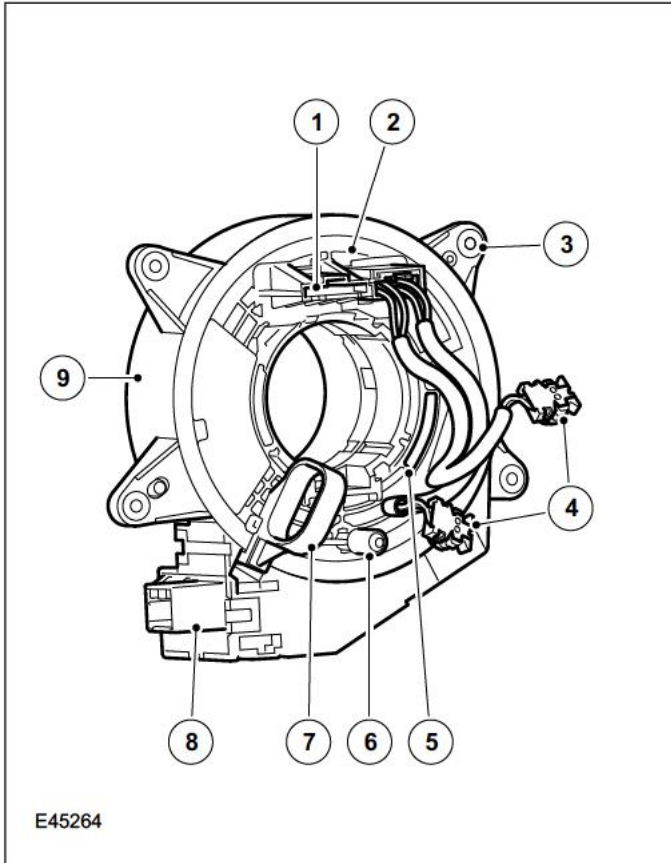


**CLOCKSPRING**



- 1 Electrical connector for steering wheel switch packs and horn
- 2 Inner rotor
- 3 Outer housing securing lug
- 4 Driver air bag link leads
- 5 Viewing window
- 6 Drive peg
- 7 Stopper
- 8 Electrical connector for steering column harness
- 9 Outer cover

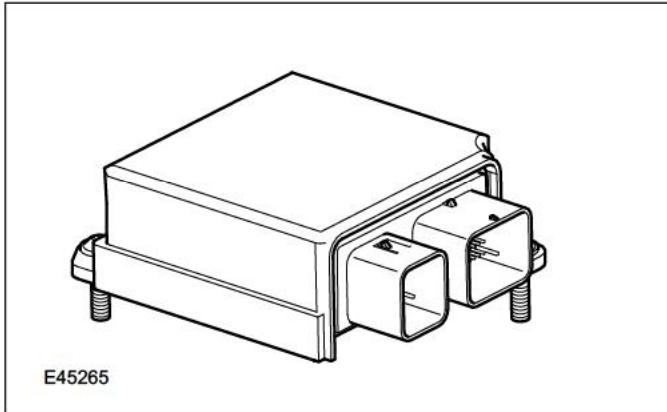
The clockspring is installed on the steering column to provide the electrical interface between the fixed wiring harness of the steering column and the components that rotate with the steering wheel, i.e. the driver air bag, the horn and the steering wheel switch packs.

The clockspring consists of a plastic cassette which incorporates an outer cover fixed to the steering column and an inner rotor which turns with the steering wheel. Four securing lugs attach the cover to the multifunction switch on the steering column. The rotor is keyed to the steering wheel by a drive peg. A lug on the underside of the rotor operates the self-cancelling feature of the turn signal indicator switch. A ribbon lead, threaded on rollers in the rotor, links two connectors on the cover to two connectors on the rotor. Link leads for the driver air bag are installed in one of the connectors on the rotor.

To prevent damage to the ribbon lead, both the steering and the clockspring must be centralized when removing and installing the clockspring or the steering wheel. The clockspring is centralized when the drive peg is at six o'clock and 50 - 100% of a yellow wheel is visible in the viewing window.

Replacement clocksprings are fitted with a stopper, which locks the cover to the rotor, in the central position. The stopper must be broken off when the replacement clockspring is installed.

## RESTRAINTS CONTROL MODULE



The restraints control module is installed on the top of the transmission tunnel, in line with the 'B' pillars, and controls operation of the SRS. The main functions of the restraints control module include:

- Crash detection and recording.
- Air bag and pretensioner firing.
- Self test and system monitoring, with status indication via the air bag warning lamp and non volatile storage of fault information.

A safing sensor in the restraints control module provides confirmation of an impact to verify if air bag and pretensioner activation is necessary. A roll-over sensor monitors the lateral attitude of the vehicle. Various firing strategies are employed by the restraints control module to ensure that during an accident only the appropriate air bags and pretensioners are fired. The firing strategy used also depends on the inputs from the safety belt switches and the occupant monitoring system.

An energy reserve in the restraints control module ensures there is always a minimum of 150 milliseconds of stored energy available if the power supply from the ignition switch is disrupted during a crash. The stored energy is sufficient to produce firing signals for the driver air bag, the passenger air bag and the safety belt pretensioners.

When the ignition is switched on the restraints control module performs a self test and then performs cyclical monitoring of the system. If a fault is detected the restraints control module stores a related fault code and illuminates the air bag warning indicator. The faults can be retrieved by T4 on a dedicated link between the restraints control module and the diagnostic socket. If a fault that could cause a false fire signal is detected, the restraints control module disables the respective firing circuit, and keeps it disabled during a crash event.

### Inputs and Outputs

Control module connector pin-out details are available in the Workshop Manual – Description and Operation.

## SRS OPERATION

### General

In a collision, the sudden deceleration or acceleration is measured by the safing sensor in the restraints control module and by the impact sensors. The restraints control module evaluates the readings to determine the impact point on the vehicle and whether the deceleration/acceleration readings exceed the limits for firing any of the air bags or pretensioners. During a collision, the restraints control module only fires the air bags and pretensioners if the safing sensor confirms that the data from the remote sensor(s) indicates an impact limit has been exceeded. The restraints control module also monitors the vehicle for a roll-over accident using the internal roll-over sensor and high speed CAN bus messages from the Anti-lock Brake System (ABS) module and the steering angle sensor.

The restraints control module incorporates the following impact thresholds to cater for different accident scenarios:



- Front impact, pretensioners.
- Front impact, driver and passenger air bags stage 1, belt unfastened.
- Front impact, driver and passenger air bags stage 2, belt unfastened.
- Front impact, driver and passenger air bags stage 1, belt fastened.
- Front impact, driver and passenger air bags stage 2, belt fastened.
- Rear impact.
- LH side impact.
- RH side impact.
- Roll-over.

The front impact thresholds increase in severity from pretensioners, through to driver and passenger air bag stage 2, belt fastened.

### Firing Strategies

The seat belt pretensioners are fired when either the pretensioner impact limit or the roll-over limit is exceeded. The restraints control module only fires the pretensioners if the related safety belt is fastened. For the front passenger pretensioner to fire, the seat must also be occupied by a large person, i.e. someone over a given weight.

The driver and passenger air bags are only fired in a frontal impact that exceeds the stage 1 threshold. Both stages of the inflator in the driver and passenger air bags are fired. At impacts between the stage 1 and 2 thresholds, the delay between the firing of the two stages varies with the severity of the impact; the more severe the impact the shorter the delay. At stage 2 impact thresholds and above, the two stages of the inflator are fired almost simultaneously. The passenger air bag is disabled unless the front passenger seat is occupied by a large person. The

time delay between firing the two stages of the inflator in the driver air bag is increased if the driver seat is forward of the seat position sensor switching point.

If there is a fault with a safety belt buckle sensor, the restraints control module assumes the related safety belt is fastened for the pretensioner firing strategy and unfastened for the driver and passenger air bag firing strategies. If there is a fault with the occupant detection system, or if there is a fault with the passenger air bag deactivation switch, the restraints control module increase the time delay between firing the two stages of the inflator in the passenger air bag.

If a side impact limit is exceeded, the restraints control module fires the side air bag and the side air curtain(s) on that side of the vehicle. If the side impact limit on the front passenger side of the vehicle is exceeded, the restraints control module also evaluates the input from the occupant classification system, and fires the side air bag only if the front passenger seat is occupied by a large person.

The side air curtain(s) on both sides of the vehicle are fired if the roll-over limit is exceeded.

If multiple impacts occur during a crash event, after responding to the primary impact the restraints control module will output the appropriate fire signals in response to any further impacts if unfired units are available.

### Crash Signal

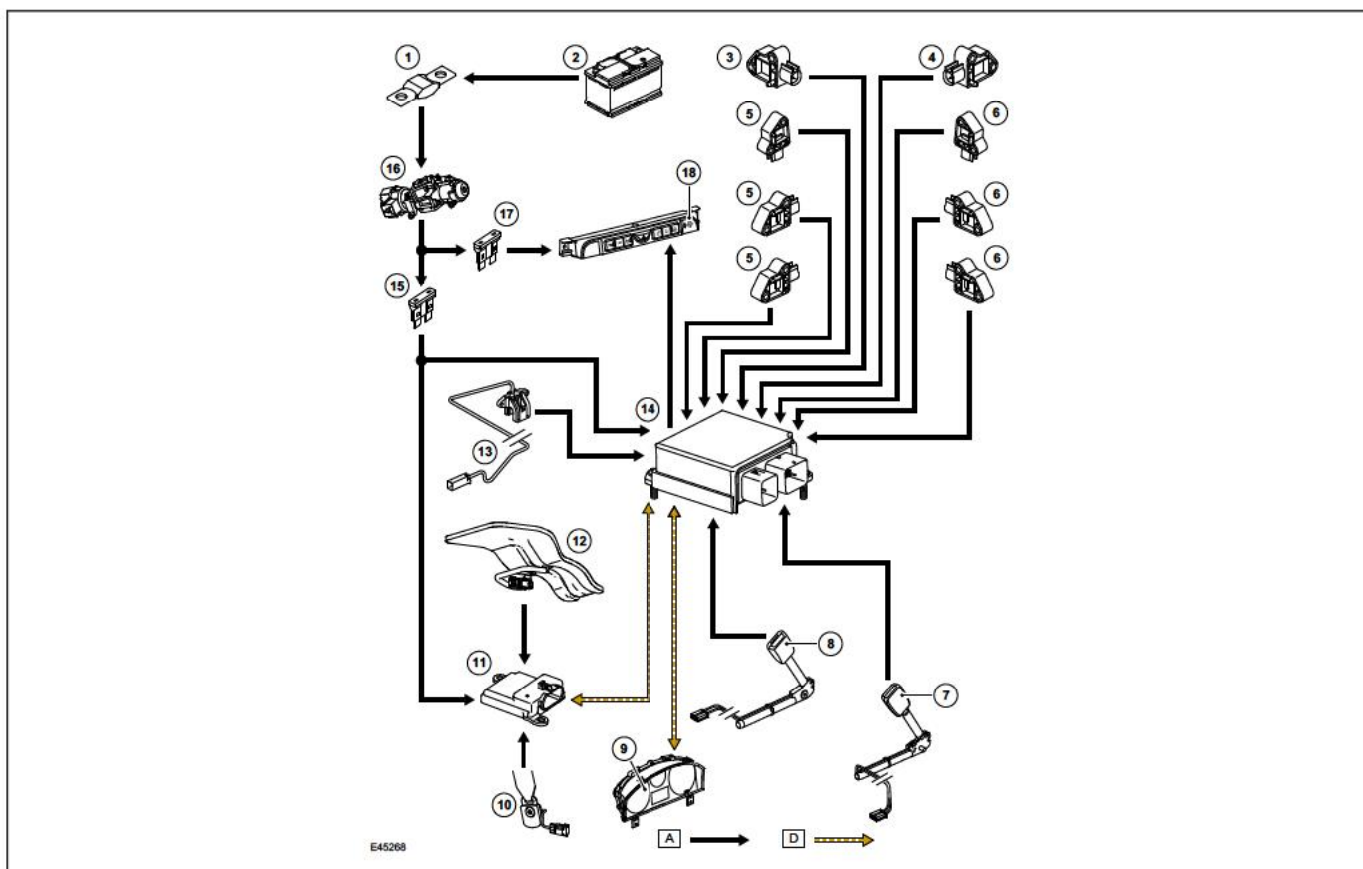
When the restraints control module outputs any of the fire signals, it also outputs a hard wired crash signal to the Engine Control Module (ECM) and changes the high speed CAN bus output message from 'no crash' to 'crash condition'. The high speed CAN bus message is used by the Central Junction Box (CJB).

On receipt of the crash signals:

- The ECM disables the fuel pump.
  - The CJB enters the crash mode and:
    - Activates all of the unlock signals of the vehicle locking system, even if the vehicle is already unlocked. After 3 seconds, the CJB activates the unlock signals again, in case a lock button is pressed during the crash, by flailing limbs for example.
    - Ignores all locking and superlocking inputs until the crash mode is cancelled, when it returns the locking system to normal operation.
  - Activates all of the courtesy lamps, except for the approach lamps. The activated courtesy lamps remain on until they are manually switched off at the lamp unit, or the CJB crash mode is cancelled, when they return to normal operation.
  - Activates the hazard warning lamps. The hazard warning lamps remain on until cancelled by turning the ignition switch from position II to position I or 0, or until the crash mode is cancelled.
- The crash mode is cancelled by cycling the ignition switch.

SRS CONTROL DIAGRAMS

FIGURE 1 OF 2



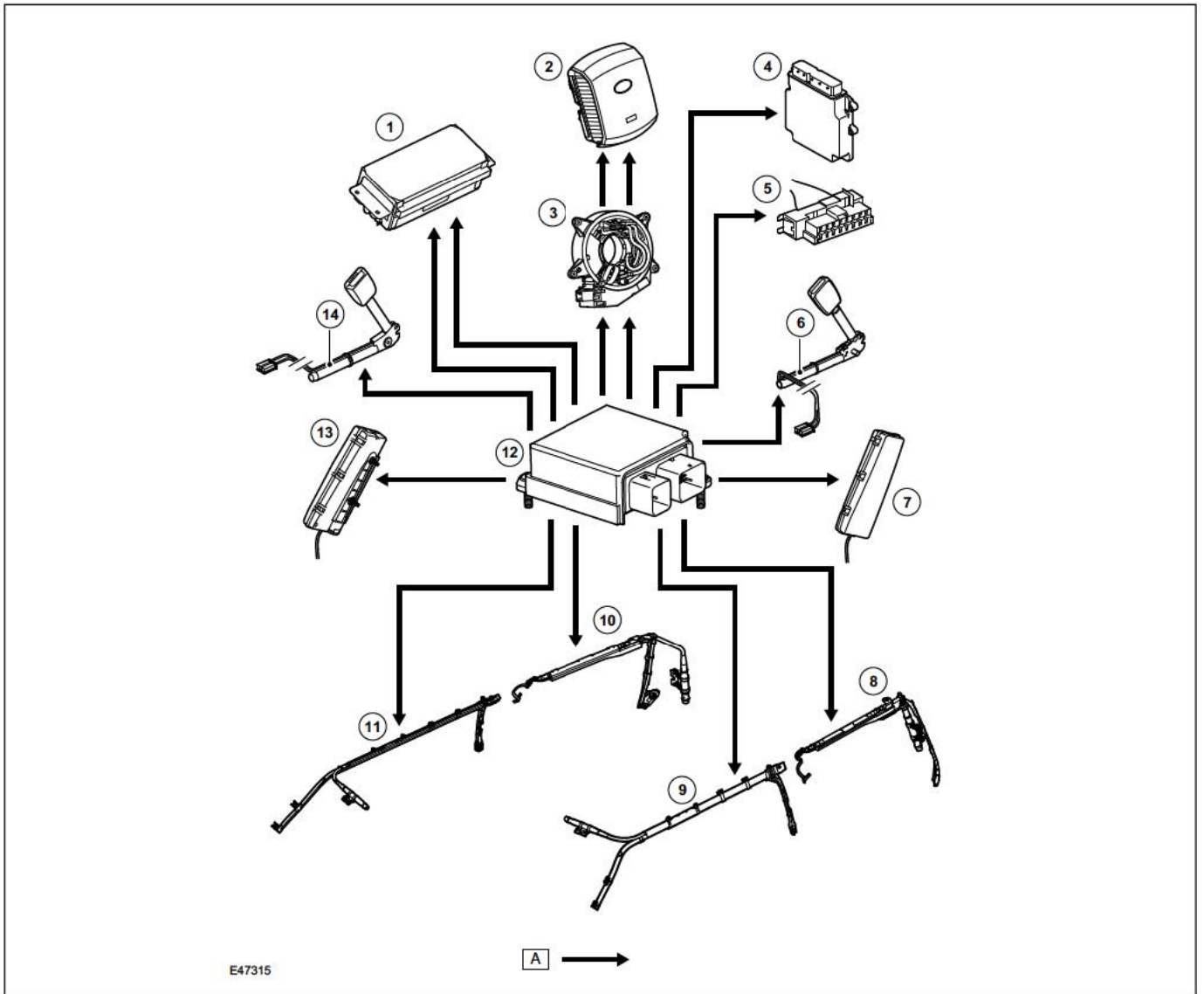
A Hardwired

D High speed CAN bus

- |      |  |    |  |
|------|--|----|--|
| 1    | Fusible link 11E, battery junction box | 12 | Pressure pad and sensor                  |
| 2    | Battery                                | 13 | Seat position sensor                     |
| 3, 4 | Front impact sensors                   | 14 | Restraints Control Module                |
| 5, 6 | Side impact sensors                    | 15 | Fuse 9P, central junction box            |
| 7, 8 | Safety belt buckle switches            | 16 | Ignition switch                          |
| 9    | Instrument cluster                     | 17 | Fuse 68P, central junction box           |
| 10   | Safety belt tension sensor             | 18 | Passenger air bag deactivation indicator |
| 11   | Occupant classification module         |    |  |



FIGURE 2 OF 2



- |   |                   |    |   |
|---|-------------------|----|---|
| A | Hardwired         | 8  | Left third row side air curtain             |
| 1 | Passenger air bag | 9  | Left first and second row side air curtain  |
| 2 | Driver air bag    | 10 | Right third row side air curtain            |
| 3 | Clockspring       | 11 | Right first and second row side air curtain |
| 4 | ECM               | 12 | Restraints Control Module                   |
| 5 | Diagnostic socket | 13 | Right side air bag                          |
| 6 | Left pretensioner | 14 | Right pretensioner                          |
| 7 | Left side air bag |    |   |