

2001 STARTING & CHARGING SYSTEMS

Starters

DESCRIPTION & OPERATION

STARTER CIRCUIT

Battery voltage is applied to terminal "B" of starter solenoid at all times. See **Fig. 3** . When the ignition is turned to START position, battery voltage is sent through either a clutch pedal position switch (M/T) or transmission range switch (A/T) to terminal "S" of starter solenoid. This energizes the solenoid, applying voltage to starter motor, engaging starter drive gear to flywheel and cranking engine.

Vehicles equipped with DOHC engine and an A/T, use a gear reduction starter. All other vehicles are equipped with conventional starters.

ADJUSTMENTS

PINION GAP

NOTE: **DO NOT apply voltage to starter assembly for more than 10 seconds.**

1. With starter on a bench, disconnect terminal connector from starter solenoid "M" terminal. See **Fig. 3** . Apply battery voltage to solenoid "S" terminal and ground starter motor body. Pinion will eject. Measure pinion gap between pinion and stopper. See **STARTER SPECIFICATIONS** .
2. If pinion gap is not within specification, make adjustment by increasing or decreasing number of washers between solenoid and drive housing. Gap will decrease as number of washers is increased.

TRANSMISSION RANGE (TR) SWITCH

NOTE: **Transmission Range (TR) switch adjustment procedure for Rio and Optima is not available from the manufacturer.**

Sephia & Spectra

1. Disconnect negative battery cable. Remove battery, air cleaner assembly, and battery tray. Remove transmission selector cable nut and clip. Disconnect selector cable. Place transmission manual shift valve in Neutral position.
2. Disconnect transmission range switch connector. Loosen range switch mounting bolts. Using ohmmeter, measure continuity between range switch connector terminals No. 5 and 6. See **Fig. 1** . Adjust switch until continuity exists.
3. Tighten transmission range switch mounting bolts. Ensure selector lever range position and transmission range switch correspond. Tighten attaching bolt to specification. See **TORQUE SPECIFICATIONS** .

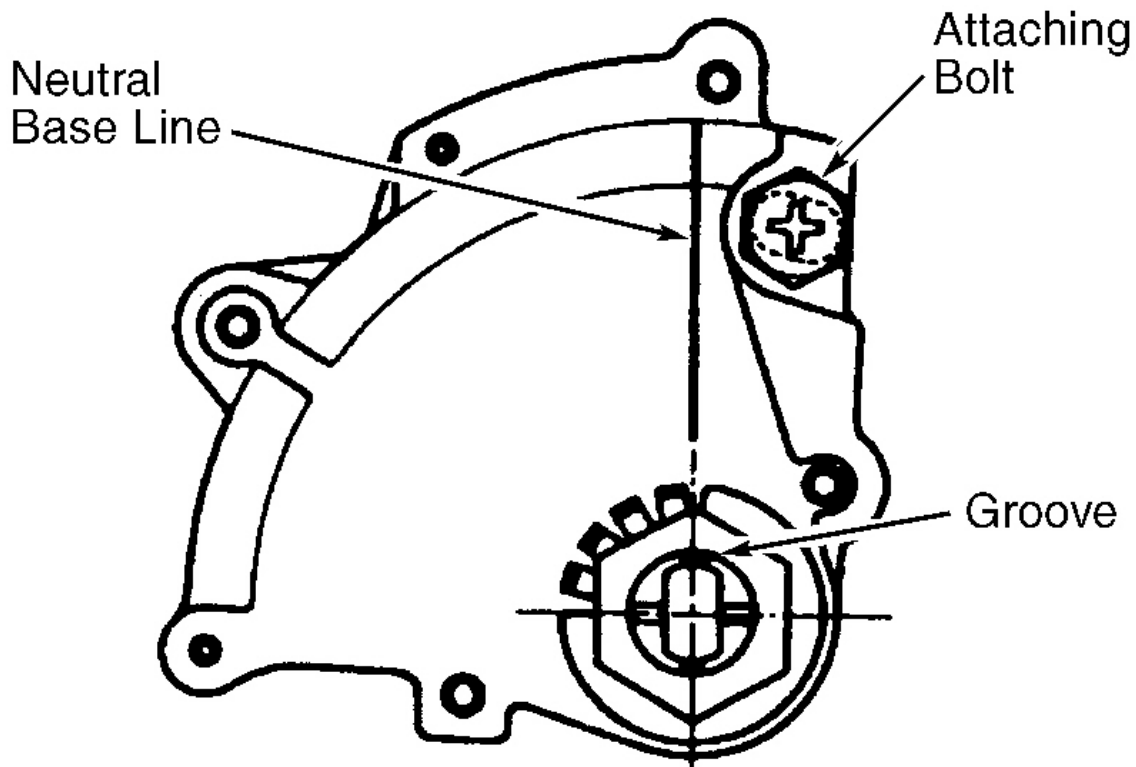
1	2	3	4	5
6		7	8	9

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Fig. 1: Identifying TR Switch Connector Terminals (Sephia & Spectra)
 Courtesy of KIA MOTORS AMERICA, INC.

Sportage

Loosen transmission range switch attaching bolt. Shift gear selector lever to Neutral. Align groove and neutral base line. See **Fig. 2** . Tighten attaching bolt to specification. See **TORQUE SPECIFICATIONS** .



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Fig. 2: Adjusting TR Switch (Sportage)
 Courtesy of KIA MOTORS AMERICA, INC.

TROUBLE SHOOTING

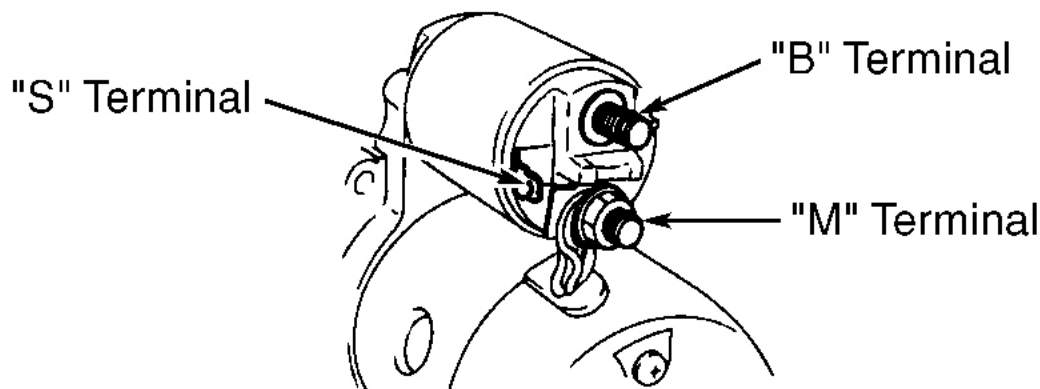
NOTE: See TROUBLE SHOOTING article in GENERAL INFORMATION.

ON-VEHICLE TESTING

NOTE: Before testing, ensure battery is fully charged, battery cables and terminals are clean and tight, and engine grounds are okay.

CIRCUIT TEST

1. If starter does not operate, check voltage at starter solenoid "S" terminal with ignition switch in START position, transmission in Park or Neutral (A/T) or clutch depressed (M/T). See **Fig. 3**. If battery voltage is present, replace starter. If battery voltage is not present, check ignition switch, transmission range switch (A/T), clutch pedal position switch (M/T) and wiring.
2. If starter motor runs and engine does not crank, remove starter for visual inspection and testing. Inspect flywheel and ring gear for damaged or missing teeth.



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Fig. 3: Identifying Starter Terminals
Courtesy of KIA MOTORS AMERICA, INC.

CLUTCH PEDAL POSITION (CPP) SWITCH TEST

Sephia & Sportage (M/T)

CPP switch is mounted on bracket, near top front of clutch pedal. Disconnect CPP switch wiring connector. Using ohmmeter, ensure continuity exists between CPP switch connector terminals when clutch pedal is depressed. If continuity does not exist, replace switch.

TRANSMISSION RANGE (TR) SWITCH TEST

Sephia & Spectra (A/T)

1. Ensure starter operates with ignition switch in START position and transmission in Park or Neutral. Ensure back-up lights illuminate with ignition switch in ON position and transmission in Reverse. Ensure that position of gear selector lever and shift pattern indicator correspond. If starter does not operate or back-up lights do not illuminate, adjust switch. See **TRANSMISSION RANGE (TR) SWITCH** under ADJUSTMENTS. If problem persists, go to next step.
2. Disconnect negative battery cable. Remove battery, air cleaner assembly, and battery tray. Disconnect TR switch connector. Check continuity between TR switch terminals. See **TRANSMISSION RANGE (TR) SWITCH CONTINUITY (SEPHIA)** table. See **Fig. 1** . If continuity is not as specified, replace and adjust TR switch. Tighten attaching bolt to specification. See **TORQUE SPECIFICATIONS** .

TRANSMISSION RANGE SWITCH CONTINUITY (SEPHIA & SPECTRA)

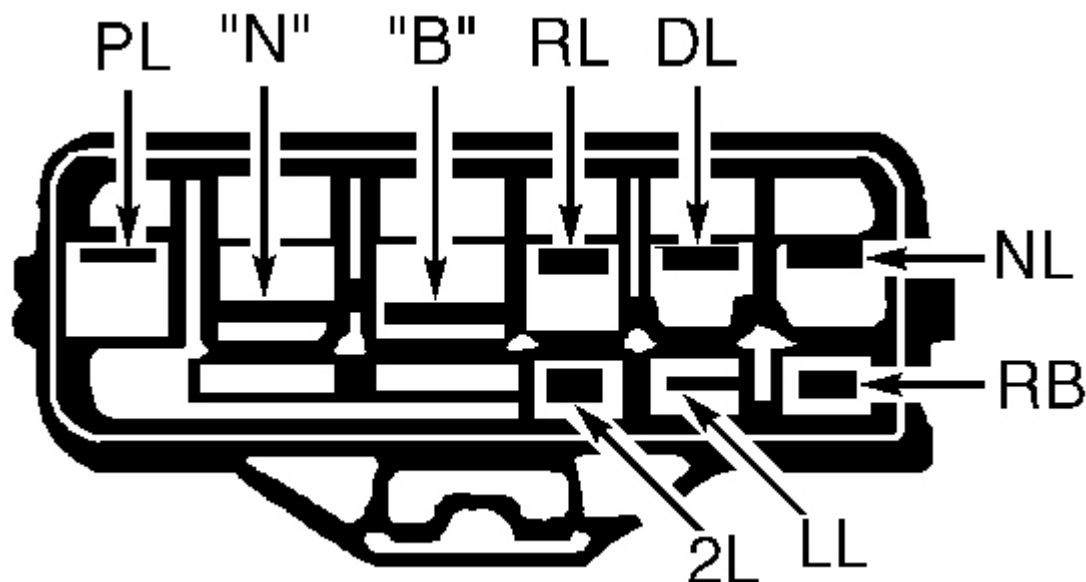
Transmission Position	Continuity Between Terminals No.
Park	1 & 9; 5 & 6
Reverse	2 & 9
Neutral	5 & 6; 7 & 9
Drive	4 & 9
2nd	8 & 9
1st	3 & 9

Sportage (A/T)

1. Ensure starter operates with ignition switch in START position and transmission in Park or Neutral. Ensure back-up lights illuminate with ignition switch in ON position and transmission in Reverse. If starter does not operate or back-up lights do not illuminate, adjust switch. See **TRANSMISSION RANGE (TR) SWITCH** under ADJUSTMENTS. If problem persists, go to next step.
2. Disconnect TR switch connector. Check continuity between TR switch terminals. See **TRANSMISSION RANGE (TR) SWITCH CONTINUITY (SPORTAGE)** table. See **Fig. 4** . If continuity is not as specified, replace and adjust TR switch. Tighten attaching bolt to specification. See **TORQUE SPECIFICATIONS** .

TRANSMISSION RANGE SWITCH CONTINUITY (SPORTAGE)

Transmission Position	Continuity Between Terminals
Park	B & N; RB & PL
Reverse	RB & RL
Neutral	B & N; RB & NL
Drive	RB & DL
2nd	RB & 2L
1st	RB & LL



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Fig. 4: Identifying TR Switch Connector Terminals (Sportage)
 Courtesy of KIA MOTORS AMERICA, INC.

BENCH TESTING

ARMATURE TEST

1. Using ohmmeter, check continuity between commutator and core. If continuity exists, replace armature. Check for continuity between commutator and shaft. If continuity exists, replace armature.
2. Place armature on "V" blocks. Using a dial indicator, measure runout at commutator. Normal runout is .002" (.05 mm). Maximum runout is .016" (.4 mm). If runout is not within specification, resurface commutator or replace armature.
3. Wipe commutator clean. Measure commutator outer diameter. See **STARTER SPECIFICATIONS**. If commutator is at, or less than limit, replace armature. Check depth of mold between commutator segments. Normal depth is .02-.03" (.5-.8 mm). Minimum depth is .008" (.2 mm). Replace armature if depth of mold is at, or less than minimum.

BRUSH & BRUSH HOLDER TEST

NOTE: Optima incorporates wear mark on brush. If brush length is at wear mark or wear mark is no longer visible, replace all brushes.

Brush

Measure brush length. See **STARTER SPECIFICATIONS**. If a brush is worn to, or beyond, wear limit, replace all brushes.

Brush Holder

Using ohmmeter, check continuity between each insulated brush and plate. If continuity exists, replace brush holder.

FIELD COIL TEST

Using ohmmeter, check for continuity between starter solenoid "M" terminal wire and brushes. If continuity does not exist, replace field coil assembly. Check for continuity between "M" terminal wire and field coil. If continuity exists, replace field coil assembly. Check field coil for looseness. If field coil is loose, replace field coil assembly.

SOLENOID TEST

Using ohmmeter, check for continuity between starter solenoid "S" and "M" terminals. See **Fig. 3**. Check for continuity between "S" terminal and solenoid body. If continuity does not exist, replace solenoid. Check for continuity between "M" and "B" terminals. If continuity exists, replace solenoid.

REMOVAL & INSTALLATION

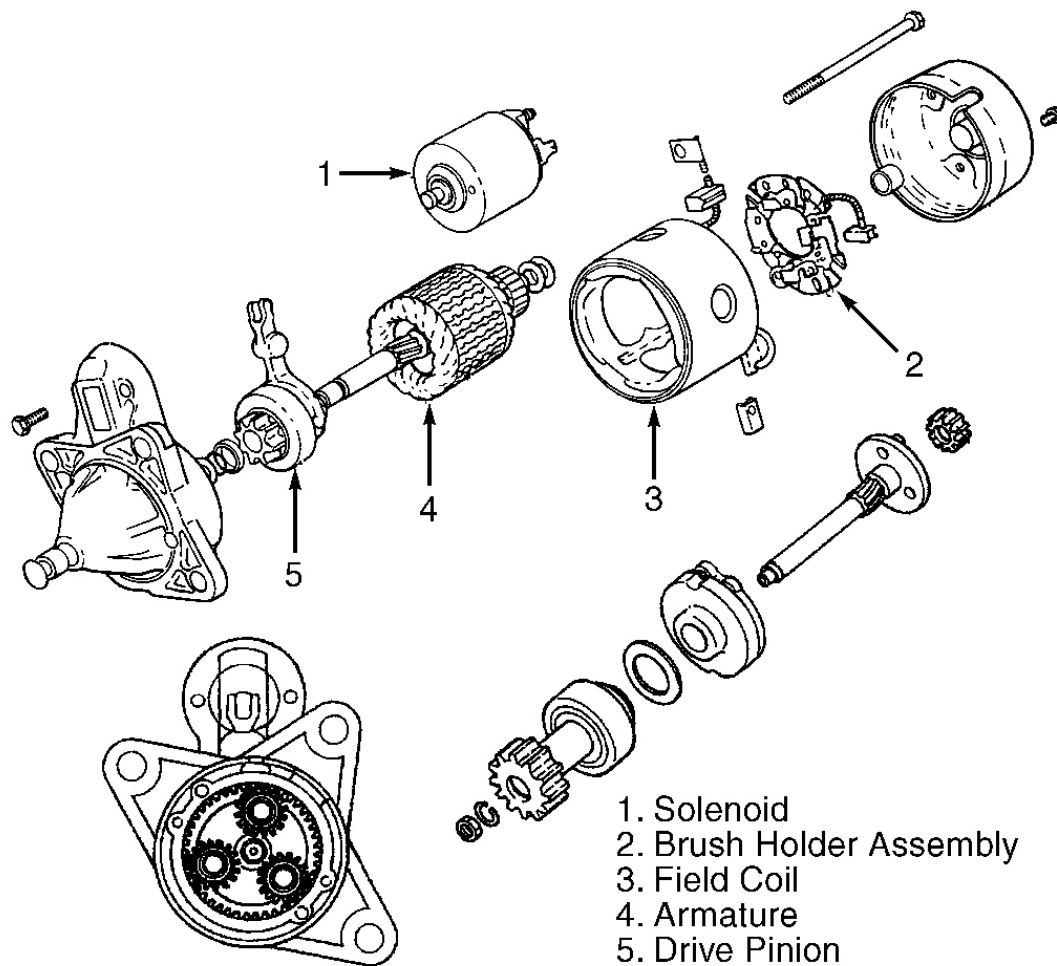
NOTE: Any time battery cables are disconnected from battery and then reconnected, theft deterrent system will be activated (horn will sound and emergency lights will flash about 3 minutes). To disarm theft deterrent system, insert ignition key and turn it to ACC position.

STARTER

Removal & Installation

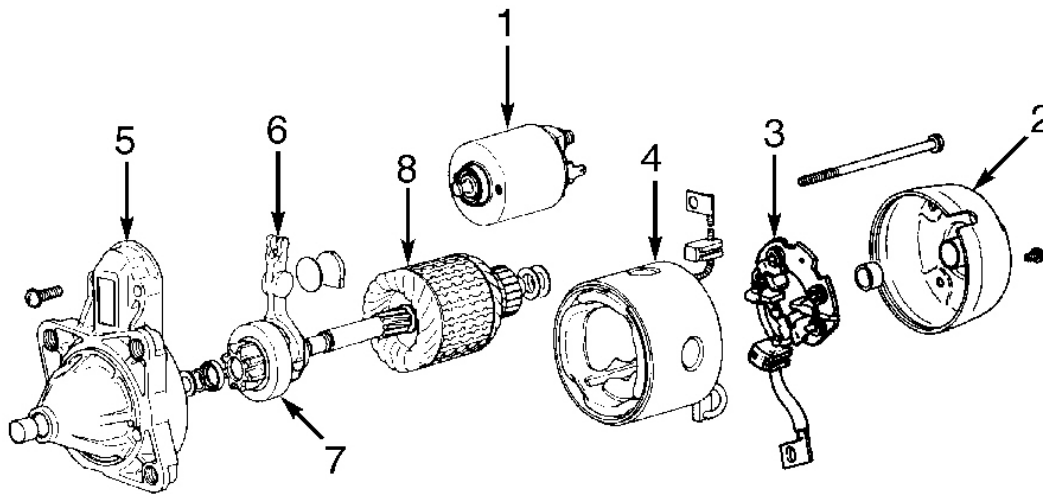
1. Disconnect negative battery cable. Remove 2 upper bolts from intake manifold bracket. Raise and support vehicle. On M/T, remove clutch slave cylinder and push it aside.
2. On all models, remove lower intake manifold bracket bolts and bracket. Remove 2 upper starter bolts and a lower bolt. Pull starter from clutch (M/T) or converter (A/T) housing and prop in place. From above, disconnect starter solenoid "S" and "B" terminal connectors. From below, push transmission harness aside and remove starter.
3. To install, reverse removal procedure. Rotate starter to provide proper clearance. Tighten all nuts and bolts to specification. See **TORQUE SPECIFICATIONS**.

OVERHAUL



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Fig. 5: Exploded View Of Gear Reduction Starter Motor (Typical)
Courtesy of KIA MOTORS AMERICA, INC.



- | | |
|--------------------------|----------------------|
| 1. Solenoid | 5. Drive End Housing |
| 2. Rear Cover | 6. Lever |
| 3. Brush Holder Assembly | 7. Drive Pinion |
| 4. Field Coil | 8. Armature |

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Fig. 6: Exploded View Of Non-Gear Reduction Starter Motor (Typical)
 Courtesy of KIA MOTORS AMERICA, INC.

STARTER SPECIFICATIONS

NOTE: Specifications for Rio are not available from the manufacturer.

STARTER SPECIFICATIONS

Application	Specifications
Armature	
Commutator Runout	
Standard	.002" (.05 mm)
Limit	.016" (.4 mm)
Commutator Diameter	
Optima	
Limit	1.118" (28.4 mm)
Sephia, Spectra & Sportage	
Limit	1.22" (31 mm)
Brush Length	

Sephia, Spectra & Sportage	
Standard	.67" (17 mm)
Limit	.45" (11.5 mm)
Pinion Gap	.020-.079" (.5-2.0 mm)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Intake Manifold Bracket Bolts	
Sephia & Spectra	27-38 (37-52)
Sportage	27-40 (37-54)
Starter Mounting Bolts	
Sephia & Spectra	27-38 (37-52)
Sportage	27-40 (37-54)
Starter Cable Nut	
Sephia & Spectra	7-9 (9.8-12.0)
Sportage	12-17 (16-23)
INCH Lbs. (N.m)	
Transmission Range (TR) Switch Bolt	
Sephia & Spectra	70-95 (7.9-10.7)
Sportage	35-61 (3.9-5.9)

WIRING DIAGRAMS

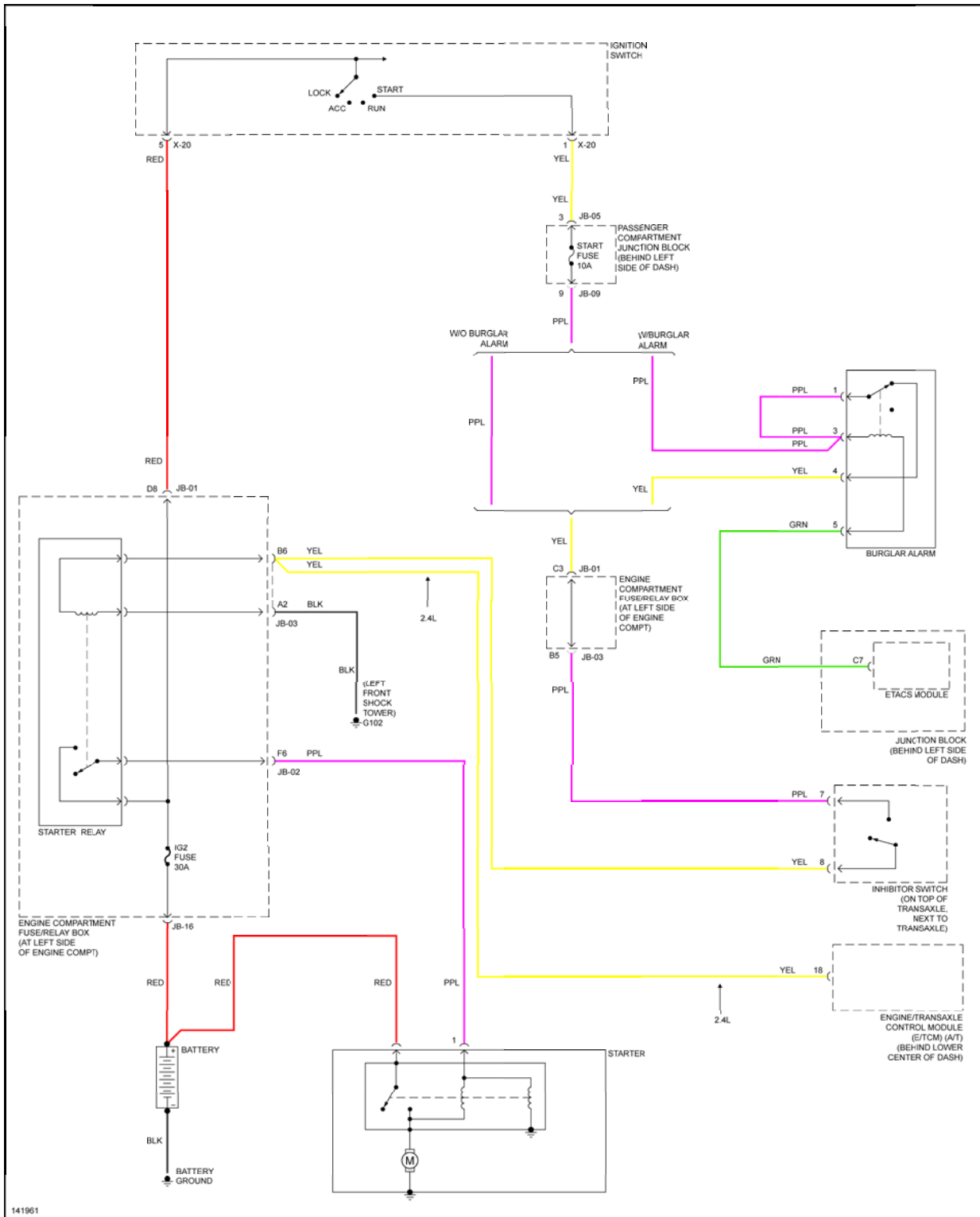


Fig. 7: Starting System Wiring Diagram (Optima - A/T)

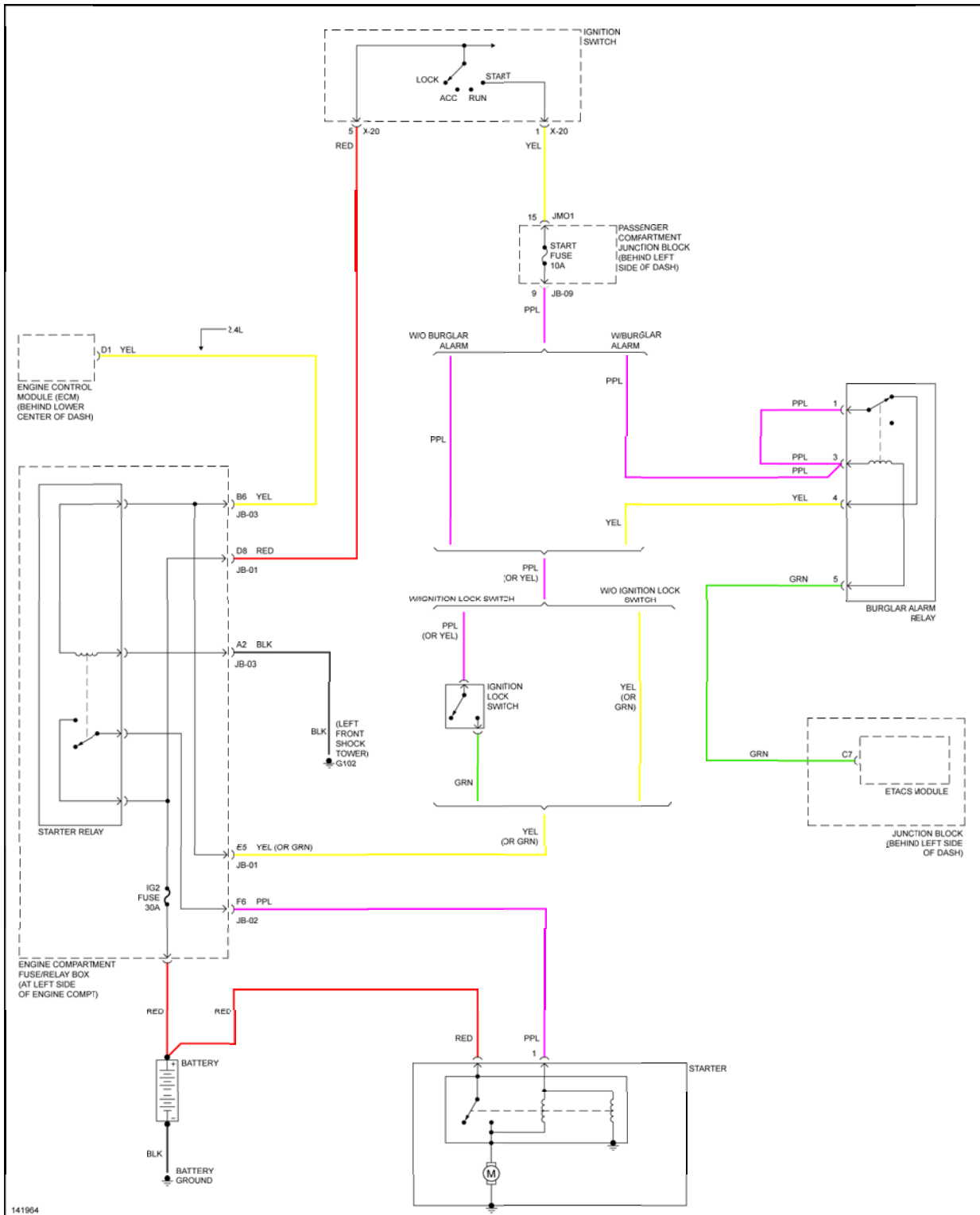


Fig. 8: Starting System Wiring Diagram (Optima - M/T)

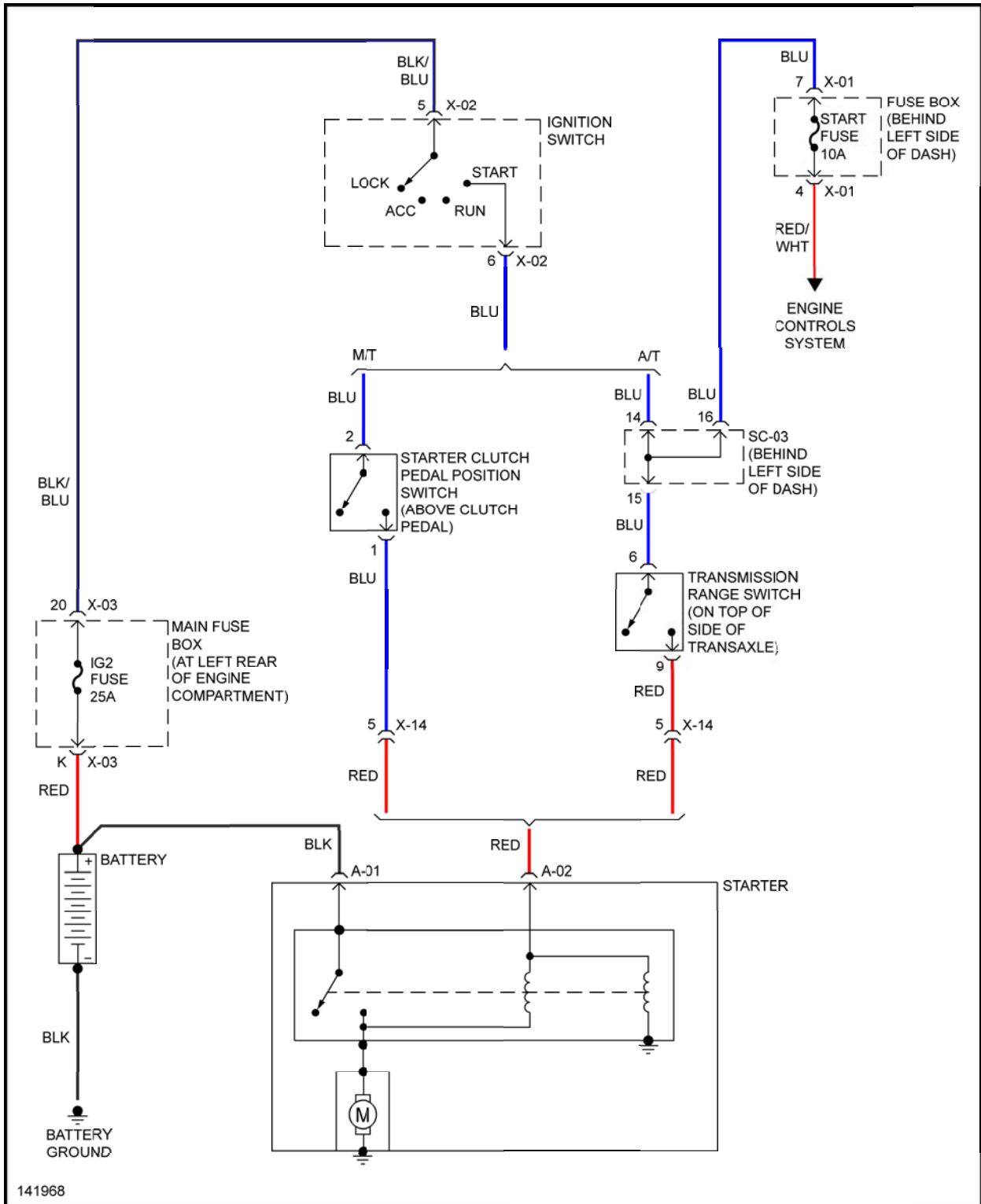


Fig. 9: Starting System Wiring Diagram (Rio)

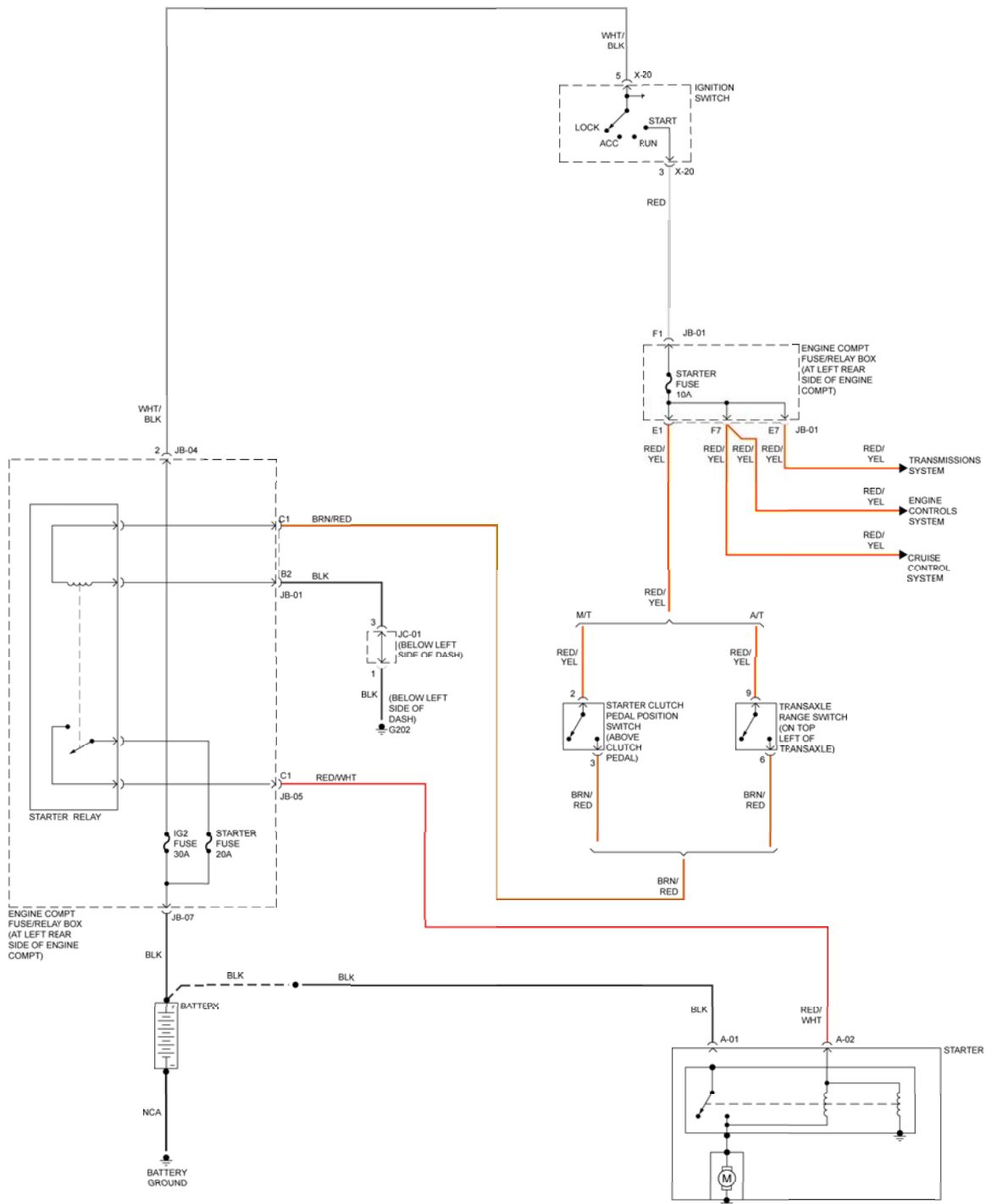


Fig. 10: Starting System Wiring Diagram (Sepia & Spectra)

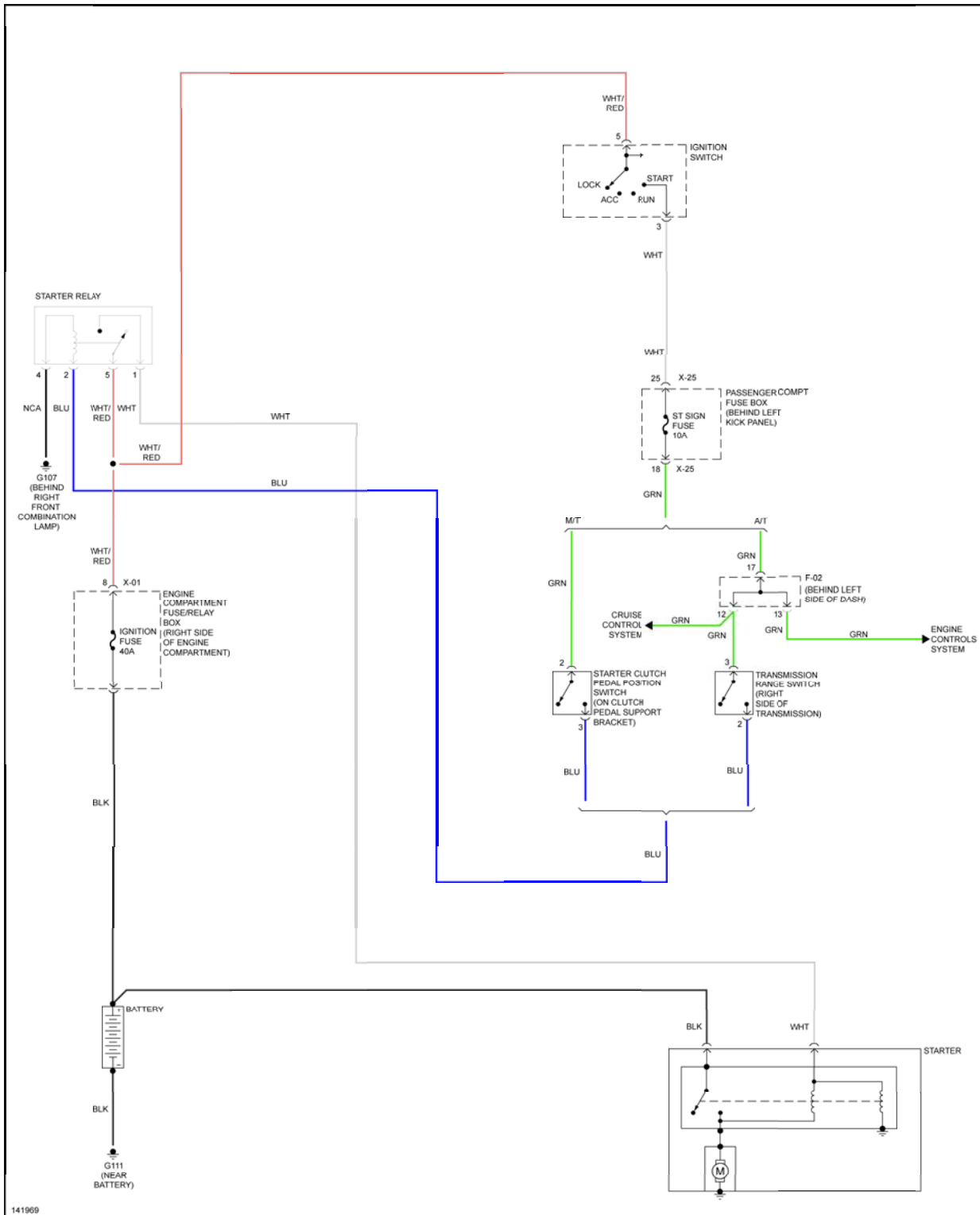


Fig. 11: Starting System Wiring Diagram (Sportage)