

# Sequential Signals of the 67/68 Cougar

In 1967, the Mercury division of the Ford Motor Company entered into the pony car arena with the debut of its Mercury Cougar. This automobile received much of its styling cues from its sibling in Ford's stall, the Ford Mustang. However, the Cougar was designed to appeal to those that appreciated the performance provided by the Mustang, but with more luxurious appointments. From its hide-away headlights up front, through its more supple interior, to the sequential turn signal system out back, Mercury engineers gave the public what it wanted: luxury with a taste of performance.

Undoubtedly, one of the most distinguishing characteristics of the classic Cougar was its sequential turn signal system. While not the first production automobile to feature this style of turn signal, it is certainly the most recognized. Ask anyone on the street to name a car model with sequential signals, and nine times out of ten, they will answer: "the Cougar". Unfortunately, the 'sequentials' were often trouble prone. We, as devout Cougar enthusiasts, likely know this all too well. I personally own two 1967 Cougars, and I received both of them with non-operable sequential turn signals. Through the knowledge I gained in restoring the sequential signals of these classics to operational status, it is my hope to shed some light on the most common ailments of these systems so that you will not have to endure the struggles that I had endured. I can truthfully say that the reward of watching these turn signals operate once again is worth the effort.

## Parts Overview

Externally, the classic Cougar's turn signal system consists of four dual-filament bulbs on each side of the car. This included one bulb mounted in the front valence panel under the bumper, and three bulbs located above the rear bumper in a horizontal arrangement. One filament of all turn signal bulbs is dedicated to the exterior lighting circuit. The other element provides the turn signal illumination. In the rear, this element also provides for brake light illumination.

On the interior, there are two dash-mounted turn signal indicator lights. Controlling and activating these turn signals are a seemingly myriad of relays, switches, connectors, and wiring. These devices are located both under the dash and in the trunk compartment.

Found in the steering column/wheel is:

### 1. Turn signal switch

- Main controlling point for sequential system. Receives +12 volts input through a 15 A in-line fuse, through which the entire sequential system is powered. Routes this power to various output lines depending on turn signal and emergency flasher switch positions.

Found in a cluster under the dash are:

### 2. Turn signal relay

- Single source of power for either dash-mounted indicator light. Activates much like typical turn signal relays, after enough electrical current passes through it to

heat a bi-metallic strip to the point where it deflects and makes the electrical connection. When turn signals are in operation, all power to illuminate the bulbs flows through this relay.

### 3. Turn signal indicator relay

- Switches the power output from the turn signal relay to the appropriate dash-mounted indicator light. Rest position provides power to the left side indicator. Input signal is required to route power to the right side indicator. This input signal originates from the turn signal switch when the switch is in the right turn position.

### 4. Emergency warning relay

- Provides the link between left and right turn signal circuits when emergency flashers are activated such that both the left and the right turn signal bulbs illuminate. The emergency flasher system makes use of the existing turn signal system.

Found on the driver's side of the trunk are:

### 1. Sequencing motor/cam/switches

- A small electrical motor that, through gear reduction, turns a shaft with three cams at approximately 1 to 2 times every second. This speed of rotation directly affects how fast the signal indicators sequence. There is one cam for each turn signal bulb in the rear.
- Each cam opens and closes a spring-loaded switch. The cams are made such that the switches close at equally spaced intervals, stay closed for a short period of time, and then close all at once. This action directly controls the perceived 'sequencing' of the rear turn signal indicators.
- All three switches, as well as the motor, receive a common power input. However, each switch has a separate output signal that is routed to the directional relay.

### 2. Directional relay

- Large, square metal box with many, many wires. Provides two functions. First, routes the three sequenced outputs from the sequencer motor assembly to the right and/or left side, depending on turn signal and emergency flasher switch position. Secondly, it routes the brake light signal to the same bulbs when turn signal operation is not requested. All eight turn signal bulbs receive their power from this relay.
- Of note is that the center turn signal bulb in the rear physically shares the same signal output from this relay. Thus, the front turn signal and the center rear turn signal bulbs illuminate simultaneously.

### 3. Emergency relay

- Effectively breaks the circuit to the rear inner and outer turn signal bulbs when the emergency flasher is activated. This is necessary to keep the overall electrical load to only four bulbs (the two in front and the two center bulbs in the rear) to avoid overheating system components.

As you can see, the sequential turn signal system of the 67/68 Cougar is very mechanical in nature. As such, it is prone to problems that often plague mechanically based systems of any sort.

## Normal Operation

From the driver's perspective, a Cougar's turn signals are controlled no differently than those of any other typical automobile. A turn signal lever sticks out of the left side of the steering wheel, including those with tilt/tilt-away wheels. Moving the lever upwards activates the turn signals on the right side of the car, while moving the lever downward activates the left side turn signals. The lever locks in either position, and a self-canceling mechanism is in place to cancel the turn signal operation as the driver steers out of a turn.

There is also an emergency flasher switch located on the right side of the steering wheel. Pulling the switch outwardly energizes these flashers. As with the turn signals, the emergency flashers have a self-canceling mechanism.

### **Left Turn Request:**

When the turn signal lever is moved downward, power is routed from the turn signal's input line, through the turn signal relay, and on to the trunk mounted components. First, this power operates the sequencing motor and provides power to the three sequencing cam switches.

As the sequencing motor turns, the three cams open and close their respective switches. This operation can often be heard in the passenger compartment, particularly when all three switches simultaneously open to turn off all three lights in the rear. The output signal from each switch is sent to the directional relay, where it is switched to the inputs to the left-side lights, including the front light. Each light illuminates as it receives power.

An additional left-turn electrical signal is sent to the trunk to select the left side circuitry in the directional relay. When either the left or the right side of the directional relay is activated, it physically connects the outputs from the sequencing switches to their respective turn signal bulbs. In the course of making these connections, the normal connection to the brake light circuitry is disrupted.

Situated between the directional relay and the sequencing motor is the emergency flasher relay. When a left or right turn is requested, this relay is energized and completes a circuit that feeds the directional relay for the inner and outer rear bulbs. When not energized, this relay disrupts this signal, causing the inner and outer rear bulbs to not illuminate.

Since all power to operate the sequencing system and lights flows through the turn signal relay, the relay will heat up with each sequencing cycle. This relay is calibrated to heat up enough to deflect its internal bi-metallic strip and complete a separate circuit to power the interior turn signal indicator lights. The strip will quickly cool off after all three sequencing switches turn off, and the dash-mounted indicator lights will then extinguish.

### **Right Turn Request:**

A right turn request is handled virtually identical in nature to a left turn request.

In addition, power is applied to the turn signal indicator relay such that the output signal from the turn signal relay will illuminate the right turn indicator in the dash instead of the left indicator.

### **Emergency Flashers :**

Operation of the emergency flashers is integrated into the Cougar's sequential turn signal system. When the emergency flasher switch is pulled, the sequencing system operates as it normally does, with the following exceptions.

First, the emergency warning relay under the dash is energized. This electrically connects the control inputs into the trunk-mounted directional relay such that both the left and the right side turn signal lights are illuminated.

Secondly, the trunk-mounted emergency flasher relay is not energized. Thus, the inner and outer turn signal bulbs do not receive power, even when their respective sequencing switch provides power to that light. Thus, only the center bulb in the rear receives power. Because the front bulb is physically wired to the center rear bulb, the front bulb will also illuminate at this time.

The sequencing motor operates as it does for a left or right turn, and this operation can be audibly verified.

All in all, four bulbs are still illuminated when the emergency flashers are in operation. Thus, the current draw through the turn signal relay is equivalent to normal turn signal sequencing operation, and should still be capable of operating the dash-mounted turn signal indicators.

### **Common Failures**

Yes, bulbs! They do occasionally burn out. Always start any diagnosis by inspecting bulbs and their sockets. Try swapping bulbs between sockets to isolate failures. Usually the cheapest repair.

These classics are now over 30 years old. Like their human counterparts, they are prone to the effects of old age. Wires may become pinched and break internally. Corrosion may develop in exposed connectors, particularly if you live in a humid environment. Many components are needlessly replaced due to faulty wiring or connectors. If possible, verify the integrity of suspected circuits using a test light and/or an ohmmeter. Clean suspect connectors of visible corrosion. Replace if necessary.

An inherent design 'flaw' in the Cougar's sequential turn signal circuitry is its single source of electrical power. All of this power flows through the turn signal switch itself. As much of the switch is plastic in composition, it is not uncommon for the switch to get warm enough during 'normal' operation to physically deform the switch. Often times, this deformity is enough to result in poor or non-existent electrical connections. Thus, the turn signal switch is a primary source of problems.

Thankfully, these switches are still being manufactured.

Both of my 1967 Cougars required replacement of its turn signal switch. It's amazing what a difference they made!

If you do need to replace it, you will likely need to keep your existing connector under the dash. Make sure you take notes on the wire color coding when you remove each wire from the original connector. You'll be glad you did!

This relay is supposedly calibrated at the factory to cycle power to the dash-mounted turn signal indicators when a preset amount of electrical current has flowed through it. This is certainly one area where the design of this system required all aspects of the system to work in very near ideal condition. If enough current does not flow through this relay, it will not cycle. The result are dash indicators that do not cycle on and off. Rather, they often stay dimly lit, and often get dimmer as each of the three bulbs in the rear sequence on, then brighter again when all exterior bulbs turn off.

Poor electrical grounding is often a contributing factor if this symptom occurs. Make sure all electrical grounds in the system are in good shape. There are grounds in the trunk, under the dash, and under the hood. Don't forget to check the engine-to-firewall ground strap!

Failure of this relay will merely result in only one, or neither, of the interior turn signal indicators to light. However, very little current flows through these relays, and they are not likely to fail.

I have not encountered any problems with either of mine.

Failure of this relay will result in only one side of the turn signal lights flashing, as its function is to command the directional relay to enable both sides of the turn signal system.

This device can have multiple failures:

**Motor:** The motor should rotate the camshaft when energized. If it does not, the lights will absolutely not sequence. You can easily remove the plastic cover over the cams and switches to verify if the motor is working. If the motor is not working, check if it is receiving power at its single wire input. If not, check the upstream circuitry, leading up to the turn signal relay under the dash.

**Cam :** Nothing can really go wrong with the cam itself, unless it somehow loosens from the motor's shaft. It may be possible that there is too much friction between the cam and its switches, resulting in slow sequencing action. Light lubrication helped in my case, although I am not sure what I should use for this application. It cannot be anything that will 'run' as it warms up, as it may contaminate the switches. But it can't be too thick at cold temperatures. Possibly a graphite-based lubricant?!?!?

**Switches:** The switches may cause problems if their contacts are dirty or burned. I had problems in this area and removed each switch and cleaned it up with a thin nail file. Take care when cleaning the contacts to avoid bending the switch or losing its spring. Make sure you replace the spade connector onto the correct switch if you remove them.

My first 1967 Cougar had problems in this area, compounded by the fact that a previous owner was a better butcher than electrical circuit repairman.

Due to its many internal connections, this relay can be particularly problematic. If only one side appears to light, the respective internal relay for the affected side may not be functioning or may have dirty contacts. This relay's metal shell can be removed by carefully bending the tabs that secure it. Note that there is a soldered connection on one of the tabs that you may need to resolder if it becomes disconnected. After shell removal, the contacts can be inspected and cleaned if necessary.

If brake lights only seem to work on one side, dirty contacts within this relay may be to blame.

Nowadays, electronic replacement parts are manufactured to replace these mechanical nightmares found in the trunk, and can be had relatively inexpensively from most Cougar vendors.

Failure of this relay usually affects the inner and/or outer rear turn signal lights. This relay normally breaks the circuit to power these lights, so a non-functioning relay will result these lights not illuminating.

It could be possible, although unlikely, that this relay could get stuck in its 'on' position, prohibiting normal emergency flasher function by illuminating all six

turn signal bulbs in the rear. While this may appear attractive, it could easily overload the turn signal components, particularly the turn signal switch in the steering wheel, causing it to fail prematurely.

## Recommendations

First of all, a general knowledge of basic electric circuit analysis is always a plus. A +12v test light comes in very handy when troubleshooting these circuits, and I certainly recommend getting one. However, circuits cannot always be tested using only a test light. I always prefer to use a volt-ohm meter, either digital or analog in nature, preferably one with an input impedance above 1M ohms.

But most of all, I could not have accomplished any of what I did without the aid of the factory service manual and its accompanying wiring diagrams. A classic Cougar's sequential turn signal system is very complicated, and can be confusing even after you think you understand how it works.

Submitted by Steve Citrone

Vice-President

Arizona Cougar Club