



MPMS Service Note 1090-301

Initial Installation Instructions for the Reciprocating Sample Option (RSO)

The MPMS Reciprocating Sample Option (RSO) can be installed on any existing MPMS running revision 2.x MPMS software. If you are running revision 1.x software, you will need to upgrade to revision 2.27 or newer software and install a new CPU board in the Model 1822 before installing the RSO. Refer to Quantum Design Service Note 1014-803 for the software upgrade procedure from 1.x to 2.x.

Your computer needs two serial ports and at least a 386 processor for the RSO to operate. The RSO operates with two serial ports connected to the computer. One serial port, Com 1, provides servo control. Its cable comes from the interior of the RSO controller. The RSO controller motherboard needs the other serial port, Com 2. Its cable is designated J-D1 on the rear panel of the RSO controller.

Make sure you have received all the parts necessary for this installation procedure by matching all the parts checked off in the *MPMS RSO Upgrade Shipping/Packing Checklist*. Also, look at the *Ready to Ship RSO Controller Upgrade* drawing (8090-002) accompanying this service note.

The installation instructions in this service note are divided into the following nine sections. Some steps, such as Repositioning the Sample Translator and Installing the RSO Controller, need two people present. Expect the installation to take 2-8 hours, depending upon your familiarity with modification necessities within the MPMS control console.

- Preparing the MPMS for the RSO Installation
- Repositioning the Sample Translator
- Installing a RSO Feedback Adapter Board in the 1822
- Installing the RSO Controller
- Installing EPROM in the CPU Board of the 1822
- Restoring the MPMS
- Upgrading to Revision 2.27 or Newer MPMS Software
- Installing the RSO Calibration Data
- Installing the RSO Transport

Preparing the MPMS for the RSO Installation

1. Set the temperature to 300 K and wait for it to stabilize.
2. Disconnect the two pumping lines from the probe head but leave them seated in their connectors so that the system remains sealed.

Note: The quick-connect fittings on these lines have two positions, a seated and a connected position. When disconnecting a line, pull back on the sliding ring, and the line will disconnect yet remain seated.

3. Turn the system power off with the switch on the front of the power distribution unit in the console cabinet.
4. Unplug the wall power cord.

Repositioning the Sample Translator

Examine the sample translator, which is the black housing installed on the inside left wall of the console cabinet. If the sample translator is mounted vertically (connections facing up instead of towards the back of the cabinet), you need to reposition it so that it's mounted horizontally to make room for the RSO transport controller. Refer to **Figure 1**, which depicts how the sample translator looks when mounted vertically and horizontally. If it is already mounted horizontally, you may skip this section of this installation procedure.

1. Refer to **Figure 2a** and **2b** to reposition the sample translator. You must use the adapter plate supplied with the installation package. Before continuing, be sure you have the 37.6 cm x 38.6 cm x 3.2 cm (14.8" x 15.2" x 1.25") wooden plate that mounts over the existing translator mounting board. The hardware for installing this plate is found in a bag labeled *Sample Translator Adapter Plate Hardware*.
2. Remove the blank front panel of the console cabinet by removing the four Phillips-head screws that hold it in place. Save the screws as you will use them later.
3. Unscrew the four screws that hold the sample translator to its mounting board inside the cabinet and carefully lay the sample translator, which is heavy, on the floor of the console cabinet. Save the screws and lock washers. Do not remove the translator's mounting board.
4. Place the adapter plate over the existing mounting board. It only fits one way.
5. Place the four silver 8-32 x 1" flat head screws provided with the adapter plate into the four through-holes indicated in **Figure 2a** to align the adapter plate with the mounting board behind it. Shift the adapter plate so that the screws all go in straight.
6. Tighten the four screws to secure the adapter plate to the inside wall of the console cabinet.
7. Screw the four black wood screws provided with the adapter plate into the holes in the corners of the plate and into the side of the cabinet (**Figure 2a**).
8. Remount the sample translator to the four holes indicated in **Figure 2a** by using the four screws and lock washers that previously held the sample translator. Position the

translator so that the power connection faces the front of the cabinet and the remaining connections face the rear of the cabinet. The sample translator should now resemble **Figure 2b**.

You have completed repositioning the sample translator. The two wood screws and two flathead screws left are extra hardware provided for this section. In most cases, they will be left unused.

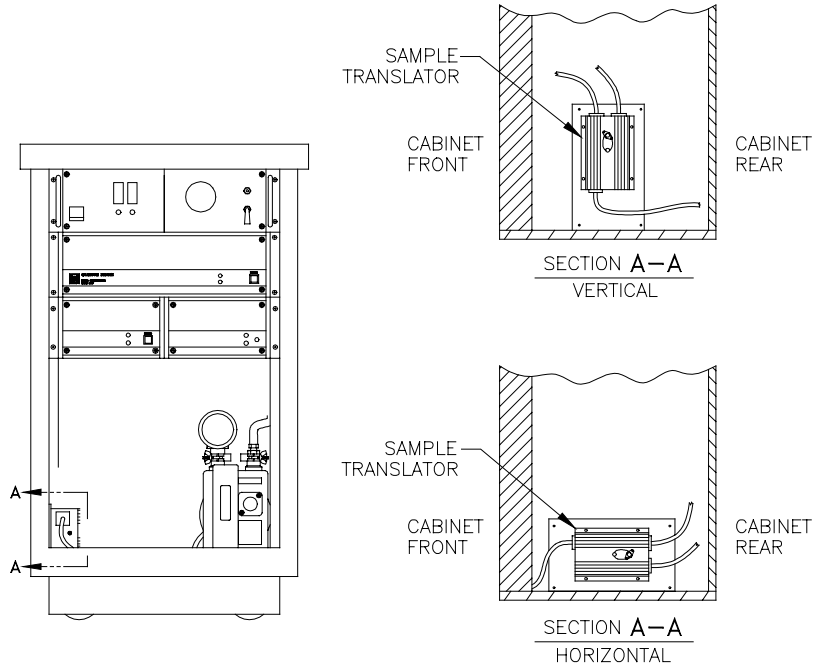


Figure 1. Views of the Horizontal and Vertical Mounting of the Sample Translator.

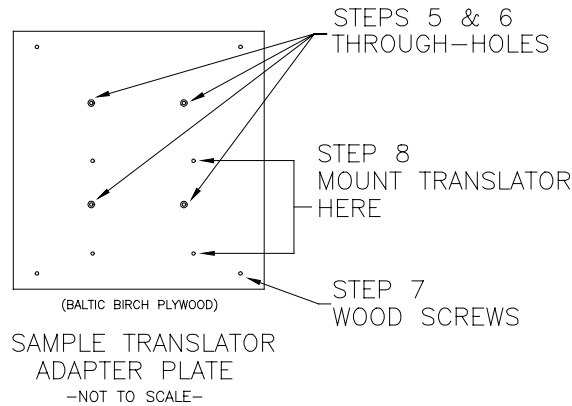


Figure 2a. Sample Translator Adapter Plate.

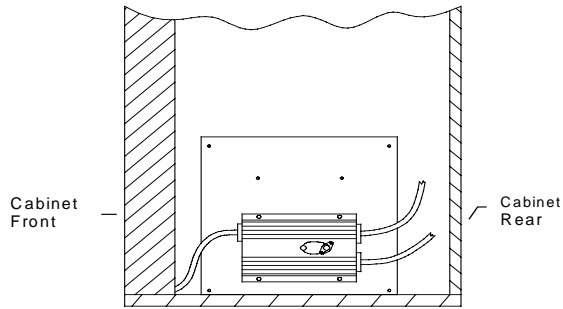


Figure 2b. The Sample Translator mounted horizontally to the adapter plate.

Installing a RSO Feedback Adapter Board in the 1822

Model 1822s constructed prior to 1996 do not contain the RSO feedback adapter board needed to install the RSO on the MPMS, unless an upgrade was performed at the factory. Model 1822s that have this adapter board also have “R” on the end of their serial number or have “R” in the third digit place (i.e. “CMR”).

To install this board in 1822s that do not have a “R” in their serial number, follow the procedures below. The hardware used in this section is found in the bag labeled *RSO Feedback Adapter Board Hardware*. Also, see the following *Note* to this section before continuing.

Note for Upgrades to Certain MPMS Systems

You may not need to install an RSO feedback adapter board in your 1822 if its serial number ends in “R” or has “R” in the third digit place (i.e. “CMR”).

In some other instances, a feedback adapter board was added to your 1822 while it was at the factory for servicing or upgrading. You will see the installed board when you try to add the new RSO feedback adapter upgrade.

Quantum Design suggests upgrading from the old feedback adapter boards to the RSO feedback adapter boards on MPMS systems shipped or serviced between 01/25/1996 and 04/08/1996 for optimal system performance.

When you upgrade to the RSO adapter feedback board, the instructions tell you to skip the next section of the installation procedure, *Installing the RSO Controller*. **Don’t** skip it. Instead, when you reach the next section, perform the first two steps to remove the 1822 from the cabinet. Then remove the existing feedback adapter board from the 1822 and continue with the procedure to install the new board. Some of the steps for disconnecting and reconnecting ribbon cables may be unnecessary.

Procedures

1. Disconnect all cords from the rear of the 1822, label them according to where each one goes if they are not already labeled.

Warning! Connecting the 1822 cables improperly during the 1822 reinstallation may cause damage to your MPMS.

2. Unscrew the four Phillips-head screws from the front panel ears of the 1822 to remove the 1822 from the console cabinet (**Figure 3**). The 1822 is heavy. Gently set it on a workbench or counter top.

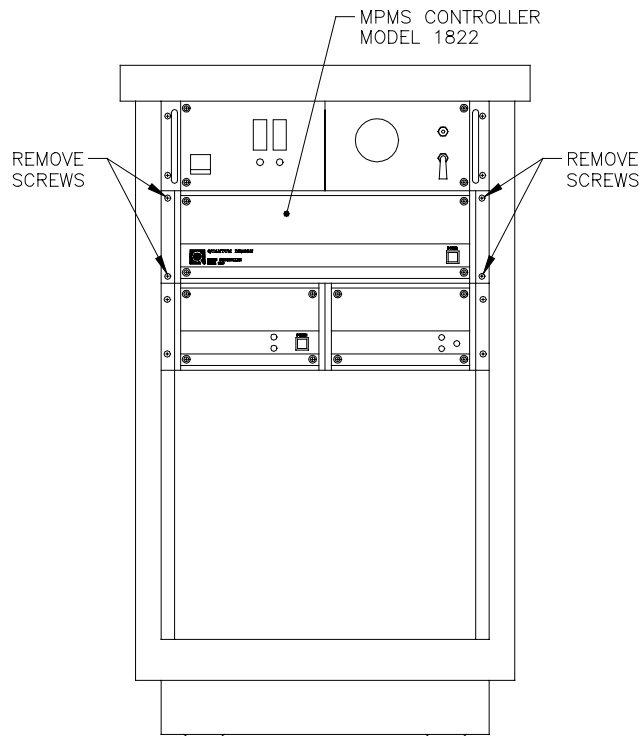


Figure 3. The screws that hold the Model 1822 into the console cabinet.

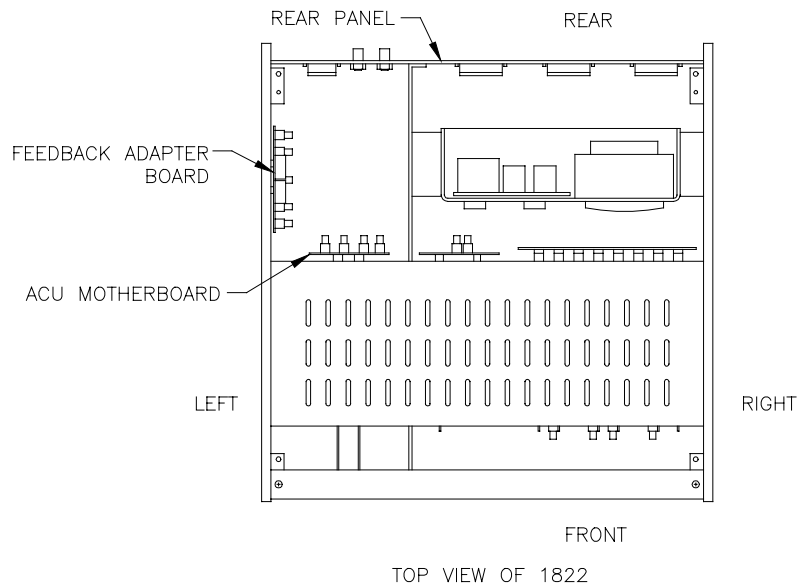


Figure 4. Top view of the 1822.

3. Locate the feedback adapter board of the 1822 in **Figure 4**.

4. From the outside, insert 1" Phillips-head screws into the four countersunk holes on the left side of the 1822 chassis (looking from the front of the unit), as indicated in **Figure 5**.
5. Screw standoffs from the feedback adapter board kit onto each of the four screws and tighten them (**Figure 5**).
6. Place the RSO feedback adapter board onto the screws, as shown in **Figure 5**, with the component side facing the interior of the 1822.
7. Place a lock washer and nut on each screw and tighten to secure the board in place (**Figure 5**).
8. Install the end of the long ribbon cable (part number 3003-207) labeled *J12 feedback adapter* in the J12 connector on the RSO feedback adapter board.
9. Examine your 1822 serial number on the back of the unit. If it begins with "CMA" or "CMR", your system is AC option-ready. Continue following steps 10-19. If the serial number does not begin with "CMA" or "CMR", coil the cable installed in step 8 so that it is not in the way (it will not be used), and skip to step 20. You will have one cable left over at the end of the installation procedure.

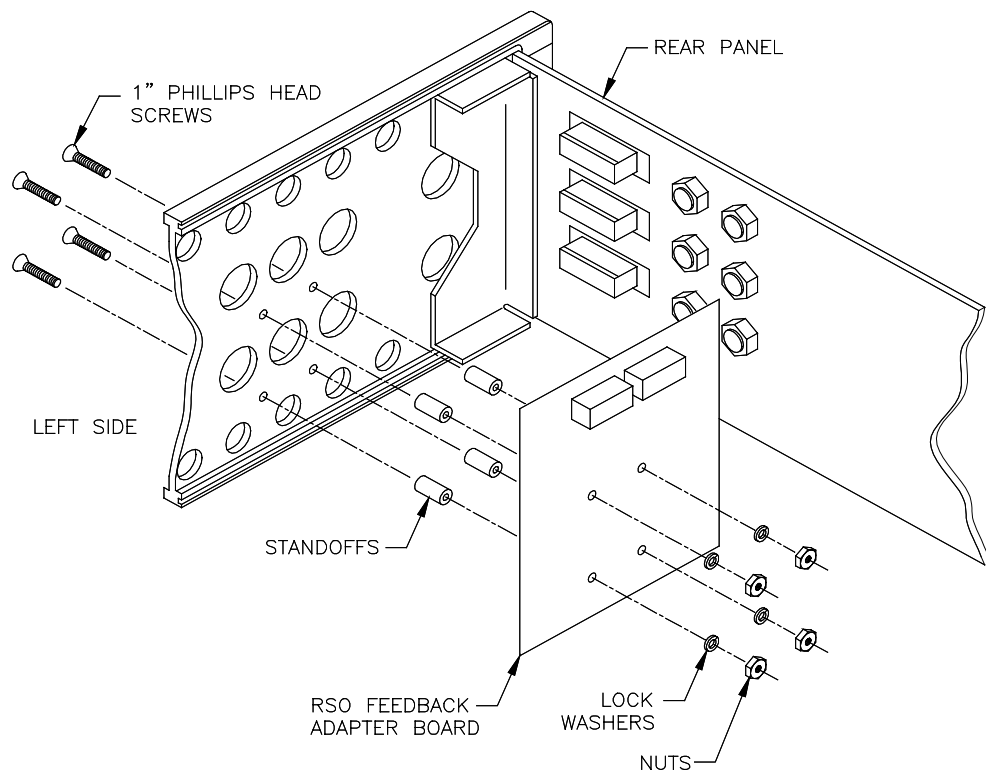


Figure 5. Installing the RSO feedback adapter board in the 1822.

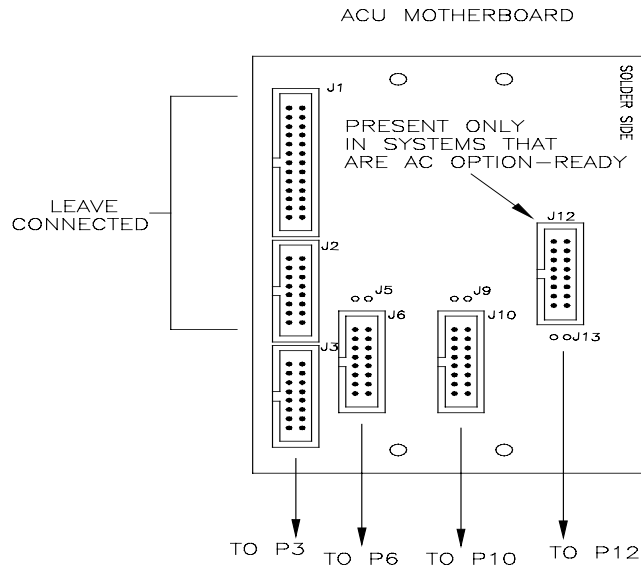


Figure 6. The ACU Motherboard.

10. Remove the ribbon cable from the J12 connector (**Figure 6**) on the right side of the ACU motherboard (next to the RSO feedback adapter board (**Figure 4**)).
11. Connect the RSO feedback adapter board P12 connector to the ACU motherboard J12 connector with the ribbon cable supplied (part number 3003-208). See **Figure 6** and **Figure 7** for the board layouts. **Figure 8** displays all the cabling on the ACU motherboard and the feedback adapter board.
12. Remove the front panel of the 1822 by removing the four screws in each corner of the panel.
13. Gently set the panel on the counter top without straining the wiring to the switches and LEDs.
14. Locate the AC drive board shown in **Figure 9**.

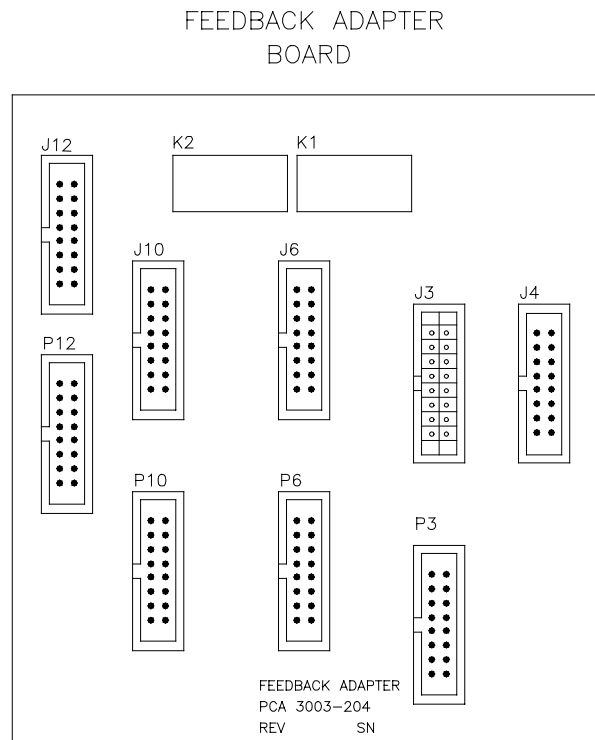


Figure 7. RSO feedback adapter board.

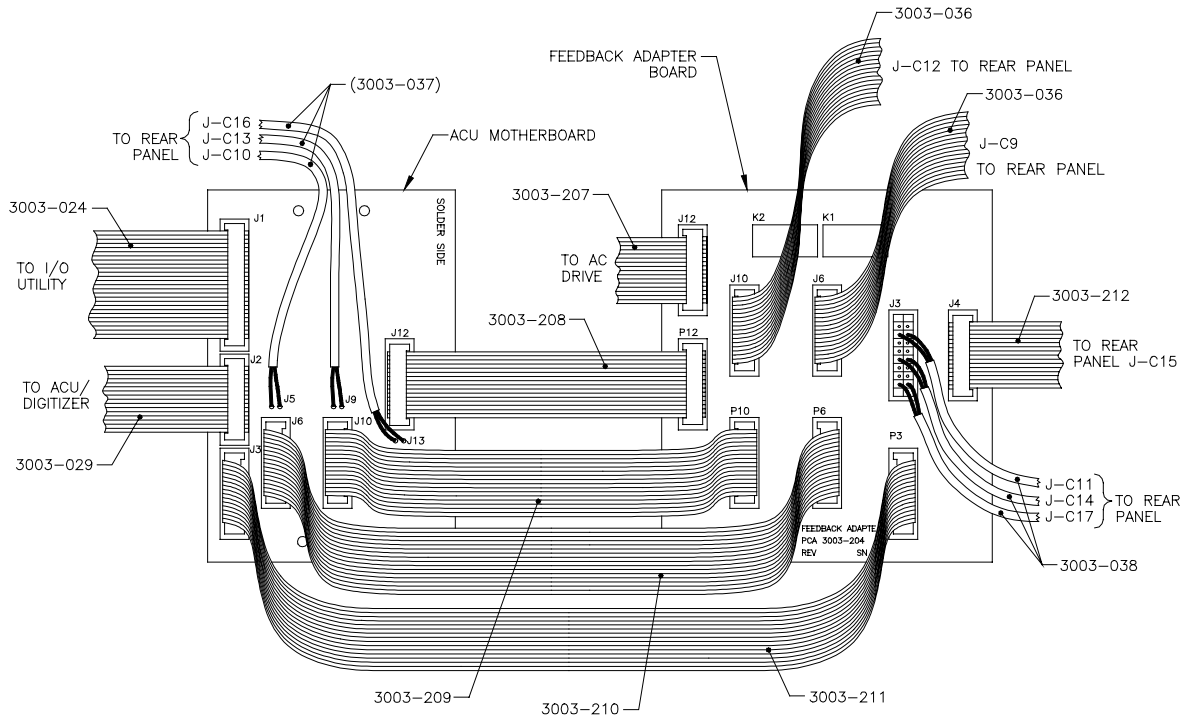
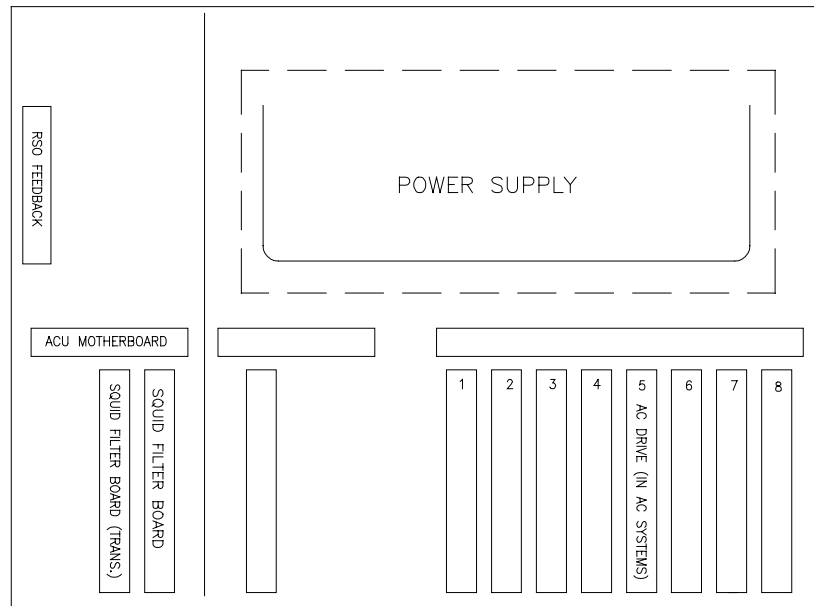


Figure 8. Cabling on the ACU motherboard and the feedback adapter board.



1822 CONTROLLER, TOP VIEW

Figure 9. Relevant boards in the 1822 for the RSO installation.

Note: There are two circuit boards towards the right (when facing the 1822) that protrude further out the front of the 1822 chassis than all the others. One is the AC drive board with three connectors at the front. The other is the digitizer board with two connectors.

15. Remove the ribbon cable from the J3 connector on the AC drive board and set it aside. This cable will no longer be used.
16. Route the new AC drive cable (now connected to the RSO feedback adapter board J12 slot (see step 8)) through the interior of the 1822 where the old cable used to be.
17. Connect the other end of this ribbon cable to the J3 connector on the AC drive board.
18. Reinstall the face of the 1822.
19. Skip to step 21.
20. Old systems, without “CMA” or “CMR” in their 1822 serial number, should have a new SQUID filter board installed. Systems with the transverse SQUID option and a system serial number of 241 or lower should have a new transverse SQUID board installed. Follow steps 20a-20f.
 - a. Remove the front panel of the 1822 by removing the four screws in each corner of the panel (**Figure 10**).
 - b. Gently set the panel on the counter top without straining the wiring to the switches and LEDs.
 - c. Locate the SQUID filter board(s) shown in **Figure 9** and **Figure 10**. Notice the additional board for systems with the transverse SQUID option.
 - d. Unplug the ribbon cable from the front of the SQUID filter board(s).
 - e. Pull the old filter board(s) out and slide the new board(s) into their places.
 - f. Plug the ribbon cable back into the front of the board(s).
21. Reinstall the face of the 1822.
22. Disconnect all of the ribbon cables from the ACU motherboard **except** for the two uppermost connectors on the left-hand edge of the board, J1 and J2 (**Figure 6** or **Figure 8**).
23. Beginning with the connectors at the bottom of the ACU motherboard, use the labeled ribbon cables supplied with the kit to make the connections to the RSO feedback adapter board (**Figure 8**).

Note: The J12 connector on the right side of the ACU motherboard is only present in systems that are AC option-ready (designated with “CMA” or “CMR” at the beginning of the serial number). If your system is not AC option-ready, you will have a ribbon cable left over that would otherwise be installed in the J12 slot on the ACU motherboard, and the P12 slot on the feedback adapter board will not be used.
24. Install the 15-pin D-shell connector on the end of the J4/J-C15 ribbon cable (part number 3003-212) into the available J-C15 slot on the rear panel of the 1822. Use the two jacksocket mounting screws provided and be sure to tighten them (**Figure 11**).

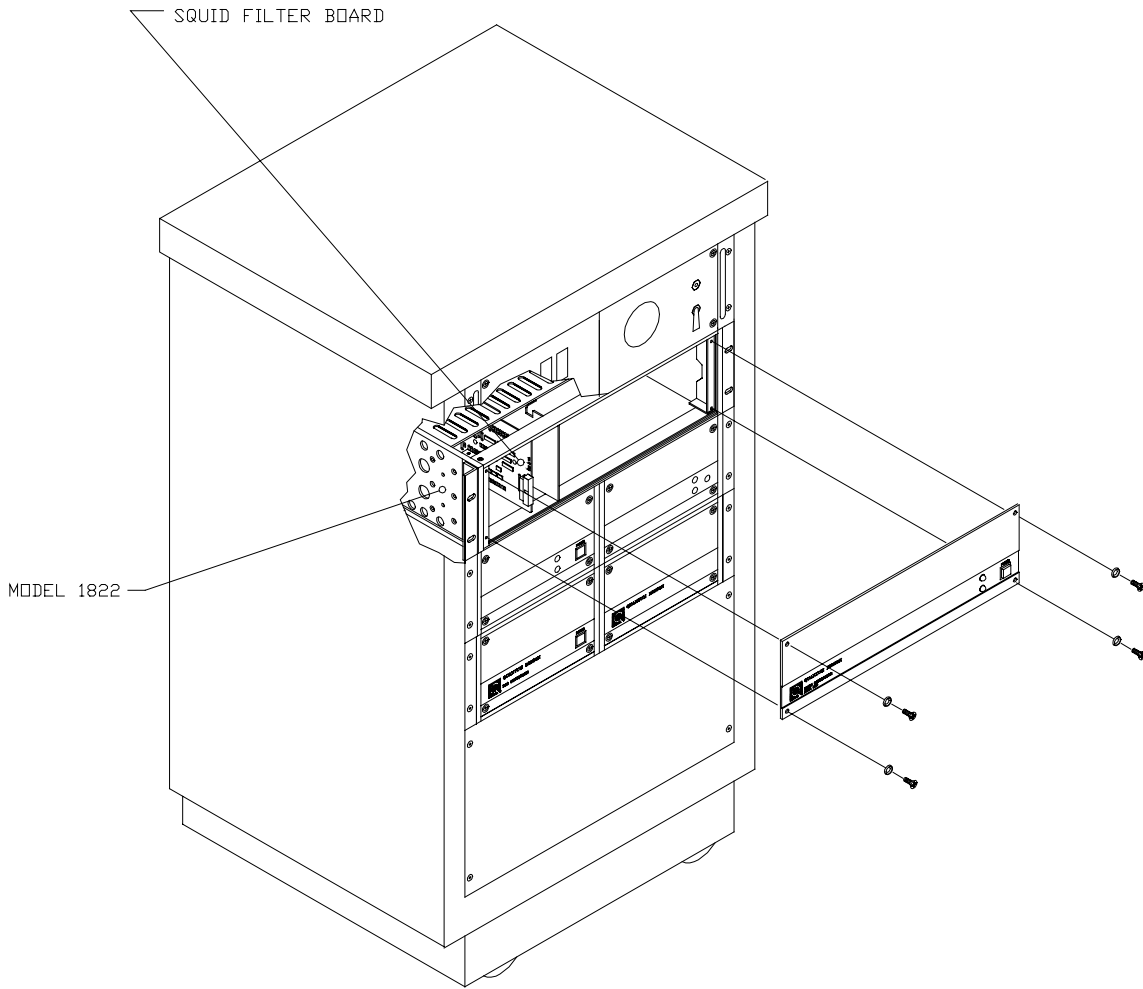


Figure 10. The SQUID Filter Board in the 1822.

25. Connect the 1822 rear panel jacks to the following RSO feedback adapter board connectors (**Figure 11**):

1822 rear panel	RSO feedback adapter board
J-C9	J6
J-C12	J10
J-C15	J4
J-C11, J-C14, J-C17	J3

Warning! Connecting the 1822 cables incorrectly during the 1822 reinstallation may cause damage to your MPMS.

Note: Do not improperly connect the black connector to feedback adapter board **J3** slot. Be sure that the connector is in the **center** of the socket so that all pins

make contact, and be sure that the black wires are towards the **rear** of the 1822. It is possible to offset the connector within the socket and to plug the connector in upside down, so be sure you have performed this step correctly.

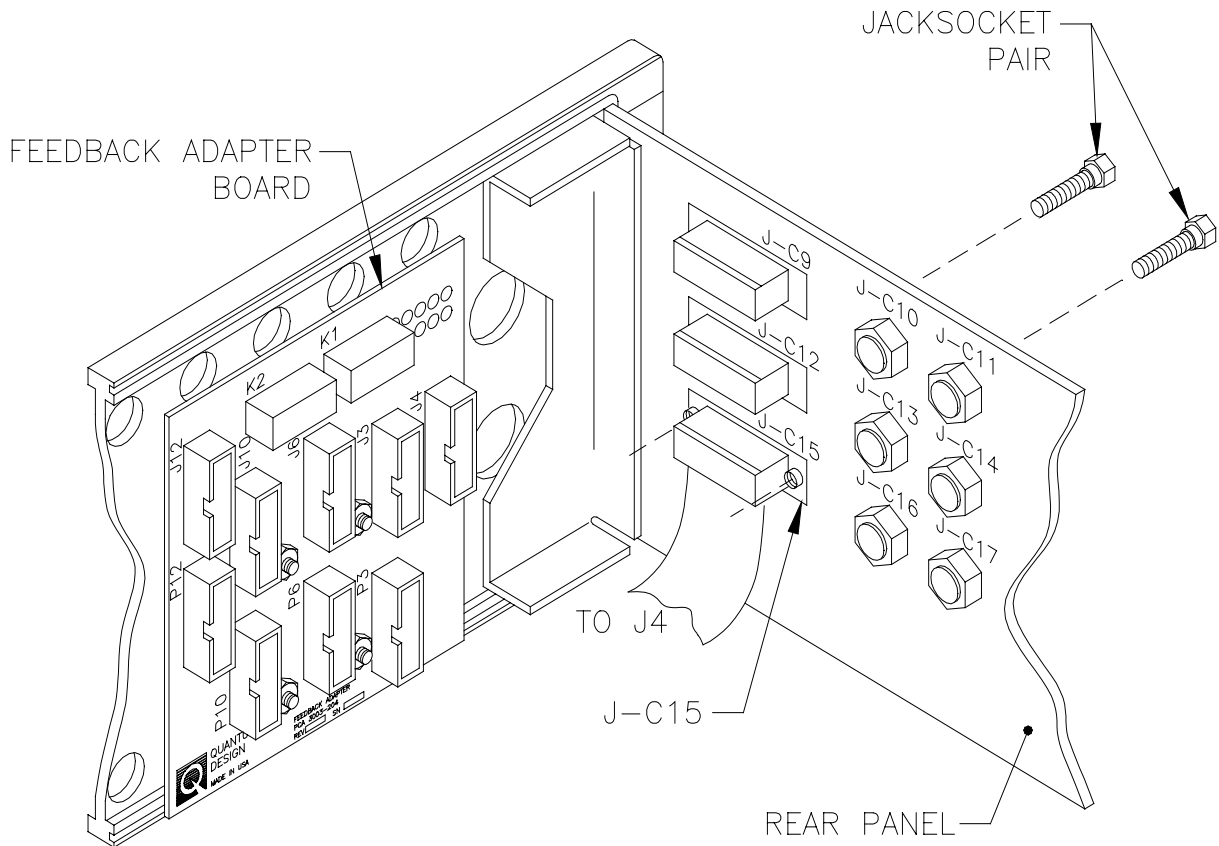


Figure 11. Cabling from the RSO feedback adapter board to the 1822 rear panel jacks.

26. Now all connections to the new board are complete. Return the 1822 to the console cabinet, screw it tightly into place, and restore all previous connections.
27. The RSO feedback adapter board installation is complete. The following extra hardware was supplied for this section and will be left unused in most cases: two flathead screws, two threaded standoffs, two split lock washers, and two nuts. **If hardware was lost inside the 1822, locate it and remove it from the unit before continuing. Failure to do so may cause the equipment to malfunction or be damaged.**

Installing the RSO Controller

Installing the Full Rack Mounting Adapter

1. Install the full rack-mounting adapter next to the RSO controller faceplate (**Figure 12**). The hardware required is found in the bag labeled *RSO Full Rack Mounting Hardware*.

- a) Slide the full rack-mounting adapter into place on the mounting bracket (the adapter installed on the right side of the RSO controller front panel).
 - b) Insert screws through the holes in the top and bottom moldings (**Figure 12**) and screw them part way in, but do not tighten them.
 - c) Insert screws through the black washers and into the two remaining holes on the front of the full rack-mounting adapter and screw them part way in, but do not tighten them.
 - d) Making sure the full rack-mounting adapter is properly lined up, the moldings are square, and the face is seated in the groove in each molding. Tighten the top and bottom screws.
 - e) Tighten the screws in the front of the full rack-mounting adapter.
2. Install the rack mounts.
- a) Position each rack mount (mounting ears) on the sides of the full rack mount into the groove in which they fit.
 - b) Insert two screws into each rack mount and tighten them.

Note: The following extra hardware was provided for this section, and will be left unused in most cases: two polished black washers and two #6 Phillips-head screws.

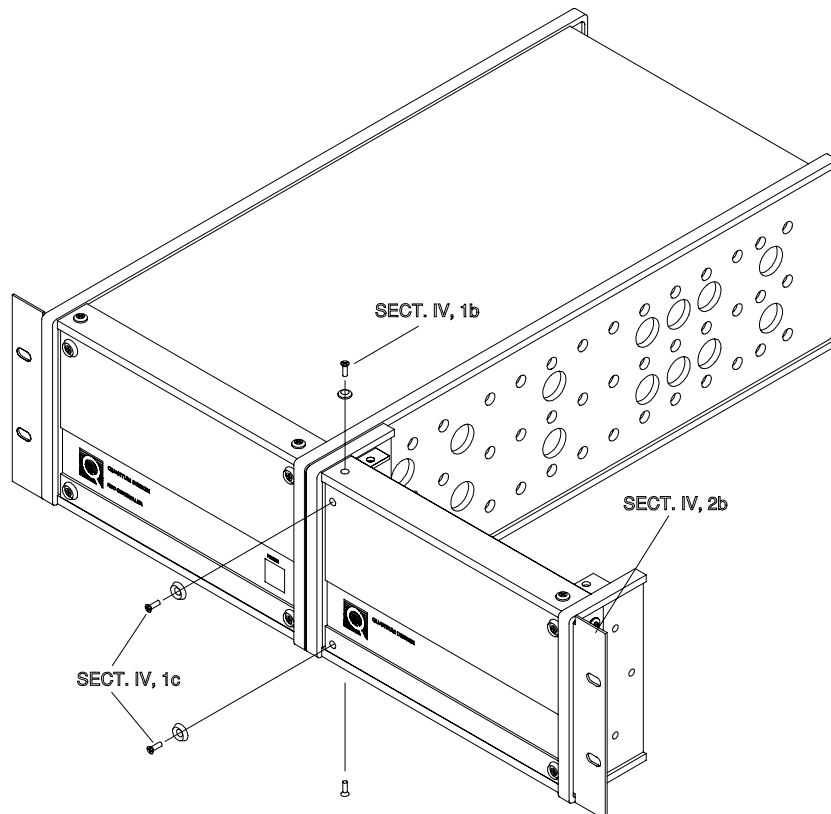


Figure 12. Install the full rack mounting adapter next to the RSO controller as shown.

Installing the RSO Controller into the Console Cabinet

1. Slide the RSO controller, along with the attached full rack-mounting adapter, into the console cabinet immediately below the Model 1802 and the power distribution unit (**Figure 13**).
2. Use the four 10-32 x 3/8" Phillips-head screws provided to screw the mounting ears of the RSO controller into the cabinet.
3. Use the power cord supplied with the controller to connect the RSO controller to the J-B2 slot on the back of the power distribution unit (PDU). See **Figure 14**.

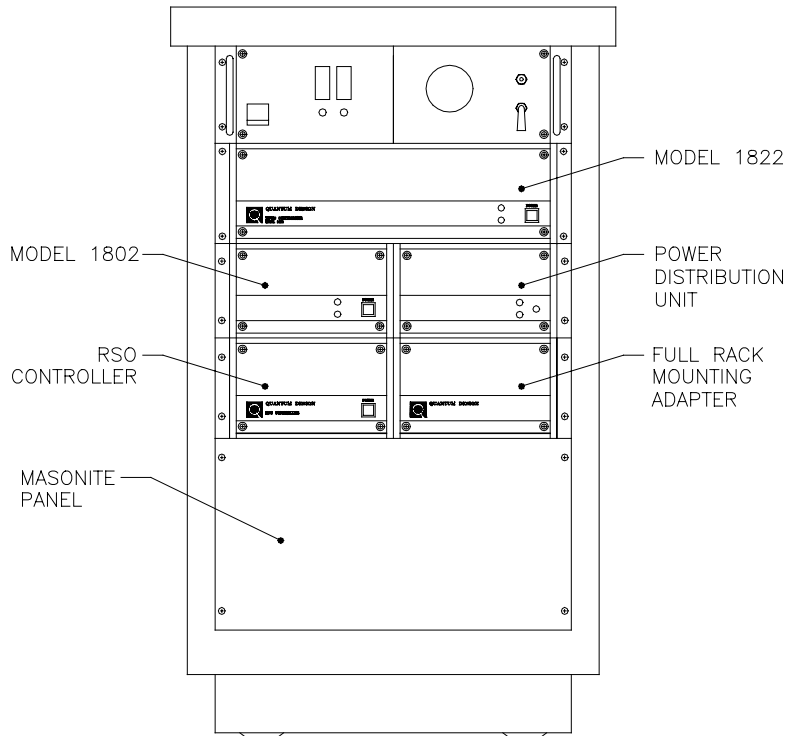


Figure 13. The MPMS console cabinet after installation is complete

4. Use the cables supplied to make the following connections to the RSO controller (**Figure 14**).

RSO Controller	Connect to...
J-D1	Computer Com 2 (or Serial B)
J-D2	1822 J-C15
Internal Serial Cable	Computer Com 1 (or Serial A)

5. Install the new masonite blank panel on the bottom front of the console cabinet using the four screws that were used for the old panel (**Figure 13**).

Note: You should have the following left over from the *RSO Controller Hardware* bag: two polished black washers, two #6 Phillips-head screws, and two #10 screws.

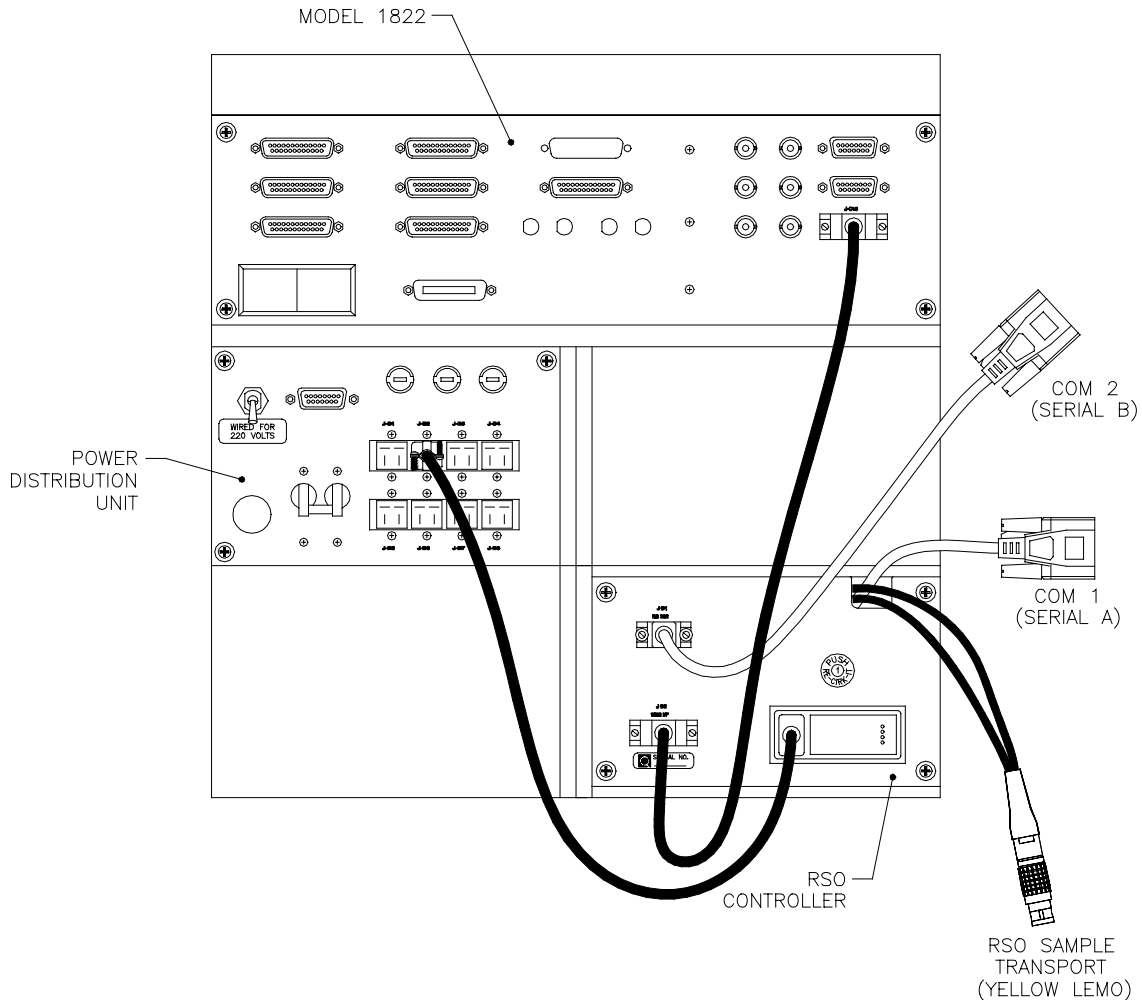


Figure 14. RSO rear panel connections.

Installing EPROM in the CPU Board of the 1822

Stop! Before continuing, you must install the new option EPROM into the Model 1822 controller no matter what your current system configuration is.

Before beginning this procedure, be sure you have the replacement HW Config EPROM, which was shipped with your MPMS option.

Note: IC chips such as the EPROM may be damaged by static discharge. You are less likely to discharge static electricity if you ground yourself by touching the metal back or side panel of the 1822 controller case before touching the internal components. Moving around increases the possibility of static discharge, so limit movements while performing the upgrade.

1. Remove the front panel of the 1822 by removing the faceplate screws and disconnecting the power and heater protect override switches (**Figure 15**).

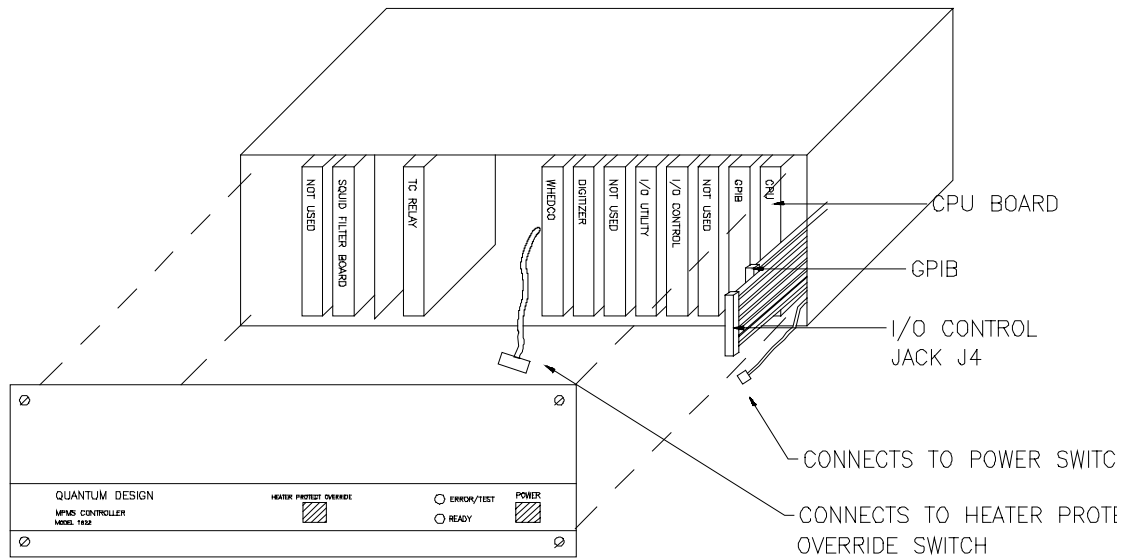


Figure 15. This 1822 controller-board layout may be slightly different for different systems, but the CPU board will always be to the far right.

Warning! Connecting the cables to the wrong receptacles will damage components of the 1822. Be sure to note the orientation and position of all the cables before removing them.

2. Still referring to **Figure 15**, locate the CPU board. This board will be at the right end of the board slots.
3. Before removing the CPU board, it will be necessary to disconnect the ribbon cables marked GPIB and I/O Control Jack J4 since these cables will obstruct the CPU board. Do not damage the cables and connectors. The cables are removed by gripping the short top and bottom edges of the connector, pulling from the top and bottom alternately (**Figure 16**). As with any connector, do not pull the ribbon cable, only the connector. Note the position of each of these connectors before disconnecting.

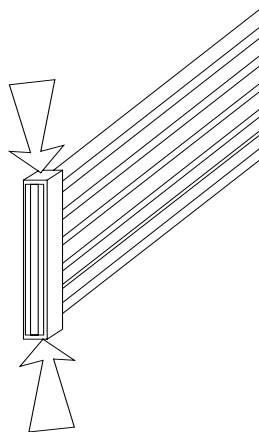


Figure 16. Remove the ribbon cable by gripping the connector.

- Remove the CPU board by pulling it out of its socket (**Figure 17**). It may be seated quite tightly. Grip the board by the top and bottom edges, being careful not to contact any of the board components. Do not bend any components during removal. For best results, ease the board out by pushing the board up and down a little as you pull it away from the slot.

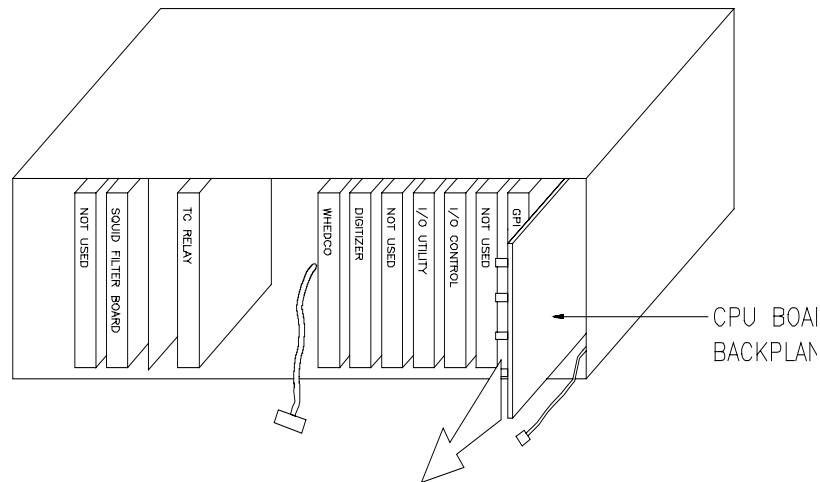


Figure 17. Removing CPU board.

- Referring to **Figure 18**, locate the EPROM sockets (sockets will be marked S1 to S4 or U30 to U27 depending upon the revision of your board).

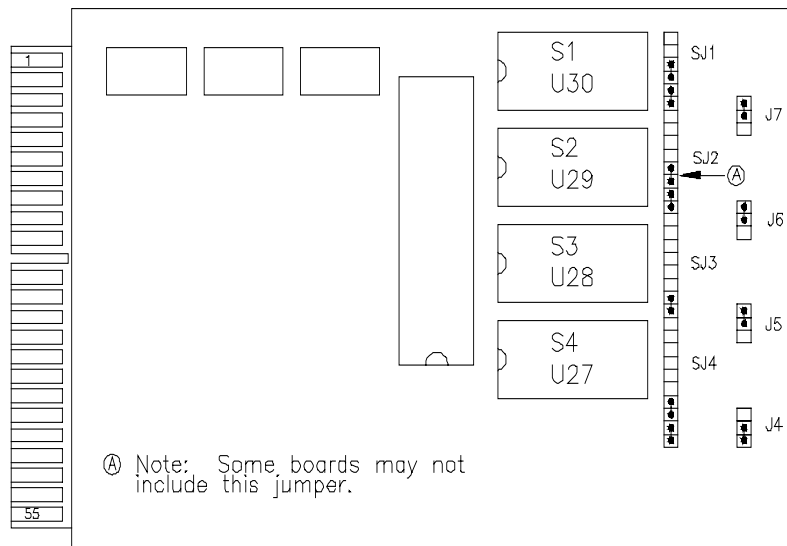


Figure 18. 1822 CPU card showing positions and orientation.

- Remove the EPROM labeled *HW Config*. This EPROM should be located in socket S3. If it is not, check with your Quantum Design representative before continuing. To remove the EPROM, place a small, flat-ended tool underneath the short ends of the EPROM. Gently pry the EPROM up, working on each end of the chip alternately. Discard the EPROM you have just removed.

7. Inspect the new EPROM HW Config. and make sure the pins are aligned. Place the EPROM over the S3 socket and make sure the pins are spread correctly to be easily seated. If it is necessary to bend the pins, place the chip on its side on a flat surface. Gently press the top edge of the chip to bend the pins under the chip (**Figure 19**).

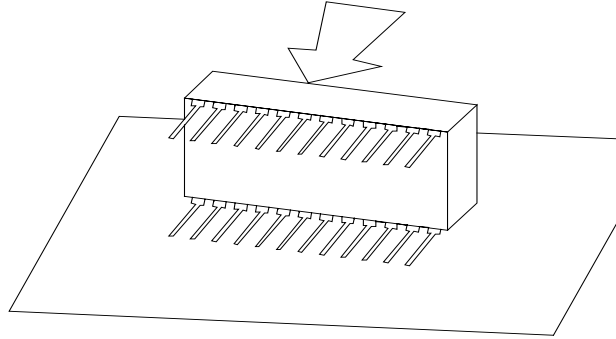


Figure 19. Aligning the chip pins.

8. Carefully insert the new EPROM into the empty S3 (U28) socket by placing the chip, with the alignment notch in the position shown in **Figure 18**, over the socket and aligning the pins to the socket holes. With the pins in place, gently press down on the top surface of the chip. Press the chip in until it is fully seated.
9. Make sure the alignment notch on the new chip is positioned correctly. It should be on the end of the chip that is closest to the connector slot.
10. Return the CPU board to the 1822. The board should be placed so that the top of the board (the side with the chips on it) faces left. The board goes in the far right slot of the 1822. Insert the board by sliding it into the socket at the rear panel. Push the board until it seats firmly into the socket at the far edge of the board.
11. Reconnect the GPIB and I/O Control Jack J4 ribbon cables (**Figure 20**). Be certain to connect the cables to their original positions with their original orientation (as noted upon removal).

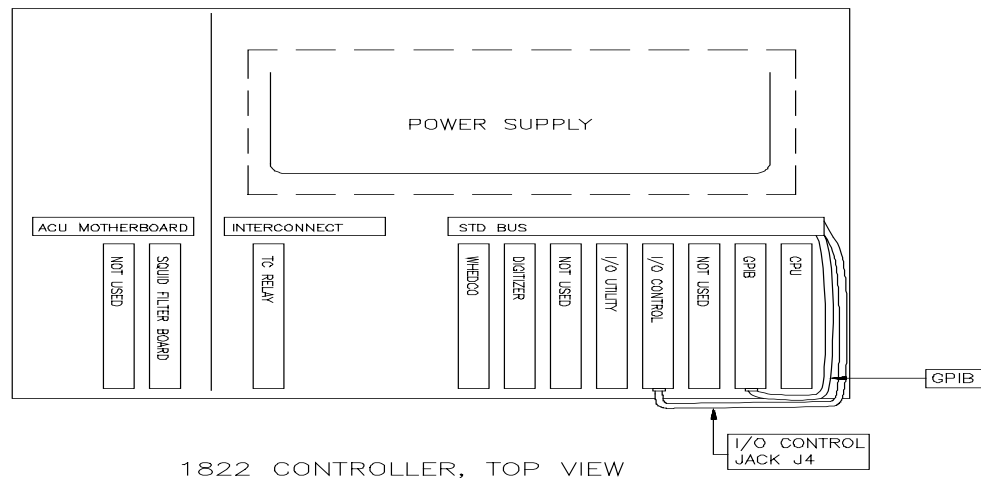


Figure 20. Reconnect the ribbon cables to their original positions with proper orientation.

12. Reconnect the power and heater protect override switches.

13. Replace the faceplate on the front of the 1822 controller.

Restoring the MPMS

1. Turn on the master power switch of the power distribution unit.
2. Reconnect the pumping lines to the probe head.
3. Plug the wall power cord back into the wall.

Upgrading to Revision 2.27 or newer MPMS Software

1. Be sure to make back up copies of the new software before installing it on the computer. After you have backed up the installation disk, follow the instructions below to install the software.
2. Turn on the power to the RSO controller by pressing the power switch located on the front of the RSO controller.
3. Turn on the MPMS computer and run DOS. If you are running the MPMS software, exit it to run DOS.
4. Insert the 90 mm (3.5") floppy disk labeled *MPMS Operating System Revision 2.27 or newer, Disk 1 of 2* into the disk drive.
5. Select the A drive by typing "a:" and pressing **Enter**. If the computer's 90 mm (3.5") disk drive is a B drive type "b:" instead.
6. Type "install" and press **Enter**.
7. When prompted to do so, eject the first disk, insert the second disk, and press **Enter**.
8. When the disk drive stops running, eject the disk.
9. Make sure that both disks are write-protected and store them in a safe place.
10. The software is now installed.

Installing the RSO Calibration Data

1. Be sure to enter your system's calibration data so that the RSO measurements are meaningful. Make a back up copy of the calibration disk before installing it on the computer. After you have backed up the calibration disk, follow the procedure below.
2. Insert the 90 mm (3.5") floppy disk labeled *RSOCALS.SEQ* into the disk drive.
3. Select the A drive by typing "a:" and pressing **Enter**. If the computer's 90 mm (3.5") disk drive is designated the B drive, type "b:" instead.
4. Copy the diskette labeled *RSOCALS.SEQ* into your sequence directory. Your sequence directory is MPMSR2/SEQ. Type "copy a: c:\MPMSR2\SEQ" and press **Enter**. There is a space between the first colon and c.
5. When the disk drive stops running, eject the disk.
6. Make sure that both disks are write-protected and store them in a safe place.




7. From the MPMS software run RSOCALS.SEQ through the **(F8) Sequence Control** menu.
 - a. Press **F8** to open the **Sequence Control** menu.
 - b. With the cursor at **Sequence File Name**, press **Enter**.
 - c. Within the directory, select **RSOCALS.SEQ**.
 - d. With the cursor at **Execute Sequence**, press **Enter**.
 - e. The calibration sequence will now run.
8. The system should now be properly calibrated.







Note: It is normal for several error messages to occur upon first executing the software after installation. This will not occur subsequently.

Installing the RSO Transport

The final step of the installation procedure is removing the existing sample transport and installing the RSO transport on the MPMS probe head. Changing sample transports may be done periodically if one sample transport is more desirable than the other. The software keeps track of which transport is installed. The instructions below are copied from the *MPMS Reciprocating Sample Option User's Manual*. The hardware used in this section is found in the bag labeled *RSO Transport Mounting Hardware*.

1. To install the RSO transport, select **(F6) Utilities | Install Transport . . .**. The software will take you through the remaining steps that follow.

Note: After performing certain steps below, you need to press **Enter** on the computer keyboard to notify the software that you are moving to the next step of the procedure. These items are denoted in the procedure below with the following symbol:   . After you press enter, the software will highlight the next step of the procedure and may also perform some special automated steps that aid the installation process.

2. Remove any sample and sample rod from the MPMS.    Be sure the airlock valve on the MPMS probe head is closed and that the airlock has been vented. If the airlock has been purged so that it is at a low pressure, vent the airlock by slightly opening and closing the airlock valve.   
3. Unplug the green Lemo cable from the standard sample transport. Unplug the yellow Lemo present on the standard sample transport if a rotator is also connected.
4. Unplug the clear tubing, the sample space boiloff tube. You may leave the other end attached.
5. Remove the two large mounting screws in the front and the two small screws on the backside of the sample transport (**Figure 21**). Keep these screws with the standard sample transport.
6. Lift the standard sample transport off of the probe head.
7. Place the RSO transport on top of the probe head.

8. Install the two 1/4-20 x 3/4" mounting screws supplied with the upgrade kit in the front and the two 4-40 x 1/2" screws on the back of the RSO transport to hold it in place (**Figure 22**).
9. Plug the yellow Lemo cable from the RSO controller into the RSO sample transport.



Note: After the computer recognizes that the RSO transport is in place, the transport is automatically initialized.

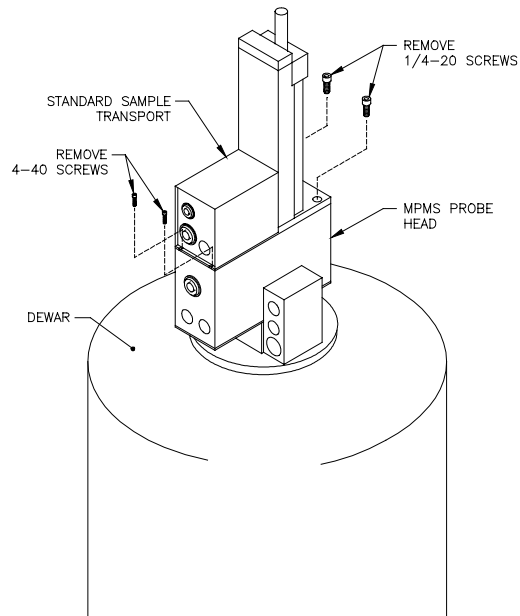


Figure 21. The standard sample transport.

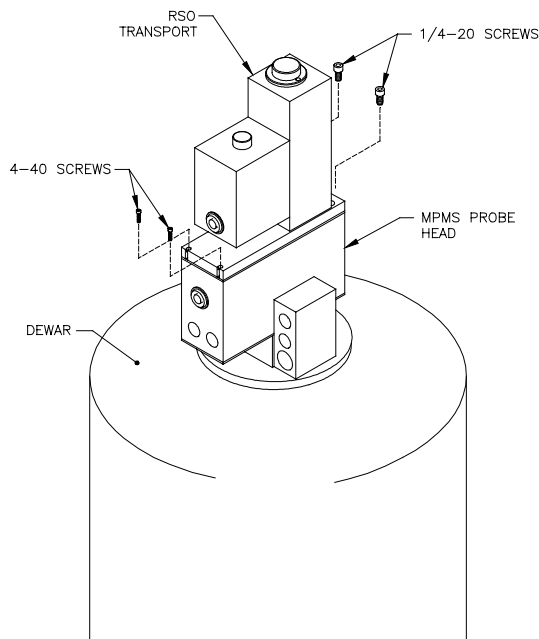








Figure 22. The RSO sample transport.

10. Be sure the black cap is in place on top of the RSO transport.   

Note: Whenever placing the cap on top of the RSO transport, make sure that the o-ring underneath the cap is clean and lubricated.

11. Purge the space between the airlock valve and the sample transport cap by pressing **Enter** with the cursor at the “purge” line in the **Install RSO Transport** screen, or by pressing the **purge airlock** button on the probe head.   

12. Open the airlock valve.   

The RSO is now installed and ready to use. Please read the *MPMS Reciprocating Sample Option User's Manual* to learn about using the RSO.

Note: The following extra hardware was provided for this section and will be left unused in most cases: two $\frac{1}{4}$ -20 x $\frac{3}{4}$ " hex socket head screws and two 4-40 x $\frac{1}{2}$ " hex socket head screws.

Note: See the RSO User's Manual, Appendix A to customize the RSO Calibration factors for your hardware.