

GEM DIAGNOSTICS

Principles of Operation

Generic Electronic Module

The Generic Electronic Module (GEM) receives inputs and delivers outputs to a majority of the electronically controlled features of the vehicle.

The GEM constantly monitors the systems under its control and reports a concern in the form of a Diagnostic Trouble Code (DTC). A DTC can be retrieved with the Rotunda New Generation Star (NGS) Tester 007-0500 or equivalent through the J1850 communication network.

The GEM is a configurable module allowing additional features to be added to the vehicle. The following are the configurable features of the GEM:

- 4WD ESOE
- Remote Keyless Entry
- Overspeed Warning Chime

The following is a brief description of the input and output features of this vehicle's system and how they function. A detailed feature list for the GEM and its functions will follow directly after.

INPUTS / OUTPUTS

The GEM will interpret the inputs which come directly from components which are hardwired to the module, and in turn command the proper output which was requested, which are also hardwired to the module.

The following is a list of features/functions which the GEM controls.

- Instrument Cluster Warning Indication and Chimes.
- Front and Rear Wiper and Washers.
- One Touch Down Power Window.
- Delayed Accessory
- Interior Courtesy Lamp Control with Illuminated Light Delay.
- Keyless and Remote Entry
- Heated Backlight
- 4-Wheel Drive Electronic Shift on the Fly.

Instrument Cluster Warning Indication and Chimes

The GEM monitors and commands the hardwired inputs and outputs for the following warning lamps and chimes:

Parking Brake and Low Brake Fluid Level Indicator

The Parking Brake Switch Indicator feature is controlled by the GEM. The Parking Brake Switch is hardwired to the GEM. If the brake is not fully released or there is a concern in the braking system, the GEM will then process the message and output a visual warning to the Brake Warning Indicator.

The low brake fluid indicator feature is controlled by the GEM. The low brake fluid switch is hardwired to the GEM. If fluid level is low, the GEM will process the message and output a visual warning to the Brake Warning Indicator.

Door Ajar Indicator and Chime

The door ajar indicator and chime feature is controlled by the GEM. The driver's, passenger's doors and liftgate ajar switches are hardwired to the GEM. If any door or liftgate is sensed as being open, the module will process the message and in turn output a audible chime and a visual warning to the Door Ajar Warning Indicator.

Safety Belt Warning Indicator and Chime

The Safety Belt indicator and chime feature is controlled by the GEM. The Driver's Safety Belt switch is hardwired to the GEM. If the seat belt is sensed as being unfastened, the module will process the message and in turn output a audible chime and a visual warning to the Safety Belt Warning Indicator.

Headlamp-On warning Chime Indicator

This function provides audible warning to the operator of the vehicle that the headlamps or the parking lamps are ON.

Key-In-Ignition warning Chime Indicator

This function provides audible warning to the operator of the vehicle that the key is left in the ignition switch while the vehicle is not running and the driver's door is open.

Tone Request Chime Indicator

The Tone Request Decoder function transforms the Tone Request signal into an Air Bag audible warning chime.

EXHIBIT F

Page 1 of 3

U of Mich file 415031- 889

GEM DIAGNOSTICS

Overspeed Warning Chime Indicator

This function provides audible warning to the operator of the vehicle that the vehicle speed exceeded 74 mph. This is an configurable feature that is for an export vehicle to the Persian Gulf state region.

Wipers and Washers

Both front and rear wipers and washers are controlled by the GEM.

Front Wiper and Washers

The multifunction switch controls the front wiper/washer portion and is hardwired to the GEM. When the switch is moved to the desired position the GEM processes this information and activates one of two hardwired relays which control the front wiper motor speeds. The GEM will respond to the wiper switch inputs only when the ignition is in RUN or ACC. The intermittent wiper speed control can vary dependent upon vehicle speed. When the front wiper/washer switch is in any of the intermittent positions, the GEM will process the information from the PCM and ABS module and decrease the wiper delay time when the vehicle is above 60 MPH.

The front washer pump relay is hardwired to the GEM which will actuate the pump when the front wiper washer switch portion of the multifunction switch is engaged.

Rear Wiper and Washers

For the rear washer and wiper, there is a remote switch that is also hardwired to the GEM. This controls the rear wiper/washer portion. When the switch is moved to the desired position the GEM processes this information and activates a hardwired relay which control the front wiper motor. There is also a hardwire relay that activates the rear washer pump motor.

One Touch Down Power Window

The One Touch Down Power Window function allows the driver to completely open the window with one button press.

Delayed Accessory

This function allows power windows and moonroof to be operated for up to 10 minutes after the ignition has been turned off.

Interior Courtesy Lamp Control with Illuminated Light Delay

The Courtesy Lighting subsystem is controlled by the GEM. The GEM monitors the states of the applicable I/O and controls the courtesy lamps by providing a ground potential or open circuit at the Interior Lamp relay coil turning the courtesy lamps ON or OFF respectively.

Keyless Entry / Computer Operated Locks

Remote Entry (RKE)

This function activates the All Door Lock/Unlock Relays, the Driver's Door Unlock Relay, the Horn Relay, Park lamp Flash Relay, the Courtesy Lamp Relay, and the Rear Door Unlock Relay (Wagon versions only) in response from the RKE key fob.

Keyless Entry Keypad

The Keyless Entry (Keypad) function controls the locks and interior lighting in response to a 5-digit factory code or an optional 5-digit user programmable code entered on a keypad.

Heated Backlight

This function controls power to the Backlight heater element.

4-Wheel Drive Electronic Shift-On-The-Fly

Sleep/Awake Mode

This function controls the module's Sleep and Awake Modes. Sleep mode is entered after 45 minutes of no module input activity with Ignition Status = OFF or Key OUT. This function turns the Battery Saver Relay ON upon exiting Sleep Mode and OFF prior to entering Sleep Mode.

Battery Saver Mode

The battery voltage monitor feature of the GEM, directly monitors the battery voltage source to the module. If the GEM monitor's low voltage, the GEM will set a Diagnostic Trouble Code (DTC).

When ignition is OFF or Key is OUT, the Battery Saver Timer feature provides timed automatic shut-off of

EXHIBIT F

Page 2 of 3

U of Mich file 415031- 889

GEM DIAGNOSTICS

power to Courtesy Lamps. The Courtesy Lamps interrupt has a time-out period of 10 minutes. When the Dome Lamp Switch is in the ON state, the Courtesy Lamp will remain on until the module enters Sleep Mode (after 45 minutes, with no transitions on any of the Wake-up inputs).

Battery Under-Voltage (LOS)

Base Battery Over/Under Voltage shutdown has two levels. The first level of Battery Over/Under Voltage shutdown protects critical outputs by disabling selected GEM functions if the battery over voltage or under voltage conditions are detected. A second level of Battery Over Voltage shutdown disables all GEM functions.

EXHIBIT F

Page 3 of 3

U of Mich file 415031-887