ELECTRONIC SHIFT SYSTEM (SE5)

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	6

SERVICE TOOLS – OTHER SUPPLIER

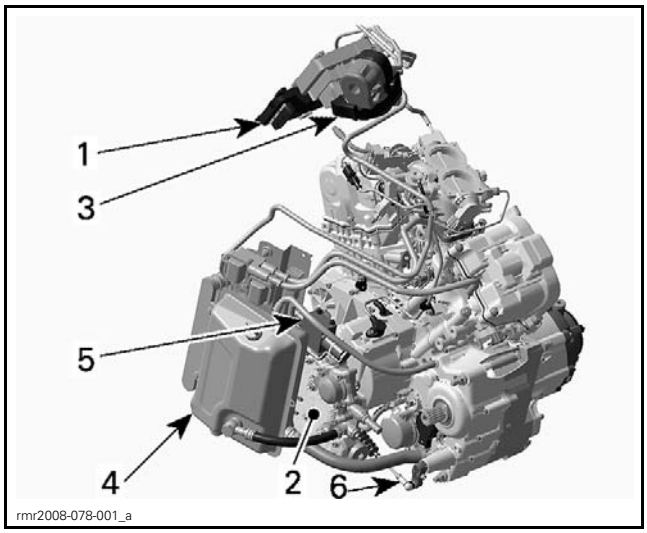
Description	Part Number	Page
FLUKE RIGID BACK PROBES	TP88	6

GENERAL

SYSTEM DESCRIPTION

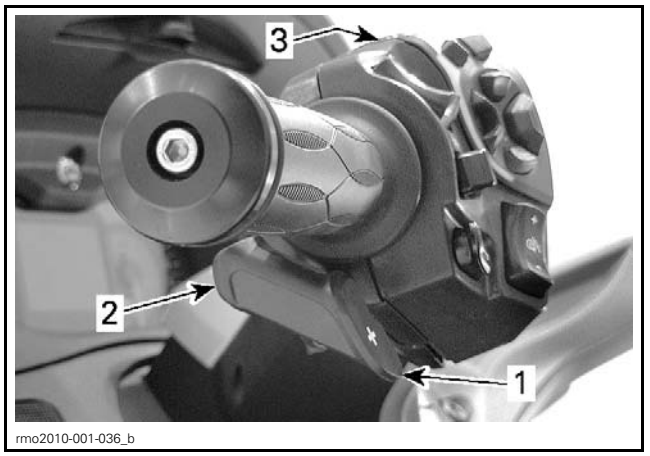
The engine features a sequential electronically controlled mechanical 5-speed gearbox (SE5) with a hydraulically-actuated type clutch system.

NOTE: The SE5 is an electronically controlled version of a sequential manual gearbox.

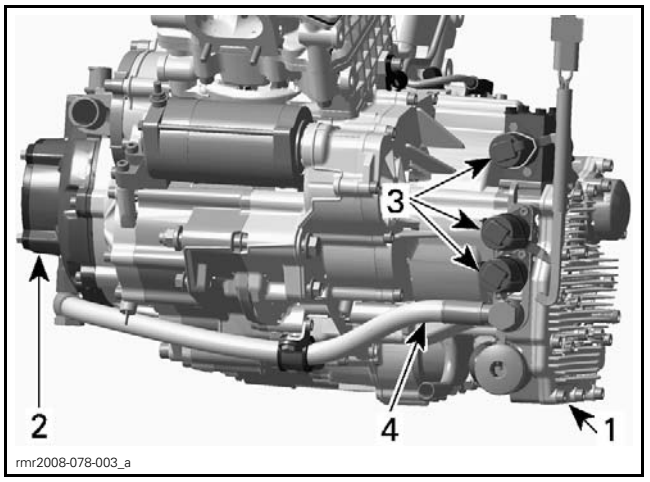


TYPICAL
1. *Transmission control module (TCM)*
2. *Hydraulic control module (HCM)*
3. *SE5 switches (upshift, downshift, reverse)*
4. *Oil tank*
5. *Solenoid valves*
6. *Link rod between HCM and shifter*

The transmission control module (TCM) manages 4 solenoid valves located on the hydraulic control module (HCM) that control and activate the gear shifting process.

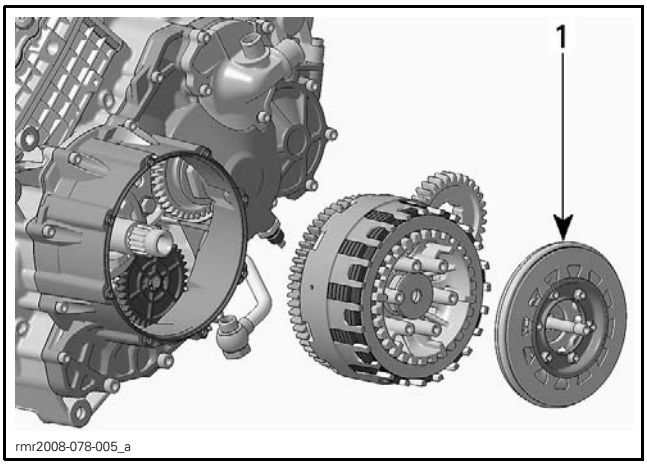


SE5 SWITCHES
1. *Upshift*
2. *Downshift*
3. *Reverse*



TYPICAL
1. *HCM*
2. *Clutch servo*
3. *Solenoid valves*
4. *Pressure hose from HCM to clutch servo*

The SE5 uses a centrifugal clutch system that engages automatically at approximately 2000 RPM as the rider increases engine RPM, and disengages when the engine falls below that RPM.



1. Centrifugal clutch

Auto Neutral

When engine is started and running, the gearbox is automatically set to the neutral position.

The gearbox is not linked with the engine until the engine speed is above approximately 2000 RPM to engage the centrifugal clutch.

Shift from Neutral

The following conditions must be met so that a gearshift can take place:

– Engine RPM is lower than 1800 RPM.
– Vehicle speed is lower than 3 km/h (2 MPH).

Upshift

When the gearshift selector is pushed (upshift) and the vehicle is stopped, the TCM will immediately signal the corresponding solenoid valves on the HCM to shift the gearbox up one gear if the gearbox is in neutral or reverse.

When the vehicle is moving and the gearbox is in 1st gear or above, a minimum RPM and speed must be met to permit an upshift to take place. Otherwise, no upshift is allowed until the required RPM is reached.

If desired, the gearbox can remain in this gear until engine reaches its rev-limited RPM.

If the gearbox is in 5th gear and the gearshift selector is pushed (upshift), nothing will happen.

Downshift

When the gearshift selector is pulled (downshift), the TCM will signal the corresponding solenoid valves on the HCM to shift the gearbox down one gear as long as it does not cause the engine RPM to exceed preset parameters.

Reverse

To shift in reverse gear:

– Engine must be running.
– Vehicle must not be moving.
– Push the reverse button.
– Pull the gearshift selector (downshift).

If gearbox is in reverse gear and the gearshift selector is pulled (downshift), nothing will happen.

Double Shift from 1st Gear or Reverse

When the gearshift selector is held for more than 1/3 second, a double shift will take place as follows:

– If gearbox is in 1st gear, the gearbox will shift to the reverse gear (reverse button must be held also).
– If gearbox is in reverse gear, the gearbox will shift to the 1st gear.

Auto Downshift

When the following conditions are met, a downshift will automatically take place:

– Throttle is released.
– Vehicle decelerates.
– A predetermined RPM is reached.
– A predetermined vehicle speed is reached.

RPM Increase on Downshift

When a downshift is commanded, the TCM will transmit a downshift signal through the CAN BUS that is used by the engine control module (ECM) to command the electric throttle actuator (ETA) to momentarily "slightly" open the throttle plates to increase engine RPM. This assists the synchronization of engine RPM and rear wheel speed without any required action by the operator. This also prevents the RPM from dropping below centrifugal clutch engagement speed.

Vehicle Stop

When coming to a complete stop, after the gearbox has shifted into first gear, the centrifugal clutch will automatically disengage the engine from the gearbox. This prevents stalling and leaves the vehicle ready for its next acceleration event.

TROUBLESHOOTING

Refer to *POWER DISTRIBUTION* for fuses and relays information.

Always refer to the *WIRING DIAGRAM* when troubleshooting an electrical circuit.

Install a battery charger on battery terminals (under seat) for any tests that involve a prolonged "key ON" period. If battery voltage gets too low, some accessories are shut off by the ECM.

NOTICE Never force a multimeter probe into an electrical terminal.

TROUBLESHOOTING GUIDELINES

This troubleshooting guideline should be used jointly with the flow chart available in the pocket located on the last page of this manual.

For any problem, start troubleshooting by:

– Checking fault codes using B.U.D.S. Communication problems should be checked first.
– Checking oil level and condition. Engine and clutch share the same oil. Oil type, level and condition are very important. Refer to *LUBRICATION SYSTEM* subsection for details.

Gearbox Does Not Shift Into Gear (Up or Down)

– Carry out the *TCM STATUS VALIDATION*. Refer to *TRANSMISSION CONTROL MODULE (TCM)* in this subsection.
– Using B.U.D.S., check shifting system components (shift switches, solenoid valves, TCM, etc.).
– Check hydraulic and mechanical components.

Erratic or Harsh Shifting

Carry out a *CLUTCH ACTIVATION TEST*, refer to *TEST WITH B.U.D.S.* in this subsection.

Gearbox Does Not Shift Into Reverse

Refer to *REVERSE BUTTON TEST WITH B.U.D.S.* in the *GEARBOX* subsection.

TROUBLESHOOTING WITH B.U.D.S.

B.U.D.S. provides useful features to troubleshoot the gear shift system. Most are obvious. The others are described here.

NOTE: Some items need the engine to be running to be monitored in B.U.D.S. In this case, follow the displayed instructions carefully.

Monitoring Page in B.U.D.S.

Clutch mod (%) is useful to acknowledge the clutch modulation while shifting.

Outputs Section

Clutch/Shift Up/Shift Down sol

– When ON, it indicates that the TCM sent the command to activate the related solenoid.

Check TCM

– When ON, it indicates that a fault relative to the TCM is active.

TCM Active

– When ON, it indicates that the TCM is working to carry out the gear shifting.
– When OFF, it indicates that the TCM is OFF because of a TCM malfunction. No gear shift will take place. Refer to *TCM STATUS VERIFICATION* in this subsection.

BLS/Reverse (R) / Neutral (N):

– They indicate their status as seen by the TCM.

Switch Inputs Section

When a LED is on, it indicates that the switch sends the signal.

Activation Page in B.U.D.S.

Activation section allows the activation of the different solenoids.

Routine section allows to force an action such as an upshift or downshift. For example, the **Shift up** button will activate all the necessary solenoids, in the proper sequence, required to carry out an upshift.

Test with B.U.D.S.

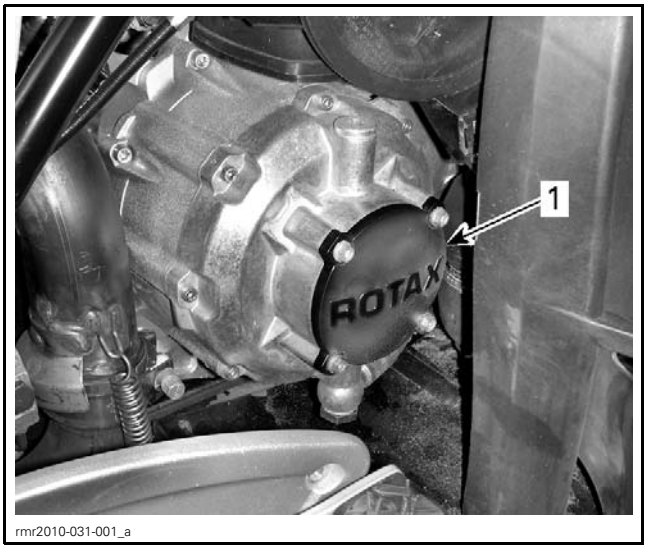
Connect vehicle to B.U.D.S.

NOTE: Make sure you have checked fault codes and engine oil level prior to carrying the following tests.

Clutch Activation Test

Refer to *BODY* and Remove RH bottom rear side panel.

Remove clutch cover cap.



1. Clutch cover cap

NOTE: If oil is present when removing cap, check the O-ring on the clutch piston nut and the clutch piston seal. Replace as required.

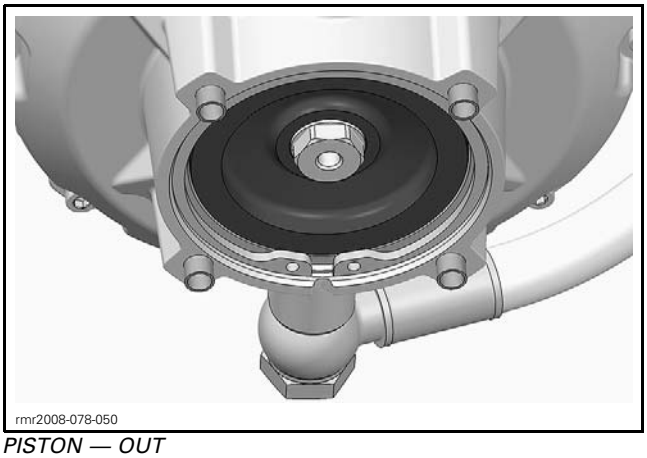
Make sure TCM is operational. Refer to *TCM STATUS VERIFICATION* in this subsection.

Select the **TCM** tab on the **Activation** page. Look at the **Routine** section.

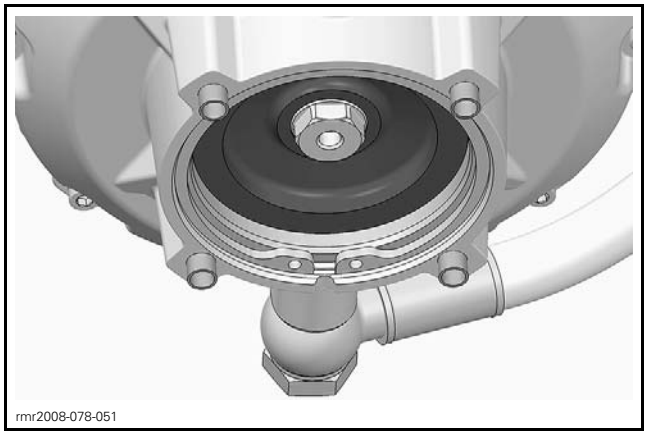
Start engine and let run at idle.

In B.U.D.S., click the **Clutch activation** button.

Clutch piston should move outwards then return approximately at the same speed.



PISTON — OUT



PISTON — IN

If test is successful, carry out a *CLUTCH ACTIVATION AND MODULATION TEST* below.

If test failed, check the HCM oil pressure and the clutch solenoids operation. Refer to *HYDRAULIC CONTROL MODULE (SE5)* subsection. If the HCM oil pressure and solenoids test good, check for clutch mechanical problems. Refer to *CLUTCH (SE5)* subsection.

Clutch Activation and Modulation Test

In B.U.D.S., click the **Clutch activ + mod** button.

Clutch piston should move outwards then return **slower** than when it moved outwards. Otherwise, check the clutch modulation solenoid operation. Refer to *HYDRAULIC CONTROL MODULE (SE5)* subsection.

Shifting Test

If shift switches DELs turn ON in B.U.D.S. when switches are pressed in but gearbox does not shift gears, carry out the following:

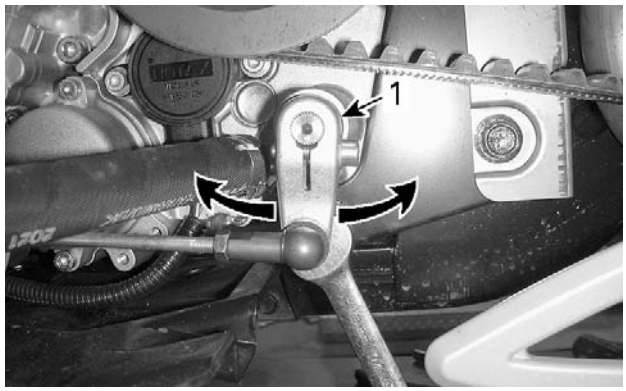
Start engine

Go in **TCM** under **Activation**. Look at the **Routine** section.

Click on the **Upshift** or **Downshift** button.

Gearbox should shift into selected gear. If not, try to manually shift gearbox through all gears as follows:

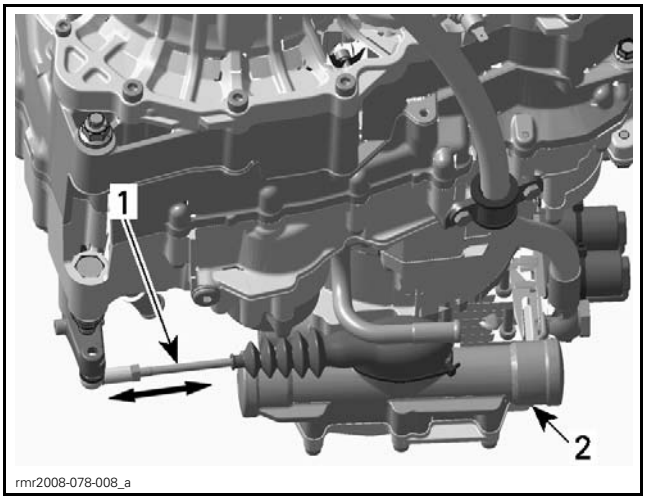
Install a 13 mm wrench on the flat edges of the shift shaft lever and use it to turn shift shaft.



1. Shift shaft lever

If the shift shaft does not turn, disconnect its linkage and try again to turn the shift shaft.

– If the shift shaft does not turn, proceed with gearbox repair.
– If the shift shaft turns, inspect the shift linkage and the HCM hydraulic piston.



VIEW FROM BACK SIDE OF HCM
1. Shift linkage
2. Hydraulic piston in HCM

PROCEDURES

GEAR SHIFTING SWITCHES

Gear Shifting Switches Test with B.U.D.S.

Connect vehicle to B.U.D.S..

Make sure that both clutch and clutch modulation solenoids and valves work.

Select the **TCM** tab in the **Monitoring** page. Look at the **Switch Inputs**.

The LEDs in B.U.D.S. should be OFF when no switch is activated and should turn ON while pressing on the corresponding switch.

If both LEDs turn ON at the appropriate moment, carry out the *SHIFTING TEST*. Refer to *TROUBLESHOOTING WITH B.U.D.S.* in this subsection.

If LEDs do not turn ON when switches are pressed in, check left multifunction switch (MSL), refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

TRANSMISSION CONTROL MODULE (TCM)

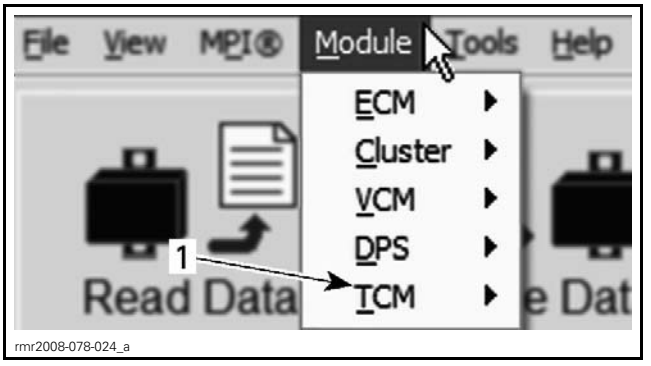
TCM Status Validation

Turn ignition key to ON.

Ensure that fuel pump turns on a few seconds. Otherwise, check ECM power supply.

Connect B.U.D.S. and logon.

Look in the **Module** menu if the **TCM** module is visible. Otherwise, the module is not powered, defective or cannot communicate via CAN.



1. TCM is visible

If **TCM** module is visible, select **Monitoring** page and **TCM** tab.

Make sure **TCM active** LED is turned on. Otherwise, turn ignition switch (key) OFF, wait 30 seconds, then turn it ON. If LED still does not turn on, try a new TCM.

NOTE: Make sure there is no communication problem code.

If **TCM** module is visible and active, carry out *GEAR SHIFTING SWITCHES TEST WITH B.U.D.S.*.

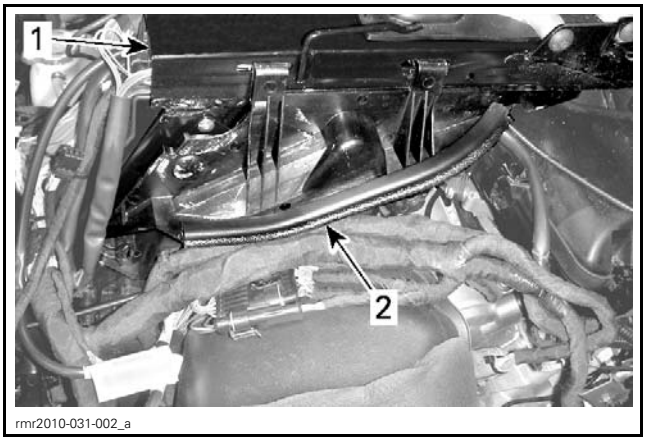
If **TCM** module is not visible or active, carry out *TCM INPUT VOLTAGE TEST*.

TCM Input Voltage Test

Check fuse MF2 in rear fuse box.

Refer to *BODY* and remove console module.

Remove acoustic panel.



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1. Frame
2. Acoustic panel

Disconnect TCM connector.

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and FLUKE RIGID BACK PROBES (P/N TP88).

Set multimeter to Vdc.

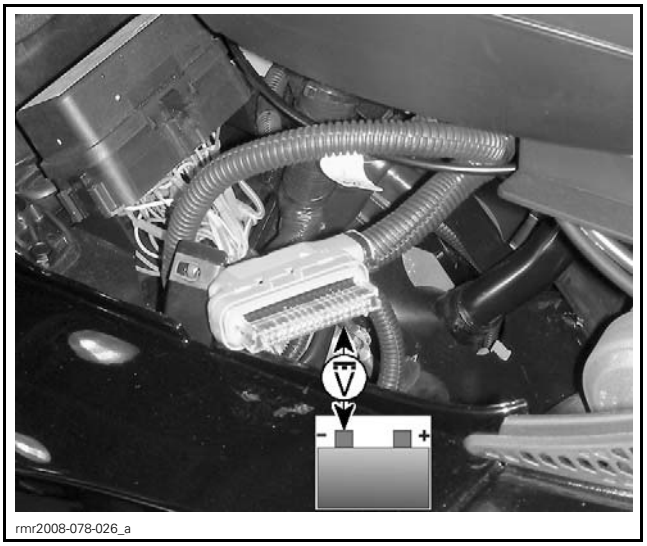
Read voltage as follows.

NOTICE To avoid damaging the connector, probe only the terminal tip.

TCM CONNECTOR	BATTERY	VOLTAGE
Pin 17	Ground	Battery voltage
Pin 35	Ground	

Turn ignition switch (key) ON.

TCM CONNECTOR	BATTERY	VOLTAGE (KEY ON)
Pin 4	Ground	Battery voltage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If voltage is not good, check wiring/connectors between TCM and main relay 2. Refer to *WIRING DIAGRAM*.

If voltage is good, carry out a *TCM GROUND TEST*.

Clear fault codes.

TCM Ground Test

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and FLUKE RIGID BACK PROBES (P/N TP88).

Set multimeter to VDC.

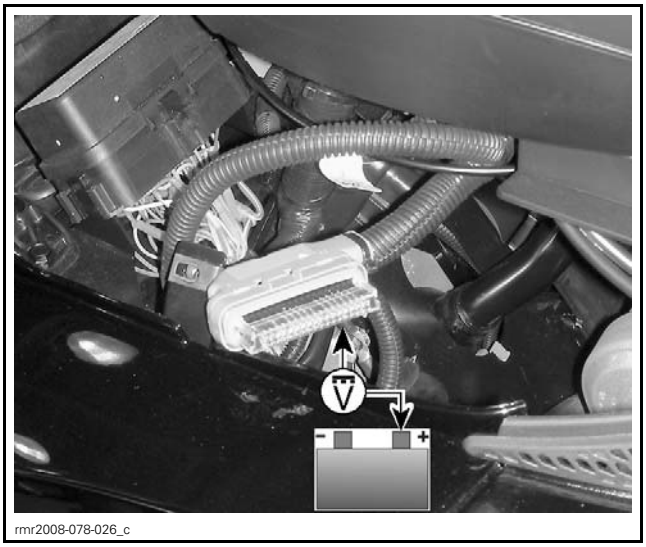
Check ground as follows:

Connect multimeter red probe to a positive source such as the battery terminal of the starter solenoid.

Probe pin 10, then pin 28 of TCM connector with the black (COM) probe of the multimeter. If ground is good, multimeter will show battery voltage.

NOTICE To avoid damaging the connector, probe only the terminal tip.

TCM CONNECTOR	BATTERY	RESULT
Pin 10	Positive source	Battery voltage
Pin 28	Positive source	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If ground circuits are not good, check wiring and connections between TCM and battery ground.

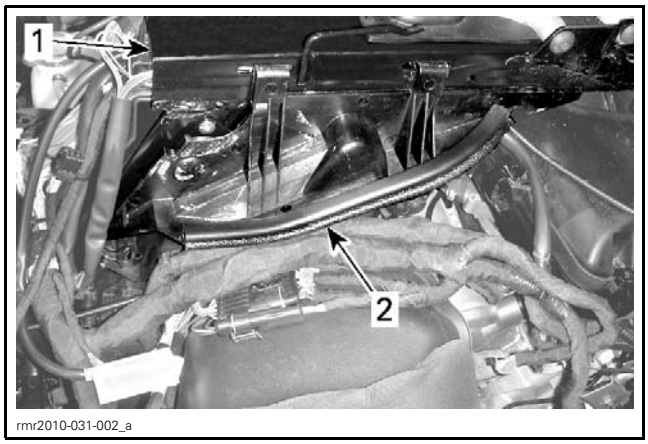
If ground circuits are good, try a new TCM.

Clear fault codes.

TCM Replacement

Removal

Refer to *BODY* and remove console module.
Remove acoustic panel.



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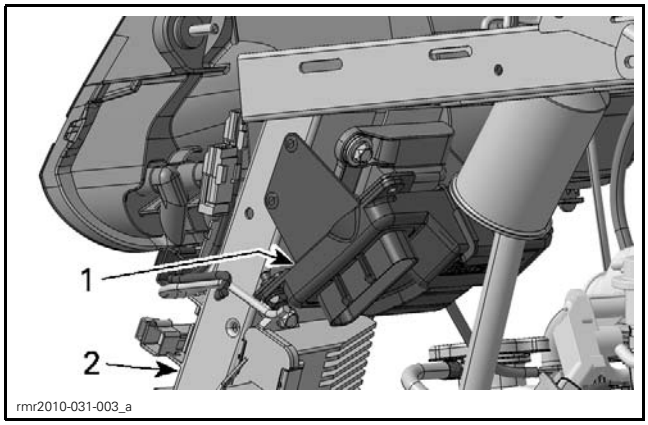
1. *Frame*
2. *Acoustic panel*

Disconnect TCM connector.
Remove TCM retaining screws.



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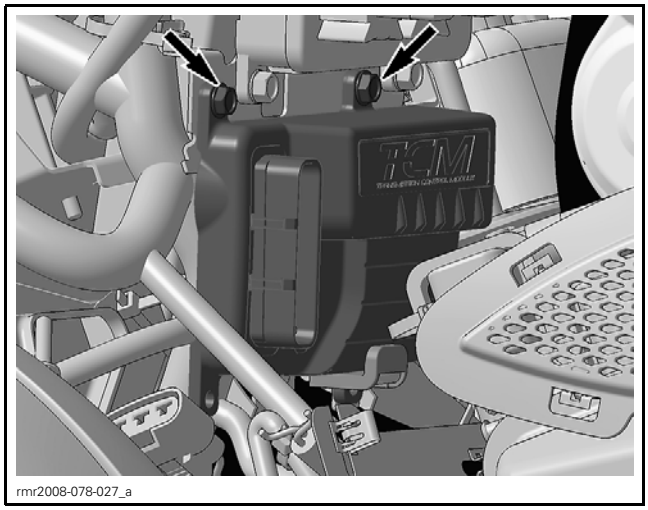
1. *TCM*
2. *Frame*



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Pull out TCM.

Installation

Reverse removal procedures.