

2001-2002 ACCESSORIES & EQUIPMENT

Accessories Control Systems - Z3 Roadster & Coupe

TROUBLESHOOTING

12 00 ... EXTERNAL JUMP-STARTING AID

Do not start the engine with help of starting sprays.

Preparation:

Conform with the following when starting engine with starting cable.

Ensure that starting cable wires are to appropriate cross-section size.

Only use fuse-protected starting cables.

Check whether the current supplying battery has 12 V voltage.

If engine is started from battery of another vehicle, ensure that there is no contact between the bodies of both vehicles.

CAUTION: Never touch ignition system components under current - dangerous high tension!

Operation:

Always conform with the procedures to avoid injury to persons or damage to parts.

Select range P in vehicles with an automatic transmission and apply the parking brake.

Move the shift lever of vehicles with manual transmission into neutral and apply the parking brake.

Ensure that the starting cables cannot get caught in rotating parts, e.g. fan.

First connect both positive poles of the batteries with one starting cable (red).

Use the positive connection point in the engine compartment for vehicles with the battery in the trunk.

Then connect the second starting cable (black) between the negative pole of the current supplying battery and engine or body earth of the vehicle to be started.

CAUTION: Never connect the second starting cable (black) on the negative pole of the battery in the vehicle to be started. Produced gas could be ignited by sparks.

Danger Of Explosion!

If the battery in the vehicle supplying power is weak, start the engine of this vehicle and let it run at idling speed.

After the engine of the vehicle to be started has started up, first disconnect the starting cable on the negative pole/earth connection. Then remove the starting cable from the positive poles.

12 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!

Siemens C 2:

When starting the vehicle engine with outside help from another vehicle, remember that overvoltage could

damage the Siemens C 2 telephone. For this reason, always disconnect the sender and receiver from the electric system before using outside starting aids.

Siemens C 3 And Motorola C 451:

Senders and receivers of Siemens C 3 and Motorola C 451 telephones are protected against overvoltage, but calls may not be made or received during outside starting.

Always pay attention to the operating instructions of different type and different make telephones. In case of doubt disconnect the sender and receiver from the vehicle electric system.

12 00 ... INSTRUCTIONS ON STARTING AID

Do not start the engine with help of starting sprays.

Preparation:

Conform with the following when starting engine with starting cable.

- Ensure that jump lead wires are to appropriate cross-section size.

- Only use fuse-protected jump leads.

- Check whether the current supplying battery has 12 V voltage.

- If engine is started from battery of another vehicle, ensure that there is no contact between the bodies of both vehicles.

CAUTION: Never touch ignition system components and current - dangerous high tension!

If the battery in the vehicle supplying power is weak, start the engine of this vehicle and let it run at idling speed.

Carrying Out:

Always conform with the procedures to avoid injury to persons or damage to parts.

- On automatic transmission, select "P" setting, apply handbrake.

- Move the shift lever of vehicles with manual transmission into neutral and apply the parking brake.

- Ensure that the jump leads cannot get caught in rotating parts, e.g. fan.

- First connect positive terminals of both batteries with one jump lead (red).

- Use positive connection point in engine compartment for vehicles with one battery in trunk.

- Then attach second jump lead (black) to negative terminal of donor battery and to engine ground or body ground on vehicle to be started.

CAUTION: Never connect second jump lead (black) to negative terminal of battery in vehicle to be started. This would produce explosive gas which could be ignited by sparks.

Danger Of Explosion!

After engine of vehicle to be started has started up, first disconnect the jump lead on the negative terminal/ground connection. Then remove jump lead from positive terminals.

61 00 ... BATTERY

NOTE: Important notes and instructions for handling batteries in the dealership can be found in:

- Disconnecting battery, refer to [12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY](#) .
- Battery charging, refer to [61 00 ... BATTERY CHARGING](#) .
- External jump-starting aid, refer to [12 00 ... INSTRUCTIONS ON STARTING AID](#) .

Battery Care And Maintenance:

In low-maintenance batteries, check the acid level at least once a year. If necessary, top up with distilled water up to the top marking.

The increasing number of electronic control units in the car reduces the self-discharging time of the battery (even in standby mode). To maintain the battery service life and to avoid exhaustive discharging, recharge laid-up vehicles every 6 weeks at the latest. The time for self-discharging depends on vehicle type and equipment specification.

Battery Test:

The battery acid density can be used to measure the charge state. However this test produces uncertainty caused by a design-related range of variation. The acid density e.g. for a charged battery is 1.28 kg/l (in the tropical version the acid density is 1.23 kg/l).

Another interference factor is the acid lamination immediately after filling with distilled water.

Battery wear with partially sulfated and/or heavily contaminated plates will also lead to incorrect acid density test results.

61 00 ... BATTERY CARE AND MAINTENANCE

Safety instructions for handling vehicle battery, refer to [61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY](#) .

Electrolyte level of present low-maintenance batteries should be checked at least annually and corrected to max. mark (specified by battery supplier) with distilled water when necessary.

Due to the increasing number of control units used in vehicles today, discharging by the power consumption of control units even in standby mode is added to the natural self-discharging of a battery. In order to achieve the battery service life and to avoid total discharging, recharge the batteries of stored vehicles at the latest every 6 weeks. The time for self-discharging depends on vehicle model and equipment.

61 00 ... BATTERY CHARGING

If a normal or quick charger is used to charge the battery, the battery must be disconnected from the vehicle electrical system and removed. This prevents damage to paintwork and upholstery.

Important!

In order to prevent the intelligent battery sensor from malfunctioning, the charging terminals in the engine compartment must be used without fail in vehicles from E60 and should be used if possible in other vehicles.

Important!

Before charging the battery while it is installed, first carry out a closed-circuit current test. Refer to [61 20 ... BATTERY OPEN-CIRCUIT CURRENT TEST](#) . If here the voltage is 10 V or less, one or more of the cells may be faulty or the entire battery may already be damaged. In this case, always remove the battery as escaping gases during charging could damage the interior equipment and trim. Attempt to regenerate faulty cells with low charging current.

If necessary, open existing plugs on the individual cells.

61 00 ... EXTERNAL JUMP-STARTING AID

Do not start the engine with help of starting sprays.

Preparations:

Conform with the following when starting engine with starting cable.

1. Ensure that starting cable wires are of appropriate cross-section size.
2. Only use fuse-protected starting cables.
3. Check whether the current supplying battery has 12 V voltage.
4. If the engine is started from the battery of another vehicle, ensure that there is no contact between the bodies of both vehicles.

If the battery in the current-supplying vehicle is weak, start the engine of this vehicle and let it run at idling speed.

IMPORTANT: Do not touch any live components of the ignition system. High voltage - mortal danger! Refer to 12 00 ... WORKING INSTRUCTIONS FOR IGNITION SYSTEM, DME (DIGITAL MOTOR ELECTRONICS) AND ENGINE ELECTRICS and 12 00 ... BREAKERLESS IGNITION DISTRIBUTION .

Procedures:

Always conform with the procedures to avoid injury to persons or damage to parts.

Select range P in vehicles with an automatic transmission and apply the parking brake.

Move the shift lever of vehicles with manual transmission into neutral and apply the parking brake.

Ensure that the starting cables cannot get caught in rotating parts, e.g. fan.

First connect both positive poles of the batteries with one starting cable (red).

Use the positive connection point in the engine compartment for vehicles with the battery in the trunk.

Then connect second starting cable (black) between negative terminal of current-supplying battery and engine or body earth of vehicle to be started.

IMPORTANT: Never connect the second starting cable (black) on the negative pole of the battery in the vehicle to be started. Produced gas could be ignited by sparks.

Danger Of Explosion!

After engine of vehicle to be started has started up, first disconnect starting cable at negative terminal/earth connection. Then remove the starting cable from the positive poles.

61 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!

Siemens C 2:

When starting engine with assistance of another vehicle, remember that overvoltage could damage the Siemens C 2 telephone. For this reason, always disconnect the sender and receiver from the electric system before using outside starting aids.

Siemens C 3 And Motorola C 451:

Sensors and receivers of Siemens C 3 and Motorola C 451 telephones are protected against overvoltage, but calls may not be made or received during external starting procedures.

Always pay attention to the operating instructions of different type and different make telephones. In case of doubt, disconnect sensor and receiver from vehicle electrical system.

61 00 ... IMPORTANT WHEN ENGINE BONNET RAISED TO WORKING POSITION

CAUTION: Do not switch on windscreen wipers with the engine hood raised! In case of unfavorable tolerances, the wiper arm on driver's side could collide with the engine hood and windscreen when the wipers are switched on. Remove fuse for windscreen wipers to avoid damaging engine bonnet and windscreen.

61 00 ... IMPORTANT WITH CONNECTED BATTERY!

Safety instructions for handling vehicle battery. Refer to [61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY](#).

Work on components, terminal connections, etc. could result in errors being stored in the fault memories of the affected control units.

61 00 ... REPAIRING AIR BAG CABLES

Refer to [61 00 ... REPAIRING AIRBAG CABLES](#).

61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY

Battery Acid Is Highly Corrosive:

Do not allow any battery acid to come into contact with the eyes, the skin or clothing. Therefore wear protective clothing, gloves and goggles.

Do not tilt the battery, acid may emerge from the vent opening.

In Event Of Contact With Acid:

If acid is splashed into the eyes, rinse them immediately for several minutes with clear water. You must then consult a doctor without delay.

If acid is splashed onto the skin or clothing, neutralize it immediately with a soapy solution and rinse with lots of water.

Seek medical attention immediately if battery acid is accidentally swallowed.

Explosion Hazard:

Strictly no flames, sparks, naked light or smoking!

A highly explosive mixture of electrolytic gas is created when batteries are charged. The rooms where charging is carried out must therefore always be well ventilated.

Avoid the formation of sparks when handling cables, wiring and electrical devices.

Turn the ignition lock to the 0 position before disconnecting or connecting the battery.

Do not place tools or any similar object on the battery (danger of short-circuiting and explosion!).

61 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT

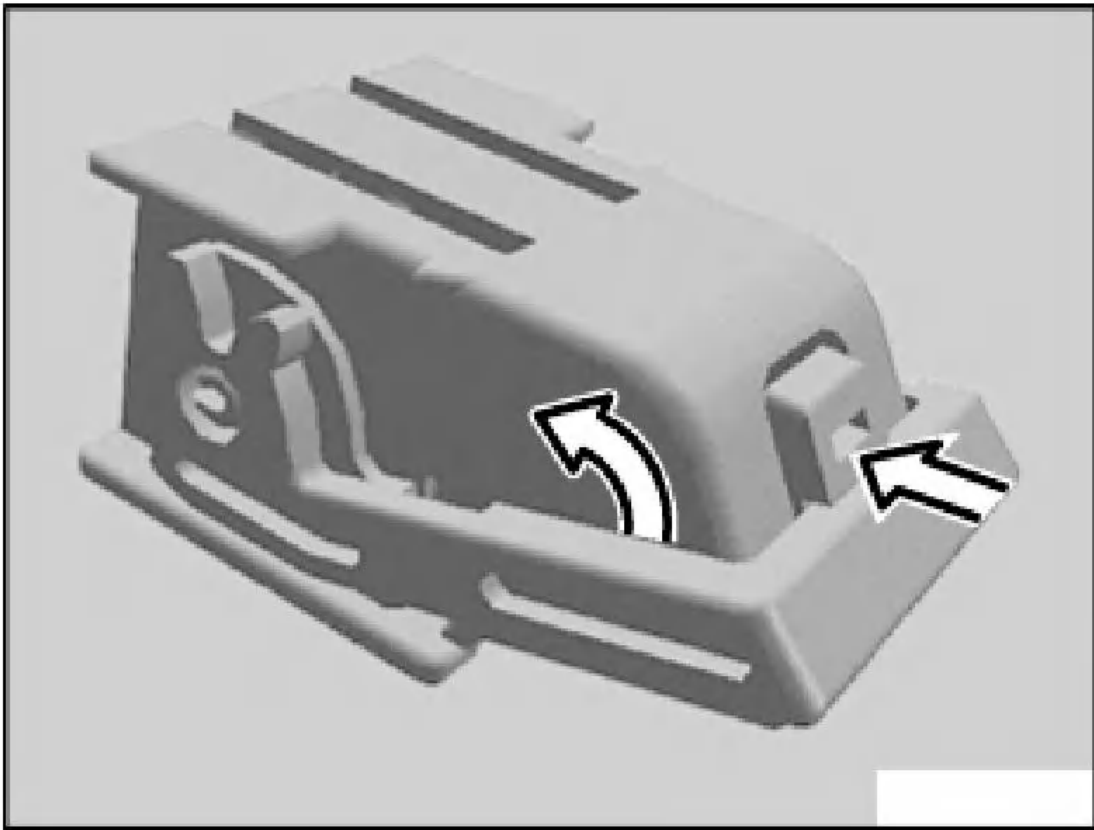
CAUTION: Disconnecting the vehicle battery will cancel the fault memories of control units. For this reason, prior to disconnection of the vehicle battery fault

memories should be interrogated and faults printed by the printer of a BMW Service tester. Investigate stored faults. Ignition must always be switched off before disconnecting or connecting control-unit connectors. Removal and installation of components, relays, fuse, etc. could cause the storage of faults in fault memories of control units capable of self-diagnosis. For this reason, fault memories must always be interrogated after working on the electrical system. Stored faults must be investigated and cancelled.

61 13 .. UNLOCKING AND DISCONNECTING DIFFERENT PLUG CONNECTIONS

NOTE: Examples of unlocking and disconnecting different plug connections.

Press lock and open clip in direction of arrow.



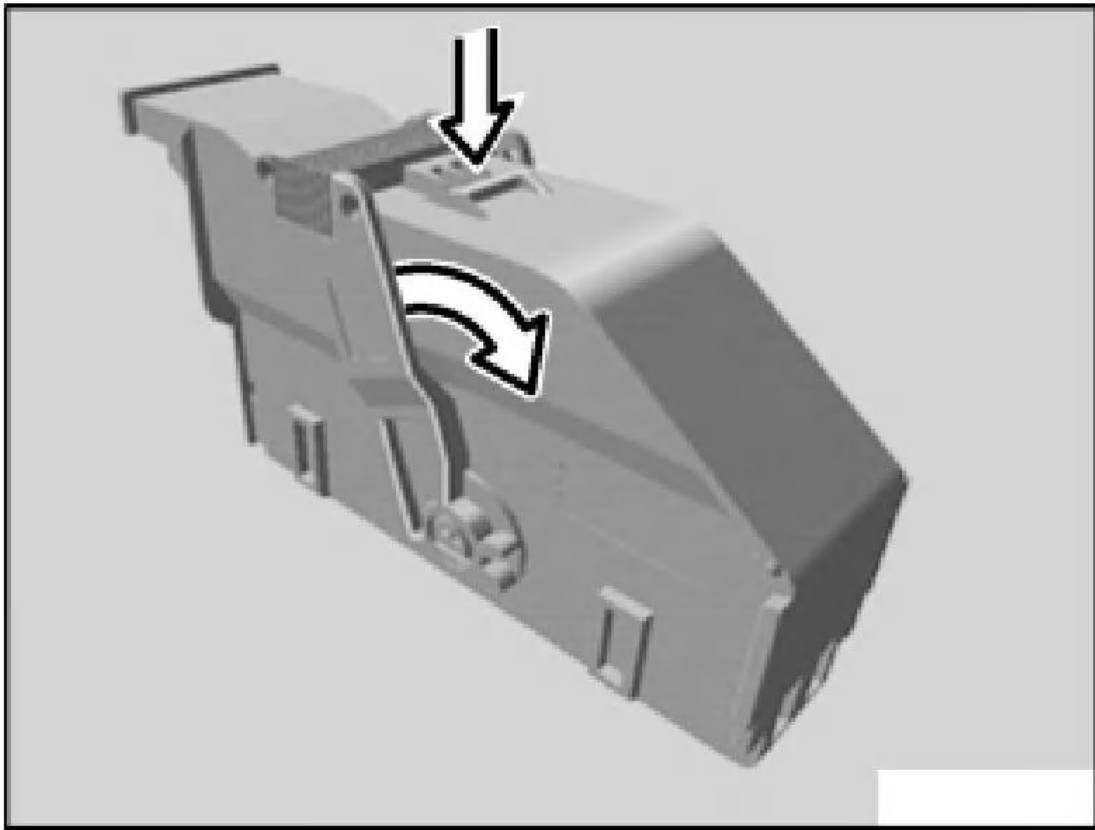
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[Fig. 1: Pressing Lock And Open Clip](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection.

Press lock and open clip in direction of arrow.



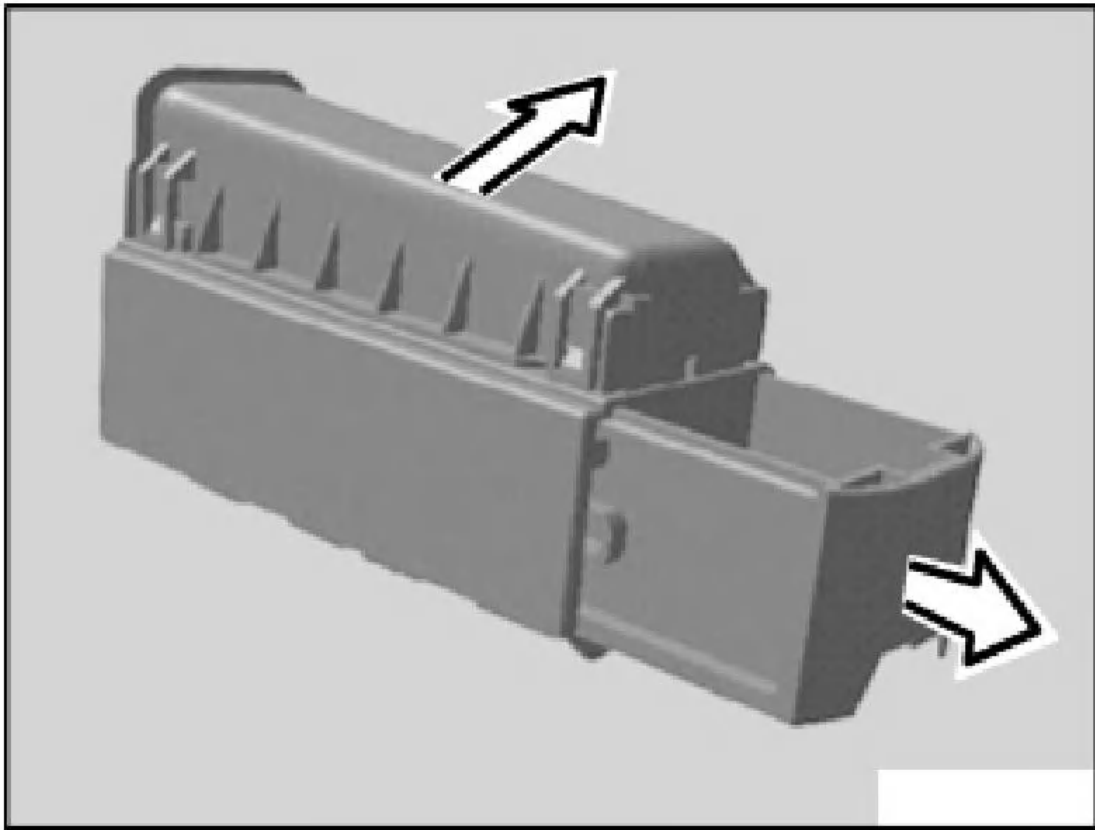
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[Fig. 2: Pressing Lock And Open Clip](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection.

Open clip in direction of arrow and disconnect plug connection in direction of arrow.

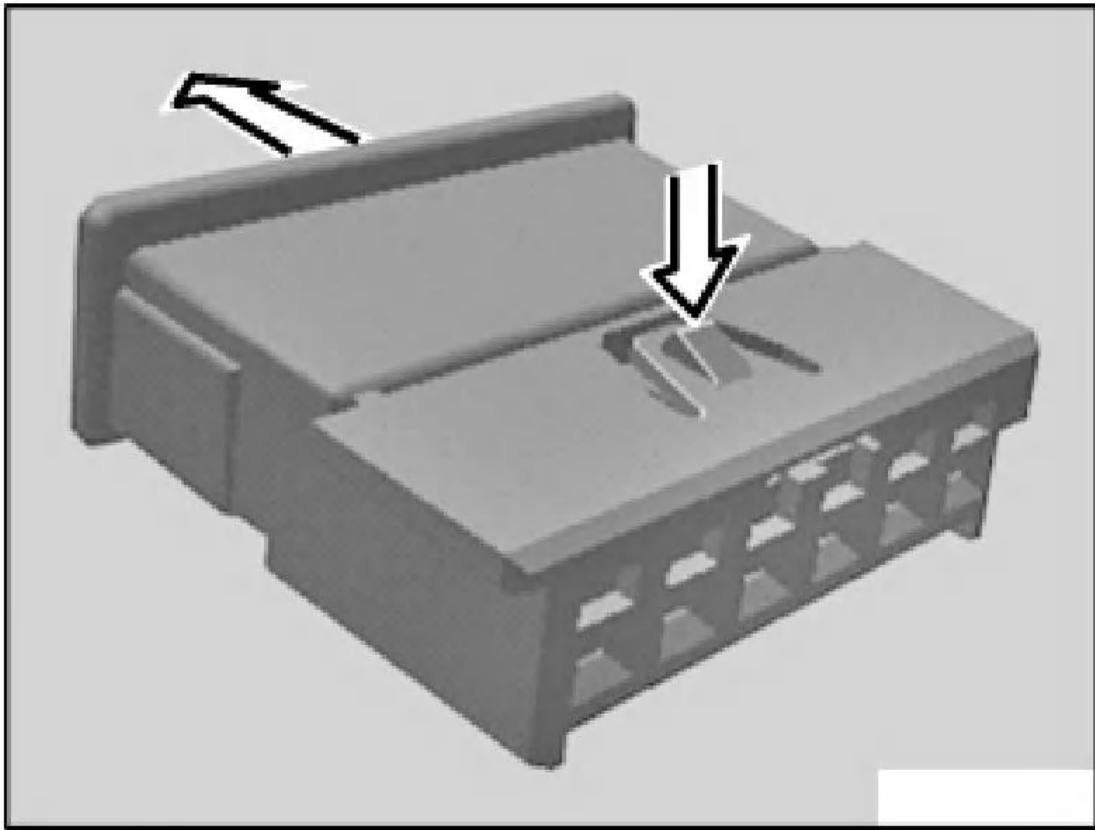


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[Fig. 3: Opening Clip And Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock and disconnect plug connection in direction of arrow.

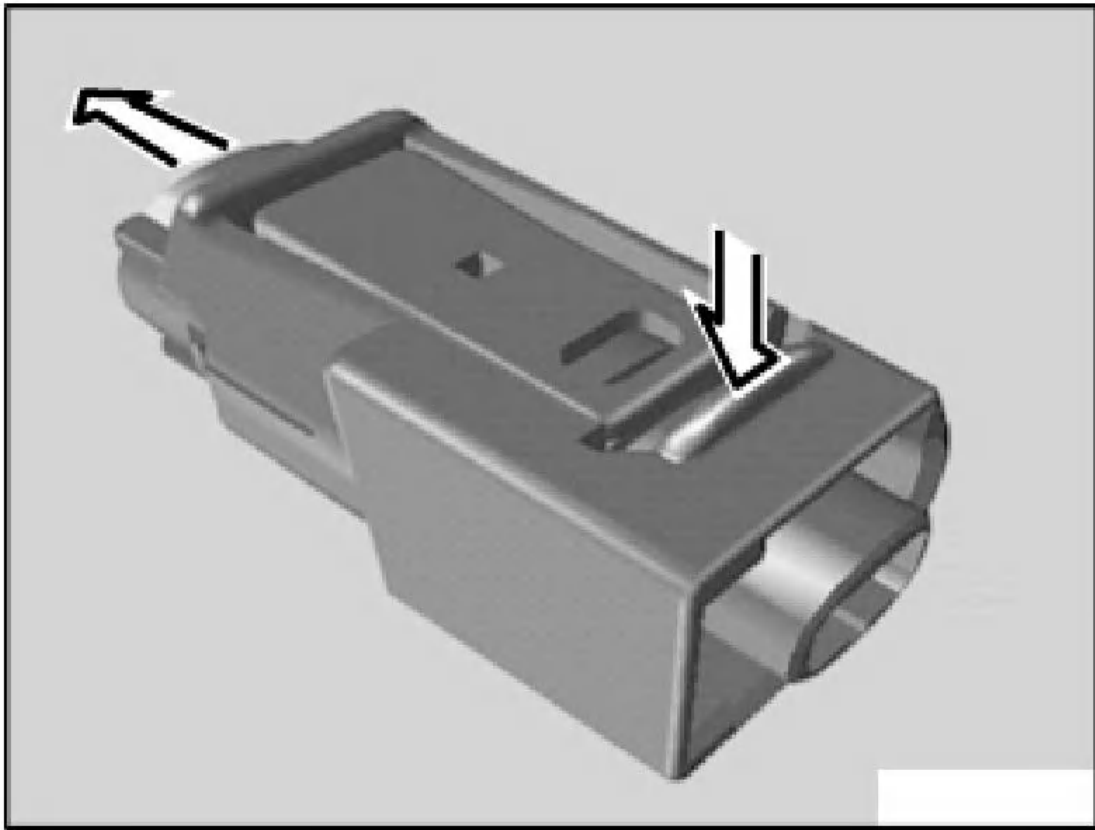


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[Fig. 4: Pressing Lock And Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock and disconnect plug connection in direction of arrow.

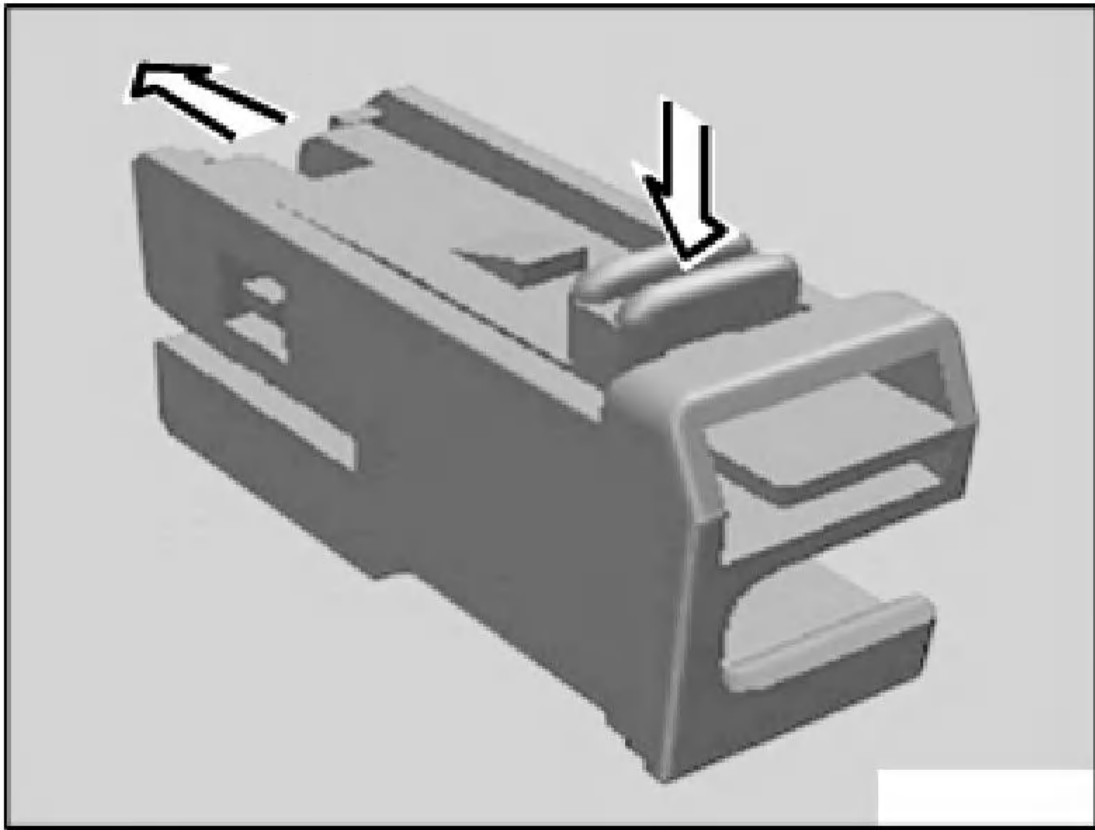


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[Fig. 5: Pressing Lock And Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock and disconnect plug connection in direction of arrow.

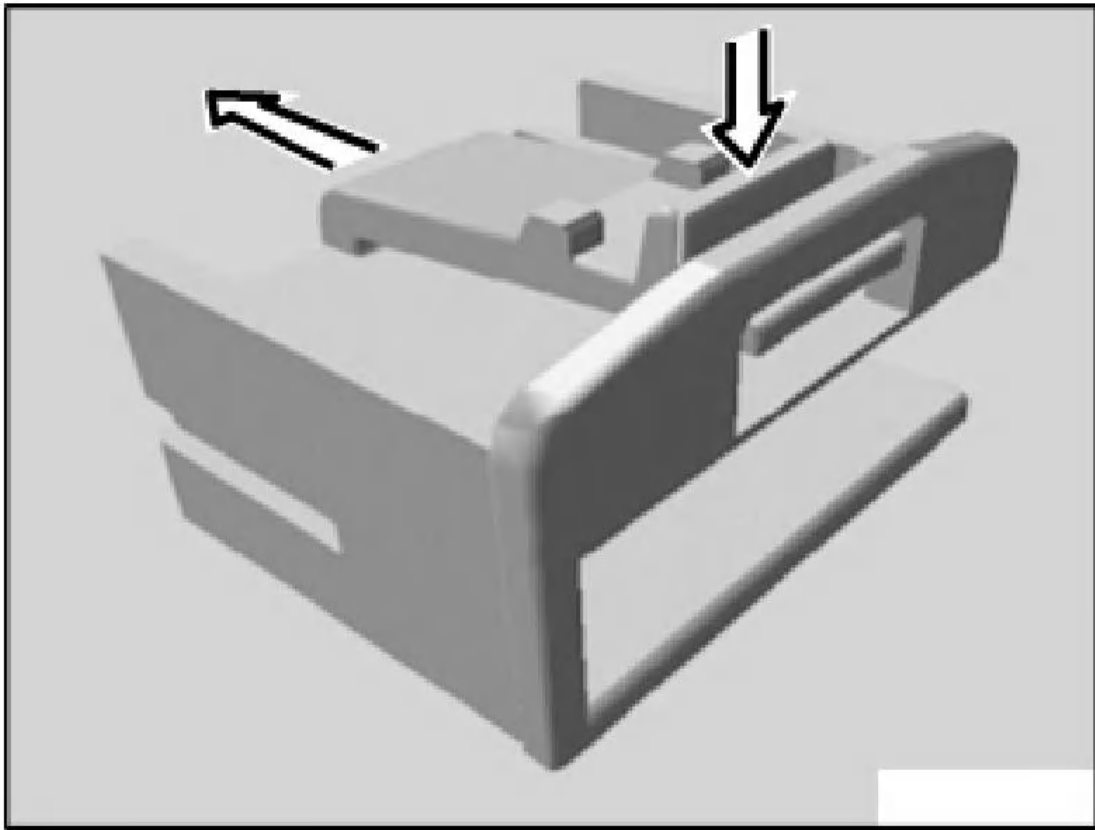


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[Fig. 6: Pressing Lock And Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock and disconnect plug connection in direction of arrow.

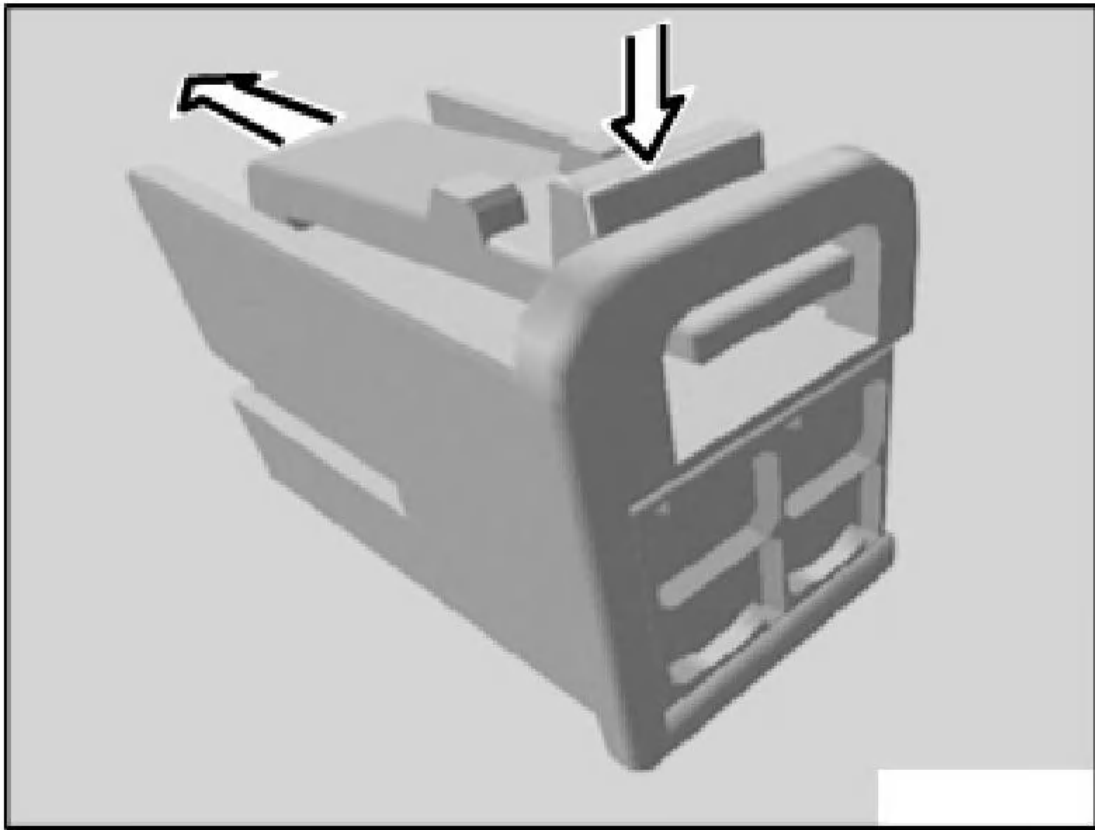


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[Fig. 7: Pressing Lock And Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock and disconnect plug connection in direction of arrow.

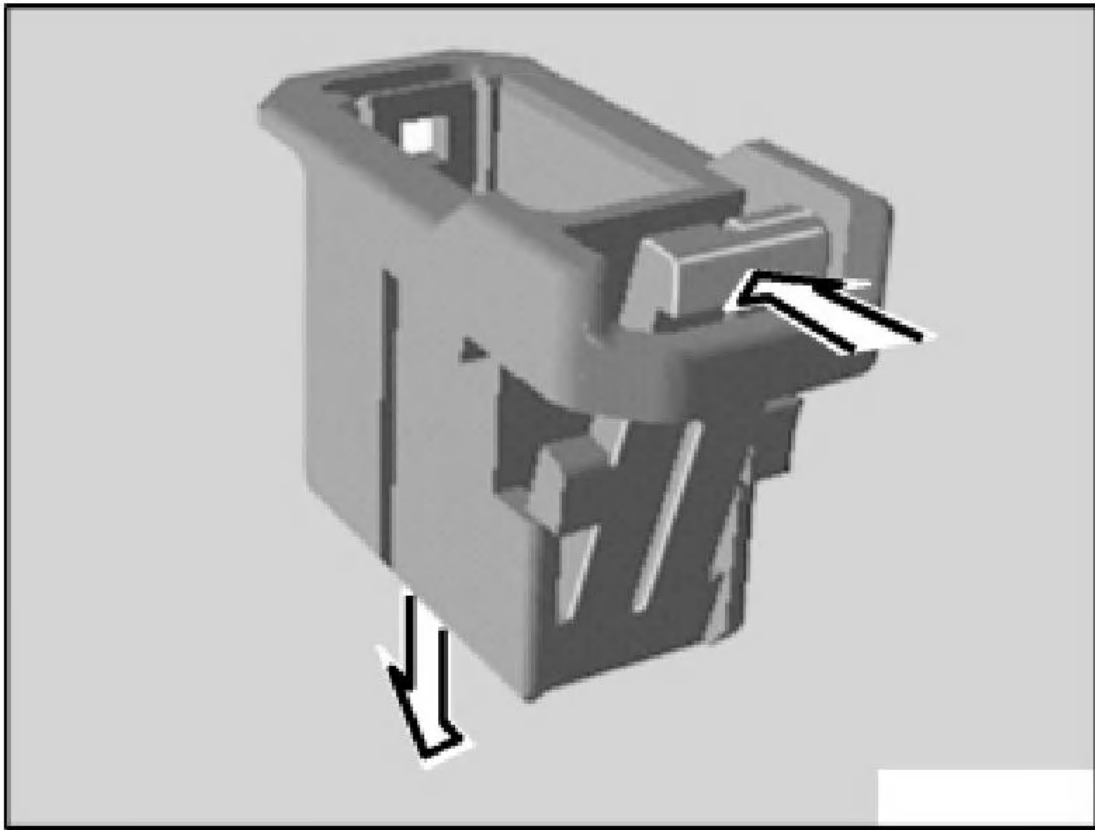


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[Fig. 8: Pressing Lock And Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock and disconnect plug connection in direction of arrow.

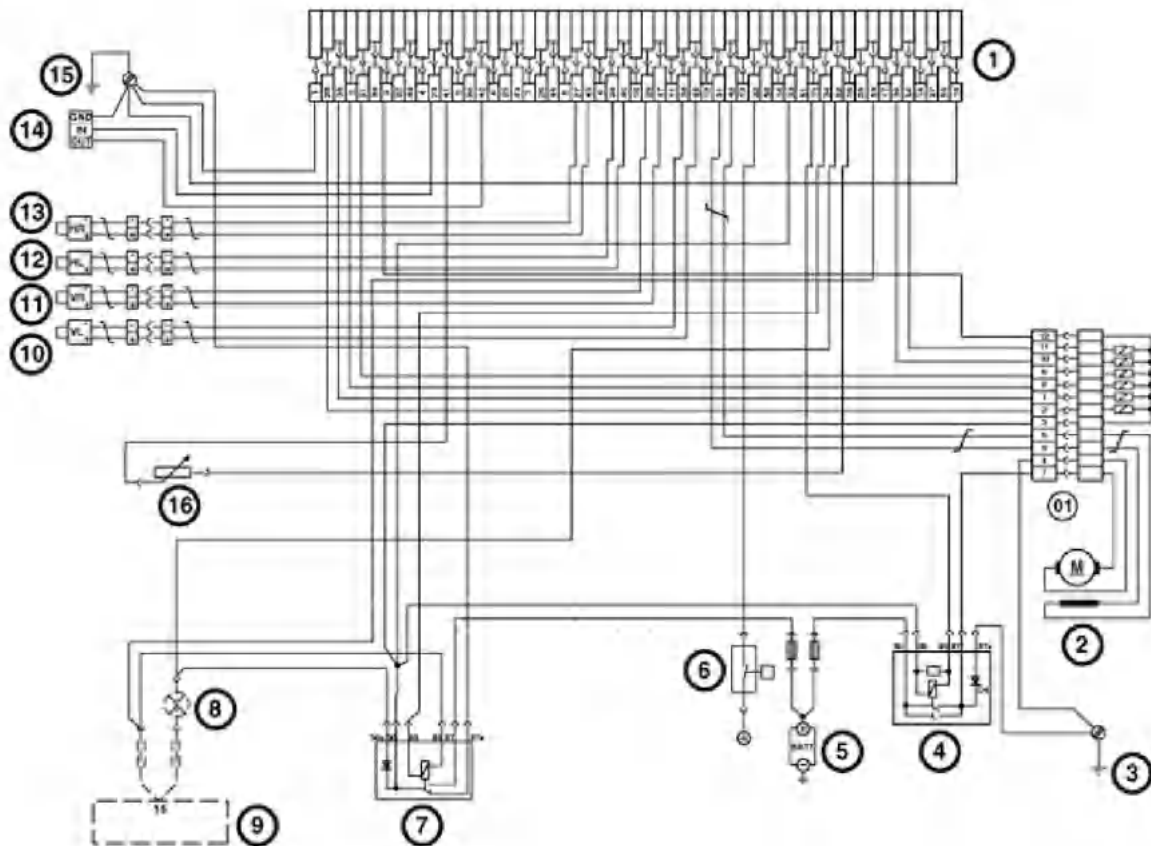


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Fig. 9: Pressing Lock And Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

AUXILIARY CABLE

61 12 ... ABS WIRING DIAGRAM



- 1 ABS control unit
- 2 Engine sensor
- 3 Earth
- 4 Pump relay
- 5 Battery
- 6 Brake-light switch
- 7 Master relay
- 8 ABS warning light

- 9 Ignition lock, terminal 15
- 10 Sensor, front left
- 11 Sensor, front right
- 12 Sensor, rear left
- 13 Sensor, rear right
- 14 Diagnosis connector
- 15 Earth
- 16 Travel sensor

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Fig. 10: Wiring Diagram - ABS

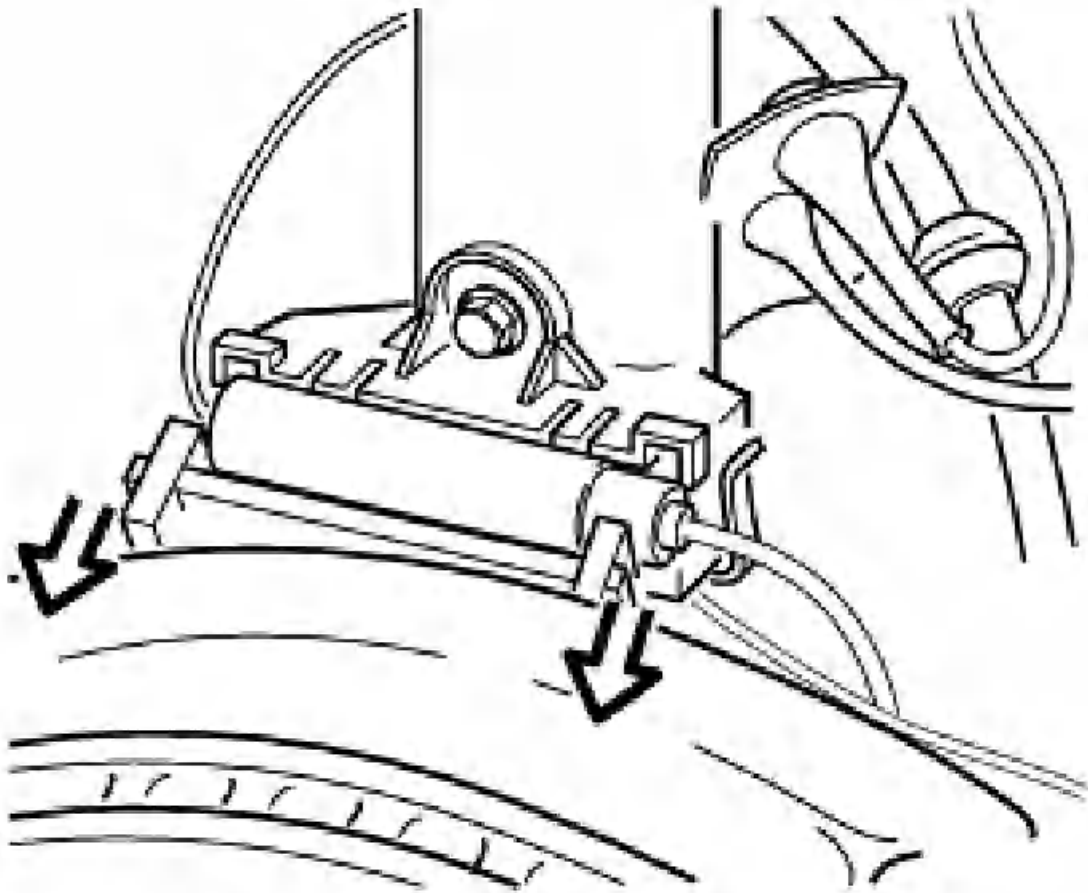
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: For troubleshooting pin assignment, refer to [INTRODUCTION](#) in Pin Voltage Charts.

61 12 515 REPLACING BOTH FRONT IMPULSE SENSORS FOR ABS

NOTE: Remove front wheel, refer to [36 10 300 REMOVING OR INSTALLING FRONT OR REAR WHEEL](#) .

Open protective box for ABS sensor.



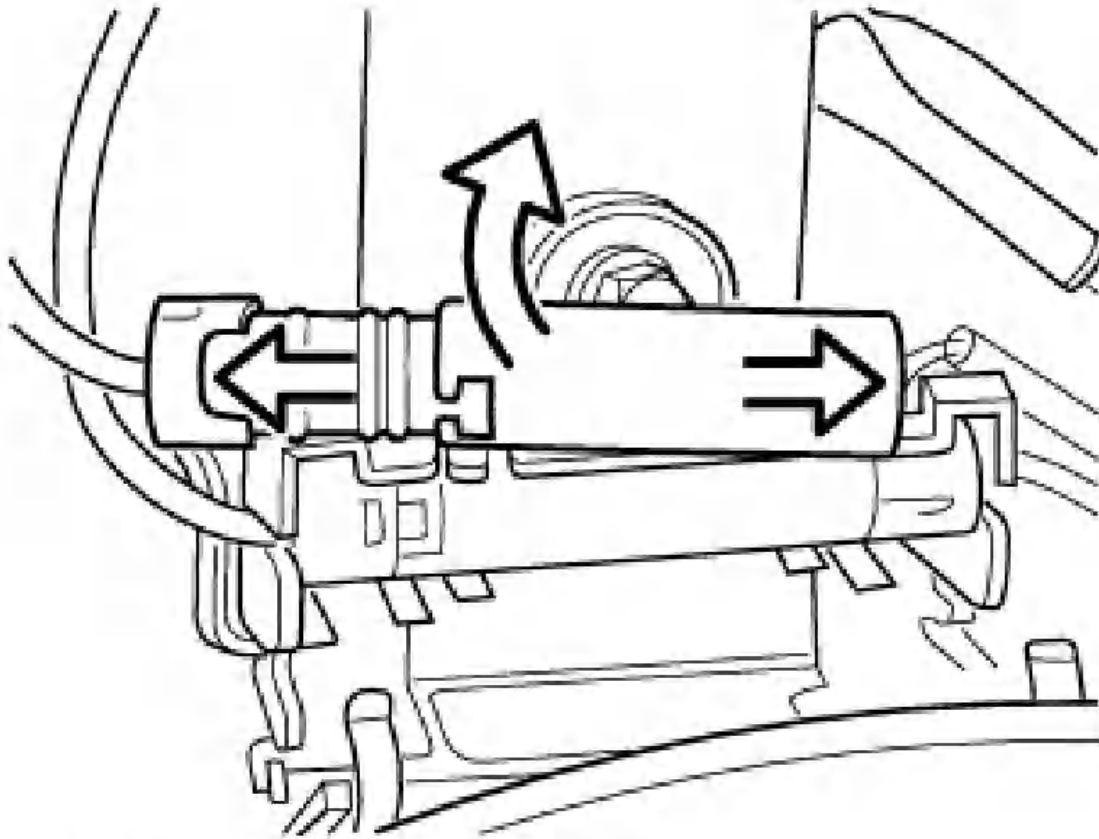
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[Fig. 11: Opening Protective Box For ABS Sensor](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Procedures for front-left sensor are analogous to those for front-right sensor.

Lift out plug-in connection.

Disconnect plug-in connection.



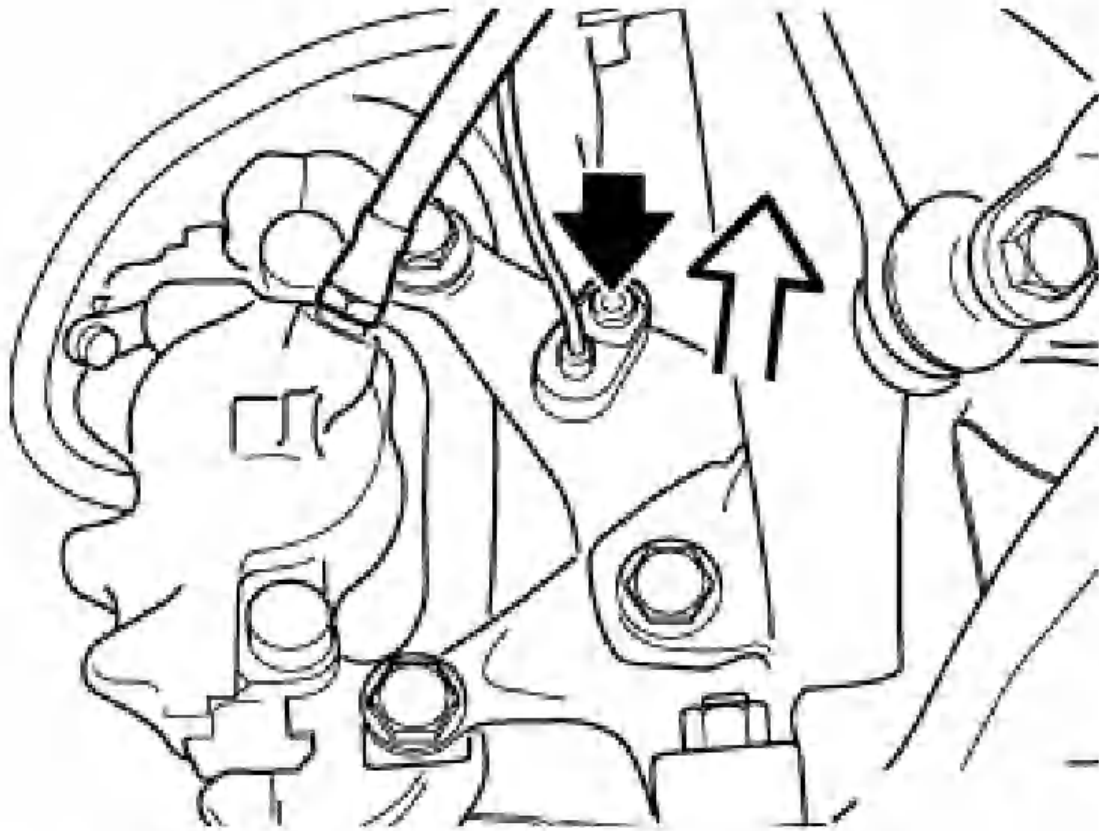
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[Fig. 12: Lifting Out Plug-In Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew hexagon screw.

Lift out sensor.



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Fig. 13: Lifting Out Sensor

Courtesy of BMW OF NORTH AMERICA, INC.

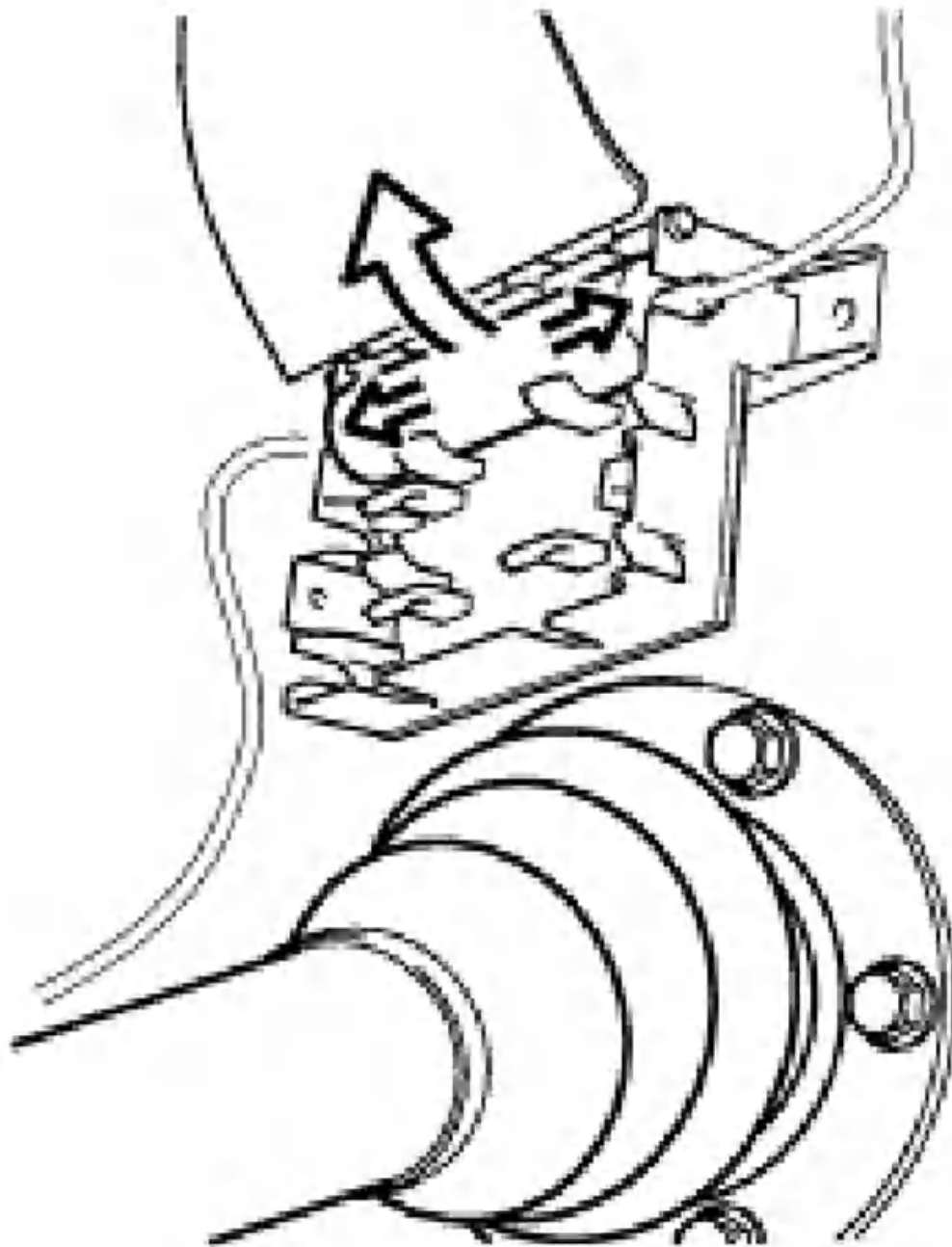
Installation:

Clean and lubricate dowel-pin bore with Staborax NBU 12/k.

61 12 525 REPLACING BOTH REAR IMPULSE SENSORS FOR ABS

NOTE: Remove rear wheel, refer to [36 10 300 REMOVING OR INSTALLING FRONT OR REAR WHEEL](#) .

Open protective box for ABS sensor.

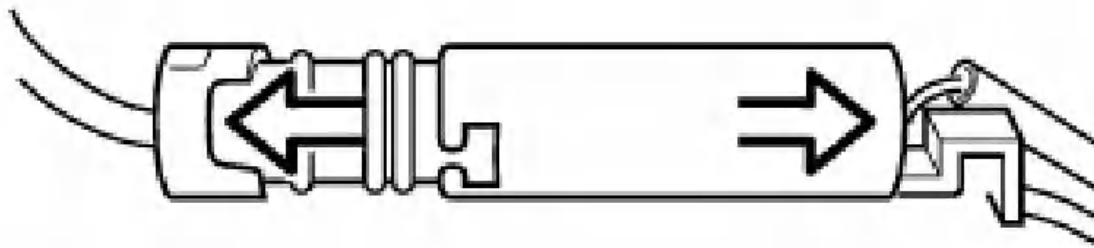


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[Fig. 14: Opening Protective Box For ABS Sensor](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Procedures for rear-left sensor are analogous to those for rear-right sensor.

Lift out plug-in connection.



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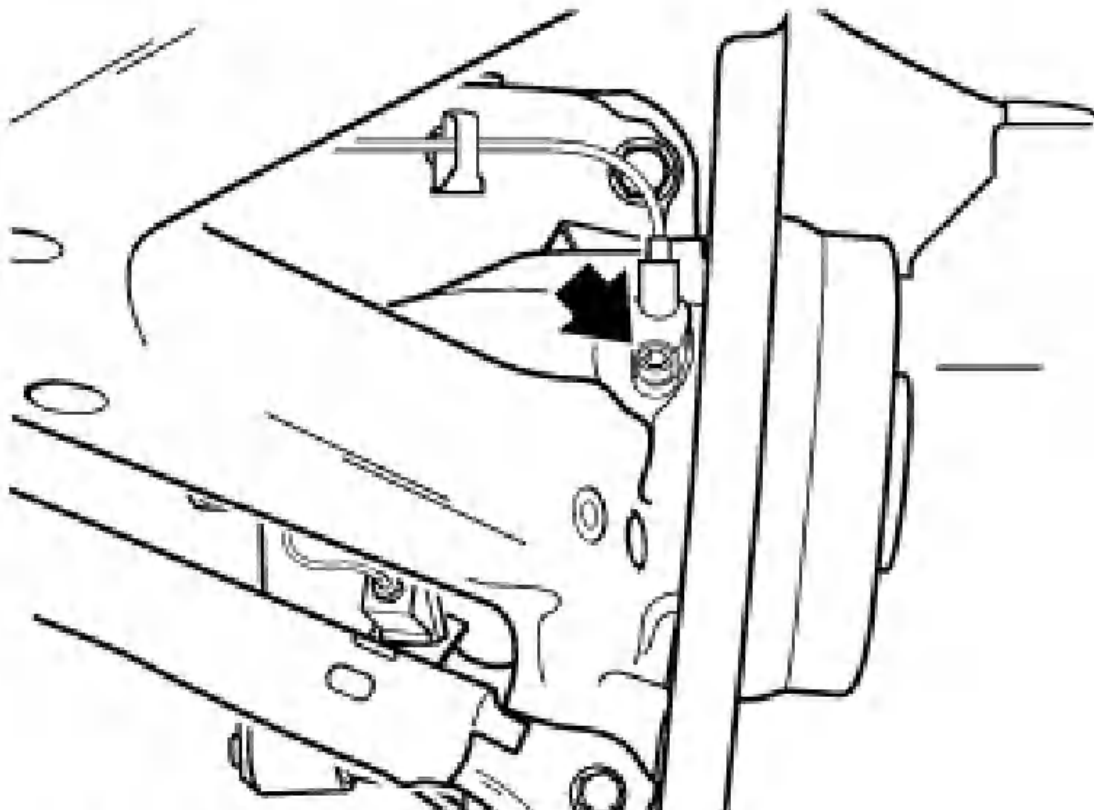
Fig. 15: Lifting Out Plug-In Connection

Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect connector.

Unscrew hexagon screw.

Lift out sensor.



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Fig. 16: Lifting Out Sensor

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean and lubricate dowel-pin bore with Staborax NBU 12/k, refer to BMW Parts Service.

61 13 .. UNLOCKING AND DISCONNECTING DIFFERENT PLUG CONNECTIONS

Refer to [61 13 .. UNLOCKING AND DISCONNECTING DIFFERENT PLUG CONNECTIONS](#) .

PLUG CONNECTION, TERMINAL

61 00 ... REPAIRING AIRBAG CABLES

Only repair those cables which show visible signs of damage. In the event of visible damage, **IMPORTANT:** make sure there is only one cable repair in effect after the repair work. If no visible damage can be identified, the entire cable must be replaced..

Safety Regulations:

Safety regulations for handling components of airbag system, refer to [AIR BAG SAFETY PRECAUTIONS](#) .

Instructions for disconnecting and connecting battery, refer to [12 00 ... DISCONNECTING AND CONNECTING BATTERY](#) .

Procedure For Cable Repair:

In Event Of Non-Visible Damage To Wiring Harness:

Disconnect plug connection on airbag module or on adapter plug. It is absolutely vital to disconnect the contacts in succession as there is a risk of them being mixed up! Cut through one cable after the other at an appropriate position, do not under any circumstances cut through both cables at the same time. Insulate cables remaining in wiring harness with insulating tape. Now disconnect plug connection on airbag control unit. Unpin contacts. Cut through one cable after the other at an appropriate position and insulate with insulating tape, do not under any circumstances cut through both cables at the same time. Pin contacts of repair cable for airbag control unit in control unit plug, assignment of repair cables is relevant. Lay repair cable in car parallel to existing airbag lead. Now pin in contacts for airbag control unit or contacts of adapter plug, assignment of repair cables is relevant. Cut off excess length of repair cable in proximity (visible area) of airbag module or of adapter plug. Twist open cables. With the connectors and shrink-fit hoses, reconnect the cables with the same cable colors. Twist cables again, open length (twist) must not exceed 40 mm. Secure interface (shrink-fit hoses) with insulating tape to prevent cables from twisting open.

Instructions for installing and removing contacts, refer to [61 13 ... OPENING PLUG HOUSINGS AND REMOVING CONTACTS OF DIFFERENT PLUG SYSTEMS](#) .

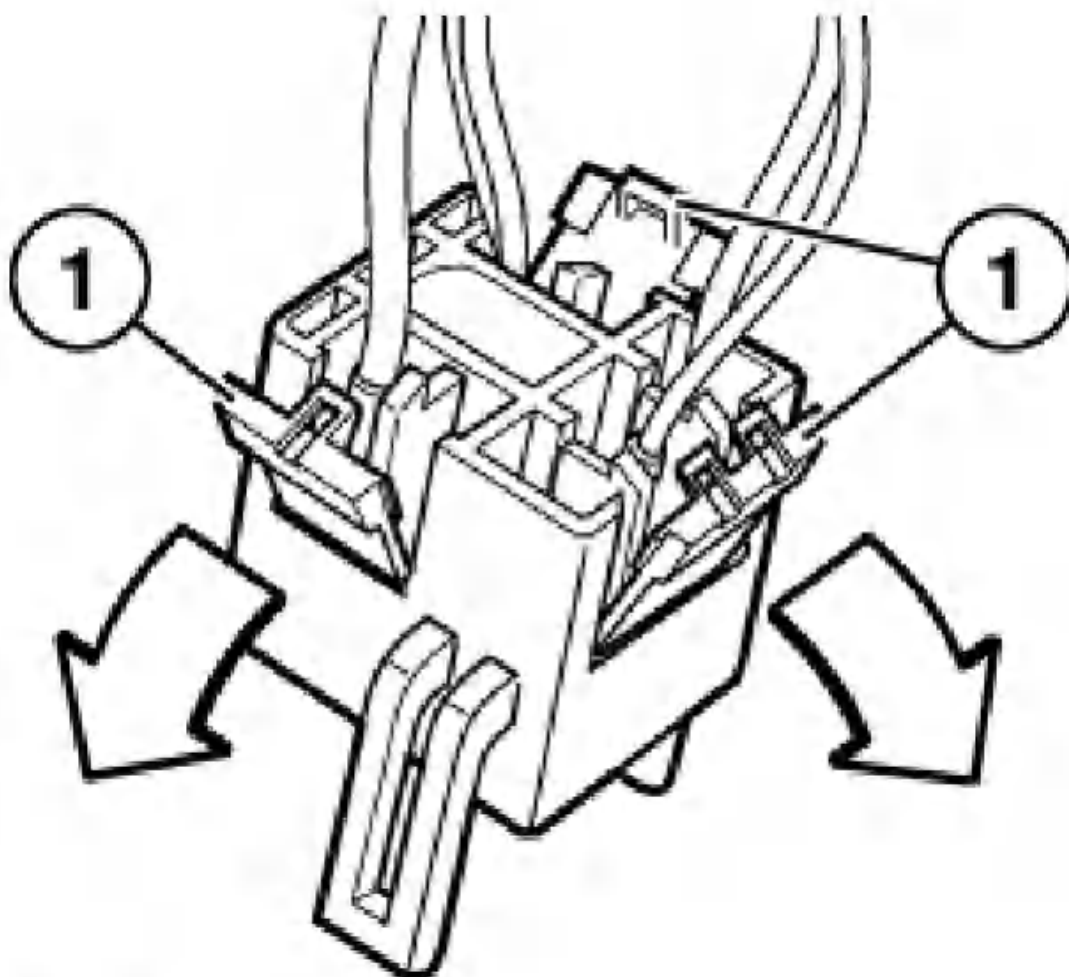
In Event Of Visible Damage:

Expose cable at damaged areas. Cut through one cable after the other at an appropriate position and insulate cables no longer required in wiring harness with insulating tape, do not under any circumstances cut through both cables at the same time. Now, depending on the scope of work, unpin contacts either on airbag control unit/airbag module or on adapter plug. Cut off unpin cables. Insulate cables remaining in wiring harness with insulating tape. Now pin in contacts of repair cable, assignment of repair cables is relevant. Lay repair lead in car parallel to existing airbag lead up to cutting point. Cut off excess length of repair lead. Twist open cables. Connect cables with connectors and shrink-fit hoses, assignment of repair cables is relevant. Twist cables again, open length (twist) must not exceed 40 mm. Secure interface (shrink-fit hoses) with insulating tape to prevent cables from twisting open.

Instructions for installing and removing contacts, refer to [61 13 ... OPENING PLUG HOUSINGS AND REMOVING CONTACTS OF DIFFERENT PLUG SYSTEMS](#) .

61 13 ... DME MASTER RELAY CONNECTOR

Unlock locking flap (1) of corresponding cable.



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[Fig. 17: Unlocking Locking Flap Of Corresponding Cable](#)

Courtesy of BMW OF NORTH AMERICA, INC.

With special tool 61 1 136 or 61 1 137 (ejector), press back arrester hook (2) of appropriate contact and pull out cable.

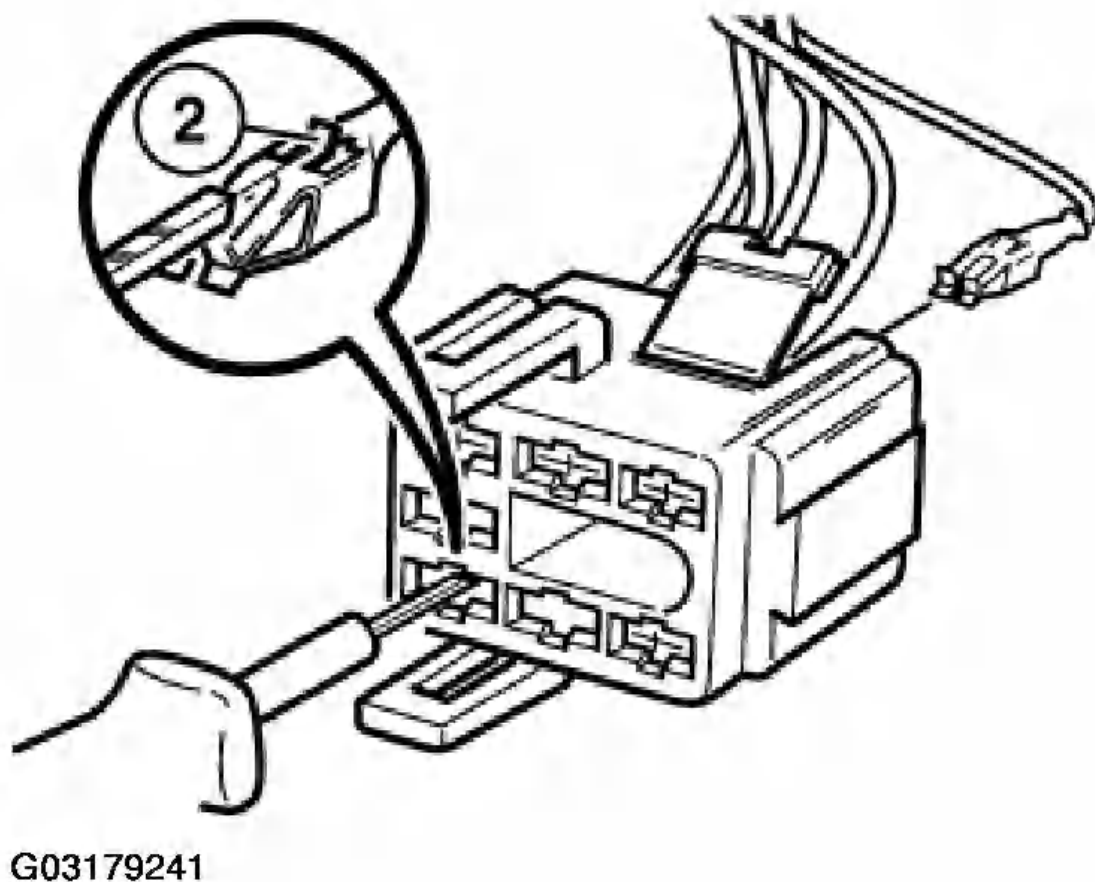


Fig. 18: Pressing Back Arrester Hook Of Appropriate Contact Using Special Tool
 Courtesy of BMW OF NORTH AMERICA, INC.

61 13 SPECIAL TOOLS FOR WIRING HARNESS REPAIRS

NOTE: For Special Tools identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 61 1 150
- 61 1 190
- 61 4 320
- 61 8 084
- 61 9 020
- 61 9 029
- 61 9 041
- 61 9 042
- 61 9 043
- 61 9 044

Repair ranges I, II, III for vehicle electrical system.

I. Order No.: 81 24 9 408 080.

II. Order No.: 81 24 9 408 300.



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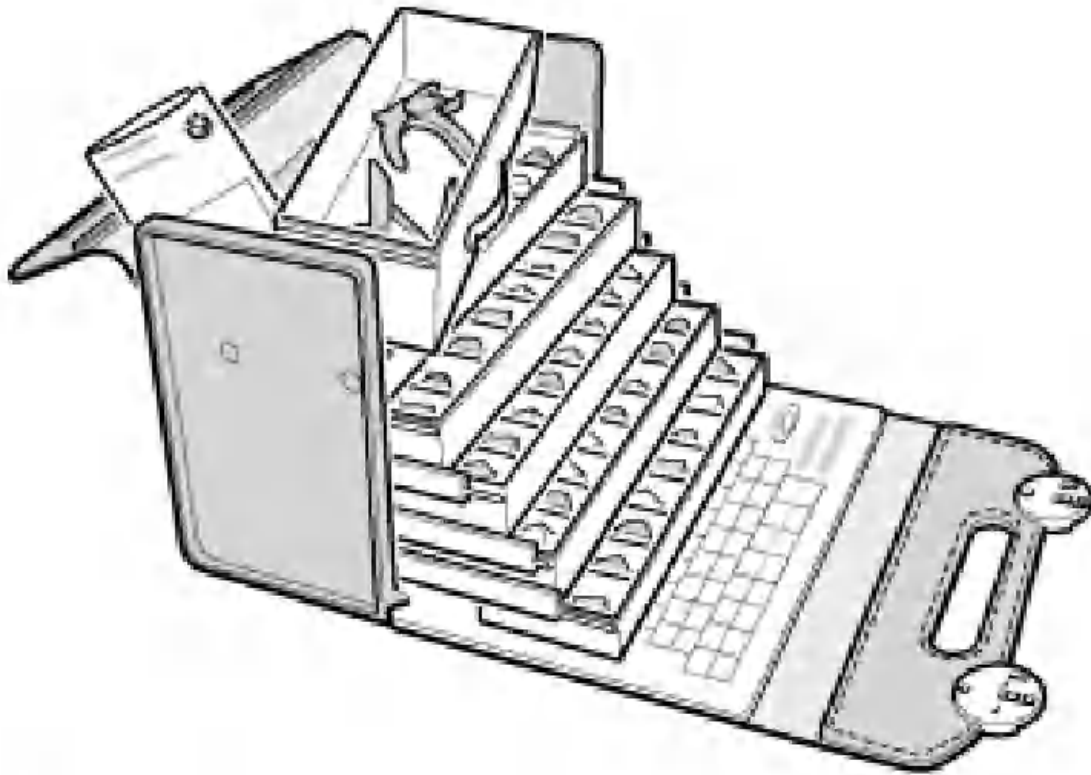
[Fig. 19: Identifying Wiring Harness Repairs Special Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Repair range IV for vehicle electrical system, special tool 61 9 020:

Contents:

- Special tool 61 9 041 (hand pliers).
- Special tool 61 9 042 (matrix).
- Special tool 61 9 043 (wire stripper).
- Special tool 61 9 044 (matrix).



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[Fig. 20: Identifying Wiring Harness Repairs Special Tool 61 9 020](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Special tool 61 9 043 (wire stripper with wire cutter) for cutting and stripping wires.



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Fig. 21: Identifying Wiring Harness Repairs Special Tool 61 9 043

Courtesy of BMW OF NORTH AMERICA, INC.

Handling:

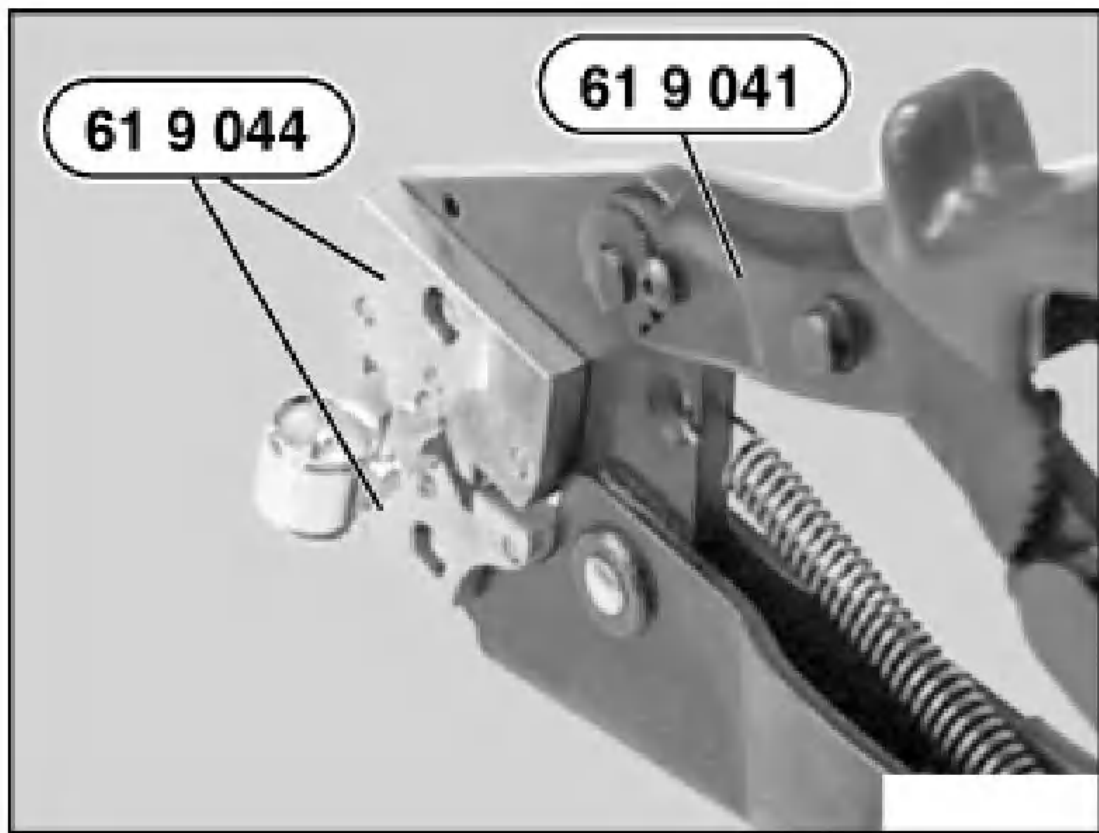
Cutting to length and stripping insulating from cables.

Special tool 61 9 041 (hand pliers) with special tool 61 9 042 (matrix) for crimping connectors and contact tubes for fan connectors up to a wire cross-section of 2.5 mm and for pushing on contact tubes for fan connectors.

Handling:

Crimping stop parts (contacts).

Fan connector for retrofitting/repairs.



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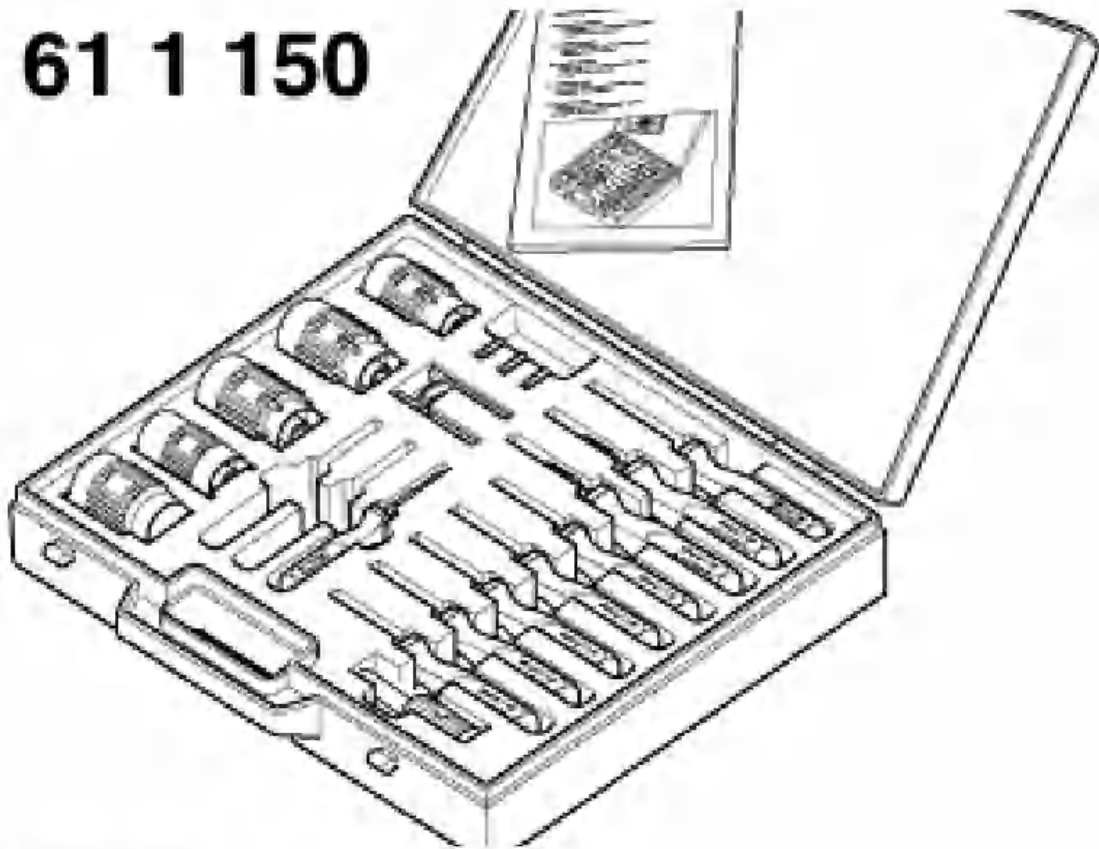
[Fig. 22: Identifying Wiring Harness Repairs Special Tool 61 9 041 & 61 9 044](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Special tool 61 1 150 (release and pressing-out tool) for:

- Releasing round plug housings.
- Releasing relay carriers.
- Pressing out contacts.
- Removing indicator lights.

61 1 150



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Fig. 23: Identifying Wiring Harness Repairs Special Tool 61 1 150

Courtesy of BMW OF NORTH AMERICA, INC.

Handling:

Opening plug housings and removing contacts of different plug systems, refer to 61 13 ... OPENING PLUG HOUSINGS AND REMOVING CONTACTS OF DIFFERENT PLUG SYSTEMS .



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[Fig. 24: Identifying Wiring Harness Repair Tool Kit](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Repair kit for ignition cables and for crimping fan connector receptacles 4 mm² .

Handling:

Crimping stop parts (contacts).

Special tool 61 4 320 (crimping set with pliers) for:

Crimping MPQ contacts, refer to [61 13 ... CRIMPING MICRO POWER QUADLOCK CONTACTS \(MPQ\)](#) .

Crimping MQS contacts, refer to [61 13 ... CRIMPING MICRO QUADLOCK SYSTEM CONTACTS \(MQS\)](#) .



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Fig. 25: Identifying Wiring Harness Repairs Special Tool 61 4 320

Courtesy of BMW OF NORTH AMERICA, INC.

61 13 .. UNLOCKING AND DISCONNECTING DIFFERENT PLUG CONNECTIONS

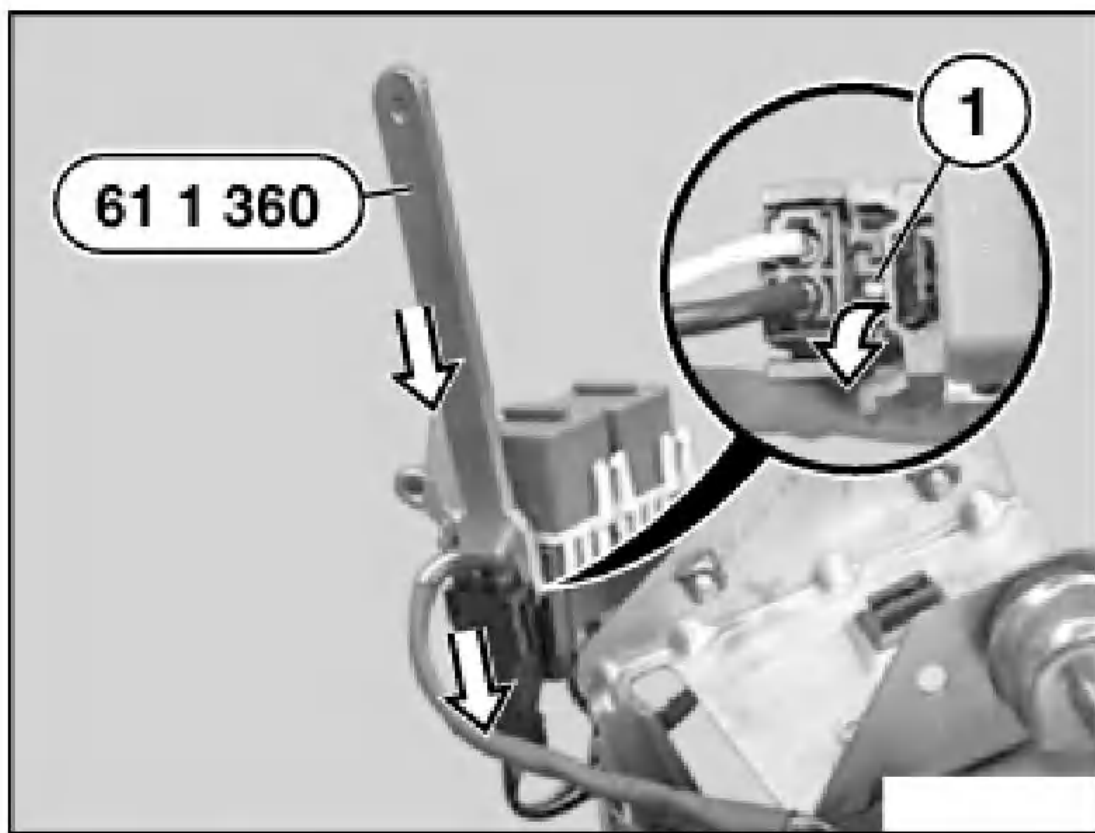
Refer to 61 13 .. UNLOCKING AND DISCONNECTING DIFFERENT PLUG CONNECTIONS .

61 13 ... ANTENNA ELBOW PLUG ON RADIO RECEIVER

This repair solution is only possible up to model year 10/ 2000. Replace entire antenna cable on
 IMPORTANT: affected vehicles. Refer to 65 21 020 REMOVING AND INSTALLING/REPLACING
 REAR ANTENNA (Z3 ROADSTER) .

61 13 ... BASE OF TAB CONNECTOR HOUSINGS

Unlock hook (1) with special tool 61 1 360 and slide plug housing downwards out of base.



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Fig. 26: Unlocking Hook With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

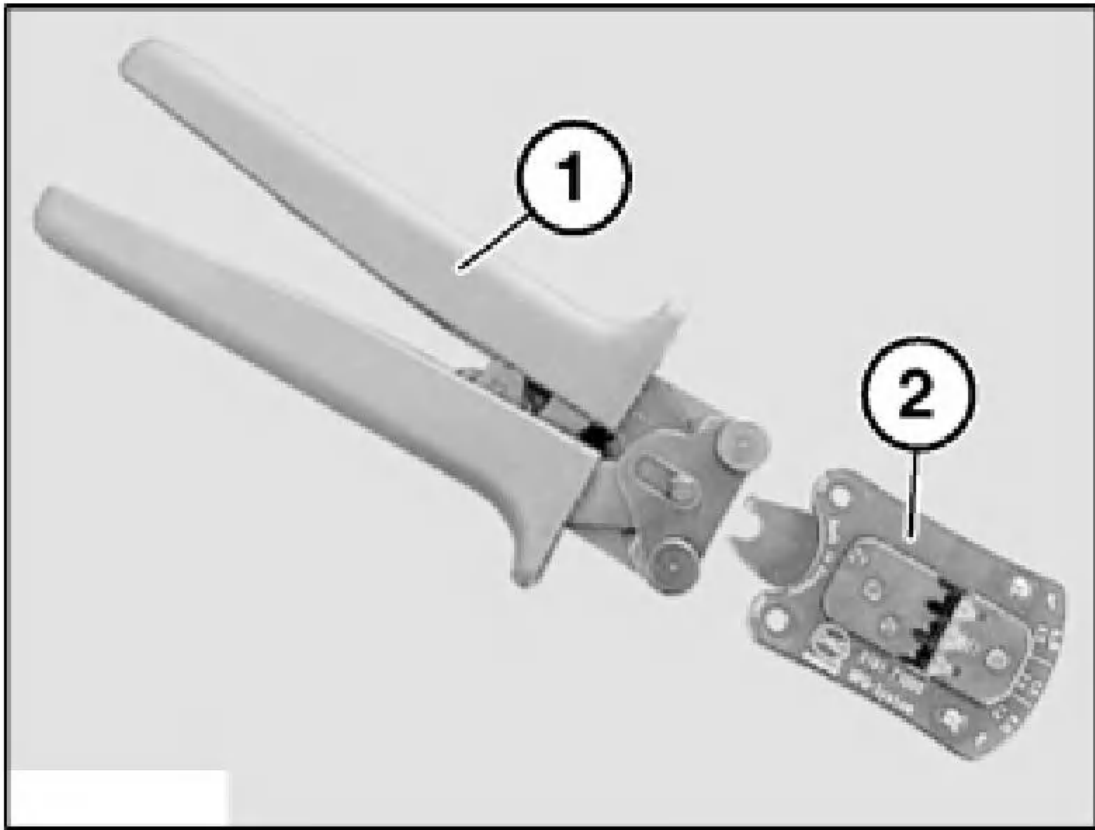
61 13 ... CRIMPING MICRO POWER QUADLOCK CONTACTS (MPQ)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 61 4 320

To crimp MPQ contacts, use pliers 61 4 321 (1) in conjunction with crimping head 61 4 325 (2) from crimping set 61 4 320.

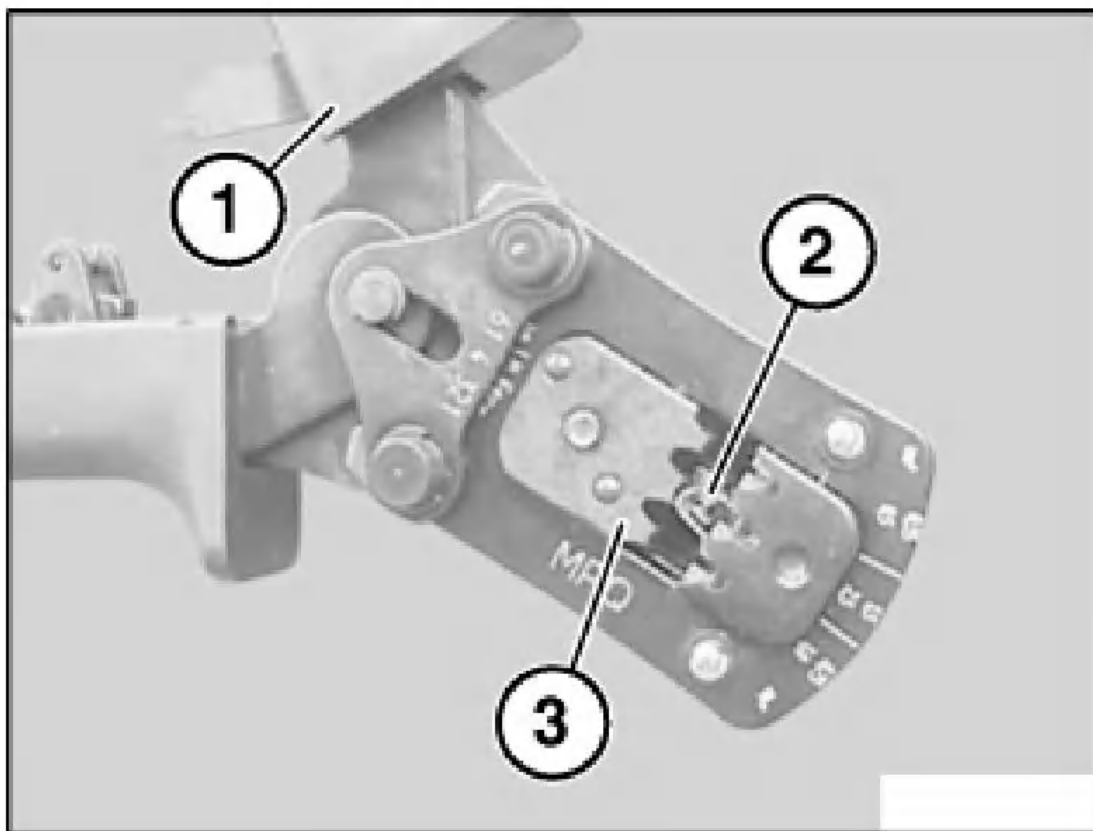


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[Fig. 27: Crimping MPQ Contacts Using Pliers](#)

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Pliers (1) open automatically as far as they will go when handles are pressed together.



G03179269

Fig. 28: Placing MPQ Contact In Crimping Head

Courtesy of BMW OF NORTH AMERICA, INC.

Open pliers (1).

NOTE: Place contact (2) with utmost care in designated nest (observe cable cross-section) in crimping head (3). Make sure it is exactly positioned.

Place MPQ contact (2) in crimping head (3).

Close pliers (1) one notch.

NOTE: Follow procedure for cutting and stripping insulation from cables.

Insert stripped cable (2).

Close pliers (1) fully.

Open pliers (1) and remove cable (2).

Fig. 29: Opening Pliers And Removing Cable

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Check contact for correct crimping.

61 13 ... CRIMPING MICRO QUADLOCK SYSTEM CONTACTS (MQS)

NOTE: For Special Tools identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 61 4 320

To crimp MQS contacts, use pliers 61 4 321 (1) in conjunction with crimping head 61 4 324 (2) from crimping set 61 4 320.

NOTE: Pliers (1) open automatically as far as they will go when handles are pressed together.

Fig. 30: Crimping MQS Contacts Using Pliers

Courtesy of BMW OF NORTH AMERICA, INC.

Open pliers (1).

Fold up contact carrier (2).

Insert MQS contact (3) in contact carrier (2).

Fold back contact carrier (2).

Fig. 31: Inserting MQS Contact In Contact Carrier

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Follow procedure for cutting and stripping insulation from cables.

Close pliers (1) one notch.

Insert stripped cable (2).

Close pliers (1) fully.

Fig. 32: Inserting Stripped Cable

Courtesy of BMW OF NORTH AMERICA, INC.

Open pliers (1).

Open contact carrier (2) gently and carefully remove MQS contact.

NOTE: Check contact for correct crimping.

Fig. 33: Opening Contact Carrier Gently And Removing MQS Contact

Courtesy of BMW OF NORTH AMERICA, INC.

61 13 ... CRIMPING ANNULAR CONTACTS

CrimpacII crimping pliers from repair kit 1 are used to crimp annular contacts.

Fig. 34: Identifying CrimpacII Crimping Pliers

Courtesy of BMW OF NORTH AMERICA, INC.

Open crimping pliers (1).

NOTE: Place contact (2) in designated nest (observe wire cross-section) with particular care. Make sure it is exactly positioned.

Insert annular contact (2) in crimping pliers (1).

Close crimping pliers (1) gently and keep closed.

Fig. 35: Placing Contact In Designated Nest With Particular Care

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Follow procedure for cutting and stripping insulation from cables.

Feed stripped cable (1) into annular contact (2) completely.

Fig. 36: Feeding Stripped Cable Into Annular Contact Completely

Courtesy of BMW OF NORTH AMERICA, INC.

Close crimping pliers (3) fully.

Open crimping pliers (3) and remove cable (2).

NOTE: Check contact for correct crimping.

61 13 ... OPENING PLUG HOUSINGS AND REMOVING CONTACTS OF DIFFERENT PLUG SYSTEMS

Abbreviations And What They Mean:

ABBREVIATIONS MEANING

MDK 3plus	Miniature double flat spring contact
JPT ELA	Junior Power Timer flat spring contacts with strand sealing.
DFK ELA	Double flat spring contacts with strand sealing.
Elo	Electronic contacts with and without strand sealing. Manufacturer: Siemens.
Elo Power	Electronic contacts for heavy loads with and without strand sealing. Manufacturer: Siemens.
MQS	Micro Quadlock System electronic contacts with and without strand sealing. Manufacturer: AMP.
MPQ	Micro Power Quadlock electronic contacts for heavy loads with and without strand sealing. Manufacturer: AMP.
D 1.5/2.5	Round contacts of 1.5 mm or 2.5 mm diameter.

Ultrasonic-Welded Connectors:

Ultrasonic-welded connectors (1) can be identified by the welds (2) on their longitudinal side.

The contacts of these connectors cannot be replaced. Replace plug completely.

Fig. 37: Identifying Ultrasonic-Welded Connectors

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Special tools referred to in the repair instructions below are contained in the following special tool kits:

Release and press-out tool 61 1 150.

61 13 ... RELAY CARRIER

Place special tool 61 1 153 on relay carrier (1) and carefully pull in direction of arrow until retaining lugs (2) on relay carrier are raised.

Fig. 38: Placing Special Tool On Relay Carrier

Courtesy of BMW OF NORTH AMERICA, INC.

Pull relay carrier (2) in direction of arrow into first catch (3).

Fig. 39: Pulling Relay Carrier

Courtesy of BMW OF NORTH AMERICA, INC.

Press down arrester hook (4) of appropriate contact and pull out cable with contact.

Press out double flat spring contact with special tool 61 1 136 or 61 1 137 (ejector).

Fig. 40: Pressing Out Double Flat Spring Contact With Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

61 13 ... RETAINING BRACKET

Pull relevant fuse out of fuse block (1).

NOTE: Mark positions when removing fuses.

Pull locking slide (2) out of fuse block (1) as far as it will go.

Fig. 41: Pulling Locking Slide Out Of Fuse Block

Courtesy of BMW OF NORTH AMERICA, INC.

With special tool 61 1 136 or 61 1 137 (ejector), press back arrester hook (3) of appropriate contact and pull out cable.

Fig. 42: Pressing Back Arrester Hook Using Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

61 13 ... SOCKET HOUSING (RADIO PLUG), HYBRID SYSTEM MQS/MPQ

Manufactured By AMP: The following contact types without strand sealing can be fitted in the plug housings:

MQS (Micro Quadlock System).

MPQ, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

Removing MPQ Contacts From Radio Plug:

Press lock (1) in direction of arrow.

Detach secondary lock (2) from radio plug.

[Fig. 43: Detaching Secondary Lock From Radio Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Feed special tool 61 1 135 past side of contact.

Press special tool 61 1 135 in direction of arrow.

Pull wire (1) with socket contact out of radio plug (2).

[Fig. 44: Pulling Wire With Socket Contact Out Of Radio Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Removing MQS Contacts From Contact Carrier:

Press lock (1) in direction of arrow and pull housing (2) out of radio plug.

[Fig. 45: Pressing Lock And Pull Housing Out Of Radio Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock (1) in direction of arrow. Pull contact carrier (2) out of housing (3).

NOTE: When the contact carrier is pulled out, the secondary locks of the socket contacts are raised.

[Fig. 46: Pulling Contact Carrier Out Of Housing](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Hold down retaining hook (1) of socket contact in opening of contact carrier with a small screwdriver.

Pull wire with socket contact in direction of arrow as far as secondary lock (2).

NOTE: The illustration shows an 8-pin socket housing where removal of the contacts is identical.

[Fig. 47: Holding Down Retaining Hook Of Socket Contact In Opening Of Contact Carrier With Screwdriver](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Hold down arrester hook in secondary lock (1) again. Pull wire with socket contact (2) out of contact carrier (3).

[Fig. 48: Holding Down Arrester Hook In Secondary Lock](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Removing MPQ Contacts From Contact Carrier:

Remove contact carrier (1) with MQS contacts from radio plug.

Raise lock (2) on radio plug.

Pull contact carrier (3) out of radio plug.

[Fig. 49: Pulling Contact Carrier Out Of Radio Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press lock (1) in direction of arrow.

Pull secondary lock (2) in direction of arrow completely out of contact carrier (3).

[Fig. 50: Pulling Secondary Lock](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press special tool 61 1 135 on inside of contact into contact carrier (2).

Pull wire with socket contact (1) out of contact carrier (2).

[Fig. 51: Pulling Wire With Socket Contact Out Of Contact Carrier](#)

Courtesy of BMW OF NORTH AMERICA, INC.

BATTERY

12 00 ... EXTERNAL JUMP-STARTING AID

Refer to [12 00 ... EXTERNAL JUMP-STARTING AID](#) .

12 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!

Refer to [12 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!](#) .

12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY

Observe safety instructions for handling vehicle battery. Refer to [61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY](#) .

Before Disconnecting Battery:

Switch off ignition.

NOTE: If the ignition is not turned off when the battery is disconnected, fault memories may be set in some control units.

Important!

- There is a danger of mixing up battery leads: If the battery positive and negative leads are the same color and you are in doubt, follow the polarity to the battery, then mark and cover the leads.
- On vehicles with radio code: After disconnecting the battery, the radio code must be re-entered. Therefore obtain the radio code card from the customer beforehand. Note stored stations and restore them after connecting the battery.
- Stored settings of the on-board computer and clock will also be lost.
- All available central keys must be recoded for cars with first generation infrared transmitter locking systems.

General Notes On Disconnecting Battery:

- Do not disconnect battery leads and leads from alternator and starter motor while engine is running.

- Cars with IBS on battery negative terminal:

Do not under any circumstances pull/lever off pole shoes by force.

Do not under any circumstances release socket-head cap screw of IBS.

- Detach terminal of battery negative lead from car battery and second battery if fitted. Cover battery negative terminal(s) and secure.
- When work is carried out on the electrical system, faults may be caused in the fault memories of some control units when the battery is connected.
- When fitting terminal for battery negative lead: Tightening torque, 61 21 1AZ. Refer to [61 21](#) **BATTERY WITH TERMINAL** .

Vehicles With A Two-Battery System:

Starter And Equipment Batteries:

A two-battery system has a starter battery circuit and an equipment battery circuit. A secondary control unit monitors both battery circuits. Depending on the situation, the battery circuits are connected to or isolated from the secondary control unit via an isolating relay.

Two AGM batteries are used as a storage battery.

Important!

These batteries must not under any circumstances be charged with a voltage in excess of 14.8 V. Rapid programs must not be used either.

Receiving/Giving Starting Assistance Via Jump Start Terminal:

The engine can be jump-started with an external voltage supply via the jump start terminal on the right side of the engine compartment.

NOTE: The starter battery is isolated from the alternators when the engine hood/bonnet is open.

Giving starting assistance via the jump start terminal is thus limited by the capacity of the starter battery when the engine hood/bonnet is open.

Charging Starter And Equipment Batteries Via Jump Start Terminal:

The starter battery is charged as a matter of priority with a charger connected to the jump start terminal. The voltage at the starter battery is the decisive factor in determining whether the equipment battery is also included in the charging operation. The secondary control unit automatically detects a charging operation at a charging voltage at the starter battery of ≥ 13.5 V. The isolating relay is closed and thus the equipment battery is connected in parallel. Both batteries are now charged.

Prerequisite:

- Terminal 61 inactive.
- Terminal 15 inactive.

If terminal 15 becomes "active" during the charging operation, the isolating relay is opened immediately and again only the starter battery is charged.

NOTE: When the engine hood is open, the isolating relay is also opened in normal operation when the engine is running. A special mode can be set by means of diagnosis for workshop/garage operation. The isolating relay is closed from

terminal R in this operating mode. This mode is automatically reset once a distance of 5 km has been driven.

Trickle Charging:

Increased closed-circuit current consumption can be compensated with the aid of the battery trickle charger (special tool 61 2 410) via the jump start terminal.

Important!

The cigarette lighter is isolated from the electrical system after terminal R "OFF" on a timed basis (60 mins.), thereby interrupting charging of the equipment battery via the cigarette lighter. This is prevented if the battery master switch (on the right side of the luggage compartment behind the panel) is turned on and off again twice within 2 seconds. (Cigarette light battery charging function).

12 00 ... INSTRUCTIONS ON STARTING AID

Refer to [12 00 ... INSTRUCTIONS ON STARTING AID](#) .

61 00 ... BATTERY

Refer to [61 00 ... BATTERY](#) .

61 00 ... BATTERY CARE AND MAINTENANCE

Refer to [61 00 ... BATTERY CARE AND MAINTENANCE](#) .

61 00 ... BATTERY CHARGING

Refer to [61 00 ... BATTERY CHARGING](#) .

61 00 ... EXTERNAL JUMP-STARTING AID

Refer to [61 00 ... EXTERNAL JUMP-STARTING AID](#) .

61 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!

Refer to [61 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!](#) .

61 00 ... IMPORTANT WITH CONNECTED BATTERY!

Refer to [61 00 ... IMPORTANT WITH CONNECTED BATTERY!](#) .

61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY

Refer to [61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY](#) .

61 20 ... THRESHOLD VALUES FOR BATTERY INSPECTION OF ALL BATTERY (TELEPHONE EXCEPT FOR (TELEPHONE BATTERY)

Safety instructions for handling vehicle battery, refer to [61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY](#) .

Test Step 1 - Before Charging The Battery:

BATTERY REFERENCE (BEFORE CHARGING)

Charge State ¹⁾	Starting Capability ^{<2)}	Test Result
Not testable.	-	Charge.
Less than 50 % ²⁾ .	-	Charge.

More than 50 %.	Less than 75 %.	Charge.
More than 50 %.	More than 75 % ³⁾ .	Charge.
More than 80 %.	More than 75 %.	O.K.

Test Step 2 - After Charging The Battery:

BATTERY REFERENCE (AFTER CHARGING)

Charge Condition ¹⁾	Starting Capability ²⁾	Test Result
Not testable.	-	Defective.
Less than 50 %.	Less than 75 %.	Charge.
More than 50 %.	More than 75 %.	Charge.

1. Charge condition and starting power must always be evaluated together.
2. When test charging for more than 5 hours, use charger Gossen CG 32 or Siemens/Gossen VB 801.
3. Fully charge until charge state is more than 80 %.

NOTE: If battery was checked on the positive terminal in the engine compartment, repeat check directly on battery for sake of safety.

61 20 ... BATTERY OPEN-CIRCUIT CURRENT TEST

NOTE: Observe safety instructions for handling vehicle battery, refer to [61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY](#) .

Fig. 52: Identifying Diagnosis And Information System

Courtesy of BMW OF NORTH AMERICA, INC.

The open-circuit current test is performed using the Diagnosis and Information System (DIS).

61 21 030 CHARGING BATTERY

NOTE: Only chargers with the following properties are suitable for charging a battery in vehicle with connected electrical system:

1. Current limitation.
2. Exponential drop of charge current when 14.2 V is reached.

Always use the B+ terminal in the engine compartment.

U/I Charge Curve Shows:

Charging with maximum current up to gassing limit voltage of 14.2 V. The charging process in the range of approx. 13.2 V - 14.2 V can take up a relative long period of time because charging is conducted with very low currents in this limit range. The battery is full charged with a charge current of < 5A.

Fig. 53: Identifying U/I Charge Curve

Courtesy of BMW OF NORTH AMERICA, INC.

Battery chargers without these properties can lead to vehicle damage (lights).

NOTE: Remove battery from vehicle when using unregulated chargers.

BATTERY/VAPOR SEPARAT...

61 21 030 CHARGING BATTERY

Refer to [61 21 030 CHARGING BATTERY](#) .

SWITCH

61 31 . . . REPLACING ALL SWITCHES AND INDICATOR LAMPS IN CENTER CONSOLE (Z3 ROADSTER, Z3 COUPE)

Unclip shift-lever cover.

Remove insulation sheet.

Carefully press hazard warning light switch or window regulator switch downwards to remove from trim.

Disconnect connector.

Fig. 54: Unclipping Shift-Lever Cover

Courtesy of BMW OF NORTH AMERICA, INC.

Remove radio finisher or, if necessary, radio. Refer to [65 11 030 RADIO \(BAVARIA C II OR C REVERSE II\)](#) or [65 11 030 REMOVING AND INSTALLING OR REPLACING RADIO \(BAVARIA C III OR C REVERSE III RDS\)](#) or [65 11 030 REMOVING AND INSTALLING/REPLACING RADIO \(BUSINESS\)](#) .

Fig. 55: Removing Radio Finisher

Courtesy of BMW OF NORTH AMERICA, INC.

Push A/C switch or indicator lamp forwards through radio aperture to unclip and remove connector.

61 31 016 REMOVING AND INSTALLING / REPLACING DIP SWITCH FOR DIRECTION OF TRAVEL

Turn steering wheel to straight-ahead position.

Remove steering wheel, refer to [STEERING WHEEL](#) .

Remove instrument paneling at bottom left.

Fig. 56: Removing Instrument Paneling At Bottom Left

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.

Fig. 57: Unscrewing Bottom Trim Panel Screw (Bottom)

Courtesy of BMW OF NORTH AMERICA, INC.

Pull bottom trim panel to the side out of the clips.

Fig. 58: Pulling Bottom Trim Panel To Side Out Of Clips

Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw and take off lower section of steering-column paneling.

[Fig. 59: Removing Screw And Taking Off Lower Section Of Steering-Column Panelling](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw for holder of steering-column stalk.

[Fig. 60: Removing Screw For Holder Of Steering-Column Stalk](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Lever off holder in downwards direction using a screwdriver.

[Fig. 61: Levering Off Holder In Downwards Direction Using Screwdriver](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Compress retainers on both sides and pull out lever.

[Fig. 62: Compressing Retainers On Both Sides And Pulling Out Lever](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Loosen cable straps on steering column.

Disconnect plug connection.

[Fig. 63: Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Do not damage self-cancelling cam of turn-indicator lever.

Move turn-indicator lever to middle position, then install.

61 31 018 REMOVING AND INSTALLING/REPLACING CRUISE CONTROL SWITCH

Unscrew screw.

[Fig. 64: Unscrewing Bottom Trim Panel Screw \(Front\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.

[Fig. 65: Unscrewing Bottom Trim Panel Screw \(Bottom\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Pull bottom trim panel to the side out of the clips.

[Fig. 66: Pulling Bottom Trim Panel To Side Out Of Clips](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw and take off lower section of steering-column panelling.

[Fig. 67: Removing Screw And Taking Off Lower Section Of Steering-Column Panelling](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Compress retainers and pull out switch.

Disconnect plug connection.

[Fig. 68: Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 31 020 REMOVING AND INSTALLING/REPLACING IGNITION STARTER SWITCH

Unscrew screw.

[Fig. 69: Unscrewing Bottom Trim Panel Screw \(Front\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.

[Fig. 70: Unscrewing Bottom Trim Panel Screw \(Bottom\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Pull bottom trim panel to the side out of the clips.

[Fig. 71: Pulling Bottom Trim Panel To Side Out Of Clips](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw and take off lower section of steering-column panelling.

[Fig. 72: Removing Screw And Taking Off Lower Section Of Steering-Column Panelling](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew headless screws on both sides, pull out switch.

Disconnect plug connection.

[Fig. 73: Disconnecting Plug Connection](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check position of ignition-start switch in relation to steering-wheel lock.

Check position of turn-indicator lever in relation to steering wheel.

Secure headless screws with varnish.

CAUTION: After installation, carry out mechanical test (lock cylinder) and electric operational check (e.g ignition, radio, etc.)

61 31 028 REPLACING LIGHT SWITCH (Z3 ROADSTER, Z3 COUPE)

Unclip button cover.

[Fig. 74: Unclipping Button Cover](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten lock nut and twist button to remove.

[Fig. 75: Unfastening Lock Nut And Twisting Button To Remove](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press together retaining clips with special tool 61 3 100 and slide backwards to remove.

[Fig. 76: Pressing Together Retaining Clips With Special Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Pull off connectors.

[Fig. 77: Pulling Off Connectors](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 31 040 REPLACING WINDSHIELD WIPER SWITCH

Turn steering wheel to straight-ahead position.

Remove steering wheel, refer to [STEERING WHEEL](#) .

Remove instrument panelling at bottom left.

[Fig. 78: Removing Instrument Panelling At Bottom Left](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew bolts.

[Fig. 79: Unscrewing Bolts](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Pull bottom trim panel to the side out of the clips.

[Fig. 80: Pulling Bottom Trim Panel To Side Out Of Clips](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw and take off lower section of steering-column panelling.

[Fig. 81: Removing Screw And Taking Off Lower Section Of Steering-Column Panelling](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw for holder of steering-column stalk.

[Fig. 82: Remove Screw For Holder Of Steering-Column Stalk](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Lever off holder in downwards direction using a screwdriver.

[Fig. 83: Levering Off Holder In Downwards Direction Using Screwdriver](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Compress retainers on both sides and pull out lever.

[Fig. 84: Compressing Retainers On Both Sides And Pulling Out Lever](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Loosen cable straps on steering column.

Disconnect connector.

[Fig. 85: Disconnecting Connector](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Be careful not to damage self-cancelling cams of turn-indicator lever. Turn turn-indicator lever to middle position before mounting.

61 31 295 REPLACING CLUTCH SWITCH FOR CRUISE CONTROL SYSTEM

Remove trim panel for pedal assembly.

Press clutch pedal with pedal support down to flow and lock in position.

Disconnect plug connection (1).

Withdraw sleeve (3) in direction of arrow up to stop.

Press both retaining clips together at front end and pull out switch (2) in direction of arrow towards rear.

[Fig. 86: Pulling Out Switch](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Slowly move clutch pedal to initial position.

61 31 300 REPLACING BRAKE-LIGHT-TEST SWITCH

Brake-light-test switch is in same housing as brake-light switch.

For removal and adjustment, refer to [61 31 310 REPLACING BRAKE-LIGHT SWITCH](#) .

Can be recognized on 4-pin connector.

[Fig. 87: Replacing Brake-Light-Test Switch](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 31 310 REPLACING BRAKE-LIGHT SWITCH

Removing instrument panelling at bottom left, refer to [61 31 016 REMOVING AND INSTALLING / REPLACING DIP SWITCH FOR DIRECTION OF TRAVEL](#)

Disconnect connector.

[Fig. 88: Disconnecting Connector](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Depress brake pedal as far as possible.

1. Pull tappet and sleeve forward completely.
2. Press together clips and pull back switch.

Fig. 89: Depressing Brake Pedal

Courtesy of BMW OF NORTH AMERICA, INC.

Installation Note:

Adjustment is made automatically after installation.

Slowly release pedal to neutral position.

Tie back lead with cable clip (1).

Fig. 90: Tie Back Lead With Cable Clip

Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Adjustment of the switch can be changed if brake pedal springs back.

Check function.

Connector assignment for brake-light switch and brake-light-test switch:

1 and 2 brake light switches.

3 and 4 brake light test switches.

Fig. 91: Identifying Connector Assignment For Brake-Light Switch And Brake-Light-Test Switch

Courtesy of BMW OF NORTH AMERICA, INC.

Schematics of brake-light-test switch and brake-light switch.

Fig. 92: Schematics - Brake-Light-Test Switch And Brake-Light Switch

Courtesy of BMW OF NORTH AMERICA, INC.

61 31 996 CARRY OUT STEERING ANGLE SENSOR ADJUSTMENT

NOTE: Steering angle sensor adjustment must be carried out:

- After adjustment work on the front axle/steering.
- After all mechanical work on the steering system.
- After the following components have been replaced/coded.
- Steering column switch cluster.
- DSC control unit.
- ARS control unit.

Connect vehicle to BMW diagnosis system.

Select and carry out steering angle sensor adjustment under Service functions.

ECUS, MODULES

61 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC

CONTROL UNIT

Refer to [61 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT](#) .

61 35 ... NOTE ON REPLACING CODABLE/PROGRAMMABLE CONTROL UNITS

Replacement:

Carry out coding/programming.

Observe following IDC specifications:

- Programming.
- Coding.

[Fig. 93: Identifying Codable/Programmable Control Units](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 35 ... NOTES ON ESD PROTECTION (ELECTRO STATIC DISCHARGE)

NOTE: For Special Tools identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 12 7 060

NOTE: Electrical components which are particularly sensitive to electrostatic discharge (electronic control units, sensors, etc.) are marked with the ESD warning symbol.

E - Electro.

S - Static.

D - Discharge.

Statically charged persons can discharge by touching electrical components.

[Fig. 94: Precaution - Do Not Touch Pins Or Multi-Pin Connectors Directly Or Static Discharge May Occur](#)

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Humans can only detect a discharge starting from a level of approx. 3000 V.

The danger threshold for electrical components already starts from a level of approx. 100 V.

Important!

Do Not Touch Pins Or Multi-Pin Connectors Directly!

Touch electrical components by their housings only.

[Fig. 95: Precaution - Touch Electrical Components By Their Housings Only](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Important!

To prevent electrical components from being damaged or destroyed by electrostatic discharge, it is absolutely essential to comply with the following instructions:

- When replacing electrical components, leave the replacement components in their original packaging until immediately before they are to be installed.
- If necessary, always return a removed component in its original packaging (always pack the component away immediately).
- Read and comply with user information on using the associated ESD special tool 12 7 060, refer to SPECIAL TOOLS - Z3 .

61 35 900 REMOVING AND INSTALLING/REPLACING RING ANTENNA OF ELECTRONIC IMMOBILIZER

Remove instrument panelling at bottom left.

Release screws.

Fig. 96: Removing Instrument Panelling At Bottom Left

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.

Fig. 97: Unscrewing Bottom Trim Panel Screw (Front)

Courtesy of BMW OF NORTH AMERICA, INC.

Pull panelling to side out of clips.

Fig. 98: Pulling Panelling To Side Out Of Clips

Courtesy of BMW OF NORTH AMERICA, INC.

Pull front end of panelling in downward direction and remove.

Fig. 99: Pulling Front End Of Panelling In Downward Direction

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.

Pull lower section of steering-column casing off upper section.

Installation:

Check for correct position of lock.

Fig. 100: Pulling Lower Section Of Steering-Column Casing Off Upper Section

Courtesy of BMW OF NORTH AMERICA, INC.

Slide in special tool 61 3 300 with flattened end (A) facing ring antenna and lever out ring antenna.

Fig. 101: Levering Out Ring Antenna

Courtesy of BMW OF NORTH AMERICA, INC.

Cut open cable connector and remove ring antenna.

Fig. 102: Cutting Open Cable Connector And Removing Ring Antenna

Courtesy of BMW OF NORTH AMERICA, INC.

DIAGNOSIS PROGRAMMING/CODING

Using the current TIS CD:

- Document type: Select SI Diagnosis Coding.
- Index number 11: Select Programming Information to display the table of contents.
- Select the current IDC for the appropriate vehicle.

RELAYS

61 13 ... DME MASTER RELAY CONNECTOR

Refer to 61 13 ... DME MASTER RELAY CONNECTOR .

61 13 ... RELAY CARRIER

Refer to 61 13 ... RELAY CARRIER .

PLUG CONNECTION TERMINAL

61 13 ... DME MASTER RELAY CONNECTOR

Refer to 61 13 ... DME MASTER RELAY CONNECTOR .

61 13 ... RELAY CARRIER

Refer to 61 13 ... RELAY CARRIER .

WINDSCREEN WIPERS

61 61 010 CHECKING OR ADJUSTING CONTACT ANGLE OF WIPER ARMS ON WINDSHIELD

The contact angle of the wiper arm on the windshield primarily determines the wiping quality during intermittent operation and the wiping quality at low vehicle speeds.

On vehicles with contact pressure control, the clearance between the adjusting screw (1) and the tappet (2) must be $A = 0-0.2$ mm with the ignition off and the wiper blade fitted.

Fig. 103: Identifying Clearance Between Adjusting Screw And Tappet

Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 00 9 230 beside fulcrum of wiper blade on windscreen.

Fig. 104: Fitting Special Tool Beside Fulcrum Of Wiper Blade On Windscreen

Courtesy of BMW OF NORTH AMERICA, INC.

If the contact angle is incorrect, the wiper arm must be turned into correct position using two special tools 00 9 220.

Procedure:

Select largest possible distance "A" between special tool (1) and special tool (2).

Hold special tool (1) firmly to ensure that no load is applied to joint (3) when bending.

Twist special tool (2).

Check function.

[Fig. 105: Turning Wiper Arm Into Correct Position](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 61 041 REPLACING BOTH WINDSHIELD WIPER BLADES

Engine bonnet closed.

Wipers switched off.

[Fig. 106: Identifying Engine Bonnet Closed](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Compress retainer. Push wiper blades forward.

[Fig. 107: Pushing Wiper Blades Forward](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 61 100 REMOVING AND INSTALLING/REPLACING BOTH WINDSHIELD WIPER ARMS

Detach caps.

Unscrew left and right nuts.

Installation:

Tightening torque, 61 61 10AZ. Refer to [61 61 WINDSHIELD WIPERS](#) .

[Fig. 108: Unscrewing Left And Right Nuts](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Fold up wiper arms up to end position and detach from drive shaft.

[Fig. 109: Detaching Wiper Arms From Drive Shaft](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Adjusting dimensions of wiper arms:

Reference points are the mountings of the wiper blades on the wiper arms to the sealing lip of the cowl panel.

A = 45 mm.

B = 25 mm.

[Fig. 110: Adjusting Dimensions Of Wiper Arms](#)

Courtesy of BMW OF NORTH AMERICA, INC.

61 61 250 REPLACING WINDSHIELD WIPER MOTOR (Z3 ROADSTER, Z3 COUPE)

NOTE: Prior to removal, allow wiper motor to run into rest position (if still possible).

Necessary Preliminary Tasks:

- Disconnect battery negative lead, refer to [12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY](#) .
- Remove complete bracket for windshield wiper system, refer to [61 61 270 REMOVING AND INSTALLING MOUNTING BRACKET FOR WINDSHIELD WIPER SYSTEM COMPLETE WITH MOTOR \(Z3 ROADSTER, Z3 COUPE, M ROADSTER, M COUPE\)](#) .

Unfasten nut on motor crank and pry off crank from motor.

NOTE: Drive rods remain fitted, illustrated without drive rods for sake of clarity.

[Fig. 111: Prying Off Crank From Motor](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove wiper motor from console.

Tightening torque, 61 61 1AZ. Refer to [61 61 WINDSHIELD WIPERS](#).

Installation:

Replace screws.

Screw new wiper motor onto wiper bracket, connect to vehicle wiring harness and run into rest position.

[Fig. 112: Removing Wiper Motor From Console](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Position motor crank on shaft so that it forms a line with drive rod on passenger side.

[Fig. 113: Positioning Motor Crank On Shaft](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Turn motor crank at nut out of rest position slightly, then grip firmly and screw down.

[Fig. 114: Turning Motor Crank At Nut Out Of Rest Position](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, 61 61 4AZ. Refer to [61 61 WINDSHIELD WIPERS](#) .

61 61 270 REMOVING AND INSTALLING MOUNTING BRACKET FOR WINDSHIELD WIPER SYSTEM COMPLETE WITH MOTOR (Z3 ROADSTER, Z3 COUPE, M ROADSTER, M COUPE)

Necessary Preliminary Tasks:

- Remove grill for air intake/heating. refer to [51 13 077 REMOVING AND INSTALLING/REPLACING GRILL FOR AIR INTAKE/HEATER \(Z3 ROADSTER, M ROADSTER, Z3 COUPE, M COUPE\)](#) .

Unfasten screws.

Feed mounting bracket for wiper system sideways out of upper guide (A) and pull out.

[Fig. 115: Feeding Mounting Bracket For Wiper System Sideways Out Of Upper Guide And Pulling Out](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock plug connection, disconnect and remove mounting bracket for wiper system completely.

[Fig. 116: Removing Mounting Bracket For Wiper System Completely](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Article GUID: A00202366

GENERAL INFORMATION

Breakout Boxes & Connectors - Overview

BREAKOUT BOXES AND CONNECTORS

Model: All

Production Date: All

CONNECTOR CONTACT KIT

Connector Contact Removal Kit

The connector contact removal kit provides tools for the disassembly of connectors. Proper use of these tools enable the technician to access wiring connectors for repairs equal to factory quality.

Always refer to the latest appropriate articles for up to date information regarding new tools.



Fig. 1: Identifying Connector Contact Removal Kit

Courtesy of BMW OF NORTH AMERICA, INC.

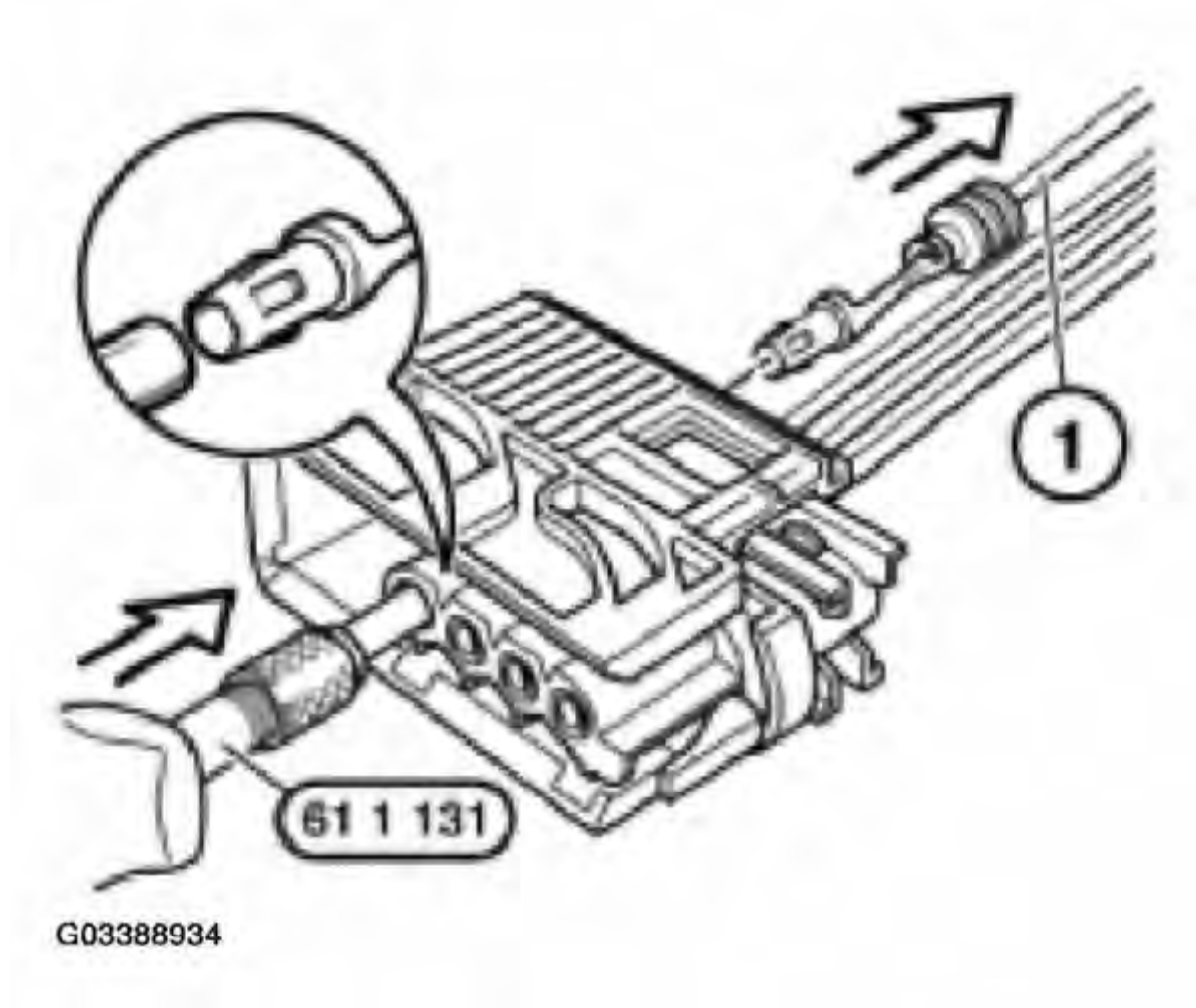
Current P/N 88 88 6 611 150.

The Connector Contact Removal Kit is used for:

- Releasing round plug housings.
- Releasing relay carriers.

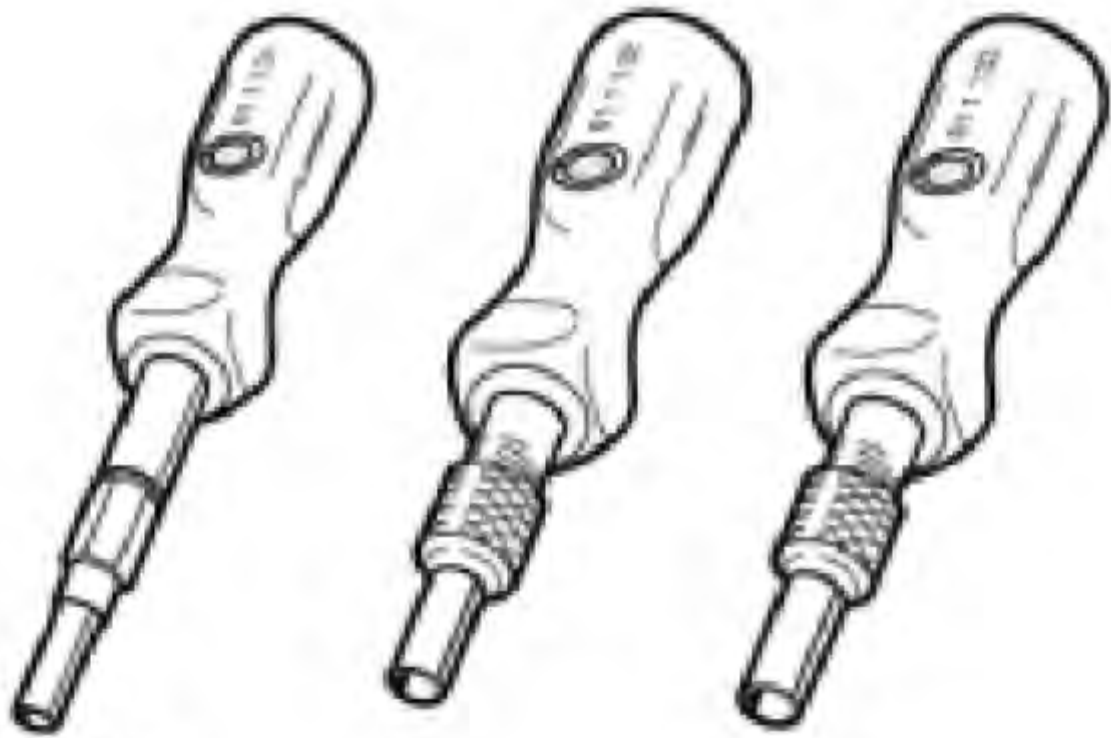
- Pressing out contacts.
- Pulling out indicator lamps.

Socket and Spring Contacts



[Fig. 2: Identifying Spring Contacts](#)

Courtesy of BMW OF NORTH AMERICA, INC.

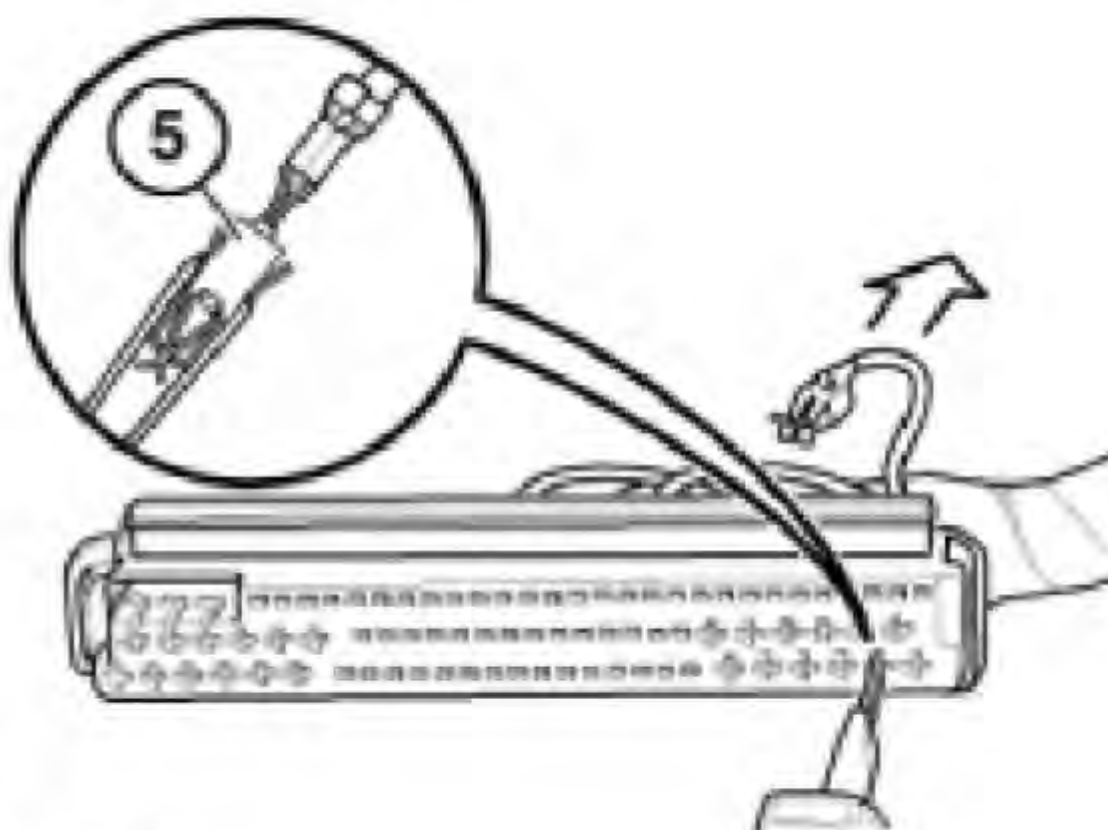


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[Fig. 3: View Of Socket Types](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Socket and Spring contacts compress the springs while the connector is pushed from the housing.



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[Fig. 4: Identifying Different Sockets](#)

Courtesy of BMW OF NORTH AMERICA, INC.



[Fig. 5: View Of Socket And Spring Contacts](#)

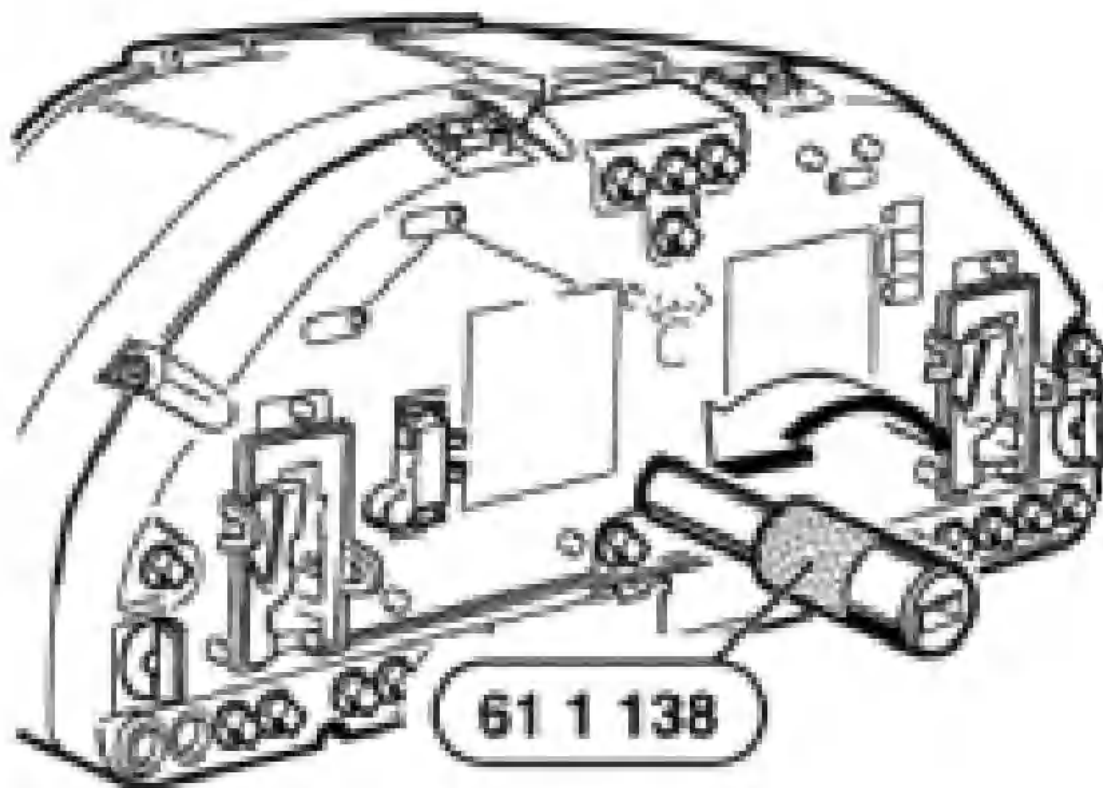
Courtesy of BMW OF NORTH AMERICA, INC.

Flat spring contacts depress the spring allowing the connector to be pushed or gently pulled from the connector housing.

Instrument Cluster Illumination Bulb Holder Removal Socket

The backlighting illumination bulbs are removed from the cluster by placing square head of the socket on the bulb holder and turning 90° counter clockwise.

The bulb removal socket is used on all instrument clusters.

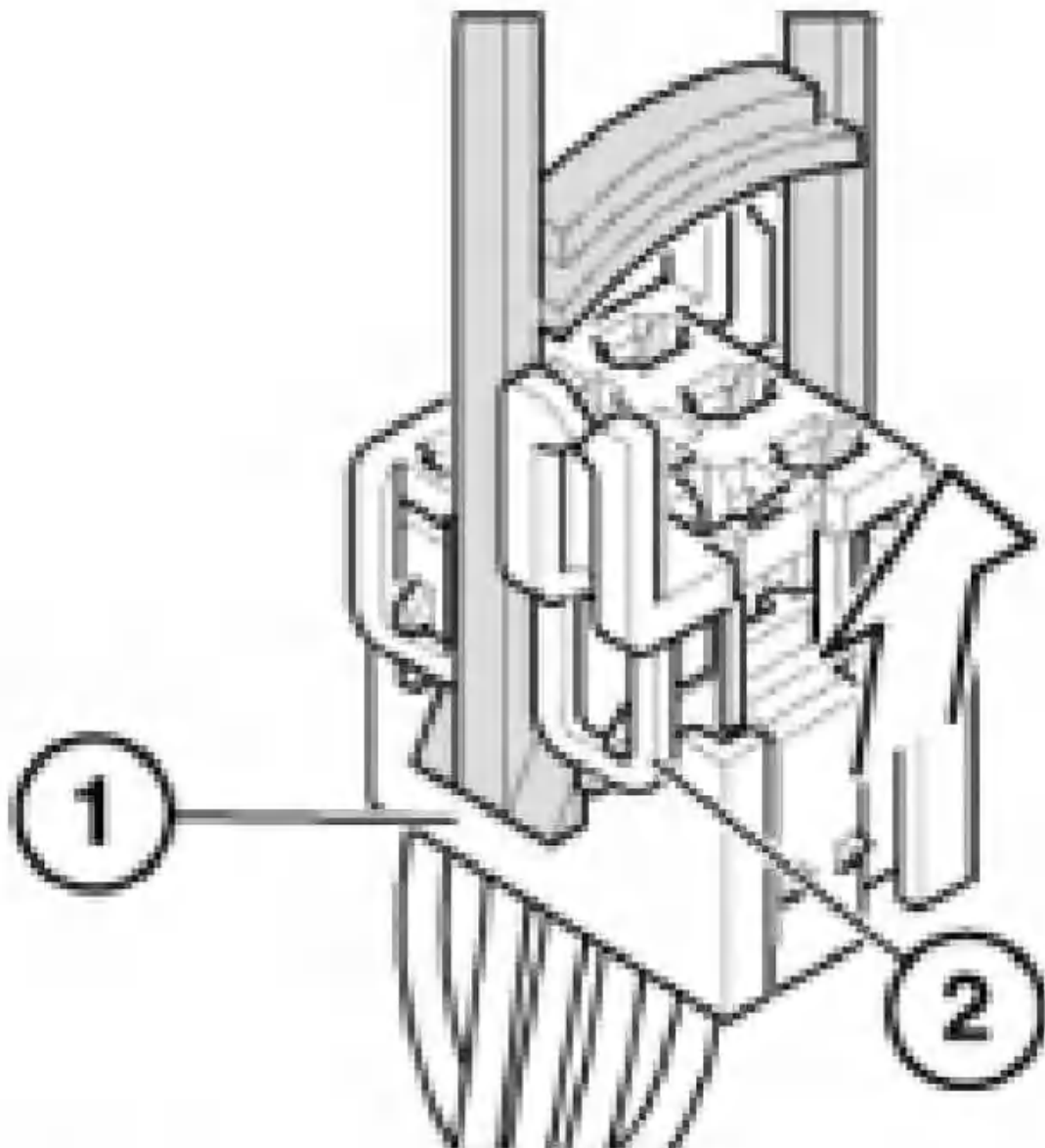


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[Fig. 6: Identifying Instrument Cluster Illumination Bulb Holder Removal Socket](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Relay Holder Disengaging Tool

This tool allows the relay holder (2) to disengage the relay connector (1).



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[Fig. 7: Identifying Relay Holder Disengaging Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Circular Connector Lock Disengager

These tools unlock the circular connector housings allowing the individual connectors to be removed.

The various sizes are reflected in the part numbers:

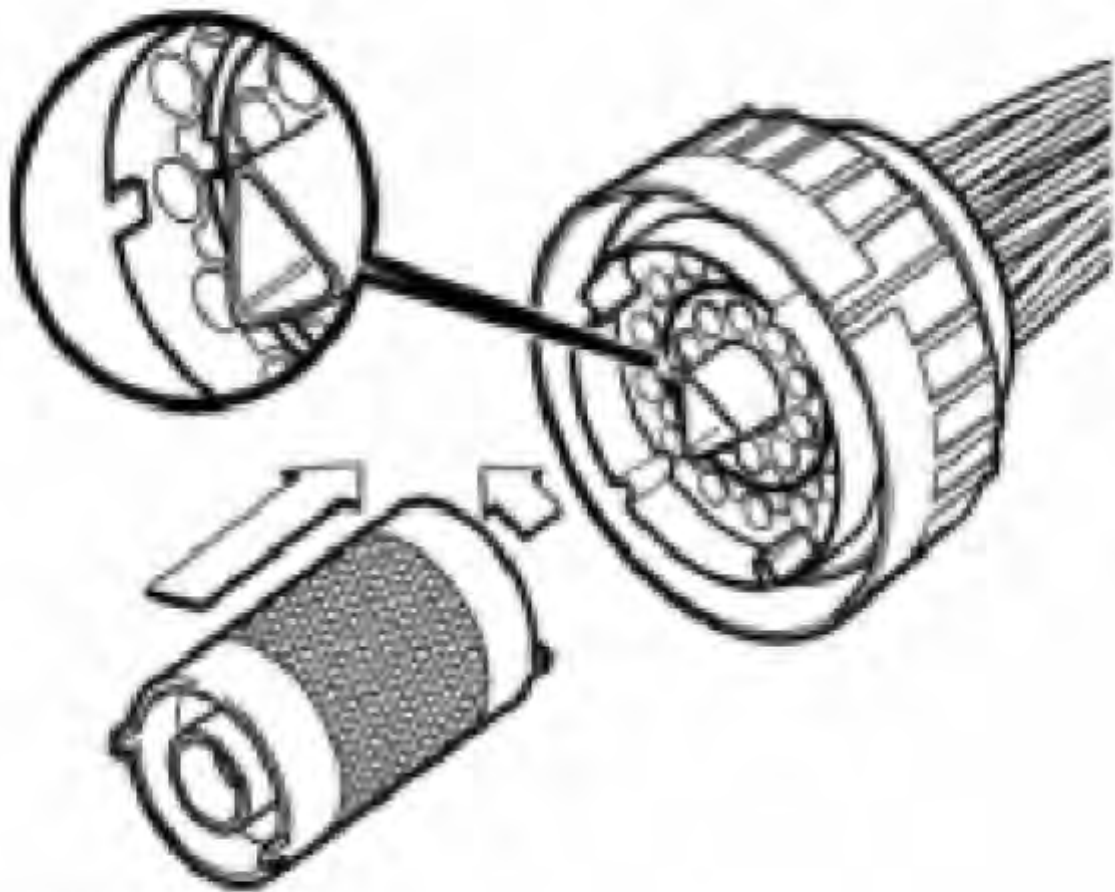
4 pin = 61 1 141.

7 pin = 61 1 142.

10 pin = 61 1 145.

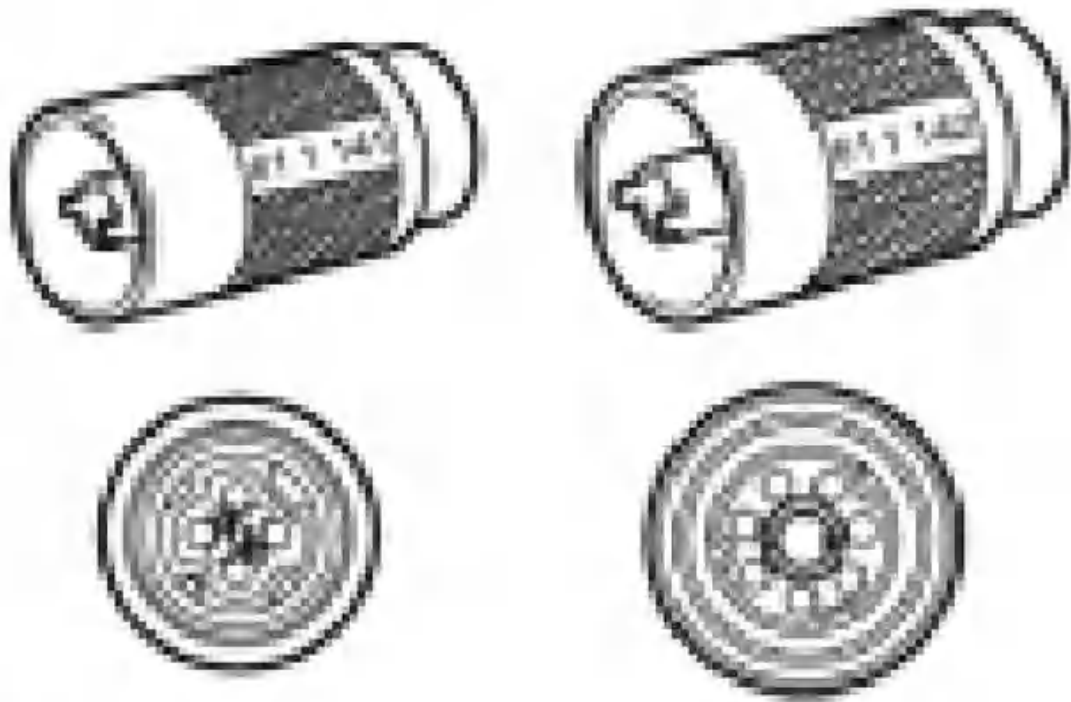
12 pin = 61 1 143.

25 Pin = 61 1 144.



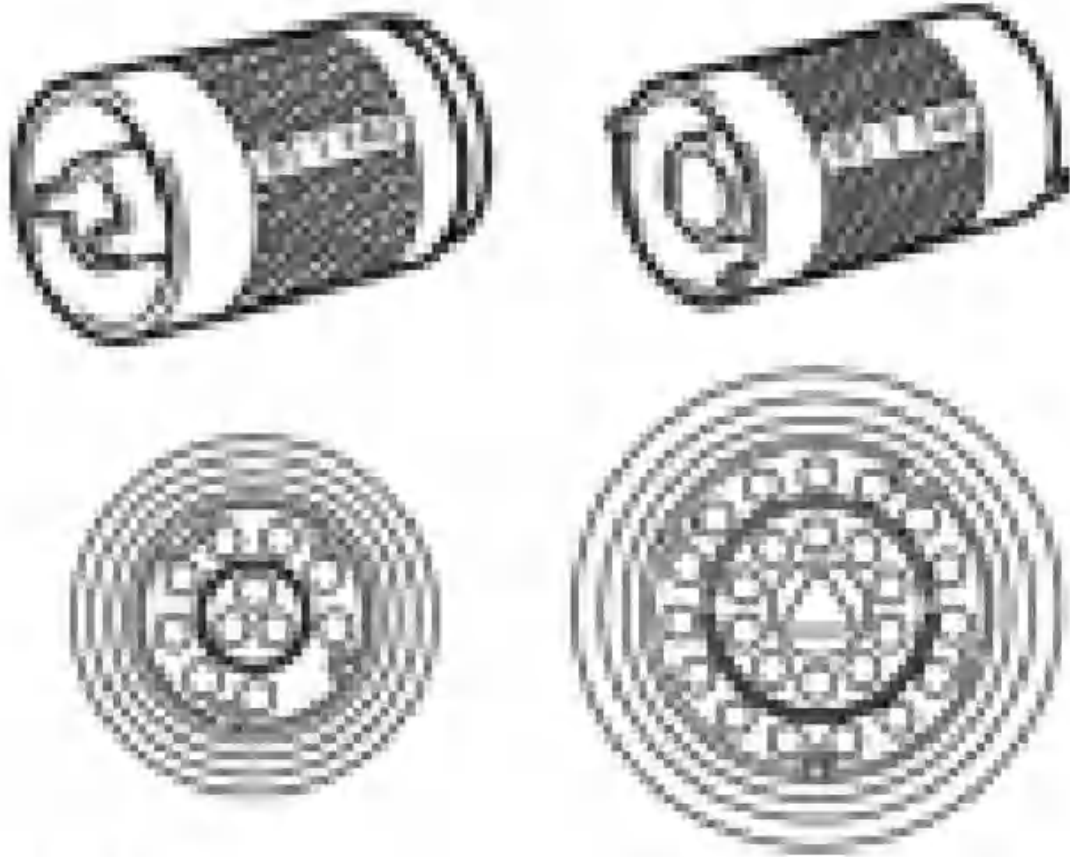
G03388940

[Fig. 8: Identifying Circular Connector Lock Disengager \(1 Of 4\)](#)
Courtesy of BMW OF NORTH AMERICA, INC.



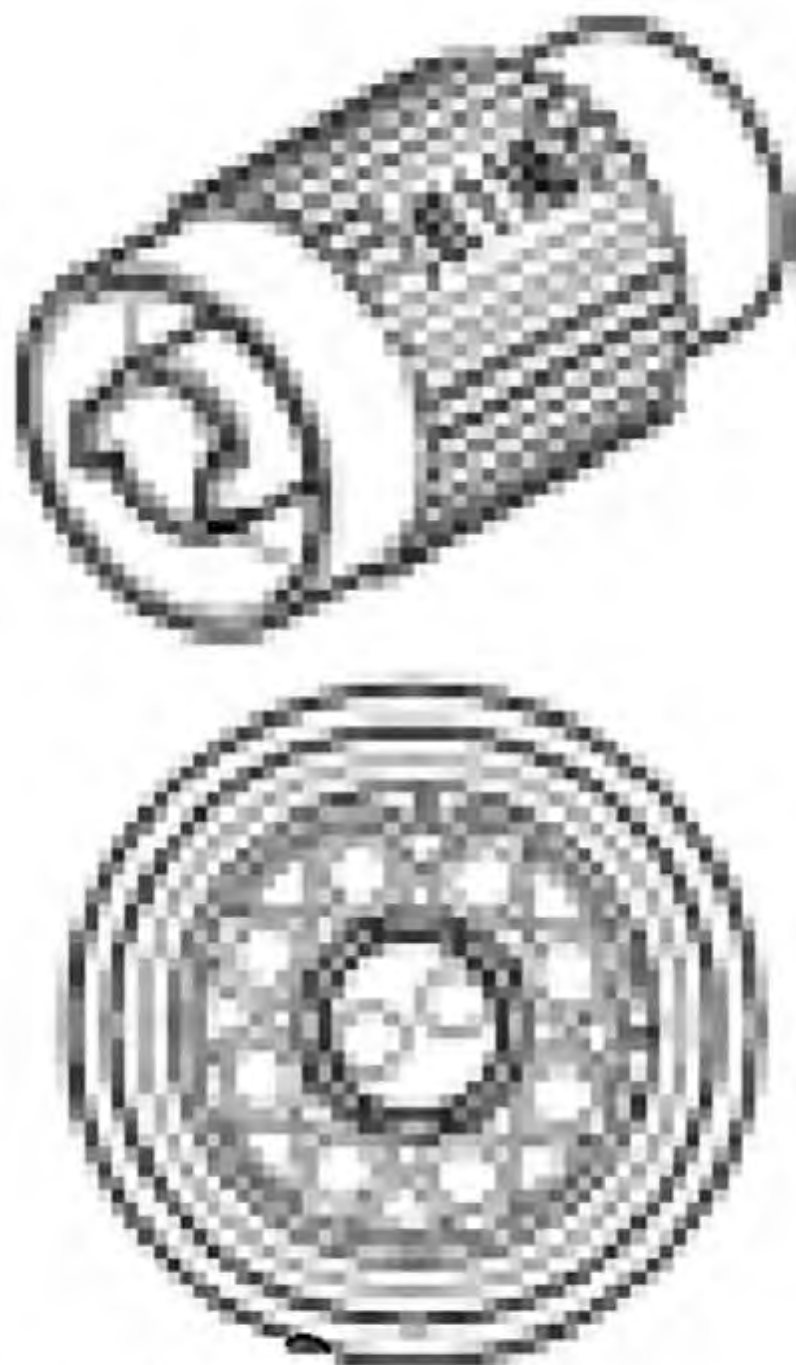
G03388941

[Fig. 9: Identifying Circular Connector Lock Disengager \(2 Of 4\)](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388942

[Fig. 10: Identifying Circular Connector Lock Disengager \(3 Of 4\)](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388943

[Fig. 11: Identifying Circular Connector Lock Disengager \(4 Of 4\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

BMW PLUG SYSTEM ABBREVIATIONS

BMW PLUG SYSTEM ABBREVIATIONS

D 1.5/2.5	Round contacts of 1.5mm or 2.5mm diameter
MDK 3 Plus	Miniature double flat spring contact
JPT ELA	Junior Power Timer flat spring contacts with strand sealing
DFK ELA	Double flat spring contacts with strand sealing
Elo	Electronic contacts with and without strand sealing

	Manufacturer: Siemens
Elo	Power Electronic contacts for heavy loads with and without strand sealing Manufacturer: Siemens
MQS	Micro Quadlock System electronic contacts with and without strand sealing Manufacturer: AMP
MPQ	Micro Power Quadlock electronic contacts for heavy loads with and without strand sealing Manufacturer: AMP

PLUG SYSTEM D1.5/D2.5

Circular Plug 7--8 Pin System D2.5

- Pull off the rubber boot (1).
- Push the retaining lugs (2) of the inner connector section 3 inward carefully to disengage the lock notch.
- Push the inner connector section (3) in the direction of the arrow in the illustration until the retaining lugs (2) are in the recessed notch (4) and use the appropriate sized spring contact tool and remove the connector from the housing.

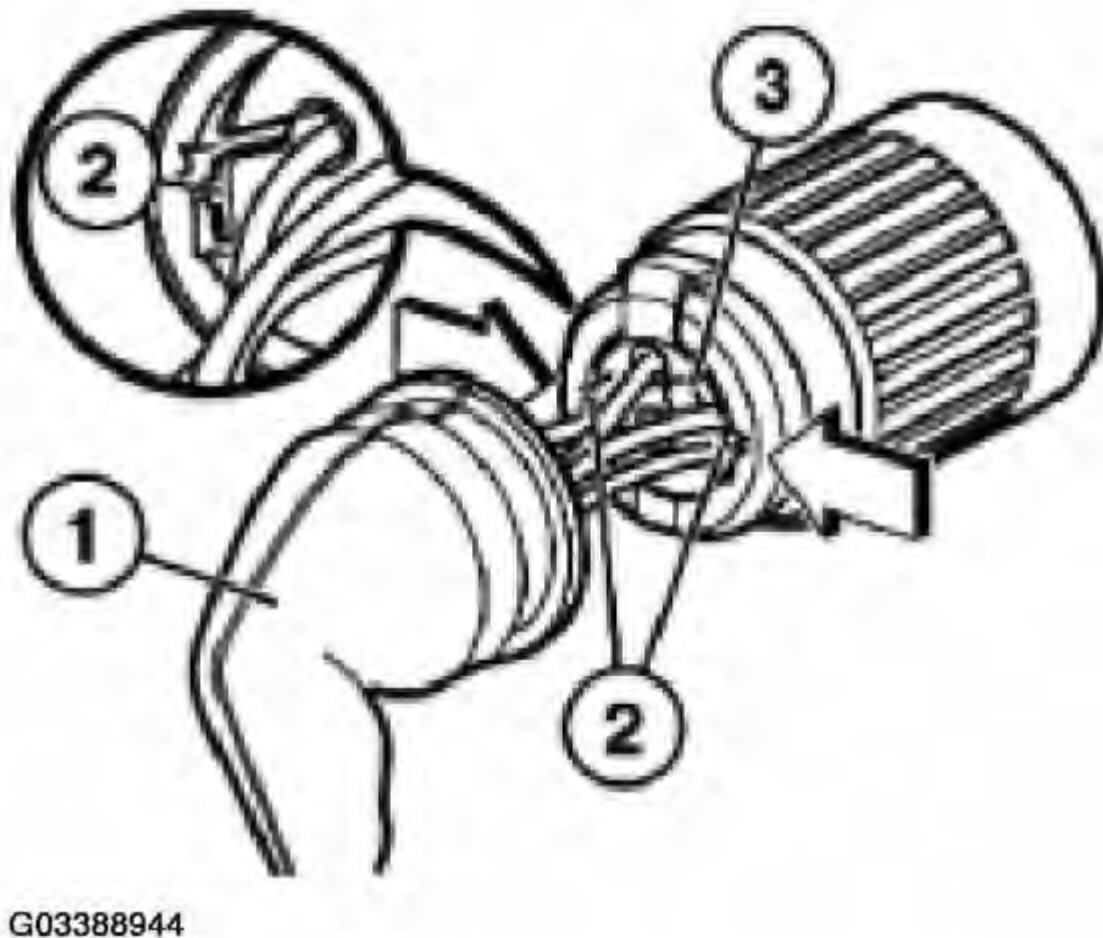


Fig. 12: Identifying Inner Connector Retaining Lugs
Courtesy of BMW OF NORTH AMERICA, INC.

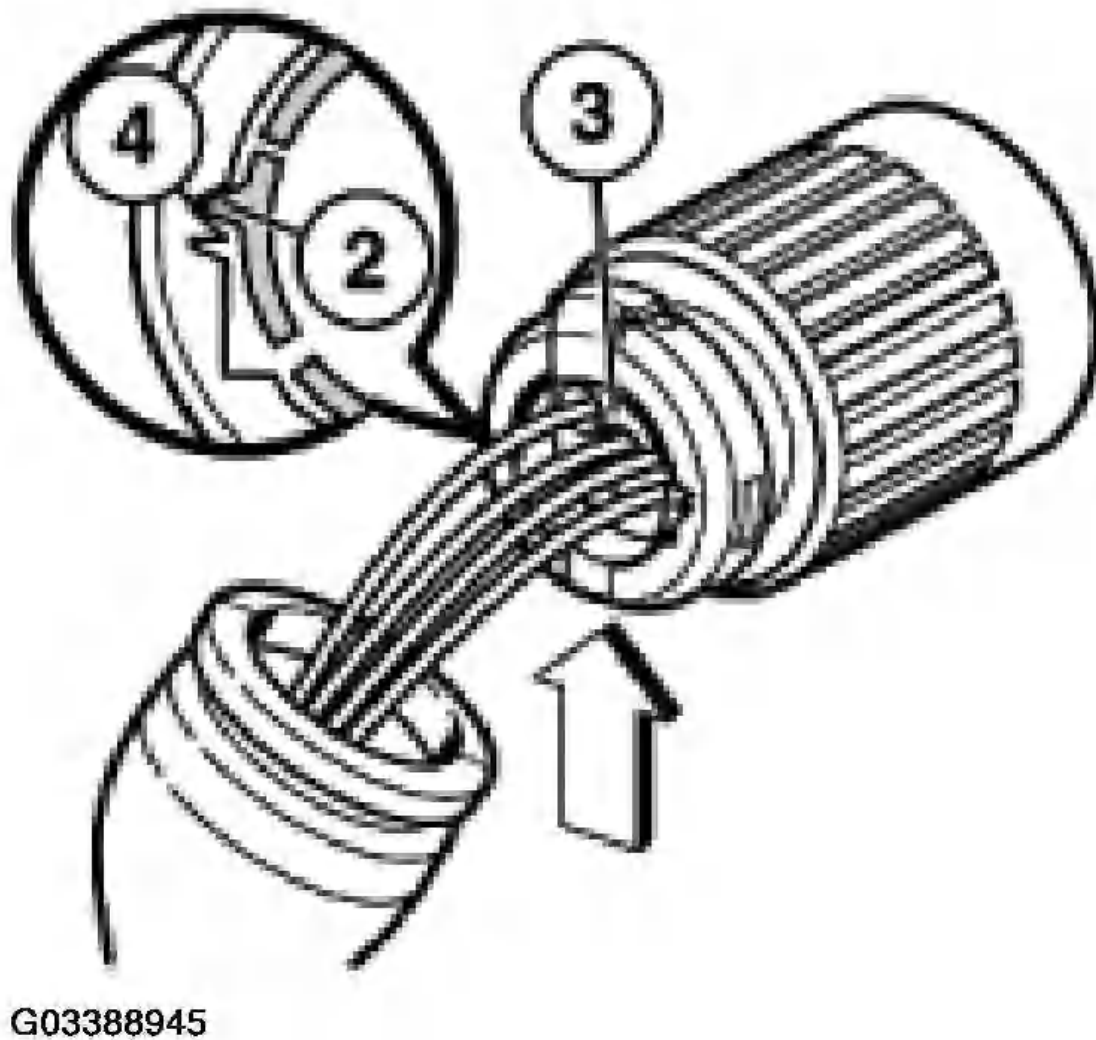
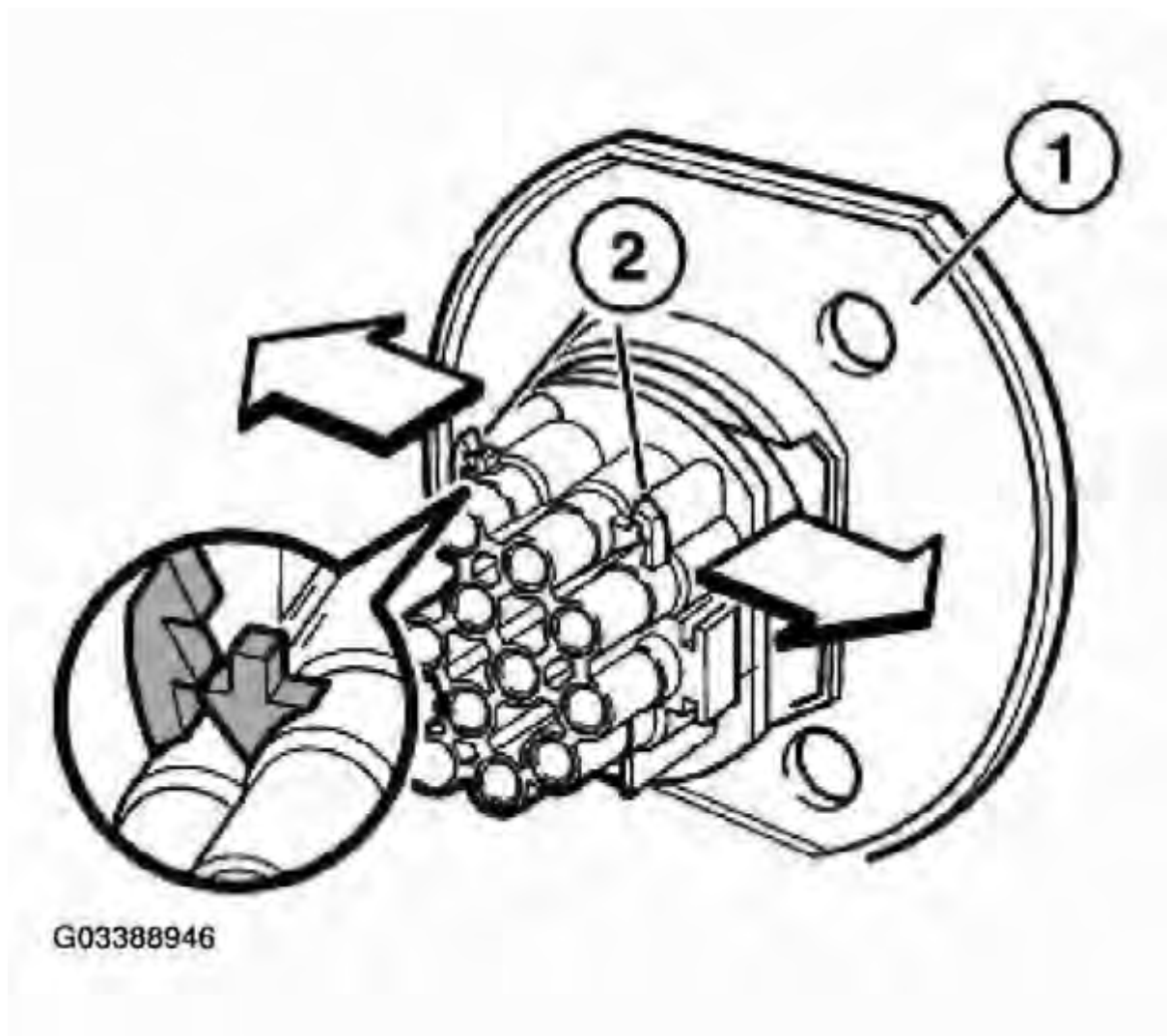


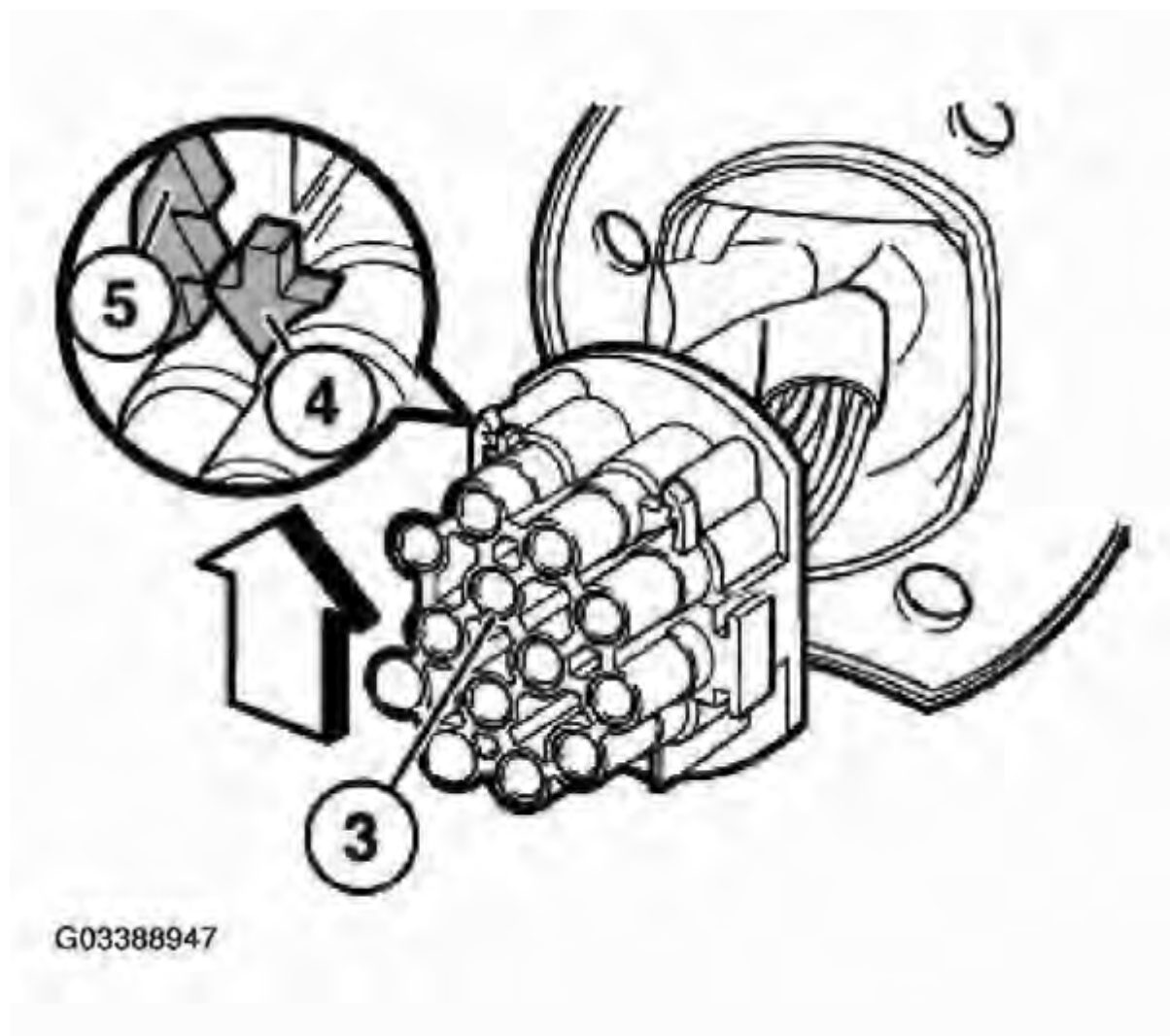
Fig. 13: Locating Recessed Notch In Inner Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Circular plug 13 Pin System D2.5

- Carefully pull off the rubber grommet (1).
- Pull the lock retainers (2) outward (direction of arrows) to allow the lock notch to disengage.
- Pull the inner section (3) upward as shown in the illustration until the lock notches (4) are in the released position of the lock retainers (5) and use the appropriate size spring contact and remove the connector from the housing.



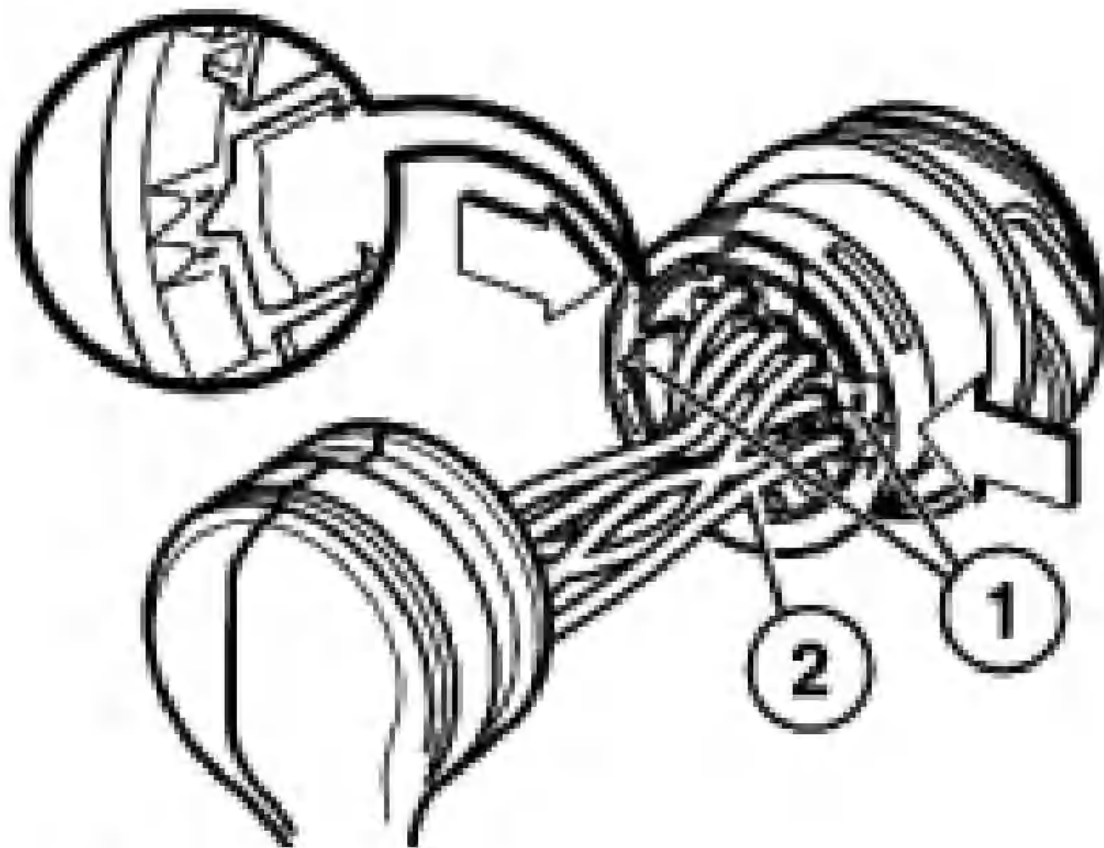
[Fig. 14: Locating Circular Plug Lock Retainers](#)
Courtesy of BMW OF NORTH AMERICA, INC.



[Fig. 15: View Of Lock Notch In Circular Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.

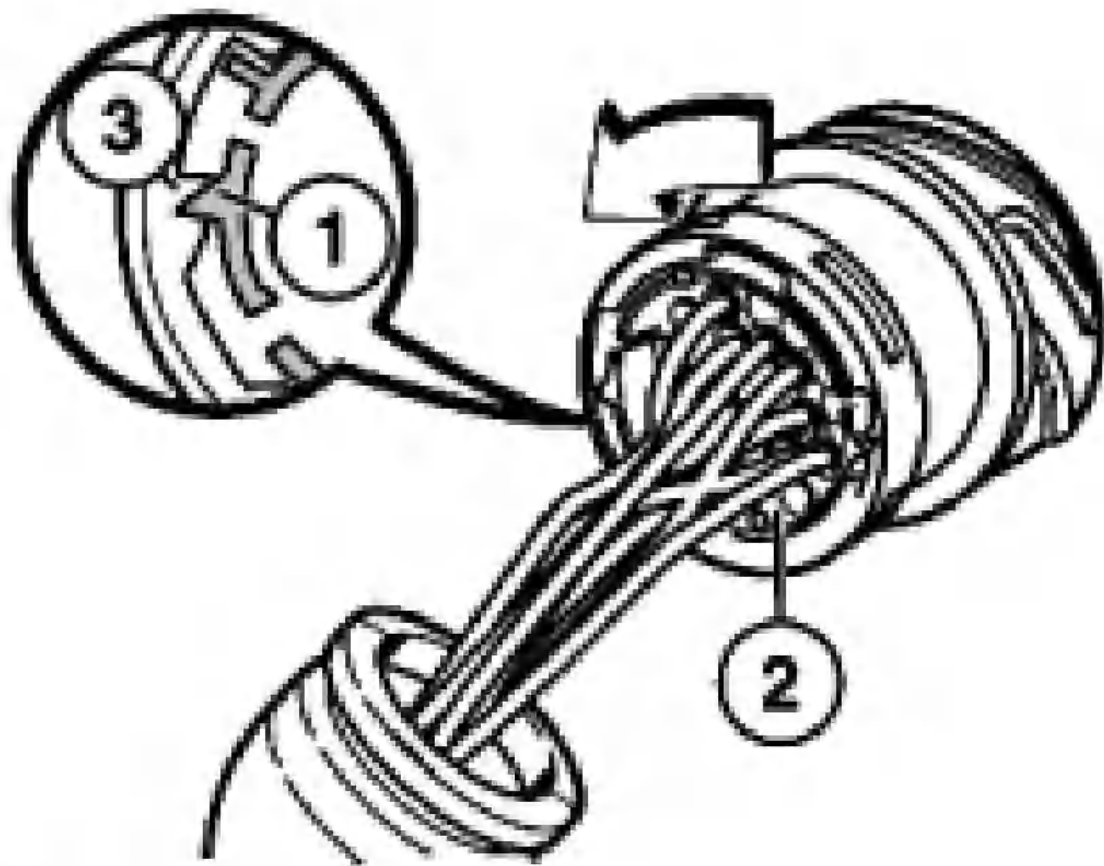
Circular Plug 20 Pin System D2.5

- With the boot pulled back, press the lock tabs (1) of the inner connector section (2) inward.
- Simultaneously, rotate the inner connection section (2) counter clockwise to allow the lock tabs (1) to engage in the unlocked position and use the appropriate sized spring contact and remove connector from the housing.



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[Fig. 16: Identifying Circular Plug Lock Tabs](#)
Courtesy of BMW OF NORTH AMERICA, INC.

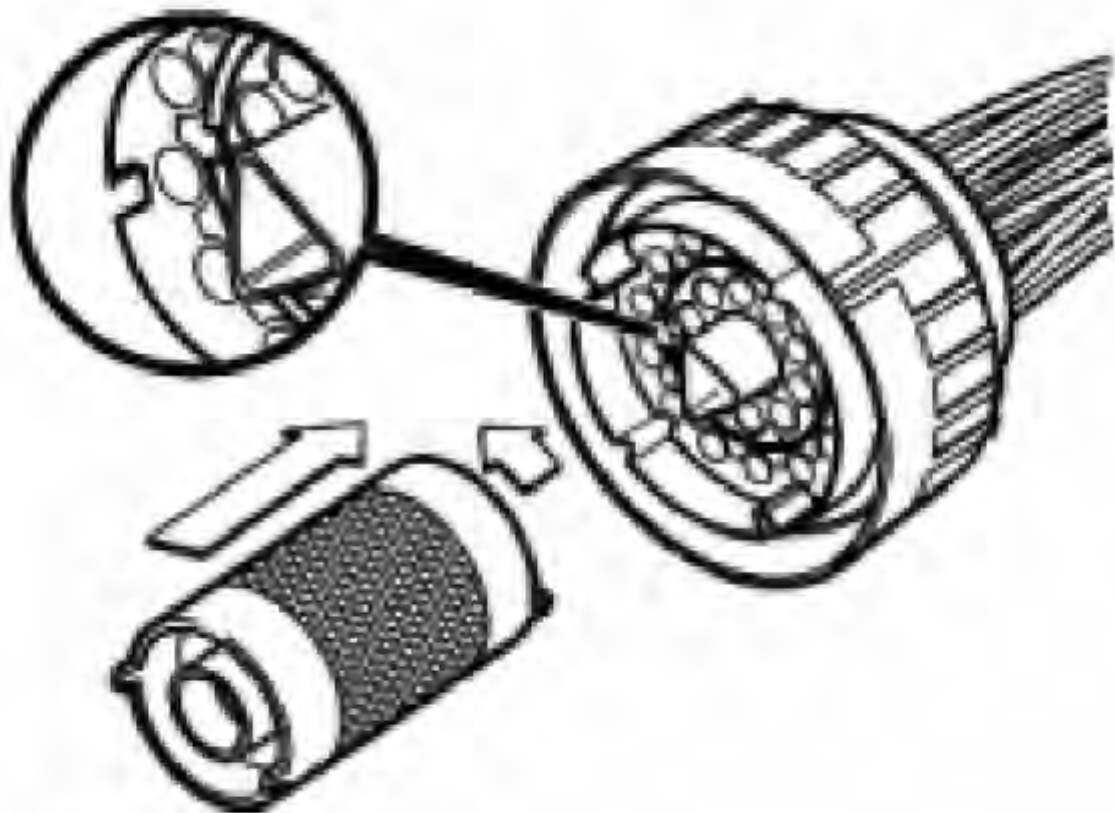


G03388949

[Fig. 17: View Of Inner Connection Of Circular](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Circular Plug 4-7-10-12-25 Pin System D1.5/D2.5

- Insert the appropriate unlocking tool (determined by the number of pins) into the connector.
- The connector is unlocked when the lock tab (3) is in the unlocked position (1). The connector is locked when the lock tab (3) is in the locked position (2).
- Use the appropriate sized spring contact and remove connector from the housing.



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[Fig. 18: View Of Circular Plug And Special Tool](#)
Courtesy of BMW OF NORTH AMERICA, INC.

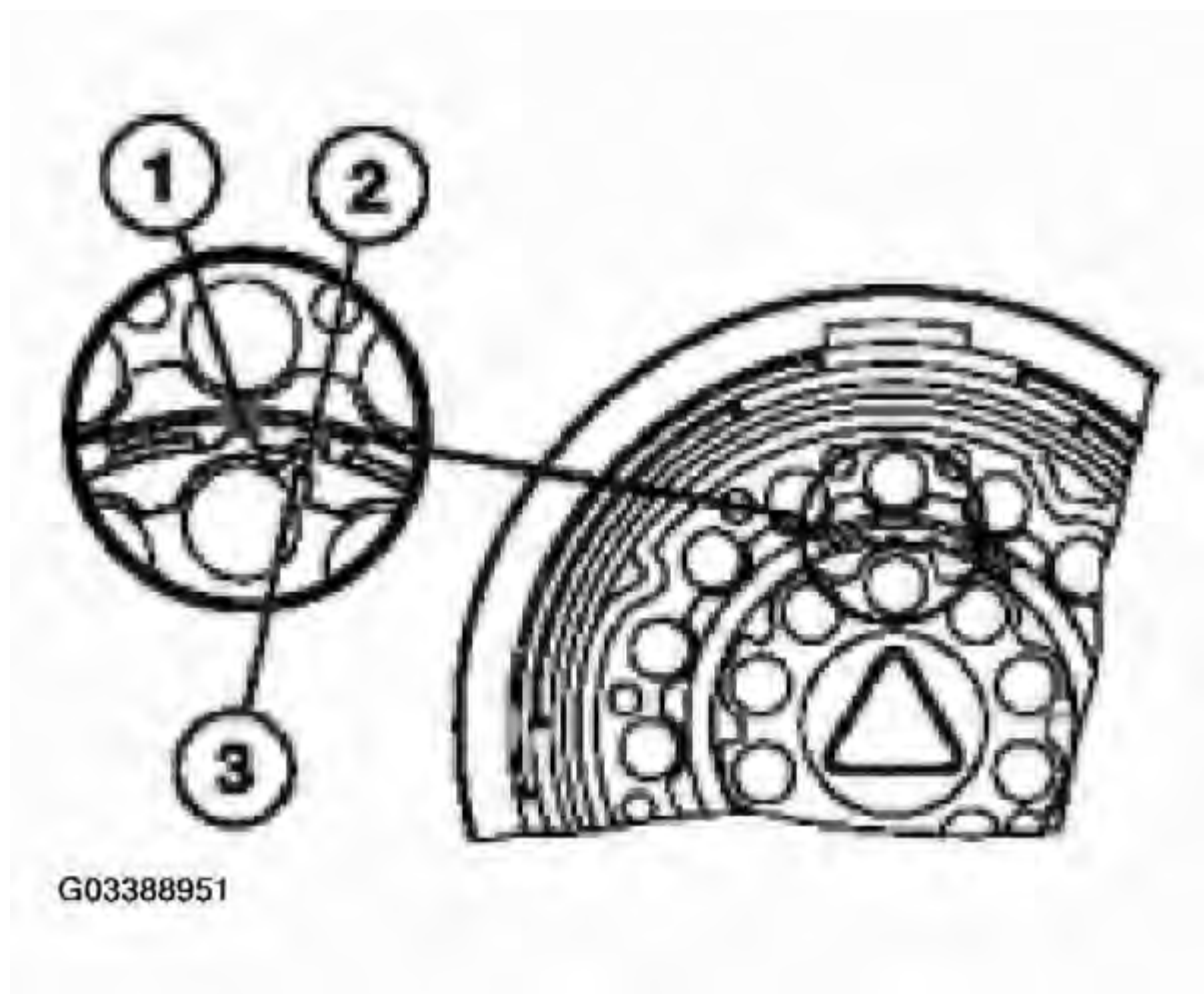
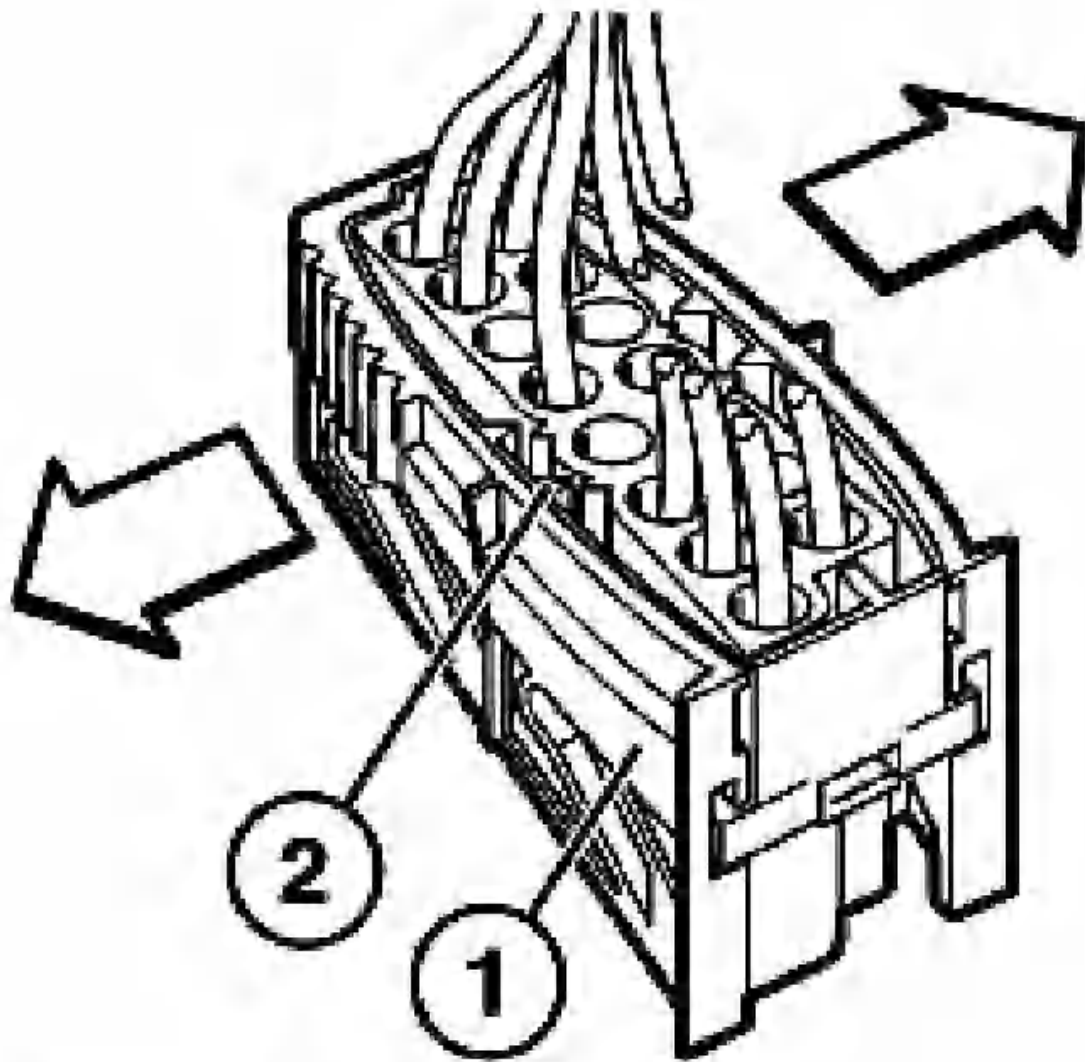


Fig. 19: Identifying Lock Tab Of Circular Plug
Courtesy of BMW OF NORTH AMERICA, INC.

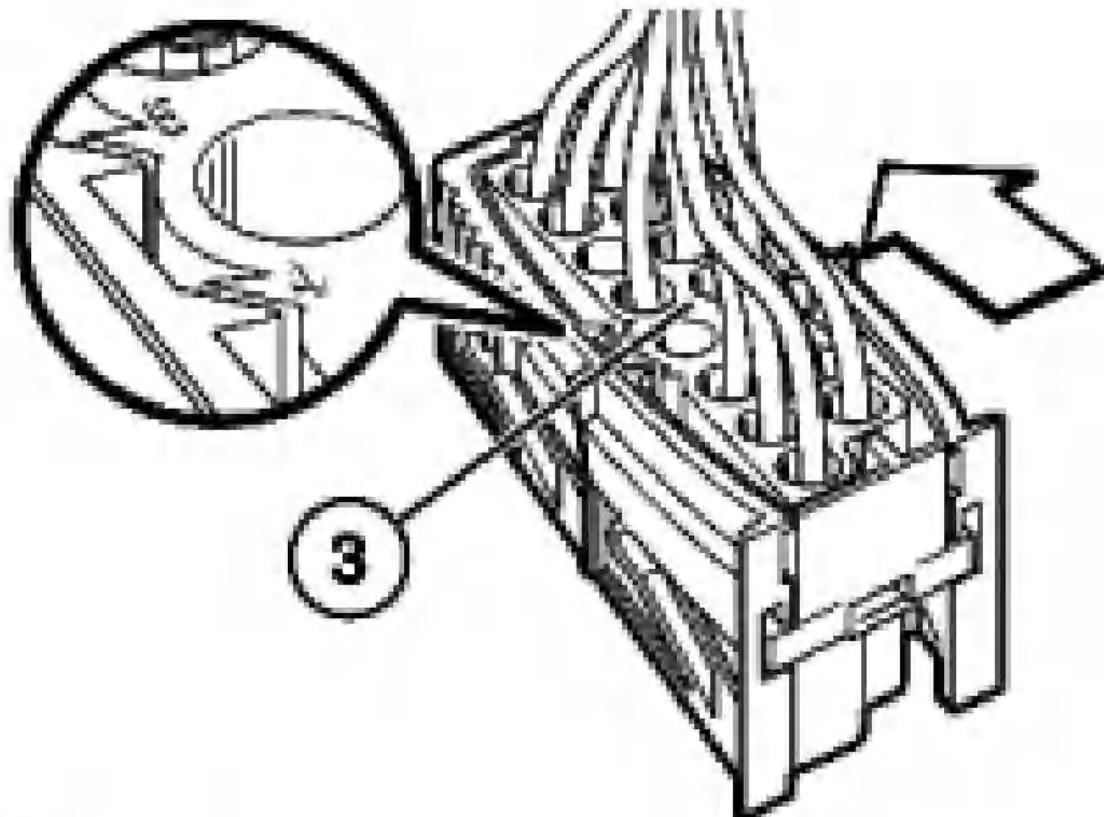
In-line Plug 15 Pin System D2.5

- Pull the outer connector section (1) slightly outward in the area of lock tabs (2).
- Simultaneously, slide the inner connector section (3) in the direction of the arrow to the unlocked position.
- Use the appropriate sized spring contact and remove connector from housing.



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[Fig. 20: Identifying In-Line Plug Lock Tabs](#)
Courtesy of BMW OF NORTH AMERICA, INC.



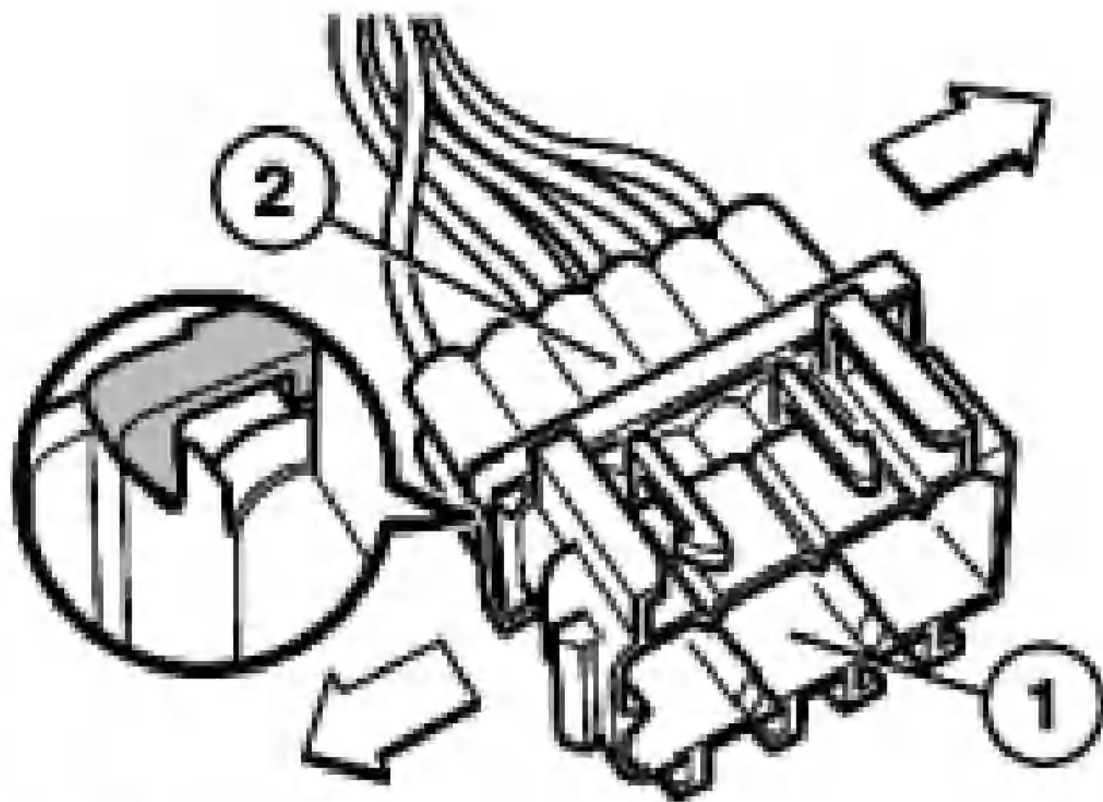
G03388953

Fig. 21: Locating In-Line Plug Inner Connector Section

Courtesy of BMW OF NORTH AMERICA, INC.

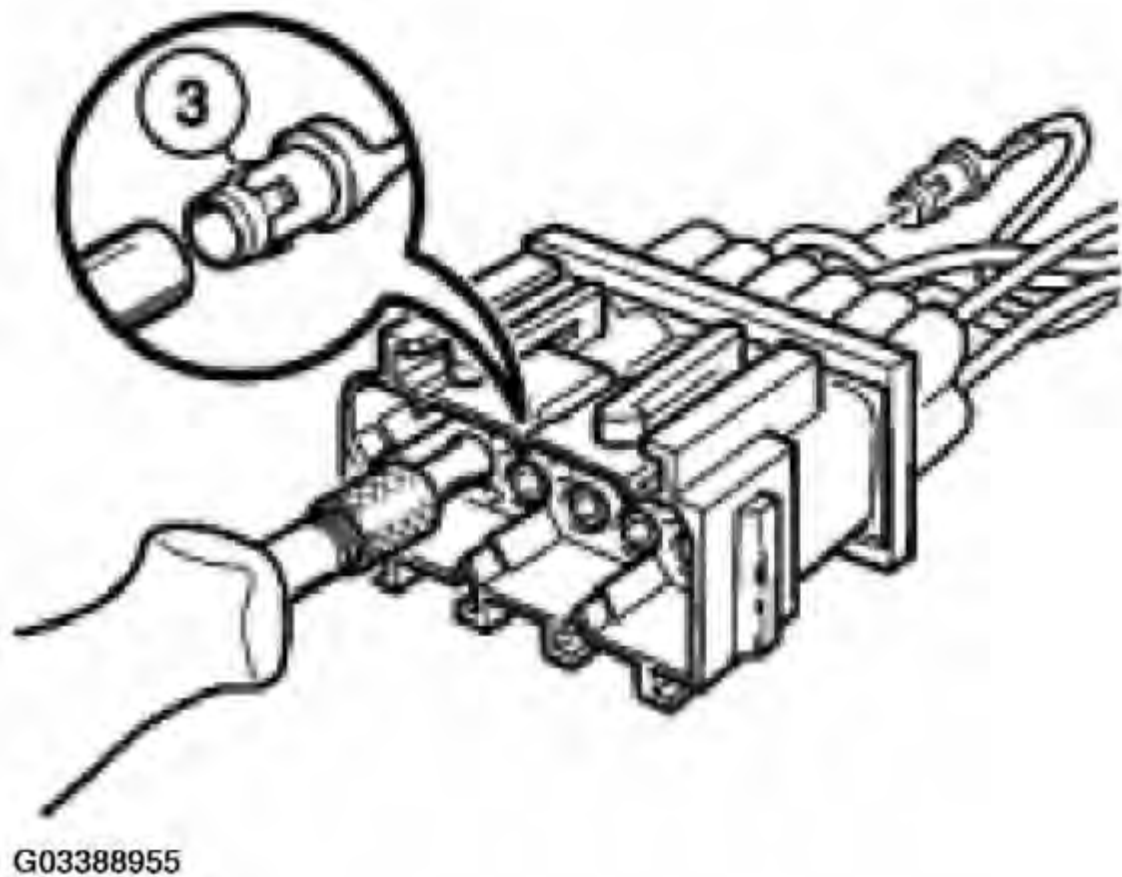
In-line Plug 8-, 12 Pin System D2.5

- Slide the upper section (1) and the lower section (2) of the connector in opposite directions to unlock the connector.
- Using special tool 61 1 132 press the spring latch down and pull the connector (3) from the housing.



G03388954

[Fig. 22: Separating In-Line Plug Lower And Upper Sections](#)
Courtesy of BMW OF NORTH AMERICA, INC.

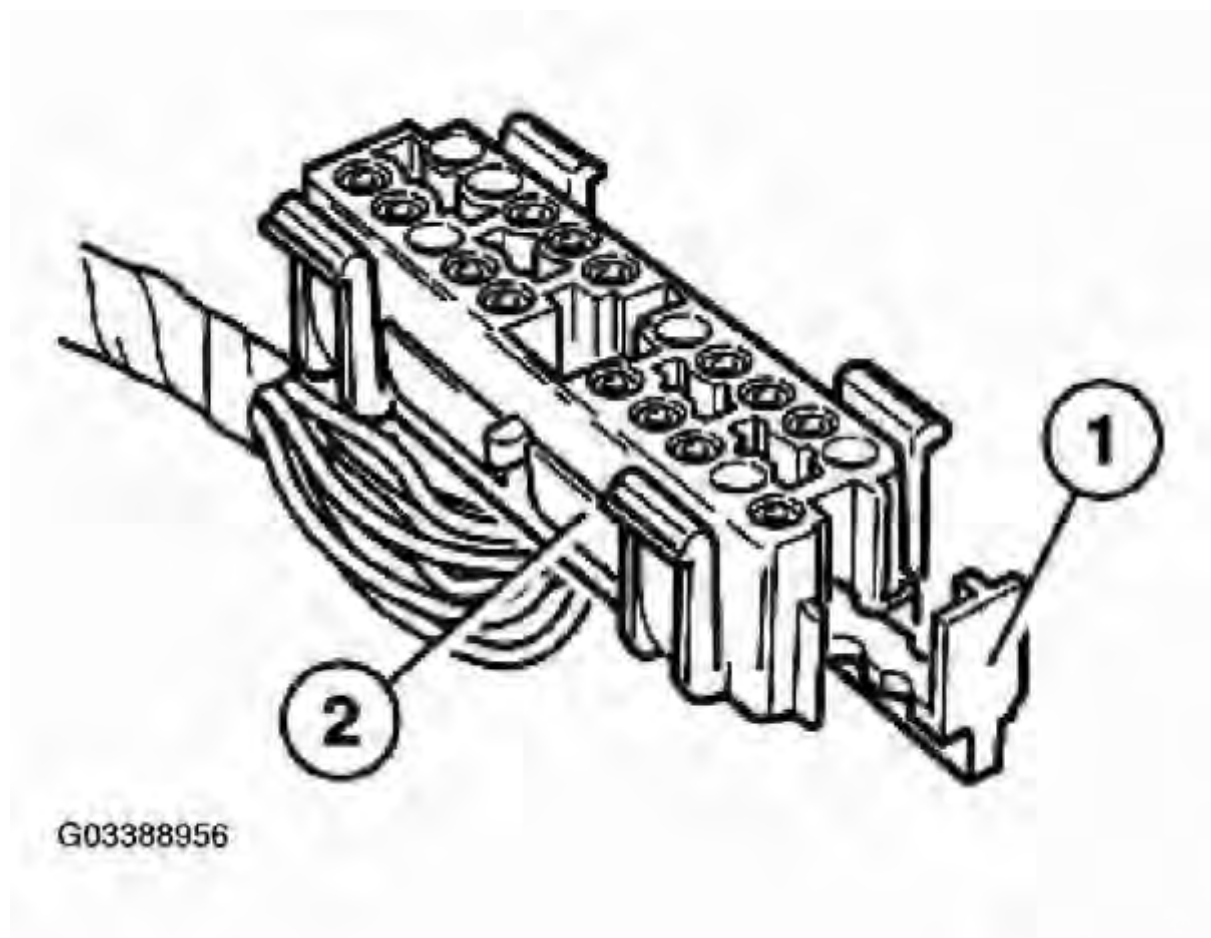


[Fig. 23: View Of In-Line Plug Connector](#)

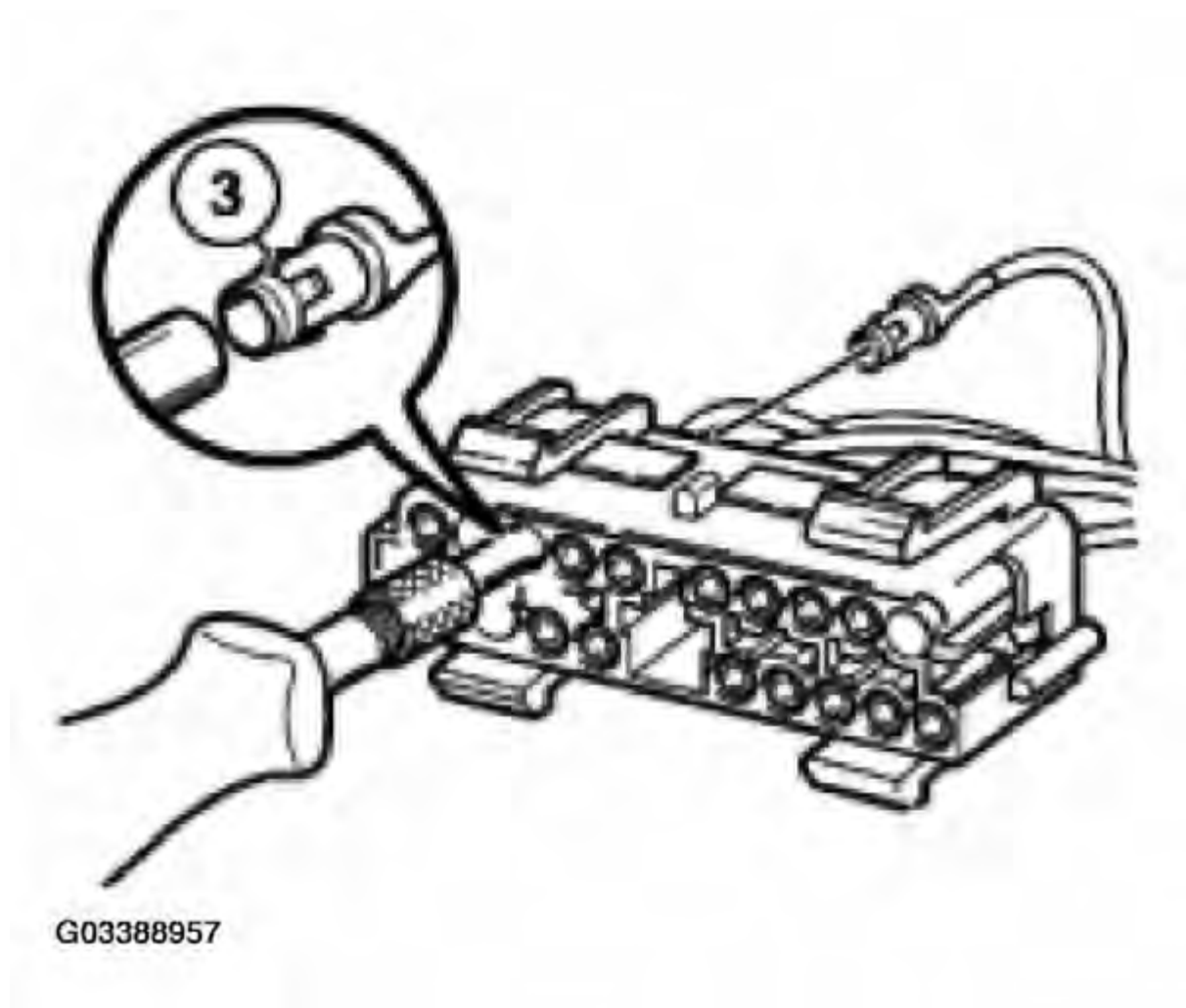
Courtesy of BMW OF NORTH AMERICA, INC.

In-line Plug 20 Pin System D2.5

- Pull locking slide (1) completely out of connector (2).
- Using special tool 61 1 132 press the spring latch down and pull the connector from the housing.



[Fig. 24: Removing Locking Slide From Connector](#)
Courtesy of BMW OF NORTH AMERICA, INC.

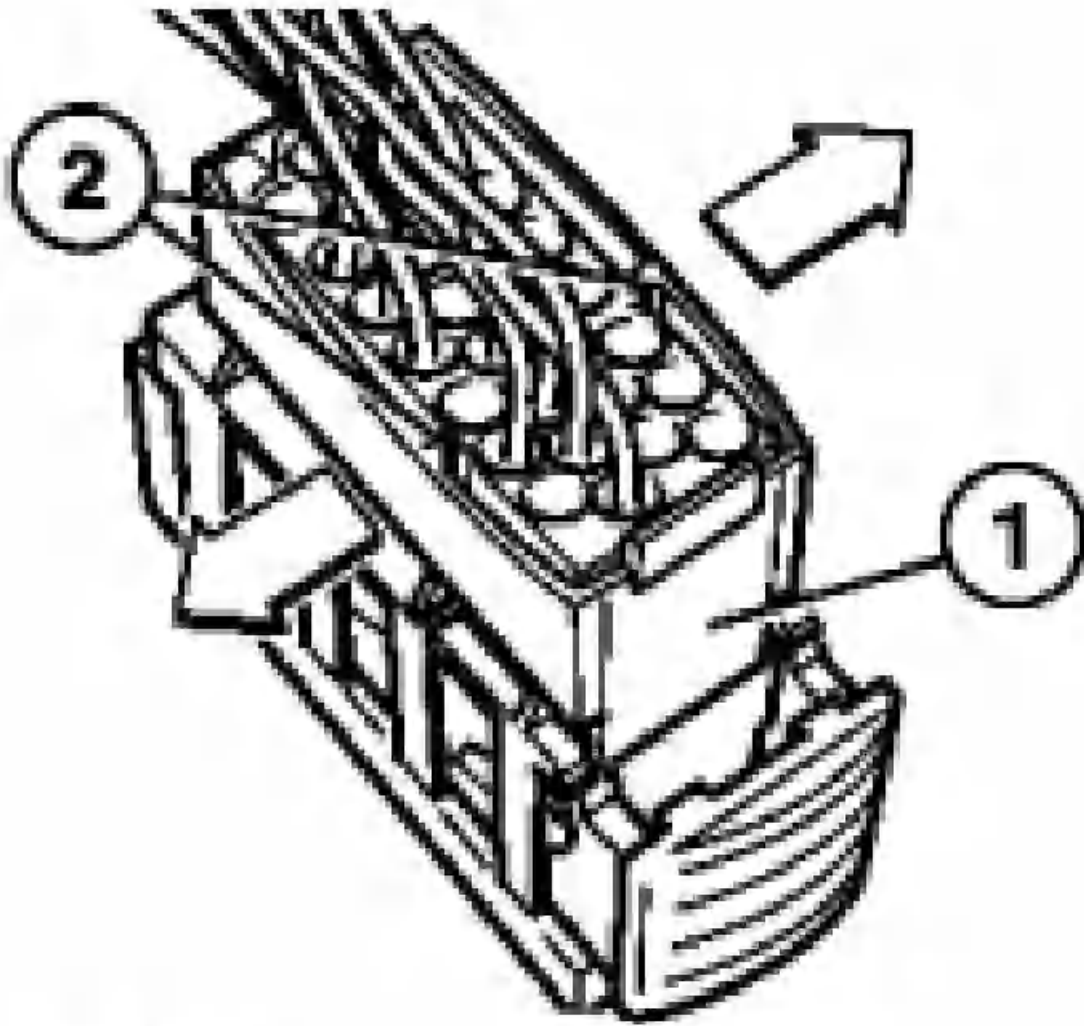


[Fig. 25: View Of In-Line Plug Connector](#)

Courtesy of BMW OF NORTH AMERICA, INC.

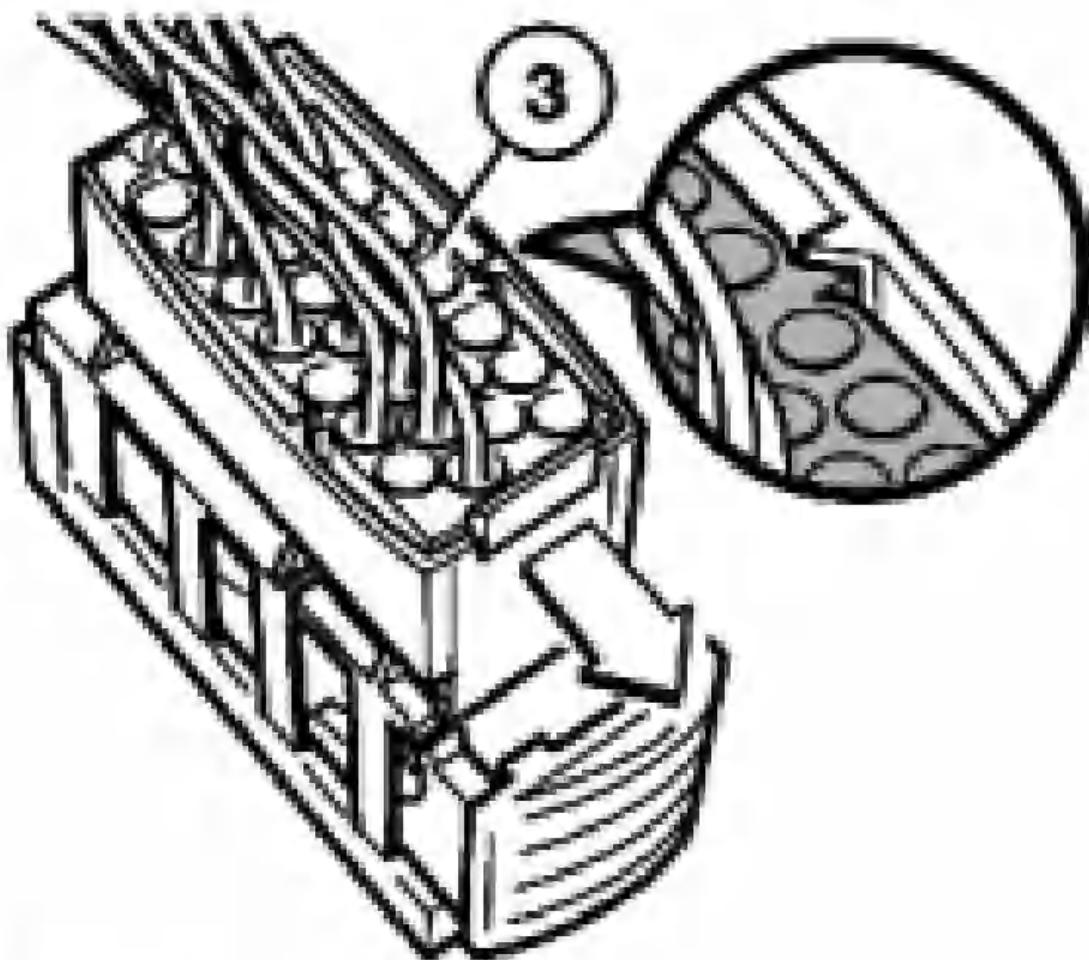
In-line Plug 30 Pin System D2.5

- Pull the outer section (1) slightly outward in the area of lock tabs (2).
- Simultaneously, slide the inner connector section (3) in the direction of the arrow to the unlocked position.
- Use the appropriate sized spring contact and remove connector from housing.



G03388958

[Fig. 26: Identifying In-Line Plug Outer Section](#)
Courtesy of BMW OF NORTH AMERICA, INC.



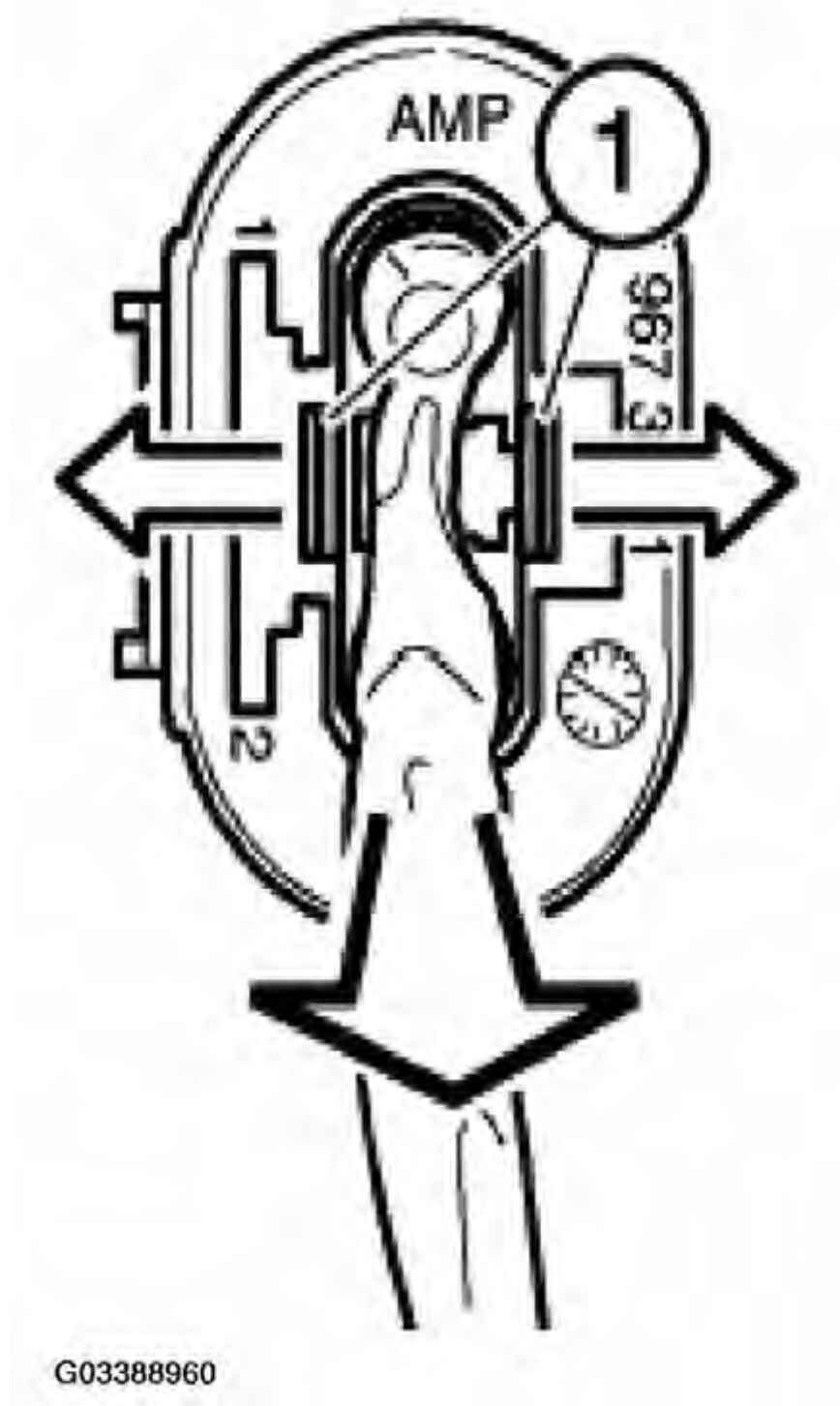
G03388959

Fig. 27: View Of Inner Section Of In-Line Plug
 Courtesy of BMW OF NORTH AMERICA, INC.

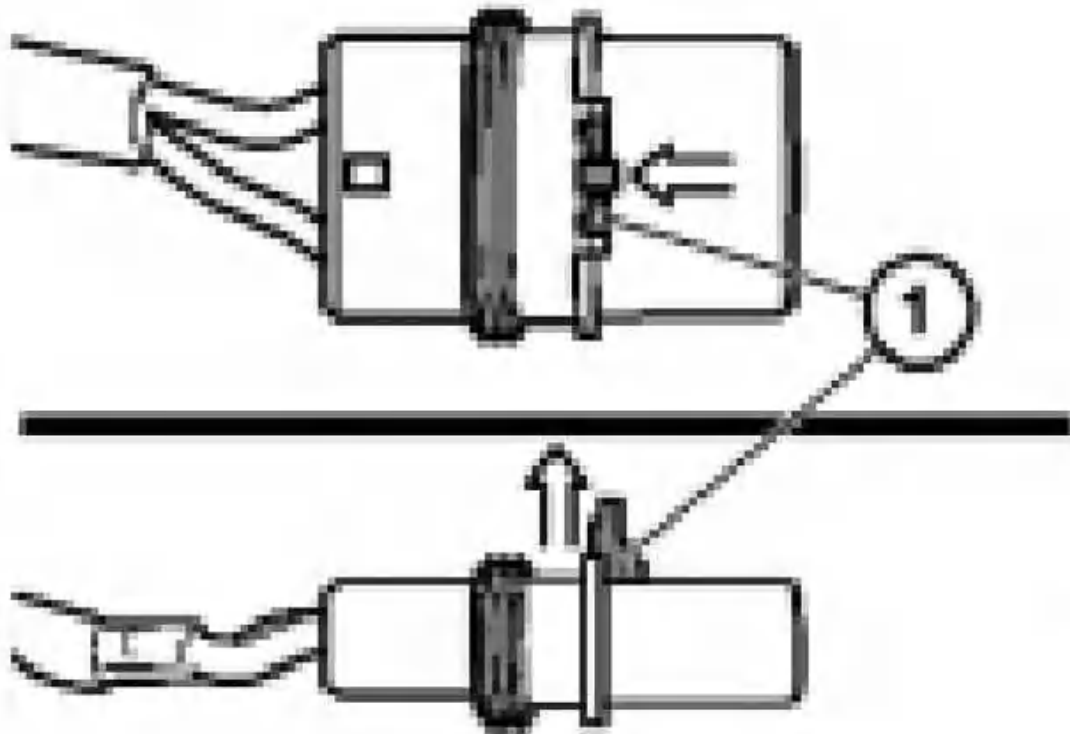
PLUG SYSTEM JPT/MDK/DFK

In-line plug 2 Pin System JPT ELA

- Press lock (1) in direction of arrow and slide plug forward.
- Press lock (1) downward and slide out to one side.
- Unlock contact with special tool 61 1 136 and pull out cable (2) and contact towards rear.



[Fig. 28: Locating Lock For In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388961

[Fig. 29: View Of In-Line Plug Lock](#)

Courtesy of BMW OF NORTH AMERICA, INC.

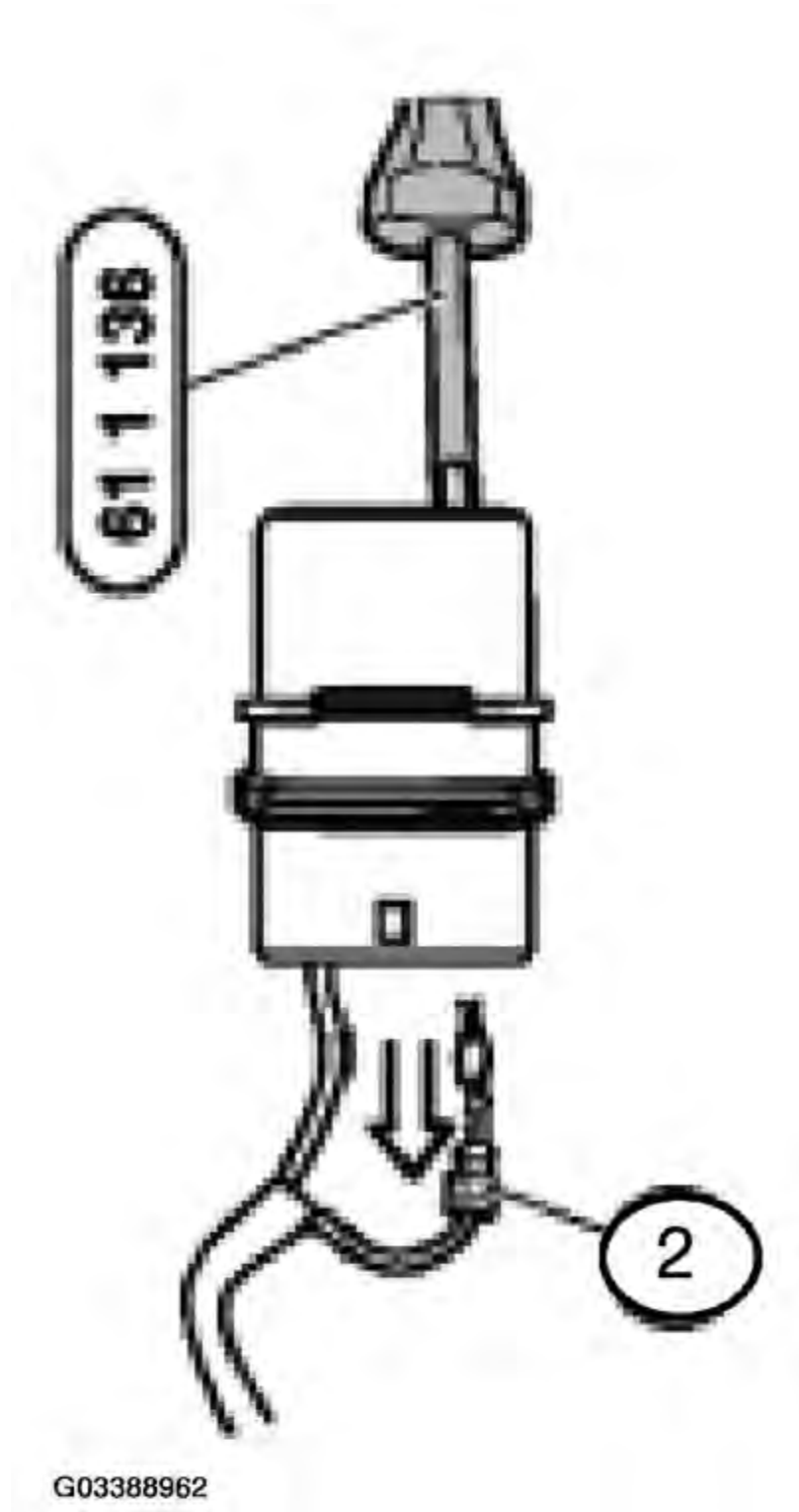
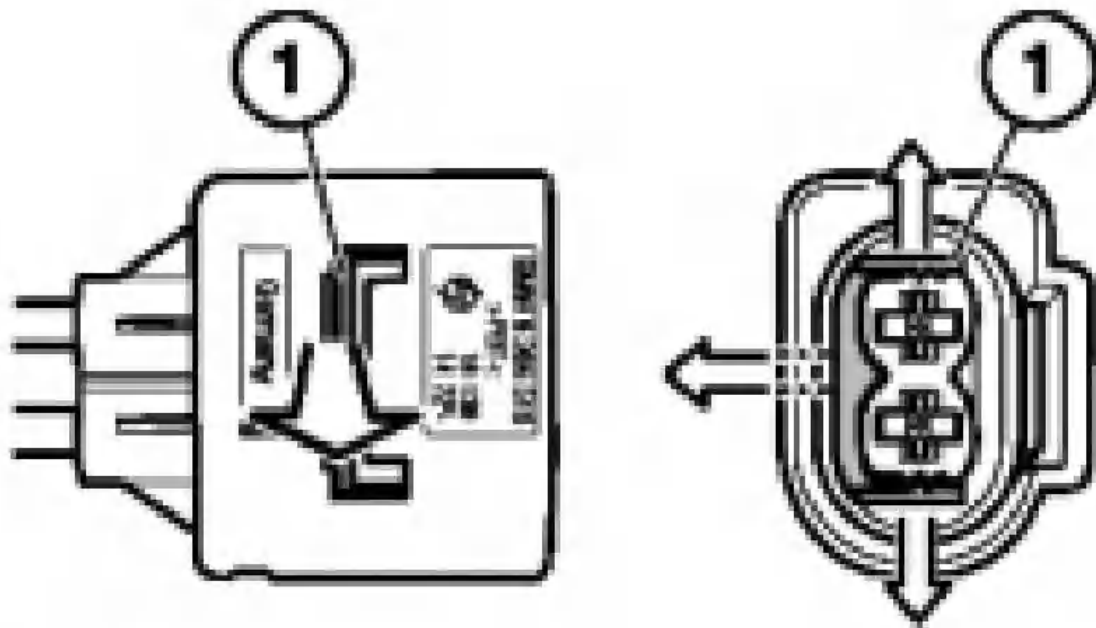


Fig. 30: Removing In-Line Plug Contact Using Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

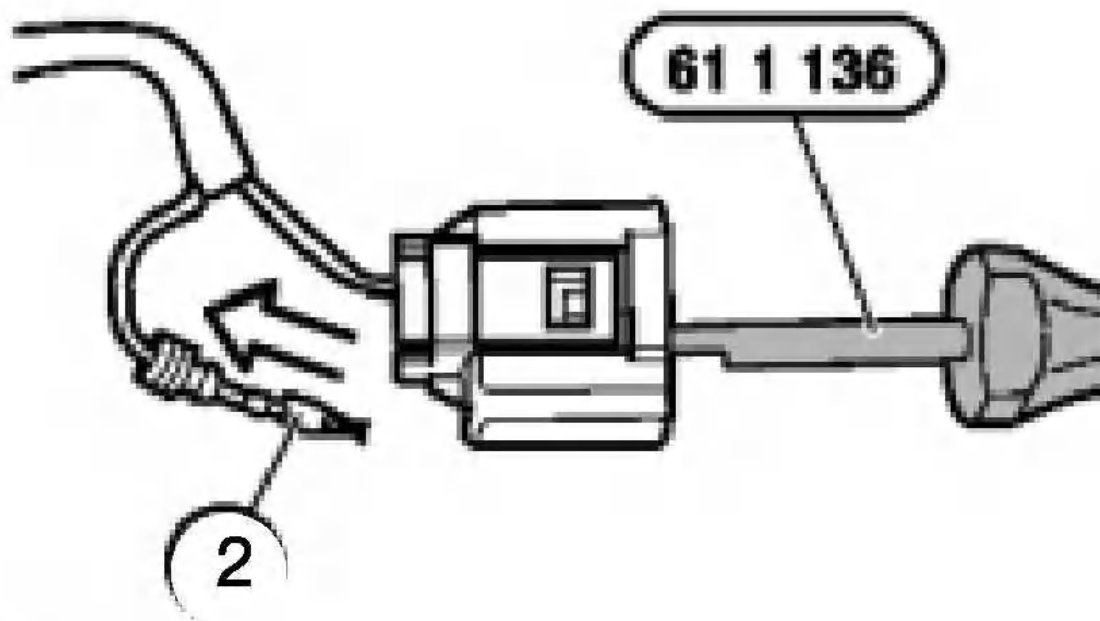
In-line plug 2 Pin System MDK 3 plus 2.8

- Unlock lock (1) on outside at arrester hook and slide out lock (1) side.
- Unlock contact with special tool 61 1 136 and pull out cable (2) and contact towards rear.



G03388963

[Fig. 31: View Of Lock On In-Line Plug Arrester Hook](#)
 Courtesy of BMW OF NORTH AMERICA, INC.



G03388964

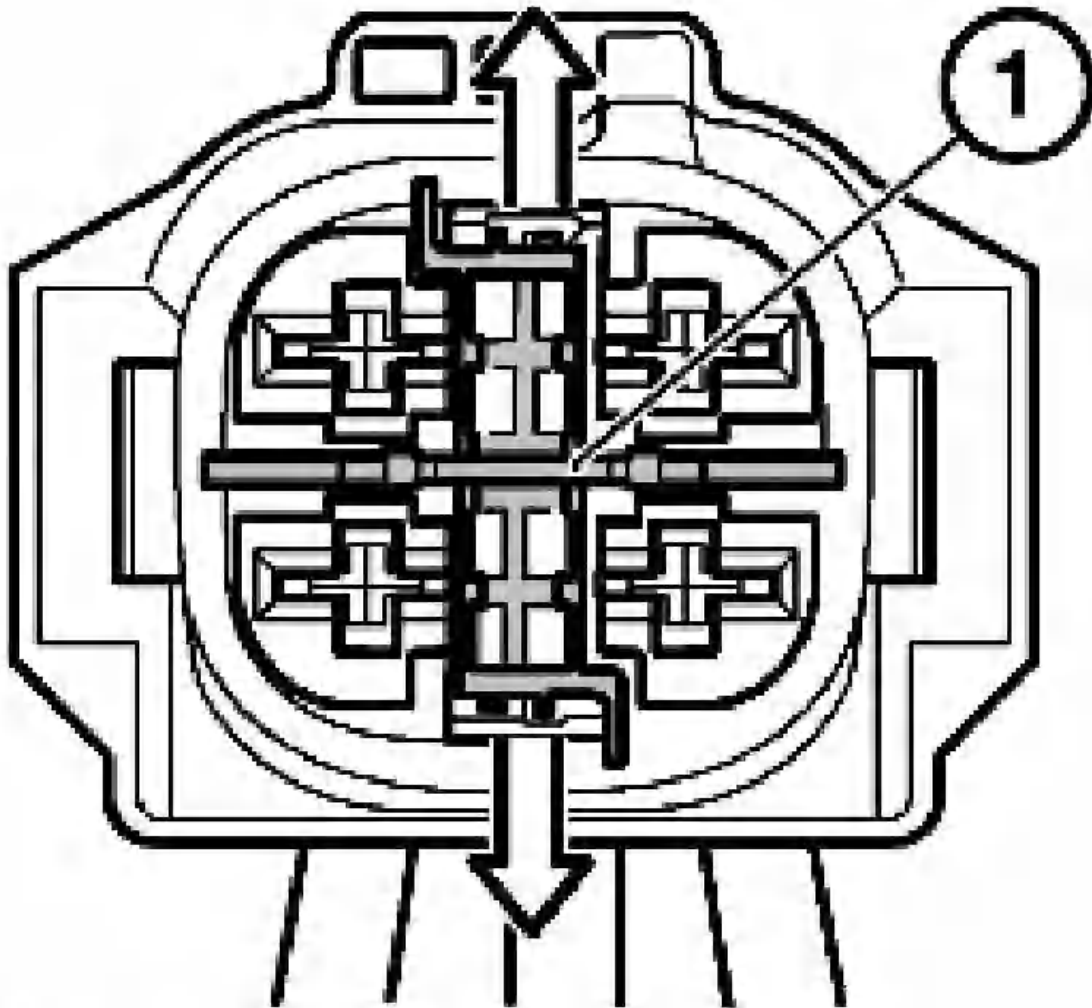
[Fig. 32: Identifying In-Line Plug And Special Tool](#)
 Courtesy of BMW OF NORTH AMERICA, INC.

In-line plug 4 Pin System DFK ELA

- Press arrester hook in direction of arrow and remove lock (1).
- Unlock contact with special tool 61 1 136 and pull cable and contact out towards rear.

Installation Instructions:

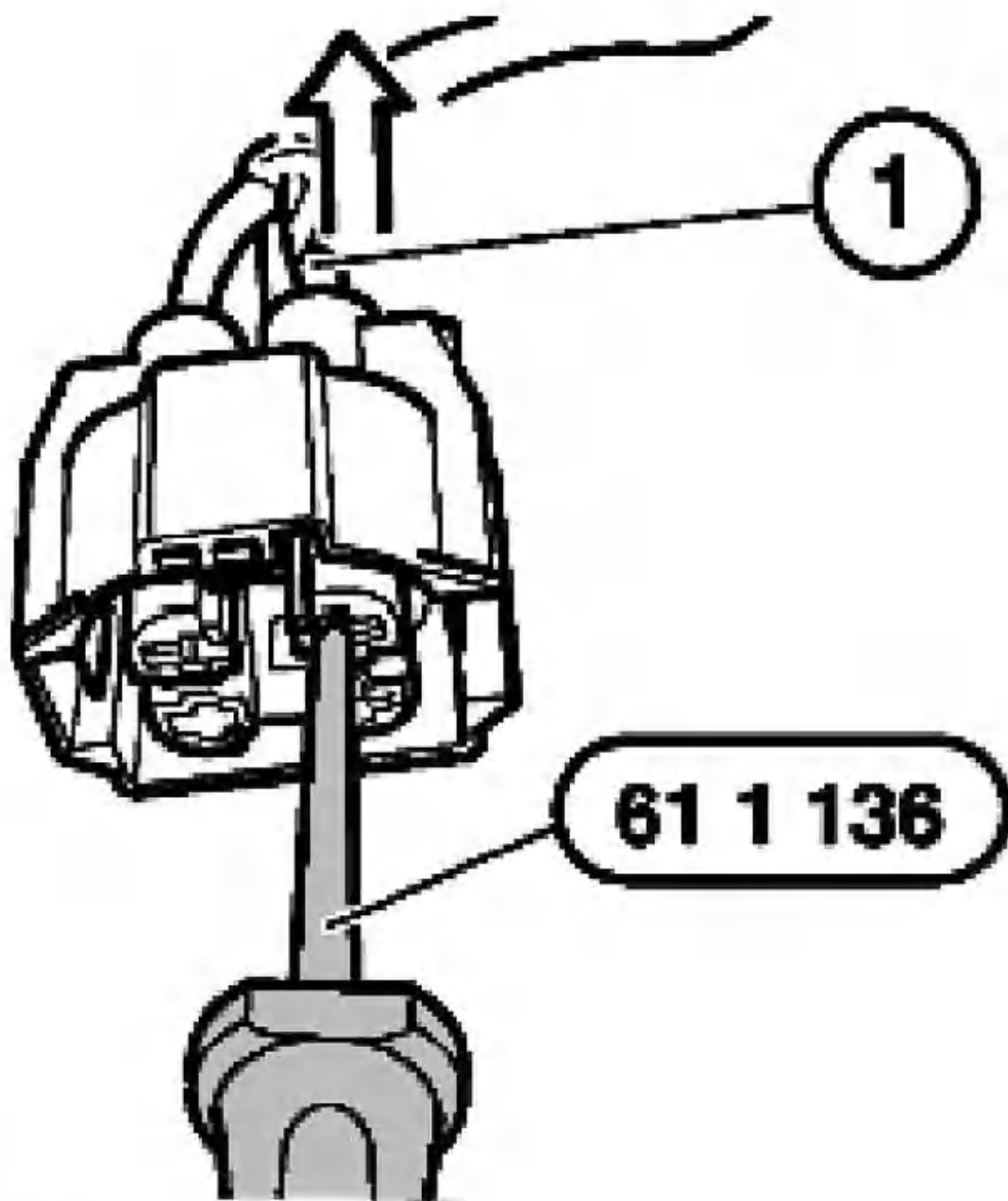
- If necessary, slide lock must also be unlocked with screw driver.



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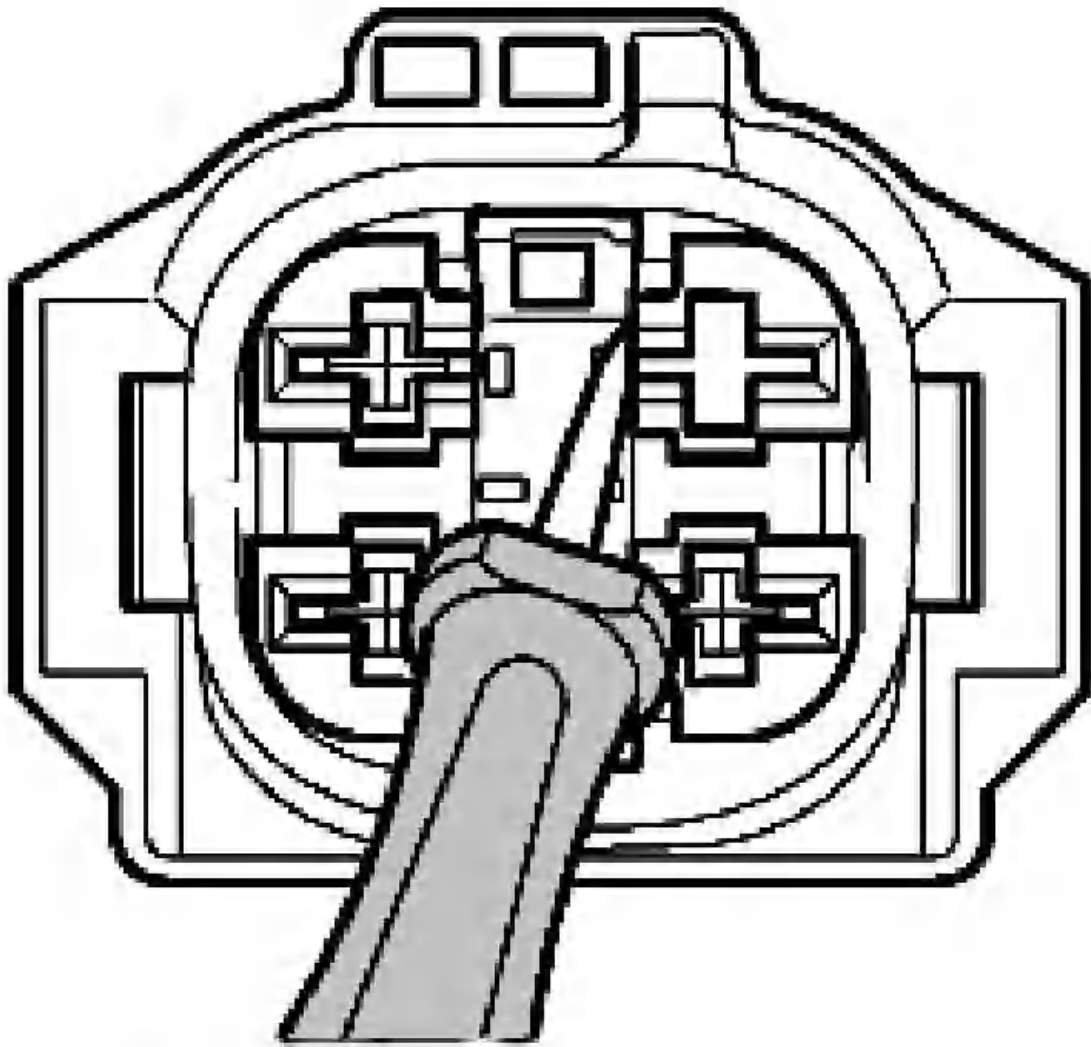
[Fig. 33: Locating Lock In Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.



G03388966

[Fig. 34: Unlocking With Special Tool \(61 1 136\)](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388967

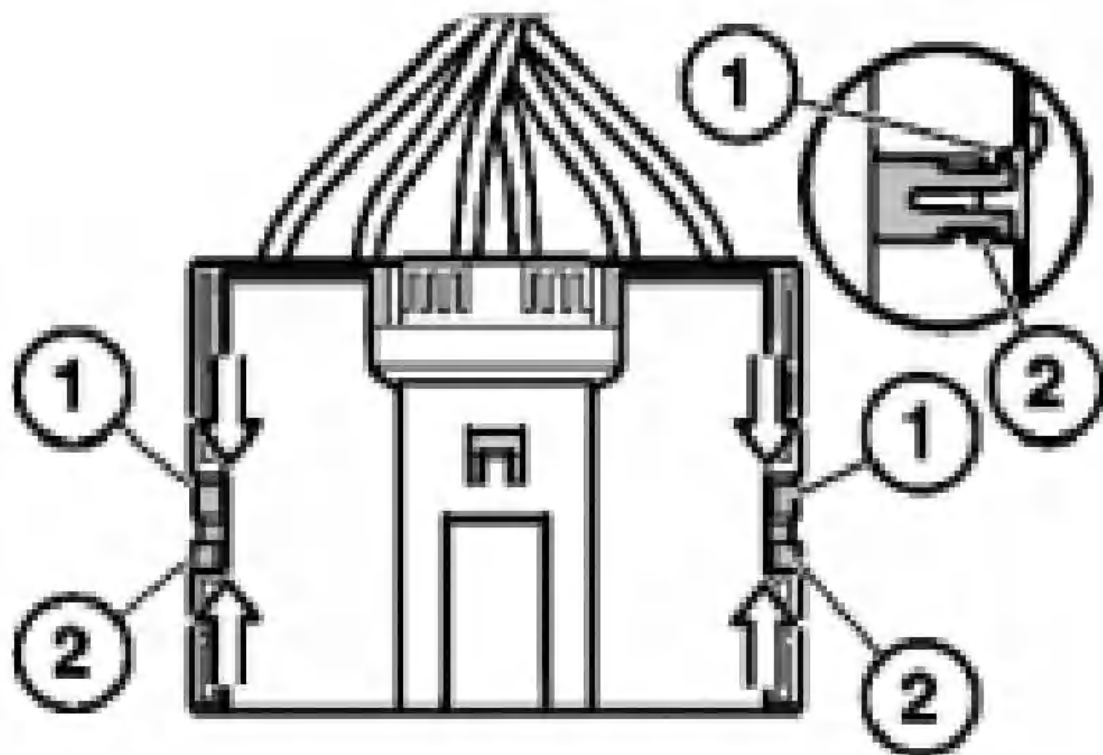
[Fig. 35: View Of Slide Lock In Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.

PLUG SYSTEM ELO/ELO POWER

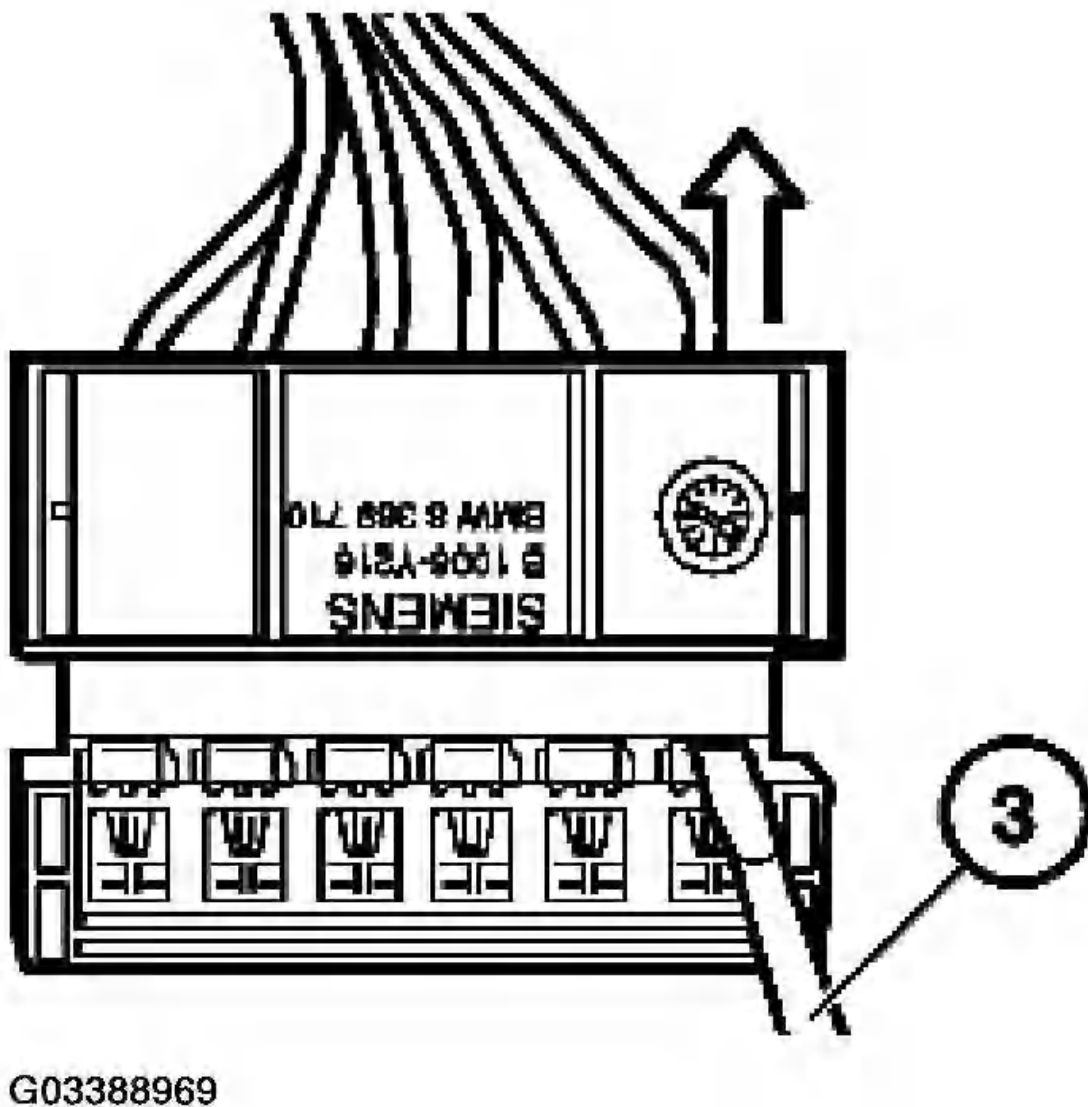
In-line Plug 3-,6 Pin System Elo-Power 2.8

- Press unlocking hook (1) in direction of arrow and disengage. Then unlock locking hook (2) and remove lock.
- Press down arrestor hook (3) with screwdriver and pull out cable with contact towards rear.



G03388968

[Fig. 36: Identifying Hook On In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.

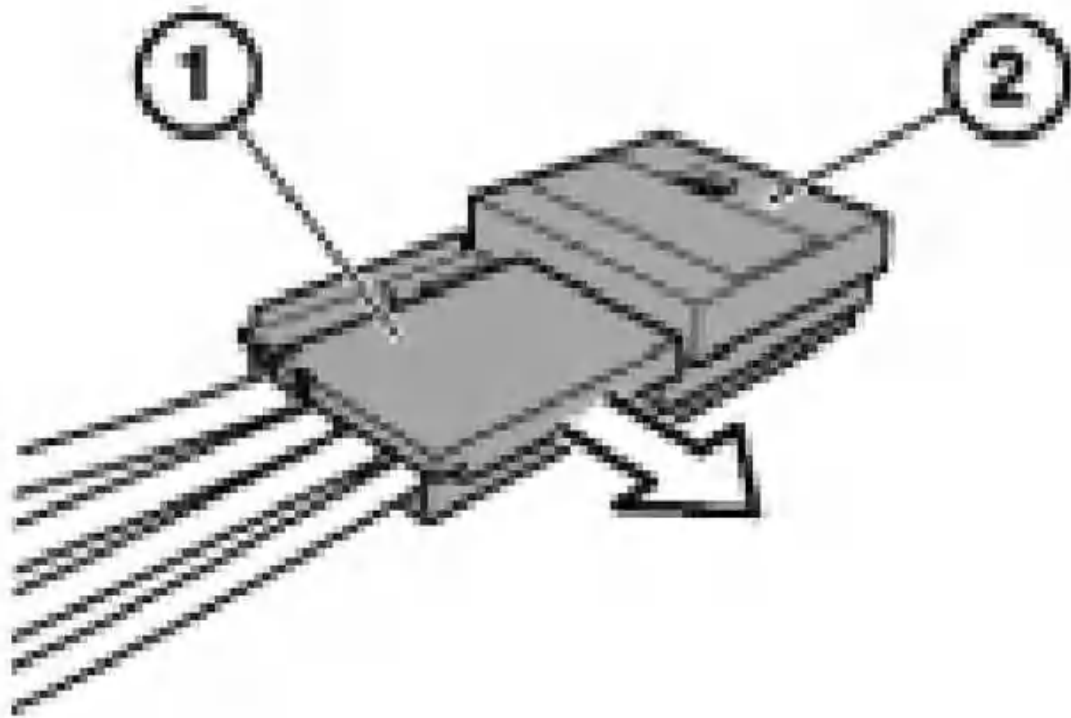


[Fig. 37: View Of In-Line Plug Arrester Hook](#)

Courtesy of BMW OF NORTH AMERICA, INC.

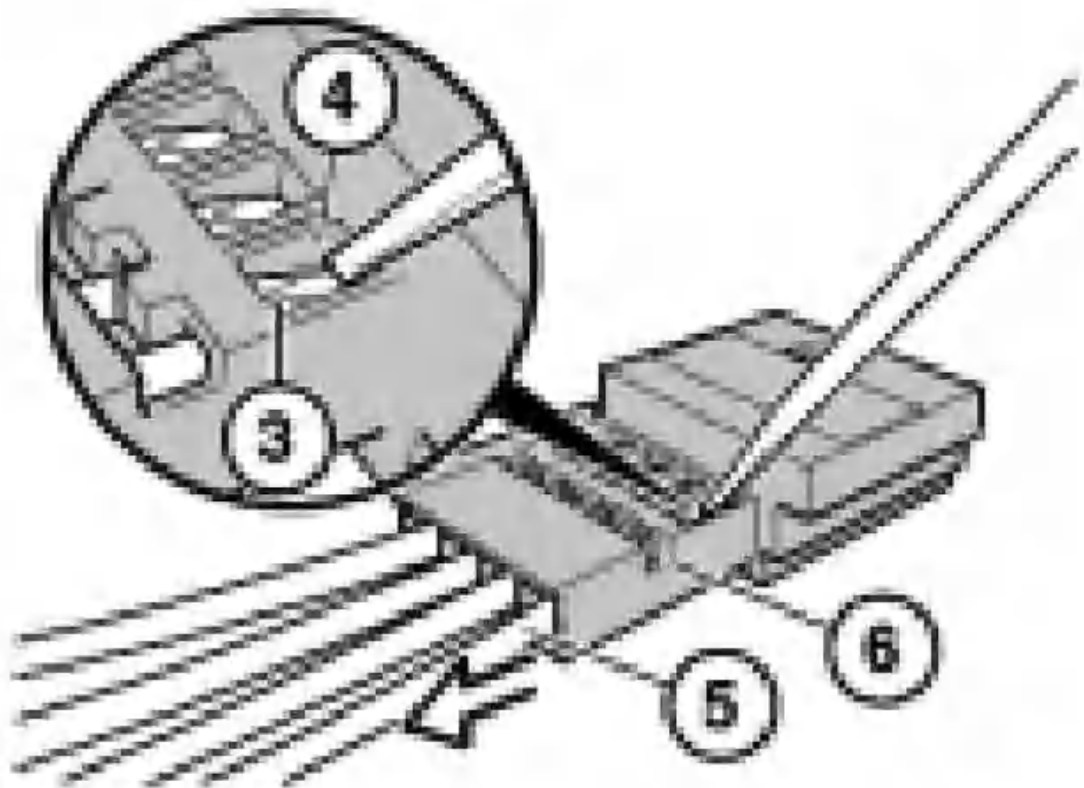
In-line plug 4-,10 Pin System Elo

- Slide connector lock (1) off of main connector body.
- Push the lock tab of the connector being removed down (3) with pin or small screwdriver in the primary lock slot (4) and pull the wire out (5) to the secondary lock position (6).
- Push the lock tab down again in the secondary lock position and remove wire completely.



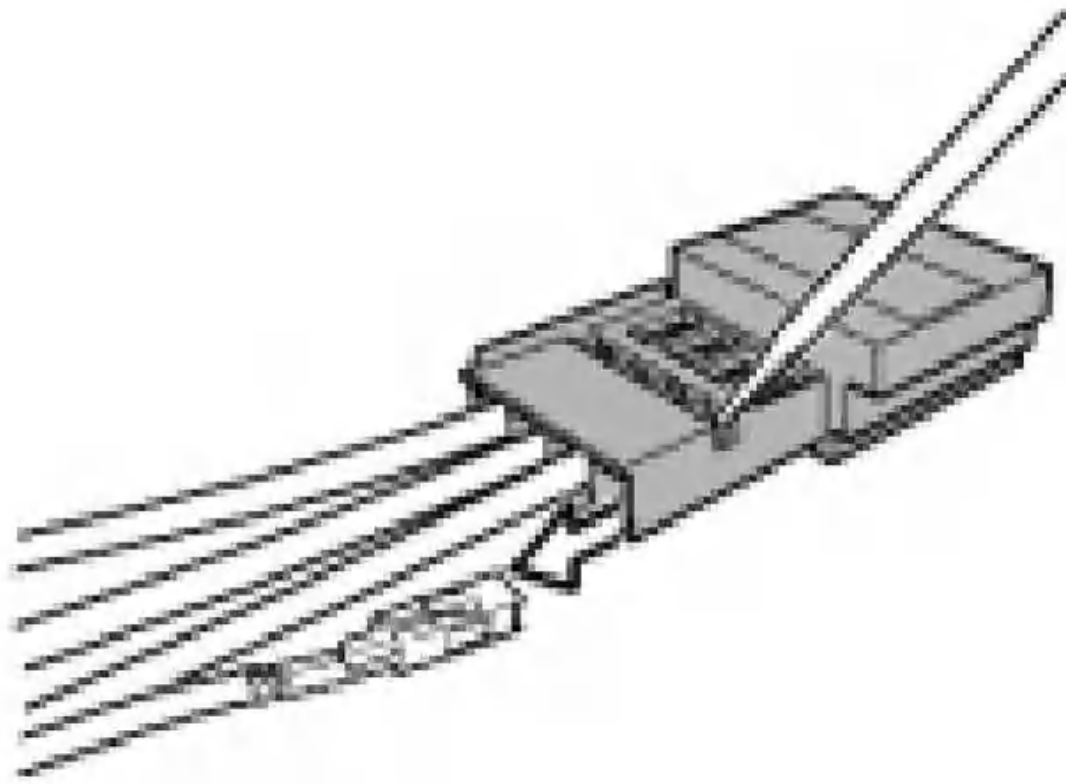
G03388970

[Fig. 38: Locating Connector Lock For In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388971

[Fig. 39: Identifying In-Line Plug Lock Tab](#)
Courtesy of BMW OF NORTH AMERICA, INC.



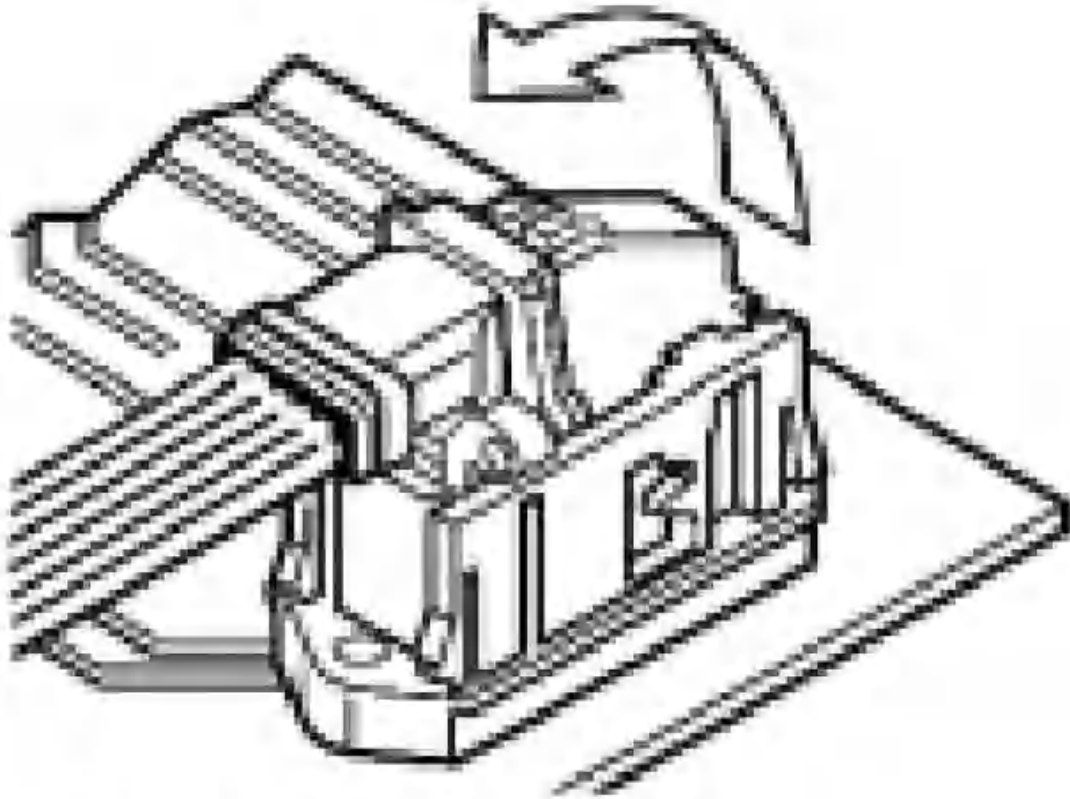
G03388972

[Fig. 40: View Of In-Line Plug 4-, 10 Pin System Elo](#)

Courtesy of BMW OF NORTH AMERICA, INC.

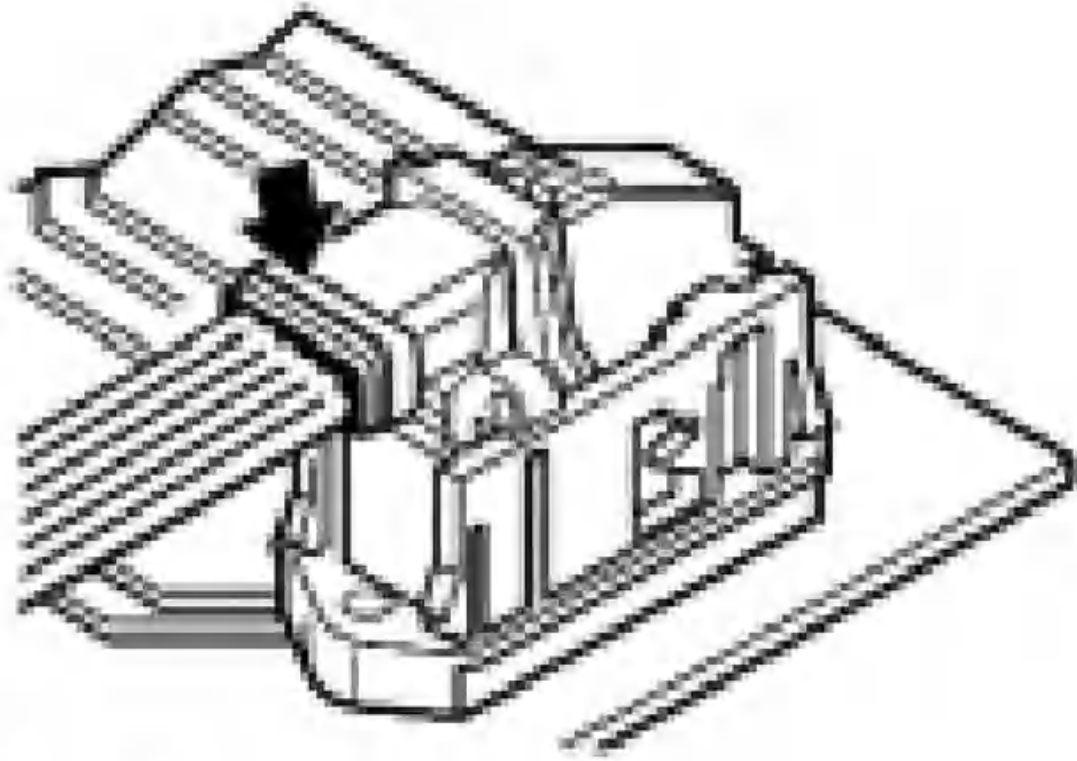
In-line Plug 6-,50 Pin System Elo

- Unlock lock ([Fig. 41](#)).
- Unfasten cable clip ([Fig. 42](#)).
- Slide connector lock (1) off of main connector body (2) ([Fig. 43](#)).
- Push the connector plate (3) out of connector shell using a small screwdriver through hole on end of connector body ([Fig. 44](#)).
- Push the lock tab of the connector being removed down (6) with pin or small screw driver in the primary lock slot (7) and pull the wire out to the secondary lock position (8) ([Fig. 45](#)).
- Push the lock tab down again in the secondary lock position and remove wire completely ([Fig. 46](#)).



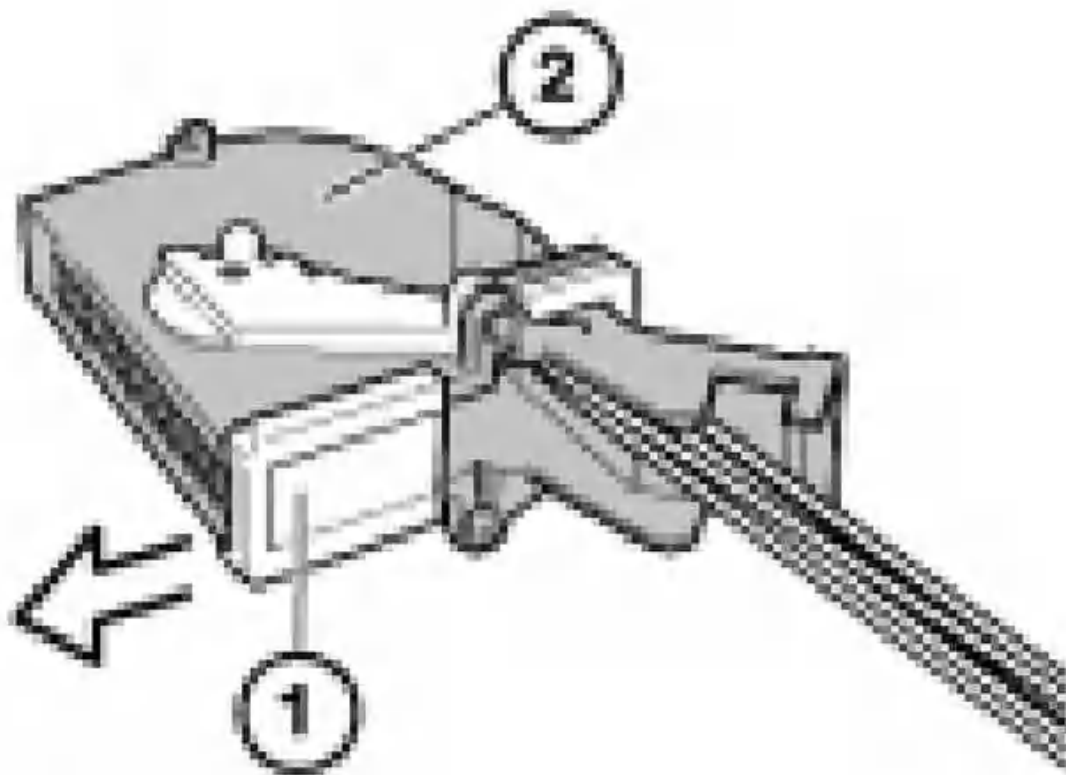
G03388973

[Fig. 41: Identifying Lock On In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



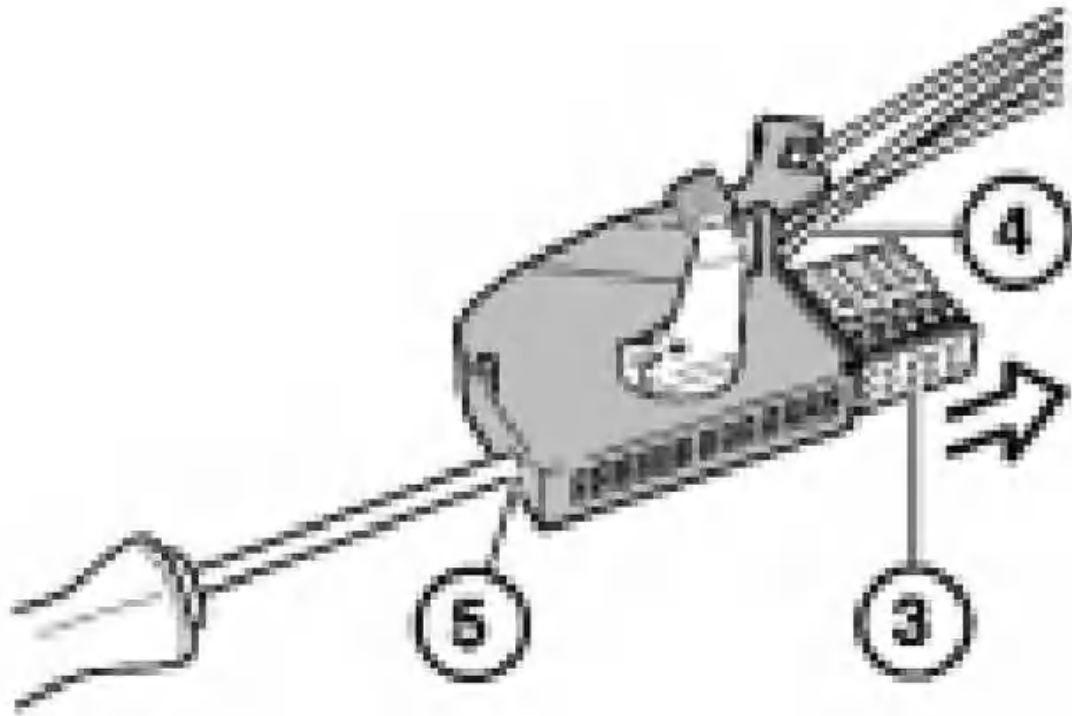
G03388974

[Fig. 42: View Of Clip On In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



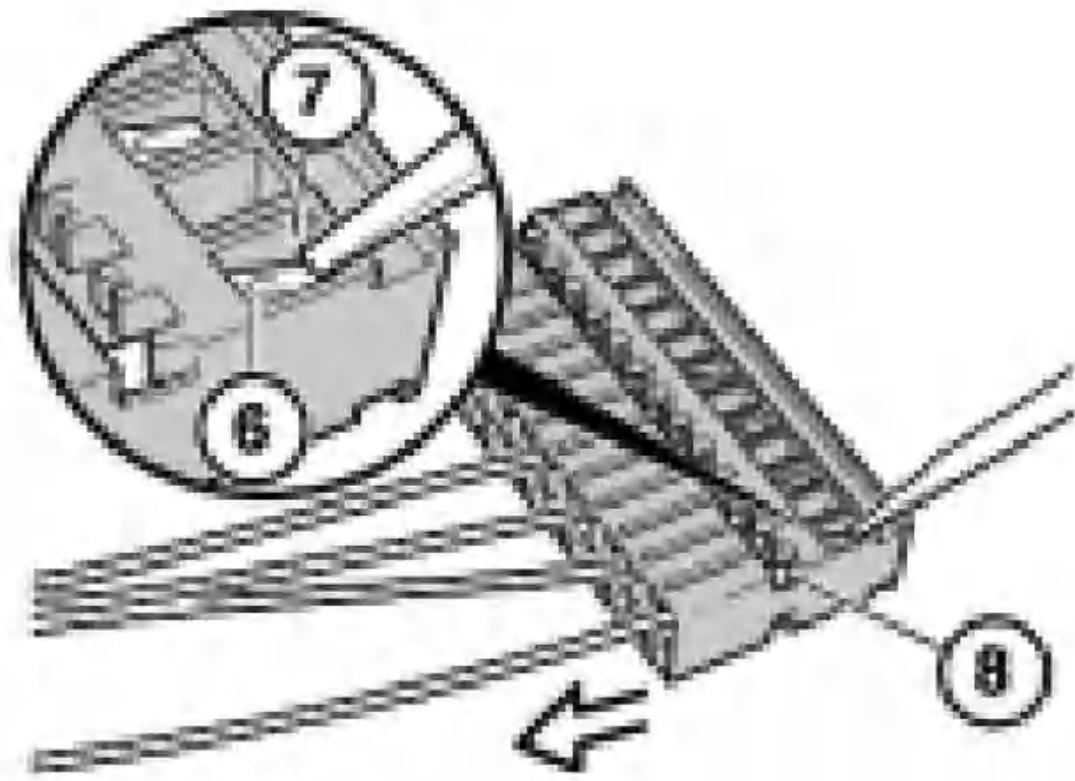
G03388975

[Fig. 43: Removing Connector Lock From In-Line](#)
Courtesy of BMW OF NORTH AMERICA, INC.



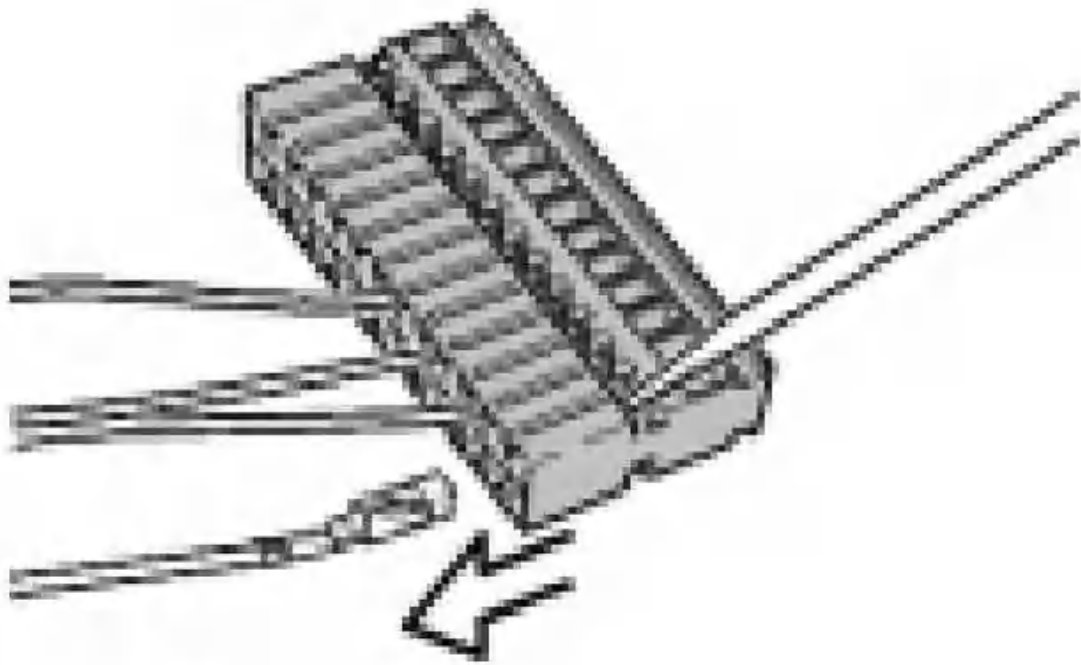
G03388976

[Fig. 44: Removing Connector Plate From In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388977

[Fig. 45: Removing Wire From Secondary Lock Position](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388978

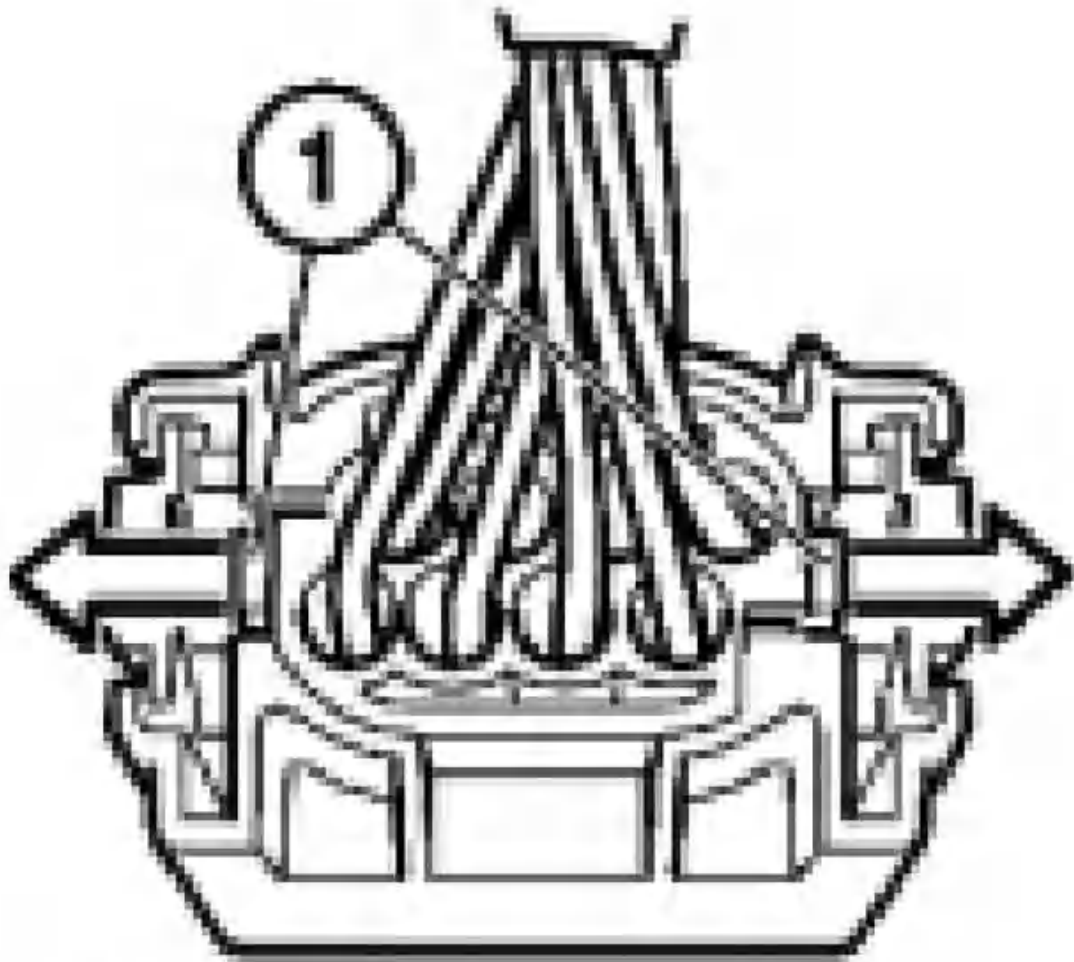
[Fig. 46: Removing Wire Using Screwdriver](#)

Courtesy of BMW OF NORTH AMERICA, INC.

PLUG SYSTEM MQS/MPQ

In-line Plug 6-,8 Pin System MQS

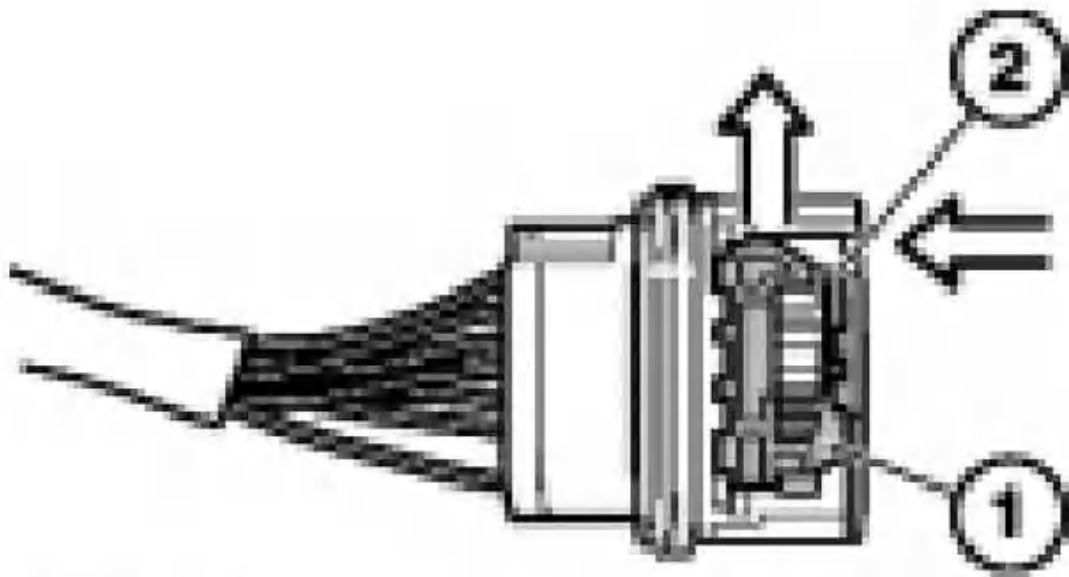
- Press lock (1) in direction of arrow and slide plug forward.
- Press locking hook (2) downward and slide lock (1) out.
- Press down arrester hook (3) with screwdriver and pull out cable with contact towards rear.



G03388979

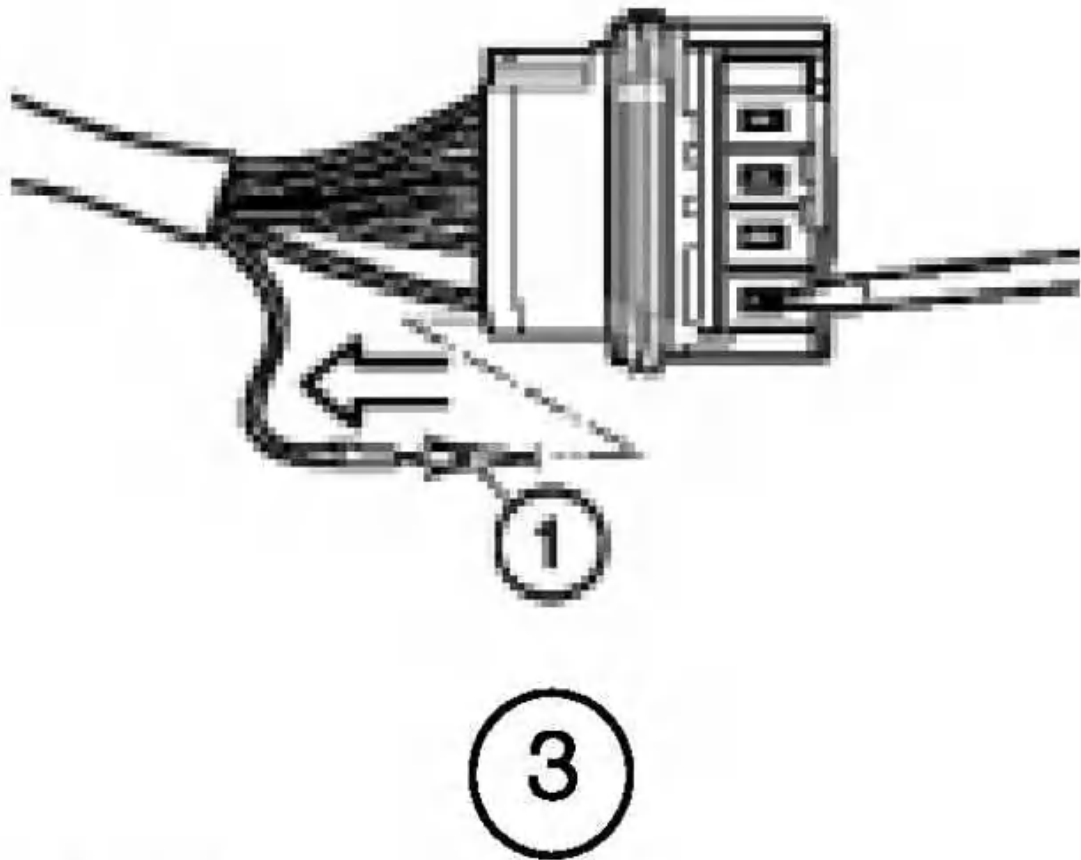
[Fig. 47: View Of In-Line Plug Lock](#)

Courtesy of BMW OF NORTH AMERICA, INC.



G03388980

[Fig. 48: Identifying In-Line Plug Locking Hook](#)
Courtesy of BMW OF NORTH AMERICA, INC.

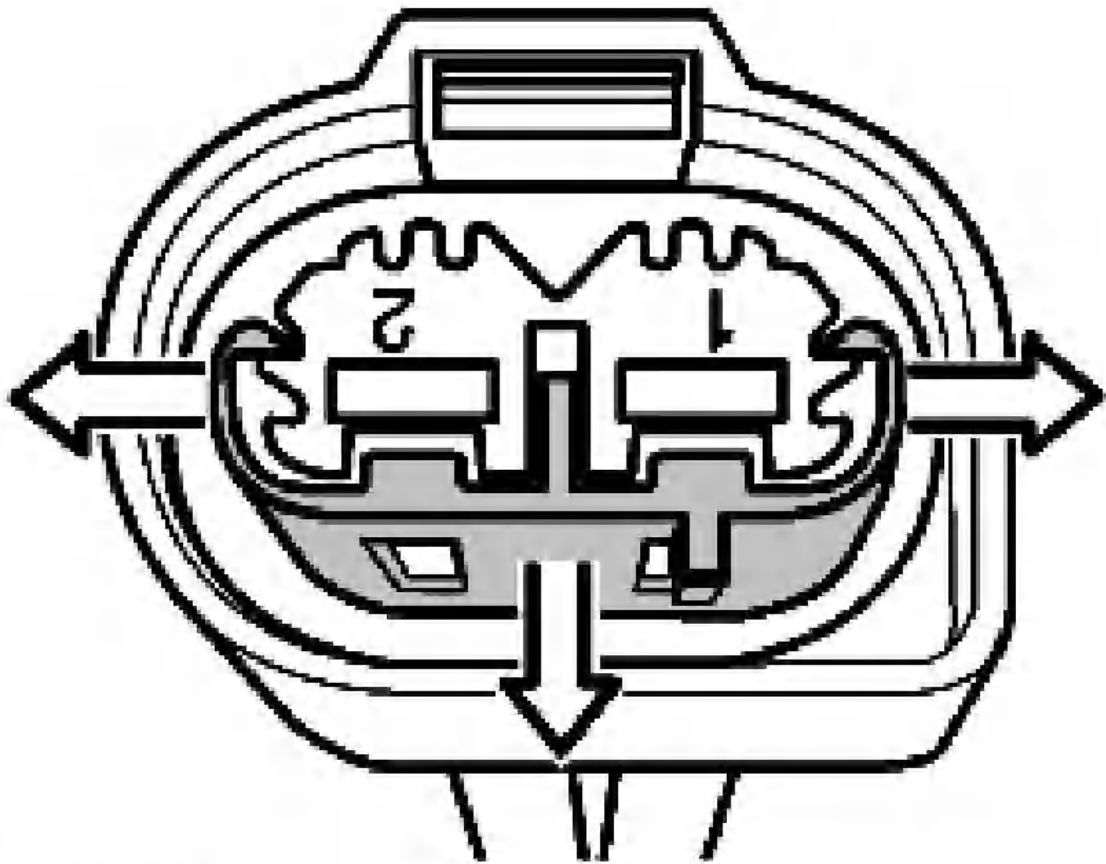


G03388981

[Fig. 49: Removing Cable From In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.

In-line Plug 2 Pin System MPQ 2.8

- Press catch on outside in direction of arrow and remove towards top.
- Press down arrestor hook (1) with screwdriver and pull out cable and contact (2) towards rear.



G03388982

[Fig. 50: Identifying Catch On In-Line Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.

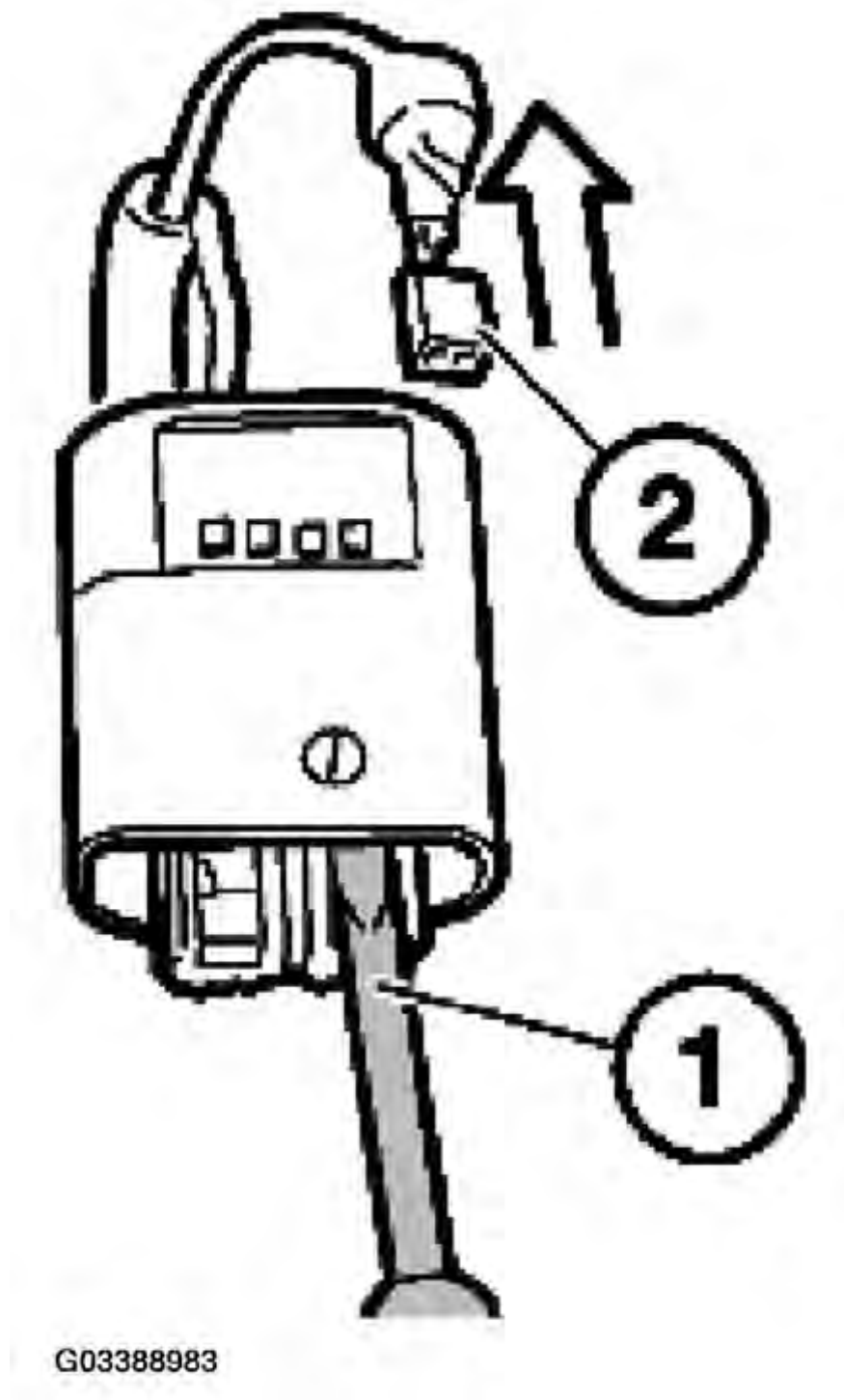
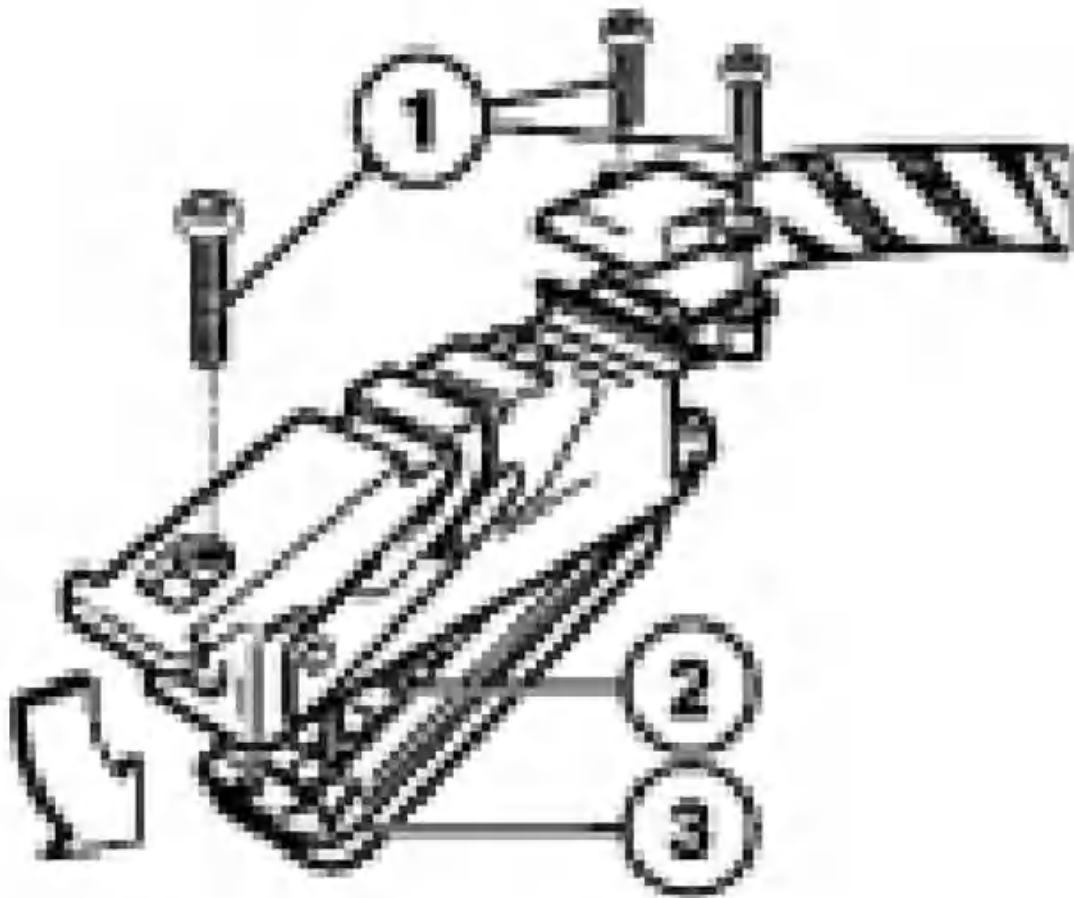


Fig. 51: Removing Cable And Contact From In-Line Plug
Courtesy of BMW OF NORTH AMERICA, INC.

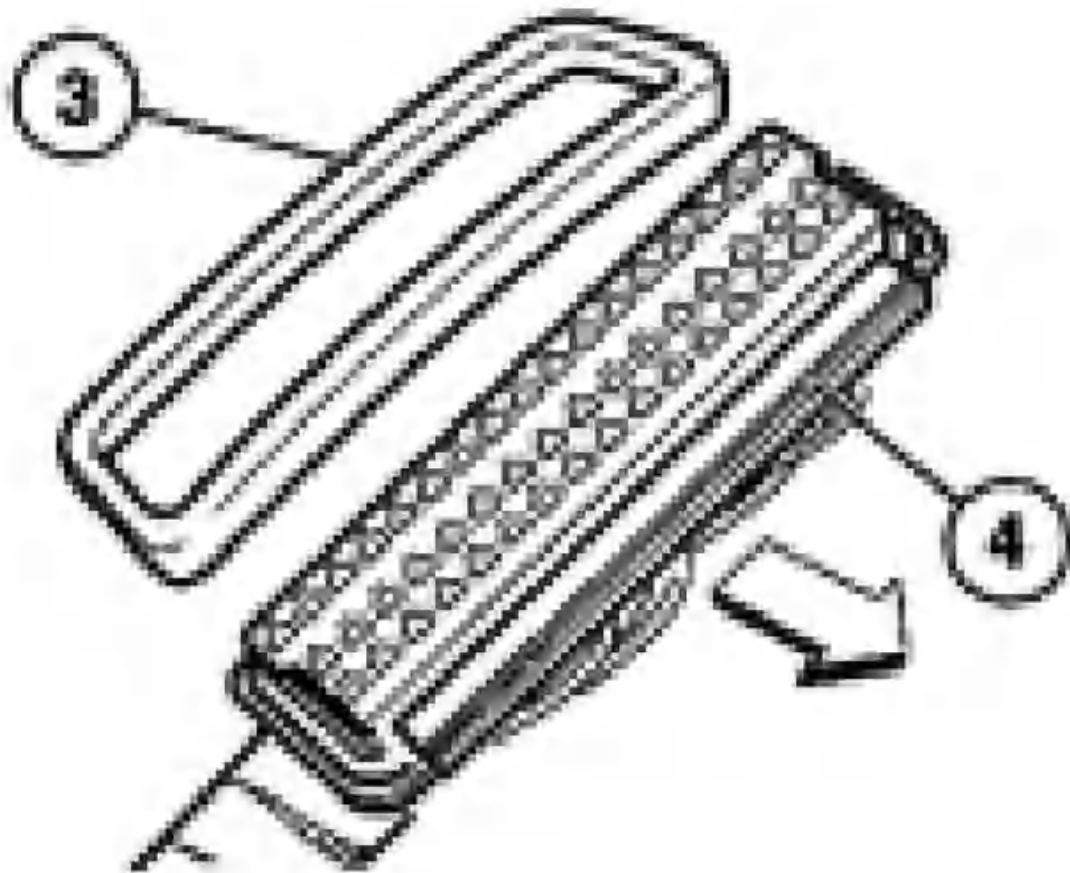
Control Unit Plug 25-, 35-, 55-,83-,88 Pin

- Remove phillips head screws (1) from connector. Gently pivot the connector plate (2) with seal (3) out of the connector shell.
- Remove seal (3) and pull connector plate lock (4) out of locked position.
- Using the appropriate sized spring contact and remove connector (5) from housing.



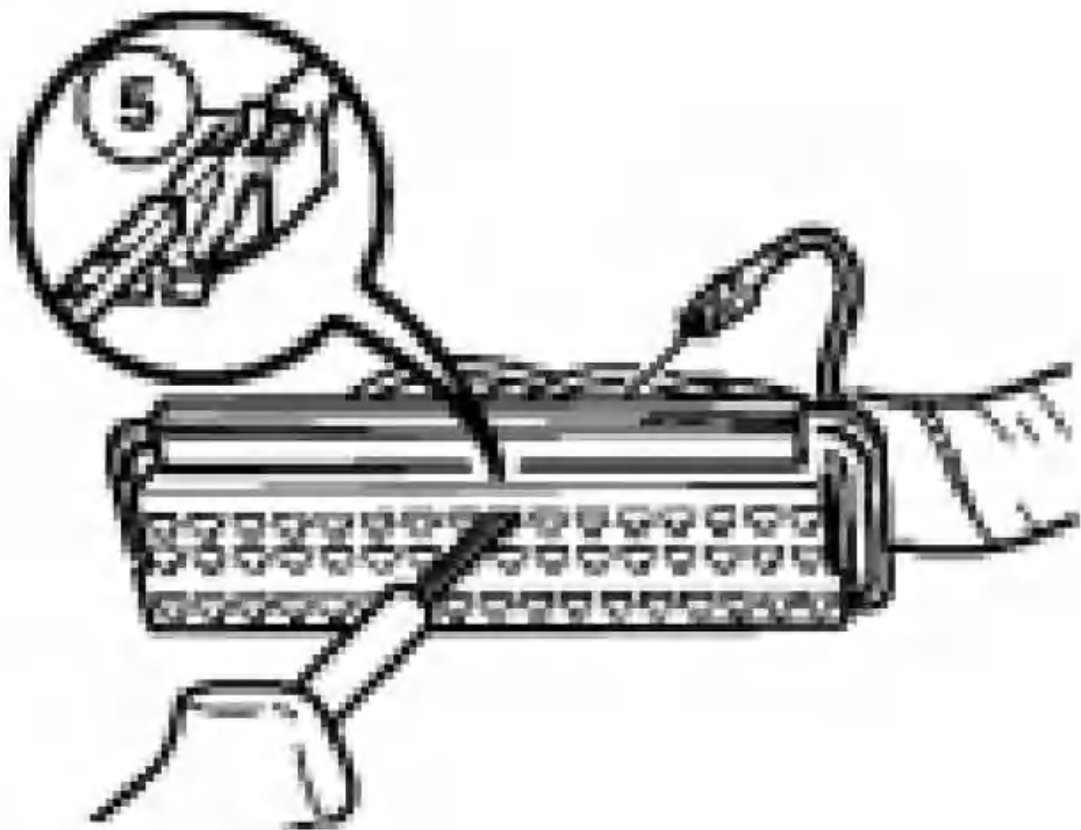
G03388984

[Fig. 52: Identifying Control Unit Plug Retaining Screws](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388985

[Fig. 53: View Of Control Unit Plug Seal](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388986

Fig. 54: Removing Connector From Control Unit Plug

Courtesy of BMW OF NORTH AMERICA, INC.

In-line Plug 24 Pin Hybrid System MQS/MPQ

Manufactured by AMP : The following contact types without strand sealing can be fitted in the plug housings:

MQS (Micro Quadlock System).

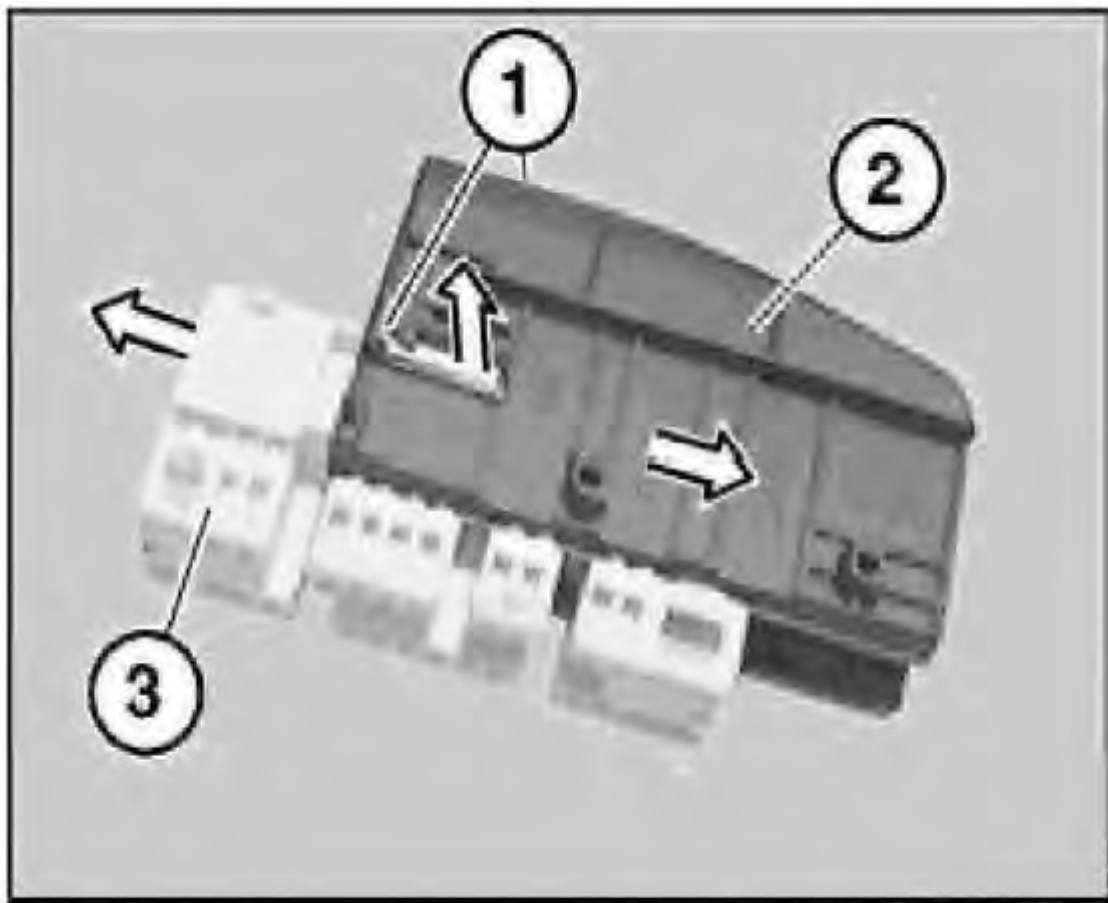
MPQ, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

Socket Housing

- Press locks (1) on cap (2) upwards on both sides.
- Detach cap from contact carrier (3).

NOTE: Detaching the cap releases the secondary lock of the socket contacts.

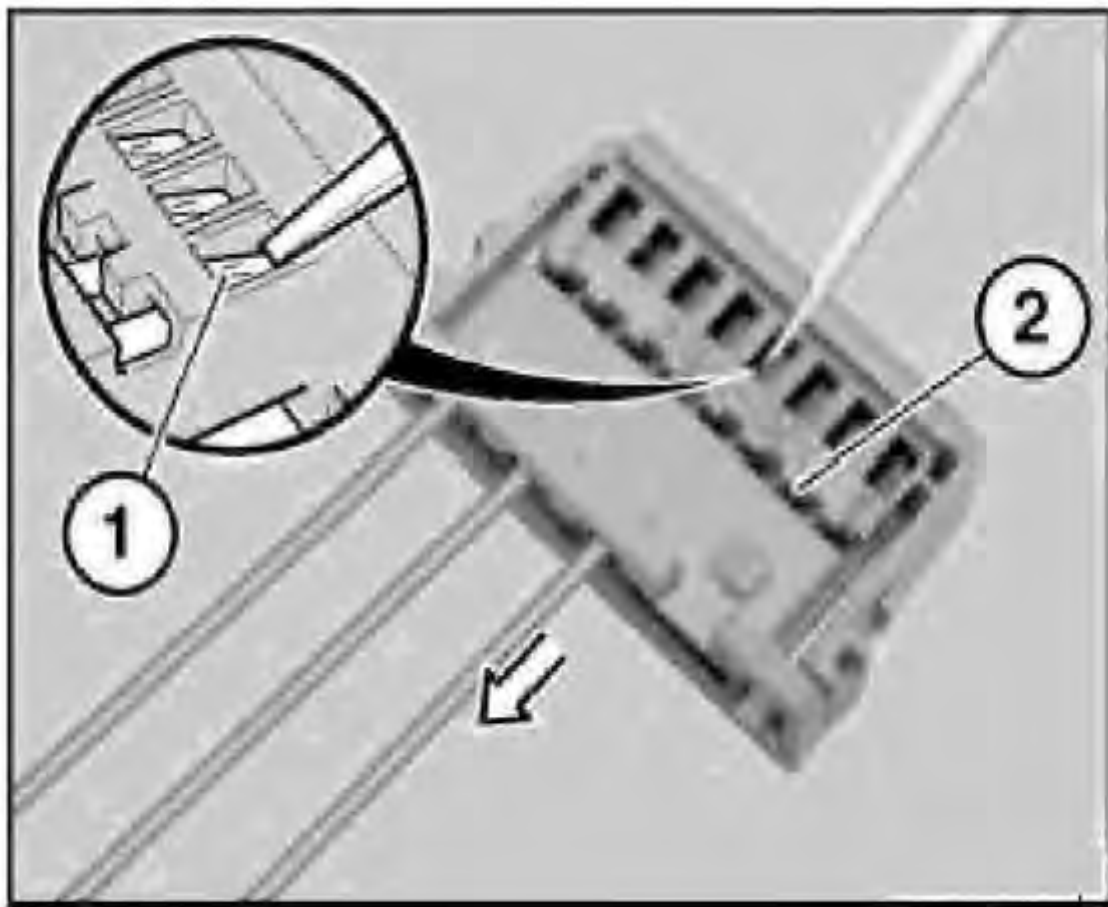


G03388987

[Fig. 55: Removing Cap From Contact Carrier](#)

Courtesy of BMW OF NORTH AMERICA, INC.

- Hold down retaining hook (1) of socket contact carrier with a small screwdriver.
- Pull wire with socket contact in direction of arrow as far as secondary lock (2). ([Fig. 56](#))
- Hold down retaining hook in secondary lock (1) again and pull cable with socket contact (2) completely out of contact carrier (3). ([Fig. 57](#))



G03388988

Fig. 56: View Of Retaining Hook In Secondary Lock

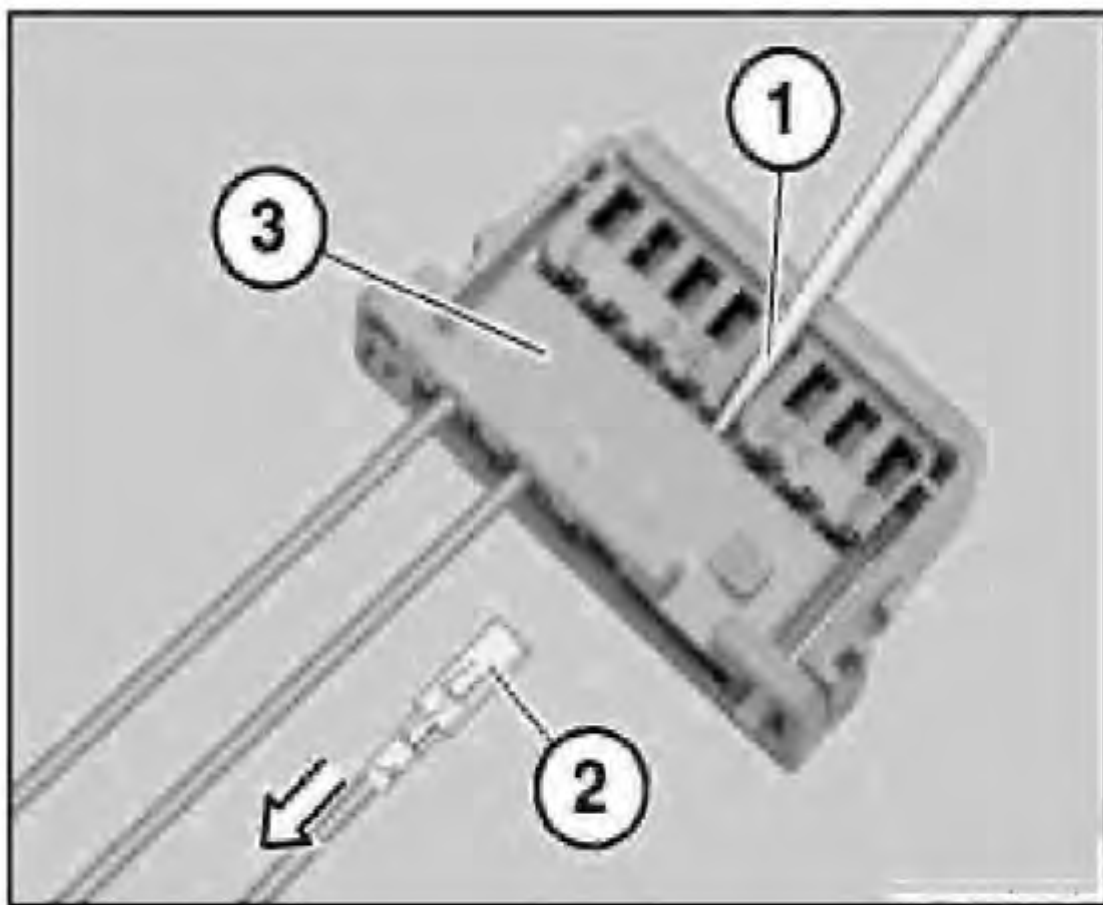
Courtesy of BMW OF NORTH AMERICA, INC.

Pin Housing

- Press locks (1) on cap (2) upwards on both sides.
- Detach cap from housing carrier (3)([Fig. 58](#)).

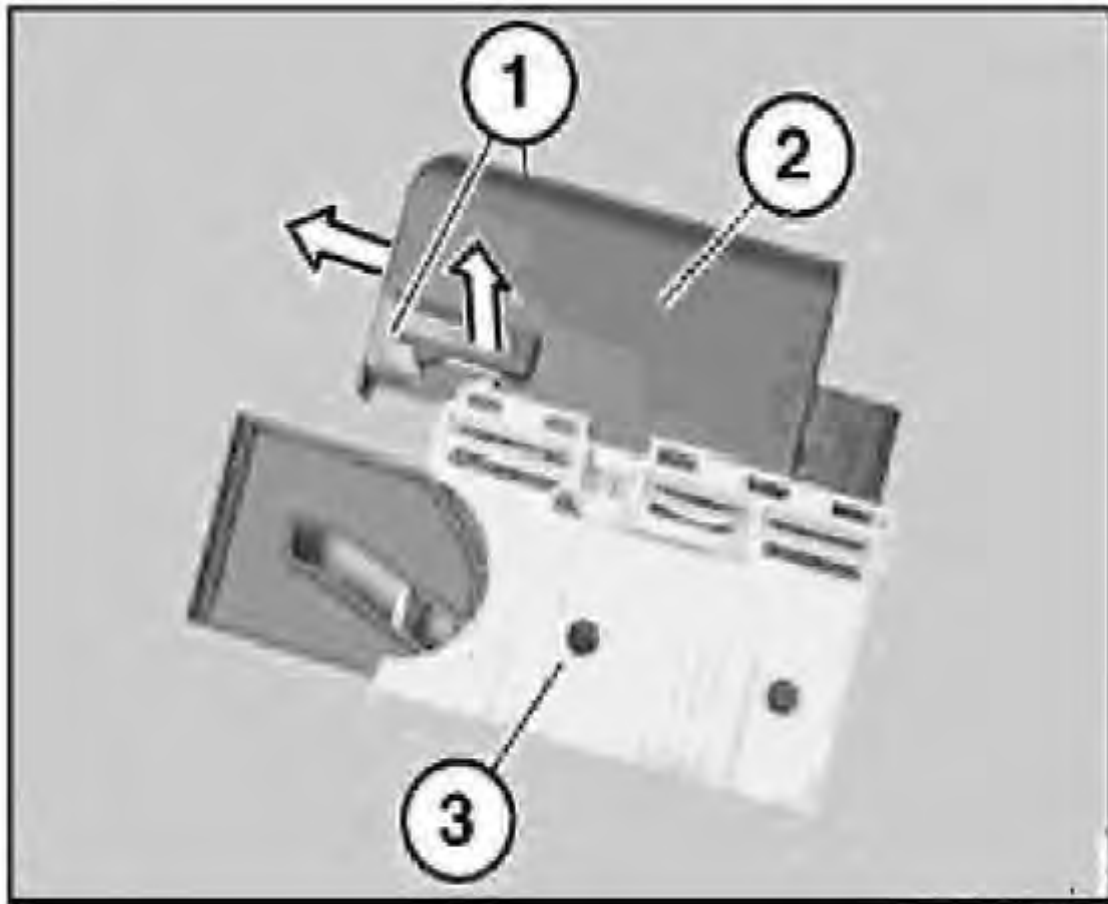
NOTE: Detaching the cap releases the secondary locks of the pin contacts in the contact carriers.

- Pull contact carrier (1) out of housing carrier (2) ([Fig. 59](#)).
- The pin contacts are pulled of a contact carrier as described under "Socket Housing".



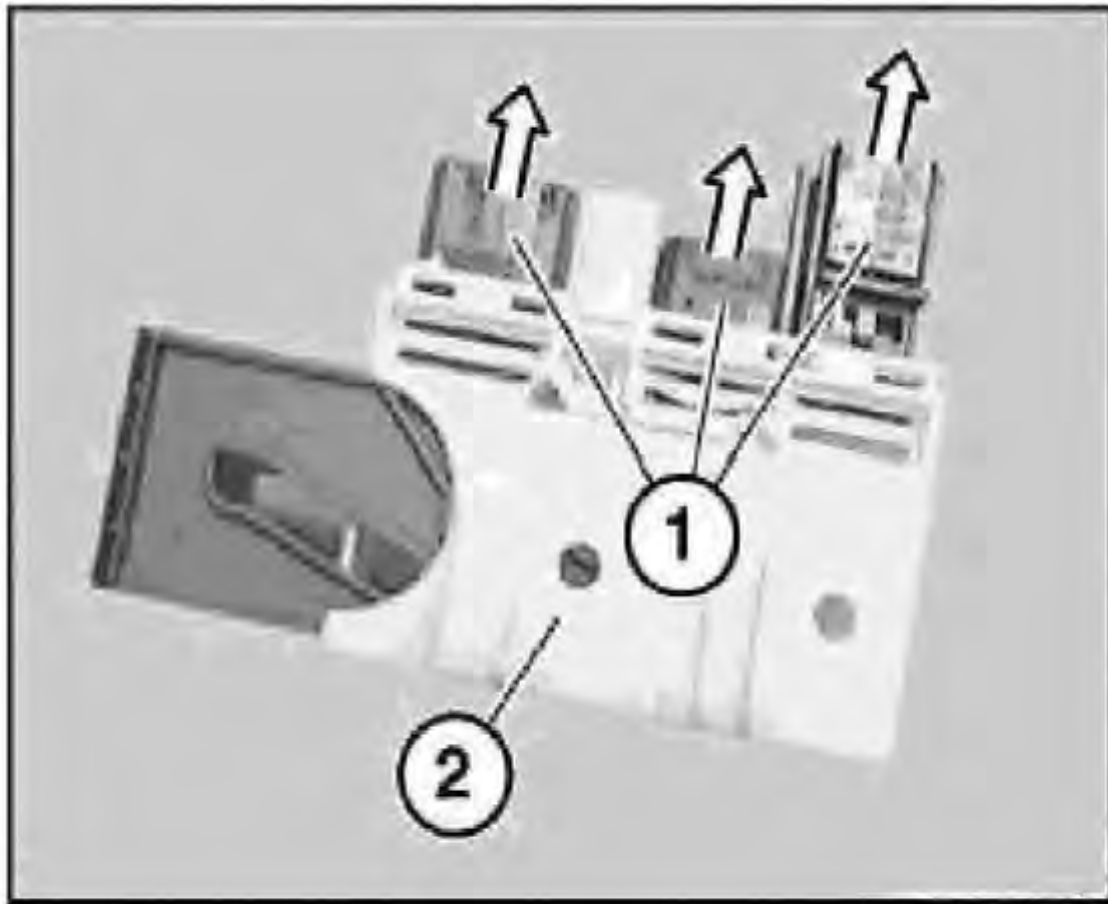
G03388989

[Fig. 57: Identifying Pin Housing Locks](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388990

[Fig. 58: Removing Cap From Pin Housing](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03388991

Fig. 59: Removing Contact Carrier From Housing

Courtesy of BMW OF NORTH AMERICA, INC.

Socket Housing 42-,43 Pin Hybrid Systems MQS/MPQ

Manufactured by AMP: The following contact types without strand sealing can be fitted in the socket housings:

MQS (Micro Quadlock System).

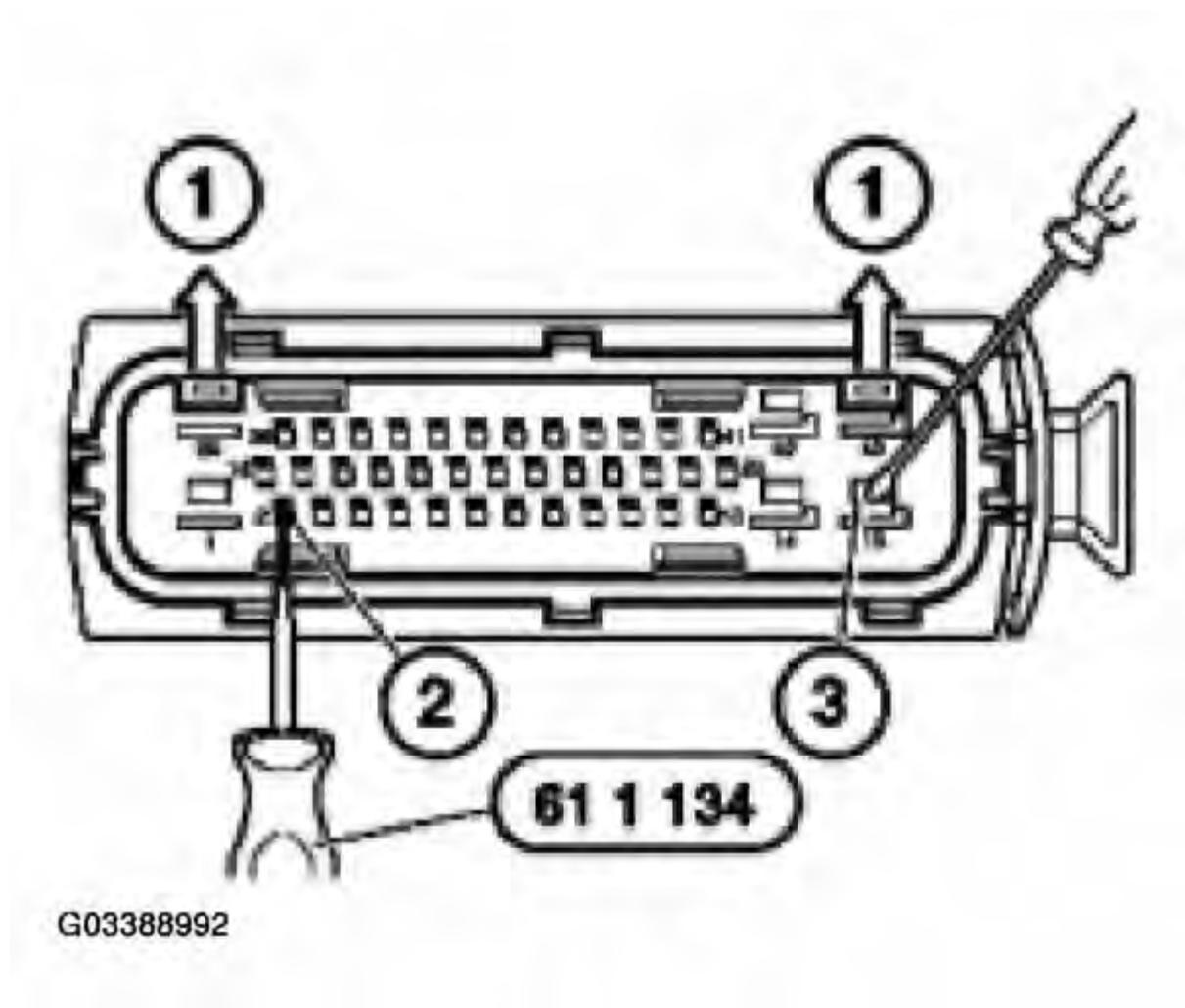
MPQ, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

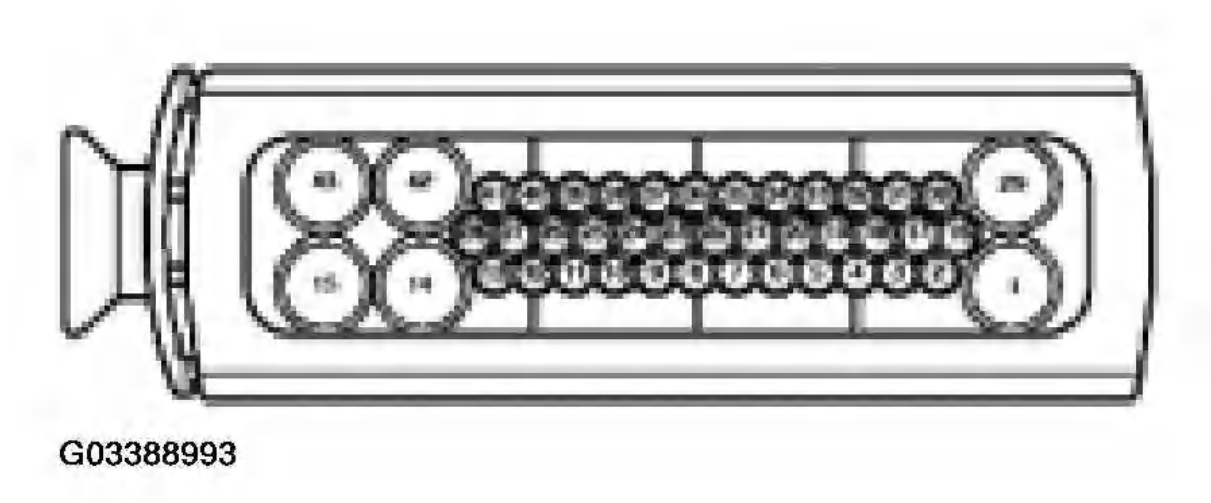
- Open secondary locks (1) on socket housing.
- Press back retaining hook of MQS contacts (2) with special tool 61 1 134 and pull out cable with contact.
- Press back retaining hook of MPQ contacts (3) with screwdriver or similar tool and pull out cable with contact.

Installation:

- Bend open retaining hook of contacts gently before inserting into plug housing.
- To install contacts, observe cavity numbers on reverse side of socket housing.



[Fig. 60: Identifying MQS Contact Retaining Hook](#)
 Courtesy of BMW OF NORTH AMERICA, INC.



[Fig. 61: Identifying Cavity Numbers On Socket Housing](#)
 Courtesy of BMW OF NORTH AMERICA, INC.

Socket Housing 2x27-, 2x27 Pin Hybrid System MQS/MPQ, Elo/Elo Power

Manufactured by Amp: The following contact types without strand sealing can be fitted in the socket housings:

MQS (Micro Quadlock System).

MQS, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

Manufactured by Siemens: The following contact types without strand sealing can be fitted in the socket housings:

Elo (electronic contact).

Elo-Power 2.8 mm wide (electronic contact for heavy loads).

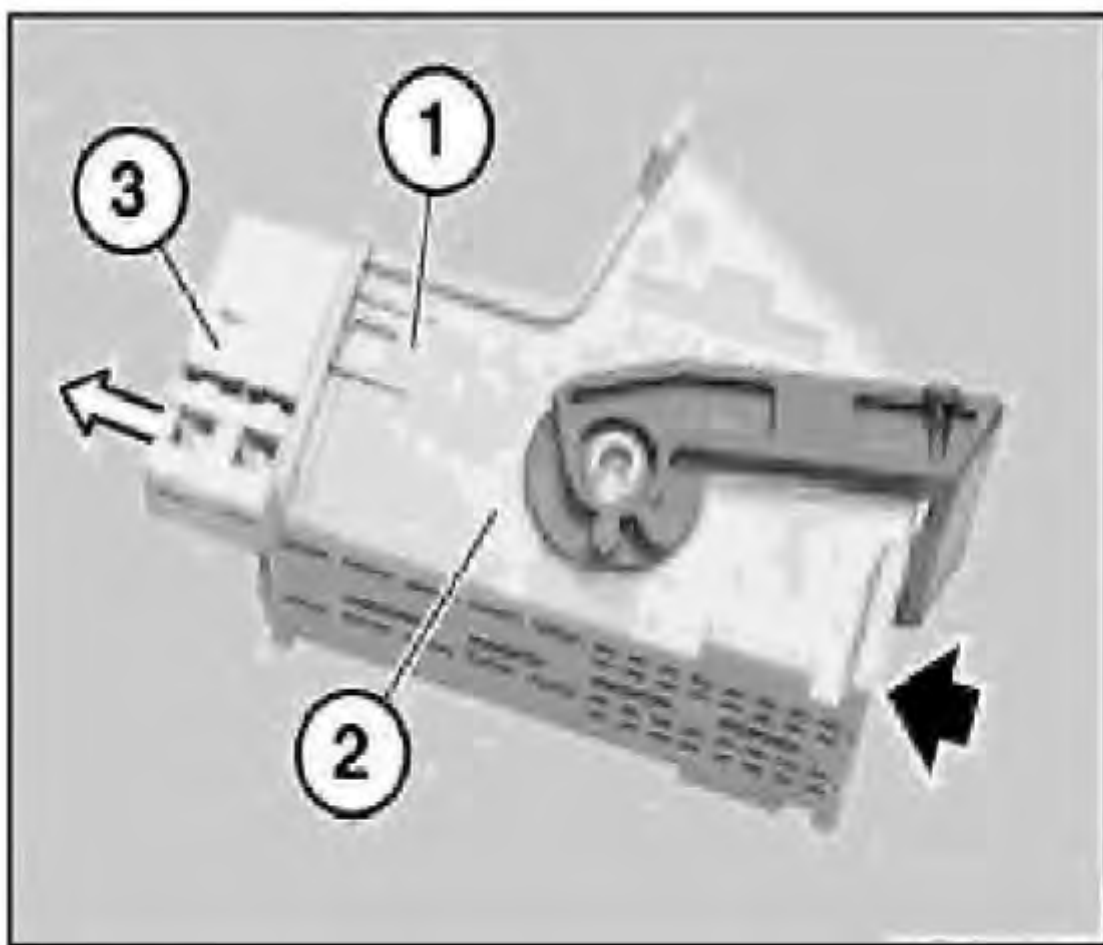
Elo-Power 5.2 mm wide (electronic contact for heavy loads).

- Raise lock (1) on housing (2).
- Push contact carrier (3) from rear out of housing.

NOTE: The second carrier is pushed out in the same way.

Pushing out the contact carrier releases the secondary locks of the secondary contacts.

Procedure for removing contacts are same as for other Elo/Elo-Power Systems, refer to the appropriate article.



G03388994

Fig. 62: Removing Contact Carrier From Rear Housing

Courtesy of BMW OF NORTH AMERICA, INC.

In-line Plug 30 Pin Hybrid System MQS/MPQ

Manufactured by AMP: The following contact types without strand sealing can be fitted in the plug housings:

MQS (Micro Quadlock System).

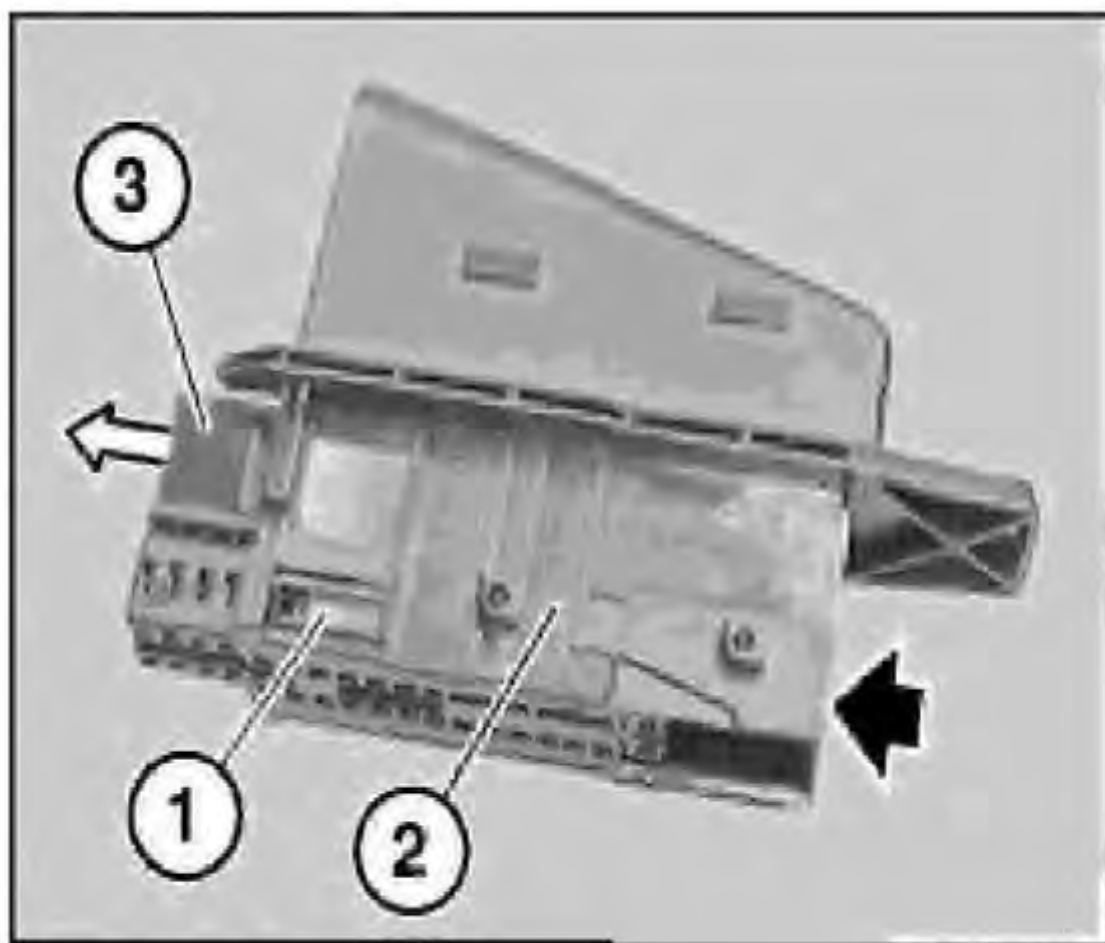
MPQ, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

Socket Housing

- Raise lock (1) on housing (2).
- Push contact carrier (3) from rear out of housing (2).

NOTE: Pushing out the contact carrier releases the secondary locks of the socket contacts. Procedure for removing contacts are same as for other Elo/Elo-Power Systems, refer to the appropriate article.



G03388995

Fig. 63: Removing Contact Carrier From Rear Out Of Housing

Courtesy of BMW OF NORTH AMERICA, INC.

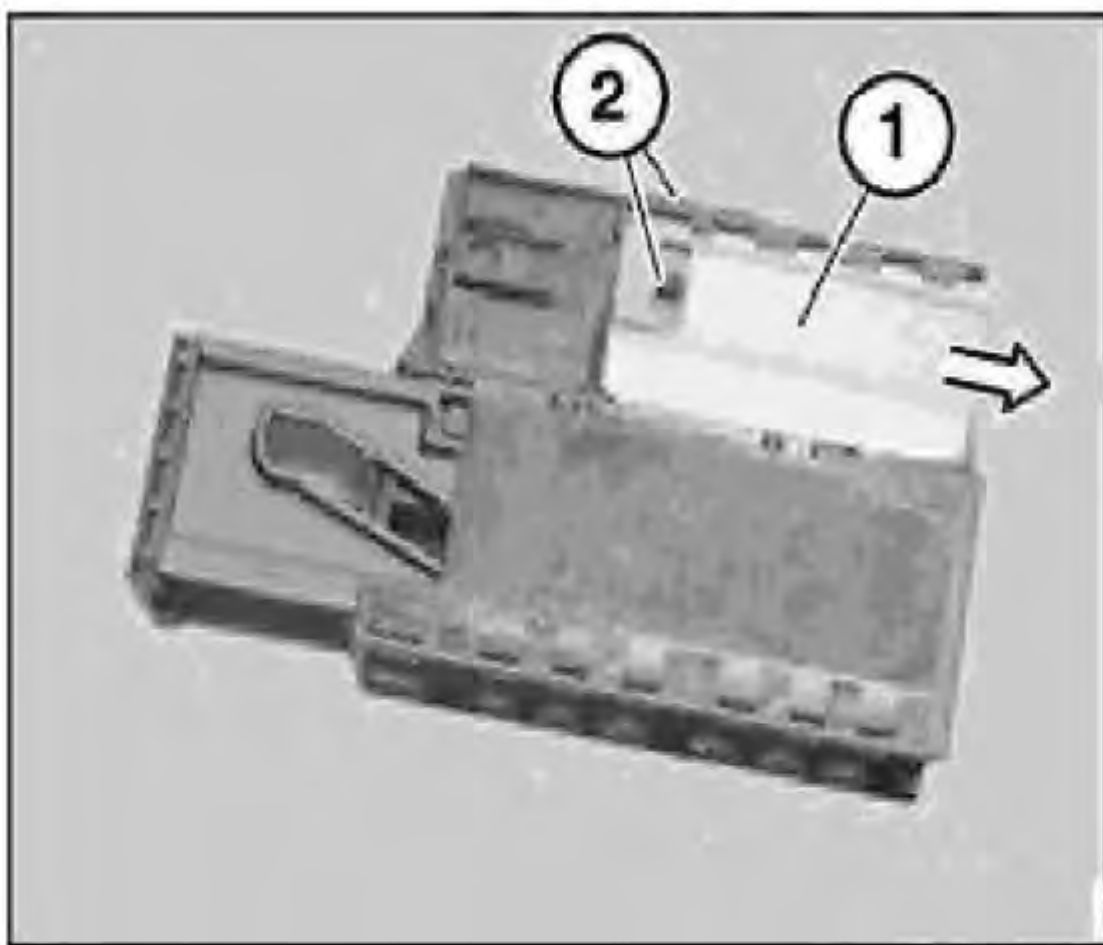
Pin Housing

- Contact 1-13 and 19-27.
- Raise locking slide (1) on both sides (2) of housing and detach.

NOTE: Detaching the locking slide releases the secondary locks of the pin contacts.

- Contacts 14-18 and 28-30.
- Pull slide (1) outward completely.
- Raise lock (2) on housing.
- Pull contact carrier out of housing.

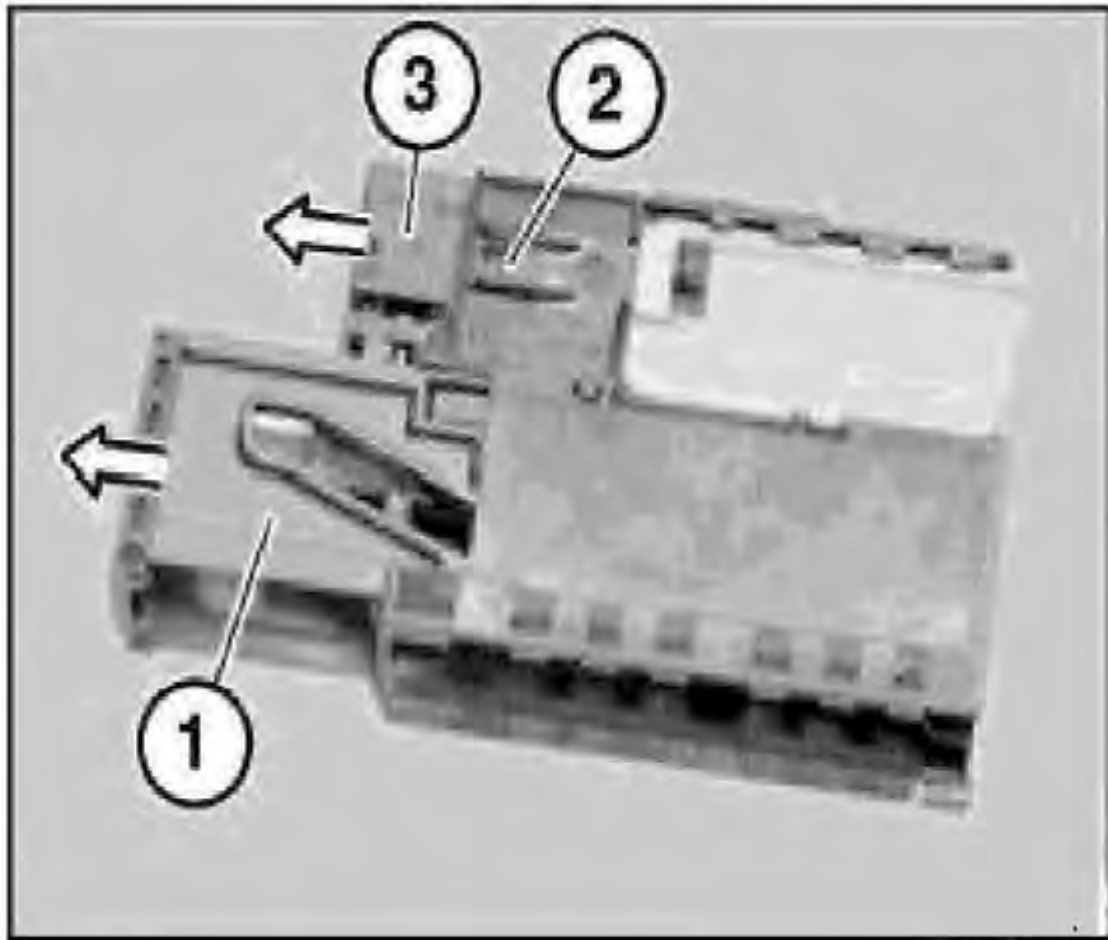
NOTE: Pulling out the contact carrier releases the secondary locks of the pin contacts.



G03388996

[Fig. 64: Identifying Pin Housing Slide](#)

Courtesy of BMW OF NORTH AMERICA, INC.



G03388997

[Fig. 65: Removing Pin Housing Contact Carrier](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Socket Housing 5-, 8 Pin System MQS/MPQ

Manufactured by AMP: The following contact types without strand sealing can be fitted in the socket housings:

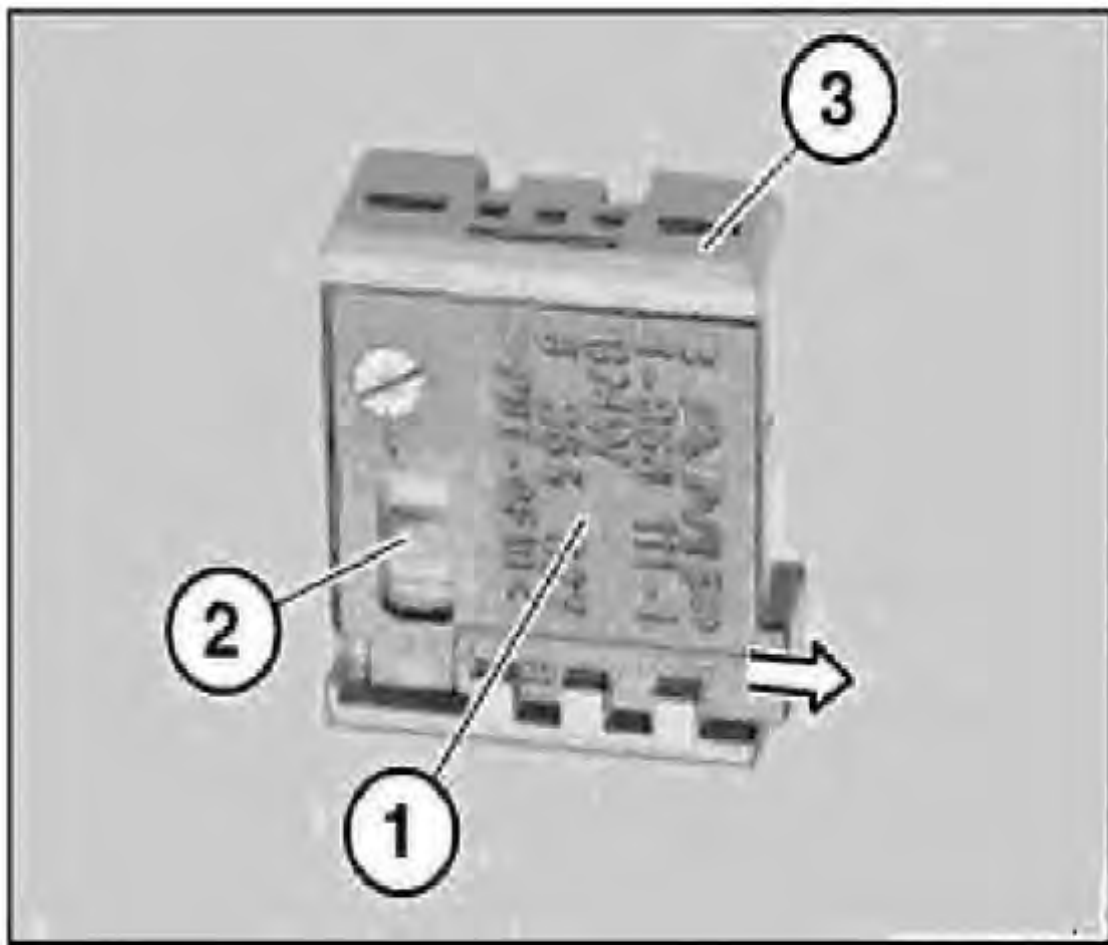
MQS (Micro Quadlock System).

MPQ, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

Socket housing 5 pin (Hybrid System MQS/MPQ)

- Raise fastener (1) (slide) by way of retaining lug (2) and detach from contact carrier (3).



G03388998

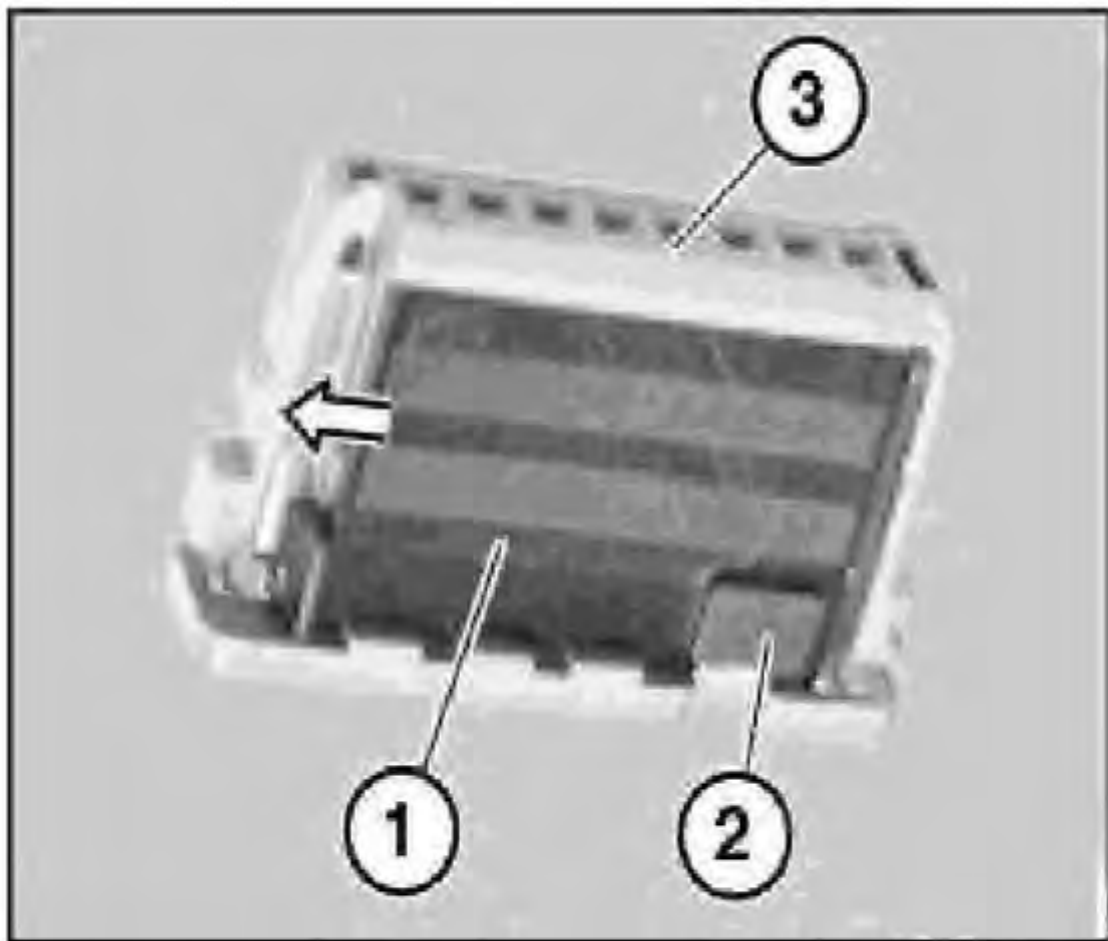
[Fig. 66: Identifying Socket Housing Fastener](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Socket Housing 8 Pin (MQS)

- Raise fastener (1) (slide) by way of retaining lug (2) and detach from contact carrier (3).

Procedure for removing contacts are same as for other Elo/Elo-Power Systems, refer to the appropriate article.



G03388999

[Fig. 67: Identifying Socket Housing 8 Pin \(MQS\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Socket Housing (Radio Plug) Hybrid system MQS/MPQ

Manufactured by AMP: The following contact types without strand sealing can be fitted in the plug housings:

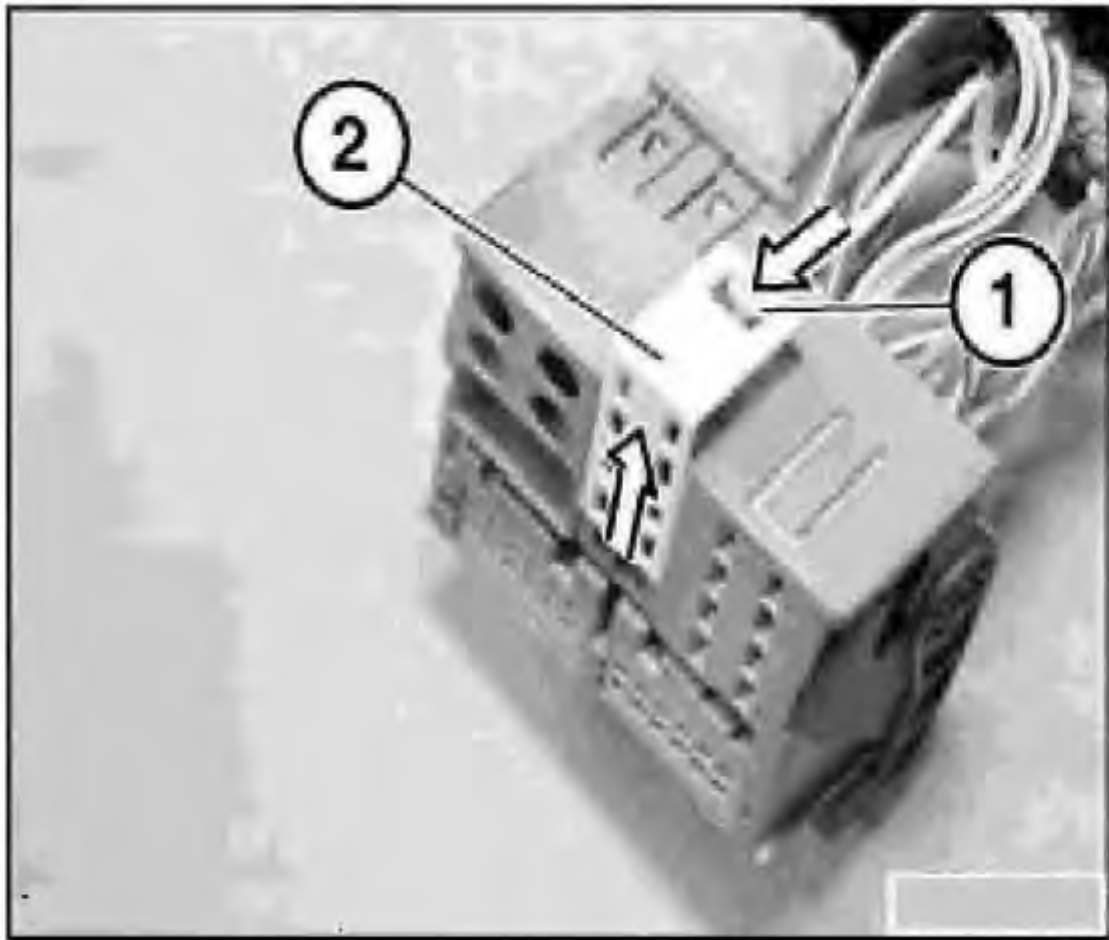
MQS (Micro Quadlock System).

MPQ, width 2.8 mm (Micro Power Quadlock).

MPQ, width 5.2 mm (Micro Power Quadlock).

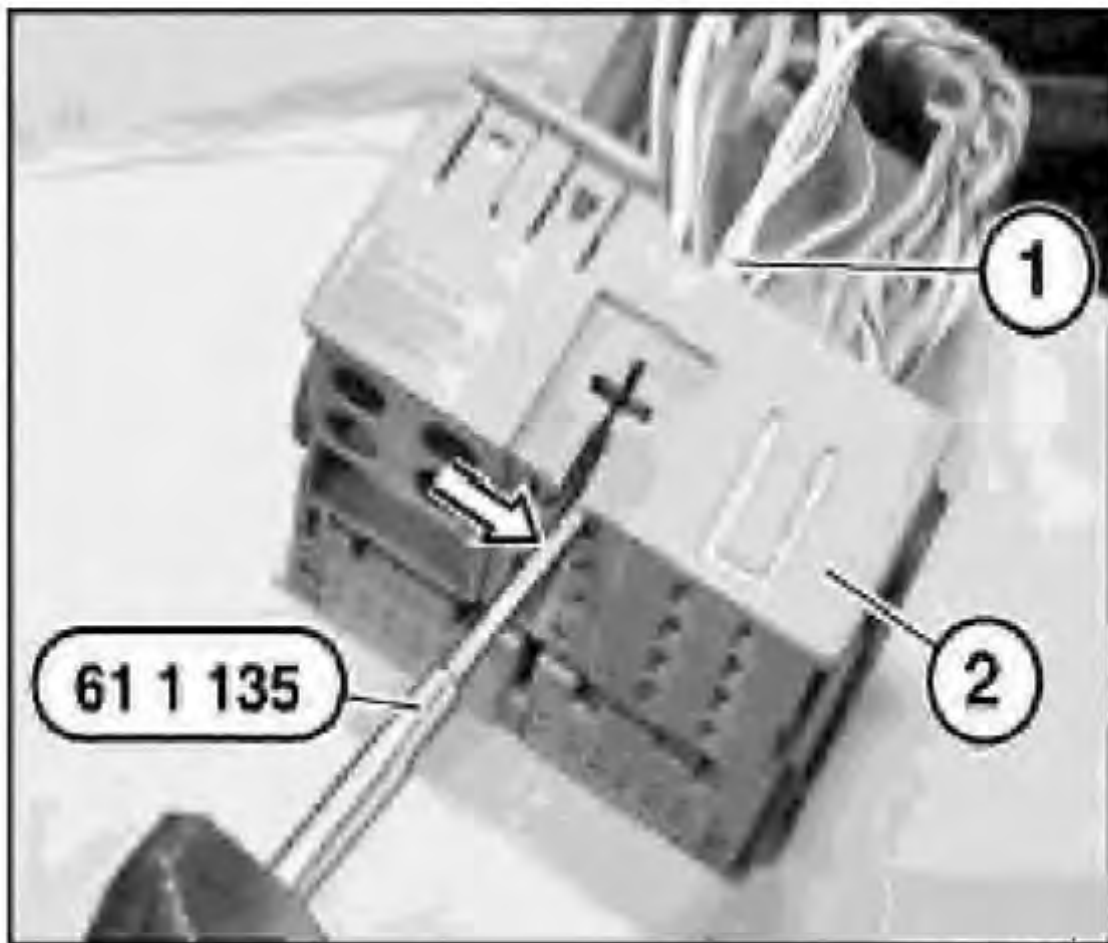
Removing MPQ contacts from radio plug:

- Press lock (1) in direction of arrow, detach secondary lock (2) from radio plug.
- Feed special tool 61 1 135 past side of contact.
- Press special tool 61 1 135 in direction of arrow.
- Pull wire (1) with socket contact out of radio plug (2).



G03389000

[Fig. 68: Locating Radio Plug Lock](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03389001

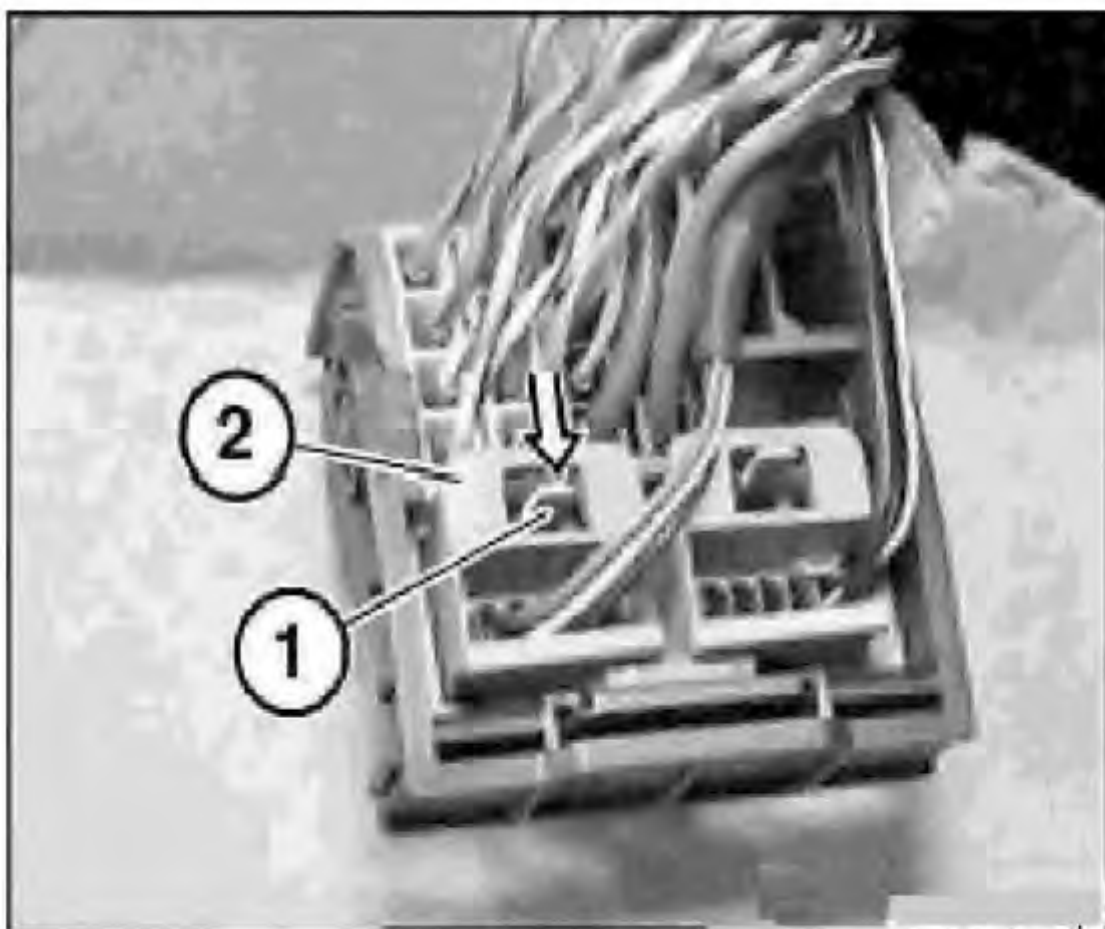
[Fig. 69: Identifying Special Tool In Radio Plug](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Removing MQS contacts from carrier

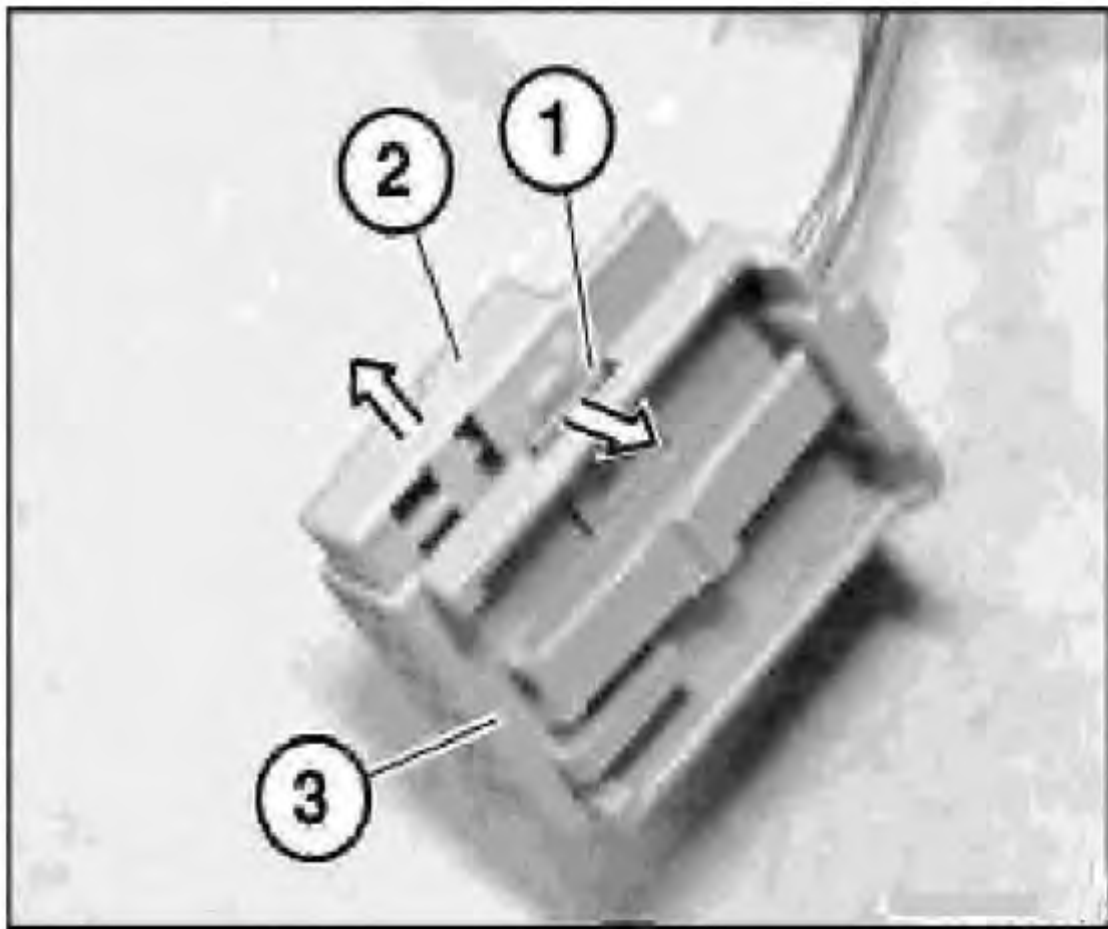
- Press lock (1) in direction of arrow and pull housing (2) out of radio plug ([Fig. 70](#)).
- Press lock (1) in direction of arrow. Pull contact carrier (2) out of housing ([Fig. 71](#)).

NOTE: When the contact carrier is pulled out, the secondary locks of the socket contacts are raised. Procedure for removing contacts are same as for other Elo/Elo-Power Systems, refer to the appropriate article.



G03389002

[Fig. 70: Removing Housing From Radio Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



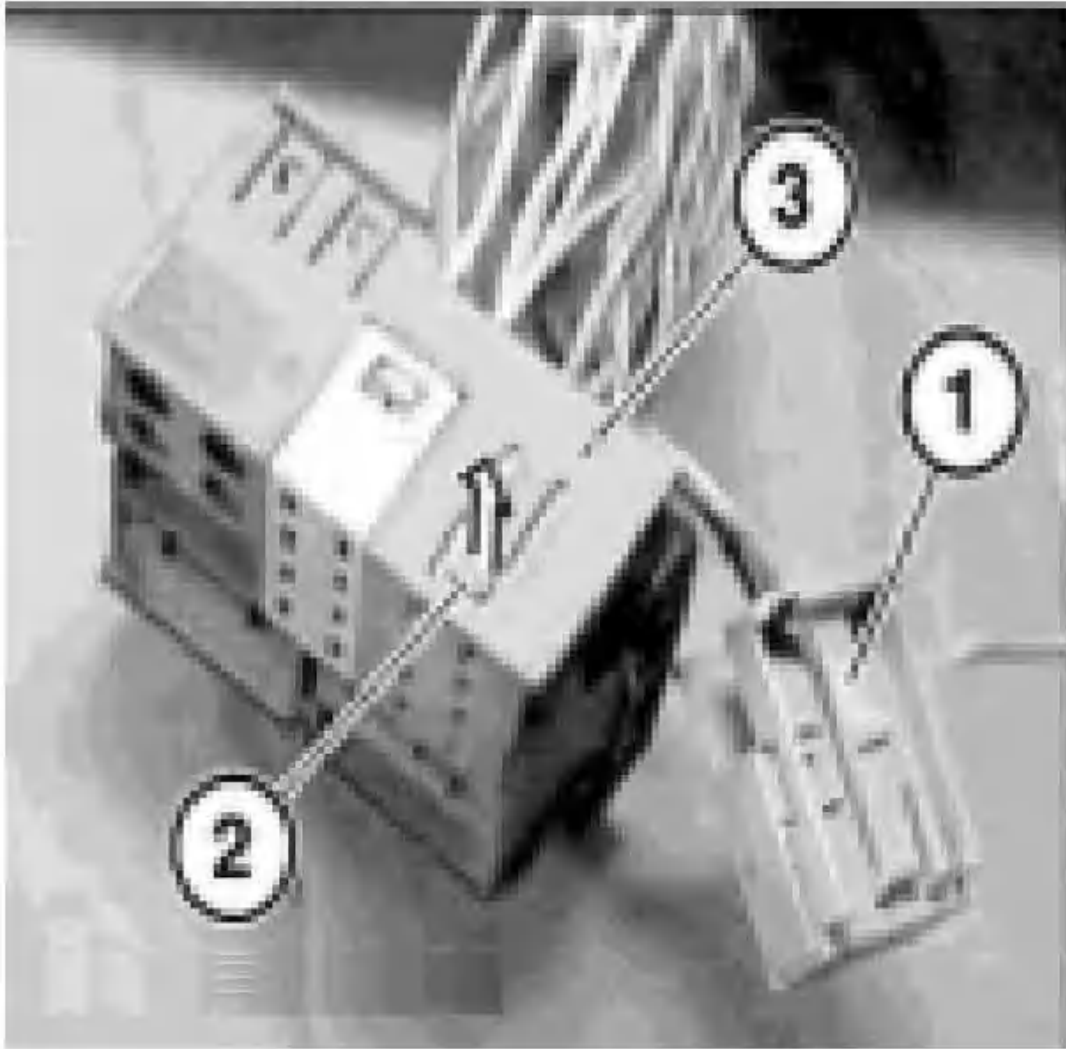
G03389003

Fig. 71: Removing Contact Carrier Out Of Housing

Courtesy of BMW OF NORTH AMERICA, INC.

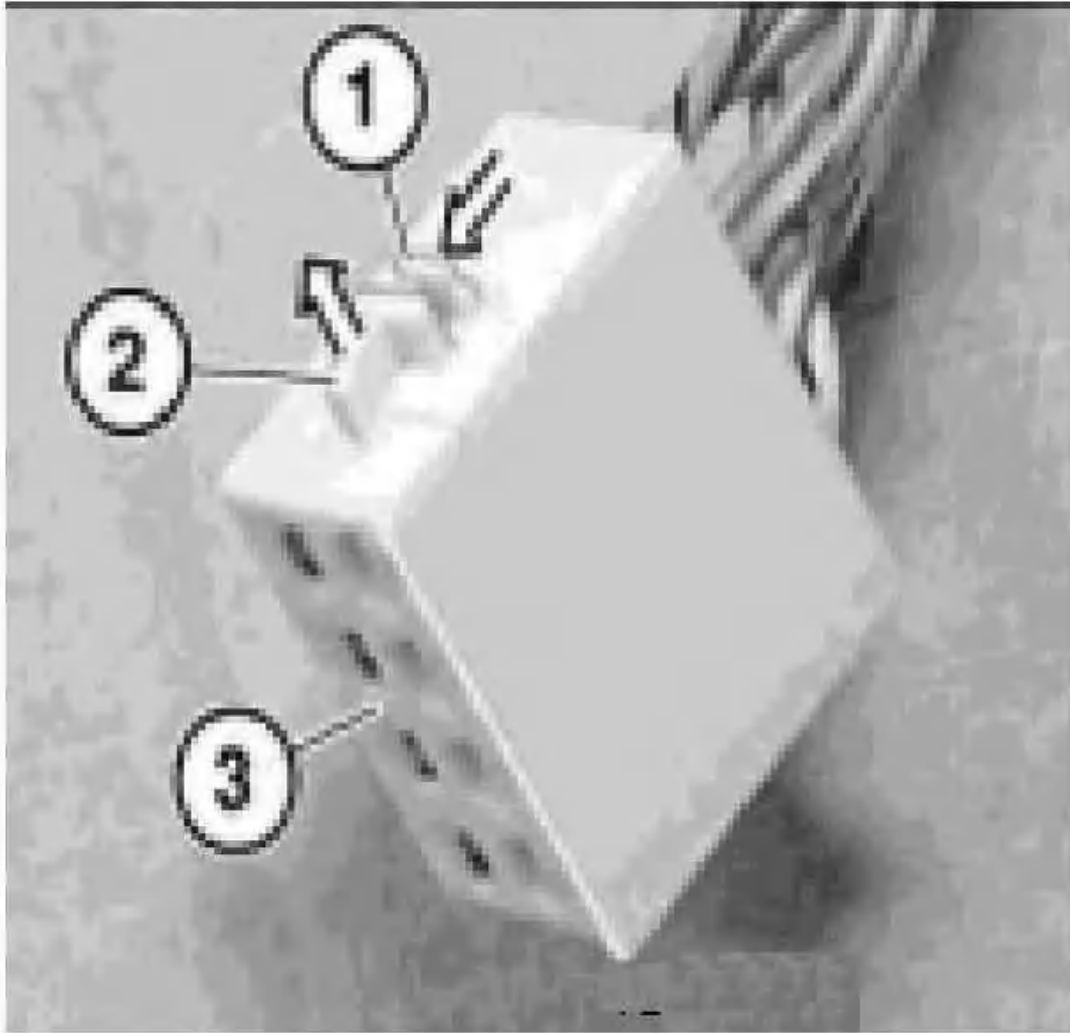
Removing MPQ contacts from contact carrier

- Remove contact carrier (1) with MQS contacts from radio plug. Raise lock (2) on radio plug. Pull contact carrier (3) out of radio plug ([Fig. 72](#)).
- Press lock (1) in direction of arrow. Pull secondary lock (2) in direction of arrow completely out of contact carrier (3) ([Fig. 73](#)).
- Press special tool 61 1 135 on inside of contact into contact carrier (2). Pull wire with socket contact (1) out of contact carrier (2) ([Fig. 74](#)).



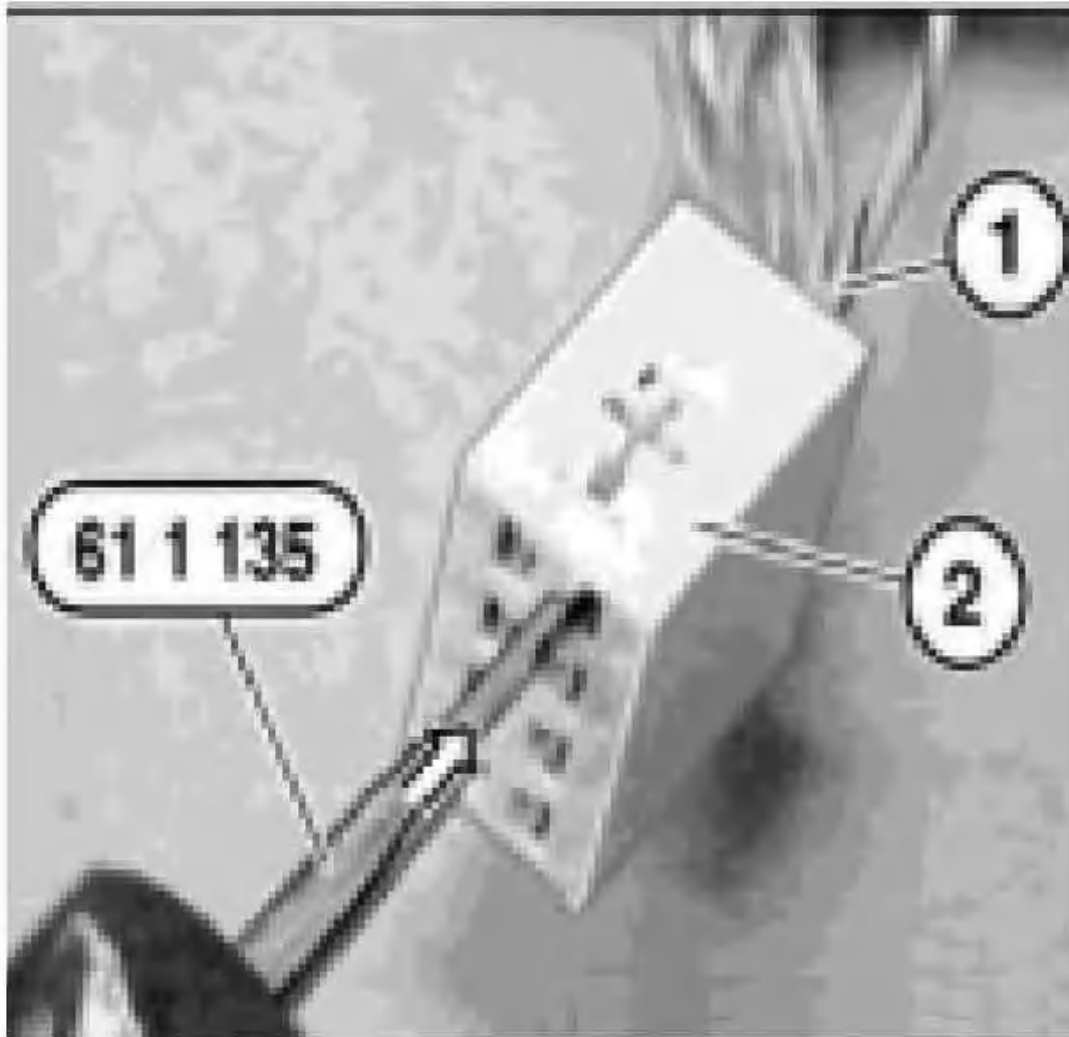
G03389004

[Fig. 72: Removing MPQ Contacts From Contact Carrier](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03389005

[Fig. 73: Removing Secondary Lock From Contact Carrier](#)
Courtesy of BMW OF NORTH AMERICA, INC.



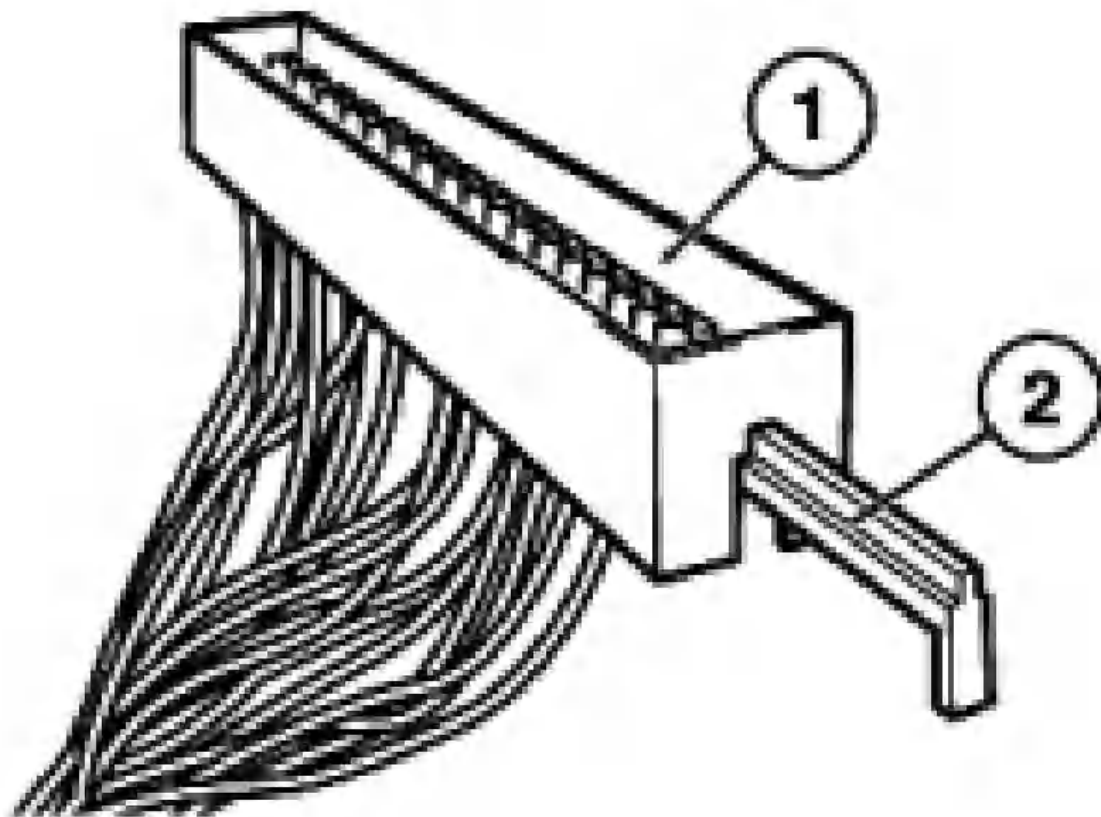
G03389006

Fig. 74: Removing Socket Contact From Contact Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

MISCELLANEOUS CONNECTORS

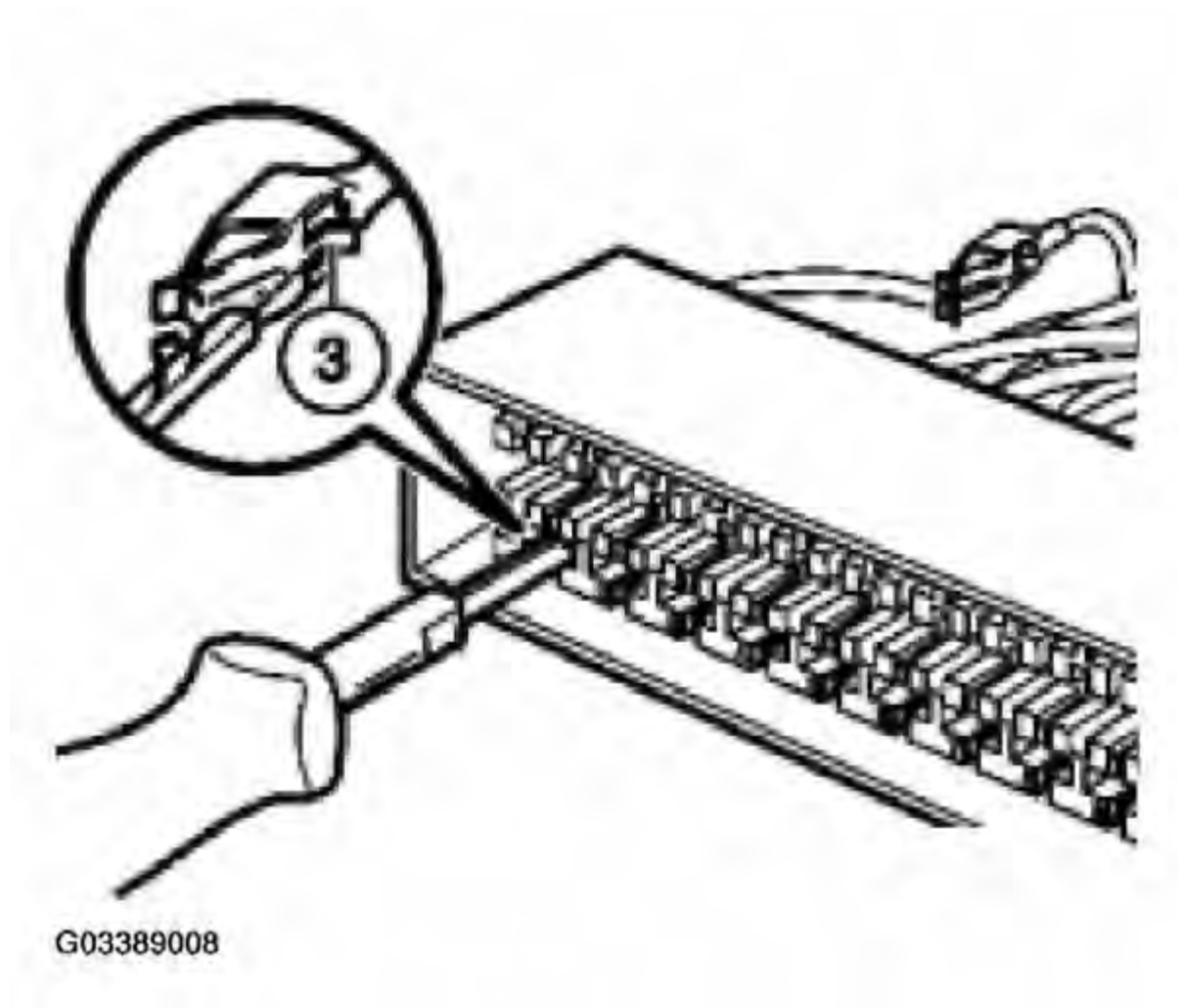
Fuse Strip

- Pull appropriate fuse from fuse strip (1).Note: Mark fuse rating and position for reinstallation.
- Pull locking slide (2) out of fuse strip until stop is felt.
- Using special tool 61 1 136 or 61 1 137 press the spring latch down (3) and pull the connector from the housing.



G03389007

[Fig. 75: Removing Locking Slide From Fuse Strip](#)
Courtesy of BMW OF NORTH AMERICA, INC.

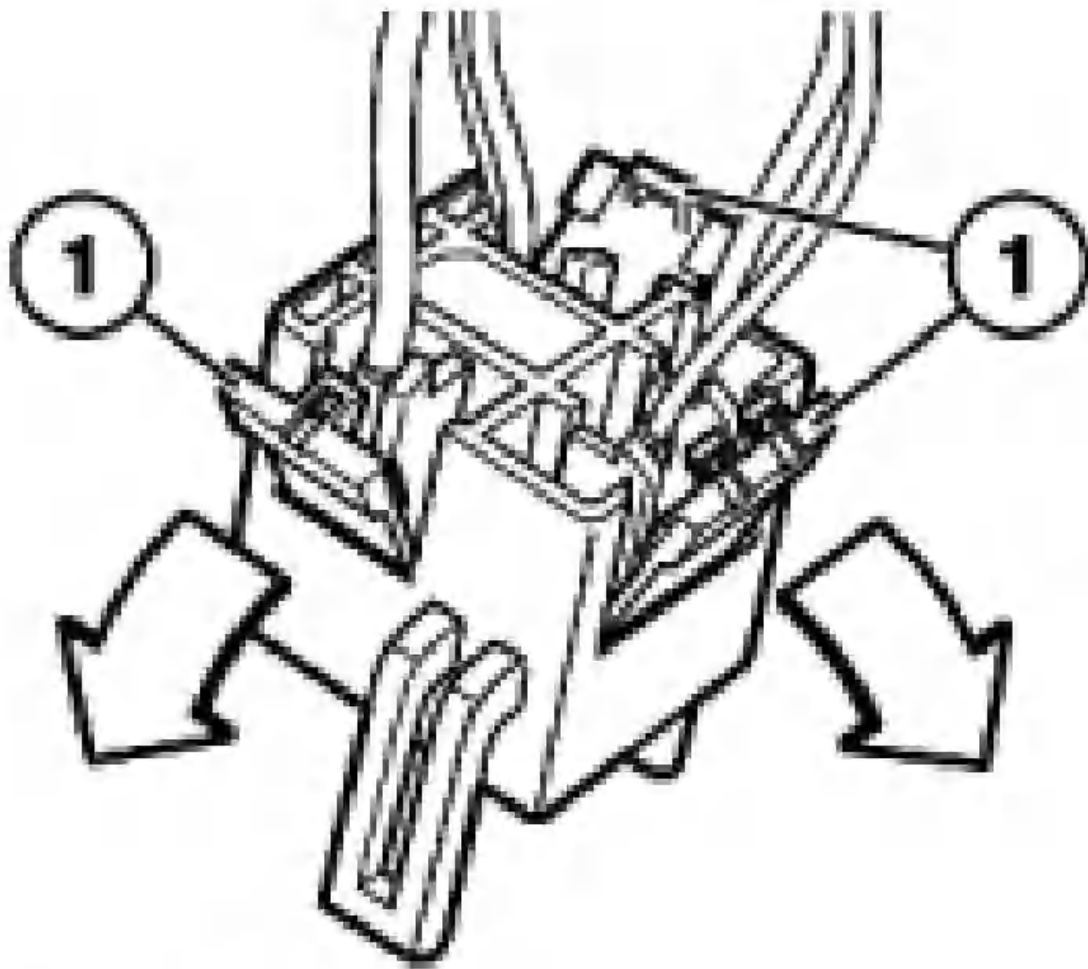


[Fig. 76: Removing Connector From Housing Using Special Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

ECM Main Relay Connector

- Unlock wire flap (1) of connector being removed.
- Using special tool 61 1 136 or 61 1 137 press the spring latch down (2) and pull the connector from the housing.



G03389009

[Fig. 77: Removing Wire Flap Of Connector](#)
Courtesy of BMW OF NORTH AMERICA, INC.

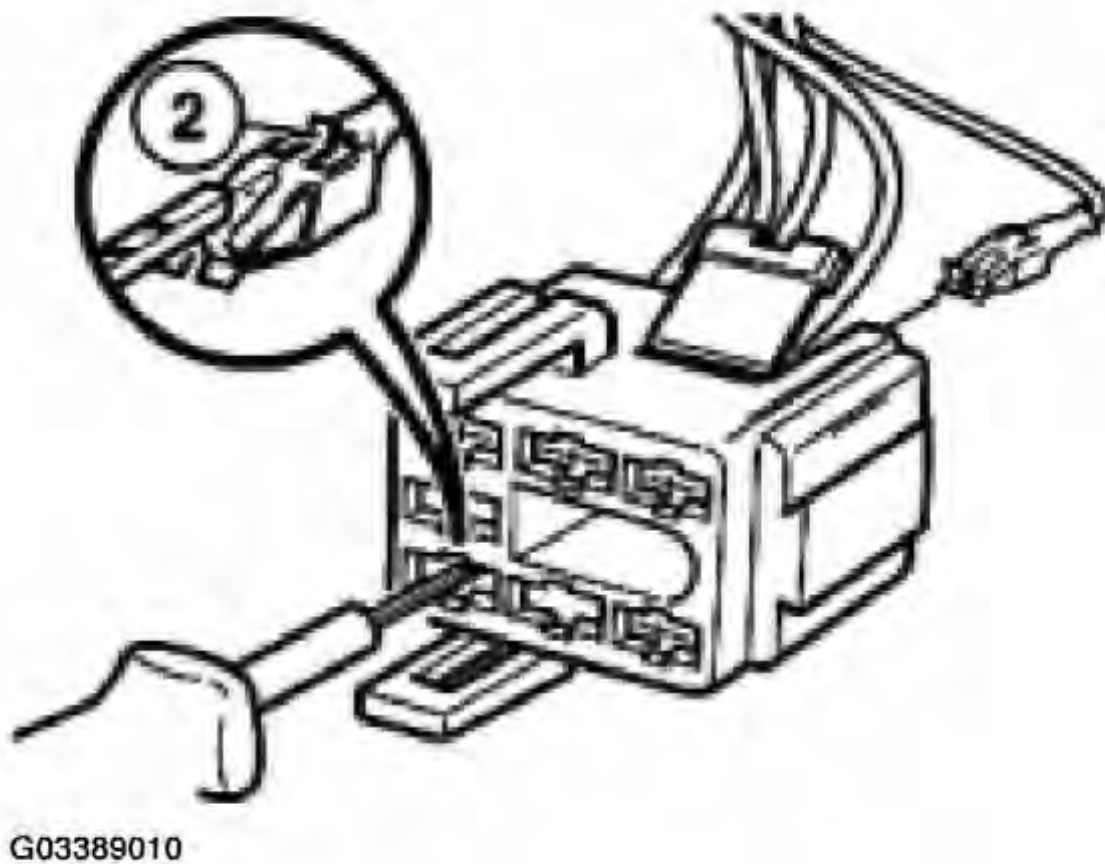


Fig. 78: Locating Spring Latch

Courtesy of BMW OF NORTH AMERICA, INC.

SOLDERLESS TERMINALS AND CONNECTORS

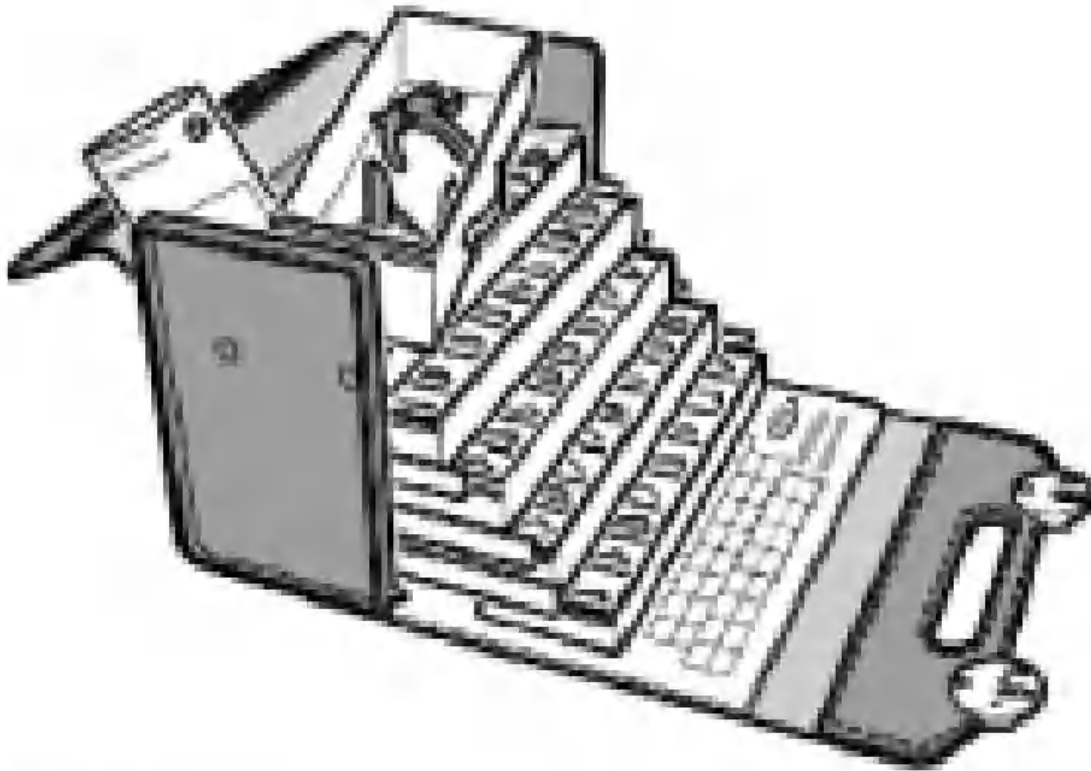
Mechanical strength of solderless terminal design and electrical conductivity must be maintained at all times. To ensure these characteristics are maintained in the vehicles electrical system several BMW repair kits are available.

The repair kits listed contain all the approved connectors, pins, and tools required for proper repair of BMW's electrical, electronics components.

- Electrical Repair Kit IV

P/N 90 88 6 619 020

The Electrical Repair Kit IV (Ref. SI. 04 18 92) is used in conjunction with the detailed repair procedures.



G03389011

[Fig. 79: Identifying Electrical Repair Kit IV](#)

Courtesy of BMW OF NORTH AMERICA, INC.

- Disassembling, replacing a plug connection on the various types of connectors.
- Cutting cable to length.
- Crimping stop parts (Contacts).
- Butt connectors for repairing a plug connection.

Operating instructions for special tools and the handling of individual parts in the repair kit are available under PN 61 9 029.

Three previous kits issued by BMW are:

- Electrical Repair Kit I (Black Case)
P/N 81 24 9 408 080
- Electrical Repair Kit II (Blue Case)
P/N 81 24 9 408 300
- Electrical Repair Kit III (Red Case)
P/N 82 11 9 408 400

Electrical repair kits I, II and III are primarily needed for repairing wiring harness and connectors of older vehicles (E30 and earlier).

Operating instructions for special tools in these kits are available under PN 61 8 084.



G03389012

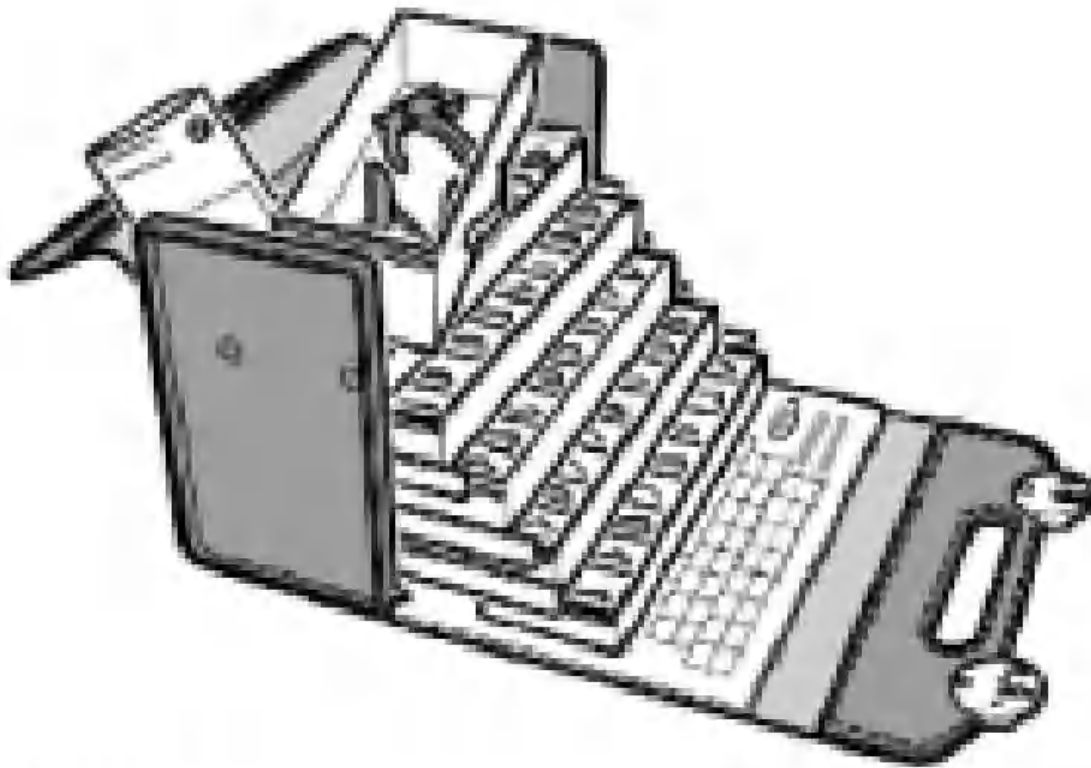
[Fig. 80: Identifying Electrical Repair Kits](#)

Courtesy of BMW OF NORTH AMERICA, INC.

ELECTRICAL REPAIR KIT IV

The Electrical Repair Kits (I, II, III and IV) have gone through various upgrades.

Electrical Repair Kit IV (PN 90 88 619 020) has been developed to handle repairs of the specialized state of the art wiring and harnesses of the newest BMW products.



G03389013

[Fig. 81: Identifying Electrical Repair Kit IV](#)

Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: The special tools contained in the Electrical Repair Kits I, II, III are not state of the art and are not suitable for specialized wiring harness repairs. Use exclusively Electrical Repair Kit IV for those repairs.

Electrical Repair Kit IV (61 9 020)

Contains the following:

61 9 041 Crimping Tool.

61 9 042 Matrix.

61 9 043 Cable Stripper.

61 9 044 Matrix.

Assorted Individual Parts.

Cable Stripper

Special Tool 61 9 043 Cable stripper with wire cutter for cutting and stripping insulation from cables.



G03389014

[Fig. 82: Identifying Cable Stripper](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Crimping Tool

Special Tool 61 9 041 Crimping Tool with special tool 61 9 044 (matrix) for crimping cable guide and strain relief device on antenna elbow plug.

Supplementary kits for Electrical Repair Kit IV are released periodically.

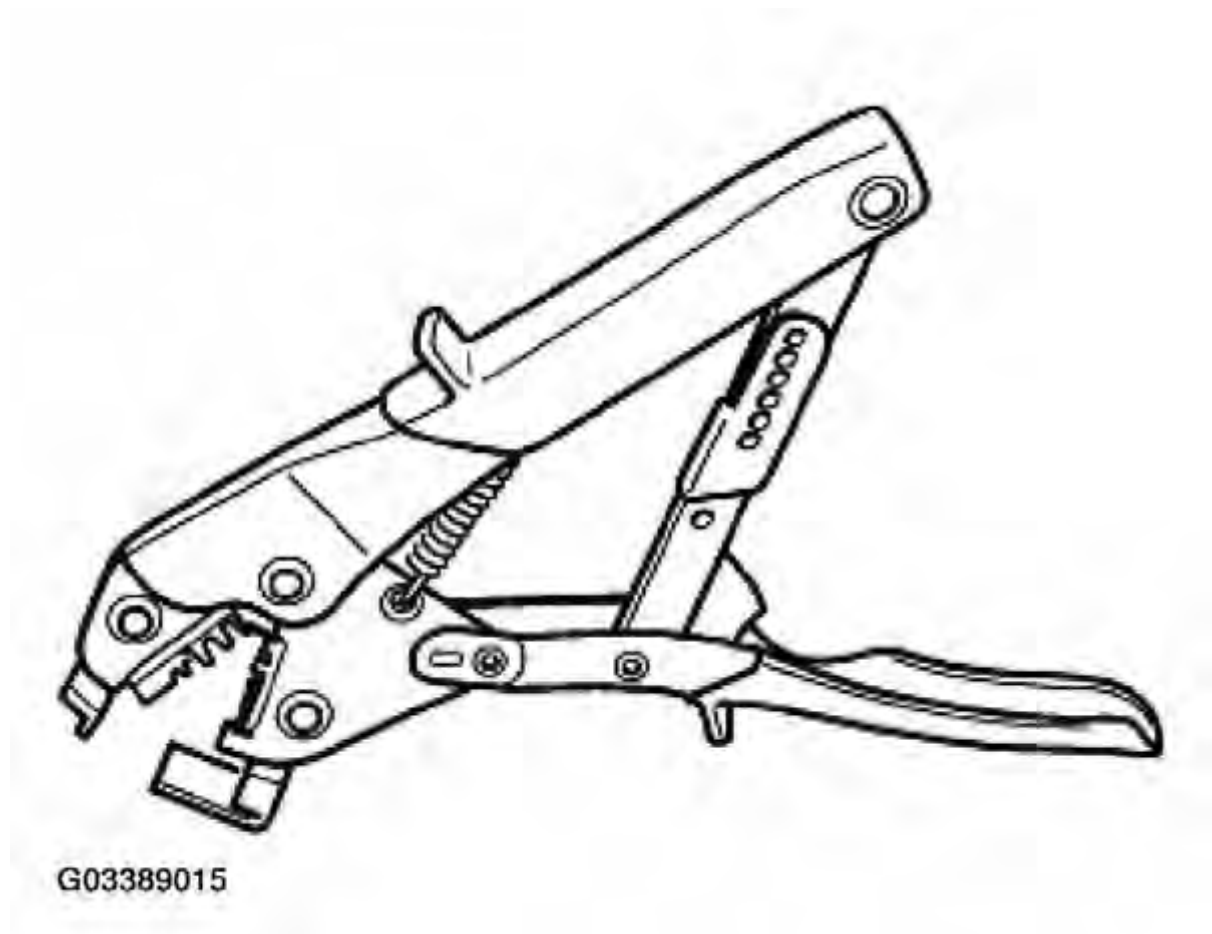


Fig. 83: Identifying Crimping Tool

Courtesy of BMW OF NORTH AMERICA, INC.

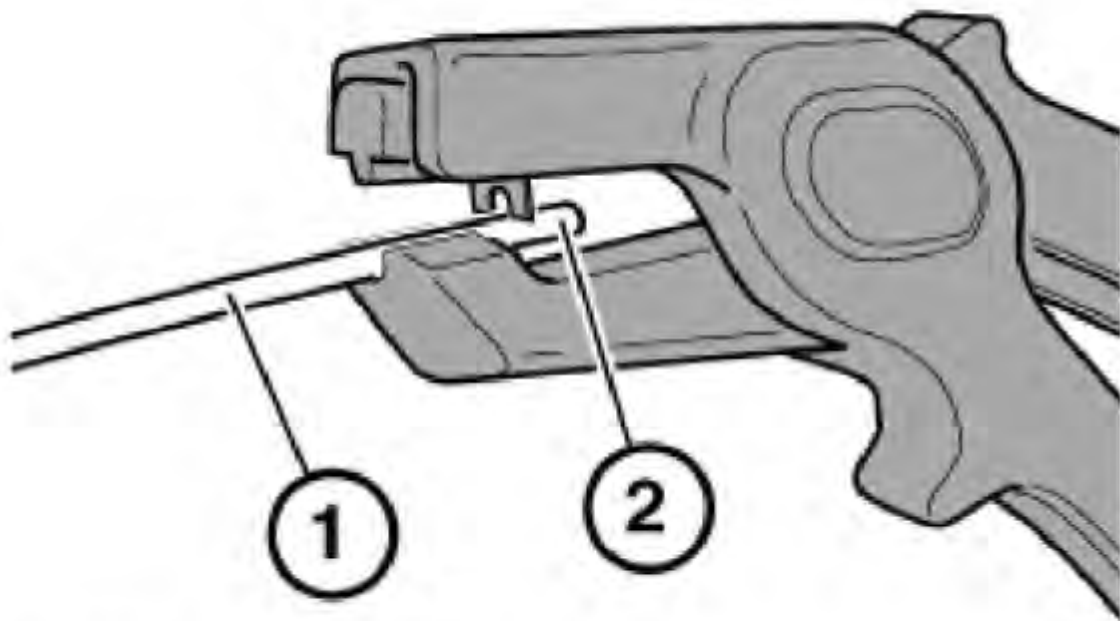
CABLE STRIPPING

Proper wire stripping and connector replacement is essential to ensure the integrity of the electrical connection. Always follow specific instructions in the Electrical Repair Kit IV instruction manual.

The length of wire to be stripped is determined by the wire gauge.

WIRE CROSS-SECTION SIZE SPECIFICATIONS

Wire cross-section size	stripped length:
mm ²	mm
0.35... 0.50	4.0
0.75... 1.00	4.5
1.00... 2.50	5.0

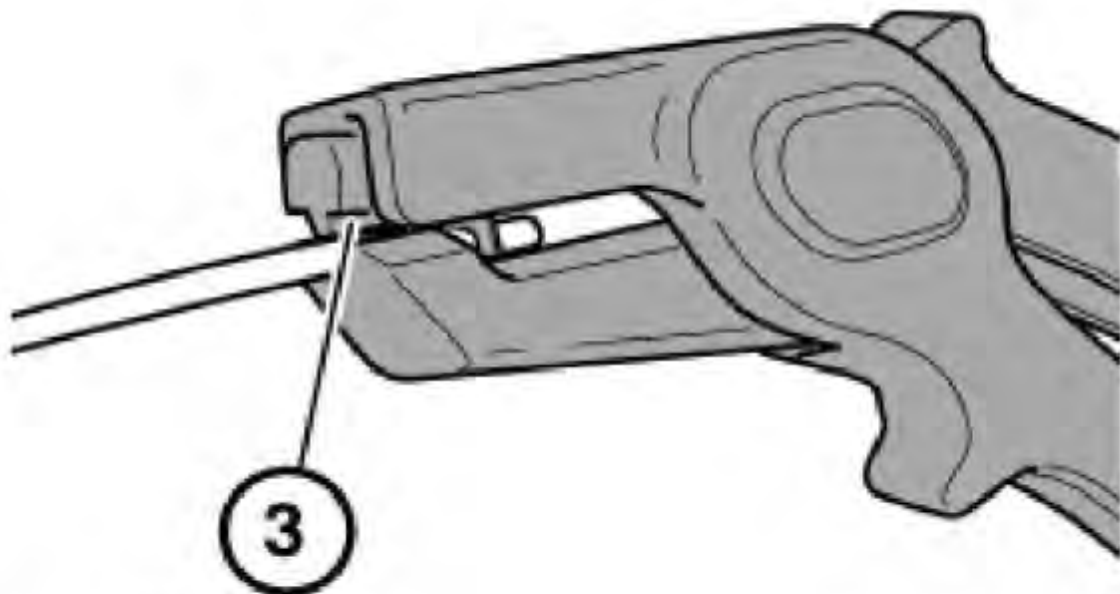


G03389016

[Fig. 84: Inserting Wire Into Cable Stripping Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Proper use of the wire stripping tool will provide consistently positive results. Insert the wire (1) into the stripper. Stop the wire when the required strip length is past the cutter (2). Squeeze the handle of the tool.

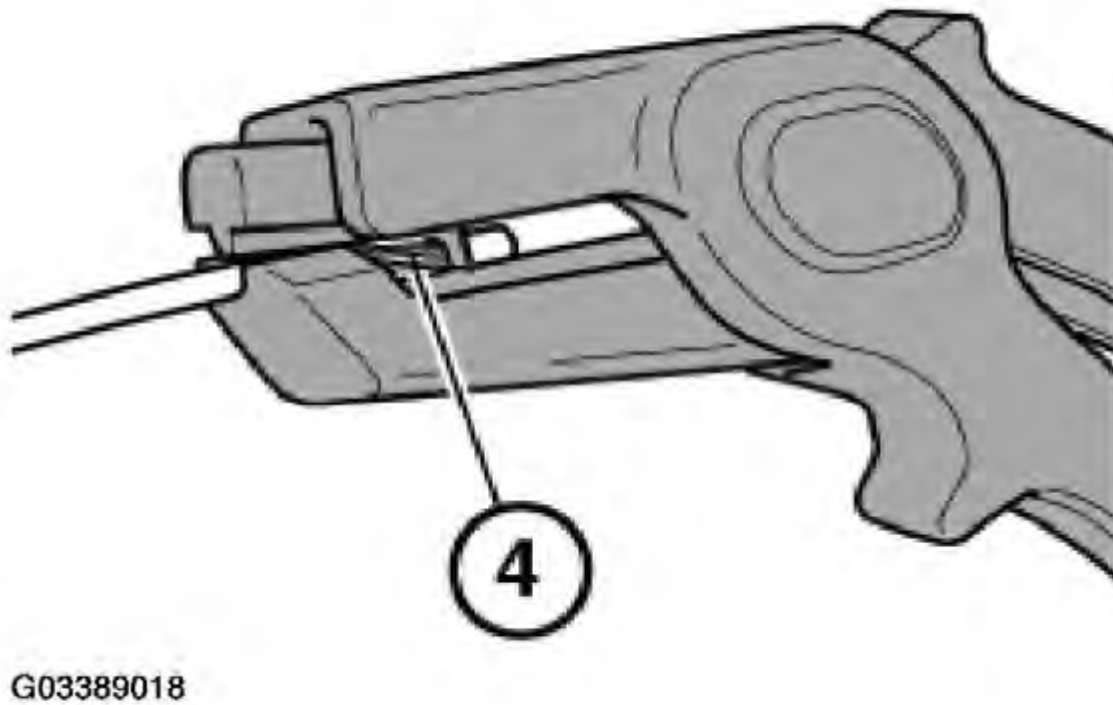


G03389017

[Fig. 85: View Of Wire In Stripper](#)

Courtesy of BMW OF NORTH AMERICA, INC.

When the top jaw of the tool touches the wire (3) the mechanism shifts the clamping action to a pulling action which strips the wire of the insulation (4).

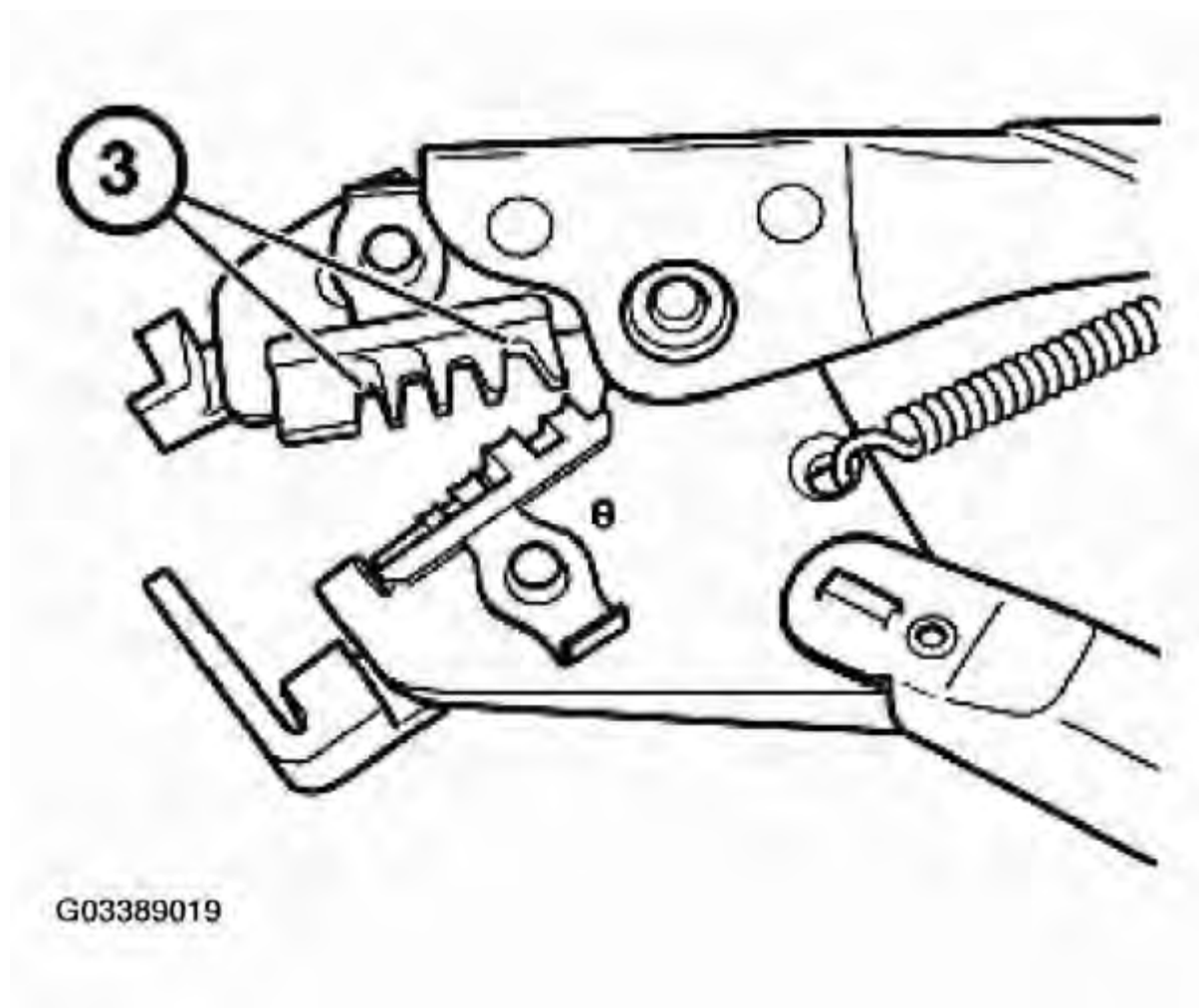


[Fig. 86: Removing Insulation Using Stripper](#)
Courtesy of BMW OF NORTH AMERICA, INC.

CRIMPING

Use the wire crimper from the BMW Electrical Repair Kit. This crimper is designed for the specific connectors found in BMW automobiles. Proper use of the tools will provide consistent good quality connector crimps.

The crimper is designed to apply just the right amount of pressure based on the wire gauge and connector size.



[Fig. 87: Identifying Removable Crimper Jaws](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The tool has removable crimper jaws (3). This feature allows for an unlimited number of connector types for future compatibility. The article refers to the different sized crimping slots as "Nests". The gauge of the wire being crimped determines which "Nest" is used.

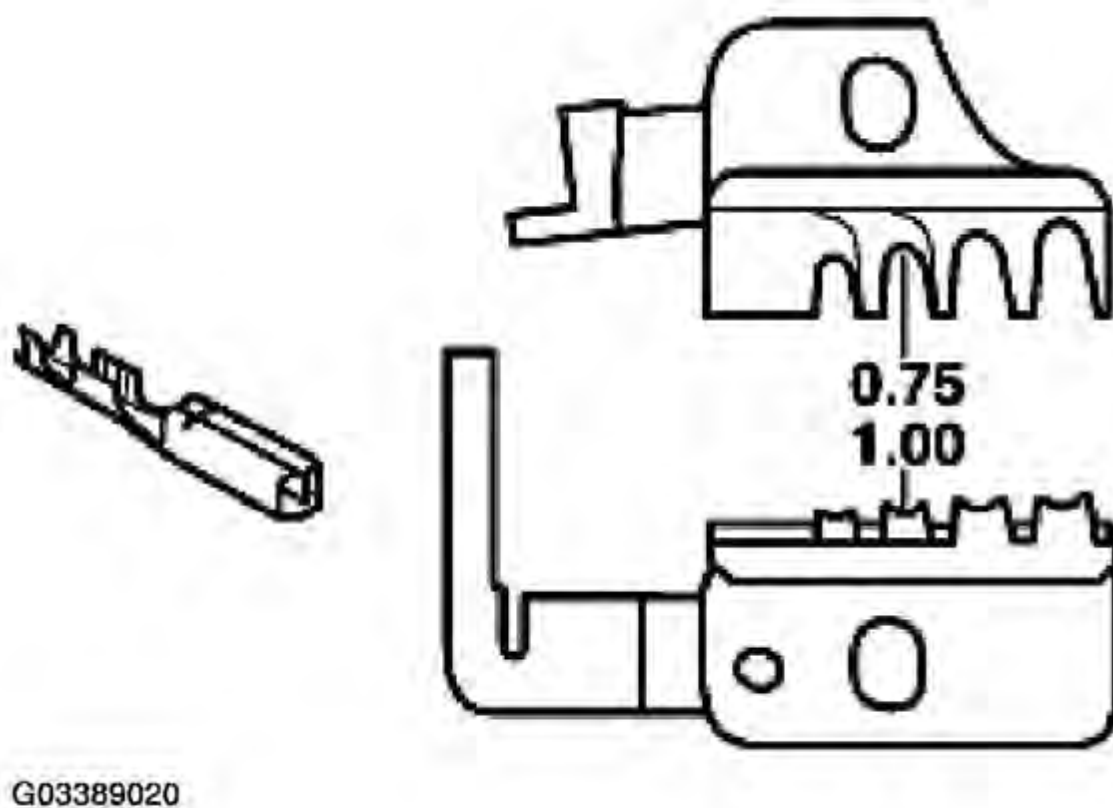


Fig. 88: Identifying Crimper Jaw Dimensions
 Courtesy of BMW OF NORTH AMERICA, INC.

WIRE CROSS-SECTION SIZE SPECIFICATIONS

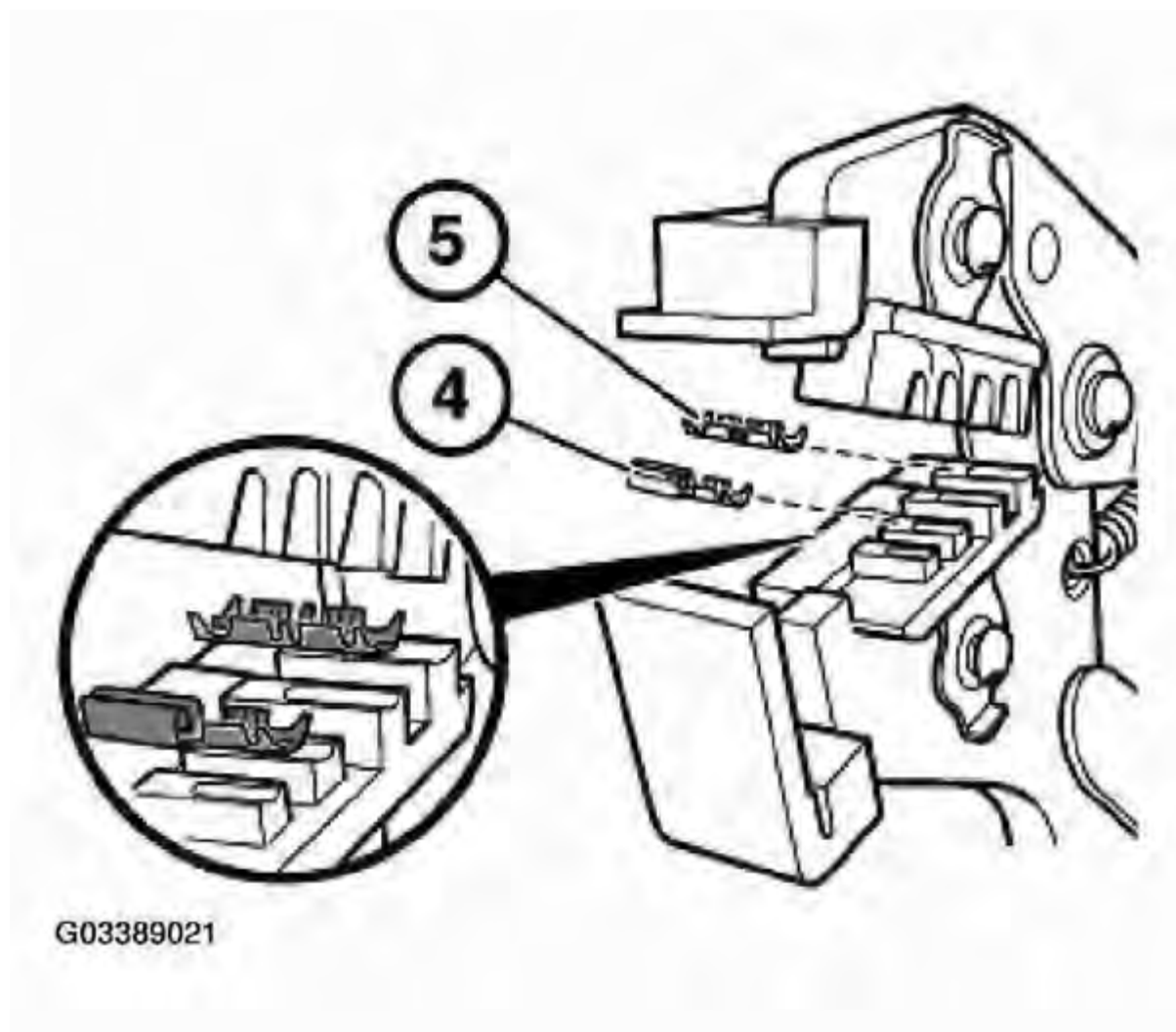
Nest	Wire Cross-section size
1	0.035....0.50mm ²
2	0.75.....1.0mm ²
3	1.5mm ²
4	2.5mm ²

Example:

A. 75 - 1.0mm gauge wire requires nest 2 for proper crimping.

Throughout the Electrical Repair Kit instruction manual are illustrations of various connectors being crimped. The highlighted box of the 16 box grid in these illustrations refers to the storage compartment in the electrical kit drawers in which that specific connector can be found.

Insert the "crimping end" of the connector into the appropriate "nest". Illustration provides example of comb replacement connector (4) and inline splice connector (5).



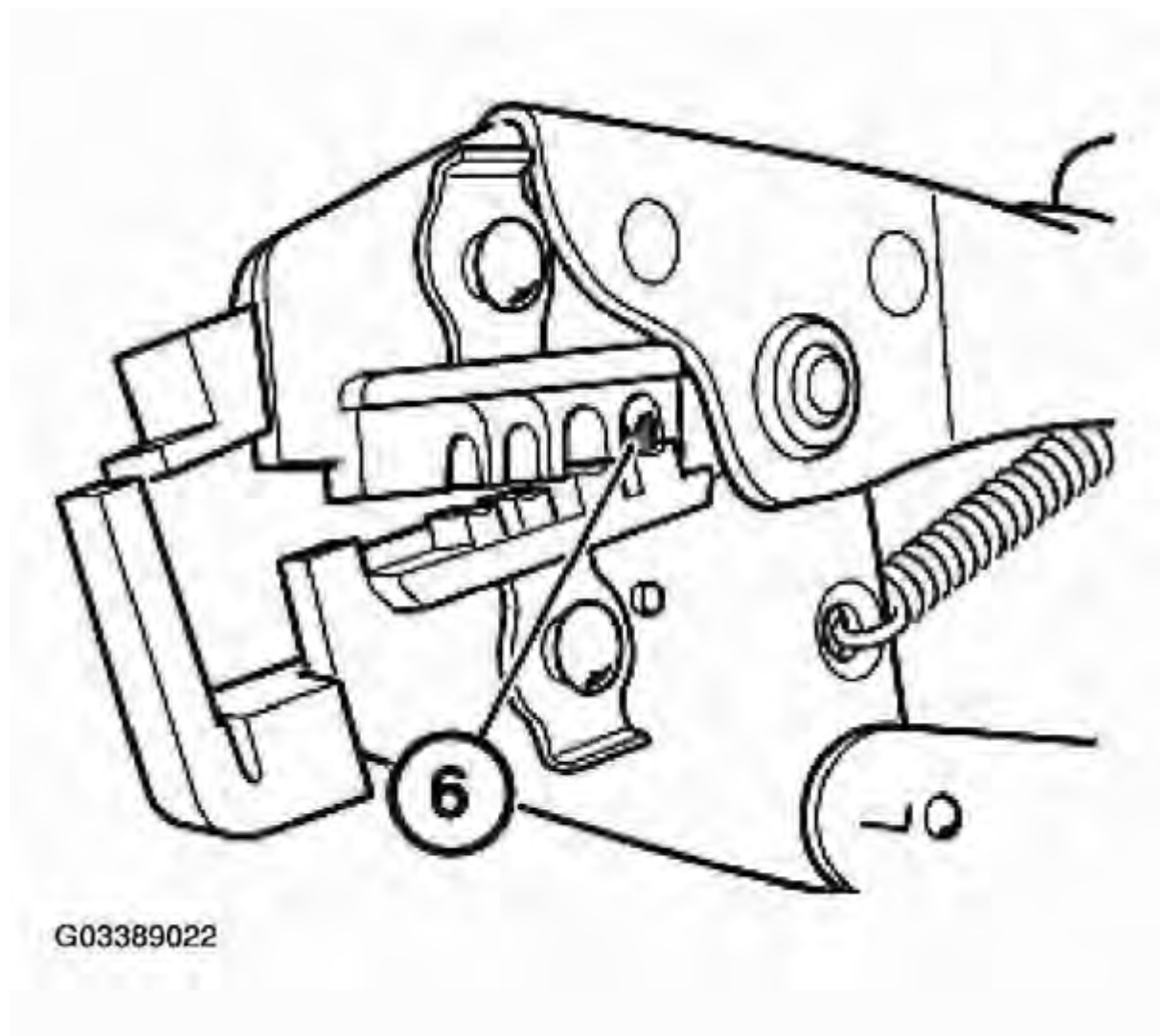
[Fig. 89: Identifying Comb Replacement Connector](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Squeeze the tool handle slightly to set the tool in the first ratchet latch position. This will hold the connector in the tool without closing the crimp (6).

Insert the stripped wire into the receiving end of the crimper tool making sure the wire is inserted far enough to ensure that only the wire insulation will be inside the insulation support barrel (7).

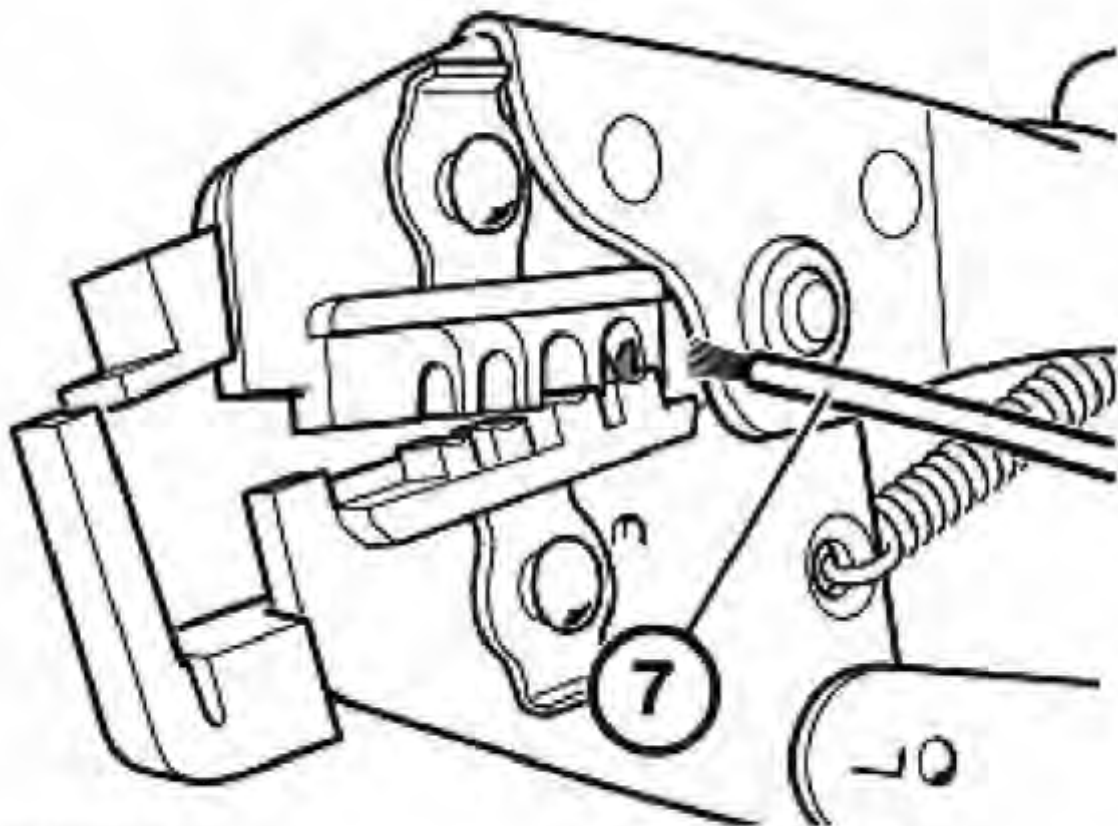
Properly crimped connectors exhibit the following characteristics:



[Fig. 90: View Of Connector In Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

- The insulation support barrel will be crimped consistently and snug against the insulation. The insulation will not be crushed (8).
- A bellmouth crimp will be visible at the wire end of the of the wire barrel (9).
- Wire strands will be visible at the contact end of the wire barrel (10).
- Insulation end will be visible in this area (11) ([Fig. 92](#)).



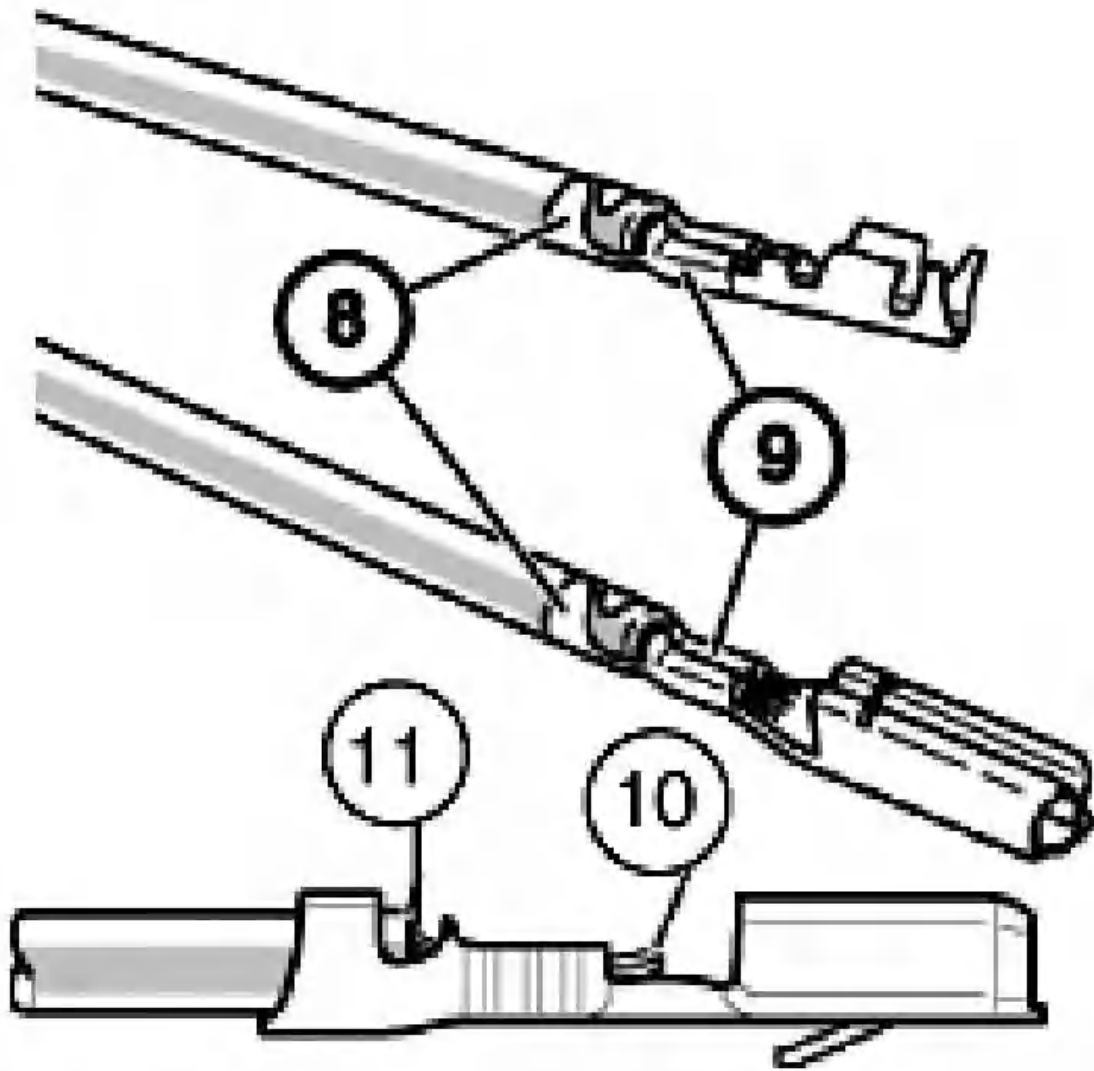
G03389023

[Fig. 91: View Of Wire Insulation In Support Barrel](#)

Courtesy of BMW OF NORTH AMERICA, INC.

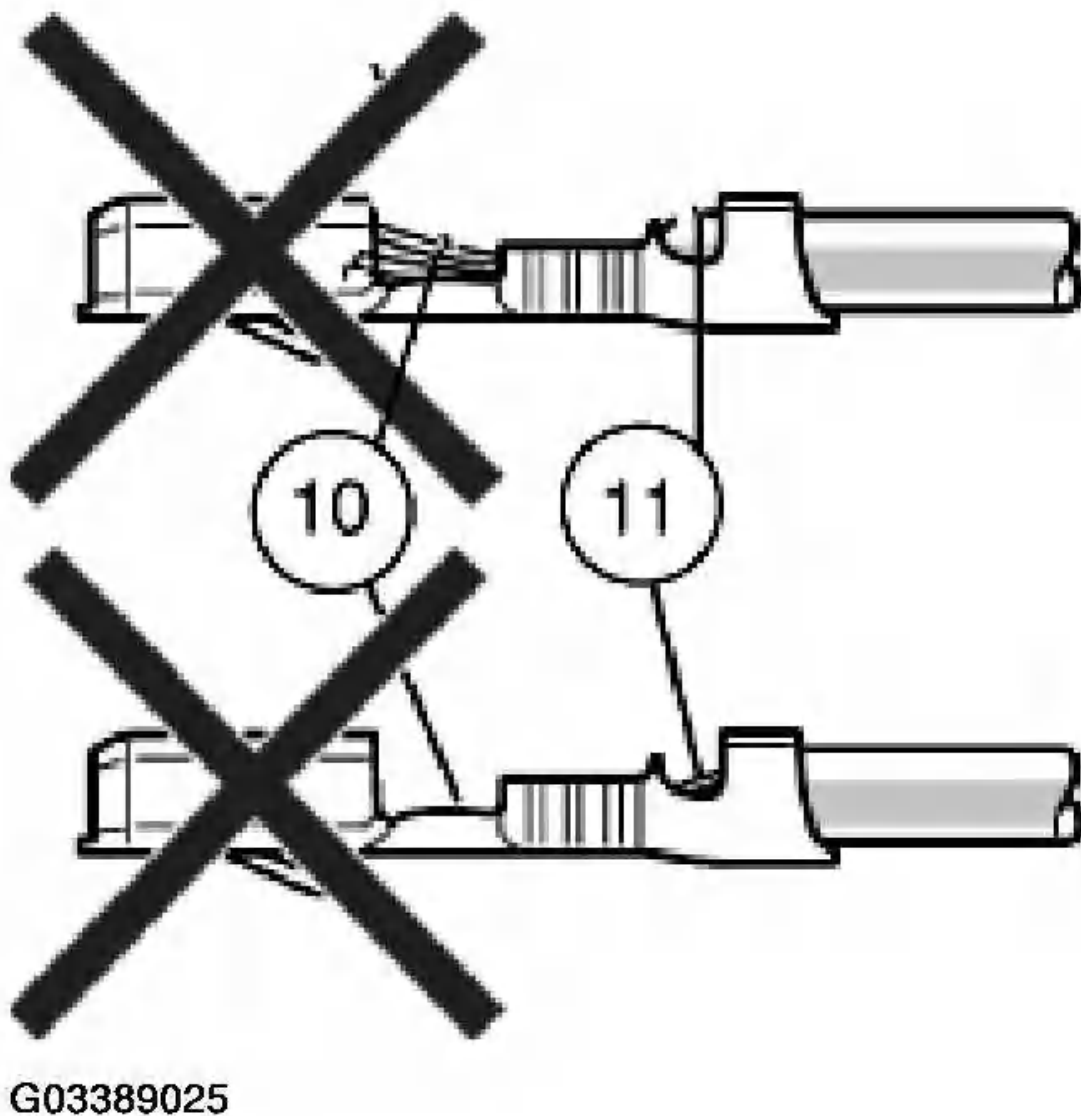
The following are examples of unacceptable crimps: ([Fig. 93](#))

- Excessive or no wire strands at the contact end of the wire barrel (10).
- Excessive or no insulation end in the acceptable area (11).



G03389024

[Fig. 92: Identifying Properly Crimped Connector](#)
Courtesy of BMW OF NORTH AMERICA, INC.



[Fig. 93: Identifying Unacceptable Crimps](#)

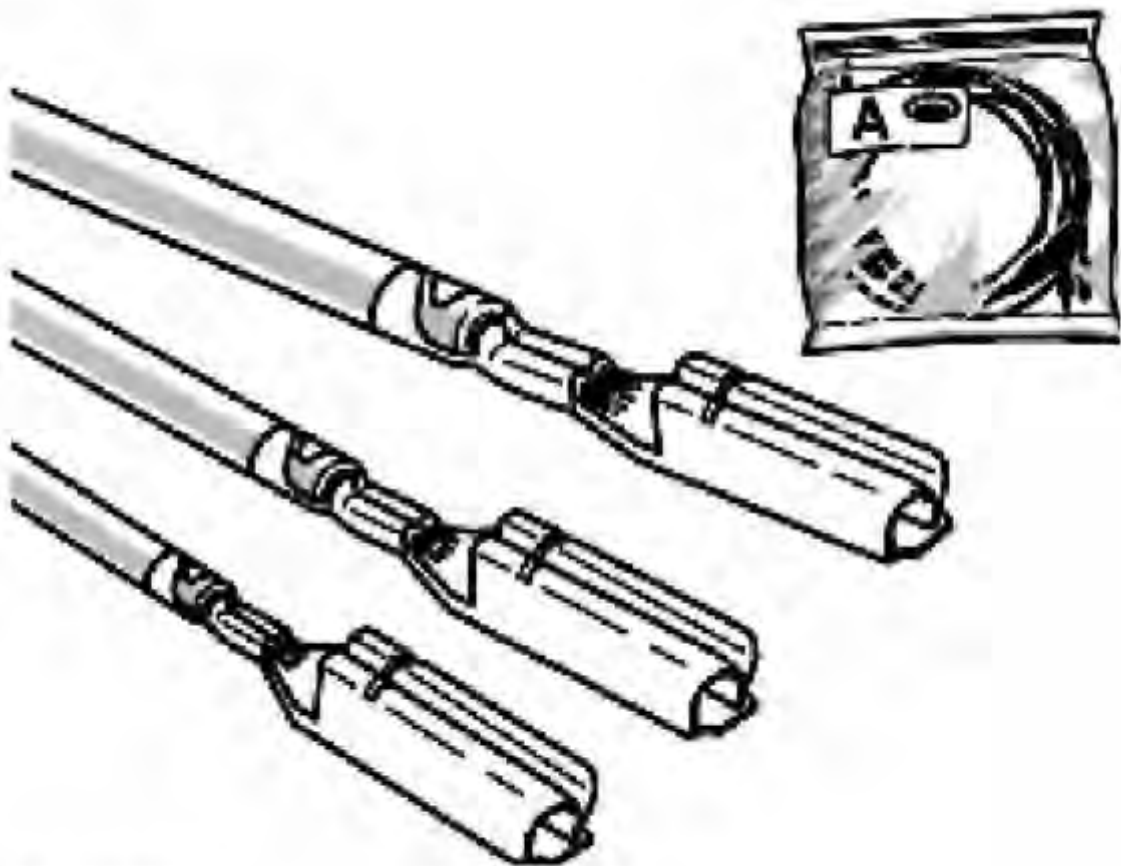
Courtesy of BMW OF NORTH AMERICA, INC.

PREPACKAGED WIRING REPAIR SETS

Included with the Electrical Repair Kit IV are a variety of wiring repair sets. These sets contain various pre-crimped wiring connectors on assorted gauge wire lengths for simple splice connection repair into a wiring harness.

The repair kits also contain:

1. Various gauge lengths of wire with precrimped connectors.
2. In-line splice connectors.
3. Heat shrink tubing.



G03389026

[Fig. 94: Identifying Prepackaged Wiring Repair Sets](#)

Courtesy of BMW OF NORTH AMERICA, INC.

When used correctly the in-line splice connectors provide a BMW factory approved wire crimp. Use the correct size nest in the crimper tool and connect one side of the in-line crimp with the wire.

Slide a piece of heat shrink tubing on the wire and crimp the other side of the in-line connector.



G03389027

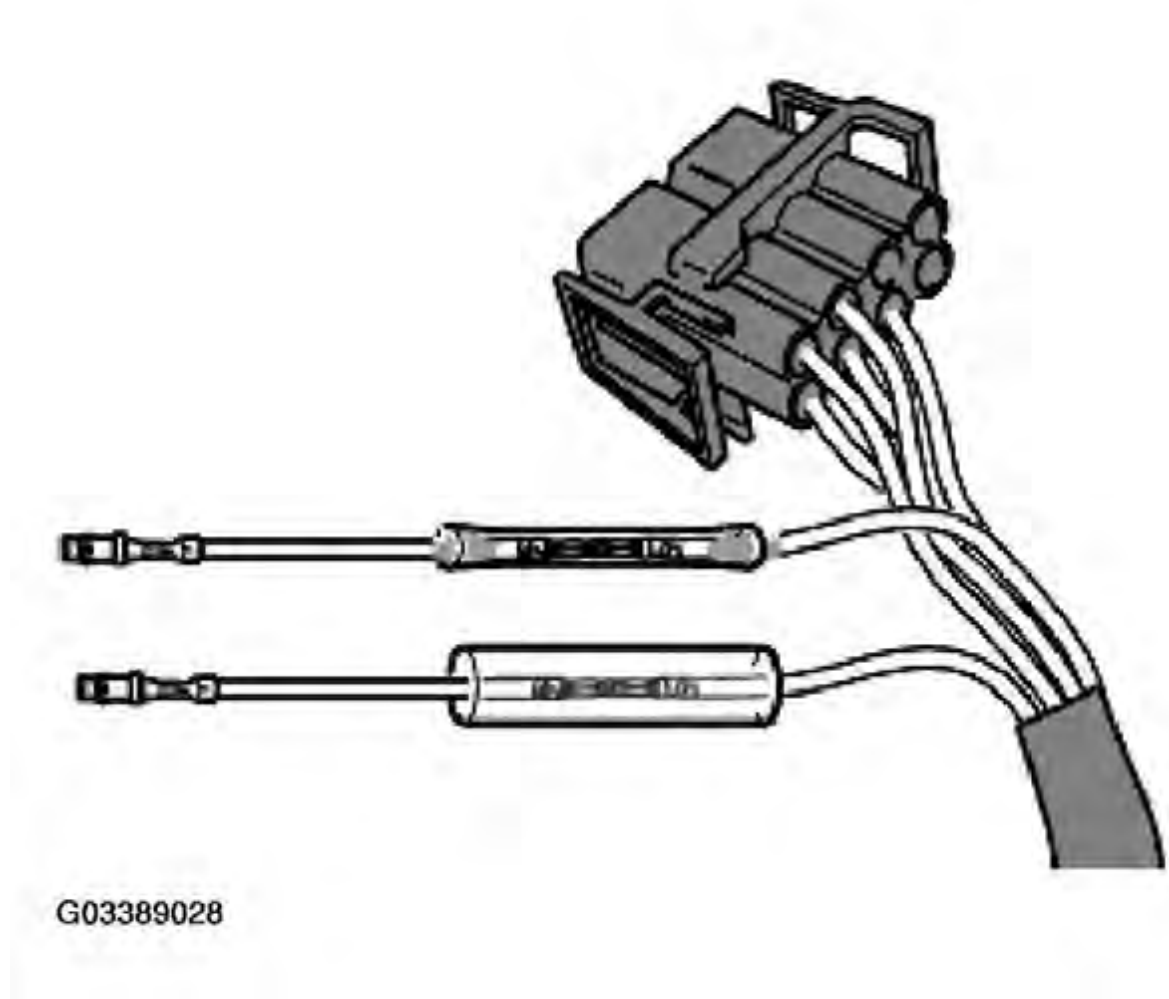
[Fig. 95: Using Correct Size Crimper Tool](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Use a heat gun to shrink the tube around the splice connector to provide a moisture resistant seal.

Part numbers for the wire sets or any component of all four electrical repair kits can be reordered from:

- The P/N reference card inside each repair kit.
- Special tools microfiche.
- The Electrical Repair Kit 1-4 component catalog (SD 92-036).



[Fig. 96: Identifying Electrical Connectors](#)

Courtesy of BMW OF NORTH AMERICA, INC.

As new connectors are developed for new vehicles, the repair kits will be added to appropriate articles.

Soldering Connections

In the event that a wiring connection must be soldered in a vehicle's electrical system, there are certain procedures which must be followed. Improper soldering will result in poor electrical connections or damage to electrical components.

SAFETY: Adhere to the following basic guidelines when preparing to solder.

- Safety glasses must be worn.
- Disconnect vehicle battery.
- Cover vehicle trim surfaces.
- Exercise your common sense.
- Provide adequate ventilation, it's the best safety precaution!

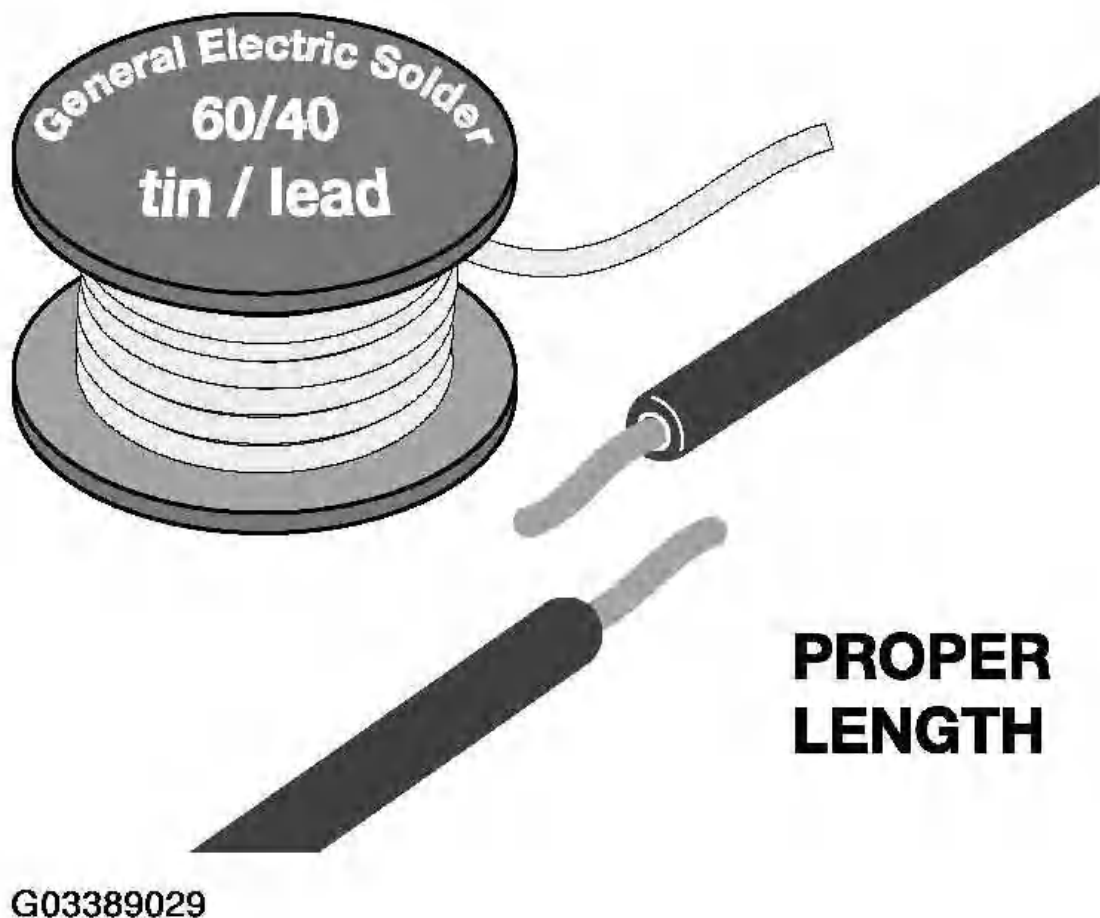
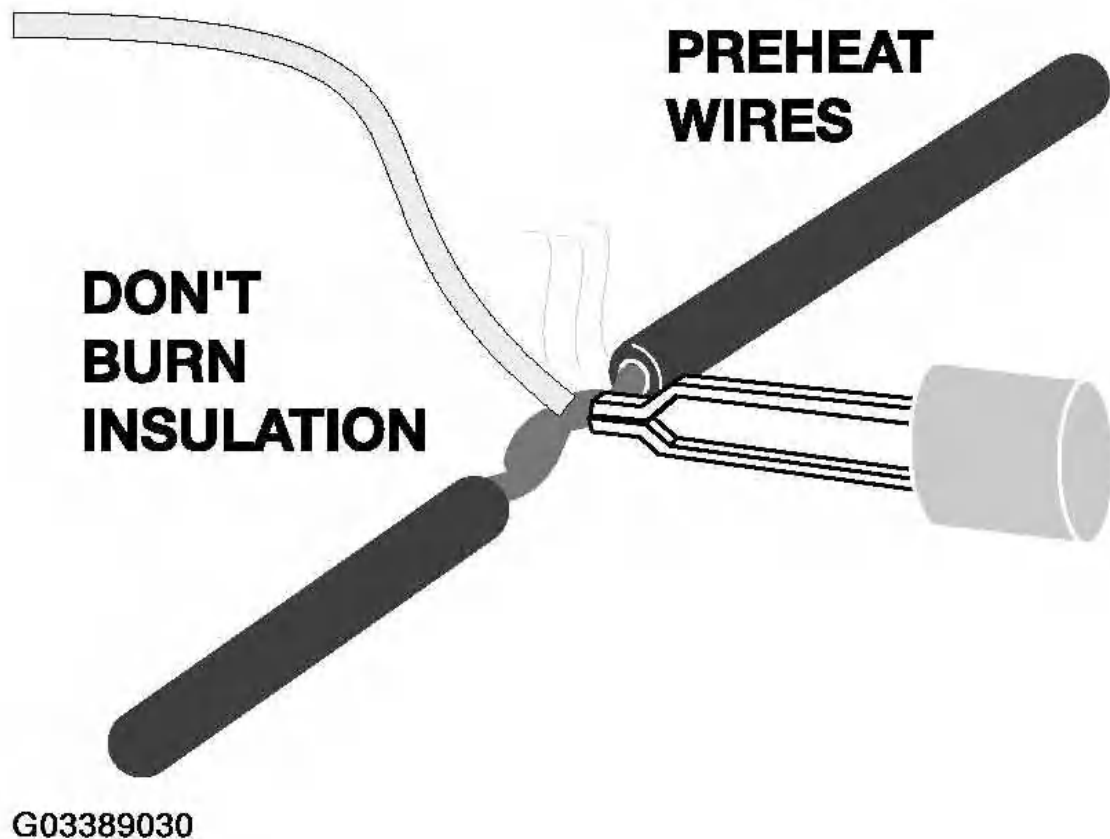


Fig. 97: Identifying Correct Amount Of Wire For Soldering

Courtesy of BMW OF NORTH AMERICA, INC.

Soldering Preparation and Procedure

- The wire insulation must be stripped to expose an adequate amount of bare wire (not too little-not too much.)
- The wires and or connectors must be clean and free of grease, dirt, wax, etc.
- A thin coating of rosin core flux must be applied to the soldering connection.
- Have enough 60/40 (tin/lead) general electrical solder on hand prior to starting.
- If heat transfer to a heat sensitive component is possible use "heat sinks" .
- Use a soldering gun tip that is the right size for the job. Do not use an overly large tip which could melt wire insulation and block your view of what is being soldered.
- The soldering tip must be "tinned" . This means to keep a thin layer of solder on the tip at all times during soldering. This will transfer the heat quickly and allow the solder to flow easily into the joint being soldered.
- Preheat the wires or connector. Introduce the solder into the joint not the soldering tip.
- When the solder starts to flow allow it to infiltrate the joint only for a moment. Almost simultaneously, pull the tip off of the joint to prevent overheating.
- A properly soldered joint will be smooth, shinny, and even surfaced.



[Fig. 98: Identifying Soldering Procedure](#)
Courtesy of BMW OF NORTH AMERICA, INC.

BREAKOUT BOXES AND "V" CABLES

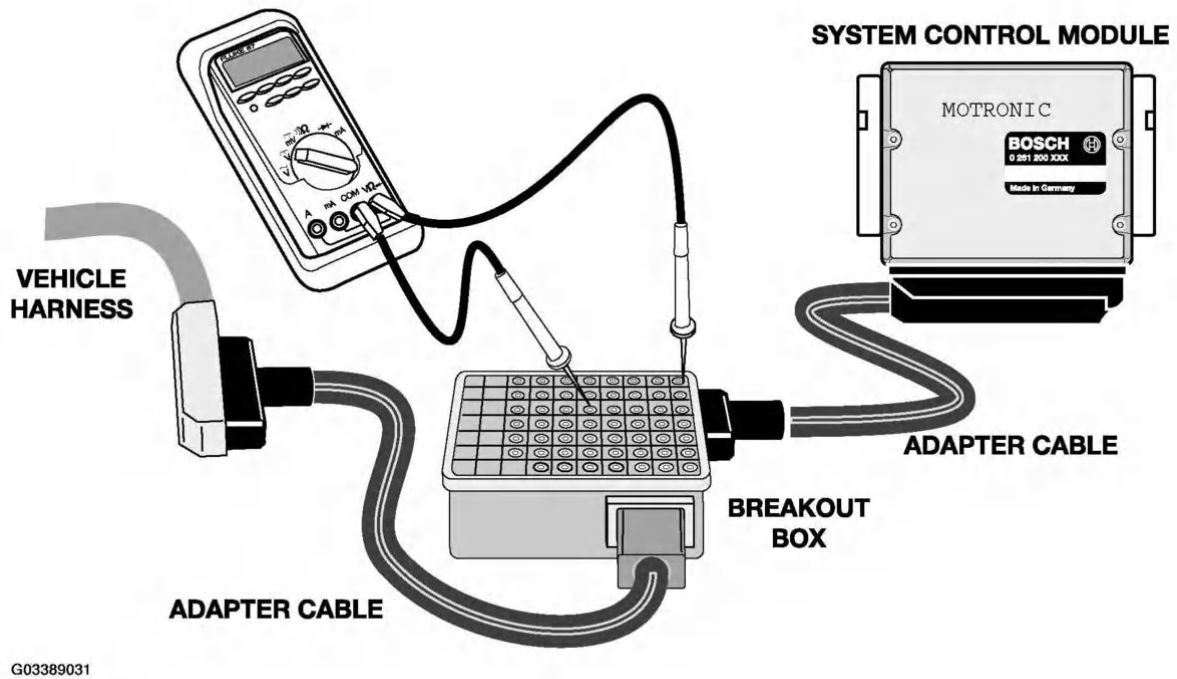
Breakout Boxes are used to:

- Provide a convenient "tap" into an electrical circuit.
- Minimize the possibility of damage to control unit connections and wire harnesses during diagnosis of electrical/electronic systems.
- Ensure solid meter connections for proper diagnosis, this in turn will help the technician to be more organized and efficient.
- Provide easier access to circuits for testing with equipment such as, multimeter, DISplus tester or other diagnostic tools.

CAUTION: Breakout box cable connections are universal in order to fit the varying coded connectors found in the vehicles. Always confirm that you are connecting the correct control module into the system harness that is on the other side of the breakout box. System damage will occur if it is not the correct system.

Example: DME and EGS/AGS control modules both utilize an 88 or 134 pin control module. These control modules reside in the same E-Box on most vehicles. The control modules are coded to prevent unintentional cross connecting at the vehicle harness. But, this connector coding is not present on the 88 or 134 pin breakout box(s). Result: A DME control module could be connected to a transmission control system. Damage will result!

Several different types of breakout boxes are available depending on the particular system being diagnosed.



[Fig. 99: View Of Breakout Box](#)

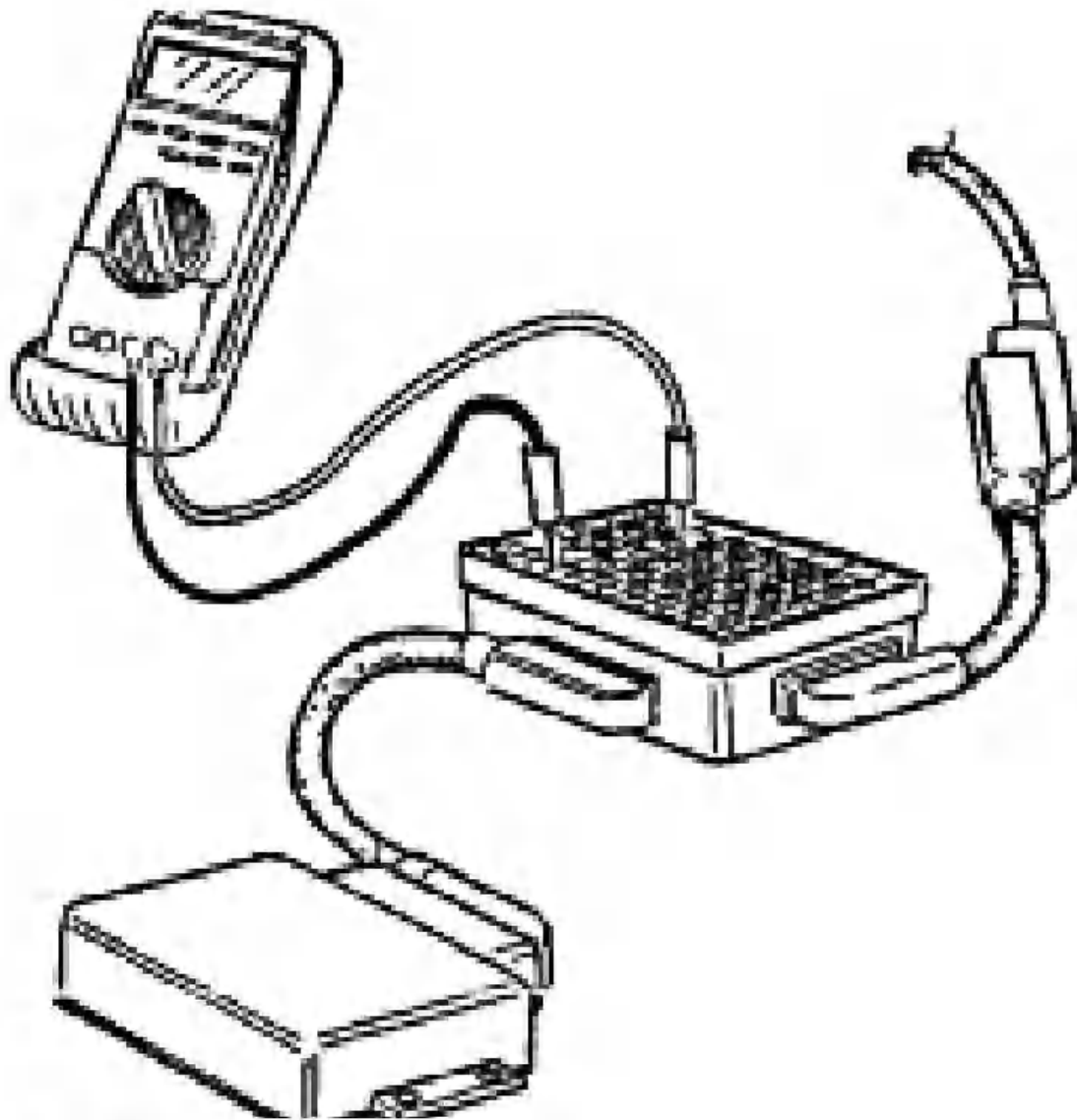
Courtesy of BMW OF NORTH AMERICA, INC.

55 pin Breakout Box P/N 81 12 9 425 091

Used with control modules that have single multipin plugs from 25 to 55 pins.

- L-jetronic.
- ABS.
- Motronic.
- EGS.

Adapter cables are required.



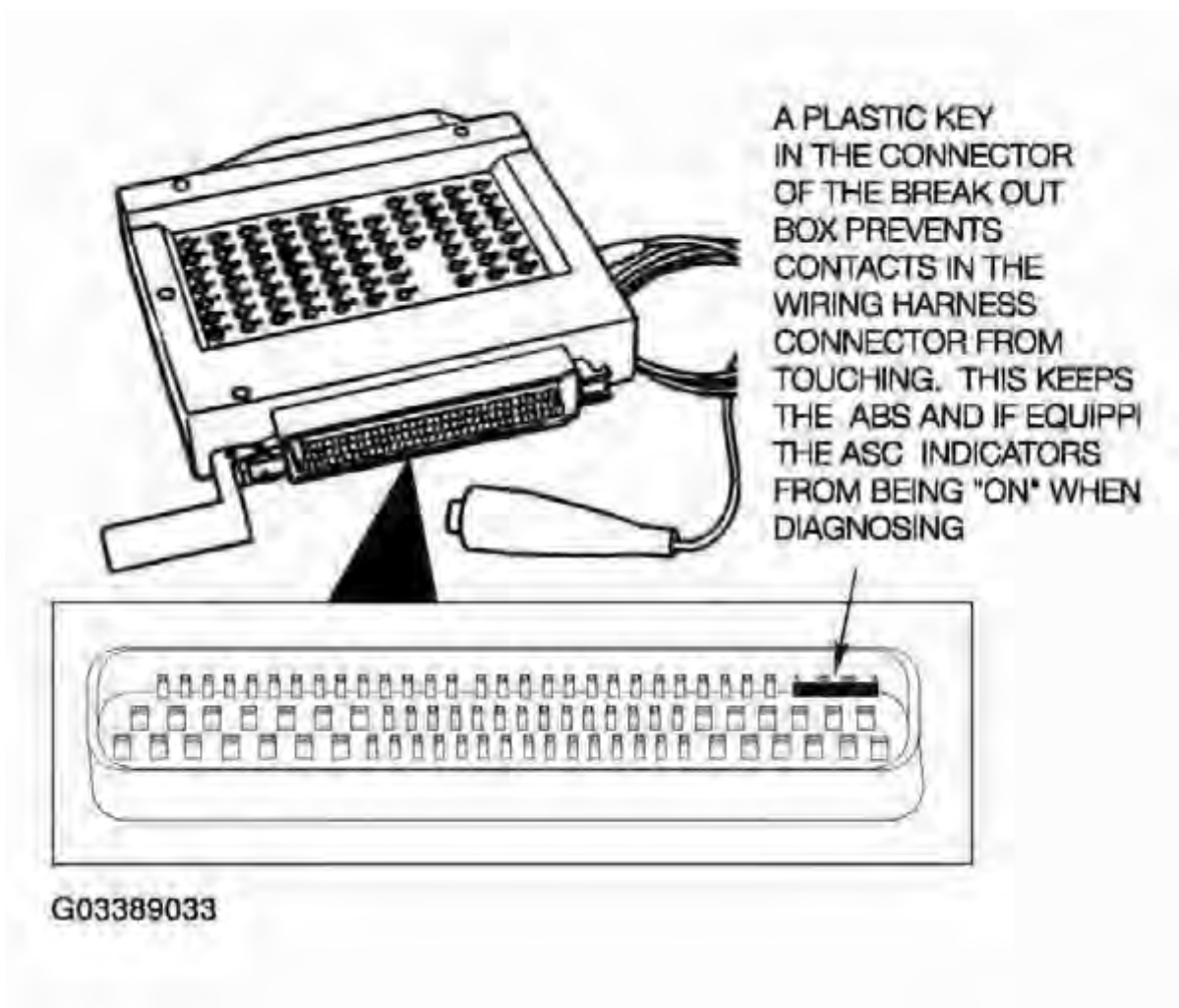
G03389032

[Fig. 100: Identifying 55 Pin Breakout Box P/N 81 12 9 425 091](#)

Courtesy of BMW OF NORTH AMERICA, INC.

83 Pin Breakout Box (Red Face) P/N 90 88 6 614 420

When used with ABS/ASC 5 system, no adapter cables are required. There is an adapter harness for use with the Teves Mark IV G ABS system of the E36.



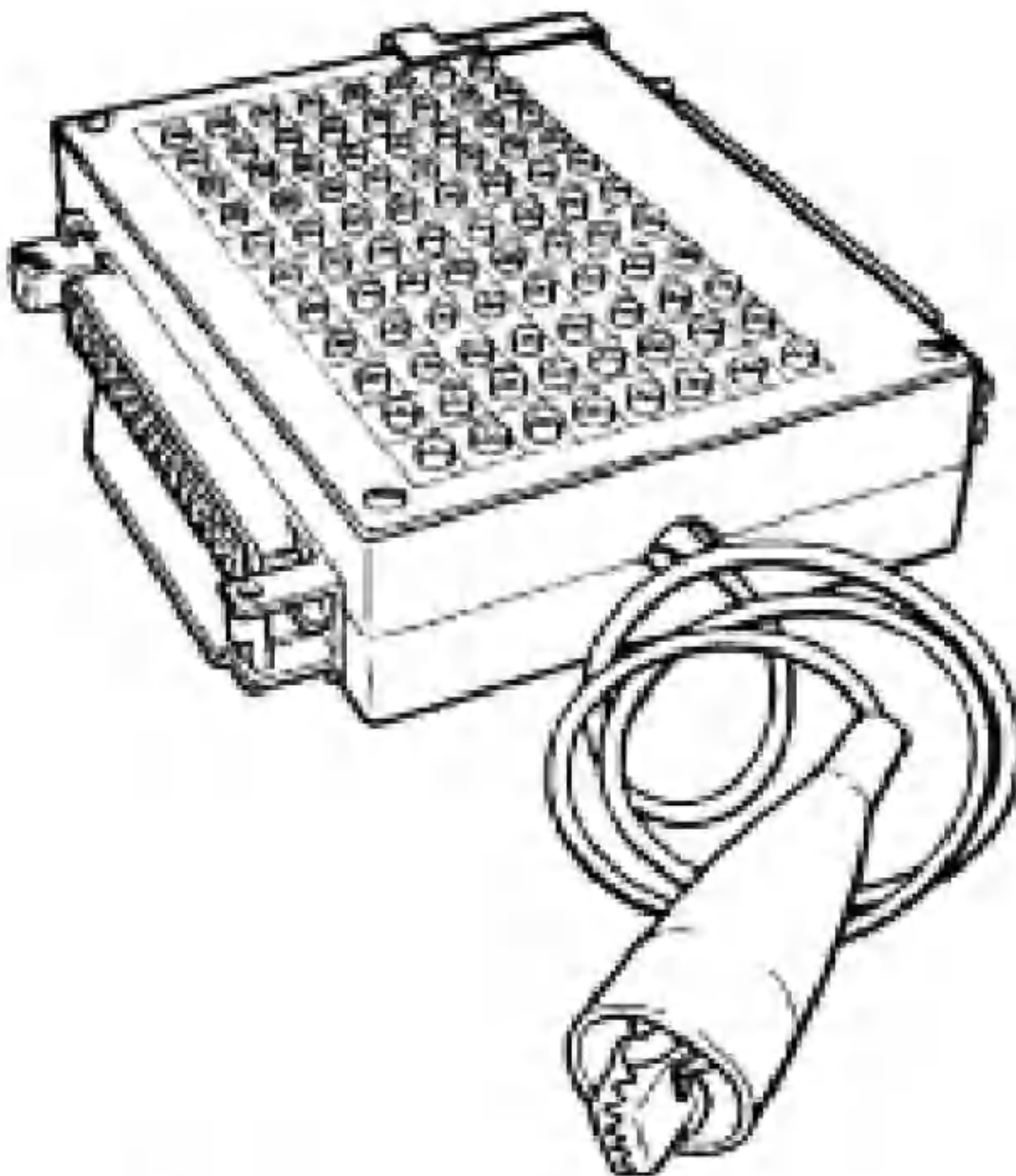
[Fig. 101: View Of 83 Pin Breakout Box \(Red Face\) P/N 90 88 6 614 420](#)
Courtesy of BMW OF NORTH AMERICA, INC.

88 Pin Breakout Box (Green Face) P/N 88 88 6 614 410

Used with control units that have up to 88 pins;

- DME.
- EGS/AGS.
- ZAE/MRS.
- LCM.

No adapter cables are required when connected to a DME or EGS/AGS control module. There are adapter harnesses for ZAE/MRS and LCM systems.

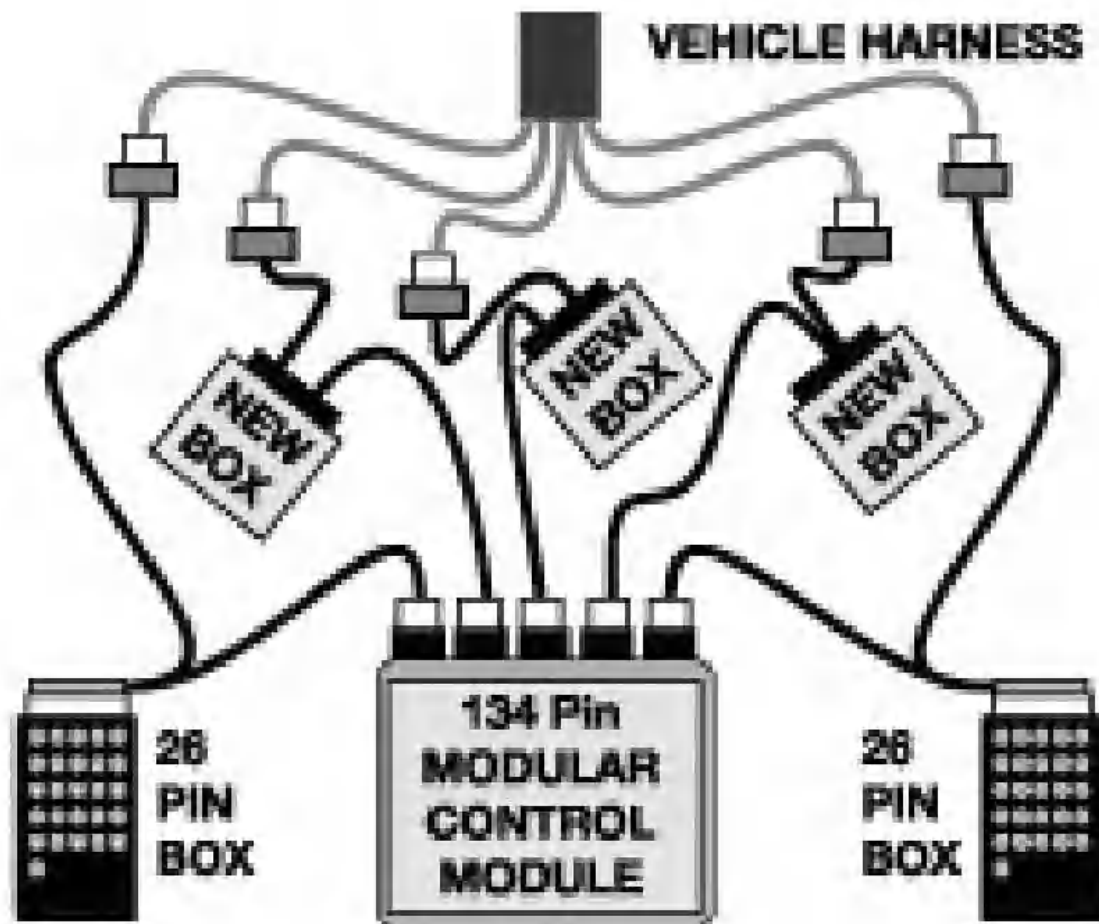


G03389034

[Fig. 102: Identifying 88 Pin Breakout Box \(Green Face\) P/N 88 88 6 614 410](#)
Courtesy of BMW OF NORTH AMERICA, INC.

[134 Pin SKE Control Module Breakout Box Set P/N 90 88 6 121 300](#)

The 134 pin modular connector DME and AGS control modules use a combination of breakout boxes for troubleshooting. The part number above provides three breakout boxes and five adapter harnesses. The two outside edge connectors use the familiar 26 pin breakout boxes. The three inside connectors use the boxes from the ordered set.



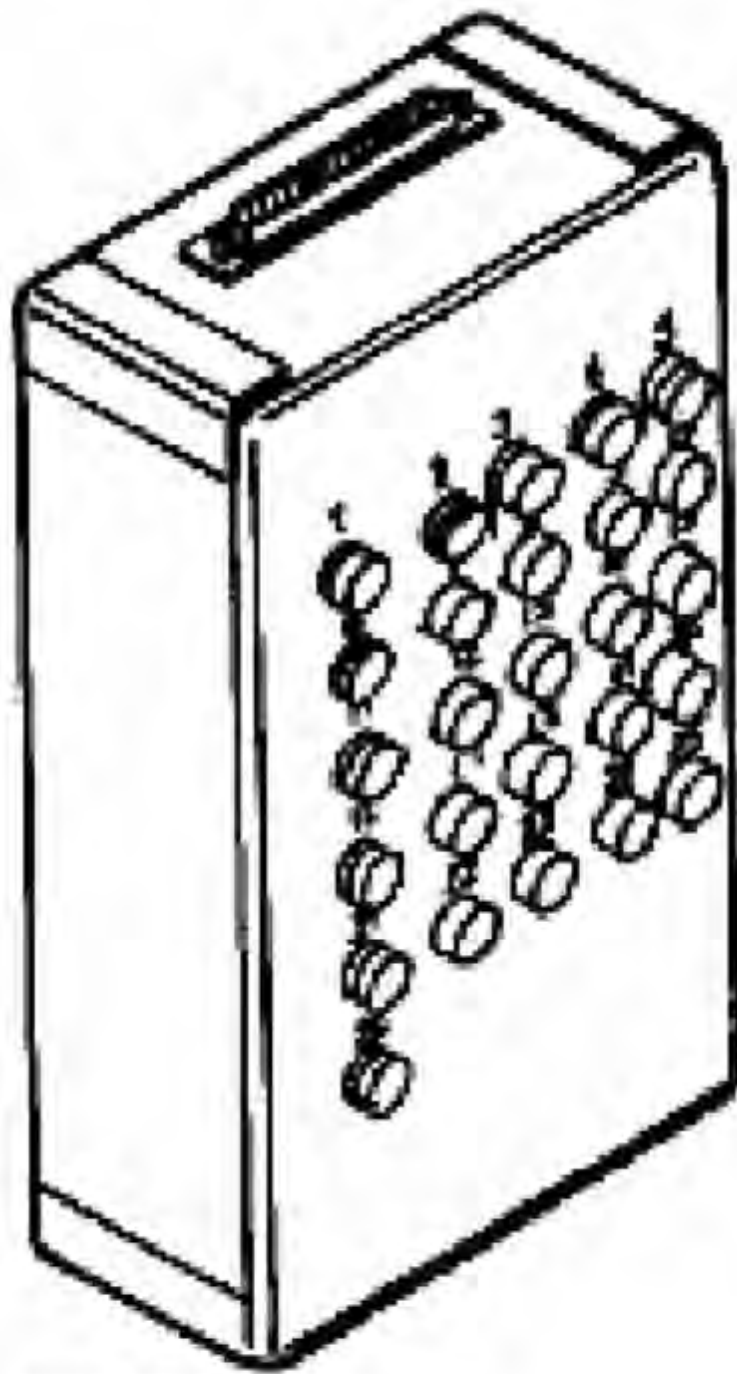
G03389035

[Fig. 103: View Of 134 Pin SKE Control Module Breakout Box Set P/N 90 88 6 121 300](#)

Courtesy of BMW OF NORTH AMERICA, INC.

[26 Pin Breakout Box P/n 88 88 6 611 459](#)

Used with system or peripheral control module that have up to 26 pins. This breakout box is used in conjunction with adapter cables called "V" Cables. There are many different types of "V" cables for the various connectors found on the vehicles.

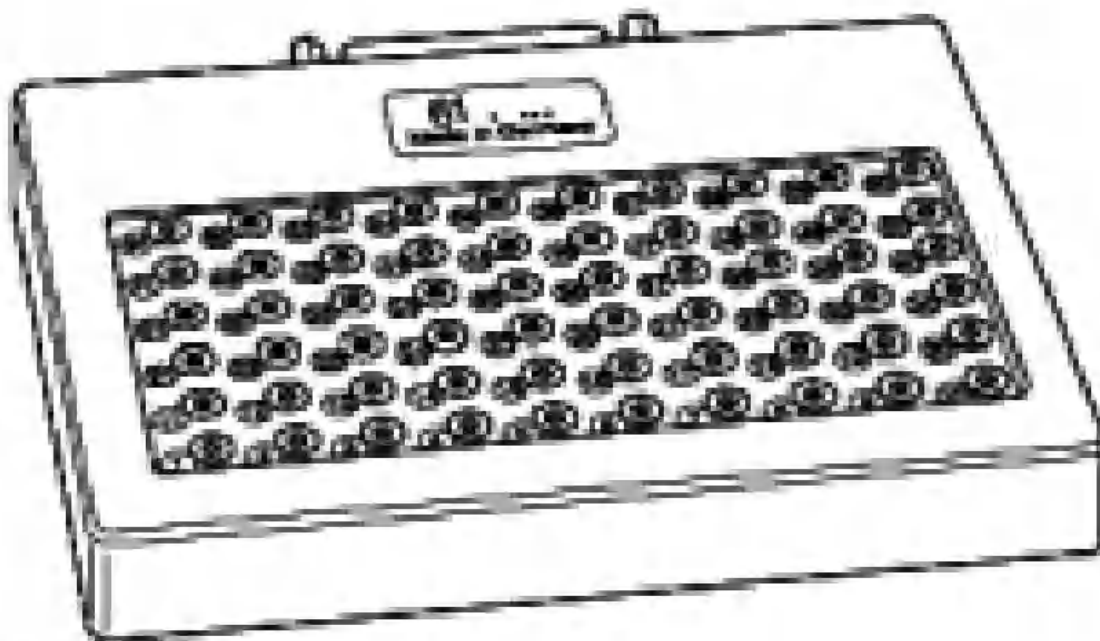


G03389036

[Fig. 104: Identifying 26 Pin Breakout Box P/N 88 88 6 611 459](#)
Courtesy of BMW OF NORTH AMERICA, INC.

[60 Pin Breakout Box P/N 90 88 6 614 390](#)

Used for connecting all adapter leads with 27 pin to 60 pin plug connections.



G03389037

[Fig. 105: View Of 60 Pin Breakout Box P/N 90 88 6 614 390](#)

Courtesy of BMW OF NORTH AMERICA, INC.

TESTER AND ADAPTER SET FOR RELAYS

The Relay Adapter provides a platform to test a relay while allowing the relay to remain active in a circuit.

The adapters included enable different pin configurations of relays to be tested using a single tester.



G03389038

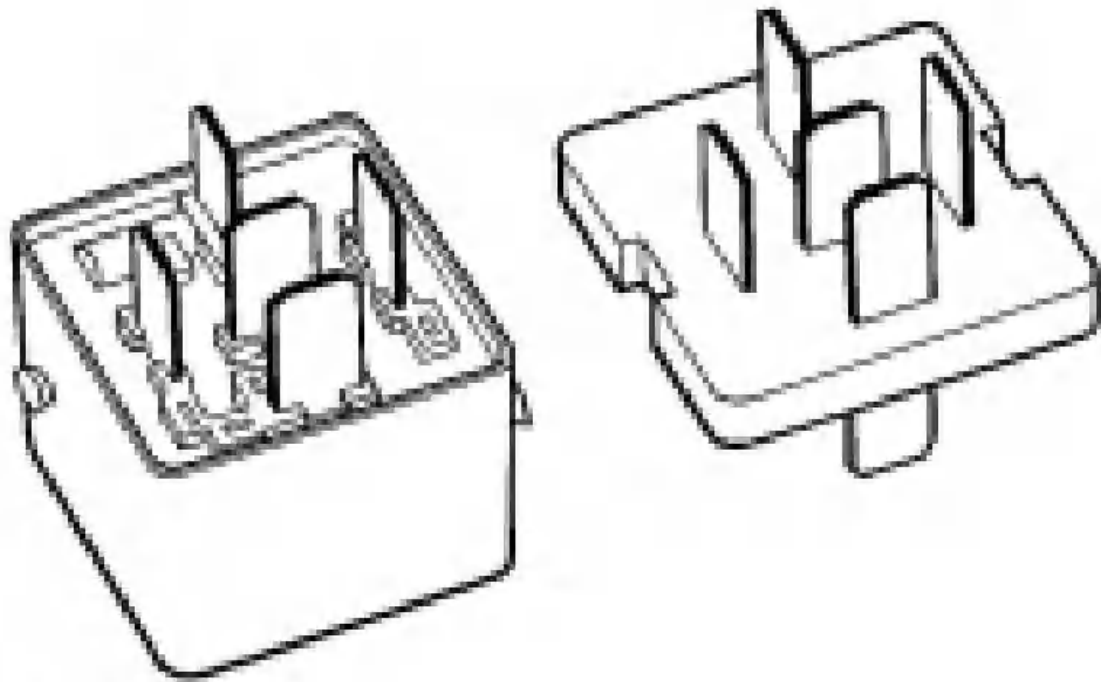
[Fig. 106: Identifying Tester And Adapter Set For Relays](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Remove relay and compare plug in adapter with plug pattern on relay. Choose correct adapter ([Fig. 107](#)).

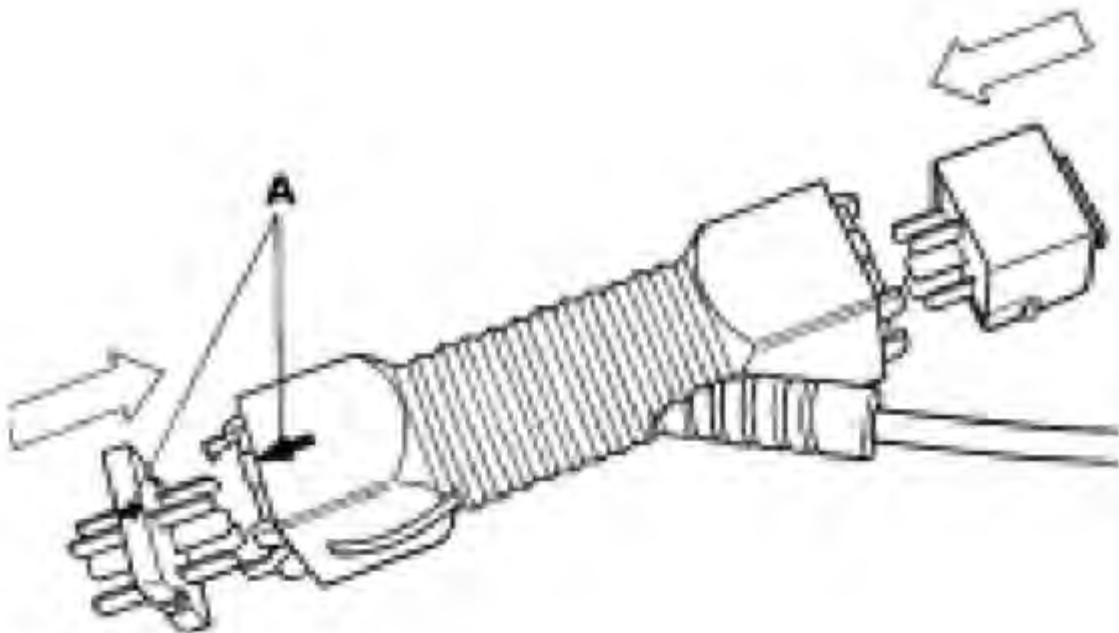
Fit adapter to Measuring bridge, noting the marker arrows (A). Fit the relay to the measuring bridge ([Fig. 108](#)).

Plug the assemble measuring bridge into the socket of the relay to be checked. Test using a multimeter. See the circuit diagram, testing instructions in the appropriate article for subsequent procedure ([Fig. 109](#)).



G03389039

[Fig. 107: Identifying Relay And Compare Plug](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03389040

[Fig. 108: Fitting Adapter To Measuring Bridge](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03389041

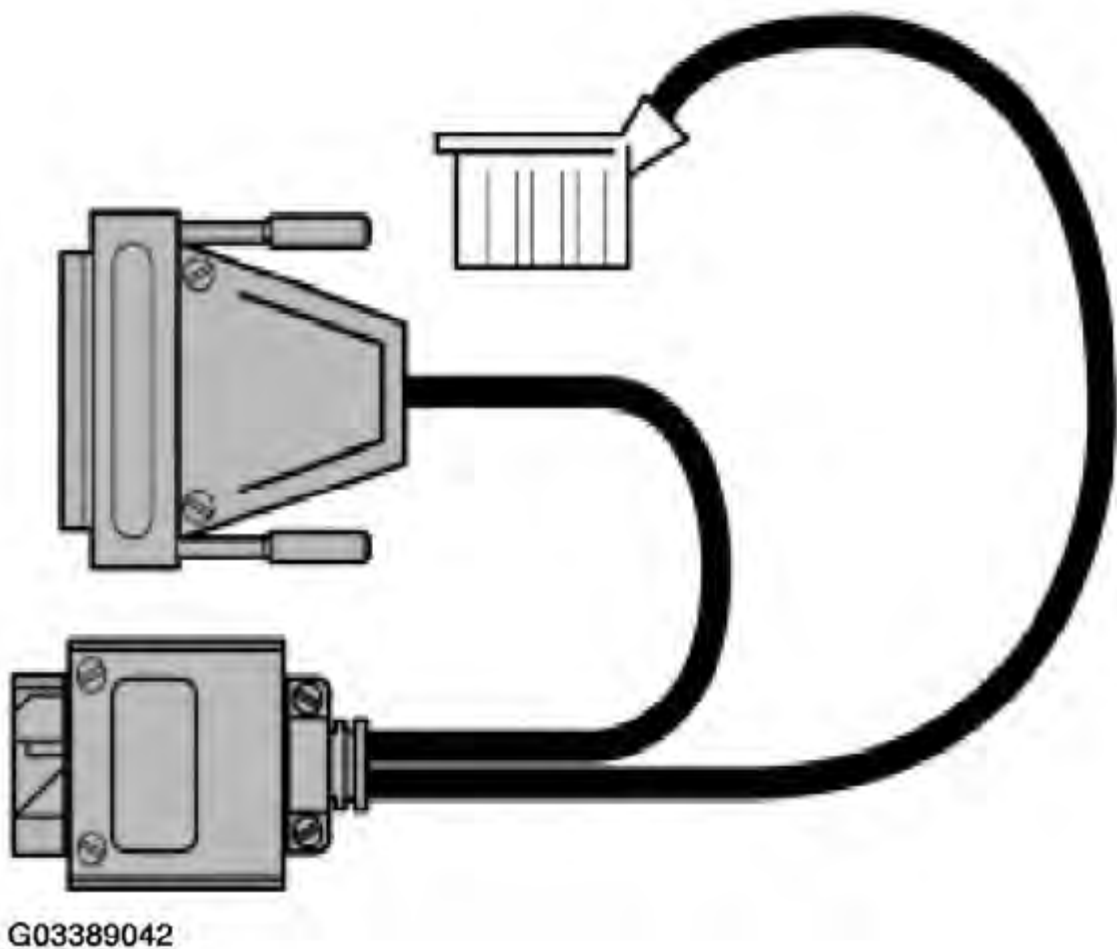
[Fig. 109: View Of Measuring Bridge In Socket](#)

Courtesy of BMW OF NORTH AMERICA, INC.

"V" Cables

"V" cables are available in different versions depending on the system being diagnosed. Always refer to the most recent information for the required special tools.

"V" cables are only used with the 26 pin breakout box to access input and output signals of peripheral modules and systems.



[Fig. 110: Identifying "V" Cables](#)

Courtesy of BMW OF NORTH AMERICA, INC.

- The appropriate cable is distinguished by the color of the connector end.
- The color will match the particular modules connector color. Unless the color matches, the cable will not fit the connector on the module being tested.
- Each colored "V" cable has a series of alignment tabs that will only fit it's particular module or system.

"V" cables with ELO connectors are also being used with the 26 pin breakout box. These cables are unique in that they have a locking arm on the component side of the cable. They are light green in color, and the number of pins will vary depending on the system being tested.

"V" harness adapters were introduced with the E38. These also have light green ELO connectors on the component side, but they do not require a breakout box.

There is a black plug on one side with same number of pins as the component being tested.

The plug has numbers stamped on it's side that corresponds with the pins on that particular component.

You access the signals by plugging the test equipment directly into those pin numbers.

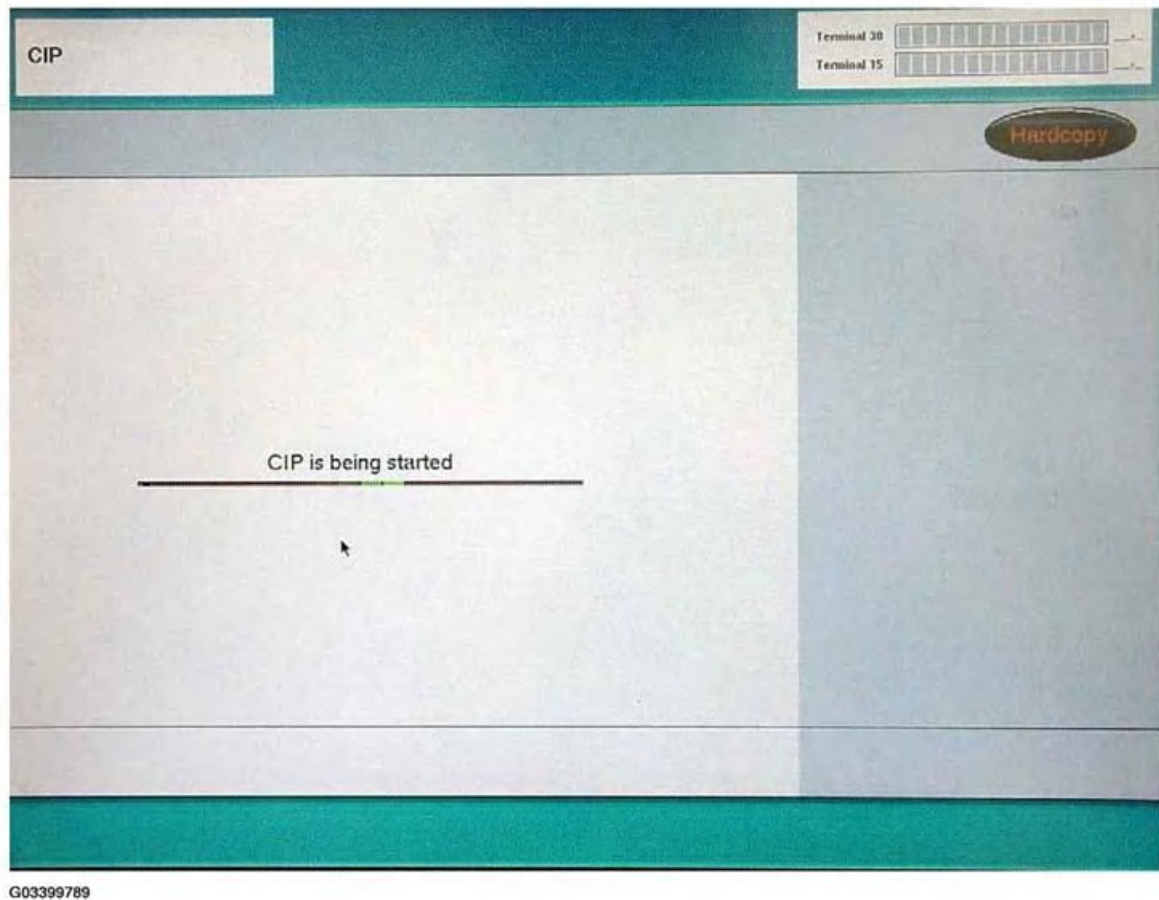
As new systems and components are being introduced, new breakout boxes and cables will also be introduced.

GENERAL INFORMATION

CIP Programming - Overview

CIP PROGRAMMING

CIP PROGRAMMING SCREENS

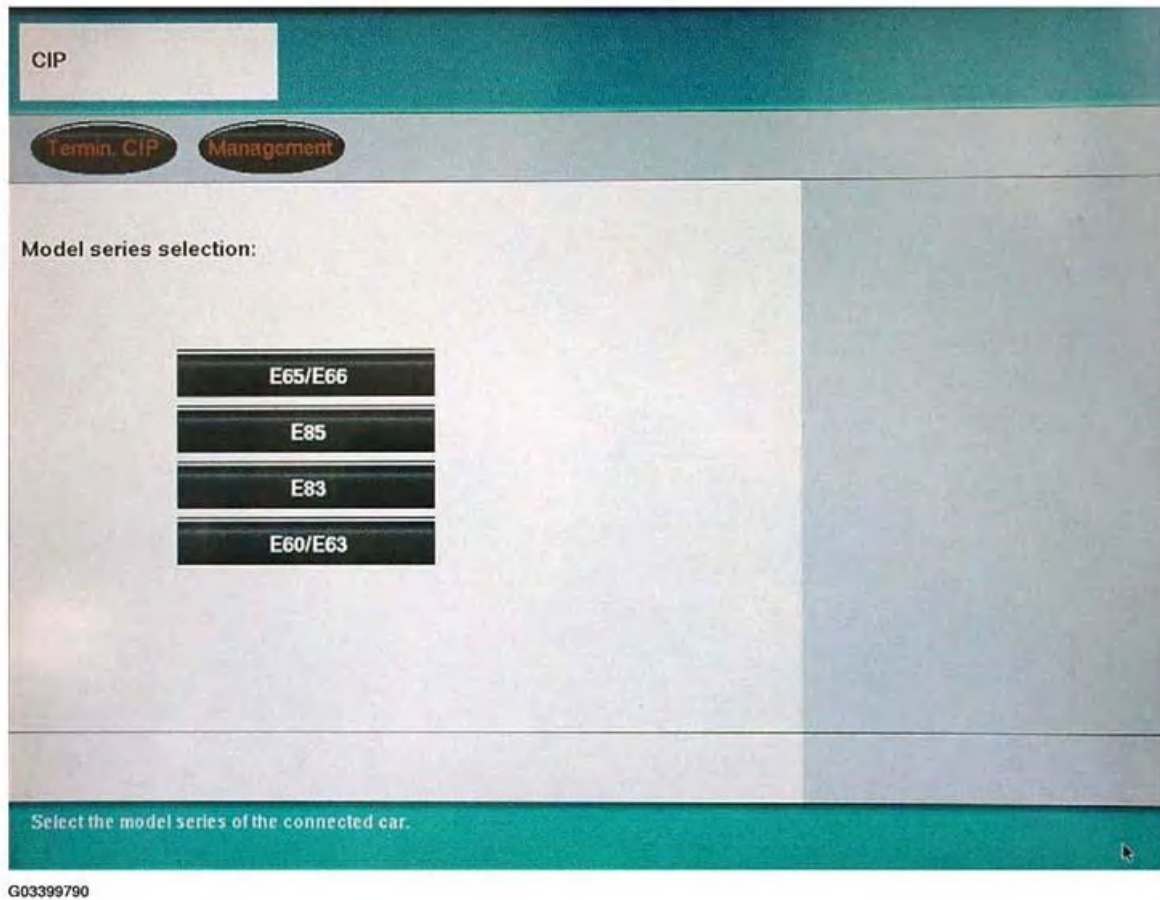


[Fig. 1: CIP Programming Screen](#)

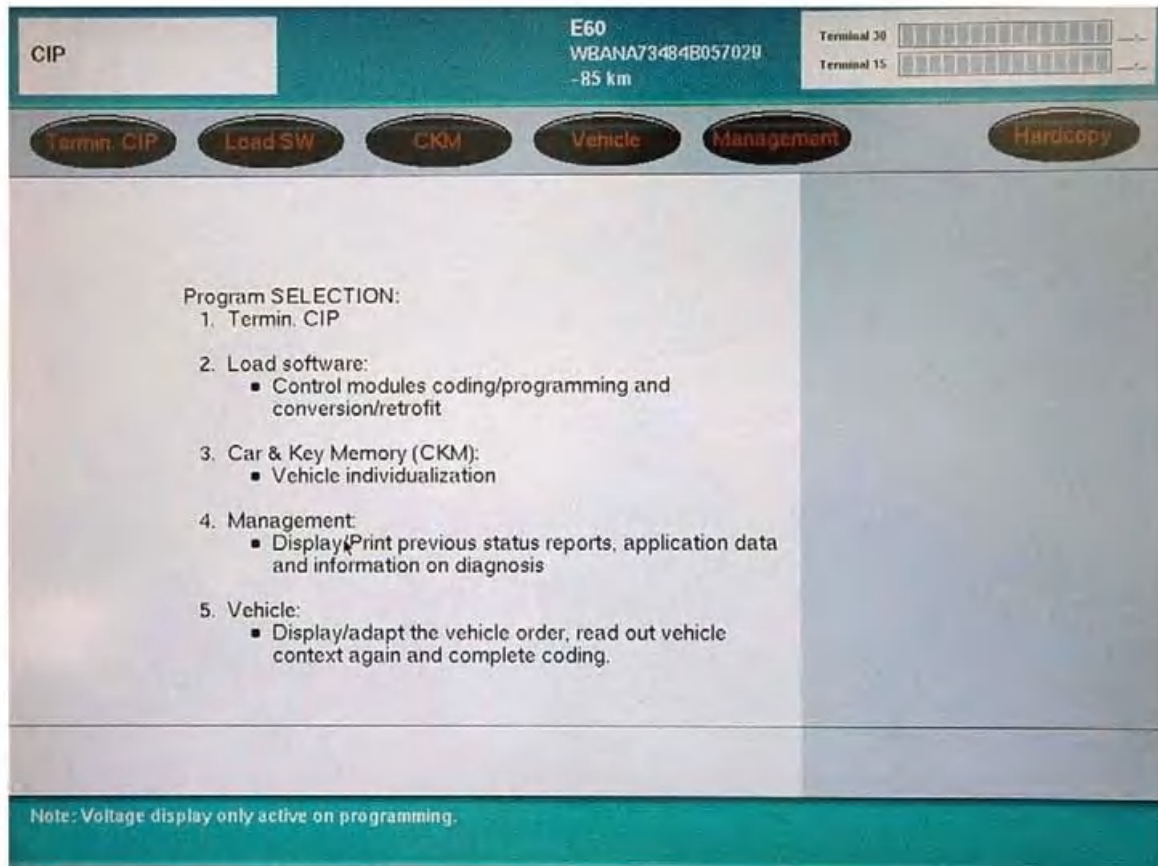
Courtesy of BMW OF NORTH AMERICA, INC.

The opening screen when CIP is started.

Choose which vehicle you will be programming.



[Fig. 2: Vehicle Selecting Programming Screen](#)
Courtesy of BMW OF NORTH AMERICA, INC.



G03399791

[Fig. 3: Programming Screen - Retrofit Select](#)

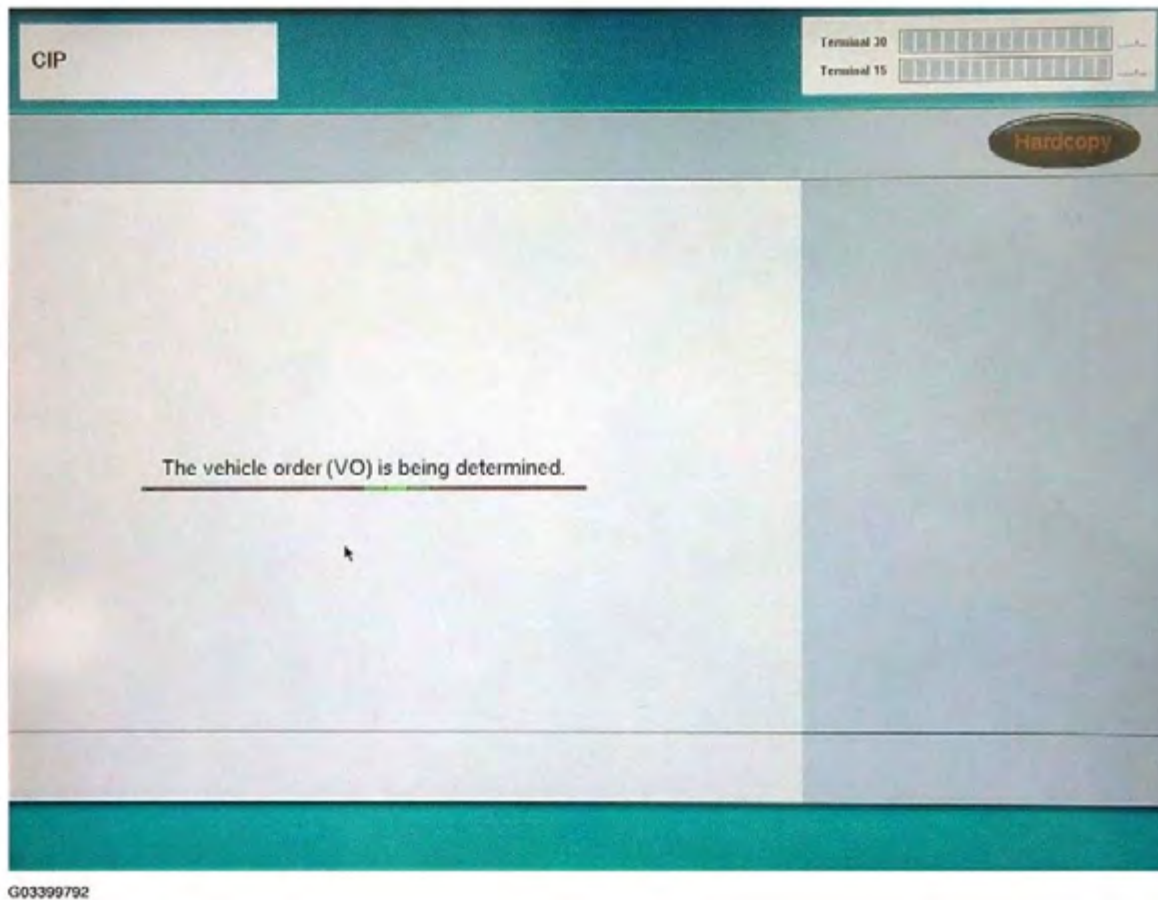
Courtesy of BMW OF NORTH AMERICA, INC.

Select depending upon programming required.

To retrofit select Load SW.

To update a vehicle select Vehicle.

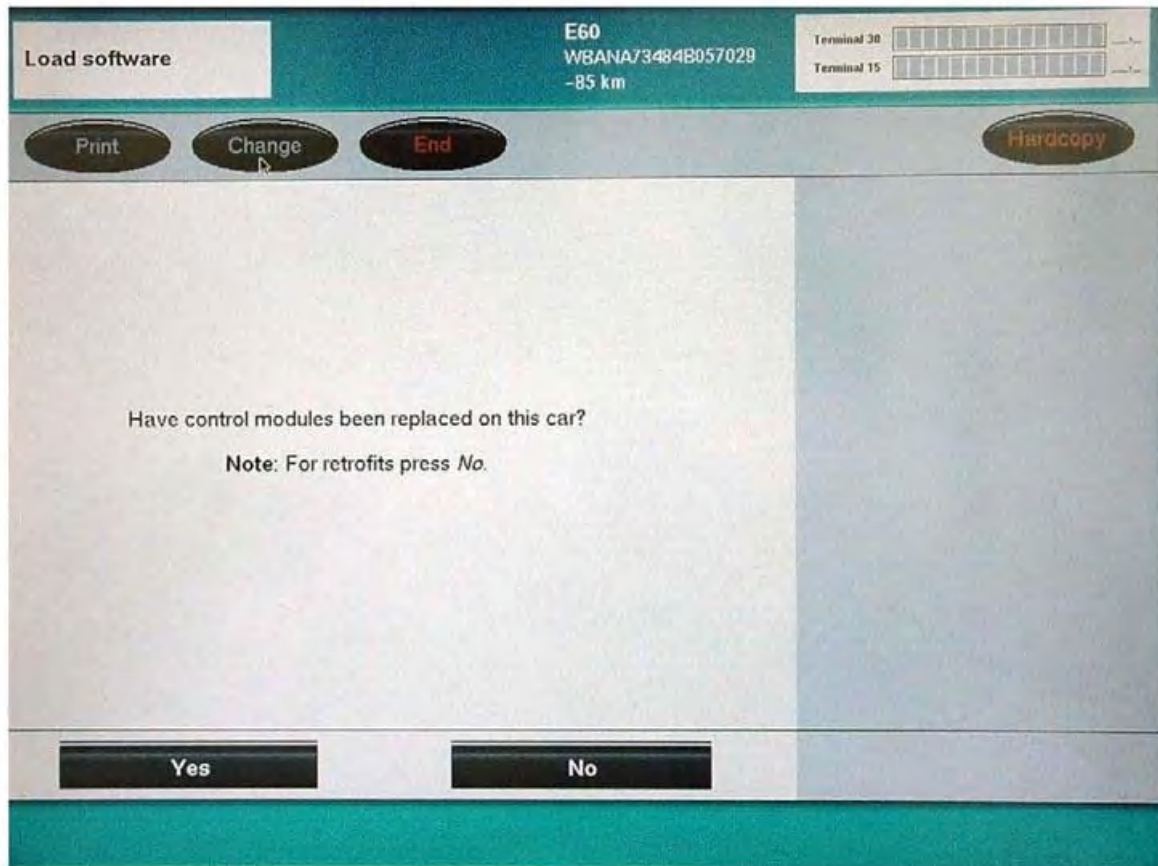
Selecting Vehicle will ensure that complete encoding is performed.



[Fig. 4: Programming Screen - Load Software](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Regardless of whether you have selected Load SW or Vehicle, the VO will be determined.

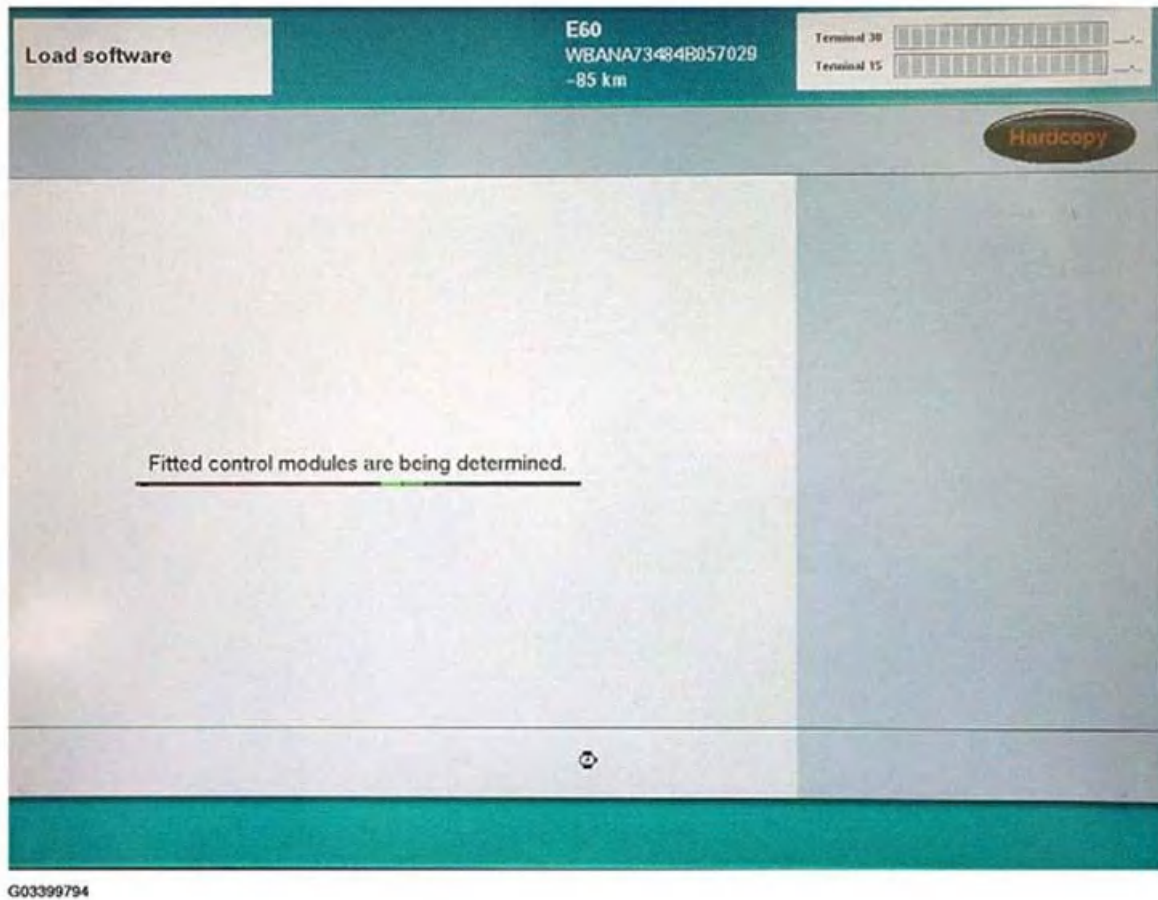


[Fig. 5: Programming Screen - Determine](#)

Courtesy of BMW OF NORTH AMERICA, INC.

A YES selection will lead you to choose which control module(s) have been replaced.

A NO selection will lead you to Retrofits .



[Fig. 6: Programming Screen - Measure Plan](#)

Courtesy of BMW OF NORTH AMERICA, INC.

After selecting YES fitted control modules will be determined.

Load software

E60

WBANA73484B057029

-85 km

Terminal 30

Terminal 15

Print

Change

End

Hardcopy

Select measures plan.

Date / time:

29.01.2004 / 11:56

Model series:

E60

Vehicle ID number:

WBANA73484B057029

Vehicle order:

E60 #0103*NA73%0892&LCSW\$205\$217\$226\$229\$302\$319

\$338\$354\$403\$415\$416\$423\$430\$431\$438\$441\$442\$459

\$473\$481\$488\$534\$540\$590\$605\$638\$645\$676\$683\$694

\$785\$823\$845\$850\$853\$876\$909\$991\$992-B110

Vehicle data status:

E060-03-12-525

Target data status:

E060-03-12-527

1. Program DSC (via DIAGBUS)

Old part no. progr. ctrl mod.

6767698

New part no. progr. ctrl mod.

6768616

DSC can still be programmed 12 times.

Accept

Print or copy out the desired measures plan.

G03399795

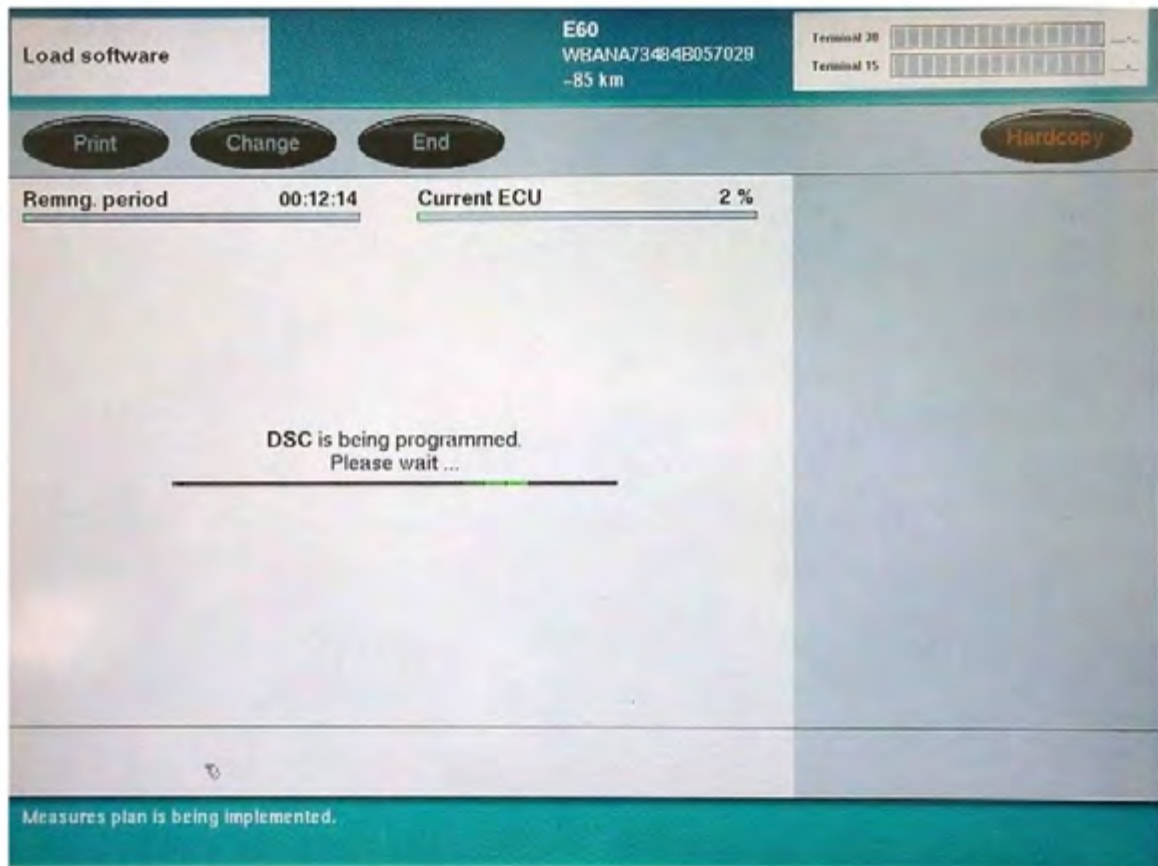
Fig. 7: Programming Screen - Control Modules

Courtesy of BMW OF NORTH AMERICA, INC.

After determining the fitted modules, a measures plan will be made. At this point you will be notified if control modules need to be replaced.

Control module replacement is required if the hardware level in a module can not be upgraded to a high enough software level.

In the case above no modules need replacement, in fact on the DSC needs to be reprogrammed.

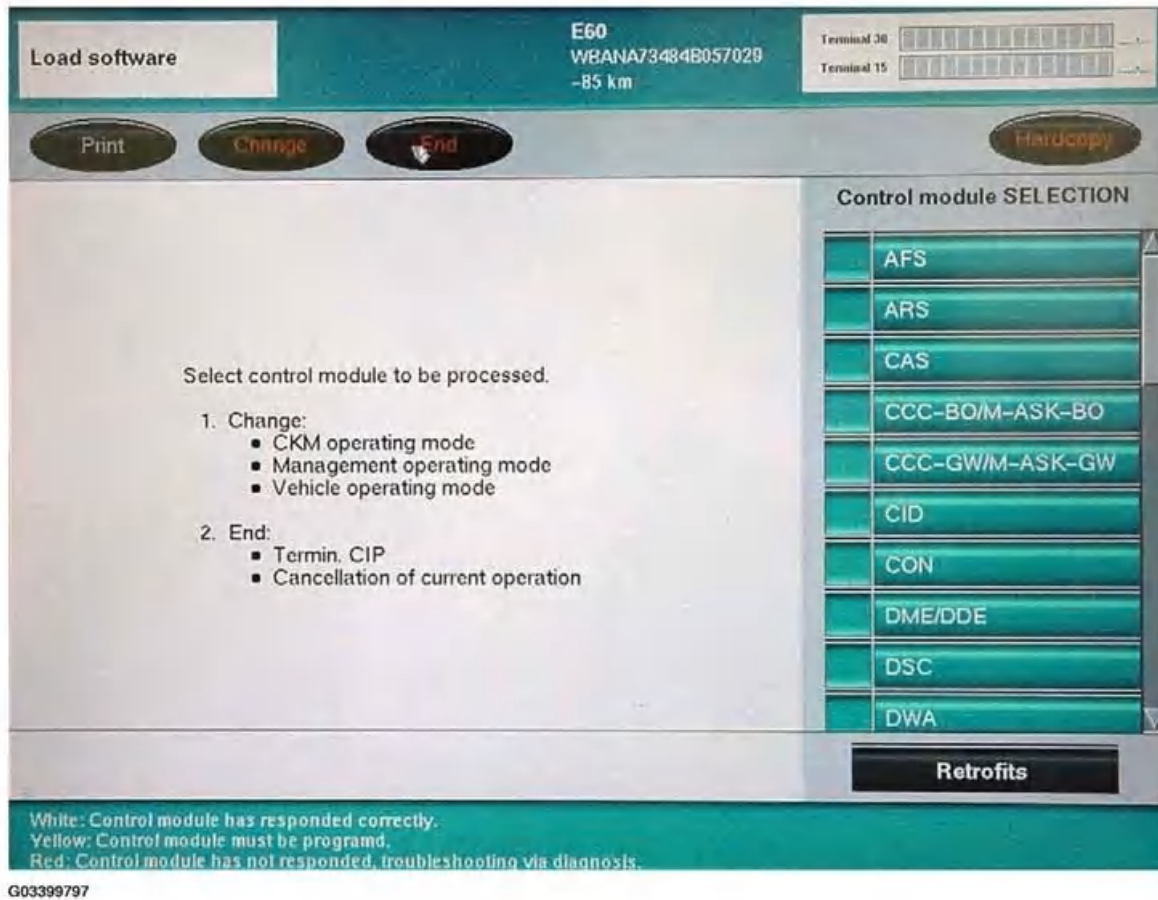


G03399796

[Fig. 8: Programming Screen - DSC Being](#)

Courtesy of BMW OF NORTH AMERICA, INC.

DSC programming is being carried out.

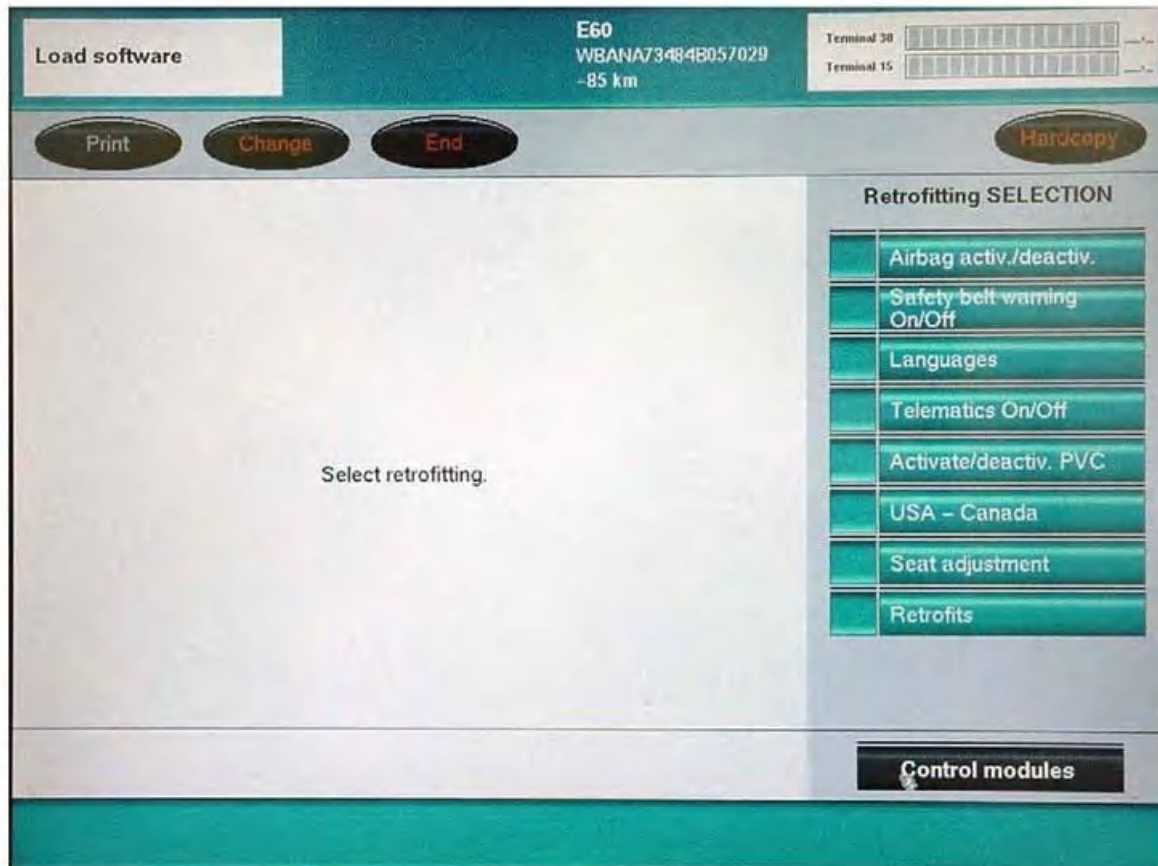


[Fig. 9: Programming Screen - Retrofit Programming](#)

Courtesy of BMW OF NORTH AMERICA, INC.

If you selected no earlier (Have any control modules been replaced?) you would come to this screen.

Here selections to reprogram individual modules can be made or entry into retrofit programming.



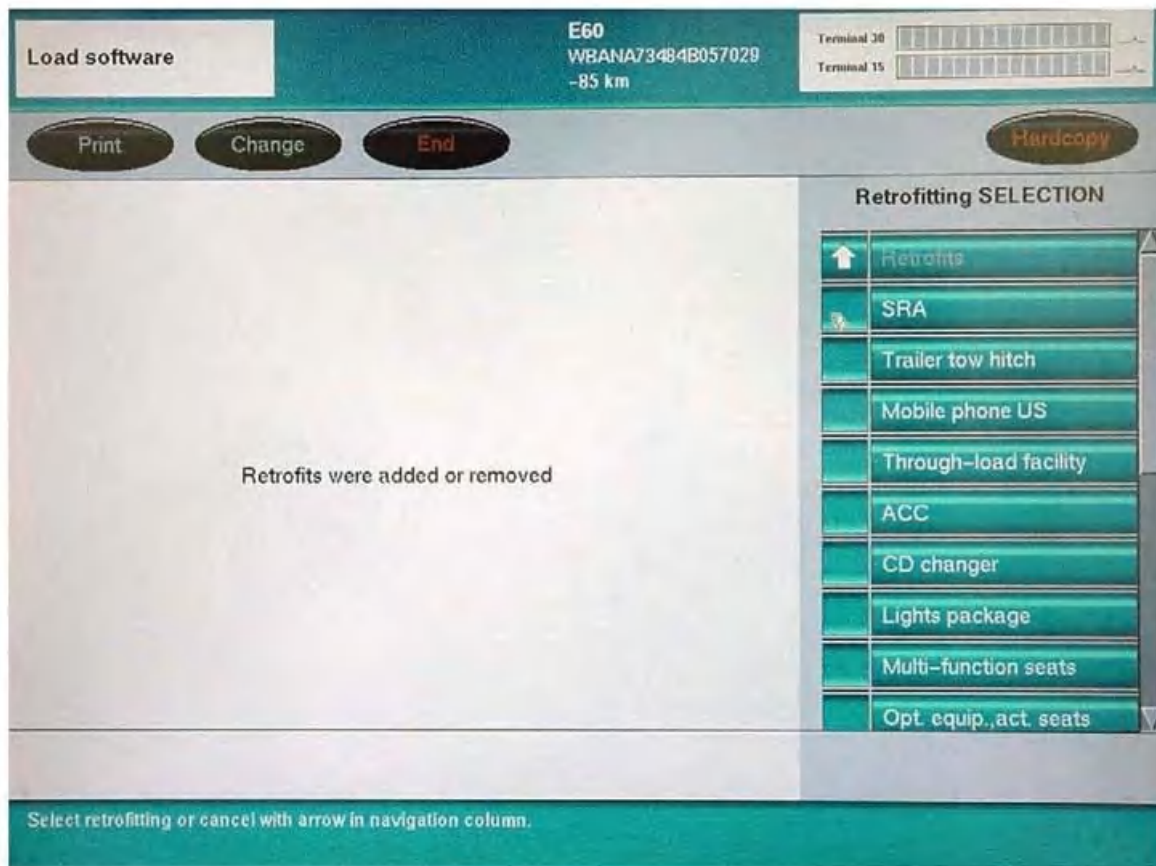
G03399798

[Fig. 10: Programming Screen - Selecting Retrofit](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Selecting retrofit on the previous screen brings you here.

More selections (such as mobile phone USA) are on the next page, accessed by pressing retrofits on bottom of selection list.

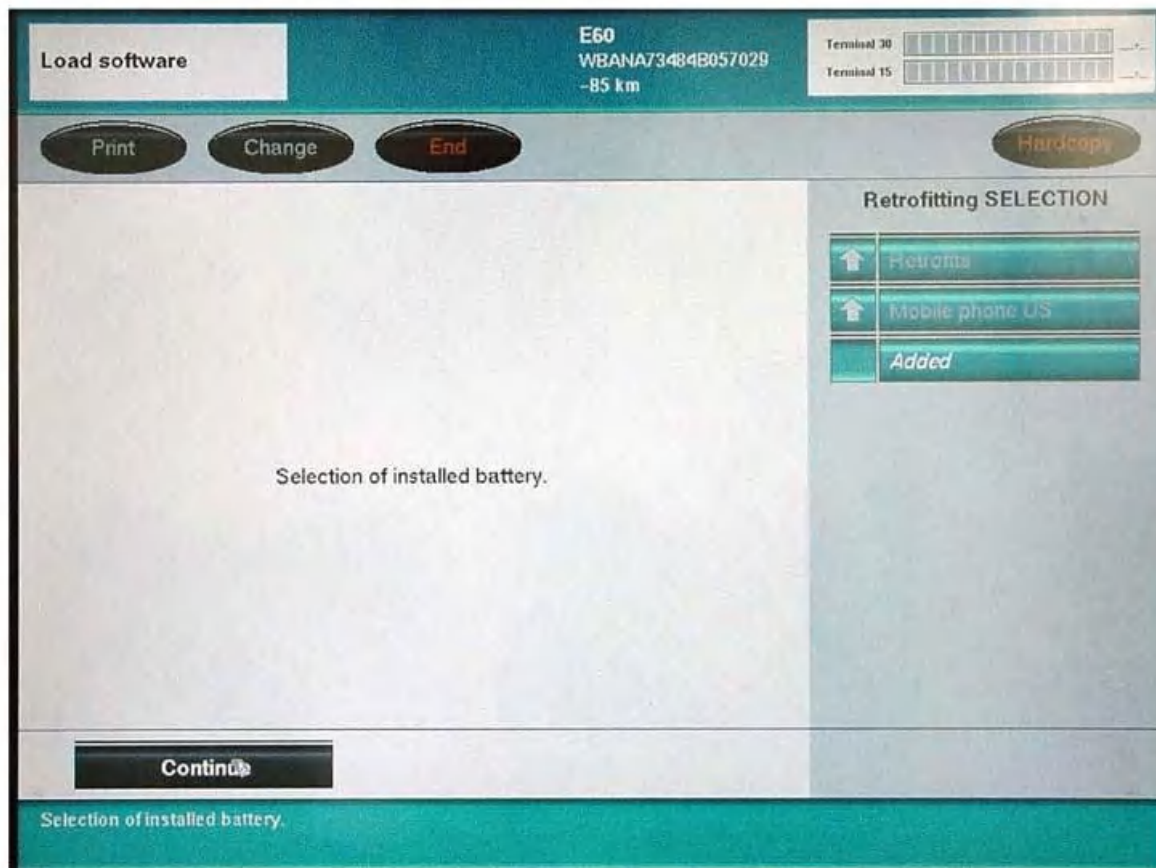


G03399799

[Fig. 11: Programming Screen - Retrofit](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Select the retrofit, in this case the Mobile phone USA.



G03399800

[Fig. 12: Programming Screen - Battery](#)

Courtesy of BMW OF NORTH AMERICA, INC.

You will be asked which battery the car has installed.

Load software

E60

WBANA73484B057029

-85 km

Terminal 38

Terminal 15

Print

Change

End

Hardcopy

Select measures plan

Date / time:

29.01.2004 / 13:59

Model series:

E60

Vehicle ID number:

WBANA73484B057029

Vehicle order:

E60 #0103*NA79%0892%LC5W\$205\$217\$226\$229\$302\$319
 \$339\$354\$403\$415\$416\$423\$430\$431\$438\$441\$442\$459
 \$473\$481\$488\$534\$540\$590\$605\$639\$645\$676\$693\$694
 \$765\$823\$845\$850\$853\$876\$909\$991\$992+B110+RASK

Vehicle data status:

E060-03-12-527

Target data status:

E060-03-12-527

1. Program TELULF
(via MOST Control)

Old part no. progr. ctrl mod.

6942592

New part no. progr. ctrl mod.

6942592

2. CCC-BD/M-ASK-BO encoding

Accept

Print or copy out the desired measures plan.

Retrofitting SELECTION

Retroms

Mobilis phone US

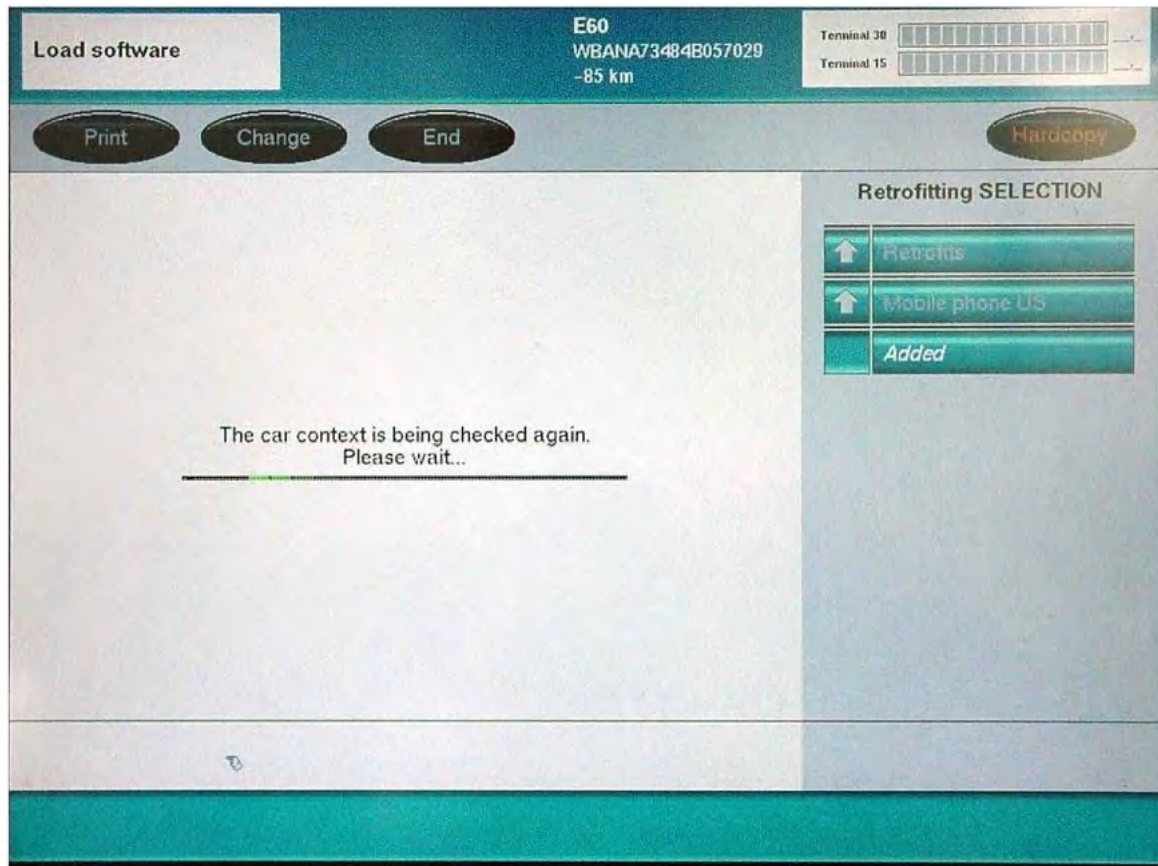
Added

G03399801

Fig. 13: Programming Screen - Measures Plan
 Courtesy of BMW OF NORTH AMERICA, INC.

A measures plan will be determined and displayed to accomplish the retrofit.

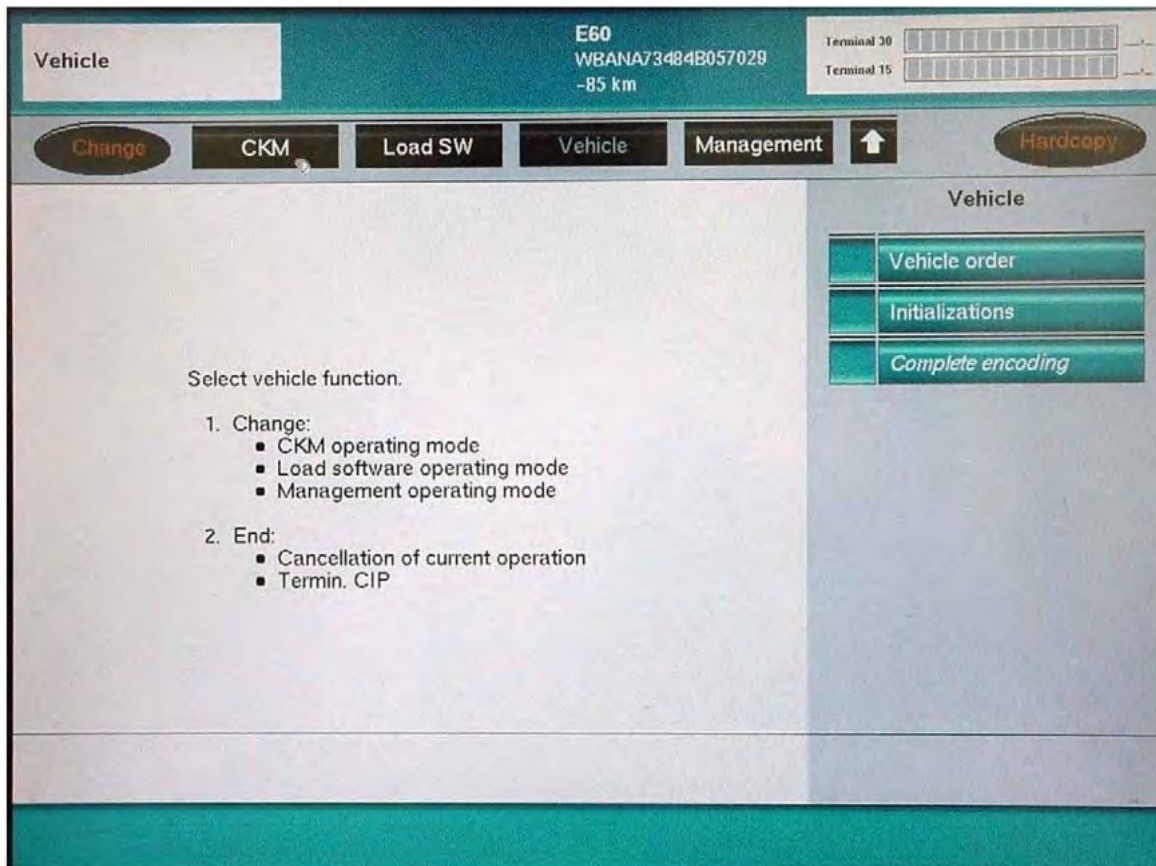
Press Accept.



G03399802

[Fig. 14: Programming Screen - Retrofit Being Carried Out](#)
Courtesy of BMW OF NORTH AMERICA, INC.

The retrofit is being carried out.



G03399803

[Fig. 15: Programming Screen - Vehicle Function](#)

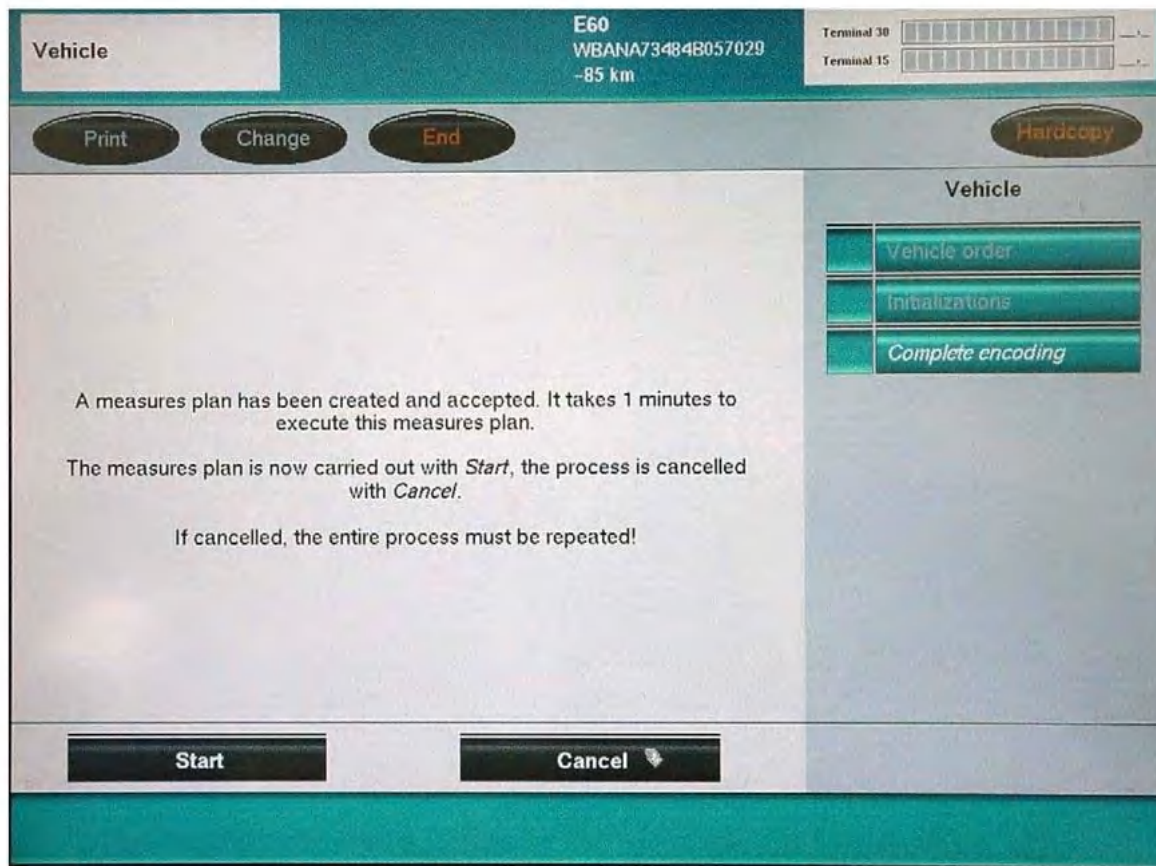
Courtesy of BMW OF NORTH AMERICA, INC.

By selecting Vehicle initially when entering CIP, you will save time when updating the vehicle.

Updating through Load SW differs from Measures Plan determined through Vehicle.

When updating through Load SW only the module programmed is re-coded. You still need to come to this screen and perform Complete Encoding.

By updating through Vehicle, the entire car is automatically encoded, after the programming is complete.



G03399804

[Fig. 16: Programming Screen - Pressing Start](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Press start to begin the programming and encoding procedure.

Article GUID: A00232176

GENERAL INFORMATION

DVOM - Overview

THE DVOM

Model: All

Production Date: All

INTRODUCING THE DVOM

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

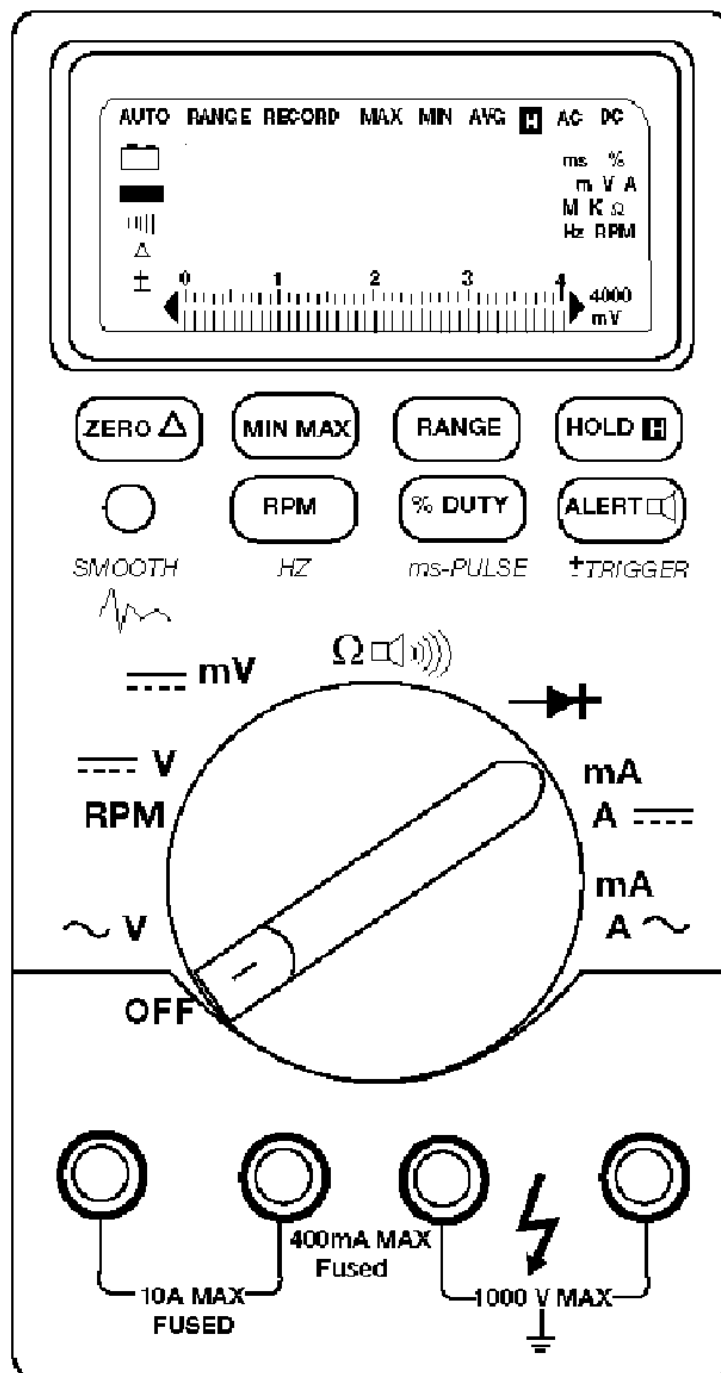
The instrument most commonly used to make electrical measurements is called the Digital Voltage-Ohm Meter (DVOM).

Basic DVOM's are capable of measuring:

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

Advanced DVOM's add:

- Frequency.
- RPM.
- Duty Cycle.
- Pulse Width.



G03388894

[Fig. 1: Identifying DVOM](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The DVOM provides for a method of accurate measurements.

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

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

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

CHOOSING A DVOM

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

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

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

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

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

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

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

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

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

Other factors in choosing the proper DVOM are:

- Cost.
- Features.

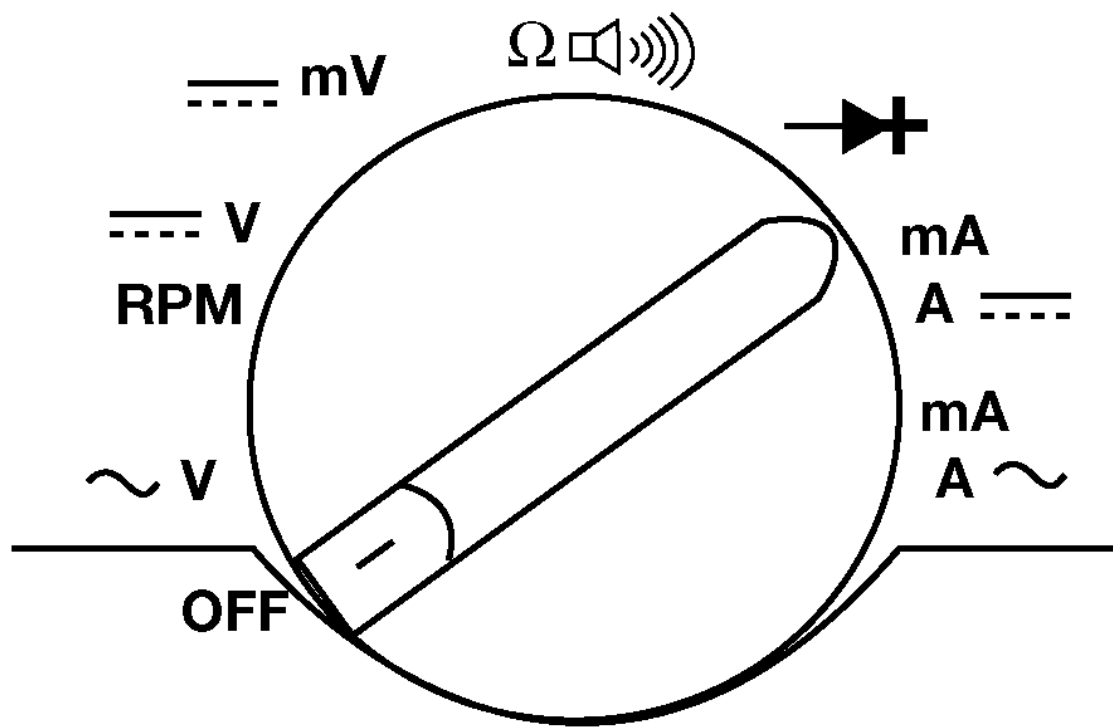
Basic DVOM's are available reasonably priced. These basic models may be more than sufficient for use in BMW Centers, given the availability of the DISplus and MoDic for advanced measurement and scope functions.

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

Choose a DVOM wisely based on personal preference and cost. Like many other tools it is valuable in the diagnosis and repair of BMW's. Experience has shown if the technician is not comfortable with the DVOM or confident in the results of the measurements, the DVOM will not be used. Considering the technology in BMW automobiles, diagnosing with a quality DVOM certainly makes repairing the problem correctly and expediently a more manageable task.

THE FUNCTIONS

Function Selector Rotary Switch

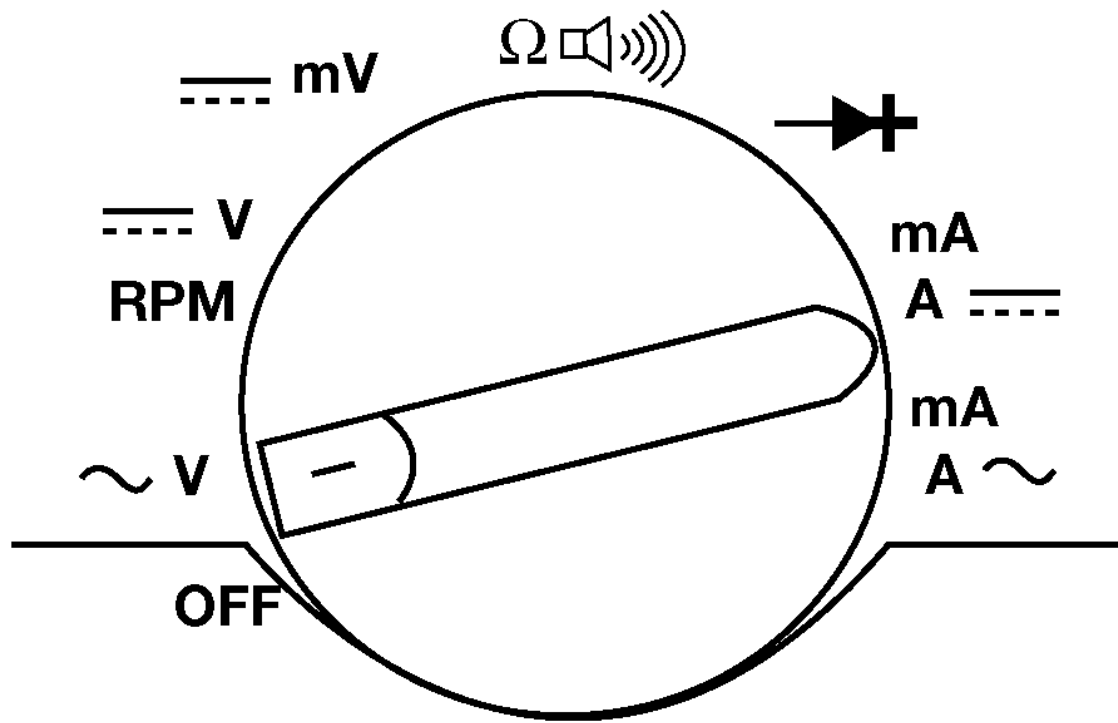


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[Fig. 2: Identifying Function Selector Rotary Switch \(Off\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Power to the meter is turned off.



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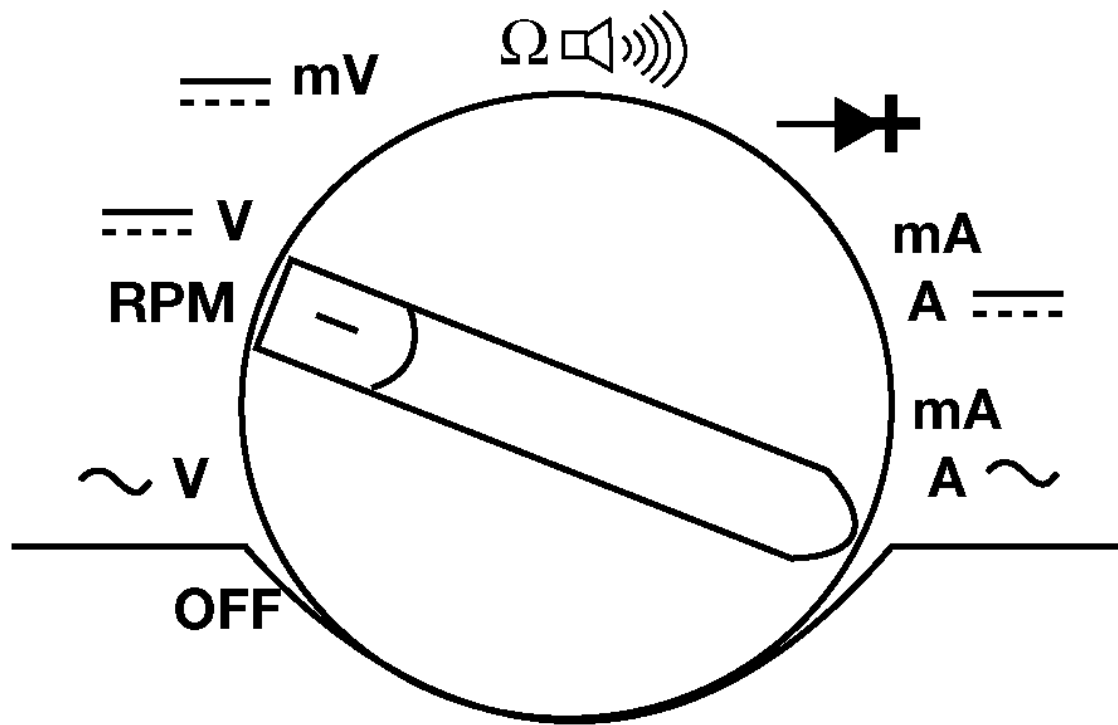
[Fig. 3: Identifying Function Selector Rotary Switch \(Volts AC\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Volts AC.

Measures AC voltage.

Ranges 400mV, 4V, 400V, 1000V.



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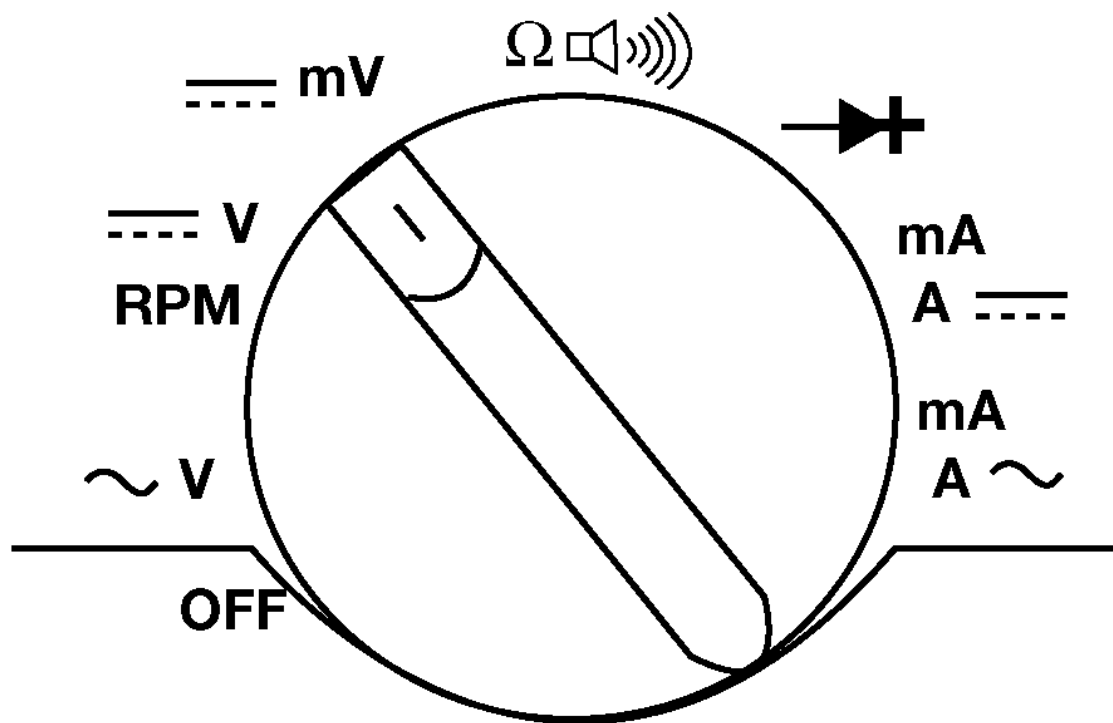
[Fig. 4: Identifying Function Selector Rotary Switch \(Volts DC, RPM\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Volts DC, RPM.

Measures DC Voltage.

Ranges 4V, 40V, 400V, 1000V.



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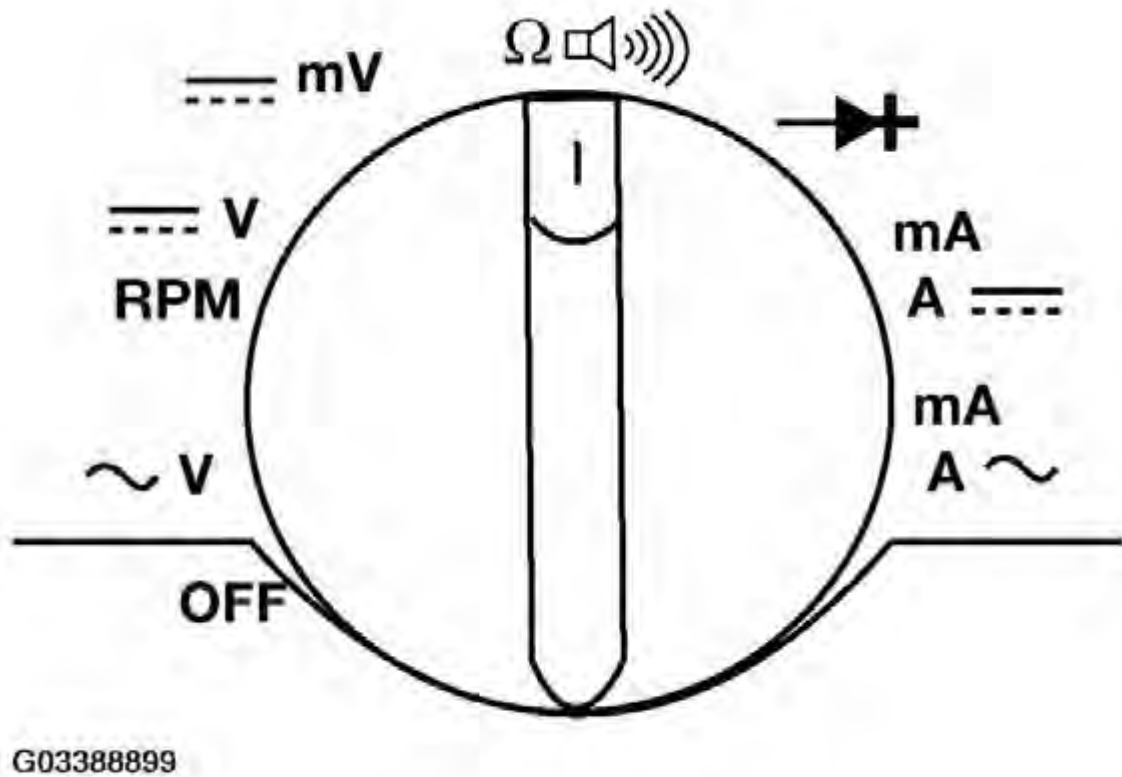
[Fig. 5: Identifying Function Selector Rotary Switch \(mV\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

mV.

Measures DC Millivolts.

Range: 400mV.



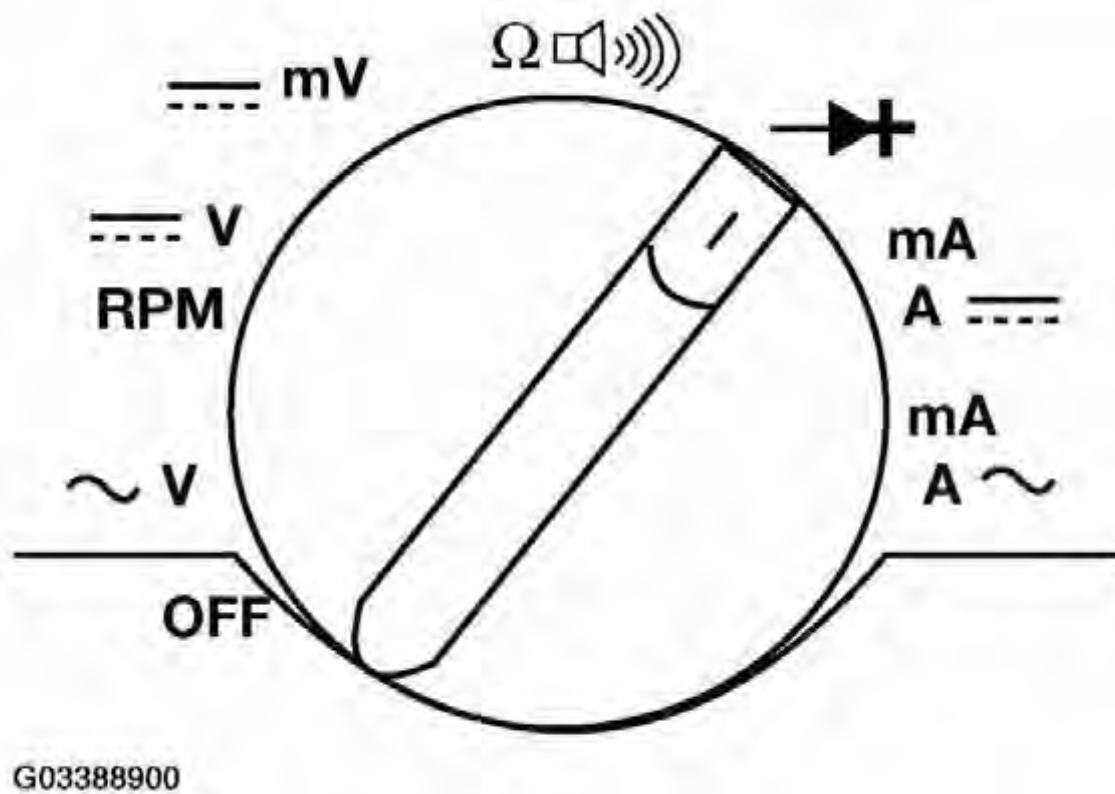
[Fig. 6: Identifying Function Selector Rotary Switch \(Continuity/Ohms\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Continuity/Ohms.

Measures Continuity and Ohm.

Ranges: 400 Ω , 4k Ω , 400k Ω , 4M Ω , 40M Ω .



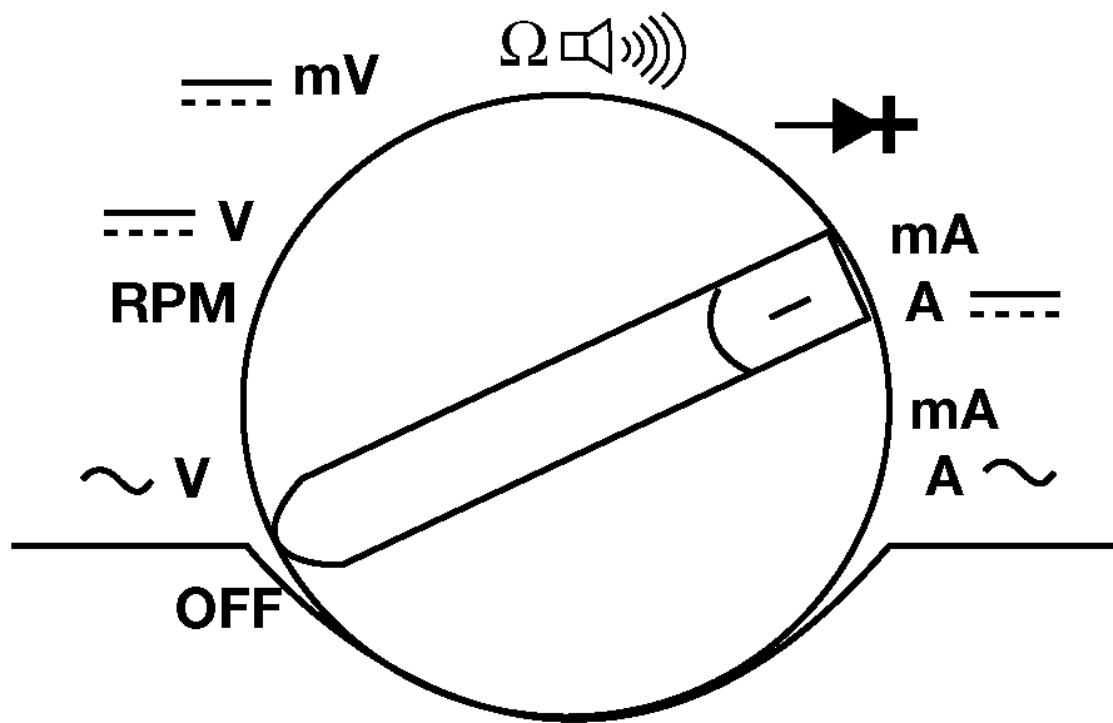
[Fig. 7: Identifying Function Selector Rotary Switch \(Diode Test\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Diode Test.

Test diode operation.

Range: 3.000V.



G03388901

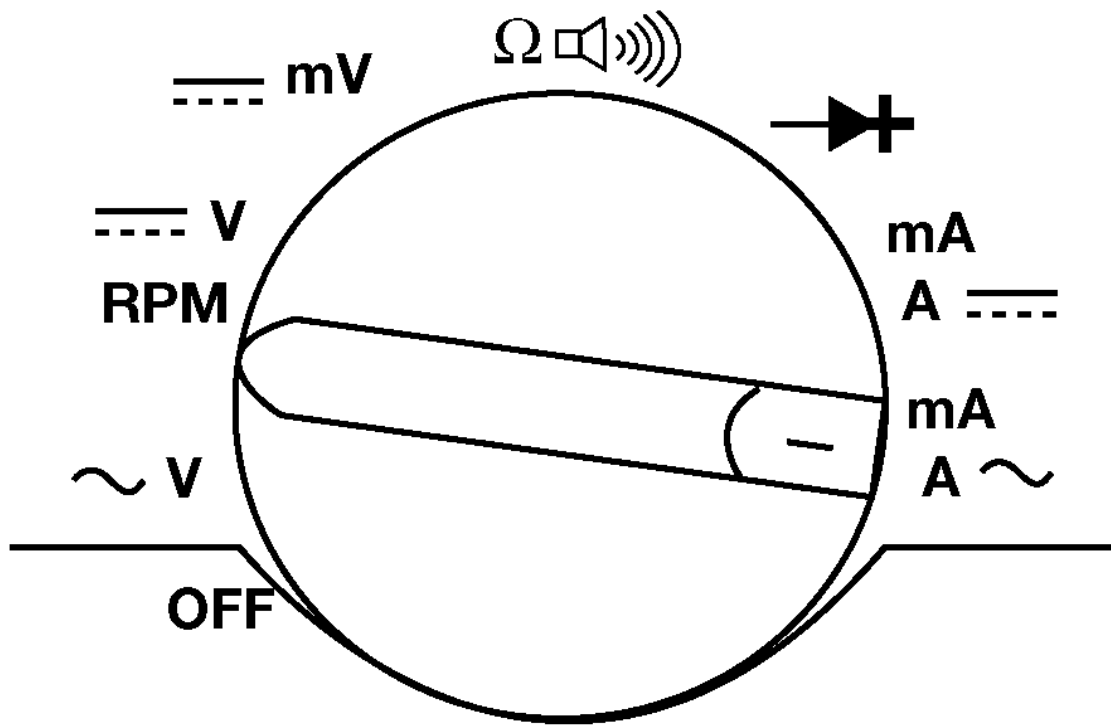
[Fig. 8: Identifying Function Selector Rotary Switch \(Amps DC\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Milliamp or Amps DC.

Measures DC Milliamps or amps.

Ranges: 40mA or 400mA for mA input 4000mA or 10 A for A input.



G03388902

[Fig. 9: Identifying Function Selector Rotary Switch \(Amps AC\)](#)

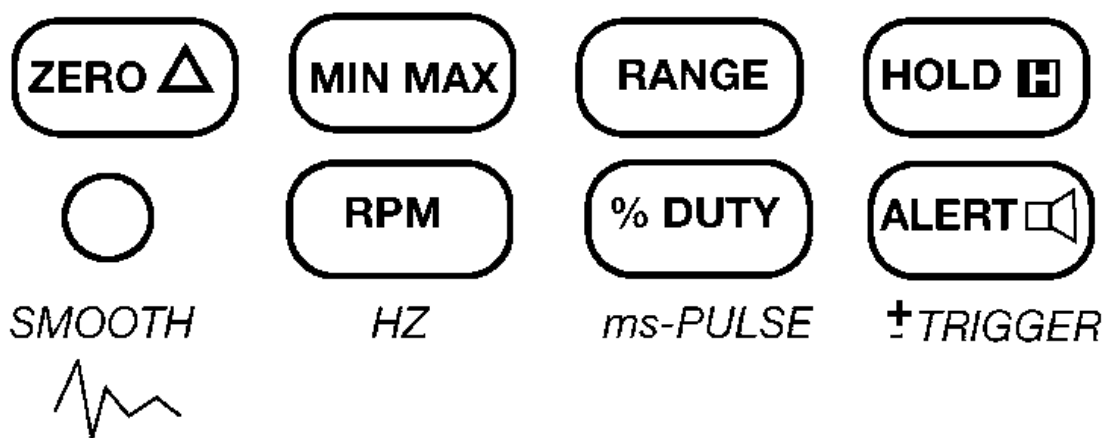
Courtesy of BMW OF NORTH AMERICA, INC.

Milliamps or Amps AC.

Measures AC Milliamps or amps.

Ranges: 40mA or 400mA for mA input 4000mA or 10 A for A input.

PUSH BUTTON FUNCTIONS



G03388903

[Fig. 10: Identifying Push Button Functions](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Zero (Relative Reading) Function:

Displays difference between the measured value and the stored value.



G03388904

[Fig. 11: Identifying Zero \(Relative Reading\) Push Button](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Minimum (Min), Maximum (Max), Average (AVG) Recording:

Records minimum, maximum and calculates the true average.



G03388905

[Fig. 12: Identifying Min/Max, AVG Recording Push Button](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Manual Range or Autorange:

In Manual Range user selects fixed range. Meter stays in that range until user changes it, selects Autorange or turns meter off. In Autorange meter selects range automatically.



G03388906

[Fig. 13: Identifying Manual Range or Autorange Push Button](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Touch Hold:

Touch Hold holds last stable reading on display. A new stable reading causes beeper to sound and display to update.

If meter is in MIN MAX Recording, RPM, Duty Cycle, Pulse Width or Hz, Touch Hold interrupts the function. The display is frozen, but recorded readings are not erased.



G03388907

[Fig. 14: Identifying Touch Hold Push Button](#)

Courtesy of BMW OF NORTH AMERICA, INC.

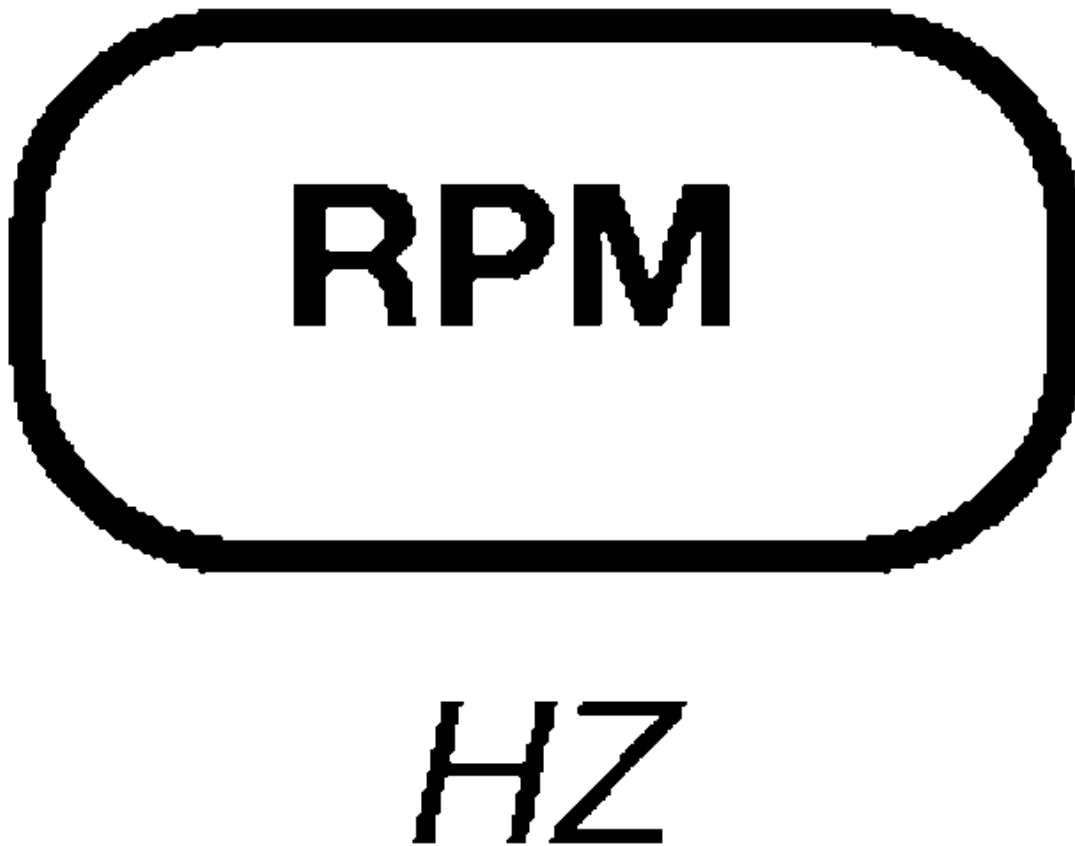
RPM / HZ.

RPM 2, RPM 1, or frequency.

RPM 2, 4-cycle engines.

RPM 1, 2-cycle engines.

Hz. counts frequency between 0.5 Hz and 200 kHz.



G03388908

[Fig. 15: Identifying RPM / HZ Push Button](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Duty Cycle or Pulse Width.

Duty Cycle between 0.0 and 99.9% displayed.

Pulse Width between 0.002 and 1999.9 ms displayed.



ms-PULSE

G03388909

[Fig. 16: Identifying Duty Cycle Or Pulse Width Push Button](#)

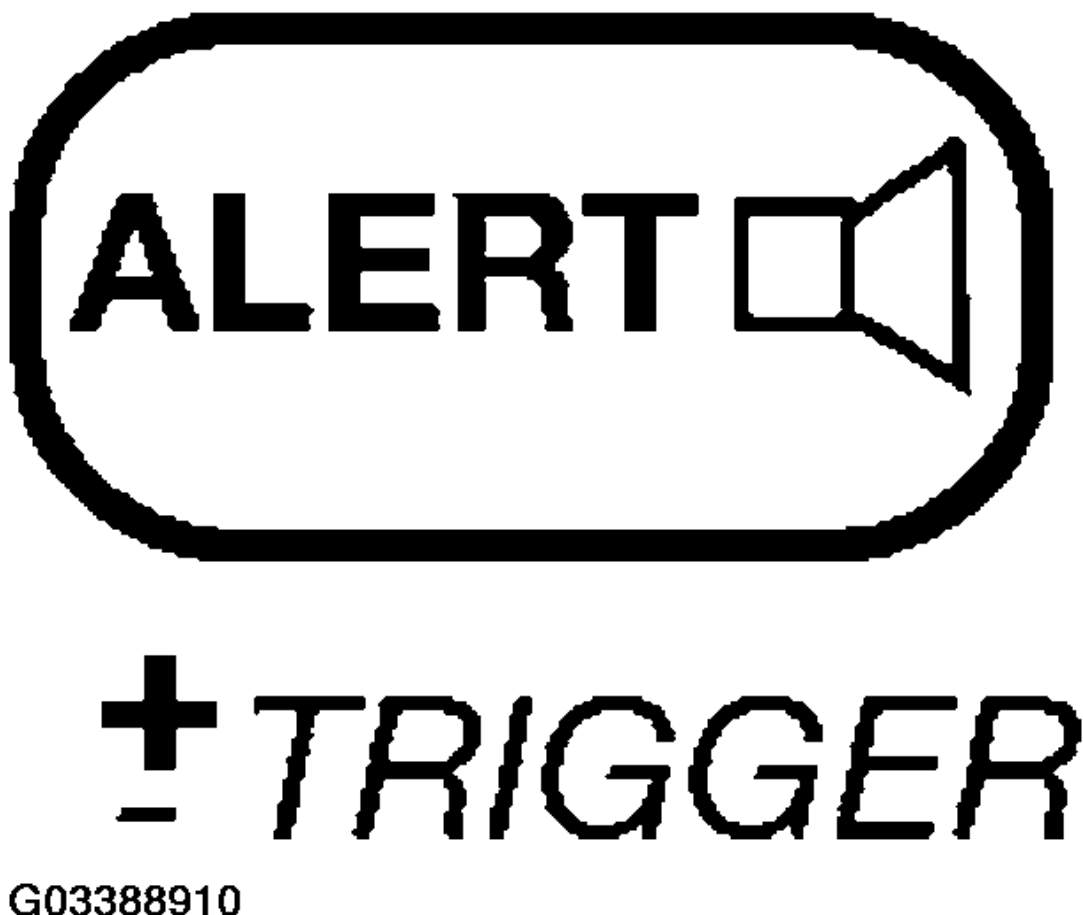
Courtesy of BMW OF NORTH AMERICA, INC.

Change Alert, Continuity Beeper or +/- Trigger.

In voltage or current functions selects Change Alert.

In Ω function selects Continuity Tests.

In Duty Cycle or Pulse Width selects trigger slope.

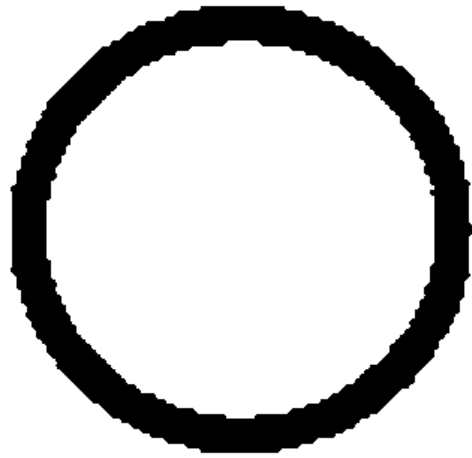


[Fig. 17: Identifying Change Alert Push Button](#)
Courtesy of BMW OF NORTH AMERICA, INC.

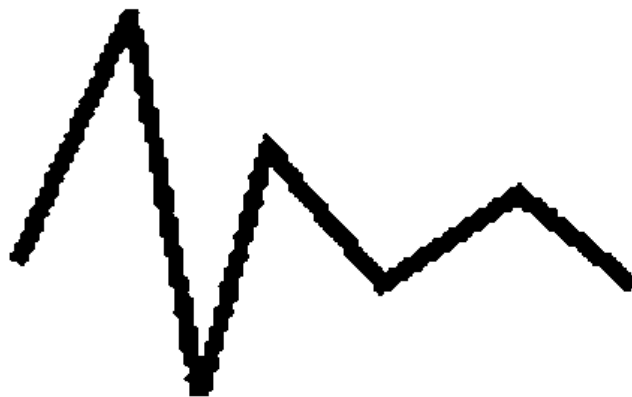
Smoothing Function and Back-light display (advance model only).

Smooth displays average of last eight readings.

Press Yellow button to turn on or off back-light.



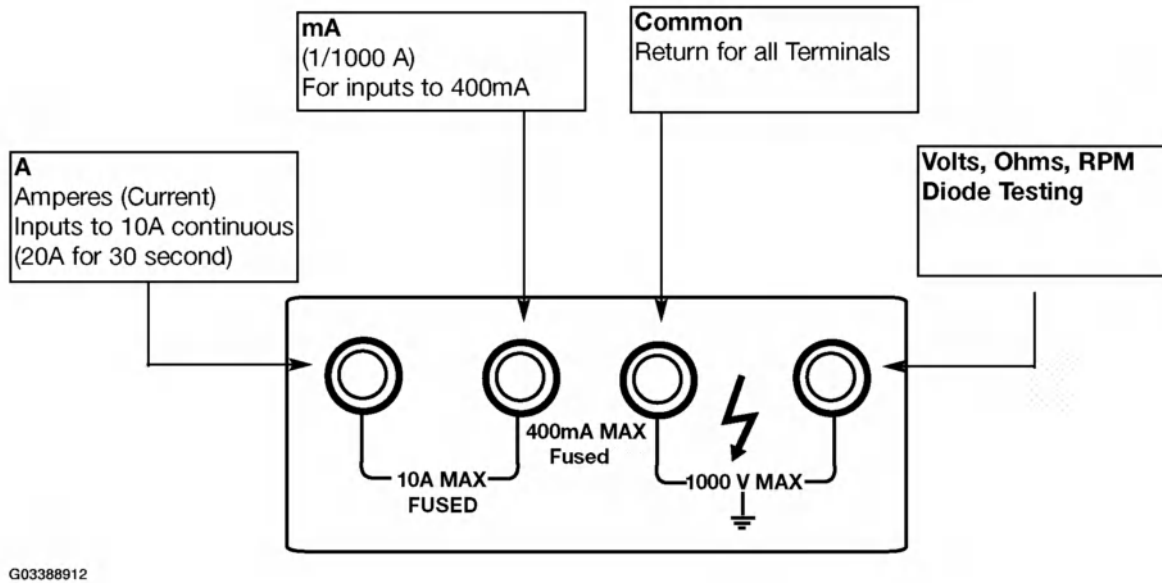
SMOOTH



G03388911

[Fig. 18: Identifying Smoothing Function Push Button](#)
Courtesy of BMW OF NORTH AMERICA, INC.

INPUT TERMINALS



[Fig. 19: Identifying Input Terminals](#)

Courtesy of BMW OF NORTH AMERICA, INC.

DISPLAY

[Fig. 20: View Of Functions Display](#)

Courtesy of BMW OF NORTH AMERICA, INC.

INFINITY DISPLAY

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

[Fig. 21: Infinity Display](#)

Courtesy of BMW OF NORTH AMERICA, INC.

VOLTAGE TESTING

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

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

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

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

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

Typical Application of Voltage Testing

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

Fig. 22: Identifying Voltage Testing

Courtesy of BMW OF NORTH AMERICA, INC.

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

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

DVOM will indicate supply or available voltage at that point.

AMPERAGE TESTING

To measure amperage the meter must be installed in series in the circuit. The current flow of the circuit must flow through the meter itself.

Current must be flowing in the circuit.

Installing the meter in parallel with the circuit may cause damage to the meter, because of the increased current flow in the circuit, due to the low resistance in the meter.

CAUTION: Most ampere meters or DVOMs are rated for no more than 10 amps. Current flow above 10 amps will damage the internal fuse of the DVOM and render it unable to measure amperage.

Typical Application of Amperage Testing

- Proper Component Operation (Correct Current Draw).
- Parasitic Draw Testing.

Fig. 23: Identifying Amperage Testing

Courtesy of BMW OF NORTH AMERICA, INC.

Ensure meter is capable of handling current flow.

Use caution when activating additional consumers.

- Select proper function of DVOM and move leads to proper position.
- Connect meter in series with (+) lead on the B⁺ side of the circuit.
- Connect (-) lead of meter to complete circuit.

NOTE: If the expected load may exceed the range of the meter, use a meter with a higher range (DISplus inductive pick-up) for initial testing. A convenient location to apply meter (e.g. across fuse terminals). DVOM will indicate current flow (Amps) through circuit.

RESISTANCE TESTING

When set for resistance testing (Ohms) the DVOM must never be connected in a live circuit.

The component or portion of a circuit being measured, must be isolated from the power source.

Most modern day DVOM's are self ranging when set to measure resistance, so the meter can not be damaged by out of range measurements.

The test leads may be used without regard for polarity, unless the circuit contains a diode.

The DVOM functions by placing a very small amount of current on the circuit being tested, the red lead must be placed on the anode side of the diode.

Typical Application of Resistance Testing

- Locating a Short to Ground (As Shown).
- Determining Resistance of Components (e.g. Temp Sensors and Injectors).

Fig. 24: Identifying Resistance Testing

Courtesy of BMW OF NORTH AMERICA, INC.

An Ohmmeter uses its internal power to test a circuit or component.

- Select correct function and range (Most meters are self ranging in this function).
- Disconnect power to circuit.
- Disconnect any circuit wired in parallel with circuit being tested.
- Connect test leads.

NOTE: There must be NO current available to the circuit during the resistance (Ohmic) test. DVOM will indicate resistance (Ohms) of component or circuit being tested.

CONTINUITY TESTING

The DVOM may have a separate setting for continuity testing.

When set for continuity testing the DVOM must never be connected in a live circuit.

The power source must be disconnected from the circuit being tested. Any circuits wired in parallel with the circuit being tested must also be disconnected.

The DVOM uses its own internal power supply to test the continuity of the circuit.

Continuity testing verifies that circuit connections are intact. The continuity mode is extremely fast and is used to detect either shorts or opens that last as little as 1ms.

When a change is detected the beeper tone is stretched to last at least 1/4 second so both shorts and opens can be audibly detected.

This is a valuable troubleshooting aid when diagnosing intermittent faults associated with wiring, connections, switches and other components of the circuit.

Typical Application of Continuity Testing:

- Circuit Continuity.
- Intermittent Wiring Harness Faults.

Fig. 25: Identifying Continuity Testing

Courtesy of BMW OF NORTH AMERICA, INC.

- Select correct function and range of DVOM.
- Disconnect power to the circuit.
- Disconnect any circuits wired in parallel.
- Connect DVOM leads to the circuit to be tested.

NOTE: There must be NO current available to the circuit during the continuity test. DVOM display will indicate continuity of circuit.

VOLTAGE DROP TESTING

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

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

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

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

Typical Application of Voltage Drop Testing:

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

Fig. 26: Identifying Voltage Drop Testing

Courtesy of BMW OF NORTH AMERICA, INC.

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

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

NOTE: All consumers of the test circuit should be active during the test. Always include ground circuit as part of voltage drop test. DVOM display will indicate the voltage drop in the circuit tested between the DVOM leads.

Article GUID: A00232593

2005 GENERAL INFORMATION

Electronic Signals - Overview - All Models

ELECTRONIC SIGNALS

Model: All

Production Date: All

PURPOSE OF SIGNALS

Electronic signals move information much like cars move passengers down the highway. It would be difficult to get to work without transportation, and there would be no transportation without signals.

Signals allow devices (e.g. sensors or switches) to communicate with control modules (either complicated processors or simple relays) which in turn perform or request (through more signaling) other functions to be carried out.

Signals inform the Climate Control of the outside air temp or tell the brake lights the right time to illuminate.

The use of electronic signals goes far beyond the basic application of electron flow to control components, enabling complex information to be passed from one component to another.

The data (input or output) is conveyed through various forms of changing voltages, resistances, current or frequency modulation.

1. AC Voltage Signals:
 - A. Inductive Signals.
 - B. Phase Shifted Signals.

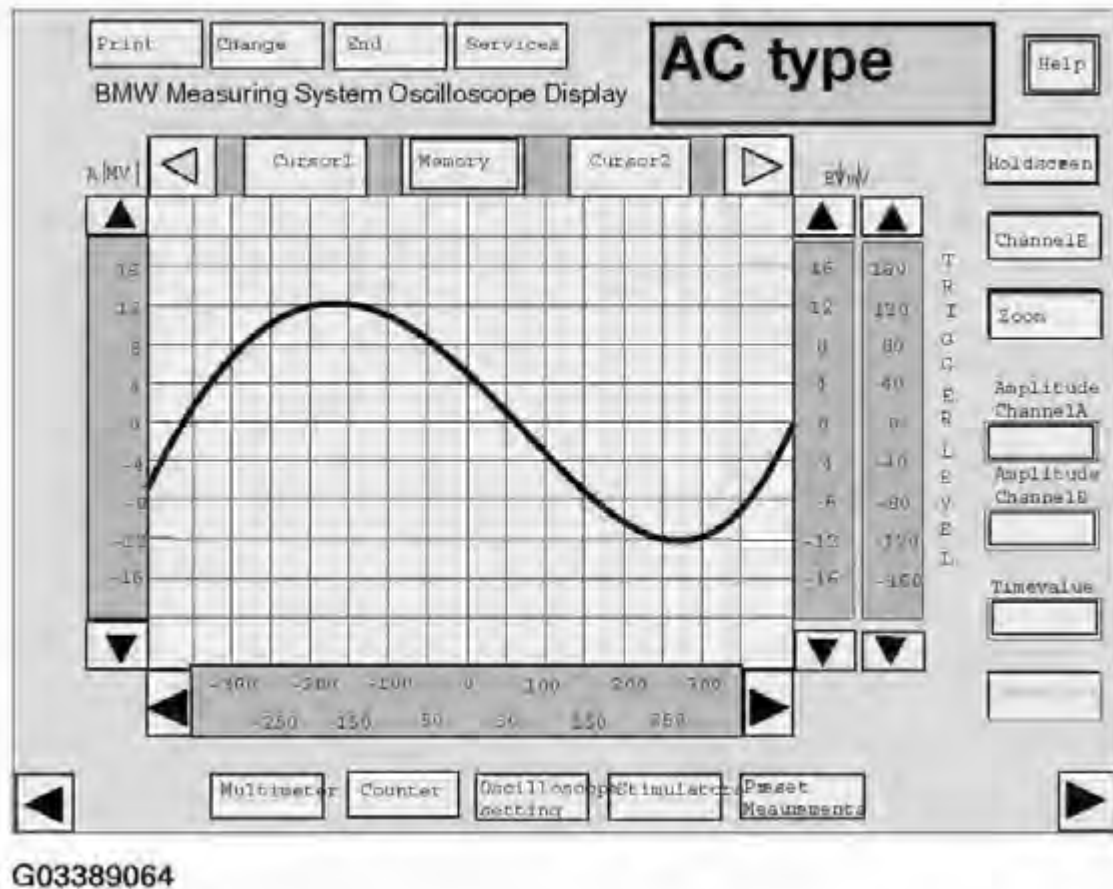


Fig. 1: Identifying AC Voltage Signals

Courtesy of BMW OF NORTH AMERICA, INC.

2. DC Voltage Signals:

A. Analog Signals.

B. Digital Signals:

1. Switched (High/Low) Signals.

2. Modulated Square Wave Signals:

a. Frequency Controlled Signals.

b. Pulse Width Controlled Signals.

c. Duty Cycle Controlled Signals.

C. Designated Value Signals.

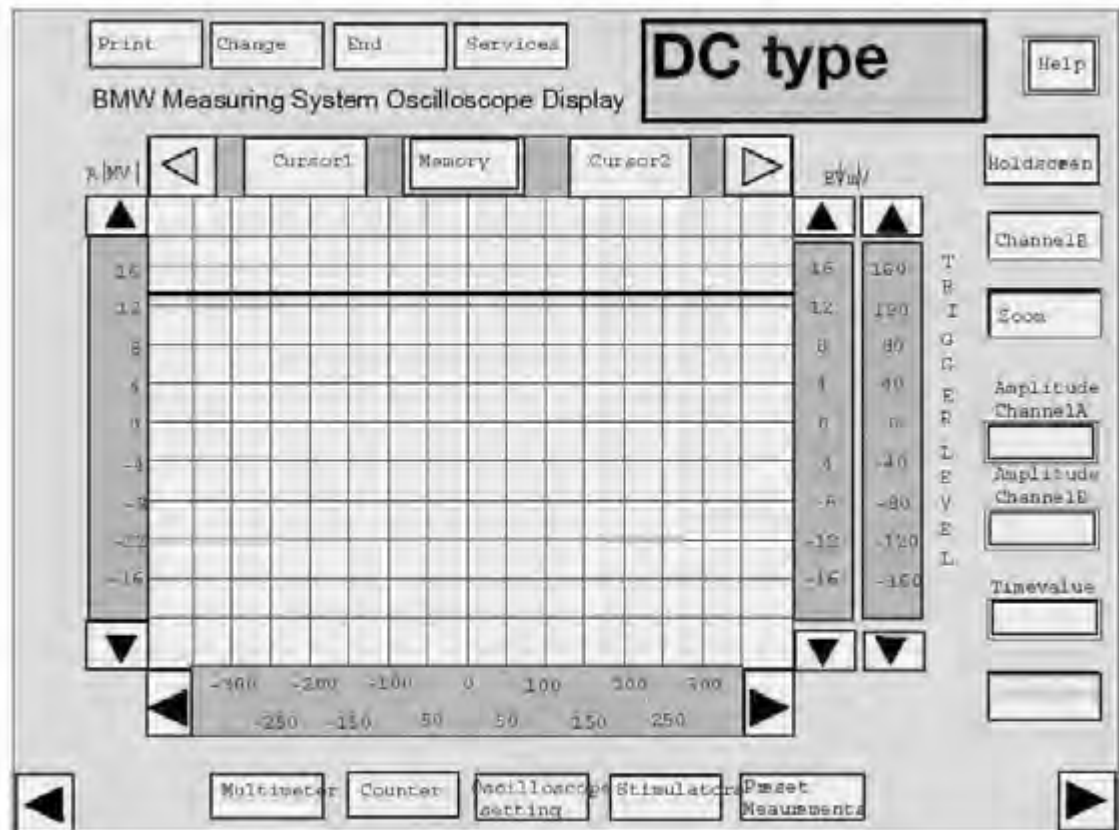
D. Coded Ground Signals.

E. Transistor Signals:

1. Modulated B+/B- Signals.

2. Momentary B+/B- Signals.

3. Constant B+/B- Signals.



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Fig. 2: Identifying DC Voltage Signals

Courtesy of BMW OF NORTH AMERICA, INC.

AC VOLTAGE SIGNALS

Two types of AC Voltage signals are used:

- Inductive Signals (Induced Voltage).
- Phase Shifted Signals (Angle Pulse Generator).

INDUCTIVE SENSORS

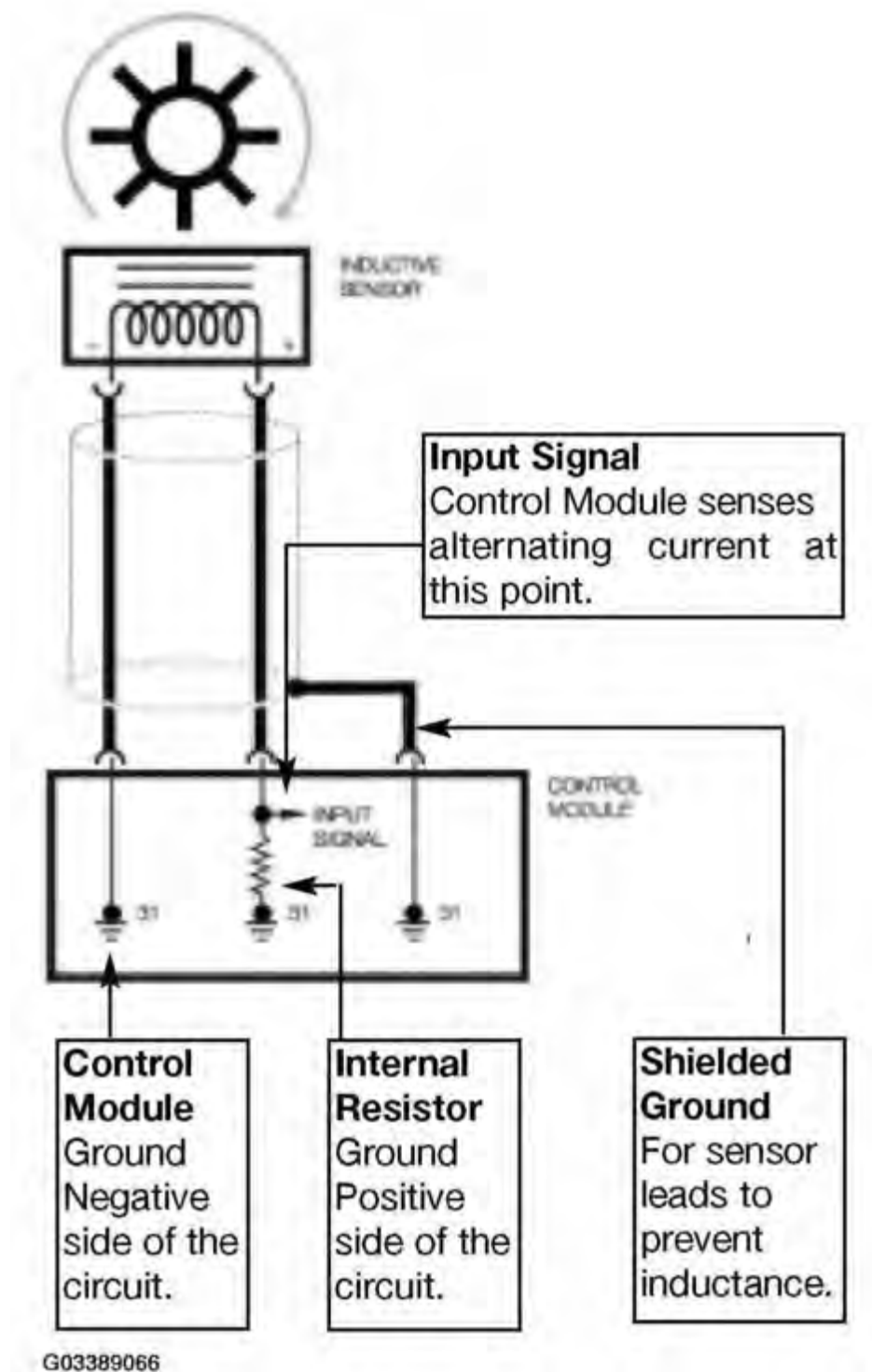
Inductive sensors produce an AC Sine Wave signal. The AC voltage is induced by the shifting of a magnetic field. The sensor consists of an impulse wheel (the moving part) and a coil wound magnetic core (the stationary part).

As each tooth of the impulse wheel approaches the sensor tip, the magnetic field of the sensor shifts toward the impulse wheel and induces a voltage pulse in the windings.

As the teeth move away from the sensor, the magnetic field shifts back inducing a voltage pulse in the opposite direction.

This shifting of the magnetic field produces an alternating current (positive to negative).

Control modules which receive this alternating current, count the impulses (shifts from positive to negative) and interpret the speed of rotation of the impulse wheel.

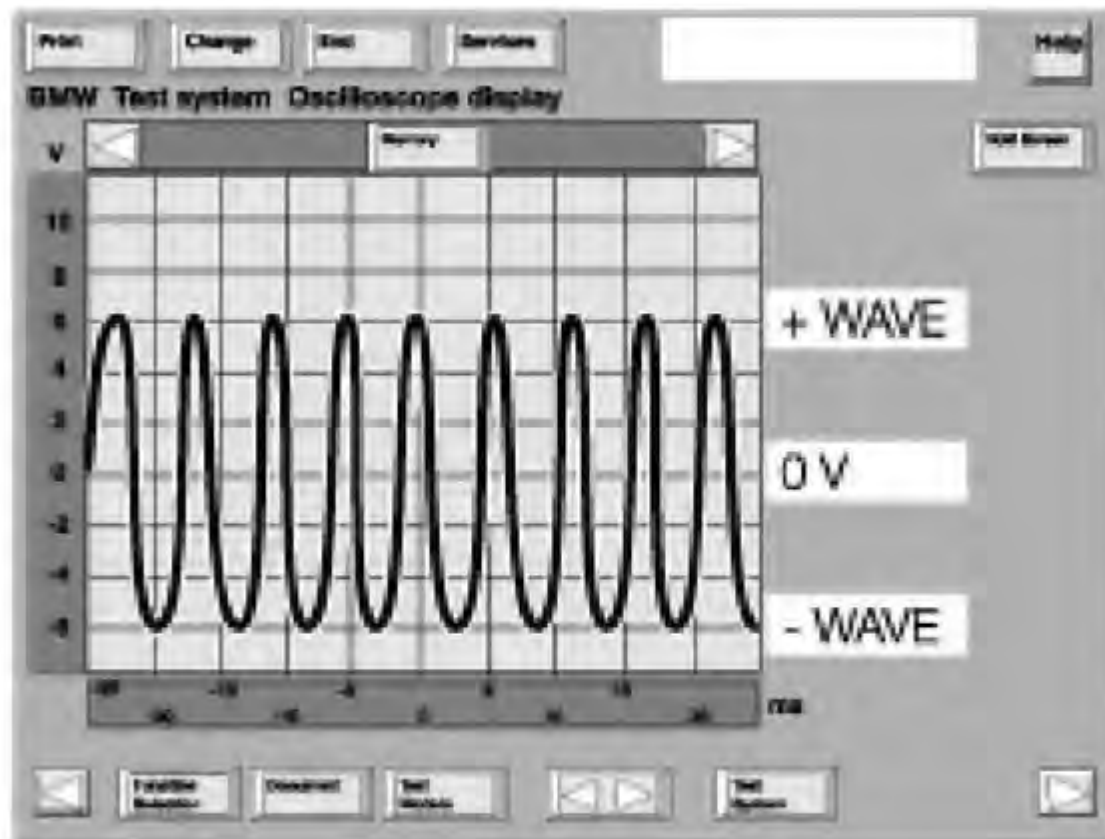


[Fig. 3: Inductive Sensor Circuit Diagram](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Inductive Sensors:

- Crankshaft Speed Sensor.
- Camshaft Speed Sensor.
- Transmission Input/Output Speed Sensor.
- Wheel Speed Sensor.



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[Fig. 4: Identifying AC Sine Wave Signal](#)

Courtesy of BMW OF NORTH AMERICA, INC.

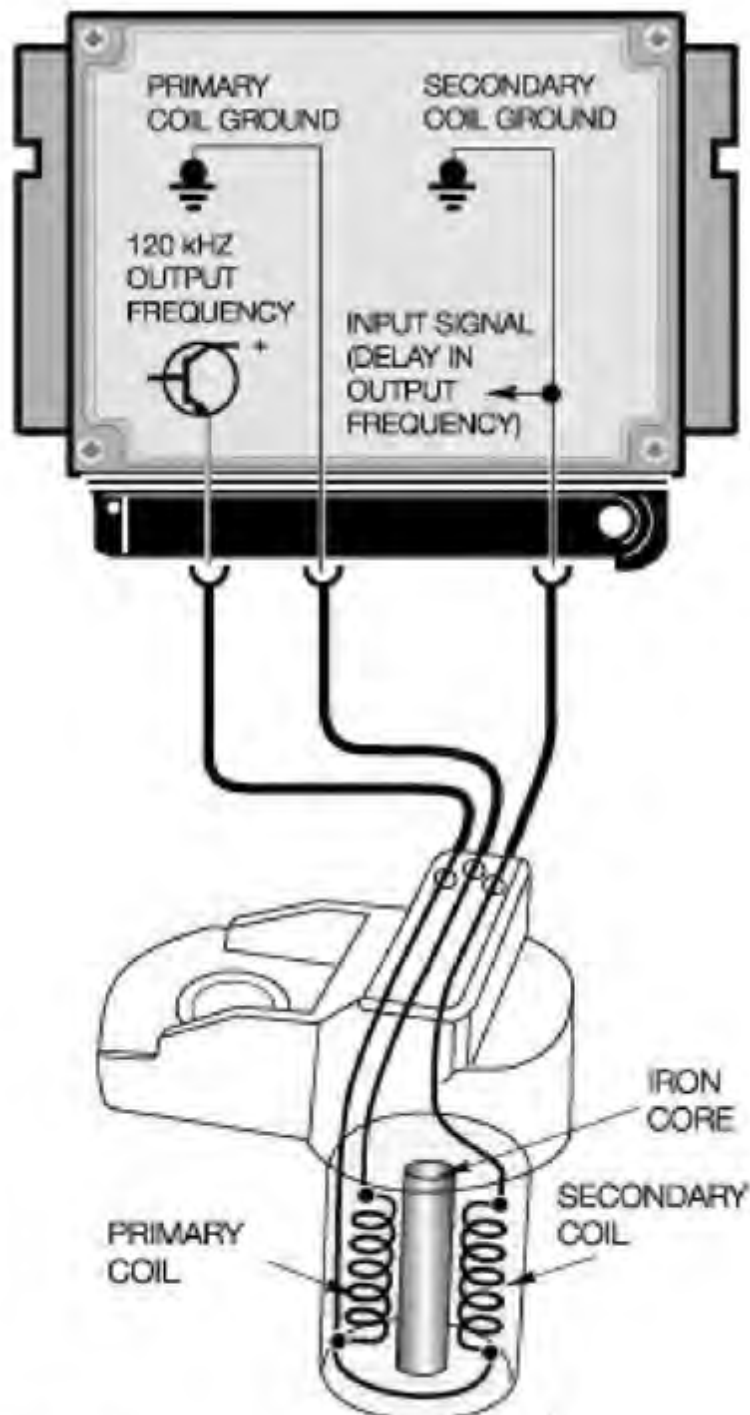
Voltage levels are dependent on sensor design.

Not all inductive sensors produce 12 volts.

ANGLE PULSE GENERATOR

An Angle Pulse Generator Sensor acts on an existing AC voltage signal rather than produce a new one.

The sensor consists of two windings (primary and secondary) that are connected together at one end and a magnetic iron core (stationary) along with a trigger wheel (movable).



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[Fig. 5: Checking Angle Pulse Generator](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The primary winding (coil) is supplied with a 120kHz AC signal by the control module. The magnetic coupling (core) causes a voltage at the same frequency to be induced in the secondary winding. The induced frequency has a slight phase shift due to the induction time delay.

The trigger wheel influences the magnetic field of the sensor and causes the phase shift to increase as the disc of the wheel moves closer to the sensor.

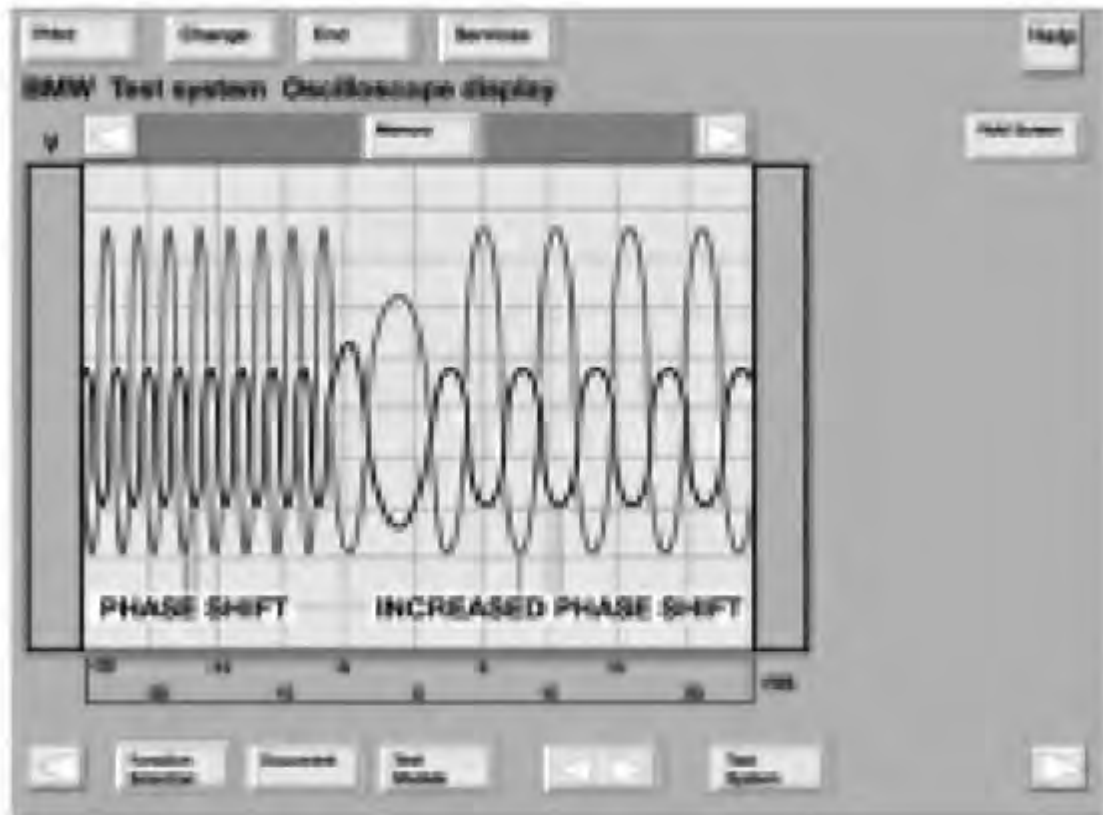
This changing of the phase shift (time delay) from a smaller time period to a larger time period and back again provides the control module with trigger wheel position.

The angle pulse generator provides position information regardless of movement. Trigger wheel position is established with the application of an output frequency from the control module and the return of the phase shifted signal.

Typical Application of Angle Pulse Generator

- Camshaft Sensor MS41.1.
- Pedal Request Sensor EML.

(a bank of three)



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[Fig. 6: Angle Pulse Generator Wave Signal](#)

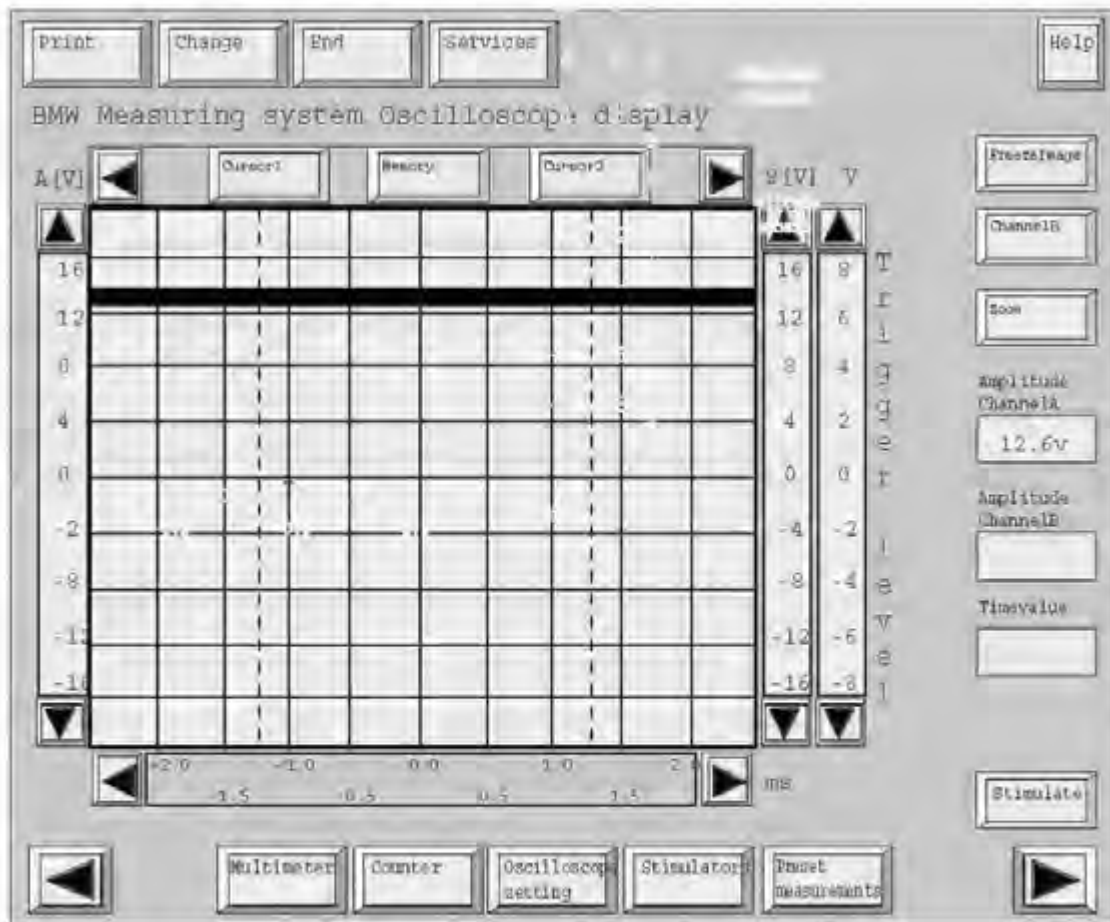
Courtesy of BMW OF NORTH AMERICA, INC.

DC VOLTAGE SIGNALS

Five Types of DC Voltage Signals Are Used:

- Analog Signals.
- Digital Signals.
- Designated Value Signals.
- Coded Ground Signals.
- Transistor Signals.

DC voltage signals are based on either 5 volts or 12 volts.



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[Fig. 7: Identifying DC Voltage Signals](#)

Courtesy of BMW OF NORTH AMERICA, INC.

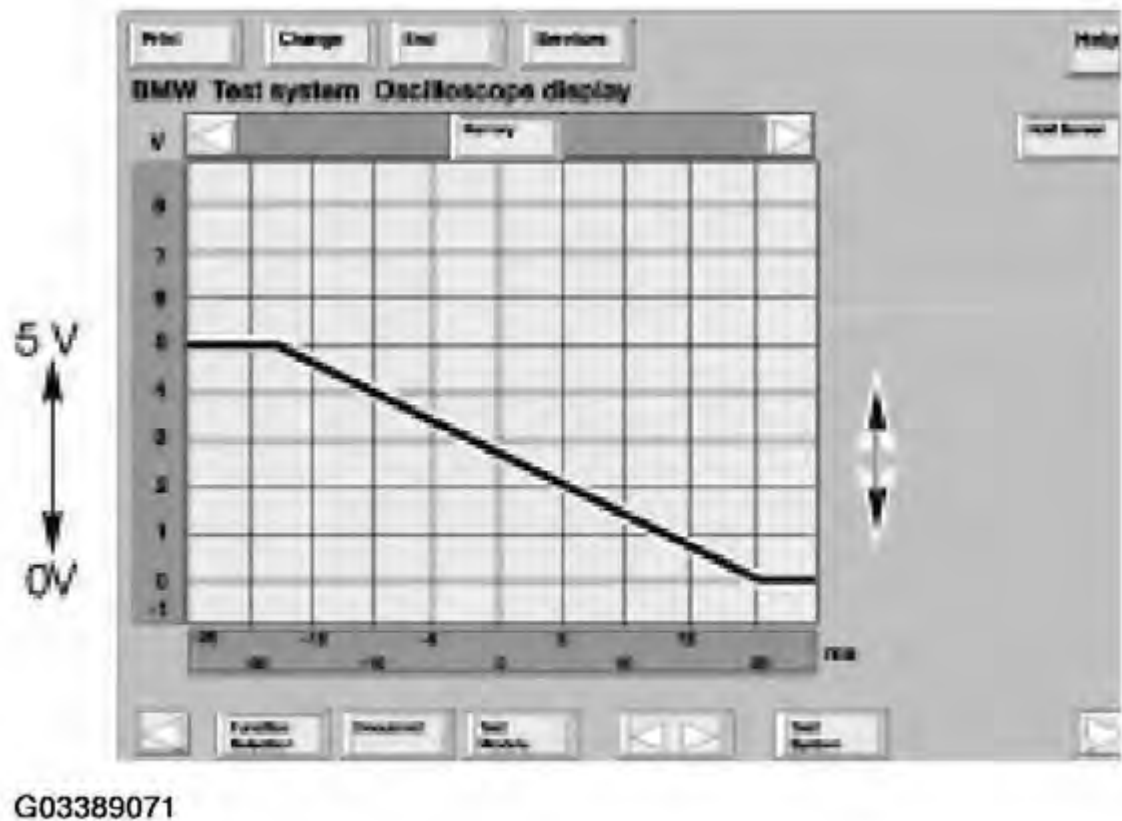
ANALOG SIGNALS

Analog signals transmit information through an electrical circuit by regulating or changing the current or voltage.

The voltage of the signal has no fixed value. The value may be anywhere in the operating range of the signal.

Three sources of analog signals are:

- NTC Sensors.
- PTC Sensors.
- Potentiometers.

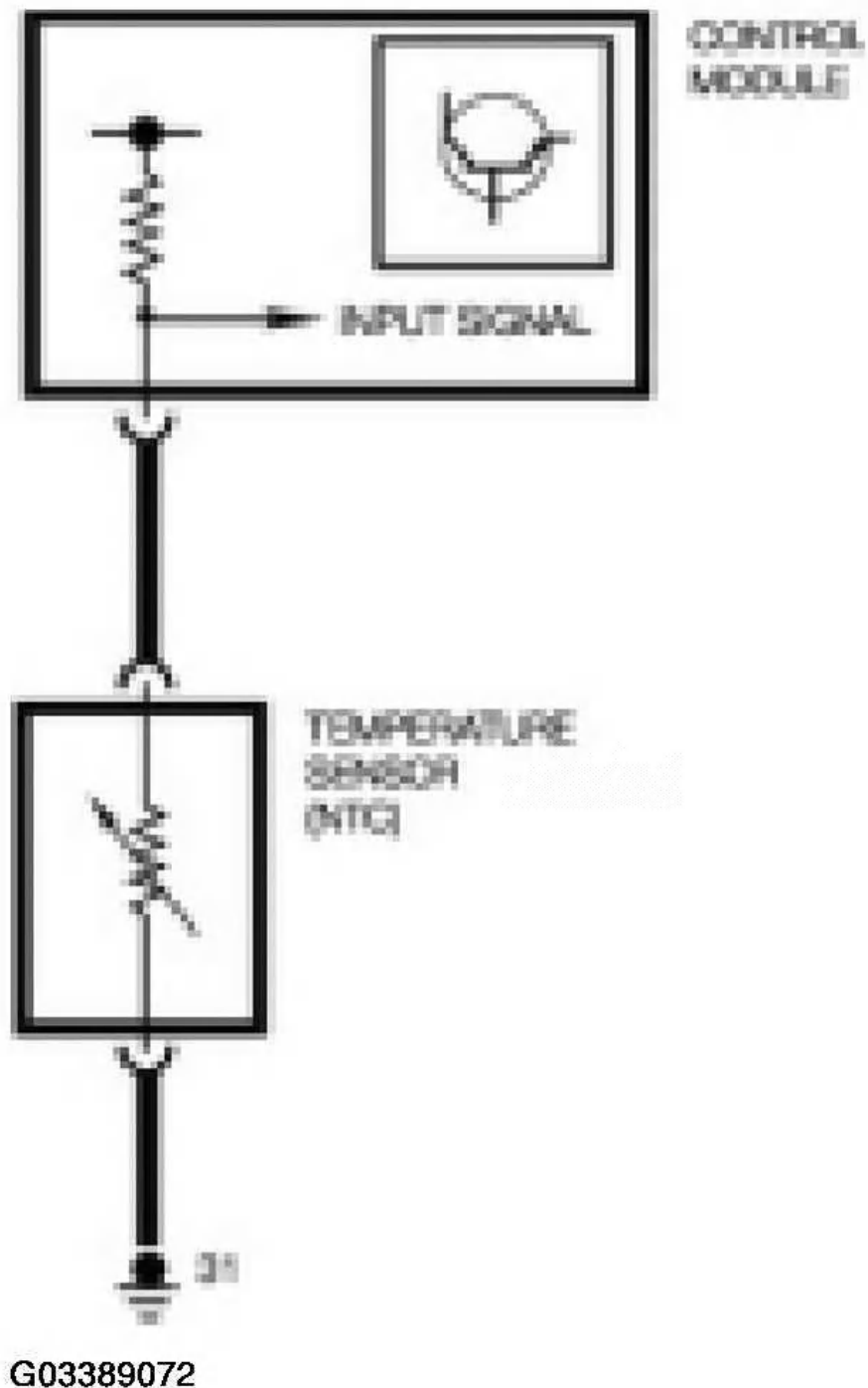


[Fig. 8: Identifying Analog Signals](#)

Courtesy of BMW OF NORTH AMERICA, INC.

NTC SENSORS

NTC (Negative Temperature Coefficient) sensors change resistance based on temperature. As the temperature goes up the resistance goes down. This decrease in resistance causes the voltage drop across the sensor to decrease and the input signal voltage at the control module decreases.



[Fig. 9: NTC Sensor Circuit Diagram](#)

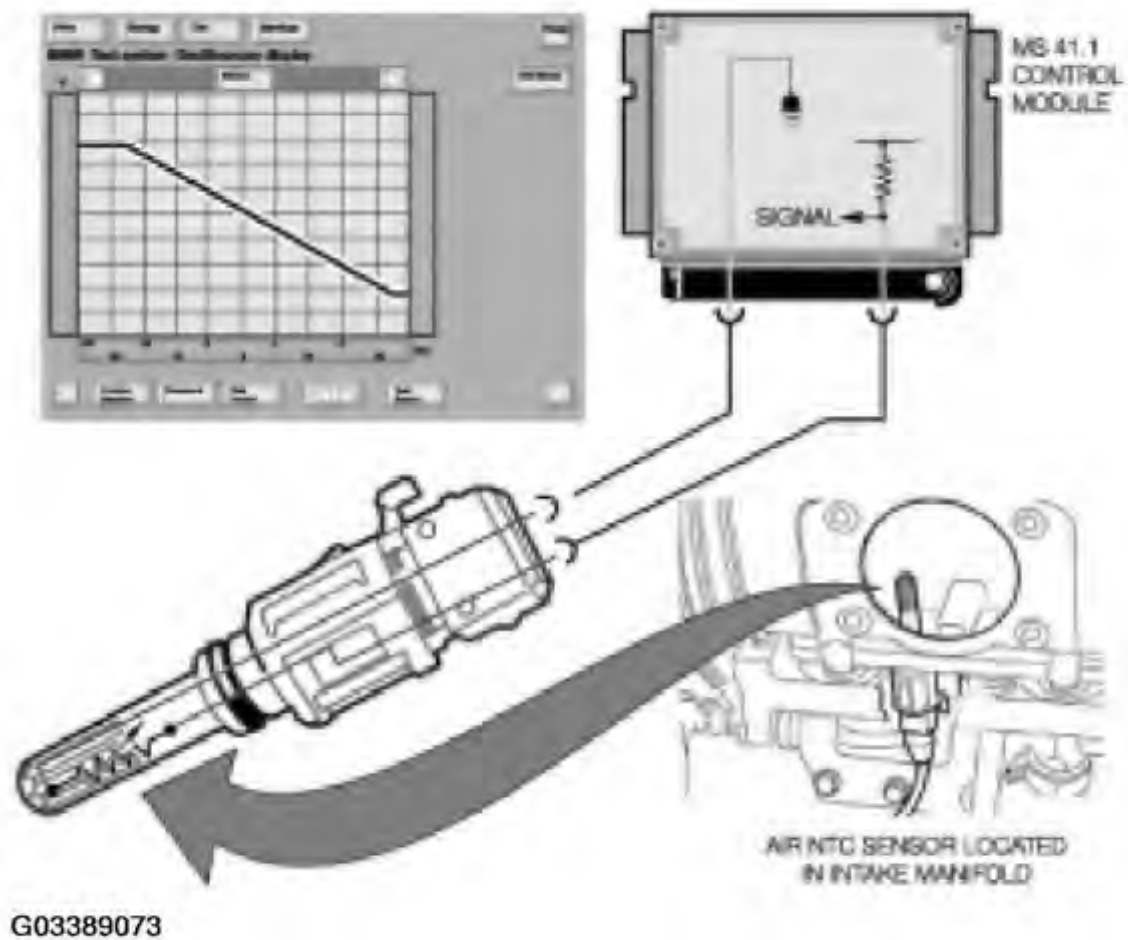
Courtesy of BMW OF NORTH AMERICA, INC.

Examples Of NTC Sensors

Intake Air Temperature Sensor

The intake air temp sensor provides a 0--5 volt analog signal to the DME indicating temperature of the incoming air.

The intake air temp sensor is located either in the intake manifold or integrated in the mass air flow meter.



[Fig. 10: Checking Intake Air Temperature Sensor](#)

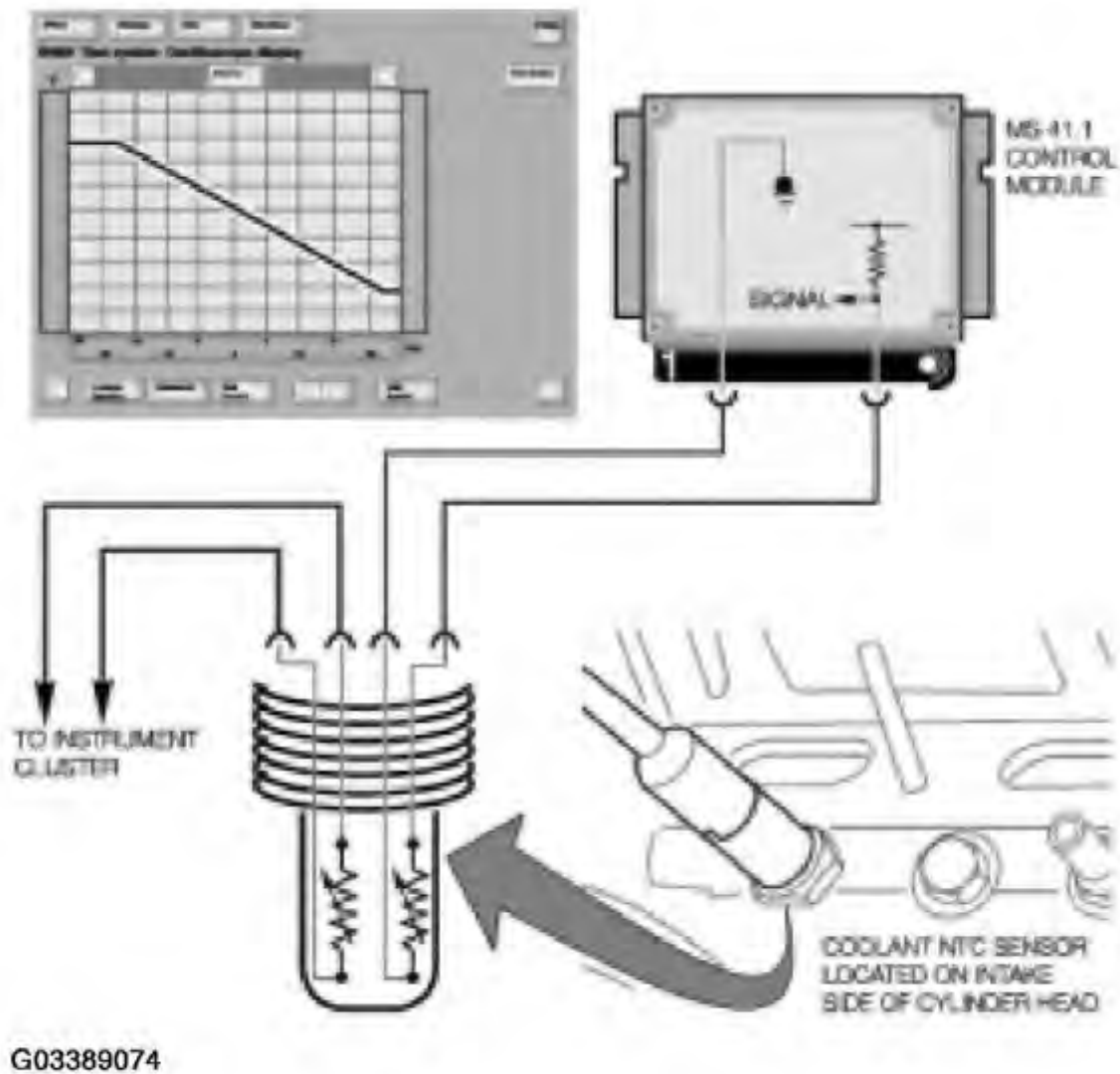
Courtesy of BMW OF NORTH AMERICA, INC.

Engine Coolant Temperature Sensor

A dual sensor is used for engine temp. Operation is the same as other NTC sensors, 0-5 volt operating range, except that two independent sensors are housed in one assembly.

One is for the engine temperature input to the DME.

The other sensor is used to input engine temp to the instrument cluster.



[Fig. 11: Checking Engine Coolant Temperature Sensor](#)

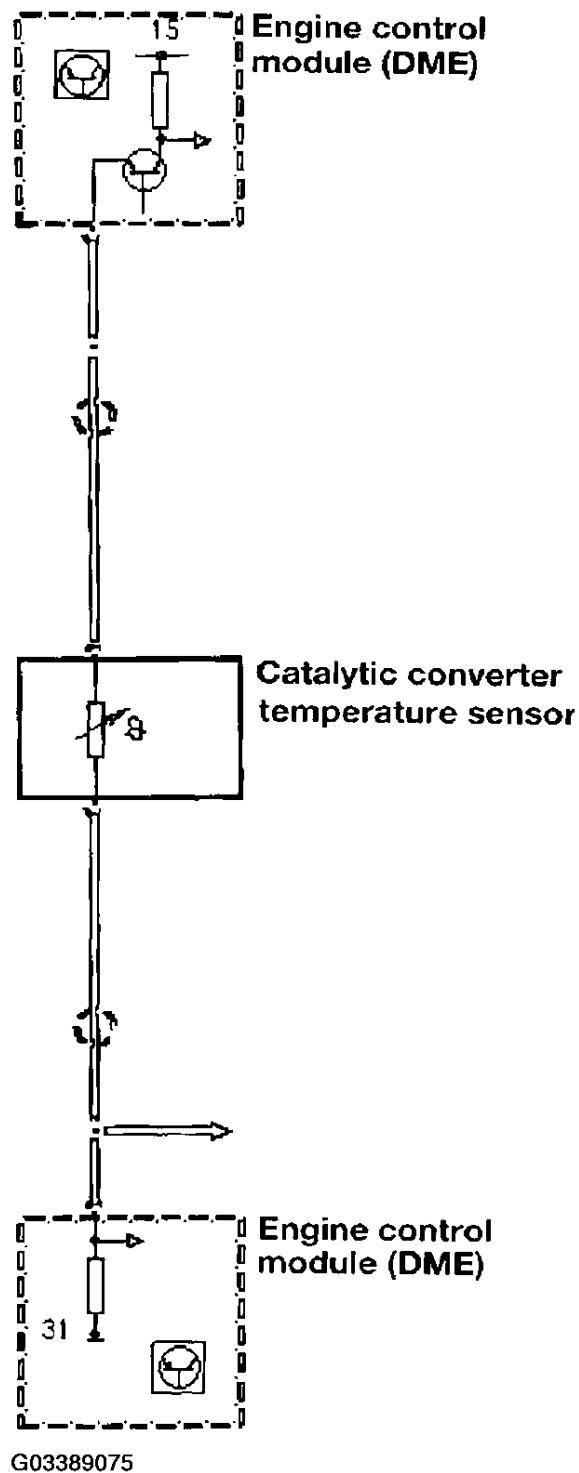
Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of NTC Type sensor:

- Engine Coolant Temp Sensor.
- Intake Air Temp Sensor.
- Transmission Temp Sensor.

PTC SENSOR

PTC (Positive Temperature Coefficient) sensors also change resistance based on temperature. In a PTC sensor as the temperature goes up the resistance also goes up. The increase in resistance causes the voltage drop across the sensor to increase and the input voltage signal at the control module increases.



[Fig. 12: PTC Sensor Circuit Diagram](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of A PTC Type Sensor:

- Exhaust Temp Sensor.
- Transmission Temp Sensor.

Example of PTC Sensor

A M5 Catalytic Converter uses a PTC type sensor to monitor exhaust temperature.

A 0-12v signal is supplied to the DME indicating catalyst temperature.

Workshop Hints NTC/PTC Sensors:

When troubleshooting a faulty input display, the input signal must be verified as "good" BEFORE the control module is replaced.

When checking a NTC Sensor look for these voltages and problems:

0 volts = no supply voltage or shorted to ground.

2v = sensor is indicating a warm condition for system being measured.

4v = sensor is indicating a cold condition for system being measured.

5v = sensor or wiring harness is open.

Remember a PTC type sensor will indicate opposite results on intermediate readings (i.e. 4 volts = warm).

POTENTIOMETERS

A Potentiometer produces a gradually changing voltage signal to a control module. The signal is infinitely variable within the operating range of the sensor.

This varying voltage reflects a mechanical movement or position of the potentiometer wiper arm and its related components.

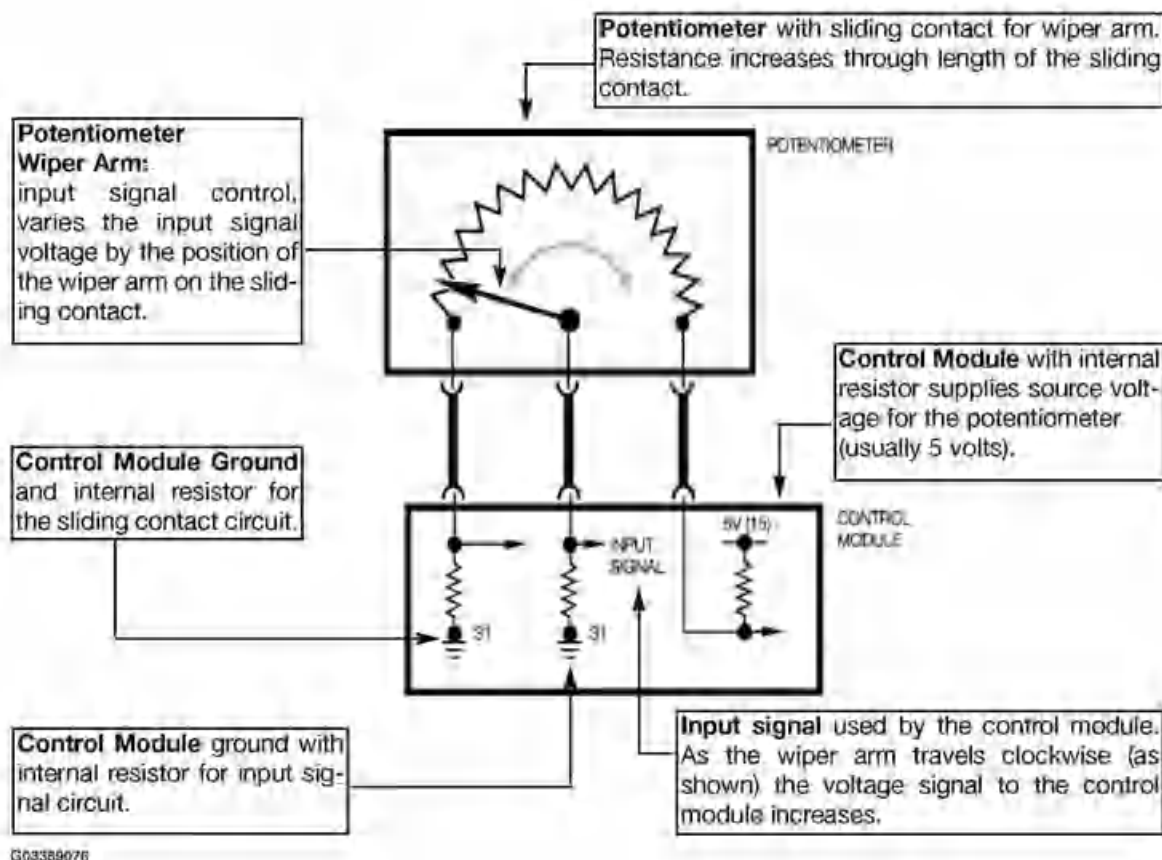


Fig. 13: Identifying Potentiometer

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Potentiometers:

- Air Flow Meter.
- Pedal Position Sensors.

- Seat and Mirror Memory Position.
- Throttle Position Sensors (Also Feedback Potentiometers).

DIGITAL SIGNALS

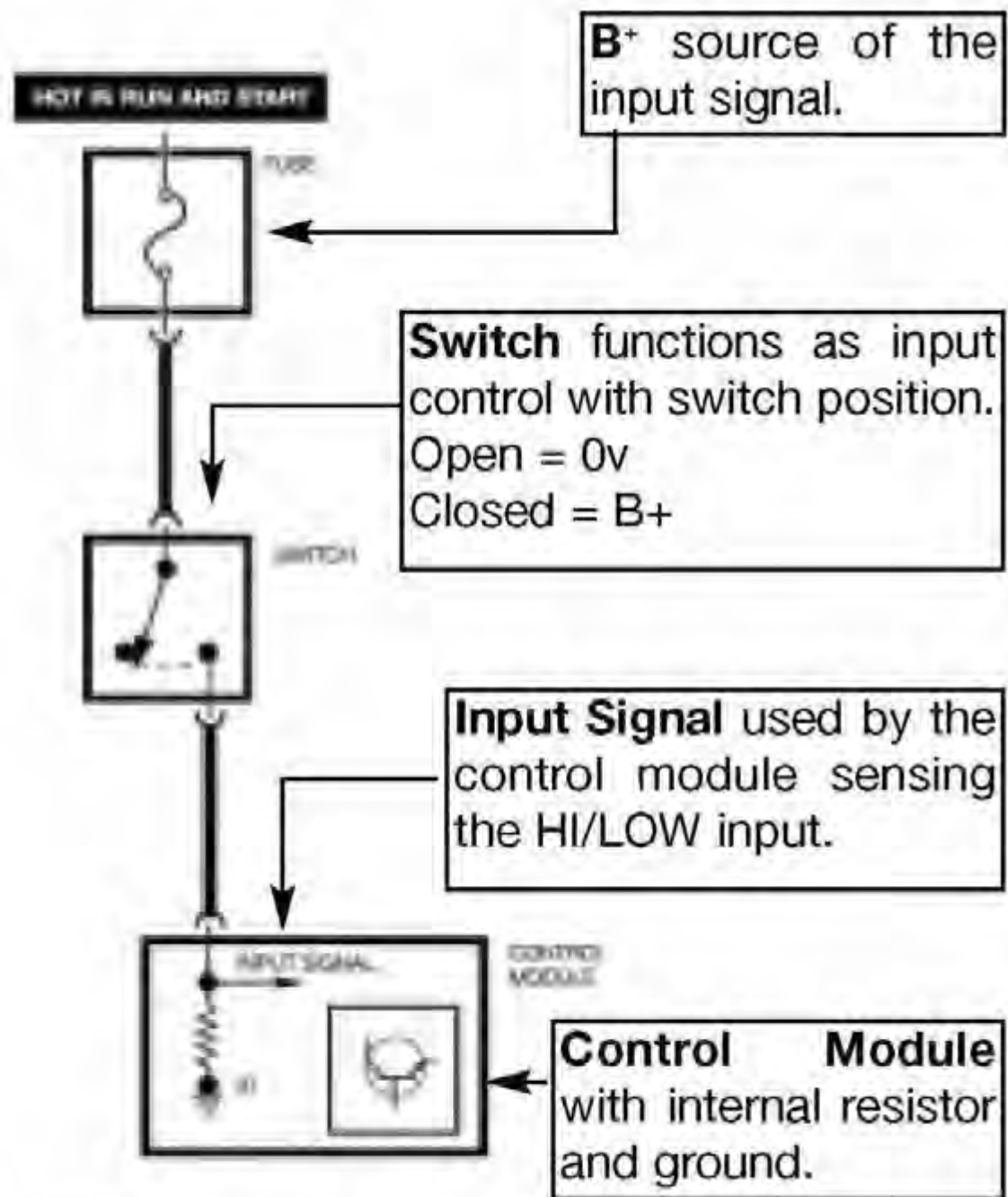
Digital Signals transfer information through an electrical circuit by switching the current on or off. Unlike analog signals which vary voltage, a digital signal has only two possible states, control voltage or 0 voltage.

Two types of Digital Signals:

- Switched (High/Low) Signals.
- Modulated Square Wave signals.

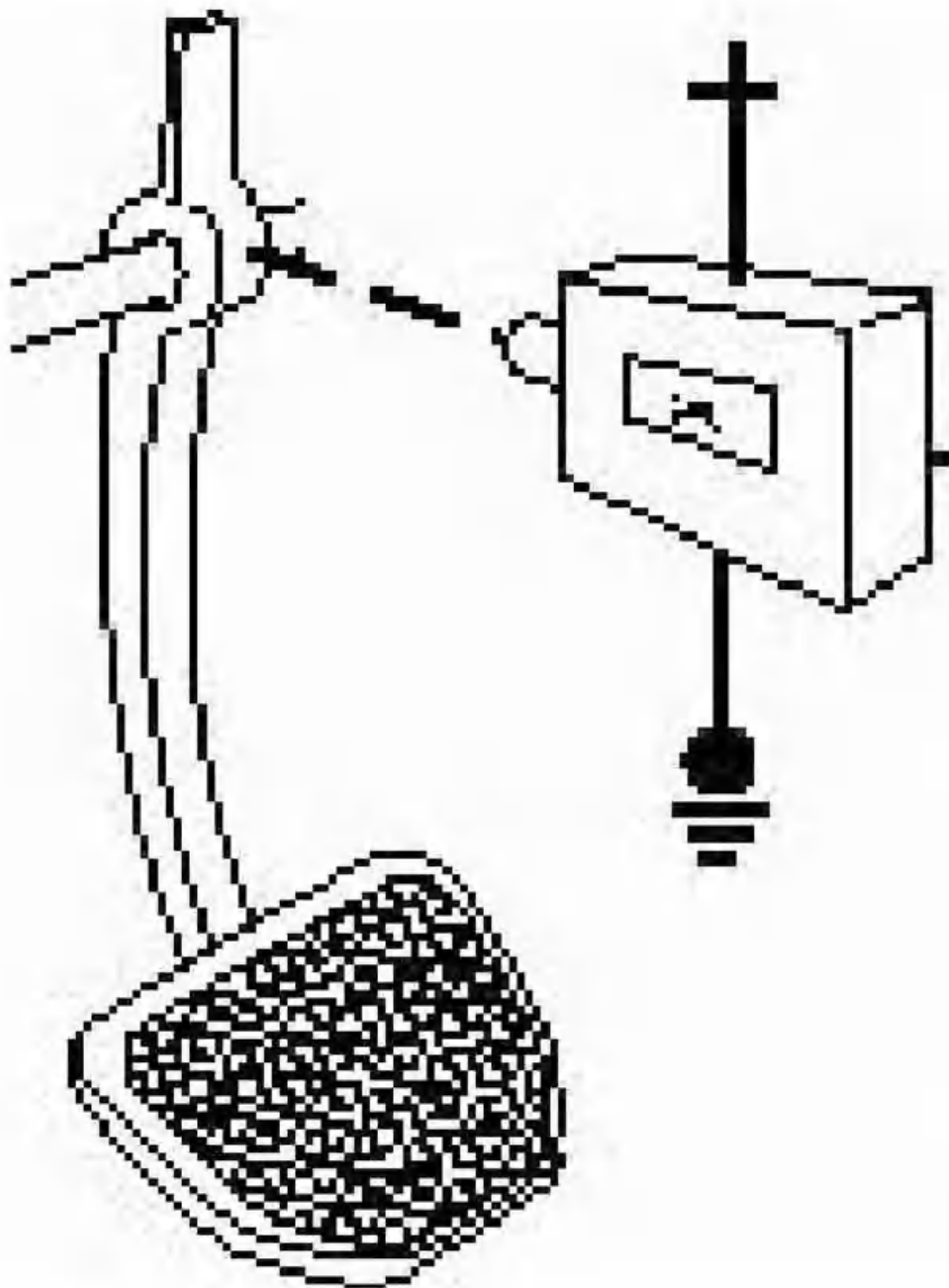
SWITCHED B+ SIGNAL

This DC voltage signal produces a YES/NO type input to the control module. The voltage level will indicate a specific operating condition.



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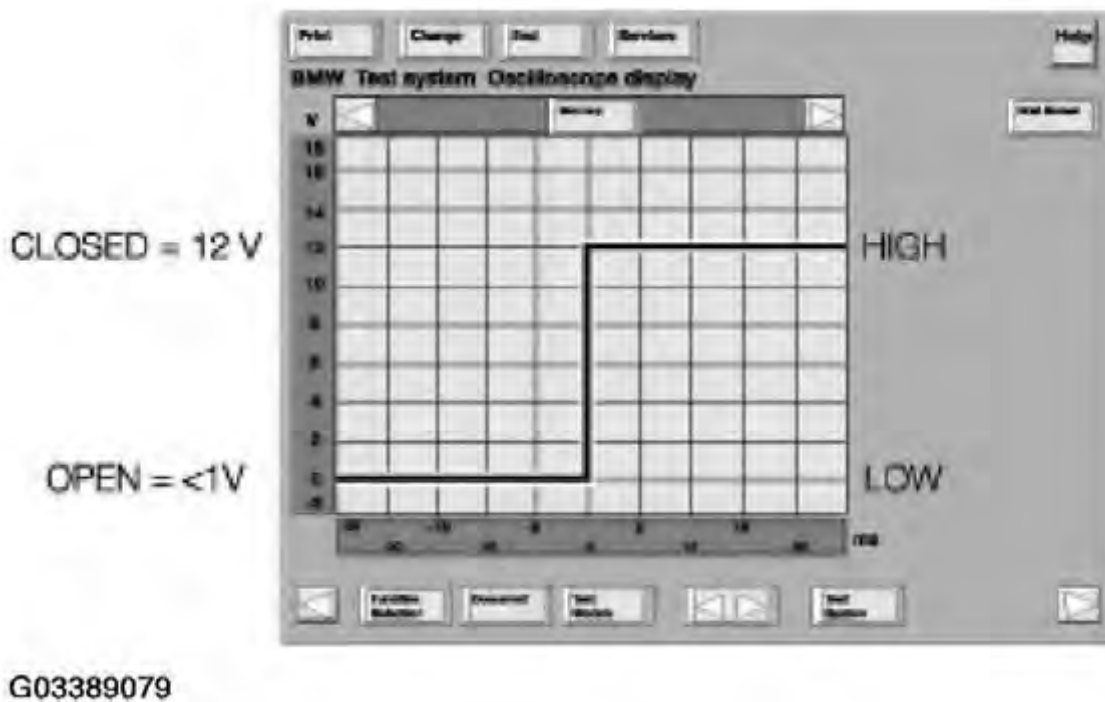
[Fig. 14: Digital Signals Transfer Information Chart](#)
Courtesy of BMW OF NORTH AMERICA, INC.



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[Fig. 15: Identifying Brake Light Switch](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Hall effect Brake Light Switch



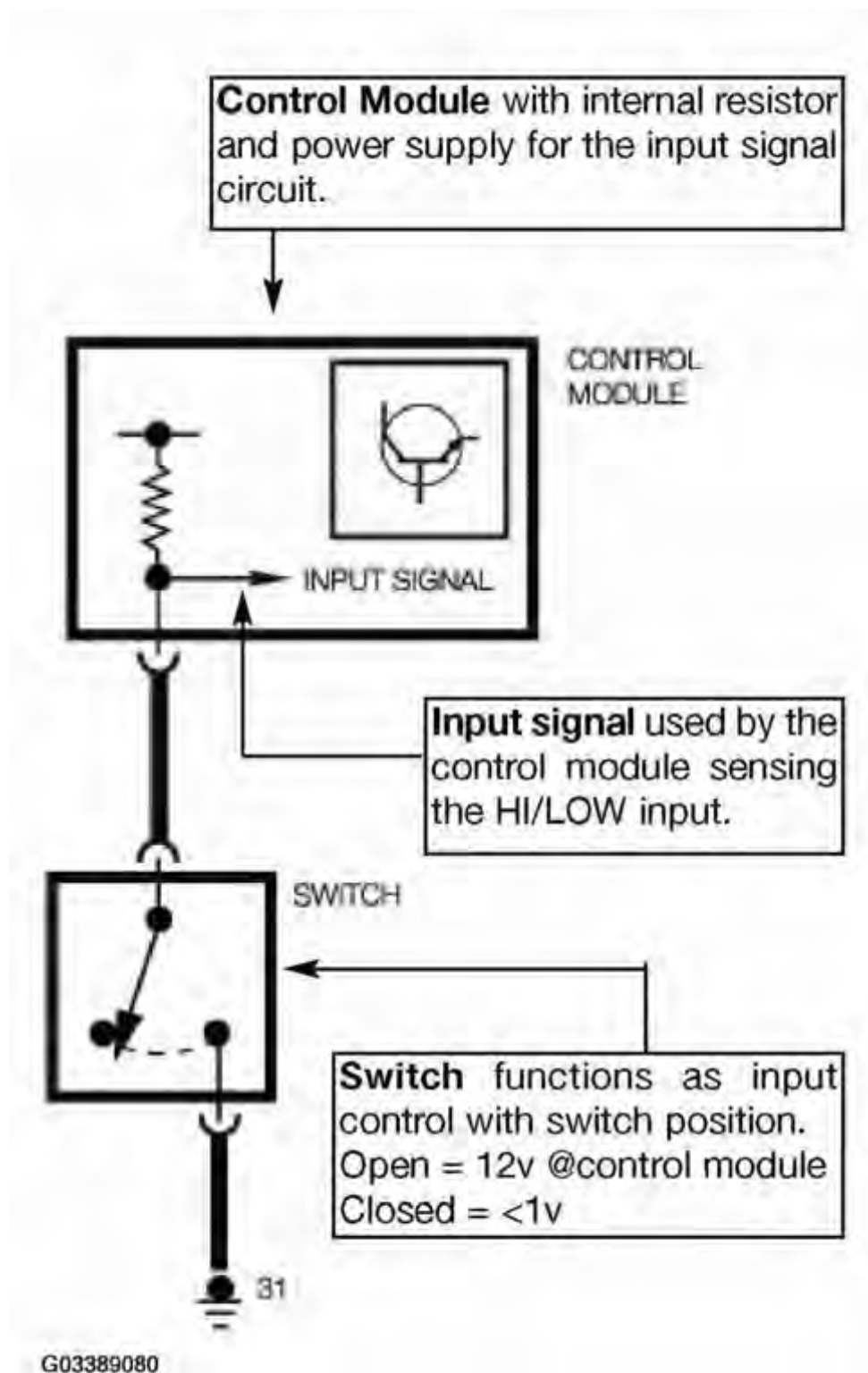
[Fig. 16: Identifying DC Voltage Signal](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Switched B+:

- Ignition Switch.
- Seat Belt Switch.
- Light Switch.
- Hall Effect Switch (e.g. Brake Light Switch).
- Reed Switch.

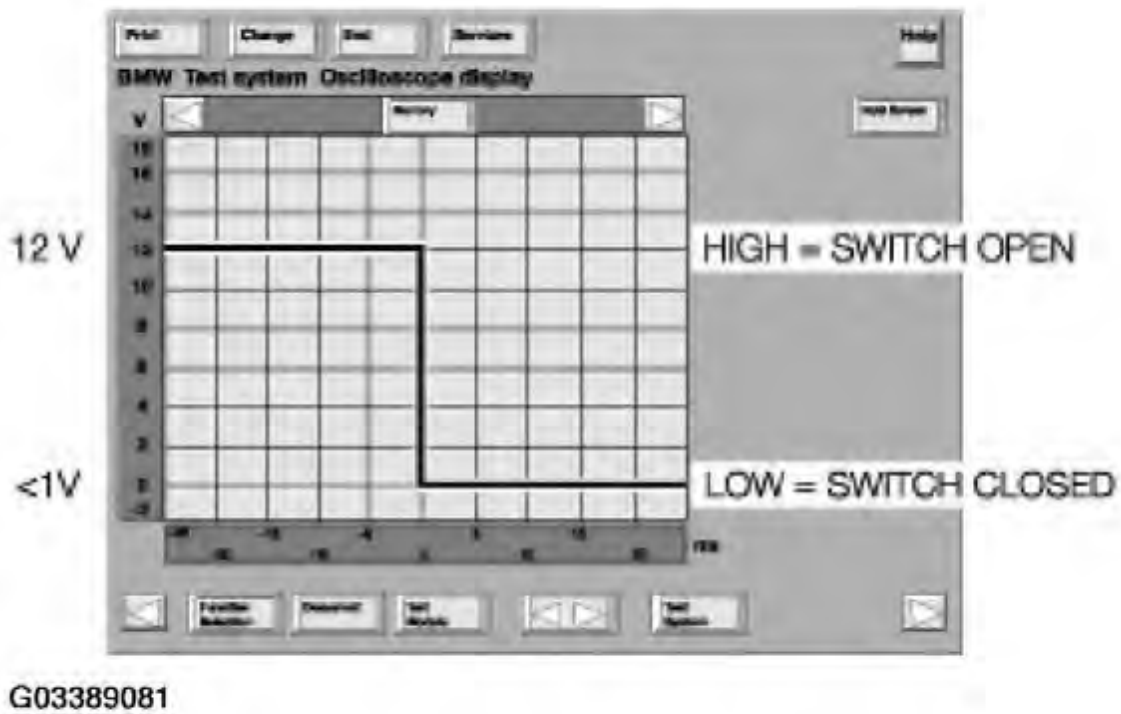
SWITCHED B- SIGNAL



[Fig. 17: Identifying \(High/Low\) Signal](#)

Courtesy of BMW OF NORTH AMERICA, INC.

This Ground Signal produces a YES/NO type input to the control module. The voltage level will indicate a specific operating condition.



[Fig. 18: Identifying Ground Signal](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Switched B-

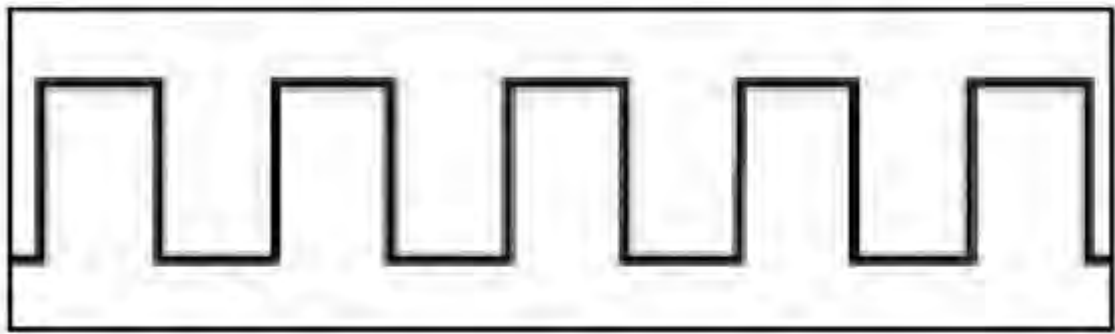
- Door Position Switch.
- Kickdown Position Switch.
- A/C Pressure Switch.

MODULATED SQUARE WAVE

A Modulated Square Wave is a series of High/Low signals repeated rapidly.

Like the switched signals (B+, B-) the square wave has only two voltage levels.

A high level and a low level.



A **Modulated Square Wave** appears as a High/Low signal repeated rapidly over and over.

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[Fig. 19: Identifying Modulated Square Wave](#)

Courtesy of BMW OF NORTH AMERICA, INC.

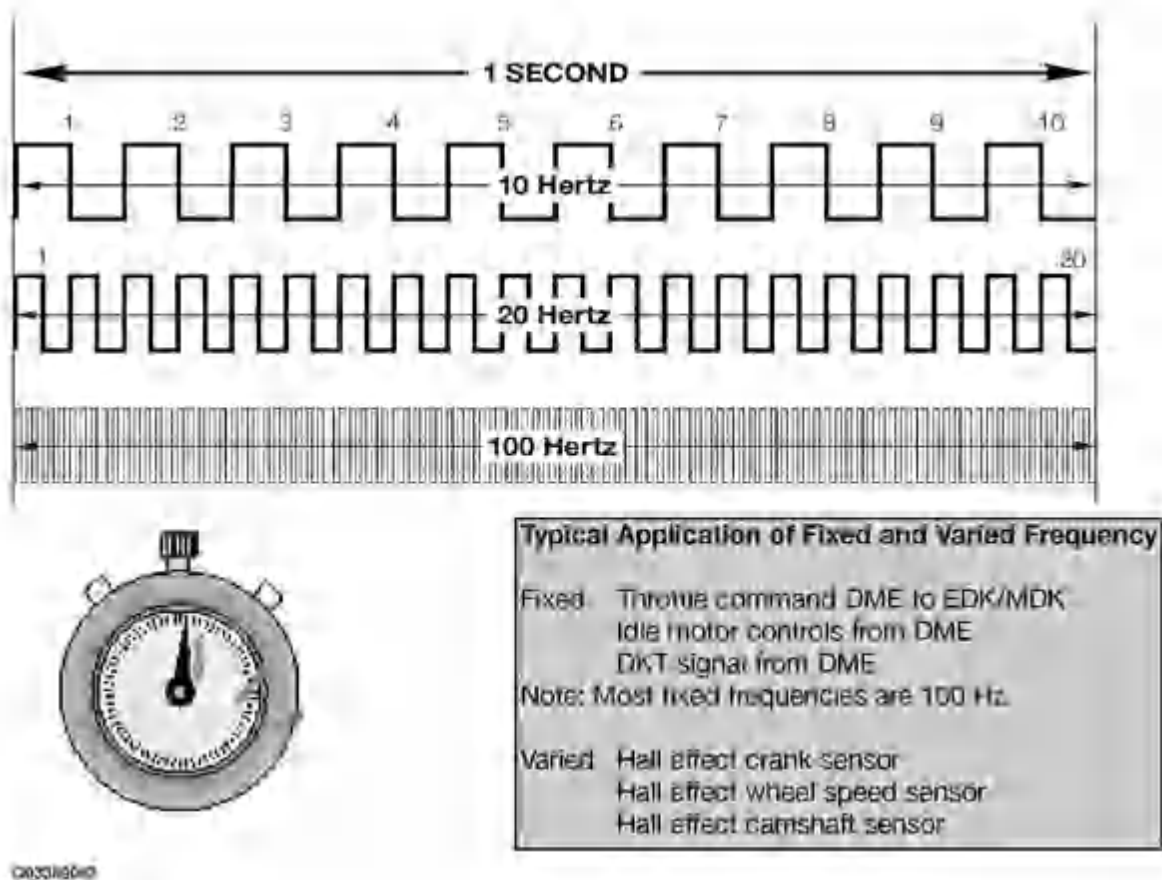
A modulated square wave has 3 characteristics that can be modified to vary the signal:

- Frequency.
- Pulse Width.
- Duty Cycle.

Frequency

The frequency of a modulated square wave signal is the number of complete cycles or pulses that occur in one second. This number of cycles or frequency is expressed in Hertz (Hz) . 1Hz = 1 complete cycle per second.

An output function may use a fixed or varied frequency.

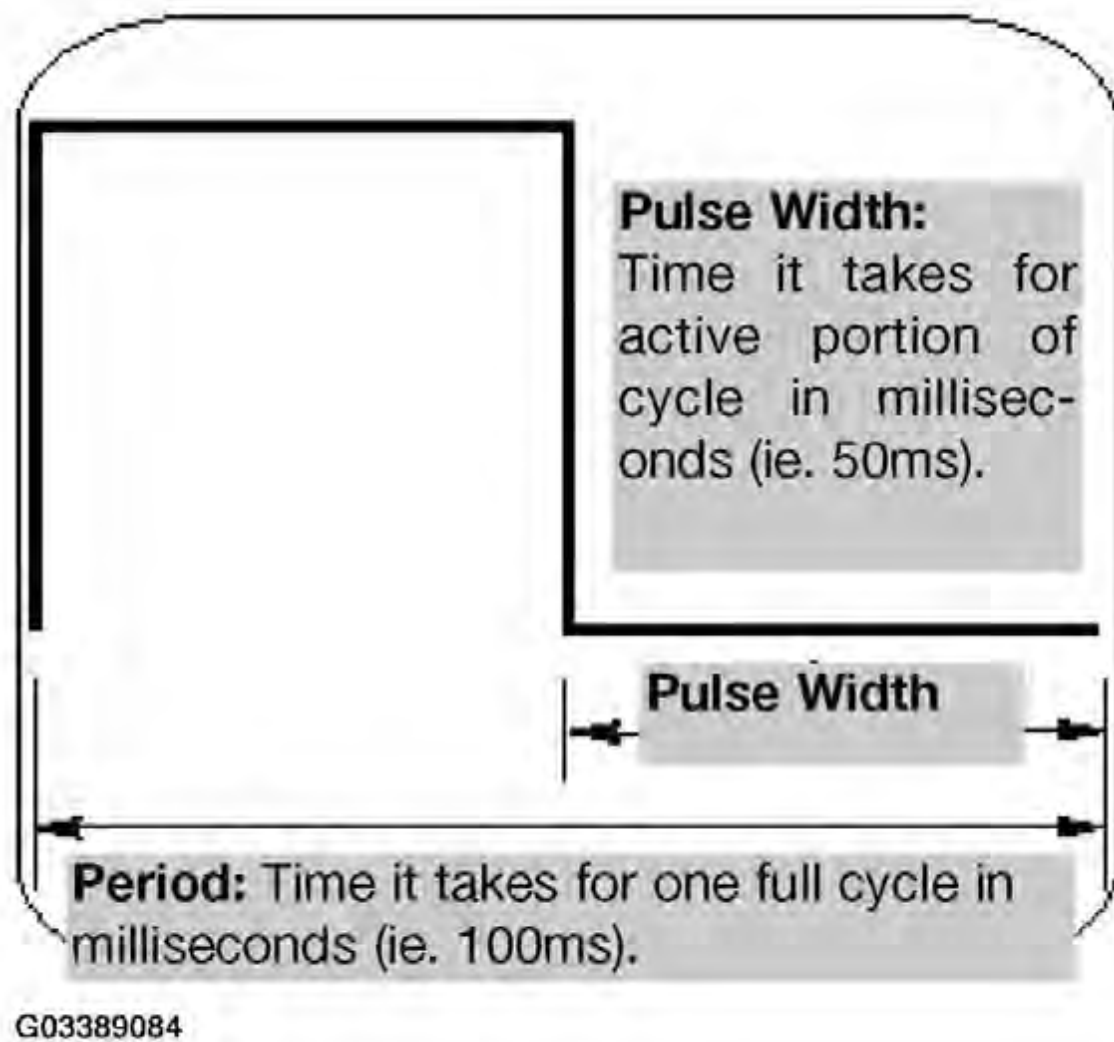


[Fig. 20: Identifying Modulated Square Wave Signal](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Pulse Width

The Pulse Width of a square wave is the length of time one pulse is ON. Vehicle systems may use fixed or varied ON times or pulse width. Pulse width is expressed in milliseconds (ms).



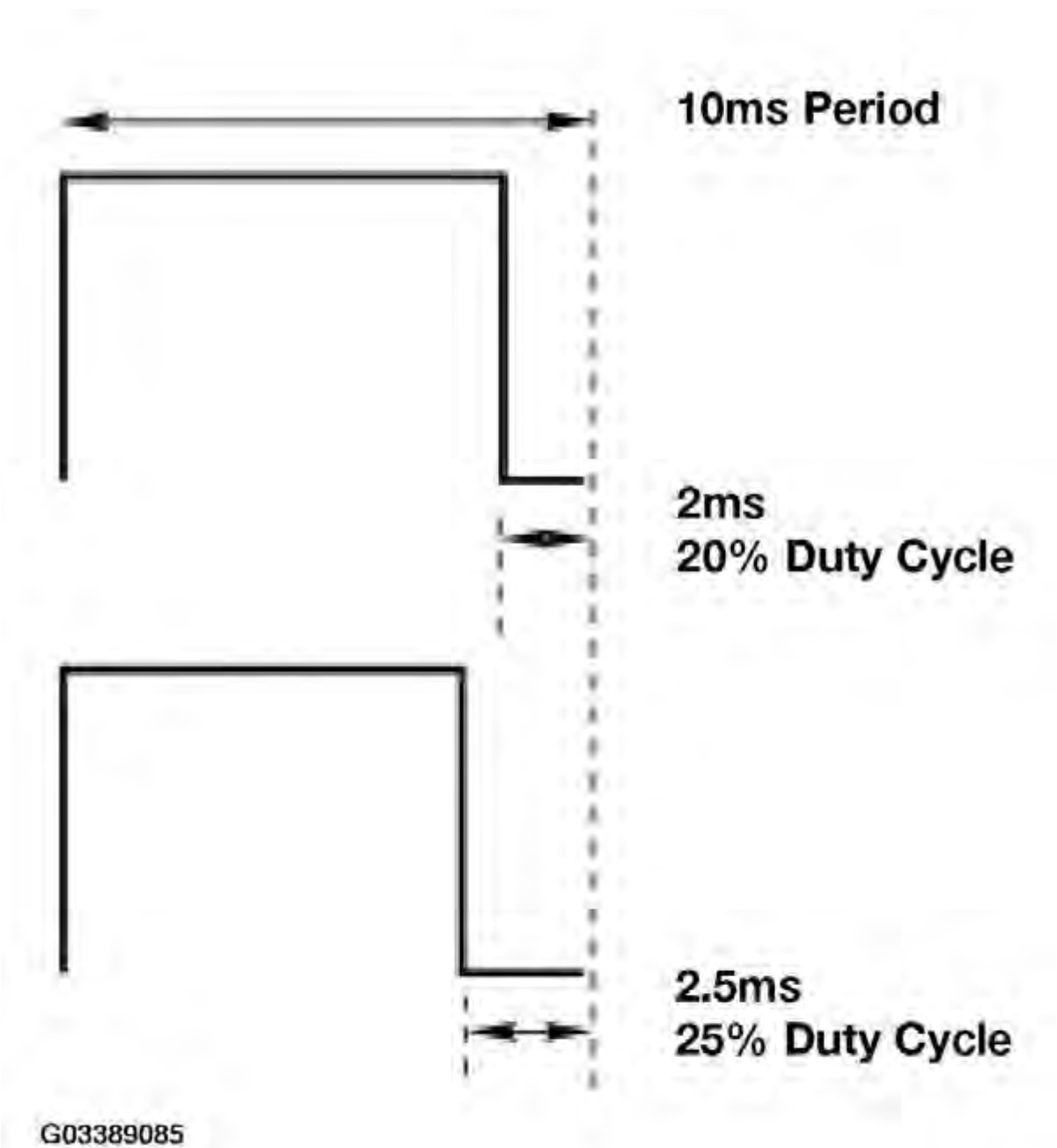
[Fig. 21: Identifying Pulse Width Display](#)
Courtesy of BMW OF NORTH AMERICA, INC.

Duty Cycle

The Duty Cycle of a square wave is the ratio of ON time to OFF time for one cycle.

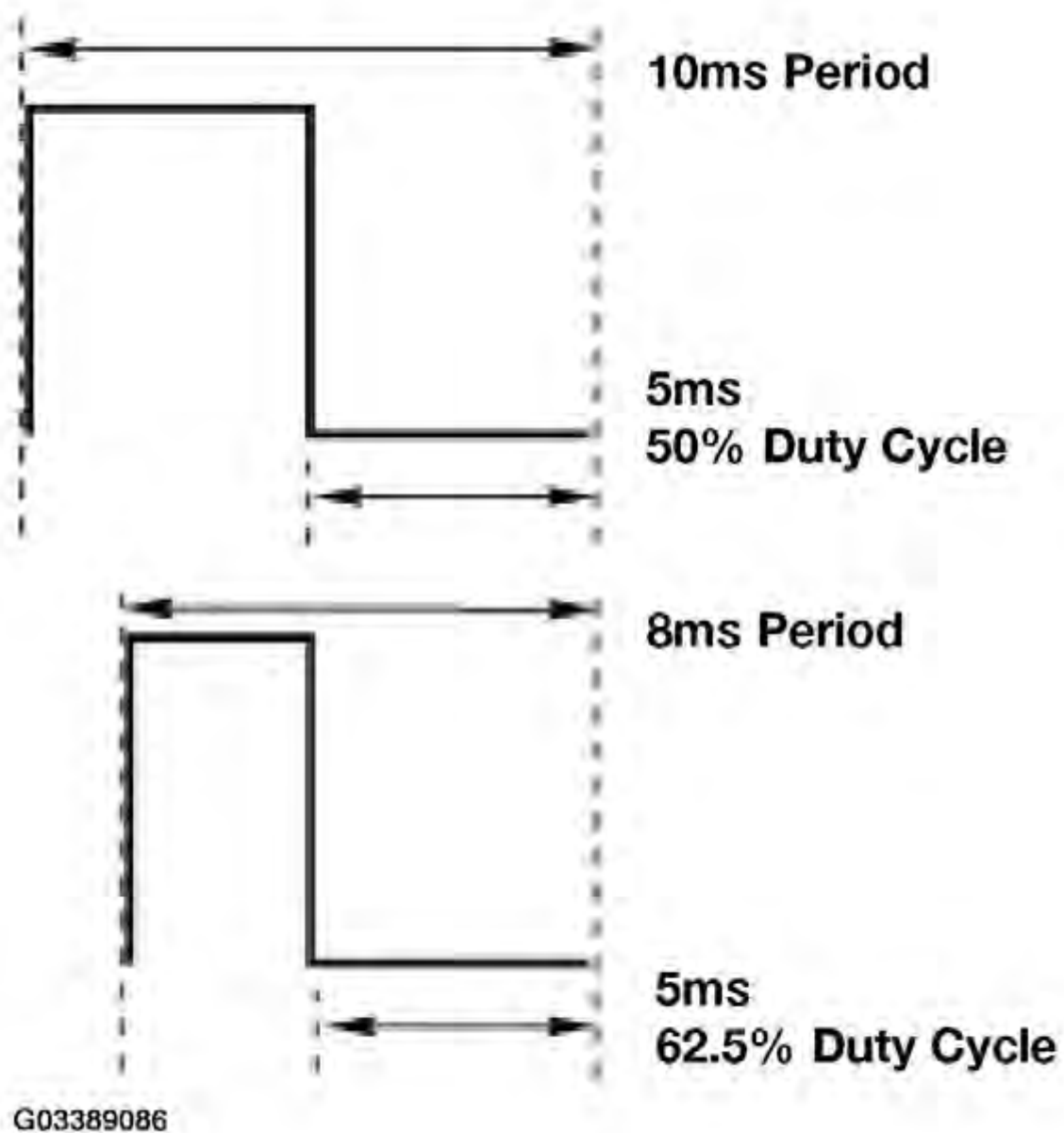
Duty cycle is expressed in %.

Vehicle systems use both fixed duty cycle signals and variable duty cycle signals.



[Fig. 22: Identifying Duty Cycle \(1 Of 2\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.



[Fig. 23: Identifying Duty Cycle \(2 Of 2\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Time

1 second = 1000 milliseconds (ms).

1/2 second = 500 milliseconds.

1/4 second = 250 milliseconds.

1/10 second = 100 milliseconds.

1/100 second = 10 milliseconds.

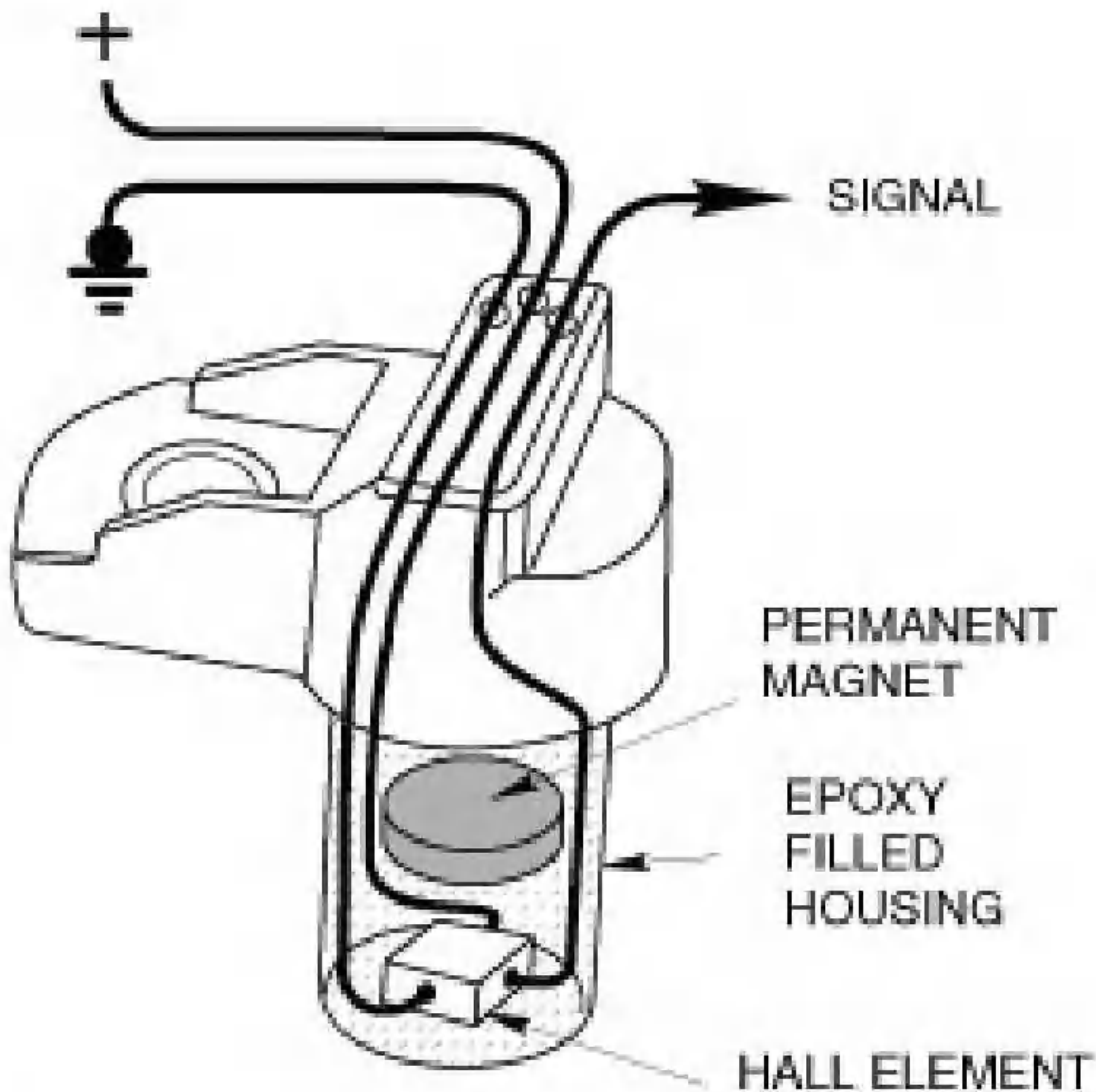
1/1000 second = 1 milliseconds.

HALL-EFFECT SENSORS

Hall Effect Sensors produce a modulated square wave.

Hall Effect Sensors are electronic switches that react to magnetic fields to rapidly control the flow of current or voltage ON and OFF.

The Hall Sensor consists of an epoxy filled non-magnetic housing containing a hall element and a magnet, and a trigger wheel.



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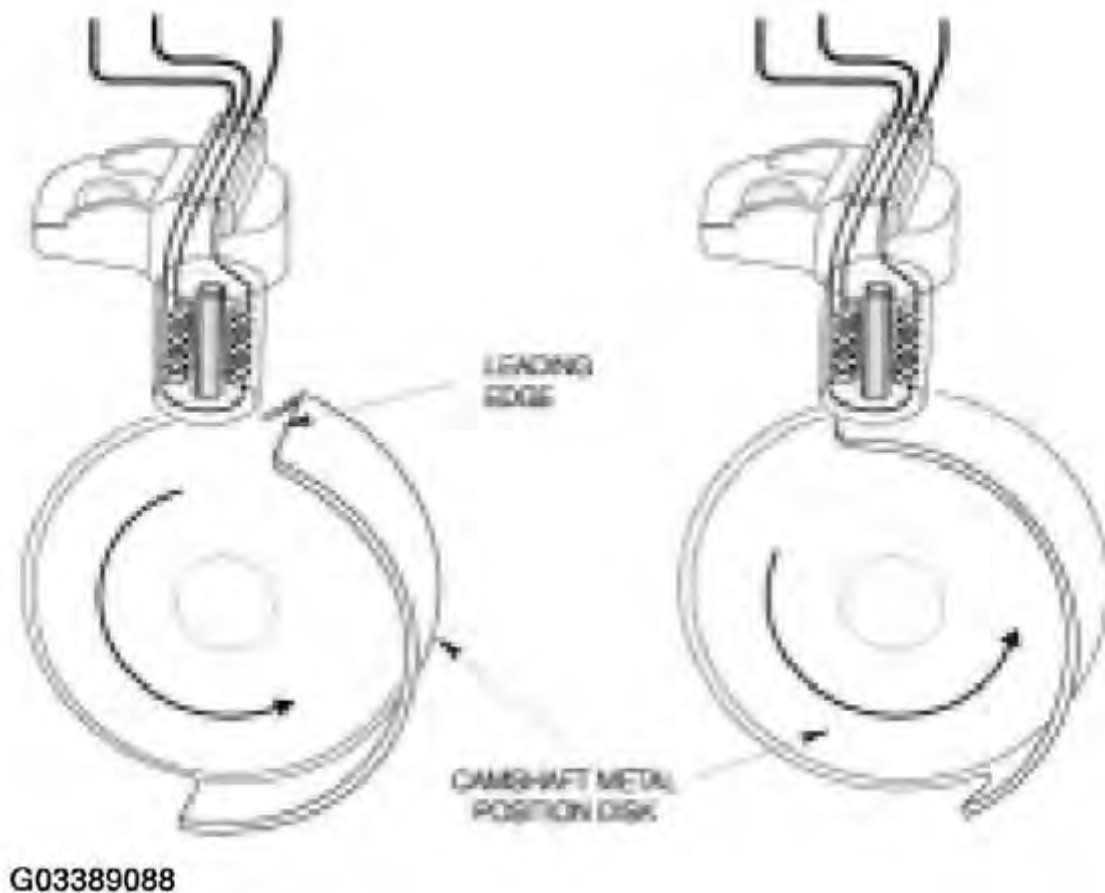
[Fig. 24: View Of Hall Effect Sensors](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The Hall element is a thin non-magnetic plate which is electrically conductive. (Voltage will flow through the plate.) Electron flow is equal on both sides of the plate.

Since everything between the magnet and the hall element is non-magnetic the magnet (magnetic field) has no effect on the current flow.

As a metal disk or solid area of a toothed wheel, flywheel or other trigger device approaches the sensor, a magnetic field is created between the magnet and the disk.



[Fig. 25: Identifying Magnetic Field](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The magnetic field cause the electron flow to stop on one side of the plate. Electrons continue to flow on the other side of the plate.

The Hall Sensor Signal is a measurement of the voltage drop between the two sides of the plate or element.

When the magnetic field increases (disc or solid toothed area in front of sensor) the voltage drop across the two sides of the element increases. High voltage on one side, little on the other. The signal output from the sensor is High.

As the disc moves away from the sensor the magnetic fields weakens and is lost. The loss of the magnetic field (blank toothed or open area of the wheel in front of the sensor) produces very little voltage drop across the two sides of the element. The output signal is Low.

This rapid switching of the voltage ON/OFF produces a HIGH/LOW signal that the control module uses to recognize speed and position.

Examples of Hall Effect Sensors

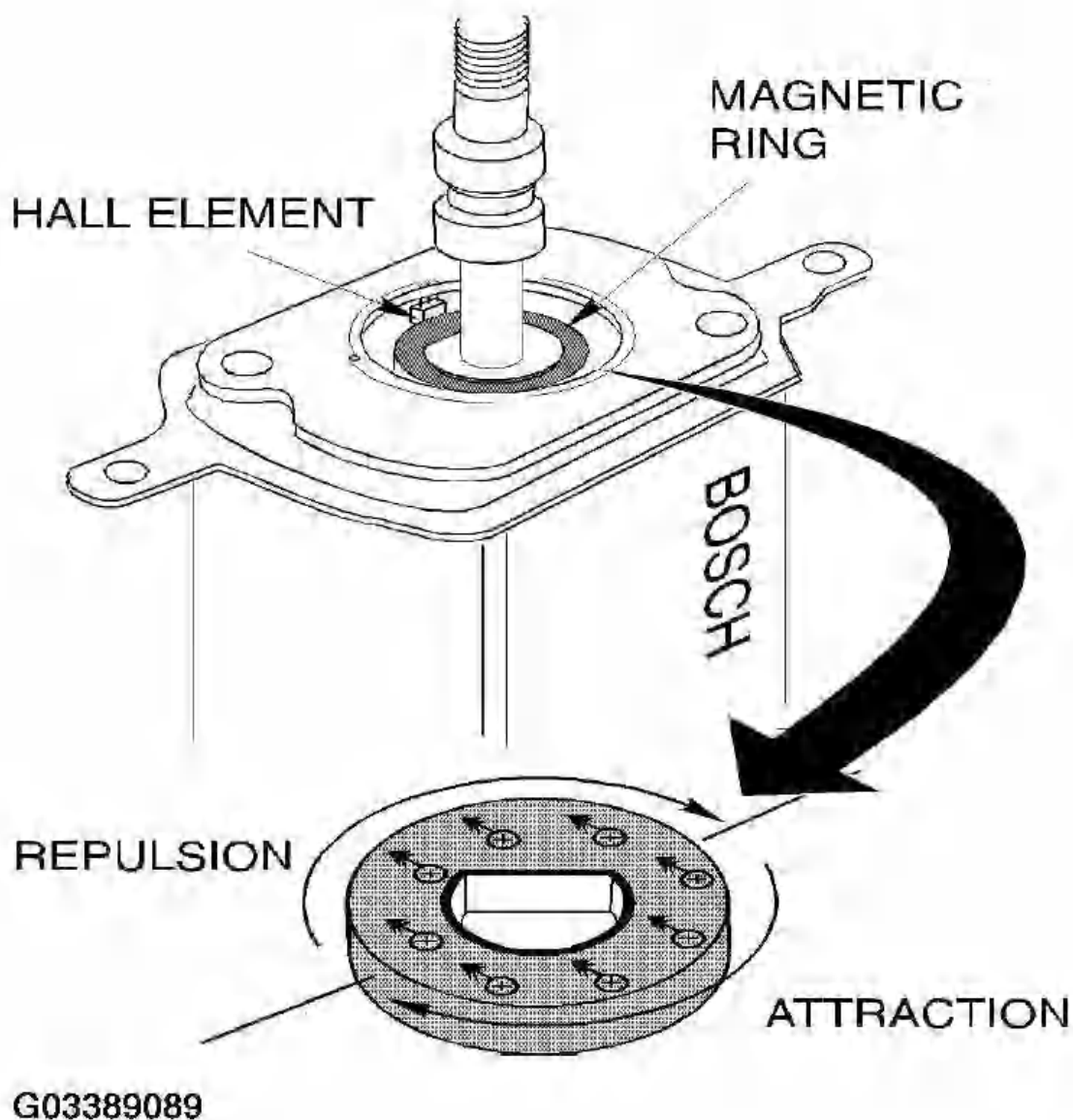
Motor Position Hall Sensors

Hall sensors are used on many electric motors to monitor speed and position. (i.e. electric window motors and sunroof motors.)

The Hall Effect principal is the same except the magnet is placed on the shaft of the motor.

The magnet is aligned to rotate in a precise position in front of the element. The polarization of the magnetic

ring causes a polarity switch in the Hall element to occur as it rotates. The square wave produced provides speed and position information to the control module.



[Fig. 26: Identifying Motor Position Hall Sensors](#)
Courtesy of BMW OF NORTH AMERICA, INC.

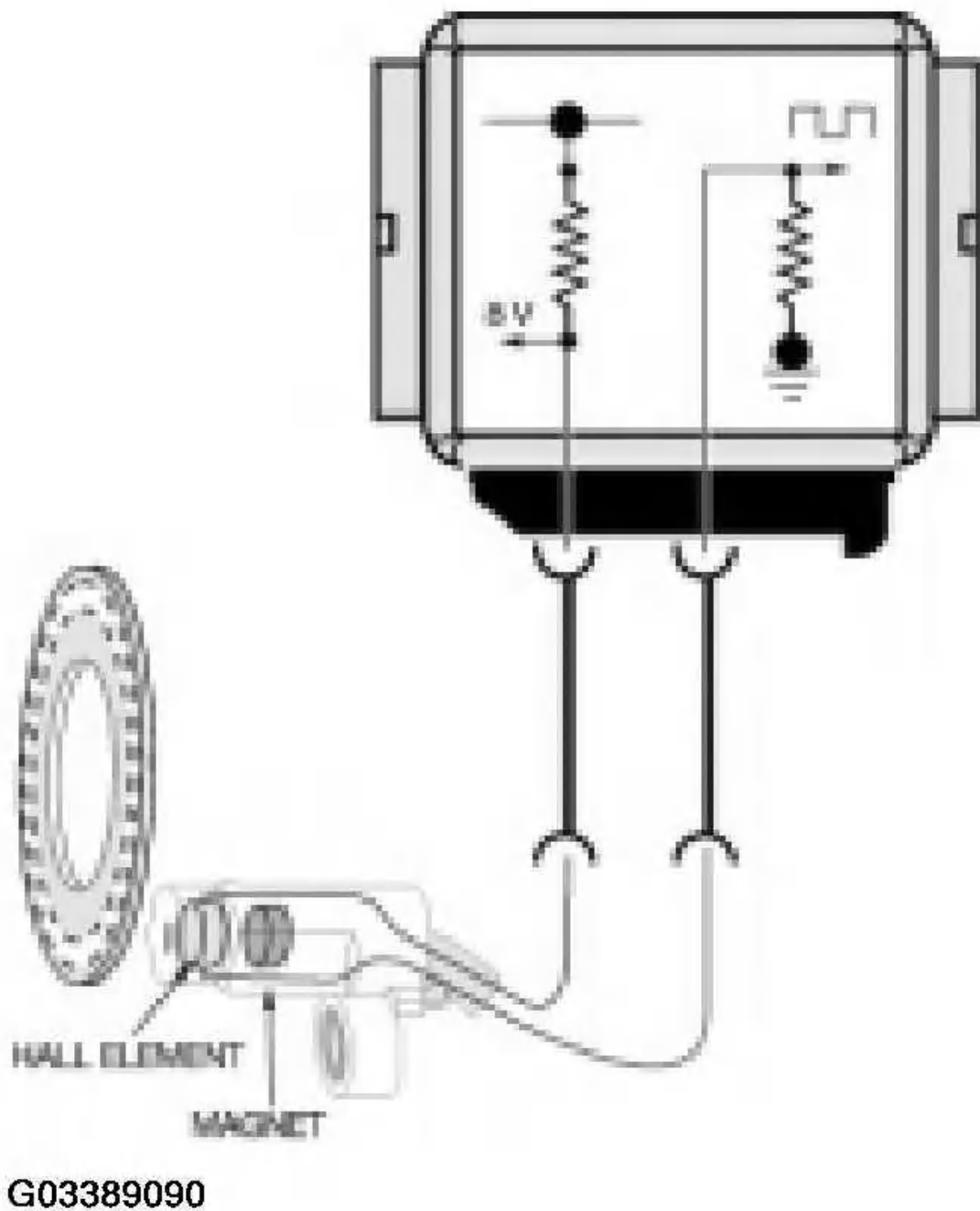
Wheel Speed Hall Effect Sensors

Hall Effect sensors are used to indicate wheel speed.

Conventional Hall Effect Sensors use three wires, power supply (usually 5v or 12v) a ground wire and a signal wire back to the control module.

The Hall Effect sensors used as wheel speed sensors are unique in that they are two wire Hall Effect Sensors.

The two wire sensors eliminate the separate ground wire and the signal wire functions as the ground also.



[Fig. 27: Identifying Wheel Speed Hall Effect Sensors](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The unique two wire arrangement provides the control module with a HIGH/LOW signal having a low voltage of .75 volts and a high voltage of 2.5 volts.

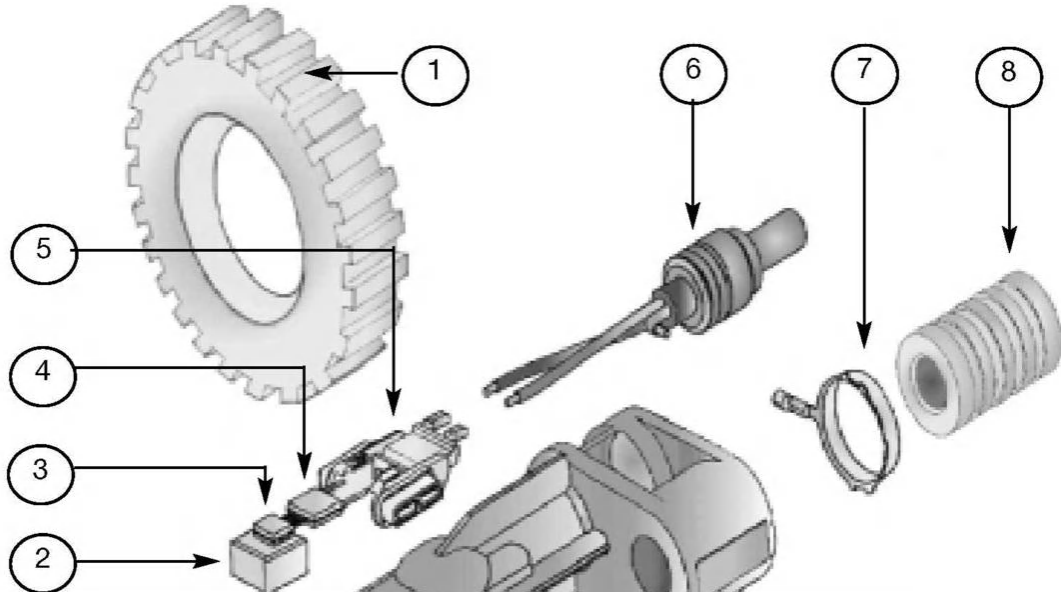
Typical Application of Hall Effect sensors

- Crankshaft Sensors.
- Motor Position and Speed Sensors (e.g. Window Motor, Sunroof Motor).
- Camshaft Sensors.
- Wheel Speed Sensors.

MAGNETORESISTIVE SENSORS

The active sensing of the Magnetoresistive Sensor is particularly suitable for advanced stability control applications in which sensing at zero or near zero speed is required.

A permanent magnet in the sensor produces a magnetic field with the magnetic field stream at a right angle to the sensing element.

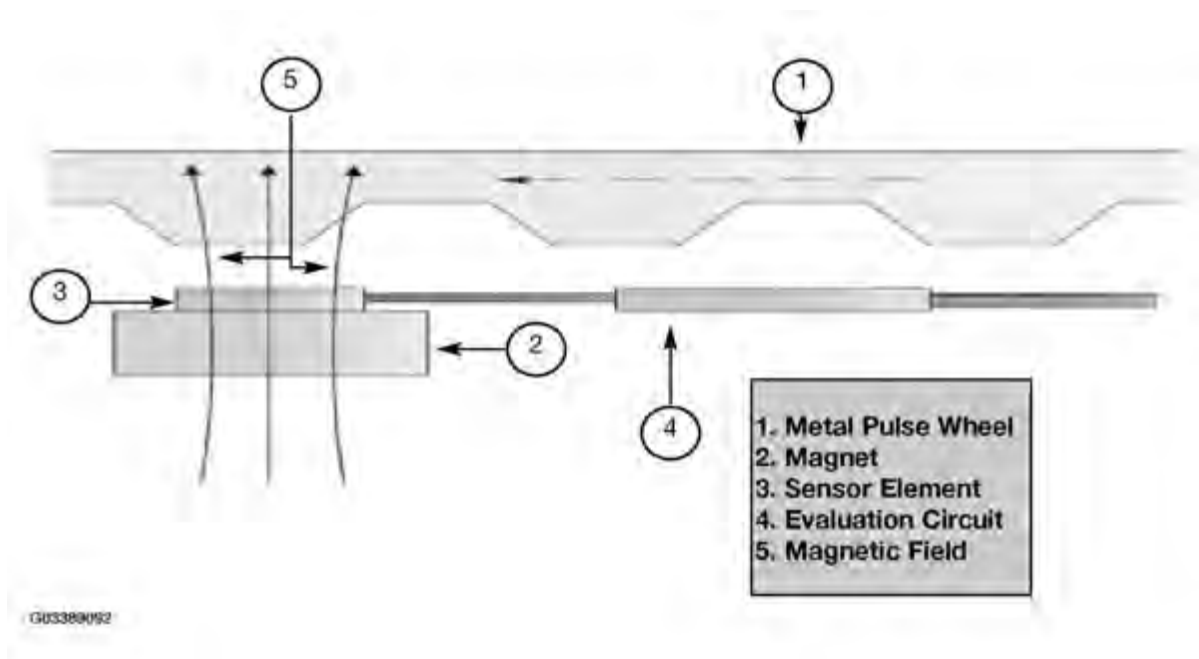


[Fig. 28: Exploded View Of Magnetoresistive Sensors](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The sensor element is a ferromagnetic alloy that changes its resistance based on the influence of magnetic fields.

As the high portion of the pulse wheel approaches the sensing element a deflection of the magnetic field stream is created. This creates a resistance change in the thin film ferromagnetic layer of the sensor element.

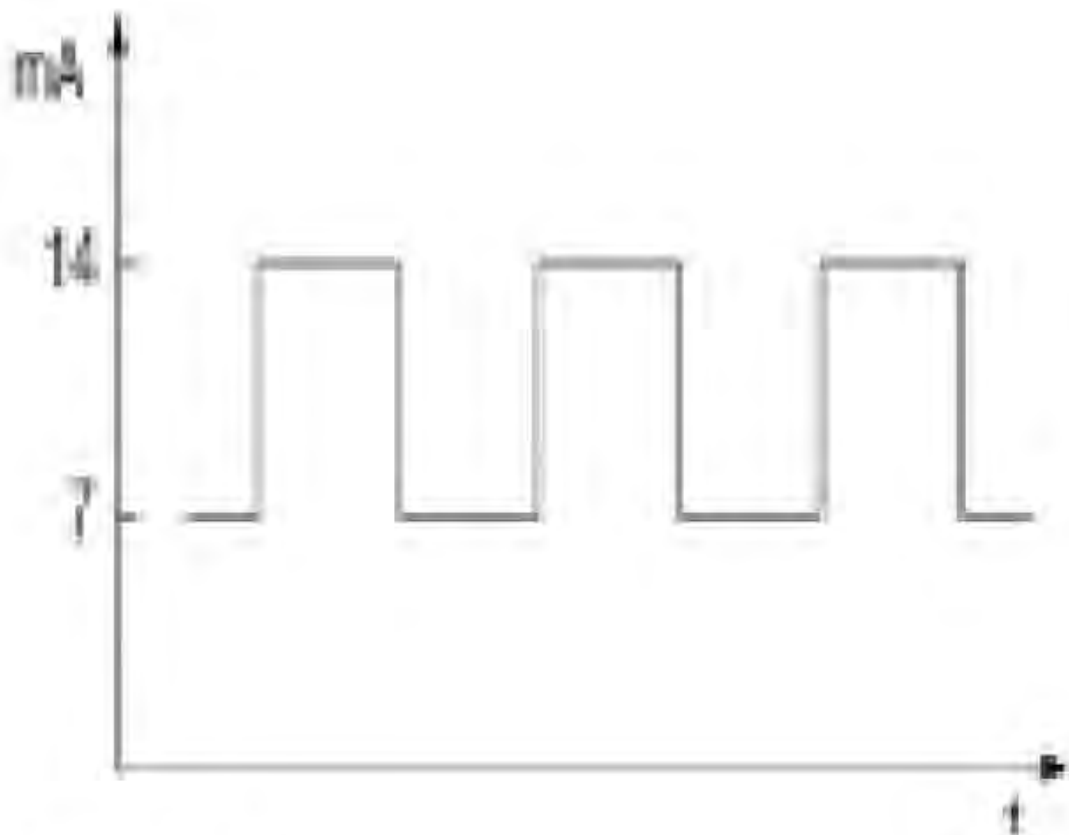


[Fig. 29: View Of Sensor Element](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The sensor element is affected by the direction of the magnetic field, not the field strength. The field strength is not important as long as it is above a certain level. This allows the sensor to tolerate variations in the field strength caused by age, temperature, or mechanical tolerances.

The resistance change in the sensor element affects the voltage that is supplied by the evaluation circuit. The small amount of voltage provided to the sensor element is monitored and the voltage changes (1 to 100mv) are converted into current pulses by the evaluation module.



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[Fig. 30: Identifying High And Low Current Pulses](#)

Courtesy of BMW OF NORTH AMERICA, INC.

- Signal Low-7mA .
- Signal High-14mA .

The sensor is supplied 12V by the control unit. Output voltage from the sensor is approximately 10V. The control unit counts the high and low current pulses to determine the wheel speed.

Typical Application of Magnetoresistive Sensor:

- Found Currently on E46 with Teves DSCIII MK-60.

DESIGNATED VALUE SIGNALS

Designated values are produced through fixed resistance positions of a multi-position switch. As the switch is operated the voltage drop across the resistor(s) of each switch position causes the voltage level of the input signal to change to a predetermined voltage value.

These predetermined (designated) voltages signal the control module to perform specific functions.

[Fig. 31: Identifying Designated Value Signals](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Voltage Values seen as input by control module.

[Fig. 32: Voltage Values Display](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Designated Values:

- Cruise Control Switch On E 32.
- Seat and Mirror Memory Position Buttons.

Coded Ground Signals

Coded ground signals produce a set of High/Low requests, the combination (pattern) of which is interpreted by the control module to perform a specific function. Coded ground signals are generated through a switch or series of switches signaling the control module requests for operation.

[Fig. 33: Identifying E 36 Wiper Circuit](#)

Courtesy of BMW OF NORTH AMERICA, INC.

[Fig. 34: Identifying E 39 Wiper Circuit](#)

Courtesy of BMW OF NORTH AMERICA, INC.

TRANSISTOR FUNCTION

The transistor takes on a number of applications that must be understood to effectively analyze a circuit.

The transistor in operation functions as two parts much like a relay. Both the relay and the transistor control high currents with a low current signal.

[Fig. 35: Identifying Transistor Final Stage Function \(1 Of 2\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The base/emitter path functions as the control circuit activated by the control module to oversee or control the work.

The collector/emitter path functions as the work side of the circuit, supplying power or switching on the work.

In operation the transistor can be switched ON momentarily, or supply a constant power or ground.

The transistor can also be modulated or pulsed to supply a modulated square wave signal.

[Fig. 36: Identifying Transistor Final Stage Function \(2 Of 2\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Modulated, Momentary, Constant B- as Input/Output

The input signal of control module 1 is an output signal of control module 2.

Control module 2 through activation of its internal transistor provides a ground input for control module 1.

[Fig. 37: Identifying Modulated, Momentary, Constant B- As Input/Output Function](#)

Courtesy of BMW OF NORTH AMERICA, INC.

The input signal at control module 1 is either a momentary/constant signal (i.e torque convertor signal from TCM to DME) or a modulated signal (i.e. vehicle speed signal ASC to DME).

[Fig. 38: Identifying Wheel Speed Signal And Output Pulse](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Modulated, Momentary, Constant B- as Input/Output Signal:

- A/C KO Signal.
- Speed Signal From ABS/ASC.
- TI/TD Output Signal From DME.

Momentary/Constant B⁺ as an Input/Output Signal

[Fig. 39: Identifying Momentary/Constant B As An Input/Output Signal Function](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of Momentary/Constant B⁺ as an Input/Output Signal:

- OBC Code Signal to DME.
- A/C Signal to DME.

Constant B-/B⁺ To Energize a Component

Constant B-

Output function to energize a component.

Relay is energized by control module.

Internal activation of the transistor provides a ground for the relay coil.

[Fig. 40: Identifying Output Function To Energize Component \(Constant B-\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Constant B⁺

[Fig. 41: Identifying Output Function To Energize Component \(Constant B⁺\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Control module output function to energize a component.

Transistor controls output function of the control module.

Control module supplies power to the relay. The relay is activated by the control module through internal activation of the transistor which provides a ground for the relay coil.

Modulated B-/B⁺ To Operate A Component

Modulated B-

Output function to operate a component.

The idle valve motor is operated by the control module through internal activation of the transistor which provides a ground for the open winding of the valve.

The idle control valve is operated by regulation of the duty cycle at a specific frequency.

[Fig. 42: Identifying Output Function To Operate Component \(Modulated B-\)](#)

Courtesy of BMW OF NORTH AMERICA, INC.

Typical Application of modulated B-

- Idle Control Motor.
- Purge Valve.
- Injector.
- Ignition Coil.

Modulated B+

Fig. 43: Identifying Output Function To Operate Component (Modulated B+)

Courtesy of BMW OF NORTH AMERICA, INC.

Output function to operate a component.

The motor is controlled by a transistorized function of the control module, which provides a modulated voltage at a specific frequency to the motor. The throttle position is changed by altering the Duty Cycle of the pulses.

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