# HAMTRONICS® COR-3 MODULE: INSTRUCTION MANUAL

## FUNCTIONAL DESCRIPTION.

The COR-3 module is designed for operation with Hamtronics fm exciters and receivers and CWID board to provide repeater operation. The unit may also be used with other makes of transmitters and receivers if the required interface signals are available.

The COR-3 module features a courtesy beep tone, which helps to prevent talk over by encouraging users to wait a short time before picking up the repeater. After the waiting period, a beep sounds on the repeater and the time-out timer is reset. Waiting this short period allows any new party to break in and identify himself. The unit comprises four main circuits.

1. An electronic carrier-operated relay provides operating power to the exciter in the transmitter enclosure whenever the receiver squelch is open. U1-B senses the presence of a COS signal from the receiver and keys the first timer, U1-A, which provides the courtesy wait period. That trips timer U1-D, which provides the silent repeater tail. That timer, in turn, keys Q1/Q2, which switches the B+ to the exciter. If the receiver should be held on for longer than the legal transmit period, (e.g., 5 minutes), time-out timer U1-C automatically shuts down the transmitter until the receiver is released.

2. An audio oscillator and pulse generator circuit provides the beep signal. The output of timer U1-A triggers one-shot multivibrator U2-C/D when the waiting period elapses. The one-shot keys square-wave oscillator U2-B. The audio output is integrated by an R/C network to create a sign-wave tone, which is applied to the mixer for output to the exciter audio circuits.

3. Audio mixer stage U2-A mixes three audio inputs from the receiver, the CWID, and the beep generator to provide the audio for the transmitter. The receiver audio level is set at the receiver to a predetermined level. Pots on the COR-3 board adjust the levels of the CWID signal and the beep tone to the desired levels relative to the receiver audio.

4. A speaker amplifier which provides adjustable drive for a local speaker separate from the repeater audio, U3, avoids having to use "L" pads, etc. and compromising local audio for benefit of repeater. This allows the receiver audio to be run at a low level to avoid distortion.

Refer to catalog for complete COR-3 module specifications.

## CONSTRUCTION.

There is no special construction sequence; but following are some notes regarding various parts.

a. Resistor bodies are designated as circles on the assembly diagram for those which are mounted vertically.

b. Note the polarity of ic's, transistors, diodes, and electrolytic capacitors.

c. Trim pots may be marked with significant figures and multipliers, such as "105" for 1 megohm.

d. Terminal pins for E1-E15 should be cut from the metal carrier strip, then snapped in place from top of board using care not to crush them. Firm pressure with a pair of fine nose pliers grasping one wall of the pin will cause it to snap and lock into hole.

e. Use ic sockets for U1 and U2 but not for U3, which must be soldered to the board for heatsinking.

f. Be careful not to interchange resistors which have similar appearing color bands, eg., 150K and 510K or 1 meg and 10 meg.

## INSTALLATION.

The COR-3 module can be mounted with standoffs in the four corners of the board. No special shielding is required. Connections are made to the terminal pins either by soldering hookup wires into hollow top of pin or wrapping around pin and soldering. Following are descriptions of required interface connections. When used with Hamtronics exciter, receiver, and CWID boards, required interface levels are assured. When used with other equipment, some care must be taken to be sure compatible interface connections are arranged. Referring to the Repeater System diagram, it can be seen that the exciter/pa and the receiver are mounted in rf tight boxes with feedthru capacitors used at control and audio signal entrances.

a. **COS OUTPUT FROM RECEIVER.** This control signal at E7, taken from the squelch stage in the receiver must be about +3 to +10 Vdc when the squelch is open and near ground when squelch is closed.

b. **AUDIO FROM RECEIVER.** The high level audio output from the ic in the receiver, which normally feeds the speaker, is connected to E6 on the COR-3 board instead. The COR-3 board applies it to the audio mixer stage for application to the exciter. The receiver audio is also connected through a (user supplied) 100K SPKR VOL control to E14. A speaker amplifier on the COR-3 board amplifies the signal from the SPKR VOL control to provide an isolated signal for a local speaker on the repeater panel. The nominal audio level at E6 should be 1.5V p-p at full 5 kHz deviation on the receiver.

c. **LOCAL SPEAKER** connected to E15 on COR-3 board should be an 8-ohm speaker. Up to 2W of audio can be obtained from the COR-3 speaker amplifier. Note that the speaker must return to ground.

d. **B+ FOR COR-3 BOARD** should


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be +13.6Vdc connected to E3. Ground should be tied to E10 unless a good ground is picked up through the mounting hardware from the chassis. Current drain depends on speaker level and amount of current supplied to exciter keyed B+ line, but normally should be about 600-700 mA.

e. **KEYED B+ TO EXCITER** at E1 is +13.4Vdc (slight drop in Q2) at up to 600 mA. Because the pa is class C, it is unnecessary to switch the B+ to the pa.

f. **REPEATER AUDIO** from E5 is connected to the microphone input of the exciter. A 500 ohm dynamic microphone can also be connected to the same exciter input. Resistor R47 prevents the microphone from being loaded down.

g. **LOCAL KEY** input E12 may be grounded by the local microphone PTT switch to key the transmitter locally.

h. Connections to CWID are as shown on the Repeater System diagram. ID TRIP normally is high and goes low when the receiver squelch closes and the beep timer elapses to provide a pulse to trip the id. The ID KEY signal normally is low and goes high to key the COR circuit while the CWID runs. The CWID audio output should be tied to E4, the input to the audio mixer on the COR-3 board. The CWID input level at E4 normally is about 4kV p-p.

i. Outputs at E2, E8, and E11 drive front panel led's to indicate repeater status. Led's are not supplied with this kit, but they are supplied in the hardware package if you bought a complete Hamtronics Repeater Kit.

## ADJUSTMENTS.

a. Adjust R3 for desired beep delay time. Delay is adjustable up to about 5 seconds.

b. Adjust R8 for desired repeat tail time. Delay is adjustable up to about 15 seconds.

c. Adjust R36 for desired time-out period, up to five minutes. (Note that the timer depends on an R-C time constant with large values of R and C.

The time out timer may require a break-in period of a week or two before the time out period is stable. Until the capacitor is fully formed by having a charge applied for an extended period, the maximum time period for reliable time-out operation may be limited. If set to too long a period, the timer may not time-out.)

d. Set up repeater audio level as follows. If a microphone will be used, set exciter controls for normal microphone operation as stated in exciter instruction manual. Then, adjust volume control on receiver for desired repeat modulation (exciter deviation to match received signal deviation).

If there is no microphone in the system, set the receiver volume control for about 1.5V p-p audio into the COR-3 module (a fairly low volume control setting on the receiver to avoid distortion); and then set the exciter mic gain control for proper deviation.

If an autopatch is used, follow the audio setup instructions supplied with the autopatch module.

It normally is not desirable to use the limiter in the exciter; since it may add a little distortion on peaks. The receiver crystal filter limits the amount of deviation of the received signal, thereby automatically limiting the transmit signal. However, when an autopatch is used, the limiter in the transmitter is used in order to prevent overdeviation on loud audio peaks from the telephone.

e. Adjust LOCAL VOLUME control to set speaker volume.

f. CWID modulation level is adjusted with R42. Normally, the ID level is set lower than voice level, eg., 2 to 3 kHz deviation.

g. Set courtesy beep level with R34. This normally is set for about 3 kHz deviation.

## TO DISABLE COURTESY BEEP.

To disable courtesy beep temporarily, merely turn down beep level pot R34. Set R8 to full CCW, and set tail time with R3 so beep occurs at carrier drop. To permanently disable beep, remove C9 or C11.

## NOTE ABOUT CWID INTERFACE.

In the normal configuration, if the COR-3 module is used with the CWID module, the id is tripped at the same time the courtesy beep occurs; so there may be an annoying overlap of the beep with the first bit of the id message. To prevent this problem, there are two easy cures.

The first is to leave the first row on the CWID board blank to force a pause before the id message.

The second method, preferred if you already programmed your id board or if you need to use the entire capacity of the id matrix, is to change the trigger point from which the ID TRIP line gets its input to a later timer stage. To do this, disconnect C4 from U1-A pin 4, and reconnect it to U1-A pin 10 (solder to lead of R13 closest to middle of board). The disadvantage of the second method is that the id now trips as a function of the tail timer, and if you don't drop the tail, the id doesn't trip every ten minutes as required. Therefore, method #1 is preferred.

## THEORY OF OPERATION.

The 3301 quad op-amp is a Norton type for single supply operation. The voltage applied through various resistor values to the (+) and (-) inputs cause the output to go high or low, depending on which input has more current flowing. The amount of current depends on the voltage and resistance. In some cases, positive feedback resistors are used for Schmitt trigger action (snap action).

The receiver COS signal is applied to threshold detector U1-B. Its threshold is set by the ratio of R1 to R2. When the squelch opens, the COS signal exceeds the 2V threshold, and U1-B goes high. This turns on U1-A, which in turn activates U1-D. The positive signal applied to U1-D causes the output to go high and turn on Q1 and Q2, which applies B+ to the exciter.

The ratio of R5 to R7 sets the turn-on threshold of U1-A at +3V. When

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the receiver is open, +12V is applied to R5. When the squelch closes, C2 discharges slowly through R3-R4. When the voltage decays to +3V, U1-A turns off. The quick-attack, slow-release action of CR1/C3/R3/R4 provides a period of adjustable length between the time the receiver squelch drops and the courtesy beep occurs. When the squelch closes and the output of U1-A goes low, an ID TRIP signal pulse is generated by C4-R20 for the CWID module. This is a "polite" ID trip; it waits until you stop talking to ID.

Timer U1-D operates in the same manner as U1-A; however, it provides the time delay after the courtesy beep, the normal silent carrier tail time. R8 adjusts the delay between the courtesy beep and the carrier dropping.

When U1-A drops, C9/R23 applies a negative-going pulse to one-shot multivibrator U2-C/D, which then produces a short square wave pulse to trigger the courtesy beep. This pulse activates oscillator U2-B for a short period of time. The audio square wave output of the oscillator is integrated by R33/C12 to produce a sine-wave tone, which is applied to one input of audio mixer U2-A.

U1-C provides a time-out timer to prevent the repeater from hanging up if the receiver stays open. The timer length is set by the charging of C10 through R36-R37. It is reset quickly through CR4 each time the receive squelch closes and U1-A drops. When the voltage of C10 reaches the 4V threshold, the output of U1-C snaps to +12V, which is applied through R15 to the (-) input of U1-D. Since the value of R15 is lower than R10, U1-C can positively override the keying of the exciter.

A third input to U1-D from E12 via R16 has veto power over both of the other inputs. If the local keyline is grounded, U1-D turns on, regardless of other signals it receives. Likewise, when the CWID is running, a TTL high is applied from E13 via CR3 and R12 to hold U1-D on.

Speaker amplifier U3 receives audio from the SPKR VOL control to drive the local speaker. Voltage divider R48-R49 reduces the gain of U3 to a practical level, since it is driven from a high level input.

U2-A is biased as a class A amplifier. The three inputs via R35, R43, and R44 mix the courtesy beep tone and the CWID audio in with the receiver audio to drive the microphone input of the exciter. R47 works in conjunction with the 2K input resistance of the exciter to reduce the audio to the desired 30 mV p-p level and provide isolation from the local microphone (if used). If you are not using a Hamtronics® exciter, you may wish to change or remove R47 to obtain proper driving level for your exciter.

## TROUBLESHOOTING.

Having read the Theory of Operation, you have a good understanding of how the circuits work. The best way to troubleshoot is to use the following sample voltages to check the operation of each circuit.

## PARTS LIST.

| Ref # | Value (marking) |
|---|---|
| C1 | .001 uf (102, 1nM, or 1nK) |
| C2-C3 | 4.7 uf electrolytic |
| C4-C6 | .001 uf (102, 1nM, or 1nK) |
| C7 | 47 uf electrolytic |
| C8 | 0.15 uf mylar (red) |
| C9 | 120 pf |
| C10 | 470 uf electrolytic |
| C11 | .01uf (103) |
| C12 | 220 pf (221) |
| C13-C14 | .001 uf (102, 1nM, or 1nK) |
| C15 | .01 uf (103) |
| C16 | 0.47 uf electrolytic |
| C17 | .001 uf (102, 1nM, or 1nK) |
| C18 | 4.7 uf electrolytic |
| C19 | 47 uf electrolytic |
| CR1-CR4 | 1N4148 |
| E1-E15 | Terminal pins |
| Q1 | 2N3904 or 2N4124 |
| Q2 | D45C1 or TIP-30 |
| R1 | 150K |
| R2 | 1 meg |
| R3 | 1 meg pot |
| R4 | 4.7K |
| R5 | 510K |
| R6 | 10 meg |
| R7 | 2 meg |
| R8 | 1 meg pot |
| R9 | 4.7K |
| R10 | 510K |
| R11 | 10 meg |
| R12 | 100K |
| R13 | 4.7K |
| R14 | 2 meg |
| R15 | 330K |
| R16 | 100 ohms |
| R17 | 330 ohms, 1/2W |
| R18 | 680 ohms |
| R19 | 470 ohms |
| R20 | not used |
| R21-R23 | 1 meg |
| R24 | 2 meg |
| R25 | 27K |
| R26 | 1 meg |
| R27 | 150K |
| R28 | 2 meg |
| R29 | 1 meg |
| R30-R31 | 10 meg |
| R32 | 27K |
| R33 | 1 meg |
| R34 | 1 meg pot |
| R35 | 2 meg |
| R36 | 1 meg pot |
| R37 | 150K |
| R38 | 3.9 meg |
| R39 | 22 meg |
| R40 | 10 meg |
| R41 | 680 ohms |
| R42 | 1 meg pot |
| R43 | 2 meg |
| R44-R45 | 1 meg |

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| | | | | | |
|---|---|---|---|---|---|
| R46 | 2 meg | R48 | 1 meg | U1-U2 | 3301 |
| R47 | 68K | R49 | 330K | U3 | LM-380 |

TYPICAL DC VOLTAGES (WITH 13.6V POWER SUPPLY):

| CONDITION | U1-1 | U1-5 | U1-2 | U1-4 |
|---|---|---|---|---|
| Rcvr Open | 0.6 | 12.6 | 0.6 | 12.6 |
| Rcvr Closed | 0 | 0.1 | 0.1 | 0 |

| | C2&C3 | U1-12 |
|---|---|---|
| Rcvr Open | 12 | 0.6 |
| Rcvr Closed | 12>0 | 0 |

| | U1-10 | Q1-C | C2-B | Q2-C |
|---|---|---|---|---|
| Xmtr On | 12.6 | 0.3 | 12.8 | 13.4 |
| Xmtr Off | 0.1 | 13.0 | 13.0 | 0.1 |

| | C10 | U1-13 | U1-9 | U1-11 |
|---|---|---|---|---|
| Normal | 0.4V | 0.1 | 0.1 | 0.03 |
| Timed Out | Charged | 0.6 | 12.6 | 0.6 to 4V |

| U3-1 | U3-6 | U3-8 | U2-2,3 | U2-4 |
|---|---|---|---|---|
| 7 | .03 | 6 | 0.6 | 7 |

TYPICAL AC VOLTAGES (FULL 5 KHZ DEVIATION):

| TEST POINT | P-P VOLTAGE |
|---|---|
| E4 CWID In | 4V |
| E6 Rcvr AF | 1.5V |
| E5 Mixer Out | 30mV (2K load) |
| U2-4 | 1.5V |
| U2-5 | 12V square wave |
| Top of R34 | 4V sine wave |
| U3-6 | Up to 0.4 V |
| U3-8 | up to 8V |

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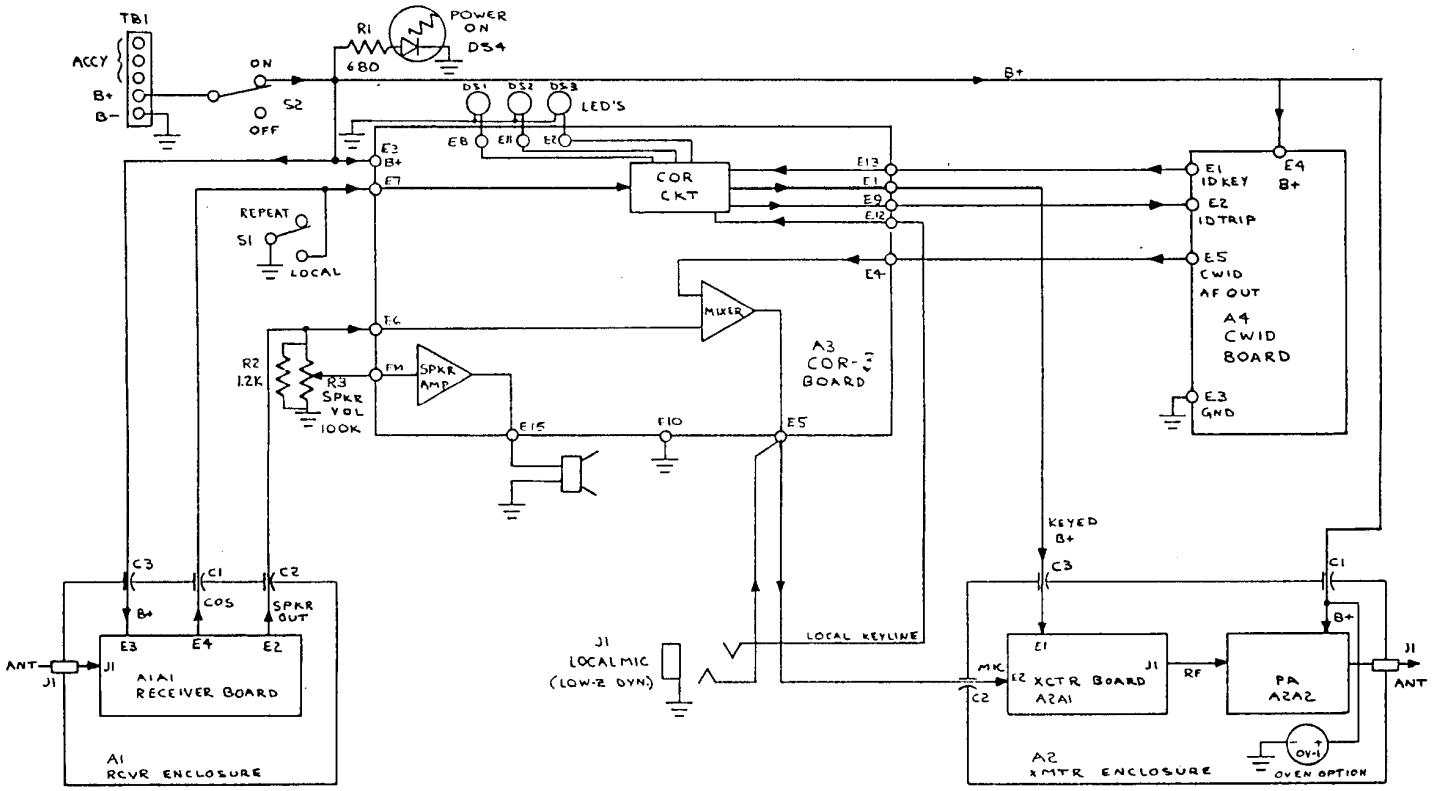
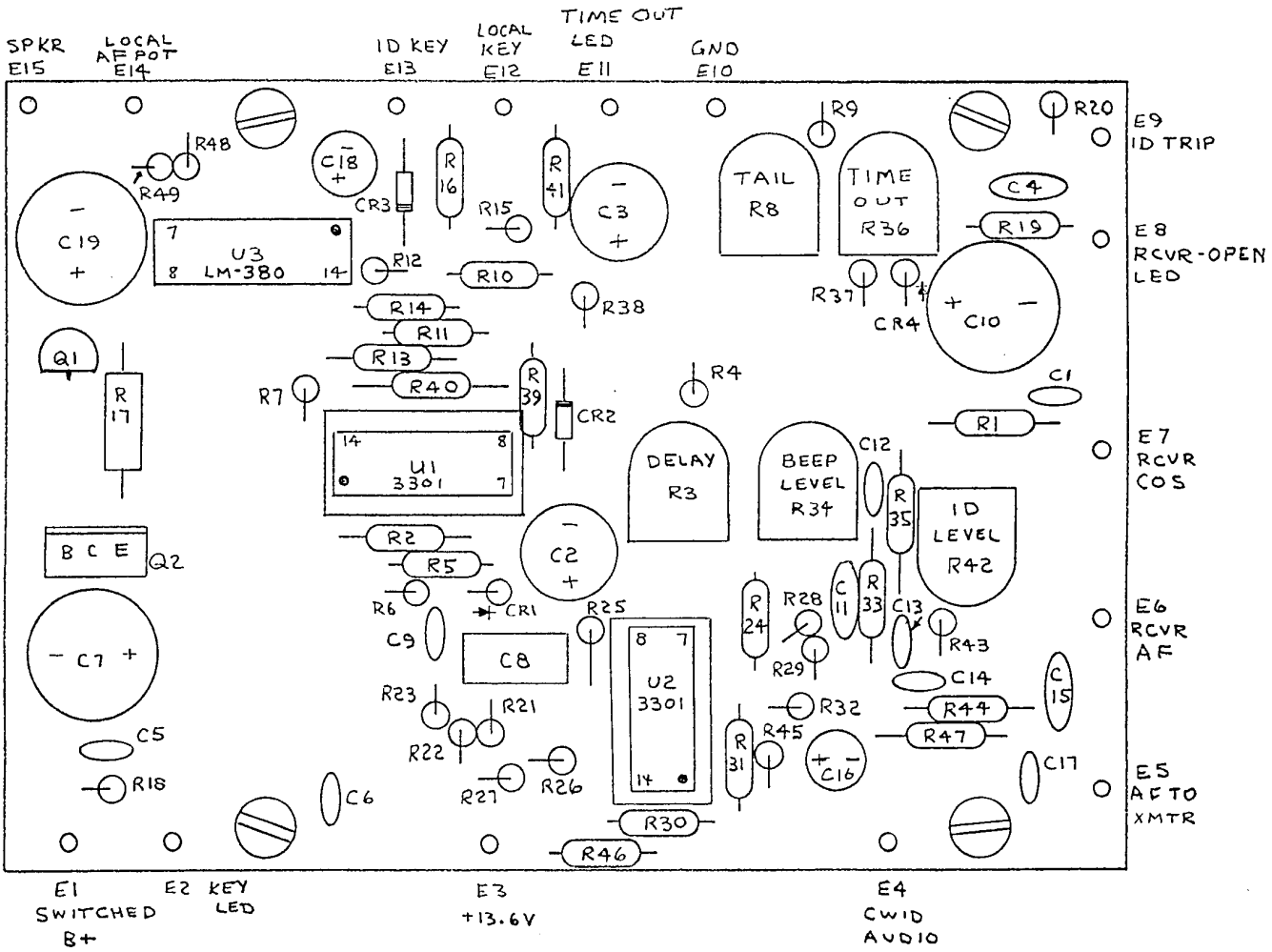



FIGURE 1. REP-100 REPEATER OVERALL SCHEMATIC

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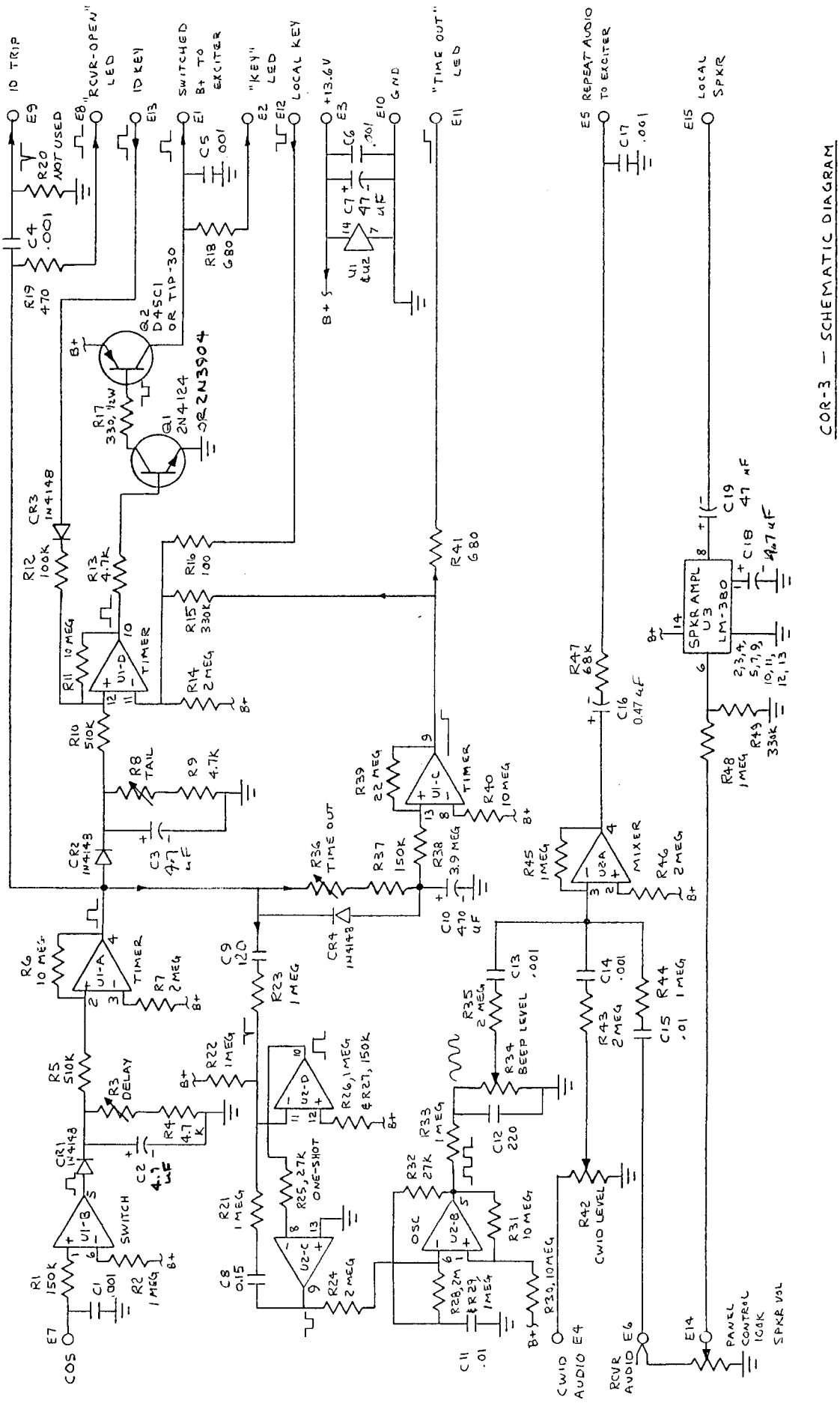


COR-3 – SCHEMATIC DIAGRAM

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