

REVISIONS			
REV	DESCRIPTION	ECO	UPDATER
C1	ADDED PICTURES AND APPENDICES A & B	EC03294	AEW
C2	ADDED INSTRUCTIONS FOR PARTIAL SHUTDOWN	EC03294	AEW
C	RELEASED PER EC03294	EC03294	AEW
D	Revised for CE compliance; steps renumbered; some language slightly adjusted or removed for clarity; x2 graphics removed from Appendix A.	EC06750	AEW

MASER START-UP PROCEDURE MODEL 2010

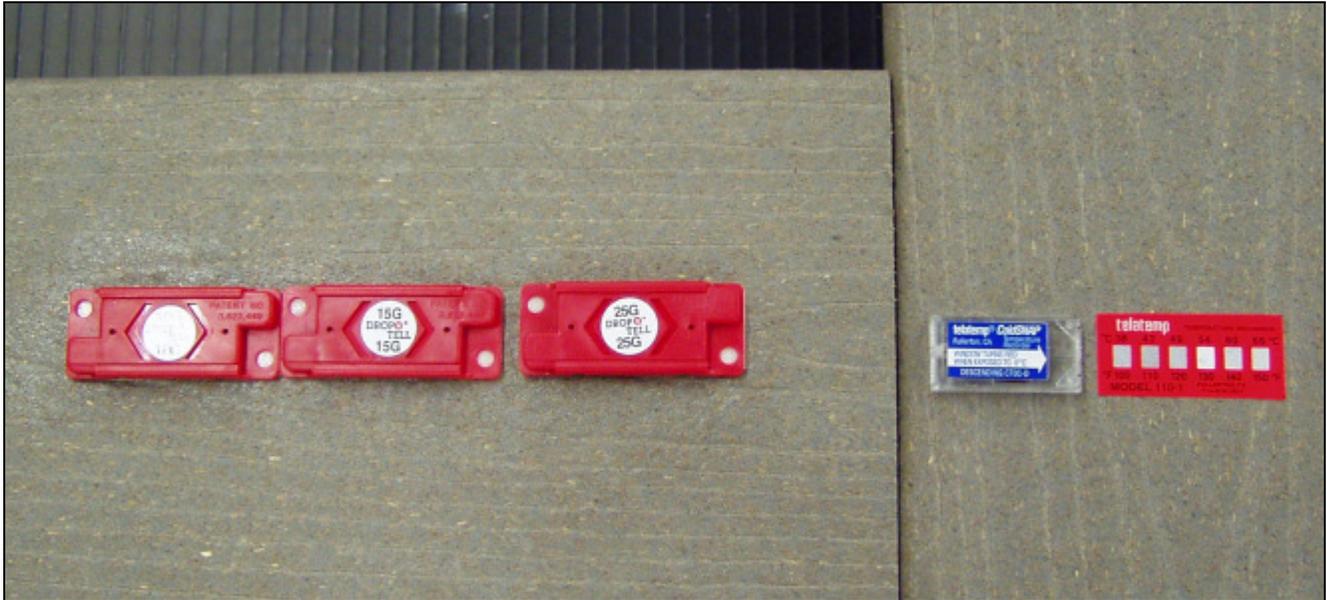
Originator	Patrick Owings 11/16/2010
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CAGE NO.	DOCUMENT NUMBER	REVISION	
N/A	75748-301	D	SHEET 1 OF 26

If the maser was delivered partially powered, complete step 9 in startup procedure, then skip to step 17 and continue maser startup.

After removing clear plastic wrap, inspect for shipping damage by checking condition of all shipping indicators mounted on the outside of the crate.



Shock and Temperature indicators untripped (OK).



Tilt Indicator untripped (OK).

If any indicators are tripped, make a note of it.
A picture of the indicators is best. Please e-mail pictures to blogan@symmetricom.com.

For more detail on shipping indicators, please see Appendix A at the end of this document.

Tools needed:

- 13mm or ½” wrench or socket
- 14mm or 9/16” wrench or socket
- #2 Phillips Screwdriver
- 9/64” (supplied) or 3.5mm hex key

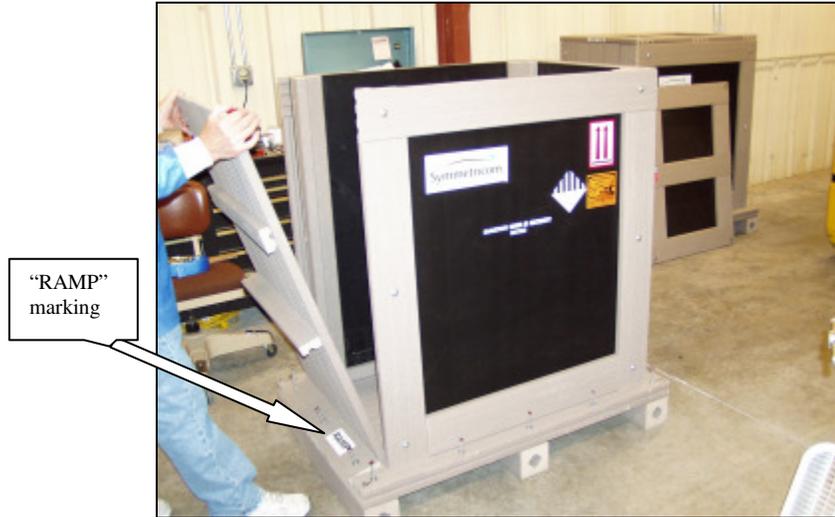
1. Note that some bolts on the crate are marked with red. All red bolts are to be removed to open the crate. Using the 13mm wrench, remove the red bolts on top of crate.



2. Using the 14mm wrench, remove the larger red bolts at the bottom of all 4 sides.



3. Remove the remaining red bolts on the sides next to the “RAMP” end. Next, remove the end marked “RAMP” off of the maser crate.



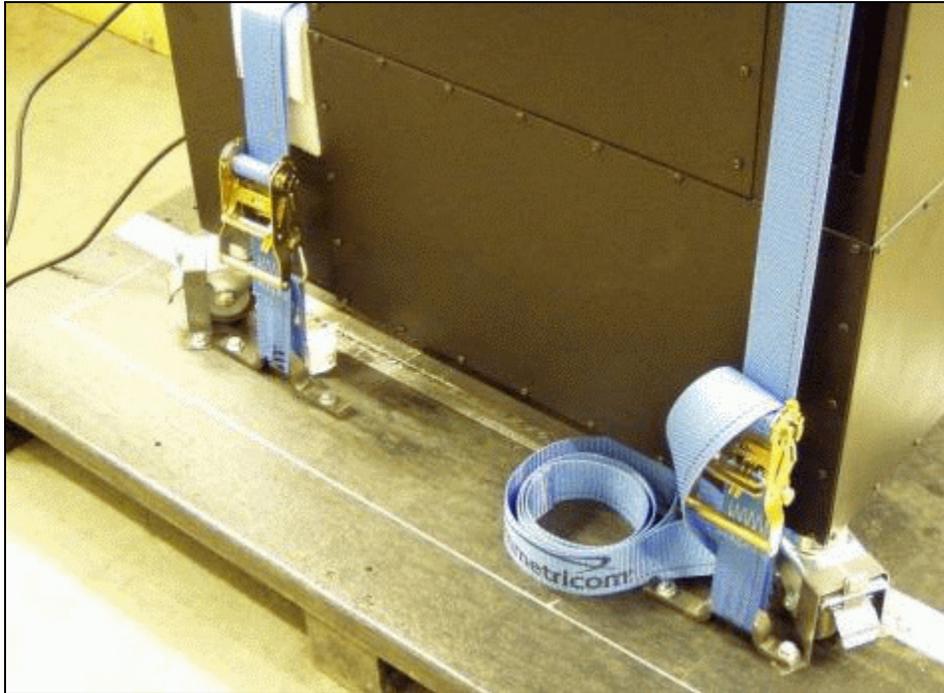
- Slide the 3 sides and top off the crate base.



Please check the shipping indicators inside the maser lower compartment at this time. If possible, photograph the indicators and email the picture to blogan@symmetricom.com.



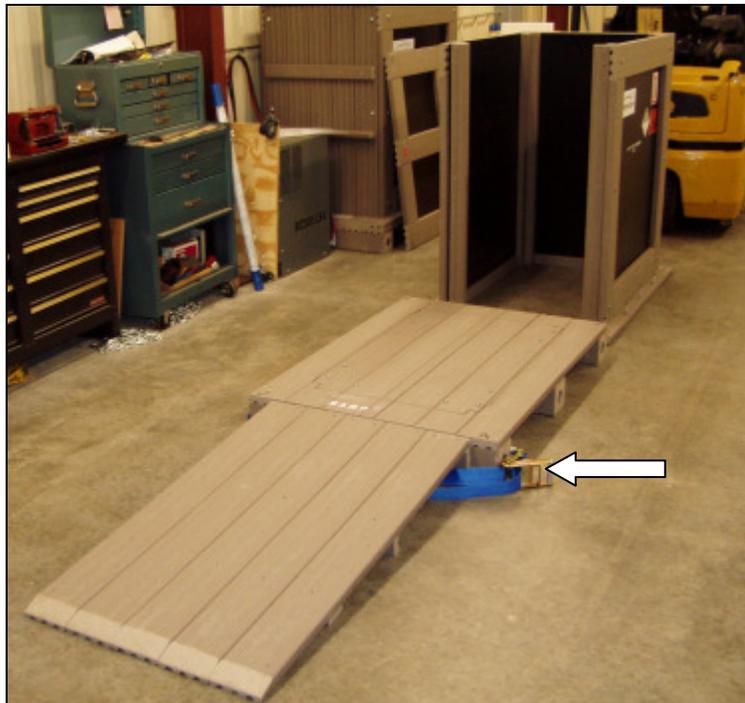
5. Remove the two shipping straps.



6. Remove the bolts securing the 4 caster brackets with the 13mm wrench.



7. Set the RAMP up against the end of the crate base and secure it to the base with one of the tie down straps from the maser. Make sure the RAMP is secure to the base before moving maser.



Arrow points to strap securing RAMP to base.

8. Gently and carefully roll the maser down the ramp. **THE MASER WEIGHS APPROX. 227 kg/500 lbs and is very fragile. SEVERAL PEOPLE SHOULD BE USED TO STEADY THE MASER AND MINIMIZE SHOCK DURING THIS STEP.**



After the maser is free of the crate, you may roll it to where it will be used. If this is not practical, carefully roll it to a safe place away from temperature extremes and high humidity.

9. Plug in one or both maser AC power cords. Power system will automatically select between 110 or 220 VAC. Wiring color code: Black (Line One)=Neutral, Black=(Line Two) Hot, Green/Yellow=Ground (Earth).

After mains power is applied, the display on the front control panel will be operational.

Also, the reserve batteries for the maser may be connected at any time after main power is connected. U.S. shipping regulations prevent us from shipping batteries. You will need to source these locally and install them in the rear compartment of your maser. Instructions for battery selection and installation can be found in Appendix B of this document. Note: the maser may be started and will operate without the batteries installed, but you will have no reserve power in the event main power is lost.

We recommend you install the batteries by the time you complete step 19, so the maser can warm up without interruption.

10. Note the front control panel LCD display. The small white button to the right of the display will scroll through the 8 different screens. Each press of the button brings up the next screen. Try it now to become familiar with its operation.

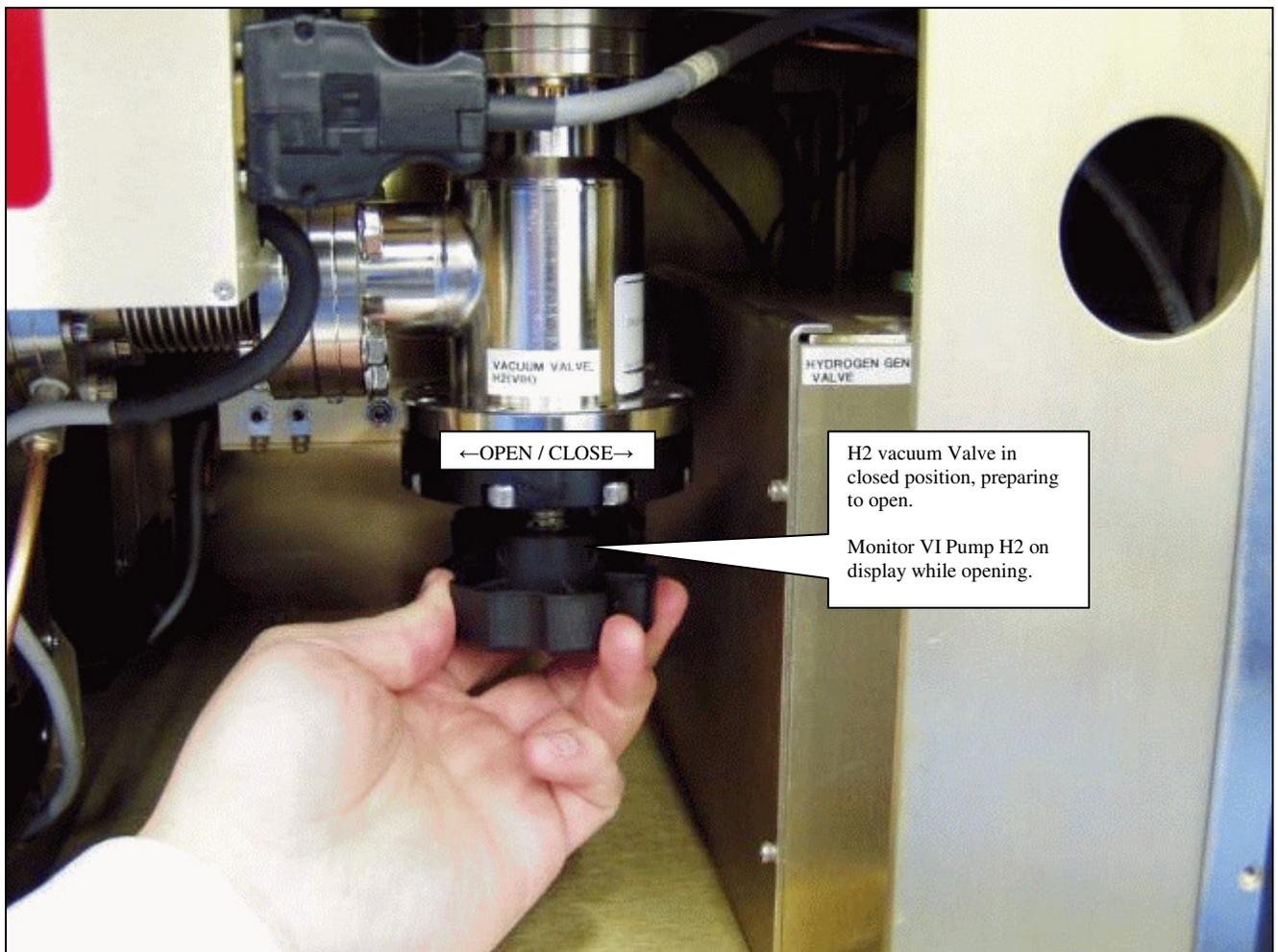


Scroll to the first screen after the “Symmetricom” front screen. You will see 2 pump channels, labeled VI Pump H2 and VI Pump Upr. Note the negative voltages displayed to the right of these names. This is a characteristic of this type of vacuum pump. These pumps are known as Ion pumps, or “VacIon” pumps by some. There are two pumps on board each maser. During shipping, they are isolated from the maser physics package by two large vacuum valves. The valves are located in the lower compartment of the maser, near the shipping indicators. For the maser to operate, these valves must be opened very slowly while monitoring pump voltage on the display to ensure no pump damage occurs. The next few steps will instruct you how to open these valves properly.

Please note that maser ion pump voltage is always displayed in Negative (-) numbers. For example, the photo above shows “VI Pump H2” -0.091. When we begin to open the valve marked ‘H2’ this voltage will increase in value to read a greater magnitude such as -1.200. The value will not “go positive”, it will always be a negative number.

STEPS 11 THROUGH 15 MAY TAKE APPROXIMATELY 1 TO 2 HOURS TO COMPLETE.

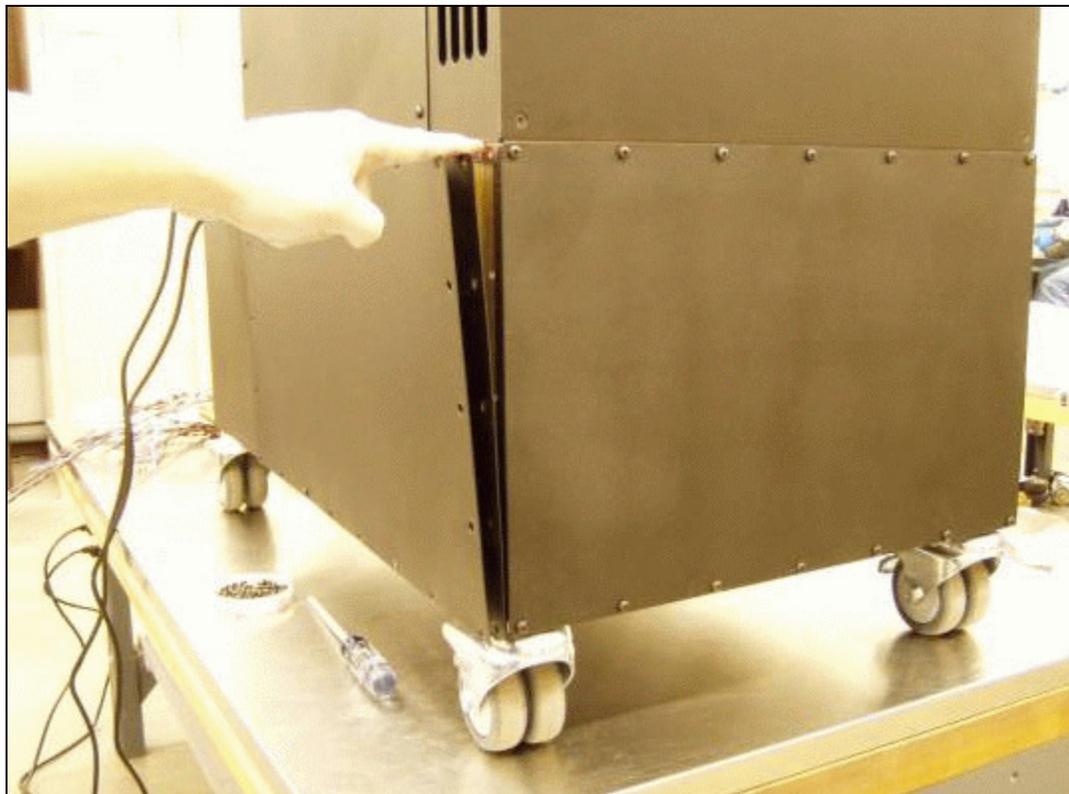
11. On the maser lower side that is open, very slowly (**DO NOT EXCEED 1 REVOLUTION PER MINUTE**) open the large H2 vacuum valve that is closest to you while monitoring VI Pump H2 on the front display. Open very slow until you get a reading of approximately -1.200. Do not exceed approximately -1.500 V; if you do, close the valve until the channel reads a lower magnitude (-1.200, -0.985, etc), and try again. Pump damage can occur if valves are opened too fast.



The voltage on the display will move around much during this step. Patience is the key. It is helpful to first open the valve until the display reads approximately -1.200, then wait until the value drops to approximately -0.500 before opening the valve more. Open a bit, wait. Open a bit, wait, etc. You may also find a small mirror to be handy in monitoring the voltage while opening the valves.

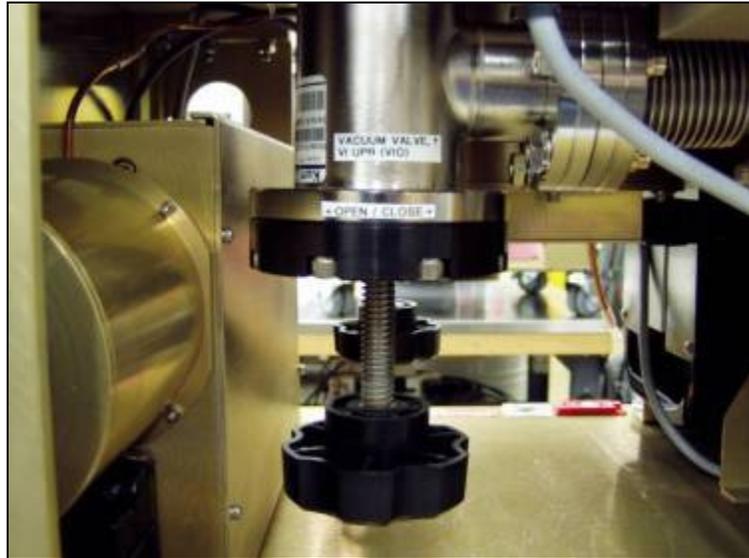
While waiting for this voltage to stabilize, continue to step 12.

12. Remove the lower side panels in order to gain access to the other large vacuum valve. Both lower side panels are attached on one side for shipping. Note: These shields are made of soft iron for magnetic shielding. Do not bend or drop them, or shield effect may be degraded.



13. Repeat step 11 with the other large vacuum valve while monitoring channel 4 (VI Pump Upr).
14. Continue to slowly open the valves, working back and forth between the 2 large vacuum valves, keeping the readings below approximately -1.200.

15. When the pump readings no longer exceed approximately -1.200, continue to open the valves all the way (fully open), then close back $\frac{1}{4}$ of a turn. Valves will be left open hereafter.



Example of vacuum valve fully open.

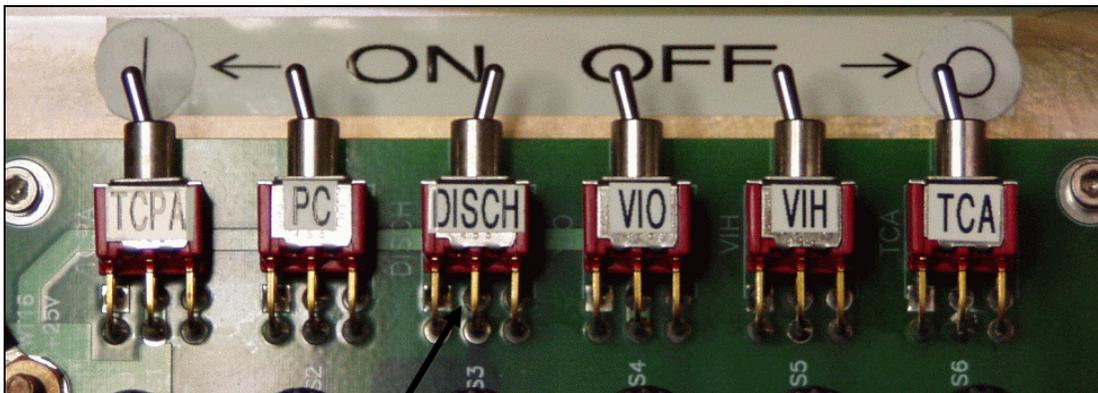
16. When large vacuum valves are both fully open, remove the maser's front cover (19 flat head Philips screws) to access the 6 switches shown (see photo).



17. Notice the position of the switches. VIO and VIH are already ON. Leave them on.

Turn ON switches labeled TCPA, PC, and TCA.

When you have done this, all switches will be ON except for DISCH. (like the photo).



Detail of Maser's system switches with discharge OFF.

DO NOT TURN ON DISCHARGE CIRCUIT, LABELED ON THE CIRCUIT BOARD AS (DISCH).

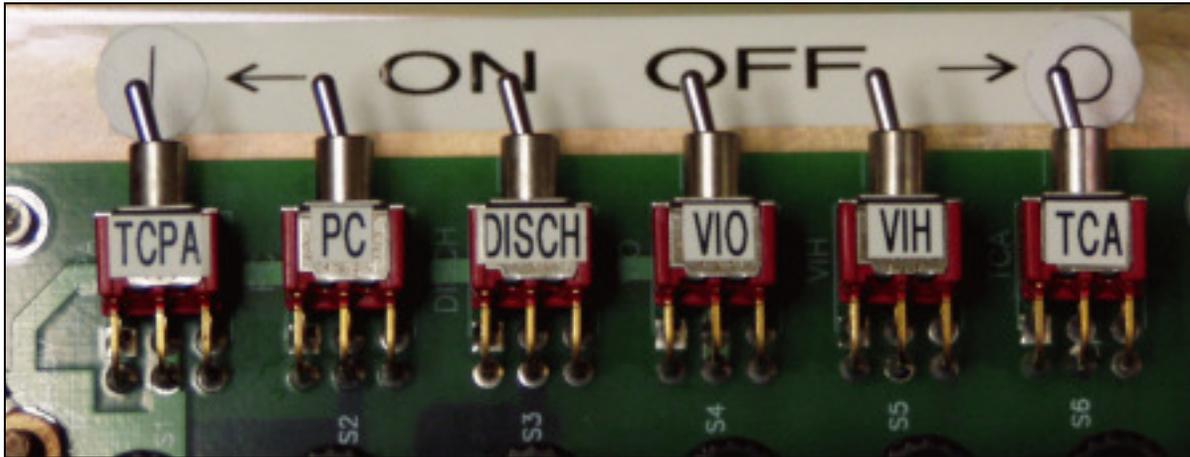
This will be done in a later step.

18. The small green Hydrogen generator valve is located on the right hand side of the originally open lower section. Open the small green H₂ generator valve by $\frac{3}{4}$ of a turn, counterclockwise.



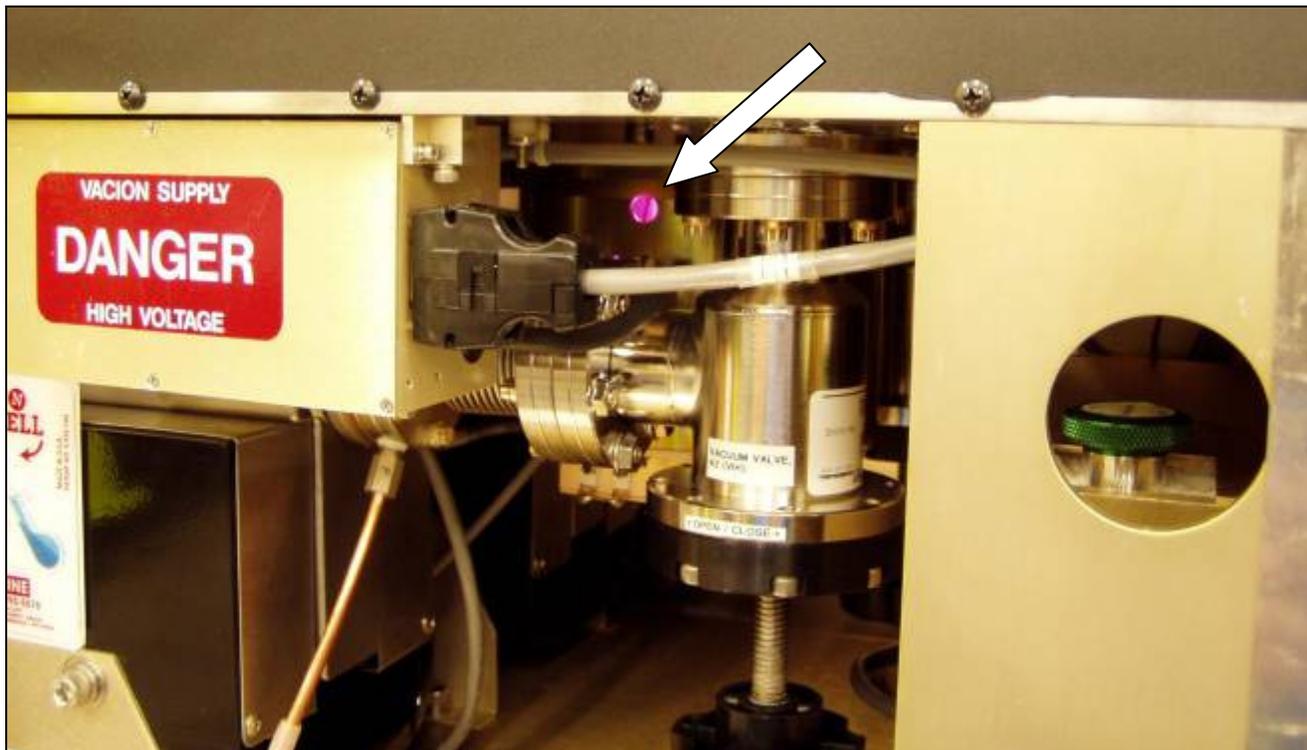
19. Scroll the menu screen on the front display to monitor pd heater (channel 17). This voltage should begin to rise within approximately 10 minutes of turning on the "PC" switch (which you did in step 16).

Allow approximately one hour for this voltage to stabilize. It should stabilize at a number between 7 and 14 volts. When this voltage is stable and below 14V, turn on the switch labeled “DISCH” to power the discharge circuit.



Detail of maser system switches with Discharge ON.

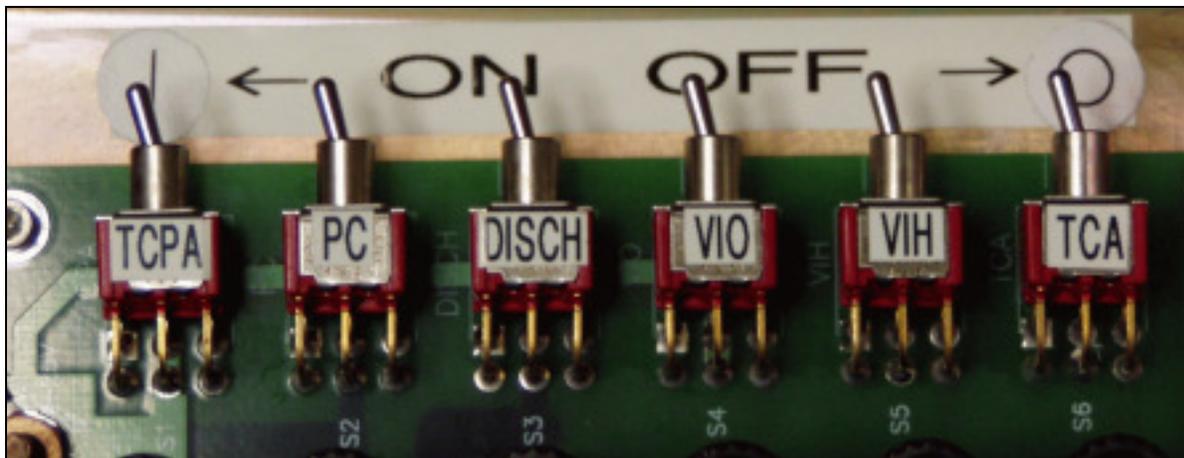
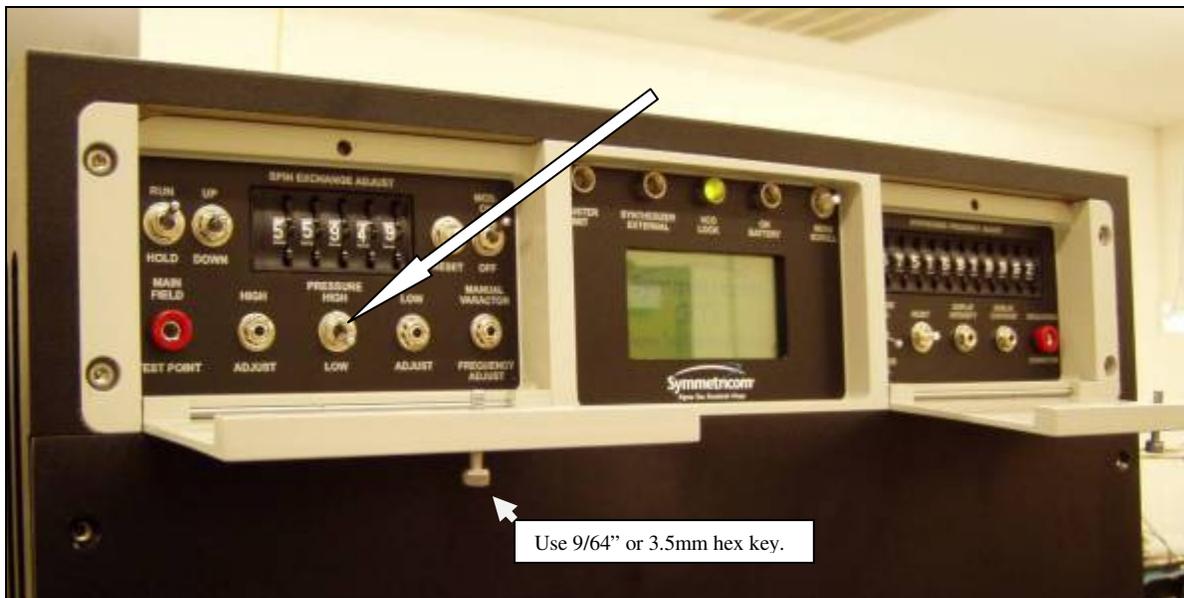
When the discharge is lighted, you may verify its operation via a small hole in the lower compartment between the two valves. It gives off a purple glow.



If discharge lights (you can see the purple glow), you may skip the next page. Leave all switches on. If the discharge fails to light after one minute with “DISCH” switch on, follow the steps on the next page.

If the discharge **does not** light after 1 minute, proceed as follows:

- turn OFF the “DISCH” switch.
- open the left control panel door on the front display (as viewed from the front) using the hex key provided.
- locate switch marked “pressure”. Maser ships with it in the “low” position.
- Set this switch to “high” and wait 30 minutes.
- With pressure switch still on “high”, turn ON the “DISCH” switch once more.
- wait for one minute to see if the discharge lights. If it does, turn pressure switch back to “low” and skip to the next page.
- If the discharge still fails to light, turn OFF the “DISCH” switch, leave the pressure switch on “high” and call Symmetricom at (205) 462-2605 or (205) 462-2601 for further instructions, or email bowings@symmetricom.com or plowings@symmetricom.com.



Example of all system switches ON.

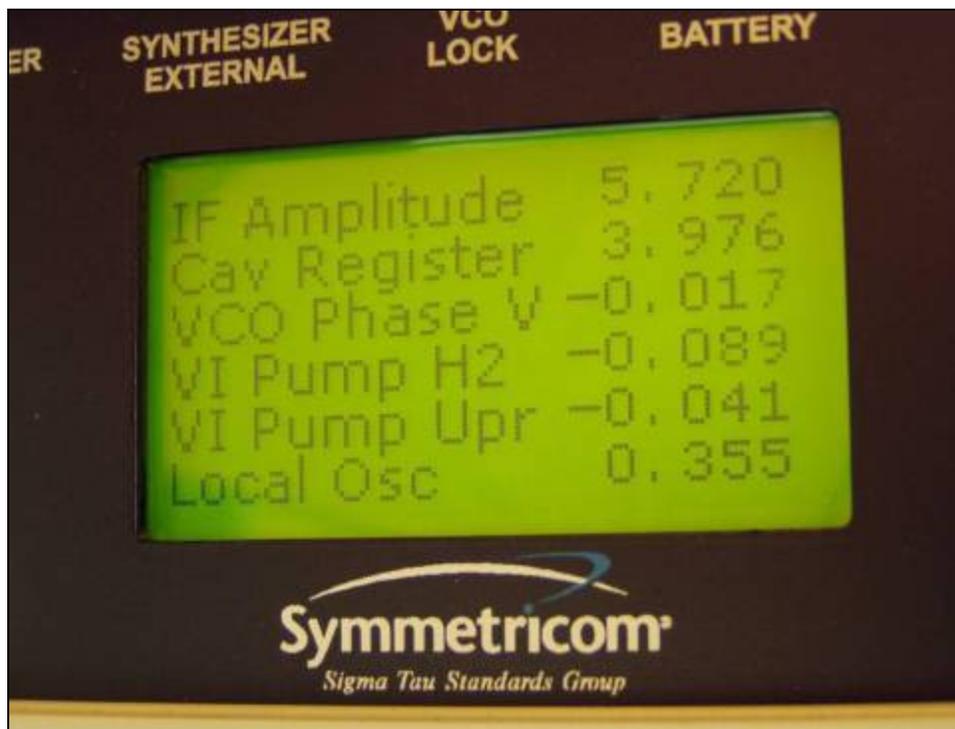
After the discharge is operational, it is time to replace the maser shields and covers.

20. Replace Front cover with the flat head Phillips screws. Also replace lower shield panels, one on each side. Leave screws loose until they are all installed, then tighten them gently.

Have the reserve batteries been installed yet? Now is a good time to ensure they are connected, strapped down if desired, and operational as outlined in Appendix B.

Congratulations! You have completed the preliminary start up of the maser. It now will take approximately 3 days for the maser's different systems to attain temperature and stabilize.

21. Within three days the maser should be oscillating. This is evidenced by the "IF Amplitude" display on the front panel. The IF Amplitude (channel 0) will be above 3 V when the maser is oscillating. In the photo below it is reading 5.720 V, which is OK.



22. When the IF Amplitude is above 3 volts, the register should be reset. The controls for this are behind the left control panel door (as viewed from front).



The Register Reset Procedure is as follows:

1. RUN/HOLD switch should be moved to HOLD.
2. The UP/DOWN switch should be moved to DOWN.
3. The RESET button should be pressed.
4. This should bring the "Cav Register" (Channel 1) to approximately 4.8 to 5 volts on the display.
5. Move the UP/DOWN switch to the center position.
6. Move the RUN/HOLD switch to RUN.



After the register has been reset, the maser will automatically return to its tuned position in a few days. The register must be reset before it will automatically tune. Refer to the maser manual (see Section 3 on the Cavity Servo System of the Operating Manual, #75666-201) for a more detailed explanation.

APPENDIX A: Shipping indicators

Drop-N-Tell style non-resettable shock indicators:



OK. Note arrows in center are RED.



Not OK (Tripped). Note Arrows in center are BLACK.

Tip-N-Tell style 45 degree tilt indicators:



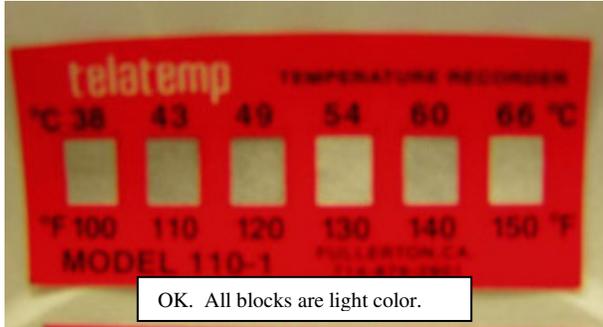
OK. Note lack of beads in triangle area.



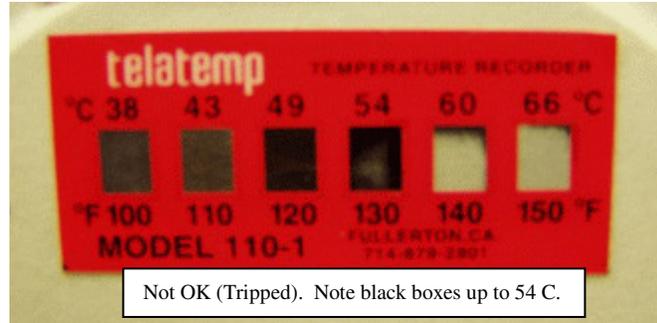
Not OK (Tripped). Note beads in triangle area.

APPENDIX A (Continued): Shipping indicators.

Telatemp non-resettable thermometer (Heat indicator):



OK. All blocks are light color.



Not OK (Tripped). Note black boxes up to 54 C.

Telatemp Coldsnap non-resettable Freeze Indicator:



OK. Window is clear.

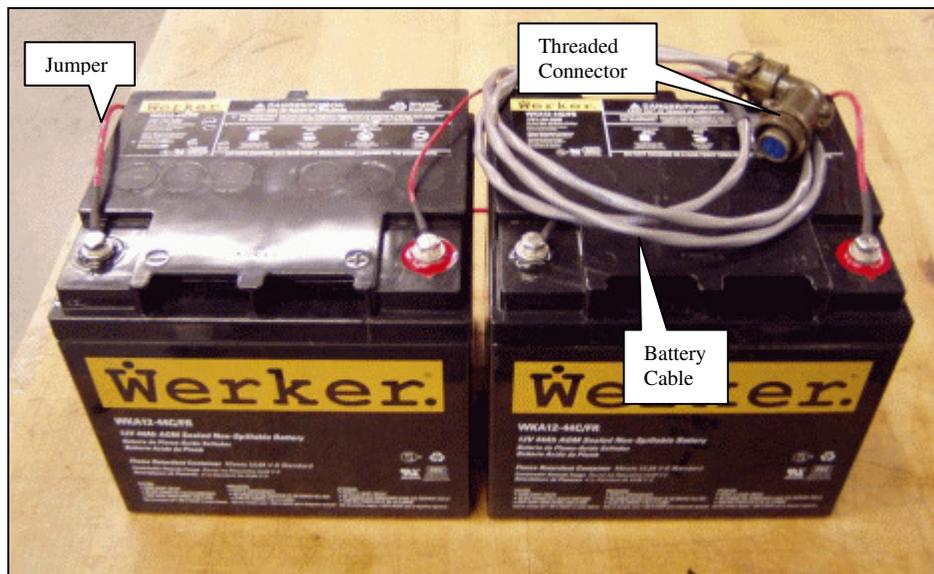


Not OK. Window is RED.

APPENDIX B: Reserve (Standby or Back-up) Batteries.

Two, 40-44 Amp-Hour, 12 Volt, sealed lead-acid “maintenance free” batteries are to be installed into the rear of the maser to provide reserve power. The batteries are connected in **series**. When new and fully charged, these batteries will power the maser for over 8 hours. Automatic recharging occurs at approximately 1.5A.

These batteries can be sourced from a variety of vendors. Some we have used include Panasonic (LC-X124P/LC-X1242AP), Werker (WKA12-44C/FR), and Power Sonic (PS-12400). The physical size of the batteries should not exceed 200mm L x 168mm W x 180mm H (7.87” L x 6.61” W x 7.08” H). The battery terminals may be the flat, square, nut and bolt style or the threaded hole style as shown. Take a moment to find the battery cables in the envelope shipped atop the maser. The ring terminal ends are generously sized to fit different batteries. Typically you will need a 10mm wrench to tighten the connections (the bolts will come with the batteries). The batteries and cables are pictured below.



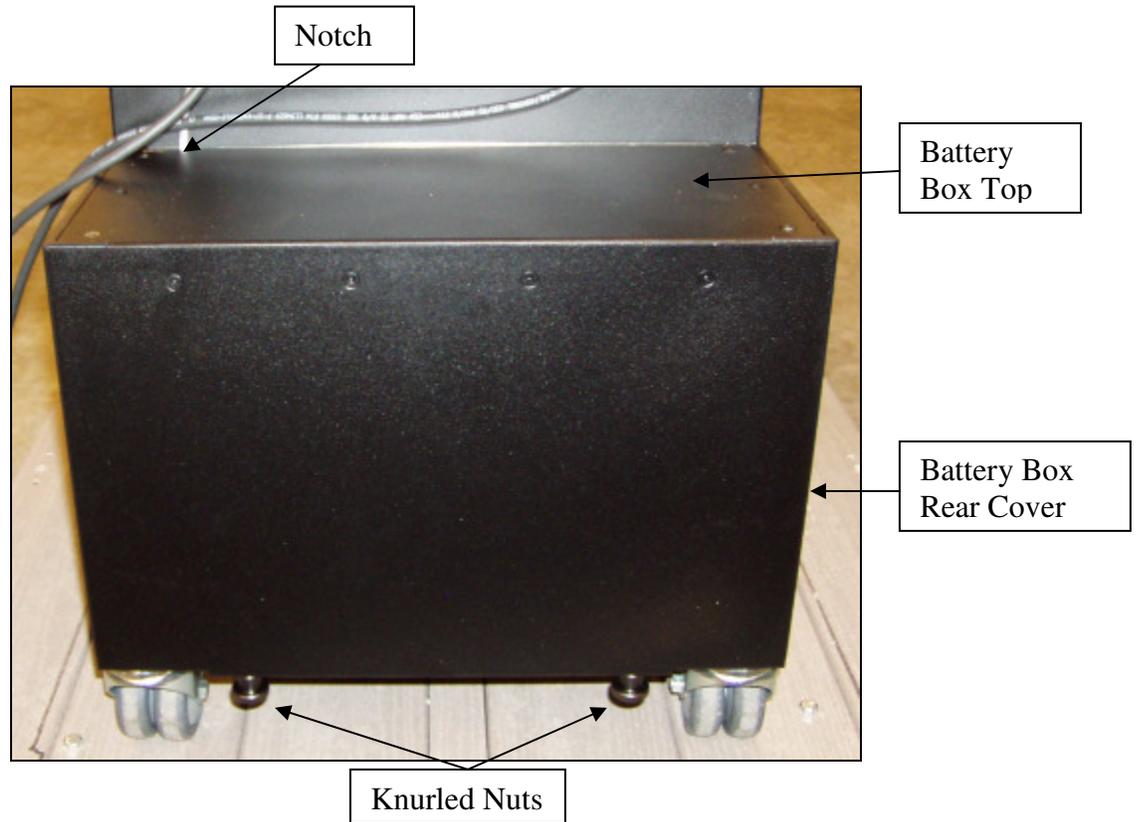
You will notice there are two battery cables.

One is gray and large, with a metal threaded connector. We will call this the “**battery cable**”. Do Not connect this threaded connector to the maser until instructed to do so later in this process.

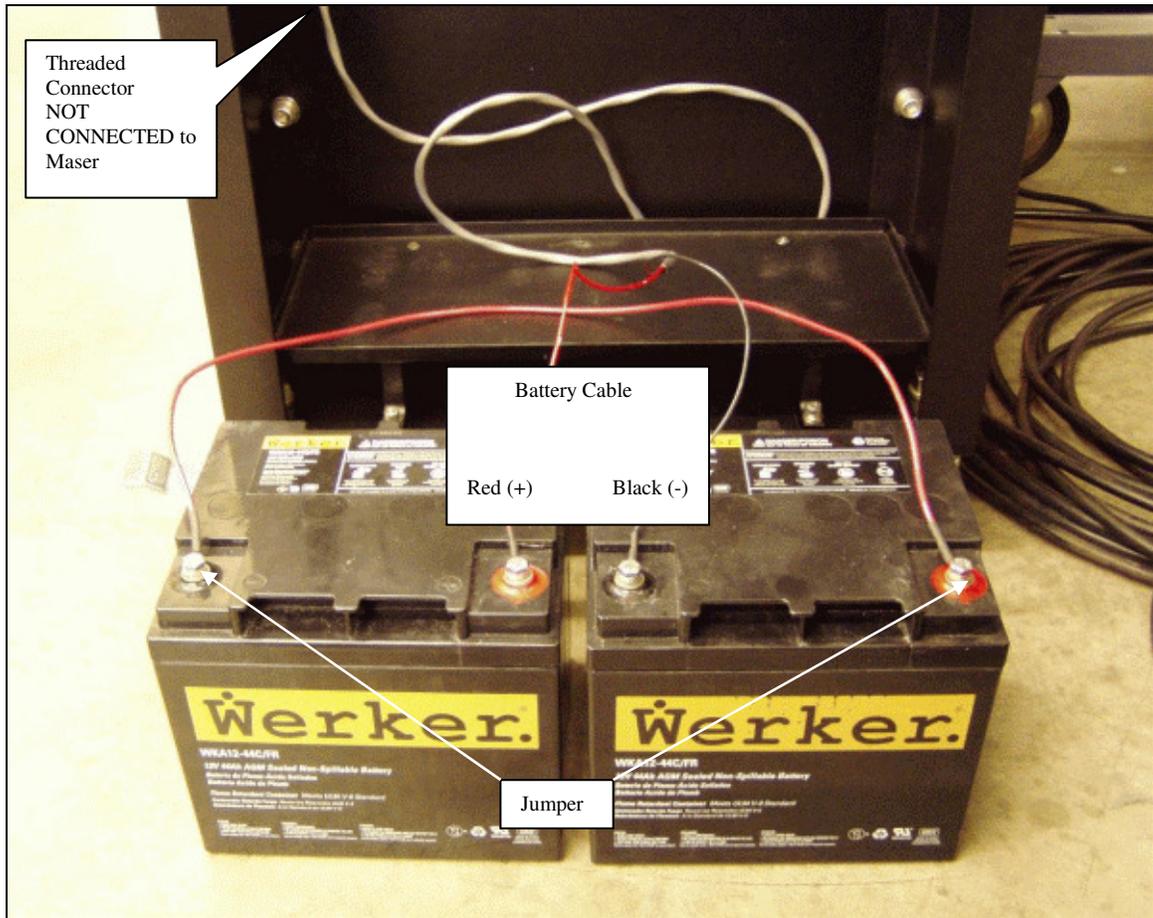
The other is small and red; we will call this the “**jumper**”.

APPENDIX B (Continued): Reserve Batteries.

1. Remove 2 knurled nuts on battery box rear cover. Gently pull out and down to remove rear cover. Lay it aside.
2. Remove the six screws on the battery box top cover. Then, carefully lift off the top cover of the battery box. Notice the orientation of the notch in the corner



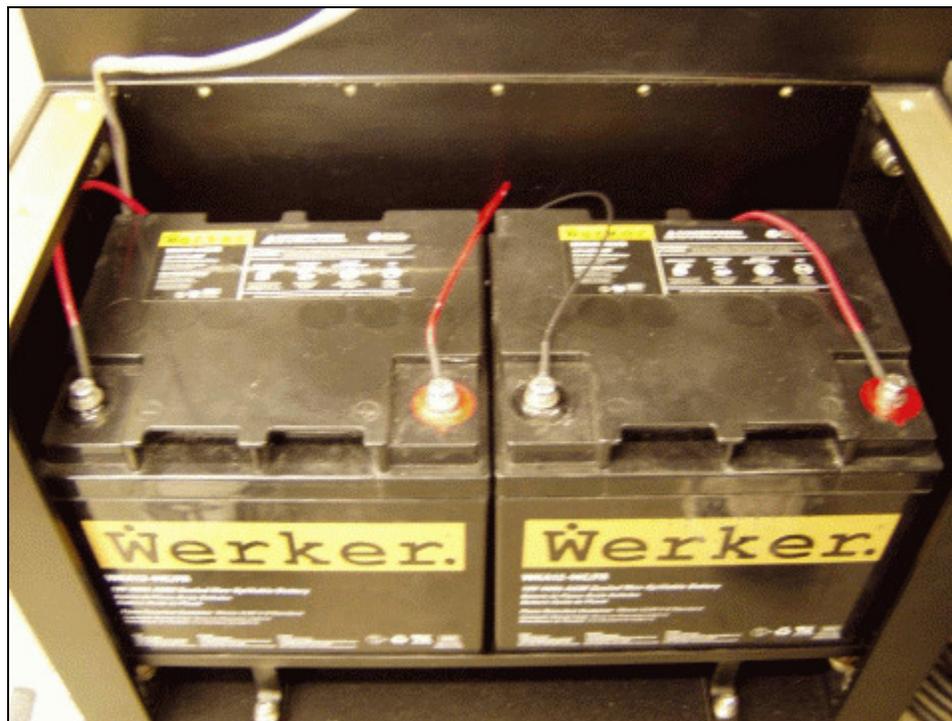
- Place the batteries as shown on the floor just behind the maser. Connect the cables in series as shown. Remember, do not connect the threaded connector to the maser yet.



Gently tighten battery connections using a 10mm wrench.

APPENDIX B (Continued): Reserve Batteries.

4. With help from an assistant, carefully lift the batteries together into the battery tray. You may need to temporarily tilt them slightly to get them in place. Be careful not to damage the cable terminals during this step. Also, to prevent shock, DO NOT let the battery terminals touch the frame of the maser. Once in place, they should look approximately like the picture below.



Place excess cable behind the batteries, and ensure the gray battery cable is exiting thru the top left side.

There is a notch in the battery box top cover for this wire.

If desired, you may install the battery straps (included in envelope) to secure the batteries from moving about.

APPENDIX B (Continued): Reserve Batteries

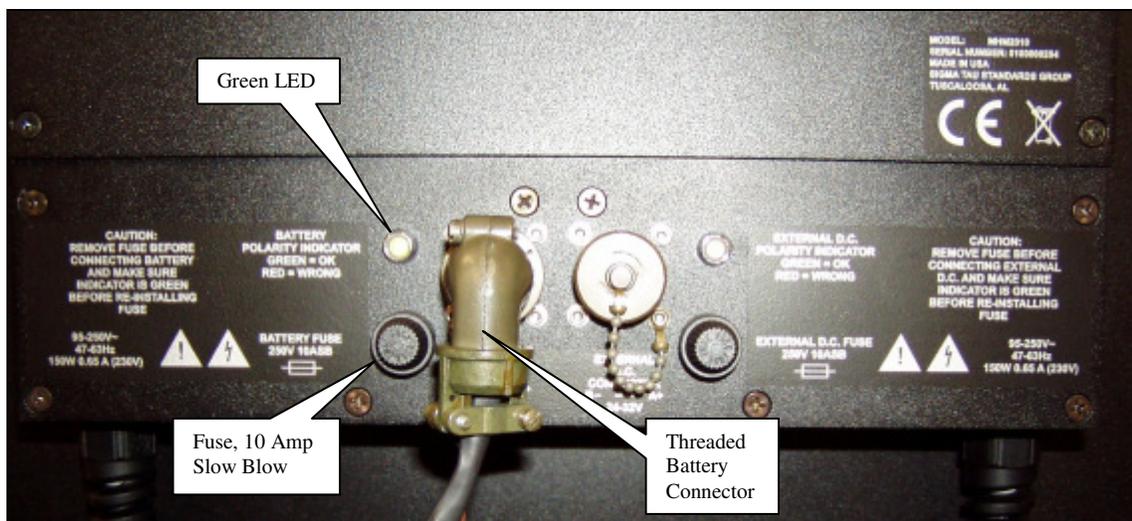
5. On the lower rear of the maser, locate the “battery connector”. Notice the fuse and LED indicator beside it.

REMOVE THE FUSE BEFORE CONNECTING THE BATTERY CABLE TO THE MASER. Push the fuse holder in slightly and turn to the left to remove fuse.

Now, connect the threaded connector on the gray battery cable to the maser. Notice the LED indicator. If it is green, continue to tighten the connector by hand. If the LED is red, something is wrong in the battery configuration, and you need to correct this in your battery connections.

Once you have a green LED indicator and the threaded connector is hand tight, install the fuse again. Push in slightly and turn to the right to secure the fuse.

Replace the battery box top cover, ensuring the gray wire is located in the notch to prevent pinching. Next, install the 6 screws that secure the battery box top. Next, install the battery box rear cover with the two knurled nuts.



Congratulations! Your maser now has reserve battery power. Battery data may be monitored from the front control panel on channel 11(Bat Charge) and channel 19 (Battery V). See Chapter 3 in your owner’s manual for more detailed information.

Removal of the batteries is the reverse of installation. Replacement of the batteries is recommended every 2 years. You may wish to make a note of the date the batteries were installed and/or replaced below.

MASER RESERVE BATTERY LOG

Date:							
Brand:							
Model #:							
Supplier:							