

# BMW Cruise Control Actuator Technical Data

November 20, 2005

[draft]

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## Usage Cross Reference

This actuator was used on several BMW models from October 1985 through May 1999. The chart below may be used to cross reference the usage of the actuator.

Part #: 65711378315

Chassis	Model	Body	Engine	Zone	Manufactured from	to
E31	840i	Coupe	M60	America	Sep-93	Nov-95
E31	840Ci	Coupe	M62	America	May-95	Jul-97
E31	840i	Coupe	M60	Europe	Dec-92	Feb-96
E31	840Ci	Coupe	M62	Europe	Dec-94	May-99
E32	735i	Sedan	M30	America	Aug-86	Jun-92
E32	735iL	Sedan	M30	America	Jan-88	Jul-92
E32	740i	Sedan	M60	America	Jun-92	Apr-94
E32	740iL	Sedan	M60	America	Jun-92	Mar-94
E32	735i	Sedan	M30	Europe	Oct-85	Jul-92
E32	730i	Sedan	M30	Europe	Jul-86	Mar-94
E32	750iL	Sedan	M70	Europe	Nov-86	Mar-94
E32	735iL	Sedan	M30	Europe	Jun-87	Jul-92
E32	750i	Sedan	M70	Europe	Jul-87	Mar-94
E32	730iL	Sedan	M30	Europe	Dec-87	Mar-94
E32	750iLS	Sedan	M70	Europe	Sep-88	Mar-94
E32	730i	Sedan	M60	Europe	Mar-91	Mar-94
E32	740i	Sedan	M60	Europe	Sep-91	Mar-94
E32	740iL	Sedan	M60	Europe	Oct-91	Mar-94
E32	730iL	Sedan	M60	Europe	Jun-92	Mar-94
E34	525i	Sedan	M20	America	Jan-88	Aug-90
E34	535i	Sedan	M30	America	Jan-88	Feb-93
E34	M5 3.6	Sedan	S38	America	Sep-89	Mar-93
E34	525i	Sedan	M50	America	Jun-90	Dec-95
E34	525i	Touring	M50	America	Oct-91	Jan-96
E34	530i	Sedan	M60	America	Nov-92	Dec-95
E34	530i	Touring	M60	America	Nov-92	Nov-95
E34	540i	Sedan	M60	America	Nov-92	Dec-95
E34	535i	Sedan	M30	Europe	Mar-87	Apr-93
E34	520i	Sedan	M20	Europe	Jun-87	Sep-90
E34	525i	Sedan	M20	Europe	Jun-87	Aug-90
E34	530i	Sedan	M30	Europe	Jun-87	Jul-90
E34	M5 3.6	Sedan	S38	Europe	Apr-88	Apr-92
E34	525i	Sedan	M50	Europe	Jan-89	Dec-95
E34	520i	Sedan	M50	Europe	Mar-89	Dec-95
E34	518i	Sedan	M43	Europe	Mar-90	Dec-95

## Usage Cross Reference

E34	520i	Touring	M50	Europe	Nov-90	Jun-96
E34	525i	Touring	M50	Europe	Dec-90	Jun-96
E34	525ix	Sedan	M50	Europe	Apr-91	Dec-95
E34	525ix	Touring	M50	Europe	Jul-91	Mar-96
E34	M5 3.8	Sedan	S38	Europe	Jul-91	Jul-95
E34	530i	Sedan	M60	Europe	Mar-92	Dec-95
E34	540i	Sedan	M60	Europe	Mar-92	Dec-95
E34	M5	Touring	S38	Europe	Mar-92	Jul-95
E34	530i	Touring	M60	Europe	May-92	Jun-96
E34	540i	Touring	M60	Europe	May-93	Jun-96
E34	518i	Touring	M43	Europe	Nov-93	Jun-96
E34	518g	Touring	M43	Europe	May-95	Jun-96
E36	325i	Sedan	M50	America	Oct-90	Sep-94
E36	325is	Coupe	M50	America	Nov-90	Sep-94
E36	318i	Sedan	M42	America	Nov-91	Sep-94
E36	318is	Coupe	M42	America	Nov-91	Sep-94
E36	320i	Sedan	M50	America	Sep-92	Sep-94
E36	325i	Convertible	M50	America	Nov-92	Sep-94
E36	318i	Convertible	M42	America	Oct-93	Sep-94
E36	M3	Coupe	S50	America	Nov-93	Sep-94
E36	325i	Sedan	M50	Europe	Nov-89	Sep-94
E36	320i	Sedan	M50	Europe	Jan-90	Sep-94
E36	325i	Coupe	M50	Europe	Oct-90	Sep-94
E36	320i	Coupe	M50	Europe	Feb-91	Sep-94
E36	M3	Coupe	S50	Europe	Mar-92	Sep-94
E36	325i	Convertible	M50	Europe	Aug-92	Sep-94
E36	320i	Convertible	M50	Europe	Nov-92	Sep-94
E36	316i	Sedan	M43	Europe	Feb-93	Sep-94
E36	318i	Sedan	M43	Europe	Feb-93	Sep-94
E36	316i	Coupe	M43	Europe	Mar-93	Sep-94
E36	318is	Sedan	M42	Europe	May-93	Sep-94
E36	316i 1.6	Compact	M43	Europe	Jun-93	Sep-94
E36	318i	Convertible	M43	Europe	Nov-93	Sep-94
E36	M3	Convertible	S50	Europe	Nov-93	Sep-94
E36	318ti	Compact	M42	Europe	Mar-94	Sep-94

## Theory of Operation

The throttle is simultaneously linked by cable to the cruise control actuator and by a second cable to the accelerator pedal. The core of the cruise control actuator is a small motorized drum which winds or unwinds a belt of rubberized fabric. This control belt is affixed to the cable connected to the throttle. Thus, by winding the belt the throttle cable can be retracted, or by unwinding it can be extended.

When the cruise control is not in use, the motor drive is disengaged from the drum. This allows the drum to turn easily and the throttle cable to move freely in response to accelerator pedal action. A clockwork style spring supplies mild tension to keep the belt wrapped around the drum and also takes up slack from the throttle cable.

A solenoid is used to engage the motor drive with the drum. When the solenoid is energized a small armature is moved which pushes a sprocket into contact with the integrated gear on the drum. At this point, if current is supplied to the drive motor, the drum will wind. If the polarity of the current is reversed, the drum will unwind.

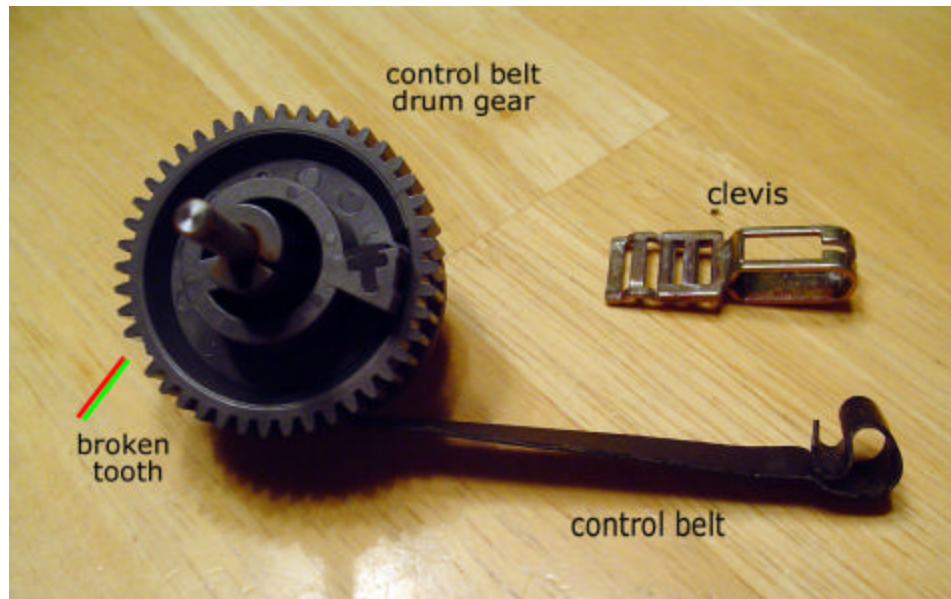
The control unit ("brain") is located in the electronics bay. The control unit can thus command the actuator to engage or disengage, to reel in the throttle cable or extend it. This provides the necessary control capabilities.

To maintain a set vehicle speed, the control unit needs to know the rotational position of the drum. A potentiometer (variable resistor) integrated into the drum supplies this information to the control unit. A resistance proportional to the position of the drum is constantly presented to the control unit. This feedback allows the control unit to determine how the actuator has responded to its commands.

By using the current vehicle speed (supplied by another sensor) along with the feedback from the actuator, the control unit can adjust the actuator as necessary to maintain vehicle speed.

## Actuator Failure Modes

The cruise control actuator will seem to work only intermittently or partially when a tooth is broken in the gear driving the control belt drum. This is because the control unit will attempt to operate the actuator, but gets inconsistent feedback from the potentiometer when the drive encounters the broken tooth.



**Figure 1 - Control belt drum with broken tooth**

When the inconsistent feedback is received the control unit will eventually give up and disengage. A similar effect is noticed when the potentiometer resistance surface or wipers become pitted or burned.

When the control belt breaks or the motor or solenoid burns out a complete failure of the actuator is observed.

## External Description

The cruise control actuator is enclosed in a two part plastic housing. The throttle control cable protrudes through a fixture on the top half. A round male electrical connector for the control cable is also located on the top half.

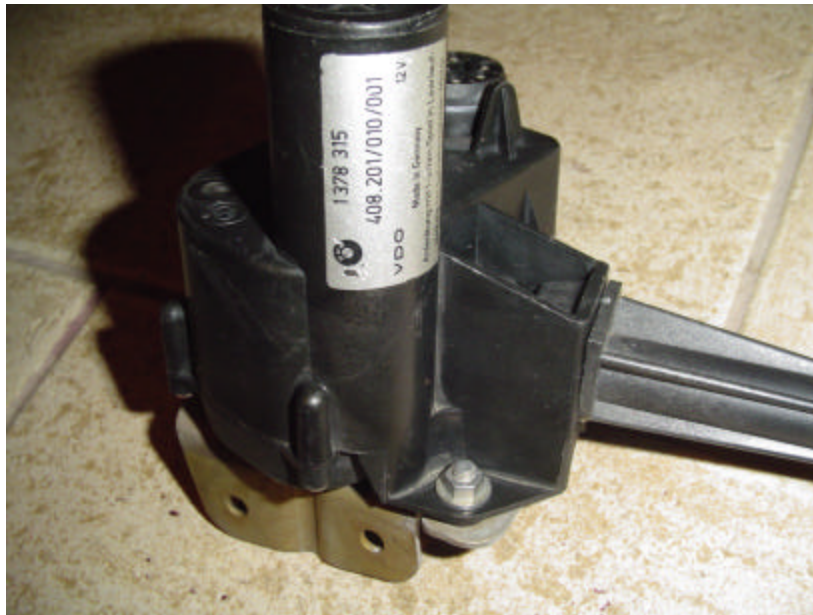


**Figure 2 - Actuator top view**

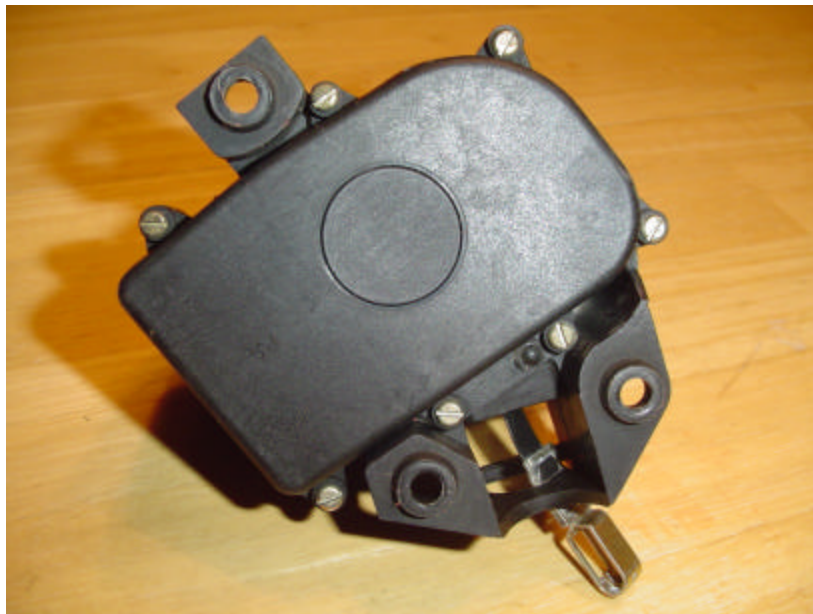


**Figure 3 - Actuator side view**

## External Description



**Figure 4 - Actuator side view**



**Figure 5 - Actuator bottom view (mounting plate and cable removed)**



## Internal Description

When the actuator is disassembled, the following components are revealed.



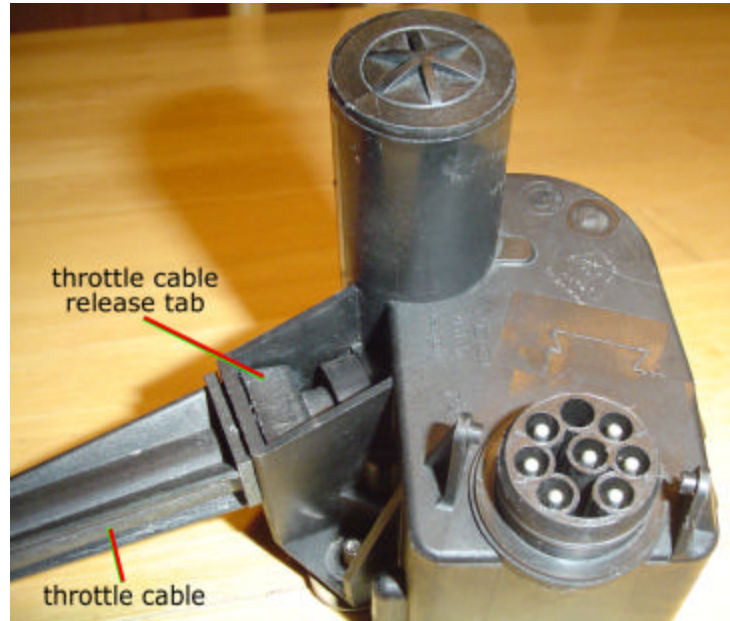
Figure 6 - Internal components



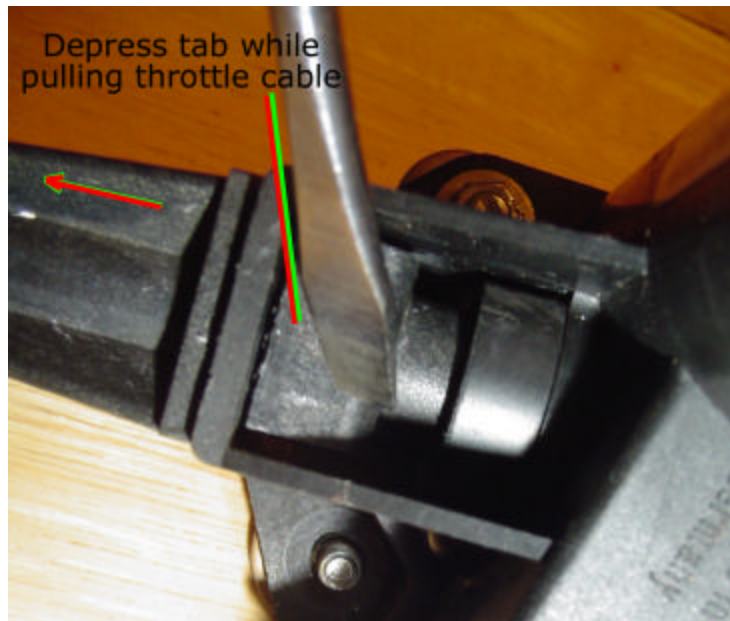
Figure 7 - Internal components (alt. view)

## Throttle Cable Removal

The throttle cable may be separated from the cruise control actuator. This may be accomplished while the cruise control actuator is in the automobile.



**Figure 8 - Throttle cable release tab**

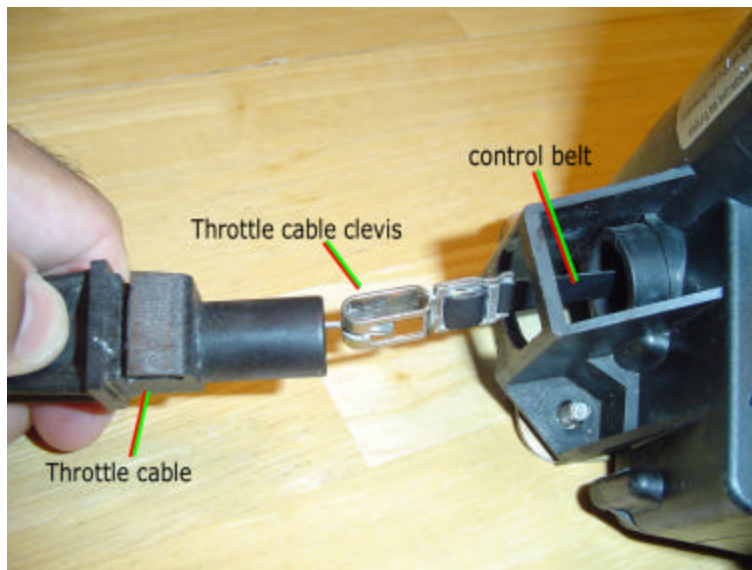


**Figure 9 - Depress tab and pull cable**

## Throttle Cable Removal

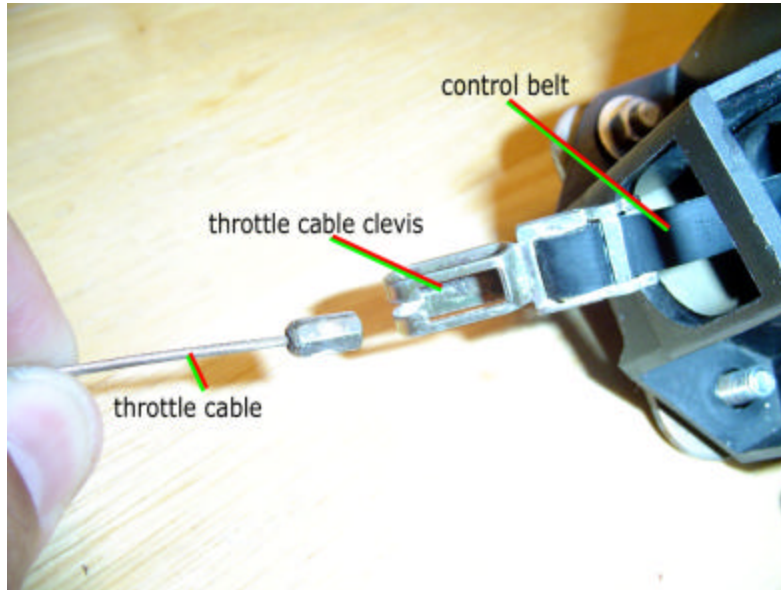


**Figure 10 - Sliding out throttle cable**



**Figure 11 - Throttle cable separated from cruise control**

## Throttle Cable Removal



**Figure 12 - Throttle cable disconnected**

## Disassembly

The actuator may be disassembled in the following steps.



**Figure 13 - Remove mounting plate nuts**



**Figure 14 - Remove shell perimeter screws**

## Disassembly



Figure 15 - Using screwdriver to separate shell halves

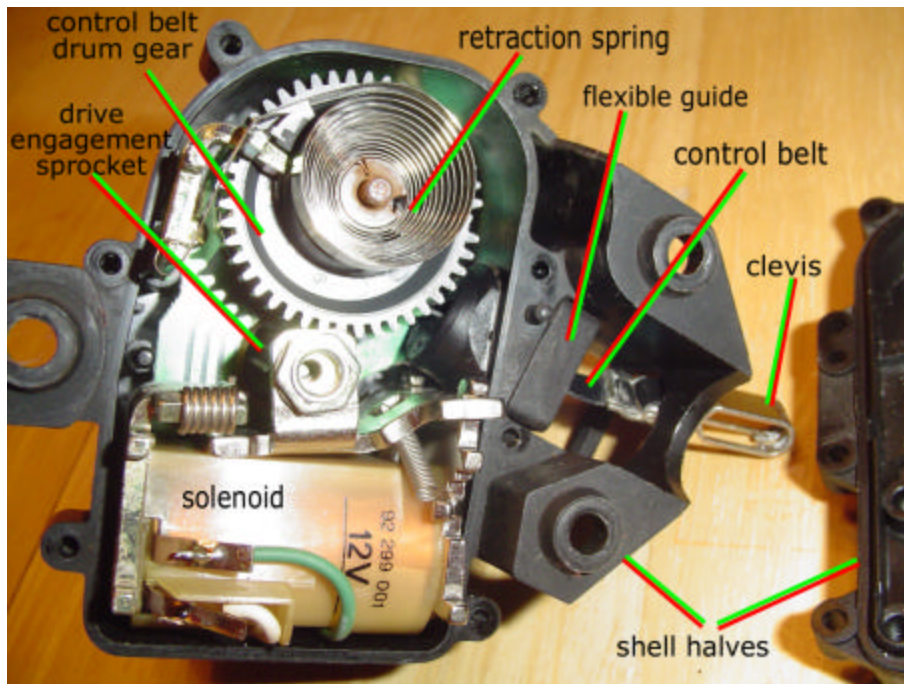


Figure 16 - Shell halves separated showing internal components

## Disassembly

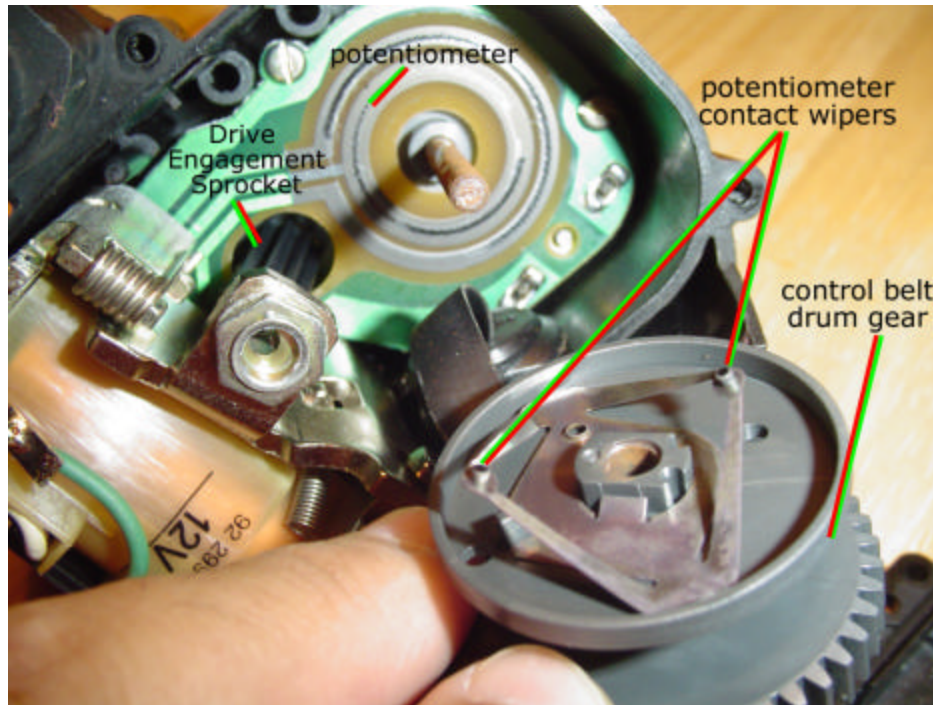


Figure 17 - Control belt drum gear and retraction spring removed



Figure 18 - Detail of control belt threading through clevis

Disassembly

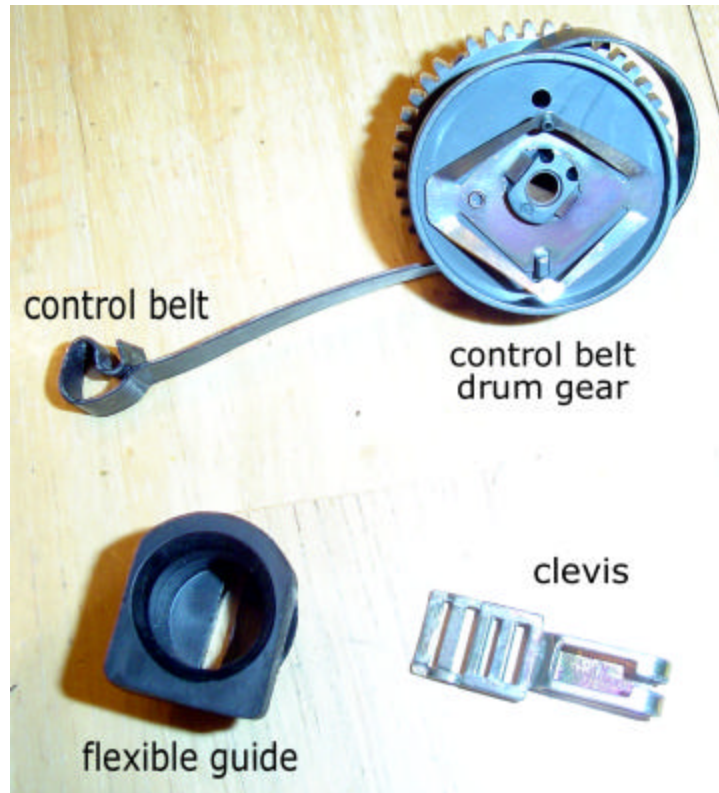


Figure 19 - Detail of control cable drum gear, flexible guide, and clevis

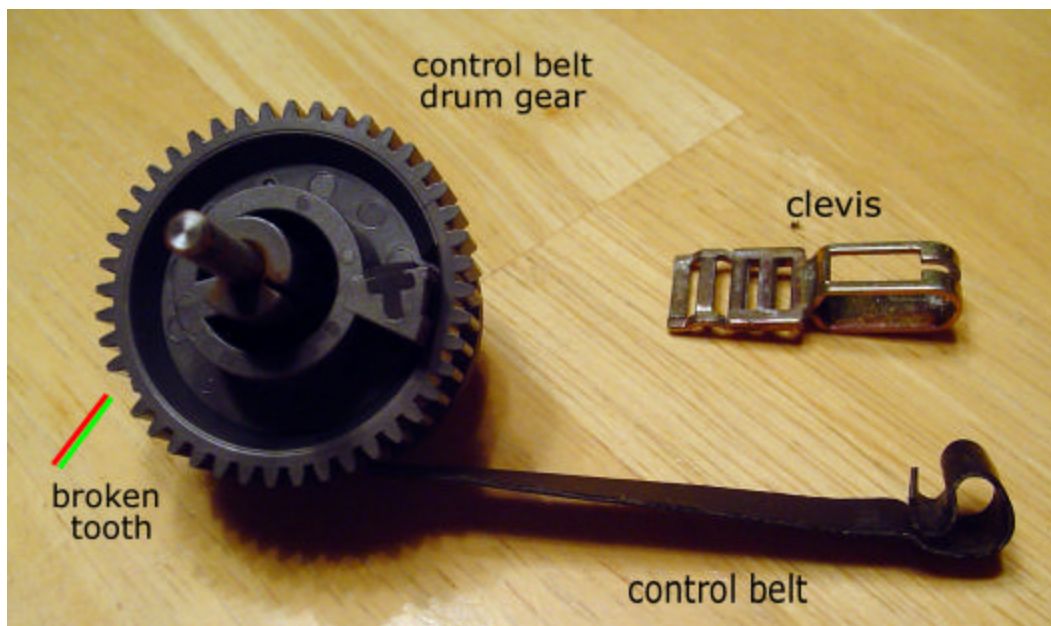
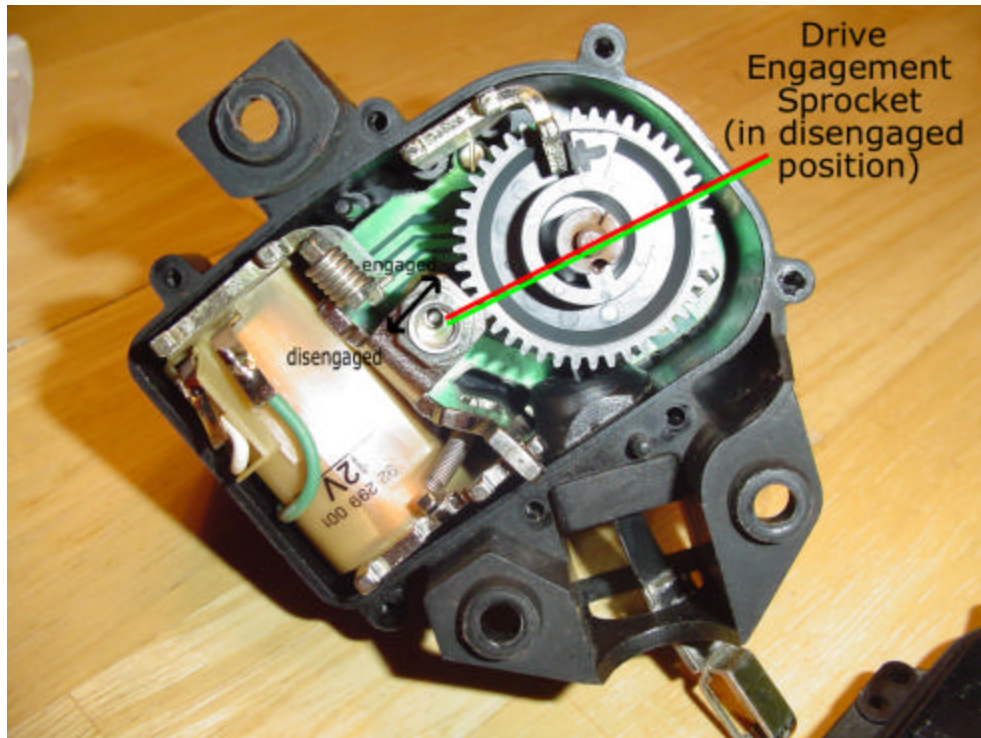


Figure 20 - Detail of control cable drum gear showing broken tooth

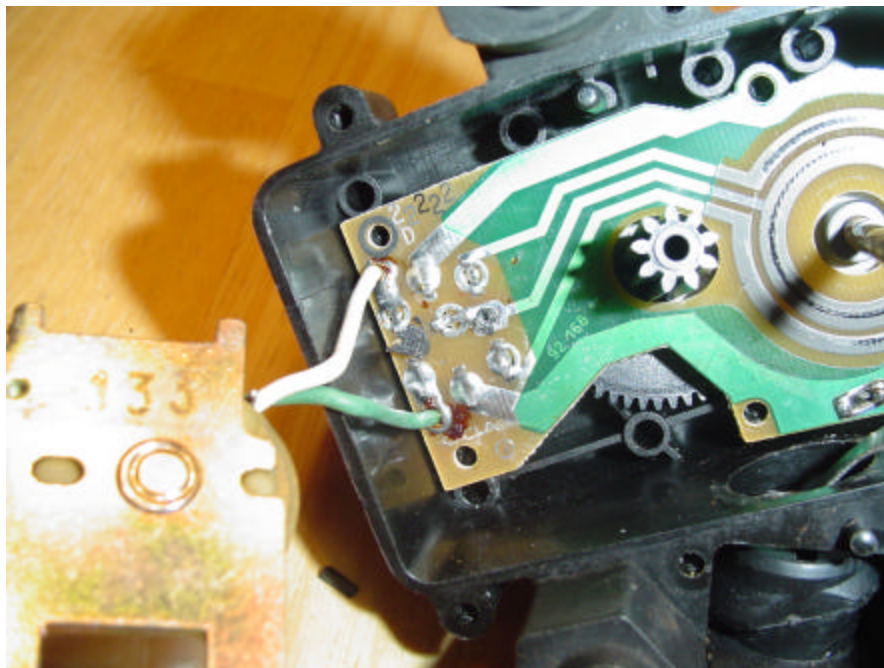


## Disassembly



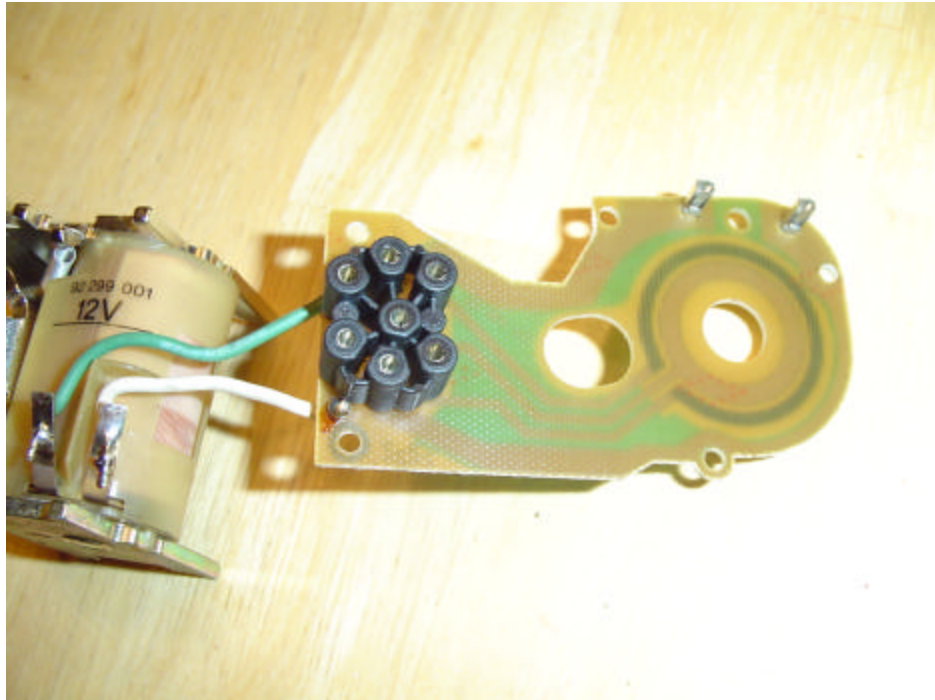
**Figure 21 - Detail of drive engagement sprocket**

The drive engagement sprocket is disengaged when the solenoid is de-energized. When disengaged, the control belt drum will turn freely. This allows the control belt to pay in or out. The retraction spring (not shown) eliminates slack.

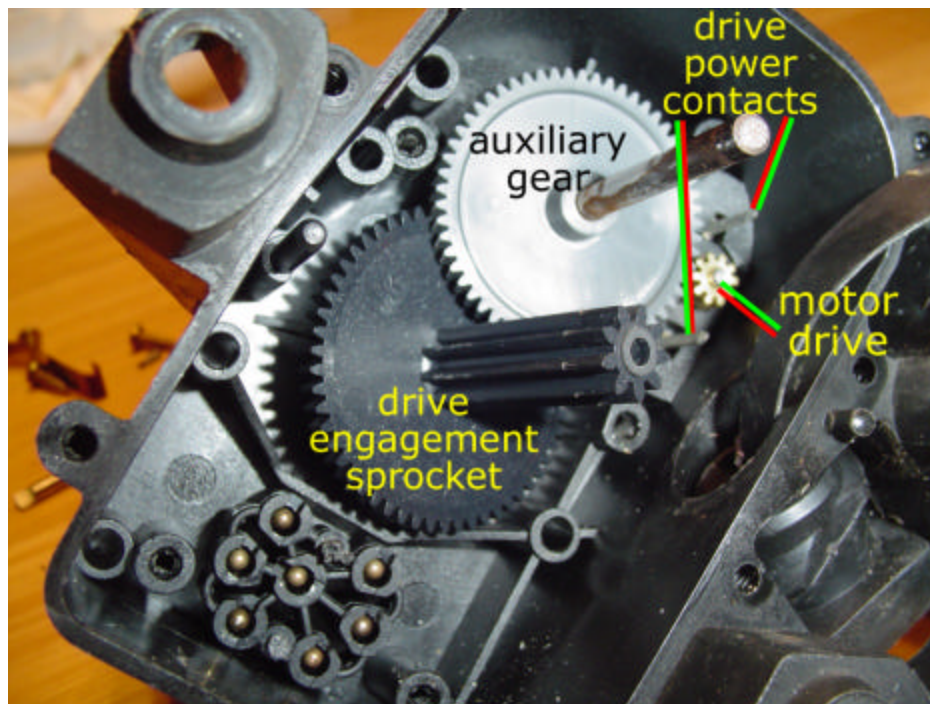


**Figure 22 - View of circuit board with solenoid removed**

## Disassembly



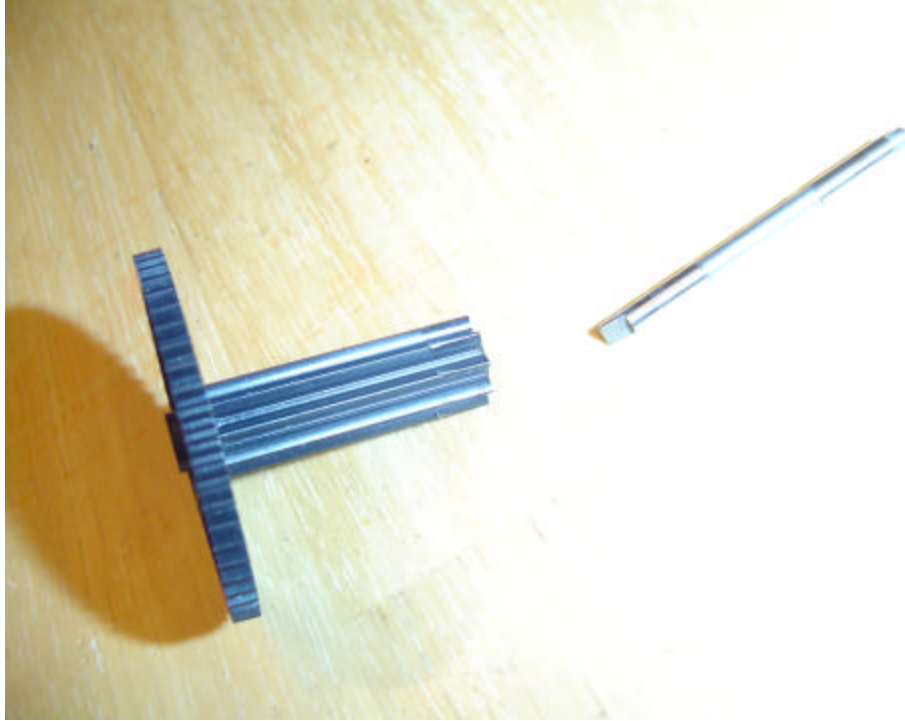
**Figure 23 - Circuit board and solenoid**



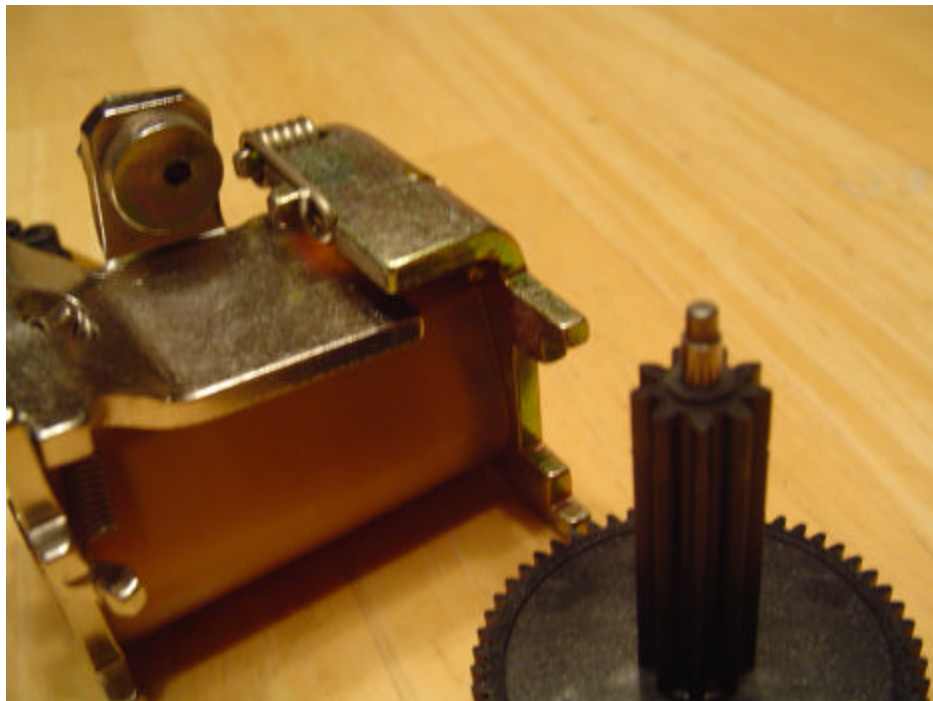
**Figure 24 - Drive engagement sprocket and motor drive**

When the circuit board and solenoid are removed, the drive engagement sprocket and motor drive with auxiliary gear are revealed.

## Disassembly

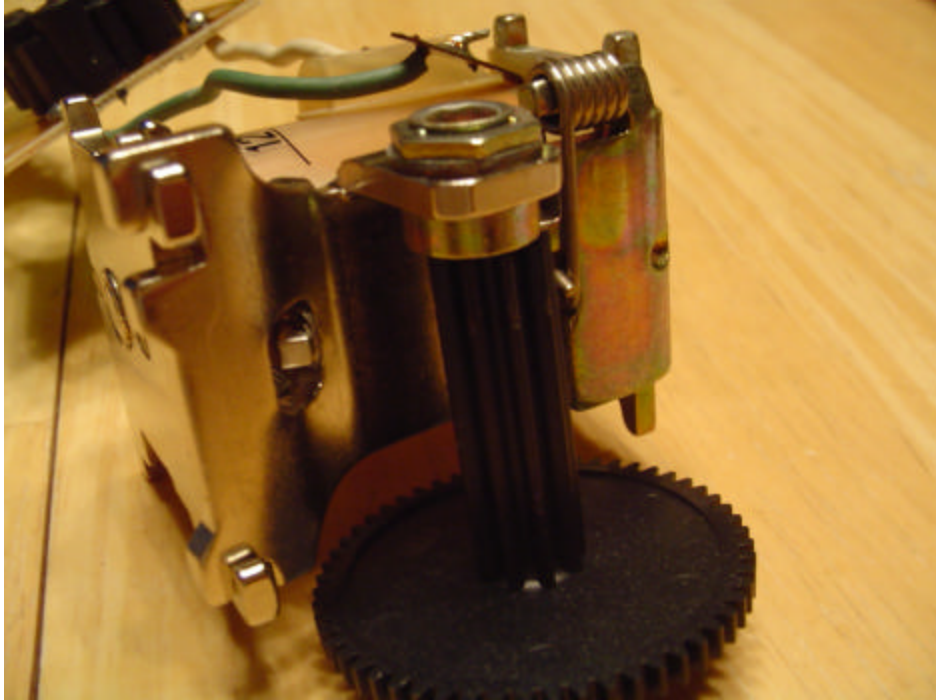


**Figure 24 - Drive engagement sprocket and shaft**



**Figure 25 - Solenoid and drive engagement sprocket**

## Disassembly



**Figure 26 - Solenoid and drive engagement sprocket (partially reassembled)**

## Actuator Removal

The cruise control actuator is easily removed from most E34 vehicles. For these vehicles, the actuator is located on the top of the engine compartment next to the power steering reservoir.



Figure 25 – Typical E34 mounting (non-540i)

On E34 540i's, the actuator is located below and in front of the brake pressure booster. This makes it difficult to remove the actuator.

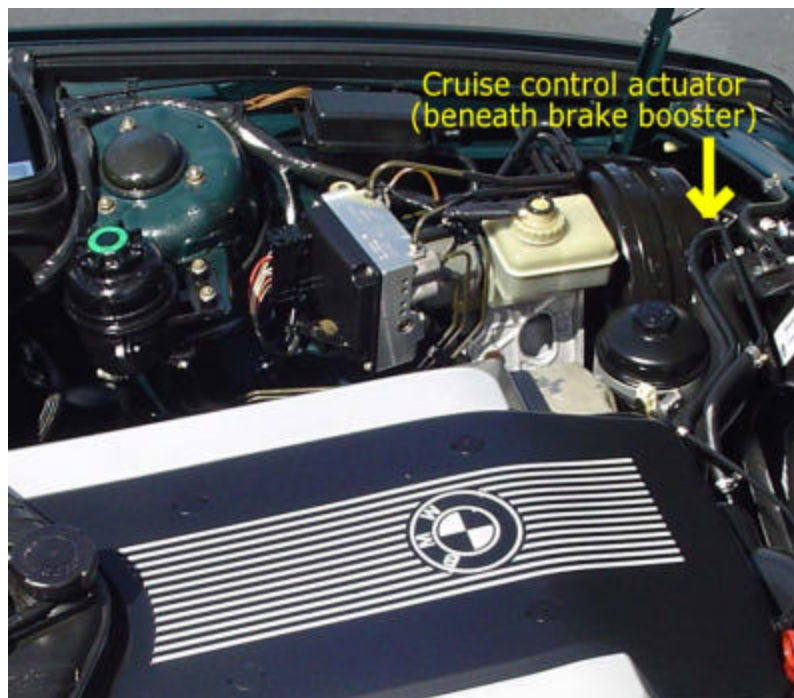
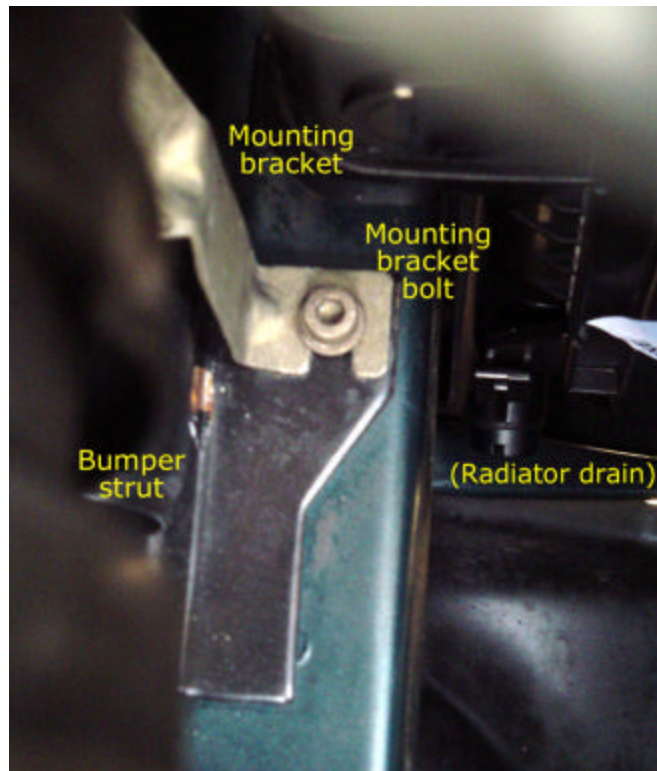


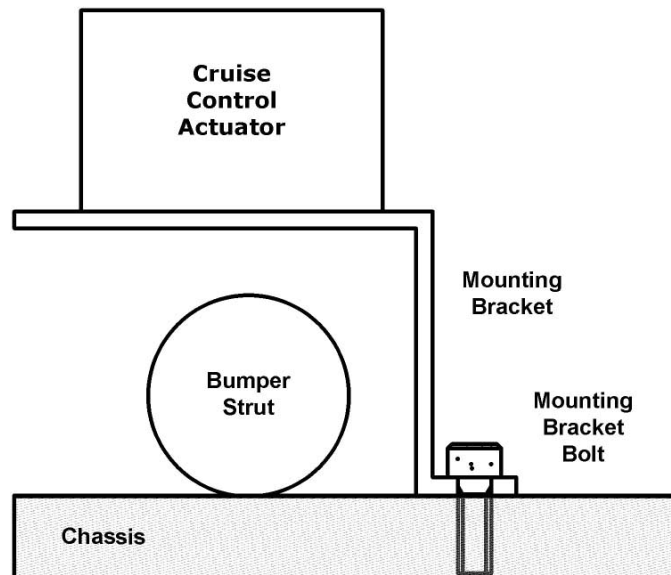
Figure 26 - Cruise control mounting on E34 540i

## Actuator Removal

A complex option is to remove the front fascia and headlight. A simpler method is to remove the mounting bracket bolt which holds the mounting bracket to the chassis.



**Figure 27 - Overhead view of mounting bracket**

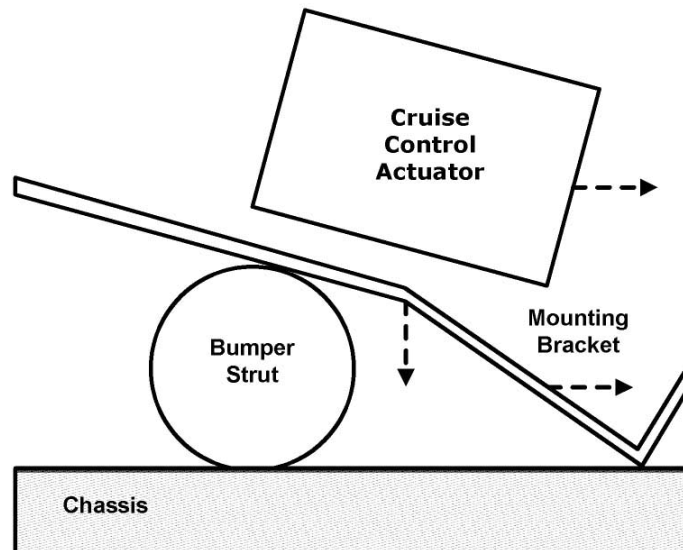


**Figure 28 - Elevation view of mounting bracket**

The mounting bracket may then be temporarily bent. This allows space for the actuator mounting screws to be removed and for the

## Actuator Removal

actuator to be slid out from under the brake pressure booster and alongside the radiator.



**Figure 29 - Elevation view of temporarily deformed mounting bracket**

Please note that the space will still be very tight. There will be a need for some maneuvering of the actuator before it will slide out.

## Circuit Board Pictorial

The Cruise Control Actuator has a simple printed circuit board with connections to a potentiometer, motor, solenoid, and eight pin connector. The motor has a measured resistance of 10 ohms and is designed for a 12vdc system. The solenoid has a measured resistance of 33 ohms and is used to engage the motor drive. The potentiometer has a measured resistance of 250 ohms and is used to sense the position of the control cable drum gear.

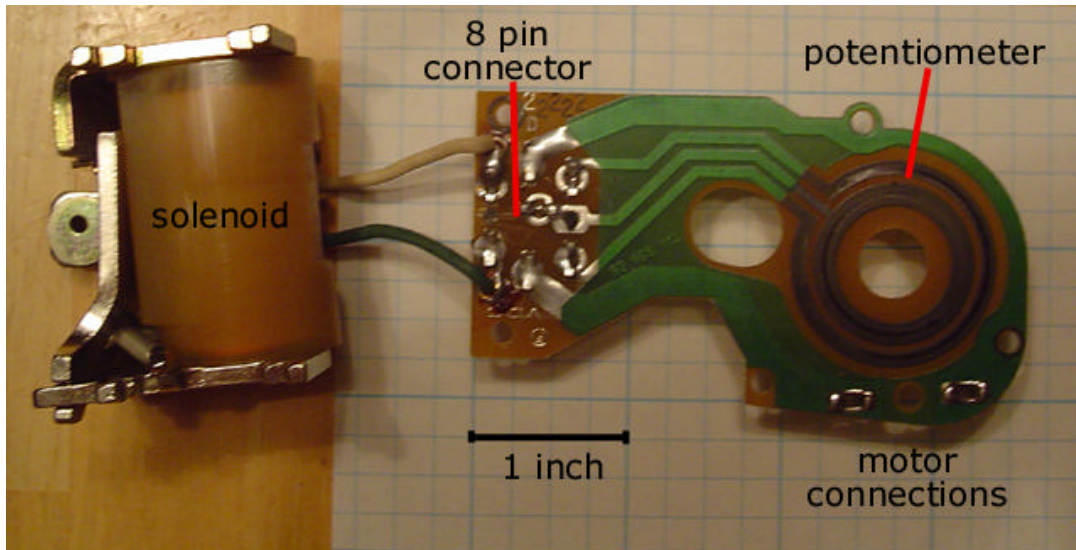


Figure 30 - Actuator circuit board (bottom)

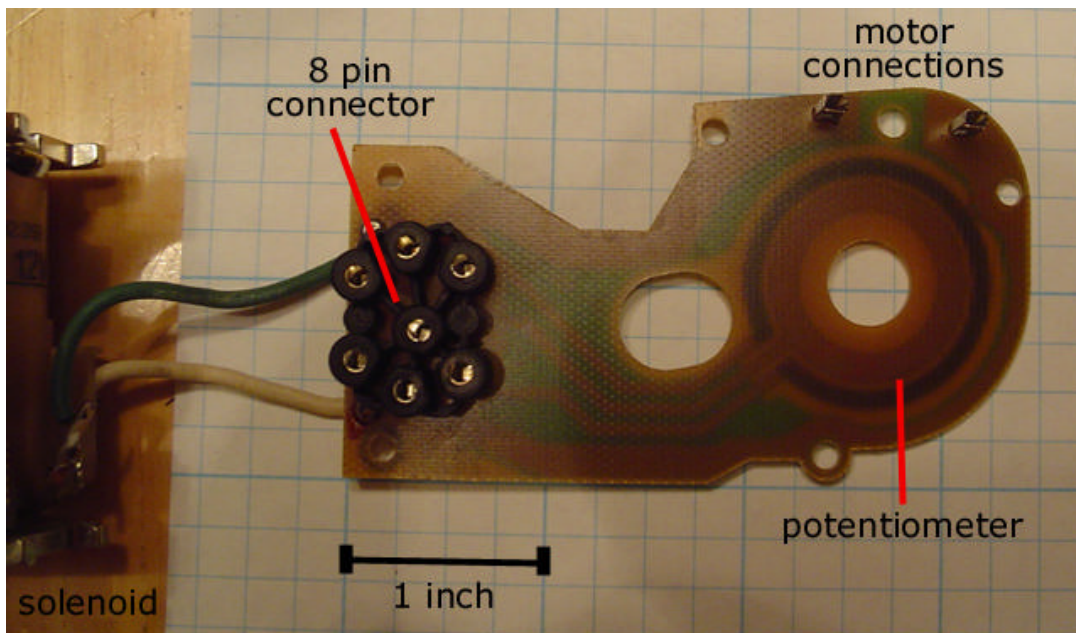


Figure 31 - Actuator circuit board (top)



## Circuit Board Schematic

The cruise control actuator is electrically a simple circuit linked to an eight pin connector. The circuit and the connector are diagramed below.

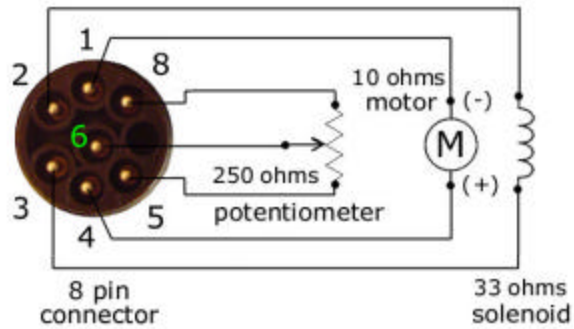


Figure 32 – Actuator Schematic

Actuator 8 pin connector	
Pin	Description
1	Drive motor (-)
4	Drive motor (+)
2, 3	Engagement solenoid
5, 8	Position sense potentiometer
6	Potentiometer center tap
7	Not used

Table 1 – Actuator 8 pin connector