

High Frequency X-Ray Generator

OPERATOR'S MANUAL

Part Number 03002 Rev. L

Introduction 1 ➤

Safety and Specifications 2 ➤

Console Controls 3 ➤

Taking an X-Ray Exposure 4 ➤

Error Codes 5 ➤

Editing APR (not avail. For 2PT) 6 ➤

Generator Exposure Tables 7 ➤

Maintenance & Cleaning 8 ➤

X-Ray Tube Data 9 ➤

Revision History

Revision	Pages Affected/Revision Description	Release Date	ECR #
A	Initial Release	6/09/06	5150
B	Revised Output Parameters	6/22/07	5605
C	Added mAs ranges table and revised warning instructions on console	3/14/08	5913
D	Added Models 42KW 1PH, 42KW 3PH and 52KW 3 PH	11/08/13	8142
E	Added 20kW, Skinny generators, Updated Error codes, added mA and mAs Tables	5/2015	8684
F	Updated Error Codes Table with errors E59 to E67	10/2016	9254
G	Updated Output Parameters. Updated Error Codes Table with errors E68 to E70	7/2018	9965
H	Updated Output Parameters Tables	10/2018	10045
J	Updated Output Parameters Tables. Added errors E71 to E74 to Error Codes Table. Added X-ray Tube Seasoning for weekly maintenance.	2/2020	10398
K	Updated EXPOSURE COUNT (sheet 18) and ROUTINE MAINTENANCE (sheet 30)	2/2021	10705
L	Updated X-ray Tube Seasoning procedure for weekly maintenance.	8/2023	11275

INTRODUCTION

1

Congratulations!

You have acquired a high frequency X-ray generator. This generator features state-of-the-art computer-based control to ensure minimum patient dose, excellent reproducibility, and superior image contrast. The operator control functions are designed to be simple and user-friendly.

GENERATOR MAIN FEATURES

- Full 125 kVp output capability
- Smaller, lighter modular design
- Constant dose output due to kVp and mA regulation during exposure
- User-friendly controls
- Extensive self-diagnostics




SAFETY NOTICE: *This manual contains important safety information. An understanding of this information is critical to the safe operation of your equipment. Please ensure that you read the warning before using the equipment.*

SAFETY AND SPECIFICATIONS

2

Keep this operator's manual with the equipment at all times, and periodically review the operating and safety instructions.

SAFETY / WARNING SYMBOLS

	<p>Warning symbol used to indicate a potential hazard to operators, service personnel or to the equipment. It indicates a requirement to refer to the accompanying documentation for details.</p>
	<p>Radiation exposure symbol used on the operator console. Lights indicate that an exposure is in progress. This is accompanied by an audible tone from the console.</p>
 <p>WARNING <i>THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS, OPERATING INSTRUCTIONS AND MAINTENANCE SCHEDULES ARE OBSERVED.</i></p>	<p>Radiation warning label on the console. Never allow unqualified personnel to operate the X-ray generator.</p>

**WARNING:**

PROPER USE AND SAFE OPERATING PRACTICES WITH RESPECT TO X-RAY GENERATORS ARE THE RESPONSIBILITY OF THE USERS OF SUCH GENERATORS. THE X-RAY GENERATOR MANUFACTURER PROVIDES INFORMATION ON ITS PRODUCTS AND ASSOCIATED HAZARDS, BUT ASSUMES NO RESPONSIBILITIES FOR AFTER-SALE OPERATING AND SAFETY PRACTICES.

THE X-RAY GENERATOR MANUFACTURER ACCEPTS NO RESPONSIBILITY FOR ANY GENERATOR NOT MAINTAINED OR SERVICED ACCORDING TO THE SERVICE AND INSTALLATION MANUAL OR ANY GENERATOR THAT HAS BEEN MODIFIED IN ANY WAY.

THE X-RAY GENERATOR MANUFACTURER ALSO ASSUMES NO RESPONSIBILITY FOR X-RAY RADIATION OVEREXPOSURE OF PATIENTS OR PERSONNEL RESULTING FROM POOR OPERATING TECHNIQUES OR PROCEDURES.

**WARNING:**

THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS, OPERATING INSTRUCTIONS AND MAINTENANCE SCHEDULES ARE OBSERVED.

X-ray radiation exposure may be damaging to health, with some effects being cumulative and extending over periods of many months or even years. **X-ray operators should avoid any exposure to the primary beam** and take protective measures to safeguard against scatter radiation. Scatter radiation is caused by any object in the path of the primary beam and may be of equal or less intensity than the primary beam that exposes the film.

No practical design can incorporate complete protection for operators or service personnel who do not take adequate safety precautions. **Only authorized and properly trained service and operating personnel should be allowed to work with this X-ray generator equipment.** The appropriate personnel must be made aware of the inherent dangers associated with the servicing of high voltage equipment and the danger of excessive exposure to X-ray radiation during system operation.

- Wear protective clothing. Protective aprons with an equivalent of a minimum of 1/64" (0.35 mm) of lead are a minimum requirement. Leaded gloves, glasses and thyroid shields are strongly recommended.
- To protect the patient and operator against radiation, always use radiation protection accessories in addition to devices that are fitted to the X-ray equipment.
- Keep as large a distance as possible away from the object being exposed and the X-ray tube assembly.

- Never operate this X-ray equipment in areas where there is a risk of explosion. Detergents and disinfectants, including those used on patients, may create explosive mixtures of gases. Please observe the relevant regulations.
- Only authorized, trained service staff may remove the covers of the generator cabinet and the control console.




Do not connect unapproved equipment to the rear of the console. INCORRECT CONNECTIONS OR USE OF UNAPPROVED EQUIPMENT MAY RESULT IN INJURY OR EQUIPMENT DAMAGE.

CAUTION:

DO NOT EXCEED THE TUBE MAXIMUM OPERATING LIMITS SHOWN IN THE X-RAY TUBE DATA. INTENDED LIFE AND RELIABILITY WILL NOT BE OBTAINED UNLESS GENERATORS ARE OPERATED WITHIN PUBLISHED SPECIFICATIONS.

APPLICABLE STANDARDS

This X-ray generator complies with the following regulatory and design standards.

- FDA 21 CFR Subchapter J (for human applications only)
 - UL 60601-1
 - CAN/CSA-C22.2 No.601.1
 - X-RAY EQUIPMENT IEC 60601-2-7
- * Degree of protection against harmful ingress of water: IPXO/Ordinary.
 - * Degree of protection against electric shock: Class I
 - * Mode of operation: Continuous operation with intermittent loading (standby - exposure).
 - * Equipment not suitable for use in presence of a FLAMMABLE ANESTHETIC MIXTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE.
- 
- * Degree of protection against electric shock is Type B.
 - * The function and intended application of this equipment is general radiography for human use.

While most Summit X-ray Generators are UL Classified, some are not. UL Classified X-ray Generators will display a UL Classified label on the rear surface of the X-ray Generator's Power Module. To determine if an X-ray Generator is UL Classified, please examine the rear surface of the Power Module looking for the UL mark as shown below:



OUTPUT PARAMETERS

kVp range:	40 to 125 kVp
kVp steps:	variable in 1 kVp steps
kVp accuracy:	± (5% of selected kVp + 1 kVp)
Rise-time (10-90%):	≤ 4 ms
mAs accuracy:	± (10% of selected mAs + 1 mAs)

GENERATOR OUTPUT POWER	
(Note: Actual power varies depending on strength of end user power line)	
GEN. MODEL	POWER
00210-016 thru -020, -050 02968-009 and -010 L500-15 and -16 L550-33 and -34	20kW
00210-000 thru -015, -021 thru -024, -026, -027, -035 thru -039, -051 thru -061, -064, -065 02968-001 thru -008, -011, -012, -015 thru -017, -019 03900-017, -018, -022, -025, -026, -028 thru -036 L300-01 thru -05 L500-01 thru -13 L550-01 thru -30	30kW
00210-028, -029, -040 thru -049, -066 thru -069 03900-001 thru -004, -009 thru -012, -019, -020, -023, -024, -027, -037, -038	40kW
00210-025, -030 thru -034, -062, -063 02968-013, -014, -018 03900-005 thru -008, -013 thru -016, -021 L550-31 and -42	42kW
00210-070 and -071 03901-001, -003, -005, -006, -008 thru -011	50kW
03901-002, -004, -007	52kW

Available MA and TIME Stations		
Generators	mA Stations	Time Range
00210-002, -005, -009, -014, -017, -019 thru -022, -050, -051 02968-001, -007, -010, -012, -015, -019 L500-** L550-01 thru -19, -22 thru -25, -29, -33, -34	50S, 100S 150L, 200L, 250L, 300L	Small: 0.005 - 2.000 seconds Large: 0.004 - 2.667 seconds
00210-000, -007, -016, -018 02968-003, -005, -009, -011	50S, 100S 100L, 300L	Small: 0.004 - 2.000 seconds Large: 0.004 - 4.000 seconds
L300-01 and -02	25S, 50S, 75S, 100S 100L, 200L, 250L, 300L	Small: 0.004 - 4.000 seconds Large: 0.004 - 4.200 seconds
00210-001, -003, -006, -008, -010, -015, -023 thru -049, -052 thru -071 02968-002, -004, -006, -008, -013, -014, -016 thru -018 03900-***; 03901-*** L300-03 thru -05 L550-20, -21, -26 thru -28, -30, -31, -42	50S, 100S 200L, 300L, 350L, 400L, 450L, 500L	Small: 0.004 - 2.000 seconds Large: 0.004 - 3.000 seconds

MAS STATIONS		
GEN. MODEL	SMALL FOCAL SPOT	LARGE FOCAL SPOT
00210 -002, -005, -009, -014, -017, -019 thru -022, -050, -051 02968 -001, -007, -010, -012, -015, -019 L500 -** L550 -01 thru -19, -22 thru -25, -29, -33, -34	0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.4, 1.7, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0, 7.5, 9.0, 10, 12, 15, 18, 20, 22, 26, 30, 35, 40, 45, 50, 55, 60, 65, 70, 80, 100	1.0, 1.2, 1.4, 1.7, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0, 7.5, 9.0, 10, 12, 15, 18, 20, 22, 26, 30, 35, 40, 45, 50, 55, 60, 65, 70, 80, 100, 120, 140, 160, 200, 240, 280, 300, 340, 400
00210 -000, -007, -016, -018 02968 -003, -005, -009, -011	0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.4, 1.7, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0, 7.5, 9.0, 10, 12, 15, 18, 20, 22, 26, 30, 35, 40, 45, 50, 55, 60, 65, 70, 80, 100	0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.4, 1.7, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0, 7.5, 9.0, 10, 12, 15, 18, 20, 22, 26, 30, 35, 40, 45, 50, 55, 60, 65, 70, 80, 100, 120, 140, 160, 200, 240, 280, 300, 340, 400
L300 -01 and -02	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.4, 1.6, 2.0, 2.1, 2.2, 2.4, 2.5, 2.6, 2.8, 3.0, 3.2, 3.4, 3.6, 3.8, 4.2, 4.4, 4.8, 5.0, 5.3, 5.6, 6.0, 6.3, 6.7, 7.1, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 12.5, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 24.0, 25.0, 26.0, 28.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0, 45.0, 48.0, 50.0, 53.0, 56.0, 60.0, 63.0, 67.0, 71.0, 75.0, 80.0, 85.0, 90.0, 95.0, 100	1.0, 1.1, 1.2, 1.4, 1.6, 2.0, 2.1, 2.2, 2.4, 2.5, 2.6, 2.8, 3.0, 3.2, 3.4, 3.6, 3.8, 4.2, 4.4, 4.8, 5.0, 5.3, 5.6, 6.0, 6.3, 6.7, 7.1, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 12.5, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 24.0, 25.0, 26.0, 28.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0, 45.0, 48.0, 50.0, 53.0, 56.0, 60.0, 63.0, 67.0, 71.0, 75.0, 80.0, 85.0, 90.0, 95.0, 100, 105, 110, 120, 125, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 240, 250, 260, 280, 300, 320, 340, 360, 380, 400, 420
00210 -001, -003, -006, -008, -010, -015, -023 thru -049, -052 thru -071 02968 -002, -004, -006, -008, -013, -014, -016 thru -018 03900 -*** 03901 -*** L300 -03 thru -05 L550 -20, -21, -26 thru -28, -30, -31, -42	Same as 3 rd row minus: 0.1	Same as 3 rd row plus: 450, 480, 510, 540, 570, 600

ENVIRONMENTAL SPECIFICATIONS

OPERATING

Ambient temperature range: 50°F (10°C) to 104°F (40°C)

Relative humidity range: 30% to 75%

Atmosphere pressure range: 20.67 inHg (700 hPa) to 31.30 inHg (1060 hPa)

TRANSPORT AND STORAGE

Ambient temperature range: -40°F (-40°C) to 158°F (70°C)

Relative humidity range: 10% to 100%

Atmosphere pressure range: 14.67 inHg (500 hPa) to 31.30 inHg (1060 hPa)



Due to the corrosive nature of processor chemicals it is strongly urged that the film processor is not installed in the same room as the x-ray equipment. See the processor manual for recommendations on venting requirements for the darkroom and processor installation.

This information is provided to help you establish safe operating conditions for both you and your X-ray generator.

Do not operate this X-ray generator except in accordance with information included in this section, and any additional information provided by the X-ray generator manufacturer and/or competent safety authorities.

OPERATION OF UNIT

GETTING STARTED

Power Switch – Press the ON button on the operator control panel. It is a good idea to turn the unit off at the end of each day, and to turn OFF the service disconnect switch. This ultimately will extend your system's life. If desired, the system can be programmed to turn itself off if not used within a specific amount of time. It can be set for 1-10 hours in 1-hour increments, or disabled. Contact your Summit dealer to program this feature.

Warm up - It is recommended that you warm up the unit prior to the first higher-powered exposure to prolong tube life. This is done by taking a series of three exposures at 20.0 mAs and 300 mA. Start with a kVp of 70 and increase to 80, then 90. Exposures should be spaced at least 20 seconds apart.

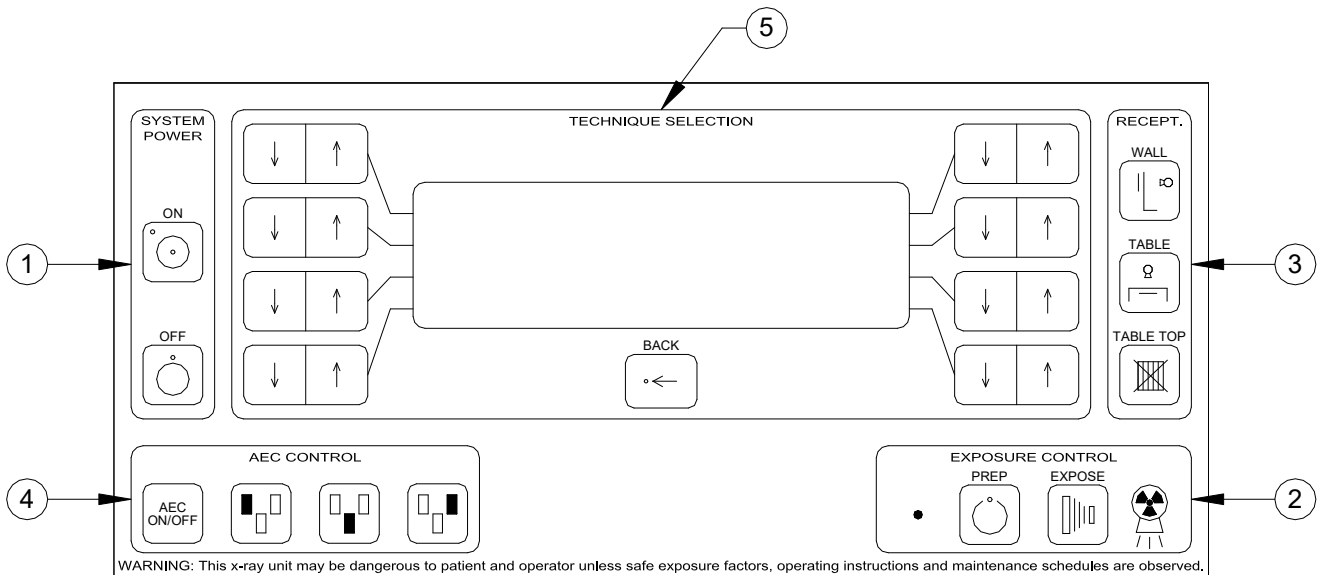
CONSOLE CONTROLS

3

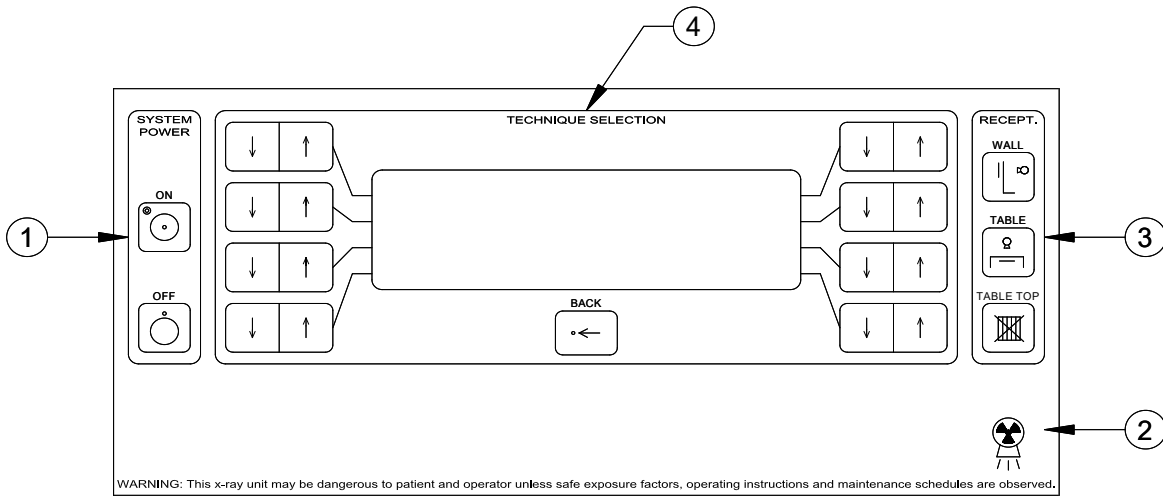
OPERATOR CONTROL Panel

All of the generator functions are controlled by selections made at the Operator Console. Turning the system on or off, selecting an anatomical region and specific view (with APR versions), selecting actual patient size (with APR versions), or changing exposure technique factors are all accessible from this console and can be done by the equipment user as described in this manual.

APR SYSTEM PANELS

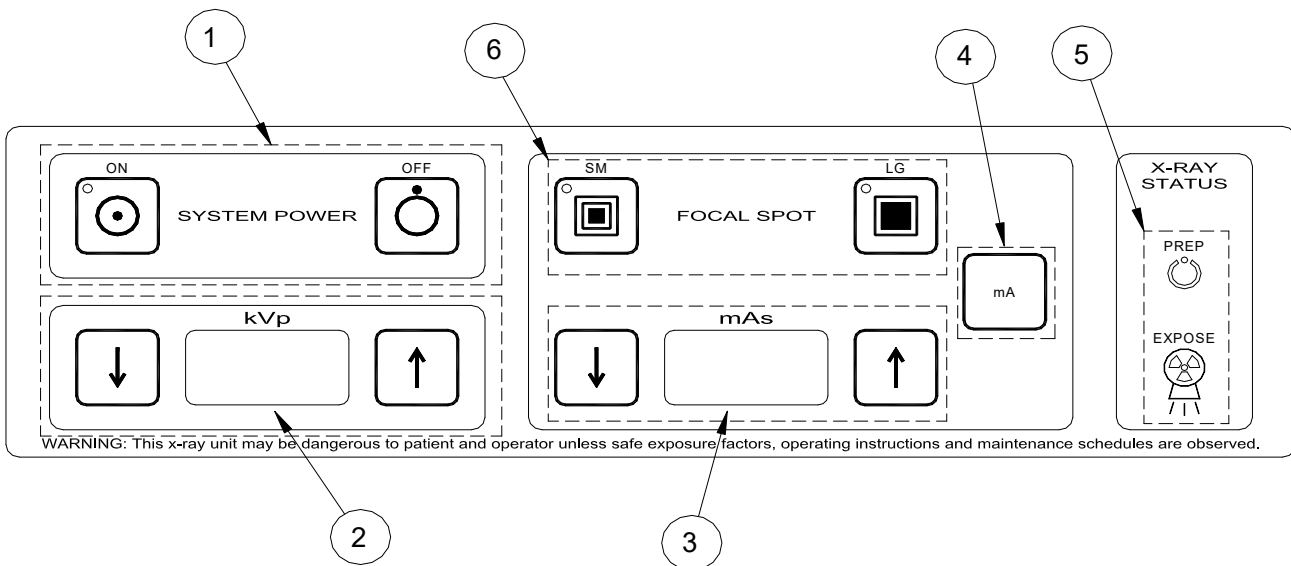


1. Power ON and OFF buttons and POWER ON indicator.
2. PREP and X-RAY exposure buttons and indicators.
3. IMAGE RECEPTOR selection buttons.
4. AEC – Automatic Exposure Control
5. LCD display window, BACK button, and APR technique selection and programming buttons.

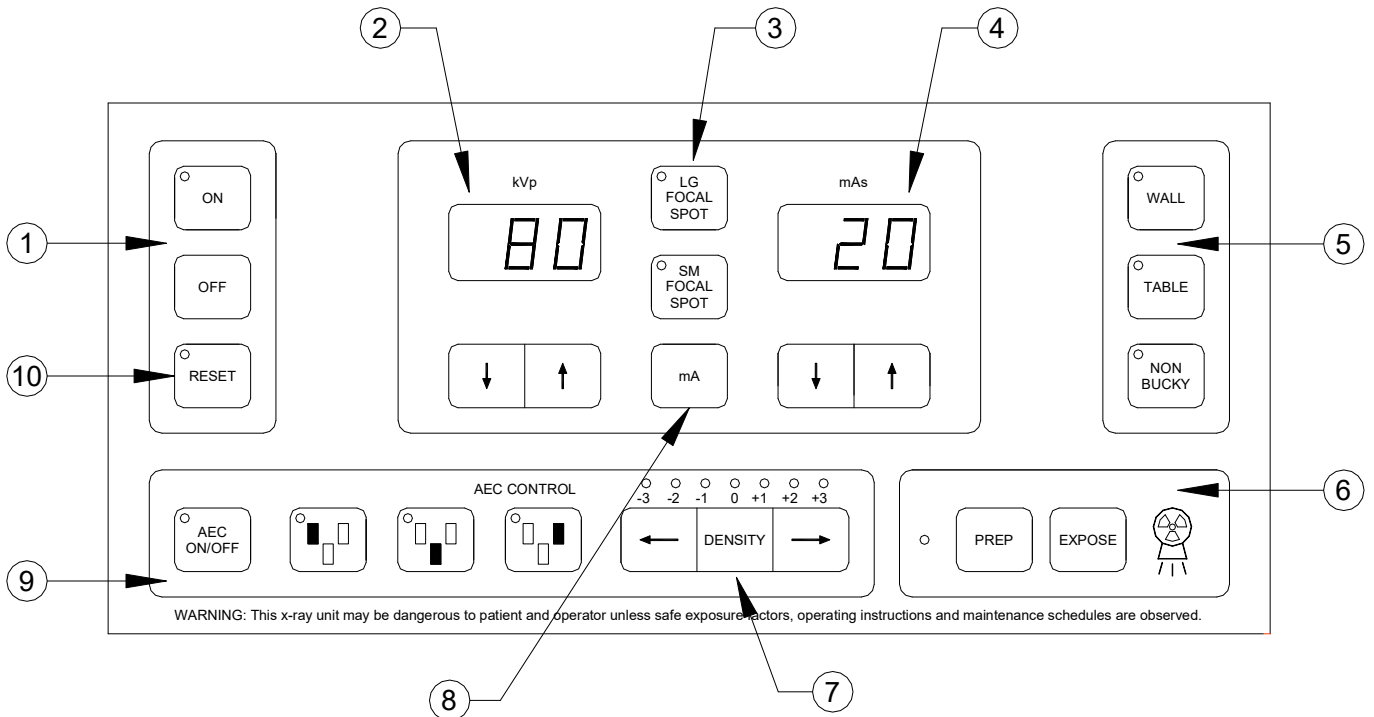


1. Power ON and OFF buttons and POWER ON indicator.
2. X-RAY EXPOSURE indicator light.
3. IMAGE RECEPTOR selection buttons.
4. LCD display window, BACK button, and APR technique selection and programming buttons.

2PT SYSTEM PANELS



1. Power ON and OFF buttons and POWER ON indicator.
2. kVp digital display and kVp increase/decrease arrow buttons.
3. mAs digital display and mAs increase/decrease arrow buttons.
4. mA display button.
5. PREP indicator light. X-RAY EXPOSURE indicator light.
6. FOCAL SPOT selection buttons and indicator lights.



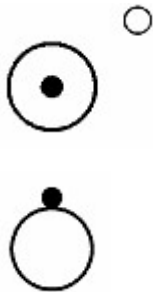
1. Power ON and OFF buttons and POWER ON indicator.
2. kVp digital display and kVp increase/decrease arrow buttons.
3. FOCAL SPOT selection buttons and indicator lights.
4. mAs digital display and mAs increase/decrease arrow buttons.
5. IMAGE RECEPTOR selection buttons and indicators.
6. PREP button and PREP READY indicator. EXPOSURE button and X-RAY EXPOSURE indicator.
7. AEC Density indicator and increase/decrease arrow buttons.
8. mA display button.
9. AEC on/off button and field select buttons and indicators.
10. RESET button and indicator.

OPERATOR CONTROL – Detailed operation guide

NOTE: THE FOLLOWING IS A GATHERING OF ALL CONTROLS FOR THE ENTIRE LINE OF HF X-RAY GENERATORS. NOT ALL CONTROLS ARE AVAILABLE ON ALL GENERATORS. SOME CONTROLS MAY APPEAR SLIGHTLY DIFFERENT THAN THE ACTUAL OPERATORS X-RAY CONTROL.

POWER CONTROLS

Power On, Power Off



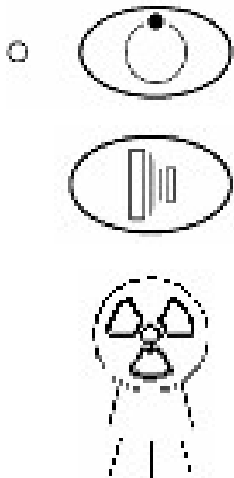
Press ON to switch the x-ray generator on. An LED will be lit when the unit is on. The console will light up and a brief self-check will be performed upon power-up. Approximately 1-2 seconds after power-up the digital display will indicate the software version.

An LED will be illuminated while console power is on.

Press OFF to switch the generator off.

PREP AND X-RAY EXPOSE CONTROLS AND INDICATORS

(some generators work with a foot switch control only)



Press and hold the prep button to spin the rotor. In approximately 1.5 to 2 seconds, the prep ready indicator (green LED) will light. While pressing the prep button, press and hold the exposure button to make an x-ray exposure.

The x-ray exposure indicator (yellow LED) will light when x-rays are being produced, and an audible tone (approx. 500ms) will sound at the end of the exposure.

-If the PREP button is released prior to depressing the EXPOSURE button, the exposure will be inhibited and the prep cycle will have to be restarted.

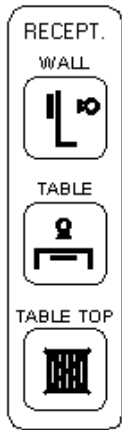
-If the EXPOSURE button is released during the x-ray exposure, the exposure will be terminated and an error message will be displayed.

-The PREP and EXPOSURE functions may also be engaged by a two-position footswitch, where the first position is for PREP, and the second position is for EXPOSURE. An optional "latching prep" foot treadle or remote wall exposure switch are also available for some generators.

- If "latching prep" is not enabled: Pressing and holding the exposure button only will cycle the generator through prep and exposure.
- If "latching prep" is enabled: Pressing and releasing the exposure button will allow the unit to latch into prep cycle. When the prep ready indicator lights steady, press and hold the exposure button to make an x-ray exposure.

IMAGE RECEPTORS

Wall Bucky, Table Bucky and Non-Bucky Image Receptor Selection



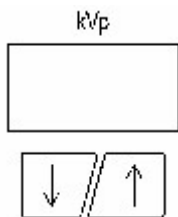
Press WALL to select the wall image receptor.

Press TABLE to select the table image receptor.

Press TABLE TOP for exposures used without an image receptor.

Upon powering some generators, and prior to the first exposure, all potentially valid image receptors will flash the LED's, prompting the Operator to make a selection before attempting an x-ray exposure. Exposures are inhibited when no image receptor is selected.

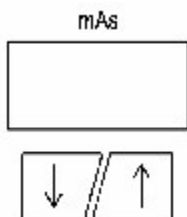
kVp CONTROL (2PT only)



The kVp digital display will indicate the kVp selected.

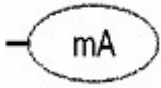
Press the UP and DOWN arrow buttons to scroll through the available kVp selection. Continuously depressing the buttons will allow the kVp to increase/decrease one kV every ½ second for five (5) steps and then accelerates to approximately ten (10) steps per second.

mAs CONTROL (2PT only)



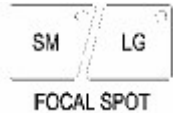
The mAs digital display will indicate the mAs selected.

Press the UP and DOWN arrow buttons to scroll through the available mAs selections. Continuously depressing the buttons will allow the mAs to increase/decrease one mAs selection every ½ second for five (5) steps and then accelerate to approximately ten (10) steps per second.



mA INDICATOR (2PT only)

Press the mA button to view the mA station to be used for the mAs selected. The mA will appear in the mAs digital display, when the mA button is depressed.



FOCAL SPOT INDICATOR (2PT only)

The X-Ray tube focal spot is selectable. Press the appropriate button to select the preferred focal spot setting. A red LED will illuminate to indicate the focal spot selected.

- Press the SM button to select the small focal spot.
- Press the LG button to select the large focal spot.

AEC CONTROLS

- AEC operation is only available if the table or wall bucky receptor is selected, and if AEC operation is enabled for the selected receptor.
- Left, middle, and right field selection is only available if a three (3) field AEC chamber is installed and programmed for the selected receptor.
- CAEC BONE and TISSUE selections are only available if the table or wall bucky receptor is selected, and if a CAEC operation is installed and programmed for the selected receptor.



Press to select or deselect AEC/CAEC operation.



Press to select the left AEC field (AEC mode only). A red LED is displayed when the AEC/CAEC is on.



Press to select the middle AEC field (AEC mode only). A red LED is displayed when this field is selected.



Press to select the right AEC field (AEC mode only). A red LED is displayed when this field is selected.



Press to select CAEC bone image density (CAEC mode only). A red LED is displayed when the bone density setting is selected.



Press to select CAEC tissue image density (CAEC mode only). A red LED is displayed when the tissue density setting is selected.

A minimum of one the above AEC or CAEC selections must be made to operate in AEC/CAEC mode.

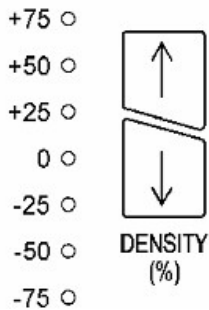
RESET CONTROL



The RESET button LED will illuminate upon sensing some system or exposure errors. Press the RESET button, when the red LED is lit, to reset the console or system.

In AEC/CAEC mode, the RESET LED will light if an exposure is terminated at the maximum available mAs for the exposure (Back-up mAs).

AEC DENSITY CONTROLS

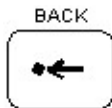
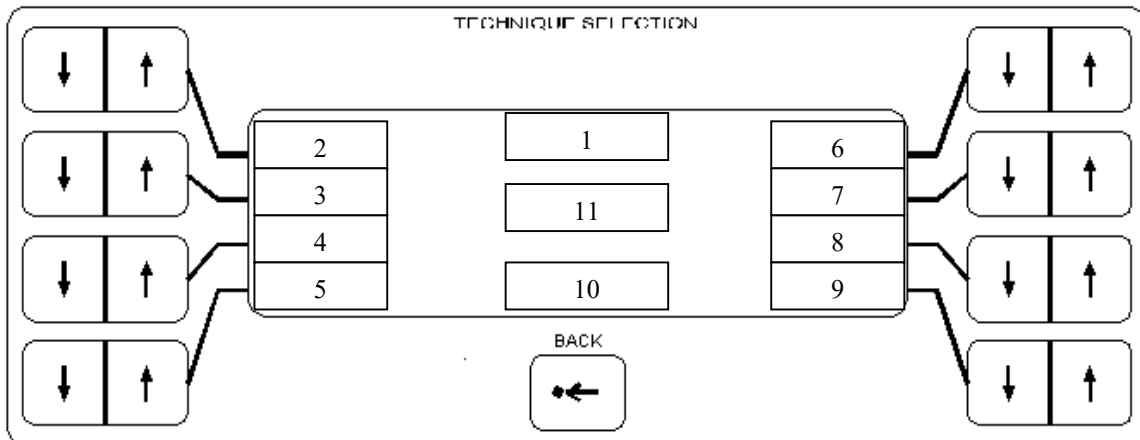


During installation, the installing dealer calibrates the AEC field(s) to achieve proper optical density (OD) in AEC/CAEC operating mode. The Synergy generator automatically defaults to this calibrated OD value when the LED is lit beside the "0".

The optical density may be altered by depressing the UP and DOWN arrow buttons. A red LED will be displayed next to the selected density setting.

Example: +50% will result in a radiographic film approximately 50% darker than a film taken at the "0" setting.

LCD DISPLAY WINDOW AND APR BUTTONS



Press the BACK button to view the previous screen.

Field	Display / Function
1	In POWER ON mode, displays date and time. In 2-POINT mode, displays 2-Point mode of operation. In APR mode, displays the APR main menu, or anatomical region, or anatomical view that has been selected.
2	In 2-POINT and APR mode, displays kVp selected.
3	In 2-POINT and APR mode, displays the mAs selected.
4	In 2-POINT and APR mode, displays the mA selected.
5	In POWER ON mode, displays the APR selection. In 2-POINT mode, location is blank. In APR mode, displays cm measurement selected.
6	In 2-POINT and APR mode, displays Focal Spot selected.
7	In 2-POINT mode, EXPOSURE COUNT can be viewed. In APR mode, displays the SID APR default.
8	In 2-POINT mode, location is blank. In APR mode, displays the Film/Screen APR default.
9	In POWER ON mode, displays 2-POINT selection. In 2-POINT and APR mode, location is blank.
10	In 2-POINT and APR mode, displays image receptor selected.
11	In 2-POINT and APR mode, displays angulation of x-ray beam in idle. Displays "PREP" or "EXPOSE" during prep and exposure, or Error Codes when a fault is detected.

EXPOSURE COUNT

The HF generators keep track of how many exposures were taken. This number can be accessed by the User as follows:

kVp/mAs generators

To display exposure count:

- Press and hold **mA** button
- While holding the **mA** button, press and release the **Sm Focal Spot** button.
- The left display will show "C##", the right display will show "###". The numbers are read as follows:
 - "C12" "718" represents 12,718 exposures

To return to normal Radiographic mode:

- Wait 5 seconds.

AP generators

Start generator and select **MANUAL 2PT** mode.

The right side of LCD will display **EXP COUNT**. Press the associated button and the LCD will now show **EXP #:NNNNN** for five seconds (after which the display will go back to normal). The NNNNN represents the exposure count. For example, **EXP #:12718** represents 12,718 exposures.

To return to AP Mode, press & release the "back" button & select AP (or APR) Mode

TAKING AN X-RAY EXPOSURE

4



When taking an x-ray exposure, the operator should exercise appropriate protection and operation. X-Ray is hazardous to both patient and operator if proper operation and protection is not practiced.

MANUAL MODE OF OPERATION (2-POINT)

1. Power the unit by pressing the ON button.
 2. If using an APR console select MANUAL 2-PT.
 3. Select an image receptor (if available) by pressing the appropriate button.
 4. Select the preferred x-ray tube focal spot size by pressing the associated arrow button.
 5. Enter the selected kVp technique by pressing the associated button.
 6. Enter the selected mAs technique by pressing the associated button.
 7. Press the PREP button until the green LED ready light appears constant.
 8. While still depressing the PREP button, press the EXPOSE button to begin the x-ray exposure (or depress footswitch to second position).
 9. Release both buttons upon completion of the x-ray exposure.
- In 2-Point mode, the generator will automatically select the highest mA and shortest exposure time available to achieve the mAs displayed.
 - If the operator terminates the exposure prior to the completion of the exposure (based on technique factor selection) an error code will be displayed as well as the mAs produced during the exposure.
 - If invalid technique exposure factors are selected, an audible tone will occur and an error code will be displayed. Refer to the Error Code section of this manual for further reference.
 - If the large focal spot is being selected, and the mAs selected is below the minimum allowable mAs, the display will alert the operator by means of an error message and audible tone. The generator will automatically change the mAs to the minimum allowable mAs on the large focal spot.
 - If the small focal spot is being selected, and the mAs selected exceeds the range of the small focal spot rating of the generator and x-ray tube, the display will alert the operator by means of an error message and audible tone. The generator will automatically change the mAs to the maximum allowable mAs on the small focal spot.
 - In manual 2-point mode (with an APR generator), pressing EXPOSURE COUNT will momentarily display the total number of exposures made on this x-ray control.

ANATOMICAL PROGRAM MODE OF OPERATION (APR)

1. Power the unit by pressing the ON button.
 2. Select APR.
 3. Select the Anatomical Region by pressing the associated arrow button.
 4. Select the Radiographic View by pressing the associated arrow button.
 5. Enter the centimeter thickness measurement by pressing the associated arrow button.
 6. Press the PREP button (or depress footswitch) to first position until the green LED ready light appears constant.
 7. While still depressing the PREP button, press the EXPOSE button (or depress footswitch to second position) to begin the x-ray exposure.
 8. Release both buttons upon completion of the x-ray exposure.
- The pre-programmed technique parameters (kVp, mAs, mA and Focal Spot) may be modified prior to making the x-ray exposure. Press the associated arrow button to override the pre-programmed value. Overriding of the programmed technique parameter does not affect the APR memory.
 - When overriding a pre-programmed technique factor (kVp or mAs), an arrow will be displayed to identify that the selected value is higher or lower than the pre-programmed technique value.

**WARNING**

If at any time during the exposure, the operator detects problems, the exposure switch should be released. If the problem continues, the operator should press the OFF button. If the problem persists, the main disconnect switch should be turned off.

When taking an x-ray exposure, the operator should exercise appropriate protection and operation. X-Ray is hazardous to both patient and operator if proper operation and protection is not practiced.

ERROR CODES

5

The operator console will display error codes on the digital displays during normal and abnormal operation of the generator. This chapter contains tables of the error codes and their descriptions. For some generators, errors may be recoverable by pressing a Reset button. The following is a gathering of all error codes for the entire line of HF X-RAY generators. Not all error codes are available on all generators.

INVALID SETTINGS & SELECTIONS		
ERROR	AP DISPLAY	Required Action
E01	kVp LIMIT	Adjust kVp technique parameter.
E02	mAs LIMIT	Adjust mAs technique parameter.
E03	TUBE LIMIT	Adjust kVp / mAs technique parameters.
E04	kW LIMIT	Adjust kVp / mAs technique parameters.
E05	TIME LIMIT	mA/mAs combination exceeds internal timer.
E06	TIME LIMIT	mA/mAs combination exceeds internal timer.
E07	BUTTON	Button is inactive in this setting.
E08	mA LIMIT	Highest mA is already selected.
E09	cm LIMIT	Highest or lowest cm is already selected.
E18	APR DATA LMT	Selection not available or installed during system set-up.
E19	DENSITY LMT	Highest or lowest AEC density setting is already selected.
E40	NO WALL AEC	Select the image receptor with AEC installed.
E41	NO TABLE AEC	Select the image receptor with AEC installed.
E42	NO T-TOP AEC	Select the image receptor with AEC installed.
E52	CAL DATA LMT	Selection not available or installed during system set-up.
-	TUBE ANGLE	Roll tube so x-ray beam points down to the table top.

ERROR CODES		
ERROR	AP DISPLAY	Required Action
E10	MICRO-P	Turn Operator console off and on to clear. Call for service.
E11	NO COMM.	Call for service.
E12	+/-12V LIMIT	Turn Operator console off and on to clear. Call for service.
E13	EEP R/W	Turn Operator console off and on to clear. Call for service.
E14	EEP CHECKSUM	Turn Operator console off and on to clear. Call for service.
E15	PREP PRESSED	Turn Operator console off and on to clear. Call for service.
E16	EXP PRESSED	Turn Operator console off and on to clear. Call for service.
E17	SYS COOL DOWN	Heat build-up. Wait for system to cool down before using.
E20	DOOR INTLK	Verify doors are closed during x-ray exposure. If error persists, call for service.
E21	TUBE INTLK	Heat build-up. Wait for tube to cool before using.
E22	COLMTR INTLK	Not used with manual collimation. Call for service.
E23	GENRL INTLK	Call for service.
E24	FAIL KV FB	Call for service.
E25	DC BUS LOW	Turn Operator console off and on to clear. Call for service.
E26	STILL ANODE	Call for service.
E27	ANODE ROT.	Turn Operator console off and on to clear. Call for service.
E28	PREP HELD	X-Ray prep cycle too long (20 seconds prep cycle limit).
E29	NO BUCKY MOT	Improper configuration at installation. Call for service.

ERROR CODES		
ERROR	AP DISPLAY	Required Action
E30	mA PRESENT	Turn Operator console off and on to clear. Call for service.
E31	kVp PRESENT	Turn Operator console off and on to clear. Call for service.
E32	LOW FIL AMPS	Call for service.
E33	HI FIL AMPS	Call for service.
E34	IPM OVERLOAD	Turn Operator console off and on to clear. Call for service.
E35	EXP. RELEASE	X-Ray exposure was pre-terminated by Operator due to early button release.
E36	LOW AEC RAMP	Press RESET button to clear error. Increase Back-up mAs or kVp technique parameter.
E37	kVp OVERLOAD	Call for service.
E38	mA OVERLOAD	Turn Operator console off and on to clear. Call for service.
E39	BACKUP MAS	Press RESET button to clear error. Increase Back-up mAs technique parameter.
E44	KVP TOO LOW	Call for service.
E45	NO ZCO	Call for service.
E46	KEY CODE BRD	Verify if correct Key Code Brd. for 20/40/42/50/52 kW Gen. is used.
E47	TUBE NOT CALIBRATED	Call for service.
E48	KV NOT CALIBRATED	Call for service.
E49	CONSOLE RST! PLS. RELEASE PREP/EXP SW!	Release prep/expose switch.
E50	CPU ERROR! WAIT FOR RST FROM CPU	Restart digital workstation.
E51	NO MEM CARD	No memory card installed.
E53	APR CHECKSUM	Call for service.
E54	INVALID GEN MOD. NO.	Call for service.
E55	AUTO CAL FAILED	Call for service.
E56	AUTO CAL / TUBE SEASON ABORTED!	Call for service.
E57	EXPOSE HELD	Release Expose switch.
E58	mA TOO LOW	Call for service.
E59	FIL I SENSOR	Call for service.
E60	CPU ERROR! COMM. ATTACK	Restart digital workstation. Call for service.
E61	mA LOW ERROR PRE-CAL (LG)	Call for service.
E62	mA LOW ERROR PRE-CAL (SM)	Call for service.
E63	mA CAL ERROR LARGE FOCUS	Call for service.
E64	mA CAL ERROR SMALL FOCUS	Call for service.
E65	mA LOW ERROR T-SEASON CHK	Call for service.

ERROR CODES		
ERROR	AP DISPLAY	Required Action
E66	mA LOW ERROR T-SEASONING	Call for service.
E67	mA LOW ERROR SYS PWR TEST	Call for service.
E68	AC LINE VOLT NOT SELECTED	Call for service.
E69	K904 VER. NOT SELECTED	Call for service.
E70	ERR. AC LINE OR K904 VER.	Call for service.
E71	mA FEEDBACK DISABLED	Call for service.
E72	mAs LIMIT FOR 208 VAC	Call for service.
E73	MAX mA LIMIT EXCEEDED	Call for service.
E74	mA NOT CALIBRATED	Call for service.



If errors are displayed, follow the advice listed under "Required Action." However, if an intermittent error code is displayed frequently during normal operation, call for service to determine the source of the error.

EDITING APR

6

(Not available on 2 PT generators)

All APR screens can be edited in the field. The menus and technique parameters can be modified and saved to memory. Once, saved to memory, all APR and calibration values can be downloaded and saved on a separate Memory Card to insure fast retrieval whenever necessary.



Only qualified personnel should have access to the edit screens, to minimize the risk of invalid or inaccurate APR technique values.

EDIT APR TECHNIQUES - Modify Technique Parameters for Radiographic Views

1. With the console power OFF, depress the BACK button.
2. While depressing the BACK button, turn the console power ON.
3. Press the associated arrow button for EDIT APR MODE.
4. By pressing the associated arrow button, select the anatomical region.
5. By pressing the associated arrow button, select the radiographic view.
6. Using the associated arrow button, select preferred mA and focal spot setting.
7. Using the associated arrow button, select the preferred SID setting.
8. Using the associated arrow button, select the preferred FILM/SCREEN speed.
9. Using the RECEPTOR button, select the preferred RECEPTOR default setting.
10. To establish the APR technique values, using the associated arrow button, select the cm START thickness measurement.
11. Using the associated UP arrow button, TOGGLE to view the cm STEP value. Using the associated arrow button, select the preferred STEP value.
12. Using the associated UP arrow button, TOGGLE to view the cm START value. Using the associated arrow buttons, select the preferred kVp and mAs value for the cm measurement displayed.
13. Using the arrow button associated with the cm value, enter the preferred kVp and mAs value for each cm value displayed. There is a total of nine (9) technique reference values to edit for each APR view.
14. To exit EDIT APR MODE, turn the console off or press the BACK button to the CAL BOOTUP screen and using the associated button, EXIT TO RAD.



When editing technique parameters, press SAVE PAGE to enter information into memory. No changes will be saved if SAVE PAGE is not selected prior to viewing a new screen/page.

EDIT APR TEXT - Text Editing

1. With the console power OFF, depress the BACK button.
 2. While depressing the BACK button, turn the console power ON.
 3. Press the associated arrow button for RENAME TECH.
 4. Using the associated arrow button with MODIFY, select the Main Menu Screen (anatomical regions) or the Region Screen (radiographic views) that requires modification.
 5. Upon displaying the preferred Screen in MODIFY, use the associated arrow button to ENTER MOD. SCREEN to edit.
 6. The text available for editing is displayed in the darkened areas. Using the associated button for SCROLL DN/UP, move the cursor (highlighted box) to the preferred text.
 7. To edit the text, use the associated button to SCROLL LT/RT through the word.
 8. Using the associated button CHANGE ALPHA, enter each letter/character to the text line. As each letter/character is modified, use the SCROLL LT/RT to continue editing the text.
 9. To exit, turn the console power off or press the BACK button to the CAL BOOTUP screen and using the associated button, EXIT TO RAD.
- To access words/text aligned on the right of the LCD window, use the SCROLL LT/RT button to move the cursor to the desired text.

STORAGE & RETRIEVAL OF APR DATA

Once APR values or text are modified and saved, Summit Industries recommends storing the new values on a digital memory card. This ensures that all the APR modifications as well as calibration information is stored external to the operator console and generator. Retrieval and reloading of the information will be fast, if the need arises.

If a Memory Card is not available, Factory Set Defaults for APR menus and technique parameters can be restored to the console's memory.

Factory Defaults

1. With the console power OFF, depress the BACK button.
2. While depressing the BACK button, turn the console power ON.
3. Press the associated arrow button for MEMORY FUNC.
4. Press the associated arrow button for DEFAULT.
5. By using the associated arrow button, select the factory defaults to be retrieved and saved to memory:
 - DFLT ALL APR - retrieves all factory default values for APR.
 - DFLT APR REG - retrieves factory defaults for select APR Regions.
6. Upon selecting the factory default(s) to be retrieved, using the associated arrow button, select YES to restore factory defaults, or select NO to maintain current console settings.
7. To exit, turn console power off or press the BACK button to CAL BOOTUP screen and using the associated arrow button, EXIT TO RAD.

Memory Card, Memory Storage

1. With the console power OFF, insert the Memory Card into the slot located on the bottom of the operator console between the angulation handles.
2. While depressing the BACK button, turn the console power ON.
3. Press the associated arrow button for MEMORY FUNC.
4. Using the associated arrow button, select CONS TO CARD.
5. Using the associated arrow button, select YES to copy APR information to the Memory Card or select NO to exit the screen.
6. Turn Off console power and remove memory card.

Memory Card, Memory Retrieval

1. With the console power OFF, insert the Memory Card into the slot located on the bottom of the operator console between the angulation handles.
2. While depressing the BACK button, turn the console power ON.
3. Press the associated arrow button for MEMORY FUNC.
4. Using the associated arrow button, select CARD TO CONS.
5. Using the associated arrow button, select YES to copy Memory Card APR information to the console, or select NO to exit the screen.
6. Turn OFF console power and remove memory card.

GENERATOR EXPOSURE TABLES

7

The following table shows exposure times resulting from pre-selected mAs and mA values. Your generator may not have all the settings. Exposure factors such as mA and mAs are dependent on generator options that were purchased. The X-ray generator has a built-in feature to prevent the user from selecting exposure that may be harmful to the x-ray tube. Therefore, some exposure factors will not be attainable depending on the type of x-ray tube being used in the system.

mAs	Exposure Time (Sec.)											
	mA Focal Spot											
	25	50	75	100	150	200	250	300	350	400	450	500
0.1	0.004	X	X	X	X	X	X	X	X	X	X	X
0.2	0.008	0.004	X	X	X	X	X	X	X	X	X	X
0.3	0.012	0.006	0.004	X	X	X	X	X	X	X	X	X
0.4	0.016	0.008	0.005	0.004	X	X	X	X	X	X	X	X
0.5	0.020	0.010	0.007	0.005	X	X	X	X	X	X	X	X
0.6	0.024	0.012	0.008	0.006	0.004	X	X	X	X	X	X	X
0.7	0.028	0.014	0.009	0.007	0.005	0.004	X	X	X	X	X	X
0.8	0.032	0.016	0.011	0.008	0.005	0.004	X	X	X	X	X	X
0.9	0.036	0.018	0.012	0.009	0.006	0.005	0.004	X	X	X	X	X
1.0	0.040	0.020	0.013	0.010	0.007	0.005	0.004	X	X	X	X	X
1.1	0.044	0.022	0.015	0.011	0.007	0.006	0.004	X	X	X	X	X
1.2	0.048	0.024	0.016	0.012	0.008	0.006	0.005	0.004	X	X	X	X
1.4	0.056	0.028	0.019	0.014	0.009	0.007	0.006	0.005	0.004	X	X	X
1.6	0.064	0.032	0.021	0.016	0.011	0.008	0.006	0.005	0.004	0.004	X	X
1.7	0.068	0.034	0.023	0.017	0.011	0.009	0.007	0.006	0.005	0.004	0.004	X
2.0	0.080	0.040	0.027	0.020	0.013	0.010	0.008	0.007	0.006	0.005	0.004	0.004
2.1	0.084	0.042	0.028	0.021	0.014	0.011	0.008	0.007	0.006	0.005	0.005	0.004
2.2	0.088	0.044	0.029	0.022	0.015	0.011	0.009	0.007	0.006	0.005	0.005	0.004
2.4	0.096	0.048	0.032	0.024	0.016	0.012	0.010	0.008	0.007	0.006	0.005	0.005
2.5	0.100	0.050	0.033	0.025	0.017	0.013	0.010	0.008	0.007	0.006	0.005	0.005
2.6	0.104	0.052	0.035	0.026	0.017	0.013	0.010	0.009	0.007	0.006	0.005	0.005
2.8	0.112	0.056	0.037	0.028	0.019	0.014	0.011	0.009	0.008	0.007	0.006	0.006
3.0	0.120	0.060	0.040	0.030	0.020	0.015	0.012	0.010	0.009	0.008	0.007	0.006
3.2	0.128	0.064	0.043	0.032	0.021	0.016	0.013	0.011	0.009	0.008	0.007	0.006
3.4	0.136	0.068	0.045	0.034	0.023	0.017	0.014	0.011	0.010	0.009	0.008	0.007
3.5	0.140	0.070	0.047	0.035	0.023	0.018	0.014	0.012	0.010	0.009	0.008	0.007
3.6	0.144	0.072	0.048	0.036	0.024	0.018	0.014	0.012	0.010	0.009	0.008	0.007
3.8	0.152	0.076	0.051	0.038	0.025	0.019	0.015	0.013	0.011	0.010	0.008	0.008
4.0	0.160	0.080	0.053	0.040	0.027	0.020	0.016	0.013	0.011	0.010	0.009	0.008
4.2	0.168	0.084	0.056	0.042	0.028	0.021	0.017	0.014	0.012	0.011	0.009	0.008
4.4	0.176	0.088	0.059	0.044	0.029	0.022	0.018	0.015	0.013	0.011	0.010	0.009
4.8	0.192	0.096	0.064	0.048	0.032	0.024	0.019	0.016	0.014	0.012	0.011	0.010
5.0	0.200	0.100	0.067	0.050	0.033	0.025	0.020	0.017	0.014	0.013	0.011	0.010
5.3	0.212	0.106	0.071	0.053	0.035	0.027	0.021	0.018	0.015	0.013	0.012	0.011
5.6	0.224	0.112	0.075	0.056	0.037	0.028	0.022	0.019	0.016	0.014	0.012	0.011
6.0	0.240	0.120	0.080	0.060	0.040	0.030	0.024	0.020	0.017	0.015	0.013	0.012
6.3	0.252	0.126	0.084	0.063	0.042	0.032	0.025	0.021	0.018	0.016	0.014	0.013
6.7	0.268	0.134	0.089	0.067	0.045	0.034	0.027	0.022	0.019	0.017	0.015	0.013
7.1	0.284	0.142	0.095	0.071	0.047	0.036	0.028	0.024	0.020	0.018	0.016	0.014
7.5	0.300	0.150	0.100	0.075	0.050	0.038	0.030	0.025	0.021	0.019	0.017	0.015
8.0	0.320	0.160	0.107	0.080	0.053	0.040	0.032	0.027	0.023	0.020	0.018	0.016
8.5	0.340	0.170	0.113	0.085	0.057	0.043	0.034	0.028	0.024	0.021	0.019	0.017
9.0	0.360	0.180	0.120	0.090	0.060	0.045	0.036	0.030	0.026	0.023	0.020	0.018
9.5	0.380	0.190	0.127	0.095	0.063	0.048	0.038	0.032	0.027	0.024	0.021	0.019
10.0	0.400	0.200	0.133	0.100	0.067	0.050	0.040	0.033	0.029	0.025	0.022	0.020
10.5	0.420	0.210	0.140	0.105	0.070	0.053	0.042	0.035	0.030	0.026	0.023	0.021
11.0	0.440	0.220	0.147	0.110	0.073	0.055	0.044	0.037	0.031	0.028	0.024	0.022
12.0	0.480	0.240	0.160	0.120	0.080	0.060	0.048	0.040	0.034	0.030	0.027	0.024
12.5	0.500	0.250	0.167	0.125	0.083	0.063	0.050	0.042	0.036	0.031	0.028	0.025
14.0	0.560	0.280	0.187	0.140	0.093	0.070	0.056	0.047	0.040	0.035	0.031	0.028
15.0	0.600	0.300	0.200	0.150	0.100	0.075	0.060	0.050	0.043	0.038	0.033	0.030
16.0	0.640	0.320	0.213	0.160	0.107	0.080	0.064	0.053	0.046	0.040	0.036	0.032
17.0	0.680	0.340	0.227	0.170	0.113	0.085	0.068	0.057	0.049	0.043	0.038	0.034
18.0	0.720	0.360	0.240	0.180	0.120	0.090	0.072	0.060	0.051	0.045	0.040	0.036
19.0	0.760	0.380	0.253	0.190	0.127	0.095	0.076	0.063	0.054	0.048	0.042	0.038
20.0	0.800	0.400	0.267	0.200	0.133	0.100	0.080	0.067	0.057	0.050	0.044	0.040
21.0	0.840	0.420	0.280	0.210	0.140	0.105	0.084	0.070	0.060	0.053	0.047	0.042
22.0	0.880	0.440	0.293	0.220	0.147	0.110	0.088	0.073	0.063	0.055	0.049	0.044
24.0	0.960	0.480	0.320	0.240	0.160	0.120	0.096	0.080	0.069	0.060	0.053	0.048
25.0	1.000	0.500	0.333	0.250	0.167	0.125	0.100	0.083	0.071	0.063	0.056	0.050

mAs	Exposure Time (Sec.)											
	mA Focal Spot											
	25	50	75	100	150	200	250	300	350	400	450	500
26.0	1.040	0.520	0.347	0.260	0.173	0.130	0.104	0.087	0.074	0.065	0.058	0.052
28.0	1.120	0.560	0.373	0.280	0.187	0.140	0.112	0.093	0.080	0.070	0.062	0.056
30.0	1.200	0.600	0.400	0.300	0.200	0.150	0.120	0.100	0.086	0.075	0.067	0.060
32.0	1.280	0.640	0.427	0.320	0.213	0.160	0.128	0.107	0.091	0.080	0.071	0.064
34.0	1.360	0.680	0.453	0.340	0.227	0.170	0.136	0.113	0.097	0.085	0.076	0.068
35.0	1.400	0.700	0.467	0.350	0.233	0.175	0.140	0.117	0.100	0.088	0.078	0.070
36.0	1.440	0.720	0.480	0.360	0.240	0.180	0.144	0.120	0.103	0.090	0.080	0.072
38.0	1.520	0.760	0.507	0.380	0.253	0.190	0.152	0.127	0.109	0.095	0.084	0.076
40.0	1.600	0.800	0.533	0.400	0.267	0.200	0.160	0.133	0.114	0.100	0.089	0.080
42.0	1.680	0.840	0.560	0.420	0.280	0.210	0.168	0.140	0.120	0.105	0.093	0.084
45.0	1.800	0.900	0.600	0.450	0.300	0.225	0.180	0.150	0.129	0.113	0.100	0.090
48.0	1.920	0.960	0.640	0.480	0.320	0.240	0.192	0.160	0.137	0.120	0.107	0.096
50.0	2.000	1.000	0.667	0.500	0.333	0.250	0.200	0.167	0.143	0.125	0.111	0.100
53.0	2.120	1.060	0.707	0.530	0.353	0.265	0.212	0.177	0.151	0.133	0.118	0.106
55.0	2.200	1.100	0.733	0.550	0.367	0.275	0.220	0.183	0.157	0.138	0.122	0.110
56.0	2.240	1.120	0.747	0.560	0.373	0.280	0.224	0.187	0.160	0.140	0.124	0.112
60.0	2.400	1.200	0.800	0.600	0.400	0.300	0.240	0.200	0.171	0.150	0.133	0.120
63.0	2.520	1.260	0.840	0.630	0.420	0.315	0.252	0.210	0.180	0.158	0.140	0.126
65.0	2.600	1.300	0.867	0.650	0.433	0.325	0.260	0.217	0.186	0.163	0.144	0.130
67.0	2.680	1.340	0.893	0.670	0.447	0.335	0.268	0.223	0.191	0.168	0.149	0.134
70.0	2.800	1.400	0.933	0.700	0.467	0.350	0.280	0.233	0.200	0.175	0.156	0.140
71.0	2.840	1.420	0.947	0.710	0.473	0.355	0.284	0.237	0.203	0.178	0.158	0.142
75.0	3.000	1.500	1.000	0.750	0.500	0.375	0.300	0.250	0.214	0.188	0.167	0.150
80.0	3.200	1.600	1.067	0.800	0.533	0.400	0.320	0.267	0.229	0.200	0.178	0.160
85.0	3.400	1.700	1.133	0.850	0.567	0.425	0.340	0.283	0.243	0.213	0.189	0.170
90.0	3.600	1.800	1.200	0.900	0.600	0.450	0.360	0.300	0.257	0.225	0.200	0.180
95.0	3.800	1.900	1.267	0.950	0.633	0.475	0.380	0.317	0.271	0.238	0.211	0.190
100.0	4.000	2.000	1.333	1.000	0.667	0.500	0.400	0.333	0.286	0.250	0.222	0.200
105.0	4.200	2.100	1.400	1.050	0.700	0.525	0.420	0.350	0.300	0.263	0.233	0.210
110.0	4.400	2.200	1.467	1.100	0.733	0.550	0.440	0.367	0.314	0.275	0.244	0.220
120.0	4.800	2.400	1.600	1.200	0.800	0.600	0.480	0.400	0.343	0.300	0.267	0.240

MAINTENANCE & CLEANING

8

WEEKLY MAINTENANCE

X-ray Tube Seasoning - It is recommended that you season the x-ray tube once a week to prevent possible pre-mature failure of high voltage (HV) components.

Setup:

- Close the collimator blades.
- Select kVp for each exposure according to tables below.
- Select 20.0 mAs and 200 mA (Lg FS).
- **If 200 mA is not available**, select 10.0 mAs and 100 mA (Lg FS).
- Take x-ray, then wait **30 seconds between each exposure**.
- Perform exposures 1-8.

Weekly Seasoning Chart			
wait 30s between exposures			
Exp #	kVp	mAs	mA
1	60	20.0	200
2	70		
3	80		
4	90		
5	100		
6	110		
7	120		
8	125		

OR

Weekly Seasoning Chart			
wait 30s between exposures			
Exp #	kVp	mAs	mA
1	60	10.0	100
2	70		
3	80		
4	90		
5	100		
6	110		
7	120		
8	125		

If an error occurs during the seasoning process:

- Cycle generator power.
- Leave **mAs** and **mA** the same.
- Repeat exposure with **previous kVp (lower)**. Keep reducing kVp if error continues.
- Increase kVp back to value when error first occurred and repeat exposure.
- Make note of the date, technique, and error messages for the next x-ray maintenance visit.

If an error occurs every week:

- In general, x-ray tube seasoning should not result in errors.
- If errors begin occurring weekly, then this is a sign of a failing HV component.
- Notify **your local** x-ray service company.
- Shorten the tube seasoning time to every 3-4 days, until the x-ray system has been repaired.

ROUTINE MAINTENANCE

Routine maintenance is to be performed thirty (30) to sixty (60) days after the initial installation, and every six (6) months thereafter. It is the responsibility of the equipment owner to ensure this maintenance is performed as scheduled to meet warranty obligations. The installing dealer, or other factory authorized service organizations will be able to perform this maintenance. The following list is a minimum checklist. Your maintenance procedure may be more extensive than that shown below.

NOTE: Maintenance schedule frequency may be determined by certain regulatory requirements of the Country or State in which the installation is located. Always check the local codes and regulations when determining a maintenance schedule.



When taking an x-ray exposure, the operator should exercise appropriate protection and operation. X-Ray is hazardous if proper operation and protection is not practiced.

Console:

- Inspect communication cables for wear, binding, and tight coupling.
- Operate all of the switches on the console and verify that they function properly. Some switches (such as AEC controls) may not be enabled.
- Note that all text and numbers on the console screen illuminate properly.

Power Module:

- Inspect internal connections for wear, binding, and tight coupling.
- Measure line voltage and verify that TB1/TB2 are set properly.
- Inspect the HF tuning capacitor (C7), located right below the Relay PCBA, for any form of deformation. A normal capacitor must have a flat top and parallel posts. If the capacitor is suspect, then it should be replaced immediately to prevent damage to other components within the generator.
- Examine the oil level of the high voltage transformer and verify that it is about $\frac{3}{4}$ in from the top of the lid.

System:

- Inspect all system cables for wear, binding, and tight coupling.
- Inspect High Voltage cables for signs of breakdown (carbon tracking), abrasion, or wear. Regrease and retighten into the HV transformer and x-ray tube.

X-Ray:

- Perform tube seasoning/calibration.
- Verify kVp and mAs outputs are within accuracy limits.
- Verify kVp and mA waveforms are of the proper amplitude and shape.
- Annually perform complete system conformance testing per section 7 of install and service manual.

CLEANING

- Never use anything other than mild soap and water to clean plastic surfaces. Other cleaners may damage the plastic.
- Never use any corrosive, solvent, or abrasive detergents or polishes.
- Ensure that no water or other liquid can enter any equipment. This precaution prevents short circuits and corrosion foaming on components.
- Methods of disinfecting used must conform to legal regulations and guidelines regarding disinfecting and explosion protection.
- If disinfectants are used which form explosive mixtures of gases, these gases must have evaporated before switching ON the equipment again.
- Disinfecting by spraying is not recommended because the disinfectant may enter the x-ray equipment.
- If room disinfecting is done with an atomizer, it is recommended that the equipment be switched OFF, allowed to cool down and be covered with a plastic sheet. When the disinfectant mist has subsided, the plastic sheet may be removed and the equipment may be disinfected by wiping.

X-RAY TUBE DATA

9

Please refer to the X-Ray tube literature provided with the x-ray tube for this installation.