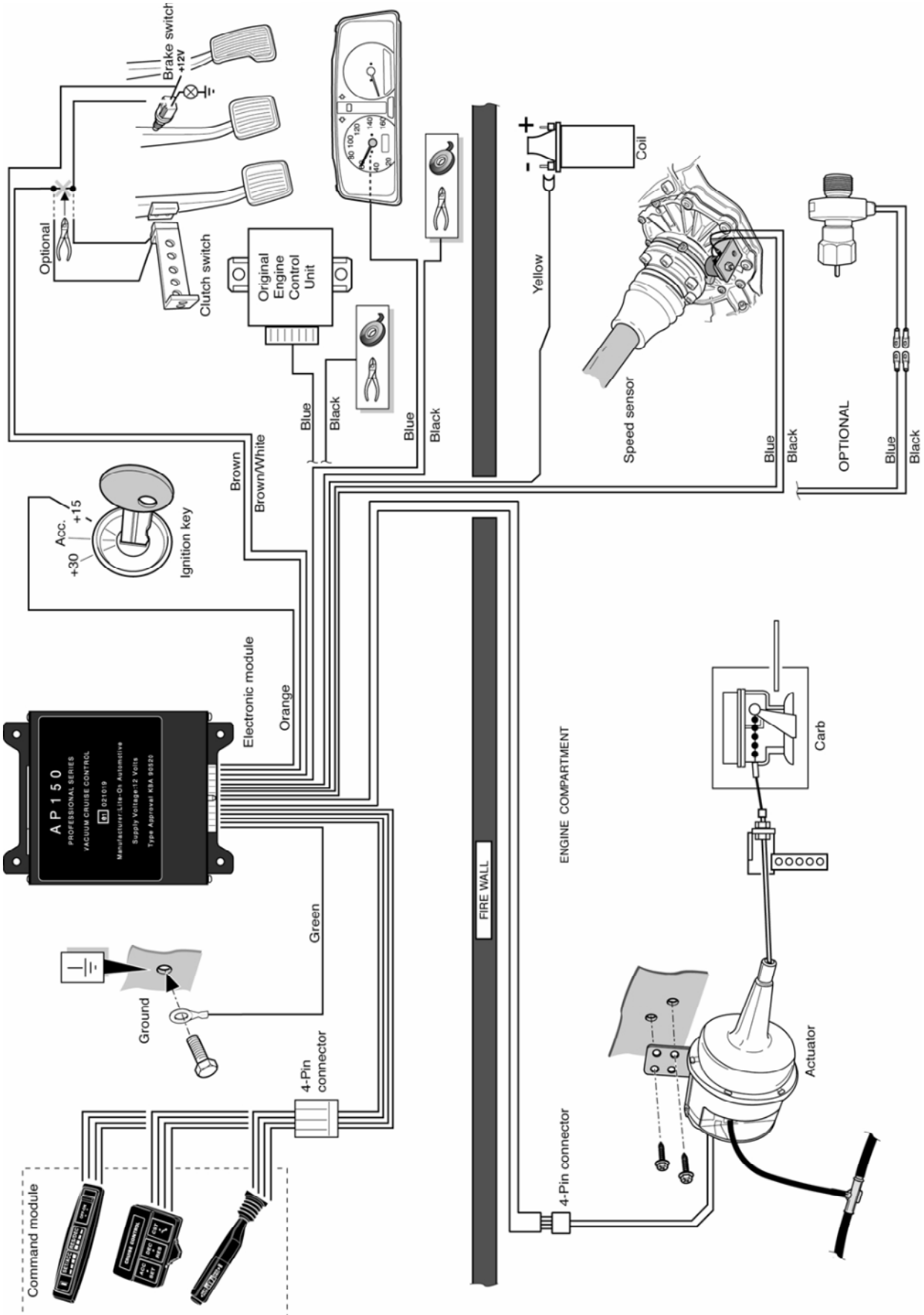
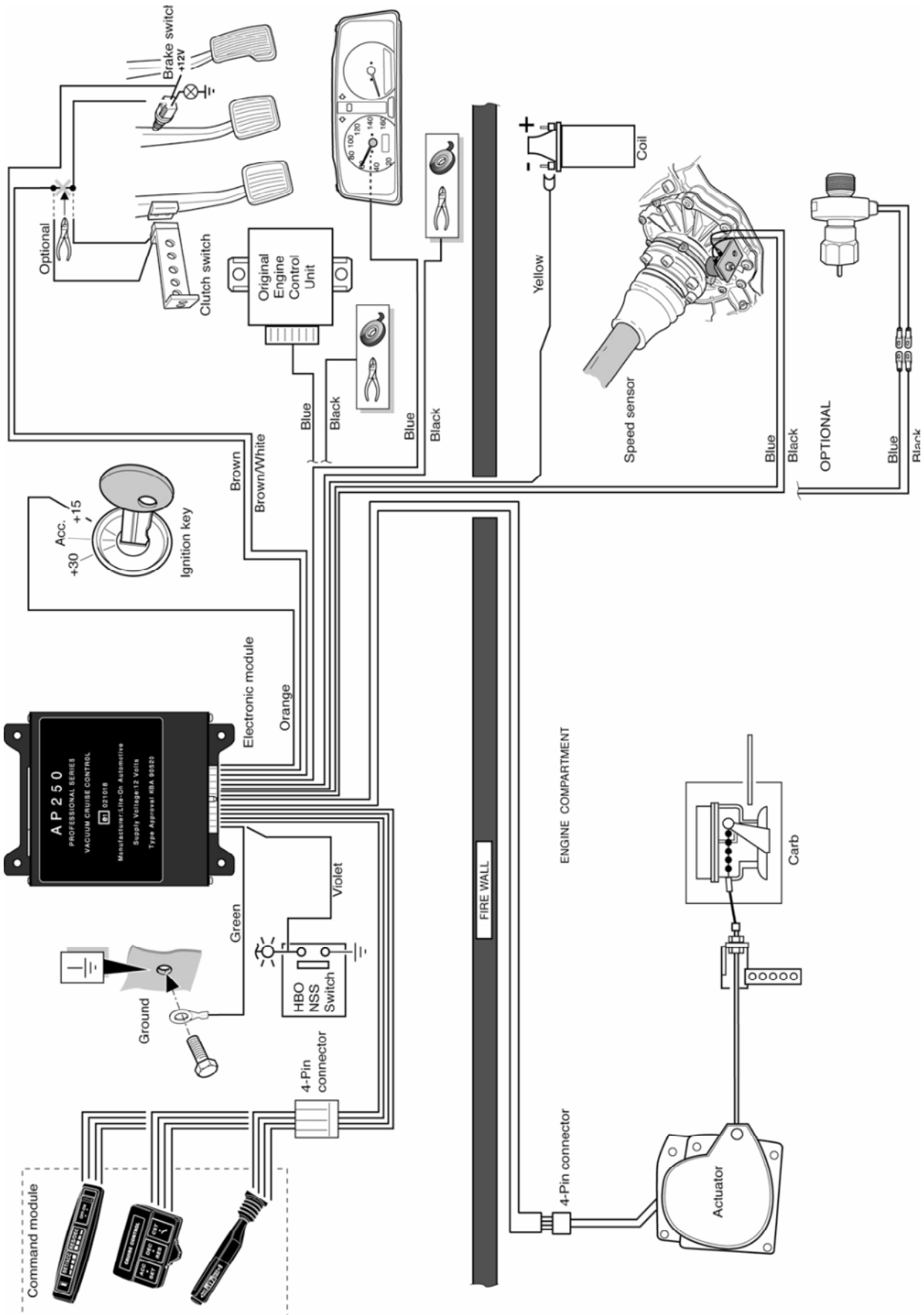
INSTALLATION SECTION

LITEON AUTOMOTIVE ELECTRONICS

AP150



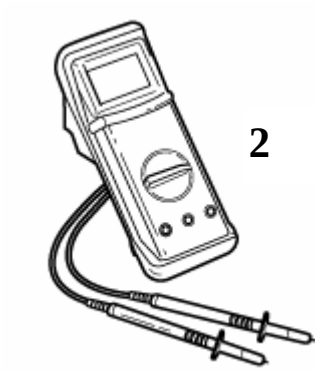
AP250


Brake switch
+12V
Optional
Clutch switch
Original Engine Control Unit
Coil
Yellow
Speed sensor
Blue
Black
OPTIONAL
Brown
Brown/White
Acc.
+15
+30
Ignition key
Electronic module
Orange
AP250
PROFESSIONAL SERIES
VACUUM CRUISE CONTROL
Green
Violet
HBO NSS Switch
Ground
4-Pin connector
FIRE WALL
ENGINE COMPARTMENT
Carb
4-Pin connector
Actuator
Command module

Tools required:

The following is a list of tools required to properly install the cruise control. While this unit may be installed without some of the tools listed, it is recommended that the installer has all these tools available. Scotch Locks are provided in the Cruise Control kit for making connections, but we strongly recommend soldering the connections to make sure of a reliable connection.

1 Electric drill
2 Volt meter
3 Soldering iron + solder
4 Wire cutters
5 Strippers
6 Crimping tool
7 Pair of pliers
8 Drill bits
9 Center punch
10 Hammer
11 Floor jack
12 Screw driver set
13 Socket set
14 Axle stands
15 Insulation tape
16 Measure
17 spanner set
18 ring spanner set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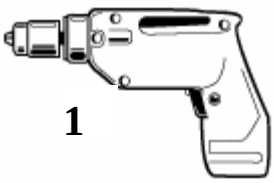
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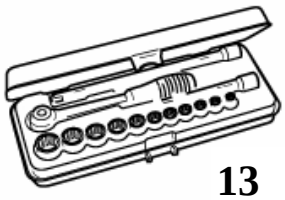
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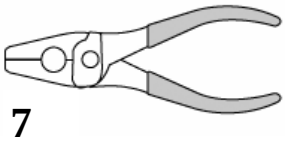
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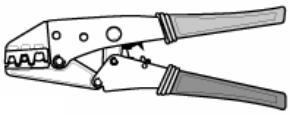
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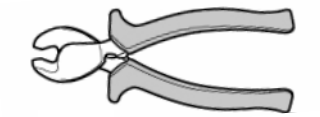
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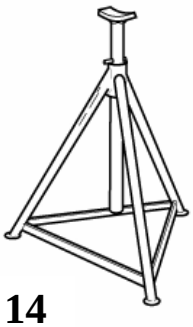
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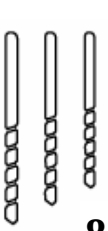
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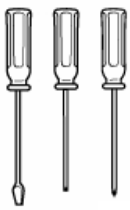
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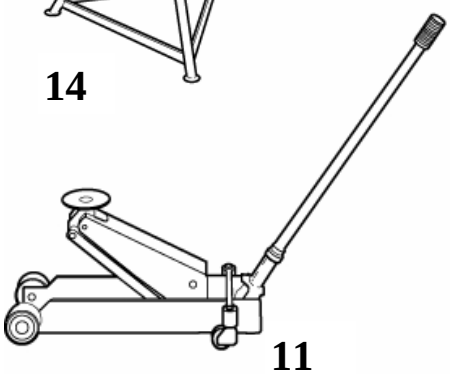
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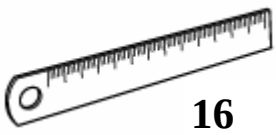
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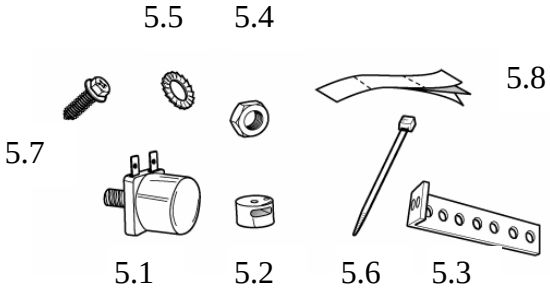
LITEON AUTOMOTIVE ELECTRONICS

AP 150

Item	Part No	Qty	Description
1	**AS44900**	**1**	**VACUUM ACTUATOR**
2	**PR9755A**	**1**	**VACUUM HOSE**
3	**AS72530**	**1**	**ELECTRONIC MODULE**
4	**WH5415A**	**1**	**WIRING HARNESS**
5	**AS72740**	**1**	**SPEED SENSOR KIT**
5.1		1	SPEED SENSOR
5.2		2	MAGNET
5.3		1	BRACKET
5.4		1	NUT M6
5.5		1	LOCK WASHER
5.6		1	CABLE TIE
5.7		2	SHEET METAL SCREW (¼-3/4")
5.8		1	DOUBLE SIDED TAPE
6	**AS4016B**	**1**	**WIRE HARNESS HARDWARE KIT**
6.1		1	GROMMET
6.2		1	SCOTCH LOCK
6.3		1	3-PIN VALVE CONNECTOR
6.4		10	CABLE TIE
7	**AS76590**	**1**	**HARDWARE KIT**
7.1		1	CABLE BRACKET
7.2		1	BRACKET "U" SLOT
7.3		1	MACHINE SCREW M6x12
7.4		2	MACHINE SCREW M6x15
7.5		1	BEAD CHAIN CONNECTOR
7.6		1	BEAD CHAIN CONNECTOR 9MM
7.7		3	LOCK WASHER M6
7.8		3	NUT M6
7.9		1	CARBURETOR SHAFT ADAPTOR
7.10		1	CARBURETOR SHAFT WASHER
7.11		1	BOLT M4x10
7.12		1	NUT M4
7.13		1	SPRING WASHER 4mm
7.14		1	SPLIT PIN
7.15		4	SHEET METAL SCREW (1/4" x ¾")
7.16		4	TAPPING SCREW
7.17		1	THROTTLE CLAMP 5/16"
7.18		1	BEAD CHAIN COUPLING
7.19		1	BEAD CHAIN COVER
7.20		1	RUBBER RING
7.21		1	WIRE LOOP 3"
7.22		1	WIRE LOOP 4"
7.23		1	WIRE LOOP 5"
7.24		1	T-PIECE 5mm
7.25		1	T-PIECE ¼" to 5/16"
7.26		1	T-PIECE 3/8" to ½"
7.27		1	MACHINE SCREW M5x12
7.28		1	NUT M5
7.29		1	DOUBLE-SIDED TAPE

LITEON AUTOMOTIVE ELECTRONICS



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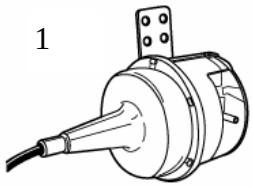
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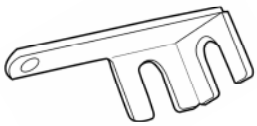
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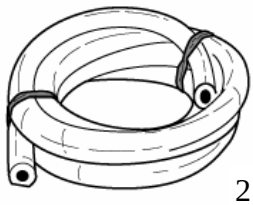
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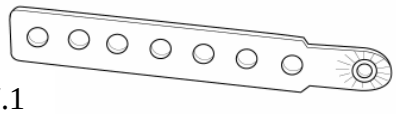
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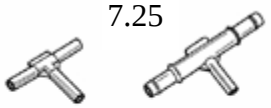
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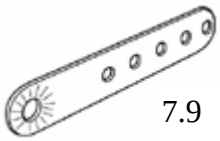
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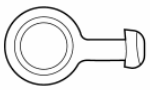
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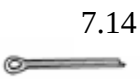
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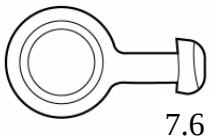
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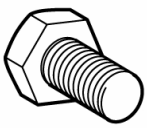
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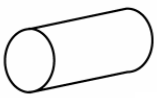
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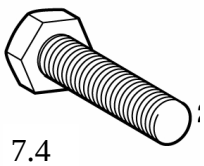
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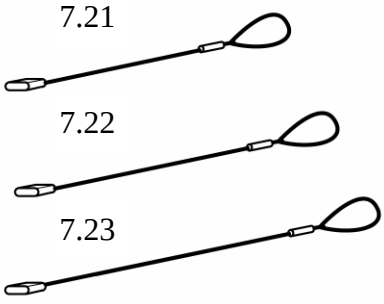
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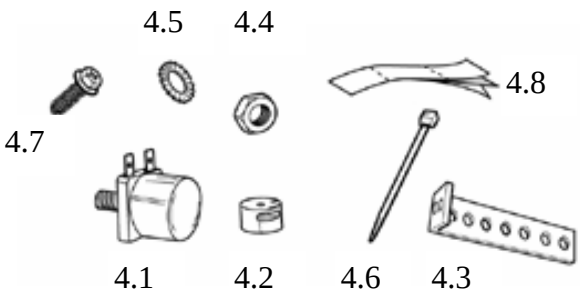
LITEON AUTOMOTIVE ELECTRONICS

AP 250

Item	Part No	Qty	Description
1	**AS4878**	**1**	**ELECTRIC ACTUATOR**
2	**AS7253**	**1**	**ELECTRONIC MODULE**
3	**WH5415**	**1**	**WIRING HARNESS**
4	**AS7274**	**1**	**SPEED SENSOR KIT**
4.1		1	SPEED SENSOR
4.2		2	MAGNET
4.3		1	BRACKET
4.4		1	NUT M6
4.5		1	LOCK WASHER
4.6		1	CABLE TIE
4.7		2	SHEET METAL SCREW (¼-3/4”)
4.8		1	DOUBLE SIDED TAPE
5	**AS4879**	**1**	**HARDWARE KIT**
5.1		1	CABLE BRACKET
5.2		1	BRACKET “U” SLOT
5.3		1	MACHINE SCREW M5x12
5.4		1	NUT M5
5.5		1	MACHINE SCREW M6x12
5.6		2	MACHINE SCREW M6x15
5.7		3	LOCK WASHER M6

LITEON AUTOMOTIVE ELECTRONICS



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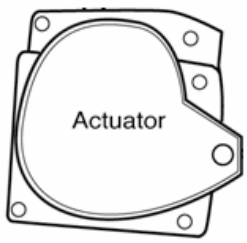

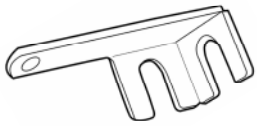

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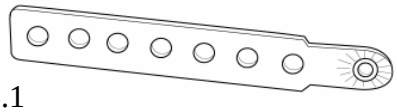

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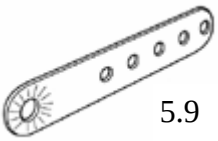

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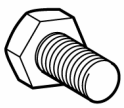

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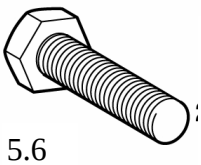

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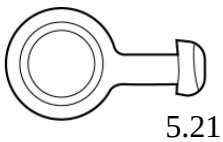

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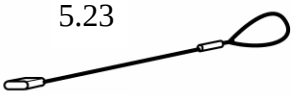

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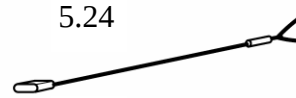

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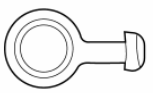

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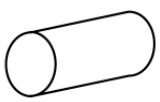

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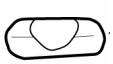


5.18

INSTALLATION INSTRUCTIONS

VACUUM ACTUATOR AP150:

Mount the actuator away from sources of excessive heat on the firewall or side skirt, and at least 300mm away from any high tension leads such as the distributor, coil, ignition wires, or alternator. Be sure the actuator cable will reach the throttle linkage without requiring a bend tighter than a diameter of 300mm, and that away from hot or rotating surfaces. The mounting bracket of the AP150 actuator may be attached to the servo in four difference positions for maximum convenience.

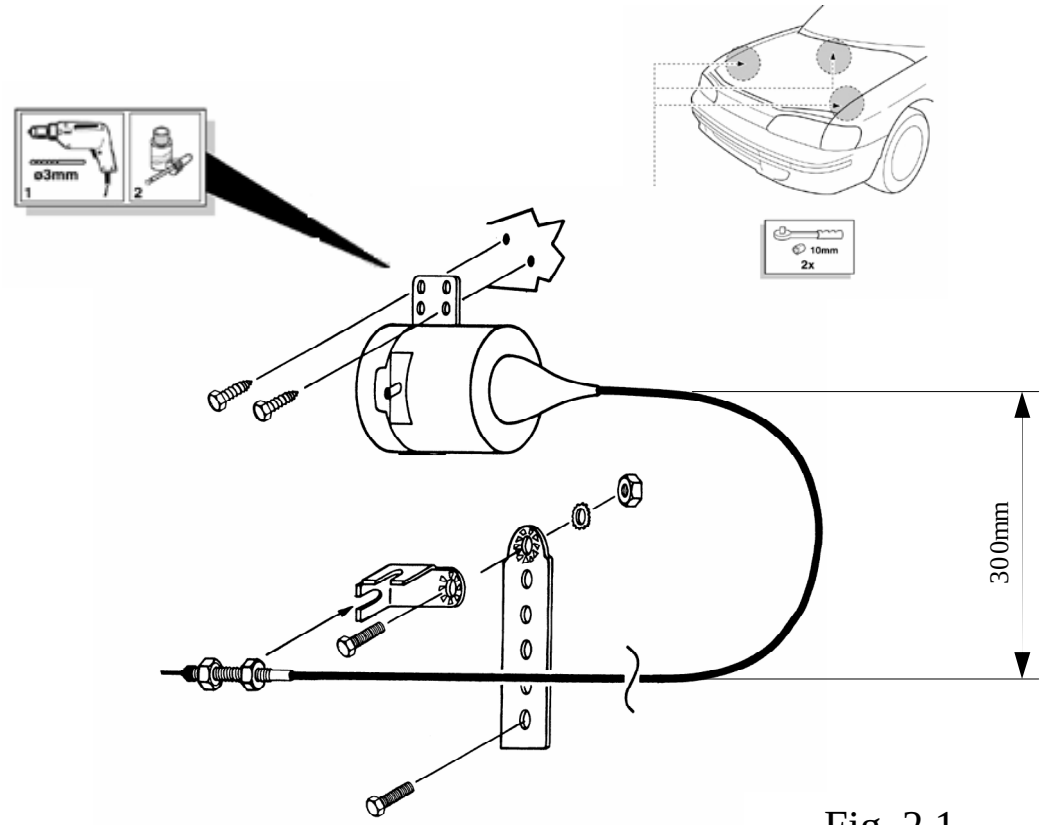


Fig. 2.1

Alternative bracket possitions:

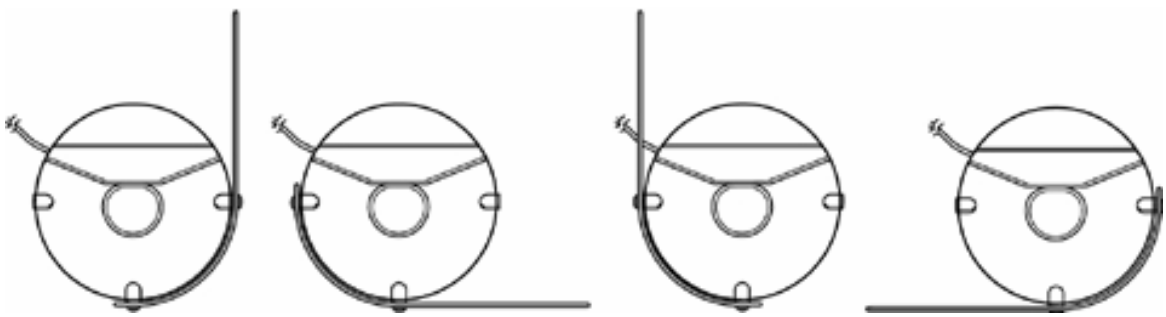


Fig. 2.2

VACUUM CONNECTION:

Locate a good non-restricted vacuum source to connect the vacuum hose of the actuator. The most common location would be straight to the intake-manifold of the engine. This can be achieved by using a separate and blocked off nipple at the intake-manifold (Fig. 2.3) or at the non-return valve located between the intake-manifold and brake booster (Fig. 2.4). For cars with a separate vacuum pump, it is recommended to make the vacuum connection between the pump and the non-return valve of the vacuum brake booster (Fig. 2.5).

Caution:

Never use a vacuum source directly from the vacuum brake booster.

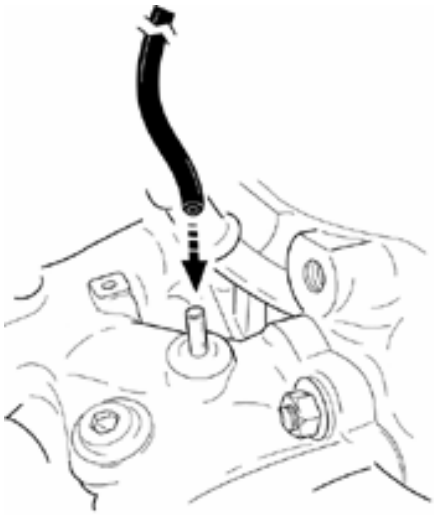


Fig. 2.3

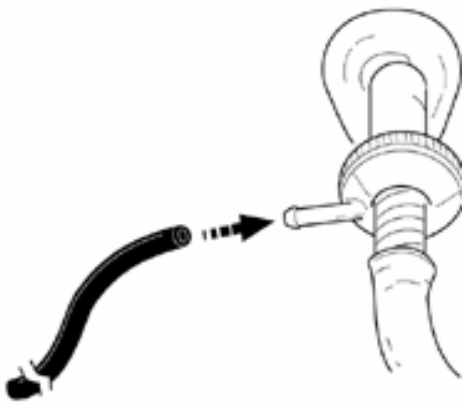


Fig. 2.4

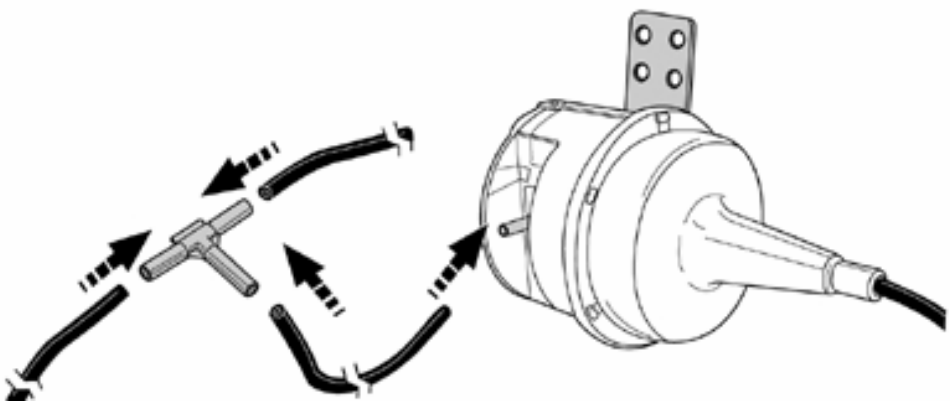


Fig. 2.5

ELECTRIC ACTUATOR AP250:

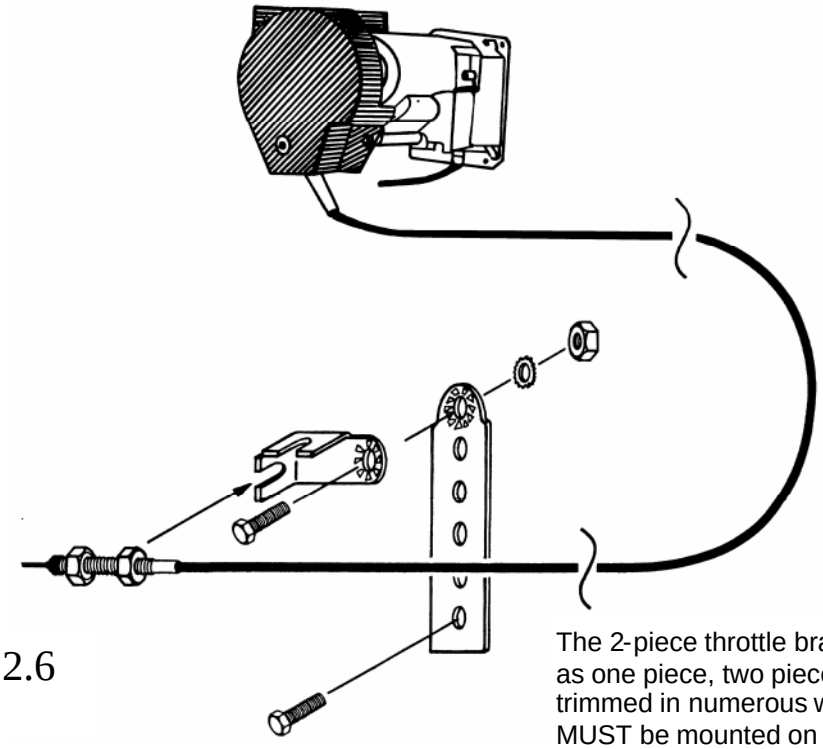


Fig. 2.6

The 2-piece throttle bracket may be used as one piece, two pieces or bent and trimmed in numerous ways. The bracket MUST be mounted on the engine. DO

THROTTLE CONNECTION:

Determine the most suitable linkage connector for your vehicle and attach to the end of the bead chain. Do not shorten the bead chain as it's length has been designed to allow proper flexing when the throttle is actuated.

Locate a suitable place to mount the throttle cable bracket that allows adjustment of cable and will pull the throttle in as close to a straight line (no more than 20 degrees) as possible from the attachment point and check as well the travle of the trottle cable from closed to open throttle position (Fig. B). With linkage connector attached to the throttle, and cable attached to the bracket, adjust the bead chain tension so that there is just a slight amount of slack. Make sure the throttle is at the idle position when the adjustment is made.

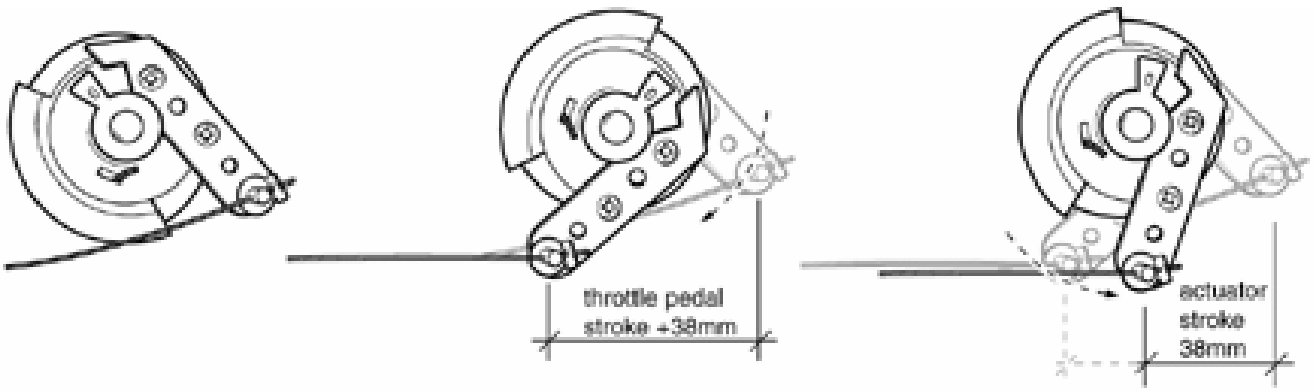
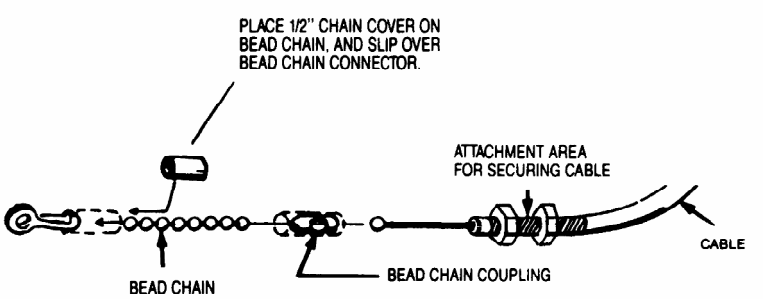
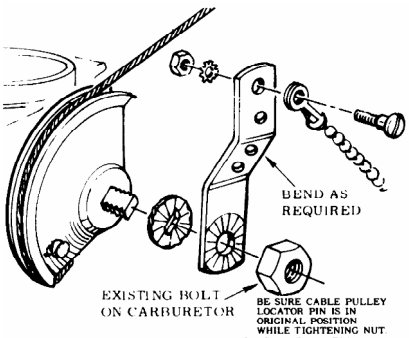


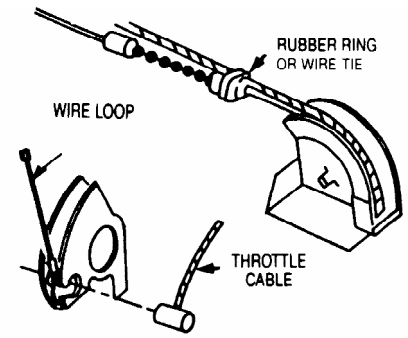
Fig. 2.7



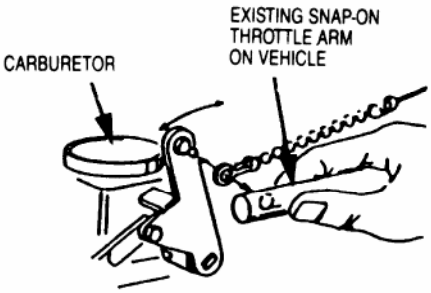
CABLE END ASSEMBLY 2.8



CARBURETOR ARM FOR CABLE PULLEY THROTTLES ON FOREIGN VEHICLES 2.9

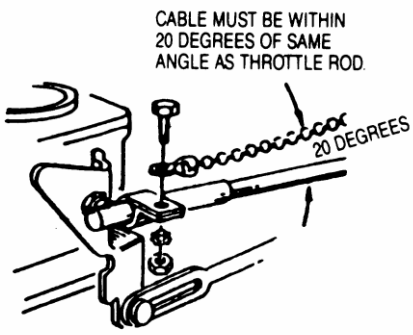


WIRE LOOP FOR PULLEY 2.10



PULL OFF THROTTLE ARM AND INSERT BEAD CHAIN CONNECTOR BETWEEN IT AND CARBURETOR ARM. BE SURE ADDITIONAL THICKNESS OF ADAPTER DOES NOT BIND LINKAGE

SNAP-ON THROTTLE ARM MOUNT 2.11



CLAMP ON THROTTLE ARM MOUNT 2.12

Some modern vehicles do not have a throttle cable. With these vehicles a connection directly to the throttle pedal is required. The best location for the actuator should still be the engine compartment. The actuator cable should route from the engine bay via the bulkhead into the passenger compartment. An overview of the attachment is shown in Fig. 2.13.

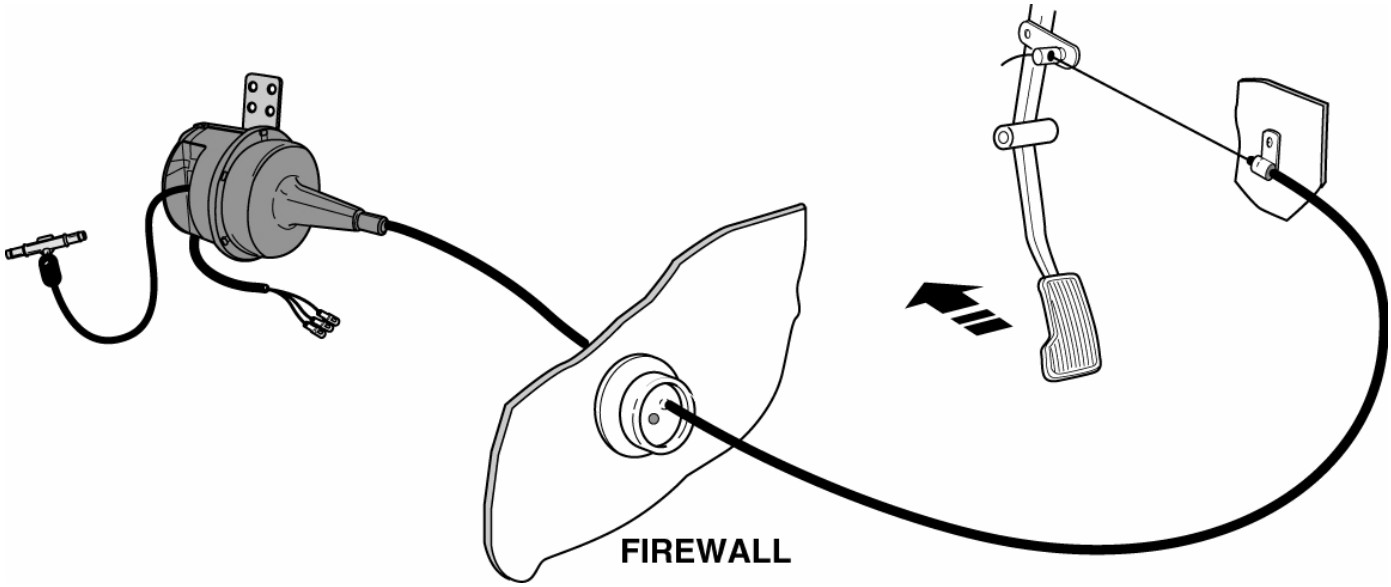


Fig. 2.13

Caution:

Your cruise control is designed with numerous safety features, but none of these can prevent a tangled or jammed throttle linkage. Double check the throttle by hand and by pressing the throttle pedal to make sure the throttle operates smoothly and will not jam in an open throttle condition.

SAFE BEAD CHAIN INSTALLATION REQUIREMENTS

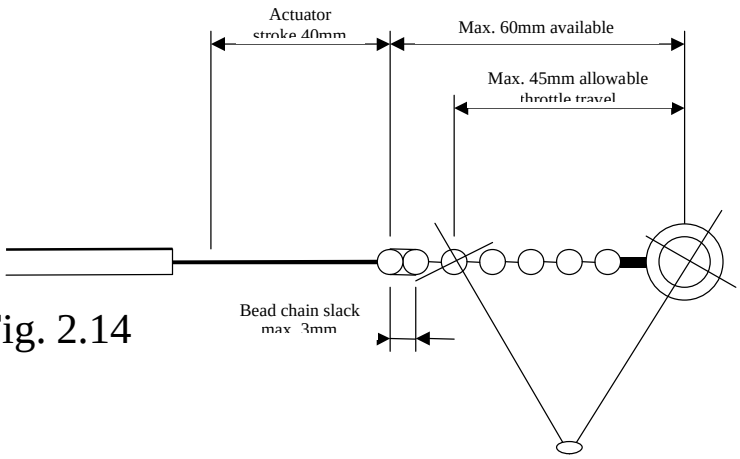
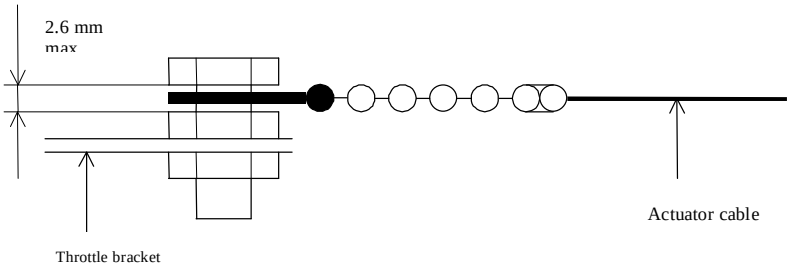


Fig. 2.14



Bead Chain Coupling Assembly

Fig. 2.15

Basic Rules:

1 The actuator cable end must be greater than 12 mm from the full throttle position using a straight line through it to the idle position.
2 Maximum Throttle travel at the point connected must not be greater than 45mm.
3 Maximum allowable rotation of the bead chain coupling on the throttle linkage must not exceed 135 Degrees.
4 Never use less than 7 bead chain links as stated in the installation manual.

Note:

If the ball on the bead chain is never closer than 12 mm from the full throttle position then even if mounted to pull in a vertical direction, the bead chain coupling can not reach 180 Degree position necessary to cause the lock up state.

Fig. 2.16

Match the actuator pull to throttle travel, so as to be greater than 40mm, but less than 45mm, to avoid a condition where the actuator is pulling past the full throttle stop and introducing the possibility of damaging the linkage

ELECTRONIC MODULE:

The electronic module should always be mounted in the passenger compartment of the car with the 4mm sheet metal screws. Avoid places with excessive heat, dampness and high-tension leads. The most common mounting locations are under the dashboard on the driver's side, behind the glove compartment or the drivers- or passenger-side kick panels (Fig. A). Do not mount the electronic module in the engine compartment. For mounting, mark holes, center punch and drill the 3mm holes or use the double sided pad to stick the electronic module to a flat surface. Always check **the other side** for clearance before drilling.

Temporarily install the electronics module in the selected position. DO NOT firmly screw or stick the electronics module down unless you have easy access to the Dip Switches of the electronic module. Until the installation has been finished, the electronic module can be mounted in the selected position.

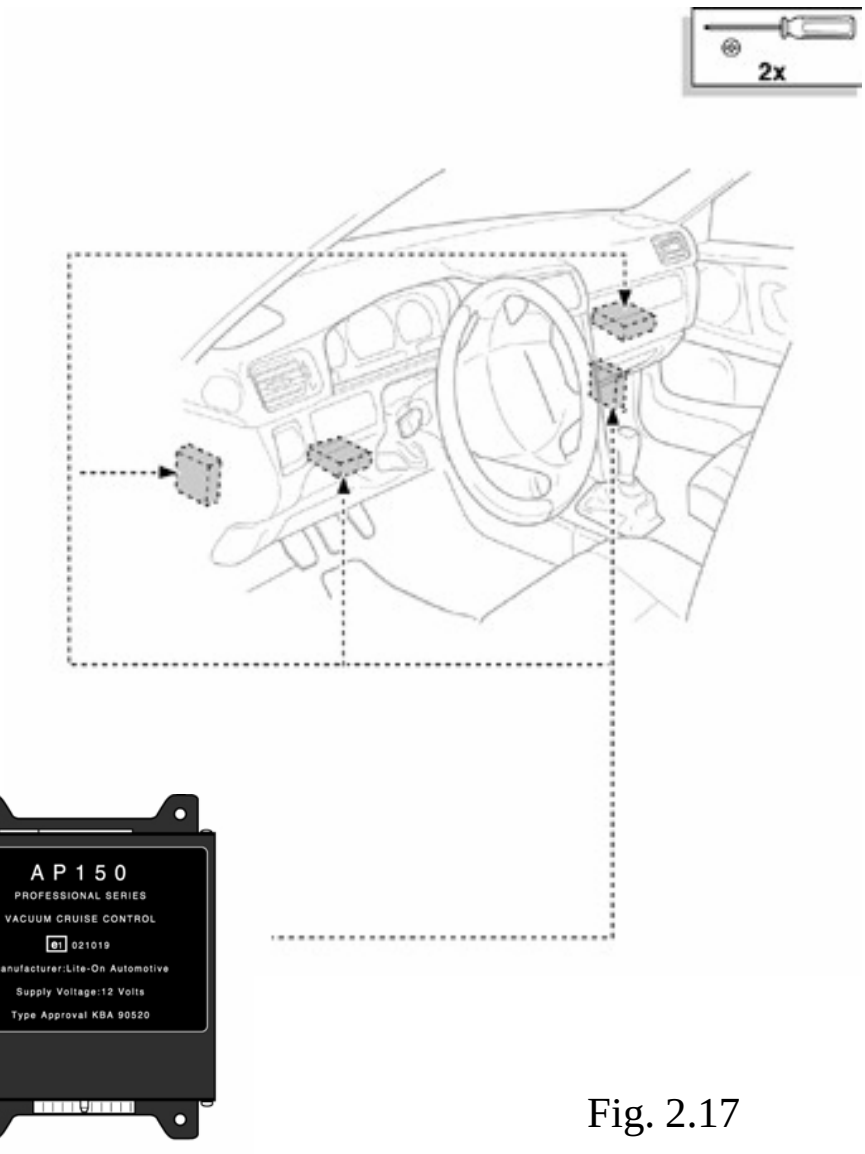


Fig. 2.17

WIRING HARNESS:

Once you have the location of the electronic module, it is possible to mount the wiring harness of the Cruise Control. To locate the wires where the connection should be made, use a voltmeter.

Command Module

The Cruise Control command module should be located in a suitable position to allow operating the unit properly even in all circumstances. Suitable positions are on the dashboard or central console.

Caution:

Ensure that the driver does not have to insert his hand through the steering wheel for operating the command module.

After selecting a suitable location for the command module, a hole of 6mm needs to be drilled near the command module. The wires of the command module can now be routed via the 6mm hole to the cruise control main harness. The terminals of the command module harness can be pushed into the connector housing (Item 9.28) and can be plugged in the 4-pin connector of the main harness.

AP150 Vacuum Actuator wires

Route the three (Red, Yellow and Green) actuator wires into the engine compartment through a hole in the firewall (original grommet) or via a drilled hole and grommet as supplied in the kit. The three connectors can now be plugged into the connector of the actuator at the location with the corresponding wire colour.

AP250 Electric Actuator wires

Route the four (Black, Green/Red, Pink/Red and Blue/Red) actuator wires into the engine compartment through a hole in the firewall (original grommet) or via a drilled hole and grommet as supplied in the kit. The three connectors can now be plugged into the connector of the actuator at the location with the corresponding colour description.

Orange wire

Connect the ORANGE wire to a fused Ignition Switched Feed. This Ignition Switched Feed must have battery voltage (+12V) when the ignition key is in the ON position. Be sure that the ignition key is in the off position when making the connection to prevent blowing a fuse.

Note: Check with a Voltmeter that the ignition switch feed you select supplies a full battery voltage. A suitable location is usually at the fuse box. It is not recommended to connect this orange wire to vehicle accessory (ACC) power wire. Make sure to disconnect the negative side of the battery before making the connection.

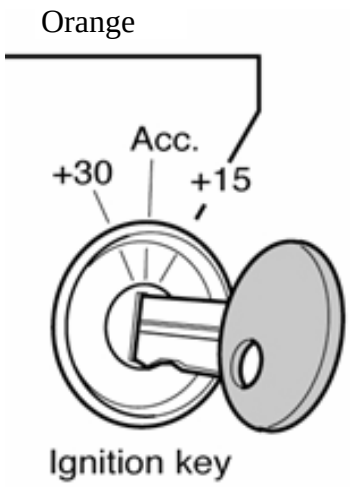


Fig. 2.18

Green wire

Attach the GREEN wire to an existing vehicle ground or a bare metal ground on the chassis (Fig. A). Most common locations for a central vehicle ground would be at the left or right-side kick panels.

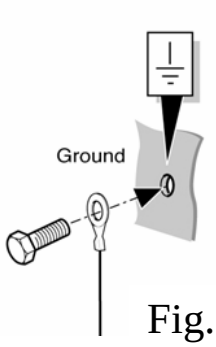


Fig. 2.19

Brown wires

The BROWN wires are the wires to connect to the brake switch (Fig. B). If there are more than two wires coming from the brake switch, use a voltmeter to locate the two wires, which should be used. One of the two wires should be either a permanent feed or ignition switched feed. The other wire should read the battery voltage (+12V) when the brake pedal is depressed and zero (0V) when released.

Note: The two BROWN wires are reversible. However as a safety feature, if the connections are not made securely and correctly the cruise will not work.

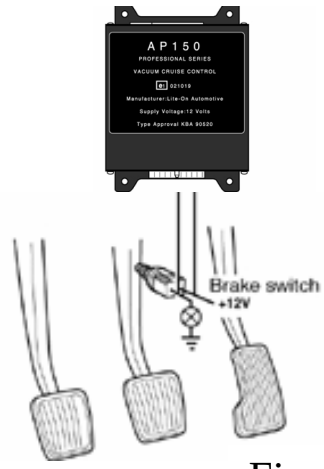


Fig. 2.20

SPEED SENSOR CONNECTION

There are two types of speed signal which can be used for a cruise control installation:

1 Speed Signal - This must be used for the installation of a cruise control on a vehicle with automatic gearbox and can be used on vehicles with a manual gear box as long as the engine over-rev protection by using either a clutch switch or the yellow wire, which should be connected to the negative side of the ignition coil (see over-rev protection in 'Safety Features' at page 21). The Blue wire must be used for this type of signal.

2 Engine RPM signal - The speed of the vehicle is related to the rpm of the engine as long as the vehicle remains in the same gear. Therefore, an engine RPM signal can be used on vehicles with manual gearbox and a clutch switch or engine over-rev protection will not be required.

There are two possible connection for an RPM signal :

1 RPM signal from an electronic tachometer (rev counter), W+ terminal of the alternator or the RPM signal at the engine ECU. The Blue wire of the cruise control should be connected to such a signal as long as its voltage level is between 1 and 14 volts (RMS).

2 The Yellow wire of the cruise control can be connected to the negative side of the ignition coil or RPM signals with a peak voltage of over 14 volts. The yellow wire must be used for this type of RPM signal to ensure that the higher peak voltages do not damage the cruise control ECU. The filter, which is indicated with a red label, should always be left in the yellow wire when connected to the negative side of the ignition coil.

Speed sensor kit

The Speed Sensor kit as supplied with the Cruise Control, generates the Speed Signal. The installing set has a numerous possibilities.

To mount the magnets, use the double-sided tape to stick the magnets to the driving shaft or universal joint. The cable tie is then used to fix the magnets to the driving shaft or universal joint.

Front wheel driven car (Fig. 2.20):

Block the wheels at the rear, ensure the gearbox is in neutral and use the hand brake. Lift the front end of the car until there is sufficient space for working and use axle stands for supporting the car. Fit the sensor on the bracket and determine a location to mount the bracket. This should be as close as possible to the gearbox as there is less movement of the shaft at this point. The inner universal joint of the shaft would be the best option. Use double-sided tape for sticking the 2 or 3 magnets to the shaft and once these are divided equally around the shaft use the cable tie to fix these to the shaft. The adjustment to the sensor should be made so there is gap of 3-5mm between the magnets and the speed sensor. Ensure that there is less than 5mm movement in a vertical direction of the shaft at this point.

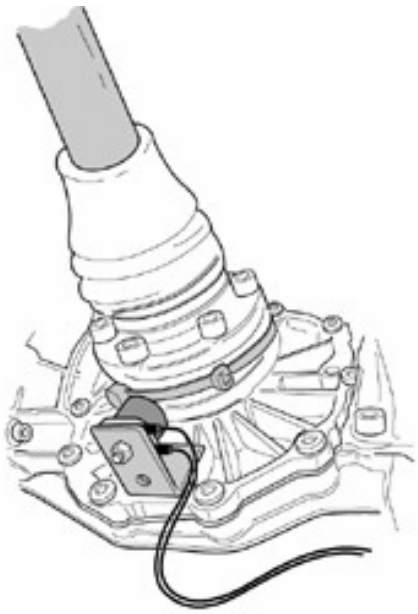


Fig. 2.21

Rear wheel driven car (Fig. 2.21):

Block the wheels at the front and ensure the gearbox is in neutral. Lift the rear end of the car until there is sufficient space for working and use axle stands for supporting the car. Fit the sensor on the bracket and determine a location to mount the bracket. This should be as close as possible to the gearbox as there is less movement of the shaft at this point. Use double-sided tape for sticking the magnets to the shaft and once these are divided over the shaft use the cable tie to fix these to the shaft. The adjustment to the sensor should be made so there is gap of 3-5mm between the magnets and the speed sensor. Ensure that there is less than 5mm movement in a vertical way of the shaft at this point.

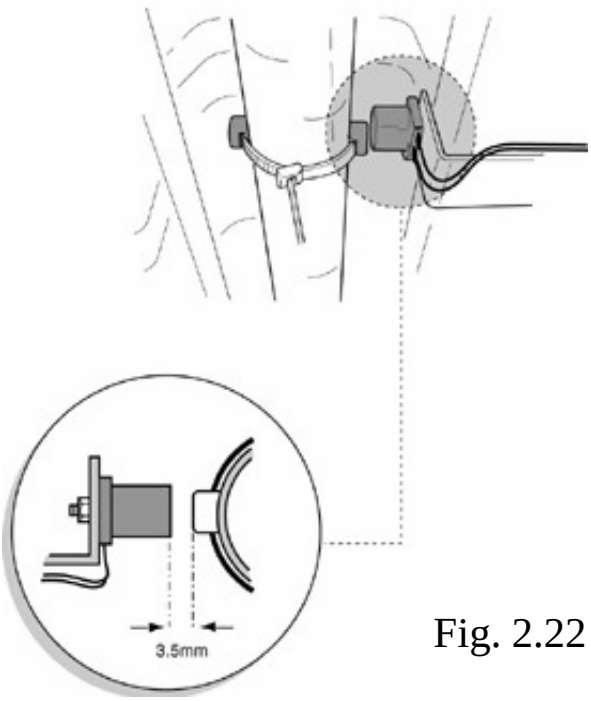


Fig. 2.22

DIAGNOSTIC MODE:

The Cruise Control has an integrated self-diagnostic mode. The three steps A, B and C, of which the self-diagnostic mode exists, are to check and test all features and functions of the Cruise Control. Check over your installation one more time to verify all connections are secure. Be sure to engage the handbrake and place the gearbox in neutral or park if the car has an automatic gearbox.

Diagnostic mode A.)

This first mode allows you to verify that all electric connections are made correctly and that the command module, brake and when installed the clutch switch are functioning correctly. This can be checked and tested via the LED on the electronic module when the ignition is switched on. The LED will flash ON and OFF whenever the SET, RES or BRAKE switches are activated and will remain on when the command module is turned off. If a clutch switch is fitted, the LED turns on when the clutch pedal is pressed. If there is a defective connection, for example with the brake switch connection, the LED on the electronics module will come on as soon the ignition is switched on and will remain on for 8 seconds. After 8 seconds it will turn off so the other functions of the cruise control can be tested. This allows you to identify the cause of the mal-function because the LED will not respond when the defective part is tested.

Diagnostic mode B.)

When the test of the features and functions in diagnostic mode A are completed successfully, the test of the Cruise Control can be continued with the diagnostic mode B. In this mode it is possible to test the functions of the actuator. Engage the handbrake and place the gearbox in neutral or park if the car has an automatic gearbox. To enter this diagnostic mode, turn on the ignition to start the engine while you press and hold the SET/ACC button of the command module. Release the SET/ACC button when the engine runs. Turn on the Cruise Control by pressing the ON/OFF button. The LED of the Command Module will turn on. Tap at the SET/ACC button of the Command Module and the actuator should start to pull the throttle in and will increase the engine revs. Use the SET/ACC and RES/DEC buttons on the command module to adjust the throttle position. The actuator can release the throttle instantly by pressing the brake pedal or using the ON/OFF switch of the command module. Turn the ignition key off to exit the diagnotic mode.

Diagnostic mode C.)

This third test is to check the speed signal. Driving the car on the road the speed signal can be checked by the LED of electronic module. The LED will flash at a rate determined by the pulse frequency of the speed signal. While driving around 50 KM/H, the LED should flash once per second. Turn the ignition key off, after the car is stopped, to exit the diagnostic mode.

NOTE:

The diagnostic mode can be used to test all features and functions of the cruise control. The cruise uses an internally generated speed reference signal to test the actuator in the diagnostic mode B. Therefore, if you completed diagnostic mode B but your cruise control will not engage the most likely cause of the problem is the speed signal.

SAFETY FEATURES:

The cruise control is fitted with numerous safety features, which will disengage the cruise control by any of the following methods:

1 Depressing the brake pedal;
2 Press the OFF button of the command module;
3 Over-rev protection of the engine when a clutch switch is fitted;
4 Decelerating to 75% of set speed
5 Overspeed dropout (150% of the set speed);
6 Turn the ignition OFF.

The cruise control will disengage if the brake fuse blows, brake lights burn out, or any of the connections become disconnected. For safe and economical operation **NEVER** operate any cruise control in congested traffic or on a wet slippery road.

SAFETY NOTE:
Should a situation ever arise where action 1 through to 5 above will not disengage the cruise you can always turn the ignition OFF (action 6). If your vehicle has a steering lock, be sure it cannot be activated when the ignition key is in the ignition lock or the car is in gear.

WARNING:
Your cruise control is designed with numerous safety features, but none of these can prevent a tangled or jammed linkage. Double-check it!

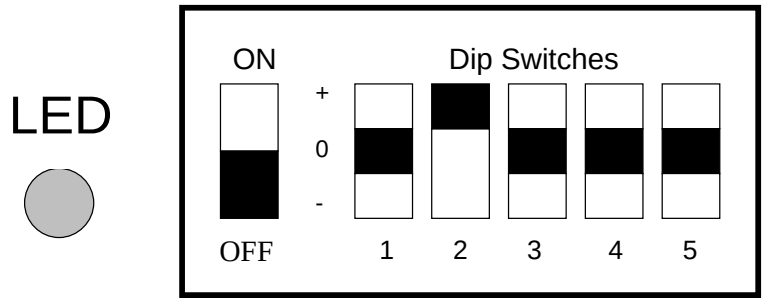
Engine Over-rev Protection
If a true road speed signal is used on a vehicle with manual gearbox, over-rev protection must be included to prevent engine damage. If the clutch is depressed when the cruise control is engaged, the cruise must automatically disengage otherwise damage to the engine could result. There are two methods of providing engine over-rev protection :-

1 A Clutch Switch can be added to the clutch pedal so that when the pedal is pressed, the cruise control will automatically disengage. See the notes on page 50 of this manual for the correct installation of the AA170 clutch switch.
2 If the blue wire provides the cruise control with a road speed signal, the yellow wire can be connected to the negative side of the ignition coil or alternative RPM signal to provide the necessary engine protection. Note that the speed signal will be supplied via the blue wire and therefore dip switch 3 must be in the 0 or + position (see DIP-Switch settings at page 22) . When the clutch is depressed, the engine RPM will increase, the cruise control will detect the increase in RPM on the yellow wire and so disengage the cruise control.

For further, more detailed information about speed signals and the correct settings for the cruise control ECU dip switches see page 22 or the technical specification section on pages 9 to 12 of this manual.

DIP SWITCH SETTING:

After installation, you have the possibility to adjust the five DIP Switches, with 3 position per switch and one On/Off slide switch (SSW), located in the electronic module. The functions of these switches are to adjust the electronic module to create a smooth working cruise control. The on/off slide switch will increase the PPM range in the 'ON' position and will divide the signal by 16.



Factory Settings:

SWITCH	FUNCTION	POSITION	SETTING DISCRIPTION
SSW	HIGH/LOW PPM RANGE	OFF	1000-12000 PPM
SW1	COURSE PPM ADJUSTMENT	0	4000-6000 / 64000-128000 PPM
SW2	FINE PPM ADJUSTMENT	+	6000 / 96000 PPM
SW3	SPEED SENSOR SELECTION	0	BLUE WIRE SPEED WIRE
SW4	COURSE GAIN ADJUSTMENT	0	MEDIUM
SW5	FINE GAIN ADJUSTMENT	0	MEDIUM

To make the DIP Switch setting, there are three simple steps to follow.

STEP 1:

SWITCH 3, SPEED SENSOR SELECTION:

– for TACH or ignition coil sensing

+ or 0 for ECM, magnet or SPG Sensing

STEP 2:

SWITCH 1&2 and SSW, Pulses Per Mile selection according the following chart.

SSW	OFF	1000	2000	3000	4000	5000	6000	8000	10000	12000
SSW	ON	16000	32000	48000	64000	80000	96000	128000	160000	192000

NOTE: If you are not sure about the pulse frequency, leave the DIP-Switch settings in the 6000PPM factory settings. Further adjustments may be necessary during road test.

GAIN	LOWEST			MEDIUM			HIGHEST		
SW4	–	–	–	0	0	0	+	+	+
SW5	–	0	+	–	0	+	–	0	+

NOTE: To change DIP-Switch setting, make sure to disconnect connector on the cruise control ECU.

ROAD TEST:

Start your vehicle and press the Command Module on with the On/Off switch.

Speed Pulse adjustments:

The lowest speed that the cruise control actually takes over is the minimum engage speed for your vehicle. If the minimum engage speed is within 25 - 40 KM/H, (15 - 25 MPH) then the PPM settings (SW1&2 and SSW) are ideal. While driving at around 40 KM/H (25MPH). Press and release the SET/ ACC button and you should feel the cruise control take over. If the minimum engage speed is too high, the pulse settings should then be increased.

Sensitivity adjustments (GAIN):

The two three-position switches (switches 4&5) at the electronic module can adjust the sensitivity. Adjustments at this switch need to be done with the ignition switch in the off position or with a disconected connector. If the cruise control gains speed, acts erratically, or seems too responsive, DECREASE the sensitivity by resetting first switch 5, which is the fine sensetifety adjustment switch (see page 20). If the cruise control loses speed or seems to be sluggish in responding, then INCREASE the sensitivity by resetting the sensitivity switch to a higher sensetivety position.

Use the throttle pedal to accelerate the vehicle to 80 KM/H (50 MPH) and maintain a steady speed. Now press and release the SET/ACC button and slowly release your foot from the throttle pedal. The cruise control should engage smoothly and maintain a stable vehicle speed.

Check the Tap Up, Tap Down, Decel, Accel, Resume and ON-OFF Switch functions.

TROUBLE SHOOTING GUIDE:

This section of the manual includes a list of potential problems and a list of recommended checks to perform to solve these problems.

1 The LED on the electronic module does not light when the command module buttons are pressed.

- Check the 4 pin command module connector from the electronic module and make certain that it is connected correctly to the command module.
- Check the color code on the command module connector and make certain that you have inserted the terminals into the command module correctly.
- Using a voltmeter, check the power supply to the cruise control electronic module. You should have the battery voltage (+12V) on the orange wire when the ignition is switched on and earth on the green wire at all times. Make certain that the ignition switch feed on the Orange wire is thefull battery voltage when the ignition is switched on.
- Using a voltmeter check the signals on the four command module wires
  - **Red wire -** Command Module ignition switch feed. You should measure the battery voltage (+12V) when the ignition is switched on.
  - **Brown Wire** - Command Module Coast Wire. You should measure 1/4 (3 - 3.5V) of the battery voltage when the command module is ON and the full battery voltage (+12V) when the command module is either OFF or in Coast.
  - **Green wire** - Command Module earth. This wire should be earth all the time
  - **Yellow wire** - Command key signal. You should measure the battery voltage (+12V) when the SET/ACC key is pressed and 1/3 (4 - 4.5V) of the battery voltage when the RES/DEC key is pressed and 0 volts at all other times.

2 The LED on the electronic module module does not light when the brake is pressed.

- Check that the LED on the electronic module lights when the command module buttons are pressed. If not, check the main electronic module power supply using a voltmeter. The Orange wire would have the battery voltage (+12V) when the ignition is switched on and earth at all times on the Green wire.
- Using a Voltmeter check the connections to the brake switch. One Brown wire from the electronic module should be connected to a brake light switch wire which is either permanent feed (+30) or an ignition switched feed (+15). The other Brown wire should be connected between the brake light bulb and the brake light switch. You will therefore read earth through the brake light bulb when the brake padel is not pressed and the battery voltage (+12V) when the brake padel is pressed. The two Brown wires are interchangeable. Some brake light circuits will have an ignition switched feed, so test the wires with the ignition switch in the ON position.
- For safety purposes, the brake light connections will not work if you have a problem with the vehicles original brake light circuit. Therefore, test the brake lights and make certain they are operating correctly.

3 The LED does not flash with a TACH signal input

- lncorrect TACH signal. Check the signal using either a voltmeter or an oscilloscope. Make certain that the peak voltage of the signal is between the limits of 14 to140V for the AP150 and 16 to 32V for the AP250 and in the frequency range of 4Hz-367Hz.
- Poor connection or damaged wiring. Once you have checked that the TACH signal is correct, test the signal again at the cruise control electronic module. Place the Red voltmeter lead or oscilloscope lead on the Yellow wire of the electronic module connector and the other lead to earth. Make certain you have the same signal at the electronic module. If not, check over your connections and make certain the Yellow wire is not damaged or broken.
- Incorrect DIP Switch Setting. If Speed sensing is selected, then the cruise control will not work from a TACH input signal. Check the Dip Switch settings and make certain that switch 3 is in the '-' position.

4 The LED does not flash with a speed signal input

- Incorrect Speed signal. Check the speed signal using either a voltmeter or an oscilloscope. Make certain that the peak voltage of the signal is between the limits of 1v to 14v and is in the frequency range 4Hz to 5872Hz. (For more details information on speed signals see page 9 - 12 of the technical specification section of this manual)
- Poor connection or damaged wiring. Once you have checked that the Speed signal is correct, test the signal again at the cruise control electronic module. Place the Red voltmeter lead or the oscilloscope lead on the Blue wire of the electronic module connector and the other lead to earth. Make certain you have the same signal at the electronic module. If not, check over your connections and make certain the Blue wire is not damaged or broken.
- If adjustment of the PPM setting has no effect in adjusting the set speed of the cruise control, check the setting of Dip Switch 3. It must be in either the '0' or '+' positions for correct speed signal (Blue wire) speed sensing.

5 The AP150 Throttle Actuator does not pull the Throttle in Diagnostic Mode

- Perform all other diagnostic mode tests to check that the problem is not either power supply or command module related.
- Turn off the ignition and exit diagnostic mode. Leave the ignition off for a few seconds and then press and hold the SET/ACC button while you turn on the ignition to re-enter diagnostic mode. Repeat the test and make certain that the servo is still not working.
- Check the servo connector to make certain the wires have been inserted into the connector correctly by checking the colour code.
- Use a voltmeter to check that each cable in the servo wiring harness is undamaged. Set the meter to earth (continuity), place one voltmeter lead in the servo connector and the other voltmeter lead in the corresponding terminal of the main electronic module connector. Make certain that the meter reads continuity (beeps) when both voltmeter leads are connected to confirm that the wire is not broken or damaged. Repeat this for each of the three cables.
- Using the notes on vacuum connections on pages 11 and 13 of the technical specification section of this manual, check the vacuum source to ensure that it suitable.

- Press the SET/ACC key on the command module and listen to the servo. You should hear the vac valve click as the button is pressed. If not, place your Red voltmeter lead on the Red servo wire in the main electronic module connector. Place your Black voltmeter lead on the Green servo wire in the main electronic module connector and set your meter to read DC volts. You should read the battery voltage (+12V) on the meter when the SET/ACC button is pressed.
- Press the RES/DEC key on the command module. You should hear the vent valve click as the button is pressed. If not, place the Red voltmeter lead on the Red servo wire and the Black voltmeter lead on the yellow servo wire in the main electronic module connector. Set the meter to DC volts and press the RES/DEC button. The meter should read the battery voltage (+12V) when the button is pressed. If either of these tests fail, change the main electronics module.
- If the VAC or VENT valves do not click when the SET/ACC or RES/DEC buttons are pressed but the signals from the electronic module are correct, disconnect the servo from the wiring harness and place the Red voltmeter lead on the Red wire of the actuator connector (the end that goes to the actuator). Move the black voltmeter lead between the Green and Yellow wire and with the voltmeter set to resistance. Ensure that the resistance of both valves is approximately 45 ohms. If the resistance is not 45 ohms on both valves, change the servo.

6 The AP250 Throttle Actuator does not pull the Throttle in Test Mode

- Perform all other diagnostic mode tests to check that the problem is not either power supply or command module related.
- Turn off the ignition and exit diagnostic mode. Leave the ignition off for a few seconds and then press and hold the SET/ACC button while you turn on the ignition to re-enter diagnostic mode. Repeat the test and make certain that the servo is still not working.
- Check the actuator connector to make certain the wires have been inserted into the connector correctly by checking the color code.
- Use a voltmeter to check that each cable in the actuator wiring harness is undamaged. Set the meter to earth (continuity), place one voltmeter lead in the actuator connector and the other voltmeter lead in the corresponding terminal of the main electronic module connector. Make certain that the meter reads continuity (beeps) when both voltmeter leads are connected to confirm that the wire is not broken or damaged. Repeat this for each of the four cables.
- Press the SET/ACC key on the command module and listen to the actuator. You should hear the clutch engage and the motor turn as the button is pressed. If not, place your Red Voltmeter lead on the Black actuator wire in the main electronic module connector. Place your Black voltmeter lead on the Green/Red actuator wire in the main electronic module connector and set your meter to read DC volts. You should read the battery voltage (+12V) on the meter when the SET/ACC button is pressed. These are the clutch connections and this +12V feed will pull in the clutch.
- Place the Red lead from your voltmeter on the Blue/Red actuator wire in the main electronic module connector and the Black voltmeter lead on the Pink wire. Press the SET/ACC key on the command module and with the meter set to DC volts, you should read the battery voltage (+12V). If either of these tests fail, change the cruise control electronic module.

- If the clutch does not engage or the motor in the actuator does not turn when the SET/ACC button is pressed but the signals from the electronic module are correct disconnect the servo from the wiring harness and place the Red voltmeter lead on the Pink wire of the actuator connector (the end that goes to the actuator). Place the black voltmeter lead on the Blue/Red and with the meter set to resistance you should measure a resistance of 5.6MOhms. Repeat the test for the clutch placing the Red meter lead on the Black wire and the Black meter lead on the Green/Red wire. With the meter set to resistance you should measure a clutch resistance of approximately 40 Ohms. If either of the reading are incorrect, change the servo.

7 The cruise control does not function. The LED on the Electronic module does not light, the command module does not function and the servo does not pull the throttle.

- Using the information on page 2 and 3 of the thechnical specification section in this manual to check the pin out of the main cruise control electronic module connector. Make certain that each cable is in the correct terminal (location) of the main connector. If a wire is in the wrong terminal, change the wiring harness.
- Using a voltmeter and the information provided on pages 2 and 3 of the technical specification section in this manual to check each cable and ensure that the voltages and signal levels are within the ranges specified. If not, identify which item generates the signal i.e command module, electronic module or vehicle. If the source of the signal is either the command module or the electronic module, swap the unit. If the source of the signal is the vehicle, use a voltmeter to check the harness to ensure that the wire is not damaged and check all joints to ensure that they are good. If the wiring is damaged or the connection has failed, change the wiring harness or replace your connections.

8 The cruise control does not function smoothly and tends to surge or hunt for the correct SET speed

- The performance of the cruise control can often be improved by adjusting the gain settings (Switches 4 and 5). If the cruise control surges or hunts for the correct set speed, reduce the gain settings by switching DIP switches 4 and 5 to the '-' position. If the cruise controls performance is sluggish and it takes a long time to reach the set speed or to respond to changes in set speed, increase the gain settings by moving switches 4 and 5 to the '+' position. Use page 22 as guidanece for the DIP switch settings.
- The gain adjustment is provided to enable you to slightly adjust the performance of the cruise control electronic module to compensate for any non-perfection's in the throttle linkage. However, if the problems with the Throttle linkage are severe, then the gain adjustment will be insufficient to allow the performance of the cruise control to be improved sufficiently. Therefore, adjust your throttle linkage or throttle actuator cable routing to reduce friction using the information on pages 10-12 of this manual for guidance.

Common vacuum related problems

Vacuum related problems can occur on some vehicles and it is important that the cause of these problems is understood.

1 **No suitable Vacuum Source** A very small number of vehicles do not have a suitable vacuum source and therefore installing an AP150 is impossible. An example of such a vehicle is a Citroen Xantia TD. The suspension and vehicle braking systems are hydraulically controlled and there is therefore no available vacuum source on this vehicle. The solution for a cruise control installation on this type of vehicle is to install an AP250.

2 **Low Level of Vacuum** Some vehicles have a low level of vehicle vacuum and problems can result from lack of vacuum particularly when the cruise control is trying to run the vehicle at full throttle conditions. Loss of performance of the cruise control can result when operating the cruise control at high set speeds and near the limits of the vehicles performance. It is important that you consider the basic performance of the vehicle, the area in which the cruise control will be used and the conditions under which the driver wants to use the cruise control.

A good example where a problem may occur is when the vehicle approaches a hill at a high set speed or pulling a heavy trailer or caravan. The gradient of the road increases and the cruise control needs to fully open the vehicle throttle to maintain the set speed. The level of vacuum will fall due to the full throttle condition and because of the reduced level of vacuum, the cruise control is unable to maintain the full throttle condition and hence the set speed. There are a number of solutions to this particular type of problem :-

a The graph on page of this manual shows two lines. The top line shows the performance of the servo without servo cable. This is the best possible performance which can be expected from the vacuum servo. The lower line shows the performance of the servo when the actuator cable is looped in 180 degree bend of radius 150mm and under the installation guide lines we have provided in this manual, is the worst performance which can be expected from the cruise control. If the vehicle slowly loses speed as it travels up the hill, this indicates that the force required to keep the throttle fully open is slightly greater than the servo is able to provide based on the available level of vacuum. An improvement in performance may therefore result from a slight adjustment of the routing of the servo cable within the engine bay. Re-route the cable removing any bends to reduce the lose in performance of the servo due to friction between the cable and the outer sleeve and hence increase the amount of force the servo is able to exert on the throttle.

Throttle Linkage Trouble Shooting

1 If the cruise control surges and you are unable to improve the performance adequately enough by adjusting the Gain setting DIP Switch 4 and 5, check over the throttle linkage and ensure that you are not pulling too much throttle. The throttle linkage must be set so that the cruise control can pull between 90-95% of the throttle. If the cruise control servo travel is significantly longer than the full travel of the throttle, there are two problems which could result:

- You risk damaging the servo cable by causing the servo to pull the throttle hard again the throttle stop
- Small movements of the servo cable will cause a large percentage of the throttle to be opened making it impossible for the cruise control to correctly control the speed of the vehicle and hence cause surging.

2 Always check your throttle linkage very carefully. If the linkage jams the cruise control safety features will not disengage the cruise control. Check :

- If you use the bead chain, make certain that you carefully follow the instruction on page 18 of this manual
- Ensure that the servo cable can not jam on the original throttle linkage, the original throttle body or any other part of the engine.
- Always check that the cruise control throttle linkage does not interfere with the throttle travel and ensure that full throttle can still be obtained using the accelerator pedal.
- If you need to remove the air filter to gain access to the original throttle linkage, always check for clearance between the filter and the cruise control cable during installation.
- When using a wire loop or adding an additional bracket to a throttle cam, always use the clip provided in the kit or cable tie to ensure that the original throttle cable can not jump out of the original cam. Ensure that the clip or cable tie does not restrict the cam preventing full throttle movement.
- Always ensure that the servo cable retaining nuts are tight.
- Always check that the addition of the cruise control does not effect the idle speed of the vehicle. This can be effected by tightening your cruise control assembly, so check immediately before FINAL ROAD TEST.
- If you are connecting via a wire loop, ensure that the servo cable and original throttle cable can not twist in the cam.
- If installing directly to the throttle pedal, make certain that the cable does not interfere with the steering column or the accelerator, brake or clutch pedal operations.

NOISE INSPECTION GUIDELINE

What is “noise”?

Noise is a broad term used to describe electromagnetic radiation of energy. Noise is generated during rapid changes of voltage or current levels (eg ignition systems, alternator and heavy current carrying wires). If noise gets coupled into the cruise control wiring harness, it can create disturbances within the electronics module. The cruise control may drop out by itself after engagement or no engagement at all even after passing all diagnostics test. These are the typical symptoms of electrical noise.

It should be noted that this cruise control complies with the latest European EMC directive (EC 95/94) and carries an e-mark.

- Be sure the noise suppressor is installed in yellow TACH wire (if connected to coil).
- Look at each ignition wire for cracks in the insulation. Replace as required.
- Be sure the electronics module and the cruise control wiring harness is kept at least 300 mm away from the distributor, coil and spark plug wires. This is particularly important for the Blue speed signal wire if it is used in conjunction with magnets, speed pulse generator or a speed signal source connection in the engine bay. The cable is screened and you should ensure that when the connection is made, you preserve as much of this screen as possible.
- Be sure that the SPEED SENSOR COIL or SPEED PULSE GENERATOR is kept at least 300 mm away from all vehicle wiring (especially on front wheel drives).
- If you think that noise is effecting your cruise control speed signal, then the ways to identify it are as follows:-
  - The LED on the electronic module should flash at regular intervals and at an even rate for a good constant speed signal. If the LED flashes at irregular intervals then the irregular flashes could be caused by noise. The best way is to identify the noise source and adjust the routing of the speed wire away from this source.
  - To identify noise use an oscilloscope. Test drive the vehicle with the oscilloscope connected to the speed source. The noise pulses should be clearly visible on the oscilloscope screen. You should find a range of evenly spaced speed signal pulses with randomly spaced noise spikes between. Using the oscilloscope for guidance, it is sometimes possible to identify the source of the noise and the speed signal wire should be re-routed away from it.
  - Because Digital Voltmeter tend to take the average reading, the noise signal and the real speed signal will be mixed and averaged by the meter. Therefore, a voltmeter set to frequency is not a good method of identifying the presence of noise.

AA170 CLUTCH SWITCH INSTALLATION

When installing a cruise control to a vehicle with manual transmission, it will be necessary to install a clutch switch for engine over-rev protection in the following circumstances :-

1 When a vehicle road speed signal is used i.e. speed signal is generated by magnets, SPG or road speed signal to engine ECU.
2 When there is no possibility to install the Yellow wire to the negative side of the ignition coil for electronic over-rev protection.

Without the clutch switch, the cruise will remain engaged even when the clutch is pressed. The cruise will therefore maintain full throttle and there is a possibility that the engine could be damaged. The clutch switch disengages the cruise control as soon as the clutch is pressed to ensure that the engine is protected.

Install the clutch switch as follows :-

1 Attach the magnet to the clutch pedal. Use the screws or double sided tape and cable ties to ensure that the magnet is firmly attached to the pedal.
2 Mount the switch so that it is within 10mm of the magnet when the clutch pedal is released.
3 Cut either the Brown wire or the Brown/White wire from the cruise control electronics module.
4 Connect each end of the cut wire to one of the brown wires from the reed switch.
5 Test the cruise control carefully and ensure that the test light on the electronics module lights as soon as the clutch is pressed. Check over the vehicle brake lights and confirm that the cruise still disengages as soon as the brake pedal is pressed.

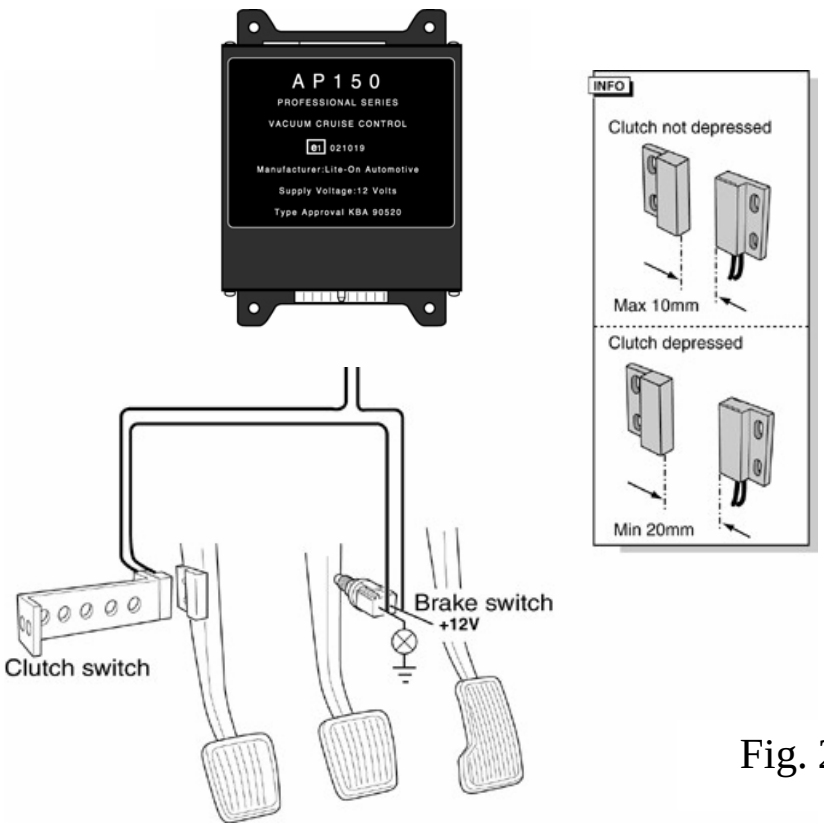


Fig. 2.22

LITEON AUTOMOTIVE ELECTRONICS

CRUISE STALK INTERFACE INSTALLATION INSTRUCTIONS

CSI-2 should be used to interface Original Equipment (OE) cruise control stalks on Lite-On AP150 and AP250 series cruise control.

MOUNTING THE UNIT

The cruise stalk interface should be mounted close to the original equipment cruise control stalk under the dashboard. Use the double sided tape or screws provided.

CONNECTING THE INTERFACE TO THE ORIGINAL EQUIPMENT CRUISE CONTROL STALK

Route the red, blue, black and white wires to the original equipment cruise control stalk and solder the connections according to the following table:

Interface wires CSI-2	**Original Equipment Cruise Stalk wires**				
	Vauxhall/Opel	Volkswagen	Audi	Mercedes	BMW
Red	Green	Red	Red (No 3)	Green	Blue
Blue	Blue	Blue	Blue (No 2)	Yellow and blue	Green
Black	Red	Black	Black (No 4)	Red	Green/white
White	Grey	White	White (No 1)	Grey	Yellow
Notes		Link the yellow and the green wires on the cruise stalk together	Link the yellow and the brown/white wires (No 5 and No 6) together	Link the yellow and the blue wires and then connect to the blue wire of the cruise stalk interface	Check carefully - possible power red wire to the green/ white wire

CONNECTING CRUISE STALK INTERFACE TO CRUISE ELECTRONICS MODULE

Route the harness with the four pin (CSI-2) male plug from the electronics module to the cruise stalk interface. Connect the female plug on the cruise stalk interface to this male plug from the cruise control electronics module.

NOTE: CSI-2 allows OE cruise control stalks to be used with Lite-On cruise controls. In some cases the operation of the OE cruise control may be slightly different from the Lite-On cruise control. This means that some buttons on the OE stalk may not perform the function as indicated whereas other buttons may perform two functions that would normally operate from separate buttons. However, the SET, RESUME and OFF functions will always be correct.

Other Original Cruise Stalk Connections

If you have an original cruise stalk which is not in the table, the correct connections can be identified using a voltmeter in the following way:-

CSI -2 White Wire - This wire is a 12 volt output (ignition switched) and should be connected to the common of the command module switches. Using a voltmeter, identify the common of the command module switches and connect it to the CSI-2 White wire.

CSI-2 Red Wire - The Red wire is the CSI-2 SET/ACC input. The command module should have a normally open switch for the SET function. Using a voltmeter set to continuity (Beep), identify the cable from the command module which causes the meter to beep when the command module SET button is pressed. Connect the CSI-2 Red wire to this cable.

CSI-2 BLUE Wire - The Blue wire is the CSI-2 RES/DEC input. The command module should have a normally open switch for the RES function. Using a voltmeter set to continuity (Beep) identify the cable from the command module which causes the meter to beep when the command module RES button is pressed. Connect the CSI-2 Blue wire to this cable.

CSI-2 Black Wire - The Black wire is the CSI-2 COAST or ON/OFF input. The command module should have a normally closed ON/OFF or COAST button. Using a voltmeter set the continuity (Beep) identify the cable from the command module which causes the meter to beep when the command module ON/OFF or COAST button is **not** pressed (lose continuity when pressed). Connect the CSI-2 Black wire to this cable. If the command module does not have an ON/OFF or COAST switch, connect the CSI-2 Black wire to the CSI-2 White wire.

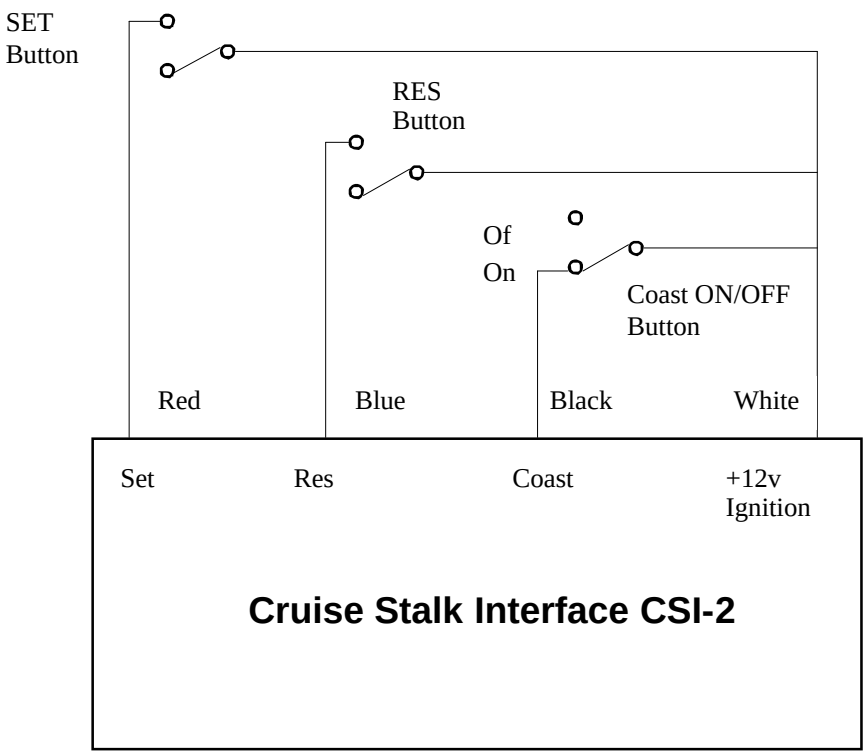


Fig. 2.23

LITEON AUTOMOTIVE ELECTRONICS

SPEED PULSE GENERATOR (SPG)

The Speed Pulse Generator (SPG) can be used for generating a speed signal on cars with a screw-on type speedometer cable. Because the SPG is generating a speed signal, cars with manual transmission should always be fitted with an additional clutch protection to prevent over reving the engine when the clutch is pressed with an engaged cruise control. The required protection should be made by using the clutch switch kit (AA170) or using the yellow wire as a over rev protection by connecting to the negative side of the ignition coil.

LITE-ON PART AA147 (5000 PPM) / PART AA144 (8000 PPM)

ITEM	PART NO	DESCRIPTION
1	AS47948	SPEED PULSE GENERATOR (AA144 ONLY)
2	AS6445A	SPEED PULSE GENERATOR (AA147 ONLY)
3	PP58220	7/8" CONNECTOR
4	MP52940	SHAFT - 2.6 mm SQUARE DRIVER
5	MP52950	SHAFT - 3.0 mm SQUARE DRIVER
6	MT95080	SHAFT - 5.00 mm ROUND DRIVER
7	MT95120	7/8" METAL ADAPTER L:15 mm
8	MT95140	7/8" METAL ADAPTER L:20 mm
9	MT95150	3/4" X 26 METAL ADAPTER
10	MT89130	3/4" X 26 METAL ADAPTER
11	MT95160	18 mm X 1.5 METAL ADAPTER
12	MT89140	18 mm X 1.5 METAL ADAPTER
13	PR98390	RUBBER WASHER

PURPOSE: These instructions will be used to install the speed pulse generator kit for your LITEON cruise control

NOTE: This kit is only for screw-on type speedometer cables.

INSTALLATION PROCEDURE

CAUTION: **If you jack up your vehicle to install the SPG, block wheels and use jack stands to support vehicle for safety.**

STEP 1: Check the transmission and speedometer for the best installing location of the SPG

STEP 2: Remove the speedometer cable on either the speedometer or transmission. Determine the size of adapter and shaft needed.

STEP 3: Insert the shaft you require (items 4, 5 or 6) into the speed pulse generator. Screw octagonal connector (item 3) counter clockwise onto speed pulse gen erator main body. Insert the rubber washer into the octagonal connector. Be sure to grease both ends of the shaft before inserting.

CAUTION: **Make sure that the shaft adapter (items 4, 5 or 6) seats in the hole of the transmission/speedometer and the shaft of the flexible cable seats nicely in the hole on the opposite end of the shaft.**

STEP 4: Check screw nut size of speedometer cable. If it does not match thread size on speed pulse generator, select correct adapter: items 9 threaded over 10, 11 over 12, 7 over 8 and screw onto speed pulse generator main body clock wise.

STEP 5: If octagonal connector (3) does not match thread size, select correct adapter: items 9 threaded over 10, 11 over 12, 9 over 10 and screw onto transmission or speedometer side. Screw speed pulse generator clockwise onto adapter.

STEP 6: Screw speedometer cable onto speed pulse generator clockwise.

STEP 7: After finishing above steps, check that all connections are secure and the flexi ble cable is clear of hot or moving parts and has no sharp bends.

STEP 8: Drive car to check for proper speedometer operation. If not, recheck **ALL** above steps.

IMPORTANT
Sharp bends in the cable and/or mounting at the speedometer end of the cable may cause excessive speedometer needle ‘jitter‘ due to cable whip/load build up.

Speedometer cable installation instruction:

1. Make sure speedometer cable is greased and rotates smoothly.
2. Cable should be installed as straight as possible. Cable should not be bent more than 45 degrees in less than 100 mm of cable length.
3. Cable must be kept straight for at least 100 mm from speed pulse generator.

CAUTION:
Do not make loop or sharp bends which will cause speedometer needle to ‘jitter’..