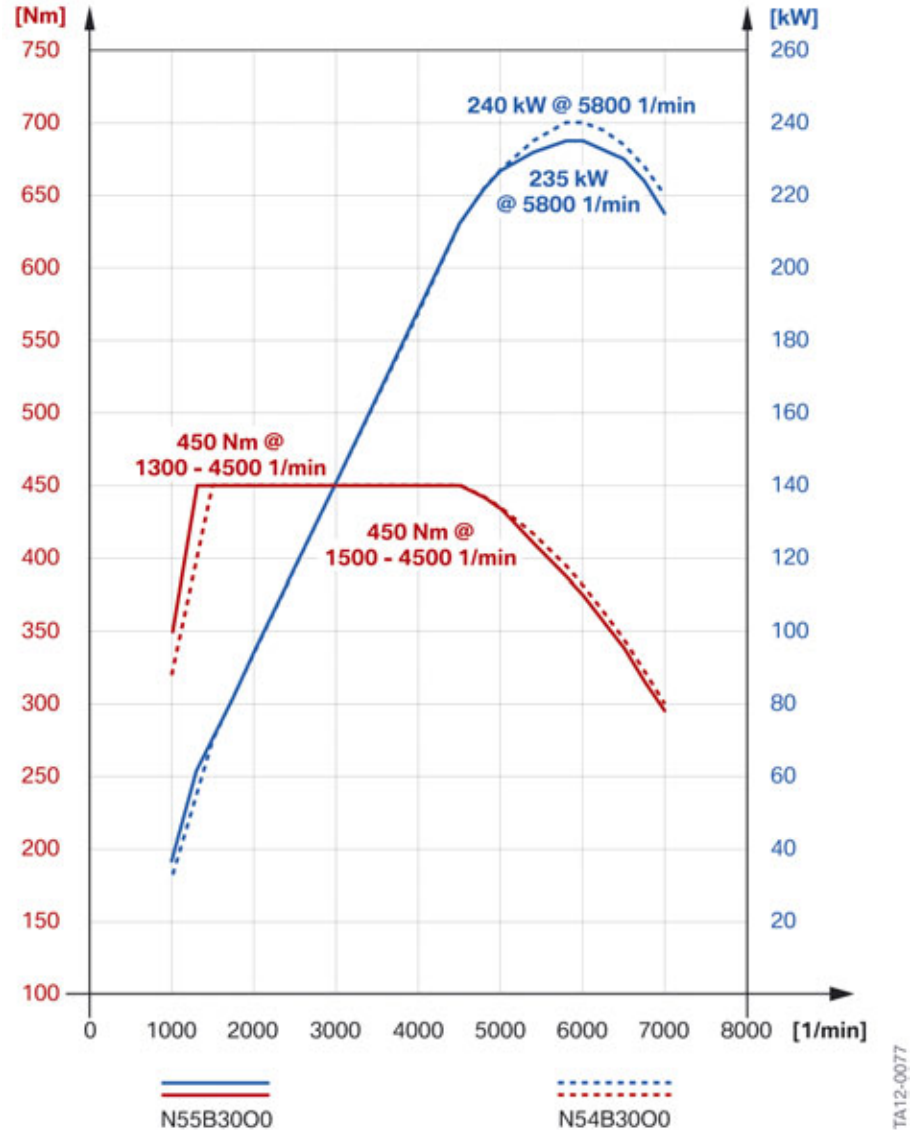
Technical data

		N54B30O0 F01, 740i F02, 740Li	**N55B30O0 F01 LCI, 740i F02 LCI, 740Li F02 LCI, 740LiH F02 LCI, 740Li xDrive**
Design		R6	R6
Valves per cylinder		4	4
Engine control		MSD 87	MEVD17.2.6
Displacement	[cm^3]	2979	2979
Stroke/Bore hole	[mm]	89.6/84.0	89.6/84.0
Power output at engine speed	[kW (HP)] [rpm]	240 (326) 5800	235 (315) 5800
Torque at engine speed	[Nm (lb-ft)] [rpm]	450 (332) 1500 – 4500	450 (332) 1300 – 4500
Compression ratio	[ε]	10.2 : 1	10.2 : 1
Fuel grade		RON 95 – 98	RON 91 – 98
Exhaust emission standards		EURO 5 (ULEV II)	EURO 5 (ULEV II)
Fuel consumption complying with EU	[l/100 km]	9.9 (F01) 10.0 (F02)	7.9 (F01 LCI) 7.9 (F02 LCI) 8.3 (F02 LCI xDrive)
Acceleration 0 – 60 mph	[s]	5.9 (F01) 6.0 (F02)	5.6 (F01 LCI) 5.6 (F02 LCI) 5.6 (F02 LCI xDrive)

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Full load diagram



Full load diagram F01/F02 LCI with N55B30O0 engine compared with F01/F02 with N54B30O0 engine.

1.2.2. N63TU engine

The N63TU engine is the successor to the N63 engine. The fundamental further development of the N63 engine to the N63TU engine is the latest fuel-mixture generation technology Turbo-Valvetronic Direct Injection TVDI. The new engine boasts better performance data at reduced fuel consumption and CO_2 emissions.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Highlights:

- New control unit concept with one control unit per cylinder head
- Integration of the engine control units in the low-temperature circuit
- New cylinder head cover with adapted crankcase ventilation
- Adaptation of the cylinder head and crankshaft drive to the new Turbo-Valvetronic direct injection TVDI
- Use of a temperature-dependent coolant pump for achieving the operating temperature of the engine quicker (not for USA and South Korea).

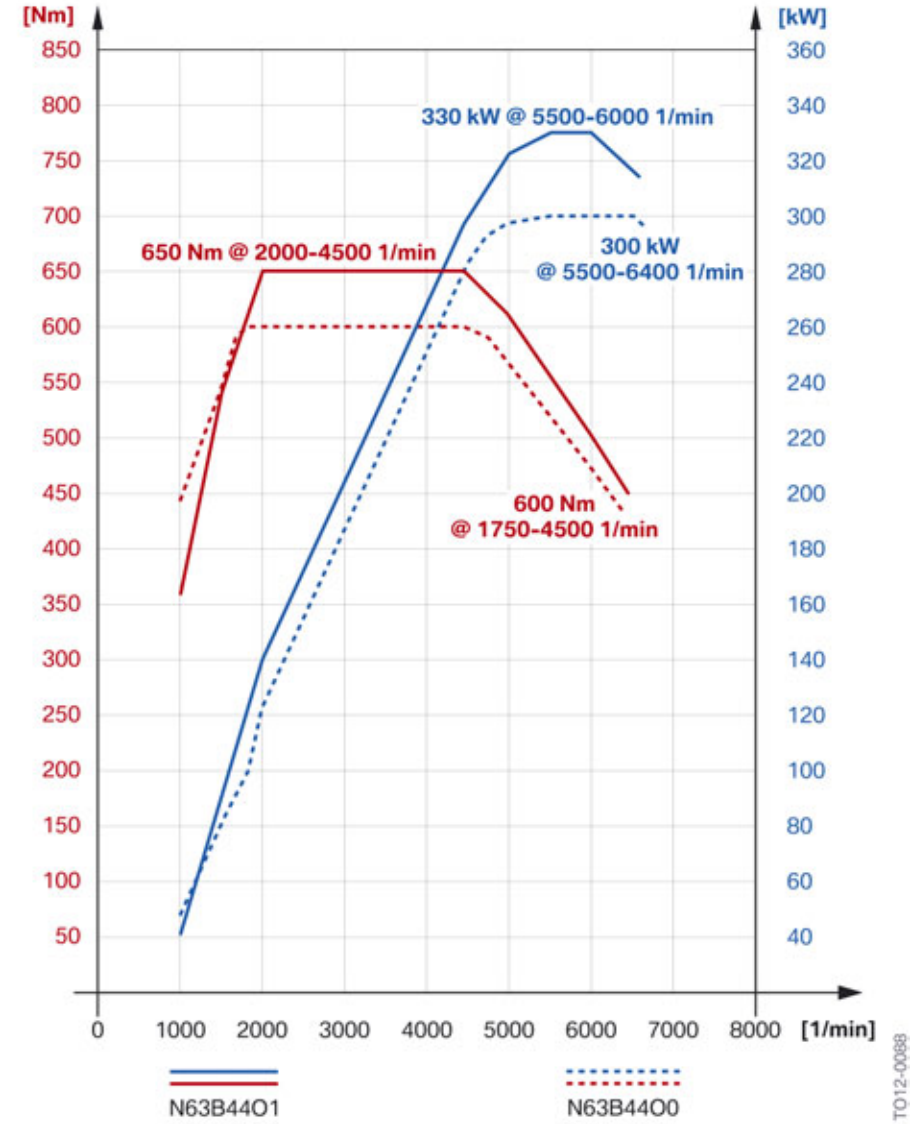
Technical data

		N63B44O0 **F01, 750i** **F01, 750i xDrive** **F02, 750Li** **F02, 750Li xDrive**	**N63B44O1** **F01 LCI, 750i** **F01 LCI, 750i xDrive** **F02 LCI, 750Li** **F02 LCI, 750Li xDrive**
Design		V8	V8
Valves per cylinder		4	4
Engine control		MSD85.0	MEVD17.2.8
Displacement	[cm^3]	4395	4395
Stroke/Bore hole	[mm]	88.3/89.0	88.3/89.0
Power output at engine speed	[kW (HP)] [rpm]	300 (400) 5500 - 6400	330 (445) 5500
Torque at engine speed	[Nm (lb-ft)] [rpm]	600 (450) 1750 – 4500	650 (480) 2000 – 4500
Compression ratio	[ε]	10.0 : 1	10.0 : 1
Fuel grade		RON 91 – 98	RON 91 – 98
Exhaust emission standards		EURO 5 (ULEV II)	EURO 5 (ULEV II)
Fuel consumption complying with EU	[l/100 km]	11.4 (F01) 11.9 (F01 xDrive) 11.4 (F02) 11.9 (F02 xDrive)	8.6 (F01 LCI) 9.3 (F01 LCI xDrive) 8.6 (F02 LCI) 9.4 (F02 LCI xDrive)
Acceleration 0 – 60 mph	[s]	5.1 (F01) 5.0 (F01 xDrive) 5.2 (F02) 5.1 (F02 xDrive)	4.7 (F01 LCI) 4.6 (F01 LCI xDrive) 4.8 (F02 LCI) 4.6 (F02 LCI xDrive)

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Full load diagram



Full load diagram F01/F02 LCI with N63B44O1 engine compared with F01/F02 with N63B44O0 engine.

For more information regarding the N63TU engine refer to the ST1209 N63TU training material and the OL1209 N63TU engine online web course available on TIS and ICP.

1.2.3. N74 engine

The N74 engine is the successor to the N73 engine, but shares many technological features with the N63 engine.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Highlights:

- High-precision injection
- Bi-turbocharging with indirect charge air cooling
- Exhaust turbocharger mounted on the outside of the engine.

Technical data

		N74B60U0 F01, 760i F02, 760Li	**N74B60U0 F01 LCI, 760i F02 LCI, 760Li**
Design		V12	V12
Valves per cylinder		4	4
Engine control		MSD87–12	MSD87
Displacement	[cm^3]	5972	5972
Stroke/Bore hole	[mm]	80.0/89.0	80.0/89.0
Power output at engine speed	[kW (HP)] [rpm]	400 (536) 5250	400 (536) 5250
Torque at engine speed	[Nm (lb-ft)] [rpm]	750 (553) 1500 – 5000	750 (553) 1500 – 5000
Compression ratio	[ε]	10.0 : 1	10.0 : 1
Fuel grade		RON 91 – 98	RON 91 – 98
Exhaust emission standards		EURO 5 (ULEV II)	EURO 6
Fuel consumption complying with EU	[l/100 km]	12.9 (F01) 13.0 (F02)	12.8 (F01 LCI) 12.9 (F02 LCI)
Acceleration 0 – 60 mph	[s]	4.5 (F01) 4.5 (F02)	4.5 (F01 LCI) 4.5 (F02 LCI)

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Full load diagram

Full load diagram F01/F02 LCI with N74B60U0 engine.

1.3. Automatic engine start-stop function

As from the market introduction (in July 2012) all F01/F02 LCI vehicles (except for the 760i/iL models) are equipped as standard with the automatic engine start-stop (MSA) function.

Compared with other BMW vehicles, already equipped with the automatic engine start-stop function, the comfort of the function has been improved in the F01/F02 LCI.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

The following measures have been implemented:

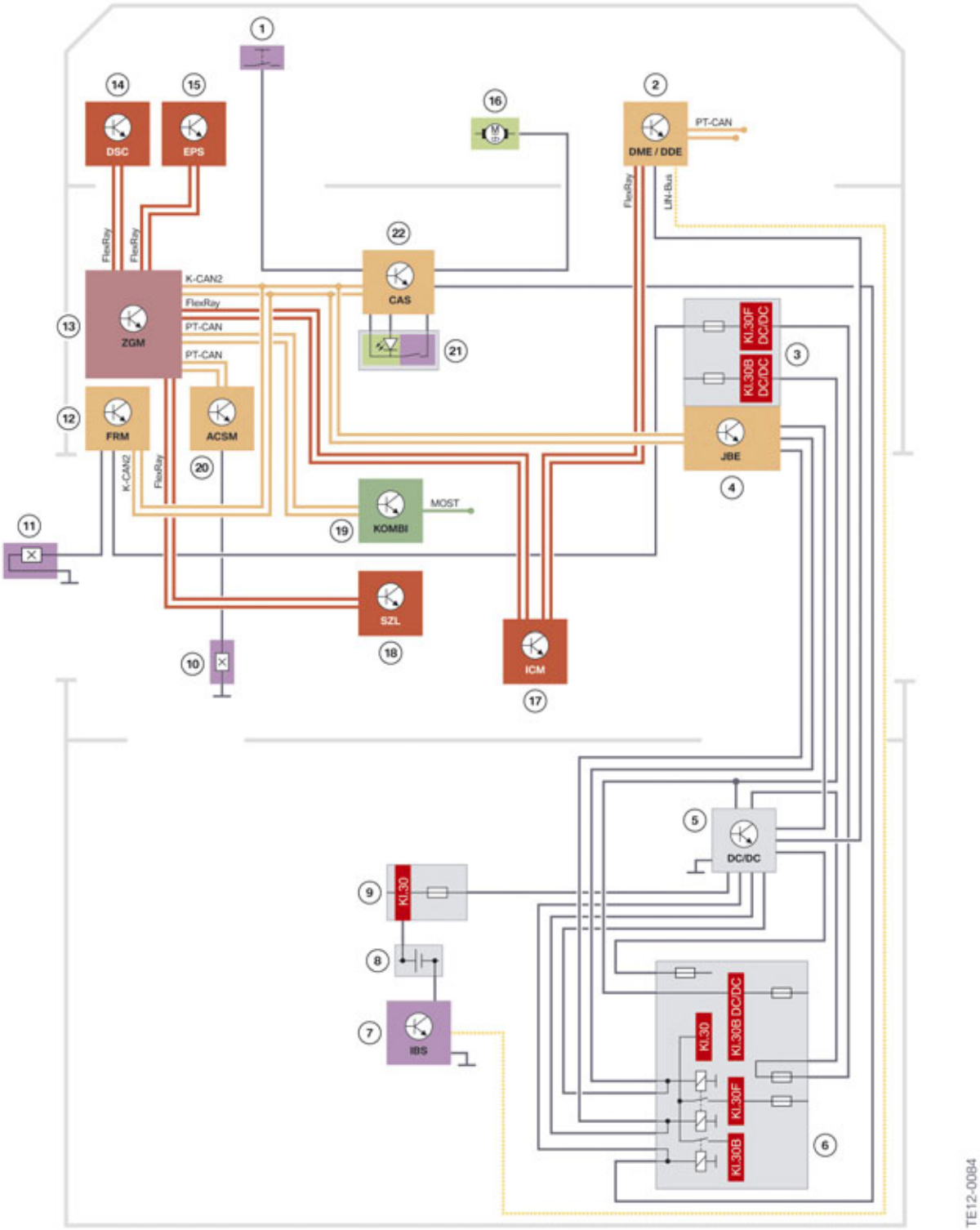
- Improved shutdown comfort is achieved by relieving the alternator and A/C compressor load on the drive train during automatic engine stopping
- Starting acoustics during automatic engine starting are improved by early starter motor demeshing in vehicles with gasoline engines and automatic transmissions
- The availability and repeatability of the automatic engine start-stop function is improved by:
  - the discontinuation of the outside temperature threshold of 3 °C / 37.4 °F (switch-off inhibitor)
  - the reduction of the reactivation speed to 5 km/h (3 mph) in vehicles with automatic and manual transmissions (switch-off inhibitor)
  - the discontinuation of time restrictions of automatic engine stops for some selected switch-off inhibitors
  - the enhanced automatic engine start by the MSA function with gear engaged for three seconds if the engine was shut down beforehand on account of insufficient engine revs (only in vehicles with manual gearboxes).

The Automatic Engine Start-Stop (MSA) function is not available in the BMW 760 i/iL models.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

1.3.1. System wiring diagram



F01/F02 LCI wiring diagram, automatic engine start-stop function II

Index	Explanation
1	Engine compartment lid contact switch
2	Digital Engine Electronics (DME)
3	Junction box for the power distribution box
4	Junction box electronics
5	DC/DC converter
6	Power distribution box, luggage compartment
7	Intelligent battery sensor (IBS)
8	Battery
9	Battery power distribution box
10	Seat belt buckle contact, driver
11	Door contact, driver
12	Footwell module (FRM)
13	Central gateway module (ZGM)
14	Dynamic Stability Control (DSC)
15	Electronic Power Steering (EPS)
16	Starter motor
17	Integrated Chassis Management (ICM)
18	Steering column switch cluster (SZL)
19	Instrument cluster (KOMBI)
20	Crash Safety Module (ACSM)
21	START-STOP button
22	Car Access System (CAS)
KI.30	Terminal 30
KI.30B	Terminal 30 basic operation
KI.30F	Terminal 30, fault-dependent

The higher frequency of starting operations in vehicles with the automatic engine start-stop function can lead to voltage dips in the vehicle electrical system. A DC/DC converter is installed to protect specific voltage-sensitive components.

1.3.2. Operation

After each engine start the automatic engine start-stop function is active, regardless of whether the automatic engine start-stop function was deactivated via the engine start-stop button when the engine was last switched off.

The automatic engine start-stop function is activated in vehicles with manual and automatic transmissions at road speeds of > 5 km/h (3 mph). In other words, the engine is only switched off if the vehicle speed prior to vehicle standstill was > 5 km/h (3 mph).

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Driving

As long as the vehicle is in motion the driver will not be aware of the automatic engine start-stop function.

Index	Explanation
1	Vehicle moving
2	Selector lever in drive position "D", driver operates accelerator pedal
3	Engine running, the driving situation is indicated by the rev counter and fuel consumption display

The purpose of the automatic engine start-stop function is to switch the engine off if the vehicle is at a standstill.

Stopping

The stopping process with subsequent engine stop from the driver's point of view is as follows:

Index	Explanation
1	Car slows to a stop, e.g. at a red light
2	Selector lever remains in the "D" drive position, driver depresses the brake pedal to decelerate and hold the vehicle at a standstill
3	The engine is switched off after roughly 1 second, "0" appears in the rev counter

In the situation depicted above the driver holds the vehicle at a standstill by operating the brake pedal.

Alternatively, the driver can move the selector lever from the "D" to the "P" position and release the brake pedal. The engine remains switched off.

Drive-off

The driver indicates his intention to drive off by releasing the brake pedal then operating the accelerator pedal.

Index	Explanation
1	Driver wishes to continue the journey (green light)
2	The selector lever remains in the "D" drive position, driver releases the brake pedal then operates the accelerator pedal
3	Engine is started, rev counter and fuel consumption display revert back to normal to reflect the driving situation

If the driver held the car at a standstill up to this point by depressing the brake pedal, the engine starts as soon as the driver releases the brake pedal.

If the driver put the selector lever into position "P" after the engine was switched off automatically, the engine starts automatically if the selector lever is now moved to position "D".

In this case, the automatic engine start is activated by the DSC control unit that monitors the brake pressure, and not automatically via a signal from the brake light switch.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Establishing start-up readiness

If the driver wants to start the engine but not yet move off, he can establish start-up readiness:

- Press the brake pedal briefly and with more force
- Release the brake pedal slightly.

The engine starts automatically.

Automatic Hold

If the driver has activated the "Automatic Hold" function, he can also release the brake pedal once the vehicle has come to a standstill. The automatic engine start-stop function also switches the engine off in this case. The vehicle is held at a standstill by the DSC hydraulics. The engine only starts when the driver operates the accelerator pedal.

Preventing automatic engine shutdown

In order to be able to drive off quickly, e.g. at a crossing, automatic engine shutdown can be prevented through active intervention within one second of the vehicle coming to a standstill.

Index	Explanation
1	Car slows to a stop, e.g. at a red light
2	Immediately after the vehicle comes to a standstill (within one second) the brake pedal is pressed briefly with more force then immediately held with the usual brake pedal force
3	The engine continues running

1.3.3. Switch-off inhibitor, switch-on requests, deactivators

Switch-off inhibitors

Under certain conditions it is necessary to suppress the automatic engine start-stop function:

- the vehicle is coasting/rolling (vehicles with manual gearboxes only)
- the brake vacuum pressure is too low (vehicles with manual gearboxes only)
- the brake pedal is not pressed firmly enough which means the vehicle is detected as not being held sufficiently
- the vehicle stops on uphill/downhill gradients > 12%
- the steer angle is > 6°
- the steering wheel movement is not yet complete (as otherwise sufficient support would not be provided by the power steering as a consequence)
- the vehicle was not driven at a speed of > 5 km/h* following the previous engine shutdown
- the engine is not running at idle speed (accelerator pedal is being pressed)
- the vehicle is reversing
- the operating temperature of the engine is too low
- the carbon canister is being flushed (gasoline engines only)
- the diesel particulate filter is being regenerated
- the fuel grade is insufficient
- the transmission adaptation is active (vehicles with automatic transmissions only)
- the hydraulic impulse storage is not yet charged (vehicles with automatic transmissions only)
- stop-and-go traffic
- the state of charge is too low
- the ambient temperature is above +30 °C / 86 °F (with heating and air conditioning system switched on)
- the condensation sensor of the IHKA detects fogging of the windshield
- the heating and air conditioning system is switched on but the passenger compartment has not yet heated up or cooled down to the required temperature
- ABS braking has been applied.

Switch-on prompts

Conversely, it may be also be necessary to start the engine:

- the vehicle is not sufficiently held by the released brake pedal (vehicles with automatic transmissions only)
- the steering wheel is moved
- the engine is not running at idle speed (accelerator pedal is being pressed)
- the driver previously shifted from position "D" to "P" so he could take his foot off the brake pedal (vehicles with automatic transmissions only)
- the transmission changes from "D" to "N" or "R" (vehicles with automatic transmissions only)
- the brake vacuum pressure is too low (vehicles with manual gearboxes only)
- the state of charge is too low

- the ambient temperature is above +30 °C / 86 °F (with heating and air conditioning system switched on)
- the condensation sensor of the IHKA detects fogging of the windscreen
- the evaporator temperature is too low to ensure sufficient climate control
- Special case: the driver's seat belt is still fastened and the driver's door is opened (e.g. when using a dummy seat belt buckle in regions where wearing a seatbelt is not mandatory).

Deactivator

If a deactivation condition exists, the automatic engine start-stop function is deactivated.

The following scenarios arise, depending on when the deactivation condition for the automatic engine start-stop function occurred:

- the engine continues running and is no longer stopped automatically
- the engine was stopped automatically and starts once again automatically
- the engine was stopped automatically and no longer starts automatically (the Check Control message "MSA off" appears - the start/stop button must be operated in order to the start the engine).

The following deactivators may occur:

- the driver's absence has been detected
- the engine did not start when the ignition was switched on
- the engine compartment lid is unlocked
- a fault related to the automatic engine start-stop function has been detected at the engine, transmission or components involved in the automatic engine start-stop function
- the bus communication is faulty
- the automatic engine start-stop function has been deactivated via the automatic engine start-stop function button
- the automatic engine start-stop function was deactivated via the diagnosis system
- the vehicle is in transport mode
- the engine was switched off on account of insufficient engine revs (in vehicles with manual gearboxes an automatic engine start is possible with the gear engaged for three seconds).

The individual statuses can be read out using the diagnosis system.

An easy-to-follow example of a deactivation with subsequent switch-on request:

- the automatic engine start-stop function is deactivated via the automatic engine start-stop function button in the automatic engine shutdown phase
- as a consequence, the engine starts automatically
- after this, no further automatic engine shutdowns occur, the automatic engine start-stop function remains deactivated.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

1.3.4. Detection of driver's absence

The automatic engine start-stop function is deactivated when the driver is absent to prevent an automatic engine start.

The driver's absence is detected via the seat belt buckle switch and via the door contact.

The automatic engine start-stop function is always reactivated if:

- the driver's seat belt is fastened and the vehicle is travelling at a speed of > 5 km/h (3 mph)
- the driver's door is closed and the vehicle is travelling at a speed of > 5 km/h*.

The prerequisites for deactivation of the automatic engine start-stop function vary, depending on which switching mode the seat belt buckle switch and door contact are in when the automatic engine start-stop function is activated:

Status during activation of automatic engine start-stop function	Prerequisites for deactivation of automatic engine start-stop function
• The driver's seat belt is fastened. • The driver's door is closed.	The driver unfastens the seat belt buckle and opens the driver's door.
• The driver's seat belt is not fastened. • The driver's door is closed.	The driver opens the driver's door.
• The driver's seat belt is fastened. • The driver's door is opened.	The driver unfastens the seat belt buckle.

After the automatic engine start-stop function has been deactivated by the detection of the driver's absence, it is reactivated if:

- the seat belt buckle is fastened and/or the driver's door is closed and the engine is started
- the seat belt buckle is fastened and/or the driver's door is closed and the vehicle is travelling at a speed of > 5 km/h* (3 mph).

1.3.5. Deactivation via automatic engine start-stop function button

F01/F02 LCI automatic engine start-stop function button

Index	Explanation
1	Button for deactivation/activation of automatic engine start-stop function

The automatic engine start-stop function can be deactivated manually via the automatic engine start-stop function button. The LED in the automatic engine start-stop function button lights up when the automatic engine start-stop function is deactivated. The automatic engine start-stop function is reactivated each time the engine is restarted.

1.3.6. Notes for Service

Protection against automatic engine start

⚠

Always observe the safety precautions when carrying out repair work on vehicles equipped with the automatic engine start-stop function!

The engine is prevented from starting automatically when repair work is being carried out in the engine compartment. The automatic engine start-stop function is deactivated as soon as the hood is opened. The automatic engine start-stop function can be deactivated temporarily via the diagnosis system.

⚠

When the contact of the hood contact switch is pulled out it engages in the service position. The automatic engine start-stop function subsequently remains active even though the hood is open!

The engine can be restarted via the start/stop button.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

The automatic engine start-stop function is reactivated if:

- the hood is closed and the engine is started
- the hood is closed and the vehicle is travelling at a speed of > 5 km/h*.

Automatic engine start-stop function checklist for acceptance by the customer

In the event of customer complaints, check these against the "Automatic engine start-stop function checklist".

Process any fault entries using the diagnosis system. If no fault entries exist, check the condition of the automatic engine start-stop function with the automatic engine start-stop function system check.

The automatic engine start-stop function system check service function shows an overview of the most recent automatic engine start-stop function status and provides further assistance with troubleshooting.

Customer complaint	Yes	No
Often no engine shutdown: An automatic engine shutdown was expected but the engine repeatedly does not stop.		
Check the general automatic engine shutdown criteria in dialogue with the customer:	☐	☐
Driver's seat belt fastened?	☐	☐
Vehicle at standstill?	☐	☐
Automatic transmission in position "D", brake pedal depressed?	☐	☐
Engine at operating temperature?	☐	☐
Vehicle not driven backwards before stopping?	☐	☐
Automatic engine start-stop function activated (automatic engine start-stop function button not operated - LED does not light up)?	☐	☐
State of battery charge OK (no long immobilization periods or excessive short-distance driving)?	☐	☐
Quality level of battery OK (no external charging procedure, no other devices connected to the battery)?	☐	☐

If all criteria have been answered with **Yes**:

- Implement automatic engine start-stop function system check service function.

If at least one criterion has been answered with **No**:

- Automatic engine start-stop function is in working order.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Customer complaint	Yes	No
Sporadically no engine shutdown: An automatic engine shutdown was expected but the engine sometimes does not stop.		
Check whether the automatic function has prevented the engine from being shut-down for safety or comfort reasons. Explain the automatic functions to the customer:	☐	☐
Heating and air conditioning system switched on and passenger compartment in cooling-down period (e.g. when setting off or following engine shutdown)	☐	☐
Windscreen starts to fog up with automatic air conditioning	☐	☐
Steering wheel movements when vehicle is at a standstill	☐	☐
Stop-and-go traffic (at least three stops made in short succession at a speed of < 25 km/h / 15.5 mph)	☐	☐

If all criteria have been answered with **No**:

- Implement automatic engine start-stop function system check service function.

If at least one criterion has been answered with **Yes**:

- Automatic engine start-stop function is in working order.

Customer complaint	Yes	No
Sudden engine start of its own: No automatic engine start was expected yet the engine started anyway.		
Check whether the engine has been automatically started by the automatic function for safety or comfort reasons. Explain the automatic functions to the customer:	☐	☐
Passenger compartment heating up with heating and air conditioning system switched on	☐	☐
Windshield starts to fog up with automatic air conditioning	☐	☐
Steering wheel movements when vehicle is at a standstill	☐	☐
The vehicle has started moving (speed < 5 km/h / 3 mph)	☐	☐
Low brake vacuum due to repeated operation of brake pedal	☐	☐
State of battery charge too low due to extended engine stop phases	☐	☐

If all criteria have been answered with **No**:

- Implement automatic engine start-stop function system check service function.

If at least one criterion has been answered with **Yes**:

- Automatic engine start-stop function is in working order.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Customer complaint	Yes	No
No engine start: The brake pedal was released yet no automatic engine start follows.		
Driver's door opened **and** seat belt buckle unfastened during the engine stop phase?	☐	☐
Or engine compartment lid open?	☐	☐

If both criteria have been answered with **No**:

- Implement automatic engine start-stop function system check service function.

If at least one criterion has been answered with **Yes**:

- Automatic engine start-stop function is in working order.

Automatic deactivation of terminal 15

Terminal 15 is switched off automatically via the door contact when the driver's door is opened and closed with the engine switched off.

Terminal 15 can be switched permanently back on by subsequently pressing the start/stop button.

Power management and battery replacement

The automatic engine start-stop function and power management are strongly intertwined.

The data on battery type and state of charge could get lost after the following:

- programming of the engine control
- replacement of the intelligent battery sensor
- disconnection of the battery
- changing of the battery.

This data will only be available again once a standby current measurement has been carried out internally in the vehicle and after it has gone to sleep and has been locked. This measurement takes around 6 hours during which the vehicle must not be woken up. The automatic engine start-stop function will remain inactive until the data is transferred.

In order for the vehicle to register the battery data after the battery has been replaced, the internal standby current must be measured.

If the battery is replaced, an AGM battery must be reinstalled (initialized) to ensure the automatic engine start-stop function remains in proper working order.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

1.4. Automatic transmission

1.4.1. Designation

A unique designation is used for the transmission in the technical documentation so it can be clearly identified. In frequent cases, however, only a short designation is used. This short form is used so the transmission can be assigned to a transmission family. The GA8HP transmission family, consisting of the GA8HP45Z, the GA8HP70Z and the GA8HP90Z transmissions for example, are often mentioned.

Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	A	Automatic transmission
3	Number of gears	6 8	Six forward gears Eight forward gears
4	Type of transmission	HP L R	Hydraulic planetary gear train Designation of General Motors Powertrain Designation of General Motors Powertrain
5 + 6	Transmittable torque	19 26 32 45 (ZF) 45 (GMPT) 70 90 390	300 Nm gasoline engine 600 Nm gasoline engine 720 Nm gasoline engine 450 Nm gasoline engine, 500 Nm diesel engine 350 Nm gasoline engine 700 Nm gasoline engine and diesel engine 900 Nm gasoline engine 390 Nm, 4th gear 410 Nm, gasoline engine
7	Manufacturer	G J R Z H	Getrag Jatco GMPT ZF In-house part

1.4.2. Variants

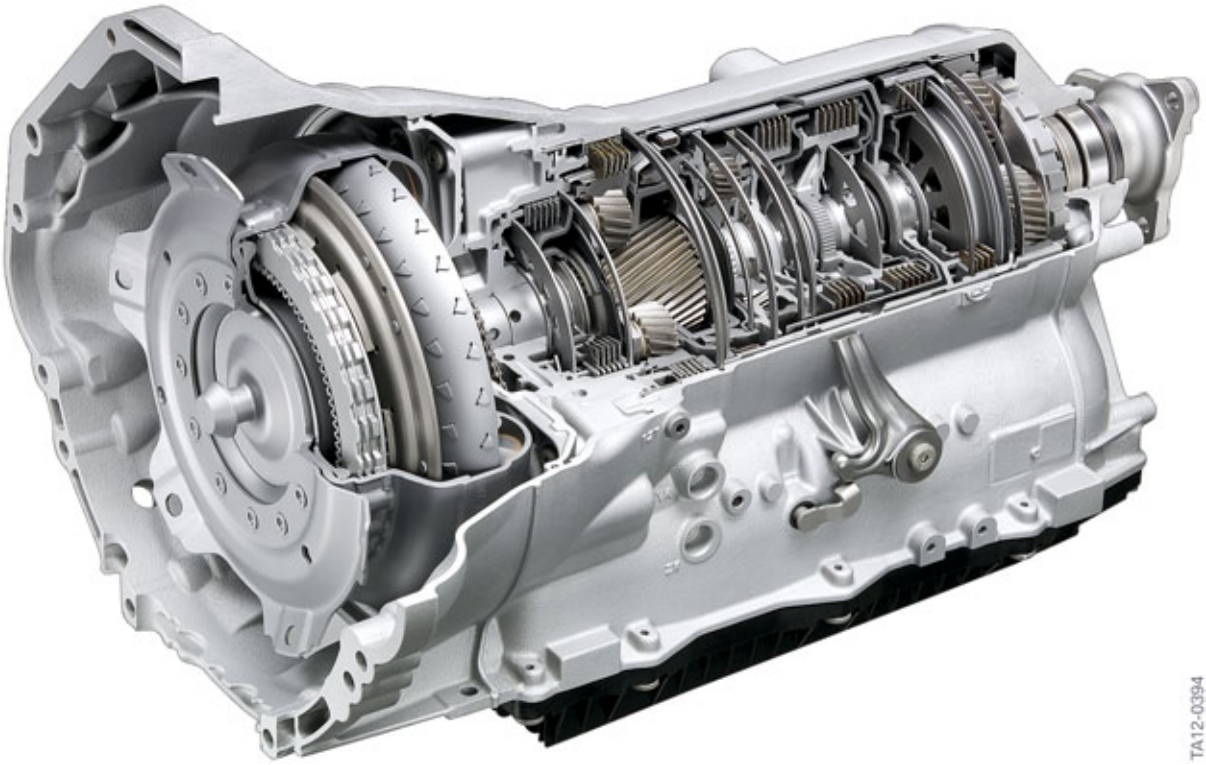
Model	Engine	Transmission	Torque converter
BMW 740i	N55B30O0	GA8HP45Z	NW235TTD
BMW 740Li	N55B30O0	GA8HP45Z	NW235TTD
BMW 740LiH	N55B30O0	GA8P70HZ	—
BMW 740Li xDrive	N55B30O0	GA8HP45Z	NW235TTD
BMW 750i	N63B44O1	GA8HP70Z	NW250TTD
BMW 750i xDrive	N63B44O1	GA8HP70Z	NW250TTD
BMW 750Li	N63B44O1	GA8HP70Z	NW250TTD
BMW 750Li xDrive	N63B44O1	GA8HP70Z	NW250TTD
BMW 760Li	N74B60U0	GA8HP90Z	NW270TTD

F01/F02 LCI Powertrain and Chassis

1. Powertrain

1.4.3. GA8HP transmission

The new automatic transmissions GA8HP45Z, GA8HP70Z and GA8HP90Z are used in the F01/F02 LCI.



GA8HP automatic transmission

Highlights

- Significantly enhanced spontaneity of the gear shifts
- Greater driving and shifting comfort as a result of smaller gear jumps
- Higher control precision of the converter lockup clutch at low engine loads
- High power transmission of the converter lockup clutch
- Reduced fuel consumption (-5 to -6%).

The GA8HP45Z and GA8HP70Z are newly developed transmissions that will supersede the existing GA6HP19Z TU 6-speed automatic transmission or GA6HP26Z TU. he overall gear ratio has been enlarged from 6.04 to 7.07; the gear jumps have become smaller, thus also reducing the differences in speed when shifting gear. The weight of the transmission has been reduced significantly using, among other things, a plastic oil pan.

The electronic transmission control (EGS) control unit is integrated in the control unit network of the electronic immobilizer (EWS). This provides better protection against theft.

It is operated via the gear selector switch or using the shift paddles (optional equipment 2TB, automatic sports transmission, via the steering column switch cluster (SZL)).

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Mechanical torsional vibration dampers of the second generation are deployed in the torque converter:

- Turbine torsional vibration damper TTD
- Two-damper torque converter ZDW (typically used with diesel engines).

The function and design of the converter is described in the "E70 automatic transmission" training material available on TIS and ICP.

The vibration isolation reduces the proportion of slip on the converter lockup clutch and enables a larger operating range with the converter lockup clutch closed. This reduces the fuel consumption by 5% to 6% in the consumption cycle (KV01) compared to the TU six-speed automatic transmissions used until now.

Technical data

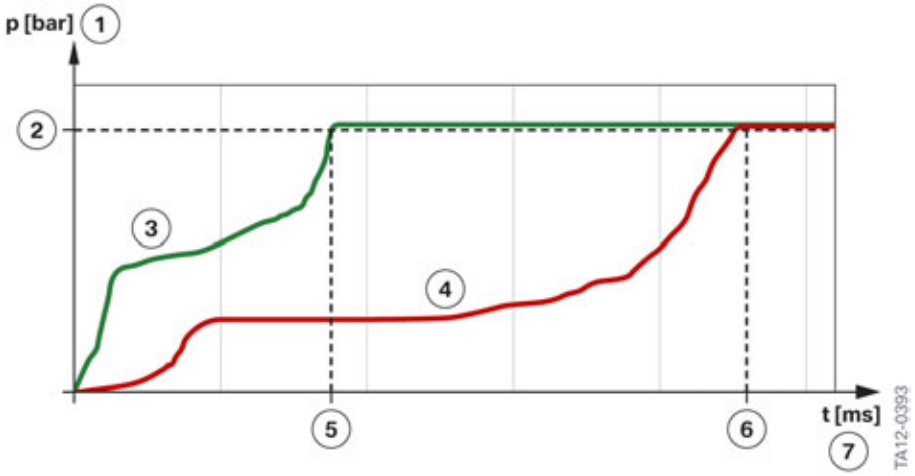
		GA8HP45Z	GA8HP70Z	GA8HP90Z
Maximum transmittable power (with gasoline engines)	[kW]	250	380	550
Maximum transmittable power (with diesel engines)	[kW]	180	240	330
Maximum transmittable torque (with gasoline engines)	[Nm]	450	700	900
Maximum transmittable torque (with diesel engines)	[Nm]	500	700	1000
Transmission ratio 1st gear		4.714	4.714	4.714
Transmission ratio 2nd gear		3.143	3.143	3.143
Transmission ratio 3rd gear		2.106	2.106	2.106
Transmission ratio 4th gear		1.667	1.667	1.667
Transmission ratio 5th gear		1.285	1.285	1.285
Transmission ratio 6th gear		1.000	1.000	1.000
Transmission ratio 7th gear		0.839	0.839	0.839
Transmission ratio 8th gear		0.667	0.667	0.667
Transmission ratio reverse gear		3.295	3.317	3.317

1.4.4. Hydraulic pressure accumulator

When the automatic start/stop function is activated the engine may shut off once the vehicle is at a standstill, the engine restarts automatically as the driver releases the brake to drive off.

In these engine stop phases the transmission oil pump is not driven, thus the fluid pressure supply ceases, the gearshift elements open, and there is no longer a transfer of power in the transmission. Maximum transmission oil pressure is required in order for the drive off process to take place dynamically without a noticeable delay when the automatic start/stop function is activated. However, the mechanically driven transmission oil pump cannot build up pressure quickly enough while the engine is starting.

A hydraulic pressure accumulator is therefore used in the F01/F02 LCI automatic transmission for this purpose. With the volume of transmission fluid stored in the hydraulic pressure accumulator, the shift elements can be filled as soon as the engine is started, even before the transmission oil pump has built up the necessary pressure to drive off.



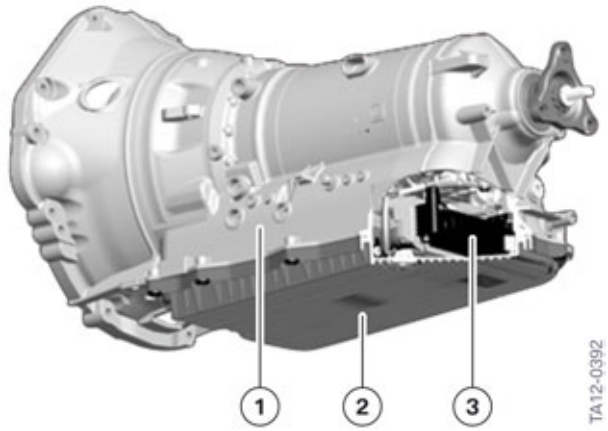
Variation in gearbox oil pressure over time at engine start

Index	Explanation
1	Transmission oil pressure
2	Nominal value of the transmission oil pressure which is required to hydraulically actuate the shift elements
3	Characteristic of the transmission oil pressure **with** hydraulic pressure accumulator
4	Characteristic of the transmission oil pressure **without** hydraulic pressure accumulator
5	Point at which the automatic transmission **with** hydraulic pressure accumulator is ready to drive off
6	Point at which the automatic transmission **without** hydraulic pressure accumulator is ready to drive off
7	Time

Installation location

F01/F02 LCI Powertrain and Chassis

1. Powertrain



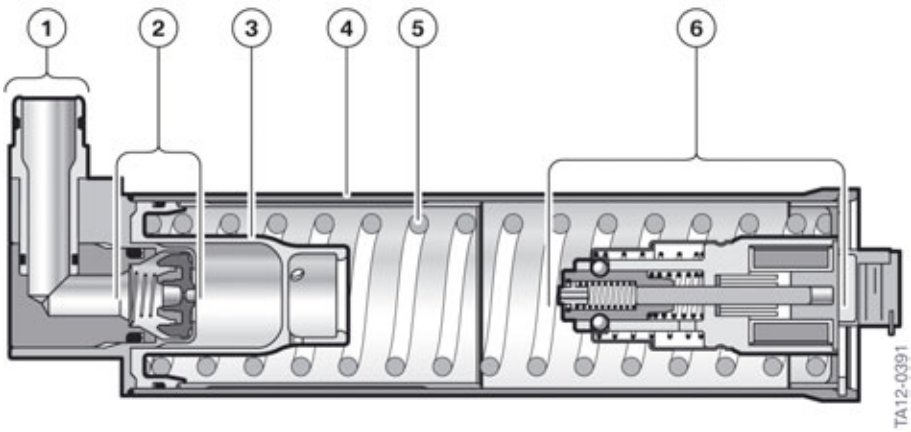
Installation location of hydraulic pressure accumulator

Index	Explanation
1	Transmission housing
2	Transmission oil sump
3	Hydraulic pressure accumulator

The hydraulic pressure accumulator is integrated in the automatic transmission. It is located in the transmission oil sump, in the direction of travel behind the mechatronics module.

The hydraulic pressure accumulator can be replaced as a separate component.

Design



Design of hydraulic pressure accumulator

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Index	Explanation
1	Connection to hydraulic system of automatic transmission
2	Throttle and non-return valve
3	Hydraulic piston
4	Hydraulic cylinder
5	Coil spring
6	Electromechanical latch mechanism

The hydraulic pressure accumulator consists of a hydraulic cylinder. This cylinder contains a piston that moves against the force of a spring. The piston can be electromechanically locked in the tensioned end position. The electromechanical latch mechanism incorporates locking balls, a tension spring, a release spring, and a solenoid.

The solenoid is activated and deactivated by the EGS. A corresponding wiring harness to the hydraulic pressure accumulator is laid inside the transmission housing.

The cylinder of the hydraulic pressure accumulator is connected to the transmission's hydraulic system directly (without any valves between them). The hydraulic pressure accumulator in fact contains an element which functions as a throttle and non-return valve. The throttle limits the volumetric flow of the fluid while the hydraulic pressure accumulator is being filled. In general, this filling operation corresponds to the charging operation of the accumulator which is why the expressions "charging" or "discharging" are used in this description.

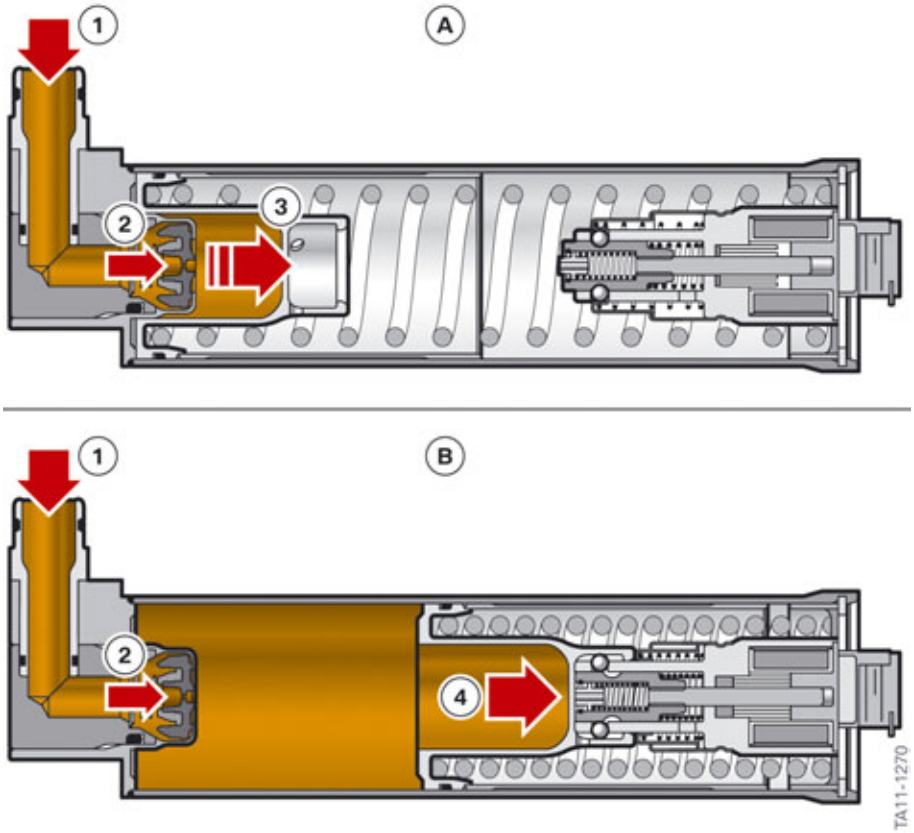
The non-return valve ensures that the transmission fluid flows into the hydraulic pressure accumulator via the throttle during charging. The transmission fluid does not flow through the throttle during the discharging process, the non-return valve now opens instead to allow an unrestricted flow of transmission fluid back into the hydraulic system. The purpose of the non-return valve is therefore not to maintain the pressure in the charged state. In the charged state, the transmission fluid in the hydraulic pressure accumulator is depressurized and the energy is stored in the tensioned spring.

Charging

The hydraulic pressure accumulator is therefore always charged when the engine is running and the transmission oil pump is working. During charging transmission fluid flows through the throttle into the hydraulic cylinder. In the process only a small volume is drawn from the hydraulic system so that the pressure level does not drop unintentionally. The transmission fluid pushes on the piston which acts against the spring force increasing the tension on the spring.

F01/F02 LCI Powertrain and Chassis

1. Powertrain



Charging of the hydraulic pressure accumulator

Index	Explanation
A	Discharged state - charging procedure starts
B	Charged state - charging procedure ends
1	Transmission fluid flows from the hydraulic system of the automatic transmission into the hydraulic pressure accumulator
2	Volumetric flow of the transmission fluid is limited by the throttle
3	The transmission fluid exerts force on the piston which moves and tensions the coil spring
4	Transmission fluid exerts a force on the piston so that it is held in the "charged" end position

At the end of the charging process the piston travels past the latch mechanism (locking balls) until it reaches the end/stop. The transmission fluid pressure holds the piston against the spring force in the end position.

The latch mechanism does not engage yet. The hydraulic pressure accumulator is fully charged in this end position.

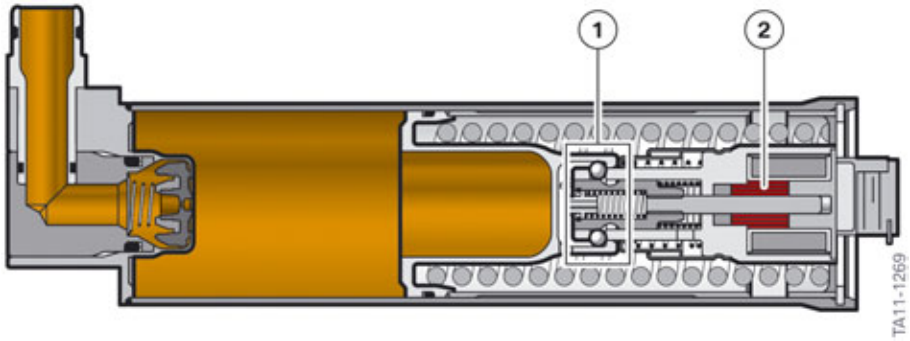
F01/F02 LCI Powertrain and Chassis

1. Powertrain

Locking

When the engine is switched off (while the hydraulic pressure accumulator is charged) the transmission oil pressure drops causing the spring to be released slightly. This allows the piston to slide into the locked position where locking balls hold the piston mechanically in place.

The now energized solenoid holds the inner slide in place so that the locking balls cannot enter the channels designated for releasing the lock. The electric power used for this is low (< 10 W) and is only required while the engine is off. Therefor the additional energy consumption of the hydraulic pressure accumulator viewed over an entire driving cycle is very low.



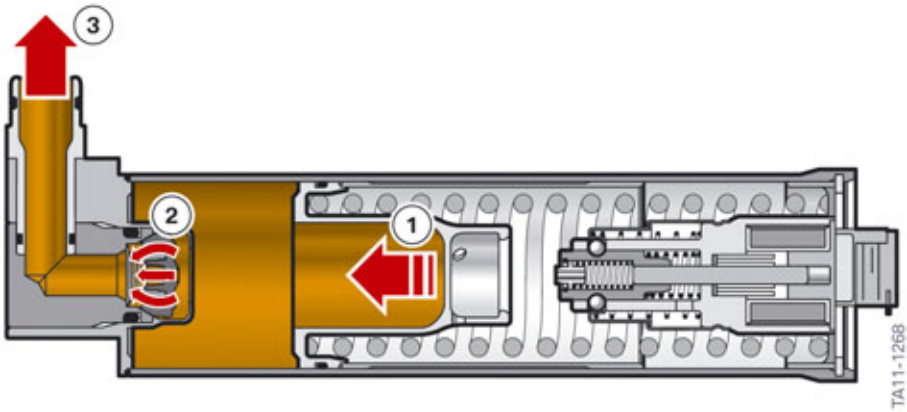
Charged and locked state of the hydraulic pressure accumulator

Index	Explanation
1	Mechanical latch mechanism
2	Solenoid activated

Discharging

When the engine is started, as the driver wants to drive off, the gearshift elements in the automatic transmission for driving off must be engaged. The hydraulic pressure accumulator supplies the transmission fluid pressure required for this during the discharging process.

As the solenoid is deactivated for discharging the inner slide (driven by a small spring) moves in the direction of the locking balls. This allows the balls to enter the channels designated for releasing the lock which in turn releases the piston. The spring (compressed during the charging process) exerts force on the piston which pressurizes the transmission fluid in the cylinder.



Discharging of the hydraulic pressure accumulator

Index	Explanation
1	The large spring pushes on the piston, which in turn, forces the transmission fluid out of the hydraulic cylinder
2	Transmission fluid can now flow through the throttle **and** the opened non-return valve
3	Transmission fluid flows from the hydraulic pressure accumulator back into the hydraulic system of the automatic transmission

The piston moves (in the graphic to the left) and thereby pushes the transmission fluid back into the transmission hydraulic system. The transmission fluid exits the cylinder through the now opened non-return valve and throttle.

The oil volume forced back into the hydraulic system of the transmission is sufficient to engage the gearshift elements needed for the driving off process. This system is designed to provide the initial fluid pressure needed for the transmission to go into “Gear” at the exact moment just before the engine is started. As soon as the engine is started, the transmission fluid pressure is then again generated by the transmission oil pump and the entire process is restarted.

1.4.5. Transmission emergency release

The F01/F02 LCI features the new control concept for operation of the mechanical transmission emergency release. The transmission emergency release is no longer operated from the passenger compartment.

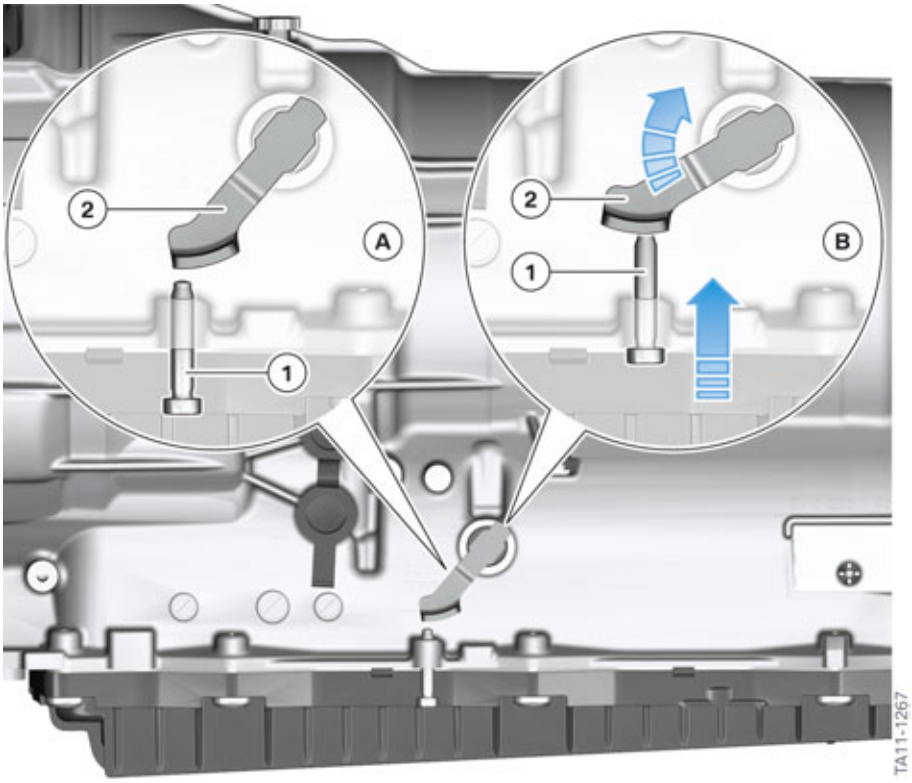
Mechanical transmission emergency release

The mechanical transmission emergency release may only be operated by specially trained Service Technician.

To actuate mechanical transmission emergency release, it is necessary to raise the vehicle and remove the underbody panelling.

F01/F02 LCI Powertrain and Chassis

1. Powertrain



F01/F02 LCI mechanical transmission emergency release GA8HP

Index	Explanation
1	Adjusting screw
2	Parking lock lever
A	Transmission parking lock engaged
B	Transmission parking lock released

In the event of a fault, the engaged automatic transmission parking lock can be disabled via a mechanical emergency release function by turning an adjusting screw in the vehicle underbody.

For detailed information on the mechanical transmission emergency release, refer to the corresponding repair instructions.

Electronic transmission emergency release

⚠

Only specially trained service technicians are permitted to actuate electronic transmission emergency release.

The vehicle must not be towed while electronic transmission emergency release is actuated; it may only be maneuvered. In case of misuse an entry is made in the fault memory.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

Electronic transmission emergency release is only possible when the engine does not start but the starter motor is turning.

Electronic transmission emergency release is active for a maximum of 15 minutes. This time is extended by an extra 15 minutes as soon as a wheel speed signal is recorded. After this time period the parking lock is engaged without a Check Control message being displayed. The time specified is dependent on the battery capacity.

Electronic transmission emergency release procedure:

- Secure the vehicle before operating the electronic transmission emergency release function to prevent it from rolling away
- Depress and hold the brake pedal throughout the entire process
- Press the start/stop button - the starter motor cranks the engine for a specific time

Electronic transmission emergency release GA8HP

Index	Explanation
1	Release button
2	Gear selector switch

- Press release button (1) and hold pressed
- Move gear selector switch (2) forwards by one step and hold for two seconds – strictly observing the specified time
- Release the gear selector switch (2) and move forwards again briefly by one step
  The transmission position "N" is displayed in the instrument cluster - the transmission is unlocked electronically.

If the start/stop button is pressed again, the parking lock is reactivated without a Check Control message being displayed.

For detailed information on the electronic transmission emergency release, refer to the corresponding repair instructions.

1.5. Front axle differential

The already familiar front axle differentials VAG 170AL and VAG 175AL are used in those models with xDrive.

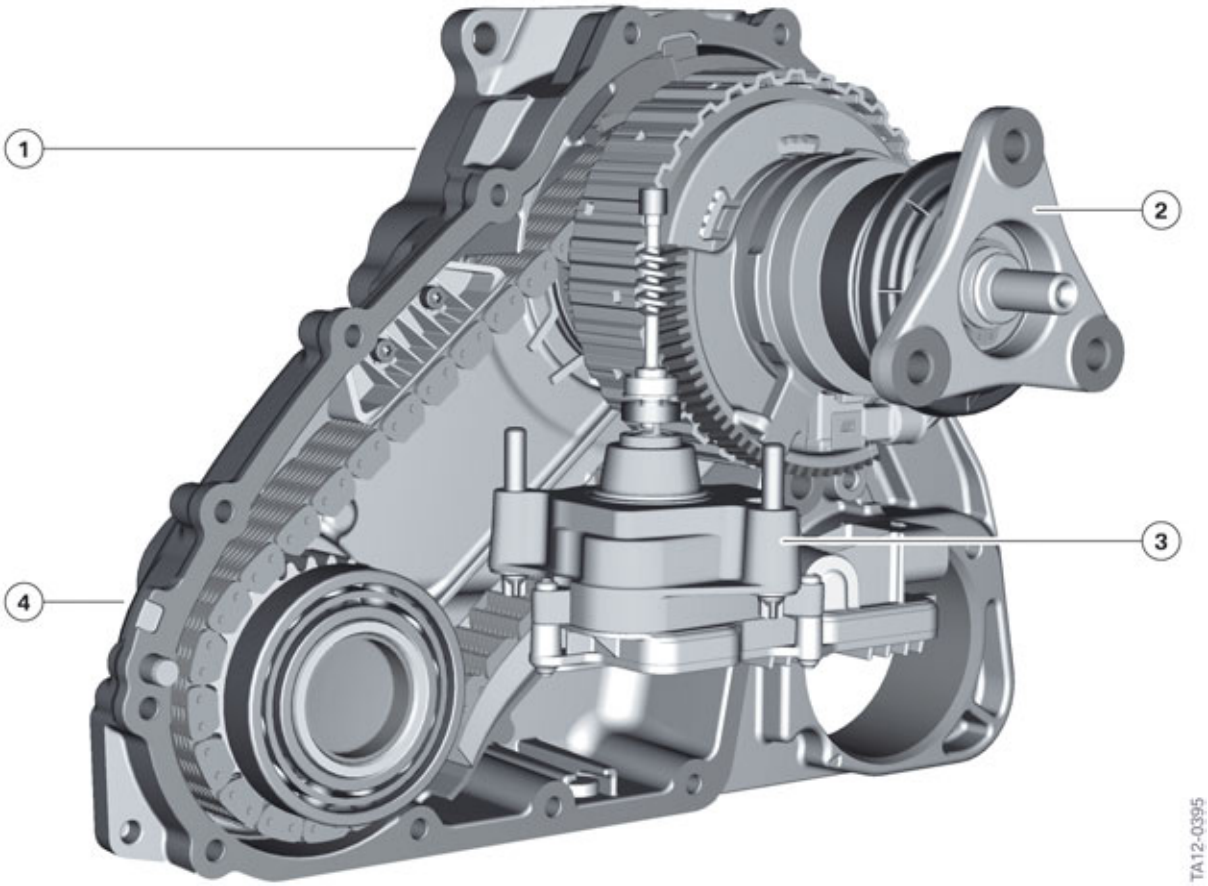
Model	Front axle differential	Gear ratio [i]	Weight (incl. oil) [kg]
BMW 740Li xDrive	VAG 170AL	3.077	14.2
BMW 750i xDrive **BMW 750Li xDrive**	VAG 175AL	2.813	14.7

F01/F02 LCI Powertrain and Chassis

1. Powertrain

1.6. Transfer box

The ATC 35L transfer box is a further development of the ATC 350.



Mechanical design of ATC 35L transfer box

Index	Explanation
1	Connection to the transmission
2	Connection to the rear axle
3	Control unit, transfer box VTG (for activating the multi-disc clutch)
4	Connection to the front axle

Highlights:

- 1.4 kg weight reduction
- Optimized efficiency
- Cost reduction.

F01/F02 LCI Powertrain and Chassis

1. Powertrain

It has been possible to achieve improved efficiency through:

- Integration of the printed circuit board and the servomotor in the transfer box VTG control unit
- Omission of the mechanical oil pump
- Lubrication and cooling of the components by the toothed chain oil delivery function
- Reduction in the actuator mechanism components
- Minimization of the mechanical tolerances.

1.7. Rear axle differential

The already established rear axle differentials HAG 205AL, HAG 225AL and HAG 235L-K are used in the F01/F02 LCI.

Model	Rear axle differential	Gear ratio [i]	Weight (incl. oil) [kg]
BMW 740i **BMW 740Li** **BMW 740LiH**	HAG 205AL	3.077	23.6
BMW 740Li xDrive	HAG 205AL	3.077	23.6
BMW 750i **BMW 750Li**	HAG 225AL	2.813	29.7
BMW 750i xDrive **BMW 750Li xDrive**	HAG 225AL	2.813	29.7
BMW 760Li	HAG 235L-K	2.813	38.2

F01/F02 LCI Powertrain and Chassis

2. Chassis and Suspension

Various adaptations have been made in the F01/F02 LCI in order to enhance ride comfort:

- Optimized suspension tuning for all models
- Improved rubber mounts on the rear axle support
- Air suspension comes as standard in the F01/F02 LCI. (A new damper is also fitted)
- Stiffer and lighter steel bases for the front seats
- Improved 18”/19” tires.

2.1. Steering

The F01/F02 LCI is now fitted (depending on the model) with Electronic Power Steering (electromechanical power steering) (EPS). It is important to note that vehicles with xDrive are fitted with hydraulic steering.

Vehicles with the Integral Active Steering (option 2VH) optional equipment and 760i/760Li models are fitted with the 24 V EPS system, as installed in the F10.

The following tables provide an overview of all the steering variants.

F01 LCI	Standard equipment	Integral Active Steering (option 2VH)
BMW 740i	EPS	EPS (24 V) with active steering
BMW 750i	EPS	EPS (24 V) with active steering
BMW 750i xDrive	Hydraulic power steering	—
BMW 760i	EPS (24 V) with active steering	

F02 LCI	Standard equipment	Integral Active Steering (option 2VH)
BMW 740Li	EPS	EPS (24 V) with active steering
BMW 740LiH	EPS	—
BMW 740Li xDrive	Hydraulic power steering	—
BMW 750Li	EPS	EPS (24 V) with active steering
BMW 750Li xDrive	Hydraulic power steering	—
BMW 760Li	EPS (24 V) with active steering	

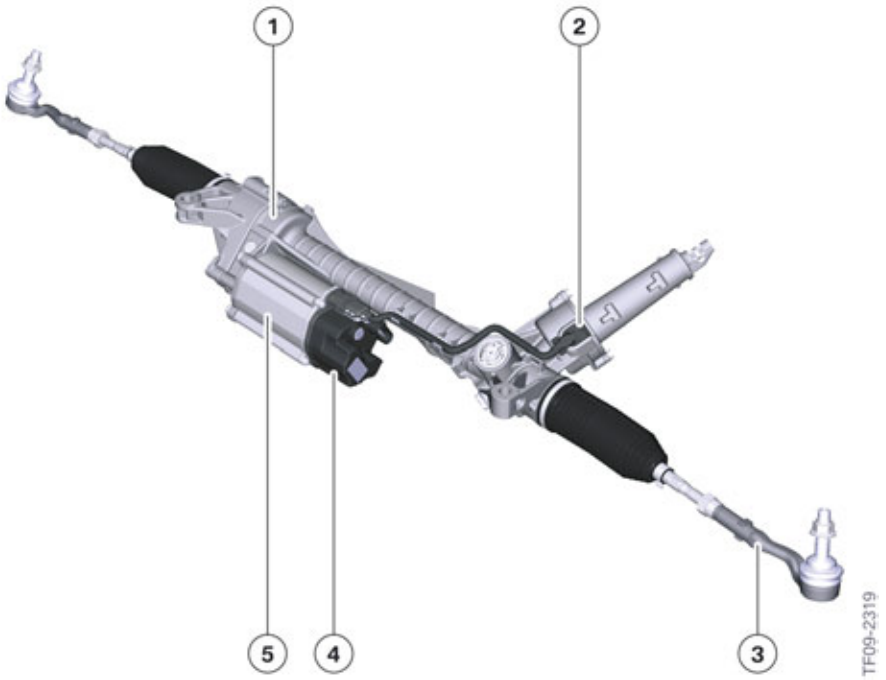
Note: The BMW 760Li is equipped as standard with Integral Active Steering (option 2VH).

Note: Vehicles with xDrive are fitted with hydraulic steering.

F01/F02 LCI Powertrain and Chassis

2. Chassis and Suspension

2.1.1. Electromechanical power steering (EPS)



F01/F02 LCI Electronic Power Steering (EPS)

Index	Explanation
1	Reduction gear
2	Steering-torque sensor
3	Track rod
4	EPS control unit
5	Electric motor with motor position sensor

Electronic Power Steering (EPS) reduces fuel consumption by roughly 0.3 l per 100 km (60 miles) when compared to conventional hydraulic power steering. This helps reduce CO_2 emissions.

As there is no oil in an EPS, it is environmentally cleaner than conventional hydraulic power steering.

For reasons inherent in the system, EPS is always equipped with the Servotronic function. Two different settings (“Normal” and “Sporty”) can be accessed via the drive dynamic control switch.

The EPS is less sensitive to external disturbance variables such as judder and steering wheel vibration. It also features active roll damping which enhances the driving safety of the F01/F02 LCI.

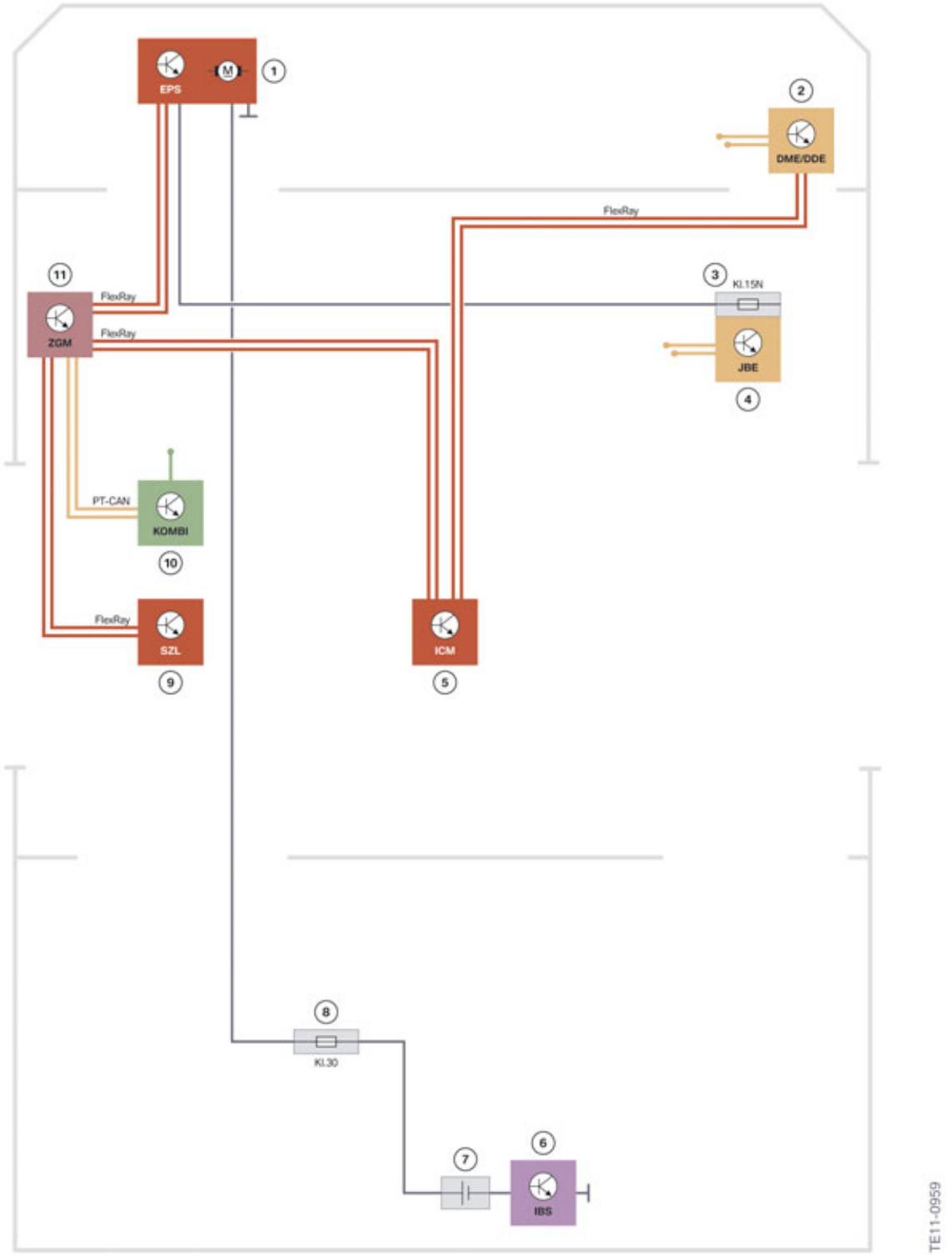
The return characteristics of the EPS are fully configurable. That means that optimum drivability can be guaranteed. EPS allows the implementation of the parking assistant feature.

The operating principle and design of the EPS are identical with those of the F10 and are described in the “Chassis Dynamics” section of the ST1202 F10 Complete Vehicle training material available on TIS and ICP.

F01/F02 LCI Powertrain and Chassis

2. Chassis and Suspension

For more information on the parking assistant, refer to the "F10 Driver Assistance systems".



F01/F02 LCI system wiring diagram, basic steering

F01/F02 LCI Powertrain and Chassis

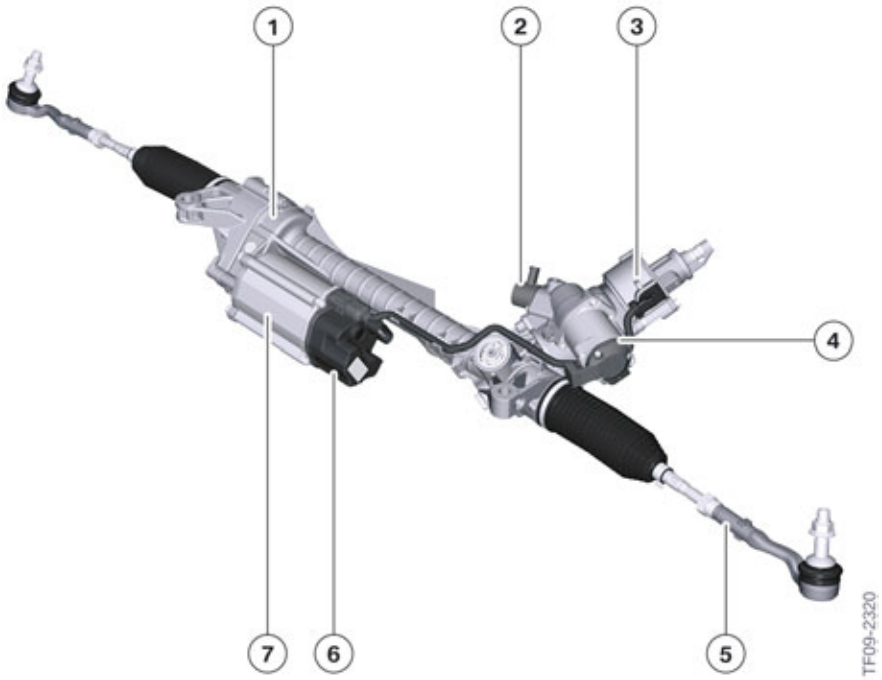
2. Chassis and Suspension

Index	Explanation
1	Electronic Power Steering (EPS)
2	Digital Engine Electronics (DME)
3	Junction box for the power distribution box
4	Junction box electronics (JBE)
5	Integrated Chassis Management (ICM)
6	Intelligent battery sensor (IBS)
7	Battery
8	Battery power distribution box
9	Steering column switch cluster (SZL)
10	Instrument cluster (KOMBI)
11	Central gateway module (ZGM)
KI.15N	Ignition (after-run)
KI.30	Terminal 30

F01/F02 LCI Powertrain and Chassis

2. Chassis and Suspension

2.1.2. Active steering



F01/F02 LCI Electronic Power Steering (EPS) with active steering

Index	Explanation
1	Reduction gear
2	Active Steering lock
3	Steering-torque sensor
4	Active Steering servomotor with motor angular position sensor
5	Track rod
6	EPS control unit
7	Electric motor with motor position sensor

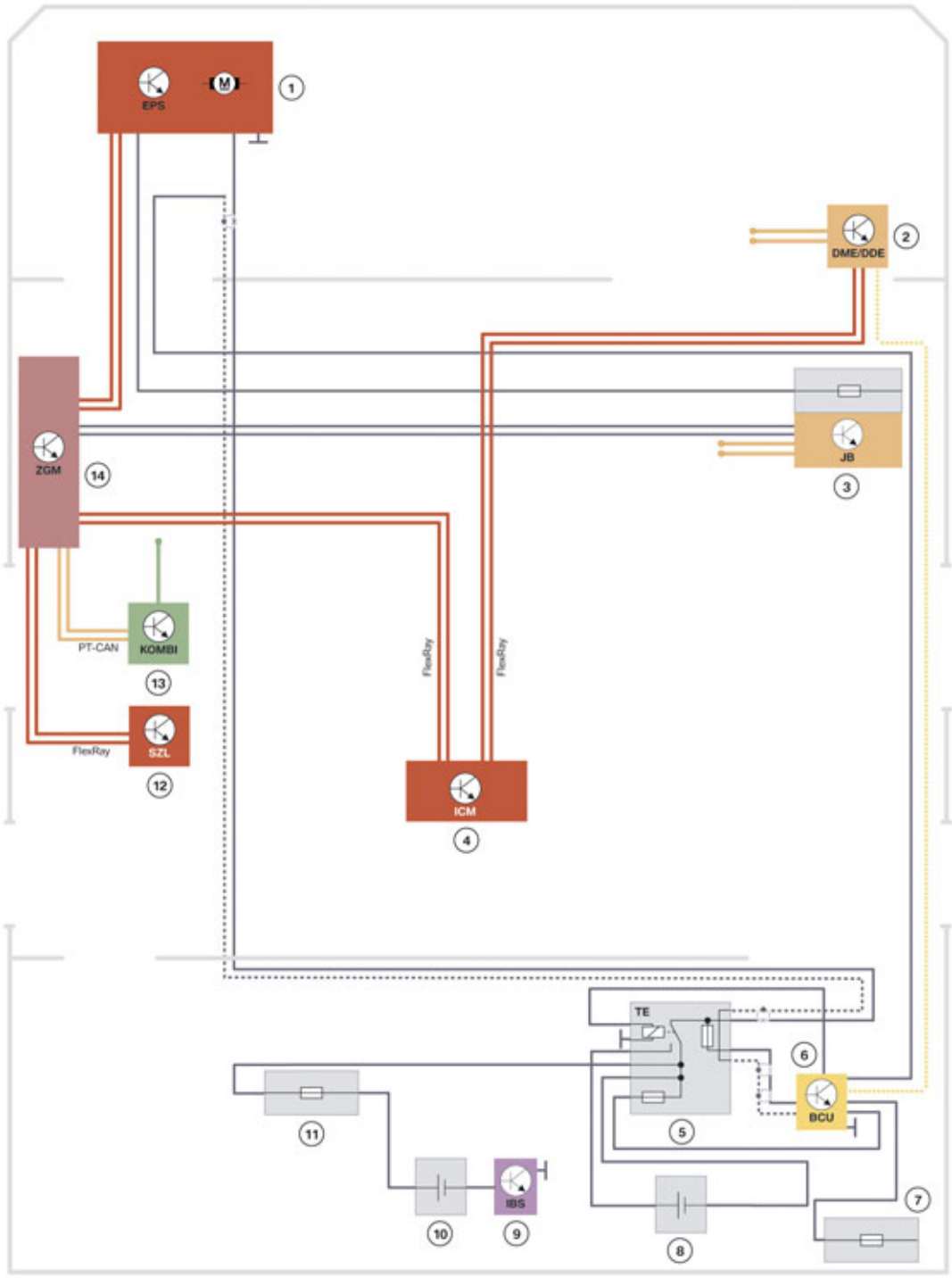
Depending on the version, EPS or hydraulic steering is used for active steering.

EPS is supplied by a vehicle electrical system nominal voltage of 12 V. The electromechanical active steering requires a 24 V power supply because of the higher steering power requirements. The 24 V vehicle electrical system is implemented by a DC/DC converter in conjunction with a second small 12 V battery.

The components of Integral Active Steering "active steering (AL)" and "rear axle slip angle control (HSR)" cannot be ordered separately and are only available with the Integral Active Steering package (option 2VH).

F01/F02 LCI Powertrain and Chassis

2. Chassis and Suspension



F01/F02 LCI system wiring diagram, EPS (24 V) with active steering

Index	Explanation
1	EPS
2	Digital Engine Electronics (DME)
3	Junction box electronics with front power distribution box
4	Integrated Chassis Management (ICM)
5	Separator
6	Charging controller for auxiliary battery (Battery Charge Unit BCU)
7	Rear right power distribution box
8	Auxiliary battery
9	Intelligent battery sensor (IBS)
10	Battery
11	Battery power distribution box
12	Steering column switch cluster (SZL)
13	Instrument cluster (KOMBI)
14	Central gateway module (ZGM)

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Technical training.
Product information.

F01/F02 LCI General Vehicle Electronics

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BMW Service

General information

Symbols used

The following symbol/schematic diagram is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further deviations may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral element of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the current respective information systems of the BMW Group for any changes/additions to the technical data.

Information status: **May 2012**
VH-23/International Technical Training

F01/F02 LCI General Vehicle Electronics

Contents

F01/F02 LCI General Vehicle Electronics

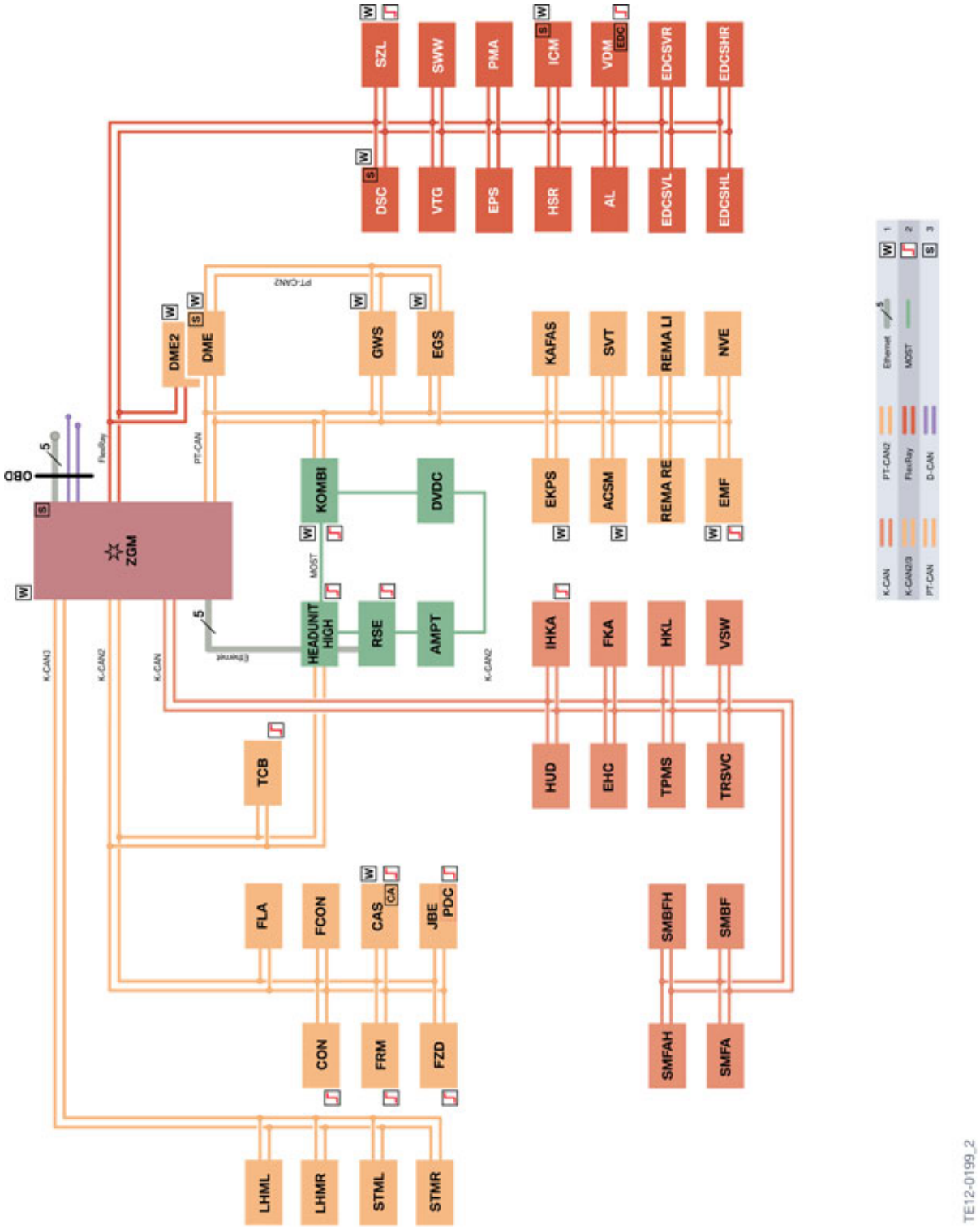
1. Introduction

This product information provides an overview of the key new features in the vehicle electrical system with the model revision of the F01/F02.

F01/F02 LCI General Vehicle Electronics

2. Electrical System

2.1. F01/F02 LCI bus overview



F01/F02 LCI bus overview

F01/F02 LCI General Vehicle Electronics

2. Electrical System

Index	Explanation
1	Control units with wake-up line
2	Control units authorized to perform wake-up function
3	Start-up node, control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AL	Active steering
AMPT	Top HiFi amplifier
CA	Car Access
CAS	Car Access System
CON	Controller
DME	Digital Engine Electronics
DME2	Digital Engine Electronics 2
DSC	Dynamic Stability Control
DVDC	DVD changer
EDC	Electronic Damper Control
EDCSHL	Electronic Damper Control satellite, rear left
EDCSHR	Electronic Damper Control satellite, rear right
EDCSVL	Electronic Damper Control satellite, front left
EDCSVR	Electronic Damper Control satellite, front right
EGS	Electronic transmission control
EHC	Electronic ride height control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic Power Steering (electromechanical power steering)
FCON	Rear compartment controller
FKA	Rear climate control
FLA	High-beam assistant
FRM	Footwell module
FZD	Roof function center
GWS	Gear selector switch
HEADUNIT HIGH	Headunit High (now incorporates most Combox functions except telematics)
HKL	Automatic operation of trunk lid
HSR	Rear axle slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management

Index	Explanation
IHKA	Integrated automatic heating / air-conditioning system
JBE	Junction box electronics
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel/Multifunctional instrument display
LHML	LED main light module, left
LHMR	LED main light module, right
NVE	Night Vision Electronics
PDC	Park Distance Control
PMA	Parking Maneuvering Assistant
REMA LI	Reversible electric-driven reel, left
REMA RE	Reversible electric-driven reel, right
RSE	Rear seat entertainment system
SMBF	Front passenger seat module
SMBFH	Rear passenger seat module
SMFA	Driver's seat module
SMFAH	Rear driver's side seat module
STML	Headlight driver module, left
STMR	Headlight driver module, right
SVT	Servotronic
SWW	Lane change warning
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TCB	Telematic Communication Box (replaced the Combox telematics functions)
VDM	Vertical Dynamics Management
VSW	Video switch
VTG	Transfer case (xDrive only)
ZGM	Central gateway module

As part of the model revision of the F01/F02 some adaptations were made to the vehicle electrical system. Similar to the other current BMW models, the F01/F02 LCI central information display (CID) now is connected to the APIX line and thus has no bus connection. For vehicles with a rear seat entertainment system this is the first time the two rear monitors are also connected to the APIX line instead of a bus connection.

The F01/F02 LCI vehicle electrical system has been enhanced with the addition of the K-CAN3 bus system. This is used for the realization of the illumination functions, among other things. More information on this bus system can be found in the "Exterior Lights" chapter in this training manual.

F01/F02 LCI General Vehicle Electronics

2. Electrical System

The US version F01/F02 LCI is available with “Navigation Professional” Headunit High as standard equipment. The Headunit High telematics functions are made available by the new Telematic Communication Box (TCB) control unit. The other “media” functions, which were previously provided by the Combox, are now directly integrated into the Headunit High. More information on these two control units can be found in the ST1211 Headunit High training material available on TIS and ICP.

2.1.1. Reversible electromotive automatic reel (REMA LI and REMA RE)

Reversible electromotive automatic reels have been introduced to the US market (for the first time) in the F01/F02 LCI vehicles as part of the standard Active Protection (5AL) system. The REMA RE and REMA LI control units are installed on both front seat belts and are an essential component of the new Pre-Crash/Post-Crash functions of the Active Protection system.

After fastening the seat belt the reversible electromotive reel reduces the belt slack as soon as the driver drives off past 10 km/h (6 mph). Removing the belt slack guarantees that the seat belt is secured to the driver or front passenger and thus a better restraining effect can be achieved in the event of an accident.

Another advantage of the reversible electromotive reel is the tensioning of the belt before a possible accident with increased retracting force. This reduces the possibility of the passenger slipping out of the belt (also called "submarining").

For more information regarding (5AL) Active Protection system please refer to the “Passive Safety” section of this training material.

F01/F02 LCI General Vehicle Electronics

3. Voltage Supply

3.1. Battery Guard

The Battery Guard function (already known from the F30) detects critical states of charge which could jeopardize engine starting and sends the relevant information to the BMW Service authorized workshop which in turn contacts the customer to schedule a service visit.

BMW Assist with enhanced Bluetooth and USB (option 6NL) and an active BMW ConnectedDrive agreement are required for the Battery Guard function which are standard in all F01/F02 LCI vehicles.

The BMW TeleServices Battery Guard Call is automatically activated by the vehicle under the following conditions:

- If the battery voltage reaches the bottom of the starting ability limit because a bus wake-up signal is present, sleep mode is prevented or there is a standby current violation the BMW TeleServices Battery Guard informs the BMW Service authorized workshop in defined cases at the next vehicle start-up (terminal 15 ACTIVE). It can then proactively contact the customer and arrange a service appointment to eliminate the cause.

F01/F02 LCI General Vehicle Electronics

4. Comfort Access

The Comfort Access function is integrated in the Car Access System (CAS) control unit in the F01/F02 LCI.

Comfort Access contains the following functions:

- Passive Entry (access authorization)
  facilitates access to the vehicle without active use of the ID transmitter
- Passive Go (drive authorization)
  enables the vehicle to be started when there is a valid ID transmitter in the passenger compartment
- Passive Exit (locking authorization)
  enables the vehicle to be locked without active use of the ID transmitter
- Convenience trunk opening
  makes possible **hands free** opening of the trunk lid by simply moving a foot under the rear bumper.

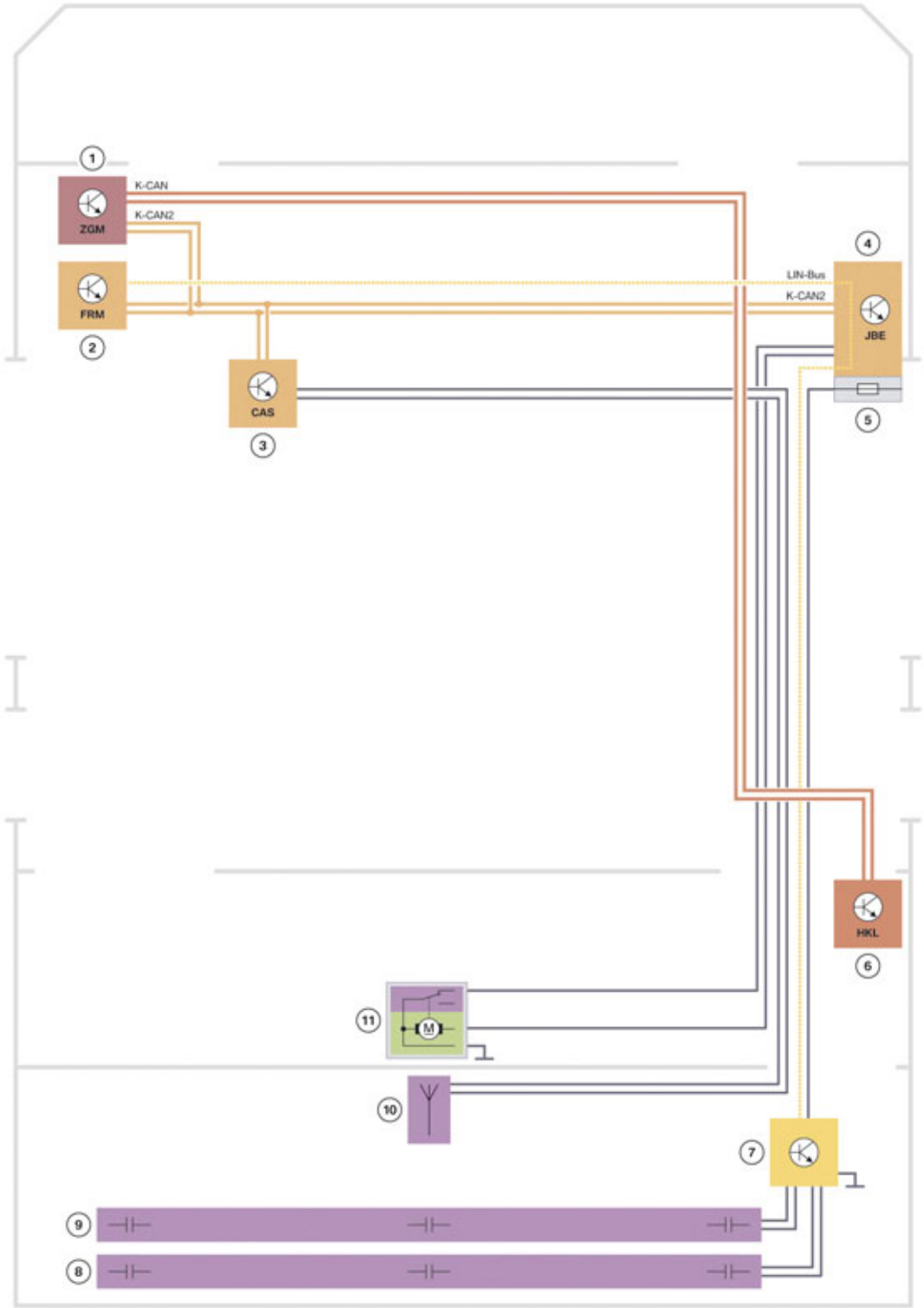
The components and functionality of Comfort Access are familiar from the current BMW models.

F01/F02 LCI General Vehicle Electronics

4. Comfort Access

4.1. Convenience trunk opener

4.1.1. System wiring diagram

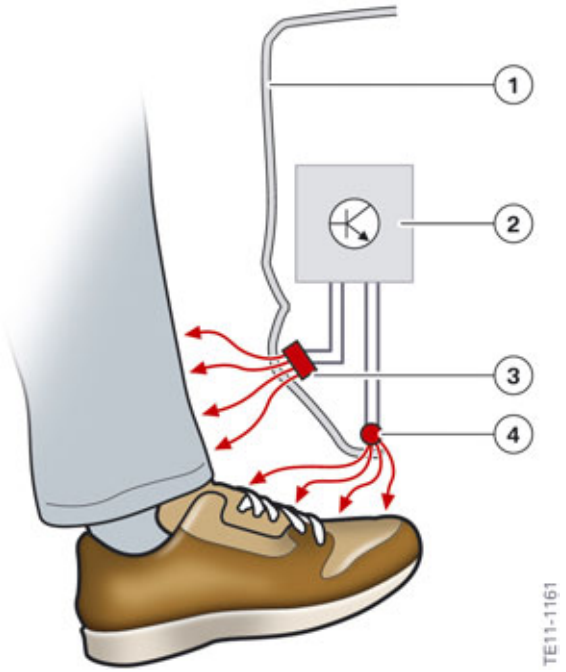


F01/F02 LCI system wiring diagram for convenience trunk opening

Index	Explanation
1	Central gateway module (ZGM)
2	Footwell module (FRM)
3	Car Access System (CAS)
4	Junction box electronics (JBE)
5	Power distribution box, front
6	Automatic operation of trunk
7	Control unit for convenience trunk opener
8	Sensor at top for convenience trunk opener
9	Sensor at bottom for convenience trunk opener
10	Comfort Access antenna, bumper, rear
11	trunk lid lock

4.1.2. Functional description

The hands free trunk lid opening function operation is done by means of targeted foot movements to and from the bumper. Two sensors detect the movement via capacitive measurements.



Hands free trunk opening by foot movement

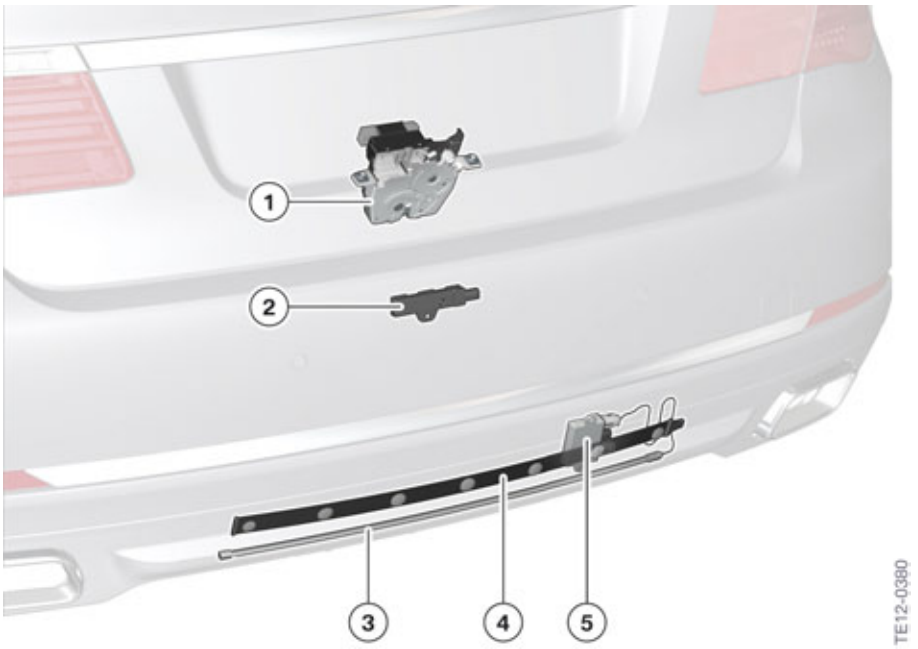
F01/F02 LCI General Vehicle Electronics

4. Comfort Access

Index	Explanation
1	Rear bumper
2	Control unit for convenience trunk opener
3	Sensor at top for convenience trunk opener
4	Sensor at bottom for convenience trunk opener

The following components are involved in the function:

- Footwell module (FRM)
- Junction box electronics (JBE)
- trunk lid lock
- Control unit for convenience trunk opener
- Comfort Access antenna, bumper, rear
- Two sensors.



F01/F02 LCI sensor for convenience trunk opener

Index	Explanation
1	Trunk lid lock
2	Control unit for convenience trunk opener
3	Sensor at bottom for convenience trunk opener
4	Sensor at top for convenience trunk opener
5	Comfort Access antenna, bumper, rear

4. Comfort Access

The two sensors are connected to the evaluation electronics and constantly measure the capacitance. A comparison of the time characteristic of the measured capacities permits the identification of a certain movement pattern.

A targeted foot movement to and from the bumper is detected as the top sensor detects the shin, the bottom sensor the toes.

The detection range is between the rear lights and is highlighted by a chrome trim strip on the rear bumper.

The sensors are secured in the inside of the rear bumper.

The evaluation electronics evaluate the signals from the sensors and make this information available to the footwell module and the junction box electronics via the local interconnect network (LIN) bus. If a valid ID transmitter is located in the vicinity of the Comfort Access antenna in the rear bumper, the junction box electronics activates the opening of the trunk lid.

The trunk opens regardless if it was locked or unlocked.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

The exterior lights are adapted to market requirements and utilize the latest technology accordingly. The F01 already impressive available options have been enhanced and supplemented with new features.

F01/F02 LCI exterior lights at front with adaptive LED headlight

Index	Explanation
1	Turn indicator in exterior mirror
2	Bi-xenon headlight with Adaptive Headlight (standard) Adaptive LED headlight (optional equipment 552, standard on 760Li)
3	LED fog light (standard)

The additional turn indicators of the front fenders have been discontinued and are now integrated into the exterior mirrors.

The design of the bi-xenon headlight has been modified. The side lights and the daytime driving lights are now realized by LEDs. The LEDs can be operated in two power stages. If they are activated at full power, they are daytime driving lights. The side lights roughly 10 % of their power is dimmed.

The standard bi-xenon Adaptive Headlight have a new design.

The exterior lights are supplemented with the LED fog lights as standard equipment (5A1) and the new adaptive LED headlights (optional equipment 552 on all models but the 760Li).

The new adaptive LED headlights are unique and are primarily distinguished from the LED headlights of other BMW models by their appearance.

In the F01/F02 LCI (for the first time) the low-beam headlight and the daytime driving lights are both realized via LED arrays. The LED arrays replace the previous corona ring design. This results in a typical and unmistakable appearance of the vehicle which is noticeable during the day and at night.

The activation of the new bi-xenon headlights with Adaptive Headlight (standard) or the new adaptive LED headlights (optional equipment 552) is realized for the first time using an additional quick body Controller Area Network bus (K-CAN3). In this bus topology the standard LIN bus is still used for the activation of the stepper motors in the headlights and for the transmission of the reduced fault and di-

agnosis information to the stepper motors. In contrast to the previous activation, the footwell module no longer addresses individual light sources, but conveys lighting functions via the new K-CAN3 data bus. This request is then implemented accordingly in the headlight control units. All headlight control units are individually supplied with voltage from the junction box power distribution box or from the luggage compartment power distribution box.

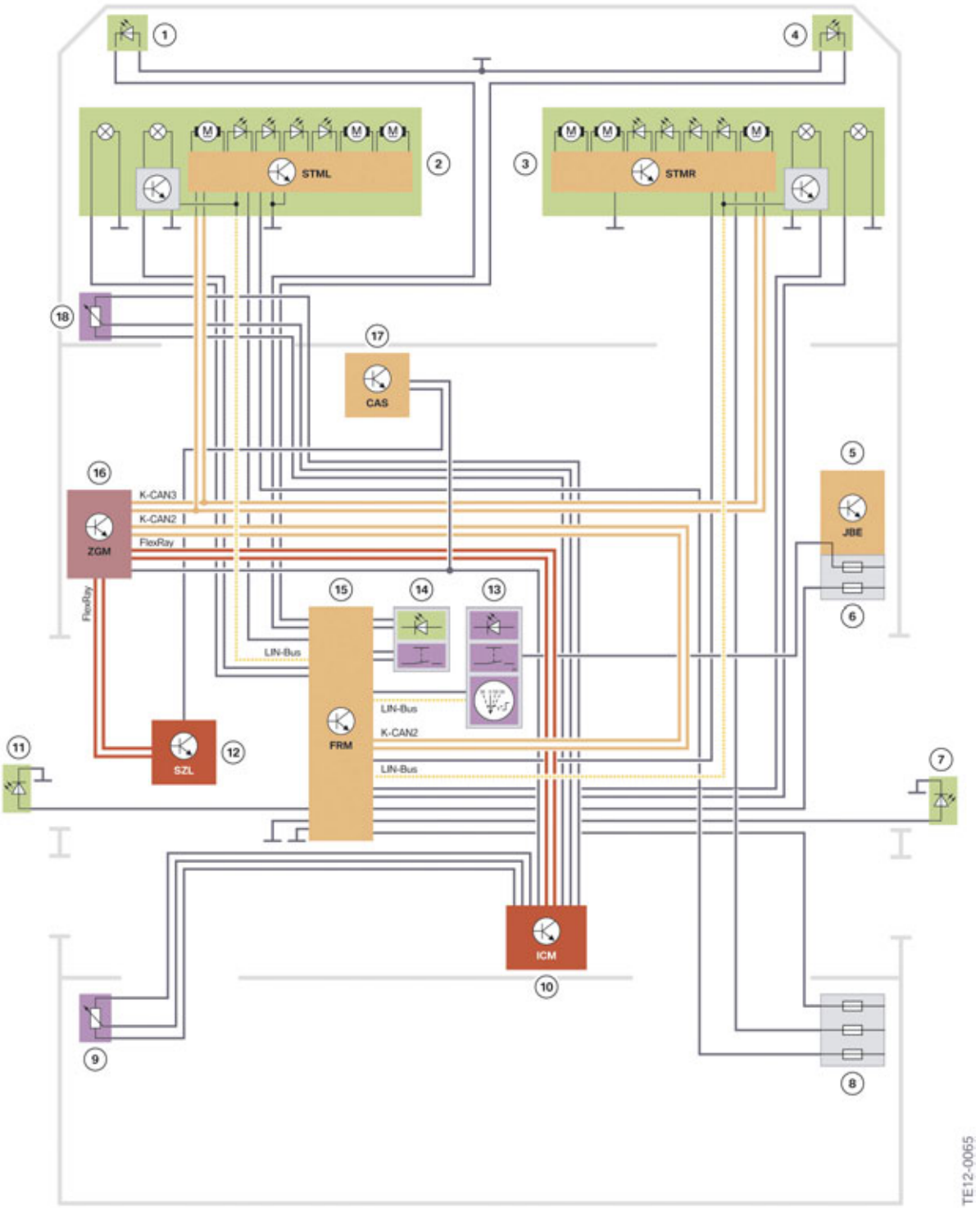
The high-beam assistant optional Automatic High-beams 5AC (standard on 760Li) is in conjunction with the LED headlight (option 552) and is offered in the ZLP Lighting Package.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

5.1. System wiring diagrams

5.1.1. Bi-xenon headlights and Adaptive Headlight (standard)



F01/F02 LCI system wiring diagram for Bi-xenon headlight and Adaptive Headlight (standard equipment SA524) and fog light

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

Index	Explanation
1	Left LED fog light (standard)
2*	Left headlight with the cornering light, the stepper motors for the Adaptive Headlight and the LEDs for side lights/daytime driving lights, the side marker light, the turn indicator and the positioning light
3*	Right headlight with the cornering light, the stepper motors for the Adaptive Headlight and the LEDs for side lights/daytime driving lights, the side marker light, the turn indicator and the positioning light
4	Right LED fog light (standard equipment 5A1)
5	Junction box electronics (JBE)
6	Power distribution box, junction box
7	Additional turn indicator in exterior mirror, right
8	Power distribution box, luggage compartment
9	Ride height sensor, rear
10	Integrated Chassis Management (ICM)
11	Additional turn indicator in exterior mirror, left
12	Steering column switch cluster (SZL)
13	Operating facility, light switch
14	Central locking button/hazard warning switch
15	Footwell module (FRM)
16	Central gateway module (ZGM)
17	Car Access System (CAS)
18	Ride height sensor, front

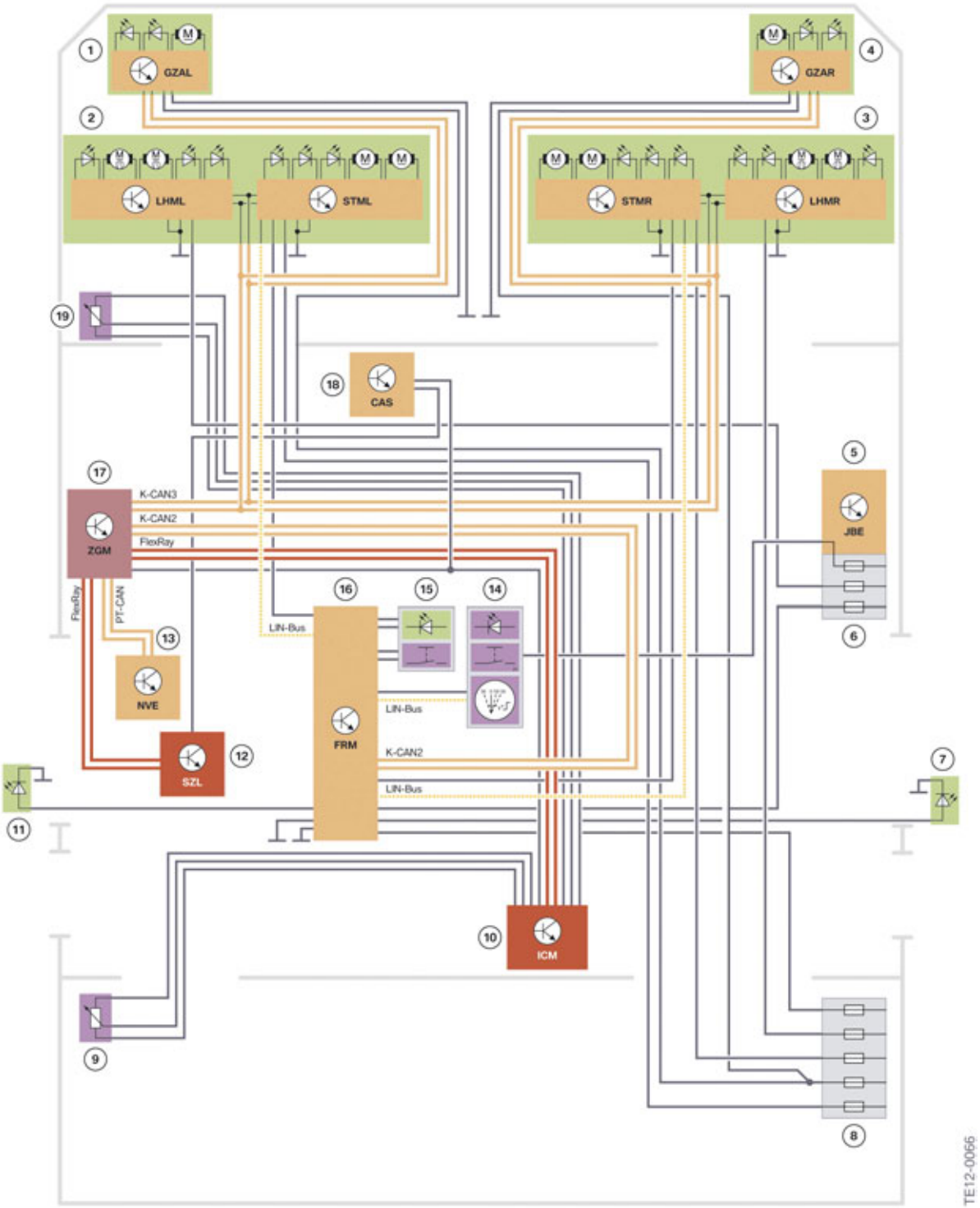
*** Not all components shown on the headlight graphic are available in the US market.**

Note: The pervious diagram shows the activation of the LED fog lights for the US market.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

5.1.2. Adaptive LED headlights (optional equipment SA552)



F01/F02 LCI system wiring diagram for Adaptive LED headlight (optional equipment 552)

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

Index	Explanation
1	Left LED fog light (standard)[1]
2	Left headlight with the LED main light module LHML (fan and LEDs for the cornering light, low-beam and high-beam headlights) and the headlight driver module STML (stepper motors and LEDs for the side marker light, the positioning light and the turn indicator)
3	Right headlight with the LED main light module LHMR (fan and LEDs for the cornering light, low-beam and high-beam headlights) and the headlight driver module STMR (stepper motors and LEDs for the side marker light, the positioning light and the turn indicator)
4	Right LED fog light (standard)[1]
5	Junction box electronics (JBE)
6	Power distribution box, junction box
7	Additional turn indicator in exterior mirror, right
8	Power distribution box, luggage compartment
9	Ride height sensor, rear
10	Integrated Chassis Management (ICM)
11	Additional turn indicator in exterior mirror, left
12	Steering column switch cluster (SZL)
13	Control unit for night vision electronics (NVE) **(only with option 5A3, Not available in the US)**
14	Operating facility, light switch
15	Central locking button/hazard warning switch
16	Footwell module (FRM)
17	Central gateway module (ZGM)
18	Car Access System (CAS)
19	Ride height sensor, front

[1] The diagram shows the activation of the headlights for targeted illumination **(option 5A3 is not available in the US)**.

Note: The activation of the LED fog light (standard equipment 5A1) is different and is described in the "Bi-xenon headlights and Adaptive Headlight (standard equipment 524)" chapter.

F01/F02 LCI General Vehicle Electronics

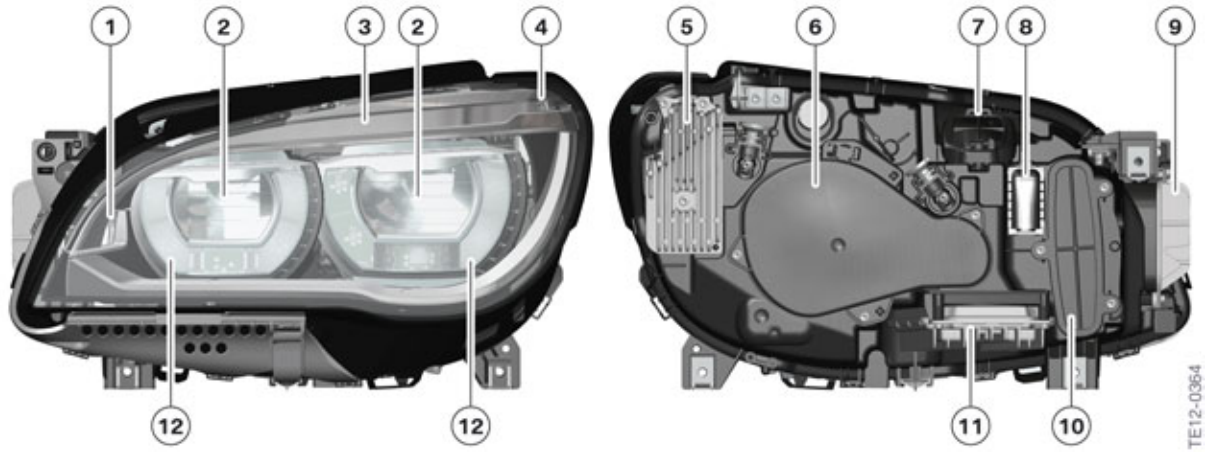
5. Exterior Lights

5.2. LED headlight

F01/F02 LCI adaptive LED headlight

The new optional equipment adaptive LED headlights (552) in the F01/F02 LCI are unique because for the first time both the low-beam headlight and the daytime driving lights are realized via LED arrays. The LED arrays replace the corona rings of the previous system and are significantly wider. The double rings are thus not only noticed during the day, but also at nighttime. This new feature supports the typical and unmistakable appearance of the vehicle.

The following graphic shows the components of the LED headlight.



F01/F02 LCI components of the LED headlight

Index	Explanation
1	Cornering light
2	High-beam headlight and headlight flasher
3	Turn indicator and positioning light/side lights
4	Side marker light
5	LED module for turn indicator and positioning light/side lights
6	Rear cover (outer fan, stepper motors)
7	Cover at top (inner fan)
8	12-pin electrical plug connection

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

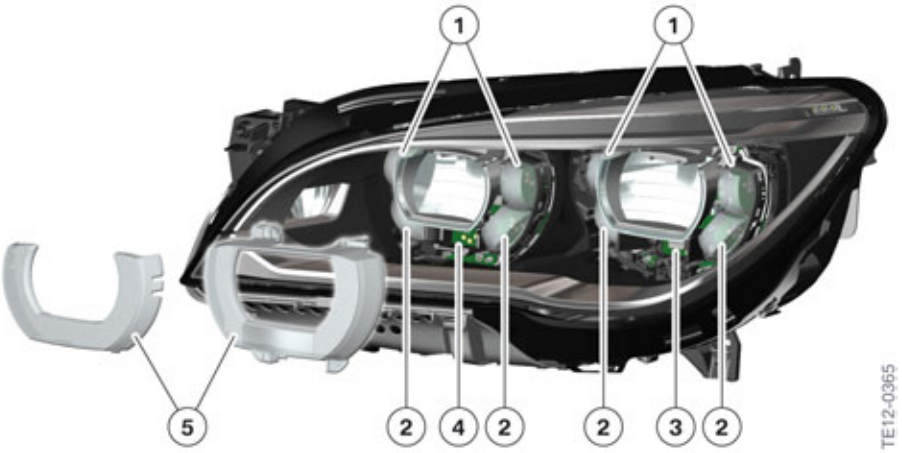
Index	Explanation
9	Cornering light LED module
10	Headlight driver module (STML / STMR)
11	LED main light module (LHML / LHMR)
12	Low-beam headlight/Daytime driving lights

5.2.1. Lighting functions

Low-beam headlight

F01/F02 LCI low-beam headlight of the LED headlight

Unlike the high-beam headlight and the LED headlights of other BMW models the F01/F02 LCI daytime driving lights and the low-beam headlight are generated from a lens projection system in the LED arrays.



F01/F02 LCI LED arrays of the LED headlight

5. Exterior Lights

Index	Explanation
1	LED arrays with free-form lens for basic light distribution
2	LED arrays with free-form lens for long-range lighting up to the horizontal light/dark boundary
3	LED array with optics module for long-range lighting of outer area (asymmetry)
4	LED array with optics module for the generation of the horizontal light/dark boundary
5	Headlight lens

Each headlight cluster incorporates five LED arrays with high-performance LEDs for the low-beam headlight and other LEDs for daytime driving lights. Each LED array generates a partial light intensity of the low-beam headlight. Special optics modules are located between the LED array and the headlight lens.

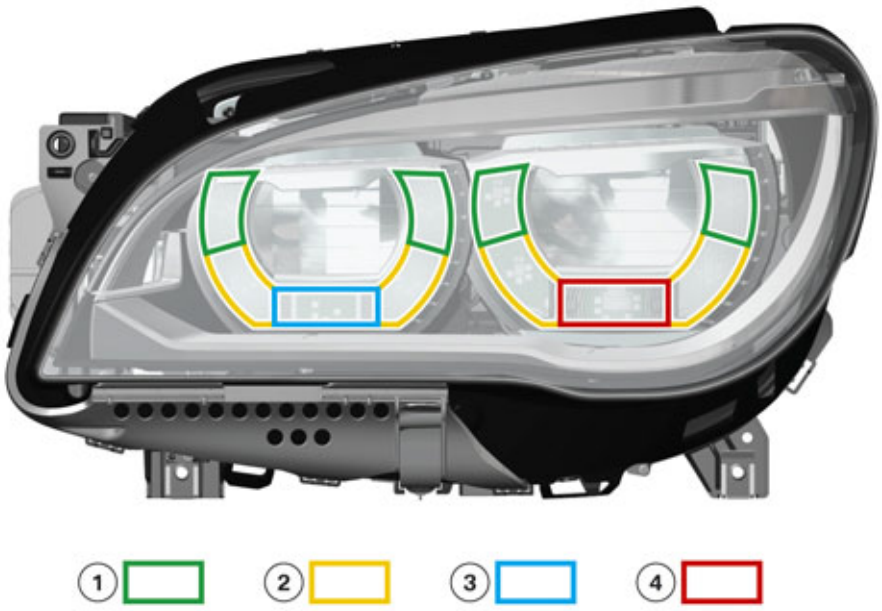
The upper LED arrays are used for basic light distribution and light up over the near field to near the horizontal light/dark boundary. The lower LED arrays are used for long-range illumination up to the horizontal light/dark boundary. The two centrally arranged LED arrays have special optics modules. The inner LED array generates the light/dark boundary and the outer the asymmetrical range of the low-beam headlight.

The light distribution for the low-beam headlight arises through the superimposition of these partial light ranges.

The following graphic shows the light distribution of the LED arrays.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights



F01/F02 LCI light distribution of the LED arrays of the LED headlight

Index	Explanation
A	Area up to the horizontal light/dark boundary roughly 60 m (197 ft) away
B	Near field up to roughly 20 m (65.6 ft) away
1	LED arrays for basic light distribution
2	LED arrays for long-range lighting up to the horizontal light/dark boundary
3	LED array for the generation of the horizontal light/dark boundary
4	LED array for the illumination of the asymmetrical range

The light of the upper LED arrays is used for basic light distribution. The light illuminates the near field symmetrically and extends to near the light/dark boundary. The near field starts roughly 8 to 10 m (26 to 33 ft) in front of the vehicle and extends up to roughly 20 m (65.6 ft) away.

The lower LED arrays are used for long-range lighting up to the horizontal light/dark boundary to roughly 60 m (197 ft) away. Their light superimposes parts in the near field and illuminates the area up to the horizontal light/dark boundary symmetrically.

The horizontal light/dark boundary between the lower bright area of the road illumination and the upper dark area arises from the superimposition with the light of the centrally arranged LED arrays of the inner LED arrays.

The centrally arranged LED array of the outer LED arrays generates the asymmetrical area of the low-beam headlight by the noticeable fresnel optics in the headlight lens. It illuminates the outer area of the roadway with an increased range.

The cornering light is always switched on dimmed to the low-beam headlight.

Daytime driving lights

For daytime driving lights the daytime driving lights LEDs in the LED arrays and the LEDs of the low-beam headlight are switched on dimmed. In addition, the positioning lights light up. The positioning light, together with the turn indicator, is installed in the LED headlight and can be replaced.

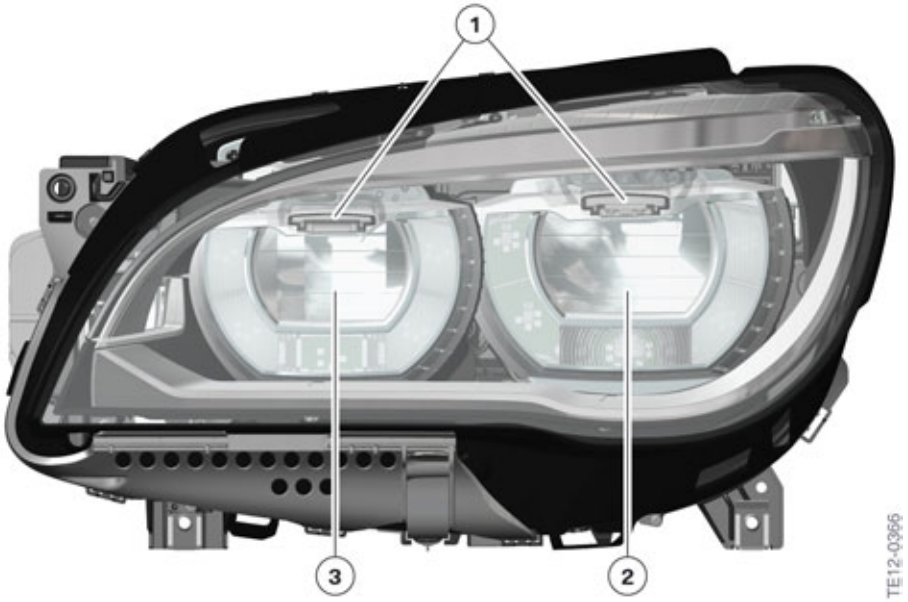
High-beam headlight

F01/F02 LCI high-beam headlight of the LED headlight

Similar to the LED headlights of other BMW models, the high-beam headlight is generated via a reflection system. In contrast to the LED headlights of other BMW models, both reflectors of the headlight are used for the high-beam headlight in the F01/F02 LCI.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights



F01/F02 LCI high-beam headlight of the LED headlight

Index	Explanation
1	LED arrays with optics module for high-beam headlight
2	Outer reflector for high-beam headlight (partial high-beam headlight, vertical light/dark boundary)
3	Inner reflector for high-beam headlight (flat illumination of the high-beam area)

The high-beam headlight arises from the superimposition of two partial areas. The outer reflector generates a vertical light/dark boundary, the partial high-beam headlight. The light distribution of this reflector is restricted inwards. The inner reflector provides flat lighting for the entire high-beam area.

Cornering light

Similar to the LED headlights of other BMW models, the cornering light is installed as an additional light source in the LED headlight and can be replaced. The cornering light supports the driver when turning, manoeuvring and parking. In addition, the cornering light is switched on dimmed to the low-beam headlight.

Side lights/Parking light and side marker light

Unlike the LED headlights of other BMW models only the positioning lights and the side marker lights are switched on for the side lights. Only the positioning light is switched on for the parking light.

The side marker light is always switched on in addition to the driving light. The LED bracket is a fixed component in the LED headlight and cannot be replaced.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

Positioning light and turn indicator

F01/F02 LCI turn indicator

Positioning light and turn indicator use a fiber-optic conductor, which as a positioning light is either fed by a white LED or as a turn indicator by a yellow LED group.

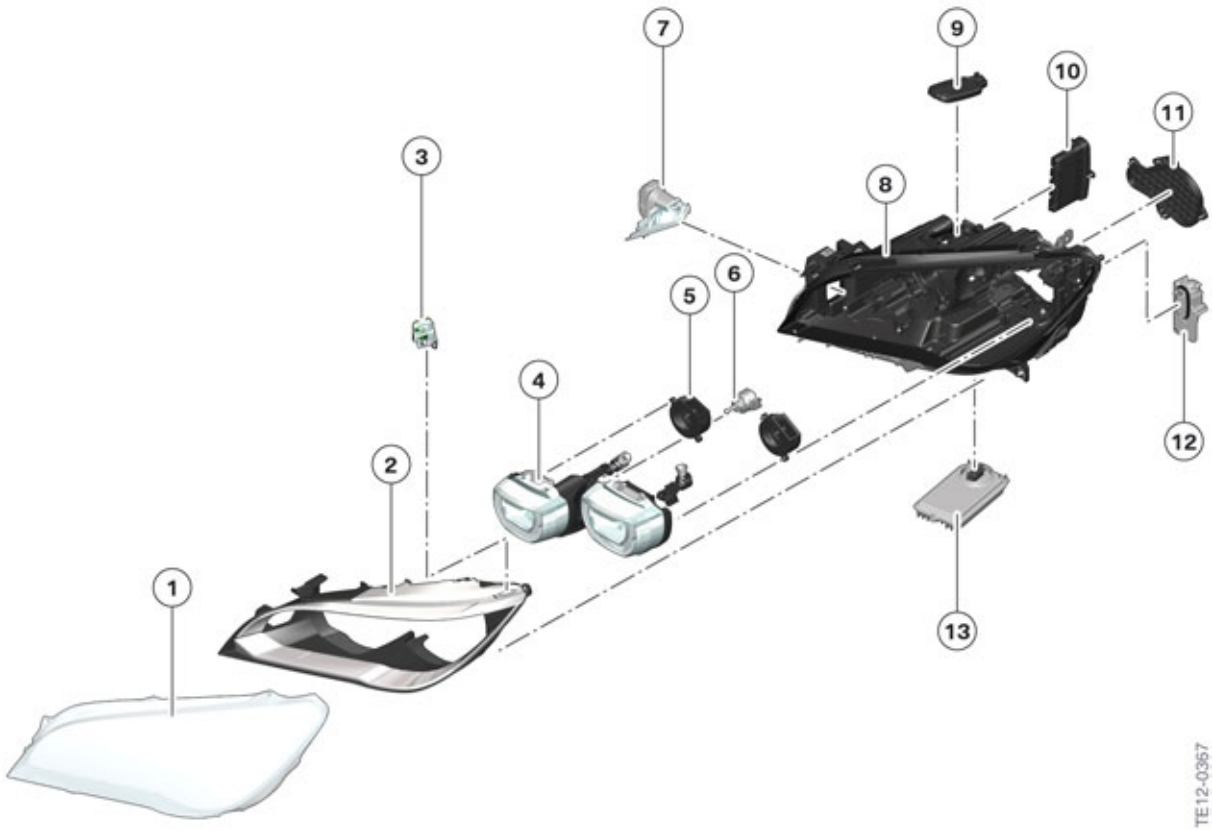
Only if the daytime driving lights are switched on, is the positioning light switched off during indicating. Otherwise the white LED of the positioning light also remains switched on during indicating.

The LED module for the turn indicator and the positioning light is installed in the LED headlight and can be replaced.

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

5.2.2. Components



F01/F02 LCI components of the LED headlight

Index	Explanation
1	Lens
2	Cover frame with inner frame and fiber-optic conductor for turn indicator and positioning light/side lights
3	LED module for side marker light
4	LED main light components
5	Fan
6	LWR stepper motor
7	Cornering light LED module
8	Headlight housing
9	Cover at top (inner fan)
10	Headlight driver module (STML / STMR)
11	Rear cover (outer fan, LWR stepper motor)
12	LED module for turn indicator and positioning light/side lights
13	LED main light module (LHML / LHMR)

F01/F02 LCI General Vehicle Electronics

5. Exterior Lights

The following components are replaceable:

- Fan
- LWR stepper motor
- Cornering light LED module
- LED module for turn indicator and positioning light/side lights
- Headlight driver module (STML / STMR)
- LED main light module (LHML / LHMR)

The headlight driver module STML / STMR and the LED main light module LHML/LHMR must be coded for the vehicle. Always follow proper repair instructions.

As with all BMW headlight systems, its imperative that all components be aligned properly using adequate equipment and repair procedure (please follow proper repair instructions).

5.3. Turn indicator

F01/F02 LCI turn indicator in exterior mirror

The additional turn indicator is integrated in the exterior mirror.

F01/F02 LCI General Vehicle Electronics

6. Interior Lighting

The components of the interior lighting in the front roof area are integrated in the roof function center (FZD), as well as above in the sun visors. The footwell lighting is located on the bottom of the dashboard. Voltage is supplied to the rear interior lighting via the roof function center (FZD). The footwell module (FRM) is the central control unit for the interior lighting.

F01/F02 LCI ambient room lighting, rear

The bulbs of the standard footwell lights are replaced with LEDs.

The scope of the optional equipment ambient light (optional equipment 4UR) has been extended and the function complemented with a color selection. Additional footwell lights on the driver and front passenger side, as well as B-column lighting, increase the effect of the ambient room lighting.

Ambient lighting includes:

- Door pocket lighting, front and rear
- Backrest rear panel lighting
- Entrance lighting
- Lighting of the storage compartment in the rear center armrest
- Footwell lighting, driver and front passenger side
- B-column lighting, driver and front passenger side.

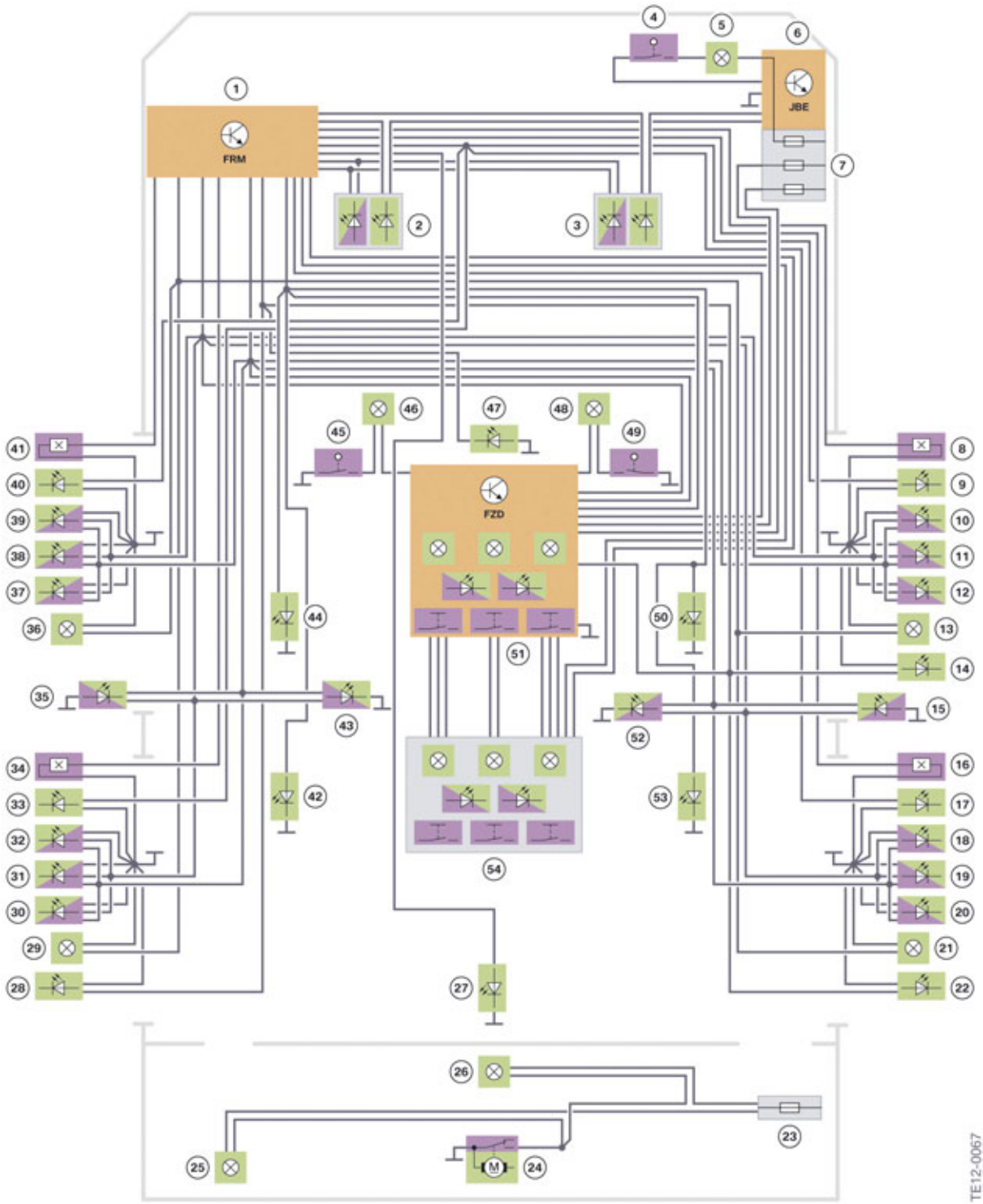
All LED lights with the exception of the floor lights, the power windows switch lighting, the entrance lighting, as well as the illuminated storage compartments in the front center console and in the rear center armrest are designed as optional two-color LEDs (orange/white). The driver can set the col-

or and brightness of the ambient lighting via the central information display (CID). He can choose between BMW Classic (orange) and BMW Modern (white), whereby the white light enhances the ambience at nighttime.

F01/F02 LCI General Vehicle Electronics

6. Interior Lighting

6.1. System wiring diagram



F01/F02 LCI system wiring diagram for interior lighting

F01/F02 LCI General Vehicle Electronics

6. Interior Lighting

Index	Explanation
1	Footwell module (FRM)
2	Footwell light and footwell lighting[1], driver's side
3	Footwell light and footwell lighting[1], front passenger side
4	Contact glove box
5	Glove box light
6	Junction box electronics JBE
7	Power distribution box, junction box
8	Door contact, front passenger side
9	Ground lights, front passenger side
10	Door area lighting[2], front passenger side
11	Inner door handle lighting[2], front passenger side
12	Door pocket lighting[1], front passenger side
13	Entrance lighting, front passenger side
14	Power window switch lighting, front passenger side
15	B-column lighting[1], front passenger side
16	Door contact, rear passenger side
17	Floor lights, rear passenger side
18	Door area lighting[2], rear passenger side
19	Inner door handle lighting[2], rear passenger side
20	Door pocket lighting[1], rear passenger side
21	Entrance lighting, rear passenger side
22	Power window switch lighting, rear passenger side
23	Power distribution box, luggage compartment
24	Trunk lid contact with trunk lid lock
25	Luggage compartment light trunk lid
26	Luggage compartment light
27	Lighting for storage compartment, rear center arm rest[1]
28	Power window switch lighting, rear driver's side
29	Entrance lighting[1], rear driver's side
30	Door pocket lighting[1], rear driver's side
31	Inner door handle lighting[2], rear driver's side
32	Door area lighting[2], rear driver's side

F01/F02 LCI General Vehicle Electronics

6. Interior Lighting

Index	Explanation
33	Floor lights driver's side, rear
34	Door contact, driver's side, rear
35	B-column lighting[1], driver's side
36	Entrance lighting, front driver's side
37	Door pocket lighting[1], front driver's side
38	Inner door handle lighting[2], front driver's side
39	Door area lighting[2], front driver's side
40	Floor lights, front driver's side
41	Door contact, front driver's side
42	Entrance lighting[1], rear driver's side
43	Backrest rear panel lighting[1], driver's seat
44	Entrance lighting[1], front driver's side
45	Vanity mirror light switch on front driver's side
46	Vanity mirror light on front driver's side
47	Front center console storage compartment lighting
48	Vanity mirror light on front passenger side
49	Switch for vanity mirror light on front passenger side
50	Entrance lighting[1], front passenger side
51	Roof function center FZD with ambient light[2]
52	Backrest rear panel lighting[1], front passenger seat
53	Entrance lighting[1], rear passenger side
54	Rear inner/reading light unit with ambient light[2]

[1] Only for optional equipment ambient light (optional equipment 4UR).

[2] Two-color ambient light for optional equipment ambient light (optional equipment 4UR).

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Technical training.
Product information.

F01/F02 LCI Driver Assistance Systems

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General information

Symbols used

The following symbol/schematic diagram is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further deviations may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral element of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the current respective information systems of the BMW Group for any changes/additions to the technical data.

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F01/F02 LCI Driver Assistance Systems

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F01/F02 LCI Driver Assistance Systems

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F01/F02 LCI Driver Assistance Systems

1. Introduction

The comprehensive driver assistance package of systems for the F01/F02 LCI has been modified and supplemented.

The driver assistance systems facilitate driving of the vehicle by:

- providing the driver with information
- giving the driver suggestions or
- automatically intervening in the driving process.

This training manual provides an overview of the driver assistance systems which are new or whose function has been modified:

- BMW Night Vision with pedestrian detection (option 6UK)
- Lane departure warning with camera-based collision warning —
  is Lane Departure Warning w/Collision Mitigation (option 5AS) and is included in the optional ZDA (Driving Assistance Package)
- Speed Limit information (option 8TH) — is also included in the optional ZDA (Driving Assistance Package
- ACC Stop & Go —
  is referred to as Enhanced Active Cruise Control (option 5AT) and can only be ordered in combination with ZDA (Driving Assistance Package)
- Collision warning with braking function —
  is an integral part of the Enhanced Active Cruise Control (option 5AT)
- Ranging information —
  is also an integral part of the Enhanced Active Cruise Control (option 5AT)

For further information on the driver assistance systems, please refer to the following ST811 F01 Complete Vehicle training manuals available on TIS and ICP:

- BMW Night Vision 2
- F01/F02 KAFAS
- F01 Cruise Control Systems
- F01 Dynamics Driving Systems

F01/F02 LCI Driver Assistance Systems

2. BMW Night Vision

BMW Night Vision detects (in optimum nighttime conditions) persons up to 100 m (328 ft) away within the system's warning range. The warning range is dependent on the driving speed and the steering angle. If there is a person within the warning range, they are categorized as being in potential danger and the system then issues a pedestrian warning.

2.1. BMW Night Vision with pedestrian detection

The operation and the warning function of the optional equipment BMW Night Vision with pedestrian detection (option 6UK) have been modified.

The pedestrian warning is now issued as early and acute warnings irrespective of how the Night Vision camera image is shown in the central information display (CID).

The warning is no longer shown in the CID, but instead appears exclusively in the instrument cluster or in the head-up display.

For further information on BMW Night Vision with pedestrian detection, please refer to the “BMW Night Vision 2” in the F01 training material.

2.1.1. Operation

Pedestrian detection (or the pedestrian warning) function is automatically activated after each engine start via the START/STOP button.

When the Night Vision button is pressed in the driver assist system operating facility, the image from the Night Vision camera is shown in the central information display (CID). The driver can adjust the brightness and the contrast from here.

The pedestrian warning is activated and deactivated as described below.

Vehicles with BMW Night Vision without collision warning

When the Intelligent Safety button is pressed in the driver assist system operating facility, the pedestrian warning front protective function is deactivated or activated:

- Pedestrian warning deactivated: LED above the button is off.
- Pedestrian warning activated: LED above the button lights up.

Vehicles with BMW Night Vision and with collision warning

When the Intelligent Safety button is pressed in the driver assistance system operating facility, the information screens for the collision warning and pedestrian detection functions are shown in the CID. The driver can deactivate or activate the pedestrian warning from here.

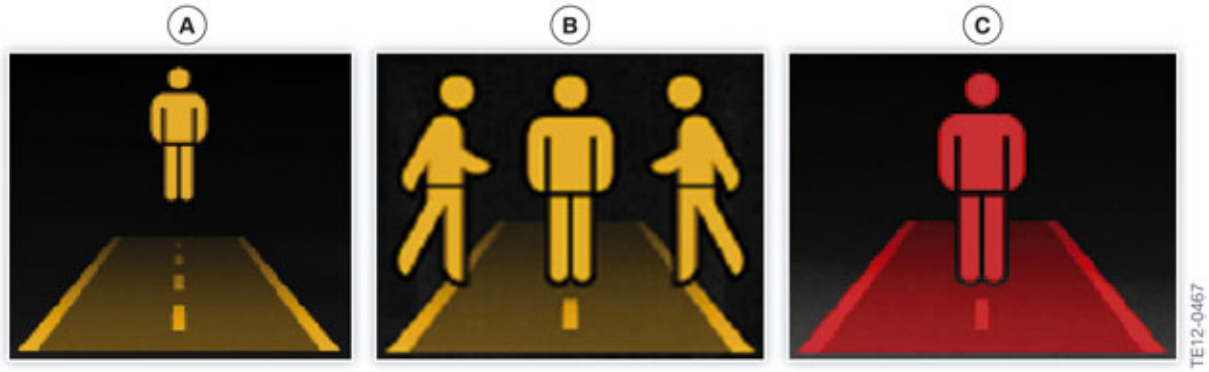
When the LED above the Intelligent Safety button in the driver assist system operating facility lights up, at least one front protective function is activated.

F01/F02 LCI Driver Assistance Systems

2. BMW Night Vision

2.1.2. Warning function

The system issues a pedestrian warning when BMW Night Vision detects a person (pedestrian) within the warning range. The pedestrian warning appears in the instrument cluster or in the head-up display. The pedestrian warning can be deactivated via the Intelligent Safety button in the driver assistance system operating facility or directly in the CID.



F01/F02 LCI - Pedestrian warning in the instrument cluster display or in the head-up display

Index	Explanation
A	Stage 1: Early warning, person is a long distance away from the vehicle
B	Stage 1: Early warning, person is a short distance away from the vehicle or is crossing the road
C	Stage 2: Acute warning, flashing person in red and acoustic warning signal

Early warning

The early warning is issued for the close range and the long-distance range when a person is detected within the warning range. The early warning shows - depending on where the person is situated - a person lit yellow who is located within the lane or is moving on it. If the early warning shows a person clearly above the roadway, they are still too great a distance away. If the early warning shows a person inside the roadway, the person at risk is already at close range.

In both cases the driver must brake or make an evasive maneuver.

Acute warning

The acute warning is issued by the system as late as possible and only if there is an immediate danger of a collision. The point at which the acute warning is issued is calculated in such a way that a collision can only be avoided by immediate emergency braking or by an evasive maneuver.

The acute warning shows a person flashing red within the roadway. In addition, an acoustic warning signal is sounded.

The acute warning does not relieve the driver of their responsibility to adapt their driving speed and driving style to the road and traffic conditions.

F01/F02 LCI Driver Assistance Systems
3. KAFAS

3.1. Lane departure warning

The lane departure warning is an integral part of the optional equipment ZDA (Driving Assistance Package **option 5AS)** in which its basic system operation remains unchanged. The lane departure warning warns the driver by vibrating the steering wheel in the event of the unintentional departure from a given lane. The prerequisite for this is the presence of suitable roadway or lane markings, that can be recognized with the KAFAS video camera of the control unit.

The system cannot replace a personal assessment of the roads and traffic situation. The lane departure warning merely supports the driver in the event the vehicle wanders away from the driven lane.

Please refer to “Functional limitations” section at the end of the chapter “KAFAS” for further information.

For further information on lane departure warning, please refer to the “KAFAS - Camera-based Driver Assist Systems F01/F02” training material available on TIS and ICP.

3.2. Collision warning (camera-based)

The camera-based collision warning is an additional function of the lane departure warning and therefore is an integral part of the optional ZDA [Driving Assistance Package (option 5AS) Lane Departure Warning with Collision Mitigation]. The collision warning alerts the driver of a possible collision danger and is realized using the KAFAS system. The camera-based collision warning is issued **without** an automatic braking function.

3.2.1. Operation

The collision warning is automatically activated after each engine start via the START/STOP button.

Vehicles with camera-based collision warning w/o Night Vision

When the Intelligent Safety button is pressed in the driver assist system operating facility, the collision warning function is deactivated or activated:

- Collision warning deactivated: LED above the button is off.
- Collision warning activated: LED above the button lights up.

The status of the collision warning is also displayed in the CID. In addition, when the collision warning is activated the driver can set the time of the early warning in three stages. The “late” setting corresponds to the point of the acute warning. The setting of the time of the early warning is saved for the current driver profile.

F01/F02 LCI Driver Assistance Systems
3. KAFAS

Vehicles with camera-based collision warning with Night Vision

When the Intelligent Safety button is pressed in the driver assist system operating facility, the information screen for the collision warning and pedestrian detection functions are shown in the CID. The driver can deactivate or activate the collision warning and the pedestrian detection from here.

In addition, when the collision warning is activated the driver can set the time of the early warning in three stages. The “late” setting corresponds to the point of the acute warning. The setting of the time is saved for the current driver profile.

When the LED above the Intelligent Safety button in the driver assist system operating facility lights up, at least one front protection function is activated.

3.2.2. Operating principle

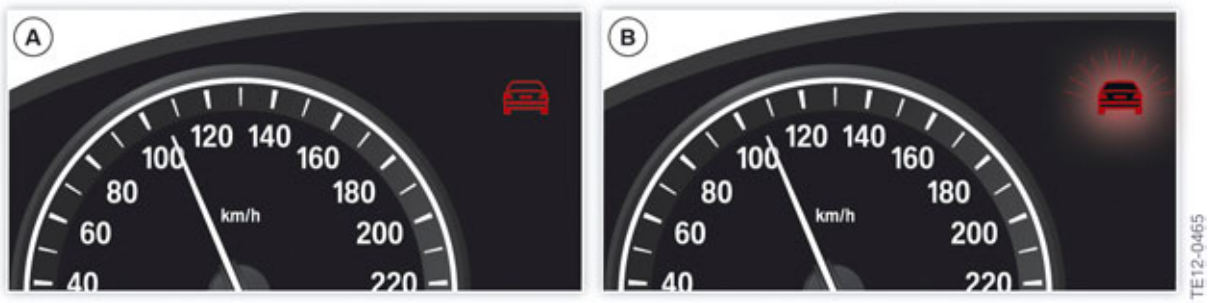
The system warns of a possible collision in two stages starting from a speed of about 15 km/h (9.3 mph).

The KAFAS video camera records the scenery ahead of the vehicle and uses image processing to detect the complete rear views of moving and stationary vehicles in the field of view. The corresponding warning stages are output in critical situations on the basis of the calculated positions, distances and relative speeds of the other vehicles. In addition to the warnings, the vehicle's brakes are prepared for emergency braking and the activation thresholds of the brake assistant are decreased. However, in contrast to Collision Warning with braking function, there is **NO** automatic brake intervention by the system.

The collision warning function is automatically activated after each engine start via the START/STOP button.

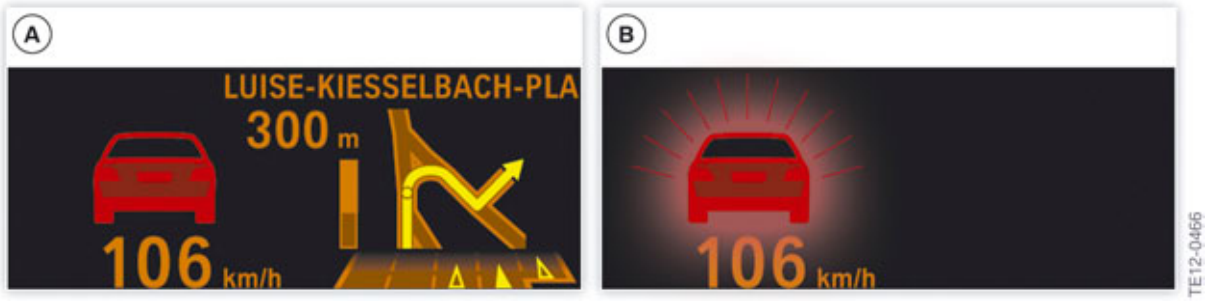
3.2.3. Warning function

The warning function is divided into two stages. It appears in the instrument cluster or in the head-up display.



F01/F02 LCI - Collision warning in the instrument cluster

F01/F02 LCI Driver Assistance Systems
3. KAFAS



F01/F02 LCI - Collision warning in the head-up display

Index	Explanation
A	Stage 1: Early warning, vehicle in red
B	Stage 2: Acute warning, flashing vehicle in red and acoustic warning signal

Early warning

The early warning is issued, for example, in the event of an imminent danger of collision on account of a high differential speed to the vehicle driving ahead or in the event of a very small distance to the vehicle driving ahead.

The early warning is indicated by a vehicle permanently illuminated in red in the instrument cluster or in the head-up display.

The time of the early warning can be configured in the CID. When the “late” setting is selected, the time of the early warning corresponds to that of the acute warning.

The collision warning is dependent on the vehicle's inherent driving speed. The distance calculated for the collision warning is much lower than the minimum distance required by law. It is therefore still the driver's responsibility to maintain the legal minimum distance.

Acute warning

The acute warning is issued by the system as late as possible and only if there is an immediate danger of a collision when the vehicle is approaching the vehicle driving ahead at relatively high differential speed. The point at which the acute warning is issued is calculated in such a way that a collision can only be avoided by immediate emergency braking or by an evasive maneuver. The acute warning therefore cannot be deliberately brought about or monitored.

If the vehicle is for example approaching at very low speed the vehicle driving ahead, no acute warning is issued either when the distance to the vehicle ahead is very small. This deliberately brought-about driving situation merely triggers off the early warning. In this way, less sensible and thus more annoying acute warnings are avoided by the system.

The acute warning cannot be deactivated. Nor can the time of the acute warning be set. If the acute warning is not to be issued, the collision warning front protective function must be deactivated.

An acute warning is indicated to the driver by a red flashing vehicle in the instrument cluster. In addition, an acoustic warning signal is sounded.

In contrast to Collision Warning with braking function, the camera-based collision warning system (5AS) does NOT automatically apply brake intervention.The acute warning does not relieve the driver of their responsibility to adapt their driving speed and driving style to the road and traffic conditions.

In towing or tow-starting situations the collision warning system must be deactivated in order to avoid malfunctions.

3.2.4. System limits

System limitations mean that warnings may under certain circumstances not be issued or are issued too late or without authorization. The driver must therefore always remain alert and observant so that they can actively intervene at any time so as to avoid the risk of an accident.

Range of detection

The collision warning has a limited capacity for detection.

This means that warnings sometime may not be issued or may be issued late.

The following vehicles may not be detected:

- A vehicle travelling at slow speed when approaching at high speed
- Vehicles that cut in suddenly or are heavily decelerating
- Vehicles with an unusual rear view or with poorly visible rear lights
- Partially concealed vehicles
- Two-wheeled vehicles travelling ahead.

Please refer to the Collision Warning w/Brake Application section for more information.

3.3. Speed Limit Information

The optional equipment Speed Limit Information (8TH) is referred to in the following section as road sign recognition for short. Current speed limits and bans on passing/overtaking are shown in the instrument cluster or in the head-up display. In this way, road sign recognition helps the driver to adhere to and not to exceed the maximum speed limit.

Road sign recognition (option 8TH Speed Limit Information) is only available in conjunction with the navigation system (standard) and it is part of the optional ZDA Driver Assistance Package.

F01/F02 LCI Driver Assistance Systems

3. KAFAS

The responsibility for the vehicle and for the speed that is adopted rests exclusively with the driver.

The control unit for the road sign recognition function is the KAFAS control unit.

The display of the speed limit signs is based on the evaluation of data from the navigation system and the evaluation of image data recorded by the KAFAS video camera.

The maximum allowable speed of the road currently driven is displayed in the instrument cluster and in the head-up display.

The KAFAS uses the video camera to monitor the road signs at the side of the road and takes into account the information from the navigation system (609). Thus, for example in some areas, the applicable maximum speed is displayed without there being actual recognizable road signs stipulating the speed.

Speed limit information displayed on the HUD **(F30 graphic shown)**

Speed limit information displayed on the instrument cluster **(F30 graphic shown)**

3.3.1. System limits

The system has a detection rate of around 90 to 95%.

Road signs for speed limits which do not conform to the legal standards, especially those which do not have square borders, are not always recognized. The same applies to road signs which are fully or partially concealed by stickers, dirt or vegetation.

Long distances to the road sign, high driving speeds and poor weather conditions, particularly at night, make it more difficult for the system to recognize road signs reliably.

The data in the navigation map must be up to date in order for the current speed limit to be correctly displayed. If the current place has not yet been incorporated for navigation purposes, for example when driving in development areas, on new roads or on roads where the routing has been changed, a recognized road sign for speed limits can only be displayed for the next 500 m (547 yds).

Supplementary sign recognition

The system can only recognize signs that are included in its database. Text references to supplementary signs cannot be read or interpreted. Before speed limits with limiting validity are displayed, the system scans further information from the vehicle electrical system.

The system can't read text, it can only recognize a sign that is included in the "sign database" – therefore the system was programed extensively in 48 US states + western/eastern Canada therefore all speed limit signs (10-80 mph + signs as e.g. "Trucks", "Trailers", "School", "Construction area") are normally (when conditions allow) recognized by the camera.

The trailer signal for vehicles in towing mode is not evaluated for the display of speed limits, as the speed limits for vehicles with trailers differ from country to country and are dependent on the trailer type.

Supplementary signs are not recognized. The speed limit is then displayed as currently valid without the supplementary sign being interpreted.

Road signs on parallel, branching-off or merging roads and on exits

Parallel roads are not recognized neither with the KAFAS video camera nor with the aid of the navigation map. Signs posted there can be recognized and displayed as speed limits for the road currently being driven.

Speed limits for branching-off or merging roads are usually also adopted and displayed for the road currently being driven.

Speed limits on highway exits with or without an arrow as a supplementary sign are usually correctly evaluated and suppressed in the displayed when the exit is driven past. This is only the case if the data in the navigation map is up to date.

In the case of overhead highway signs with different, lane-specific speed limits, the speed limit nearest to the lane the vehicle is driving in is displayed. The display is not modified after a later lane change.

Information signs in the road sign surroundings

Information signs with speed limits at border crossings with references to the different legal maximum speeds for ordinary roads and highways, can be mistakenly recognized as currently valid and displayed. The same applies to information signs set out only in different colors, e.g. for minimum or recommended speeds.

Stickers on vehicles

Stickers showing a speed limit on vehicles driving ahead or on overtaken vehicles, e.g. on trucks, buses, trailers and construction machinery, can be mistakenly recognized as the currently valid speed limit and displayed.

Town/city limits

If the town/city limits sign is not clearly recognized and the data in the navigation map are not up to date, the speed limit at town/city limits may be incorrectly displayed.

Legal changes

If maximum speeds prescribed by law are changed, these are only available after a navigation software update. The original, but no longer valid speed limits are displayed until the update is issued.

The system can only currently detect speed limit signs and no other traffic signs.

This system cannot replace the driver's personal assessment of the road and traffic situation. Speed Limit Information supports the driver but does not is not intended to replace the human eye.

3.4. Functional limitations

The function of the KAFAS video camera and thus also the function of the corresponding driver assistance systems may be impaired in the following situations:

- heavy fog, rain, spray or snow
- strong light in the camera lens
- if the field of view of the KAFAS video camera or the windshield is dirty or concealed
- on sharp corners
- up to 10 seconds after engine starting via the START-STOP button
- during the calibration process of the KAFAS video camera immediately after vehicle delivery or a camera change.

System and functional limitations mean that warnings and bans may under certain circumstances not be issued or are issued too late or without authorization. The driver must therefore always remain alert and observant so that they can actively intervene at any time so as to avoid the risk of an accident.

F01/F02 LCI Driver Assistance Systems

4. High-beam Assistant

In vehicles without adaptive headlights (option 524) and without adaptive LED headlights (option 552) the function of the high-beam assistant (option 5AC) remains unchanged at two stages. The high-beam headlights are automatic switched on and off.

For further information on the high-beam assistant in this case, please refer to the “KAFAS - Camera-based Driver Assistance Systems” ST811 F01 Complete Vehicle training material available on TIS and ICP.

The high-beam assistant cannot replace a personal decision on the use of the high-beam headlight. In some situations, manual dipping is required as otherwise there is a safety risk.

F01/F02 LCI Driver Assistance Systems

5. ACC Stop & Go

Active cruise control with Stop & Go function (ACC Stop & Go) has enhanced functionality in the F01 LCI. Option 5AT (Enhanced Active Cruise Control) requires the optional ZDA Driving Assistant Package.

ACC Stop & Go adjusts a driver-specified desired speed and, if required by the traffic situation, also the preselected following distance automatically to the vehicle driving ahead. Passenger cars, trucks and motorcycles are detected. The scope of this application ranges from high speeds down to a full stop. Depending on the stationary time, driving off from a standstill is performed automatically or in response to a prompt by the driver.

The F01/F02 LCI ACC Stop & Go system can (for the first time) not only detect slowly stopping vehicles but also vehicles that are already stationary and therefore can react to these situations accordingly. The detection of stationary vehicles is a unique feature as the function of this application is also extended to include high-capacity urban (arterial) and ring (loop) roads.

The reaction to transverse movements has also been improved. This enables the system to react more swiftly to vehicles that are veering in and out of our lane or turning.

By connecting the KAFAS video camera to the ACC Stop & Go system we extend the scope of this application. In addition to the radar data, the image data from the video camera is now evaluated in ACC Stop & Go. This combination of image and radar data facilitates the clear identification of lane markings and distinction between stationary vehicles and other immobile objects.

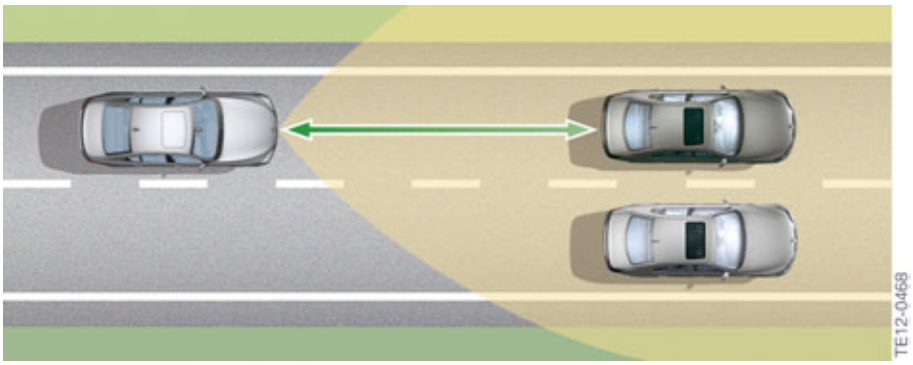
In addition, the adjustment range for the set speed has been increased from 180 km/h to 210 km/h (112 mph to 130 mph).

The acceleration behavior of ACC Stop & Go is also adapted for ECO PRO mode. ACC Stop & Go accelerates the vehicle in ECO PRO mode much more smoothly for optimized fuel consumption. The ECO PRO instructions regarding the accelerator pedal position are suppressed (not displayed) when ACC Stop & Go is activated.

5.1. Introduction

ACC Stop & Go offers the driver optimum support not only in flowing traffic, but also in traffic jam situations.

The scope of application of ACC Stop & Go ranges from high speeds down to a full stop. The distance and the speed are automatically adjusted in this range.



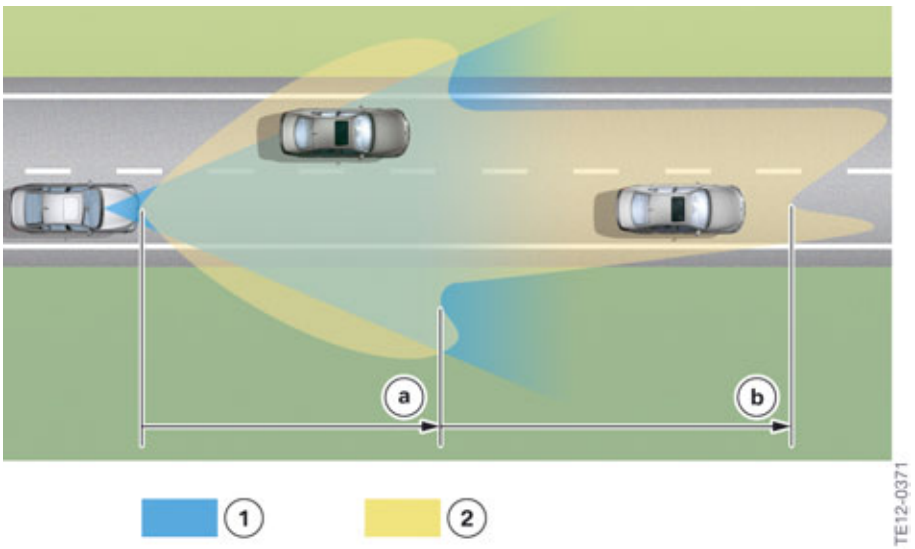
F01/F02 LCI - Active cruise control

F01/F02 LCI Driver Assistance Systems

5. ACC Stop & Go

ACC Stop & Go controls the speed if there is no vehicle driving directly ahead and automatically switches to distance control (ranging) if the radar sensor detects a slower vehicle in its lane.

A 77 GHz radar sensor in the system can identify vehicles up to 200 m (218.7 yd) ahead; this sensor can operate largely independently of weather conditions. Thanks to the radar sensor's improved detection capability and the calibration with the image data from the KAFAS video camera, even vehicles in the neighboring lanes are detected. If these vehicles drive into the subject vehicle's own lane, ACC Stop & Go adapts the speed to vehicles veering in or driving ahead. Consequently the time interval selected by the driver is maintained constant.



F01/F02 LCI - Schematic diagram of monitoring ranges

Index	Explanation
a	Close range
b	Long-distance range
1	Detection range of KAFAS video camera
2	Detection range of radar sensor

The detection range (cone) of the radar sensor is up to 60 m (65.6 yd) wider in the close range than in the long-distance range. This provides for wider lane coverage. Within this range the radar data or detected objects are verified with the image data from the KAFAS video camera.

The KAFAS control unit can detect transverse movements better, assign lanes and clearly identify vehicles. In this way, vehicles veering in and out at close range can be detected earlier and much more quickly. The combination of radar and video data also facilitates the clear identification of stationary vehicles.

The system's Stop & Go function brings the vehicle to a complete stop if necessary. If the vehicle in front starts again after a standstill, information is output to the driver. To drive off again, the driver must acknowledge this information. Only if the duration of the standstill is very short does the starting process take place fully automatically by ACC Stop & Go.

In this way, ACC Stop & Go supports the driver not only in flowing traffic, but also in traffic jam situations, both on multiple-lane highways and ordinary roads and on urban arterial and ring roads.

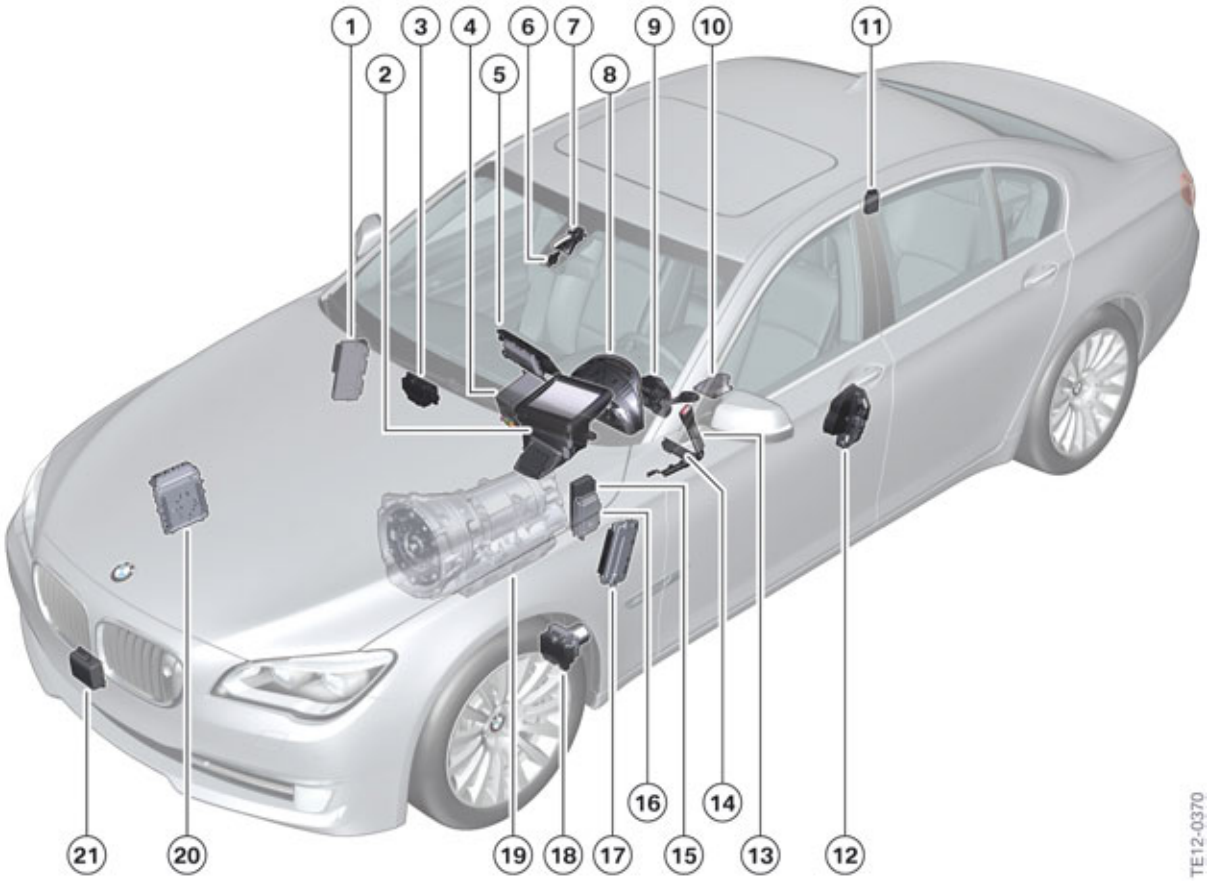
F01/F02 LCI Driver Assistance Systems

5. ACC Stop & Go

Further consideration should be given here to the following areas of the driver assist system ACC Stop & Go:

- System components
- Information from the vehicle environment
- Control functions
- Operation and display
- Behavior when driver intends to exit
- Monitoring functions.

5.2. System components



F01/F02 LCI - System components, ACC Stop & Go

F01/F02 LCI Driver Assistance Systems

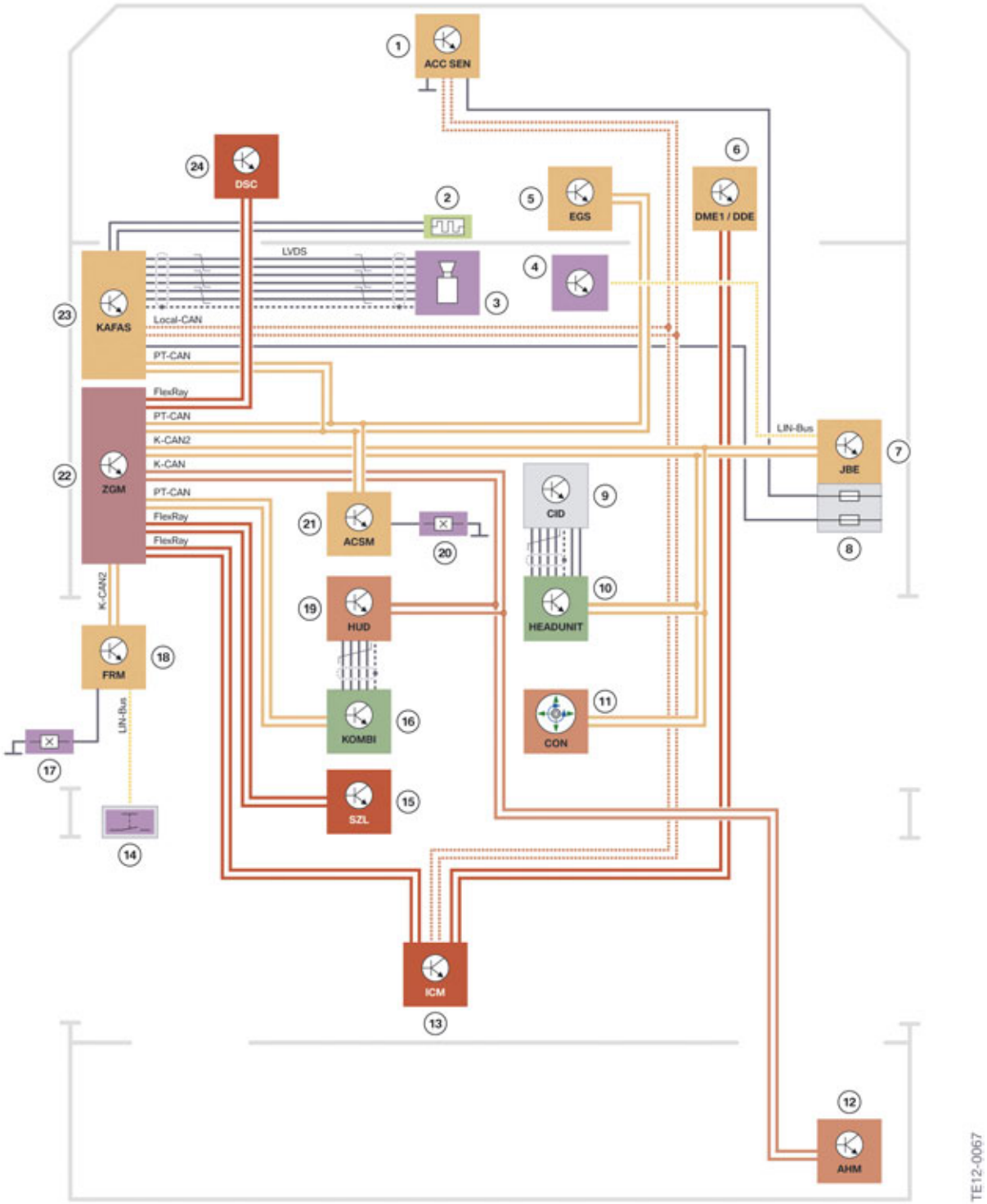
5. ACC Stop & Go

Index	Explanation
1	Junction box electronics (JBE) and power distribution box
2	Head-up display (HUD)
3	Crash Safety Module (ACSM)
4	Headunit
5	Central information display (CID)
6	Rain-light-solar-condensation sensor (RLSBS)
7	KAFAS video camera
8	Instrument cluster (KOMBI)
9	Steering column switch cluster (SZL)
10	Integrated Chassis Management (ICM)
11	Trailer module **(Not for US)**
12	Door contact driver's door
13	Seat belt buckle contact, driver
14	Operating facility for driver assist systems
15	Central gateway module (ZGM)
16	KAFAS control unit
17	Footwell module (FRM)
18	Dynamic Stability Control (DSC)
19	Electronic transmission control (EGS)
20	Digital Engine Electronics
21	Radar sensor for ACC Stop & Go

F01/F02 LCI Driver Assistance Systems

5. ACC Stop & Go

5.2.1. System wiring diagram



F01/F02 LCI - System wiring diagram, ACC Stop & Go

F01/F02 LCI Driver Assistance Systems
5. ACC Stop & Go

Index	Explanation
1	Radar sensor for ACC Stop & Go
2	Video camera heater
3	KAFAS video camera
4	Rain-light-solar-condensation sensor (RLSBS)
5	Electronic transmission control (EGS)
6	Digital Engine Electronics
7	Junction box electronics (JBE)
8	Junction box for the power distribution box
9	Central information display (CID)
10	Headunit
11	Controller
12	Trailer module **(Not for US)**
13	Integrated Chassis Management (ICM)
14	Operating facility for driver assist systems
15	Steering column switch cluster (SZL)
16	Instrument cluster (KOMBI)
17	Door contact driver's door
18	Footwell module (FRM)
19	Head-up display (HUD)
20	Seat belt buckle contact, driver
21	Crash Safety Module (ACSM)
22	Central gateway module (ZGM)
23	KAFAS control unit
24	Dynamic Stability Control (DSC)

5.2.2. Radar sensor for ACC Stop & Go

The radar sensor sends out bundled electromagnetic waves. The echoes reflected by objects are received and evaluated by the radar sensor. Information on objects located in front of the radar sensor can be achieved in this way. This information includes size, distance and the speed derived therefrom.

For the first time in the F01/F02 LCI the radar sensor receives additional information from the KAFAS control unit via its own sensor bus. This information is lane information on transverse movements and information on vehicle identification. The information supports the radar sensor in detecting and evaluating objects and facilitates clear vehicle identification. This video data is required for the reaction to stationary vehicles.

F01/F02 LCI Driver Assistance Systems

5. ACC Stop & Go

F01/F02 LCI - Radar sensor for ACC Stop & Go

The radar sensor is located behind a removable grill on the front bumper.

F01/F02 LCI - Installation location of radar sensor

Index	Explanation
1	Radar sensor for ACC Stop & Go
2	Removable grill

5.2.3. KAFAS video camera and control unit

The KAFAS control unit detects vehicles when their rear ends are recorded by the video camera. The KAFAS control unit also supplies lane information and thus helps the radar sensor to determine vehicle position and movement much more quickly. The data is transmitted via the sensor bus to the radar sensor.

5.2.4. Integrated Chassis Management (ICM)

For a detailed description of Integrated Chassis Management (ICM), please refer to the “F01 Dynamic Driving Systems” in ST811 F01 Complete Vehicle training material available on TIS and ICP. The following text provides a brief overview and addresses the particulars connected with the topics presented here.

The ICM in the F01/F02 LCI calculates the control functions, sensor data and vehicle values used to influence longitudinal and transverse dynamics. Also integrated in ICM are micromechanical sensors which supply driving dynamics signals.

Two different ICM versions are used in the F01/F02 LCI, a basic version for vehicles without ACC Stop & Go and a high version for vehicles with ACC Stop & Go.

5.3. Information from the vehicle environment

Information on road users ahead is required for the ACC Stop & Go function. This information is obtained with the aid of the radar sensor for ACC Stop & Go and prepared in ICM.

5.3.1. Recording objects

The detection of the road users ahead is one of the most important functions of the Active Cruise Control. For the Stop & Go function, this task must be done not only in the long-distance range, but also in close range up to directly in front of the vehicle. This is necessary as at low speeds one can drive up very close to the vehicle ahead.

The radar sensor for ACC Stop & Go records the close range and long-distance range ahead of the vehicle with the aid of radar waves. In addition to detecting objects, the position of objects in the x and y directions the radar sensor for ACC Stop & Go can also determine the relative speed of a particular vehicle. With the aid of the image data from the KAFAS video camera, objects can be clearly identified as vehicles and transverse movements as lane changes.

The radar sensor for ACC Stop & Go also uses the driving speed to calculate the acceleration of the vehicles driving ahead in relation to the subject vehicle. These values are required for distance control (ranging).

5.3.2. Processing object data

The object data vehicle detection, position and motion variables are already prepared in the radar sensor for ACC Stop & Go. Individual vehicles are summarized and tracked over time in order to bypass measurement failures. The object data is subjected to an initial filtering process and then summarized again, since parts of the close and long-distance ranges overlap. This overlap occurs in particular in close range.

With the summarized object data, another filtering precess is done, which takes into account the special requirements for distance control (ranging). The filtered object data is transmitted to ICM for assessment.

5.3.3. Assessing objects

To decide which vehicle should be used for distance control, a diagnostic statistic is calculated in ICM for each vehicle from its object data.

The following two key criteria are included in the calculation:

- Position and relative movement of the vehicle driving ahead to the subject vehicle. The closer the vehicle driving ahead is to the subject vehicle and/or the faster it moves to the subject vehicle, the higher the diagnostic statistic.
- Period spent by the vehicle driving ahead in the particular lane.

The vehicle with the highest diagnostic statistic is used for distance control. Here the vehicles are also classified according to the motion status. A distinction is made between driving and stationary vehicles. For a reaction to a stationary vehicle its object data must be verified by the image data from the KAFAS video camera. If the KAFAS video camera fails, there can be no reaction to stationary vehicles. The driver is informed of the failure by means of a display in the instrument cluster and a Check Control message.

5.4. Control functions

5.4.1. Cruise control

Cruise control for ACC Stop & Go basically corresponds to (DCC) Dynamic cruise control.

5.4.2. Distance control (ranging)

Distance control (ranging) is the core function of the ACC Stop & Go system. It is integrated for ACC Stop & Go in ICM. The driver can select a desired distance in four stages using two buttons on the multifunction steering wheel. ACC Stop & Go calculates the set-point distance for the control from this preselection.

The set-point distance during the journey is proportional to the driving speed. At a lower driving speed and at standstill, the proportional distance to the driving speed is no longer used, but instead value in meters. Distance control uses the prepared vehicle object data with the highest diagnostic statistic as input variables.

Distance control takes into consideration the following situations (in particular):

- **Maximum values for acceleration and deceleration:**
  The maximum values for acceleration and deceleration below around 50 km/h (30 mph) are dynamic values. They correspond to the acceleration values which the driver himself would use and considers comfortable. Depending on the situation, ACC Stop & Go accelerates by a maximum of 2 m/s² (6.56 ft/s²) and decelerates by a maximum of 4 m/s² (13.1 ft/s²).
- **Prompt to take over vehicle handling:**

When ACC Stop & Go is no longer able to maintain a safe distance, e.g. on account of very high differential speeds or an insufficient maximum deceleration, two short warning tones sound and the orange vehicle symbol is displayed in the instrument cluster or flashes in the head-up display. The system continues to perform its control function and prompts the driver to take over vehicle handling and to keep their distance accordingly.
If the collision warning with braking function is activated, this will issue a warning if the takeover prompt is not followed and there is an imminent danger of collision. The red vehicle symbol is then displayed in the instrument cluster or in the head-up display. For further information, please refer to the chapter “Collision warning with braking function”.

5.4.3. Cruise control when cornering

Cruise control of ACC Stop & Go on bends is based on that of DCC. In the case of an object loss on the bend, it is necessary to wait a certain period of time to see whether the object reappears again (transition curve). The vehicle is accelerated only if the object no longer appears.

5.5. Operation and display

5.5.1. Activation and deactivation

Activation and deactivation of ACC Stop & Go and DCC are virtually identical as other BMW vehicles. ACC Stop & Go cannot only be activated by the driver during the journey, but also when the vehicle is at a standstill, if the system detected another vehicle before its own vehicle. To activate ACC Stop & Go at standstill, the driver must press the brake pedal and at the same time press the RES button. The following conditions must also be satisfied:

- Seat belt fastened and door closed
- Drive position “D” engaged
- Engine running
- Parking brake not activated
- No system faults detected.

The set speed can be set in a range from 30 to 210 km/h (18.6 to 130 mph). Compared to the DCC, a vehicle with ACC Stop & Go receives a keypad in the multifunction steering wheel, which also has two buttons for setting the distance.

F01/F02 LCI Driver Assistance Systems

5. ACC Stop & Go

F01/F02 LCI - Steering wheel, ACC Stop & Go

Index	Explanation
1	Button - speed SET
2	Button - decrease distance
3	± rocker switch - change speed, set speed
4	Button - increase distance
5	Button - switch ACC Stop & Go on/off
6	Button - retrieve saved speed (RES)

A (brief) press of the respective button for changing the distance increases or reduces the desired distance, which ACC Stop & Go uses for control. A total of four stages are available to the driver for this purpose. In the instrument cluster the selected stage of the distance is faded-in.

Like for DCC, it is also necessary that the symbol screen masks are complemented if necessary with notes in the instrument cluster for ACC Stop & Go. The symbol screen masks are for example the set speed and the distance bar. The displays are faded-in for about 3 seconds. For each renewed operation the display is faded-in again for another 3 seconds.

ACC Stop & Go information is also shown in the head-up display.

5.5.2. Changing the desired speed

The driver can change the desired speed of ACC Stop & Go in just the same way as for DCC if the system is switched on. Also if the particular vehicle is brought to a standstill by ACC Stop & Go, this adjustment option is given. The adjustable range of the desired speed is 30 to 210 km/h (18.6 to 130 mph).

5.5.3. Changing the desired distance

The desired distance can be changed by a brief press of the corresponding button in the multifunction steering wheel when the system is switched on. The usual four distance stages are available for selection, which are represented by bars in the instrument cluster. The change of the desired distance im-

mediately results in a noticeable vehicle response during the journey. The vehicle accelerates or decelerates slightly in order to adjust to the new desired distance. At standstill the vehicle is not set in motion by the change of the desired distance.

If ACC Stop & Go is oversteered by the driver, no change of the desired distance can be effected. During oversteering by the driver the distance bars in the instrument cluster disappear.

5.5.4. Stopping and starting

If the vehicle ahead stops, ACC Stop & Go also decelerates until at a full stop, whereby a safe distance to the vehicle ahead is observed. If the vehicle ahead starts moving again within 3 seconds, the F01/F02 LCI also starts up without intervention by the driver. If the vehicle remains stationary for longer than 3 seconds, the F01/F02 LCI no longer starts up automatically. Instead, ACC Stop & Go indicates to the driver in the instrument cluster that they can start driving again. As soon as the driver acknowledges this signal by pressing the accelerator pedal or by pressing a button on the steering wheel, the vehicle is set in motion again.

In the event of extreme external conditions, such as a sharp incline for example, the ACC Stop & Go may no longer be able to drive off. In this case, the brake pressure required to hold the vehicle is built up again. The system remains in this state until the driver switches it off or performs the starting process him/herself manually. This does not represent a fault, but a situation in which the limits for the operating range of ACC Stop & Go have been exceeded.

5.5.5. Behavior when driver gets out of the vehicle

ACC Stop & Go reliably decelerates the vehicle to standstill with help of the DSC hydraulics and stops it there. Without the supply of electrical energy, the DSC hydraulics is not able however to maintain the brake force required for stopping for a long period.

If the driver leaves the vehicle in standstill when the system is active, ACC Stop & Go is deactivated and the vehicle is permanently kept in standstill with help of the parking lock of the transmission.

The signals of the seat belt buckle contact (driver) and of the door contact (driver's door) are evaluated to detect the driver's intention to exit the vehicle. A seat occupancy detection signal (driver's seat) is not used in the F01/F02 LCI.

5.6. Monitoring functions

ICM monitors the system network to the effect that all the participating subsystems are operational, all the input signals required for the function are valid, and the electronics of the particular control unit are fault-free. When troubleshooting it is important to incorporate not only individual components, but also participating systems from the system network.

If there is a fault in the radar sensor system, the function is deactivated completely. If the video information from the KAFAS control unit fails, the function will only continue to be available with limited effect. In both cases the driver is informed of the failure by means of a display in the instrument cluster and a Check Control message. An activation will only be possible again when the fault is no longer present.

F01/F02 LCI Driver Assistance Systems

6. Collision Warning w/Brake Application

The collision warning with brake application function is a supplement function to ACC Stop & Go and uses its sensor system and components. It is an integral part of **(option 5AT Enhanced Active Cruise Control)** which can only be ordered in combination with the optional ZDA (Driving Assistance Package).

The collision warning alerts the driver of a possible danger of collision and provides assistance in an emergency in the form of an automatic brake intervention.

By combining the radar and KAFAS image data the braking deceleration of the braking function is increased up to 8 m/s² (26.2 ft/s²). This is applied differently for the lower (≤ 50 km/h/ 30 mph) and upper (> 50 km/h/ 30 mph) speed ranges as braking is now done in two stages.

6.1. Operation

6.1.1. Vehicles with collision warning w/o Night Vision

The collision warning with braking function is automatically activated after each engine start via the START/STOP button.

When the Intelligent Safety button is pressed in the driver assist system operating facility, the collision warning with braking function is deactivated or activated:

- Collision warning deactivated: LED above the button is off.
- Collision warning activated: LED above the button lights up.

The status of the collision warning with braking function is additionally displayed in the CID. In addition, when the collision warning is activated the driver can set the time of the early warning in three stages. The “late” setting corresponds to the point of the acute warning. The setting of the time of the early warning is saved for the current driver profile.

6.1.2. Vehicles with collision warning and with Night Vision

The collision warning with braking function is automatically activated after each engine start via the START/STOP button.

When the Intelligent Safety button is pressed in the driver assist system operating facility, the information pages for the collision warning and pedestrian detection functions are shown in the CID. The driver can deactivate or activate the collision warning with braking function and pedestrian detection from here.

In addition, when the collision warning is activated the driver can set the time of the early warning in three stages. The “late” setting corresponds to the point of the acute warning. The setting of the time is saved for the current driver profile.

When the LED above the Intelligent Safety button in the driver assist system operating facility lights up, at least one front protective function is activated.

F01/F02 LCI Driver Assistance Systems

6. Collision Warning w/Brake Application

6.2. Operating principle

The system warns of a possible collision from a speed of around 15 km/h (9.3 mph) initially with an early warning and then if the danger persists with an acute warning.

The collision warning is also available when cruise control is deactivated.

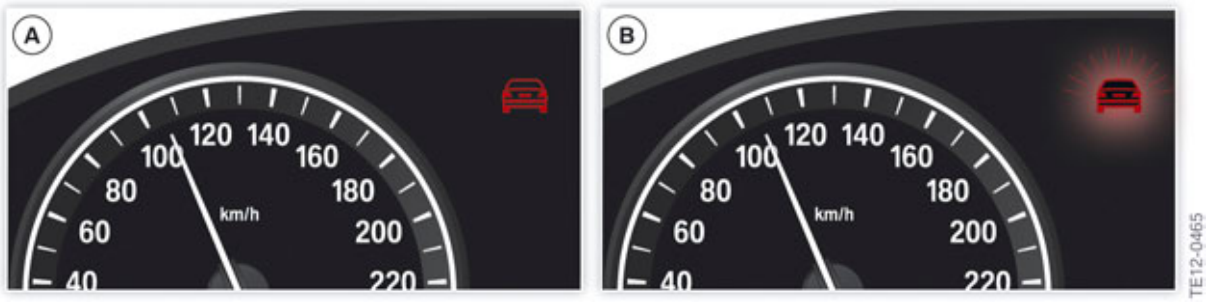
Stationary as well as moving vehicles are taken into consideration.

In addition to the warnings, the vehicle's brakes are prepared for emergency braking and the activation thresholds of the brake assistant are decreased. In an emergency an automatic brake intervention is performed by the system.

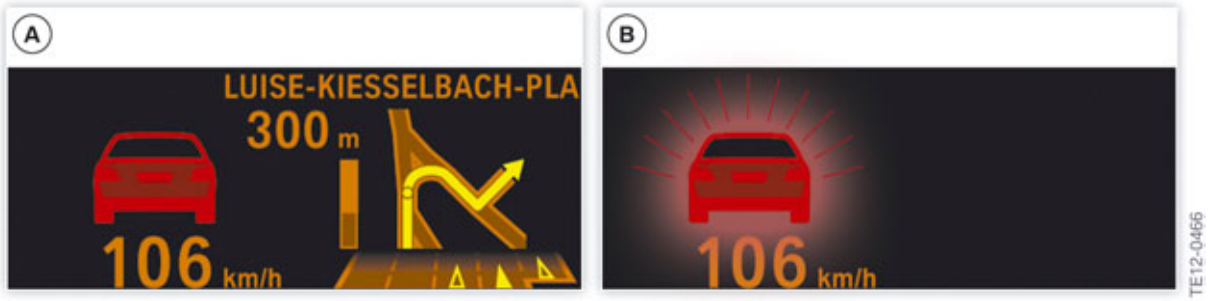
In the event of a deliberate forward collision with a vehicle, the system sensitivity is reduced and thus the warnings are not displayed.

6.3. Warning function

The warning function is divided into two stages. It appears in the instrument cluster or in the head-up display.



F01/F02 LCI - Collision warning in the instrument cluster



F01/F02 LCI - Collision warning in the head-up display

Index	Explanation
A	Stage 1: Early warning, vehicle in red
B	Stage 2: Acute warning, flashing vehicle in red and acoustic warning signal

6.3.1. Early warning

The early warning is issued, for example, in the event of an imminent danger of collision on account of a high differential speed to the vehicle driving ahead and in the event of a very small distance to the vehicle driving ahead or stationary vehicle.

The early warning is indicated by a vehicle permanently illuminated in red in the instrument cluster or in the head-up display.

The time of the early warning can be configured in the CID. When the “late” setting is selected, the time of the early warning corresponds to that of the acute warning.

6.3.2. Acute warning

The acute warning is issued by the system as late as possible and only if there is an immediate danger of a collision when the vehicle is approaching the vehicle driving ahead at relatively high differential speed. The point at which the acute warning is issued is calculated in such a way that a collision can only be avoided by immediate emergency braking or by an evasive maneuver.

The acute warning issues a prompt for intervention and is usually supported in the event of a danger of collision by a two-stage brake intervention. Brake intervention is limited in time to about 3 seconds and must end when by vehicle has been decelerated by around 50 km/h (30 mph). This avoids additional dangers for the following traffic.

In the lower speed range up to 50 km/h (30 mph) brake intervention is applied initially with a brake force of 5 m/s². When the target object is verified by the camera data, brake intervention is applied after about 0.5 seconds at max. 8 m/s² (26.2 ft/s²). The vehicle can therefore be braked to a full stop in the lower speed range ≤ 50 km/h (30 mph).

At a driving speed in excess of 50 km/h (30 mph) brake intervention is applied initially with a brake force of 4 m/s² (13.1 ft/s²). When the target object is verified by the camera data, brake intervention is applied after about 0.5 second at max. 6 m/s² (19.6 ft/s²).

At a driving speed in excess of 210 km/h (130 mph) the speed reduction is limited to 10 km/h (6.2 mph).

Brake intervention is also applied when the driver fails to depress the brake pedal sufficiently.

Brake intervention is applied only when Dynamic Stability Control (DSC) is switched on.

An acute warning is indicated to the driver by a red flashing vehicle in the instrument cluster and in the head-up display. In addition, an acoustic warning signal is sounded.

The acute warning does not relieve the driver of their responsibility to adapt their driving speed and style to the road and traffic conditions and to maintain the prescribed safety distance.

Brake intervention can be cancelled by pressing the accelerator pedal or by applying a clear steering wheel movement.

The collision warning with braking function must be deactivated (in towing situations) in order to avoid malfunctions.

F01/F02 LCI Driver Assistance Systems
6. Collision Warning w/Brake Application

The braking function is deactivated when Dynamic Stability Control (DSC) or Dynamic Traction Control (DTC) is deactivated.

If the KAFAS video camera fails, brake intervention is applied only with a brake force of max. 4 m/s² (13.1 ft/s²) and solely in response to detected moving or stopped vehicles. In the case of vehicles which were already stationary when they entered the radar sensor's detection range, there is no braking. If the radar sensor fails, the collision warning with braking function is deactivated completely. In both cases the driver is informed of the failure by means of a display in the instrument cluster and a Check Control message.

System limitations mean that warnings may (under certain circumstances) not be issued or are issued too late or without authorization. The driver must always remain alert and observant so that he/she can actively intervene at any time to avoid the risk of an accident.

6.4. History

The collision warning with braking function (formerly known as the adaptive brake assistant) was introduced for the first time in 2007 with the E60 LCI. The table below describes the various development stages, their features and their initial implementation in BMW models.

Features	Adaptive brake assistant	Adaptive brake assistant with warning function	Collision warning with braking function	Collision warning with braking function Latest generation
Initial implementation	03/2007 E60 LCI	08/2009 F01	01/2010 F10	07/2012 F01/F02 LCI
Pre-pressurizing of brake system	X	X	X	X
Adaptation of brake assistant	X	X	X	X
Early and acute warnings				
in response to moving/stopped targets		X	X	X
in response to stationary targets			X	X
Braking				
in response to moving/stopped targets			X	X
in response to stationary targets				X

F01/F02 LCI Driver Assistance Systems

6. Collision Warning w/Brake Application

Features	Adaptive brake assistant	Adaptive brake assistant with warning function	Collision warning with braking function	Collision warning with braking function Latest generation
at max. 3 m/s² (9.8 ft/s²)			X	
at v ≤ 50 km/h (30 mph) at max. 8 m/s² (26.2 ft/s²) two-stage **to a full stop**				X
at v > 50 km/h (30 mph) at max. 6 m/s² (19.7 ft/s²) two-stage				X

F01/F02 LCI Driver Assistance Systems

7. Distance Ranging Information

Distance ranging information utilizes the sensor system and components of the active cruise control (ACC Stop & Go).

Thus it is an integral part of the optional equipment Enhanced Active Cruise Control (option 5AT), available only with ZDA Driving Assistance Package

When ACC Stop & Go is deactivated, the distance ranging information notifies the driver if their vehicle is too close to the vehicle driving ahead. Here the distance can be smaller than a minimum distance required by law. The distance ranging information is removed as soon as the distance is increased again.

The indication appears only in the head-up display. The display can be deactivated via the CID.

F01/F02 LCI - Distance ranging information in the head-up display

The distance ranging information symbol is only displayed in the following situations:

- ACC Stop & Go is deactivated
- ranging information is activated
- the vehicle is being driven faster than 70 km/h (43.4 mph)
- the distance is too small for several seconds.

Distance ranging information does not relieve the driver of their responsibility to adapt their driving speed and driving style to the road and traffic conditions and to maintain the prescribed safety distance.

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Technical training.
Product information.

F01/F02 LCI Infotainment

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BMW Service

General information

Symbols used

The following symbol/schematic diagram is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further deviations may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral element of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the current respective information systems of the BMW Group for any changes/additions to the technical data.

Information status: **May 2012**
VH-23/International Technical Training

F01/F02 LCI Infotainment

Contents

F01/F02 LCI Infotainment

1. Introduction

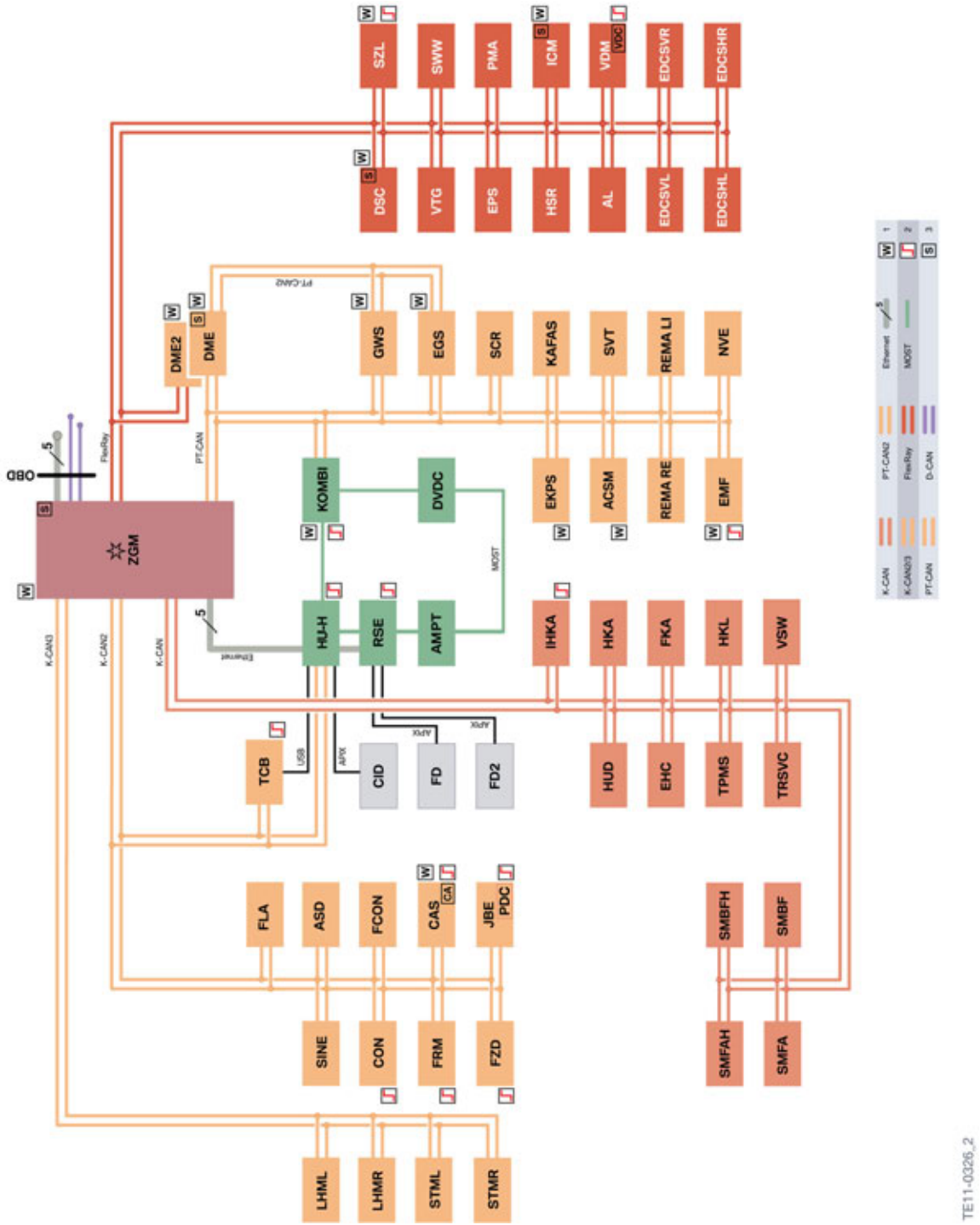
Entertainment and communication play a very important role in the F01/F02 LCI therefore a wide selection of Infotainment systems are available to the driver.

This product information manual is intended to provide an overview of the systems used. For more information regarding the Headunit High please refer to the ST1211 Headunit High training manual available on ICP and TIS.

F01/F02 LCI Infotainment

1. Introduction

1.1. F01/F02 LCI bus overview



F01/F02 LCI bus overview

F01/F02 LCI Infotainment

1. Introduction

Index	Explanation
1	Control units with wake-up line
2	Control units authorized to perform wake-up function
3	Start-up node control units for starting and synchronizing the FlexRay bus system
ACC	ACC sensor (sensor and control unit for Active Cruise Control)
ACSM	Advanced Crash Safety Module
AL	Active steering
AMPT	Amplifier Top (top high fidelity amplifier)
ASD	Active Sound Design
CAS	Car Access System
CID	Central information display
CON	Controller
DME	Digital Engine Electronics (DME)
DME2	Digital Engine Electronics 2
DSC	Dynamic Stability Control
DVDC	DVD changer
EDCSHL	Electronic Damper Control satellite, rear left
EDCSHR	Electronic Damper Control satellite, rear right
EDCSVL	Electronic Damper Control satellite, front left
EDCSVR	Electronic Damper Control satellite, front right
EGS	Electronic transmission control
EHC	Electronic ride height control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic Power Steering (electromechanical power steering)
FCON	Rear compartment controller
FD	Rear compartment display
FD2	Rear compartment display 2
FKA	Rear climate control
FLA	High-beam assistant
FRM	Footwell module
FZD	Roof function center
GWS	Gear selector switch
HU-H	Headunit High (now incorporates most Combox functions except telematics)
HKA	Automatic rear air-conditioning and heating

F01/F02 LCI Infotainment

1. Introduction

Index	Explanation
HKL	Automatic operation of tailgate
HSR	Rear axle slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air-conditioning system
JBE	Junction box electronics
KAFAS	Camera-based driver support systems
K-CAN	Body controller area network
K-CAN2	Body Controller Area Network 2 (500 kBit/s)
K-CAN3	Body Controller Area Network 3 (500 kBit/s)
KOMBI	Instrument panel
LHML	LED main light module, left
LHMR	LED main light module, right
MOST	MOST
NVE	Night Vision Electronics
PDC	Park Distance Control
PMA	Parking Maneuvering Assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
OBD	Diagnostic socket
REMARE	Reversible electric-driven reel, right
REMALI	Reversible electric-driven reel, left
RSE	Rear Seat Entertainment system
SINE	Siren with tilt alarm sensor
SME	Battery management electronics
SMBFH	Seat module, passenger
SMFAH	Driver's seat module
STML	Headlight driver module, left
STMR	Headlight driver module, right
SVT	Servotronic module
SWW	Lane change warning
SZL	Steering column switch cluster
TCB	Telematic Communication Box (replaced the Combox telematics)
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for reversing camera and Side View

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1. Introduction

Index	Explanation
VDM	Vertical Dynamics Management
VSW	Video switch
VTG	Transfer case control unit (xDrive only)
ZGM	Central gateway module

F01/F02 LCI Infotainment

2. Headunit

2.1. Headunit High

The new Headunit High is used for the first time as a successor to the previous Car Information Computer (CIC) in the F01/F02 LCI. The Headunit High is installed in combination with the (standard equipment) Navigation system professional SA609.

A high resolution 10.25" (diagonal) CID is now connected to the headunit via an APIX (Automotive pixel link) interface similar to other current BMW models.

A Combox is no longer required with the Headunit High as the telephone and multimedia functions are now integrated into the Headunit. There is also a new control unit installed for telematics functions called the Telematic Communication Box (TCB) . The changes to the antenna system and the rear seat entertainment system of the F01/F02 LCI are also described in the following product information manual.

The Navigation Professional Headunit High is also referred to as “NBT” by engineering and product development.

2.2. New Features

The CIC user interface has been completely revised and upgraded with an enhanced (3D effect) perspective view. The structure of the individual menus is now shown in virtual high resolution with enhanced graphics. The symbols on the symbol bars have been standardized and a variety of move-

ments and animations have also been added. Images of vehicles and objects (previously only visible in the Options menu) have now been integrated directly in the submenus for a more sophisticated and ultra modern look and feel.

Main menu and start screen; comparison of CIC (left) to Headunit High 3rd Generation HU-H (right)

The hardware was completely revised and is now equipped with a new 1.3 GHz processor, 1 GB working memory, 8 GB flash memory and a **200 GB SATA hard disk**

The music collection now has 20GB of space and has been enhanced with many new features (e.g. favorites).

The USB interface in the center console can now play **video files**, as well as audio files. It is also used for importing/exporting data and updating navigation maps, as the USB in the glove compartment has been discontinued.

New to the **IBOC** is the display of album art and station logos (these are only displayed if the station provides such content over the HD digital signal)

The Headunit High is equipped with a **message dictation "Speech-to-text" Office function** to answer and compose text messages and emails directly via the iDrive and the use of a BMW “Tested” phone. A **Voice memo Office function** is also available where voice memos can be recorded, saved to a USB or sent via email as sound files.

The Navigation Professional is packed with new and enhanced features and has a redesigned user interface and menu structure. It also offers the new Advanced Real Time Traffic Information (ARTTI). This new system offers faster and more detailed traffic information which provides a cleaner and more understandable traffic overview than RTTI.

Navigation Professional introduces (for the first time) POI brand icons (currently only for fuel stations) and weather icons in the map overview.

For more detailed information regarding the Navigation Professional and Headunit High please refer to the ST1211 Headunit High training manual available on ICP and TIS.

F01/F02 LCI Infotainment

3. Telephone System

With the model revision for the F01/F02 LCI the new optional equipment structure known from current BMW models is also used for the telephone systems.

	6NL BMW Assist with enhanced Bluetooth and USB is standard
USB connection, center console	included
Bluetooth	included
Base plate	included
Speech input system	included
Telematics	included
Control units for the realization of the functions with Headunit High	Headunit High and TCB

Note: BMW Apps (6NR) is available as optional equipment on all F01/F02 LCI models but is included as standard on the 760Li.

More information regarding the new telephone functions of the Headunit High can be found in the ST1211 Headunit High training manual available on ICP and TIS.

Note: For further information regarding BMW tested phones and their functions please refer to bmwusa.com/bluetooth**.**

F01/F02 LCI Infotainment

4. Speaker Systems

4.1. Overview

The speaker systems in the F01/F02 LCI are available in three specification levels:

- HiFi system (standard equipment)
- Premium (Top) HiFi system (optional equipment 677)
- Bang & Olufsen High-End Surround Sound System (optional equipment 6F2)

The following table gives an overview of the possible speaker systems in the F01/F02 LCI.

HiFi system	Premium HiFi system	Bang & Olufsen High-End Surround Sound System
7-channel HiFi amplifier (205 W) (5.2 audio system) 12 speakers	9-channel HiFi amplifier (600 W) (7.2 audio system) 16 speakers	16-channel HiFi amplifier (1200 W) (14.2 audio system) 16 speakers

An eight-channel amplifier with digital equalizer is incorporated in the HiFi system. However, the HiFi system only uses seven of the eight channels. The bass speakers are located under the front seats. They are connected to either side sill. In this way, the volume required for bass reproduction is increased.

With the same diameter of the speakers in the HiFi system and Top HiFi system, there are differences in speaker performance. This is achieved through the use of different materials such as diaphragms, coils and solenoids.

The Premium HiFi system uses a digital 10-channel amplifier although the system only uses nine of the ten channels.

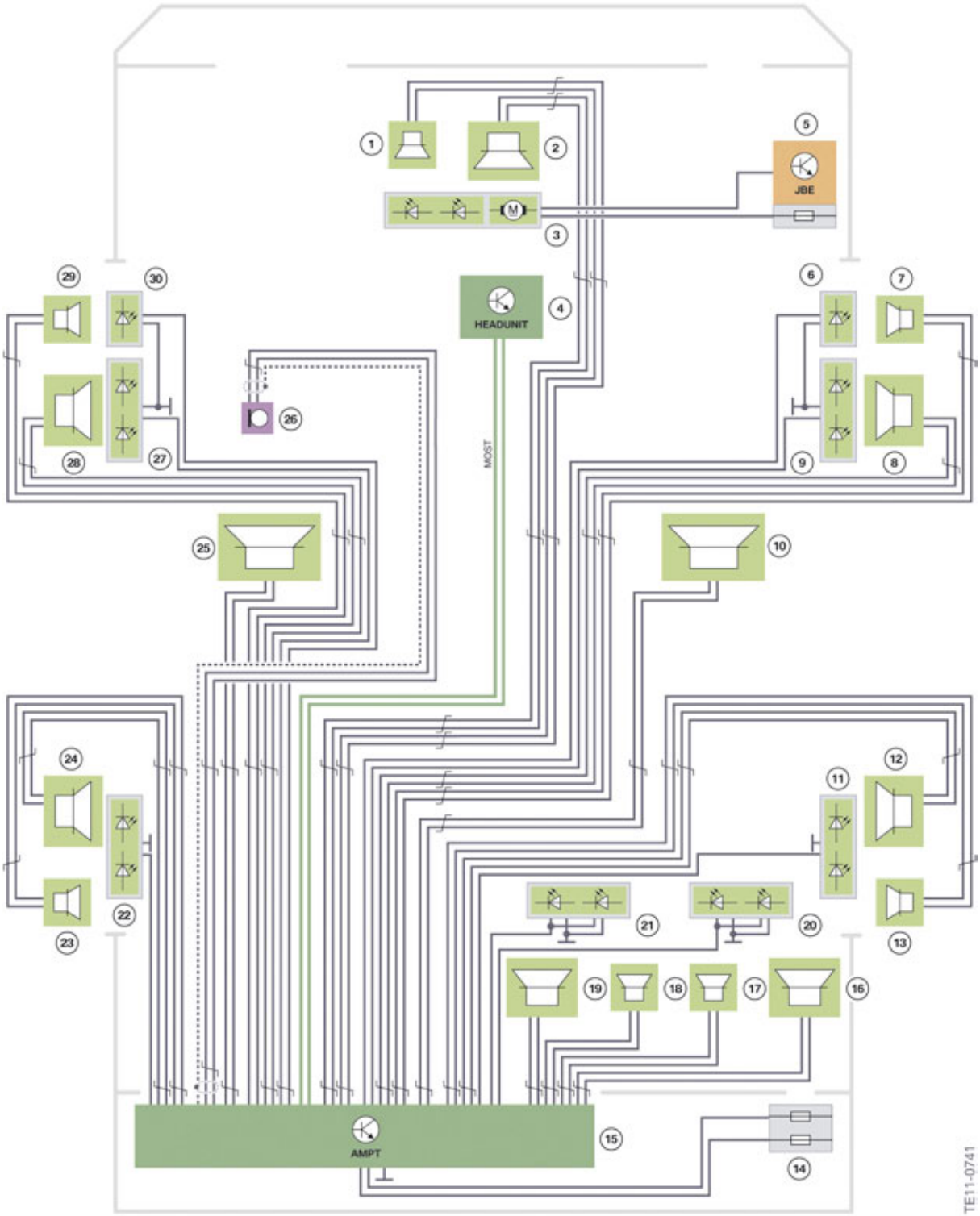
The Premium HiFi system and the Bang & Olufsen High-End Surround Sound System support the playback of multi-channel audio formats (DTS®, Dolby Digital®, AC3®). The playback of multi-channel audio formats is possible via the drive of the Headunit High or via the six DVD changer.

4.2. Bang & Olufsen High-End Surround Sound System

In the F01/F02 LCI the Bang & Olufsen High-End Surround Sound System is used as new optional equipment (option 6F2).

F01/F02 LCI Infotainment

4. Speaker Systems



F01/F02 LCI system wiring diagram for Bang & Olufsen High-End Surround Sound System

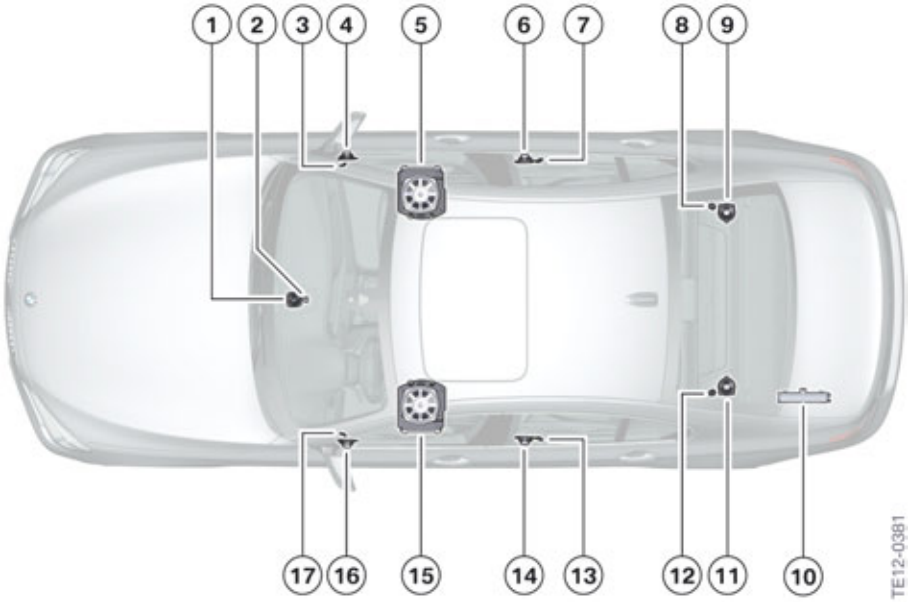
F01/F02 LCI Infotainment

4. Speaker Systems

Index	Explanation
1	Tweeter, dashboard center
2	Mid-range speaker, dashboard center
3	Extendible center cover
4	Headunit
5	Junction box for the power distribution box
6	Cover, front passenger side
7	Tweeter, front passenger side
8	Mid-range speaker, front passenger side
9	Cover, front passenger side
10	Bass speaker, front passenger side
11	Cover, rear right
12	Mid-range speaker, rear right
13	Tweeter, rear right
14	Power distribution box, luggage compartment
15	Top HiFi amplifier
16	Mid-range speaker storage shelf, right
17	Tweeter storage shelf, right
18	Tweeter storage shelf, left
19	Mid-range speaker storage shelf, left
20	Storage shelf cover, right
21	Storage shelf cover, left
22	Rear cover, left
23	Tweeter, rear left
24	Mid-range speaker, rear left
25	Bass speaker, front driver's side
26	Microphone
27	Cover, front driver's side
28	Mid-range speaker, front driver's side
29	Tweeter, front driver's side
30	Cover, front driver's side

F01/F02 LCI Infotainment

4. Speaker Systems



F01/F02 LCI Bang & Olufsen High-End Surround Sound System

Index	Explanation
1	Extendible mid-range speaker, dashboard center
2	Extendible tweeter, dashboard center (acoustic lens)
3	Tweeter, front right door
4	Mid-range speaker, front right door
5	Bass speaker under the front right seat
6	Mid-range speaker, rear right
7	Tweeter, rear right
8	Tweeter storage shelf, rear right
9	Mid-range speaker storage shelf, rear right
10	High-end amplifier
11	Mid-range speaker storage shelf, rear left
12	Tweeter storage shelf, rear left
13	Tweeter, rear left
14	Mid-range speaker, rear left
15	Bass speaker under the front left seat
16	Mid-range speaker, front left door
17	Tweeter, front left door

Visually, the Bang & Olufsen High-End Surround Sound System differentiates itself from conventional audio systems through an extendible speaker in the dashboard as well as the lit up aluminium speaker covers in a special design by Bang & Olufsen.

F01/F02 LCI Infotainment

4. Speaker Systems

F01/F02 LCI speaker covers by Bang & Olufsen

With the so-called Welcome production (upon switching on the headunit) the speaker covers briefly light up to the maximum. After this it dims back to normal lighting. The control of the LEDs for the light production or the illuminating speaker covers takes place in the high-end audio amplifier.

The Bang & Olufsen High-End Surround Sound System acoustically impresses with an optimized sound playback to all seats for stereo and multi-channel audio formats. Two sound modes can be selected which were developed by the Swedish company Dirac.

F01/F02 LCI tone setting in the CID

- Studio
  In Studio mode a frequency and phase correction of the speakers takes place. In this the signal is modified in both time and in the frequency range in order to compensate for various time delays and sound reflections in the vehicle depending on seating position. This leads to a linear and correctly timed playback in the passenger compartment. Through the signal fidelity formed in this way an exceptionally diverse and lively sound experience is created for all occupants.
- Expanded
  The Expanded mode ensures an open and lively room through special sound field modulation in the passenger compartment. This inspires the illusion that the speakers have been replaced by virtual speakers and have been moved outwards.

For individual sound adjustment an equalizer is available.

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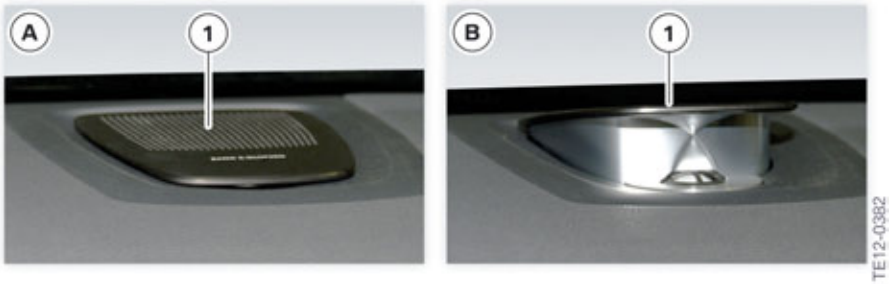
4. Speaker Systems

4.2.1. Speaker

The speakers installed in the F01/F02 LCI are operated at the following power:

- Tweeters: 7 x 25 watt
- Mid-range speakers: 7 x 75 watt
- Bass speakers: 2 x 250 watt.

The extendible speaker dashboard is a combination of a mid-range speaker and an acoustic lens for the tweeter. The extendible speaker dashboard extends upwards when the audio system is switched on.



F01/F02 LCI extendible speaker dashboard

Index	Explanation
A	Speaker in retracted position
B	Speaker in extended position
1	Extendible speaker dashboard

All speakers (tweeters, mid-range and bass speakers) are directly connected to the audio amplifier.

The tweeters are equipped with a ceramic calotte. This ceramic calotte ensures optimum radiation behavior. The mid-range speakers and the bass speakers have a hexagonal diaphragm for extreme signal fidelity and linearity.

F01/F02 LCI Infotainment

4. Speaker Systems

F01/F02 LCI speaker

Index	Explanation
1	Tweeters
2	Mid-range speakers
3	Bass speakers

All visible speakers can be illuminated according to the settings in the "Bang & Olufsen" light setting. The front bass speakers are not illuminated and are both located under the driver and front passenger seat.

F01/F02 LCI Infotainment

4. Speaker Systems

4.2.2. High-end audio amplifier

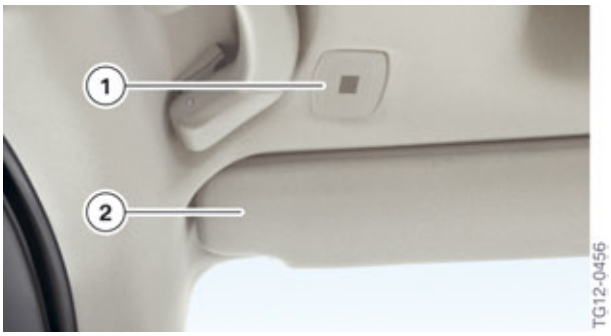
The 16-channel amplifier of the Bang & Olufsen High-End Surround Sound Systems (AMPT) is an audio amplifier with active frequency diplexers. Active frequency diplexers produce better acoustic results than passive frequency diplexers. By installing the active frequency diplexer in the high-end audio amplifiers each individual speaker only receives the frequency range designed to it. Therefore every speaker is directly connected to the high-end audio amplifier.

The high-end audio amplifier is a control unit in the MOST network. The class D audio output stages of the high-end audio amplifier used have a significantly higher efficiency and lower the power loss compared to conventional audio output stages.

The speed-dependent volume adjustment (Speed Volume) used in other speaker systems are replaced in the Bang & Olufsen High-End Surround Sound System with a new automatic adaptation of the volume. The automatic adaptation takes place subject to the noises that can be heard in the passenger compartment, such as driving and wind noise. These are measured with the help of a microphone.

4.2.3. Microphone

The microphone for the automatic speaker adaptation is located in the F01/F02 LCI in the roofliner on the driver's side.



F01/F02 LCI microphone

Index	Explanation
1	Microphone
2	Sun visor

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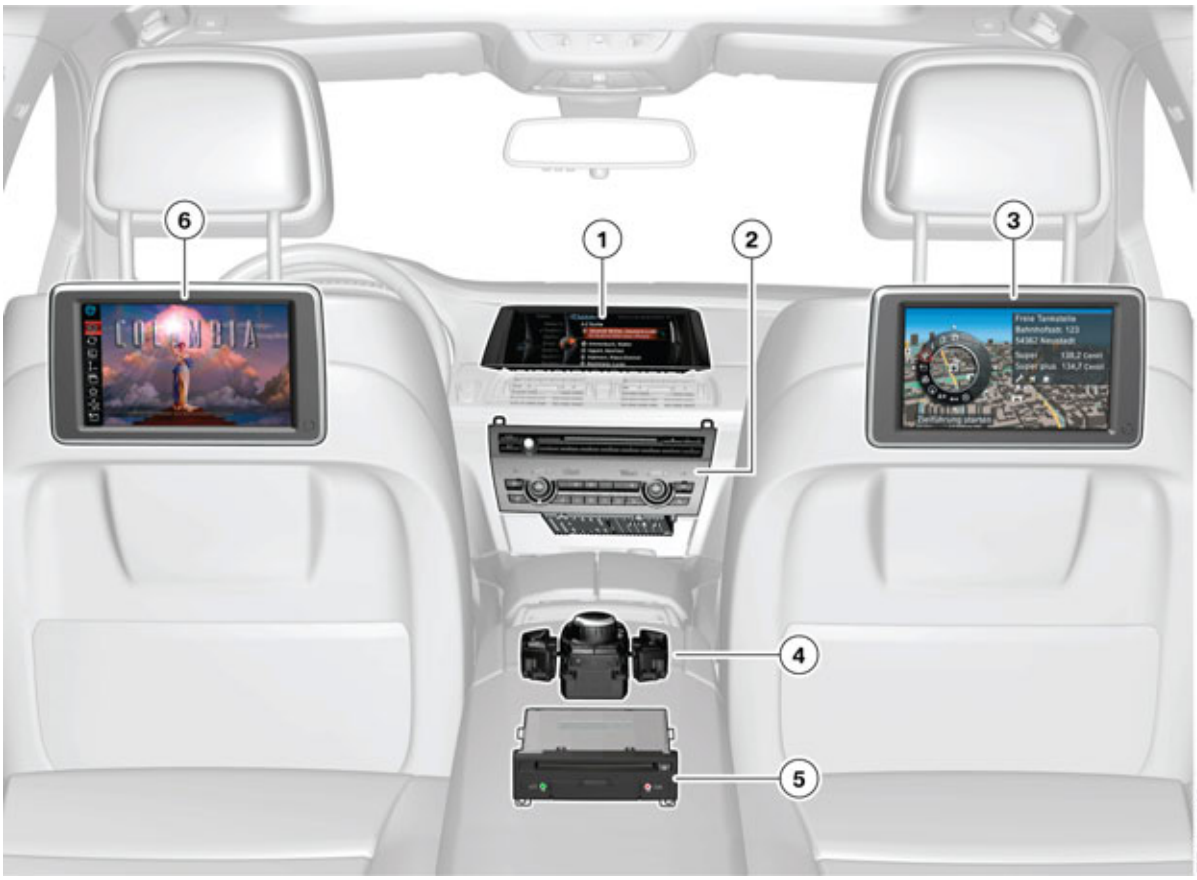
5. Rear Seat Entertainment System (RSE)

The **Rear seat entertainment system professional with iDrive control (SA6FR)** is available as an option for the F01/F02 LCI. It uses 2 rear displays, a separate RSE control unit, in conjunction with the Headunit High and (in contrast with the previous RSE system) a rear (iDrive) controller.



Rear seat entertainment system professional with iDrive control (SA6FR)

1	CID
2	Headunit High
3	Right rear monitor
4	RSE rear controller
5	Rear entertainment control unit (RSE)
6	Left rear monitor

The new free-standing 9.2" rear monitors are no longer on the bus network, but are connected directly to the RSE control unit via an APIX (Automotive pixel link) connection. The connection of the headphones was changed from the previously used infrared transmission to radio transmission and have to be installed via the “Connections” menu of the Headunit High. The previous headphones are therefore not compatible with this system.

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5. Rear Seat Entertainment System (RSE)

F01/F02 LCI rear seat entertainment system

F01/F02 LCI rear seat entertainment system iDrive controller

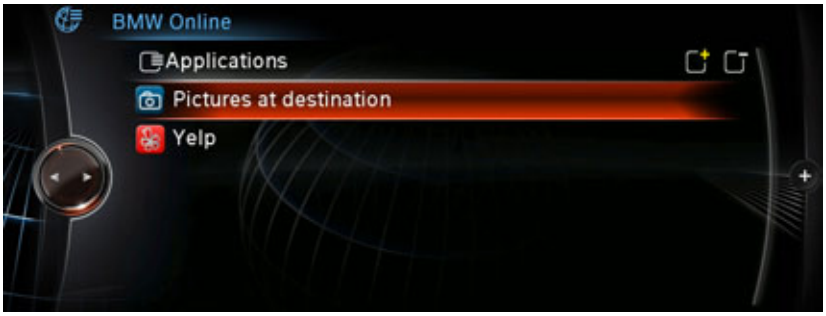
More information regarding the new components and functions of the rear seat entertainment system (RSE) can be found in the “ST1211 Headunit High” training manual available on ICP and TIS.

F01/F02 LCI Infotainment

6. ConnectedDrive

6.1. BMW Online

The ConnectedDrive Services is pleased to announce that “Yelp” and “Pictures at Destination” applications were recently added to BMW Online. With the recent update to BMW Online’s layout, BMW can seamlessly add new features (known as “applications”) as they become available. “Yelp” and “Pictures at Destination” are the first such applications and there will be more to follow.



New Applications available on BMW Online

Pictures at Destinations is just what the name suggests. You can display photos for several destinations when the route guidance is active.

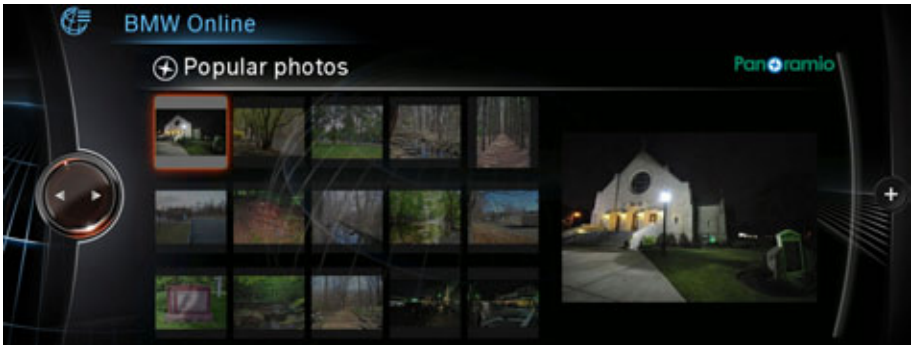
Different photos can be selected depending on the availability. In this case, photos from the Internet service provider Google™ Street View and Google™ Panoramio are used.

The Google™ Street View or Panoramio can be selected.

Google™ Street View.

F01/F02 LCI Infotainment

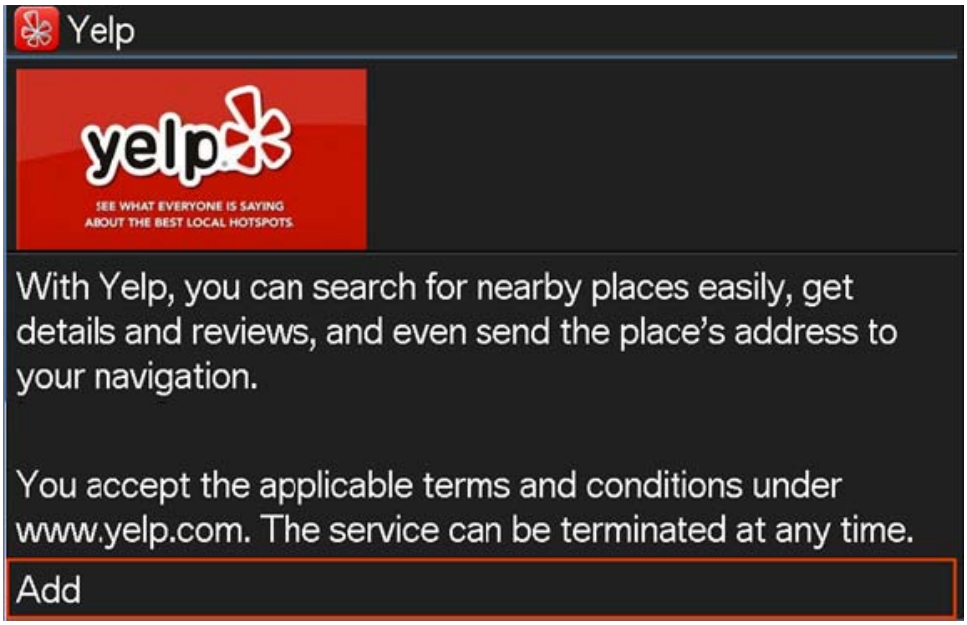
6. ConnectedDrive



Google™ Panoramio view.

"Pictures at destination" is only available for vehicles equipped with the Navigation system (SA609) and telematics.

Route guidance must be active in the Navigation to display images.



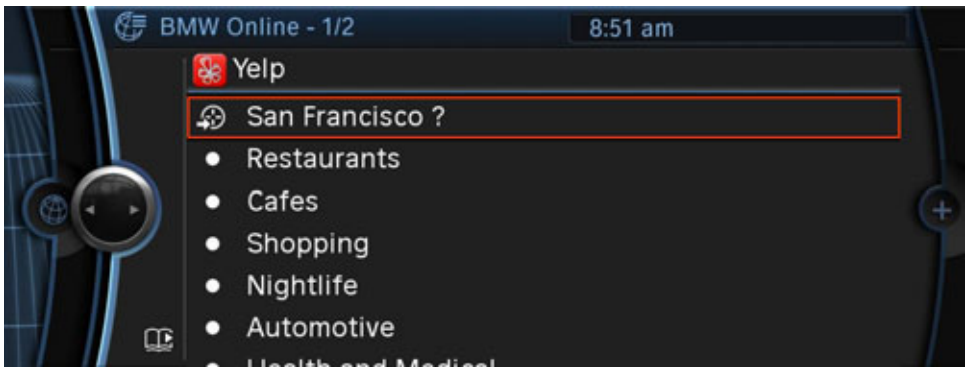
With Yelp on-board, customers can search for everything from the best local restaurants and boutiques to parking garages and banks. They are able to see ratings for those businesses while hearing reviews read out to them via the vehicle's text-to-speech feature.

F01/F02 LCI Infotainment

6. ConnectedDrive

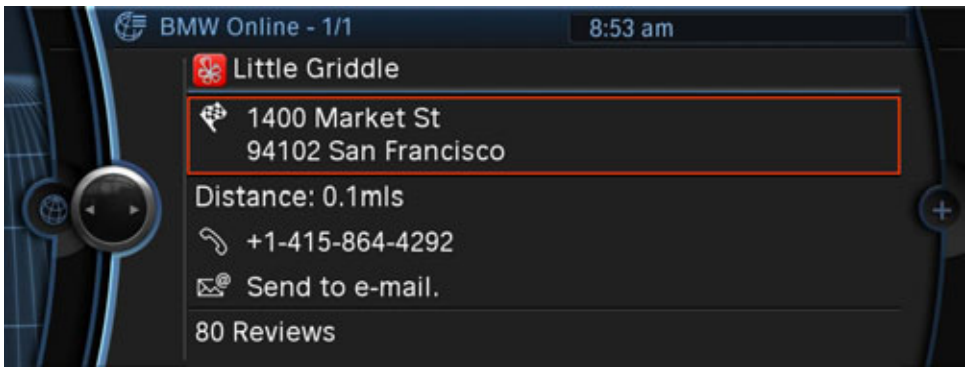
Features

- Category Search – Search by category for nearby restaurants, cafes, shopping, nightlife, and more.



- Results Overview - Results are sorted by distance and show user-generated ratings of the places, category, and number of reviews.

- Details – Selecting a particular place gives more details about it. Customers can see the rating, address, distance, phone number, and information about reviews. Additionally, they can email details of the business to themselves or any other email address.



- Reviews – The 3 latest reviews are available for the business. The customer can select one of those reviews and have it read back automatically.

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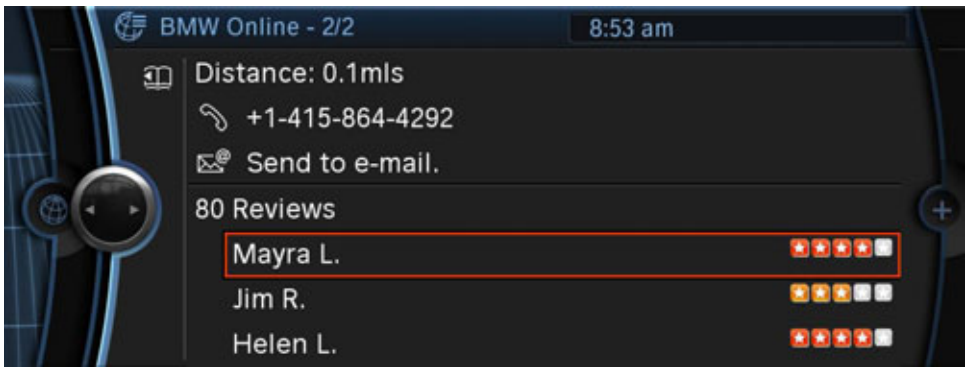
6. ConnectedDrive

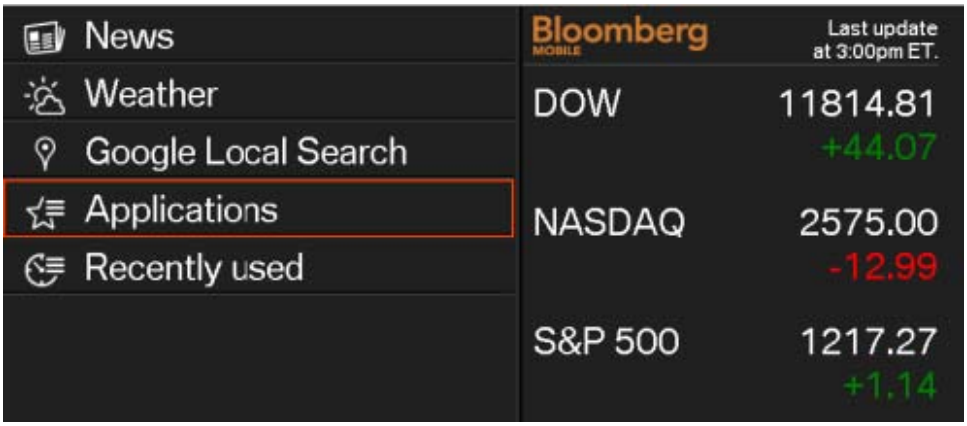


Adding new applications to BMW Online

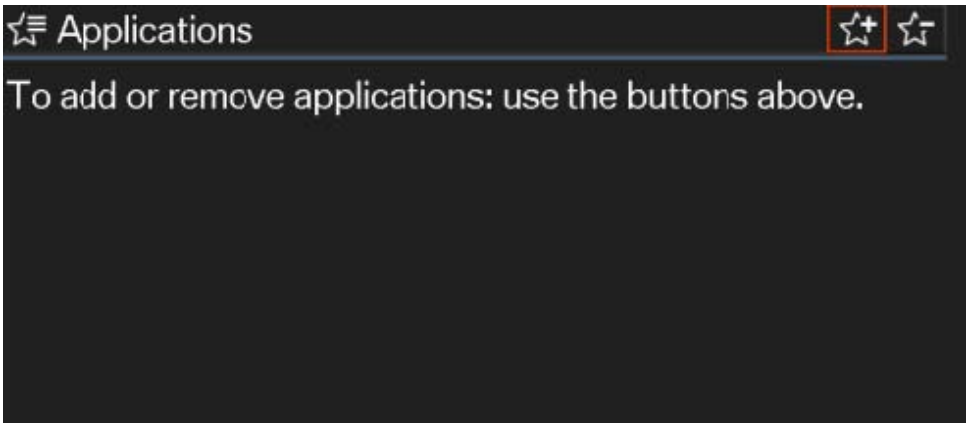
Before we can use a new application like for example “Yelp”, it must be added to the Applications menu in BMW Online.

To add a new Application to BMW Online:

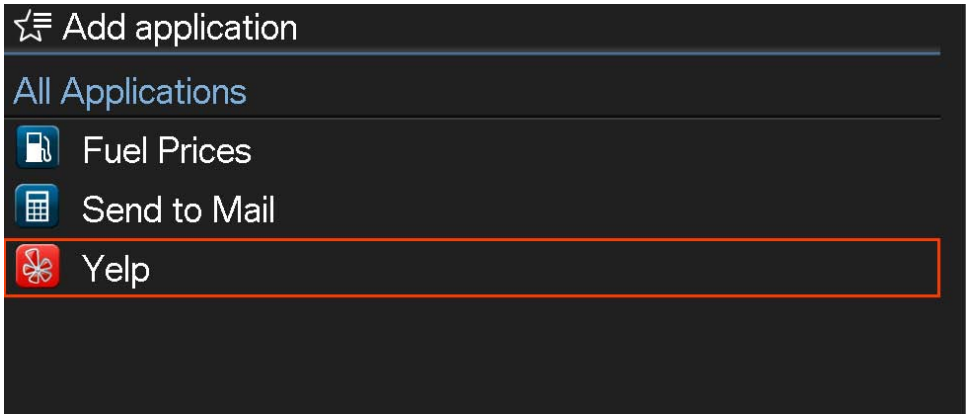
1 Select the Applications menu.



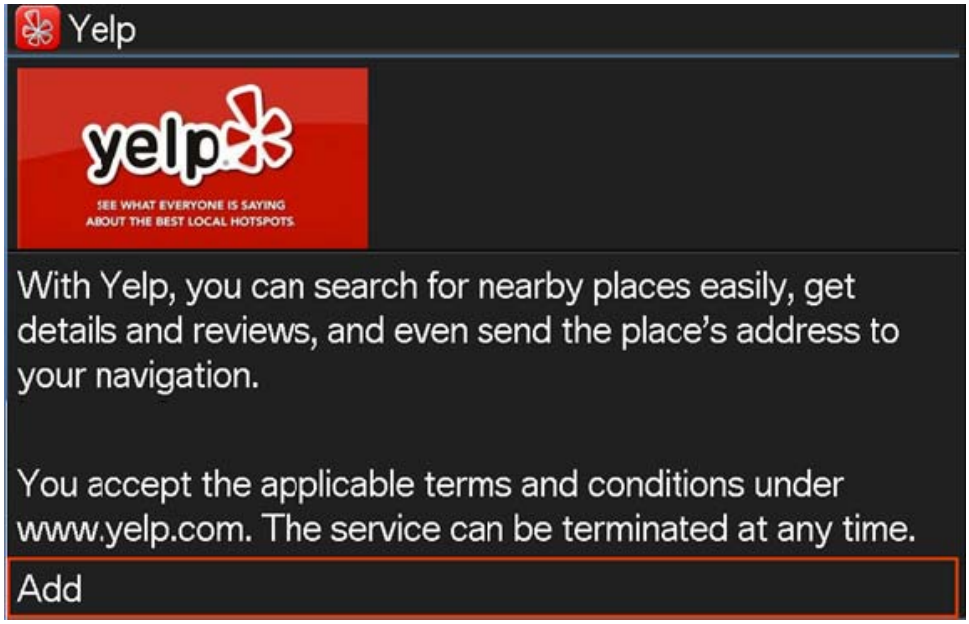
2 Select the “add” button from the upper-right corner.



3 On the “Add application” menu, select Yelp.



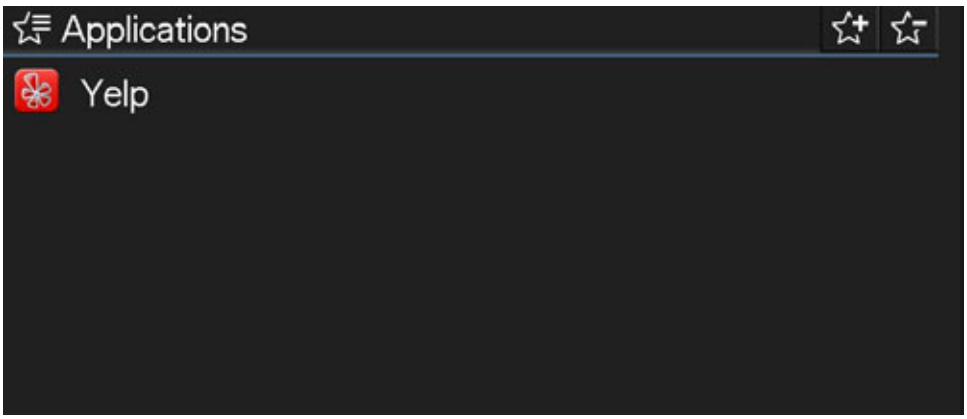
4 On the next screen, you will see a description of Yelp. Select “Add” to add Yelp.



5 You will now be able to access Yelp, under the “Applications” menu in the main menu.

F01/F02 LCI Infotainment

6. ConnectedDrive



More information on BMW Online Applications can be found in the "ST1211 Headunit High" training manual training material available on TIS and ICP.

Many of the new features require that the customer has an active subscription to the BMW Assist™ Safety Plan or Convenience Plan.

	US		Canada
	Safety Plan	**Convenience Plan**	**Safety Plan**
Advanced Real-Time Traffic Information (ARTTI)	**X**		**X**
Weather Icons in Navigation Map	**X**		**X**
Google™ Autocomplete Functionality		**X**	**X**
Pictures at Destination		**X**	**NA**
Points of Interest (POI) Enrichment		**X**	**NA**
Message Dictation		**X**	**X**
BMW Online Improvements		**X**	**NA**

In Canada, BMW Online is not yet available. Therefore, BMW Online Improvements, including Pictures at Destination and POI Enrichment, are also not available.

To view a video on demand regarding the BMW 7 Series LCI models please refer to the OL1212 F01/F02 LCI Complete Vehicle online course available on ICP.

Bayerische Motorenwerke Aktiengesellschaft
Händlerqualifizierung und Training
Röntgenstraße 7
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Technical training.
Product information.

F01/F02 LCI Displays and Controls

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1212 10/1/2013

BMW Service

General information

Symbols used

The following symbol/schematic diagram is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further deviations may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral element of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the current respective information systems of the BMW Group for any changes/additions to the technical data.

Information status: **May 2012**
BV-72/Technical Training

F01/F02 LCI Displays and Controls

Contents

F01/F02 LCI Displays and Controls

1. System Overview

1.1. Introduction

As with all other BMW models, the operating concept of the BMW 7 Series F01/F02 is based on a clear and optimized layout of the controls and indicators. The display and operating elements are organized in a hierarchical arrangement corresponding to their function. Adaptations have also been made to the operating facility of driver assist systems as part of the LCI model revision.

F01/F02 LCI overview of displays, indicators and controls

Index	Explanation
1	Head-Up Display (HUD)
2	Central Information Display (CID)
3	Favorite buttons for individual assignment and operation of automatic air conditioning system
4	Gear selector switch (GWS)
5	Controller (CON)
6	Control buttons, steering wheel
7	Driver assistance system operating center
8	Instrument panel/Dynamic digital instrument display (KOMBI)

F01/F02 LCI Displays and Controls

2. System Components

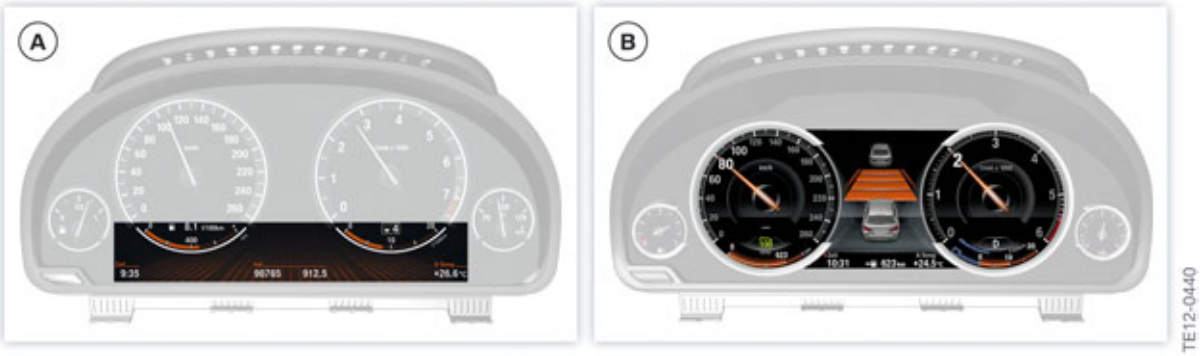
2.1. Instrument panel

In the F01/F02 LCI the familiar instrument panel with 4 analog round instruments and a 9.2" TFT display are used as standard equipment up to 2014 MY. The display has a resolution of 960 x 160 pixels and is integrated in the bottom area in the round instruments.

Instrument panel F01/F02 LCI

2.2. Dynamic digital instrument display

For the first time a dynamic digital instrument display (6WB), which replaces the instrument panel, is now standard equipment in the 2014 F01/F02. The dynamic digital instrument display is a new development and has a 10.25" display with a resolution of 1280 x 480 pixels and LED backlighting. The display not only stretches over the lower area, similar to the instrument panel, but almost the entire height of the instrument.



Comparison of the instrument panel/dynamic digital instrument display

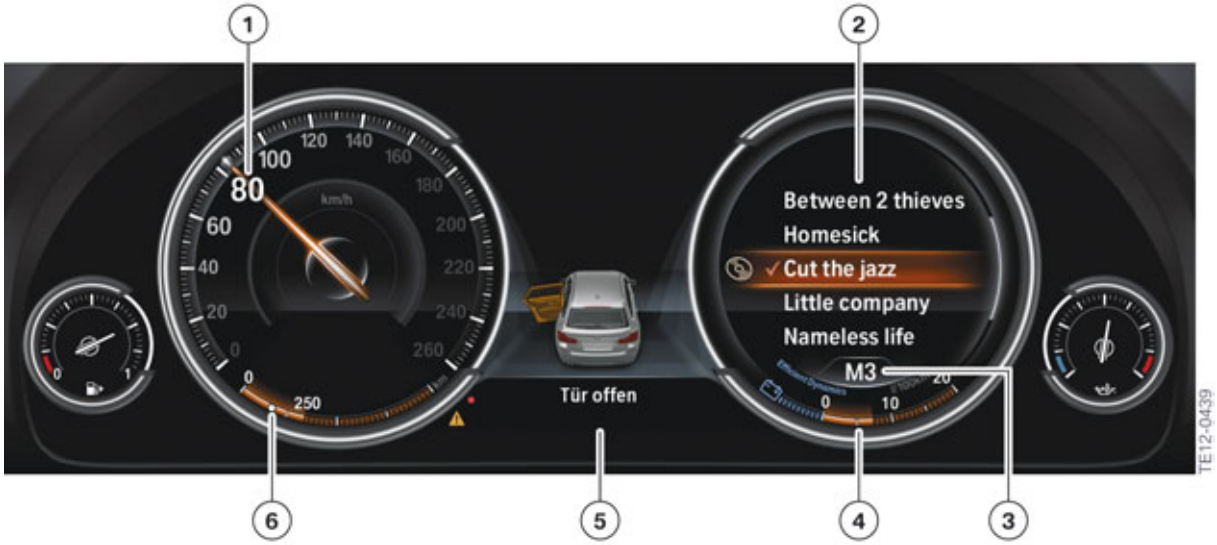
Index	Explanation
A	Instrument panel
B	Dynamic digital instrument display

F01/F02 LCI Displays and Controls

2. System Components

Only the fuel tank and the oil temperature gauge are listed as analog round instruments. The speed reading and the engine speed display, including the needle, are all integrated in the display for the first time at BMW. Thanks to the implementation of the displays it is possible to adapt all displays according to the situation. This flexibility of the display is used for the following improvements:

- Minimizing the distraction of the driver by situation displays at a suitable location.
- Optimization of the arrangement of relevant functions so that these can be detected at a glance.
- Improvement of the ride comfort by the representation of new indicating instruments (e.g. EfficientDynamics display).
- Improvement of the driving experience through a display that can be adapted to the driving situation.



Sample display of dynamic digital instrument display

Index	Explanation
1	Magnifying glass effect
2	List display
3	Driving program
4	EfficientDynamics display
5	Vehicle diagram
6	Range

An example of the improvements which are possible with the new dynamic digital instrument display is the representation of lists, e.g. for the radio station selection. Lists can now be displayed larger and more noticeably by taking up the entire area of the tachometer.

F01/F02 LCI Displays and Controls

2. System Components

The dynamic digital instrument display also has 3 processors, of which one is a graphic processor. This allows an attractive and fluid animation of the needles and the magnifying effects can be realized to the scaling in the area of the needle. The magnifying effects for the scaling can be switched off via the menu in the CID. In addition, improved vehicle diagrams can be shown for some Check Control messages.

2.3. Central Information Display

F01/F02 LCI CID

The CID in the F01/F02 LCI has been revised technically and visibly for the F01/F02 LCI model. The CID is now connected to the headunit via an APIX interface similar to other current BMW models. The design of the cockpit has been enhanced with chrome accents adding to the already sophisticated look.

A 10.25" (diagonal) CID is installed in connection with the standard equipment Navigation system.

The Central Information Display is an integrated display and user interface for the following functions:

- Audio functions such as radio, CD, MP3
- Telephone and data services
- On-board computer, journey computer
- Vehicle information, Interactive Owner's Manual (IBA)
- Heating and air conditioning system
- Personalized features such as station choice
- Vehicle functions such as PDC and EDC
- BMW Services

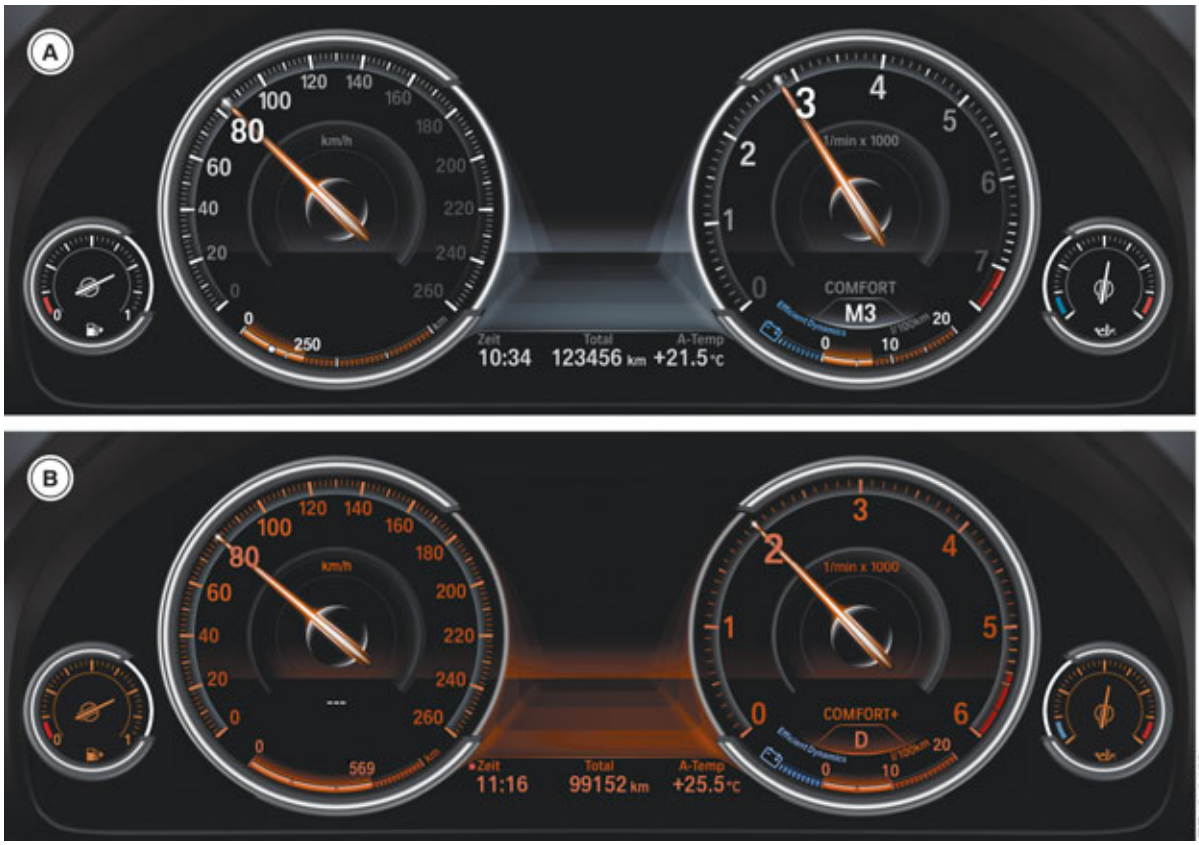
F01/F02 LCI Displays and Controls

2. System Components

2.3.1. Display of driving experience modes

Depending on the driving experience mode selected, for the first time not only parts of the displays, but also the entire design of the dynamic digital instrument display and the display concept can be adapted to the selected mode.

COMFORT mode



Display of COMFORT mode

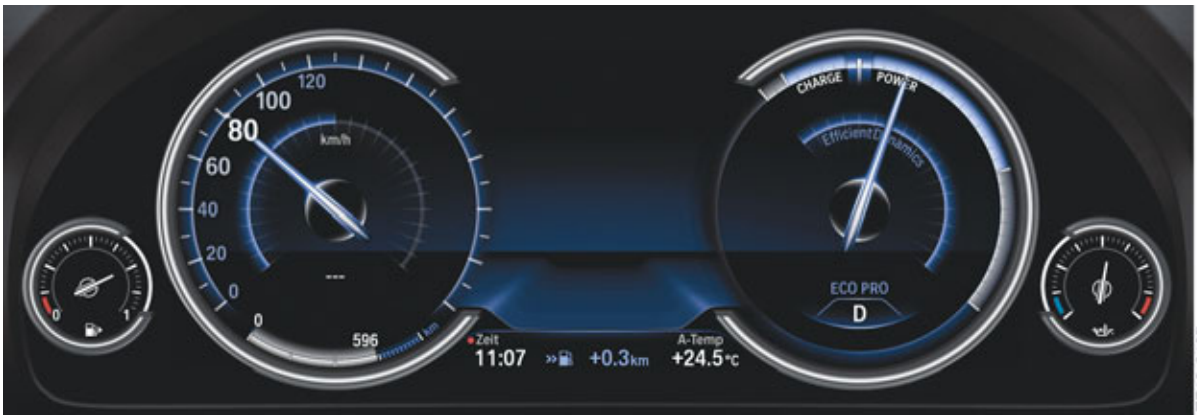
Index	Explanation
A	Day mode
B	Night mode

In the arrangement of the displays, the COMFORT mode corresponds to the greatest possible extent to the familiar design of the instrument panel. In COMFORT mode the dynamic digital instrument display, like the instrument panel, automatically switches between day design (white) and night design (orange).

F01/F02 LCI Displays and Controls

2. System Components

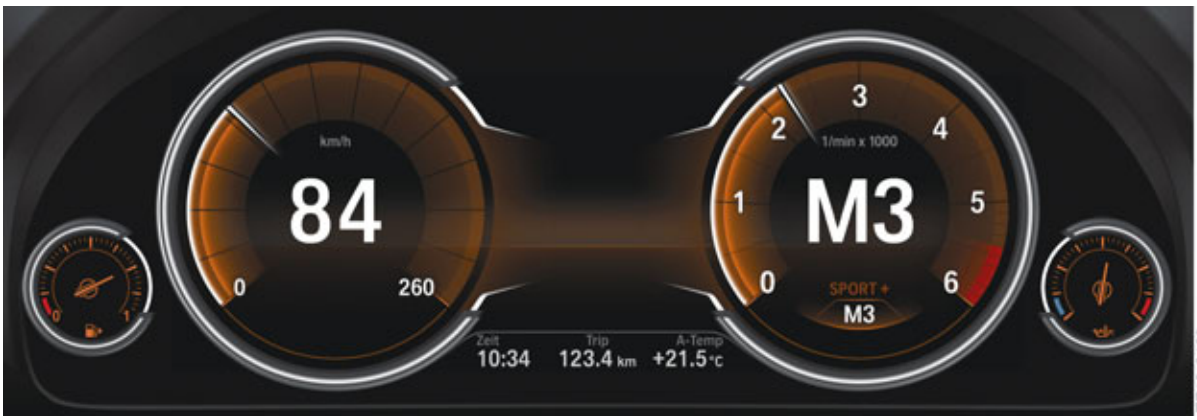
ECO PRO mode



Display of ECO PRO mode

In ECO PRO driving mode the dynamic digital instrument display switches to the ECO PRO display. This display supports a consumption-friendly driving style by a clearer representation of the efficiency display, as well as different ECO PRO tips. The engine speed display on the right side is replaced by a dynamic EfficientDynamics display. This corresponds as much as possible to the EfficientDynamics display in the lower right area of the instrument panel. In the center of the display the range gain, which was achieved by the different auxiliary materials of the ECO PRO mode, is visualized.

SPORT mode



Display of SPORT mode

In SPORT and SPORT+ driving mode the dynamic digital instrument display switches to the sport displays. This display supports a sporty driving style by a clearer representation of the engine speed display, the gear displays, as well as the speed.

F01/F02 LCI Displays and Controls

2. System Components

Settings

Switching on/off changeover of displays

Index	Explanation
1	Switching on/off range and current consumption
2	Switching on/off changeover of displays when changing driving mode
3	Functions in the on-board computer

In addition, the displays of the range and the current consumption can be switched on and off below the speed and engine speed display in the menu and the functions available in the on-board computer configured.

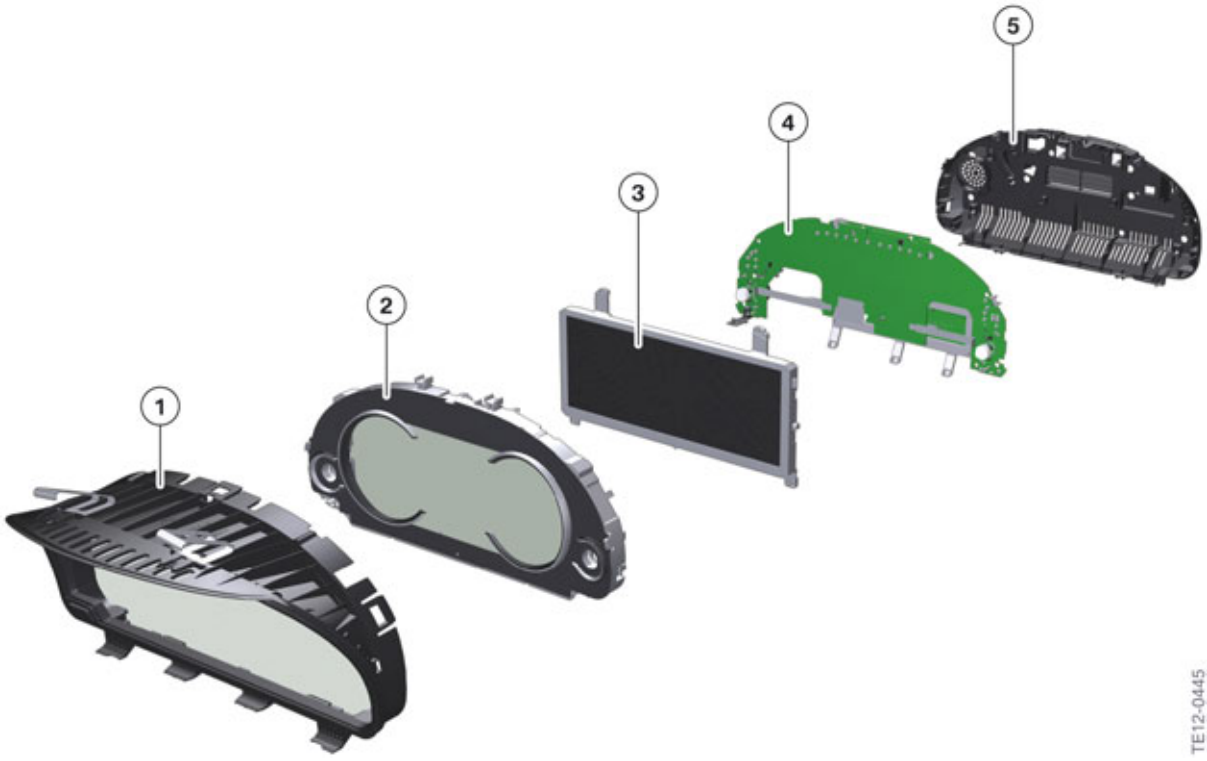
The changeover of the displays when changing driving modes in the dynamic digital instrument display can be switched on and off under "Info display" in the "Settings" menu in the CID. The COMFORT mode displays are then always shown.

2.3.2. Installation location and structure

The dynamic digital instrument display is, like the instrument panel, fixed to the dashboard and clipped with two clamps.

F01/F02 LCI Displays and Controls

2. System Components



Structure of dynamic digital instrument display

Index	Explanation
1	Front frame with glass cover
2	Symbol dial, black panel and decorative rings
3	Display
4	Electronics
5	Rear frame

The dynamic digital instrument display, like the instrument panel, has a black panel so that the display appears black when switched off. The decorative rings of the round instruments are attached above the display and contain fiber-optic conductors which enable the decorative rings to be illuminated in different colors. The decorative rings lend the dynamic digital instrument display an appearance typical of BMW.

The dynamic digital instrument display has the same interfaces as the instrument panel. The dynamic digital instrument display is a participant in the PT-CAN and MOST. It can also be connected via an APIX interface.

2.3.3. On-board computer

The F01/F02 LCI also has an on-board computer with the dynamic digital instrument display.

The on-board computer functions can be called up by briefly pressing the on-board computer button on the steering column switch.

Pressing the on-board computer button again displays information in the following order:

- Range
- Average consumption
- Average speed
- Distance (with activated route guidance)
- Arrival time (with activated route guidance)
- Arrow display of the navigation system (with activated route guidance and deactivated display in the Head-Up Display)
- Date
- Speed limit information
- ECO PRO bonus range

The functions to be displayed in the CID can be selected via "Settings" -> "Information Display".

F01/F02 LCI buttons on the steering column switch

Index	Explanation
1	On-board computer button
2	High-beam assistant button
3	Steering column switches

More detailed information can be obtained from the current Owner's Handbook for the BMW 7 Series.

2.3.4. Test functions

Similar to the instrument panel, there are also test functions shown on the display for the dynamic digital instrument display. The test functions are used by BMW Service to check the encoding. The test functions also provide help in troubleshooting without a BMW diagnosis system. The dynamic digital instrument display has a reduced number of test functions in comparison to the instrument panel.

F01/F02 LCI Displays and Controls

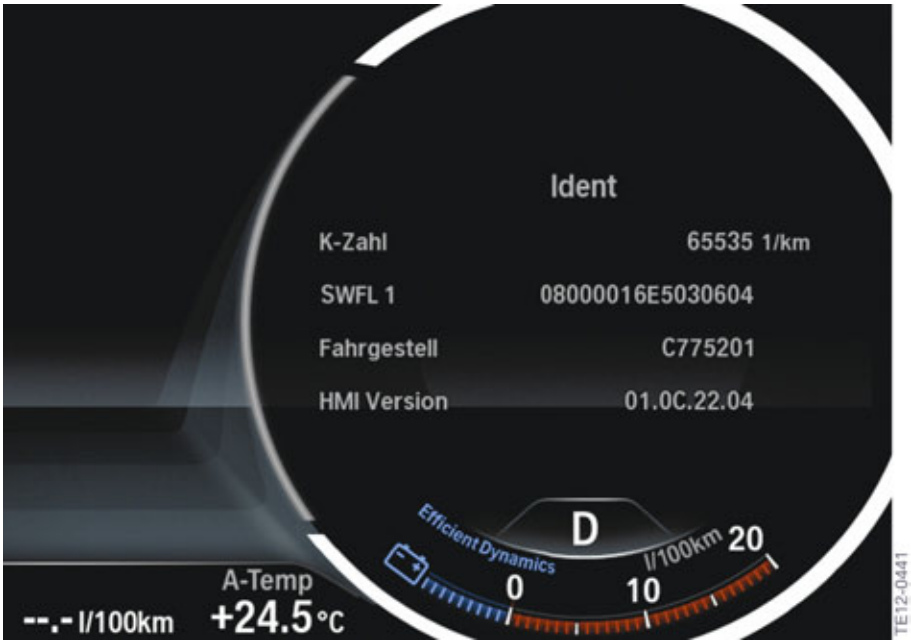
2. System Components

Starting a functional check

- Terminal 15 ON
- Hold down the reset button in the dynamic digital instrument display for 10 seconds.

All the described test functions can also be performed via the BMW diagnosis systems.

Display of test functions



Workshop menu on the dynamic digital instrument display

The test functions are shown at the position of the engine speed display in the TFT display for the dynamic digital instrument display. The number of test functions has been reduced in comparison to the instrument panel. Similar to the instrument panel, it is not necessary to unlock the test functions for the dynamic digital instrument display.

The main test functions of the instrument panel are listed in the following table and the test functions available in the dynamic digital instrument display are marked.

Test function	Description	Dynamic digital instrument display
01	Identification	X
02	System test	X
03	Test end	
04	Unlock test functions	
05	Current consumption	
06	Range consumption	
07	Fuel gauge values	X

Test function	Description	Dynamic digital instrument display
08	Coolant temperature, ambient temperature	X
09	On-board computer average values	X
10	Speedometer / Rev counter	
11	Display of operating voltage	
12	Trigger audio signals	
13	Read fault codes	
14	Dim LCD	
15	Dim PWM signal	
16	Condition Based Service	
17	Check Control	
18	Correction factor, consumption figures	X
19	Software reset / RAM reload	

Operation of test functions

The test functions are operated with the assistance of the reset button in the dynamic digital instrument display.

Press the reset button briefly once to scroll through the test functions. Keep the reset button pressed down for longer to access the selected test function.

Exiting test functions

- Terminal 15 OFF.
- Hold reset button pressed for longer than 10 seconds.
  The main menu is shown in the dynamic digital instrument display.
- Call up test function 03 (end test).
- Call up test function 19 (RESET).

To protect against unauthorized access, all but the first four test functions are locked again when the test functions are exited.

2.3.5. Resetting the scope of maintenance work

If the service has been carried out for one or more scopes of maintenance work, replacement of front brake pads for example, the full service interval must be reset for these scopes.

F01/F02 LCI Displays and Controls
2. System Components

When resetting the scopes of maintenance work, a distinction is made between two types:

- Statutory scopes of maintenance work, such as the technical vehicle inspection in Germany (HU), can only be reset in the "Service" menu.
- All scopes of maintenance work such as changing spark plugs are reset via the reset mode in the dynamic digital instrument display.

Activating reset mode

- Terminal 15 ON
- Hold down the reset button in the dynamic digital instrument display for between 5 and 10 seconds.

Press the reset button for longer than 10 seconds to access the test functions.

Press the reset button briefly to scroll through the scopes of maintenance work. Keep the reset button pressed for longer to access the reset menu for the selected scope of maintenance work. Press and hold the button again to reset the scope of maintenance work. It is only possible to reset the scopes of maintenance work once thresholds for specific scopes of maintenance work have been undercut.

Exiting reset mode

- Terminal 15 OFF
- Start engine
- Do not press button for 15 seconds.

2.3.6. Central Information Display

F01/F02 LCI CID

The CID in the F01/F02 LCI has been revised technically and visibly with the model revision. The CID is now connected to the headunit via an APIX interface similar to other current BMW models. The integration in the driving area has been smartened up with chrome applications.

In the standard equipment a CID with a diagonal of 6.5" is installed. In connection with the optional equipment Navigation Professional (option 609) a CID with a diagonal of 10.25" is installed.

F01/F02 LCI Displays and Controls
2. System Components

The Central Information Display is an integrated display and operating facility for the following functions:

- Audio functions such as radio, CD, MP3
- Telephone and data services
- On-board computer, journey computer
- Vehicle information, Interactive Owner's Handbook IBA
- Heating and air conditioning system
- Personalized scopes such as station choice
- Vehicle functions such as PDC and EDC
- BMW Services.

As with all new BMW models, the system is operated by means of the central operating controller.

2.4. Head-Up Display

The Head-Up Display (HUD) projects a virtual image into the driver's field of view. Important information, e.g. from the cruise control or navigation system with arrow display, is reflected on the windshield and is therefore permanently available in the driver's field of view.

The (optional equipment SA610) Head-Up Display in the F01/F02 LCI contains various functions aimed at enhancing road safety and ride comfort.

This includes display of the following:

- Cruise control with braking function (Dynamic Cruise Control)
- Active cruise control with Stop&Go function
- Collision warning with braking function
- Navigation system
- Check Control messages
- Vehicle Speed
- Speed Limit Information
- Distance information

Having the displays in the driver's direct field of view increases safety, as this allows the driver to keep his eyes on the road at all times.

2.5. Operating controls on the steering wheel

A switch block is integrated into the steering wheel on the left- and right side respectively.

The operating controls for the cruise control with braking function (Dynamic Cruise Control) and the active cruise control (ACC) are on the left-hand side of the steering wheel.

F01/F02 LCI Displays and Controls

2. System Components

The operating controls for operation of the radio and telephone functions are on the right.

F01/F02 LCI operating controls on the steering wheel

Index	Explanation
1	Reduce distance button (only with optional equipment 5DF)
2	Rocker switch ±, change speed, set speed
3	Knurled wheel, select/set radio station or CD track
4	MODE button, change between audio sources
5	Shift paddle for upshifting (only with optional equipment 2TB)
6	Rocker switch +, increase volume
7	Rocker switch -, lower volume
8	Voice recognition system button
9	Telephone button
10	Increase distance button (only with optional equipment 5DF)
11	Switch ACC/DCC on/off, interrupt
12	Resume button, call-up stored speed
13	Speed SET button
14	Shift paddle for downshifting (only with option 2TB)

F01/F02 LCI Displays and Controls

2. System Components

2.6. Operating controls in the center console

F01/F02 LCI operating controls in the center console

Index	Explanation
1	Gear Selector Switch
2	Controller
3	Electronic Parking Brake
4	Automatic Hold
5	Park Distance Control (PDC) or Parking Assistant
6	Side View
7	Hill Descent Control (HDC)
8	Driving Experience Switch
9	Dynamic Stability Control (DSC)

The labelling of the button "CD" has been changed to "MEDIA" similar to other current BMW models. For the heating and air conditioning system the labelling of the button has been changed to "A/C".

2.6.1. Driving experience switch

The driver can use the driving experience switch to select different programs which alter various properties of the vehicle depending on the vehicle's equipment specification.

F01/F02 LCI Displays and Controls

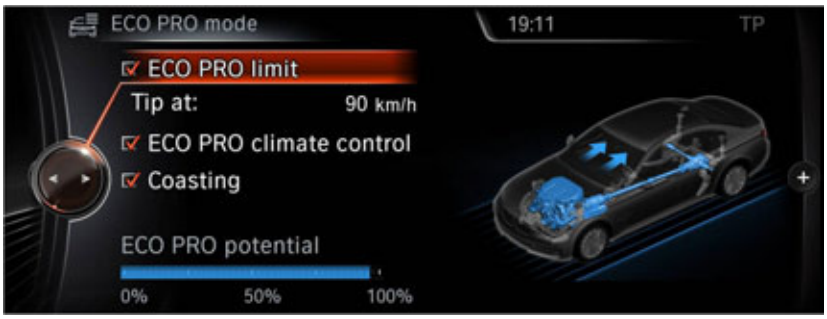
2. System Components

The following programs are available:

- SPORT
- SPORT+
- COMFORT
- COMFORT+
- ECO PRO

When the driver switches to a different program, the selected program is displayed in the instrument panel. In addition, a pop-up for the selected program appears in the CID and for vehicles with a dynamic digital instrument display the design and display concept are adapted to the driving mode.

ECO PRO mode



The ECO PRO mode supports the driver in adopting a consumption-optimized driving style and reduces fuel consumption through intelligent control of energy and A/C management.

The following measures help to reduce fuel consumption:

- A modified accelerator pedal characteristic curve and shift program with automatic transmission helps the driver adopt a driving style that optimizes fuel consumption.
- The A/C system is placed in the ECO PRO operating condition. Here the A/C system operates at reduced air drying and cooling. If the required temperature can be achieved without cold production, the A/C compressor is switched off. During heating mode the engine operating mode with increased heat dissipation is to the greatest possible extent dispensed with and the electric auxiliary heater is operated at low power.
  The ECO PRO operating state of the heating/air-conditioning unit can be reset by the driver in the COMFORT operating condition. The setting of the operating condition of the heating and A/C system is stored and reestablished when the ECO PRO mode is called up again.
- The exterior mirror heating is switched off and the seat heating temperature is limited to 37.5 °C (99.5 °F) instead of 42 °C (107.6 °F). These measures are allied to the ECO PRO operating condition of the heating and A/C program.
- The driver is prompted by various displays to adopt a driving style that optimizes consumption and is supported in optimizing their driving style.

F01/F02 LCI Displays and Controls

2. System Components

These measures are supplemented with the following additional measures in the F01/F02 LCI with the model revision:

- **Coasting:** Under certain prerequisites the engine is automatically disconnected from the transmission in gear selector switch position “D”. The vehicles continues to roll in idle state at reduced consumption. As soon as the brake or accelerator pedal is pressed, the engine is automatically reconnected.
  The coasting mode is shown in the EfficientDynamics display by the blue bar in the zero display. The coasting function can be manually switched on and off in the configuration menu of the **ECO PRO mode**. The setting is saved for the profile currently used.
  The following prerequisites must be satisfied for the coasting function:
  - Speed between 50 and 160 km/h (30 and 100 mph)
  - Accelerator and brake pedal are not pressed
  - Gear selector switch in position D
  - Engine and transmission are at operating temperature
  - DSC OFF or TRACTION are not activated
  - Cruise control is not activated
  - No trailer towing.

  The coasting function is also not available if the state of charge is temporarily too low, if there is an excessive current requirement in the vehicle electrical system or when driving on sharp inclines or downhill gradients.

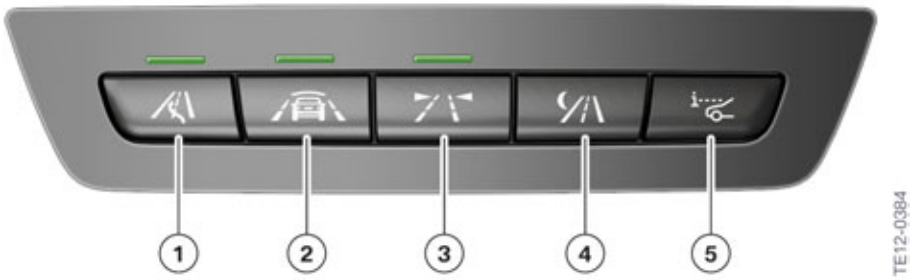
ECO PRO mode is available on all F01/F01 LCI models except the 760Li .

F01/F02 LCI Displays and Controls

2. System Components

2.7. Driver assistance system operating facility

The individual driver assistance systems can be activated or deactivated via driver assistance systems operating facility, which is located next to the steering wheel in the dashboard.



F01/F02 LCI driver assistance system operating facility

Index	Explanation
1	Blind Spot Detection (Lane change warning)
2	Intelligent Safety (collision warning with braking function)
3	Lane departure warning
4	Night Vision with pedestrian detection
5	Head-Up Display

The new “Intelligent Safety” button replaces the previous button for the collision warning with braking function. Via the Intelligent Safety button the collision warning with braking function is switched on and off. This function is switched on or off each time the button is pressed and the LED above the button is turned on or off respectively. The LED above the button illuminates as soon as at least one of the functions is switched on. This front protection function is automatically switched on each time the engine is started via the START-STOP button. In the case of the blind spot detection and the lane departure warning as before the last setting is always retained even after an engine start.

In addition, information screens on the respective driving systems are shown in the CID when the system is switched on.

The settings for the warning time of the collision warning with braking function can be accessed and preset via the information screens of Intelligent Safety menu.

F01/F02 LCI Displays and Controls

2. System Components

F01/F02 LCI Intelligent Safety menu displays in the CID

Note: Further information on the driver assistance systems can be found in the "F01/F02 LCI Driver Assistance Systems" section of this training material.

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Technical training.
Product information.

F01/F02 LCI Passive Safety Systems

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BMW Group University
Technical Training
ST1212 9/1/2012

BMW Service

General information

Symbols used

The following symbol/schematic diagram is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further deviations may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral element of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the current respective information systems of the BMW Group for any changes/additions to the technical data.

Information status: **May 2012**
VH-23/International Technical Training

F01/F02 LCI Passive Safety Systems

Contents

F01/F02 LCI Passive Safety Systems

1. Introduction

1.1. Passive Safety

The passive safety system of the F01/F02 LCI is based on the objectives and characteristics of current BMW models and satisfies all legal requirements worldwide.

The 4th generation Advanced Crash Safety Module (ACSM) is used as the central airbag control unit in the passive safety system for the F01/F02 LCI . The central sensor system is stored in the ICM as with other current BMW models.

The new Active Protection system (option 5AL) is installed for the first time (in the US market) in the F01/F02 LCI. Active Protection is standard equipment on the F01/F02 LCI and it comprises the attention assist function and two independent functions (Pre-Crash and Post-Crash) which introduce measures to protect vehicle occupants before and after a crash.

F01/F02 LCI Passive Safety Systems

2. Models

2.1. Overview

The F01/F02 LCI passive safety system uses the 4th generation Crash Safety Module.

The following table provides an overview of the versions installed for different models:

Series	Model	Used as of	Version
E60	BMW 5-Series sedan	09/2005	ACSM 1
E61	BMW 5-Series Touring	09/2005	ACSM 1
E85	BMW Z4 Roadster	01/2006	ACSM 1
E86	BMW Z4 Coupe	05/2006	ACSM 1
E87*	BMW 1-Series 5-door	04/2004	MRS 5
E88	BMW 1-Series Convertible	04/2008	ACSM 2
E90	BMW 3-Series Sedan	03/2005	MRS 5
E70	BMW X5	11/2006	ACSM 2
E71	BMW X6	04/2008	ACSM 2
E93	BMW 3-Series Convertible	03/2007	ACSM 2
F01	BMW 7-Series Sedan	11/2008	ACSM 3
F02	BMW 7-Series Sedan, long wheelbase	11/2008	ACSM 3
F07	BMW 5-Series Gran Turismo	10/2009	ACSM 3
F10	BMW 5-Series Sedan	03/2010	ACSM 3
F25	BMW X3	11/2010	ACSM 4
F12	BMW 6-Series Convertible	03/2011	ACSM 4
F20*	BMW 1-Series 5-door	09/2011	ACSM 4
F30	BMW 3-Series Sedan	02/2012	ACSM 4
F01 LCI	BMW 7-Series Sedan	07/2012	ACSM 4
F02 LCI	BMW 7-Series Sedan, long wheelbase	07/2012	ACSM 4

* These vehicles where not available in the US market.

F01/F02 LCI Passive Safety Systems

3. System Overview

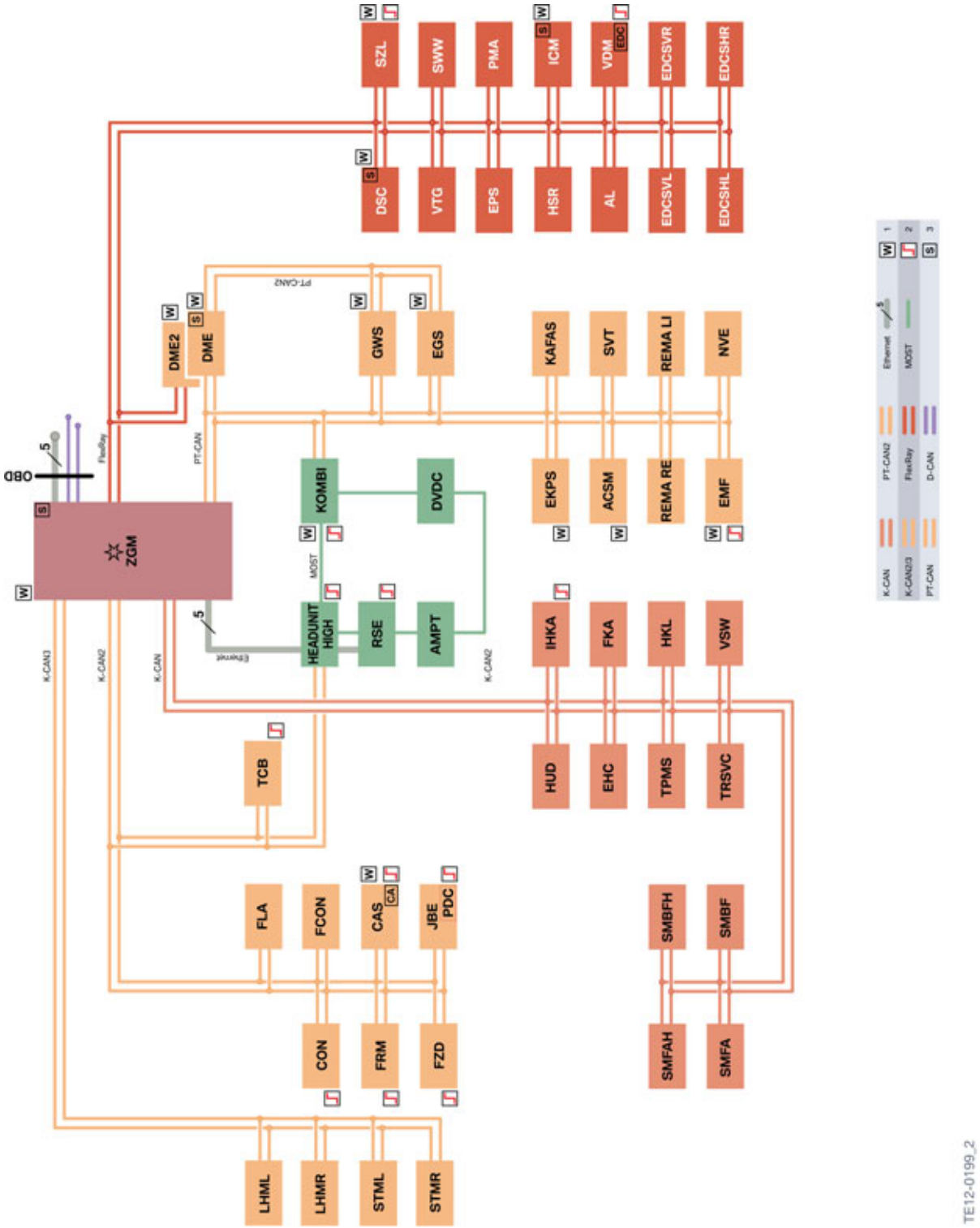
3.1. System wiring diagrams

The following bus overview shows the vehicle circuit structure of the F01/F02 LCI and incorporation of the modules on the powertrain CAN.

F01/F02 LCI Passive Safety Systems

3. System Overview

3.1.1. F01/F02 LCI bus overview



F01/F02 LCI bus overview

F01/F02 LCI Passive Safety Systems

3. System Overview

Index	Explanation
1	Control units with wake-up line
2	Control units authorized to perform wake-up function
3	Start-up node, control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AL	Active steering
AMPT	Top HiFi amplifier
CA	Car Access
CAS	Car Access System
CON	Controller
DME	Digital Engine Electronics
DME2	Digital Engine Electronics 2
DSC	Dynamic Stability Control
DVDC	DVD changer
EDC	Electronic Damper Control
EDCSHL	Electronic Damper Control satellite, rear left
EDCSHR	Electronic Damper Control satellite, rear right
EDCSVL	Electronic Damper Control satellite, front left
EDCSVR	Electronic Damper Control satellite, front right
EGS	Electronic transmission control
EHC	Electronic ride height control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic Power Steering (electromechanical power steering)
FCON	Rear compartment controller
FKA	Rear climate control
FLA	High-beam assistant
FRM	Footwell module
FZD	Roof function center
GWS	Gear selector switch
Headunit High	Headunit High (now incorporates most Combox functions except telematics)
HKL	Automatic operation of tailgate
HSR	Rear axle slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management

F01/F02 LCI Passive Safety Systems

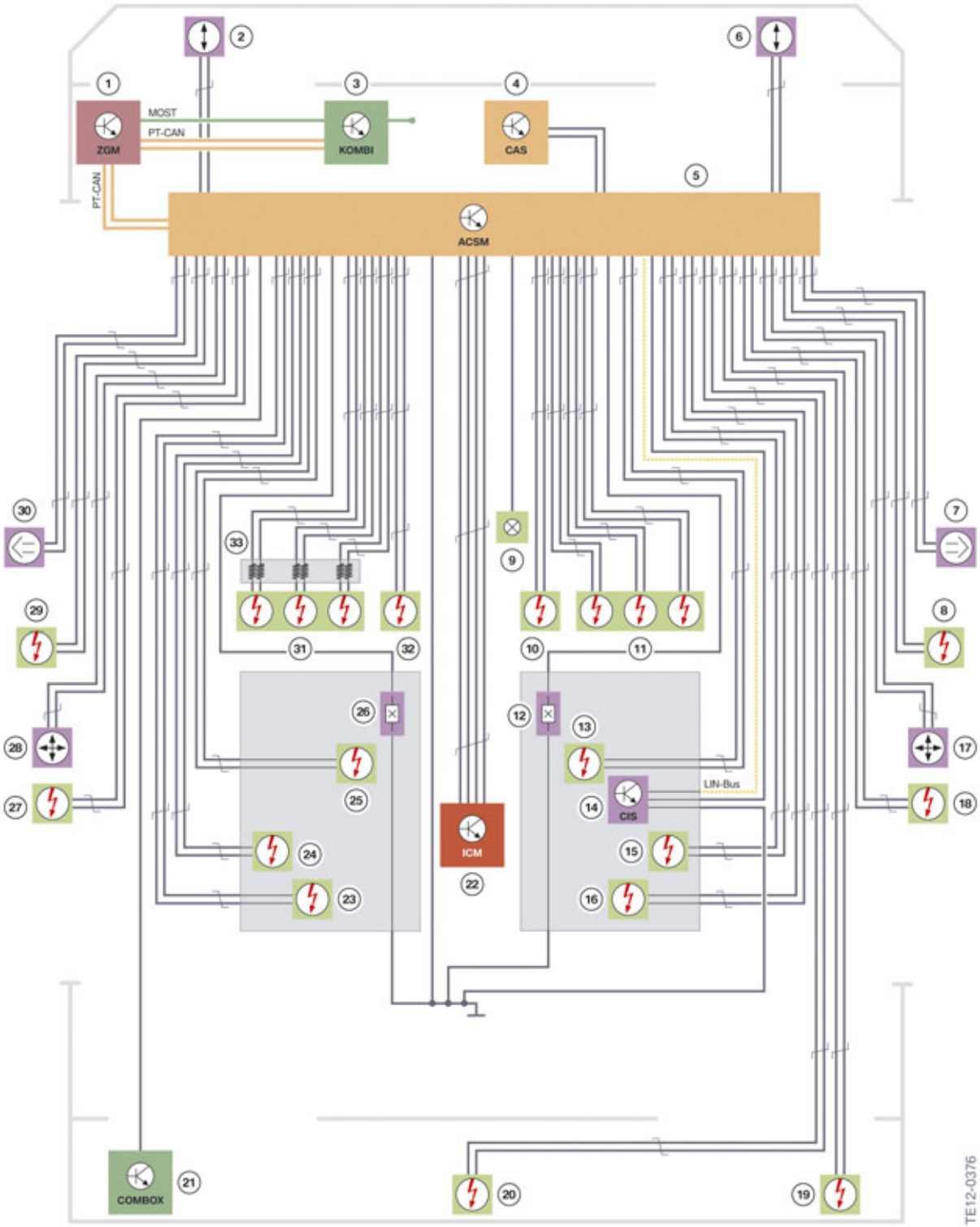
3. System Overview

Index	Explanation
IHKA	Integrated automatic heating / air-conditioning system
JBE	Junction box electronics
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel/Multifunctional instrument display
LHML	LED main light module, left
LHMR	LED main light module, right
NVE	Night Vision Electronics
PDC	Park Distance Control
PMA	Parking Maneuvering Assistant
REMA LI	Reversible electric-driven reel, left
REMA RE	Reversible electric-driven reel, right
RSE	Rear seat entertainment system
SMBF	Front passenger seat module
SMBFH	Rear passenger seat module
SMFA	Driver's seat module
SMFAH	Rear driver's side seat module
STML	Headlight driver module, left
STMR	Headlight driver module, right
SVT	Servotronic
SWW	Lane change warning
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TCB	Telematic Communication Box (replaced the Combox telematics functions)
VDM	Vertical Dynamics Management
VSW	Video switch
VTG	Transfer box (xDrive only)
ZGM	Central gateway module

F01/F02 LCI Passive Safety Systems

3. System Overview

3.1.2. System wiring diagram



F01/F02 LCI system wiring diagram

F01/F02 LCI Passive Safety Systems

3. System Overview

Index	Explanation
1	Central gateway module (ZGM)
2	Front sensor, left engine support
3	Instrument panel (KOMBI)
4	Car Access System (CAS)
5	Crash Safety Module (ACSM)
6	Front sensor, right engine support
7	Airbag sensor, door, right (pressure)
8	Head airbag, front passenger
9	Indicator lamp for front passenger airbag deactivation in roof function center
10	Knee airbag, front passenger
11	Front passenger airbag, two-stage with ventilation
12	Seat belt buckle contact, front passenger
13	Seat belt buckle tensioner, front passenger
14	Seat occupancy mat, CIS mat
15	Side airbag, front passenger
16	Crash-active headrest, front passenger
17	Acceleration sensor, B-pillar on right
18	Adaptive belt force limiter, front passenger
19	Safety battery terminal (only for high-security vehicles)
20	Safety battery terminal
21	Combox (Telematic Communication Box (TCB) for vehicles with Headunit High)
22	Integrated Chassis Management (ICM)
23	Crash-active headrest, driver
24	Side airbag, driver's side
25	Seat belt buckle tensioner, driver
26	Seat belt buckle contact, driver
27	Adaptive belt force limiter, driver (only vehicles with option 5AL Active Protection)
28	Acceleration sensor, B-pillar on left
29	Head airbag, driver
30	Airbag sensor, door, left (pressure)
31	Driver's airbag, two-stage with ventilation
32	Knee airbag, driver
33	Clock spring

F01/F02 LCI Passive Safety Systems

4. Functions

4.1. Crash Safety Module

The function of the Crash Safety Module is to permanently evaluate all sensor signals in order to identify a crash situation. As a result of the sensor signals and their evaluation, the Crash Safety Module identifies the direction of the crash and the severity of the impact.

The ACSM evaluates the information from the sensors and then forwards corresponding measures for selective activation of the necessary restraint systems.

The Crash Safety Module monitors the system itself and indicates when it is ready for operation by switching off the airbag indicator light.

If an error occurs during operation this is stored in a fault memory and can be read out for diagnosis purposes.

If a crash situation is detected, a crash message is sent to the other bus users in the data bus network as notification. The relevant control units respond to this signal by executing their own activities according to the severity of the crash.

The activities include:

- Opening the central locking system
- Activating the hazard warning flasher
- Switching on the interior light
- Deactivating the fuel pump
- Switching off the auxiliary heater
- Making an emergency call.

An additional function of the Crash Safety Module is the acoustic seat belt warning that reminds the driver and front passenger using visual and acoustic signals to fasten their seat belts. Seat belt buckle switches are used to identify whether the driver and/or the front passenger have their seat belts fastened. Information on occupancy of the front passenger seat is also included for the acoustic seat belt warning. In addition, for vehicles with option 460 comfort seats in the rear passenger compartment the status of the rear belt contacts is monitored and displayed in the instrument panel. Furthermore, in US vehicles the position of the driver and the front passenger seat is monitored.

The functions of the Crash Safety Module generally belong to one of the following areas:

- Crash-relevant functions
- System-monitoring functions
- Additional convenience functions.

F01/F02 LCI Passive Safety Systems

4. Functions

4.2. Crash-relevant functions

The Crash Safety Module must fulfil the following crash-relevant functions:

- Evaluating the sensor signals
- Crash detection
- Determining actuators to be activated
- Specifying the trigger time and trigger sequence
- Activation of the ignition circuit output stages
- Sending the crash message to all bus users
- Crash documentation
- Emergency call function.

4.2.1. Evaluating the sensor signals

The sensors serve to identify and verify head-on, side and rear-end crashes and also roll-over detection.

The sensors are directly connected to the Crash Safety Module where their signals are evaluated and processed.

4.2.2. Crash detection

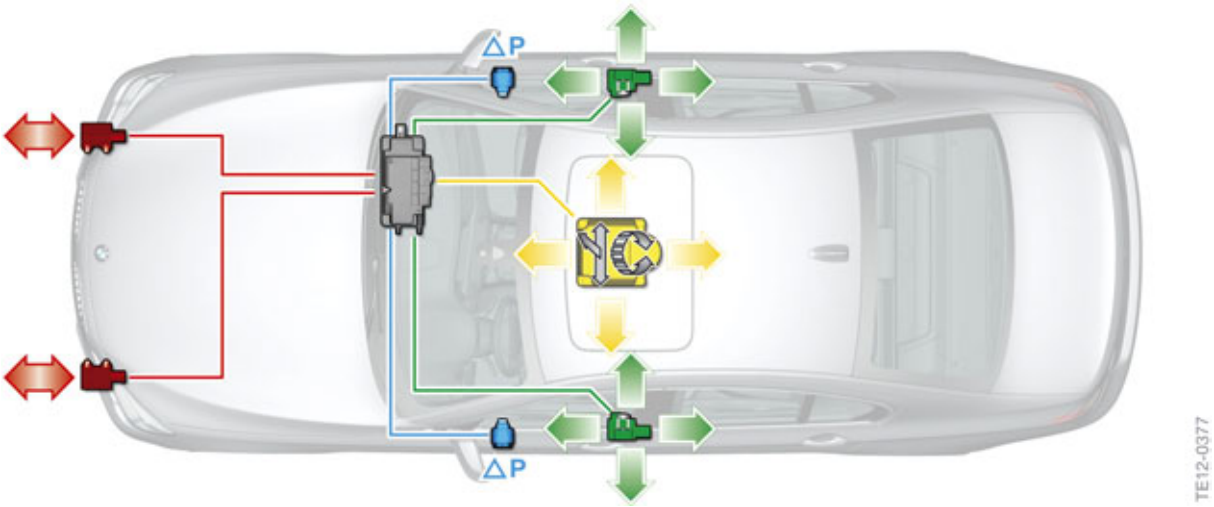
The US vehicles are equipped with the following sensors:

- one lateral and one longitudinal acceleration sensor in the B-pillars (green)
- one airbag sensor to monitor the pressure in each of the front doors (blue)
- one lateral and one longitudinal acceleration sensor in the ICM (yellow)
- one roll rate sensor in the ICM (yellow)
- one vertical acceleration sensor in the ICM (yellow)
- one front sensor on each of the engine supports (red).

The front sensors on the engine supports assist with the identification of a head-on collision and the corresponding severity.

F01/F02 LCI Passive Safety Systems

4. Functions



F01/F02 LCI sensors

4.2.3. Trigger time and trigger sequence

The Crash Safety Module uses the values transmitted by the sensors to determine the direction and severity of the crash.

In the case of a head-on crash, corresponding high acceleration values from the longitudinal acceleration sensors in the B-pillar and ICM respectively must be detected for example. An algorithm determines the severity and direction of the crash based on the accelerations. This information is used to assist calculation of the trigger times and sequence in which the restraint systems are activated.

A possible imminent rollover is also detected and the appropriate protection systems are energized.

4.2.4. Activation of the ignition circuit output stages

The Crash Safety Module is supplied with power by the Car Access System CAS with terminal 30b. The Crash Safety Module is in offline mode with terminal 30B. This means: It is active on the data bus and can perform all diagnostic functions. Triggering of the ignition circuits is blocked and is only enabled as of terminal 15 once the system self-test is complete. The Crash Safety Module is also ready for ignition, even with the logical terminal R after engine off.

The ignition capacitors are recharged via a switching controller. These ignition capacitors make the firing energy available in the event of a crash. If the voltage supply is interrupted during a crash, the ignition capacitors serve briefly as an energy reserve.

The ignition circuit output stages consist of a high-side and a low-side power switch. The high-side power switch connects the ignition voltage, while the low-side power switch connects to the ground. The ignition circuit output stages are controlled by a microcontroller.

The high-side and low-side power switches also serve to check the ignition circuits during the system self-test.

4.2.5. Sending the crash message

In the event of a crash involving activation of the restraint systems, the Crash Safety Module sends a crash message to the bus users in the bus-system network. In tandem with this, the Telematic Communication Box (TCB) or Combox is prompted to send an emergency call via a direct single-wire connection.

As a result, the respective control units perform the following functions depending on the crash severity:

Function	Control unit
Deactivating the fuel pump	Digital Engine Electronics (DME)
Switch off the auxiliary heater	Integrated automatic heating / air-conditioning system (IHKA)
Release central locking system	Junction box electronics (JBE)
Switch on hazard warning flashers	Footwell module (FRM)
Switch on interior light	Footwell module (FRM)
Send emergency call	Telematic Communication Box (TCB) (or Combox on models other)

4.2.6. Crash documentation

In the event of a crash where one or more actuators are activated, a crash entry is stored in a non-erasable memory. After three crash entries, a non-erasable fault entry is stored in the fault memory together with the information that the three crash messages have been saved. The airbag indicator light also lights up continuously.

The three crash entries could also be stored during the course of an accident. Each crash entry is assigned a system time. The control unit remains capable of firing even after three crash entries. The crash entries cannot be erased and serve the purpose of subsequent device diagnosis. A maximum of three crash entries can be stored. The control unit must then be replaced.

US market vehicles

In preparation for a new legal requirement in the USA on the documentation of crashes, US-version vehicles have an advanced crash documentation, the so-called Event Data Recorder (EDR). The EDR is realized using modified software in the ACSM. For each crash sensor data such as speed, status of the passengers, status of the belt contacts, etc. is saved for the crash process. The data can now only be read via the BMW workshop system.

4.2.7. Emergency call function

The emergency call functions are country-dependent and are available to customers in countries with the BMW Assist infrastructure. This means an appropriate service provider with a call center must be available. A telephone network must also be available in order to be able to make an emergency call.

F01/F02 LCI Passive Safety Systems
4. Functions

The BMW Assist SA612 (standard on all F01/F02 LCI models) must be installed for the emergency call function to be available.

Manual emergency call

Drivers who are not directly involved in the accident can use the manual emergency call to request assistance.

The emergency call button is located in the roof function center and is connected to the Headunit High or Combox directly.

Voice contact with the relevant service provider for the country is established by pressing the emergency call button. The voice contact is indicated by a flashing LED in the switch.

Automatic emergency call

The Crash Safety Module sends a message to the Telematic Communication Box or Combox in the event of an accident with corresponding crash severity. The Combox or the Telematic Communication Box (TCB) sends an emergency call, and also the location of the vehicle if available.

Attempts are made at the same time to establish a voice contact with the occupants of the vehicle in order to obtain more detailed verbal information about the accident (e.g. condition of occupants). Further rescue operations can be initiated accordingly.

Advanced Automatic Crash Notification

In addition, the Advanced Automatic Crash Notification function features in vehicles with BMW Assist.

The data from different sensors is transferred to the call center in the case of an emergency call, for example the status of the belt contacts to determine the number of persons in the vehicle or sensor data on the severity of the crash to obtain the probability of risk of injury.

The emergency call contains additional specific information on the circumstances of the accident. This means that more precise information regarding the accident and risk of injury is therefore available at the call center and can be forwarded to the emergency coordination center. The emergency coordination center can then initiate appropriate measures.

4.3. System-monitoring functions

The Crash Safety Module has the following system-monitoring functions:

- System self-test (pre-drive check)
- Display of system operability
- Cyclic monitoring
- Fault display and fault storage
- Output of faults (diagnosis)
- Acoustic and visual seat belt warning
- Deactivation of the front passenger airbag and side airbag and knee airbag on the front passenger side in the US vehicles.

4.3.1. System self test

The Crash Safety Module performs a system self test from terminal 15. The airbag indicator light is energized for roughly five seconds during the system self test.

Once the system self test is complete and no faults have been identified, the airbag indicator light goes out and the system is ready to operate.

4.3.2. Display of system operability

The airbag indicator light in the instrument panel goes out to indicate that the Crash Safety Module is ready for operation.

4.3.3. Cyclic monitoring

Once the system self-test has been successfully concluded and the system is ready for operation, a cyclic monitoring procedure is performed for fault-monitoring purposes. This cyclical monitoring is used for the internal diagnosis of the control unit and overall airbag system. Cyclical monitoring takes place continuously from terminal 15. This also continues when logical terminal R is reached after the engine is switched off.

4.3.4. Fault display and fault storage

The Crash Safety Module has a non-volatile fault memory. The airbag indicator light lights up to indicate a fault entry.

Events, such as the activation of an airbag or seat belt buckle tensioner, are also stored in the fault memory.

If the fault memory contains the entry that the restraint system has been activated, this only means the ignited restraint system is not available for further activation and not that it malfunctioned during the crash.

4.3.5. Output of faults (diagnosis)

The fault memory can be read out via the diagnostic interface with the assistance of the Integrated Service Technical Application ISTA in the BMW diagnosis system. After rectifying the faults or after renewing activated components, the fault memory can be cleared with the diagnosis command "Clear fault memory".

4.3.6. Acoustic and visual seat belt warning

An acoustic and visual seat belt warning is a standard feature of all vehicles equipped with the Crash Safety Module. The Crash Safety Module records whether or not the driver or front passenger have fastened their seat belts. If they have not, an acoustic and visual warning is output to remind them to fasten their seatbelts. Both seat belt buckle switches are monitored separately.

4.3.7. Deactivating the airbag

US vehicles

Provision is made in US versions of the vehicles for the airbag to be deactivated automatically in order to satisfy the regulations of the National Highway Traffic Safety Administration (NHTSA). When the child seats listed in the regulation are occupied by a child this must lead to deactivation of the airbag.

To do so, a seat occupancy mat is used on the front passenger seat for the purpose of occupancy detection and classification of occupants in the front passenger seat. A further development of the Occupant Classification 3 mat (OC3 mat), the Capacitive Interior Sensing mat (CIS mat), is used in the F01/F02 LCI.

The CIS mat is made up of two elements: A sensor wire, which runs parallel to the seat heating in the seat cushion and an evaluation unit. The CIS mat measures the capacity and ohmic resistance between the sensor wire (anode) and the vehicle ground (cathode) at a frequency of 120 kHz. The CIS mat determines from the change in capacity and resistance whether the front passenger seat is occupied by an adult or a child in a child seat.

The deactivation of the front passenger airbag, the side airbag and knee airbag on the front passenger side is signalled by the indicator lamp for front passenger airbag deactivation.

The indicator lamp for front passenger airbag deactivation in the roof function center lights up if a child seat with child for e.g. a child restraint system that has been tested in accordance with the NHTSA regulations and is holding a small child is detected on the front passenger seat or if the front passenger seat is unoccupied.

The display brightness is controlled by automatic regulation of the display illumination.

4.4. Active Protection

The standard equipment Active Protection feature (5AL) comprises the following three independent sub-systems:

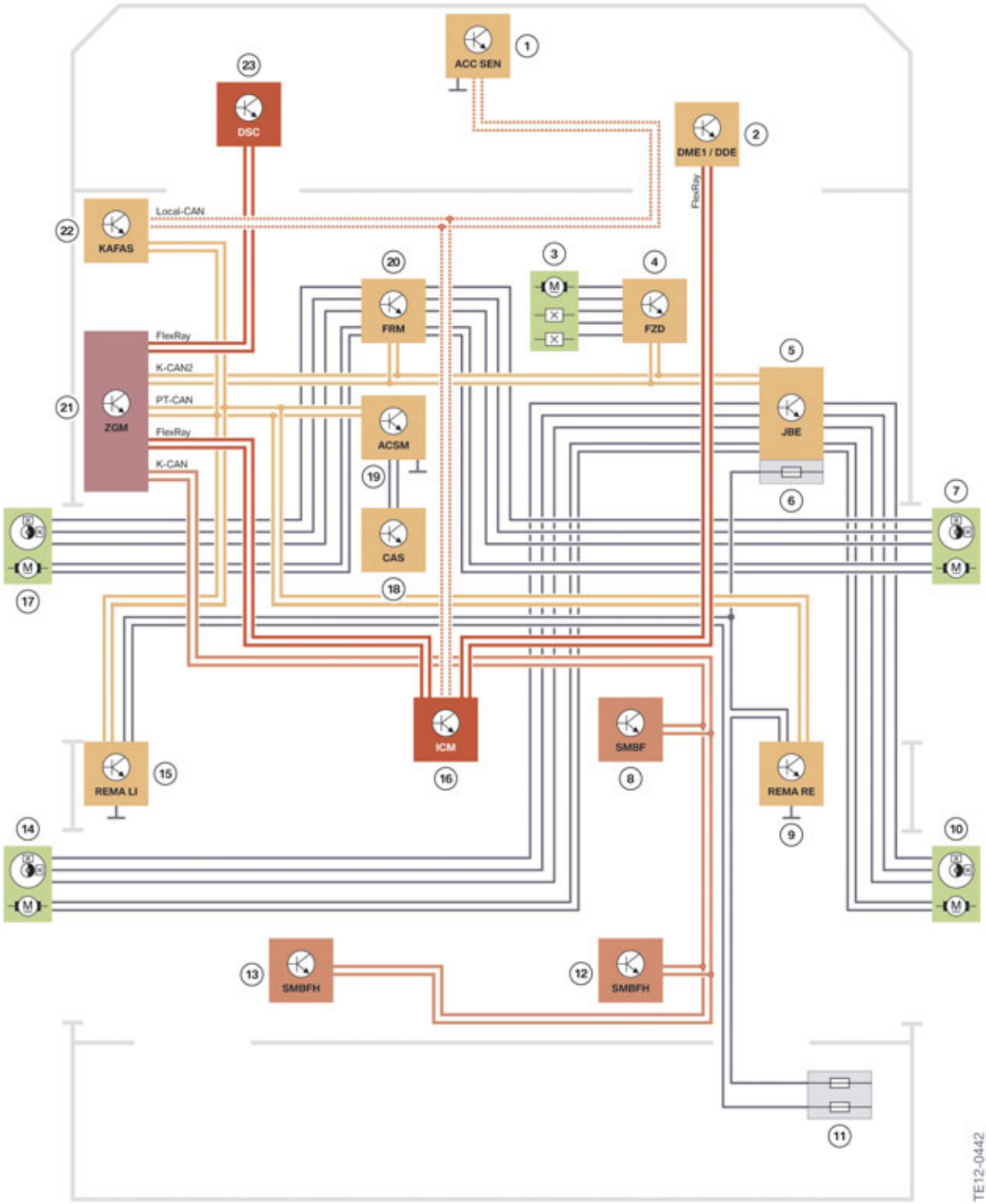
- Pre-Crash
- Post-Crash
- Attention assist.

The system increases the safety of the vehicle occupants through preventative measures in the event of critical driving situations (Pre-Crash) and through measures after a crash (Post-Crash). The attention assist monitors the driving style of the driver during the journey and encourages the driver to take breaks if necessary.

F01/F02 LCI Passive Safety Systems

4. Functions

4.4.1. System wiring diagram



F01 F02 LCI system wiring diagram for Active Protection

Index	Explanation
1	Radar sensor ACC Stop & Go ACC SEN
2	Digital Engine Electronics (DME)
3	Motor, slide/tilt sunroof
4	Roof function center (FZD)
5	Junction box electronics (JBE)
6	Power distribution box, front
7	Power window motor, front right
8	Front passenger seat module (SMBF)
9	Reversible motor-driven reel, right (REMA RE)
10	Power window motor, rear right
11	Power distribution box, rear
12	Front passenger seat module, rear (SMBFH)
13	Driver's seat module, rear (SMFAH)
14	Power window motor, rear left
15	Reversible motor-driven reel, left (REMA LI)
16	Integrated Chassis Management (ICM)
17	Power window motor, front left
18	Car Access System (CAS)
19	Crash Safety Module (ACSM)
20	Footwell module (FRM)
21	Central gateway module (ZGM)
22	Camera-based driver support systems (KAFAS)
23	Dynamic Stability Control (DSC)

4.4.2. Pre-Crash

The Pre-Crash sub-system introduces preventative protective measures for the occupants in known critical driving situations which may lead to an accident.

4. Functions

Identification of critical driving situations

Critical driving situations are identified with help of the inertial sensor system installed in the vehicle.

Critical driving situations include:

- Emergency braking initiated
- Strong understeer
- Strong oversteer
- Rollover of the vehicle.

For vehicles with Enhanced Active Cruise Control (option 5AT) or Lane Departure Warning w/Collision Mitigation (option 5AS) imminent collisions which were identified with help of the radar sensor system or KAFAS camera are also considered. If both systems are installed, then the collisions identified by the radar sensors are evaluated. For the Pre-Crash identification, separate thresholds to the collision warning thresholds are made available by the KAFAS or FRR for activating the Pre-Crash functions.

The following table contains an overview of the sensor data evaluated by the Pre-Crash function depending on the vehicle equipment:

Data source	Information
ICM	Speed, longitudinal acceleration, lateral acceleration, yaw rate, steering angle, side slip angle, actual deceleration (automatic braking after an crash), driving experience switch status
DME	Accelerator pedal
DSC	Braking torque, parameter status (automatic braking after crash)
ACSM	Belt contact, roll-over detection
FRR, KAFAS	Pre-Crash identification

The evaluation of the sensor data is realized in the REMA_LI and REMA_RE control units. The two control units are integrated in the reversible motor-driven reel, which is connected to the respective automatic reel or automatic retractor. The REMA_LI and REMA_RE control units are bus users in the powertrain CAN. The REMA_LI control unit (on the left side of the vehicle) assumes a master function for the Pre-Crash function.

Measures for occupant protection

If a critical driving situation has been detected, the following measures are introduced to protect the occupants:

- Reduction of belt slack
- Closing of side windows
- Closing of slide/tilt sunroof
- Positioning of the backrest of the front passenger seat
- Positioning of the backrests of the rear seats (only with equipment Comfort seats in the rear passenger compartment, option 460).

F01/F02 LCI Passive Safety Systems

4. Functions

If a critical driving situation has been identified and the seat belts are fastened, the seat belts of the driver and front passenger are reversibly tensioned and the belt slack reduced as a preventative measure by the reversible motor-driven reel. The effectiveness of the belt tensioner is thus increased and the severity of injuries in the event of a crash can be reduced. The belt is released again as soon as the critical driving situation no longer exists.

In addition, the backrest of the front passenger seat is positioned in order to minimize the risk of injury for the front passenger in conjunction with the other passive safety systems. For vehicles with equipment Comfort seats in the rear passenger compartment (option 460) the position of the backrests of the rear passenger compartment seats is also adapted to reduce the risk of injury. The position of the backrests is not adapted automatically after the critical situation or after a crash but must be manually adjusted.

Closing the side window and the slide/tilt sunroof prevents objects entering the passenger compartment in the event of a crash. If the vehicle is at a standstill after a crash, the side windows are opened a fraction so that the gases released when the airbags were triggered can escape quicker. The control of the window and the slide/tilt sunroof is realized by the REMA_LI control unit.

In addition, the reversible motor-driven reel makes available the comfort tensioning function. This reduces the belt slack of the driver and front passenger each time the belt contact is closed at a speed of about 10 km/h (6 mph).

Design and function of the reversible motor-driven reel

The reversible electric-driven reel is an extension of the functions of the existing inertia reels. The inertia reel is an automatic reel with an adaptive force limiter. The reversible electric-driven reel essentially comprises a control unit, an electric motor, a transmission unit and a clutch which establishes the connection between the automatic tensioner.

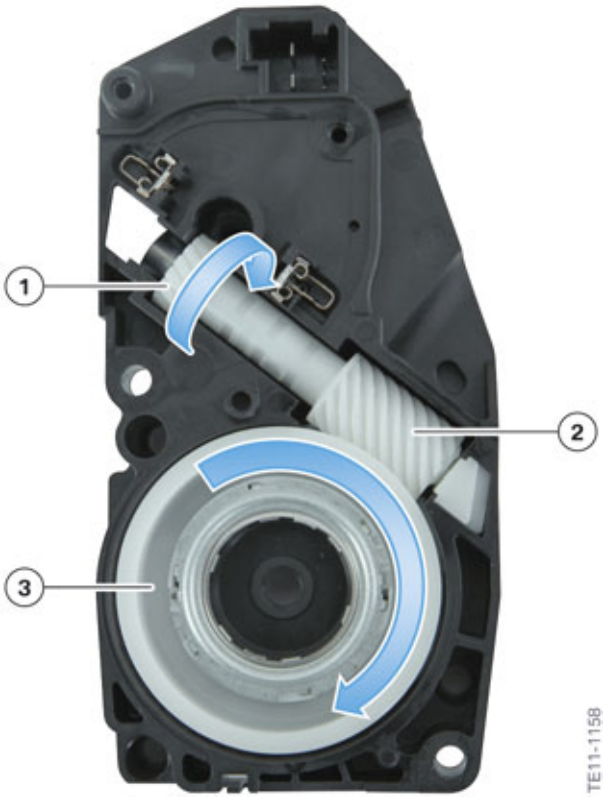
Structure of reversible motor-driven reel

Index	Explanation
1	Automatic tensioner
2	Clutch bell
3	Belt shaft
4	Driven gear with clutch
5	Transmission unit
6	Electric motor

If the reversible electric-driven reel is not in operation, the locking pawls are retracted. The clutch bell and the belt shaft are freely rotatable. The seat belt can be pulled out or reeled in.

If the reversible motor-driven reel is put into operation to reduce the belt slack, the electric motor is activated and moves the drive shaft with the worm gear.

The worm gear turns the driven gear with the clutch. The locking pawls extend and reach into the clutch bell.

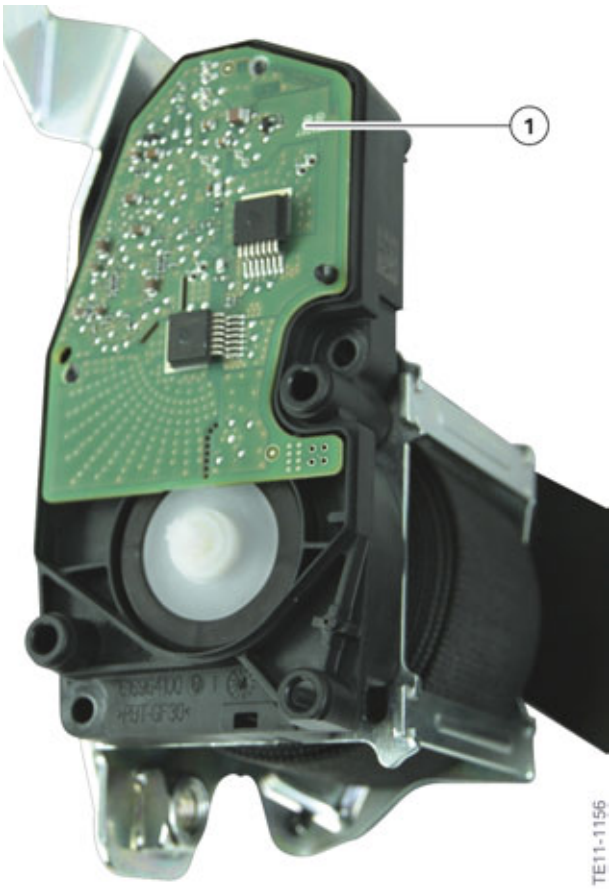


Structure of reversible motor-driven reel

Index	Explanation
1	Sprocket of drive shaft
2	Worm gear
3	Driven gear with clutch

The clutch bell which is on the belt shaft drives the belt shaft. The seat belt is wound on the belt shaft and thus shortened. The seat belt on the occupant is thus tightened.

The REMA control unit is under a cover in the transmission unit of the REMA.



Control unit for reversible motor-driven reel

Index	Explanation
1	Control unit

4.4.3. Post-Crash

The Post-Crash sub-function includes the automatic braking function after an accident, which brakes the vehicle to a standstill in certain accident situations without intervention from the driver. The risk of another collision can thus be reduced. The driver may oversteer the automatic braking after a crash by pressing the brake pedal or accelerator pedal.

The automatic braking after a crash is activated if a crash with sufficient severity has been identified in the ACSM. The ACSM then sends a signal to the electronic fuel pump control unit EKPS to switch off the fuel pump. This same signal is evaluated by the DSC control unit. The DSC control unit then brakes the vehicle with help of the DSC pump and brings it to a standstill.

The DSC generates a set-point deceleration of 5 m/s^2 (16.6 ft/s^2) for braking. The set-point deceleration is only achieved if road conditions permit this. During automatic braking the accelerator pedal and brake pedal are monitored. The automatic braking is interrupted if the accelerator pedal is pressed or if the brake pedal is pressed for a longer period by the driver. Pressing the accelerator pedal only causes the braking process to stop. Acceleration of the vehicle is not possible as the fuel pump is switched off.

Also during automatic braking the ABS prevents the wheels from blocking and the DSC stabilizes the vehicle. If the DSC is in DSC OFF mode during automatic braking, a forced activation of the DSC is effected.

About 1.5 seconds after reaching standstill, the brake is automatically activated and the vehicle must be secured against rolling away.

If a crash is identified, which leads to activation of the safety battery terminal, then automatic braking cannot be activated as the DSC pump is no longer supplied with current.

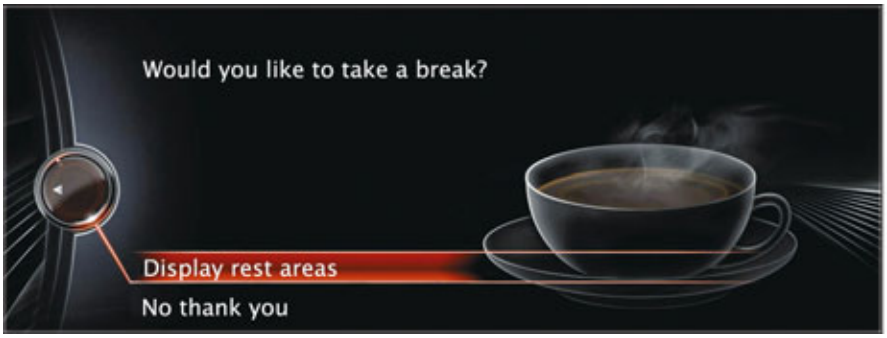
Automatic braking is not activated under the following conditions:

- The DSC has failed before the crash
- The ABS has failed before the crash
- The brake fluid level is too low.

If these faults occur during or after the crash, the control is led to the end as these faults are then interpreted as consequences of the crash.

4.4.4. Attention assist

The attention assist is included as a functional enhancement in the Active Protection package (option 5AL) and helps avoid accidents caused by driver fatigue during long monotonous journeys. The attention assist recognizes a modified drivability of the driver. In the case of dwindling attention or if the driver is tired, the attention assist shows a recommended break as a Check Control message in the central information display CID.



Check Control message break recommendation in the central information display CID

4. Functions

Operating principle

The attention assist is automatically active after each engine start from a speed of roughly 75 km/h (46.6 mph) and cannot be switched off. If the attention assist is active, the driver is taught-in at the start of a journey and an attention profile created. The personal driving style such as the steering behavior and the journey conditions such as time, journey duration and speed, are taken into consideration.

The drivability of the driver changes in the case of distraction or increasing fatigue. If the modified drivability differs strongly from the taught-in drivability of the attention profile, the attention assist shows a break recommendation in the central information display CID. This message must be acknowledged by the driver. In addition, he receives the option of having stop opportunities (POIs) displayed. The break recommendation is only displayed once during an uninterrupted journey. After a break a new break recommendation is not shown in the following 45 minutes of the journey. If the break lasts at least 1 hour the driver is taught-in again after an engine start.

Note: The attention assist feature is implemented in the Integrated Chassis Management (ICM) and does not have its own sensor system.

System limits

Personal responsibility

The attention assist feature cannot replace the personal assessment of the physical condition and may not be able to identify or identify on time dwindling attention or driver fatigue. Therefore the driver must always ensure he is well rested and alert during a journey. Otherwise dangers can be identified too late and an accident caused as a result.

The function can be restricted in the following situations for example and an unwarranted break recommendation or no break recommendation at all shown:

- If the time is set incorrectly
- If the speed is mainly lower than 75 km/h (46.6 mph)
- In the case of a sporty driving style, e.g. heavy acceleration or quick cornering
- In active driving situations, e.g. frequent lane change
- Poor road condition
- Strong crosswind.

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