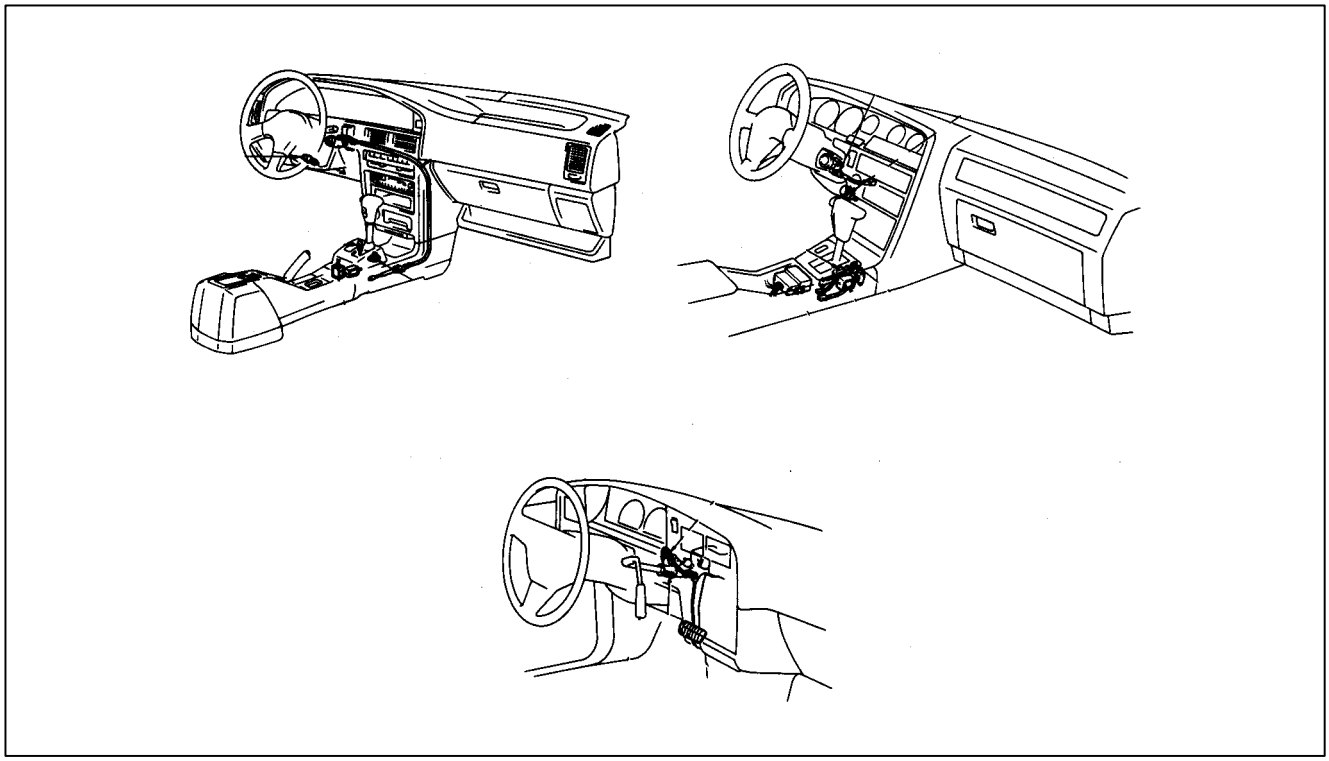
Section 12

SHIFT LOCK SYSTEM



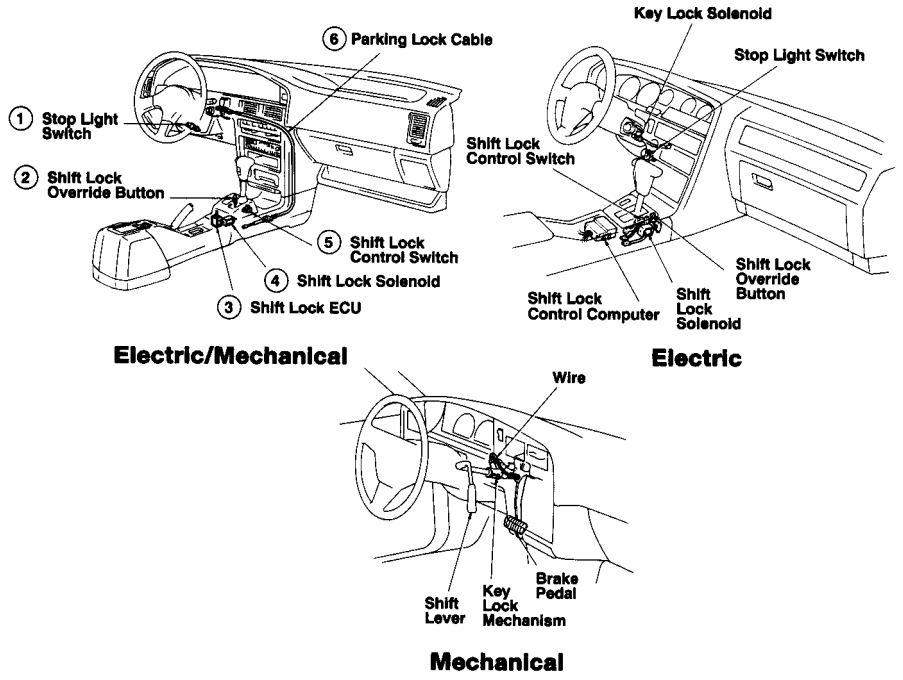
Lesson Objectives:

1. Describe the control of the key lock mechanism for the mechanical shift lock system.
2. Describe the control of the shift lock mechanism for the mechanical shift lock systems.
3. Describe the effect of the brake pedal input on the shift lock mechanism for electrical and electrical/mechanical systems.
4. Describe the effect of the gear shift selector position on the key lock mechanism for electrical systems.
5. Given a voltmeter and repair manual, demonstrate the pin checks of the shift position switch.

The shift lock system is designed to ensure the proper operation of the automatic transmission. The driver must depress the brake pedal in order to move the gear selector from Park to any other range. In addition, the ignition key cannot be turned to the Lock position and removed from the ignition switch unless the gear selector is placed in the Park position.

There are three systems available in Toyota models; electrical, electrical/ mechanical and mechanical. We will not cover the application by model but rather by system type. For the specifics on a particular model, consult the repair manual.

Shift Lock Systems



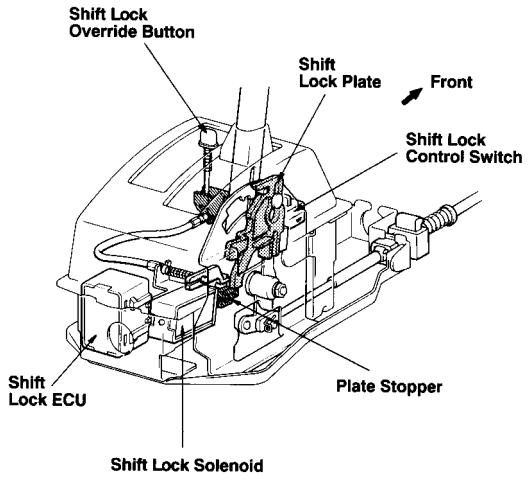
Electrical Shift Lock Type

The electrical type uses electrical control of the shift lock mechanism, as well as the key lock mechanism.

Shift Lock Mechanism

The shift lock mechanism is made up of a number of components as seen in the illustration below.

Shift Lock Mechanism



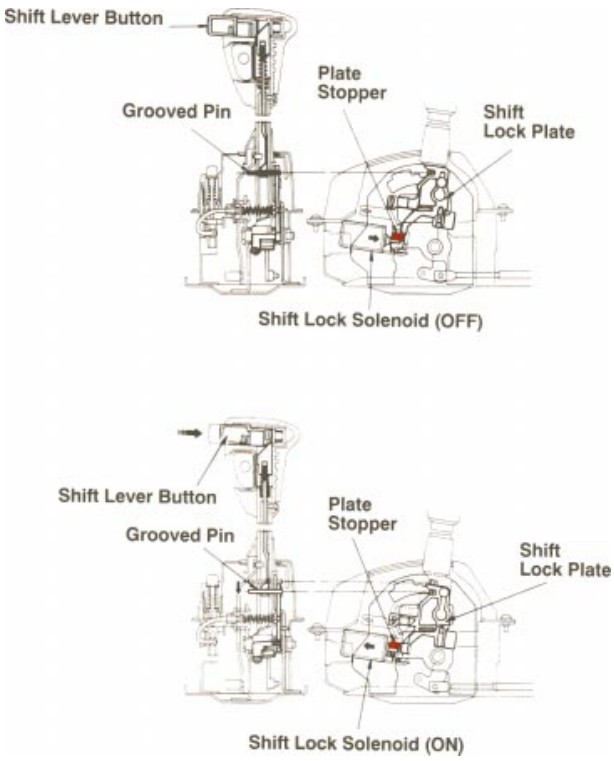
The shift position switch (shift lock control switch) is used to detect the position of the shift lever. It has two contacts, PI and P2. When the select lever is in the Park position, PI is on (closed) and P2 is off (open). In this position, the key can be removed but the select lever is locked in position.

When the select lever is in a position other than Park, PI is off (open) and P2 is on (closed). In this position, the key cannot be removed.

The grooved pin is part of the normal detent mechanism which requires that the shift lever button be depressed in order to move the gear selector into and out of Park position and also into Manual 2 or Manual Low positions. The shift lock plate is mounted next to the detent plate. In the Park position, the grooved pin fits into the slot at the top of the shift plate. The shift lock plate movement is limited by the plate stopper when the solenoid is not energized.

Shift Lock Mechanism Operation

The shift lock plate is blocked by the shift lock solenoid and plate stopper holding the shift lever in teh park position until energized.



In order to move the shift lever out of Park, the ignition switch must be in the Accessory or ON position and the brake pedal must be depressed. When the brake pedal is depressed, the ECU turns on the solenoid, moving the plate stopper and allowing the shift lock plate to move down with the grooved pin.

Shift Lock Override Button

If the shift lock solenoid becomes inoperative, the shift lever cannot be moved and the vehicle cannot be moved. The shift lock override button can be used to release the plate stopper from the shift lock plate, releasing the shift lever so it can be moved from the Park position.

Shift Lock ECU

The ECU is generally found near the shift select lever. The shift lock system computer controls operation of the key lock solenoid and the shift lock solenoid based on signals from the shift position switch and the stop light switch.

Key Interlock System

A camshaft is provided at the end of the key cylinder rotor. This camshaft has a cam with the cut-out portion of its stroke from the ACC position to the ON or Start position. The pin of the key lock solenoid protrudes out against the cam when the current is on and is pulled back by the return spring when the current is off.

When the shift lever is shifted to a range other than the P range, current flows from the computer to the key lock solenoid, causing the pin to protrude out. If the key cylinder is turned with the pin in this position, it can be turned to the ACC position but cannot be turned further, due to the pin pushing against the cam. This prevents the key cylinder from being turned to the Lock position.

The current to the key lock solenoid is cut off when the shift lever is shifted to the P range and the pin is pulled back by the return spring. This allows the key cylinder to be turned to the Lock position, and the key can be removed.

Shift Lock System Computer

The shift lock system computer controls operation of the key lock solenoid and the shift lock solenoid based on signals from the shift position switch and the stop light switch.

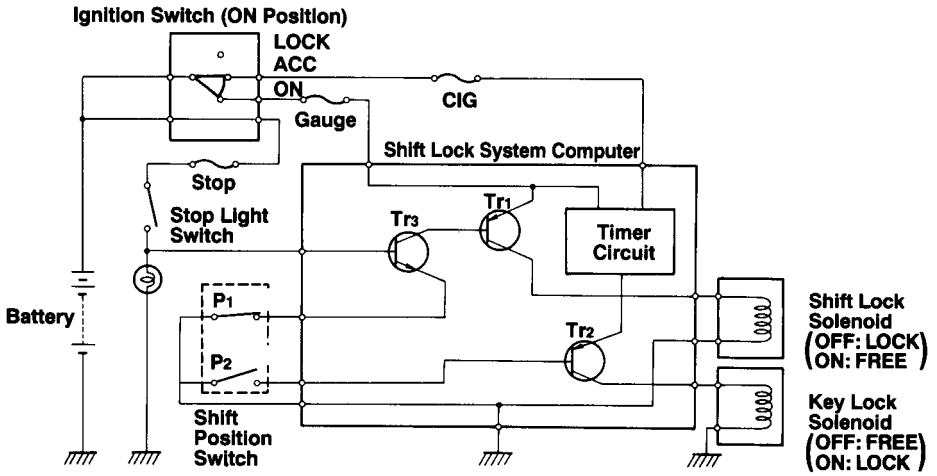
Key Lock Solenoid Control

The shift position switch P2 is on (closed) when the shift lever is in a range other than the Park range. Current from the ACC and ON terminals of the ignition switch flows to Tr2 through the timer circuit. The base circuit of Tr2 is grounded by switch P2, and Tr2 goes on, energizing the key lock solenoid, preventing the key from going to the Lock position. The timer circuit cuts off the flow of current to Tr2 approximately one hour after the ignition switch is turned from ON to ACC, switching off the key lock solenoid. The timer circuit prevents the battery from being discharged.

By placing the gear selector in the Park position, switch P2 is off (open), current no longer flows to the base of Tr2 and it goes off. The solenoid is no longer energized, and the solenoid plunger is retracted, and the key can be removed.

Shift Lock System Control

The shift position switch provides the primary input to control the operation of the shift lock and key lock solenoids.



Shift Lock Solenoid Control

When the shift lever is in the Park range, shift position switch PI is on and the emitter circuit of Tr3 is grounded. Base current for Tr3 is provided through the stop light switch which is open while the brake is not applied, so Tr3 is off. Tr3 controls the base of Trl, and as long as Tr3 is off, the shift lock solenoid will remain off and the gear selector will be locked in the Park position.

When the brake pedal is depressed, the stop light switch goes on, providing current to the base of Tr3. When Tr3 goes on, base current flows in Trl and it then goes on, causing current to flow to the shift lock solenoid and freeing the shift lever. When the shift lever is shifted out of Park, the shift position switch PI goes off and Trl switches the shift lock solenoid off.

Electrical/ Mechanical Shift Lock Type

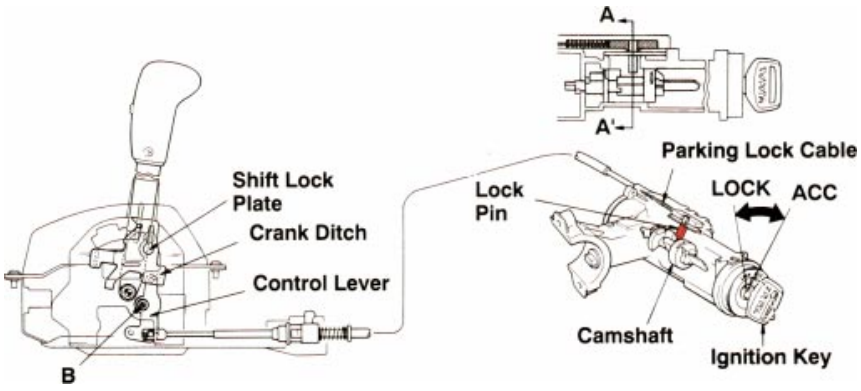
The electrical/mechanical type uses electrical control of the shift lock mechanism and a mechanical control of the key lock mechanism.

Key Interlock Device

Similar to the construction discussed previously, a camshaft is provided at the end of the key cylinder rotor. This camshaft has a cam with the cut-out portion of its stroke from the ACC position to the ON or Start position. The lock pin is attached to the end of the parking lock cable and slides with the movement of the control lever mounted to the shift lever mechanism. The control lever is separate from the shift lock plate but is actuated by it.

Notice the crank ditch slot in the shift lock plate. It is cut at an angle so that when the shift lock plate moves up or down, it causes the control lever to pivot at point B in the illustration below.

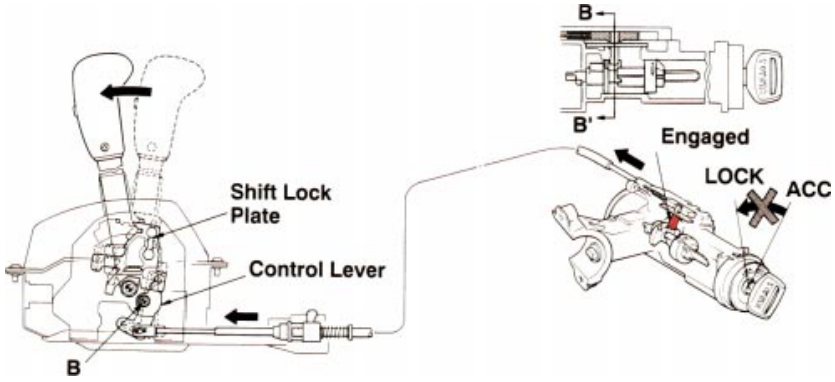
Key Interlock Released



When the shift lever is in the Park position, the control lever rotates around B counterclockwise, pushing the parking lock cable so that the lock pin does not interfere with the camshaft. In this position, the key can be turned to the Lock position and removed.

When the shift lever is moved from the Park position, the shift lock plate is pushed downward by the shift lever button and the grooved pin. When the shift lock plate moves downward the control lever rotates clockwise, pulling the parking lock cable and lock pin into engagement with the camshaft. In this position, the key cannot be turned to the Lock position and removed from the ignition as seen in the following illustration.

Key Interlock Engaged

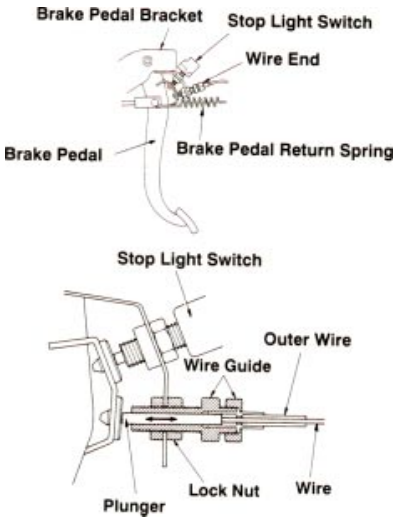


Mechanical Shift Lock Type

The mechanical type uses mechanical control of the shift lock mechanism and the key lock mechanism. A cable extends from the brake pedal bracket to the shift lever control shaft bracket. A lock pin engages the shift lever shaft to lock it into the Park position until the brakes are applied.

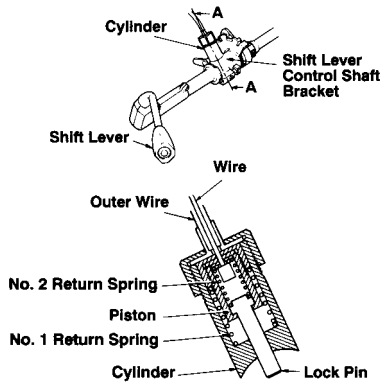
The cable (wire) end on the brake pedal bracket is mounted just below the stop light switch. The plunger is attached to the cable and is mounted in a wire guide and is able to slide in and out. When the brake pedal is not depressed, the plunger is held in position by the brake pedal return spring.

Brake Pedal Cable End



The other end of the cable is attached to a lock pin located in the shift lever control shaft bracket. The lock pin is spring loaded to release the lock pin from the inner shaft of the shift lever.

Shift Lever Cable End



A - A' Cross Section

Shift Lever Cable End

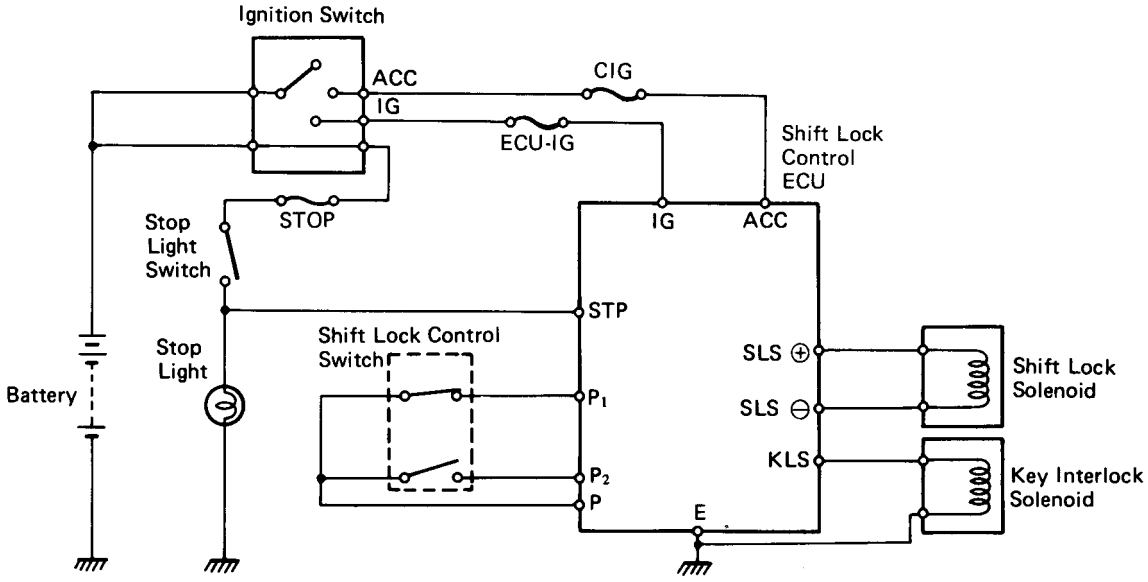
When the shift lever is in the Park range and brakes are not applied, the cable compresses the No. 1 return spring and pushes the lock pin engaging the round hole in the inner shaft, locking the shift lever in Park.

When the brakes are applied with the transmission in Park, the No. 1 spring pushes the cable, lock pin and plunger out toward the brake pedal. With the plunger released, the shift lever can be moved from Park.

When the shift lever is in positions other than Park with the brakes released, the brake pedal return spring pushes the plunger and cable back toward the shift lever control shaft. The lock pin cannot enter the inner shaft, so the No. 2 return spring compresses. With the lock pin spring loaded, when the gear selector is moved to the Park position, it will immediately lock.

WORKSHEET 9
Shift Lock System,

Vehicle	Year/Prod. Date	Engine	Transmission



Check System for Proper Operation

1. With the key ON, can the shift lever be moved from the PARK position?

   _____

2. With the key ON, can the shift lever be moved out of the PARK position if the brake pedal is depressed?

   _____

3. With the shift lever NOT in the PARK position, can the key be turned to the LOCK position and removed?

   _____

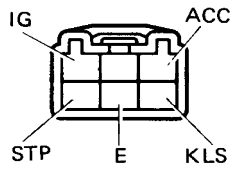
4. Can the key be turned to the LOCK position and removed with the shift lever in the PARK position?

   _____

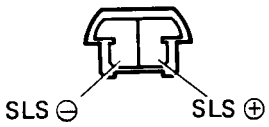
WORKSHEET 9
Shift Lock System,

Inspection and Testing of the Shift Lock Computer

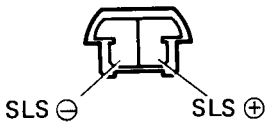
Use a voltmeter and measure the voltage at each of the following terminals of the Shift Lock Computer by backprobing each connector. **Note: Do not disconnect the computer connector.**



Terminals	Condition	Measured Voltage
ACC - E	Ign. sw. ACC position	
IG - E	Ign. sw. ON position	
STP - E	Brake pedal depressed	
KLS - E	Ign. sw. ON position, Shift lever in P	
KLS - E	Ign. sw. ON position, Shift lever not in P	



Terminals	Condition	Measured Voltage
SLS+ - SLS-	Ign. sw. ON position, Shift lever in P	
SLS+ - SLS-	Ign. sw. ON position, Shift lever in P, Brake pedal depressed	
SLS+ - SLS-	Ign. sw. ON position, Shift lever not in P, Brake pedal depressed	



Terminals	Condition	Measured Voltage
P1 - P	Ign. sw. ON position, Shift lever in P, Brake pedal depressed	
P1 - P	Ign. sw. ON position, Shift lever not in P, Brake pedal depressed	
P2 - P	Ign. sw. ACC position, Shift lever in P	
P2 - P	Ign. sw. ACC position, Shift lever not in P	

Inspection of Solenoids

Disconnect solenoid connectors. Using an ohmmeter, measure the resistance of each solenoid:

Solenoid	Resistance
Shift Lock Solenoid	
Key Lock Solenoid	