Appendix

Technical Publication
AP-0015R2

Quick Installation Guide for SHF Generators

HF Series Generators

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	JAN 7, 2004	First edition
1	OCT 16, 2007	General Update & Improvement
2	AGO 06, 2009	Dip–Switch configuration of HT Controller

This Document is the English original version, edited and supplied by the manufacturer.

The Revision state of this Document is indicated in the code number shown at the bottom of this page.

ADVISORY SYMBOLS

The following advisory symbols will be used throughout this manual. Their application and meaning are described below.

DANGERS ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEEDED OR AVOIDED WILL CAUSE SERIOUS PERSONAL INJURY OR DEATH.

ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEEDED OR AVOIDED COULD CAUSE SERIOUS PERSONAL INJURY, OR CATASTROPHIC DAMAGE OF EQUIPMENT OR DATA.

Advise of conditions or situations that if not heeded or avoided could cause personal injury or damage to equipment or data.

Note ☞

Alert readers on pertinent facts and conditions. Notes represent information that is important to know but which do not necessarily relate to possible injury or damage to equipment.

TABLE OF CONTENTS

SECTION 1 INSTALLATION

WARNING

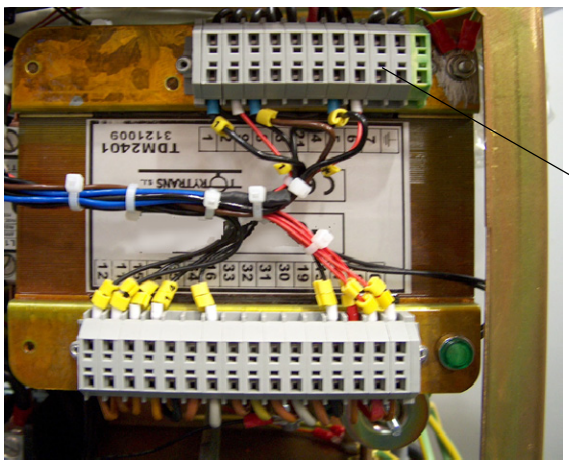
THIS DOCUMENT PROVIDES A STEP BY STEP GUIDE AND IS NOT INTENDED TO TAKE THE PLACE OF THE SERVICE MANUAL. AS STEPS ARE COMPLETED CHECK OFF THE LIST TO THE LEFT OF EACH NUMBER OR PARAGRAPH.

1. Place the Power Module close to its permanent position. For easy interconnection and calibration place the Generator Cabinet on a table or pedestal; or mount it to the wall using the Wall Support provided.

2. Verify that wire marked "⁎" on Transformer 6T2 terminal strip is matched to the incoming power. Identify the Generator type: Single–Phase, Three–Phase or Battery Powered.

	POWER SUPPLY LINE FOR SINGLE-PHASE OR BATTERY POWERED GENERATORS			
	110 VAC or Stand-Alone option	**208 VAC**	**220 / 230 VAC**	**240 VAC**
Cable-⁎ in Transformer 6T2	TB-3 or TB-8	TB-21	TB-4 or TB-5	TB-6 or TB-7

	POWER SUPPLY LINE FOR THREE-PHASE GENERATORS				
	220 / 230 / 240 VAC	**400 VAC**	**415 VAC**	**440 VAC**	**480 VAC**
Cable-⁎ in Transformer 6T2	TB-4 or TB-5	TB-8	TB-7	TB-9	TB-10



3. ***THIS POINT <u>ONLY</u> APPLIES TO <u>BATTERY POWERED</u> GENERATORS.***

   a. Open hinged door to access to Charger Module (Mod 1) by removing the Allen screws.

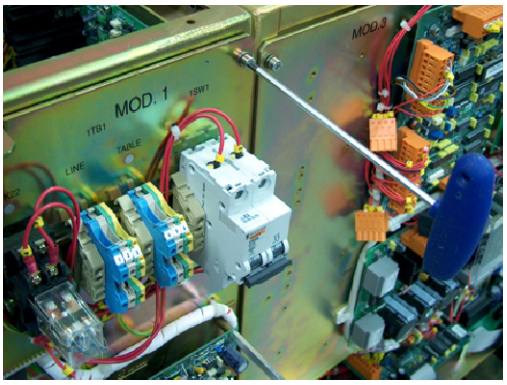
   b. Verify that wire marked "⁎" is connected to Transformer 2T1 terminal strip – 110 (for 110 VAC).

   c. Remove plastic covers over Charger Board and Line Monitor Board.

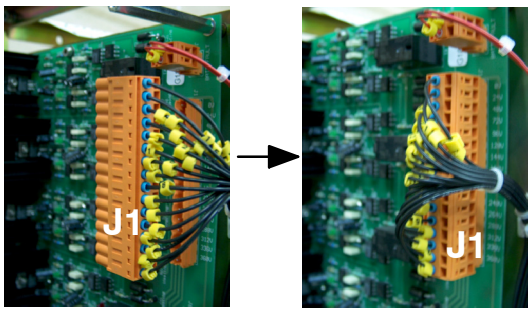
   d. Plug J1 into the Charger Board, it is unplugged at the factory for safety.

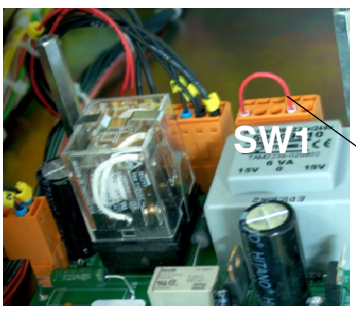
   e. Verify Jumper SW1 connection between SW1–5 and SW1–4 (110 VAC).

   f. Re-install plastic covers.

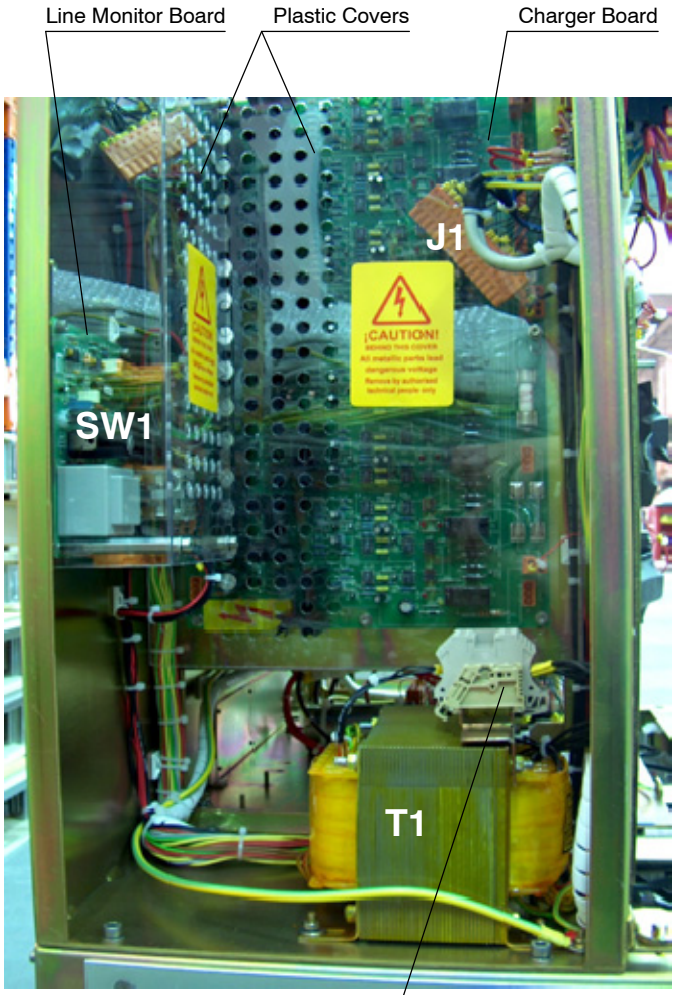


J1 Connection

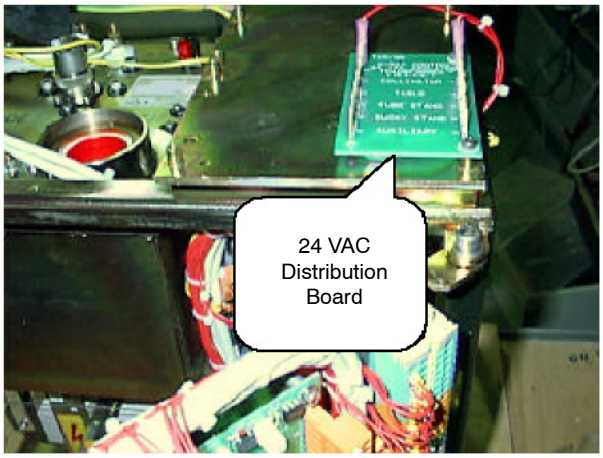


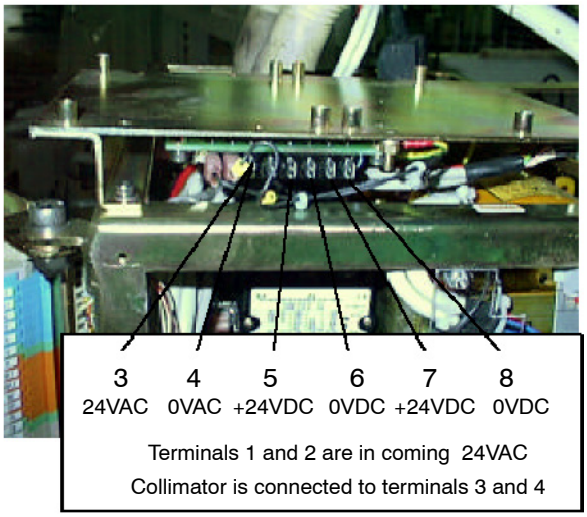


SW1 Jumper
As Shown, 5-4-3-2-1
As Shwn, 5 & 2: 220VAC
><
5 & 4 for 120 VAC Source

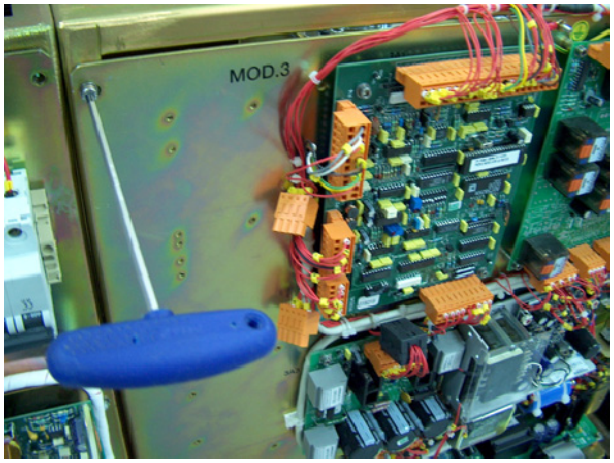


4. TXR products require 24 VAC for locks. At top of the Generator cabinet a 24 VAC Distribution Board has been added to connect these locks.



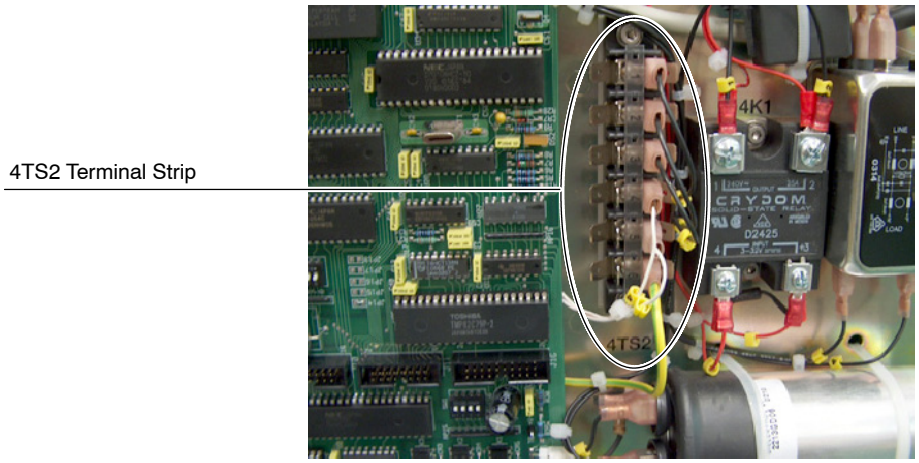


5. Remove Allen screws that secure hinged door on MOD3 side.

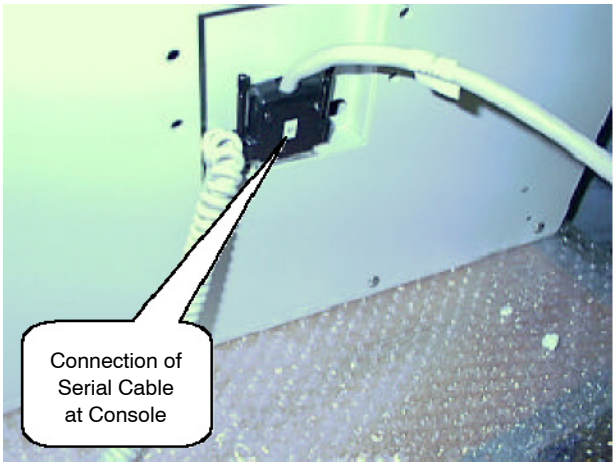


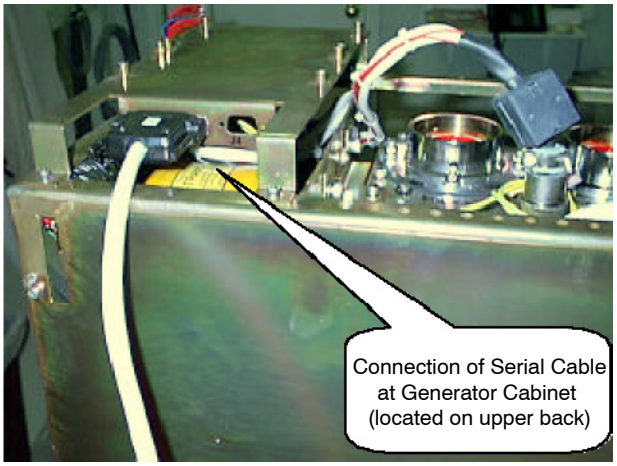
6. The Terminal Strip 4TS2 is located on Module 4 (back of Module 3) of the hinged door. Connect the X-ray Tube Rotor wiring as follows:

WIRE FROM X-RAY TUBE	CONNECTION IN 4TS2
BLACK	4TS2-1
RED	4TS2-2
WHITE	4TS2-3
THERMAL	4TS2-4
THERMAL	4TS2-5
GROUND *	4TS2-6
* *If X-ray Tube have not a shielded Ground wire, terminal 4TS2-6 is not used.*	



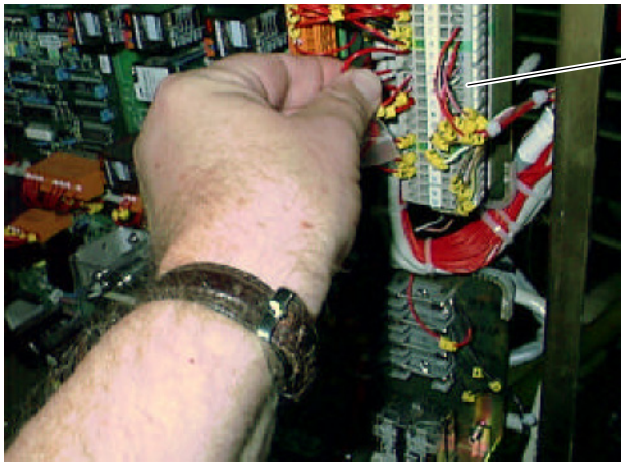
7. Carefully connect the J5 side of the Serial cable to the Console and then route the Handswitch wire. Connect the J1 side of the Serial cable from the Console to the Generator Cabinet.





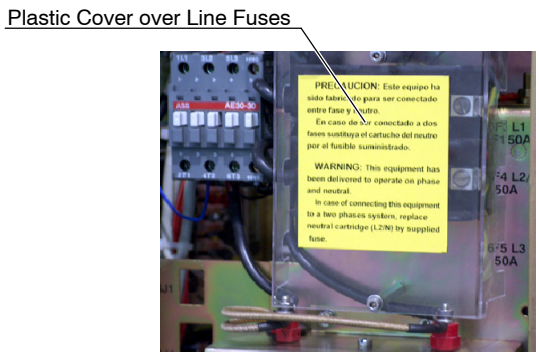
8. Add insulating compound or insulating oil to both High Voltage Transformer receptacles. Connect both High Voltage cables (Anode and Cathode) from the X-ray Tube to the HV Transformer receptacles.

9. The Terminal Strip 3TS1 is located on Module 3 (out-side of hinged door). Verify or connect a jumper between terminals 3TS1–22 and 3TS1–23 to bypass the Door Interlock.

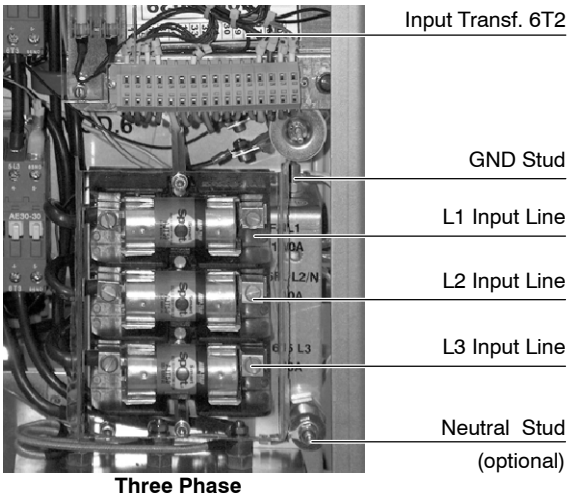


10. ***THIS POINT ONLY APPLIES TO LINE POWERED GENERATORS.***

Remove the plastic cover over the Line Fuses and connect the Line Power cables to the right side of the Fuses at L1 & L2 for Single Phase Generators and also at L3 for Three Phase Generators.



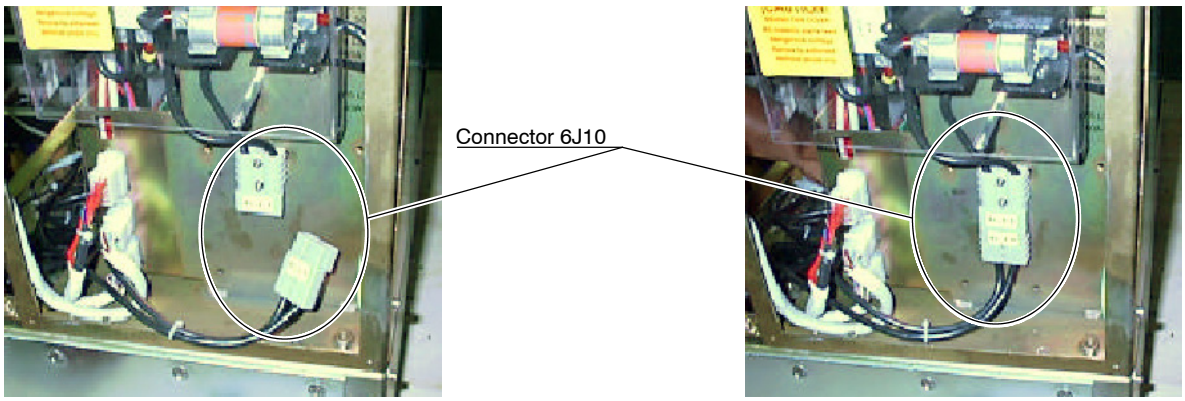
Single Phase



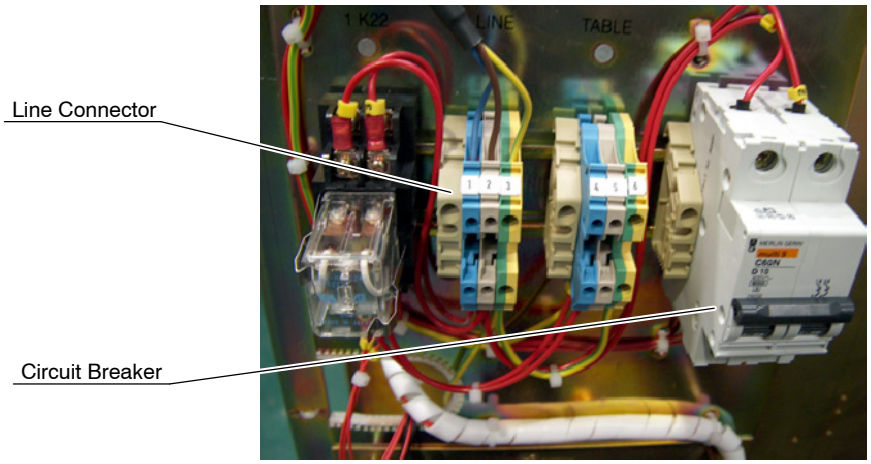
Three Phase

11. ***THIS POINT <u>ONLY</u> APPLIES TO <u>BATTERY POWERED</u> GENERATORS.***

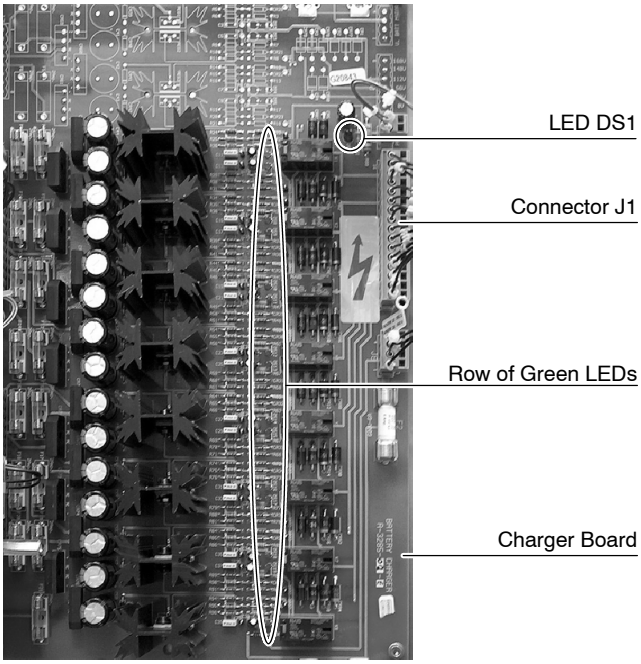
a. Connector 6J10 on the right side of Generator Cabinet (Module 6) is unplugged for safety during transport. Plug in it.



b. Connect the Line Power cable to Line Connector (wire-1 to left, wire-2 to middle, ground wire to right). These connections are color coded.



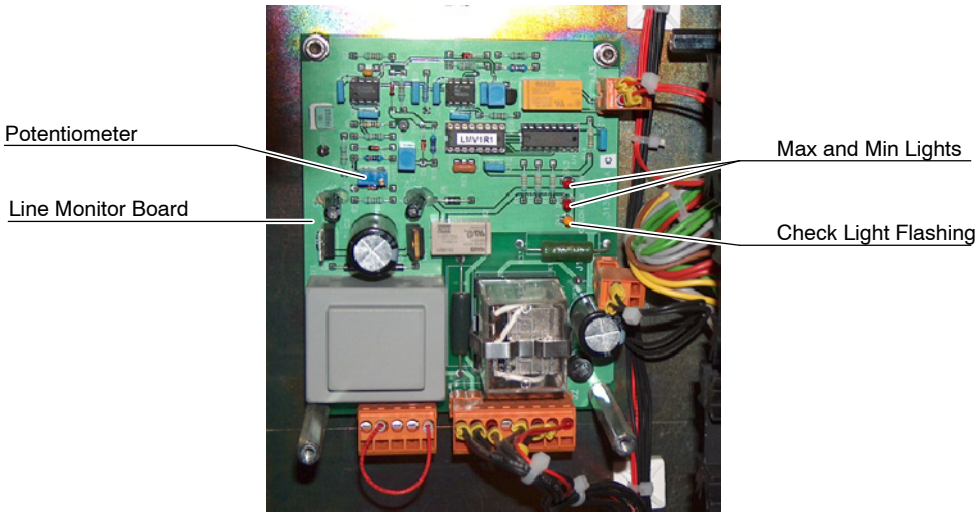
c. Turn On the Circuit Breaker. Visually check that all green lights and LED DS1 are lit on the Charger Board.



d. Visually verify that **LED DL1** (yellow) **is flashing** on the Line Monitor Board (2A3). The **MAX and MIN LEDs** (red) on the Line Monitor Board check the line coming in, **neither should be on**.

Potentiometer POT1 is factory adjusted. If MAX or MIN LED is ON, first check that Mains Voltage is according to specifications on page 1 of this guide. If Mains Voltage is correct, adjust POT1 (CW up, CCW lower) measuring between TP-1 and TP-2 on Line Monitor Board. Potentiometer adjustment should be:

$$\text{Potentiometer} = \frac{\text{Mains Voltage}}{\text{Nominal Voltage}} \times 2.5$$



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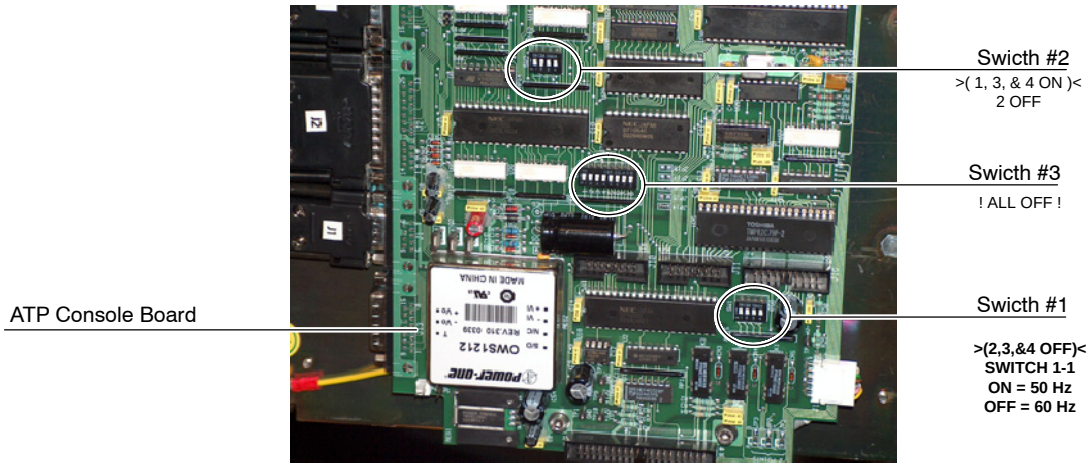
SECTION 2 CONFIGURATION

2.1 PROPER DIP SWITCH SELECTIONS ON THE ATP CONSOLE CPU BOARD

Note ☞ *The ATP Console CPU Board is located on Module 4 side of the Hinged Door.*

1. Locate Switches #1, #2 and #3 on the ATP Console CPU Board from the illustration.

   - Switch #1 contains four Dip Switches.
   - Switch #2 contains four Dip Switches.
   - Switch #3 contains eight Dip Switches (for factory use).



2. **Configuration of Switch #1.**

   - **For use with 60 Hertz Line Supply**: All four Dip Switches must be placed in the down (OFF) position.
   - **For use with 50 Hertz Line Supply**: The first Dip Switch must be placed in the up (ON) position. The second, third and fourth Dip Switches must be placed in the down (OFF) position.

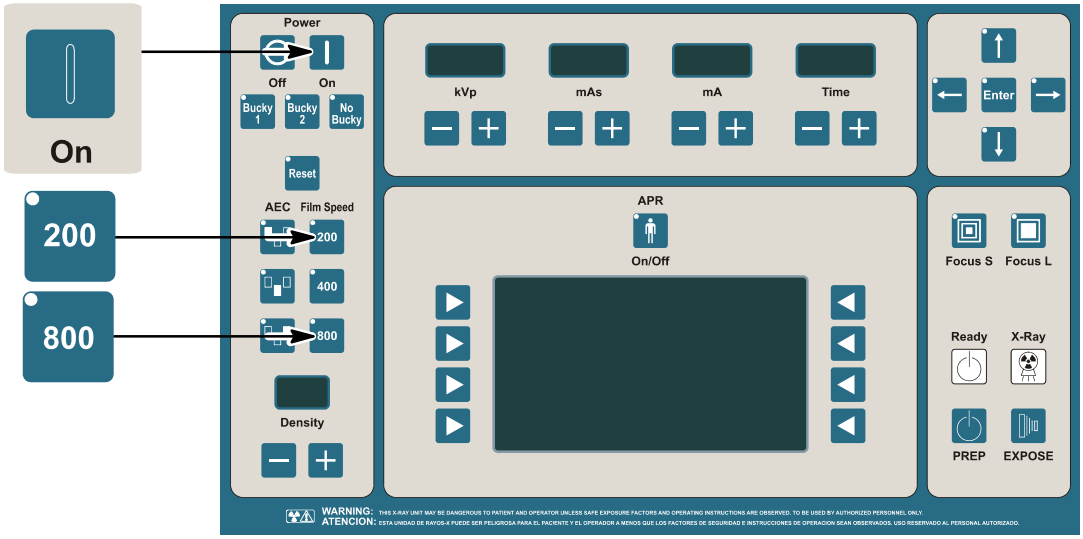
3. **Configuration of Switch #2.** The first, third and fourth Dip Switches must be placed in the up (ON) position. The second Dip Switch must be placed in the down (OFF) position.

4. **Configuration of Switch #3.** All eight Dip Switches must be placed in the down (OFF) position.

2.2 CONFIGURING THE WORKSTATIONS

1. With the Generator OFF, make sure Dip 3 of Switch #2 on the ATP Console CPU Board (Module 4 side) is placed in the closed (ON) position (Service Mode enabled).

2. Turn ON the Line Power and then the Console power. Wait for the self testing to finish, then enter in configuration mode by maintaining pressed Power ON, “200” and “800” simultaneously for at least two seconds until all of the workstations push-buttons are illuminated.



3. **Results you should see:**

   A display of numbers will be visible on the kVp, mAs, mA and time displays. The visible numbers will either be 0, 1, 2, etc.

   The Console is equipped to operate in five different modes (workstations). The three push-buttons at the upper-left provide a way to program for different operations. *See the following tables for proper selections.*

4. Select the first workstation to be configured (Bucky 1, Bucky 2, No Bucky) by pressing the respective push-button, only this push-button blinks and the console shows one of the following values:

DISPLAY	FUNCTION	VALUE	DESCRIPTION
1st Value	**SELECT THE TUBE**	0	No-configured workstation
		1	Tube-1
		2	Tube-2
2nd Value	**SELECT THE DEVICE (WORKING MODE)**	0	Direct (No Bucky)
		1	Bucky-1
		2	Bucky-2
		3	Standard Tomo **1)*
		4	Standard RF
3rd Value	**SELECT THE ION CHAMBERS BEING USED (ONLY WITH AEC)**	0	No AEC
		1	Ion Chamber-1
		2	Ion Chamber-2
		3	Ion Chamber-3
		4	Ion Chamber-4
Notes.- Some values may not be configurable, depending on Generator model. **1) Only when the Tomo is controlled by the Generator.*			

5. Set the new value by pressing the Density "+" or "–" buttons located at the bottom left corner of the Operator Console. When the first value is "0", the second and third value are "0".

   The following table is an example of a 2 tube System with 2 Buckys and no Ion Chambers.

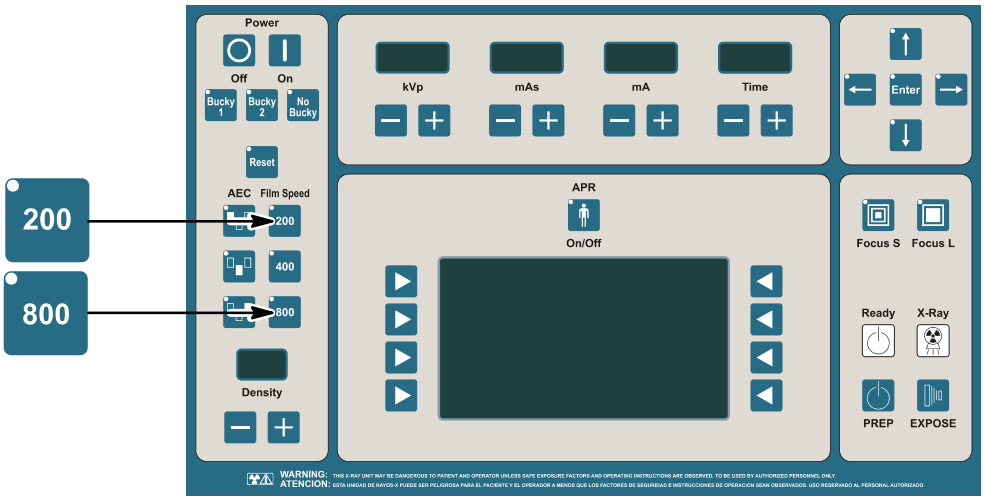
Button	kVp	mAs	mA	Time
Bucky 1	1 (tube 1)	1 (Bucky 1)	0 (no Ion Chamber)	0
Bucky 2	2 (tube 2)	2 (Bucky 2)	0 (no Ion Chamber)	0
No Bucky	1 (tube 1)	0 (No Bucky)	0 (no Ion Chamber)	0

6. Continue Configuration for the remaining Workstations.

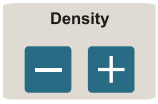
7. Exit from configuration by pressing the "*200*" and "*800*" pushbuttons down simultaneously for at least two seconds until you hear an audible double beep. This sound signals that you have successfully saved the workstations you had selected. **Configuration of the Workstations is now completed.**

2.3 CONFIGURING THE TUBE TYPE

1. To configure the X-ray Tube type, it is necessary to enter into Calibration Mode by pressing the "*200*" and "800" push-buttons simultaneously. The light of the selected workstation blinks (*Bucky 1*, *Bucky 2* or *No Bucky)*.



2. Press the "*mA Increase*" push-button until you reach the maximum mA capacity. Press the "*mA Increase*" push-button twice more to reach the Extended Memory Code "*E02*", that will appear on the mA Display.



3. In order to configure the X-ray Tube type and model, press the "+" or "–" Density push-buttons until one of the Tube Type numbers listed below is shown on the kVp Display. (The entire list of Tube Data is found in your Service Manual on the last page of the Configuration Section).

   Normally one of the following three Tube capacities is chosen:

TUBE NUMBER (kVp Display)	TUBE CODE (ID) (mAs Display)	MODEL	FOCAL SPOT	POWER RATINGS		KHU
				LS (kW)	HS (kW)	
001	139	TOSHIBA E7239X	1.0 / 2.0	22 / 45	-	133
003	140	TOSHIBA E7242X	0.6 / 1.5	18 / 49	-	187
004	090	TOSHIBA E7252X	0.6 / 1.2	15 / 42	26 / 73	300

SECTION 4 X-RAY TUBE DATA

The following table lists several common X-ray tubes and their corresponding number. If a specific tube is not listed, tube specifications are given to enable you chose a similar tube type. If none of the listed tubes are satisfactory, contact your generator supplier to obtain special software.

Table 4-1
X-ray Tube Numbers

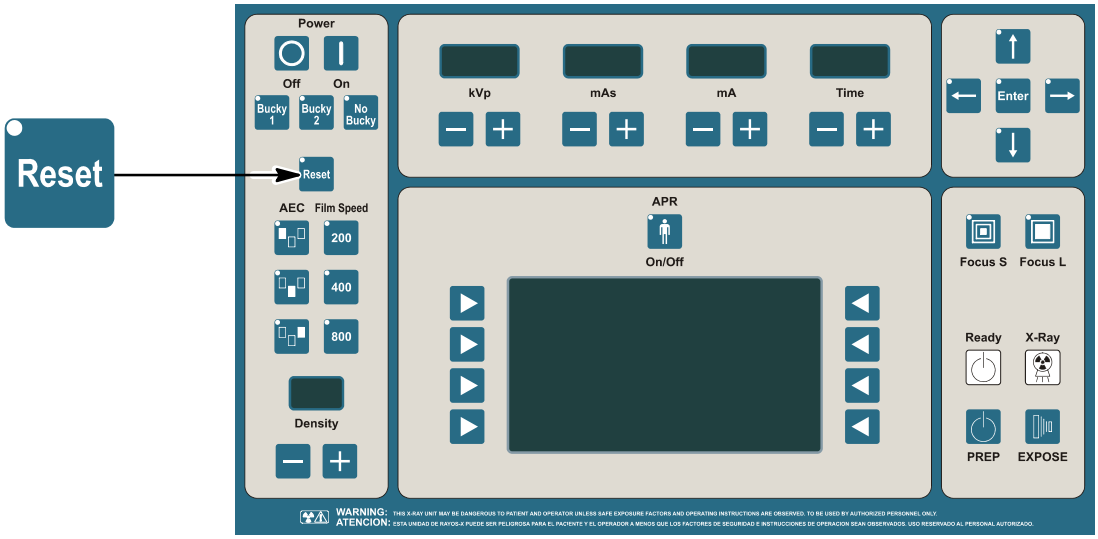
TUBE NUMBER	TUBE CODE (ID)	MODEL	FOCAL SPOT	POWER RATINGS		KHU
				LS (kW)	HS (kW)	
001	139	TOSHIBA E7239X	1.0 / 2.0	22 / 45	-	133
002	201	TOSHIBA E7240X	0.6 / 1.2	15 / 30	-	140
003	140	TOSHIBA E7242X	0.6 / 1.5	18 / 49	-	187
004	090	TOSHIBA E7252X	0.6 / 1.2	15 / 42	26 / 73	300
005	412	TOSHIBA E7254FX	0.6 / 1.2	23 / 60	40 / 102	400
006	407	TOSHIBA E7884X	0.6 / 1.2	21 / 52		300
007	310	TOSHIBA E7843X	0.6 / 1.2	22 / 49	-	150
008	344	TOSHIBA E7865X	0.3 / 1.0	3 / 40	-	140
009	402	TOSHIBA E7876X	0.6 / 1.2	22 / 53		230
010	260	IAE RTM 101 HS	0.6 / 1.2	22 / 55	37 / 99	400
011	441	TOSHIBA E7886X	0.7 / 1.3	16.9 / 40		300
012	381	TOSHIBA E7869 X	0.6 / 1.2	21 / 55	36 / 96	600
013	404	VARIAN RAD 14	0.6 / 1.2	21 / 54	32 / 77	300
014	161	VARIAN RAD 21	0.6 / 1.2	21 / 64	36 / 100	300
015	395	VARIAN RAD 60	0.6 / 1.2	26.1 / 66	40 / 100	400
016	238	VARIAN RAD 74	0.6 / 1.5	20 / 52	-	200
017	252	VARIAN RAD 92	0.6 / 1.2	26 / 62	40 / 99	600
018	092	VARIAN A-192	0.6 / 1.2	25 / 63	40 / 96	300
019	309	VARIAN A196	0.6 / 1.0	20 / 47	32 / 72	350
020	438	VARIAN A-292	0.6 / 1.2	25 / 62.5	39.6 / 96	400
021	208	VARIAN G 292	0.6 / 1.2	25 / 63	39 / 95	600
022	051	GE-CGR MN 640	1.0 / 1.8	23 / 46	-	150
023	064	GE MAXIRAY-75	0.6 / 1.5	12 / 37	21 / 62	300
024	062	GE MAXIRAY-100	0.6 / 1.25	18 / 55	31 / 100	350
025	261	SIEMENS DR 154/30/50	1.2 / 1.8	31 / 53	-	200
026						
027						

Note .- Power Ratings are for 60 Hz. To calculate Power Ratings for 50 Hz multiply the values by 0.91

TB63 (+S)

4. Verify that the Tube code (ID) shown on the mAs Display is the same as the tube code listed in the table above or in the Tube Table of the Service Manual.

5. Press the "*Reset*" Push-button to save and permanently store the X-ray Tube configuration. You will once again hear an audible beep to confirm that you have successfully saved your selection.



Note ☞ *At this point, if your selected Bucky is still blinking, you are already in Service Mode and ready for Autocalibration. If your selected Bucky is not blinking, press "200" and "800" simultaneously for at least two seconds to enter Service Mode.*

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SECTION 3 CALIBRATION

3.1 PREVIOUS TASKS

Before calibration, keep in mind that:

1. To calibrate and measure the kVp output, a Non-Invasive kVp Meter is needed.

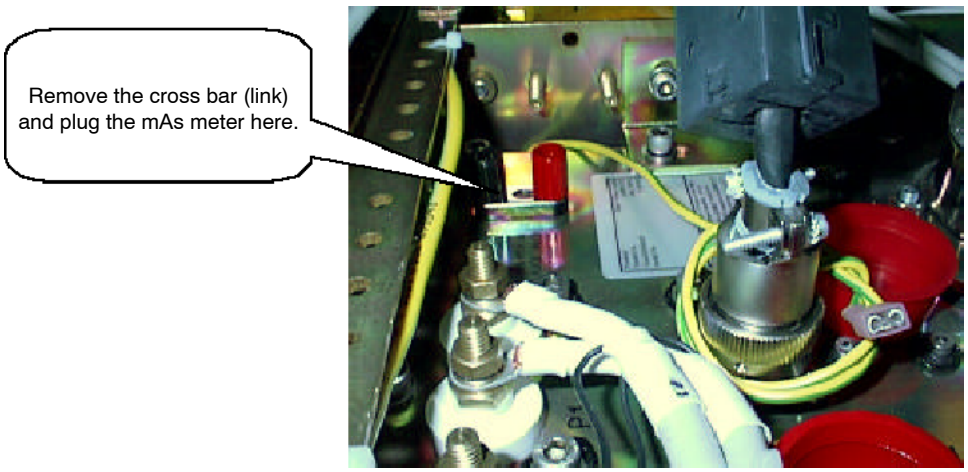
   Place and center a Non-Invasive kVp Meter on the X-ray Tube output at the required SID (*refer to the Non-Invasive kVp Meter documentation*).

2. To calibrate and measure the mA or mAs, a mAs Meter needs to be plugged to the banana plug connection at the top of the HV Transformer.

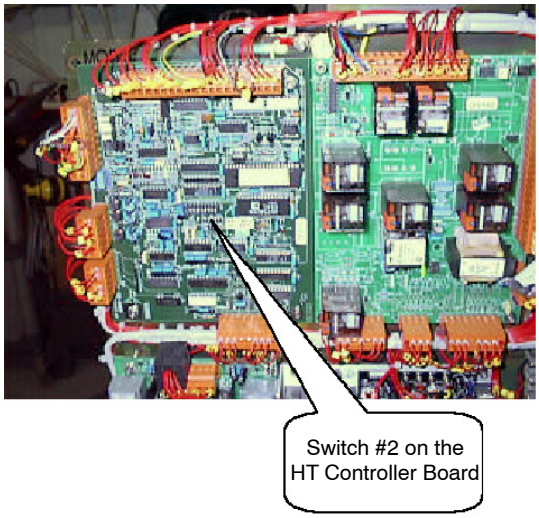
CAUTION

The cross bar (link plate) should not be connecting the banana plug. Turn the Generator OFF to connect the mAs meter if you did not connect one at the beginning.

Remember to re-install the cross bar between the banana plug connections after removing the mAs meter.



3. Before calibration procedure, verify that the Dip Switches of Switch #2 of the HT Controller Board (A3000-xx) are in the "OFF" position. This board is located on Module 3 at the hinged door.



3.2 DIGITAL KV LOOP OPEN

Extended Memory Location E06 contains the calibration factor for Digital kV Loop Open.

Note ☞

The Value in E06 Memory Location is only related to the Generator performance (it is not related to the X-ray Tube(s) or another components installed), ***this Memory Location is factory adjusted****. Only perform this procedure if the HT Controller Board and/or HV Transformer have been replaced in the unit. For that, refer to the Service Manual – Calibration Chapter.*

3.3 DIGITAL mA LOOP CLOSED

Extended Memory Locations E03 and E05 contain the calibration factor for Digital mA Loop Closed.

Note ☞

Values in E03 and E05 Memory Locations are only related to the Generator performance (they are not related to the X-ray Tube(s) installed). ***These Memory Locations are factory adjusted****. Only perform this procedure if the HT Controller Board and/or HV Transformer have been replaced in the unit. For that, refer to the Service Manual – Calibration Chapter.*

3.4 AUTO-CALIBRATION OF DIGITAL mA LOOP OPEN

To achieve the most accurate calibration, **this procedure has to be automatically performed by the Generator (Auto-calibration).**

The Calibration procedure should be manually performed only if Auto-calibration is not possible. In this case, refer to the Service Manual (*Calibration Chapter – Section "Manual Calibration of Digital mA Loop Open"*).

Auto-calibration of the Filament Current Numbers is divided in two separated procedures related to the mA stations configured for the Small or Large Focal Spots. Start with the Small Focal Spot (first group) and continue with the Large Focal Spot (second group).

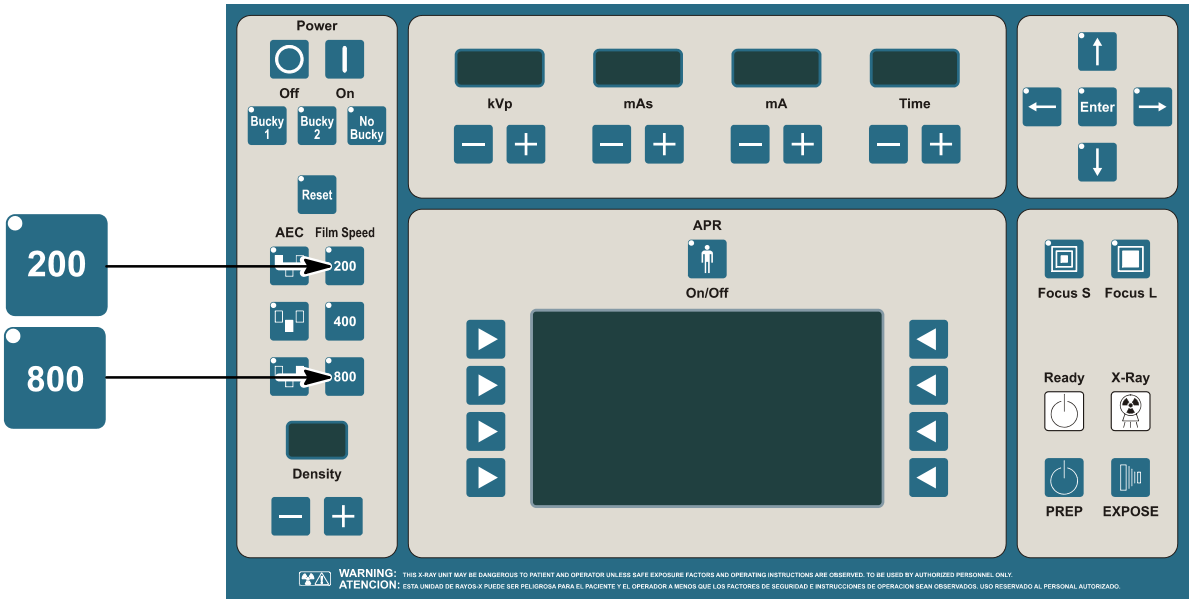
EACH TIME THAT AUTO-CALIBRATION IS ACTIVATED IN A mA STATION (OR IN "E01" MEMORY LOCATION), ALL THE FILAMENT CURRENT NUMBERS OF THE SELECTED FOCAL SPOT ARE AUTOMATICALLY SET TO "344". SO A NEW COMPLETE CALIBRATION OF THE FILAMENT CURRENT NUMBERS FOR THIS FOCAL SPOT WILL BE REQUIRED.

Auto-calibration starts with the minimum available mA station for the selected Focal Spot at 50 kV and follows with the other combinations of mA stations for the selected Focal Spot at 80 kV, 120 kV and 40 kV.

1. For this procedure, set Dip Switch 4 of Switch #2 on the HT Controller Board back in the ***"ON"*** position (Digital mA Loop Open / Filament Current Constant).

1. Select the "*No Bucky*" workstation (Direct).

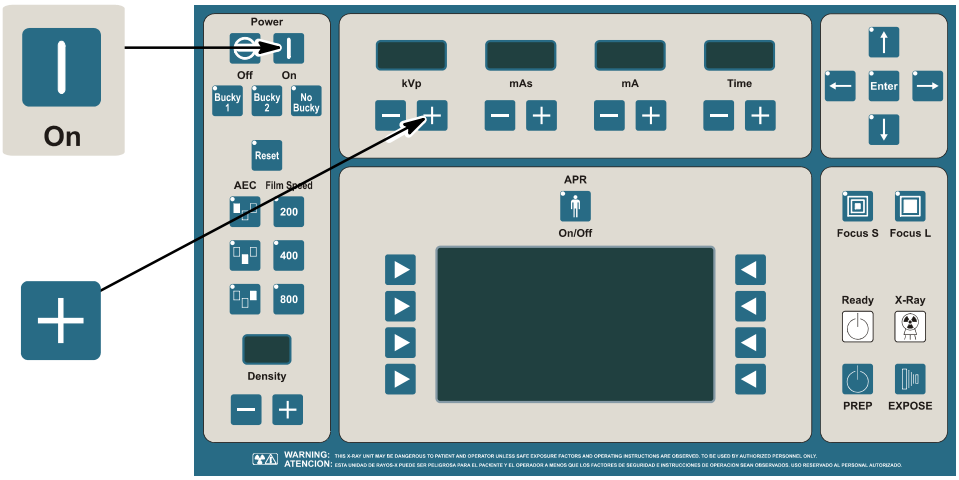
2. Enter calibration mode by pressing the "*200*" and "*800*" push-buttons simultaneously and select one of the configured mA stations for the **Small Focal Spot** (Light will be blinking for workstation selected if you are in Service Mode).



3. Enter Auto-calibration mode by pressing the "*Power On*" and "*kV increase*" push-buttons simultaneously for 2 seconds. After releasing both push-buttons, code "***222***" will be flashing on the Console waiting for confirmation to then enter Auto-calibration mode.

   Press the "*kV increase*" and "*Power On*" push-buttons again until code "***222***" disappears on the Console to confirm Auto-calibration mode.

   Auto-calibration is activated after releasing both push-buttons. At this moment, the Generator will check the mA stations available for the **Small Focal Spot**. When 50 kV at 10 mA is displayed in the display windows, the Unit is ready for Auto-calibration.



4. Check that the Heat Units available for the X-ray Tube are 100% (kV Display shows "H – –" on the Console).

5. Keep the Handswitch push-button fully pressed or use the Exposure Controls on the Console to perform continuous exposures.

CAUTION

Auto-calibration can be stopped momentarily by releasing the Handswitch push-button or the Exposure Controls. Do not exit from Auto-calibration before the procedure has been completed.

If the Heat Units available for the X-ray Tube are less than 40%, exposures are inhibited momentarily and code "***111***" will be flashed on the Console accompanied by an alarm. In this case, release the Handswitch or Exposure Controls to stop momentarily the Auto-calibration procedure. The alarm will stop when the X-ray Tube begins to cool and recovers the Heat Units capacity. Exposures can be performed again even though code "***111***" is shown on the Console.

At this point, it is recommended to wait until the Heat Units available are close to 80% of the X-ray Tube capacity without making any exposure.

The Generator will try to calibrate each kV / mA combination for ten (10) attempts (maximum). If calibration is aborted (after ten attempts), code "***888***" will flash on the Console until the "*Power On*" push-button is pressed to exit Calibration. Calibration might also abort due to space charge during calibration of the lowest kV at the highest mA stations for the Focal Spot selected, so code "***777***" will be flashing on the Console until the "*Power On*" push-button is pressed.

IF AUTO-CALIBRATION IS ABORTED (CODE "888" OR "777"), CONTINUE AUTO-CALIBRATION FOR THE OTHER FOCAL SPOT. CHECK AT THE END OF AUTO-CALIBRATION WHICH KV / MA COMBINATIONS HAVE NOT BEEN AUTO-CALIBRATED FOR EACH FOCAL SPOT (THESE COMBINATIONS HAVE THE FILAMENT CURRENT NUMBER SET TO "344"). MANUALLY CALIBRATE THESE KV / MA COMBINATIONS AS EXPLAINED IN THE SERVICE MANUAL (CALIBRATION CHAPTER - "MANUAL CALIBRATION OF DIGITAL mA LOOP OPEN").

When Auto-calibration is successfully performed, code "***999***" will be flashing on the Console until press the "*Power On*" push-button for 2 seconds to exit from Auto-calibration mode. The "***999***" code will disappear when you have successfully exited Calibration.

6. To calibrate the **Large Focal Spot**, select one of the configured mA stations for the Large Focal Spot by pressing the mA "+" push-button. Repeat steps 2.– 5.

   Before starting the exposures, it is recommended to wait until the Heat Units available are closed to the 80% of the X-ray Tube capacity.

7. After performing both procedures (for Small and Large Focal Spots), select in calibration mode each combination of the available mA stations at the kV break points (40, 50, 80 and 120 kV). Press the "*Reset*" push-button to read on the kV Display the new value of the Filament Current Number stored for each combination and write down the new values in the Data Book.

   Note that the highest mA station for Small Focal Spot may have numbers larger than the lowest mA station for Large Focal Spot. This is normal.

8. Repeat the above calibration process for the second tube.

9. Exit calibration mode.

10. **Set Dip Switch 4 of Switch #2 on the HT Controller Board back in the *"OFF"* position (Digital mA Loop Closed).**

Table 3-1
mA Calibration Numbers

mA STATION	FILAMENT CURRENT NUMBERS AT kV BREAK POINT			
	40	50	80	120
10				
12.5				
16				
20				
25				
32				
40				
50				
64				
80				
100				
125				
160				
200				
250				
320				
400				
500				
640				
800				
Note.- Some Generator models do not contain all the mA stations listed above.				

3.5 FINAL CHECKS

Verify that all Configuration and Calibration data have been properly stored in memory.

1. Enter in calibration mode and check that the values noted for the *"Filament Current Numbers"* and *"Extended Memory Locations"* of the Data Book are the same values displayed and stored in memory. Press the "*Reset*" button to read the stored values.

2. Exit from calibration mode and Service mode.

3. Turn the Generator OFF and verify position of Dip Switches of Switch #2 on the HT Controller Board are:

   - Dip Switch 2 in *"**Off**"* position (enables Filament and Rotor Interlocks).
   - Dip Switch 4 in *"**Off**"* position (Digital mA Loop Closed).

4. Set Dip Switch 3 of Switch #2 on the ATP Console CPU Board in *"**Off**"* position to place the Generator in normal operating mode.