Part III

The Holy Grail of Traffic Signals

With restoration of an iconic traffic signal well underway, it’s time to finish the job

An Acme traffic signal does its job in the background as a citizen celebrates the end of World War II by waving a newspaper with the banner headline “Peace” at the famous Hollywood and Vine intersection.
Robert D. Rentzer

With the street pole and base completed and with the parts refinished, now came the task of wiring, rewiring and reassembling. A hole had to be drilled in the thick steel base plate to accommodate an electrical cord, which would be run up through the pole to reach the motor that ran the signal. The motor and mechanical parts that drove the arms were mounted on a cast-metal block that fit into the top housing that had been removed when it, too, went to the plater. Those parts had to be separated and individually degreased.

The motor, a G.E. model exactly like those powering early electric fans, had to have its internal wires replaced, but I was able to avoid an expensive complete overhaul and rewinding of the motor coil, which a motor shop claimed was needed. Thanks to the same friend who labored beside me throughout the project — John Long of Star Systems (sstec.com), who was both a mechanical and electri-
cal master and a computer programming genius — the motor was brought back to life. John also worked on the other internal parts, including two little oil cylinders that provided lubrication for the internal shaft at the front and back of motor. He even took the cylinders apart to confirm they had oil. The motor was then returned to its rightful place, along with the arm mechanisms and brake device inside the mounting block, which was then fitted back into the top of the Acme.

Next, the oil trough had to be checked. Doing this, we discovered an anomaly. The oil trough, which contained saturated horsehair padding to retain the oil, had a strange pinhole at the top lip of its wall, which ran down inside the entire length of that wall and let out to the exterior. There was no discernible purpose for this, unless it was some sort of breathing shaft. But even more curious were two holes where the trough sat mounted on a gasket above the worm gear. Oddly, those two holes were not accessible once the trough was mounted in place. Perhaps one of Antique Trader’s faithful readers can explain this odd setup.

With all the labor-intensive work completed, what remained was the highly technical job of finding a way to power up the Acme. While some units had a complex control box on the pole, modern technology has allowed an entire control to be put on a small circuit board mounted inside the top of the signal.

Making that board was an unimaginable task. Not only did my friend, John, need to cut the mounting board to fit; conceive all the relays, capacitors, resistors, diodes and chips needed to then build it; and wire it, he also wrote five pages of computer code to program the main chip, which served as the brain. And, for extra fun, in place of a simple on-off switch, John integrated a small remote control that offered multiple functions, so that all the signal’s features, red and green lights, amber blinker, arms and bell could be operated individually or in any combination. That way, he said, I could set the signal to work just as it once did, the arms working 10 hours per day and retiring at dark, the amber light blinking 10 hours a day, from late night to early morn, and the red and green lights to come on at dark and to remain on for four hours. He also integrated a feature for the bell, all depending on which of the two buttons I pushed on the remote and the number of times I pushed them.

During the process, all the internal wiring needed to be replaced — the old cloth-covered electrical wires were dangerously frayed — and the new wires needed to be run from the newly installed circuit board down to the lights and further down to the bell.

Finally, before placing the lenses back in place, the lights had to be tested. The original bulbs all still worked and were a special type designed just for use in traffic signals, so as not to require constant replacement. Those special bulbs, I learned, were soon to be banned for sale, so I found a source and purchased several extras. That proved to be unnecessary, because, even there, John made an improvement. He changed the way current reached the devices so there was no surge each time a
light came on, significantly extending the life of the bulbs, which may now last as long as I do!

My Acme was made operational Nov. 24, 2010, the day before Thanksgiving, which gave me a lot to be thankful for. But I still was not done.

What task remained? Obtaining and installing the correct bird spike. The reproductions all had a fantasy bird spike that looked more like a bird bath then a bird spike. Although my original Acme had been fitted with a correctly styled one, it was made of wood, but it should have been aluminum. It is believed Acme used wooden bird spikes as finials when street signs sat atop the signal and the spike had to be put above those street signs. The sales manager of Orange Empire Railway Museum acknowledged having acquired surplus Acme parts, among which were two wooden bird spikes.

In my quest to replace my wooden bird spike with the correct aluminum one, I was fortunate enough to get assistance from the owner of the Deer Park Winery and Auto Museum. So, after starting the project on March 25, 2009, my Acme was fully restored just before Christmas 2010.

The photo from the April 6, 2011, edition shows my Fisk sign, which began my odyssey, mounted behind my completed Acme Semaphore signal standing proudly in my game room, mid-phase, with arms crossing each other.

But what the cover cannot show is how, with each signal change (every 30 seconds), the bell proudly offers its echoes of the past.

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Collector Robert D. Rentzer wanted to offer up all the technical aspects of the Acme signal restoration for those who are interested in it and understand it. John Long, the electronics engineer who programmed the Acme, shares his take on the restoration efforts. — Editor

By John Long

Because of the importance of this restoration, I intended that it would be done the right way and in a deluxe way, if possible. To do the job right would require more than just timers and circuits, it would take a microcontroller. That is a specially purposed microprocessor with what used to be many different chips rolled into one, used for controlling gadgets and devices. Most of the original wires had been sloppily replaced through the years, and finding new cloth-covered wire was a bit much. Luckily, I had four rolls, about 1,000 feet each, of 40-year-old wire of colors that matched the function for the motor and the lights in the Acme — white, black, red and green wires. The original oil-soaked and frayed wires from the motor were carefully replaced at their soldered points to the field and brushes, the commutator cleaned and old brushes replaced with new.

The original Acme was wired as chassis neutral, which is not proper in this day and age or then, actually. If it was ever connected to an improperly wired outlet, the chassis would become dangerously hot. This was corrected by re-wiring it to be chassis ground and common neutral on the base wiring block, above the amber light in the lower cast assembly. The bell and all lights were rewired with this new old stock wire. The hot sides of all the relevant circuits were run from there to the upper cast assembly, where the specially designed circuit board with microcontroller was to be located. Those wires were hot, neutral, ground, red, green, amber and bell. The brake coil, which was also improperly wired to the frame for one of its terminals, had new leads installed and was rewrapped, replacing its frayed cloth covering. I also added a female/male AC plug to the power wire in the pole below the lower cast assembly to allow easy disconnection for removal of the Acme from the pole.

The microcontroller (the brain) can be seen mid-left of the circuit board, adjacent to the date of this Acme stamped into the casting (8-29-51). I included a small neon light next to the fuse and power supply signifying live AC. The blue coiled wire is the antenna for the remote receiver. There were many factors that required consideration in the physical, electronic and program design of this controller. One of the most troubling was how to control the Acme without cutting or drilling into it for switches or buttons. The replicas had an ugly wired box on the power cord, and that was out of the question for an original Acme. I first considered a small touch pad to be placed on the side of the Acme with double-stick tape, but that would be awkward, not remotely controllable and might damage the powder coat finish. I finally resolved the issue by using a repurposed two-button remote control, which now provides for five functions: on; off; change state; toggle bell on/off; and park the arms and shut down using the brake. Additional functions or changes are a simple matter of rewriting code, then reconnecting my computer and uploading the new code.

Providing for the initial intended operations required just more than 300 lines of custom C code to be written. There are eight outputs and three inputs to the processor, and the code complexity was actually somewhat routine, once I got over some hurdles on this particular processor. Although I have been designing and coding for more than 30 years, it had been 26 years since I used to do similar design and coding for devices like this. The hard part was how to stay live and responsive to remote input changes during the long delays without the use of interrupts or internal timers. Since I was under the gun to get this working before Thanksgiving (I only had about a week to learn the processor and write the code) and the data book references on those are a bit Greek, it was a luxury I did not have. For this first version, I resolved the problem with some re-entrant coding tricks.
The next version will add in interrupts and possibly use the timers for the delays.

Zero crossing solid-state relays were used to minimize a pesky relay clicking noise, as well as to prevent a voltage spike each time the lights were switched on, which should increase bulb life tenfold. Five neon lights were used to test and code the microcontroller on the workbench without the benefit of the Acme. It was a thrill to see the Acme correctly functioning and working as intended the very first time it was powered up, and that included the motor direction governing the deployment of a stop or go arm relative to whether a red or green light came on. That was a lucky 50/50 guess. I had no motor on the workbench, so coordinating it was entirely hypothetical for me until it actually worked. The only changes made after installation were for timing considerations: from 9 to 28 seconds for the cycle time, and the reversal of two lines of code to correct a minor error, affecting only the bell toggle option, resulting from a late-night mad coding spree. This initial success should be unheard of, because it was more than a year since I began conceptualizing, first ran the replacement wires, envisioned the design and began the research as to the hardware and software needed. The four wire bi-directional motor drives a worm gear through a coupling, which turns the gear-arm mechanism. Each arm gear is driven in opposition to the other through an intermediate shaft and gear for the reversal. A friction clutch is on these arm gears, next to each counterweight. This allows the arms to stop in their movement without forcibly locking up the motor. I added in a current sense for a closed-loop feedback to detect when the motor had driven the arms to their extent, thereby relieving any undue burden on the parts.

A major selling point for this system, according to the 1931 manual, was to lower electricity usage for the city of L.A., vs. running streetlights 24/7 for each signal. Originally, it was supposed to run with the arms during the day, switching to red and green lights during the evening and finally switching to just the blinking amber light late at night until dawn. Because of the design, where both arms move in opposite directions and concurrently, one arm will always be out when the other is down. In order to park both arms — for the light only operation — there is a brake mechanism in the Acme. When an arm is down and its counterweight is up, there is a notch in the arm gear hub that is for the brake. If the brake (the solenoid at the nearest end) is activated, then that pushes a bar down, which then locks the currently down arm in place. Then the motor is activated in the next logical direction, which pulls the other arm down whilst slipping the clutch on the held arm, effectively parking both arms.

This project was an exciting challenge, which proved to be both fun and a valuable learning experience.

Robert Rentzer started his career as a television actor under the name Bob Dennis and later joined Broadway productions. While raising a family, he launched a successful law career and formerly served as a deputy district attorney and prosecutor in Los Angeles. Now in private practice, Rentzer is credited with taking on high profile cases, including representing Rodney King and participating in both the Los Angeles and Las Vegas O.J. Simpson cases. Rentzer is also an author whose latest book stands ready and waiting for a publisher. He may be contacted via his website, www.lawcal.com.
John Long, owner-operator of Star Systems Technologies, programs the restored Acme. Based in Tarzana, Calif., Long’s company offers electronics design and analog, digital, microcontroller and multi-language programming, in addition to UNIX system administration and webmaster services.
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