

# CircuitWerkes ComboLok Option Board

## Description

The CircuitWerkes combination lock is a separate board which mounts inside either an AD-16 telephone remote control or a DTMF remote control to provide security with over 11,000 possible combinations. The lock board is physically mounted on top of the DTMF decoder. When part of an AD-16, the ComboLok is connected to the coupler board via jumpers. This version of the combination lock must operate in conjunction with a CircuitWerkes DTMF 16 remote control board.

## Setup

The combination lock, as installed at our factory, comes ready to operate with a randomly preset combination. The factory set combination is posted on a separate sheet of paper accompanying this manual or on a sticker attached to the bottom of the case. The ComboLok may be set up to operate in several configurations. If the ComboLok option was ordered with an AD-16, the board will normally be connected to both the AC-2 autocoupler board and the DTMF decoder. Removing jumper J2 disables the AC-2 automatic disconnect timer. J2 should be off if you are not using the ComboLok with an AC-2. When closed, J2b keeps the timer from hanging up the AC-2. If you are using the ComboLok with an AD-16 and don't want the coupler to time out, J2 would be off & J2b on.

## Changing the Combination:

You must start by disassembling the case. Remove the six screws which hold it together and gently pull the top half away from the bottom. The Combolok is physically mounted to top of the DTMF-16 decoder. On the lock board, near the large (4514) I.C. are six rows of header pins that are 12 pins long. The pins are in groups of three rows. The center row of each of three groups contains the 12 outputs corresponding to the standard DTMF tones. In other words, rows 2 and 5 are DTMF outputs with rows 1, 3, 4 & 6 being the combination inputs.

The jumper positions on the in-line headers determine the combination of your unit. The DTMF outputs are printed along the edge of the first row of pins. The pin nearest to the edge of the board is digit number 1. The following pins, in order, are 2 thru 9, 0, \*, and #. The row of pins closest to the 4514 is the first input to the combination lock IC. Each of the rows is labeled 1st, 2nd, 3rd and 4th representing the four inputs to the lock. To change the combination, simply move the four jumpers to the appropriate pins. For example, if a jumper is placed from row one to two at the 9 pin, another jumper from row two to three at the 5 pin, the third jumper from row four to five at the 2 pin and the fourth jumper from row five to six at pin 8, the combination becomes 9528. You cannot repeat digits. For instance the combination cannot be 4444. If the lock is used as part of an AD-16, the combination must be received in the correct order, within about ten seconds or the unit will hang up. After setting the combination and writing it down for future use, simply reassemble the two halves of the case, and you're ready to operate.

## Resetting the lock

When part of an AD-16, the ComboLok is usually reset when the coupler hangs up. When used with a stand alone DTMF decoder (no AC-2 autocoupler) the lock must be externally reset. This is done by momentarily placing +5 Volts on the common pin. The lock can be easily reset through any of the DTMF-16 optocoupler outputs by tying the (C)ommon pin of H3 (pin 2 of the D-37 connector to the emitter and connecting the collector to VCC (pin 22 of the D-37) or the (R)eset pin of H3. Alternately, the lock may be remotely enabled by connecting the (E)nable pin (which is actually near ground) of H3 to the (C)ommon Pin. Additional information and diagrams pertaining to external lock controls and outputs may be found on the following two pages. Note: the external reset may be applied even when the lock is connected to an AD-16 however, if you are using an accompanying AC-2, the autocoupler will hang up the line immediately upon locking if the H2 wiring harness is connected to the AC-2.

## Theory of Operation

BCD output from the SSI-202 on the DTMF board is routed to the 4514 inputs via the 2 by 4 header strip. The 4514 is operated as a four line to 12 line demultiplexer with active high outputs. Each of the decoded outputs is routed to a column of header pins where they can be individually selected for routing to the 7220 combination decoder chip. When all four tones are detected in the correct sequence, the 7220's Lock Indicator (pin 8) changes states from high to low. This output is used to disable the 7220, the 4514, and to enable the DTMF decoder board. U2b is a simple inverter which is used to drive one input of U2a. The other input of U2a is driven by the fourth DTMF tone in the unlock sequence. Capacitor C1 provides a time delay to prevent the last combination tone from instantly operating the DTMF board. As with U2b, U2d is operated as an inverter. When the unit is unlocked, Q1's base is low turning it on and pulling the 4514 inhibit pin high. This disables the 4514 until the unit is reset. Transistor Q4 is driven from the low going data valid (DV) pulse from the DTMF board. When a valid DTMF tone is detected, Q4 is on and momentarily pulls up the FOLLOW input (pin 1) of the 4514 as the DV pulse simultaneously pulls the INH pin low, causing the 4514 to operate in a momentary mode.

The 7220 lock I.C. has both a power on type reset and an auxiliary reset input. Each time power is applied to the unit, it resets to the locked mode. For use with the AD-16, diode D1 is connected to a ground sinking transistor on the coupler board so that each time the coupler answers, it pulls Q3's base low which, in turn, pulls the 7220 to ground turning it on. A momentary high at the reset pin pulls the base of transistor Q3 high turning it off and breaking the ground path for U1, causing it to reset. Each time the lock is turned on, C2 & R5 form a timer circuit which holds pin 8 of U2 low for approximately 8 seconds. If no valid combination is received, U2 pin 9 remains high. When the timer window has expired, U2 pin 8 again becomes high causing the autocoupler to hang up. When the ComboLok is used as part of a stand alone DTMF controller, C2 & R5 may prevent the lock from resetting on very short ground pulses. To eliminate the possibility of reset problems, jumper J2 should be removed to isolate that part of the circuit. If you are using the ComboLok with a coupler but do not want the lock to automatically hang up the coupler, jumper J2b should be on.

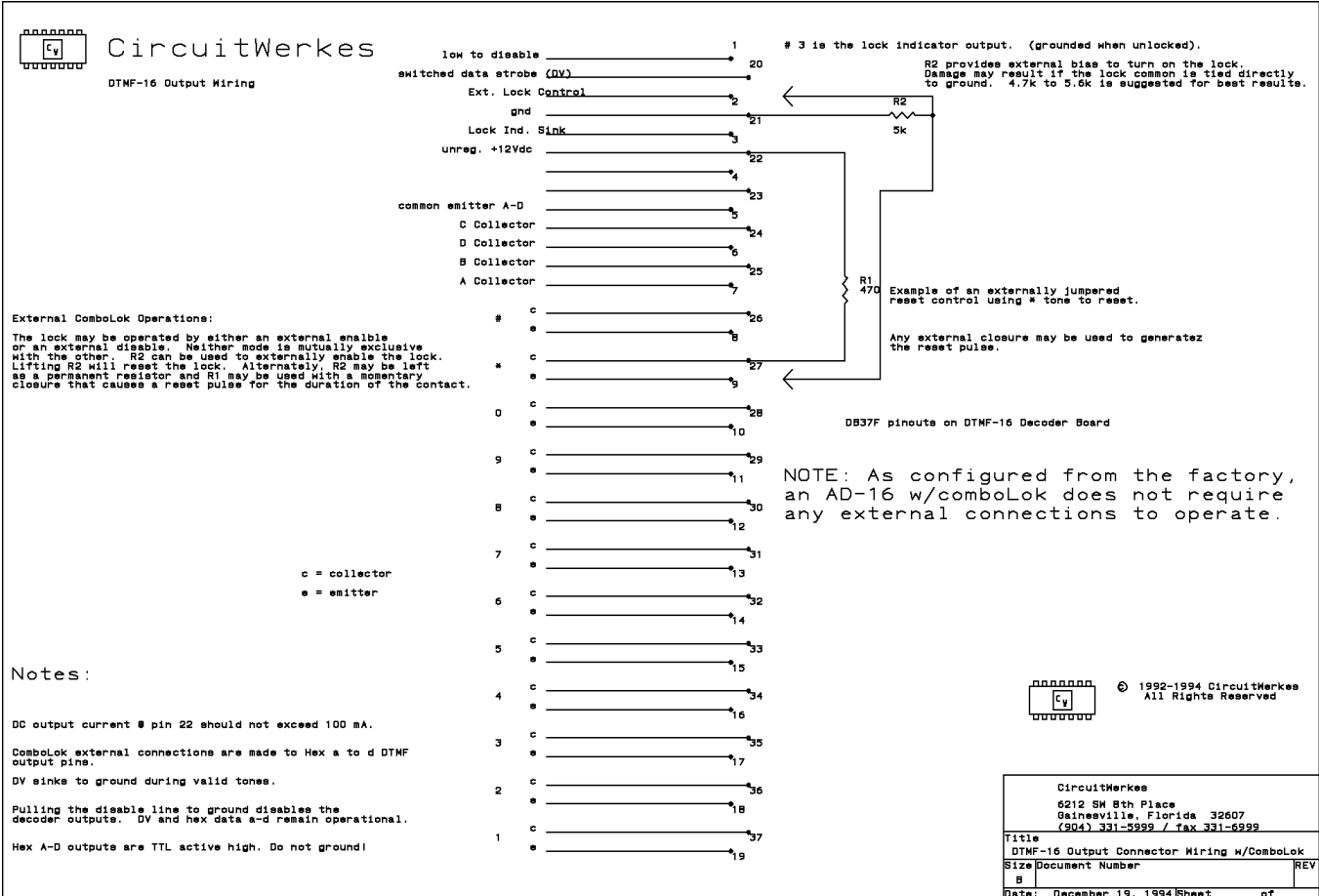
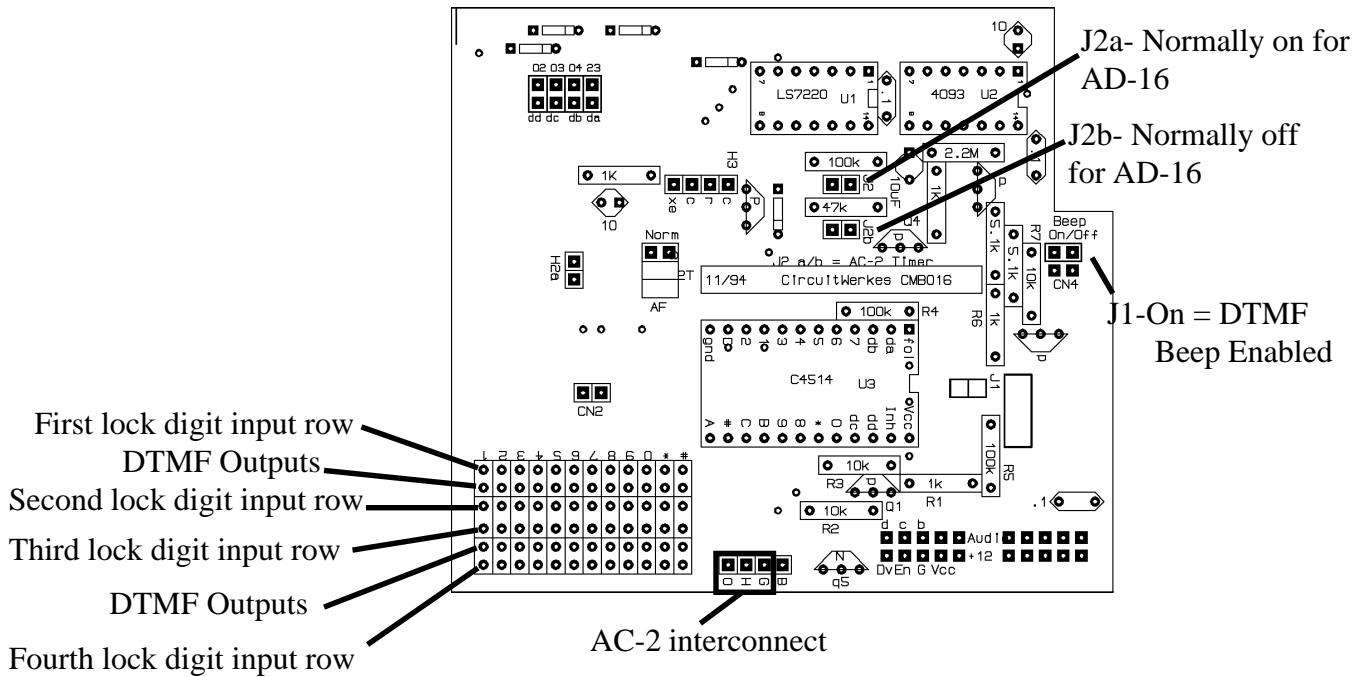
The ComboLok has several outputs available that allow it to be interfaced with various other CircuitWerkes products. Any time the unit is unlocked, U2a is low, enabling the DTMF-16 line and turning on Q4 while turning Q5 off. Transistors Q5 operates as the lock indicator ground sink. Q6 acts as a shunt holding the DTMF decoder disable line low when locked.

NOTE: The ComboLok can be disabled allowing unrestricted use of the AD-16 or DTMF decoder by pulling the ComboLok board free of the DTMF-16 & removing the push connector to the AC-2.

## External Connections (I/O) & Controls

When used with an AD-16 or DTMF-16, the ComboLok can be configured to bring the external reset and lock indicator out via the four D-37 connector pins that are normally used for hex data a through d. In this configuration, there are up to four jumpers that may be removed to break the path from the optocoupler outputs and the D-37 pins. Connected to the outputs will be at least one connector from the lock board. The ComboLok remote reset & enable (Common) input from H3 is connected to pin 2. Grounding pin 2 (to pin 21) through a 5k resistor will turn on the lock and allow you to enter your code. **DO NOT GROUND THE COMMON PIN WITHOUT GOING THROUGH AT LEAST A 1K (5K SUGGESTED) RESISTOR. COMBOLOK DAMAGE WILL RESULT.** After it is unlocked, a momentary high at pin 2 (shorted to pin 22 via a 1k resistor) will cause the lock to reset itself to the locked. The unlocked status indicator is a ground sink output that is brought out on pin 3 of the Db37. When the unit is UNLOCKED, the sink transistor is turned on.

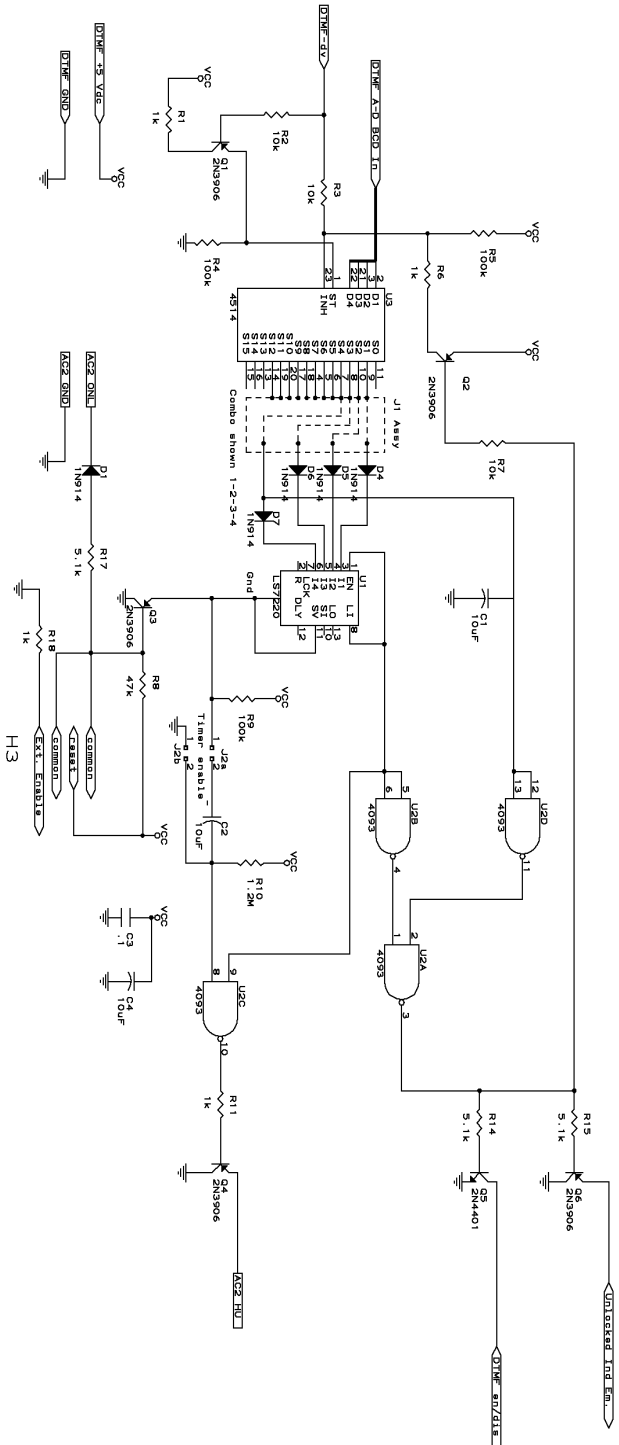
# ComboLok PCB Layout



## ComboLok External I/O and Reset Options



# CircuitWerkes Combolok V1.6



Key to HEADER symbols  
[Symbol] -> DTYPE -V  
[Symbol] -> DTYPE -GND  
[Symbol] -> DTYPE -5V  
[Symbol] -> DTYPE -VBE  
[Symbol] -> DTYPE -GND  
[Symbol] -> K12 GND  
[Symbol] -> K12 GND  
[Symbol] -> H3  
[Symbol] -> UNLOCKED and Em  
[Symbol] -> DTYPE -20V/DIS

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The preset Password for your ComboLok is \_\_\_\_ - \_\_\_\_ - \_\_\_\_ - \_\_\_\_.

You may change the password by following the instructions on the first page of the CoboLok section (flip back a couple of pages from here) of this manual.

# NOTES