THE XCELL® 160/225/320

X-ray Irradiator Systems with X-ray Imaging Capability



INSTRUCTIONS FOR USE

KUBTEC® SCIENTIFIC

The XCELL® 160/225/320 X-ray Irradiator Systems with X-ray imaging capability
Instructions for Use IFU-33 Rev C September 2026

The information in this publication is provided for reference only.
KUB Technologies, Inc. (KUBTEC®) shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. This publication may contain or refer to information and products protected by copyrights or patents not held by KUBTEC and does not convey any license under the patent rights of KUBTEC or the rights of others. The product names in this manual are trademarks or registered trademarks of their respective manufacturers. KUBTEC does not assume any liability arising out of any infringements of patents or other rights of third parties. KUBTEC makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

All rights reserved. Printed in the United States of America

No part of this manual may be used or reproduced in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher except in the case of brief quotations embodied in critical articles and reviews. Making copies of any part of this manual for any purpose other than for the sole use of the legal product owner and the expressed use for which this document was intended is a violation of the United States copyright laws.

This manual is shipped with the system and is considered as is, without warranty of any kind, either expressed or implied, regarding the contents of this manual, including but not limited to implied warranties for the manual's quality, performance, merchantability, or fitness for any particular purpose. Neither KUBTEC nor its dealers, distributors, nor the authors is liable to the purchaser or any person or entity with respect to any liability, loss, or damage caused or alleged to have been caused directly or indirectly by this manual.

KUBTEC is the owner and sole manufacturer of The XCELL® 160/225/320 X-ray Irradiator Systems.

Read this manual thoroughly before using this device. Follow all safety procedures and guidelines when operating radiographic systems. The information in this document has been carefully checked and is believed to be accurate. However, KUBTEC assumes no responsibility for inaccuracies. All specifications are subject to change.

Copyright © 2026 KUBTEC®. All rights reserved.

Acknowledgments

The DIGISOURCE® Irradiator Software and The DIGICOM® Software is a proprietary KUBTEC software. This manual may contain product names and references that are used for identification purposes only. These product names may be trademarks or registered trademarks and are the sole property of their respective manufacturers.

Microsoft Public License (Ms-PL)

Extended WPF Toolkit™ Community Edition

Microsoft .NET

Microsoft SQL Server Compact 4.0

LibTiff.Net

Copyright © 2008-2014, Bit Miracle

All rights reserved.

This software is provided by the copyright holders and contributors “as is” and any express or implied warranties, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose, are disclaimed. In no event, shall Bit Miracle be liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, procurement of substitute goods or services; loss of use, data, or profits; or business interruption) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way out of the use of this software, even if advised of the possibility of such damage.

Software Limited Warranty

KUBTEC warrants for one year of normal use from the date of purchase that:

- Media on which the software and electronic documentation are furnished is not defective.
- Software is correctly recorded on the enclosed software media.
- Electronic documentation is substantially complete and contains all the information KUBTEC deems necessary to use the software.
- Software functions substantially as described in the documentation.

KUBTEC’s entire liability and exclusive remedy shall be the replacement of any software media or electronic documentation not meeting these warranties, which is returned to KUBTEC or an authorized dealer, together with a copy of paid receipt. The above is the only warranty of any kind, either express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular use that by KUBTEC makes on this licensed software. In no event shall KUBTEC be liable to the user or to any third party for consequential, special, indirect, or incidental damages that may incur as a result of using the licensed software, including, but not limited to, loss of data, or information of any kind.

Disclaimer

The information in this document has been carefully checked and is believed to be accurate. KUBTEC assumes no responsibility for inaccuracies. All specifications are subject to change without notice.

LIMITED WARRANTY - GOODS AND SERVICES

All goods are warranted to be free of defects in material and workmanship for one year from the time of shipment. We make no other express warranty with respect to any good, and we expressly disclaim any and all implied warranties with respect to any good or service. All claims for nonconforming or defective goods must be made in writing within this warranty period. Our sole responsibility with respect to any such claim, once substantiated, for nonconforming or defective goods, or for any damage or loss to goods if we are found liable therefore, shall be to repair or replace any such good or component thereof, with the choice of repair or replacement being at our option unless a complete loss is involved and replacement is thus the sole option. In no event shall we be responsible with respect to any good or service offered by us that is purchased from us or otherwise supplied by us for any monetary damage or be liable for any incidental, consequential, statutory, punitive, or other damage, including without limitation any claims for lost profits, business interruption, or any and all claims by any and all third parties due to any cause whatsoever, even if we are advised on the possibility of such damages. This limitation shall apply to all causes of action, whether based on contract, tort, warranty, strict liability statute, equity, or otherwise. This warranty does not apply to any good that has been damaged by accident, has been misused, abused, neglected, or not maintained, or has been altered or repaired by anyone other than us or our authorized representatives. The warranty is void if the system is relocated from its original installation location.

The foregoing constitutes our sole liability and the purchaser's sole remedy with respect to goods and services sold by us. Except as expressly set forth in these standard terms and conditions, we disclaim all warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

Table of Contents

PREFACE

Intended Use ..... P-i
KUBTEC Customer Care Center ..... P-i
User Responsibility ..... P-ii
Training ..... P-ii
Safety Information ..... P-ii
Terms and Definitions ..... P-iii

CHAPTER 1: GENERAL INFORMATION

Introduction 1-1
Safety Information 1-2
Additional Considerations 1-3
System Handling 1-3
System Maintenance 1-5
System Inspection 1-5
Labels 1-6
Recommended Separation Distances 1-8
Compliance 1-9

CHAPTER 2: COMPONENTS AND CONTROLS

System Overview 2-1
Specimen Cabinet 2-2
Exposure Chamber 2-3
The Exposure Chamber Control Panel 2-4
User Interface 2-5
Collimator 2-6
Filters 2-7

CHAPTER 3: SYSTEM USE FOR IRRADIATION

Introduction....3-1
How to Start the System....3-1
System Dose calibration....3-2
Main Screen Components....3-2
Main Screen Description....3-3
Menu Bar: Users Manager....3-4
Menu Bar: View Logs....3-5
Menu Bar: Seasoning....3-6
Menu Bar: Timer and Dosimeter....3-6
Irradiate the Sample....3-8
Cool Down Period....3-8
System Shutdown....3-8

CHAPTER 4: SYSTEM USE FOR IMAGING

Introduction....4-1
Pre-Startup Checks....4-1
How to Start the System....4-1
Main Screen....4-2
Main Screen Legend....4-3
Menu Bar....4-4
Menu Bar: Settings....4-4
Menu Bar: Presets....4-5
Menu Bar: Import/Export....4-6
Menu Bar: Import Image....4-7
Menu Bar: Import DICOM....4-8
Menu Bar: Export Images....4-9
Menu Bar: Help....4-11
Live Feed Software....4-12
Image Acquisition Options....4-13
Recall a Case from the Archive....4-13
Create a New Case....4-13
Acquire X-ray Images....4-14
Acquire with Presets and Manual....4-14
Add a Preset....4-15

Acquire Optical (RGB) Image 4-15
Magnification 4-15
Create a Copy Path 4-16
How to Shut Down the System 4-16

CHAPTER 5: IMAGE VIEWER

Introduction 5-1
How to Use Image Viewer Tools 5-2
Image Processing Tools 5-2
Annotation Tools 5-4
View Options 5-8
Window/Level Options 5-9
Other Image Viewer Tools 5-9
Image Viewer Menu 5-10

CHAPTER 6: SYSTEM SPECIFICATIONS

XCELL 160 System Specifications 6-1
XCELL 225 System Specifications 6-3
XCELL 320 System Specifications 6-5

CHAPTER 7: SYSTEM MAINTENANCE

Introduction 7-1
Cleaning and Disinfecting 7-1
Recycling and Disposal 7-2

FREQUENTLY ASKED QUESTIONS

Frequently Asked Questions FAQ-1
Troubleshooting FAQ-2

APPENDIX

Work Instruction on Dose Calibration App-1
Instructions to Set kV and mA App-3
Rules for kV and mA Setpoints App-3
Common Settings and Configurations App-5

INDEX

This page is intentionally blank.

PREFACE

Intended Use

The XCELL® 160/225/320 X-ray Irradiators are standalone X-ray cabinets used to irradiate organic and inorganic samples and components. These systems are intended for use by qualified/trained personnel. These systems are not intended for use on humans. Optionally, these systems can be equipped with a radiographic detector to capture images of samples.

The purpose of the Instructions for Use (IFU) is to provide guidance for the proper use and care of the system. Keep this manual with the system for easy reference.

The Instructions for Use do not cover detailed electronic functions or major system troubleshooting and repair. For assistance in these areas, contact KUBTEC® Customer Care Center.

KUBTEC Customer Care Center

KUBTEC offers customer support through the KUBTEC Customer Care Center at any time for problems not resolved through online help or product documentation. If the Customer Care Center is closed when you call, leave a voicemail message. Make sure to have the following information available when you call:

- Your site name
- Hardware system type
- System serial number
- Software version number

Phone: USA: +1.203.364.8544, option 3
International: +1.203.364.8544, option 3

Email: service@kubtec.com

Web: www.kubtecscientific.com

Mail: KUBTEC®
111 Research Drive,
Stratford, CT 06615 USA

NOTE: Any serious incident that occurs in relation to the device should be reported to the manufacturer, and the competent authority of the Member State in which the user is established.

User Responsibility

When the system is assembled, operated, maintained, and repaired in accordance with the instructions provided, the system conforms with the description in the Instructions for Use and with accompanying labels and/or inserts.

- It is the responsibility of the user to ensure that this product is checked periodically.
- Do NOT use a defective product.
- Replace broken, missing, worn, distorted, or contaminated parts immediately.
- If repair or replacement is required, call 203-364-8544, option 3, or submit a written service request by emailing service@kubtec.com.
- Do NOT use this product or any of its parts other than in accordance with the written instructions provided by KUBTEC and KUBTEC-trained personnel.
- Do NOT alter this product without the prior written approval from KUBTEC.
- The user of this product has the sole responsibility for any malfunction that results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than KUBTEC.
- As part of the installation of your system, the Windows operating system has been configured not to allow Windows updates to be executed automatically. If there is a requirement by your facility's IT to make a change to this configuration, then your site assumes all responsibility for ensuring that the updates are scheduled in a manner that does not impact the use of the system.

Training

Before working with the system, users need adequate training on safe and effective use. Training requirements may vary from country to country. It is the responsibility of the user to make sure training is received in accordance with local laws or regulations that have the force of law. Information on training is available from your local KUBTEC representative.

Safety Information

Observe and heed all warnings, cautions, and notes in the manual and on the system.



WARNING:

Warnings are directions that, if not followed, can cause fatal or serious injury, and/or lead to damage to the system. Warnings in this manual are emphasized with a yellow triangle safety icon.

Safety Information (continued)



CAUTION:

Cautions are directions that, if not followed, can cause damage to the system and/or cause environmental pollution. Cautions in this manual are indicated with a blue circle surrounding an exclamation point.

NOTE: Notes provide tips and important information to guide the use of the system. Notes in this manual are emphasized with the word "**NOTE**" in capital and bold letters.

Terms and Definitions

Click - Throughout the manual, the instruction for "click" means to left-click the mouse. When a right-click is needed, it will be stated as such.

A qualified engineer/technician is a person who has completed training conducted by KUBTEC and has been certified by KUBTEC on this system.

CE Mark

This product carries the CE Mark.

CE

Class 1

The CE Declaration of Conformity becomes invalid if the product is changed without the explicit consent of the manufacturer. This applies to all parts, not only to safety elements.

Name of Product

The XCELL® 160/225/320 X-ray Irradiator Systems

Manufacturer



KUB Technologies, Inc. (KUBTEC®)
111 Research Drive,
Stratford, CT 06615 USA
Tel: +1.203.364.8544

www.kubtec.com

Authorized Representatives

EC REP

Advena Ltd. Tower Business Centre,
2nd Flr., Tower Street, Swatar,
BKR 4013 Malta

Email: info@advenamedical.com

CH REP

MedEnvoy Switzerland,
Gotthardstrasse 28,
6302 Zug Switzerland

CHAPTER 1: GENERAL INFORMATION

Introduction

The XCELL® 160/225/320 Systems are a standalone X-ray systems typically used for X-ray irradiation of organic and inorganic samples and material components. The system uses a high-energy X-ray source and The DIGISOURCE® Irradiation Software.

NOTE: The appearance of some system components may vary from those shown.



Figure 1-1: The XCELL® 160 System

Safety Information

The following warnings and cautions appear at appropriate places in this manual and on the system. Contact KUBTEC® Customer Care Center if any of these statements are unclear.



WARNING: Do not remove covers. Potentially lethal voltages are present inside the system.



WARNING: Never operate this system with the grounding conductor disconnected.



WARNING: This is a heavy system. If the system needs to be moved, use assistance. If access underneath is required, make sure it is securely supported first.



CAUTION: This system is sensitive and needs to be handled with care. Dropping it from a height or banging it against a hard surface can damage interior components.



CAUTION: When transporting this system, do not drag the cables along the floor.



CAUTION: No operator serviceable parts inside. Refer servicing to qualified personnel.

Additional Considerations

To minimize possible risks that undetected radiation might create, follow these guidelines:

- Transport or relocation of the system is prohibited unless performed or approved by KUBTEC or its authorized representative.
- Keep the exposure chamber door closed at all times except during loading and unloading periods.
- Turn the power switch to the OFF position when the system will not be used for an extended period.
- Continuously monitor the X-ray ON indicator lights to be sure they are off after each exposure.
- At least once a year, and whenever the unit is moved or serviced by authorized personnel, a radiation survey should be performed with a properly calibrated radiation survey instrument.

To preserve the life of the X-ray tube, do not bypass the tube warm-up procedure within the KUBTEC DIGISOURCE Software.

System Handling

Transporting

- Use the utmost care when transporting this system. Any drop or bump can lead to extensive damage and the inability to produce X-rays.
- Disconnect cables using the cable connector that attaches to the source.
- DO NOT pull on the electric or data cable, as this can result in an electric shock or fire.
- DO NOT drag the cables along the floor.
- When the system reaches its final destination, ensure that it rests on a flat surface.

Environmental conditions

- To ensure consistent irradiation, operate the system at normal room temperature within the guided operating levels stated in Table 1-3: Performance Specifications.
- Drastic and sudden changes in temperature can cause condensation to form on the surfaces. It is strongly recommended to wait until the condensation dissipates and the system temperature acclimates to the surrounding environmental conditions before operating the system.

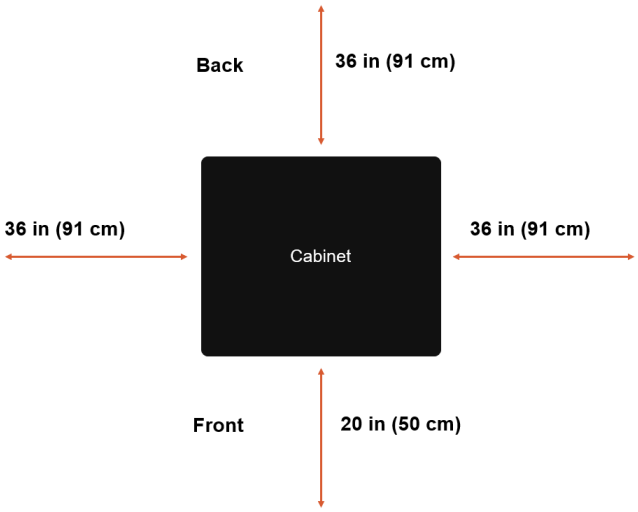
System storage

Store the system in a safe, dry location with particular caution to minimize any chance of damage due to falling objects or tipping.

System Handling (continued)

Clearance Requirements

- Allow at least 36 in (91 cm) of space between the rear of the system and the wall for air circulation and unit servicing.
- Allow at least 20 in (50 cm) in front of the cabinet for system operation.
- The cabinet should be placed in an area to facilitate easy access to the rear panel during installation and servicing.



System Maintenance

The Maintenance Chapter contains specific instructions for the care of the system. To ensure safe and consistent use of the system, make sure to read, understand, and follow the stated instructions.



CAUTION: For safety reasons, be sure to inspect the system before using it. Additionally, a regular inspection should be performed at least once per year.



CAUTION: Changes, additions, or maintenance to the equipment performed by persons without appropriate qualifications and training and/or using unapproved spare parts can lead to a serious risk of injury and damage to the system as well as voiding the warranty.



CAUTION: Use ONLY a soft cloth, neutral detergents, or cleaning liquids to wipe system parts and accessories that come in contact with samples during use. Harsh liquids or rough surface cleaners will damage the system surfaces.

System Inspection

Inspect the system daily before use by following the daily inspection checklist in the Maintenance Chapter. Perform annual inspections by a KUBTEC engineer or a KUBTEC-trained engineer. This ensures your system is kept compliant with performance and regulatory guidelines.



WARNING: If necessary, the dosimetry of this system must be performed by a qualified technician only.



WARNING: The system must be repaired by a qualified engineer only. If it is not repaired properly, it can cause a fire, electric shock, or an accident.

System Inspection (continued)

Inspection Procedures

Instructions to perform each inspection are found in the Maintenance Chapter. If any problem is found during the inspection, take the indicated measures. If the problem persists, contact the KUBTEC representative or distributor.

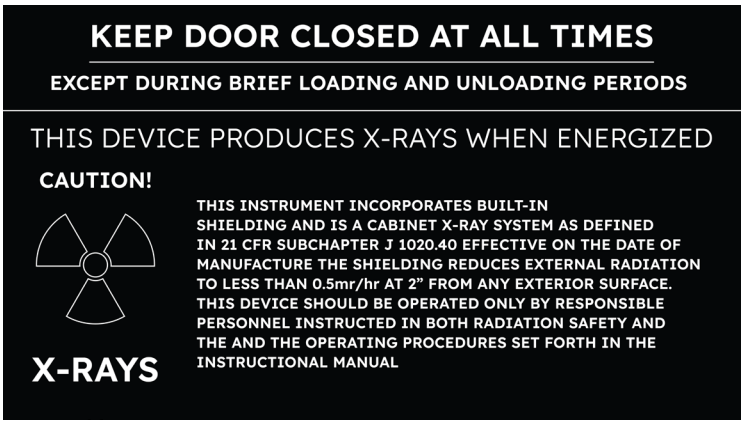
It is recommended to maintain a record of these inspections. Either copies of the checklists can be used, or those provided by the facility or administrator can be used.

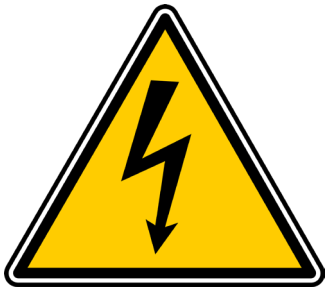
Labels

Warning labels, safety labels, and a certification label are attached at various locations on the unit. These labels must remain permanently attached and in good condition. Tampering with labels is against federal law. Under NO circumstances should the labels be removed or re-affixed.



Labels (continued)





Shock hazard.
Disconnect power before servicing.



X-rays are produced when energized.



CAUTION: To ensure safe system operation, read the Instructions for Use before operating this system.

Recommended Separation Distances

The system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or user of this system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and this system as recommended below, according to the maximum output power of the communications equipment.

Table 1-1: Recommended separation distances between portable and mobile RF communications equipment and The XCELL® 160/225/320 Systems

Rated maximum output power (W) of the transmitter	**Separation distance (m) according to the frequency of the transmitter**		
	150 kHz to 80 MHz $d = 1,2 \sqrt{P}$	80 MHz to 800 MHz $d = 1,2 \sqrt{P}$	800 MHz to 2.5 GHz $d = 2,3 \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance (d) in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Compliance

These systems comply with US federal guidelines that require radiation leakage of not more than 0.5 mR/hr (5 µSv/hr) at a distance of 5 cm from the external machine surface.

These systems are designed, manufactured, and registered in accordance with strict criteria established by the US Department of Health and Human Services (DHHS), Food and Drug Administration (FDA), and the Center for Devices and Radiological Health (CDRH). These systems meet or exceed all certification requirements for a cabinet X-ray system used in an industrial/laboratory environment.

These systems are manufactured, tested, and certified to comply with the US Federal Performance Standards for Cabinet X-ray Systems, Title 21, Sub-chapter J of the Code of Federal Regulations, Section 1020.40. Modification or damage to the equipment could result in an X-ray exposure hazard.

KUBTEC recommends that you review and comply with work site safety requirements regarding radiation safety.

These systems are designed and tested for compliance when used per this IFU. These systems are intended for use in the electromagnetic environment specified in the next table. The customer or user of these systems shall ensure that they are used in a Guidance and Manufacturer Declaration environment.

Table 1-2: Guidance and Manufacturer Declaration for Electromagnetic Immunity

Immunity test	IEC 61010-1 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines	±2 kV for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) and neutral	±1 kV line(s) and neutral	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	<5 % U_T (>95% dip in U_T) for 0,5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5s	<5 % U_T (>95% dip in U_T) for 0,5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5s	Mains power quality should be that of a typical commercial or hospital environment. If a dip or an interruption of mains power occurs, the current of the system may drop off from the normal level, and it may be necessary to use an uninterrupted power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	Not applicable	Not applicable
NOTE: U_T is the AC mains voltage prior to application of the test level.			

Table 1-2: Guidance and Manufacturer Declaration for Electromagnetic Immunity (continued)

Immunity test	IEC 61010-1 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of this system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance: d = 1,2 √P d = 1,2 √P 80 MHz to 800 MHz d = 2,3 √P 800 MHz to 2.5 GHz • P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation. • Distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, and should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol: 
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	
NOTE: At 80 MHz and 800 MHz, the higher frequency range applies. **NOTE**: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.			

Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcasts, and TV broadcasts, cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, conduct an electromagnetic site survey. If the measured field strength at the location where the system is used exceeds the applicable RF compliance level, observe the system to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the system.

Over the frequency range of 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

These system are designed to meet the following requirements:

Table 1-3: Performance specifications

Degree of protection against penetration of water	No protection provided
Radiation leakage	Certified to US FDA 21 CFR 1020.40 standards
Classification in accordance with 61010-1 degree of protection against electric shock	This system has no applied parts
Methods of sterilization or disinfection	See Cleaning and Disinfection section in the Maintenance Chapter
Where equipment is not suitable for use	In the presence of flammable mixtures
Mode of operation	Up to 100% duty cycle
Temperature range (user operation)	0–40°C (32–104°F)
Pollution degree rating	Pollution degree 2 (normal atmosphere)
Electromagnetic compatibility (EMC) in accordance with 61010-1 • Noise suppression • Immunity to interference	This system conforms to the requirements of IEC 61010-1 (EMC)
Product Life	Service life of the product is 7 to 10 years

Table 1-4: Wireless adapter specifications

Hardware	
Interface	USB 3.0
Button	WPS button
Dimensions (W x D x H)	1.59 × 0.78 × 0.41 in. (40.50 × 19.72 × 10.29 mm)
Antenna type	Internal
Wireless	
Wireless standards	IEEE 802.11ac, IEEE 802.11a, IEEE 802.11n, IEEE 802.11g, IEEE 802.11b
Frequency	5 GHz 2.4 GHz
Signal rate	**5 GHz** 11ac: Up to 867 Mbps (dynamic) 11n: Up to 300 Mbps (dynamic) 11a: Up to 54 Mbps (dynamic) **2.4 GHz** 11n: Up to 400 Mbps (dynamic) 11g: Up to 54 Mbps (dynamic) 11b: Up to 11 Mbps (dynamic)
Transmit power	<23 dBm (EIRP)
Wireless modes	Ad-hoc/Infrastructure mode
Wireless security	Supports 64/128-bit WEP, WPA/WPA2, WPA-PSK/WPA2-PSK
Modulation technology	DBPSK, DQPSK, CCK, OFDM, 16-QAM, 64-QAM, 256-QAM
Certification	CE, FCC, RoHS



For cybersecurity, ensure your network is secure.

WARNING:

This page is intentionally left blank.

CHAPTER 2: COMPONENTS AND CONTROLS

System Overview

The XCELL® 160/225/320 Systems consist of an upper and a lower section. The upper section houses the specimen cabinet, the user interface, and the X-ray tube. The lower section houses the generator and power supply. The lower section components should be only accessed by service personnel.

NOTE: The appearance of some system components may vary from those shown.



Figure 2-1: System Components

Figure Legend

1 Computer Monitor
2 Control Panel
3 Lower Section
4 Upper Section
5 Access Port

Specimen Cabinet

The specimen cabinet houses an exposure chamber door with safety interlocks, turntable, and a user interface consisting of a touchscreen and a control panel. An X-ray warning light on top of the cabinet is activated when the system is initially powering up or generating X-rays.

CAUTION: Users of the system should never attempt to access the X-ray generation components.



Figure 2-2: Sample Cabinet

Figure Legend

1. X-ray Warning Light
2. Touch Screen Monitor
3. Control Panel
4. Exposure Chamber Door

NOTE: System components are subject to change and may not be the same as those shown.

Exposure Chamber

The exposure chamber consists of an inner chamber and an outer door. The inner chamber has tray rails at varying heights to allow irradiation at different intensities (i.e. different distances from the X-ray source). A light inside the chamber illuminates when the key switch on the control panel is in the ON position.

The exposure chamber door has electrically-independent interlocks. Disengaging either of these interlocks causes X-ray generation to stop.

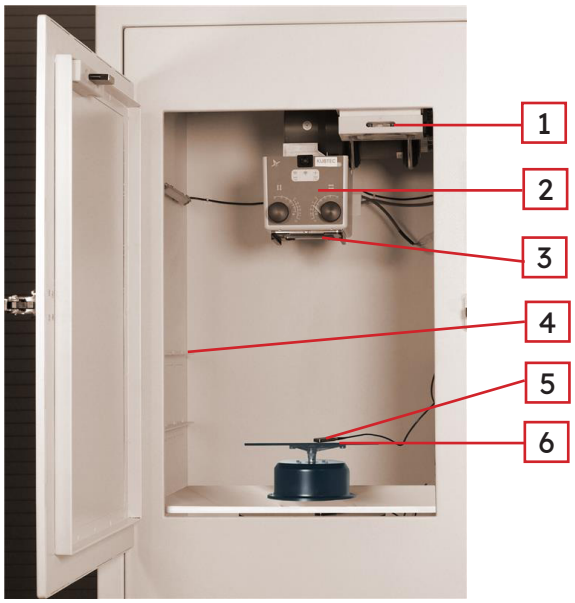


Figure 2-3: Cabinet Chamber

Figure Legend

1 Interlock Switch
2 Collimator
3 Filter Bracket
4 Tray Rails
5 Dosimeter Probe
6 Turntable

The Exposure Chamber Control Panel

The control panel has functions for locking and unlocking the system, turning system power on and off, using the turntable inside the chamber, and warning when X-rays are being generated.



Figure 2-4: Control Panel

Figure Legend

1	Power light	Power ON = LED is green Power OFF = LED is clear
2	Ready light	Illuminates when door interlock circuits are closed to indicate the system is ready to generate X-rays.
3	Turntable speed switch	Turn left or right to select slow or fast speed for the turntable.
4	Emergency stop button	Push to have the system immediately stop generating X-rays. Pull out to reset.
5	Turntable button	Press to turn the turntable ON (button lights) or OFF (button is not lit). **NOTE:** The turntable can be unplugged and removed from the chamber to adjust the shelf height.
6	Key switch	**OFF** position = Key is turned to the left. The system is locked. X-rays cannot be generated. **ON** position = Key is turned to the right. The system is unlocked and ready to be powered up. X-rays can be generated. **NOTE:** The key is removable when it is in the OFF position. To prevent unauthorized use of the system, KUBTEC® recommends removal of the key when the system is not in use.

User Interface

The user interface consists of a touchscreen monitor and the control panel.

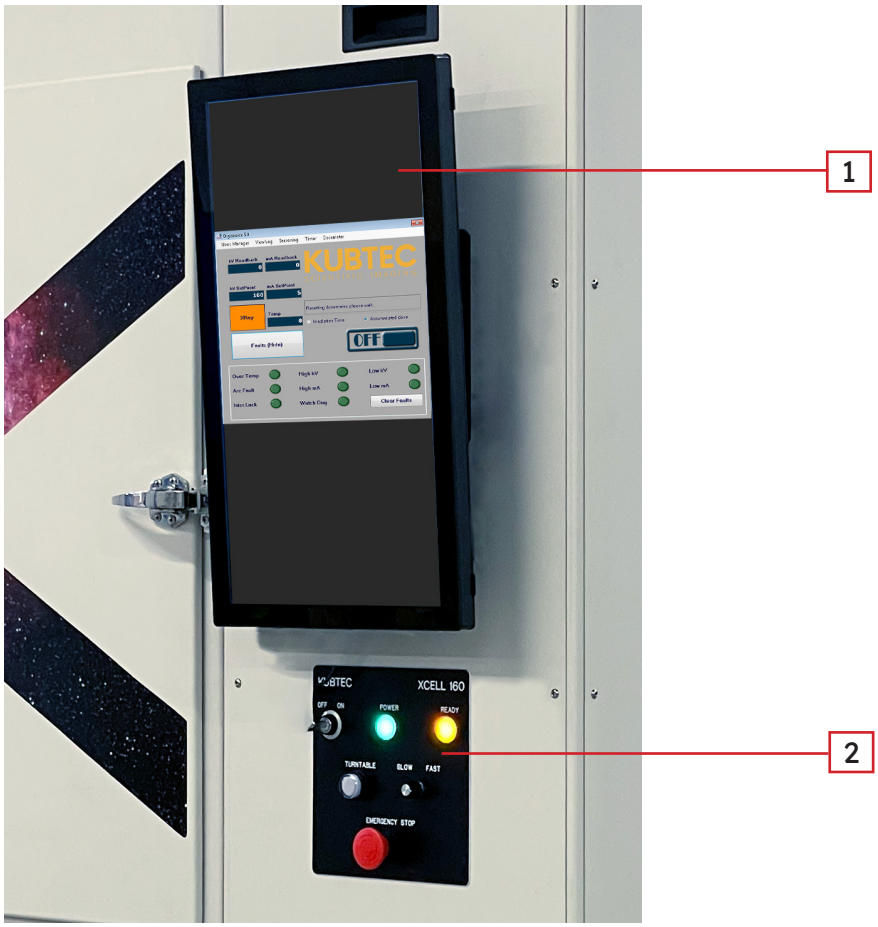


Figure 2-5: User Interface

Figure Legend

1 Touchscreen Monitor

2 Control Panel

Collimator

The collimator's power functionality includes:

- The collimator receives power from the X-ray system.
- The collimator does not include a separate power switch.



Figure 2-6: Collimator

The irradiator has two separate lighting systems:

Cabinet lights — Illuminate the interior when the door is open, so the user can see inside the cabinet.

Collimator LED light field — Because X-rays are invisible, this light field indicates where the X-ray field will be. Pressing the lamp ON button on the collimator turns on the LED, projecting light to show the X-ray field location.

NOTE: The collimator LED light field operates independently of the irradiation function. If the LED overheats and shuts off, the irradiator can continue to operate while the LED cools. Only the light field is temporarily unavailable; irradiation is not affected.

Light Field and Laser controls

- LED and crosshair lasers ON - Press the lamp ON button once to turn ON the LED and the crosshair lasers.
- LED and crosshair lasers OFF - Press the lamp ON button again to turn them OFF.
- LED only (lasers OFF) - Press and hold the lamp ON button for 1 second to turn ON only the LED.
- Crosshair lasers only - Press and hold the lamp ON button until only the crosshair lasers activate.
- **NOTE:** The crosshair lasers Only mode is intended for service personnel during collimator pre-alignment and should not be used during routine operation.

Collimator (continued)

Thermal Safety Limit

- If the LED remains ON for more than 7–8 minutes, the thermal protection sensor will automatically turn the LED OFF.
- The lasers will flash once per second to indicate LED overheating.
- Turn off the light on the collimator and allow it to cool for 10–15 minutes before reuse.

CAUTION: Do not operate the LED continuously for extended periods. Prolonged operation may cause overheating and automatic shutdown of the light on the collimator.

NOTE: If the lasers flash continuously, this indicates an LED over-temperature condition. Allow sufficient cooling time before operating the collimator again.

Filters

The collimator includes a filter bracket used for sliding filters into position.

A filter bracket is included with the collimator, allowing filters to be slid into position. The light field must be used to confirm alignment before any filter is inserted.



Figure 2-7: Filter Bracket and Filters

NOTE: Increasing the filter's thickness or density removes low-energy X-rays, enhancing penetration and hardening the beam's energy spectrum towards monoenergetic.

Purpose

Filters are used to remove low-energy photons, improve beam quality, and reduce unnecessary deposited dose. Only approved filters should be used with the system.

CAUTION: Do not perform exposures with a partially inserted filter. Improper seating can affect beam alignment and image quality for systems that have optional X-ray imaging.

Filters (continued)

The XCELL® 160 System

Available Filters

Standard filters included with the system:

- 1 mm Al
- 2 mm Al
- 0.2 mm Cu
- 1 mm Al + 0.2 mm Cu
- 2 mm Al + 0.2 mm Cu
- 1 mm Al + 0.4 mm Cu

The XCELL® 225 System

Available Filters

Standard filters included with the system:

- 1 mm Al
- 2 mm Al
- 1.5 mm Cu
- 1 mm Al + 0.2 mm Cu
- 2 mm Al + 0.4 mm Cu
- 0.2 mm Cu + 0.8 mm Sn

The XCELL® 320 System

Available Filters

Standard filters included with the system:

- 1 mm Al
- 2 mm Al
- 1 mm Al + 0.2 mm Cu
- 2 mm Al + 0.6 mm Cu
- 1 mm Al + 0.8 mm Sn
- 2 mm Al + 0.6 mm Cu + 0.8 mm Sn

Filters (continued)

TIPS

- Aluminum filters (1–2 mm): Basic filtration to remove low-energy photons.
- Copper filters (0.2–0.4 mm): Additional beam hardening for high-density sample.
- Combination filters (Al + Cu): Provide improved beam quality.
- Ensure the filter is fully seated in the bracket before exposure.
- Do not use the system with a partially inserted filter.
- When using combination filters, position the metal with the highest atomic number closest to the X-ray tube (order: tin, then copper, then aluminum). If the combination includes aluminum, place aluminum at the bottom; if the combination includes tin, place tin at the top.

This page is intentionally left blank.

CHAPTER 3: SYSTEM USE FOR IRRADIATION

Introduction

Before The XCELL® System is turned on for the first time each day, perform the daily inspection as stated in the checklist in the Maintenance Chapter.

NOTE: To obtain consistent results, the system should be operated at normal room temperature and within the guided operating levels stated in the levels stated in Table 1-3. Drastic and sudden changes in temperature cause condensation to form on the surfaces. It is strongly recommended to wait until condensation dissipates and the system acclimates to the surrounding environmental conditions before operating it.

How to Start the System

To power up the system and start the software program, follow these steps:

1. Confirm the power is properly connected.
2. Turn the key switch to the **ON** position. The power LED on the control panel illuminates.
3. If the monitor is not ON, press the monitor power button.
4. Confirm the Cobia dosimeter screen is on and displaying the dose measurement.
5. Press the down arrow button on the Cobia dosimeter to switch between the Accumulated Dose (Gy), Dose Rate (mGy/s), and Time (s) displays.

NOTE: Calibrate the dosimeter every two years to ensure accuracy of dose measurements.



Figure 3-1: Dosimeter Screen

How to Start the System (continued)

6. Double-click the  icon.
7. When the **Login** screen displays, do the following:

   - Enter the User Name and Password assigned to you by the System Admin.
   - Click **Login**.

   NOTE: KUBTEC is the default User Name. kubtec is the default Password. Both are case sensitive and both can be changed by the system Admin.

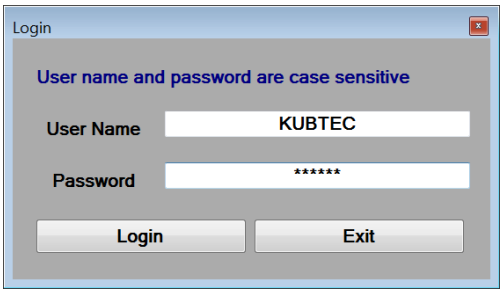


Figure 3-2: Login Screen

User Name	Password	User type	Permissions
KUBTEC	kubtec	Administrator	• Operate X-ray. • Create/modify regular user's profiles.
USER	aaa	Regular user	Operate X-ray.

When the software finishes loading, the Main Screen displays. All functions of the irradiator system are controlled from this screen.

System Dose calibration

Dose calibration is recommended before performing any experiment. Refer to **APPENDIX** for detailed Work Instructions on Dose Calibration.

Main Screen Components

The Main Screen provides the means to enter exposure factors, start and stop X-ray generation, view usage logs, add and delete users, and view system messages. Readback indicators on the screen provide feedback during the exposure sequence.

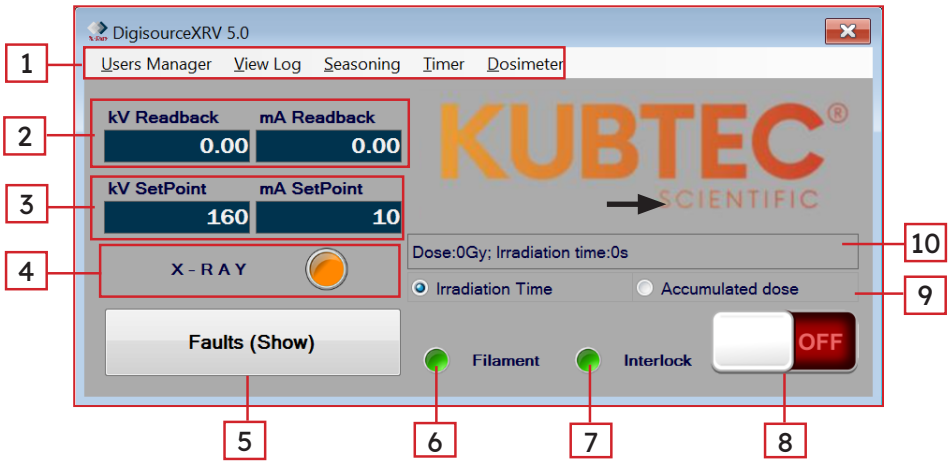


Figure 3-3: XCELL 160/225/320 Main Screen

Main Screen Description

Legend for the Main Screen

No.	Function
1	**Menu Bar**: Provides access to Admin functions, user logs, seasoning options for the X-ray source, and settings for the timer and dosimeter. Use of each of these options is described in the next section.
2	**kV and mA Readback** fields: Dynamically displays actual kV and mA values while the X-ray is in progress..
3	**kV and mA SetPoint** fields: Allows manual entry of values for kV (up to 160 or 225 or 320) and mA (up to 30.0).
4	**X-RAY** indicator: • Solid unlit or clear: X-rays are not being generated. • Solid amber: The system is ready to generate X-rays. • Blinking amber: Pre-warning for X-ray generation. • Blinking bright red: X-rays are being generated.
5	**Faults** field: Displays system faults. When a fault is corrected, system function remains locked until the **Clear Faults** button is pressed.
6	**Filament** LED: • **Green:** The filament in the X-ray source is ready to generate X-rays. • **Red:** The filament has not reached the required temperature for X-ray generation.
7	**Interlock** LED: • **Green:** The chamber door is closed properly. • **Red:** The chamber door is in the open position.
8	**X-RAY (ON/OFF)** button starts X-ray generation. It also can be used to stop X-ray generation before the set time reaches zero.
9	**Irradiation Time** and **Accumulated dose** options: Allow selection of the mode of operation: • **Irradiation Time** - X-ray generation stops when set time is reached. • **Accumulated dose** - X-ray generation stops when the designated dose has been accumulated.
10	Display: Shows the dose parameters.

Menu Bar: Users Manager

The Users Manager option provides the system Admin with the ability to view and export user logs, clear logs, create and delete users, and change user passwords. To access these functions, click **Users Manager** in the menu bar at the top of the Main Screen.
The **ADMIN (Super Administrator)** screen displays.

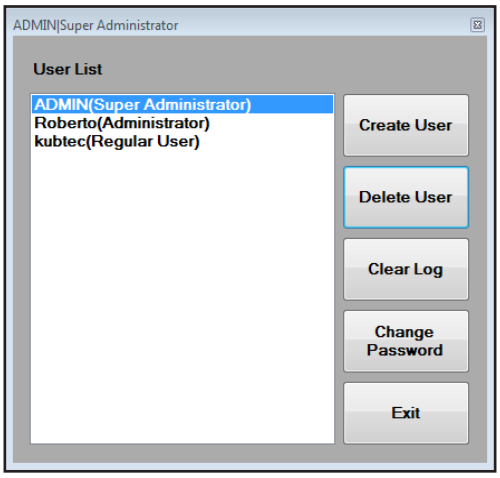


Figure 3-4: ADMIN (Super Administrator) Screen

- To create a new user, click the **Create User** button to access the Create a New User screen. Enter the Username and Password, select the **User Type**, then click **Create**.

- To delete a user, click the user name in the **User List**, click the **Delete User** button, click **Yes** to the prompt about the selected user's log being deleted, then click **OK** to the User Deleted prompt.

- To clear a log, click the **name of the user** whose log you want to clear, then click **Clear Log**. The Clear Log screen offers two options: **Delete log for this user** OR, **Delete a Log before a Date.** Select an option, then respond to the prompts that display.



Figure 3-5: Clear Log Screen

- To change a password, click the name of the user whose password you want to change, then click **Change Password**. In the **Change Password** screen, type in the new password in both fields, then click **Change**. Click **OK** on the Password Updated prompt.

Menu Bar: View Logs

The system stores logs of irradiation usage for each user of the system. These user logs contain information about the date, time, and dose for each irradiated sample.

To export a user log, select the desired user log. Click **Export** in the top menu bar. Navigate to the desired export location and click **OK**.

To view a log, click **View Logs** in the top menu bar of the Main Screen. For a Regular user, only the log for that the user who is logged in displays.

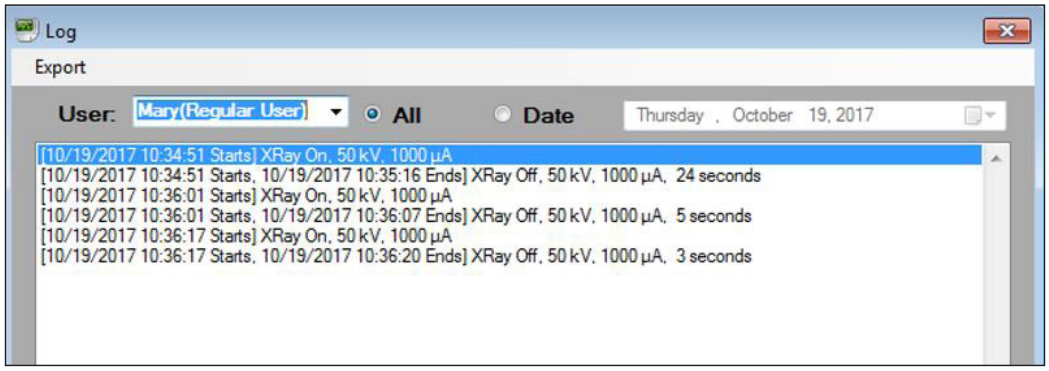


Figure 3-6: Regular User Log

The system admin has access to the logs for all users through the **User** dropdown menu.

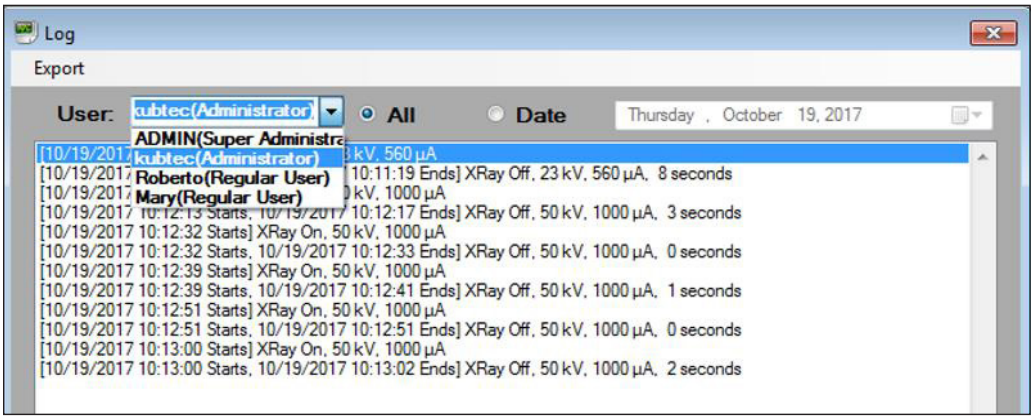


Figure 3-7: Admin Log

Menu Bar: Seasoning

Intelligent tube conditioning (also called seasoning) is a procedure that warms up the X-ray tube/source. The warm-up time varies with the number of hours that have passed since the system was last used. To run the correct system warm-up, follow these steps:

1. From the menu at the top of the screen, select **Seasoning**.
2. In the displayed menu, the system automatically selects the required warm-up time based on how long the system has been idle.

Warm-up mode	System Idle Time	Seasoning Time
Daily	> 8hr < 1 week	20.5 min
Weekly	More than a week	60 min
Monthly	More than a month	2 hrs 22 min
Test	For technician use only	

3. When the screen displays with the settings needed to perform the selected warm-up, click **ON** to start the warm-up.
4. Wait for the warm-up process to finish.

Menu Bar: Timer and Dosimeter

When the system is ready for use, follow these steps to enter the exposure parameters (kV and mA values, and either the time the sample needs to be irradiated, or the accumulated dose to be delivered to the sample):

1. On the Main Screen, enter kV and mA values:
   - In the **kV SetPoint** field, enter a kV value between 100 and the maximum kV of the unit (160/225/320).
   - In the **mA SetPoint** field, enter an mA value between 1.0 and 30.0, limited by the power (1.6 kW, 3.0 or 40 kW, depending on the model).

   NOTE: kV and mA settings must be configured according to system specifications. Refer to the **APPENDIX** for detailed information on setting kV and mA.

   NOTE: A red warning message will appear on the screen if the user selects kV and mA values that exceed the power limit. The user will not be able to start the X-ray until valid values are selected.

Menu Bar: Timer and Dosimeter (continued)

2. On the Main Screen, enter time or dose:

To enter the exposure time:

- Click the **Irradiation Time** button.
- Enter a value up to 60 minutes and 60 seconds.
- Click **OK**.

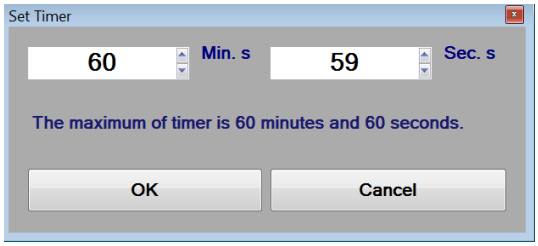


Figure 3-8: Set Timer Screen

To enter the irradiation dose:

- Click the **Accumulated dose** button.
- Enter a value up to 200 Gy.
- Click **OK**.

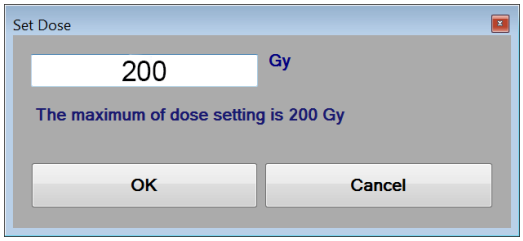


Figure 3-9: Set Dose Screen

Irradiate the Sample

After the exposure parameters are set, follow these steps:

1. Center the sample on the tray (or rotation device if used).
2. Close the chamber door gently and tightly to ensure interlocks engage.
3. Ensure the **READY** LED is lit. This happens automatically when the door is closed correctly.
4. Click **ON** in the lower right corner of the screen to start X-ray generation. The **X-RAY** button glows during X-ray generation. The kV and mA ReadBack fields provide feedback during the exposure sequence.

   NOTE: To stop X-ray generation before the set time, click **OFF** in the lower right corner of the Main Screen. The system remains powered up, but the X-rays will be stopped.

   NOTE: When a quick and immediate shutdown of the system is needed, push the **Emergency Stop** button.



CAUTION:

Monitor the **X-RAY** indicator to ensure it lights during an exposure and turns off when the exposure finishes.



CAUTION:

Keep the chamber door closed and latched except during the loading periods.

Cool Down Period

It is recommended that the cooling system be allowed to run for 30 minutes after the last X-ray ON cycle. This allows coolant to circulate through the system before the key switch is turned to the OFF position.

System Shutdown

Follow these steps to do a normal system shutdown:

1. Ensure the chamber is empty, then close the door tightly.
2. Click the X in the upper right corner of the screen to close the Main Screen.
3. Click in the lower left area of the screen.
4. Click the power icon, and then click **Shut down** to turn off the computer. The power button light will turn off.
5. Turn the key switch to the **OFF** position.

CHAPTER 4: SYSTEM USE FOR IMAGING

Introduction

Before the system is turned on for the first time each day, perform the daily inspection as stated in the checklist in the Maintenance Chapter.

NOTE: To obtain consistent results, the system should be operated at normal room temperature within the guided operating levels stated in the Specifications Chapter. Drastic and sudden changes in temperature may cause condensation to form on the surface. If this happens, it is strongly recommended to wait until the condensation dissipates and the system acclimates to the surrounding environmental conditions before resuming operation.

Pre-Startup Checks

Make sure of the following:

- The system is on a flat surface.
- The cart casters are in the locked position.
- The power cord is fully inserted into the wall outlet.

How to Start the System

1. Press the monitor power button.
2. Turn the key switch to the ON position.
3. Press the power button. The computer automatically starts.
4. Double-click the  icon on the desktop. Make sure the cabinet door is tightly closed. If an initialization screen displays, wait for the initialization process to finish. When the software finishes loading, the Main Screen will display. A message will flash on the that says **Checking if Calibration is Required, Please Wait...**
5. Make sure that there is nothing in the X-ray field inside the drawer.
6. Close the cabinet door gently and tightly. The **X-Ray Ready** light at the bottom left of the screen illuminates.
7. Select **NEXT**. The **Calibration Wizard** automatically performs the calibrations for the detector.

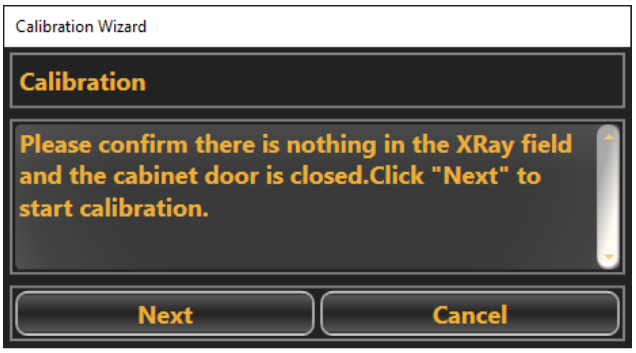


Figure 4-1: Calibration Screen

8. When the calibration process is complete, click **Back to Main Window**.

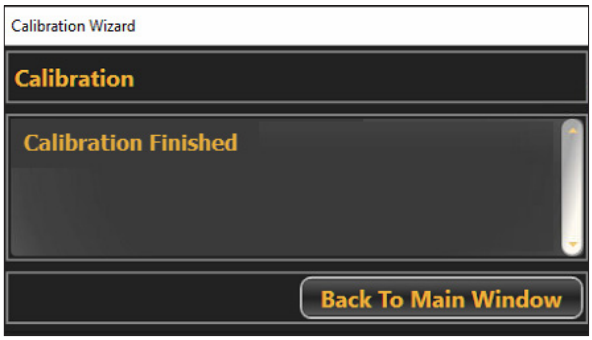


Figure 4-2: Calibration Finished Screen

The system is now ready to start the image acquisition process. Follow the instructions in the next chapter for acquiring images.

Main Screen

The Main Screen provides access to all software functions of the system. Each component of this screen is explained in the Legend starting below.

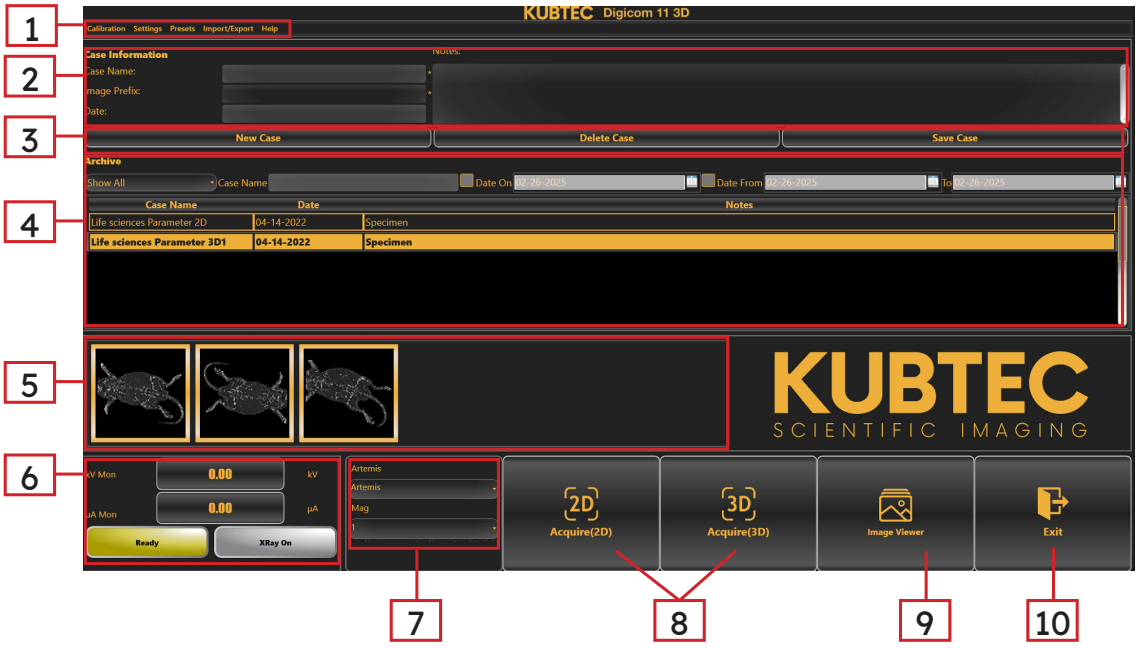


Figure 4-3: Main Screen

Main Screen Legend

Screen Legend

No.	Function
1	**Menu bar functions** • **Calibration** access the Calibration Wizard. • **Settings** has options to return to factory settings and to create Master settings. • **Presets** displays the Presets Manager screen. • **Import/Export** **Import** has the option for importing a series or importing an image contained in a series. **Export** provides the means to send studies to a removable storage device, such as USB flash drive. • **Help** provides user access to the Instructions for Use and KUBTEC® contact information. The **Registration** option is for service personnel to register the software for use.
2	**Case information** displays image data that is retrieved from stored files or manually entered as a new case.
3	Options to create a **New Case**, **Delete the current case**, and **Save the current case**.
4	**Archive** allows searching for stored cases by case Name or by the date.
5	Icons of acquired images are displayed in this area.
6	**Ready Light and XRay On Light** • **Ready** light illuminates when the system is prepared to generate X-rays. • **X-rays On** light illuminates when the system is generating X-rays.
7	**Image Filter** and **Magnification** options.
8	**Acquire** initiates the X-ray exposure process.
9	**Image Viewer** provides full screen display of the last acquired image (or one selected thereafter by the user) along with a toolbar for image processing.
10	**Exit** closes the system software program.

NOTE: The screen layout will appear different in portrait and landscape orientations; however, all functionality remains the same.

Menu Bar

The menu bar provides options for setting up the system and customizing it for client use. The use of each menu bar option is described next.



Figure 4-4: Main Screen Menu Bar

Menu Bar: Settings



Figure 4-5: Calibration Screen

Click **Calibration** in the menu bar to access the **Calibration Wizard**.

To calibrate the system:

1. Remove any object that is in the X-ray field.
2. Close the cabinet door gently and tightly.
3. Click **Next** to start the calibration.
4. When the calibration finishes, click **Back to Main Window**.



Figure 4-6: Settings Options

Click **Settings** to access the Factory and Master Setting options.

Factory Settings are those that are in place when the system is delivered. The use of this option requires password access.

Master Settings include those for the online image filter, window/level, and preset technologists and radiologists. The use of this option requires password access.

Menu Bar: Presets

Click **Presets** in the Main Screen menu bar to open the **Presets Manager** screen, where exposure parameter combinations (Presets) can be added. Each created setting is displayed as a selectable option on the Presets screen, which is displayed when the manual mode is selected for image acquisition.

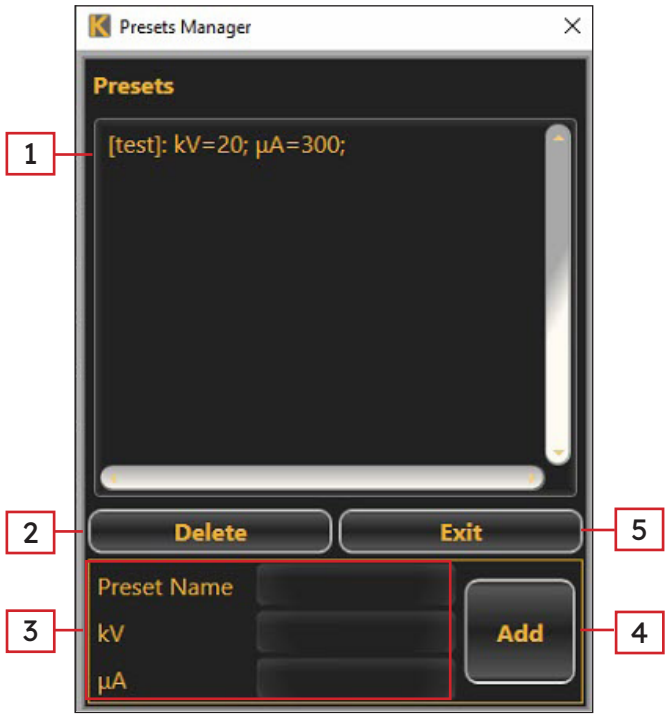


Figure 4-7: Preset Manager Screen

Screen Legend

1 List of Presets.

2 Delete a selected Preset.

3 Enter data for a new Preset.

4 Add a new Preset.

5 Exit the Preset Manager screen.

To add a Preset to the list:

1. In the **Preset Name** field, enter a name for the new Preset.
2. In the kV and µA fields, enter the desired values for this Preset.
3. Click **Add**.
4. Click **Exit**.

To delete a Preset from the list:

1. Click the Preset to delete it.
2. Click **Delete**.

Menu Bar: Import/ Export

The Import option in the **Import/Export** menu allows users to import images that are saved in a different location in the current series. The Export option allows users to send images that are saved in the system to an external device.

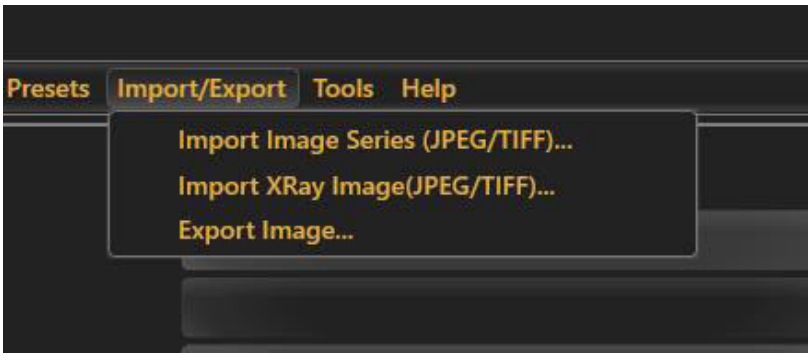


Figure 4-8: Import/Export Options

The use of each option in the Import/Export menu is explained in the following sections.

Menu Bar: Import Image

To import an image (or images) into the current case:

1. Click **Import Image** in the Import/Export menu bar option list.
2. Click **Browse** and navigate to the image(s) to import.
3. Select the files to be imported.
4. Click **Import**.
5. When the files finish importing, click **Exit** to close the screen.

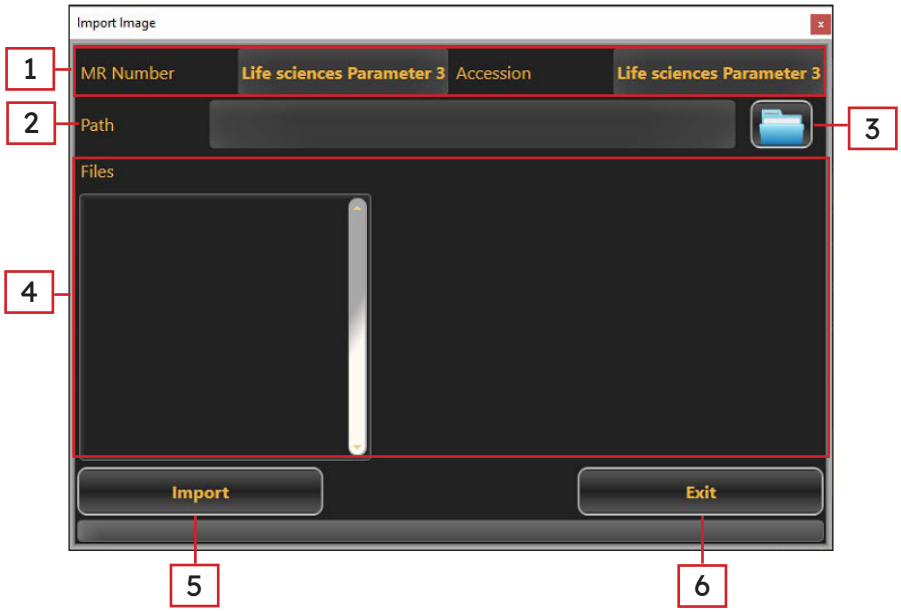


Figure 4-9: Import Image Screen

Screen Legend

1 Current case identification.

2 Location of the files to be imported.

3 Browse to image to be imported.

4 List of files for preview.

5 Import the selected image(s) into the current case.

6 Close the Import screen.

Menu Bar: Import DICOM

To import DICOM images into the current case:

1. Click **Import Dicom** in the Import/Export menu bar option list.
2. Click the **Browse** button, then navigate to the DICOM image(s).
3. Select the image(s) to import.
4. Click **Import**.
5. When the files finish importing, click **Exit** to close the screen.

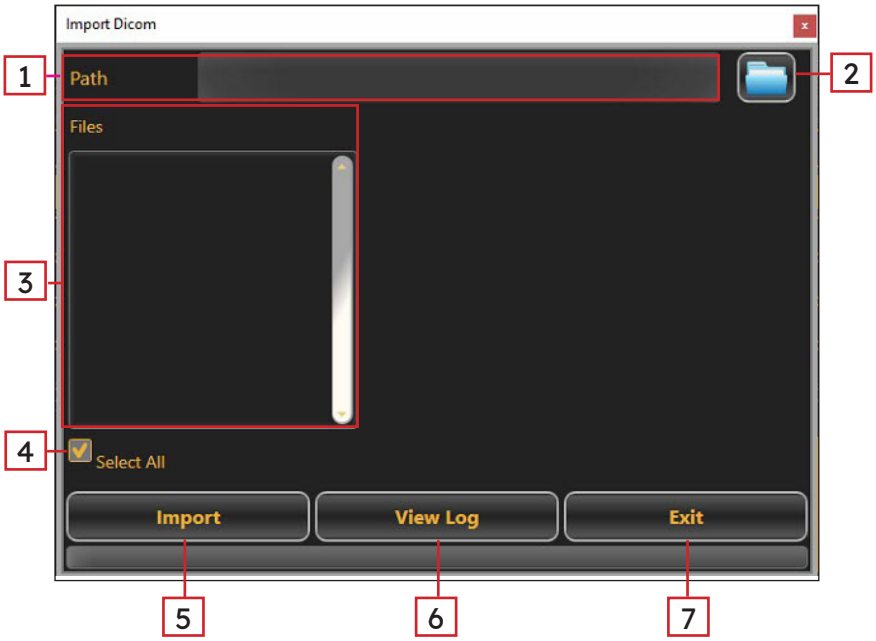


Figure 4-10: Import DICOM Screen

Screen Legend

1 Location of the images to be imported.

2 Browse to the image(s) to be imported.

3 List of files for preview.

4 Selects all files displayed in the list.

5 Import the selected image(s) into the current case.

6 Displays the path of the file to be imported and the status of the import.

7 Close the Import screen.

Menu Bar: Export Images

To export images from the system:

1. Click **Export Images** in the Import/Export menu bar option list.
2. Click the **Browse** button and navigate to the image(s) to be exported.
3. Select the image(s) to be exported, then assign a format.
4. Identify the destination for the exported image(s).
5. Click **Export**.
6. Click **Exit** to close the screen.

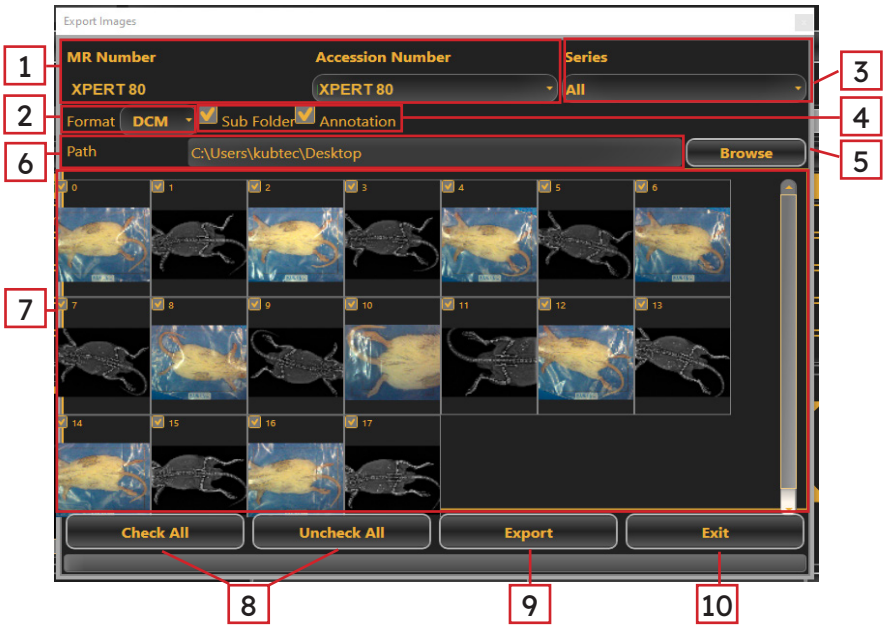


Figure 4-11: Export Images Screen

Menu Bar: Export Images (continued)

Screen Legend

1 Current case identification.

2 The dropdown menu options for the format of images to be exported:

- DCM is DICOM. This is the default and recommended format for systems that have a DICOM viewer.
- JPEG minimizes image size, making the image more compact.
- TIFF provides a full-resolution image, and is recommended for systems that do not have a DICOM viewer.

3 The dropdown menu allows the selection of all images in the series or individual images.

4 **Subfolder**: Option to have all selected images contained in a separate folder when they are exported to the location in the **Path** field.

Annotation: Option to keep existing annotations with the images to be exported.

5 Navigate to the location of the image(s) to be exported.

6 Location of the images to be exported.

7 Image preview.

8 Select or unselect all images in the display area.

9 Export selected images to a designated location.

10 Close the Export screen.

To export images:

1. Select Import/Export from the menu bar, then select **Export Image**.
2. In the Export screen, select the images to export.
3. Assign a format.
4. Identify the destination.
5. Select Export.

Menu Bar: Help

The **Help** option provides access to information about the system.

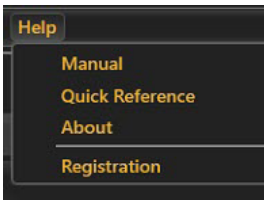


Figure 4-12: Help Menu

- **Manual** is to access the PDF of the Instructions for Use (IFU).
- **About** is to see KUBTEC® contact information and the version of the software that is currently running on the system.

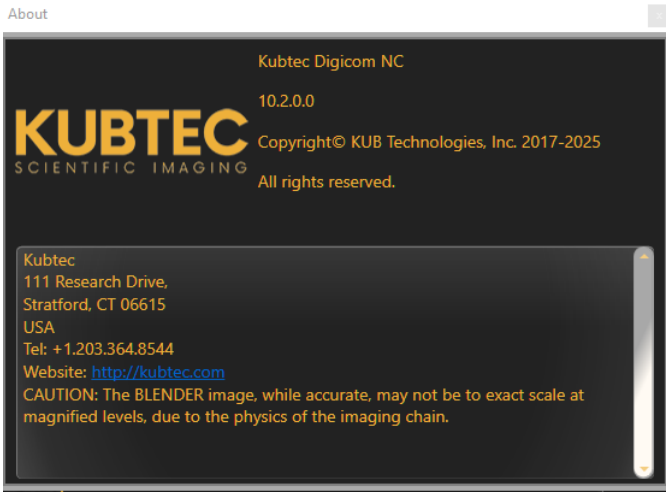


Figure 4-13: About Screen

- **Registration** is to access the screen which allows the application provider remote access to your system. The provider requires the alphanumeric string displayed in the **Machine Code** field and the registered **Product Key** for the software.

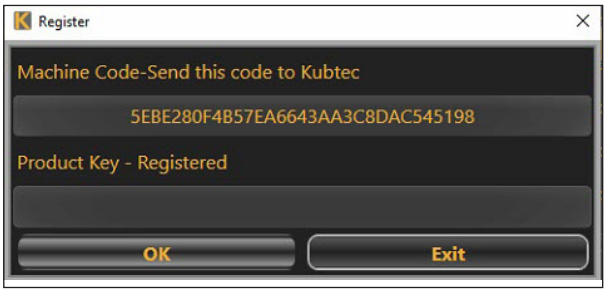


Figure 4-14: Registration Screen

Live Feed Software

This feature is used in parallel with The DIGISOURCE® Irradiator Software to preview the interior of the cabinet (chamber):

1. Double-click on the live feed  icon on the desktop to open the Live feed software.

   NOTE: Make sure to turn on the light switch inside the chamber on the upper right before beginning a live feed.



Figure 4-15: Chamber Light Switch

2. Click **Enable AE**.

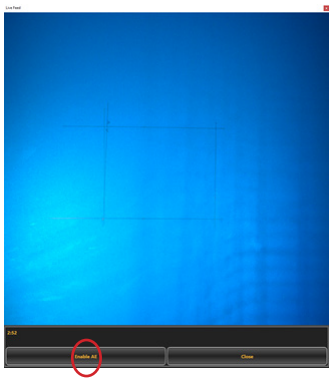


Figure 4-16: Enable Auto Exposure (AE)

NOTE: The live feed will continue for 20 seconds after which time the user must restart the application.

NOTE: The live feed application cannot be opened while The DIGICOM® Software is running.

3. Optical (RGB) images are acquired while the X-ray images are being acquired.

Image Acquisition Options

After the system is properly set up, it is ready to start the image acquisition process. The first step is to identify the sample to be X-rayed. The system software offers two options to do this:

- Recall an existing case from the system archive.
- Create a new case.

Use of each option is explained next.

Recall a Case from the Archive

To recall an Archived Case, follow these steps:

1. From the dropdown menu in the **Archive** section of the screen, select **Show All** to display a list of cases that are loaded into the system. OR, select **Show by Case Name**, then enter the **Case Name**.

   NOTE: Additional filtering options allow searching the archived cases by a date or date range.

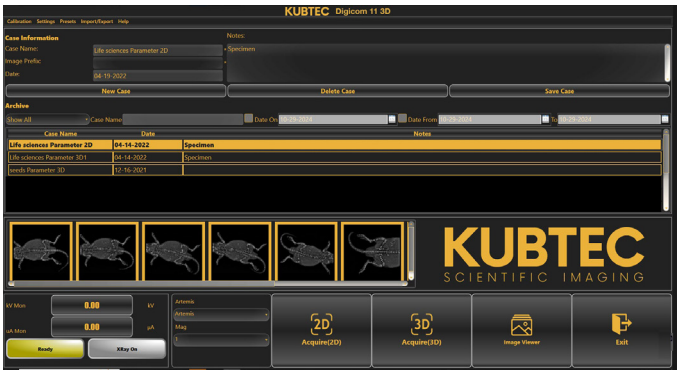


Figure 4-17: Case Selection from Archive

2. Double-click the desired case. Information about that case is displayed in the **Case Information** section of the screen. Images from the case study are displayed below the list of cases.

Create a New Case

To create a New Case:

1. In the Main Screen, click **New Case**.
2. In the New Case screen, type in the required information,
3. Click **Save Case**. The new case information is displayed at the top of the Main screen and in the Archive section.

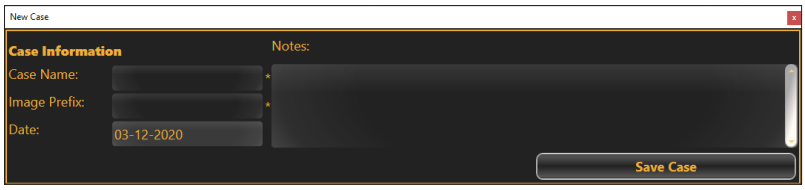


Figure 4-18: New Case Screen

Acquire X-ray Images

The system offers the following options for acquiring X-ray images:

- Presets
- Manual

Use of each option is described in the next sections.

Before acquiring images, ensure that the detector tray is pulled out in a flat position.

Acquire with Presets and Manual

To acquire images using a Preset or with manual entry of exposure factors:

1. Ensure that the case selected on the Main Screen is the intended case.
2. Center the sample within the imaging area indicated by the white marks on the contact level or magnification tray.
3. Close the cabinet door tightly.
4. Ensure the X-ray Ready indicator is lit.
5. Right-click the **Acquire(2D) button** at the bottom of the Main screen.
   The Preset screen displays.



Figure 4-19: Preset Screen

6. Acquire the X-ray image:
   - To acquire an X-ray image using a **Preset**, double-click the preset option from the list and then click **Acquire**.
   - To acquire an X-ray image using **Manual** settings, enter the desired kV and µA values within the range for each setting, and then click **Acquire**.

     When the X-rays are turned on, the X-RAY ON indicator on the control panel lights, and "**Acquiring images please wait...**" is displayed. Shortly thereafter, the 2D image is displayed. An optical (RGB) image is also acquired during this process.

Add a Preset

To add a Preset to the Presets list, follow these steps:

1. In the menu bar at the top of the Main screen, select the Preset (P) option.
2. In the **Preset Manager** screen, type in the Preset Name, the desired kV, and the desired µA (within the range of values for your system).
3. Click **Save Preset**, then click **Exit**.

Acquire Optical (RGB) Image

To acquire only an optical (RGB) image, follow these steps:

1. Right-click the **Acquire(2D)** button at the bottom of the Main screen.
2. Click the **Acquire Optical Image Only** button.

The acquired image opens in the Image Viewer, and the optical (RGB) camera window closes. The image automatically becomes part of the case study and displays along with other acquired images in the display area of the Main Screen.

Magnification

The plexiglass magnification tray features visible markings to guide correct sample placement. Align each sample with the corresponding marking to ensure accurate positioning and prevent errors during use. When the sample is not positioned properly, a shadow from the cutout shows in the X-ray image. When you use a magnification greater than 1x, you may need to re-position the sample in the center of the cutout.

To acquire magnification images:

1. Place the magnification tray in the magnification tray rails for the level of magnification that you want.
2. Center the sample on the magnification tray.
3. Close the door tightly. Ensure the X-ray Ready indicator is lit.
4. At the bottom of the Main Screen, select the Mag level from the dropdown magnification menu.
5. Acquire the image:
   - To acquire an X-ray image using a **Preset**, double-click the preset option from the list and then click **Acquire**.
   - To acquire an X-ray image using **Manual** settings, enter the desired kV and µA values within the range for each setting, and then click **Acquire**.

   When the X-rays are turned on, the X-RAY ON indicator on the control panel lights, and "**Acquiring images, please wait...**" is displayed. Shortly thereafter, the 2D image is displayed. An optical (RGB) image is also acquired during this process and is cropped according to the selected magnification level.

Create a Copy Path

A copy path can be created to a designated location for storing images. Once a copy path has been set up, acquired images are automatically stored in that location.

To create a copy path, follow these steps:

1. Select **Master Settings** from the **Setting(s)** tab in the menu at the top of the Main Screen.
2. Enter the password (kubtec), then click **OK**.
3. Click **Copy Path**, then identify the location where you want to store acquired images.
4. Select the image type from the dropdown menu.
5. Click **Save** > **OK**.
6. Click **Exit Master Settings** to return to the Main Screen.



CAUTION:

To avoid software issues, make sure the shared drive is always connected.

How to Shut Down the System

To shut down the system:

1. Click 

on the Main Screen, then click **OK** to the exit program prompt.
2. Click  in the lower left area of the screen.
3. Click the power icon, and then click **Shut down** to turn off the computer.



WARNING:

Do not turn off the monitor. It will automatically enter standby mode and power on with the computer.

4. On the control panel of the shielded cabinet, push the power button. The power button light extinguishes.
   - If the system is to remain in its current location, leave the key switch in the ON position, and the power cord connected to the wall.
   - If the system is planned to be moved, turn the key switch to the OFF position, disconnect the power cord from the wall receptacle, and prepare the unit for transport.

CHAPTER 5: IMAGE VIEWER

Introduction

The XCELL® 160/225/320 Irradiator Systems has tools for processing acquired images and options for viewing acquired images. These tools by default appear as icons on the right side of the acquired image in the Image Viewer.

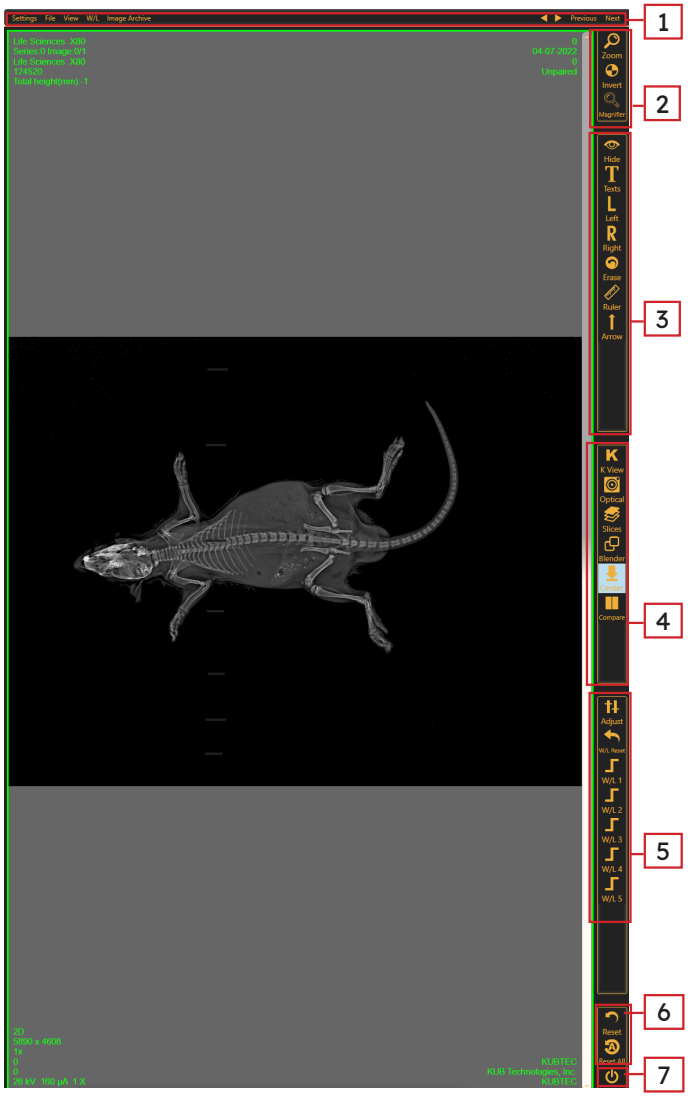


Figure 5-1: Image Viewer

Figure Legend

1 Image Viewer toolbar
2 Image processing tools
3 Annotation tools
4 Viewing options
5 Window/Level tools
6 Reset options
7 Close the Image Viewer

How to Use Image Viewer Tools

The next tables describe the use of each tool available in the Image Viewer.

How to Use Image Viewer Tools

1. Use the arrows at the top of the Image Viewer to scroll through images within a series, or click Previous or Next to go to another series.
2. Click a tool to activate it, then click on the image to use the tool.

NOTE: To pan the image, left-click and hold while you move the mouse.

Image Processing Tools

The information in the following table describes tools that provide the means to enhance the visualization of specific areas within an acquired image.

Table 5-1: Image Processing Tools

Icon	Name	Function
	**Zoom**	• Click the **Zoom** icon, then left-click on the image to zoom in, or right-click on the image to zoom out. • You can also hold the left mouse button and move the mouse to pan the image, or hold the right mouse button down and slide the mouse up to zoom in or slide the mouse down to zoom out. • To disable, click the Zoom icon again.
	**Crop**	• Click the **Crop** icon, then click on the image • Draw a box over the area that you want to extract from the image. • Select the Copy icon, then click **OK**. The cropped image is added as the last image in the series/case. • To return to the original image, keep clicking the Up arrow until you see the original image. OR, click the Exit Image Viewer icon to return to the Main screen where you can scroll to and select the original image.
	**Invert**	• Click the **Invert** icon to change the black pixels to white pixels. • Click this icon again to reverse the pixels.
	**Flip V**	• Click the **Flip V** icon to reverse the positions of the top and bottom of the image. • Click the icon again to return the image it its original position.

Image Processing Tools (continued)

	**Flip H**	• Click the **Flip H** icon to reverse the positions of the left and right side of the image. • Click this icon again to return the image to its original position.
	**Rotate**	• Click the **Rotate** icon to display the Rotation window. • Select from one of three programmed rotation angles, or use the slider to select another rotation angle. • The Crop option removes areas of the image that fall outside of the image frame during rotation. • The Resize option fits the image within the frame, so that no data is lost.
	**Magnifier**	• Click the **Magnifier** icon to display the Magnifier Window that has a variety of options. • Select the tool shape, size of the viewer, and the number of times you want the view to zoom in. • Move the mouse over the image. A window appears. As you move this window around image, all data within the window is magnified. • To stop the tool, click the Exit icon in the Magnifier screen.
	**Apply To ALL**	Click the Apply **To ALL** check box to apply processing to all images in the grid.

Annotation Tools

Table 5-2: Annotation Tools

Icon	Name	Function
	**Left Tag**	Click the **Left** icon, then click on the image. • To access the Text Input box which offers options for text entry and formatting, and options for presets, double-click the L tag on the image. • To delete an L tag, close the Text Input box (if opened), left-click the green box above the L tag in the image, then press Delete. • To stop the Left Tag tool, click the highlighted L icon in the toolbar.
	**Right Tag**	Click the **Right** icon, then click on the image. • To access the Text Input box which offers options for text entry and formatting, and options for presets, left double-click the R tag in the image. • To delete an R tag, close the Text Input box (if opened), left-click the green box above the R tag in the image, then press Delete. • To stop the Right Tag tool, click the highlighted R icon in the toolbar.
	**Texts**	• Click the Texts icon, then click on the image. • The Text Input screen appears on the image allowing you to add text on the image. The text tool will continue to add new texts to the image after the text input screen is closed until the Texts icon is clicked again. • You must close the Text Input screen to stop the Texts tool.
	**Arrow**	• Click the **Arrow** icon, then click on the image. • Move the mouse to draw an arrow to a region in the image, then click to end arrow creation. • To stop creation of additional Arrows, double right-click on the image. • To change the direction or length of the arrow, click and hold one end of the arrow while dragging it. • To stop the Arrow tool, click the highlighted Arrow icon.

Annotation Tools (continued)

Table 5-2: Annotation Tools

Icon	Name	Function

	**Ruler**	• Click the **Ruler** icon, then click one end of the area in the image to be measured.
		• Move the mouse along the path to be measured, then click at the end of that path. The distance between the two points displays while you move the mouse.
		• To change the measurement from inches to mm or cm:
		  • Click **Annotation Settings** in the top menu bar.
		  • In the dropdown menu for **Unit Type**, select mm or cm.
		  • Click Save.
		• To delete the ruler path, select the marker in the image, then press Delete.

	**Density Box**	• Click the **Density Box** icon, then click on the image. • Drag the mouse to create a rectangle shape, then click to end creation of the rectangle. The average pixel intensity in the rectangular region will display at the top left corner of the rectangle. • To delete the density box annotation, select it in the image, then press Delete.
	**Rectangle**	• Click the **Rectangle** icon, then click on the image. • Move the mouse to create a rectangle shape, then click to end creation of the rectangle. • To delete the rectangle, select it in the image, then press Delete.
	**Show Grid on Image**	• Click the **Grid** icon to display a grid on the image along with the Grid Size window. • Options in this window allow adjustment to the Width and Height of the displayed grid, and to show/hide the grid. • Use the grid to section out the image in desired dimensions.

Annotation Tools (continued)

Table 5-2: Annotation Tools

Icon	Name	Function
	**Line**	• Click the **Line** icon, then click on the image. • Move the mouse to draw a line from one point to another, then click to end creation of the line.
	**Free Hand**	• Click the **Free Hand** icon, then click on the image. • Move the mouse to draw free hand on the image, then click to end creation of the drawing.
	**Polygon**	• Click the **Polygon** icon, then click on the image. • Move the mouse to create one side of the shape, then click and move again to create another side of the shape. • Repeat this sequence to create the desired shape, then double-click to end creation of the shape.
	**Ellipse**	• Click the **Ellipse** icon, then click on the image. • Move the mouse to create the shape, then click to end creation of the shape.
	**Degree**	• Click the **Degree** icon, then click on the image. • Move the mouse to create one side of an angle, then click. • Move the mouse to create the other side of the angle, then click. The degree of the created angle displays. • To stop the tool, click the highlighted Degree icon.
	**Polygon Ruler**	• Click the **P Ruler** icon, then click on the image. As you move the mouse to create one side of the shape, the measurement displayed. • Click and move again to create another side of the shape. As you repeat this sequence to create the desired shape, measurements show. • Double-click to end creation of the shape.

Annotation Tools (continued)

Table 5-2: Annotation Tools

Icon	Name	Function
	**Rectangle Area**	• Click the **R Area** icon, then click on the image. As you move the mouse to create the rectangle, the area of the shape is displayed. • Click to end the creation of the shape.
	**Ellipse Area**	• Click the **E Area** icon, then click on the image. As you move the mouse to create the ellipsis, the area of the shape is displayed. • Click to end the creation of the shape.
	**Histogram**	View a graph (**Histogram**) of pixels vs. grayscale values of the whole image or for a selected area of the region of interest.
	**ROI His**	View a graph (ROI His) of pixels vs. grayscale values of the whole image or for a selected area of the region of interest.
	**Density Profile**	View a graphical representation (Density Profile) of grayscale values across a line drawn through any part of the image. This tool is useful in highlighting breaks in continuity or distinct changes in the density of the image.
	**Hide**	Click the **Show/Hide** icon to show/hide annotations on an image.
	**Erase**	Click the **Erase** icon, then click Yes to the prompt to erase all annotations in the image.

View Options

Table 5-3: View Options

Icon	Name	Function
	**Optical (RGB) Image**	• Click the **Optical** (RGB) icon to view the RGB image. • Click on the RGB window to switch between images in the smaller RGB window and the larger main Image Viewer window.
	**Blender**	The **Blender** overlays the RGB image on the X-ray image. • To enable the Blender, click the **Blender** icon. A window opens and offers these options: • Slider changes opacity of the RGB image: Fully to the right shows only the RGB image. Fully to the left shows only the X-ray. • Save to Series saves as a new DICOM image and becomes part of the series. • Open Blended viewer allows blended images to be displayed in the main viewer. If there are many blended images, then a selection window opens for the user to choose which image to display. • Export saves image as a .jpg or .tiff to a selected destination.
	**Compare Two Images**	• Click the **Compare** icon to enable comparison of two images. In the screen that displays, you have options to select the accession number, series, view, image ID, and blended images. • To stop the tool, click another view icon.
	**Display 2D Image**	Click the **2D View** icon to display the 2D image only (without the RGB image overlay).
	**Horizontal Toolbar**	Click the **H Toolbar** icon to display the toolbar along the bottom of the screen.
	**Vertical Toolbar**	Click the **V Toolbar** icon to display the toolbar along the side of the screen.

Window/Level Options

Table 5-4: Window/Level Options

	**W/L Adjusts**	• Click the Window/Level **Adjust** icon to display the vertical slides that allow you to adjust W/L in the displayed image. • In either slide, click and hold the button, then drag up or down the slide.

	**W/L Reset**	• Click one of the Window Level **W/L Reset** icons to have the image display in a pre-defined W/L value.
		• To change a preset:
		  • Adjust the Window/Level of the image.
		  • Right-click on the preset you want to change, then click Yes to the prompt about overwriting the existing preset.
		  • Select YES to confirm the new value.

	**Region of Interest**	• Click the **ROI** icon to create a box in the image. • Hold the left mouse button down and drag the box within the image to an area you want, then release the mouse. • You can now adjust the W/L within that static box. This W/L is the setting for areas that show within that box as you move around the image.
	**Window of Interest**	The **WOI** tool adjusts W/L as you move the window around the image.
	**Window/ Level Preset**	• To use a Window/Level Preset, click the Preset you want. The image automatically adjusts to the values. • To change a preset, adjust the Window/Level of the image and then, right-click on the preset that you want changed.

Other Image Viewer Tools

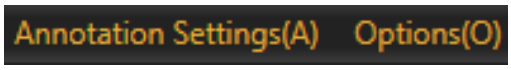
Table 5-5: Other Image Viewer Tools

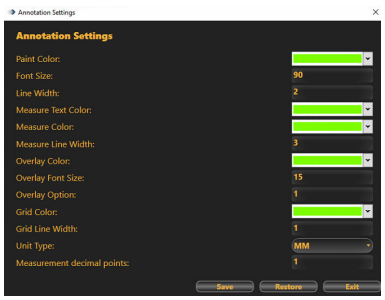
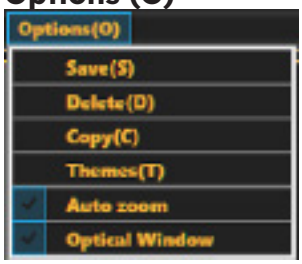
Icon	Name	Function
	**Reset**	Click the **Reset** icon to delete all the annotations on the displayed image.
	**Exit**	Click the **Exit** icon to return to the Main screen.

Image Viewer Menu

The Image Viewer menu at the top of the screen has options for displaying and handling acquired images. Menu items are described in the following table:

Table 5-6: Image Viewer Menu

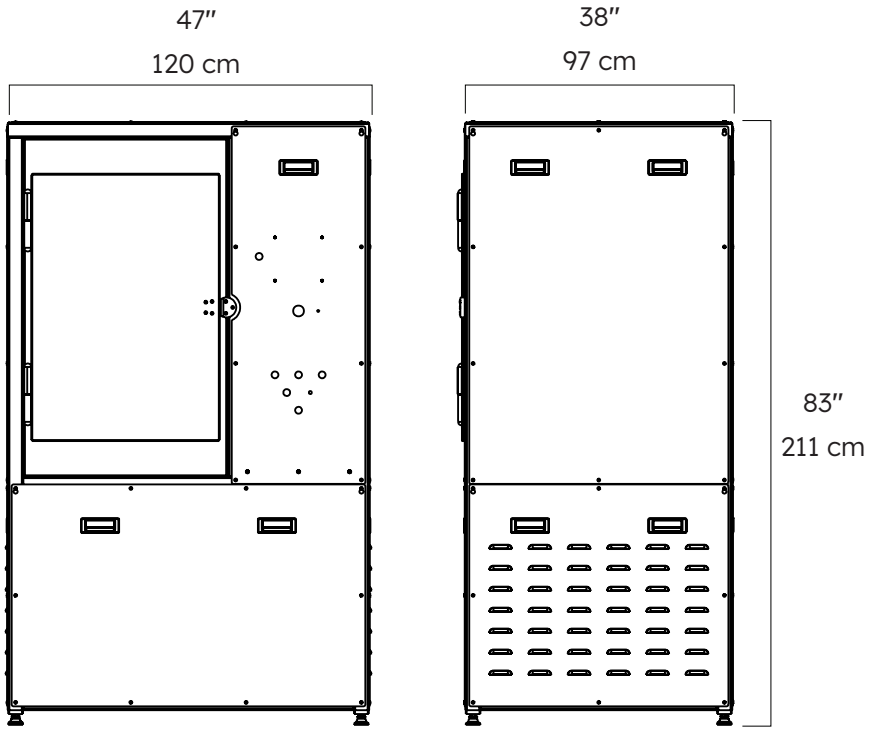


Menu Item	Function
Annotation Settings (A) 	Provides options for the appearance of annotations on the image. You can select the color and size of the overlay as well as the grid, and you can change the unit of measurement.
Options (O) 	**Save(S)** - Click Save to overwrite the original image with the current image that is displayed in the image viewer. **Delete(D)** - Click Delete to remove the displayed image from the study. **IMPORTANT: Deleted images cannot be recovered.** **Copy(C)** - Makes a copy of the displayed image. **Themes(T)** - Provides options for changing the color scheme of the image viewer. **Auto Zoom** - When enabled use image processing to locate the sample, then zooms in until the whole sample is visible and fills as much of the screen as possible. **Optical Window** - When enabled the RGB image will display when the Image Viewer starts.
	Provides the means to scroll through acquired images.

CHAPTER 6: SYSTEM SPECIFICATIONS

This section contains tables that list specifications for components of The XCELL® 160 System.

XCELL 160 System Diagram



XCELL 160 System Specifications

This section contains tables that list specifications for components of The XCELL® 160 System.

Machine

Table 6-1: Machine Specifications

Maximum potential	160 kV
Focal spot	7.5 mm
Maximum current	30 mA
Inherent filtration	0.8 mm Be
Recommended breaker rating	30 A
X-ray Power (maximum)	3000 W
Frequency	47/63 Hz
Beam angle	40 degree
Irradiation chamber dimensions	24″ W x 24″ D x 42″ H (61 cm x 61 cm x 107 cm)

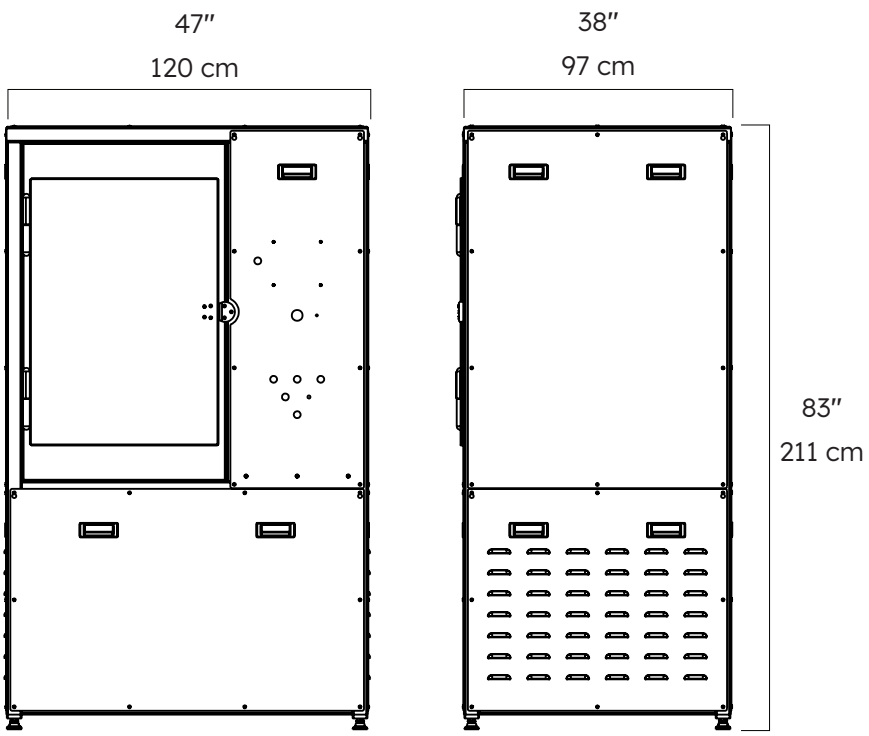
Machine (continued)

System dimensions	47″ W x 38″ D x 83″ H (120 cm x 97 cm x 211 cm)
Source-to-Sample Distance (SSD)	See **Table 6-5: SSD in each Irradiator**
Weight	1650 lbs (748 kg)
Maximum beam coverage	Collimated 14″ x 14″ (36 cm x 36 cm)
Warmup	Automatic
Software	The DIGISOURCE® Software

Accessories, Monitor, and Computer: These specifications are the same for all XCELL systems. See **Table 6-4: Common Specifications.**

XCELL 225 System Diagram

This section contains tables that list specifications for components of The XCELL® 225 System.



XCELL 225 System Specifications

This section contains tables that list specifications for components of The XCELL® 225 System.

Machine

Table 6-2: Machine Specifications

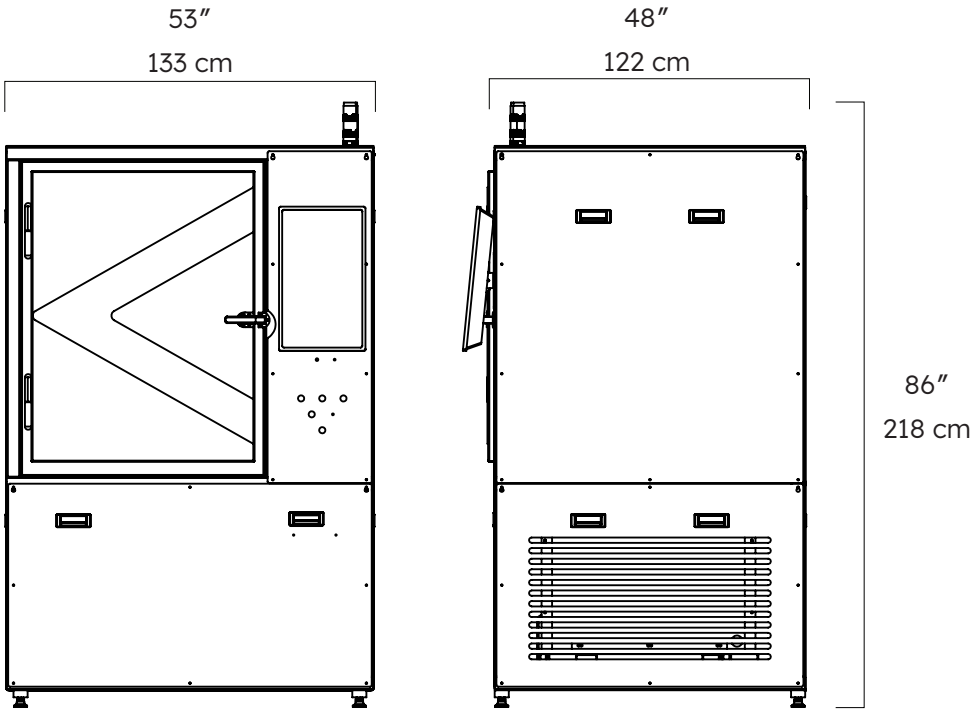
Maximum potential	225 kV
Focal spot	7.5 mm
Maximum current	30 mA
Inherent filtration	0.8 mm Be
Recommended breaker rating	30 A
X-ray Power (maximum)	3000 W
Frequency	47/63 Hz
Beam Angle	40 degree
Irradiation chamber dimensions	24″ W x 24″ D x 42″ H (61 cm x 61 cm x 107 cm)
System dimensions	47″ W x 51″ D x 83″ H (120 cm x 97 cm x 211 cm)

Machine (continued)

Source-to-Sample Distance (SSD)	See **Table 6-5: SSD in each Irradiator**
Weight	2150 lbs (975 kg)
Maximum beam coverage	Collimated 14″ x 14″ (36 cm x 36 cm)
Warmup	Automatic
Software	The DIGISOURCE® System

XCELL 320 System Diagram

This section contains tables that list specifications for components of The XCELL® 320 System.



XCELL 320 System Specifications

This section contains tables that list specifications for components of The XCELL® 320 System.

Machine

Table 6-3: Machine Specifications

Maximum potential	320 kV
Focal spot	8.0 mm
Maximum current	30 mA
Inherent filtration	3.0 mm Be
Recommended breaker rating	40 A
X-ray Power (maximum)	4000 W
Frequency	47/63 Hz
Beam angle	40 degree
Irradiation chamber dimensions	32″ W x 32″ D x 42″ H (81 cm x 81 cm x 106 cm)
System dimensions	53″ W x 48″ D x 86″ H (135 cm x 122 cm x 219 cm)

Machine (continued)

Source-to-Sample Distance (SSD)	See **Table 6-5: SSD in each Irradiator**
Weight	5000 lbs (2268 kg)
Maximum beam coverage	Collimated 14″ x 14″ (36 cm x 36 cm)
Warmup	Automatic
Software	The DIGISOURCE® Software

Common Specifications

Table 6-4: Common Specifications (160/225/320 XCELL Systems)

Accessories

Accessories Specifications	
Standard	• Entry port for anesthesia/monitoring lines • Optical (RGB) camera
Optional	• Mouse irradiation kit. Includes six components as follows: 1. Pie cage 2. Partial body irradiation L Restrainer 3. Partial body irradiation R Restrainer 4. Partial body irradiation L Shield 5. Partial body irradiation S Shield 6. Gas anesthetizing box • Integrated digital X-ray imaging (DIGICOM Software)

Touchscreen

Touchscreen Monitor Specifications	
Screen size	21.5″ (546 mm) (diagonal) 10.5″ x 18.7″ (H x V) (267 mm x 480 mm)
Resolution	HD full screen (1920 x 1080)

Computer

Computer Specifications	
Hard drive	500 GB
RAM	8 GB
Processor	i5
Operating system	Windows® 11
Serial port	Yes

Source-to-Sample distances (SSD)

Table 6-5: SSD in each Irradiator*

Shelf Level	160 kV (1.8 kW)	225 kV (3.0 kW)	320 kV (4.0 kW)
1 (Contact)	37.25″	36.06″	36.56″
2	30.75″	29.75″	23.88″
3	24.75″	23.75″	16.04″
4	18.75″	17.75″	NA

*Using turntable adds an additional 5″ to shelf level (i.e. subtracts 5″ from SSD)

CHAPTER 7: SYSTEM MAINTENANCE

Introduction

This chapter provides information on actions that users must perform to maintain the safe and consistent performance of the system. The first section of this chapter provides information about cleaning and disinfection. There are recommendations for products to use and procedures to follow.

The second section of this chapter contains checklists for routine system inspections. These lists detail the steps for each procedure in the inspection. KUBTEC recommends that you make a copy of each checklist to use for the inspection and to keep on file as a record of your completion of the inspection tasks.

Cleaning and Disinfecting

At the completion of each sample case, clean and disinfect the interior components of the upper cabinet and all system controls and components which the user touched during the examination. This practice is both for user protection and to avoid cross-contamination of samples.

Cleaning

For purposes of this manual, cleaning means wiping off dust, fingerprints, and other substances that do not contain biological or contaminating fluids. Solutions to use for this purpose are over-the-counter, neutral detergents and/or liquids. Be sure to use a soft cloth with these cleaners.



CAUTION: Harsh liquids or rough surfaces will damage the system surfaces.

Cleaning and Disinfecting (continued)

Disinfecting

For purposes of this manual, disinfecting means using approved solutions to wipe areas that have come in contact with biological or contaminating fluids. The following list shows cleaning solutions (and their main ingredients) that KUBTEC approves for use in cleaning/disinfecting the system.

KUBTEC Approved Item	Ingredients
CaviWipes-XL	Quaternary ammonium + alcohol disinfectant
Accel-TB wipes	Stabilized hydrogen peroxide
PDI and Clorox disinfectant bleach wipes	1:10 hypochlorite:water
PDI super saniCloth wipes	Quaternary ammonium and isopropyl alcohol (IPA) disinfectant

Areas to Clean/Disinfect



WARNING: To disinfect trays, use a soft cloth that is dampened with an approved solution to wipe the tray surface. DO NOT spray or spill solutions directly onto the detector surface.

In addition to cleaning/disinfecting surfaces that contact and hold the samples, surfaces touched by the user(s) also need to be cleaned/disinfected at the end of each exam. These surfaces include:

- Interior and exterior walls of the chamber
- Control panel buttons and indicators
- Touchscreen monitor

Recycling and Disposal



At the end of the service life, KUBTEC® requests that the system be returned for proper disposal and recycling. Responsible recycling helps reduce waste and ensures that hazardous materials do not pose a risk to public health.
The hazardous materials present in the system include:

- Lead is used to line the cabinet and within the monoblock assembly.
- Oil is contained in the monoblock assembly.
- Beryllium (Be) in the X-ray tube.

Additionally, the system contains electronic components that must be recycled appropriately.

Daily Inspection Checklist

Perform the following inspection daily, before you use the system. Contact a KUBTEC representative or distributor if there is any problem.

Inspection	Review	Remedy
Visual	Are there any anomalies with the system?	If there are any visual anomalies during this procedure, contact KUBTEC or your distributor.
Test image	Was a test exposure completed?	If there are any issues completing a test exposure or with the image quality, contact KUBTEC or your distributor.
Dosimeter calibration (if applicable)	Were you able to complete a dosimeter calibration?	If there are any issues completing a dosimeter calibration, contact KUBTEC or your distributor.

Yearly Inspection

Preventive Maintenance services are to be performed annually by a KUBTEC engineer or a KUBTEC-trained engineer. This ensures your system is kept compliant with performance and regulatory guidelines.

This page is intentionally left blank.

FREQUENTLY ASKED QUESTIONS

Frequently Asked Questions

This section provides answers to questions that users typically ask about The XCELL® 160/225/320 Systems.

Q: How is the computer turned on?

If the computer does not automatically start when you put the key switch in the ON position, wait a few seconds. If it still doesn't start, ensure the monitor is ON, then press and hold the black button on the back of the monitor for a few seconds.

Q: How long does the Uninterruptible Power Supply (UPS, optional device) last when AC power is interrupted?

The standard UPS maintains the usability of the system for about 24-30 minutes. The longevity of the usability depends on the activity being performed by the system.

Q: Does the unit need to be kept plugged in?

If the UPS option is available, KUBTEC® recommends leaving the system plugged in so that the UPS is always charged..

Q: Should the key be removed at night?

Follow institutional policy regarding X-ray equipment. To prevent unauthorized use of the system, KUBTEC recommends the removal of the key when the system is not in use.

Q: Does it matter how the sample is positioned in the unit?

Position the sample so it is centered with the laser crosshairs on the tray (or turntable).

Q: Is the user being exposed to radiation? Is a lead apron required for shielding?

X-rays are controlled and sealed inside the unit. A lead apron is not required.

Q: How can the unit be cleaned?

Wipe the tray of the sample chamber with a soft cloth that is dampened with an approved solution to disinfect and prevent infection. Do not spray or spill solutions directly onto surfaces. Refer to the Maintenance Chapter in the Instruction for Use (IFU) for more details about cleaning and disinfection.

Q: How often does the system need to be serviced?

Manufacturer recommendation is that the system get serviced once a year by a KUBTEC trained/certified technician.

Troubleshooting

Problem	Cause	Solution
The AC power key switch is set to ON but the system is not powered up. AC power indicator is out.	Multiple possibilities.	• Ensure the key switch is in the ON position. • Ensure the red Emergency Stop switch is ON (pulled out). • Ensure the power cord is fully plugged into the outlet. • Check that circuit into which the system is plugged is live.
The system is powered but X-rays cannot be generated. The **READY** light on the front panel is not lit.	The system is still warming up, or the **X-Ray** interlock switch is not engaged.	• Make sure the door to the unit is tightly shut. • If the **X-Ray** light does not come on, ensure that the settings in the software are in the proper range.

APPENDIX

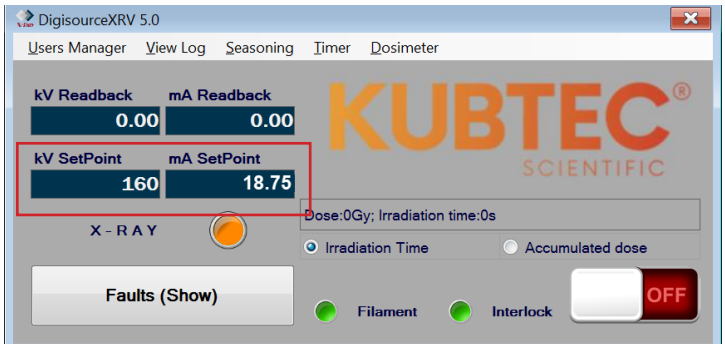
Work Instruction on Dose Calibration

Scope

These work instructions pertain to the dose calibration calculation required to establish accumulated dose time for The XCELL® Systems.

Instructions

1. Place the Cobia probe at the shelf level and height where the sample will be positioned.
2. Ensure that the Cobia probe is positioned at the center of the light field, as indicated by the laser crosshair.
3. Adjust the collimator jaws to the required opening, or leave them fully open.
4. Place the desired filter in the collimator filter holder.
5. Open The DIGISOURCE® Irradiator Software and type the desired irradiation parameters (kV and mA) in the corresponding fields, as shown in the figure.



6. Turn the X-ray on and give the unit a few seconds to reach the commanded values and stabilize.
7. From the Cobia display, record the dose rate in mGy/s.
8. Determine the total dose required (in Gy).
9. From the Correction Factor tables included with the unit, find the correction factor that corresponds to the filter and energy used for the irradiation.

10. Insert the values in the formula below:

$$\text{Time (min)} = \frac{\text{Total Dose Required (Gy)}}{\left(\text{Cobia Dose Rate}\left(\frac{\text{mGy}}{\text{s}}\right) \times \frac{1}{1000}\left(\frac{\text{Gy}}{\text{mGy}}\right) \times 60\left(\frac{\text{s}}{\text{min}}\right) \times \text{Correction Factor}\right)}$$

Convert the decimals to seconds by multiplying the decimal part by 60.

For example:
Total Dose Required = 15 Gy
Cobia Dose Rate = 7.18 mGy/s
Correction Factor = 1.40755

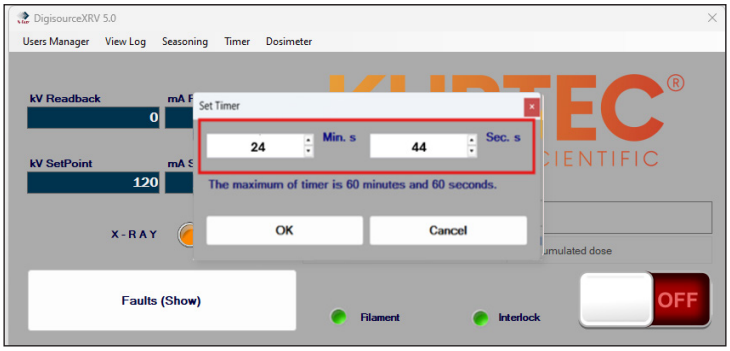
$$\text{Time (min)} = \frac{15(\text{Gy})}{\left(7.18\left(\frac{\text{mGy}}{\text{s}}\right) \times \frac{1}{1000}\left(\frac{\text{Gy}}{\text{mGy}}\right) \times 60\left(\frac{\text{s}}{\text{min}}\right) \times 1.40755\right)} = 24.73 \text{ min}$$

Convert decimals to seconds by multiplying the decimal part by 60:

$$\text{s} = 0.73\left(\text{min}\right) \times 60\left(\frac{\text{s}}{\text{min}}\right) = 43.8 \text{ s} \approx 44 \text{ s}$$

24.73 min = 24 min 44 s

11. Go to the **Timer** tab and input the time calculated above. Click **OK**.



12. Remove the Cobia probe from the center of the cabinet, and place the sample to be irradiated.
13. Ensure The DIGISOURCE® Software is set to Irradiation Time, and start the X-ray.
14. The X-ray will stop once it reaches the commanded irradiation time.

Instructions to Set kV and mA

KUBTEC® floor-standing irradiator systems are designed to operate at maximum power. For operation at settings below the maximum, it is important to understand the relationship between kV and mA.



KUBTEC systems use X-ray tubes with varying power ratings (for example, 4000 W, 4100 W, 4200 W). Users must ensure that the selected energy (kV) and current (mA) values comply with the isowatting rules that define the maximum allowable load for each configuration.

CAUTION: Operating the system outside the recommended kV and mA combinations may result in excessive tube loading and potential tube damage.

Rules for kV and mA Setpoints

The kV and mA peak setpoints are determined by the combination of peak energy (kV), current (mA) limits, and isowatting rules, as described below:

Maximum Energy (kV):

The highest possible energy (kV) is defined by the X-ray tube and generator used in the system. KUBTEC offers three configurations: 160 kV, 225 kV, and 320 kV.

Minimum Energy (kV):

The lowest possible energy (kV) is limited by the value required to protect the X-ray tube. Operating near the highest available kV is recommended, as it helps extend tube life. Although a 320 kV system can theoretically operate at 160 kV, doing so will significantly reduce the tube's lifetime

Table 3-1: kV Settings

System	Lowest possible kV	Recommended lowest kV	Recommended kV
160 kV systems	30 kV	100 kV	160 kV
225 kV systems	30 kV	160 kV	225 kV
320 kV systems	30 kV	240 kV	320 kV

Maximum Current (mA):

The maximum allowable current is the same for all systems: 30.0 mA.

APPENDIX

Isowatting Rules:
The range of values between the peak and minimum kV and mA settings is governed by isowatting rules, as described below.

Isowatting:

Isowatting is a functionality that allows the X-ray system to maintain a constant output power as the energy (kV) and current (mA) values are adjusted. When the energy (kV) changes, the current (mA) compensates to produce the same output power, and vice versa. Therefore, although the system is capable of reaching a current of 30.0 mA, it may not always be permitted to do so, depending on the selected energy (kV) setting.

Isowatting Formula: Current (mA) = Power (W) / Energy (kV)

- **3000 W 160 kV System:**
  at 160 kV the mA limit is: 3000 W / 160 kV → 18.7 mA
- **3000 W 160 kV System:**
  at 120 kV the mA limit is: 3000 W / 120 kV → 25.0 mA
- **3000 W 225 kV System:**
  at 160 kV the mA limit is: 3000 W / 160 kV → 18.7 mA
- **3000 W 225 kV System:**
  at 100 kV the mA limit is: 3000 W / 100 kV → 30.0 mA
- **4000 W 225 kV System:**
  at 225 kV the mA limit is: 4000 W / 225 kV → 17.8 mA
- **3000 W 225 kV System:**
  at 200 kV the mA limit is: 3000 W / 200 kV → 20.0 mA
- **4000 W 320 kV System:**
  at 320 kV the mA limit is: 4000 W / 320 kV → 12.5 mA
- **4000 W 320 kV System:**
  at 280 kV the mA limit is: 4000 W / 280 kV → 14.3 mA

Common Settings and Configurations

A summary of the most common settings and configurations is provided below:

Table 3-2: Common Settings and Configurations

System	Max Power	mA at Max kV	Recommended Default Irradiation	Max kV	Recommend Min kV to protect the tube
XCELL 160 160 kV, 1.8 kW	1800 W	11.2 mA	160 kV at 11.2 mA	160 kV	100 kV
XCELL 160 160 kV, 3.0 kW	3000 W	18.7 mA	160 kV at 18.7 mA	160 kV	100 kV
XCELL 225 225 kV, 3.0 kW	3000 W	13.3 mA	225 kV at 13.3 mA	225 kV	160 kV
XCELL 225 225 kV, 4.0 kW	4000 W	17.7 mA	225 kV at 17.7 mA	225 kV	160 kV
XCELL 320 320 kV, 4.0 kW	4000 W	12.5 mA	320 kV at 12.5 mA	320 kV	240 kV
XCELL 320 320 kV, 4.2 kW	4200 W	13.1 mA	320 kV at 13.1 mA	320 kV	240 kV

Table 3-3: Common Settings and Configurations (continued)

System	Absolute min kV	Max mA	Start of kV Isowatt Range	kV Isowatting Range	mA in IsoWatt Range
XCELL 160 160 kV, 1.8 kW	30 kV	30.0 mA	1800 W/30.0 mA → 60 kV	60–160 kV	mA=Power/kV
XCELL 160 160 kV, 3.0 kW	30 kV	30.0 mA	3000 W/30.0 mA → 100 kV	60–160 kV	mA=Power/kV
XCELL 225 225 kV, 3.0 kW	30 kV	30.0 mA	3000 W/30.0 mA → 100 kV	100–225 kV	mA=Power/kV
XCELL 225 225 kV, 4.0 kW	30 kV	30.0 mA	4000 W/30.0 mA → 133 kV	133–225 kV	mA=Power/kV
XCELL 320 320 kV, 4.0 kW	50 kV	30.0 mA	4000 W/30.0 mA → 133 kV	133–320 kV	mA=Power/kV
XCELL 320 320 kV, 4.2 kW	50 kV	30.0 mA	4200 W/30.0 mA → 140 kV	140–320 kV	mA=Power/kV

This page is intentionally left blank.

INDEX

A

acquire images
  magnification 4-15
  optical (RGB) image 4-15
  options 4-12
  with presets and manual 4-14
add preset 4-15
annotation settings 5-10

C

cabinet control panel 2-4
checklists 7-3
  daily inspection 7-3
  yearly inspection 7-3
cleaning 7-1
components 2-1
copy path 4-16

D

daily inspection 7-3
definitions P-iii
disinfecting 7-1

E

environmental conditions 1-3

F

FAQ FAQ-1

H

help menu 4-10

I

image acquisition options 4-12
image viewer menu 5-10
image viewer tools 5-1
import 4-3
  image series 4-6
  X-Ray image 4-7
import/export for imaging 4-6
inspection 1-5, 7-3
instructions for use P-i, 4-3

K

key switch 3-1

L

live feed 4-11

M

magnification 4-15
main screen for imaging 4-2
main screen for irradiation 3-2, 3-3
maintenance 1-4

O

optical (RGB) image 4-15

P

preset, add 4-15
presets for imaging 4-5

S

safety P-ii, 1-2
separation distances 1-7
settings 4-4
shut down for imaging 4-15
shut down for irradiation 3-9
specifications 6-1
start up 3-1, 4-1
storage 1-3

support
  email P-i
  phone P-i
system
  shut down for imaging 4-16

T

training P-ii
transporting 1-3

U

user interface 2-5
user manual
  instructions for use P-i, 4-3
user responsibility P-ii

Y

yearly inspection 7-3

KUBTEC®
SCIENTIFIC

111 Research Drive
Stratford, CT 06615
www.kubtec.com

Telephone
USA: +1.203.364.8544
International: +1.203.364.8544