



# APPLE-1 CASSETTE INTERFACE

## INTRODUCTION

The Apple Cassette Interface (ACI) is a peripheral device for the Apple Computer which enables the user to store and retrieve information (data and programs) using a standard audio grade cassette recorder. The ACI attaches directly to the Apple Computer and jacks are provided on the ACI board to connect to the cassette recorder. The ACI reads and writes data at the rate of approximately 1500 baud (depending upon the data). All the ACI timing is done in software, resulting in extreme accuracy, no adjustments, and consistency between units.

## TAPE RECORDERS & TAPE

Almost any cassette recorder will work well with the ACI. As a recommendation, we have found the least expensive (under \$40) Panasonic to be very reliable and of good quality, although it is not equipped with a tape counter, which is useful (though not essential) for locating files within a tape. (An alternative method of discerning files is to record a voice identification between files.)

Among the 'under \$25' cassette recorders there may be variations in head alignment and internal electronics,

resulting in the inability to accurately read a tape that has been recorded on a different machine. However, if the same unit is used for both recording and reading, even the cheapest of cassette recorders will work reliably.

Most tapes available in the \$2-\$4 category work well for data storage. You may experience an occasional tape which 'loses bits,' which is caused by severe oxide thickness variations on the tape and cannot be corrected. Special leaderless tapes need not be used as the ACI automatically transmits a ten second 'header' of all ones before transmitting the data, which insures that the leader will have passed.

## JUMPERS

For operation of the ACI, a permanent jumper must be placed between 'R' and 'C' in the block select area of the main board (B9,10). This jumper from 'R,' which is connected to enable the ACI, to 'C' selects the ACI when the 12th 4K block ('C') is addressed.

Also, for running Apple Basic in the 2nd 4K bank of on-board memory, it is necessary to break the solder jumper between 'W' and '1' and then jumper 'W' to 'E.' This moves the 2nd 4K bank from the '1' block to the 'E' block, which is where Apple Basic resides.

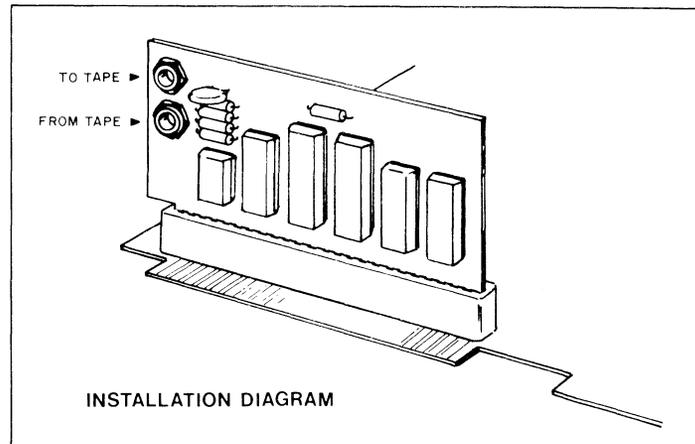
## INSTALLATION

Install the ACI board into the connector on the main board **with the components on the ACI board facing away from the main board (the jacks to the edge of the main board)**. SEE FIGURE 1. The system power should be **OFF** whenever installing or removing the ACI board.

Install cables from the ACI jack marked "TO TAPE" to the recorder microphone input and from the ACI jack marked "FROM TAPE" to the recorder earphone output. One cable can be appropriately switched between the two paths if necessary.

## USING THE ACI

The Cassette program is contained in two PROMS on the ACI board and runs at C100. When entered, the program should echo an "\*" . The format for specifying the memory address ranges to be either stored (write) or deposited into (read) is identical to the standard monitor format: **Beginning . End** , suffixed with either a 'W' (write) or an 'R' (read). Execution will start following a carriage return (CR). The cassette program will return control to the system monitor upon completion of a read or write. Illegal characters (or the absence of characters) in the address line will return control to the system monitor without execution, following a carriage return.



## MULTIPLE RANGES

The ACI is capable of reading and writing multiple address ranges. The format is: **A.BW C.DW** (R for read). Again, spaces are ignored. The ACI will write a ten second header, the first range, another header and the second range. **100.200W 300.500W** will write a header, 100 to 200, a second header, and 300 to 500. When reading a multiple range tape, **YOU MUST USE THE SAME ADDRESS INCREMENTS AS WERE USED IN WRITING THE TAPE**. This does not mean the same absolute addresses, but rather the same increments.

The procedure for reading from a tape into memory is:

**C100R (RET)** This enters the cassette program and should echo an "\*"

**E000 . EFFF** This will load the tape data into memory locations E000.EFFF . 'R' denotes a read, and spaces are ignored. (Don't hit 'return' yet.)

### **Start the Tape**

**Hit 'RETURN'** A carriage return will start execution of a read. The 'return' can be hit immediately, however, it must be hit within 5 seconds after the start of tape motion.

When the last location (EFFF in this example) has been loaded, the program will print a '/' and return control to the monitor.

The procedure for a write is identical except the suffix 'W' is substituted for 'R' in the address line. For both read and write, the tape should always be moving before hitting the RETURN.

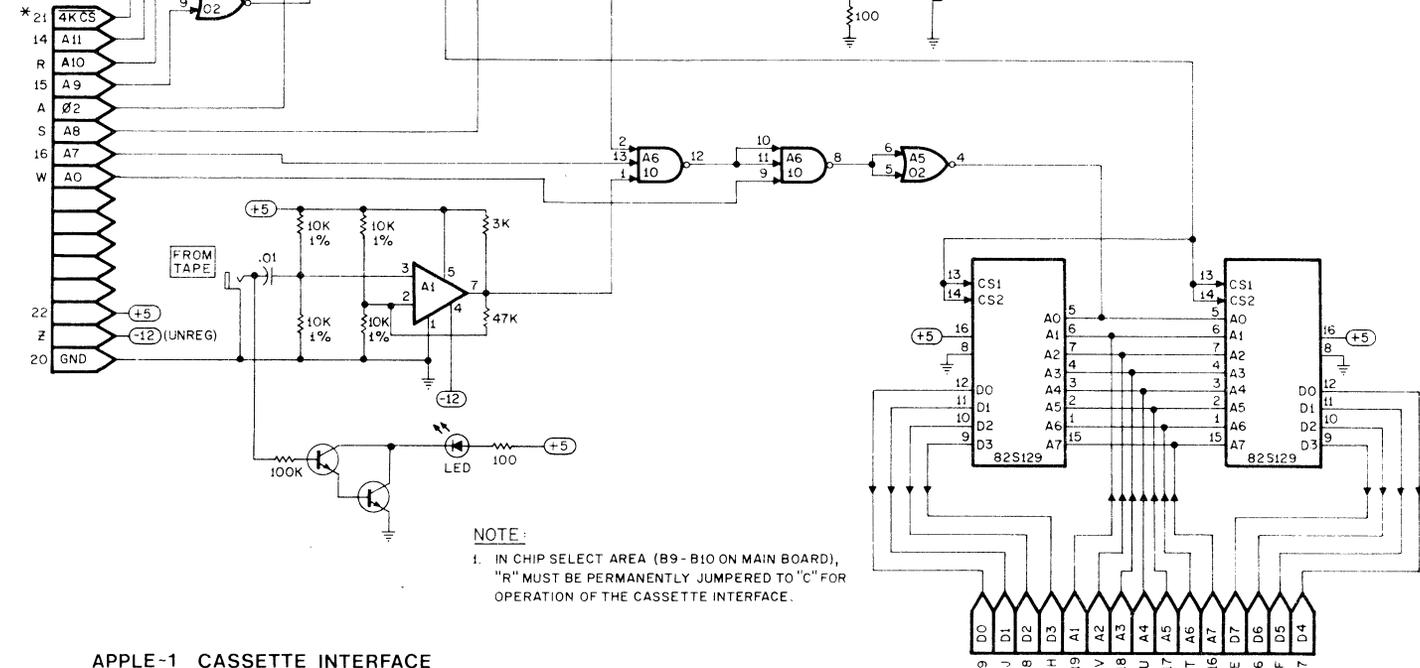
## **LEVEL**

The Cassette recorder output level should be set to where the LED on the ACI is just fully lit. Increase the level from zero until the LED glows fully. If you experience a bad read, try it a LITTLE higher. The LED indicator is operational even when the cassette program is not executing, and the level should be set prior to reading a tape, NOT during the reading of a tape.

## **SPEED**

The ACI uses the technique of recording a whole cycle of either a 1kHz cycle (representing a 'one' data bit) or a 2 kHz cycle (representing a 'zero' data bit). Therefore, with an average data mix of one's and zero's, data will be recorded at 1500 baud. A ten second header of all ones will automatically be recorded on the tape prior to memory data. This is to insure that the clear leader portion of the tape will have passed. See schematic for further details.

SEE  
NOTE



**NOTE:**

1. IN CHIP SELECT AREA (B9 - B10 ON MAIN BOARD), "R" MUST BE PERMANENTLY JUMPERED TO "C" FOR OPERATION OF THE CASSETTE INTERFACE.

**APPLE-1 CASSETTE INTERFACE**

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