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# The QRP Accu-Keyer

The Accu-Keyer is a low-cost TTL integrated circuit keyer having many features comparable to those of many high-cost commercial keyers. These features include: self-completing dots and dashes, dot and dash memories, iambic operation, dot and dash insertion, and automatic character spacing.[1] The Accu-Keyer was first described in the August, 1973 issue of *QST*. However, that keyer used TTL circuits which are not compatible with QRP operations. The QRP Accu-Keyer is a much needed alternative to the original design.

The QRP Accu-Keyer uses an integrated circuit family known as CMOS. CMOS (also known as COS/MOS by RCA) was first introduced during the middle 60's as an extremely low power digital circuit using complementary-symmetry metal oxide semiconductors. The basic CMOS circuit uses complementary, insulated gate FETs, to achieve extremely low standby power – 10 nW per package for gates. This power feature and moderate cost makes CMOS an attractive logic family to consider for QRP operations, where power is at a premium. This is the philosophy behind the QRP Accu-Keyer.

## Design Concepts

Several modifications must be made to the original Accu-Keyer logic in order to incorporate the CMOS family. The basic flip flop design in CMOS differs from that of TTL. The notable exceptions are the set and clear functions. The set and clear functions on a TTL flip flop are inverse logic compared to CMOS functions. CMOS circuits use a logic "one" as a set or reset signal and a logic "zero" as a normal state. This is directly opposite to TTL where a normal state is high and a set/clear command is low. Therefore, it is clear that to convert a TTL logic diagram to a CMOS diagram, all sets and clears must be inverted.

Another difference between the two families is that of supply voltage. TTL requires a rather critical supply source near 5 volts in order to function properly. CMOS, on the other hand, will work properly with any supply voltage between 3 and 15 volts, and the supply regulation is non-critical. This means that the keyer will operate directly from the batteries which power the QRP rig, without any regulation needed. This is an excellent feature of CMOS over TTL.

## QRP Accu-Keyer Circuit

Fig. 1 shows the schematic of the QRP Accu-Keyer. There are several differences between the QRP version and the original design. A CMOS astable clock was designed so that discrete components could be held to a minimum. IC8 is connected as a typical astable, producing a square wave output. The output period is equivalent to one time unit in Morse code. Secondly, since the keyer is used with a QRP rig, HW-7 in this instance, the output driver needs to be only a low level transistor switch. This greatly simplifies the output stage of the keyer. Driving a higher power rig would only require the inclusion of a suitable output transistor after Q1. Thirdly, as previously mentioned, all set/clear lines on the type "D" flip flops must be inverted when using CMOS in the original circuit.

## Construction

Only eight CMOS circuits are needed for this design. The ICs were mounted in sockets for ease of construction. The sockets were

[1] Garrett, "The WB4VVF Accu-Keyer", *QST*, August, 1973, p. 19.

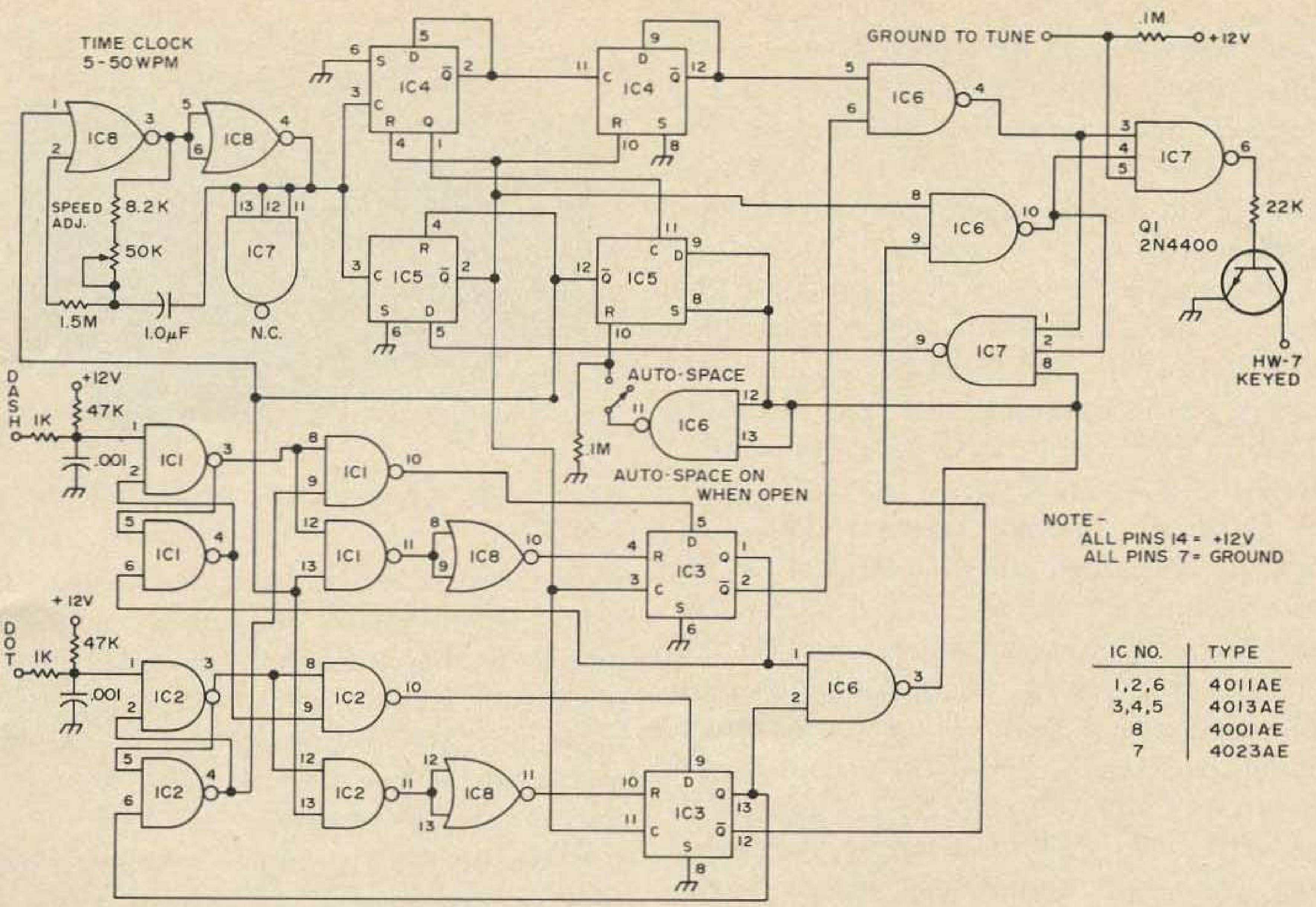
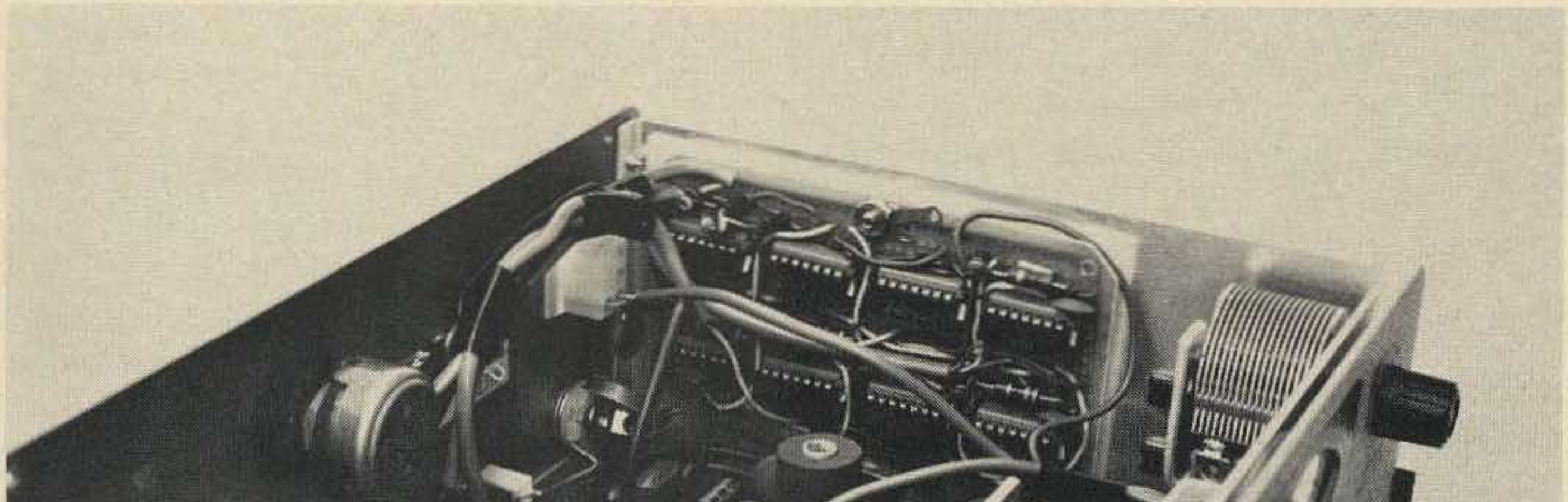



*Fig. 1. Schematic diagram of the QRP Accu-Keyer using CMOS integrated circuits. Output transistor is sufficient to drive a HW-7 QRP transceiver. Standby power is less than a microwatt.*

first mounted on a perforated board and then hard-wired together with small solid hook-up wire. No special precautions are needed when working with CMOS. However, it is recommended that CMOS not be in the circuit when using a soldering iron with an ungrounded tip. CMOS are now presently being made with diode protected inputs, and

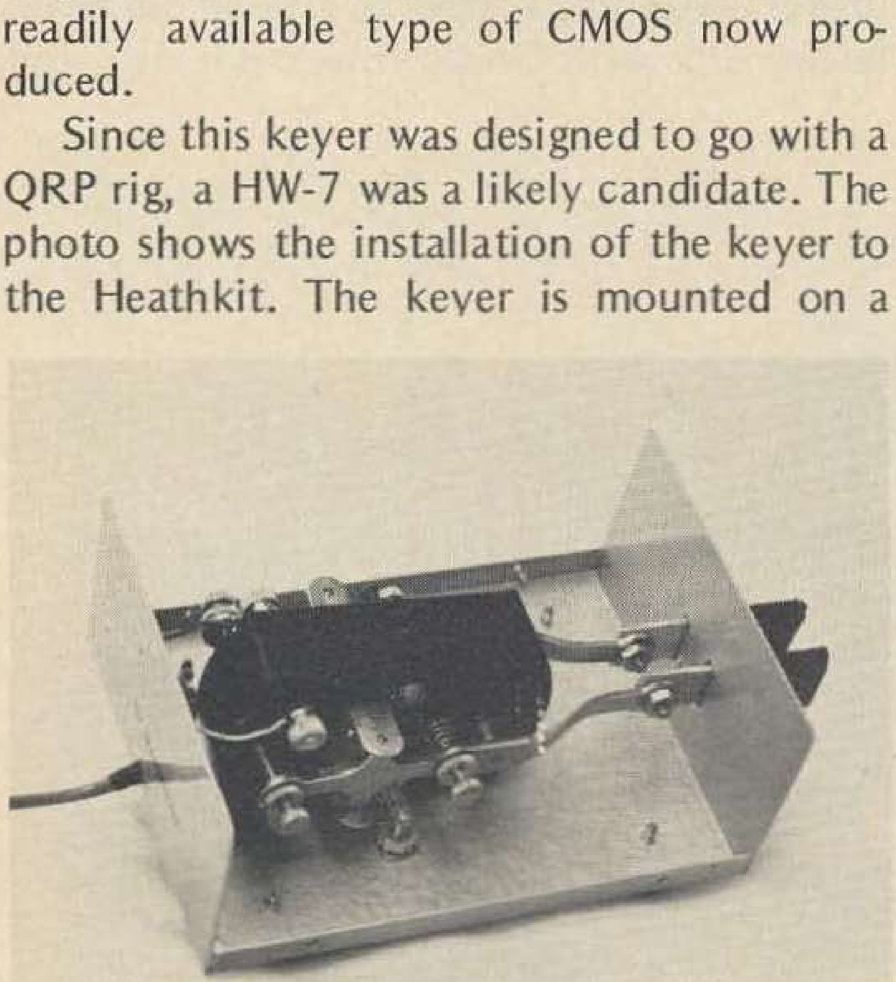


*Inside photograph of HW-7 with keyer board in place. Placement of the keyer board is non-critical inside of the HW-7. The associated controls are mounted on the rear panels, as well as a tune button. Three conductor phone jack replaces the usual two conductor jack for the twin paddle key. (Photos courtesy of Robert Baker WA5KVB.)*

can usually withstand a limited amount of abuse, but why take a chance? Bypassing the CMOS supply is not necessary because of the excellent noise immunity inherent in the family. The excellent flexibility and ease of design make CMOS a very attractive family to work with.

There may be some question as to the suppliers of CMOS. There are several surplus advertisers who list CMOS. Allied Electronics and Burstein-Applebee also list CMOS in their current catalogues. Generally, the D flip flops are from $1 to $1.50, while the gates are all well below a dollar per package. Although the ICs appear to be more expensive than their TTL counterparts, the power supply requirements and ease of applications should be considered also. There are several nomenclature items which should be stated. The RCA's commercial version of CMOS (4000 series) is listed with the suffix AE, signifying supply voltage of 3-15 volts and commercial specs respectively. The AD suffix signifies 3-15 volts with military specs. The AE version is significantly less expensive than the AD version, and is usually more plentiful on the surplus markets. The 4000 series is the most readily available type of CMOS now produced.

Since this keyer was designed to go with a QRP rig, a HW-7 was a likely candidate. The photo shows the installation of the keyer to the Heathkit. The keyer is mounted on a



*Inside view of the "Siamese" twin paddle key. Two inexpensive straight keys are used, although higher quality keys could be substituted. Box measures 4" x 2" 3/8" x 6" inches.*

*Rear view of the control layout on the HW-7.*

vector board and located in the rear side corner of the HW-7. The keyer is connected directly across the supply terminal since no regulation is necessary. The speed adjustment pot and auto-space switch are both mounted on the rear plate. A tune pushbutton is also included to facilitate the tune-up of the rig. Since a twin paddle is now needed instead of a straight key, a 3 conductor earphone jack is installed where the previous jack was located.

The twin paddle built makes use of two straight keys in a Siamese paddle configuration.[2] Two inexpensive straight keys were bolted together and mounted perpendicular to the bottom of a small utility box. Two small paddles, made from a fiberglass PC board, were then connected to the two straight keys. If a better "feel" is needed, two higher grades of straight keys can be used. However, the original design is quite adequate.

The QRP Accu-Keyer is definitely the answer to the power crisis when working QRP from a battery source. Extremely low standby power can be obtained by using the CMOS integrated circuits. This keyer can be used with any rig if the appropriate driver transistor is installed. I hope these suggestions will be helpful to those who work CW-QRP from a finite power source.


**Additional Reference**

COS/MOS Digital Integrated Circuits SSD-203A, RCA.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[2] Hexter, "The Siamese Paddle", *Hints and Kinks*, Volume Six, p. 66.