Technical Publication
CF-1004R4

Configuration

HF Series Generators

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	APR 1, 2001	First edition
1	FEB 10, 2003	Documentation update
2	MAY 20, 2004	Documentation update
3	APR 1, 2005	Text revision
4	AUG 1, 2005	Anode Stator Configuration

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 to 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.

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SECTION 1 INITIAL CONFIGURATION PROCEDURE

Configuration provides the initial settings for extended memory and checkout procedures that must be carried out prior to making X-ray exposures. Functional characteristics of this Generator are defined at the time of installation.

Calibration data and some configuration data are stored in the extended memory area on a non-volatile memory chip (U3-EEPROM) located on the HT Controller Board in the Power Cabinet.

When the initial setup and checkout has been completed the Generator will be ready for Calibration.

Note ☞ *Record all the configuration settings in the Data Book.*

DO NOT SUPPLY THE MAIN POWER UNTIL SPECIFICALLY INSTRUCTED TO DO SO IN THIS DOCUMENT.

THE MAIN CAPACITORS OF THE HIGH VOLTAGE INVERTER RETAIN A LARGE PORTION OF THEIR CHARGE FOR APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF.

The Generator configuration is determined by:

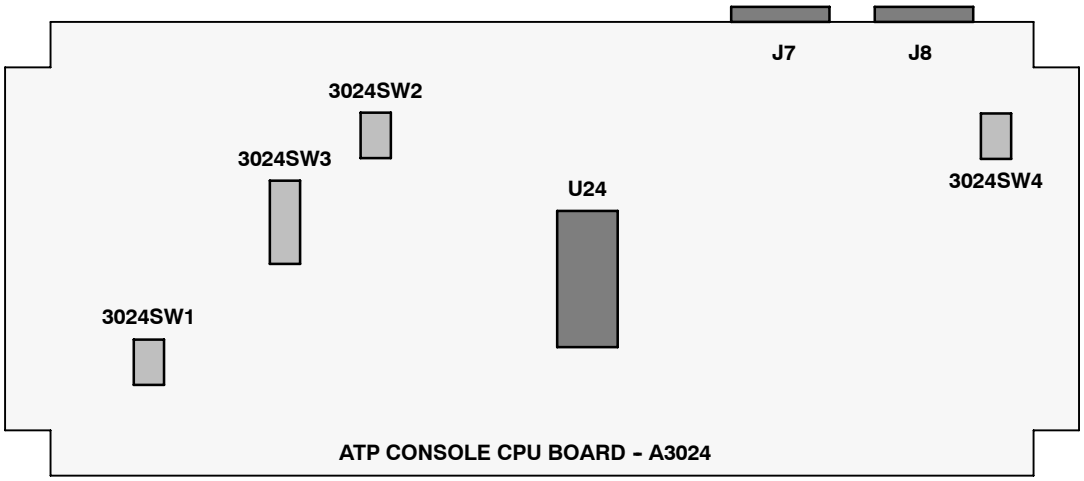
- X-ray Tube(s) number, model and use.
- System requirements (Bucky, Tomo, AEC, ...)
- Maximum kV, mA, kW.

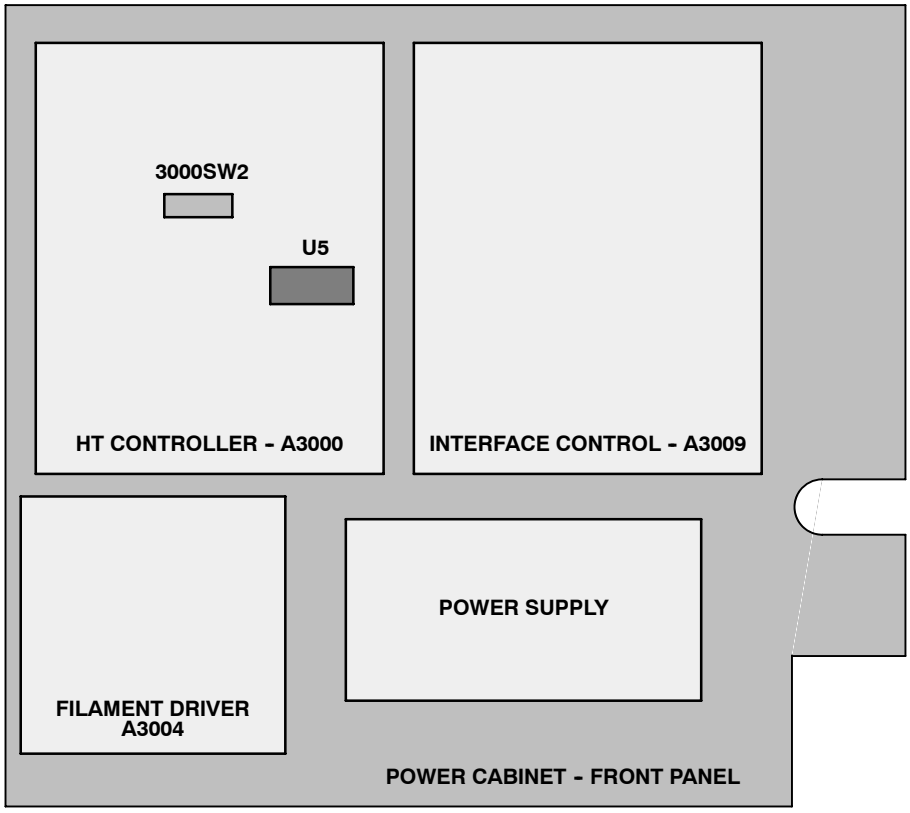
Specific versions of U24-EPROM on the ATP Console CPU Board and U5-EPROM on the HT Controller Board are based on the Generator configuration. (*Refer to Illustration 1-1*).

The system configuration and test switches are:

DIP SWITCH LOCATION	FUNCTION
3024SW1 - ATP Console CPU Board	System Configuration
3024SW2 - ATP Console CPU Board	Test
3024SW3 - ATP Console CPU Board	No used for Configuration
3000SW2 - HT Controller Board	System Configuration and Test

Illustration 1-1
EPROM and Switch locations





1.1 CONFIGURATION AND TEST SWITCHES

ATP Console Dip Switches must be configured with the Generator turned OFF, and they are read when the Generator is turned ON again.

1.1.1 3024SW1 - ATP CONSOLE CPU BOARD

Set dip switch 3024SW1 in accordance with the Table 1-1.

Table 1-1
System Configuration Dip Switch 3024SW1 on the ATP Console CPU Board

3024SW1 POSITION	OPEN (OFF)	CLOSED (ON)
1	60 Hz **1)*	50 Hz **1)*
2	-	**Normal** - Application mode. Exposures are inhibited when Door Interlock Switch is opened.
3	Not used. *Set in "OFF" position.*	Not used.
4	Not used. *Set in "OFF" position.*	Not used.
Note.- **1) This switch is related with the frequency of the Rotor Controller. For Generators with High Speed Starter (LV-DRAC) or Generators Powered through Batteries with Stand-Alone set always SW1-1 to 60 Hz, in the rest of Generators set SW1-1 in accordance with the Power Line Frequency.*		

1.1.2 3024SW2 - ATP CONSOLE CPU BOARD

Set dip switch 3024SW2 verifying that each position is set as Table 1-2.

Table 1-2
Test Dip Switch 3024SW2 on the ATP Console CPU Board

3024SW2 POSITION	OPEN (OFF)	CLOSED (ON)
1	Skips reception with the HT Controller. Use only for display purposes, troubleshooting or Demo Consoles when there is no Power Module. Be sure that J3 connector is not plugged to the ATP Console CPU Board.	**Normal** - Application mode.
2	Tick Sound (button / command acknowledge) is not emitted by the ATP Console CPU Board.	Tick Sound (button / command acknowledge) is emitted by the ATP Console CPU Board.
3	**Normal** - Application mode.	**Service Mode .** In this mode and some Consoles, if the selected Focal Spot indicator is blinking it means that Generator is operating in High Speed. It will help to service engineer during Configuration and Calibration procedures.
4	kV Log (Renard) Scale Mode for kV variation (kV changes in logarithmic steps).	kV Lineal Scale Mode for kV variation (**Normal mode**) (kV changes one by one).

1.1.3 3024SW3 - ATP CONSOLE CPU BOARD

Dip Switch 3024SW3 is not used for configuration but all their switches must be set in "***Off***" position.

1.1.4 3024SW4 - ATP CONSOLE CPU BOARD

Dip Switch 3024SW4 is not used for configuration but all their switches must be set in "***Off***" position.

1.1.5 3000SW2 - HT CONTROLLER BOARD

HT Controller Dip Switches can be configured while the Generator is ON except Dip Switch 3000SW2-1.

Set dip switch 3000SW2 as indicated in Table 1-3.

Table 1-3
Test Dip Switch 3000SW2 on the HT Controller Board in the Power Module

3000SW2 POSITION	OPEN (OFF)	CLOSED (ON)
1	Normal.	Programming of Rotor Boost Time and Filament Setting Time *1) *2)
2	Normal.	Bypasses: Filament, Rotor Ready, Error E11. *1) *3)
3	Normal – Not used.	Not used.
4	Normal – Digital mA Loop Closed	Digital mA Loop Open / Filament Current Constant *1)
5	125 kV *4)	150 kV *4)
6	All Generators except for two Tubes RAD.	Only for Generators with two Tubes RAD.
7	Boosting Tube–1 (Filament)	No Boosting Tube–1 (Filament) *5)
8	Boosting Tube–2 (Filament)	No Boosting Tube–2 (Filament) *5)

*Notes.– *1) Set in Closed (On) position only for Calibration and Testing procedures when indicated in the Service Manual.*

**2) Note that SW2-1 in Closed (On) position is only set to program the Rotor Boost Time and Filament Setting Time, therefore it changes the functions of Switches SW2-2 and SW2-4 to SW2-8.*
Refer to Sections 2.3 and 2.3.2 and configure the Rotor Boost Time and Filament Setting Time switches after X-ray Tube Type selection.

**3) This turns off the filament so no radiation will be produced during the exposure.*

WARNING: THE kV OUTPUT OF THE HV TRANSFORMER WILL BE WHAT IS SET ON THE CONSOLE. IF THE X-RAY TUBE HV CABLES ARE NOT CONNECTED TO THE HV TRANSFORMER, FILL COMPLETELY BOTH HV RECEPTACLES WITH HV OIL.

**4) Set SW2-5 according to the Generator kV rating (refer to the Generator model and/or specifications).*

**5) Set to "No Boosting" when using X-ray Tubes with Small Focal Spot smaller than 0.6 .*

1.2 ANODE STARTER CONFIGURATION

1.2.1 HIGH SPEED VERSION

The High Speed Starter (LV-DRAC - Low Voltage Digital Rotating Anode Controller) is required for High Speed X-ray Tube(s). Connections between the LV-DRAC and the Generator Cabinet are factory made, so any wire connection is required.

1.2.2 LOW SPEED VERSION

For Low Speed, voltage and capacitor is factory set to 220 VAC, 30 μF. Other voltages require their corresponding adaptation. In all cases, refer to X-ray Tube Product Data.

Check that capacitor values of the Low Speed Stator correspond to the values recommended by the X-ray Tube manufacturer. Also, the Rotor speed must be the indicated by manufacturer. If needed replace the capacitors.

CONFIGURATION FOR ONE OR TWO TUBES WITH THE SAME STARTING VOLTAGE (110 VAC OR 220 VAC)

When the stator requires a voltage of 110 VAC (a.e. X-ray Tube Toshiba E7239 / E7240 / E7242 / E7252 / E7299 / E7813 / E7865) perform the following modifications:

If the Power Input Transformer 6T2 is for using with power lines up to 240 VAC (part number 50509030), remove the wire connected to terminal 6T2-4 (230 VAC RTR) and connect it to terminal 6T2-3 or 6T2-8 (110 VAC).

If the Power Input Transformer 6T2 is for using with power lines up to 530 VAC (part number 50509029), remove the wire connected to terminal 6T2-4 (230 VAC RTR) and connect it to terminal 6T2-40 (110 VAC).

For X-ray Tube Toshiba E7252 or E7813 (or when it is required) replace also the Fuse F1 (6A) on the LF-RAC Board by another fuse of 10 A.

This change affects to all the Tubes connected to Generator.

CONFIGURATION FOR TWO TUBE STATORS WITH DIFFERENT STARTING VOLTAGE AND CAPACITOR

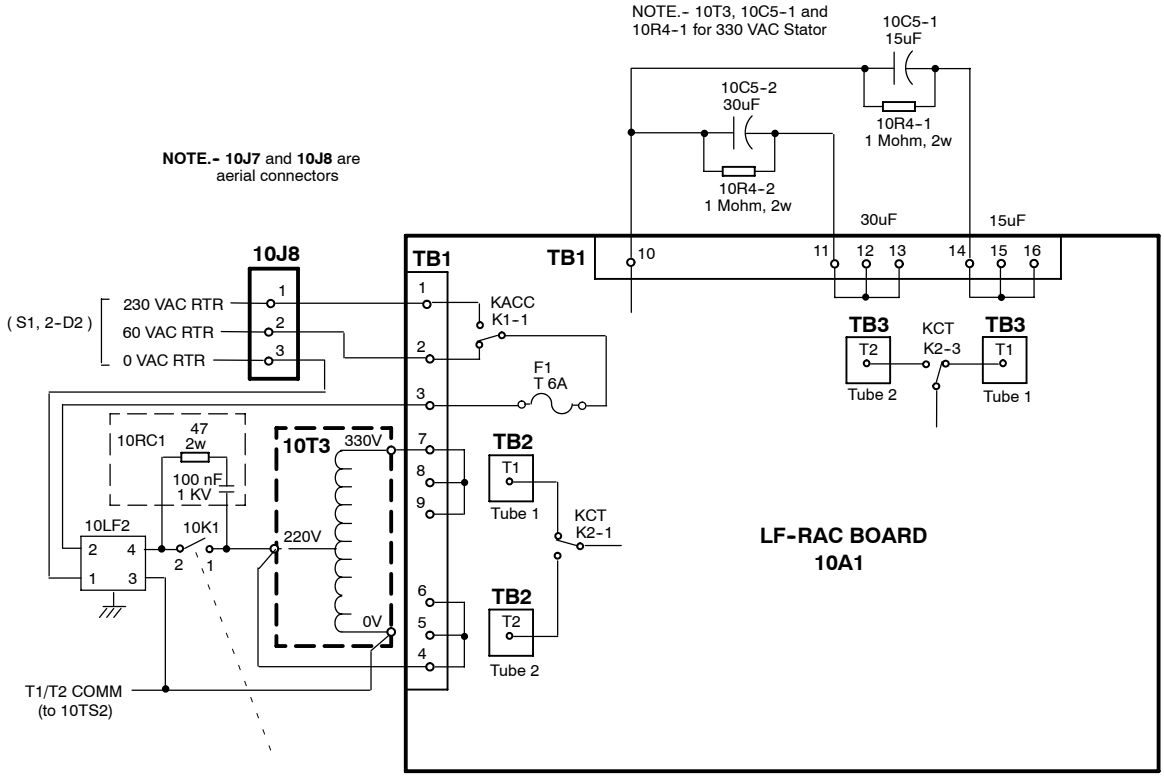
For Generators equipped with a LF-RAC module for two X-ray Tubes, with possible selection of voltage and capacitor jumpers on the LF-RAC Board, set jumpers according to the respective X-ray Tube(s) as indicated in next pages.

The DC Brake of the Low Speed Starter (LF-RAC) can be removed by desoldering CR6 on the LF-RAC Board (*refer to schematic 543020xx*). In this case, the Tube will remain coasting.

STARTING VOLTAGE OF 220 VAC AND 330 VAC

(A "Kit of 330 VAC" is required with this configuration).

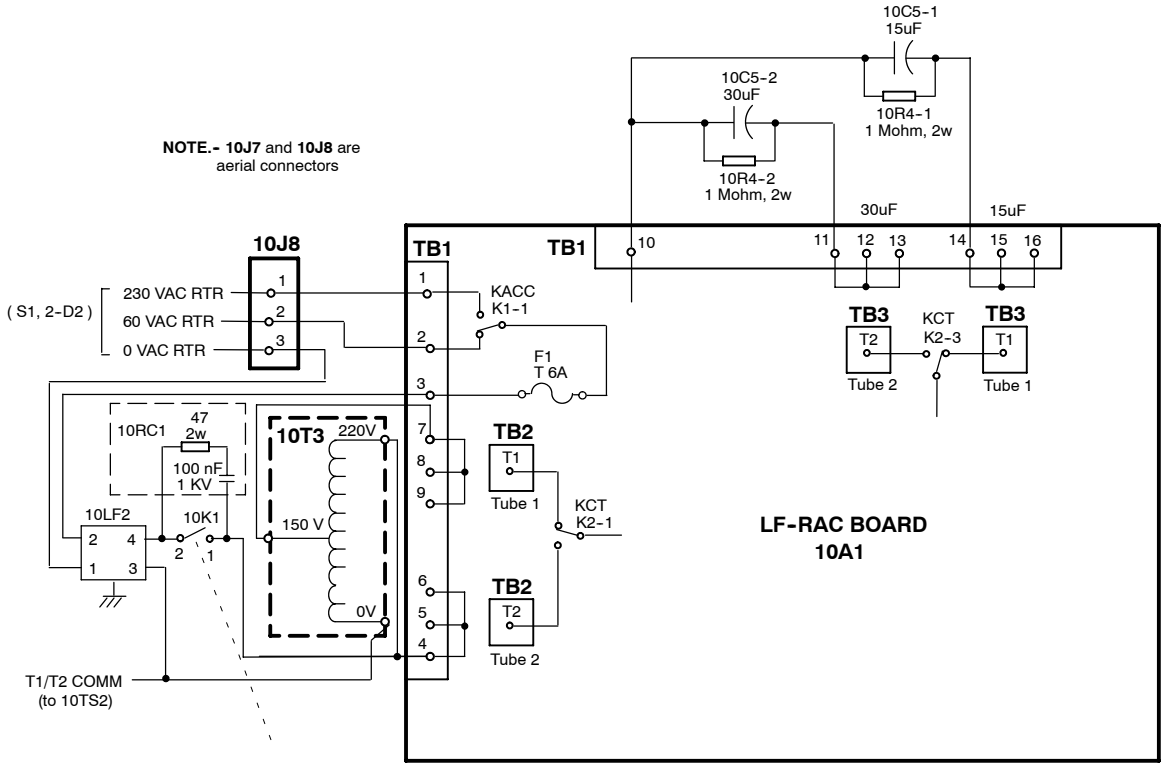
		TUBE MODEL	
		220 VAC , 30 µF	**330 VAC , 15 µF**
TUBE-1	**VOLTAGE**	TB2-T1 with TB1-5 or TB1-6	TB2-T1 with TB1-8 or TB1-9
	CAPACITOR	TB3-T1 with TB1-12 or TB1-13	TB3-T1 with TB1-15 or TB1-16
TUBE-2	**VOLTAGE**	TB2-T2 with TB1-5 or TB1-6	TB2-T2 with TB1-8 or TB1-9
	CAPACITOR	TB3-T2 with TB1-12 or TB1-13	TB3-T2 with TB1-15 or TB1-16



STARTING VOLTAGE OF 220 VAC AND 110 VAC

(A "Kit of 110 VAC" is required with this configuration).

		TUBE MODEL	
		220 VAC , 30 μF	**150 VAC , 30 μF**
TUBE-1	**VOLTAGE**	TB2-T1 with TB1-5 or TB1-6	TB2-T1 with TB1-8 or TB1-9
	CAPACITOR	TB3-T1 with TB1-12 or TB1-13	
TUBE-2	**VOLTAGE**	TB2-T2 with TB1-5 or TB1-6	TB2-T2 with TB1-8 or TB1-9
	CAPACITOR	TB3-T2 with TB1-12 or TB1-13	



1.3 WORKSTATIONS CONFIGURATION

The workstations can be configured according to the customer preferences or default.

Each combination of Tube / Device / Ion Chamber is associated to one workstation in the system. If during the system configuration some push-button has not been related to one workstation (*value "Tube – 0"*), these push-buttons won't be able to be selected during operation.

The different combinations of X-ray Tubes, Devices, Ion Chambers and kV Tracking (optional) are configured from the Console as described below:

CUSTOMIZED CONFIGURATION

Note ☞ *This procedure has to be performed always that "ATP Console CPU Board" is replaced by a new one.*

1. With the Generator OFF, set dip switch 3024SW2-3 on the ATP Console CPU Board in ***"On"*** position to permit the service mode.

2. In accordance with the Console model, enter in configuration mode by holding pressed the "*ON*" push-button and then simultaneously press "*+2*" and "*-2*" density (*or "Slow" and "Fast" Film/Screen*) push-buttons, until all the workstations push-buttons are illuminated.

3. Select the first workstation to be configured, by pressing the respective push-button or combination of push-buttons, only these push-buttons blink and the Console shows one of the following values:

DISPLAY	FUNCTION	VALUE	DESCRIPTION
1st Value	**TUBES**	0	No-configured workstation
		1	Tube-1
		2	Tube-2
2nd Value	**DEVICES - WORKING MODE**	0 - Direct	Direct (No Bucky)
		1 - Bucky 1	Bucky-1
		2 - Bucky 2	Bucky-2
		3 - STD Tomo	Standard Tomo *1)
		4 - STD RF	Standard RF (Spot Film Device)
		5 - DSI	Digital Rad and Fluoro *2)
		6 - Cine	Cine *2)
		7 - DSA	DSA *2)
3rd Value	**ION CHAMBERS**	0	No AEC
		1	Ion Chamber-1
		2	Ion Chamber-2
		3	Ion Chamber-3
		4	Ion Chamber-4
		5	Photomultiplier
4th Value	**kV TRACKING (OPTIONAL)**	1	Formula-1
		2	Formula-2
		3	Formula-3
		4	Formula-4
		5	Formula-5
		6	Formula-6
		7	Formula-7
		8	Formula-8

Notes:

- Some of listed values are not configurable depending on the Generator model .

**1) Only when the Tomo is controlled from the Generator. In this case, the workstation has to be configured as Tube "1" or "2", Device "STD Tomo" and Ion Chamber "0".*
If the Tomo is controlled from the Table, the workstation has to be configured as Tube "2", Device "STD RF" and Ion Chamber "0".

**2) These Devices are only available for Generators provide with interface option for Digital Systems.*

4. Set the new value by pressing the corresponding "*Increase*" or "*Decrease*" push-buttons.

Note ☞ *In some Consoles, "No Bucky" is selected when neither of the "Bucky" nor "Tomo" push-buttons are selected.*

5. Select the next workstations to be configured and set the respective values of each one.

6. Exposures made from workstations configured with:

   - Device "*Direct (No Bucky), Bucky-1, Bucky-2* and *Standard Tomo*" are **only enabled** with the internal "*Preparation*" and "*Exposure*" signals controlled by the Handswitch or Rad Footswitch.

   - Device "*Standard RF*" and "*DSI*" are **only enabled** with the external signals for "*Preparation*", "*RAD Exposure*" and "*Fluoro Exposure*". **Fluoro can only be made from this Device selection.**

   - Device "*Infimed: DSI, Cine, DSA*" are **only enabled** with the external "*Digital Preparation*" and "*Exposure*" signals connected to Terminal Block 4TS3 of the Generator Cabinet.

7. Select one of the workstation configured as available and in accordance with the Console model exit configuration mode by simultaneously pressing "*+2*" and "*–2*" (*or "Slow" and "Fast" Film/Screen*) push-buttons, then a double-bip will sound and the Console go on with the starting process.

Note ☞

1) Optional "Tomo / Bucky Adaptation Board" (in the Power Cabinet) is required to configure more than two Buckys or one Tomo Device in the system.

For systems without the optional "Tomo / Bucky Adaptation Board" only can work directly with two Buckys, and the value assigned to them must be "1" and "2" in the second value.

2) TOMO must be always related to Bucky-1. Only one TOMO can be used in the system, so only one of the workstations should be configured with the value "3" in the second value.

3) Optional "AEC Control Board" (connected to the Console CPU Board) is required to configure any Ion Chamber.

Optional "AEC Adaptation Board" is required to configure any no-standard or more than one Ion Chambers in the system.

DEFAULT CONFIGURATION

Default configuration sets some default values to each workstation. It only should be used to re-initialize the workstation configuration when the complete configuration has been lost or it is not possible to select any workstation.

1. With the Generator OFF, set dip switch 3024SW2-3 on the ATP Console CPU Board in *"**On**"* position to permit the service mode.

2. In accordance with the Console model, enter in configuration mode by holding pressed the "*ON*" push-button and then simultaneously press "*+2*" and "*-2*" density (*or "Slow" and "Fast" Film/Screen*) push-buttons, until all the workstations push-buttons are illuminated.

3. Press the "*AEC Reset*" push-button once, and in accordance with the Console model exit configuration mode by simultaneously pressing "*+2*" and "*-2*" (*or "Slow" and "Fast" Film/Screen*) push-buttons, then a double-bip will sound and the console go on with the starting process.

4. It is recommended to perform a proper configuration of each workstation in the system after a default configuration.

1.4 BASIC CONFIGURATION OF GENERATOR BOARDS

The following Jumpers should be factory set or removed to configure the Generator boards for working with the application. Checks the below jumpers in the Generator boards.

GENERATOR BOARDS	JUMPERS POSITION
HT CONTROLLER	JP1 and JP2 in “2”
	JP3, JP5 and JP6 in “2” and JP4 in “1” : for Compact Generators. JP3, JP5 and JP6 in “1” and JP4 in “2” : for Vertical Generators.
FILAMENT CONTROL	JP1 in “A”
INTERFACE CONTROL	W1 in “2-3”
	W2 in “1-2”
	W3 to W10 in “A” : for positive High Voltage supply for Ion Chamber W3 to W10 in “B” : for negative High Voltage supply for Photomultiplier Tube
ATP CONSOLE CPU	JP1, JP2 and JP3 in “B” (soldered)
	JP4 in “B” (Cam-Sync)
	JP5 in “B” (for ATS Digital System set JP5 in “C”)
	JP6 in “A” (soldered)
	Connector J8 configured for RS232 so: JP9, JP10 and JP11 in “A”. JP7, JP8, JP21 and JP22 do not matter jumpers position
	JP12 removed
	JP13 installed (set)
	JP14 installed (soldered)
	JP15, JP16, JP17 and JP18 removed
	JP19 in “A” (soldered)

1.5 AEC CONFIGURATION

Configure the following Jumpers on the "*AEC Control Board*" (located over the "*ATP Console CPU Board*") and on the "*AEC Adaptation Board*" when this option is installed in the Generator Cabinet.

AEC CONTROL BOARD (A3012-01/02/05)

JUMPER			DESCRIPTION
JP1	A B C	FOR TV CAMERA FOR PHOTOMULTIPLIER FOURTH ION CHAMBER & ATS-DIG	A3012-05: JP1-C, JP2-A AND JP4-B FOR FOURTH ION CHAMBER & ATS-DIG A3012-02: JP1-A, JP2-A AND JP4-A FOR ABC WITH TV CAMERA A3012-01: JP1-B, JP2-B AND JP4-A FOR ABC WITH PHOTOMULTIPLIER
JP2	A B	FOR TV CAMERA FOR PHOTOMULTIPLIER	
JP4	A B	FOR PHOTOMULTIPLIER - AEC FOR ION CHAMBER - AEC & ATS-DIG	
JP3	A B	FOR HIGH SENSITIVITY FOR LOW SENSITIVITY	JP3-A FOR AEC WHEN USING ION CHAMBER WITH HIGH SENSITIVITY JP3-B FOR AEC WHEN USING ION CHAMBER WITH LOW SENSITIVITY
NOTE:		*HIGH SENSITIVITY IS > 2 V / mR (> 0.223 V / μGy) (a.e. Vacutec Ion Chamber)* *LOW SENSITIVITY IS < 2 V / mR (< 0.223 V / μGy) (refer to Ion Chamber documentation)*	

AEC CONTROL BOARD (A3012-06/07/09)

JUMPER			DESCRIPTION
JP1	A B C	FOR TV CAMERA FOR PHOTOMULTIPLIER EXTERNAL kV CONTROL	JP1-A FOR ABC WITH TV CAMERA JP1-B FOR ABC WITH PHOTOMULTIPLIER JP1-C FOR ABC WITH EXTERNAL kV UP & DOWN CONTROL
JP2	A B	FOR HIGH SENSITIVITY FOR LOW SENSITIVITY	JP2-A FOR AEC WHEN USING ION CHAMBER WITH HIGH SENSITIVITY JP2-B FOR AEC WHEN USING ION CHAMBER WITH LOW SENSITIVITY
JP3	B	FOR NORMAL OPERATION	JP3-B FOR NORMAL OPERATION
JP4	A	FOR NORMAL OPERATION	JP4-A FOR NORMAL OPERATION (Only in A3012-06)
NOTE:		*HIGH SENSITIVITY IS > 2 V / mR (> 0.223 V / μGy) (a.e. Vacutec Ion Chamber)* *LOW SENSITIVITY IS < 2 V / mR (< 0.223 V / μGy) (refer to Ion Chamber documentation)*	

AEC ADAPTATION BOARD (A3263-03)

ION CHAMBER TYPE	JUMPERS POSITION		
	JP3, JP4, JP7, JP8	JP1, JP2, JP5, JP6	JP13, JP14, JP15, JP16
IC1 = IC2 = IC3 = IC4	B	B	B
IC1 = IC2 = IC3	B	B	A
IC1 = IC2	B	A	A
IC1 ≠ IC2 ≠ IC3 ≠ IC4	A	A	A

ION CHAMBER OUTPUT	JUMPERS POSITION			
	JP9 (IC1)	JP10 (IC2)	JP11 (IC3)	JP12 (IC4)
NO-OFFSET ADJUSTMENT	A	A	A	A
OFFSET ADJUSTMENT	B	B	B	B
TEST POINT AND POTENTIOMETER (ONLY IF JUMPER IS IN "B" POSITION)	TP1 - R11	TP2 - R8	TP4 - R2	TP12 - R5

1.6 FLUORO CONFIGURATION

Fluoro configuration depends on position of jumpers W1 and W2 in the "*Fluoro CPU Board*" and jumper JP4 in the "*Console CPU Board*", as indicated below:

JUMPERS IN FLUORO CPU BOARD (A3213-XX)	INSERTED	REMOVED
W1	ABC not enable	ABC enable
W2	Always inserted (installed)	

JUMPERS IN ATP CONSOLE CPU BOARD (A3024-XX)	
JP4	Always in "B" position - Camera

Also, configure the following Jumpers on the optional "*RF Adaptation Board*" according to the Board version.

RF ADAPTATION BOARD (A3514-03)

JUMPER	POSITION	FUNCTION
JP1, JP3, JP4, JP8, JP9, JP10, JP12, JP13, JP14	Set all jumpers	+24 VDC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Remove all jumpers	230 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Set only JP1, JP8 and JP12	115 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
JP2	Set	Generator +24 VDC for PREP / RAD / FLUORO ORDER
	Removed	External supply for PREP / RAD / FLUORO ORDER
JP5	A	ZOOM 1 output selected from Generator (-9 IN SEL)
	B	ZOOM 1 output selected from Table or external control
JP6	A	ZOOM 2 output selected from Generator (-6 IN SEL)
	B	ZOOM 2 output selected from Table or external control
JP7	A	ZOOM 3 output selected from Generator (-4 IN SEL)
	B	ZOOM 3 output selected from Table or external control
JP11	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP15	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP16	A	EXP ON/END output active for only RAD exposure
	B	EXP ON/END output active for Fluoro and RAD exposure
JP17	A	For EXP ON output active along the RAD exposure
	B	For EXP END output active about 50 ms pulse at the end of the RAD exposure
JP18	A	For ABC Window adjustment
	B	For normal operation
JP19	A	Pulsed Fluoro sync. from the Line sync.
	B	Pulsed Fluoro sync. from the TV Camera sync.
	C	Pulsed Fluoro sync. from an external sync. (digital, etc.)
JP20	A	For ABC OUT signal from the video in
	B	For ABC OUT signal from a negative System ABC signal
	C	For ABC OUT signal from a positive System ABC signal
JP21	A	ABC OUT signal generated from a System ABC signal
	B	ABC OUT signal incoming directly from the System
JP22	Set	When JP21 in position A
	Removed	When JP21 in position B
JP23	Set	Normal position
	Removed	To reduce noise in the ABC circuitry

RF ADAPTATION BOARD (A3514-04)

JUMPER	POSITION	FUNCTION
JP1, JP3, JP4, JP8, JP9, JP10, JP12, JP13, JP14	Set all jumpers	+24 VDC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Remove all jumpers	230 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
	Set only JP1, JP8 and JP12	115 VAC for the inputs PREP ORDER, RAD ORDER, and FLUORO ORDER
JP2	Set	Generator +24 VDC for PREP / RAD / FLUORO ORDER
	Removed	External supply for PREP / RAD / FLUORO ORDER
JP5	A	ZOOM 1 output selected from Generator (-9 IN SEL)
	B	ZOOM 1 output selected from Table or external control
JP6	A	ZOOM 2 output selected from Generator (-6 IN SEL)
	B	ZOOM 2 output selected from Table or external control
JP7	A	ZOOM 3 output selected from Generator (-4 IN SEL)
	B	ZOOM 3 output selected from Table or external control
JP11	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP15	A	LIH output selected from an external enable signal
	B	LIH output selected for Last Image Hold function
JP16	A	EXP ON/END output active for only RAD exposure
	B	EXP ON/END output active for Fluoro and RAD exposure
JP17	A	For EXP ON output active along the RAD exposure
	B	For EXP END output active about 50 ms pulse at the end of the RAD exposure
JP18	A	For ABC Window adjustment
	B	For normal operation
JP19	A	Pulsed Fluoro sync. from the Line sync.
	B	Pulsed Fluoro sync. from the TV Camera video.
	C	Pulsed Fluoro sync. from an external sync. (TV Camera, digital, etc.)
JP20	A	For ABC OUT signal from the video in
	B	For ABC OUT signal from a negative System ABC signal
	C	For ABC OUT signal from a positive System ABC signal
JP21	A	ABC OUT signal generated from a System ABC signal
	B	ABC OUT signal incoming directly from the System
JP22	Set	When JP21 in position A
	Removed	When JP21 in position B
JP23	Set	Normal position
	Removed	To reduce noise in the ABC circuitry
JP24	A	Normal position
	B	For Fluoro order enable

SECTION 2 EXTENDED MEMORY SETTING

2.1 EXTENDED MEMORY LOCATIONS

Miscellaneous configuration and calibration data are stored in the Extended Memory Locations. It is recommended to note the values factory stored in each Memory Location. (*Refer to Table 2-1*)

Note ☞ *For Generators with only one Radiographic X-ray Tube, this Tube have to be configured, calibrated and used as Tube-1.*

Note ☞ *Generators with one or two X-ray Tube(s) for only Radiographic use do not require to store any value in the Memory Locations: E19, E25, E26, E27.*

Note ☞ *For Generators with a Fluoroscopic X-ray Tube, this Tube have to be configured, calibrated and used as Tube-2.*

For these Generators, the value of the E17 Memory Location is not readable as "Tube-2 - Filament stand-by (Autocalibrated)".

Note ☞ *Generators with a single X-ray Tube for Fluoroscopy / Spot Film requires to store the respective values of the Memory Locations:*
- *E01: Tube-1 - RAD filament stand-by (Autocalibrated).*
- *E17: Tube-2 - Fluoro filament setting.*
- *E18: Tube-2 - Fluoro Tube type.*
- *E29 and E31: Tube-2 - Exposure Time adjustments.*
- *Other required Memory Locations.*

Table 2-1
Extended Memory Locations

MEMORY LOCATION	FUNCTION	VALUE
E01	TUBE-1 – RAD filament stand-by (*Autocalibrated. Not field changeable*)	
E02	TUBE-1 – RAD Tube type	
E03	Low Digital mA Loop Closed (from 10 mA to 80 mA)	
E04	AEC-1 calibration	
E05	High Digital mA Loop Closed (from 100 mA)	
E06	kV Loop	
E07	Maximum kW *(Factory set. Only field changeable to lower value)*	
E08	AEC-1 tracking	
E09	AEC-2 calibration	
E10	AEC-2 tracking	
E11	AEC Compression Device - Time adjustment	
E12	AEC Density Scale	
E13	TUBE-1 – Exposure Time adjustment - Delay	
E14	Not used.	
E15	TUBE-1 – Exposure Time adjustment - Ceq kV	
E16	Not used.	
E17*	TUBE-2 – RAD filament stand-by (*Autocalibrated. Not field changeable*)	
	TUBE-2 – FLUORO filament setting	
E18	TUBE-2 – RAD or FLUORO Tube type	
E19	Maximum FLUORO kV	
E20	AEC-3 calibration	
E21	Not used.	
E22	Not used.	
E23	AEC-4 calibration / Photomultiplier AEC calibration (SF camera)	
E24	AEC-3 tracking / AEC-4 tracking (equal value for both)	
E25	FLUORO mA display calibration at 50 kV	
E26	FLUORO mA display calibration at 80 kV	
E27	FLUORO mA display calibration at 120 kV	
E28	Not used.	
E29	TUBE-2 – Exposure Time adjustment - Delay	
E30	Not used.	
E31	TUBE-2 – Exposure Time adjustment - Ceq kV	
E32	Not used.	
** Note.– For Fluoroscopic use, value in E17 means "Fluoro filament setting" and must be manually set*		

2.2 HOW TO ENTER AND STORE DATA IN THE EXTENDED MEMORY

The Extended Memory data are entered from the Console when the unit is in service mode. Access to memory locations as indicated below:

1. Turn the Generator OFF and set the Test dip switch 3024SW2-3 on the ATP Console CPU Board in *"**On**"* position to permit the service mode.

2. Turn the Generator ON by pressing the *"Power On"* push-button on the Console.

3. In accordance with the Console model, enter calibration mode by simultaneously pressing "*+2*" and "*-2*" density *(or "Slow" and "Fast" Film/Screen)* push-buttons. The indicator lamp for the selected workstation will be flash confirming that the Generator is in the calibration mode.

Note ☞ *In calibration mode, only the kV and mA parameters can be modified, values for Time and mAs are factory programmed.*

4. Increase the mA value beyond the maximum mA position, one step for each of the memory locations. The mA Display will show the first Extended Memory location (E01), they will continue sequentially as the "*Increase mA*" push-button is pressed.

   The values stored in each location are displayed on the kV Display after pressing the "*AEC Reset*" push-button or after pressing the "*+1*" or "*-1*" *(or "Increase" and "Decrease")* density push-buttons. Since these push-buttons are also used to increase or decrease the stored values one number should be added or subtracted from the reading to obtain the stored value.

5. Select the new value by pressing "*+1*" or "*-1*" *(or "Increase" and "Decrease")* density push-buttons. Each time these push-buttons are depressed the displayed value (on the kV Display) is increased or decreased one step.

6. Store the new value by pressing the "*AEC Reset*" push-button (Check-summ function).

Note ☞ *If the "AEC Reset" push-button is not pressed after a new value is selected, no modified data will be retained and the kV Display reverts to either the selected kV value or the original data.*

7. Exit calibration mode by simultaneously pressing "*+2*" and "*-2*" *(or "Slow" and "Fast" Film/Screen)* push-buttons.

8. Turn the Generator OFF and set Test dip switch 3024SW2-3 on the ATP Console CPU Board in *"**Off**"* position to place the Generator in normal mode.

2.3 X-RAY TUBE TYPE SELECTION

2.3.1 X-RAY TUBE INSERT PROTECTION CURVES

In order to properly select the X-ray Tube Insert Protection Curves for the Tubes connected to the Generator, perform the following procedure:

1. Select one workstation of the corresponding X-ray Tube to be configured.
2. Enter in calibration mode and select the respective memory location (E02 or E18) (memory location is shown on the mA Display).
3. Identify in Section 4 "*X-ray Tube Data*", the X-ray Tube that is being installed and note its Tube type number.
4. Set the Tube number by pressing "*+1*" or "*-1*" *(or "Increase" and "Decrease")* density push-buttons until the correct number is showed in the kV Display.
5. Store the value by pressing the "*AEC Reset*" push-button.
6. Verify that the Tube code (ID) showed in the mAs Display is the same of the Tube code listed in Section 4 "*X-ray Tube Data*". The Tube code (ID) can be only read for the selected X-ray Tube after pressing the "*AEC Reset*" push-button.
7. If required, repeat this procedure for the other X-ray Tube.
8. Exit calibration mode.

For Generators with High Speed Starter, configure NOW the High Speed X-ray Tubes by setting the respective dip switches 3243SW1 and / or 3243SW2 on the "Control DRAC Board". (Refer to "LV-DRAC - Digital Rotating Anode Controller" document).

Note ☞ *Record configuration data for E02 and E18 in the Data Book.*

2.3.2 PROGRAMMING OF ROTOR ACCELERATION TIME AND FILAMENT SETTING TIME

CAUTION

Rotor Acceleration Time is determined by the X-ray Tube and Rotor characteristics and it must be considered when the Generator is about to be configured. X-ray Tube could be permanently damaged unless the required RPM are reached before an exposure. (Refer to technical information of the X-ray Tube).

Dip Switch 3000SW2 on the HT Controller Board is used to program:

- *Rotor Acceleration Time*. That depends on Stator voltage, Stator frequency, and Stator type, quality of X-ray Tube bearings, and X-ray Tube anode size. A reed tachometer can be used to determine the anode RPM. Customer application will determine the acceleration times. Be sure that the Rotor Acceleration Times meet all requirements for anticipated customer applications.
- *Rad Filament Setting Time*. Sometimes, after configuration of the Rotor Acceleration Time, it is required to increase the Filament Setting Time to the following time. For that, configure the respective switches again. This adjustment avoids Error-12.
- *Fluoro Rotor Hold-over Time.*
- *Fluoro Filament Hold-over Time.*

Note ☞ *They are only allowed when dip switch 3000SW2-1 is in "Closed" (On) position after power the Generator OFF and back ON again.*

LOW SPEED STARTER VERSION (LF-RAC)

Rotor Acceleration Time is programmable from 0.8 to 2.7 seconds. After this time the Rotor is hold running in maintaining mode as long as "*Prep*" is active.

Fluoro Rotor and Filament Hold-Over Time can be also programmed to run for 1 minute or not at all, after releasing the Fluoro Pedal.

1. Turn the Generator OFF and note current settings of the dip switch 3000SW2 on the HT Controller Board.

CAUTION

Dip switch 3000SW2-1 should not be switched with power on.

2. Set dip switches 3000SW2-1 and 3000SW2-2 as indicated below, in order to enable the selection of times with the Low Speed Starter.

3000SW2-1 (selection enable)	3000SW2-2 (Low Speed Starter)
ON	OFF

Note ☞ *With Low Speed operation, Rotor Acceleration Time, Filament Setting Time, and Fluoro Rotor and Filament Hold-Over Time are configured with dip switch 3000SW2 per this instruction.*

3. Configure the Rotor and Filament Times by setting the dip switches 3000SW2-4 through 3000SW2-8 per Table 2-2.

Table 2-2
Low Speed: Configuration of Rotor and Filament Times

TUBE-1 ROTOR ACCELERATION TIME AND FILAMENT SETTING TIME	3000SW2-7		3000SW2-8	
	OPEN (OFF)	CLOSED (ON)	OPEN (OFF)	CLOSED (ON)
0.8 seconds		❑		❑
1.2 seconds	❑			❑
1.8 seconds		❑	❑	
2.7 seconds	❑		❑	

TUBE-2 ROTOR ACCELERATION TIME AND FILAMENT SETTING TIME	3000SW2-5		3000SW2-6	
	OPEN (OFF)	CLOSED (ON)	OPEN (OFF)	CLOSED (ON)
0.8 seconds		❑		❑
1.2 seconds	❑			❑
1.8 seconds		❑	❑	
2.7 seconds	❑		❑	

FLUORO ROTOR AND FILAMENT HOLD-OVER TIME	3000SW2-4	
	OPEN (OFF)	CLOSED (ON)
After releasing the Fluoro Pedal, the Rotor stops and the Filament Current goes back to stand-by.		❑
After releasing the Fluoro Pedal, 1 minutes passes before the Rotor stops and the Filament Current goes back to stand-by.	❑	

Note ☞ *The Rotor Acceleration Time and Filament Setting Time is factory set to 1.8 seconds. Maintain this value when it is unknown or not provided with the X-ray Tube documentation.*

Record switch configuration in the Data Book.

4. To validate previous configuration, turn the Generator ON, wait until Error−01 (E01) appears on the Console and turn the Generator OFF.

CAUTION

Set dip switch 3000SW2 to the original settings as recorded in step-1. (Refer to Section 1.1.5 for the normal settings of Dip Switch 3000SW2).

HIGH SPEED STARTER VERSION (LV-DRAC)

1. Turn the Generator OFF.
2. Configure the High Speed X-ray Tube according to the LV-DRAC documentation, specially dip switches 3243SW1 and 3243SW2 of the LV-DRAC (*refer to this document in the Service Manual*).
3. Record current settings of the dip switch 3000SW2 on the HT Controller Board.

CAUTION

Dip switch 3000SW2-1 should not be switched with power on.

4. Set dip switches 3000SW2-1 and 3000SW2-2 as indicated below, in order to enable the selection of times with the High Speed Starter.

3000SW2-1 (selection enable)	**3000SW2-2 (High Speed Starter)**
ON	ON

Note ☞

With High Speed operation:

− Rotor Acceleration Time is related to the High Speed X-ray Tubes configured in the LV-DRAC (HSS).

− Fluoro and Spot Film Rotor Hold-Over Time is configured in the LV-DRAC (HSS).

− Rad Filament Setting Time and Fluoro Filament Hold-over Time are configured with dip switch 3000SW2 per this instruction.

5. Configure the Filament Times by setting the dip switches 3000SW2-4 through 3000SW2-8 per Table 2-3. The Filament Setting Time should be configured in accordance to Rotor Acceleration Time of the X-ray Tube.

Table 2-3
High Speed: Configuration of Filament Time

TUBE-1 FILAMENT SETTING TIME	3000SW2-7		3000SW2-8	
	OPEN (OFF)	CLOSED (ON)	OPEN (OFF)	CLOSED (ON)
0.8 seconds		❑		❑
1.2 seconds	❑			❑
1.8 seconds		❑	❑	
2.7 seconds	❑		❑	

TUBE-2 FILAMENT SETTING TIME	3000SW2-5		3000SW2-6	
	OPEN (OFF)	CLOSED (ON)	OPEN (OFF)	CLOSED (ON)
0.8 seconds		❑		❑
1.2 seconds	❑			❑
1.8 seconds		❑	❑	
2.7 seconds	❑		❑	

FLUORO FILAMENT HOLD-OVER TIME	3000SW2-4	
	OPEN (OFF)	CLOSED (ON)
After releasing the Fluoro Pedal, the Filament Current goes back to stand-by.		❑
After releasing the Fluoro Pedal, 1 minutes passes before the Filament Current goes back to stand-by.	❑	

Note ☞ *The Filament Setting Time is factory set to 1.8 seconds. Maintain this value when it is unknown or not provided with the X-ray Tube documentation.*

Record switch configuration in the Data Book.

6. To validate previous configuration, turn the Generator ON, wait until Error–01 (E01) appears on the Console and turn the Generator OFF.

Set dip switch 3000SW2 to the original settings as recorded in step-1. (Refer to Section 1.1.5 for the normal settings of Dip Switch 3000SW2).

2.4 LIMIT OF MAXIMUM kW

The Maximum kW of the Generator is factory set according to the Generator performance. Generator kW can be limited to a lower value.

Note ☞ *This limit can be set to a lower value to match the maximum Generator power to the Line power, due to a high line impedance (refer to Pre-installation document).*

1. Enter calibration mode.
2. Select the E07 Memory Location (memory location is shown on the mA Display).
3. Set the new limit of Maximum kW by pressing the "*+1*" or "*–1*" *(or "Increase" and "Decrease")* density push-buttons until the correct number is showed in the kV Display.
4. Store the new value by pressing the "*AEC Reset*" push-button.
5. Exit from calibration mode.

Note ☞ *Record configuration data for E07 in the Data Book.*

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SECTION 3 FILAMENT AND ANODE TESTS

3.1 FILAMENT DRIVER

Make sure the Generator is OFF.

Verify that Test dip switch 3000SW2-2 (Filament and Rotor interlock bypass) on the HT Controller Board is in the ***"Off"*** position.

Turn the Console ON and verify that both LEDs (DS1 and DS2) on the Filament Driver Board are ON.

3.2 FOCAL SPOTS CONFIGURATION AND TEST

Determine the mA station where switch-over from Small to Large Focal Spot will take place. The smallest mA station for the Large Focal Spot can be any of the available mA station or E01 memory location when is required to configure all mA stations for the Small Focal Spot. This mA station is selected according to the Tube rating and/or customer preference.

IF THE mA STATION FOR FOCAL SPOT CHANGE IS NOT CONFIGURED ACCORDING TO THE X-RAY TUBE RATINGS, THE TUBE FILAMENTS CAN BE PERMANENTLY DAMAGED.

1. With the Generator OFF, set dip switch 3024SW2-3 on the ATP Console CPU Board in ***"On"*** position to permit the service mode.
2. Power ON the Console and enter in calibration mode.
3. Select the smallest mA for the Large Focal Spot by using the "*mA Increase / Decrease*" push-buttons.
4. Store the selected mA station by pressing the "*Power On*" and "*AEC Reset*" push-buttons on the Console. This stores the switch-over point for the focal spot selection. When it is confirmed, the ATP Console CPU Board emits a "double-beep".

If the focal spot switch-over point is changed after mA calibration, the mA stations affected must be re-calibrated.

5. Exit from calibration mode and perform the following test.

Note ☞ *The test described only applies to RAD Tubes.*

In case of a R&F Tube (Tube-2) both filament are always ON (lighted). Select a "Direct" workstation and a mA station for the Small Filament. Press "Prep" for RAD and observe through the X-ray Tube window that the Small Filament lights more than the Large Filament.

6. Select the highest mA station for the Small Focal Spot. Verify that effectively the Small Filament is ON (lighted) and the Large Filament is OFF. Observe filaments through the X-ray Tube window.

7. Select the lowest mA station for the Large Focal Spot. Verify that effectively the Large Filament is ON (lighted) and the Small Filament is OFF. Observe filaments through the X-ray Tube window.

8. If required for the second Tube, repeat this procedure.

3.3 ANODE ROTATION TEST

Perform the following tests for each X-ray Tube in the installation, checking the low and high speed when it is required.

Note ☞ *Two people are needed for these tests, one at the Console and the service engineer looking at the anode of the X-ray Tube. These tests also can be done by hearing the sound of the anode rotating.*

NEVER MAKE EXPOSURES DURING THE TESTS, THE PERSON CLOSE TO THE X-RAY TUBE WILL BE EXPOSED.

1. With the Generator OFF, set dip switch 3024SW2-3 on the ATP Console CPU Board in *"**Off**"* position (application mode), turn the Console ON and select the corresponding X-ray Tube.

2. Press the "*Prep*" push-button and visually check that the Tube anode rotates in the proper way. (*Refer to the X-ray Tube documentation*).

3. Hold pressed the "*Prep*" push-button and check that the rotation speed of the Tube anode is in compliance with the X-ray Tube specifications (check the low and high speed when it is required).

   For this test is recommended to turn off the Tube filaments (switch 3000SW2-2 on the HT Controller in "***On***" position) and use a stroboscope to measure the anode speed.

Note ☞ *In service mode (switch 3024SW2-3 in "On"), if the Focal Spot indicator is blinking it means the Generator is operating in High Speed. To select High Speed increase the kV, mA and/or Exposure Time values.*

4. Release the "*Prep*" push-button and visually check that the Tube anode brakes.

5. If required for the second Tube, repeat this procedure.

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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	377	TOSHIBA E7254FX	0.6 / 1.2	25 / 66	39 / 100	400
006	274	TOSHIBA E7255FX	0.6 / 1.2	23 / 60	39 / 101	300
007	310	TOSHIBA E7843X	0.6 / 1.2	22 / 49	-	150
008	344	TOSHIBA E7865X	0.3 / 1.0	3 / 40	-	140
009	351	TOSHIBA E7100X	0.6 / 1.2	24 / 59	40 / 100	300
010	260	IAE RTM 101 HS	0.6 / 1.2	22 / 55	37 / 99	400
011	273	IAE RTM 101 HS	0.6 / 1.5	24 / 76	40 / 136	400
012	233	VARIAN RAD 8	1.0 / 2.0	25 / 47	-	150
013	244	VARIAN RAD 14	0.6 / 1.2	16 / 44	27 / 72	300
014	161	VARIAN RAD 21	0.6 / 1.2	21 / 64	36 / 100	300
015	265	VARIAN RAD 60	0.6 / 1.2	26 / 67	39 / 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	094	VARIAN A-292	0.6 / 1.2	25 / 62	39 / 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 TB47

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