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Push Button Start: The new ignition switch

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Presentations

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NACAT 09 presentation

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Push Button Start: The new ignition switch

NACAT ‘09

Matt Dixon and Omar Trinidad

Southern Illinois University Carbondale

Push Button Start:

Starting a vehicle is now like starting a computer

We researched the system on 3 cars

2005 Toyota Avalon

2009 Acura TL

2009 Dodge Challenger

Remote/System Name

Dodge Challenger	Acura TL	Toyota Avalon
Keyless Go FOBIK	Keyless Access Remote	Smart Key

Vehicle Entry

Dodge Challenger	Acura TL	Toyota Avalon
Operator must press “unlock” on FOBIK	Capacitive door handle unlocks the vehicle with remote in the detection zone.	Capacitive door handle unlocks the vehicle with remote in the detection zone.

Vehicle Entry

ECU the remote communicates to

Dodge Challenger	Acura TL	Toyota Avalon
PEM & WIN	Keyless Access	Smart Key

Start/Stop Switch

Dodge Challenger	Acura TL	Toyota Avalon
Button Switch: Detects if present Contact Switch	Push Button: Switch to Ground Switch to Power	Push Button: Two Switches to Ground
		

ECU's that monitor the Start/Stop switch

Dodge Challenger	Acura TL	Toyota Avalon
WIN	PCU Keyless Access Remote Slot	PSC Smart Key

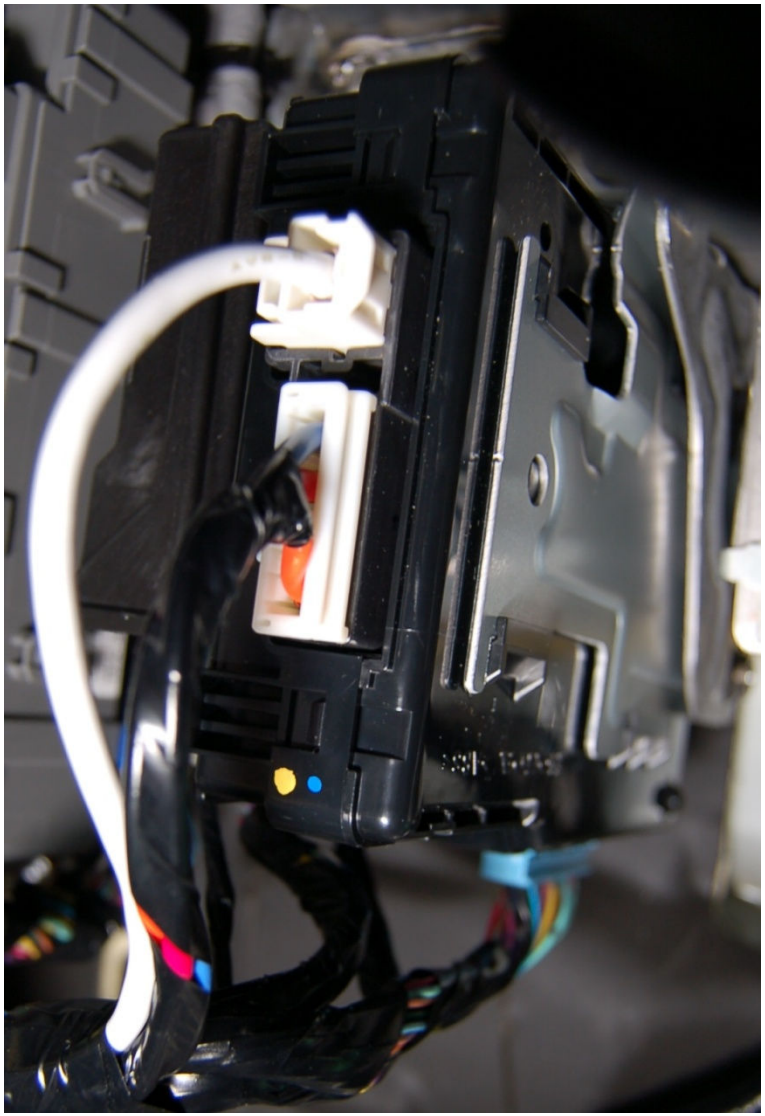
Security ECUs

Dodge Challenger	Acura TL	Toyota Avalon
WIN	Driver's MICU Integral Immobilizer	Immobilizer & Smart Key

Module acting as Ignition Switch

Dodge Challenger	Acura TL	Toyota Avalon
TIPM	PCU	PSC

Power Control Unit (PCU)



Remote Failure Strategy

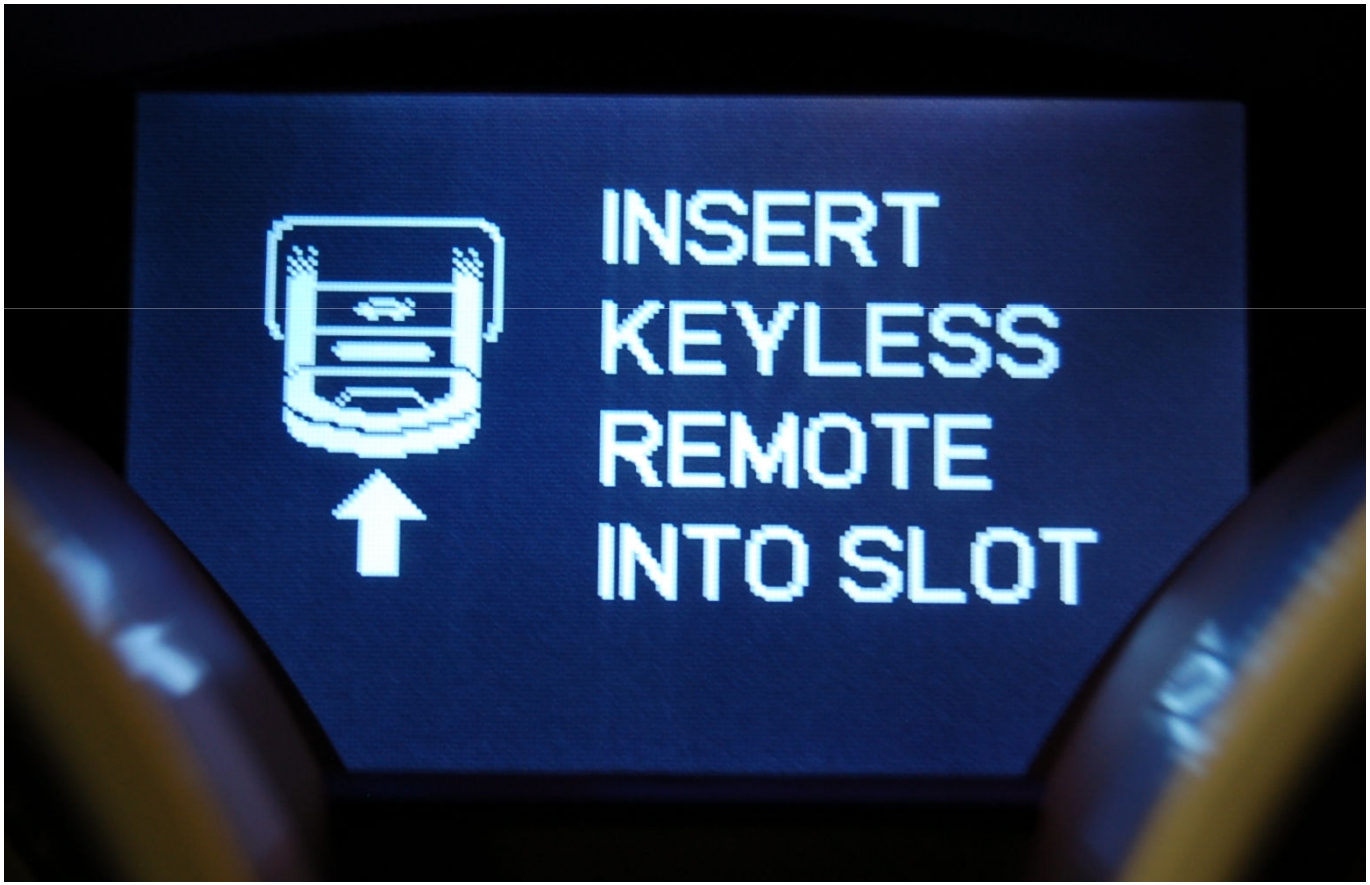
Dodge Challenger	Acura TL	Toyota Avalon
Pry off the start/stop button, insert FOBIK into slot and rotate	Insert the remote into the slot	Hold the Smart Key next to the start/ stop switch

Remote Failure Strategy

Icons & Display

Dodge Challenger	Acura TL	Toyota Avalon
Information Display in cluster	Dash Message Screen, Keyless Icon	Start/ Stop Switch LED colors, Keyless Icon

Icons & Display



Communication Networks

Dodge Challenger	Acura TL	Toyota Avalon
CAN C CAN B Diagnostic CAN C	F-CAN B-CAN K-Line Isolated Networks	LIN High Speed CAN

Modes

ACC

RUN

START

OFF

Accessory

Dodge Challenger	Acura TL	Toyota Avalon
TIPM activates the ACC relay, Some modules turn on via bus message	PCU activates the ACC relay	PSC activates the ACC relay

Run

Dodge Challenger	Acura TL	Toyota Avalon
TIPM activates the RUN/ START Relay	PCU activates IG1a, IG1b, and IG2 relays	PSC activates IG1, IG2, and Start Cut Relays

Engine Start Request

Dodge Challenger	Acura TL	Toyota Avalon
Sent through the CAN C from WIN to PCM	12 volt “STS” signal from PCU to PCM	12 volt signal “STSW” from the PSC to PCM

Starter Control

Dodge Challenger	Acura TL	Toyota Avalon
PCM grounds the control side of the starter relay	PCM powers and P/N switch grounds the control side of starter relays 1 and 2,	PCM sends power through the start cut out relay and the P/N switch to the control side of starter relay

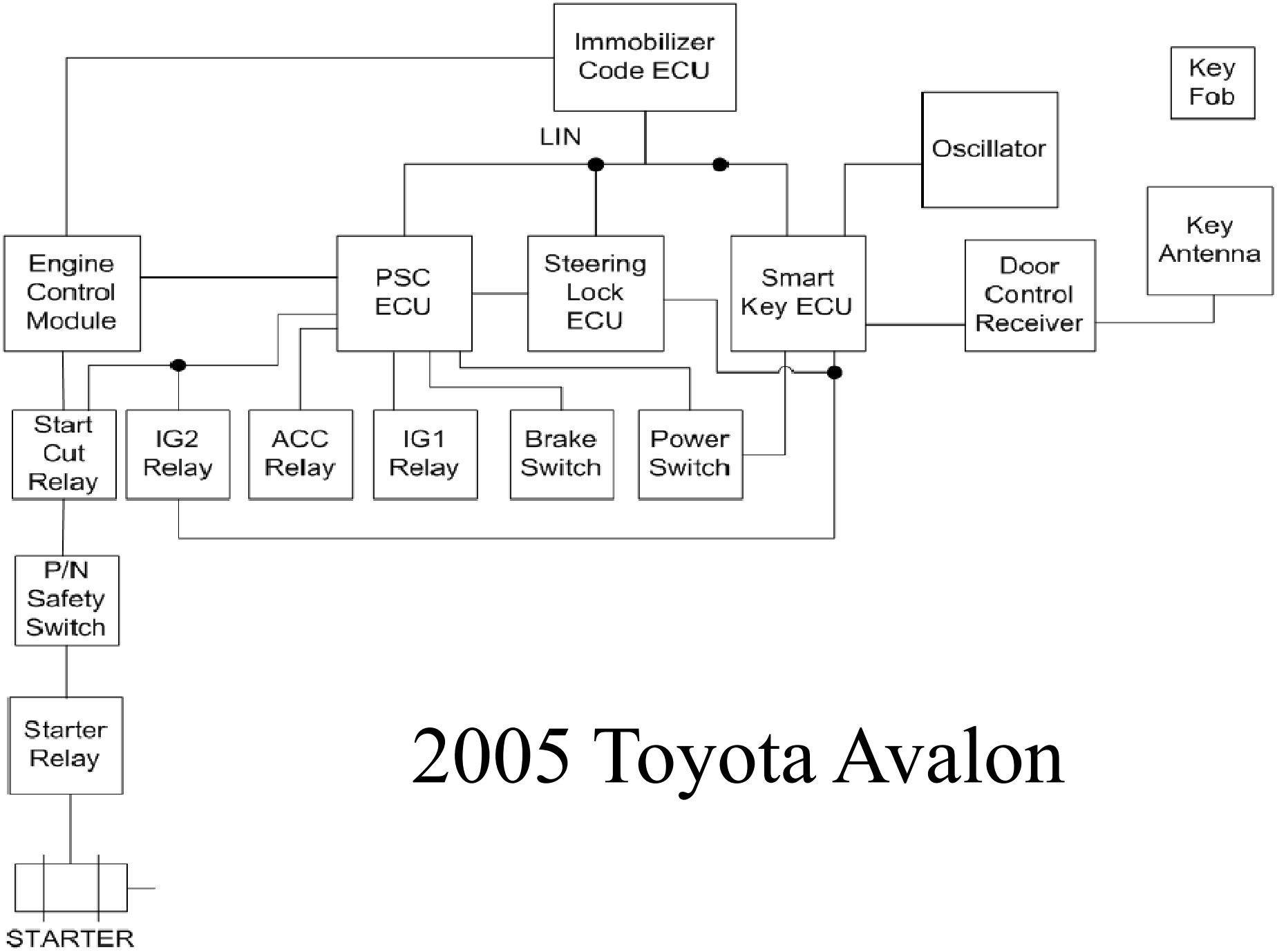
PCM Ignition Feeds

Dodge Challenger	Acura TL	Toyota Avalon
Connector 1 11: Accessory, Run, Start from TIPM 12: Run/Start from relay	Connector B 42: IGN1 from PCU Connector A 13: ACC from ACC relay	Connector D 9: from the IG1 relay

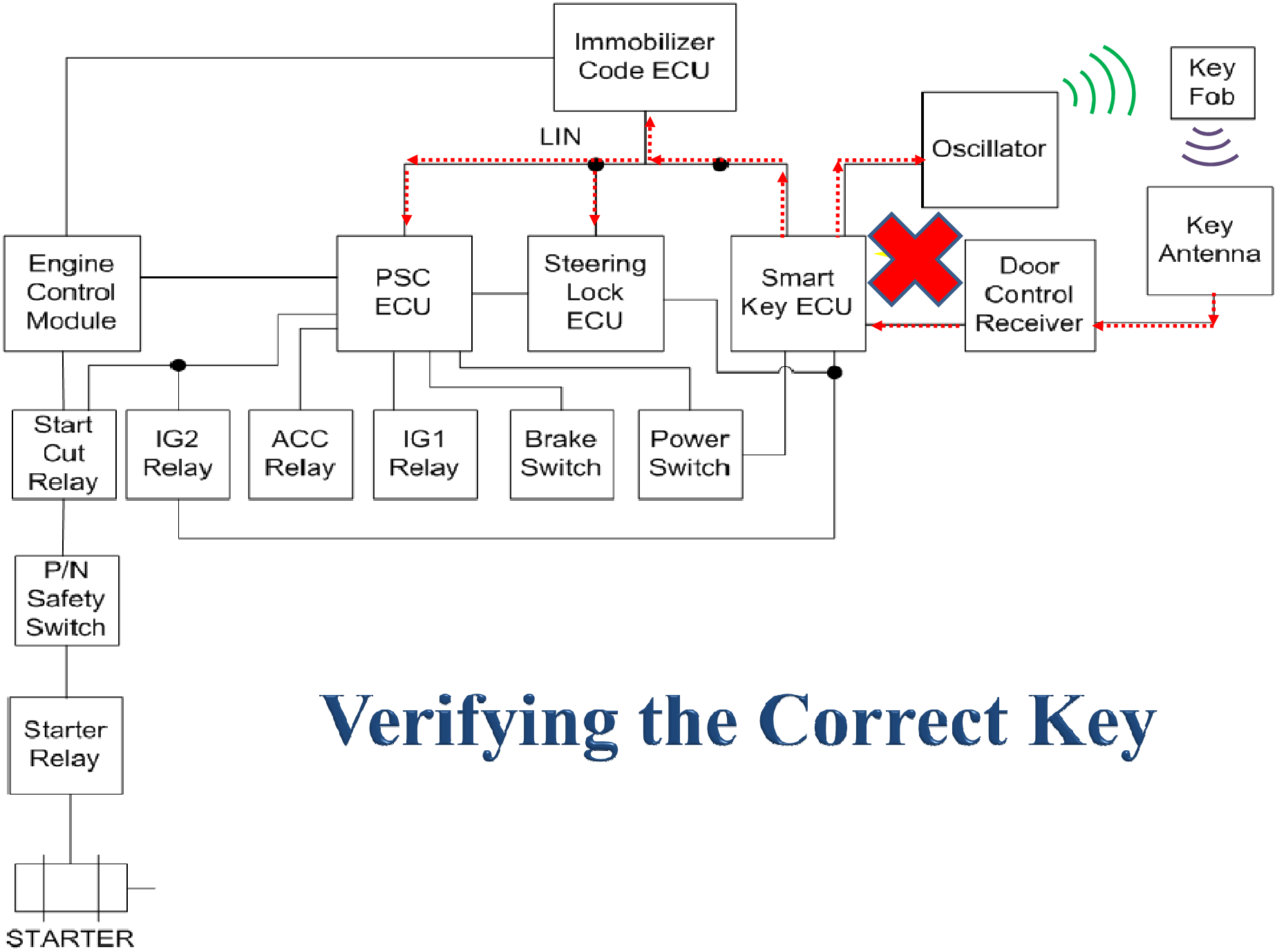
SRS Ignition Feeds

Dodge Challenger	Acura TL	Toyota Avalon
Run/Start: fuse 27 from run/start relay Run: Fuse 41 from run relay	IG1A: Fuse 11 IG1B: Fuse 5	IG2 10 amp fuse powered off IGN2 relay

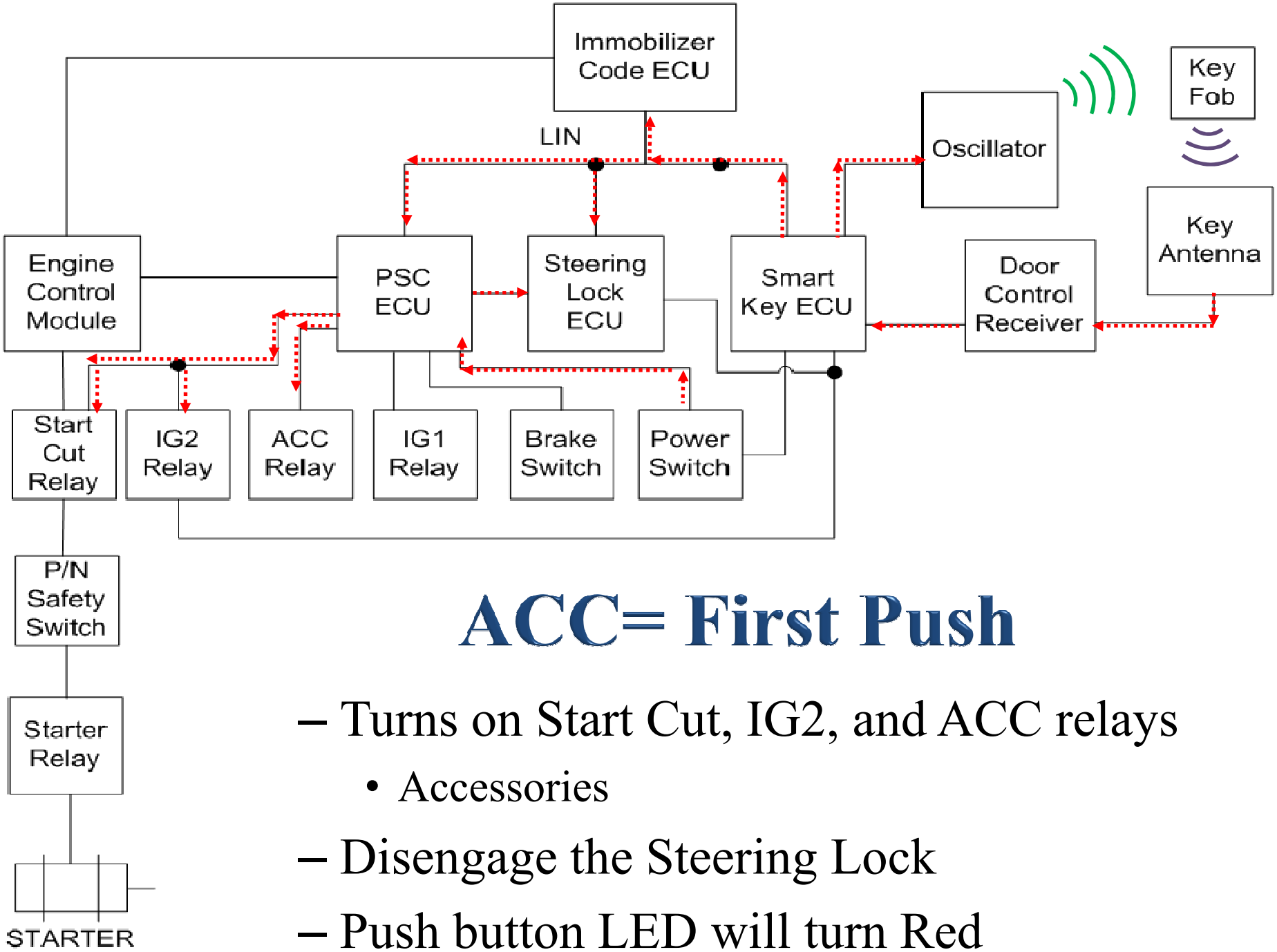
2005 Toyota Avalon



2005 Toyota Avalon



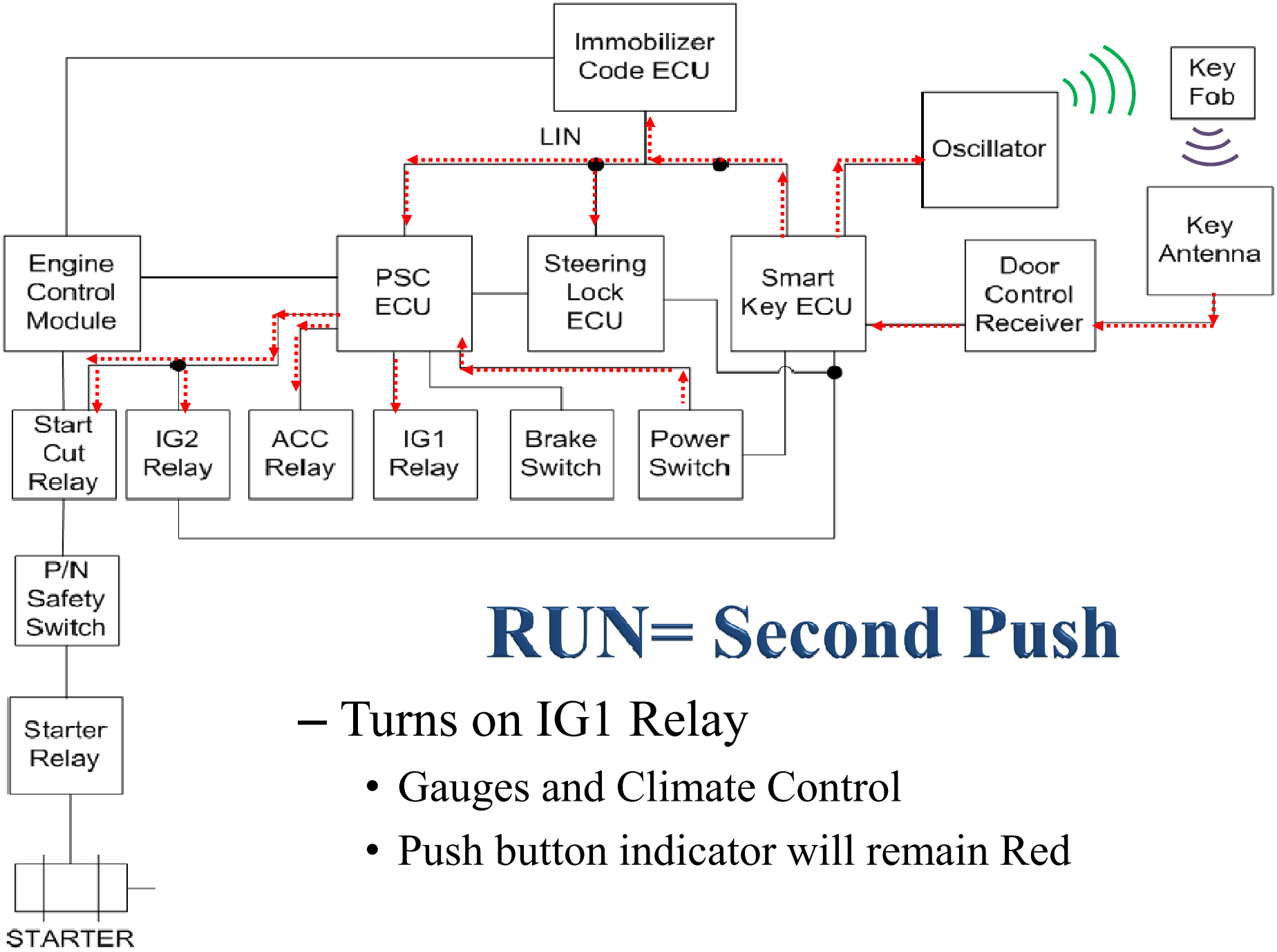
Verifying the Correct Key



ACC= First Push

- Turns on Start Cut, IG2, and ACC relays
  - Accessories
- Disengage the Steering Lock
- Push button LED will turn Red

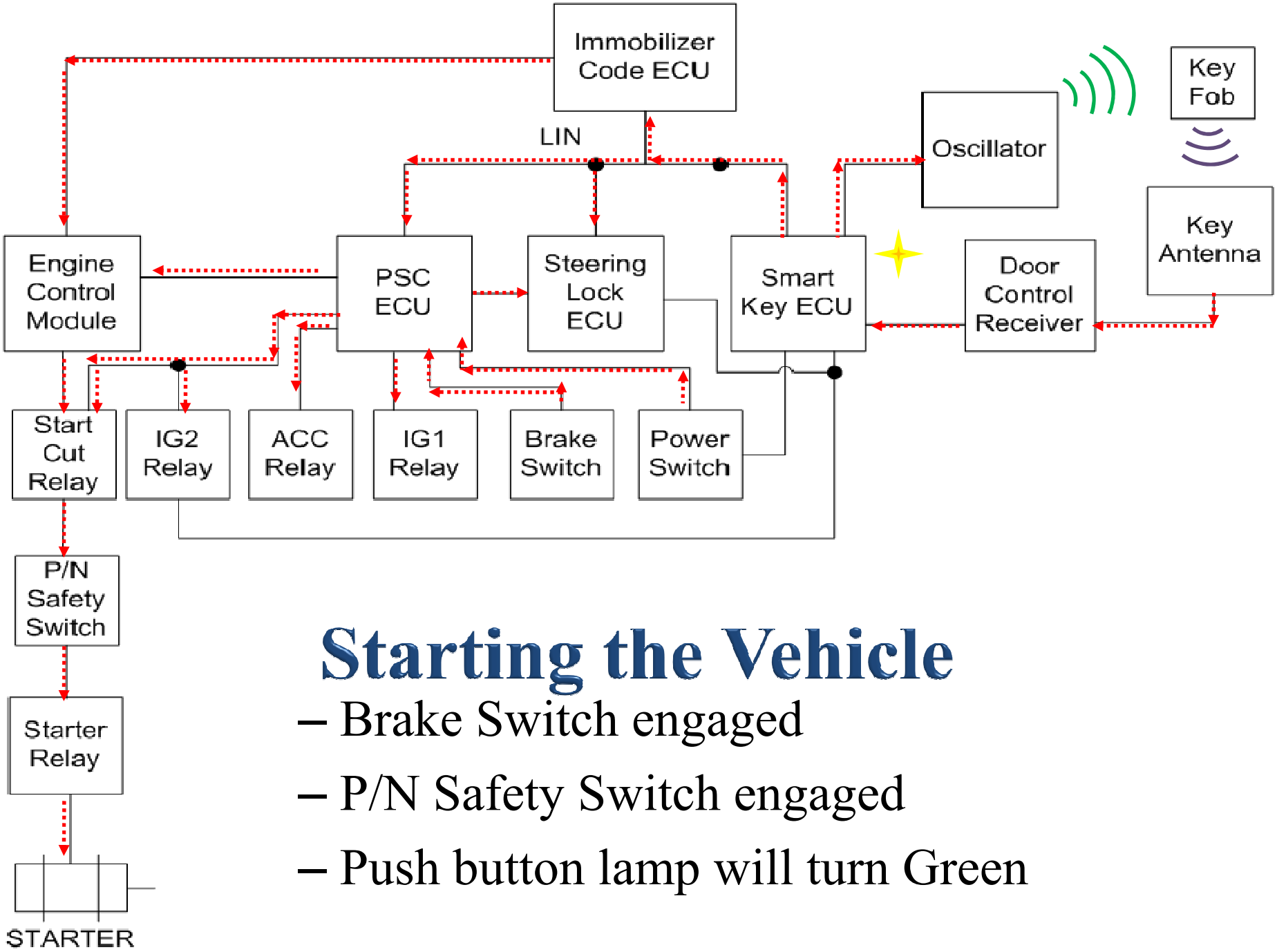
Accessory Position= First Push



RUN= Second Push

- Turns on IG1 Relay
  - Gauges and Climate Control
  - Push button indicator will remain Red

Second Push of the Button

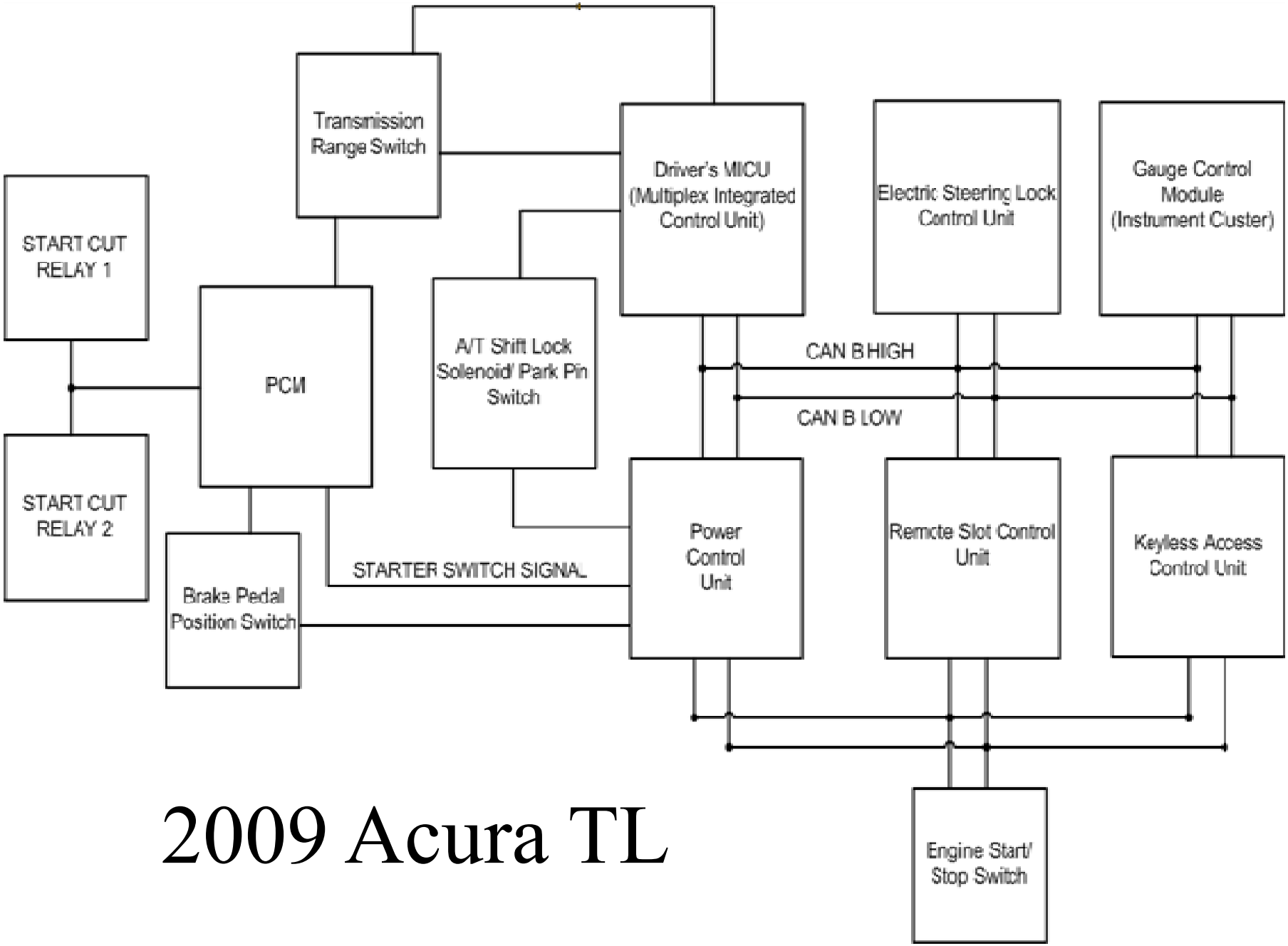


Starting the Vehicle

- Brake Switch engaged
- P/N Safety Switch engaged
- Push button lamp will turn Green

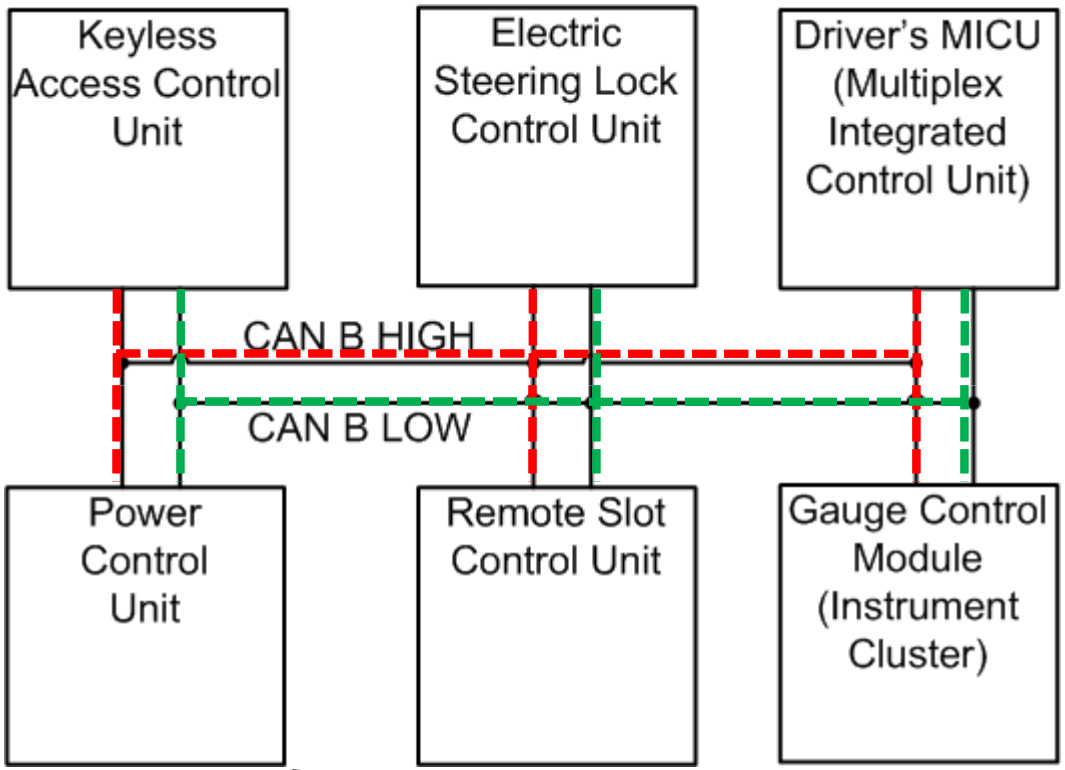
Starting the Vehicle

2009 Acura TL

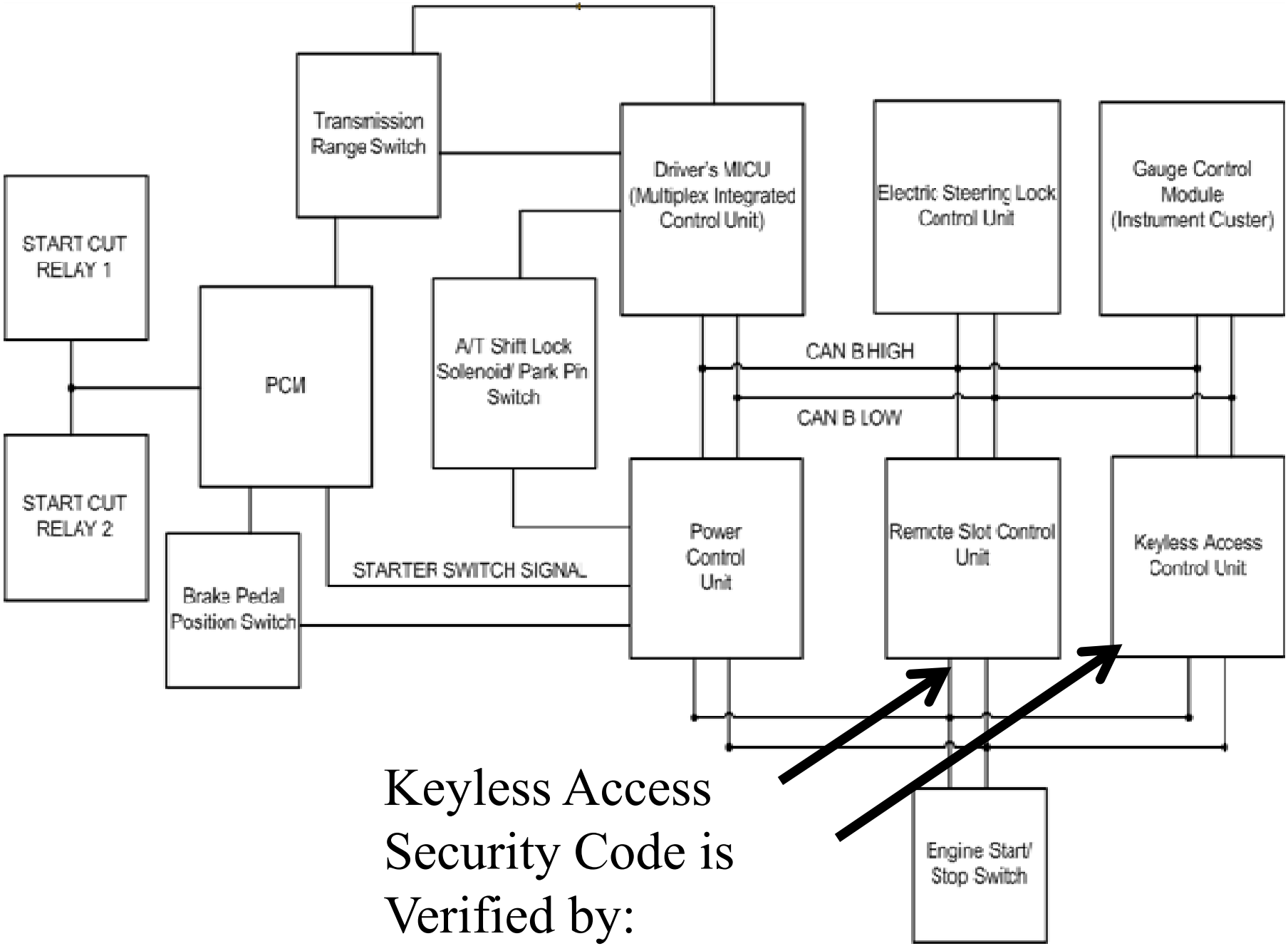


2009 Acura TL

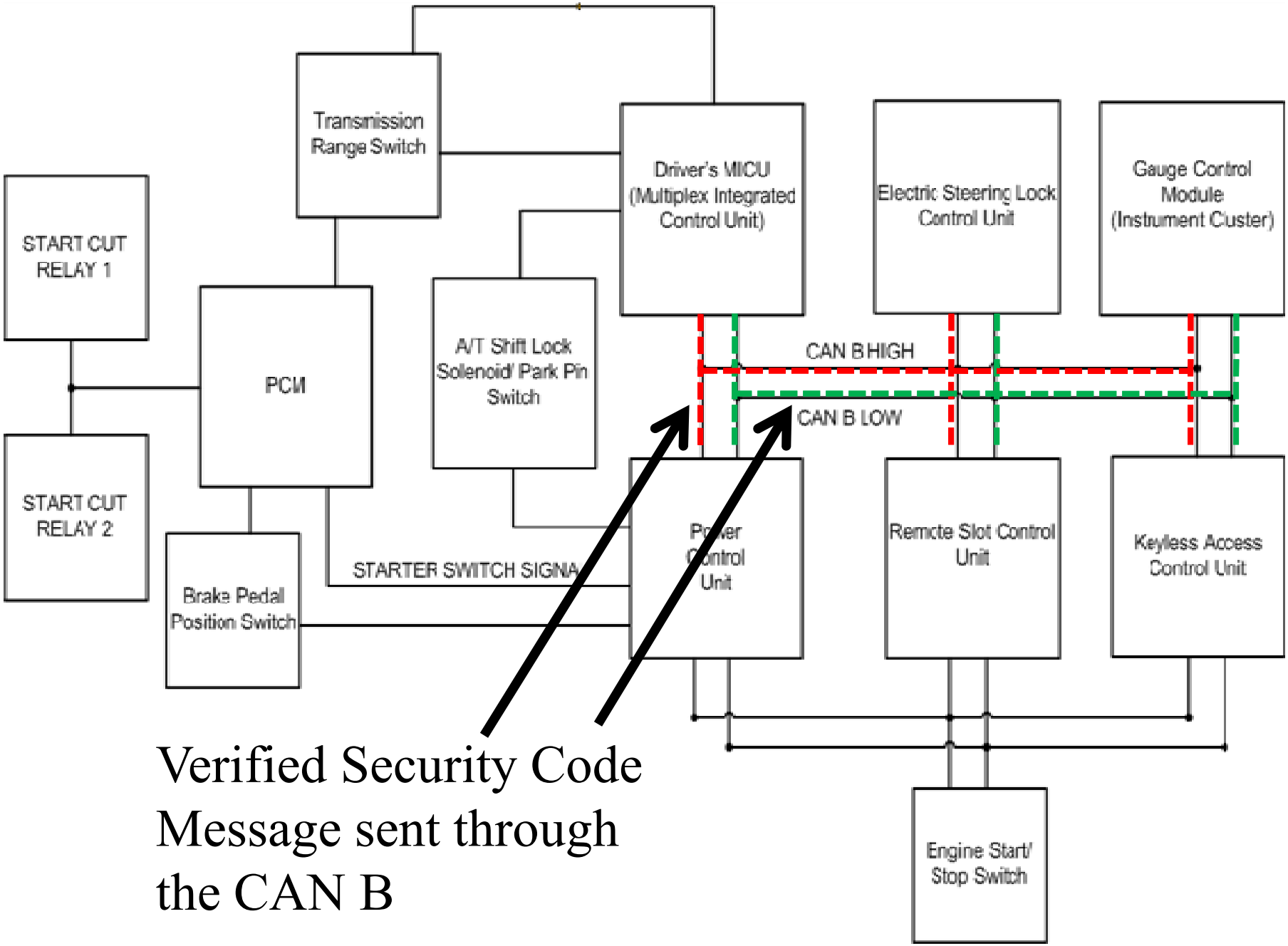
CAN B Modules



Contains IG1a, IG1b, and IG2 Relays



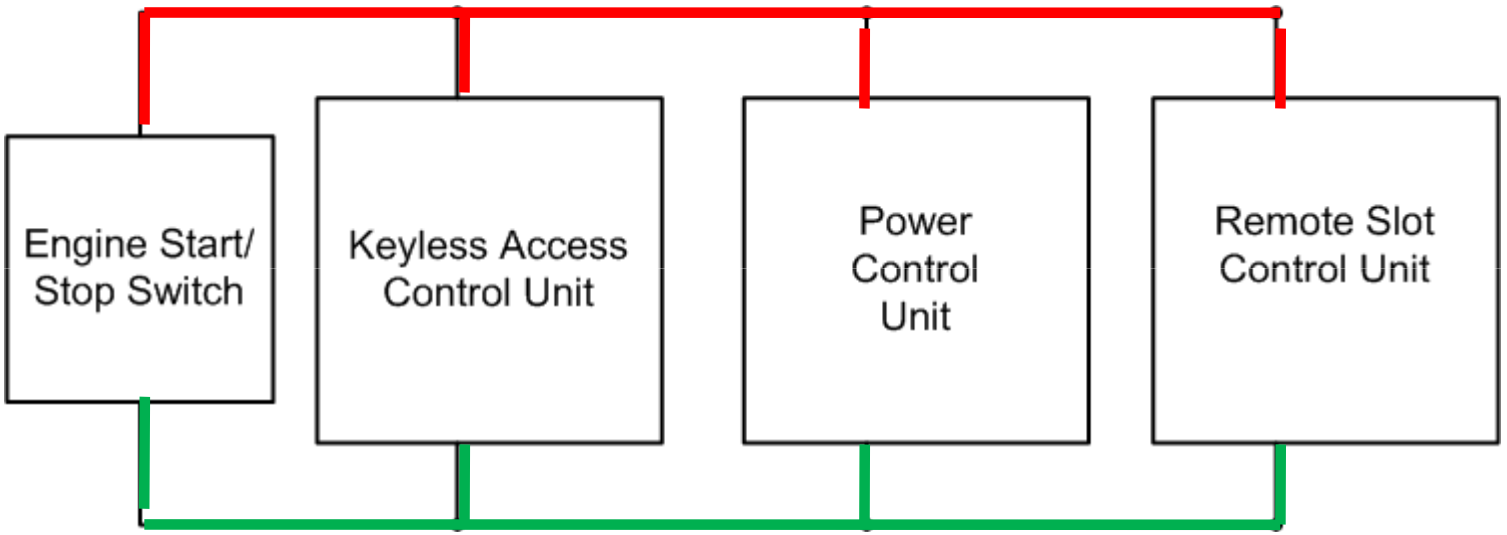
Keyless Access Security Code is Verified by:



Verified Security Code Message sent through the CAN B

Start/Stop Switch

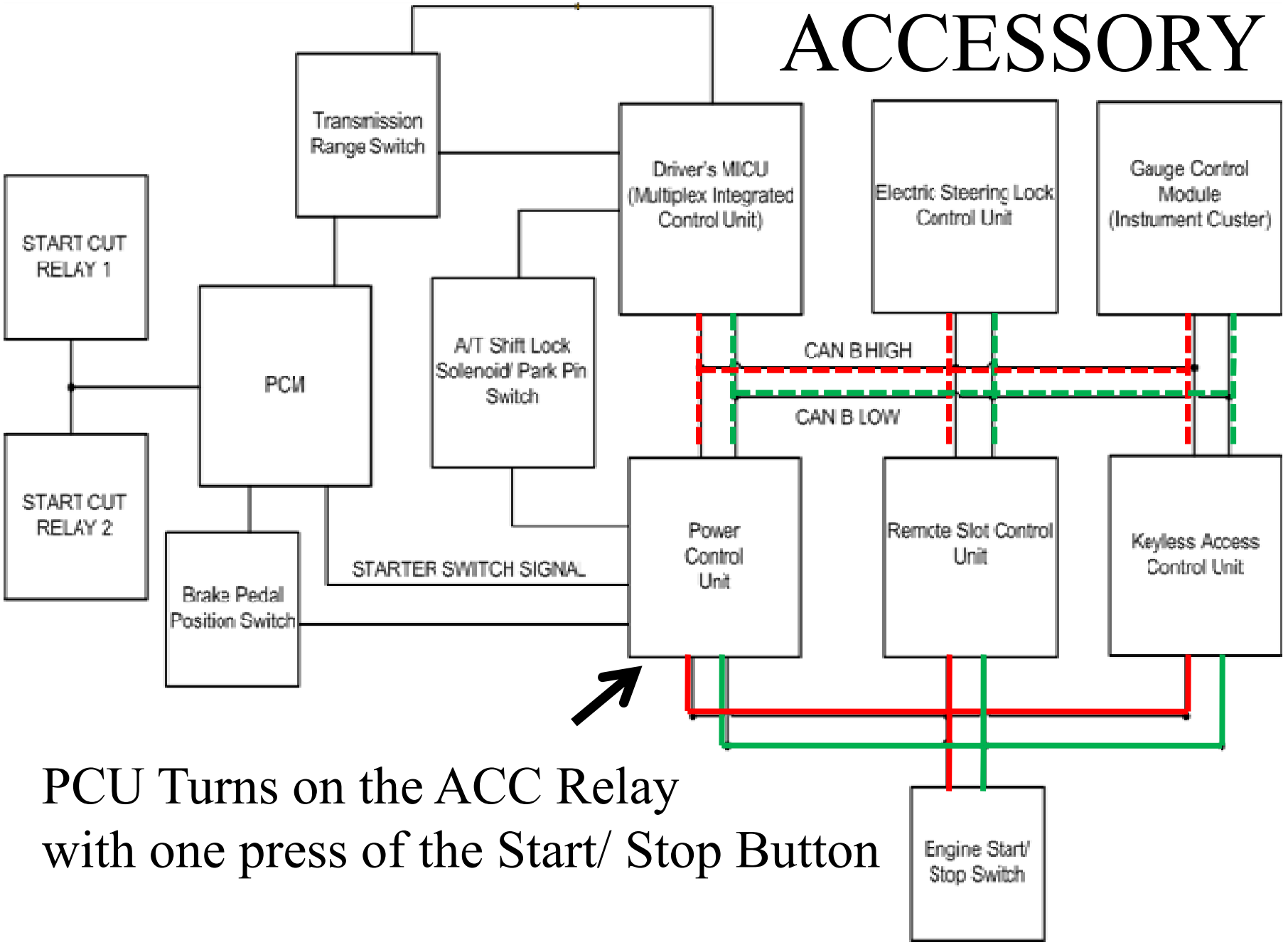
Pulls Voltage UP



Pulls Voltage Down

Start/Stop Switch Button

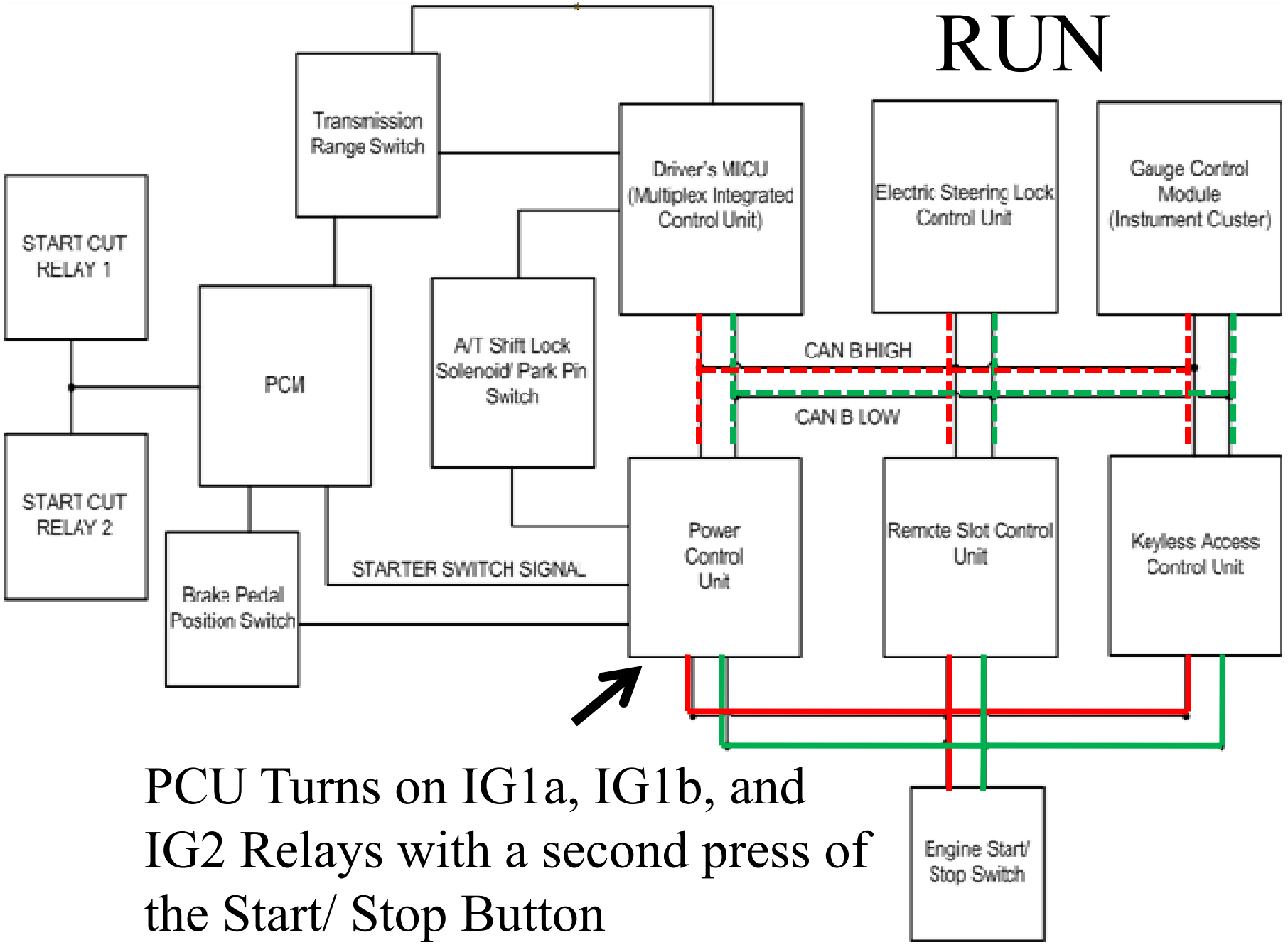
ACCESSORY



PCU Turns on the ACC Relay
with one press of the Start/ Stop Button

ACCESSORY

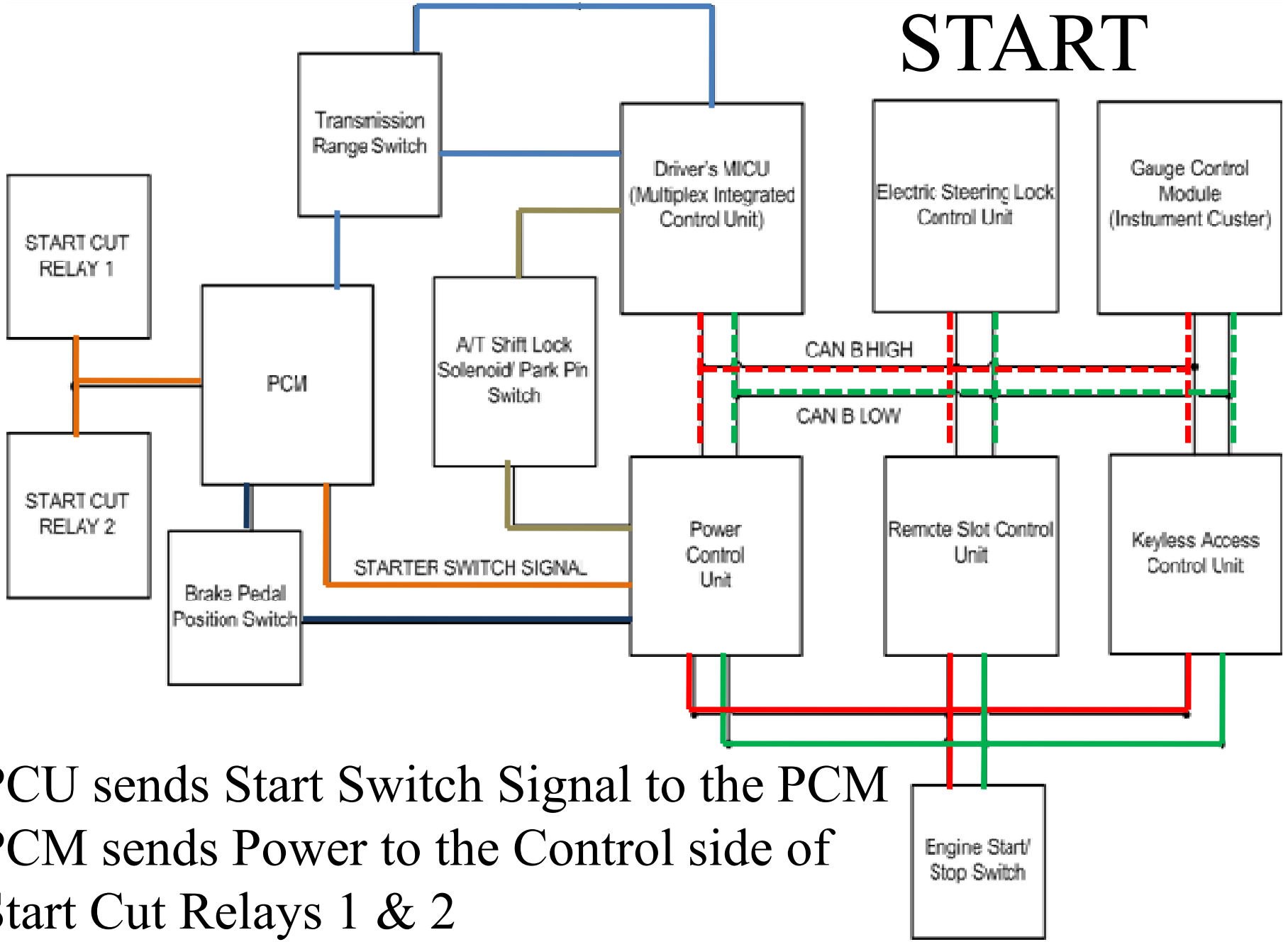
RUN



PCU Turns on IG1a, IG1b, and IG2 Relays with a second press of the Start/ Stop Button

RUN

START



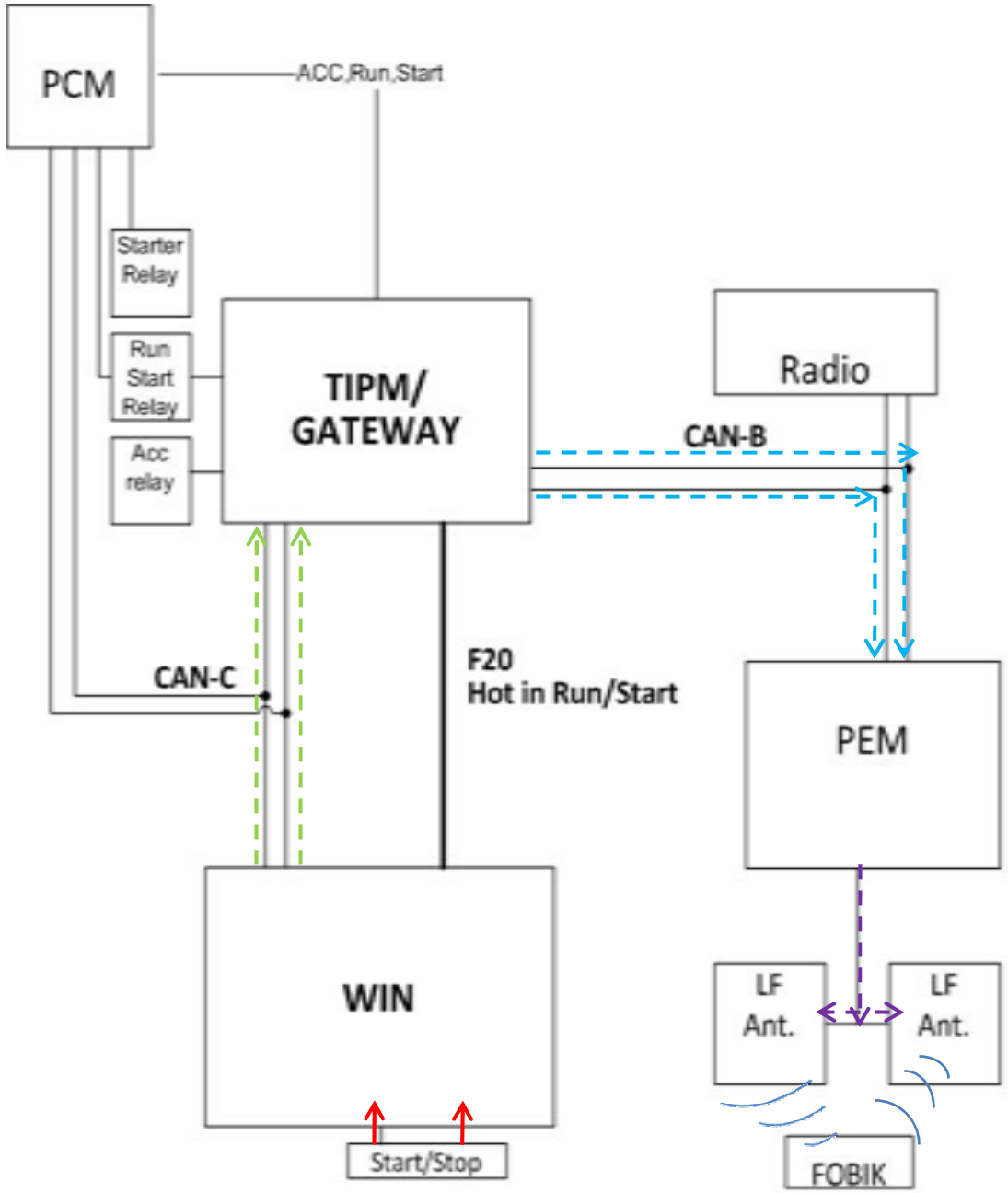
PCU sends Start Switch Signal to the PCM

PCM sends Power to the Control side of Start Cut Relays 1 & 2

START

2009 Dodge Challenger

Validate FOBIK

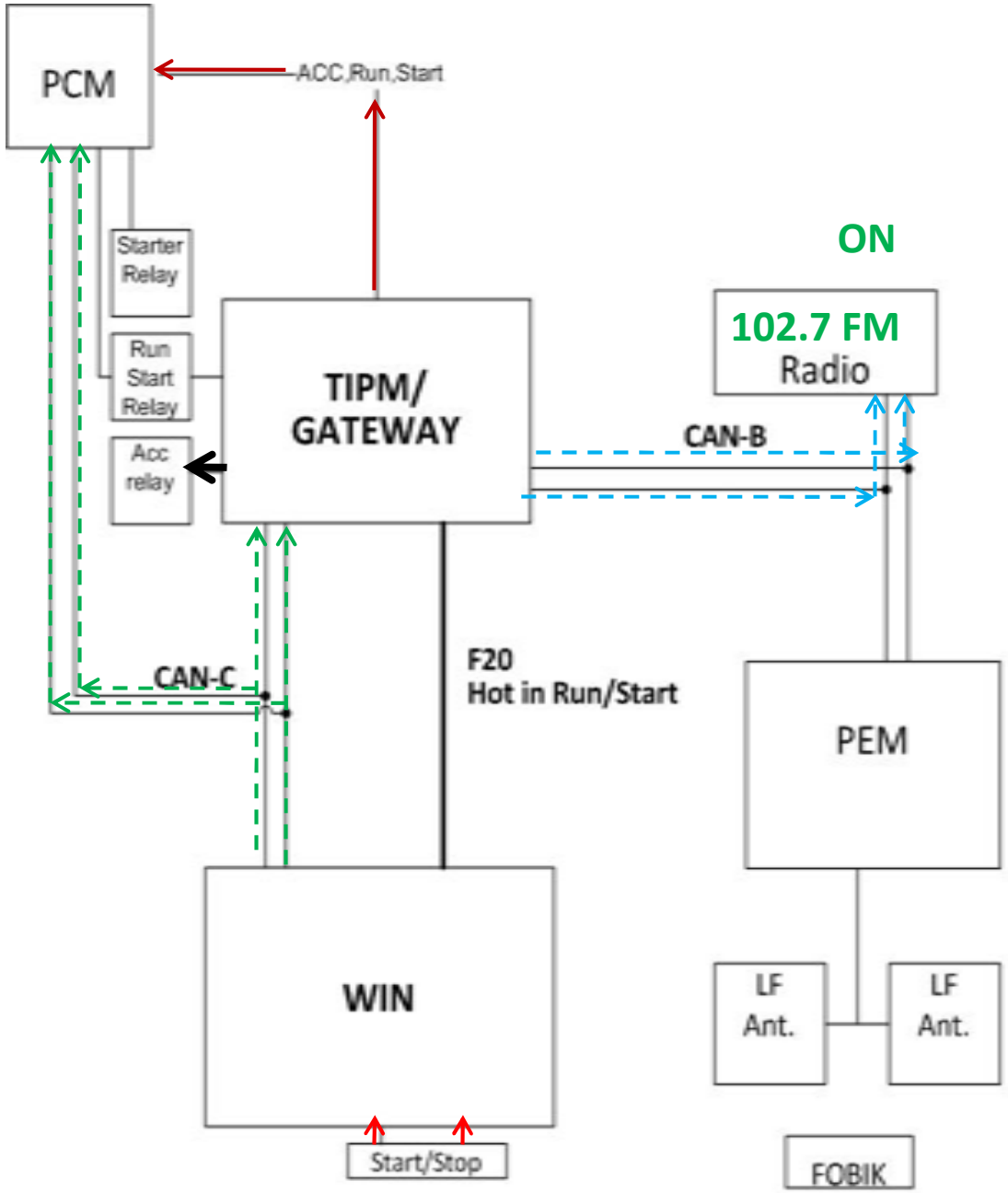


Start/Stop pressed

WIN sends 64 bit challenge to PEM

PEM broadcasts 20 KHz signal to FOBIK using 2 antennas

FOBIK returns challenge to PEM with 433 MHz signal

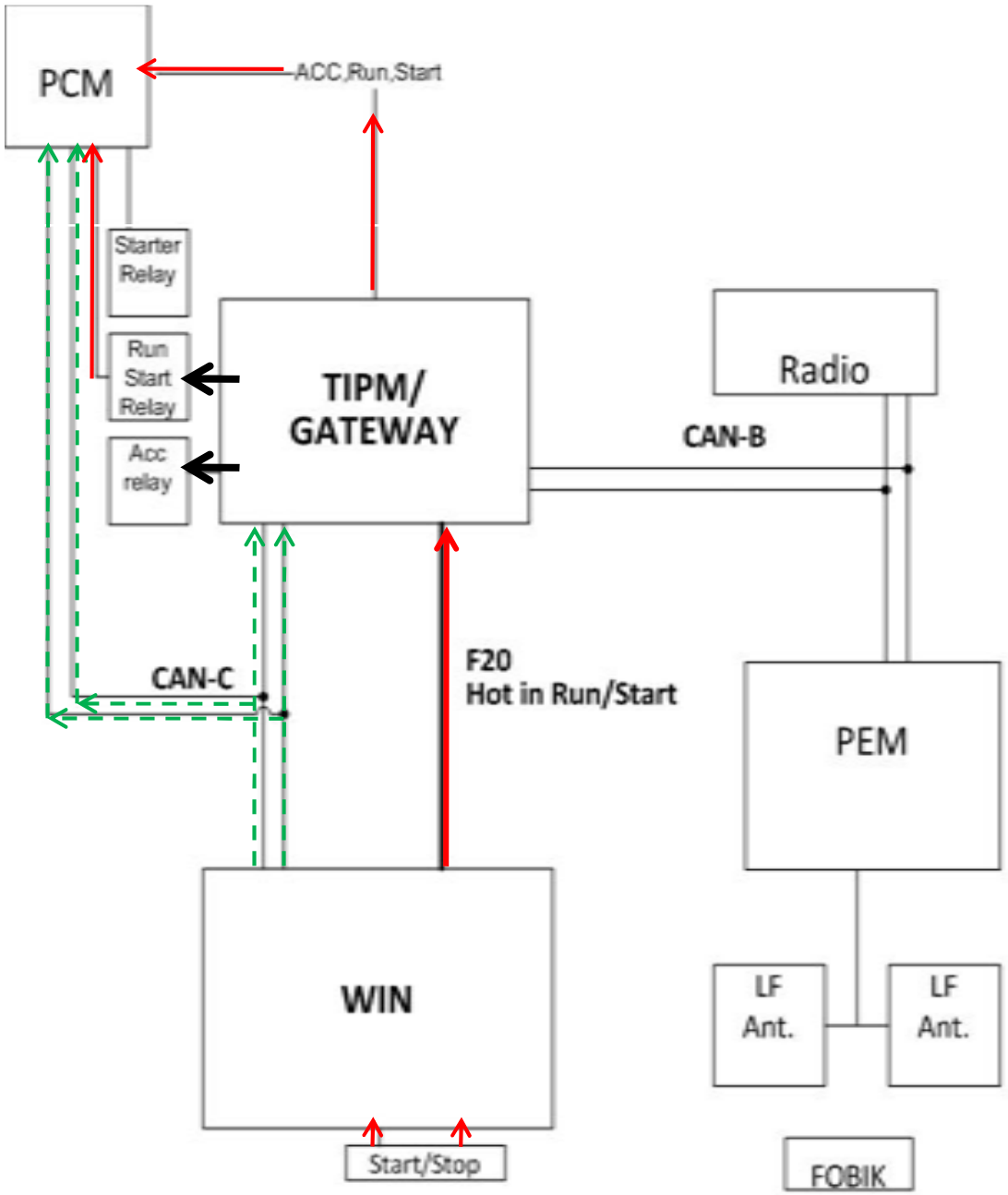


Accessory Mode:

WIN broadcasts mode on CAN, some modules activate from bus message

TIPM powers PCM feed:11 and activates ACC relay

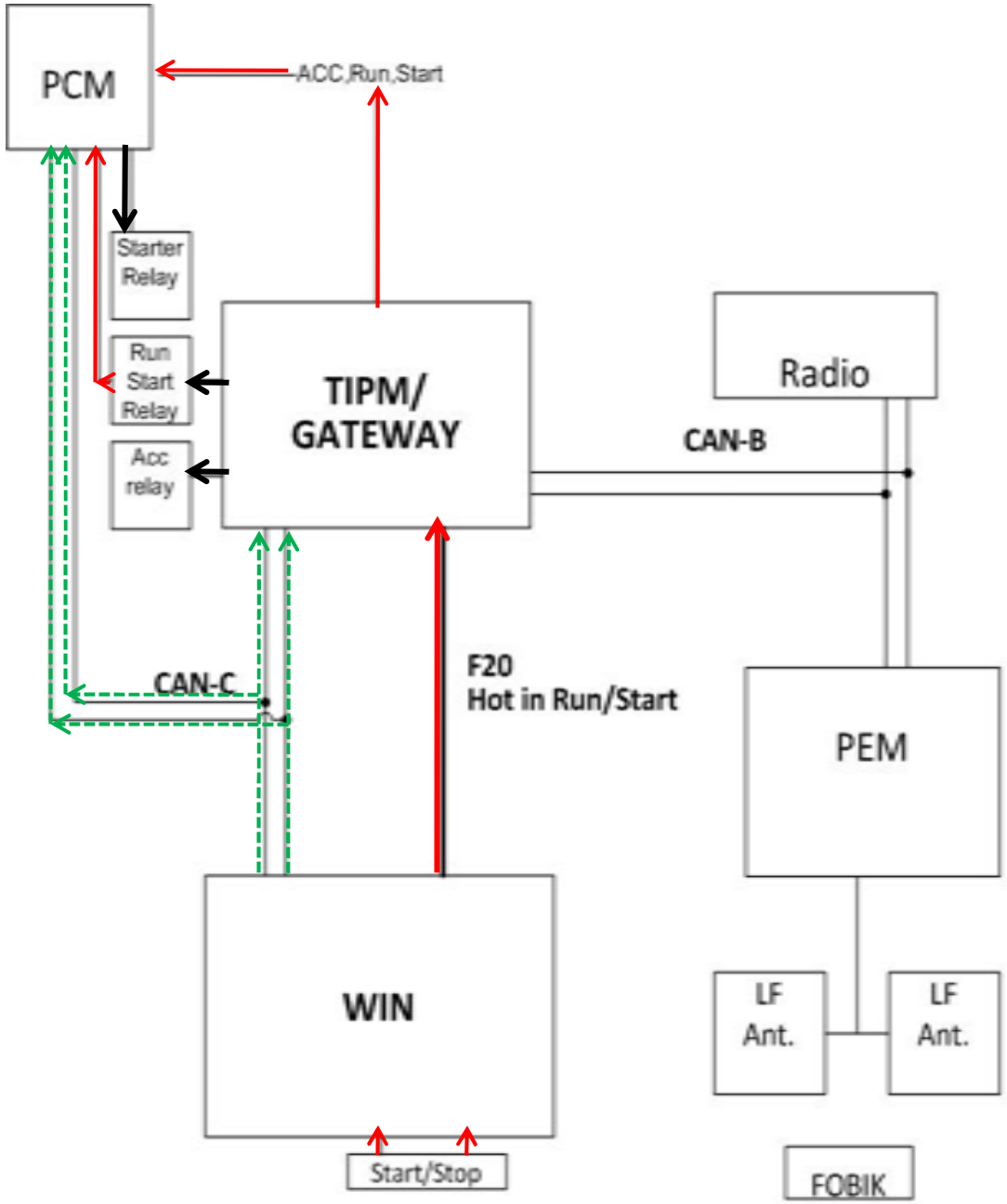
Run Mode



WIN broadcasts mode on CAN and powers the F20 circuit

TIPM activates the run and run/start relays

PCM powered on 2 terminals: 11, 12



Start Mode:

Brake monitored by WIN must be pressed

WIN broadcasts mode on CAN and powers the F20 circuit

PCM checks inhibits and grounds control of starter relay

Starting the Challenger

Diagnostics

1. First observe exactly what works and what does not. Radio work?, What icons are displayed etc.

Starting System Fault Icon

Diagnostics

2. Rule out transmitter/battery issues by trying the failsafe mode. Has the remote been programmed correctly?

Failsafe Mode

Diagnostics

3. If some systems operate and vehicle will not crank, test vehicle battery/connections and then check brake switch operation

Avalon LED Indicator

Diagnostics

(continued): If brake switch operation is good check the 12 volt start signal to the PCM on the Acura and Toyota. The Dodge is more reliant on CAN.

Diagnostics

4. No Start and No PCM communication: Begin by PCM ignition feed(s), B+, grounds and CAN checks.

Diagnostics

5. Nothing works: If vehicle battery/connections are good, check fuses, then access the module that acts as ignition switch: check inputs and outputs

Diagnostics

Overall good point of many quick checks are the underhood relays: ACC, IGN, Run/Start etc.

Questions?

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