

# **RAM X 128K**

# **Apple II, II+**

## Installation and User Guide

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## Thank You!

Firstly, thank you for supporting JD Micro by purchasing a RAMX128K RAM card! It means a lot to us. RAMX128K is our first RAM expansion product and we hope that you enjoy using it in your Apple ][ system.



We will be sharing tools and related documentation at [jdmicro.com](http://jdmicro.com) – be sure to check the site regularly for updates.

Before removing your RAMX128K card from the ESD compliant packaging, please study the [ESD Prevention](#) section of this guide, then read the [Hardware Introduction](#) to familiarise yourself with the RAMX128K hardware before installation.

## ESD Prevention

Whenever you open an Apple II or other electrical device, you are exposing its internal components to potential damage from the static electricity that builds up in your body through normal activity. Electrostatic discharge (ESD) occurs when static electricity is discharged from one conductor (such as your finger) to another conductor (such as an integrated circuit).

Ideally, installation should be carried out on a static-safe surface such as a grounded anti-static mat, while wearing an anti-static wristband. If you have these available, be sure to use them.

Following the guidelines below will reduce the risk of ESD damage to both your computer and the RAMX card at installation time:

- Leave the RAMX card in the ESD-compliant packaging until you are ready to install it.
- Ensure that the computer is turned off but leave the power cord connected to a grounded outlet. Even with the power turned off, the power cord acts as a ground for the computer system, protecting it from static electricity.
- Before removing the card from the ESD-compliant packaging, touch the metal case of the Apple II power supply to discharge static electricity that may have accumulated on your body.
- When handling RAMX cards, avoid touching any components on the PCB, or the gold “fingers” of the edge connector.
- If you must remove/replace any RAM or ROM chips during the installation procedure, handle the chip by the ends of the package – avoid touching the pins.

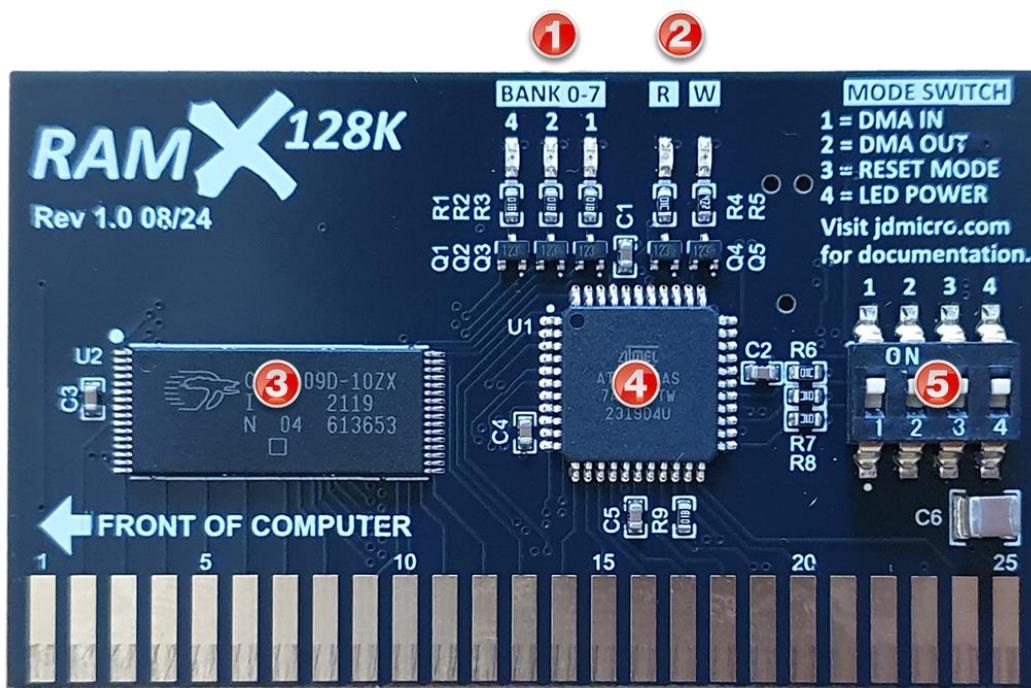
## RAMX128K Hardware Introduction

RAMX128K is a plug-in RAM card designed to provide an extra 128KB of RAM for Apple II and Apple II+ computers.

Apple's Language Card defined the memory bank addressing scheme and I/O soft switches to allow an additional 16KB of Language Card RAM to be swapped into the ROM address space (\$D000-\$FFFF). Saturn Systems later expanded on this scheme with introduction of their 64KB and 128KB RAM cards, providing 4 or 8 x 16KB RAM banks respectively. To ensure full software compatibility, the first 16KB bank was controlled in the same manner as the Apple Language Card, with additional soft switches used to access the remaining banks.

RAMX128K is fully compatible with the Saturn 128K RAM card and is therefore also fully compatible with software designed to run with Apple's Language Card (PASCAL, FORTRAN, etc), Microsoft's RamCard and Z80 Softcard (CP/M, COBOL-80, FORTRAN-80, etc) and other RAM cards that follow the same memory bank switching scheme.

Major components of RAMX128K are as follows:



1. Three bank LED's (amber when on) to indicate which of the eight 16KB RAM banks is currently selected. The selected bank is displayed in binary 0 through 7. Eg for bank 5, bank LED "4" plus bank LED "1" would be on as  $4 + 1 = 5$ . Bank LED "2" would be off.
2. Read (green when on) and Write (red when on) LEDs to indicate whether RAM read or RAM write is currently active.
3. 128KB Static RAM (SRAM).
4. Complex Programmable Logic Device (CPLD).
5. Mode Switch. Switches 1-3 are used to configure behaviour of the card and will be covered in detail in a later section. Switch 4 is used to control LED power – you can turn off all the LED's by setting switch 4 to the OFF position (down).

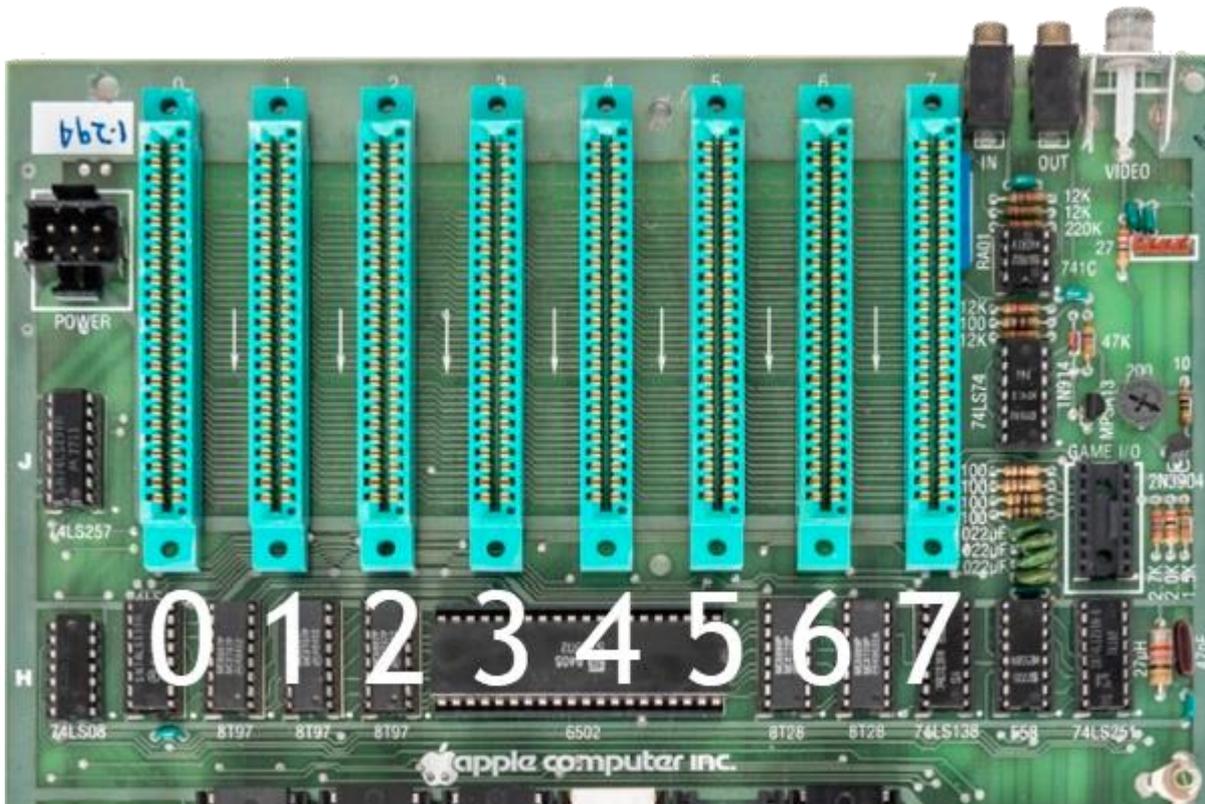
## RAMX128K Installation

The RAMX128K is typically used to expand a 48KB machine to 64KB whilst providing a further 112KB of bank switched RAM that can be used by various compatible applications.

To achieve a full 64KB Apple II, the entire 48KB of motherboard memory is required to be installed and fully functional before installing RAMX128K.

### Step 1 : Determine The Recommended Installation Slot

The recommended installation slot for a RAMX128K card depends upon whether an Apple Language Card, 16KB RAM card or other RAM expansion card is already present in the system. The motherboard expansion slots are numbered 0 to 7, with slot 0 being the left-most slot (closest to the power supply) when viewed from the front of the computer:



- If an Apple Language Card or other 16K RAM card is installed in Slot 0 then the recommendation is to remove it from the system and install the RAMX128K card in slot 0. See [APPENDIX 1 : Apple Language Card Removal](#).
- If a RAMX128K card is already installed in slot 0 then you can install an additional RAMX128K card in any available slot.
- If no card is present in slot 0, then install the RAMX128K card in slot 0.

## Step 2 : Set the Mode Switches

Following ESD precautions, remove the RAMX128K card from the ESD-compliant packaging and visually inspect it to ensure that there is no physical damage.

RAMX128K supports the so-called “ROM-sharing” protocol, allowing the RAMX128K to coexist with an always-enabled ROM card.

By default, the ROM-sharing protocol is enabled via the DMA IN and DMA OUT mode switches being set to the ON position, but this may cause issues with DMA-capable peripheral cards.

In general, an empty slot should be left between the RAMX128K and any DMA-capable peripheral card, otherwise the ROM-sharing protocol should be disabled.

As shipped, all 4 mode switches will be in the ON position. This is the default and should be suitable for most installations. If you are installing multiple RAMX128K cards in adjacent slots or are using DMA enabled peripheral cards then you may need to reconfigure the DMA IN/OUT switches or simply disable both of them.

### Switch 1 : DMA IN

With Switch 1 in the ON position, RAMX128K will deactivate when a DMA request from a higher priority card is detected. DMA priority is based on slot number where slot 0 has highest priority.

With Switch 1 in the OFF position, RAMX128K will ignore the DMA IN signal from higher priority peripheral cards.

For a RAMX128K card installed in Slot 0 (highest priority), the DMA IN switch will have no effect and can be left in the ON position or turned OFF.

For a RAMX128K card installed in Slot 1, the DMA IN signal should only be used if an always-enabled ROM card or DMA enabled peripheral card is installed in Slot 0 else it should be turned OFF.

### Switch 2 : DMA OUT

With Switch 2 in the ON position, RAMX128K DMA\_OUT signal will follow the DMA\_IN signal when the card is active and will go low when inactive.

With Switch 2 in the OFF position, RAMX128K DMA\_OUT signal will follow DMA\_IN regardless of whether the card is currently active or not.

Switch 2 in the ON position may cause issues for a lower priority RAMX128K card that has its DMA IN switch enabled – this is software dependent.

### Switch 3 : RESET MODE

Switch 3 controls the behavior of the read enable and write enable latches when the system is reset. Switch 3 is also used in conjunction with the DMA\_IN switch (switch 1) to determine the behavior of the Bank selection latches on reset.

With Switch 3 ON, a RESET signal will cause the read and write enable latches to reset (read and write disabled).

With Switch 1 ON and Switch 3 ON, a RESET signal will cause the bank latch to reset to bank 0.

With Switch 3 OFF, a RESET signal will have no effect on the Read and Write enable latches (although they will still be reset once at power on).

With Switches 1 and 3 both OFF, the bank latch will also retain its state on RESET, making RAMX128K fully compatible with Saturn 128K which displays the same RESET behavior.

### Switch 4 : LED POWER

Switch 4 simply controls 5V power to the LEDs on the board. If you do not wish to see the LED's then you can disable them by moving switch 4 to the OFF position.

### Step 3 : Install the Card

Switch off the computer and remove the top cover.

1. Touch the case of the power supply to discharge any static electricity that may have accumulated on your body.
2. Visually locate the desired installation slot as per Step 1 above.
3. Install the card ensuring that the arrow markings face towards the front of the computer (the component side of the PCB should face AWAY from the power supply).



## Step 4 : Test and Operation

If you have ROMX or ROMX+ installed then the Memory Test Utility ROM image can be used to test your entire system memory, including a Saturn 128K compatible card such as RAMX128K.

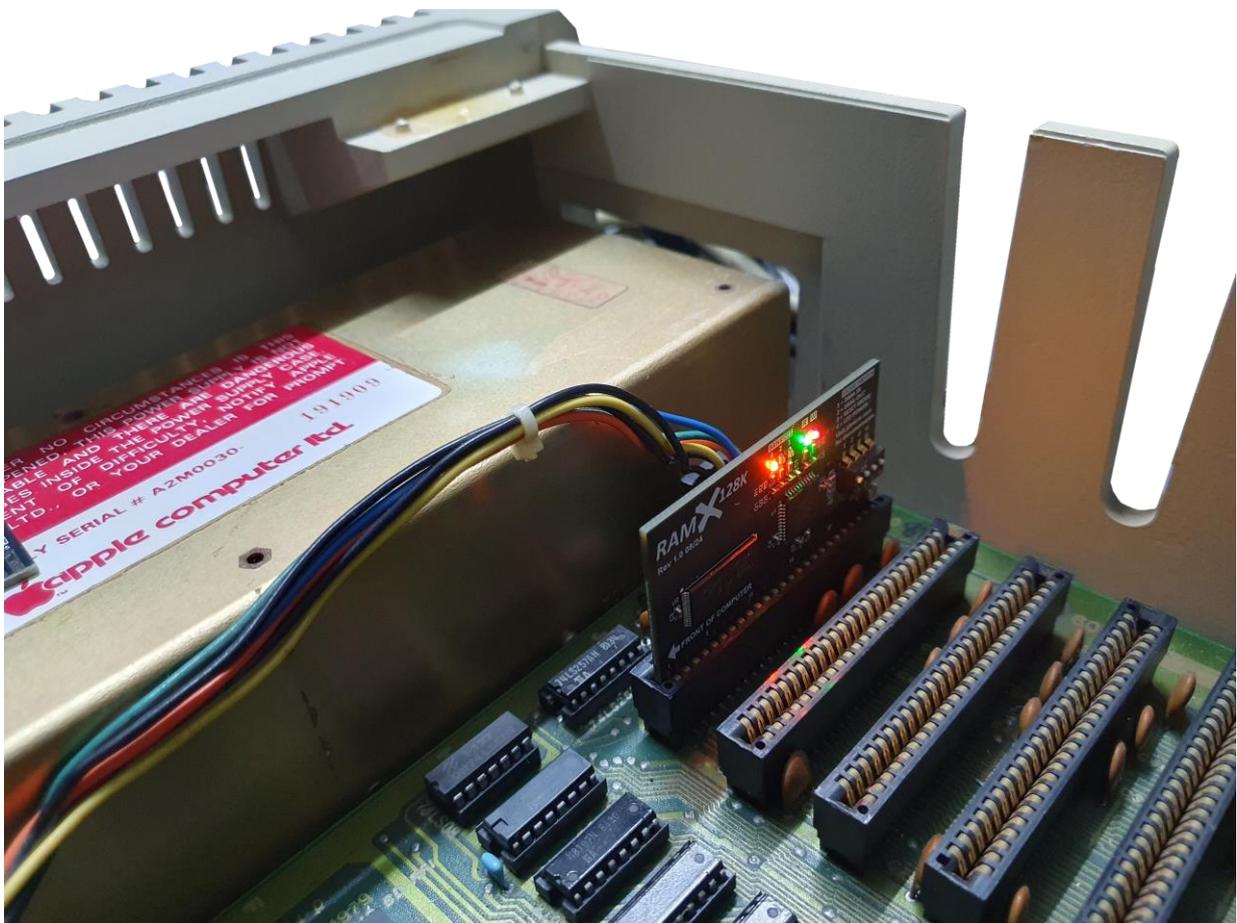
Alternatively, you can test your RAMX128K card using the *Saturn 128 Utilities for DOS 3.3* disk which is available from the RAMX Utilities section at [jdmicro.com](http://jdmicro.com). Boot the disk, then type:

```
BRUN RAMTEST128K <return>
```

Lastly, Locksmith has inbuilt tests for the Saturn 128K. After booting Locksmith, select R for RAMCD UTILS – the RAMX128K card should be detected as a Saturn 128K, and can be tested using the Test function.

Locksmith 6.0 is available from the RAMX Utilities section at [jdmicro.com](http://jdmicro.com).

As RAMX128K is fully compatible with Saturn 128K and Apple Language cards, please refer to the Saturn 64K/128K Operations Manual and Apple Language Card Manual for a detailed list of soft switches and for operational guidance. These manuals are both available from the RAMX Documentation section at [jdmicro.com](http://jdmicro.com).



## APPENDIX 1 : Apple Language Card Removal

### Background

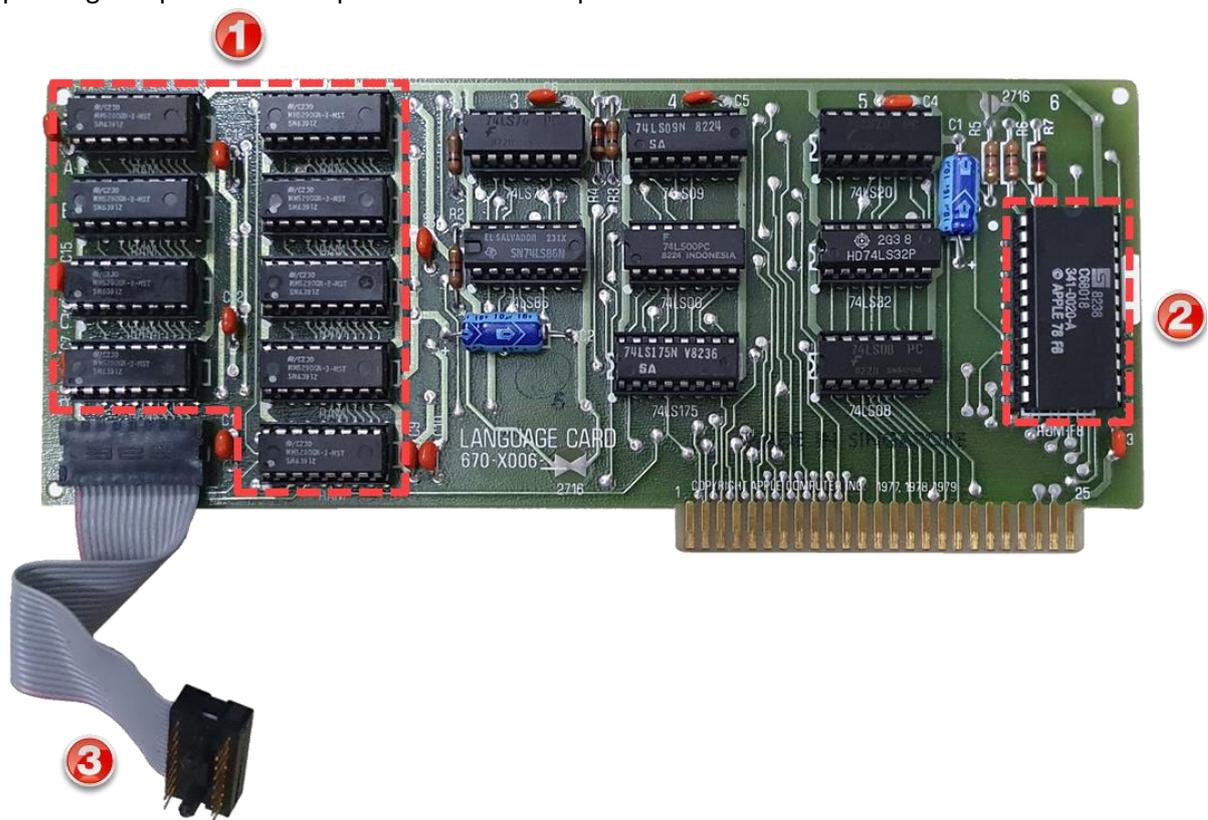
When the Apple Language Card was released in 1979 with the Apple Pascal Language system, it served two purposes:

1. Provide an Autostart F8 ROM, allowing an Apple II to auto boot from a floppy disk drive at powerup.
2. Provide an extra 16KB of RAM to a fully expanded 48K Apple, bringing the total memory available to 64KB (the extra 16KB is bank switched with the ROM address area \$D000-\$FFFF).

In 1979 Apple developed the Autostart F8 ROM and began to install it in the motherboard from factory. Cheaper 16K RAM expansion cards that excluded the F8 ROM were to follow (e.g the Microsoft 16K card), rendering the Apple Language Card obsolete.

The image below shows the major components of the Apple Language Card:

1. 16K bytes RAM + 1 additional 16K bit chip. The additional chip is needed as the card installation requires 1 chip to be removed from the motherboard such that the ribbon cable can be connected to the motherboard RAM socket.
2. Autostart F8 ROM (\$F800-\$FFFF) containing updated ROM routines to support auto boot etc.
3. Ribbon cable and connector for connection to the motherboard RAM socket at position E3. A special white socket was installed on later motherboards to make installation easier - the plug has two plastic guide pins that line up with holes in the special RAM socket.

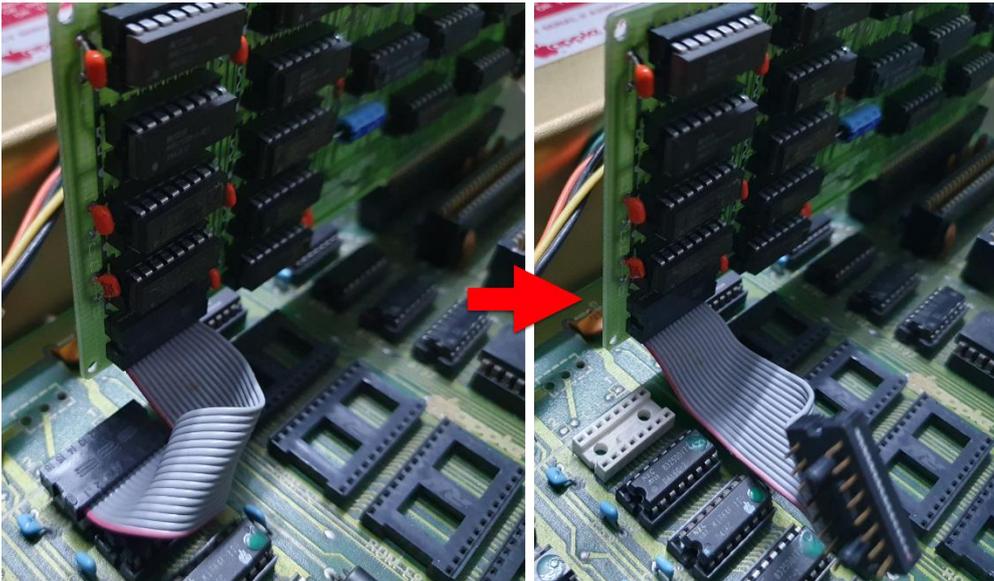


## Removal

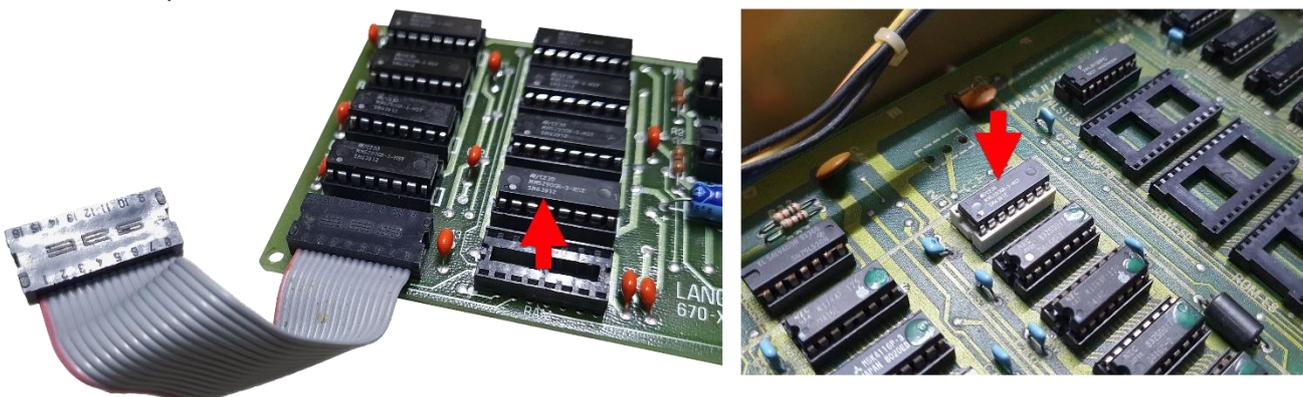
The Apple Language Card must be removed from Slot 0 to make space for the RAMX128K Card. Follow the [ESD Prevention](#) guidelines throughout the procedure.

To remove the Apple Language Card:

1. Carefully unplug the ribbon cable from the motherboard RAM socket at position E3. Take your time and gently lever the plug from the socket working end-to-end a little at a time until the connector is free.



2. Remove the Language Card from Slot 0 and identify the nine RAM chips on the board.
3. Remove one of the RAM chips from the Language Card and install it in the motherboard at position E3, taking care to check the correct orientation of the IC – pin one is located toward the front of the computer.



4. After double-checking your work, power on the computer. If it starts with APPLE ][ at the top of the screen then you already have an Autostart F8 ROM on the motherboard – there is no need to install the F8 ROM from the Apple Language Card. With ROMX installed this is also the case. Proceed to Step 5.

If however the computer boots to the \* prompt without the APPLE ][ legend, then remove the F8 ROM from the Apple Language Card, and swap it with the F8 ROM installed on your motherboard at position F3.

Position F3 is the leftmost ROM socket and is labelled F8-ROM.



After replacing the F8 ROM on the motherboard with the ROM from the Language Card, the computer should now boot with APPLE ][ at the top of the screen.

5. You have successfully removed the Apple Language Card from the computer and can now install RAMX128K in expansion slot 0.