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# On Board Monitor and Navigation Systems

**Model: All with Navigation**

**Production: Start of Production MY 2004**

## OBJECTIVES

After completion of this module you will be able to:

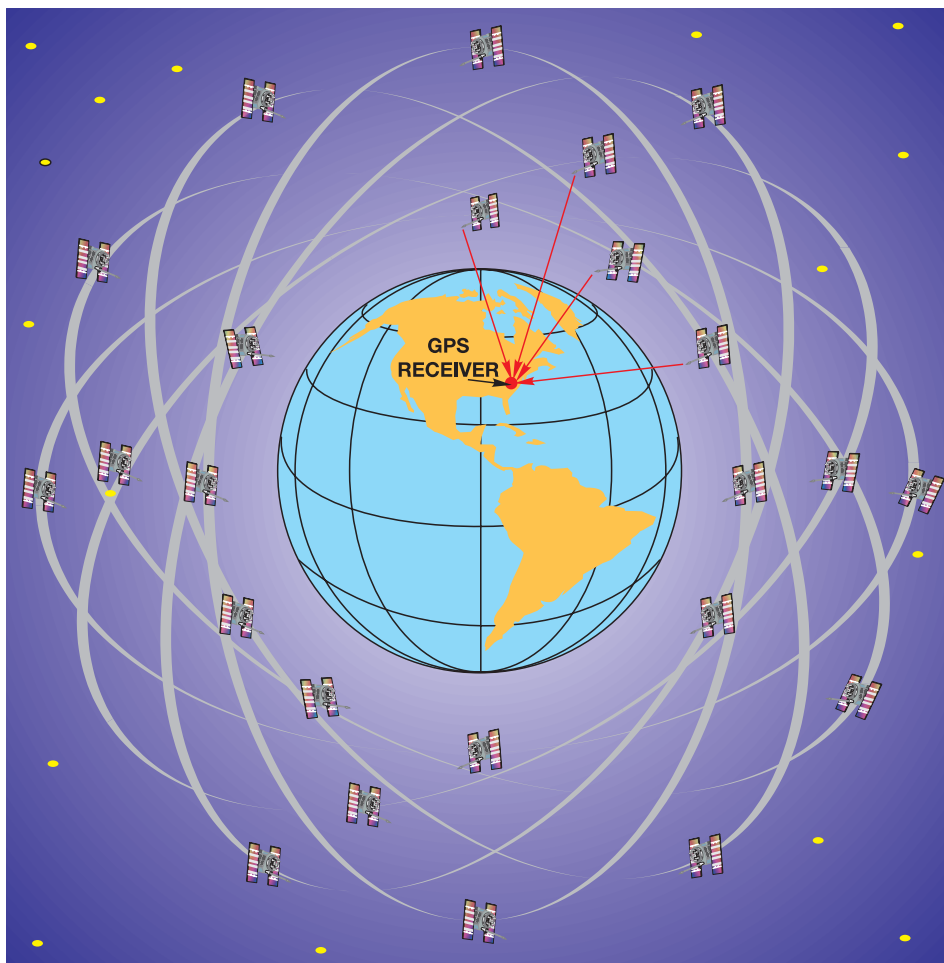
- Understand basic Navigation functions
- Identify and locate navigation system components
- Diagnose navigation system concerns
- Perform Navigation Service Mode Functions

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## Navigation Systems

The navigation systems used on BMW vehicles have been in use since the E38 in 1997. There have been various versions which have been carried over into other models as well. These navigation systems are possible due to the available Global Positioning System technology.

The BMW Navigation system operates in conjunction with the Global Positioning System (GPS). Utilization of the GPS improves the accuracy and provides redundancy for the Navigation system which also incorporates a dead reckoning system. The GPS was designed by the US Government in the 1970s for military purposes. In recent years it has been made available for civilian use.

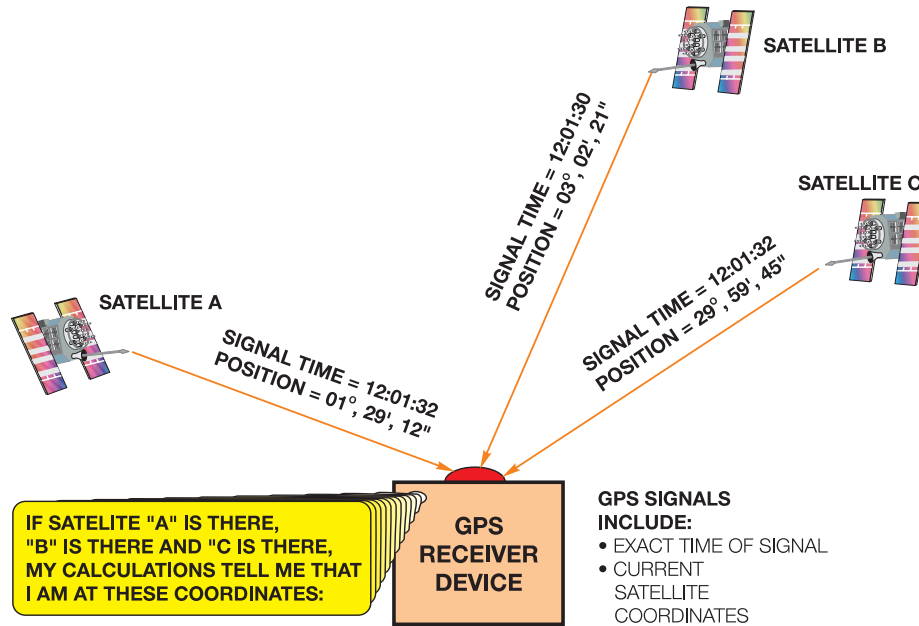


There are 24 satellites equally divided among six geosynchronous orbits that are positioned 11,000 miles out in space. Each satellite continuously emits a radio signal. The signals contain short information messages including:

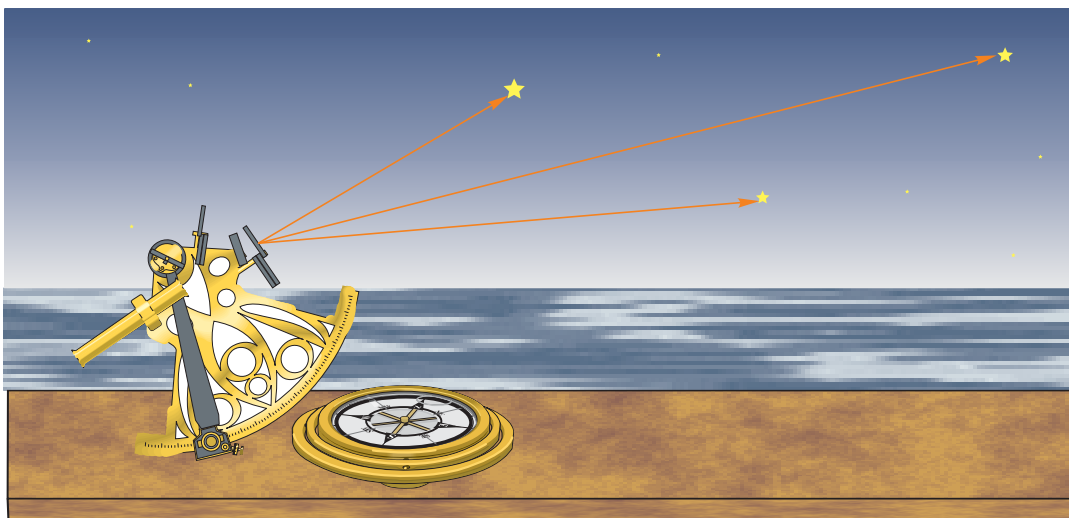
- The exact time the message was broadcast.
- Current latitude and longitude positions relative to the geosynchronous orbit.

A GPS receiver device on earth receives these signals from the satellites and determines its own location by:

- Comparing its internal clock signal with the satellites. This determines the distance from the satellites location.
- Through triangulation computation, the receiver module calculates its own longitude and latitude position. This is only possible when it receives a minimum of three satellite signals.



In a sense, GPS can be compared to navigation methods used by sailing ship navigators years ago. They used a sextant to plot the changing locations of known stars to determine their own position. This, in conjunction with compass navigation, proved an accurate method of sailing across the seas.

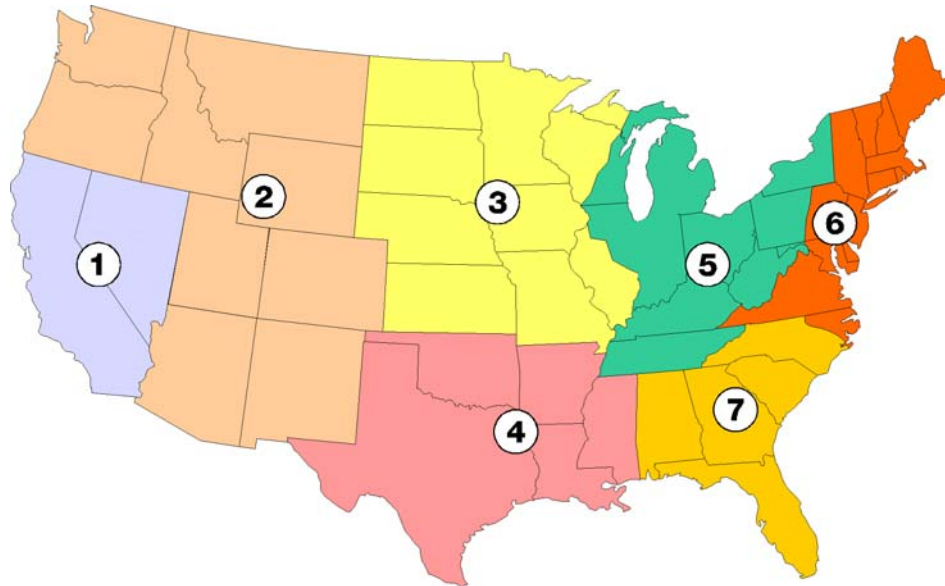


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The BMW navigation system is based on the CARiN™ system developed by Philips Electronics. (CARiN™ = Car Information and Navigation System.)

The BMW Navigation system is a CD driven, on board, active route mapping computer. The driver can enter a destination through the On Board monitor and the navigation system will select a mapped route, from the current location, to the destination.

The route maps are stored digitally on a navigational database CD that is installed in a dedicated CD drive in the navigation computer.



The U.S. is currently divided into 7 mapped CD database areas ranging from:

- Area 1- California and Nevada, through
- Area 7 - Covering the South Eastern States.

In addition to the digitized route maps, other information such as hotels, restaurants, service stations, dealerships, points of interest and local sight-seeing attractions along with their addresses are stored on the database CD.

The map CDs are currently being updated twice a year. As the updates occur, more streets and roads will be added. In addition, more local information will be added with regards to businesses, hotels, motels, local attractions, etc.

### **DVD Navigation**

For the 2003 model year, BMW introduced a DVD based navigation system. The DVD based navigation system uses 1 map DVD to cover the US and Canada rather than the previous 8 CDs needed to cover the same area.

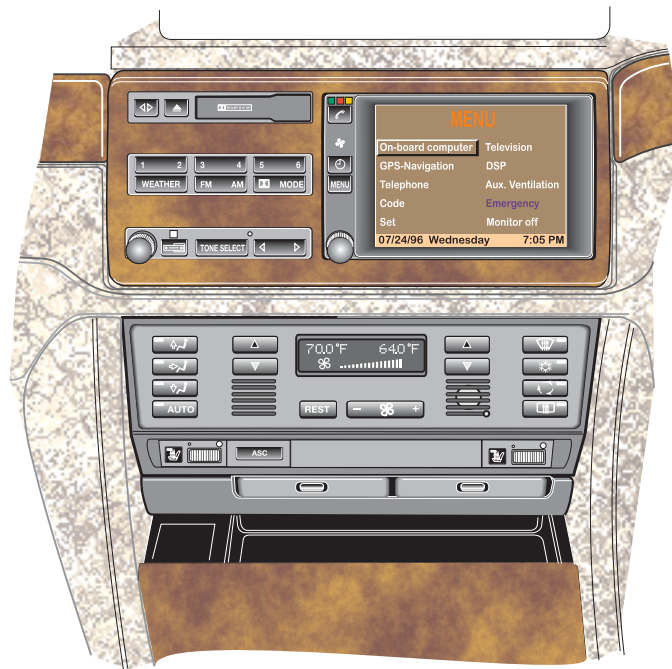
The vehicles included are the E39, E46, E52, E53 and E85. The DVD navigation system was introduced on E39, E46 and E52 vehicles from 9/02, and on E53 and E85 from 10/02 production.

## Components

This training module covers all BMW Navigation systems from Mark I through Mark III. These navigation systems are installed on the E38, E39, E53, E46 and the E52. Some components are system specific and not used on all versions of navigation systems. These differences will be pointed out as necessary. The DVD based navigation systems will be covered in their respective training modules (i.e. E83,E85 etc.)

### On Board Monitor/Display

On vehicles equipped with navigation, the On Board Monitor (OBM) is used as a display unit. The OBM replaces the MID (or radio) and therefore provides controls for the audio systems and display functions for the On Board Computer. Depending upon the model, the OBM comes in several configurations.



The abbreviation BMBT is also used to refer to the Board Monitor. BMBT is derived from the German words “Board Monitor Bedien Tiel”, translated into English these words mean On Board Monitor Control Panel.

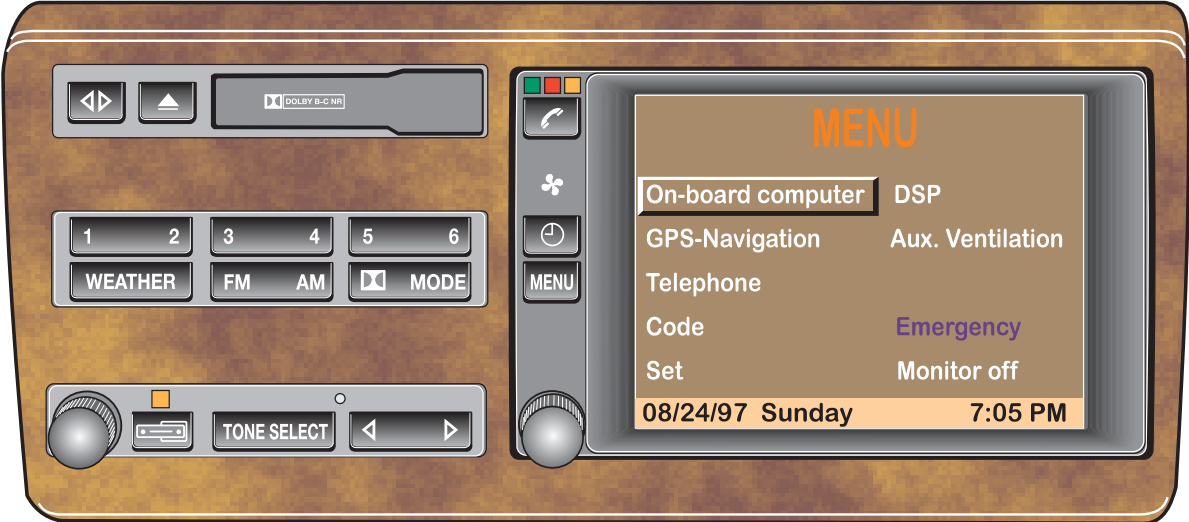
Depending upon vehicle application, the BMBT is connected to either the I or K-Bus.

Later models also used a new version of BMBT referred to as the “wide screen” On Board Monitor. The wide screen BMBT which uses a larger display screen of 6.5 inches as compared to the E46/E53 of 5 inches and the E38/E39 at 5.25 inches.

The wide screen BMBT is only used on the Mark III navigation systems. These include MK III systems installed on the E38, E39, E53 and E46. The E52 continues to use the MIR with the monochromatic screen.



**MK II On Board Monitor Display**

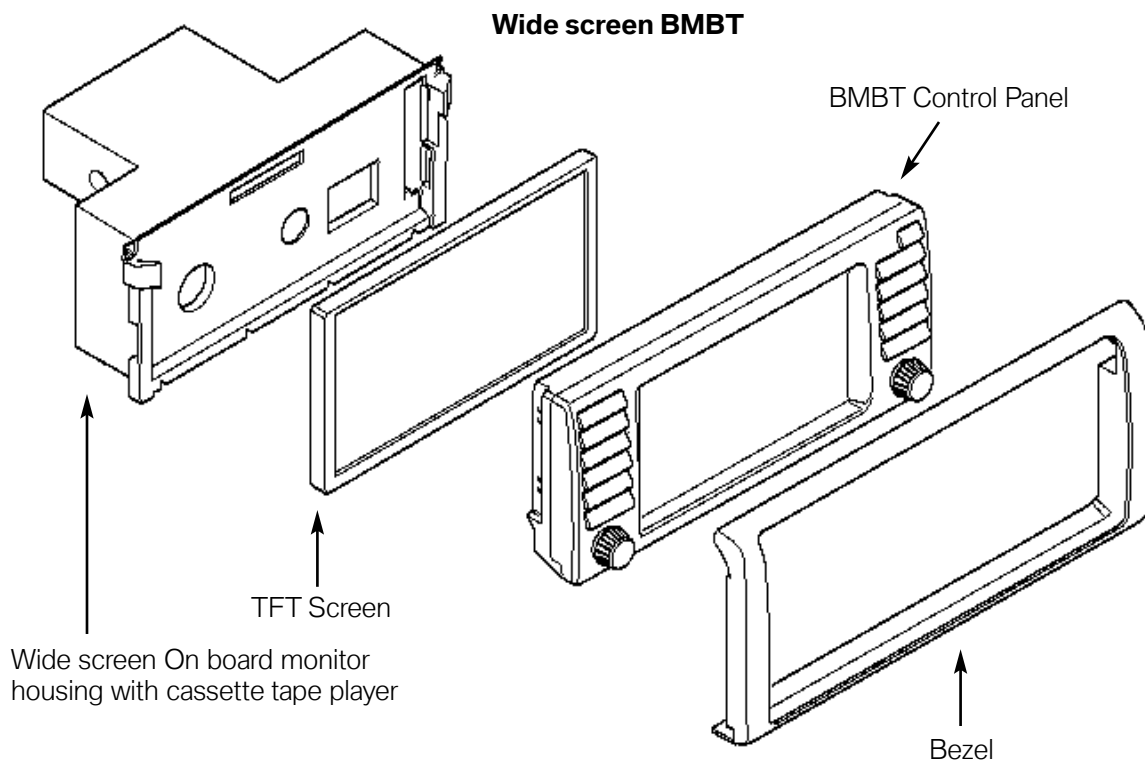
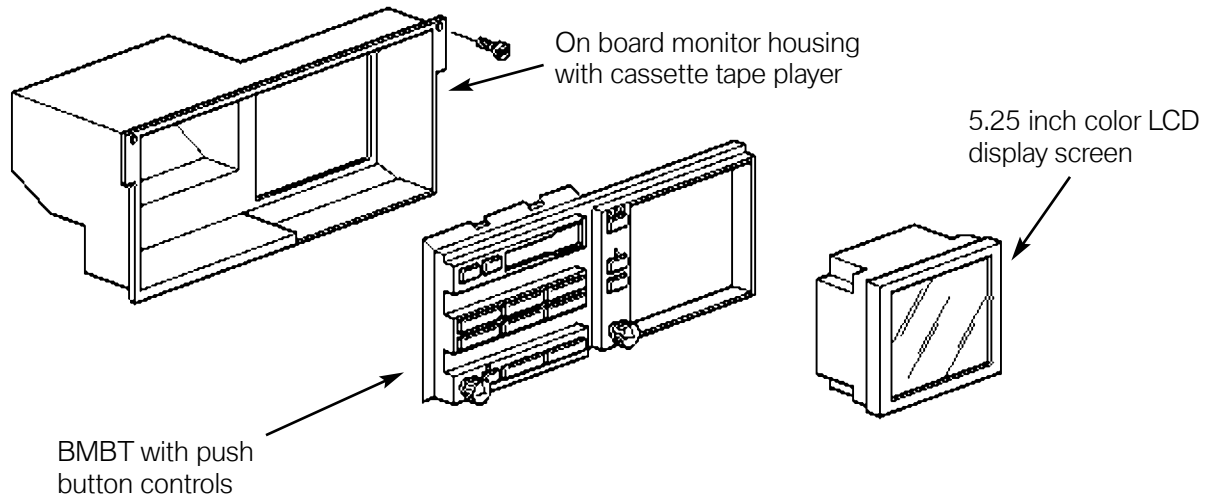


**E46 On Board Monitor Display (Mk-II)**



## On Board Monitor Assembly

The BMBT is mounted in the center console and consists of the following components:



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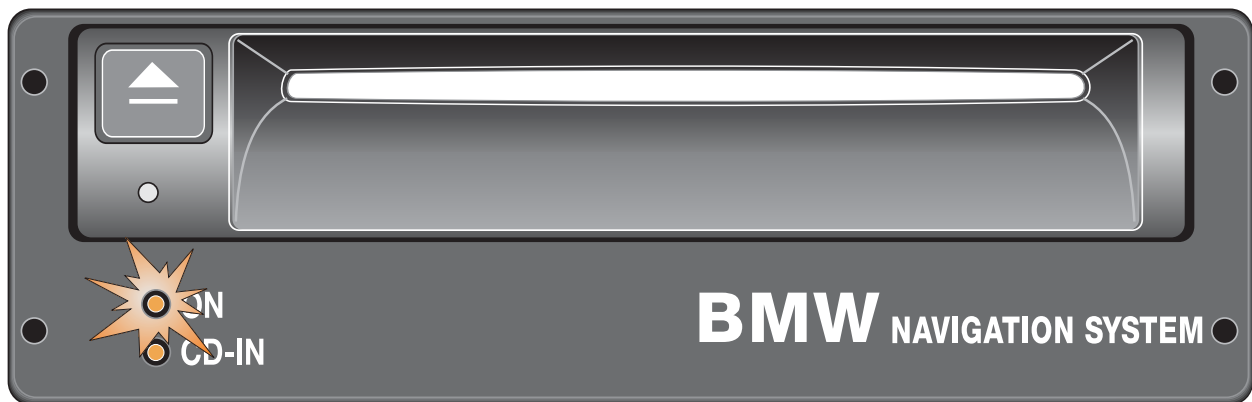
## Navigation Computer

The navigation contains a microprocessor and CD drive for navigation system operation. The computer collects data from various sensors to compute the vehicle location.

The location information is used to calculate the correct route to destination. This information is ultimately displayed on the BMBT screen.

There are several configurations of the navigation computer depending upon version. The navigation computer on most models is located on the left side of the luggage compartment (except E52 which is behind the seats).

The Mark I and Mark II navigation computer can be identified by the “On” and “CD-IN” LED’s on the front face plate.



The Mark III computer can be identified by the “Power” LED and the lack of the “CD-IN” LED.

The navigation computer contains several components important to navigation system operation. Depending upon the version, the components/systems include:

- CD Drive for Map CD and Navigation software
- Hardware for Navigation functions
- GPS Receiver
- Gyro Sensor (Mark II and III Only)
- Output for audio interface
- Output for visual display
- Cooling fan
- Magnetic Field Sensor Connector (Mark I only)

### Mark I Navigation Computer

The Mark I navigation computer uses blade type connections for inputs and outputs. There is an external 3 amp fuse and there also 2 additional connectors, 1 for the magnetic field sensor and 1 for the “ARCNET” interface.

### Mark II Navigation Computer

The Mark II computer introduced on the E38 and E39 as of 9/97 production. There are considerable changes to the system. The connectors for the ARCNET and magnetic field sensor have been deleted as well as the 3 amp external fuse. The external blade type connections have been replaced by two 26-pin ELO type connectors.

Internally, a Gyro Sensor has been added to measure the motion of the vehicle on its vertical axis. The gyro sensor is integral to the navigation computer and cannot be serviced separately.

The internal gyro sensor eliminates the need for the magnetic field sensor from Mark I.

The front faceplate of the Mark II computer appears identical to the Mark I system, however they are not interchangeable.

#### Mark I Navigation computer (rear view)

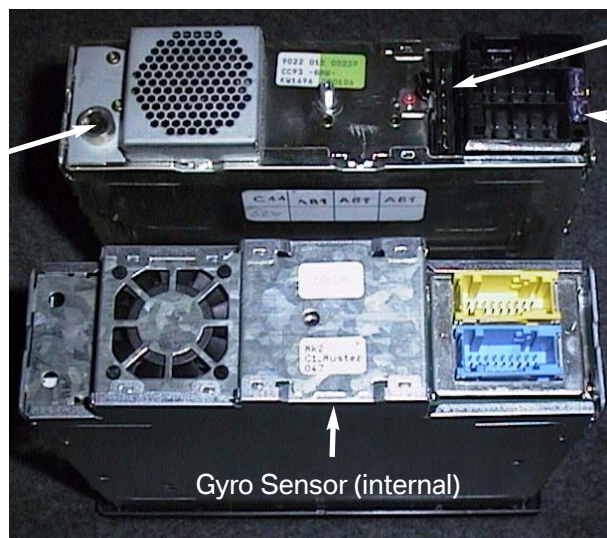
ARCNET connector

Magnetic field sensor connector

3 amp fuse

#### Mark II Navigation computer (rear view)

Gyro Sensor (internal)



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### Mark III Navigation Computer

The Mark III navigation computer retains many of the features from the Mark II system but is physically different in appearance from the Mark I and II systems. Most noticeably is the lack of the “CD-IN” LED on the front faceplate.

The GPS receiver module is now integrated into the housing of the Mk-3 computer. There is also an optimized memory capability for faster processing and improved navigation operation.

The same navigation computer is used for color systems as well as the monochrome display used on MIR navigation systems.

There are also two 18-pin ELO connectors.

**Note: The Mark III navigation computer is also used as a retrofit for previous systems.**



### Video Module (Mk-I Only)

The video module is only used on the Mk-I system. It is used to create the RGB (Red, green, blue) signals which are sent to the BMBT screen via the RGB signal lines.

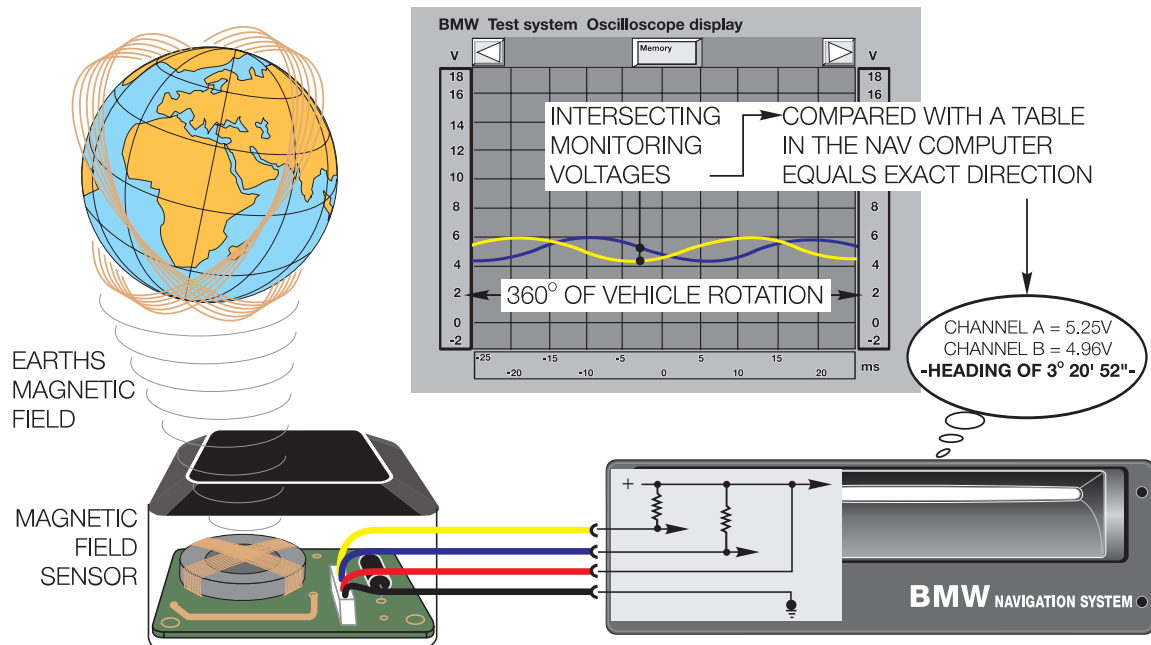
The video module also serves as a data memory for the navigation system. As needed the video module instantly provides the RGB signals to change the on-board monitor display and sends the audio signals to the audio system amplifier (or radio).

It is located below the navigation computer in the luggage compartment. The functions of the video module are integrated in the navigation computer on the Mark II and Mark III systems. Therefore, the video module is omitted on these systems.

## Magnetic Field Sensor (Mk-I only)

In addition to the current position of the vehicle, the navigation computer also needs a direction of travel input. The magnetic field sensor is used for this purpose.

The sensor consists of a ferromagnetic ring with two coils placed 90 degrees apart. Signals from the two coils become the vehicle's directional input when the navigation system is in operation.



## Sensor Operation

The sensor receives its operating power and ground from the navigation computer. When the system is switched on, magnetic fields are introduced into the coils. The coils produce a voltage signal that is input into the navigation computer.

As the vehicle turns left or right, the earth's magnetic field influences the magnetic fields in the coils causing them to increase and decrease.

The changing strength of the magnetic fields causes the voltage signal induced in the coils to increase linearly. This creates a changing voltage drop at the monitoring circuit in the navigation computer.

The navigation computer determines the direction of travel of the vehicle by plotting the simultaneously changing voltage signals.

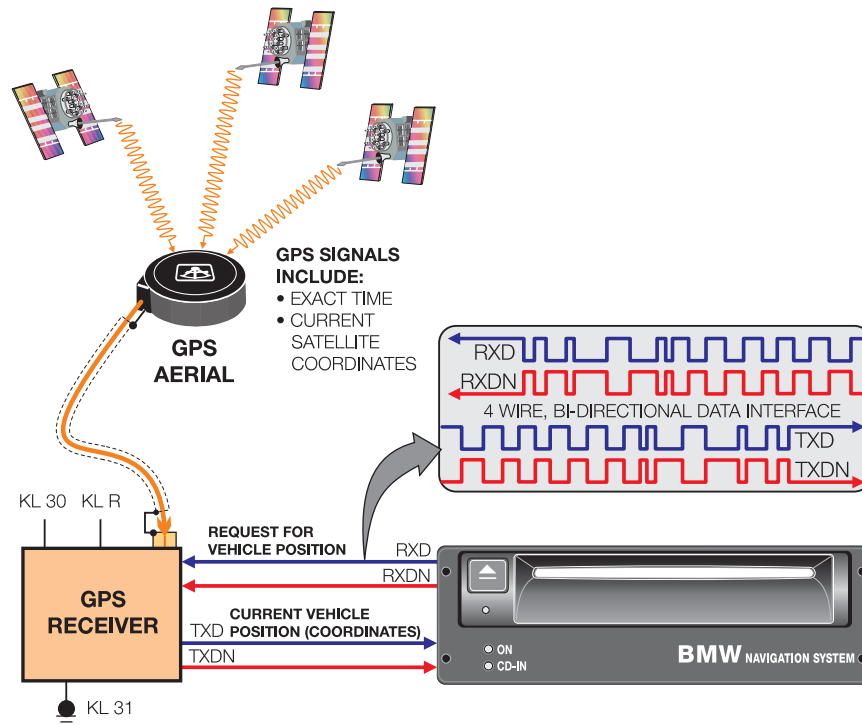
When the rear defroster is switched on, the navigation computer is informed by the IHKA via a specified bus signal path.

The magnetic field created by the rear window defroster is compensated for by the navigation computer. This compensation is derived from the calibration procedures (See workshop hints).

## GPS Antenna

The GPS antenna is used to receive input information from the satellites in orbit. The antenna receives time messages along with latitude and longitude information. This information is used by the navigation computer to calculate the exact position of the vehicle.

The antenna is an input to the GPS receiver module on Mk-I and Mk-II systems and a direct input to the navigation computer on Mk-III systems.



The antenna design differs slightly between systems. The location of the antenna also differs between vehicles as well.



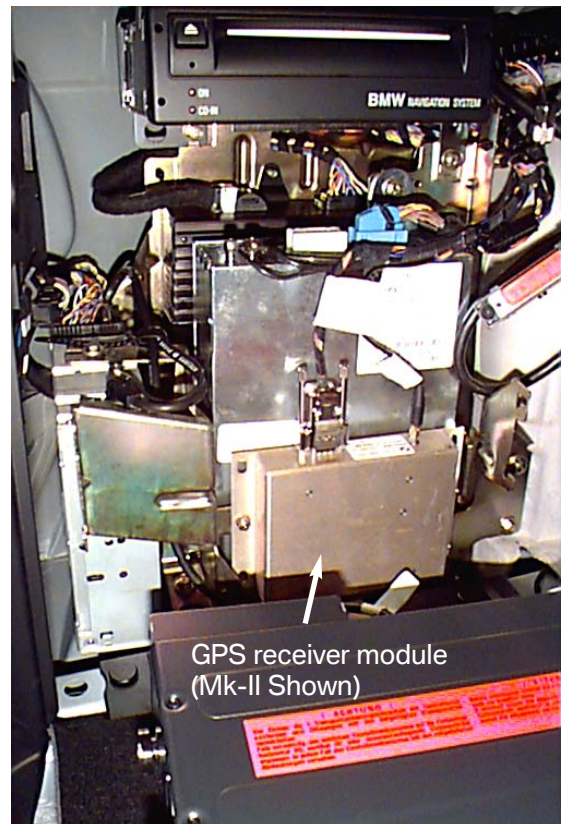
## GPS Antenna Locations

Vehicle	Antenna Locations
E38	Under rear parcel shelf
E39 Sedan	Under rear parcel shelf
E39 Sport Wagon	Behind the dashboard on the left hand side
E46 Sedan/Coupe	Under rear parcel shelf
E46 Sport Wagon	Above the rear glass under the spoiler
E46 Convertible	Behind the instrument cluster
E52	Left front corner behind the dashboard
E53	Above the rear glass under the spoiler

## GPS Receiver Module

The GPS receiver module is responsible for receiving the satellite signals from the GPS antenna and providing the position of the vehicle to the navigation computer. Information provided by the GPS receiver can be displayed in the “service mode” (refer to workshop hints).

The GPS receiver on Mark I and II system is located near the navigation computer. On Mark III systems, the GPS receiver is integrated into the Mark III navigation computer.





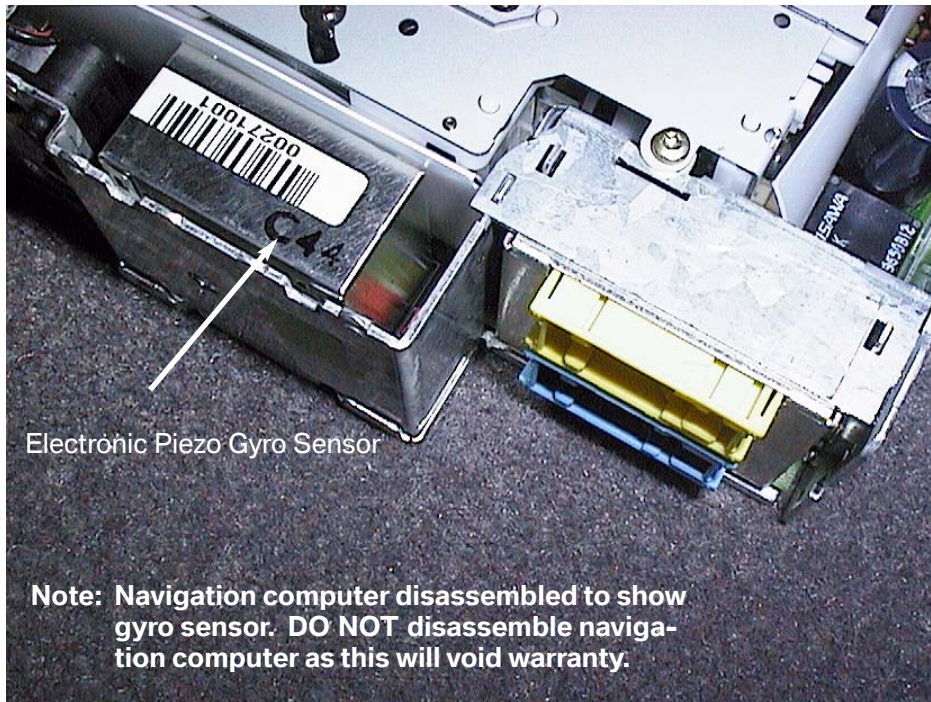
## Gyro Sensor (Mk-II and III)

The navigation computer now contains an electronic gyro sensor that detects changes in the vehicle's driven direction (changes in vehicle yaw). Similar to the Rotation Rate Sensor of the DSC III system, the gyro sensor measures the motion of the vehicle on its vertical axis.

This gyro sensor was introduced on the Mk-II systems and is an internal component of the navigation Computer. It is not serviceable nor does it require calibration.

The gyro sensor provides status of vehicle turning maneuvers in the form of a changing voltage signal that the navigation computer uses as an input signal.

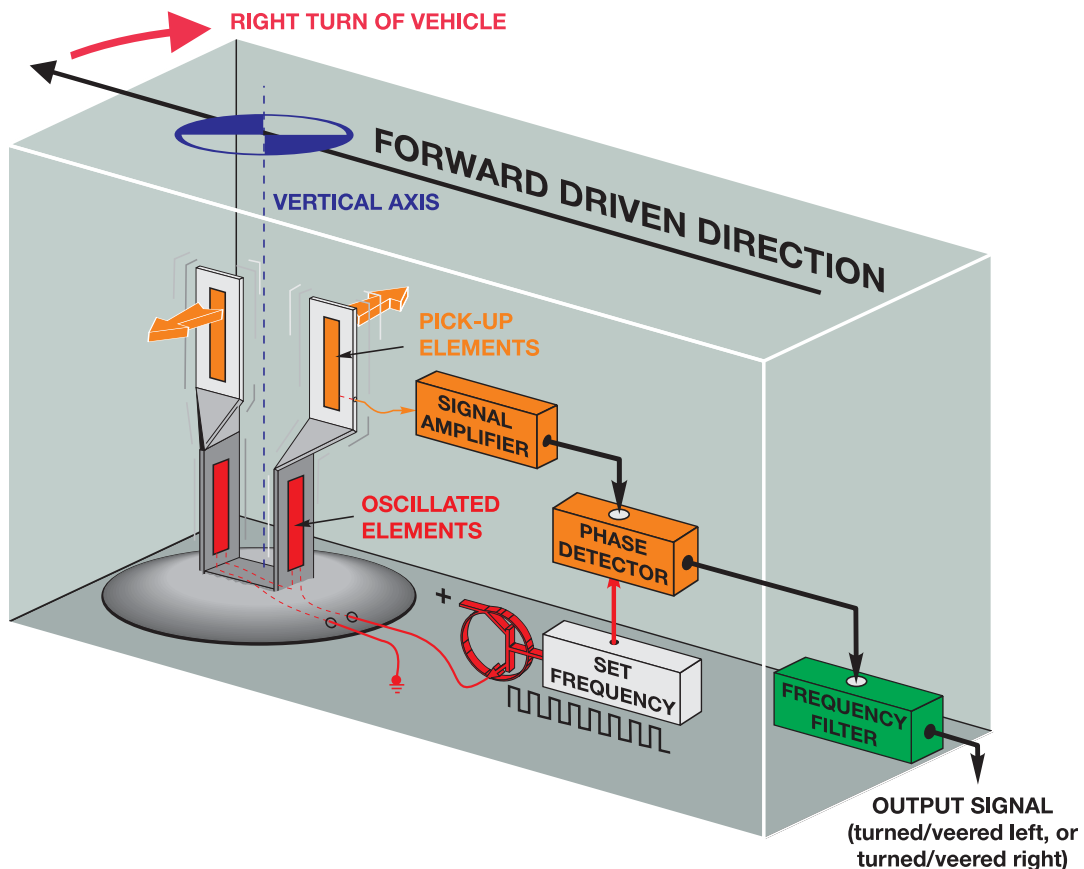
The navigation computer requires the gyro sensor's input signal along with the digitized map CD, the vehicle speed signal, and the GPS signals together to calculate, continually update and display the exact vehicle position on the LCD.



The gyro sensor eliminates the need for the magnetic field sensor uses on the Mk-I system, therefore the magnetic field sensor is not used on Mk-II and Mk-III systems.

## Gyro Sensor Operation

- The internal control electronics of the sensor maintain a constant set frequency which is applied to the oscillation elements causing a calculated vibration to occur. The frequency is also simultaneously monitored by the phase detector.
- The vibration passes up to the pick-up elements of the tuning fork causing them to vibrate and be suspended in a free floating state, easily influenced by rotational movement.
- When the vehicle turns, the free-floating upper ends of the tuning fork flex. This generates a millivoltage signal proportional to the turn.
- The signal amplifier receives the signal and passes it on to the phase detector which compares it to the original set frequency.
- The phase detector determines what direction the vehicle has turned and passes the result on to the frequency filter.
- Since the piezo gyro sensor is also picking up other vibrational movements in the vehicle, the frequency filter isolates the pertinent yaw signals and provides a DC voltage signal proportional to the left/right turning movement of the vehicle.



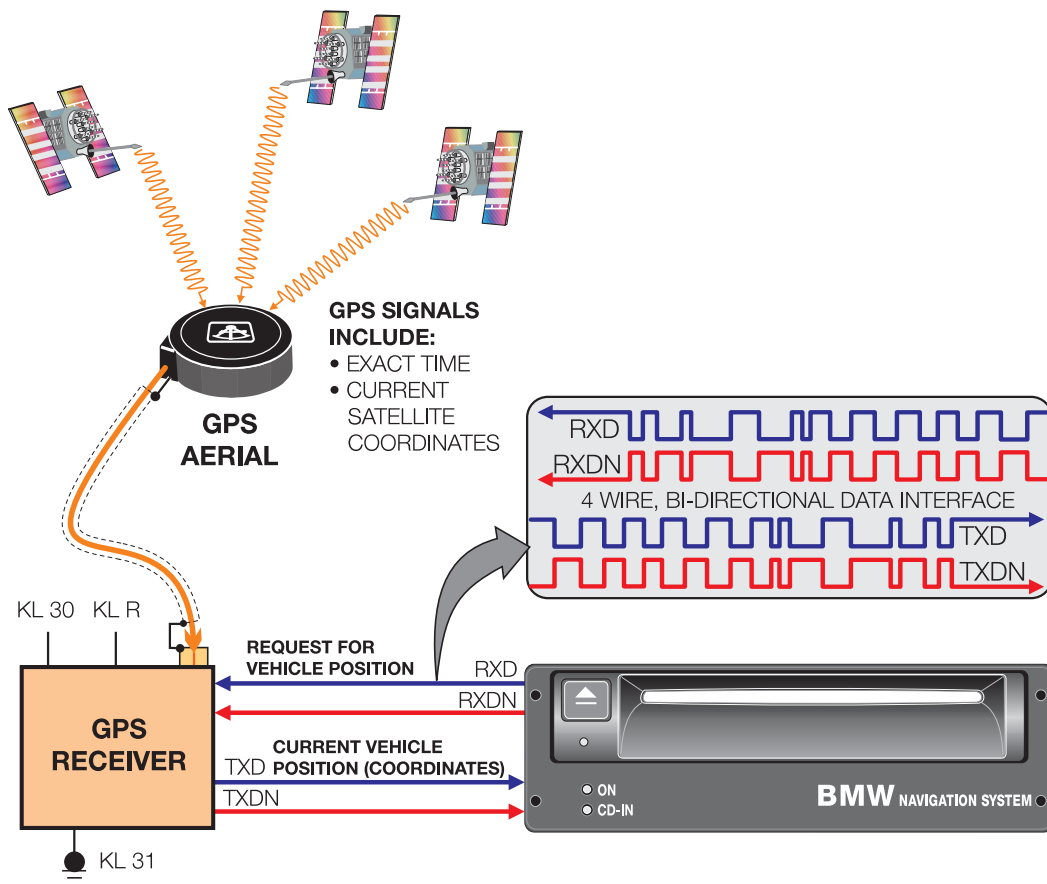
## Navigation System Interfaces

### GPS Input Signal

On vehicle equipped with a GPS receiver, (Mk-I and II) the information from the receiver is transferred to and from the Navigation computer via a 4 wire bi-directional interface. The navigation computer will send a “request” to the GPS receiver for the current vehicle position. This request is sent over a two wire link. The two wires are referred to as RXD and RXDN.

The navigation computer receives the current vehicle position over another 2 wire link referred to as TXD and TXDN. Each two wire link is similar to the CAN line but is unidirectional. When a “data burst” is transmitted, it is mirrored on the other wire as a self-check of data transmission.

Do not confuse these signals with the diagnosis bus (TXD/RXD), they are only related in name, not in function.



## Wheel Speed Sensor Input

Wheel speed sensor input is used to determine distance traveled, vehicle speed as well as direction.

Mark I navigation systems monitored both the left and right front wheel speed sensors. The left and right signals are used to determine direction in turns by comparing the speed difference between the signals. This was due to the fact the the Mark I system did NOT use a gyro sensor.

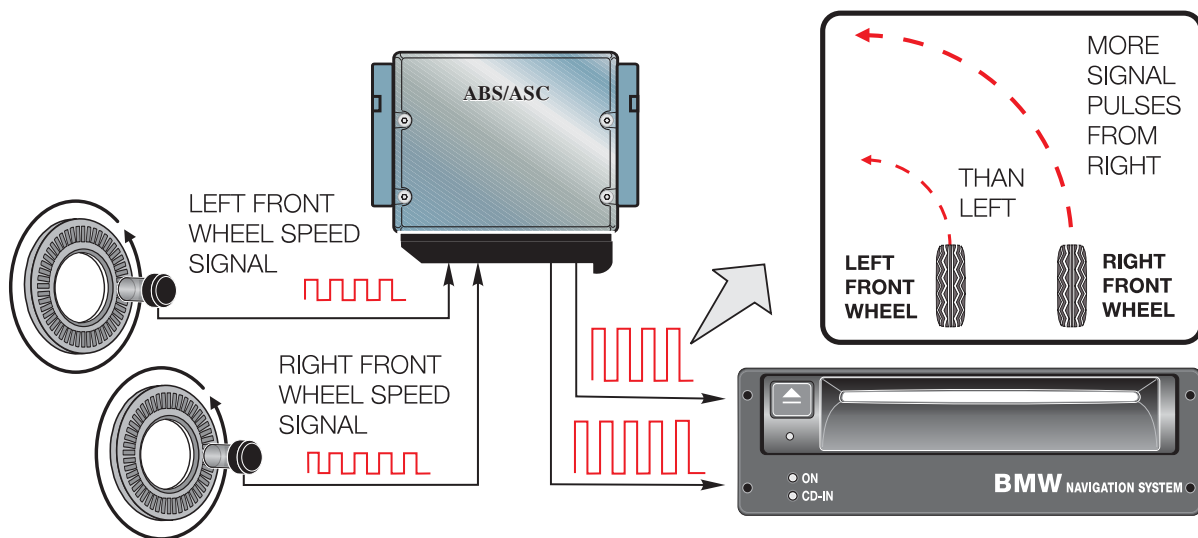
Mark II and III systems only use one wheel speed signal. The wheel speed signal for the E46 comes from the left rear wheel. On all other vehicles, the left front wheel speed sensor is used.

Wheel speed is needed by the navigation to determine distance traveled especially when the overhead view is obstructed to the satellites (i.e tunnels, trees etc.). This allows the navigation computer to have an uninterrupted measurement of distance.

**Note: The installation of aftermarket wheels of improper size can greatly affect the accuracy of the navigation system. When investigating complaints of navigation inaccuracy, always be sure to check for proper tire size.**

### Wheel speed sensor signals

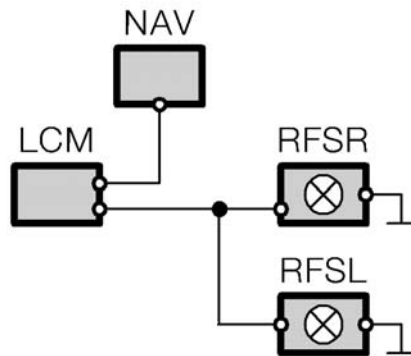
(Example of Mark I)



## Reverse Gear Signal

The navigation computer receives a reverse gear signal to determine direction of travel. Wheel speed signals are not directional, therefore an indication of the direction of travel is needed.

On all vehicles except the E46, the reverse gear signal comes from the LCM. The E46 reverse gear input signal comes from a splice connection to the reverse lights.



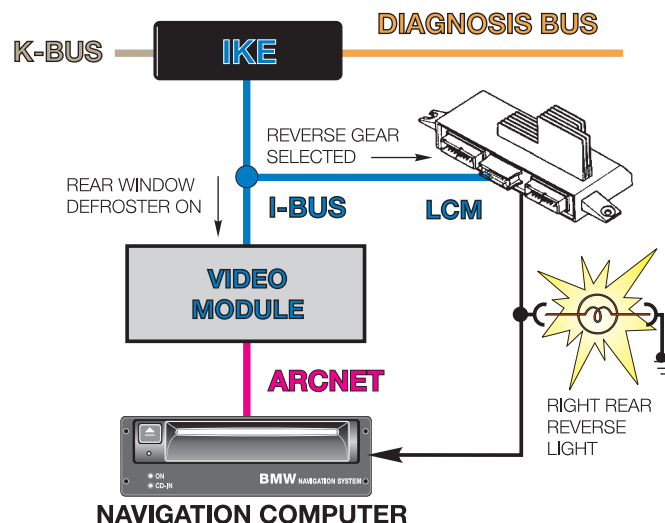
## Rear Window “Defroster ON” Signal (Mark I Only)

On Mark I navigation systems, the magnetic field sensor (compass) can be falsely influenced by magnetic fields which are not from the earth’s natural magnetic field. The magnetic field sensor is installed under the rear parcel shelf, which is in close proximity to the rear window defroster. This creates the need for a signal compensation when the rear defroster is switched on.

The compensation is derived from the dealership calibration procedures (see workshop hints).

When the rear defroster is ON, the navigation computer receives the ON signal via the bus network. As the illustration shows, the signal is sent via the following pathway:

*IHKA module > K-Bus > IKE > I-Bus > Video Module > ARCNET > Navigation*

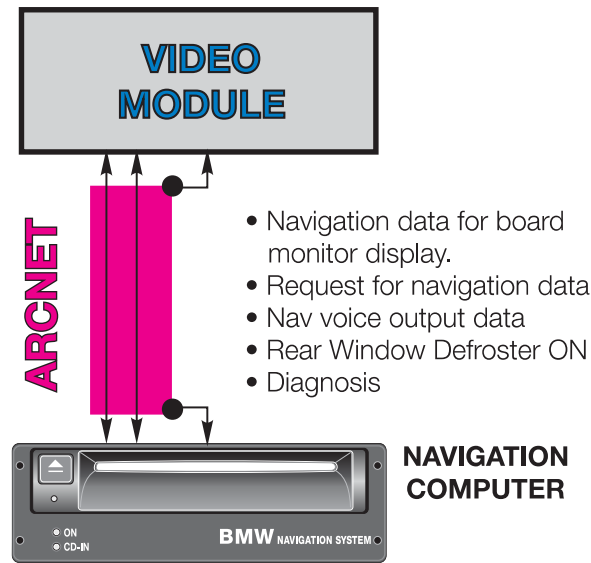


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## ARCNET (Mark I Only)

The Attached Resources Computing Network is a high speed (2Mb/sec) digital data link. ARCNET connects the Video module to the navigation computer.

ARCNET is made up of two data wires and a shield similar to the early CAN-Bus network. The shielded ARCNET cable has its own tri-axial type connector ends that are pushed onto their mating connectors on the modules.



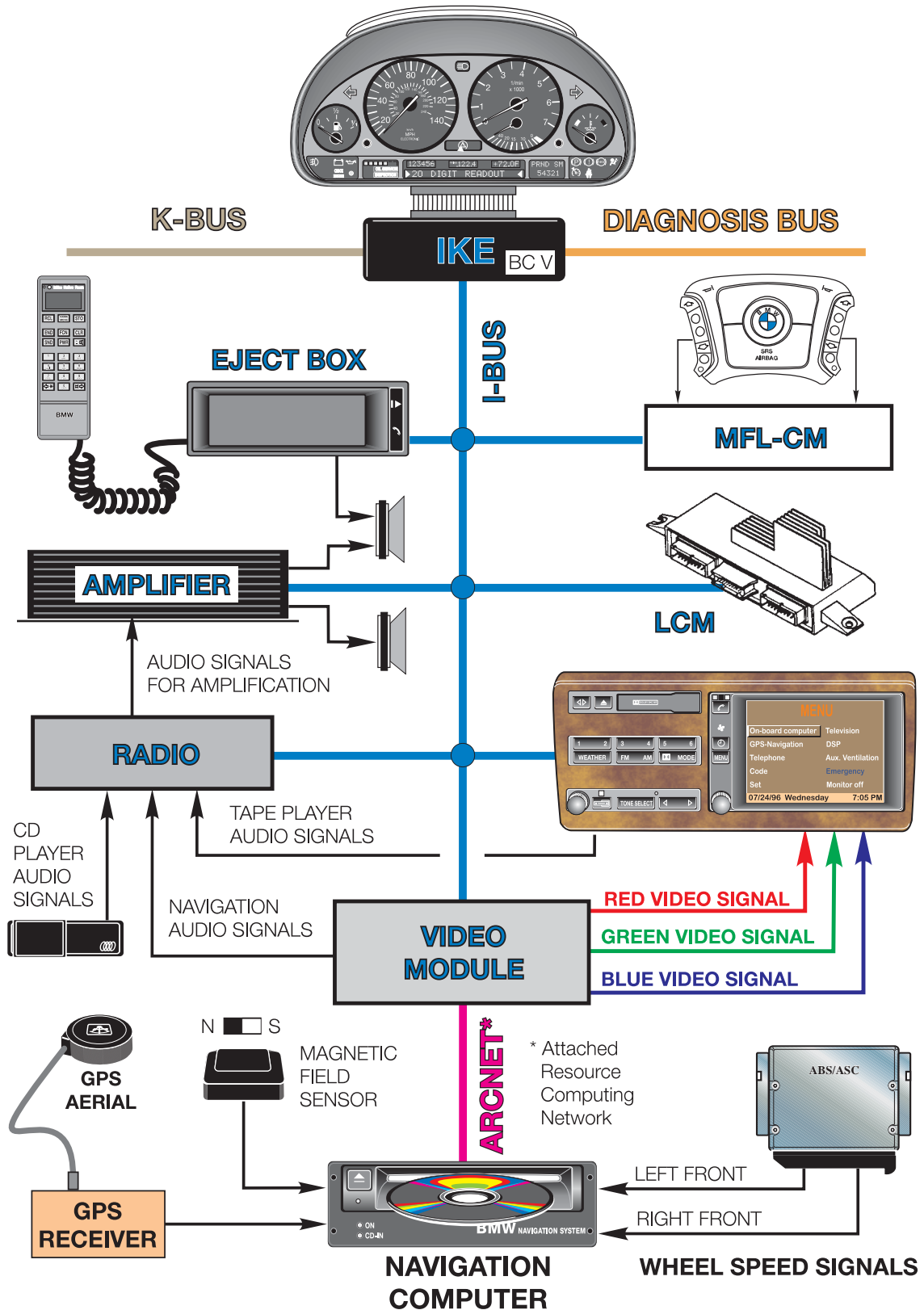
## RGB

The RGB interface connects the navigation computer to the LCD screen in the BMBT. RGB stands for Red, Green, Blue and provides the video signals for monitor operation. They are low voltage video signals. RGB is used on all versions of navigation.

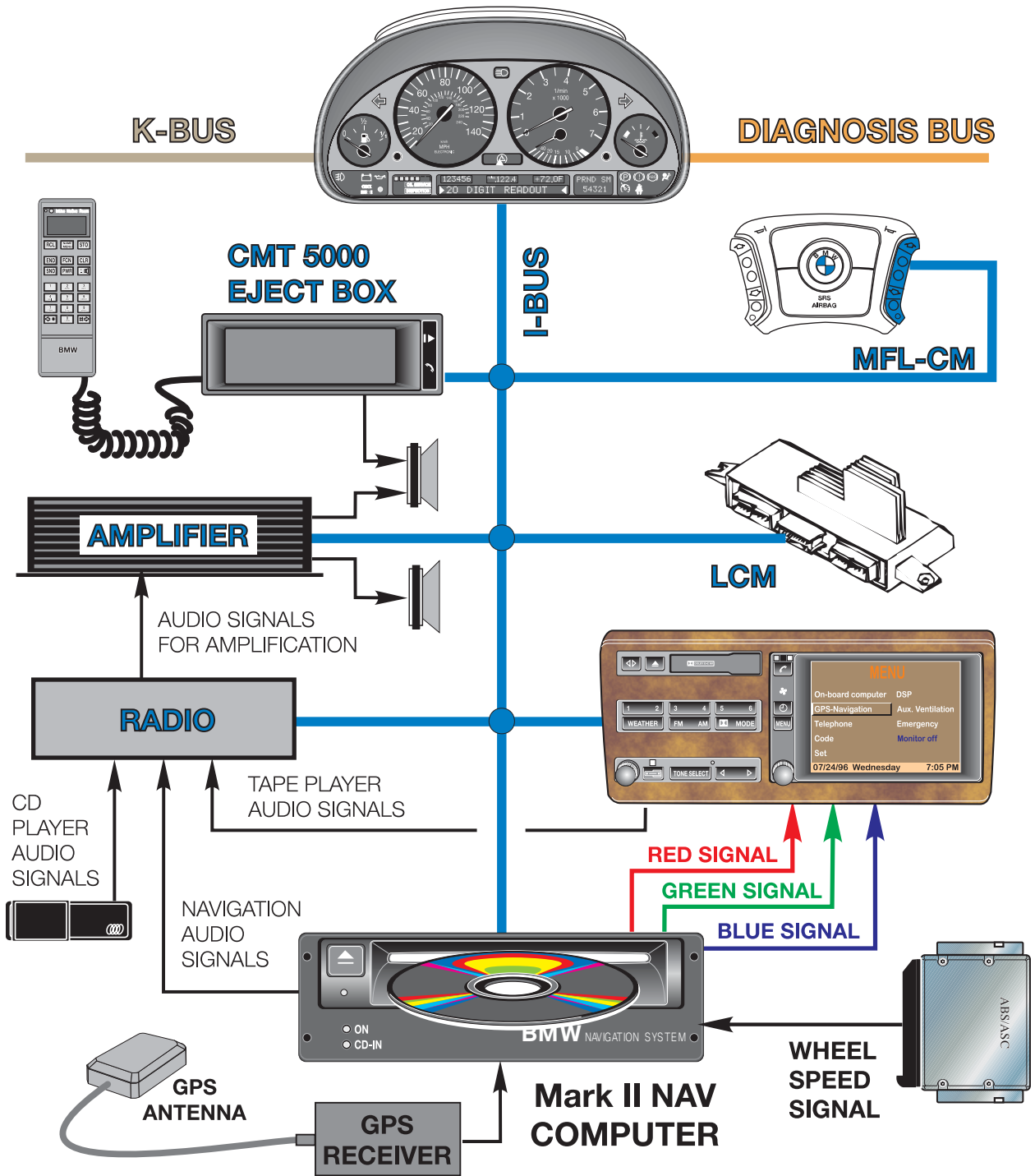
## Bus Network

In order to provide all of the necessary signals for navigation operation, the navigation computer is connected to the bus network. Depending upon vehicle application, the navigation computer can be connected to either the I-Bus or K-bus.

# Mark I Navigation Bus Network Overview

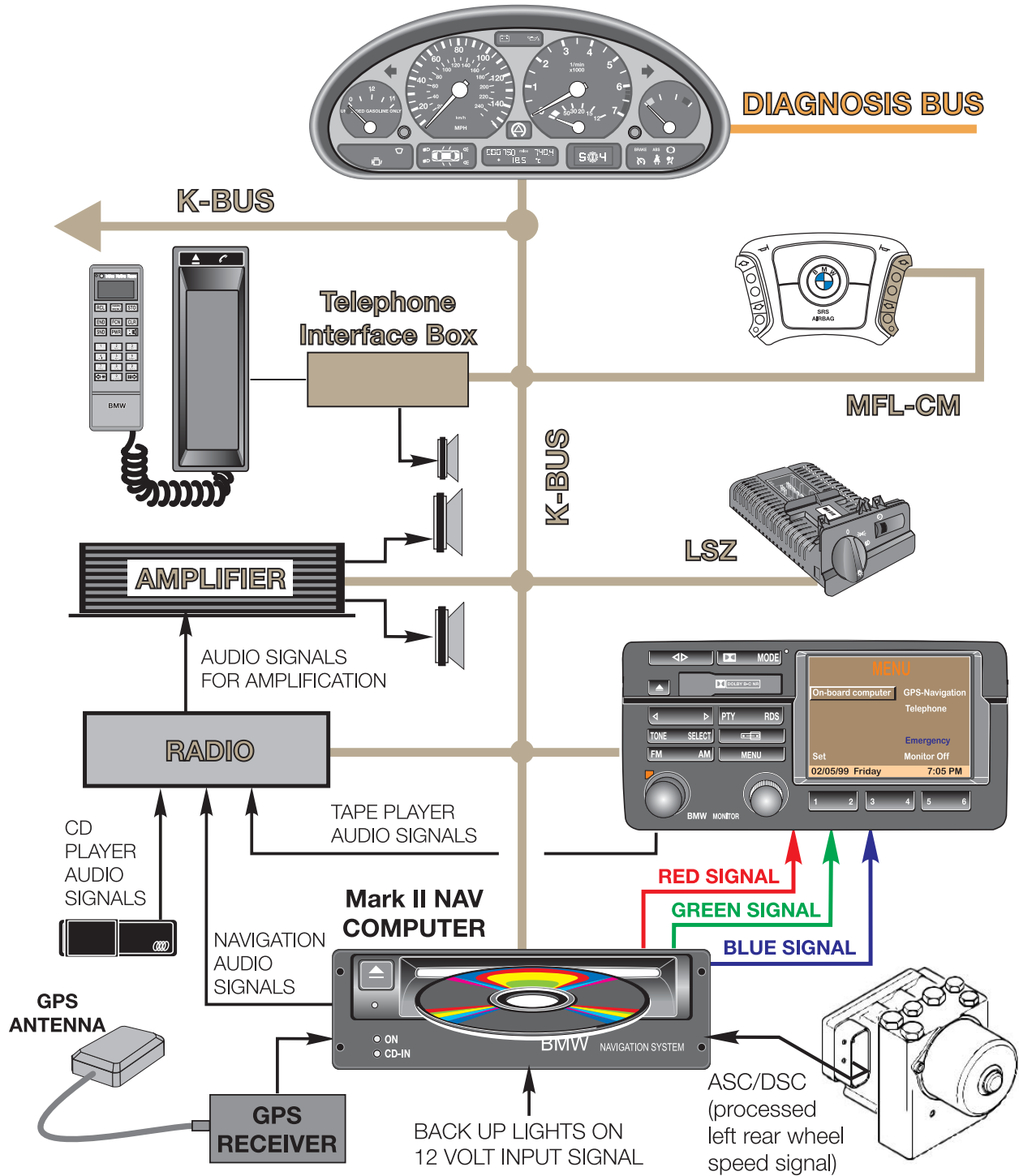


# Mark II Navigation Bus Network Overview





# Mark II (E46) Navigation Bus Network Overview



## Navigation System Operation

The following instructions are for basic navigation system operation. There have been numerous changes to navigation systems since introduction. Always refer to the latest owners manual and service bulletins when applicable.

The following example uses the rotary knob to input a destination from the input destination screen. Enter the navigation system by pressing the GPS-Navigation button from the main menu.

After acknowledging the system warning, any previously entered destination is displayed. This destination must be deleted or overwritten in order to input a new destination.

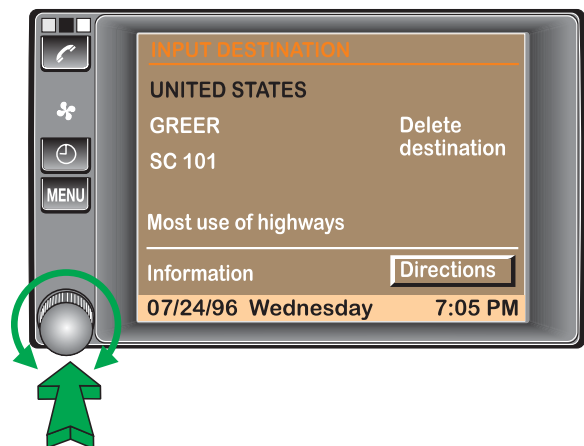
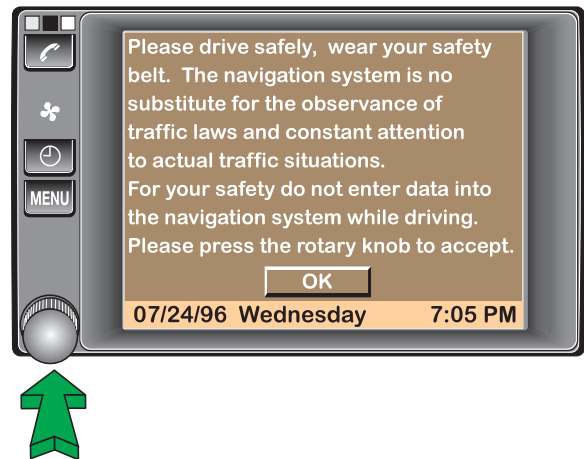
The rotary knob is used to enter a city/town from an Alpha-Numeric menu or the destination can be selected from the index of listed locations that are mapped on the CD.

Next the desired street is entered in the same fashion. The street number can also be entered at this time. If the street number is on the database CD, the navigation system will guide the driver directly to the house number.

There are two choices for route preference available from this screen:

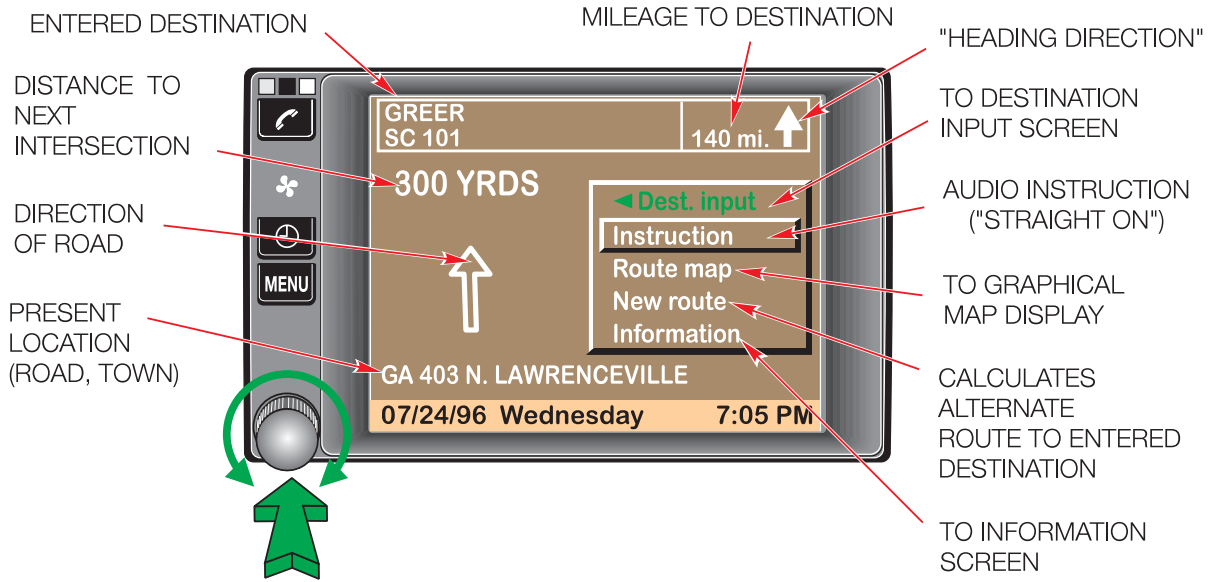
- “most use of highways”
- “least use of highways”

With either selection, the system will pick the most direct route to the destination, based on the selection. Once the location has been entered, the navigation system is ready for guidance. Press the directions button.

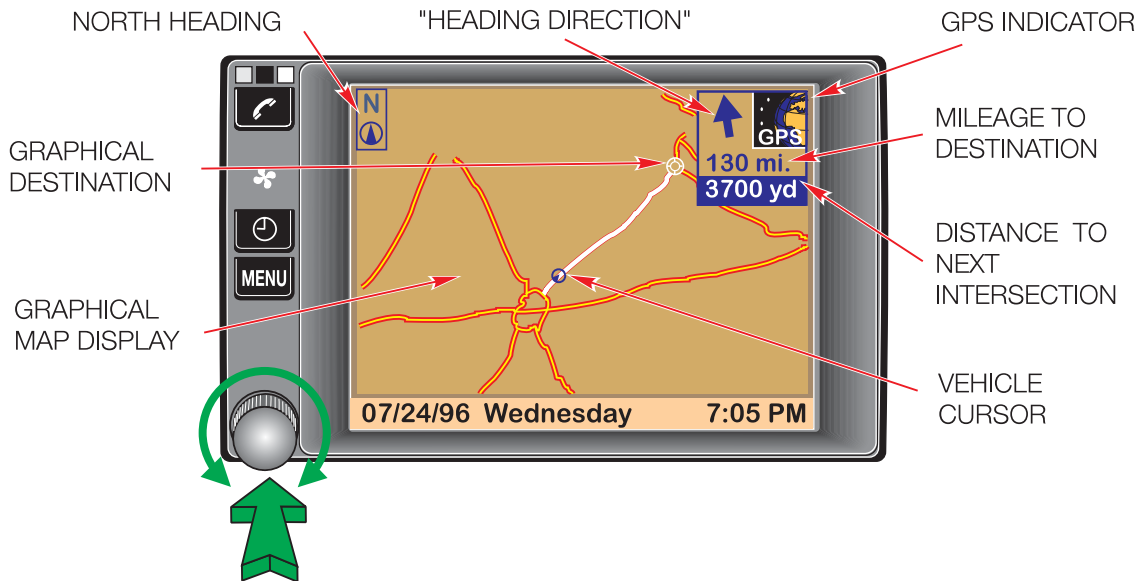


The system will guide the driver via:

- The graphical direction display - which consist of arrows and text that show the current location, the destination and direction of travel. When turns or intersections approach, a voice command will inform the driver when to turn.



- The graphical map display - which consists of a digital road map showing the entered route, destination and vehicle position.



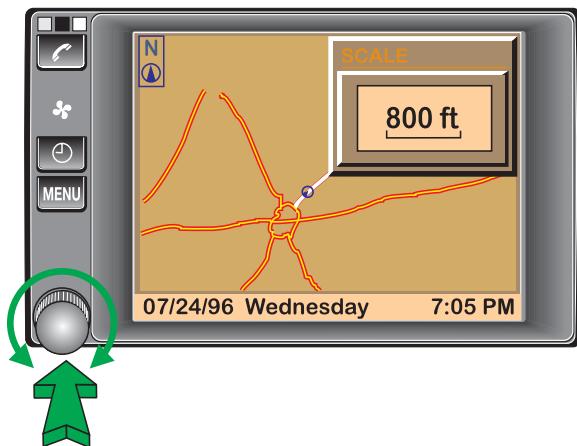
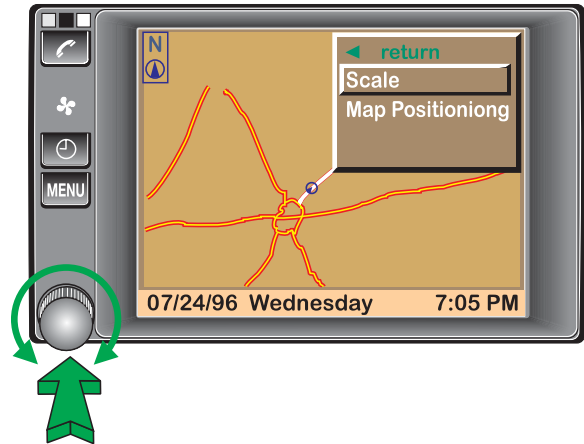
In either display mode a voice command will inform the driver when to turn when turns or intersections approach.

The navigation screen display can be turned OFF (from main menu) and the system will remain in operation. The voice command will continue to inform the driver when to turn.

## Graphical Map Scale

The graphical map display can be scaled up or down from 400 feet to 50 miles depending on the distance to the destination.

This function is activated by turning the knob one click, and a sub menu will display on screen. Choose "Scale" and adjust as it is needed.

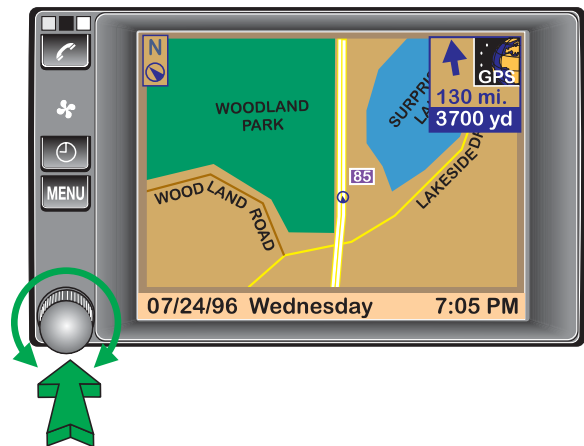


## Graphical Map Positioning

The graphical map can be displayed "North Pointing" or "Direction of travel". This function is also accessed by turning the knob one "click" as described above.



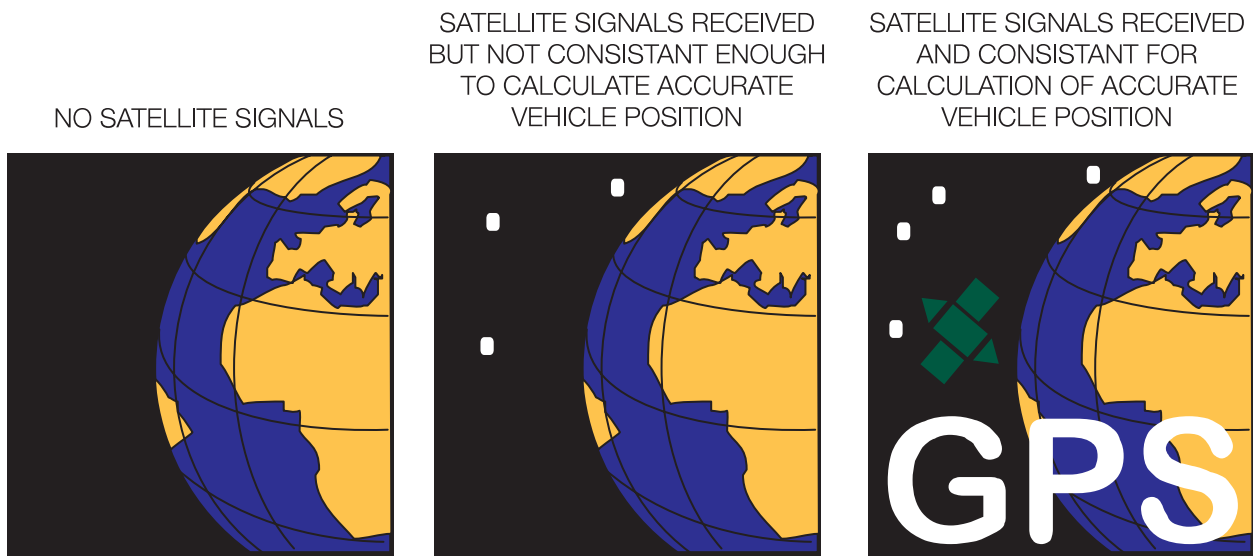
**North Pointing**  
Top of map is always facing north



**Direction of Travel**  
Top of map is always facing direction of vehicle travel

## GPS Indication

Satellite reception, by the navigation system, is indicated in the upper right corner of the display screen. The number of satellite signals being received by the system is indicated by small white dots in the display that surround the picture of the globe. In addition, the GPS logo is displayed at the bottom of the graphic.



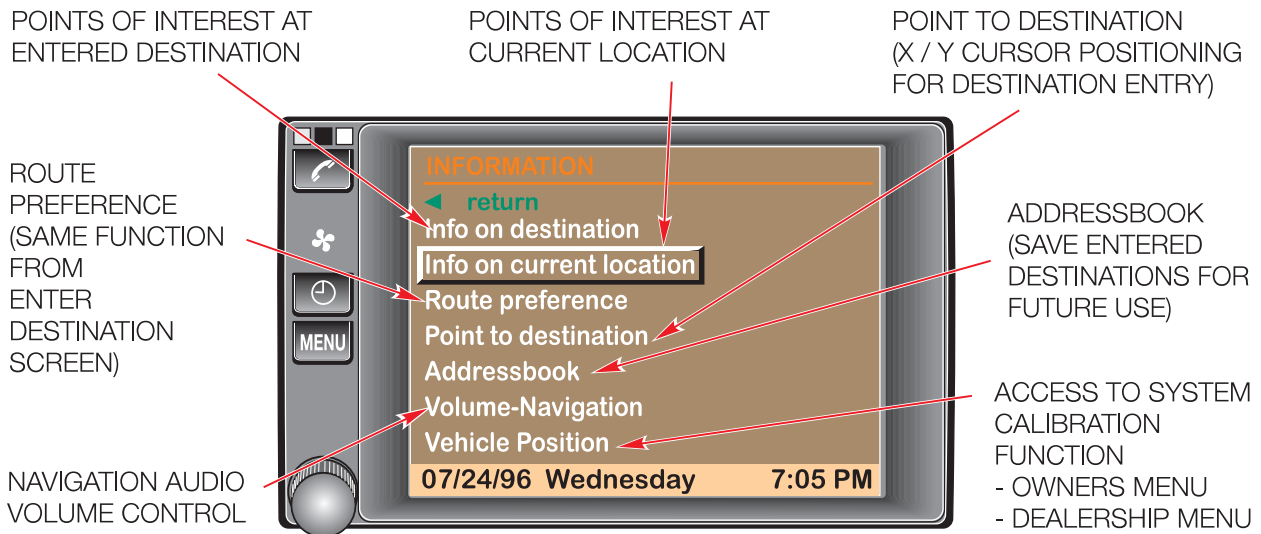
The number of dots indicate the number of satellite signals that the navigation computer is receiving.

If only the globe graphic is displayed, without the dots or logo, the vehicle is in a poor reception area or the signals are being blocked by some obstruction. The dead reckoning function of the compass and wheel sensors provide adequate navigation in this situation.

If the dots and logo fail to display in a known good reception area, than a fault is indicated and troubleshooting should be carried out according to the fault symptom "GPS Problems".

## Navigation System Information Screen

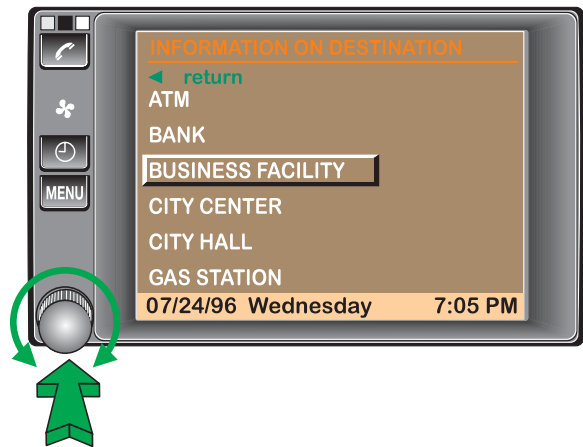
The Information screen provides access to the balance of the navigation system features including:



Information on destination or current location provides a detailed list of stored points of interest such as:

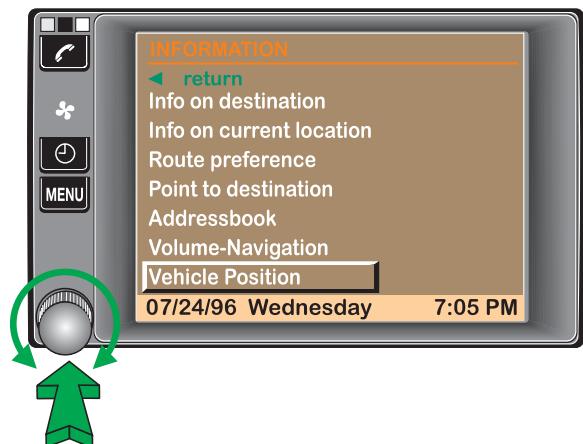
- Gas stations
- Banks
- Restaurants
- Hotels, etc.,

This feature allows the user to enter the point of interest and change the route to guide the driver to the entered point.



## Vehicle Position

The vehicle position selection from this screen provides access to the Calibration function of the navigation system.



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## Workshop Hints

### Mark I Navigation System Calibration

The Mark I navigation system will require “calibration” at some point in its service life. The reasons that cause the necessity of a calibration procedure are as varied as inaccurate navigation display data, after the installation of a new set of tires, to the replacement of a shattered rear window.

Calibration procedures are divided into two categories:

- Vehicle Owner Calibration - Calibration that the vehicle owner can perform.
- Dealership Calibration - Procedures only an authorized dealer can perform.

This section is divided into these two categories. Always consider what the owner of the vehicle could have inadvertently changed when troubleshooting and/or calibrating the vehicle.

Check these data inputs before you embark on a full dealership calibration procedure.

### Vehicle Owner Calibration

The vehicle owner’s manual contains the information on how to set the vehicle position and adjust the tire calibration. Both of these adjustments are found on the vehicle position screen which is accessed from the information screen.

“The Owner Calibration Procedures shown are for information purposes only. A full Dealership Calibration is the recommended method for accurate system calibration.”

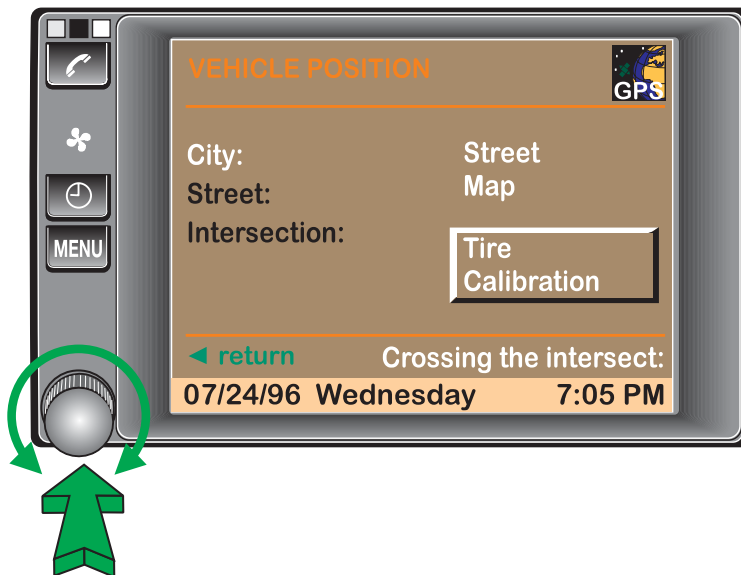
#### 1. Resetting Vehicle Position

A mis-located vehicle is caused by driving in and out of the digitized map areas or starting a vehicle after it has traveled on a flat bed or train. The system will eventually relocate itself automatically through GPS but it can be entered through the on-board monitor for immediate resetting.

From the Vehicle Position Screen, rotate the knob to “city:” and push the knob. Enter the city and street information as you would enter a destination. Press the “Intersection” button and select the closest intersecting street from the displayed index.

Drive to the entered intersection and press the “Crossing the intersect” button when you cross.

Drive the vehicle to see if it is positioned correctly.

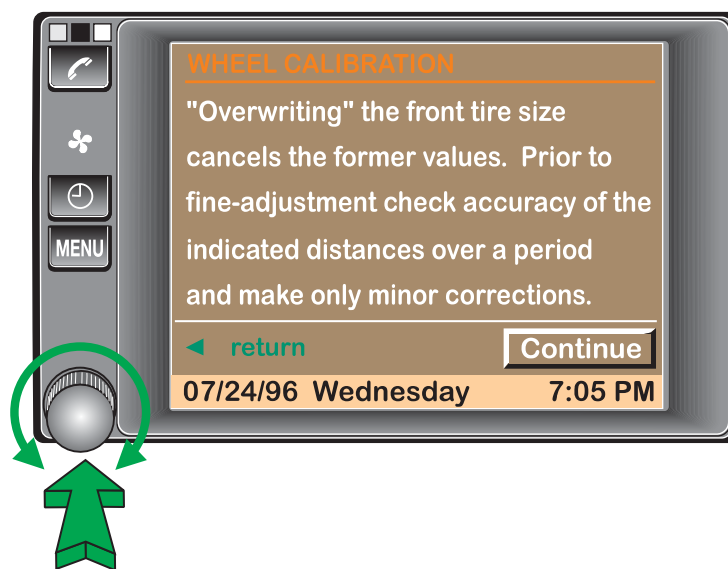


## 2. Adjusting Tire Size

Tire calibration is a required input for the navigation computer to base, tire rotation: distance covered ratio. It should be checked to determine that the entered tire size is the same as the tires equipped on the vehicle.

Additionally, if the vehicle does not have factory equipped tires installed, the tire calibration will need to be changed to match the new tire size.

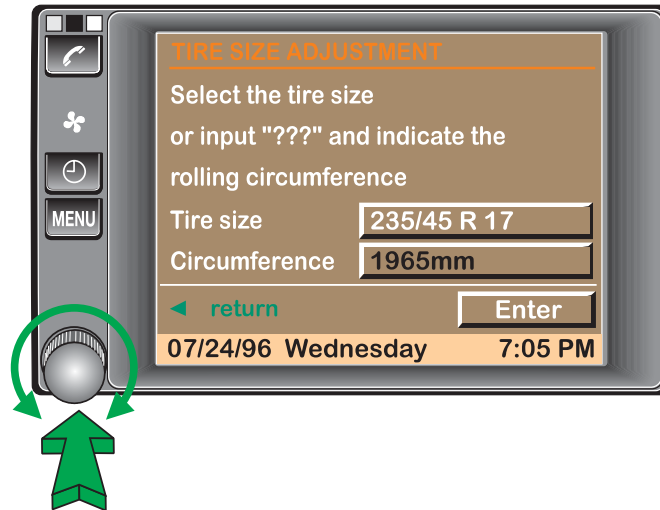
Press the "Tire Calibration" button from the vehicle position screen. The following message is displayed noting the overwrite of existing values once the procedure is completed.





Press continue to access the tire adjustment screen.

Press the tire size and rotate the knob to see if the tire size is listed. Select the correct tire size and press the button once again. Note that the tire circumference size automatically changes to the set tire size.

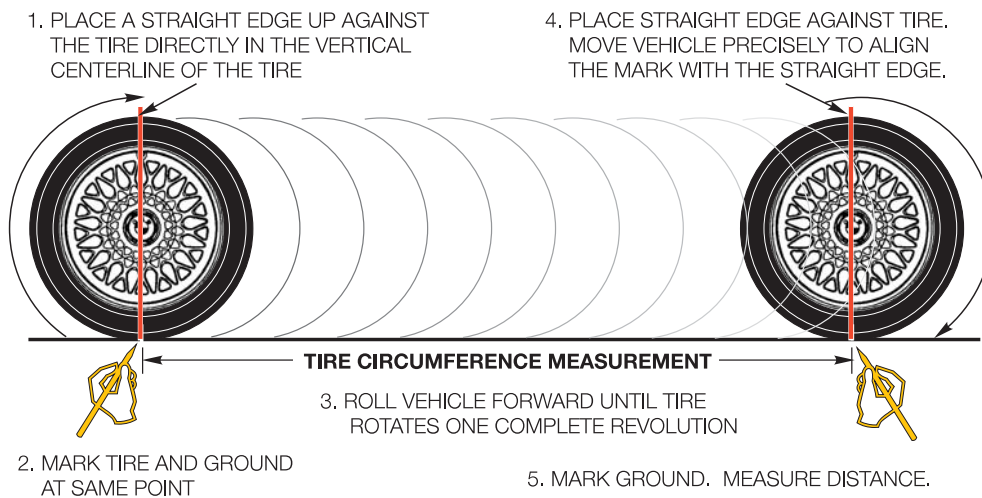


If the tire size is not listed the tire circumference value must be entered manually by rotating the tire size button to the “???” position. Press and adjust the actual tire size dimension in millimeters.

This value is available from the tire manufacture or it can be measured as illustrated on the next page.

Once the correct tire size or circumference has been entered, press the return button to return to the information screen or press the continue button to go on to the Precision Adjustment screen.

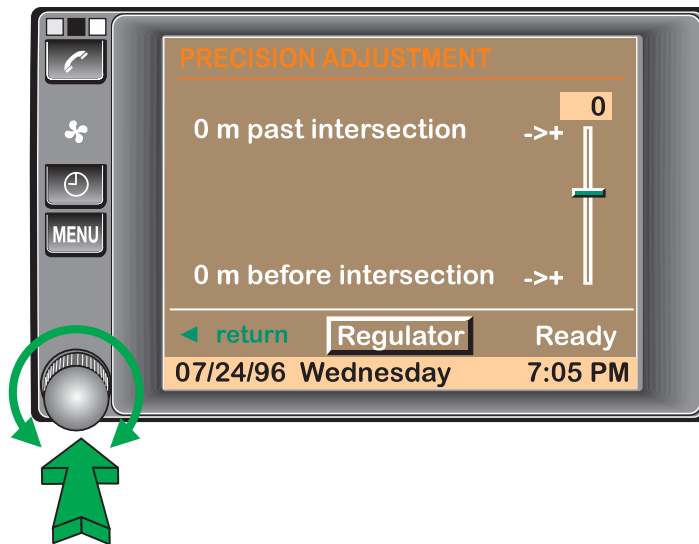
## Tire Circumference Measurement



## Precision Adjustment

This screen activates a “Regulator” function that “fine tunes” the tire adjustment with regard to the displayed distance to an intersection measurement.

If the displayed measurement is consistently “0” before the intersection is reached slide the regulator bar towards the “-” end of the scale.



If the displayed measurement is consistently “0” after the vehicle has passed the intersection, slide the regulator bar towards the “+” end of the scale. When finished press the Ready button.

It will require a little “trial and error” to achieve precision adjustment.

Keep in mind that distance displays that are 30’ to 60’ out of intersection, in either direction, are within the design tolerances of the system and are acceptable. Don’t expect major results from using the regulator function.

If there is an unacceptable displayed distance (more than 150’), the most effective method to calibrate the system is to keep the regulator adjustment at “0” and perform a full dealership calibration procedure.

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## Dealership Calibration

Calibration of the navigation system must be checked or performed when various components of the system are changed or when the troubleshooting procedures of the diagnostic module call for it.

The calibration procedures are stored in the Navigation computer module and are called up for display on the LCD screen.

Complete or partial calibration is required when the following components are changed:

- Navigation Computer Module - Complete calibration automatically required.
- Magnetic Field Sensor or rear window (defroster replacement) - Sensor Check and Compass Calibration
- Tires/Wheels - Setting of tire size in tire calibration screen (from Owner Calibration Section) and wheel sensor calibration.

Additionally, if the vehicle has had body work (new sheet metal or welding work) a sensor check and Compass calibration should be performed.

The following preconditions must exist before a successful calibration can be carried out:

- No faults stored in the Navigation system.
- The correct tire size set in the tire calibration screen. Tires inflated to correct pressures.
- Known location of a large flat parking lot with enough width to allow the vehicle to be driven in tight circles to the left and right and a “back street” (no traffic) with a minimum 100 meter (approximately 330 ft) straight path.
- There should be no overhead power lines/transformers in the immediate vicinity of the parking lot to create any magnetic interference with the magnetic field sensor.
- All electrical consumers should be switched off - Rear window heating, Radio, seat heating, air conditioning, etc.

## Tools Needed for Dealership Calibration

The following tools are needed:

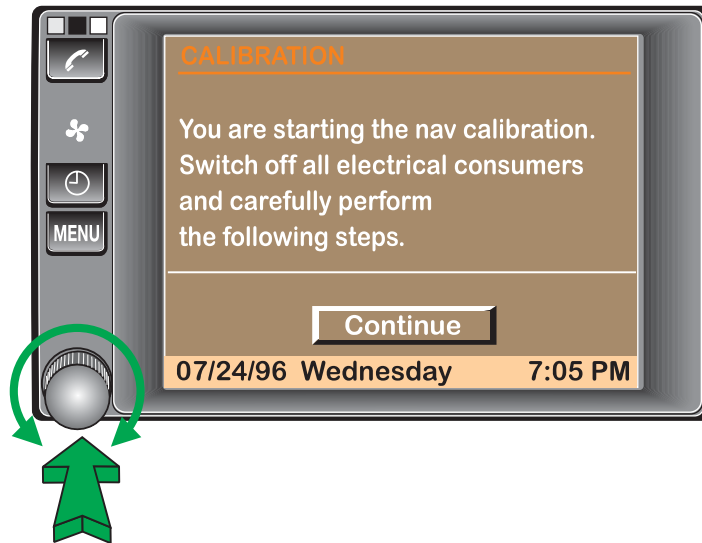
- Metric tape measure (minimum 8 meters).
- Piece of white chalk.
- 2” X 2” angle iron (6’ long).

---

## Calibration Procedures

The navigation system calibration screen menu is called up from the information menu screen.

Select “Vehicle Position” from the information screen, then press and hold the menu button for a few seconds. The system will enter the calibration mode.



Press “Continue” to proceed with the desired system calibration.

The first Dealer calibration screen provides five selections. A full dealer calibration procedure consists of carrying out all five selections.

Though they can be done individually with positive results, it is recommended to complete all five steps to achieve consistent positive results.

Start at “Setting Car Parameters” and end with “Finish Calibration”.

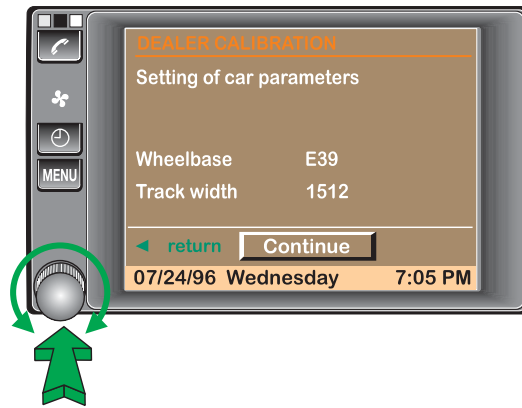
**Note: If a new navigation computer is being calibrated for the first time, the individual buttons will not be selectable. The system will automatically go into a “fixed sequence calibration” requiring all steps be performed.**

## 1. Setting of Car Parameters

There are two settings in the parameters screen:

- The vehicles wheel base which will be an E38 long/short wheel base or an E39.
- The vehicle's track which is as follows for the different vehicles:
  - E38 - long = 1549
  - E38 - short = 1549
  - E39 = 1512

Changing these settings is not required unless a new Navigation computer is installed in the vehicle. If a new navigation computer is being calibrated for the first time, enter the vehicle type.



**Note: These settings should be checked as part of the troubleshooting procedures to verify that they are correct. If the displayed setting does not match the figures above, momentarily select another vehicle type and switch back to the correct vehicle. The track width value will change to the displayed values as shown above.**

### Aftermarket Wheels or Suspension Modifications

If the vehicle is equipped with aftermarket wheels or has modified suspension components, the track width may need to be manually adjusted. Do the following to obtain this figure:

1. With the vehicle on the ground (suspension loaded), measure the distance between the two front rims (inner rim tire bead lips) in millimeters and note the measurement.
2. Measure the thickness of one front rim (inside lip to outside lip) using calipers and note the measurement.
3. Add these two figures together. The total is the measured track width.

Turn the rotary knob to the vehicle type. Then turn the knob "one click" to the LEFT to access the track measurement. Turn the knob to enter the value manually. Press knob when finished.

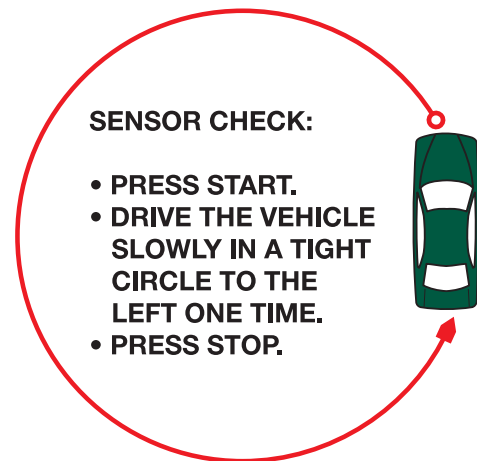
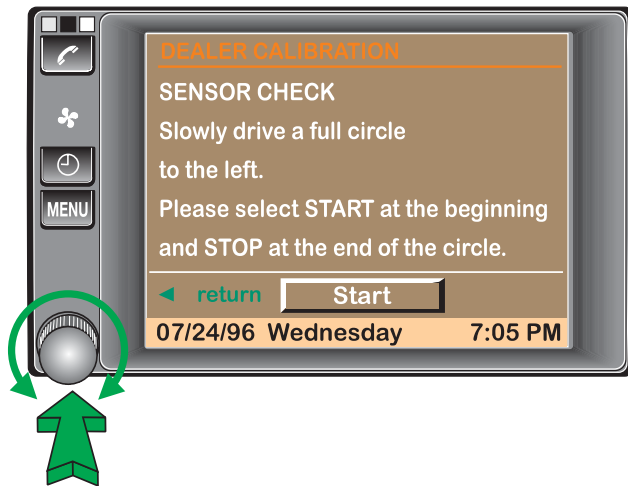
## 2. Sensor Test

The Sensor Test performs a functional check of the wheel speed sensors and magnetic field sensor inputs to the navigation computer.

This test must be carried out if the navigation computer is replaced. The DIS will also call for this test to be carried out as part of the troubleshooting procedures.

The test requires driving the vehicle in a tight circle at a speed of 6 MPH or less.

If there are no faults with the inputs, the system will display "Calibration Successful". At this point the calibration procedures can be continued or the vehicle can be returned to the workshop to continue the diagnostic procedures.



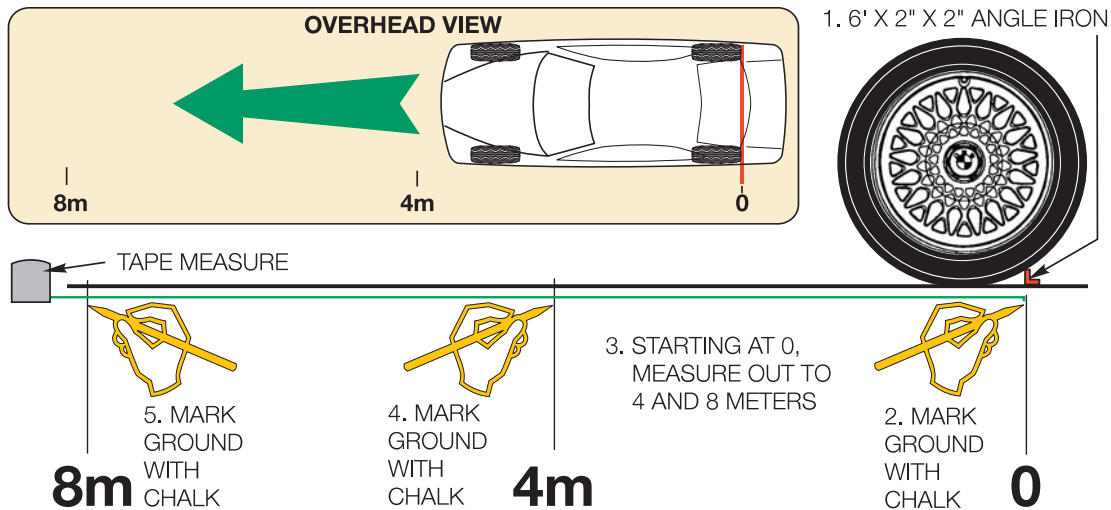
### 3. Wheel Sensor

This procedure is necessary when the navigation computer or wheel/tires have been changed. The procedure calibrates the wheel circumference/speed sensor input to the navigation computer so that the distance traveled input is correct.



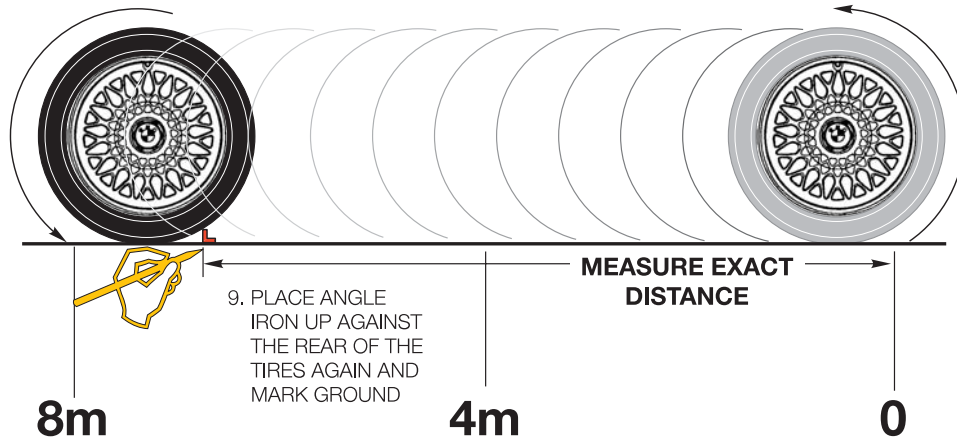
**Note: The screen instructions will indicate a 4 and 6 meter distance in this procedure. Field testing has proven that a distance of 8 meters provides a more precise wheel sensor calibration.**

The tire inflation pressure must be checked and correctly set prior to carrying out this test.



1. Make sure the front wheels are facing forward. Place the angle iron against the back side of the rear tires.
2. Mark the road with the chalk where the angle iron contacts the road. This is your starting point.
3. Using a metric tape measure, measure out 4 and 8 meters from the starting point
4. Mark the distance on the road surface at four (4) meters.
5. Mark the distance on the road surface at eight (8) meters.
6. Press the start function on the On-board monitor.

7. Drive the vehicle slow and continuously forward (don't stop) until the rear tires are between the 4 and 8 meter marks (go as close to the 8 meter mark as possible) and stop.

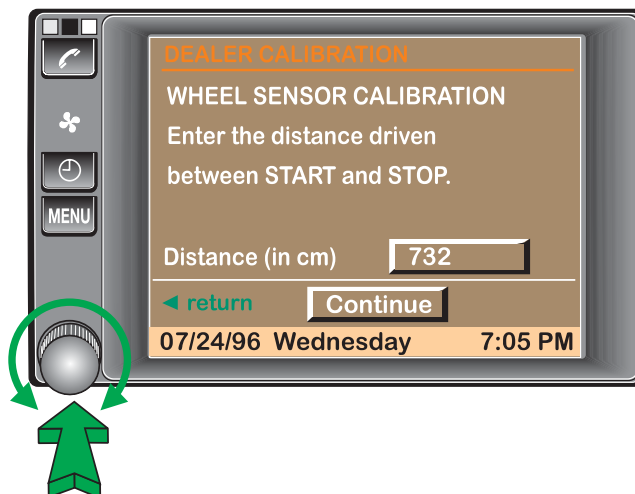


8. Press the stop button on the monitor. Set the parking brake.
9. Place the angle iron up against the rear of the back tires again and mark the ground with the chalk.
10. Precisely measure the distance from the starting point to the end point (tolerance <1cm) and input this value using the rotary knob. Then press continue.

Drive the vehicle to the known minimum 100 meter street or area.

Press the start button by driving the vehicle straight ahead for a distance of at least 100 meters.

- The vehicle speed must also be < 40 KMH and the steering wheel must be held straight.
- Once you have travelled at least 100 meters stop the vehicle and press stop.
- The monitor screen will display the calibration has successfully completed.





#### 4. Compass (Magnetic Field Sensor Calibration)

The magnetic field sensor must be calibrated if:

- The field sensor is replaced
- The navigation computer is replaced
- The rear window with the heating grid is replaced
- Body work (welding, reconstruction)

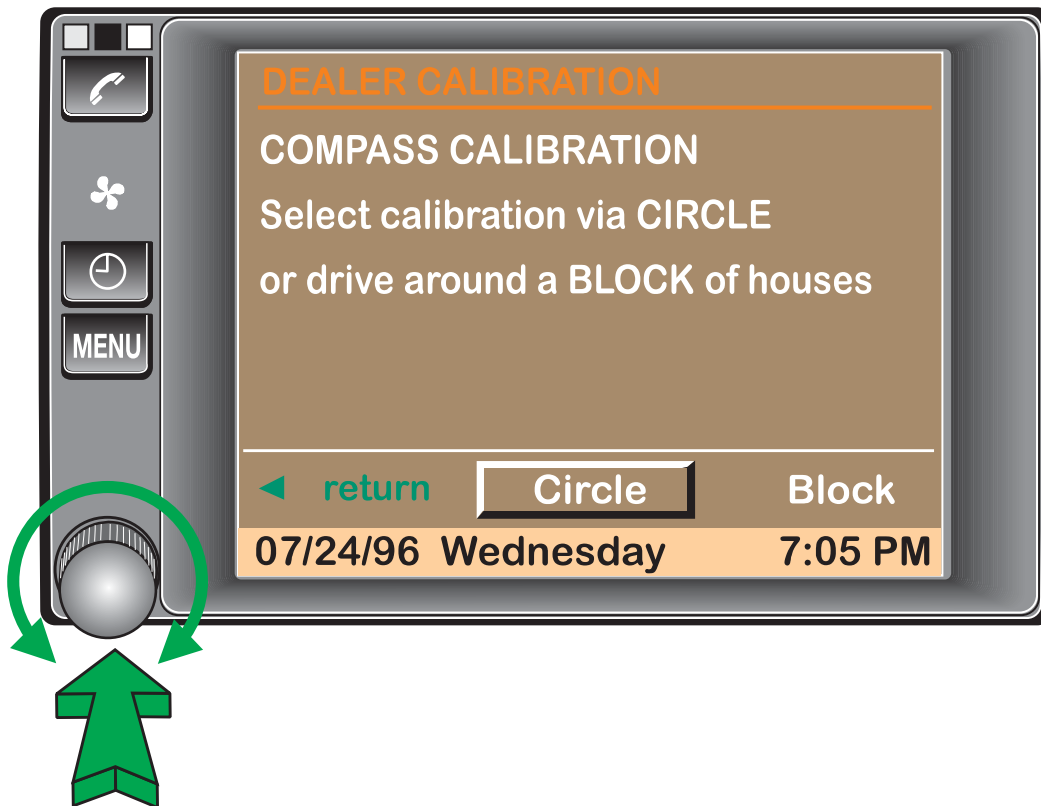
Calibration of the field sensor is a three step process that includes:

##### Compass Step 1

Allowing the sensor to read all directions of travel. This is carried out in one of two different methods:

- Driving the vehicle in several tight “circles”, or
- Driving several times around a “block” (“city block”, “block of houses”)

One of these methods must be selected on the monitor before beginning.



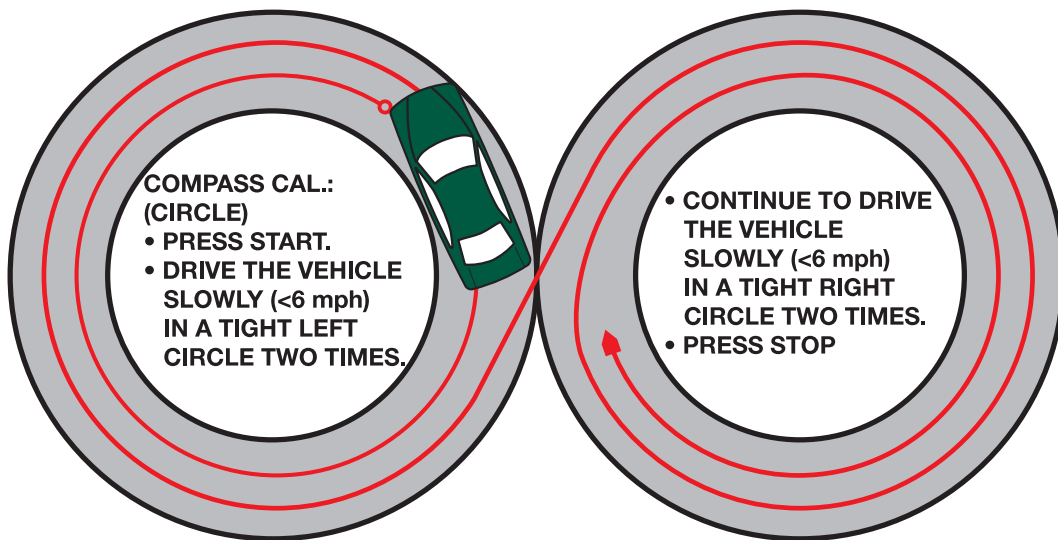
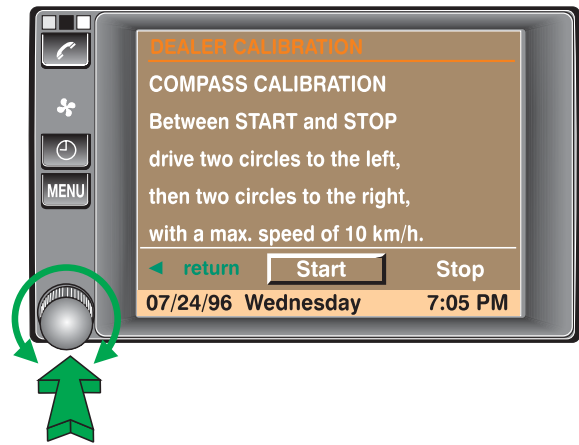
### Preferred Method- CIRCLE

Driving the vehicle two complete circles - both counterclockwise and clockwise - will cover all directions.

Press Start, the speed of the vehicle must not exceed 6 MPH during the calibration.

Press Stop when you have completed.

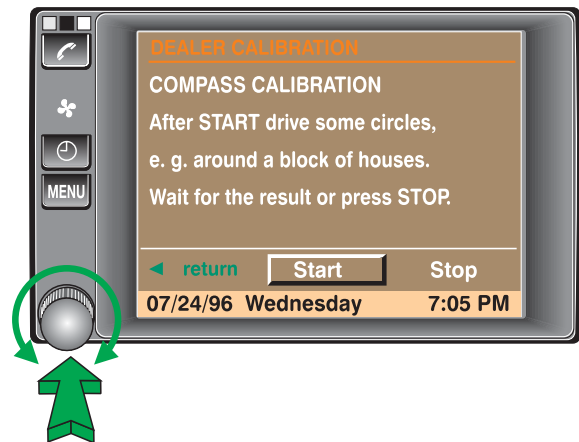
The monitor will indicate that the navigation computer has seen all directions of travel by displaying "Calibration Successful".



### Alternate Method - BLOCK

Driving the vehicle around a block several times will also allow the navigation computer to see all directions of travel.

The monitor will automatically indicate when this section of the calibration is completed.

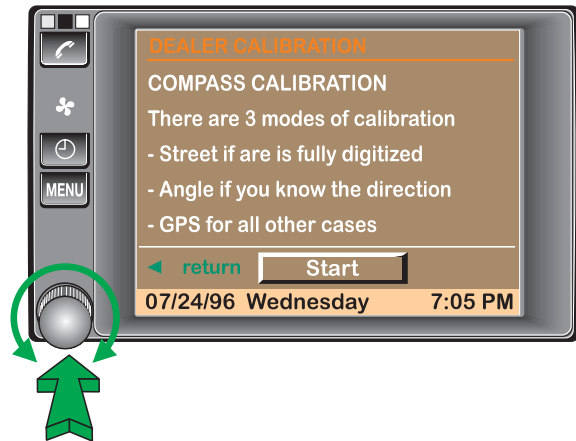


## Compass Step 2

Calibration of the magnetic field sensor input to the navigation computer.

This procedure is only possible after STEP 1 has been completed. Step 2 is carried out in one of three different methods;

- Calibration using a digitized address.
- Calibration using the GPS satellite signals.
- Angular calibration using the direction of a long section of road.

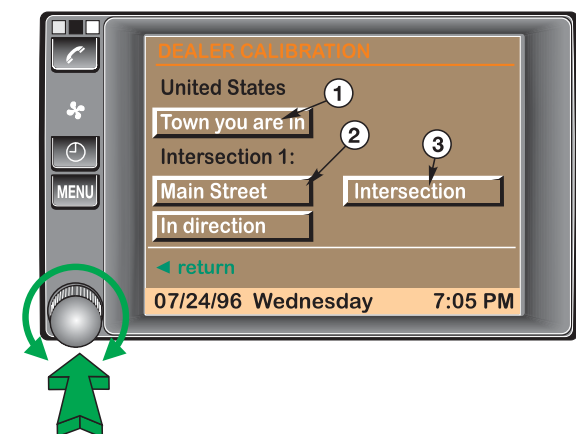
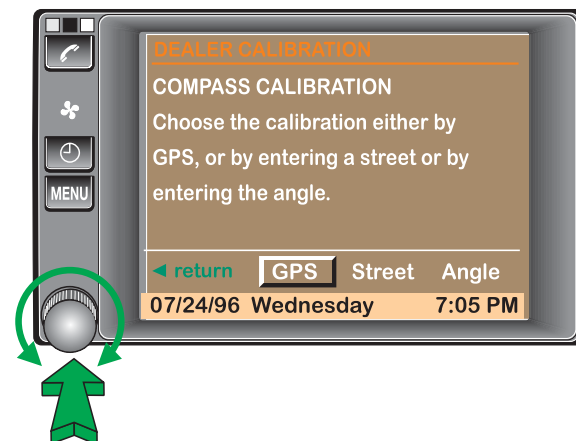


### Preferred Method - Digitized Address

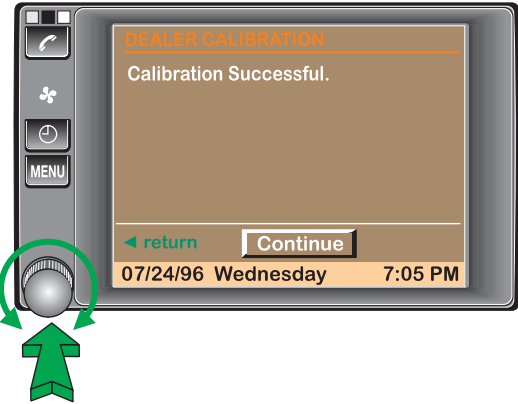
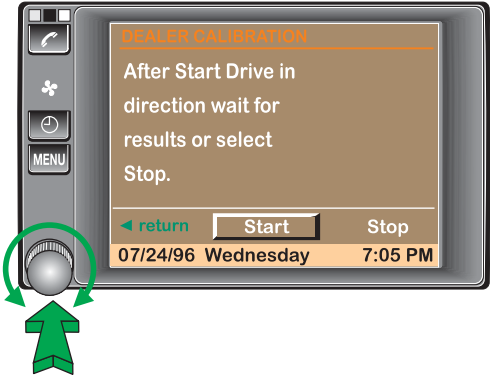
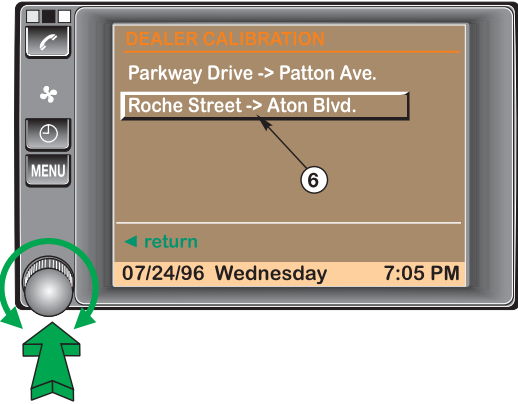
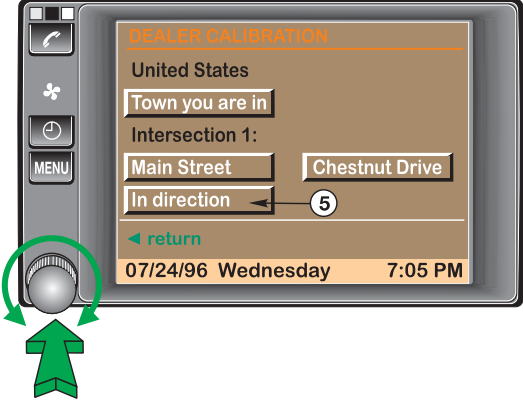
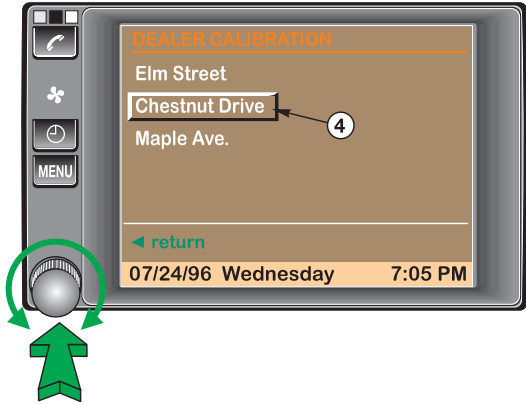
This procedure can only be used within a fully digitized CD map area.

The actual location is entered into the on-board monitor and the navigation system will display a route between two road intersections, along which the vehicle must be driven.

1. If the town is not already displayed, enter it in the same method as entering a destination.
2. Enter the street at which you want to start the calibration.
3. Press the intersection button.
4. Select the street from the list of intersecting streets that is close to where the vehicle is at this point.
5. Press the "In direction" button. This brings up a list of streets that are in the direction of your planned calibration drive.
6. Select the street that is in your planned direction of travel.
7. Press Start when you begin to drive.



The screen will automatically confirm that the calibration was successful. Press the continue button to go to Compass Step 3; Rear Window Defroster grid compensation calibration.



## Compass Step 2

Alternate Method - GPS - This requires driving the vehicle in all directions until the navigation computer fixes the field sensor inputs.

This may require several minutes of driving to complete this step. The roads should be as straight as possible and free from any overhead obstructions that might block the upward view to the satellite signals.

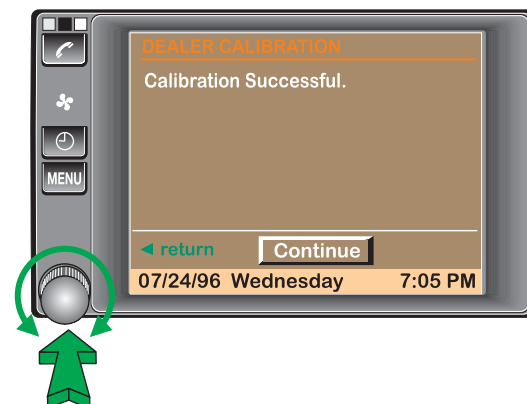
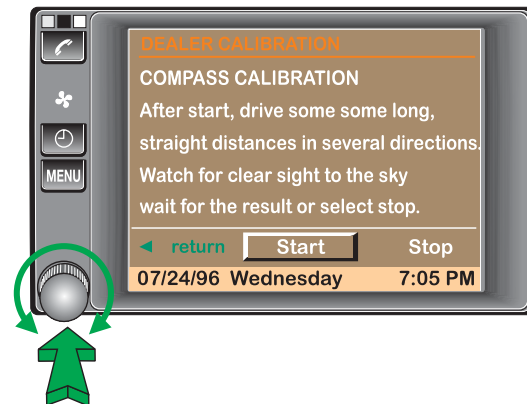
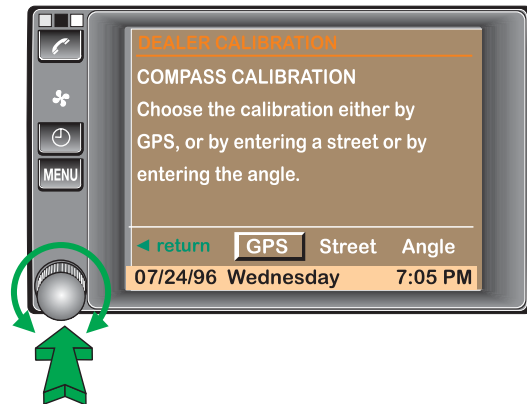
The screen will automatically confirm that the calibration was successful.

Press the continue button to go to Compass Step 3; Rear Window Defroster grid compensation calibration.

## Last Method - Angle

Angular calibration using the direction of a long section of road. To use this method, the geographical angle of the road must be known and input into the navigation computer to within  $\pm 1^\circ$ , then the vehicle must be driven along this route.

Any of these three described methods will perform the second step in the compass calibration. Once this step is complete, the last step can be carried out.

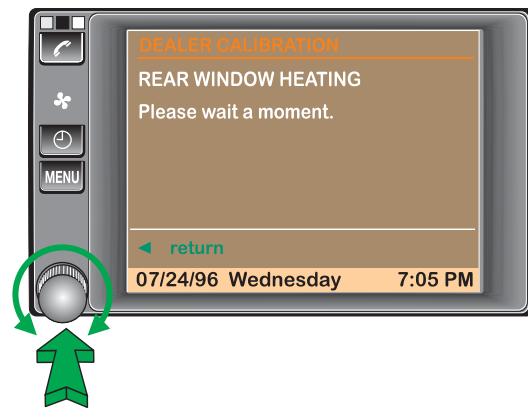
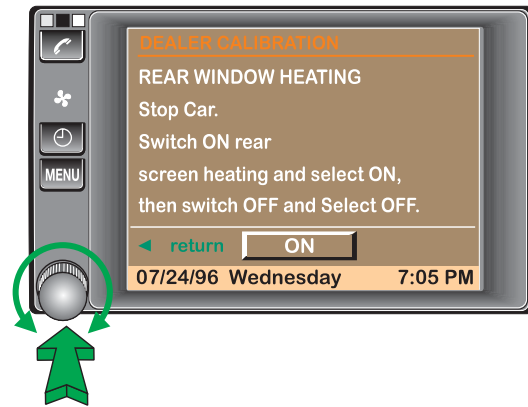


### Compass Step 3 - Rear Window Defroster Compensation

This procedure is only possible after steps #1 and #2 have been successfully completed.

The navigation computer determines the magnetic field generated by the defogger grid so it can compensate for this when the rear defogger is switched on.

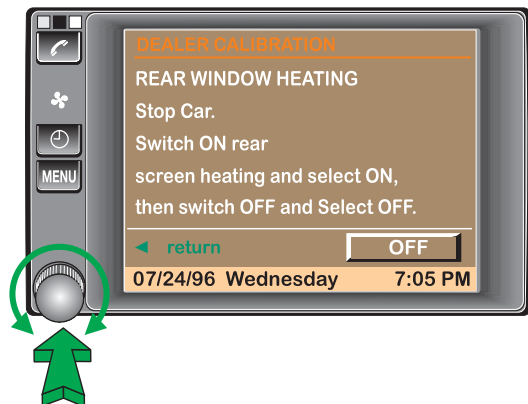
- Switch the rear defogger ON and confirm the input on the Monitor screen. Wait for acknowledgment by the navigation system.
- Switch the rear defogger OFF and confirm the input on the monitor screen. Wait for acknowledgment by the navigation system



### Finish Calibration

Once all of the required calibration procedures have been carried out, press the “finish calibration” button.

This will display whether the calibration process was successful or if faults or problems have occurred that require troubleshooting with the DISplus/GT-1.



## Mark I Diagnosis and Troubleshooting

There are three diagnostic programs for the On Board Monitor system with the navigation Computer.

Based on the customer complaint, one or more of these systems will need to be accessed with the DIS Tester for diagnostic purposes.

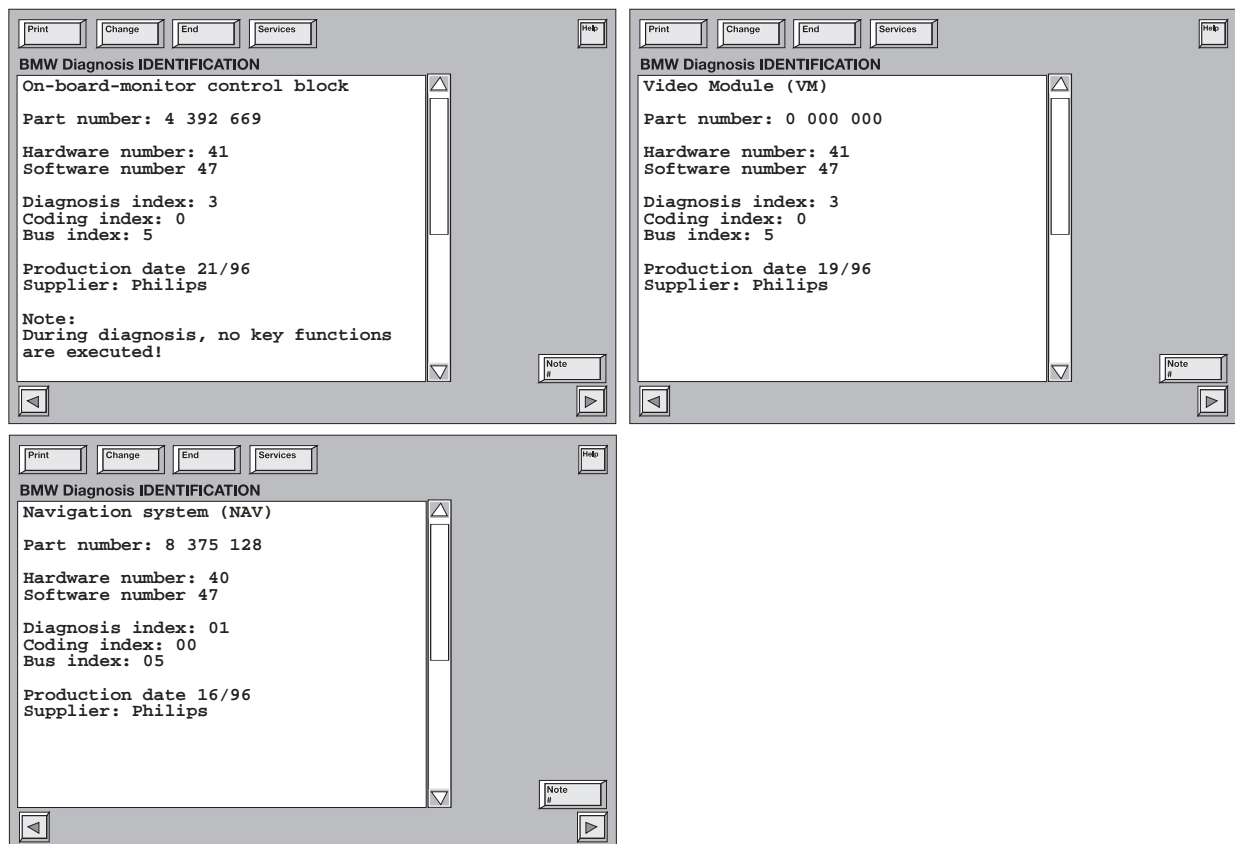
The On Board Monitor system must be fully functional before any visual displays, inputs or programming can be carried out.

The Video Module must be fully functional before any graphical displays can be transmitted to the Monitor unit.

The Navigation Computer must be fully functional before any programmed destinations can be called up for display and directions.

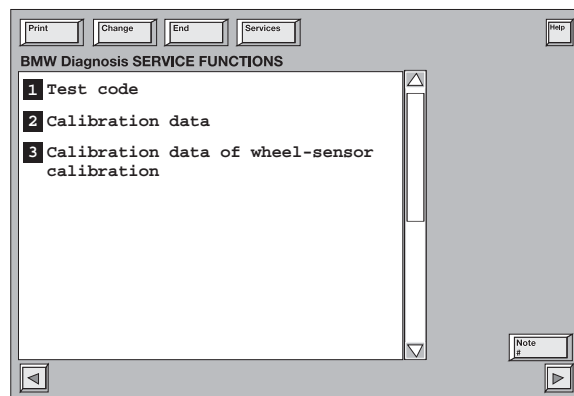
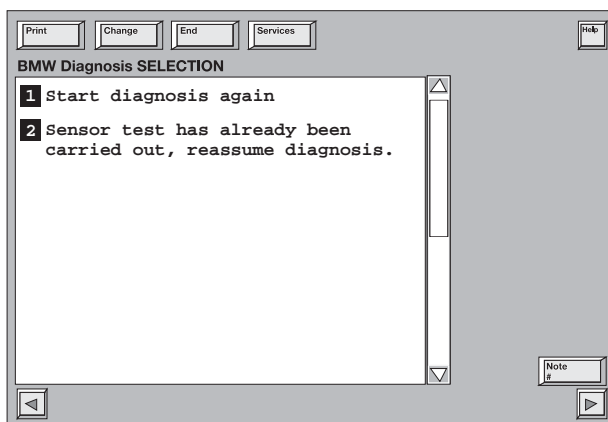
In all cases fault troubleshooting should begin with the "Fault Symptom" troubleshooting paths provided by the DIS.

In the case of positioning errors or faults with the Navigation System, the DIS will request a "Sensor Test" be performed prior to carrying out the diagnosis. This test procedure is outlined in the calibration procedures.



The navigation system diagnostic software has a “SELECTION” screen that is unique to any previous system.

- The choice, 1 - “Start diagnosis again”, means to start the diagnostic session (either the first time or restart a fresh diagnostic session.)
- 2- “Sensor test has already been carried out, reassume diagnosis.”, means to resume the diagnostic session. This selection is used when you have first started a session and the instructions on the DIS screen request that you disconnect the vehicle and bring it outside for a sensor check or another “field test” of some type as described in the diagnostic pages. When you return to the DIS, Select #2 to resume the diagnostic session started previously.



The Navigation Service Functions contains calibration data screens to review the vehicles present state of calibration (calibration status list). The calibration data (#2) is set up for E38 vehicles only at the time of navigation system introduction.

Calibration data of wheel-sensor calibration provides a printout page of the vehicles actual distance to wheel sensor pulse. This screen will prove helpful when dealing with the technical hotline if additional data is requested from them on wheel sensor calibration data values.

## Navigation Computer Flash Codes

The “ON LED” of the navigation computer automatically provides flash codes for when a fault is present.

- Single Flash = Internal control module fault.
- Triple Flash = ARCNET data link problem (open, short).

Rely on fault symptom troubleshooting in conjunction with the flash codes during diagnosis procedures.





## Mark II Navigation System Diagnostic Mode Displays

The Mark II system does not communicate with the DIS. It does however provide an on board diagnostic mode on screen display function.

These screens provide system hardware/software identification numbers and status of Navigation specific functions for use as a diagnostic tool. The screens are accessed as follows:

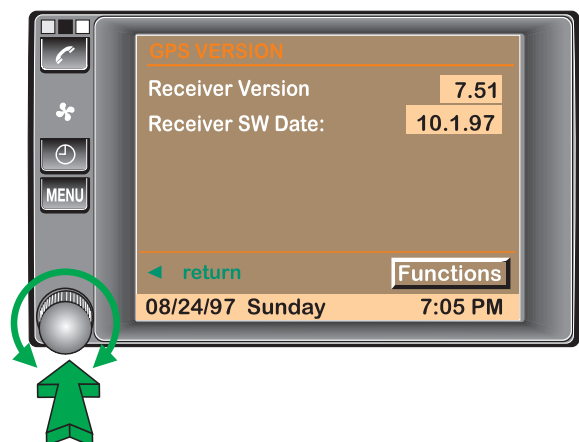
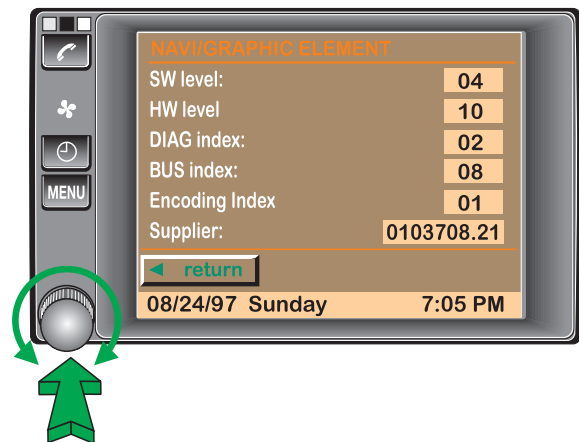
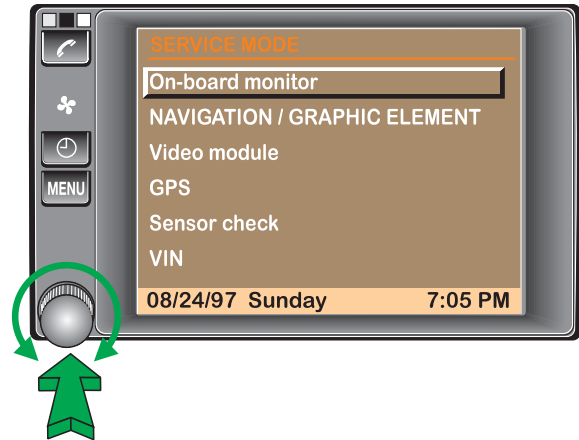
- From the main menu select "Set".
- Once in the Set function, press and hold the menu button for 8 seconds.
- The first screen to appear is the SERVICE MODE menu.

The On-board monitor and Video module selections are not functional even though they are displayed.

The first accessible function is the NAVI/GRAPHIC ELEMENT. This screen is for identification of hardware/ software specific index versions for the installed system.

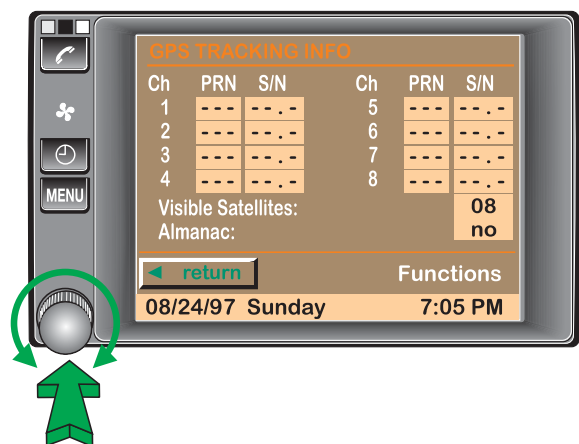
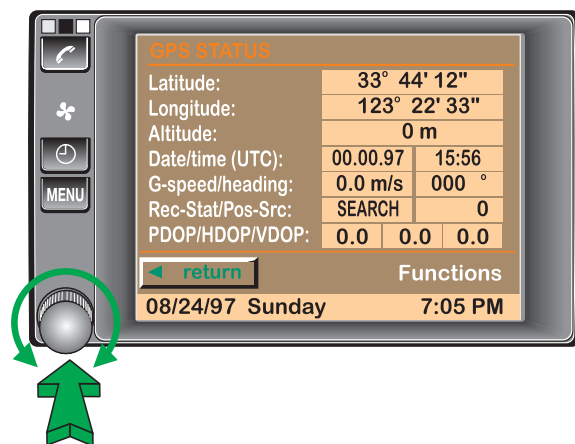
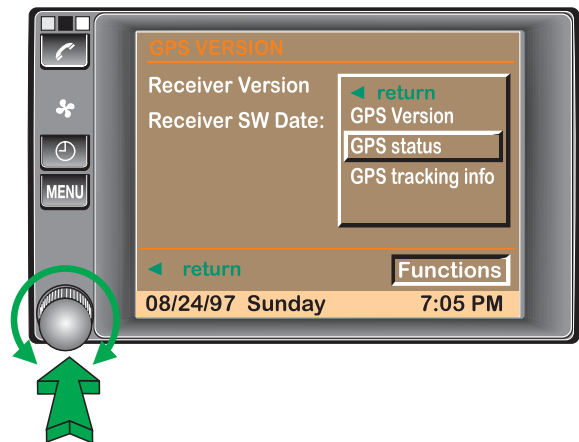
The next available selection from the service mode menu is GPS. Pressing GPS brings up the GPS version display. This display provides the GPS receiver module hardware version number and date of programmed software.

Pressing the functions button in the lower right corner of this screen provides a sub-selection menu of additional GPS system status.



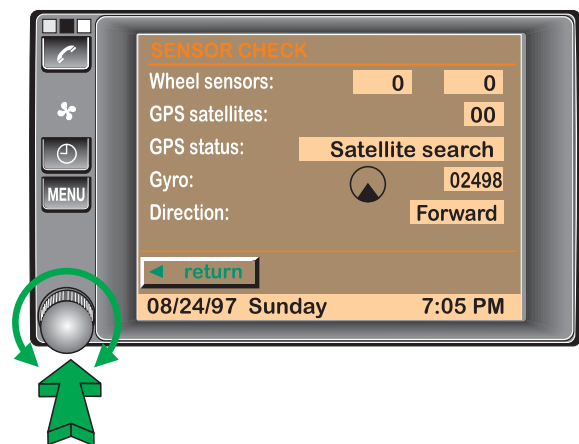
The sub-selection menu additionally includes GPS “Status” and “Tracking” choices.

- GPS Status provides information on the exact coordinates of the vehicle based on the calculations of the GPS receiver module.
- GPS Tracking provides information about the individual satellites currently sending signals to the GPS receiver module.



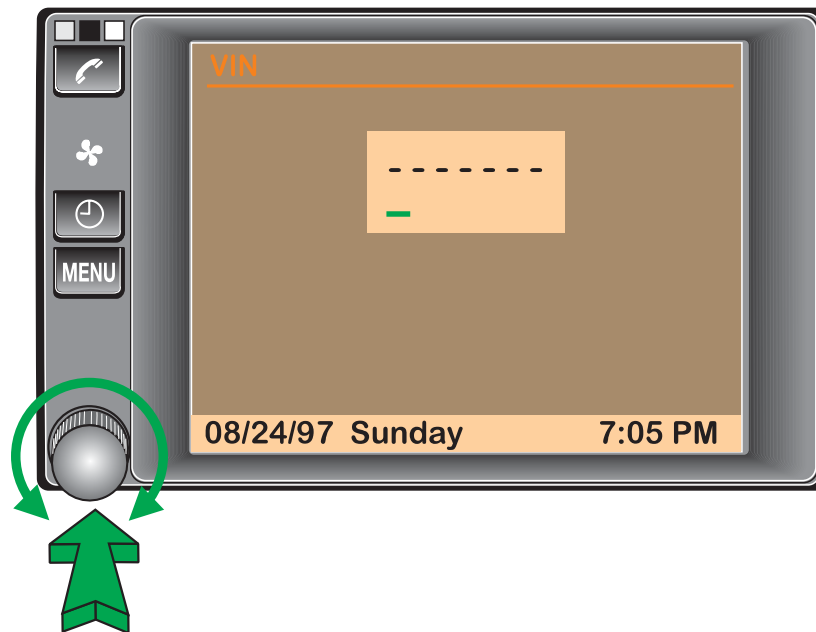
The next selection available from the SERVICE MODE menu is “Sensor check” which provides the following:

- Wheel speed input (only one wheel speed signal, displayed in the right side window).
- Total number of GPS satellites currently providing signals.
- What mode the GPS receiver module is currently in (ie: Search).
- The Gyro status provides the millivoltage value the navigation computer is utilizing for the current vehicle position. This area also includes an icon representing what direction the vehicle is heading in.
- The direction status relates to what gear the vehicle is currently in (forward or reverse).



The last selection available in the Service Mode menu is the VIN entry display. The VIN is entered at the VPC when prepped prior to distribution. This is for the VIN display in the Emergency program if needed when calling the Cross Country Group Roadside Assistance Program. Additionally, if the vehicle is equipped with a Phase V phone the system will automatically utilize the entered VIN as follows.

Similar to the previous phone system, the Phase V phone has the capability to contact Cross Country Group using the “Assist” or “Emergency” button from the Emergency or Telephone functions.



What's new for the Phase V system is the use of dual tone multi frequency (DTMF) signalling. DTMF signalling provides a download of the VIN, the telephone number of the Phase V phone and the vehicle coordinates when the assist button was pressed. This information is displayed on a computer screen of the Cross Country Group “assist” personnel prior to any verbal communication taking place.

Through a data base, the VIN provides the Owner's Name. This, in conjunction with the vehicle coordinates and the phone number provides the “assist” personnel with crucial preliminary information.

When the call is patched in from the vehicle, the assist personnel can answer appropriately for an “assist” or “emergency” situation. This quick response with the owner's pertinent information provides an added personnel touch and time savings in an emergency situation.

The VIN is entered at the VPC for all vehicles (with or without a Phase V phone). If the VIN has been incorrectly entered it can be changed by turning and pressing the rotary knob when the correct letter or digit of the last seven character of the VIN is displayed.

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## Mark II Navigation System Calibration

The calibration procedure of the Mark I system is not required with the Mark II system. This system self calibrates automatically as the vehicle is driven after following the steps below.

- System must be fully functional with no faults present in fault memory.
- Correct Map data base CD installed for your .
- Vehicle outside with an unobstructed overhead view. Switch ignition on and allow system adequate time to receive a minimum of three GPS signals. This is confirmed by the green GPS indicator in the map display.
- Set the map display to the 400' scale and drive the vehicle on digitized roads. Make frequent turns at intersections where possible.

While driving, the system utilizes the map CD, the received GPS coordinates, the Gyro sensor to determine turn activity and the wheel speed sensor input. It compares all of these variables and automatically pinpoints the vehicle position.

### Mark II Navigation System Diagnosis

The navigation computer does not communicate with the DISplus/GT-1. Diagnosis of the navigation Computer is performed with conventional procedures and by utilizing the Status displays on the previous pages.

Refer to the DIS for RGB output signal oscilloscope displays for visual confirmation of signal integrity.

The Board monitor (BMBT) does however communicate with the DISplus/GT-1. Follow the fault symptom path of the DIS Diagnosis Program for detailed diagnostic procedures.

## E46 Mark II Board Monitor and Navigation Service Mode Displays

The Mark II system provides a service mode display function. These screens provide system hardware/software identification numbers and status of Board Monitor and Navigation specific functions for use as a diagnostic tool. The screens are accessed as follows:

- From the Main Menu select “Set”.
- Once in the Set function, press and hold the menu button for 8 seconds.
- The next screen to appear is the Service Mode menu.

The first accessible function is “On-board monitor”. Pressing this selection calls up the version screen which provides identification of hardware/ software specific index versions for the installed system.

Pressing the functions key at the bottom continues into additional screens including the Key Functions and Brightness controls.

Key Functions tests the key input on the BMBT. Input status (1-25) will display in the window.

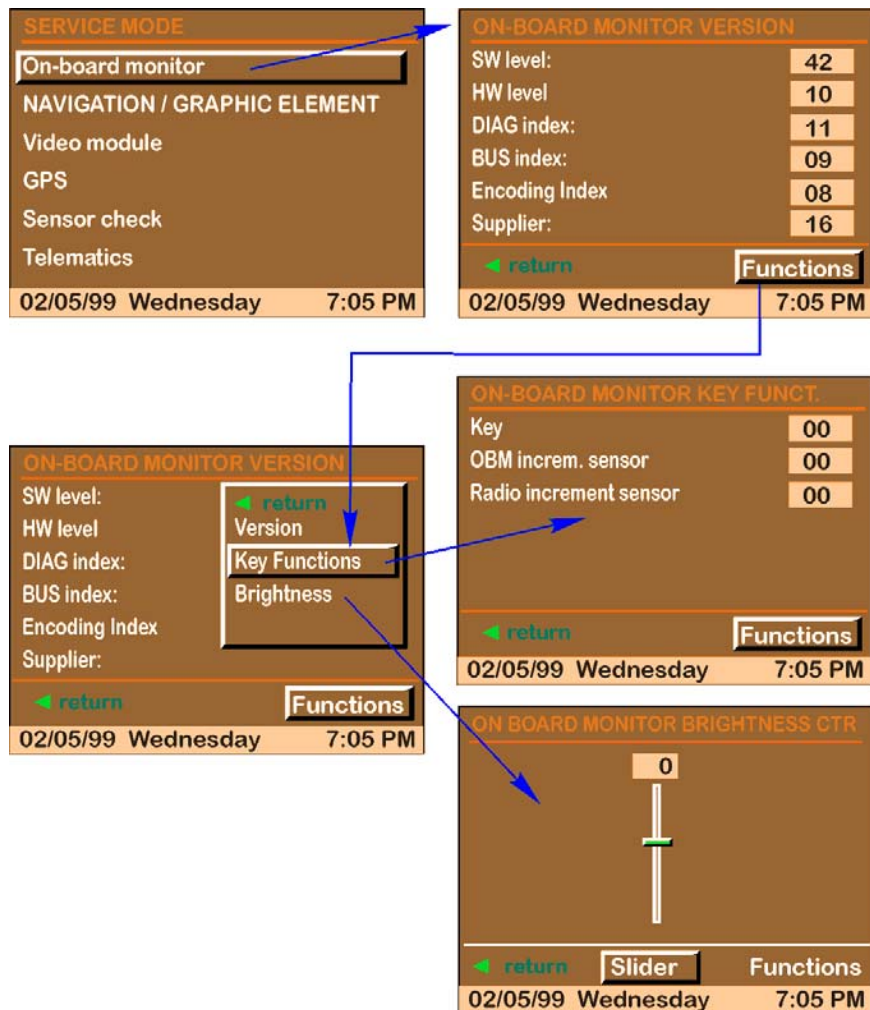
If no keys are pressed the status will be displayed as “FF”.

Rotating the left or right rotary knob displays hex code input status.

Rotated slowly, the display changes with each increment. The display eventually stops at “1F” in the left rotated direction and “E0” to the right.

The key function test terminates automatically if no keys or knobs are moved after a short duration (“00”).

The brightness control allows the display illumination to be manually adjusted.



The next accessible function is the NAVI/GRAPHIC ELEMENT.

This screen identifies hardware/ software specific index versions for the installed system.

*The Video module selection is not functional since the US version Mark II navigation system does not utilize the video module.*

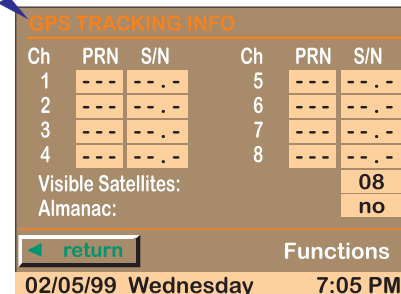
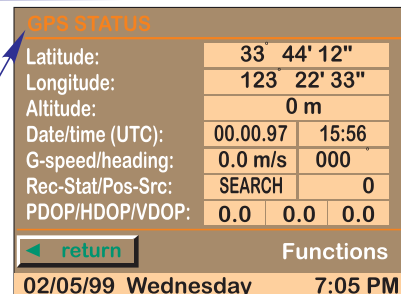
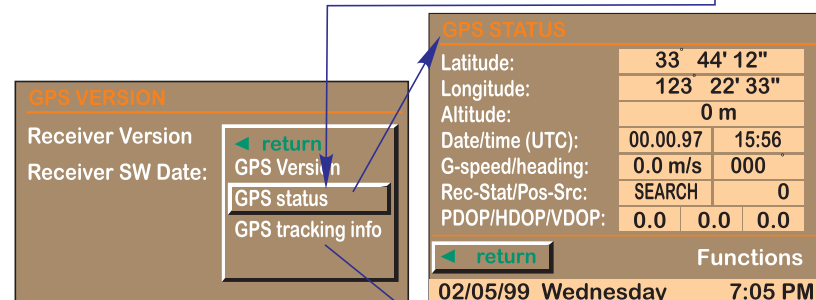
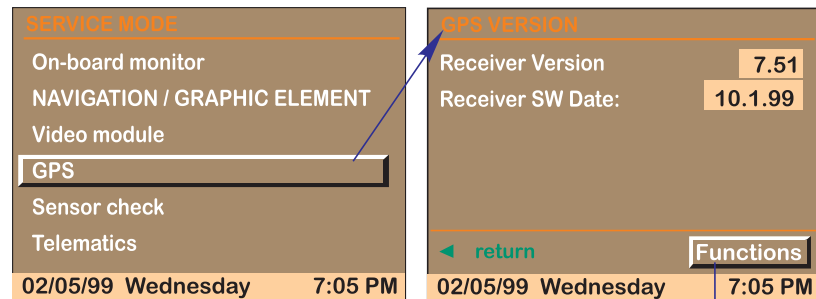
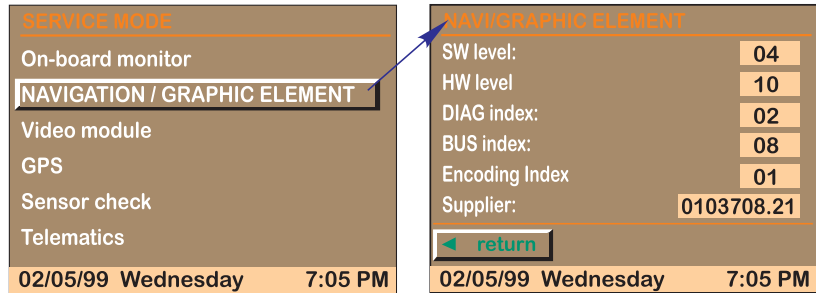
The next available selection from the service mode menu is "GPS".

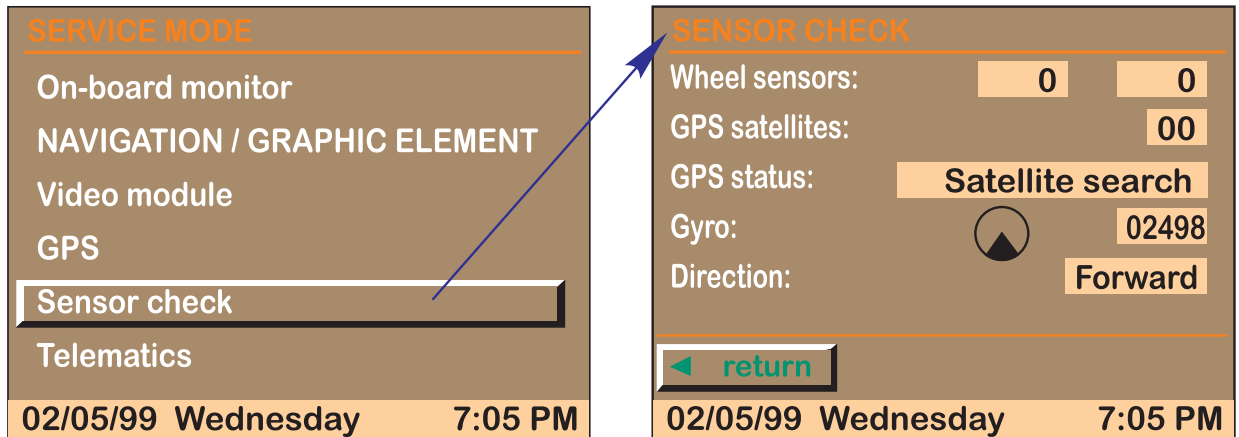
This display provides the GPS receiver module with the hardware version number and date of programmed software.

Pressing the functions button in the lower right corner of this screen provides a sub-selection menu.

GPS Status provides information on the exact coordinates of the vehicle based on the calculations of the GPS receiver module.

GPS Tracking provides info about the individual satellites currently sending signals to the GPS receiver module. Though interesting, this display provides data which is not usable for BMW service technician scope of diagnosis.



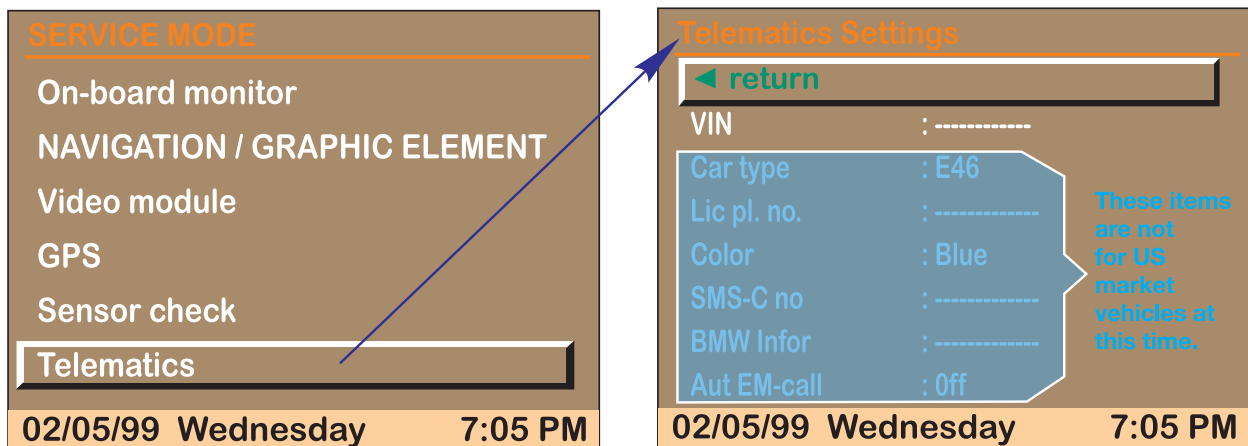


The next selection available from the SERVICE MODE menu is “Sensor check” which provides:

- Wheel speed input (only one wheel speed signal, displayed).
- Number of satellites detected.
- What mode the GPS receiver module is currently in; (ie: Search)
- The Gyro status provides the millivoltage value the navigation computer is utilizing for the current vehicle position. This area also includes an icon representing what direction the vehicle is heading in.
- The direction status indicates what gear is selected (forward or reverse).

The Sensor check display is intended to be used while test driving the vehicle. Use the legend on the following pages to compare with the display status.

The last selection available is the Telematics entry display. This replaces the “VIN” selection from the E38/E39 Mark II systems. The only requirement of this entry screen is that the VIN is entered at the VPC when prepped prior to distribution.



This is necessary for the Emergency program if needed when calling the Cross Country Group Roadside Assistance Program.

Additionally, if the vehicle is equipped with a Phase V phone the system will automatically utilize the entered VIN as per E38/E39 Mark II systems.

The VIN is entered at the VPC for all vehicles (with or without a Phase V phone). If the VIN has been incorrectly entered it can be changed by turning and pressing the rotary knob when the correct letter or digit of the last seven character of the VIN is displayed.

The balance of the data displayed below the VIN entry is not currently used in the US market.

### Service Mode Menu Chart (Sensor Check)

Status Display	What should be displayed	What to do if NOT OK.
<b>Wheel speed sensors:</b>	As the vehicle is driven, the number should increase with an increase in vehicle speed.	Check fault codes in DSC system. If necessary carry out wheel speed sensor test.
<b>GPS Satellites:</b>	With an unobstructed upward view of the sky, the display should be > 3.	Check for interference of signals to GPS antenna. Check integrity of circuit from GPS antenna to navigation computer.
<b>GPS Status:</b>	"See legend below"	
<b>Gyro:</b>	Direction icon moves with vehicle turning movement.  Display voltage is in millivolts and should read approximately 2500 mV (+/- 400mV) when the vehicle is stationary or driven straight ahead.  When the vehicle is turning, the signal voltage should increase on right hand turns and decrease on left hand turns.	Replace navigation computer
<b>Direction:</b>	Reverse is displayed when range selector is in reverse. Forward should be displayed when in any other range.	Check reverse light signal input.



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## Service Mode Diagnostic Explanations

GPS Status Text Display	Description
1. "GPS fault"	Problem with GPS system. Swap navigation computer and or antenna from known good vehicle after checking GPS status display information.
2. "Reception Interference"	Problem with GPS system. Same as above.
3. "No Almanac"	No data yet stored from satellites. The GPS almanac is a memory account of received satellite signals. If the vehicle battery has been disconnected or after replacing a navigation computer it has an empty memory and requires satellite signals to be functional. After the navigation computer receives battery voltage and ground, it must be left outside with an unobstructed sky above with the ignition switched to KLR for approximately 15 minutes.
4. "Satellite Search"	GPS is currently searching for satellite signals.
5. "Satellite Contact"	At least one satellite is found
6. "Position Known"	Vehicle's latitude and longitude known. Navigation is possible.

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## Replacing the Mk-3 Navigation Computer

When replacing the Mk-3 navigation computer be aware that there are two hardware variants depending on the installation position (vertical or horizontal).

The ignition should be in position 0 during removal and replacement of the computer. After installing, close all doors, hood and trunk. A bus line reset will be carried out within two minutes. Resetting allows the gyro to perform a calibration run. Do not move the car during this reset period.

The coding sequence for the Mk-3 navigation computer has been changed from the previous Mk-2. There is now an additional step (configuration) that must be done before the software can be loaded.

After resetting, a configuration signal is needed to allow the computer to load the correct software for use with a board monitor or MIR. This is performed using the DIS coding program (CD 22.0 onward) and the Navigation System operating software (CD V15.0 onward).

### **Note: Vehicles using the wide screen BM require CD V16.1 onward.**

1. From the DIS/GT-1 Coding /Programming select "1 ZCS Coding"
2. Select the appropriate series (E46,E39,E38,E52,E53)
3. Select "4 Conversion"
4. Select "3 IKE?Kombi"
5. Select "2 language"
6. At the prompt "is the CD ROM present?"select yes , but do not install the operating software CD ROM yet.
7. First select the main language and then an additional language. (i.e. English-spanish)
8. Select the gender of the navigation audio voice.
9. Select "automatic coding-yes"
10. After coding is done the DIS/GT-1 instructs you to follow the instructions on the monitor for the installation of the Navigation System CD ROM.
11. Place the navigation system software in the navigation computer CD drive.

### **Important: Do not switch the ignition off during the software loading procedure. Do not use any software for the Mk-3 earlier than CD V15.0.**

12. Once loading has been completed, remove the CD and then confirm completion by pressing the rotary push-button on the monitor.
13. Turn off the key for 10 seconds, then turn it back on and conduct a functional check.

- 
14. After this step has been finished, encode the navigation computer using the “Recoding” path in ZCS Coding. The coding process involves coding vehicle specific data: VIN, Model, Telematics data etc.

The software status can be confirmed from the “Set” screen for Mk-3 systems.

- 3 = Third generation system Mk-3.
- 1 = Device variant (1=Color screen, 2= MIR monochrome screen).
- 20 = Software version of the graphic component (Version 2.0).

After the navigation computer has been successfully programmed and coded the vehicle should be left in an area with a clear view of the sky with the key in KL R for at least 15 minutes to complete the calibration process.

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## **Service Mode**

Just as Mk-2, Mk-3 provides an on-screen service mode for diagnosis. The service mode provides five different test screens:

- On-board monitor
- Navigation/Graphic element
- GPS
- Sensor Check
- Telematics

To enter the Navigation Service Mode:

- Turn the ignition key to position 1 (KL R).
- From the Menu screen select “SET”.
- Once in the Set screen, press and hold the “MENU” button for 8 seconds.
- The Service Mode menu will appear on the display.
- Select from the Service Mode menu for navigation specific tests.

## **Diagnosis**

Diagnosis is carried out using Test Modules in the Diagnosis Program as well as on-screen in the Service mode. The Sensor Check display is intended to be used while test driving the vehicle. The following pages contain charts with explanations of the Service Mode display.

## Service Mode Menu Chart (Sensor Check)

Status Display	What should be displayed	What to do if NOT OK.
<b>Wheel speed sensors:</b>	As the vehicle is driven, the number should increase with an increase in vehicle speed.	Check fault codes in DSC system. If necessary carry out wheel speed sensor test.
<b>GPS Satellites:</b>	With an unobstructed upward view of the sky, the display should be > 3.	Check for interference of signals to GPS antenna. Check integrity of circuit from GPS antenna to navigation computer.
<b>GPS Status:</b>	"See legend below"	
<b>Gyro:</b>	Direction icon moves with vehicle turning movement.  Display voltage is in millivolts and should read approximately 2500 mV (+/- 400mV) when the vehicle is stationary or driven straight ahead.  When the vehicle is turning, the signal voltage should increase on right hand turns and decrease on left hand turns.	Replace navigation computer
<b>Direction:</b>	Reverse is displayed when range selector is in reverse. Forward should be displayed when in any other range.	Check reverse light signal input.

## Service Mode Diagnostic Explanations

GPS Status Text Display	Description
1. "GPS fault"	Problem with GPS system. Swap navigation computer and or antenna from known good vehicle after checking GPS status display information.
2. "Reception Interference"	Problem with GPS system. Same as above.
3. "No Almanac"	No data yet stored from satellites. The GPS almanac is a memory account of received satellite signals. If the vehicle battery has been disconnected or after replacing a navigation computer it has an empty memory and requires satellite signals to be functional. After the navigation computer receives battery voltage and ground, it must be left outside with an unobstructed sky above with the ignition switched to KLR for approximately 15 minutes.
4. "Satellite Search"	GPS is currently searching for satellite signals.
5. "Satellite Contact"	At least one satellite is found
6. "Position Known"	Vehicle's latitude and longitude known. Navigation is possible.

## Service Mode Diagnostic Explanations

Menu	Display	Explanation
GPS Status	G-Speed Heading Rec Status Pos-src PDOP HDOP VDOP	Relative speed over the ground Direction of Travel Search/track/position receiver status Number of satellites available for analysis Accuracy of the calculated location <8=sufficient determination of location <4=very good determination of location
GPS Tracking Info	CH PRN S/N Visible Sat  Almanac	Channel Satellite detection Better reception as the value increases Number of visible satellites, receivable signals, depending upon time of day/configuration Satellite database, loaded automatically after 15 minutes
Telematics	VIN Color GSM BMW info Emergency call out Initialization Logging off	VIN (Automatically assigned during coding) Color code or text Telephone network/contract number Customer specific info On/off status Telematics services on/off status Logging off telematics services

### Abbreviation explanations for chart:

- PDOP** Position Dilution of Precision
- HDOP** Horizontal Dilution of Precision
- VDOP** Vertical Dilution of Precision
- S/N** Signal/noise relationship
- Gyro** Piezo gyro sensor (in navigation computer)
- Dir** Direction of travel

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## Navigation System Software

Aside from coding the navigation computers after installation, the proper navigation system software must be loaded to ensure proper operation.

Always check the most current version of SIB# B84 01 02 for the latest navigation software and loading instructions.

There are two version of navigation software CD's. One is for Mark III navigation systems without split-screen. The other version is for Mk-I through Mk-III systems including DVD based navigation on I-Bus (K-bus) vehicles.

Refer to the application chart in SIB# B84 01 02 for the most current navigation software.

## Checking Software Version

### MK I Systems

The software version is shown in the top right corner of the "setting" screen. The software/hardware version is displayed as "1-1/80". The numbers have the following meanings: first digit 1 - is a 1st generation navigation system (MK I); second digit 1 - is a 1st device variant (top navigation – MK Ic color screen); the last two digits 80 - are the software version of the graphic component (8.0).

### MK II Systems

The software version is shown in the top right corner of the "setting" screen. The software/hardware version is displayed as "2-1/81". The numbers have the following meanings: first digit 2 - is a 2nd generation navigation system (MK II); second digit 1 - is a 1st device variant (top navigation – MK IIc color screen); the last two digits 81 - are the software version of the graphic component (8.1).

### MK III Systems

The software version is shown in the top right corner of the "setting" screen. The software/hardware version is displayed as "3-1/63" or "3-2/63"(MK III with split screen). The numbers have the following meanings: first digit 3 - is a 3rd generation navigation system (MK III); second digit 1 - is a 1st device variant (top navigation – MK IIIc color screen), or 2 – is a 2nd device variant (radio navigation – MK IIIm monochrome display); the last two digits 63 - are the software version of the graphic component (6.3).

### DVD Navigation System for I-Bus Vehicles

The software version is shown in the top right corner of the "setting" screen. The software/hardware version is displayed as "4-1/42". The numbers have the following meanings: first digit 4 - is a 4th generation navigation system (DVD); second digit 1 - is a 1st device variant (top navigation – DVD color screen), or 2 – is a 2nd device variant (radio navigation – DVD monochrome display); the last two digits 42 - are the software version of the graphic component (4.2).

## On Board Monitor System

The On-board Monitor System was introduced as optional equipment on the E38 and E39 for the 1997 model year. It uses the latest advances in electronic technology to bring new levels of comfort and convenience to the driver and passengers for control of the audio/communication systems.

Subsequent models such as the E53 and E46 also incorporate navigation and board monitors functions as well.

In addition, the Navigation system (Mk-I through Mk-III) is incorporated into the total scope of On-board Monitor Control.

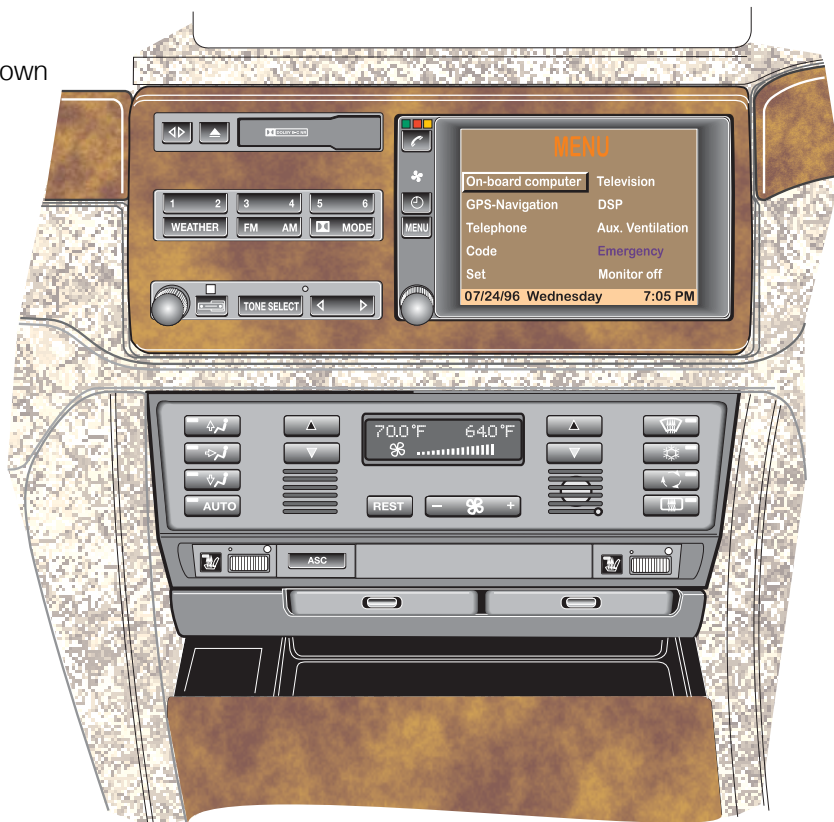
**Note: The six cylinder models of the E39 and E53 with the On-board Monitor option are equipped with the high version IKE and On Board Computer functions.**

The On-board Monitor is essentially a control and display unit. All data processing and calculations are carried out by the individual system control modules. The display data is sent to the On-board Monitor over the various bus interfaces.

The On-board Monitor is mounted in the center dash console. It replaces the Radio/Tape Player, MID and DSP control panel (E38) if equipped.

It consists of control knobs and buttons for programming and operating the various systems.

**Board Monitor**  
E38/E39 style shown





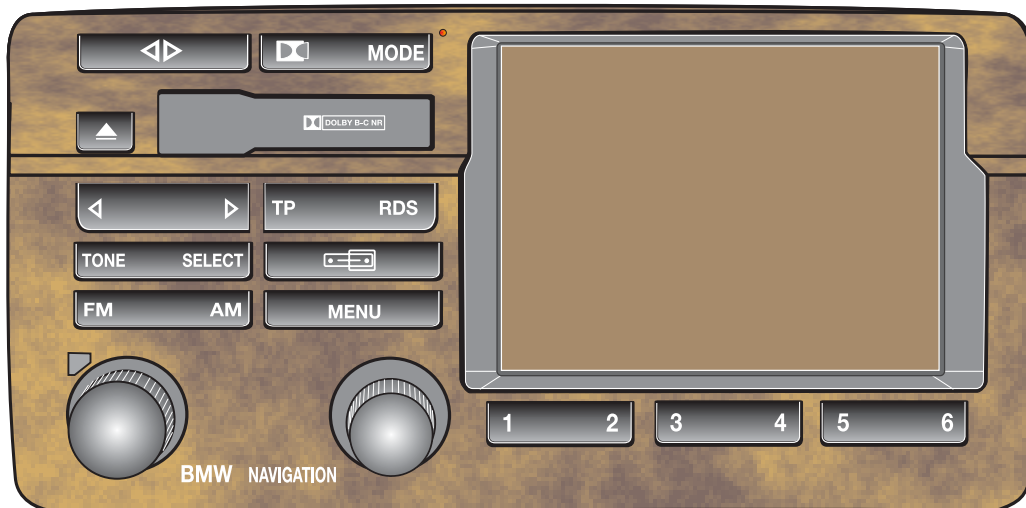
Depending upon the year and model, there is a 5 1/4 inch, color LCD screen for display of all system functions on the E38 and E39. The E46 and E53 models used a 5 inch screen.

Later models with Mk-III navigation, adopted the “wide screen” on board monitor which has a 6.5 inch screen. The wide screen was available on the E38 and E39 from 9/00 production. The E53 uses the wide screen BMBT from 1/01. The E46 models adopted the wide screen configuration starting with 3/01 for the convertible and 9/01 for all the other E46 models.

The tape player drive is also part of the On-Board Monitor unit. However, the radio receiver/amplifier module is now mounted in the trunk. The audio system is controlled from the on-board monitor.

Additionally, the systems controlled and programmed through the On-board Monitor include:

- On Board Computer
- Navigation system
- Telephone
- Code Function
- Set (on-board monitor setup)
- Digital Sound Processor (DSP)
- Auxiliary Ventilation
- Emergency (provides vehicle location and automatically dials telephone for help).
- Monitor Off (Switches the monitor off).

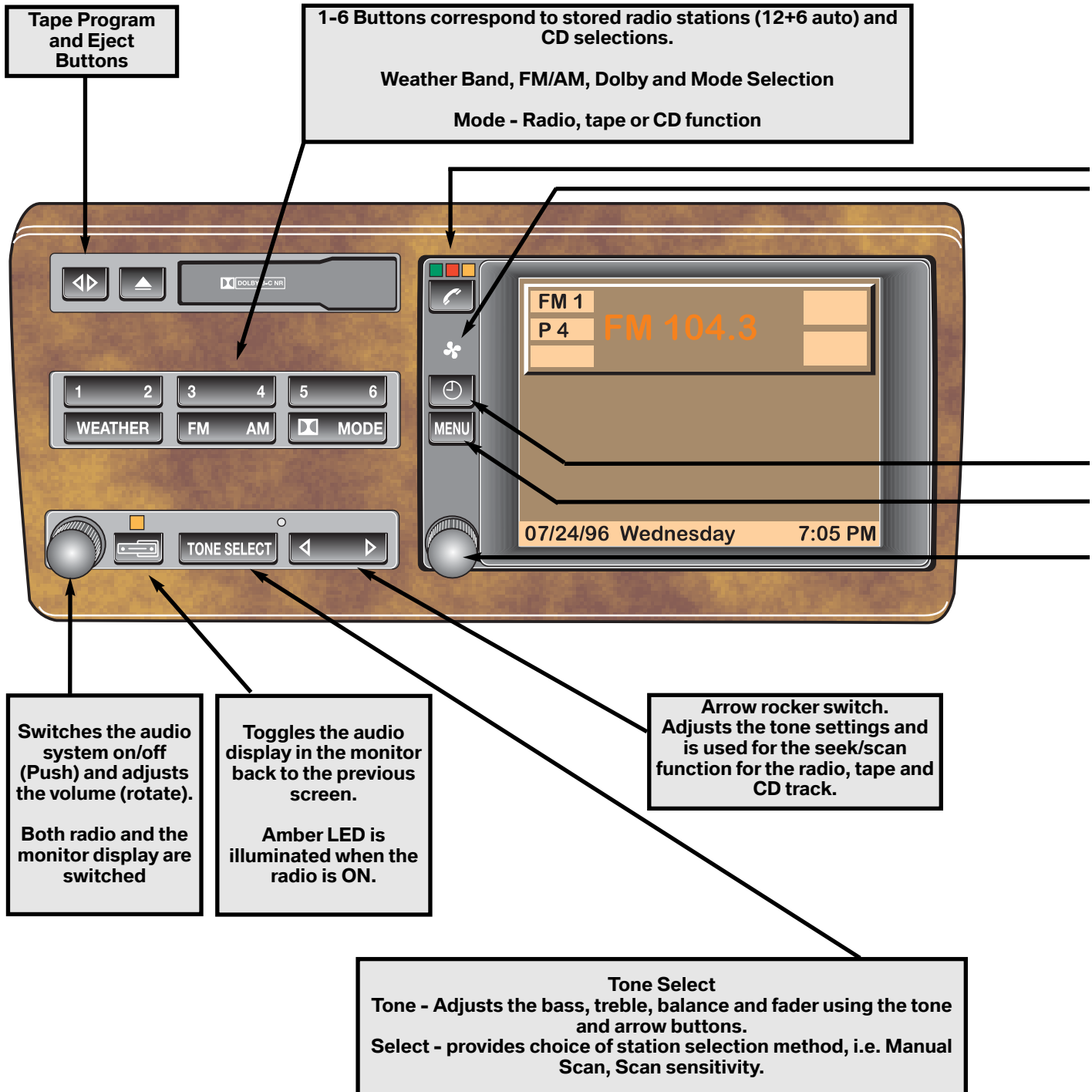


**E46 On Board Monitor** (small screen)

## On Board Monitor and Controls and Indicators

### Audio System

Operation of the audio system (radio/tape/CD) is similar to current systems installed in other models. The major difference is that the display of stations and settings is through the LCD panel.



**Send/End Button** - As on previous systems this button sends the call to the displayed telephone number in the On Board monitor display or ends the current call.

The telephone LED's correspond the MID equipped vehicles:  
Green = Phone call in progress  
Red = Phone is on  
Amber = Steady - Roaming is same type system as home system  
Flashing - Roaming in different type of system as home system

**Fan Symbol** - Flashing indicates the parked car ventilation system is programmed for activation. A steady LED indicates that the parked car ventilation is currently ON.

**Clock button** - Displays the time with the key switched OFF. Additionally, this button also switches the parked car ventilation system to off when it is on.

#### Menu Button

The menu button is used to call up the main menu show at the right.

This menu provides access to all of the On Board Monitor functions including:



#### Rotary Knob

**Push** - Switches the monitor ON or activates the selected program displayed in the monitor.

**Rotate** - Selects the desired function for programming or display.  
Adjusts the various settings of any function

## On Board Monitor Functions

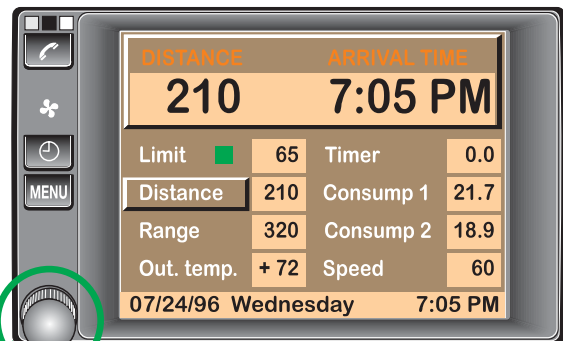
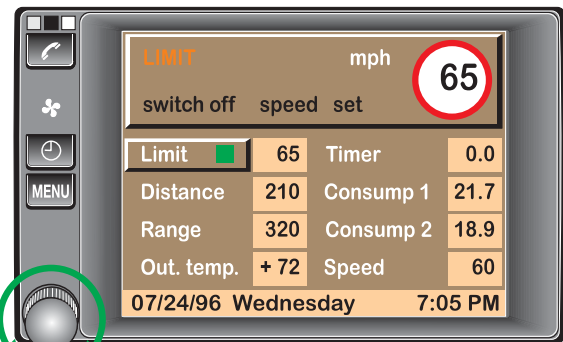
The following On Board Monitor functions are a guide to the basic operation of these functions. Due to changes between systems and versions of software, always refer to the later service information

## On Board Computer

The functions of the On Board Computer remain the same as previous systems. All On Board Computer calculations are still performed by the IKE (or cluster).

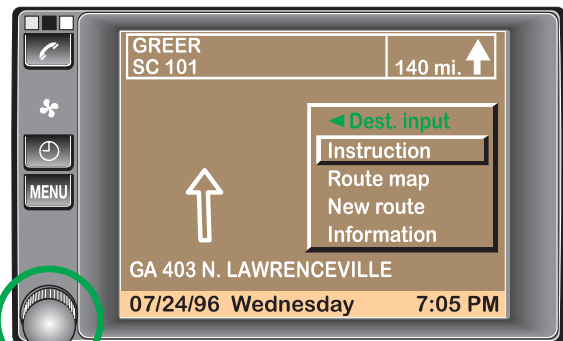
The OBC is called up from the on board Monitor main menu by highlighting the BC and pressing the knob.

Once the computer functions are displayed, all programming and resetting of the displays is carried out using the rotary knob.



## GPS Navigation

The on-board monitor provides access to the new Navigation system. The Navigation system is controlled and displayed via the on board monitor. Refer to the navigation portion of this training module for more information on navigation system operation.



## Telephone

Selecting the Telephone function on the Monitor screen will call up a rotary dial display. The telephone can be dialed with the rotary knob by turning the knob and pressing it when the desired digit is highlighted. Once the number is input, the call is initiated by pressing the send/end button at the left of the Monitor.

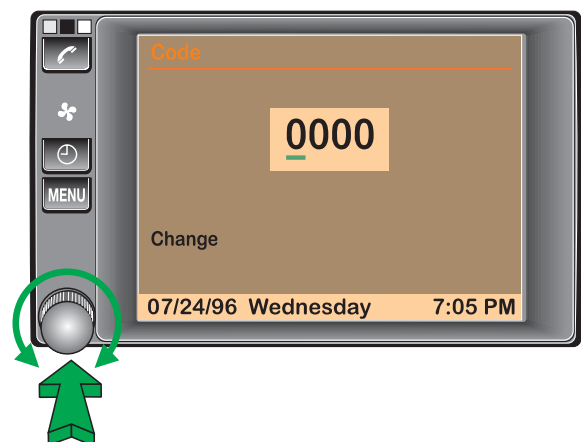
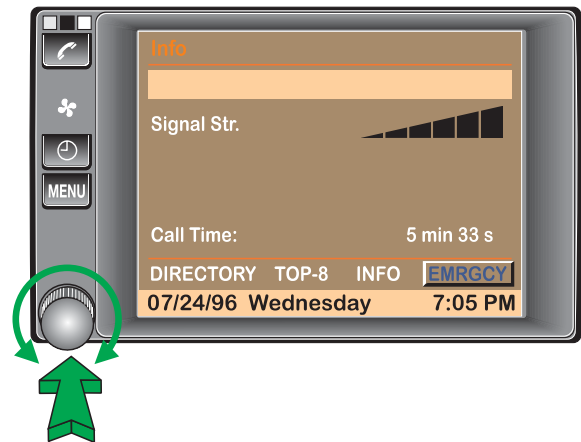
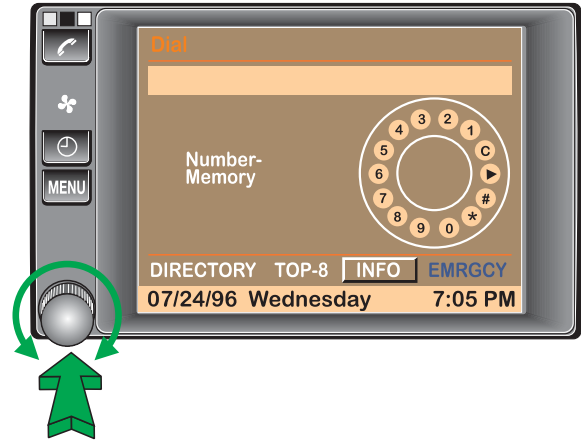
All telephone programming is carried out through the handset as on other telephone models.

Other features of the monitor telephone control include:

- Memory storage and recall
- Information on signal strength and call timer
- Top 8 number storage
- Emergency call feature
  - Displays 911 or Assist.
  - Displays the vehicles current coordinates in latitude and longitude along with the street name (if the street is on the digitized map database).

## Code Function

The familiar BC code function is carried over to the On-board Monitor system. A four digit code can be entered into the system that will disable the vehicle from starting as with previous systems.

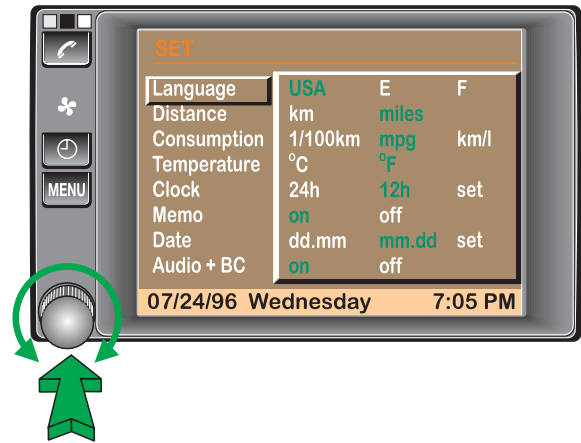


## Set Screen

The Set Menu provides the on-board monitor display set up. This includes:

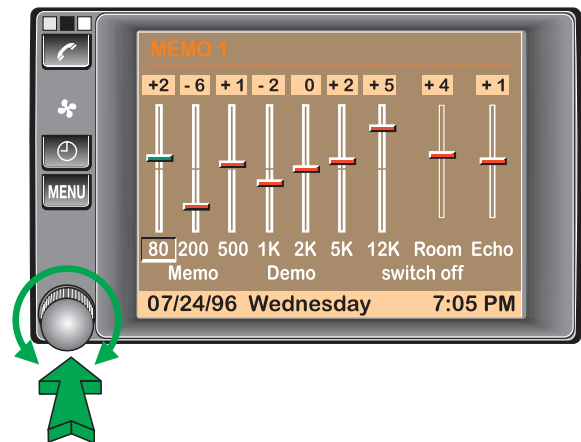
- Language Selection
- Time/date set and format
- Etc.

The “Audio+BC” selection at the bottom of the list switches the BC display off when the audio display is in the monitor.



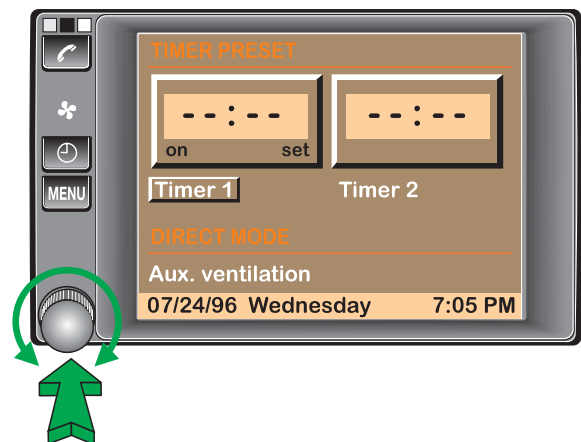
## Digital Sound Processor (DSP)

The DSP system, introduced with the E38 is now controlled and programmed through the On-board Monitor. DSP is available on the E38, E39 and E53.



## Auxiliary Ventilation

The control and programming of the auxiliary ventilation feature is done with the on-board monitor. Use the rotary knob to program the on times for system operation. This function is also referred to as “Parked Car Ventilation”.



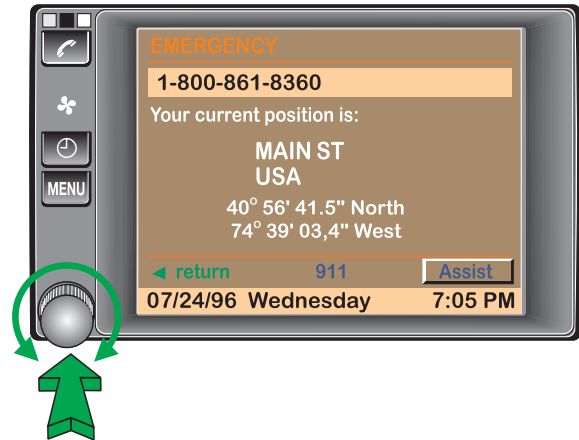
## Emergency

The Emergency function provides the exact location of the vehicle including:

- Street and Town (if on digitized map)
- Longitude and Latitude Coordinates

If the vehicle is equipped with the BMW Telephone, 911 or Assist (BMW roadside assistance) can be called directly from this screen.

If the vehicle is not equipped with the BMW Telephone the emergency program provides your location.



## Monitor OFF

Pressing the “Monitor Off” button switches the monitor to a blank screen. All programs are still functioning but not displayed in the monitor. The monitor is turned back on by pressing or turning any button on the on-board monitor.

## Mark II On Board Functions

At first glance the system looks and operates similar to the previous system. Only when looking further into the control settings and features is a change noticed.

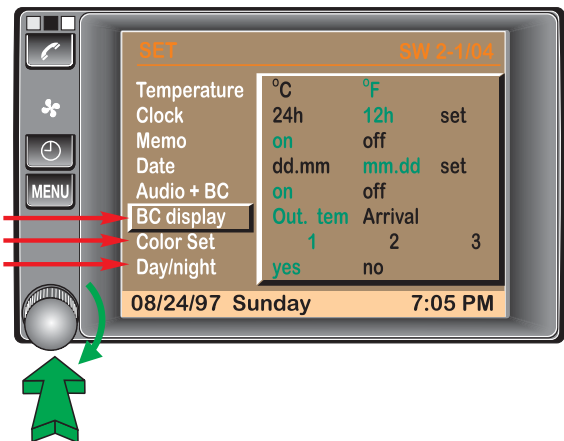
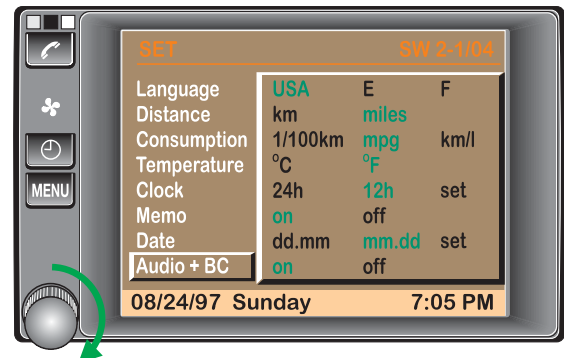
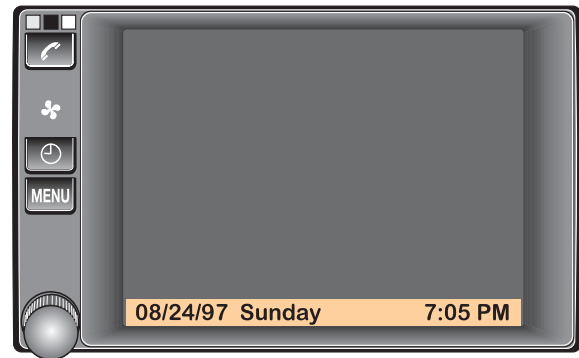
### Automatic Date/Time Display

When a door is opened the GM signals status of “door open” on the K-bus. Via the I-Bus, the IKE passes the signal onto the navigation computer which generates the RGB signals for display of the Date/Time on the bottom edge of the LCD.

The Set function of the opening menu provides additional owner customized settings for the board monitor display. After selecting set from the main menu, scroll down to the bottom of the list, an additional three items are included:

- BC display: Provides selection of either the outside temperature or estimated arrival time of the set distance set in the board computer functions. These items are displayed along with the other BC functions when the Audio and BC set function is “On”.
- Color set: Provides three set variations of screen color schemes.
- Day/night: Provides a deviation of the selected color set when the headlights are switched on.

Though subtle, these changes provide added convenience and provide the owner the opportunity to slightly customize their vehicle’s On-board monitor display.





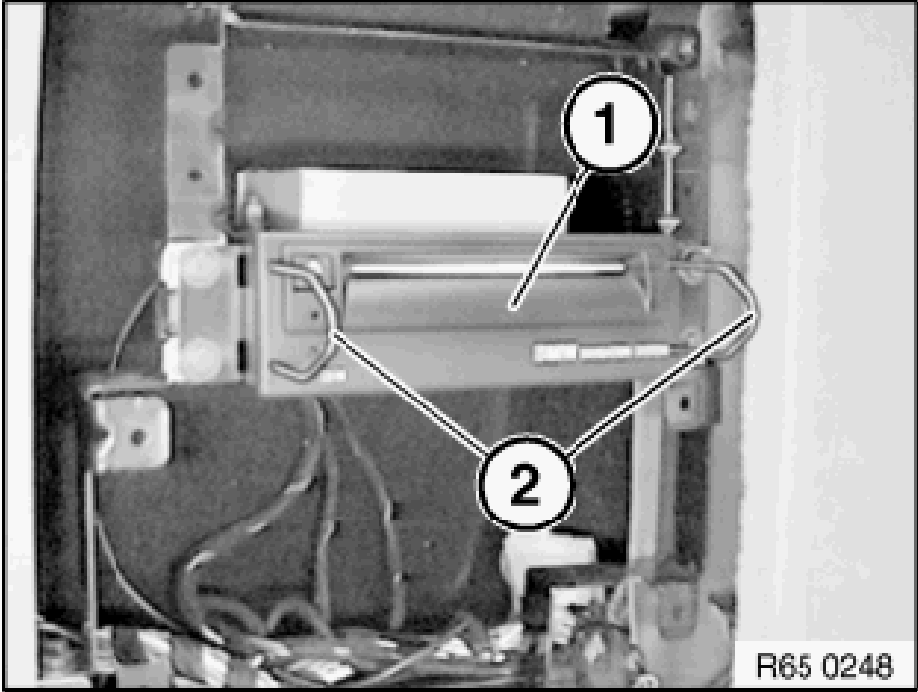
### Navigation Computer Removal

Removal of the navigation computer can be done by placing 4 small philips head screw drivers into the holes provided.

The preferred method is to use special tool number 65 5 400.



INSERT A SMALL PHILLIPS HEAD SCREWDRIVER INTO EACH HOLE













## Classroom Exercise - Review Questions

1. What is different about the GPS receiver between the Mark I, II and III systems?

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2. How can the signal provided by the gyro sensor to the navigation computer be checked?

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3. Describe how the display signals are transmitted from the navigation computer to the board monitor.

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4. What step is necessary before loading the navigation computer operating software CD on a newly replaced navigation computer? Where can the software status be confirmed after it has been loaded?

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5. How is the VIN entered into the navigation computer?

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## Classroom Exercise - Review Questions

6. List the most significant changes made to the Mk-3 navigation computer over the previous Mk-2.

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7. What is the difference between the “magnetic field sensor” (compass) and the gyro sensor? What systems use each of these sensors?

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8. What is (was) ARCNET and why systems is it used on?

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9. How is the navigation computer removed?

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10. What are some of the advantages of the “widescreen” navigation system?

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