INTELLIGENT THROTTLE CONTROL (iTC)

SERVICE TOOLS

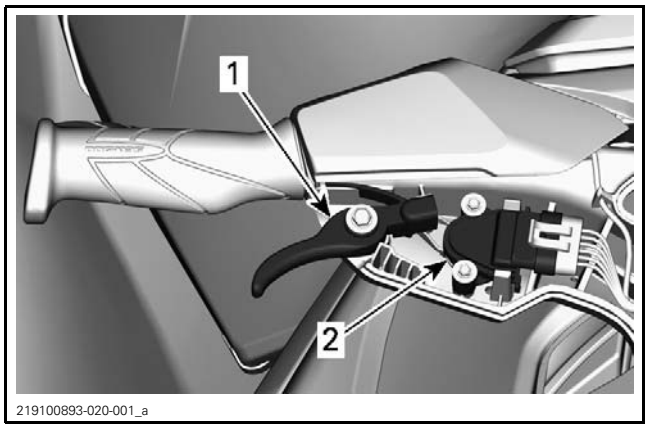
Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 384	85
FLUKE 115 MULTIMETER	529 035 868	86

GENERAL

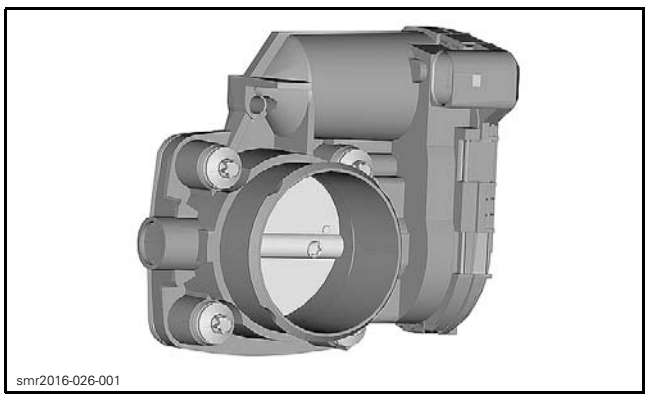
SYSTEM DESCRIPTION

Some functions or features described in this section may not apply to every PWC model, or may be available as an option.

The iTC is an electronic throttle control system that includes a cableless throttle control located on the RH side of handlebar, an electric throttle actuator (ETA) located on the throttle body and the engine control module (ECM). The iTC is often referred to as a "throttle by wire" system.



1. Throttle lever
2. Throttle accelerator sensor (TAS)



The throttle lever operates the throttle accelerator sensor (TAS). It is a double output hall effect sensor. The redundancy is used for security purposes.

The throttle actuator (ETA) is a DC motor on the throttle body that regulates the throttle plate via a drive gear. Pulse width modulation (PWM) is used to control the motor. In the throttle body, there is a double throttle position sensor (TPS). The redundancy is used for security purposes. The TPS is a potentiometer that supplies the ECM the actual angle position of the throttle plate.

According to the torque demand from the TAS, the ECM powers the ETA motor to rotate towards open or close the throttle plate. When the ECM detects through the TPS that the throttle plate has reached the targeted opening, the ECM stops the throttle actuator.

The iTC allows the throttle actuator to be moved irrespective of the accelerator sensor position since it is not directly linked by a throttle cable.

While the throttle lever might be fully pulled in and held, the ECM could close the throttle plate instead of opening it if the iBR lever were pulled in. Then, the ECM could open the throttle plate to accelerate the engine to increase the braking effect. These different throttle plate movements could be achieved while the throttle lever was still fully pulled in. This is one of the great flexibility of the iTC.

The use of the iTC allows the following additional engine modes of operation.

Touring Mode

Touring mode allows the operator to choose for progressive throttle response at certain engine speed.

Available engine power and acceleration is reduced when accelerating from a complete stop and when operating in the low engine power range under certain conditions.

When throttle is applied, the engine will progressively accelerate to an operating range whereby full power eventually becomes available. If the engine is throttled down sufficiently and for a long enough period of time, engine power and acceleration will again be reduced.

Sport Mode

Sport mode allows the operator for instant throttle response.

Maximum engine power is available throughout the engine operational range.

ECO Mode

When ECO mode is selected (fuel economy mode), engine RPM is limited whereby an optimal cruising speed is maintained in order to reduce fuel consumption.

Cruise Control

Cruise mode is a function of iTC (intelligent Throttle Control) system that allows the operator to set the desired maximum watercraft speed.

This is useful when cruising for long distances, operating in limited speed zones, or towing a tuber, skier or wake boarder.

Cruise mode only limits forward speed, the operator must keep the throttle depressed to maintain forward speed.

Once the maximum cruise speed is set, the operator can vary the watercraft speed from idle speed up to the set cruise speed using the throttle lever. The set cruise speed will not be exceeded even if the throttle lever is fully depressed.

As you proceed under a constant cruising speed setting, keep your attention level up to maintain good situational awareness.

Slowing down is a matter of releasing the throttle lever further than the set point, or by pulling the iBR lever in or decrease speed with the DOWN button.

If the iBR lever is pulled in for braking, CRUISE mode is overridden but **not deactivated**.

Once the iBR lever is released and the throttle is pulled in to engage forward position, the cruise function will reengage to limit the watercraft speed as it was set before iBR lever activation.

Slow Speed Mode

The Intelligent Throttle Control also allows for a Slow Speed Mode where the driver can adjust and set idle speed. This is useful when operating in slow speed zones where the driver must be especially attentive to possible obstacle avoidance.

The throttle plate will open and close as necessary to maintain the set speed.

Ski Mode

Ski mode allows for repeated and precisely controlled launches and a set towing speed, designed specifically for towing a skier or wake boarder.

RAMP Function

The RAMP function available in ski mode is a preprogrammed function used for launching and accelerating the PWC when towing a skier or wakeboarder.

TARGET SPEED Function

The TARGET SPEED function limits the maximum towing speed.

Learning and Rental Keys

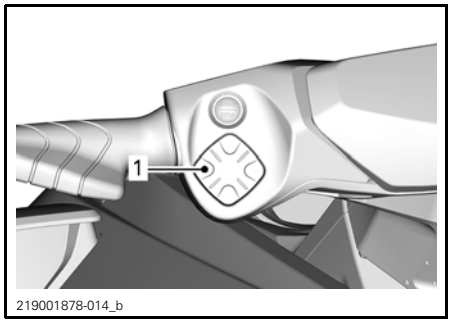
Learning and Rental keys limit the watercraft maximum speed. The full stroke of the throttle lever is used while only a partial stroke of the throttle plate is achieved. Therefore, greater throttle lever movement is used while a smaller engine speed and torque variation is applied through the throttle actuator. This permits a more accurate and easier throttle operation to control the engine within a specified torque curve and maximum speed setting for a learner.

OPERATING MODES

OPERATING MODE AVAILABLE	GTX 155, GTX 230	GTX LIMITED 230, GTX LIMITED 300	RXT	RXT-X	WAKE PRO	FISH PRO
Touring mode	X	X	X	X	X	X
Sport mode	X	X	X	X	X	X
ECO mode	X	X	X	X	X	X
Speed limiter mode	X	X	X	X	X	X
Slow speed mode	X	X	X	X	X	X
Ski mode	-	-	-	-	X	-
Learning key mode	X	X	X	X	X	X

X = Indicates a **standard** feature
- = See a Sea-Doo dealer for availability.
N.A. = Not Available

To change the operating mode;
- Press MODE button,
- Acknowledge the safety message by pressing and holding MODE button will get the SPORT mode,
- Pressing MODE button again will activate the SKI mode,
- Pressing the MODE button again will activate the ECO mode.



1. Mode button

Touring Mode

By default, the watercraft is set to TOURING mode of operation when started.

Sport Mode

SPORT MODE provides for instant throttle response and more rapid accelerations than TOURING MODE.

Once activated, SPORT MODE will remain active until it is deactivated by the operator, or the engine is shut down whereby it defaults back to TOURING MODE.

Activating Sport Mode

To activate the Sport mode, press once on the mode button while in touring mode. The sport icon will start to flash and a safety message will scroll. For safety reason, follow the instruction in the safety message to activate the sport mode. Once activated, the SPORT icon will turn ON.

Deactivating Sport Mode

A single press on mode button will take you to the SKI mode (if available) or ECO mode.

ECO Mode (Fuel Economy Mode)

ECO mode provides a smoother throttle application and increased fuel economy.

Speed Limiter Mode

Speed limiter mode is a function of iTC (intelligent Throttle Control) system that allows the operator to set the desired maximum watercraft speed.

This is useful when cruising for long distances, operating in limited speed zones, or towing a tuber, skier or wake boarder.

The operator must keep the throttle depressed to maintain forward speed.

Once the maximum speed is set, the operator can vary the watercraft speed from idle speed up to the set speed using the throttle lever. The set speed will not be exceeded even if the throttle lever is fully depressed.

As you proceed under a constant speed setting, keep your attention level up to maintain good situational awareness.

Slowing down is a matter of releasing the throttle lever further than the set point, or by pulling the iBR lever in.

If the iBR lever is pulled in for braking, Speed Limiter mode is overridden but **not deactivated**.

Once the iBR lever is released and the throttle is pulled in to engage forward thrust, the speed limiter function will reengage to limit the watercraft speed as it was set before.

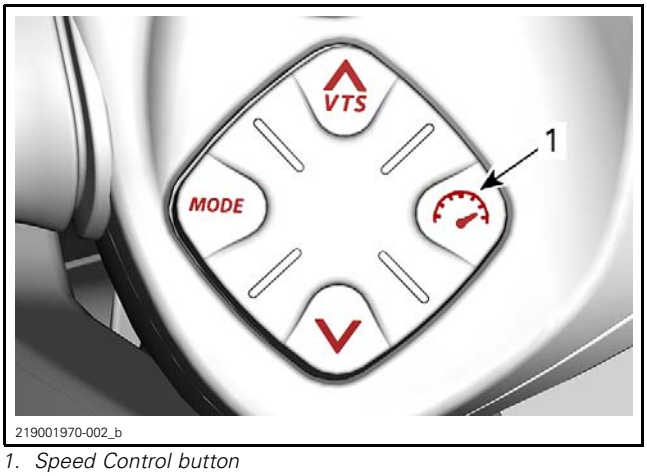
Prerequisite for Speed Limiter Mode Activation

NOTE: Speed limiter mode is not available if slow speed mode or ski mode (if equipped) is engaged.

Speed limiter MODE can be activated when the watercraft is going at more then 15m/h.

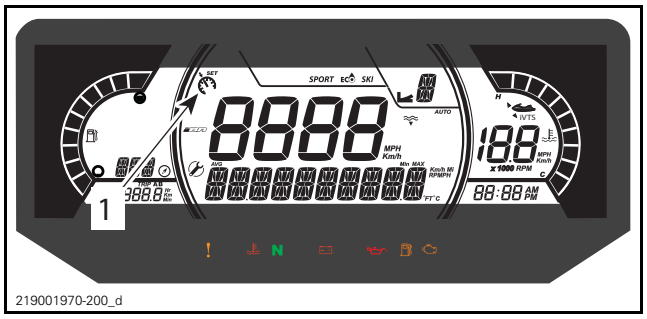
Activating Speed Limiter Mode

1. Maintain a constant speed.
2. Press the Speed Control button.



1. Speed Control button

You will hear a beep indicating that you are now in speed limiter mode, and a speed limiter MODE indicator will be lit.



TYPICAL
1. Speed limiter/Slow Speed MODE INDICATOR

NOTE: Activating speed limiter mode of operation only limits the maximum speed available when depressing the throttle lever. The throttle lever must be held in to maintain forward speed. Watercraft speed can be varied from idle up to the set cruise speed using the throttle lever once the speed limiter function is activated. Watercraft speed may vary depending on water conditions during use.

To change the set speed; keep throttle lever fully depressed and press the UP or DOWN arrow button.

Deactivating Speed Limiter Mode

To deactivate speed limiter mode:

1. Release the throttle lever.
2. Press the speed limiter button.

Deactivation of speed limiter mode is indicated by:

– The speed limiter indicator will go off.

NOTE: If the throttle lever is not fully released when the button is pressed to deactivate the speed limiter mode, the speed limiter MODE indicator will remain on. The speed limiting function will stay active until the throttle is fully released, then the speed limiter MODE indicator will go out.

Slow Speed Mode

The Intelligent Throttle Control also allows for a Slow Speed Mode where the driver can adjust and set idle speed. This is usefull when operating in slow speed zones where the driver must be especially attentive to possible obstacle avoidance.

The operator can set idle speed between 1.6 km/h to 11 km/h (1 MPH to 7 MPH).

If you accelerate above approximately 14 km/h (9 MPH) , Slow Speed Mode will be deactivated and the engine will return to idle RPM when the throttle is released.

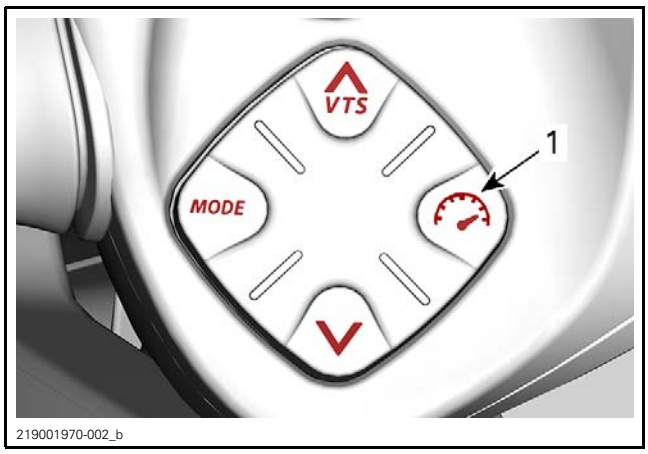
Should a situation arise where the operator must stop or accelerate quickly away from a hazardous situation, pulling in the iBR lever, or pulling in on

the throttle lever will deactivate slow speed mode and normal control of the watercraft will be returned to the operator.

Activating Slow Speed Mode

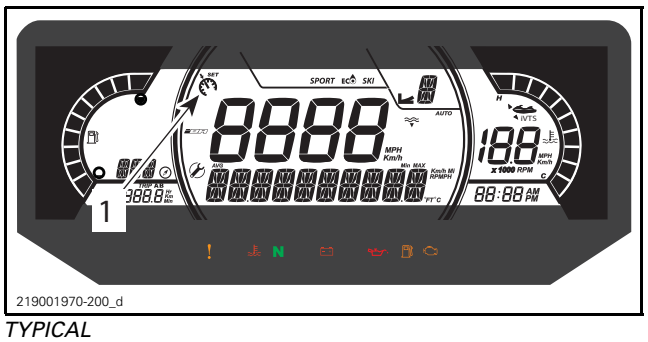
To activate slow speed mode of operation:

1. Release the throttle lever to idle RPM.
2. Press the Speed Control button.



1. Speed Control button

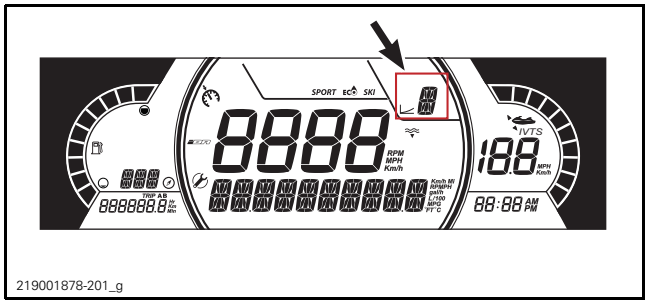
The Speed limiter/Slow Speed indicator will come on in the multifunction display to indicate activation.



TYPICAL
1. Speed limiter/Slow Speed INDICATOR

A message will scroll in the multifunction display to specify that you are now in slow speed mode.

The default slow speed setting of 5 will show in the numerical display.



Changing Set Slow Speed

To **increase** or **decrease** the set slow speed, press the UP/DOWN button on the RH handlebar once, or repeatedly.

NOTE: There are 9 slow speed settings available (1 through 9). Adjust slow speed mode to desired speed.

When pressing the up/down button, a message ''SET LEVEL'' will appear. You can select from one of the 9 slow speed setting (1 to 9).

Level 5 is the default and it correspond to the normal idle of the vehicle. By using level 1-4 you can slow down the vehicle and go as slow as 1.5 km/h (1 MPH). The slow speed mode can be used as a trolling mode and is useful for fishing. Level 6-9 gives you the ability to go up to 12 km/h (7 MPH) without touching the throttle lever.

NOTE: Speed will vary depending on load, wind and waves conditions

Deactivating Slow Speed Mode

The slow speed mode can be deactivated using any of the following methods:

– Pressing the Speed Control button.
– Depressing the iBR lever.
– Accelerating past the set slow speed.

When deactivating SLOW SPEED MODE by accelerating using the throttle lever, the iBR gate stays in the forward position.

When using the iBR lever, the iBR gate will move towards the reverse position, then neutral when the lever is released.

SLOW SPEED MODE deactivation will be indicated in the following manner:

– The Speed Limiter indicator will go out

Ski Mode (If equipped)

Ski mode allows for repeated and precisely controlled launches, and a set towing speed, specifically for towing a skier or wake boarder.

RAMP Function

The RAMP function offers a pre-programmed setting for launching and accelerating the PWC.

RAMP 1 provides:

– Slowest launch (smoothest)
– Slowest acceleration rate

RAMP 5 provides:

– Quickest launch
– Quickest acceleration rate

TARGET SPEED Function

The TARGET SPEED function limits the maximum towing speed.

Once the RAMP has been selected, an average PWC target speed for that RAMP will be visible in the numerical display.

The operator may increase or decrease the target speed to any value within the selected RAMP speed range.

Using Ski Mode

Press MODE button to select the SKI mode.

1. Press OK button when SKI icon flashes.
2. Select ski ramp by using the UP or DOWN arrow button. Ramp 1 will give the slowest acceleration.

NOTE: Acceleration ramp will not behave the same depending on the vehicle type, vehicle load and water conditions. For safety reasons, always start using ramp # 1 to familiarize your skier with acceleration and then change the ramp as needed.

3. Press RIGHT arrow button to confirm acceleration ramp.
4. Select the maximum target speed by using the UP or DOWN arrow button.
5. Press RIGHT arrow button to confirm.

NOTE: At any moment you can use the left and right arrow to change the ramp and speed selection.

6. After your selection and when your are ready, press the OK button to activate the function.

The message SKI READY will display.

Keep throttle fully applied to ski.

Releasing the throttle or applying the brake will pause the SKI mode, simply press OK button to reactivate the SKI mode.

Deactivating Ski Mode

To end a ski run and completely deactivate ski mode, release the throttle to idle, then press the MODE button.

Learning Key Mode

The learning I key provides a mode of operation whereby engine power and speed is limited.

There are 5 speed settings available.

By default, the speed setting is no 1.

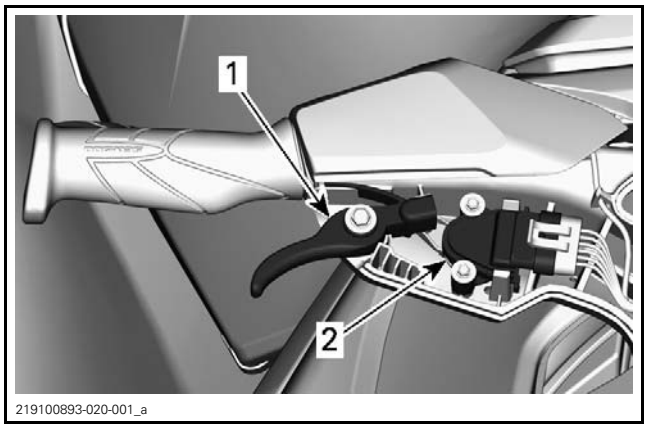
Contact an authorized Sea-Doo dealer for adjustment.

PROCEDURES

THROTTLE ACCELERATOR SENSOR (TAS)

General

The throttle accelerator sensor (TAS) is a double hall effect sensor that sends a signal to the ECM which is proportional to the throttle lever angle.



1. Throttle lever
2. Throttle accelerator sensor (TAS)

First ensure the throttle lever functions adequately. Pull the throttle lever fully in towards the handlebar, then release it. It must reach the wide open position and return to the idle position freely when released. Otherwise, refer to *STEERING SYSTEM* for an inspection.

Testing TAS Voltage

1. Disconnect the 20-pin steering connector.

1. 20-pin connector

2. Connect the diagnostic harness to make an in-line connection between the disconnected connectors.

REQUIRED TOOL	
DIAGNOSTIC HARNESS (P/N 529 036 384)	

3. Install the tether cord on the engine cut-off switch.
4. Briefly press the START button to wake up the ECM.
5. Measure the voltage readings on the installed diagnostic harness connector as follows. Refer to wiring diagram for details.

20-PIN CONNECTOR		**IDLE POSITION**	**WIDE OPEN POSITION**
PIN		VOLTAGE (VDC)	
13 (VI/BU)	14 (BK)	4.9 - 5.1	
14 (BK)	15 (YL/BU)	0.15 - 0.35	1.4 - 1.6
16 (VI/GN)	17 (BK)	4.9 - 5.1	
17 (BK)	18 (YL/GY)	0.4 - 0.6	2.9 - 3.1

If voltage is as per specification, the TAS sensor is functional.

If voltage is out of specification, check continuity of wires between the ECM and the sensor. If continuity is good, replace sensor.

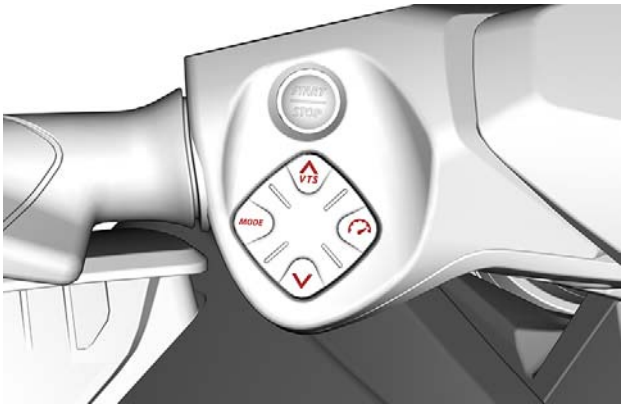
6. Reinstall removed components.

Replacing the TAS

Refer to mol`barob ^q qeb bka lc qefp pubsection.

MODE/SPEED CONTROL SWITCH

Mode/Speed Control Switch Overview



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The Mode/Speed Control switch contain a series of 4 diodes for the Mode and Speed Control switches.

The center wire to the switches (pin C), is common for Mode/Speed Control switch and VTS switch. The other two wires (pins A and B), act as signal wires for each set of switches to the gauge. They actually each form one branch of an electronic circuit within the gauge.

Each diode (in circuit) drops a nominal 0.6 Vdc when conducting electricity. If the circuit current passes through all four diodes (if the Mode/Speed Control switch is open), a drop of 2.4 Vdc would be measured across the 4 the diodes (pin A to pin C). This 2.4 Vdc at pin A tells the gauge the Mode/Speed Control switch is open.

If the Mode button is pressed, 2 diodes are bypassed. The remaining two diodes in the circuit drop 1.2 Vdc (at pin A).

If the Speed Control button is pressed, 1 diode is bypassed. The remaining three diodes in the circuit drop 1.8 Vdc (at pin A).

The gauge senses these voltages through pin 14 of its connector, and interprets them as signals that tell it which switch is activated.

When Mode or Speed Control button is pressed, a circuit within the gauge will translate it to CAN protocol and transmit it through the CAN bus. The ECM (engine control module) will react to the command and carry out the function.

NOTE: The above stated voltages vary slightly depending on the actual voltage applied to the circuit and the current flow through the diodes. When using a Fluke 115 multimeter for testing in diode test mode, the voltage and current applied by the multimeter are lower than in circuit. The quality of probe contact, the actual probes and leads, and the precision of the meter calibration will all affect the results, which will most likely be slightly lower than nominal values stated.

Testing the Mode/Speed Control Switch

If Mode/Speed Control switches do not allow the selection, test the switches as follows:

– Connect the vehicle to the BRP diagnostic software (BUDS2). Refer to *COMMUNICATION TOOLS* subsection.
– Check if there is any occurred or active fault code(s). If not, proceed with the following test.
– In BUDS2, go to:
  • **Measurements** page
  • **Cluster** button
  • **Cluster - Basic** tab
– Depress the Mode button on steering and check the **Mode** light status.
– Repeat with the Speed Control switch. **Speed Control** light status should change

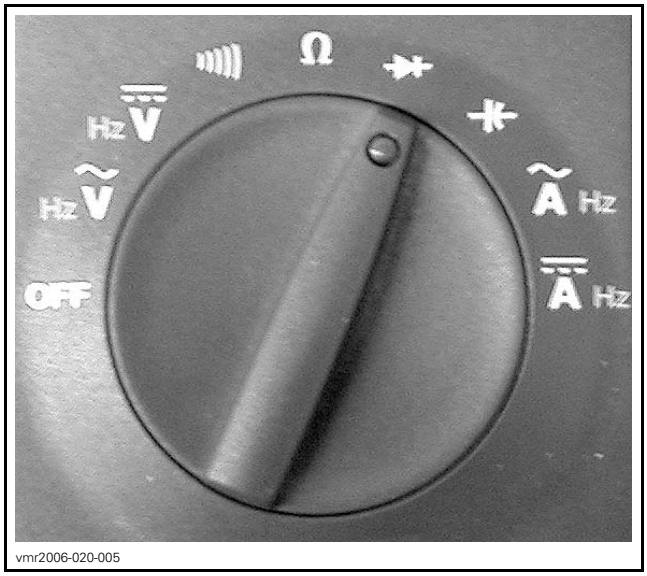
If one switch does not function, replace Mode/Speed Control switch.

If both switches stay off, do the following to verify the circuit.

1. Remove the gauge support cover.
2. Disconnect the gauge connector.
3. Using the multimeter set to the diode test function, test the Sport or ECO switches as per following tables.

REQUIRED TOOL
FLUKE 115 MULTIMETER (P/N 529 035 868)

NOTE: In diode test mode, the multimeter will test the voltage drop through the diodes.



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MULTIMETER LEAD/ GAUGE CONNECTOR	SWITCH POSITION	VOLTAGE
RED lead/Pin 14 BLACK lead/Pin 15	Both switches released	± 2.4 Vdc
	Speed Control switch depressed	± 1.8 Vdc
	Mode switch depressed	± 1.2 Vdc
RED lead/Pin 15 BLACK lead/Pin 14	Both switches released	OL
	Speed Control switch depressed	
	Mode switch depressed	

NOTE: Remember that each diode should drop approximately 0.6 Vdc when positively biassed, and read as an OL (open circuit) when negatively biassed (leads reversed).

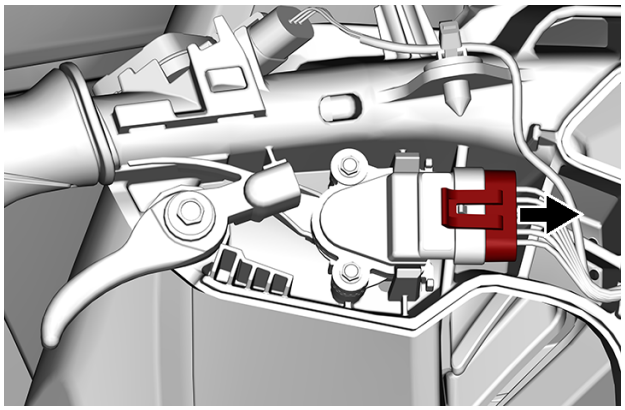
If, when measuring between pins 14 and 15 an OL is obtained with both positive and negative diode biassing, test the wiring harness continuity between the gauge and switch assembly. If harness continuity is good, replace the switch assembly.

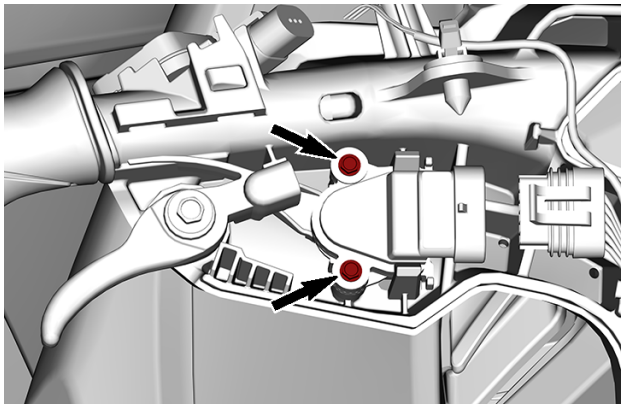
If any reading is significantly different than listed, carry out the same test at the switch connector, refer to the wiring diagram. If you obtain the same results, replace the switch assembly.

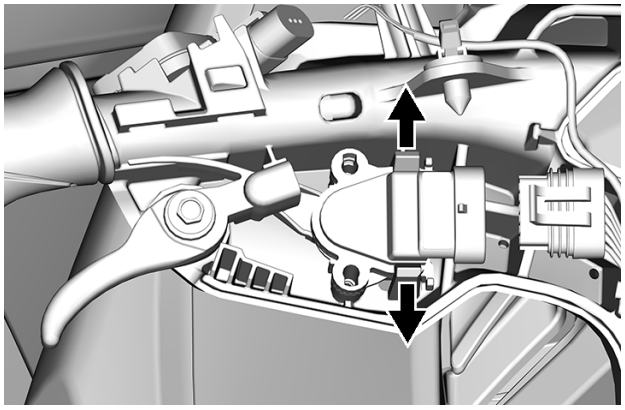
If voltages measured on every switch are as listed in the previous tables (or very close to it), the switches and the wiring harness are good. The fault may be within the gauge, or in the circuit or component the function applies to.

Replacing the TAS

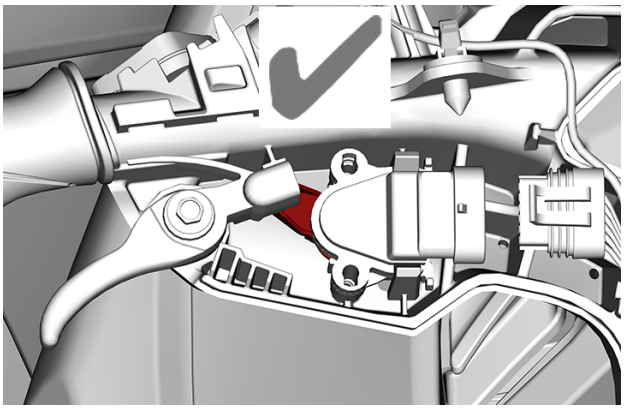
1. Remove RH steering cover. Refer to *Steering System*.
2. Remove sensor.

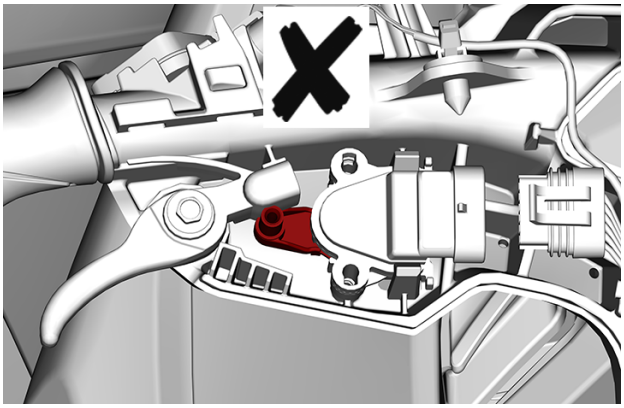






3. The installation is the reverse of the removal procedure. However pay attention to the following.
4. Ensure to properly install the lever arm on the sensor.





5. Press sensor into position until locking tabs engage. Ensure it is properly locked in place.
6. Tighten screws to specification.

Tightening Torque	
TAS screw	0.7 ± 0.1 Nm (6 ± 1 lbf-in)

7. When installation is complete, ensure throttle lever functions properly.
8. Carry out *Testing the TAS Using BUDS2*. Refer to the procedure in this subsection.