OEC FlexiView 8800™ Mobile C-Arm

Operator's Guide

Part Number 00-884008-01

GE Medical Systems
OEC

Text Manual Revision History

Rev	Dash	Date	Change Description
A	-01	Dec, 2001	First release
B	-01	Feb, 2002	Addition of Labels for Germany
C	-01	Apr, 2002	X-Ray Tube specification changes

CAUTION!
US Federal law restricts this device to sale by, or on the order of, a physician.

The text of this manual was originally written, approved and published by the manufacturer in English (P/N 884008-01).

Table of Contents

Introduction and Safety 1-1

Overview 1-1
Owner Responsibilities 1-2
System Compatibility 1-3
Operator Qualifications 1-3
Continued Compliance 1-3
Unauthorized Modifications 1-3
GE Medical Systems 1-4
System Certification 1-4
X-ray Source Assembly Certification 1-4
After-sale Operating and Safety Practices 1-4
Communication Center Telephone Numbers 1-5
Safety Hazards 1-10
Safety Hazard Alerts 1-10
Burns 1-11
Non -anesthetic Proof(Explosion) 1-12
Collision 1-13
Motorized Mechanical Movement 1-14
Improperly Attached Equipment 1-14
Electrical Shock 1-15
Electrical Fire 1-17
Recycling 1-18
Packing Materials 1-18
Radiation Exposure 1-19
General Protection 1-19
Source-to-Skin Distance 1-20
Ingress of Fluids 1-21
Equipment Malfunction 1-21
External Devices 1-22
Patient Environment 1-23
Within United States 1-23
Outside United States 1-24

Start-up and Storage 2-1

Overview 2-1
Power On 2-2
Draping 2-7
Standby or Power Off 2-8
    Standby 2-8
Power Off 2-9
Storing the C-arm 2-10
    Temporary Storage (less than 60 days) 2-10
    Long Term Storage or Shipment (60 days or more) 2-10

Operating Controls 3-1

Overview 3-1
Control Panel Housing 3-2
    Control Panel 3-3
        Image Orientation 3-4
        Remote Workstation Operation 3-5
        Image Intensifier Field Size 3-7
        Collimator Control 3-8
        Contrast/Brightness 3-10
        Generator Control 3-12
    Fast Stop Switches 3-17
    X-ray On Switch 3-19
Footswitch and Handswitch 3-20

Mechanical Positioning 4-1

Overview 4-1
C-arm Identification 4-2
Component Identification 4-3
C-arms with 9 inch Image Intensifiers 4-3
Positioning 4-5
C-arm Orbital Rotation 4-5
C-arm Orbital Rotation Brake 4-6
C-arm Yoke Rotation 4-7
C-arm Yoke Brake 4-8
Vertical Column Operation 4-9
Vertical Column Switches 4-10
Horizontal Cross-arm 4-11
Horizontal Cross-arm Brake 4-12
Wig-Wag 4-13
Wig-Wag Brake 4-14
8800 C-Arm Wheel Brakes 4-15
8800 C-Arm Steering Handle 4-16
Moving the C-arm 4-17

Radiographic Film 5-1

Overview 5-1
Setup and Make a Film Exposure 5-2
Prearm for Film Exposure 5-6

Maintenance 6-1

Overview 6-1
Performance Checks 6-3
- Mechanical Performance Check 6-3
- Electrical Performance Check 6-4
- Fast Stop Performance Check 6-5
- Fluoro Mode Performance Check 6-6
- Film Mode Performance Check 6-7

Cleaning 6-8
Periodic Maintenance 6-9

Display Messages.....7-1

Overview 7-1
Error Recovery Steps 7-2
Messages 7-3

Labels and Symbols 8-1

Overview 8-1
Labels 8-2
Symbols 8-4

Technical Reference 9-1

Overview 9-1
Classification Type 9-2
Electromagnetic Compatibility Statement 9-2
Optional equipment 9-3
Replacement Items 9-3
Camera Output Video Signal 9-4
Environmental Requirements 9-4
C-arm Power Requirements 9-5
X-ray Source Assembly 9-5
Collimation 9-7
Tube Rating Charts 9-8
Filament Emission Characteristics 9-8
Single Load Rating - Small Focus 9-9
Single Load rating - Large Focus 9-10
Heating and Cooling Charts-Anode 9-11
Generator Specifications 9-12
Generator Operating Parameters 9-13
Measurement Basis for Technique Factors 9-14
Radiographic mA
As a Function of kV and mAs 9-14
Focal Spot (0.6 x 1.4 mm) 9-15
Focal Spot (1.4 mm) 9-16
Dimensions 9-17
C-arm (9-inch II) 9-17
Film Cassette Dimensions 9-17
Material Safety Data Sheets 9-18

Chapter 1

Introduction and Safety

Overview

This guide describes FlexiView8800 Mobile C-arm operation only. It is designed to provide fluoroscopic and spot film imaging of the patient during diagnostic and surgical procedures. It is intended for qualified medical personnel who have been trained in the use of medical imaging equipment. It is not designed to replace or substitute for certified training in the radiological or medical field.

Functional capabilities and operation of the equipment are described here which can be used in a variety of diagnostic, therapeutic and surgical applications.

The Mobile C-arm's dependency on the workstation for power and image processing requires that setup and basic interaction between these components be included here. Complete Workstation operating instructions are contained in the 1k x 1k Workstation Operator's Guide.

Owner Responsibilities

The owner has the responsibility to ensure system compatibility, operator qualifications and the continued compliance of equipment and operating specifications. Systems should only be used in designated use areas with approved AC receptacles. Unauthorized changes or modifications to any part of the system could have hazardous consequences. Changes or modifications must not be made unless specifically authorized by GE Medical Systems.

This Product complies with the regulatory requirements of the following:

Council Directive 93/42/EEC concerning medical device:

For a system, the location of the CE marking label is described in the System Manual.

i) For the Product with CE 0459 label affixed and manufactured in Wendelstein, Germany, the European registered place of business:
OEC Medical System GmbH
Wilhelm Maisel Str.14
90530 WENDELSTEIN Germany.

ii) For the Product with CE 0459 label affixed and manufactured in Bangalore, India, the European registered place of business:
GE Medical Systems Europe
Quality Assurance Manager
BP 34
F 78533 BUC CEDEX France
Tel:+33 (0)1 30 70 40 40.

System Compatibility

The Flexi View 8800 Mobile C-arm should only be used in conjugation with a 1k x 1k Workstation. **The FlexiView 8800 is not compatible with Workstations sold as part of a 9600 and 9800 system.** Damage may result to the system if incompatible components are connected.

Operator Qualifications

It is the responsibility of the owner to ensure that the system is operated only by properly trained, qualified personnel who have obtained credentials from the appropriate authorities.

Continued Compliance

The owner is responsible for verifying continued compliance with all applicable regulations and standards. Consult local, state, federal and/or international agencies regarding specific requirements and regulations applicable to the use of this type of medical electronic equipment.

Unauthorized Modifications

When properly assembled with a compatible beam limiting device, the X-ray source assembly fully meets US Federal regulations and International standards, provided no components or parts are removed from the unit and no unauthorized adjustment is made in the beam limiting device or tube housing assembly. Never remove any part of the housing or beam limiting device . Never adjust any part of the beam limiting device unless directed by qualified GE Medical Systems personnel.

GE Medical Systems Responsibilities

GE Medical Systems certifies each system and X-ray source assembly. After-sale operating practices and safety are the responsibility of the owner/ operator.

System Certification

GE Medical Systems certifies that each system complies with the US Federal regulations and International standard applicable to diagnostic equipment.

X-Ray source Assembly Certification

In accordance with 21 CFR 1020, GE Medical Systems certifies that the components contained in the X-ray source assembly, when assembled according to manufacturer's instructions, are compatible for use with the FlexiView8800.

The use of any X-ray tube or beam-limiting device not authorized by GE Medical Systems may affect compliance with standards and regulations applicable to X-ray source assemblies.

After-sale Operating and Safety Practices

GE Medical Systems assumes no responsibility or liability for after-sale operating and safety practices; nor can it be responsible for personal injury or damage resulting from misuse of its systems.

Communication Center Telephone Numbers

If the system does not operate properly or fails to respond to the controls as described in your operator's manual, call GE OEC Medical Systems, Inc. to request service. The communication center's telephone numbers are listed below:

Service Offices

For service issues, contact the Service Office for your Country.

AMERICAS

UNITED STATES OF AMERICA

GE Medical Systems OEC Headquarters
384, Wright Brothers Drive.
Salt Lake City, Ut 84116

Tel: +1-801-321-9300
Fax: +1-414-544-3384

GE Medical Systems
Milwaukee, U.S.A.

LATIN AMERICA

GE Medical Systems
Latin America Headquarters
5101 NW 21st Avenue, Suite 350
FORT LAUDERDALE, FL 33309 USA

Tel: +1-305-497-1200

ASIA

(Japan)

GE Yokogawa Medical Systems, Ltd
4-7-127 Asahigaoka 4-chome, Hino-shi,
Tokyo, 191-8503 JAPAN

Tel :81-42-585-5500
Fax: 81-42-585-5470

(Singapore)

GE Pacific Pte Ltd
298 Tiong Bahru Road #15-01/06
Central Plaza, Singapore 168730

Tel: 65-291-8528
Fax: 65-275-9424

(China)

GE (China)Co. Ltd., Medical Systems
6F, North Tower , Grand Pacific Building
8A Guanghua Road, Chao Yang District
Beijing, PR China - 100026

Tel: 86-10-6506-0088
Fax: 8610-6581-6101

(Korea)

Samsung GE Medical Systems
65-1 Sangdaewan-Dong
Chungwon-ku, Sungnam-Si
Kyunggi-Do, Korea 462 120

Tel:82-342-740 6046
Fax:82-342-740 6431

(India)

Wipro GE Medical Systems Ltd.
4 Kadugodi Industrial Area
Bangalore 560 067, India

Tel:91-80-845 2923
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DANMARK (Denmark)

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DEUTSCHLAND (Germany)

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352 Buckingham Avenue
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Safety Hazards

Potential hazards exist in the use of medical electronic devices and X-ray systems. Operators using the equipment should understand the safety issues, emergency procedures and the operating instructions provided.

Safety Hazard Alerts

The following pages describe hazardous and potentially hazardous conditions, and how to adequately protect yourself and others from possible injury.

There are three hazard classifications, which are denoted and prioritized by the alert words:

1. Danger
2. Warning
3. Caution

This list describes the use of each classification:

Alert	Circumstances for Use
DANGER	Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Caution indicates a potentially hazardous situation which, if not avoided, may result in moderate to minor injury, equipment damage or loss of data.

Burns

Continuous Fluoro exposure, overtime, especially HLF may cause components such as X-ray tubes housing to reach temperatures capable of inflicting burns.Do not touch the housing or place the X-ray housing near patients. Warning messages are displayed on the C-arm's Control Panel Display regarding the X-ray tube housing's temperature. Refer to the Chapter on Display Messages for more information.

CAUTION

Placing a hot X-ray tube housing in close proximity to human anatomy could result in serious burns.

NOTE: *When the X-Ray tube housing is draped, heat will not dissipate as efficiently.*

Non-anesthetic Proof (Explosion)

Vapors and gases can be ignited by electrical arcs that can occur during the normal operation of switches, circuit breakers, push buttons and other circuit components.

The system must never be operated in the presence of flammable anesthetic or other flammable or explosive liquids, vapors, or gases. If flammable substances are detected after the system has been energized:

1. Do not turn the system off or unplug it from the AC receptacle.

2. Do not operate any other electrically powered equipment.

3. Evacuate all personnel from the area and ventilate with fresh air. Avoid operating any automated (electrically operated) doors or windows.

4. Contact your local fire department as soon as possible.

Collision

If your system is mounted on wheels and casters and it is moved or operated improperly, it could roll out of control. Follow these guidelines:

- Two people should maintain control of the equipment when moving up or down an incline.
- Place all mechanical assemblies in their most compact (transport) position and lock brake handles prior to moving the equipment.
- Use the handles designed for moving the equipment and mechanical assemblies.
- Never attempt to move the system up or down steps or on an incline greater than 10 degrees. System can be moved at 10 degrees incline only in Transport position.
- Do not operate the C-arm equipped with a 9-inch image intensifier on inclines greater than 10 degree.
- Do not lock the wheel brakes and leave the equipment unattended on unlevel floors.
- Always apply the wheel locks when the system is in its final position.
- Do not move the equipment if the castors or wheels are not functioning properly.
- Mechanical shocks to the equipment while disk drives are accessing information may cause damage to the disk drive.

Motorized Mechanical Movement

The Vertical column assembly is motorised and may cause injury if operated improperly.

Observe the vertical Column closely when operating the motor to avoid collision with a person or object.

Improperly Installed Film Cassette Holder

If your equipment accommodates a film cassette holder or some other piece of equipment and is not properly installed, it could fall, causing injury to patient or operator. Use only equipment supplied by GE Medical Systems. Verify that the cassette holder is correctly installed.

Note: Refer to the Chapter on Radiographic Film Mode for instructions on installing the film cassette holder.

Incorrect Film Cassette size

A film cassette with incorrect dimensions may not fit in the cassette holder properly.

Only use film cassettes that are the correct size. Refer to the chapter on Technical reference for film cassette dimensions.

Electrical Shock

Observe the following safety procedures to avoid electric shock or serious injury to operators and patients and to avoid system malfunction:

- Make all electrical connections to equipment while outside the patient environment. Do not touch a connector and the patient at the same time.
- Do not bypass jumper or otherwise disable the safety interlocks.
- Do not remove any of the assembly covers. Only trained service representatives should perform repairs.
- Do not place food or beverage containers on any part of the equipment. If spilled, they can cause short circuits.
- Always remove power to the equipment before cleaning. Use a slightly damp cloth or sponge for cleaning.
- Only qualified service engineers are allowed to service or repair a system.

WARNING

The Mobile C-arm is not waterproof. Water, soap or other liquids, if allowed to drip into the equipment, can cause electrical short circuits leading to electric shock and fire hazards. If liquids should accidently spill into the system, do not apply power or turn the system on until the liquids have dried or evaporated completely.

Certain components within the system produces high voltages which can be potentially hazardous. To avoid this hazard, only qualified service engineers are allowed to service or repair a system.

WARNING

Electrical circuits inside the equipment may use voltages which are capable of causing serious injury or death from electric shock. To avoid this hazard, never remove any of the cabinet covers.

Electrical Fire

In the event of electrical fire perform the following emergency procedure:

NOTE: *Any emergency procedure developed by the owner, for the area in which the system is used, should include these safety measures:*

- Remove electrical power to the system by placing the power switch in the off position.
- Unplug the power cord from the AC receptacle.
- Evacuate personnel from the area.
- Only use a fire extinguisher that is approved for use on electrical fires.
- Call your local fire department for help if necessary.

WARNING

The use of the wrong type of fire extinguisher presents electrical shock and burn hazards. To avoid these hazards, a fire extinguisher which meets applicable regulations and standards must be available in the room where the equipment is being used. Remember that equipment that is equipped with batteries is a source of electrical current, even when AC power is disconnected.

Recycling

Machines or accessories at end of life:
The elimination of machines and accessories must be in accordance with national regulations for waste processing.

All materials and components that could pose a risk to the environment must be removed from the end of life machines and accessories (examples : dry and wet cell batteries, transformer oil, consumables, etc.)

Please consult your local GE Medical Systems representatives before discarding these products.

Packing Materials

The materials used to pack our rquipment are recyclable. They must be collected and processed in accordance with the regulations in force for the country where the machines or accessories are unpacked.

Radiation Exposure

General Protection

WARNING
This equipment either produces or is used in the vicinity of ionizing radiation. Observe proper safety practices during operation.

- The owner must designate areas suitable for safe operation and service of the equipment and ensure that they are only used in these designated areas. It is the responsibility of the owner to ensure that all personnel wear appropriate protective clothing and radiation monitoring devices while using the equipment.
- A visual indicator on top of the workstation is provided to alert you that an X-ray switch has been actuated and the X-Ray tube is generating ionizing radiation. An audible alarm can also be configured to sound if you desire one.Contact your field service representative to turn on the fluoro alarm.

NOTE: Refer to your Workstation Operator's Guide for information about adjusting the frequency (pitch) of the alarm through menus on the workstation.

Source-to-Skin Distance

International regulations specify that a minimum source-skin distance shall be maintained at 30 cm, except for specific surgical applications. In these applications, provisions have been made to allow for operation at 20 cm. By removing the skin spacer from the collimator assembly, the minimum source to skin distance can be altered from 30 cm to 20 cm.

WARNING
Removing the skin spacer may result in increased radiation exposure to the patient.

The skin spacer should only be removed on the instructions of a physician. The spacer should be reattached to the collimator assembly immediately following the procedure.

Ingress of Fluids

Excessive amounts of fluids such as antiseptics, cleaning solutions or body fluids may damage internal components, if they are allowed inside the equipment. Use drapes, if necessary, to protect equipment when performing procedures and do not apply excessive amounts of fluid when cleaning.

Equipment Malfunction

If either the hospital or equipment circuit breakers trip, an equipment malfunction may be indicated. Do not attempt to operate the equipment until it has been checked by a qualified service engineer.

If any of the equipment controls fail to respond as indicated in this manual, you should:

1. Remove power to the equipment by placing the power switch in the off position and unplugging the power cord from the AC receptacle.

2. Notify a qualified service engineer.

3. Do not operate the equipment until the service technician advises that it is operating properly.

External Devices

To ensure patient safety, only connect external equipment that has been approved by GE Medical Systems. All equipment attached to the external interface connections must meet the requirements of IEC 60601-1 when operated within the patient environment. When used outside of the patient environment, each externally connected device must comply with the relevant IEC/ISO requirements for that device. In any case, the combination of all externally connected equipment shall not cause the leakage current of any device used within the patient environment to exceed the limits stated in IEC 60601-1.

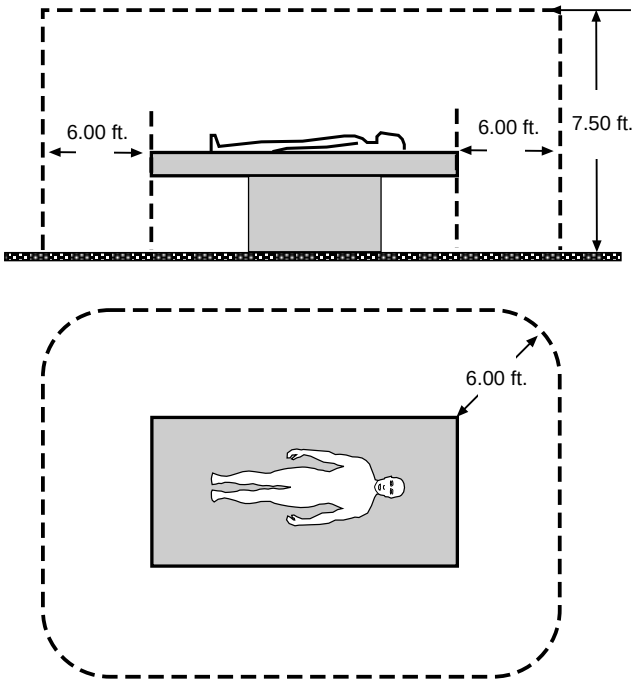
Patient Environment

Within the United States

Within the US the Patient Environment is defined by NFPA 99 and UL 2601-1.

In areas in which patients are normally cared for, the patient environment is the space with surfaces likely to be contacted by the patient or an attendant who can touch the patient**.**

This encloses a space within the room, 6 ft. beyond the perimeter of the bed (examination table, dental chair, treatment booth, etc.) in its intended location, and extending vertically 7.5 ft. above the floor.

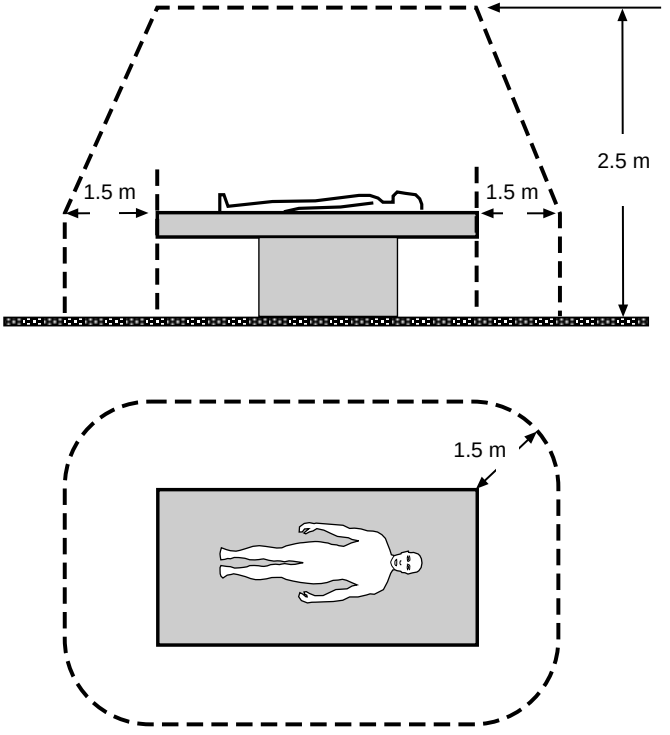


Outside the United States

Outside the US the Patient Environment is defined by IEC 60601-1-1.

In areas in which patients are normally cared for, the patient environment is the space with surfaces likely to be contacted by the patient or an attendant who can touch the patient.

This encloses a space within the room 1.5 m beyond the perimeter of the bed (examination table, dental chair, treatment booth, etc.) in its intended location, and extending vertically 2.5 m above the floor.



Chapter 2

Start-up and Storage

Overview

This chapter describes:

- Applying power
- Removing power
- Storing the C-arm

Power ON

If you are starting the system after a period of long term storage it may be necessary to allow the system to warm up or recharge the batteries before it can be used. The system clock will sense how long the system has been in storage and display a message that describes the action required. Refer to the "Display Messages" chapter for more information.

The Mobile C-arm receives power through an interconnect cable attached to the Workstation. The C-arm must be connected to the Workstation and electrical power before operation. Refer to the 1k x1k Workstation Operator's Guide for additional information.

CAUTION
If the connector does not lock in place, unreliable system operation may result.

---

1. Insert the Workstation interconnect cable into the connector located on the right side cover of the C-arm by aligning the index marks (red dots) on the connector and pushing the connector in until it locks in place.

CAUTION

Damage may result to the C-arm if the interconnect cable is inserted after the workstation power cord is plugged into an AC receptacle.

2.

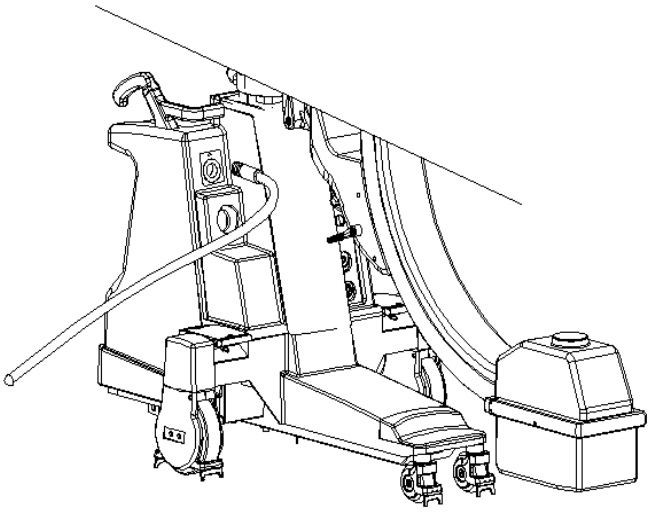


Figure 2.1. Connect the C-arm to the Workstation

Connect the footswitch and/or handswitch to the sockets on the C-arm interface panel located on the left side cover. Verify that each connector locks in place.

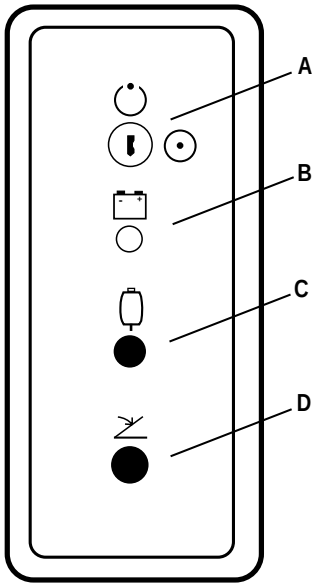


Figure 2-2. *C-arm interface panel.*

A When the keyswitch is placed in the on position (clockwise; horizontal) the C-arm is fully operational. When the keyswitch is placed in the standby position (counter-clockwise; vertical) X-rays and vertical column movement are disabled, but the C-arm remains powered.

B Battery charger indicator lamp illuminates when the batteries are charging.

C Handswitch connector socket.

D Footswitch connector socket.

3. Plug the Workstation power plug into a properly rated AC receptacle. Refer to the *OEC Workstation Operator Manual* for information about power requirements.

NOTE: *Once the Workstation power cable has been plugged into an AC receptacle, the battery charger indicator on the C-arm interface panel will illuminate indicating that the batteries are charging.*

4. Turn the key switch located on the C-arm interface panel clockwise to enable X-rays and motorized mechanical movement.

5. Press the Workstation power switch. The light within the switch will turn on indicating the power is turned on. Both the Workstation and the C-arm will begin their power up sequence.

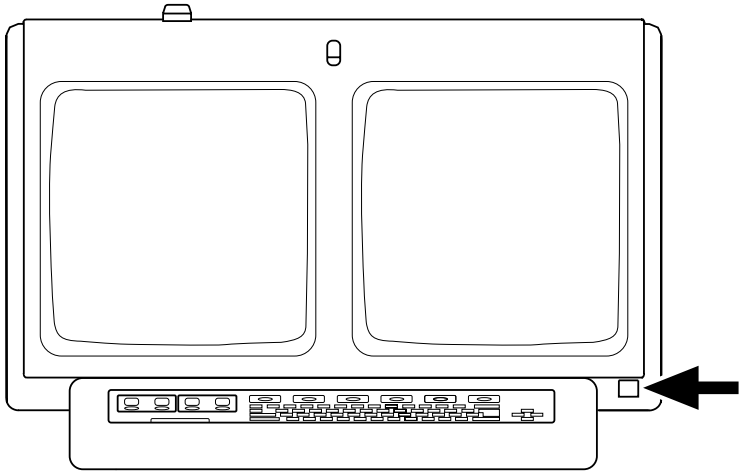


Figure 2-3. *Power on the system.*

NOTE: *The C-arm control panel will display a sequence of lighted segments indicating that it is proceeding with the power up sequence.*

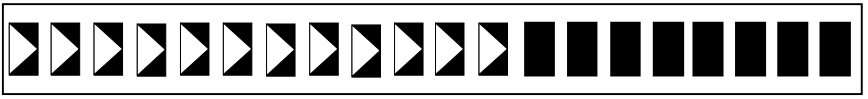


Figure 2-4. *C-arm control panel display on boot-up.*

The system has completed the power on sequence when the Workstation displays the Patient Information screen on the right monitor and the C-arm control panel displays the Auto Fluoro technique.

The C-arm controls will default to the following settings at Power on:

Image Orientation: You may select either Retain Last or Reset to Home via the Workstation's Customize Options. Refer to the *OEC Workstation Operator Manual* for more information.

Field Size: NORM

Collimation: The iris is fully opened. The leaf/leaves are opened and rotated 180^{o} degees from the stops.

Brightness/Contrast: Auto Brightness/Contrast is selected.

Generator: Auto Fluoro technique is selected along with the Standard ABS table. Pulse and Film are off.

NOTE: *If a problem is encountered during power up, the sequence of lights on the C-arm control panel will be interrupted or an error message may be displayed. Refer to the "Display Messages" chapter for more information about messages.*

Draping

If you are performing a procedure where draping is necessary, drape the C-arm using the SteriQuick draping system. The draping system can be purchased from GE Medical Systems by contacting your sales representative.

NOTE: *Use of a footswitch cover is recommended during all medical procedures.*

Draping the X-ray tube housing will inhibit air flow resulting in cooling inefficiencies. This may result in the housing reaching its rated heat capacity sooner. You will receive messages indicating the temperature of the housing. When the housing reaches its maximum rated heat capacity, X-rays will be discontinued until the housing has cooled. Refer to the "Display Messages" section for more information.

NOTE*: Instructions for draping are contained in the drape packaging.*

Standby or Power OFF

Perform the following steps to place the C-arm in Standby or to completely remove power.

Standby

1. Turn the C-arm keyswitch to the standby position (counter-clockwise; vertical).

NOTE: *Placing the equipment in standby disables X-rays and vertical column operation so these features will not be activated unintentionally. A message will be visible on the control panel display indicating that the keyswitch is in standby.*

2. Turn the keyswitch back to the on position when you are ready to use the C-arm. The Workstation power switch will remain lit, indicating the system is still powered on.

Power OFF

1. Place the Workstation power switch in the off position.

2. Unplug the Workstation power cord from the AC receptacle.

3. Disconnect the Workstation interconnect cable from the C-arm.

NOTE: *Remove all power from the system before moving the system or if a problem occurs which prevents normal operation. All power should also be removed when periodic maintenance and cleaning is performed.*

CAUTION

Do not disconnect the interconnect cable from the C-arm before unplugging the worstation from the AC receptacle. Power is still being applied to the C-arm batteries via the interconnect cable.

Storing the C-arm

Temporary Storage (less than 60 days)

1. To prepare the C-arm for storage, move all mechanical assemblies into their most compact position, set all locks and brakes and remove all power. Store any accessories with the C-arm.

2. Cover the C-arm with a dust cover. Refer to the "Technical Reference" chapter for the range of environmental conditions in which the C-arm can be safely stored.

Long Term Storage or Shipment (60 days or more)

To prepare the C-arm for long term storage or shipment, observe the following recommendations:

1. Move all mechanical assemblies into their most compact positions, set all locks and brakes and remove all power.

2. Wrap the image intensifier, X-ray tube assembly, C-arm cable, and the control panel housing with bubble wrap.

3. Pack all accessories such as cassette holders and store them with the system.

4. Cover the C-arm and accessories. Attach each to a solid supportive shipping base and enclose in a protective container adequate for shipment or storage. Refer to the "Technical Reference" chapter for the range of environmental conditions in which the C-arm can be safely stored.

Chapter 3

Operating Controls

Overview

This chapter describes the C-arm operating controls. Before you begin imaging, familiarize yourself with the following controls:

- Control Panel Housing Controls
- Footswitch
- Handswitch

Control Panel Housing

The C-arm control panel, fast stop switches and X-ray on switch are all located on the C-arm control panel housing.

Item	Description
1	Control panel display
2	Control panel
3	Fast Stop switches (one on each side)
4	X-ray on switch
5	Vertical column motor switches

NOTE: *Instructions for using the vertical column motor switches are contained in the chapter titled "Mechanical Positioning."*

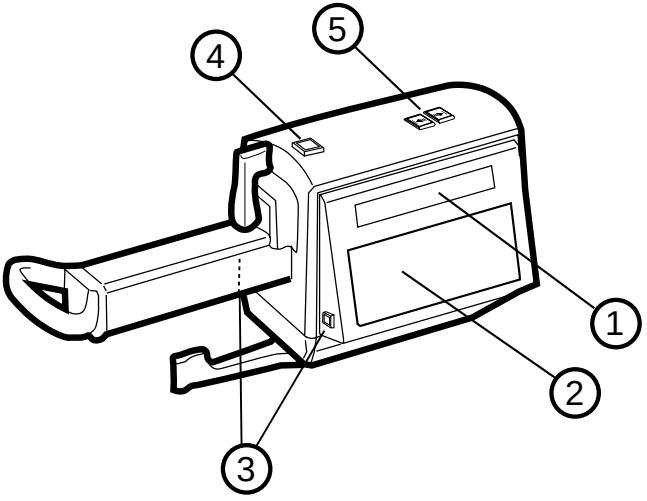
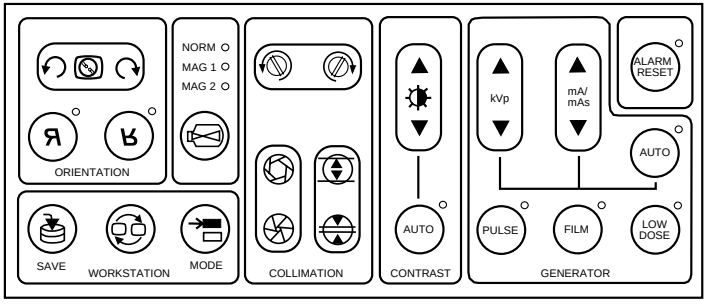


Figure 3-1. *Control locations on the control panel housing.*

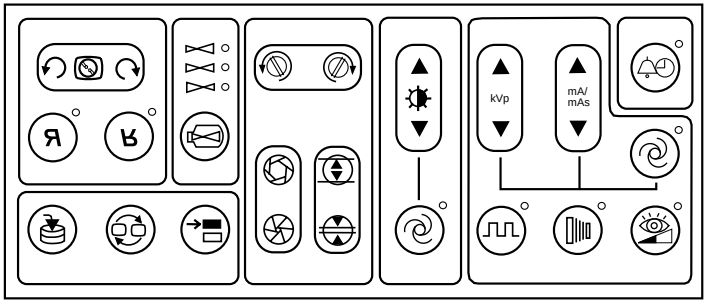
Control Panel

The C-arm control panel allows you to adjust how images are generated and displayed. Two different panels are available: text or icon. The keys on the control panel are grouped according to their function. These groups of keys allow you to:

- Orient the image.
- Operate frequently used Workstation functions remotely.
- Select the image intensifier field size.
- Control the semitransparent leaf/leaves or iris collimator.
- Adjust contrast/brightness levels.
- Control generator functions.
- Reset the fluoro alarm and timer.



TEXT VERSION



ICON VERSION

Figure 3-2*. The control panel.*

Image Orientation

Use these keys to rotate or reverse the image produced once X-rays have been generated and live video is present on the left Workstation monitor.

Image rotation and image reversal are not available to be used with cine playback, on a recalled or swapped image, or when image annotation has been applied. Rotation and reversal are best used with the most recent image held.

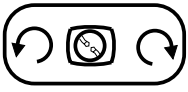


IMAGE ROTATION

Press the left portion of the key to rotate the image counter-clockwise. Press the right portion of the key to rotate the image clockwise.

A camera icon will display and move to indicate which part of the image will be rotated to the top. Once camera movement has ceased, the image will display rotated.

This feature is used with the most recent shot in order to aid setting optimal camera orientation for the next live shot. The "last image hold" is used for a source image while rotation and flip are applied.

IMAGE REVERSAL

Use these keys to change the orientation of the image displayed on the Workstation's left monitor. Press the left key to reverse the image from left to right. Press the right key to invert the image from top to bottom.

Remote Workstation Operation

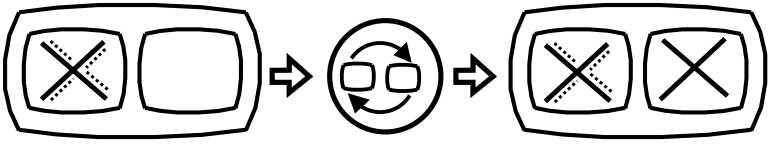
SAVE

The save function can be used during a live X-ray or afterward to save the last image displayed on the left monitor. While generating X-rays, press the SAVE key to save one frame of the live X-ray to the Workstation's hard-drive without interrupting live X-rays. After you have completed the exposure, press the SAVE key to save the last image displayed on the left monitor to the Workstation hard-drive.

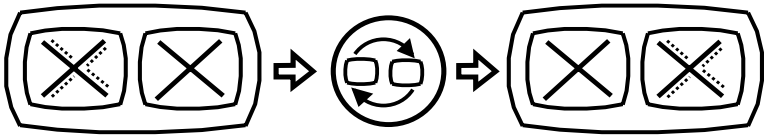
SWAP

Use this function while generating live X-rays or after X-rays have been terminated.

While generating live X-rays - press the SWAP key to copy one frame of the live X-ray and move it to the right monitor. Pressing SWAP again will discard the previously swapped image and replace it with the new image.



After X-rays have been terminated -the last frame of the exposure is retained on the left monitor (last image hold). Press the SWAP key to swap the images displayed on the left and right monitors.



If the right monitor is blank, press the SWAP key to copy the image on the left monitor to the right monitor.

MODE

Use the MODE key to toggle between the standard fluoroscopy mode and the vascular imaging mode when the C-arm is connected to a Vascular Workstation.

On nonvascular systems an audible beep will sound to signify that this function is not available.

Image Intensifier Field Size

FIELD SIZE

Selects the X-ray field size. Available field sizes are dependent on the size of the tri-mode image intensifier installed: 23 cm (9-inch).

The illuminated LED indicates which field size is selected. Press the FIELD SIZE key until the field size you want is selected. Refer to the table below:

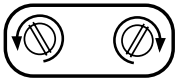
TEXT	ICON	9-INCH II
NORM		23 cm (9-inch)
MAG1		15 cm (6-inch)
MAG2		11 cm (4-inch)

Collimator Control

The X-ray beam may be collimated by using either the iris collimator or the semitransparent leaf collimator. The collimator leaves and iris can be positioned prior to generating X-rays. Press a collimator leaf or iris key and a graphic icon representing the position and orientation of the real collimator leaves (two lines) or iris (circle) will be displayed on the left monitor.

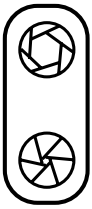
***NOTE**: Your C-arm may be equipped with one or two semitransparent collimator leaves. If your collimator has one leaf the graphic icon will display only one line instead of two.*

Press the key until the leaves or iris are in the position you desire and then press any X-ray switch. An X-ray image, collimated according to the position and orientation of the graphic icon, will be displayed on the left monitor. This feature helps reduce exposure to X-rays while collimating.



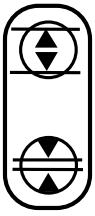
COLLIMATOR LEAF ROTATION

Press the left portion of the key to rotate the collimator leaf/leaves counter-clockwise or the right portion to rotate the collimator leaf/ leaves clockwise.



IRIS COLLIMATOR OPEN/CLOSE

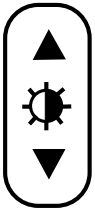
Press the iris collimation key to open or close the collimator iris. Press the top portion of the key to open the iris or the bottom portion of the key to close the iris.



COLLIMATOR LEAF OPEN/CLOSE

Press the collimator leaf key to open and close the semitransparent collimator leaf/leaves. Press the top portion of the key to open the leaf/leaves or press the bottom portion of the key to close the leaf/leaves.

Contrast/Brightness



MANUAL CONTRAST / BRIGHTNESS

Pressing this key changes control to manual contrast/brightness mode and may be used to manually adjust contrast/brightness during live X-rays or during post-processing on the last image held.

You can increment or decrement through a series of contrast/ brightness levels by pressing the top or bottom portion of the key. A visual indicator is displayed on the monitor to help you adjust the contrast/brightness to the level you desire.

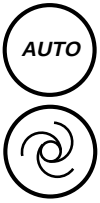
- Press the top portion of the key to increase the contrast and reduce the brightness level applied to the left monitor image.
- Press the bottom portion of the key to decrease the contrast and increase the brightness level applied to the left monitor.

To adjust contrast or brightness independently of each other, use the separate brightness and contrast keys available on the Workstation.

With **Smart Metal** feature enabled in auto mode, the above key can be used to adjust metal rejection levels indicated on the left monitor.

When the metal rejection levels are being adjusted, the Auto LED on the workstation begins to blink indicating that the level is being adjusted. To exit the smart metal mode, this key is pressed again.

Please Note: To completely disable the smart metal function, please contact GE Medical Systems service personnel.

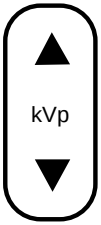


AUTO CONTRAST / BRIGHTNESS

Press this key to enable the system to automatically select the optimum amount of contrast and brightness. When selected, the LED will illuminate indicating that auto contrast/brightness is on.

Deselecting auto contrast/brightness will extinguish the LED and the level of contrast/brightness set by the system will remain set until adjusted manually or unless auto contrast/brightness is reselected.

Generator Control

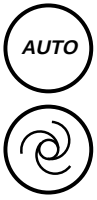


kVp

Manually adjusts kVp and overrides auto technique setting. Press the top portion of the key to increase kVp or press the bottom portion of the key to decrease kVp.

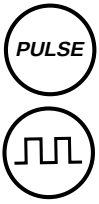
mA/mAs

Manually adjusts mA/mAs for fluoroscopy/film respectively and overrides auto technique setting. Press the top portion of the key to increase mA/mAs or press the bottom portion to decrease mA/mAs.



AUTO TECHNIQUE

Pressing this key enables the system to produce an optimum image by adjusting the technique (kVp, mA, and camera gain) automatically.



PULSE

Press this key to enable pulsed imaging mode using the currently selected pulse rate. The pulse LED lights when pulse is enabled. Press this key again to disable pulsed imaging.

A preset number of X-ray pulses are generated each second while the X-ray switch is pressed. Pulsed X-rays can be used to reduce total radiation dose. Pulse mode cannot be used with Film or Digital Spot mode.

Pulse rates are selected from the Workstation's MODE screen. Refer to your *1k x 1k Workstation Operator's Guide* for details on pulse rate selection.

FILM

Press this key to enable Film operation. The Film LED illuminates when Film mode is enabled. Press the Film key again to disable Film operation or select Auto Fluoro Mode. Refer to the chapter "Radiographic Film" contained within this operator's Guide.

LOW DOSE

Press this key to select the Low Dose mode. The corresponding LED will illuminate to indicate that Low Dose mode is selected.

Select Low Dose mode when possible to reduce the exposure dose rate to the patient.

Press this key again to select the standard dose mode. The corresponding LED will extinguish to indicate that standard dose mode is selected.

ALARM RESET

The C-arm counts or accumulates the amount of time that X-rays are generated when an X-ray switch is pressed. The amount of accumulated exposure time is indicated on the C-arm control panel display.

If pulse mode is enabled, the amount of time accumulated depends on the length of time an X-ray switch is pressed and the length of the pulses and the number of pulses per second.

Systems within the U.S.

Systems sound an alarm and illuminate the Alarm Reset LED at the end of each 5 minute (default) interval of accumulated fluoro time. To silence the alarm or reset the accumulated fluoro time:

- Press ALARM RESET briefly to silence the alarm.
- Press and hold ALARM RESET for approximately two seconds to reset the accumulated exposure time to zero and silence the alarm.

Systems outside the U.S.

Systems sound an alarm and illuminate the Alarm Reset LED at the end of each 5 minute (default) interval of accumulated fluoro time. To silence the alarm or reset the accumulated fluoro time:

- Press ALARM RESET briefly to silence the alarm.
- Press and hold ALARM RESET for approximately two seconds to reset the accumulated exposure time to zero and silence the alarm.

In addition, when the accumulated fluoro time reaches a preset limit, default is 10 minutes maximum, X-rays will be terminated. Thirty seconds prior to termination an alarm will sound. To override X-ray termination and silence the alarm, press the ALARM RESET key briefly.

If you are unable to reset the alarm before X-rays are terminated, release the X-ray switch and then press the X-ray switch again to enable X-rays.

***NOTE**: The time duration before X-rays are terminated can be adjusted by your field service representative.*

Fast Stop Switches

Fast Stop switches are located on each side of the C-arm control panel. Press either Fast Stop switch to stop motorized mechanical movement (vertical column) and disable X-rays.

WARNING
If pressing a Fast Stop switch fails to stop motor movement or X-rays, place the Workstation power switch in the off position, or disconnect the power plug from the AC receptacle.

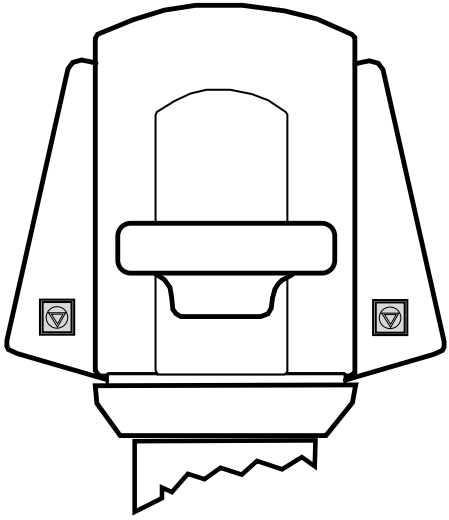


Figure 3-3. *Fast Stop switches are located on each C-arm control panel.*

If the Fast Stop switch is pressed, on purpose or inadvertently, while an operator is pressing the vertical column switch, vertical column operation will cease and X-rays will be disabled. After both switches have been released, it may be possible to operate the vertical column. However, X-rays will remain disabled until the system is rebooted.

If the Fast Stop switch is pressed when a run-away condition exists, vertical column motion will cease and X-rays will be disabled. Under this condition it is not possible to operate the vertical column or take X-rays. Call your service representative.

If the Fast Stop switch has been pressed to disable unintended X-rays, do not reboot the system. Call your service representative.

X-ray On Switch

The X-ray ON switch is located on the C-arm control panel housing. The switch can be used to take a film exposure, generate Fluoro images or initiate roadmapping on Vascular systems. In essence, it functions just like the left footswitch or handswitch and the function is dependant on the imaging mode selected: standard fluoroscopy or vascular imaging.

When generating X-rays in Fluoro mode, the image is displayed on the left Workstation monitor. When the X-ray switch is released, X-rays are terminated and the last image or frame of the exposure is retained on the left monitor. This is referred to as "Last Image Hold."

Refer to your *1k x1k Workstation Operator's Guide* for additional information about imaging modes.

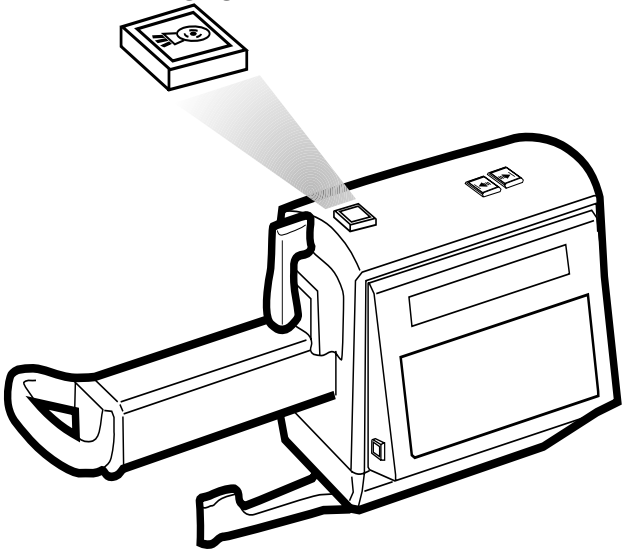


Figure 3-4*. The location of the X-ray on switch.*

Footswitch and Handswitch

Use the footswitch and handswitch to generate continuous X-Rays or Film exposures. A mode switch is also present on both the footswitch and the handswitch housings. Refer to the following descriptions of each switch for more information. Your 1k x 1k Workstation Operator's Guide contains additional information for using these switches and selecting different imaging modes.

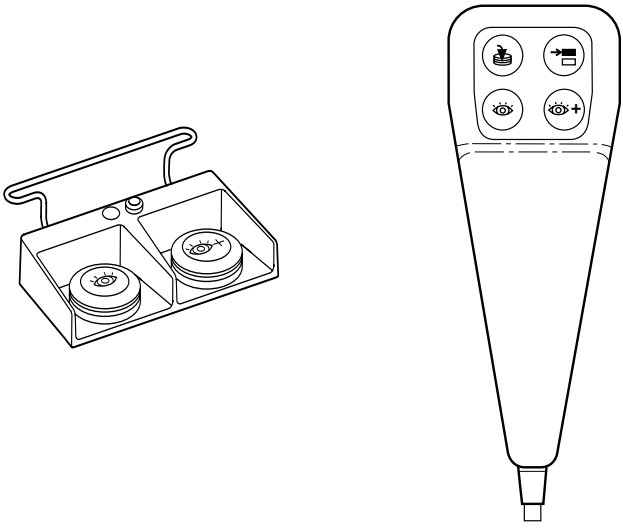


Figure 3-5. *The Footswitch and Handswitch*

Press the left switch to generate standard fluoroscopic images or a roadmap.

Press the labeled switch to produce high-level fluoro (HLF) images, Snapshot, or a subtraction.

Use the Mode switch to change between standard fluoroscopy and vascular imaging modes. The Mode switch is inactive on non-vascular systems.

Press the SAVE key on the handswitch to save an image displayed on the left monitor. While generating X-Rays, press the SAVE key to save one frame of the Live X-Ray to the workstation's hard-drive without interrupting live X-Rays. After you have completed the exposure, press the SAVE key to save the last image displayed on the left monitor to the Workstation's hard drive.

CAUTION

Do not stretch the hand control cord further than 10 feet (3.048m). This may result in damage to the cord. If the cord is damaged and touches the floor, it is safety hazard. Call the communications centre for assistance.

Chapter 4

Mechanical Positioning

Overview

This chapter describes:

- C-arm identification
- Component identification
- Moving the C-arm

C-arm Identification

The C-arm has a 9 inch image intensifier (II) attached.

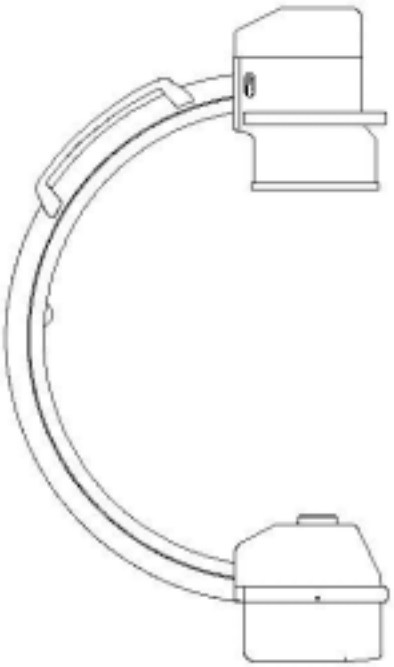


Figure 4-1. *C-arm.*

Component Identification

C-arms with 9-inch Image Intensifiers

Component identification is virtually identical for C-arms with 9-inch image intensifiers. Therefore only the standard C-arm with a 23 cm (9-inch) II is illustrated. Refer to the "Technical Reference" chapter for dimensional differences.

The items listed below identify the location of components used during setup and positioning and correspond to the circled items in the following figure.

1. Horizontal cross-arm handle

2. Horizontal cross-arm brake handle

3. Vertical column lift switches

4. Control panel display

5. Wig-wag brake handle

6. Rotational brake

7. Interface panel (left side cover)

8. Image intensifier handle

9. C-arm orbital rotation brake

10. Rear wheel brake pedal

11. C-arm Handle

12. Steering handle (right side only)

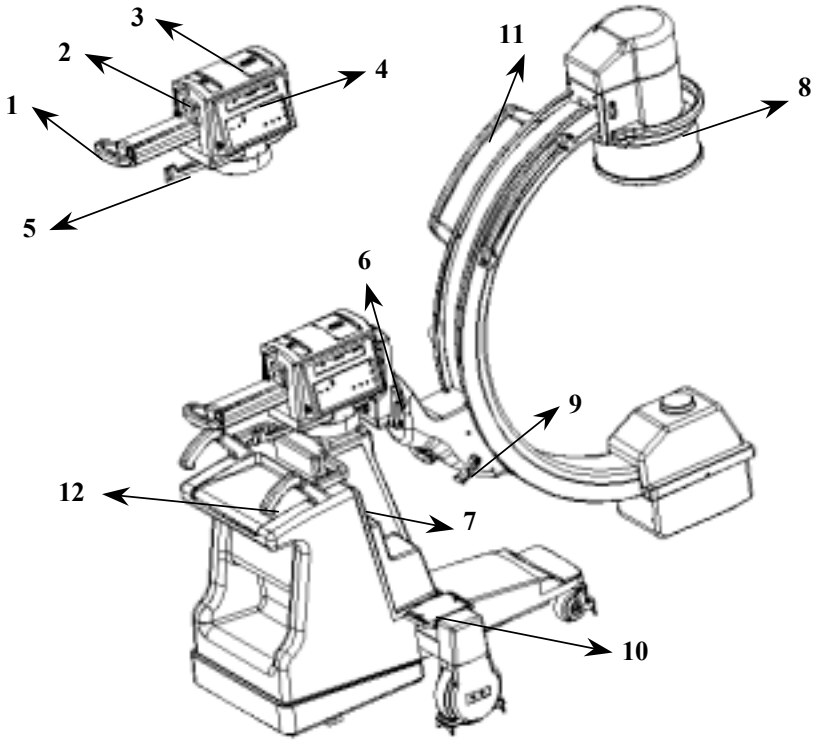


Figure 4-2. *Component identification for C-arms.*

Positioning

C-arm Orbital Rotation

The 9 inch C-arm configuration provides 135° of orbital rotation (90° underscan and 45° overscan). The back of the C-arm is marked with a scale to aid in positioning.

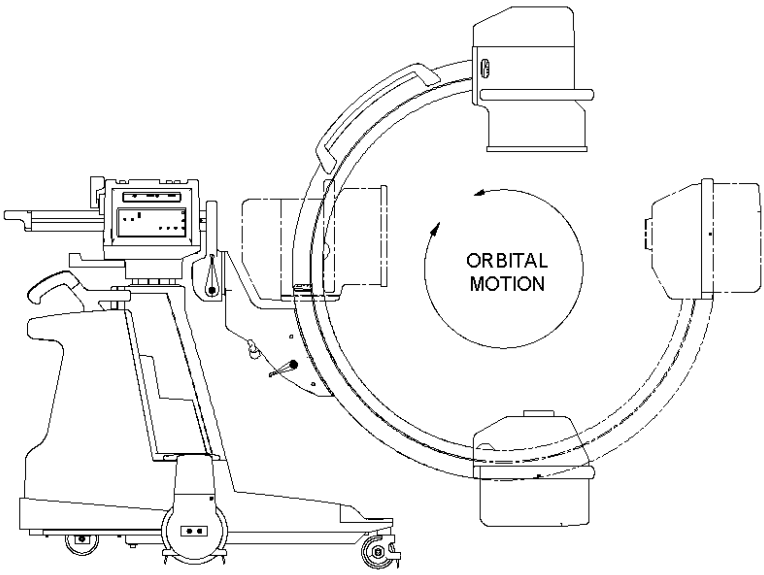


***Figure 4-3**. C-arm Orbital Rotation for 9 inch*

C-arm Orbital Rotation Brake

To lock or unlock the orbital rotation brake, turn either of the brake handles located on both sides of the C-arm support assembly. The locked position is indicated by a "lock" icon.

CAUTION
Grasp one of the C-arm positioning handles to prevent uncontrolled C-arm movement whenever you release the brake.

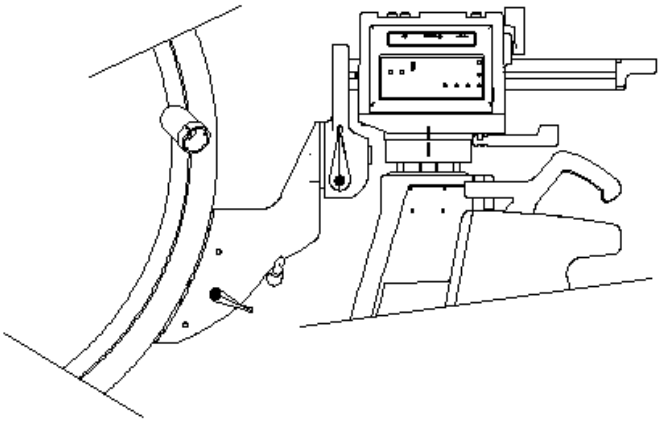


Figure 4-4. *Orbital rotation brake in the unlocked position.*

Yoke Rotation

The L-arm on 9 -inch C-arm configurations rotates 180° in either direction (for a total of 360°). An Yoke rotation indicator, located on the back of the Yoke , indicates the degree of Yoke rotation

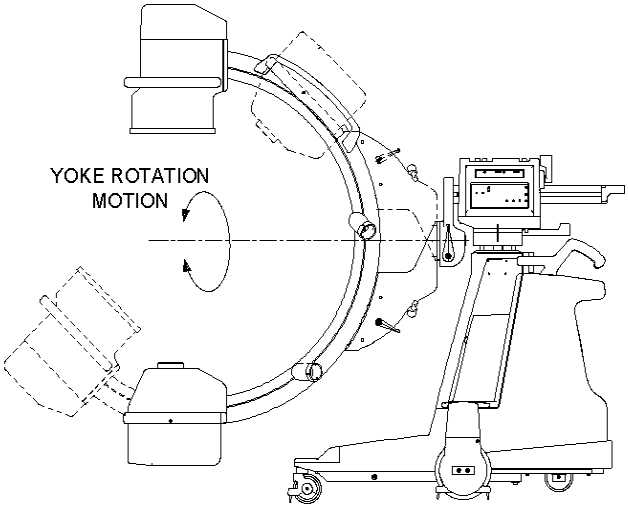


Figure 4-5. *Yoke rotation for 9-inch system*

Rotational Brake

To position the Yoke:

1. Release the Rotation brake by moving the brake handle into the position identified by the "unlock" icon.
2. Position the Yoke.
3. Lock the Rotation brake by placing the brake handle in the position identified by the "lock" icon.

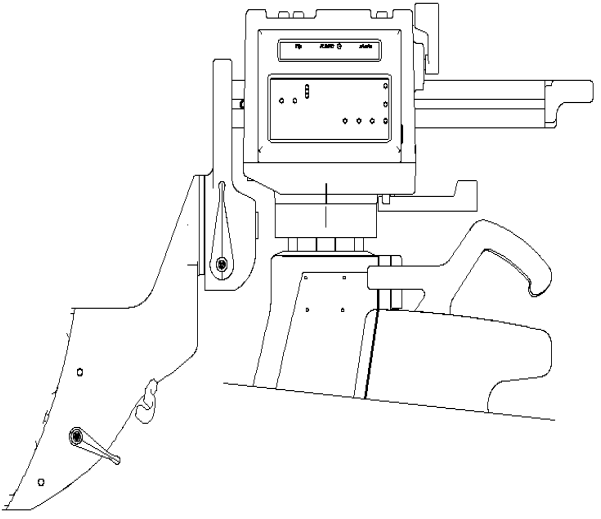


***Figure 4-6**. Yoke brake for 9-inch system.*

Vertical Column Operation

Use the vertical column to elevate the C-arm a maximum of 46cm (18 inches). Use the scale located on the vertical column to help position the C-arm at the height you want.

CAUTION

A possible pinch point exists between the C-arm and the tip of the front cover. Do not place your foot on the tip of the front cover while operating the vertical column or while positioning the C-arm.

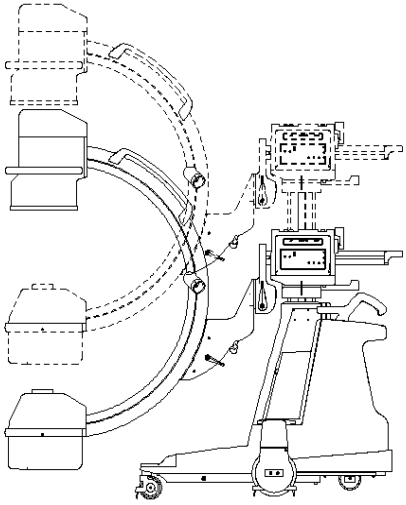


Figure 4-7. *Elevating or lowering the vertical column.*

Vertical Column Switches

The vertical column motor is actuated by pressing the vertical column extension or retraction switches located on top of the control panel housing.

WARNING
When positioning the vertical column, observe the moving assemblies to ensure the safety of patients and hospital personnel.

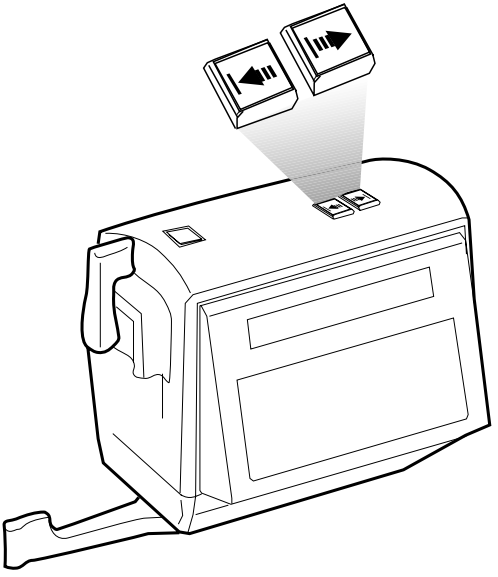


Figure 4-8. *Motorized vertical column switches.*

Horizontal Cross-arm

The horizontal cross-arm extends a maximum of 20 cm (8 inches).

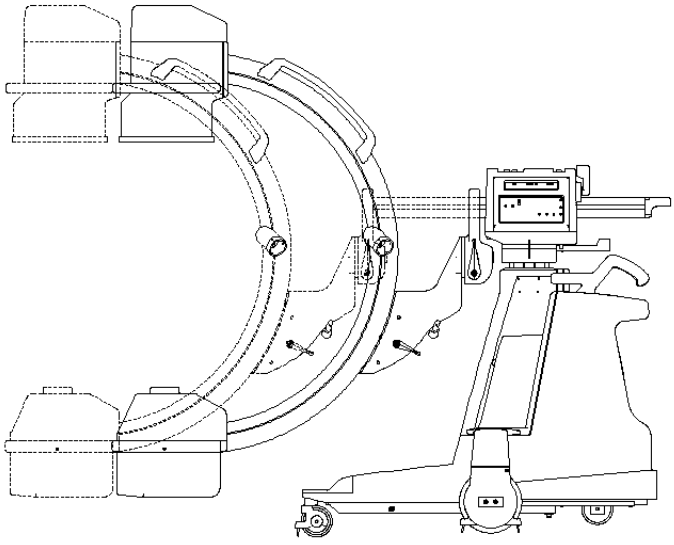


Figure 4-9. *Positioning the horizontal cross-arm.*

Horizontal Cross-arm Brake

To position the cross-arm:

1. Release the cross-arm brake by placing the brake handle in the position identified by the "unlock" icon.
2. Push or pull the cross-arm to the desired position. Use the centimeter scale located on the cross-arm as an aid in positioning.
3. Lock the cross-arm brake by placing the brake handle in the position identified by the "lock" icon.

NOTE: *The cross-arm brake may be used to apply light tension, and allow some movement of the cross-arm, while restricting free-drift.*

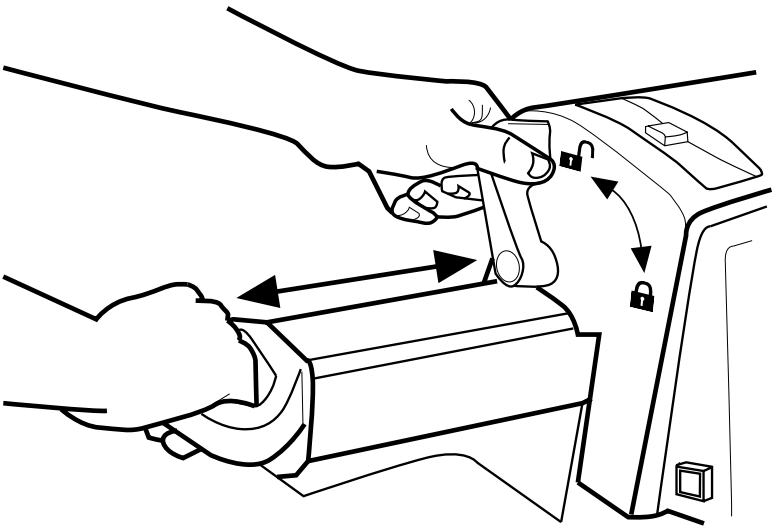


Figure 4-10. *The horizontal cross-arm brake.*

Wig-Wag

The mechanical assemblies attached to the horizontal cross-arm can "Wig-Wag," or move from side-to-side. The total distance travelled from side-to-side is dependent on whether the horizontal cross-arm is extended or retracted. The total distances travelled is listed in the following table for each system:

Item	Position	23 cm (9-inch)
1	extended	49.6 cm (19.5")
2	retracted	42.4 cm (16.7")

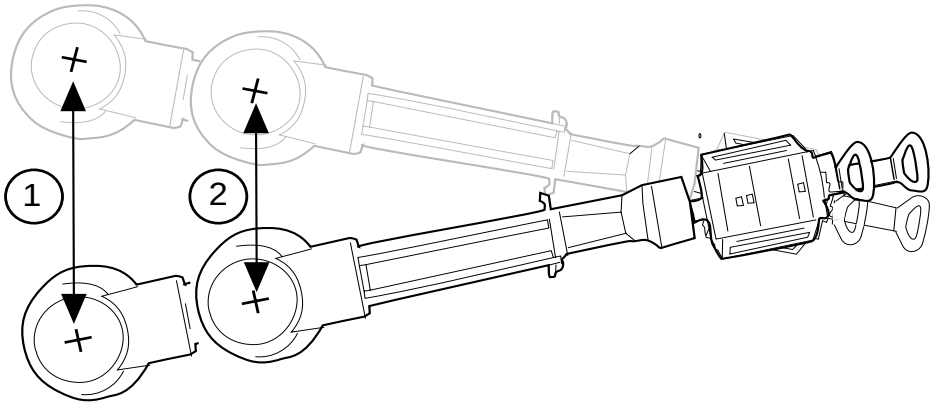


Figure 4-11. *Wig-Wag motion for a 23 cm (9-inch) system is shown.*

Wig-Wag Brake

1. Release the Wig-Wag Brake by placing the brake handle in the position indicated by the "unlock" icon.

2. Move the horizontal cross-arm, C-arm and Yoke into position.

3. Lock the Wig Wag brake by placing the brake handle in the position indicated by the "lock" icon.

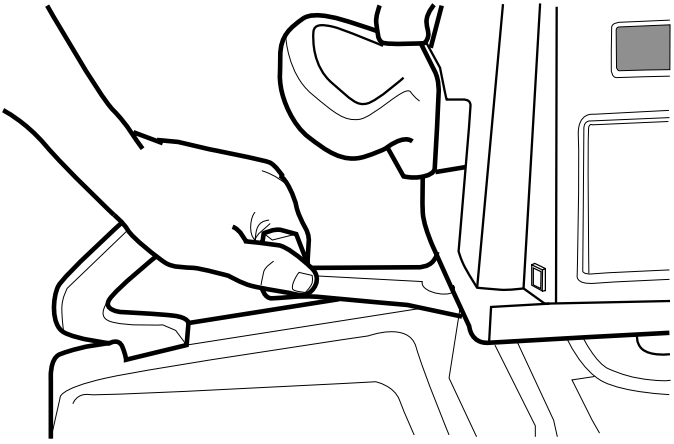


Figure 4-12. *The Wig-Wag brake.*

FlexiView8800 C-Arm Wheel Brakes

The C-arm brake pedals are located above the rear wheels on both sides of the C-arm. The pedals operate much like rocker switches. The pedal positions are:

Position	Description
1.	Locks the rear wheel brakes.
2.	Unlocks the rear wheel brakes allowing the wheels to rotate freely.
3.	Locks the rear wheel brakes.

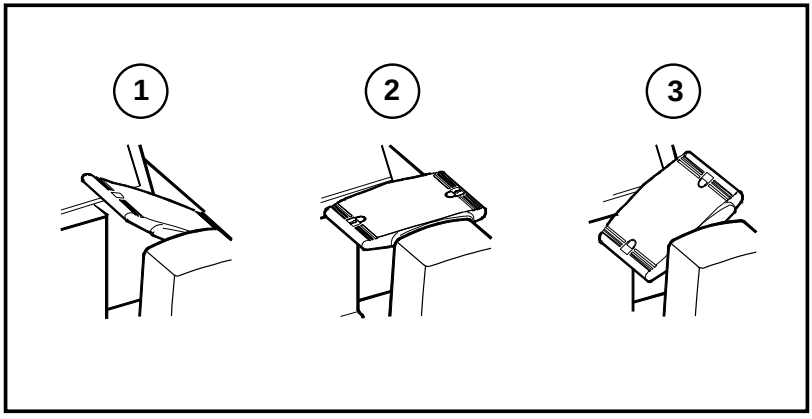


Figure 4-13. *C-arm brake pedal positions.*

FlexiView8800 C-Arm Steering Handle

Use the right steering handle to turn the rear wheels from 0° - 90° to the right or left. Use this feature to position the C-arm during clinical applications or to negotiate sharp turns during transport. The rear wheels turn at approximately the same angle as the right steering handle.

NOTE: *The rear wheels can be positioned in this manner whether the brakes are applied or not.*

CAUTION
To avoid losing control of the C-arm, always reduce transport speed before moving the steering handle out of the 0° position.

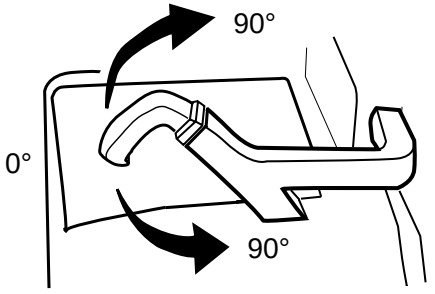


Figure 4-14. *Right steering handle.*

CAUTION
If the Wig-Wag brake is set to the extreme right, use caution not to injure your knuckles when turning the steering handle 90° to the left.

Moving the C-arm

Familiarize yourself with the location and mechanical operation of all controls prior to moving the C-arm.

CAUTION
Use the handles provided on the C-arm to position mechanical assemblies. The handles are provided for your safety.

---

1. Return all moving assemblies to their most compact positions. Lower the vertical column and retract the cross-arm. On 23 cm(9 inch) systems orient the Yoke vertically and down.

2. Lock all movable mechanical assembly brakes: the C-arm orbital rotation brake, the Wig-Wag brake, the Yoke brake and the horizontal cross-arm brake.

3. Remove all power from the Workstation.

4. Disconnect the interconnect cable from the C-arm and coil and secure the cable around the Workstation's handle/hangers.

5. Store the footswitch on the shelf located between the two C-arm steering handles and store the handswitch in the holster located on the C-arm's left front cover.

6. Place the C-arm's right steering handle in the 0° position and unlock the wheel brakes.

7. Guide the C-arm by pushing with the steering handles, or by pulling with the image intensifier positioning handles.

CAUTION

Do not move the C-arm over inclines greater than 10°. Do not move the C-arm up or down stairs or steps. Do not lock the C-arm in place on an incline greater than 5°.

8. When you reach your destination place the C-arm wheel brakes in the locked position.

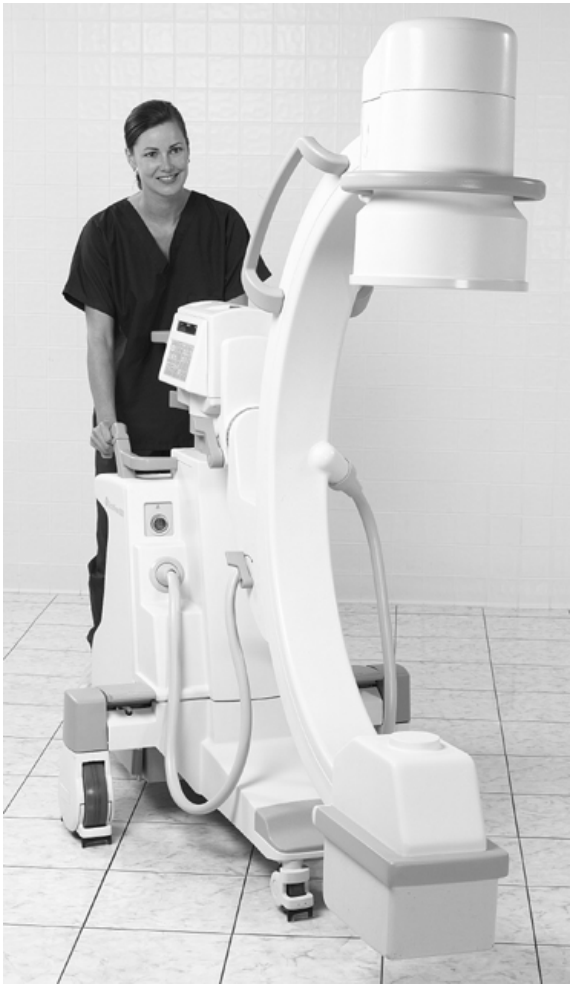


Figure 4-19. Moving the FlexiView8800 Mobile C-arm
(Standard 9-inch system Shown).

Chapter 5

Radiographic Film

Overview

Use film mode to produce radiographic films. The film cassette holder described in this section is available as an option and should be used if you use film mode.

This chapter describes how to:

- Setup and make a film exposure.
- Prearm for a film exposure.

Setup and Make a Film Exposure

Perform the following steps to make a film exposure:

1. Press the FILM button on the C-arm control panel.

***NOTE**: Once film mode has been selected, the field size and collimator settings are locked. If further adjustments are required, you must first reenter Fluoro mode.*

2. Place the cassette holder over the face of the image intensifier with the handle opened out.

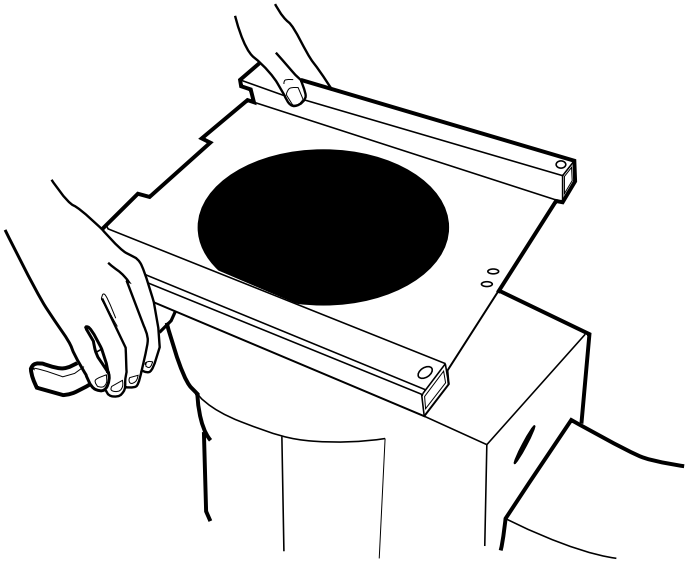


***Figure 5-1.** Installation of cassette holder.*

3. Rotate the cassette holder handle to securely attach the cassette holder to the image intensifier.

WARNING
Verify that the cassette holder is securely attached to the image intensifier. Unsecured cassette holders may fall, injuring patients or personnel.

4. Insert a film cassette into the cassette holder and center it.

NOTE: *The cassette holder uses friction to hold the cassette. Refer to the "Technical Reference" chapter for film cassette sizes.*

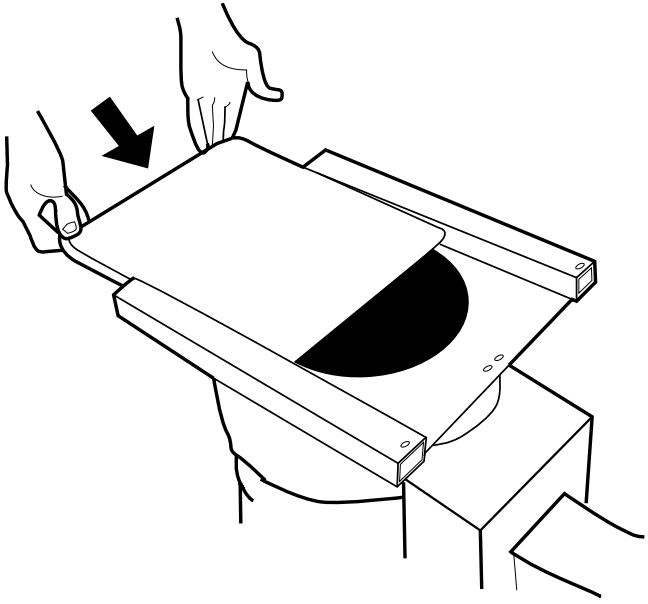


Figure 5-2*. Insert a cassette.*

WARNING
Verify that the cassette is held securely within the cassette holder. Unsecured film cassettes may fall, injuring patients or personnel.

5. Adjust the radiographic technique (kVp and mAs) to the desired levels.

6. Press and hold any X-ray switch.

NOTE: *There is a 2-second delay after the switch is pressed while the filament is heated. The beginning of the exposure is signaled by a beep. The end of the exposure is signaled by three quick beeps.*

7. Release the X-ray switch at the end of the exposure (when you hear three quick beeps).

NOTE: *If a film exposure is terminated prematurely, the message RELEASED EARLY will be displayed briefly on the C-arm control panel. When the message is no longer displayed, you can continue.*

8. Remove the film cassette by pushing the cassette out of the cassette holder.

9. To remove the cassette holder, open the cassette holder handle and press firmly against the side of the cassette holder.

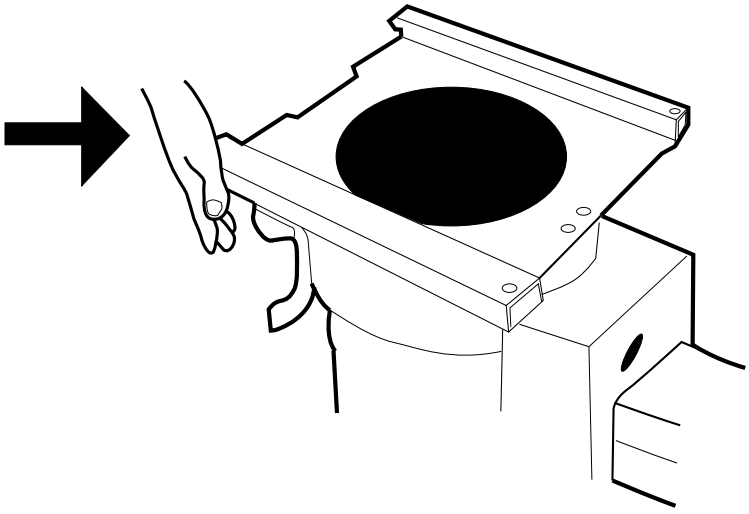


Figure 5-3. *Remove the cassette holder.*

NOTE: *The cassette holder is designed to snugly attach to the image intensifier lip when the handle is engaged. It may be necessary to strike the cassette holder with the palm of your hand to dislodge the cassette holder from the image intensifier.*

Prearm for Film Exposure

The system can be prearmed in film mode up to sixty seconds in advance to avoid the 2-second delay when the X-ray switch is pressed. To prearm the system:

1. Set the desired technique (kVp and mAs).

2. Press any X-ray switch and release before the 2-second delay expires.

NOTE*: The C-arm control panel displays the message* "ARMED."

3. When you are ready to make the exposure, press the X-ray switch again. The system will initiate an exposure immediately. There will be no delay.

4. If you decide not to make a prearmed exposure, wait sixty seconds or press any control panel key (except the X-ray on key) to cancel prearming.

Chapter 6

Maintenance

Overview

This section describes routine performance checks that you can perform to ensure that the system is operating correctly. The performance checks listed are not intended to substitute for scheduled periodic maintenance. If problems are found during these checks, contact a qualified service engineer to troubleshoot and repair the system.

In addition to performance checks, safe cleaning practices are included and a description of periodic maintenance that should be performed. All periodic maintenance should be performed by a GE Medical System's representative or a qualified service engineer.

Prior to performing any of the performance checks in this section, it is important that potential hazards associated with these tasks are understood. Review the "Introduction and Safety" chapter of this guide before proceeding.

WARNING

Circuits inside the equipment use voltages which are capable of causing serious injury or death from electrical shock. Do not remove the covers or perform any type of service task, except as specifically instructed here.

Move the system into a safe operating area prior to beginning these checks and observe all radiation safety precautions. The performance checks should be performed as often as equipment use and circumstances warrant. Extensive use warrants increasing the frequency of performance checks. In addition, circumstances such as accidents during transport or exposure to excessive fluids may warrant that performance checks be performed to verify operation of the equipment.

Performance Checks

Mechanical Performance Check

1. Check the Wig-Wag brake operation. Check Wig-Wag for ease of movement (side to side swing) without excessive play.

2. Check the Horizontal Cross-arm brake operation. Extend and retract the Horizontal Cross-arm. Check for ease of movement without excessive play.

3. Check the C-arm orbital rotation brake operation. Check orbital rotation of the C-arm for ease of movement without excessive play.

4. Check Yoke rotation on standard systems with 9-inch image intensifiers. On 9 inch II systems, check Yoke brake operation. Move the Yoke and verify that no excessive mechanical drift occurs.

5 Check the operation of the rear wheel pedal brakes.

6 Check for proper operation of the steering handle and control of the rear wheels. Check for ease of movement without excessive play.

Electrical Performance Check

1. Inspect the high voltage cables for signs of wear and abrasion.

2. Inspect the footswitch and hand control cables for signs of wear and abrasion.

3. Perform the Workstation performance checks. Refer to your *1k x 1k Workstation Operator's Guide*.

4. Turn the system on and verify that the system successfully completes the power-up sequence.

5. Raise the vertical column by pressing the switch located on top of the C-arm's control panel housing.

Fast Stop Performance Check

This check is performed as a matter of routine operator maintenance to ensure that the Fast Stop safety feature is functioning properly. Refer to the operator performance checks contained in the "Maintenance" chapter of this guide. In addition, perform this check as often as conditions, such as removal from long term storage and exposure to fluids, warrant it.

1. Press and hold one of the vertical column control switches and while motion is occurring, press either Fast Stop switch.

2. Verify that mechanical motion stops and a message stating that Fast Stop has been activated appears on the C-arm control panel display.

3. Press any X-ray switch and verify that X-rays are disabled.

4. Cycle the Workstation power switch to off and then on to reboot the system.

NOTE: *Images and annotations will be lost when the system is restarted unless you have saved them. If you have saved images you can access them through the Workstation's Image Directory function.*

Fluoro Mode Performance Check

WARNING

This procedure produces X-rays. Take the appropriate precautions.

1. Position the C-arm so that the X-ray head is directly above the image intensifier.

2. Place a suitable test object on the face of the image intensifier tube.

3. Verify that auto mode is selected. The LED next to the AUTO key (generator grouping) on the C-arm control panel will be illuminated.

4. Press the X-ray on switch located on top of the control panel housing. Verify that a digitized fluoro image of the object appears on the left monitor and that it remains there after the exposure is terminated.

5. Connect the footswitch and hand control and while pressing a footswitch or handswitch X-ray switch:

   a) Verify operation of the C-arm image orientation keys: rotation and image reversal.

   b) Verify operation of the field size selection keys: NORM, MAG1 and MAG2.

   c) Verify operation of the motorized collimation controls: leave rotation, iris collimation, and leave open/close.

   d) On vascular systems verify operation of the MODE switch, located on the footswitch and handswitch.

Film Mode Performance Check

WARNING

This procedure produces X-rays. Take appropriate precautions.

1. Select film mode and enter the technique: 60 kVp @ 2.5 mAs.
2. Install the film cassette holder on the image intensifier and load a film cassette.
3. Press the footswitch. Wait for 2 seconds approximately before the X-ray ON indicator lights.
4. Release the footswitch after you hear three beeps.
5. Develop the film and inspect the exposure.

Cleaning

Make sure the system is turned off and unplugged before cleaning. Clean the covers and panels periodically with a damp cloth. Use a mild detergent, if necessary, to remove scuffs and stains. Do not use any solvents which may damage or discolor paint finishes or plastic components.

CAUTION

The C-arm is not waterproof. Be careful not to spill or splash liquids where they can enter electronic assemblies.

Periodic Maintenance

Periodic maintenance should be performed by a GE Medical Systems field service engineer or staff that have been trained by GE Medical Systems . Periodic maintenance should be performed on a semiannual basis. Periodic maintenance and service includes the following:

- Manual movement of mechanical assemblies and brakes.
- Electromechanical performance.
- Safety interlock performance (Fast Stop circuit).
- Electrical performance including exterior cabling inspection, ground continuity, line voltage regulation, power supply operation, battery and static discharge component performance.
- Ventilation including circuits and fans.
- Imaging chain performance including image resolution, beam alignment, auto technique tracking, and entrance exposure calibration.
- Functional operation of any remaining features.

Chapter 7

Display Messages

Overview

This chapter describes messages that appear on the C-arm control panel during system operation. The messages are listed in alphabetical order. Messages may indicate any of the following:

- Status messages
- Error messages
- Warning messages

Error Recovery Steps

Perform the following error recovery procedure if you encounter problems during start-up or operation:

1. Some messages require that you press a control panel key on the C-arm to resume system operation. If this fails to restore system operation, then proceed with step 2.

2. If a message persists then place the Workstation power switch in the off position; wait five seconds, then place the power switch in the on position. If this fails to restore normal operation then proceed with step 3.

3. Turn the power switch off and call for service. Refer to the "Introduction and Safety" chapter for communication center telephone numbers. Do not continue using the system.

WARNING
Ignoring error and warning messages may result in equipment damage and personal injury.

Messages

4 HOUR WARM-UP REQUIRED - PRESS ANY KEY If the system has been stored for more than 60 days, a warm-up period is necessary for ion removal from the image intensifier tube. Leave the system on with no operation for 4 hours. Press any C-arm control panel key to continue.

24 HOUR RECHARGE REQUIRED - X-RAYS DISABLED If the system has been in storage for more than six months, the batteries need recharging. X-rays are disabled. Leave the Workstation power cord plugged in, make sure the interconnect cable is properly connected, and wait 24 hours before use. The system does not need to be turned on.

ANODE IS HOT - XX% This message alternates with the technique displayed on the control panel display and an alarm sounds. The anode temperature is at 80% of its rated heat capacity or greater. The alarm may be disabled by pressing the ALARM RESET key on the control panel. Continued use without cooling may damage the X-ray tube. Although fluoroscopy is not prevented, you should wait for the tube to cool before making another exposure. HLF and film exposures are not allowed.

WARNING

When the ANODE IS HOT - XX% message displays, personnel should avoid body contact with the X-ray tube. Do not allow the X-ray tube housing to contact the patient.

ANODE IS WARM - XX% This message will alternate with the technique displayed on the control panel display. Anode temperature is at 70% of its rated heat capacity or greater. You may continue with fluoroscopy, but discretion is advised.

WARNING
When the ANODE IS WARM - XX% message displays, personnel should prevent all body contact with the X-ray tube.

ARMED This message is displayed as the system prepares the technique for a film exposure. If the X-ray switch has not been pressed after 60 seconds, the message will be removed from the display.

BATTERY CHARGE - XX% If the effective battery charge drops to between 70 to 40 percent, this message will alternate with the technique displayed on the control panel display. Fluoro, film and HLF exposures are still allowed. To charge the batteries, leave the system plugged into an AC receptacle with the interconnect cable in place between the C-arm and the Workstation. The Workstation power switch should be turned to the off position. Normally, a full battery recharge requires only a few hours. If the batteries are further discharged without adequate recharge time, the effective charge may drop below 70 percent.

BATTERY CHARGE - XX%/WAIT If the effective battery charge drops below 40 percent, this message will alternate with the technique displayed on the control panel display. The WAIT message appears in the center of the technique display. Exposures are allowed in fluoro mode but film and HLF exposures are not allowed until the battery has recharged. To charge the batteries, leave the system plugged into an AC receptacle with the interconnect cable in place between the C-arm and the Workstation. The Workstation power switch should be turned to the off position.

CHARGER FAILED If the battery charger fails at boot-up, this error is displayed and the system will not operate. Perform the error recovery steps described at the beginning of this chapter.

If the failure occurs during operation the message will alternate with the technique displayed on the control panel. Continued use will result in system failure. Call your service representative as soon as possible.

COLLIMATOR CAL REQUIRED - PRESS ANY KEY The software has determined that the current collimator iris or leave position values do not match the reference values stored in memory. Press any key to continue. Call your service representative as soon as possible.

COL IRIS POTENTIOMETER ERROR - PRESS ANY KEY The software has sensed that the collimator iris potentiometer is not working and therefore the iris position cannot be determined. Press any key to continue. Call your service representative as soon as possible.

COL IRIS TOO LARGE The collimator iris is larger than the control panel indicates. This message will alternate with the technique displayed on the control panel display.

CAUTION

Continuing system operation when the COL IRIS TOO LARGE message is displayed may result in over exposing the patient due to a larger than indicated field size. Complete the current procedure if necessary, then call for service.

COL IRIS UNSTABLE The iris collimator motor control cannot maintain position tolerance. This message alternates with the technique displayed on the control panel display. You may continue to use the system, although the iris instability may degrade the image at the edges of the X-ray field. Complete the current procedure if necessary and then call your service representative.

COLLIMATOR STUCK This message alternates with the technique displayed on the control panel display. The collimator iris motor is unable to open or close the collimator iris. You may continue to use the system, although you will not be able to adjust the collimator iris. Complete the current procedure if necessary and then call your service representative.

COMMUNICATION FAILED System communication has failed. The Flexi view 8800 Mobile C-arm is not allowed to take X-rays under these conditions. Wait for approximately one minute for this condition to clear and if it does not, perform the error recovery steps at the beginning of the chapter.

CONTROL PANEL ERROR Communication to the control panel has been lost, terminating system operation. Perform the error recovery steps described at the beginning of this chapter.

DATA ERROR Corrupted software or data has been detected. X-rays are disabled. Perform the error recovery steps described at the beginning of this chapter.

FAST STOP ACTIVATED, POWER OFF WAIT 5 SECONDS: This message will display after a FAST STOP key has been pressed. Push the Workstation power switch to OFF and then ON to restart the system.

If you did not press a FAST STOP key and this message is displayed, a hardware or software fault has occurred. Perform the error recovery steps described at the beginning of this chapter.

FILAMENT CAL REQUIRED - PRESS ANY KEY The system has sensed that the filaments have not been calibrated. It is possible to receive multiple mA errors, if this condition exists. Call your service representative as soon as possible to perform a calibration .

WARNING

If the procedure is continued when the FILAMENT CAL REQUIRED message is displayed, the patient may receive a higher dose than that indicated. Press any C-arm control panel key to continue with the procedure if necessary, then call for service.

FILAMENT REGULATOR FAILURE - PRESS ANY KEY The filament current has been sensed as out of tolerance. You may press any C-arm control panel key to continue. However, the resolution of future images may be degraded. Contact your service representative as soon as possible.

WARNING
If the procedure is continued when the FILAMENT REG FAILURE message is displayed, the patient may receive a higher dose than that indicated. Press any C-arm control panel key to continue with the procedure if necessary, then call for service.

FILAMENT SELECT ERROR - PRESS ANY KEY The filament size selected by software does not match the current filament in the PIO hardware. Press any C-arm control panel key to continue. X-rays are disabled while the message is displayed.

HLF OVERTIME The HLF (High Level Fluoro) exposure has exceeded the preset time interval and has been terminated. The time interval parameters are dependant on the pulses per second selected. This safety precaution discourages excessive continuous lengths of time in HLF mode. This message remains displayed until the footswitch is released.

HOUSING IS HOT - XX% This message alternates with the technique displayed on the control panel display and an alarm sounds. The housing temperature is at 80% of its rated heat capacity or greater. The alarm may be disabled by pressing the ALARM RESET key on the control panel. Although fluoroscopy is not prevented, you should wait for the tube to cool before making another exposure. HLF and film exposures are not allowed at this temperature.

CAUTION

Continued use without cooling may damage the X-ray tube. Although fluoroscopy is not prevented, you should wait for the tube to cool before making another exposure.

WARNING

When the HOUSING IS HOT - XX% message displays, personnel should avoid body contact with the X-ray tube housing. Do not allow the X-ray tube housing to contact the patient.

HOUSING OVERHEATED This message is displayed when the X-ray tube is at 100 percent of its rated housing capacity. Operation is terminated. Let the housing cool.

CAUTION

When the HOUSING OVERHEATED message appears, the X-ray tube housing is extremely hot and must be allowed to cool before taking more exposures.

Avoid body contact with the X-ray tube housing. Do not allow the X-ray tube housing to contact the patient.

HOUSING WARM - XX% The housing temperature is at 70% of its rated heat capacity or greater. This message alternates with the technique displayed on the control panel display. You may continue with fluoroscopy, but discretion is advised.

WARNING

When the HOUSING WARM - XX% message displays, personnel should avoid body contact with the X-ray tube. Do not allow the X-ray tube housing to contact the patient.

HV GENERATOR ERROR: Software has detected an error in the High Voltage Generator. The system automatically shuts down, preventing operation. Perform the error recovery steps described at the beginning of this chapter.

HV REGISTER FAIL: Software has detected a failure in the high voltage register. The system automatically shuts down, preventing operation. Perform the error recovery steps described at the beginning of this chapter.

GENERATOR ERROR: Software has detected an error in the CAN communication with Monoblock and also local fault in Monoblock Generator. The System has to be rebooted. Perform the error recovery steps described at the beginning of this chapter.

INTERLOCK FAILURE The interlock circuit has failed during system start-up. Reboot the system and if the message is displayed again, call for service.

KEY STUCK - RELEASE, THEN PRESS ANY KEY TO CONTINUE
A key press has been sensed on the control panel during boot-up, possibly indicating a stuck control panel key. Verify that there are not any objects pressing against the control panel. After releasing the stuck key, press any C-arm control panel key to continue.

A malfunctioning control panel key may interfere with operation if you attempt to continue. Contact your field service representative as soon as possible.

KEYSWITCH IN STANDBY - XRAYS AND MOTORS DISABLED
This message will display whenever the X-ray keyswitch located on the C-arm is turned to the standby position. Turn the keyswitch to the on position to operate the system. If the keyswitch is already in the on position, there may be a fault in the keyswitch or software. In this case perform the error recovery steps described at the beginning of this chapter.

KV ON IN ERROR High voltage is being generated without an X-ray switch being activated, indicating a fault with the high voltage generator. The system will not operate with this error. Perform the error recovery steps described at the beginning of this chapter.

LIFT SWITCH STUCK If the lift switch is pressed continuously for 30 seconds, this message will display briefly. This may indicate a foreign object is pressing against the switch or a faulty switch or lift circuit. If there is no object pressing against the switch, perform the error recovery steps described at the beginning of this chapter.

WARNING
In the event of uncommanded vertical column movement, immediately move the C-arm out of the patient environment until the problem has been corrected.

MA ON IN ERROR X-ray current (tube current) has been detected without an X-ray switch being activated, indicating a fault with the X-ray generator. The system will not operate with this error. Perform the error recovery steps described at the beginning of this chapter.

OVERLOAD FAULT This may indicate a fault in the high voltage regulator circuit. The first time this fault is detected, the message appears only briefly after an exposure. The second time this fault occurs, the system automatically shuts down and the message remains on the display. Perform the error recovery steps described at the beginning of this chapter.

OVERVOLTAGE FAULT This may indicate an X-ray generator failure. The first time this fault is detected, the message appears only briefly after an exposure. The second time this fault occurs, the system automatically shuts down and the message remains on the display. Perform the error recovery steps described at the beginning of this chapter.

PLEASE WAIT This message may be displayed briefly on the control panel when the system is updating generator data or performing internal tests. The message should clear within moments. If the message does not clear within 30 seconds to a minute, perform the error recovery steps described at the beginning of this chapter.

PRECHARGE CIRCUIT TIMEOUT The contact relay has failed to close during the start-up process. This condition results in automatic system shutdown. Perform the error recovery steps described at the beginning of this chapter.

PRECHARGE VOLTAGE ERROR The precharge voltage has been sensed as too high during the start -up process. This condition results in automatic system shutdown. Perform the error recovery steps described at the beginning of this chapter.

RELEASED EARLY During a film exposure, the X-ray switch was released before the desired mAs was reached. The exposure time may have been too short for a good image. This message appears briefly at the end of the terminated exposure. Using a new film in the cassette, press the X-ray switch and allow enough time for the system to terminate the exposure.

WARNING, HIGH KV - PRESS ANY KEY An error has been detected in the kV loop. The actual kVp is higher than that indicated on the control panel display and is not within specified tolerances.

WARNING

Continuing with the procedure when the WARNING, HIGH KV message has been displayed may subject the patient to a higher dose than that indicated. Press any C-arm control panel key to continue with the procedure.

WARNING, HIGH MA - PRESS ANY KEY A calibration error has been detected. The actual mA is higher than that indicated on the control panel display and is not within specified tolerances.

WARNING

Continuing with the procedure when the WARNING, HIGH MA message has been displayed may subject the patient to a higher dose than that indicated. Press any C-arm control panel key to continue with the procedure.

WARNING, LOW KV - PRESS ANY KEY An error has been detected in the kV loop. The actual kVp is lower than that indicated on the control panel display and is not within specified tolerances. Lower kVp may result in poor image quality. Press any C-arm control panel key to continue.

WARNING, LOW MA - PRESS ANY KEY A calibration error has been detected. The actual mA is lower than that indicated on the control panel display and is not within specified tolerances. Lower mA may result in poor image quality. Press any C-arm control panel key to continue.

X-RAY OVERTIME - PRESS ANY KEY The film shot has continued beyond the time required to achieve the correct exposure and software has terminated the exposure. Press any control panel key to continue.

WARNING

When the X-RAY OVERTIME message is displayed, the patient may have received a higher dose than expected and continued film exposures may result in a higher than expected dose and longer exposure times.

X-RAY SWITCH SECURITY ERROR A mismatch between the handswitch or footswitch and a security line has been sensed. System operation is terminated. Call your service representative.

X-RAY SWITCH STUCK One of the X-ray exposure switches has been detected as enabled during the boot sequence. Verify that switches are not being enabled by a foreign object. Or disconnect the handswitch and/or footswitch and attempt restarting the system. If the system restarts, the disconnected device may contain a fault requiring service. If the message persists, there is an internal fault that is preventing system operation. Call your service representative.

TEMP SENSOR FAIL The condition of the X-ray tube's heat sensing element is tested duringstart-up. This message appears if the test indicates that the element is defective. You may continue using the system, but there is a danger that the X-ray tube may overheat during use without further warnings being given. Press any C-arm control panel key to acknowledge the message and call your service representative.

X-RAYS DISABLED This error message appears on control panel if there is a software mismatch between C-arm mainframe and workstation. Contact field service representatives for reloading the appropriate versions of software.

ROOM DOOR OPEN –CLOSE DOOR This message is displayed if room door is open while system is ON. X-rays are disabled till the room door is closed. Please note that this message will appear only when the room door interlock hardware is present in the system.

Chapter 8

Labels and Symbols

Overview

This chapter describes labels and symbols that are located on your FlexiView8800 Mobile C-Arm and that are not described elsewhere.

Two types of labels are described: warning labels and regulatory certification labels. Warning labels define potential hazards and advise against misuse that might result in personal injury. Familiarize yourself with these labels and their meanings in order to ensure a safe environment for both the patient and yourself. Regulatory labels indicate that the system meets the requirements of specific governmental, medical and industrial organizations.

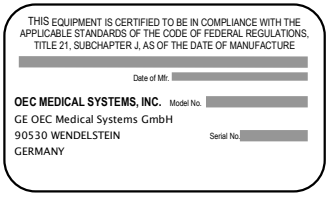
Symbols are provided to visually represent concepts such as locked and unlocked brake positions or the proper transport position of the C-arm. Many of the symbols described here are listed in IEC 417 and ISO 7000.and are not developed by GE Medical Systems.

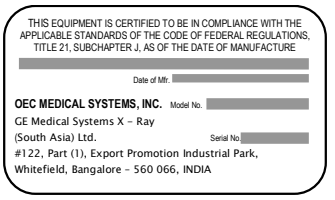
Labels

The system has been tested and certified by the German testing and certification institute Verband Deutscher Elektrotechniker (VDE).

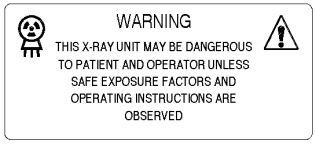
The system has been tested and certified by the Canadian Standards Association to comply with applicable U.S. and Canadian Standards.

This symbol indicates the system was tested by a Notified Body and was found to be in compliance with the requirements of all relevant directives and standards in effect within the European Union at the time of manufacture



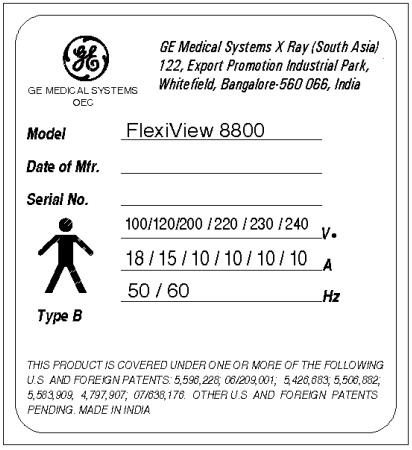


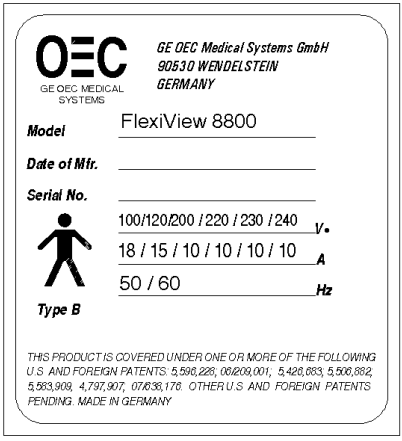
These labels (for the system and certified components) certify that the FlexiView8800 system meets applicable federal standards and regulations for X-ray equipment as of the date of manufacture..



The operator should be familiar with safe operating practices associated with this equipment before using the system.

System nameplate /rating label. Indicates manufacturer information and input power requirements.





Label with Flexiview 8800 from India ***Label with Flexiview 8800 from Germany***

Indicates the location of certification labels. Open the panel to view labels inside.

Symbols

Indicates the Equipotential terminal on the 8800 C-Arm. This terminal allows connection between the C-arm and the equipotential bus bar of the facility.

Attention, see accompanying documentation.

Near the interconnect connector on the C-arm this symbol means that the interconnect cable must be connected to the C-arm prior to plugging the power cord into an AC receptacle.

On the C-arm transport label, this symbol means there is information contained in the Operator Manual for positioning subassemblies for transport.

IP68

This symbol is located on the bottom of your footswitch. The electrical switching mechanism within the footswitch is protected from exposure to dust and the effects of continuous immersion in water. However, placement inside a protective cover is recommended.

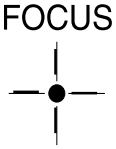
Type B equipment

Alternating Current

Ionizing radiation

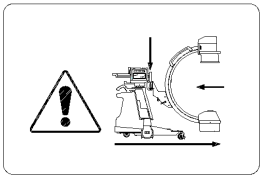
Indicates locked position of brake handle.

Indicates unlocked position of brake handle.



This symbol marks the approximate location of the X-ray tube focal spot projected on a straight line at right angles to the central axis of the beam.

This symbol indicates the locations of Fast Stop switches on the C-arm.



This symbol indicates that tthe 8800 C-Arm mechanical subassemblies should be placed in their most compact position before transporting or moving the system. Refer to the chapter on positioning for directions on moving the 8800 C-Arm.

Chapter 9

Technical Reference

Overview

The policy of GE Medical Systems , is one of continual product development and improvement. For this reason, GE Medical Systems , reserves the right to change the operating characteristics and specifications of newer products at any time, without prior notice, and without incurring any obligation relating to previously manufactured items.

The specifications listed are limited to general performance and physical data. Specifications of optional equipment provided by other manufacturers are given in the applicable manuals provided with those options.

Classification Type

Class I Equipment (as defined by IEC 60601-1)
Type B protection against electric shock
Ordinary protection against ingress of water
Non AP(Non-anesthetic Proof)
Continuous Operation (Refer to the fluoroscopic and film mode duty cycle specification contained in Generator Operating Parameters.)

Electromagnetic Compatibility Statement

This equipment generates and uses radio frequency energy and must be installed and used according to the manufacturer's instructions in order to avoid receiving radio frequency interference. If this equipment generates or receives interference do the following to correct the problem:

- Verify that the equipment is the cause by turning the system on and off.
- Reorient the equipment until the interference stops.
- Relocate the equipment with respect to other equipment in the room.
- Plug the equipment into a different outlet so that the equipment and the receiver are on different branch circuits.

***NOTE**: All cables that are used to connect to the D-Sub connector I/O ports of the Workstation must be shielded cables or cables supplied by GE Medical Systems .*

Optional Equipment

*T*he following accessories have been tested with, and are Known to work with the FlexiView8800 Mobile C-arm. Call The communication center to order optional equipment. Refer to the introduction and safety chapter to obtain the communication centers telephone number:

- GE Medical Systems , *Laser Aimer*
- GE Medical Systems, *Film Cassette Holder*

Replacement Items

The following replacement items can be ordered by calling the communication center. Refer to the Introduction and safety Chapter to obtain the communication centers telephone number.

- Film/Paper
- Sterile drapes and Cover.

Camera Output Video Signal

Hi-res 1k x 1k pixel, 1260lines/Frame @30Hz, 1320 lines/Frame @25Hz.

Environmental Requirements

Ambient Temperature	Operating: 50° to 95° F (+10° to +35° C)
Extended Storage and Transportation	> 2 days: 32° to 104° F (0° to +40° C)
Short-term Storage and Transportation	< 2 days: 14° to 131° F (-10° to +55° C)
Storage and Transportation Altitude	15,000 ft. (4572 meters) maximum
Operating Altitude	10,000 ft. (3048 meters) maximum
Humidity	Operating: 20 to 80%, non-condensing Storage and transport: 10%-80%, condensing
Shock and Vibration	1G at 5-200 Hz for 2 hours

C-arm Power Requirements

Interconnect Cable:

The C-arm obtains AC power from an interconnect cable attached to the Workstation. The power is isolated single phase (neither side at ground potential), 99-128 VAC, less than 8 Amps RMS maximum, 60 or 50 Hz.

Maximum Continuous Power Dissipation: 3,280 BTU/Hr. (This is based on a maximum real power value of 960 watts).

NOTE: *The interconnect cable provides video and communication signal interface, in addition to power.*

Connector Output Voltages:

Footswitch: 5 VDC 30 mA current source
Handswitch: 5 VDC 30 mA current source

X-ray Source Assembly

Type: Lohmann 110/3DF (Stationary Anode)

Focal Spot: Dual, 0.6 x 1.4 mm and 1.4 mm

Target Angle: 10^{o}

Inherent Filtration	0.8 mm Al
Added Filtration	2 mm of Al
Total Filtration	>2.5 mm of Al equivalent
Anode Heat	75,000 HU
Storage Capacity	
Anode Maximum Cooling Rate	37,000 HU/minute.
Housing Heat Storage Capacity	960,000 HU
Housing Cooling Rate	16,000 HU/minute.
Leakage Technique Factors	110 kVp and 1.0 mA
X-ray Tube Rating	110kVp maximum
Max. Symmetrical Radiation Field measured on X-axis	100 cm from focal spot equals 220 mm 30 cm from focal spot equals 75 mm

Collimation

Fluoroscopy

Nominal diameter circle for 9/6/4-inch II system:
23 cm (9-in.)
15 cm (6-in.)
11 cm (4.5-in.)

Continuously adjustable to an area less than 5 cm x 5 cm, measured at the image receptor plane (II input surface).

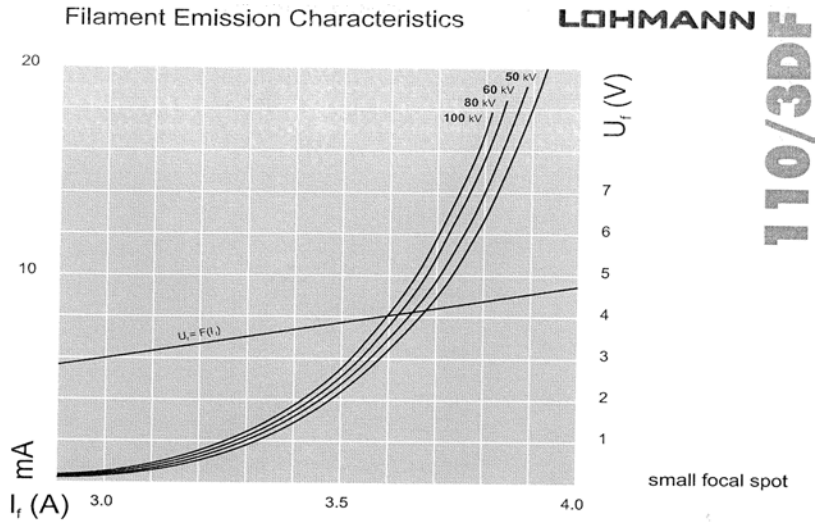
Radiography

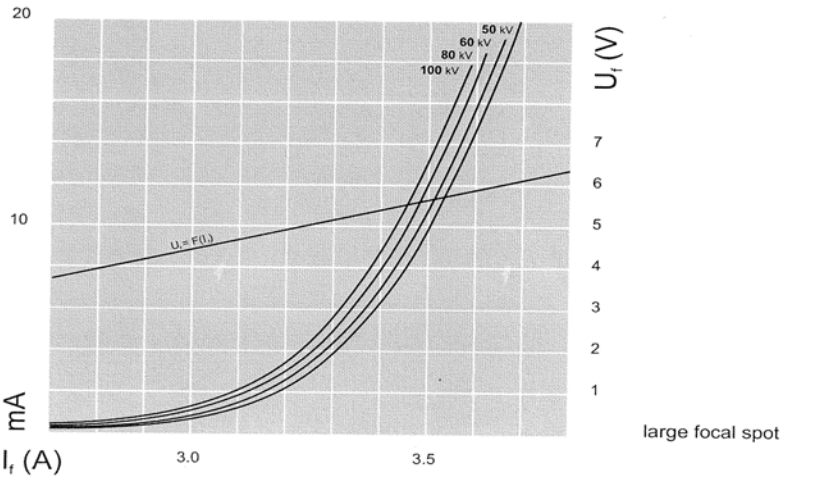
Nominal diameter circle 9-inch II system:
23 cm (9-in.)

Continuously adjustable to an area less than 5 cm x 5 cm, measured at the image receptor plane (II input surface).

Tube Rating Charts

The following charts and data describe tube characteristics when operated with three-phase full-wave rectification, a reasonable approximation to the high frequency generator with minimal ripple.

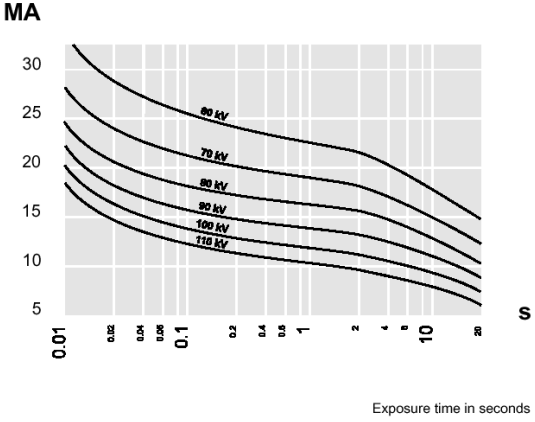




110/3DF LOHMANN

Single Load Rating

full wave rectified



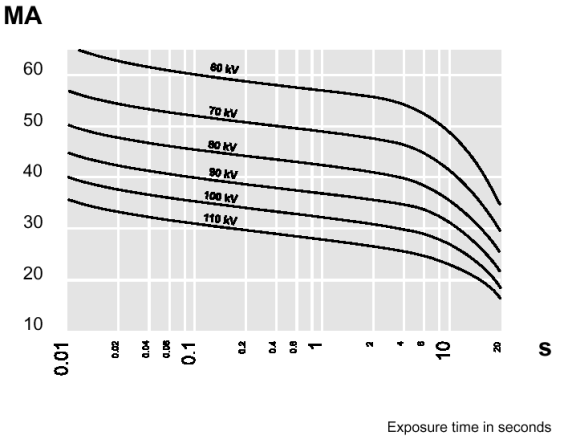
Exposure time in seconds

small focal spot

LOHMANN 110/3DF

Single Load Rating

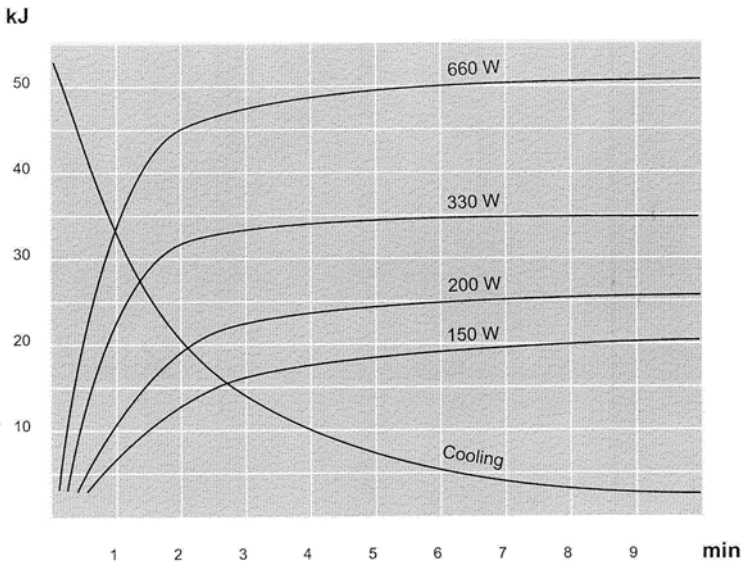
full wave rectified



large focal spot

LOHMANN 110/3DF

Thermal Characteristic



Ambient oil temperature 40°C

Generator Specifications

The following information is provided in accordance with IEC 60601-2-7 (1998).

1. Maximum kVp

Film mode	110 kVp @ 20 mA (max)
Normal Mode	110 kVp @ 3 mA (max)
HLF Fluoro	110 kVp @ 6 mA (max)
Pulsed Fluorography	110 kVp @ 12 mA (max)

2. Maximum mA

Film Mode	20 mA @ 110 kVp
Normal Mode	4 mA @ 83 kVp
HLF Fluoro	12 mA @ 55kVp
Pulsed Fluorography	16 mA @ 80 kVp

3. Maximum Output Power

Film Mode	2.2 kW for kVp range 50 -110 kVp

4. Lowest mAs setting

Film Mode	1.0 mAs (independent of kVp)

6. Nominal shortest exposure time

Film Mode	0.2 second

Generator Operating Parameters

Type:	Switched design, 22 kHz nominal operating frequency
kVp Accuracy:	± (3% or 3 kVp) greater of the two
mA Accuracy:	± (10% or 0.05 mA)
mAs Accuracy:	± (5% or 2 mAs)
Linearity:	Film mode linearity ≤ 0.08
Reproducibility:	C.O.V. ≤ 0.04
Focal Spot:	0.6x1.4 mm Small filament, 1.4 mm Large filament
Fluoroscopy Duty Cycle:	70 kVp @1.0 mA Continuous
Film Mode Duty Cycle:	110 kVp @ 20 mA, 4 seconds (80 mAs) 30 times per hour
Pulse Width Accuracy (Pulsed & HLF Pulsed Mode)	± (10%)

Measurement Basis for Technique Factors

kVp - The peak value of high voltage generator output in the interval after a 20 mS delay period to the end of the exposure.

mA - The time average of the current flow into the high voltage cable/X-ray tube assembly, beginning at the point where kVp crosses the 35 kVp level.

Time - Measurement of exposure time begins when the kVp crosses the 35 kVp level (80% of kVp selected).

mAs - The time integral of mA as defined above.

Focal Spot (0.6 x 1.4mm)

Mode	mA Range	mAs Range	KVp Range	Pulse Rate (pps)	Pulse Width (ms)
Auto Fluoro	0.1 to 4.0	N/A	40 to 110	N/A	N/A
Manual Fluoro	0.1 to 4.0	N/A	40 to 110	N/A	N/A
High Level Fluoro Continuous	0.1 to 12.0	N/A	40 to 110	N/A	N/A
Pulsed Auto Fluoroscopy	0.1 to 16.0	N/A	40 to 110	60 HZ: 1,2,3.75,7.5 50 Hz: 1,2.083,4.167, 8.33	50 (25)
Pulsed Manual Fluoro	0.1 to 16.0	N/A	40 to 110	60 HZ: 1,2,3.75,7.5 50 Hz: 1,2.083,4.167, 8.33	50(25)
Snap Shot	16	N/A	40 to 110	N/A	660ms(50Hz) 480ms(60Hz)

Focal Spot (1.4 mm)

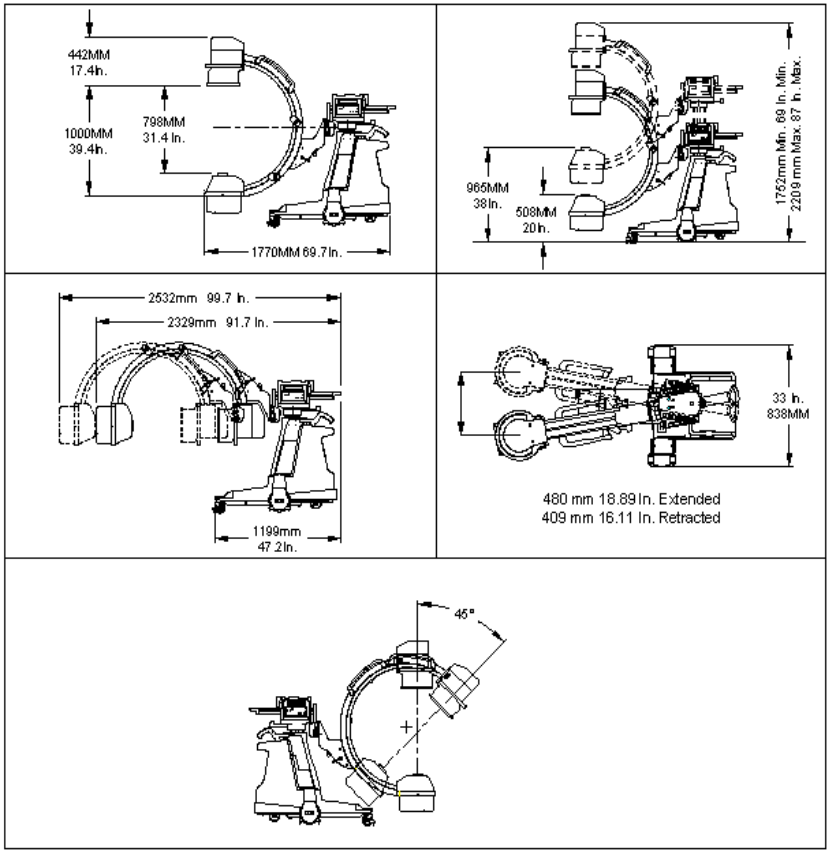
Mode	mA Range	mAs Range	kVp Range	Pulse Rate (pps)	Pulse Width(mS)
Radiographic	5-20	1-80	50 to 110	N/A	N/A

Film Cassette Dimensions

	9-inch II
Metric	24 cm x 30 cm
Standard	10 in. x 12 in.

Dimensions

OEC FlexiView 8800 Mobile C-Arm (9-inch II)



Material Safety Data Sheets

Manufacturer's Material Safety Data Sheets are available from the manufacturer upon request. Contact the following manufacturer's with regard to the materials listed.

Dow Corning R 5 Compound (Silicone)-Dow Corning Corporation, South Saginaw Road, Midland MI 48686, (517) 496-8306.

Shell Diala R Oil Ax (Oil MSDS No. 60030-5)-Shell, Inc., Product Safety and Compliance, PO Box 4320, Houston, TX 77210, (713) 473-9461.

Panasonic Sealed Lead Acid Battery-Matsushita Industrial Battery Co., Ltd, Battery Storage Division, 11-66 Honsyuku-Cho, Chigasaki, Kanagawa, Japan, (0467) 51-1121.

Sealed Lead Acid Battery-Hawker Energy Products, Inc., 1050 South Broadway, PO Box 5887, Denver, CO., 80217, (303) 744-4806.