

## **TEN-TEC INSTRUCTION SHEET MODEL KR5-A**

The KR5-A is a solid state, integrated circuit electronic keyer incorporating a reed relay as the actual keying component. It can be used to key all grid blocked keying systems as well as many cathode keyed transmitters, limited as outlined later by the 15 volt-ampere contact rating. For high current keying circuits, the KR5-A can key an intermediate power relay. Because of the extremely low contact resistance of the reed relay when closed, (no possible in solid state switches), this keyer is ideally suited to key very low impedance and/or low voltage keying lines, such as those encountered in transistorized equipment.

The KR5-A features self completing dits and dahs, preset weighting for optimum articulation in the most used speed range, an over-ride button switch for transmitter tune-up, QRS sending or emphasis, DC operation from 6 to 14 volt and plug-in PC board for easy servicing.

### **SPECIFICATIONS**

Keyed Output:	Reed Relay; 15 volt-amp contacts, 400 volts max.
Speed Range:	6 to 50 WPM
Time Base:	Keyed to start with paddle actuation
Character Generation:	Self-completing dits and dahs
Weighting:	Dit length increased app. 10 % @ 20 WPM (can be changed internally)
Power:	6 to 14 VDC, 75–140 mA
Paddle:	Single molded plastic with adjustable contact spacing
Semiconductors:	1 Integrated Circuit, 6 Transistors, 10 Diodes
Size (HWD):	2" x 4" x 6"
Weight:	1 lb, 8 oz

### **CIRCUIT DESCRIPTION**

Q1, Q2 and Q3 constitute a relaxation oscillator whose frequency is determined by the RC combination of C1, R1 and the setting of the SPEED potentiometer. The oscillator is keyed to the operating state when either the dit or dah contact is grounded by placing the base of Q2 at ground potential. Diodes D6 and D7 are steering diodes to isolate the paddle contacts from the self-completing circuits once the paddle contact is made.

Output from the relaxation oscillator is applied to the dual flip-flop, IC-1. If a dit is sent, the first section of the flip-flop changes state upon closure of the paddle. The relaxation oscillator remains in the "on" condition because of the low potential applied to the base of Q2 through D2 from output pin 11 of the flip-flop. The high output on pin 10 is applied to the base of Q5, the relay driver, through D2 during this time. With the application of the next timing pulse from the oscillator to the input of the flip-flop, the state of the flip-flop is again changed back to the original. This turns Q5 off and opens the reed relay to complete the dit. During the sending of a dit, the second flip-flop is disabled by application of a low potential at pin 3 from conducting Q4.

The same procedure is followed for a dah, except that when this contact is closed, the second flip-flop is "set" or enabled by applying a positive voltage to the "set" terminal 3 through inverting transistor Q4. Now D2 and D5 alternately keep the oscillator running until the second flip-flop completes its cycle, and D3 and D4 alternately turn on the relay driver transistor.

The outputs from the two flip-flops add to result in a dah. The over-ride switch shunts the collector of Q5 to ground and applies voltage to the reed relay coil. Q6 is a series regulator whose output voltage is determined by the zener diode D10 in its base circuit. It regulates all input voltages between 6 and 14 volts down to approximately 5 volts, which powers all circuits.

## OPERATION

### Controls - Front Panel

POWER:	Slide switch.
SPEED:	Continuously variable between 6 and 50 WPM.
CONTACT SPACING:	Thumb screws on paddle assembly. Dah on the left side, dit on the right side.
OVER-RIDE SWITCH:	Touch button located on top lip of case. Momentary contact type.

### Connections - Rear Apron

TRANS:	This jack is keyed output presenting a short circuit to chassis whenever a character is being sent and an open circuit at all other times. Connect this jack to the transmitter KEY jack. It is advisable to use shielded cable to prevent RF pick up.
6 – 12 VDC:	Power input jack. Connect source of DC voltage between 6 and 14 volts. Center pin is positive, chassis is ground.

### Reed-Relay Contact Protection

Most commercial vacuum tube transmitters and/or transceivers use a form of grid block keying. The voltage present at the key terminals varies from a few volts to several hundred volts. The current being keyed is usually small. The steady state voltage and current are easily handled by the reed contacts. In some transmitters a capacitor is placed across the key line for by-pass purposes. The energy stored in this capacitor is released across the keyer relay contacts whenever the transmitter is keyed. Depending on the circuit constants, the surge current can exceed the ratings of the contacts which may result in welded together contacts. Since this is a high impedance circuit, a small resistor can be connected in series with the keyer relay output to limit the transient current surge to a safe value without affecting the operation of the transmitter. Should relay contact sticking occur, place a ½ Watt resistor in series with the relay output leads. The value should nominally be equal to twice the value of the transmitter key line voltage in the key-up condition. E.g. Transmitter key line voltage = 120 volts -- resistor should be about 240 ohms. Use next larger standard value of 270 ohms.

When cathode keyed transmitters are used with the KR5-A, determine if the volt-ampere ratings are being exceeded by multiplying the key-up cathode voltage by the key-down cathode current. This product should be less than 15 to be within contact ratings. If it is higher, an intermediate power relay should be used. E.g. key up cathode voltage = 50 volts and key down cathode current = 200 mA. Product  $E \times I = 50 \times 0.2 = 10$  volt amps. Within ratings.

### Over-Ride button switch

To key the transmitter on continuously or to send at a speed slower than that set by the SPEED control without changing it, lightly touch the orange disc button switch on the unit. This is a momentary type that requires very little force and displacement. A natural hand position for utilizing this feature is to use the thumb and middle finger for paddle actuation and the index finger for the over ride.

### Increasing Maximum Speed

To increase the maximum speed of the KR5-A, replace R1 on the PC assembly with a resistor of lesser value. A 1k8 resistor will increase maximum speed attainable to approximately 90 WPM. Values between 3k3 and 1k8 will adjust highest speed to a value between 50 and 90 WPM. The lowest speed of 6 WPM will not be materially affected by this change. The increased speed range resulting from this modification may be somewhat more difficult to adjust accurately. To compensate for this, you may choose to increase the minimum speed as details below.

### Increasing Minimum Speed

The minimum speed of the KR5-A may be increased from the nominal 6 WPM as shipped by shunting a resistor across the two active terminals of the SPEED potentiometer or by replacing the potentiometer with one of smaller resistance value. For example, a 27 k $\Omega$  resistor shunted across the SPEED control terminals, or replacing the control with one whose resistance is 15 k $\Omega$  will result in a minimum speed of approximately 9 WPM. Lower resistance values will increase the minimum speed with this modification since the control resistance is turned to zero.

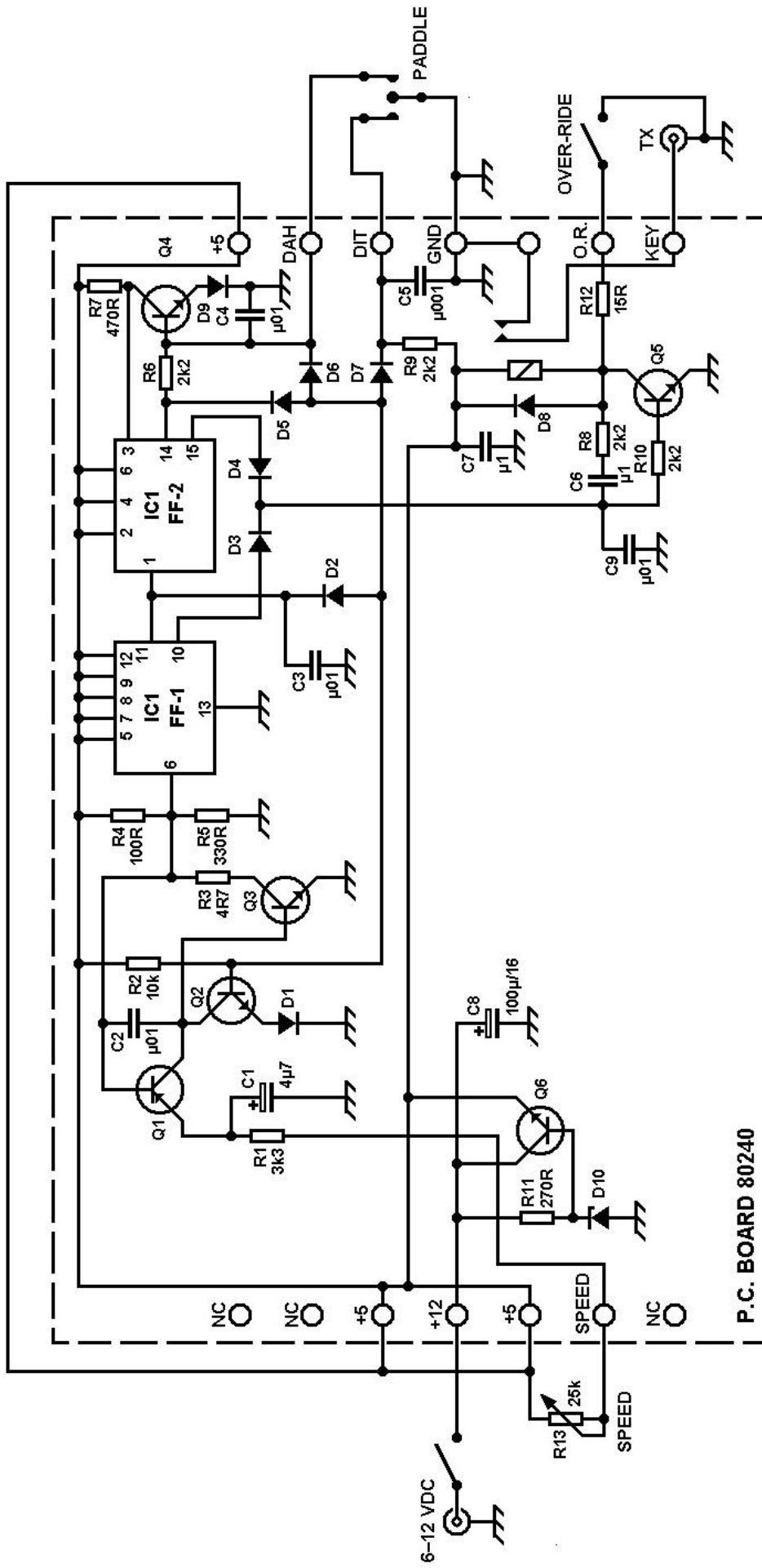
### Changing Weighting

To remove all weighting so as to result in equal dit and space duration, remove either R8 or C6 from the PC assembly. To lengthen the dit length more than that provided, increase the value of C6. As shipped from the factory, the weighting lengthens the dit length from the classical equal dit and space times by about 10 % at 20 WPM. The percentage increases with faster speeds and decreases with slower speeds. Changing C6 from 0 $\mu$ 1 to 0 $\mu$ 2 will approximately double the percentage. It is recommended that heavy weighting be avoided since articulation will deteriorate somewhat at the faster speeds. In no case should C6 be greater than 0 $\mu$ 22.

## **IMPORTANT NOTICE**

We have had a number of field reports of sticking reed relay contacts. In most cases, the installation instructions and precautions listed for contact protection were not followed. Therefore, BEFORE USING YOUR KEYER, PLEASE READ THE PARAGRAPHS ON CONTACT WELDING PREVENTION:

Although implied in the calculations of the value of current limiting resistance needed, actual mention of an upper current limitation of one half (1/2) ampere is not made in the instructions. Therefore, not only the maximum 15 volt/ampere and 400 volts ratings should be heeded, but also the 1/2 ampere contact rating. High current switching is most prevalent in cathode keyed transmitters, so cathode currents of more than 500 mA should be switched with an intermediate relay.



P.C. BOARD 80240

- Q1 = 2N5087
- Q2, 3, 4, 5 = MPS8097
- Q6 = MJE520
- IC1 = 7476
- D1 = 1N4002
- D2 ... D9 = 1N4154
- D10 = 5V6 Zener

**TEN-TEC, INC.**  
**Model KR5-A**  
 8-78