CROMEMCO 16 KPR ROM INSTRUCTION MANUAL

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1.0 INTRODUCTION

The Cromemco 16KPR EPROM memory board provides space for 16 2708 type 1024-byte erasable PROM memory devices, giving the user 16K of PROM density on one convenient card. The card can also be used with 2708 compatible ROM memory ICs, such as the 2308.

Like other Cromemco memory components, the 16KPR will operate at 2 or 4 MHz (user-selectable), without wait states, in the usual sequential addressing class of operation.

The 16KPR includes Cromemco's Address Anticipation circuitry, which allows virtually full speed operation at 4 MHz. The 16 KPR also has Memory Bank Select, a feature that allows expansion of memory space beyond 64K bytes. With bank select, memory space may be organized into 8 banks of 64K bytes each. Direct Memory Access Override is another feature of the 16KPR that allows a DMA transfer to take place between any addresses in memory without regard to residence in a particular memory bank.

The 16KPR provides ideal EPROM support for the Cromemco Z-80 CPU card, and is also compatible with any S-100 bus computer.

2.0 INITIAL SWITCH AND JUMPER SETUP

2.1 Logical Address Block Select

The 16KPR may be mapped to any of four blocks of address space within any combination of eight memory banks. The Block Select switches are switches 1 and 2 located in the extreme upper right-hand corner of the card. These two switches encode and control address bits A15-A14 respectively. Setting a switch UP enables the board to respond to a high logic level in that address bit. Table I summarizes the switching data for each block in memory.

Table I. 16KPR Block Addresses

		Starting Address	Ending Address
16K Block	Switch 1;2	Hexadecimal	Decimal
1	0,0	0000 3FFF	0 16383
2	0,1	4000 7FFF	16384 32767
3	1,0	8000 BFFF	32768 49151
4	1,1	C000 FFFF	49152 65535

2.2 Memory Bank Mapping Select

With Cromemco's unique, software-controlled, Memory Bank Select, the 16KPR may be mapped to any of 8 levels of 64K memory space. The 8-place DIP switch in the upper right-hand corner of the card controls bank selection.

On power-up, the active memory bank is Bank Ø. Only memory

boards mapped to this bank are active immediately after power-up. At this point, any bank or banks may be selected through software control by addressing I/O port 40H which is dedicated to this function. The 8 bits output from port 40H enables or disables the corresponding bank in memory. A set bit "1" in the corresponding bit position will enable the memory bank. A reset bit "0" will disable it.

2.3 Direct Memory Access Override

The 16KPR also features Direct Memory Access Override, a circuit which allows memory blocks with identical or overlapping addresses residing in different memory banks to be available for DMA transfer. Switches 3 and 4 in the 4-place DIP switch in the extreme upper right-hand corner control these functions.

Switch 4, when in the UP position, enables the DMA Override for this block. When DOWN, the DMA Override is disabled. Switch 3, when in the UP position, locks out the block during DMA transfer. When in the DOWN position, switch 3 makes the block accessible to DMA regardless of whether it resides in the currently active memory bank. (See Memory Bank Mapping Select for further details.)

2.4 Board Disable

When the Board Disable jumper is inserted, the 16KPR will go into a disabled state at POWER-ON-CLEAR or RESET. In this disabled state, the memory may not be written to or read from. The Bank Select Port must be used to enable the board. This jumper is used when several

boards occupy the same logical address (in different memory banks) or for bootstrap arrangements. Normally this jumper is not inserted.

2.5 Bank Select Enable

When the Bank Select Enable jumper is inserted, the Bank Select Port becomes operational. With the jumper out, the board will ignore the output to the Bank Select Port.

2.6 Wait Disable

If the 16KPR is used with a 2 MHz, 8080 system, no wait states are required and the Wait Disable jumper should be inserted. This disables an occasional wait state during stack operations. Do not insert this jumper when using a Cromemco ZPU. The 16KPR senses the 2/4 MHz line and automatically disables wait states for 2 MHz operation.

2.7 Block Disable

If the user wishes, the 16K of EPROM on the 16KPR card can be split in half and either the upper or lower 8K of memory may be disabled. This allows the user to tailor the amount of EPROM residing at a particular address in system memory.

There are two user-selectable jumpers on the card; one to disable the upper 8K of PROM and the other for the lower 8K. If the jumper is inserted in the upper block disable (D1 on the schematic), the 8K of PROM will reside at the address programmed by the Logical Address Block Select. For example, if the 16K block mapped to 8ØØØ

(32K) had its upper block disabled, the remaining 8K would occupy memory addresses 8ØØØ to AØØØ (32-40K).

3.0 ASSEMBLY DATA

3.1 Assembly Instructions

The 16KPR is a state-of-the-art memory board designed to use the 1024-byte ultraviolet-erasable 2708 EPROM operating at 4 MHz. In assembly, the user should keep in mind the fine tolerances necessary for top performance and assemble the card with great care.

As with any construction of an electronic component, only a high-quality, rosin-core solder should be used, along with a fine-tipped low-wattage soldering iron. Do not neglect to perform the pertinent tests to assure that values are within their proper limits. The 16KPR is a high-quality memory device which, with proper care, will provide years of performance. While working on this card, keep in mind that prevention is easier than troubleshooting.

Examine the parts side of the board. As can be seen, a parts legend has been printed on this side. The integrated circuit chips (IC's) are oriented vertically, with PIN 1 being the square pin hole at the top left corner. Be sure to note all orientation data on the parts legend. There are four small jumper locations which can be enabled by soldering a small bit of wire between the poles marked with a white line between them. The PROM Block Disable jumpers are marked with the parts legend "DISABLE ROMS 0-7" and "DISABLE ROMS 8-15". The jumper holes are located directly below diodes D1 and D2 in the lower-

middle part of the board under socket IC15. The Bank Select Enable jumpers are next to IC35 in the lower right-hand corner. The Wait Disable is directly below Bank Select Enable. The Board Disable jumper is between IC35 and IC36.

The 16 sockets for the 2708 EPROMs are the 24-pin sockets in the upper-middle of the card. Notice the number printed directly above the socket location of the upper eight PROMS and similar numbers printed directly below the lower PROM locations. These numbers represent the starting addresses in memory that these PROMS will reside at if the Block Select switches are set to locate the 16KPR board at 0000 -- 3FFF hexadecimal. This corresponds to setting switches A15 and A14 to the DOWN position. To determine the location of a given PROM in system memory when mapping the 16KPR to starting locations other than 0000H, simply add the PROM address on the card to the 16KPR starting location.

Turn the board over and examine the solder side. Care must be taken to prevent 'solder bridges' which can electrically connect two circuit traces accidentally with unpredictable results. Cromemco coats the 16KPR with a high-quality solder mask to help prevent this mishap.

Again, take care in assembling this card. If you see a defect or abnormality, stop and check the assembly data. If you cannot identify or correct the problem, consult the Cromemco Engineering Department. It is best to deal with problems as they arise.

The assembly of the 16KPR has been broken down into a number of steps. We suggest that the builder complete each step carefully before proceeding to the next.

Sockets

The IC sockets should be installed first. There are three kinds of sockets supplied with the 16KPR: 24, 16, and 14 pin. Align the notched end as the legend describes, making sure all pins enter their holes without bending under or breaking off. If you have a block of foamed, stiff plastic, place it under the solder side and push the sockets into place from the parts side. Verify that they are seated firmly and evenly. Solder quickly and evenly, using minimum heat applied to the junction of pin and board. Solder a single pin of each socket on a vertical or horizontal line of sockets. This will keep them from falling out. The remaining pins can then be soldered in carefully. Work across the card in a logical order.

Resistors

Next, the resistors should be installed. Orientation of the ends of these parts is not critical but the values must be accurate. Refer to the color code below. Trim the resistor leads as short as is practical to keep the board neat and to allow better access to soldering other parts. The resistor color code is as follows:

Resistors R1, R2, R4, R6, R8, R9, and R10 are YELLOW-VIOLET-RED.
Resistors R3, R7, and R11 are BROWN-BLACK-RED.
Resistor R5 is RED-RED-BROWN.

Capacitors

The capacitors should be installed next. There are two types supplied in the 16KPR kit. All but seven of the capacitors are ceramic disk types. Orientation is not critical with these parts. The other seven capacitors (C9, C11, C12, C21, C22, C33, and C34) are electrolytic tantalum capacitors. They are marked with a + sign at one end. This must be aligned with the + sign at the corresponding capacitor location on the board. The capacitor will be destroyed if wired in reverse.

Diodes

There are two diodes in the 16KPR kit. These are mounted on the card, next to each other, below the socket labeled IC15. The CATHODE end is banded and must be aligned with the banded end of the parts legend diagram.

Voltage Regulators

The four Voltage Regulators may now be installed. These are mounted on the large black metal heatsinks, two to each heatsink. Two of the VR's will be marked 7905. These two are mounted together on a heatsink in the upper right corner of the card. When mounting these two devices, use the two nylon screws supplied and place a small piece of orange film between the VR and the heatsink. Fasten the screw down and remember to add the hex nuts. Leave enough lead attached so that the VR's can be easily bent down to the heatsink.

The other two VR's are listed as IC's 1 and 2. IC1 is a 12 volt

device marked 7812 and IC2 is a 5 volt device marked 7805. They are installed as pictured on the parts legend without insulating film and with metal screws. Remember to leave adequate lead length.

Switches

The two DIP switch packages are installed above the 7905 voltage regulator assembly in the upper right corner. One switch is 8-pole and one is 4-pole. Mount them so the switches are readable when the S-100 bus pins are pointing down.

Final Checklist

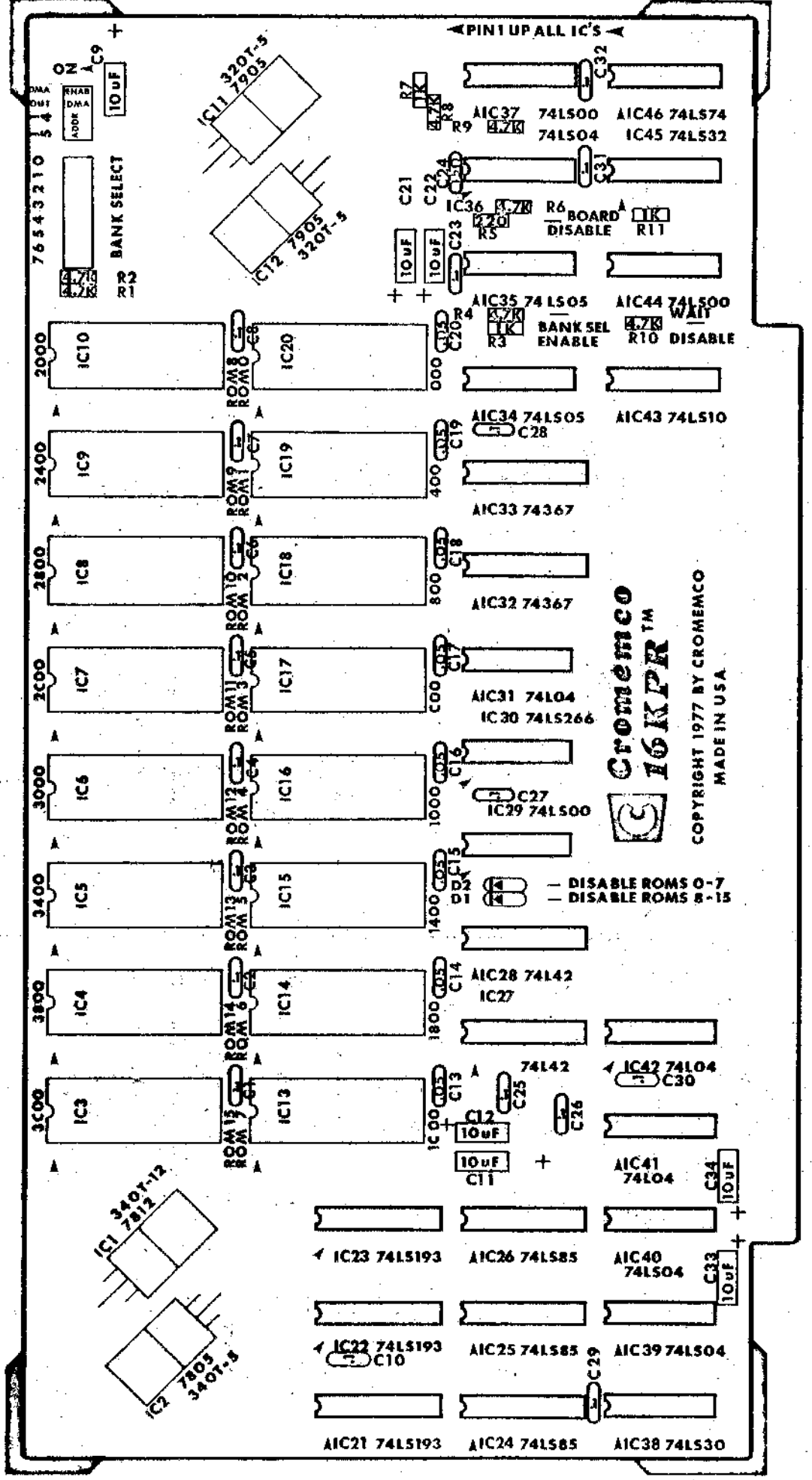
Before inserting the actual integrated circuits into their locations on the card, take a few minutes and check off these items.

( ) 1. Are any component leads touching each other? Check areas where parts are packed tightly.

( ) 2. Are all sockets installed properly with each pin making good contact? Have any pins bent under in installation?

( ) 3. Are the four voltage regulators installed in their proper positions (7805 and 7812 in the upper left, the 7905s in the upper right)? Did you remember the insulating film under the 7905's?

( ) 4. Are capacitors C9, C11, C12, C21, C22, C33, and C34 in their proper locations and correctly oriented?



3.2 PARTS PLACEMENT DIAGRAM

( ) 5. Are the two diodes aligned with the parts legend on the board?

( ) 6. Check both sides of the board for excess solder that could hide a potential solder bridge between two IC pins. If in doubt, resolder the connection carefully.

This completes the instructions for populating your 16KPR board. Install the ICs in their sockets following the legend and parts numbers.

3.3 Parts List

Capacitors		Cromemco Part Number
C1-C8	.1 Disc	004-00030
C9	10 uf Tantalum	004-00032
C10	.1 Disc	004-00030
C11-C12	10 uf Tantalum	004-00032
C13-C20	.05 Disc	004-00027
C21-C22	10 uf Tantalum	004-00032
C23	.1 Disc	004-00030
C24	150 pf Disc	004-00011
C25-C32	.1 Disc	004-00030
C33-C34	10 uf Tantalum	004-00032

Resistors		Cromemco Part Number
R1	4.7K	001-00024
R2	4.7K	001-00024
R3	1K	001-00018
R4	4.7K	001-00024
R5	220	001-00010
R6	4.7K	001-00024
R7	1K	001-00018
R8	4.7K	001-00024
R9	4.7K	001-00024
R10	4.7K	001-00024
R11	1K	001-00018

Diodes		
D1-D2	IN914 (IN4148)	008-00002

IC Sockets		
16	24 pin	017-00005
10	16 pin	017-00002
16	14 pin	017-00001

Integrated Circuit Chips		
IC1	7812 (340T-12)	012-00002
IC2	7805 (340T-5)	012-00001
IC3-IC10	2708 EPROM (not supplied)	011-00001
IC11-IC12	7905 (320T-5)	012-00000

IC13-IC20	2708 EPROM (not supplied)	011-00001
IC21-IC23	74LS193	010-00041
IC24-IC26	74LS85	010-00053
IC27-IC28	74L42	010-00071
IC29	74LS00	010-00069
IC30	74LS266	010-00037
IC31	74L04	010-00074
IC32-IC33	74367	010-00080
IC34-IC35	74LS05	010-00065
IC36	74LS04	010-00066
IC37	74LS00	010-00069
IC38	74LS30	010-00059
IC39-IC40	74LS04	010-00066
IC41-IC42	74L04	010-00074
IC43	74LS10	010-00063
IC44	74LS00	010-00069
IC45	74LS32	010-00058
IC46	74LS74	010-00055

Miscellaneous

1	Printed circuit board
1	8-pole DIP switch
1	4-pole DIP switch
2	Wakefield heatsinks
6	6-32 x 5/8 pan head screws, steel
2	6-32 x 5/8 pan head screws, nylon

8	6-32 hex nuts
10	Augat pins
2	pieces yellow insulating film

4.0 WARRANTY

Your factory-built 16KPR is warranted against defects in materials and workmanship for a period of ninety (90) days from the date of delivery. We will replace or repair products that prove to be defective during the warranty period provided that they are returned to Cromemco. No other warranty is expressed or implied. We are not liable for consequential damages.

Should your factory-built 16KPR fail after the warranty period, it will be repaired, provided that it is returned to Cromemco, for a fixed service fee. We reserve the right to refuse to repair any product that in our opinion has been subjected to abnormal electrical or mechanical abuse. The service fee is currently $35 and is subject to change without notice.

Your assembled 16KPR kit will be repaired, provided that it is returned to Cromemco, for a fixed service fee. We reserve the right to refuse to repair any kit that in our opinion has not been assembled in a workmanlike manner or has been subject to abnormal electrical or mechanical abuse. Payment of service fee must accompany the returned merchandise. The service fee is currently $35 and is subject to change without notice.