BL – AIR BAG



OBJECTIVES OF SUBJECT

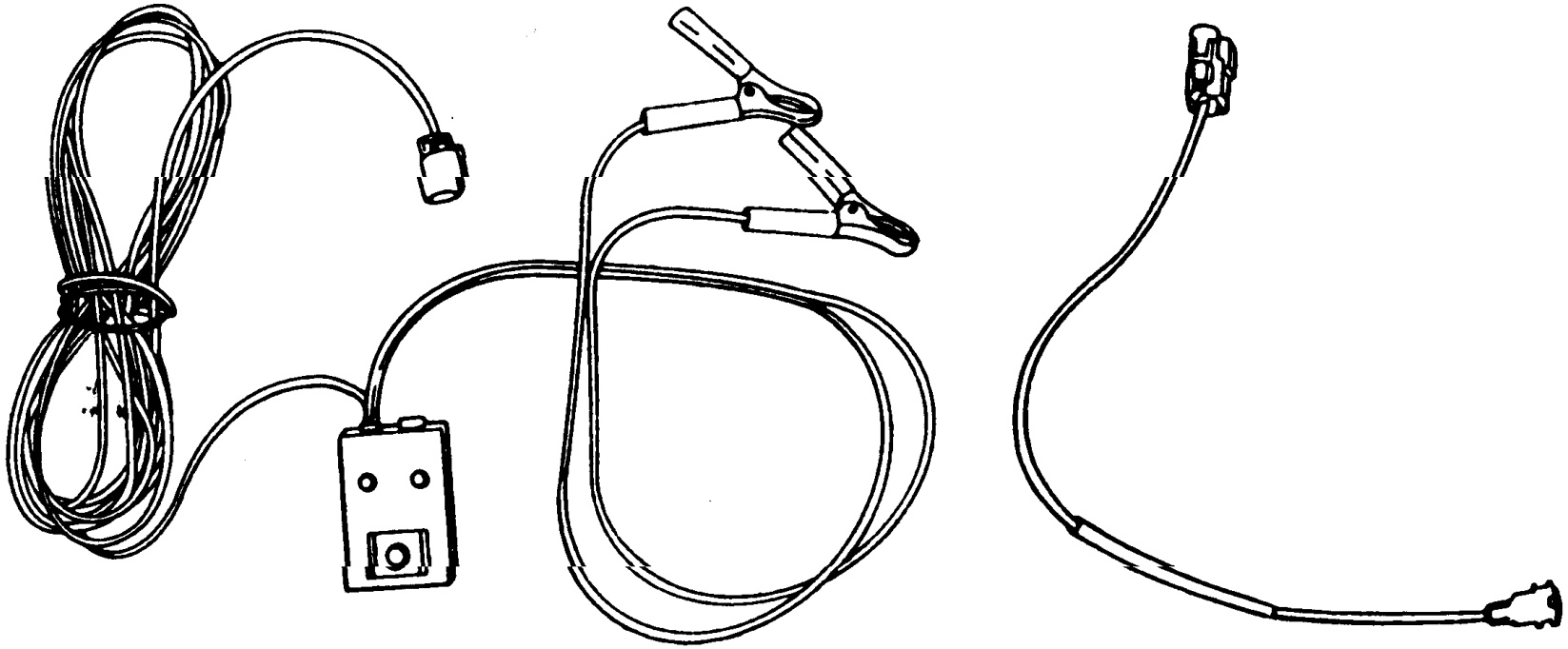
- To understand on A/Bag System
- Operation of Each components
- Diagnosis
- Diagnostic trouble codes
- Troubleshooting

CAUTIONS

Service procedure

- Make sure that ignition is on off position.
- Disconnect the battery (-) terminal and, make sure it does not come into contact with the body.
- Wait for about 1 minute.
- Pull off the plug from the connector at DAB,PAB,CAB,BPT.
- Never attempt to disassemble and repair the A/Bag modules

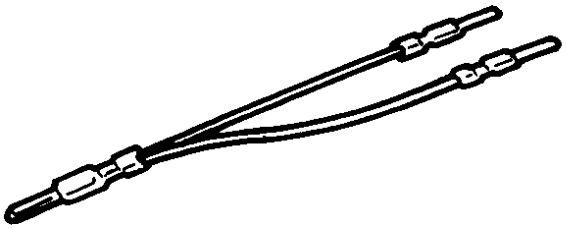
Special Service Tool (1)



Deployment tool (0957A-34100A)

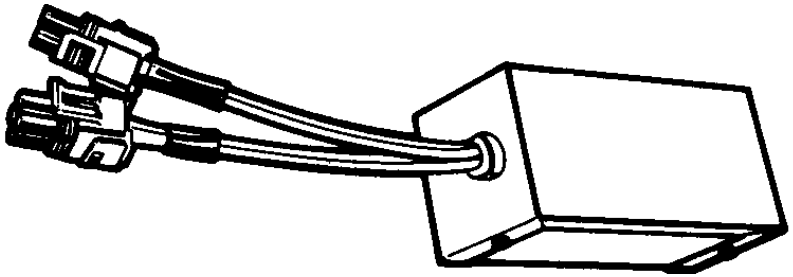
- **Deployment of undeploy airbag module**
- **SRSCM DEPLOYMENT ADAPTER HARNESS**
  DAB,BPT: 0957A - 38500
  PAB: 0957A – 38100

Special Service Tool (2)



Diagnosis check wire

0957A - 38000



Dummy
0957A - 38200

Dummy adapter
DAB, BPT: 0957A - 38400
PAB: 0957A - 38300

Special Service Tool (3)

		
Dummy adapter **0957A – 38300** **Adapter to connect PAB**	**Dummy adapter** **0957A - 38400** **Adapter to connect BPT**	**Deployment adapter** **0957A - 38100** **(Use with 0957A - 34100A)**

FUNCTIONS OF AIRBAG

- Absorbs kinematics energy of occupants.
- Protects occupants from interior trims.
- Protects occupants from broken glass.
- Reduces occupants neck load by kinematically restraining spin of neck.

Depowered Air bag

March 1997, NHTSA in U.S.A. announced that vehicle manufacturers can depower (reduce the inflation pressure) all airbags so that they inflate less aggressively.

* Depowering of 20 to 35 percent of the severity (inflator)
* Purpose of ensuring the female and child
* Added the neck injury criteria

- Flexion Bending Moment	190 Nm
- Extension Bending Moment	57 Nm
- Axial Tension	3300 peak N
- Axial Compression	4000 peak N
- Fore-and-after Shear	3100 peak N

* Widely plan to apply to 98MY
* Be allowed until Aug. 31, 2001.

OPERATING SEQUENCE

- CRASH
- CRASH SENSING
- IGNITION THE INFLATOR
- PRODUCE GAS TO DEPLOY AIRBAG
- BAG DEPLOYING
- FULL DEPOLYMENT OF THE BAG
- PROTECT THE FRONT OCCUPANTS
- VENT GAS (BAG DEFLATION)
- AIR BAG SYSTEM COMPLETED

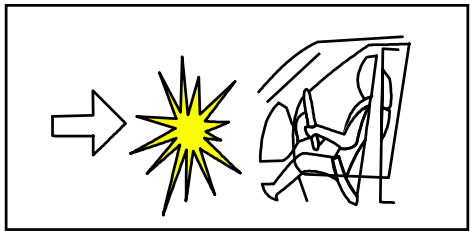
AIRBAG - GENERAL

AIRBAG SYSTEM OPERATING SEQUENCE

Crash

Crash Sensing

3m Sec



Ignite the Inflator

Produce Nitrogen Gas to Inflate the Bag

Bag Deploying

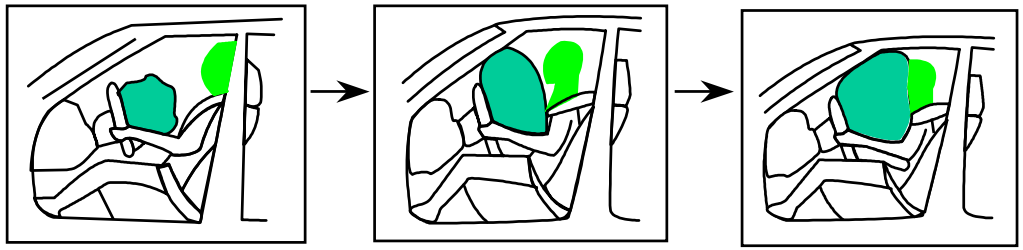
Full Deployment of the Bag

Protect the Occupants

20m Sec

35m Sec

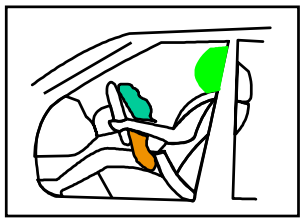
40m Sec



Vent Gas (Bag Deflation)

Airbag System Completed

105m Sec



Characteristics of A/Bag BL

- SMART A/BAG
  - -DAB (Two Squib)
  - -PAB (Two Squib)

- Curtain Air Bag
- Front Impact Sensor
- Side Impact Sensor
- Seat Track Sensor

Application

Type 01 : DAB +(2) BPT + BS

Type 02 : DAB + PAB +(2) BPT + BS

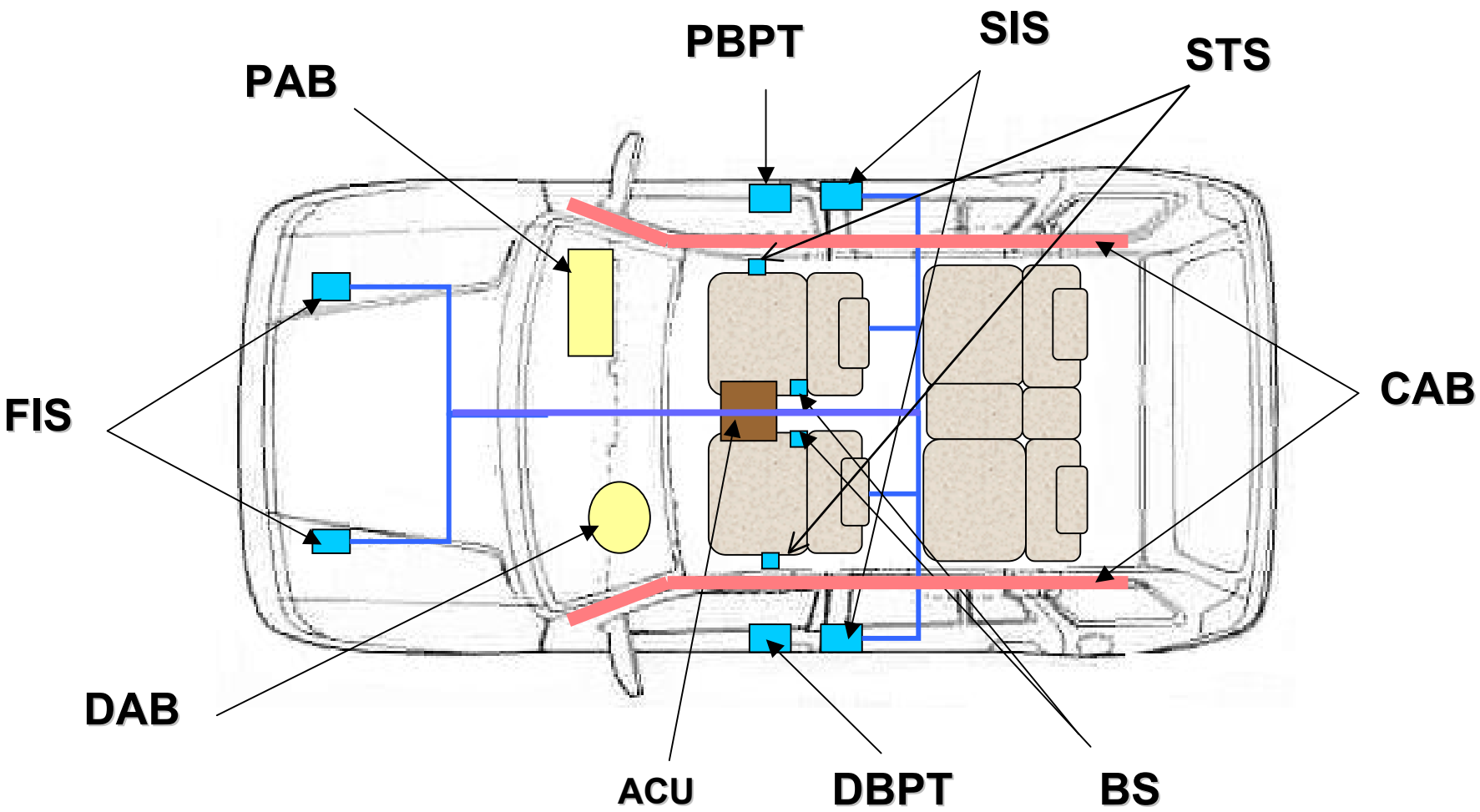
Type 03 : DAB + PAB + (2)BPT + BS + CAB

Type 04 : 2 DAB + 2 PAB + (2)BPT + BS

Type 05 : 2 DAB + 2 PAB + (2)BPT + BS + (2)CAB

- DAB: Driver Airbag
- PAB: Passenger Airbag
- CAB: Curtain Airbag
- BPT: Belt Pretensioner
- BS: Buckle Switch

Components , Location

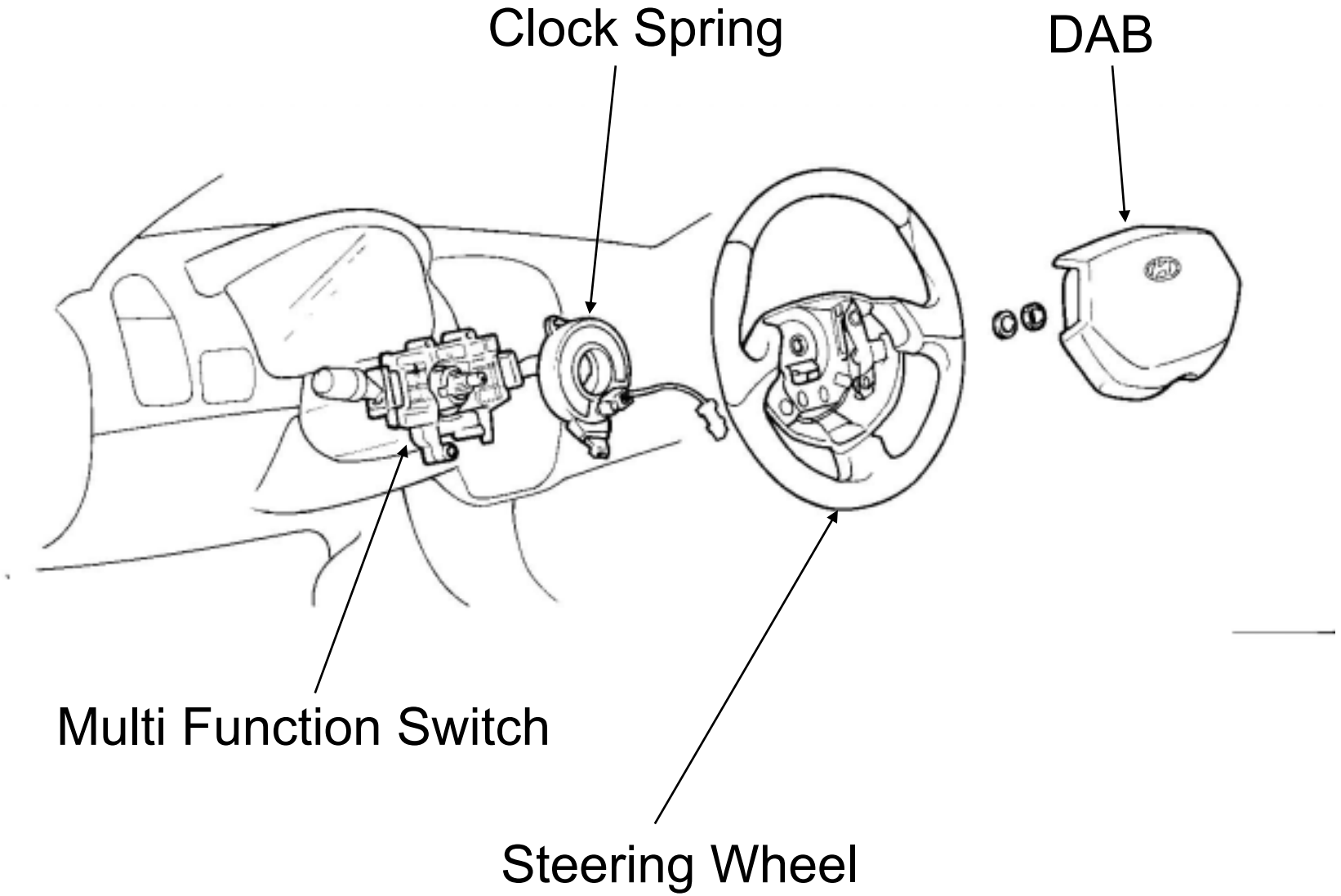


Components

MAJOR COMPONENT

- SRS CM
- D.A.B. MODULE
- C.A.B. MODULE
- P.A.B. MODULE
- SEAT TRACK SENSOR (Driver & passenger)
- SEAT BELT PRETENTIONER (Driver & passenger)
- SRS SRI
- FRONT IMPACT SENSOR
- SIDE IMPACT SENSOR
- BUCKLE SWITCH

SYSTEM OF DAB



AIRBAG MODULE (DAB)

- **Inflator Assembly (Depowered)**
- **Mounting plate (Reaction Plate)**
- **Bag : not coated -- 60 L**

  2-VENT HOLES

- **Two Squibs**

DAB MODULE







1st squib

2nd squib

AIRBAG MODULE (PAB)

- **Inflator Assembly (Depowered)**
- **Mounting plate**
- **Module cover (Trim cover)**

  “U”-pattern tear seam
- **Bag : not coated -- 140 L**

  No-VENT HOLES

P.A.B.

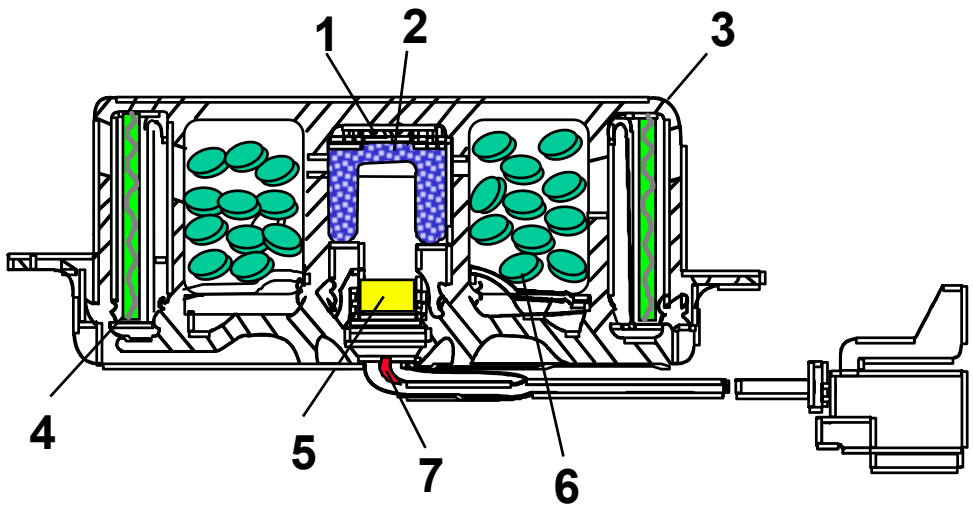
Inflator assembly



SRS AIRBAG - COMPONENTS

INFLATOR ASSEMBLY

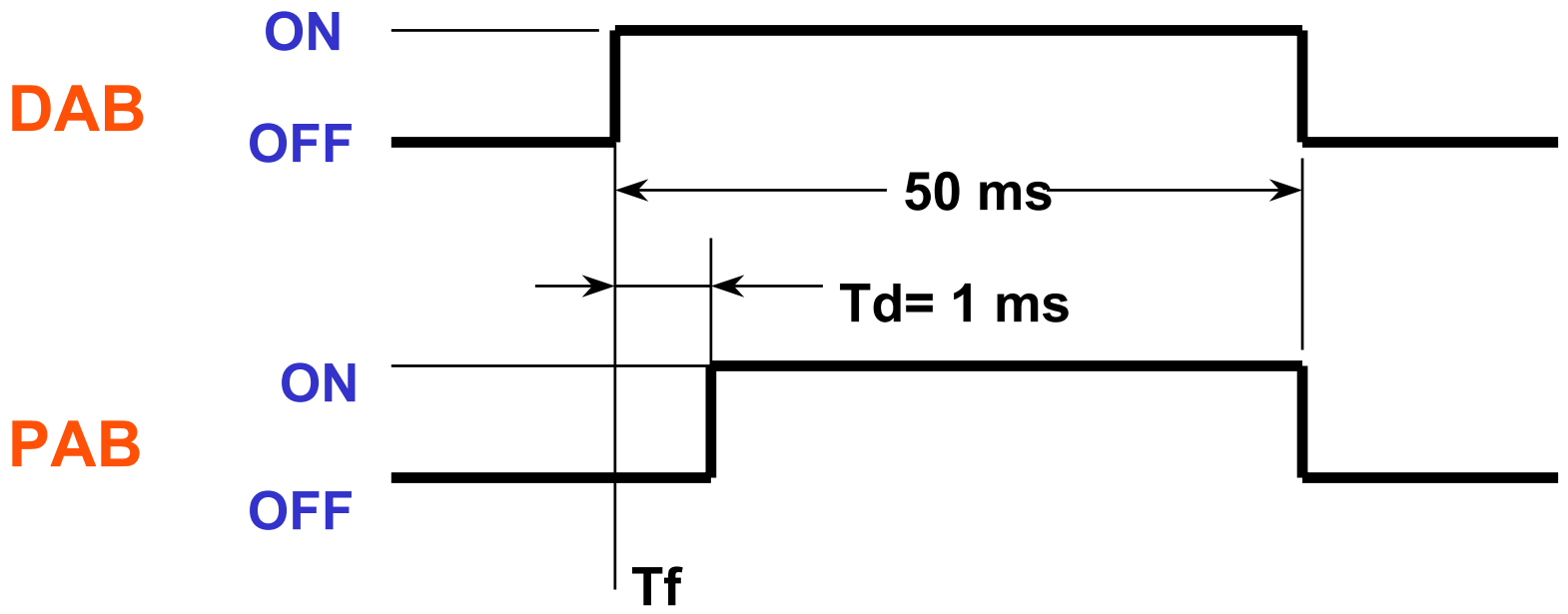
PYROTECHNIC INFLATOR



1. Ignition system
2. Autoignition charge
3. Inflator housing
4. Filter system
5. Initiator
6. Gas generator
7. Connector with integral shorting clip

AIRBAG FIRING SEQUENCE

The firing circuit for the inflator will be activated in the following sequence for deployment (Tf is the instant at which the deployment decision is made)



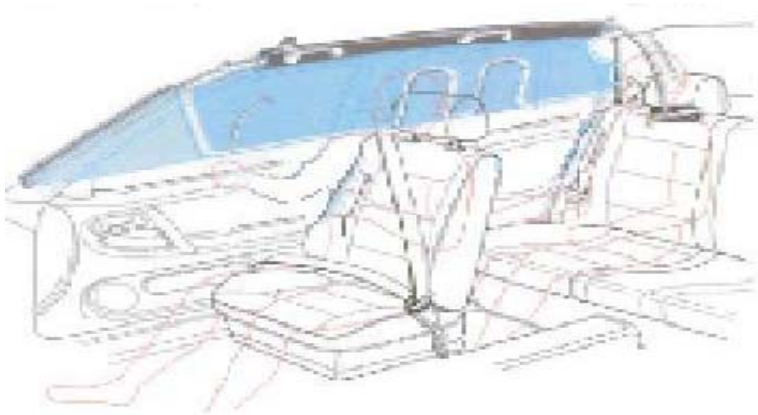
Curtain Air Bag Module

ROLL TYPE

INFLATOR



CURTAIN AIR BAG





BELT PRETENSIONER

Function

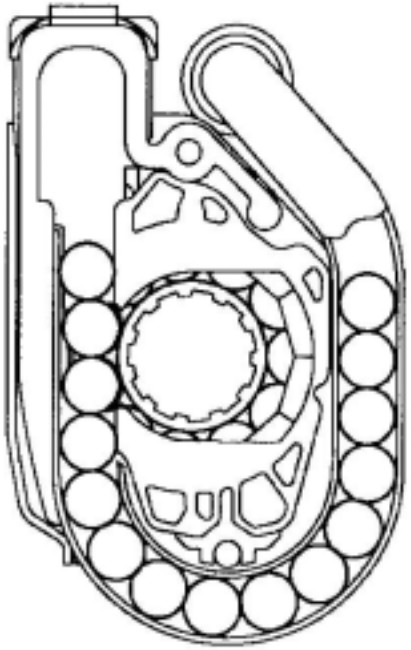
When a vehicle has crashed with a certain degree of frontal impact, the gas generator is made to ignite by the electrical firing signal from SRSCM.

Gas from the gas generator causes movement of the piston in the manifold case (cylinder), which operates a rack gear.

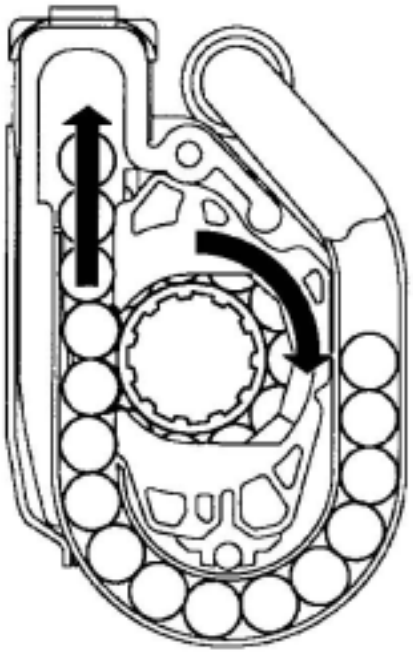
Finally the webbing is retracted by the rotation of the spool. Therefore the seat belt pretensioner helps to reduce the severity of injury tot he front occupant by retracting the seat belt webbing to prevent the occupant from moving forward and hitting the steering wheel or instrument panel when the vehicle is crashed.

BELT PRETENSIONER

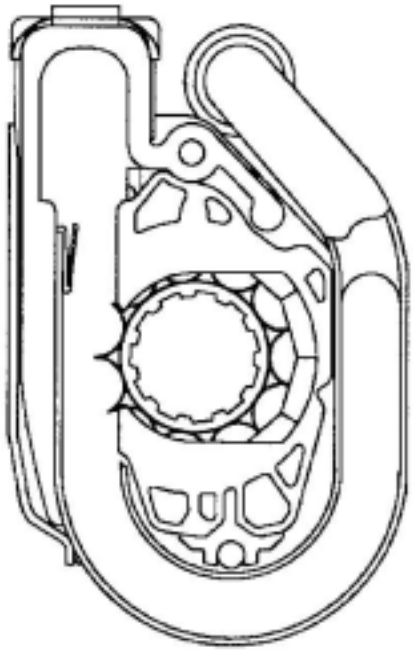
Initial



Operating



Completed



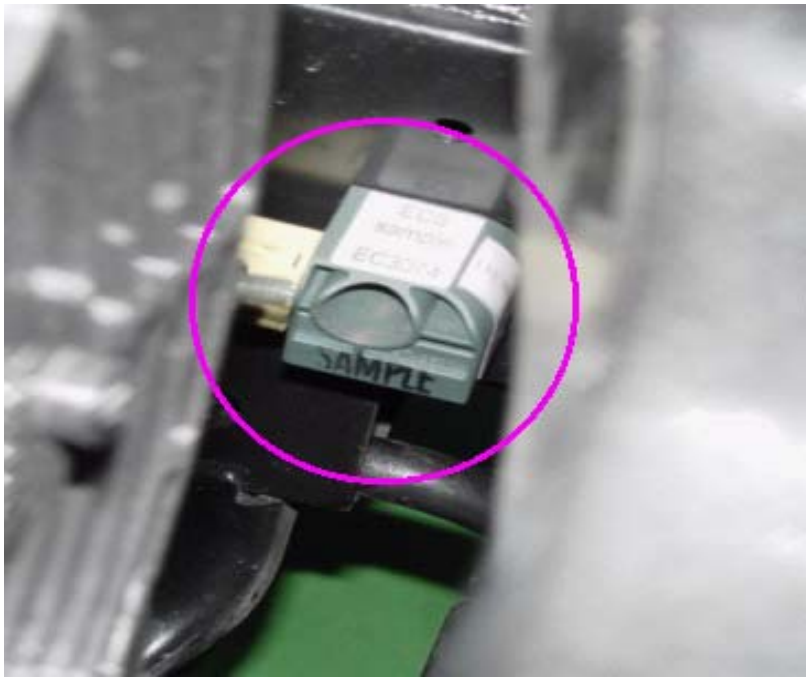
Belt Pretensioner Activation

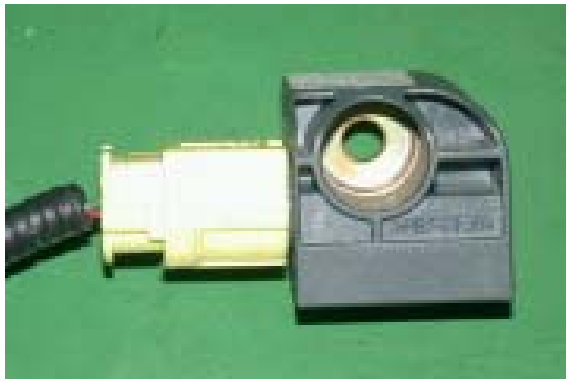
Under a must-deploy condition, the SRE-SMART will supply firing current to the activators when the microprocessor determines that a deployment is required and activates the firing circuits. A safing sensor is not implemented.

Each time the seat belt pretensioners are activated an internal counter is incremented. If this counter reaches the value of 6, the warning lamp is set, and a fault message (SRSCM) internal fault, replace SRSCM is written into the non-volatile memory. Hereby the SRSCM unit can be reused 5 times after a seat belt pretensioner activation. After 6 times activation, the Control Module should be replaced as new one.

FRONT IMPACT SENSOR

- Faster ACU G Sensor
- Support ACU G Sensor



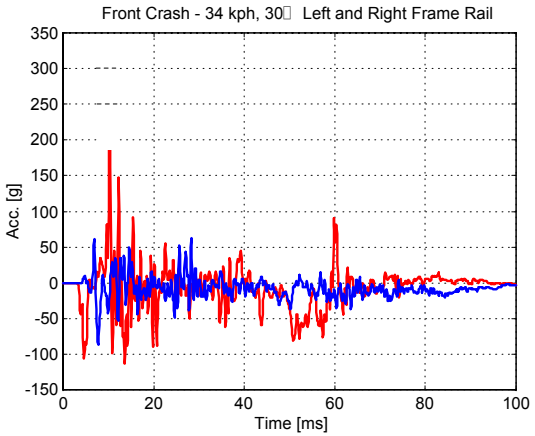




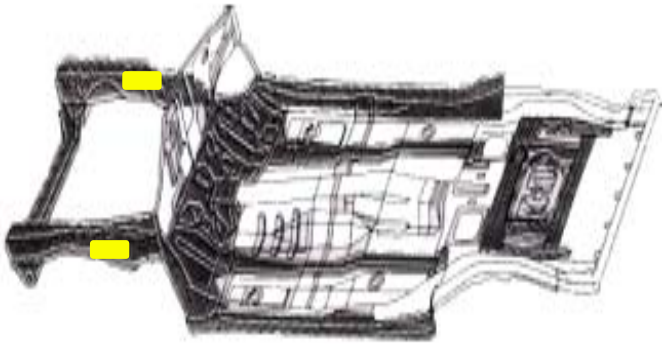
FRONT IMPACT SENSOR



FRONT IMPACT SENSOR



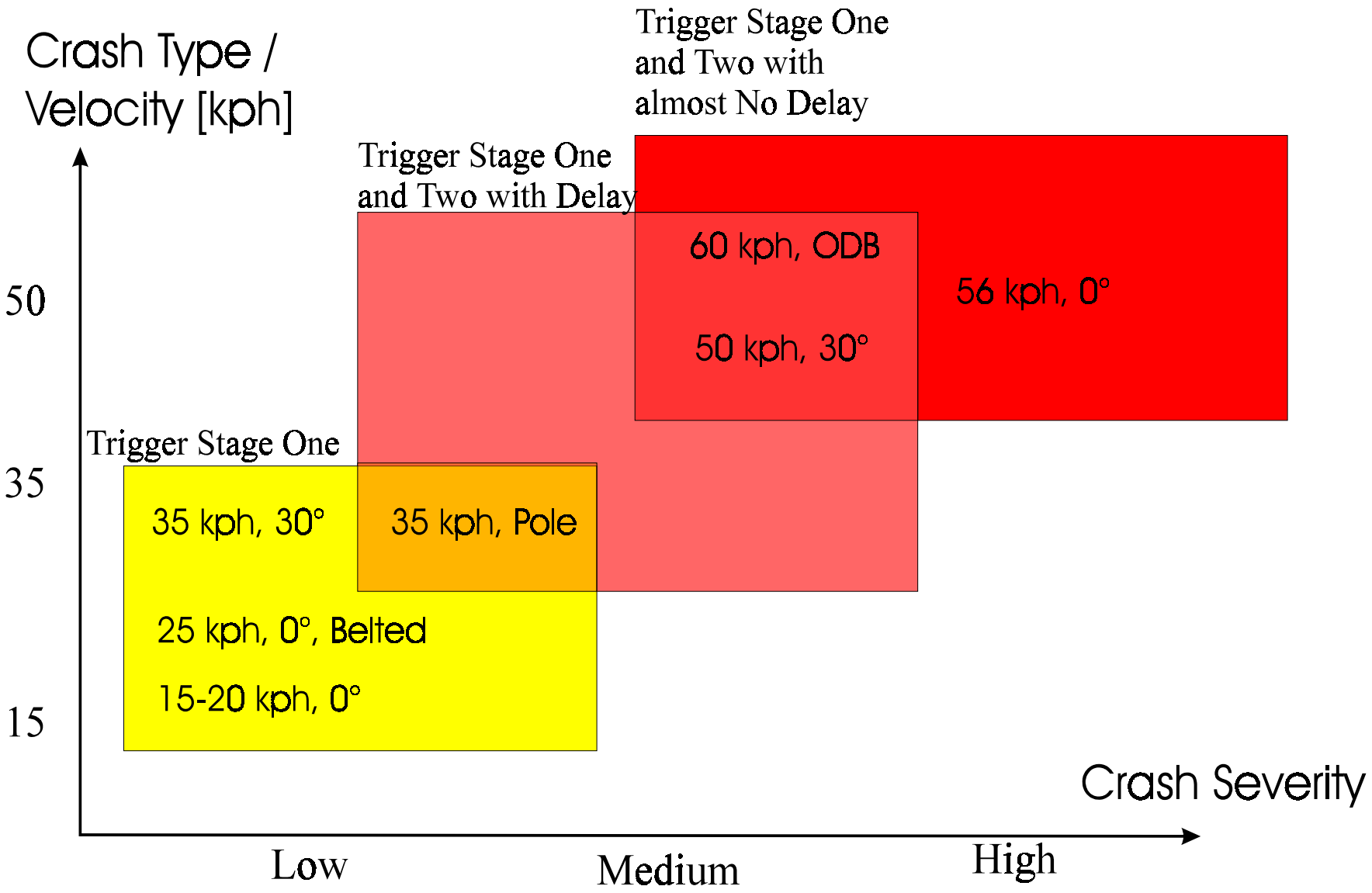
Sensor Issuses
Acceleration Range +/- 250 g
Shock Resistancy up to 1500 g



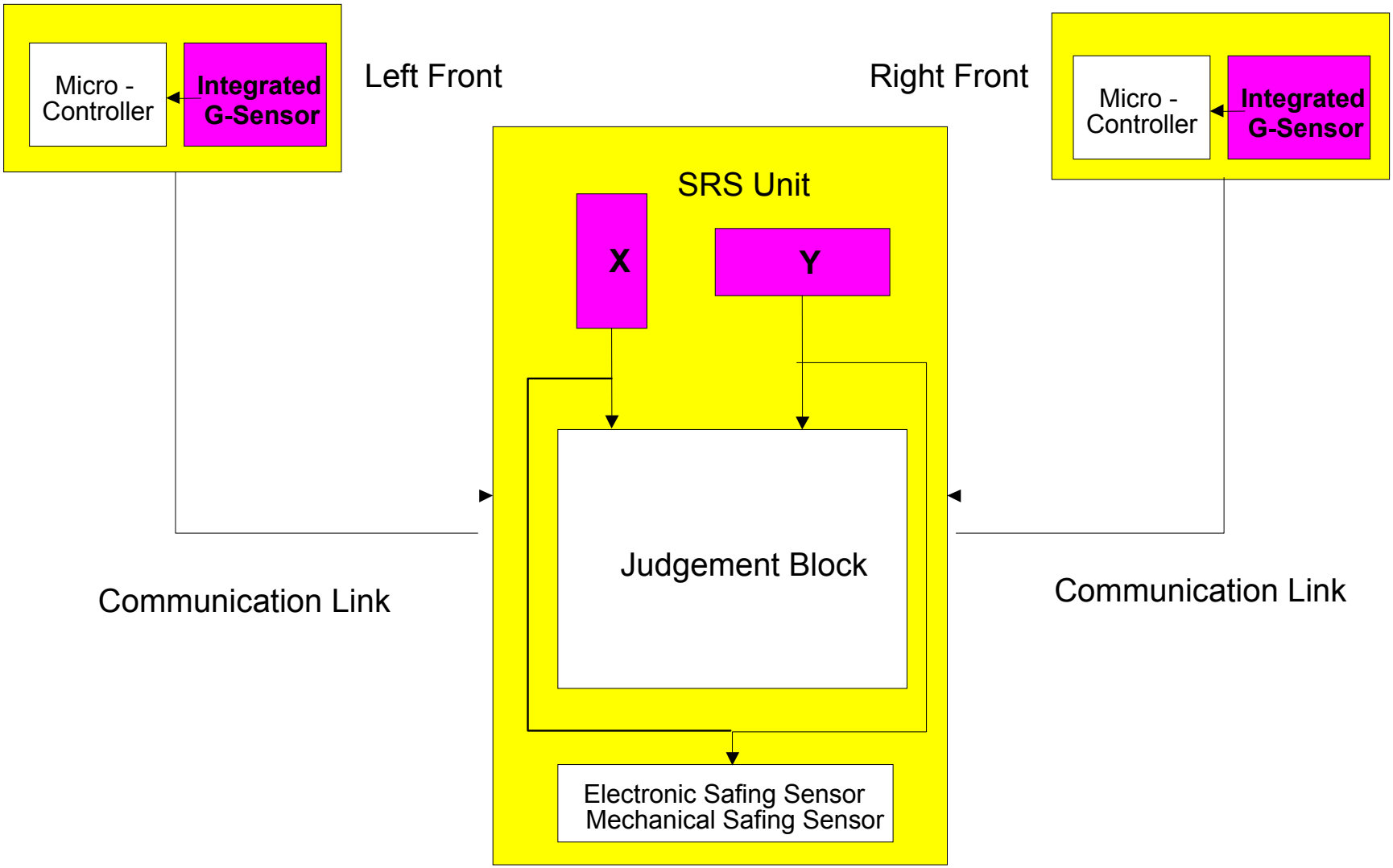
Mounting Issuses Influencing the Signals

- The impact side and the severity can be derived from the seperate sensor signals.
- Performance of Pole-Tests is dependend on vehicle structur

FRONT IMPACT SENSOR



FRONT IMPACT SENSOR

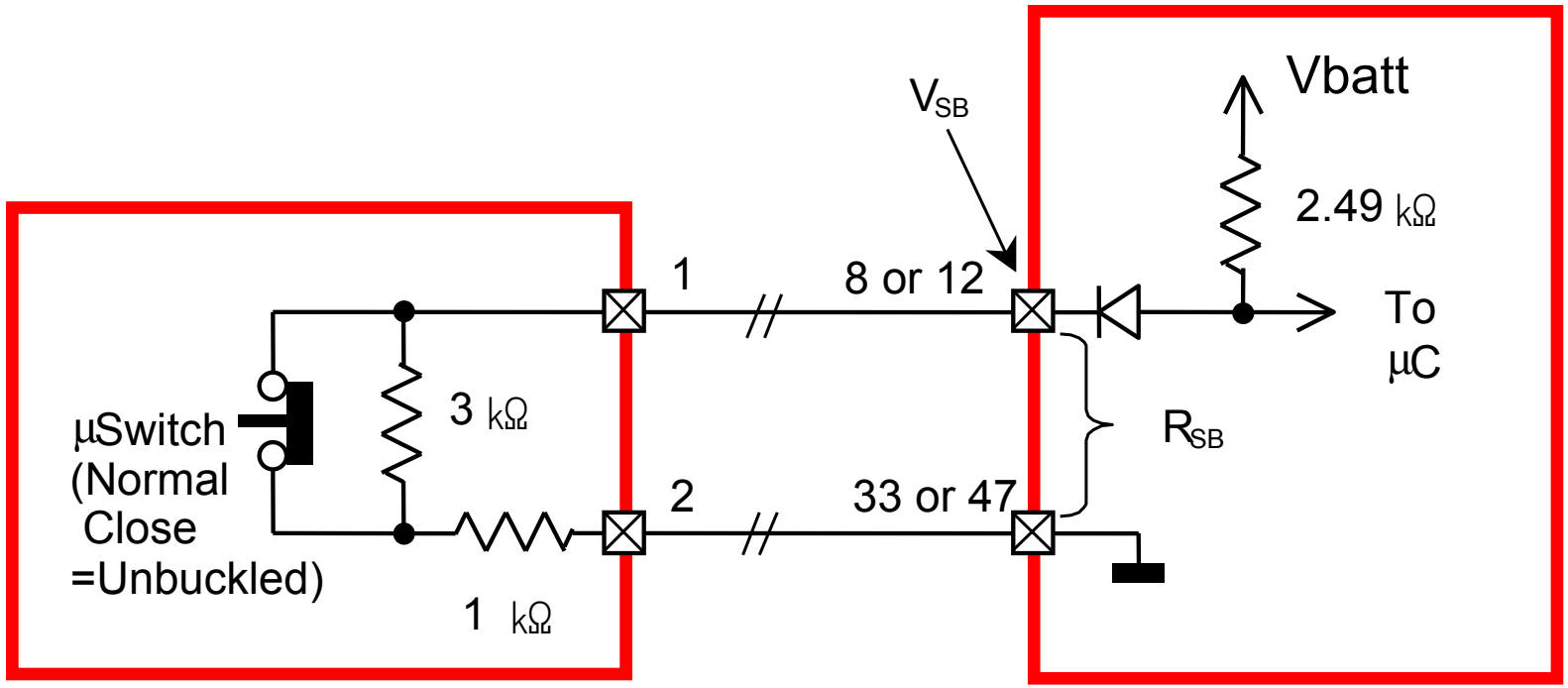


SIDE IMPACT SENSOR



Seat belt buckle switch

Belted (Buckled) : 4 KΩ ± 10%
Unbelted (Unbuckled) : 1 K Ω ± 10%
Type: Micro switch type



Seat-belt Buckle Switch
(µSwitch Type)

HAE3

Buckle Switches

Resistance of 402 Ohms ±10% (Closed Switch) as UNBUCKLED

Resistance of 1006 Ohms ±10% (Open Switch) as BUCKLED

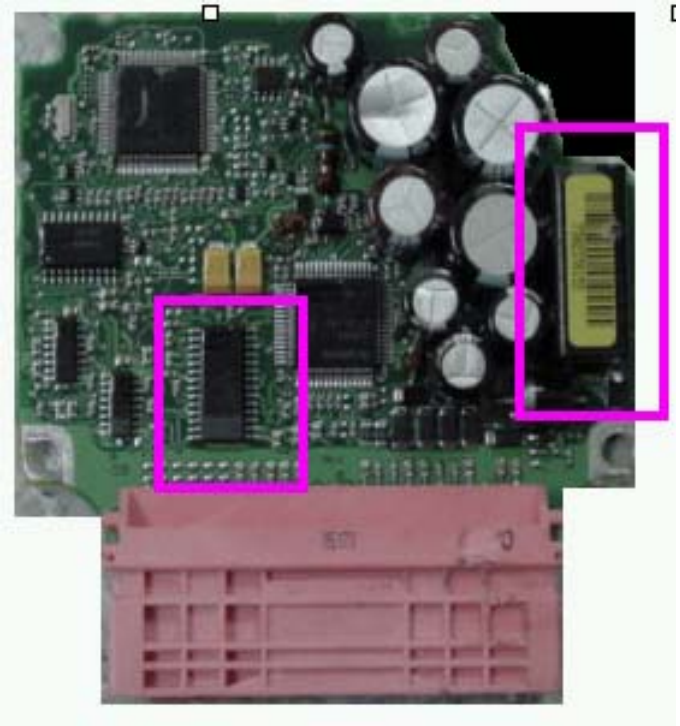
Buckle Status Change	2sec.
Maximum test voltage	5.0 Volts
Maximum measurement current	< 20 mA
Maximum current is limited	< 100 mA
Groundshift from ECU to Buckle Switch must be	< 200 mVolts

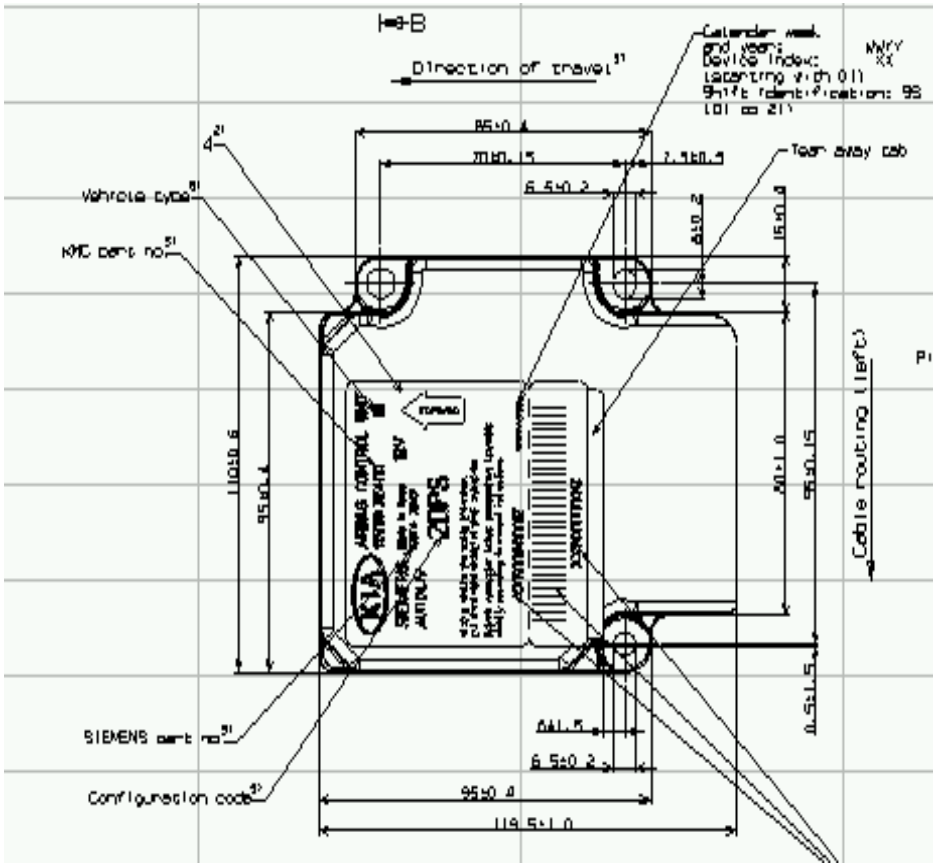
The buckle switches are cyclic polled. A state is changed if 5 cycles of corresponding resistance measure are accumulated.

SEAT TRACK SENSOR



ACU CM




Direction of travel
Vehicle type
KMC part no
SIEMENS part no
Configuration code
Cable routing (left)

CONTROL MODULE (ESPS)

➢ T.B.D. angle

Within 30 °from vehicle's centerline : LAW

Within 45 °from vehicle's centerline : Maker

➢ Hard object

The vehicle crashed a deer with 80 Km/h, but the airbag did not operate.

➢ T.B.D. velocity

9 MPH or below ---------- Not deploy

9 - 12 MPH ---------- Deploy or not

12 MPH or above ---------- Must deploy

WIRING HARNESS

All airbag circuits are designated as such and contained in a special overlay harness. Color coding and unique identification in proper locations throughout the overlay harness is recommended.

Front end wire routings and connections should be reviewed with particular emphasis on the airbag circuits, maintaining electrical continuity in the event of collision.

Location of Control Module



CONTROL MODULE (ACU)

The primary functions are

- Crash Detection
- Activation of the front airbags, Curtain airbags and belt pretensioners
- Monitoring of the airbag restrain system
- Indicate system readiness and faults to the driver by means of a fault warning lamp
- Facilitate servicing capability via a serial diagnostic communication interface (Hi Scan-Pro)

CONTROL MODULE (ACU)

Main Functions

- Longitudinal and orthogonal central acceleration sensor
- One firing circuit with Energy Reserve for 1st stage DAB
- Two firing circuit **without** Energy Reserve for Frontal BPT
- Warning lamp for system fault display
- One Service Communication Interface (K-Line)
- Driver and Passenger BS Monitoring and Status-Recording

CONTROL MODULE (ACU)

Optional Functions

-One firing circuit with Energy Reserve for 1st stage PAB

-Two firing circuit with Energy Reserve for 2nd DAB & PAB

-Two firing circuit with Energy Reserve for for Curtain Airbags

-Two Early Crash Sensor Interfaces

-Seat tract sensor Monitoring and Status-Recording

CONTROL MODULE (ACU)

Measurements in the start up phase

- Watchdog
- EEPROM, ROM, RAM
- Warning Lamps
- Autonomous Operating Time
- Acceleration Sensor

- 경고등 점등 되는 그림 필요

CONTROL MODULE (ACU)

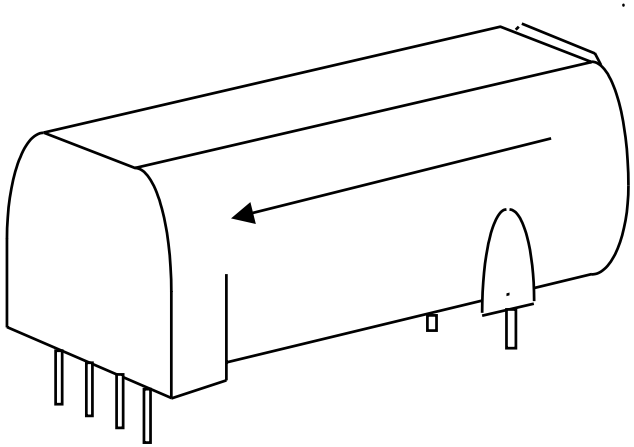
Cyclic Measurement

After the start up phase the microcontroller is executing cyclic test on following modules / parts:

- **A/D Converter (Accelerometer, ±50g)**
- **Battery Voltage**
- **Firing Loops**
- **Warning Lamps**
- **Firing Voltage Internal**
- **Safing Sensor (Trigger Switch)**
- **Seat Track Sensor**
- **Early Crash Sensor**
- **Buckle Switches**

Safing sensor

The safing sensor is dual contact electromechanical switch, which closes if it experiences a deceleration exceeding a specified threshold.



The operation of the sensor is completely independent of all electronic components in the SRSCM and firing current must flow across the safing sensor contact to activate the squibs.

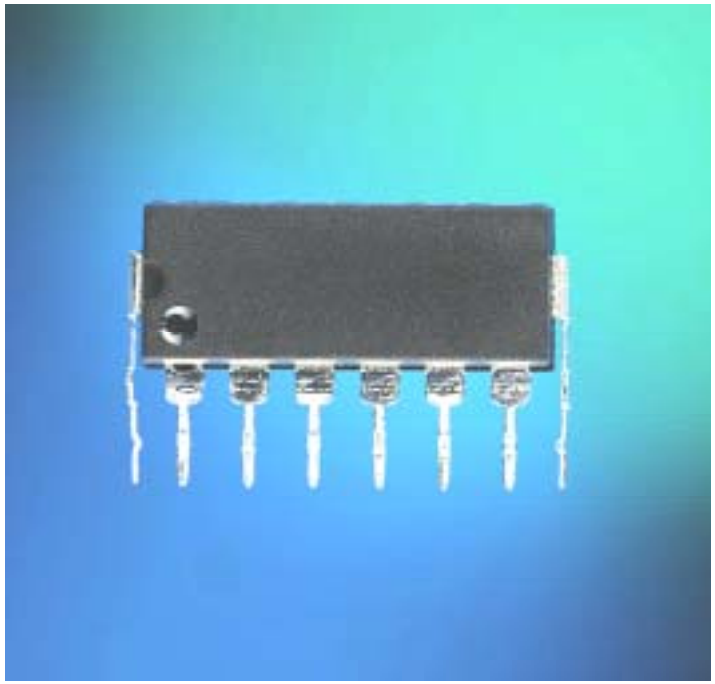
This provides additional protection against an unwanted deployment for the airbag firing circuits.

Accelerometer

The integrated electronic accelero-meter provides an electrical representation of the acceleration experienced by the vehicle in the longitudinal axis.

This electrical signal is linearly proportional to the acceleration in G.

The accelerometer is included low pass filter. (reduce unwanted noise)



SRSCM Connector

2.2 Connector Pinning *(Subject to be changed later)* **and Coding**

25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51

Shorting bar trap (SBT). *NC: Electrical not connected.*

Pin #	Name	Description
1		Not used
2~25	STB	Shorting Bar
26	VBatt	Battery Supply (VBatt)
27	WL	Warning Lamp
28	GND	Battery Ground
29	DAB 1Lo	Front Driver A/Bag Inflator,1 Low
30	DAB 1Hi	Front Driver A/Bag Inflator, 1High
31	PAB 1Hi	Front A/Bag Passenger Inflator,1 High
32	PAB 1Lo	Front A/Bag Passenger Inflator ,1 Low
33	DBPT Lo	Driver Belt Pretensioner, Low

Control Module Connector Pin

34	DBPT Hi	Driver Belt Pretensioner, High
35	PBPT Hi	Belt Pretensioner, High (Passenger)
36	PBPT Lo	Belt Pretensioner, Low (Passenger)
37	DCAB Lo	Driver Curtain Airbag, Low
38	DCAB Hi	Driver Curtain Airbag, High
39	PCAB Hi	Passenger Curtain Airbag, High
40	PCAB Lo	Passenger Curtain Airbag, Low
41	DAB 2Lo	Front Driver A/Bag Inflator,2 Low
42	DAB 2Hi	Front Driver A/Bag Inflator,2 High
43	PAB 2Hi	Front A/Bag Passenger Inflator, 2High
44	PAB 2Lo	Front A/Bag Passenger Inflator, 2Low
45~53		Not used
54		K-Line
55~57		Not used

Control Module Connector Pin

58	ACOut	Advanced Crash Output
59		Not used
60	DSTS	Driver Seat Track Sensor
61	DBSW	Driver Buckle Switch
62	PBSW	Passenger Buckle Switch
63	PSTS	Passenger Seat Track Sensor
64~67		Not used
68	PSIS Lo	Passenger Side Impact Sensor Low
69	PSIS Hi	Passenger Side Impact Sensor High
70	DSIS Hi	Driver Side Impact Sensor High
71	DSIS Lo	Driver Side Impact Sensor Low
72	PFIS Lo	Passenger Front Impact Sensor Low
73	PFIS Hi	Passenger Front Impact Sensor High
74	DFIS Hi	Driver Front Impact Sensor High
75	DFIS Lo	Driver Front Impact Sensor Low

FUNCTIONS (CM: BL)

- Internal electromechanical safing sensor.
- Crash detection, calculation of firing time.
- Internal electronic acceleration sensing element.
- Self-test, cyclic monitoring of critical components.
- SRI activation circuitry with optional monitoring.
- Storage of faults in non-volatile memory.
- Energy reserve to provide autonomous operation.
- Optional crash recording.
- Provision of 8 airbag firing circuit.
- 1-wire bi-directional communication interface.

Service Reminder Indicator (S.R.I.)

Status Display

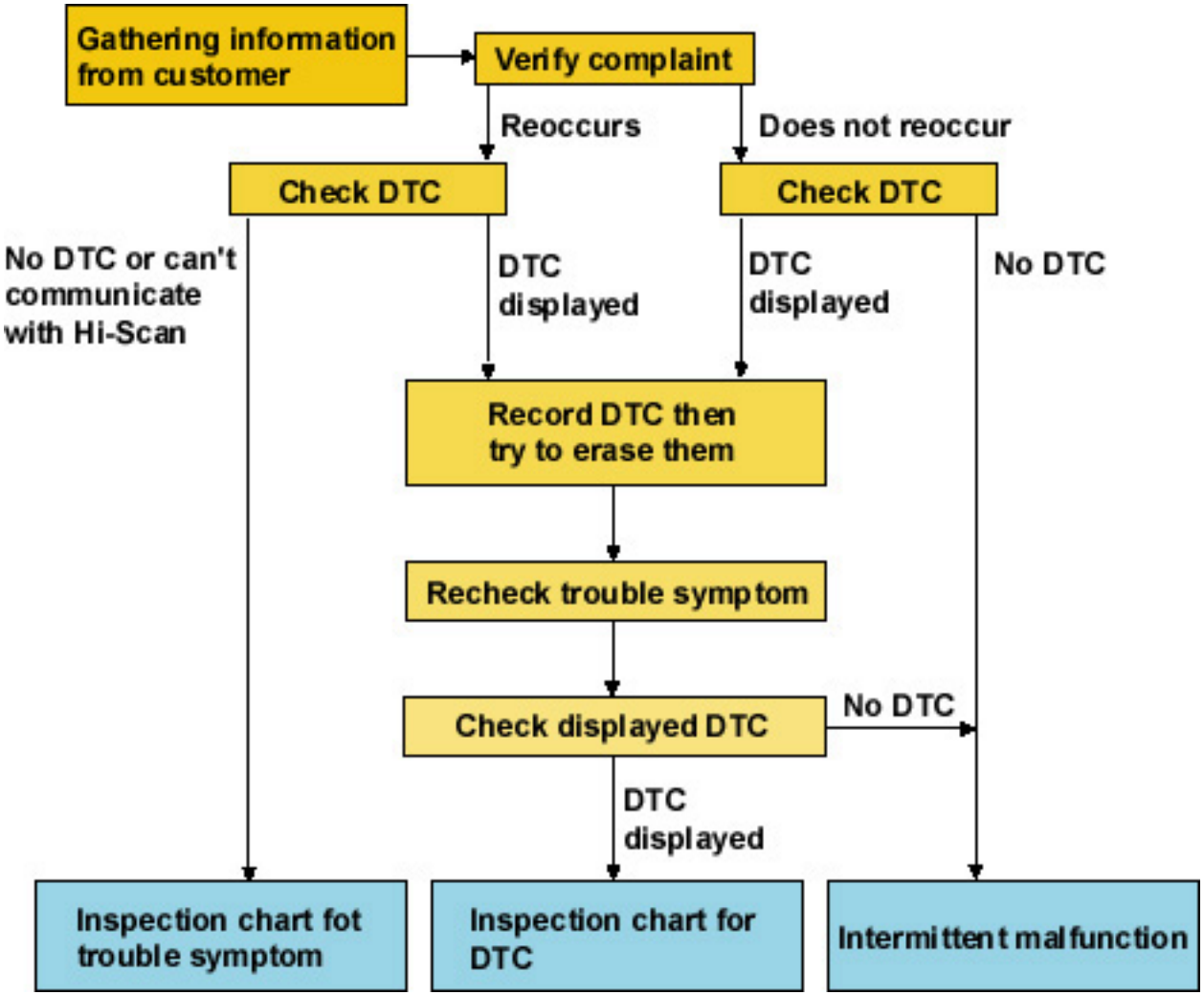
As soon as operating voltage is applied to the CM activates the SRI for a bulb check. The lamp shall blink 6 times for 6 seconds at 1HZ during the initialization phase and be turned off afterwards.

During the initialization phase, the CM will not be ready to detect a crash and deployment will be inhibited until the signals in the CM circuitry stabilize.

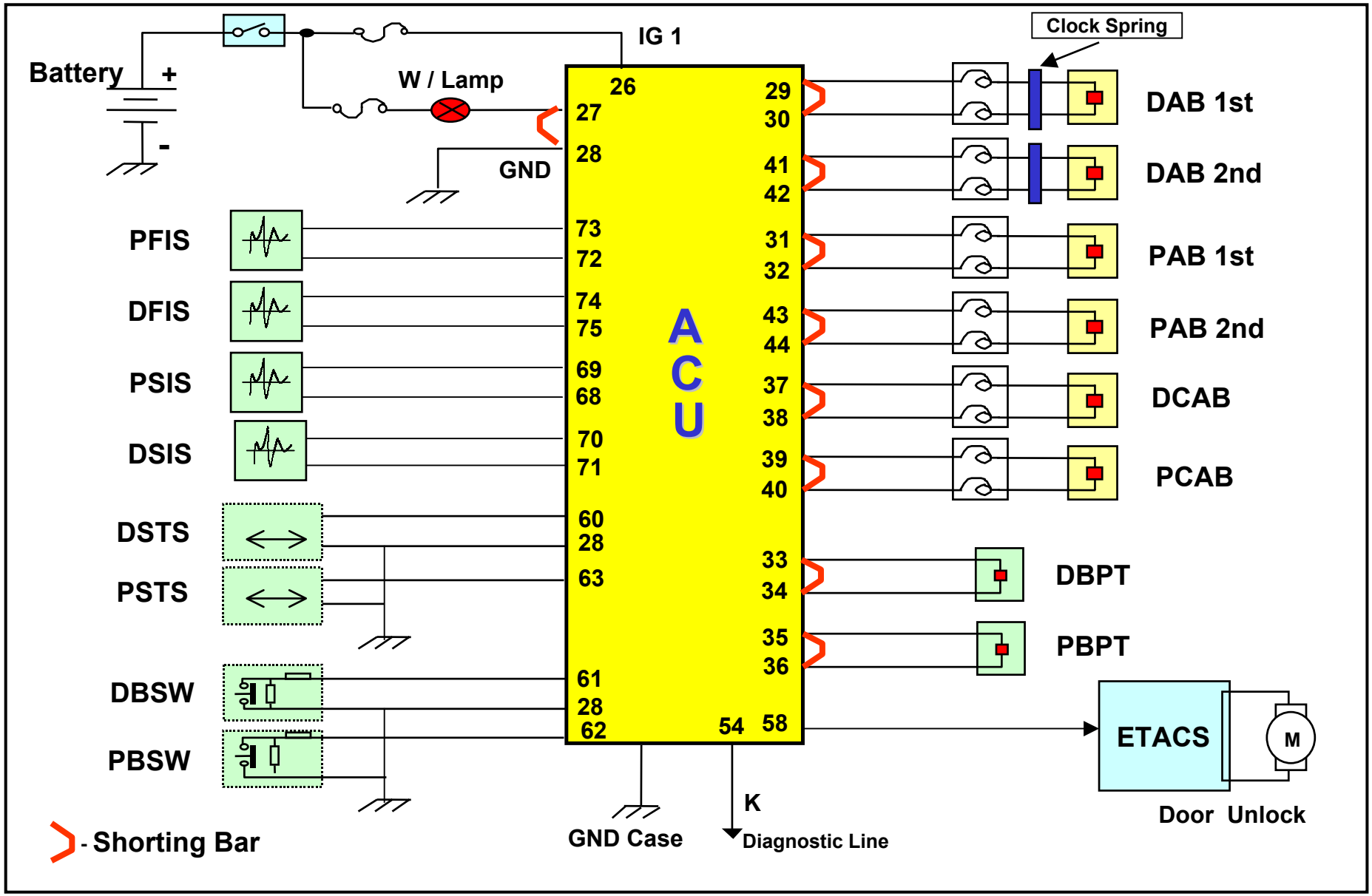
SERVICE REMINDER INDICATOR

- Loss of ignition voltage supply to the CM: lamp turned on continuously.
- Loss of internal operating voltage: lamp turned on continuously.
- Loss of CM operation: lamp flashed at approx. 1Hz by watchdog circuitry.
- Continuous Reset caused by Watchdog Trigger failure: SRI blinks
- CM not connected: lamp turned on through shorting bar in wiring harness connector.

Diagnostic Troubleshooting Flow Chart



SRSCM BLOCK DIAGRAM (BL)



Diagnostic Troubleshooting

Specification

	DAB / PAB	FCAB	BPT
Resistance	2Ω ± 0.3Ω	2.0Ω ± 0.2Ω	2.15Ω ± 0.35Ω
No-fire current	250mA for 10 sec	0.4A for 10sec	0.2A for 10sec
All-fire current	1.2A for 3ms (1.7A for 2ms)	1.2A for 3ms (1.7A for 2ms)	0.8A for 2ms
Cyclic test current	50mA continuous		50mA continuous

Caution

Never measure the resistance any component for Airbag system

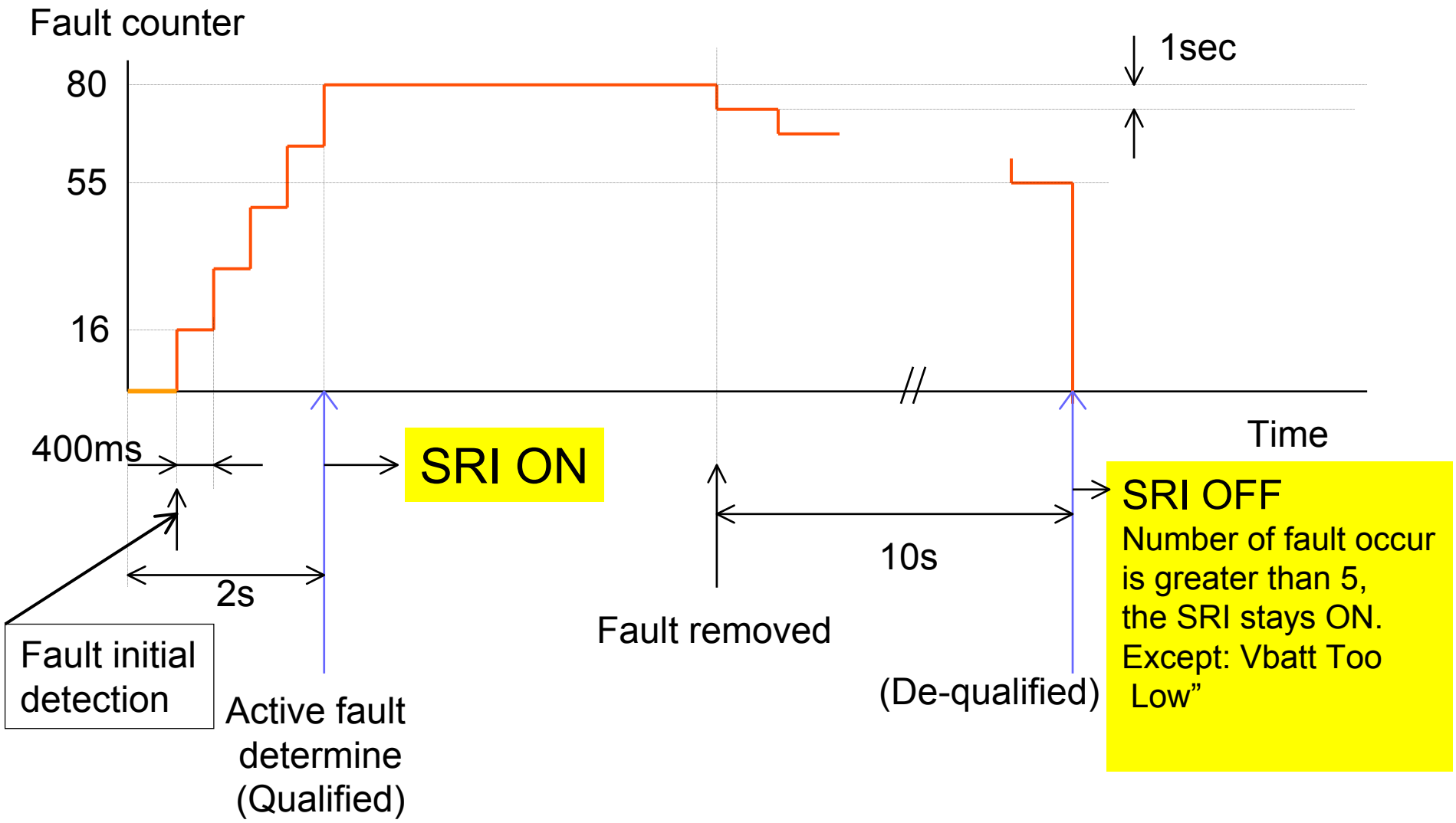
Diagnosis Function

The CM shall be equipped with a self-diagnostic function.

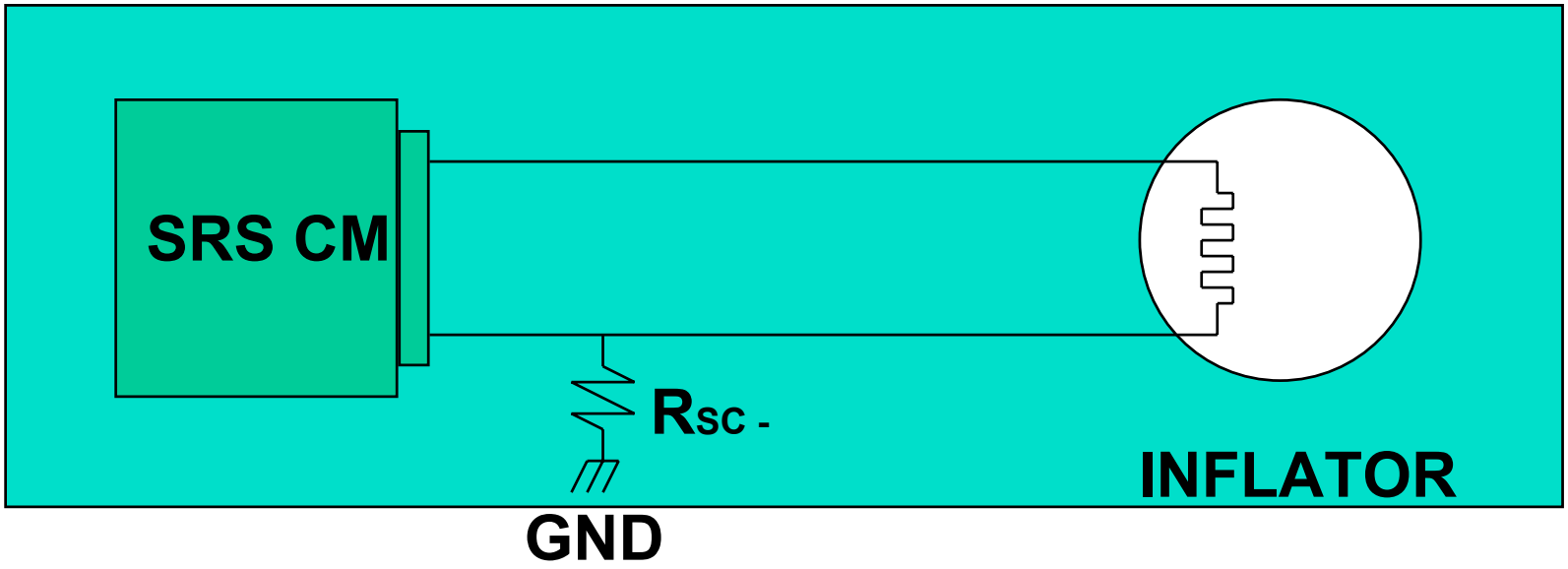
Real time Self-Test mode : Self testing is carried out during CM normal mode of operation

Diagnostic Command mode : This mode sets the CM into a serial communication mode with an external off-board tester where a specified subset of normal function are required.

Fault qualification (External fault)

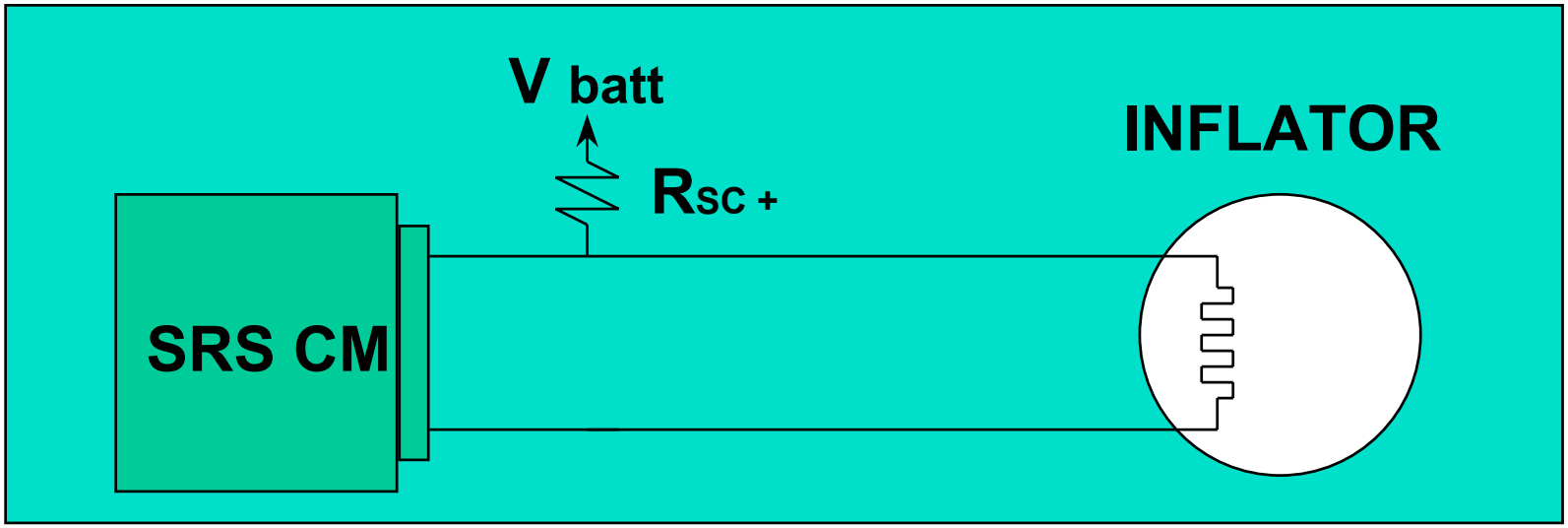


EXTERNAL FAULT



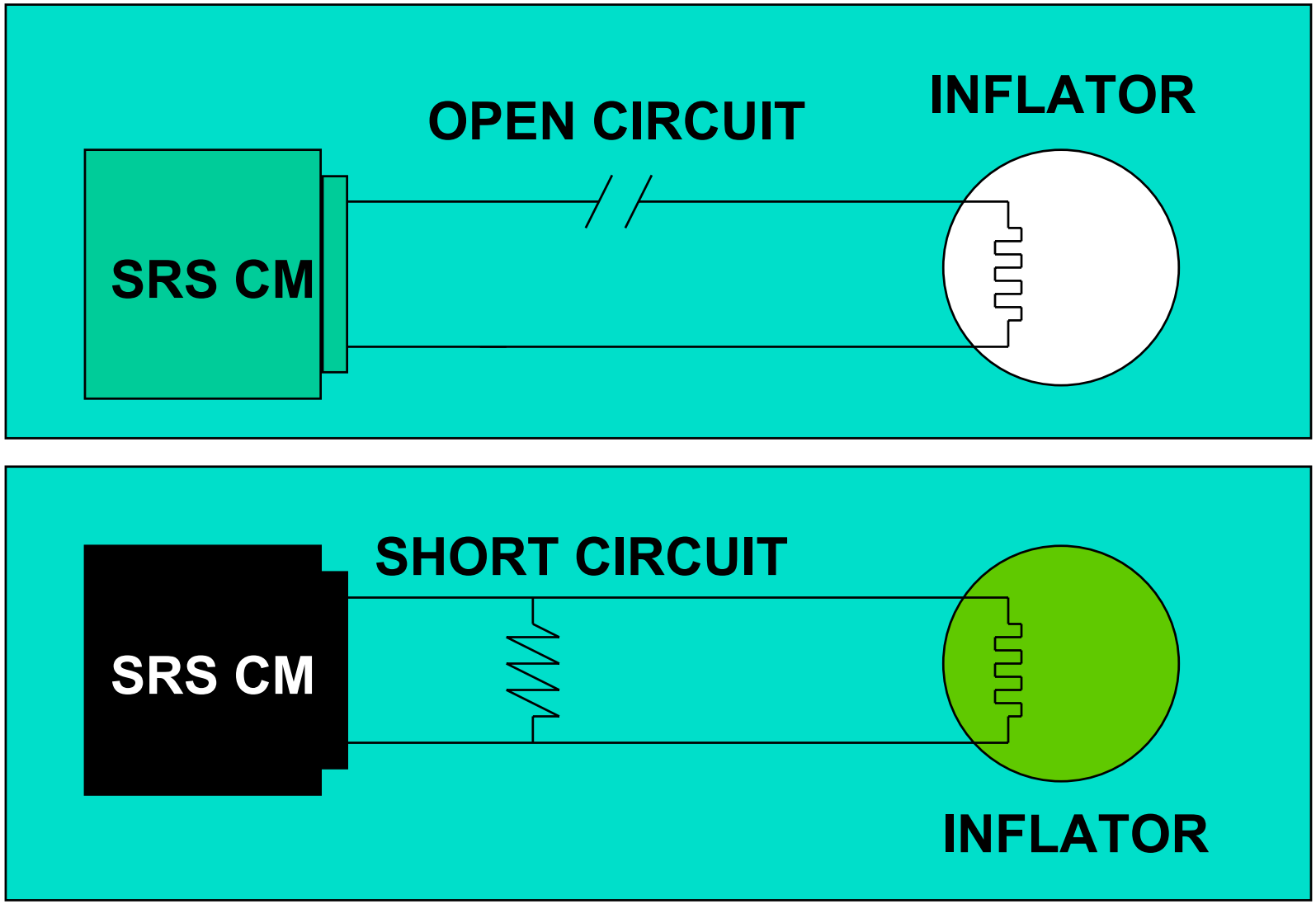
DTC: DAB (B1348), PAB (B1354)	
Rsc - < 2k Ω	Low Resistance in the short circuit
Rsc - >10K Ω	High Resistance in the short circuit
2k Ω <Rsc - <10k Ω	Tolerance band

EXTERNAL FAULT



DTC: DAB (B1349), PAB (B1355)	
Rsc + < 2k Ω	Low Resistance in the short circuit
Rsc + >10K Ω	High Resistance in the short circuit
2k Ω <Rsc + <10k Ω	Tolerance band

EXTERNAL FAULT



INTERNAL FAULT

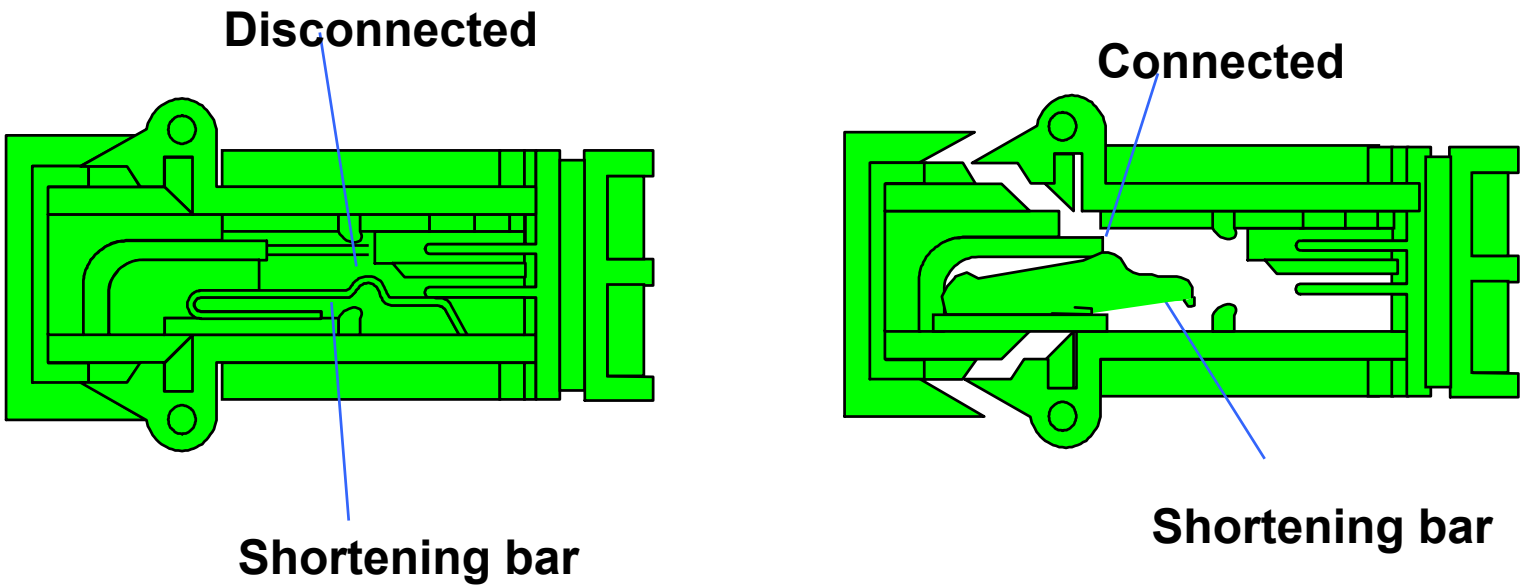
The internal SRSCM faults which can be recognized and recorded are given in the table below. These codes will not be available to service personnel.

FAULT DESCRIPTION	
Microcontroller	AD converter or EEPROM defect
DAB firing circuit	Activation fault measuring circuit fault
PAB firing circuit	Activation fault measuring circuit fault
Firing voltage	Inadequate
Watchdog / reset	Fault
Electronic accelerometer	Fault operation
Sensor	Sensor broken Sensor not in steady state mode Sensor test pulse result fault

SRS AIRBAG - COMPONENTS

DAB MODULE CONNECTOR

Anti deploy mechanism



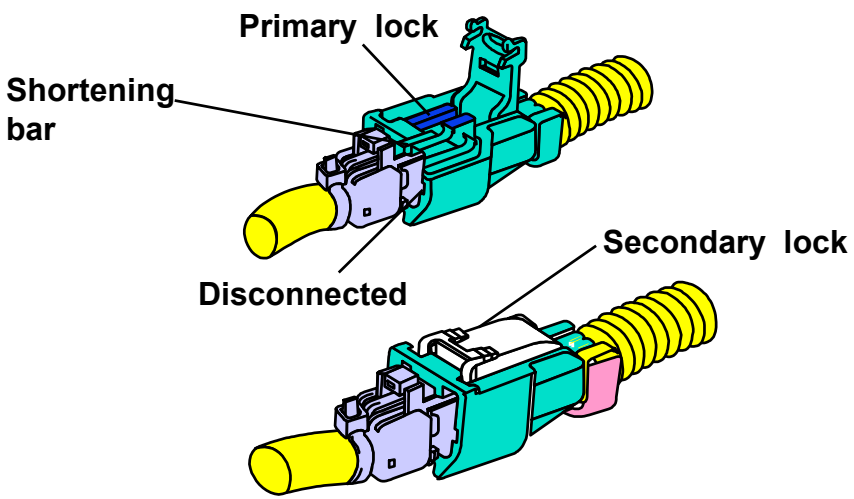
SRS AIRBAG - COMPONENTS

DAB MODULE CONNECTOR

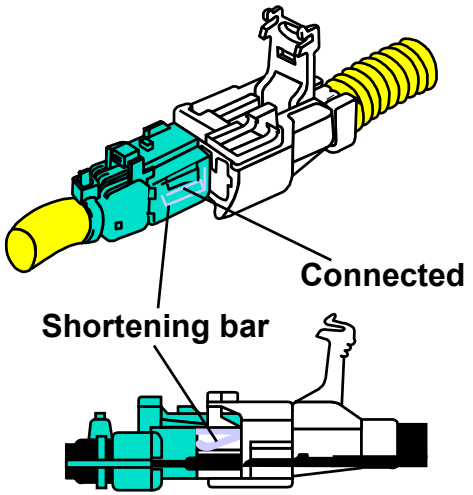
Driver Air-Bag Module (DAB)

Two security mechanisms of the DAB are the twin-lock mechanism and anti-deploy mechanism. The Anti-deploy mechanism prevents unexpected deployment by the shortening of the two squib terminals.The twin-lock mechanism connectors (male and females) are fastened by two locking devices to increase connection reliability. If the primary lock is incomplete, ribs will prevent the secondary lock from coming apart.

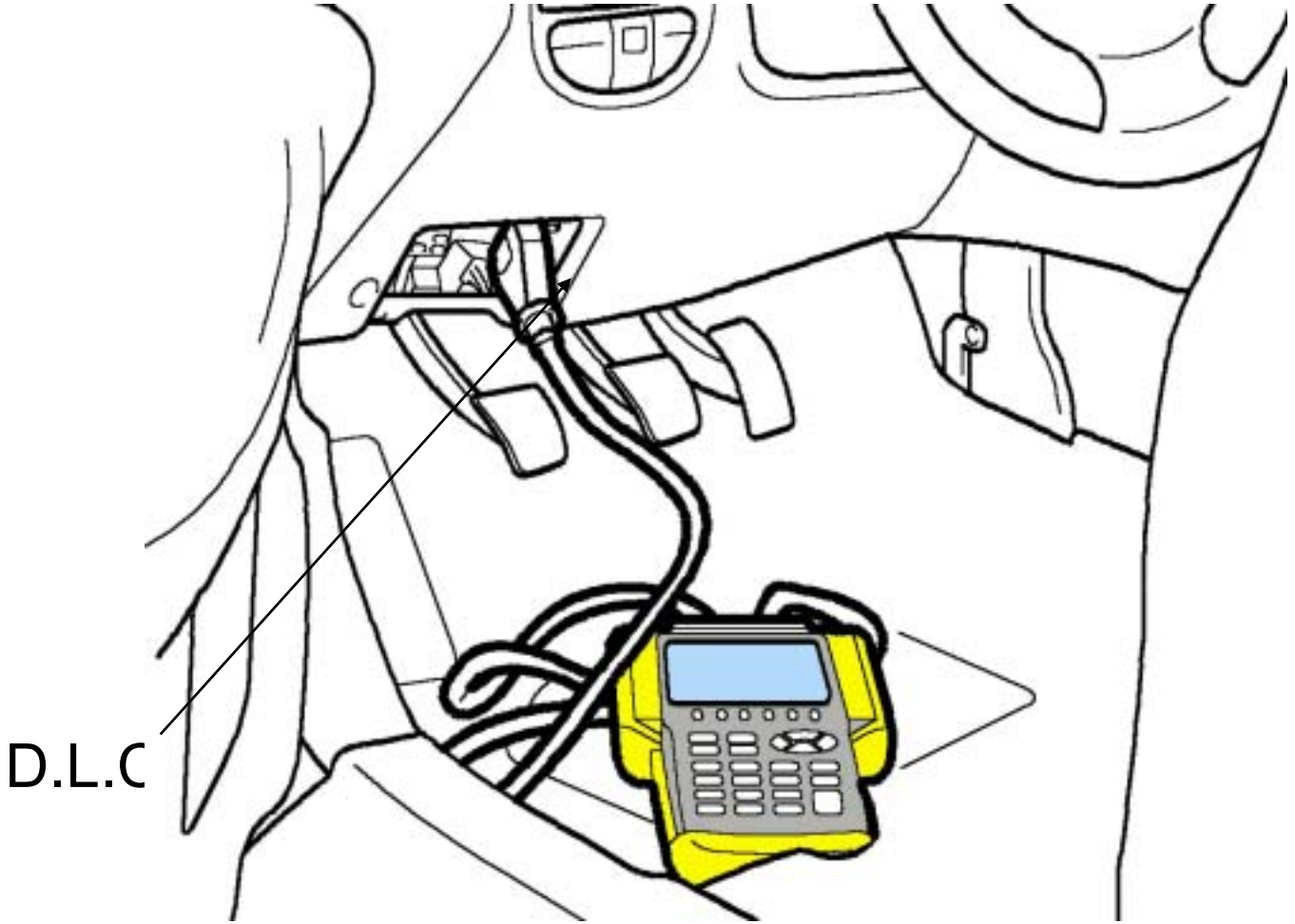
Twin lock mechanism



Anti deploy mechanism

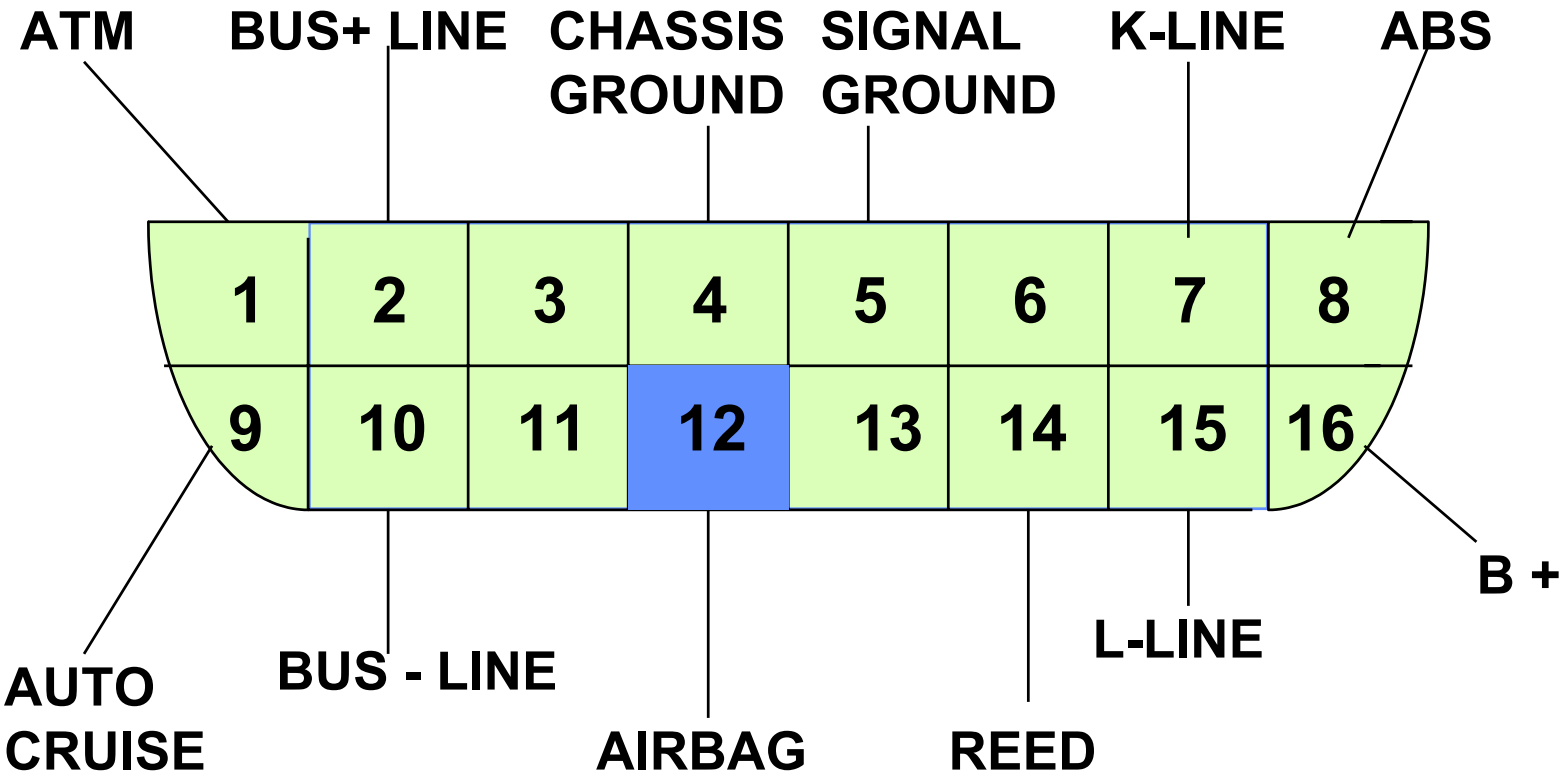


Location of Data Link Connector



DATA LINK CONNECTOR

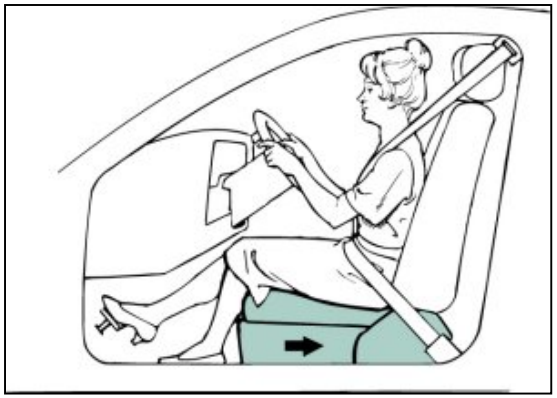
16-PIN (Vehicle side connector: female)



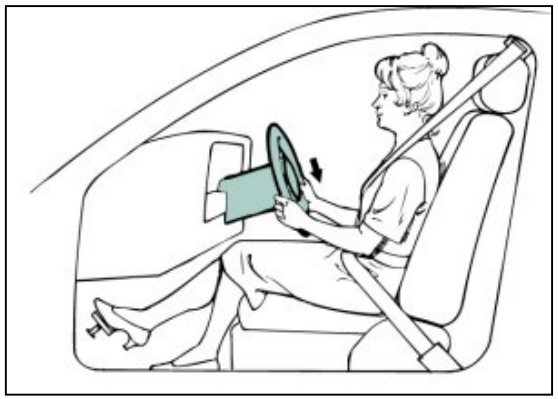
Good Position

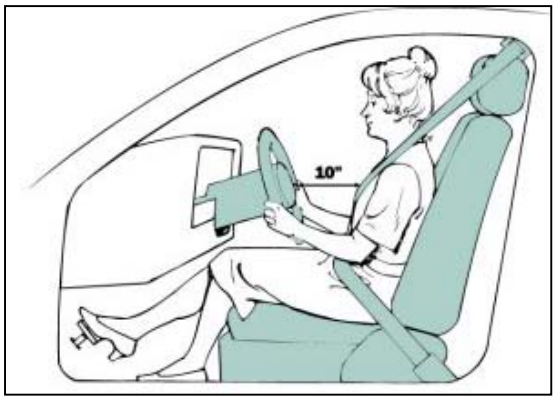












What Do the Stars Mean?

Frontal

 = 10% or less chance of serious injury

 = 11% to 20% chance of serious injury

 = 21% to 35% chance of serious injury

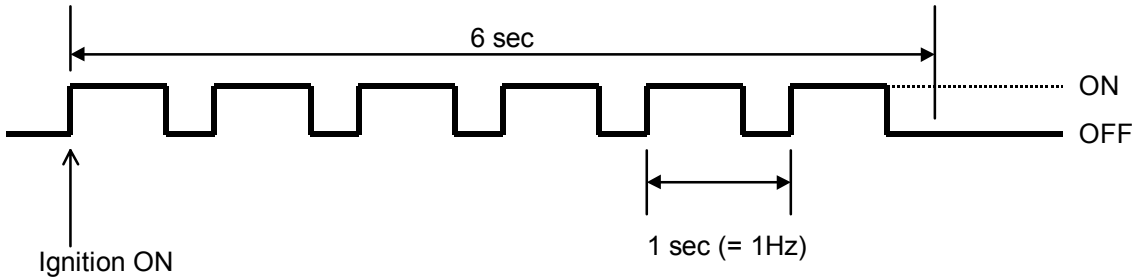
 = 36% to 45% chance of serious injury

 = 46% or greater chance of serious injury

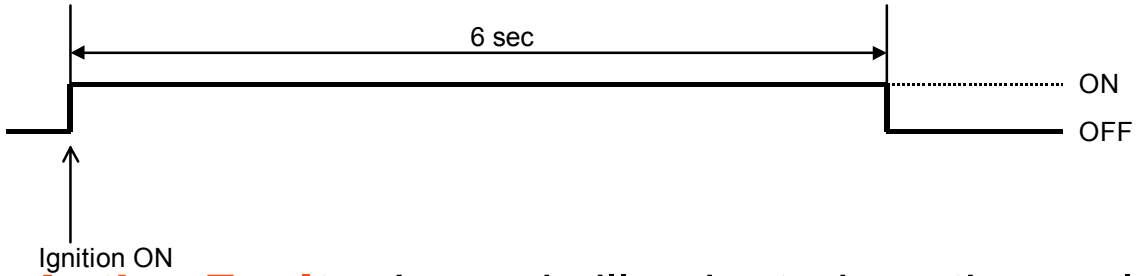
A serious injury is considered to be one requiring immediate hospitalization and may be life threatening.

BULB CHECK

Case1: No Fault - When there are no active fault codes and the intermittent fault codes are not registered.



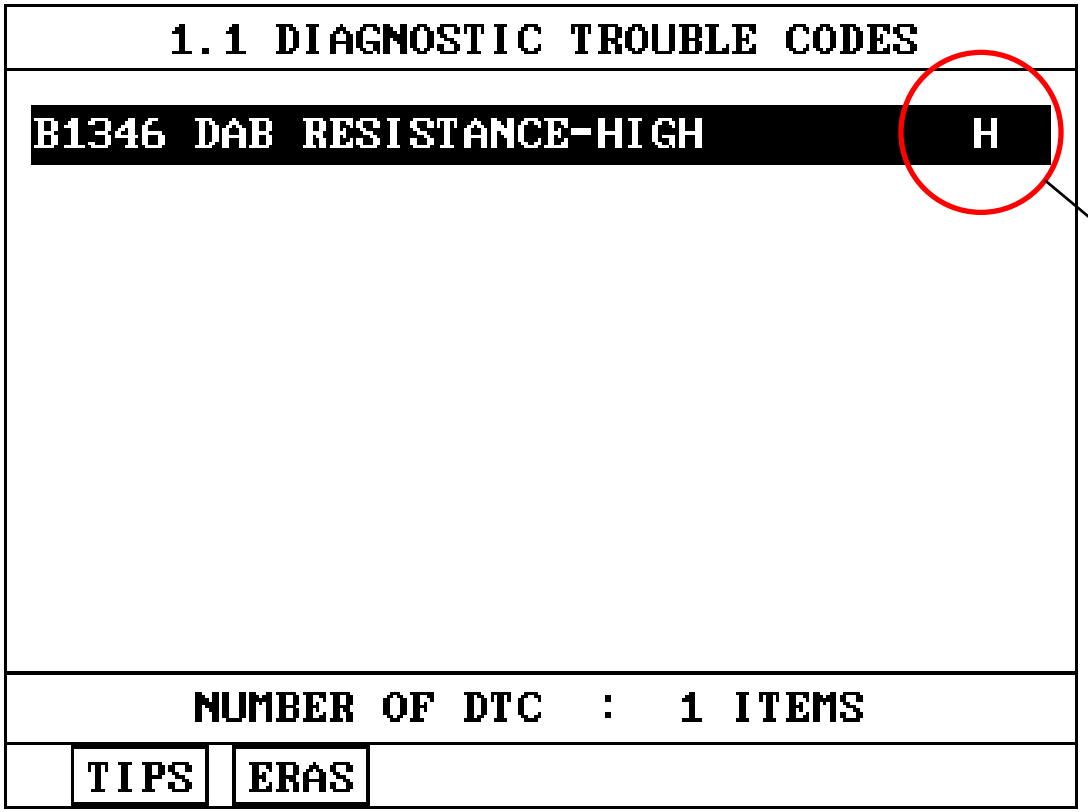
Case2: Intermittent Fault - When the intermittent external fault codes from 1 to 5 are occurred. (Except : "Battery voltage is too low")



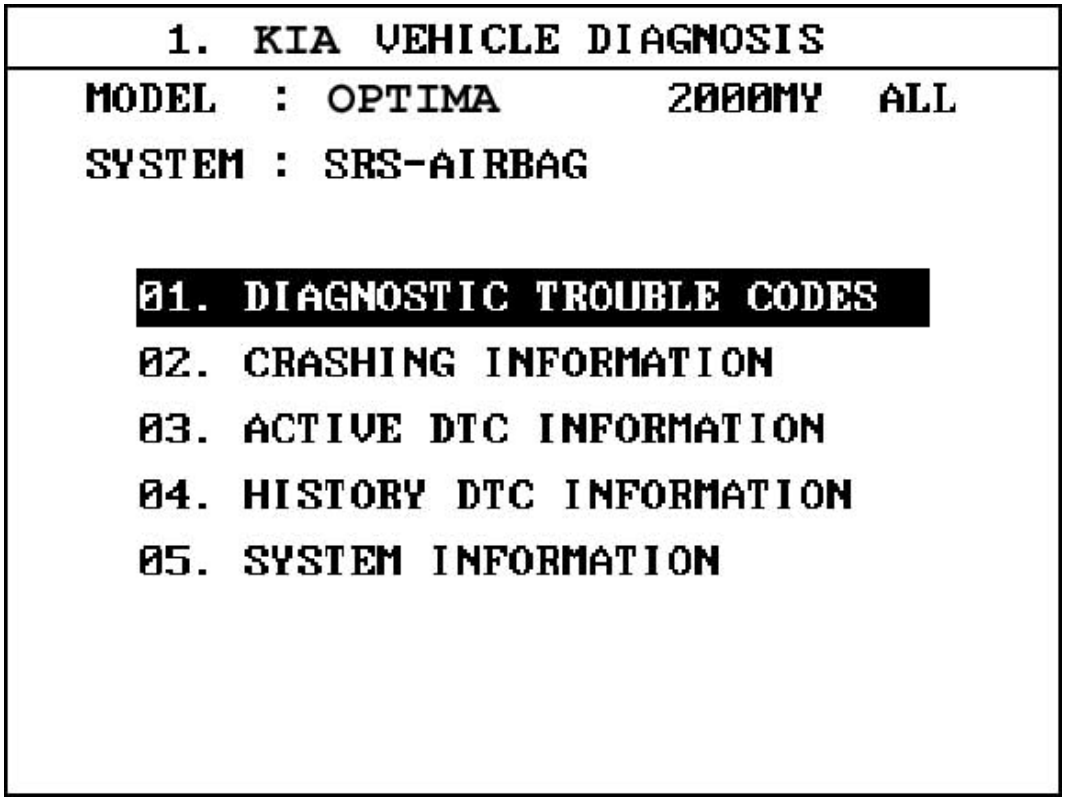
Case3: Active Fault - Lamp is illuminated continuously if the total number of external fault occurrences are greater than 5 or the crash register is memorized in the non-volatile memory.



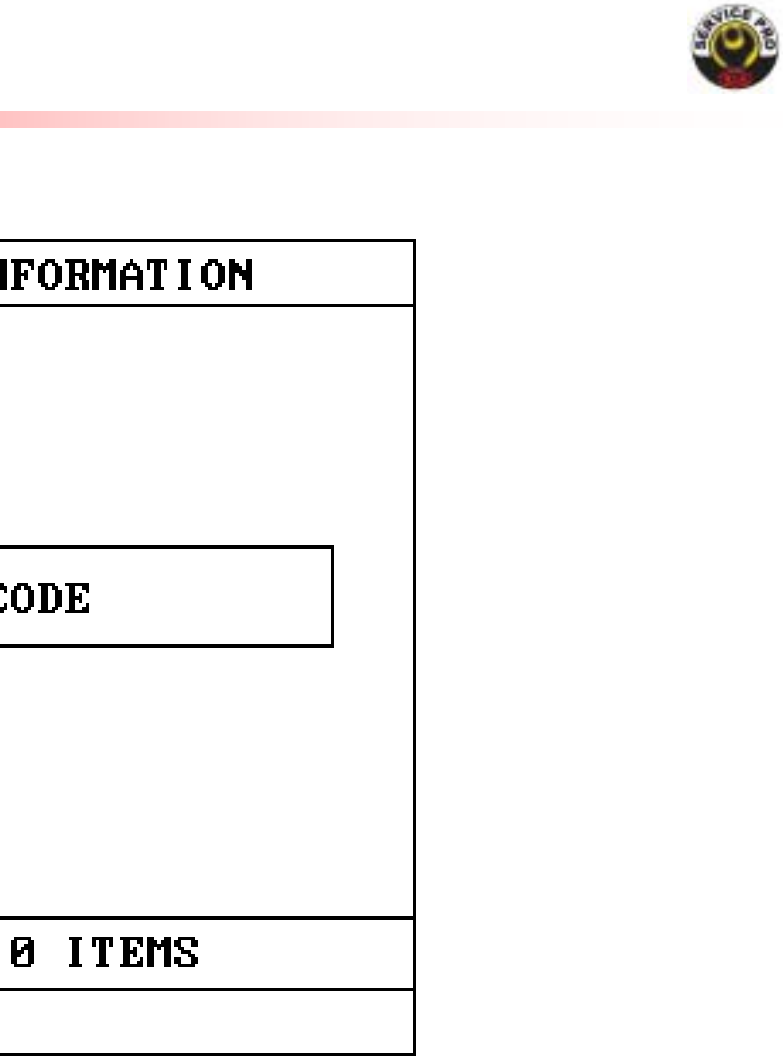
Hi-Scan Pro Display



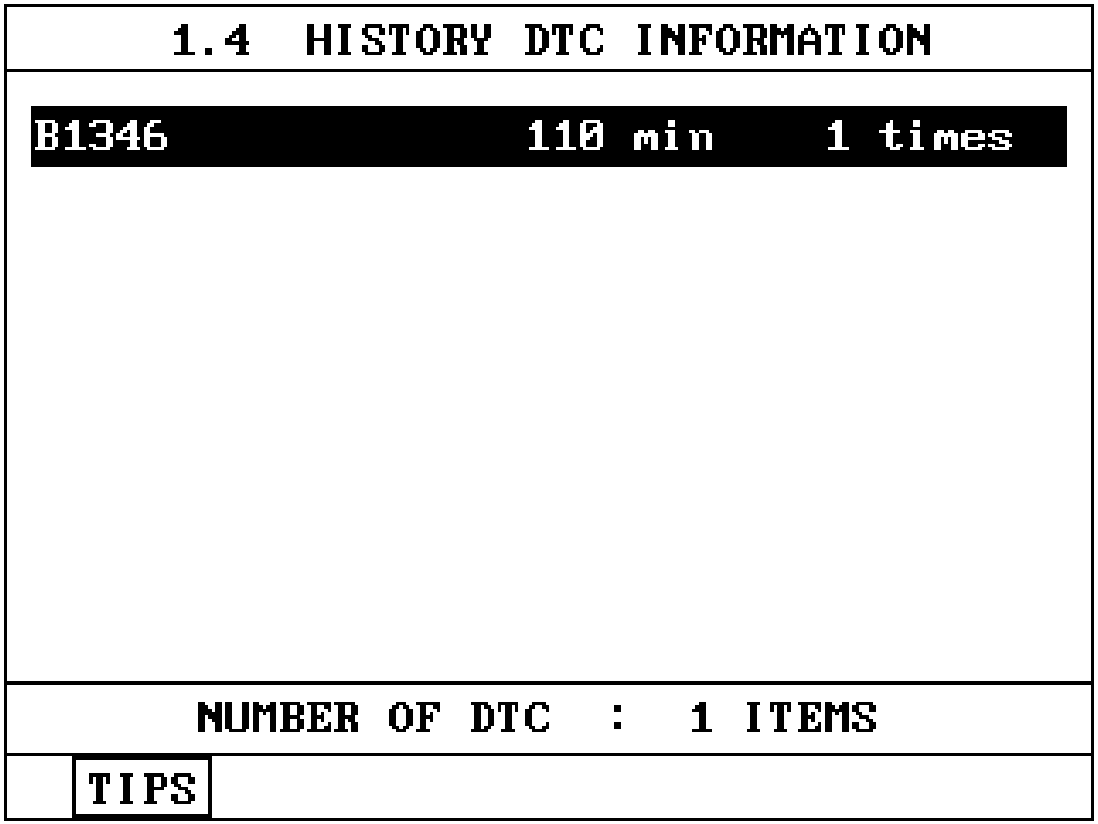
Hi-Scan Pro Display



Hi-Scan Pro Display



Hi-Scan Pro Display



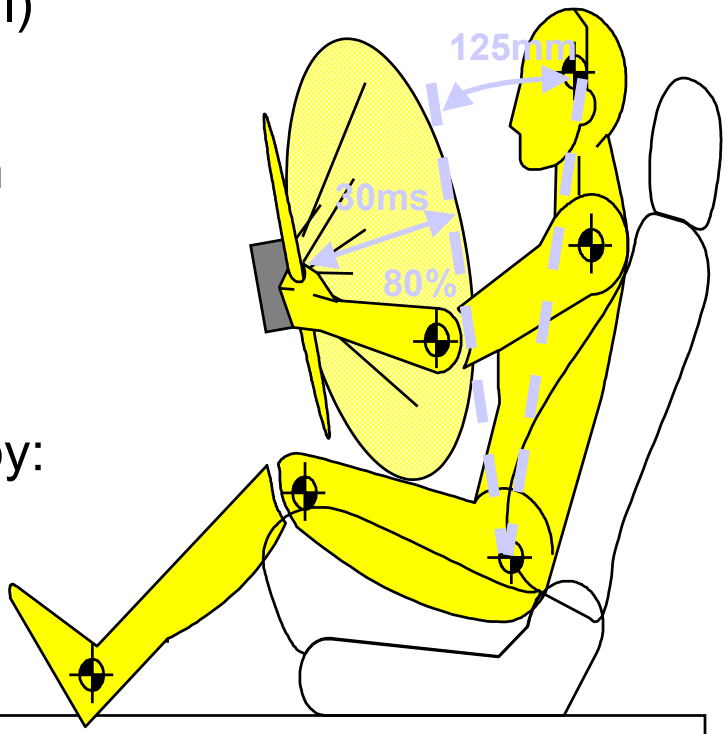
Fault code B1346 was recorded once, and it exists for 110 min.

Airbag Deployment

- The airbag must be inflated 80% when the driver reaches 125mm forward displacement
- The airbag (driver = 60 l, pass = 140 l) takes 30ms to reach 80% inflation
- 125mm forward displacement is reached after 40-80ms depending on the impact velocity
- The Fire/No Fire decision must be reached by the crash algorithm 10-50ms after impact.
- The optimum firing time is obtained by:
  - Crash film analysis
  - Double integral of acceleration

Optimum Firing Time Calculation

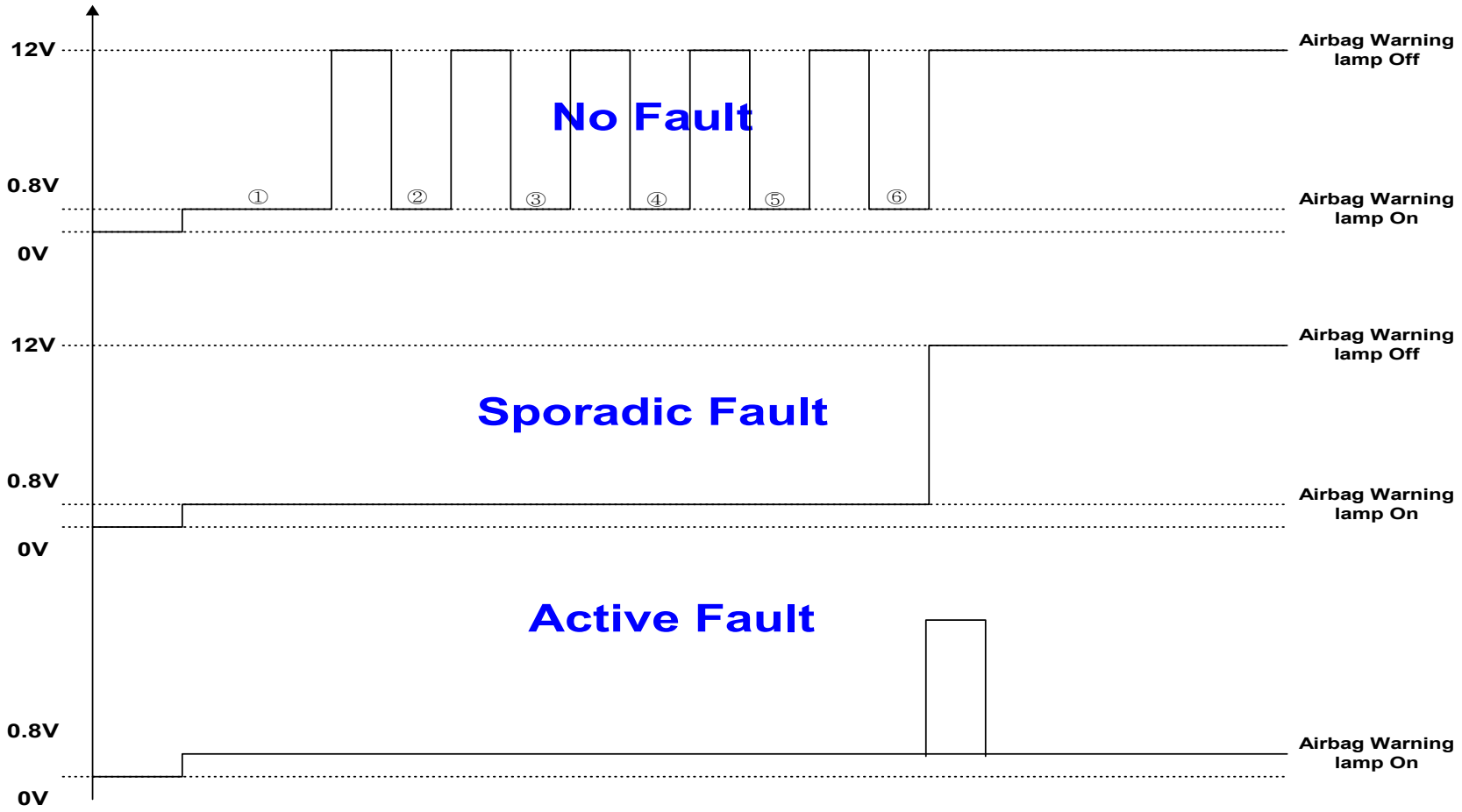
- ***Crash Performance***



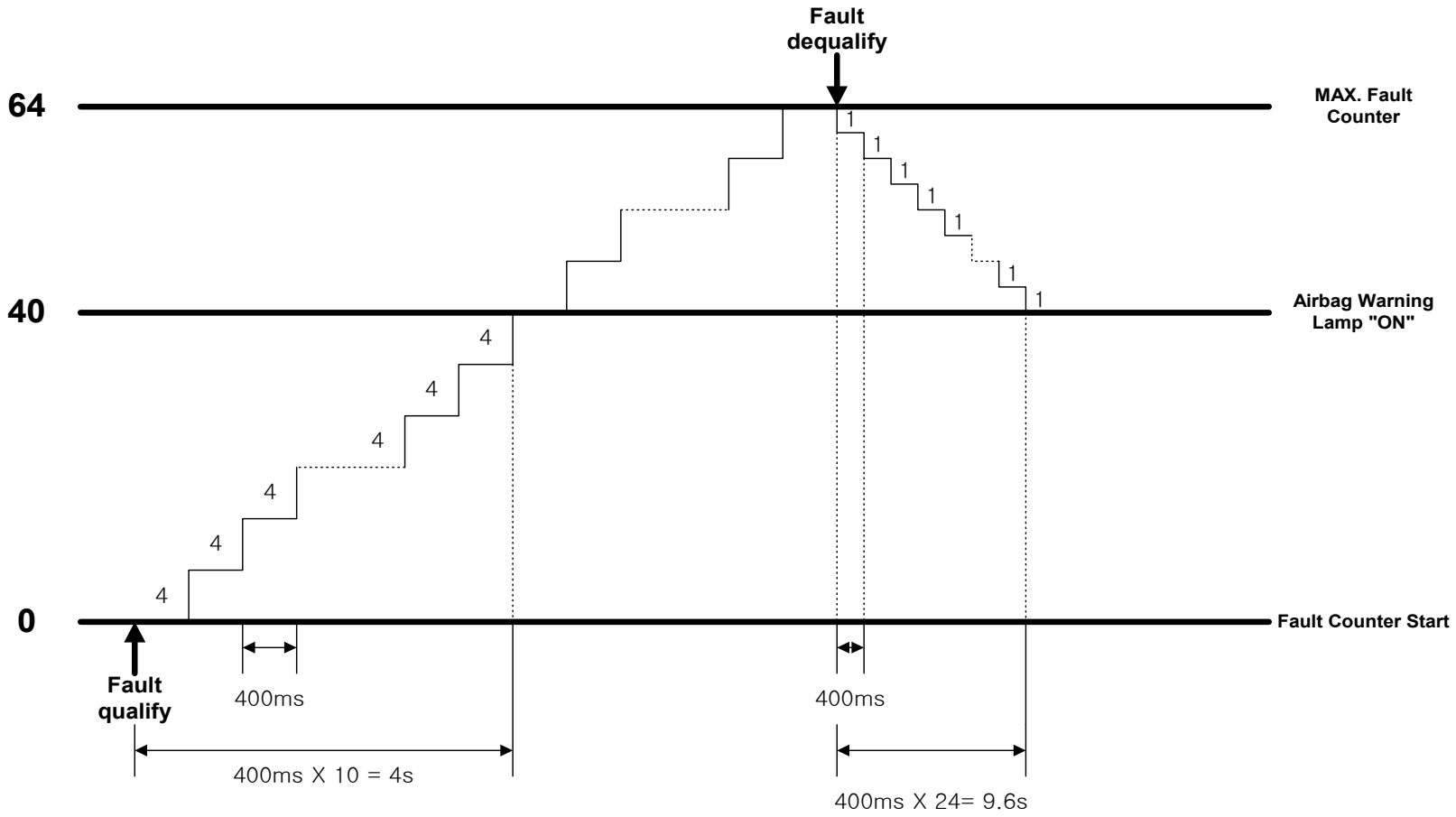
$$T_{Fire} = T_{125mm\ Forward\ Displacement} - 30ms_{\ Airbag\ Inflation\ Time}$$

SAE/SRE-HMC

Airbag Warning Lamp Behavior



Fault


Fault dequalify
64
MAX. Fault Counter
40
Airbag Warning Lamp "ON"
0
Fault Counter Start
Fault qualify
400ms
400ms
400ms X 10 = 4s
400ms X 24= 9.6s
4
4
4
4
4
4
1
1
1
1
1
1
1