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MULTIPLE RESTRAINT SYSTEM (MRS III)

INTRODUCTION

The X5 is equipped with the Multiple Restraint System (MRS III) which employs the use of "SMART" technology. Smart technology refers to the control module's programming which allows for the deployment of the airbags, in stages, depending on the severity of the impact. Two stage airbags are used for both the driver and front passenger which allows for a softer cushioning effect when the bags are triggered at lighter impacts.

The MRS III system is installed in E38/E39 and E46 Sedan vehicles as of 3/99 production and in E46 Coupes as of 6/99 production.

MRS III control modules are manufactured by either Bosch or Temic. While the functional operation of both modules are the same. The control modules are not interchangeable from a replacement standpoint. Always refer to the EPC parts system to ensure that the proper module is installed in the vehicle.

In addition to the use of two stage airbags for the driver and passenger, the following features are also included in the MRS III system:

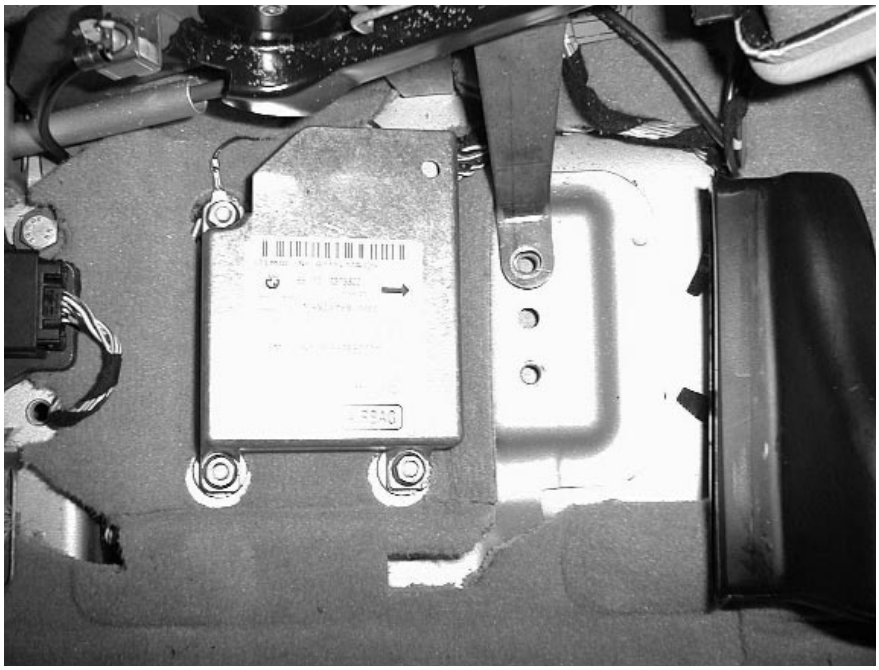
- The MRS III control module is linked to the K-Bus for coding and diagnosis.
- The MRS III includes a fuel pump cut off feature in the event of an airbag deployment.
- Inert gas generators are now used for all air bags and seat belt tensioners.
- The inert gas is a mixture of hydrogen (13.5%) and oxygen (86.5%).

COMPONENTS

MRS III CONTROL MODULE

The control module is mounted in the center console area on the driveshaft tunnel below the center storage box. The X5 will use the TEMIC system that can be recognized by the green 50 pin connector on the module.

The control module contains the processing electronics (Smart Technology) for triggering of all air bags and pyrotechnic devices installed in the vehicle. Two electronic deceleration sensors are installed in the module for crash or impact detection.

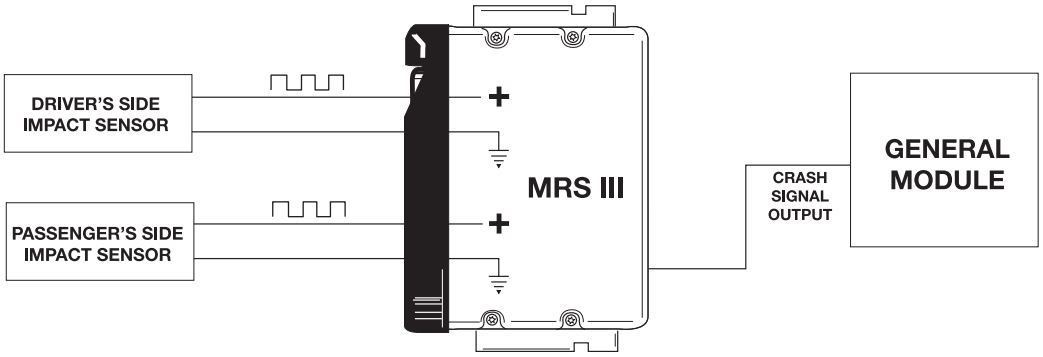


COMPONENTS

SATELLITE SENSORS

The satellite sensors are mounted below the driver's and passenger's front seats on the seat frame. The function of the sensors is to detect the severity of side impacts and signal the MRS III control module, through a pulse modulated signal, in the event of a crash. The control module uses this input signal along with its internal impact sensor signal to determine the deployment of the side/head airbags.

As with the control modules, the satellite sensors are manufacturer specific. The Temic sensors in the X5 have a three wire connector which will not interchange with the Bosch sensors. Only two of the wires are used for the satellite sensor's operation. The signal for deployment of the bags is carried over the power wire of the sensor.



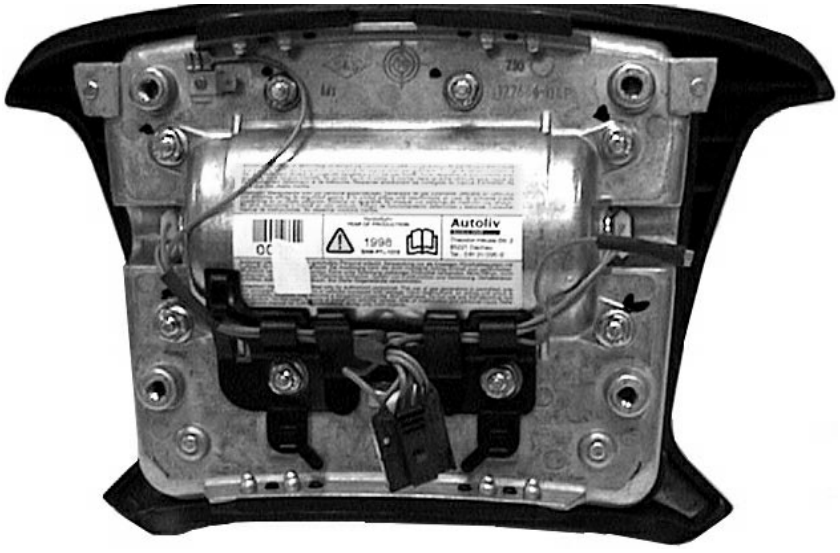
COMPONENTS

DRIVER'S FRONT AIRBAG

With the MRS III system, the driver's front airbag becomes a two stage bag similar to the passenger's front side bag, introduced on the 1999 model E38/E39s. The complete assembly is mounted beneath the cover in the center of the steering wheel as with previous airbags. The assembly now contains the inert gas generator chamber and two ignition stages (ignitors).

The airbag consists of:

- Accumulator/gas generator
- Two ignition capsules
- Propellant gas - 13.5% hydrogen/86.5% oxygen
- 64 liter airbag

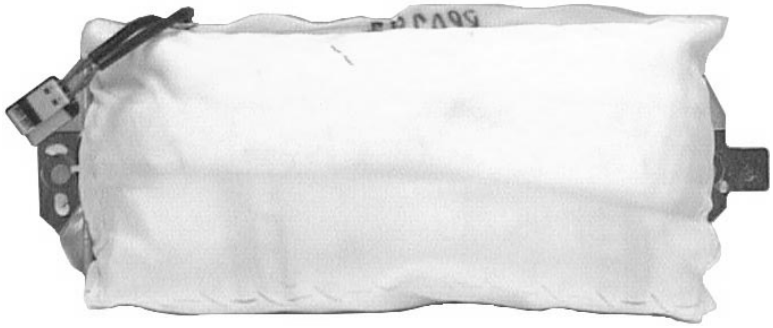


COMPONENTS

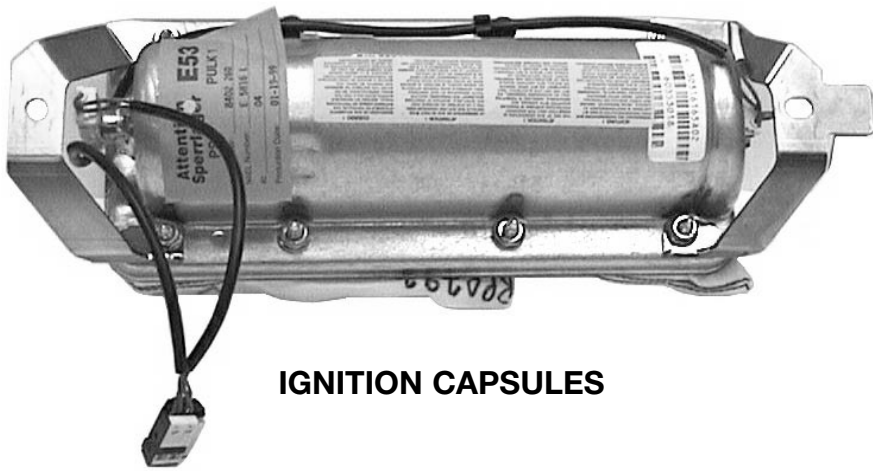
PASSENGER'S FRONT AIRBAG

The passenger's front airbag is the same unit as installed on E38/E39 vehicles as of 9/98 production. The passenger's airbag consists of:

- Pressure accumulator/gas generator
- Two ignition capsules - for two stage activation
- Propellant gas of - 13.5% hydrogen/86.5% oxygen
- 105 liter airbag



PRESSURE ACCUMULATOR



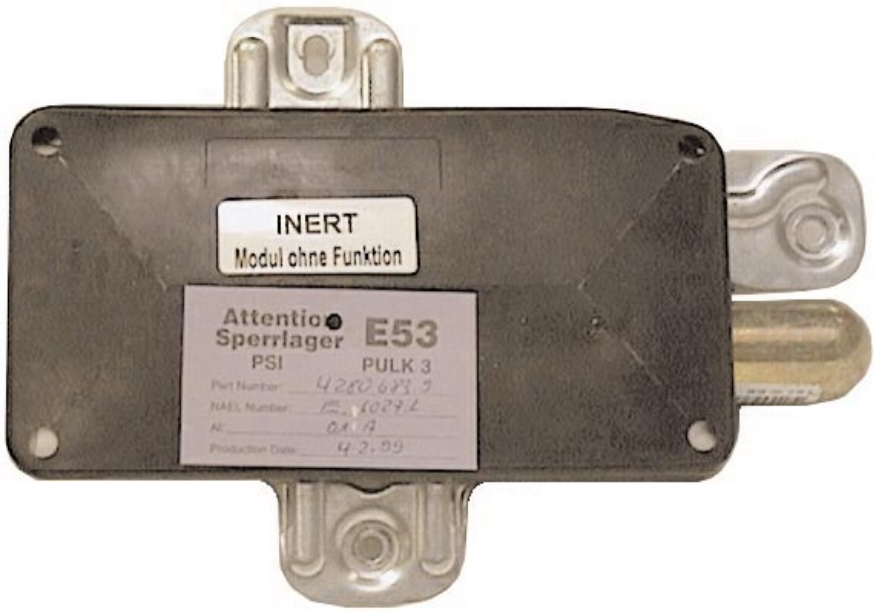
IGNITION CAPSULES

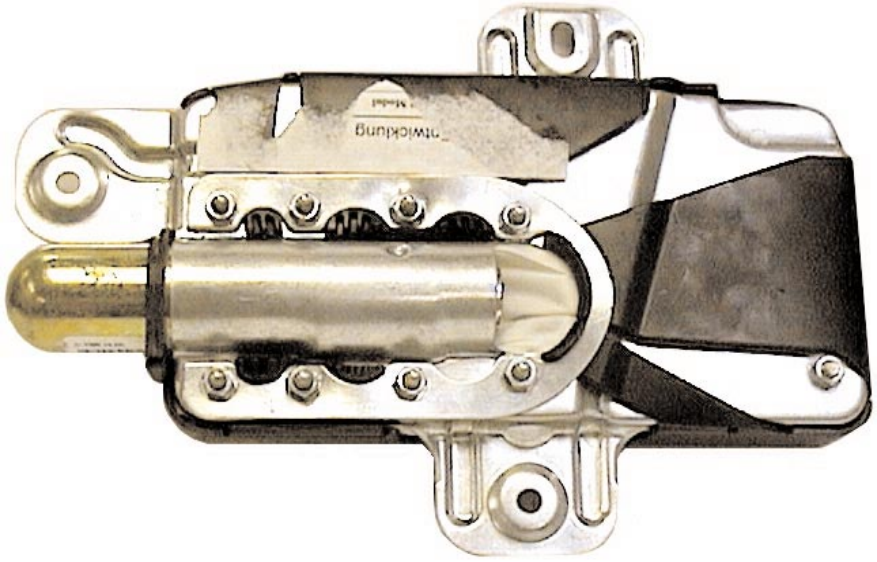
COMPONENTS

SIDE AIRBAGS FRONT/REAR (THORAX)

The side airbags continue to be mounted in the door panels on the front and rear doors. Deployment of the side airbags is dependent on the triggering thresholds programmed in the MRS III control module, based on the inputs from the satellite sensors and internal crash sensor.

The side airbags use the same cold gas inflation method as the driver's and passenger's front bags.





COMPONENTS

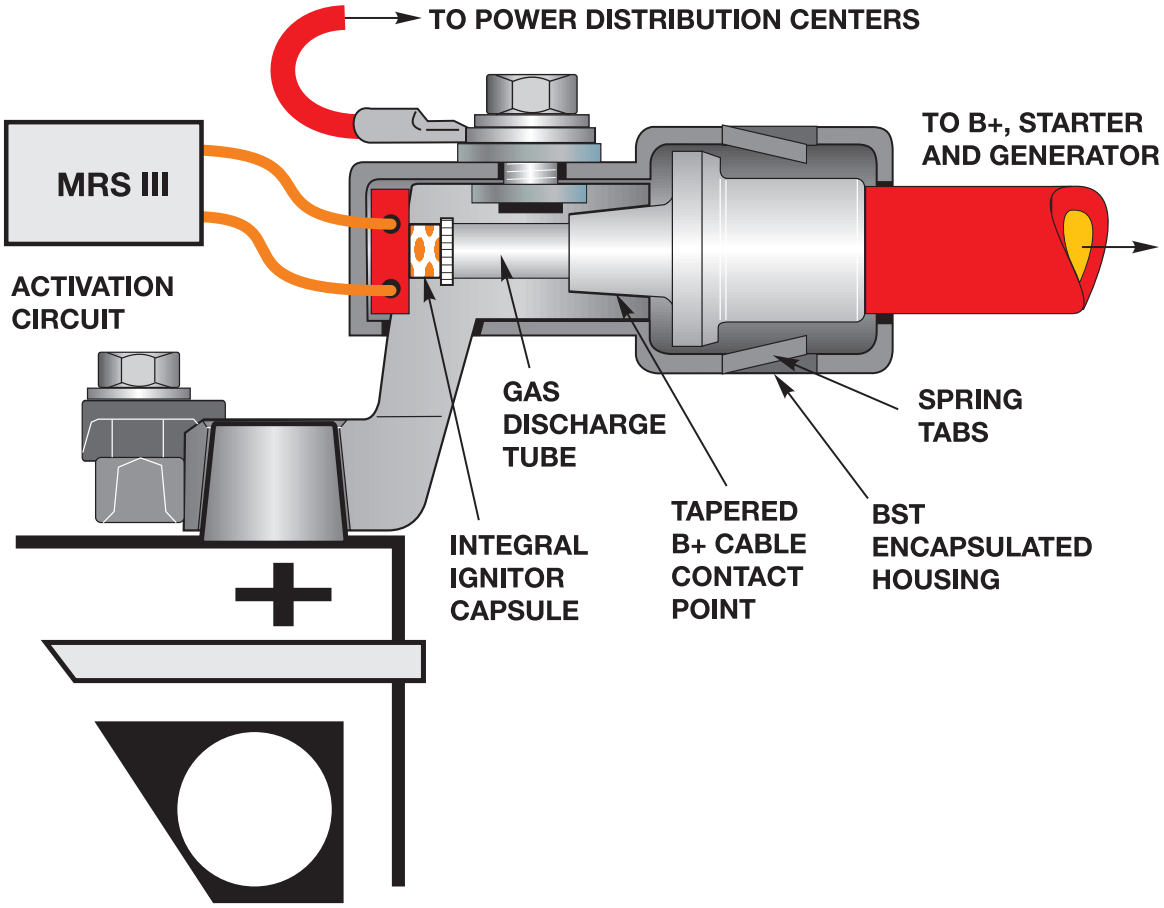
HEAD AIRBAG (ITS)

The head airbags are similar to the ITS bags used on the MRS II system. They continue to be mounted from the “A” pillar up along the headliner and are anchored behind the “B” pillar. The ITS bags of the MRS III system are also the cold gas inflation type. The head airbags are always triggered with the side (Thorax) bags.

COMPONENTS

BATTERY SAFETY TERMINAL (BST)

As with previous systems, the BST is used to disconnect the battery's "B+" connection to the engine compartment in the event of an airbag deployment. The safety measure helps prevents the possibility of a short circuit causing a fire.

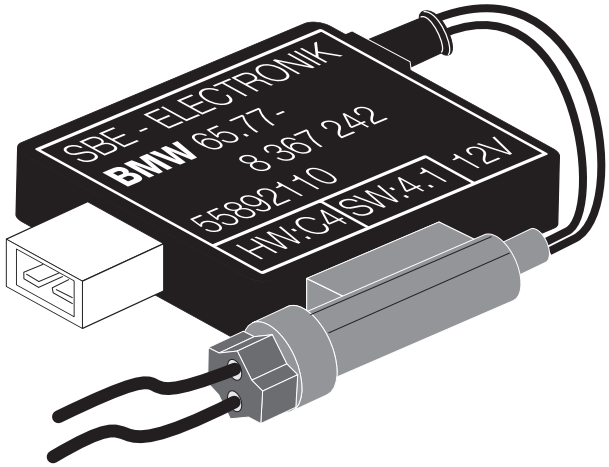


COMPONENTS

SEAT BELT TENSIONERS

The seat belt tensioners are a new design and also make use of the inert gas for triggering. The MRS III control module will deploy the seat belt tensioners based on the programmed parameters during impact.

SEAT OCCUPANCY SENSOR (SBE)



The SBE continues to be used as an input to the MRS III control module for detection of a front seat passenger. The module uses the input to determine seat belt tensioner and/or front airbag deployment.

MRS III OPERATION

As with previous systems, the triggering thresholds are programmed in the MRS III control module. These thresholds are determined by BMW through crash and vehicle testing during the design and development of the vehicle. These thresholds will vary depending on the vehicle size and design.

There are several different thresholds for airbag and safety restraint deployment including;

- Belt pre-tensioner threshold for activation of the seat belt tensioners.
- Airbag threshold #1 - the first level of activation for the two stage front airbags, always deployed first when the front triggering threshold is reached.
- Airbag threshold #2 - the second level of the two stage front airbags, can be deployed simultaneously or after a time delay, depending on the severity of the impact.
- Rear crash threshold - for activation of the seatbelt tensioners with a rear impact.
- Battery safety terminal threshold - for activation of the BST with airbag deployment.
- Side airbag/ITS threshold - for deployment of the side and thorax airbags.

MRS III OPERATION

TRIGGERING THRESHOLDS - TWO STAGE AIRBAGS

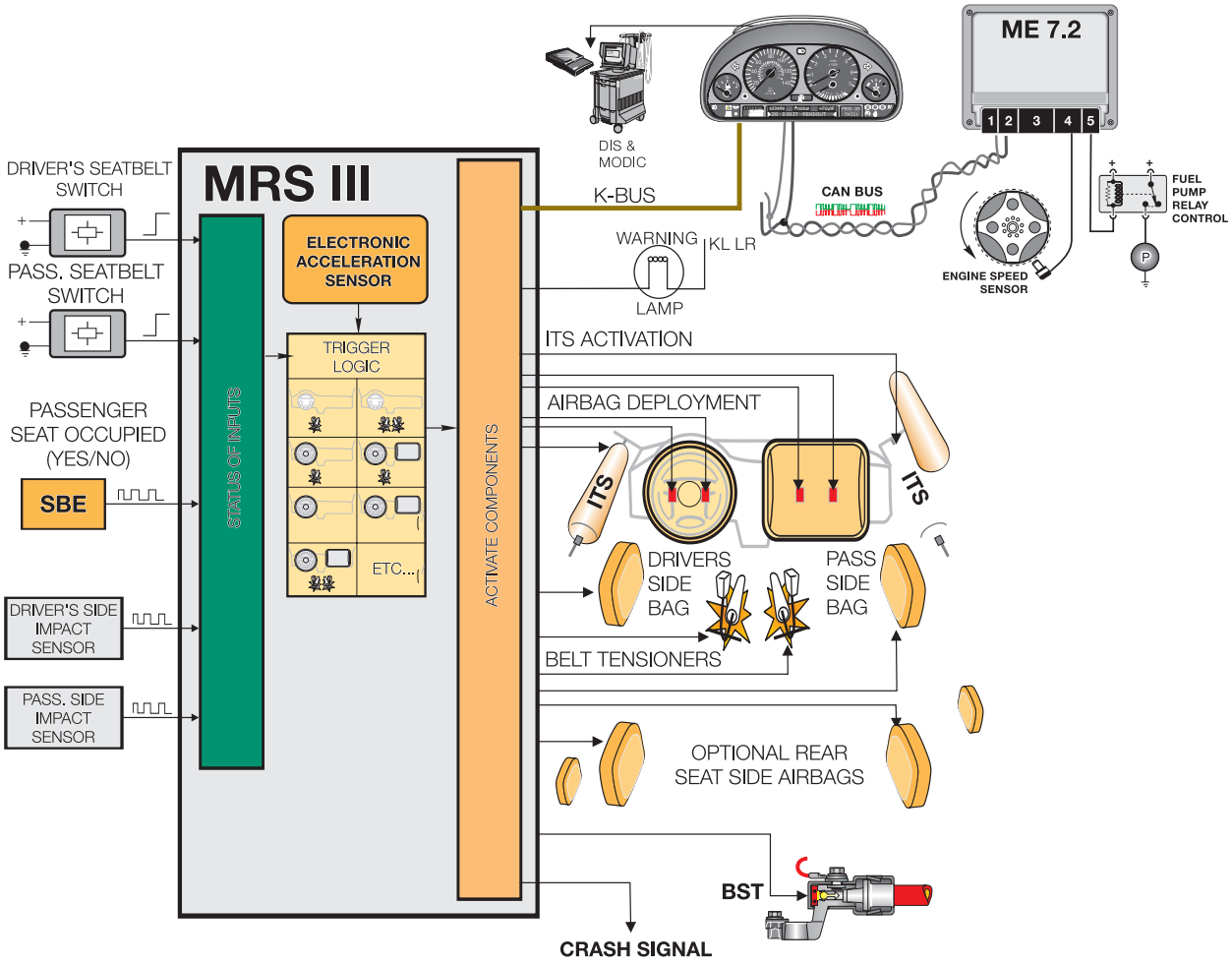
The programming of the MRS III includes four triggering thresholds for the two stage front airbags. The triggering of the front airbags is also dependent on whether the seat belts are connected and if the front passenger seat is occupied. The triggering thresholds for the two stage airbags are as follows:

THRESHOLD	NO-SEATBELT	BELTED
1	Ignition Stage 1	No Activation
2	Ignition Stage 1 & 2 with Time Delay	Ignition Stage 1
3	Ignition Stage 1 & 2 with Time Delay	Ignition Stage 1 & 2 with Time Delay
4	Ignition Stage 1 & 2 Simultaneously	Ignition Stage 1 & 2 Simultaneously

If the signal from the SBE is defective on triggering, the MRS III will deploy as if the seat is occupied.

If the signal from the seat belt contacts are defective, the MRS III will deploy as if the belts were not buckled.

MRS III I-P-O


DIS &
MODIC
ME 7.2
1 2 3 4 5
DRIVER'S SEATBELT
SWITCH
MRS III
K-BUS
CAN BUS
FUEL
PUMP
RELAY
CONTROL
ELECTRONIC
ACCELERATION
SENSOR
WARNING
KL LR
LAMP
ENGINE SPEED
SENSOR
PASS. SEATBELT
SWITCH
TRIGGER
LOGIC
ITS ACTIVATION
AIRBAG DEPLOYMENT
PASSENGER
SEAT OCCUPIED
(YES/NO)
SBE
STATUS OF INPUTS
ACTIVATE COMPONENTS
ITS
ITS
DRIVERS
SIDE
BAG
PASS
SIDE
BAG
ETC...
DRIVER'S SIDE
IMPACT
SENSOR
PASS. SIDE
IMPACT
SENSOR
BELT TENSIONERS
OPTIONAL REAR
SEAT SIDE AIRBAGS
BST
CRASH SIGNAL

TRIGGERING THRESHOLDS

SIDE AIRBAGS/ITS

The triggering thresholds for the side airbags/ITS is dependent on the signals from the satellite sensors and the crash sensor in the MRS III control module. The triggering thresholds are independent of the belt tensioners.

BELT TENSIONER

The triggering of the belt tensioners is dependent on the signal from the seat belt contact and the severity of the impact as detected by the control module.

BATTERY SAFETY TERMINAL

The BST will deploy in a frontal impact at threshold 2 or greater. The threshold for BST activation with a side impact is programmed separately in the side deployment criteria. The BST will also be deployed when the rear impact threshold is exceeded.

FUEL PUMP SHUT-DOWN

New to the MRS III system is the link via the K-Bus/CAN Bus to the Engine Control Module for deactivation of the fuel pump. The MRS III will signal the DME over the K-Bus through the instrument cluster and CAN Bus to shut off the fuel pump in the event that any crash threshold is exceeded.

DIAGNOSIS

Diagnosis and troubleshooting of the MRS III system is fault driven and can be accessed using the DIS Tester or MoDiC. The control module performs a self test of the system every time the ignition is switched on (this includes the satellite sensors and seat occupancy sensor). Any faults with the system will cause the warning lamp in the instrument cluster to remain illuminated after the engine is started.

Installation of a new or replacement control module requires ZCS coding also using the DIS or MoDiC.

When servicing or replacing any MRS III components, always follow precautionary measures outlined in the repair manual of TIS. this includes disconnecting the battery prior to any repair or maintenance work being performed.

All airbag components are part number specific by model and require verification in the EPC to ensure the correct component is being installed.