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PH-001 2114 RAM ADAPTER

USER INSTRUCTIONS

1.0 INTRODUCTION

The OPTIMIZED DATA SYSTEMS PH-001 2114 RAM ADAPTER allows the use of the industry standard 2114 1K x 4 RAM as a replacement for defective 22 pin 6550 memory chips in the Commodore PET 2001-8 computer. The 2114 is less expensive and more readily available than the 6550.

The PH-001 plugs into the two 6550 sockets in column #8 of the PET and provides space for up to eight 2114s (4K bytes). If more than eight 6550s require replacement, a second adapter can be used in the column #4 6550 sockets. Even though the adapter uses the two 6550 sockets for connection, both 6550 ICs can still be installed in sockets on the adapter. Therefore, the adapter may be installed prior to any 6550 failure and be ready for use when one does occur.

For each 6550 failure, one 2114 is installed on the adapter (8 maximum per adapter).

2.0 ASSEMBLY

Assembly instructions for the PHB-001 bare PCB and PHK-001 kit are included in this section. If you purchased the assembled PH-001 then continue with 3.0.

2.1 Parts Required

Purchasers of the PHB-001 bare PCB must obtain the following parts to complete the adapter:

Item #	Qty.	Description
1	2	22 pin wire-wrap socket
2	1	74LS139 dual 2 x 4 decoder
3	1	16 pin IC socket (solder type)
4	2	0.1 uf capacitor (10 wvdc or greater)
5	1-8	18 pin IC socket (solder)
6	1-8	2114L 1K x 4 RAM

Items #3 and #5 sockets are optional but recommended for easy replacement of ICs.

Low power 2114s (2114L) with access times of 450 ns or faster should be used.

The item #1 22 pin wire-wrap socket is used as a method to "piggy-back" the PH-001 adapter into the PET 6550 sockets.

Other methods are possible that require less insertion force, but are either more expensive or increase assembly time. Such as:

1) Use an Augat #622-AG1 adapter plug in place of the wire-wrap socket. Disadvantages are that there will be no sockets for a 6550 on the adapter (thus requiring 2 each 2114s at installation) and the additional expense.

2) Solder a 22 pin IC plug (i.e. patch, header, etc.) to the pins of a 22 pin socket (solder type) after it has been installed on the adapter.

This is a tricky soldering procedure and also subject to mechanical failure in the future.

2.2 Assembly Procedure

Assembly of the PH-001 Adapter is straight-forward and will require very little effort. Refer to figure 1 for parts placement and follow the steps shown below. When soldering the IC sockets, use caution not to bridge solder between an IC pin pad and the adjacent pad or circuit etch.

a) Install and solder the two 22 pin sockets. Ensure the pins are at right angles to the board.

b) Install and solder the 16 pin socket.

c) Install and solder the desired number of 18 pin sockets for the 2114s. If all sockets are installed initially, it will eliminate the need to remove the adapter later to add more sockets. Also less "shuffling" of 6550s will be required to match an empty 6550 socket with a 2114 adapter socket when a 6550 failure occurs. A socket should be installed in location U1 as a minimum.

d) Install and solder the two 0.1 uf capacitors.

e) Fill the feedthru holes used for power and ground with solder to increase the current carrying capacity. See figure 1 for their location. (OPTIONAL)

f) Clean all solder rosin flux from the board with an appropriate cleaner (such as from Radio Shack) or lacquer thinner and a Q-tip. Also carefully inspect the solder side of the PCB for solder bridges (shorts) between a pad and the adjacent etch. Shorts are most likely in the area of the eight 2114 locations.

g) Install the 74SL139 (item #2) in its socket. Match it with the pin #1 designation on the PCB.

This finishes the assembly of the PH-001 adapter. The 2114s should be left out of the adapter until it is installed and has been verified not to cause problems due to shorted etches.

3.0 INSTALLATION

Installation of the PH-001 adapter into the Commodore PET is not a complicated procedure. However, certain precautions must be observed to prevent damage to the static sensitive 2114 and 6550 devices.

a) Turn off power to the PET.

b) Remove the power cord from the wall socket to prevent possible electrical shock.

c) Open the top cover of the PET and brace it with the metal rod inside the left side of the cover. Do this slowly and disconnect any cables that are too short to allow the cover to fully open. Removal of the two screws on each side of the cover (under the lip) may be required.

d) Prior to proceeding further, touch a grounded metal object near your workspace with your bare hand. This will eliminate any static electricity build-up in your body.

e) Remove the two 6550 ICs in column #8 at the left end of the PET memory IC area (or column #4 for the second adapter). This area is the two rows of eight 22 pin ICs at the front of the board. Carefully lift each IC from its socket by using a small screwdriver to pry each end of the device. Do this slowly and keep the IC as level as possible by lifting first at one end and then the other. This will prevent bending its pins.

   As each 6550 is removed, place it into the PH-001 adapter sockets (U10 and U11) with the notch in the 6550 pointing away from the 74LS139 IC.

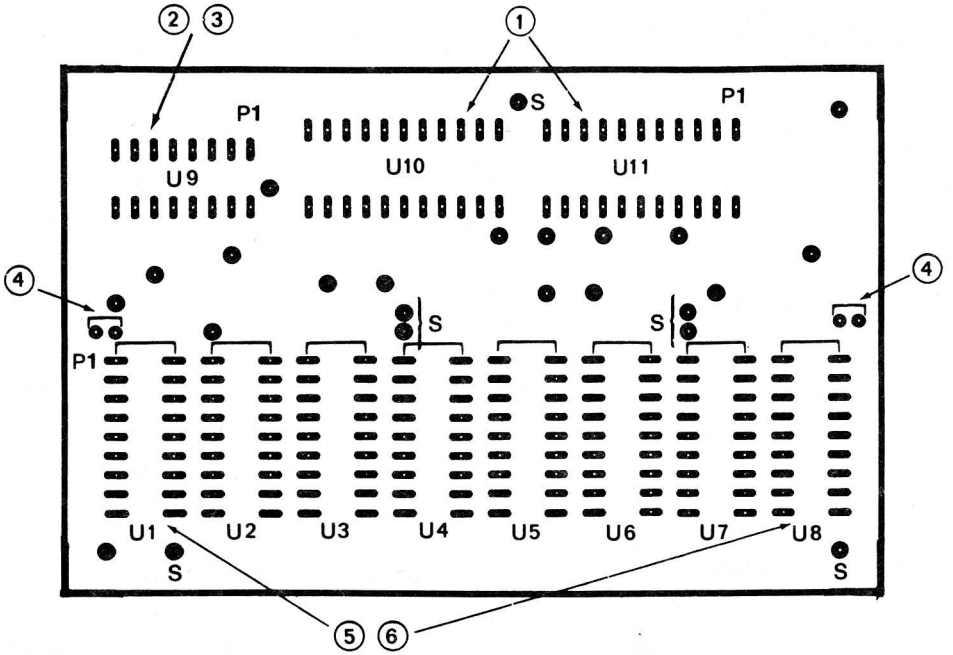
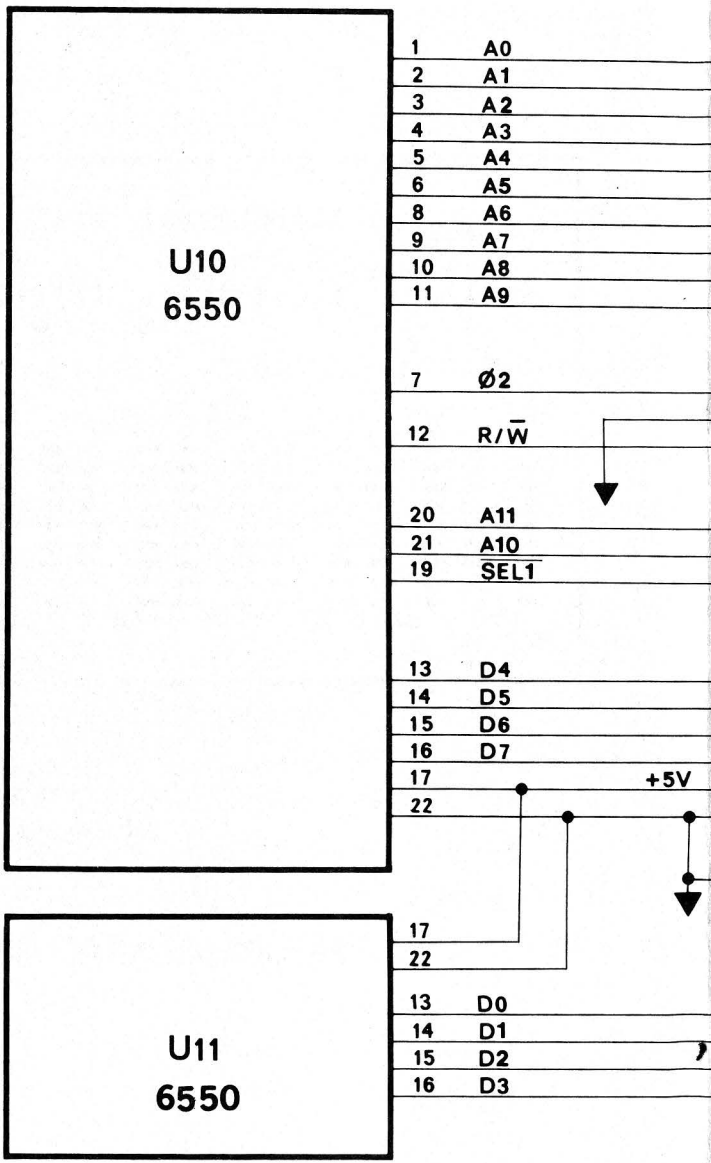
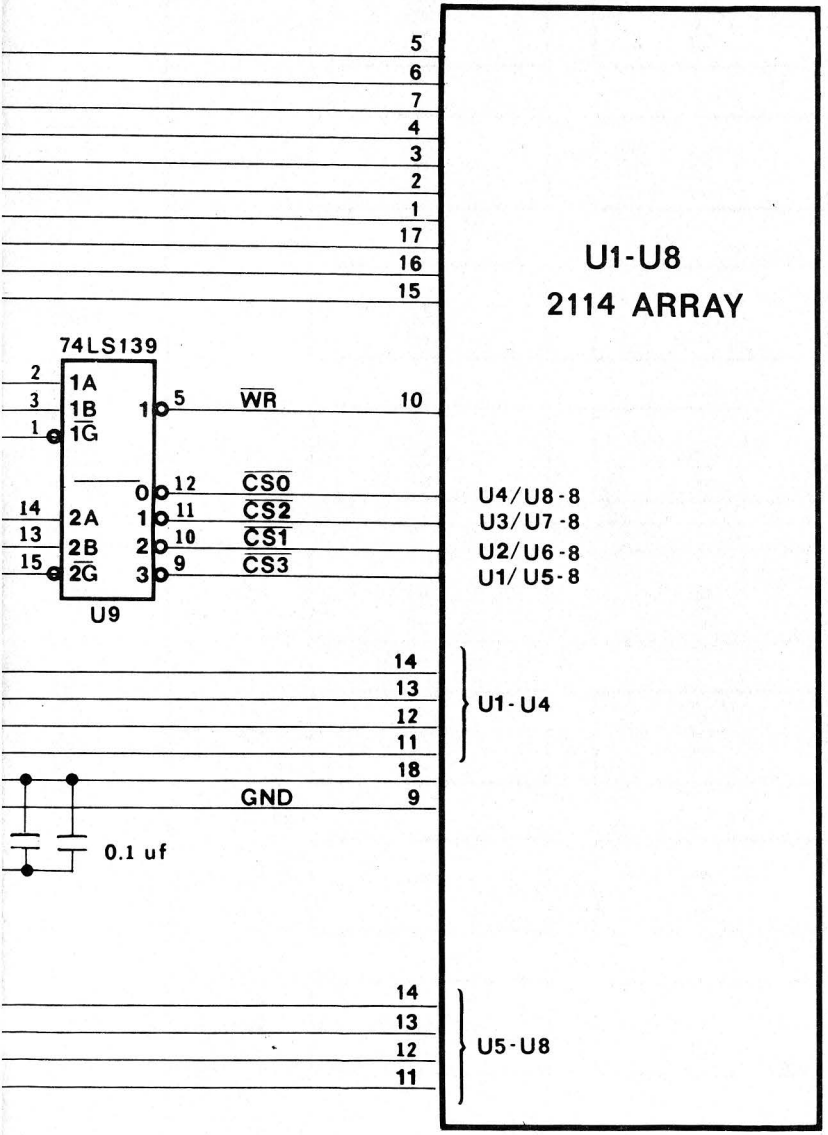


FIGURE 1 - PARTS LAYOUT


U10
6550
1 A0
2 A1
3 A2
4 A3
5 A4
6 A5
8 A6
9 A7
10 A8
11 A9
7 Ø2
12 R/W
20 A11
21 A10
19 SEL1
13 D4
14 D5
15 D6
16 D7
17
22
+5V
U11
6550
17
22
13 D0
14 D1
15 D2
16 D3

FIGURE


5
6
7
4
3
2
1
17
16
15
U1-U8
2114 ARRAY
74LS139
2
3
1
1A
1B
1G
5
WR
10
0
12
CS0
14
2A
1
11
CS2
U4/U8-8
13
2B
2
10
CS1
U3/U7-8
15
2G
3
9
CS3
U2/U6-8
U1/U5-8
U9
14
13
12
11
U1-U4
18
GND
9
0.1 uf
14
13
12
11
U5-U8

3 - SCHEMATIC

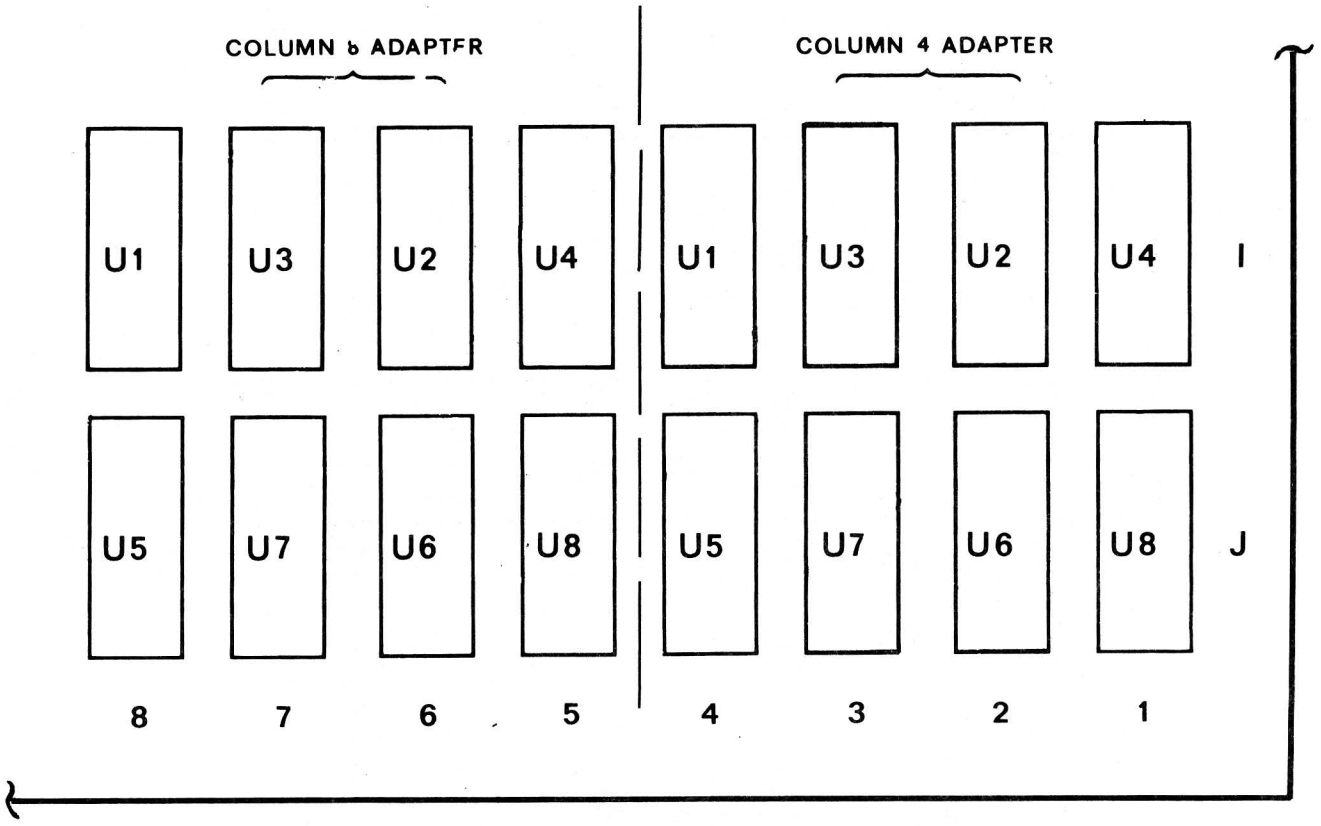


FIGURE 2 - 6550 VS. 2114 SOCKETS

f) Before installing the adapter into the PET, remove any 2114 ICs from the adapter and temporarily place them in conductive foam or pins down on a piece of aluminum foil.

g) You are now ready to install the adapter.

The PH-001 is installed with the 2114s to the left side of the PET and the 74LS139 to the rear. Carefully bend flat any capacitors on the PET board that will be beneath the adapter when installed.

Align the right side of the adapter's 22 pin socket pins with the openings of the two empty 6550 sockets. After you are sure they are aligned, place one hand beneath the PET electronics board for support and press the adapter into the 6550 sockets with the other hand.

Due to the number of pins involved, a moderate, but not excessive, amount of force is required. Keep the PET board firmly supported with your hand to prevent harmful bending. If you cannot insert the adapter, recheck for proper alignment with the openings in the 6550 sockets.

h) Before installing any 2114s on the adapter, your PET should be powered up as a preliminary check. The BYTES FREE message should read exactly the same as before the adapter was installed. If it does not, then a shorted memory address or data signal line may exist on the adapter. Turn off power, remove the adapter and inspect for solder shorts with a magnifying glass. Other possibilities are that the 74LS139 has shorted inputs or the 22 pin sockets have a cold solder joint.

i) If the BYTES FREE value is correct, then turn off power to the PET and proceed with section 4.0.

4.0 6550 REPLACEMENT

WARNING!! Never remove or insert 2114 or 6550 devices with power on.

A single PH-001 adapter will allow a direct one-for-one replacement of a 2114 for a 6550 in columns 5-8 of the PET (memory addresses $1000-$1FFF). If a 6550 fails in columns 1-4 or all 2114 sockets are not installed on the adapter, additional "shuffling" of 6550s will be required. A second adapter installed in column #4 allows replacement of 6550s in columns 1-4 ($0000-$0FFF).

Figure 2 shows the correspondence between 2114 sockets and 6550 sockets. For instance, the front #6 6550 socket corresponds to 2114 socket U6 on the adapter in column #8.

When a 6550 failure occurs, use the following information to localize the defective 6550.

Power up BYTES FREE less than	Defective Column
1023	2
2047	3
3071	4
4095	5
5119	6
6143	7
7167	8

If column 1 RAMs are defective, the PET will probably not show the BYTES FREE message.

If the defective RAM is in columns 5-8, then remove one 6550 from the defective column and place a 2114 in the corresponding adapter socket. If the BYTES FREE is now correct, then the defective 6550 has been found. If it is unchanged, then the other 6550 in the same column is defective. Replace it with the 6550 just removed.

If the failure is in columns 1-4 and only one adapter is installed, then a 6550 from columns 5-8 must be removed and used to find the defective RAM in #1-4. The 2114 socket that corresponds to the now empty column 5-8 6550 is then filled.

REMEMBER -- at no time should a 2114 be installed on the PH-001 adapter without the corresponding PET 6550 socket being empty!

5.0 CIRCUIT DESCRIPTION

A schematic of the PH-001 Adapter is shown in figure 3.

Both the 2114 and 6550 are 1K byte by 4 bit static NMOS memory devices. The primary differences between the 2114 and 6550 RAMs are in pin configuration and use of an internal 1K chip select decoder in the 6550. The PH-001 provides the necessary circuitry to adapt the 2114 to the 6550 socket.

The ten address lines (A0-A9) are connected to all 2114 sockets from the rear 6550 socket. The upper 4 data lines (D4-D7) are connected to 2114 sockets U1-U4 from this 6550 socket also. Lower data lines D0-D3 are connected to 2114 sockets U5-U8 from the front 6550 socket. Power for the adapter is drawn from both 6550 sockets.

One half of the 74LS139 dual decoder is used to provide 1K byte block chip selects for the 2114s. The PET 4K block ($1000-$1FFF) chip select signal, SEL1, enables the decoder (SEL0 for second adapter). Upper order address lines A10 and A11 are then decoded to provide enabling signals for the 2114s. Each decoder output is connected to a pair of 2114s (upper and lower data bit "nibbles").

The other half of the decoder provides a write strobe to all 2114s during valid data. The 6502 read/write line (R/W) enables the decoder in the low, or write, state and the "#1" output of the decoder produces an active low output pulse when the 6502 clock, Ø2, is high. Only the 2114 pair selected by the other half of the decoder accepts the write pulse.

There is a one-to-one correspondence between 6550 address and data lines and the 2114s. Therefore, any memory diagnostic program you may use that refers to memory locations or bits (i.e., $7FE3 bit D2) will still correspond properly to the 2114 locations.

6.0 MISCELLANEOUS

6.1 External Memory Expansion

Since the PH-001 adapter provides a 4K x 8 block of memory, it can be used as a low cost 4K byte memory expansion for the PET. This requires constructing a cable between the PH-001 wire-wrap sockets and the PET memory expansion connector. Connect the A0-A9 address lines, D0-D7 data lines and Ø2 and R/W lines to the matching signal names (BA0, BD0, etc.) on the expansion connector. The block select signal (U10-19) must be connected to the first unused block select signal (SEL2 for an 8K PET, SEL4 for a 16K PET). In addition +5vdc (350 ma per adapter) and ground must be connected.

Adding a second external adapter, for 8K bytes total, can be accomplished by merely plugging it into the first adapter at sockets U10 and U11. However, pin U10-19 of the second adapter must first be bent out for connection to the next block select signal (SEL_X) on the memory expansion connector.

6.2 Screen RAM Replacement

The PH-001 is electrically but not fully physically compatible for replacing the 6550s used as screen RAM. This replacement can be accomplished, however, by plugging U10 of the adapter into socket C4 of the PET and building a cable from U11 pins 13, 14, 15 and 16 to the same pins of PET socket C3.