

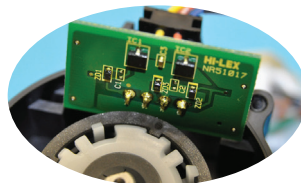
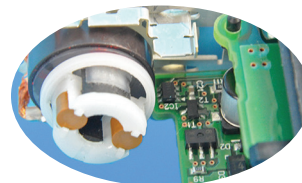
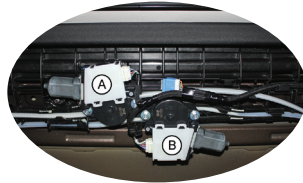


SUBARU

Confidence in Motion

Technician Reference Booklet Advance Electrical Systems and Diagnosis

COURSE 06L402002I



SUBARU

MSA5P2602C

April 2019

This Technician Reference Booklet (TRB) is designed to be used in a classroom environment or as a guide for self study.

The TRB is not intended to be used as a supplement or substitute for the Subaru Service Manual. Always consult the appropriate Service Manual when performing any diagnostics, maintenance or repair to any Subaru vehicle.

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MIDTRONICS: 800-776-1995 http://bmis.midtronics.com/Account/Login.aspx?ReturnUrl=%2F https://subaru.dss5000.com/	*Battery Management Information System (BMIS) *DSS-5000 Knowledge Database
SKILS EMAIL LMSTechnicalTraining@Subaru.Com	Email for all SKILS training related questions and concerns.
SUBARU DIAGNOSTIC SYSTEM (SDS) AND SUBARU SELECT MONITOR (SSM) NUSPIRE 877-782-7404	For SDS, SSM, Flash write, DST-i and printer issues
SUBARU FOUNDATIONS 888-780-2255	For Pinnacle and Foundations program information, card services and technical questions. Use for SKILS related issues and concerns
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SUBARU TRAINING DEVELOPMENT DevTechnicalTraining@Subaru.Com	Email for feedback, questions, ideas, and issues related to instructor led and web based technical (Technician) training.

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Driver Access and Convenience

Keyless Entry

Function of Keyless Entry System



Figure 1-1 Keyless Transmitter

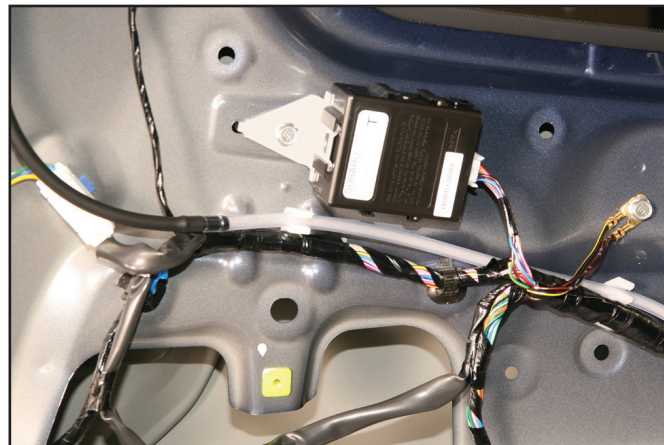


Figure 1-2 2011 Forester TPMS and Keyless Entry Control

Function	Function method	Action on a vehicle	Answer back
Locking the doors	Press the Lock button once.	All doors lock.	The hazard flasher blinks once and the buzzer sounds once (if all the doors were closed when the Lock button was pressed).
			The hazard flasher blinks 5 times and the buzzer sounds 5 times (if any of the doors were open when the Lock button was pressed).
Unlocking the doors	The first time: Press the Unlock button once.	Only the driver's door unlocks. (*1)	The hazard flasher blinks twice and the buzzer sounds twice.
	The second time: Press the Unlock	All doors unlock.	
Unlocking the trunk lid	Press and hold the Trunk lid/Rear gate button for at least 2 seconds	Only the trunk lid unlocks.	The hazard flasher blinks twice and the buzzer sounds twice.
Unlocking the rear and gate.	Press the Trunk lid/Rear gate button once.	Only the rear gate unlocks.	The hazard flasher blinks twice and the buzzer sounds twice.
Panic alarm	Press the Panic button once.	The horn sounds and the hazard flasher blinks continuously.	
Stopping the panic alarm	Press any button once.	The horn stops sounding and the flasher stops blinking.	
Buzzer ON/OFF	(1) Press the Unlock button once.	The buzzer setting switches from ON to OFF.	The hazard flasher blinks twice and the buzzer sounds twice.
	(2) Simultaneously press and hold both the Lock and Unlock buttons for at least 2 seconds.	The buzzer setting switches from OFF to ON.	The hazard flasher blinks once and the buzzer sounds once.
Vehicle finder function	Press the Lock button 3 times in succession within 5 seconds.	The horn sounds once and the hazard flasher blinks 3 times.	
Confirming that doors are closed.	(1) Press the Lock button once when a door is open. (2) Close all the doors.	All doors lock.	The hazard flasher blinks once

***1: If any of the doors are open when you press the Unlock button (even for the first time), all the door will unlock.**

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How To Register the Transmitter

Using the Subaru Select Monitor

- 1) Make a note of the ID number. A label showing the ID number is affixed either to the bag containing the transmitter or the circuit board inside the transmitter.



Figure 1-3 Bag (ID Number)



Figure 1-4 Open Transmitter

- 2) Connect the Subaru Select Monitor (SSMIII) to the vehicle.
- 3) Turn the ignition switch to the ON position.
- 4) Operating the SSMIII as described below.

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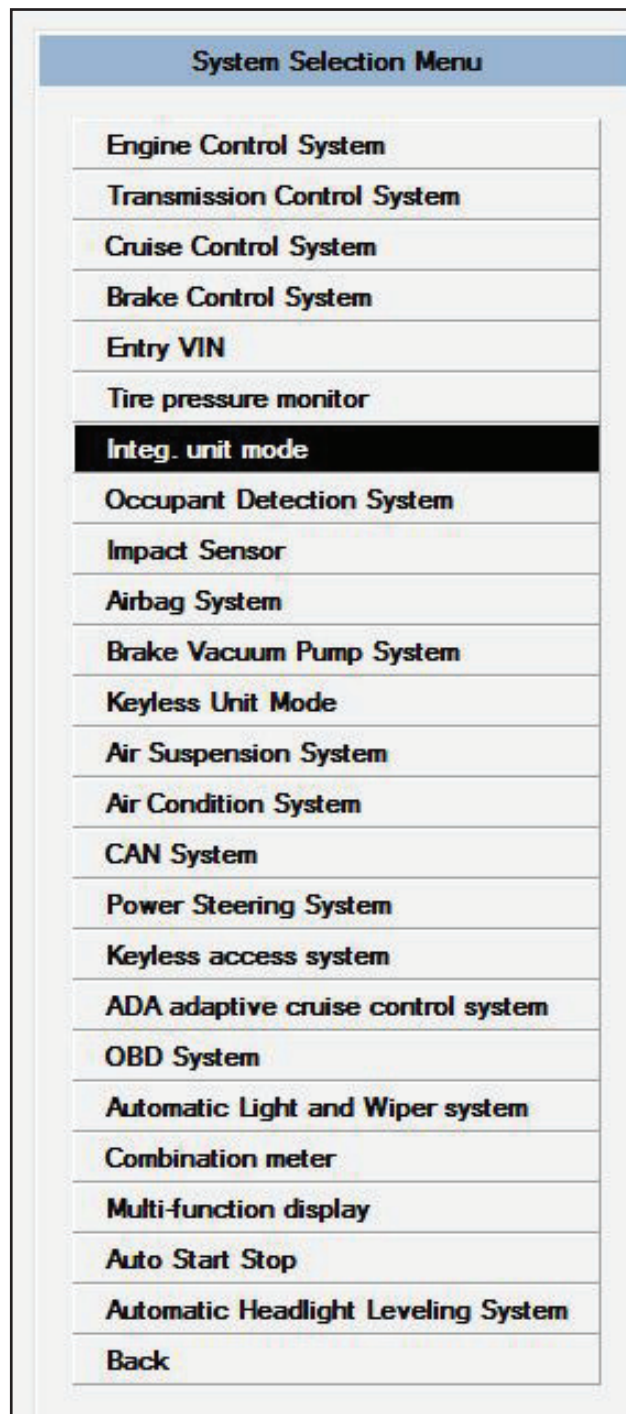


Figure 1-5 System Selection Menu

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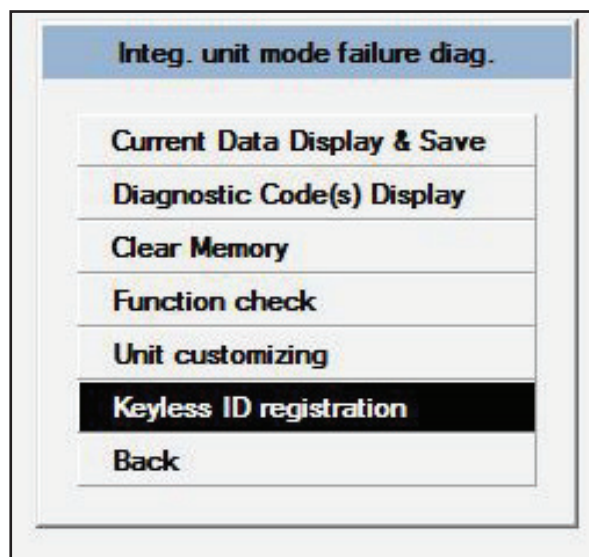


Figure 1-6 INTEG. UNIT Mode Failure Diag.

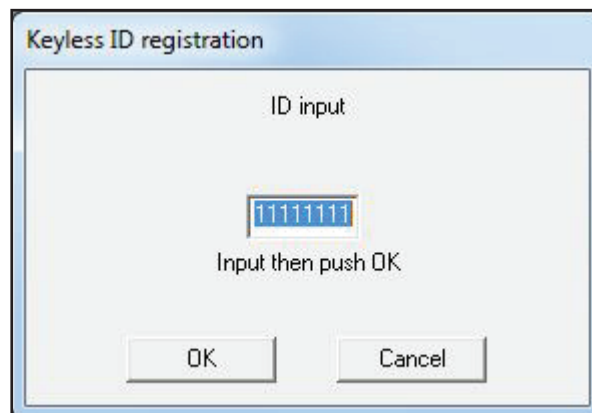


Figure 1-7 ID Input

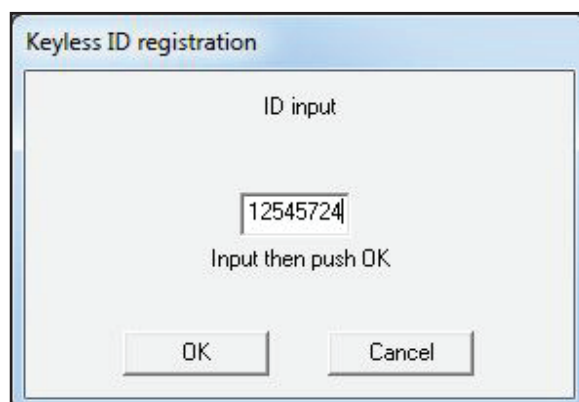


Figure 1-8 ID Input

- 5) Use the [Δ] key or the [∇] key on the SSMIII to change the number, and then use the [$\triangleleft$] key or the [$\triangleright$] key to move to the next digit.

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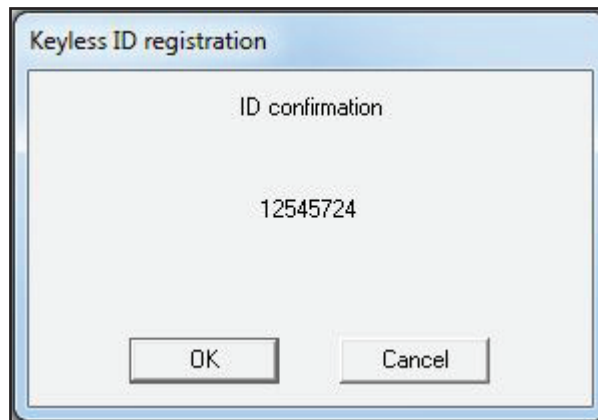


Figure 1-9 ID Confirmation



Figure 1-10 ID Complete

- 6) Confirm the displayed number with the number recorded in step 1.
- 7) Press “yes” to enter another transmitter code. Press “no” to end the procedure. A maximum of four transmitters can be registered to a single vehicle.

NOTE: Press and hold a button on the transmitter after programming to complete the registration process.

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Security System

The security system for the 2005 and newer Legacy vehicles is controlled by the BIU. The security system and its chosen operating characteristics must be set and adjusted with the SSMIII.

The following select monitor displays briefly introduce the items to be set and adjusted.



Figure 1-11 Security System

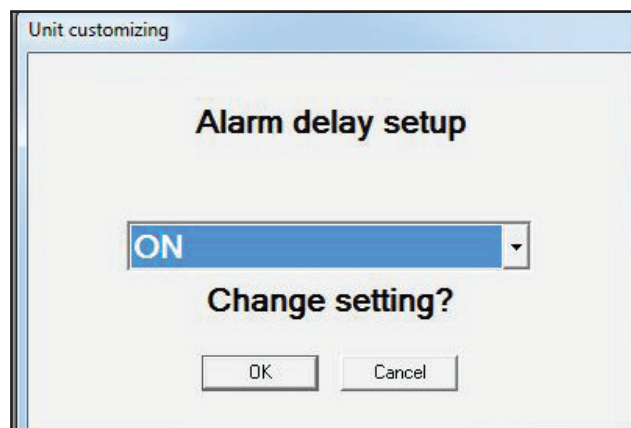


Figure 1-12 Alarm Delay Setup

Alarm Delay Setup-The Alarm System is activated by the keyless entry transmitter. The Alarm system can be adjusted to arm immediately or enter a 30 second delay. This is accomplished using the "Alarm delay Setup". During the 30 second delay the security light will flash at 5 Hz and change to a 1 Hz flash when the system is armed.

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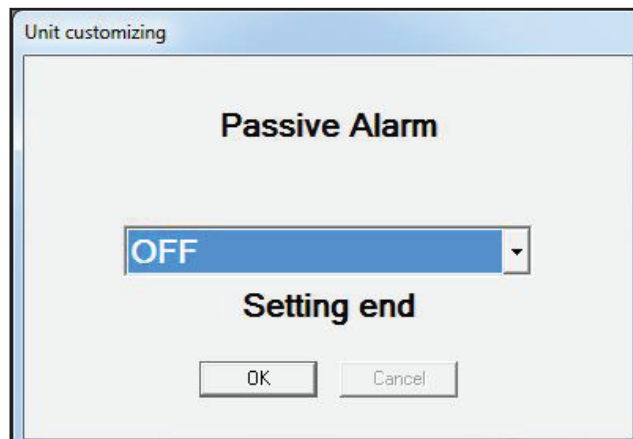


Figure 1-13 *Passive Mode*

Passive Mode-The Alarm system is activated by exiting the vehicle. The Alarm system will arm 60 seconds after all doors are closed. This time cannot be adjusted.

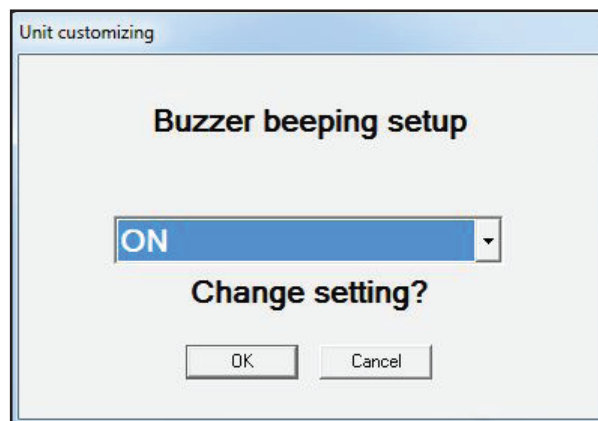


Figure 1-14 *Answer-Back Buzzer Setup*

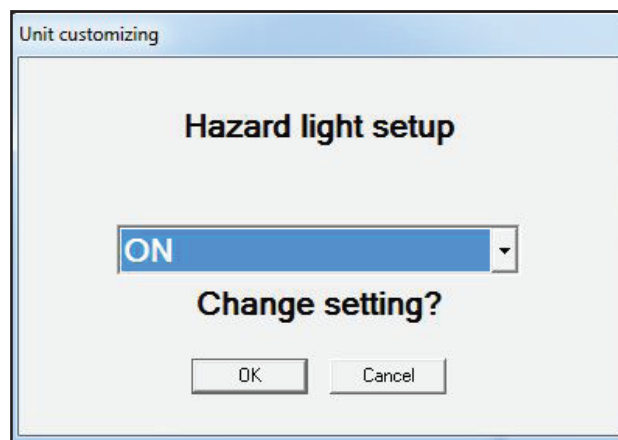


Figure 1-15 *Hazard Answer-Back Setup*

The Buzzer Beeping setup and the Hazard Light answer back can be programmed to respond or not to respond to the arming or disarming of the Alarm system.

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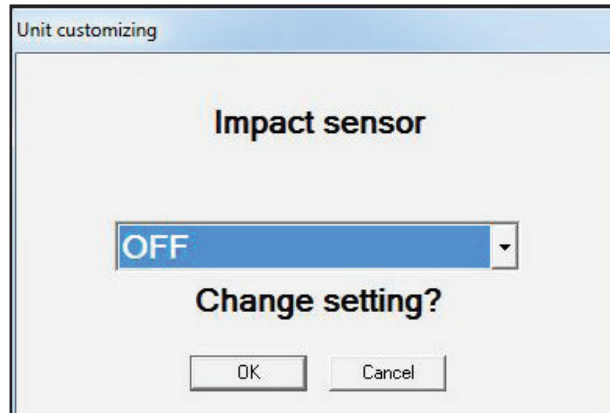


Figure 1-16 *Impact Sensor*

The impact sensor must be turned ON and the sensitivity adjusted.

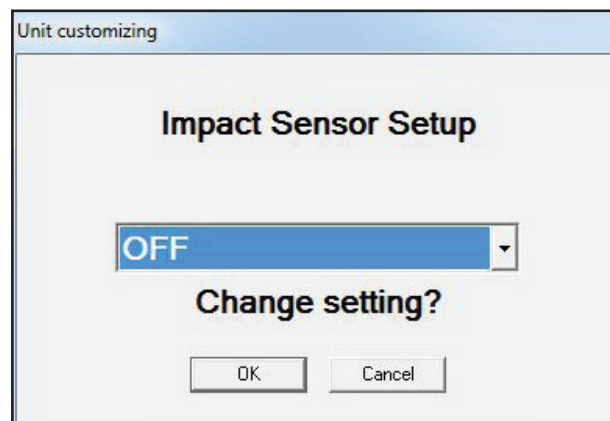


Figure 1-17 *Impact Sensor Setup*

Sensitivity is adjustable on a scale of 1 to 10 with 5 being the setting from the factory. The smaller the number is, the more sensitive the sensor becomes.

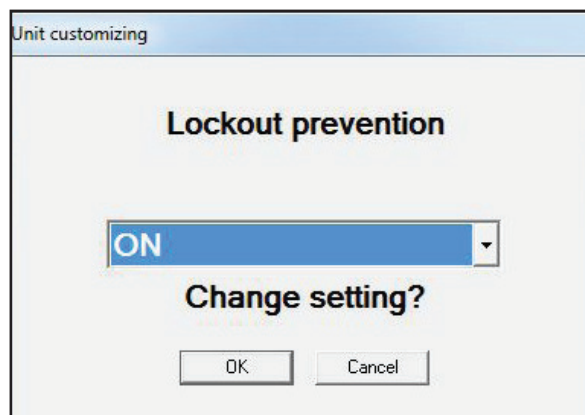


Figure 1-18 *Lockout Prevention*

Lock out prevention is also adjustable. This prevents the vehicle from being locked while the keys are in the ignition.

This functions when using the lock button to lock the vehicle only.

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Immobilizer Type A

System Construction

The Subaru Immobilizer is designed to prevent unauthorized people from operating the vehicle. This is accomplished by the use of a coded transponder key that reacts with the Body Integrated Unit (BIU), Engine Control Module (ECM) and the Combination meter.

The Immobilizer almost simultaneously checks the key, BIU, combination meter and Engine Control Module to see if they are all part of a matched set. If any one part does not match, the vehicle becomes inoperable.

The Immobilizer is not a security system. However the vehicle is wired to accept the addition of the components needed to install the security system.

NOTE: The installed items must be programmed into the BIU using the Subaru Select Monitor III.



Figure 1-19 Key

The key contains the transponder which consists of an antenna, capacitor and integrated circuit.

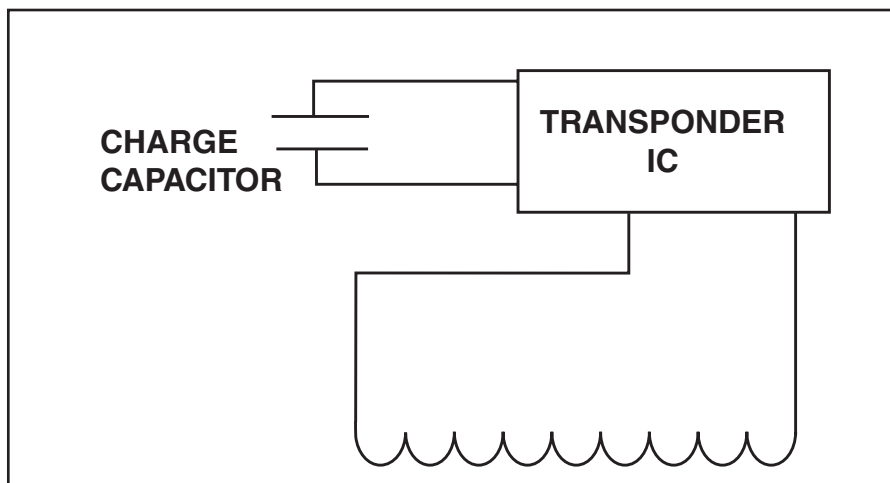


Figure 1-20 Transponder (Artwork)

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Figure 1-21 Ignition Switch

When the key is placed into the ignition a signal from the key warning switch activates the BIU to send a high frequency electric wave to the antenna coil surrounding the ignition switch.

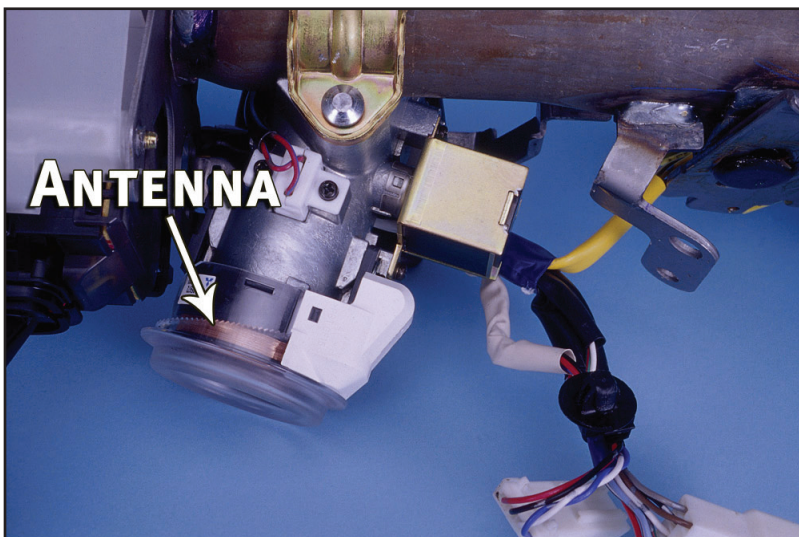


Figure 1-22 Antenna

The electric wave, absorbed by the antenna in the transponder, charges the capacitor in the transponder. An encrypted code is sent at the end of the charging wave. The transponder decrypts the code and sends an encrypted code back to the antenna coil, which travels back to the BIU.

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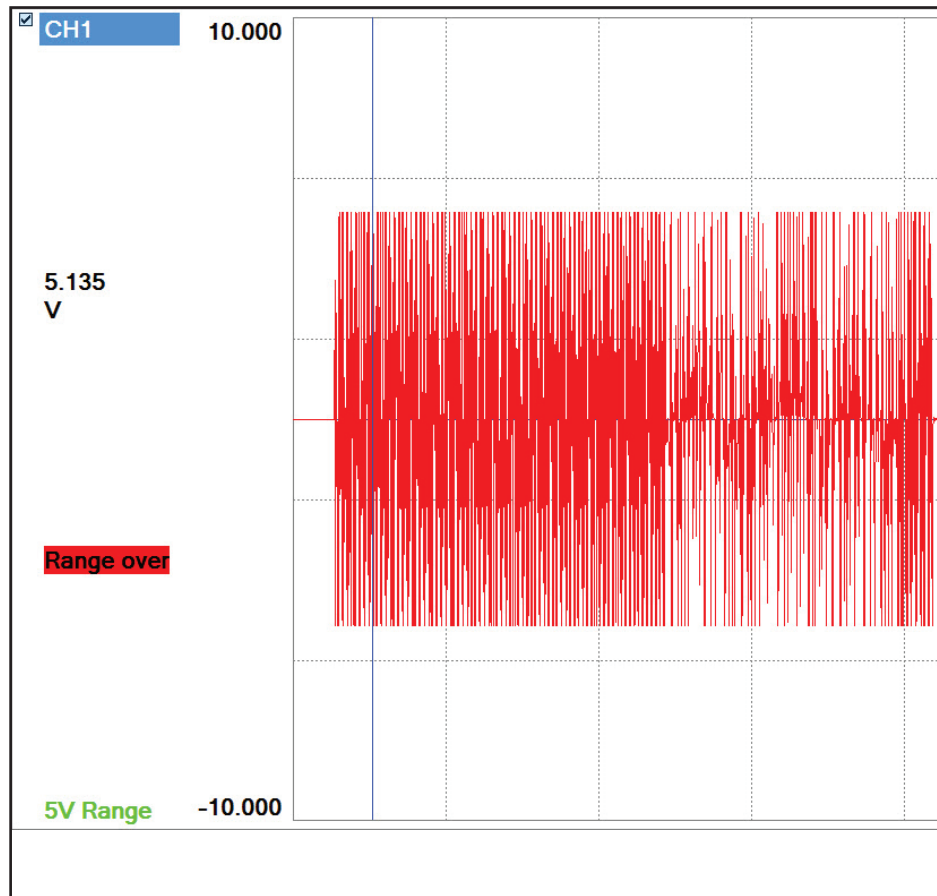


Figure 1-23 Signal Sent and Received at Antenna Coil

The BIU compares the code sent by the transponder with the code programmed into the BIU and sends an encrypted code to the combination meter.



Figure 1-24 Combination Meter

The combination meter decrypts the code and sends a response back to the BIU.

The result of this signal determines if the engine is allowed to continue operating if it has been started.

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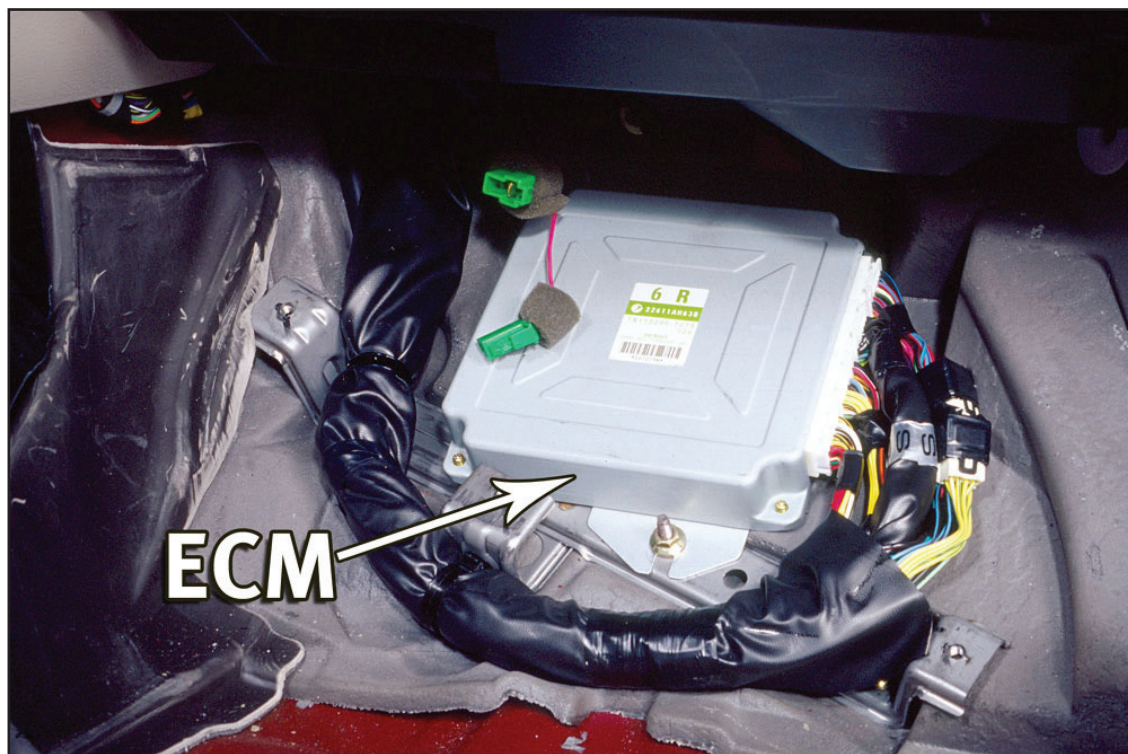


Figure 1-25 ECM

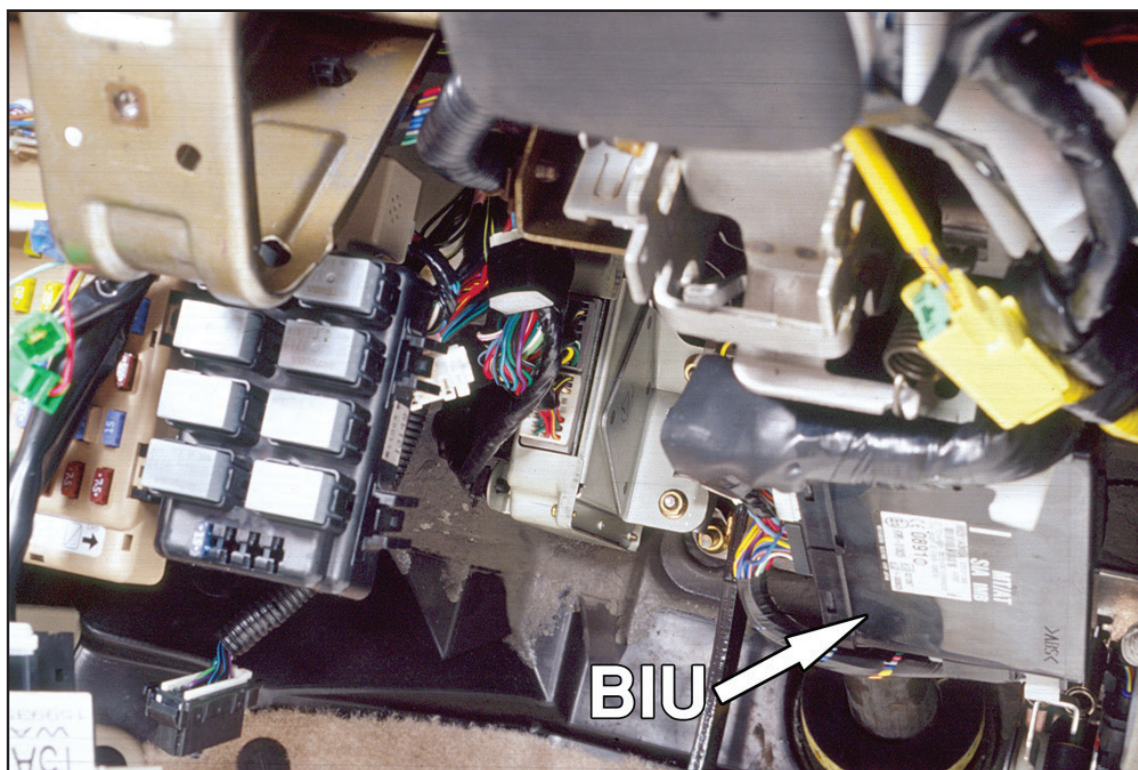


Figure 1-26 BIU

The result sent from the combination meter is stored in the BIU until the Engine control module has requested a decision to allow the engine to operate or to turn off the injectors and shut the engine off.

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Key

The vehicle is shipped with two keys (May change by model and year). Both keys contain a transponder that is registered to the vehicle. One key is the master key and the other key is the valet key. The only functional difference is that the valet key will not open the trunk lock. Also shipped with the vehicle, on the key ring, are two metal tags.

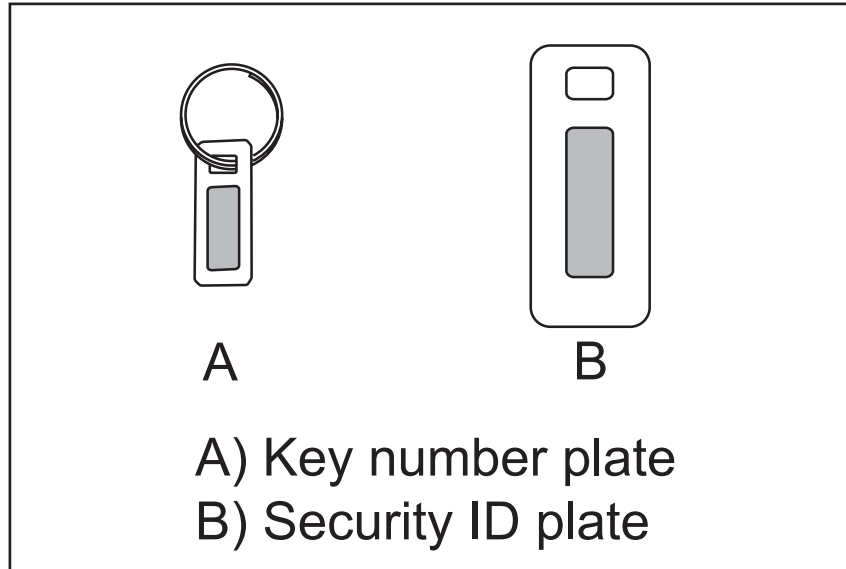


Figure 1-27 Key Tags

The smaller tag is the mechanical key code. This is what the customer would use to have another key cut for the vehicle. The larger tag is the security code for the Immobilizer. This number must be available to the Technician when the vehicle Immobilizer system and its components are being serviced.

A key can only be registered to one vehicle. A vehicle may have up to four keys registered to it. The registration process, once started, clears the BIU of all keys. This means that when one key is registered, they all must be registered. The registration process is accomplished using the Subaru Select Monitor III.

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BIU

Replacing the BIU requires that all the keys be replaced. The new keys must be registered to the vehicle and the new BIU (2005-2009).

NOTE: The Keys do NOT need to be replaced when changing the BIU for 2010 Legacy and newer and 2011 Forester and newer.

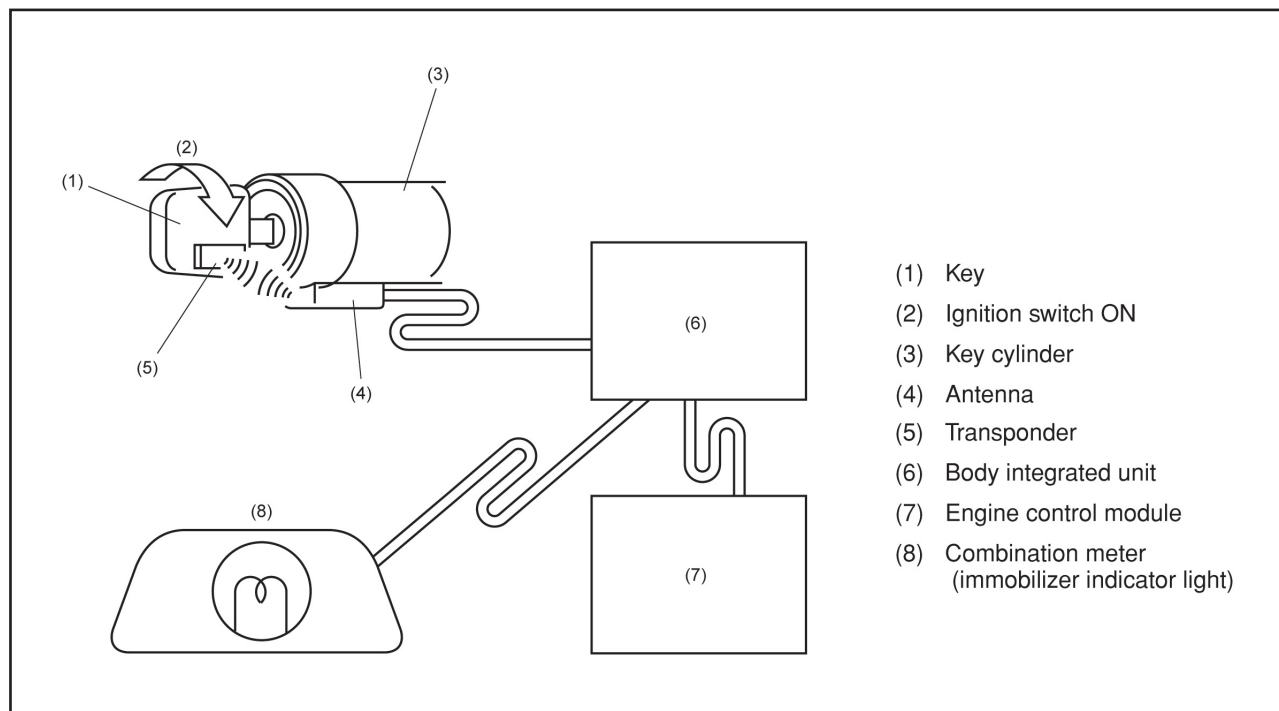


Figure 1-28 BIU (Artwork)

NOTE: The installation of a new BIU requires that all keyless transmitters be reprogrammed to the vehicle. The BIU customizing features must be set at this time. If possible record the current settings of the BIU before replacement. If the current settings cannot be obtained ask the customer to provide you with their selections.

NOTE: The BIU on all vehicles must be set to “market mode”.

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Combination Meter or Engine Control Module

Replacement of the combination meter or Engine Control Module* requires that the new part be registered to the vehicle after installation. Also all the keys previously registered to the vehicle must be present. Failure to register the current keys during the registration process will result in the absent keys not being able to start the engine.

- While diagnostic items are being checked, do not operate radios, portable telephones, etc. which emit electromagnetic waves near or inside the vehicle.
- When turning the ignition switch to ON or OFF while diagnostic items are being checked, do not allow keys with different ID codes close to the ignition switch. If the ignition key is in a key holder, remove it from the holder before carrying out diagnosis.
- When repeatedly turning the ignition switch to ON or OFF while diagnostic items are being checked, it should be switched in cycles of “ON” for at least 5 seconds and “OFF” for at least 8 seconds.
- If the engine fails to start with a registered ignition key, detach the ignition key from ignition switch and wait for approx. 1 second until immobilizer indicator light begins to flash. And then start the engine again.
- Before checking the diagnostic items, obtain all keys for the vehicle to be checked possessed by owner.

Registration Process

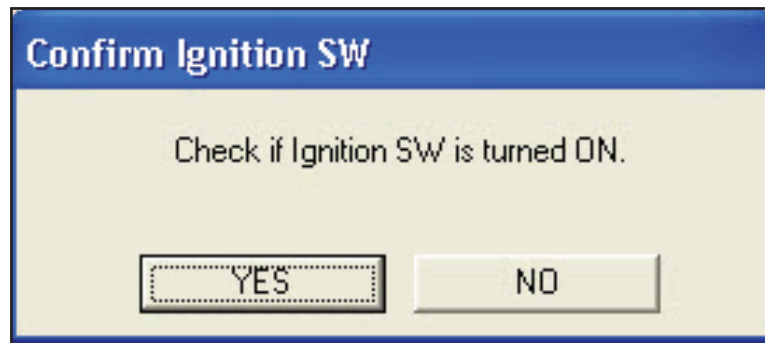


Figure 1-29 Turn Ignition Switch ON

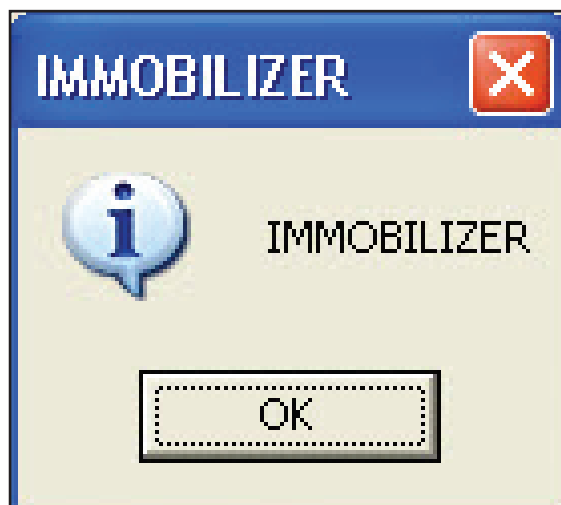


Figure 1-30 Immobilizer OK

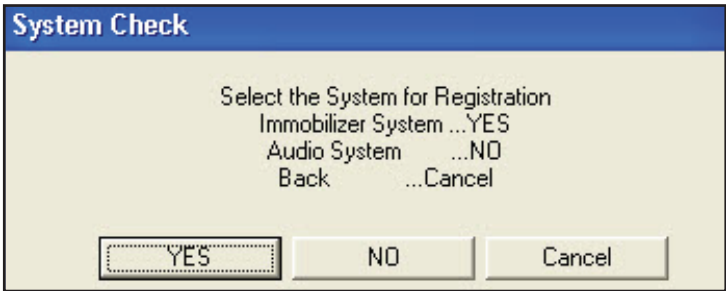


Figure 1-31 Immobilizer System Click YES

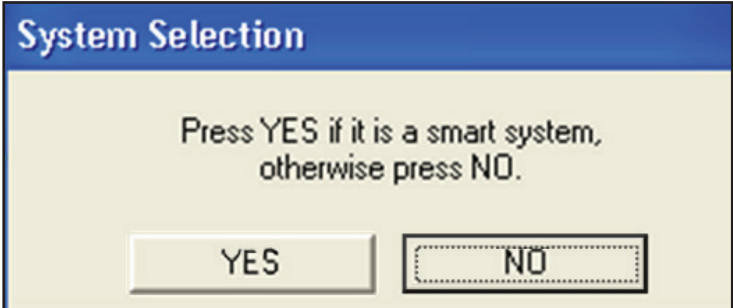


Figure 1-32 Press NO

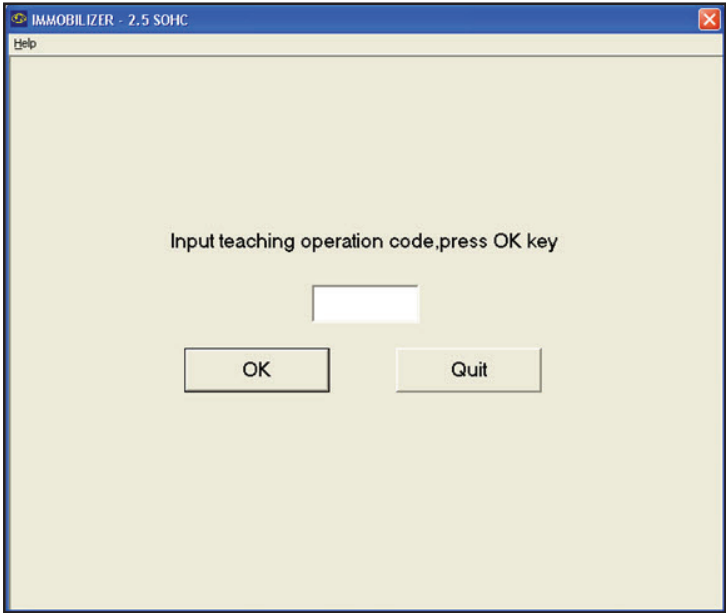


Figure 1-33 Input Teaching Code

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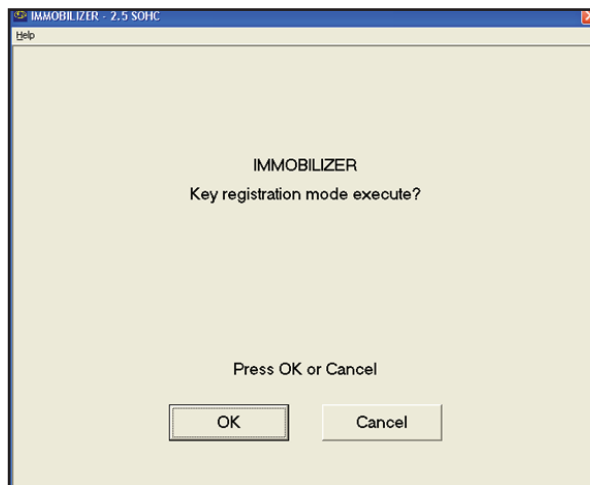


Figure 1-34 Key Registration Mode Execute

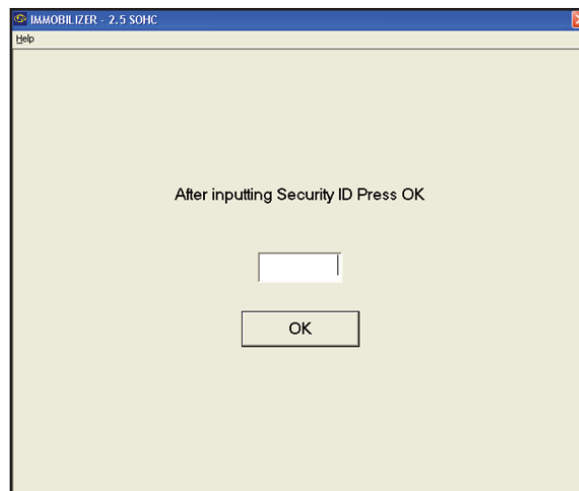


Figure 1-35 Security ID

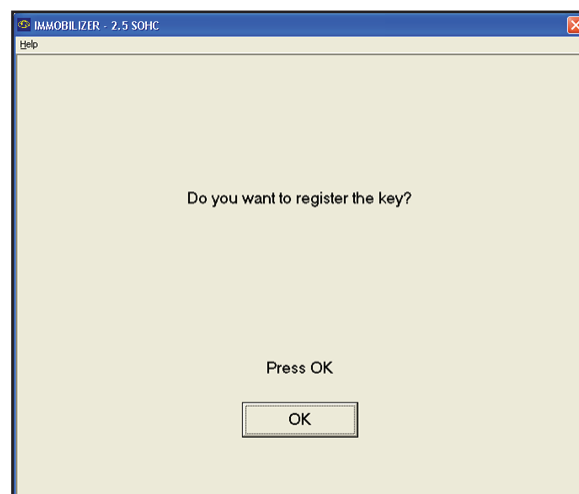


Figure 1-36 Press OK to Register another Key

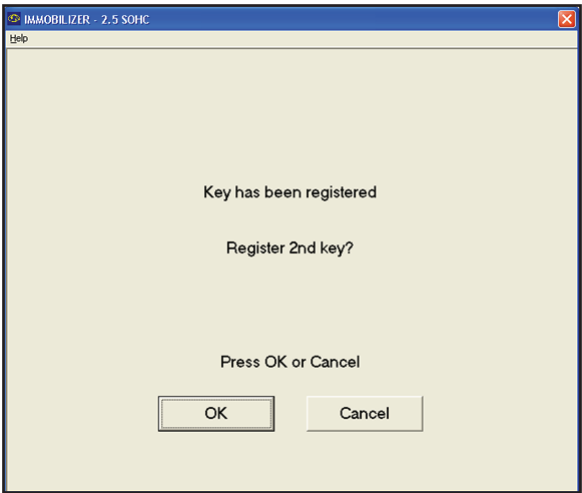


Figure 1-37 Press “OK” To Register Second Key



Figure 1-38 Register Third Key

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ECM Replacement

Replacement of the ECM requires that the new ECM be registered to the vehicle by the vehicle identification number (VIN). Using Subaru Select Monitor III.

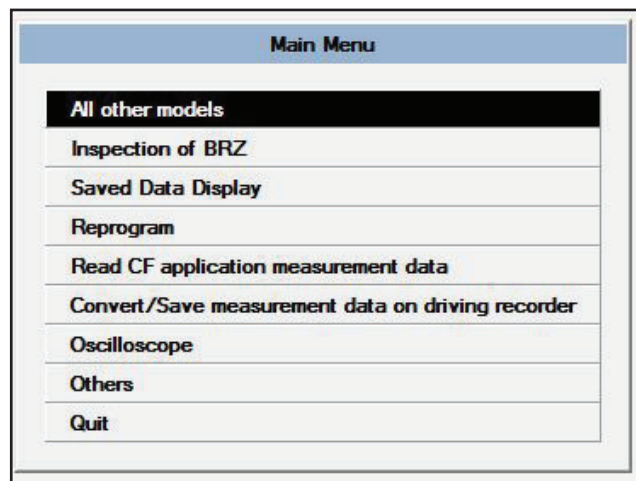


Figure 1-39 ECM Replacement Main Menu

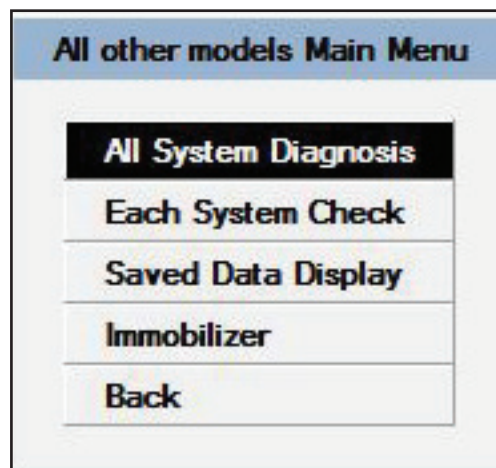


Figure 1-40 All Other Models Main Menu

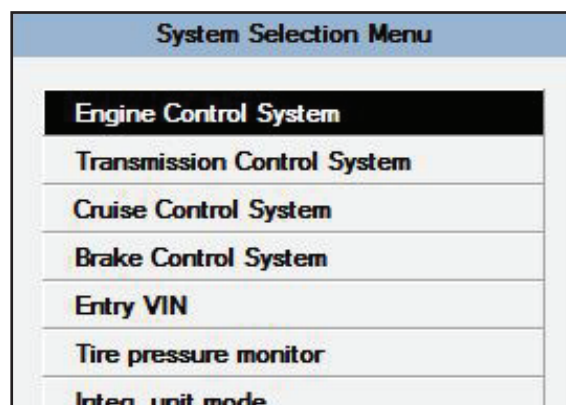


Figure 1-41 System Selection Menu

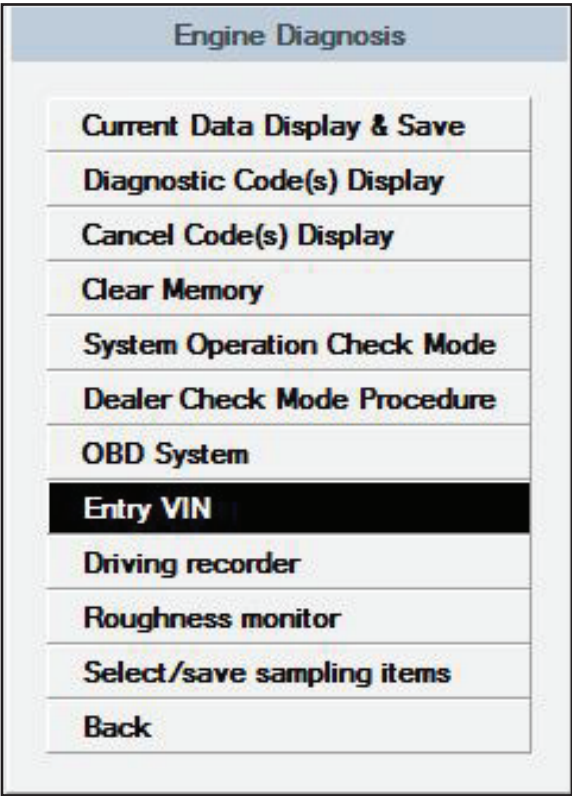


Figure 1-42 Engine Diagnosis Menu



Figure 1-43 VIN Registered in ECM

Follow the directions on the SSMIII to register the ECM. An ECM can only be registered once. Confirm the VIN before entering the number.

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Immobilizer Type B

The Immobilizer Type “B” system was introduced with 2012MY Impreza Models.

The Immobilizer Type “B” simplifies the registration of new parts and reduces the need to have all of the registered keys on hand to perform service work.

If an ECM or Combination Meter is replaced.

- Only the key accompanying the car to the dealer needs to be present. In this case only the replacement part needs to be registered.

If the BIU is replaced.

- All of the keys need to be present. (Remote Engine Start will need to be reprogrammed).
- The keys do not need to be replaced.

The Immobilizer Type “B” does not utilize a security code and requires no teaching code when registering any part of the Immobilizer system. There will only be one metal tag on a new vehicle’s key ring set. This tag is for the mechanical key code.

Security identification is through the use of one registered key. If all registered keys are missing, the BIU and Combination Meter must be replaced (and the number of keys requested by the customer). Four (4) keys and RES can be programmed to the Immobilizer system. The new Combination Meter and BIU will register the unregistered key.

NOTE: Driver’s door must remain open during all registration procedures.

The following charts should be referenced when replacing single parts or multiple parts of the Immobilizer system.

When only one part is failed or lost

Destination	Parts failed/lost						Parts required to replace or prepared when items on the left fail					Procedures to perform after parts replacement			
	Key		Body integrated unit	Combination meter	Security CU	ECU	Key	Body integrated unit	Combination meter	Security CU	ECU	(1)	(2)	(3)	(4)
Others	Not all	All													
0	X						One registered key					“Immobilizer Key ID deletion” (Deleting lost keys)	“Immobilizer system registration” (Registering keys needed)		
0		X					Keys you want to register	#	#			Immobilizer system registration			
0			X				All registered keys	X				Immobilizer system registration			
0				X			One registered key		X			“Meter/SCU registration”			
0						X	One registered key				X	“Engine ECU registration”			

0 = Yes

X = Applicable Condition

= Not failed but must be replaced for security reasons



SUBARU

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When two or more parts need to be replaced.

Destination	Parts failed/lost						Parts required to replace or prepared when items on the left fail					Procedures to perform after parts replacement			
	Key		Body integrated unit	Combination meter	Security CU	ECU	Key	Body integrated unit	Combination meter	Security CU	ECU	(1)	(2)	(3)	(4)
Others	Not all	All													
0	X			X			One registered key		X			"Meter/SCU registration"	"Immobilizer key ID deletion" (Deleting lost keys)	"Immobilizer system registration" (Registering keys needed)	
0	X					X	One registered key				X	"Engine ECU registration"	"Immobilizer Key ID deletion" (Deleting lost keys)	"Immobilizer system registration" (Registering keys needed)	
0		X	X				Keys you want to register	X	#			"Immobilizer system registration"			
0		X		X			Keys you want to register	#	X			"Immobilizer system registration"			
0		X				X	Keys you want to register	#	#		X	"Immobilizer system registration"			
0			X	X			Keys you want to register	X	X			"Immobilizer system registration"			
0			X			X	All registered keys	X			X	"Immobilizer system registration"			
0				X		X	One registered key					"Meter/SCU registration"	"Engine ECU registration"		

Parts and Service Guide for Two or more failed or lost Parts

0 = Yes

X = Applicable Condition

= Not failed but must be replaced for security reasons

The following is an example of the SSMIII screens and possible conditions that may exist for correct and incorrect registration procedures.

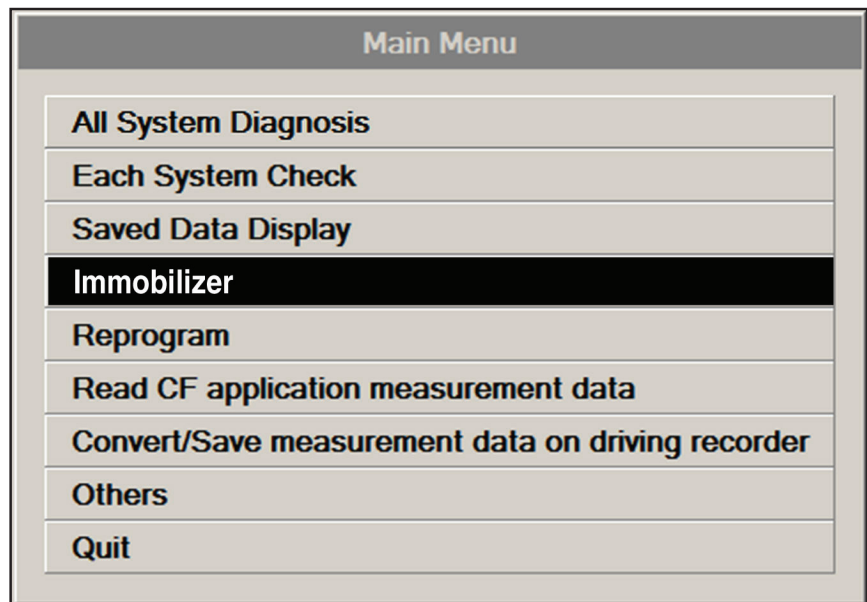


Figure 1-44 Main Menu

Enter the SSMIII Immobilizer menu and follow the instructions.

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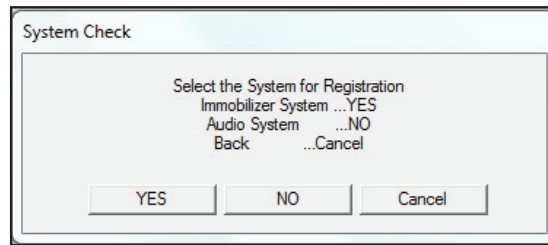


Figure 1-45 System Check

Press YES for Immobilizer.

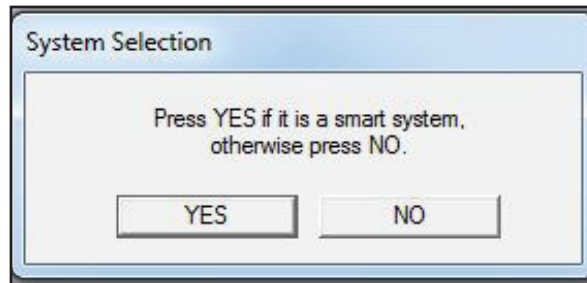


Figure 1-46 System Selection

Press NO, if the vehicle is not Keyless Access and Push Button Start.

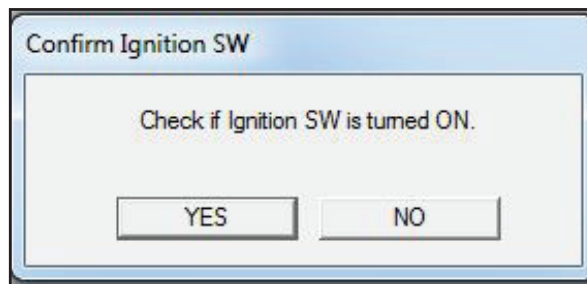


Figure 1-47 Confirm Ignition SW

The ignition switch should be in the on position.

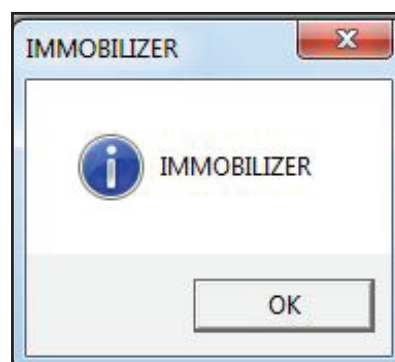


Figure 1-48 Immobilizer

This screen confirms the correct procedure has been followed.

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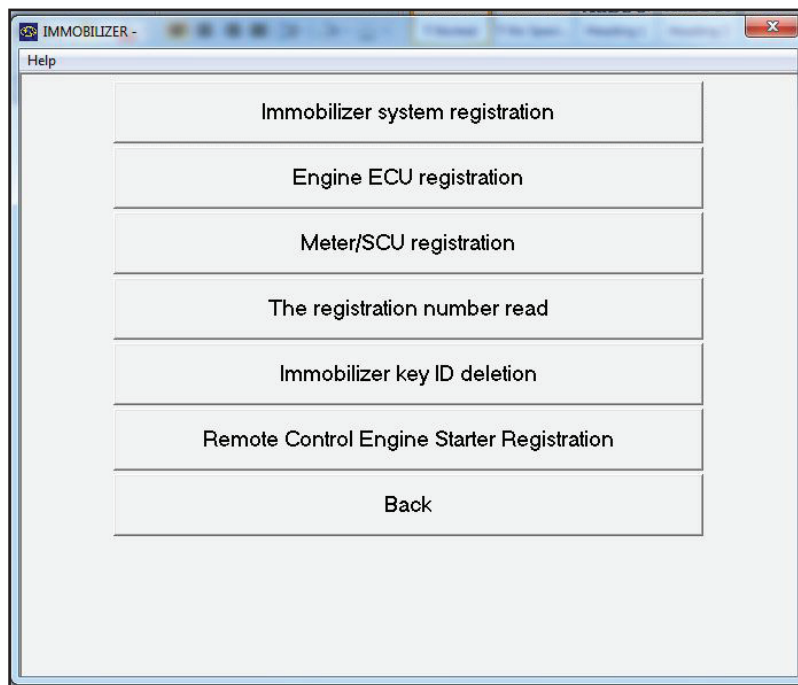


Figure 1-49 Immobilizer Menu-6 Choices

This decision screen provides 6 choices.

1. Immobilizer system registration-
This process closely resembles the procedure currently used for type A Immobilizer systems. New and old keys are registered with this selection. Use this selection when adding new keys (**old keys must first be deleted**), and when the BIU is replaced (**RES must also be registered using separate selection**).

NOTE: The only time the keys need to be replaced is when they are lost.

2. Engine ECU registration-
This process allows registration of the Engine ECU (ECM) **and eliminates the need to register each key.**
3. Meter/SCU registration-This process registers a new Combination Meter and eliminates the need to register each key. SCU (Security Control Unit) is equipped on Canadian vehicles only.
4. The registration number read-Indicates the number of keys registered to the car.
5. Immobilizer key ID deletion-This process erases the registration of keys from the BIU except the one key that is in the ignition switch. This process is used when replacing lost or damaged keys.

Only 4 keys (plus RES) can be registered to the BIU.

6. Remote Control Engine Starter Registration-
This process allows the RES to be registered to the BIU. This process should be utilized when installing RES to the vehicle or when replacing the BIU.

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Immobilizer System Registration

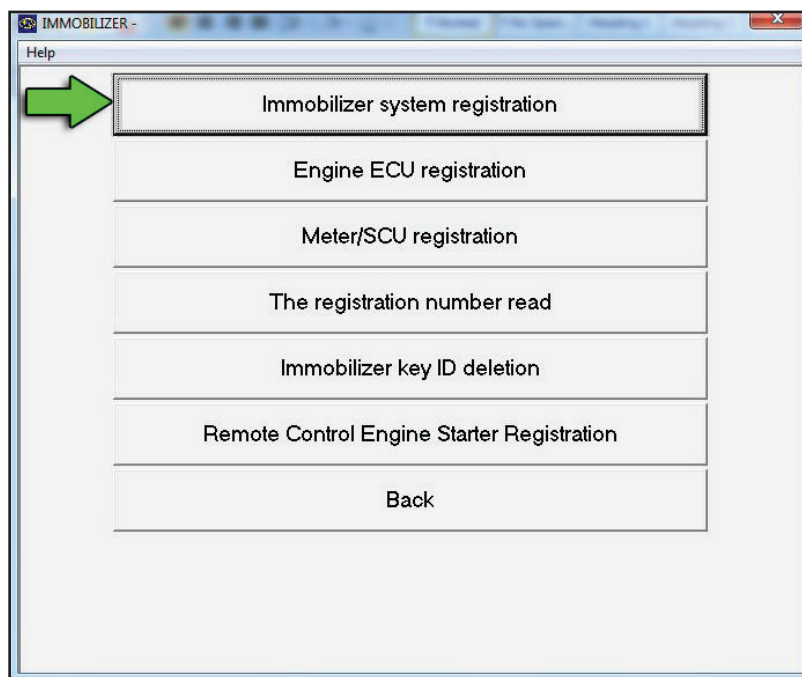


Figure 1-50 Immobilizer System Registration

This process closely resembles the procedure currently used for type “A” Immobilizer systems.

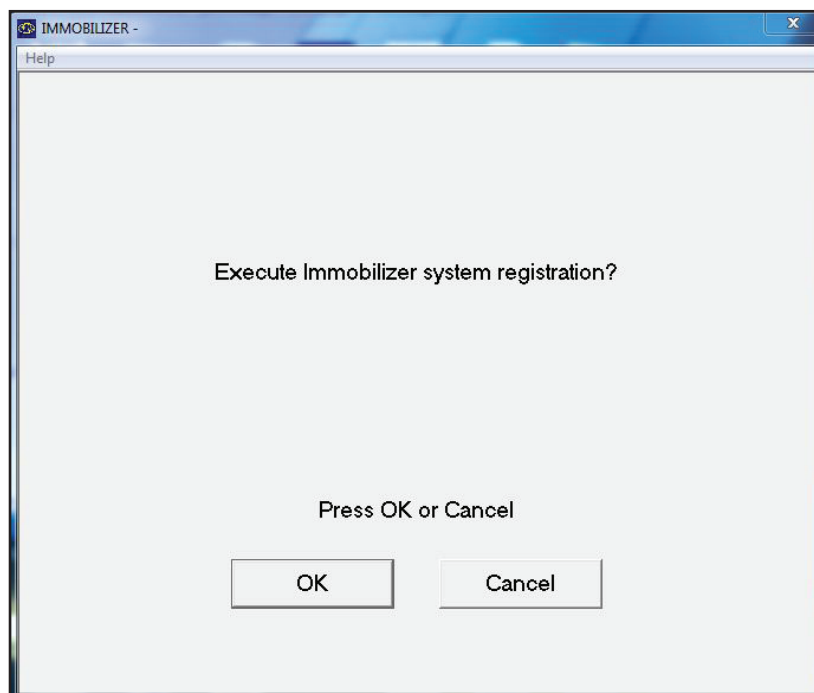


Figure 1-51 Execute Immobilizer

New and old keys are registered with this selection. Use this selection when adding new keys (old keys must first be deleted), and when the BIU is replaced. (RES must also be registered using separate selection).

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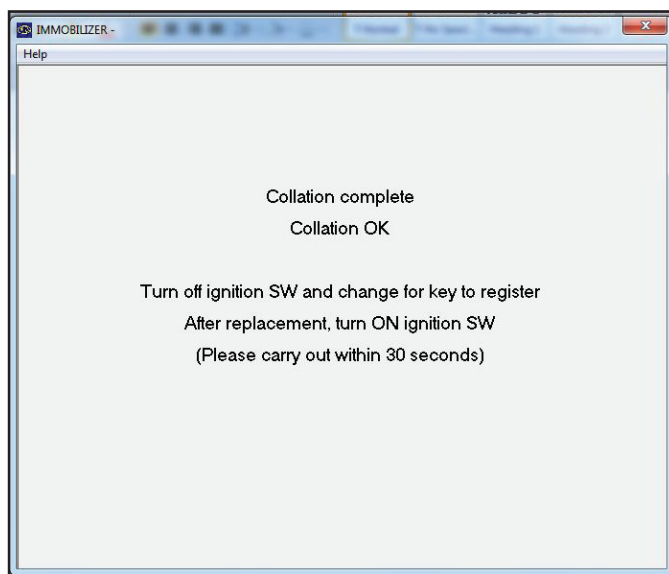


Figure 1-52 Registering Each Key

This screen displays as the Immobilizer is registering each key.

If this process is accidentally exited before completion of the first key, no key will start the vehicle. (No DTCs will be created)

Correction to this condition is performed by the following:

1. Turning off the ignition and remove the key.
2. Wait for about 1 minute with the door open.
3. After one minute the BIU will enter sleep mode and click can heard from underneath the steering wheel.
4. Begin the Immobilizer system registration from the beginning.
5. Test all keys for engine start after completion.

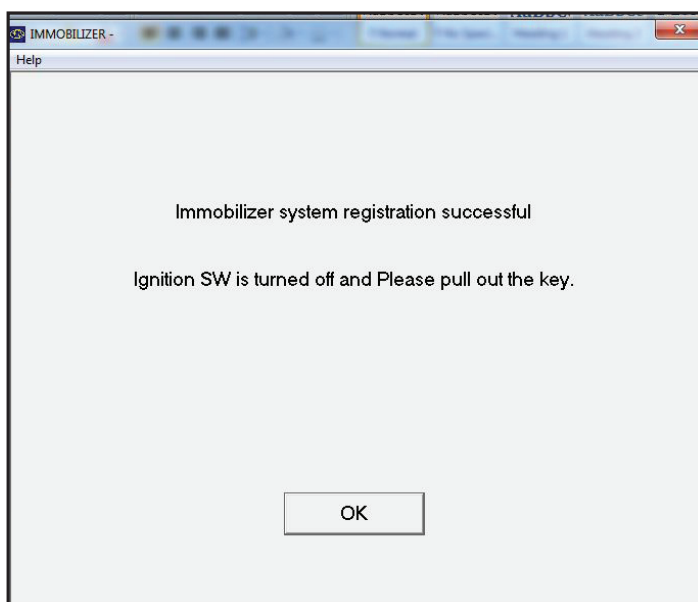


Figure 1-53 Registration Successful

Follow the instructions on the screen until the Immobilizer main menu is displayed.

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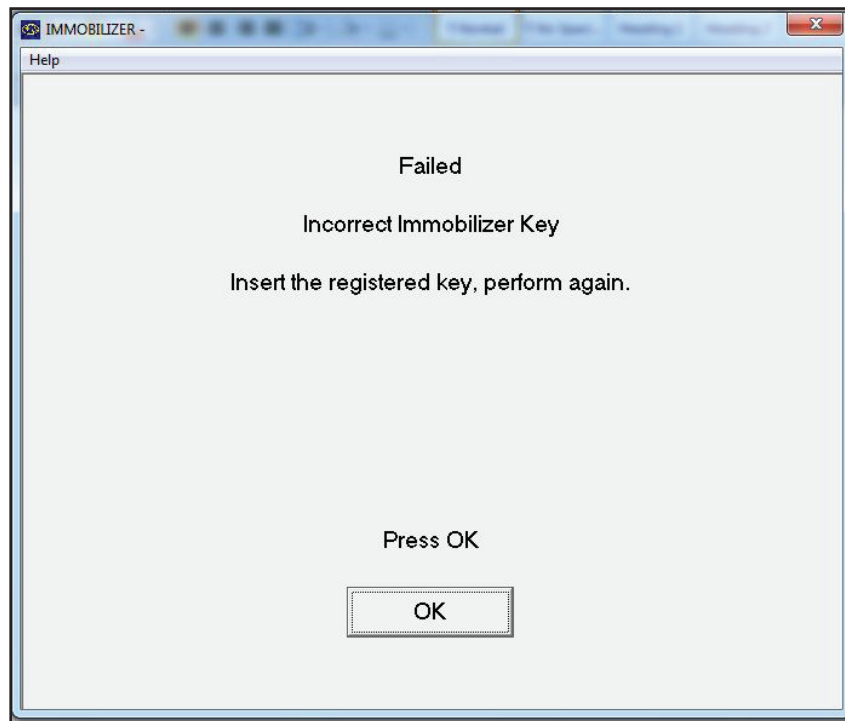


Figure 1-54 Failed Screen

Failure to change keys within 30 seconds results in the registration of one key only. Perform the Immobilizer registration process from the beginning to register all keys.



Figure 1-55 Previously Registered Key

This information is displayed after attempting to register a previously registered key.

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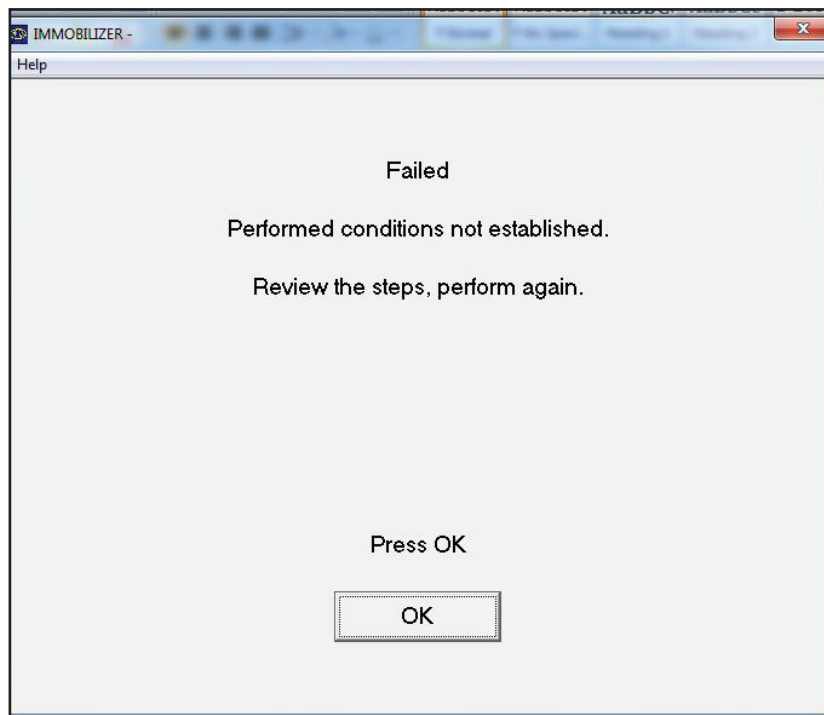


Figure 1-56 *Failed Unregistered Key*

This information will be displayed if an unregistered key is being used to begin the Immobilizer registration process. Remove that key and replace the key with one that is already registered.

NOTES:

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

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Engine ECU Registration

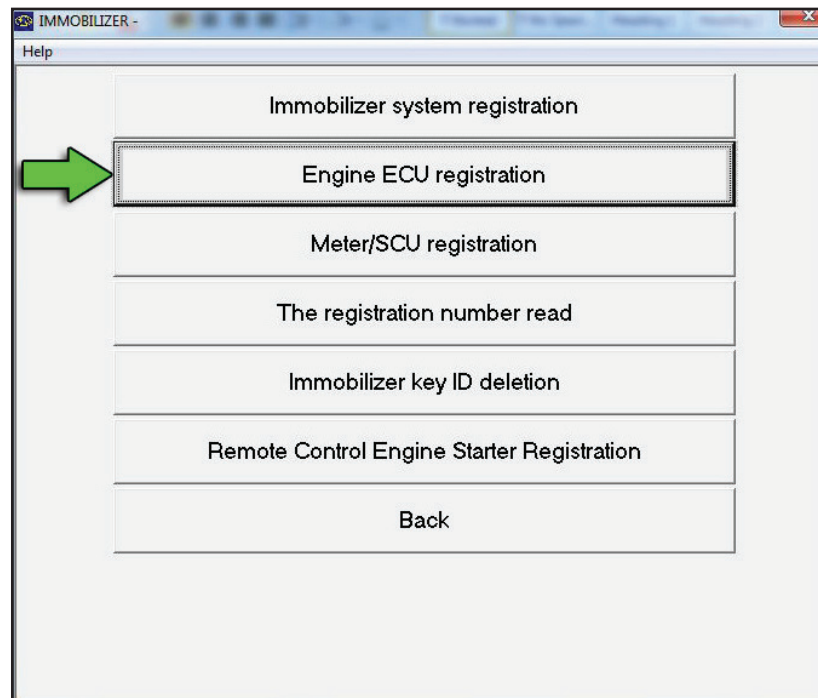


Figure 1-57 Immobilizer - Engine ECU Registration Choice

This process allows registration of the Engine ECU and eliminates the need to register each key.

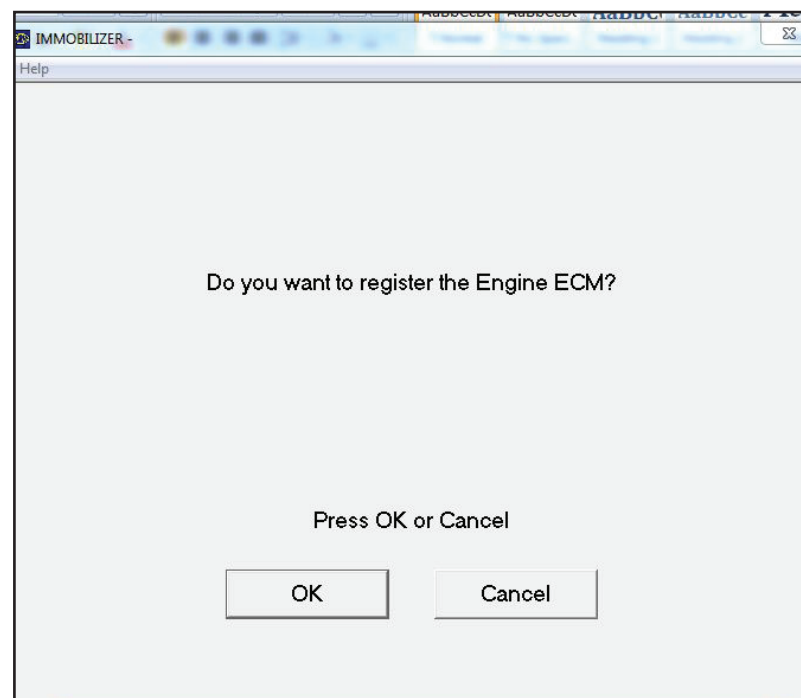


Figure 1-58 Register the ECM (ECU)

This must be performed when a new Engine ECM is installed.

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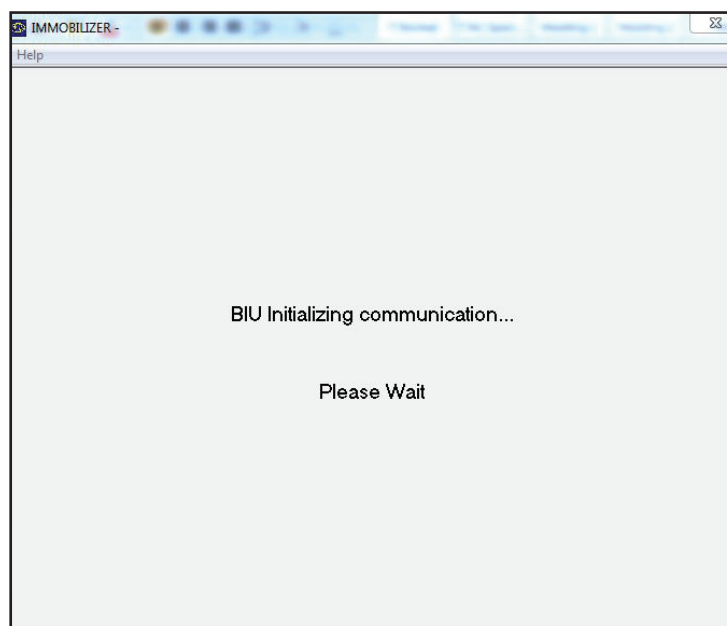


Figure 1-59 *BIU Initializing*

This screen will display as the BIU communicates with the new Engine ECM.

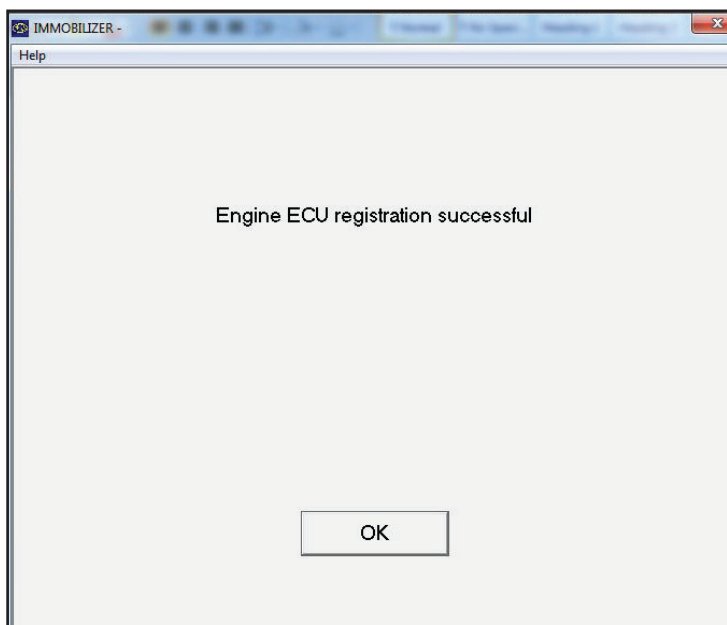


Figure 1-60 *Engine ECU Successful*

This screen will display if the registration process of the new Engine ECM completed correctly.

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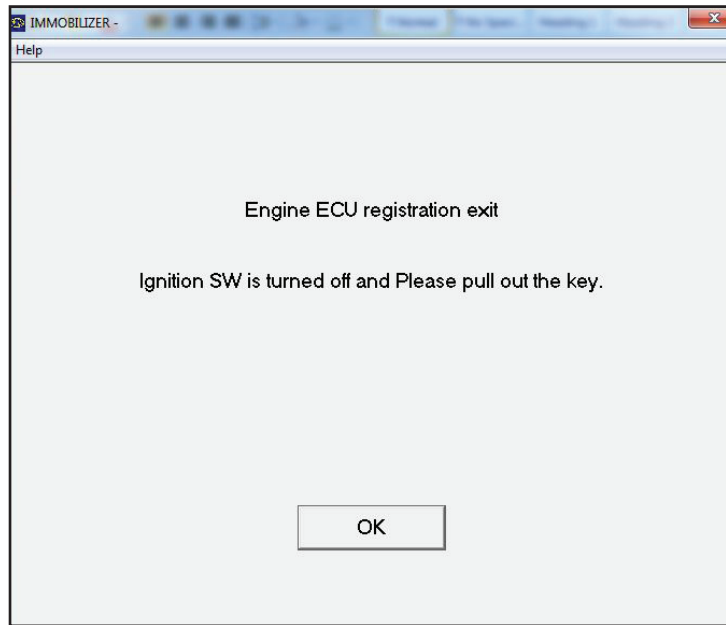


Figure 1-61 Engine ECU Registration Exit

Follow the instructions on the screen until the main Immobilizer menu is displayed.

NOTES:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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Meter/SCU Registration

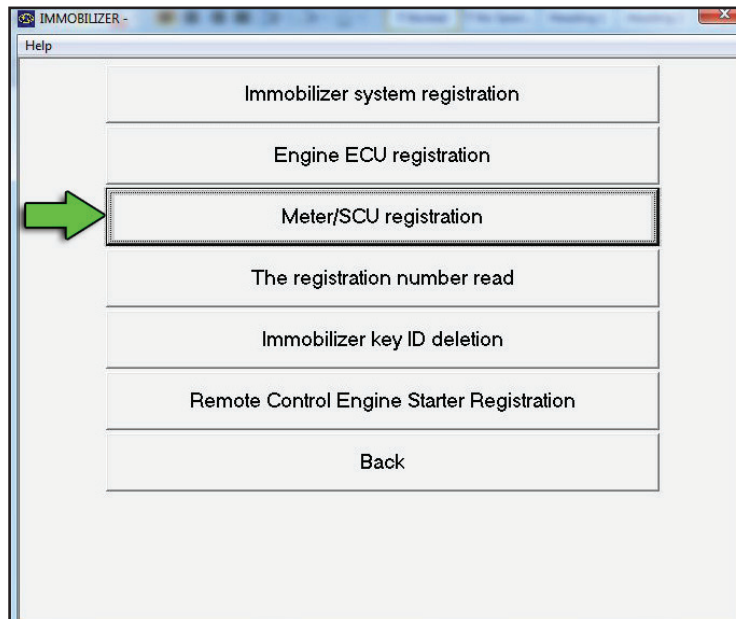


Figure 1-62 Meter / SCU Registration

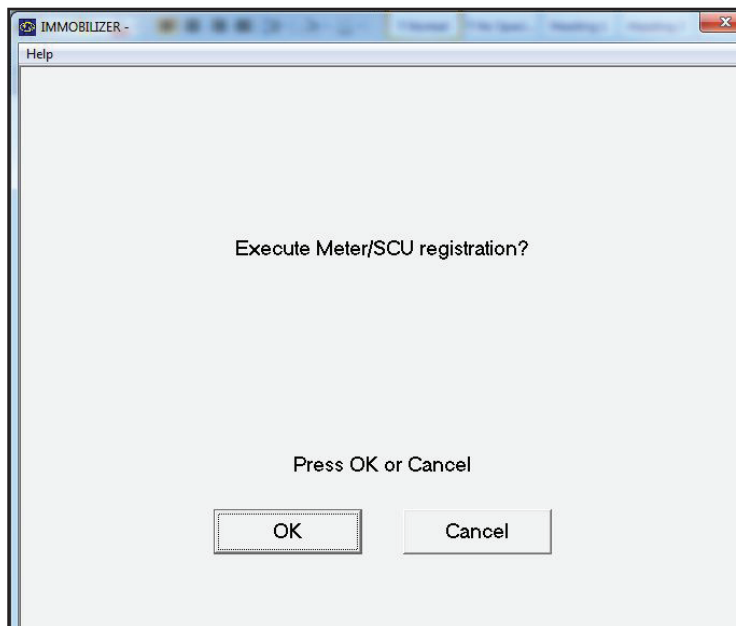


Figure 1-63 Execute Meter / SCU Registration

This process registers a new Combination Meter and eliminates the need to register each key. SCU (Security Control Unit) is equipped on Canadian vehicles only.

Follow each instruction on the screen until the Immobilizer menu is displayed.

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The Registration Number Read

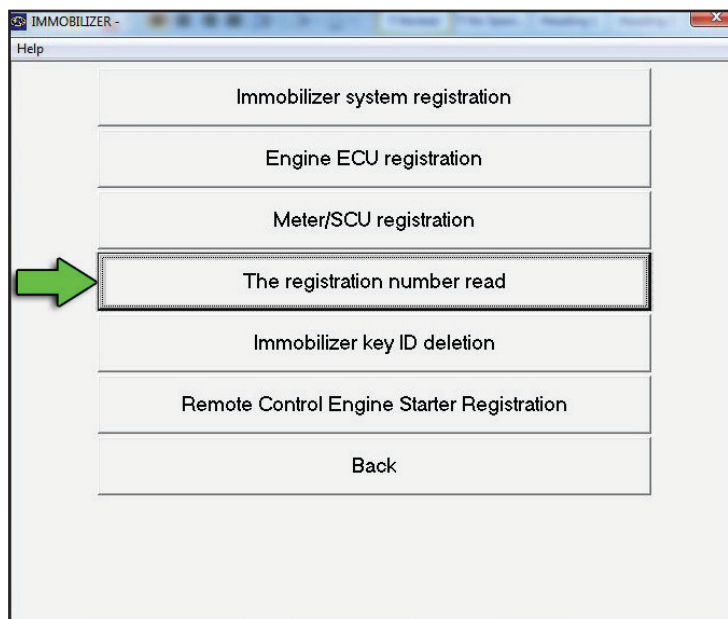


Figure 1-64 *The Registration Number Read*

The display will indicate the number of registered keys but will not indicate if the vehicle is equipped with RES.

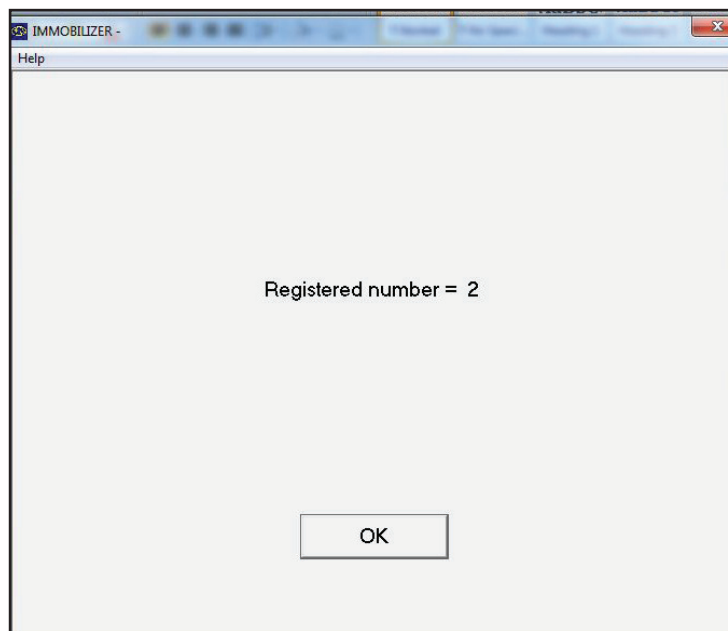


Figure 1-65 *How Many Keys Registered to Car*

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Immobilizer Key ID Deletion

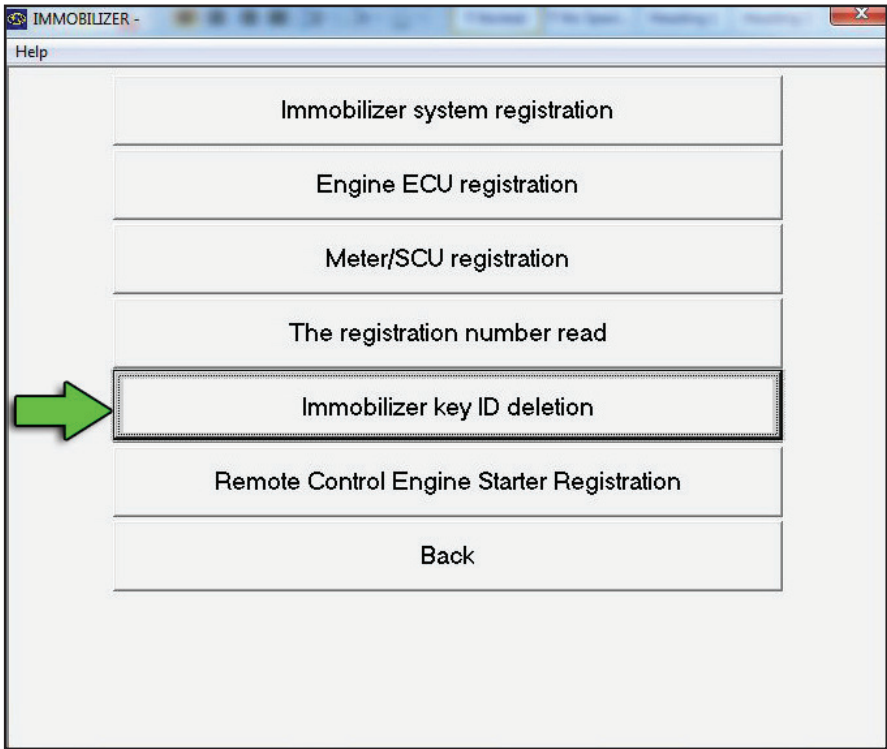


Figure 1-66 Immobilizer Key ID Deletion

This process is used when replacing lost or damaged keys.

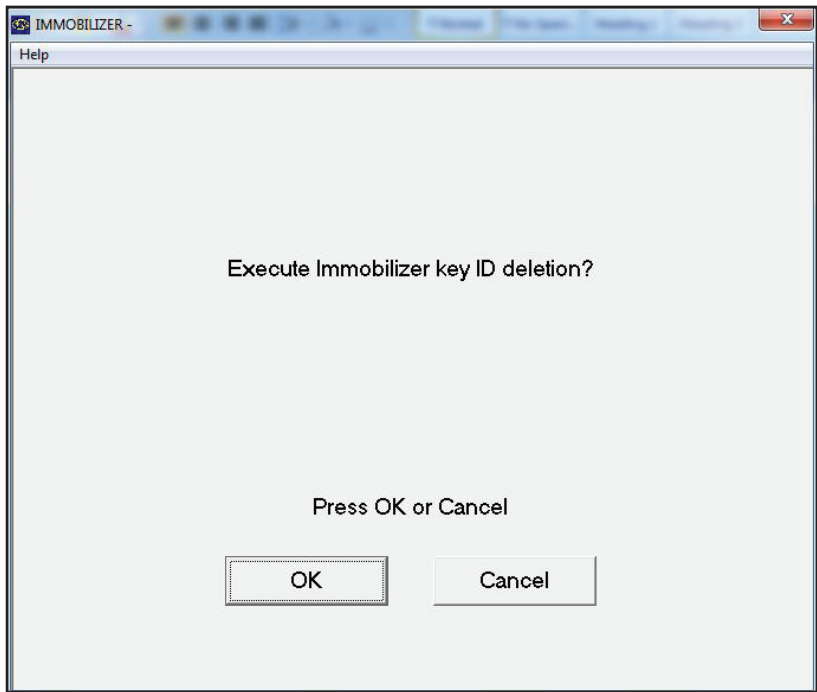


Figure 1-67 ID Deletion

This process erases the registration of keys from the BIU except the one key that is in the ignition switch.

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Only 4 keys (plus RES) can be registered to the BIU.

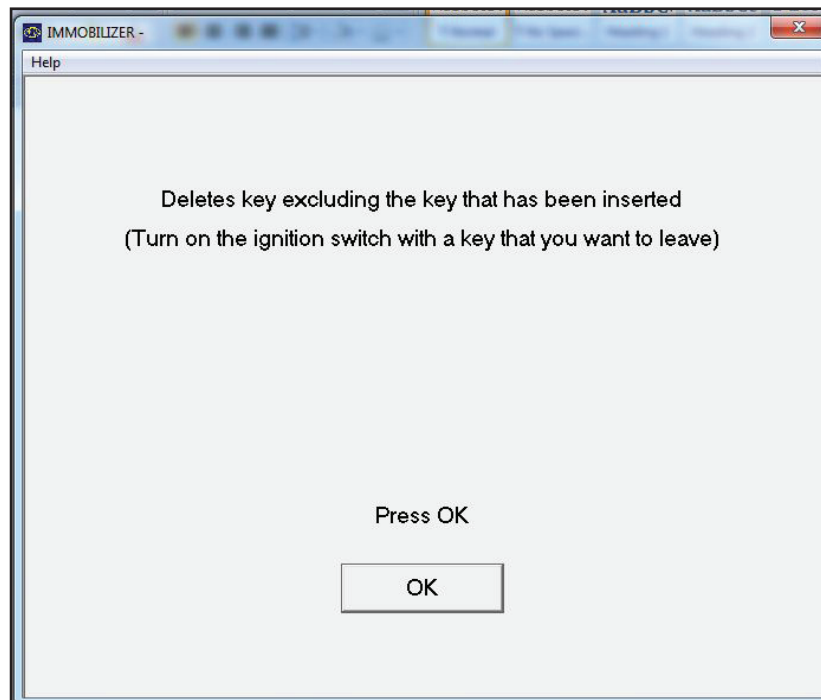


Figure 1-68 Erasing the Registration

This screen will be displayed as the BIU is erasing the registration of all keys except the key in the ignition switch.

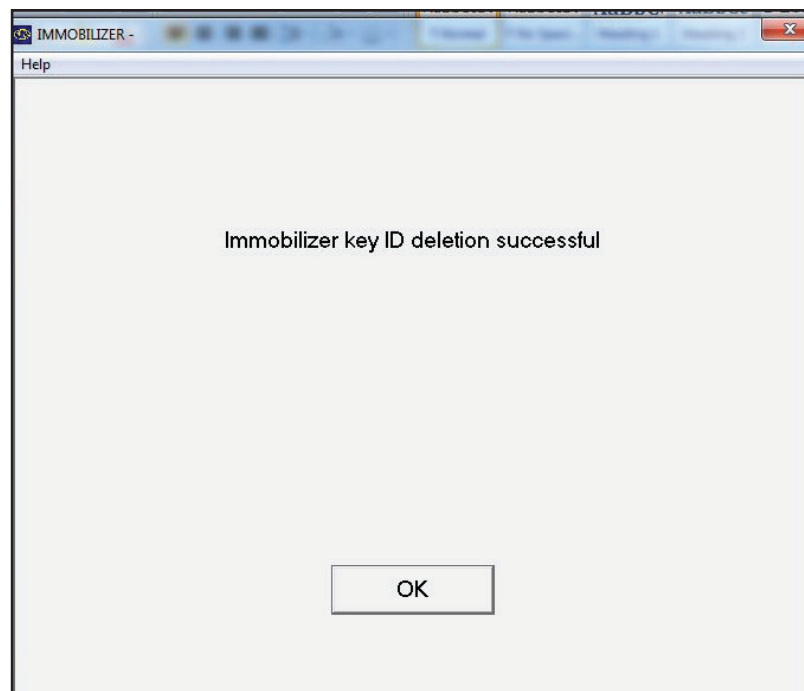


Figure 1-69 Deletion Successful

This screen indicates the deletion process finished correctly.

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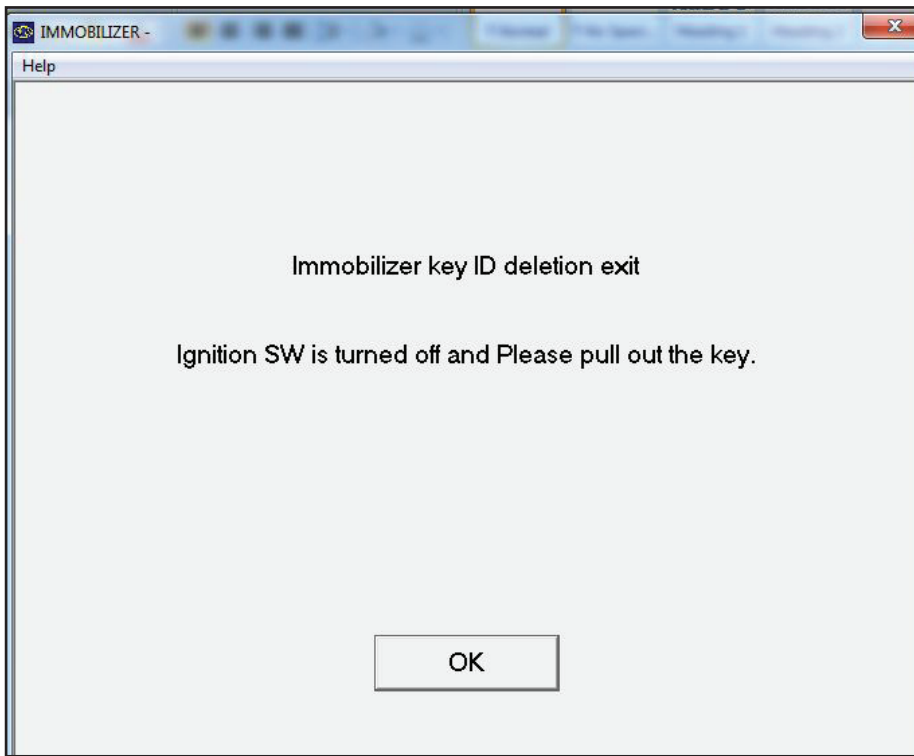


Figure 1-70 *Deletion Exit*

Follow each instruction on the screen until the Immobilizer menu is displayed.

NOTES:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

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Remote Control Engine Starter Registration

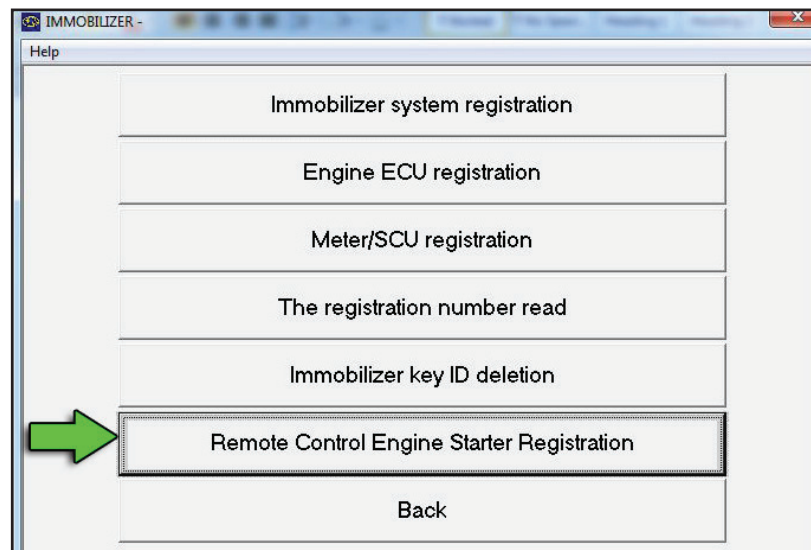


Figure 1-71 Remote Control Engine Starter Registration

This process allows the RES to be registered to the BIU.



Figure 1-72 Start Registration

This process should be utilized when installing RES to the vehicle or when replacing the BIU.

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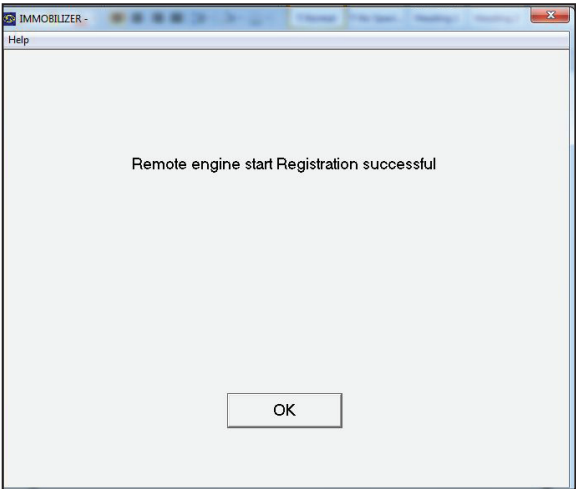


Figure 1-73 Registration Successful

Follow each instruction on the screen until the Immobilizer menu is displayed.

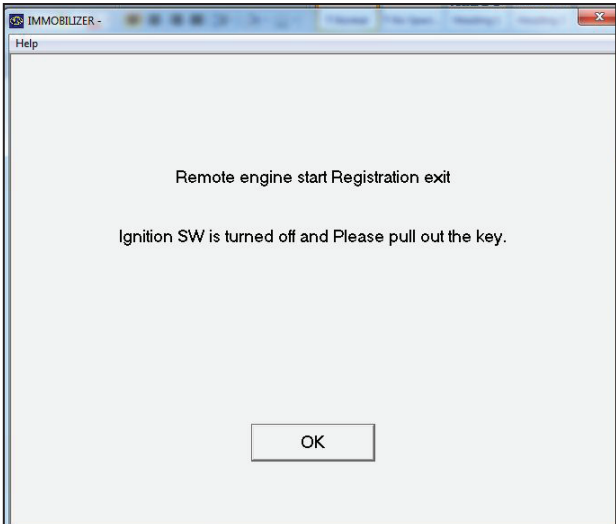


Figure 1-74 Exit

This screen indicates the RES was correctly registered.

NOTE: If a door of the vehicle is opened during RES operation, the RES turns the vehicle off and generates the following DTCs. These DTCs appear only as past codes. This condition is described as normal operation and requires no diagnosis or repair.

Examples of DTC Codes:

Code	Description & trouble position	Trouble occurre...	Trip Count	Time Count	Count	
Number of Diagnostic Code(s): 2						
B1402	Immobiliser Key collation NG	—	0	0	Common	
B1410	Transponder communication abnormal	—	0	0	Common	

Figure 1-75 DTC Codes

***Perform a correct and incorrect Immobilizer registration process**

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Keyless Access with Push Button Start System (Type D)

Introduced with 2013MY Legacy/Outback models, Keyless access with Push Button Start systems are referred to as “Immobilizer Type D”.

The Keyless Access with Push Button Start System allows:

- Doors to be unlocked or locked with a touch of the hand.
- The trunk can be unlocked by pushing the exterior trunk opener button.
- The vehicle to be started using a push button.

NOTE: Do not leave a spare remote transmitter in the vehicle or store any remote transmitter within 5 meters (16 ft.) of the vehicle. The keys and the vehicle will maintain constant communications and drain the remote transmitter’s battery.

Normal Operation



Figure 1-76 Driver's Hand in Door Handle

Vehicle Entry and Locking

1. The driver approaches the vehicle with the remote transmitter key in his or her pocket. The driver's hand is positioned into the pull area of the door handle. The receiver receives the wireless signal from the remote transmitter and unlocks the driver's door. The entry illumination activates.

NOTE: The next 10 pages use artwork and photographs to describe the natural progression for Keyless Access and Push Button Start functions.

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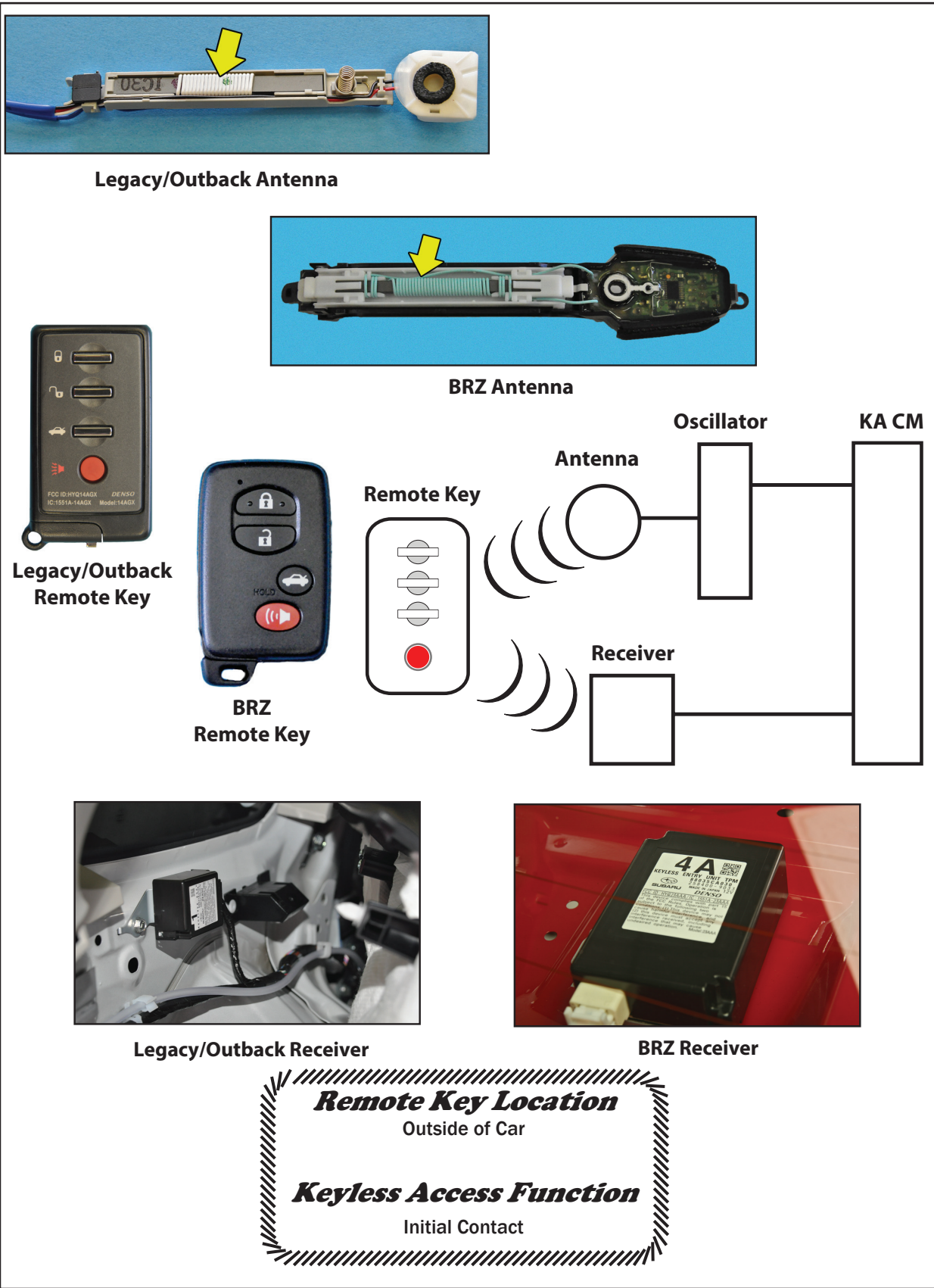


Figure 1-77 Antenna and Receiver Locations

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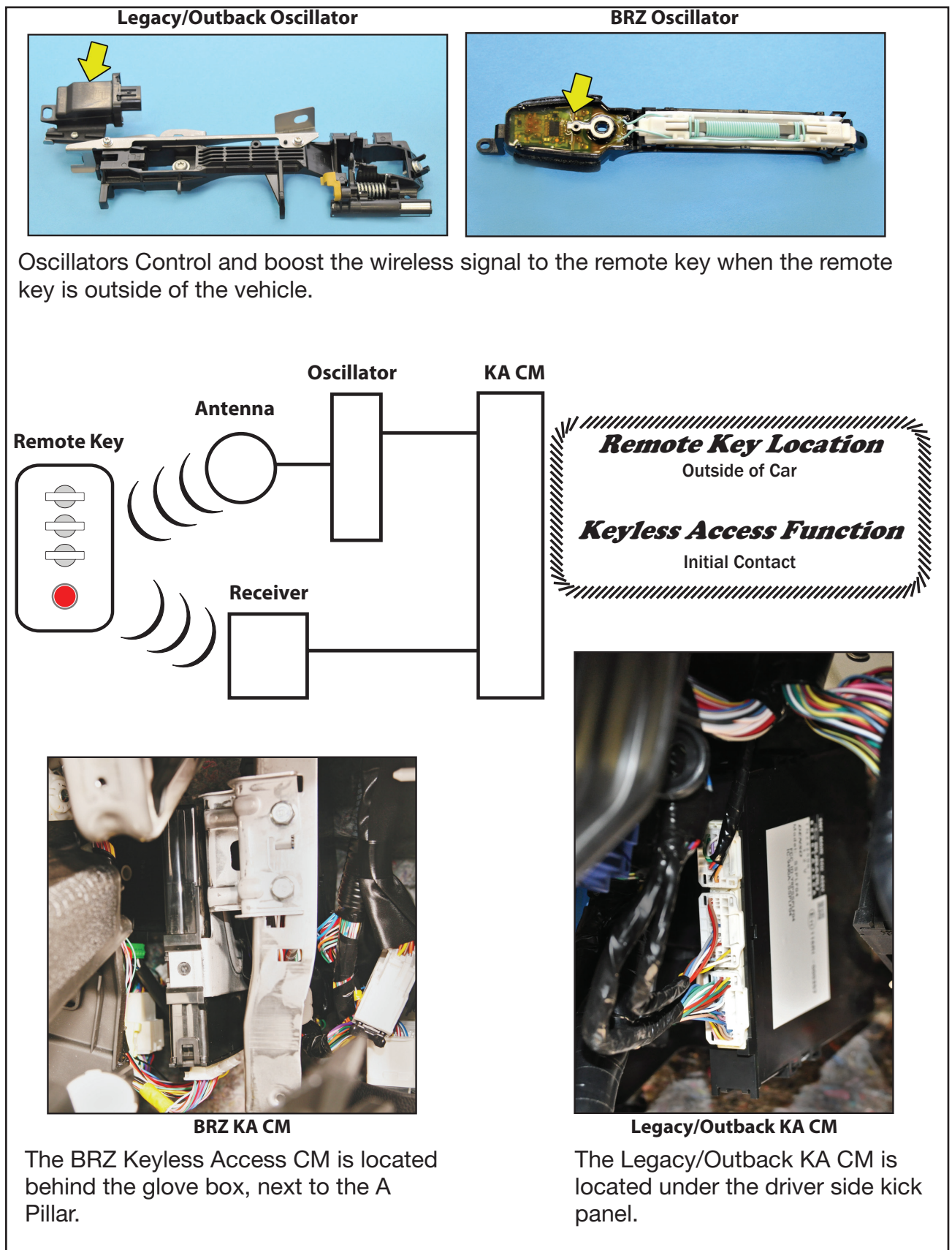


Figure 1-78 Oscillator and KA CM Locations

A close-up photograph of a person's hand pressing a white, rectangular button mounted on a glass door. The button is slightly recessed into the glass. The hand is positioned with the index finger pressing down on the button. The background is a plain, light-colored wall.

2. The driver changes their mind and shuts the door. The driver touches the lock button or sensor of the door handle and the doors lock. The entry illumination turns off.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the paper.

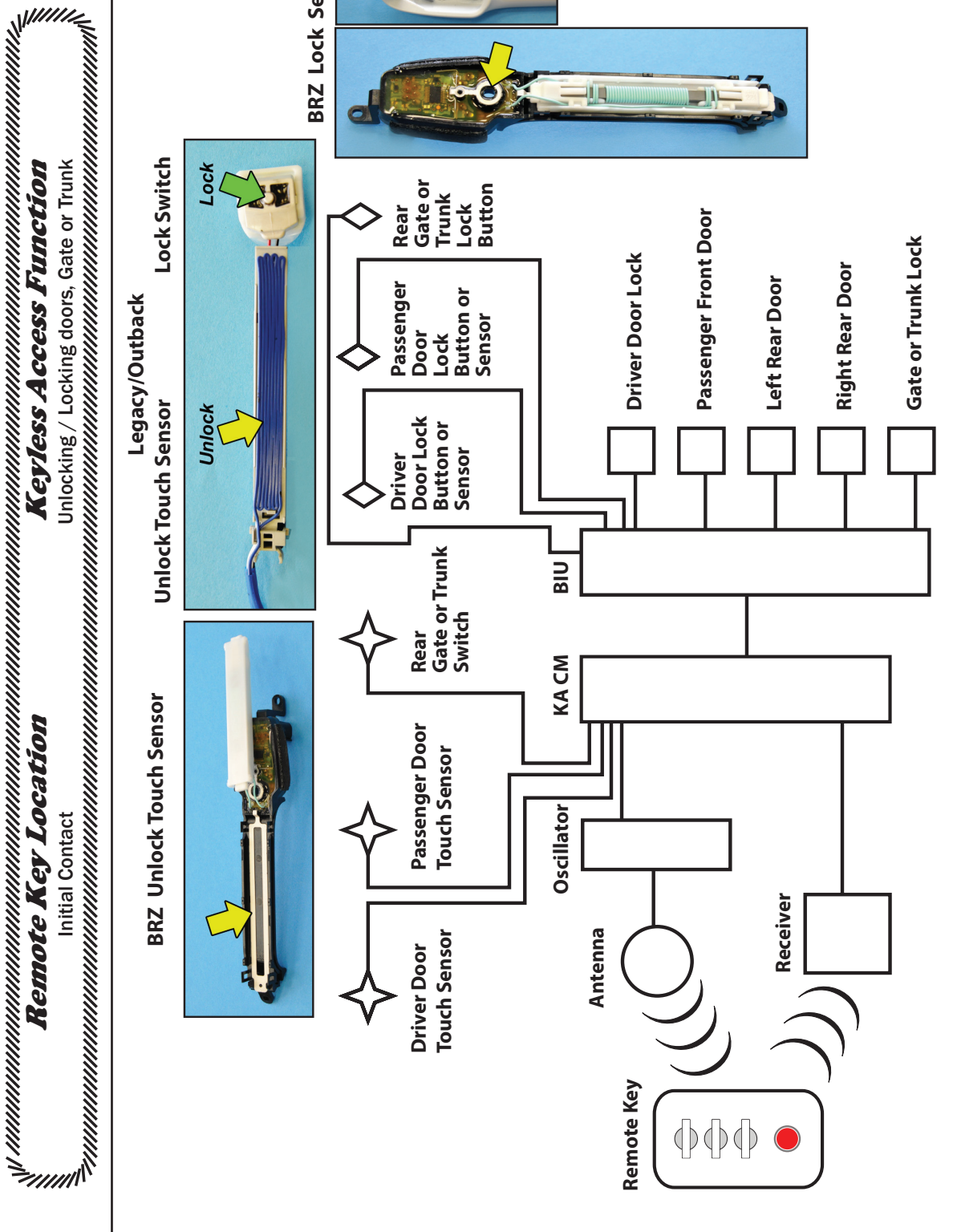


Figure 1-80 Unlocking and Locking doors, Gate or Trunk

The touch sensors are one wire capacitance type sensors. Touching the sensor or sensor cover (door handle) changes the capacitance of the sensor circuit and determines the location and function to be performed.

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NOTE: If the vehicle is unlocked with the remote transmitter or keyless entry controls and the door is not opened, the doors will automatically lock after 1 minute (Type D only).



Figure 1-81 Driver Touching Trunk Switch



Figure 1-82 Trunk Switch

3. The driver walks to the trunk or luggage area and pushes the trunk opener switch (a slight delay is normal). The trunk exterior antenna transmits a signal to the remote key and the remote key transmits a signal to the receiver. The trunk is unlocked. The trunk mechanically locks when the trunk lid is closed.
4. The vehicle can also be unlocked or locked with the keyless entry controls of the remote transmitter.
5. The vehicle can be locked using the mechanical or electrical unlock and lock buttons on the door panel. The door handle of the vehicle must be held out as the door is closed.



Figure 1-83 Mechanical Key in Door Lock



Figure 1-84 Trunk Mechanical Key Slot

6. The driver door or trunk can be unlocked with the mechanical key contained inside the Remote Transmitter. The vehicle alarm will activate as the door or trunk is opened. Turning the ignition on will deactivate the alarm.

Ignition and Engine Start



1. The driver sits in the driver seat. The interior antenna transmits a signal to the remote key. The remote key transmits a signal to the receiver.
2. The driver presses the Engine Start and Stop button once with their foot off of the brake pedal. The accessory position circuit turns on and allows operation of all accessory circuit devices.

NOTES:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

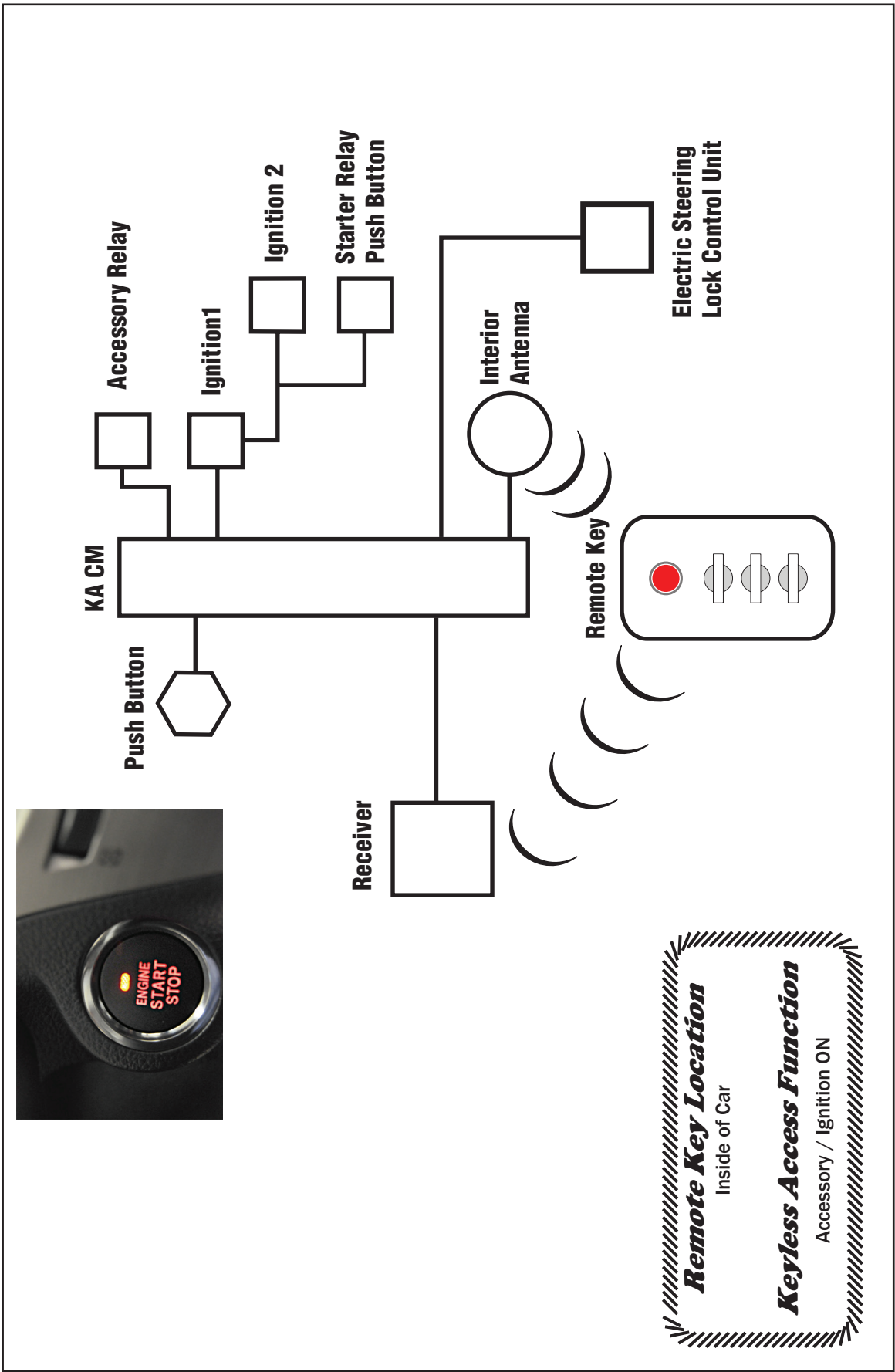


Figure 1-86 Accessory / Ignition ON

3. The driver presses the Engine Start and Stop Button twice with their foot off of the brake pedal. The ignition turns on and allows operation of all ignition circuit devices.

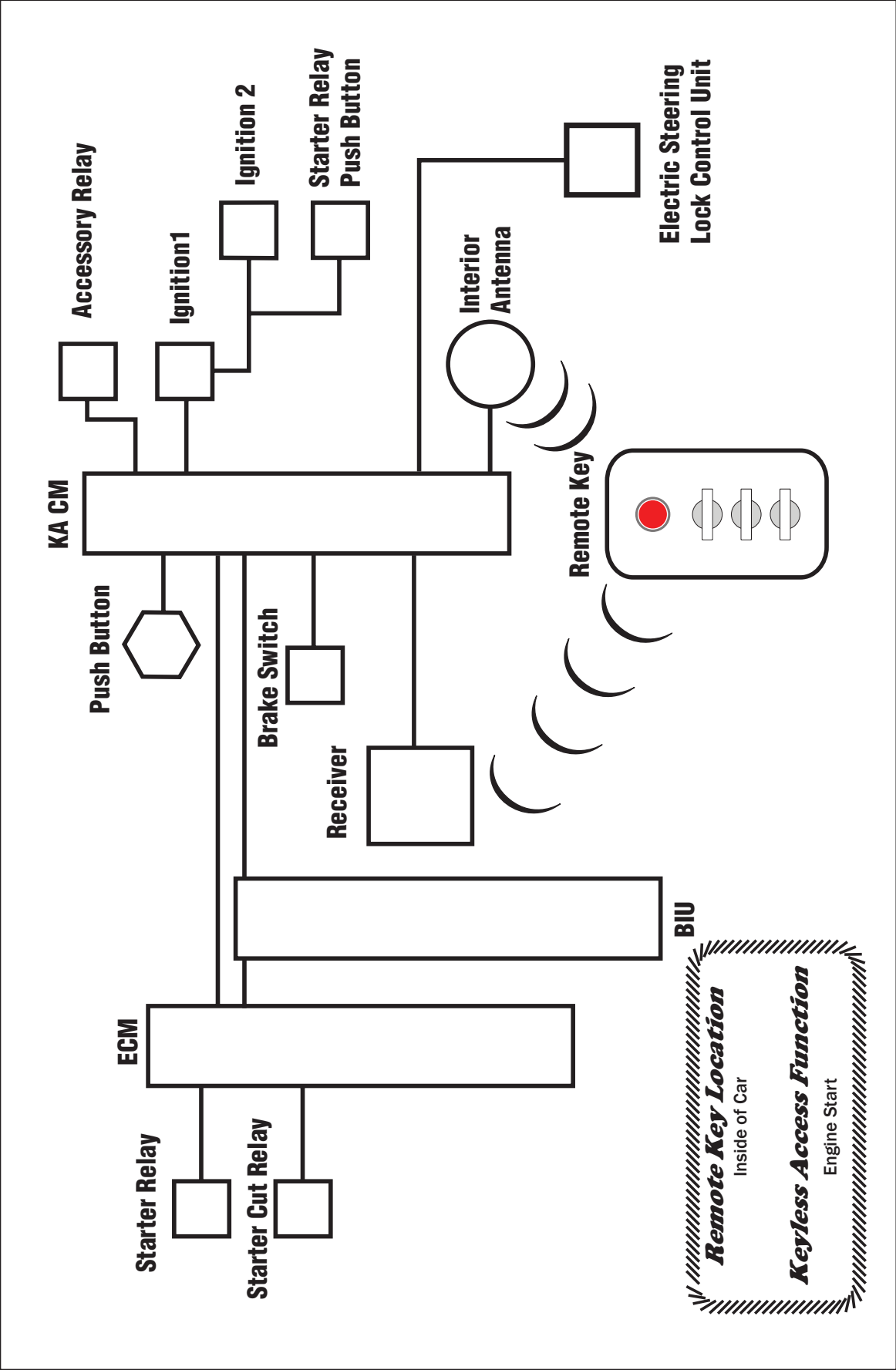


Figure 1-87 Keyless Access Function Engine Start

4. The driver presses the brake pedal and pushes the Engine Start and Stop button once. The starter engages and operates until the engine starts or for 10 seconds.

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NOTE: Pressing the Engine Start and Stop button while the starter is operating will turn off the starter.



Figure 1-88 Remote Transmitter Position for Dead Transmitter Battery

5. A dead battery in the remote transmitter will prevent normal starting of the engine. In this condition, hold the remote key to the chrome ring of the Engine Start and Stop button and push the Engine Start and Stop button once while holding the brake pedal. The starter will engage and operates until the engine starts or for 10 seconds.
6. The engine and ignition are turned off by pressing the Engine Start and Stop button once.
7. The starter can be engaged without pressing on the brake pedal by performing the following: Turn the Accessory position on and press the Engine Start and Stop Button a second time but do not release the button. Holding the button in this condition for 20 seconds will engage the starter until the engine starts or for 10 seconds.

NOTE: If the vehicle is moving, the engine and ignition will turn off if the Engine Start and Stop Button is pressed for 3 seconds. Restart is accomplished by shifting to neutral, lightly pressing the brake pedal and pushing the Engine Start and Stop button once.

NOTES:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Key Warning



Figure 1-89 *BRZ Combination Meter Warning Light*

1. If the remote transmitter is removed from the vehicle with the engine operating, a flashing indicator light on the combination meter will activate and an audible chirp will be sounded.

NOTE: This function is cancelled if the check engine is illuminated. (Type D only)

2. If the remote transmitter exits the vehicle the engine and the ignition will remain on, but the vehicle will not restart.
3. If the ignition is turned off and the driver side door is opened and remains open (key left in vehicle), a continuous tone from the warning buzzer is activated. This can be disabled during service work by pressing and releasing the door switch (open and close switch).

NOTES:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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Wireless Communications

1. When the vehicle and the remote transmitter are separated, the vehicle outputs a signal every 250 milliseconds. This is the signal that wakes up the remote key. The wake signal is transmitted by the door handle antennas or trunk exterior antenna. Each antenna is equipped with an oscillator that controls the signal.
2. The remote transmitter LED (Type D) will begin to flash when the remote transmitter is within range of the wake up signal.
3. The remote transmitter will transmit a continuous signal to the vehicle when the remote transmitter is within range.
4. The wake up signal will change frequency to 1 signal every 3 seconds when the remote transmitter has been activated.
5. When the remote transmitter crosses the threshold of outside to inside the vehicle, the door handle antenna stops transmitting. The LED on the remote transmitter will stop blinking.

Collation and Immobilizer

1. The vehicle transmits a wireless signal (135 KHZ) to the Remote Transmitter.
2. The Remote Transmitter transmits a wireless signal (315 MHZ) to the vehicle.
3. The signal from remote transmitter includes the Immobilizer Identification.

Automatic Door Locks

Beginning in 2018, with Legacy and Outback models an automatic door lock system is used.

The automatic power door lock/unlock system automatically locks all the doors, rear gate, and the fuel door to improve vehicle security. With the default settings, the system locks the doors when the vehicle speed exceeds 13mph. The system automatically unlocks the doors when the driver's door is opened. The system setting and variations of operation can be customized to the driver's needs through the Audio Unit's Vehicle Setting menu or the SSM.

The Automatic Door Locks can set the (Lock) function to:

- Vehicle Speed (default) (13 mph)
- Shift Out of PARK
- Off

The Automatic Door Locks can set the (Unlock) function to:

- Shift In to PARK
- Ignition Off
- Driver's Door Open (default)
- Off

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Collision Detection Auto Door Unlock Function

The Collision Detection Auto Door Unlock Function automatically unlocks all doors and the rear gate when the vehicle suffers a strong impact. This allows occupants to more easily exit the vehicle after a collision.

Warning: This function may not activate in some cases due to the strength of the impact or other factors.

NOTE: Because this function is related to occupant safety, it cannot be deactivated in the customization settings.

Backup Unit

A backup unit is installed for the collision detection door unlock function. The backup unit is charged with only the power necessary to operate the door lock actuators. In the event that the vehicle is subjected to a collision or other strong impact and the body integrated unit power supply fails, the backup unit provides the necessary power for unlocking the doors. This backup unit is located behind the audio unit.

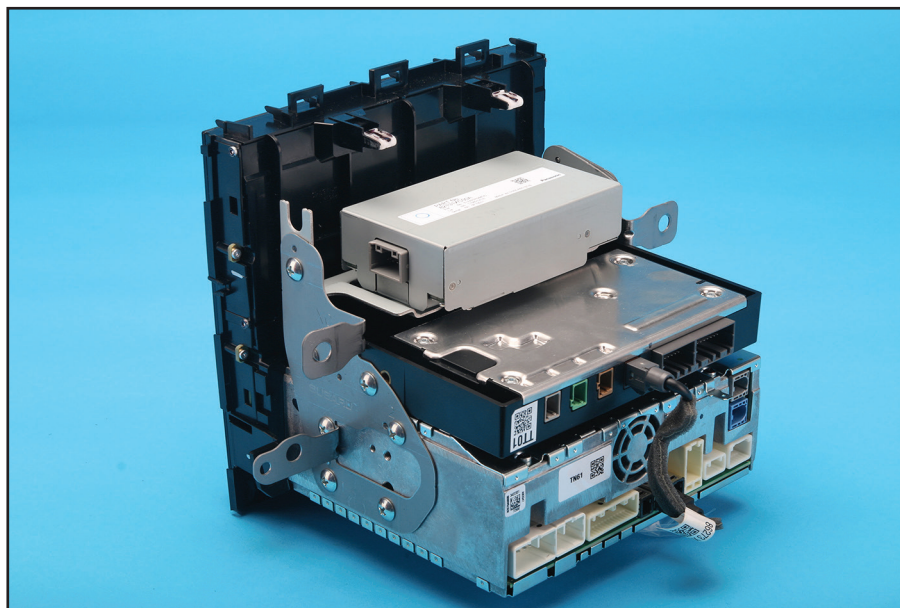
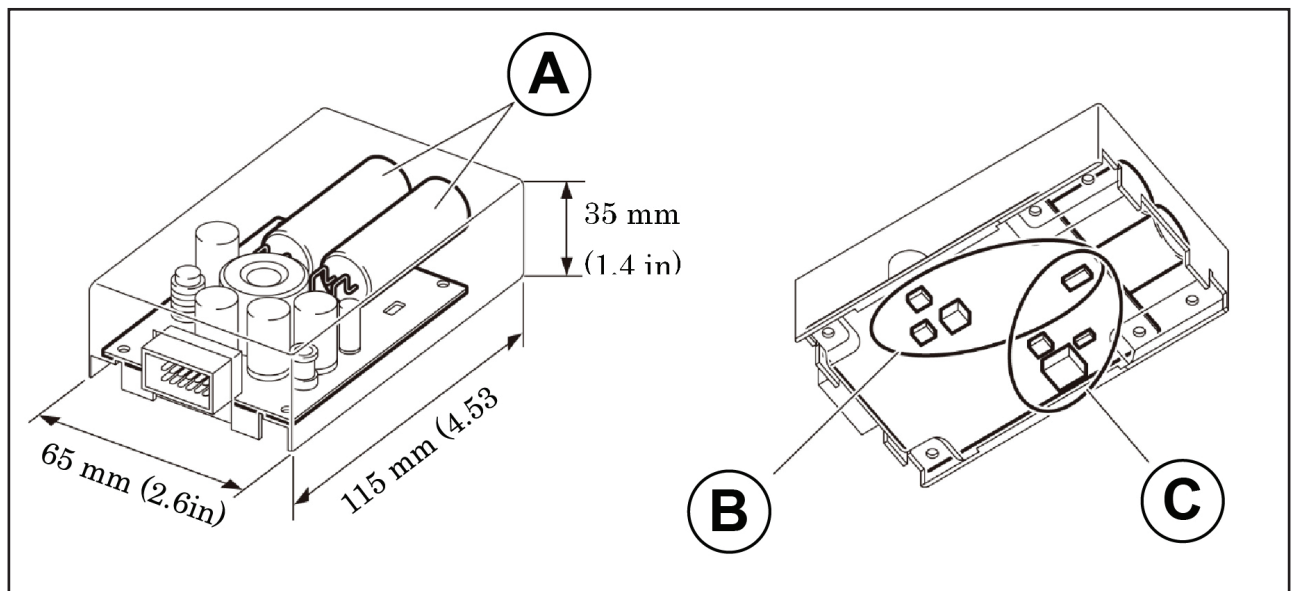


Figure 1-90 Backup Unit (Ascent)



A	Capacitor
B	Charging DC/DC Converter
C	Output DC/DC Converter

Figure 1-91 Backup Unit

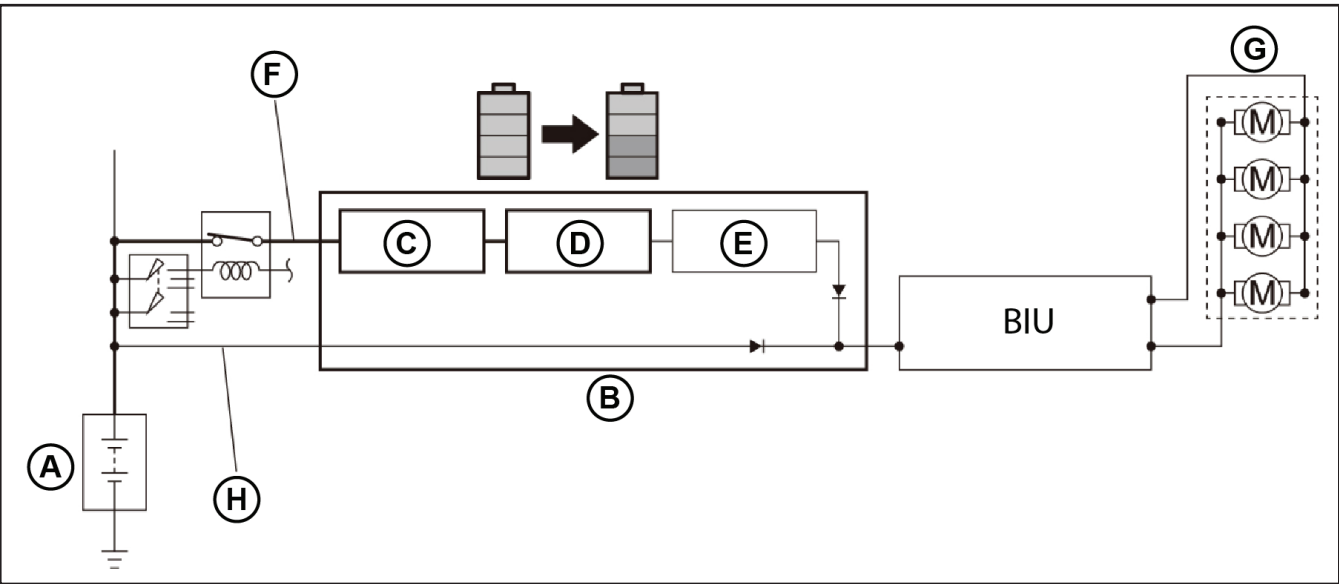
When backup unit is charging (standby)

When the ignition switch is turned ON, the capacitor inside the backup unit is charged within 90 seconds.

When backup unit activates (at time of collision)

In case of a collision, the charged capacitor supplies power to the body integrated unit and all door actuators in order to unlock the doors.

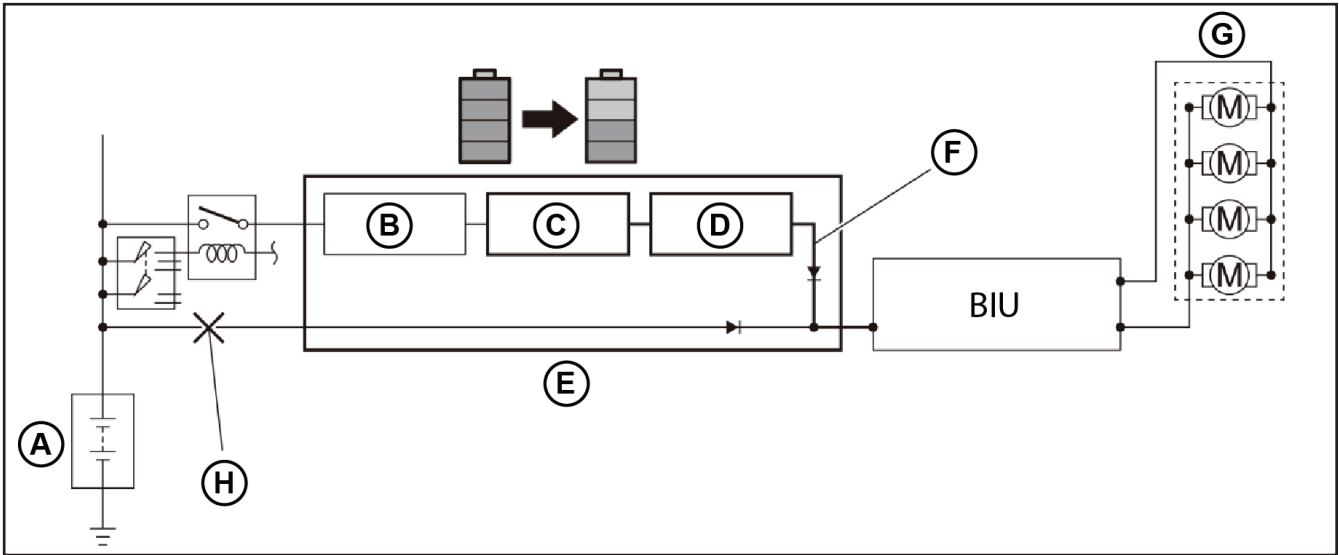
Advanced Electrical Systems & Diagnosis



07-19-3930-4013

A	Battery	E	Output DC/DC converter
B	Backup Unit Assembly	F	Backup power supply route
C	Charging DC/DC converter	G	Door Lock Actuators
D	Capacitor	H	Body integrated unit power supply

Figure 1-92 When Backup Unit is Charging



07-19-3930-4014

A	Battery	E	Backup Unit Assembly
B	Charging DC/DC converter	F	Backup power supply route (at time of collision)
C	Capacitor	G	Door Lock Actuators
D	Output DC/DC converter	H	Failure of body integrated unit power

Figure 1-93 When Power Supply is Interrupted

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Driver Information and Infotainment

Combination Meter



Figure 2-1 Combination Meter

Beginning in 2017MY, if a Combination Meter is replaced, it maybe necessary to follow the “Variant Work” procedures to transfer information (including odometer readings).



Figure 2-2 Combination Meter Replacement

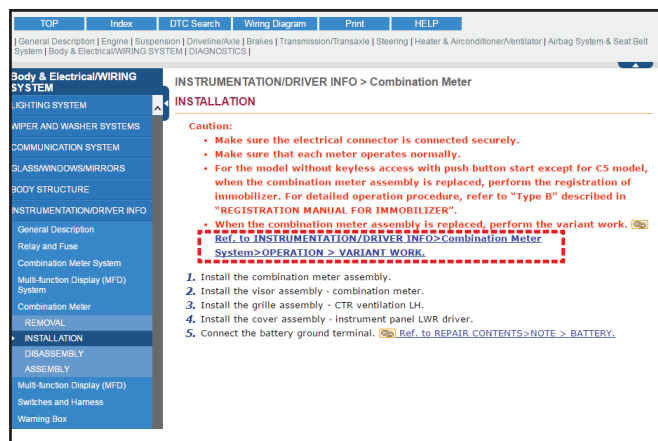


Figure 2-3 Combination Meter – Variant Work

Two procedures (A & B) are outlined depending on the ability of the SSM to communicate with the Combination Meter assembly.

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NOTE: Consult the appropriate Service Manual for full procedure details.

Operation Procedure A (when communication with the SSM is possible)

1. Read and store the ECM setting information
2. Read the Odometer value
3. Replace the Combination Meter assembly with a new part
4. Write the Odometer value
5. Write the ECM setting
6. Check if the Combination Meter assembly operates normally

Operation Procedure B (when communication with the SSM is not possible)

1. Replace the Combination Meter assembly with a new part
2. Write the Vehicle Data (Using the Applied Model and Option Codes found inside the passenger door)
3. Check if the Combination Meter assembly operates normally

NOTE:

A new Combination Meter can only be written one time. Carefully read and follow all Service Manual direction carefully. If communication is not possible with the installed Combination Meter, then odometer mileage cannot be transferred or written to the new assembly.

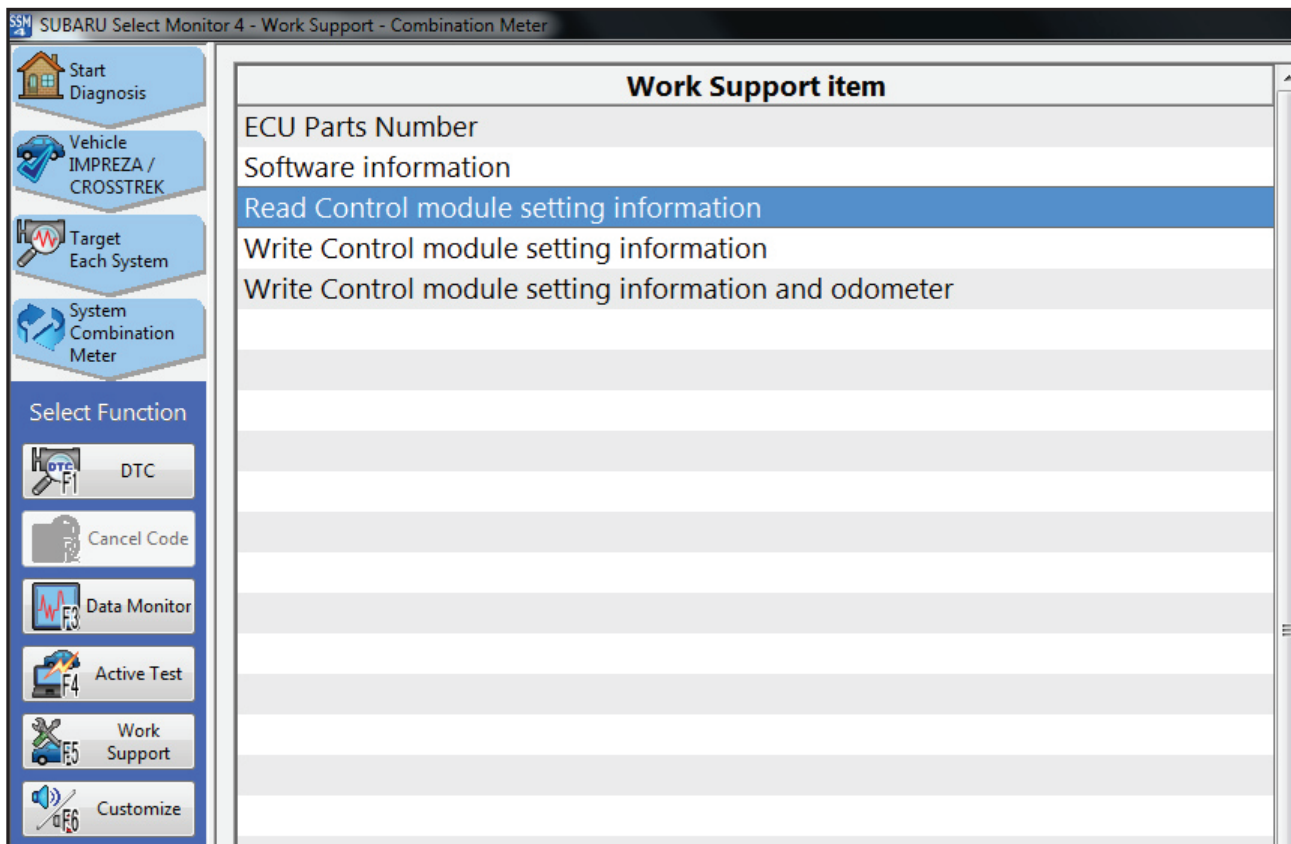


Figure 2-4 Variant Work – Read Setting (A)

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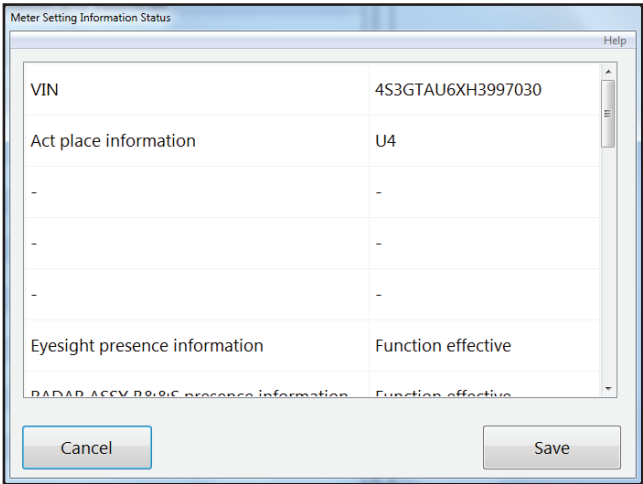


Figure 2-5 Variant Work – Setting Status (A)

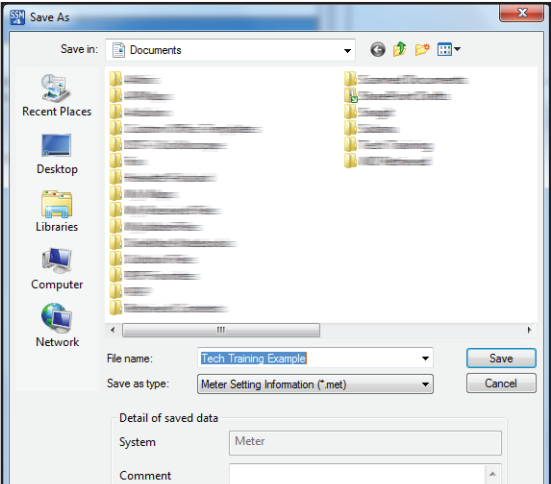


Figure 2-6 Variant Work – Save Setting (A)

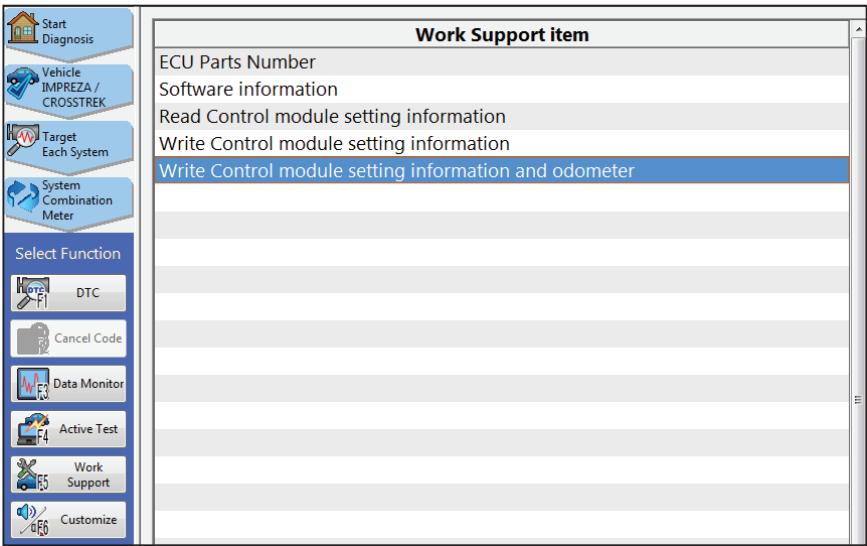


Figure 2-7 Variant Work – Write Setting (A)

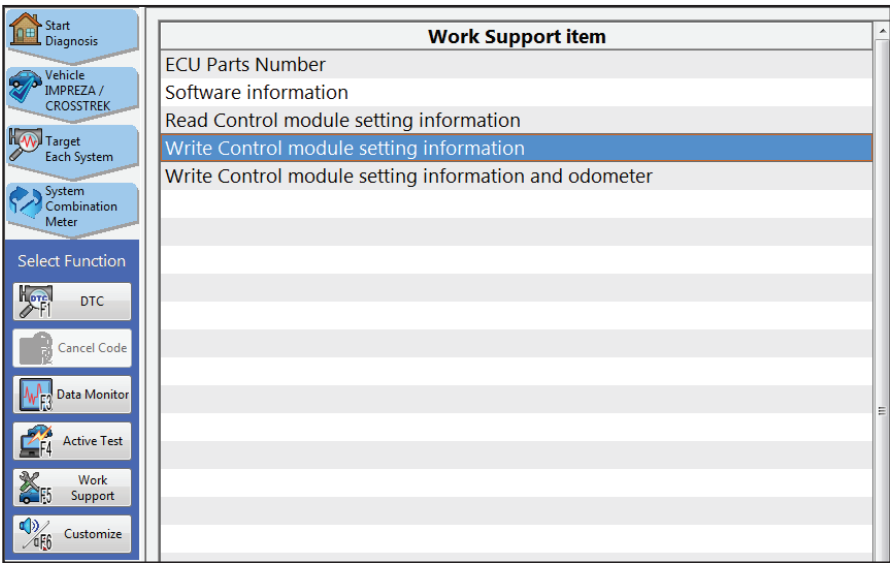


Figure 2-8 Variant Work – Write Setting (A or B)

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2017 Multi-Function Display (MFD)

Beginning with the 2017 Impreza, some Subaru models feature an enhanced 6.3-inch, high resolution, full-color LCD Multi-Function Display (MFD) at the top center of the instrument panel.



Figure 2-9 Multi-Function Display – MFD

The MFD includes the following content screens:

- Clock
- Audio
- Fuel Efficiency
- Driver Favorites
- Preventative Safety
- EyeSight®
- Electrical Component Operating Condition
- Self-Check
- Settings

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The new Electrical Component Operating Condition screen provides the driver ON/OFF status of numerous systems and functions such as headlights, turn signals, RAB, BSD/RCTA, EyeSight®, and HVAC at a quick glance.



Figure 2-10 Component Operating Condition – OFF



Figure 2-11 Component Operating Condition – ON

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Generation 3 Multimedia systems (Harmon Kardon)

First used on the 2017 Impreza, generation 3.0 multimedia system is available in three options. A 6.5-inch system can be found on base and premium models. 8-inch systems are found standard on sport and limited models. 8-inch with Navi systems are optionally available on limited and touring models.

NOTE:

Information related to earlier Multimedia Systems can be found in the “Supplemental Information” section of this Technician Reference Booklet (TRB).

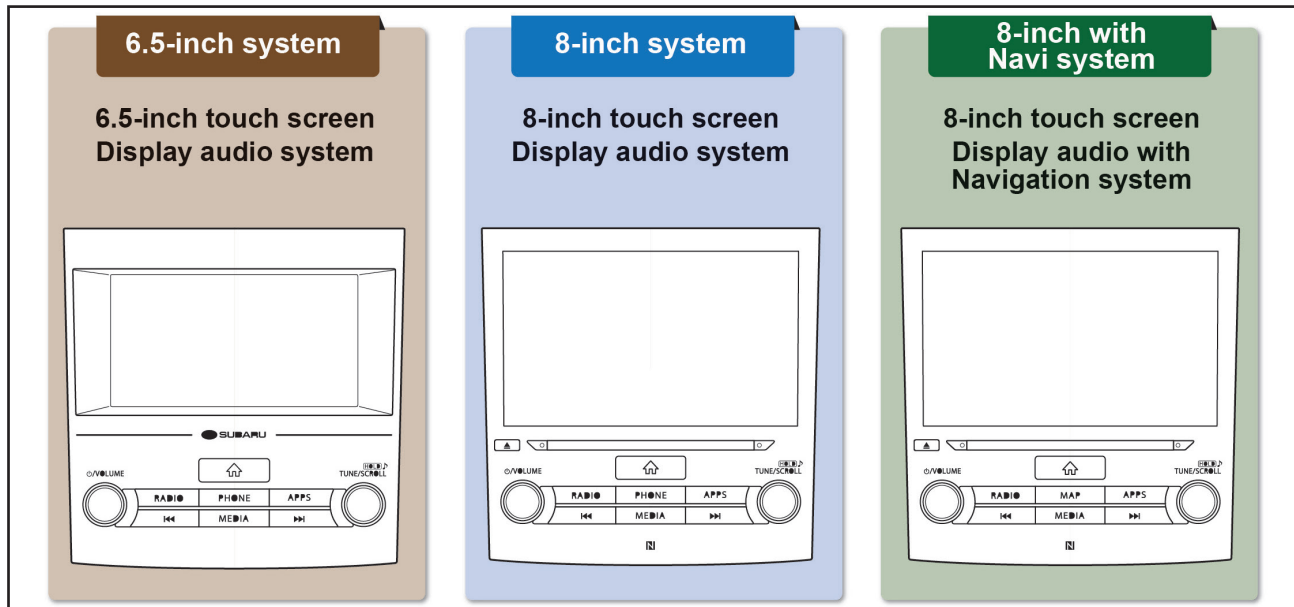


Figure 2-12 2017 Impreza – Multimedia Systems

6.5-inch multimedia systems feature SUBARU STARLINK™ with Apple CarPlay™, Android Auto™, Pandora®, and Aha™ smartphone app integration, high-resolution LCD touch screen display, AM/FM stereo, USB port/iPod® control, Bluetooth® audio streaming and hands-free phone connectivity, and a 3.5-mm auxiliary jack. These systems are available with either 4 or 6 interior speakers.



Figure 2-13 6.5 Inch Multimedia System

6.5" systems do not feature a CD player, HD Radio or Accessory Satellite Radio Options.

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In addition to the 6.5-inch features, the 8-inch systems offer NFC (Near-Field Communication) technology, CD player, high-resolution LCD multi-touch gesture display, dual USB ports/iPod® control, Bluetooth® audio streaming, hands-free phone and text messaging, and a 3.5-mm auxiliary jack. These systems are available with either 4 or 6 interior speakers.



Figure 2-14 8-Inch with Navi System

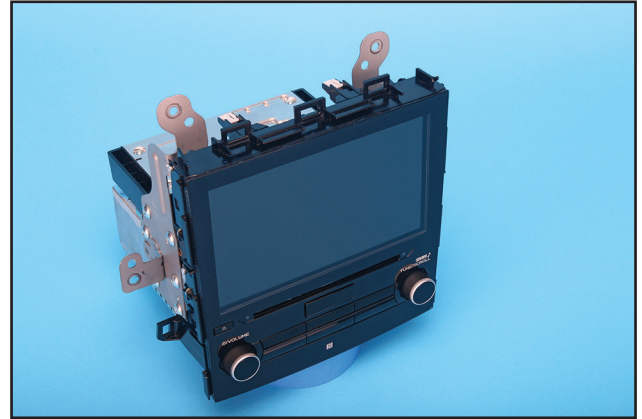


Figure 2-15 Multimedia System – Removed

8-inch and 8-inch with Navi systems also feature SUBARU STARLINK™ cloud-based applications including access to news, navigation, food, weather, music, podcasts, audiobooks, and other multimedia content through Yelp, iHeart® Radio, Magellan® Navigation, SiriusXM All Access Radio™, and Travel Link™.



Figure 2-16 Home Screen



Figure 2-17 Apps

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Compatible smartphones can connect to the multimedia systems using the new Apple CarPlay™ or Android Auto™ applications to allow the driver to control their smartphone functions through the steering wheel, touch screen, and/or head-unit buttons.

NOTE: Utilizing Apple CarPlay™ or Android Auto™ requires connecting a phone directly to the vehicle's USB port located in the center console using a data cable.

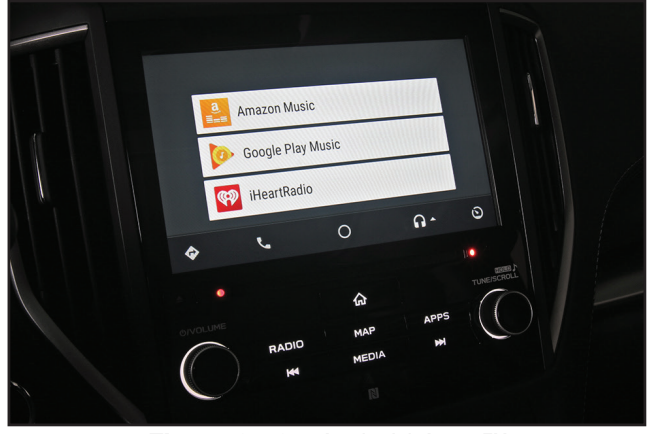
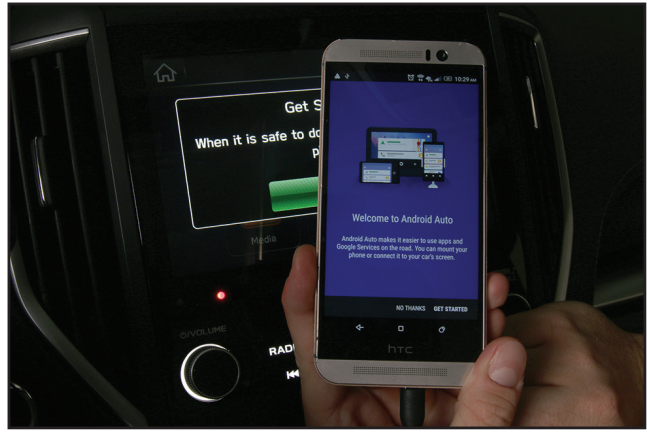
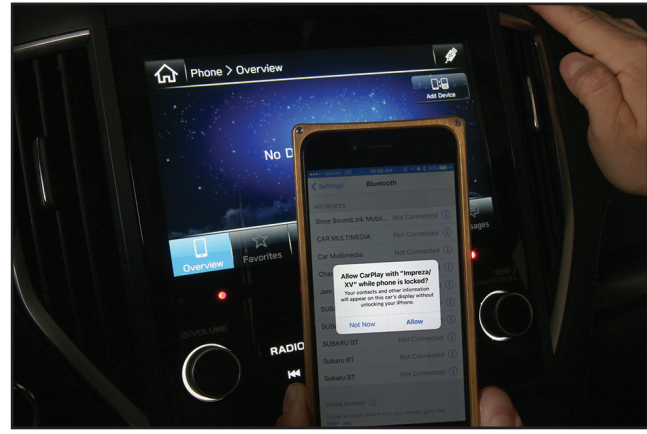
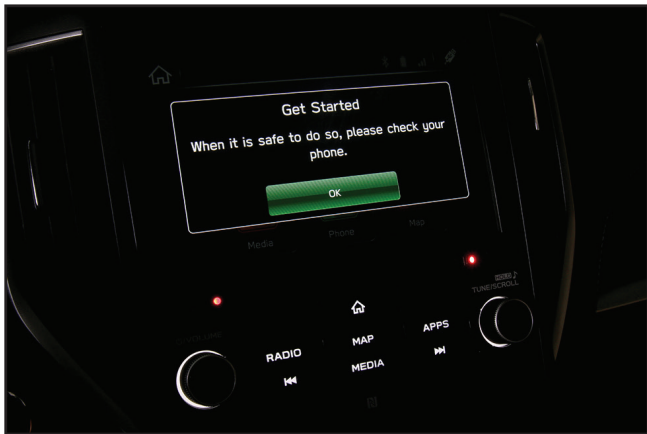


Figure 2-18 Apple CarPlay™ Screens

Figure 2-19 Android Auto™

Refer to the respective developer websites for further application information:

Apple CarPlay™	http://www.apple.com/ios/carplay/
Android Auto™	https://www.android.com/auto/

Figure 2-20 Website Addresses

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Software Updates

8-Inch and 8-Inch with Navi. Models feature the ability to perform system updates OTA (over the air) via WiFi, as needed to improve functionality. If necessary, these systems can also be updated using USB memory. 6.5-inch models require software updates be performed via USB memory.

NOTE:

Further information regarding Multimedia System updates can be found via www.Subarunet.com > Service Operations & Technical > Forms/Downloads > Downloads for Audio/Navi. This section contains both download files and corresponding TSBs detailing update procedures and requirements.

NOTE:

System updates do not include updates to Navigation Maps. Maps are updated via USB memory. Information regarding map updates can be found through www.Subaru.com/owners.

Total OTA update size is generally between 150-200MB. Updates are expected to be available ap-proximately every 6 months. Check Subarunet and STIS for version release announcements and de-tails.

NOTE:

It is not possible to update the system across several versions. Therefore, it is important to “Check for Updates” immediately following an update to ensure the most up to date version has been installed.



CAUTION

Always ensure the vehicle is in the Park “P” position when downloading and performing updates.



Figure 2-21 Check for Updates Setting



Figure 2-22 Download Setting

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Figure 2-23 Software Version Check

Current system information can be found under the “General” menu, “System Information” option.



Figure 2-24 System Information



Figure 2-25 Software Version

The system must be connected to a Wireless network (WiFi) in order to download updates.



Figure 2-26 Wi-Fi Settings



Figure 2-27 Add WiFi Network

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Service and Diagnostics

Service of the Multimedia unit (audio assembly) is possible once the left and right center air grilles and the center trim panel have been removed. All three trim pieces are removed by applying firm pressure away from the vehicle's bulkhead (toward rear of vehicle). Once accessible, the audio assembly is secured to the dash with 4 screws.

NOTE:

Failure to disconnect the negative battery cable before removing the audio head unit will result in an inoperable backup camera. This occurs because the audio head unit, after powering up, does not see the backup camera and assumes there is not one installed in the vehicle. This can be repaired by removing the backup power fuse and waiting 30 seconds. Then install the backup power fuse and test the backup camera. This condition is not the fault of software or hardware. Follow the instructions currently in place in the Subaru Service Manual for audio head unit removal and installation.



Figure 2-28 Multimedia Unit Service



Figure 2-29 Trim Panel – Removal

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Use caution when removing the connectors at the rear of the unit to prevent damage to other trim pieces or attached harnesses.



Figure 2-30 Connector Removal

Always note all connectors as they are removed and ensure they are securely reinstalled in the correct location prior to repair verification or customer delivery.

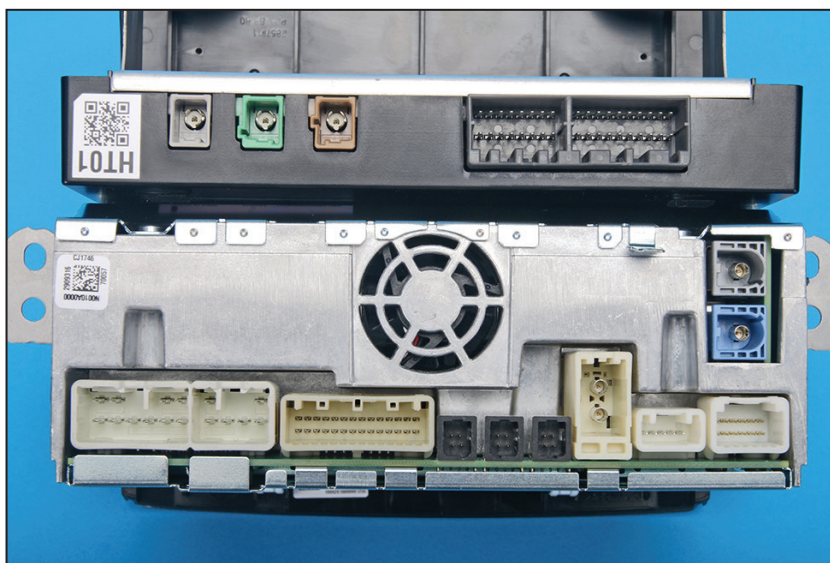


Figure 2-31 Rear Connections

Gen. 3 Multimedia systems feature Service Diagnostic modes (Line Diag Mode) that allow technicians to verify system functions and isolate the source of potential malfunctions. These diagnostic modes can be executed through the Multimedia System display or through the Subaru Select Monitor (SSM) software (new for 2017 Impreza). Both methods provide the same basic checks including

- Connectivity
- Panel and Switch
- Microphone
- Vehicle Signal

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Entering the diagnostic mode through the system display is accomplished by pressing the “TUNE/SCROLL” button twice while holding the “HOME” button. Functions and checks within the system display diagnostic mode remain similar to previous models.

NOTE:

A full listing of the diagnostic modes can be found in the Service Manual (Diagnostics > Infotainment (Diagnostics) > Service Diagnostics Mode > Operation).



Figure 2-32 Enter Diagnostic Mode

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Using the SSM software, Multimedia system diagnostics can be performed by entering the “infotainment” system. The Infotainment System in the SSM offers diagnostic features including Diagnostic Trouble Codes (DTCs), Data Monitoring, Active Test, Work Support, and Customizing.

NOTE: Only the Service Diagnostic mode through the System Display provides touch screen inspections, GPS inspections, and camera setting adjustments.

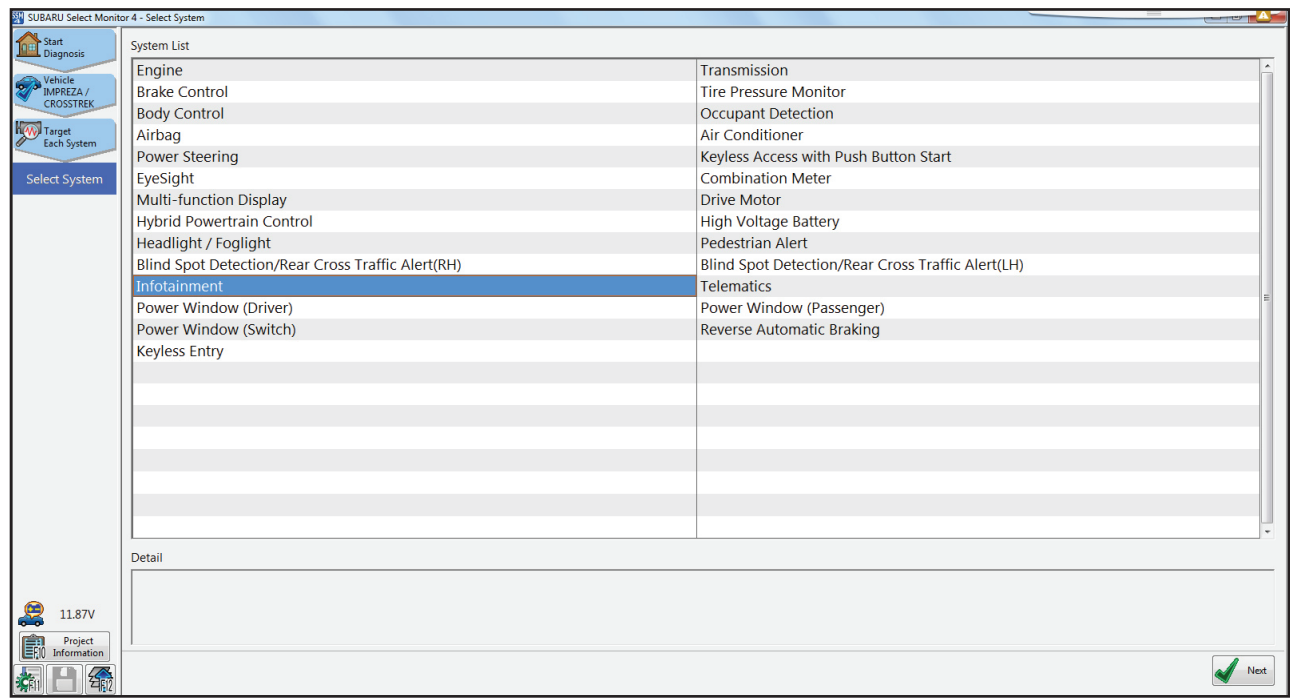


Figure 2-33 SSM – System Selection

New Diagnostic Trouble Codes (DTCs) with diagnostic procedures are available for Gen. 3 systems. Descriptions and troubleshooting can be found in the Service Manual.

Status▲	Code▲	Description & trouble part	Time stamp			FFD▲
			Trip C...▲	Time Co...▲	Group	
			00790	1214100	Current	
History	B2241	CAN Communication	00698	2972800	Common	
History	B2244	Amplifier Communication	00164	3263900	Common	
History	B2249	Bluetooth Module	00064	0	Common	
History	B224A	Backup Camera	00165	0	Common	
History	B224D	XM / Satellite Digital Audio Radio Servie Antenna Faults(Shorted or Open)	00547	0	Common	
History	B2253	Damaging a Coil due to the Electric Current to the Speaker Coil				
History	B2254	GPS Antenna Faults				
History	U0122	Lost Communication With Vehicle Dynamics Control Module				
History	U1140	Lost Communication With Body Control Module BODY-CAN				
History	U0155	Lost Communication With Instrument Panel Cluster (IPC)				
		Lost Communication With Body Control Module BODY-CAN				

Figure 2-34 SSM – DTCs

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Infotainment DTCs also feature enhanced HTML service manual diagnostics.

TOP	Index	DTC Search	Wiring Diagram	Print	HELP	New car info
General Description Engine Suspension Driveline/Axle Brakes Transmission/Transaxle Steering Heater & Airconditioner/Ventilator Airbag System & Seat Belt S						
DIAGNOSTICS						
Braking(DIAGNOSTICS)						
IMMOBILIZER (DIAGNOSTICS)						
LAN SYSTEM (DIAGNOSTICS)						
KEYLESS ENTRY(DIAGNOSTICS)						
KEYLESS ACCESS WITH PUSH BUTTON START(DIAGNOSTICS)						
BODY CONTROL(DIAGNOSTICS)						
MULTI-FUNCTION DISPLAY(DIAGNOSTICS)						
COMBINATION METER (DIAGNOSTICS)						
INFOTAINMENT(DIAGNOSTICS)						
Basic Diagnostic Procedure						
Check List for Interview						
General Description						
Electrical Component Location						
Control Module I/O Signal						
Inspection Mode						
Diagnostic Procedure for Subaru Select Monitor Communication						
Data Monitor						
Freeze Frame Data						
Customize						
Work Support						
Diagnostic Trouble Code (DTC)						
OPERATION						
LIST						
Diagnostic Procedure with Diagnostic Trouble Code (DTC)						
Diagnostics with Phenomenon						
Service Diagnostics Mode						

INFOTAINMENT(DIAGNOSTICS) > Diagnostic Trouble Code (DTC)		
LIST		
Code	Description & trouble part	Reference
B2240	CAN COMMUNICATION (AUDIO) STUCK	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B2240 CAN COMMUNICATION (AUDIO) STUCK.
B2241	CAN COMMUNICATION	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B2241 CAN COMMUNICATION.
B2244	AMPLIFIER COMMUNICATION	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B2244 AMPLIFIER COMMUNICATION.
B2247	CD MECHANICAL	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B2247 CD MECHANICAL.
B2249	BLUETOOTH MODULE	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B2249 BLUETOOTH MODULE.
B224A	BACKUP CAMERA	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B224A BACKUP CAMERA.
B224B	RADIO ANTENNA FAULTS(SHORTED OR OPEN)	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B224B RADIO ANTENNA FAULTS(SHORTED OR OPEN).
B224D	XM / SATELLITE DIGITAL AUDIO RADIO SERVIC ANTENNA FAULTS(SHORTED OR OPEN)	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B224D XM / SATELLITE DIGITAL AUDIO RADIO SERVIC ANTENNA FAULTS(SHORTED OR OPEN).
B224E	DIGITAL AUDIO BROADCAST ANTENNA FAULTS	Ref. to INFOTAINMENT(DIAGNOSTICS) >Diagnostic Procedure with Diagnostic Trouble Code (DTC)>DTC B224E DIGITAL AUDIO BROADCAST ANTENNA FAULTS.

Figure 2-35 Service Manual – DTCs

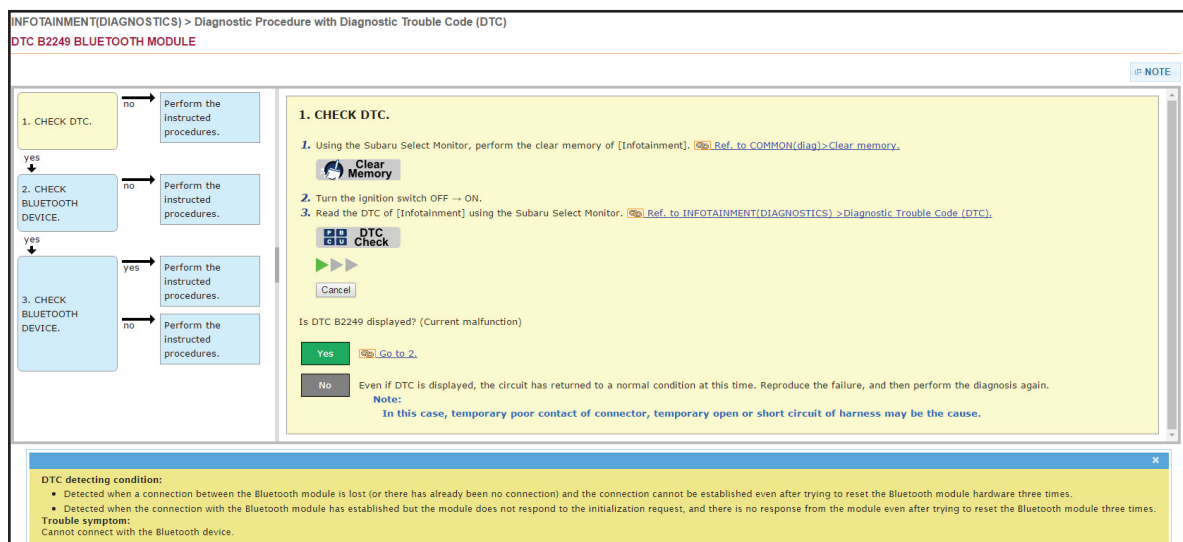


Figure 2-36 Service Manual – Diagnostic Procedure

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The Data Monitor function provides information related to the current state of the Multimedia system. The connectivity and operation of input and other peripheral devices can be inspected using this function.

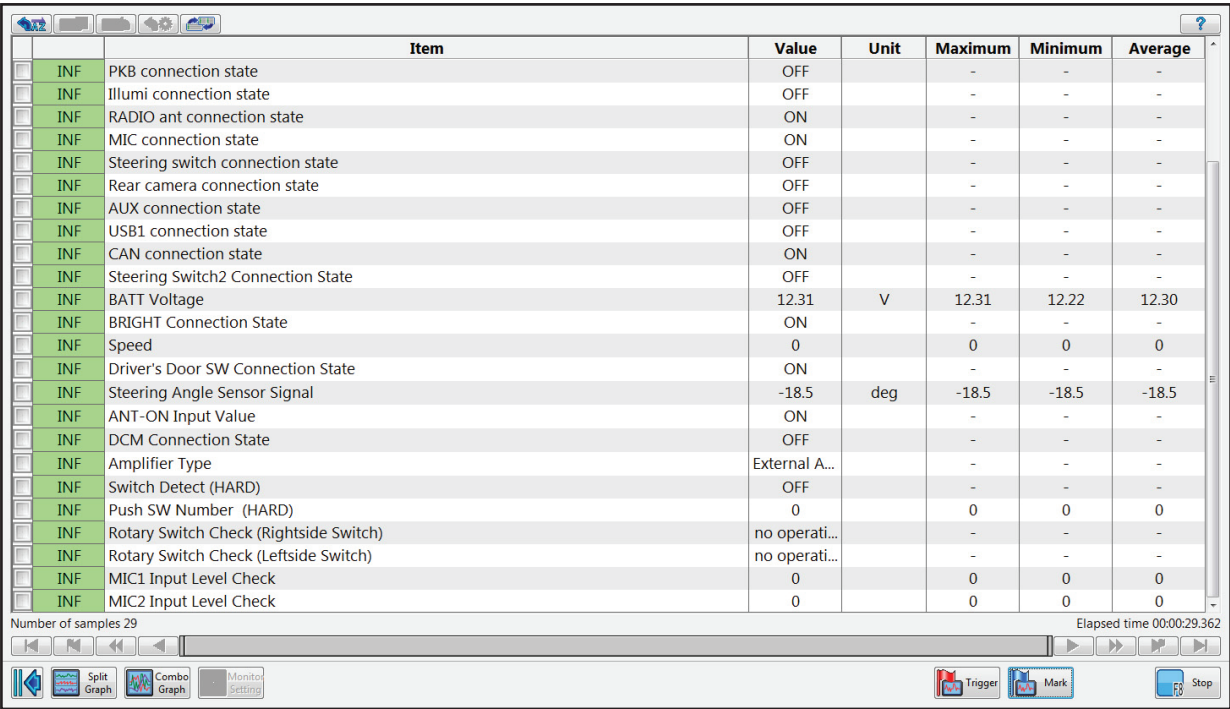


Figure 2-37 SSM – Data Monitor

Active Test provides the ability to actuate certain functions of the Multimedia System.

NOTE: Diag. Recorder is used for engineering purposes only.

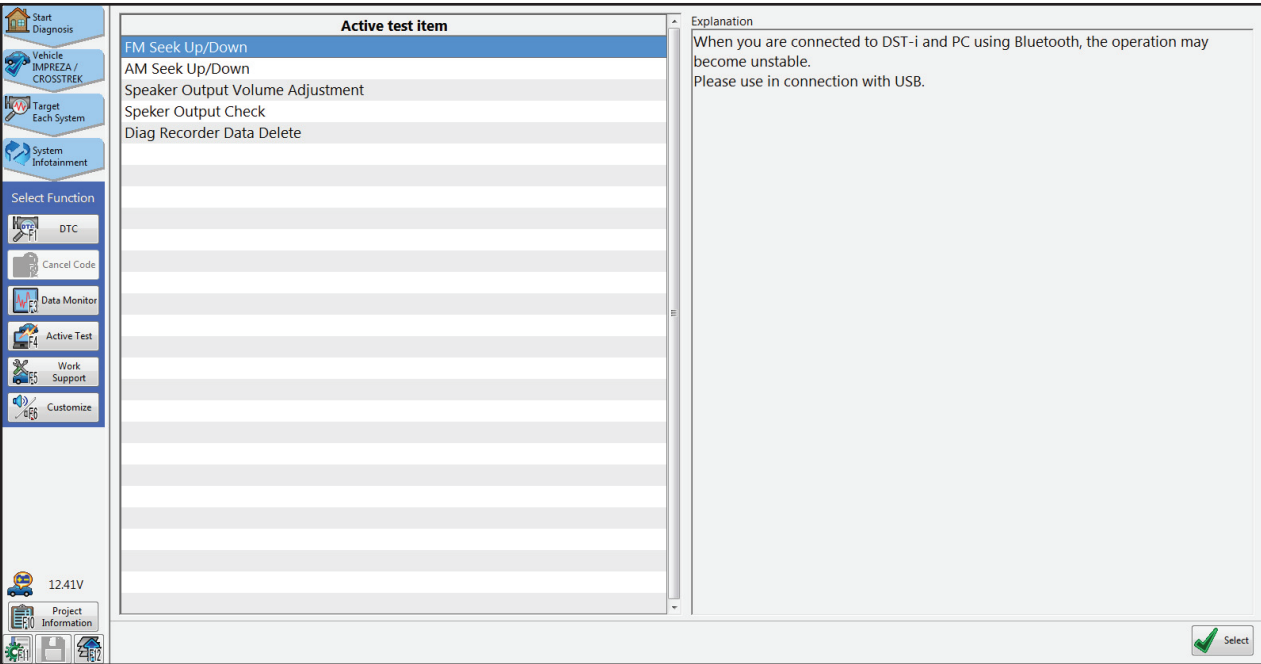


Figure 2-38 SSM – Active Test

The Work Support function provides information on the Multimedia Systems part number and software versions.



This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

Advanced Electrical Systems & Diagnosis

SUBARU STARLINK™ - Telematics (Generation 1)

Introduced with some 2014 MY vehicles, SUBARU STARLINK™ is an infotainment system that offers owners application integration through their multimedia systems and mobile devices.



Figure 2-40 Subaru STARLINK logo

The STARLINK system has been expanded for some 2016 MY vehicles to include a new “Connected Service” know as Telematics. Telematics offers owners safety, security, vehicle maintenance/diagnostics, and remote service features to enhance their ownership experience. Telematics features are accessible via in-car controls, the MySubaru.com website, the MySubaru mobile app, or dialing a toll-free number.



Figure 2-41 SUBARU STARLINK™



Figure 2-42 SOS and i-Call (i-button) Switches

Advanced Electrical Systems & Diagnosis

System Features

1. Safety

♦ **SOS Emergency Assistance**

In the event of an emergency, other than the Automatic Collision Notification, depressing the overhead mounted console “SOS” button will alert a SUBARU STARLINK™ Customer Care Advisor. The Advisor will ask about the nature of the emergency and dispatch the appropriate emergency assistance. If the driver is unable to answer, the advisor will let them know that emergency service has been notified and is on its way. The advisor will also remain on the line until help arrives.

♦ **Enhanced Roadside Assistance**

Depressing the overhead console mounted i-Call (i-button) (information) switch links to Subaru Enhanced Roadside Assistance provider. Enhanced Roadside Assistance uses the vehicle’s GPS antenna to locate the vehicle and can help with jump starts, emergency lockout service, gasoline (up to 2 gallons), flat tire change, and minor fluid replacement.

♦ **Automatic Collision Notification (ACN)**

When any of the airbags (SRS) in the vehicle are deployed, the ACN will alert a STARLINK Customer Care Advisor. An Advisor will respond promptly, 24/7/365 via SUBARU STARLINK™ to determine the nature of the emergency.



Figure 2-43 STARLINK Connection Screen

Advanced Electrical Systems & Diagnosis

2. Vehicle Maintenance and Diagnostics

◆ Maintenance Notifications

Maintenance Notification e-mails are sent to alert the owner of required maintenance. Maintenance Notifications and Health Reports are generated through the Subaru Care Connect system.

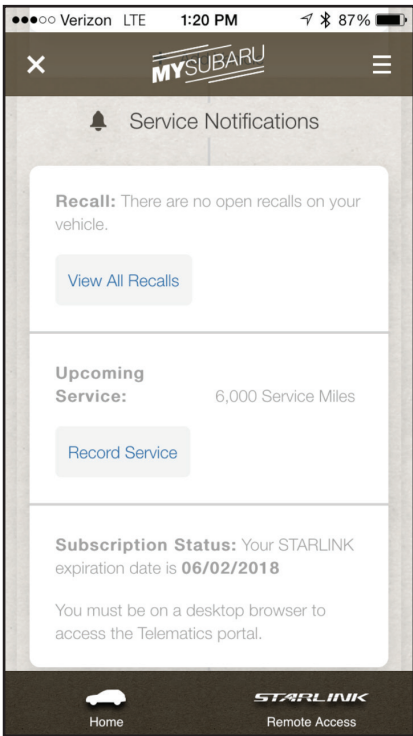


Figure 2-44 MySubaru App Service Notifications

◆ Vehicle Health Report

The owner will receive a monthly e-mail from SUBARU STARLINK™ reporting on vehicle conditions such as systems check, mileage attained, future maintenance, etc.

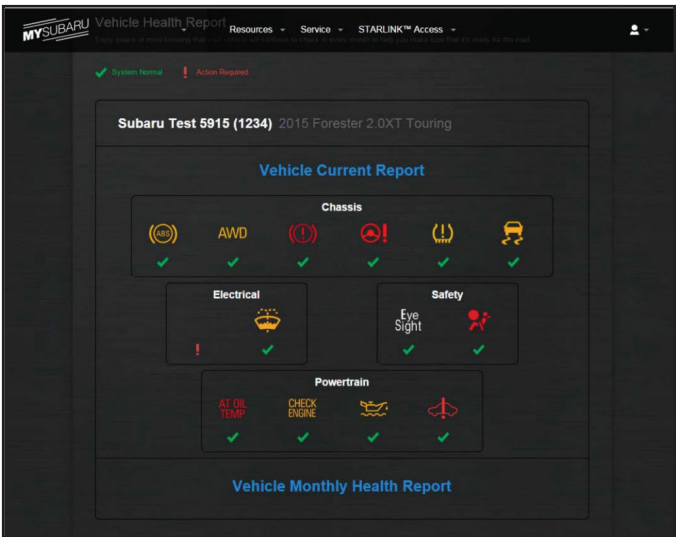


Figure 2-45 Vehicle Monthly Health Report

Advanced Electrical Systems & Diagnosis

◇ Diagnostic Alerts

SUBARU STARLINK™ monitors critical vehicle systems. If a warning light illuminates on the dashboard (Because of a DTC), the owner will receive an e-mail explaining the issue and how to resolve it. More serious issues will require the owner to visit the local Retailer. The 1st e-mail notification is sent to the owner within 24 hours of the first occurrence of a warning light(s) illumination. The second e-mail notification is sent if the issue has not been corrected based on the e-mail notification schedule below. The second e-mail is the final notification of a warning light until resolved.

NOTE:

Generic e-mails are sent when multiple warning lights are triggered at the same time.

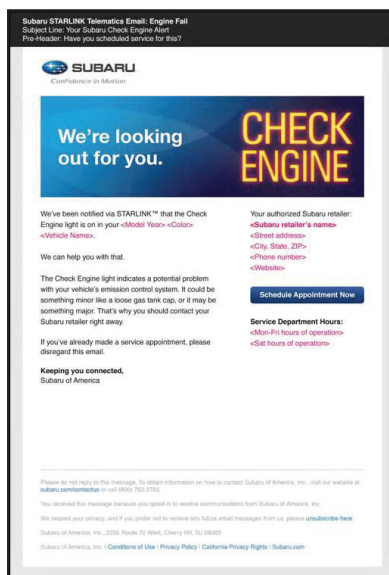


Figure 2-46 MySubaru Diagnostic Alert (e-mail)

Warning Lights	Warning Light Description	1st Email Notification	2nd Email Notification
	Check Engine	Day 1	Day 3
	ABS System	Day 1	Day 3
	VDC System	Day 1	Day 3
	Airbag System	Day 1	Day 3
	Electric Power Assisted Steering (EPAS)	Day 1	Day 3
	Automatic Transmission Oil Temperature	Day 1	Day 3
	Brake System	Day 1	Day 3
	Telematics System (SUBARU STARLINK Safety & Security)	Day 1	Day 3
	EyeSight System	Day 1	Day 3
	Hybrid System	Day 1	Day 3
	Engine Oil Level	Day 1	Day 3
	All-Wheel Drive	Day 1	Day 3
	Multiple Warning Lights	Day 1	Day 3
	Tire Pressure Monitoring System (TPMS)	Day 1	Day 7
	Washer Fluid	Day 1	Day 7

Figure 2-47 E-mail Notification Schedule

Advanced Electrical Systems & Diagnosis

3. Security

◆ **Stolen Vehicle Recovery**

A SUBARU STARLINK™ Customer Care Advisor will work with local law enforcement to attempt to recover a stolen vehicle. In order for this service to be activated, a police report must first be filed and the case number provided to the STARLINK Customer Care Advisor.

◆ **Vehicle Security Alarm Notification**

Notifies the owner when the security alarm is activated via preselected automated phone call, text messaging, and/or e-mail (user defined preference).

◆ **Convenience Features**

The Telematics system offers convenience features via the MySubaru.com website or MySubaru Mobile App. The Telematics system is an “embedded” system, which means that ACN, SOS, and i-Call (i-button) features function without the use of a smart phone. However, all remote convenience features require the use of a smart phone or other form of internet access.

NOTE:

A complete list of compatible smart phones can be found online at www.Subaru.com/STARLINK™.

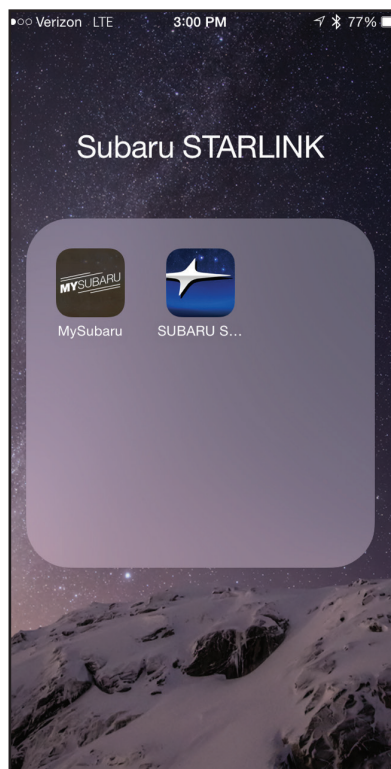


Figure 2-48
SUBARU STARLINK Apps



Figure 2-49
MySubaru App Intro

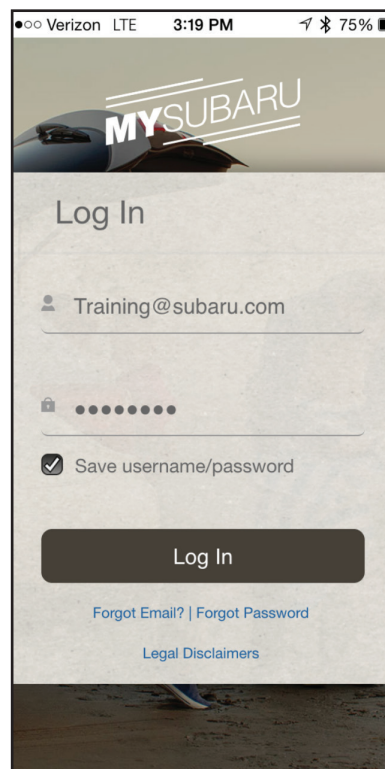


Figure 2-50
MySubaru App Log In

Advanced Electrical Systems & Diagnosis

Use of the convenience features requires the owner to enter their STARLINK Personal Identification Number (PIN). PIN information can be changed by accessing the “STARLINK Remote Access” tab on the MySubaru.com account page.

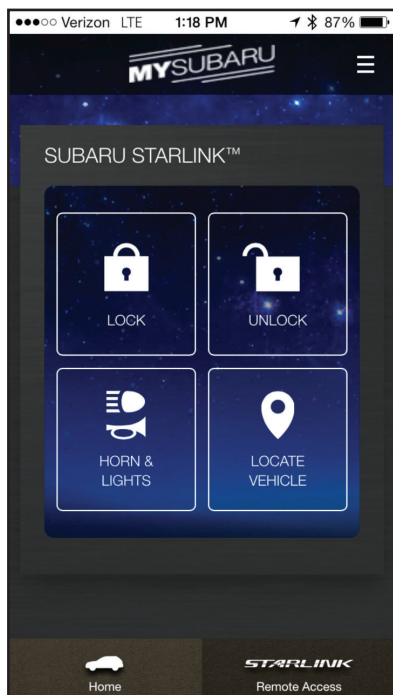


Figure 2-51 MySubaru App Features

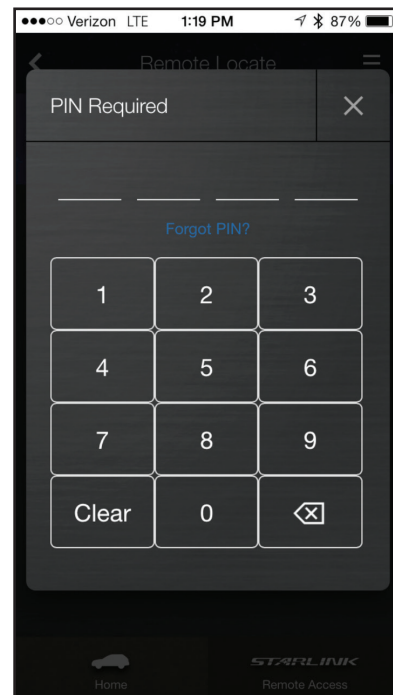


Figure 2-52 MySubaru App PIN

◇ Remote Door Lock/Unlock

Unlocks the driver's door only. If after 60 seconds no door is opened, a notification buzzer will sound and the doors will automatically re-lock.

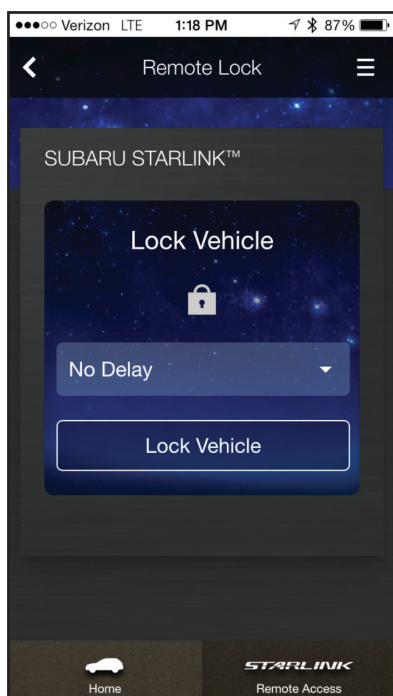


Figure 2-53 Lock Vehicle Features

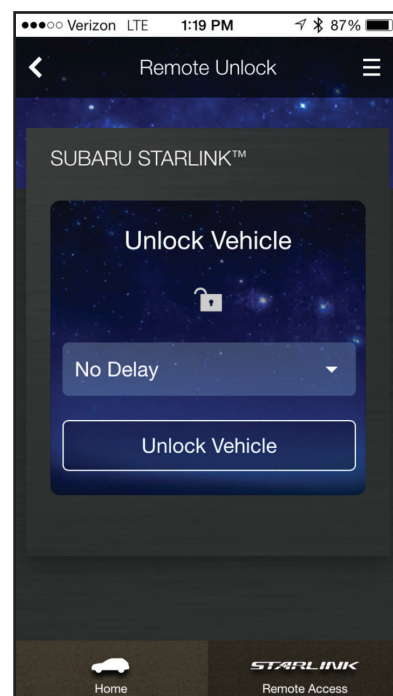


Figure 2-54 Unlock Vehicle Features

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◇ Remote Headlights or Horn & Lights

Flashes the exterior lights and activates the horn to assist in locating a misplaced vehicle.

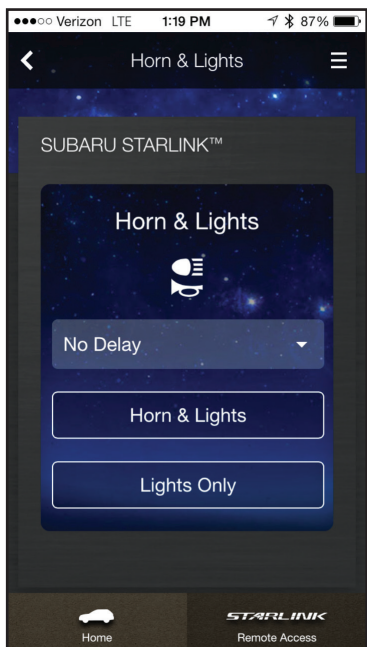


Figure 2-55 Horn & Lights Features

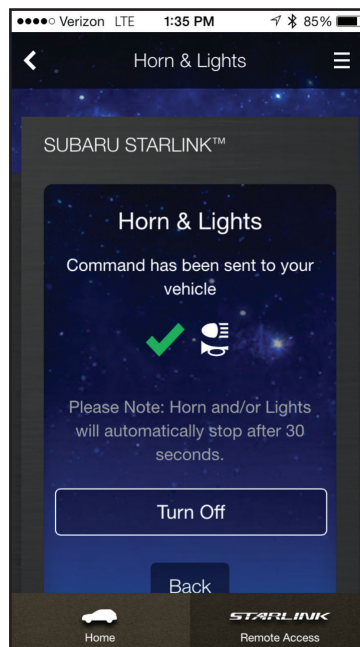


Figure 2-56 Horn & Lights Confirmation

Remote Door Lock/Unlock and Remote Headlight or Horn & Light features will not work under the following conditions:

- The key is in the ignition
- Ignition is ON
- Vehicle is Moving
- Any vehicle door/ tailgate or trunk is ajar
- After 14 days from the last time the vehicle was started
- Weak signal area (AT&T cellular network)

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Remote Vehicle Locator

Quickly and easily find the specific location of the vehicle using the GPS capabilities of the Telematics system.

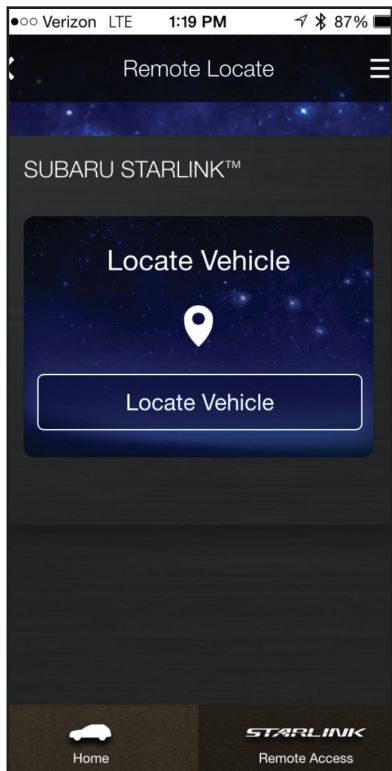


Figure 2-57
Locate Vehicle Features

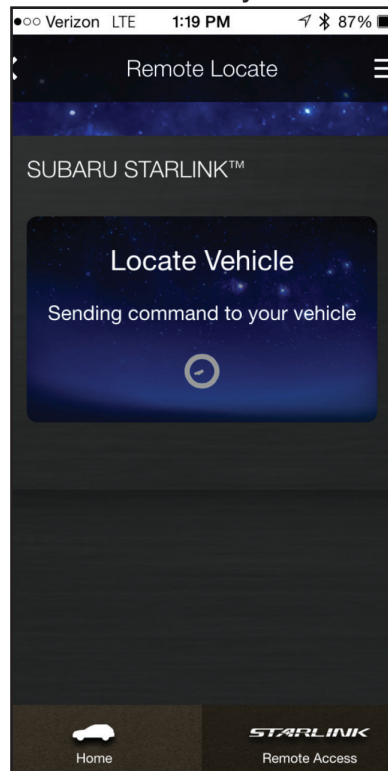


Figure 2-58
Locate Vehicle Command

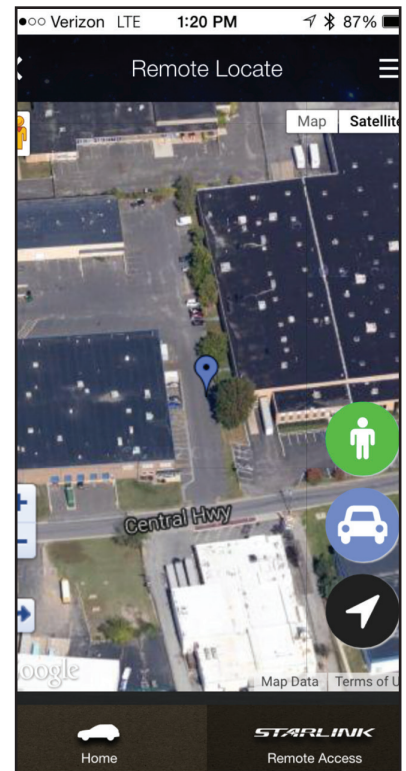


Figure 2-59
Vehicle GPS Location

The Remote Vehicle Locator feature will not work under the following conditions:

- GPS signal is not available
- After 14 days from the last time the vehicle was started
- Weak signal area (AT&T cellular network)

Use of the Telematics system features requires one of two paid subscription options. Pricing and option information is available through Subaru Retailers, the MySubaru app, or Subaru.com.

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System Features – Telematics (Generation 2)

Introduced in 2019, the Ascent, Crosstrek, Forester, and Impreza models, feature the second generation Telematics system. This system incorporates all of the features found on the Generation 1 systems and adds the following features:

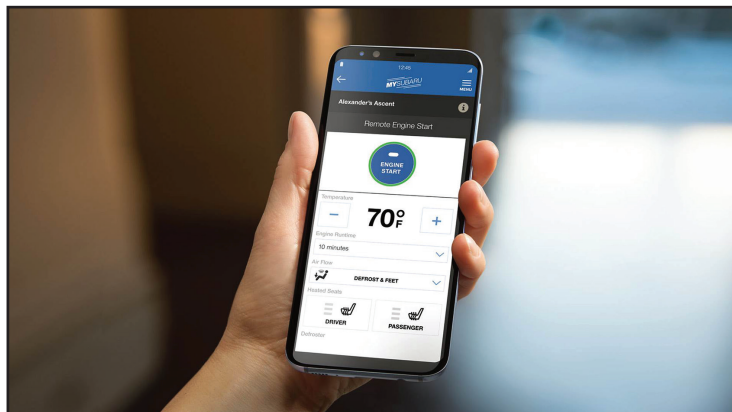


Figure 2-60 Remote Engine Start feature on Generation 2 Telematics systems

- **Safety**

- **Advanced Automatic Collision Notification**

- Provides detailed information about a collision including the number of impacts and severity of the impact. This information is used by call center and emergency services to send the appropriate level of response.

- **Maintenance**

- **Vehicle Condition Check**

- Get vehicle information on the My Subaru app like the odometer reading, driving range, tire pressures, and average MPG.

- **Service Appointment Scheduler**

- Sends notifications when the vehicle's next service is due, and assists with scheduling an appointment at your preferred retailer.

- **Security**

- **Stolen Vehicle Immobilizer**

- Enhances the stolen vehicle recovery service by preventing the vehicle from being started after being shut off.

- **Vehicle Alerts**

- o **Boundary Alert**

- Set a round or square boundary over a digital map using the My Subaru app. The owner will then receive a notification each time the vehicle leaves the boundary.

- o **Speed Alert**

- Set a maximum speed for the vehicle using the My Subaru app. The owner will then receive a notification each time the vehicle exceeds the speed limit.

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- o **Curfew Alert**

Set a time frame the vehicle may be operated using the My Subaru app. The owner will then receive a notification if the vehicle is operated outside of the time frame. The driver will also be notified they are operating the vehicle outside of the allowed time. This feature will not disable the vehicle
- Convenience
 - **Remote Services**
 - o **Remote Engine Start with Climate Control**

Use the My Subaru application to remotely start the vehicle and adjust climate control settings to the desired level including temperature, mode, blower speed, and defroster operation.
 - **STARLINK Concierge**

The Concierge service allows the user to get real-time assistance with restaurant and hotel reservations and purchasing tickets for sporting/theater events. The service operator can assist with locating points of interest and send the directions to the navigation system. Concierge also provides service appointment scheduling.

	STARLINK Safety Plus
	SOS Emergency Assistance
	Enhanced Roadside Assistance
	Advanced Automatic Collision Notification (AACN)
	Maintenance Notifications
	Vehicle Health Report
	Remote Vehicle Condition Check
	Service Appointment Scheduler
	STARLINK Security Plus
	Stolen Vehicle Recovery Plus
	Stolen Vehicle Immobilizer
	Vehicle Security Alarm Notifications
	Remote Lock & Unlock
	Remote Horn & Lights
	Remote Vehicle Locator
	Remote Engine Start with Climate Control
	Boundary Alert
	Speed Alert
	Curfew alert
	STARLINK Concierge
	Destination to Vehicle
See MySubaru for more details	

Figure 2-61 Generation 2.0 Telematics System Features

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System Construction

Telematics is the technology of sending, receiving, and processing information from a vehicle. The Telematics system contains two control buttons, a Data Communication Module (DCM), Main Antenna, Sub Antenna, and GPS Antenna. The DCM contains an embedded mobile device that sends and receives data using the nationwide AT&T 4G LTE cellular network (where available). This technology uses automatic roaming, optimizes connections, and prioritizes emergency requests. The Telematics system also works closely with the Audio-Navigation Unit to provide interaction with STARLINK Customer Care Advisors.

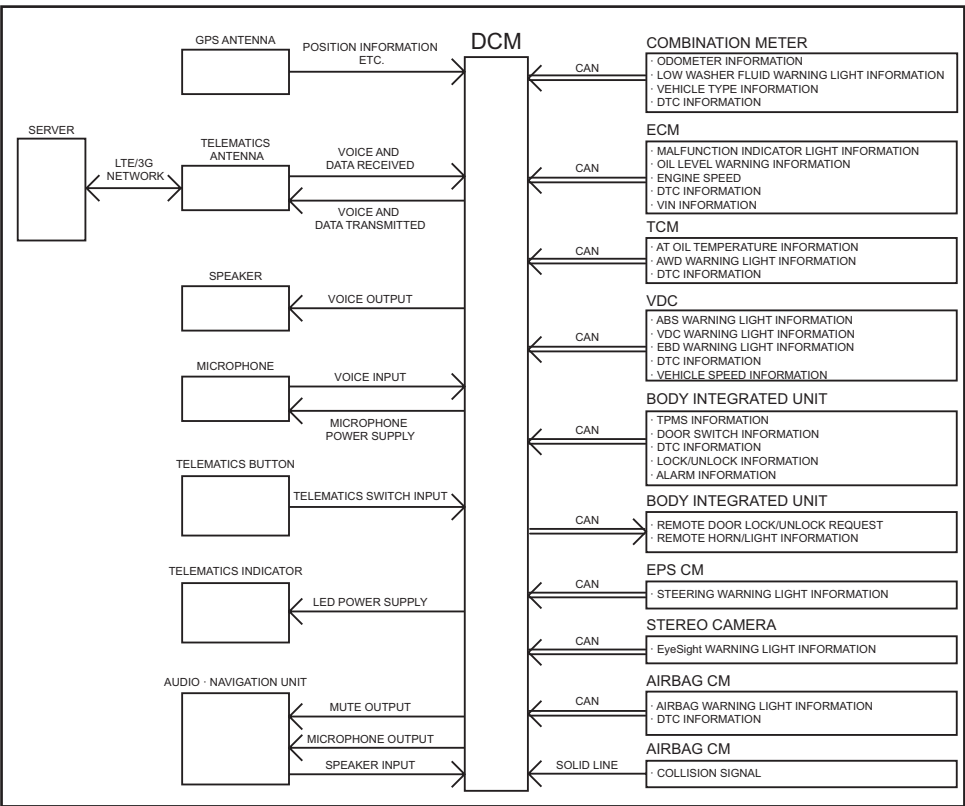


Figure 2-62 Telematics Communication Diagram

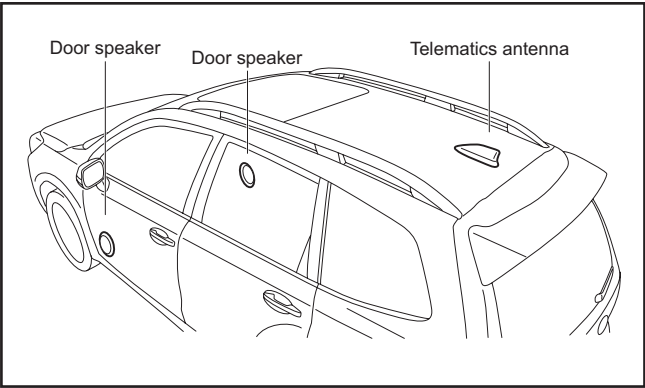


Figure 2-63 Telematics Component Locations

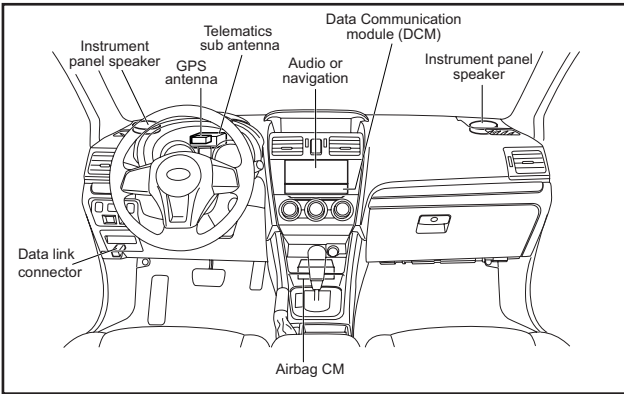


Figure 2-64 Telematics Component Locations

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The SOS and i-Call (i-button) (information) Switches are located on the overhead console area (Map light or Eyesight Camera cover). The SOS and i-Call (i-button) switches provide an input signal to the Data Communication Module (DCM). Depressing either button will initiate a request to the corresponding service. In the event a request is placed in error, the request can be canceled by depressing the same button for approximately 2 seconds.

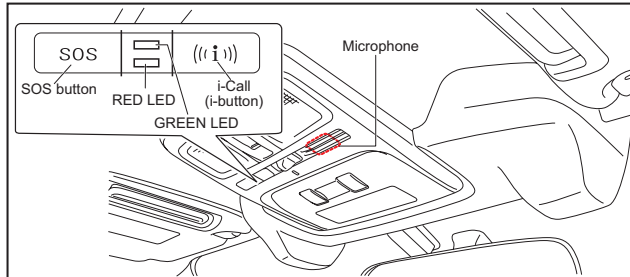


Figure 2-65 SOS and i-Call (i-button) Switches

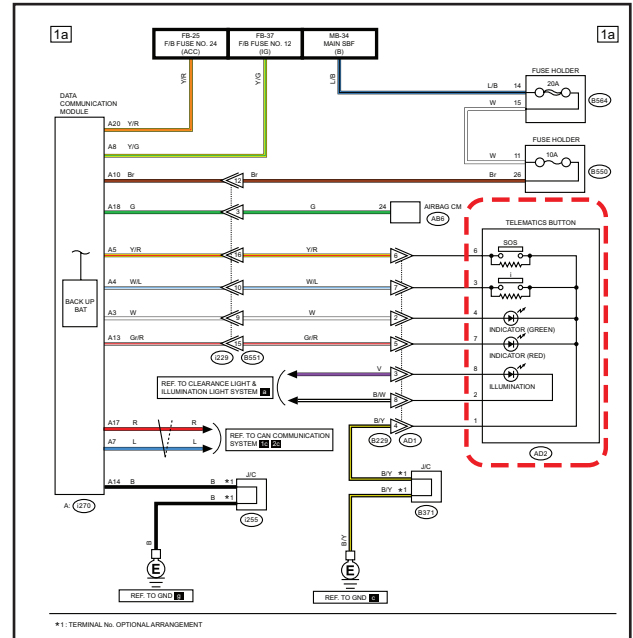


Figure 2-66 SOS and i-Call (i-button) Switches-Wiring Diagram

Data Communication Module (DCM)

The Data Communication Module (DCM) controls the communication and networking functions of the Telematics system. The DCM is connected to the vehicle's Main and Body CAN circuits to control the Telematics system features and identify diagnostic trouble codes (DTCs) for the Vehicle Maintenance and Diagnostic services.



Figure 2-67 Data Communication Module (DCM)

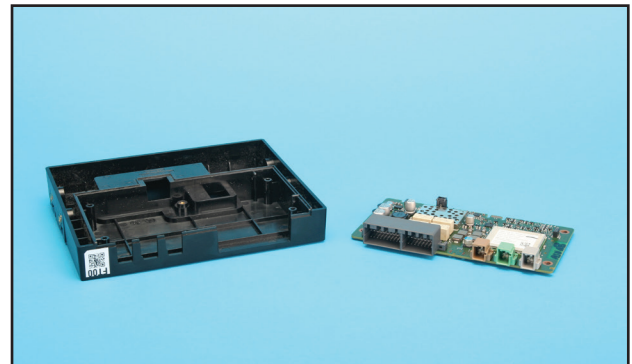


Figure 2-68 Data Communication Module (DCM)

The DCM is connected to the Main, Sub, and GPS antennas. The i271 connector houses all the audio input and output devices while the i270 connector houses the power supplies, ground, CAN, and SOS/i-Call (i-button) switch functions. Additionally, the DCM receives a "collision signal" from the Airbag Control Module through a dedicated circuit.

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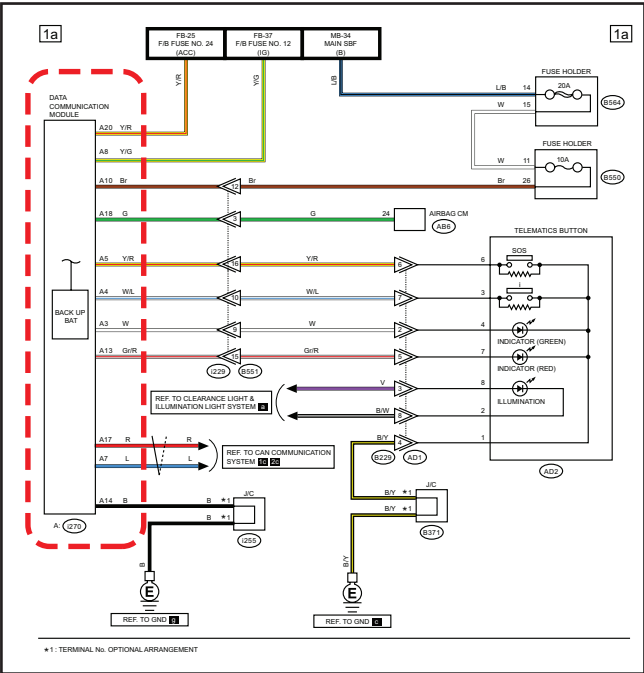


Figure 2-69 Data Communication Module (DCM)-Wiring Diagram

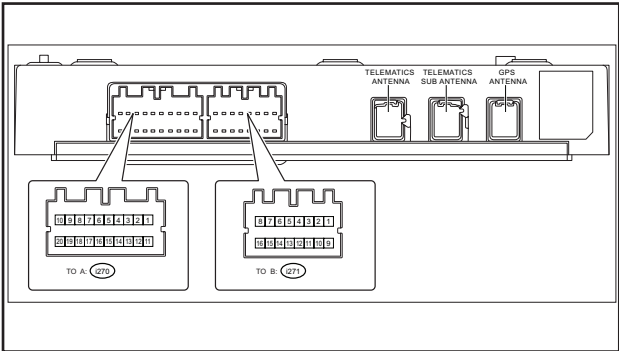


Figure 2-70 Data Communication Module (DCM)-I/O

The DCM houses a 3.2v Lithium-ion Back-up Battery (BUB) that provides the necessary voltage to create an ACN or SOS signal in the event conventional power supply is lost. The battery is serviceable separately from the DCM and has a 5 year service life (approximate). However, replacement should only be performed when BUB DTCs are stored.

NOTE: Battery terminal removal during regular service or dead a vehicle battery will not cause discharge issues with the BUB.



Figure 2-71
Back-up Battery (BUB) Cover



Figure 2-72
Back-up Battery (BUB)

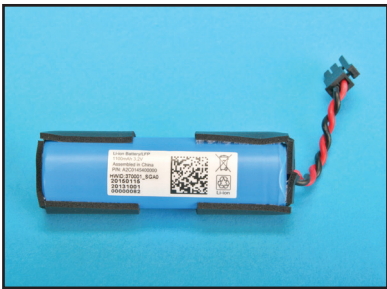


Figure 2-73
Back-up Battery (BUB)
removed

NOTE: If the DCM requires replacement the new part will not have a Back-up Battery installed it will have to be swapped from the old DCM to the new.

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The DCM uses the vehicle's audio system (speakers and microphone) for communication with STARLINK Customer Care Advisors. The system uses the front speakers and tweeters on both sides of the vehicle so that if one speaker/tweeter is damaged in a collision the other can still function. When an emergency call is in operation, the DCM sends a mute signal to the stereo unit.

NOTE: When diagnosing a microphone concern, wiring should be verified from the microphone to both the audio unit and DCM. If the microphone harness is open or shorted, this could cause the condition.

NOTE: DCM part numbers vary by the audio system equipped in the vehicle.

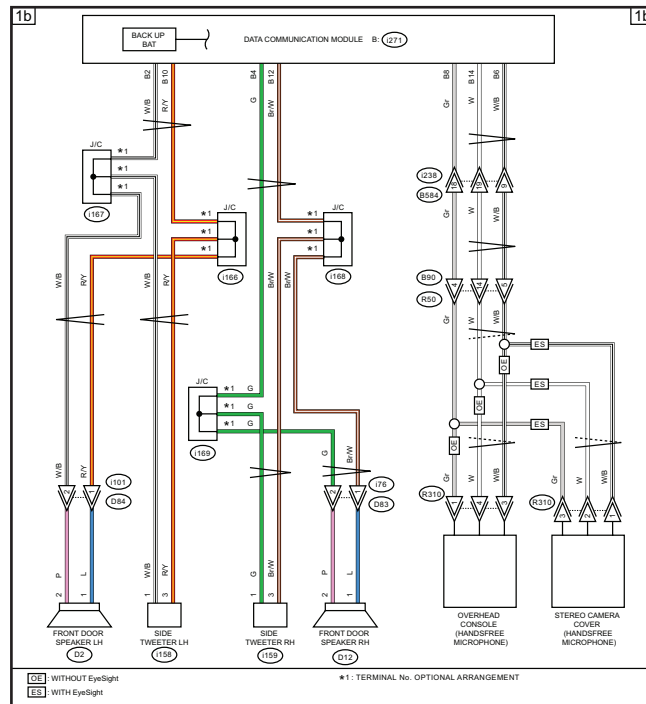


Figure 2-74 Audio Wiring-Without Amplifier

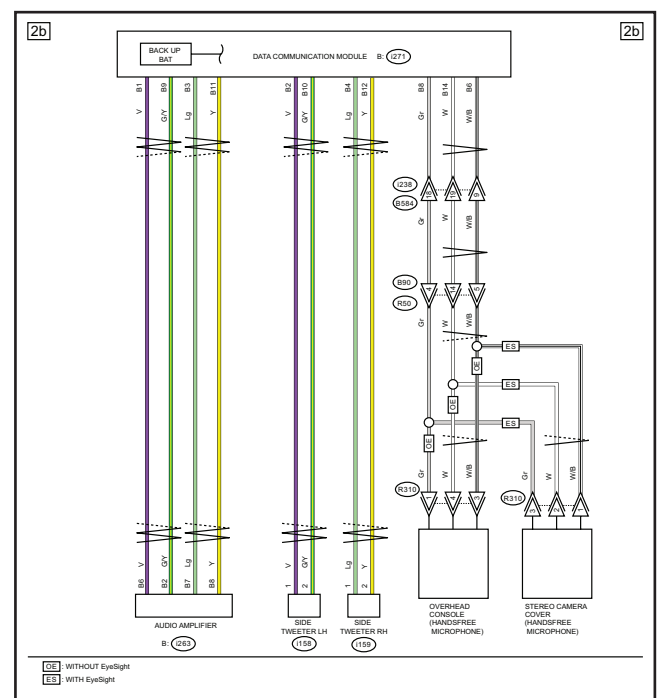


Figure 2-75 Audio Wiring-With Amplifier

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Antennas

The Telematics system requires multiple antennas to send and receive information from the mobile device embedded in the DCM via the AT&T 4GLTE network to the SiriusXM or Roadside Assistance call centers.

NOTE:

Telematics rely on the strength and reliability of cellular service. Weak cellular service or heavy cell use during peak hours may result in delays in Telematics performance.

The “Sharkfin” on the rear of the vehicle houses the Main Telematics Antenna.



Figure 2-76
Main Antenna (Sharkfin)

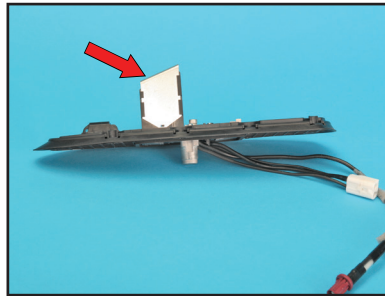


Figure 2-77
Main Antenna-Disassembled

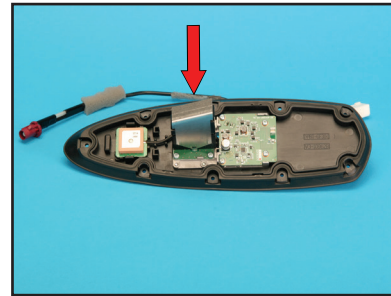


Figure 2-78
Main Antenna-Disassembled

The Sub Antenna is located in the vehicle behind the Combination Meter.

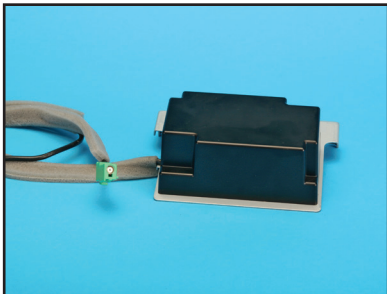


Figure 2-79
Sub Antenna-Removed (Top)



Figure 2-80
Sub Antenna-Removed (Bottom)



Figure 2-81
Sub Antenna Location

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Both antennas share the same construction and can function independently in the event one antenna fails. However, if only one antenna is functional then 4G services may be weaker or the system may utilize 3G service.

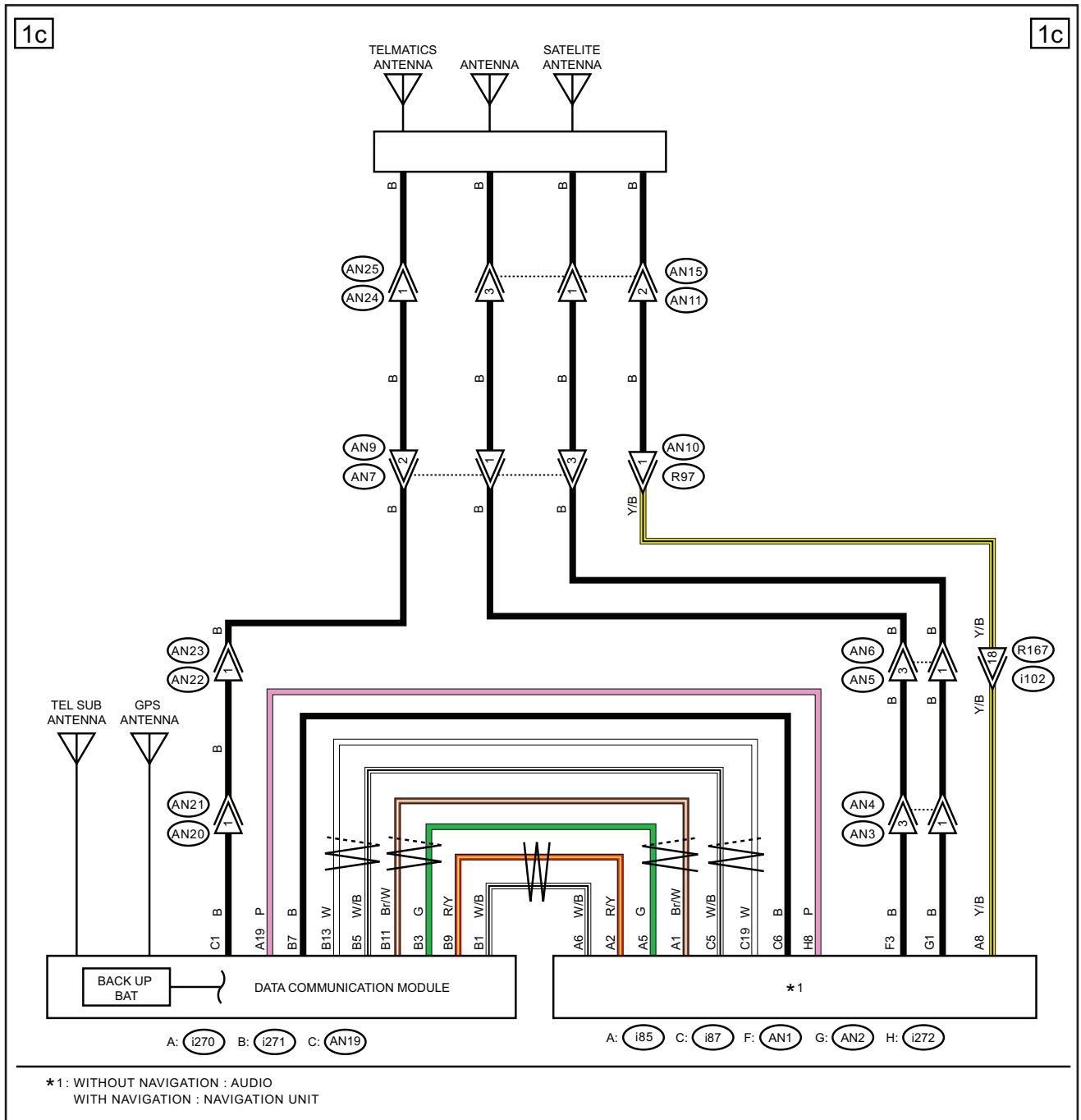


Figure 2-82 Telematics Antennas-Wiring Diagram

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The DCM utilizes the same antenna as the Navigation Unit for GPS signal. The connector for the antenna is split at the rear of the two units.

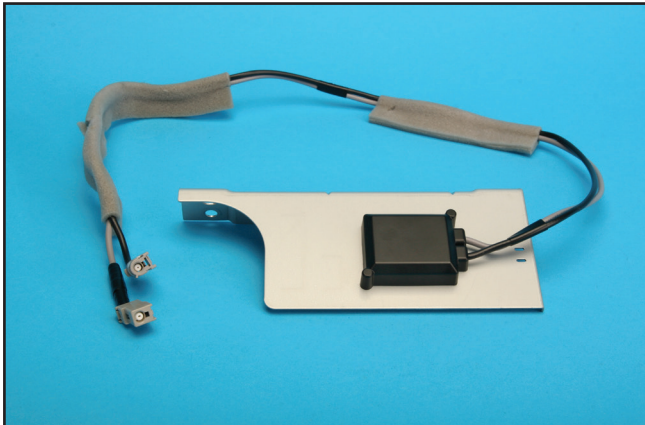


Figure 2-83 GPS Antenna

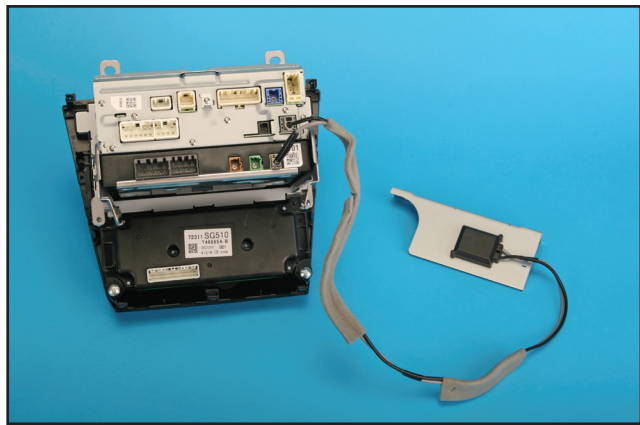


Figure 2-84 GPS Antenna Connection Points

Telematics Workflow

The workflow of the Telematics system varies based on the feature being utilized. In the example of an SOS Emergency call, the initial request originates from the overhead console mounted SOS SW. The ON signal is transmitted from the vehicle to the SXM (SiriusXM) call center via the AT&T network. The SXM call center identifies the nature of the emergency and contacts the appropriate emergency service (PSAP = Public Safety Answering Point).

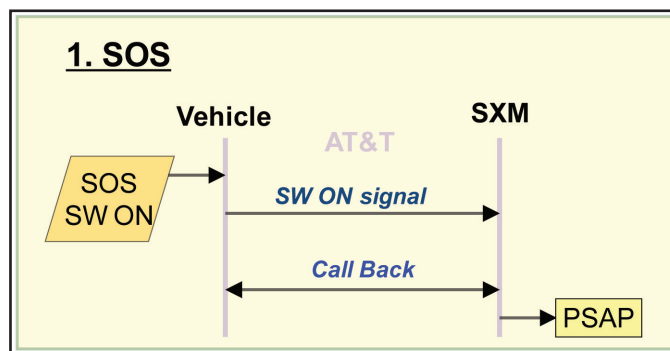


Figure 2-85 SOS Workflow

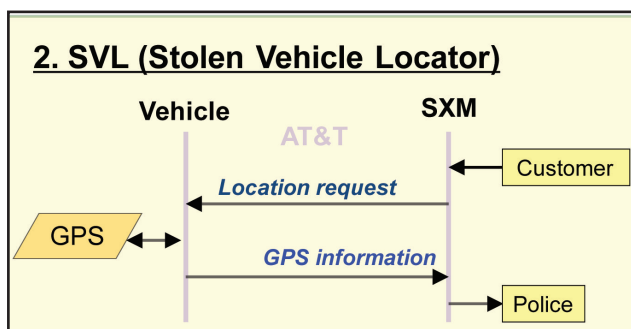


Figure 2-86 Stolen Vehicle Recovery Workflow

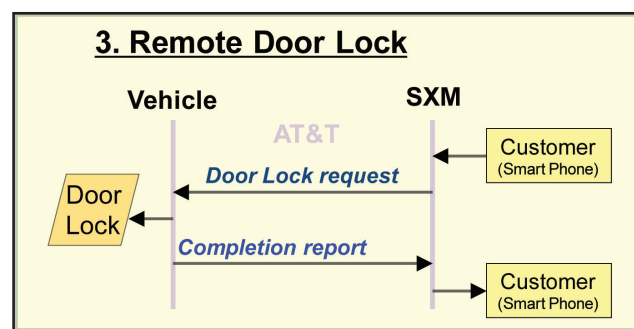


Figure 2-87 Remote Door Lock Workflow

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Diagnostic information pertaining to the Telematics system can be found under the “DIAGNOSTICS” heading in the Subaru Service Manual.

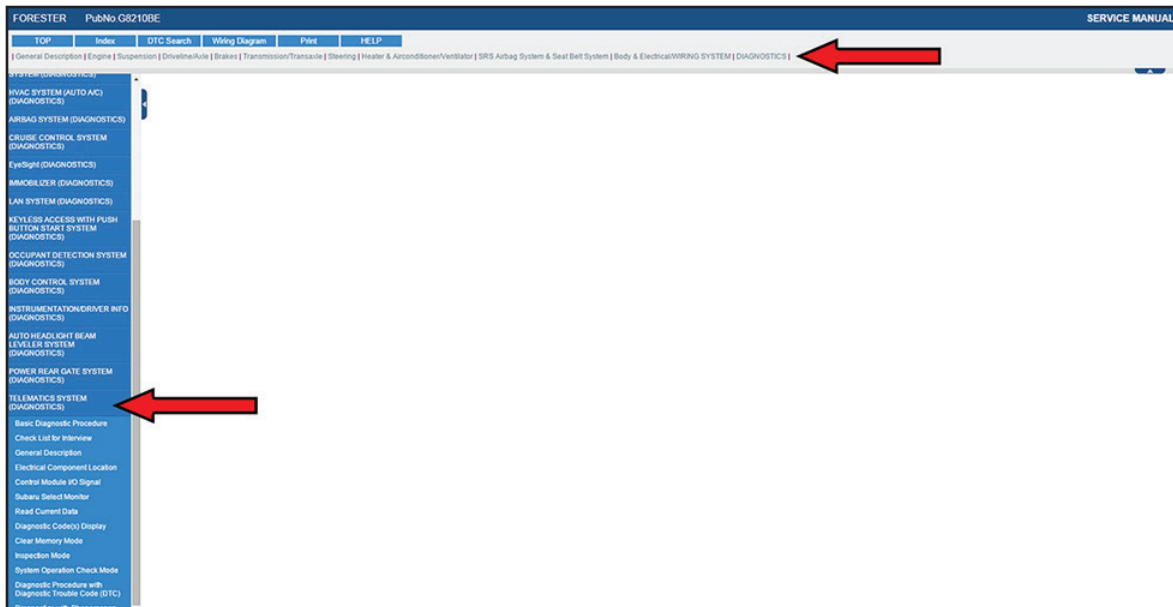


Figure 2-88 STIS-Diagnostics

Basic diagnosis of the Telematics system begins with completing the Customer Interview to verify critical information such as the conditions/situation during the event, mobile phone used, and Telematics subscription status. This information can be obtained through the combination of a vehicle inquiry and SSM Normal Sampling Data.

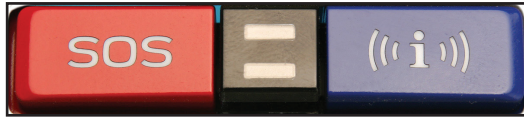
The screenshot shows the Subaru Service Manual interface for a Forester. The 'DIAGNOSTICS' menu is highlighted in blue on the left side, with a red arrow pointing to it. The main content area shows the 'TELEMATICS SYSTEM (DIAGNOSTICS) > Check List for Interview' form. The form includes sections for 'CHECK', '1. CHECK LIST FOR INTERVIEW', and '2. CHECK LIST FOR INTERVIEW'. The form contains various fields for customer information, vehicle details, and diagnostic results.

FORESTER PubNo GA210BE																																						
TOP	Index	DTC Search	Wiring Diagram																																			
General Description Engine Suspension Driveline/Axle Brakes Transmission/Transaxle Steering Heater & Airconditioner/Ventilator SRS Airbag System & Seat Belt System Body & Electrical WIRING SYSTEM DIAGNOSTICS																																						
DIAGNOSTICS ENGINE (DIAGNOSTICS) (H400) ENGINE (DIAGNOSTICS) (H400T) CONTINUOUSLY VARIABLE TRANSMISSION (DIAGNOSTICS) POWER STEERING CONTROL (PSC) (DIAGNOSTICS) VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS) POWER ASSISTED STEERING (DIAGNOSTICS) TIME PRESSURE MONITORING SYSTEM (DIAGNOSTICS) PASC SYSTEM (AUTO A/C) (DIAGNOSTICS) AIRBAG SYSTEM (DIAGNOSTICS) CRUISE CONTROL SYSTEM (DIAGNOSTICS) Daylight (DIAGNOSTICS) WHEELS (DIAGNOSTICS) LAN SYSTEM (DIAGNOSTICS) KEYLESS ACCESS WITH PUSH BUTTON START SYSTEM (DIAGNOSTICS) OCCUPANT DETECTION SYSTEM (DIAGNOSTICS) ROOF RACK SYSTEM (DIAGNOSTICS) INSTRUMENTATION/DRIVER INFO (DIAGNOSTICS) AUTO HEADLIGHT BEAM LEVELER SYSTEM (DIAGNOSTICS) POWER REAR GATE SYSTEM (DIAGNOSTICS) TELEMATICS SYSTEM (DIAGNOSTICS) Basic Diagnostic Procedure Check List for Interview General Description Electrical Component Location Control Module I/O Signal Subaru Select Monitor Read Current Data Diagnostic Code(s) Display Clear Memory Mode Inspection Mode System Operation Check Mode Diagnostic Procedure with Diagnostic Trouble Code (DTC) Diagnosis with Phenomenon																																						
TELEMATICS SYSTEM (DIAGNOSTICS) > Check List for Interview CHECK 1. CHECK LIST FOR INTERVIEW Inspect the following items regarding the vehicle's state. Print <table border="1"> <thead> <tr> <th colspan="2">Telematics Check List for Interview</th> <th colspan="2">Received Year Month Date</th> </tr> </thead> <tbody> <tr> <td>Customer's name</td> <td>Registration No.</td> <td>Initial year of registration</td> <td>Year Month Date</td> </tr> <tr> <td>Inspector</td> <td>Vehicle model</td> <td>Frame number</td> <td></td> </tr> <tr> <td></td> <td>Engine type</td> <td>Odometer reading</td> <td></td> </tr> <tr> <td colspan="4">Customer specified content</td> </tr> </tbody> </table> Date when problem occurred <table border="1"> <thead> <tr> <th>Year Month Date</th> <th>Frequency of trouble occurrence</th> <th>Always occurs</th> </tr> </thead> <tbody> <tr> <td>Weather</td> <td>Frequency of trouble occurrence</td> <td>Sometimes occurs (times per day, times per month)</td> </tr> <tr> <td>Temperature</td> <td>Frequency of trouble occurrence</td> <td></td> </tr> <tr> <td>How often</td> <td>Frequency of trouble occurrence</td> <td></td> </tr> <tr> <td>When and how</td> <td>Frequency of trouble occurrence</td> <td></td> </tr> </tbody> </table> Situations at event In what situations did it occur? Fast Driving Rough Roads Parked Unknown Other In what operations did it occur? JACC On JPress J-button or SOS button Operating door lock function with mobile phone Operating door unlock function with mobile phone Operating horn and hazard function with mobile phone Operating own vehicle positioning function Unknown Other Situations at restoration What helped the status return to normal? Recover on its own JACC Off and On JDoes not recover JOther Location at event Unknown JCity Place JDriving around open areas like in the country JDriving around cities with large buildings JDriving around residential areas or no large buildings JDriving around rough roads or railway tracks Error message Error message displayed Mobile phone carrier (Example: DoCommo) Mobile phone model (Example: Apple iPhone4) Mobile phone OS version (Software version information) Subscription (Year Month Date) JNon-Contract LED illumination status RED LED JOff JOn Jblink GREEN LED JOff JOn Jblink Check result Reproducibility JAlways JSometimes JCannot be reproduced Condition JCold alarm JAt starting JImmediately after starting JDuring warm-up At the JWhen start driving JWhile driving JAt deceleration JAt deceleration JWhen applying brake MISSION No. of SSM Confirm on data monitor. Ref. to TELEMATICS SYSTEM (DIAGNOSTICS) > Read Current Data. Diagnostic Trouble Code				Telematics Check List for Interview		Received Year Month Date		Customer's name	Registration No.	Initial year of registration	Year Month Date	Inspector	Vehicle model	Frame number			Engine type	Odometer reading		Customer specified content				Year Month Date	Frequency of trouble occurrence	Always occurs	Weather	Frequency of trouble occurrence	Sometimes occurs (times per day, times per month)	Temperature	Frequency of trouble occurrence		How often	Frequency of trouble occurrence		When and how	Frequency of trouble occurrence	
Telematics Check List for Interview		Received Year Month Date																																				
Customer's name	Registration No.	Initial year of registration	Year Month Date																																			
Inspector	Vehicle model	Frame number																																				
	Engine type	Odometer reading																																				
Customer specified content																																						
Year Month Date	Frequency of trouble occurrence	Always occurs																																				
Weather	Frequency of trouble occurrence	Sometimes occurs (times per day, times per month)																																				
Temperature	Frequency of trouble occurrence																																					
How often	Frequency of trouble occurrence																																					
When and how	Frequency of trouble occurrence																																					

Figure 2-89 Customer Interview

Advanced Electrical Systems & Diagnosis

The SOS and i-Call (i-button) switches also feature red and green LED indicators. These provide information on the current state of the Telematics system.



-  Ignition ON: both LEDs off — the system is ready to subscribe
-  Ignition ON: green LED on — the vehicle has an active subscription
-  Ignition ON: both the red and green LEDs are on — the vehicle's Telematics device is having a communication issue
-  Ignition ON: red LED on — the system has a hardware issue
-  Ignition ON: green LED blinking — the system is not registered push and hold the i-Call (i-button) for 2 seconds to register

Figure 2-90 Telematics LED Illumination Status

Diagnosis with Phenomenon requires the use of the SSM to monitor Normal Sampling Data (Data Monitor) within the Telematics system.

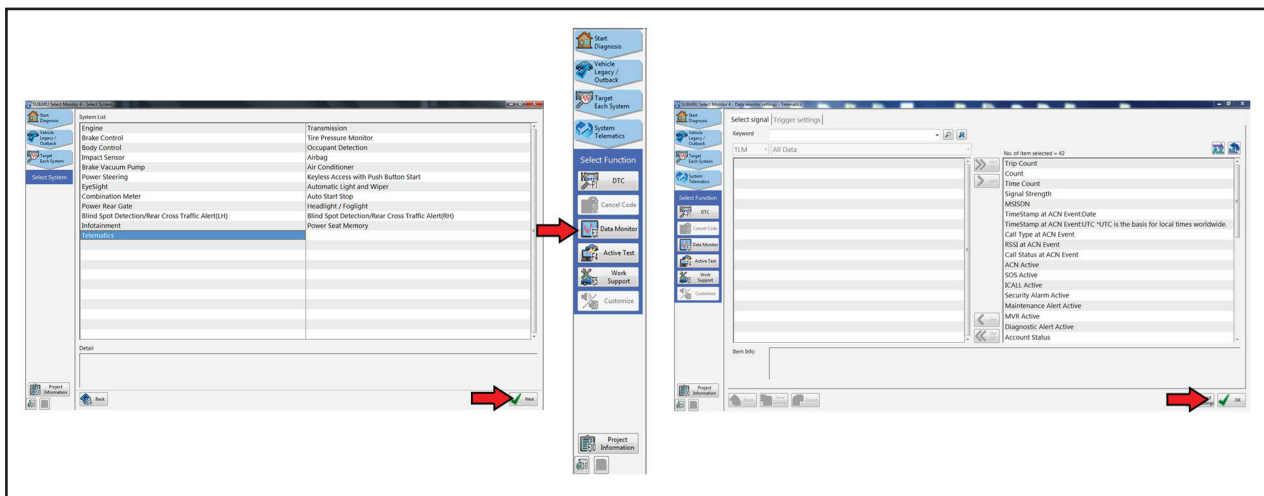


Figure 2-91 Subaru Select Monitor (SSM) Menus

Advanced Electrical Systems & Diagnosis

The SSM Normal Sampling Data (Data Monitor) includes basic diagnostic information from the DCM and its supporting peripherals. Details about each of the PIDs can be found under the “Read Current Data” heading of the Telematics System Diagnostics section of the Service Manual.

Item	Value	Unit	Maximum	Minimum	Average
Trip Count	230	Time	230	230	230
Count	Common		-	-	-
Time Count	426800	ms	688400	426800	557595
Battery Voltage	11.96	V	12.33	11.96	12.16
Power Source Status	DCM Currently Running On VBATT		-	-	-
Stored VIN	JF2SJGXC7GH400018		-	-	-
MSISDN	0x313536363939383133353700000000		-	-	-
Subscription Status	Subscribed		-	-	-
Signal Strength	56	%	56	56	56
ACN Active	TRUE		-	-	-
SOS Active	TRUE		-	-	-
ICALL Active	TRUE		-	-	-
Security Alarm Active	TRUE		-	-	-
Maintenance Alert Active	TRUE		-	-	-
MVR Active	TRUE		-	-	-
Diagnostic Alert Active	TRUE		-	-	-
Account Status	TRUE		-	-	-
GREEN LED Voltage	5.87	V	6.05	5.87	5.97
RED LED Voltage	0.02	V	0.03	0.02	0.02
Speaker Gain Level	Premium Radio/4 Speakers		-	-	-
Left Speaker Status	No Speaker Diagnostic Fault(Default)		-	-	-
Right Speaker Status	No Speaker Diagnostic Fault(Default)		-	-	-

Figure 2-92 SSM Basic Diagnostic Data

FORESTER PubNo.G8210BE			
TOP	Index	DTC Search	Wiring Diagram
Print	HELP		
General Description Engine Suspension Driveline/Axle Brakes Transmission/Transaxle Steering Heater & Airconditioner/Ventilator SRS Air			
DIAGNOSTICS			
URBAG SYSTEM (DIAGNOSTICS)	ACN Active	Subscription information on ACN function	Call Connected
CRUISE CONTROL SYSTEM (DIAGNOSTICS)	SOS Active	Subscription information on SOS function	TRUE
EyeSight (DIAGNOSTICS)	ICALL Active	Subscription information on I-CALL function	TRUE
IMMOBILIZER (DIAGNOSTICS)	Security Alarm Active	Subscription information on Security Alarm function	TRUE
AN SYSTEM (DIAGNOSTICS)	Maintenance Alert Active	Subscription information on Maintenance Alert function	TRUE
KEYLESS ACCESS WITH PUSH BUTTON START SYSTEM (DIAGNOSTICS)	MVR Active	Subscription information on MVR function	TRUE
OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)	Diagnostic Alert Active	Subscription information on Diagnostic Alert function	TRUE
BODY CONTROL SYSTEM (DIAGNOSTICS)	Account Status	Basic subscription information	TRUE
INSTRUMENTATION/DRIVER INFO (DIAGNOSTICS)	Power Source Status	Operation power supply information (main battery or DCM built-in BUB)	DCM Currently Running On BUB DCM Currently Running On VBATT
OUTSIDE HEADLIGHT BEAM LEVELER SYSTEM (DIAGNOSTICS)	Subscription Status	DCM mode information	Factory Mode Comm Check Unsubscribed Subscribed
POWER REAR GATE SYSTEM (DIAGNOSTICS)	Battery Voltage	Voltage information on main battery	V
TELEMATICS SYSTEM (DIAGNOSTICS)	Stored VIN	VIN information stored in DCM	
Basic Diagnostic Procedure	GPS Data at Time of Button Push(1)	GPS information at SOS/I-CALL event occurrence (latest record)	
Check List for Interview	Timestamp at Time of Button Push(1)	Time stamp information at SOS/I-CALL event occurrence (latest record)	Note: The time stamp is displayed in the Coordinated Universal Time (UTC), which is different
General Description			
Electrical Component Location			
Control Module I/O Signal			
Subaru Select Monitor			
Read Current Data			
OPERATION			
LIST			
Diagnostic Code(s) Display			
Clear Memory Mode			
Inspection Mode			
System Operation Check Mode			
Diagnostic Procedure with Diagnostic Trouble Code (DTC)			
Diagnostics with Phenomenon			

Figure 2-93 STIS-Read Current Data

During numerous diagnostic procedures, the Subaru Service Manual may require verification of any or all of the Subscription Statuses.

1. CHECK THE SUBSCRIPTION STATUS.

Display the current data [ICALL Active] of the Telematics.  [Ref. to TELEMATICS SYSTEM \(DIAGNOSTICS\)>Read Current Data.](#)

Is the data [TRUE]?

Yes

 [Go to 2.](#)

No

The user does not have a service subscription; therefore, it is not a failure.

Figure 2-94 STIS Diagnostic-Subscription Status

Advanced Electrical Systems & Diagnosis

Information about the Subscription status can be found on the SSM Normal Sampling Data (Data Monitor)

Item	Value	Unit	Maximum	Minimum	Average
☐ Trip Count	230	Time	230	230	230
☐ Count	Common		-	-	-
☐ Time Count	426800	ms	688400	426800	557595
☐ Battery Voltage	11.96	V	12.33	11.96	12.16
☐ Power Source Status	DCM Currently Running On VBATT		-	-	-
☐ Stored VIN	JF2SJGXC7GH400018		-	-	-
☐ MSISDN	0x313536363939383133353700000000		-	-	-
☐ Subscription Status	Subscribed		-	-	-
☐ Signal Strength	56	%	56	56	56
☐ ACN Active	TRUE		-	-	-
☐ SOS Active	TRUE		-	-	-
☐ ICALL Active	TRUE		-	-	-
☐ Security Alarm Active	TRUE		-	-	-
☐ Maintenance Alert Active	TRUE		-	-	-
☐ MVR Active	TRUE		-	-	-
☐ Diagnostic Alert Active	TRUE		-	-	-
☐ Account Status	TRUE		-	-	-
☐ GREEN LED Voltage	5.87	V	6.05	5.87	5.97
☐ RED LED Voltage	0.02	V	0.03	0.02	0.02
☐ Speaker Gain Level	Premium Radio/4 Speakers		-	-	-
☐ Left Speaker Status	No Speaker Diagnostic Fault(Default)		-	-	-
☐ Right Speaker Status	No Speaker Diagnostic Fault(Default)		-	-	-

Figure 2-95 Subaru Select Monitor (SSM) Menus

This information can be cross-referenced/verified within a vehicle inquiry found on Subarunet.

Subaru Vehicle

Vehicle Inquiry

Open in New Window

Enter Another Inquiry

26-May-2015 10:56:51

Page: 1

DEALER VEHICLE INQUIRY

FOR DEALER: cweh

Vin

JF2-SJAGC1 GH400013

Description

(GFF C DGM) 2016 Forester 2.5i Premium

Option Description

All-Weather Package + Eyesight + Navigation System

Model Code

Option Code

Ext/Int

Spec

Engine #

Ign Key

Trans #

GFF

15

DGM/GRA

C

645923

32948

976832

Dir Demo

Soa Demo

Service Contract

Case

Ship

Port

07-May-2015

3922

184

003

Production Date

ETA Date

Warranty Start

Retail Date

Retail Delivery

26-Mar-2015

07-May-2015

SUBARU STARLINK - Telematics

Start Date

End Date

Package Type

01-Jul-2015

30-Jun-2016

Safety Plus

Salesman: ###-##-

Sales Order Type: Corporate

Sale Type:

Sold Order: N

ALLOCATED:

INVENTORIED TO:

Subaru of America Inc.

550986

SOA PA_IB INTERNAL (DO

100

2235 ROUTE 70 WEST

2035 ROUTE 70 EAST

SUBARU HEADQUARTERS

CHERRY HILL NJ 08002

Figure 2-96 Vehicle Inquiry-Subscription Status

Advanced Electrical Systems & Diagnosis

SSM Normal Sampling Data (Data Monitor) also contains “History” data for the most recent ACN and SOS/i-Call (i-button) events. This data provides critical diagnostic information about the conditions of recent Telematics performance.

NOTE:

Timestamped information is displayed in UTC (Coordinated Universal Time) format and must be converted to the local time zone and date.

Item	Value	Unit
Timestamp at ACN Event:Date		
Timestamp at ACN Event:UTC *UTC is the basis for local times worldwide.	12:00:00 AM	
Call Type at ACN Event	No Attempt	
RSSI at ACN Event	0	%
Call Status at ACN Event	Call Not Started	
Timestamp at Time of Button Push(1):Date	6/22/2015	
Timestamp at Time of Button Push(1):UTC *UTC is the basis for local times worldwide.	6:08:51 PM	
Call Type at SOS/ICALL Event(1)	I-Call	
RSSI at SOS/ICALL(1)	54	%
Call status at SOS/ICALL Event(1)	Call Ended by Driver	
Timestamp at Time of Button Push(2):Date	6/22/2015	
Timestamp at Time of Button Push(2):UTC *UTC is the basis for local times worldwide.	6:11:15 PM	
Call Type at SOS/ICALL Event(2)	I-Call	
RSSI at SOS/ICALL(2)	57	%
Call status at SOS/ICALL Event(3)	Call Ended by Driver	
Timestamp at Time of Button Push(3):Date	6/19/2015	
Timestamp at Time of Button Push(3):UTC *UTC is the basis for local times worldwide.	8:08:19 PM	
Call Type at SOS/ICALL Event(3)	I-Call	
RSSI at SOS/ICALL(3)	56	%
Call status at SOS/ICALL Event(3)	Call Ended by Driver	

Figure 2-97 SSM-History Data

Particular attention should be paid to the RSSI (Received Signal Strength Indicator) data as part of Service Manual diagnostics. In order for the Telematics system to properly communicate via the AT&T 4G LTE network, the RSSI must be at least 26%. A higher percentage indicates a stronger network signal.

3. CHECK THE RECEIVED SIGNAL STRENGTH WHEN i-button WAS PRESSED. (CHECK THE CURRENT DATA.).

Display the current data [RSSI at SOS/ICALL(1)] of the Telematics. [Ref. to TELEMATICS SYSTEM \(DIAGNOSTICS\)>Read Current Data .](#)

Is the data 26% or more?

Yes

[Go to 5.](#)

No

[Go to 4.](#)

Figure 2-98 Subaru Service Manual Diagnostics-Signal Strength

Advanced Electrical Systems & Diagnosis

To support diagnostics of a customer concern of poor system performance due to poor RSSI, a “STARLINK – AT&T Coverage Map” is available under the “Service > STARLINK-Service” heading on Subarunet.

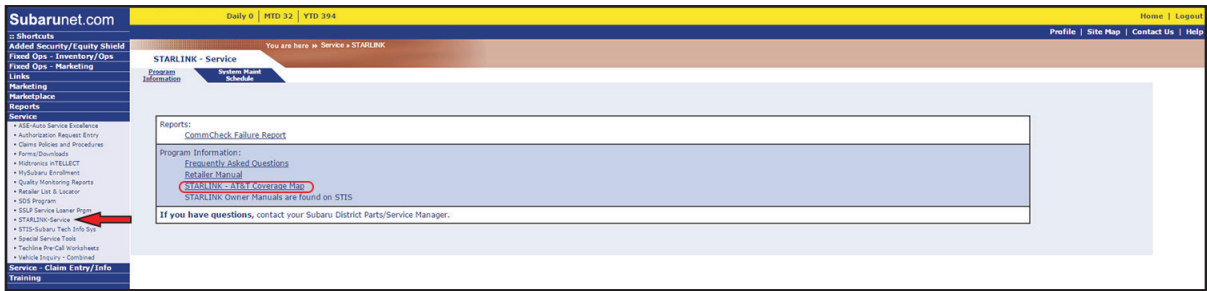


Figure 2-99 Subarunet-STARLINK Service

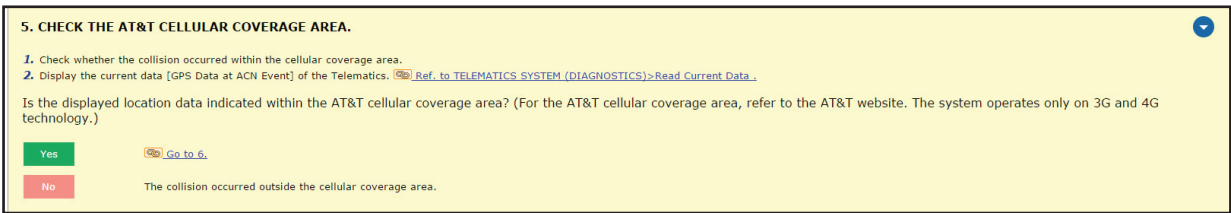


Figure 2-100 STIS Diagnostics-AT&T Coverage

The AT&T coverage maps provide color coded areas of 4G LTE data and voice coverage. Data is the optimal coverage for normal Telematics functions whereas voice is the typically the minimum coverage necessary in order for the ACN and SOS features to operate.

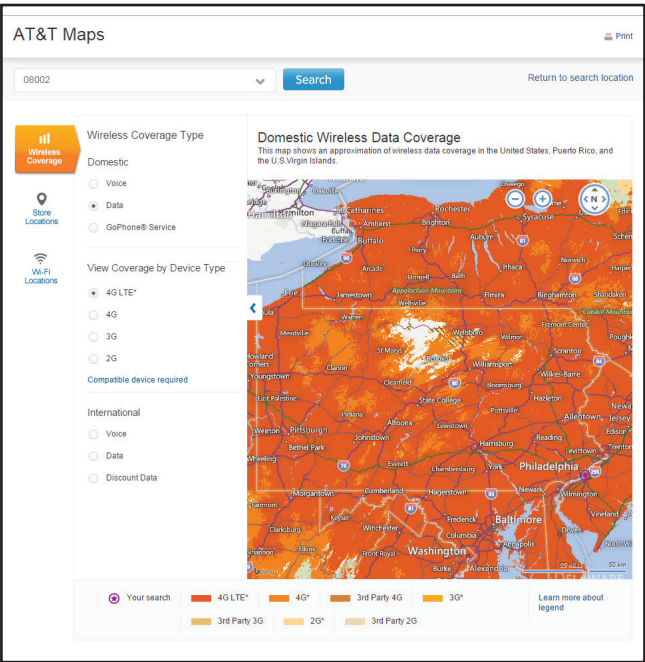


Figure 2-101 AT&T Coverage-4G LTE Data

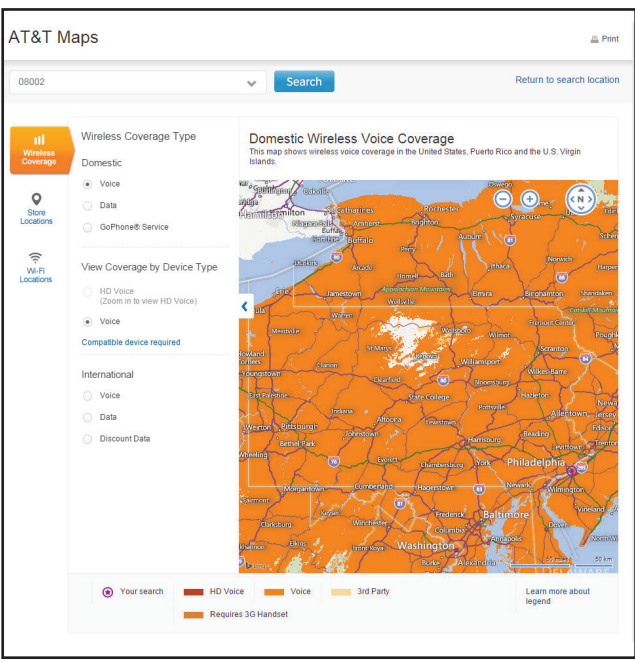


Figure 2-102 AT&T Coverage-4G LTE Voice

Advanced Electrical Systems & Diagnosis

The Active Test function of the SSM allows the user to test the output of the overhead button LEDs and the Speaker(s) outputs.

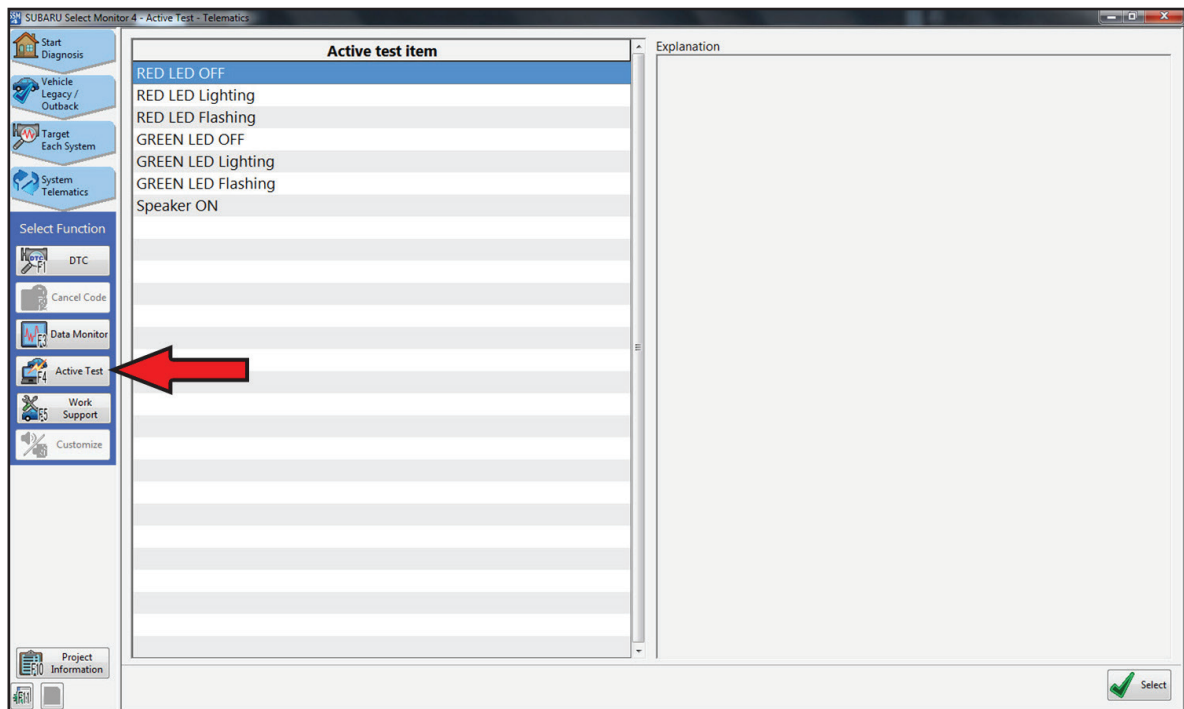


Figure 2-103 SSM-Active Test

In this example, the “RED LED Flashing” function cycles the RED LED at 2 different frequencies that are used by the Telematics system.

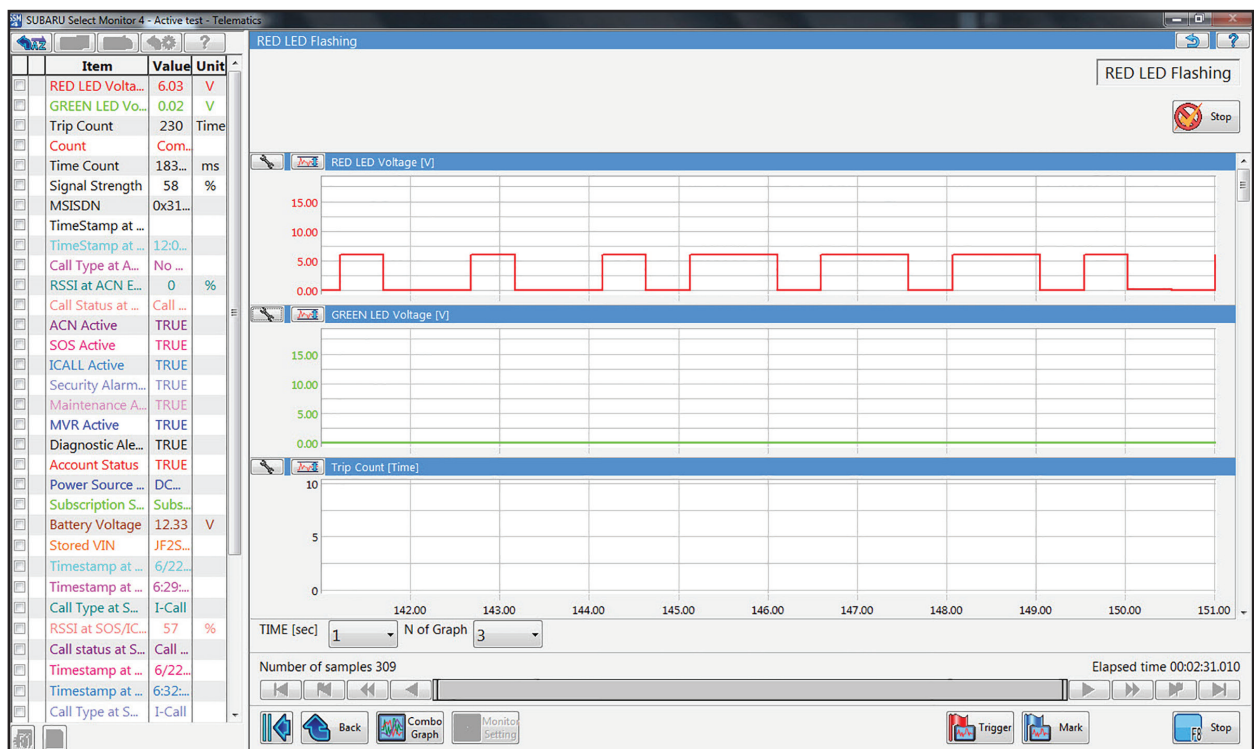


Figure 2-104 Active Test-RED LED Flashing

Advanced Electrical Systems & Diagnosis

Service

Service Procedure information for the Telematics system can be found under the “Entertainment” heading in the Subaru Service Manual.

FORESTER PubNo.G8210BE

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HELP

General Description | Engine | Suspension | Driveline/Axle | Brakes | Transmission/Transaxle | Steering | Heater & Airconditioner/Ventilator | SRS Airbag System & Seat Belt System | Body & Electrical/WIRING SYSTEM | DIAGNOSTICS |

Body & Electrical/WIRING SYSTEM

LIGHTING SYSTEM

WIPER AND WASHER SYSTEMS

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Antenna

Steering Satellite Switch

Microphone

Navigation Body

GPS Antenna

DATA COMMUNICATION MODULE

REMOVAL

INSTALLATION

INSPECTION

Switches and Harness

ENTERTAINMENT > TELEMATICS SYSTEM

NOTE

For procedure of each component in the navigation system, refer to the respective section.

Data communication module: [Ref. to ENTERTAINMENT>DATA COMMUNICATION MODULE.](#)

Antenna: [Ref. to ENTERTAINMENT>Antenna.](#)

GPS antenna: [Ref. to ENTERTAINMENT>GPS Antenna.](#)

Switches and harness: [Ref. to ENTERTAINMENT>Switches and Harness.](#)

Figure 2-105 STIS Telematics Service Information

2-96

 SUBARU

Advanced Electrical Systems & Diagnosis

If the DCM is replaced with a new part, the new part must be registered. The overhead console mounted Green LED will blink until the system is registered. The process of registering the DCM may also be referred to as a “COMM CHECK”. Completing this procedure is accomplished by pressing the i-Call (i-button) switch for 2 seconds or more. The process identifies the VIN (via the ECU) and DCM ID and transmits them to the SOA network (via the AT&T 4G LTE network). Subscription information is associated with the VIN and verified on the Subaru of America, Inc. (SOA) servers. When the registration is complete, the Telematics system will automatically activate and the overhead console mounted Green LED will illuminate solid. The telematics system will not function without the correct VIN entered into the ECM. For this reason, always verify the correct VIN is entered in the ECM. An incorrect VIN requires ECM replacement.



Figure 2-106 i-Call (i-button) Switch For COMM CHECK



CAUTION

DCMs must NEVER be swapped as part of any diagnosis unless directed to do so.

NOTE:

Claims for DCM replacement MUST include the NEW DCM's Serial Number in the Misc. Detail Field of the claim submission. In addition, the IMEI number should always be documented on the Repair Order.

The software version of the Telematics system can be verified using the “Work Support” function of the SSM.

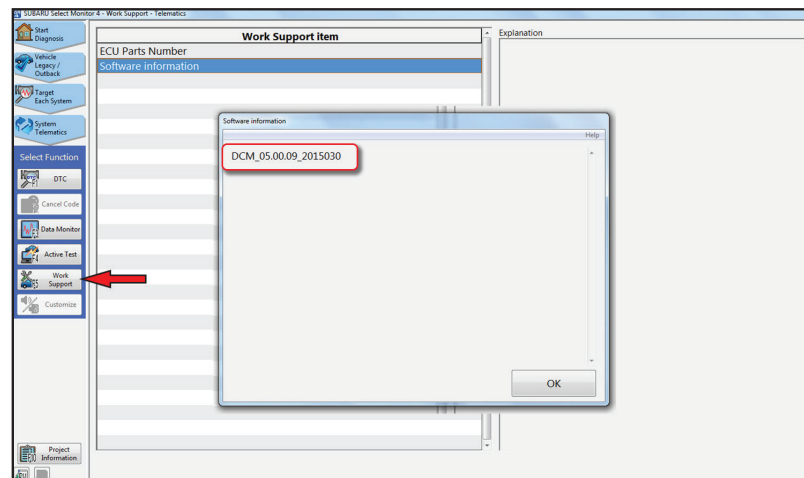


Figure 2-107 SSM-DCM Software Version

Advanced Electrical Systems & Diagnosis

Headlight Systems

Halogen

Most previous generation Subaru vehicles use conventional halogen lamps to provide the necessary illumination when driving in low light conditions or using signals.



Figure 3-1 Conventional Headlight

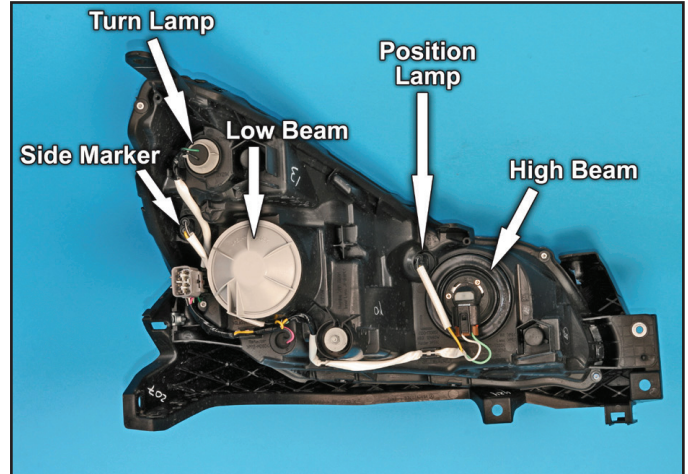


Figure 3-2 Bulb Locations

Halogen lamps offer reliable performance at a low cost and do not use hazardous materials.



CAUTION

Avoid direct contact with the glass bulb housing as contamination may lead to premature bulb failure.



Figure 3-3 Halogen Headlight Lamp

Advanced Electrical Systems & Diagnosis

The headlight operating logic from 2008 Impreza, 2009 Forester, 2010 Legacy and Outback and newer vehicles is described below.

Lighting Switch

No parking switch is available.

Headlight Operation

Condition	Explanation of condition	Headlights switch condition needed to turn on headlights or parking lights
Normal	Ignition or Engine ON	Turn switch to ON
Key In	Ignition OFF	A. Lights turn ON when key is placed into the ignition switch. (Lights were on when the key was last removed.) B. Turn switch to ON
Key Out		A. Turn switch to On B. Turn switch OFF then ON NOTE: BUZZER SOUNDS IN THIS MODE WHEN THE DRIVER'S DOOR IS OPEN

Advanced Electrical Systems & Diagnosis

Daytime Running Lamps



Figure 3-4 DRLs OFF



Figure 3-5 DRLs ON

Some Daytime Running Lamp (DRL) systems used by Subaru operate the high beam lamps at a reduced output to provide daytime visibility to other vehicles on the road.

When the low beams are in the OFF position, the high beam relay is energized allowing current to flow to the high beam lamps. The ground side of the high beam lamps contains a “DRL Cancel Relay” and a “DRL Resistor”. During DRL operation the DRL cancel relay is de-energized causing the current to flow through the DRL resistor before reaching a ground source. This creates a significant voltage drop in the circuit reducing the available voltage for the high beam lamp. When full high beam operation is required, the DRL cancel relay will be energized allowing current to bypass the DRL resistor. This allows the high beam lamp to utilize full source voltage for illumination.

Automatic Transmission models - DRLS DO NOT OPERATE IN PARK.

All models parking brake ON - DRLS DO NOT OPERATE.

All models have a Headlight ON indicator.

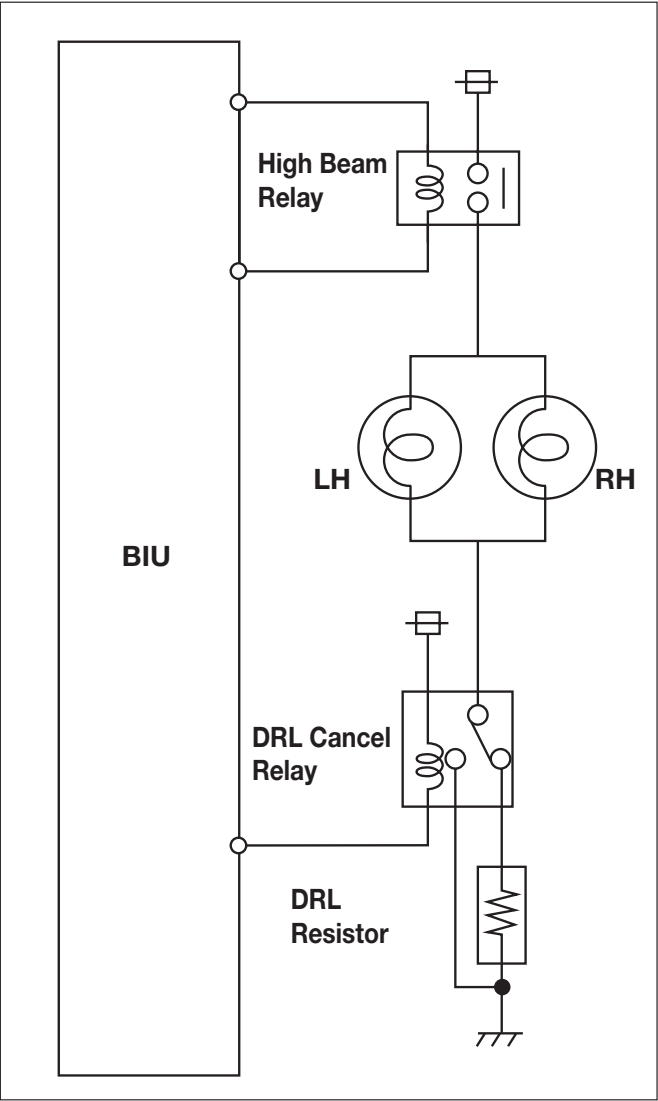


Figure 3-6 DRL Circuit



Figure 3-7 DRL Resistor

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DRL Cancel Function

Beginning with 2015 Legacy and Outback models, the DRL system has been expanded to provide better turn signal visibility for surrounding vehicles and pedestrians. This is accomplished by disabling the low beam on the side of turn signal activation.



Figure 3-8 DRLs OFF



Figure 3-9 DRLs ON

In order to achieve this function, an additional DRL cancel relay, High Beam relay, and DRL resistor have been added. This effectively creates 2 independent high beam control circuits allowing independent function.

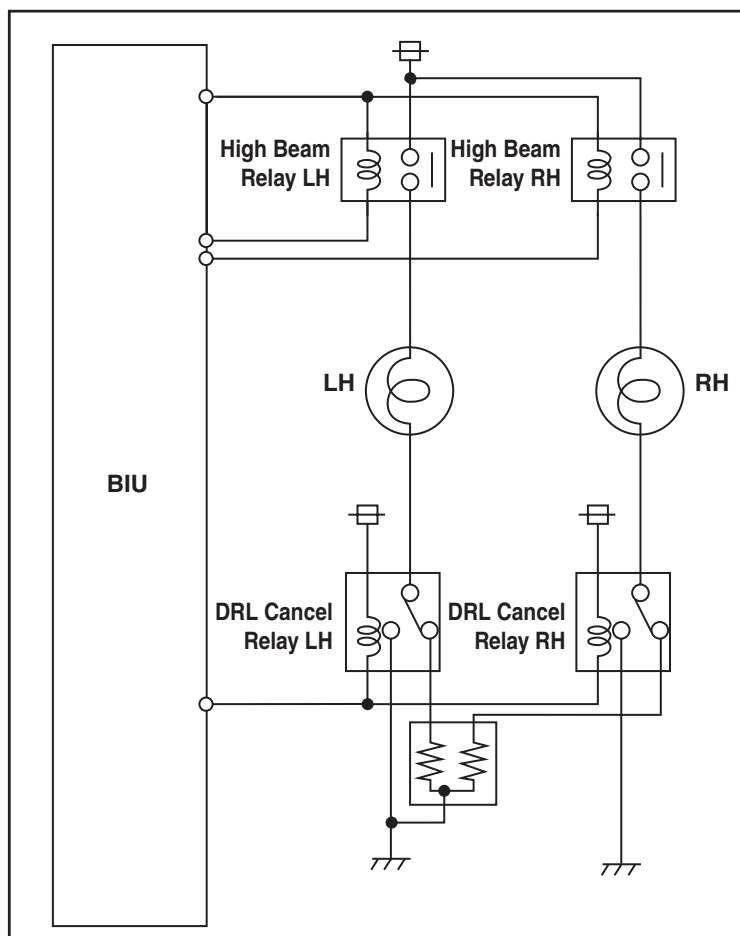


Figure 3-10 DRL Cancel Circuit

Advanced Electrical Systems & Diagnosis

Automatic Headlights

When in Auto Mode, the headlights and tail-lights turn on and off based on the ambient light detected by the Sunload Sensor.

The Sunload Sensor (applicable models) of the HVAC System performs two jobs.

- Sunload for HVAC System
- Ambient light for the Automatic Headlights

Conventional Sunload Sensors have 2 wires.

Combination Sunload and ambient light Sensors have 4 wires: B+, ground, analog signal to HVAC, and a wire delivering a digital signal to the BIU.

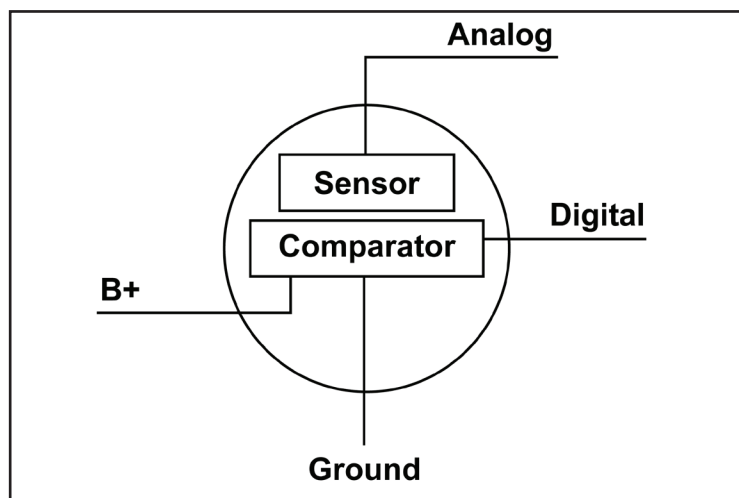


Figure 3-11 Sunload Sensor 4 Wires (ARTWORK)

A comparator circuit is built inside the Sunload Sensor that produces a constant triangle or ramp wave. This provides one input to the comparator circuit.

The other input is the voltage generated by the absorbed sunlight. The comparator evaluates the 2 voltages and outputs a square wave duty ratio that is sent to the BIU. When the duty ratio crosses a set level up or down, the headlights and taillights turn on or off.

There are 4 levels of sensitivity that can be set by a technician using the SSMIII.

- Dull
- Normal
- Sensitive
- Very Sensitive

NOTE: The number of levels may change by model.

These settings as listed on the SSMIII refer to the Sunload Sensors ability to detect darkness.

Dull would be late on and early off.

Very Sensitive would be early on and late off.

The Integ mode of the SSMIII shows the duty ratio from the Sunload Sensor.

Dull on approx. 150 HZ, Off approx. 440 HZ

Very Sensitive on approx 350 HZ, off 500 Hz

Advanced Electrical Systems & Diagnosis

High Intensity Discharge (HID)

Beginning with the 2004 Impreza WRX STi, some Subaru models may be optionally equipped with High Intensity Discharge low beam headlights for improved visibility.



Figure 3-12 HID Headlight

HID headlights operate by applying a high electrical charge through two electrodes that are surrounded by a xenon and mercury gas in a sealed glass tube. The gas emits light as it is heated by the electrical current.

NOTE:

HID headlights contain mercury. For that reason, it is necessary to remove HID headlights before vehicle disposal. Once removed, please recycle or dispose of the headlights as hazardous waste in accordance with applicable state laws.

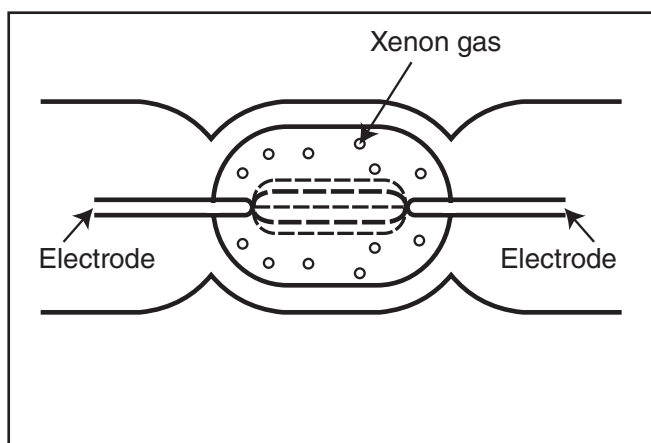


Figure 3-13 HID Internal Function



Figure 3-14 HID Bulb (Low Beam)

The HID headlight bulb is fitted into the normal location for the low beam and sealed with a protective cover.

NOTE:

It is normal for the color or temperature of an HID bulb to shift from slightly blue when it is new to pink as it ages.

Advanced Electrical Systems & Diagnosis

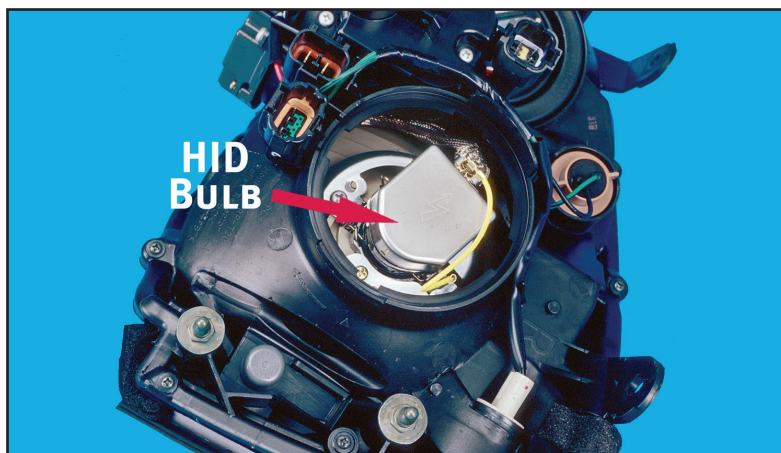


Figure 3-15 *HID Bulb*

In order to achieve the intense light emission from the xenon gas, a large voltage supply is required. An HID ballast containing a control unit, DC/DC convertor, DC/AC inverter, and starter is fitted to each HID headlight. When an HID headlight is first turned on the starter in the HID ballast will provide nearly 23,000 volts AC. After the initial spike, the DC/DC convertor will raise the 12.6 volt supply to around 85 volts DC. The 85 volts DC is then inverted to 85 volts AC for sustained operation of the HID headlight.

Warning: Do not attempt to disconnect the HID headlight assembly or related components with the headlights in the ON position.



Figure 3-16 *HID Ballast*

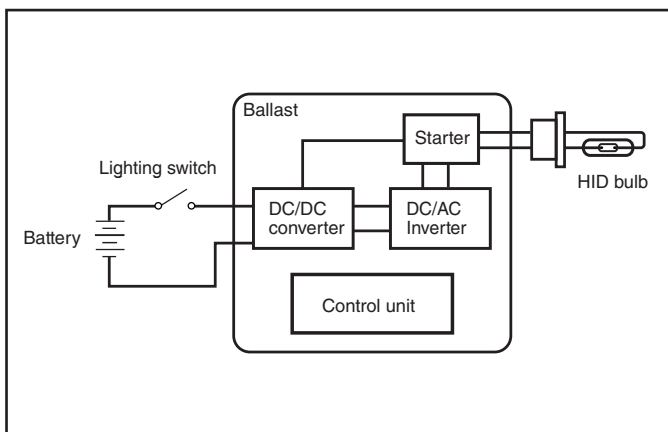


Figure 3-17 *HID Schematic*

Due to the high voltage and high heat generation, always exercise caution and read warning labels before attempting any service of the HID headlight system.

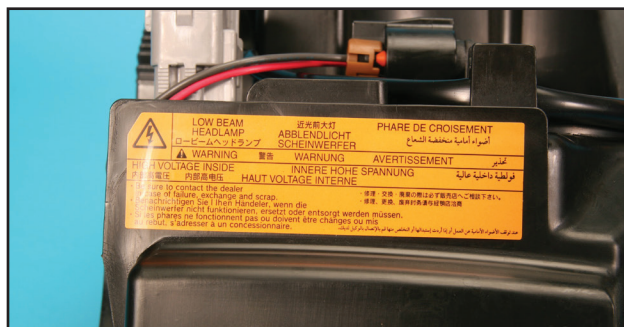


Figure 3-18 *HID Warning Label*

Advanced Electrical Systems & Diagnosis

Light Emitting Diode (LED)

Beginning with the 2015 WRX and STI, light emitting diode (LED) low beam and parking lamps have been added for improved reliability and reduced power consumption.

NOTE: The LED low beam and parking lamps are not serviceable. The entire headlight assembly must be replaced if an internal failure occurs. However, the halogen high beam lamp is still individually serviceable.



Figure 3-19 LED Parking Lamp



Figure 3-20 LED Low Beam

The LED headlight system is equipped with a warning message in the event an LED failure occurs.

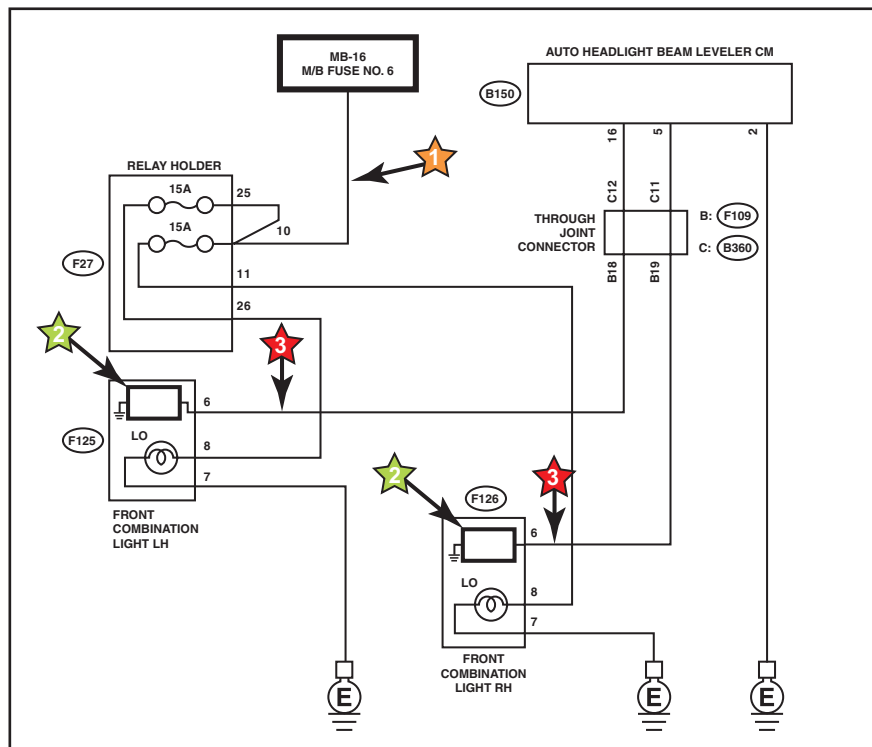


Figure 3-21 LED Headlight Circuit

The Automatic Headlight Leveling Control Module (AHLCLM) monitors the power supply to the LED low beam. During normal operation, the LED headlights illuminate when power is received from MB-16 (Orange star 1). Parallel circuits at the Relay Holder provide independently fused circuits to each headlight assembly.

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As each headlight operates the supply power is monitored by voltage check modules (Green star 2) that are located inside the headlight assembly.

When the circuit is operating normally, the voltage at terminal 6 (Red star 3) of F125 and F126 is 0 volts. If power is lost on one or both headlights, the voltage at terminal 6 becomes 5 volts and a DTC (82905 LED HEADLAMP LEFTHAND ERROR or DTC 82904 LED HEADLAMP RIGHTHAND ERROR) is set.

NOTE:

The actual construction and internal wiring of the LED headlights is not represented in this drawing. A set of high strength light emitting diodes are wired in series and use a DC to DC converter to amplify the battery voltage. The amplification is required due to the voltage drop that occurs at each LED.



Figure 3-22 LED Headlight Disabled Warning

Advanced Electrical Systems & Diagnosis

Headlight Adjustments and Levelers

Proper headlight aiming is critical for good visibility and safety. Following any headlight related services always ensure the headlights are properly aimed and adjusted.

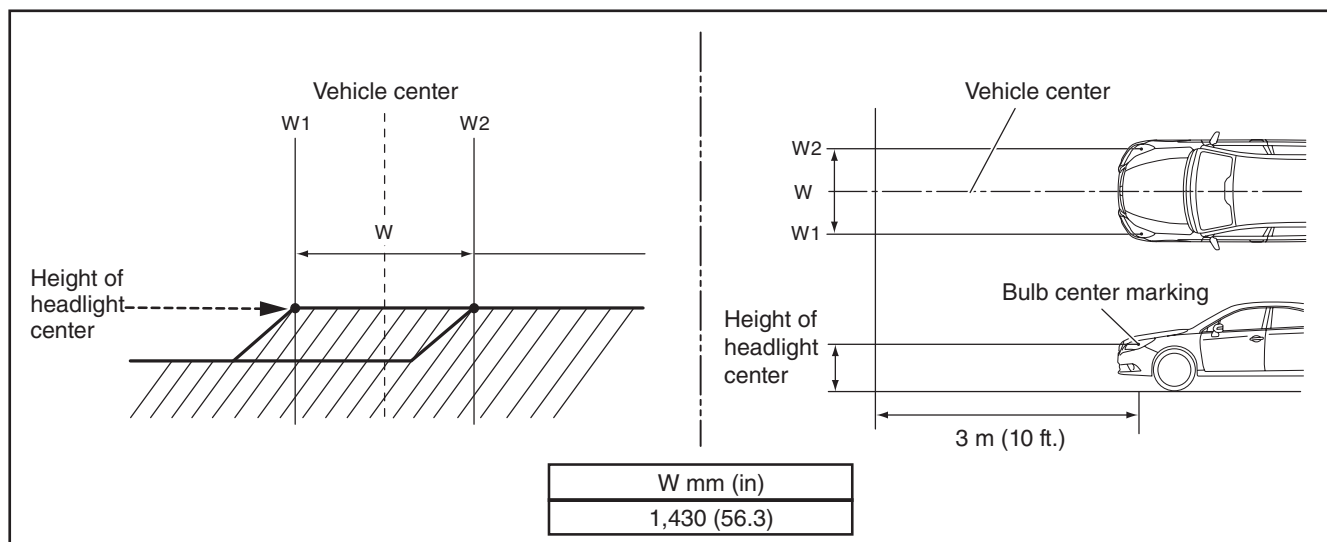


Figure 3-23 Headlight Aiming

For conventional headlights, aiming is accomplished by turning the adjustment screw fitted to the rear of the headlight assembly. Consult STIS for the location and access of the adjustment screw.

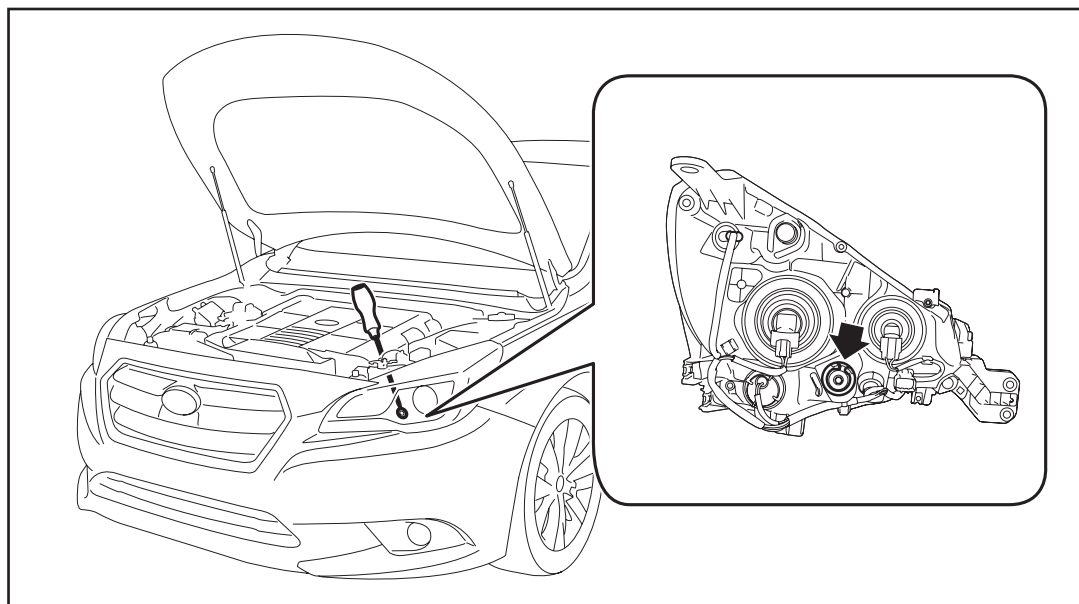


Figure 3-24 Manual Adjustment

Some Subaru models are fitted with on-board headlight leveler systems. These systems use a leveler motor to adjust the vertical axis of the low beam lamps.

Advanced Electrical Systems & Diagnosis

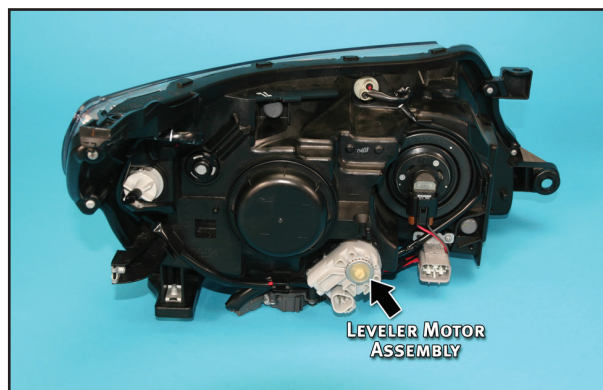


Figure 3-25 Leveler Motor

Some headlight leveler systems are actuated by console mounted switches. These systems are commonly referred to as manual leveler systems.



Figure 3-26 Headlight Leveler Switch

Other headlight leveler systems are equipped with automatic adjustment functions. These systems utilize information received from a rear height sensor to adjust the vertical axis of the headlights. An Automatic Headlight Lever Control Module (AHLCD) interprets the information from the rear height sensor and controls the headlight leveler adjustment.



Figure 3-27 Automatic Headlight Leveler Control Module (AHLCD)

The rear vehicle height sensor is mounted to the rear subframe and arm. As weight is added or subtracted the vehicle ride height will fluctuate. Generally, a weight increase will cause the rear suspension to sink to a lower level. This will cause the front suspension to have a more upward angle resulting in an undesirable headlight angle.

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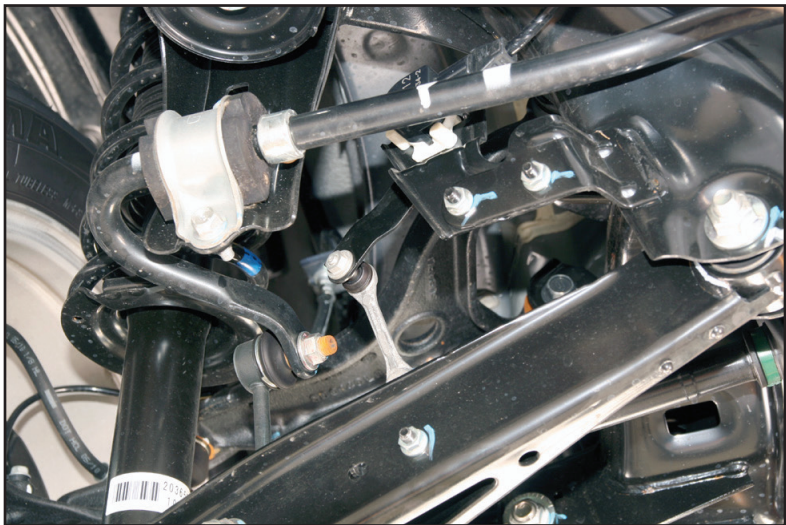


Figure 3-28 Rear Height Sensor

The rear vehicle height sensor is connected to the Auto Headlight Beam Leveler CM with 3 wires. Those 3 wires represent a 5 volt reference, ground, and signal voltage. The sensor may be inspected by measuring the voltage between the connector terminals when the sensor link is removed from the suspension arm.

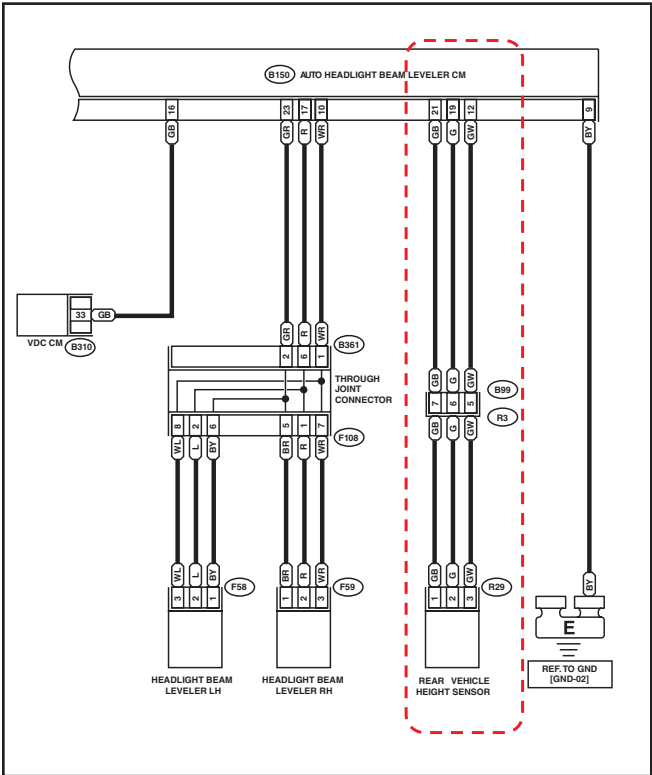


Figure 3-29 Rear Height Sensor Circuit

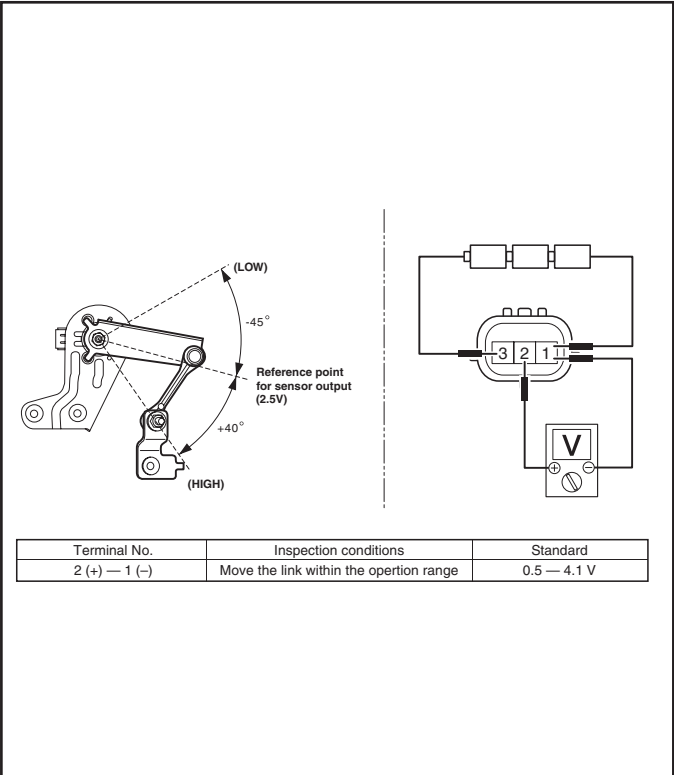


Figure 3-30 Rear Height Sensor Inspection

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In response to the rear vehicle height sensor input, the AHBLCM will command both the left and right leveler motor assemblies to move up or down as needed. The AHBLCM provides supply voltage, ground, and an actuating signal to the headlight levelers.

NOTE: Weight changes in the front seats may cause headlight adjustment, but since they are located close to the center of the vehicle the effect on the rear height sensor and headlight adjustment is minimal.

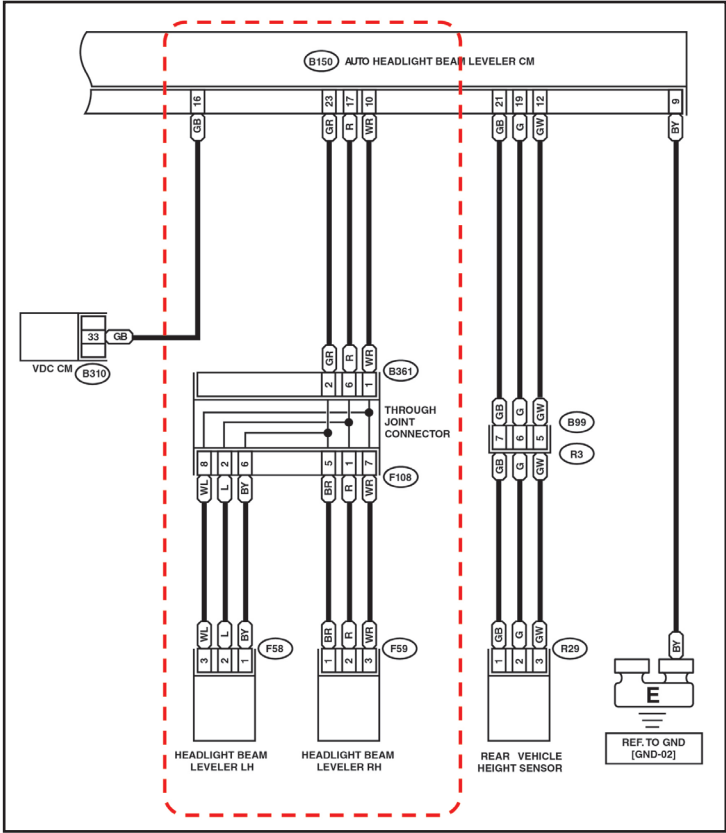


Figure 3-31 Leveler Motor Circuit

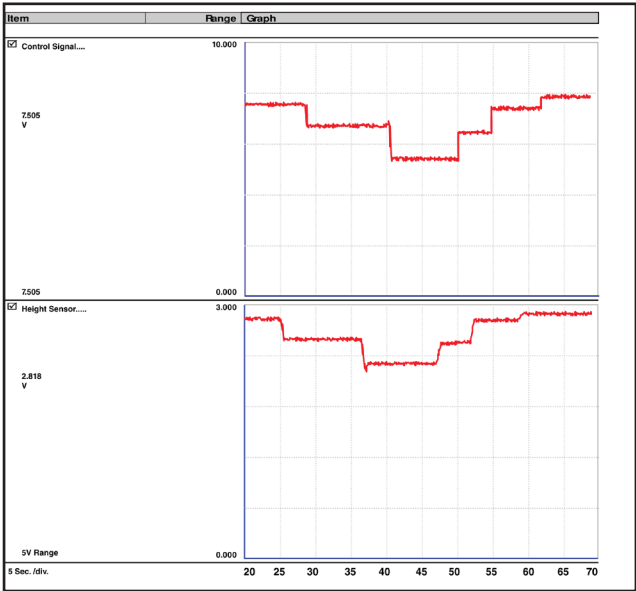


Figure 3-32 Leveler Motor Operation

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The AHBLCM receives one signal wire from the Vehicle Dynamics Control (VDC) CM to monitor vehicle speed. High frequency input from the rear height sensor is compared with the current vehicle speed. When the vehicle speed is above 19 mph (30 km) the headlight leveler system will have altered parameters to prevent excessive adjustment.

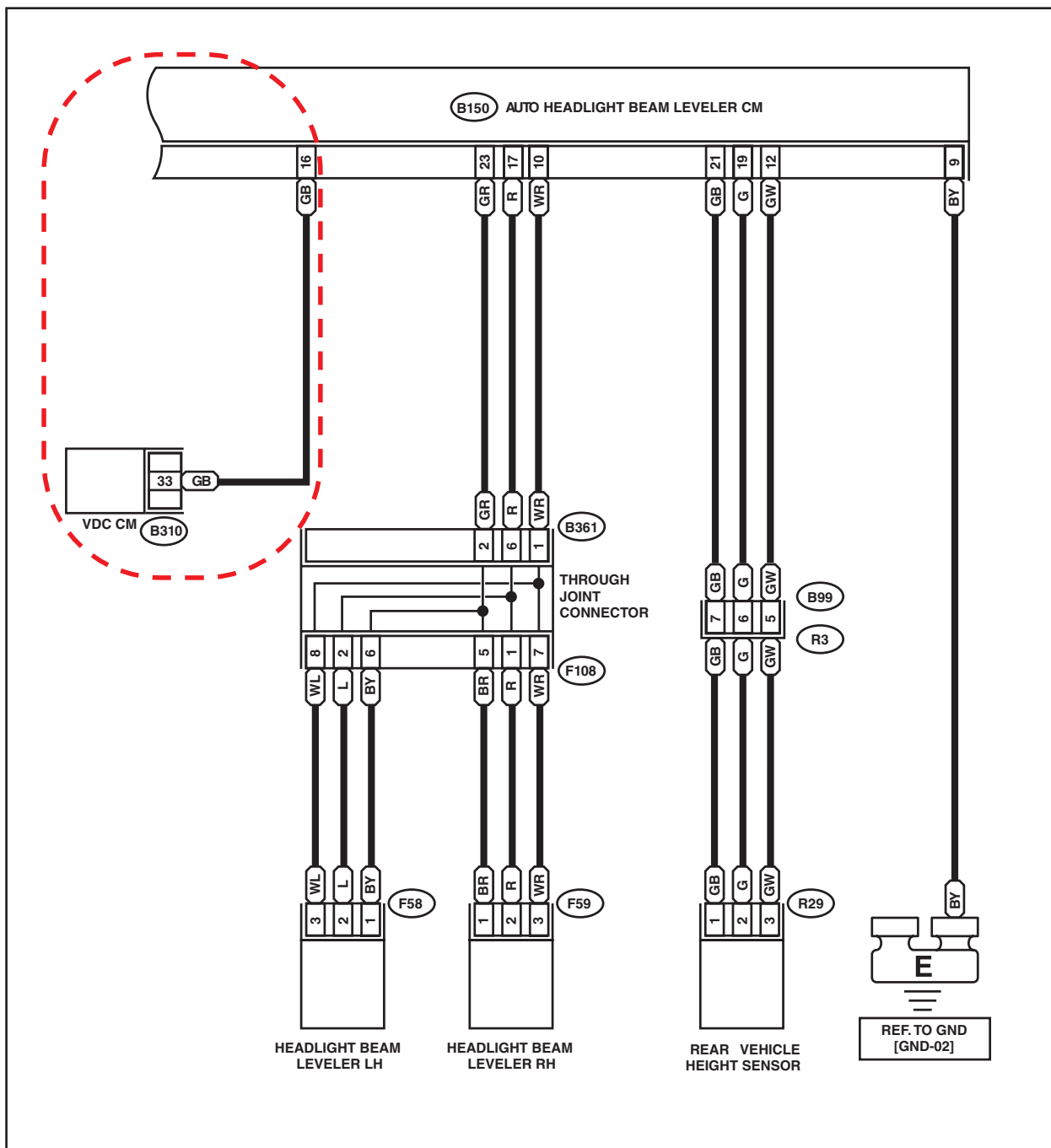


Figure 3-33 VDC Communication Circuit

NOTE:

Newer systems with automatic headlight beam leveling do not use an external sensor. These system rely on a ride height sensor mounted inside the AHBLCM. This is a G-force type sensor, and requires the same initialization / reinitialization procedures if work is performed on the vehicle.

Advanced Electrical Systems & Diagnosis

There are two different service procedures that must be performed when parts are removed or replaced from the system. Always consult STIS for the proper procedures.

Before attempting either of these service procedures always ensure the following conditions have been met;

- The vehicle is parked on a level surface
- Tire inflation is correct
- Cargo is unloaded from the vehicle
- The fuel tank is fully filled

Initialization	When the auto headlight beam leveler CM was replaced with a new module.
Reinitialization	• When the auto headlight beam leveler CM was replaced with a part from another vehicle. • When suspension parts have been removed or replaced. (Crossmember, front arm, sub frame, lateral link, housing, strut etc.) • When the vehicle height sensor has been replaced or removed.

Figure 3-34 Auto Headlight Service Procedures

During the service procedures, the headlight leveler lamp will illuminate to provide feedback. This lamp is only used for the initialization and re-initialization service procedures. It will not illuminate if a fault has occurred in the system.

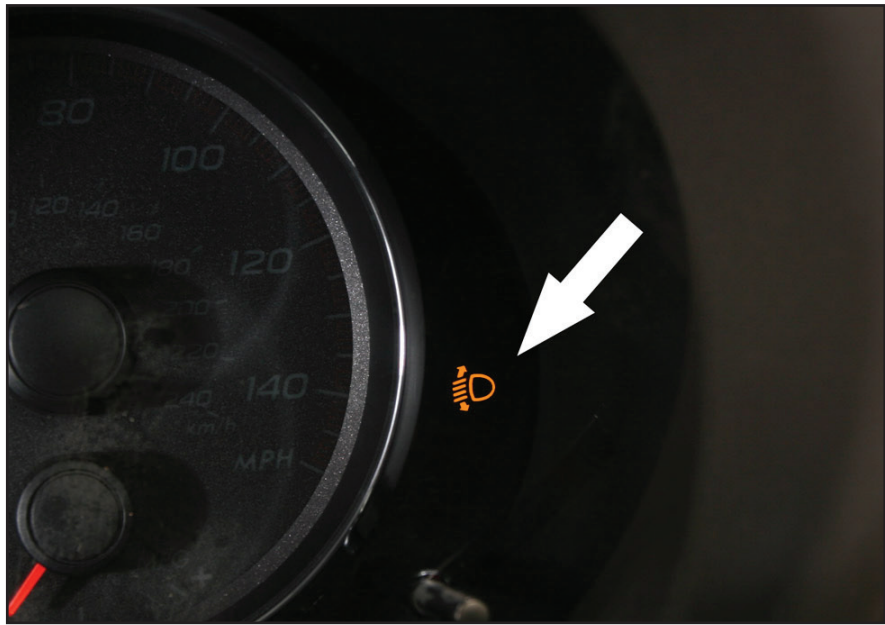


Figure 3-35 Headlight Leveler Lamp

Advanced Electrical Systems & Diagnosis

Steering Responsive Fog Lights (SRF)

Beginning with the 2015 Legacy and Outback models, a new Steering Responsive Fog Light (SRF) system was optionally equipped to provide enhanced visibility in the direction of a turn. The SRF system communicates with the vehicle CAN circuit to monitor vehicle speed and steering angle and controls the on and off functions of the fog lights accordingly.

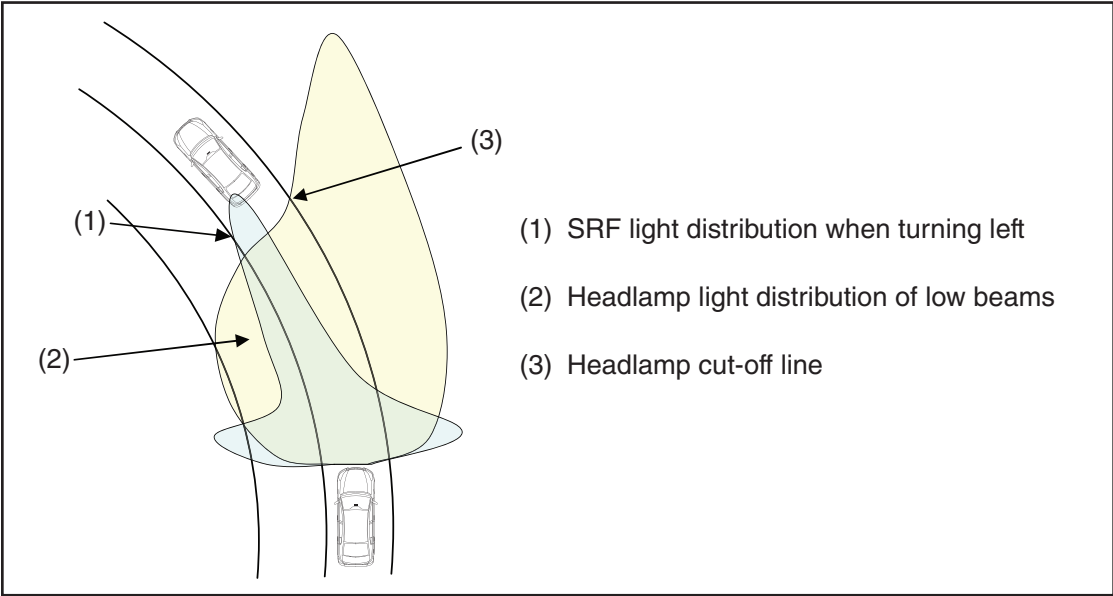


Figure 3-36 SRF Light Distribution



Item	Value	Unit
☒ VSO	28.12	MPH
☒ Steering Angle Signal	0.5	deg
☒ Fog Light Control Status	LH/RH Light off	

Figure 3-37 Fog Lights OFF



Item	Value	Unit
☒ VSO	28.68	MPH
☒ Steering Angle Signal	-18.1	deg
☒ Fog Light Control Status	RH Light on	

Figure 3-38 Right Turn, Fog Light ON



Item	Value	Unit
☒ VSO	28.06	MPH
☒ Steering Angle Signal	16.1	deg
☒ Fog Light Control Status	LH Light on	

Figure 3-39 Left Turn, Fog Light ON

In order for the system to function the following conditions must be met;

Low beam light	ON
Fog lamp	OFF
Shift position	Except "R"
SRF OFF switch	OFF
Vehicle speed & Steering angle condition is satisfied	

Figure 3-40 SRF Conditions

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The SRF system can be temporarily disabled by pressing the “SRF OFF” button located on the lower left instrument panel.

NOTE: The SRF system is defaulted to the ON position after cycling the ignition.

If equipped, the SRF system may share the same control unit as the Automatic Headlight Leveler system.



Figure 3-41 SRF OFF Switch



Figure 3-42 Lighting Control Unit

Inspection of the SRF system can be performed using the Subaru Select Monitor.

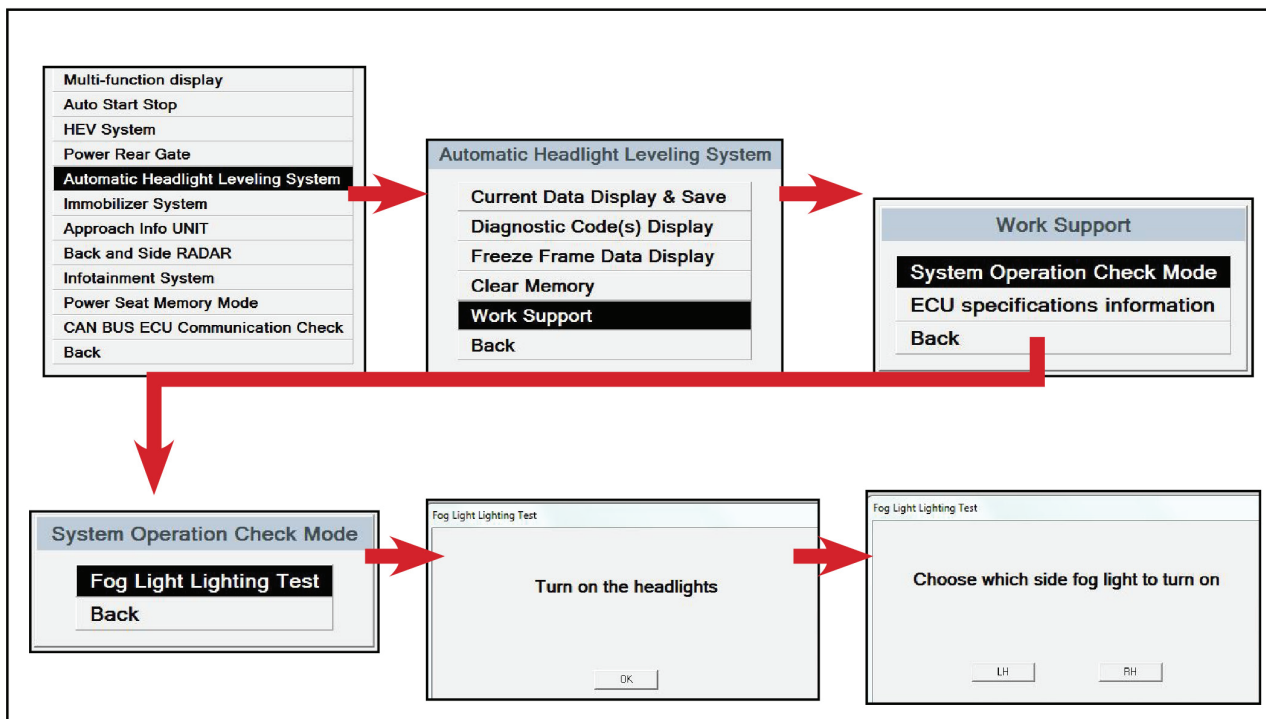


Figure 3-43 Inspection of the SRF system with SSMIII

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Steering Responsive Headlights

Introduced with certain 2017MY vehicles, Steering Responsive Headlights (SRH) are designed to improve driving illumination while cornering the vehicle by moving the headlight beams in the direction of steering wheel movement.

The SRH functions with the low beam and high beam headlight settings through the use of a non-serviceable Swivel Actuator in the headlight assembly, a serviceable dash mounted SRH OFF switch, and the CAN network. All SRH systems include Automatic Headlight Leveling functions. Both systems are controlled through the Automatic Headlight Leveling Control Module (AHLCM).

NOTE: The SRH system will remain off while the Daytime Running lights are operating.

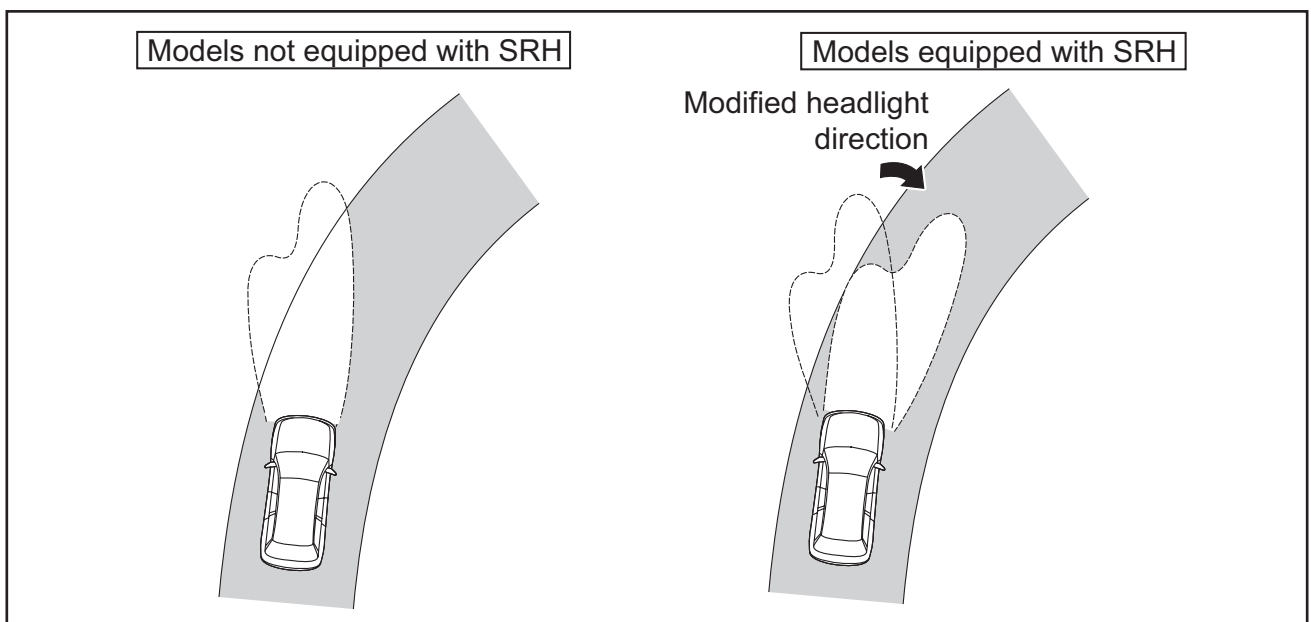


Figure 3-44 Illumination with and without SRH

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Basic Operation

The SRH system is defaulted to the on setting each time the ignition is turned to the on position and performs an initialization process to test the operation of the system.



Figure 3-45 Center



Figure 3-46 Maximum Inside



Figure 3-47 Maximum Outside

A successful completion of this process is required to allow SRH operation. During the initialization process the headlights move from the center position to the inside, back to center, and then to the outside and finally back to the center position. This is performed each time the engine is started, regardless to the headlight switch setting.

Required vehicle conditions for SRH operation:

- Successful completion of the initialization process
- Headlight Switch is on (or Automatic)
- The vehicle is traveling forward
- Vehicle speed is at least 5 m.p.h. (8 km/h)
- SRH OFF switch has not been activated
- Manual transmission vehicles must be in the 2nd gear range or higher

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NOTE:

SRH operation on manual transmission vehicles will continue to operate after the vehicle has been shifted down to 1st gear, until the vehicle comes to a complete stop. At that time the SRH operation will not return until the vehicle has been upshifted to at least 2nd gear.

When the headlights are turned on, the AHLCM checks the vehicle speed and steering angle and computes the size of the curve. It then controls the swivel actuators via LIN communication.

The AHLCM uses the following CAN and LIN signals to control the swivel actuator:

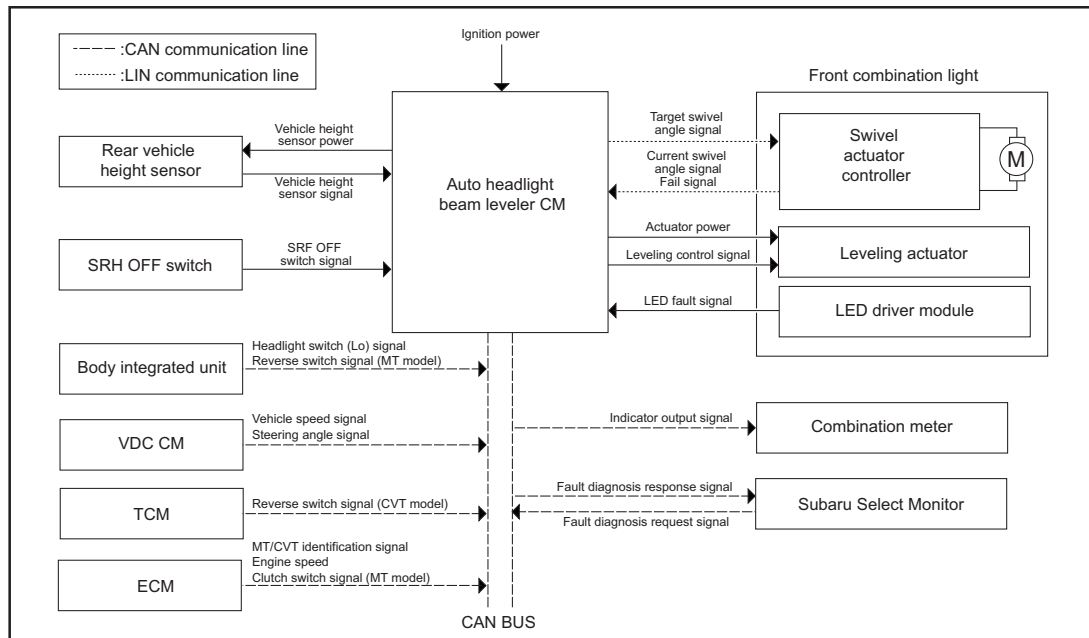


Figure 3-48 CAN and LIN

The Driver can turn off the SRH system using the SRH OFF button located on the dash, left of the steering wheel.

The SRH OFF indicator light will illuminate in the combination meter or on the Multi-Function Display to indicate the switch has been activated and the system has been turned off. This light will flash if there is a malfunction with the system.

The angle of movement of each headlight is independently controlled. The only time the two headlights are at the same angle is at 0 degree steering angle.

NOTE:

Steering left produces a negative steering angle and steering right produces a positive steering angle.

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Figure 3-49 SRF OFF Button

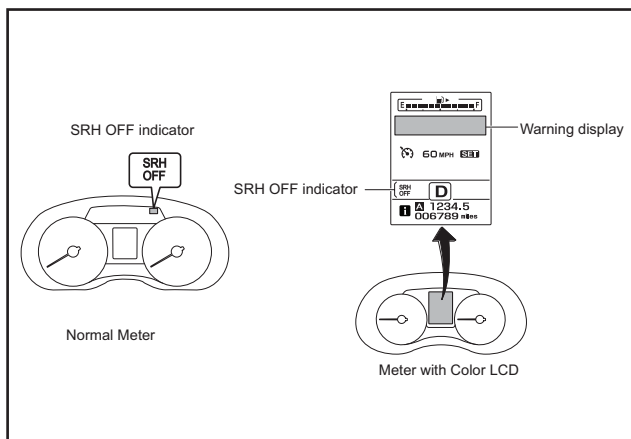


Figure 3-50 SRH OFF Indicator

During a left hand turn the inside headlight (left) will move a maximum of -18 degrees to the left. The outside headlight (right) will move a maximum of -5 degrees to the left.

During a right hand turn the inside headlight (right) will move a maximum of 18 degrees to the right. The outside headlight (left) will move a maximum of 5 degrees to the right.

This operating logic provides for optimal illumination for the area directly in front of the vehicle and into the intended path of travel.

NOTE: The operating logic for the headlights is not adjustable.

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During turns in either direction, the degree of movement of the headlights is controlled by the steering angle sensor input and vehicle speed.

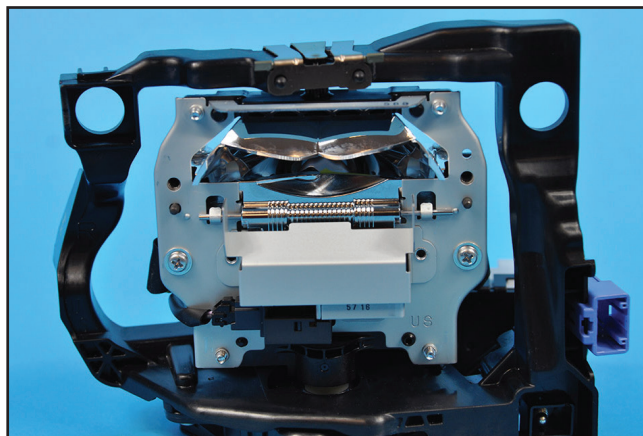


Figure 3-51 Shutter Door Low Beam

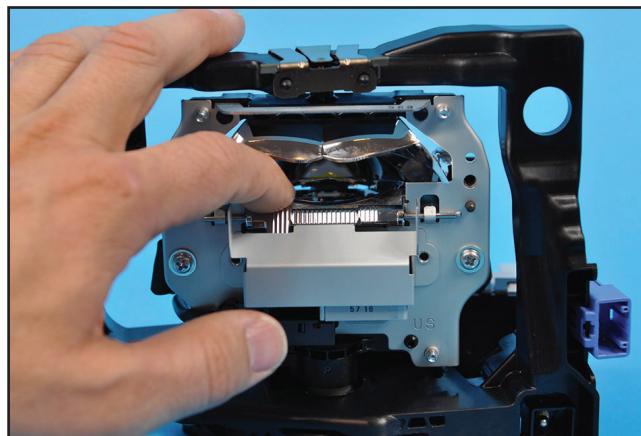


Figure 3-52 Shutter Door High Beam

Toggle back and forth between 6-49 and 6-50 to show High and Low beam

The yellow reflection at the center of the picture is the LED.

The shutter door of the SRH system controls the high and low beam headlight operations by shading the illumination from the headlight assembly. A single LED assembly turns on for headlight light operation, operating at a constant current value. A solenoid activates the shutter door.

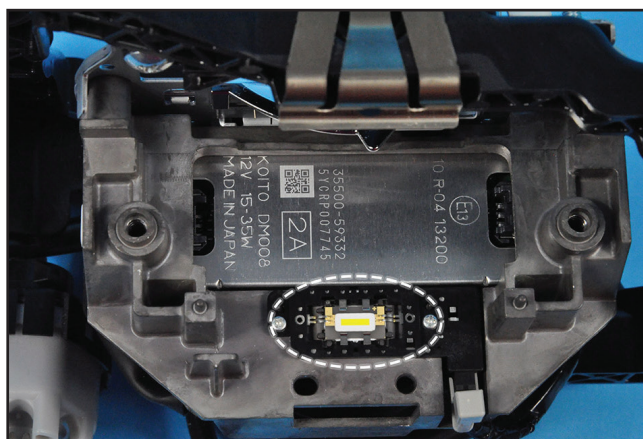


Figure 3-53 LED

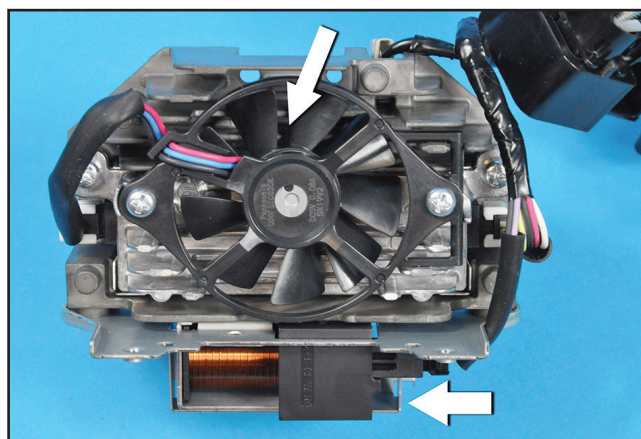


Figure 3-54 Shutter Door High Beam solenoid and cooling Fan

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Electrical Operation

The heat sink for the LED assembly and the LIN transceiver are cooled by a fan with a brushless 5- volt DC motor. The fan is in operation any time the headlights are operating.

The SRH swivel actuator performs all left and right movements of the projector lens of the headlight assembly. The actuator is wired with an ignition power supply, body ground, LIN communication, and malfunction signal circuits.

All commands and position signals are sent and received through the LIN communication wires from the headlight assembly to the Automatic Headlight Leveler Control Module (AHLCM). This includes left and right movements, and high/ low beam settings of the shutter doors. A failure with the LED assembly, shutter door, or swivel actuator requires replacement of the headlight assembly. The swivel actuator is non-serviceable. Replace the headlight assembly if the swivel actuator has failed.

NOTE:

The Headlight Beam Leveler is wired independently to the AHLCM. Headlight assembly replacement is required for a Headlight Leveler Failure.

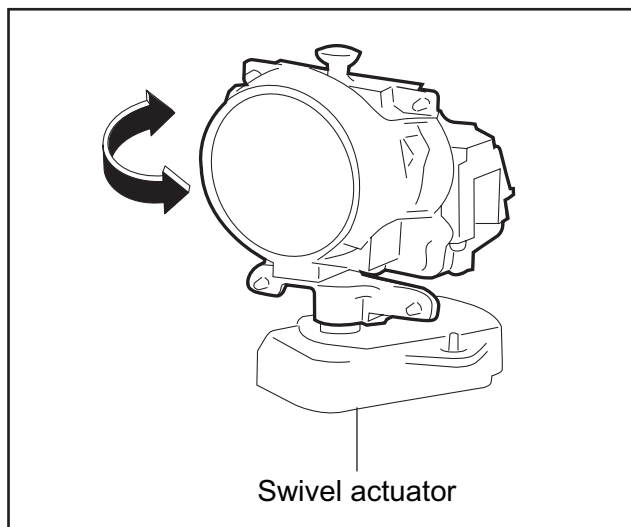


Figure 3-55 Swivel Actuator

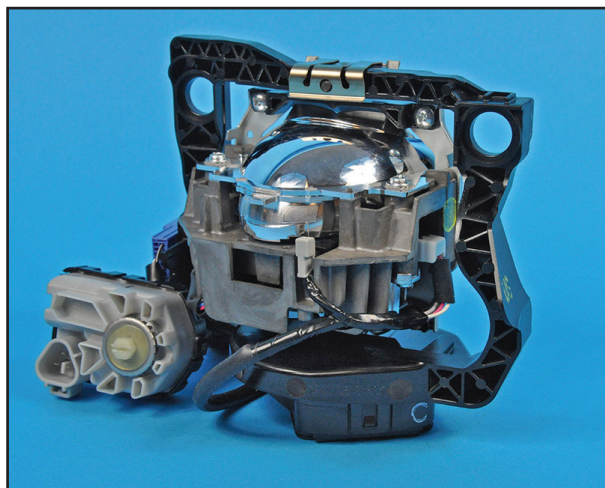


Figure 3-56 Headlight Beam Leveler

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The swivel actuator of the SRH system contains a LIN bus transceiver, control circuits for the actuator motor, shutter door, shutter door solenoids, and a head light position sensor. The transceiver receives target swivel angle and head light leveling target setting commands from the AHLCM and directs the control circuits to operate the actuator motor and shutter door solenoid. The headlight position sensor communicates the current headlight positions back to the AHLCM through the LIN communications wire.

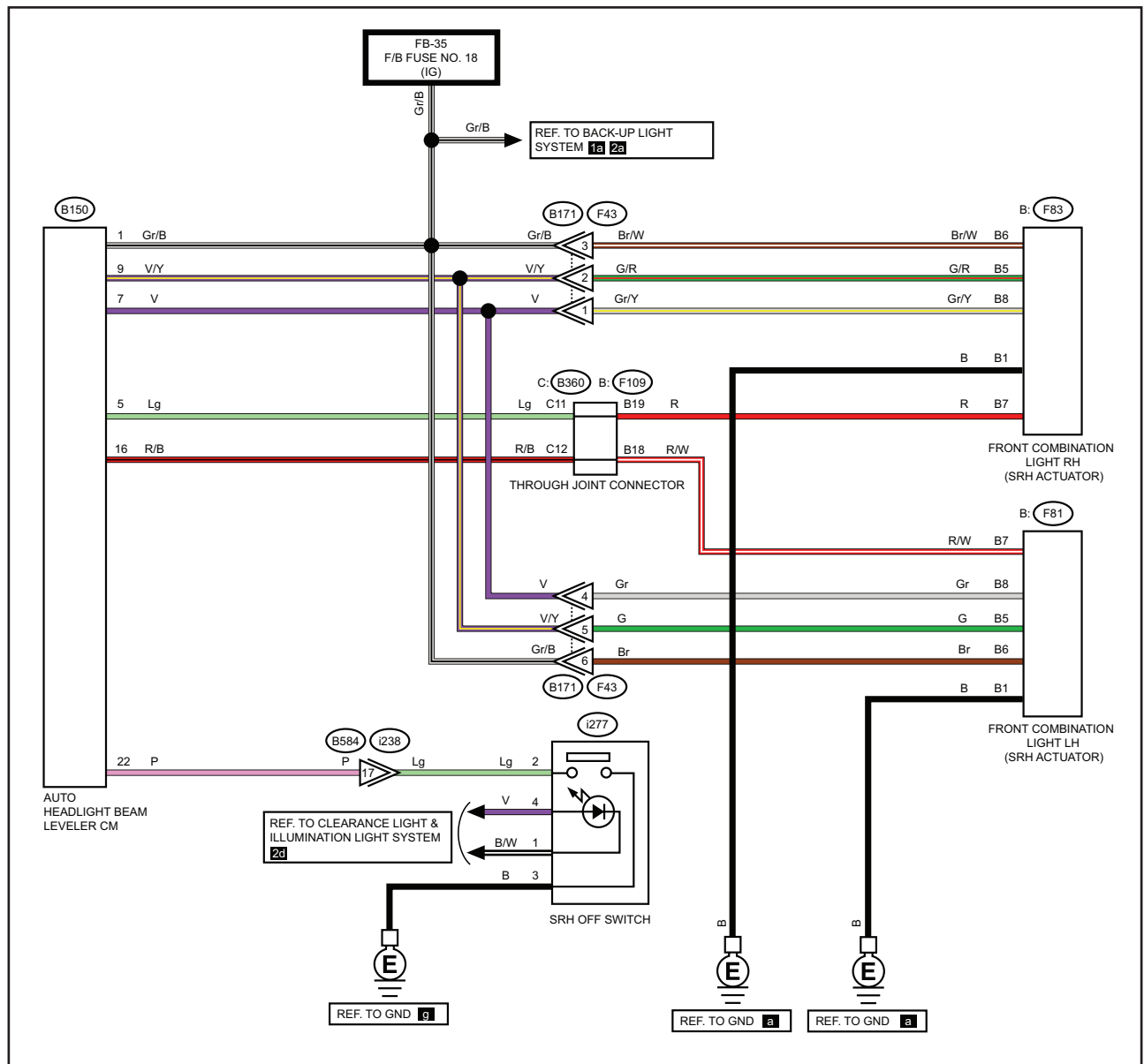
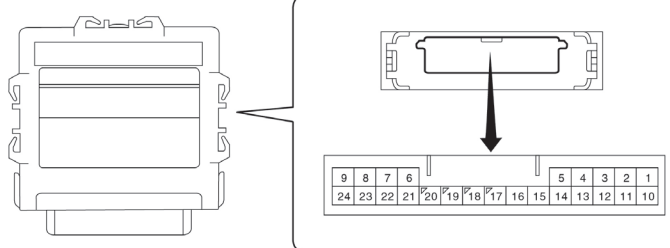


Figure 3-57 SRH Wiring Schematic

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Input/output Chart



Terminal No.	Content	Measuring condition	Standard
1 ↔ Chassis ground	IG power supply	Ignition switch ON	8 — 16 V
2 ↔ Chassis ground	GND	Always	Less than 1 Ω
3 ↔ Chassis ground	Rr vehicle height sensor GND	Always	Less than 1 Ω
4	Not used	—	—
5 ↔ Chassis ground	RH headlight malfunction signal	Always	1 MΩ or more
6	Not used	—	—
7 ↔ Chassis ground	SRH signal (LIN)	Always	1 MΩ or more
8	Not used	—	—
9 ↔ Chassis ground	SRH GND	Always	Less than 1 Ω
10 ↔ Chassis ground	Leveling actuator power supply	Ignition switch ON	10 — 16 V
11 ↔ Chassis ground	Leveling actuator GND	Always	Less than 1 Ω
12 ↔ 3	Rr vehicle height sensor power supply	Ignition switch ON	4.75 — 5.25 V
13	Not used	—	—
14	Not used	—	—
15	Not used	—	—
16 ↔ Chassis ground	LH headlight malfunction signal	Always	1 MΩ or more
17 ↔ Chassis ground	Leveling actuator signal	Headlight off → on	Less than 1 V → 1.0 — 14.4 V (for 17 seconds)
		Headlight on, no vehicle height change → change and hold vehicle height for 3 seconds or more	
18	Not used	—	—
19 ↔ Chassis ground	Rr sensor signal	IG ON (with no passenger, no load and vehicle stopped)	Approx. 2.5 V (changes according to vehicle condition)
20	Not used	—	—
21	Not used	—	—
22 ↔ Chassis ground	SRH OFF switch	Switch OFF → ON (at SRH OFF)	1 MΩ or more → less than 1 Ω
23	CAN-H	Always	1 MΩ or more
24	CAN-L	Always	1 MΩ or more

Figure 3-58 I/O Chart

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Service and Diagnostics

Basic Diagnostic Procedure

Customer Interview

When performing diagnostics on the headlight system, start with the customer interview check list. The headlight diagnostics includes two check lists. The first one is for the Automatic Headlight Leveler system and the second is for the Steering Responsive Headlights. The second check list contains all of the questions of the first check list and additional, more detailed questions. It is recommended to start with the second check list.

NOTE: The functions of the headlight system are intermixed with many operations of illumination control which may lead to customer difficulty in isolating a complaint.

Steering • Responsive • Headlight Check List for Interview				Date the Vehicle is Received
Year	Month	Day	Registration No.	Initial year of registration
Customer's name			Vehicle model	Frame number
Interviewer	Inspector	Engine type	Odometer reading	
Customer specified content • • •				
Date and time when the trouble occurred		Frequency of trouble occurrence	Always occurs Sometimes occurs (times per day, times per month)	
Condition of trouble occurrence (How the trouble occurs)		Weather	Fine • Cloudy • Rainy • Snowy • Others ()	
		Temperature	°C (°F) —	
Road conditions				
Accessory installation condition				
Confirmation of trouble condition				
Curve of trouble occurrence	☐ Right-hand curve ☐ Left-hand curve ☐ Both			
Information on curve of trouble occurrence <i>Note:</i> Check the location and curve on the map.	☐ Specific location ☐ Gentle curve ☐ Sharp curve ☐ Uphill ☐ Downhill ☐ Other			
Vehicle speed at trouble occurrence	Approximately km/h (MPH)			
SRH OFF indicator status	☐ Light OFF ☐ Light ON ☐ Blink			
Headlight switch operation	☐ Lo-Hi switch available ☐ Lo-Hi switch unavailable			
Range inspection for CVT vehicle	☐ Shift indicator operates according to the shift position ☐ Shift indicator does not operate according to the shift position			
☐ Diagnostic Trouble Code				

Figure 3-59 Customer Interview Sheet

Function Check (Initialization)

Basic diagnostics of the Headlight systems includes a function check of SRH operation. This is referred to “as the initialization function”.

1. Stop the vehicle at approximately 1 m (3.3ft) away and perpendicular to the wall.
2. Make the vehicle vicinity dark.
3. Set the vehicle headlight switch to ON.
4. Make sure that both headlights' cut lines move immediately after the engine has started. (Together towards the inside (8 degrees) back to center and then to the outside (13 degrees)).

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Diagnostics by Phenomenon

If no diagnostic trouble codes have been created, diagnose the vehicle according to the chart below and the accompanying instructions in the service manual.

Symptoms
1. The auto headlight beam leveler does not operate.
2. The steering responsive headlight does not operate.
3. The steering responsive headlight operates in a direction different from the target.

Figure 3-60 Service Manual Chart

Utilizing the diagnostic procedure, basic inspections of the system should be performed in the event DTCs are not present. Diagnostics by phenomenon may lead to mechanical issues, such as severe vehicle alignment issues.

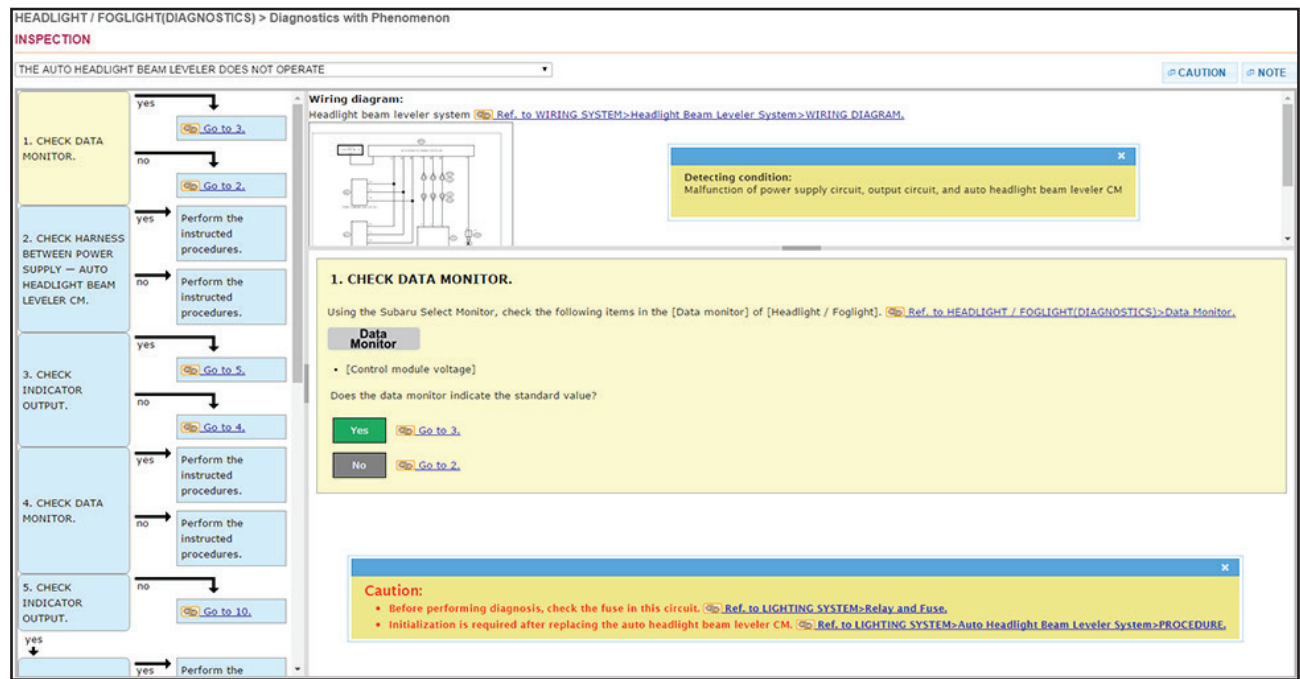


Figure 3-61 Diagnostics with Phenomenon

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Subaru Select Monitor (SSM)

Diagnostic Trouble Codes

Four new diagnostic trouble codes have been added to the headlight system. Follow the diagnostics with trouble codes procedures in the service manual to make accurate and timely repairs.

DTC	Description	Diagnostic details
B2908	SRH actuator error (RH)	Internal actuator error
B2909	SRH actuator error (LH)	
B2910	SRH actuator LIN communication error (RH)	LIN data from the actuator is not received or erroneous
B2911	SRH actuator LIN communication error (LH)	

Figure 3-62 SRH DTCs

Data Monitor

Basic Information related to SRH can be found using the Data Monitor function within the Headlight/Foglight Menu of the SSM.

	Item	Value	Unit
LT	Shift Position Signal	"P"	
LT	Trip Count	2118	Time
LT	Count	Common	
LT	Time Count	802200	ms
LT	R Sensor Signal	2.43	V
LT	Actuator Signal	0.0	%
LT	ECU ACC	13.94	V
LT	Vehicle Speed Signal	0.00	MPH
LT	H/L Lo Signal	ON	
LT	LED HEADLAMP(LH) error Signal	OFF	
LT	LED HEADLAMP(RH) error Signal	OFF	
LT	Steering Angle Signal	-32.8	deg
LT	MT Reverse SW	OFF	
LT	SRH-OFF SW	ON	
LT	Engine Speed	837	rpm
LT	Left Steering Responsive Headlight Current Angle	0.0	deg
LT	Right Steering Responsive Headlight Current Angle	0.0	deg
LT	Left Steering Responsive Headlight Target Angle	0.0	deg
LT	Right Steering Responsive Headlight Target Angle	0.0	deg
LT	Left Steering Responsive Headlight Power Supply Failure	Normal	
LT	Right Steering Responsive Headlight Power Supply Failure	Normal	
LT	Left Steering Responsive Headlight Motor Failure	Normal	
LT	Right Steering Responsive Headlight Motor Failure	Normal	
LT	Left Steering Responsive Headlight Sensor Failure	Normal	
LT	Right Steering Responsive Headlight Sensor Failure	Normal	
LT	SRH/ADB Setup Status	ON	

Figure 3-63 SSM4 SRH System Data

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Active Test

Active Test in the Headlight/Foglight menu allows for individual testing of each headlight assembly. Performing the active test allows the user to monitor the Target Angle and the Current Angle to determine if the assembly is performing correctly.

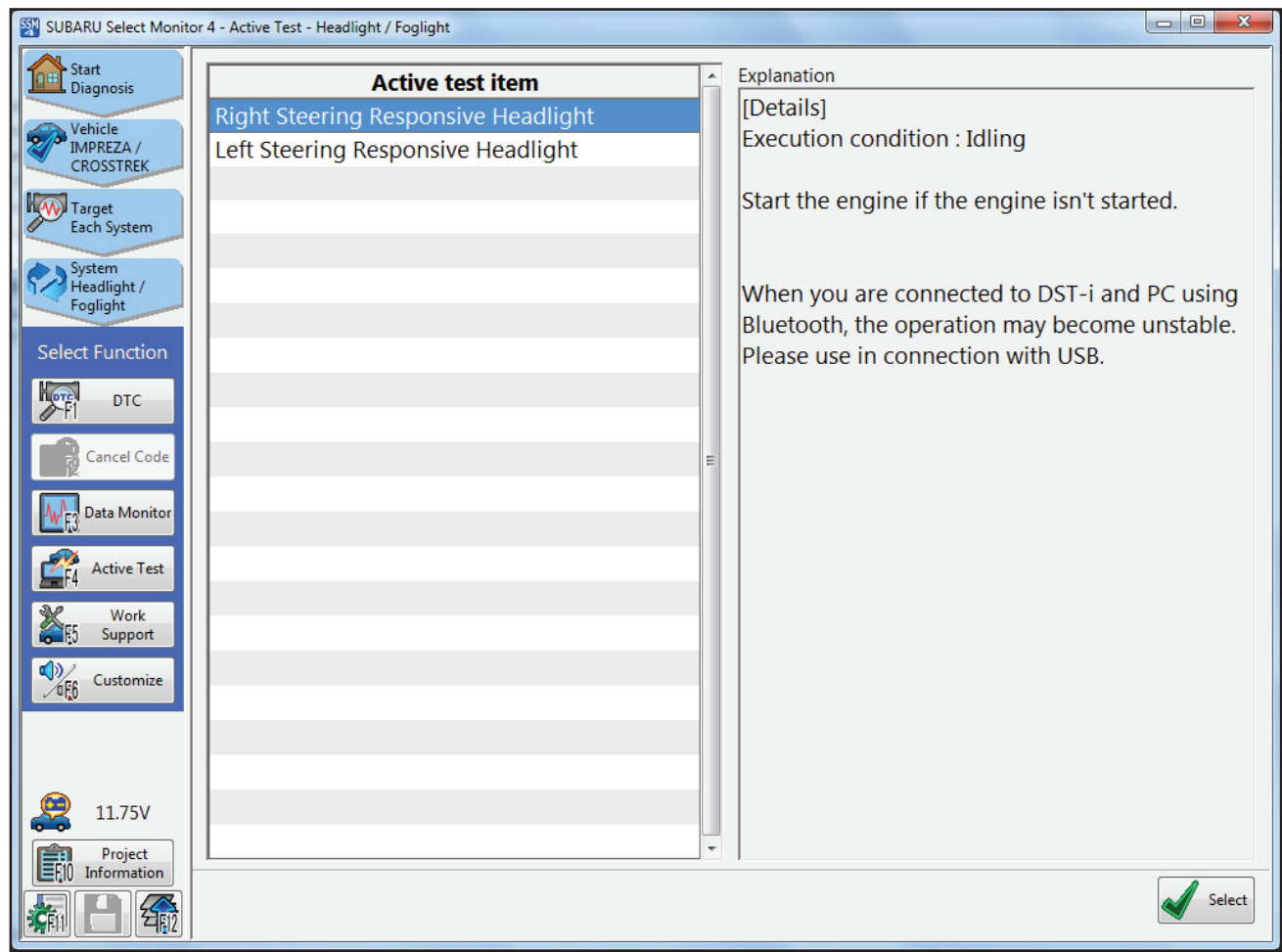


Figure 3-64 SSM – Active Test

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High Beam Assist (HBA)

Introduction

Introduced on some 2017MY Subaru vehicles, the High Beam Assist (HBA) system is designed to increase the use of the vehicle's High Beam headlights to improve low ambient light visibility. This is accomplished by automatically switching the headlights between high and low beam according to the conditions in front of the vehicle. The HBA system provides the following benefits to the driver:

Reduced operation of the headlight switch

Prevents driver from forgetting to turn off the high beams

Improves EyeSight® recognition during nighttime driving



Figure 3-65 2017MY Headlights



CAUTION

Do not overestimate the capacity of the high beam assist function. The driver always has the responsibility to understand the surrounding situation, to drive safely, and to change the headlight mode manually if necessary.

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System Operation

Based on the preceding (in front of the vehicle) conditions, the system will toggle the low and high beam headlights to maximize visibility while reducing distraction to other objects in front of the vehicle. The system detects light sources in a 30° (approximate) range in front of the vehicle. The range of detection is limited to the input method of the system and any environmental conditions that may exist.

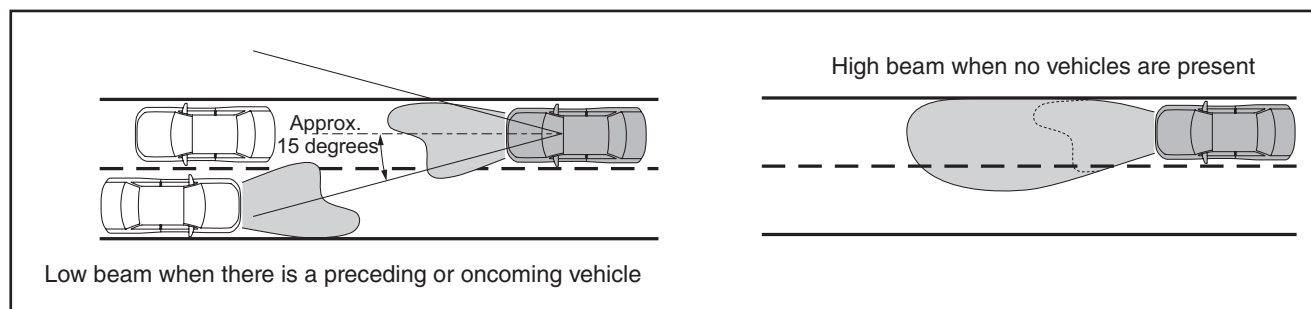


Figure 3-66 HBA System Operation

When any of the following conditions are met, the headlight will change to **high** beam

- When the vehicle speed increases to or above 20 mph (32 km/h).
- There is no preceding or oncoming vehicle
- The forward area of the vehicle is dark
- The road does not have a sharp curve

When any of the following conditions are met, the headlight will change to **low** beam

- When the vehicle speed decreases to or below 10 mph (16 km/h)
- When the forward area of the vehicle is bright
- When there is a preceding or oncoming vehicle
- When the EyeSight® system is malfunctioning or is temporarily stopped.

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The HBA system uses the EyeSight® (Ver. 3) system's stereo cameras to identify driving conditions such as oncoming vehicles and road curvature. However, light source identification may be derived from one of two potential sources depending on the model. On some models, the EyeSight® stereo cameras are used whereas other models utilize a dedicated Monocular camera mounted to the rear view mirror.

Model	Introduced in Model Year	Driving Condition Detection	Light Source Detection
Legacy/Outback	2017	EyeSight® Stereo Camera	Monocular Camera
Forester	2017	EyeSight® Stereo Camera	EyeSight® Stereo Camera
WRX	2017	Not Available	Not Available



Figure 3-67 EyeSight® Stereo Cameras and Monocular Camera

Advanced Electrical Systems & Diagnosis

Regardless of the input method, the HBA system will monitor the light source of objects in front of the vehicle such as the headlamps of oncoming vehicles, tail/brake lamps of preceding vehicles, street lights, and reflectors.

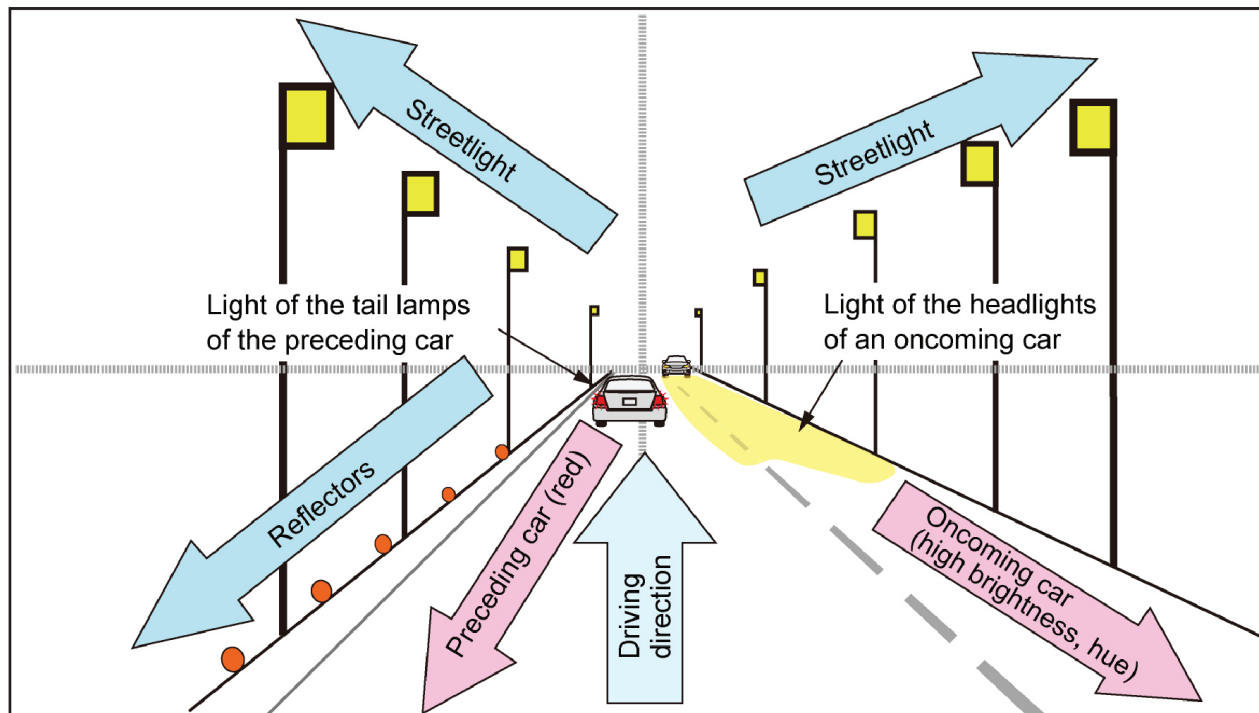


Figure 3-68 HBA Recognition Theory (Right hand drive image)



CAUTION

The High Beam Assist function recognizes surrounding objects based on the brightness of illumination in front of the vehicle.

Therefore, the headlight mode may not match the driver's sense in the following conditions (including, but not limited to):

- In bad weather (fog, snow, sand, storm, heavy rain, etc.)
- If there is light similar to headlights or tail lights in the surrounding area
- When an oncoming vehicle or vehicle ahead is driven without its headlights or tail lights
- There are objects that reflect light strongly, such as a road sign or a mirror
- Driving on a road with many ups and downs or uneven surfaces

***For a full listing of HBA warnings and cautions, consult the applicable Subaru Owner's Manual and/or Service Manual.**

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To enable the HBA system, the driver must select the “AUTO” position on the Light Control Switch and push the Turn Signal Lever forward to the “High Beam” position. When these two selections are made, a green “High Beam Assist Indicator” will be displayed on the combination meter.

NOTE:

The HBA function will not begin until the low beams are turned on as judged by the auto headlight system (light sensor).



Figure 3-69 Turn Signal Lever — AUTO Position

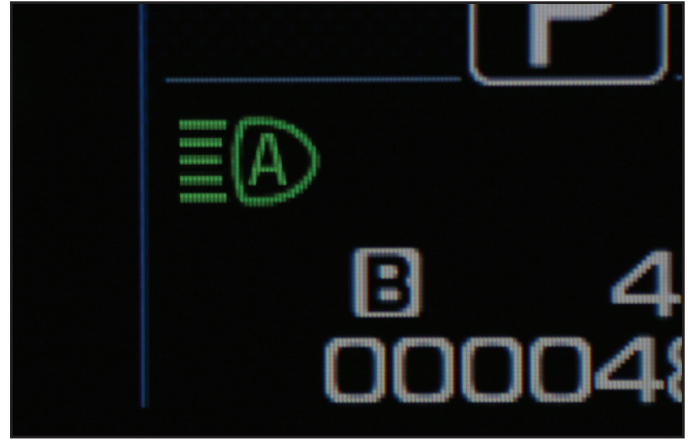


Figure 3-70 High Beam Assist Indicator

The sensitivity of the HBA system can be temporarily lowered by the user based on the systems performance in certain environments. Depending on the model, this may be accomplished through the use of the steering wheel mounted “Following Distance” switch or rear view mirror “Automatic Dimming ON/OFF” button. Consult the appropriate Owner’s Manual for specific directions.

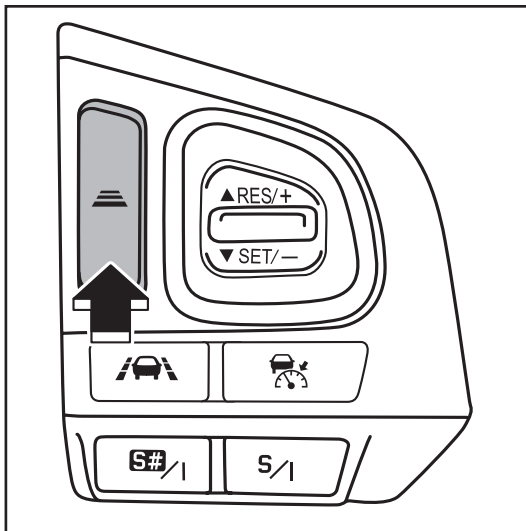


Figure 3-71 Following Distance Switch

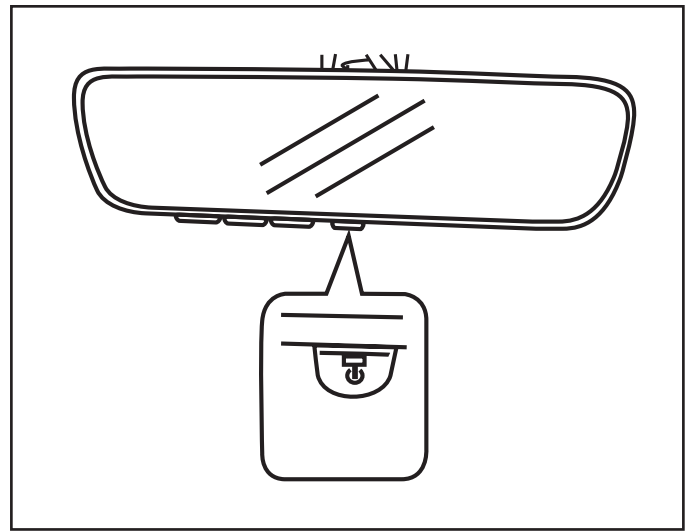


Figure 3-72 Automatic Dimming ON/OFF Button

NOTE:

The sensitivity of the high beam assist function returns to normal level the next time the ignition switch is turned to the “LOCK”/ “OFF” position and the engine is restarted.

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Construction

Currently, there are two types of HBA input methods. However, both systems feature the same basic functionality.

- EyeSight® stereo cameras for light source detection
- Monocular camera for light source detection

2017MY Forester uses the EyeSight® (Ver. 3) stereo camera as the primary input for HBA judgements. On these vehicles, the EyeSight® system uses the vehicle's CAN network to transmit and receive any and all necessary information to allow for HBA function.



Figure 3-73 Eyesight® Stereo Cameras

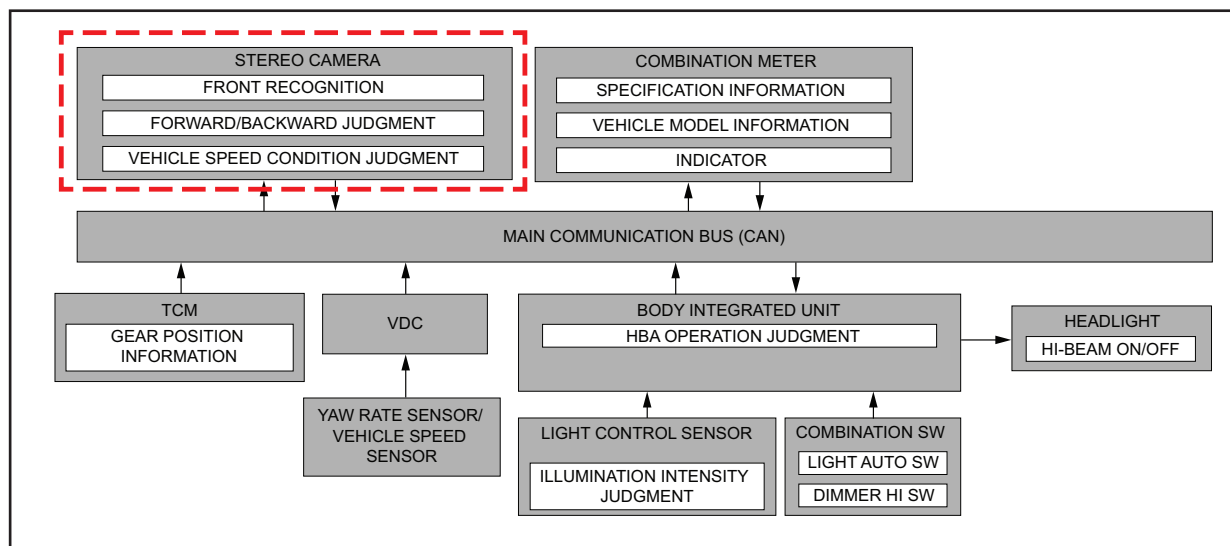


Figure 3-74 HBA System Architecture - EyeSight®

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2017 Legacy and Outback models utilize a dedicated Monocular (single) camera mounted to the rear view mirror. The Monocular Camera also serves as the High Beam Assist Module.

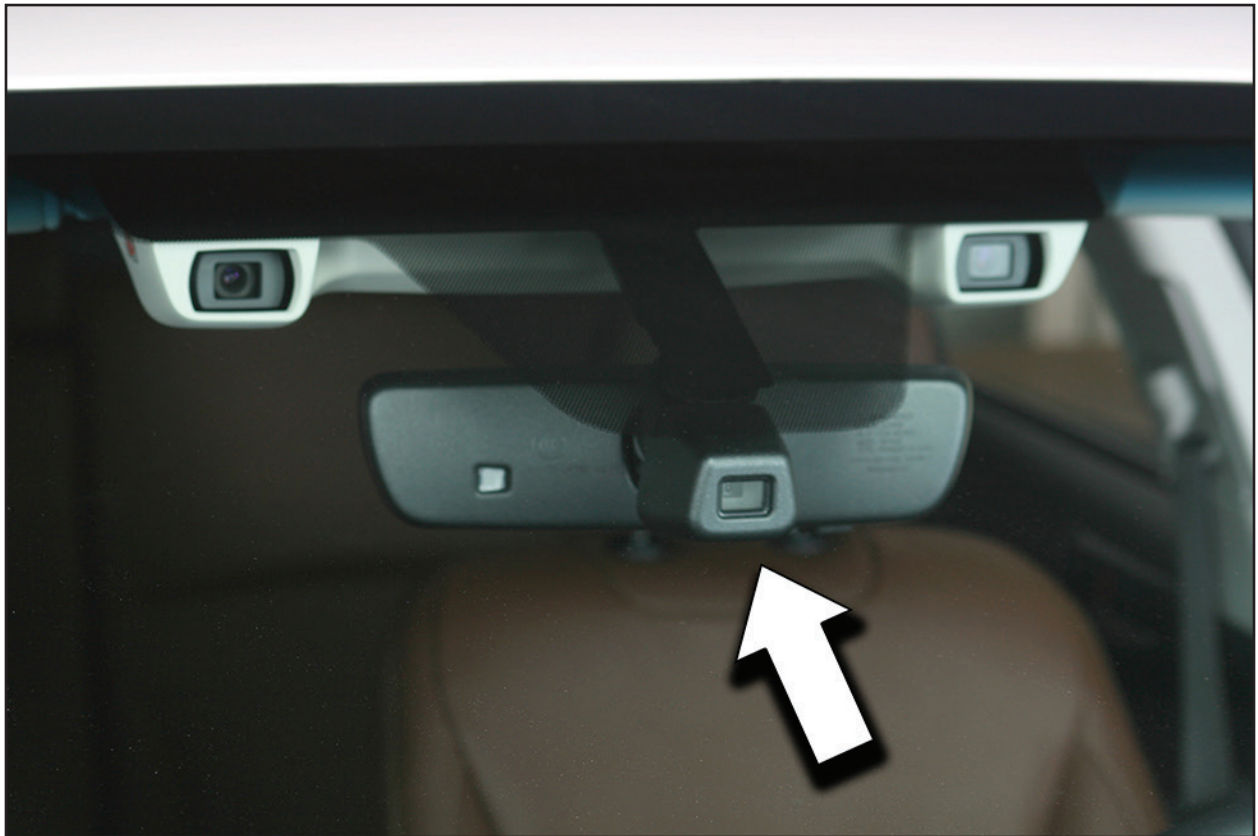


Figure 3-75 Monocular Camera

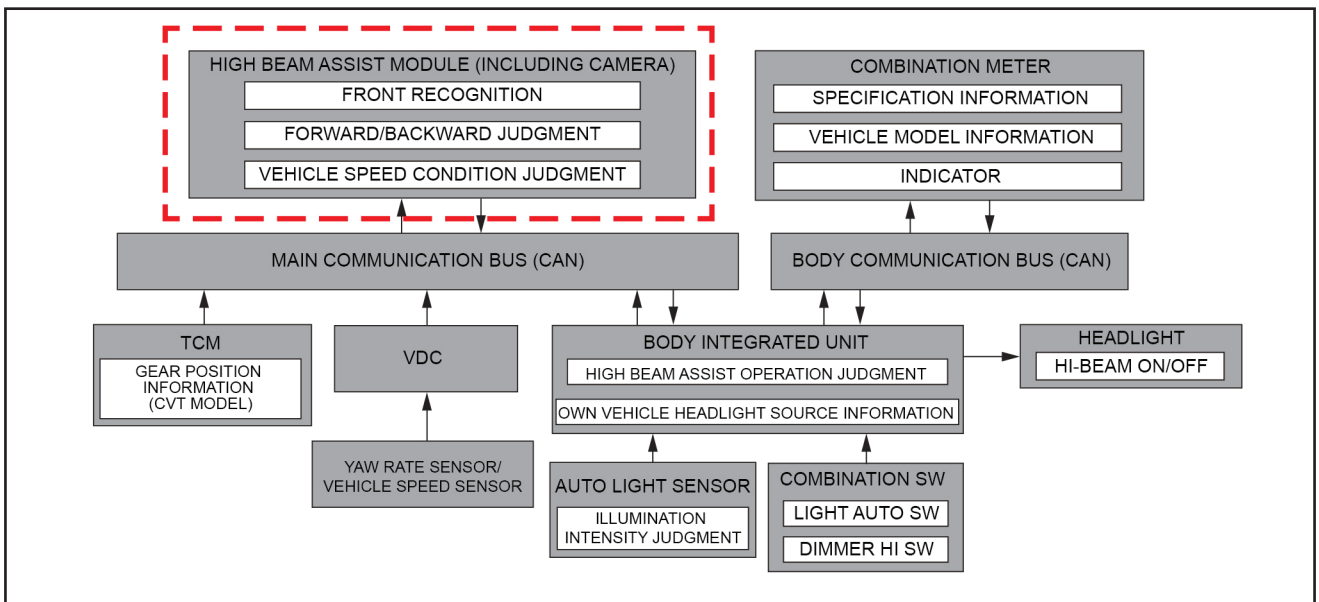


Figure 3-76 HBA System Architecture – Monocular

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Rear view mirrors that utilize the monocular camera also feature a front light sensor to measure the ambient source in the forward direction.



Figure 3-77 Front Light Sensor

The HBA Unit/Monocular Camera is directly connected to the vehicle's Main CAN network to transmit and receive necessary information for HBA function.

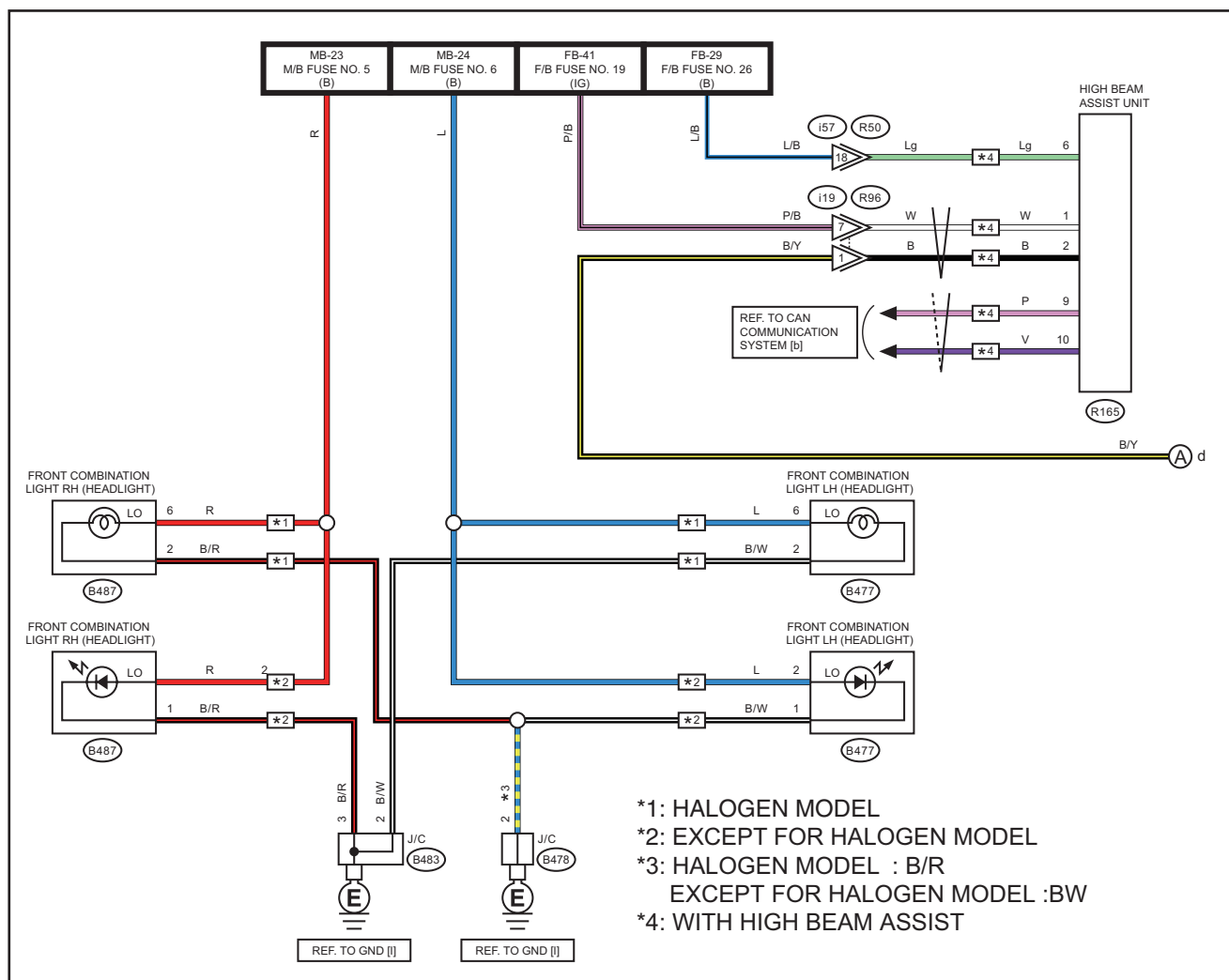


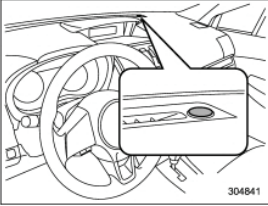
Figure 3-78 Wiring Diagram — Monocular

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Service

On certain models, the HBA system may be disabled based on customer request as outlined in the Owner's Manual.

▼ Sensor for the auto on/off headlights (if equipped)

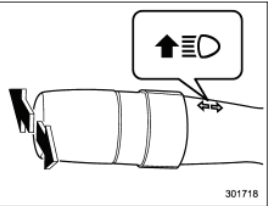


The sensor is on the instrument panel as shown in the illustration.

CAUTION

If any object is placed on or near the sensor, the sensor may not detect the level of the ambient light correctly and the auto on/off headlights may not operate properly.

■ High/low beam change (dimmer)



To change from low beam to high beam, push the turn signal lever forward. When the headlights are on high beam, the high beam indicator light  on the combination meter is also on.

To switch back to low beam, pull the lever back to the center position.

▼ High beam assist function (if equipped)

NOTE

- The high beam assist function utilizes the stereo camera installed at the position of the front map lights.
- For details on how to handle the stereo camera, refer to the Owner's Manual supplement for the EyeSight

system.

The high beam assist function automatically changes the headlight from high beam to low beam (or vice versa).

When all of the following conditions are met, the headlight will change to high beam.

- When the vehicle speed increases to or above 20 mph (32 km/h).
- There is no preceding or oncoming vehicle.
- The forward area of the vehicle is dark.
- The road does not have a sharp curve.

When any of the following conditions is met, the headlight will change to low beam.

- When the vehicle speed decreases to or below 10 mph (16 km/h).
- When the forward area of the vehicle is bright.
- When there is a preceding or oncoming vehicle.
- When the EyeSight system is malfunctioning or is temporarily stopped.

NOTE

The factory setting (default setting) for this function is set as "operational". This setting can be changed to OFF (non-operation) at SUBARU dealers.

– CONTINUED –

3-96 Instruments and controls/Light control switch

For more details, contact a SUBARU dealer.

▼ How to use the high beam assist function

The high beam assist function will be activated when all the following conditions are met.

- The light control switch is in the "AUTO" position and the low beam headlights are on automatically.
- The turn signal lever is pushed forward.

NOTE

If the high beam assist function is malfunctioning or is temporarily stopped, the headlight will be fixed at low beam. For details, refer to the Owner's Manual supplement for the EyeSight system.

▼ How to temporarily lower the sensitivity of the high beam assist function

The sensitivity of the high beam assist function can be lowered by the following conditions.

- The sensitivity of the high beam assist function cannot be lowered in the following conditions.
 - Cruise control or Adaptive Cruise Control is in operation
 - The EyeSight warning indicator (yellow) is illuminated
- The sensitivity of the high beam assist function returns to normal level the next time the ignition switch is turned to the "LOCK"/"OFF" position

Figure 3-79 2017MY Owner's Manual — HBA Operational Setting

Fulfillment of this request is accomplished by accessing the function setting in the Body Control menu on the Subaru Select Monitor.

	Current Setting Value	Changed value	Setting Reading Val.	
	Item		Setting value	
	Buzzer sounding setting	OFF	ON	
	Abnormal warning lamp flashing setting	OFF	ON	
	Door open warning	OFF	ON	
	Dome Light Alarm Setting	OFF	ON	
	Auto A/C Setting	OFF	ON	
	Wiper Deicer setting	OFF	ON	
	Sedan/Wagon Setting	Sedan	Wagon	
	MT/AT Setting	MT	AT	
	Seat Memory Setting	No Support	Support	
	Illumination Sensor Setting	OFF	ON	
	Factory initial setting	Market	Factory	
	Sunroof setting	OFF	ON	
	Welcome Light (Exit)	OFF	30s	60 s
	Welcome Light Off Delay Time(Approaching)	OFF	30s	60 s
	Keyless Buzzer Volume	1	2	3
		6	7	
	Wiper link Auto Light Setup	OFF	ON	
	High Beam Assist Function	No Support	Support	
	High Beam Assist Current Setting	OFF	ON	
	Head Lamp Low Beam Specification	Halogen	HID	LED
	Head Lamp High Beam Specification	Halogen	HID	LED

Figure 3-80 Body Control Customizing — Monocular

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Inspection

The HBA system requires that a specific area of the front windshield be free from oil film, dirt, fogging, scratches, or any accessories (such as Electronic Toll Collection (ETC), stickers, or labels) in order to perform correctly. Always inspect the specified area of the windshield during basic diagnosis.

On EyeSight® models, the prohibited area remains the same as the primary input for the HBA system is the Stereo Cameras.

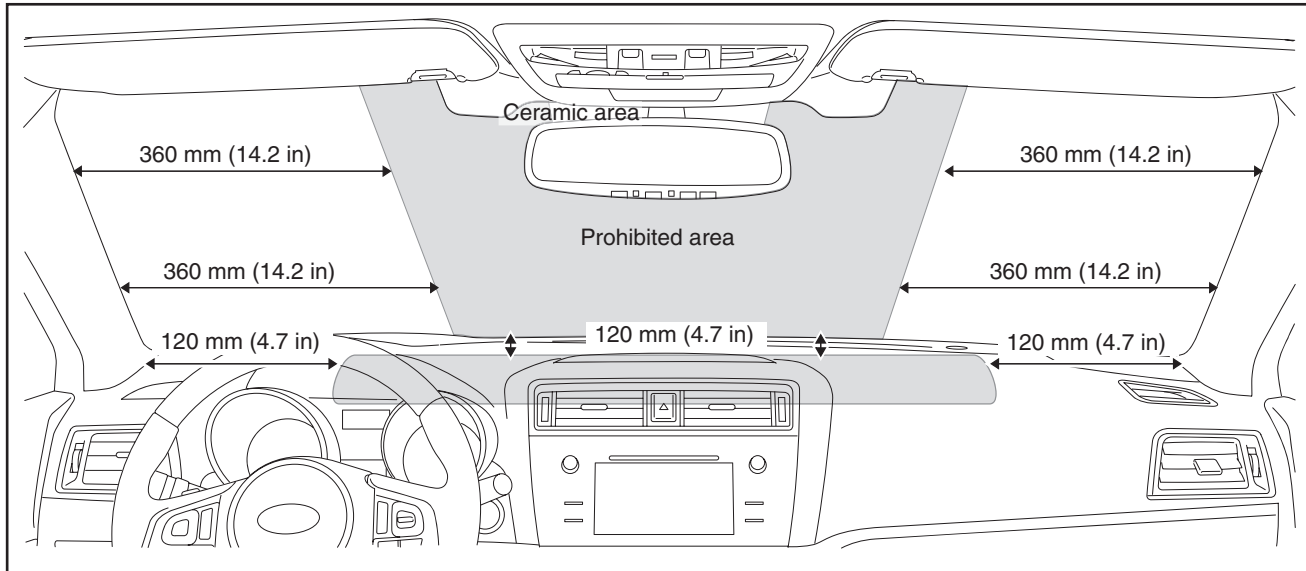


Figure 3-81 EyeSight® Prohibited Areas

Models that utilize a Monocular Camera have an additional “prohibited area” in the front windshield. This area must be free of oil film, dirt, fogging or any other obstructions in order for the HBA system to function properly.

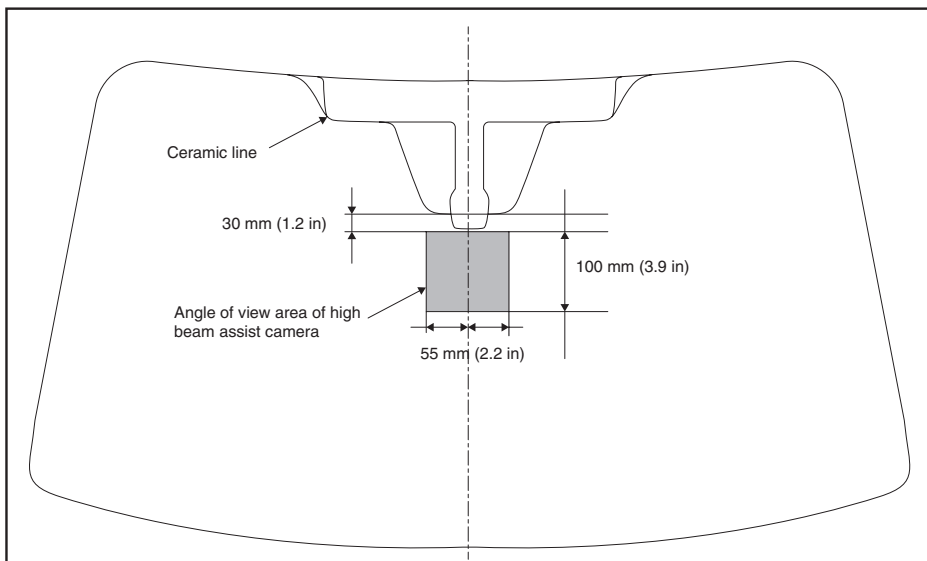


Figure 3-82 Monocular Camera Prohibited Area

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Additionally, the monocular camera should have the lens surface inspected for contamination such as cleaner residue or fingerprints.

NOTE: If the Monocular camera is touched it is possible to clean the lens using a soft cloth.



Figure 3-83 Monocular Camera and Lens

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Diagnostics

A “yellow” High Beam Assist warning indicator may be displayed on the Combination Meter Multi Information Display (MID) if a malfunction is present in the system (Monocular camera vehicles).

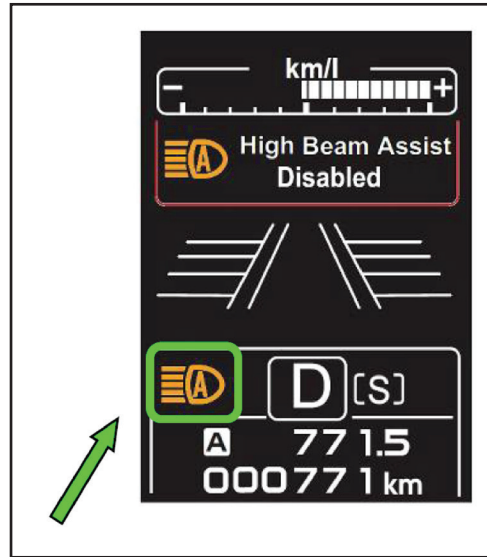


Figure 3-84 HBA Malfunction Indicator

Basic diagnosis of the HBA system should always begin with the completion of the Check List for Interview found in the Service Manual.

High Beam Assist Check List for Interview		Date of Vehicle Bring-in			Year	Month	Day	
Customer's name		Registration No.		Initial year of registration		Year	Month	Day
		Vehicle model		Frame number				
Interviewer	Inspector	Engine type		Odometer reading				
Customer specified content								
Date and time when the symptom occurred	Year	Month	Date	Approximate time				
Frequency of symptom occurrence	Always occurs Sometimes occurs (times per day/ times per month)							
Conditions upon symptom occurrence	Weather		• Fine • Cloudy • Rainy • Snowy • Foggy • Other ()					
	Temperature		°C (°F) — °C (°F)					
	Vehicle speed		km/h (MPH) to km/h (MPH)					
	Road condition		• Dry • Wet • Accumulated snow • Unpaved road • Bumps (uneven) Other ()					
	Road conditions		Own vehicle • Straight • Gentle right-hand curve • Gentle left-hand curve • Sharp right-hand curve • Sharp left-hand curve • Uphill • Downhill • Intersection • Top of the hill • Other () Oncoming vehicle • No oncoming vehicle • Straight • Gentle right-hand curve • Gentle left-hand curve • Sharp right-hand curve • Sharp left-hand curve • Uphill • Downhill • Intersection • Top of the hill • Other () Headlight of oncoming vehicle • HID/LED (white) • Halogen • Only one side was lit • Other ()					
Conditions upon symptom occurrence		Road conditions		Preceding vehicle		• No preceding vehicle • Straight • Gentle right-hand curve • Gentle left-hand curve • Sharp right-hand curve • Sharp left-hand curve • Uphill • Downhill • Intersection • Top of the hill • Other ()		
				Number of street light ahead		• 0 • 1 • 2 • 3 • 4 • 5 • More ()		
				Reflection board/Signs		• 0 • 1 • 2 • 3 • 4 • 5 • More () • Red • White • Blue • Other ()		
		Vehicle status		Number of passengers: (Front seats: /Rear seats:)		Cargo room load capacity		
				Tire inflation pressure (when vehicle was brought in)		• Front wheel kPa (psi) • Rear wheel kPa (psi)		
		Driving duration and distance with the described load condition		• Distance km (mile) • Time minutes				
		Driving environment before symptom occurrence (Approximately 10 minutes before the occurrence)		• Inner city (surroundings are bright by street lights) • Suburbs (surroundings are relatively dark due to sparse street lights)				
Accessory installation condition								
Diagnostic code								
Other		NOTE: • Describe things that were noticed, if any. • Attach illustration or photo of the road ahead of the vehicle at the time of the symptom occurrence.						

Figure 3-85 HBA Check List for Interview

Data related to the HBA system's inputs and outputs can be found under the EyeSight® system Data Monitor information.

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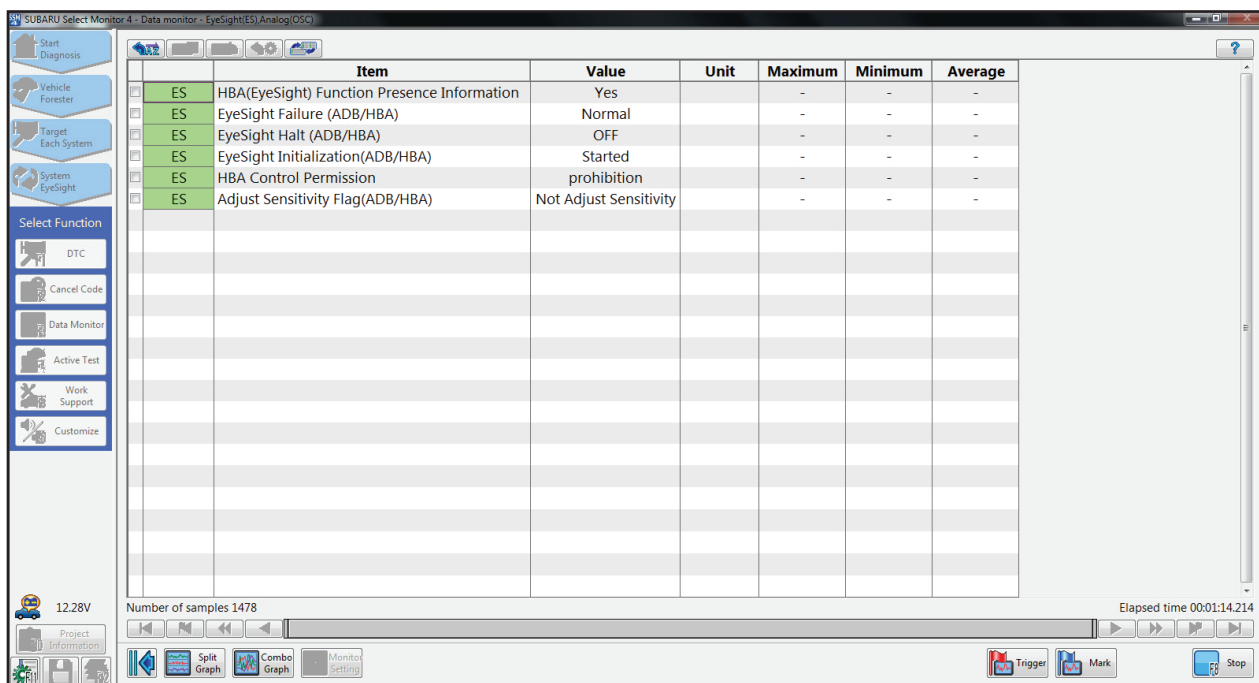


Figure 3-86 HBA Data Monitor — EyeSight®

Models that use a Monocular camera contain HBA related data within the Body Control system menu of the SSM.

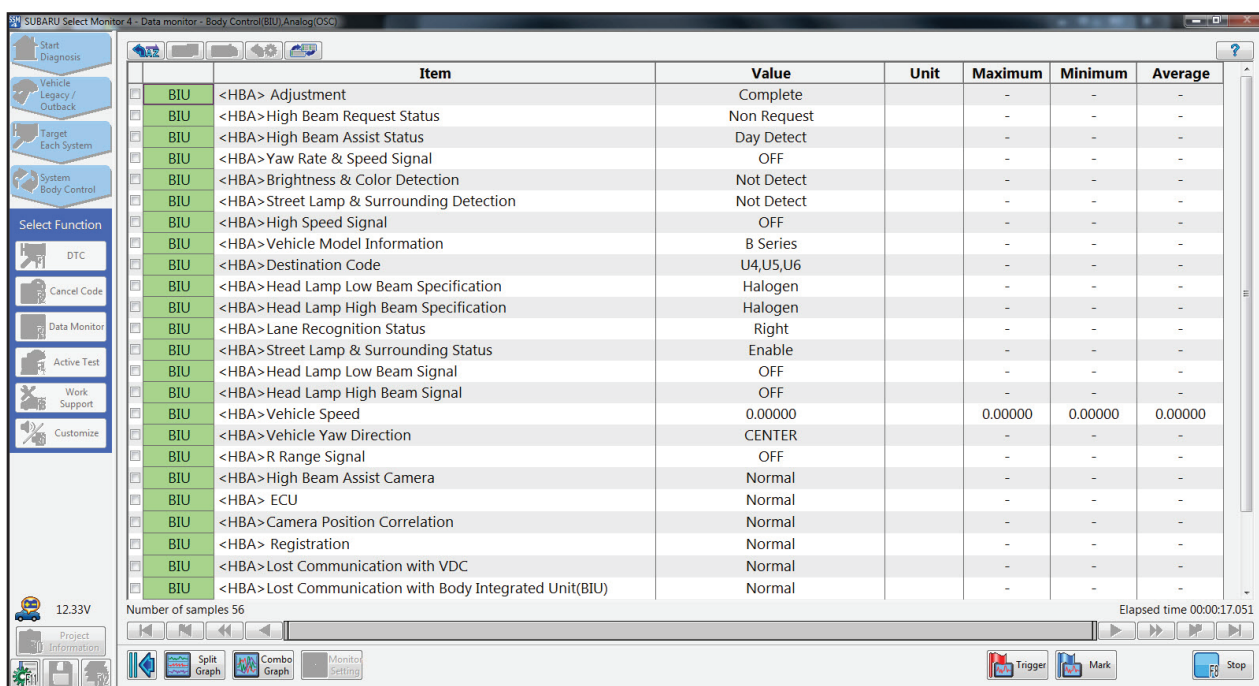


Figure 3-87 HBA Data Monitor — Monocular

NOTE:

Both HBA systems are equipped with a self-adjusting function. As a result, no aiming is required during removal or replacement.

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EyeSight® based systems do not contain any unique HBA DTCs since the system contains no unique components. However, monocular camera systems contain approximately eleven unique DTCs due to the additional complexity.

DTC	Item	Note
B2680	HIGH BEAM ASSIST SENSOR	<Ref. to BC(diag)-60, DTC B2680 HIGH BEAM ASSIST SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B2681	HIGH BEAM ASSIST CONTROL MODULE	<Ref. to BC(diag)-62, DTC B2681 HIGH BEAM ASSIST CONTROL MODULE, Diagnostic Procedure with diagnostic Trouble Code (DTC).>
B2682	HIGH BEAM ASSIST UNIT FIELD OF VIEW	<Ref. to BC(diag)-65, DTC B2683 VEHICLE SPECIFICATION INFORMATION REGISTRATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U111F	<HBA>LOST COMMUNICATION WITH BODY CONTROL MODULE	<Ref. to BC(diag)-75, DTC U111F <HBA>LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1145	<HBA>LOST COMMUNICATION WITH BODY CONTROL MODULE	<Ref. to BC(diag)-75, DTC U1145 <HBA>LOST COMMUNICATION WITH BODY CONTROL MODULE. Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U115A	<HBA>LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE	<Ref. to BC(diag)-76, DTC U115A <HBA>LOST COMMUNICATION INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U123C	LOST COMMUNICATION WITH HIGH BEAM ASSIST CONTROL MODULE	<Ref. to BC(diag)-76, DTC U123C LOST COMMUNICATION WITH HIGH BEAM ASSIST CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U141A	<HBA>INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE	<Ref. to BC(diag)-76, DTC U141A <HBA>INVALID DATA RECEIVED FROM VEHICLE DYNAMICS CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U142A	<HBA>INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE	<Ref. to BC(diag)-76, DTC U142A <HBA>INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1446	<HBA>INVALID DATA RECEIVED FROM BODY CONTROL MODULE	<Ref. to BC(diag)-76, DTC U1446 <HBA>INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE, Diagnostic Trouble Code (DTC).>
U153D	INVALID DATA RECEIVED FROM HIGH BEAM ASSIST CONTROL MODULE	<Ref. to BC(diag)-76, DTC U153D INVALID DATA RECEIVED FROM HIGH BEAM ASSIST CONTROL MODULE, Diagnostic Procedure with Diagnostic trouble Code (DTC).>

Figure 3-88 HBA DTCs — Monocular

Use the BIU customizing Menu to adjust the automatic headlight sensitivity.

If a customer prefers that the automatic headlights activate closer to dark and turn off early after sunrise then select “Dull”.

If long before dark and long after Sunrise operation is preferred then select “Very Sensitive”

Normal and sensitive fall in between the two extremes.

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Welcome Lighting

For added night time security, the 2015 Legacy and Outback feature standard Welcome Lighting that automatically turns on cabin illumination and exterior lights (low beams and position lamps) as the driver approaches/unlocks or leaves/locks the vehicle.



Figure 3-89 Welcome Lights OFF



Figure 3-90 Welcome Lights ON

Review operating conditions for Welcome Lamp operation

Welcome Lighting operating conditions for approaching the vehicle

- Lighting ON
 - Doors are unlocked with the remote key
 - The Headlight switch is set to the “AUTO” position
 - The area around the vehicle is dark (Light Sensor input)
- Lighting OFF
 - Doors are relocked
 - The Headlight switch is turned to a position other than “AUTO”
 - The Ignition switch is turned to the “ON” or “ACC” positions
 - Automatically, based on a customizable Delay Time setting (30/60/90 sec).

Welcome Lighting operating conditions for leaving/Exiting the vehicle

- Lighting ON
 - When Ignition switch is turned to the “OFF” position or key is removed from ignition
 - The area around the vehicle is dark (Light Sensor input)
- Lighting OFF
 - The Headlight switch is turned to a position other than “AUTO”
 - The “Locking” operations is performed twice from either the door handle or keyless remote
 - Automatically after Driver’s door has been opened and closed, based on a customizable Delay Time Setting (30/60/90 sec)
 - Automatically after 3 min. even if the Driver’s door is opened, but not closed. (To conserve the battery)

Approach and Leaving/Exiting Delay times can be adjusted for Welcome Lighting through the BIU or Combination Meter. This can be set to 30, 60, or 90 second delays.

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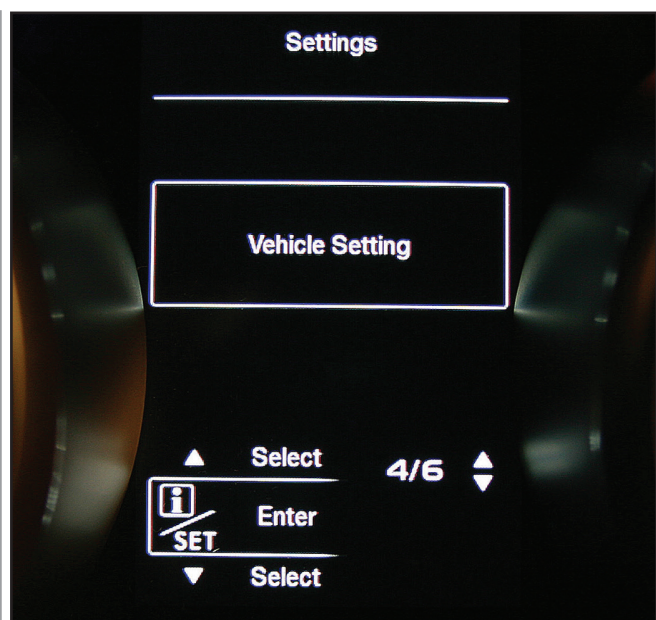


Figure 3-91 Vehicle Settings

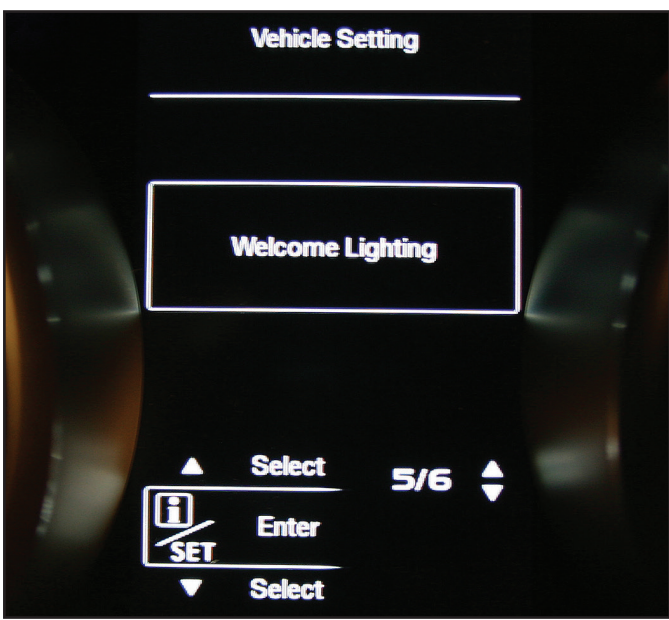


Figure 3-92 Welcome Lighting

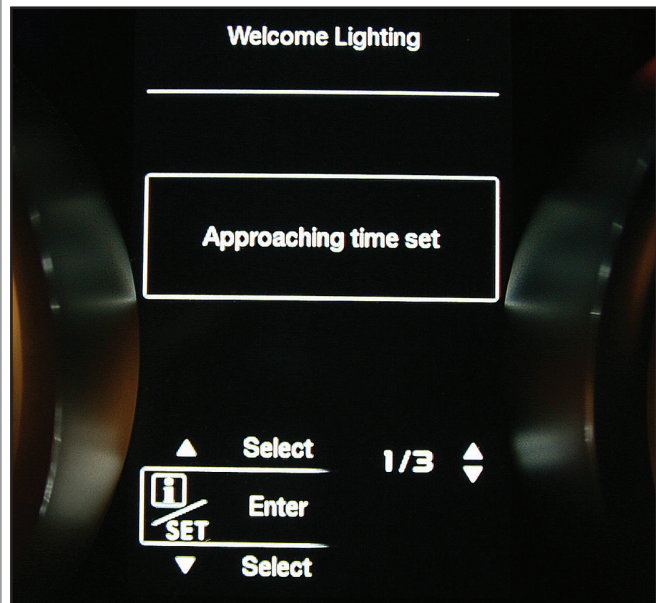


Figure 3-93 Approaching Time Set

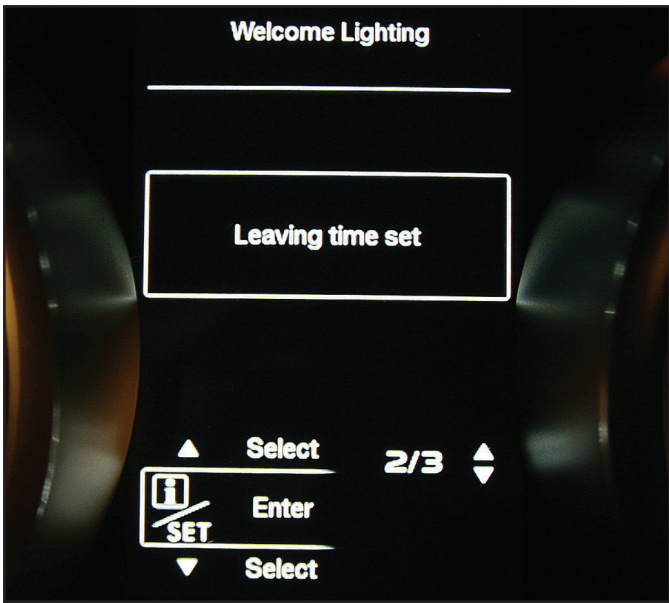


Figure 3-94 Leaving Time Set

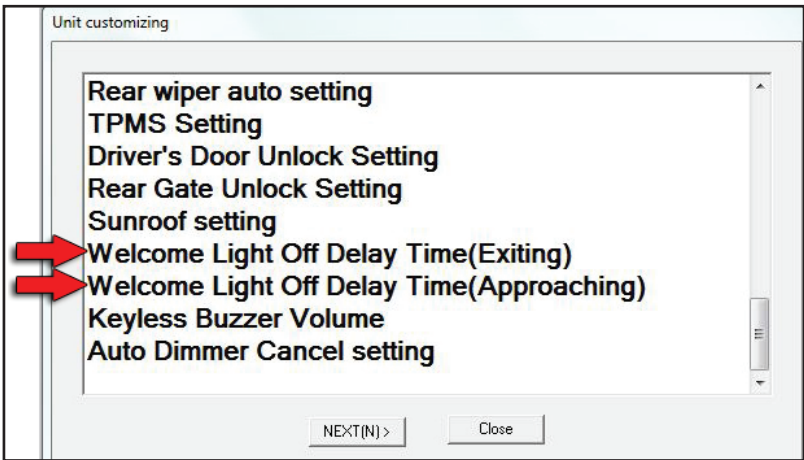


Figure 3-95 BIU Customizing

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Soft Close/Open Power Windows

First used on the 2017 Impreza, a soft open/close power window system is used to improve passenger comfort.

An Auto Open/Close function is also used for the driver and passenger side front power windows and rear window on (some applications) to enhance convenience. A speed control function has been added when the windows are operating automatically.

- The speed of the windows decrease slightly before they are fully closed or opened
- Window moves slowly at the end of travel to reduce unpleasant sounds

Pulse Width Modulation is used to control the motor speed.

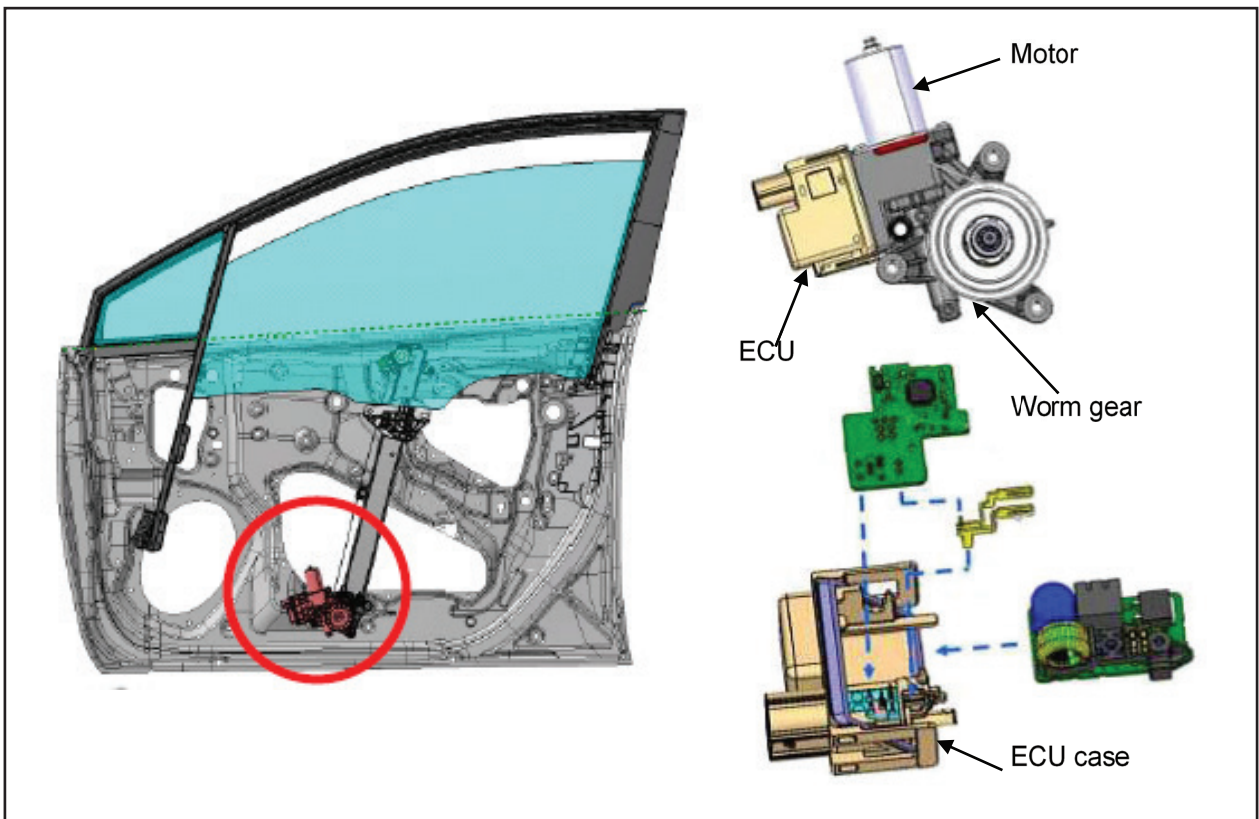


Figure 4-1 Power Window Construction

Each soft/open close window motor assembly is fitted with a control module. The window motor control modules receive input from the motor switch through the BIU over a LIN bus communication circuit. The door mounted window switch for all windows except the Left front (Driver's) are wired as an input to each window module.

Each window motor/module will not operate until it is commanded by the BIU.

As a failsafe, if the LIN bus communication circuit fails, power window operation is still possible by repeatedly operating or holding the power window switch at the desired door.

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Details of Up/Down Speed Control

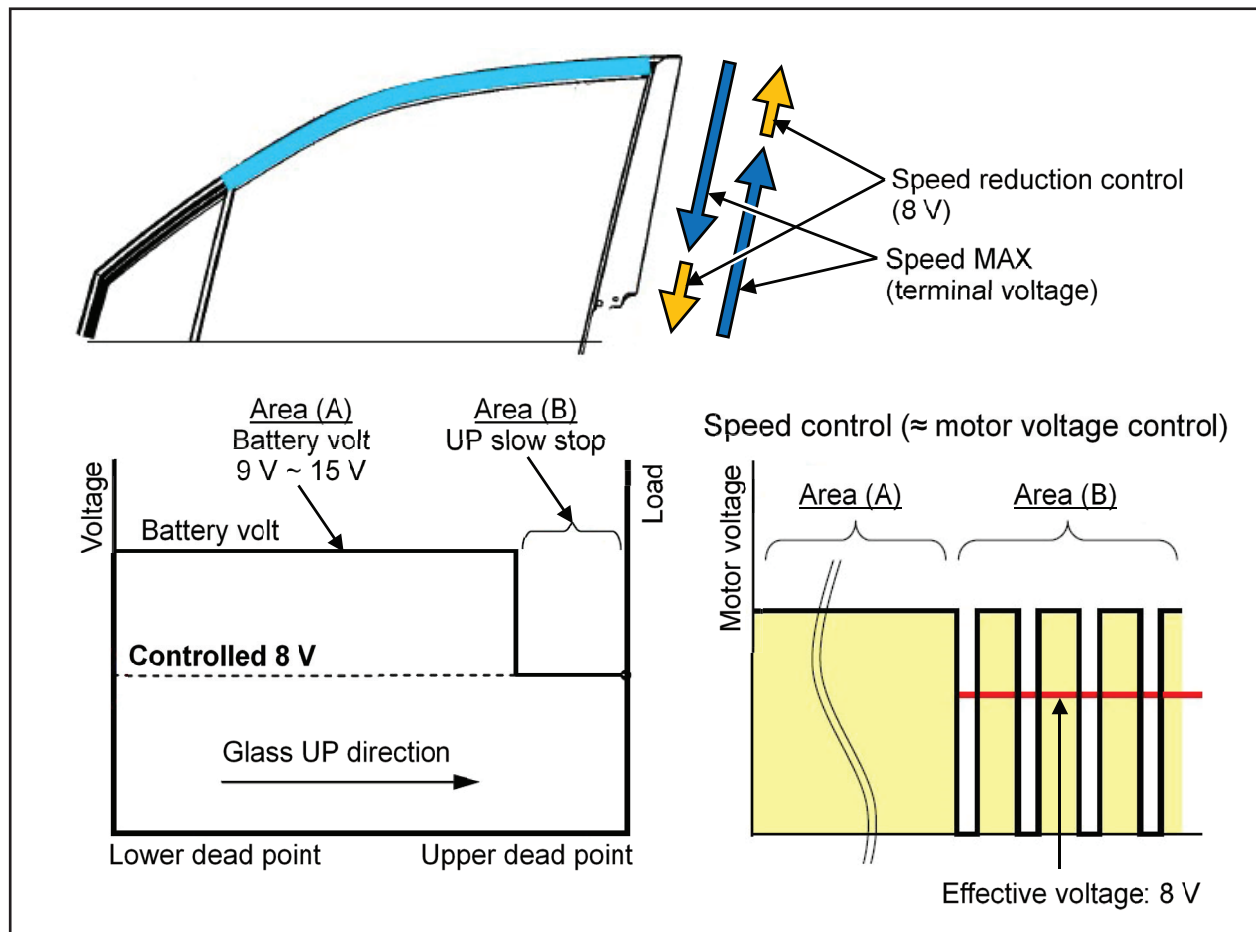


Figure 4-2 Power Window Operating Logic

The Select Monitor is able to communicate through the BIU with the Power Window Control Units for operational data and Active Tests.

NOTE:

Initialization is accomplished by moving the window to the fully open position and continue holding the switch to the open position for a few seconds. Then move the window to the fully closed position and continue holding the close button for a few seconds.

Window initialization is not lost on models equipped with this system when the battery is disconnected. If a window closes or stops in the wrong position, the values can be cleared using the Select Monitor. Then reinitialize the window.

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A sensor mounted onto the power window control unit interfaces with the alternating magnet poles of a magnetic sleeve that is press fitted onto the window drive mechanism.

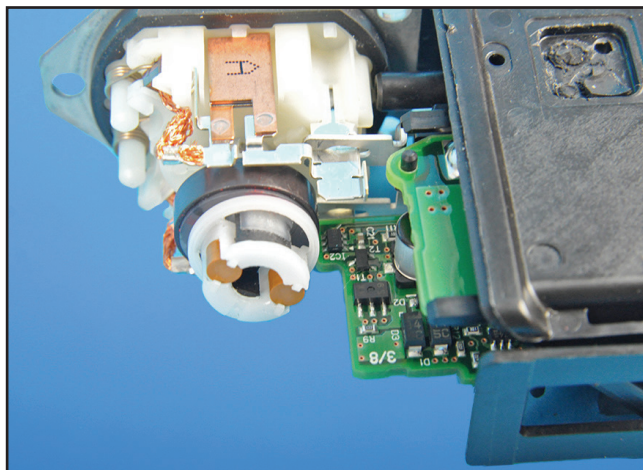


Figure 4-3 Pulse Sensor

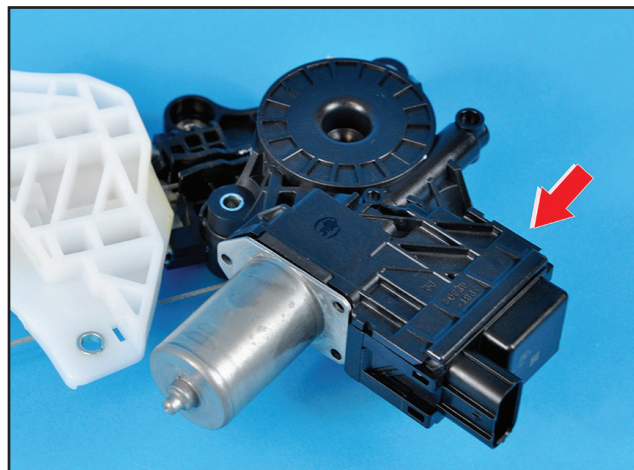


Figure 4-4 Power Window Control Unit

As the motor operates, the changing magnetic poles create input signals that allow the power window control unit to determine the window position (provided the initialization process has been completed).

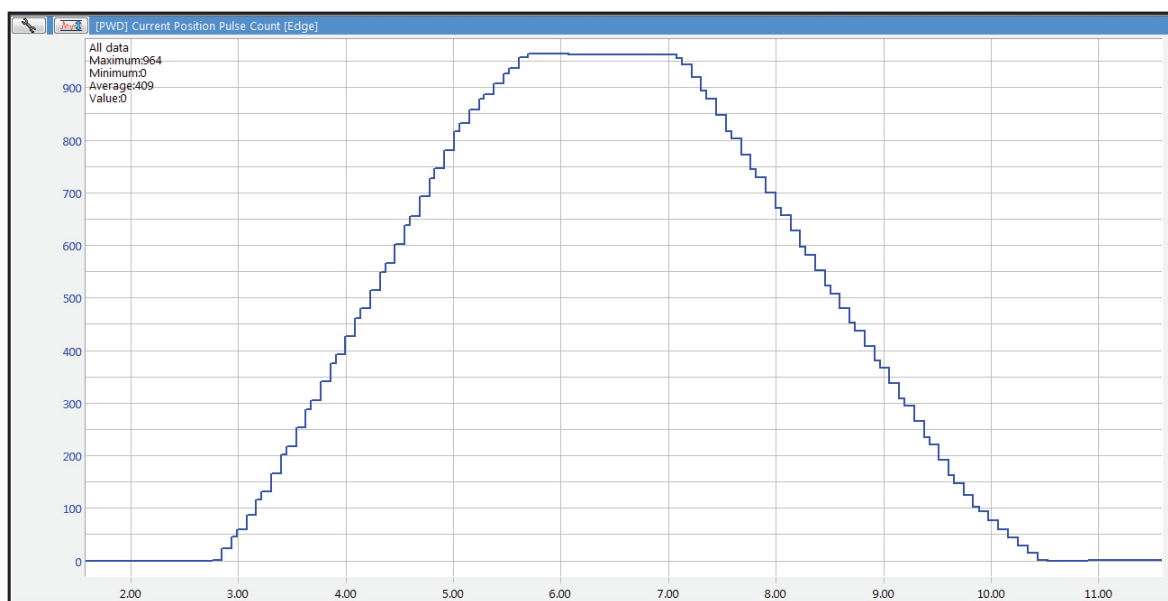


Figure 4-5 Pulse Count Graph

The changing magnetic poles create 4 pulses per revolution. These pulses can be observed on the Select Monitor (approximately 975 pulses to travel from the full open to the full closed position).

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The motor output engages with a worm gear that turns the window regulator drive gear. It takes 75 turns of the worm gear to equal 1 turn of the regulator drive gear.

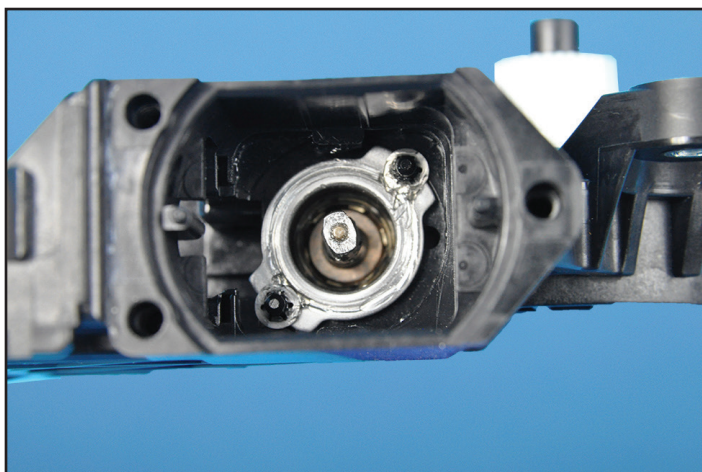


Figure 4-6 Worm Gear



Figure 4-7 Window Regulator Drive and Driven Gears

The regulator drive gear turns approximately 3.24 times to move the window from the fully open position to the fully closed position.

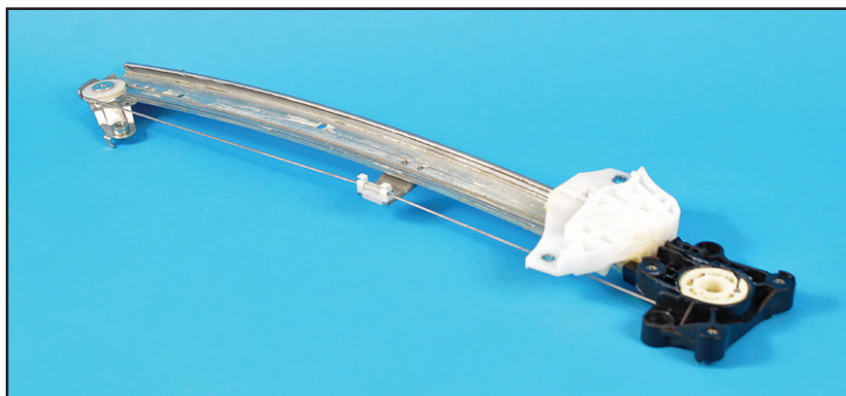


Figure 4-8 Power Window Regulator

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Power Rear Gate (PRG)

Spindle Drive Style

The spindle drive style Power Rear Gate (PRG) system was introduced on the 2014 Forester and only used on 2014-2018MY Forester. This system uses a motor to drive a threaded rod and nut to operate a lift rod attached to the rear gate. The system also uses two gas charged rear gate stays.

The PRG provides an electric powered opening and closing feature that is controlled through a touch switch on the rear gate, instrument panel, keyless access remote, or the mechanical keyless entry key.



Figure 5-1 Rear Gate

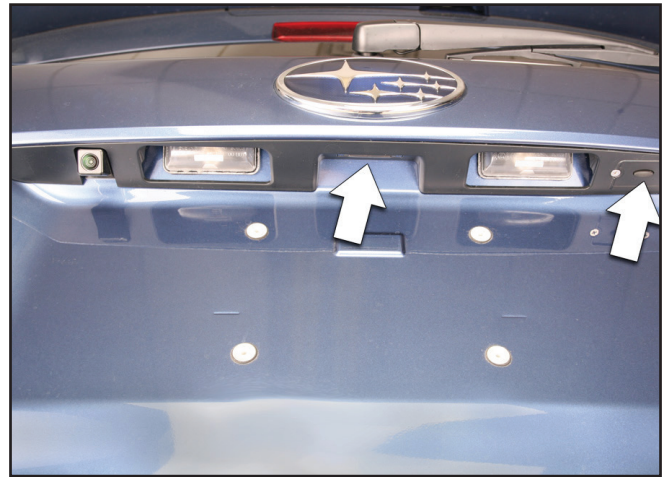


Figure 5-2 Gate Opener Switch Location & Keyless Access Lock Button

The opener switch on the PRG is located between the rear license plate light lenses.



Figure 5-3 Gate Opener Switch

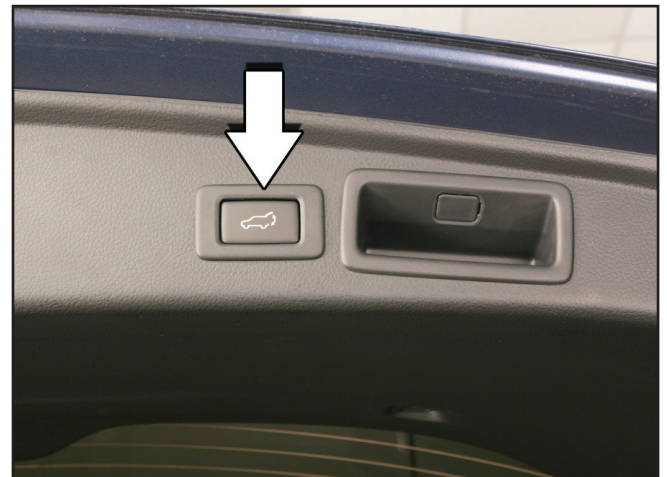


Figure 5-4 Gate Inner (Close) Switch

The closer switch of the PRG is mounted next to the close handle.

NOTE: Do not force the PRG closed if a memorized position has been set or if the PRG is partially open. Damage to the PRG Drive Unit may occur.

Warning: Keep away from the closing area of the rear gate (PRG). The outer edge of the rear gate (PRG) beyond the touch sensor cannot detect solid objects and will not trigger a safety maneuver until the amperage of the rear gate (PRG) exceeds pre-established specifications.

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The Keyless Access and Push Button Start Remote key (KAC) can be used to open and close the PRG if the ignition is in the off position. Press the PRG switch for more than 2 seconds to toggle between the open and close operation. The PRG memory switch and the interior PRG opener/closer switch are located to the lower left of the steering column.



Figure 5-5 KAC Remote Transmitter & Keyless Entry Key



Figure 5-6 Interior PRG Open/Closer Switch



Figure 5-7 Gas Shock and PRG Connecting Rod

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Operation Mode

The system only operates, when the vehicle status is “not moving” and the following conditions exist:

1. AT model: Shift lever is in P position.
2. MT model: Parking brake is applied.
3. If the rear gate is open and the vehicle starts to move, the PRG will not operate and the gate will remain open. A caution buzzer alerts the driver that the rear gate is open.
4. If a switch is pushed while the rear gate is closed and the vehicle moves, the PRG will not operate.
5. If the opener switch is pushed while the gate is opening, the gate operation is changed towards the inverse direction and closes.
6. The doors must be unlocked (interior switch only).
7. Outside temperature is between -22° and 158° Fahrenheit.

PRG Components and Operation

The PRG control unit is located behind the driver side rear cargo area trim panel. Communications to the LAN/CAN for operation and diagnostics are through a LIN line. Communications with the Subaru Select Monitor are very slow due to the limited speeds of the LIN line. Select only the P.I.D.s (2 or 3 maximum) required to perform diagnostics for a current condition.

NOTE: No work support is provided for the PRG.
The BIU work support provides for the PRG opening and closing.
Toggle through execution to open and close the rear gate.



Figure 5-8 PRG Control Unit

NOTE: PRG must be set to support in the BIU.

The PRG drive unit consists of a motor, drive gear, driven gear, half stop solenoid, half stop solenoid switch, pulse or rotation sensor, and an electric clutch. When the driven gear turns, a threaded drive block pushes or pulls the connecting rod that opens or closes the PRG.

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Figure 5-9 PRG Drive Unit



Figure 5-10 PRG Driven Gear

A parking or half stop gear is made onto the lower end of the driven gear. This gear is used to lock the PRG in place if the memory height has been programmed or if the PRG was opened and stopped beyond half-way.

The half stop solenoid pushes or pulls a rod that locks the parking or half stop gear, preventing the driven gear from turning and holding the PRG in place.

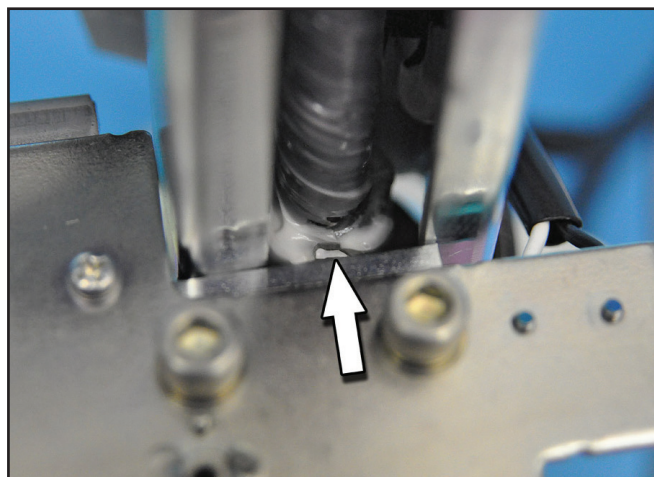


Figure 5-11 Half Stop Gear

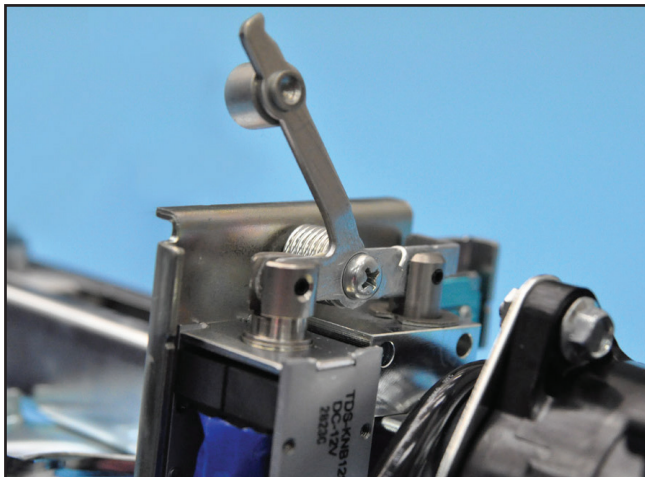


Figure 5-12 Half Stop Solenoid

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A manual release lever is provided to disengage the half stop mechanism in the event of mechanical or electrical malfunction.

WARNING: The PRG may operate if the lever is activated, stay away from moving parts.

NOTE:

An access panel is provided on the cargo area trim to release the half-stop solenoid in event of malfunction.

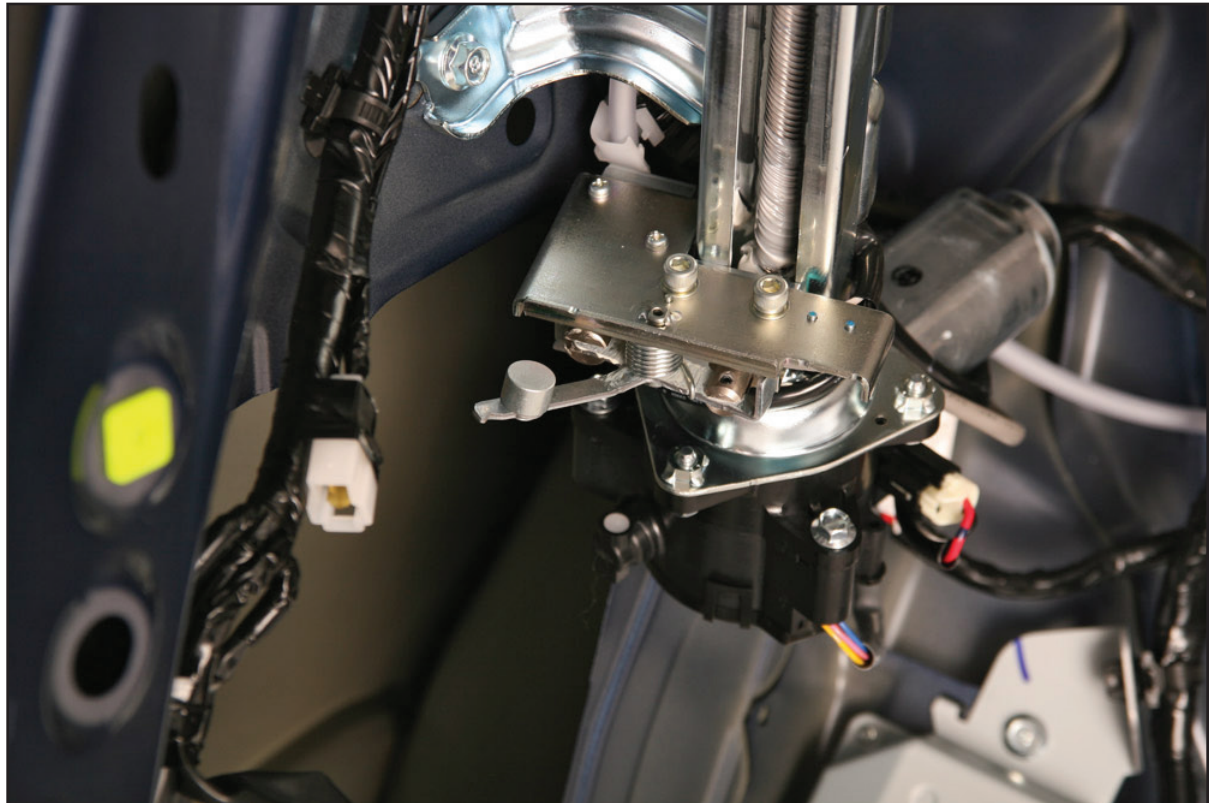


Figure 5-13 Manual Release Lever

A micro switch is attached to the half stop mechanism to signal the PRG control unit of the locked or unlocked position.

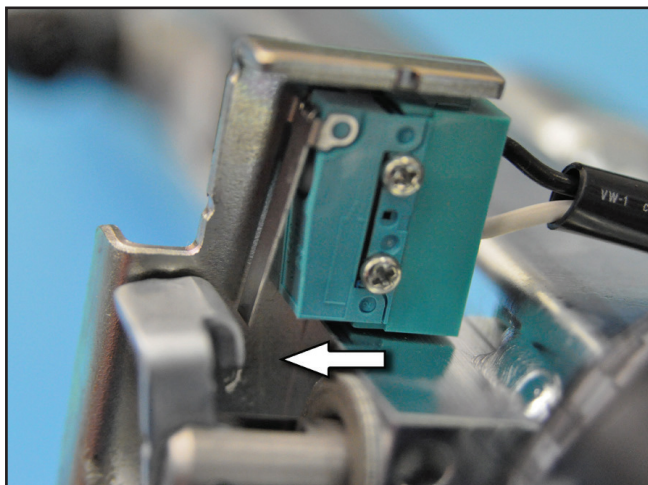


Figure 5-14 Half Stop Solenoid Unlocked

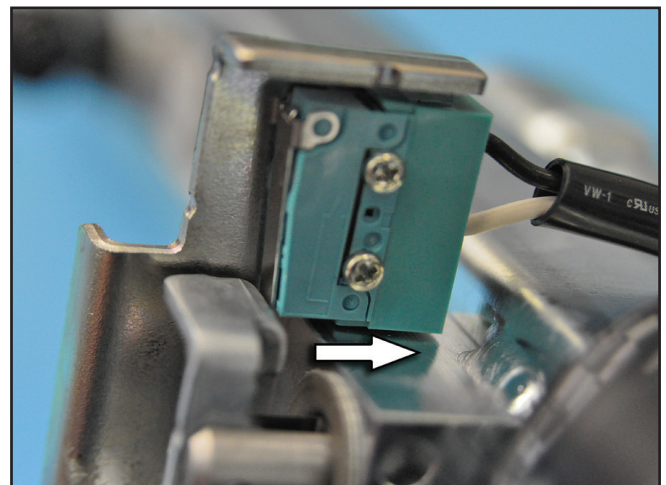


Figure 5-15 Half Stop Solenoid Locked
Out put of clutch

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The motor direction is controlled by changing the polarity of the positive and ground supply through the PRG control unit. A duty ratio of 40 to 70 % controls the opening of the PRG and 60 to 80% duty closes the PRG. This is due to the assist and resistance provided from the gas shocks.

NOTE: The duty ratio near the end of opening or closing should be approximately 30%.

NOTE: Weak or failed gas shocks will increase the closing speed of the PRG and set a DTC.

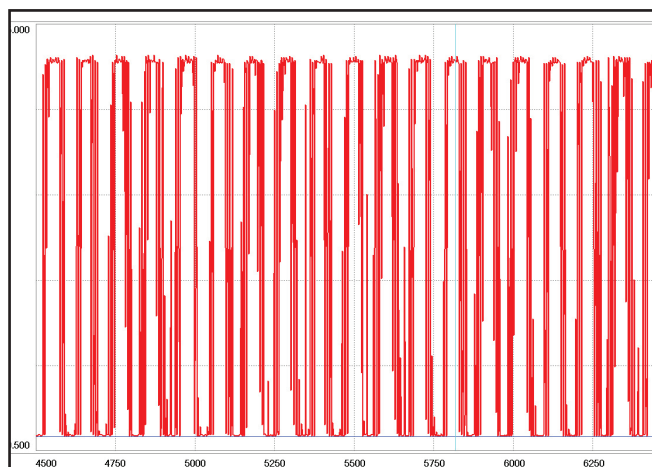


Figure 5-16 PRG Drive Unit Motor Power Duty Ratio

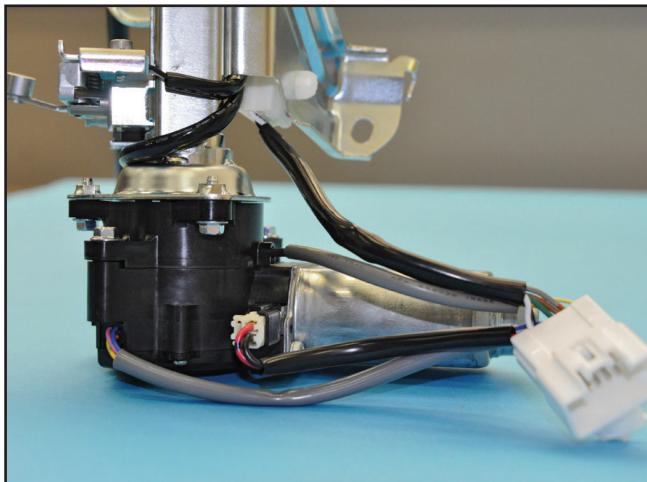


Figure 5-17 PRG Drive Unit Motor

Normal amperage flow during opening is approximately 16 amps to begin movement with a sustained 2 amps.

Amperage flow during incorrect mechanical conditions or any condition that would block the PRG from opening can reach as high as 20 amps. This high amperage will continue to flow until the PRG control unit stops the opening function and re-latches the PRG.

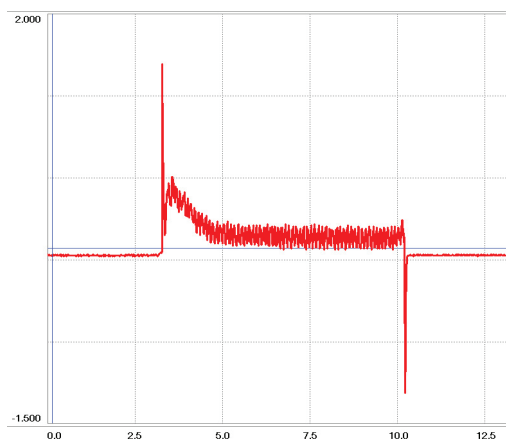


Figure 5-18 PRG Drive Unit Motor Amperage Normal Condition

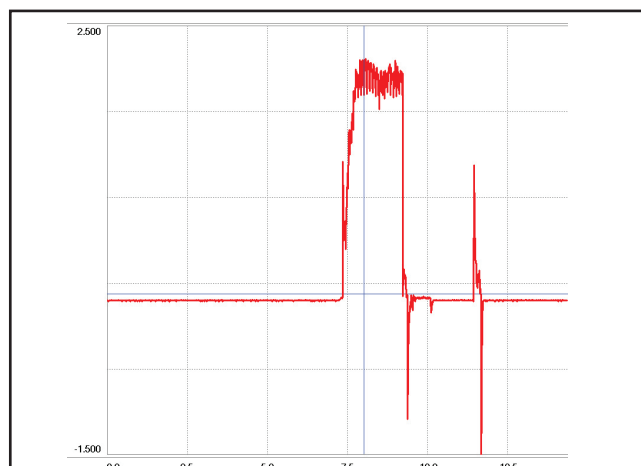


Figure 5-19 PRG Drive Unit Motor Amperage with Gate Blocked

NOTE: Continued amperage flow above normal will result in the PRG reversing direction. If the amperage is above normal for 2 consecutive attempts all PRG functions will be canceled.

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The drive and driven gears of the motor drive assembly and the PRG drive unit mesh together to transfer the opening or closing force needed to control the PRG. Mechanical output of the motor to the coupling gear is controlled with an electric clutch.

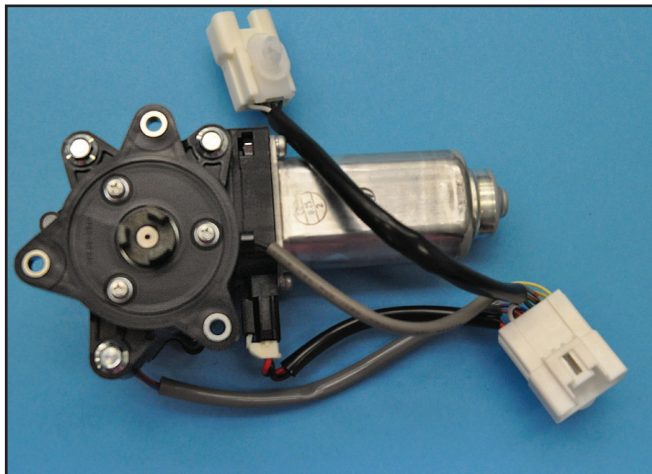


Figure 5-20 PRG Drive Unit Motor Coupling Gear
Out put of clutch

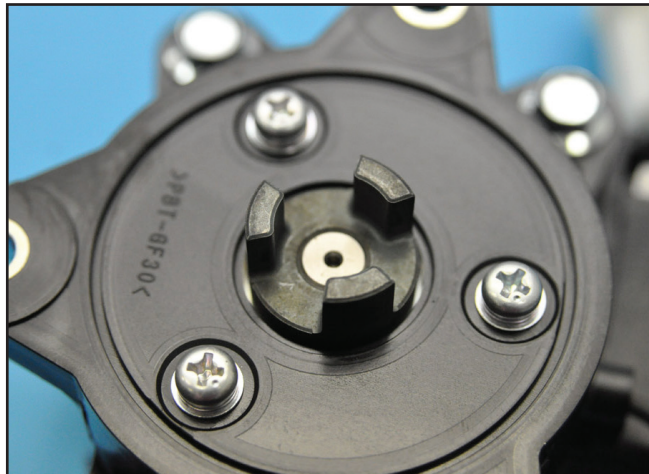


Figure 5-21 PRG Drive Unit Motor Coupling Gear
"Close Up"

The motor is connected to a worm gear drive that meshes with a reduction gear. The reduction gear is keyed to a ferrous metal plate that locks to the output shaft of the clutch assembly. The PRG control unit controls the ground and the power for the electric clutch.

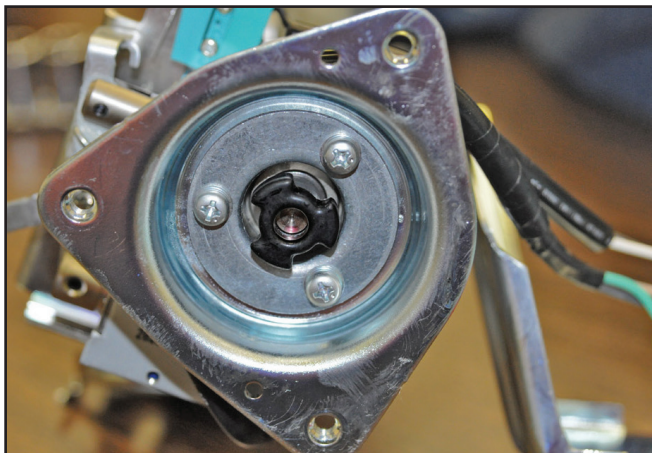


Figure 5-22 PRG Drive Unit Driven Gear Coupling
Gear

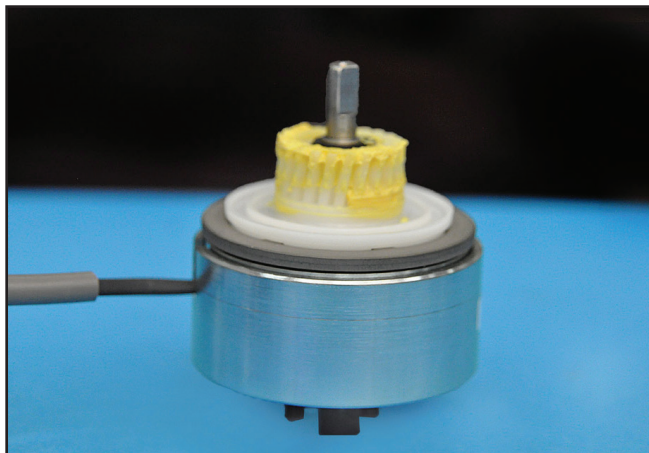


Figure 5-23 Clutch and Reduction Gear



Figure 5-24 PRG Drive Unit Motor Coupling Gear



Figure 5-25 PRG Drive Unit Motor Coupling Gear
"Close Up"

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If the rear gate is blocked from opening, a slipping sound will be heard from the PRG drive unit. Continued attempts to operate the PRG in this condition will damage the clutch.



Figure 5-26 Clutch Coil and Hub

An electro-magnetic coil is located under the output shaft coupling surface. The resistance of the coil is approximately 9.8 ohms. The voltage at the clutch should be near battery voltage. A small ripple effect should be considered normal (by-product from the PRG control unit duty control of the PRG motor). Normal clutch amperage flow is approximately 1.2 amps.

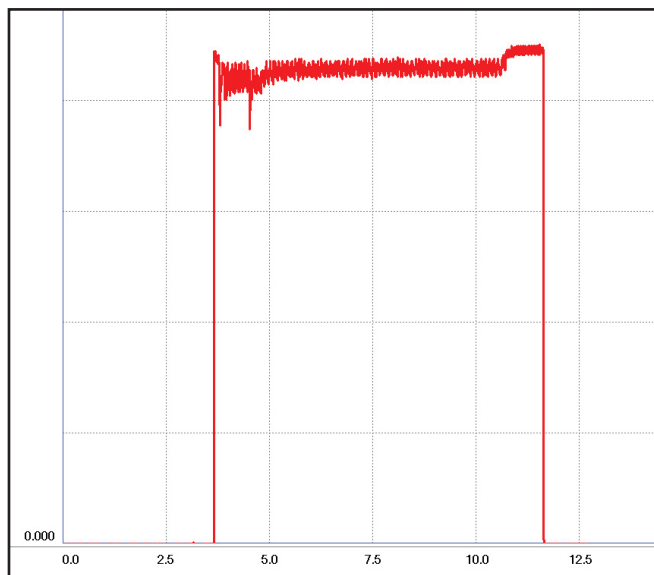


Figure 5-27 Clutch Voltage

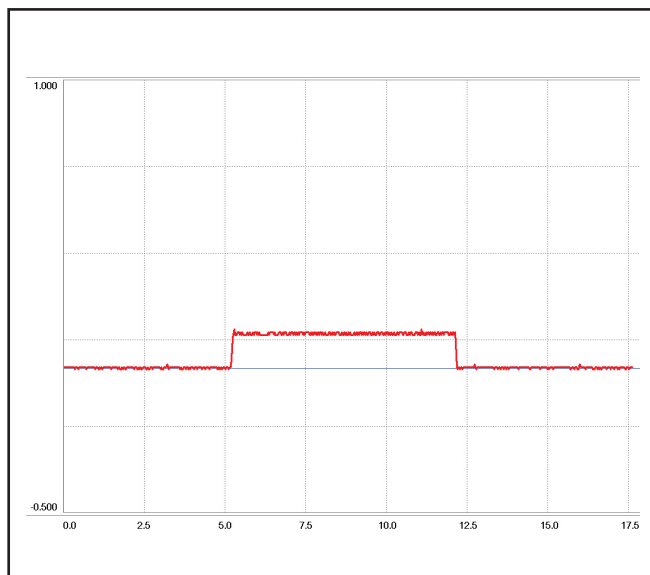


Figure 5-28 Clutch Amperage

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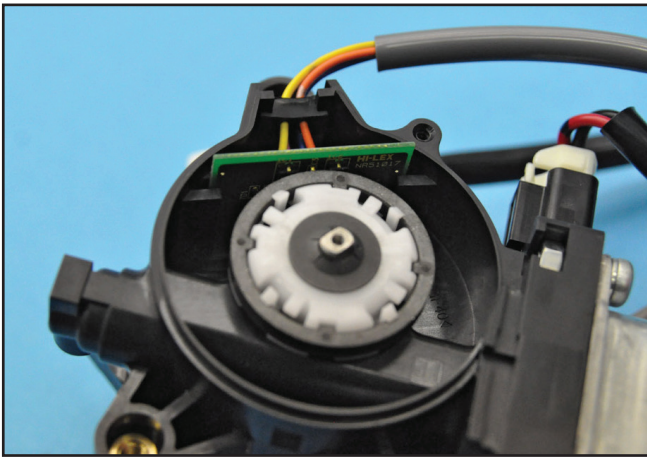


Figure 5-29 Pulse Count Sensor

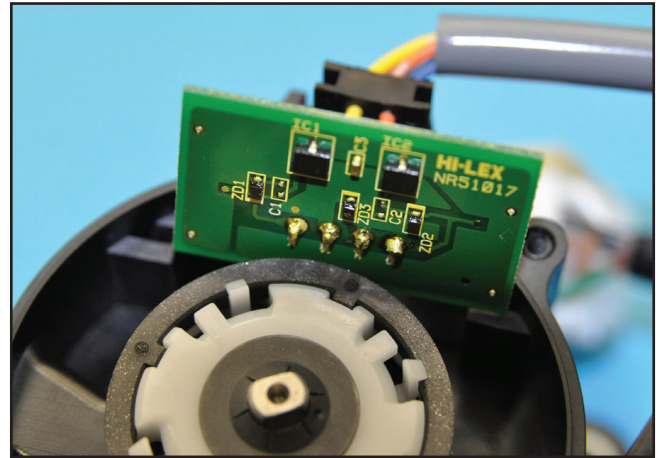


Figure 5-30 Sensor A and B

The two signals are inputs to the PRG control unit. Sensor A and sensor B, as described in the I/O chart, range from 0 to 5 volts with the PRG in motion. A failure with either signal results in a DTC and PRG functions will be cancelled.

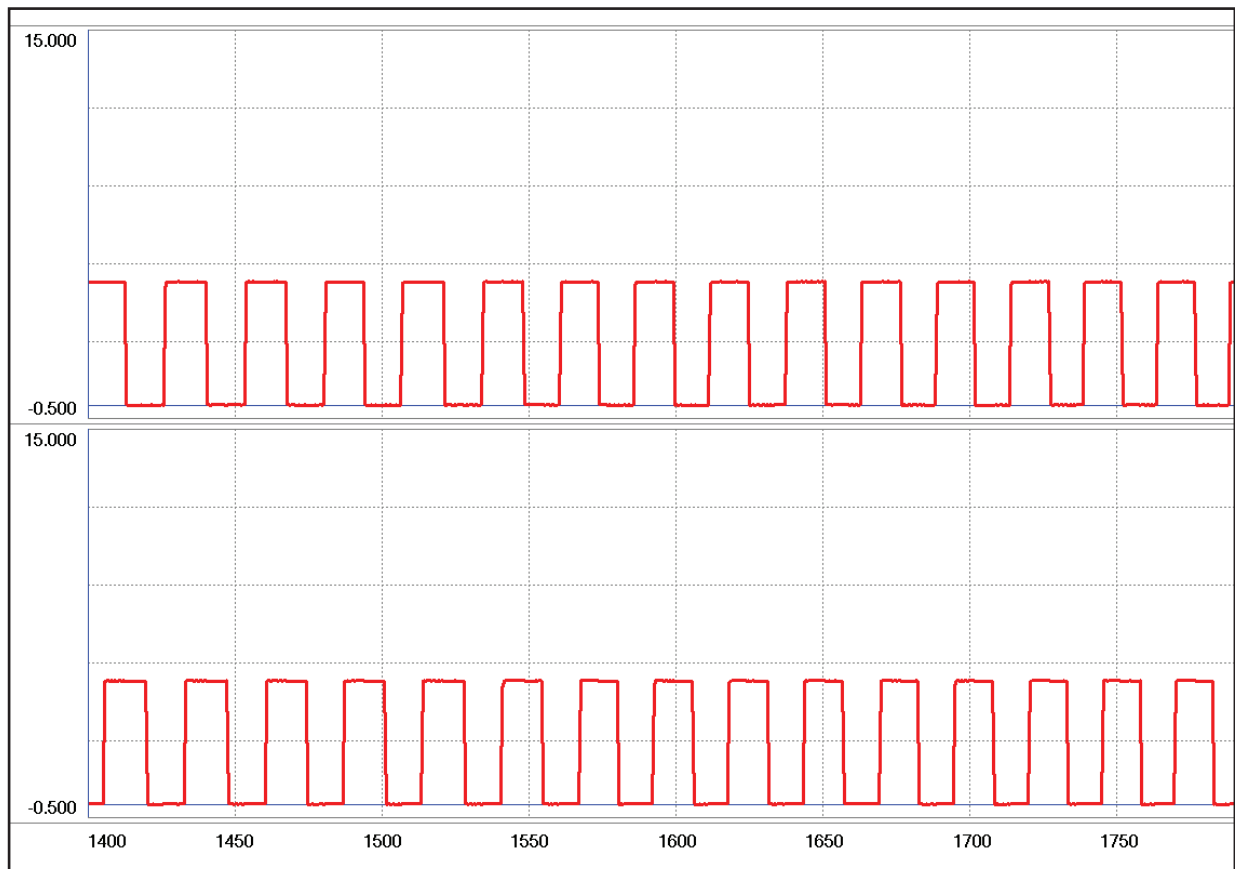


Figure 5-31 Sensor A and B Output

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Touch Sensors

A pinch or touch Sensor is installed on the left and right inner edge of the rear gate. If either sensor is compressed during closing, the PRG automatically reverses and moves to the open position.



Figure 5-32 Touch Sensor

The touch sensor is constructed in a soft rubber tube, consisting of 4 spiral wound wires. The wires are coated with a semi-conductive coating that allows the wires to act as a switch. When the tube or sensor is compressed, the wires will touch each other and lower the resistance in the pinch circuit. The more the wires are compressed, the lower the resistance becomes.

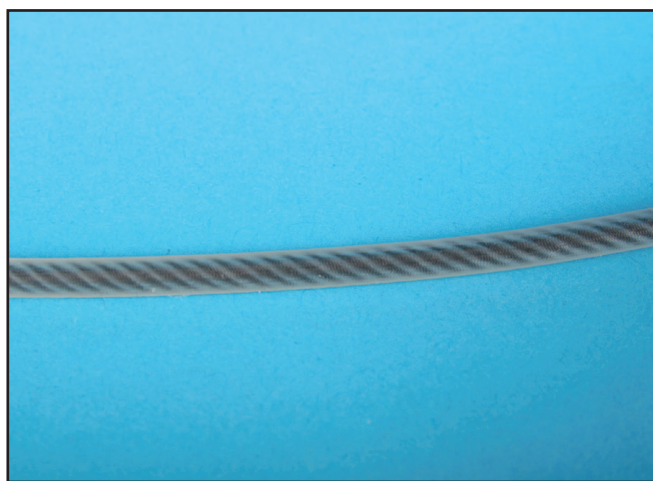


Figure 5-33 Touch Sensor Tube



Figure 5-34 Touch Sensor Resistor

A resistor (approximately 975 ohms) is connected in parallel with the touch sensor so that the touch sensors can be monitored by the PRG control unit. If either sensor is not connected, or has the incorrect resistance, a DTC will set and the PRG will not function (manual mode will be available).

Warning: Keep away from the closing area of the rear gate (PRG). The outer edge of the rear gate (PRG) beyond the touch sensor cannot detect solid objects and will not trigger a safety maneuver until the amperage of the rear gate (PRG) exceeds pre-established specifications.

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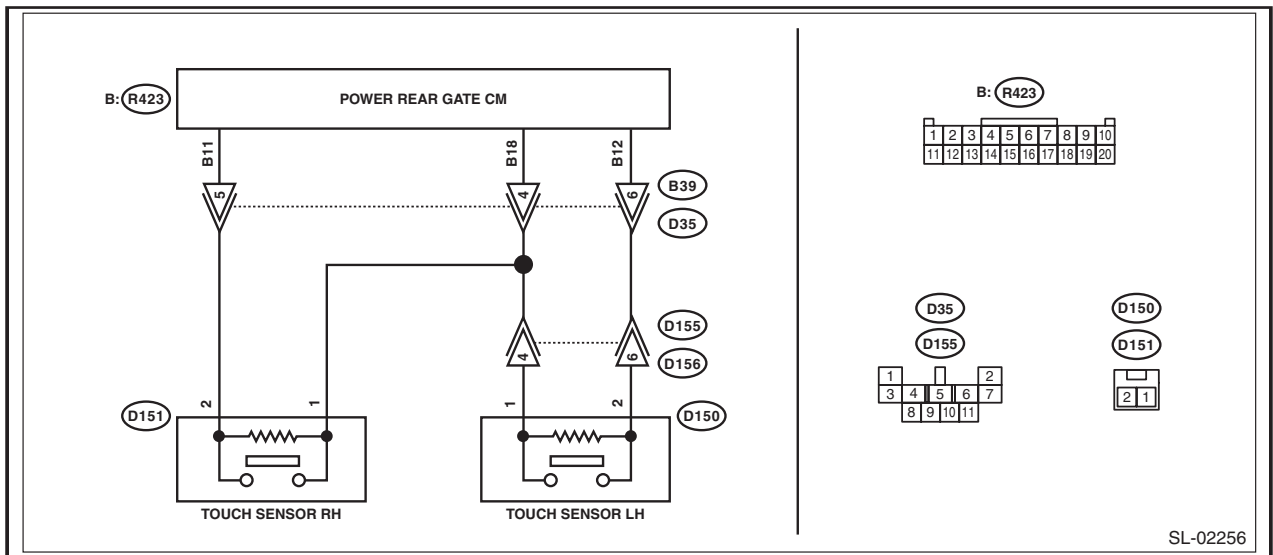


Figure 5-35 Touch Sensor Schematic

“Memory Height” Learning Procedure

NOTE: The ignition should be off and the PRG should be closed.

1. Push the “Memory Height SW” on the instrument panel in so that it is at its lowest position. (ON)



Figure 5-36 Memory Height Switch Location and Highest Setting (OFF)



Figure 5-37 Memory Height Switch Lowest Setting (ON)

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Figure 5-38 Gate Opener Switch

2. Set the PRG to manual mode by pushing the “Opener SW” on the gate for more than 0.8 seconds.

NOTE: Immediately open the PRG so that the auto close function does not engage.

3. Open the gate manually, until the position of your preference is reached and then push and hold the “**Gate Inner SW**” for more than 3 seconds. A beep notifies you that a memorized position has been set.
4. **Push down the gate manually** towards a position before the complete close point and then wait until the gate closes completely through the auto closing function.
5. **The “Memory Height SW” on the instrument panel must be kept in the on position (lowest position) for the PRG to open only to the memorized position.**
6. The Full open position of the PRG can be obtained by pushing the “**Memory Height SW**” on the instrument panel to its highest (OFF) position and then pressing any of the opener switches.
7. Manual mode can be activated by pushing the Opener SW on the gate for more than 0.8 seconds if the “**Memory Height SW**” is at its lowest setting (ON).
8. The memorized position is not erased if the PRG control unit power is removed. The memory once set cannot be erased, only overwritten.



CAUTION

DO NOT move the PRG manually if the PRG is opened to a memorized position. Damage to the half stop pin or solenoid will occur.

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Lift Arm Style PRG

The lift arm style PRG system was introduced on the 2015MY Outback. This system uses a motor to drive an arm through a gear reduction. The arm connects to the rear gate with a lift rod. This system uses two gas charged gate stays as well. The PRG provides an electric powered opening and closing feature that is controlled through a switch on the rear gate, instrument panel, keyless access remote, or the mechanical keyless entry key.



Figure 5-39 Open PRG



Figure 5-40 Opener Switch

The Opener switch on the PRG is located between the rear license plate light lenses.

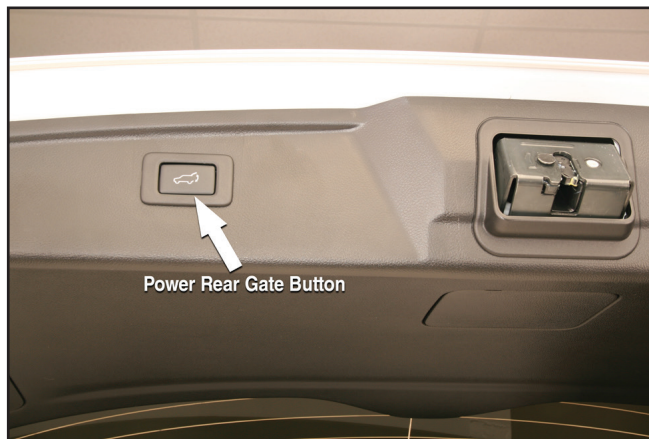


Figure 5-41 Closer Switch



Figure 5-42 Switch Cluster

The Closer switch is located on the left side of the gate, near the mechanical latch assembly. The interior PRG Opener/Closer switch and PRG Memory Height switch are located on the switch cluster to the left of the steering wheel.

NOTE: The lift arm style PRG operates with a constant mesh gear drive system. Do not use excessive force to manually operate the PRG or damage to the PRG will occur.

Warning: Keep away from the closing area of the rear gate (PRG). The outer edge of the rear gate (PRG) beyond the touch sensor cannot detect solid objects and will not trigger a safety maneuver until the amperage of the rear gate (PRG) exceeds a pre-established specification.

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The lift arm style PRG system receives mechanical power from the motor through a set of stacked reduction and drive gears. A spring is used to assist with the initial movement of the gate (opening or closing).

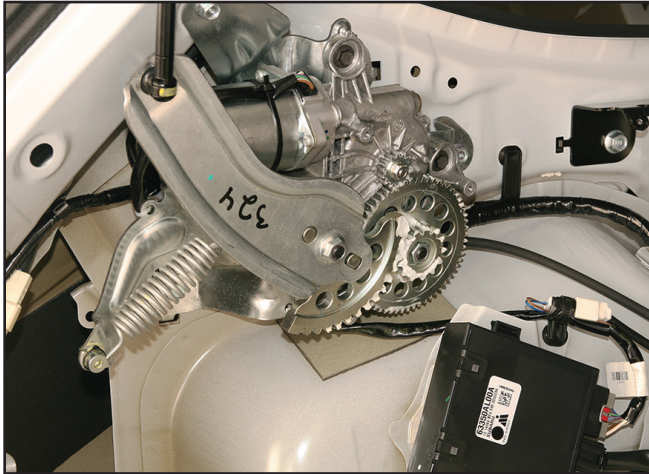


Figure 5-43 Lift Arm PRG

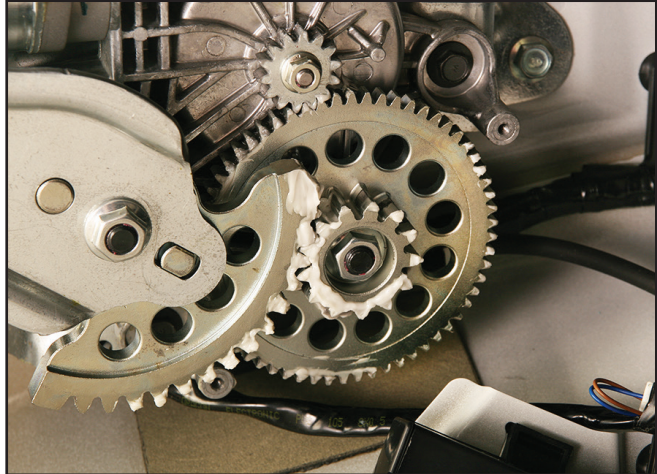


Figure 5-44 PRG Gear Set

The lift arm style PRG of the Outback can never be separated from the reduction drive gears. This type of system eliminates the need for a motor clutch and half stop solenoid. The combined gear ratio and force from the gate struts will hold the gate in a set position.

Constant mesh Lift arm PRGs cannot separate the gate lifting mechanism from the drive system which prevents any type of fail-safe mechanical release. Removing the lift arm is the only way to separate the gate from the PRG assembly.

Construction

The PRG is driven by a DC brushed motor that delivers power to the PRG gear assembly. The motor transfers mechanical power through a flexible metal drive shaft to a worm gear.

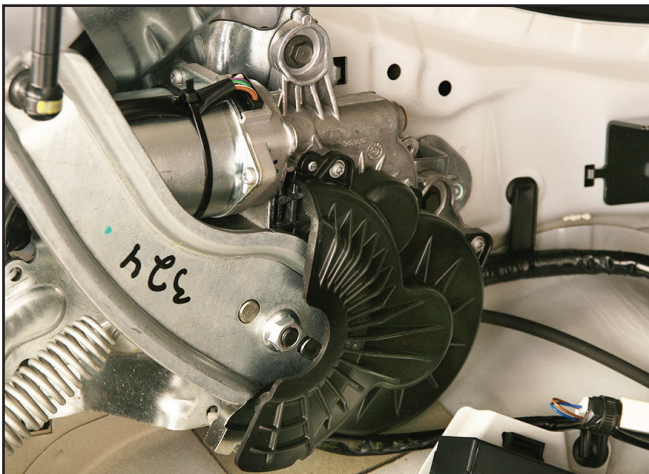


Figure 5-45 PRG Assembly

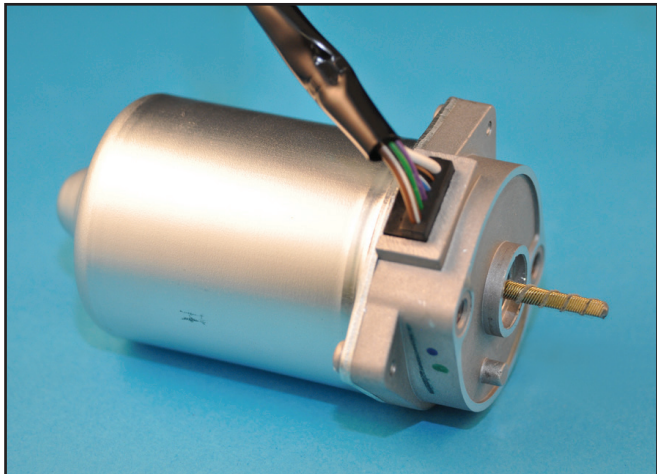


Figure 5-46 PRG Motor and Drive Shaft

The metal drive shaft is wire wound to increase strength. A spiral wound fiber thread surrounds the drive shaft to ensure the clearance between engagement points is minimum.

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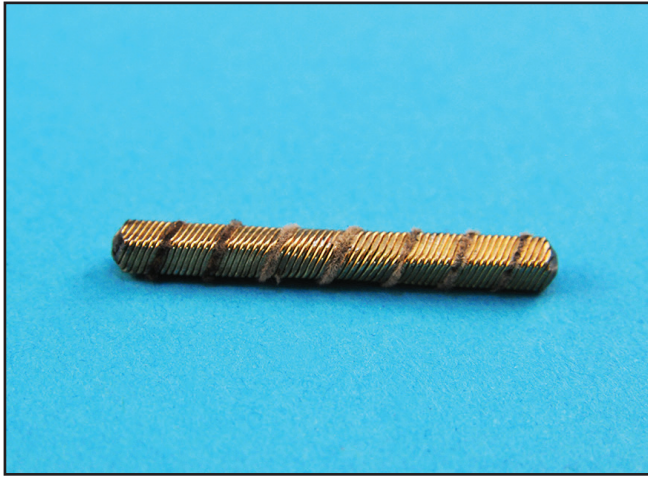


Figure 5-47 Drive Shaft

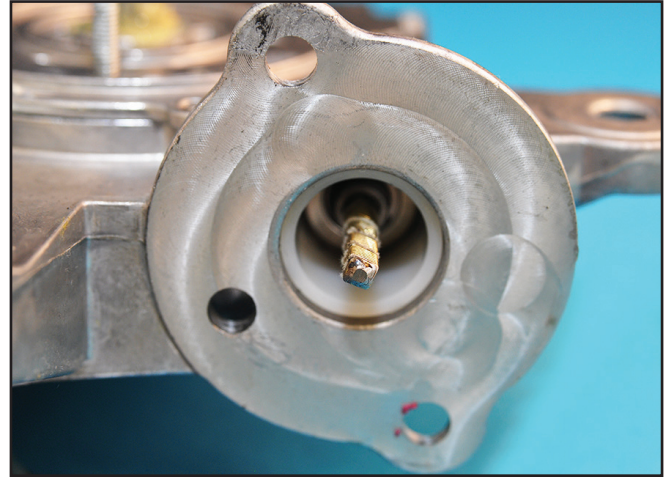


Figure 5-48 drive Shaft and Worm Gear

The drive shaft transfers power from the motor rotor to the worm gear set of the PRG gear assembly. The final gear ratio provides the strength and speed needed to open and close the rear gate.

All gears are lubricated during construction and require no additional maintenance.

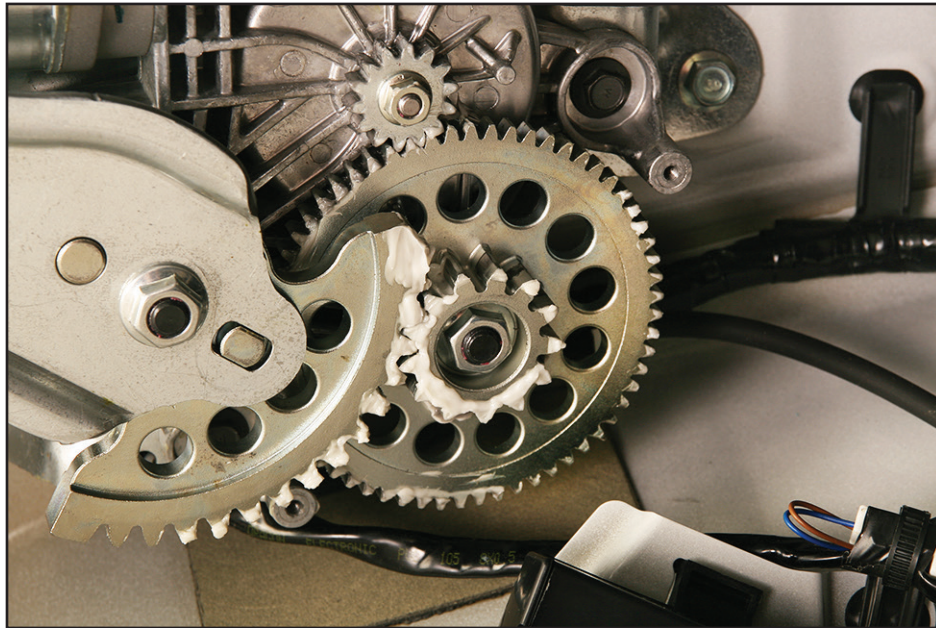


Figure 5-49 Gears and Lubrication

NOTE:

Due to the constant mesh design of the gear set, Manual Mode is not recommended. The opening force required to open the rear gate in Manual Mode is 25 to 30 lbs., which is approximately double the force required to open the Forester spindle drive PRG.

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Electrical Control

The PRG Control Unit is located next to the PRG motor assembly and is secured to the vehicle body with 2 clips that are made onto the plastic body of the control unit. Use care when removing the control unit so that the clips are not damaged. The PRG control unit communicates with the BIU through a LIN communications wire for all PRG operations. Data to the Select Monitor will be slow due to the reduced communications speed of the LIN circuit.



Figure 5-50 PRG Control Unit

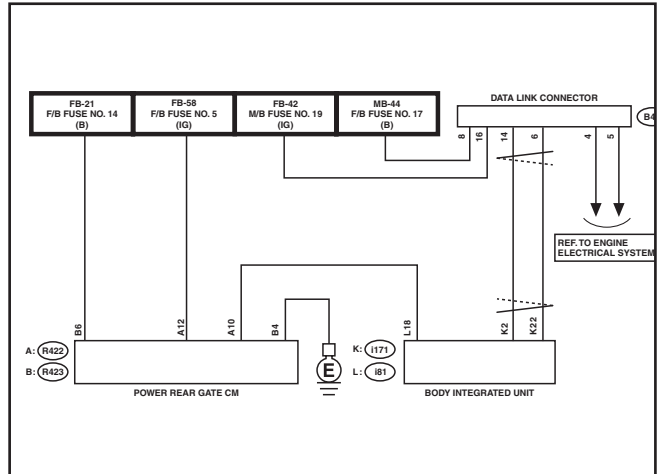


Figure 5-51 LIN Circuit

The armature of the PRG motor is equipped with a revolution sensor retractor which is constructed with alternating magnetic poles. Two Hall sensors, Hall 1 and Hall 2, create input signals to the PRG control unit as the alternating magnetic poles revolve by the sensors.

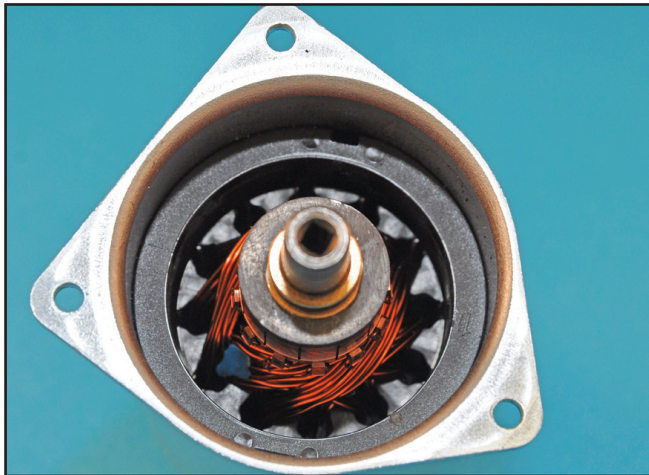


Figure 5-52 Revolution Sensor Retractor

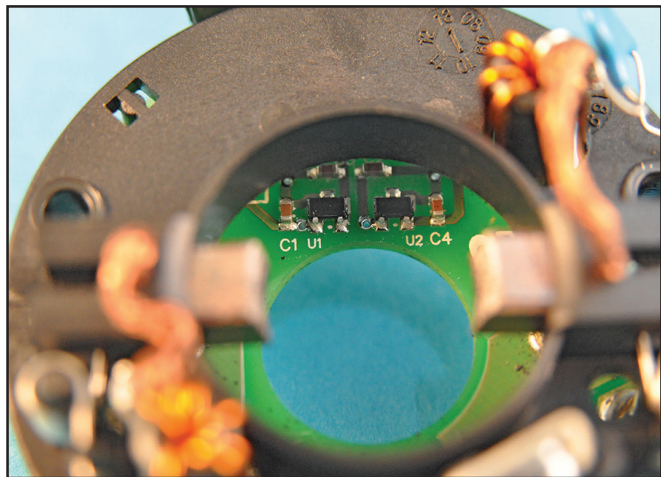


Figure 5-53 Hall Sensors

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The PRG control unit combines the two signals to create the data viewed on the Subaru Select Monitor as Rear Gate Speed and Pulse-count 2.

Item	Value	Unit
☒ Rear Gate Target Speed	60	mm/s
☒ Rear Gate Speed	66	mm/s
☒ PRG MOTOR Duty	49	%
☒ Pulse-count 2	1432	Count

Figure 5-54 Select Monitor Hall Sensor Data

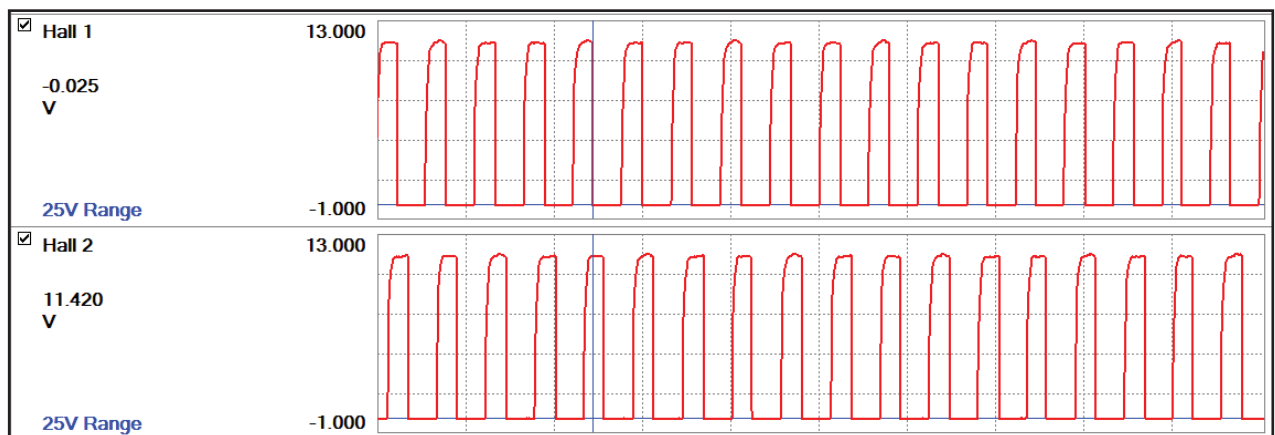


Figure 5-55 Revolution Sensor Patterns

The speed and direction of the PRG motor is controlled by the power supply frequency and duty ratio to the brushes and armature.

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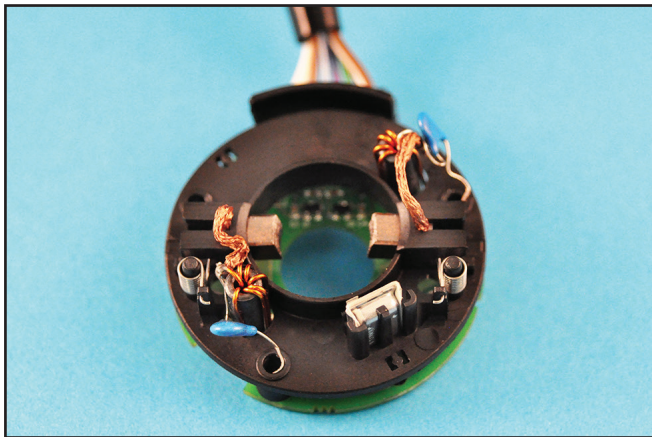


Figure 5-56 Brushes

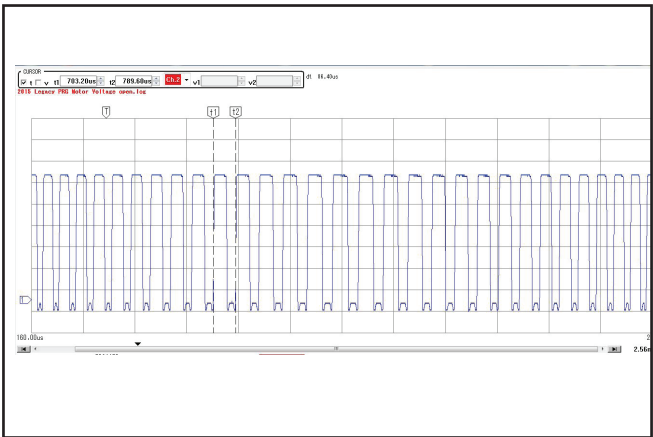


Figure 5-57 PRG Motor Control

The frequency of the power supply can reach as high as 16,000 Hz. Typical motor amperage is 18 amps during start up and 6 to 8 amps during normal movement. A blocked rear gate can create current flow as high as 23 amps in the motor drive circuit, which will result in a reversal of the rear gate direction.

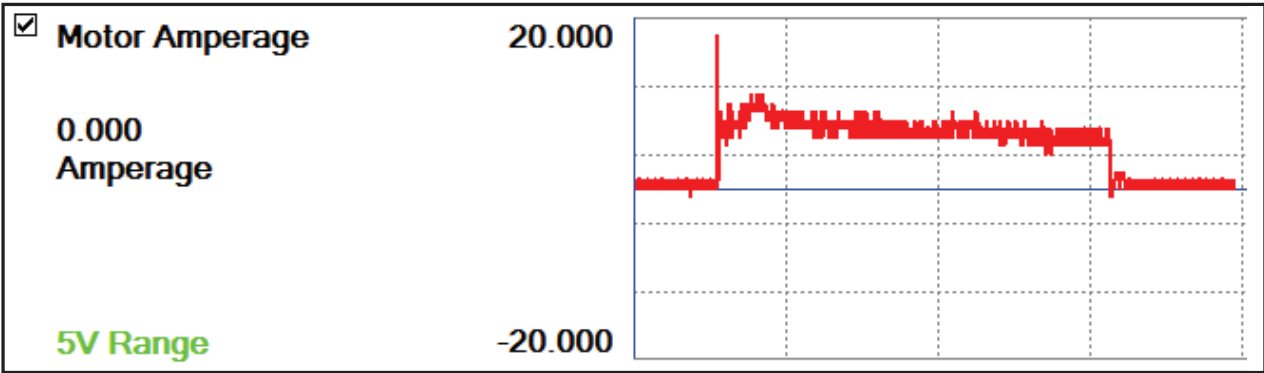


Figure 5-58 Normal PRG Motor Amperage

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Touch Sensors

The pinch or touch Sensor of the lift arm style PRG is comprised of four individual sensor strips that are wired in series, providing only one input to the PRG control unit. Each side of the gate has upper and lower sensor strips that are connected together under the upper edge trim of the lower sensor. The lower sensor strips are bolted into place while the upper sensor strips are held in place by an adhesive strip. Never re-use an upper sensor strip once it has been removed from the vehicle.

NOTE: If the rear window glass is removed, the upper sensor strips must be replaced.



Figure 5-59 Touch Sensors

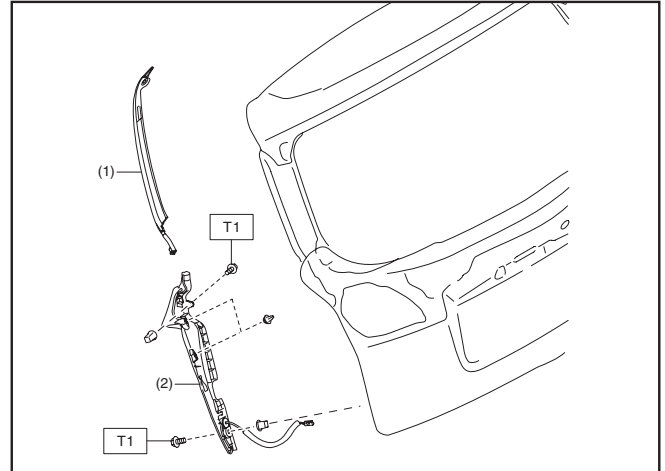


Figure 5-60 Upper and Lower Touch Sensors

Always separate the upper and lower sensor strips during diagnostics to isolate an open or short circuit of the individual sensors strips.

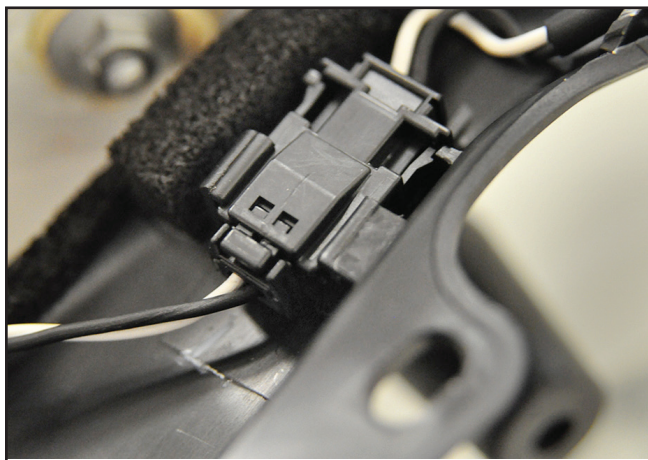


Figure 5-61 Connector

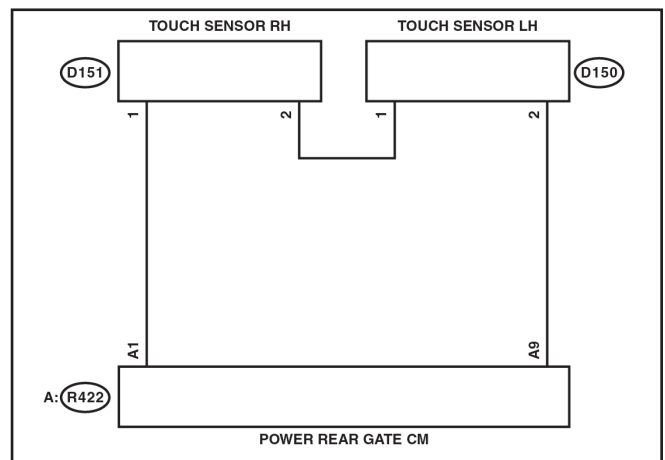


Figure 5-62 Touch Sensor Artwork

A single DTC, B2524 Touch Sensor Failure, is provided to indicate a problem with the Touch Sensor.

NOTE: The line drawing of the Touch Sensor in the PRG Diagnostics section of the Subaru Service Manual does not include the detail needed to perform diagnostics. Always refer to the PRG wiring schematics in the electrical section of the Subaru Service Manual.

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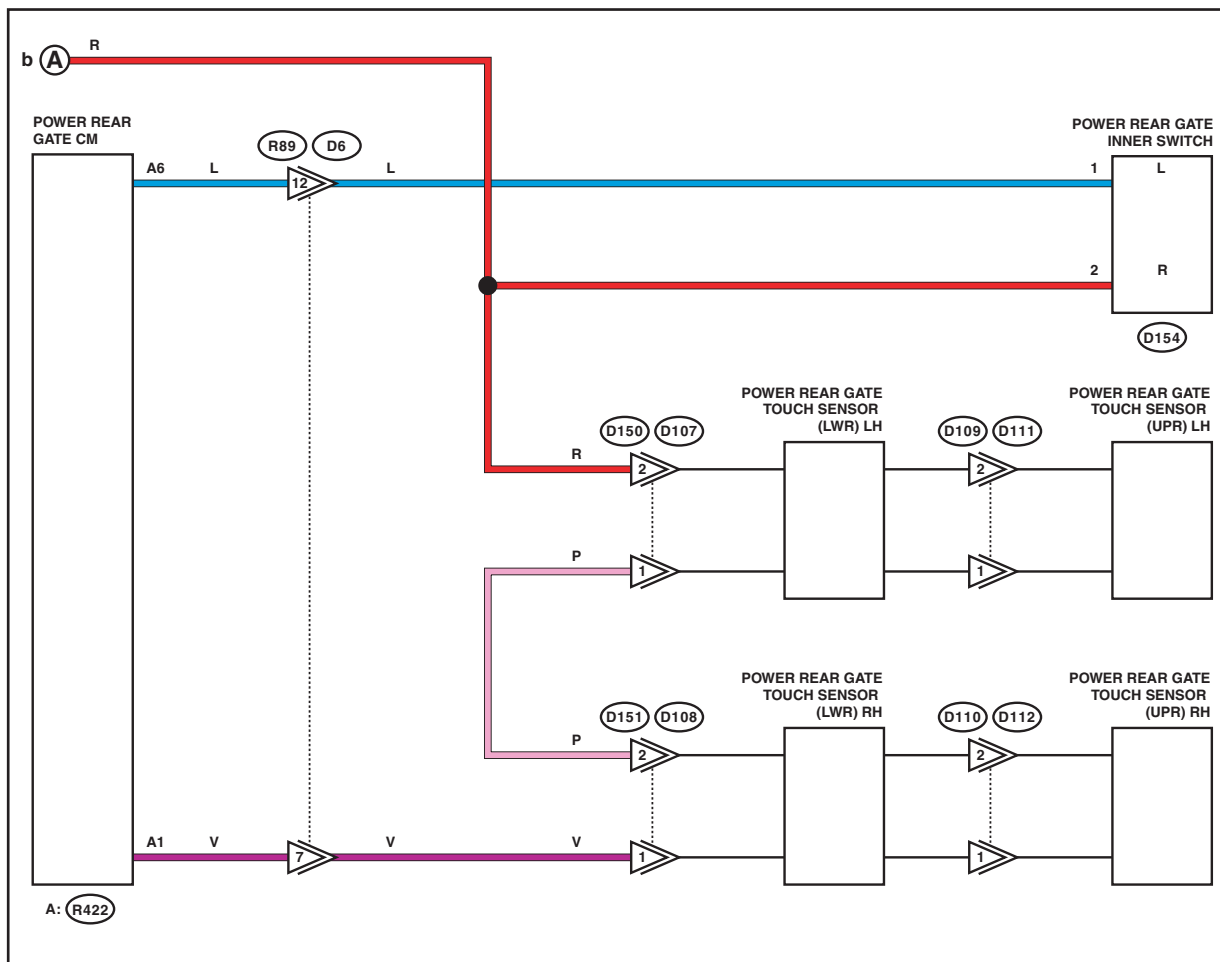


Figure 5-63 Touch Sensor Wiring Schematic

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Separating the Rear Gate from the PRG Assembly

Rear Gate will not close



CAUTION

Disconnect the power supply or fuse from the PRG motor before removing the lift arm.

SBF-6, Fuse Number 14, and Fuse Number 5



Figure 5-64 Main Box, Engine Compartment

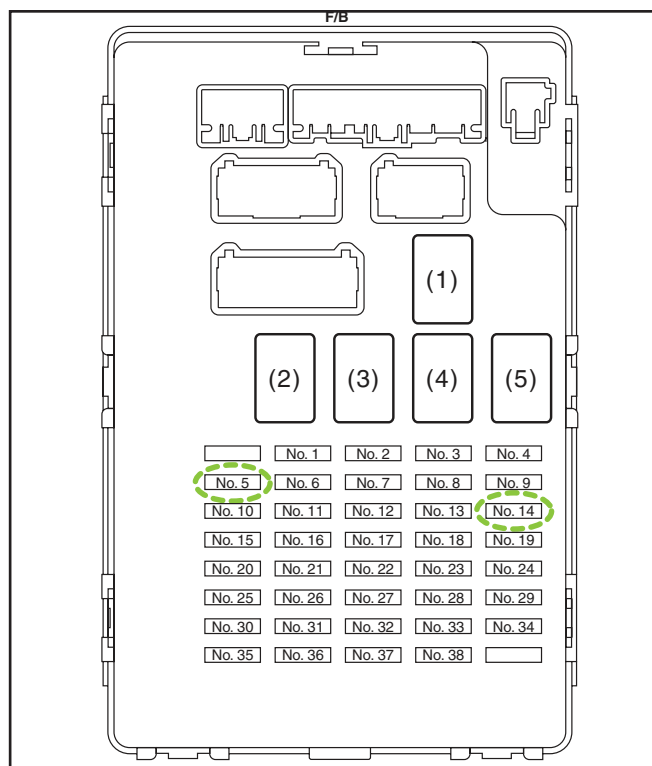


Figure 5-65 Fuse Box, In Car

Should a mechanical condition prevent the lift arm style PRG of the Outback from closing, release the lift arm at the motor arm and then release the opposite end at the gate.



Figure 5-66 Access Panel Removed



Figure 5-67 Lift Arm

An access panel is provided to allow a technician room for removing the lift arm connection.

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Rear Gate will not open



Figure 5-68 Open Access Panel with Gate Closed



Figure 5-69 Top of Gate Lift Arm Gate Closed

If the PRG will not open from a mechanical condition, remove the power supply as previously described and enter the rear of the vehicle from the back seat. Remove the lift arm at the gate and open the gate from the emergency release. Exit the vehicle from the rear.

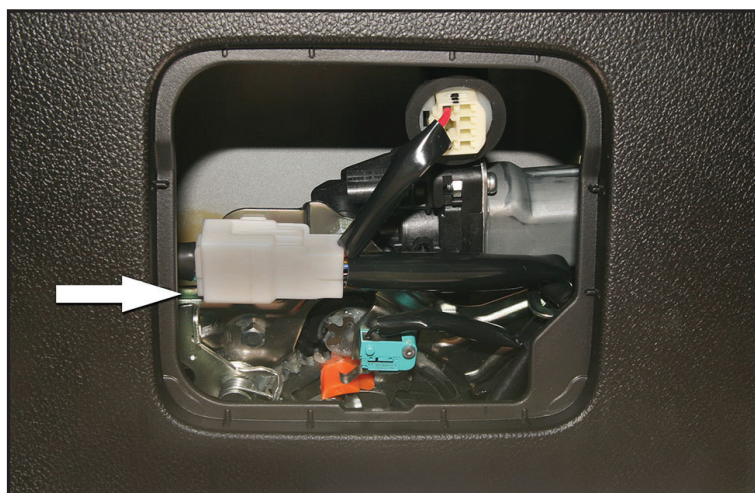


Figure 5-70 Emergency Release

NOTE:

Access to the emergency release is gained by removing the cover panel and pushing on the indicated lever towards the driver side of the vehicle.

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"Memory Height" Learning Procedure



Figure 5-71 Memory Height Button



Figure 5-72 Closer Switch

NOTE: The ignition should be off and the PRG should be closed (Memory Height Button should be "OFF").

1. Open the rear gate by using the power rear gate function.
2. With the rear gate at the desired height, stop it by using the power rear gate function (use any control button to stop the gate).
3. Press the memory switch to select the "ON" status (Lowest Position).

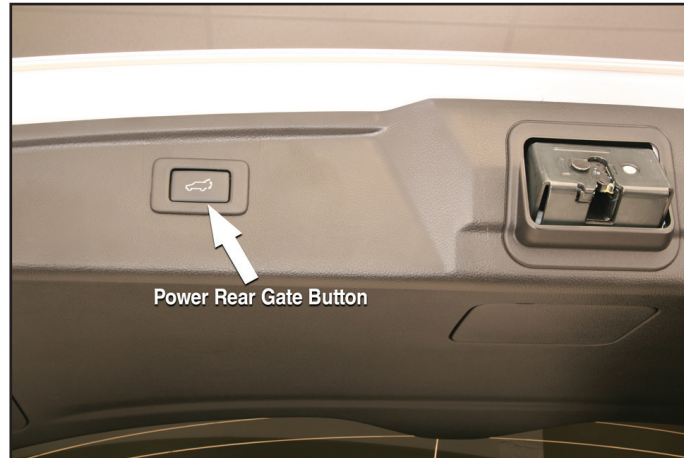


Figure 5-73 Power Rear Gate Button

4. With the rear gate at the desired height, press and hold the power rear gate button on the inside edge of the rear gate until an electronic chirp is heard and the hazard warning lights flash three times.

The electronic chirp and the flashing hazard warning lights confirm the selected rear gate height has been registered.

It is possible to register the height from approximately 12 in (30cm) or more from the completely closed position.

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Retrieval of the rear gate height:

To open the rear gate and stop it at the registered height, perform the following procedure.

1. Press the memory switch to select the ON status.
2. Press and hold any of the power rear gate switches. Even if any of the power rear gate switches are pressed and held while the memory switch is in the OFF status, you can stop it at the registered height by pressing the memory switch to select the ON status before the rear gate reaches the registered height.

Operating Characteristics

NOTE: The rear gate will open to the position that is stored in the memory function even if the rear gate is opened by the reverse (Safety) function.

Rear gate drop prevention function

If, while fully opened via the power rear gate function, the rear gate is lowered by the weight of snow and such, an electronic chirp will sound and the rear gate drop prevention function will apply braking to the rear gate so that it prevents a rapid closure of the rear gate.

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Powered Rear Gate Stay Style (PRG)

System Operation



Figure 5-74 Power Rear Gate Lift Strut

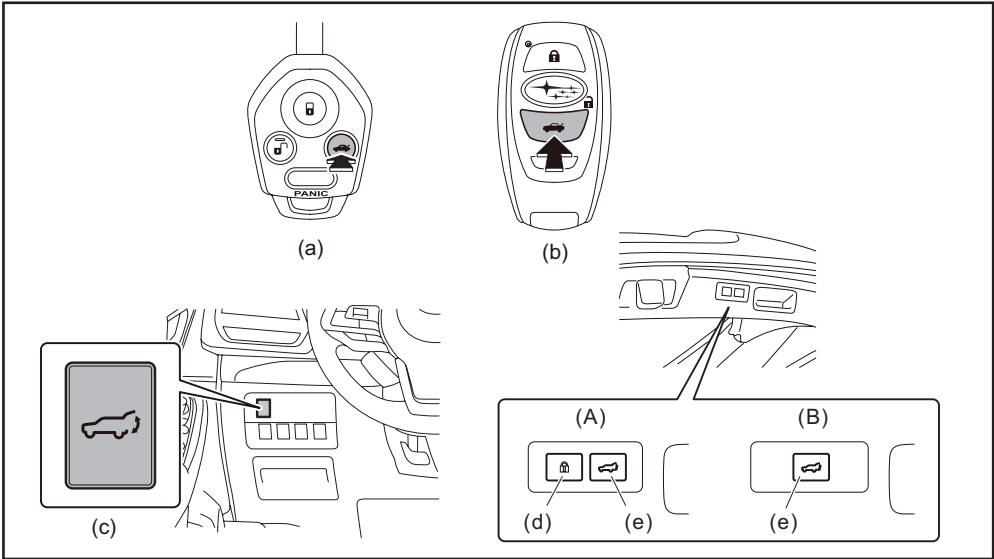
The power rear gate stay style PRG system was introduced on the 2019 Ascent. This system's use was expanded to the 2019 Forester and 2020 Outback models as well. This system uses one PRG stay and one traditional gas charger rear gate stay.

The following components make up this PRG system:

- PRG control module – Uses inputs from the Body Integrated Unit (BIU), pinch sensors / touch sensors, memory height switch, opener switch, rear gate switch, auto closer position switches, and drive motor speed / position sensors to control the operation of the auto closer cinch motor, PRG operation buzzer, and the PRG stay / motor assembly
- BIU – Relays commands via a LIN communication line to the PRG control module and flashes the hazard lights when operating the rear gate. The BIU also controls permission to operate. When vehicle conditions do not meet operating requirements, the BIU will inhibit an operation request to the PRG control module.

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- PRG auto closer (Latch) – Releases and cinches the rear gate latch at the beginning and end of PRG operation
- PRG rear gate stay and motor assembly – Opens and closes the rear gate during PRG operation. The assembly also uses two hall-effect sensors to count pulses from a rotating magnet attached to the motor armature. The PRG control module uses the signals from the sensors to track PRG position and speed
- PRG pinch sensors / touch sensors – Used to monitor for obstructions in the door while closing. The left and right sensors use a series connection to the PRG control module which judges an obstruction when the circuit resistance across them decreases.



A	Vehicle with power rear gate lock switch	B	Vehicle without power rear gate lock switch
a	Keyless transmitter ^{*1}	d	Power rear gate lock switch (rear gate)
b	Access key ^{*2}	e	Power rear gate inner switch (rear gate)
c	Rear gate driver's switch (instrument panel)		
^{*1}	Vehicle without keyless access with push button start system		
^{*2}	Vehicle with keyless access with push button start system		

Figure 5-75 Rear Gate Control

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To operate the rear gate:

- Push and hold the rear gate button on the Keyless Entry fob for two seconds
- Push the gate open / close button on the front instrument panel near the driver's knee
- Push the rear gate button just above the license plate when closed
- Push the rear gate button on the bottom of the rear gate when open
- Pull down on the gate handle when open
- Push the LOCK button on the bottom of the rear gate when open

The PRG has a programmable memory height that is set to the customer preference as in previous models. Turn the memory function ON and OFF by toggling the Memory button on the instrument panel.

As with previous models, the PRG detects an obstruction when opening or closing which causes the gate to reverse its movement.

PRG Rear Gate Stay / Drive Motor Construction

The PRG rear gate stay / drive motor uses a DC motor, gear reduction, and a high-tension assist spring.

NOTE:

The rear gate stay is a non-serviceable assembly. The following images are for understanding of operation only.

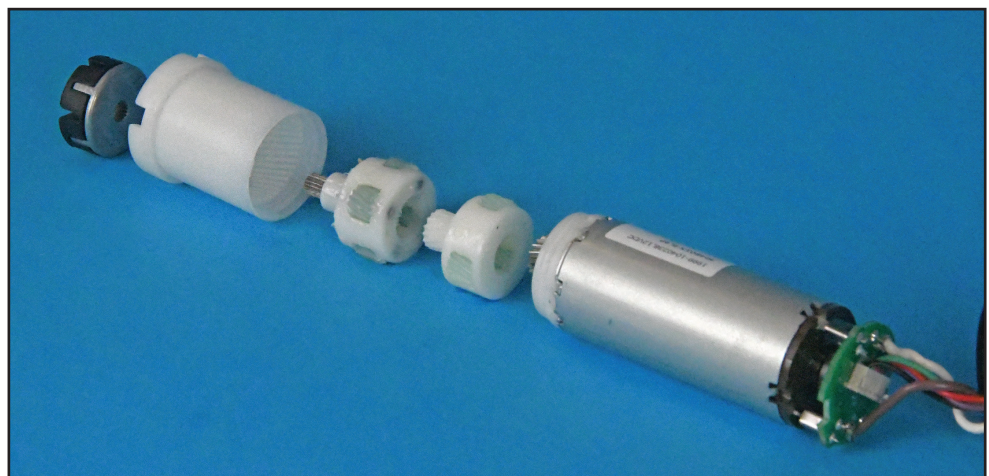


Figure 5-76 PRG Drive Motor and Planetary Gears

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The PRG drive motor uses a compound double planetary gear set to achieve the torque needed to operate the rear gate. The motor / planetary assembly outputs torque into a rubber damper to drive a force screw. The force screw threads into and out of a fixed nut. Threading IN makes the assembly shorter to lower the gate, and OUT makes the assembly longer to raise the gate. The power rear gate stay uses a large spring to counter act the weight of the rear gate and reduce the amount of drive force needed to operate the rear gate.



Figure 5-77 PRG gate stay assist spring, motor drive damper, and planetary gearset

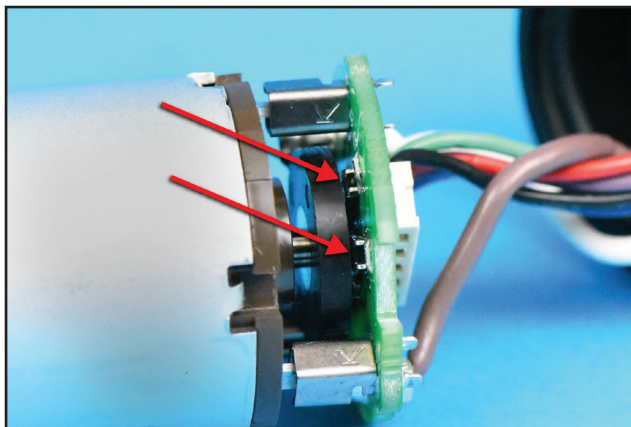


Figure 5-78 Hall-effect sensors used to monitor rotation of the drive motor armature / gate position

The drive motor uses two hall-effect sensors to monitor rear gate position by monitoring pulses as the motor armature rotates. Rotation of the armature is proportional to rear gate movement. The PRG control module monitors the hall-effect sensor for signals and faults. If the PRG control module fails to receive signal from the hall effect sensors, the PRG system will not function.

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Figure 5-79 PRG position sensor Hall 1 and 2 – Opening



Figure 5-80 PRG position sensor Hall 1 and 2 – Closing

The control module determines direction of motor rotation by monitoring the voltage from the sensors very closely. The waveforms above illustrate the shape of the waveform changing based on direction of rotation.

Electrical Diagram – PRG Drive Motor



5-178

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Auto Closer

The PRG Auto Closer is located in place of the conventional rear gate latch assembly. The PRG Auto Closer is equipped with the following components:

- Rear gate latch
- Gate latch motor
- Sector switch
- Courtesy and Latch Switch

NOTE: The PRG Auto Closer functions in normal PRG operations and manual mode.

NOTE: If a problem with the Sector Switch or Courtesy and Latch Switch exists, the PRG will not fully latch. The rear gate will try to fully close but the PRG control unit will sound a long beep and the gate will move away from the rear gate latch. The rear gate cannot be opened until pushed completely closed and the opener button is then pressed and held for more than 3 seconds.

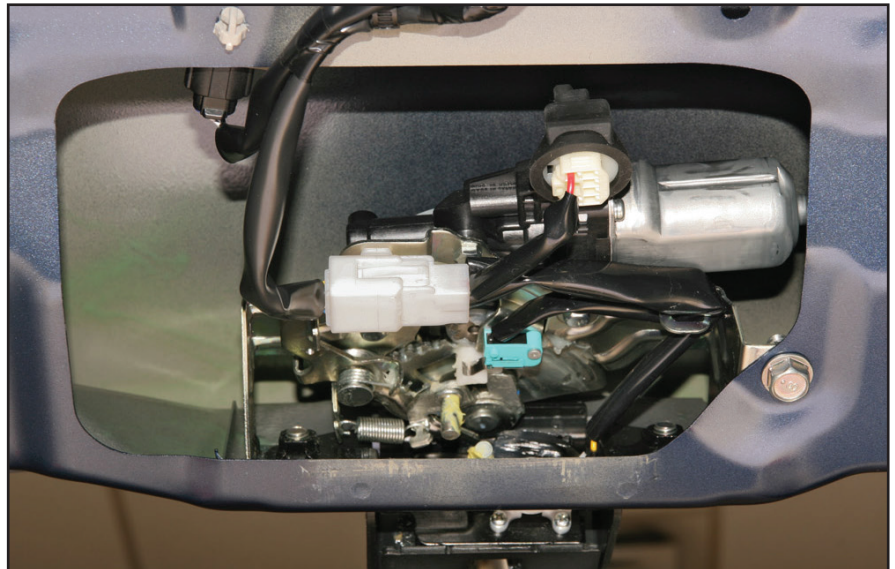


Figure 5-82 PRG Auto Closer

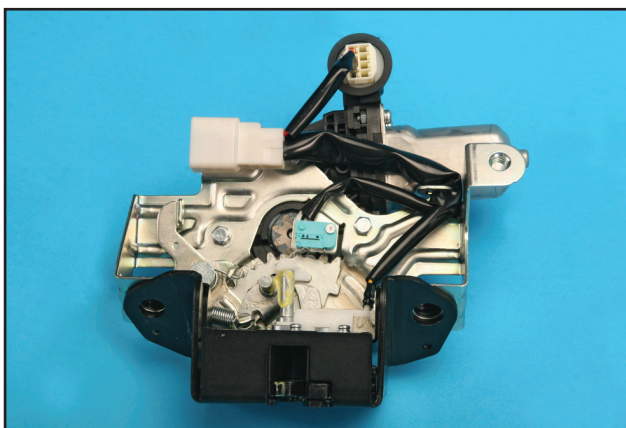


Figure 5-83 Auto Closer Bottom View

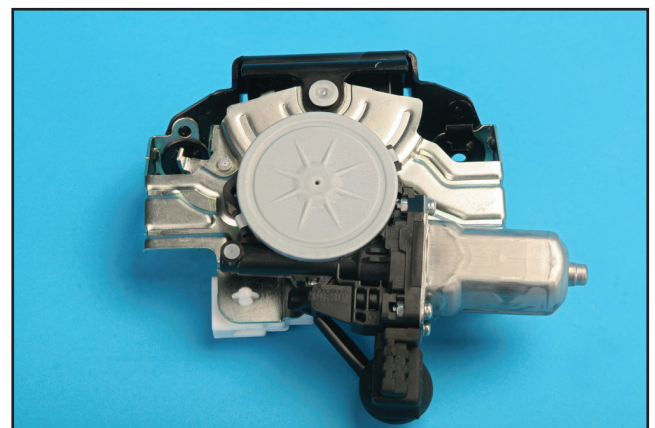


Figure 5-84 Auto Closer Top View

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PRG Auto Closer Parked

During normal operation with the PRG closed, the arm of the sector switch is resting on the white plastic detent of the latch assembly driven gear (Sector gear). This represents an off or closed position for the PRG control unit. 5 volts will be present at the PRG control unit on the sector switch terminal.

At the same time, the courtesy and latch switch assembly is in the off or closed position. Five (5) volts will be present at the latch switch terminal of the PRG control unit and 12 volts will be present at the courtesy switch terminal.

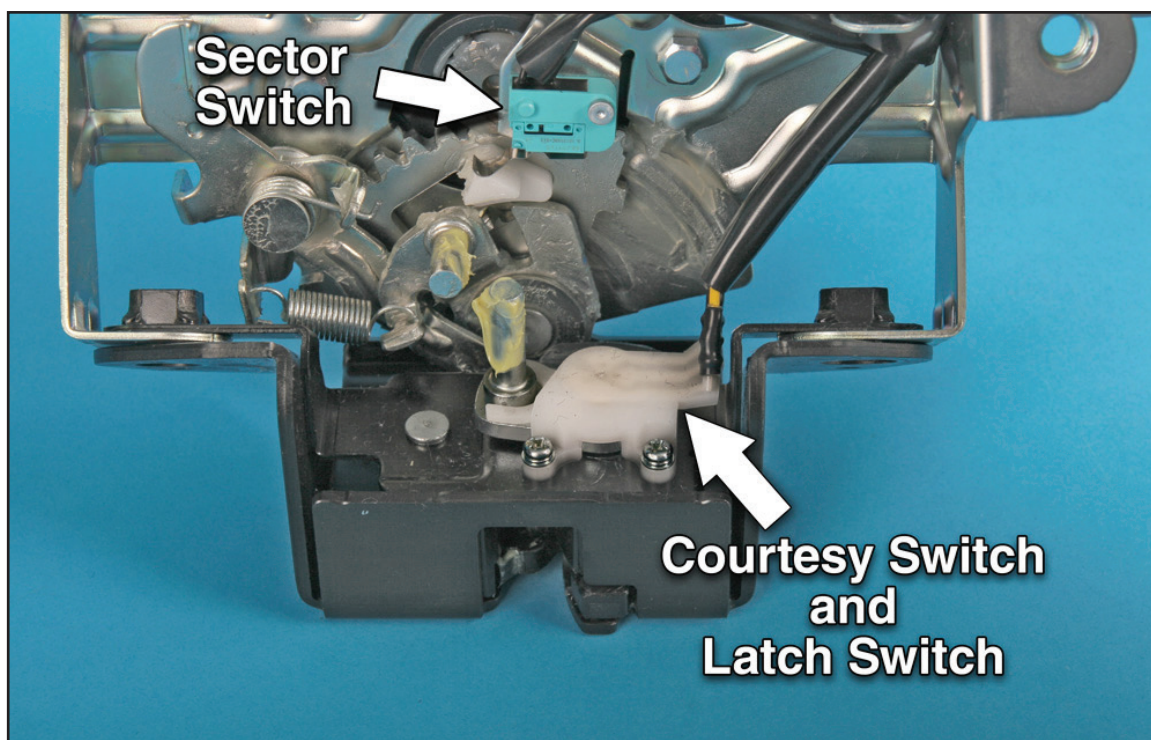


Figure 5-85 Courtesy and Latch Switch Assembly and Sector Switch

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PRG Auto Closer Opening

When the PRG auto closer assembly is commanded to open, the driven gear will be turning counter-clockwise (as viewed in figure 5-87, figure Figure 5-88). The gear will move as far as possible, creating a spike in amperage.

NOTE:

The spring force created by the weather stripping of the PRG places a preload on the latch assembly. Additional amperage flow through the motor is required to overcome this preload and assure the unlocking and opening function is performed.

During that time, the mechanical latch assembly will be released and the gate should be traveling upward. Approximately 1 second later, the polarity at the power gate auto closer motor will be reversed. The driven gear will turn clockwise, (as viewed in Figure 5-87, 5-88), until the arm of the sector switch is resting on the white plastic detent of the latch assembly driven gear. Very little amperage is required to turn the gear due to no resistance being placed on the PRG.



Figure 5-86 PRG Auto Closer Voltage and Amperage

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PRG Auto Closer Closing

As the PRG auto closer assembly contacts the gate striker, the courtesy and latch switch close. The PRG control unit combines this information with the low pulse count of the PRG drive unit motor and activates the auto closer motor.

When the PRG auto closer assembly is closing, the driven gear will be turning clockwise as viewed in Figure 5-87). The gear will move as far as possible, creating a spike in amperage. The spring force created by the weather stripping applies resistance against the gate closing, therefore the amperage of the motor increases. When the motor reaches a certain amperage value, the PRG control unit will reverse the polarity and the motor reverses. The motor will continue to operate until the arm of the sector switch is resting against the white plastic detent of the latch of the driven gear.

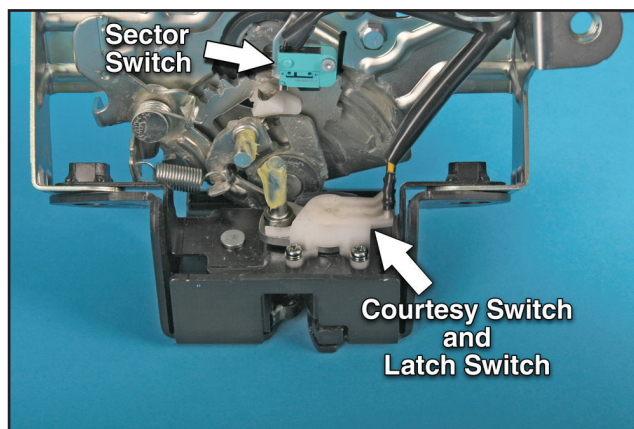


Figure 5-87 Courtesy and Latch Switch

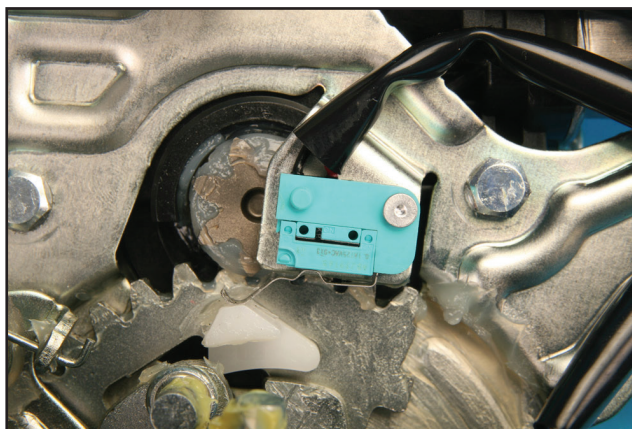


Figure 5-88 Sector Switch Arm

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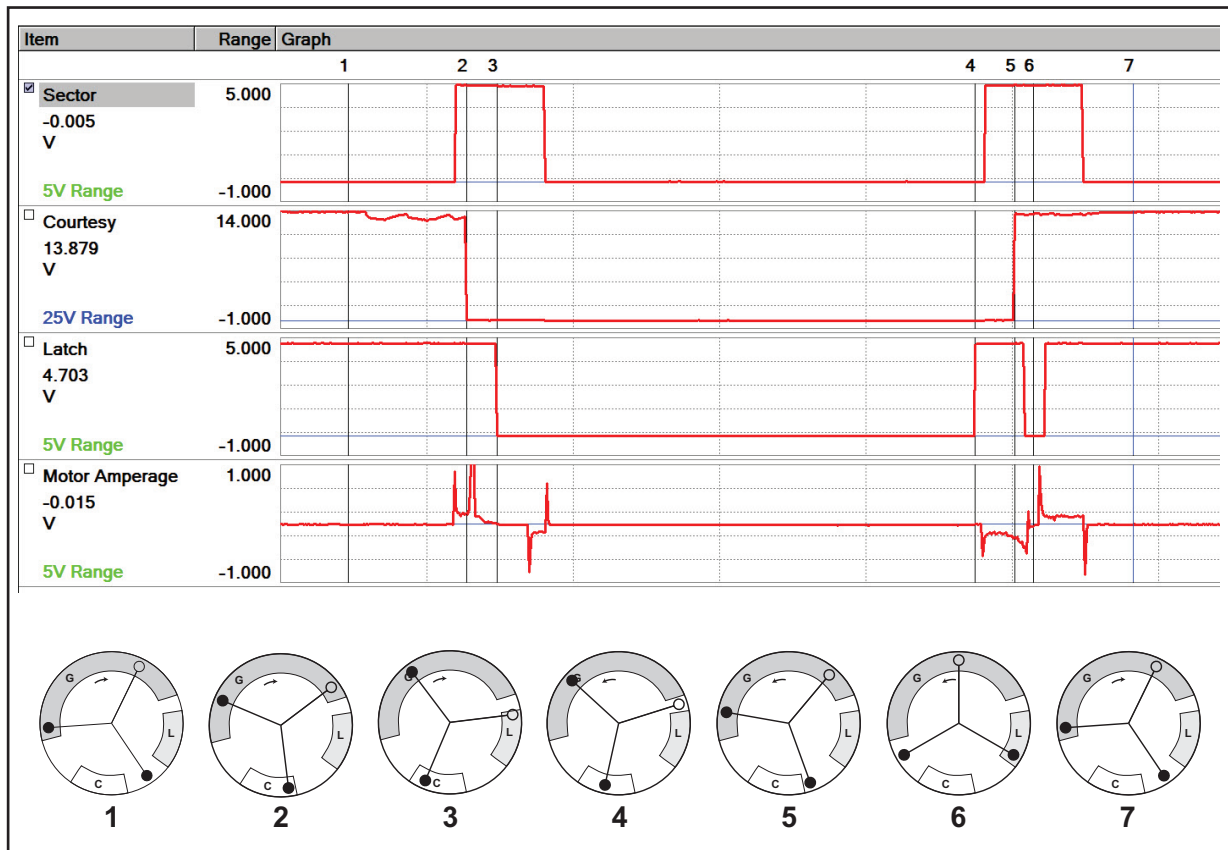


Figure 5-89 Courtesy and Latch Switch Operation

- Position 1: Auto Closer at parked position.
- Position 2: Auto Closer beginning to move in a clockwise direction. Sector switch has moved off of the park position (ground removed). Courtesy switch has been connected to ground.
- Position 3: Continued movement in the clockwise direction. Latch switch has been pulled to ground. The Auto Closer motor has finished its clockwise movement, and will begin its counter-clockwise movement after approximately 500 m/seconds. When the Auto Closer motor has finished its counter-clockwise movement the Sector switch connects to ground.
- Position 4: The latch switch opens, signaling the Auto Closer motor to begin closing movement in a counter-clockwise direction. The Sector switch moves off of the park position.
- Position 5: The courtesy switch opens. The Auto Closer motor is still moving in a counter-clockwise direction.
- Position 6: The latch switch is connected to ground. This is the signal for the Auto Closer motor to reverse direction and move clockwise.
- Position 7: The Sector switch has been connected to ground, stopping the Auto Closer motor movement. This brings the Auto Closer motor back to the park position.

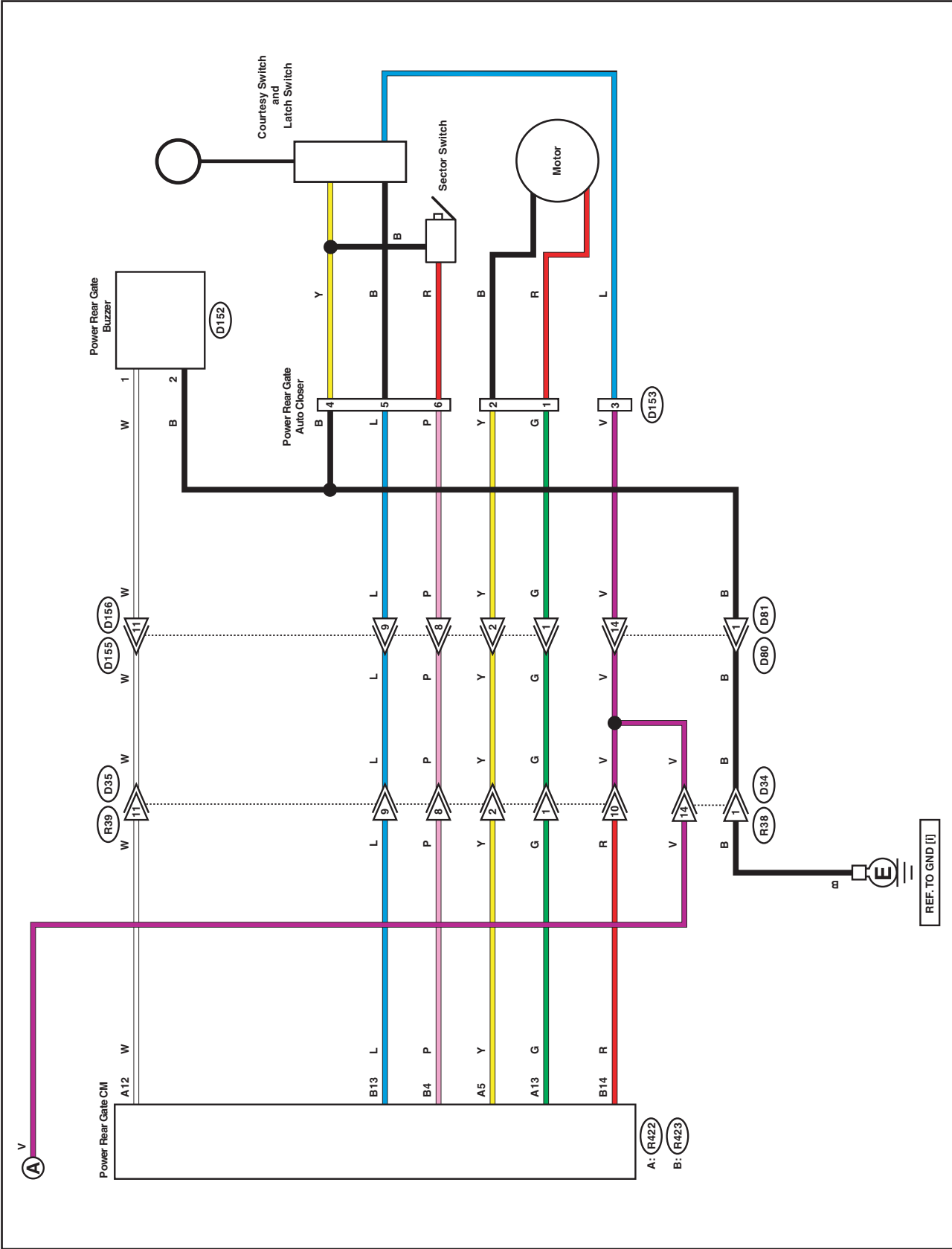


Figure 5-90 PRG Auto Closer Schematic

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Control Module I/O Chart

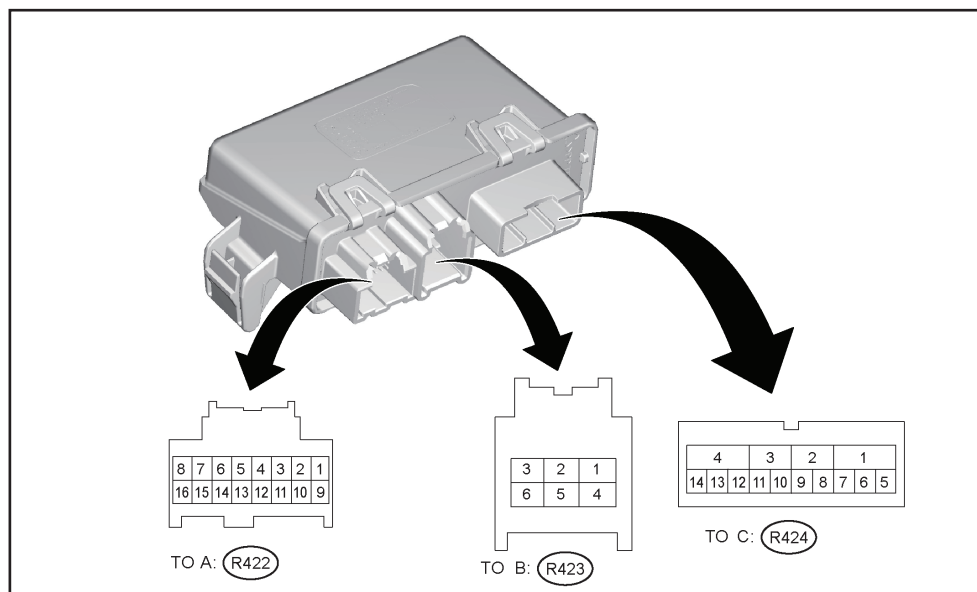


Figure 5-91 Example IO Chart

Terminal No.	Contents	Measuring condition	Standard
(R422) No. 1 ↔ (R422) No. 9	Touch sensor	When sensor is ON	2.7 V or less
(R422) No. 2	—	—	—
(R422) No. 3 ↔ (R422) No. 9	Latch switch	When rear gate is fully closed	3.7 — 16 V
(R422) No. 4 ↔ (R422) No. 9	Courtesy switch	When rear gate is fully closed	3.7 — 16 V
(R422) No. 5 ↔ (R422) No. 9	Sector switch	When rear gate is fully closed	3.7 — 16 V
(R422) No. 6 ↔ (R422) No. 9	Power rear gate inner SW	When power rear gate inner switch is ON	Less than 1 V
(R422) No. 7	—	—	—
(R422) No. 8 ↔ Chassis ground	Memory height switch	When memory height switch is ON	Less than 1 V
(R422) No. 9	Switch GND	—	—
(R422) No. 10	—	—	—
(R422) No. 11 ↔ (R422) No. 9	Ratchet switch	When rear gate is fully closed	Less than 1 V
(R422) No. 12	—	—	—
(R422) No. 13 ↔ Chassis ground	Power rear gate driver's switch	When driver's switch is ON	Less than 1 V
(R422) No. 14 ↔ Chassis ground	LIN communication line	—	—

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Terminal No.	Contents	Measuring condition	Standard
(R422) No. 15 ↔ Chassis ground	Hazard output	When hazard is not operating	Less than 1 V
(R422) No. 16 ↔ Chassis ground	Ignition SW	When ignition switch is ON	9 — 16 V
(R423) No. 1 ↔ Chassis ground	Battery power supply (+POWER B)	Always	9 — 16 V
(R423) No. 2 ↔ Chassis ground	Closer (CLOSE)	When power rear gate auto closer is in pull-in operation	9 — 16 V
(R423) No. 3 ↔ Chassis ground	Closer (OPEN)	When power rear gate auto closer is performing the release operation	9 — 16 V
(R423) No. 4 ↔ Chassis ground	GND	Always	Less than 1 Ω
(R423) No. 5	—	—	—
(R423) No. 6 ↔ Chassis ground	Battery power supply (+B)	Always	9 — 16 V
(R424) No. 1	—	—	—
(R424) No. 2	—	—	—
(R424) No. 3 ↔ Chassis ground	Motor (CLOSE)	When auto-closing is in operation	Pulse
(R424) No. 4 ↔ Chassis ground	Motor (OPEN)	When auto-open is in operation	Pulse
(R424) No. 5	Buzzer (-)	—	—
(R424) No. 6 ↔ (R424) No. 5	Buzzer (+)	When buzzer sounds	Pulse
(R424) No. 7	—	—	—
(R424) No. 8 ↔ Chassis ground	HALL RETURN	—	—
(R424) No. 9 ↔ (R424) No. 8	HALL2	—	—
(R424) No. 10 ↔ (R424) No. 8	HALL1	—	—
(R424) No. 11 ↔ Chassis ground	HALL FEED	—	—
(R424) No. 12	—	—	—
(R424) No. 13	—	—	—
(R424) No. 14	—	—	—

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Diagnosis

Diagnosis of the Power Rear Gate system follows the same basic procedure used for most systems.

Basic Diagnostic Procedure

1. Perform customer interview – Determine the conditions surrounding the fault
2. Basic inspection – Test operation
3. Check if Subaru Select Monitor communication is possible
4. Check for stored DTC(s)
5. Perform diagnostic procedure for any recorded DTC(s)
6. Perform Diagnostics with Phenomenon if no DTC(s) are present

DTC List

DTC	Item
B2500	Battery power supply
B2506	PRG motor current surge
B2507	PRG motor circuit open
B2508	PRG motor circuit low
B250B	Rotation sensor A stuck
B250D	Rotation sensor B stuck
B250F	Rotation sensor pulse / count
B2511	Rotation sensor pulse / reverse direction
B2513	Latch condition
B2514	Ignition
B2515	Latch SW
B2516	Sector SW
B2519	Power +B open
B251A	Lin connection no-receive data
B2522	EEPROM
B2524	Touch sensor circuit / open
B2525	Rotation sensor power supply
B2526	Auto closer motor circuit open
B2527	Auto closer motor circuit low

Figure 5-92 PRG System Example DTC List

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Diagnosis with Phenomenon

Symptoms
Turn hazard lights do not illuminate
The buzzer does not sound
Operation by the power rear gate driver's SW is not possible
Memory height SW does not function
Power rear gate inner SW does not work
Power rear gate position cannot be memorized
Does not stop at a height registered in memory
Rear gate opener button does not function
Operation from keyless / keyless access mobile key is not possible
Power rear gate does not operate
Either auto-open or auto-close does not operate
The rear gate does not hold at the full-open position

Figure 5-93 PRG - Diagnosis with Phenomenon Chart

Diagnosis with Phenomenon provides the technician with a symptom based diagnostic tree. Always refer to the diagnostic procedure for any current DTCs prior to using the diagnosis with Phenomenon chart.

Repair

System Initialization

Initialize the system when replacing any of the PRG components. The initialization process is as follows:

NOTE:

Perform the initialization of the power rear gate auto closer when the battery ground cable is connected with the rear gate open. Initialization is not required when the battery ground cable is connected with the rear gate closed.

1. Turn the ignition switch to OFF.
2. Close the rear gate slowly and release the hold of rear gate after hearing a clicking sound and the latch is engaged halfway.
3. The auto closer function then operates and pulls the rear gate to engage fully.
4. Operate the power rear gate after the rear gate closes fully to check that automatic open / close of the power rear gate operates normally.

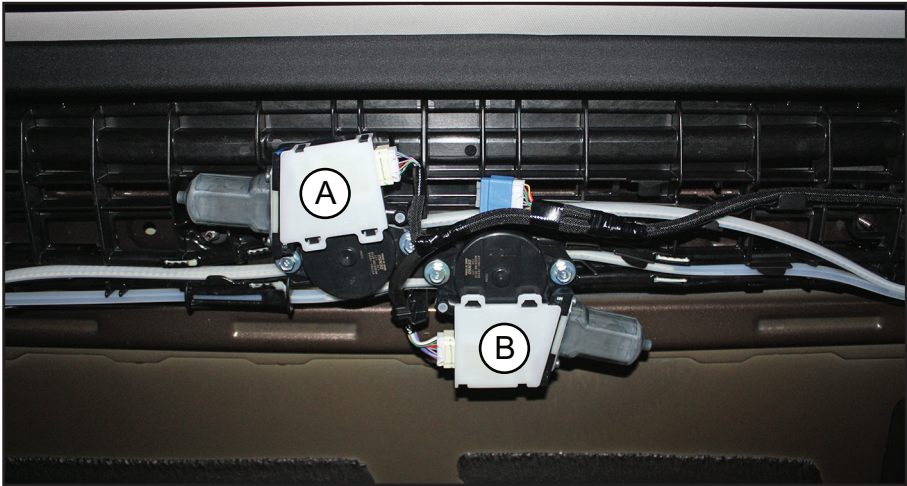
Panoramic Moonroof

Starting in 2019, the Ascent is equipped with a Panoramic Moonroof and an electronic moonroof shade, a first for Subaru. The electric moonroof can be retracted with a one-touch for driver convenience.



Figure 6-1 Panoramic Moonroof

There are two motors for the moonroof mechanism, both of which appear very similar. The moonroof shade is operated by the front-most motor and the moonroof glass is operated by the rear-most motor.



A	Shade
B	Glass

Figure 6-2 Moonroof Motors

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Moonroof Shade Removal

The moonroof shade is removable with the moonroof frame installed in the vehicle. Special precautions apply and will be outlined in the following removal procedure.

- Step 1.** Open the moonroof
- Step 2.** Remove the moonroof side seal (Figure 6-3)



Figure 6-3 Moonroof Side Seal

- Step 3.** Close the moonroof
- Step 4.** Open the sunshade
- Step 5.** Disconnect the vehicle battery
- Step 6.** Remove the 4 cap screws retaining the rear moonroof glass. (T25)
- Step 7.** Remove the rear moonroof glass
- Step 8.** Remove the 2 cap screws connecting the shade to the moonroof track (Figure 6-4)



Figure 6-4 Screw Connecting the Shade to Moonroof Track

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- Step 9.** Insert a 1.5mm hex key into the sunshade assembly to maintain tension on the spring. This hole is found on the passenger's side and is accessed from above. (Figure 6-5)



Figure 6-5 Hex Key

- Step 10.** Insert a small flat-tip screwdriver (pocket screwdriver) into the groove in the sunshade assembly, pressing in on the spring-loaded center shaft. This groove is on the driver's side and accessed from below.

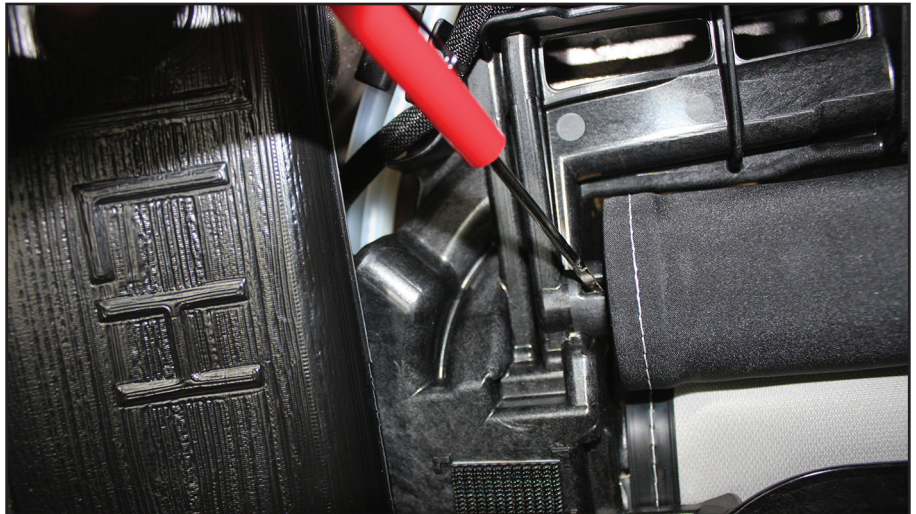


Figure 6-6 Sunshade Assembly

- Step 11.** Pull down on the sunshade assembly to remove it from the vehicle.

Installation is the reverse procedure.

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Driver Assist Systems

Front View Monitor

First used on the 2019 Ascent. Some vehicles are equipped with the Front View Monitor which incorporates a camera located under the front grille emblem and a monitor located in the **Multi-Function Display (MFD)** or the audio unit display to aid low speed visibility. This feature is helpful when pulling out of parking spots or alleys with little front side visibility.



Figure 7-1 Front View Monitor Camera (Ascent)

This feature is operated by selecting the “View” button. When turned on, the system displays approximately a 180° view across the front of the vehicle. This display also features guide lines showing the width of the vehicle marking approximately 19-20 inches in front of the vehicle.



Figure 7-2 View/Enter Button (Ascent)

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Figure 7-3 Front View Monitor Display

Guideline adjustment is available but not required after replacemnt.

Special attention should be paid to the wiring colors during diagnosis. The wire colors change significantly between the MFD and the Camera Assembly.

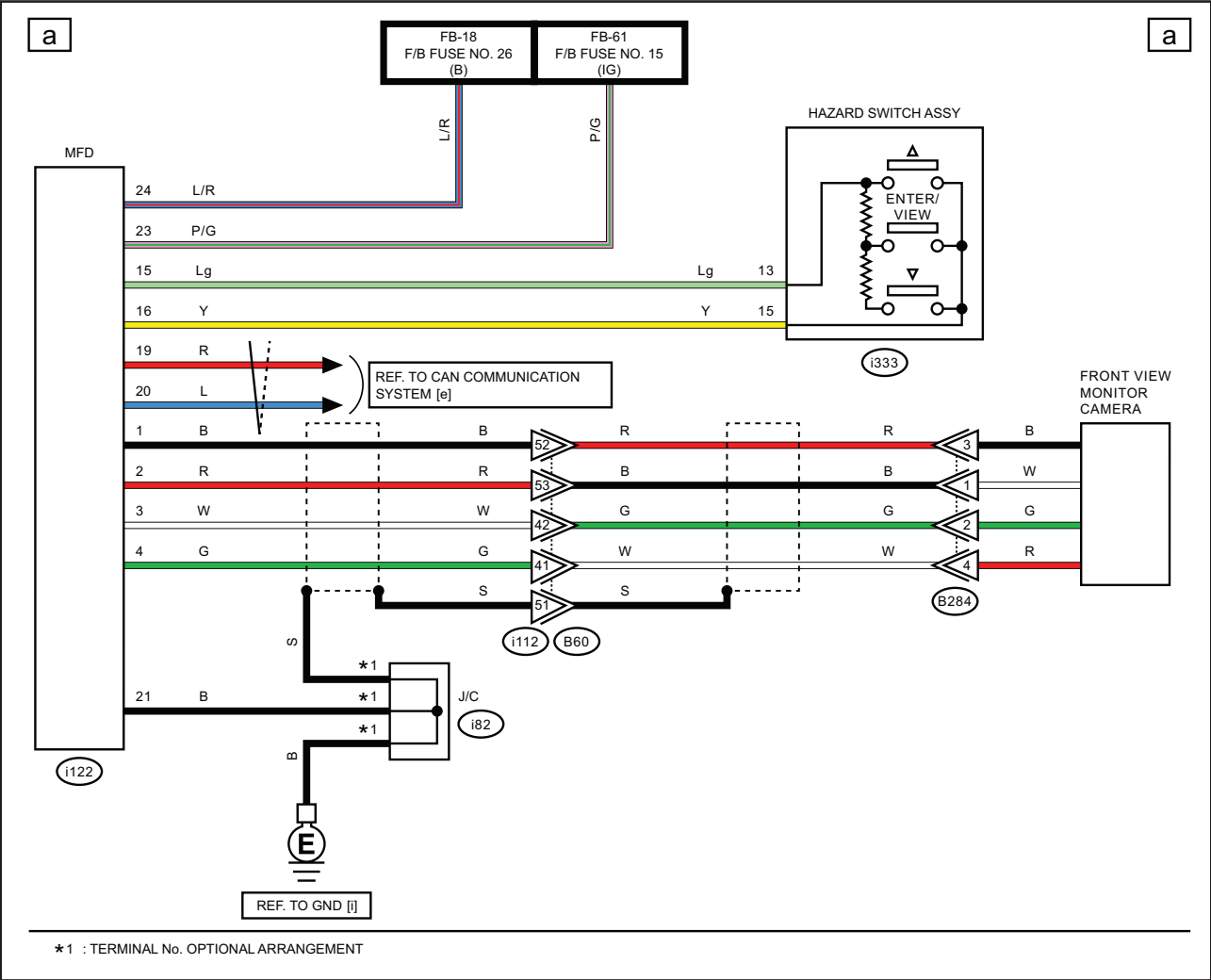


Figure 7-4 Wiring (Ascent)

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Smart Rearview Mirror

First used on the 2019 Ascent. Some vehicles are equipped with a Smart Rearview Mirror. This system includes a mirror with a video display and a dedicated camera on the top of the rear gate. This mirror operates as an auto-dimming Homelink mirror. When the Mode Lever Switch is pulled forward, the mirror will change to a video display of the view from the rear of the vehicle. This feature is helpful when the vehicle is fully occupied, cargo blocks rear vision, or in fluctuating light conditions such as driving at sunrise or sunset.



Figure 7-5 Switch OFF (Mirror Function)



Figure 7-6 Switch ON (Rear Camera Display)



Figure 7-7 Smart Rearview Mirror (Camera Cover)



Figure 7-8 Smart Rearview Mirror Camera (Ascent)

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Rearview Camera

Many Subaru models are equipped with a rearview camera to aid in safely reversing the vehicle. On the 2019 Ascent, this image is displayed in the Entertainment System and includes backup lines, vehicle path lines (respond to steering wheel movement), and RAB controls (if equipped).



Figure 7-9 Rearview Camera Display



Figure 7-10 Rearview Camera

Always refer to the Subaru Service Manual for guideline confirmation after camera replacement.

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EyeSight Assist Monitor

First used in 2018 on the WRX the **EyeSight Assist Monitor (EAM)** provides a **Heads-up Display (HUD)** of EyeSight system warnings and EyeSight system status information. This information is displayed on the windshield directly in front of the driver by colored LEDs. This system prevents the driver from taking their eyes off the road to review important alerts.

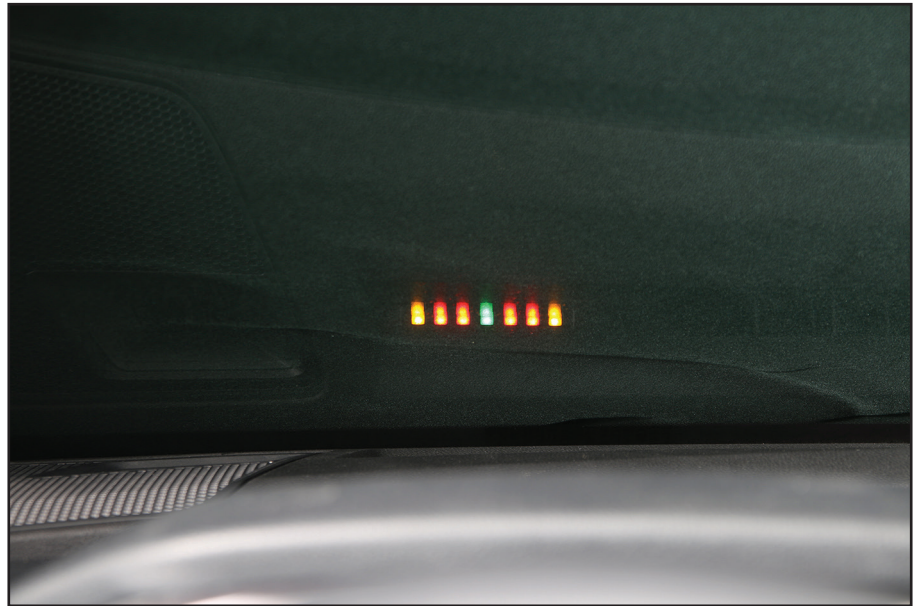


Figure 7-11 EyeSight Assist Monitor – All LEDs Illuminated (Active test)



Figure 7-12 EyeSight Assist Monitor Control Module

When the ignition is cycled on, the EyeSight Assist Monitor performs a bulb-check, where-in the lights will begin to illuminate in pairs, starting from the outer yellow lights to the inner green light. This process then repeats a second time, after which the light will stay off until an EyeSight function is used.

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The Green LED illuminates when Adaptive Cruise Control is utilized and a vehicle preceding (in front) is recognized by the EyeSight system.

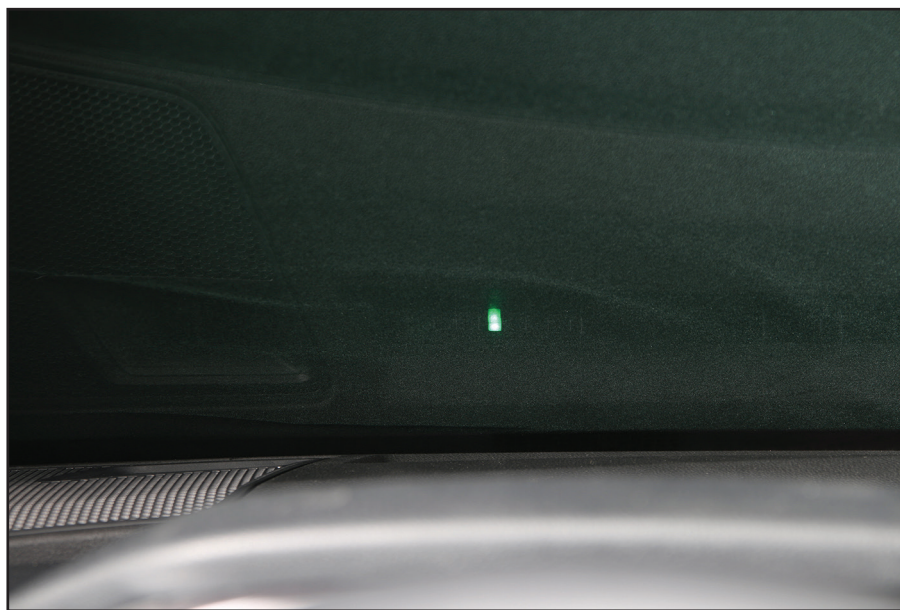


Figure 7-13 Green LED illuminated

The Yellow LEDs on the edge of the monitor illuminate as a warning to the driver for the following reasons:

- Blinking in Yellow (one side), Solid in Yellow (opposing side) – Lane Departure Warning is operating
- Blinking in Yellow (both sides alternately) – Lane Sway Warning is operating
- Blinking in Yellow (simultaneously) – Steering wheel operation has not been detected for a given time

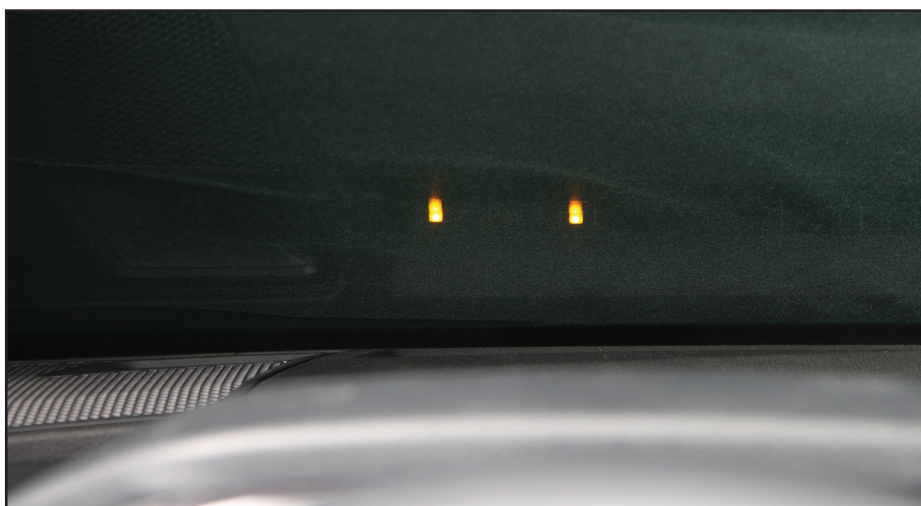


Figure 7-14 Yellow LEDs Illuminated

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The Red LEDs illuminate as a warning to the driver for the following reasons:

- Vehicle Distance Warning
- Pre-Collision Braking System Warning (primary and secondary brakes)
- “Brake More” Warning
- Pre-Collision Throttle Management Warning

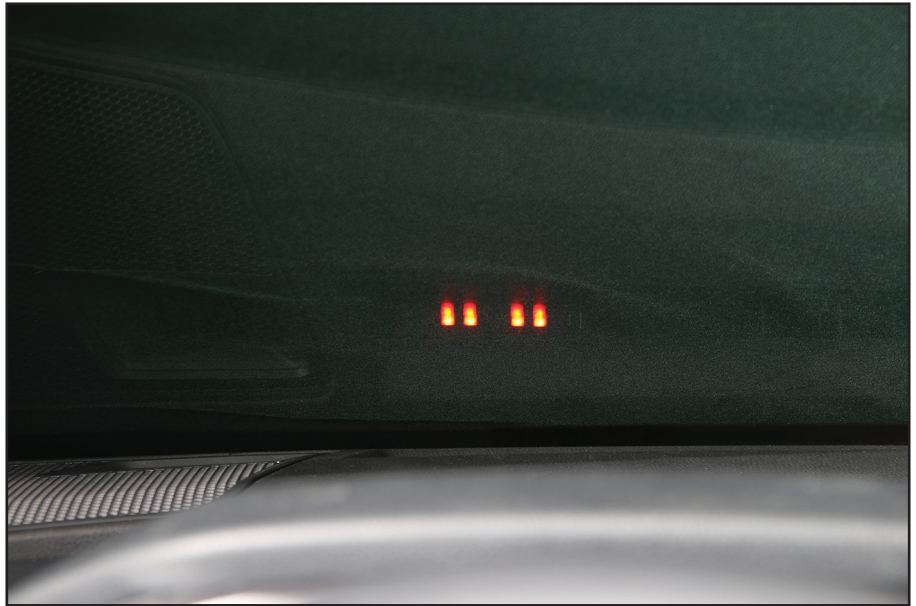


Figure 7-15 Red LEDs Illuminated

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Automatic Windshield Wipers

The automatic windshield wiper feature uses a rain sensor to sense rain and control the operation of the windshield wiper switch in changing weather conditions and to reduce driver fatigue. When the wipers are placed in the Automatic position, the wiper speed is automatically controlled and adjusted accordingly. This adjustment occurs by monitoring the amount of rainfall using a rain light sensor located in the upper portion of the windshield, and by monitoring vehicle speed. The rain light sensor sensitivity can be adjusted by using the control dial on the wiper switch.



Figure 8-1 Automatic Wiper Sensitivity Adjustment



Figure 8-2 Rain Sensor (Center)

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The rain sensor communicates with the BIU over a LIN communication bus. In addition to the LIN connection, the rain sensor receives feedback from the wiper motor to determine when the windshield wipers are in the PARK position for more accurate measurement of rain on the windshield.

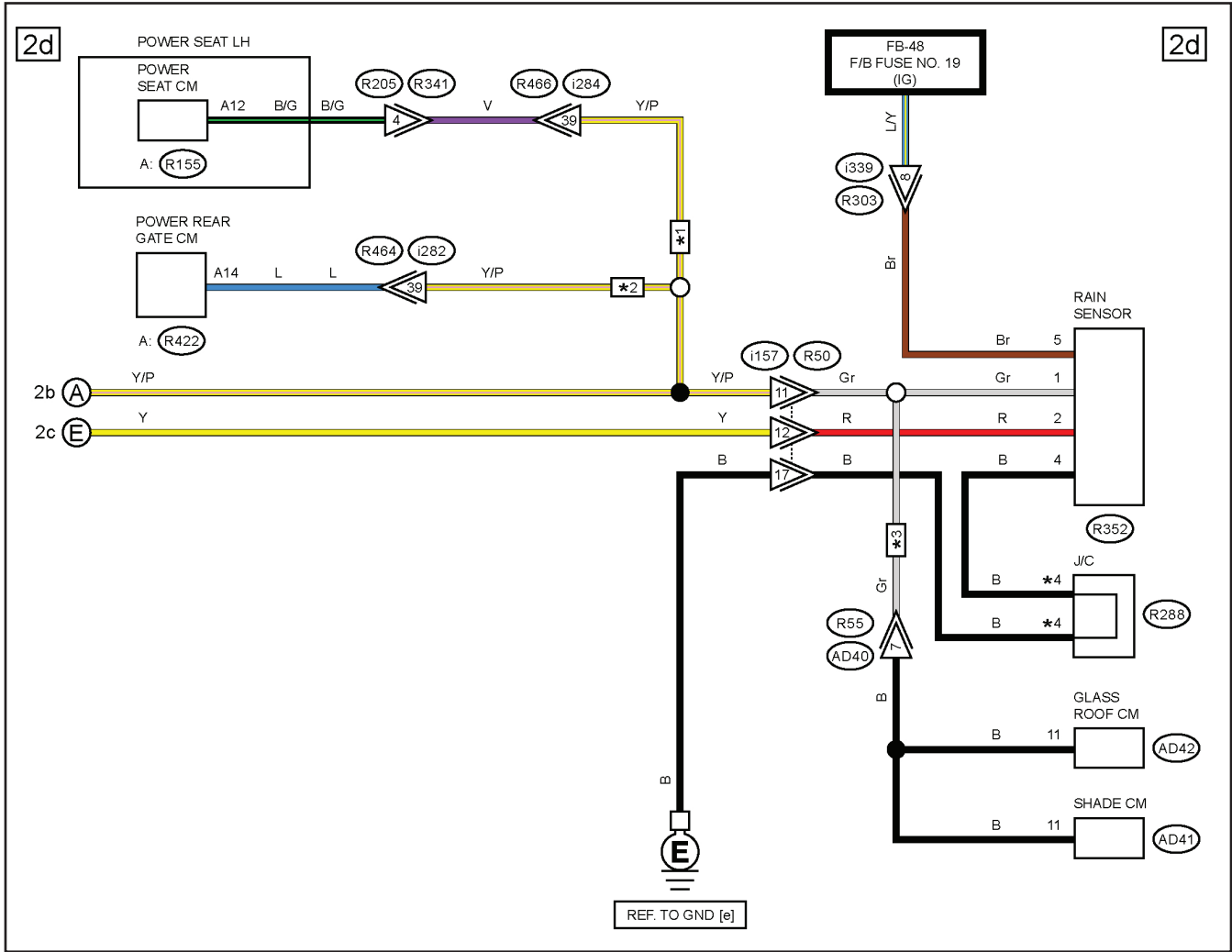


Figure 8-3 Rain Sensor Wiring

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The windshield wiper operation is commanded by the BIU and controlled through the use of an additional Wiper Relay Unit. This relay unit is located in the right front corner of the vehicle, between the bumper cover and turbocharger ducting.



Figure 8-4 Wiper Relay Unit

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Rain Sensor Removal

A unique procedure is required for removal of the rain sensor. Begin by disconnecting the ground cable from the battery, then remove the stereo camera cover assembly. Release the claws on the connector cover, remove the connector cover, then disconnect the connector from the rain sensor.

Prepare a tool with a width of approximately 10mm, and a thickness of 1 to 1.5mm.

1. Insert the tool in the indentation at the bottom of the sensor assembly to release the lock on the sensor bracket
2. Pull the sensor away from the glass, and remove it from the bracket by sliding it upwards

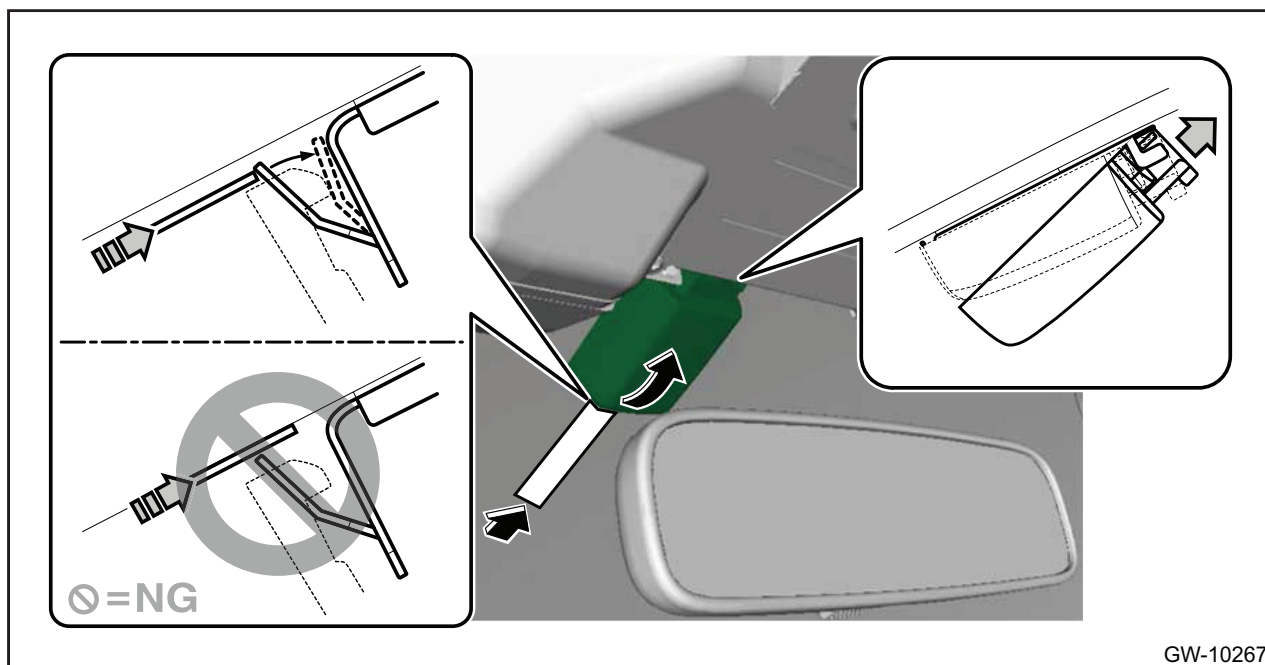


Figure 8-5 Rain Sensor Removal

NOTE:

Do not touch the sensor face or the windshield glass after removal of the rain sensor.

If the rain sensor is replaced, the Rain Sensor Initial Setting must be performed through Work Support in the Subaru Select Monitor.

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DriverFocus - Driver Monitoring System

Operation



Figure 9-1 DriverFocus - Driver Monitoring System Camera Location

The DriverFocus Driver Monitoring system uses a camera and a near infrared LED light to illuminate and monitor the driver and provide an alert if a driver becomes distracted or drowsy. The Driver Monitoring System can also recognize registered drivers and recalls their preferences such as:

- Seat and side mirror positions
- HVAC settings
- Mileage
- Favorite combination Meter display (CMD)
- Favorite Multi-Function Display (MFD) Screens

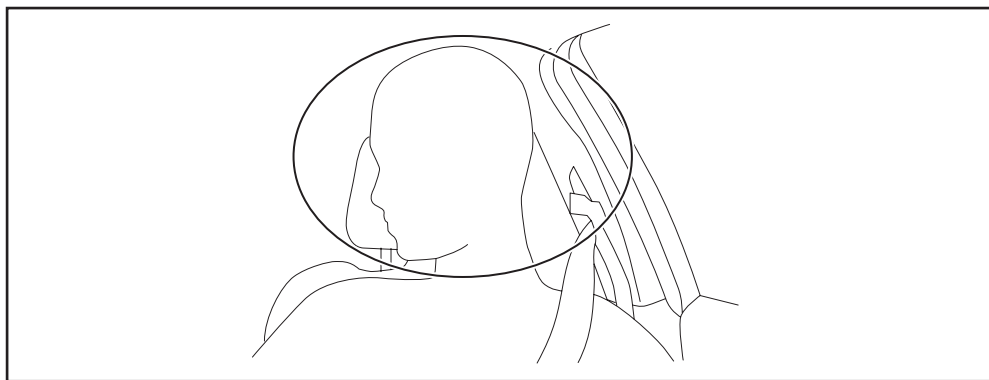


Figure 9-2 Capturing the Face Direction and Presuming Level of Inattentive Driving

The wandering gaze warning is given if the angle of the driver's head (not eyes) has deviated from the straight ahead position by a predetermined angle and time. If the system determines the driver is inattentive, it warns the driver with a buzzer and message in the Combination Meter Display (CMD). Monitoring for inattentive driving is performed only while driving. The warning is not issued when the turn signals are turned ON or when the vehicle is stopped.

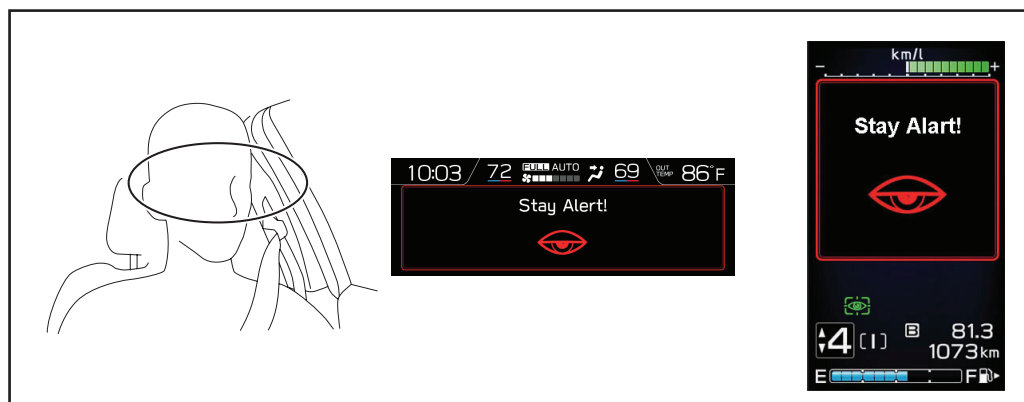


Figure 9-3 Watching the Eye Opening Degree and Presuming Level of Drowsiness/Sleepiness

The sleepy/drowsy driving warnings are determined by monitoring the ratio of time between the driver's eyes being open and closed.

- If the driver's eyes are staying closed for a moderate amount of time, the system determines the driver is sleepy. When the level exceeds the predetermined level, the system warns the driver with the buzzer and a message in the CMD to take a break.
- If the driver's eyes are staying closed for a longer amount of time, the system determines the driver is very sleepy. When the level exceeds a predetermined level, the system warns the driver with a buzzer and messages in both the CMD and MFD to stay alert. This function mutes the audio volume so that the driver can easily hear the buzzer sounding

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Monitoring for drowsiness or sleepiness is performed only while driving. The warnings are not issued when the turn signals are turned ON or when the vehicle is stopped.

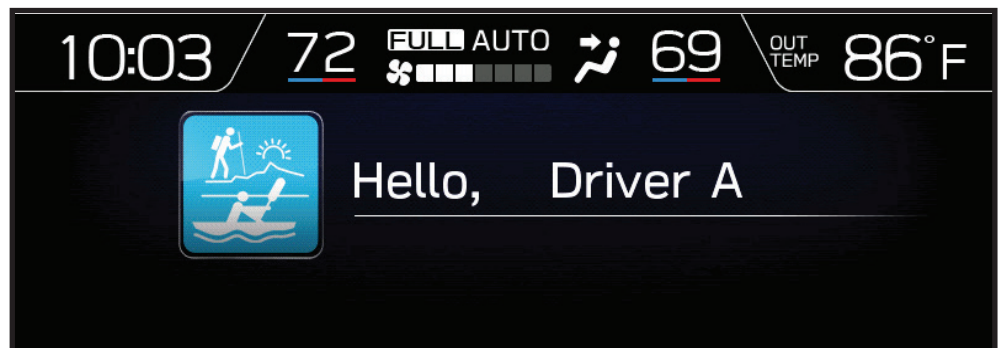


Figure 9-4 Driver Recognition Screen on the MFD

When the driver's door is opened and then closed, the driver recognition system scans the driver and displays the recognition result on the MFD. If the driver has previously registered to the system, it will then automatically set the driver's recorded seat position, door mirror positions, favorite MFD screen, favorite CMD screen, mileage reading, and HVAC settings. Driver registration is performed on the customizing screen of the MFD by using the steering wheel satellite switch marked INFO and the meter operation switch when the ignition is ON. Up to five drivers can be registered.



Figure 9-5 DriverFocus ON/OFF Switch

The Driver Monitoring System can be turned OFF for the current ignition cycle with the OFF switch located in the instrument panel switch assembly. The system will be turned ON again automatically when the ignition is cycled OFF and back ON.

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NOTE: The drowsy driving and wandering gaze warnings will not function if the system is turned OFF.

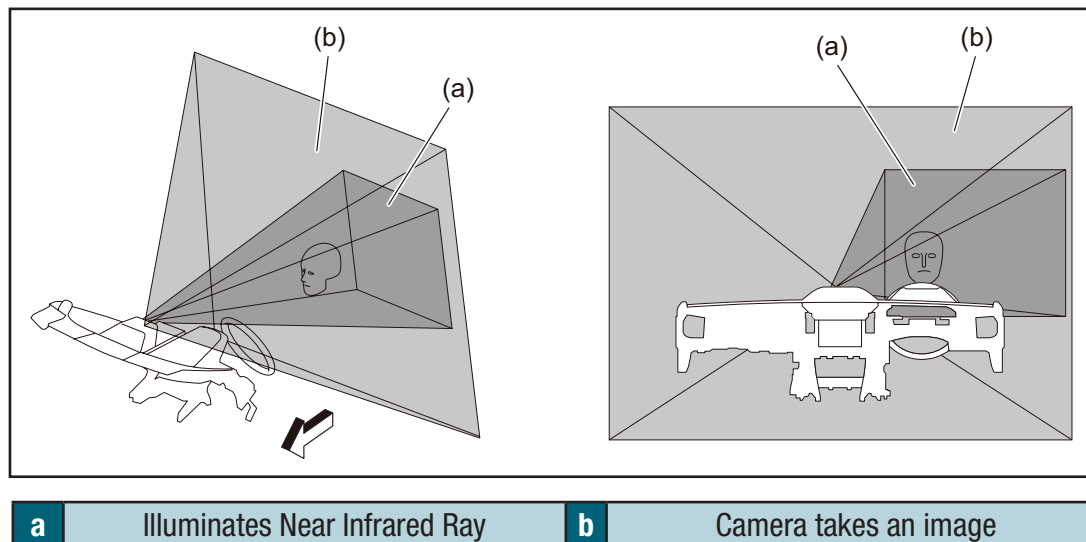


Figure 9-6 DriverFocus Camera

DriverFocus camera operation: Near infrared illumination area (A) and Camera capture area (B).

The system captures images of the driver using a camera and near-infrared LEDs to illuminate the driver. The initial images are used to identify the driver to the system. Images are then continually taken while the vehicle is in motion to calculate facing direction and the amount of time the driver's eyes are opened and closed. This information is used to give wandering gaze and drowsy driving warnings.

NOTE: The images are not saved or stored in the system to protect personal information..

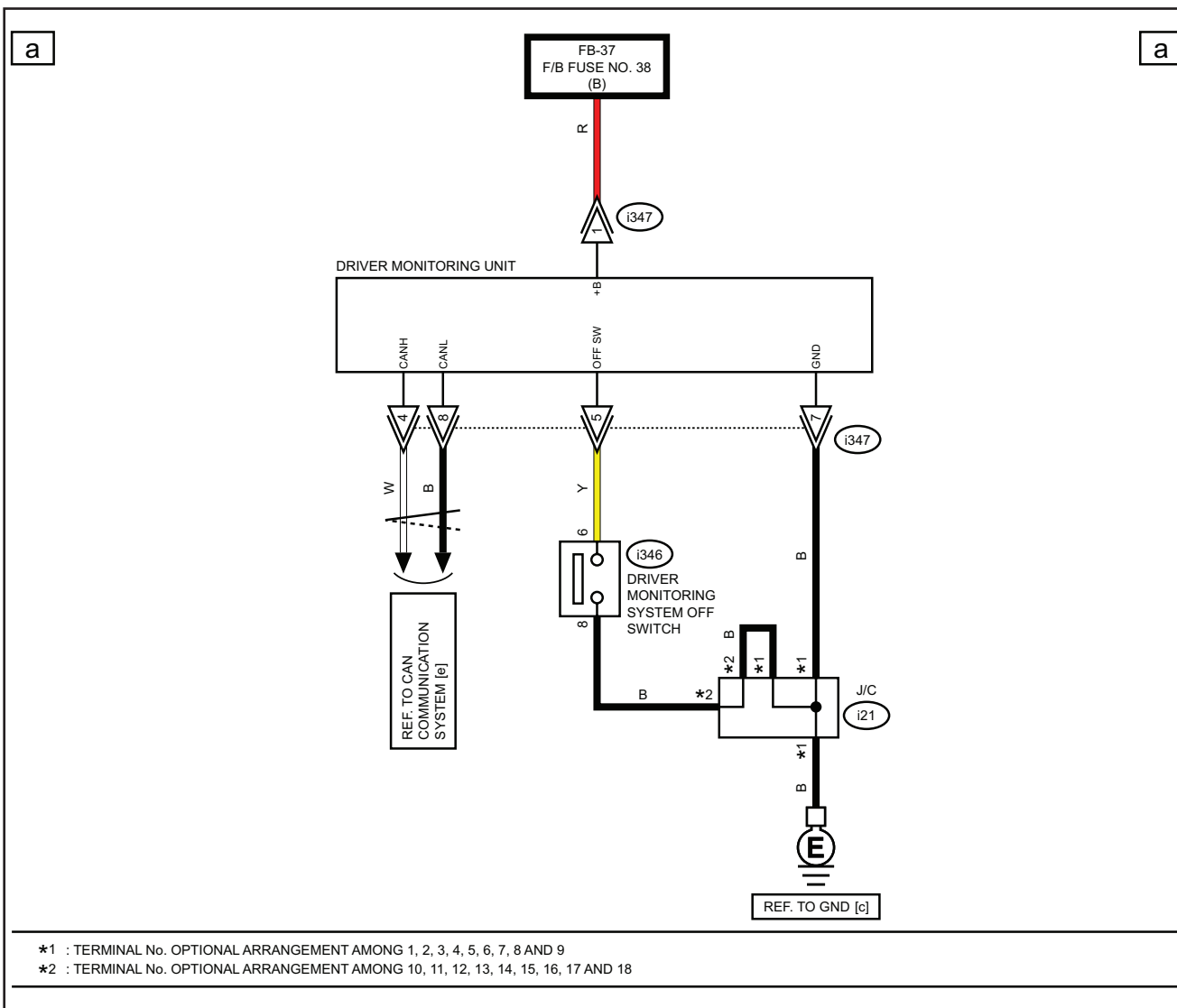


Figure 9-7 DriverFocus System Wiring Schematic

The DriverFocus System consists of a standalone control module and camera assembly that communicates with other systems on the vehicle's high speed CAN network. This module uses a power wire, a ground wire, two high speed CAN communication wires, and an input signal from the DriverFocus System OFF Switch.

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Registering A User



Figure 9-8 Items Which May Prevent User Recognition

When registering or recalling users, remember the following points:

- The camera in the center of the dash must be able to see the driver's entire face for biometric identification – Both eyes, nose, and mouth
- The system may have difficulty identifying a user under the following circumstances
 - Wearing sunglasses
 - Wearing a scarf
 - Wearing a hat
 - Wearing dark eye make-up
 - Wearing an eye-patch
 - Change in or growth of facial hair
 - Sun shining off of oily skin
 - Wearing facial jewelry

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Figure 9-9 Eyes facing camera



Figure 9-10 Head facing camera

- In many cases it is necessary to alternately face forward then turn your face to the camera with your chin lowered, not just look at the camera and then straight forward.

Diagnosis

Diagnosing DMS system concerns must begin with the customer Interview worksheet being completed. This system is subject to many variables which the technician may not be able to reproduce in a service bay. In many cases the customer will need to be present to demonstrate their concern. This is especially true for registration / recognition concerns. The unique shape of a person's face and their posture may be the source of their difficulty. A trained technician can help the customer through these potential difficulties.

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Customer Interview Worksheet

Driver Monitoring System Check List for Interview				Date the Vehicle is	
Received	Year	Month	Day		
Customer's name			Registration No.	Initial year of registration Year Month Date	
			Vehicle model	Frame number	
Interviewer	Inspector		Engine type	Odometer reading	
Customer specified content • • •					
Date and time when the trouble occurred	Year Date	Month	Frequency of trouble occurrence	Always occurs Sometimes occurs (times per day, times per month)	
Condition of trouble occurrence (How the trouble occurs)			Weather	Fine • Cloudy • Rainy • Snowy • Others ()	
			Temperature	°C (°F) — °C (°F)	
Occurrence timing	During driving / during stopping / cornering				
Road type	Express way / general road / mountain road				
Position of solar radiation	Front / right side / left side / back				
Road conditions	Traffic congestion / restriction due to construction				
Road condition	Paved / gravel / bumpy				
Passenger room condition	Vehicle accessories equipment information (such as retrofitted inner mirrors)				
	Sun visor usage information				
	Was anything hanging from the inner mirror?				
	Does the vicinity of the driver monitoring system screen likely damage or dirty the screen?				
Display type	Where was it displayed?				
	What type of display was it?				
	What color was it?				
	How did it sound?				
Condition of warning light	Green / yellow / temporary stop indicator / OFF indicator				
About the customer	Sex	Male / Female			
	Age	Teens / 20s / 30s / 40s / 50s / 60s / 70s / 80s or older			
	Height cm (ft)	140 — 150 (4.6 — 4.9) / 151 — 160 (5 — 5.2) / 161 — 170 (5.3 — 5.5) / 171 — 180 (5.6 — 5.8) / 181 — 190 (5.9 — 6.2) / 190 (6.2) or more			
Special mentions on customer usage	Sunglasses / glasses / contact lens / hat / mask, etc.				
Other special mentions on the customer	Large • narrow eyes / false eyelashes / long • short nose, etc.				
Accessory installation condition					
Diagnostic trouble code					
Time stamp					
Control module item number/Ver.					
Condition of trouble occurrence (How the trouble occurs)					
Vehicle bring-in history information					
Acquirement of a facial image of the person	When agreed, take an image and store it together with the Check List for Interview.				

Figure 9-11 Customer Interview Worksheet should be completed whenever trying to diagnose a concern with the Driver monitoring system

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Repair

When making repairs involving the DMS system and its convenience features, read the stored information from the old module (if possible) and write it to the new module. This additional step requires little additional time and will prevent the customer from having to re-register all users. The following modules retain information used by the DMS system to recall customer preferences and allow the reading and writing of customized settings:

- Combination Meter
- Driver Monitoring System Control Module
- HVAC Control Module
- Memory Power Seat and Side Mirror Control Module

Driver Monitor System Operation – Overview

Review the following document and refer to it so questions regarding the DMS system.

Subaru DriverFocus–Driver Monitoring System

◆ Function for safety and security

This function utilizes the user recognition camera to recognize the driver status and support safe driving. Under conditions such as when driver's eyes are closed for a certain length of time during driving, or when the direction of the face is significantly deviated from straight ahead, the system concludes that the driver is drowsy or not paying attention to the road, and warns the driver by means of a warning sound and warning display.

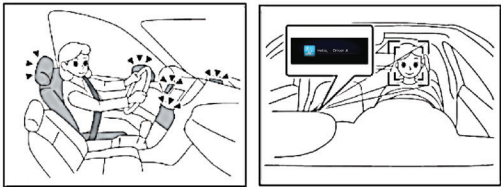
Caution

There are limits to the recognition performance of the Driver Monitoring System. Do not rely excessively on the Driver Monitoring System when driving.

- It cannot detect whether or not the driver actually feels drowsy, or whether or not the driver is actually concentrating on safe driving.
- It cannot judge whether the driver is awake or asleep, or whether the driver's driving performance has diminished or the driver is concentrating properly on safe driving.
- Depending on the circumstances, the system may not be able to correctly detect the driver conditions.

◆ User data link function

When a user is registered, the registered driver seat position, door mirror angle, and other functions that are linked with the user data of each individual are automatically recalled based on the user information.



◆ Inattention/drowsiness warning

Under conditions such as when driver's eyes are closed for a certain length of time during driving, or when the direction of the face is significantly deviated from straight ahead, the system concludes that the driver is drowsy or not paying attention to the road, and activates a warning. When the inattention/drowsiness warning activates, the buzzer sounds, and an interrupt screen is displayed.

Information

The inattention warning does not activate when the turn signals are operating or when the shift lever is in the "R" position.

● Inattention warning

Under conditions such as when driver's eyes are closed for a certain length of time during driving, or when the direction of the face is significantly deviated from straight ahead, the system concludes that the driver is drowsy or not paying attention to the road, and activates a warning. When the inattention/drowsiness warning activates, the buzzer sounds, and an interrupt screen is displayed.

Keep Eyes on Road

Information

- The Driver Monitoring System may not function correctly due to circumstances such as external light or sunlight shining into the vehicle. Refer to Owner's Manual (OM).
- The Driver Monitoring System may not function correctly when the driver is wearing accessories, such as eyeglasses or sunglasses, a mask, or similar item. Refer to OM.
- The Driver Monitoring System may not function correctly when there is an object between the system and the driver's face. Refer to Owner's Manual (OM).
- It may not be possible to monitor the driver correctly when there is dirt, fingerprints, condensation, or other substance on the camera. If there is dirt, fingerprints, condensation, or other substance on the camera, wipe it off gently using a dry, soft cloth, dampened cloth that has been wrung out forcefully to remove all water, or similar item. Refer to OM.
- Correct recognition may not be possible when the surface of the user recognition camera or infrared light source (LED) is scratched. Therefore, take care that no hard objects contact them. Refer to OM.
- In the following cases, correct recognition may not be possible, and the drowsiness warning or inattention warning buzzer may sound:
 - The driver is looking downward to check the instruments, navigation screen, or other item.
 - The driver's eyes are narrowed due to laughter, dazzling outside light, or other reason.
 - The driver's eyes were closed for a certain length of time or blinking frequently.
 - The driver is leaning forward, sticking his/her face out the window, or is otherwise not in the correct driving posture.
- The Driver Monitoring System temporarily stops operating due to the system status, recognition conditions, or other factor.

* For other detailed information, refer to OM.

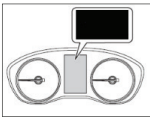
● Drowsiness warning

The system judges the driver status from the degree of eyelid closure and warns the driver. When a warning occurs, the buzzer sounds, and an interrupt screen is displayed.

Driver status judged by the system	Multi-information display	Multifunction display	Warning sound
Drowsy driving Very drowsy	Stay Alert! 		Beep beep beep... (Continues until the driver's eyes open.) 5 beeps
Slightly drowsy	Take a Break! 	Normal	1 beep
Not drowsy	Normal	Normal	None

◆ Indicator/warning icons

The status of the Driver Monitoring System is indicated on the multi-information display.



<Type of displayed screen>

Screen display (icon)	Name	Explanation
	Driver Monitoring System operation indicator (green)	Illuminates when the Driver Monitoring System is operating.
	Driver Monitoring System OFF indicator	Illuminates when the driver pressed the Driver Monitoring System OFF switch and the Driver Monitoring System stopped operating.
	Driver Monitoring System temporary stop indicator	Illuminates when the Driver Monitoring System has temporarily stopped operating.
	Driver Monitoring System warning icon (yellow)	Illuminates when there is a problem with the Driver Monitoring System. Have the system inspected at a Subaru dealership.

◆ Overview of the user data link function

When a user is registered, the following settings can be recalled automatically:

● Driver positions

The registered seat position and door mirror angles are recalled. The registered angle of the reverse-linked tilt-down mirror is recalled.

Warning

Be sure to perform registration, recall, and deletion of the seat position and door mirror angles before driving. If registration, recall, or deletion is performed while driving, there is the risk of an accident.

● Instruments

The basic screen that was selected by the user just before he or she last exited the vehicle is displayed on the multi-information display.

● Multifunction display

Multifunction display basic screen

The basic screen that was selected by the user just before he or she last exited the vehicle is displayed on the multifunction display.

Personal fuel economy meter

Can display the average fuel economy for driving by that user.

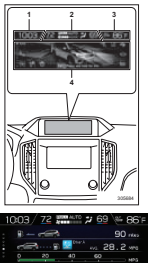


Figure 9-12 Driver Monitor System Operation (DMS) [page 1]

Advanced Electrical Systems & Diagnosis

Customization linked with the user data link function

The items which can be customized are the following:

Settings menu	Item
Time/date	Birthday
	Anniversary
Screen/volume	Screen OFF
	Favorites
	Interrupt display
	Volume
A/C settings	Basic settings
	Link to occupants
Camera settings	Link to camera select lever

A/C settings

The A/C temperature, discharge outlets, and other settings that were selected by the user just before he or she last exited the vehicle are recalled.

Driver Monitoring System ON/OFF setting

The Driver Monitoring System ON/OFF status that was selected by the user just before he or she last exited the vehicle is recalled.

◆ User recognition and registration

◆ User recognition

- When the push engine switch is OFF, opening the door displays the scan screen on the multifunction display.
- The Driver Monitoring System begins driver scan. Sit in the driver's seat and face straight ahead for a few moments.
- When a driver is detected, the Hello screen is displayed on the multifunction display.
- When a registered user was detected, the user name is displayed. At this time, the various settings are recalled based on the user information.
- When a registered user is detected and the push engine switch is turned OFF, the See You screen is displayed on the multifunction display.



Information

- Avoid closing your eyes when registering for user recognition.
- If you frequently change between glasses and contact lenses when driving, it is recommended that you register yourself both when you are wearing glasses and when you are wearing contact lenses.
- When a twin or other person whose facial features resemble your own is registered, the wrong user may be detected when either of you enters the vehicle.
- If user recognition fails, perform recognition again.
- If the user recognition success rate is low, it is possible that the user is not registered correctly. Delete the registration data and perform registration again.

● User registration

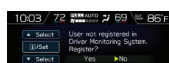
Performing user registration

Before performing registration, adjust the seat position, door mirror angles, and angle of the reverse-linked tilt-down mirror to the positions for the correct driving posture.

Information

A screen recommending user registration is displayed under the following conditions:

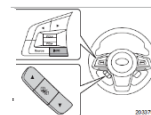
- The push engine switch is ON.
- The shift lever was moved to the "P" position from a position other than "P".
- User registration of the driver has not been completed.
- The number of registered users is 4 or less.
- The Driver Monitoring System operation indicator is illuminated.
- The user data link function is ON.



Displaying the registration screen

This operation is possible when the push engine switch is in the ACC or ON position.

- When the settings selection screen is displayed, press and hold the INFO switch to change to the settings screen.
- Operate the ▲ (Back) and ▼ (Forward) switches to select the number to register, and then pull the **i** (information)/SET switch to confirm.



User registration settings

Operate the ▲ (Back) and ▼ (Forward) switches to select "Driver Monitoring System Settings", and then pull the **i** (information)/SET switch to confirm. The screen changes to the Driver Monitoring System settings item selection screen.



- Operate the ▲ (Back) and ▼ (Forward) switches to select "User Registration", and then pull the **i** (information)/SET switch to confirm.
- Operate the ▲ (Back) and ▼ (Forward) switches to select the number to register, and then pull the **i** (information)/SET switch to confirm.
- Select "Settings", and then pull the **i** (information)/SET switch to confirm.
- Remain seated in the driver's seat, and face straight ahead for a few moments.
- When the beep sound occurs and the screen changes, registration is completed.



Information

- If the screen does not change, turning your face to alternately look directly at the multifunction display and straight ahead may make it easier for the system to detect you.
- If "Unable to register. Perform registration again" is displayed, perform the procedure beginning from Step 3 again.

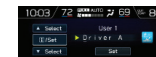
- Input your name and set the icon.

- Inputting your name:

Operate the ▲ (Back) and ▼ (Forward) switches to move to the input position. Pull the **i** (information)/SET switch to change to input mode.

The ► mark on the screen changes to **i**.

Operate the ▲ (Back) and ▼ (Forward) switches to change the letter. Pull the **i** (information)/SET switch to confirm.



- Icon selection:

Operate the ▲ (Back) and ▼ (Forward) switches to move to the input position. Pull the **i** (information)/SET switch to change to input mode.

The ► mark on the screen changes to **i**.

Operate the ▲ (Back) and ▼ (Forward) switches to select the desired icon. Pull the **i** (information)/SET switch to confirm.



<Types of icons that can be selected>



Figure 9-13 Driver Monitor System Operation (DMS) [page 2]



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