

Service Manual

Fault tracing

Section 2	Group 27
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Cruise Control 200 1980-

TP 30866/2 - Reprinted w/o changes

May 1990

VOLVO

VOLVO CARS NORTH AMERICA

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A bar in the margin indicates changes/additions in text and/or specifications in this manual.

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Order number: TP30866/2
Supersedes TP30866/1

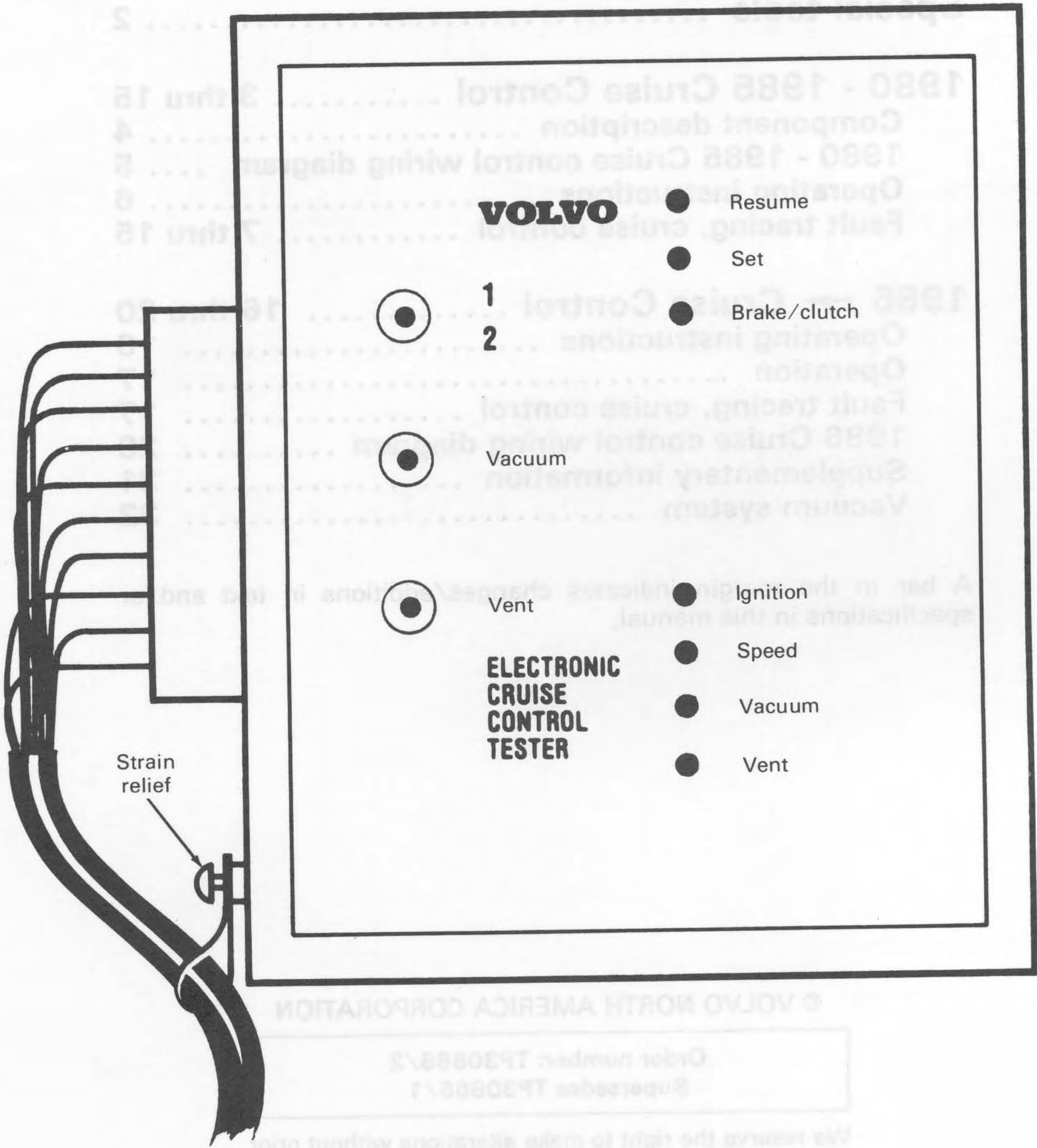
We reserve the right to make alterations without prior notification.

Reprint of 1986 literature with minor changes.

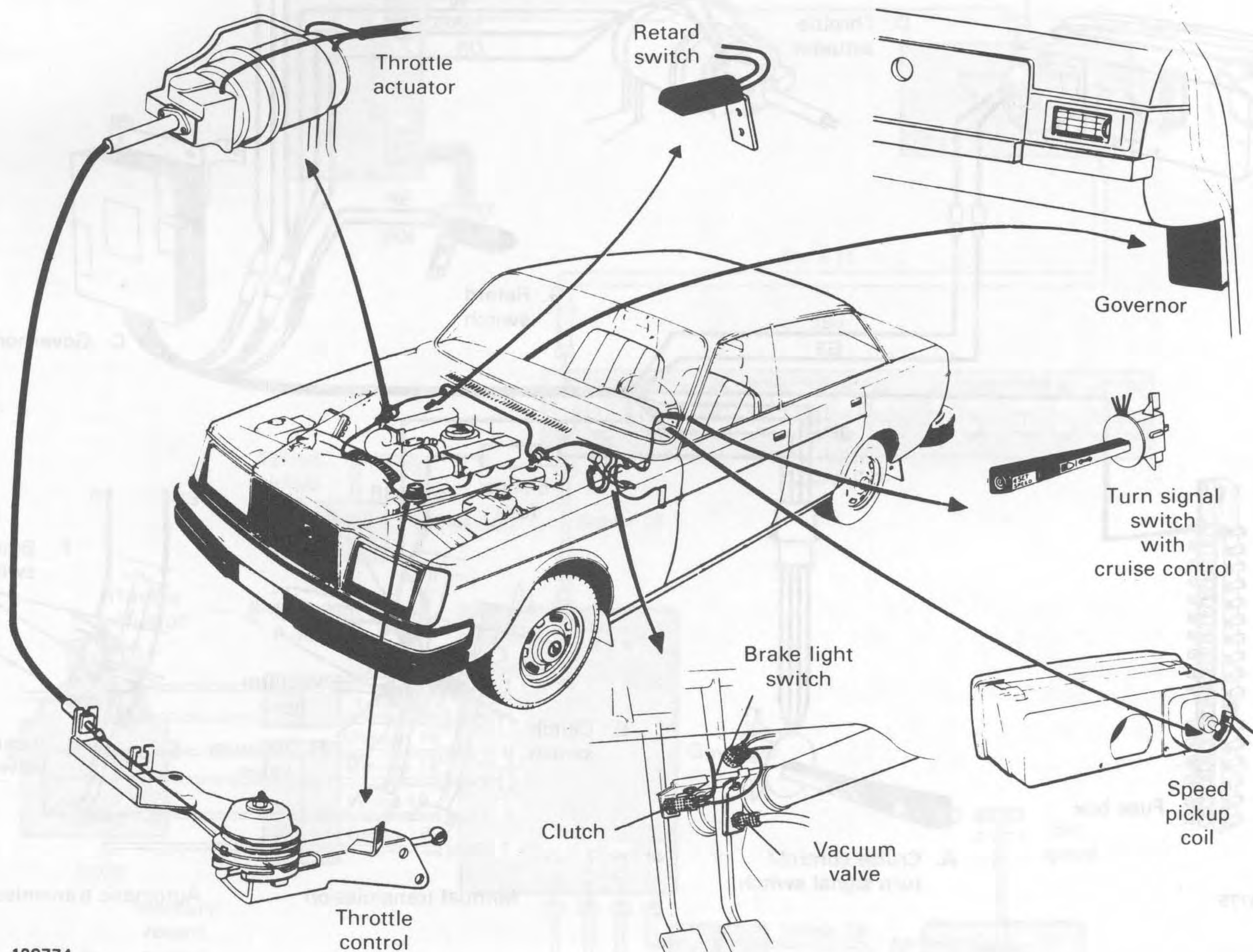
Special tools

1986 on Electronic Cruise Control System Only

999-	Description - use
0943-4	Electronic Cruise Control Tester - P-20 1986 on



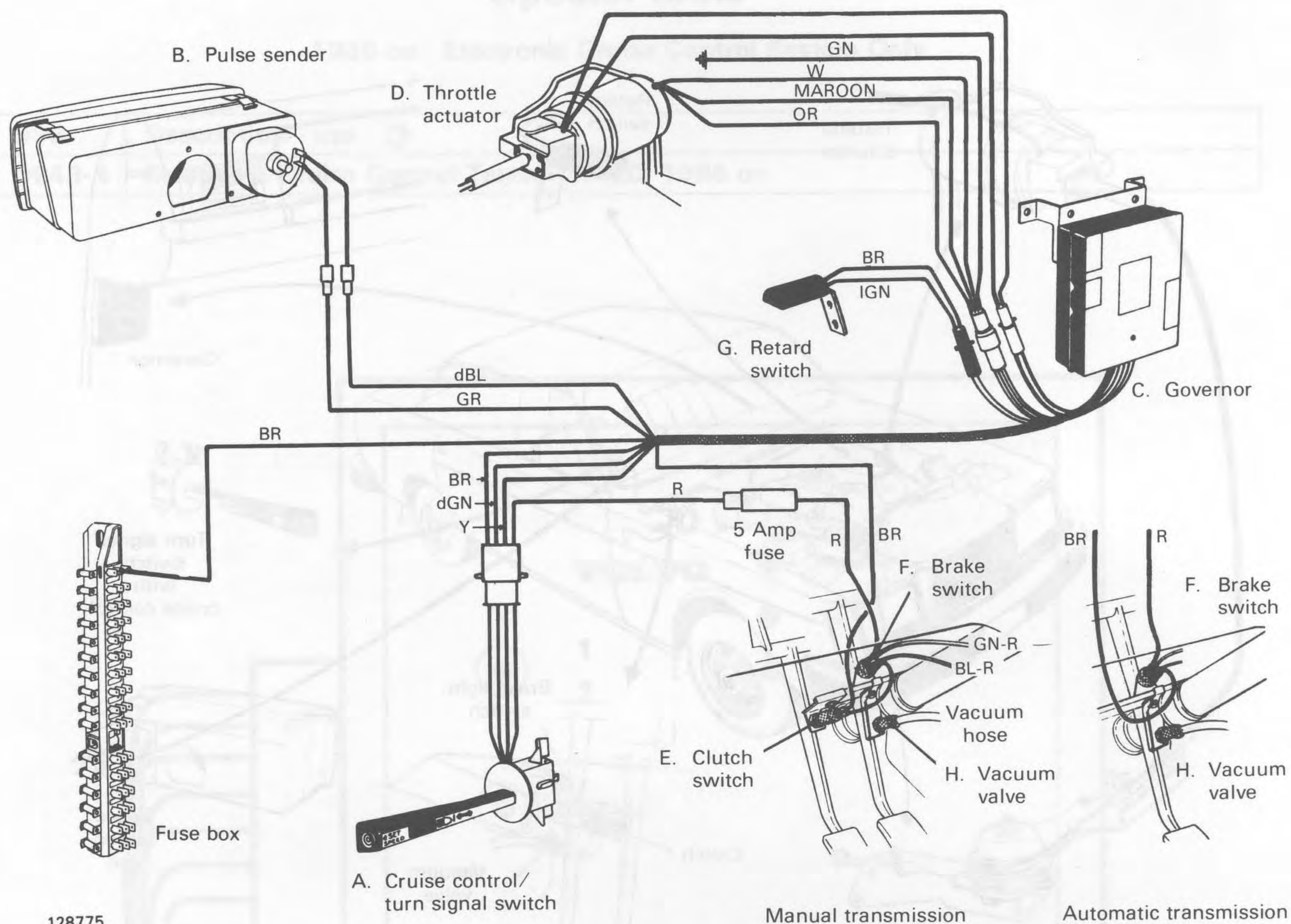
1980 - 1985 Cruise control



An electronic sender (speed pickup coil) attached to the speedometer provides speed reading. Previously, the speed indicator was a centrifugal type driven by the speedometer cable.

The control system on the turn signal lever is the same. Refer to the following pages for description, operating instructions, wiring diagram, as well as fault tracing and adjusting instructions.

Component description



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A. Cruise control switch/turn signal lever
Positions: ON, OFF, RESUME, SET SPEED.

B. Speed pickup coil in speedometer
Senses the speedometer revolutions and sends a signal to the system control unit and governor.

C. Governor
Receives the signals from the speed pickup coil in the speedometer and monitors any change in speed. The governor controls the throttle actuator motor to maintain the set speed.

D. Throttle actuator
Changes throttle position to maintain a constant speed. Throttle actuator is controlled by the governor.

E and F. Clutch switch and brake switch

Interrupts system operation when clutch pedal or brake pedal are operated. Set speed can be resumed by operating RESUME switch on the turn signal lever.

There are two additional safety items: a retard switch and a vacuum valve. These will cut out the cruise control system if the brake switch does not function.

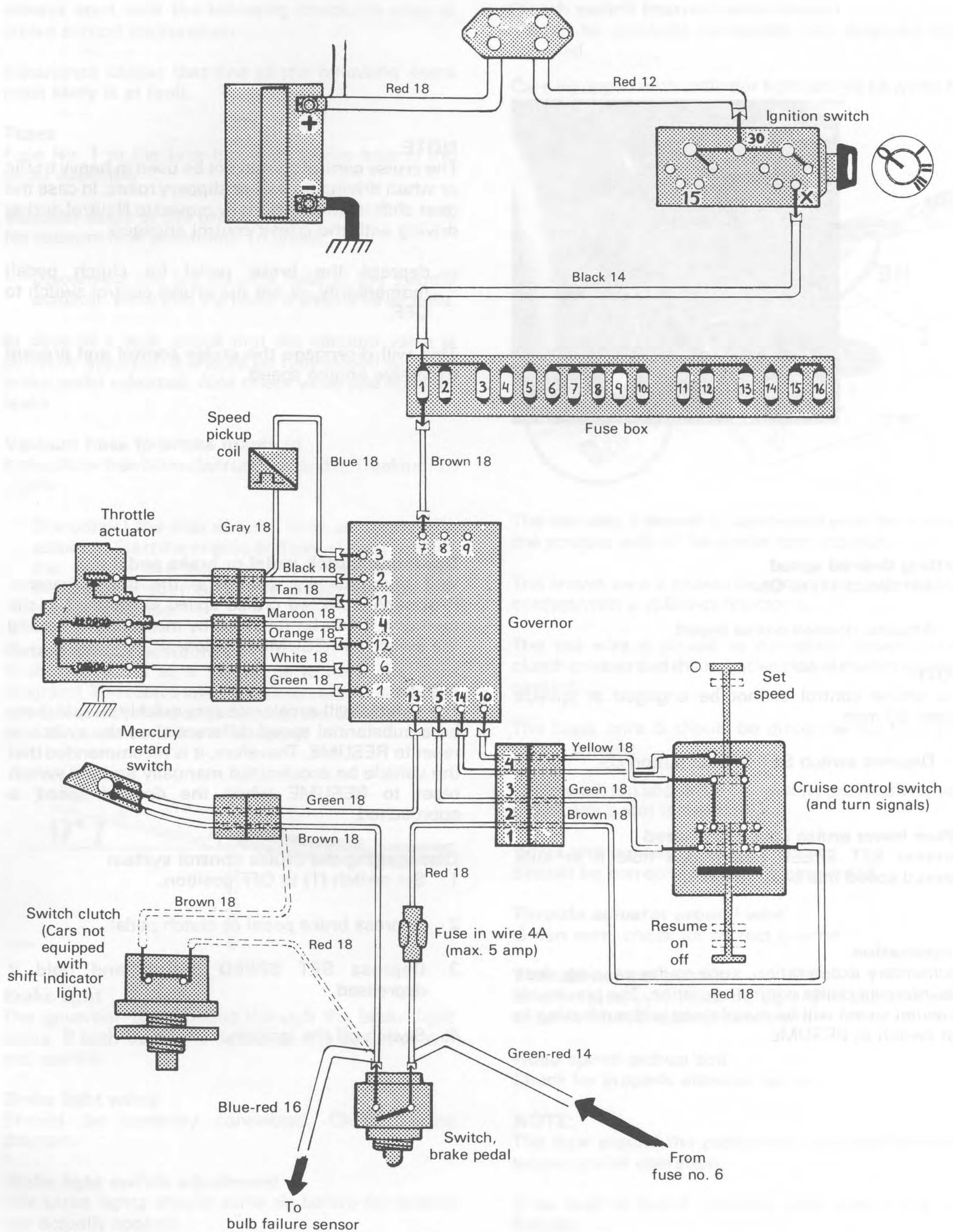
G. Retard switch

Cuts out the cruise control system when the brakes are applied beyond a certain pressure.

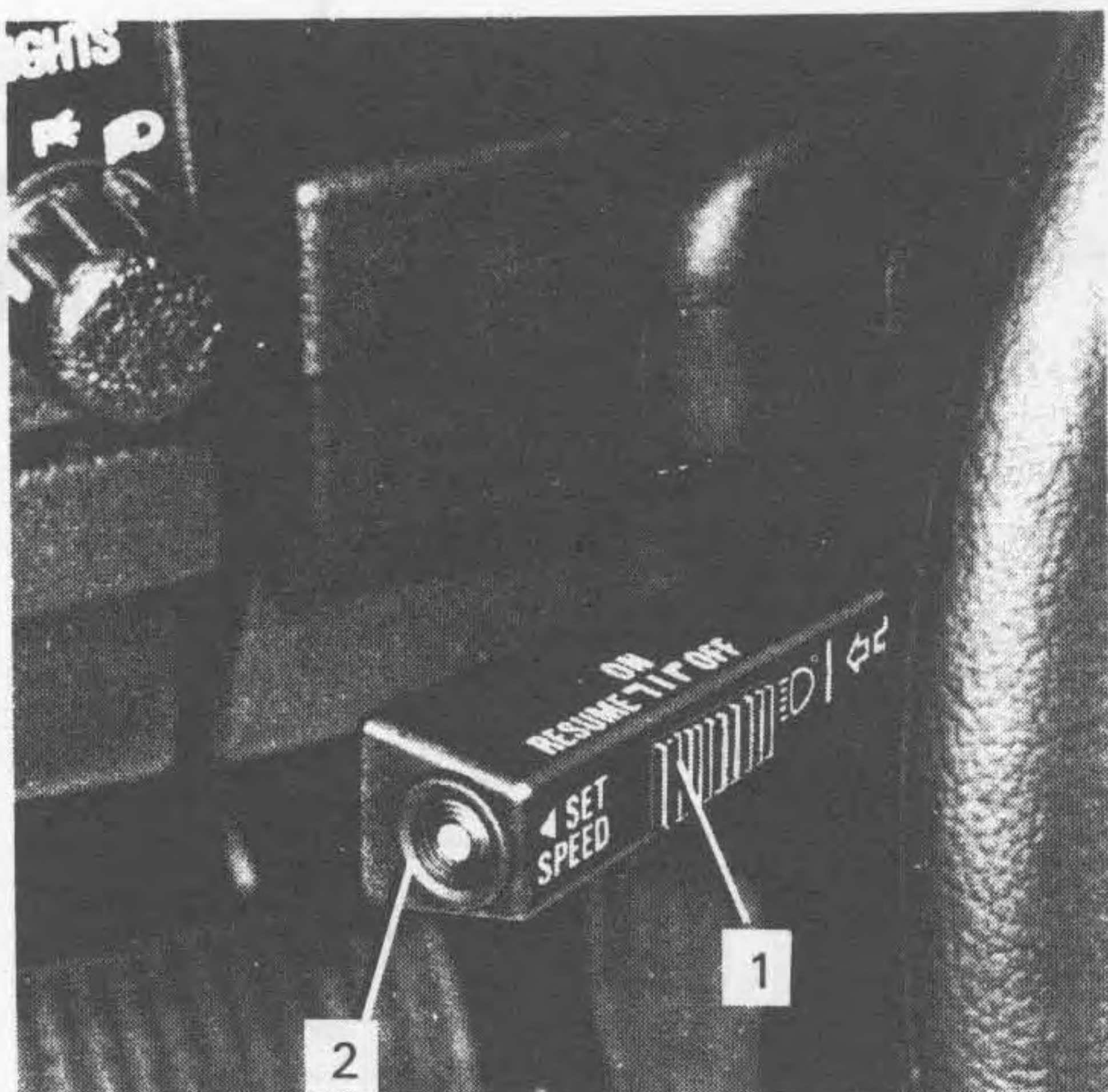
H. Vacuum valve

Will open when the brake pedal is depressed. The vacuum of the throttle actuator is opened to atmospheric pressure causing the throttle actuator to become inoperative, applying no force on the throttle cable.

1980 - 1985 Cruise control wiring diagram



Operating instructions



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NOTE:

The cruise control should not be used in heavy traffic or when driving on wet or slippery roads. In case the gear shift is unintentionally moved to Neutral during driving with the cruise control engaged:

- depress the brake pedal (or clutch pedal) momentarily, or set the cruise control switch to OFF.

This will disengage the cruise control and prevent excessive engine speed.

Setting desired speed

1. Set switch (1) to ON.
2. Assume desired cruise speed.

NOTE:

The cruise control cannot be engaged at speeds below 30 mph.

3. Depress switch SET SPEED button (2).

When lower cruise speed is desired

Depress SET SPEED button and hold it in until desired speed has been reached.

Acceleration

Momentary acceleration, such as for passing, does not interrupt cruise control operation. The previously selected speed will be maintained without having to set switch to RESUME.

Operating clutch pedal or brake pedal

Will automatically disengage the cruise control. Previously selected cruise speed is retained in the memory. It can be resumed by momentarily setting the switch to RESUME position.

NOTE:

The vehicle will accelerate very quickly should there be a substantial speed differential as the switch is reset to RESUME. Therefore, it is recommended that the vehicle be accelerated manually and the switch reset to RESUME when the desired speed is approached.

Disengaging the cruise control system

1. Set switch (1) to OFF position.
2. Depress brake pedal or clutch pedal.
3. Depress SET SPEED button and hold it depressed.
4. Switch off the ignition.

Fault tracing, cruise control

Always start with the following checks in case of cruise control malfunction.

Experience shows that one of the following items most likely is at fault.

Fuses

Fuse No. 1 in the fuse box and in-wire fuse at the pedal assembly.

Vacuum valve at the brake pedal

No vacuum leak permitted. To check:

- Disconnect the big vacuum hose at the throttle actuator. Blow into the hose. It should be air tight.

In case of a leak, check that the vacuum valve is correctly adjusted. It should be fully closed with the brake pedal released. Also check valve and hose for leaks.

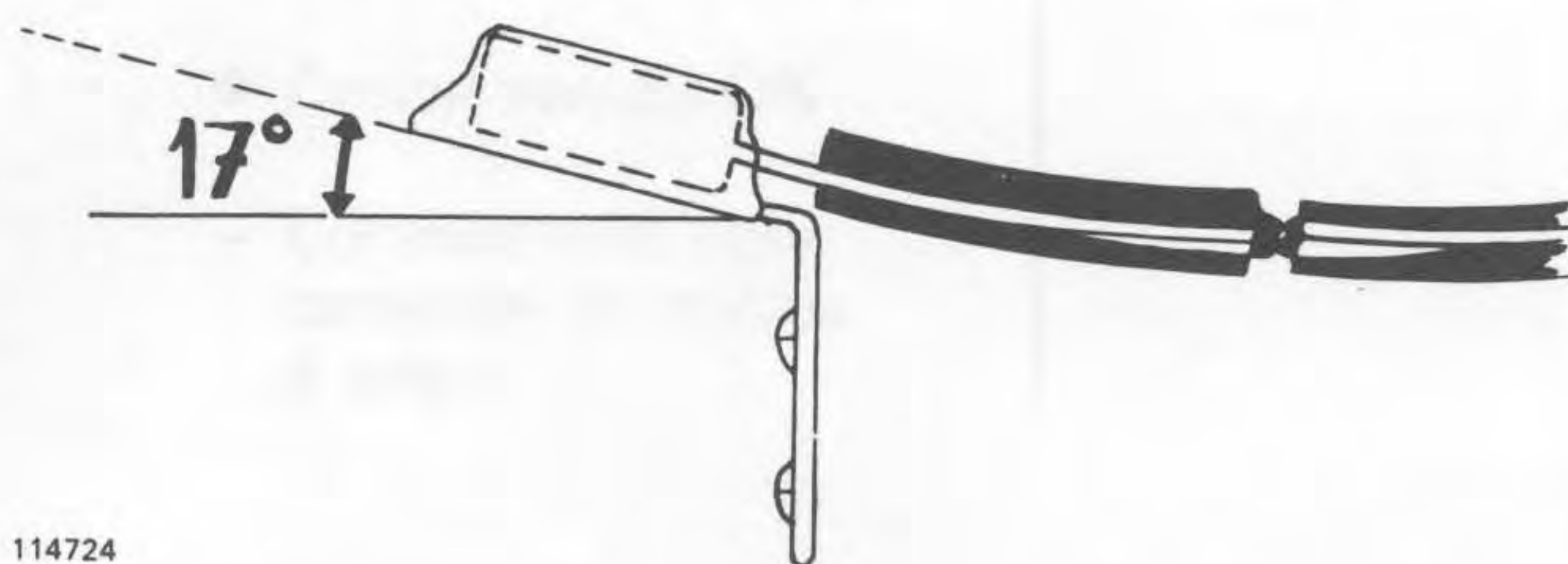
Vacuum hose to intake manifold

It should be free from obstructions and not leaking. To check:

- Disconnect the thin vacuum hose at the throttle actuator. Start the engine and use a finger to block the end of the hose and feel vacuum force. Release to check that the idle speed increases and becomes erratic.

Retard switch position

It should be set at a 17° angle to horizontal (see diagram). The retard switch is a mercury switch and it is important that the angle is accurate. Otherwise the flow of current will be interrupted.



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Brake light

The governor is grounded through the brake light bulbs. If both bulbs are defective, the governor will not operate.

Brake light wires

Should be correctly connected. Check wiring diagram.

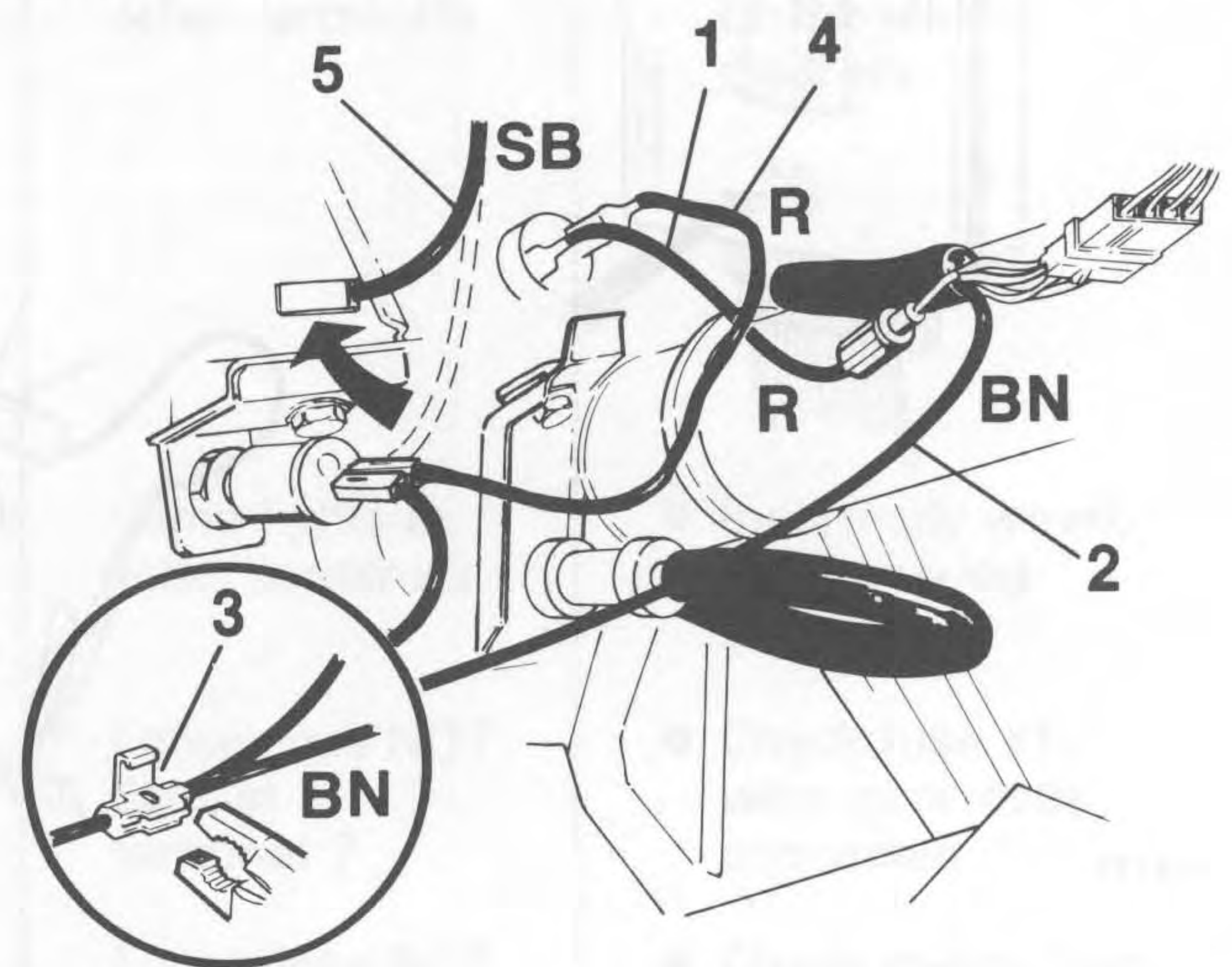
Brake light switch adjustment

The brake lights should come on before the brakes are actually applied.

Clutch switch (manual transmission)

Should be correctly connected (see diagram) and adjusted.

Cars equipped with indicator light should be wired as follows:



The red wire 1 should be connected with the fuse to the positive side of the brake lamp contact.

The brown wire 2 should be connected to the clutch contact with a splice-connector 3.

The red wire 4 should be connected between the clutch contact and the negative side of the brake lamp contact.

The black wire 5 should be disconnected from the clutch contact.

The switch pin should be completely pressed in when the clutch pedal is disengaged.

Wires and connectors

Should be correctly and firmly connected.

Throttle actuator ground wire

Green wire, check for correct ground.

Throttle control bobbin

Mounting screws must be tight and secured with suitable thread-locking compound.

Road speed pickup coil

Check for properly attached wires.

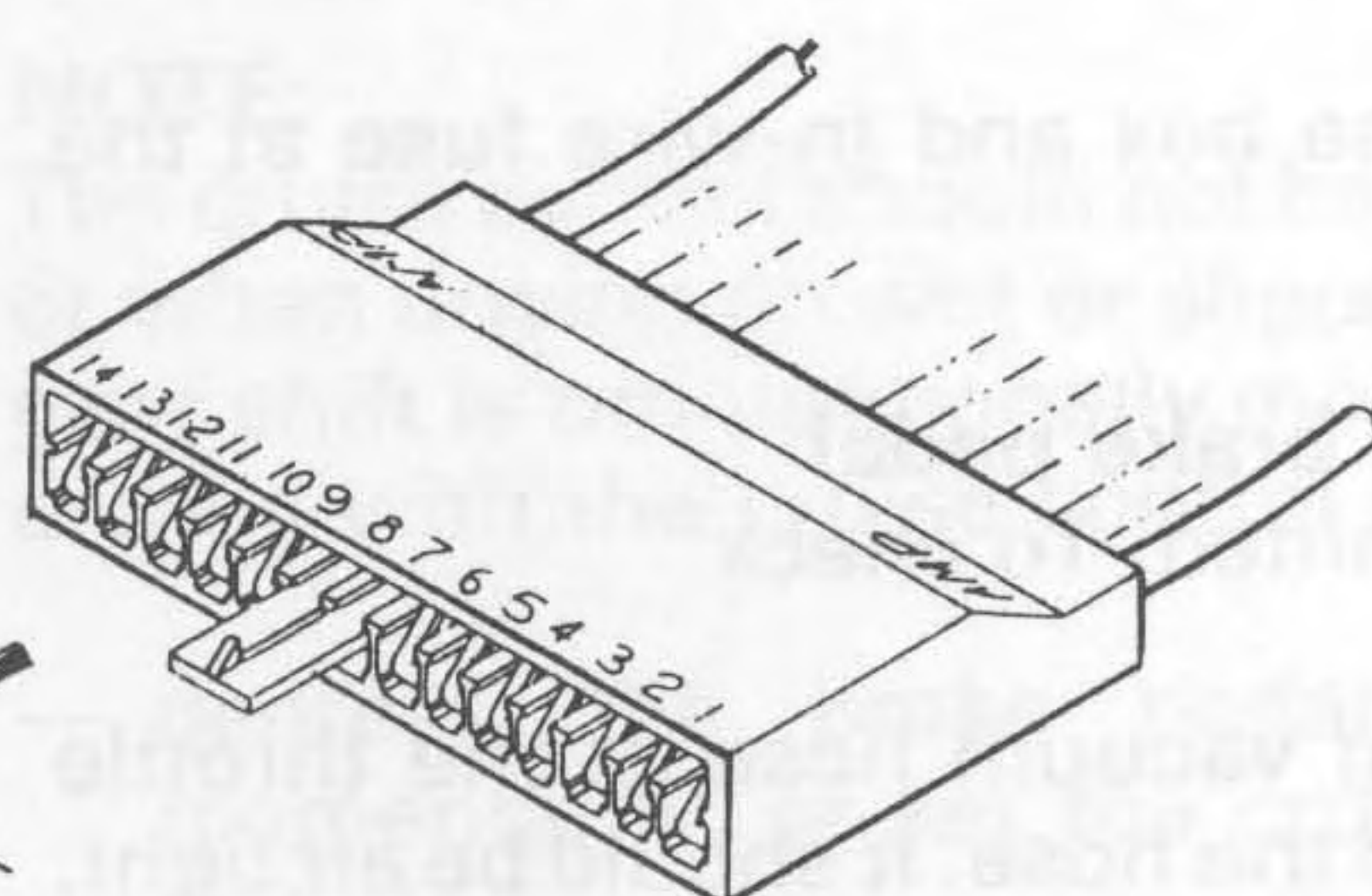
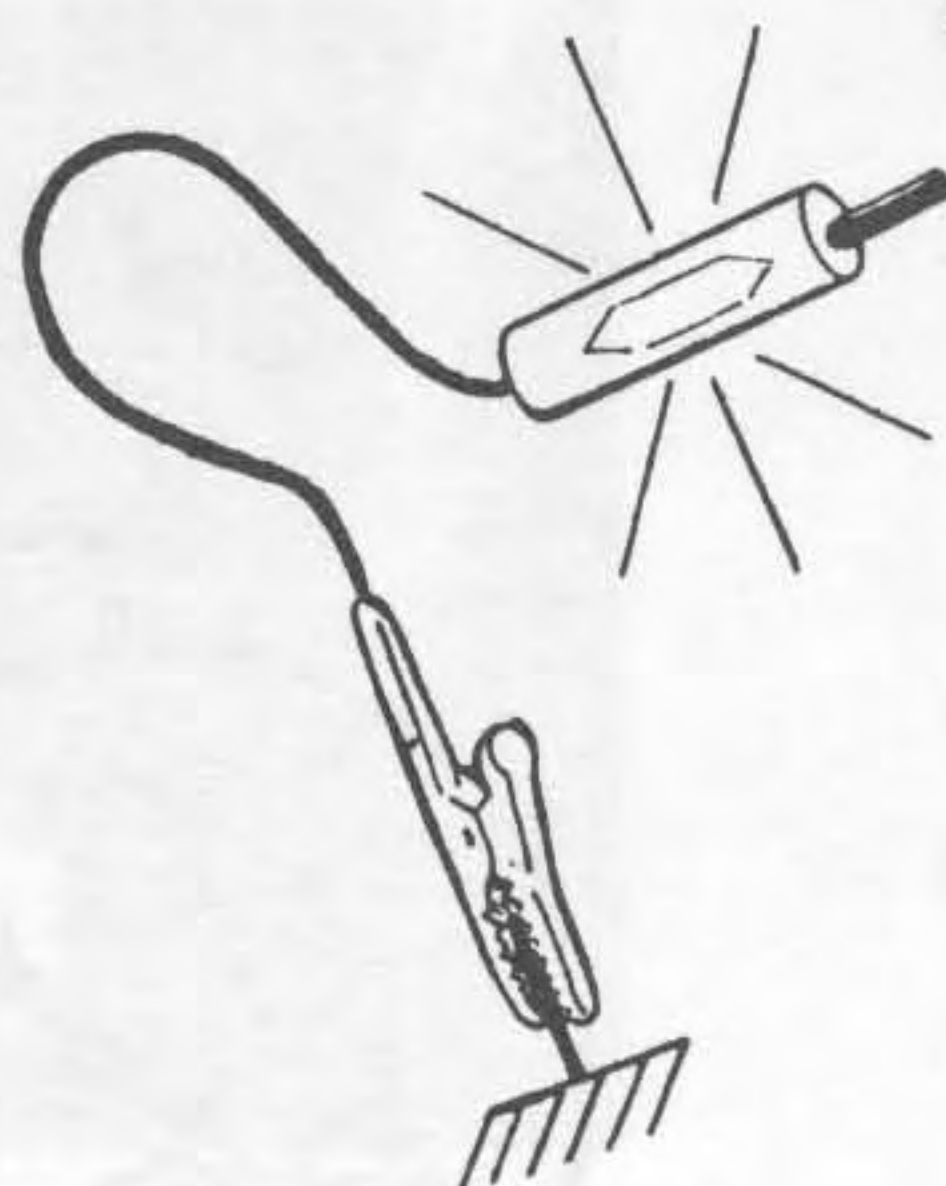
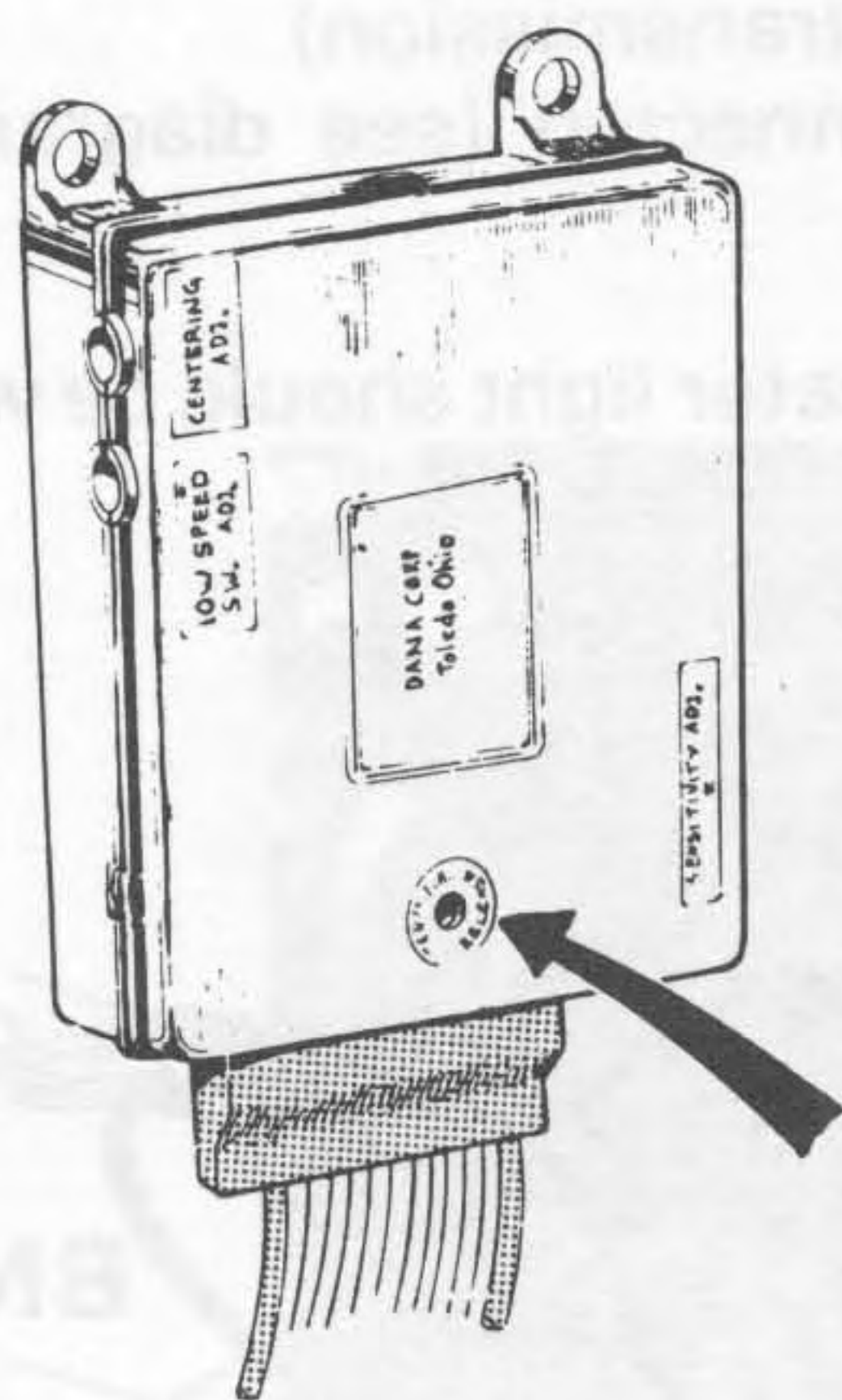
NOTE:

The tape around the pickup coil may interfere with proper cruise operation.

If no fault is found, continue with checks A-E, as follows.

Use a small drill bit or equivalent to depress TERMINAL RELEASE. Pull out the connector.

Use a test light for these checks.



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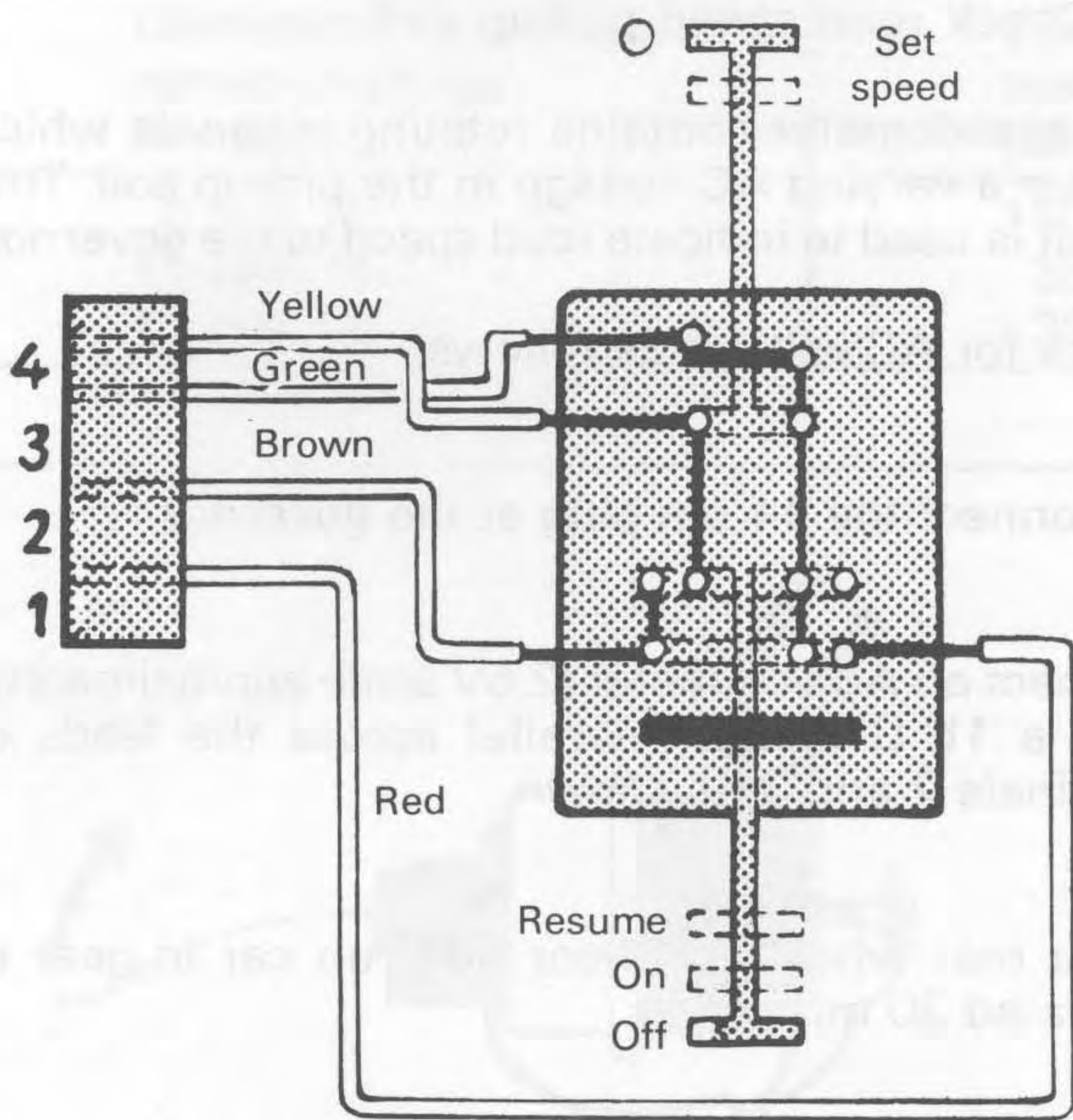
Check
"A"

TEST CONDITIONS/ PROCEDURES	RESULT	FAULT SYMPTOMS	CAUSE/REMEDY
<ul style="list-style-type: none"> ● Ignition OFF ● Cruise switch ON - Connect test light between ground and terminals 1 thru 14 	Lamp should light at 5 and 14 ONLY	Lamp lights at other terminals	<ul style="list-style-type: none"> ● Incorrectly wired; Check wiring diagram
<ul style="list-style-type: none"> ● Ignition ON ● Cruise switch ON - Connect test light between ground and terminals 1 thru 14 	Lamp should light at 5, 7 and 14 ONLY	<p>Lamp lights at other terminals</p> <p>Lamp does NOT light at terminal 7</p> <p>Lamp does NOT light at terminal 5</p>	<ul style="list-style-type: none"> ● Incorrectly wired; Check wiring diagram ● Check fuse #1; wire incorrectly connected ● Check in-line fuse ● Wire to brake switch incorrectly connected. ● Check cruise switch ● Check cruise switch
<ul style="list-style-type: none"> ● Ignition ON ● Cruise switch ON - Connect test light between terminals 5 and 1 	Lamp should light	<p>Lamp lights at 5 but NOT at terminal 14</p> <p>Lamp does NOT light</p>	<ul style="list-style-type: none"> ● Check ground (green wire at throttle actuator)

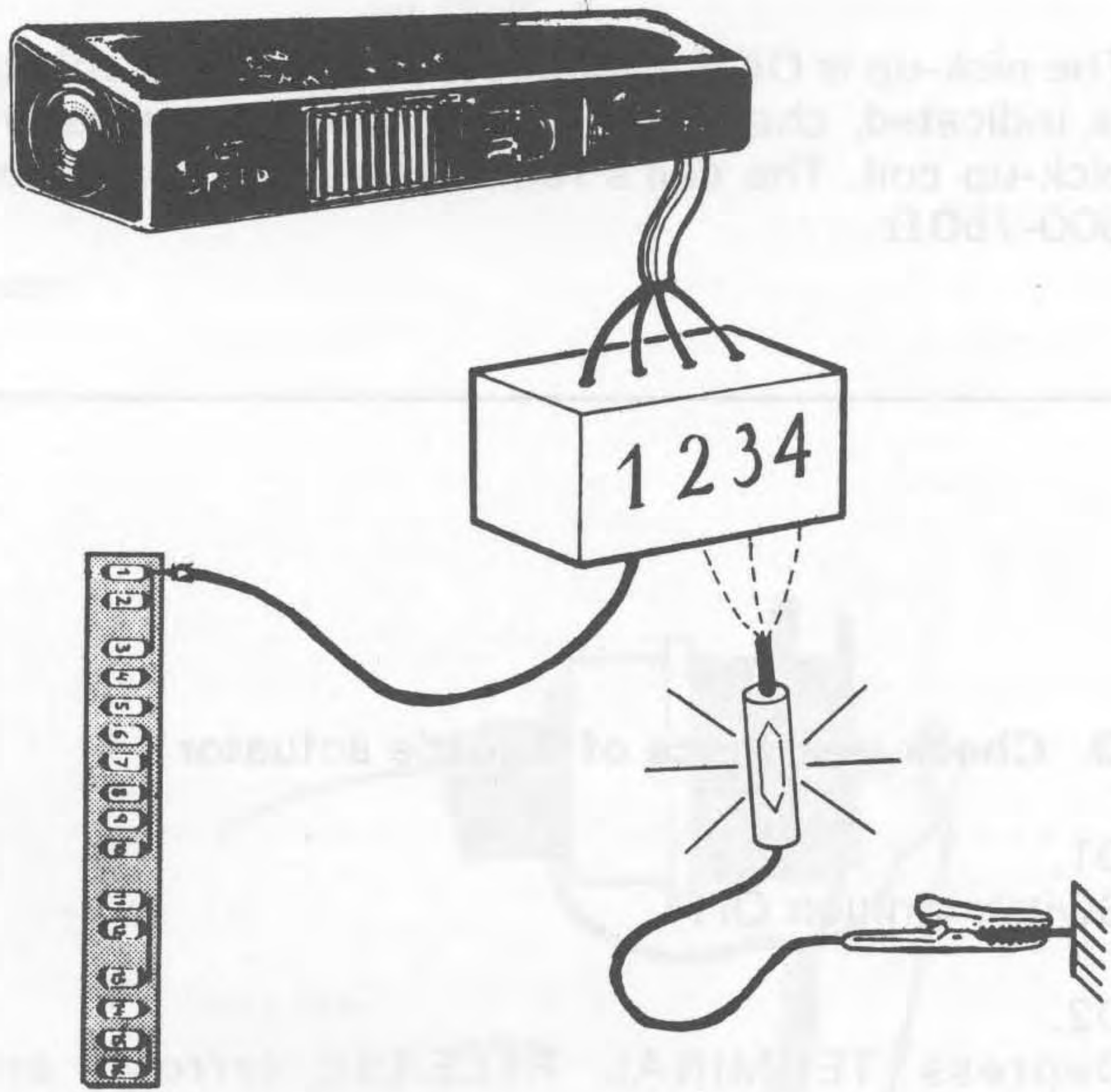
Cruise control

Check
"A" (cont'd)

TEST CONDITIONS/ PROCEDURES	RESULT	FAULT SYMPTOMS	CAUSE/REMEDY
<ul style="list-style-type: none"> ● Ignition ON ● Cruise switch ON – Connect test light across terminals 5 and 13 	Lamp should light when brake pedal is UP	Lamp does not illuminate	<ul style="list-style-type: none"> ● Check: retard switch position, clutch switch adjustment, brake light operation. Components could also be defective
	Lamp should GO OUT when brake pedal or clutch pedal is DEPRESSED	Lamp does NOT go out when depressing the pedal(s)	<ul style="list-style-type: none"> ● Check adjustment of switches ● Check for shorted wiring
<ul style="list-style-type: none"> ● Ignition ON ● Cruise switch ON ● Depress and hold SET SPEED – Connect test light across ground and terminal 14 	Lamp should NOT light	Lamp illuminates	<ul style="list-style-type: none"> ● Check cruise switch; proceed to check "B"
<ul style="list-style-type: none"> ● Ignition ON ● Hold cruise switch in RESUME – Connect test light across ground and terminals 5, 10 and 14 respectively 	Test light should light at all three terminals	Lamp does NOT light at all terminals	<ul style="list-style-type: none"> ● Check cruise switch; proceed to check "B"



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Wire color	Cruise control switch position			
	OFF	ON	ON and SET SPEED depressed	RESUME
Test light indication				
Brown	off	on	on	on
Green	off	on	off	on
Yellow	off	off	on	on

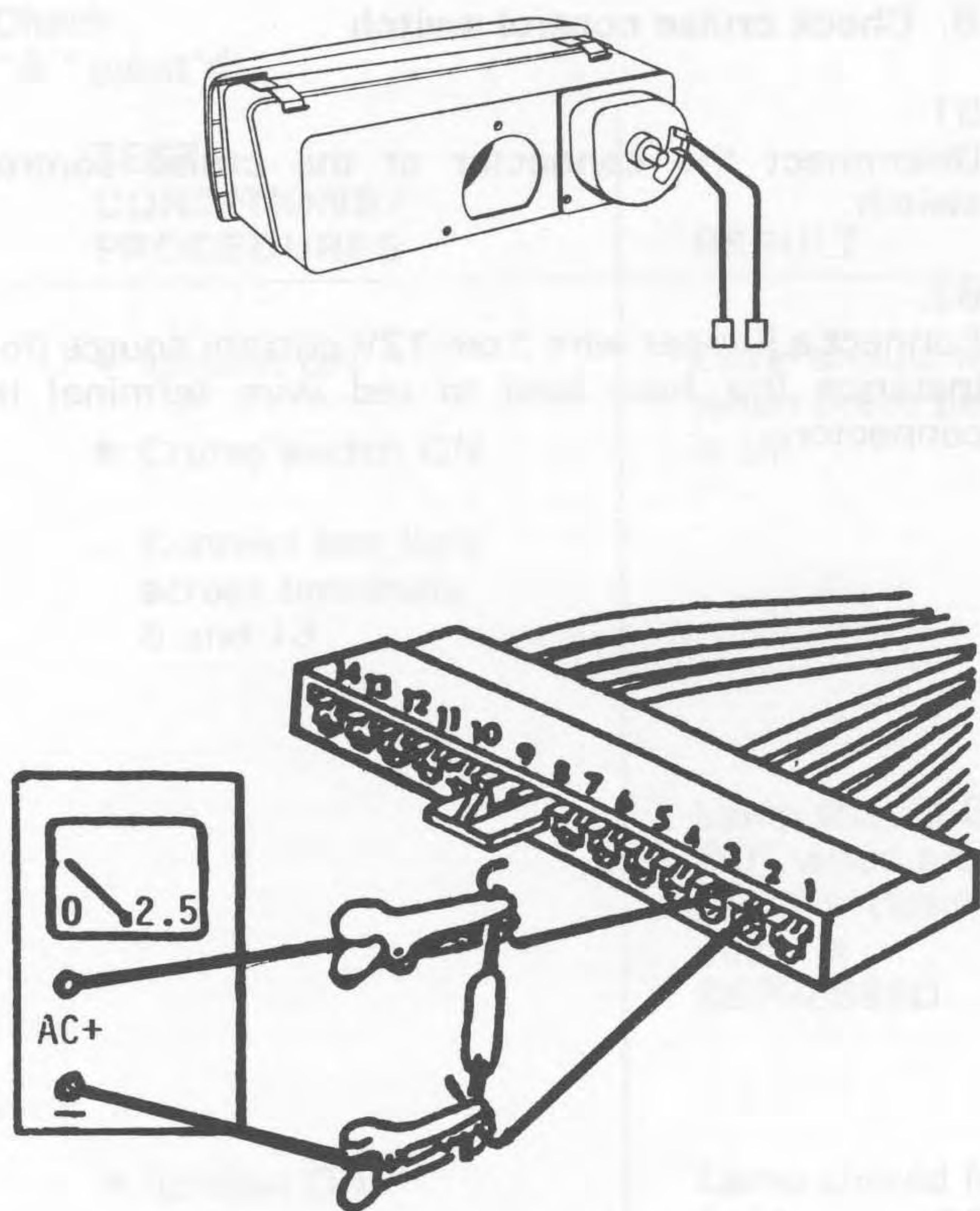
B. Check cruise control switch

B1. Disconnect the connector at the cruise control switch.

B2. Connect a jumper wire from 12V current source (for instance the fuse box) to red wire terminal in connector.

B3. Connect a test light across ground and the three wires, in order.

B4. Correct test light indication is shown in table at left. Replace the cruise control switch in case of incorrect indication.



Load meter with
1000 ohm resistor

C. Check road speed pickup coil

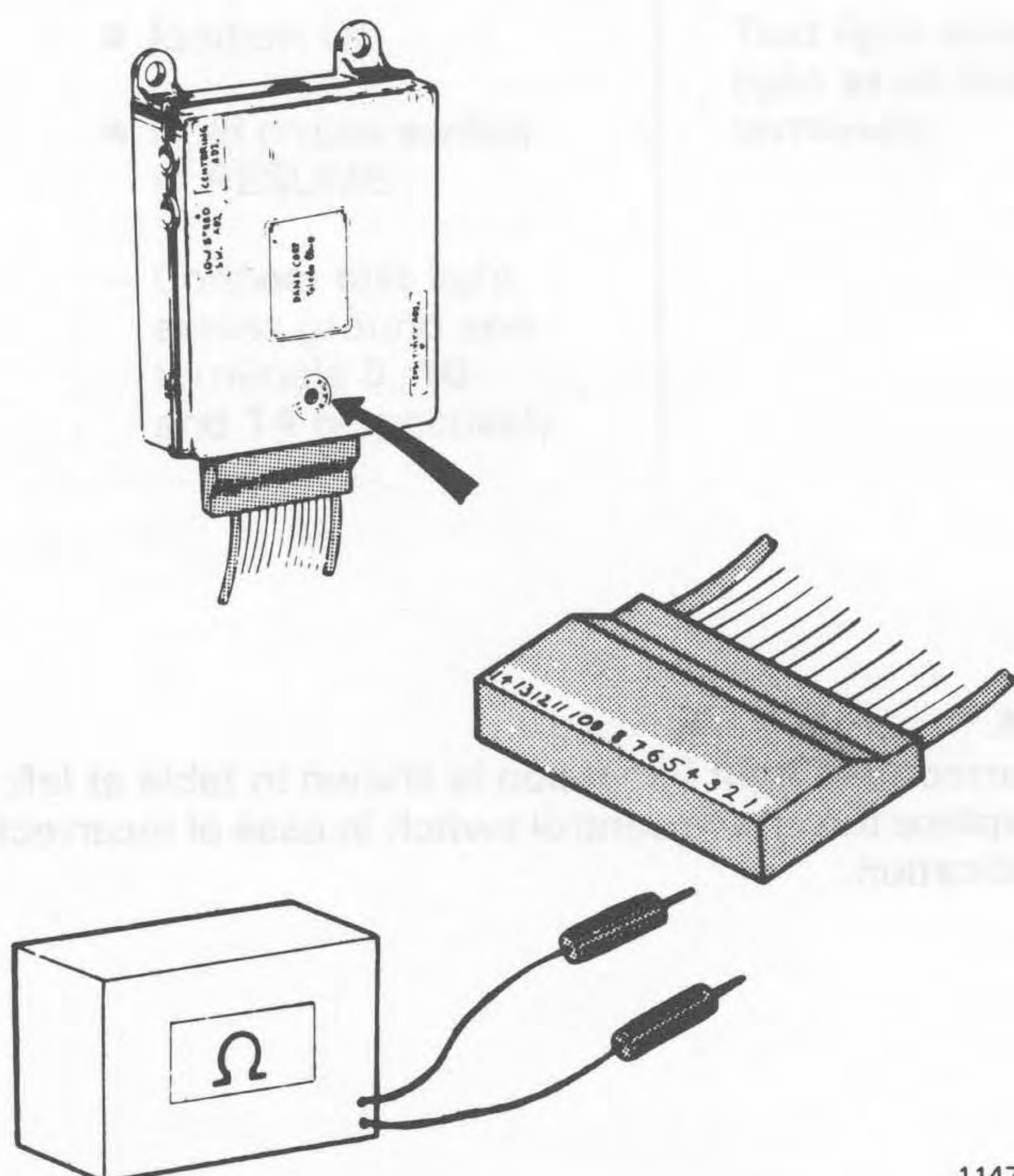
The speedometer contains rotating magnets which induce a varying AC voltage in the pickup coil. This signal is used to indicate road speed to the governor.

Check for AC voltage as follows:

- C1.
Disconnect the 14 pin plug at the governor.
- C2.
Connect an AC volt meter (2.5V scale approximately) with a 1K Ω resistor parallel across the leads to terminals 2 and 3 as shown.
- C3.
Raise rear wheels off floor and run car in gear at indicated 30 mph.
- C4.
The voltage signal should show an AC voltage.

The regulator uses a minimum of 0.5 volts at 30 mph (48KPH). You will see an increase in voltage as speed increases.

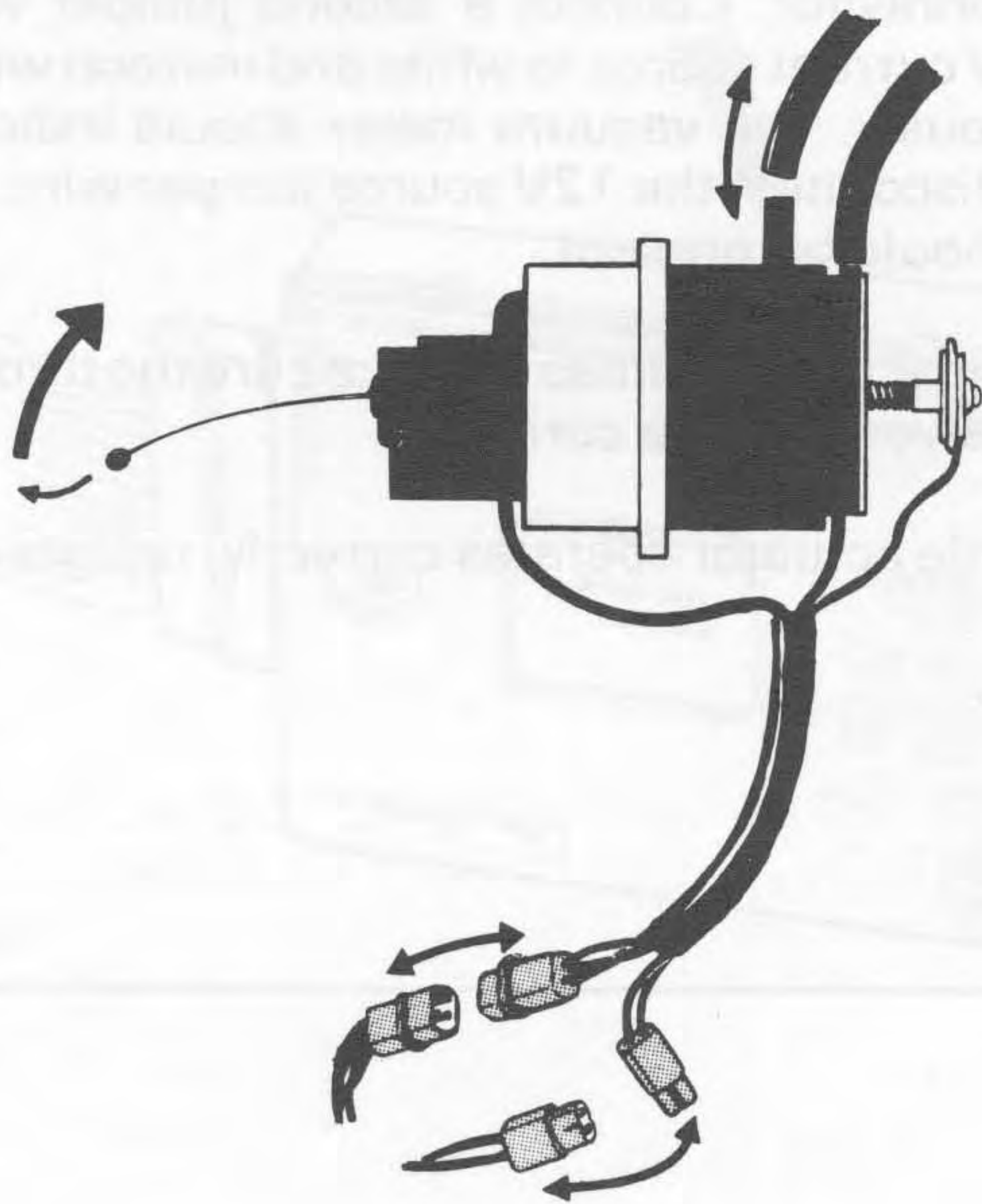
The pick-up is OK if a voltage is present. If no voltage is indicated, check the continuity of the wires and pick-up coil. The coil's resistance is approximately 500-750 Ω .



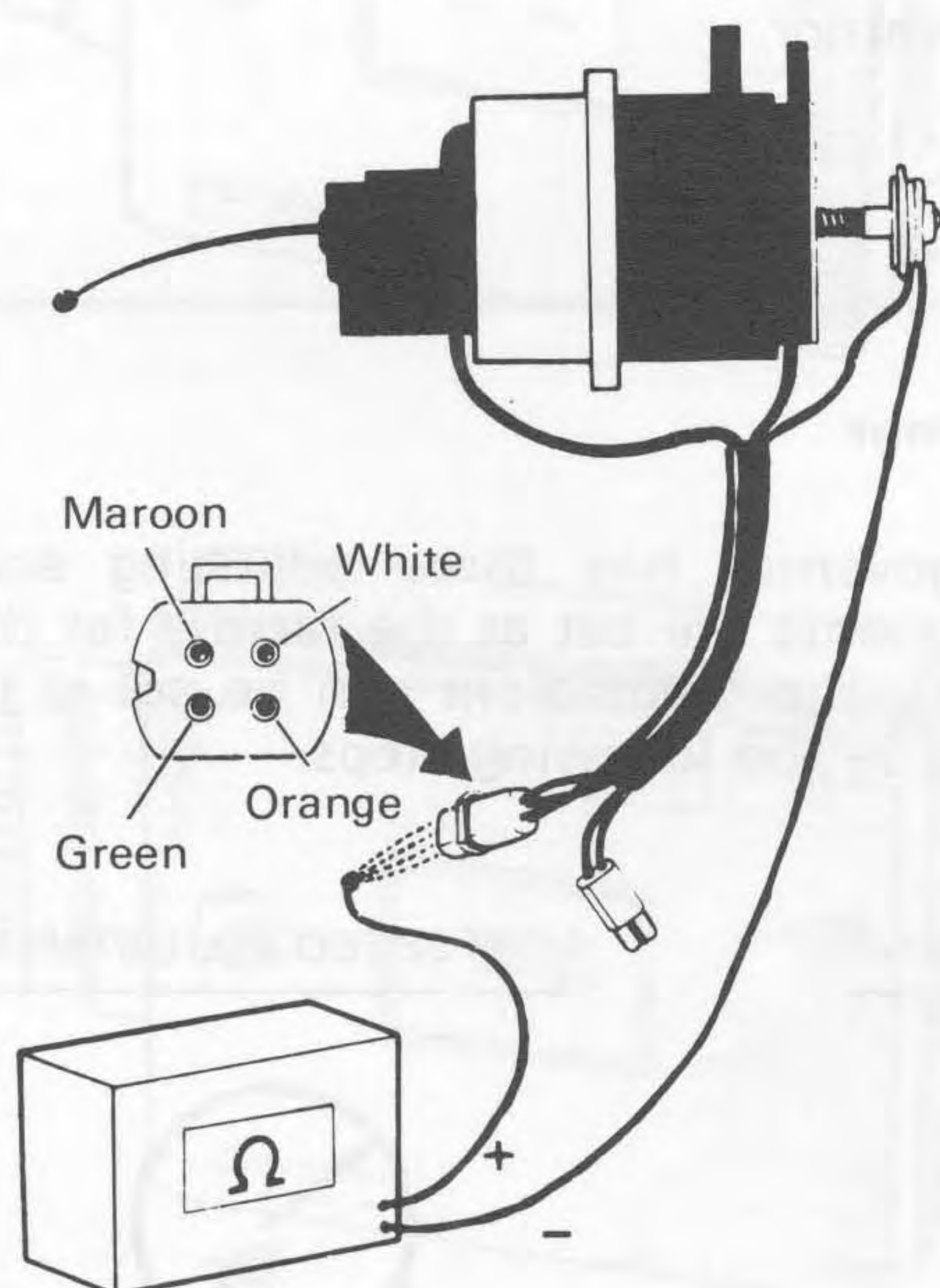
D. Check resistance of throttle actuator

- D1.
Switch ignition OFF.
- D2.
Depress TERMINAL RELEASE (arrow) and disconnect the connector.
- D3.
Check resistance; see table (next page). Use ohmmeter with high degree of accuracy better than $\pm 2\%$.
- D4.
In case of incorrect resistance, first check wiring before replacing components.
- D5.
If readings are correct, continue with check E.

Ohmmeter connected across terminal numbers	Correct resistance (ohm)	Component checked
2 and 11	180 - 600	Resistor in throttle actuator
12 and 4	38 - 48	Vacuum valve in throttle actuator
12 and 6	38 - 48	Bleeder valve in throttle actuator



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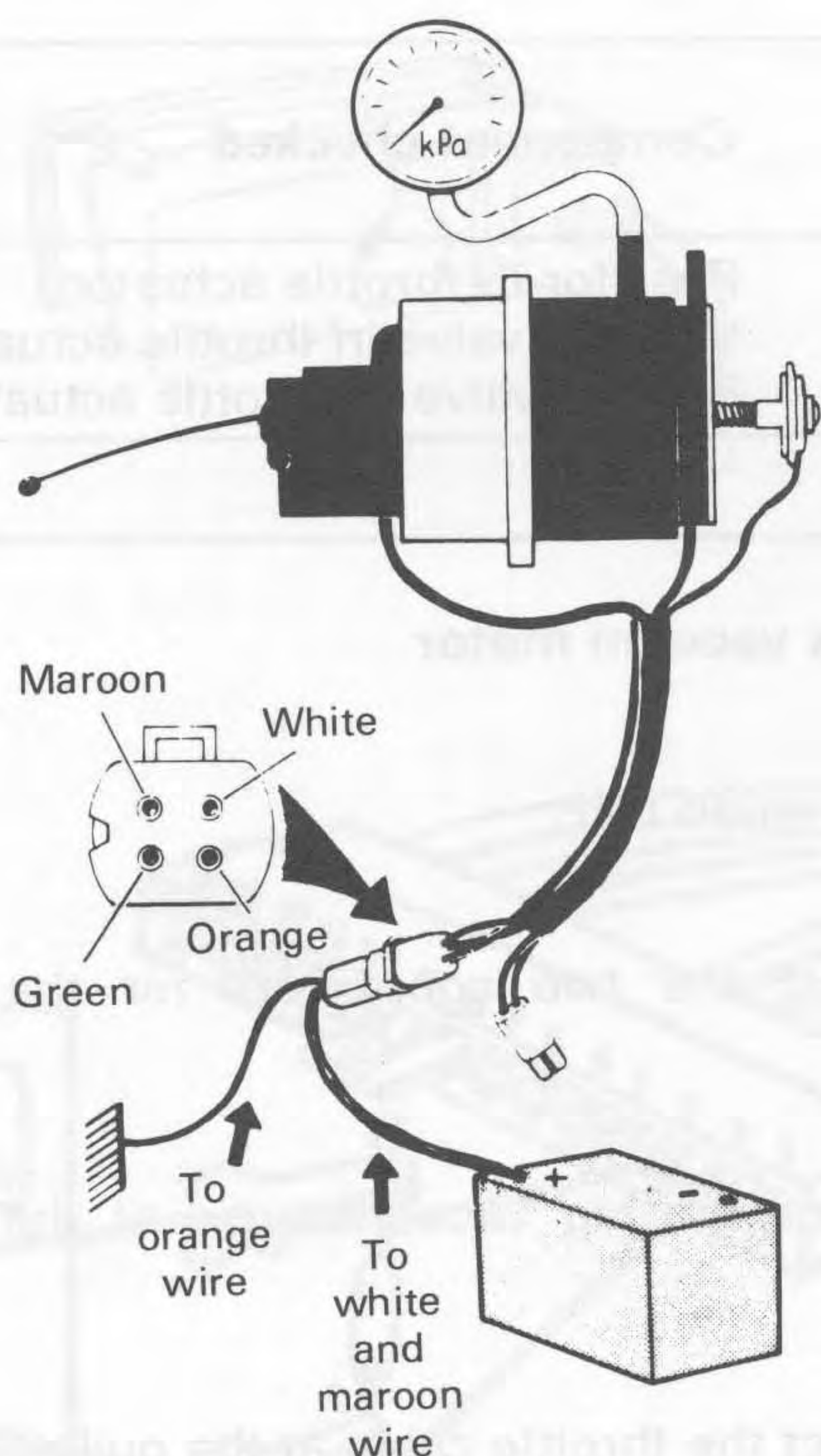
E. Check vacuum motor

- E1. Switch ignition OFF.
- E2. Disconnect the two connectors for the throttle actuator.
- E3. Disconnect the big vacuum hose at the throttle actuator.
- E4. Disconnect the throttle cable at the pulley.
- E5.
 - a. Connect ohmmeter NEG to one of the throttle actuator stud bolts.
 - b. Connect ohmmeter POS, in order, to maroon, orange, and white wires in connector.
 - c. The ohmmeter should indicate ∞ .

In case of resistance readings between 0- ∞ there is a short in the throttle actuator. It should be replaced.

A short in the throttle actuator damages the transistors in the governor, this requires that the governor also be replaced.

In case of no ohmmeter readings, continue on tests 6-8.



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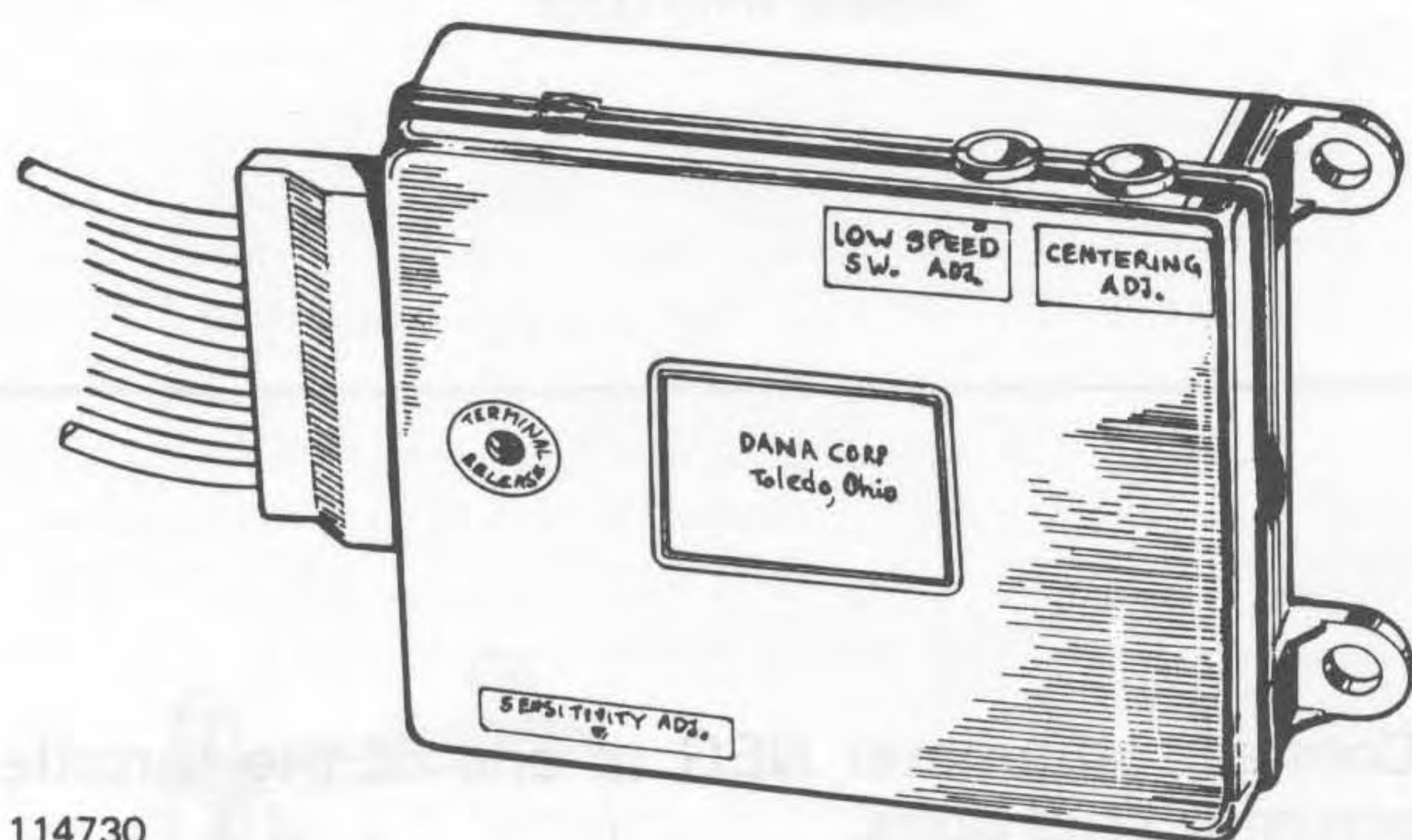
E6.
Connect a vacuum gauge to the large vacuum hose connection at the throttle actuator.

E7.
Apply the parking brake. Gear selector in Park or Neutral. Start the engine.

E8.
Connect a jumper wire across ground and orange wire in connector. Connect a second jumper wire from a 12V current source to white and maroon wires simultaneously. The vacuum meter should indicate vacuum. Disconnect the 12V source jumper wire. No vacuum should be present.

Repeat Step 8 several times to make sure the throttle actuator valves operate correctly.

If the throttle actuator operates correctly, replace the governor.



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F. Replacing the governor

The governor cannot be easily tested without installing it in a known good cruise system.

NOTE:
Perform ALL other tests before checking or replacing the governor.

G. Adjusting governor

NOTE:
Use care in performing these adjustments as the potentiometers are the delicate wafer type.

The governor has three adjusting screws. The adjustments are set at the factory for the average vehicle. The adjustment can be set to the factory setting by the following steps.

CENTERING ADJUSTMENT



PER ILLUSTRATION

SENSITIVITY ADJUSTMENT



TURN FULLY CLOCKWISE

LOW SPEED ADJUSTMENT



PER ILLUSTRATION

If the factory adjustments are not suited to the driver of the vehicle, use the following steps to fine-tune the governor.

Remove the governor without disconnecting harness. During the test drive, make adjustments in the order listed below.

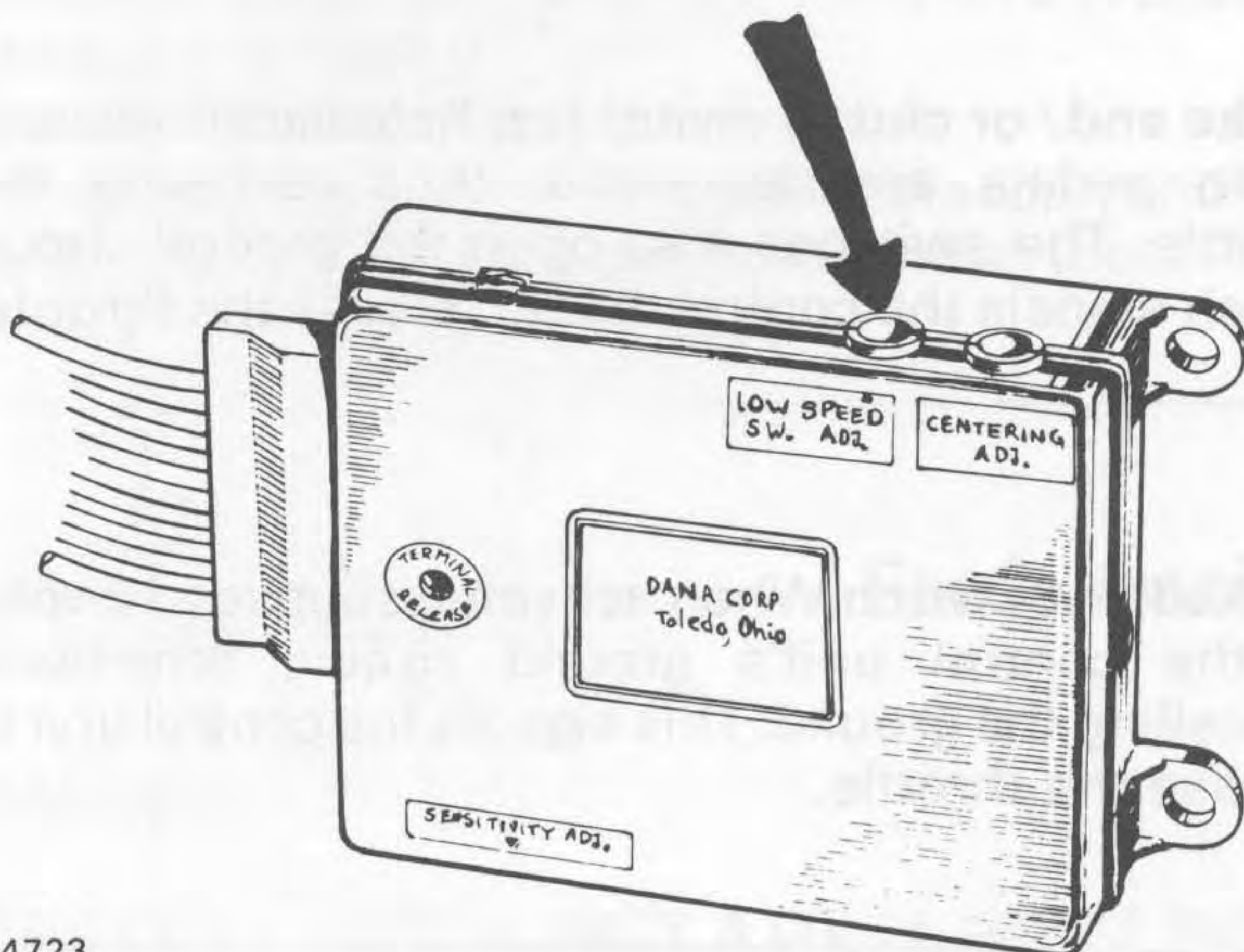
CAUTION:

Make adjustments while vehicle is stationary.

Low speed switch adjustment

The system should not engage below 30 mph. Hold the cruise control switch in RESUME position. From a low speed, accelerate slowly using the throttle pedal. Note the speed at which the cruise control system engages (the throttle pedal will be pulled down by the throttle actuator).

Turning the screw clockwise increases engagement speed, counterclockwise decreases it.



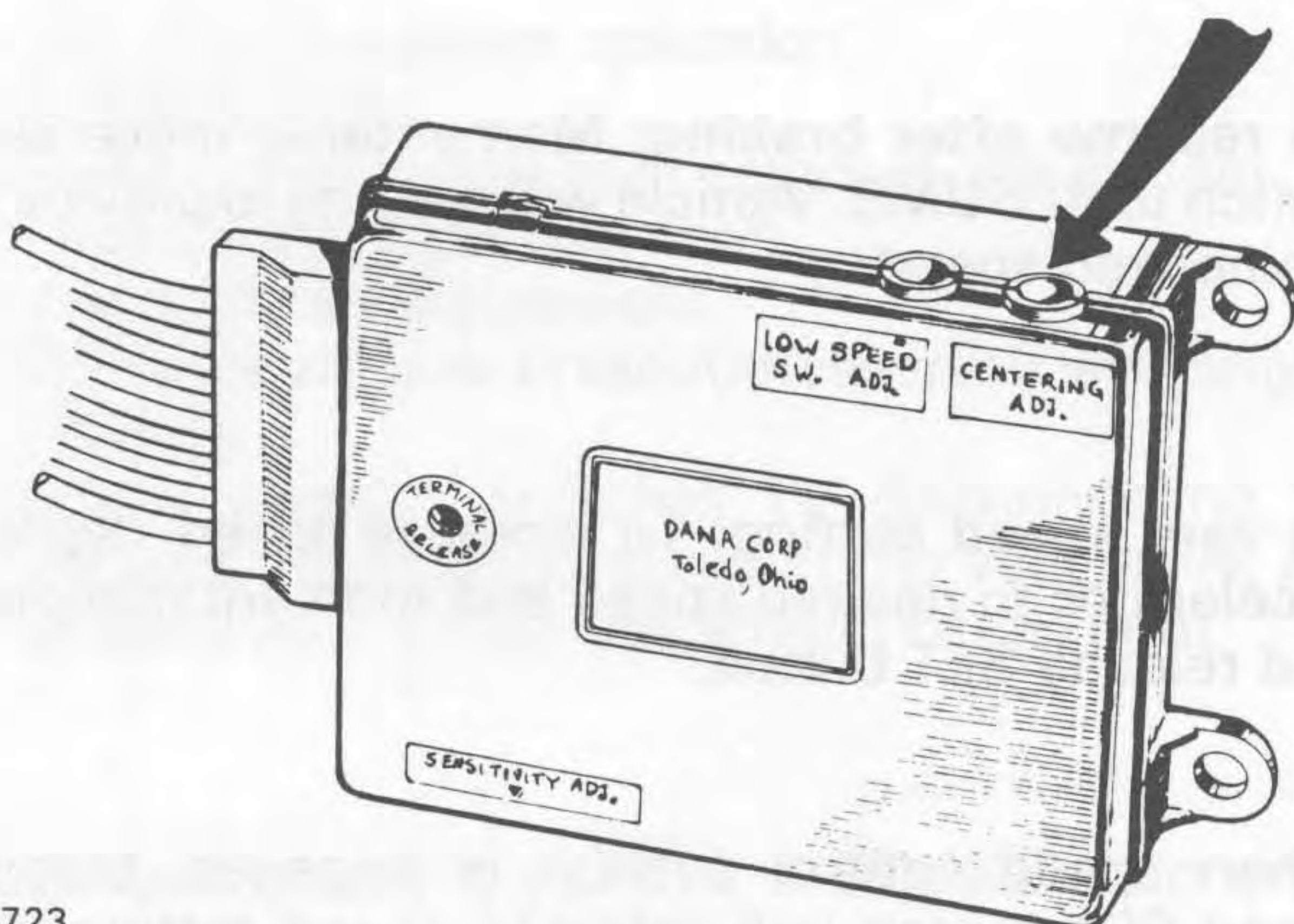
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Centering adjustment

The system should hold the set speed within ± 3 mph limits.

Drive on level road with a speed of approximately 45 mph. Switch to ON position and depress SET SPEED. Let the cruise control take over.

Turning the screw clockwise maintains closer control limit, counterclockwise widens control limit.



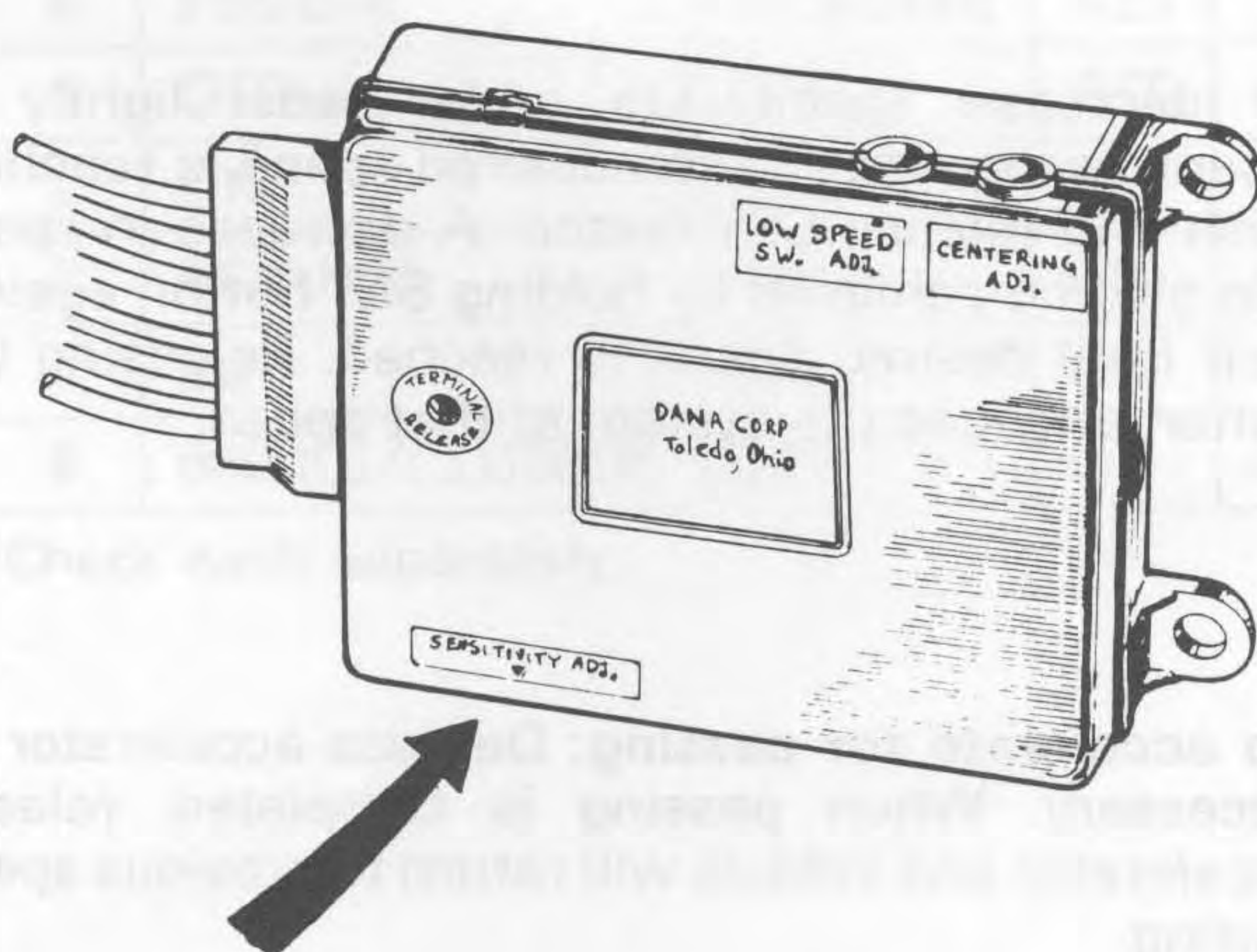
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Sensitivity adjustment

The governor is adjusted at the factory for maximum sensitivity. The cruise control system continuously adjusts the throttle control according to any differences in road and driving conditions.

Sensitivity can be reduced for vehicles driven mostly with light cargo load or to improve fuel mileage. This will also influence the centering adjustment (governor adjustment B) to a certain degree.

If all input signals are correct and the governor cannot be adjusted to function properly, replace it.



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Cruise control 1986 →

In 1986, a new cruise control system was introduced which is used in conjunction with the electronic speedometer. The control module stores the exact speed of the vehicle at the moment that the set button is pressed and released. This system adjusts the throttle position eight times per second to hold the speed within a ± 1 mph range as long as the car is capable of achieving the speed selected.

The system uses a vacuum reservoir to maintain the set speed when climbing a hill. This electronic system is accurate enough so that any speed from 25 to 85 mph can be selected and maintained. The electronic control also permits the system to conserve engine vacuum.

The system has the following safety features:

Rapid deceleration cutoff Turns the system off if a 10 mph/sec deceleration rate occurs even if there is no indication that the brakes have been applied.

Wheelspin cutoff Disengages the system if the set, resume, brake or clutch switches do not close and re-open when actuated or if a wiring malfunction occurs in these circuits. This prevents the system from operating in an unexpected manner because of a system malfunction.

Brake and/or clutch switch(es) Release all vacuum when pedals are depressed, thus releasing the throttle. The switches also open the ground circuit which signals the control unit to release the throttle.

Brake light switch When activated supplies 12 volts to the control unit's ground circuit, effectively cancelling the ground. This signals the control unit to release the throttle.

Operating instructions

The cruise control system is electrically actuated and vacuum operated. The multifunction control lever incorporates a slide switch with 3 positions, OFF, ON, and RESUME. The SET button is located at the end of the turn signal lever. The system is designed to operate at speeds above 25 mph.

WARNING:

THE USE OF THE CRUISE CONTROL SYSTEM IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

To engage: Turn the unit on and press the set button to engage the system and enter the speed into the control module's memory. Release the accelerator; speed will be maintained at the present level. Moving the slide switch from OFF to ON while vehicle is in motion provides power to the module without system engagement.

To disengage: Normal brake or clutch application, or a soft tap on the brake pedal will disengage control unit without erasing speed memory. Moving slide switch to OFF position or turning ignition off also disengages the system and in addition erases the speed memory.

To resume after braking: Momentarily move slide switch to RESUME. Vehicle will resume to previously memorized speed.

To vary speed setting: To increase speed, depress accelerator to desired speed and momentarily push and release SET button.

When speed control system is engaged, tapping speed SET button will increase speed setting in 2 mph increments.

To decrease speed, tap brake pedal lightly to disengage system. When desired speed is reached, push and release SET button. A decrease in speed can also be achieved by holding SET button against stop until desired speed is reached. Releasing the button engages the system at that speed.

To accelerate for passing: Depress accelerator as necessary. When passing is completed, release accelerator and vehicle will return to previous speed setting.

Operation

The servo valve housing contains two vacuum solenoid valves which the control unit uses to control speed regulation. When energized, the supply solenoid applies vacuum to the servo to open the throttle and increase speed.

The vent solenoid holds vacuum in the servo when energized, to allow speed to increase or remain constant. When de-energized, it releases vacuum to allow the throttle to close.

When operating on a level road, both supply and vent solenoids are closed most of the time so that airflow

through the system is minimal. A vacuum supply is needed only to set, resume or open the throttle to maintain speed on a hill.

A one-way check valve is used to trap vacuum in the vacuum reservoir. When engine vacuum drops, as in climbing a hill, the reservoir supplies the vacuum needed to open the throttle and maintain speed. The vent solenoid remains closed during hill climbing and constant throttle operation to make this function possible.

Fault tracing, cruise control**

Road test

Road test vehicle to verify a cruise control system malfunction. If the road test indicates an inoperative system, check the following:

- Check speedometer operation.
- Check fuse #1.
- Check all electrical connectors in the system.
- Check brake light operation.
- Check clutch adjustment.
- Check for vacuum at vacuum reservoir with engine running.
- Check vacuum switches by disconnecting the vacuum line marked **servo** at the vent valve, and blowing into it. The line should be air tight.

The most accurate method of fault tracing this cruise control system requires the use of special tool # 999 0943-4. The test unit was developed to check the functions of all components including the control unit.

Connecting Cruise Control Tester

Remove left-hand under-dash panel. Disconnect cruise control harness from control unit. Connect tester lead to the control unit. Connect the cruise control wiring harness to tester unit.

Tester switch must be in position 1.

Turn ignition key to position II. DO NOT start engine.

Test #	Switch Position	Tester Lamps						
		RESUME	SET	BRAKE/CLUTCH	IGNITION	SPEED	VAC	VENT
1	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
2	ON	OFF	ON	OFF	ON	OFF	ON	ON
3	RESUME	ON	ON	OFF	ON	OFF	ON	ON
4	SET	ON	OFF	OFF	ON	OFF	ON	ON
5	BRAKE/CLUTCH*	OFF	ON	DIMLY LIT	ON	OFF	ON	ON

* Check each separately.

**See Supplementary Information

TEST #6 Speed Signal

Raise left rear wheel off ground. Rotate wheel slowly while watching SPEED light on tester. Light should blink on and off with low light intensity.

NOTE:

On vehicles equipped with limited-slip differential, both rear wheels must be raised off ground and transmission placed in neutral.

TEST #7

CAUTION:

Turn Cruise Control OFF.
Start engine to build up vacuum.
THEN, TURN ENGINE OFF.

- Turn ignition key to position II.
- Turn cruise control on.
- Depress VAC and VENT buttons on tester simultaneously. Throttle pedal should be pulled down to floor. If not, check the following:
 - Check vacuum supply.
 - Verify that tests 1-6 are correct.
 - Replace control unit.

Release the VAC button on tester and keep the VENT button depressed for a minimum 15 seconds. The throttle pedal should remain steady. If not, the system has a vacuum leak.

TEST RESULTS

If tester lamps do not light in correct sequence, check the following:

Ignition Lamp:

Main power supply to cruise system.
Check fuse #12 and wiring.

Resume and Set Lamps:

Check yellow and green wires between control unit and switch. If OK, replace switch.

Brake/Clutch Lamp:

Check adjustment of switches on pedals.
Check wiring. Check brake light operation.

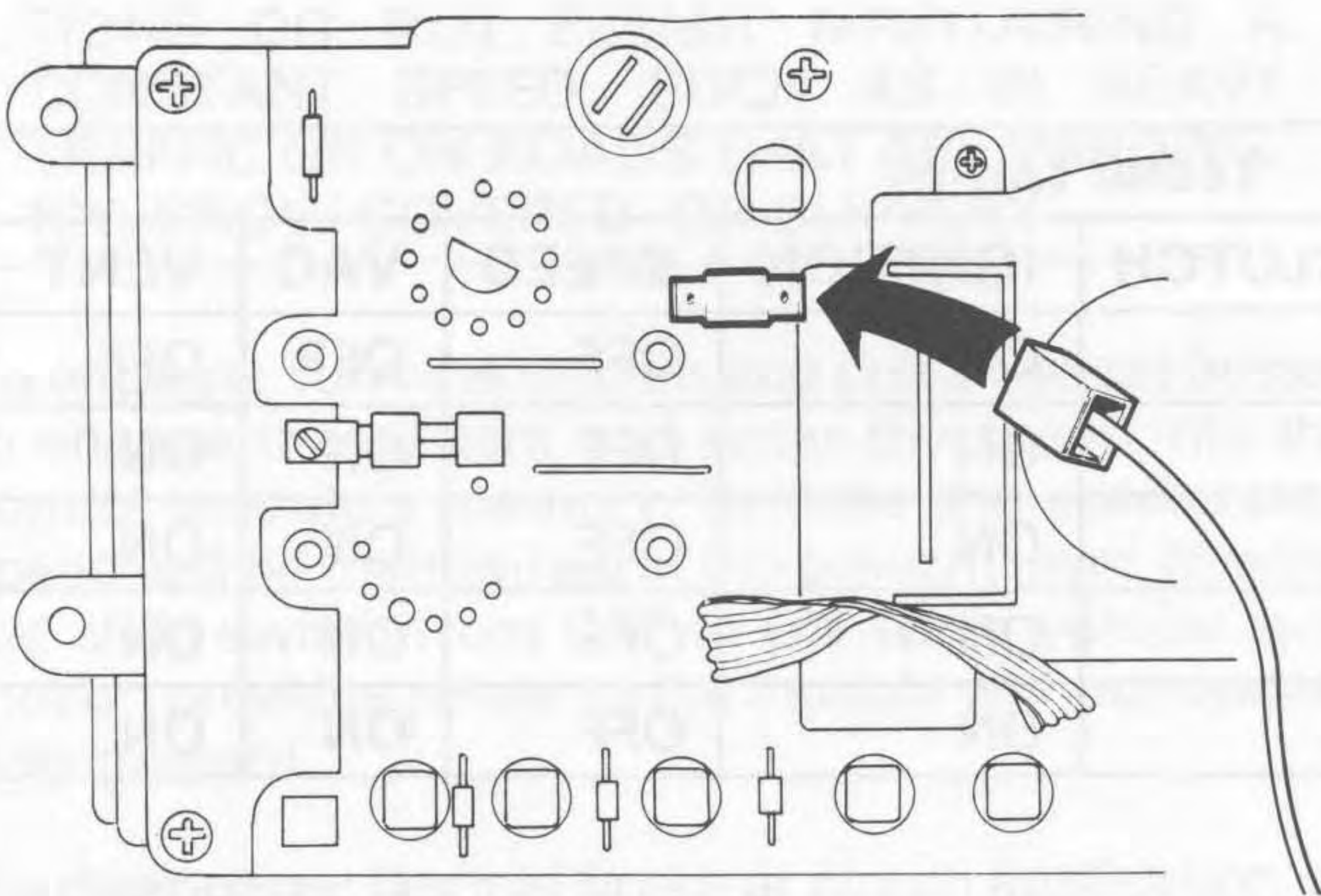
Speed Lamp:

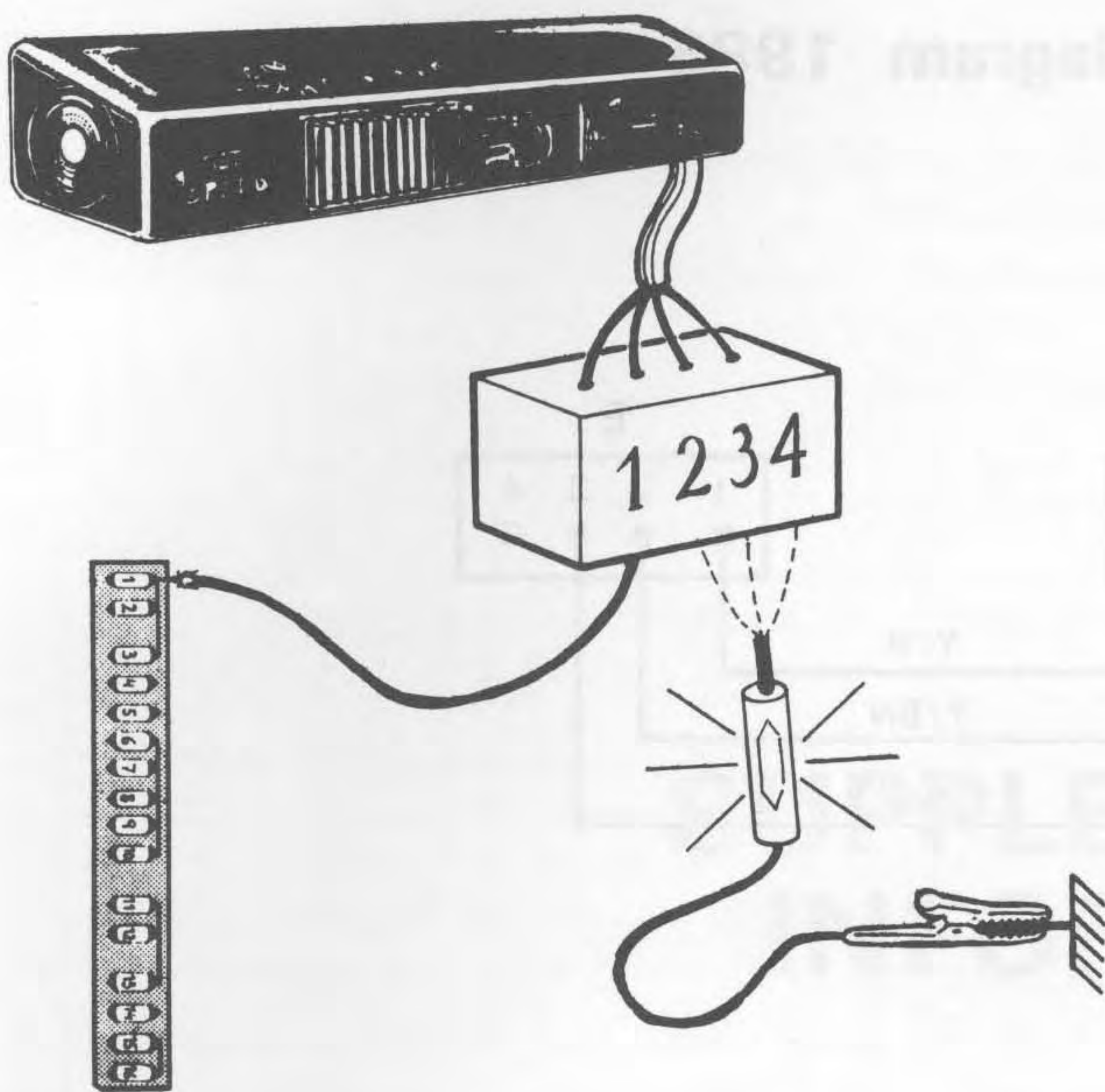
Verify proper speedometer operation. Check for proper connection of orange wire to rear of instrument cluster.

Vac and Vent Lamp:

Check the three wires going to the servo valve under the hood.

- yellow/red wire
- yellow/brown wire
- white/red wire

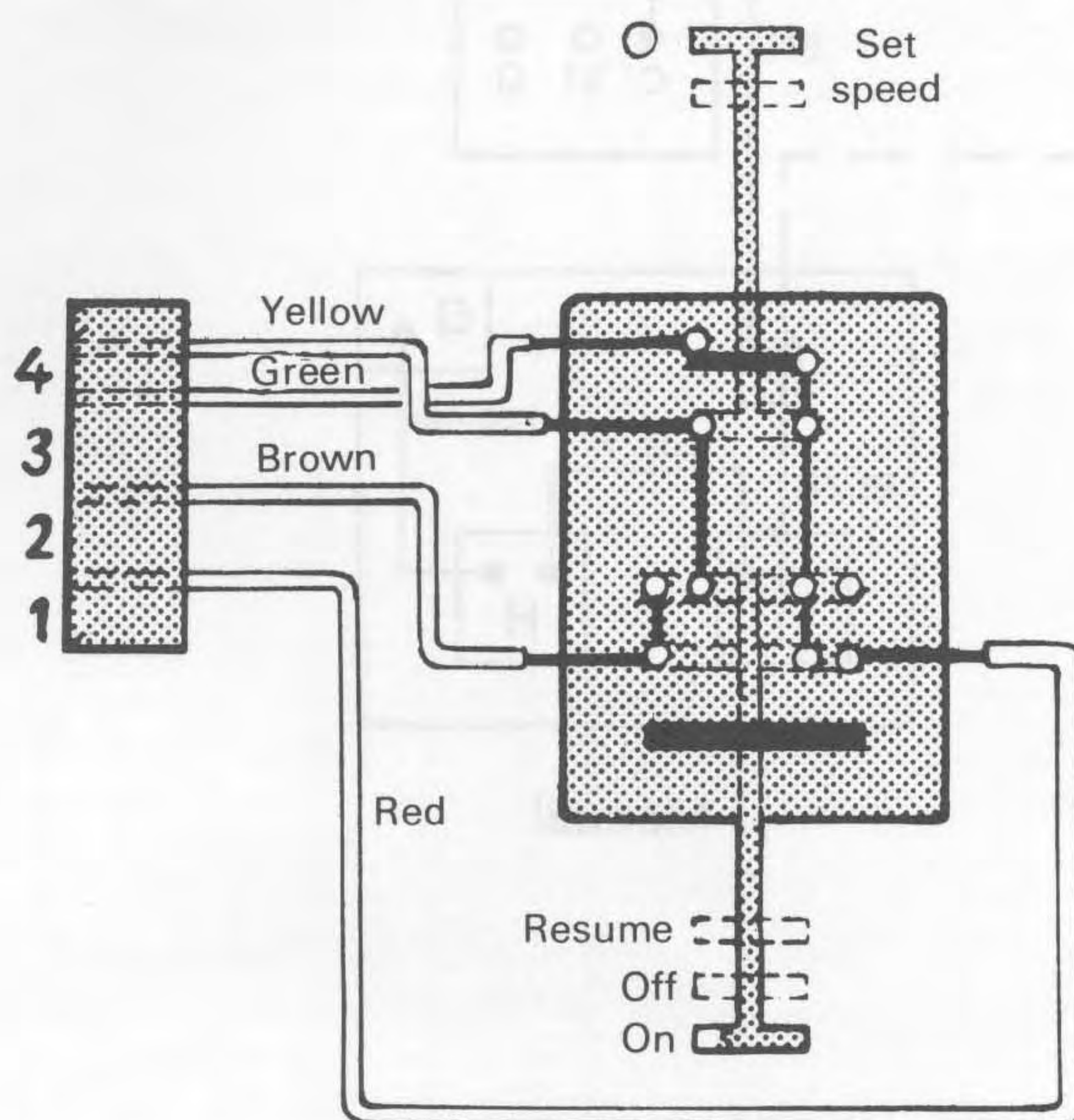




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Check cruise control switch

- Disconnect the connector at the cruise control switch.
- Connect a jumper wire from 12V current source (for instance, the fuse box) to red wire terminal in connector.
- Connect a test light across ground and the three wires, in order.
- Correct test light indication is shown in table below. Replace the cruise control switch in case of incorrect indication.

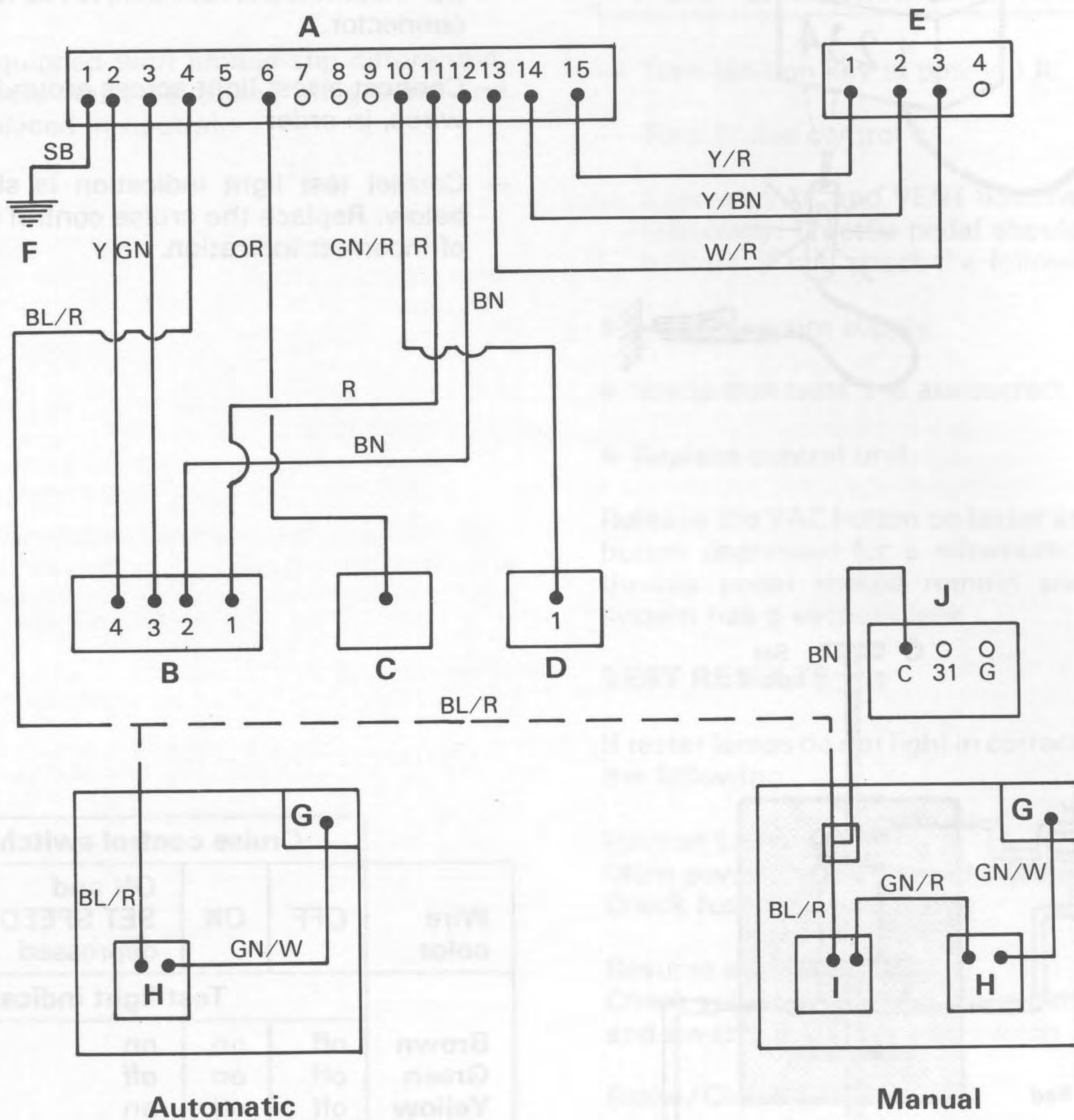


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Wire color	Cruise control switch position			
	OFF	ON	ON and SET SPEED depressed	RESUME
Test light indication				
Brown	off	on	on	on
Green	off	on	off	on
Yellow	off	off	on	on

Illustration at left shows cruise control switch circuits. Also see wiring diagram.

Cruise control wiring diagram 1986 →



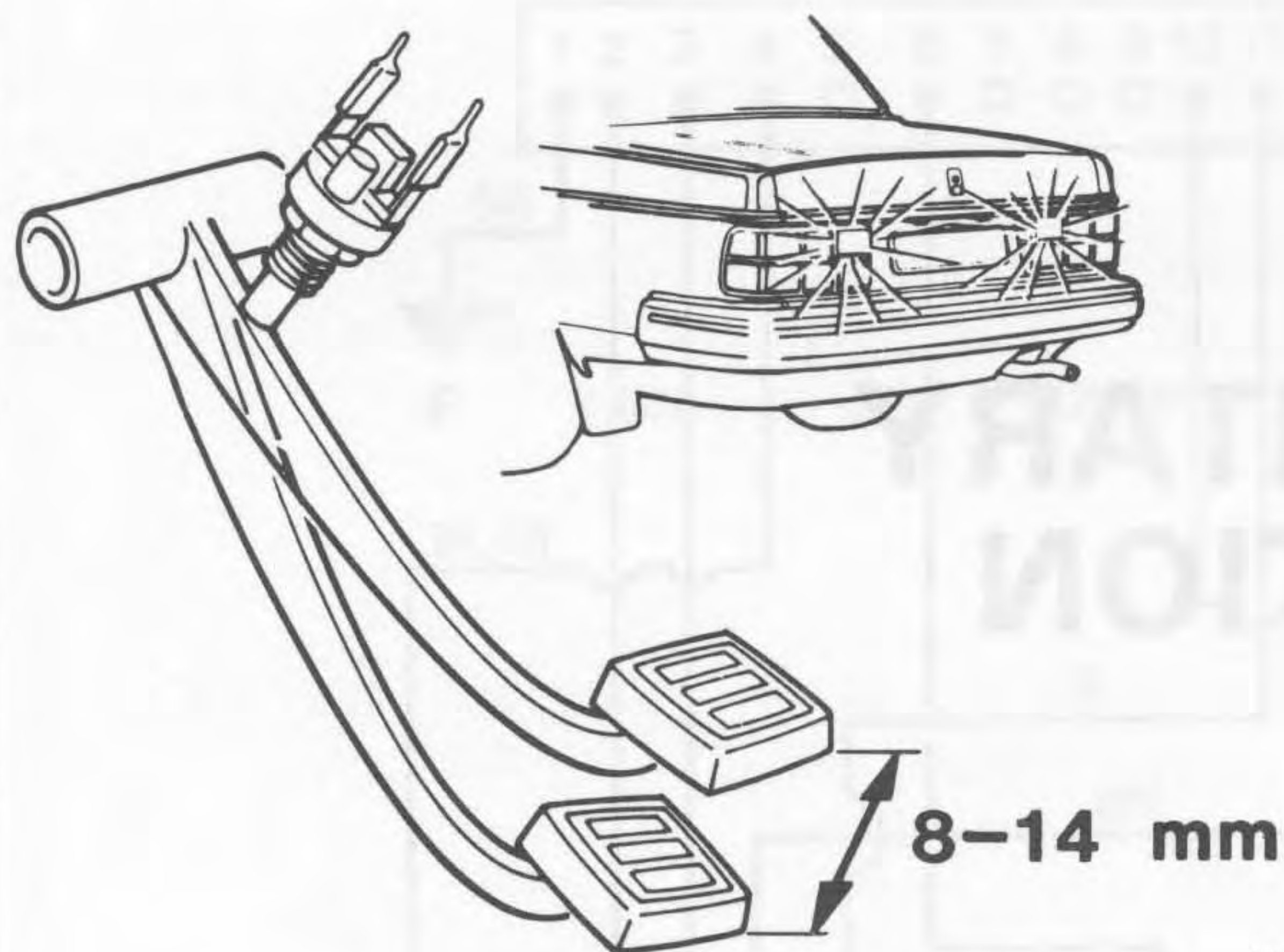
- a - control unit
- b - turn signal lever switch
- c - main instrument
- d - fuse 1
- e - valve housing

- f - ground
- g - brake light switch
- h - vacuum valve - brake
- i - vacuum valve - clutch
- j - control unit - gear shift indicator

This describes fault tracing and adjustment procedures of the **vacuum** system for 1986 M/Y —> electronic cruise control.

Check that fuse #1 is okay.

Check that the brake lights work and that the brake light switch is correctly adjusted.



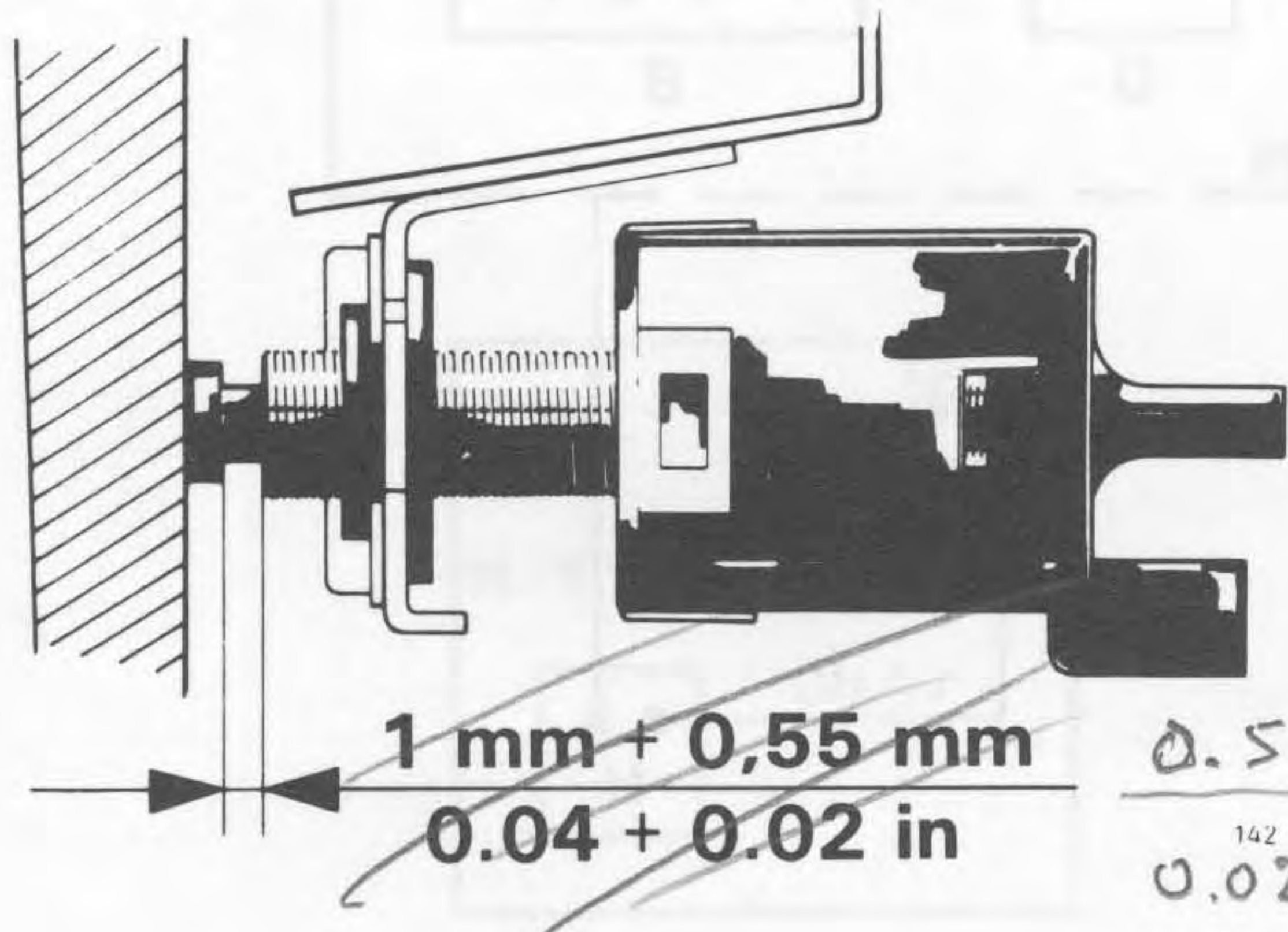
142 161

The control unit is grounded via the brake lights. If both brake light bulbs are blown, the control unit will not function.

The brake lights should come on when the pedal is depressed 8-14 mm (0.3-0.6 in) before the brakes are applied. Adjust if required.

Remove underdash panel from driver's footwell.

Check that air valves at brake and clutch pedals are correctly adjusted and do not leak.



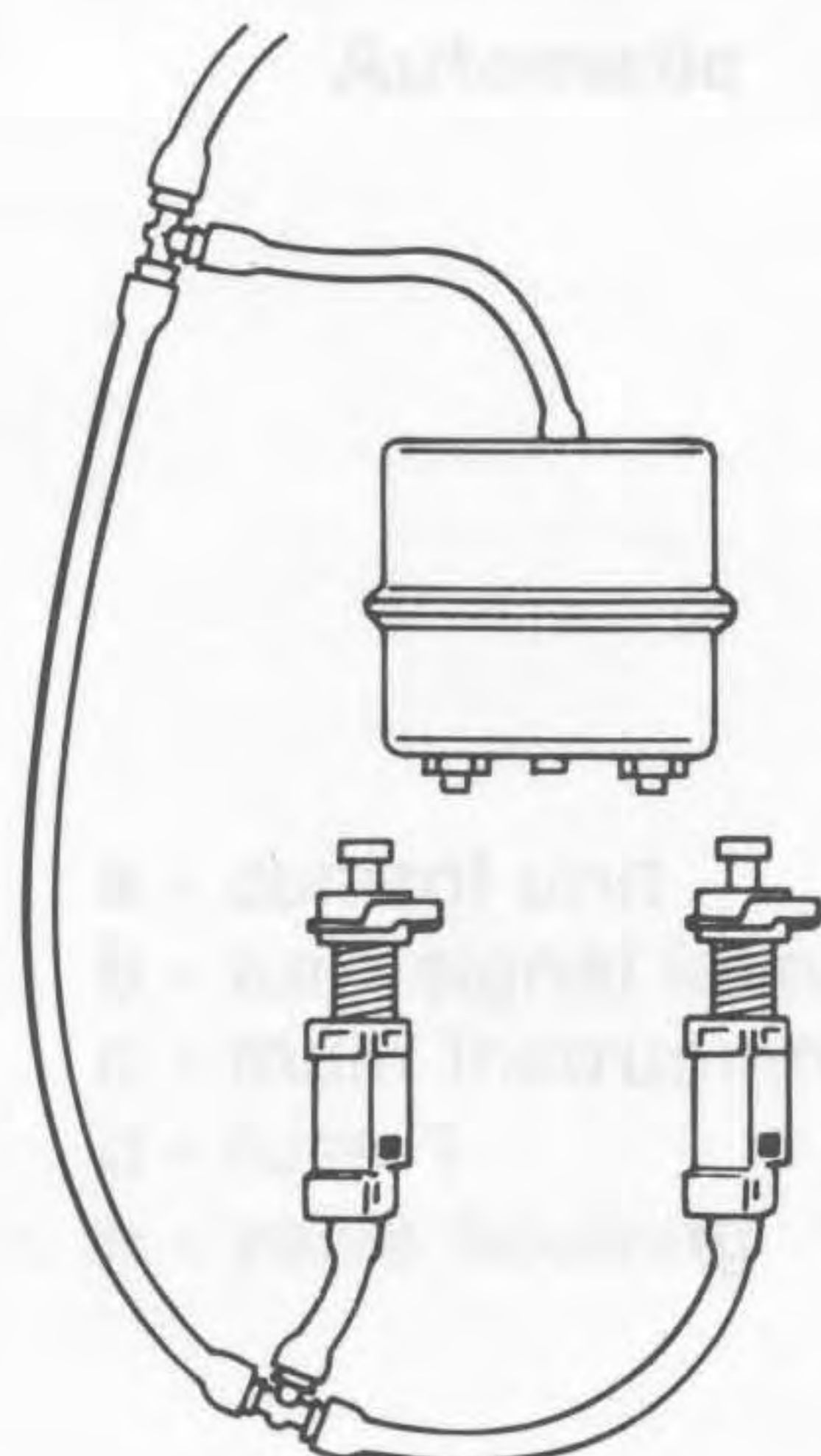
142 163

The valve should be closed when the pedals are up and open when the pedals are depressed.

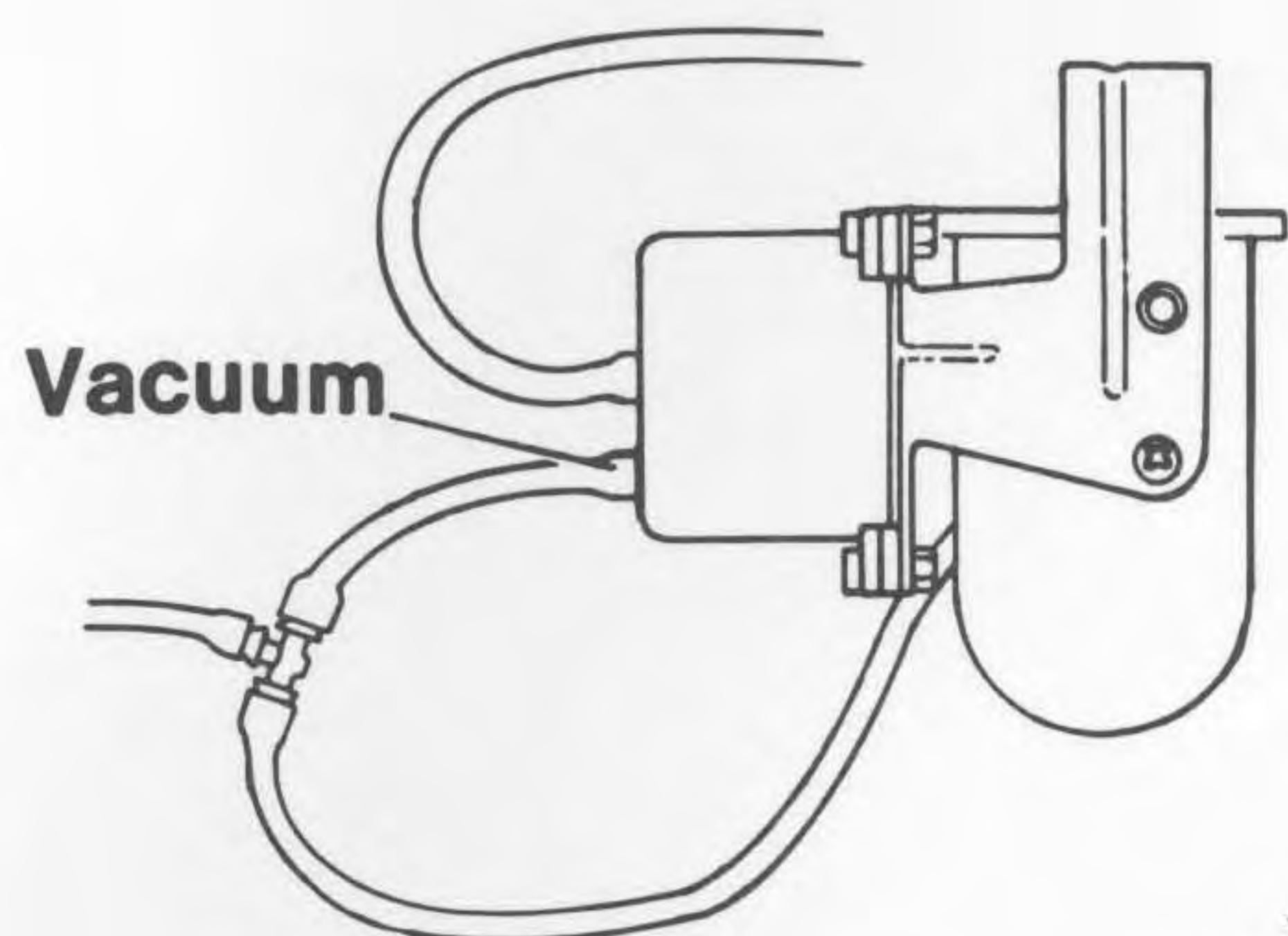
Test each valve by connecting a hose to it and blowing through.

Adjust if required.

Check that vacuum servo hoses and air valve hoses are correctly connected and not kinked.



142 164



142 165

Make sure that vacuum hose connected to intake manifold is not blocked or punctured.

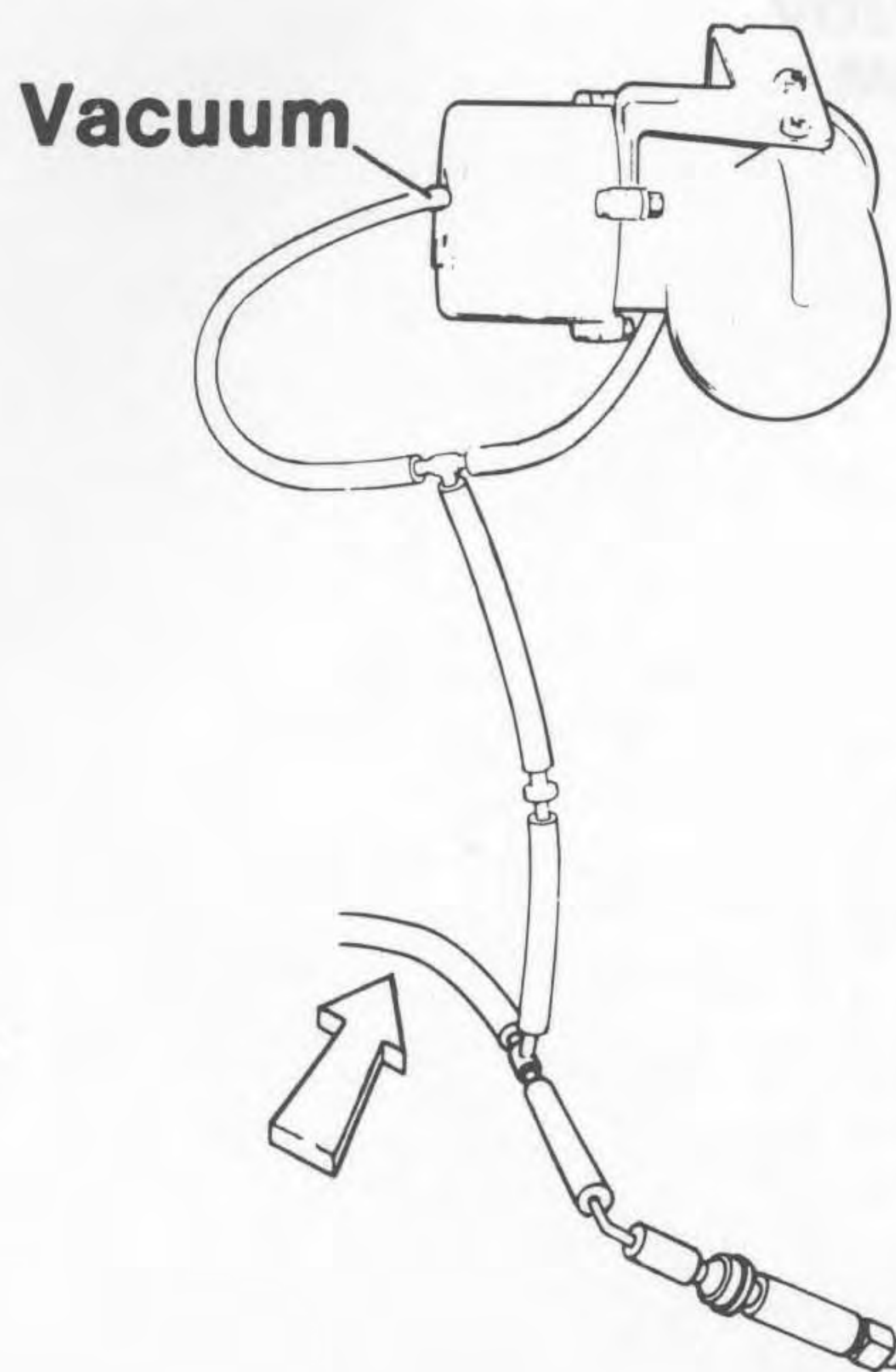
Disconnect hose from connection marked VACUUM on valve housing.

Start engine and place thumb on end of hose. Suction should be felt.

No suction: check hose and connection to intake manifold.

Reconnect hose.

Start engine and leave running for about 30 seconds to establish vacuum.



142 166

Turn engine OFF.

Disconnect hose from valve housing connection marked VACUUM. A hiss should be heard.

No hiss indicates a leak in cruise control vacuum system.

(Vehicles with CU heater: leak might occur from heater shutter valve vacuum system.)

Reconnect hose to valve housing.

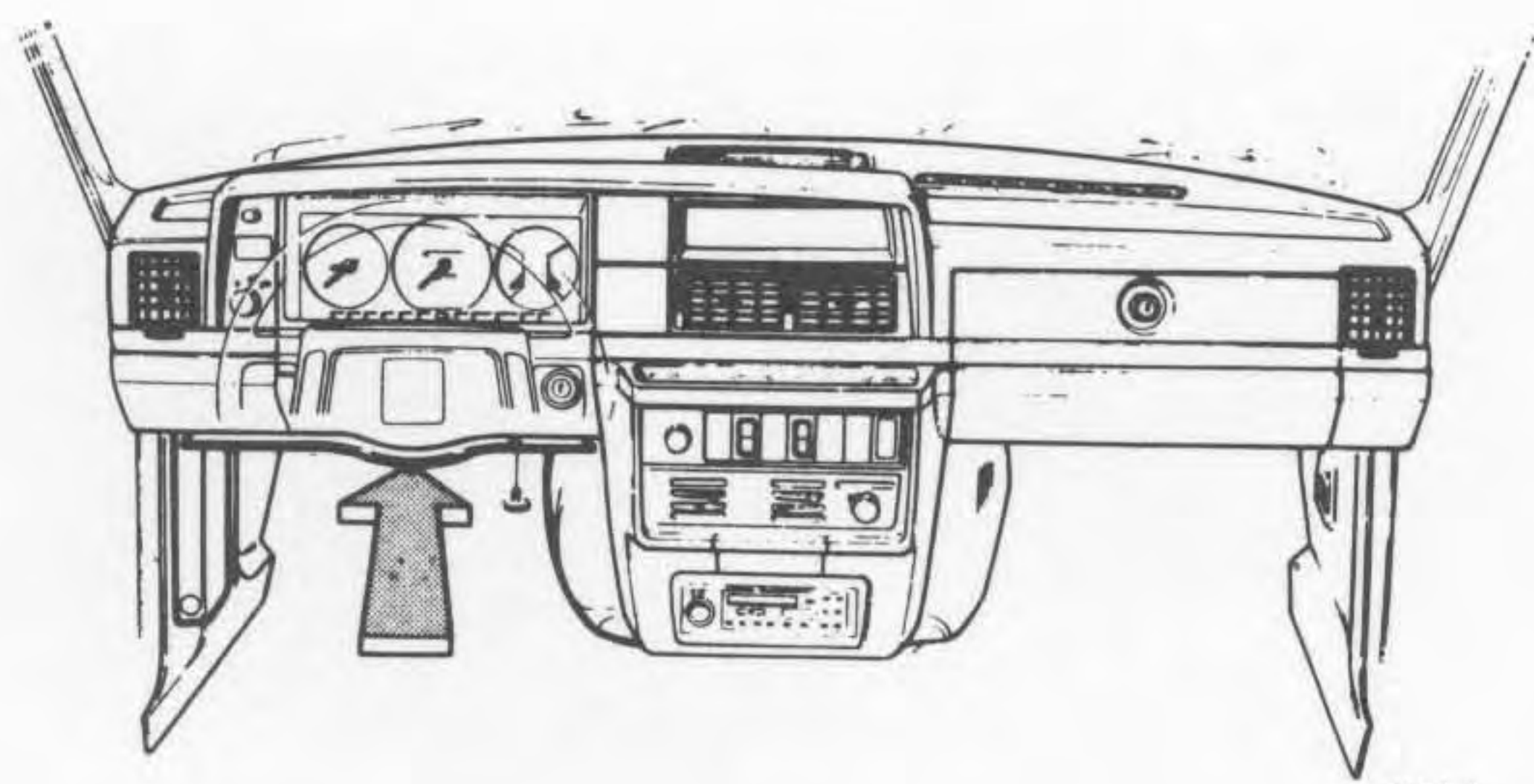
To find out if leakage is from CU system or cruise control system, pinch hose indicated by arrow and start engine to establish a vacuum.

Turn engine OFF after 30 seconds.

Disconnect hose from connection marked VACUUM on valve housing. If a hiss is heard this indicates that the CU heater vacuum system is leaking. No hiss indicates that the cruise control vacuum system is leaking.

Correct as required and recheck.

Reinstall underdash panel (arrow).



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