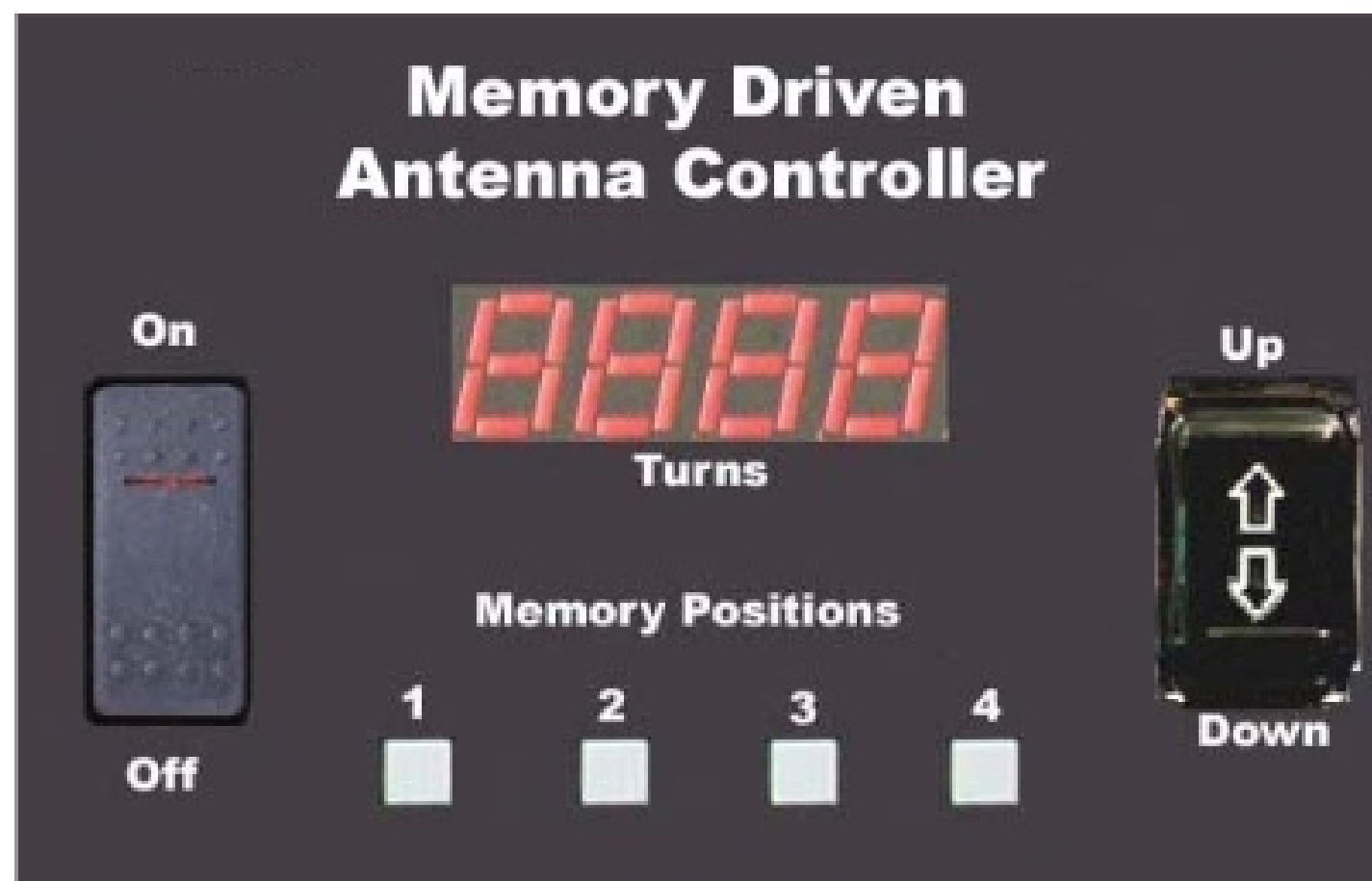


Memory Driven Antenna Controller
submitted to:

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EXECUTIVE SUMMARY

The popularity of mobile amateur radio operation has grown in the past few years. The increase in mobile operation introduced the multi-band screwdriver antenna to the amateur market. Today, amateurs are adopting the use of the screwdriver antenna for mobile operation. In order to use the screwdriver antenna, an operator needs an external controller to position the antenna. Current controllers do not offer the ability to automatically recall previously tuned antenna positions. Early screwdriver antenna controllers required the user to manually tune the antenna to a resonant frequency. These controllers require constant monitoring which creates a safety hazard by distracting the driver and extending the hazard to other drivers around the operator.

A solution to this problem is to develop an automatic memory-driven screwdriver antenna controller. The need for automation introduces four key design constraints. The overall goal of the memory-driven antenna controller is to accurately tune the antenna, so it must return to a specified position within ± 2 inductor turns. The controller must contain non-volatile memory to accomplish automation. Since the controller is in a vehicle, it must operate over a wide range of temperatures ranging from -40°C to 80°C . In addition, the circuit must operate from varying voltages in vehicles. The supply voltage must be regulated to five volts with an error of ± 5 percent.

The design is composed of five main components: a seven segment Light Emitting Diode display (LED), voltage regulator, microcontroller, relays, and memory. The LED display shows the number of turns counted by the microcontroller. The voltage regulator maintains a constant five-volt supply, which is based upon voltage requirements for the microcontroller, memory, and display. The microcontroller receives a signal from a sensor mounted inside the antenna, which allows it to keep an accurate count of the inductor turns. The relays allow the microcontroller to move the antenna motor to a specified position. The memory stores programmed positions as well as the current position, which allows the user to utilize the recall mode. In order to use this mode, the user first tunes the antenna to a desired frequency by using the controller's manual adjustment switch. Once the user tunes the antenna, the position of the antenna can be saved by holding the desired memory button for approximately two seconds. The recall mode retrieves the saved position to move the antenna to the desired position. In order to maintain an accuracy of ± 2 inductor turns, the microcontroller must account for coasting with the motor's momentum. After the antenna halts, the position automatically saves to memory. If the power cycles on and off, the controller restores the last known position.

In order to ensure the controller meets the key design goals, the memory buttons were programmed with antenna positions that represent different bands in the HF spectrum. The controller restored these positions accurately to within ± 2 inductor turns. The voltage regulator was tested with the varying voltages with a range of 8-16 volts, and the regulator falls within the given constraint of ± 5 percent of the five-volt output. Because of the electromechanical nature of the relays, the life of the controller is seriously degraded, but new designs are being researched to extend it.

In order to become a viable product, a strict budget is in place for the prototype costs. The maximum amount of \$30.00 is allotted to create a working prototype. With the current estimation of parts for the design excluding the packaging and circuit board, the approximate cost for building the prototype is \$18. The memory recall process is a unique feature in this type of product and decreases the risk of distracting the operator while driving. Ultimately, the memory-driven screwdriver antenna controller is the perfect choice for the mobile amateurs who use a screwdriver antenna. It will be a very competitive product in the market by introducing new designs and features desired by mobile amateurs.

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