

RAM STORAGE UNIT



Ram Storage Unit manual

POTENTIAL FOR RADIO AND TELEVISION INTERFERENCE (FOR U.S.A. ONLY)

The ERAMCO Ram Storage Unit "RSU 1" generates and uses radio frequencies energy and, if not installed and used properly, that is, in strict accordance with the manufacture's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a class B computing device in accordance with the specifications in subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If your "RSU 1" does cause interference to radio or television reception, you are encouraged to try to correct the interference by one or more of the following measures:

Ram Storage Unit manual

- * Reorientate the receiving antenna.
- * Relocate the computer with respect to the receiver.
- * Move the computer and "RSU 1" away from the receiver.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet prepared by the federal Communication Commission helpful: How to Identify and Resolve Radio- TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

Ram Storage Unit manual

	Introduction.....	2
I	The box.....	4
I.1	Identification of sides.....	4
I.2	Opening and closing the device....	6
I.3	Inside the box.....	7
I.4	Installation of batteries.....	8
I.5	Battery information.....	10
I.6	Address and enable switches.....	11
I.7	Spare components.....	12
II	Connecting to the calculator.....	14
II.1	Initializing with the RSU rom.....	17
II.2	Initializing with the MLDL rom....	17
II.3	Initializing with the ZENROM.....	18
III	Addressing the RSU.....	20
III.1	Address switches.....	21
III.2	Addressing the ports.....	22
III.3	Enable switches.....	27
III.4	Independent modules.....	28
IV	Error conditions of the RSU.....	30
V	Crash recovery.....	33
VI	Limited 180 days warranty.....	37

Ram Storage Unit manual

INTRODUCTION

Congratulations. You have just bought an excellent piece of equipment for your HP-41 system. The Eramco Systems Ram Storage Unit provides a large and expandable data and/or program storage capacity. This easy-to-use device works with any model HP-41 calculator: HP41C, CV or CX.

NB. The Ram Storage Unit has to be used with some kind of operating system. It is not useful as a stand alone device. This is comparable to HP Extended Memory modules. When used in conjunction with the HP-41 Extended Functions module, Extended Memory modules provide a large data storage space, but when plugged in without the Extended Functions module the Extended Memory modules are useless.

Similarly with the Ram Storage Unit: when plugged in as a stand alone device it cannot be accessed, but when used in conjunction with an appropriate operating system it provides a large storage capacity. One "RSU" contains the same amount of memory as four complete Extended Functions/Memory sets.

Ram Storage Unit manual

The application of the "RSU" depends greatly on the kind of operating system used in conjunction with it. At the time of the writing of this manual, three established operating systems are available. Two of these operating systems deal with the creation of machine code (microcode), and the other deals with data and program storage.

The first two operating systems are the ZENROM produced and marketed by Zengrange Ltd, and the MLDL operating system, produced and marketed by **ERAMCO SYSTEMS**.

The third operating system is a module developed by **ERAMCO SYSTEMS** especially for this "RSU". With this module you will get over four times the storage capacity of the complete HP-41 Extended Functions/Memory. Also the module provides you with the facility to create and run your own program modules within the "RSU", releasing the calculator's memory for data storage and other use.

Before operating the "RSU", please read carefully through the entire manual. This will give you an idea how to operate the "RSU", and how to get the most out of it. Operation is quite simple, but should be understood fully to avoid disappointment or trouble.

Ram Storage Unit manual

I. THE BOX

The "RSU" is a flat plastic box approximately the same size as the HP-41 calculator, making it easy to place the "RSU" underneath the calculator for compact installation. No extra space is required on your worktable for the "RSU".

I.1 IDENTIFICATION OF SIDES

When shipped the box is closed. The top of the box is the face with the decal attached. Correct positioning of the box is with the decal visible and the protruding cable leading away from you (see figure 1).

Ram Storage Unit manual

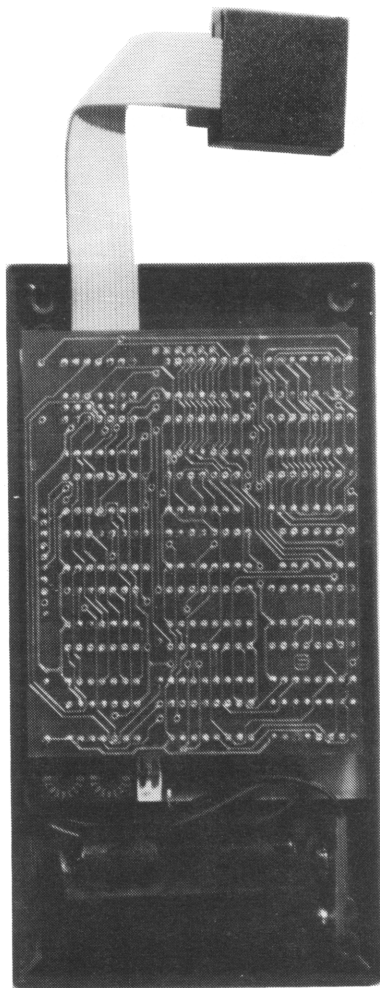


Figure 1.

Ram Storage Unit manual

I.2 OPENING AND CLOSING THE DEVICE

To open the box, face the underside up and remove the 4 screws in the corners. Use a normal, not-too-small screwdriver for this. If the box is going to be opened frequently we suggest that you do not replace the screws, but hold the base and lid together with the rubber band provided. Keep the screws in a safe place so that you can refit them if required.

To close the box, keep the cable leading away from you and replace the lid so that the text on the decal is readable. Turn the box over and put the four screws back in the holes. Tighten the screws until they will not turn anymore. It must be stressed that it is important not to use too much force as this can do irreparable damage to the case. Always use the screws provided as these are the exact length required for the box.

Ram Storage Unit manual

I.3 INSIDE THE BOX

When you look inside the box you will see a Printed Circuit Board and a small battery case. Leading from the upper side of the Printed Circuit Board you will see the cable that connects the "RSU" to your calculator. At the bottom of the box you will see the battery case.

In fact there are two Printed Circuit Boards which are connected to each other with special components. Under NO circumstances should the two Printed Circuit Boards be separated from each other as this could cause irreparable damage to the unit through possible electrostatic discharge.

The Printed Circuit Boards and the battery case are both mounted in the box with strips of double-sided adhesive tape. Do not remove the Printed Circuit Boards from the box, as this also can cause irreparable damage.

Ram Storage Unit manual

I.4 INSTALLATION OF BATTERIES

When the box is shipped the battery case is empty and not secured. The installation or replacement of the batteries is a simple procedure but must be carried out carefully.

Take out the battery case and unplug the clip, making sure not to place any strain on the wires leading from it to the Printed Circuit Board. Inside the battery case is a diagram showing the correct orientation of the batteries. Also see figure 2 for the correct insertion procedure.

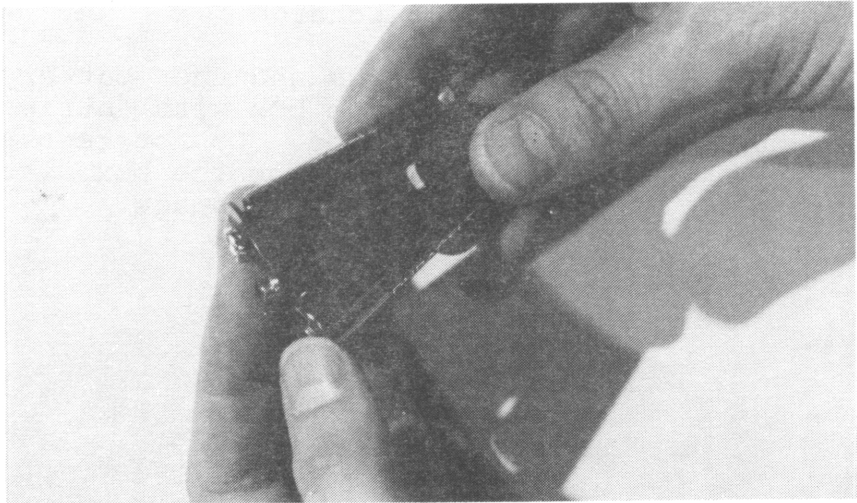


Figure 2.

Ram Storage Unit manual

After inserting the batteries fit the strip of double sided adhesive tape to the underside of the battery case. If you have been replacing old batteries it is advisable to replace the strip of self adhesive tape at the same time. See figure 3.

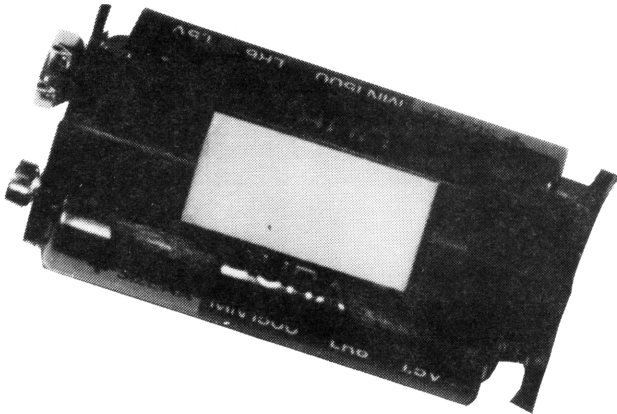


Figure 3.

Reconnect the battery case to the clip and wires from the Printed Circuit Board. This can be done in only one way. Finally, carefully replace the battery case in the box.

Ram Storage Unit manual

When replacing the batteries, it may be necessary to apply some pressure to get the battery case out of the box. This is best done using a small screwdriver, carefully lifting the battery case out.

I.5 BATTERY INFORMATION

The batteries contained in the "RSU" are used to keep memory alive even when the "RSU" is disconnected from the calculator. In this way you can use several "RSU"s to store data and still retain it, even after months of no operation.

No power is drained from the battery when the "RSU" is connected to the calculator. Battery life is therefore dependent on particular usage. If the "RSU" is always connected to the calculator, its battery will last indefinitely. If on the other hand the "RSU" is connected intermittently then battery life is shortened accordingly.

With fresh batteries data integrity is guaranteed for at least six months when the box is not connected to the calculator. When the "RSU" is connected more frequently to the calculator it may vary between six months and two years.

Ram Storage Unit manual

As batteries are susceptible to corrosive leakage it is advisable to replace them every six months. For replacement procedures see I.4 It is advisable to remove the batteries completely if the box is not used for a long period of time.

It is advisable to use leakproof alkaline batteries size UM-3 (commonly known as "penlight" batteries AA-size)

I.6 ADDRESS AND ENABLE SWITCHES

Just above the battery case are two small rotary switches (see figure 1) which can be set correctly with the help of a small screw driver. Do not use a large screw driver as it can damage the markings on the plastic surrounds.

To the right of the two "address" switches are two small on/off switches. These are the "port enable" switches. The on position of these switches is when they are pushed towards the top edge of the box. They are in the off position when switched down. The off position is marked on the switches themselves. The brown switch corresponds to the leftmost rotary address switch, and the red switch corresponds to the rightmost rotary address switch.

Ram Storage Unit manual

For detailed operation of these switches refer to chapter II of this manual. At the moment it is enough to set both enable switches to the off position, the left rotary address switch to 2, and the right rotary switch to 3.

The "RSU" is initially shipped with the switches in the above configuration.

I.7 SPARE COMPONENTS

The "RSU" is delivered with some spare components to facilitate its adaption to your own requirements. Firstly, the rubber band delivered with the unit is to keep the box closed in case you do not use the screws. This is advisable if you are going to open the box frequently.

Secondly the Velcro pads included can be fixed to both the calculator and the box. Pressing the two together then gives a single complete package which is especially handy when the "RSU" is used in field work.

Thirdly, four rubber feet are included for use in desk-top work.

Ram Storage Unit manual

The Velcro pads can be attached as follows. Afix the thin flat metal parts to the underside of the calculator. Press the second, soft, part of the pads onto each other and remove the protective shields. Place the "RSU", with the lid facing upwards, on a table. Carefully position the calculator above the "RSU" and press it onto the "RSU", while keeping it in position. Now you have an easily transportable combination.

If you intend to use the "RSU" on a desk or table with the calculator sitting on top it might be advisable to use the rubber feet included in the package. These feet should be attached to the underside of the "RSU", near the corners, making sure they do not cover the screw-holes.

Now your box is ready for use. Proceed to the next chapters for detailed information on how to connect your "RSU" to the calculator and how to operate the address switches. Leave the box open until all necessary adjustments are made.

Ram Storage Unit manual

II. CONNECTING TO THE CALCULATOR

The "RSU" is connected to the calculator through the module at the end of the cable. The module does not have an extractor handle and therefore it is necessary when disconnecting the "RSU" from the HP-41 to pull the module out by the cable. Do not pull too hard on the cable as this can damage the connections inside the module. The most convenient way to connect the "RSU" to the HP-41 is to place the connector in either port 4 or port 2.

When connecting the "RSU" for the first time, make sure that the rotary address switches are in positions 2 and 3. The two enable switches to the right side of the rotary address switches should be positioned to "off". Make sure that there are no other modules and or devices connected to the calculator through port 3.

Ram Storage Unit manual

You can now turn on your calculator. The calculator should turn on in the normal way. If the calculator behaves strangely or does not turn on at all, switch the HP-41 off and disconnect the "RSU". Try to switch your calculator on again. If the calculator still behaves strangely refer to your operating manual. A possible solution is to press backarrow while turning the calculator on. This causes a MEMORY LOST. After this the calculator should operate normally. If it still does not work, refer to your operating manual or contact your dealer.

Connect the "RSU" again and switch the calculator on. If it still does not work properly, check the two enable switches in the "RSU". These switches should be in the off position. If not, switch them off, and repeat the whole procedure again. If the calculator with the "RSU" connected is still not working properly see chapter IV for possible causes and recovery methods.

Ram Storage Unit manual

Now the "RSU" and the calculator are connected to each other and the calculator should function normally. In order to get the calculator working properly with a "RSU" connected to it, the following procedure should be followed.

In the introduction we explained that the "RSU" cannot be used without some kind of operating system. We also mentioned three useful operating systems that are marketed at this time. Any of these three systems are capable of initializing your "RSU" properly. For your convenience the method of initializing the "RSU" with each of these operating systems is explained below in detail. For other operating systems refer to the manuals supplied with them.

Ram Storage Unit manual

II.1 INITIALIZING WITH THE RSU ROM

When you are using the "RSU-1A" operating system initialization is very simple, and accomplished by the execution of the function CLRSU. This function will clear every "RSU" that is connected to the calculator, so before using it disconnect any "RSU" you want to maintain the contents of. The function operates independently of the setting of the switches in the "RSU". During execution of CLRSU the message "CLEAR RSU" will be displayed.

The CLRSU function operates in the "RSU" in a manner analogous to memory lost in the HP-41, so be careful when executing it not to have any required data in the unit.

II.2 INITIALIZING WITH THE MLDL ROM

The ERAMCO MLDL operating system contains the function CLBL to initialize the "RSU". This is nearly the same function as the CLRSU function, but it needs more manual inputs to operate properly. Like CLRSU, the CLBL function will also clear every connected "RSU".

Ram Storage Unit manual

To clear the "RSU" with CLBL you have to enter the beginning and ending address of the block to be cleared into the alpha register. Switch to alpha mode by pressing the alpha key once and key in the string "8000FFFF". After you have keyed in this string press alpha once more to leave the alpha mode. Now you can execute the function CLBL. This will take about 20 seconds to execute. Upon completion of the function CLBL your "RSU" is completely cleared.

For more details about the operation of CLBL refer to the MLDL operating system manual.

II.3 INITIALIZING WITH THE ZENROM

The last operating system we will describe here is the ZENROM. This system is especially intended for writing machine code ("microcode") and therefore has an mcode editor which can be used to initialize the "RSU".

Ram Storage Unit manual

Execute the function MCED. This will activate the mcode editor and you will see the prompt "COMMAND?". Now press the CLR key (this is the divide key). You will be prompted for a beginning and ending address: CLR:____,____. Type in 8000. This will change the display to CLR:8000,____. Next type in FFFF and the display will change to CLR:8000,FFFF. Any mistakes made during entry of the addresses can be corrected with the backarrow key. When the prompt is filled correctly, press the R/S key. After 20 seconds the display will change to COMMAND? as it was when you entered the MCED function.

The "RSU" is now cleared and you can return to the normal operating mode of the HP-41 by pressing EXIT.

For more details on operation of the MCED function refer to the ZENROM manual.

Ram Storage Unit manual

III. ADDRESSING THE RSU

To get a better understanding of the rotary address switches it is necessary to go a little deeper into the addressing scheme of the HP-41 calculator. The calculator has four user ports numbered from one to four. Normally these ports are empty or contain HP modules. When a module is plugged in it uses the physical space of the port and also the corresponding electronic space.

With normal HP modules you will never have any problems concerning electronic port usage, as this is the same as the physical port addressing. However, a single "RSU" has two modules built in, but uses only one physical port. Therefore the modules in the "RSU" must be assigned to the appropriate electronic ports. This is done with the rotary address switches.

In the following paragraphs the modules in the "RSU" will be referred to as a "block". Each "block" consists of two "pages", and each "page" has storage capacity of 4096 (4K) words. This gives a total capacity in the "RSU" of 16384 words (16K). For program storage a "word" is equivalent to a byte.

Ram Storage Unit manual

III.1 ADDRESS SWITCHES

The "RSU" box contains four switches as mentioned in chapter I. These switches control which ports of the calculator will be used. A good understanding on how these switches can be set will ensure that you can use the "RSU" to it's full capacity.

The switches specifying the two electronic ports to be used are located just above the battery. These are two small rotary switches that can be adjusted with a small screwdriver. If you have a close look at these switches, you will see that they have 16 postions, numbered from 0 thru F. As the box will address only four ports, it is evident, that there are twelve spare positions. These twelve spare positions are not used.

The unused positions on the switches are equivalent to the four used positions from 0 to 3. Following is a table with equivalent switch positions.

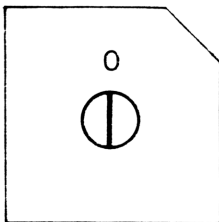
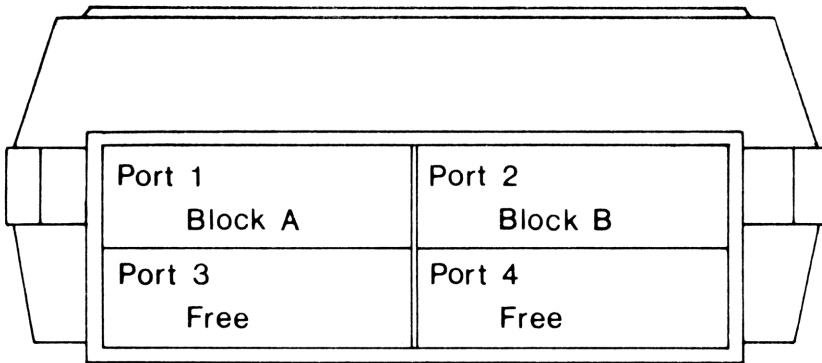
0	△	4	△	8	△	C
1	△	5	△	9	△	D
2	△	6	△	A	△	E
3	△	7	△	B	△	F

For clarity we will describe use of the positions zero to three only. This also makes the use of the "RSU" in conjunction with the ES RSU -1A rom easier.

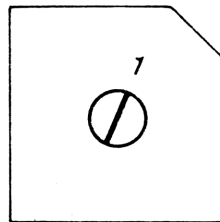
Ram Storage Unit manual

III.2 ADDRESSING THE PORTS

The "RSU" can be used together with normal HP modules in many combinations, but make sure that you do not address the "RSU" to a port where an HP module is residing. This can be avoided easily if you make use of the following diagrams. They show you where the "RSU" is addressed and which ports are free to be used for normal HP modules.

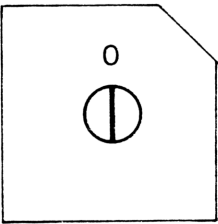
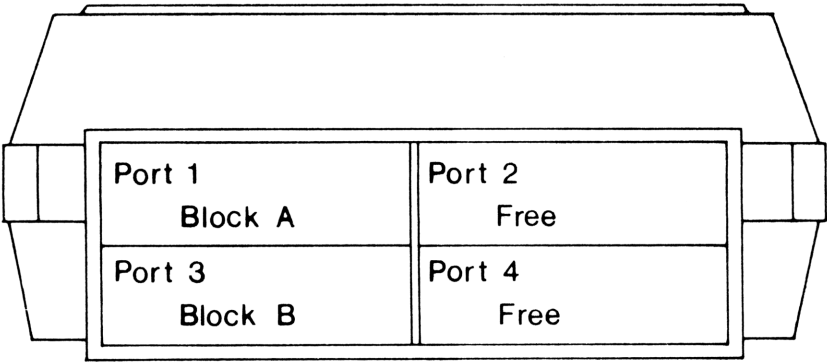


A

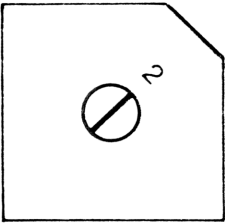


B

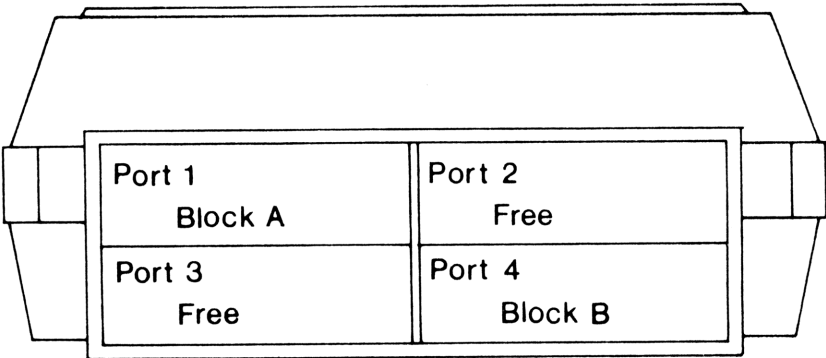
Ram Storage Unit manual



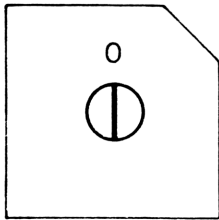
A



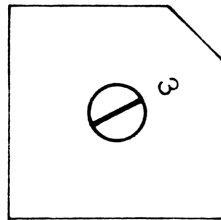
B



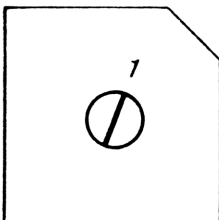
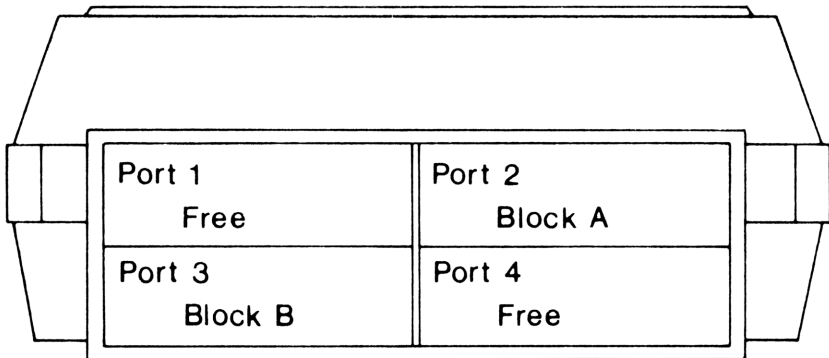
Ram Storage Unit manual



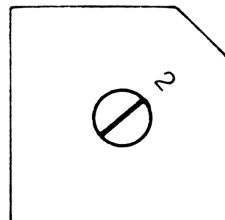
A



B

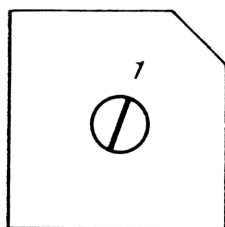
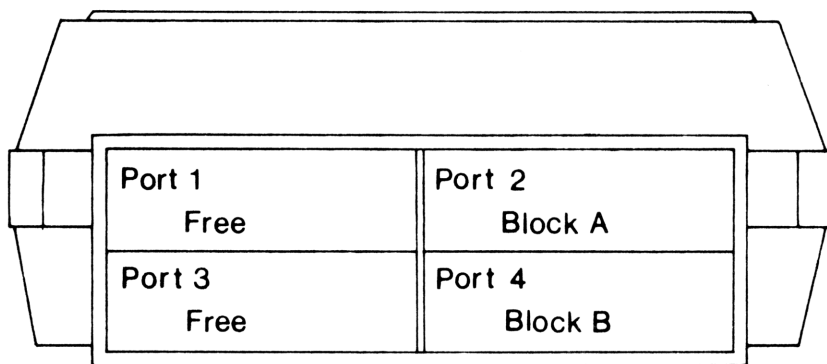


A

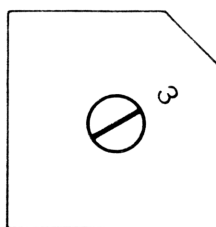


B

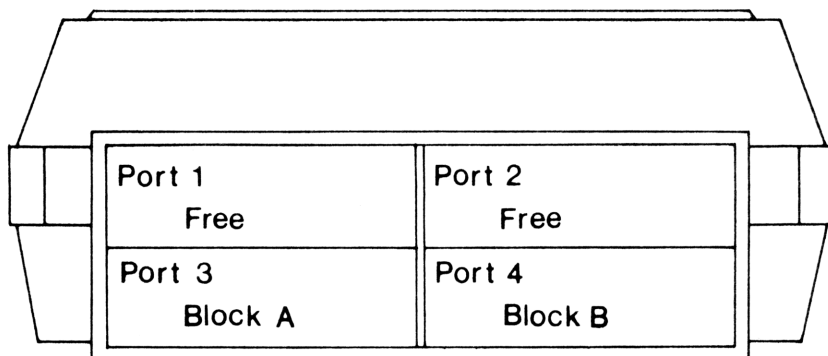
Ram Storage Unit manual



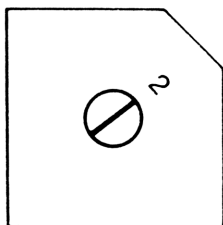
A



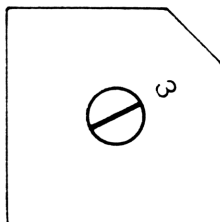
B



Ram Storage Unit manual



A



B

As can be seen from the diagrams, the addressing of the "RSU" is quite simple. Choose the port you want one of the "RSU" blocks to be located in, take the port number and subtract 1. This gives the number you have to select on the rotary address switch.

Repeat this procedure for the second block in the "RSU" and set the second switch to the appropriate position. It is not important which switch is set first. The letters A and B should be swapped in the above diagrams if the setting order is reversed.

Do not set both switches to the same port. The "RSU" will not be damaged, but you will have access to only one of the two blocks. This is an unnecessary loss of storage capacity. If you only want to use one block, you can switch it off with the enable switches, as described in the next paragraph.

Ram Storage Unit manual

III.3 ENABLE SWITCHES

To make it easy to switch off one storage block of the "RSU", in case you need the port for other purposes, two "block-enable" switches are provided. These are the switches to the right of the rotary addressing switches. Each switch controls one block. The right (red) switch controls the block that is addressed by the right rotary address switch. The left (brown) switch controls the block addressed by the left rotary address switch.

When the "block-enable" switches are in the off position the blocks are switched off. The "RSU" is initially shipped in this state.

For example, assume that the right-hand address switch is set to position 2. Add one to this number, to get the port occupied by the block, that is, port 3. To use this block for storage capacity, push the right (red) "block-enable" switch upwards to the on position. Port 3 cannot now be used for HP application modules (there are some exceptions to this, explained below). If, later, port 3 is needed to hold the HP math pac we have to switch off the block in the "RSU" that is addressed to port 3.

Ram Storage Unit manual

This can be accomplished in three ways. Firstly we can disconnect the complete "RSU". However, this also loses the capacity of the second "RSU" block. A second method is to address the block in the "RSU" to another port. If we want to use the math module for a short time only this may be inconvenient as we have to figure out which port can be used instead. Lastly we can switch the block in the "RSU" off. This is accomplished by setting the corresponding enable switch to the off position. When the math module is removed, we can regain control of the block in the "RSU" by setting the enable switch to the on position.

III.4 INDEPENDENT MODULES

The "RSU" contains two blocks of storage space, occupying one port each. As described in the first part of this chapter, the "RSU" uses more "electronic" port space than physical port space. Some HP modules on the other hand occupy physical port space, but not electronic port space. When these modules are used together with the "RSU" you can plug them into a physical port that is being electronically used by the "RSU" at the same time.

Ram Storage Unit manual

For example, if you have the HP timer module, you can plug it into a port that is simultaneously being electronically used by the "RSU". Let us assume that you have set the blocks of the "RSU" to ports 3 and 4 respectively. If the "RSU" is plugged physically into port 3 it will also electronically use port 4. Because the timer module is an independent (or "system") module it may be plugged into port 4 without any problem. In this way you can make maximum use of the available ports. All independent (or "system") HP modules are listed below.

- . Extended Memory modules
- . Single density RAM memory modules
- . Quad density RAM memory modules

- . Timer module
- . HP IL module
- . Printer module (both IL and
dedicated printer)

As you can see, you can, for instance, use a printer and cassette or disc drives together with the "RSU" without having to remove or disable any of the "RSU" blocks.

When you are short of physical ports it may be advisable to have some of the independent "system" modules built into the calculator. This is done by several parties, with full guarantee, of which **ERAMCO SYSTEMS** is one. For more information refer to your local HP dealer or write to **ERAMCO SYSTEMS** for advise.

Ram Storage Unit manual

IV. ERROR CONDITIONS OF THE RSU

As with every kind of memory, you can make mistakes using it, or worse, the contents of the memory can be lost. In most cases you will have no problem returning to normal operation. However, with some systems it is not so easy to return to normal operation and special methods are necessary to regain control of the memory.

One good example of this is the HP-41 calculator itself. When using special programming techniques (called Synthetic Programming) it is quite easy to "crash" the calculator. Programs do not function properly, or worse, are totally inaccessible. In these cases it is necessary to clear the contents of the calculator completely to be able to continue.

Similarly with the "RSU". When used properly, with the RSU -1A operating system you will not experience any problems at all. However, when operating the "RSU" with the MLDL operating system or a ZENROM you may crash quite easily.

Crashing the "RSU" will result in one of the following three error conditions and/or behaviors.

Ram Storage Unit manual

- 1) The calculator with the "RSU" connected does not operate anymore. You are unable to switch the machine on.
- 2) You are still able to switch the calculator on, but when switched on the calculator does not respond to the keyboard, or does so only after a long time. It is also possible that the display will flash on and off very rapidly.
- 3) The calculator can be switched on in the normal way and responds normally to the keyboard, but when executing a CAT 2, or trying to execute a non-keyboard function from the keyboard, the calculator crashes.

These error conditions can have many causes, dependent on the kind of operating system being used.

When using the RSU -1A operating system you will experience no problems at all, provided you have set up the "RSU" properly, as described in chapters 2 and 3. In this situation the "RSU" will only crash if it is disconnected from the calculator with its batteries removed from the "RSU" or flat. On reconnection to the calculator the random memory state of the unpowered "RSU" can cause the problems described above. For recovery methods see the next chapter.

Ram Storage Unit manual

With the other two operating systems it is a lot easier to crash the "RSU". These crashes can be caused by careless use of almost any function in the operating systems. It is impossible for us to give details about every function and the way it might get your calculator and "RSU" "hung". Therefore we will explain only the most likely causes.

The first way of crashing a "RSU" is by moving or writing code into certain locations at the end of a page in the "RSU". These locations are the so-called interrupt points, and are used by the HP-41 to give control to certain plug in modules. In the case of the first two problems described in this chapter these interrupt locations will probably contain spurious code. For recovery procedures see chapter V.

The second type of calculator crash is when the first 130 words of a page contain random code. The problem resulting from these disrupted words is described in note 3) above. For recovery in this situation refer to the next chapter.

Ram Storage Unit manual

V. CRASH RECOVERY

Chapter IV describes some of the commonly known results of a crash. Such crashes can result from electrostatic discharge, flat batteries, or incorrect usage of the "RSU" pages. The last will only occur if you use an operating system intended to create machine code. When you use such operating systems, refer to their respective manuals for information on how to clear only the page that is causing the trouble. The recovery method described in this chapter is unpleasant, as it destroys all data contained in the "RSU", but very effective. It also handles the battery problem.

Please follow the instructions in this chapter carefully: they will guarantee an easy solution to problems with the "RSU".

When you have a flat battery the calculator with the "RSU" connected to it will usually not respond to any action (see chapter IV). The following procedure will regain control of the "RSU".

Ram Storage Unit manual

First switch off the two "RSU" blocks. This is done with the two enable switches at the right of the address switches (for a detailed description of switch location and operation see the chapters I and III). Try to switch on your calculator. If the problem is caused by the "RSU" the calculator will respond normally at this stage.

If the calculator still behaves strangely you should disconnect the "RSU" and try to get the calculator back to normal operation. One solution is to clear the entire calculator with the memory lost sequence. This is performed by pressing the backarrow key and holding it, whilst switching the calculator on with the ON key.

If your calculator still does not operate in the normal way, you should check with your dealer for service on your calculator.

With the calculator operating normally again, reconnect the "RSU". Make sure the enable switches in the "RSU" are switched off. Switch on the calculator. If the calculator cannot be switched on, or behaves strangely after switching on, you should contact your dealer for service on the "RSU".

Ram Storage Unit manual

Assuming that both your calculator and "RSU" are operating normally, next check to see if the problem is caused by disrupted data or is just a "normal" crash (operation of the HP-41 is susceptible to disruption by high levels of static electricity). Switch the "RSU" enable switches to their on position and try to turn the calculator on and off several times. If there are no problems you should try to execute first some functions from the calculator, and next some functions or programs contained in the "RSU". If you are using the RSU -1A operating system, also try a data file directory. If all works correctly, it is most probable you have had a "normal" electrostatic crash and you should be able to resume operation without further problems.

If the calculator crashes again after enabling the storage blocks of the "RSU" you should repeat the above procedure. However, do not switch on the "RSU" blocks as it is likely that the contents of the "RSU" are disrupted and advisable to "clean up" the whole "RSU" by following the procedure described in chapter II.

Ram Storage Unit manual

After clearing the "RSU" the two enable switches can be set to the on position again. If the calculator still behaves strangely, you should return the "RSU" for service.

With no more problems evident you can resume normal operation. However it is advisable to check the "RSU" again after a few days to see if it still operates normally. If it again malfunctions it is most likely that the batteries are flat. Replace the batteries following the procedure described in I.3

Ram Storage Unit manual

LIMITED 180 DAYS WARRANTY

ERAMCO SYSTEMS warrants their RSU - Boxes against defects in materials and workmanship for 180 days from the date of original purchase. If the unit is sold or transferred to other persons or institutions the warranty is automatically transferred to the new owner. During the warranty period ERAMCO SYSTEMS will repair or, at their option, replace at no charge a product that proves to be defective, provided the product is returned, shipping prepaid, to ERAMCO SYSTEMS or their official service representative.

WHAT IS NOT COVERED

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than ERAMCO SYSTEMS or their official service representative.

No other express warranty is given. Any implied warranty of merchantability or fitness is limited to the 180 days period of this written warranty. In no event shall ERAMCO SYSTEMS be liable for consequential damages. ERAMCO SYSTEMS' liability shall in no way exceed the catalog price of the product at the time of sale.

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