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Configuration & Calibration

X-ray System

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	SEP 19, 2022	First Edition.

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 PURPOSE AND SCOPE OF THIS MANUAL

This Configuration and Calibration document provides information and procedures to perform all the adjustments required to establish an optimal performance of this X-ray System and its Generator.

Use the Service Mode Tool (*refer to Section 2.1*) on the Control Console software of the Overhead Tube Crane (OTC) to calibrate the Positioner, the RAD Table and the RAD Wall Stand and configure all X-ray System settings. Service Mode is accessible in the Control Console, but also using any PC or auxiliary console connected to the system.

Configuration and calibration procedures for Positioner and X-ray Room equipment are detailed in Section 2, as well as the description of the Service Mode Tool. Furthermore, Generator procedures are described in Section 3.

Generator Service Console is accessible from a PC workstation connected to the system. It allows to access the service screens for Configuration and Calibration procedures of the Generator, reading the Error Log and Exposure Counters, downloading the Tube parameters and updating the software (*refer to Sections 4, 5 & 6*). It also allows the access to the User Console in order to control the exposure parameters (*refer to Section 7*).

Contact with Technical Service for further information about broadband network connection for Remote service and required software (*refer to Pre-installation Manual for further details*).

Note ☞ *Configuration and Calibration should only be performed by Service Engineers who are specialized in servicing this specific X-ray System.*

Note ☞ *The Calibration and Configuration Procedure must be done once all the components of the System have been installed definitely. Any change in the room layout and configuration means that a new process of calibration and configuration of the room may be carried out; in this case, contact with the Manufacturer Technical Service.*

Note ☞ ***The X-ray Generator has been configured by the Manufacturer. None of the procedures indicated in the Generator Configuration section of this document should be necessary upon first run, unless esteemed otherwise. Only the Calibration procedures are needed.***

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SECTION 2 SYSTEM CONFIGURATION & CALIBRATION

2.1 SERVICE MODE LOGIN AND MAIN MENU

To access the Service Mode, touch and hold the System status icon. After a few seconds, the Login screen will be displayed. Draw the unlock pattern (2–4–3–4) as shown in *Illustration 2-1* to display the Service Mode screen.

Illustration 2-1
Service Mode Login

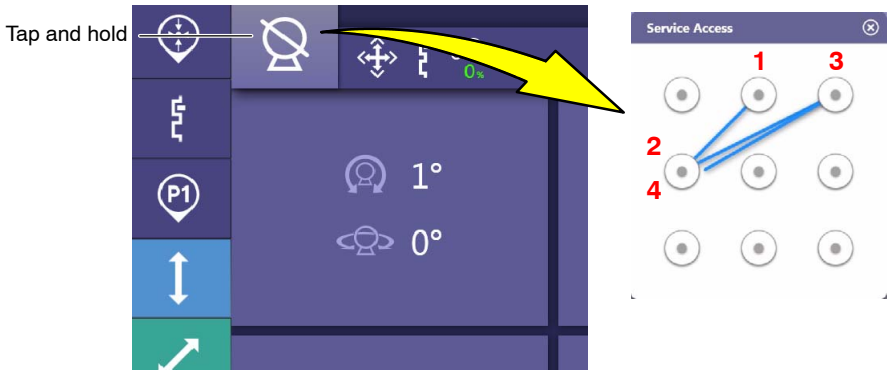
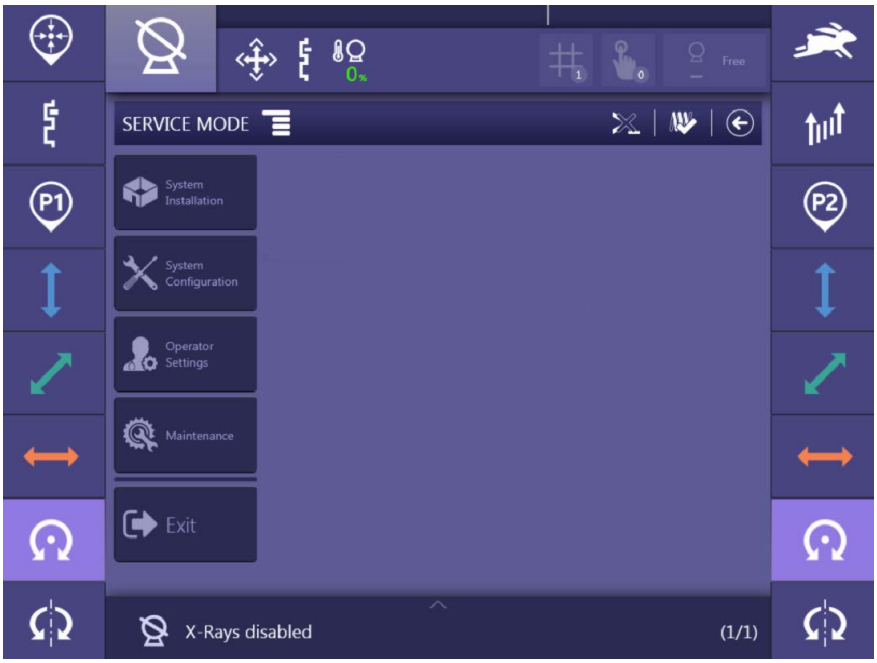
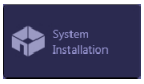


Illustration 2-2
Service Mode Main Menu



Following options are displayed in Service Mode main menu:

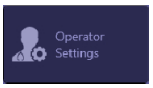


SYSTEM INSTALLATION

Touch the “System Installation” button to display the options used to calibrate the whole system (*refer to Section 2.3*).

SYSTEM CONFIGURATION

Touch the “System Configuration” button to display the options used to select the different components of the equipment and system configurations. This option is the first step in order to proceed with the system calibration (*refer to Section 2.2*).



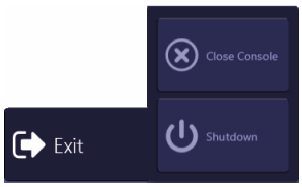
OPERATOR SETTINGS

Touch the “Operator Settings” button to display the options related to system operation settings (*refer to Section 2.4*).

MAINTENANCE

Touch the “Maintenance” button to access the system maintenance information (*refer to Section 2.5*).

EXIT



Touch the “Exit” button to display the options related to logging off the system:

- **CLOSE CONSOLE**. Touch the “Close Console” button to exit to the Operating System interface.
- **SHUTDOWN**. Touch the “Shutdown” button to turn off the whole system.

In both cases, a confirmation message will be displayed. Press “OK” to exit or press “Cancel” to go back to the main menu.

SHELL MODE

Press this button to exit the “Shell Mode”. The Control Console is operated in this mode by default. It means that general features of Windows are disabled. Deactivation of Shell mode could be used, for example, to perform upgrades.

Once selected a confirmation window indicates that, if continued, Control Console will be rebooted an exit the Shell Mode.

GENERATOR FILAMENTS

This icon indicates whether the Generator Filaments are activated or deactivated. (*For detailed information on filaments, refer to the Generator sections of the Service Manual*).

Note ☞ *The Generator Filaments can be activated or deactivated by means of the Generator Service Console installed on any PC or auxiliary console connected to the system and located outside the radiographic room (refer to Section 4).*

BACK TO USER CONSOLE

Press the “Back” icon to leave the Service Mode and go back to the User Console. This icon can be found in every menu of the Service Mode to come back to the Service Mode main menu.

Note ☞ *Every time the “Back” icon is used to leave the Service Mode after making configuration changes, the system requires a reboot.*

2.2 SYSTEM CONFIGURATION

The “System Configuration” menu is used to set the different components of the equipment (Receptors, Positioner) and the configuration of the workstations.

Each configuration procedure can be performed separately, without a pre-established order.

Note ☞ *It is necessary to set all these configuration menu options before starting the calibration procedure in “System Installation”.*

Illustration 2-3
System Configuration Options

The System Configuration screens have some common controls that are described below:

ADD. Touch to add a new item to the list.

RESTORE. Touch to load the default configuration.

SAVE. Touch to apply the changes. This icon becomes active when any field of the screen is modified.

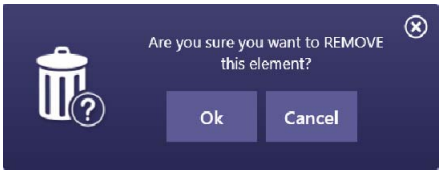
BACK. Touch to leave the current screen. A confirmation message will be displayed if the changes have not been previously saved.

EDIT. Touch to modify the configuration of the selected item. The gray shaded fields become highlighted to indicate they can be edited.

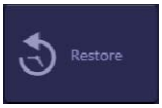
DELETE. Touch to delete the selected item from the list.

Whenever you modify or delete any of the configurable elements, a pop-up window will appear asking for confirmation of the requested action.

Illustration 2-4
System Configuration Confirmation Window



2.2.1 RESTORE

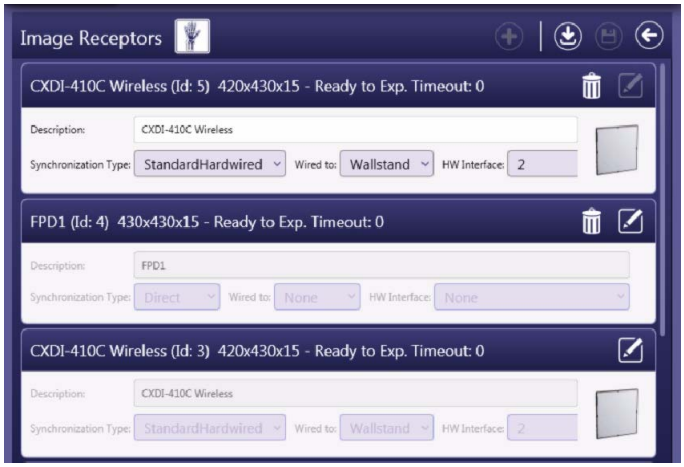


For information about the Restore function, *refer to Section 2.5.5.*

2.2.2 IMAGE RECEPTORS

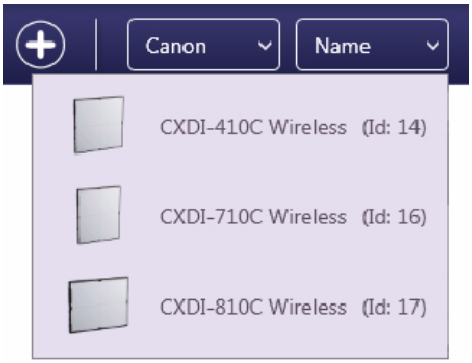
The “Image Receptors” screen shows the receptors used in the system. It is possible to add a new receptor from the catalog anytime or to modify the values of the current receptors on the list.

Illustration 2-5
Image Receptors



To add a new receptor, tap on the “Add” button. Then, select the manufacturer and model among the available options (costumer’s catalog).

Illustration 2-6
Receptor Selection

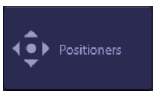


Once the Receptor is selected, it will be added to the list with an Id number and a description to facilitate its identification. To configure the Receptor, select:

- Synchronization Type:
  - Direct: There is no connection with the Receptor. Confirmation signal is not sent before the exposure.
  - Software: Receptor sends the confirmation signal via software. It is not wired to Wall Stand, Table or Generator.
  - Standard Hardwired: Receptor is connected to the GPIO board of Wall Stand or Table; or to the Generator.
  - Dynamic Hardwired: Receptor is connected to the GPIO board of Wall Stand or Table; or to the Generator for Fluoro operation.
- Wired to: For “Standard Hardwired” and “Dynamic Hardwired” options it is necessary to select which equipment it is connected to. Available options are:
  - None.
  - Table. Wired to GPIO board.
  - Wall Stand. Wired to GPIO board.
  - Generator. Wired to the Bucky signals of the Interface board.
  - AEM. Wired to the Terminal Strips on the top panel of the Generator.

- Hardware Interface: Also for “Standard Hardwired” and “Dynamic Hardwired” options. Each board in Wall Stand, Table and Generator has two connectors. Select as follows:
  - None
  - 1
  - 2

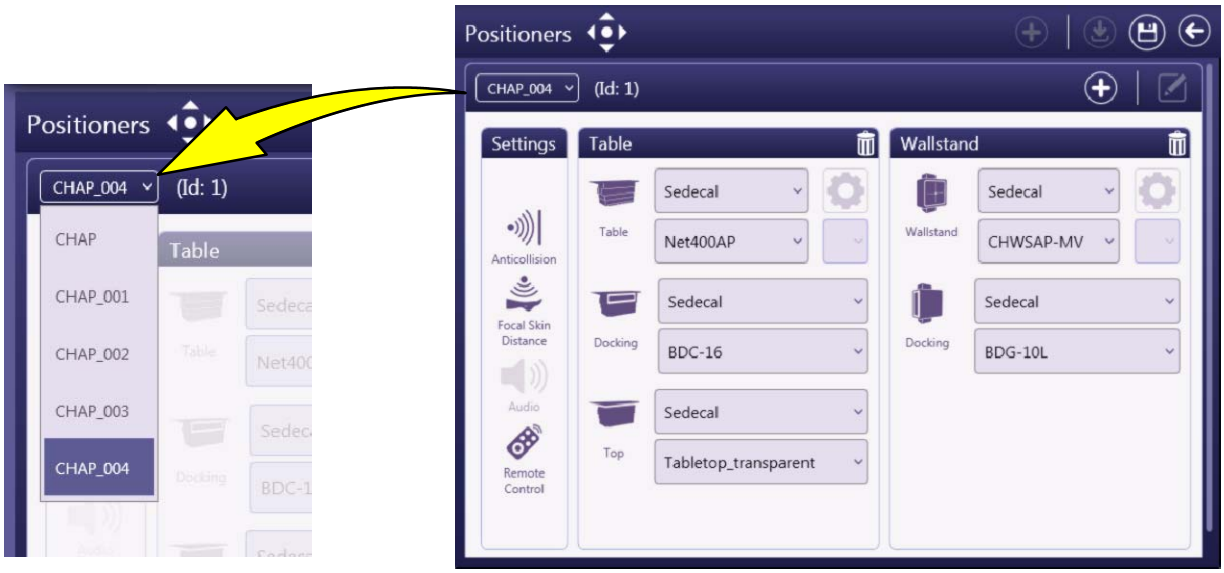
2.2.3 POSITIONERS



The “Positioners” window allows to select or modify the different components of the provided system. Each time a system component is added or modified, its corresponding calibration will be needed in the “System Installation” menu option. A new system can be added anytime by touching the “Add” icon.

The identification bar is provided with a drop-down list in order to select the system model which is properly labelled on the back of the OTC telescopic column.

Illustration 2-7
Positioners Configuration Screen & OTC Model Selection



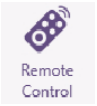
Note ☞ *Check that the OTC model and the different components selected in the Positioners Configuration Screen (Table, Wall Stand, Dockings, etc.) correspond to the model indicated on their respective labels.*

The “Settings” section of this screen allows to activate or deactivate system options.

Proximity Sensors on the Tube-Collimator Assembly

Focal Skin Distance Sensor

Intercommunication System



Remote Control

To select the components of a newly added system or modify those of an existing one, select the manufacturer and model from the drop-down list among the available options for each component.

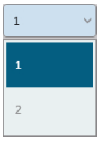
- Table
  - Table Cabinet
  - Tabletop
- Wall Stand
  - Wall Stand Cabinet
- Collimator
- X-ray Tube
  - Starter
- Dosimeter

Note ☞ *Calibration Wizard screens in “System Installation” will be different depending on the configured system in this screen (with or without RAD Table, with or without RAD Wall Stand, different models, options selected...).*

Analog Systems Options: By selecting Table or Wall Stand from other manufacturers than "*Sedecal*", two options are enabled for each component:

- Digital Inputs Configuration: Push the "Gear" button to display a pop-up window consisting of the following elements:
  - Inputs: FS1–FS6 corresponds to the different pins of each connector (J3 and J5). Each option comprises its own parameters selection from the Film Sizes section.
  - Film Sizes: Choose the film size for the FS1–FS6 selected in Inputs section so that the software can recognize the Receptor size inserted.
  - Receptor Alignment with Tube-Collimator Assembly: Drop-down list to select the default Receptor position inside the cabinet (Top/Center/Bottom).
  - Set MAX: Radio button to set the Receptor size detected as the maximum collimator aperture. That is, if a 43x43 Receptor is inserted, the collimator is not allowed to open more than 43 cm.
  - Set FOV: Radio button to set automatically the collimator aperture size as the Receptor size when it is inserted.

Illustration 2-8
Digital Inputs Configuration Window



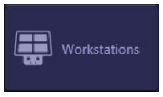
- Positioner Selection**:** A two-option drop-down list allows to select which connectors on an Analog System Kit of the Generator connect to the Table (2 by default) and which to the Wall Stand (1 by default). Option 1 corresponds to Terminal Blocks T1 and T3 of the Analog System Kit; and option 2 corresponds to Terminal Blocks T2 and T4. *(Refer to the Service Information Note of the Analog System Kit for more information on Table and Wall Stand connection)*.

2.2.4 GENERATOR

This procedure must be performed by means of the Generator Service Console installed on any PC or auxiliary console connected to the system and located outside the radiographic room *(refer to Sections 3, 4 & 5)*.

Note ☞ *Any change made with the options available in this menu does not modify the parameters of the Generator. This procedure must be performed by means of the Generator Service Console.*

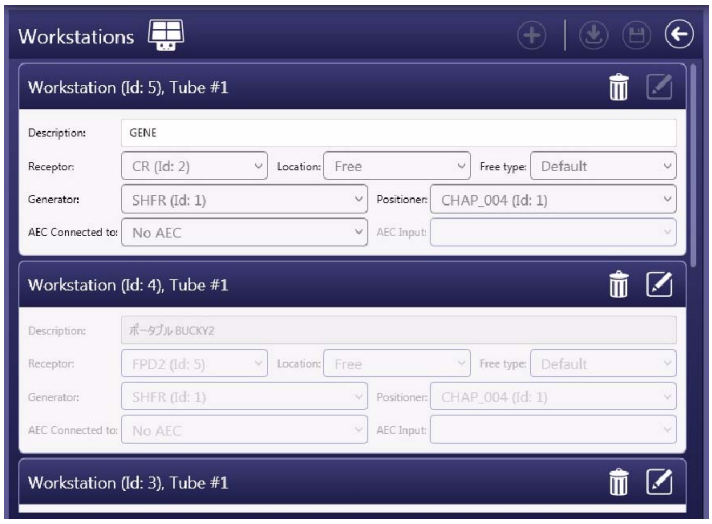
2.2.5 WORKSTATIONS



The workstations can be configured according to the customer preferences. Up to five Workstations can be configured. Set the respective values of each Workstation to be configured (select the new value by clicking on the corresponding option).

- Description: Enables to identify more specifically a workstation.
- Receptor: Receptor selection.
- Location: This field allows, through a drop-down list, to select the workstation location between “Table”, “Wall stand” or “Free”.
- Free type: This field allows, through a drop-down list, to select the type of free location between “Default”, “TableFree” or “WallStandFree”.
- Generator: Enables to indicate the Generator for the system configuration.
- Positioner: This field allows, through a drop-down list, to select the Positioners configurations available.
- AEC Connected to: This field allows, through a drop-down list, to select the Ion Chamber interconnections between “No AEC”, “Generator” or “eBox”.
- AEC Input: This field allows to indicate the interface connector used by the AEC. The valid values are “1” or “2”.

Illustration 2-9
Workstations Configuration Screen



2.3 SYSTEM INSTALLATION

In order to proceed with the System Installation, use the “Generator Setup” and “Positioner setup” options. These menus are used to calibrate the whole system.

Note ☞ *Please, note that you first have to set all the components of the system equipment installed in the room in “System Configuration” (section 2.2). Otherwise, calibration may be incomplete.*

2.3.1 GENERATOR SETUP

This procedure must be performed by means of the Generator Service Console installed on any PC or auxiliary console connected to the system and located outside the radiographic room *(refer to Sections 3, 4 & 6).*

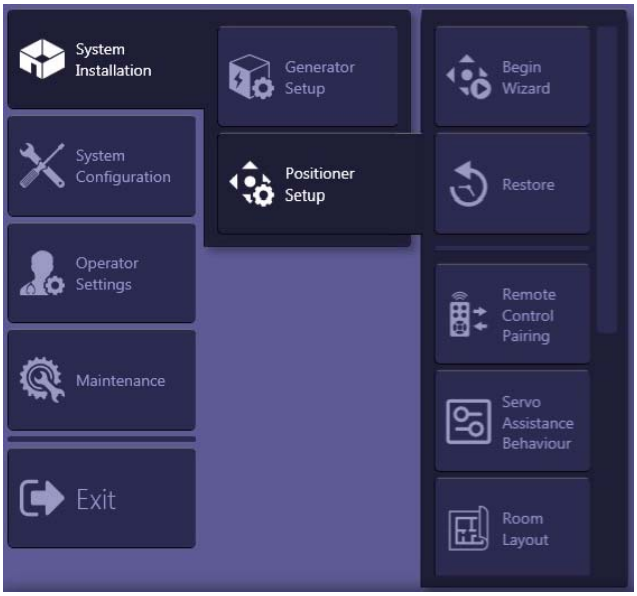
2.3.2 POSITIONER SETUP

The “Positioner Setup” menu is used to calibrate the System components, the Room layout and the Remote Control. The Servo Assistance Behaviour and the proximity sensors of the Overhead Tube Crane are also calibrated using this menu.

Scroll down through the list of options to display all the System configuration options *(refer to Illustration 2-10).*

Note ☞ *Note that the list of available options will depend on the system configured in the option “System Configuration” (section 2.2).*

Illustration 2-10
Positioner Setup Menu



The “Positioner Setup” wizards have some common controls that are described below:

SKIP STEP. Touch to skip the current calibration step.

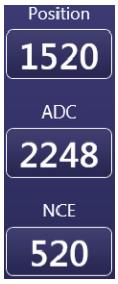
PREVIOUS STEP. Touch to return to the previous calibration step.

START CALIBRATION. Touch to proceed with the calibration step operation.

CANCEL CALIBRATION. Touch to cancel the current calibration operation, once it was started.

RESTART CALIBRATION. Touch to start the calibration step again. This button is only available when the process was successful, canceled or failed.

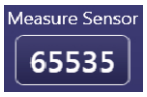
Some calibration steps show some values that determine the position of the system components:



POSITION. Position according to current calibration.

ADC. Value of the Analog-to-Digital Converter of the potentiometer.

NCE. Value of the hybrid motor.



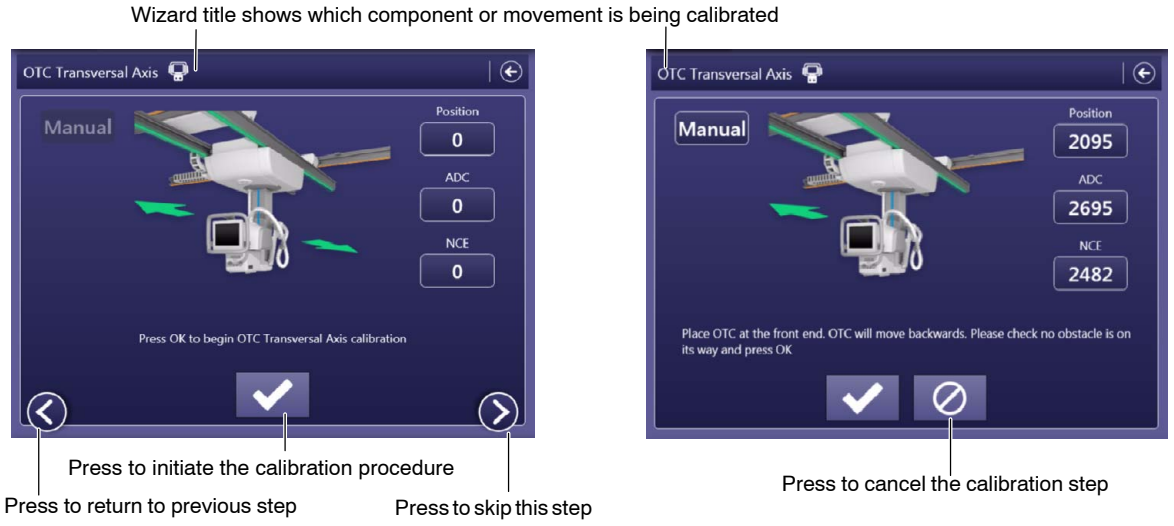
MEASURE SENSOR. Value detected by a proximity sensor.

(Refer to Illustration 2-11 on next page).

Illustration 2-11
Calibration Wizards Navigation

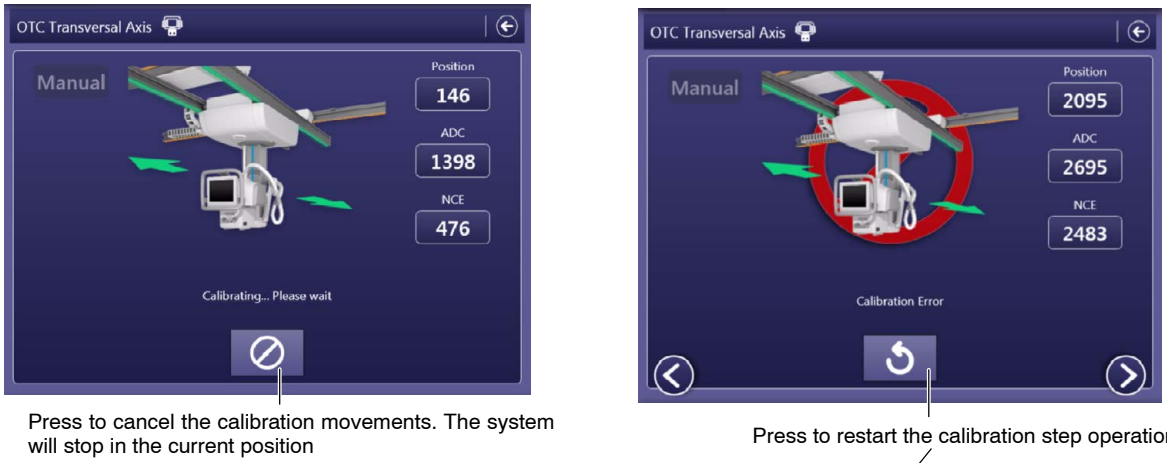
1) Press the start calibration button

2) Follow the screen instructions and proceed with the calibration movements or cancel to return to the initial screen

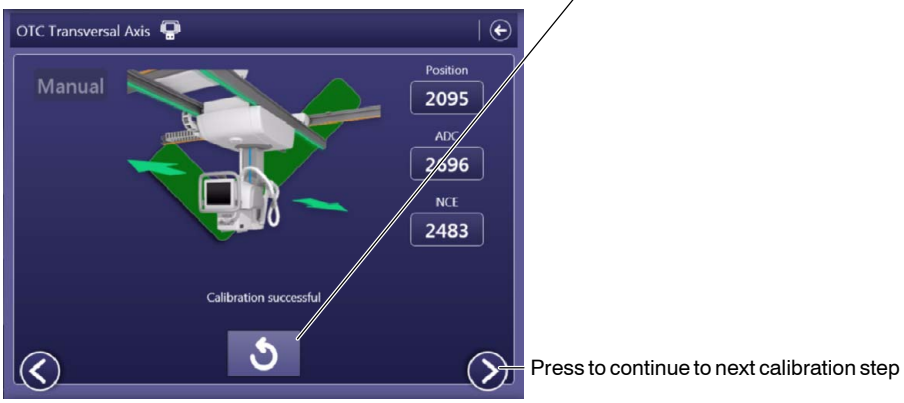


3) Calibration movements in progress

4)Restart calibration step in case of success, error or cancellation

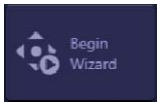


5) Successful calibration message



POSITIONER SETUP WIZARD

This Setup Wizard is the default calibration option for first installation of the System. It includes the calibration of OTC Axis, Positioners, Servo Assistance Sensors and Room layout.

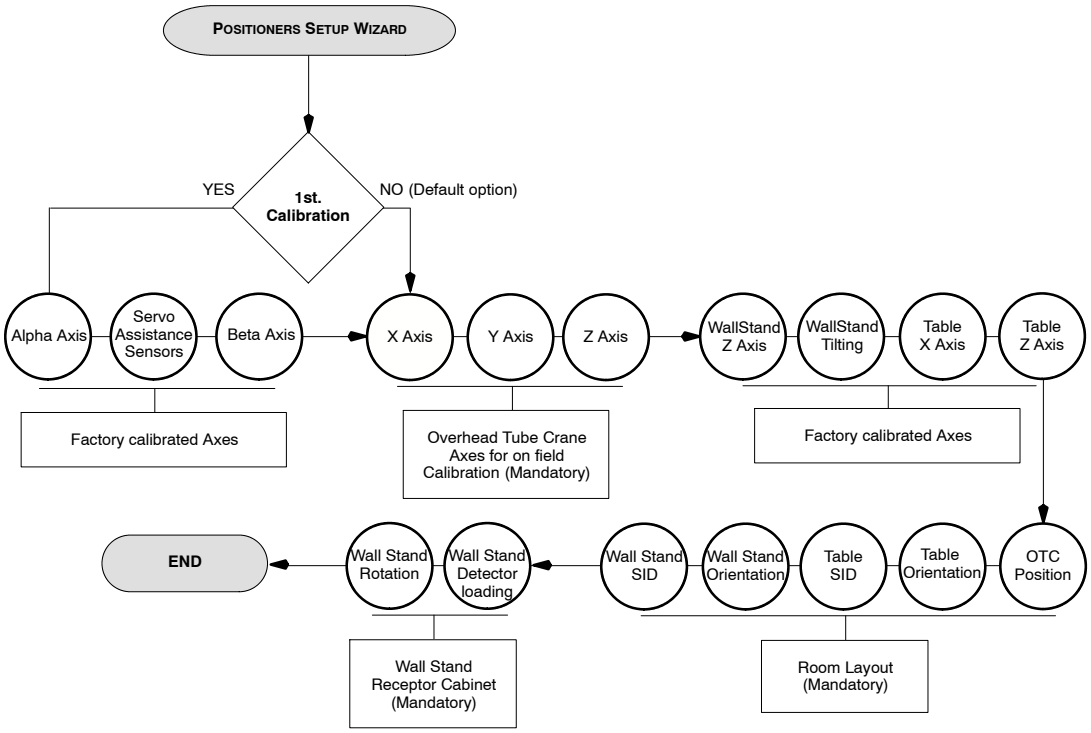


Press the “Begin Wizard” button and follow the instructions displayed on screen. Some calibration steps are factory set, so it is not necessary to perform these steps again upon first installation of the System. Refer to *Illustration 2-12* to check which steps are mandatory when performing the first calibration procedure.

Note ☞ *This X-ray System is partially calibrated and configured in factory according to the requirements of the client. However, changes on field may be required to set definitely the System to the room.*

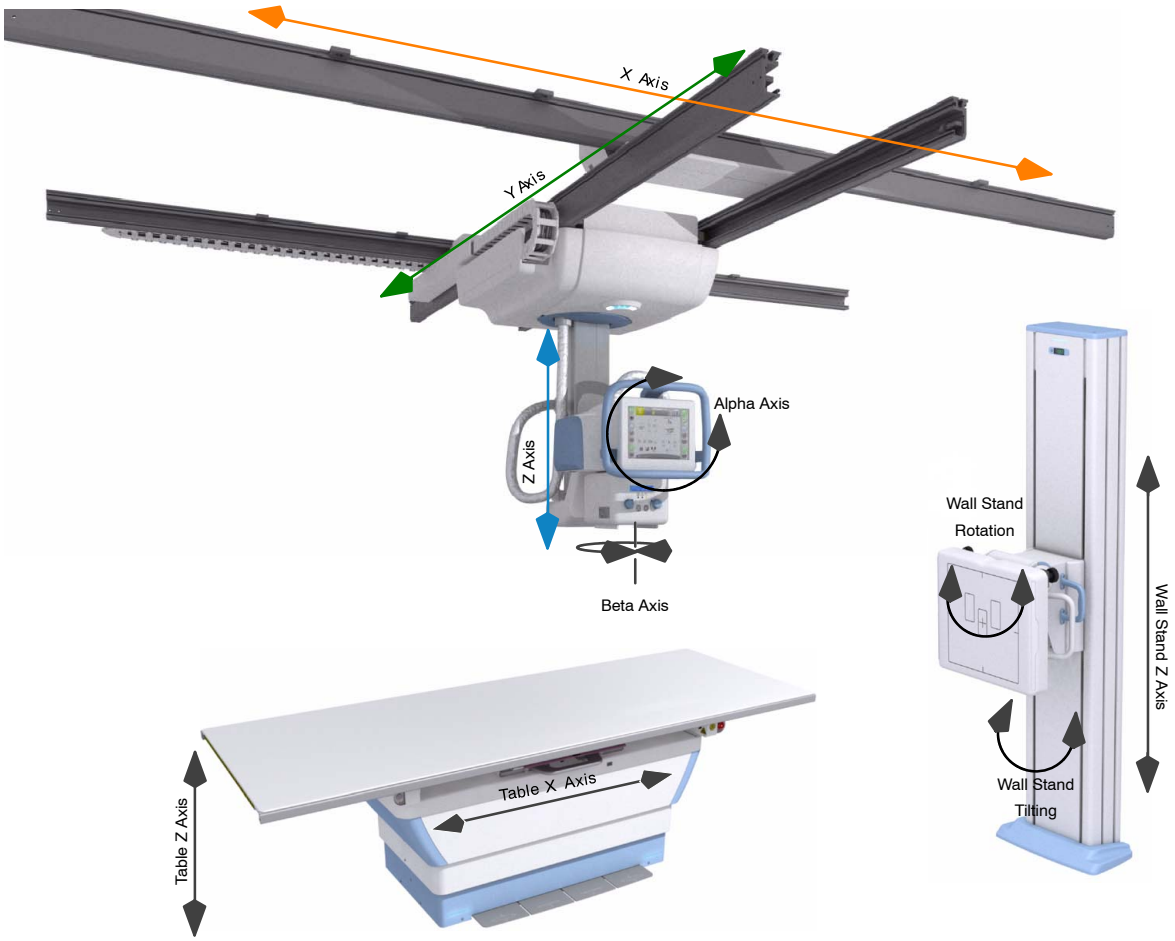
The Calibration procedure workflow is described below:

Illustration 2-12
Calibration Workflow



Check Illustration 2-13 for all axes of the X-ray System. Some of them are factory set *(refer to Illustration 2-12).*

Illustration 2-13
X-ray System Axes



Different calibrations are grouped into four blocks in the wizard:

1. **Factory Calibrated Axes.** Rotation and angulation axis of the Overhead Tube Crane, Servo Assistance Sensors, Horizontal and Vertical movements of the Elevating Table and Vertical and Tilting movements of the Wall Stand are factory calibrated. If any of these axes has to be calibrated on field, follow the instructions on screen. Otherwise, press the arrow icon to skip the current step *(refer to Illustration 2-11)*.

    a. Alpha Axis

    b. Servo Assistance Sensors

    c. Beta Axis

    d. Wall Stand Z Axis

    e. Wall Stand Tilting

    f. Table X Axis

    g. Table Z Axis

Note ☞ *Check Illustration 2-13 for all axes of the X-ray System.*

Illustration 2-14
Factory Calibrated Axes Wizard

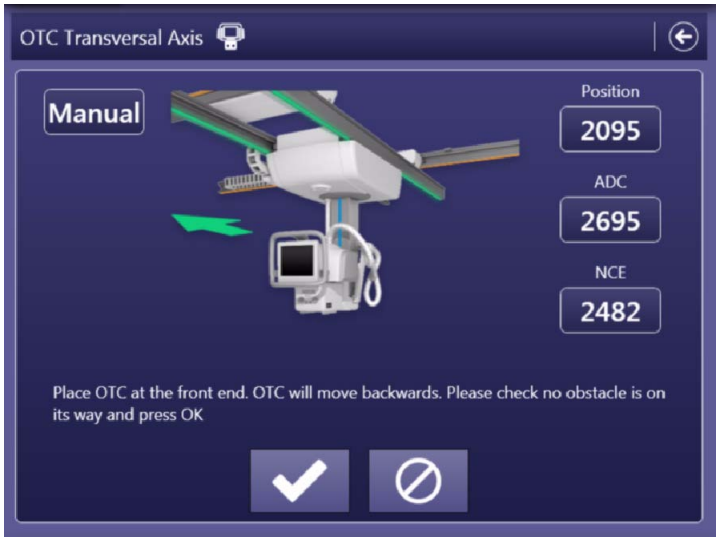
2. **OTC Axes.** Longitudinal, Transverse and Vertical movements of the Overhead Tube Crane have to be calibrated on field, since these axes calibration depend on the rails length and on the ceiling height.

   a. X Axis

   b. Y Axis

   c. Z Axis

Illustration 2-15
OTC Axes Wizard



3. **Room Layout.** It is necessary to set the Table and Wall Stand positions on the room, as well as the SID with the Tube.

   a. OTC Position

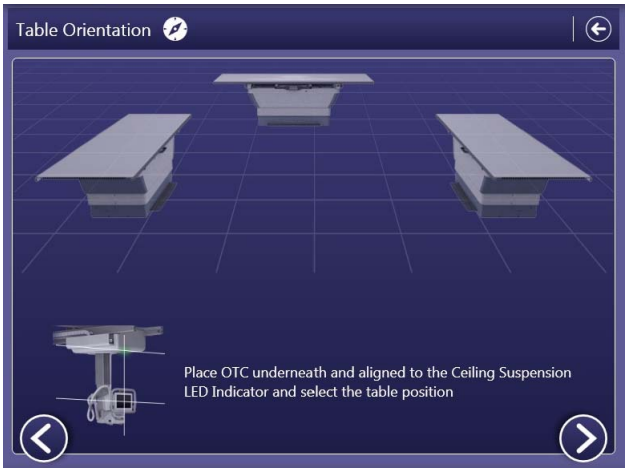
   b. Table Position

   c. Table SID

   d. Wall Stand Position

   e. Wall Stand SID

Illustration 2-16
Room Layout Calibration Wizard



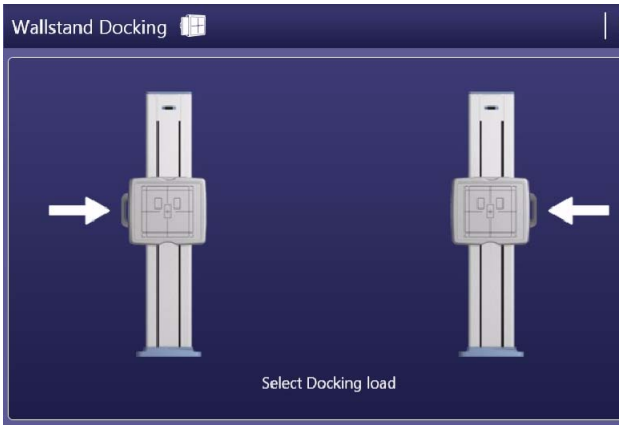
Note ☞ *Some calibration steps require an item selection other than common buttons.*

4. **Wall Stand Receptor Cabinet.** Wall Stand Detector Loading and Rotation (if installed) have to be calibrated on field.

   a. Wall Stand Detector Loading

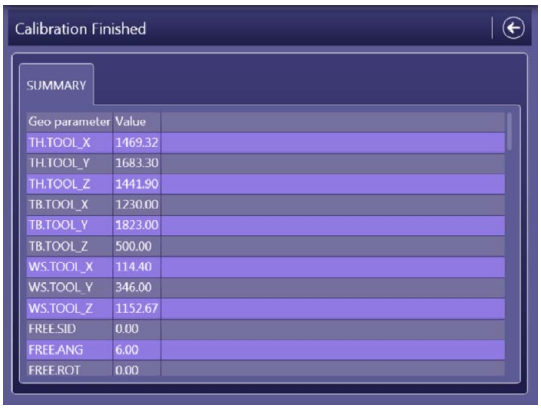
   b. Wall Stand Rotation (only if installed)

Illustration 2-17
Wall Stand Receptor Cabinet Wizard

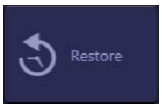


5. **Calibration Finished.** It shows a list summarizing all values stored in each calibrations steps.

Illustration 2-18
Calibration Finished Window



2.3.2.1 RESTORE

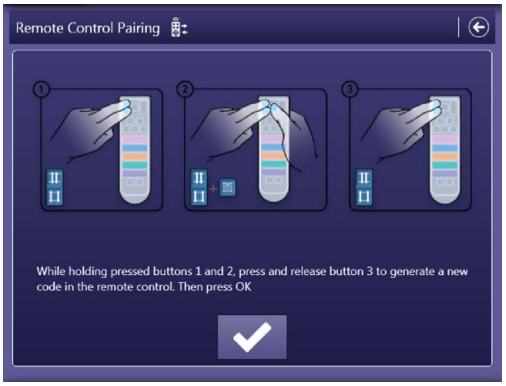


For information about the Restore function, *refer to Section 2.5.5.*

2.3.2.2 REMOTE CONTROL PAIRING

To calibrate the Remote Control, follow the instructions on screen. Just press the indicated buttons pointing the Remote Control at the Overhead Tube Crane and wait for the confirmation on screen. A confirmation message will be displayed once the pairing process has finished. If there were any problem during the Remote Control calibration, an error message would be displayed indicating the situation.

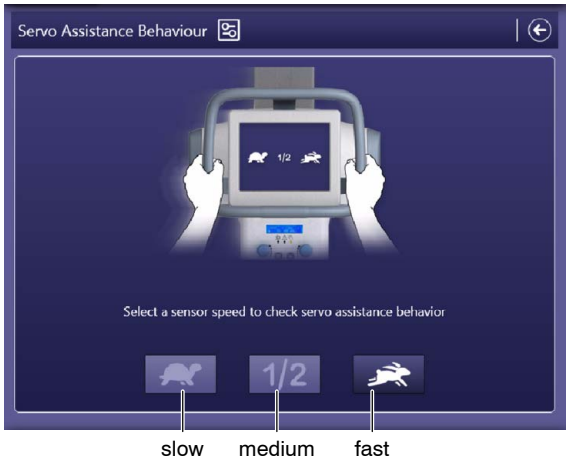
Illustration 2-19
Remote Control Pairing



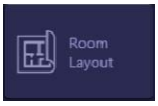
2.3.2.3 SERVO ASSISTANCE BEHAVIOUR

Select the desired speed of the servo-assisted movement of the Overhead Tube Crane, which is controlled from the Control Console steering wheel. Available options are *slow*, *medium* and *fast*.

Illustration 2-20
Servo Assistance Behaviour



2.3.2.4 ROOM LAYOUT

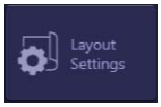


This option is intended for the specific calibration of the system with regard to the room's geometry and the location of the components. All the mandatory steps related to Room Layout are included in the Setup Wizard, and they cover all necessary procedures to set the Table and Wall Stand positions on the room, as well as the SID with the Tube (*refer to Illustration 2-12*).

This calibration block includes:

- OTC Position
- Table Orientation
- Table SID
- Wall Stand Orientation
- Wall Stand SID

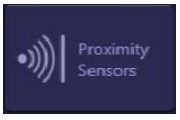
2.3.2.5 LAYOUT SETTINGS



From this window you can set the travel ranges (or offsets) of each of the axes of the system components in terms of the room's geometry.

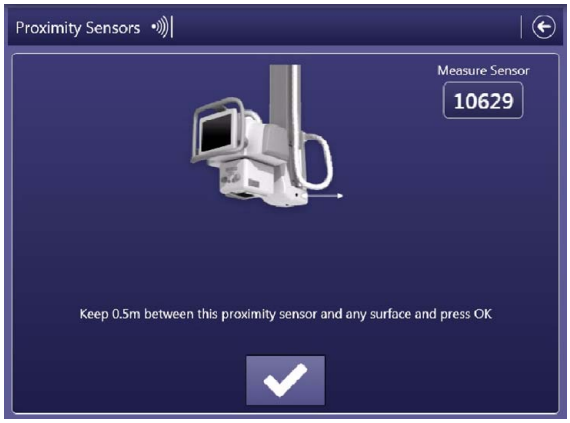
Illustration 2-21
Layout Settings

2.3.2.6 PROXIMITY SENSORS



The Overhead Tube Crane is equipped with four proximity sensors. Each sensor is oriented to each side of the Beta Axis, at left, right, back and bottom. To calibrate them, place any object or obstacle with a flat surface at the required distance from the sensor in calibration when indicated on screen and follow the instructions. Each sensor has to be calibrated with an object/obstacle at 0.5 meters (19.7 inches) and 1.5 meters (59.1 inches).

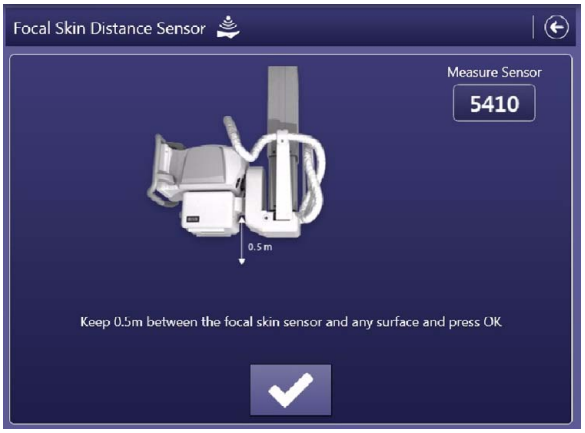
Illustration 2-22
Proximity Sensors Wizard



2.3.2.7 FOCAL SKIN DISTANCE SENSOR

The Overhead Tube Crane is equipped with a sensor to calculate the Focus to Skin distance. To calibrate this sensor, place any object with flat surface at the required distance from the sensor, measuring the distance from the lower part of the sensor as indicated on screen, and follow the instructions.

Illustration 2-23
Focal Skin Distance Sensor Wizard



2.3.2.8 TROUBLESHOOTING

This option is intended to support service personnel in the process of troubleshooting. The screen shows a table with several values concerning the hardware of the system, the dockings (Table, Wall Stand), the servo-assisted movements and the anticollision sensors.

To verify the proper operation of the system, it is advisable to check that these values change as the different components of the room move.

The displayed parameters can be:

- Hardware
  - Axis (Movement Direction)
  - Type (Type of Motor)
  - Position (Axis Position)
  - POT Pos (Potentiometer Position)
  - NCE Pos (Non Contacting Encoder Position)
  - RES Pos (Resolver Position)

- ENC Pos (Encoder Position)
- POT (Potentiometer Counts)
- NCE (Non Contacting Encoder Counts)
- RES (Resolver Counts)
- ENC (Encoder Counts)
- Motor Current (mA)
- Vsupply (Voltage Supply)
- Motor temp (Motor Temperature)
- PBA temp (Board Temperature)

- Dockings
  - Docking (Table/Wall Stand)
  - HW signals (Hardware Signals)
  - Tray (Tray Status)
  - Detector (Detector Status)
  - P/L [Detector Orientation (Portrait/Landscape)]
  - Detector size
  - Assembly [Detector Position (Top/Center/Bottom)]
  - Grid signals
  - Grid (Grid Status)
  - Film signals
  - Assembly signals

- Servoassistance
  - Name (Type of Servoassistance Sensor)
  - Measure
  - Calibration
  - Raw

- Filtered
- Current (mA)
- Speed (mm/sec)

- Distance Sensors
  - Anticollision sensor (Focal Skin Distance/Right/Left/Back/Down)
  - Distance (cm)

Illustration 2-24
Troubleshooting Window

2.4 OPERATOR SETTINGS

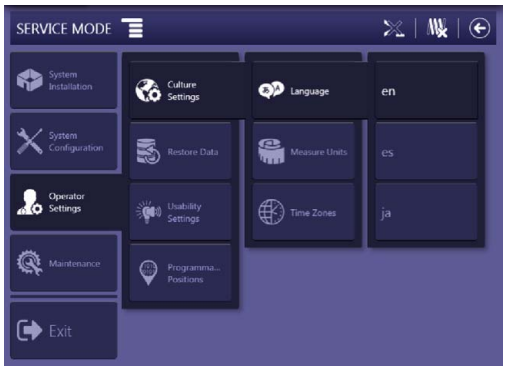
"Operator Settings" menu includes multiple aspects of system operation such as visualization, usability, or programmable positions configuration.

2.4.1 CULTURE SETTINGS

LANGUAGE

Tap the "Language" button to switch between English, Spanish and Japanese. The Service Mode and the User application will be automatically updated to match the selected language.

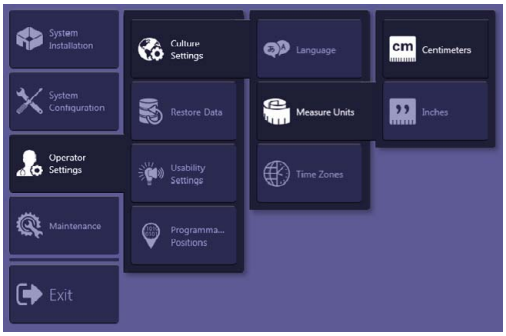
Illustration 2-25
Language Selection



MEASURE UNITS

Use the "Measure Units" button to switch between the Metric system and the American/Imperial system. Available options are "Centimeters" or "Inches".

Illustration 2-26
Measure Units selection



Note ☞ *It is necessary to reboot the Console to apply the change of Measurement Units, but not the whole system.*

TIME ZONES

Use the “Time Zones” button to to select the relevant time zone. Press the “Save” button to store the selected zone.

Illustration 2-27
Time Zone Selection

2.4.2 RESTORE DATA

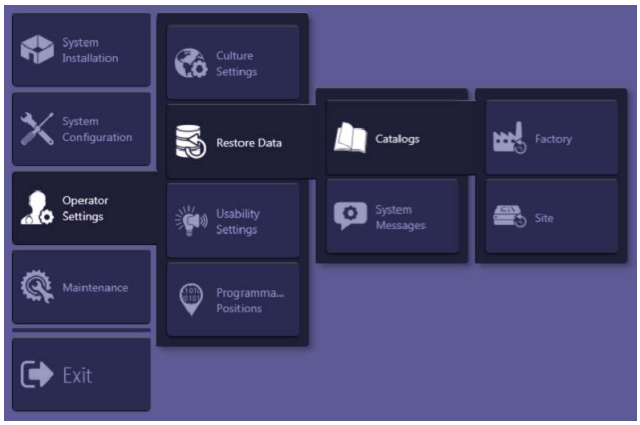
The “Restore Data” option is intended to recover some specific data related to Culture Settings group. There are two types of restoration:

- **Catalogs:** Enables the restoration of lists of system options as those selectable in System Configuration menu (Image Receptors, Positioners or Workstations) that could have been modify according to the customer’s preferences.
- **System Messages:** Enables the restoration of the default or previous system messages lists and their properties, which could have been modify according to the customer’s preferences.

For each of the two options, it is possible to perform the restoration of a previously generated backup or the original factory system data. The available options are:

- **Factory.** Press this button to restore the system's factory data.
- **Site.** Press this button to recover a backup stored in the equipment memory.

Illustration 2-28
Restore Data Option



Note ☞ *For additional information about the Restore function, refer to Section 2.5.5.*

2.4.3 USABILITY SETTINGS

The "Usability Settings" window is used to set some certain functional settings related to the way in which acoustic and visual signals are emitted/displayed, the collimator, the motion policy, etc.

SOUND SOURCE

In this section, each of the available system components can be selected as source of acoustic signals.

SOUND SETTINGS

This section allows the activation/deactivation of acoustic signals in the following situations:

- System moving
- System moving within Safety Area
- Target reached
- Error in System
- Exposure
- Minimum Exposure Time (minimum exposure time for acoustic signals can be set here)
- Target Reached Sound (sound selection for target reached)
- Positioner Error
- Positioner Exposure

COLLIMATOR SETTINGS

- Lamp On Time: Set the period of time (in seconds) during which the collimator lamp remains on when it is activated during the operation.
- Lamp On Automatically: Enables to activate the default automatic policy regarding collimator lamp turn-on.
- FOV Inversion: Activation/Deactivation of inverted Field Of View.

MOTION POLICY SETTINGS

- Distance to top position for 'Inverted U': This field allows to set the distance (in centimeters) to the top position for "Inverted U".
- Activation of Grab and Go Move after position selection: By selecting this checkbox the Auto-center function will be automatically activated after selecting an Auto-position.
- Activation of Grab and Go Move Tracking axis after positioning: By selecting this checkbox the Auto-tracking function will be automatically activated after positioning.
- Time to Activate Tracking Axis after positioning: This field allows to set the time (in milliseconds) in which Auto-tracking remains active after reaching the position.

- Distance to activate double speed for Tracking: Enables to set the distance (in millimeters) in which the double speed for tracking is activated.
- System stops when new position selection: When this parameter is activated, system will stop (if it was in motion) whenever a new auto-position is selected.
- Autocenter extension enable by remote: By selecting this checkbox the Auto-center function can be activated by the Remote Control.
- Safety/Patient areas enabled for manual movements: Selection of this checkbox enables the movement limitation when the positioner enters the Safety Area and movement inhibition when it exceeds the limits of Patient Area.
- Servoassistance mode: Servoassistance mode selection.
- Motor Phase Check interval. This field allows to set the frequency (in minutes) at which the servo drive of the OTC vertical axis checks that the motor cable is properly punctured.
- Focal point to table detector surface margin distance. This field allows to set the minimum distance (in millimeters) required between the focal point and the detector surface to move the Tube-Collimator Assembly over the Table. If this distance is not reached, the system prevents displacement in order to avoid collisions.
- Use wheel as bumper. Selection of this checkbox enables the use of the steering wheel as a collision detector (if excessive vibration is detected during an automatic movement launched from the remote control, the movement stops in order to prevent collisions).

OMNI AXES

By selecting the OMNI checkbox, the button to release several axes at the same time is displayed in the Control Console. All other fields (Alpha, Beta, X, Y, Z) indicate which axes are released by grabbing the steering wheel in case the previous button is pressed.

If only the OMNI checkbox is selected in the “OMNI axes” section, the button to release several axes at the same time appears in the Control Console, but cannot be enabled.

SERVOASSISTANCE

- Calibration weight. This field indicates the force (in kilograms) at which the maximum speed is reached during OTC handling.
- OTC_Z speed. This field allows to set the maximum speed (in mm/sec) of the Z axis in servoassistance mode.
- Full calibration. Selection of this checkbox allows to enable the weight calibration of the servoassistance sensors. In this case, the calibration must be performed by using Counterweight Tools placed on both sides of the Control Console Wheel.

DAP

This section indicates the waiting time (in milliseconds) from the end of the exposure until the dosimeter measurement is read.

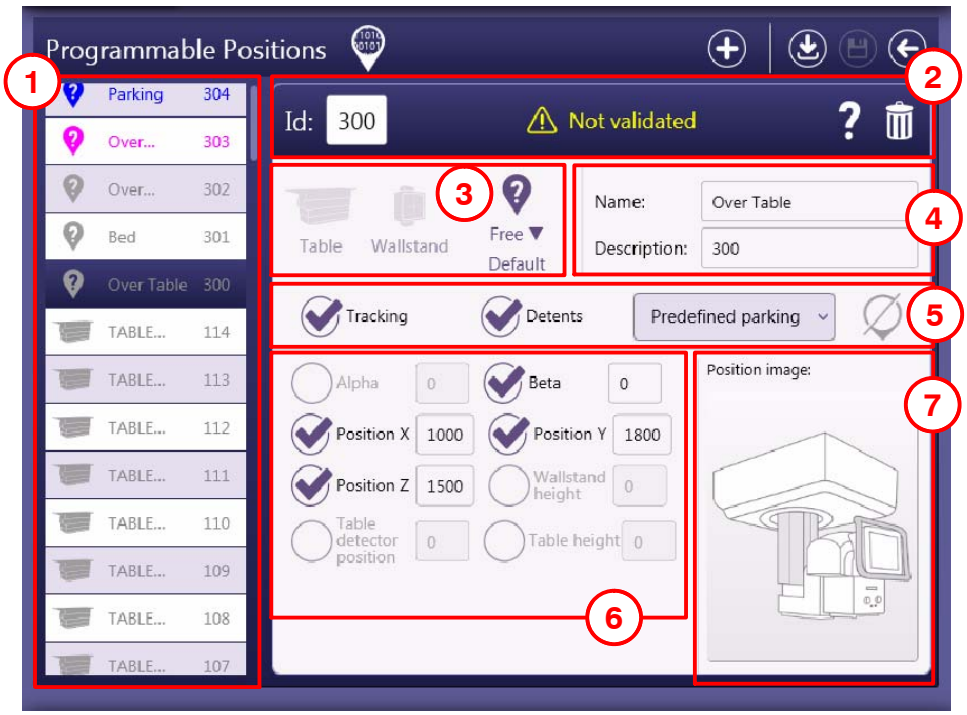
Illustration 2-29
Usability Settings

2.4.4 PROGRAMMABLE POSITIONS

The “Programmable Positions” window is used to configure new Auto-positions or edit/erase the existing ones. Besides the list of different Auto-positions for Wall Stand, Table or Free, the Predefined Positions (*P1*, *P2*, *P3*, *P4*) and the Parking Position can be defined in this screen.

Below are detailed the different sections that compose this window and all the options it contains.

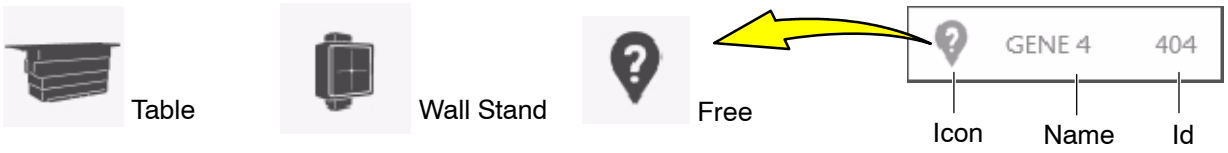
Illustration 2-30
Programmable Positions Window Main View



1. **Programmable Positions List.** It shows the complete list of system positions. Tap on the desired position to edit its parameters.

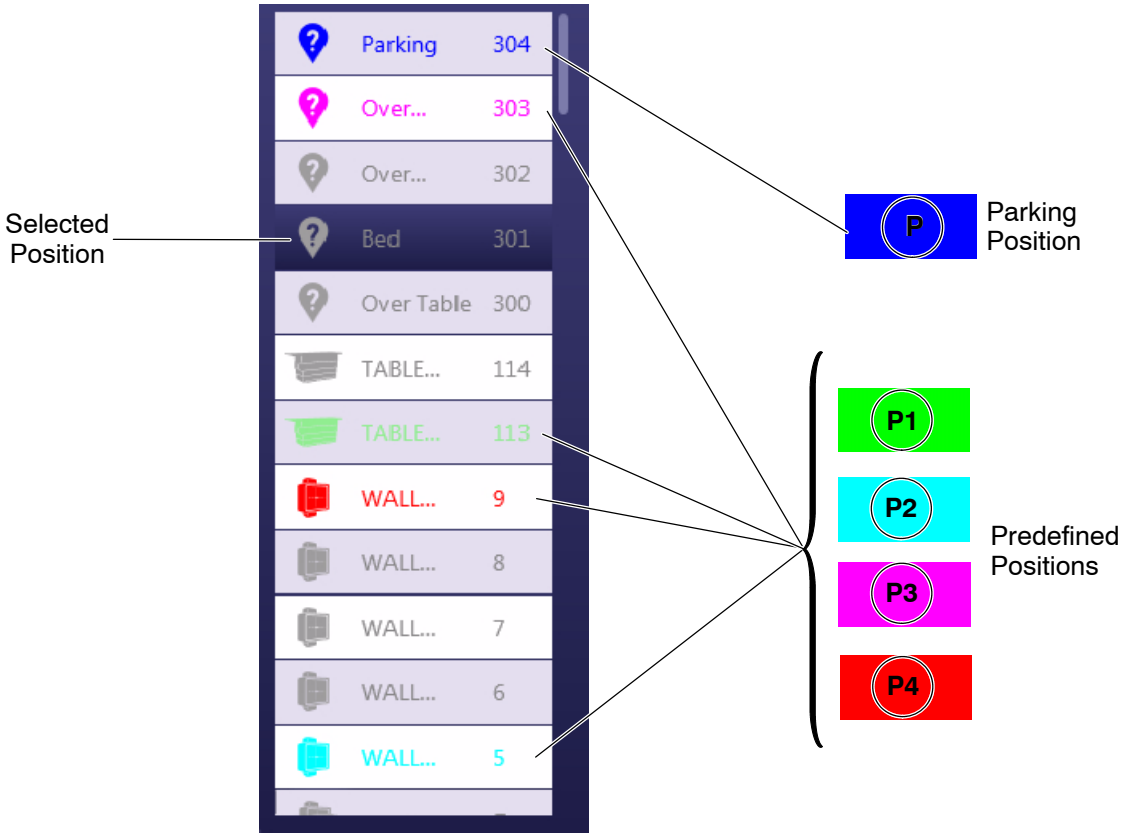
   Each position is represented by an icon (which indicates the Workstation selection), the name that has been designated and the ID number that identifies it.

Illustration 2-31
Workstation Icons



If a position in this list is highlighted in a color, it means that it has been designated as a predefined position (*P1, P2, P3, P4*) or as a parking position.

Illustration 2-32
Positions List and Colors Legend



2. **Identification Bar**. This bar is the main element by means of which to identify and operate with the selected position. It is present at the top of the Programmable Positions Window and contains the following features:

- **Id:** Numeric text field that allows to modify the position Id for another one that is not already being used.

- **Position validator:** Tap on the question mark button to verify that selected position is reachable. This means that the values entered in the Position Parameters Area are within the range limits of each axis.

The status of this validation, which is always displayed in the center of the bar, include: "*Not validated*" (the current parameters have not been validated), "*Reachable*" (the position is within the range limits) or "*Not reachable*" (the parameters of this position are not valid).

Illustration 2-33
Reachable Position Display

- **Erase programmable position:** Tap on this button to remove the selected position. A pop-up window will require the removal confirmation.

3. **Workstation Selection Area.** This area is used to select the workstation to which the selected position will be associated (Table, Wall Stand or Free).

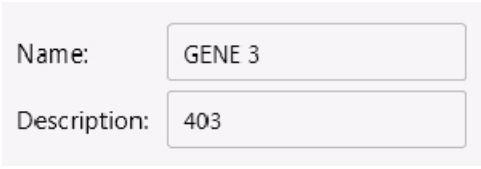
   The Free selection has a drop-down list to select from among this options:

   - Default: for Direct exposure by default.
   - TableFree: enables new Table fields for entering values in the Position Parameters Area.
   - WallStandFree: enables new Wall Stand fields for entering values in the Position Parameters Area.

Illustration 2-34
Workstation Selection Area

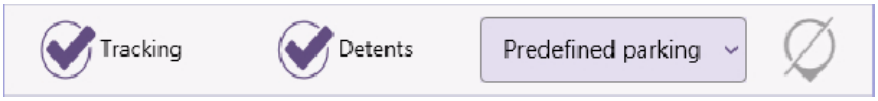
4. **Description Area.** Two text fields allow to designate a name and description for the selected position.

Illustration 2-35
Description Area



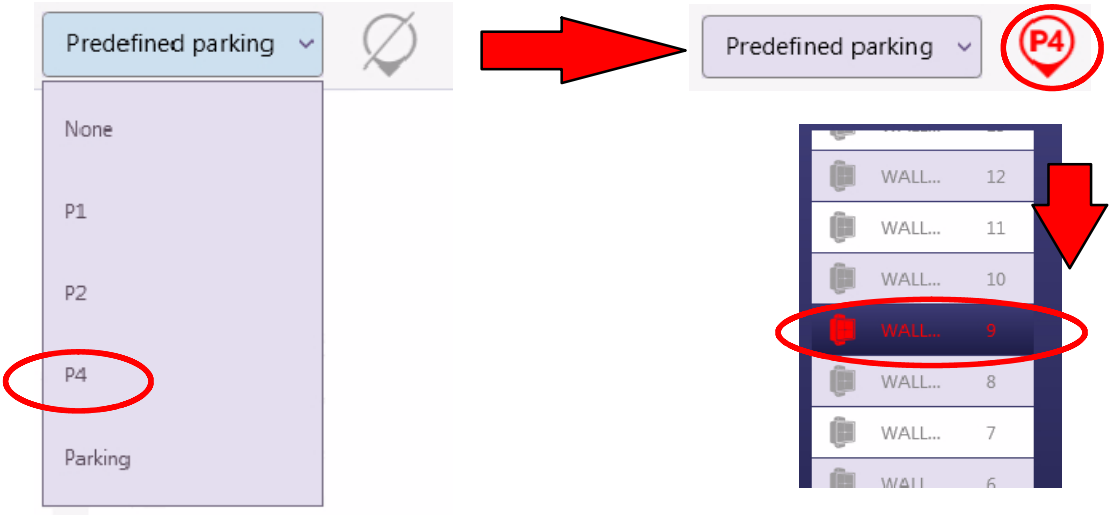
5. **Position Type Selection Area.** The main purpose of the fields in this area is to designate the typology of the programmable position, which can be set as Predefined Position, Parking Position or as a generic Auto-position.

Illustration 2-36
Position Type Selection Area



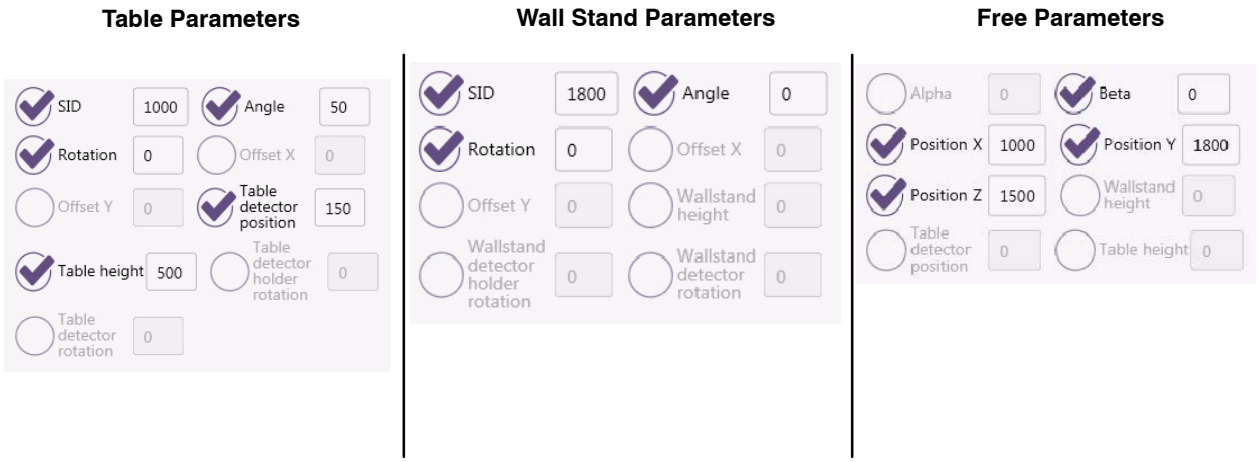
To set the selected position as a Predefined or Parking Position, tap on the type selection drop-down list and select the desired one. Once pressed, the left icon displays the selected option turned into the relevant color as same as the Positions List.

Illustration 2-37
Position Type Selection Area



6. **Position Parameters Area.** This area is where the axes coordinates and values of distance, angulation or rotation of the position can be defined. Depending on the selected Workstation (Table, Wall Stand or Free), different parameter fields for setting the position will be displayed.

Illustration 2-38
Position Parameters Area



To set each parameter, firstly activate its corresponding radio button by pressing it. Then enter the desired value in the text field.

7. **Image Selection.** Tap on this area (Position image) to access the picture gallery of positions.

Illustration 2-39
Image Selection Area

Select the image with which the position has to be designated. By default, the picture gallery displayed is the one pre-installed with the Console software and it is represented by the *star* icon.

Illustration 2-40
Picture Gallery of Positions

In order to select other pictures than the pre-installed ones, press the “Saved pictures” icon to access other galleries available on the PC Workstation.

2.4.4.1 ADDING A NEW PROGRAMMABLE POSITION

To add a new Programmable Position, tap on the “*Add*” button. A new item is created in the Programmable Position List and a new blank PP window is displayed, both with an automatically assigned ID.

Fill in the fields in each section of the window (described in *Section 2.4.4*) to define the new PP and tap on the “*Save*” button to store it.

2.4.4.2 MODIFYING OR DELETING A PROGRAMMABLE POSITION

For detailed information on editing or deleting Programmable Position, refer to *Section 2.4.4*.

2.5 MAINTENANCE

The “Maintenance” menu is used to check the system information (components versions, license functionalities), generate logs and recover backups.

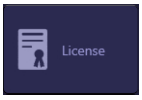
Illustration 2-41
Maintenance Options

2.5.1 SOFTWARE / HARDWARE VERSIONS

Press the “Software / Hardware Versions” button to display the software and hardware versions of all the system components. Press the “Back” button to go back to the main menu.

Illustration 2-42
Software / Hardware Versions Screen

2.5.2 LICENSE



Press the “License” button to display all the system functionalities (Standard and Extended) enabled by license. Press the “Back” button to go back to the main menu.

Illustration 2-43
License Window

2.5.3 SYSTEM LOGS

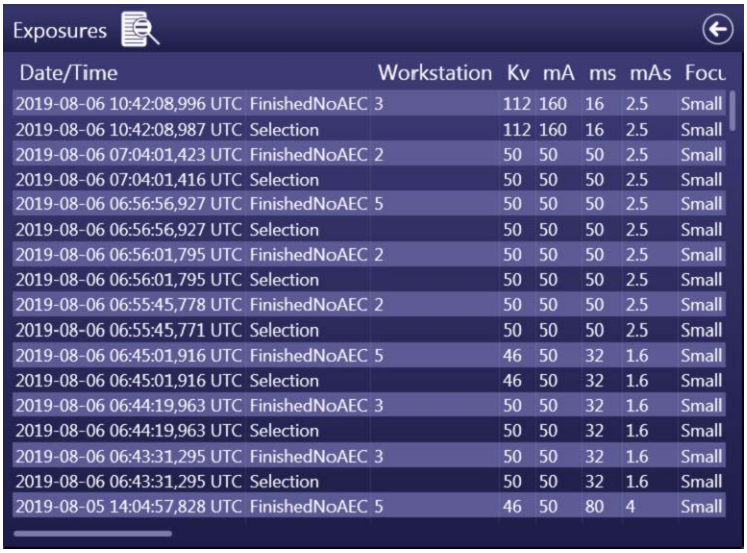
The purpose of the “System Logs” menu is to display the log files generated by the system, as well as to enable them to be exported.

Illustration 2-44
System Logs Menu

The available options are:

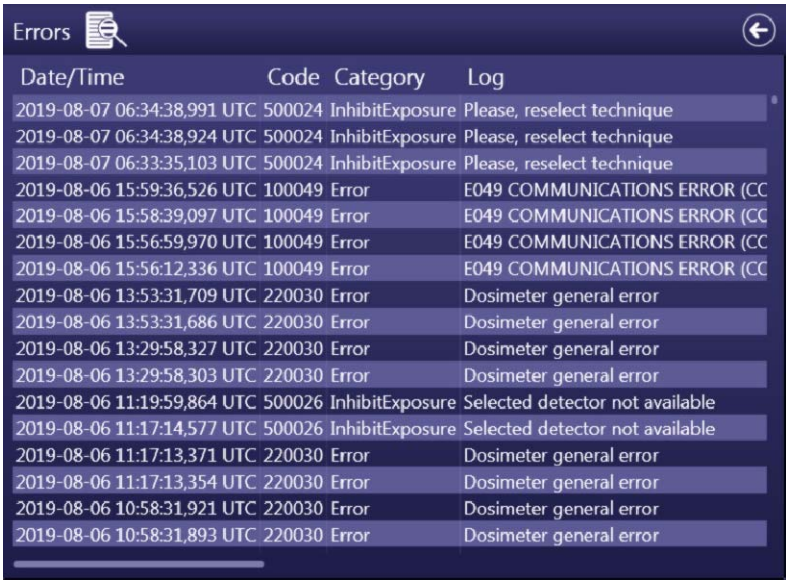
- **Exposures.** Press this button to display the record of all the exposures performed with the system.

Illustration 2-45
Exposures List Window



- **Errors.** Press this button to display all the errors (and other system messages) stored during system operation.

Illustration 2-46
Errors List Window



Note ☞ *The generation of error log files (System Snapshot) is available in the Message History window of the Operator Mode (refer to Operation Manual for further details).*

- **Export to USB Drive.** Press this button to export the log files to a USB flash drive. (This option is only available when an operating memory stick is connected to a USB port).

2.5.4 BACKUP

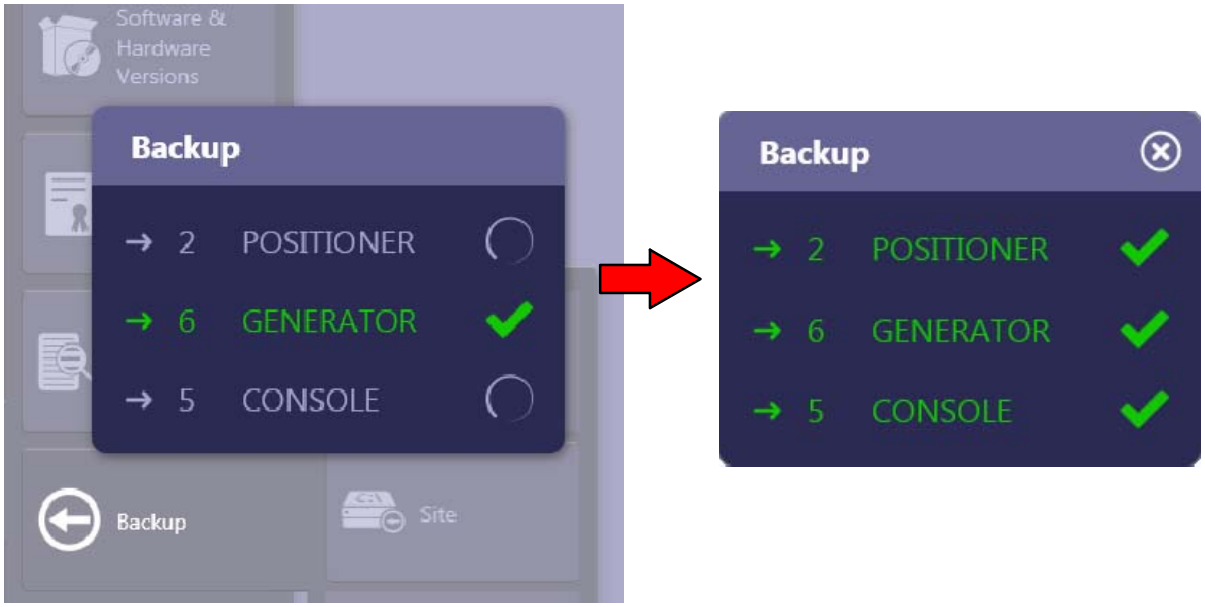
The “Backup” menu enables the generation of recovery files with the configuration of all system settings for each component. The available options are:

- **Factory.** The backup with the default settings is set only once in factory. Afterwards, this option will always remain disabled.
- **Site.** Press this button to generate a backup of the current system settings in the equipment memory.
- **USB Drive.** Press this button to generate a backup of the current system settings in USB flash drive. (This option is only available when an operating memory stick is connected to a USB port).

Illustration 2-47
Backup Menu

Regardless of the option selected, a pop-up window will show the progress of backup generation for each component. Once the backup export is finished, press the “Close” button to return to the menu.

Illustration 2-48
Backup Generation



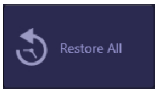
The different statuses of the Backup capture can be:

Backup export in progress

Successful backup export

Failed backup export

2.5.5 RESTORE ALL



The “Restore All” menu enables the restoration of a previously generated backup or the system’s factory settings. The available options are:

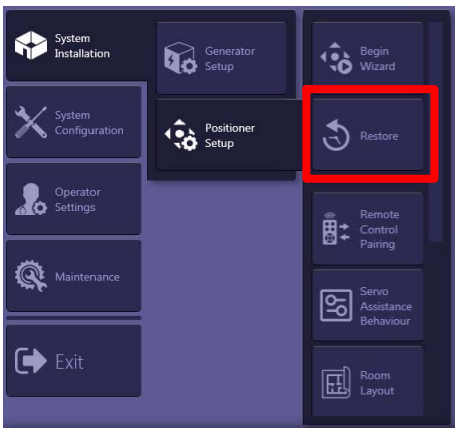
- **Factory.** Press this button to restore the system’s factory settings.
- **Site.** Press this button to recover a backup stored in the equipment memory.
- **USB Drive.** Press this button to restore a configuration backup stored in a USB flash drive. (This option is only available when an operating memory stick is connected to a USB port).

Illustration 2-49
Restore All Menu

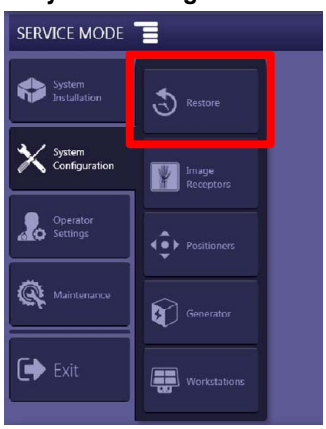
Note that System Installation and System Configuration menus have an specific Restore option for each settings group.

Illustration 2-50
Restore Options in Other Setting Menus

System Installation



System Configuration

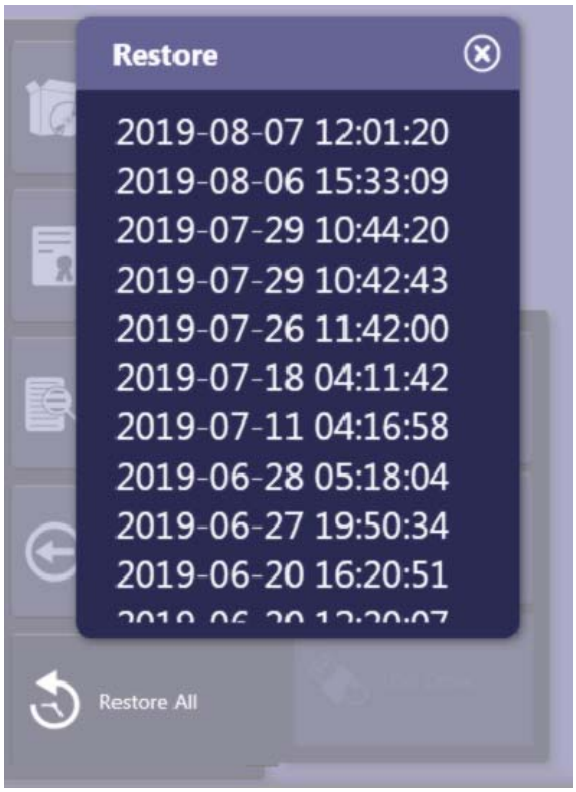


The Restore function works in the same way in these menus, but only recovering the settings they contain (System Installation/Calibration and System Configuration). However, the Restore All option restores all stored configuration data and settings for each of the Service Mode menu options.

To restore all data, proceed as follows in the Maintenance Menu:

1. If the option selected was “Site” or “USB Drive”, a pop-up window will display the stored backup files, which are identified by creation date and time (*see Illustration 2-51*). Select the desired backup.

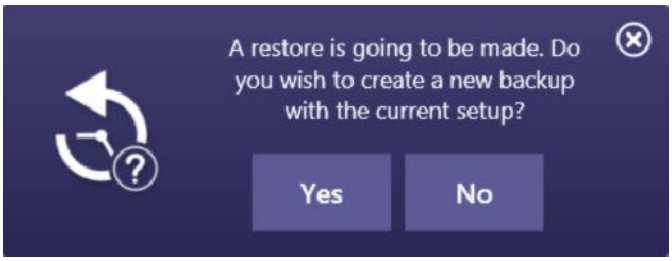
Illustration 2-51
Backup Selection



2. Regardless of the option selected (”Factory”, “Site” or “USB Device”), since the saved configuration will be deleted, a pop-up confirmation window will offer the possibility of making an automatic backup of the current configuration so as not to lose the data.

   - Press “Yes” to proceed with the restoring process by creating a new backup.
   - Press “No” to proceed with the restoring process without creating a backup.
   - Press the “Close” button to cancel the restoring and return to the menu.

Illustration 2-52
Restore Confirmation Window



3. A pop-up window shows the progress of the restoring process. Once all the system settings have been restored, press “Close” to confirm and the Console will boot up.

SECTION 3 PRELIMINARY CONSIDERATIONS TO GENERATOR CONFIGURATION & CALIBRATION

Generator Configuration & Calibration provides information and procedures to perform all the adjustments required to establish an optimal performance of this Generator.

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.

3.1 SYSTEM INTERCONNECTION

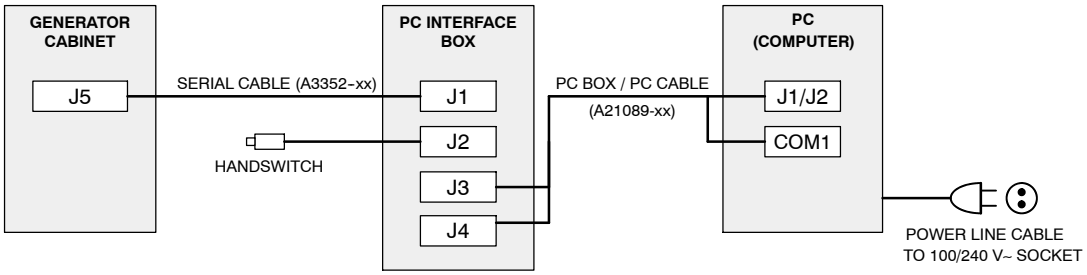
This section identifies the System Interconnection needed for Generator Configuration & Calibration.

The Generator must communicate directly to the PC in order to perform the Configuration & Calibration procedures. For this reason, the OTC must be disconnected from the PC before starting the Generator Configuration & Calibration.

Perform the following connections:

1. Remove the Back Cover of the PC Interface Box.
2. Disconnect the RS232 cable (S0021936-XX) from COM1 of the PC (*refer to Installation Manual and DI 6070300 of the Schematics document*).
3. Disconnect the COM1 connector of the Interface Box-Computer Cable (A21089-XX) from the RS232 adapter conected to the RS232 cable from COM2 of the OTC (*refer to Installation Manual and DI 6070300 of the Schematics document*).
4. Connect the COM1 connector of the Interface Box-Computer Cable (A21089-XX) to COM1 of the PC.
5. Re-install the Back Cover of the PC Interface Box.

Illustration 3-1
Interconnections with the A16296-XX Interface Box



Note ☞ *Once the Generator configuration and calibration procedures are completed, the OTC must be reconnected to the PC* (*refer to Installation Manual and DI 6070300 of the Schematics document*).

3.2 INITIAL CONFIGURATION PROCEDURE

Configuration provides the initial settings that define the functional characteristics of this Generator.

All the Calibration and Configuration data are stored in a non-volatile memory chip (U66-EEPROM) located on the A3640-XX Control board. Other information, such as serial number, version and revision; is also stored in the EEPROM.

Note ☞ *A backup copy of the configuration data is automatically stored in the computer once the configuration procedure is finished.*

The Generator configuration is determined by:

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

The Generator characteristics, power, options and allowed configuration are saved in a license key plugged to J17 on the A3640-XX Control board.

Check that all the information, system requirements and kW power saved in the licence key are correct (*refer to Section 2.5.2*). In the event that the licence is not plugged or the I2C Bus access is failing, error 47 will be displayed. If the licence has not been burned or it is defective, error 61 will be displayed.

These errors are displayed when turning on the Generator. In this case, the equipment remains in demo mode with only 5 kW power. No X-ray will be allowed in demo mode.

3.2.1 GENERATOR SWITCHES

The system configuration and test switches are:

DIP SWITCH LOCATION	FUNCTION
3640SW2 - Control board	Not used for Configuration
3640SW6 - Control board	Test
3640SW7 - Control board	Not used for Configuration
S0008009S1 - Dual Speed Starter board	Not used for Configuration

3.2.1.1 3640SW2 - CONTROL BOARD

Dip switch 3640SW2 is not used for configuration but all its switches must be set to **On**.

3.2.1.2 3640SW6 - CONTROL BOARD

Dip Switches 3640SW6-2 and 3640SW6-4 can be configured with the Generator ON, there is no need to turn it OFF to modify their position. Other switches modification require to reboot the Generator to apply the changes.

Set dip switch 3640SW6 as indicated in *Table 3-1.*

Table 3-1
Test Dip Switch 3640SW6 on the Control board

3640SW6 POSITION	OPEN (OFF)	CLOSED (ON)
1	Not used. *Set to OFF.*	Not used.
2	Normal.	Disables Hardware errors.
3	Normal.	Demo mode (no X-ray).
4	Normal.	Disables the filaments[1].
5	Normal.	Disables Dosemeter.
6	Not used. *Set to OFF.*	Not used.
7	Not used. *Set to OFF.*	Not used.
8	Normal.	Initializes the EEPROM[2].

Note.— 1) This turns off the filaments so no radiation will be produced during the exposure.

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

2) It only initializes the EEPROM if there is no data or data is corrupted (Error E010 is displayed). All calibration and configuration data will be lost. EEPROM will be restored to default values.

Dip Switch 3640SW6 can also be used to erase the EEPROM, the NVRAM or the configuration data. To do so:

6. Turn off the Generator and set Dip Switches 3640SW6-1 to 3640SW6-8 to ON.

7. Turn on the Generator and, once the A3640-XX Control board is powered up, set Dip Switches according to the procedure to be performed:

- To erase the NVRAM, set Dip Switches 3640SW6-1 to 3640SW6-4 to OFF.

- To erase the EEPROM, set Dip Switches 3640SW6-1, 3640SW6-3, 3640SW6-5 and 3640SW6-7 to OFF.

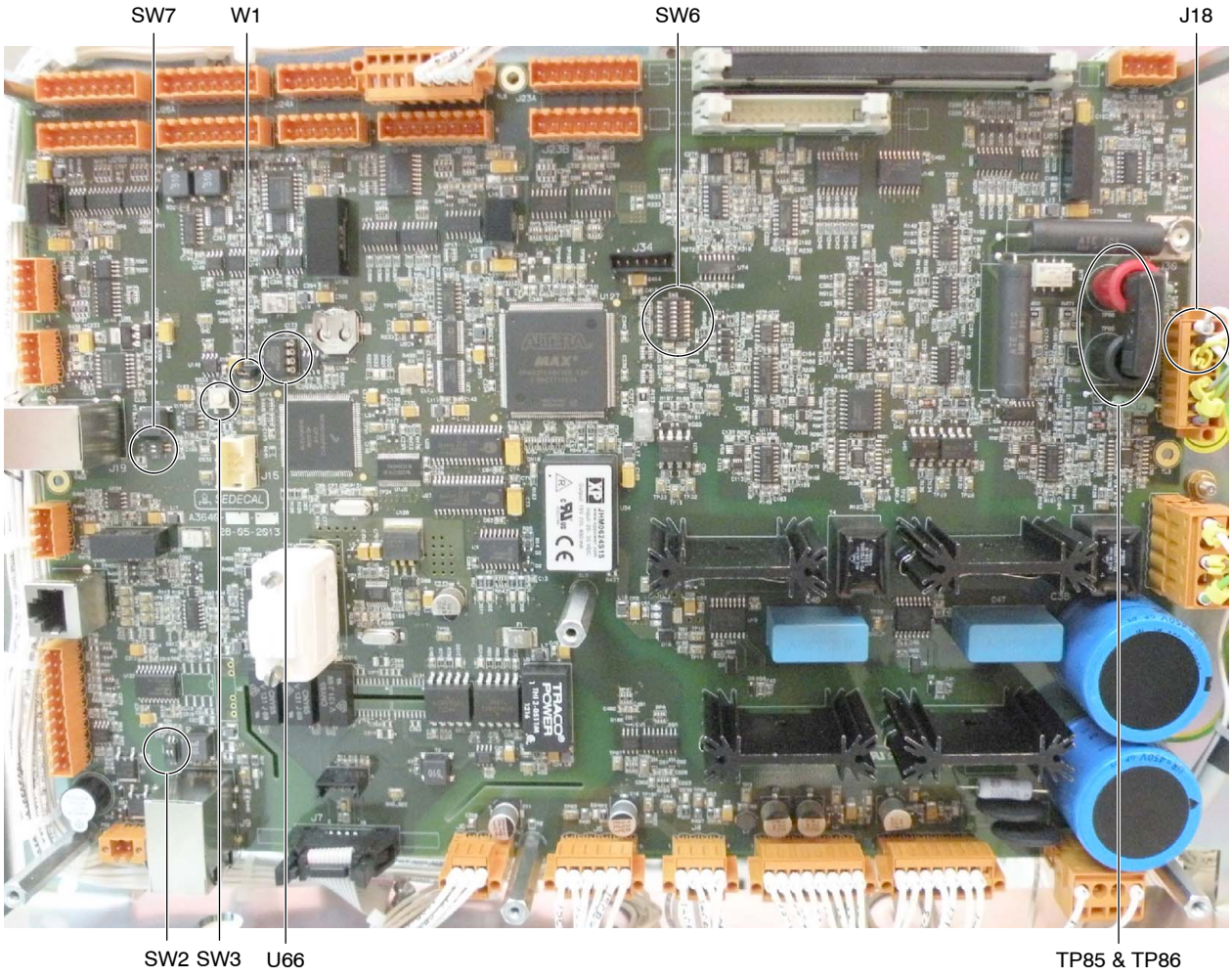
8. Set all the pins in Dip Switch 3640SW6 to their previous position (usually, all to OFF).

Note ☞ *Bear in mind that calibration data will be lost and restored to default values whenever the EEPROM is initialized.*

3.2.1.3 3640SW7 - CONTROL BOARD

Dip switch 3640SW7 is not used for configuration but all its switches must be set to **On**.

Illustration 3-2
Control board A3640-XX EEPROM, switches and jumpers



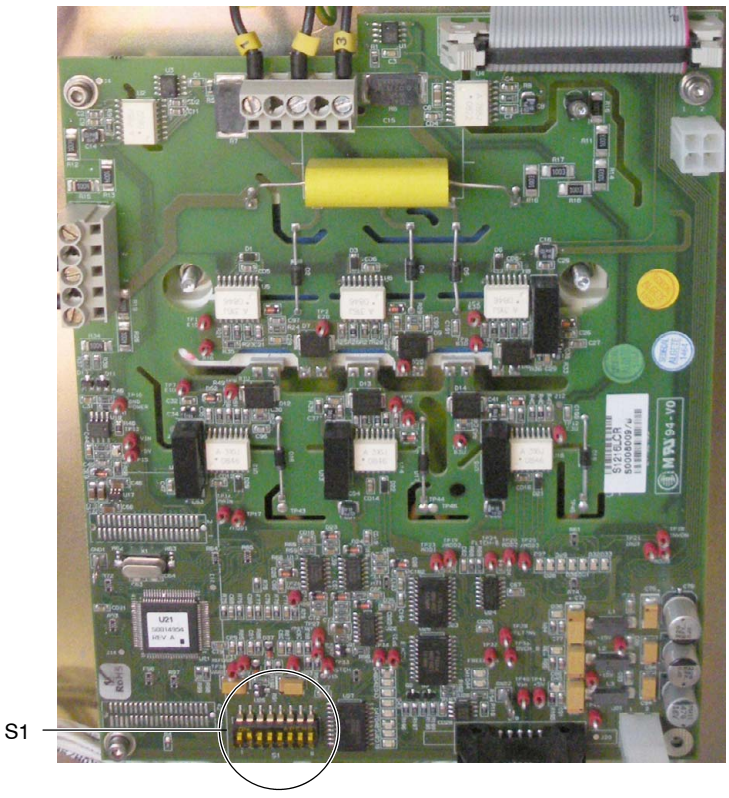
3.2.1.4 S0008009S1 - DUAL SPEED STARTER

Set dip switch S0008009S1 as indicated in Table 3-2.

Table 3-2
Test Dip Switch S0008009S1 on the Dual Speed Starter

S0008009S1 POSITION	OPEN (OFF)	CLOSED (ON)
1	Not used. *Set to OFF.*	Not used.
2	Not used.	Not used. *Set to ON.*
3	Not used. *Set to OFF.*	Not used.
4	Not used. *Set to OFF.*	Not used.
5	Not used. *Set to OFF.*	Not used.
6	Not used. *Set to OFF.*	Not used.
7	Not used. *Set to OFF.*	Not used.
8	Not used. *Set to OFF.*	Not used.

Illustration 3-3
Dual Speed Starter S0008009 switches location



3.2.2 BASIC CONFIGURATION OF GENERATOR BOARDS

The following Jumpers are factory set or removed to configure the Generator boards according to the customer order. Check the jumpers position in the Generator boards.

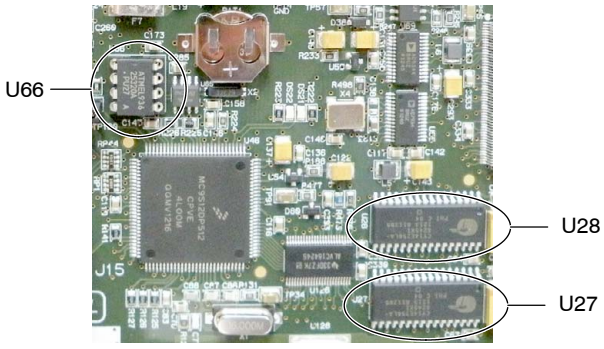
GENERATOR BOARDS	JUMPERS POSITION
CONTROL BOARD	W1 installed. Remove to update the software if software download has been interrupted and software can not be updated using the Downloader *(refer to the Troubleshooting document).*
	TP85 and TP86 installed. Remove for mAs measurement.
	J18 in "7-8" to allow the kV oscillator operation.

3.3 CALIBRATION CONSIDERATIONS

Calibration data is entered in digital form and stored in a non-volatile memory chip (U66-EEPROM) located on the Control board, thus no battery back-up is required. The U66 memory is fitted in a socket and it can be easily removed for data transfer from one Generator to another, in case the calibration and configuration backup files cannot be restored from the computer.

U27 and U28 are the non-volatile RAM, where the Error log, Generator and Tubes Counters, daylight saving time, Generator power limited by user, initial parameters values (as set before the last shut down), downloaded tube's data and oscilloscope data are saved.

Illustration 3-4
EEPROM and RAM location



Note ☞ *Calibration procedures must be performed in the order listed in this document. Perform only the sections required to calibrate this unit.*

3.3.1 GENERATOR SPECIFICATIONS

3.3.1.1 MINIMUM CURRENT TIME PRODUCT (mAs)

- Minimum Current Time Product obtained at 0.1 s is 1 mAs.
- Minimum Current Time Product within the specified ranges of compliance for linearity and constancy is 0.1 mAs.

3.3.1.2 ACCURACY OF RADIOGRAPHIC PARAMETERS

Note ☞ *Specified accuracy does not include test equipment accuracy.*

PARAMETERS		ACCURACY (with 12 BITS HT)
RAD	kV	± (3% + 1 kV)
	mA	± (4% + 1 mA)
	Exposure Time	± (2% + 0.1 ms)
	mAs	± (10% + 0.2 mAs)

3.3.1.3 HV FREQUENCY

The operating HV Frequency of this Generator is 25 kHz.

3.3.1.4 DUTY CYCLE

The Generator duty cycle is continuous, but limits should be set during installation depending on the capacity of the X-ray tube.

SECTION 4 GENERATOR SERVICE MODE

To install the Service Console, plug the USB with the Software Service Tools of the Generator in the PC and click on the .exe file, *Tech Service Console Setup.* When installing the Service Console program in the computer, if the installer starts downloading .NET Framework from Internet, cancel the download and install version 4.0 *(dotNetFx40_Full_x86_x64.exe)* from the folder where the main application installer is. Then, install the Service Console program.

The Service Console (SC) program allows the access to the service screens for Configuration and Calibration procedures, reading the Error Log and Exposure Counters, downloading the Tube parameters and updating the software. It also allows the access to the User Console.

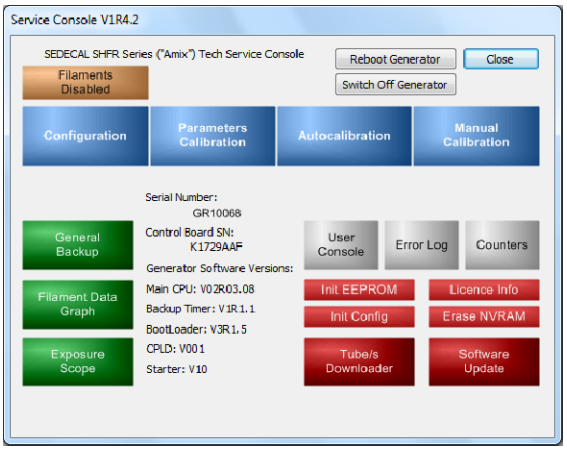
Start the SC program by clicking on the “Tech Service Console” desktop icon created during installation or in the path: *C:\Program Files (x86)\Sedecal\Service Tools\Tech Service Console X.X.X* (this is the path by default after installing the program). **A password is required, enter the following password in the pop-up window: 2434.**

Note ☞

It might be necessary to change the port selection in the .ini file (located in the Tech Service Console folder) in case the cable is not connected to COM1 on the PC. In this case, open the ServiceConsole.ini file in the Notepad and modify the serial port selection according to the one in use, e.g. SERIAL_PORT=COM3 (refer to Illustration 4-2).

The Service Console menu shows some information such as the Generator and the Control board Serial Numbers, and the Software versions.

Illustration 4-1
SC Menu



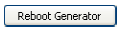
The different screens of the Service Console program are displayed after selecting the respective button on the Service Console main screen. Press “Close” to return to the SC menu.

Note ☞ *The minimum screen resolution required to correctly display the screen is 800x600. Take into account that, when this screen resolution is used, the lower part of the Exposure Scope is not displayed on screen.*

Note ☞ *Whenever the “Configuration” menu is closed (by pressing the “Close” button) after pressing the “Store Data (In SHFR)” button, a long double-beep will sound confirming the storage of the values set for each workstation. A short double beep would alert the user in case any error occurs.*

Press the “Close” button to exit from the SC program.

REBOOT GENERATOR BUTTON



It is needed to reset the Generator when performing some of the configuration procedures in order to apply the changes. Press the “Reboot Generator” button in the Service Console menu screen and wait for the Generator to reboot.

If communication with the computer is lost, press the SW3 button in the A3640-XX Control board *(refer to Illustration 3-2)* to reset the Generator.

SWITCH OFF GENERATOR BUTTON

To Switch Off the Generator, press the “Switch Off Generator” button. Wait for the Generator to turn off and then close the Service Console program.

If communication with the computer is lost, press the Off button in the Interface Box or in the Control Console, depending on the System configuration, instead of using the SC.

If the microprocessor does not respond and the Generator cannot be shut down, press the Off button in the Interface Box or in the Control Console, depending on the System configuration, during 5 seconds to force the shutdown.

NEVER PRESS THE SW3 RESET BUTTON OR FORCE THE SHUTDOWN OF THE GENERATOR WHEN THE TUBE IS IN HIGH SPEED.

GENERATOR SERIAL NUMBER

The Generator Serial number can be modified by double-clicking on it and entering the password for advanced options *(refer to Section 5.1.5).* This option is especially useful to restore the Generator serial number if the A3640-XX Control board has to be replaced.

ENABLING/DISABLING THE FILAMENTS

This button is used to disable and enable the filaments, just as switch 3640SW6-4 of the Control board *(refer to Section 3.2.1.2).* When filaments are disabled, no radiation will be produced during the exposure.

Take into account that filaments are always disabled when switch 3640SW6-4 is set to On, regardless of this selection. Filaments can be enabled/disabled by pressing this button only when switch 3640SW6-4 is set to Off.

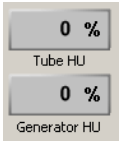
RESET ERROR BUTTON

The “Reset Error” button appears when an error code or message is displayed in the lower part of the SC program and in the User Console. Press it to reset the error indication.

EXPOSURE STATUS ICONS

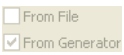
Exposure status icons for “Ready” and “X-ray On” are located on the Manual Calibration, Autocalibration and User Console screens. “Ready” icon gets lighted when the Exposure Control is pressed halfway (“Prep” position) and “X-ray On” icon is lighted when the Exposure Control is pressed full way and remains lighted during the length of exposure.

HEAT UNITS



Used Heat Units of the Generator and Tube are shown in the right bar of the Manual Calibration, Autocalibration, User Console, AEC calibration and Fluoro calibration screens.

DATA SOURCE



Configuration, Calibration and Filament Data Graph screens show the source of the displayed data:

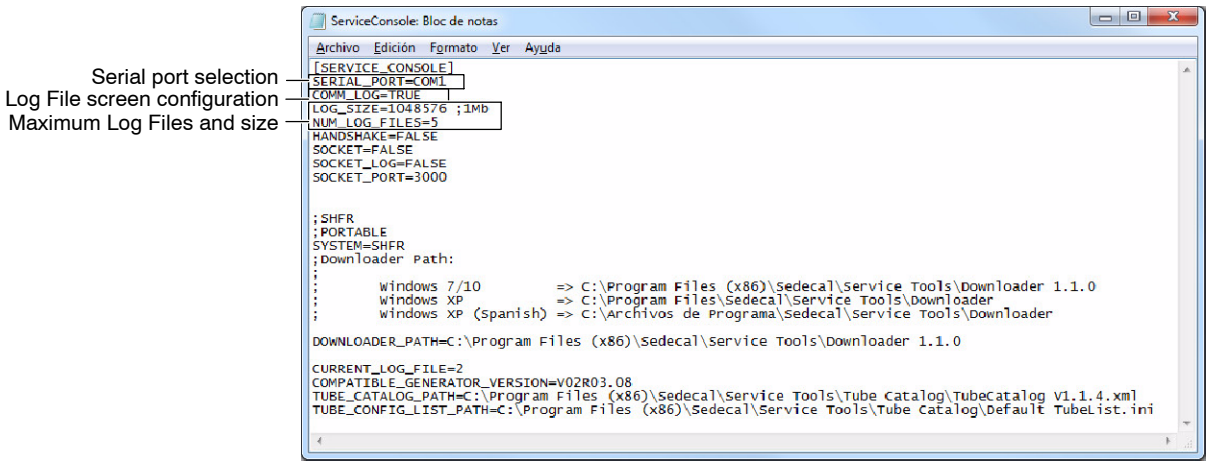
- From File: The data displayed is the data restored from a file but not necessarily saved in the Generator yet.
- From Generator: The data displayed is the data saved in the Generator.

4.1 LOG FILE SCREEN

The Log File screen provides the user general information about the configuration and calibration processes, errors and exposures. It also allows communication from user to system.

The Log File screen can be configured to be automatically opened along with the SC program. To do so, modify the ServiceConsole.ini file in the Tech Service folder *(refer to Illustration 4-2).*

Illustration 4-2
ServiceConsole.ini



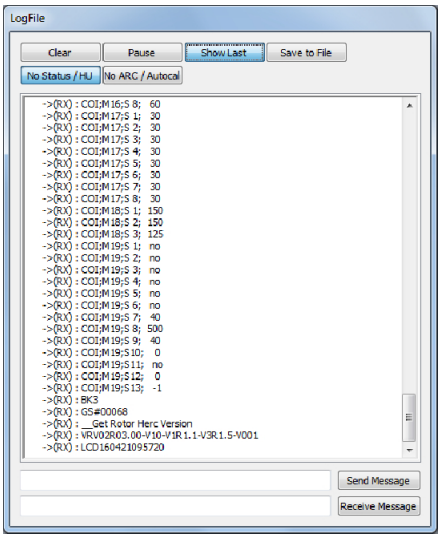
Open the .ini file in the Notepad and modify the command line parameter:

- **COMM_LOG=FALSE:** Log File screen is not displayed.
- **COMM_LOG=TRUE:** Log File screen is displayed when launching the SC application and a Log file is saved in the Service Console folder containing all the Log information. This file will be automatically updated with every new Log message. The number and size of Log files can be configured as follows:
  - **LOG_SIZE.** Selects the maximum size of the Log file. It is set to 1Mb by default.
  - **NUM_LOG_FILES.** Selects the maximum number of Log files saved in the computer. When the maximum configured Log files is reached, the first one is overwritten. It is set to 5 by default.

Log File screen buttons:

- Clear: deletes all the messages. The Log file saved in the Service Console folder does not lose its data.
- Pause: messages popping momentarily stops.
- Show last: when pressed, the Log File screen automatically scrolls down to show the last messages.
- Save to File: press to save a .txt file containing the messages shown in the Log File screen. It is recommended to press the “Pause” button first to make sure that the desired messages are saved in the last position, so they are easier to find. After pressing the “Save to File” button, assign a name to the file and save it in the desired folder on the computer. The message “Log File Saved” will be displayed. Press “Accept”.
- No Status/HU: it is pressed by default to hide all the status and heat units messages. When it is not pressed, this messages are shown constantly.
- No ARC/Autocal: press to hide starter and autocalibration messages.

Illustration 4-3
Log File screen



4.2 GENERAL BACKUP

The “General backup” button is used to make a backup of all the data of the equipment (Configuration, Parameters Calibration, FIlament Data Graph, Error Log and Counters).

Once the calibration and configuration procedures are completed, it is strongly recommended to save a general backup in the computer in case it is needed to be restored in the future. It is also possible to make a backup of just the Configuration data *(refer to Section 5.1.6),* the Parameters Calibration data *(refer to Section 6.9),* or the Filament Data Graph *(refer to Section 6.5).*

Error log and Counters data can also be saved independently using the “Save to file” button in their respective screens.

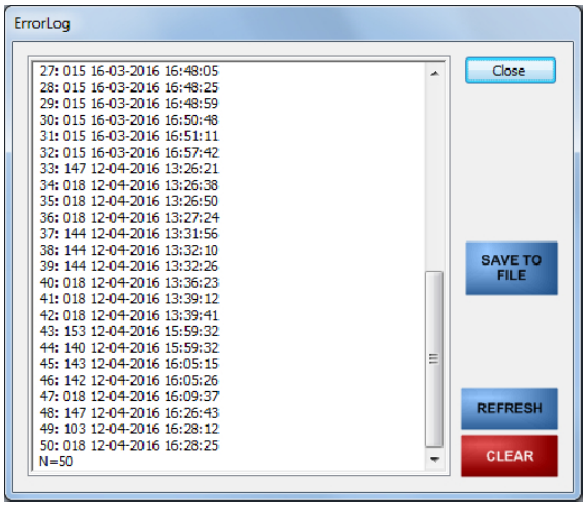
When the “General backup” button is pressed, several backup files are stored in the designated directory of the computer; five of them containing the saved data and a General Backup file, as named by the user, containing the Generator switches position *(refer to Section 3.2.1).* All the files include the Service Console version, the A3640-XX Control board serial number, the date of the backup, the date of the last calibration and the Generator software versions.

To restore the Configuration, Parameters Calibration and Filament Data Graph backup files, use the restore buttons located in their respective screens *[refer to their respective sections in this document (Configuration Window, Parameters Calibration Window and Filament Data Calibration Checks and Backup)].*

Note ☞ *If the selected backup file to be restored has been created using a different version of the Tech Service Console, a warning will be displayed giving the user the option to abort the loading process.*

4.3 ERROR LOG

Illustration 4-4
Error Log screen



The Error Log screen shows the list of errors encountered by the system with a description of the error and the time it happened.

To make a backup in the computer of the last errors shown (up to 50), follow the next steps:

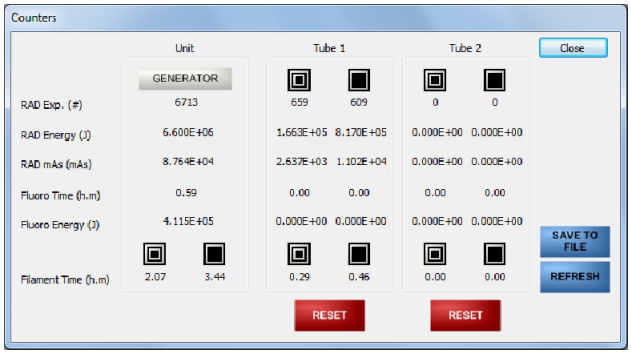
1. Press the “Save to file” button.
2. Assign a name to the file to be saved and save it in the desired folder on the computer.
3. The message “Error File Saved” will be displayed. Press “Accept”.

Click “Refresh” to update values.

Click “Clear” to reset the list to zero.

4.4 COUNTERS

Illustration 4-5
Counters screen



The Counters screen shows:

- The number of Rad exposures made with any of the Focal Spots of the X-ray Tube.
- The accumulated RAD Energy used by the Generator.
- The accumulated mAs used.
- The accumulated Fluoro exposure time in hours and minutes (in Generators with fluoro option).
- The accumulated Fluoro Energy used by the Generator (in Generators with fluoro option).
- Filament use time in hours and minutes.

To make a backup in the computer of the counters data, follow the next steps:

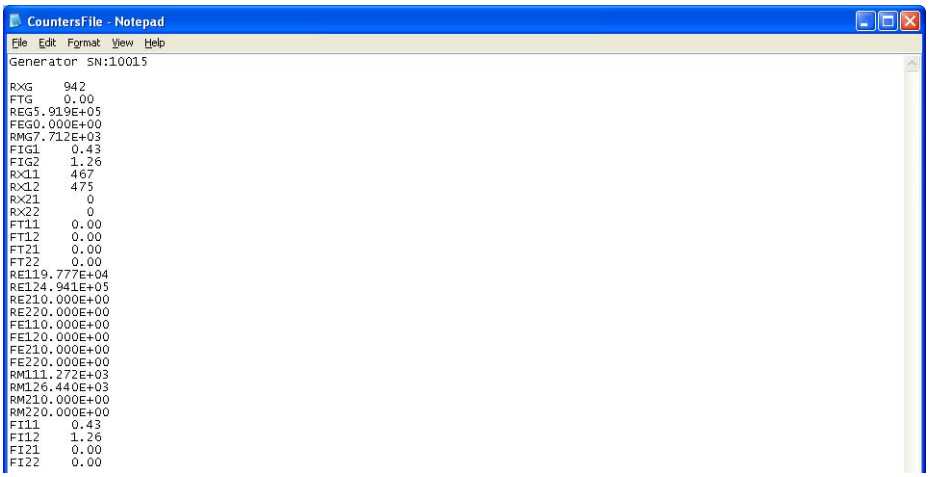
1. Press the “Save to file” button.
2. Assign a name to the file to be saved and save it in the desired folder on the computer. A .txt file will be saved in the designated folder.

Click “Refresh” to update values.

Click “Reset” to reset the tube counters to zero (Generator counters cannot be reset). To reset the tube counters a password is required. Use the password for advanced options *(refer to Section 5.1.5).*

Exit by pressing “Close”.

Illustration 4-6
Counters .txt file



The information saved in the .txt file is shown in several sets of characters encoded as follows:

- RX: RAD Exp.
- RE: RAD Energy
- RM: RAD mAs
- FT: Fluoro Time
- FE: Fluoro Energy
- FI: Filament Time

The previous sets of characters are followed by any of this characters:

- G: Generator
- G1: Generator, Small Focal spot
- G2: Generator, Large Focal spot
- 11: Tube 1, Small Focal spot
- 12: Tube 1, Large Focal spot
- 21: Tube 2, Small Focal spot (not used)
- 22: Tube 2, Large Focal spot (not used)

4.5 EEPROM INITIALIZATION

Init EEPROM

It is possible to restore the EEPROM to default values by pressing the “Init EEPROM” button on the SC menu.

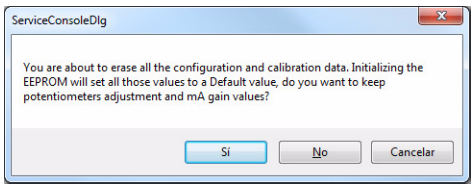
The user will be asked for confirmation and will be given the option to keep the potentiometers adjustment and mA gain values:

- Click “Yes” to initialize the EEPROM keeping the potentiometers adjustment and mA gain values *(refer to the Calibration document of the Service manual for further information about the calibration data).*
- Click “No” to initialize the EEPROM without keeping any stored value.
- Click “Cancel” to exit without initializing the EEPROM.

A password is needed to complete the EEPROM initialization. Use the password for advanced options *(refer to Section 5.1.5).*

Note ☞ *Bear in mind that calibration and configuration data will be lost and restored to default values whenever the EEPROM is initialized.*

Illustration 4-7
Confirmation message



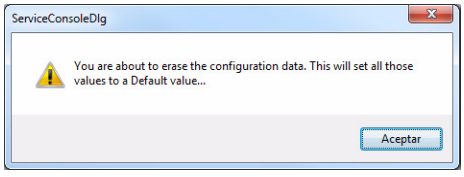
4.6 CONFIGURATION INITIALIZATION

Init Config

It is possible to restore the configuration data to default values by pressing the “Init Config” button on the SC menu.

The user will be asked for confirmation and a password is needed to complete the Configuration initialization. Use the password for advanced options *(refer to Section 5.1.5).*

Illustration 4-8
Confirmation message



4.7 ERASE NVRAM

Erase NVRAM

It is possible to delete all the data stored in the NVRAM and restore it to default values. The user will be asked for confirmation and a password is needed to complete the procedure. Use the password for advanced options *(refer to Section 5.1.5).*

Note ☞ *This option is specially useful to reset these data to default values when the A3640-XX Control board has been repaired.*

Press this button to erase the following data:

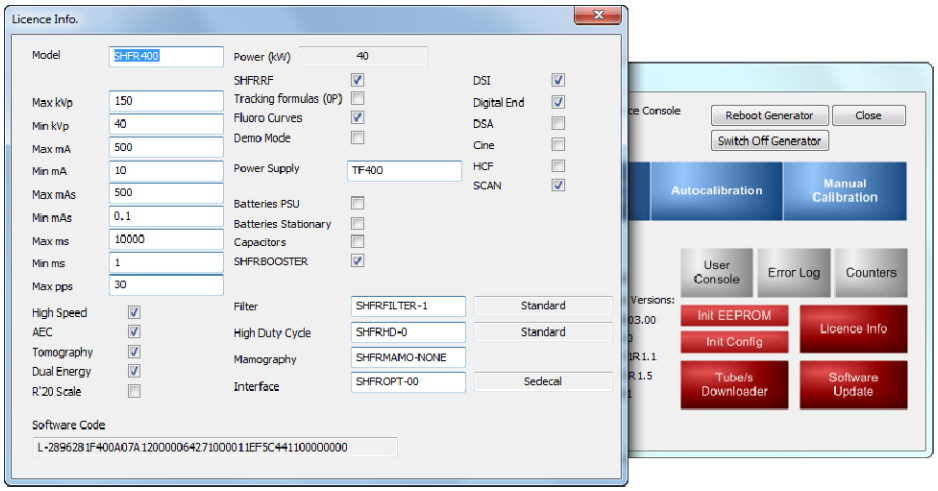
- Counters. Resets the Generator and Tube counters to 0.
- Error logs. Erases all the errors saved in the Error Log of the Generator.
- Tubes data. Erases the list of Tubes of the Generator. *Refer to Section 4.9* for information on how to load Tubes in the Generator.
- Calibration date. Erases the date of the last calibration, which is displayed in the Filament Data Graph screen and included in the backup files that can be stored in a computer. A default date will be displayed instead of the real date.
- Fluoro curve. Erases the Fluoro curve stored in the Generator and sets the default one, where all the values are the same.
- Filament enable. Disables filaments in the main screen button in case they were enabled.
- Power limit percentage. Sets the Power Reduction of the User Console to 100%.
- Tube thermal status. Sets the Tube Heat Units to 0%.
- Inverter thermal status. Sets the Generator Heat Units to 0%.

TAKE INTO ACCOUNT THAT IF THE GENERATOR HAS BEEN IN USE PRIOR TO THE NVRAM RESET, THE TUBE AND/OR GENERATOR THERMAL STATUS MAY NOT GUARANTEE THE SAFETY USE OF THE GENERATOR EVEN THOUGH THE HEAT UNITS HAVE BEEN RESET TO 0%. IN THIS CASE, WAIT FOR THE TUBE AND/OR GENERATOR TO COOL DOWN BEFORE MAKING ANY X-RAY EXPOSURE.

4.8 LICENCE INFO

Press this button to display a window showing all the information (Generator characteristics, power, options and allowed configuration) stored in the licence plugged to J17 on the A3640-XX Control board.

Illustration 4-9
Licence Info screen



4.9 TUBES DOWNLOADER

Note ☞

Connect the serial cable between COM1 port on the PC and J28 on the A3640-XX Control board if the computer is not connected already to the Generator through the Interface Box or through the Control Console.

It might be necessary to change the port selection in the .ini file located in the Tech Service folder in case the cable is not connected to COM1 on the computer (refer to Illustration 4-2). In this case, open the ServiceConsole.ini file in the Notepad and modify the serial port selection according to the one in use.

1. Launch the Tubes Downloader from the Service Console by pressing the “Tube/s Downloader” button. A list of the tubes loaded in the Generator is displayed, showing only their IDs.

2. **To download the Tubes one by one, follow the procedure explained below:**

   a. Press “browse” to select the folder of the USB with the Software Service Tools that contains the .xml Tube catalog and open the file (select the file and press “Open” or double click on it). Once the Tube catalog has been opened and the “Refresh” button is pressed, some other information is shown in the “Tube list at the generator” column along with the IDs of the downloaded tubes:

   - Nominal focal spot value.
   - Brand and model of the tube.
   - Starter name or type.
   - Date or revision of the tube catalog: some of the tube specifications may change from one revision to another. Make sure that the revision of the selected tube matches the installed one.

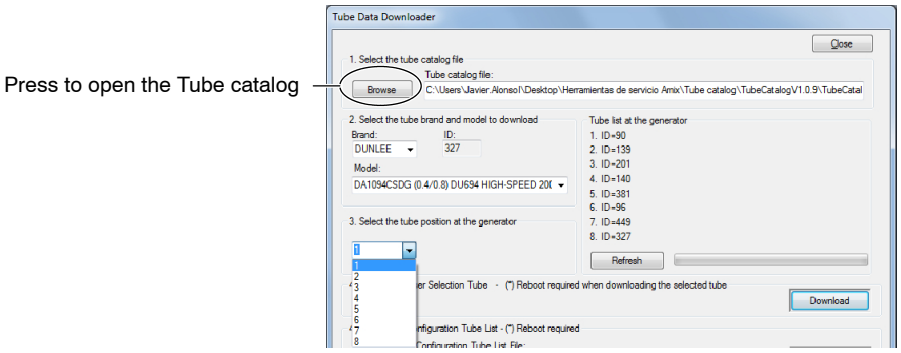
   b. Select the Tube Brand and Model to be downloaded and assign an Index position to it. Up to eight Tubes can be downloaded from the Tubes Catalog (the selected tubes are stored in the non-volatile RAM).

   c. Start the transfer by clicking on the “Download” button and wait until the process ends and the Tube ID and model is displayed in the Status screen.

   d. Repeat the process for all the Tubes to be downloaded.

   e. Finally, press the “Close” button and reboot the Generator.

Illustration 4-10
Tube and index selection



3. **To download a complete list of tubes instead of downloading the tubes one by one, follow the procedure explained below:**

Note ☞ *It is needed a .ini file containing a list of eight tubes with their ID and model to perform this procedure.*

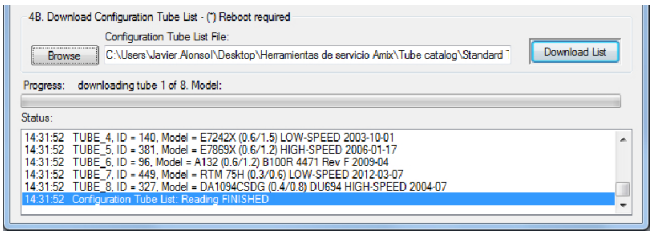
a. Press “browse” to select the folder of the USB with the Software Service Tools that contains the .xml Tube catalog and open the file (select the file and press “Open” or double click on it).

b. Press the “browse” button in the section 4B (Download Configuration Tube List) of the screen to select the folder containing the Tube’s list (.ini file) and open it (select the file and press “Open” or double click on it).

c. Start the transfer by clicking on the “Download List” button and wait until the process ends and the Tubes IDs and models are displayed in the Status screen.

d. Finally, press the “Close” button and reboot the Generator.

Illustration 4-11
Tube list download



SECTION 5 GENERATOR CONFIGURATION

Press the “Configuration” button to launch the Configuration window. This window has several tabs to access the different configuration screens (Configuration Main Page, Workstations and Starter, Tubes, Generator behavior, Date and Time and Fluoro).

When all the configuration parameters are set on each screen, press the “Store Data (In SHFR)” button to save the changes. If any value is later modified, press the “Store Data (In SHFR)” button to save the changes. It is required to reboot after saving the changes when modifying any of the parameters marked with an asterisk.

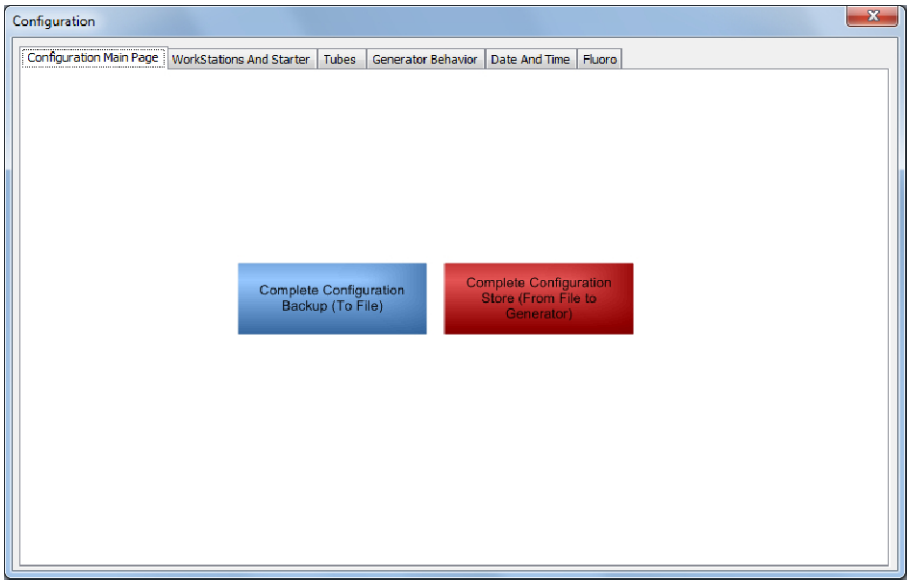
To check if a value has been properly saved, click on the “Refresh (From SHFR)” button. Values can be recovered from the Generator using the “Refresh (From SHFR)” button.

5.1 CONFIGURATION MAIN PAGE

The Configuration window initially displays the Configuration main page, with two options:

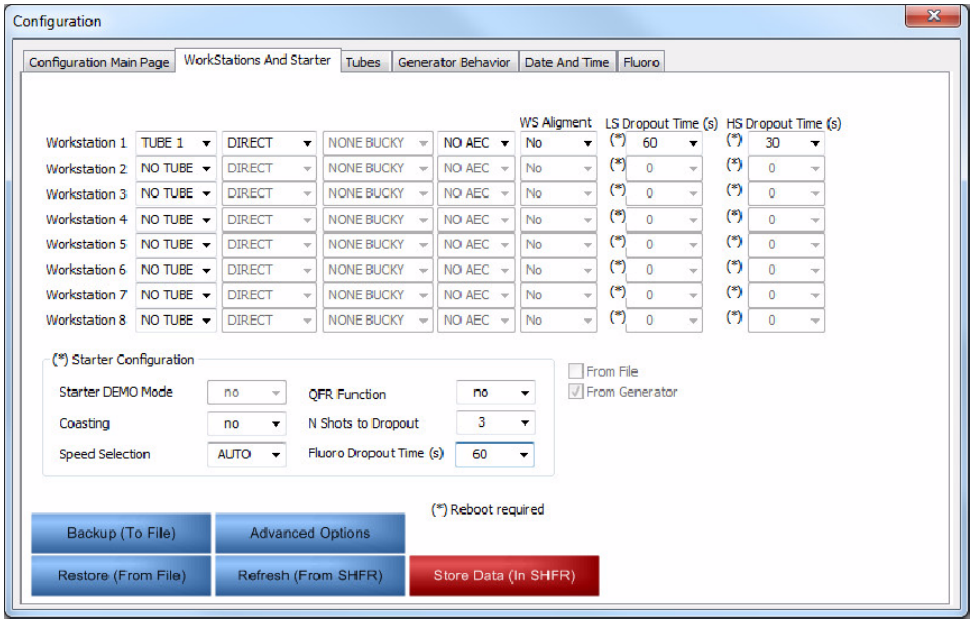
- **Complete Configuration Store (From File To Generator):** Click to restore the configuration data previously saved in a computer.
- **Complete Configuration Backup (To File):** Use this option once the Configuration process is completed *(refer to Section 5.1.6).*

Illustration 5-1
Configuration main page



5.1.1 WORKSTATIONS AND STARTER

Illustration 5-2
Workstations and Starter configuration screen



5.1.1.1 WORKSTATIONS CONFIGURATION

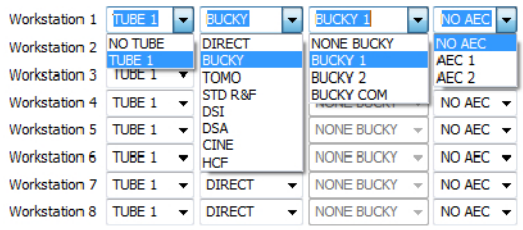
WORKSTATIONS PARAMETERS

The workstations can be configured according to the customer preferences. If a workstation is configured with the value “No Tube”, it can not be selected during operation.

Set the respective values of each Workstation to be configured (select the new value by clicking on the corresponding option). Up to 8 Workstations can be configured.

Note ☞ *When selecting an option that is not compatible with any of the other selectable options for that workstation, unsupported values will appear shaded. For example, if direct workstation is selected, bucky options are automatically blocked.*

Illustration 5-3
Workstation configuration

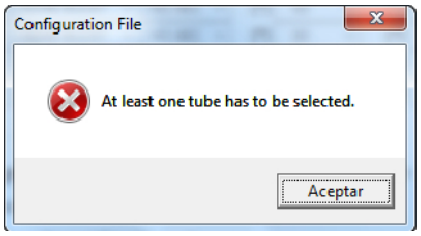


Note ☞ *Some of the values are not configurable depending on the Generator model. Before exiting the Workstations and Starter screen, make sure that all the configured and saved parameters are allowed by the licence plugged to J17 of the A3640-XX Control board* (refer to Section 4.8). *Otherwise, error 2 will be displayed on screen.*

Note ☞ *"BUCKY COM" can be selected in more than one Workstation when several Buckys/Detectors are connected to the serial port (wired or wireless). The operator must assign each Bucky/Detector to its corresponding Workstation later in the user interface.*

Note ☞ *If "Tube 1" is not selected in, at least, one Workstation, operation will not be allowed. A pop-up window will be displayed alerting the user when trying to save the values.*

Illustration 5-4
Workstation configuration error message

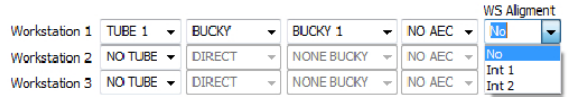


WORKSTATION ALIGNMENT INTERLOCK

Two interlocks can be configured for the Table and Wall Stand Workstations in order to allow the X-ray exposure only when the X-ray Tube is aligned with the selected positioner.

These hardware signals correspond to the same signals used for Interlock 1 and 2 of the general interlocks that can be configured in the Generator Behaviour tab *(refer to Section 5.1.3 and to the schematics document).*

Illustration 5-5
Workstations Interlocks



DROPOUT TIME

Select the Tube Dropout Time for High speed and Low speed depending on the tube requirements on each workstation according to the technique to be used.

Note ☞ *If the Low Speed Dropout Time is longer than the High Speed one, Dropout Time will be always the selected value for Low Speed, even in High Speed.*

The anode rotation continues during the selected time when the Exposure Control is pressed to preparation position a predetermined number of times in less than one minute, as set in the “N Shots to Dropout” field.

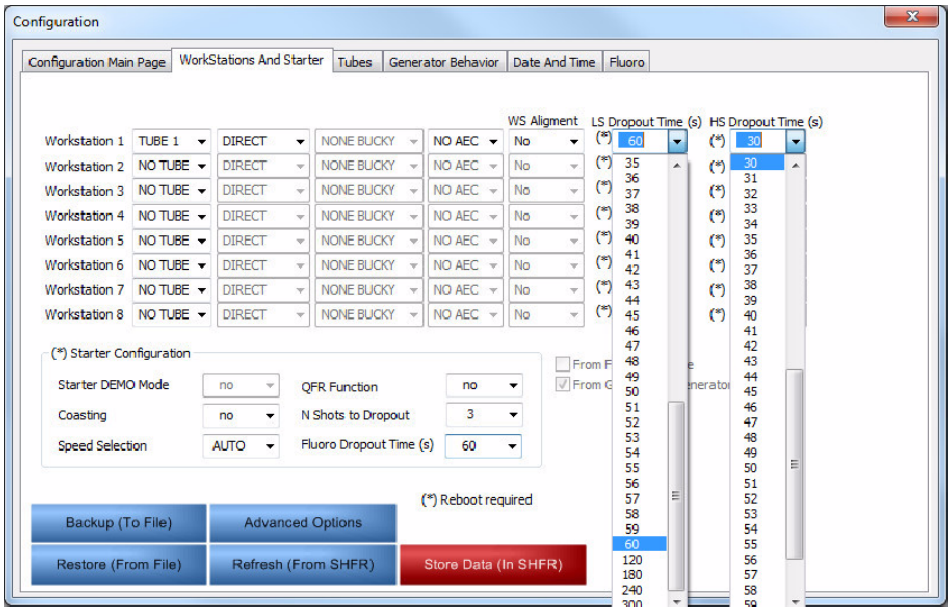
If the Exposure Control is pressed during Dropout Time, the Tube anode will continue rotating to complete a whole new Dropout Time cycle.

Low speed Dropout Time is factory set to 60 seconds.

High speed Dropout Time is factory set to 30 seconds.

Maximum Dropout Time is 300 seconds for both Low and High speed and 0 means no Dropout Time.

Illustration 5-6
Dropout Time configuration



5.1.1.2 STARTER CONFIGURATION

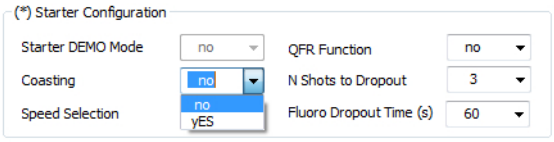
COASTING

Select the required option according to the tube manufacturer recommendations.

- "Yes": Select to deactivate the Low speed brake.
- "No": Select to activate the Low speed brake.

Note ☞ *High speed brake is always active. If the Tube is in High speed, it first reduces to Low speed regardless of the selected option.*

Illustration 5-7
Coasting configuration

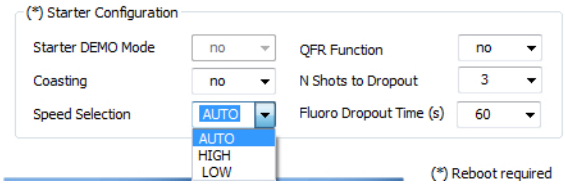


SPEED SELECTION

Generator can be set to work permanently in high speed, whenever the Tube allows it, or in low speed.

This option is set by default to “Auto”, so high speed is only used when the exposure parameters can not be achieved in low speed. Set it to “High” to work always in High speed or to “Low” to work always in Low speed, depending on the customer preferences.

Illustration 5-8
Tube Speed selection

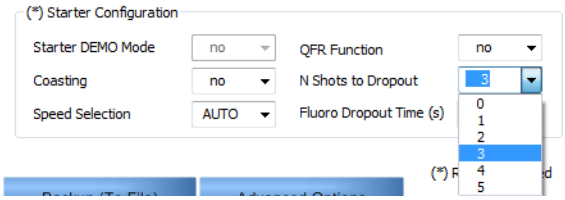


NUMBER OF SHOTS TO DROPOUT

Select the desired number of times the Exposure Control has to be pressed in less than one minute in order to start the Dropout Time, as set in the “Dropout Time” field in the Workstations and Starter screen *(refer to Section 5.1.1.1).*

0 means no dropout time.

Illustration 5-9
Number of Shots to Dropout selection



5.1.2 TUBES

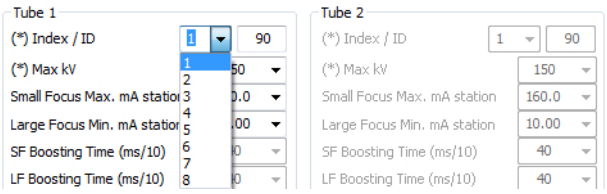
TUBE INDEX CONFIGURATION

An Index position (1 to 8) is assigned to the tubes when they are downloaded from the Tubes catalog *(refer to Section 4.9).*

Select the corresponding Index position of the Tube to be used and check that its ID matches the installed Tube in the system.

Note ☞ *If the selected Tube does not match the installed one in the system, an error message will be displayed when turning on the Generator and exposure will not be allowed.*

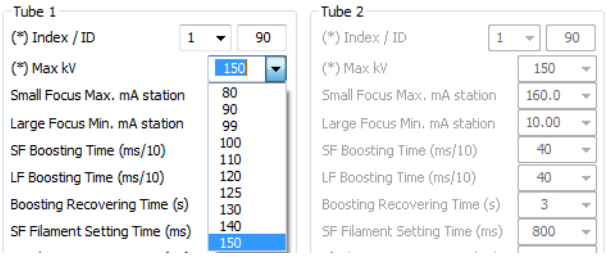
Illustration 5-10
Tube position selection

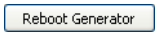


MAX kV

Maximum kV of the equipment can be limited from the maximum allowed by the licence down to 80. This option is especially useful when the X-ray Tube is not working properly at high voltage techniques.

Illustration 5-11
Maximum kV selection





If the Max kV value is modified, it is needed to reset the Generator to apply the changes. Press the “Reboot Generator” button.

Note ☞ *If the Generator is switched off after saving, changes will be applied next time the Generator is switched on.*

mA STATIONS CONFIGURATION

This configuration determines the highest mA station for the Small Focal Spot and the smallest mA station for the Large Focal Spot. Small and Large Focal Spots can overlap each other, so it is possible to configure all the mA stations for the Large Focal Spot.

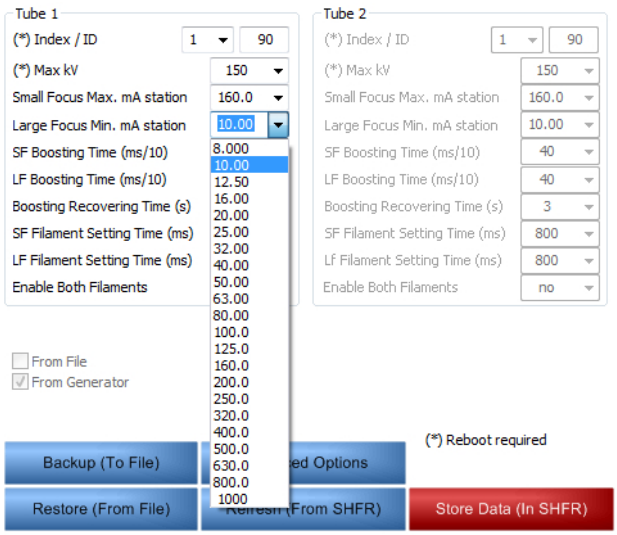
The smallest mA station for the Large Focal Spot must be selected according to the customer preference. If Small and Large Focal Spots overlap each other, the Focal Spot change must be always performed manually. On the contrary, if they are not overlapped, the Focal Spot change will be made automatically when increasing or decreasing mA. When the mA stations are configured, a pop-up message alerts about the Focal Spot change condition, which can be automatic or non-automatic.

If more mA stations are selected for any of the Focal Spots after performing the calibration procedure, calibration of the new mA stations must be completed before using the equipment. Otherwise, the X-ray tube could be damaged.

1. Select the maximum mA station for the Small Focal Spot. If the maximum mA station configured for the Small Focal Spot exceeds the limits allowed by the X-ray Tube, it will be limited by software. The value will not be reachable in the User Console.

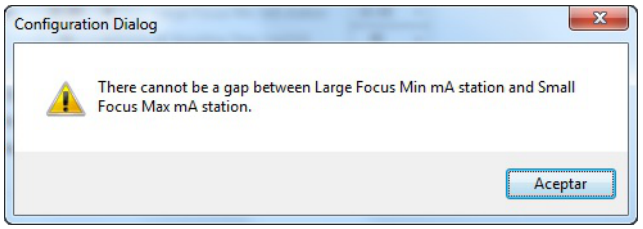
2. Select the minimum mA station for the Large Focal Spot.

Illustration 5-12
mA Stations Configuration



Note ☞ *If the mA stations selection is not correct, a pop-up message is shown alerting about it and the selection will not be modified.*

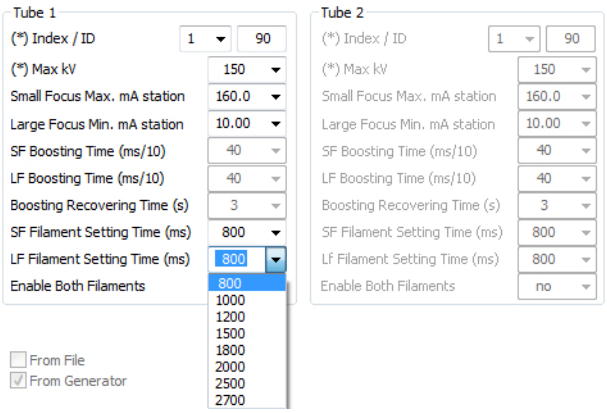
Illustration 5-13
mA stations configuration error



FILAMENT SETTING TIME

This option is used to set the minimum preparation time. Filament Setting Time for both Focal Spots is configurable, so it can be modified, if needed, depending on the tube characteristics.

Illustration 5-14
Filament Setting Time Configuration

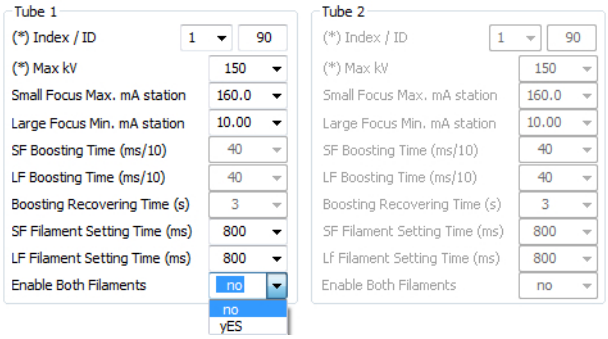


ENABLE BOTH FILAMENTS

"Yes" is selected to preheat both filaments of the X-ray Tube. This option is especially useful for Fluoro operation, so faster transitions from RAD to Fluoro, and vice versa, are allowed.

Select "No" to preheat only the selected filament.

Illustration 5-15
Filaments heating options



Press the "Store Data (In SHFR)" button to save the changes before exit the Tubes screen.

5.1.3 GENERATOR BEHAVIOR

MAX POWER (kW)

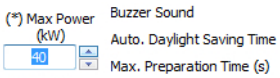
The maximum kW of the Generator is factory set according to the Generator performance. Generator kW can be limited to a lower value in 1 kW steps, from full power to 1 kW.

This reduction is applied to the Generator not only in user mode, but also during calibration. Bear in mind that the power reduction selected in the User Console *(refer to Section 7.1)* is applied to the limit set in this configuration field.

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).*

Press the “Increase” or “Decrease” button to modify the value.

Illustration 5-16
Generator Max Power selection



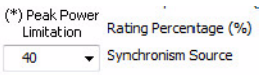
PEAK POWER LIMITATION

The maximum power of single phase Generators can be limited for X-ray exposures which take longer than 20 ms.

Note ☞ *This field will be shaded in gray for three-phase Generators.*

Select the maximum kW for this limitation, which will only be activated when the selected time for the X-ray exposure is higher than 20 ms.

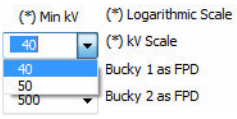
Illustration 5-17
Power Limit for Single-phase Generators



MIN kV

Minimum kV of the Generator is 40. However, it can be limited to 50, so the 40 kV station will not be calibrated during the autocalibration procedure and 50 kV will be automatically picked by the Generator as the minimum kV station available.

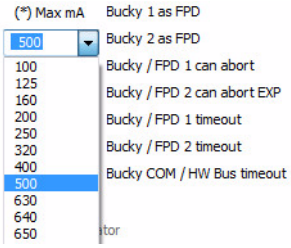
Illustration 5-18
Min kV selection



MAX mA

Maximum mA can be limited down, so the mA stations over the established limit will not be calibrated during the autocalibration procedure.

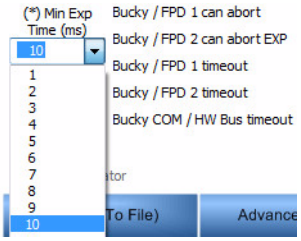
Illustration 5-19
Max mA selection



MIN EXPOSURE TIME

Minimum exposure time can be set to any value from the minimum allowed by the licence up to 40 ms. This is especially useful for AED panels, so the minimum exposure time can be set according to the minimum adquisition time of the panel.

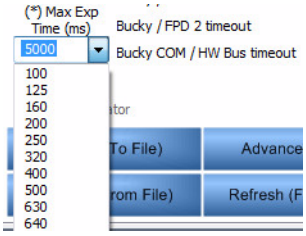
Illustration 5-20
Min Exposure Time selection



MAX EXPOSURE TIME

Maximum exposure time can be limited down to 100 ms, to make sure it is not higher than the maximum adquisition time of the digital panel.

Illustration 5-21
Max Exposure Time selection



BUZZER SOUND

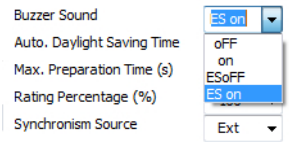
Buzzer sound is, at least, 500 ms long. It lasts as long as the exposure time when the exposure is longer than 500 ms, except for DSI, in which case it lasts as long as the pulse to avoid a continuous beep.

It is recommended to use the “ON” option (all sound enabled). Nevertheless, exposure or other sounds can be disabled for customers which use their own sounds.

Select the desired option in accordance to the customer preferences:

- OFF: Sound is disabled.
- ON: Sound is enabled.
- ES OFF: Exposure sound is disabled. Every other sound is enabled.
- ES ON: Exposure sound is enabled. Every other sound is disabled.

Illustration 5-22
Sound configuration



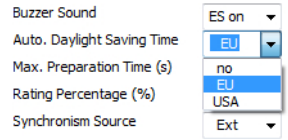
AUTOMATIC DAYLIGHT SAVING TIME

This option sets the clock to be automatically adjusted for summer time in those countries that are observing Daylight Saving Time.

Select:

- “EU” or “USA”, depending on your location, for Automatic Daylight Saving Time.
- “No” to turn this option off, so the clock will not be set forward by one hour in the summer.

Illustration 5-23
Automatic Daylight Saving Time configuration

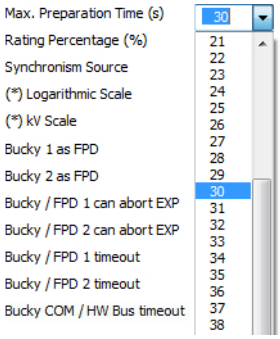


MAXIMUM PREPARATION TIME

A maximum preparation time can be established to protect the Tube filament. When the Exposure control is pressed halfway (“Prep” position), the X-ray Tube is ready for the exposure. If the handswitch remains pressed in “Prep” position longer than the maximum preparation time, the Filament will be automatically switched to stand-by position.

Select a value from 10 to 50 seconds.

Illustration 5-24
Maximum Preparation Time selection

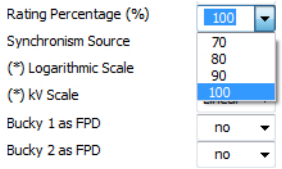


RATING PERCENTAGE

The X-ray Tube power can be limited from 100% to 70% in 10% steps for operating modes “0P” (Zero Point), “1P” (One Point) and “2P” (Two Points). When the Tube power is decreased, exposure time will be automatically increased as needed to properly perform the X-ray exposure.

Set the X-ray power limit in the “Rating Percentage (%)” field.

Illustration 5-25
Tube Power configuration

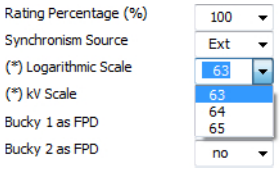


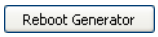
LOGARITHMIC SCALE

The logarithmic scale defines the steps for the mA and exposure time selection. It is set based on the Generator model and its characteristics, and on the customer preferences as well.

Logarithmic scale is factory set, but it can be modified by selecting the desired value (63, 64 or 65).

Illustration 5-26
Logarithmic Scale selection





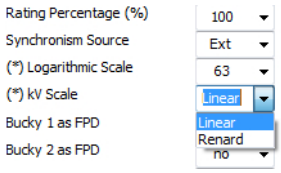
It is needed to reset the Generator to apply the changes. Press the “Reboot Generator” button.

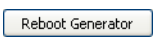
Note ☞ *If the Generator is switched off after saving, changes will be applied next time the Generator is switched on.*

kV SCALE

kV selection for the exposure can be made using the linear scale (40, 41, 42, 43, 44…) or the renard scale (40, 41, 42, 44, 46…).

Illustration 5-27
kV scale selection





It is needed to reset the Generator to apply the changes. Press the “Reboot Generator” button.

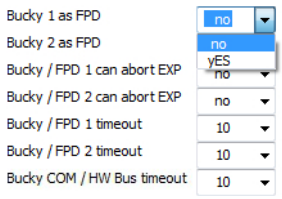
Note ☞ *If the Generator is switched off after saving, changes will be applied next time the Generator is switched on.*

BUCKY AS FPD

Select “Yes” for Bucky 1 and/or Bucky 2, if any of them is configured as Flat Panel, when using a Flat Panel Detector. In this case, the Generator limits the maximum exposure time to 2.5 seconds.

The maximum exposure time set by default can be modified using the customer’s application. It can be increased up to the maximum allowed for each detector model.

Illustration 5-28
Bucky as FPD Configuration

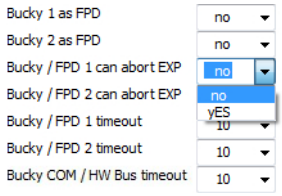


BUCKY OR FPD CAN ABORT EXP

Bucky/Detector RX_ORDER (Acknowledge) signal could be continuous or one pulse only.

- For continuous signal Buckys/Detectors:
  - When “Yes” is selected, if the RX_ORDER (Acknowledge) signal is stopped before the exposure is completed, it will be immediately aborted.
  - Select “No” to finish the exposure even if the Acknowledge signal is stopped before the exposure is completed.
- For one pulse signal Buckys/Detectors always select “No”. Otherwise, exposure will always be aborted from the very first moment as soon as the Acknowledge signal turns off.

Illustration 5-29
Bucky or FPD can abort EXP Configuration

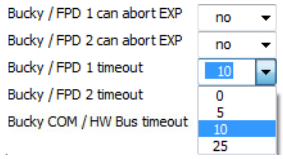


BUCKY/FPD TIMEOUT

"Bucky/FPD Timeout" sets the elapsed time since the RX_RQ (Request) signal is sent from the Generator until the RX_ORDER (Acknowledge) signal is sent back from the Bucky/Detector. If no answer is received from the Bucky/Detector within the designated time, exposure will not be initiated and error 24 will be displayed.

Time is set in seconds and "0" means no waiting, so the Acknowledge signal from the Bucky/Detector must be received immediately.

Illustration 5-30
Bucky Timeout Configuration

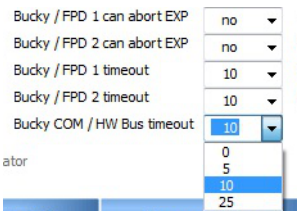


BUCKY COM / HW BUS TIMEOUT

"Bucky COM / HW Bus timeout" sets the time for the Bucky COM selection or Hardware Bus connected devices to be ready for the exposure.

Time is set in seconds and "0" means no waiting.

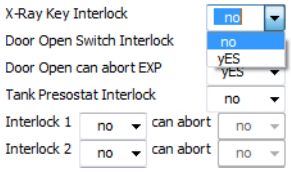
Illustration 5-31
Bucky COM Timeout Configuration



X-RAY KEY INTERLOCK

The Generator Control board can be provided with a key interlock to abort exposure. Select “Yes” when this option is used.

Illustration 5-32
Key Interlock selection

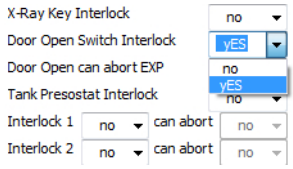


DOOR OPEN SWITCH INTERLOCK

Select “Yes” when using a switch for door open detection. This will prevent the user from making any exposure whenever the door is open.

This option shall be always set to “No” in portable Generators.

Illustration 5-33
Door Open Switch Interlock selection

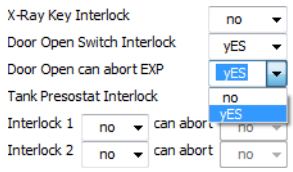


DOOR OPEN CAN ABORT EXP

If the Generator is provided with a switch for door open detection:

- Select “Yes” to interrupt the exposure when the door is opened during an exposure.
- Select “No” to continue with the exposure even if the door is opened once the exposure has been started.

Illustration 5-34
Exposure interruption selection

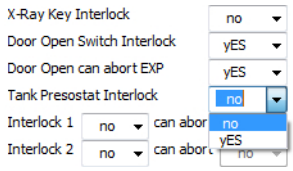


TANK PRESOSTAT INTERLOCK

Select “Yes” if the Generator is equipped with a presostat which is intended to be used as an Interlock when the tank gets automatically opened due to overheat.

Note ☞ *If the Generator is not equipped with a presostat and “Yes” is selected, error 34 will be displayed when pressing the Handswitch to prep position.*

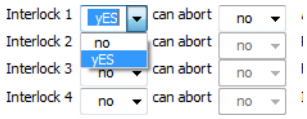
Illustration 5-35
Tank Presostat selection



INTERLOCKS

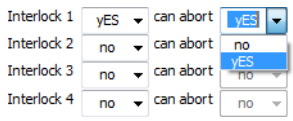
Up to four general inputs can be used for Interlock devices *(refer to the schematics document).* Select “Yes” in all the general Interlock inputs that are going to be used by the customer.

Illustration 5-36
Interlocks selection



Along with the Interlocks selection, it is possible to configure whether the selected interlocks can abort the exposure once it has been started or not.

Illustration 5-37
Interlocks operation

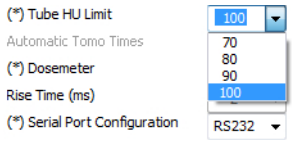


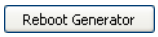
TUBE HEAT UNITS LIMIT

The maximum heating of the Tube in respect to its capacity can be limited to a lower value in 10% steps, from 100% to 70%.

The Heat Units value will always be displayed to the user in a scale from 0 to 100, with 100 being the maximum value set in this field.

Illustration 5-38
Tube HU Limit configuration





It is needed to reset the Generator to apply the changes. Press the “Reboot Generator” button.

Note ☞ *If the Generator is switched off after saving, changes will be applied next time the Generator is switched on.*

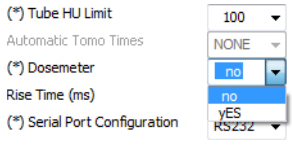
DOSEMETER

Serial port J28 is available for general use unless “Yes” is selected in the “Dosemeter” field, thus becomes only available for the Dosemeter.

When “No” is selected, J28 can be used to connect a second Control Console, touch screen or computer.

Even if “Yes” is selected, J28 can be used for general use by switching dip switch 3640SW6-5 to On *(refer to Section 3.2.1.2).*

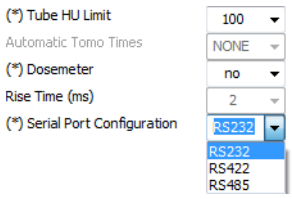
Illustration 5-39
Dosemeter configuration



SERIAL PORT CONFIGURATION

Configure the serial communications port (J25) for RS232, RS422 or RS485 standard in the “Serial Port Configuration” field.

Illustration 5-40
Serial port configuration



AEC RAPID TERMINATION

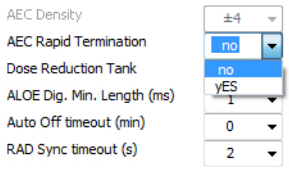
Rapid Termination is a Safety device that cuts the X-ray exposure in case of an error with the selected Ion Chamber or if the selected parameters (short backup time) are not appropriate for an exposure with AEC.

When selected, AEC Rapid Termination compares the AEC ramp with 30% of the final value at 30% of the Backup Time. It is activated after 30% of the exposure back-up time and after 10 ms of exposure, both conditions have to be fulfilled.

For a proper operation of the Rapid Termination feature, the operator must select an exposure back-up time higher or equal to 40 ms whenever the AEC is ON. Anyway, the back-up time must be selected according to the examination and patient, this exposure time is slightly higher than the worse case expected.

When AEC Rapid Termination is activated, Error Code “E070” is shown on the Service Console.

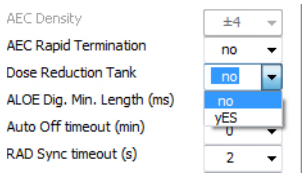
Illustration 5-41
AEC Rapid Termination configuration



DOSE REDUCTION TANK

Select the corresponding option depending on how the Generator is equipped.

Illustration 5-42
Dose Reduction Tank selection



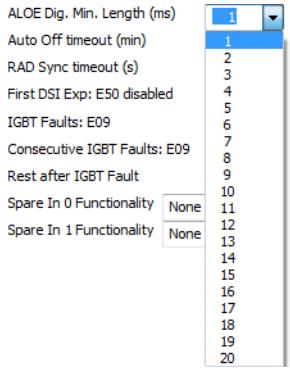
ALOE MINIMUM LENGTH

A minimum length of the pulse that indicates the X-ray on condition is required in certain systems. The value set in this field determines the minimum length of this pulse.

Set the needed value according to the equipment characteristics to ensure that, no matter how short the exposure is going to be, the mentioned pulse is going to be received.

If the selected time is longer than the exposure to perform, the pulse will last as long as established. If the selected time is shorter than the exposure to perform, ALOE pulse will last as long as the exposure. Either way, the length of ALOE will not affect the length of the exposure.

Illustration 5-43
ALOE dig. min. length configuration

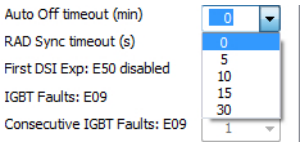


AUTO OFF

The Generator can be programmed to automatically shut down when not in use. This option is especially useful for battery powered generators.

Time is set in minutes and “0” means infinite waiting.

Illustration 5-44
Automatic shut down configuration

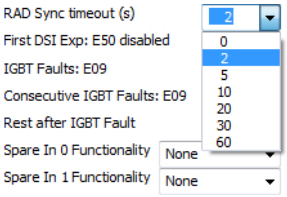


RAD SYNCHRONISM TIMEOUT

This field is used to select the maximum time waiting for DSI synchronism pulses from the system to the equipment before error 54 is displayed.

Time is set in seconds and “0” means infinite waiting.

Illustration 5-45
Rad Synchronism Timeout selection

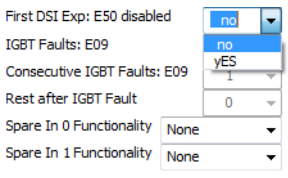


FIRST DSI EXP: E50 DISABLED

When “No” is selected, if the handswitch is released during the first exposure of DSI, exposure is aborted and error 50 is displayed. if it is released during the second exposure or later, exposure is completed and DSI process is finished then.

When “Yes” is selected, if the handswitch is released during the first exposure of DSI, although the exposure is aborted, no error is displayed.

Illustration 5-46
E50 configuration

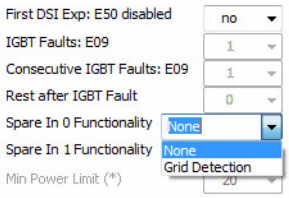


SPARE INPUT 0 FUNCTIONALITY

When “Grid Detection” is selected, the Generator detects automatically whether the grid is inserted or not. If the grid is not inserted, a message is sent to the User Console to alert the user about the situation. This signal is located in J11-2 of the A3640-XX Control board.

To use this functionality, connect the Grid’s cable to J11-2 and J11-3 and place a jumper between J20-1 and J20-2.

Illustration 5-47
Spare input 0 configuration

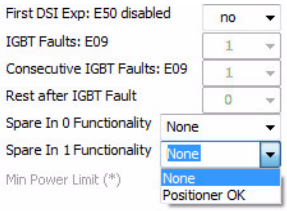


SPARE INPUT 1 FUNCTIONALITY

Select “Positioner OK” when this hardware bus signal is going to be used as an interlock or set this option to “None” if this signal is not in use.

This signal is located in TS1-7 of the A3674-XX Interface board. When the A3674-XX Interface board is connected to the A9599-XX board, connect to J1 or J2 of the A9599-XX Hardware BUS – Ethernet-CAN – SHFR Adaptation board to use this functionality.

Illustration 5-48
Spare input 1 configuration



MIN POWER LIMIT

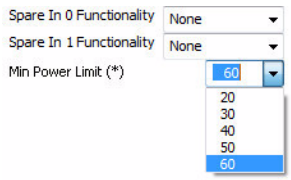
Select the power derating to be applied in single phase Generators expressed as a percentage of the nominal power of the equipment. The maximum power allowed for exposures longer than 100 ms will be calculated according to a linear reduction from the nominal power at 100 ms to the selected percentage at 1 second.

Note ☞ *This field will be shaded in gray for three-phase Generators.*

For example, in a 40 kW single phase Generator with a selected value of 50%, an exposure of 100 ms or shorter will allow to select a technique of a maximum power of 40 kW, an exposure of 550 ms will allow to select a technique of a maximum power of 30 kW and an exposure of 1 second or longer will allow to select a technique of a maximum power of 20 kW.

The power derate can be set from 60% to 20% in increments of 10%.

Illustration 5-49
Power derating configuration



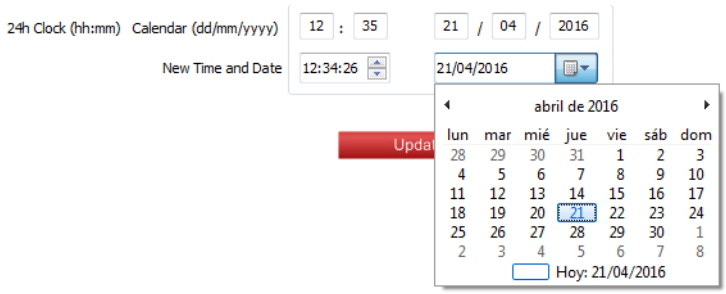
Press the “Store Data (In SHFR)” button to save the changes before exit the Generator Behavior screen.

5.1.4 DATE AND TIME

The “Date and Time” screen contains a digital clock and a calendar to ensure that the date gets entered into the database in the correct format.

The first line shows the time and date stored in the Generator while the second line shows the time and date fields that can be used to modify the “Real Time Clock” of the Generator.

Illustration 5-50
Time and Date



1. To adjust the time, click on the group to be modified (hour, minutes or seconds). The numbers are now highlighted. Click on the increase/decrease buttons to modify the value or use the cursor movement keys to navigate and modify the values.

2. To adjust the date, click on the group to be modified (day, month or year). The numbers are now highlighted. Click on the increase/decrease buttons to modify the value or use the cursor movement keys to navigate and modify the values.

3. The date can also be adjusted using a drop-down calendar. Click on the “down arrow” button on the right of the date to drop down the calendar.

   a. Use the cursor movement keys to navigate trough the calendar and press Enter to exit or

   b. Modify the date using the mouse:

   - Press the left/right arrow buttons and click on the desired date or
   - click on the name of the month or in the year displayed on top of the calendar to select a different month/year or
   - click on the “Today” area on the bottom of the calendar to set the date to today’s date.

Update RTC (In SHFR)

4. Press the “Update RTC (In SHFR)” button to save the changes before exit.

5.1.5 ADVANCED OPTIONS

Press the “Advanced Options” button located in the different Configuration screens and enter the **password 5365** to activate the hidden options.

Press the “Store Data (In SHFR)” button to save the changes before exit any of the Configuration screens.

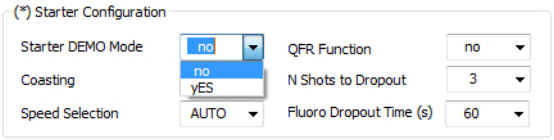
THIS SETTINGS SHOULD NOT BE MODIFIED UNLESS WELL AWARE OF THE EQUIPMENT. OTHERWISE, IT IS RECOMMENDED TO USE THE FACTORY SET VALUES.

5.1.5.1 WORKSTATIONS AND STARTER ADVANCED OPTIONS

STARTER DEMO MODE

When “Yes” is selected, some errors related to the Starter are disabled. This option is useful for some troubleshooting procedures and shall not be used during normal operation of the equipment.

Illustration 5-51
Starter Demo Mode



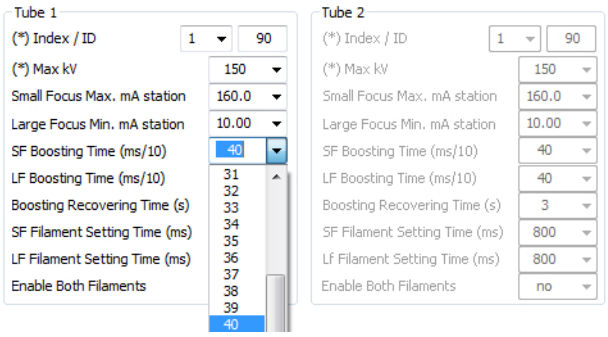
5.1.5.2 TUBES ADVANCED OPTIONS

BOOSTING TIME

Filament current boosting time is factory set for both Small Focal Spot and Large Focal Spot. Although it is editable, it is recommended to use the default value to maximize X-ray Tube life.

Set to 0 the SF Boosting Time when using X-ray Tubes with Small Focal Spot smaller than 0.6.

Illustration 5-52
Boosting Time Configuration

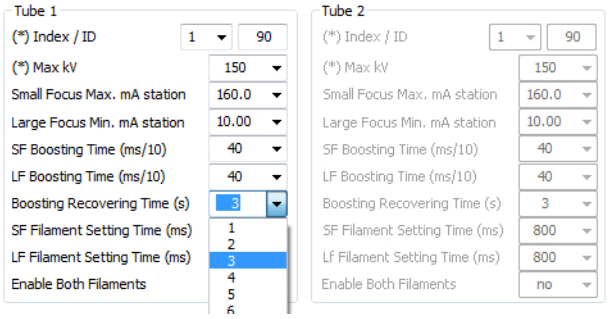


BOOSTING RECOVERY TIME

Boosting Recovery Time is the minimum time needed (in seconds) to perform a complete boost since the last time the filament was in emission state. Boosting time will be automatically reduced if boosting recovery time is not observed.

Boosting recovery time can be modified to select any value within 1 and 10 seconds.

Illustration 5-53
Boosting Recovery Time Configuration



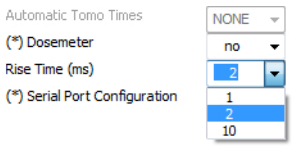
5.1.5.3 GENERATOR BEHAVIOR ADVANCED OPTIONS

RISE TIME

It is possible to select the desired rise time for voltage. Available options are 1, 2 and 10 ms, but it is strongly recommended to use the default value.

Rise time is automatically set to 10 ms when the filament current is disabled. Once the filaments are enabled again, kV rise time is set to the configured value again.

Illustration 5-54
Rise Time selection



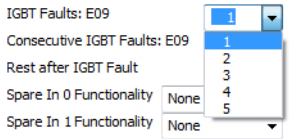
IGBT FAULTS: E09

Select how many IGBT faults should occur during the whole scan in order to show Error 9 and abort the sequence.

When 1 is selected, the sequence is aborted and Error 9 is displayed after the first IGBT fault.

Note ☞ *Bear in mind that all the pulses with IGBT fault are aborted, no matter if Error 9 is displayed on screen or not.*

Illustration 5-55
IGBT Faults configuration



CONSECUTIVE IGBT FAULTS: E09

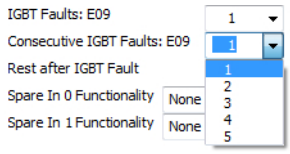
Select how many consecutive IGBT faults should occur in order to show Error 9 and abort the sequence.

If 1 is selected in this option or in the “IGBT Faults: E09” option, the sequence will be aborted and Error 9 will be displayed after the first IGBT fault.

Other selection means that the sequence will be aborted and Error 9 will be shown after the specified number of consecutive IGBT faults.

Note ☞ *Bear in mind that all the pulses with IGBT fault are aborted, no matter if Error 9 is displayed on screen or not.*

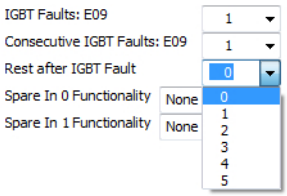
Illustration 5-56
Consecutive IGBT Faults selection



REST AFTER IGBT FAULT

Select the number of pulses to be ignored after an IGBT Fault. During the selected number of pulses, there will not be X-ray exposures.

Illustration 5-57
Rest after IGBT Fault selection



5.1.6 BACKUP AND RESTORE DATA

Once the Configuration process has finished, it is recommended to make a backup copy of the Configuration data. It is possible to save a backup of all the Configuration data or just a part of it.

COMPLETE CONFIGURATION BACKUP AND RESTORATION

To save all the configuration data in the computer, go to the Configuration Main Page and press the “Complete Configuration Backup (To File)” button. A file containing the configuration data will be created in the designated directory of the computer.

To restore a complete configuration:

1. Go to the Configuration Main Page and press the “Complete Configuration Store (From File to Generator)” button.
2. Select the folder that contains the file with the data and open it.
3. Wait until the confirmation message is displayed on screen.

This is especially useful to restore an old configuration or to copy the configuration data to the U66-EEPROM of a new Generator instead of removing the EEPROM from the socket of the old Generator to fit it in the new one.

PARTIAL CONFIGURATION BACKUP AND RESTORATION

To save just part of the configuration data, go to one of the Configuration screens and press the “Backup (To File)” button to save in the computer the configuration data contained in that screen. A file containing the configuration data will be created in the designated directory of the computer.

Note ☞ *It is recommended to press the “Refresh (From SHFR)” button before pressing the “Backup (To File)” button to ensure that the created backup file matches exactly the configuration of the generator.*

To recover the data saved on the file:

1. Press the “Restore (From File)” button.
2. Select the folder that contains the file with the data and open it.
3. Check that the restored file contains the desired data and press the “Store Data (in SHFR)” button to apply the changes.

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SECTION 6 GENERATOR CALIBRATION

Note ☞ *Enter and store calibration data in the Calibration screens as described in Sections 6.3, 6.4, 6.11.1, 6.6 and 6.7.*

Before calibration, bear in mind that:

- For calibration and kVp measurement it is recommended a Non-Invasive kVp Meter placed and centered on the X-ray Tube output at the required SID *(refer to the Non-Invasive kVp Meter documentation).*

  A HV Bleeder can also be used when a Non-Invasive kVp Meter is not available.

- For calibration and mAs measurement it is needed a mAs Meter plugged to TP85 and TP86 on the Control board *(refer to Section 6.1).*

- It is needed a jumper on pins 7 and 8 on J18 Connector to allow the kV oscillator operation.

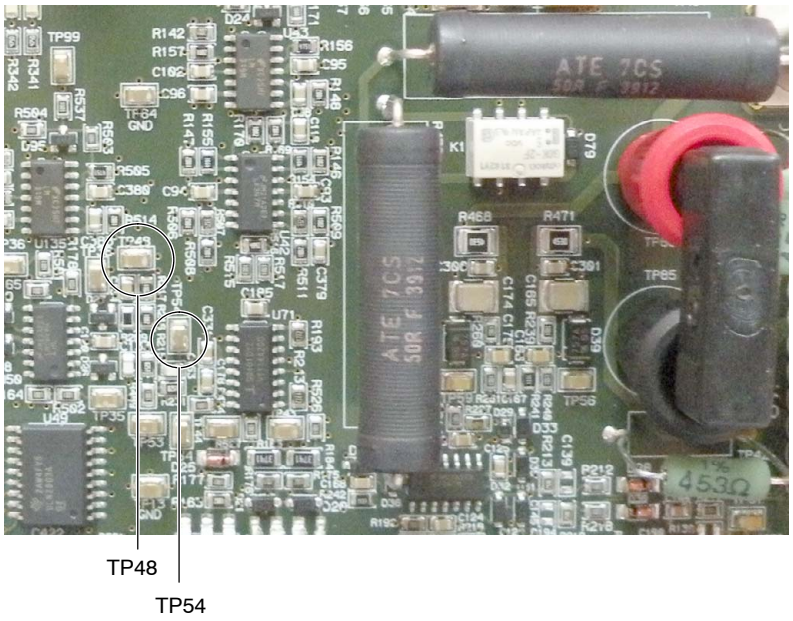
Note ☞ *Test points on the Control board can also be used to monitor the kV and mA readings but* ***should not be used*** *to calibrate the unit. These test points must be checked with scope:*

— mA test point is TP48 and the scale factor is:

— up to 10 mA, 1 volt = 1 mA.
— from 10 to 80 mA, 1 volt = 10 mA.
— from 100 mA, 1 volt = 100 mA.

— kV test point is TP54 and the scale factor is 1 volt = 33.3 kVp (0.3 volt = 10 kVp).

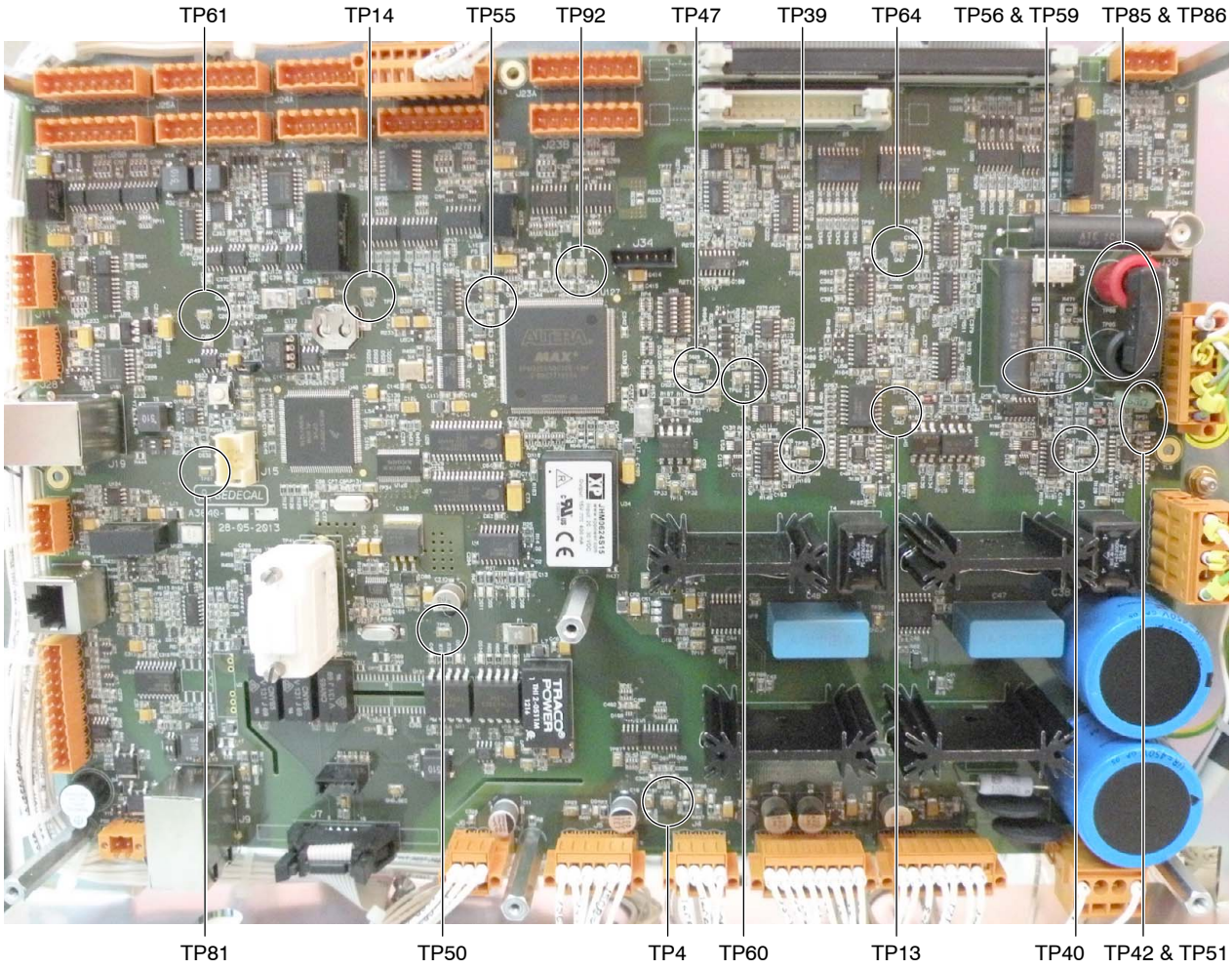
Illustration 6-1
TP48 and TP54 location



- Verify position of dip switches on the Control board during every calibration procedure:

DIP SWITCH	OPEN (OFF)	CLOSED (ON)
3640SW6-4	Position during operation — Enables Filament	Disables Filament so no radiation will be produced during the exposure.

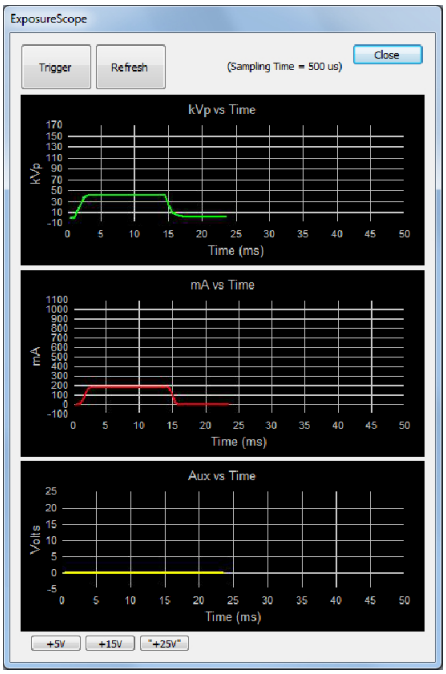
6.1 TP LOCATION



6.2 EXPOSURE SCOPE

Open the Exposure Scope by pressing the “Exposure Scope” button on the SC menu.

Illustration 6-2
Exposure Scope



The Exposure Scope can be used as an internal oscilloscope, it shows the measurement made by the microprocessor located on the Control board. Nevertheless, it is recommended to connect an external oscilloscope to the Generator to accurately perform the measurements indicated in this document. The measures obtained using the internal oscilloscope are not precise, they can only be used as a visual reference, not as trusted measurements.

The Exposure Scope screen is divided in three different fields, the first two are related to kVp and mA. Measurement scale is automatically adjusted according to the performed measurements once the exposure has been made.

If the Exposure Scope is open during Autocalibration *(refer to Section 6.4),* kV and mA are shown in their corresponding fields with every exposure, but it makes the Autocalibration process a little slower.

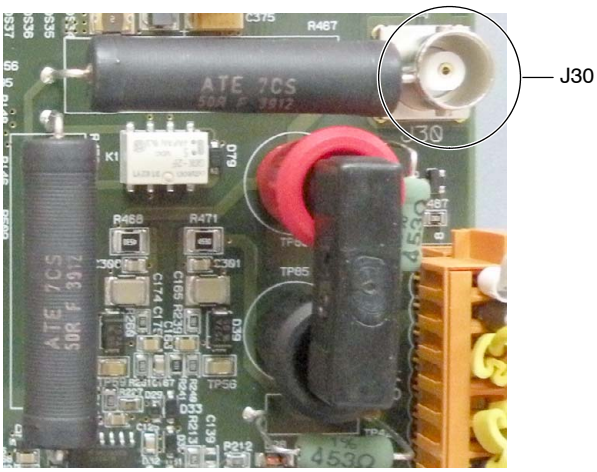
During DSI no signal is shown until the exam is finished. Then, only the last exposure kV and mA can be seen.

The third field can be used to measure any other signal on the Control board connecting a 1x scope probe (the usage of a 10x scope probe will result in obtaining an attenuated signal) to J30 of the Control board instead of connecting it to an oscilloscope. 5V, 15V and 25V scales can be selected, depending on the value to be measured. Only positive signals up to 25V can be measured.

WARNING

USE A SCOPE PROBE CONNECTED TO J30 TO MEASURE ONLY SIGNALS REFERENCED TO THE A3640-XX CONTROL BOARD GROUND (GND).

Illustration 6-3
J30 on Control board



6.3 PARAMETERS CALIBRATION WINDOW

Press the "Parameters Calibration" button to launch the Parameters Calibration window. This window has several tabs to access the different calibration screens (Parameters Calibration Main Page, General Parameters, Fluoro Calibration and AEC Calibration).

When all the calibration parameters are set on each screen, press the "Store Data (In SHFR)" button to save the changes. If any value is later modified, press the "Store Data (In SHFR)" button to save the changes.

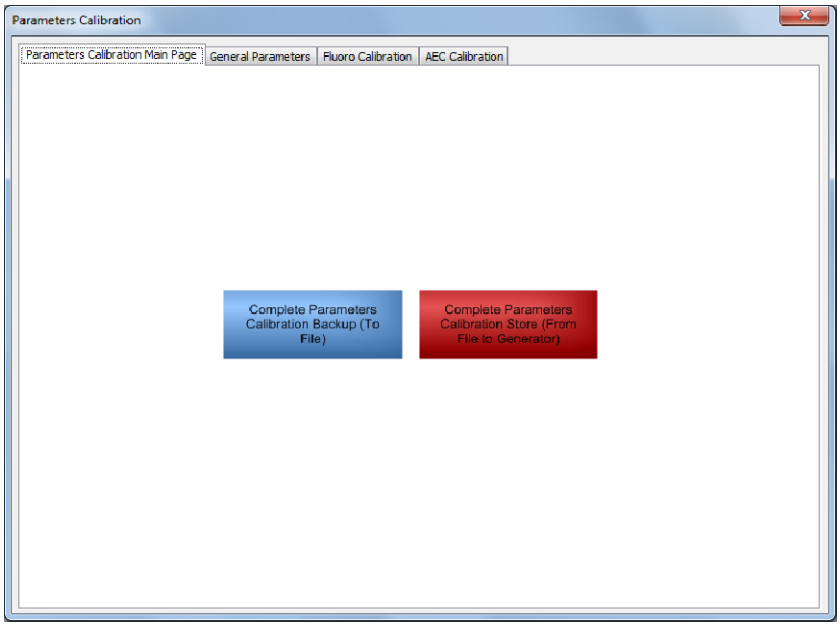
To check if a value has been properly saved, click on the "Refresh (From SHFR)" button. Values can be recovered from the Generator using the "Refresh (From SHFR)" button.

6.3.1 PARAMETERS CALIBRATION MAIN PAGE

The Parameters Calibration window initially displays the Parameters Calibration main page, with two options:

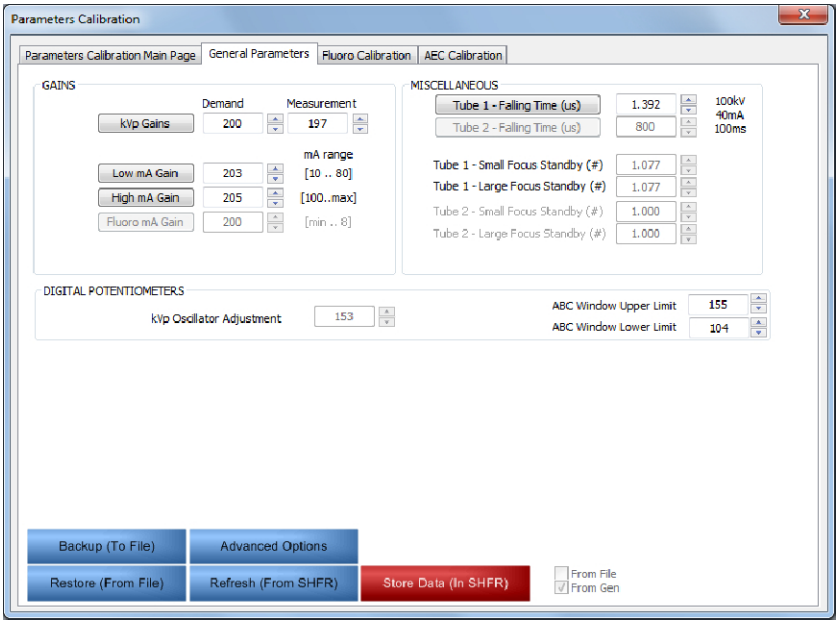
- **Complete Parameters Calibration Store (From File To Generator):** Click to restore the calibration data previously saved in a computer.
- **Complete Parameters Calibration Backup (To File):** Use this option once the Calibration process is completed *(refer to Section 6.9).*

Illustration 6-4
Parameters Calibration main page



6.3.2 GENERAL PARAMETERS

Illustration 6-5
General Parameters screen



6.3.2.1 kVp OSCILLATOR ADJUSTMENT

Note ☞ *kVp oscillator is factory adjusted. There is no need to adjust it again unless the EEPROM is initialized without keeping the potentiometers adjustment or if the A3640-XX Control board is replaced.*

Press the “Advanced Options” button in the General Parameters screen and enter the **password 5365** to activate the kVp Oscillator Adjustment option.

SINGLE PHASE GENERATORS

Two adjustments are needed for Single Phase Generators, kVp oscillator and auxiliary kVp oscillator, both measured in TP60. To switch between one and the other, press the “Aux. kVp” button.

The type of adjustment needed (A, B or C) according to the Generator maximum power is displayed next to the kVp oscillator adjustment field *(Refer to Illustration 6-6).*

Illustration 6-6
Single Phase Generator adjustments

GENERATOR	ADJUSTMENT	KVP OSCILLATOR	AUX. KVP OSCILLATOR
50 Kw	A	41 μ	60 μ
40 Kw	B	41 μ	50 μ
32 Kw	C	41 μ	50 μ

To adjust the kVp oscillator, proceed as follows:

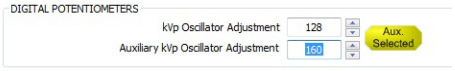
4. With the “Aux. kVp” button grey shaded, measure the kVp inverter frequency in TP60 with an oscilloscope, it must be adjusted to 41 μs. If the measured value is higher, increase the value in the kVp Oscillator Adjustment field. If the measured value is lower, decrease the value in the kVp Oscillator Adjustment field.

5. Press the “Aux. kVp” button. It gets lighted and changes to “Aux. Selected”. Now, the auxiliary kVp oscillator is measured in the same TP.

6. The Auxiliary kVp inverter frequency measured in TP60 with the oscilloscope must be adjusted to 50 μs for 32 kW and 40 kW Generators and to 60 μs for 50 kW Generators. If the measured value is higher, increase the value in the Auxiliary kVp Oscillator Adjustment field. If the measured value is lower, decrease the value in the Auxiliary kVp Oscillator Adjustment field.

The new value is automatically stored in both cases, it is not necessary to press the “Store Data” button. Just close the Parameters Calibration window to exit once the kVp oscillator and the auxiliary kVp oscillator are adjusted.

Illustration 6-7
kVp Oscillator and Auxiliary kVp Oscillator Adjustments

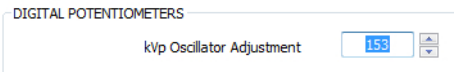


THREE PHASE GENERATORS

Measure the kVp inverter frequency in TP60 with an oscilloscope, it must be adjusted to 36 μs, except for Generators operating at 230 V~, which must be adjusted to 40 μs. If the measured value is higher, increase the value in the kVp Oscillator Adjustment field. If the measured value is lower, decrease the value in the kVp Oscillator Adjustment field.

The new value is automatically stored, it is not necessary to press the “Store Data” button. Just close the Parameters Calibration window to exit once the kVp oscillator is adjusted.

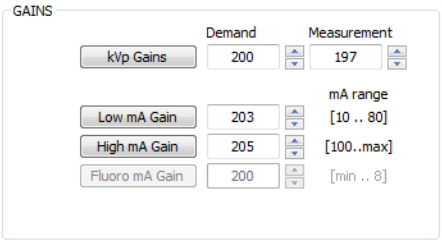
Illustration 6-8
kVp Oscillator Adjustment



6.3.2.2 GAINS ADJUSTMENT

Note ☞ *Gains are factory adjusted. There is no need to calibrate them again unless the A3640-XX Control board or the HV Transformer have to be replaced (just the kV gain) or if the EEPROM is initialized. In this case, kV and mA gains have to be adjusted unless the EEPROM has been initialized keeping the mA gain values, so only the kV gains have to be calibrated.*

Illustration 6-9
Gains calibration



Gains values have a 15% tolerance. Starting value is 200, so the final value will be within 170 and 230.

The following gains are adjustable (only the needed gains have to be adjusted):

- kVp gain.
- Low mA gain: from 10 to 80 mA.
- High mA gain: from 100 mA.
- Fluoro mA gain: below 10 mA (if available).

Note ☞ *Use a non-invasive meter or a HV Bleeder to measure kVp and a mA/mAs meter connected to TP85 and TP86 of the Control board for mA measurement* (refer to Section 6.1).

Before the Gains calibration it is necessary to calibrate manually one or several mA stations (only the needed mA stations have to be calibrated):

1. Go to Manual Calibration by pressing the "Manual Calibration" button on the SC menu and calibrate:

   a. 10 mA for **Low mA gain** adjustment, 100 mA for **High mA gain** adjustment and 8 mA (if available) for **Fluoro mA gain** adjustment, all of them for 80 kVp and Large Focal Spot, if possible *(refer to Section 6.11.1)*. Otherwise, calibrate for Small Focal Spot those mA stations which are not available for Large Focal Spot.

   b. The lowest mA station with 80 kVp for **kVp gain** adjustment, if it has not been calibrated in the previous step. Calibrate it for Large Focal Spot if the lowest mA station of the Generator is available for Large Focal Spot. Otherwise, calibrate it for Small Focal Spot *(refer to Section 6.11.1)*.

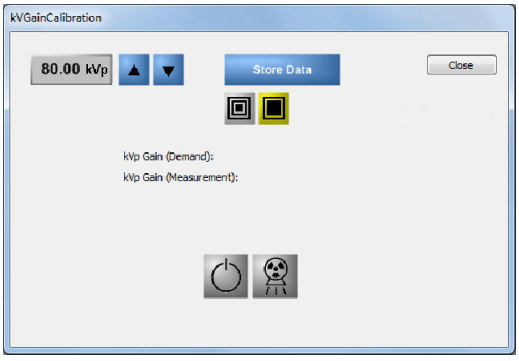
2. Write down the FIlament Data of the calibrated mA stations.

PERMANENT DAMAGE CAN BE CAUSED TO THE TUBE IF THE REQUIRED MA STATIONS ARE NOT ACCURATELY CALIBRATED BEFORE PERFORMING THE GAINS ADJUSTMENT.

kVp GAIN ADJUSTMENT

1. Press the "kVp gains" button in the General Parameters screen. A pop-up screen will be displayed.

Illustration 6-10
kVp Gain calibration screen



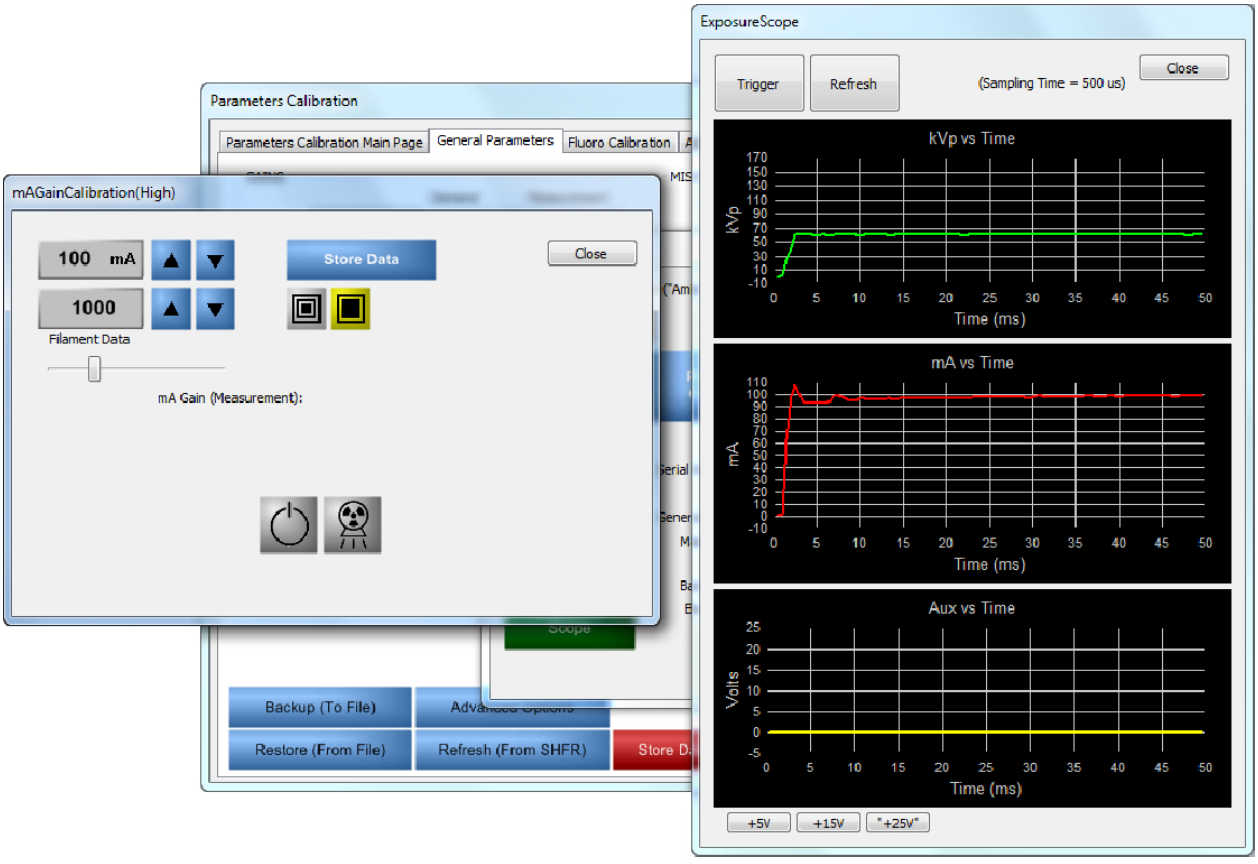
2. Make an exposure and measure kVp with a non-invasive meter or with a HV Bleeder.

3. Select on the “kV Gain Calibration” screen the measured value and press “Store Data”.

4. Press “Close” to exit. kVp is then adjusted and the “Demand” and “Measurement” values are automatically modified.

mA GAIN ADJUSTMENT

Illustration 6-11
High mA Gain calibration screen



1. Open the Exposure Scope *(refer to Section 6.2)*.

2. Press the “Parameters Calibration” button and go to the General Parameters screen.

3. Press the “Low mA Gain” button. A pop-up screen will be displayed *(refer to Illustration 6-11).*

4. Enter the Filament Data obtained for the 10 mA station previously calibrated.

5. Make an exposure and measure mA with the mA/mAs meter.

6. Increase or decrease the Filament Data in small steps, making exposures, and modify the Filament Data as needed in order to reach 10 mA in less than 40 ms, as seen in the Exposure Scope.

7. Select on the “mA Gain Calibration (Low)” screen the measured value of mA and press “Store Data”.

8. Press “Close” to exit. Low mA Gain is then adjusted and its value is automatically modified in the Parameters Calibration menu.

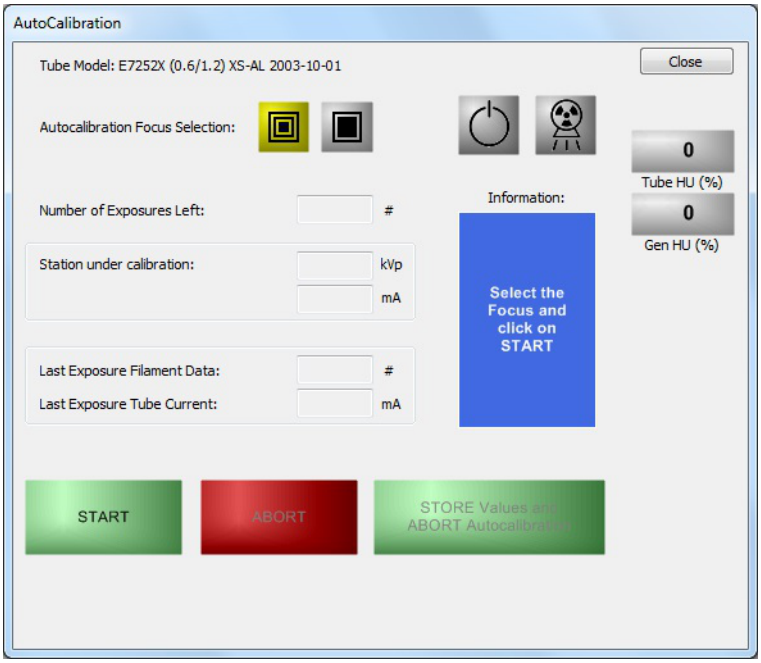
9. Repeat the same procedure for High gain, entering the Filament Data obtained for the 100 mA station previously calibrated and adjusting it to reach 100 mA in less than 40 ms.

10. Finally, repeat the procedure for Fluoro gain (if available) to reach 8 mA in less than 40 ms.

Note ☞ *If the Automatic adjustment of the kVp and/or mA gains cannot be performed, proceed with the Manual adjustment* (refer to Section 6.11.2).

6.4 AUTOCALIBRATION

Illustration 6-12
Autocalibration screen



Autocalibration of the Filament Current data is divided in two separated procedures related to the mA stations configured for the Small or Large Focal Spots.

It is recommended to start with the Small Focal Spot and continue with the Large Focal Spot.

Autocalibration process can be carried out with any workstation selection.

If Filament Data Graph *(refer to Illustration 6-15)* is open during Autocalibration, a red curve representing the Filament Current is drawn during the process. This can be used to check if any error occurs while autocalibrating (insufficient mA, space charge, etc.). Keep in mind that keeping the Filament Data Graph open during Autocalibration makes the process slightly slower.

Exposure Scope *(refer to Section 6.2)* can be open during Autocalibration as well. kV and mA are shown in their corresponding fields every time a exposure is made but, as with the Filament Data Graph, keeping the Exposure Scope open during Autocalibration makes the process a little slower.

1. Enter in Autocalibration mode by pressing the “Autocalibration” button on the SC menu.

2. Check that the Heat Units used by the X-ray Tube are 0% or nearly.

3. Select the **Small Focal Spot** and press the “Start” button.

4. Keep the Handswitch button fully pressed to perform continuous exposures. The “Ready” icon is lighted in green and the “Exposure” icon is lighted in yellow every time a exposure is made.

Note ☞ *In Autocalibration mode, all technique parameters are factory pre-programmed and they can not be changed.*

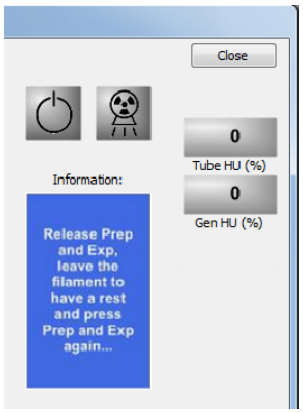
Autocalibration starts with a series of exposures, increasing the Filament data in 100 steps until reaching half of the mA of the first station to be calibrated.

Then, Autocalibration of the first kVp/mA station begins with the minimum available mA station for the selected Focal Spot at the minimum kVp and follows with all the other combinations of mA stations for the selected Focal Spot at Low, Medium and High kVp.

5. Autocalibration process is paused after every kVp station calibration, then it is mandatory to release the Handswitch, a message is shown in the screen asking to do so. Wait a few seconds and then press and hold the Handswitch again in order to continue with the calibration process.

Note ☞ *It is strongly recommended to release the handswitch and keep it released for quite a while to let the Tube to cool down (check the HU indicator) to prevent filament overheat when many stations are to be calibrated.*

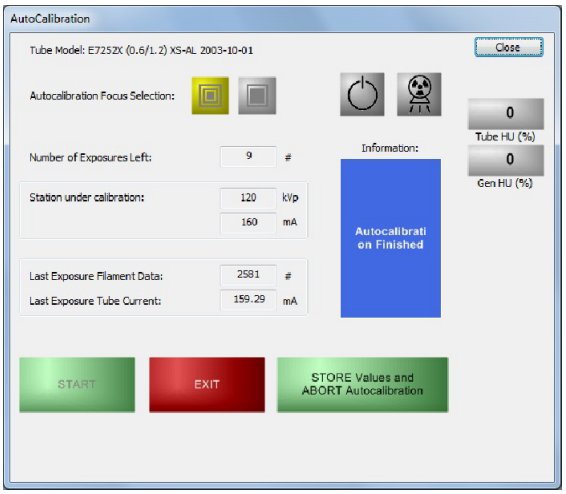
Illustration 6-13
Release the Handswitch when instructed to do so



Note ☞ *To exit Autocalibration without calibrating every station, press the "Store Values and Abort Autocalibration" button after completing the last needed station. Previously stored values will be deleted and replaced by the values calibrated so far. Non-calibrated values have to be calibrated manually* (refer to Section 6.11.1).

6. When Autocalibration ends, the message "Autocalibration Finished" is shown in the Information screen. Press the "Exit" button, all calibrated parameters will be automatically saved.

Illustration 6-14
Autocalibration completed successfully



Note ☞ *Autocalibration can be paused momentarily releasing the Handswitch button, whenever there is not an exposure in process. Press the Handswitch again to resume the Autocalibration process.*

Note ☞ *Press the "Abort" button before starting the calibration procedure to leave without losing any data previously stored. This can be made even if the "Start" button has been pressed, whenever the Handswitch has not been pressed yet.*

CAUTION ***Autocalibration can be cancelled by releasing the Handswitch and pressing the "Abort" button. All data will be lost.***

Note ☞ *If the Tube Heat Units are too high, calibration procedure will be momentarily stopped. No message will be shown on screen, just release the handswitch and wait for the Tube to cool down before pressing the handswitch again to continue with the autocalibration.*

Generator tries to calibrate each kV/mA combination in ten (10) attempts (maximum). If it is not possible to calibrate the current mA station in ten attempts, error “E60” is shown on the screen. Reset the error condition and continue with the Autocalibration procedure.

When Autocalibration is successfully performed, message “Autocalibration Finished” is shown on the screen. Press the “Exit” button and close the Autocalibration screen to go back to the SC menu or select the Large Focal Spot and press the “Start” button to continue with the other Focal Spot calibration procedure.

7. Repeat the same procedure for the **Large Focal Spot.**

Note ☞ *If any error occurs during the Autocalibration process or the Autocalibration process ends before the whole procedure is completed, refer to Section 6.11.1 for manual calibration of the remaining kV/mA combinations.*

8. After performing both procedures (for Small and Large Focal Spots), enter in “Manual Calibration” mode by pressing the “Manual Calibration” button on the SC menu, and select each combination of the available mA stations for each Focal Spot at the kV break points (Low, Medium and High kVp). Read on the “Filament Data” field the new value of the Filament Current data stored for each combination and write down the new values in the Data Book.

9. Exit from “Manual calibration” mode.

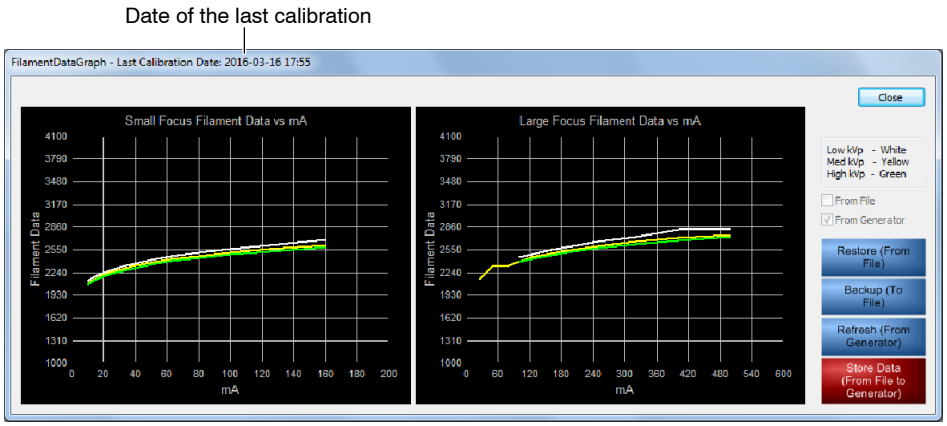
Note ☞ *The Filament Stand-by value is adjusted by the Generator during the Autocalibration process and is automatically stored. Filament Stand-by values are not field changeable.*

6.5 FILAMENT DATA CALIBRATION CHECKS AND BACKUP

1. Press the “Filament Data Graph” button to see the Filament curves of the calibrated Tube. The left graphic shows the Small Focus Filament data and the right one shows the Large Focus Filament data, with the Low kVp curve drawn in white, the Medium kVp in yellow and the High kVp in green.

2. Check that there are neither sawtooth waves nor step waves in the curves graphs. That would indicate an unreliable calibration.

Illustration 6-15
Filament Data Graph



The following operations can be performed in the Filament Data Graph screen:

- **Restore (from File):** Press to view the Filament Current data stored in a file previously saved in a computer. Data is shown on screen but not transferred to the Generator. Use this option before storing the Filament Current data in the Generator to check that the mA stations contained in the file are allowed by the licence (check “Licence info” in the SC menu) and by the Configuration of the Generator (”Min kV” and “Max mA” fields).

- **Backup (to File):** Press to make a backup copy of the Filament Current data in the computer. A file containing the calibration data will be created in the designated directory of the computer.

- **Refresh (from Generator):** Press to view the Filament Current data of the calibrated mA stations as stored in the Generator.

- **Store Data (from File to Generator):** Press to replace the Filament Current data of the Generator with the data stored in a file previously saved in a computer.

Note ☞ *The data storage process will not be completed if the file to be restored contains mA stations not allowed by the licence plugged to J17 of the A3640-XX Control board or by the Configuration of the Generator (”Min kV” and “Max mA” fields).*

6.6 FALL TIME ADJUSTMENT

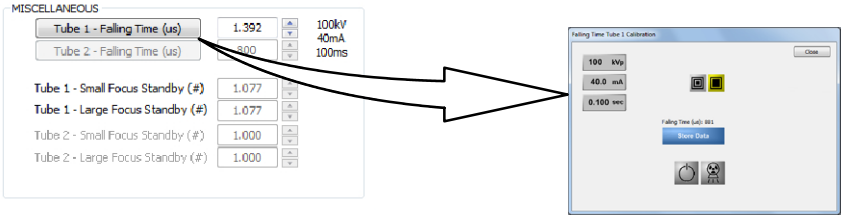
Once the Autocalibration process is completed, go back to the General Parameters screen *(refer to Section 6.3.2)* to perform the Fall Time adjustment.

Note ☞ *kVp gain and Low mA gain must be adjusted before proceeding with the Fall Time adjustment. Otherwise, the microcontroller is not able to precisely measure the cables capacity* (refer to Section 6.3.2.2).

CAUTION

It is mandatory to perform the Fall Time adjustment every time the A3640-XX Control board, Tube, HV cables or HV Tank are replaced.

Illustration 6-16
Fall Time data



1. Press the “Tube 1 - Falling Time (µs)” button. A pop-up window will be displayed showing the parameters of the exposure to be made.
2. Make an exposure.
3. Press the “Store Data” button. The Fall Time value is automatically adjusted.
4. Close the pop-up window and press the “Store Data (in SHFR)” button to save the changes.

Note ☞ *If the Automatic adjustment cannot be performed, proceed with the Manual adjustment* (refer to Section 6.11.3).

6.7 AEC

This section describes the adjustments needed to calibrate the AEC according to the customer input. Therefore, AEC exposures will be made during the calibration process in order to insure AEC functionality.

The Optical Density/Dose Level is controlled by the values stored in the generator memory. These values are influenced by film speed, screen speed, dark room procedures and customer requirements.

Use a homogeneous Phantom with enough density to produce an exposure of 100 ms. The AEC will be calibrated to produce a density of 1.0 (or the customer preference Optical Density/Dose Level):

- Filtration based on the RQA5 standard (21 mm Al) for the Collimator Filter Holder (recommended for AEC/ABC calibration).
- Copper Plates can be used Instead of Aluminum:
  2 units of 1 mm thickness,
  1 unit of 0.5 mm thickness,
  2 units of 0.2 mm thickness,
  1 unit of 0.1 mm thickness.
- Acrylic Plastic Plates can be used Instead of Copper Plates:
  6 units of 5 cm. thickness,
  5 units of 1cm. thickness.

Note ☞ *For AEC calibration with Film, use the same Film and Cassettes used by the customer. AEC calibration must be performed using all the Film/Screen speed combinations that are going to be used by the customer. The Medium Film/Screen speed has to be double of the Slow and half of the Fast (a.e. 200-Slow, 400-Medium, 800-Fast).*

Note ☞ *When using CR (Computed Radiography) or DR (Digital Radiography) calibrate the sensitivities used by the customer and instead of measuring Optical Density:*

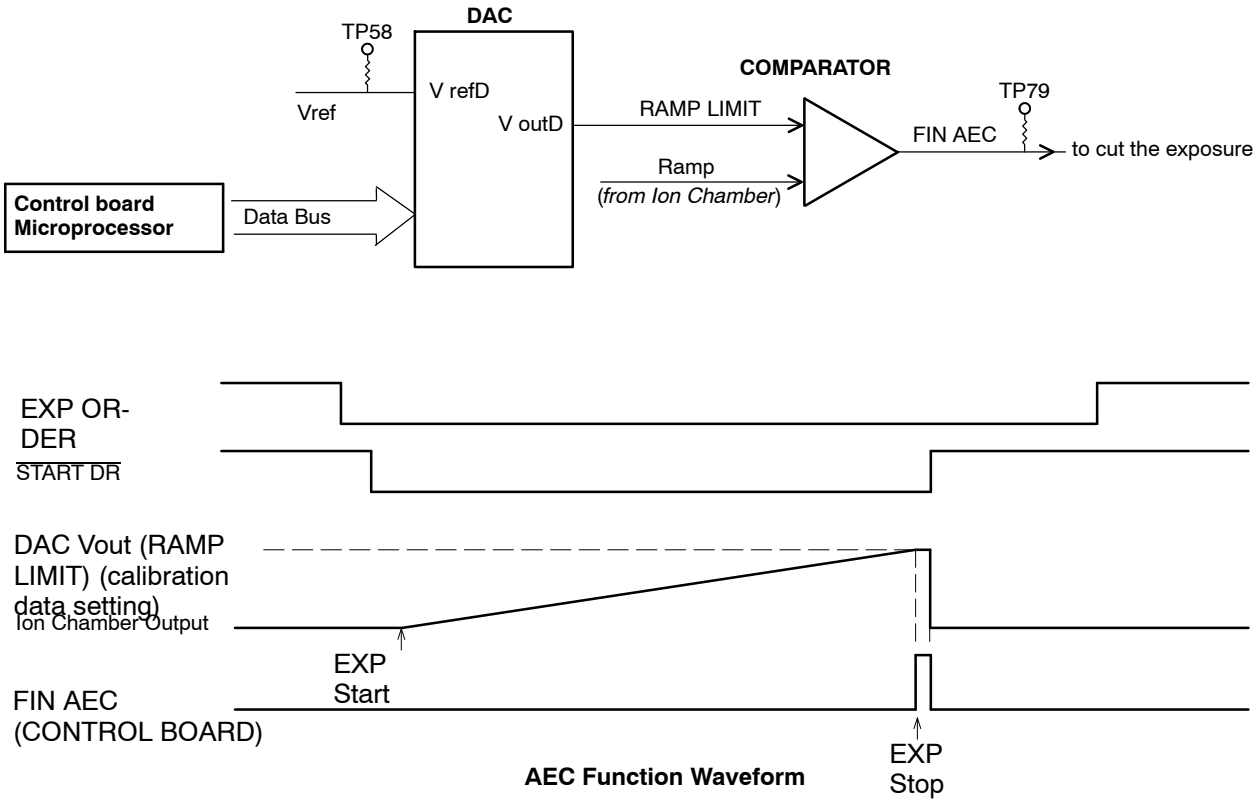
- measure the Image Gray level by using the needed software tools inside each application (refer to CR or DR documentation).

- or measure the Dose level:

- For CR, placing the Dosimeter as close as possible to the Cassette and centered with the Central Area of the Ion Chamber.

- For DR, placing the Dosimeter as close as possible to the Panel, centered with the Central Area of the Ion Chamber and with the Grid removed.

Illustration 6-17
Automatic Exposure Control



6.7.1 PREVIOUS CHECKS

Before starting with the AEC Calibration, it is necessary that the Alignment of X-Ray Beam and the Alignment of Light Field with X-Ray Field should be performed.

Make sure the automatic processor works correctly, and the concentration and temperature of the solutions comply with manufacturer specifications.

Obtain a sensitometric curve to determine gamma (γ) of the film and the solution quality. The procedure normally requires a sensitometer, but if it is not available proceed as follows:

1. Make two exposures using the same kV and Film/Screen combination (medium is recommended) but with different mAs settings, mAs(f1) and mAs(f2).

2. Develop and measure the Density (d) of each, d(f1) and d(f2).

3. Determine gamma (γ) by the formula:

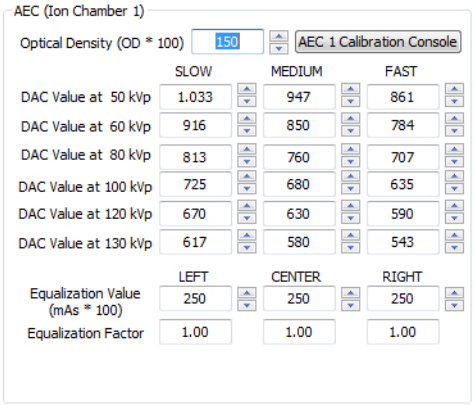
$$\gamma = \frac{d(f2) - d(f1)}{log_{10} \frac{mAs(f2)}{mAs(f1)}}$$

Gamma (γ) must be between 2 and 3, if not change or renew solutions.

6.7.2 AEC CALIBRATION

1. Press the “Parameters Calibration” button on the SC menu and go to the AEC Calibration screen.

Illustration 6-18
AEC calibration screen



2. If the Ion Chamber has the following switches or potentiometers, set them to mid range (Refer to the *Ion Chamber documentation*):
   - Master Gain switch or potentiometer
   - Balance potentiometers for the Three Field Detectors (cells)
3. Set the Master Gain potentiometer of the Ion Chamber to mid range (*refer to the Ion Chamber documentation*).

Note ☞ *This section describes the AEC calibration using the Service Console. AEC can be calibrated using the Ion Chamber potentiometers as well (refer to the Ion Chamber documentation).*

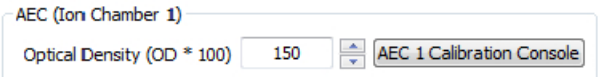
4. Set the SID at any Focal Distance from 1 to 2 meters (39 to 78 inches).
5. Collimate the X-ray beam so that it completely covers all three fields.

6. Add a filtration based on the RQA5 standard (21 mm Al) in the Collimator Filter Holder.

Note ☞ *Make sure that the X-ray beam does not extend beyond the limits of the phantom if it is placed on the tabletop of the Table or on the Wall Stand front panel instead of being placed in the Collimator Filter Holder.*

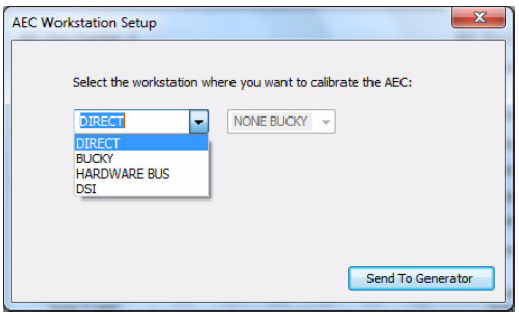
7. Set the Optical Density/Dose Level to the desired value in the “Optical Density (OD * 100)” field. A value of 100 is equal to an Optical Density/Dose Level of 1. Value can be set from 100 to 500.

Illustration 6-19
Optical Density



8. Click on the “AEC 1 Calibration Console” button. A pop-up window with the available Workstations for the AEC calibration will be displayed.

Illustration 6-20
AEC Workstation Setup

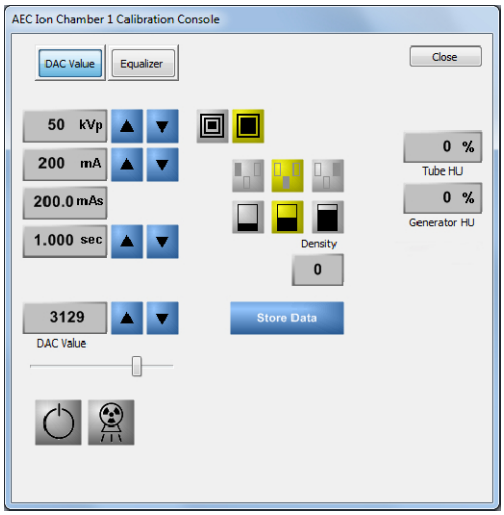


9. Select the Workstation where the AEC is going to be calibrated and click on “Send To Generator”.

10. The Calibration Console is now displayed. Select:

- RAD: 50 kV, 200 mA, Large Focal spot and 1 second back-up time.
- AEC: Select the Film/Screen combination to be calibrated. “Central Area” and “Density 0” are selected by default.

Illustration 6-21
AEC calibration menu



11. **For analog buckys:**

    a. Make an exposure with film in the cassette (exposure time varies if film is removed) and make sure the exposure time is within 40 and 100 ms. Modify the mA selection as needed in case the time is out of this boundaries. Time will be increased when decreasing the mA selection and vice versa. Make as many exposures as needed using the same film to get the desired exposure time.

    b. Insert into the Bucky tray a cassette with the Film-Screen combination used by the customer. Make an exposure, develop the film and check the density, it should be approximately 0.8 to 1.2 (or the customer's density preference).

    c. Increase the value in the "DAC Value" field in case it is needed to increase the density or decrease the value if the measured density is too high. When modifying this value, exposure time could change. Modify the mA selection as needed and make a new exposure using the same film to check that the exposure time is within 40 and 100 ms.

d. Make an exposure with new film in the cassette to check the density again.

e. Repeat steps b. and c. as many times as needed until getting the desired density and click on the “Store data” button.

f. Go to step 13.

12. **For Digital Detectors:**

a. Make an exposure with the previously selected values, as explained in step 8., and measure the Dose level.

b. Increase the value in the “DAC Value” field in case it is needed to increase the density or decrease the value if the measured density is too high. Time must be always within 40 and 100 ms, modify the mA selection as needed in case the time is out of this boundaries. Time will be increased when decreasing the mA selection and vice versa.

c. Repeat steps a. and b. as many times as needed to accurately calibrate the “DAC value” and click on the “Store data” button.

d. Go to step 13.

13. Repeat the previous procedure for 60, 80, 100, 120 and 130 kVp.

Note ☞ *If the Generator maximum kV are lower than 130, use the same DAC value obtained for 120 kVp to calibrate the 130 kVp station.*

Note ☞ *Adjust the potentiometers of the Ion Chamber if unable to get an exposure time within 40 and 100 ms for every kVp station.*

14. Repeat the whole procedure for the remaining film/screen speed combinations.

6.7.3 EQUALIZATION

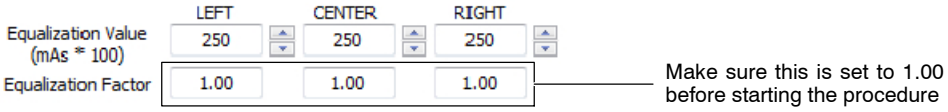
Note ☞ *Make sure to keep the same SID during the whole process and that the Exposure field covered by the X-ray beam remains constant.*

Once the Central Area is calibrated, it is needed to calibrate the Left and Right Ion Chamber fields by adjusting the Equalization value. The equalization Factor remains constant for the Central Area and is automatically adjusted for the Left and Right Areas when modifying their respective Equalization value.

CAUTION

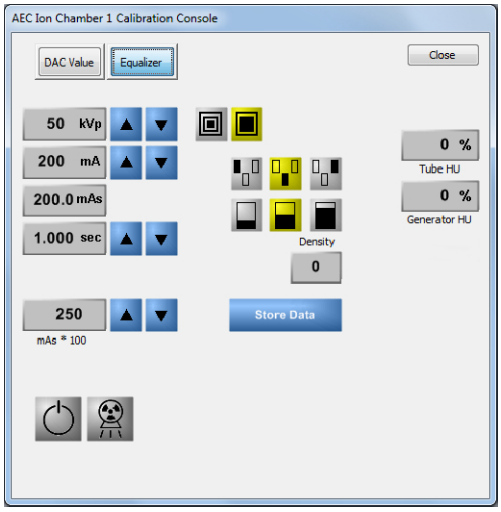
The equalization Factor for the Left, Center and Right areas must be set to 1.00 before starting this process.

Illustration 6-22
Equalization Factor before starting the Equalization procedure



For the Left and Right Ion Chamber fields calibration, perform the following procedure:

1. Click on the “Equalizer” button in the “AEC 1 Calibration Console” screen.



2. Select 80 kVp and Central Area and make an exposure to get a mAs value close to 2.5.

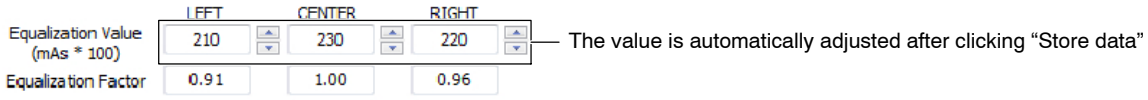
Note ☞ *It is recommended to make three exposures with the same parameters and calculate the average mAs value for a more accurate calibration.*

3. Enter the obtained mAs multiplied by 100 in the “mAs * 100” field (must be close to 2.5) and click on the “Store data” button.

4. Make the same exposure/s with the Left Area and, finally, with the Right Area selected, storing their respective mAs values after the exposures. The equalization factor is then automatically adjusted so the same mAs is obtained with every exposure, no matter which field or combination of fields is selected.

5. Click “Close” to exit the “AEC 1 Calibration Console”.

Illustration 6-23
Equalization Value



6. Repeat the whole calibration and equalization procedures for AEC 2 if a second Ion Chamber is to be used, clicking on the “AEC 2 Calibration Console”.

6.8 DETECTOR CALIBRATION

Note ☞ *Detector calibration is performed from the corresponding Detector application (depending on each Detector model).*

Note ☞ *For exposures configuration during the Detector calibration, it is necessary to open the Generator Service Console (refer to Section 4).*

To perform the Detector calibration, follow the next steps:

1. In the desktop of the PC or auxiliary console, open the Detector folder.

Illustration 6-24
Detector Folder

2. Run the Detector application file.
3. In the Detector application, select the required Detector and connect it.
4. Access the calibration section of the Detector application and follow the instructions on the screen.
5. In the desktop of the PC or auxiliary console, open the Generator Service Console *(refer to Section 4)*.
6. Access the Generator User Console *(refer to Section 7)*.
7. Select the Direct Mode.
8. Select the radiographic parameters to proceed with the Detector calibration *(refer to Section 7.1)*.

6.9 BACKUP AND RESTORE DATA

Once the Calibration process has finished, it is recommended to make a backup copy of the Calibration data. It is possible to save a backup of all the Calibration data or just a part of it.

COMPLETE CALIBRATION BACKUP AND RESTORATION

To save all the calibration data in the computer, go to the Parameters Calibration Main Page and press the “Complete Parameters Calibration Backup (To File)” button. A file containing the calibration data will be created in the designated directory of the computer.

To restore a complete calibration:

1. Go to the Parameters Calibration Main Page and press the “Complete Parameters Calibration Store (From File to Generator)” button.
2. Select the folder that contains the file with the data and open it.
3. Wait until the confirmation message is displayed on screen.

This is especially useful to restore an old calibration or to copy the calibration data to the U66-EEPROM of a new Generator instead of removing the EEPROM from the socket of the old Generator to fit it in the new one.

PARTIAL CALIBRATION BACKUP AND RESTORATION

To save just part of the calibration data, go to one of the Parameters Calibration screens and press the “Backup (To File)” button to save in the computer the calibration data contained in that screen. A file containing the calibration data will be created in the designated directory of the computer.

Note ☞ *It is recommended to press the “Refresh (From SHFR)” button before pressing the “Backup (To File)” button to ensure that the created backup file matches exactly the calibration of the generator.*

To recover the data saved on the file:

1. Press the “Restore (From File)” button.
2. Select the folder that contains the file with the data and open it.
3. Check that the restored file contains the desired data and press the “Store Data (in SHFR)” button to apply the changes.

This is especially useful to restore part of the calibration data when some other values have to be recalibrated, e.g. to restore just the AEC data when the A3640-XX Control board has to be replaced.

6.10 FINAL CHECKS

1. Verify that all configuration and calibration data have been properly stored:

- Go to the Configuration window and press the “Refresh (from SHFR)” button on every screen to check that all the configuration parameters stored in the Generator are correct.
- Go to the Parameters Calibration window and press the “Refresh (from SHFR)” button on every screen to check that all the calibration parameters stored in the Generator are correct.
- Go the the Filament Data Graph screen and press the “Refresh (from Generator)” button to check that calibration of the Filament Current data is correct for both focal spots.

2. Turn off the Generator and check that Dip switches are set as indicated in Section 3.2.1:

- A3640-XX Control board:
  - **3640SW2:** All its switches in **On** position.
  - **3640SW6:** All its switches in **Off** position once the calibration and configuration procedures are finished.
  - **3640SW7:** All its switches in **On** position.
- S0008009 Dual Speed Starter:
  - **S0008009S1:** All its switches but S0008009S1-2 in **Off** position. Dip switch S0008009S1-2 in **On** position.

3. Once the calibration and configuration procedures are completed, it is strongly recommended to save a general backup in the computer in case it is needed to be restored in the future *(refer to Section 4.2).* Write down in the Data Book the name and location of the folder containing the backup files.

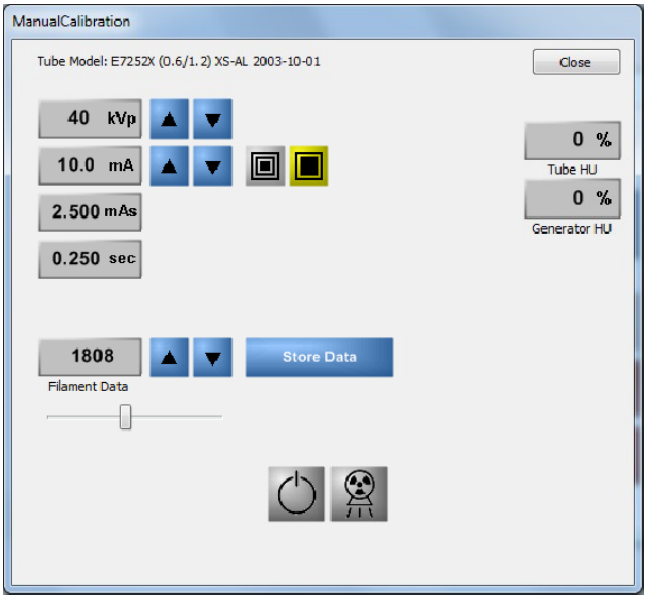
4. Once the calibration and configuration procedures are completed, the OTC must be reconnected to the PC (*refer to Installation Manual and DI 6070300 of the Schematics document*).

6.11 MANUAL CALIBRATION PROCEDURES

Note ☞ *Perform the procedures explained in this section only if the Automatic procedures cannot be done or if specifically indicated in the previous sections of this document.*

6.11.1 MANUAL CALIBRATION

Illustration 6-25
Manual calibration screen



This procedure describes the Manual calibration of all the Filament Current data. To enter in Manual mode press the “Manual Calibration” button on the SC menu.

Note ☞ *Manual Calibration has to be performed before the Gains calibration (in case it is needed and just for the needed mA stations) and to calibrate the kV/mA combinations not performed during Autocalibration procedure if it has not been completed. These combinations have the Filament Current data set to “1000”, so only these combinations have to be manually calibrated as described in this procedure.*

If Autocalibration for one of the Focal Spots has been successful, it is only required to perform the manual calibration of the mA stations that have not been calibrated for the other Focal Spot.

Manual Calibration is initiated at the Low kVp break point by entering the appropriate Filament Current data for the proper tube current at each selectable mA. Calibration at the other kV break points (Low, Medium and High kVp) are obtained by adding or subtracting values as indicated in Table 6-1.

Although the suggested values *(refer to Table 6-1)* could change depending on the X-ray tube used, entering those values will approximate accurate calibration without making excessive exposures.

Table 6-1
mA Calibration Data Change

mA STATION	FILAMENT CURRENT DATA AT kV BREAK POINT		
	Low kVp	Medium kVp	High kVp
10	A_1	A_1-30	A_1-45
12.5	A_2	A_2-30	A_2-45
16	A_3	A_3-30	A_3-45
20	A_4	A_4-30	A_4-45
25	A_5	A_5-30	A_5-45
32	A_6	A_6-30	A_6-45
40	A_7	A_7-30	A_7-45
50	A_8	A_8-30	A_8-45
63/64/65*	A_9	A_9-30	A_9-45
80	A_{10}	A_{10}-30	A_{10}-45
100	A_{11}	A_{11}-50	A_{11}-70
125	A_{12}	A_{12}-50	A_{12}-70
160	A_{13}	A_{13}-50	A_{13}-70
200	A_{14}	A_{14}-50	A_{14}-70
250	A_{15}	A_{15}-50	A_{15}-70
320	A_{16}	A_{16}-70	A_{16}-100
400	A_{17}	A_{17}-70	A_{17}-100
500	A_{18}	A_{18}-70	A_{18}-100
630/640/650*	A_{19}	A_{19}-70	A_{19}-100
800	A_{20}	A_{20}-70	A_{20}-100
1000	A_{21}	A_{21}-70	A_{21}-100

Note.— The mA station values depends on the Generator model. Some models do not contain all the mA stations listed above.

** Configurable under requirement*

In “Manual Calibration” mode, the Filament Current data is shown on the “Filament Data” box after selecting the respective kV/mA combination. The value can be changed by pressing the “Increase” or “Decrease” buttons and stored by pressing the “Store Data” button.

Note that in Manual calibration mode, only the mA stations and kV (at the break points) can be selected.

1. With the Generator power OFF, remove the link between TP85 and TP86 on the Control board and connect the mA/mAs meter to TP85 and TP86 to measure mAs.

2. Turn the Generator ON and enter in Manual calibration mode by pressing the “Manual Calibration” button on the SC menu.

3. Check that the Heat Units used by the X-ray Tube are 0% or nearly.

4. According to X-ray tube ratings or maximum Generator power, check which kV/mA combinations in Table 6-1 are allowed.

   If an intermittent beep sounds after selecting a kV/mA combination, it means this particular combination is not allowed for the selected X-ray Tube or the Generator power is exceeded by this combination.

   Note which combinations in Table 6-1 can not be calibrated by making exposures (combinations not allowed due to Tube rating, maximum Generator power, space charge, etc.).

5. Select the lowest kV/mA combination available that was not automatically calibrated (Filament Data set to “1000”). Enter the Filament Current data of the previous mA station for the same kV **increased in 40.**

Note ☞

If Autocalibration has not been performed before initiating the Manual calibration or no kV/mA combination has been calibrated for any reason, it is recommended to start the Manual calibration by selecting 40 kV and the lowest mA station available. Start increasing the Filament Data in 100 steps, making exposures and calculating the mA based on the measured mAs. Then, increase the Filament data in 10 points for every mA that is needed to be increased (only when calibrating mA stations lower than 25 mA) and make another exposure. Adjust the Filament data to obtain the desired mAs and proceed to calibrate the rest of the desired kV/mA stations using the Filament data of the calibrated station as a reference and Table 6-1 as a guide, as explained in this section.

6. Make an exposure. The mAs read on the mA/mAs meter must be the same mAs displayed on the calibration screen with a tolerance of ± 0.1 mAs (tolerance of the parameter and mA/mAs meter).

7. If the mAs is low, increase the filament data. If the mAs is high, decrease the filament data. Repeat until the mA station is calibrated. Press the "Store Data" button once the kV/mA station is calibrated.

Note ☞ *Press the "Store Data" button to store the new data (Filament Current) before selecting the next kV or mA stations.*

CAUTION

Filament data (currently in memory) may or may not be close to your requirements. If it is not close, the potential exists to damage the X-ray tube (i.e. too much mA). Thus, as the mA calibration procedure starts, note how close or how far from the mA break points you are. If a large adjustment (more than 40 points) is required at the low mA stations, make estimated adjustments to the high mA stations before those exposures are made.

8. Select the next mA station at Low kVp, increase in 40 the Filament Current data calibrated for the previous mA station and repeat steps 6. and 7.

Note ☞ *To make calibration easier, Filament Data is kept the same when moving up or down one mA or kVp station after storing a new Filament value.*

To check the real value of a kVp/mA combination consecutive to the combination that has been just stored, select the kVp/mA combination to be checked, then, select the next or the previous kVp or mA station and return to the kVp/mA combination to be checked.

9. Complete the calibration process for all mA stations at Low kVp as described before.

   The new values stored for the calibrated mA stations appear in the "Filament Data" field when selecting the desired station. Write down the new values stored for each mA station at Low kVp in the Data Book.

10. Select the kV/mA combinations not allowed for Low kVp and store as their Filament data the value of the previous mA station increased in 40.

11. Complete the calibration process for the remaining kV/mA combinations at Medium and High kVp **using Table 6-1 as a guide.** It is not necessary to make exposures to do so. Compute the value for all the kV break points of each available mA station, even for those combinations that are not reachable due to the Generator power limit. Select the corresponding kV/mA combination and enter the computed value.

12. Check calibration at all break points (making exposures) and correct any Filament data as needed.

Note ☞ *If "Tube Overload" error is shown directly after the selection of an allowed combination (refer to step-4.), wait until the X-ray tube anode cools down to permit the calibration of the mA station.*

13. Recalculate the values of the non-allowed combinations in accordance to the new values obtained by exposures. (*Refer to Table 6-1*).

14. Exit from Manual Calibration and enter in user mode by pressing the "User Console" button on the SC menu. Select the nearest allowed kVp value to each kV/mA combination not allowed (keeping the same mA). Check calibration at these kV/mA combinations by making exposures. If needed, enter in Manual Calibration mode and correct the Filament Current data of the respective non-allowed kV/mA combination.

15. Exit from the "User Console" screen and enter in Manual Calibration mode, select each combination of the available mA stations at the kV break points (Low, Medium and High kVp). Read on the "Filament Data" box the final value of the Filament Current data stored for each combination. Write down the final values in the Data Book.

16. Exit Manual Calibration mode.

17. Make a backup copy of the Filament Current data *(refer to Section 6.5).*

18. After calibration of Filament Current data:

    - Switch the Generator power OFF.
    - Disconnect the mAs Meter from TP85 and TP86 on the Control board.
    - Re-install the link between TP85 and TP86.

6.11.2 GAINS MANUAL ADJUSTMENT

Note ☞ *Perform the Manual adjustment only if the Automatic adjustment cannot be done.*

kVp GAIN ADJUSTMENT

1. Go to the User Console by pressing the “User Console” button on the SC menu, select 80 kVp and the lowest mA station of the Generator (previously calibrated), make an exposure and read the kVp measured with the non-invasive kVp meter or with a HV Bleeder.
2. Exit the “User Console” screen and enter in the General Parameters screen of the Parameters Calibration window.
3. **Increase** the kVp gain in the Demand field if the value measured is **lower** than the one selected or **decrease** the gain if the value measured is **higher.**
4. Press the “Store Data (in SHFR)” button to save the changes and check again.
5. Repeat the process as many times as necessary to accurately calibrate the kVp gain. kVp and mA selection remains the same, there is no need to go to the User Console again.

mA GAIN ADJUSTMENT

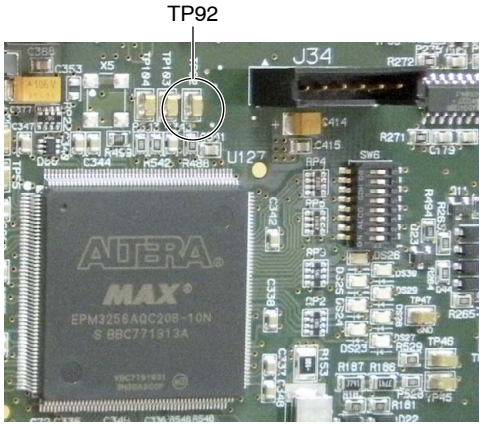
1. Go to the “User Console“ screen, make an exposure with 10 mA (previously calibrated) and long exposure time (at least 2 seconds), and measure the value with the mA meter.
2. Exit the “User Console” screen and enter in the General Parameters screen of the Parameters Calibration window.
3. **Increase** the Low mA gain if the value measured is **higher** than the one selected or **decrease** the gain if the value measured is **lower.**
4. Press the “Store Data (in SHFR)” button to save the changes and check again.
5. Repeat the process as many times as necessary to accurately calibrate the Low mA gain.
6. Repeat the process for High mA gain calibration with the 100 mA station previously calibrated selected and, finally, with the 8 mA station (if available) for Fluoro mA gain calibration.

6.11.3 FALL TIME MANUAL ADJUSTMENT

Note ☞ *Perform the Manual adjustment only if the Automatic adjustment cannot be done.*

1. Use an oscilloscope to check the XOn signal (TP92) and kVp (TP54).

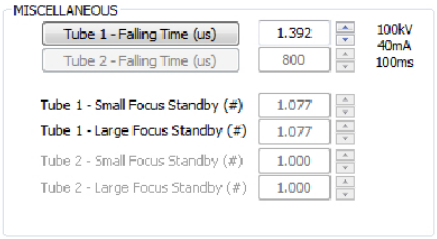
Illustration 6-26
TP92 in Control board



2. Enter in User mode and select 100 kVp, 40 mA and 40 ms (less time selection could result in a non-precise mA measurement).
3. Check the elapsed time since the kV start falling from 100% until they reach 75% using the XOn signal measured in TP92 as a reference.
4. Write down the time in μs and insert the data in the “Fall Time” field in the General Parameters screen of the Parameters Calibration window *(refer to Illustration 6-27).*
5. Make a short exposure (e. g. 20 mA and 5 ms) and check that the exposure time is correct.
6. **Increase** the Fall Time data if the exposure time measured is **higher** than the one selected or **decrease** the data if the time measured is **lower.**
7. Make different exposures increasing and decreasing the mA and check that the cut-off point at 75% is always the same.
8. Adjust the Fall Time value if needed until the cut-off point at 75% is the same for any parameters selection.

9. Press the “Store Data (in SHFR)” button to save the changes.

Illustration 6-27
Fall Time data



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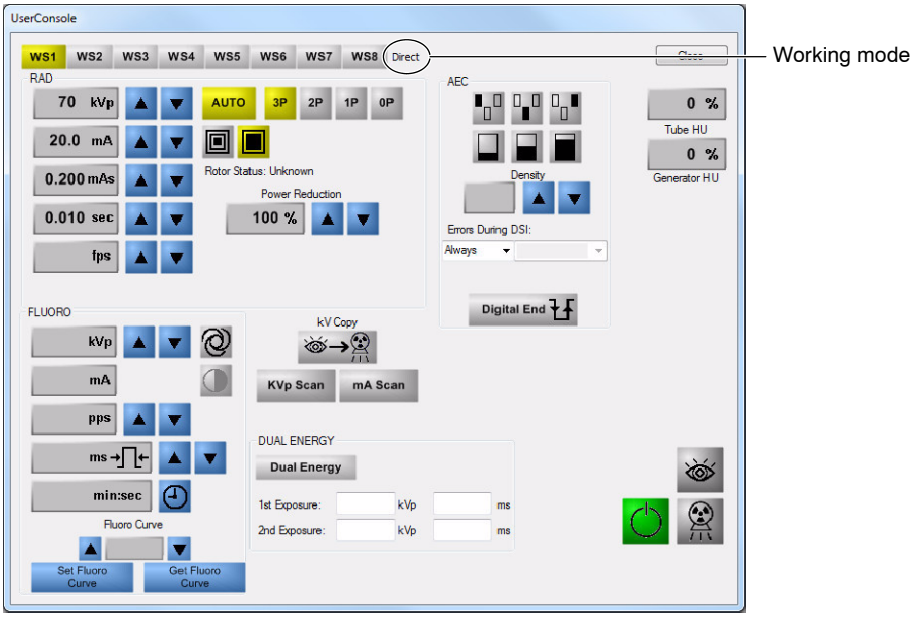
SECTION 7 GENERATOR USER CONSOLE

Illustration 7-1
User Console

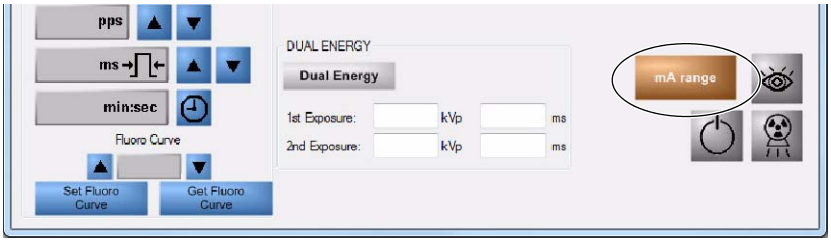


Up to 8 workstations can be selected, depending on how many have been previously configured. AEC and Fluoro can be selected according to the Generator characteristics and to workstations configuration.

The working mode (Direct, Bucky, Tomo, etc.) is displayed on the right of the Workstation selection panel.

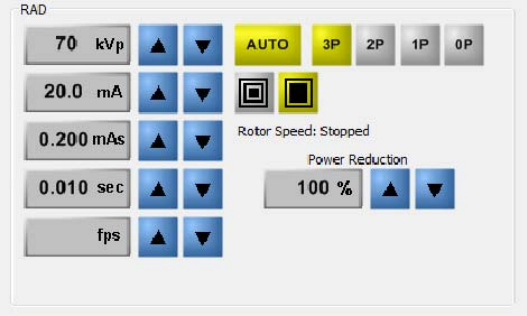
A warning is displayed in the bottom right corner if any of the Generator limits is reached while modifying the technique parameters. When this happens, the modified parameter is blocked. Warnings related to AEC are displayed in the AEC area.

Illustration 7-2
Radiographic Parameters selection warning



7.1 RADIOGRAPHY

Illustration 7-3
RAD Parameters



The RAD controls show the kVp, mA, mAs and exposure time (sec) values, Working Modes, Focal Spot selection, Rotor speed and the Generator power reduction.

RADIOGRAPHIC PARAMETERS

The Radiographic Displays show the kVp, mA, mAs and exposure time (sec) values:

- kVp: The radiographic kVp value selected for the technique.

- mA: The radiographic mA value selected for the technique.

- mAs: The radiographic mAs value selected for the technique.

- sec: The time value (in seconds) selected for the technique.

- fps: Frames per second selected for DSI, DSA, CINE and HCF Workstations.

WORKING MODES

Four different RAD Working Modes can be selected according to the parameters to be controlled:

Illustration 7-4
Working Modes

- **Three Point Mode (3P):** kVp, mA and sec are controlled independently, without any relationship between them. The mAs value can not be modified directly.
- **Two Point Mode (2P):** kVp and mAs are controlled independently. The mAs selection sets the highest mA value available for the selected Focal Spot and the respective exposure time (sec). The mA and sec values can be modified directly by the user, keeping constant the selected mAs value.
- **One Point Mode (1P):** This mode requires the operation with the AEC (when available). When 1P is selected, AEC field is activated and the mAs value is automatically set to the maximum value available. The kVp value is directly controlled by the user. mAs, mA and sec are controlled as described for 2P.
- **Zero Point Mode (0P):** This mode requires the operation with Fluoro and AEC (when available).

When “AUTO” is selected (lighted in yellow), every value (kVp, mA, mAs and sec) can be modified. The working mode switches automatically from 3P to 2P and vice versa depending on the selected value.

FOCAL SPOT ICON AND FILAMENT CURRENT

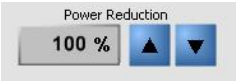
The Focal Spot icons allow the user to select the small or large focal spot by clicking on the desired one.

To shut down the Filament current of both Focal Spots press the selected Focal Spot icon (lighted in yellow). The message “Filament power down mode” is shown in the screen until a Focal Spot is selected or the Handswitch is pressed.

ROTOR SPEED

When the tube is not rotating, this indicator shows the message “Rotor Speed: Stopped”. Once the handswitch is pressed, it indicates whether it is rotating in high speed or low speed.

POWER REDUCTION



The maximum kW of the Generator is factory set according to the Generator performance. Generator kW can be limited to a lower value in 10% steps, from 100% (full power) to 10%.

Note ☞ *This reduction percentage only applies when in user mode. Bear in mind that it is applied to the limit set in the "Max Power" field of the Configuration screen.*

1. Press the "Increase" or "Decrease" button to modify the value (e.g. a 40 kW Generator limited to 80% of its maximum power will perform as a 32 kW Generator).

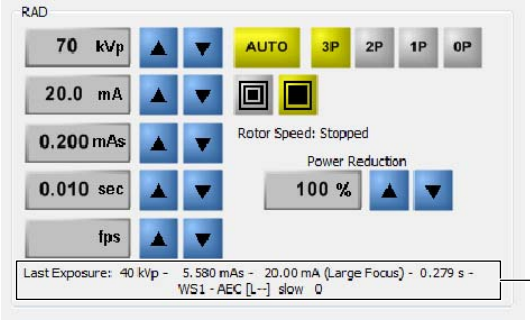
Note ☞ *An intermittent beep might sound when reducing the Generator power due to an excessive kVp/mA selection. Reduce the technique parameters or increase the Power percentage.*

2. Check that mA and kVp selection can be done in accordance to the new Power Reduction.
3. Press "Close" to save and leave.

LAST EXPOSURE PARAMETERS

When an exposure is made from the User Console, the last exposure parameters are also shown in the Radiography area.

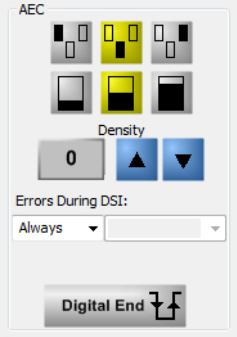
Illustration 7-5
Last Exposure Parameters



Radiographic parameters of the last exposure

7.1.1 AEC

Illustration 7-6
AEC Parameters



The AEC comprises the controls for activating the AEC, the Sensitivity, the Density and the Digital End.

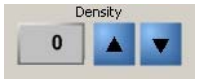
FIELD SELECTION

Each control indicates its related physical location of the selected field in the AEC Exposure Detector, and it may be selected or deselected by pressing it. Any combination of fields can be selected and the color of controls change (highlighted) when active.

SENSITIVITY

Sensitivity allows the adjustment of the mAs in relation to a programmed Film/Screen Combination that can be Slow, Medium or Fast. Press to select the desired Sensitivity.

DENSITY



To configure the AEC Density indicate a value from -4 to +4.

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SECTION 8 DATA BOOK

This Data Book is the register of some of the Configuration and Calibration data of the generator and the register of each Periodic Maintenance Service carried out. Keep this book always with the equipment for reference.

Note ☞ *Enter the data with a pencil in order to modify them later due to future changes.*

If the Control board is replaced, configuration, calibration and filament data can be recovered using the "Restore (From File)" button in the Service Console application, whenever backup files have been previously created (refer to Section 4.2 for more information about the backup procedure). If the backup files cannot be restored, transfer the U66-EEPROM from the old Board to the new Board. Compare the recovered data displayed on the Console with the values noted in this document.

Also, make some exposures using different techniques and Focal Spot and check that mA stations are calibrated correctly. If not, perform Calibration procedures.

Note ☞ *Verify that "Configuration Control Sheet" and "Final Test Results" pages from factory have been included with the equipment.*

8.1 INSTALLATION DATA

Enter the following information.

HOSPITAL			
INSTALLED AND TESTED BY		**DATE**	

8.2 MAINTENANCE HISTORY

Enter the following information in this book after each data modification or Periodic Maintenance Service.

DATE	PERFORMED BY	BACKUP FILES FOLDER	SERVICE NOTES

8.3 CONFIGURATION DATA TABLE

Table 8-1
Workstations

Note in the following table the configuration of the Workstations.

WORKSTATION	WORKSTATION CONFIGURATION (Tube, Receptor, etc.)
WS1	
WS2	
WS3	
WS4	
WS5	
WS6	
WS7	
WS8	
Note.- Workstation data such as X-ray Tube, Receptor (Bucky, CR, Detector), Tomo, Ion Chambers, etc. must be registered.	

8.4 CALIBRATION DATA TABLE

Table 8-2
mA Calibration Data

mA STATION	FILAMENT CURRENT DATA AT kVp BREAK POINT		
	Low kVp	Medium kVp	High kVp
10			
12.5			
16			
20			
25			
32			
40			
50			
63/64/65 *			
80			
100			
125			
160			
200			
250			
320			
400			
500			
630/640/650 *			
800			
1000			
Note.- Some generator models do not contain all the mA stations listed above.			
** Configurable under requirement*			