GE HealthCare

CardioLab User Manual

AltiX BT22 Edition

0197

Digitally signed by Ceaicovschi Tudor
Date: 2026.07.01 10:40:31 EEST
Reason: MoldSign Signature
Location: Moldova
MOLDOVA EUROPEANĂ

5222002-1EN
Revision 3.0
US English

Contents

Publication Information

The information in this manual applies to Mac-Lab/CardioLab/MLCL Client Software . It does not apply to earlier versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

† Mac-Lab, CardioLab, Centricity, DASH, Innova, Solar, and CARESCAPE are all trademarks of General Electric companies.

†† All third-party trademarks are the property of their respective owner.

Micropace digital stimulators are sold by GE HealthCare for Micropace EP Inc.

This product complies with regulatory requirements of EU Medical Devices Regulation 2017/745.

In accordance with General Requirements of Annex I of Regulation 2017/745 Section 6, the medical device has a lifetime of seven years.

The first year Mac-Lab was CE marked is 1999.

The first year CardioLab was CE marked is 2000.

The first year ComboLab™ was CE marked is 2002.

CE 0197

MD

Rx Only

Contact Information

Manufacturer

GE Medical Systems
Information Technologies, Inc.
3114 N Grandview Blvd
Waukesha, WI 53188 USA
www.gehealthcare.com

EC REP

GE Medical Systems
283 rue de la Minière
78530 BUC, FRANCE

CH REP

GE Medical Systems (Schweiz) AG
Europa-Strasse 31
8152 Glattbrugg, Switzerland

Revision History

The document number and revision appear on the bottom of each page. The following table outlines the changes applied with each revision.

Revision	Date	Comment
1.0	2022-02-10	Initial release
2.0	2022-07-26	Released for software version 8.1
3.0	2025-03-26	Updated compliance information

Page intentionally left blank

1

Chapter 1 Introduction

1.1 Manual information

1.1.1 Purpose

This manual is intended solely as a reference for the operation of the CardioLab System, including the CardioLab application of the MLCL Client Software. It is not intended as a replacement for thorough and complete training on the system capabilities and operation by a qualified instructor; it is intended as a supplement to such training.

It is important that all of the instructions in this manual be followed. However, these instructions in no way supersede current medical practices regarding patient care and safety.

1.1.2 Product references

The name of the product described in this manual is CardioLab. It will also be referred to as "the system" throughout this manual.

1.1.3 Printed copies

Contact your local GE HealthCare representative to request a paper copy of this manual.

1.1.4 Intended audience

This manual is written for clinical professionals who use, maintain and/or troubleshoot the CardioLab. Clinical professionals are expected to have a working knowledge of appropriate medical procedures, practices and terminology used in the treatment of patients.

1.1.4.1 Operators

- Operators can record and calculate data, review, and store data, perform elementary caliper type measurements of the data and generate reports of the data from pediatric or adult patients as they undergo electrophysiological studies and related procedures.
- It is recommended that Mac-Lab/CardioLab operators be trained to become familiar with the capabilities and operations of the Mac-Lab/CardioLab system. The following training options are available:
  - Classroom training
  - On-site customer training
  - Remote training

1.1.4.2 System administrator

- Coordinating the overall MacLab/CardioLab system is the responsibility of the system administrator. This person has access to additional system supervisory functions, including operational setup parameters and system backup functions.
- The system administrator is also responsible for monitoring and reporting system hardware and software problems using the procedures described in Chapter 19 System Administration on page 265.
- The Mac-Lab/CardioLab system administrator should be familiar with the Windows desktop and be fully trained on the Mac-Lab/CardioLab features and configuration settings.

NOTE
A system administrator password is required.

- It is recommended that Mac-Lab/CardioLab system administrators be trained to become familiar with the capabilities and operations of the Mac-Lab/CardioLab system. The following training options are available:
  - Classroom training
  - On-site customer training
  - Remote training

1.1.4.3 Field service engineer

This manual does not address system problems. Only trained GE HealthCare field service engineers may diagnose and correct system problems. Refer system problems to GE HealthCare product support.

1.1.5 Indications for use

Mac-Lab

The Mac-Lab system is indicated for use on patients of all ages when a physician determines that a patient would benefit from a hemodynamic procedure. The Mac-Lab can be used in a variety of hospital and clinical settings to record hemodynamic data and measurements, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

CardioLab

The CardioLab system is indicated for use on patients of all ages when a physician determines that a patient would benefit from an electrophysiology procedure. The CardioLab can be used in a variety of hospital and clinical settings to record electrophysiology data and measurements, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

ComboLab™

The ComboLab system is indicated for use on patients of all ages when a physician determines that a patient would benefit from either a hemodynamic or electrophysiology procedure. The ComboLab can be used in a variety of hospital and clinical settings to record hemodynamic and electrophysiology data and measurements, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

MLCL Client Software

The MLCL Client Software is indicated for use on patients of all ages when a physician determines that a patient would benefit from either a hemodynamic or electrophysiology procedure. MLCL Client Software can be used in a variety of hospital and clinical settings to record, document, and/or review hemodynamic and electrophysiology data and measurements, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

1.1.6 Clinical benefits

Mac-Lab™ displays and records clinical data (ECG waveforms, heart rate, pulse oximetry, respiration rate, CO2, temperature, and hemodynamic measurements) and provides the clinical tools needed to help physicians deliver patient diagnoses.

CardioLab™ displays and records clinical data (ECG waveforms, intracardiac signals, stimulus data, ablation data, pulse oximetry, respiration rate, CO2, temperature, invasive and noninvasive blood pressures) and provides the clinical tools needed to help physicians deliver patient diagnoses.

ComboLab™ displays and records clinical data (ECG waveforms, heart rate, intracardiac signals, stimulus data, ablation data, pulse oximetry, respiration rate, CO2, temperature, hemodynamic measurements, invasive and noninvasive blood pressures) and provides the clinical tools needed to help physicians deliver patient diagnoses.

The MLCL Client Software displays clinical data (ECG waveforms, heart rate, intracardiac signals, stimulus data, ablation data, pulse oximetry, respiration rate, CO2, temperature, hemodynamic measurements, invasive and noninvasive blood pressures) and provides the clinical tools needed to help physicians deliver patient diagnoses.

1.1.7 Patient benefit

The Mac-Lab, CardioLab, and ComboLab™ recording systems maintain a comprehensive archive for performed procedures that may include waveform data, reports, and a time-based procedure log. The hemodynamic or electrophysiology study information is archived and available to provide continuity in patient care should additional treatments be necessary if indicated by a healthcare professional. The study information may also be transmitted to an Electronic Medical Records system. All study data stored or transmitted by the Mac-Lab, CardioLab, or ComboLab is encrypted to maintain the security of patient medical records and to ensure private health information is protected.

1.1.8 Intended Use/Intended Purpose

1.1.8.1 Types of systems

The following system names are used:

- **Mac-Lab**: A hemodynamic recording system typically used in catheterization laboratories.
- **CardioLab**: An electrophysiology recording system built on a common platform with Mac-Lab.
- **ComboLab™**: A single system that contains the features of both the Mac-Lab and the CardioLab systems.
- **MLCL Client Software**: The Mac-Lab and CardioLab acquisition software that is made available for installation on stand-alone systems to operate as a review workstation.

1.1.8.2 Mac-Lab system

The Mac-Lab system is intended for recording hemodynamic clinical data, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

1.1.8.3 CardioLab system

The CardioLab system is intended for recording electrophysiology clinical data, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

1.1.8.4 ComboLab system

The ComboLab™ system is the combination of both the Mac-Lab and CardioLab systems intended for recording hemodynamic and electrophysiology clinical data, respectively, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

1.1.8.5 MLCL Client Software

The MLCL Client Software is intended for recording, documenting, and/or reviewing clinical data for hemodynamic and electrophysiology procedures, which can then be displayed, filtered, digitized, amplified, measured, calculated, and/or transmitted for storage, analysis, and viewing at distributed locations.

1.1.9 Compliance

The system complies with the following standards:

- IEC/EN 60601-1 3rd ed (Amendment 1 and Amendment 2) Medical Electrical Equipment, Part 1 General Requirements for Basic Safety and Essential Performance
- IEC/EN 60601-1-2 4th ed (Amendment 1) Electromagnetic disturbances - Requirements and tests

1.1.10 Electromagnetic Disturbances (EMD)

The Mac-Lab, CardioLab, and ComboLab™ systems are intended for use as specified within the Indications for Use.

WARNING

The Mac-Lab, CardioLab, and ComboLab systems are not intended to be used together with high-frequency surgical equipment. The combined use may result in decreased immunity of the Mac-Lab, CardioLab, and ComboLab system.

Electromagnetic disturbances do not impact the basic safety of the Mac-Lab system. The Mac-Lab system does not have essential performance, as defined in IEC 60601-1.

Electromagnetic disturbances do not impact the basic safety of the CardioLab system.

Electromagnetic disturbances could result in lost or degraded display and accuracy of intracardiac waveforms, which is the essential performance of the CardioLab system. If this occurs, intracardiac signal noise is possible.

- Refer to the troubleshooting section of the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN) for instructions for resolving the different types of intracardiac signal noise.
- Refer to the technical specifications and maintenance sections of the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN) for instructions to maintain the Mac-Lab, CardioLab, and ComboLab systems.

WARNING

EQUIPMENT FAILURE

Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.

Accessories specific to the CardioLab II Plus Amplifieror Prucka^{TM} 3 Amplifier, which are necessary to maintain essential performance of the CardioLab system, are highlighted in the equipment overview section of this manual.

HDMI video cables are likely to affect the compliance to emissions and immunity of the system. Only replace HDMI video cables with the GE HealthCare part numbers that are specified in the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN).

WARNING

Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.

WARNING

Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 in) to any part of the Mac-Lab, CardioLab, and ComboLab systems, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

NOTE

The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

The Mac-Lab, CardioLab, and ComboLab systems require special precautions regarding electromagnetic disturbances and must be installed and put into service according to the information provided in the accompanying Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN).

Portable and mobile RF communications equipment can affect the system. Avoid the use of strong intentional radio transmitters in the immediate vicinity, including cellular telephones.

The following actions can be taken to reduce electromagnetic disturbances:

- Assess the environment of the healthcare facility for potential sources of electromagnetic interference (EMI) (for example, identify radio transmitters in and around the facility).
- Increase the distance between sources of EMI and susceptible devices.
- Lower power transmitted from electrical and electronic equipment (EMI sources) under hospital control (that is, paging systems).
- Educate healthcare facility staff (nurses and doctors) to be aware of and to recognize potential EMI-related problems.

For more information about managing EMI in the hospital environment, consult the Association for the Advancement of Medical Instrumentation Technical Information Report 18, "Guidance on Electromagnetic Compatibility of Medical Devices or Clinical/Biomedical Engineers."

NOTE
Safety with regard to electromagnetic disturbances (EMD) replaces electromagnetic compatibility (EMC) for safety in IEC/EN 60601-1-2 4th ed.

1.1.11 Classification

1.1.12 Conventions

The following conventions are used throughout this manual.

Bold	Indicates keys on the keyboard, text to be entered or hardware items such as buttons or switches on the equipment.
Italics	Indicates software terms that identify menu items, buttons or options in various windows.
Key 1 + **Key 2**	Indicates a keyboard operation. A **+** sign between the names of two keys means press and hold the first key while pressing the second key once. For example, "Press **Ctrl** + **Esc**" means to press and hold down the **Ctrl** key while pressing the **Esc** key.
Enter	Press the **Enter** or **Return** keys on the keyboard. Do not type "enter."

1.1.13 Illustrations and names

All illustrations in this manual are provided as examples only. They may not necessarily reflect your system's setup or the data on your system.

In this manual, all names appearing in examples and illustrations are fictitious. The use of any real person's name is purely coincidental.

1.1.14 Related documents

Refer to the following documents listed for additional information.

Part number	Description
5222001-1EN	Mac-Lab User Manual

Part number	Description
5222003-1EN	Centricity Cardiology INW User Manual
5222004-1EN	Mac-Lab/CardioLab Privacy and Security User Manual
5222037-1EN	ComboLab^{TM} Quick Reference Guide for AltiX BT22 Key-board
5222007-1EN	Mac-Lab/CardioLab/Centricity Cardiology INW Pre-Installation Manual
5222010-1EN	Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual

1.2 Safety information

Read through the following safety information and the safety information in the OEM component support documentation before putting the system into use. Disregarding information on safety is considered abnormal use.

1.2.1 Definitions

Hazard is defined as a source of potential injury to a person.

The terms "Danger," "Warning," and "Caution" are used throughout this manual to identify hazards.

DANGER

IMMINENT DEATH OR SERIOUS INJURY

Danger messages indicate an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

POTENTIAL DEATH OR SERIOUS INJURY

Warning messages indicate a potentially hazardous situation which, if not avoided, may result in death or serious injury.

CAUTION

POTENTIAL INJURY, EQUIPMENT DAMAGE, OR LOSS OF DATA

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

NOTE
Notes provide additional user information.

1.2.2 General safety information

WARNING

ELECTRICAL HAZARD

Connect equipment only as specified in the cabling diagrams. Failure to do so may lead to increased electrical safety risk.

WARNING

SHOCK HAZARD

DO NOT contact the system or patient during defibrillation.

WARNING

SHOCK HAZARD

Do not leave the conductive parts of patient-connected accessories exposed. This leaves the patient susceptible to shock.

WARNING

SUPERVISED USE REQUIRED

The system must be used in an attended environment where there is direct visual and audible communications between the physician performing the procedure and the system operators.

WARNING

UNSUPERVISED USE

This device is intended for use under the direct supervision of a licensed healthcare practitioner.

CAUTION

INACCURATE VALUES

Do not change system regional settings after installation. Doing so may result in inaccurate calculations.

1.2.3 Applicable messages

The following safety information applies to the CardioLab. Additional safety messages may be found throughout this manual that provide safe operation information.

WARNING

Do not open the acquisition computer when power is on. This will cause the computer to automatically shut down.

WARNING

Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.

WARNING

The Mac-Lab, CardioLab, and ComboLab systems are not intended to be used together with high-frequency surgical equipment. The combined use may result in decreased immunity of the Mac-Lab, CardioLab, and ComboLab system.

WARNING

Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 in) to any part of the Mac-Lab, CardioLab, and ComboLab systems, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

WARNING

This system is designed to comply with the applicable IEC/EN 60601-1 series safety standards when connected and powered as specified. Connecting additional devices, parts, or accessories that are not recommended by GE HealthCare could lead to a reduced level of safety. Before connecting supported interfaced devices to the system, ensure that the devices and system configuration meet the requirements of the applicable IEC 60601 series safety standards. Refer to the Service Manual for equipment connection and service information. Contact GE HealthCare if questions arise.

WARNING

ANTI-VIRUS SOFTWARE INSTALLATION

The System is delivered with the Microsoft Defender anti-virus application active to ensure some level of protection during system setup. Customers may choose to leave this software active or replace it with a product of their choosing. Lack of virus protection could lead to system instability or failure.

WARNING

AUDIBLE INDICATORS MALFUNCTION

The audible indicators are for reference only. The audible indicators are not designed for use as a patient alarm.

WARNING

EQUIPMENT HAZARD

Do not attempt to service the UPS or replace the battery. Doing so could result in equipment damage. Contact qualified GE HealthCare Service personnel for service or replacement.

WARNING

EQUIPMENT FAILURE

Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

WARNING

EQUIPMENT FAILURE

Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.

WARNING

EXPLOSION HAZARD

Do not incinerate the battery or store at high temperatures. Serious injury or death could result.

WARNING

EXPLOSION OR FIRE HAZARD

Using non-recommended batteries could result in injury/burns to the patients or users.

Only use batteries recommended or manufactured by GE HealthCare. The warranty can be voided if non-recommended batteries are used.

WARNING

INACCURATE WAVEFORM DISPLAY

To avoid incorrect waveform display, ensure intracardiac catheter connections and settings are configured as intended.

WARNING

NOT A PATIENT MONITOR

The system is intended to be used as a recording system for catheterization, electrophysiology and related specialty laboratories. A defibrillator or ECG monitor should be attached for patients in need of uninterrupted ECG display. An additional means to display SpO_2 should be attached for patients in need of uninterrupted SpO_2 display. A temporary pacemaker needs to be available for patients in need of uninterrupted delivery of pacing. An additional means to display CO_2 should be attached for patients in need of uninterrupted CO_2 display.

WARNING

PHYSICAL INJURY

Do not install the device above a patient. Make sure the battery is completely inserted and the battery door is completely closed. Falling batteries could seriously or fatally injure neonatal or other vulnerable patients.

WARNING

SHOCK HAZARD

Damaged cables and loose connections present a shock hazard and could cause signal noise or impaired device operation. Ensure all cables are in good condition, protected from potential sources of damage, and securely connected before powering on equipment. Replace damaged cables immediately.

WARNING

SHOCK HAZARD

Defibrillator protection is only guaranteed when approved accessories are used. Do not use unspecified accessories.

WARNING

SHOCK HAZARD

Do not modify or attempt to service any system equipment. This equipment contains no user serviceable parts. Refer servicing to qualified service personnel.

WARNING

SHOCK HAZARD

Do not power unspecified devices from the system equipment outlets.

WARNING

SHOCK HAZARD

If liquids or foreign materials have entered a device, take it out of service and have it checked by qualified service personnel to verify safety and functionality before it is used again. Ingress of foreign substances may result in shock, fire, excess leakage current, or device failure.

WARNING

SHOCK HAZARD

Incorrect power connections could result in an electrical hazard. Power the isolation transformer only as specified. Do not use extension cords or power strips.

WARNING

SHOCK HAZARD

To ensure patient safety, all equipment connected to the system must be powered from an isolated power source.

WARNING

SHOCK HAZARD

To reduce the risk of electric shock or damage to equipment, the equipment must only be connected to a properly installed power outlet with protective ground contacts.

WARNING

SHOCK HAZARD

To reduce the risk of ingress of water into the equipment, do not mount the PDM Slim Connect or PDM Base Station Plus in a vertical position with the patient cables facing up or down.

WARNING

SHOCK HAZARD

To reduce the risk of ingress of water into the equipment, do not mount the PDM in a vertical position with the patient cables facing up or down.

WARNING

SHOCK HAZARD

Use caution when cleaning the environment near equipment. Fluid ingress may damage devices or compromise electrical safety.

WARNING

SYSTEM INSTABILITY

Do not install or use anti-virus software that does not meet the requirements mentioned in the ICAR security website. Doing so may result in system instability or failure.

WARNING

SYSTEM INSTABILITY

Do not open files from external media on the system. This could introduce malware and result in system instability or failure.

WARNING

TIPPING HAZARD

Do not attempt to transport the Mobile Workstand while the wheels are locked.

WARNING

TRIPPING HAZARD

Keep cables away from accessible walkways. Failure to do so may present a tripping hazard and could result in cable damage.

WARNING

VISUAL INDICATORS MALFUNCTION

The visual indicators are for reference only. The visual indicators are not designed for use as a patient alarm.

CAUTION

FALLING EQUIPMENT

Do not place the PDM more than 147 cm (58 in) from the floor when mounting on an IV pole with a base less than 58 cm (23 in) in diameter. This may cause the IV pole to tip over.

CAUTION

INACCURATE VALUES

Do not change the system time. Doing so may cause the Log window not to reflect the events as they actually happened. An apparent lag time may be introduced, events may appear out of order, or medication values could be affected. Confirm that the times between the acquisition system and the clients are the same prior to system use. Contact a GE Healthcare representative for system clock issues.

CAUTION

OVERLOAD HAZARD

The maximum load of the utility basket on the Mobile Workstand is not to exceed 5 lbs / 2.25kg.

CAUTION

OVERLOAD HAZARD

Only use the hooks on the Mobile Workstand to hold or organize cables.

CAUTION

UNINTENTIONAL PACING

To avoid unintentional cardiac stimulation, ensure the stim configuration has been set correctly before attempting to pace.

CAUTION

UNINTENTIONAL PACING

If catheters are placed too close together, unintentional pacing may occur.

CAUTION

UNINTENDED MOTION

Ensure the wheels on the Mobile Workstand are locked before using the Mac-Lab or CardioLab application.

1.2.4 Serious incident reporting

Report any serious incidents related to the operation of this product to the manufacturer and the health authority or competent authority where the product is installed.

To report to GE HealthCare, contact your local service representative or email

in-box.complaints@gehealthcare.com. Include the following information.

- The catalog number or the model identifier of the product as it shows on the identification plate attached to the product.
- The system ID, serial number, or lot number of the product.
- The date of the incident.
- A description of the incident, including any patient or user impact or injury.
- Your contact information, including the facility, address, contact name, title, and phone number.

1.2.5 Responsibility of the manufacturer

GE HealthCare is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications or repairs are carried out by persons authorized by GE HealthCare.

- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

1.2.6 Responsibility of the user

Keep this manual with the equipment at all times. Periodically review this manual for information regarding system operation. If further assistance is required, contact GE HealthCare.

Any serious incident related to the use of the device should be reported to the manufacturer and the health authority/competent authority where the device is installed.

1.2.6.1 Anti-virus software

WARNING

ANTI-VIRUS SOFTWARE INSTALLATION

The System is delivered with the Microsoft Defender anti-virus application active to ensure some level of protection during system setup. Customers may choose to leave this software active or replace it with a product of their choosing. Lack of virus protection could lead to system instability or failure.

WARNING

SYSTEM INSTABILITY

Do not install or use anti-virus software that does not meet the requirements mentioned in the ICAR security website. Doing so may result in system instability or failure.

The following should be noted regarding the use of anti-virus software. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for further information.

- It is the customer’s responsibility to acquire, install, and maintain anti-virus software.
- The customer is responsible for updating anti-virus definition files.
- If a virus is found, contact the facility system administrator and GE HealthCare technical support.
- GE HealthCare provides installation instructions for some reference anti-virus software packages, but the customer is not limited to these packages. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.
- Check with the vendor for any special instructions or prerequisites for operating system versions installed on the Mac-Lab/CardioLab client systems.
- Use a language version of the anti-virus software that matches the operating system language if possible. If there is no anti-virus software that matches the operating system language, install the English version of the anti-virus software.

1.2.6.2 Product vulnerability and security patches

Customers are responsible to stay informed on the Mac-Lab/CardioLab product vulnerability status and the installation of validated security patches for the Mac-Lab/CardioLab systems. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for further information.

1.2.6.3 Preventative maintenance

WARNING

EQUIPMENT FAILURE

Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

It is the responsibility of the user to properly maintain the system equipment. See Chapter 18 Planned Maintenance and Troubleshooting on page 223 and refer to Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN) for further information.

Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Regular maintenance, irrespective of usage, is essential to ensure that the Mac-Lab/CardioLab system is always functional when required. In the event that service is needed for the equipment, contact your GE HealthCare service representative.

1.2.6.4 Product life

Based on general maintenance needs, a lifetime of seven (7) years for the product may be expected. Regular inspection by authorized personnel, according to planned maintenance procedures, is recommended to maintain the safety and performance of the system. The lifetime of the system may be impacted by obsolescence (software or hardware) that is beyond GE HealthCare's control.

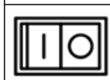
1.2.6.5 Service

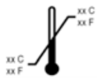
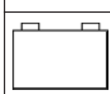
Refer equipment servicing to GE HealthCare authorized service personnel only. Any unauthorized attempt to repair equipment under warranty voids that warranty.

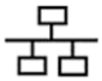
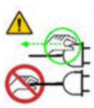
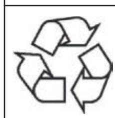
It is the user's responsibility to report the need for service to GE HealthCare or to one of their authorized agents.

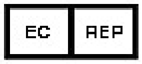
1.2.7 Equipment symbols

Equipment symbol	Description
Rx Only	Caution: United States federal law restricts this device to sale by or on the order of a licensed healthcare practitioner.
	Underwriters Laboratories, Inc. Medical – general medical equipment as to electrical shock, fire and mechanical hazards only in accordance with AAMI ES60601-1 (2005) + AMD 1 (2012), AAMI ES60601-1:2005/(R)2012 and A1:2012/(R)2012 and A2:2021, CAN/CSA-C22.2 No. 60601-1:14, CAN/CSA-C22.2 No. 60601-1:14 (Reaffirmed 2022), IEC 60601-1-6:2010 + A1:2013, and IEC 60601-1-6:2010 + A1:2013 + A2:2020.

Equipment symbol	Description
	**WEEE** Indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of equipment.
 Pb/Cd/Hg	**WEEE** The separate collection symbol is affixed to a battery, or its packaging, to advise you that the battery must be recycled or disposed of in accordance with local or country laws. The letters below the separate collection symbol indicate whether certain elements (Pb=Lead, Cd=Cadmium, Hg=Mercury) are contained in the battery. To minimize potential effects on the environment and human health, it is important that all devices with batteries are properly recycled or disposed. Information on the potential effects on the environment and human health of the substances used in batteries is available at this url: http://www.gehealthcare.com/euen/weee-recycling/index.html
	**Fuse**
	**Equipotential Ground Point** A nonessential electrical connection which may be used to connect the chassis to other equipment to achieve the same potential.
	**Standby**
	**Mains power switch.** **I** is on. **O** is off.
	**Type CF Equipment that is Defibrillator Proof** Type CF Applied Part: Isolated (floating) applied part suitable for intentional external and internal application to the patient excluding direct cardiac application. The "paddles" outside the box indicate that the part is defibrillator proof. (Medical Standard Definition:) F-Type applied part (floating/isolated) complying with the specified requirements of IEC 60601-1/UL 2601-1/CSA 601.1 Medical Standards provide a higher degree of protection against electric shock than that provided by Type B applied parts.
	**Type BF Applied Part** Type BF (IEC 60601-1) protection against electric shock. Isolated (floating) applied part suitable for intentional external and internal application to the patient, excluding direct cardiac application.
	**Type BF Equipment that is Defibrillator Proof** Type BF Applied Part that is defibrillator proof: Isolated (floating) applied part suitable for intentional external and internal application to the patient excluding direct cardiac application. "Paddles outside the box indicate the applied part is defibrillator proof. (Medical Standard Definition:) F-Type applied part (floating/isolated) complying with the specified requirements of IEC 60601-1/UL 2601-1/CSA 601.1 Medical Standards provide a higher degree of protection against electric shock than that provided by Type B applied parts.

Equipment symbol	Description
	**Atmospheric Pressure Limits**
	**Temperature Limits**
	**Humidity Limits**
IPX1	**Protected against potentially harmful effects of vertically falling water drops.**
	**Consult instructions for use or consult electronic instructions for use.**
	**Caution** **NOTE** Per IEC 60601-1, the description of this symbol is "Attention, consult ACCOMPANYING DOCUMENTS".
	**Mandatory Action: Follow Instructions For Use** Read and understand the operator's manual before using the device or product. As a mandatory action sign, this symbol is identified by a blue background and white symbol.
	**Warning** General warning sign. This symbol is identified by a yellow background, black triangular band, and a black symbol.
	**Input Symbol**
	Identifies the device manufacturer and date of manufacture, if indicated.
	Date of manufacture.
REF	Identifies the product's catalog, or orderable part, number.
SN	Identifies the unit's serial number.
UDI	Unique Device Identifier
	**Battery**

Equipment symbol	Description
	**Communication**
	**ePort Connection**
	**Power**
	**Network Connection/Interface**
	**Serial Connection/Interface**
	**USB Connection Interface**
	**WARNING: SHOCK HAZARD** Remove power cord from the mains source by grasping the plug. Do not pull on the cable. This may cause cable damage, which could result in loss of protective earthing or exposure to mains voltage.
	**Zero All**
	**Recyclable Lithium-Ion**
	**Recycled materials or may be recycled**
	**Indicates Safe Working Load for the Mobile Workstand**
	**CE Marking** Compliance with applicable EU (European Union) directives.
	**Indicates the authorized representative in Switzerland**
	**Medical Device** Indicates the item is a medical device.

Equipment symbol	Description
	**Authorized Representative in European Community**

1.2.8 Controls, connectors, and indicators

Refer to the original equipment manufacturer manuals which shipped with the system for an explanation of the equipment controls, connectors, and indicators not described in this manual.

Chapter 2 Getting Started

This chapter describes the procedures to follow to ensure that the system is properly configured before you turn it on. This chapter also describes system sign in and sign out procedures, how to turn on the acquisition system and the review workstation, and how to use removable media.

2.1 Inspection

Do the following inspections before you use the equipment:

- Verify that all equipment (including accessories, cables, cords, and input devices) is undamaged and correctly located.
- Verify that all cords and cables are properly connected and tight.
- Verify that mounted equipment (such as remote monitors or PDM) is installed correctly and secure.
- Verify that all cords, socketed components, and connectors are securely seated.
- Verify that the keyboard, mouse, and any other input devices are functional.

If signs of equipment damage or degradation are present, contact GE HealthCare to determine if equipment is safe for use or if a replacement is needed.

2.2 Turn on the acquisition system

1. Ensure the isolation transformer is turned on as indicated by the power button being in the up position. If the isolation transformer is not turned on, put the power button in the up position.
2. Ensure the UPS is powered on, as indicated by the green LED on the front of the UPS. If the UPS is not powered on, push and hold the power button until the green LED is lit and the audible tone stops.
3. Ensure the acquisition system is turned on as indicated by the white LED on the front of the acquisition system. If the acquisition system is not turned on, push the power button on the front of the computer until the LED illuminates.

   NOTE
   The acquisition system should remain turned on at all times to ensure that the scheduled database maintenance can run during off-peak hours. A database maintenance job runs on acquisition systems for better performance and to check for consistency and integrity errors in the databases. In a network environment, the acquisition systems must be turned on for studies to periodically move from the acquisition systems to the server.

4. Ensure the peripheral devices (printer, ablation device, cardiac stimulator, PDM Base Station Plus, or PDM Slim Connect) are turned on as indicated by their power LEDs. If the peripherial devices are not turned on, refer to the device-specific manuals for instructions to do so.

   NOTE
   Refer to 3.2.6 CardioLab amplifier on page 53 for information about turning on the amplifier .

2.3 Turn on the review workstation

1. Ensure the isolation transformer is turned on as indicated by the power button being in the up position. If the isolation transformer is not turned on, put the power button in the up position.
2. Ensure the review workstation computer is turned on as indicated by the power LED being illuminated. If the review workstation computer is not turned on, push the power button on the front of the computer.
3. Ensure the monitor is turned on as indicated by the power LED being illuminated. If the monitor is not turned on, push the power button on the front of the monitor.

   NOTE
   The review system should remain turned on at all times to ensure that the scheduled database maintenance can run during off-peak hours. A database maintenance job runs on review systems for better performance and to check for consistency and integrity errors in the databases.

4. Ensure the CARESCAPE, Dash, or Solar monitor (pre/post-workstations only) is turned on as indicated by the CARESCAPE, Dash, or Solar monitor power LED. Refer to the CARESCAPE, Dash, or Solar manual for more detailed information.

   NOTE
   The CARESCAPE, Dash, and Solar monitors must only be connected to pre/post-workstations. Do not connect a CARESCAPE, Dash, or Solar monitor to an acquisition, nurse's, or remote workstation.

5. Ensure that any peripheral devices (e.g., printer) are turned on. Refer to the device-specific manuals for instructions, if necessary.

2.4 System sign in and sign out

2.4.1 Users

The site network administrator classifies all system operators as either a user or an administrator.

Contact the site network administrator for a detailed explanation of the responsibilities associated with each user function, as well as your assigned classification.

2.4.2 Normal sign in

Sign in to the system with either a personal account or with a shared account. All accounts are created and managed by your site network administrator. Shared account passwords may change. If you cannot sign in to the system, contact your site network administrator.

1. Push the power button on the front of the computer.

   The Windows 10 sign in screen appears.

2. Select a user profile name.
3. If the **Sign in to** domain specification is present, select the appropriate domain name per the site network administrator.

4. Enter the user profile password and push **Enter**.

   NOTE
   To change a password, contact the site network administrator for help.

5. Double-click the **Mac-Lab CardioLab** desktop icon.

2.4.3 Windows scaling level warning message

If the system displays a warning message that says you need to change the Windows scaling level, do this task.

1. Close the Mac-Lab/CardioLab application.
2. Right-click the desktop and select **Display settings**.
3. Under **Scale and Layout**, select **125%** for **Change the size of text, apps, and other items**.
4. Repeat step 3 for the remaining displays.
5. Select the **Apply** button, if it is enabled.
6. On the Windows taskbar, select the **Start** icon, and then select the **User Profile** icon.
7. Select **Sign out**.
8. Sign in to Windows.

2.4.4 Emergency access

Contact the site network administrator for your facility's policy on accessing the system in an emergency situation when normal sign on is not available.

2.4.5 Screen saver

A screen saver may be enabled on review workstations.

NOTE
Do not enable the screen saver on acquisition systems. The screen saver could appear during a procedure.

2.4.6 Change accounts

Make sure to close the Mac-Lab/CardioLab application completely before you change accounts.

1. If you are in an open study, select **Study** > **Close Study**.
2. On the *Study Navigator* window, select **Study** > **Exit**.
3. On the Windows taskbar, click the **Start** icon, and then click the **User Profile** icon.

   The user profile menu appears.

4. Select a different user profile name.

   The Windows 10 sign in screen appears with the new user profile name.

5. If the **Sign in to** domain specification is present, select the appropriate domain name per the site network administrator's instructions.
6. Enter the password for the user profile and press **Enter**.

2.4.7 Logoff, restart, shutdown

The following is recommended:

- At the end of the day, sign out. Leave the system at the Windows 10 sign in screen.
- Restart the system at least once a week.
- Do not completely shut down the system unless either cleaning or maintenance is necessary.
- The system must be turned on so that antivirus software and scheduled tasks may run, such as database maintenance.
- Do not use the keyboard command **Ctrl**+**Action**+**Delete** when in a study. This command may cause system anomalies. This command also creates confusion over which user profile initially signed on.

1. Select **Study** > **Exit** at the *Navigator* window to close the application.
2. Select **Start** > **Power** > **Shut Down** or **Restart**, if applicable.
   - For shutdown: The system completely shuts down. Turn off any other associated equipment.
   - For restart: The system restarts and returns to the Windows 10 sign in screen.
3. If shutting down, turn off the isolation transformer and any other associated equipment.

2.5 Removable media

Patient data is saved on the acquisition system or network on a protected hard drive. Additionally, an offline copy may be automatically created on study close. In network systems this additional copy is optional. To change the configuration, see 19.1.1 File paths on page 265 for details.

2.5.1 About the SD card drive

A SD card drive may be used to back up studies or to transfer studies from one system to another. The required media for the SD card drive is an SDHC card with capacity of at least 16 GB, and speed of at least Class 6 (Class 10 and higher is also acceptable). GE HealthCare recommends using media formatted as Extended File Allocation Table (exFAT) to support large signal data files.

- The SD card slot is located on the front of the system and under the power button.
- The text **SD** is printed under the SD card slot.
- The SD drive designation is **E:**.

2.5.2 Safely remove the SD card

1. On the desktop, double-click **This PC**.
2. Right-click **E: drive** and select **Eject**.
3. After the system displays the message that the hardware can be safely removed, remove the SD card from the drive.

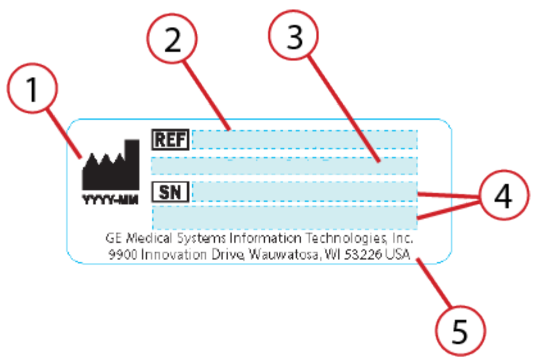
Chapter 3 Equipment Overview

This chapter describes serial number identification, equipment for both acquisition systems and review workstations, types of review workstations, supported peripheral devices, and additional equipment compatible with the CardioLab system.

3.1 Serial number identification

Every system has a unique serial number for identification. The serial number appears on the product labels, which are located (while facing the product) as follows:

- Acquisition computer — on the top
- Review workstation — on the top
- PDM — on the bottom
- PDM Base Station Plus or PDM Slim Connect — on the back
- CardioLab amplifier — on the back
- CO_2 module — on the right side



Item	Name	Description
1	Manufacture date	Date of manufacture in YYYY-MM format.
2	Part number of product	GE HealthCare part number for product.
3	Product code description	Identifier for type of product.
4	Serial number and barcode	Unique serial number for identification. Encoded as a barcode below the displayed number.
5	Manufacturer information	Name and address of device manufacturer.

3.2 Acquisition system

3.2.1 Control room components

Acquisition computer

The acquisition computer provides the ability to record the patient's real time waveform data. It uses the Microsoft Windows operating system and has the following drives:

- DVD drive: used for installation and service of the computer.
- SD drive: used to store backup copies of patient procedure data.

The required media for the SD card drive is an SDHC or SDXC card with capacity of at least 16GB, and speed of at least Class 6 (Class 10 and higher is also acceptable).

Cardiac Stimulator (optional)

Provides direct cardiac stimulation to assist the physician during a CardioLab case.

CARTO® 3 System (optional)

Provides 3D electroanatomical cardiac maps to the CardioLab.

Desk (optional)

Provides a workspace for control room components.

HD Hub

A small enclosure that houses the required components for HD video (three HD video distribution amplifiers and one HD switcher). The HD Hub distributes video and communication signals to the control and procedure rooms.

Isolation transformer

Provides isolated power for components.

Monitors

For Mac-Lab systems, two monitors are standard to display *Real-Time* and *Review* windows. For CardioLab and ComboLab™ systems, an optional third monitor displays images acquired from the X-ray and ultrasound systems or can be used as a workspace integrator display.

Printer (optional)

Used to print snapshots, images, and reports after a procedure.

NOTE
Connect the printer only to the hospital network, not to the acquisition computer.

Uninterruptible power supply (UPS)

The UPS provides emergency power to the acquisition computer in the event of a power outage. It will sustain power to the computer for a minimum of 20 seconds. When the UPS battery is low, it will beep. If this happens, do not attempt to replace the battery. Contact a GE HealthCare representative.

NOTE
The UPS provides uninterrupted power to the acquisition computer. Only the first monitor will be powered during a power outage.

NOTE
When loss of power occurs, close the study, exit the Mac-Lab/CardioLab software, and shut down the acquisition computer. When power is restored, turn on the acquisition computer, start the Mac-Lab/CardioLab software, and continue the study (see 5.5.1.4 Continue existing study on page 79). See 18.6.16 Force restart the app on page 263.

Video splitter

Used to split the video signal from the *Real-Time*, *Review*, or *Image* monitors for display on additional monitors.

Video switch

Used to provide one switched video output to a remote monitor.

Wired barcode scanner (optional)

Used to scan in supplies and medication used in a procedure.

Wireless barcode scanner (optional)

Used to scan in supplies and medication used in a procedure.

The wireless barcode scanner must be in proximity of the acquisition computer and/or the barcode scanner base to scan items into the procedure. It is recommended to place the barcode scanner back in the cradle when not in use to ensure that the wireless barcode scanner is charged. The wireless barcode scanner used with the Mac-Lab/CardioLab system includes a label to ensure that the proper scanner is used in the event that there are multiple wireless barcode scanning devices in the lab environment.

3.2.2 Procedure room components

Ablation device (optional)

A physician- or technician-controlled device. An RF ablation device burns heart tissue, and a cryoablation device freezes tissue.

Analog IO box (optional)

Distributes ECG, intracardiac, or blood pressure signals from the amplifier to other equipment and provides 4 analog input ports.

Catheter input modules

Used for connecting intracardiac catheters to the CardioLab amplifier .

CardioLab amplifier

The amplifier gathers intracardiac, surface ECG, and blood pressure data for both the ComboLab and CardioLab systems.

CARTO® 3 System Patient Interface Unit (PIU) (optional)

The CARTO® PIU gathers data for the CARTO® 3 System .

CO_2 module (optional)

The CO_2 module acquires the patient's respiration data for the system. The CO_2 module is powered by the PDM Base Station Plus or PDM Slim Connect.

Large display monitor (LDM) (optional)

The LDM is a large widescreen flat-panel LCD monitor used for simultaneous display of several image sources, including the acquisition system.

Monitors

One remote monitor is standard. Switched video is optional between the *Real-Time* and *Review* windows. A second monitor is also optional.

PDM

The PDM acquires patient data such as respiration rate, non-invasive blood pressure, SpO_2 and temperature for the CardioLab system. The PDM is powered by the PDM Base Station Plus or PDM Slim Connect unit.

PDM Base Station Plus or PDM Slim Connect

Provides power and communication to the PDM and CO_2 modules.

Remote operators terminal (RMOT) (optional)

The RMOT consists of three monitors, a keyboard and a mouse remotely connected to the acquisition system to provide remote control of the acquisition computer from the procedure room.

Remote speakers

Provide output for ECG QRS tone and optional audible indicators in the procedure room.

RF filter box (CardioLab II Plus Amplifier only)

Filters RF noise from intracardiac signals acquired by an ablation device .

3.2.3 Patient data module (PDM)

The PDM, along with the CardioLab amplifier, is used to collect patient data for the CardioLab system. It receives power from the PDM Base Station Plus or PDM Slim Connect unit and is placed in the procedure room near the patient table. The PDM rests in a dock that can be mounted to a bed rail, a pole, or a stand that also holds the PDM Base Station Plus or PDM Slim Connect.

NOTE
The PDM cath amplifier can be used for acquiring waveform and vitals data during a procedure with a CardioLab system.

The CardioLab amplifier acquires the following data:

- ECG (12 lead)
- Invasive blood pressure
- Intracardiacs (IC)
- Heart rate

PDM has the following patient data input features:

- Respiration rate (requires ECG lead II to be connected from the PDM): green connector
- Temperature: brown connector
- Pulse oximetry (SpO_2): blue connector
- Non-invasive blood pressure (NIBP): black connector

NOTE
The red connectors and the white connector, used for invasive blood pressure and analog output respectively, are used on Mac-Lab systems only.

NOTE
The PDM waveform defibrillation recovery time is 10 seconds.

NOTE
The temperature input allows for thermodilution cardiac output (TDCO) display on Mac-Lab systems only.

When using PDM with the PDM Base Station Plus or PDM Slim Connect, an optional CO_2 module can acquire end-tidal CO_2 data.

See I.1 PDM Battery on page 325 for information about the PDM battery. Refer to the Mac-Lab/CardioLab/ComboLab™/SpecialsLab Accessories Supplement (PN 2102845-001) for a list of accessories approved for use with the PDM.

3.2.4 PDM Base Station Plus or PDM Slim Connect

The PDM Base Station Plus or PDM Slim Connect powers and communicates with the PDM and CO_2 module. The PDM and PDM Base Station Plus or PDM Slim Connect are located in the procedure room near the procedure table.

Figure 3-1 PDM Base Station Plus (front)

Item	Description
1	For future use
2	To CO_2 module

Figure 3-2 PDM Slim Connect (front)

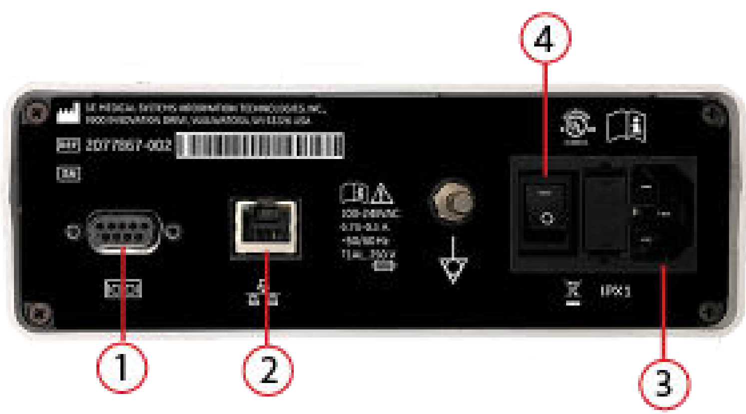
Item	Description
1	To CO_2 module

A green power light indicates the PDM Base Station Plus or PDM Slim Connect is attached to AC power and is turned on.

Figure 3-3 PDM Base Station Plus (rear)

Item	Description
1	To PDM
2	To acquisition system workstation
3	For future use
4	AC power 100-240VAC 50/60Hz
5	On/Off power switch

Figure 3-4 PDM Slim Connect (rear)



Item	Description
1	To PDM
2	To acquisition system workstation
3	AC power 100-240VAC 50/60Hz
4	On/Off power switch

3.2.5 PDM and PDM Base Station Plus or PDM Slim Connect mounting options

You can position the PDM and the PDM Base Station Plus or PDM Slim Connect in several ways:

PDM Base Station Plus or PDM Slim Connect	• In the floor stand, with or without the PDM • Mounted to the bedrail • On the floor, on the provided feet (connected to the PDM with a longer cable)
PDM	• In the floor stand, with or without the PDM Base Station Plus or PDM Slim Connect • Mounted to the bedrail • Mounted to the pole

Figure 3-5 PDM Slim Connect and PDM in floor stand

Figure 3-6 PDM Slim Connect on bedrail

NOTE

- Ensure the knob is fully tightened when you clamp the PDM to bedrails or poles.
- The distance between the PDM Base Station Plus or PDM Slim Connect and the PDM is greater than the distance of the other mounting configurations. Use a cable of the appropriate length.

Figure 3-7 PDM dock on pole

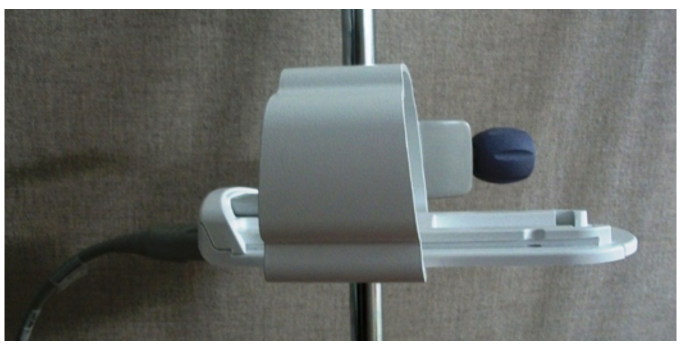


Figure 3-8 PDM dock and PDM on pole

Figure 3-9 PDM dock and PDM on bedrail

WARNING

TRIPPING HAZARD

Keep cables away from accessible walkways. Failure to do so may present a tripping hazard and could result in cable damage.

WARNING

SHOCK HAZARD

To reduce the risk of ingress of water into the equipment, do not mount the PDM in a vertical position with the patient cables facing up or down.

WARNING

SHOCK HAZARD

To reduce the risk of ingress of water into the equipment, do not mount the PDM Slim Connect or PDM Base Station Plus in a vertical position with the patient cables facing up or down.

CAUTION

FALLING EQUIPMENT

Do not place the PDM more than 147 cm (58 in) from the floor when mounting on an IV pole with a base less than 58 cm (23 in) in diameter. This may cause the IV pole to tip over.

3.2.6 CardioLab amplifier

The CardioLab amplifier collects and amplifies electrophysiological and invasive blood pressure data for the CardioLab system. It also routes pacing energy from the stimulator to the patient.

This section describes the hardware aspects of the amplifier. For amplifier configuration instructions, see Chapter 7 Study Configuration on page 113. For amplifier use with CARTO®, see Chapter 16 CARTO® 3 System Interface on page 207.

3.2.6.1 Amplifier features

The CardioLab amplifier has the following data input features:

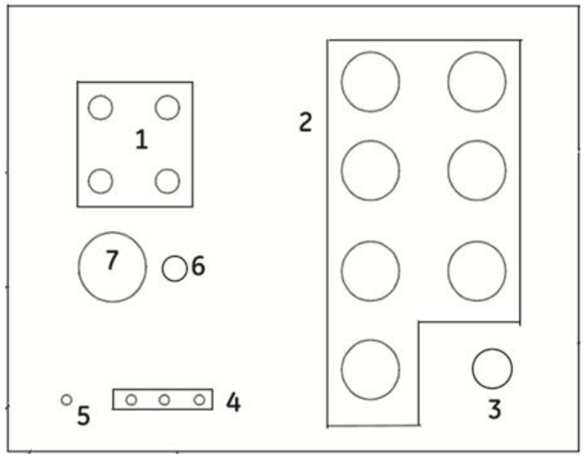
- **Intracardiac ECG:** Intracardiac signals are acquired through catheters connected to the catheter input modules (CIM), allowing for bipolar or unipolar signal recording.
- **Surface ECG:** The amplifier accepts 10 lead ECG inputs (4 limb leads and 6 chest leads). The system allows the user to display 12 lead ECG signals: aVR, aVL, aVF, I, II, III, V1, V2, V3, V4, V5, and V6.
- **Invasive blood pressure:** The amplifier accepts up to four invasive blood pressure signals.
- **Auxiliary:** The amplifier allows for connection of an additional catheter input via the auxiliary connection. This catheter input is not routed through the CIM. It is used to provide an additional ground reference option for unipolar measurement configurations.
- **Stimulator:** The amplifier can be connected to a stimulator to display pacing signals and route pacing energy to the patient through catheters that are connected to the CIM. A maximum of four stimulus inputs are accepted. The stimulus is directed to the desired catheter poles using the CardioLab software.
  Each CIM also contains direct stimulator connection inputs, which provide direct connections between the patient and the stimulator. These inputs should be used in the event of CardioLab system failure to allow pacing to occur.
- **Ablation:** The amplifier can be connected to an ablation device to display intracardiac signals recorded by the ablation device catheters.

NOTE
The amplifier waveform defibrillation recovery time is five seconds.

The CardioLab II Plus Amplifier is available in 64 and 128 channel configurations. The Prucka™ 3 Amplifier is available in 128 channel configuration. These configurations differ in the number of configurable catheter channels and the number of available intracardiac ECG catheter input poles. The following table summarizes the data input abilities of each amplifier option.

	Prucka™ 3 Amplifier 128	CardioLab II Plus Amplifier 128	CardioLab II Plus Amplifier 64
Total recording channels	128	128	64
Catheter channels	112	112	48
Intracardiac ECG inputs	224	224	96
Stimulator input	4	4	4
Auxiliary input	1	1	1
ECG Input Channels	12 Lead	12 Lead	12 Lead
Pressure Input Channels	4	4	4

3.2.6.2 Amplifier equipment

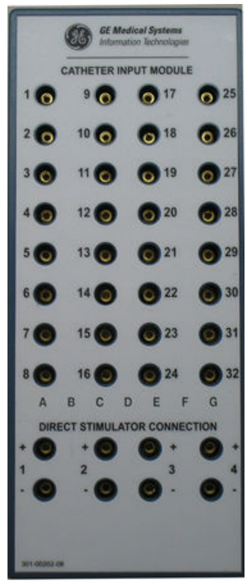


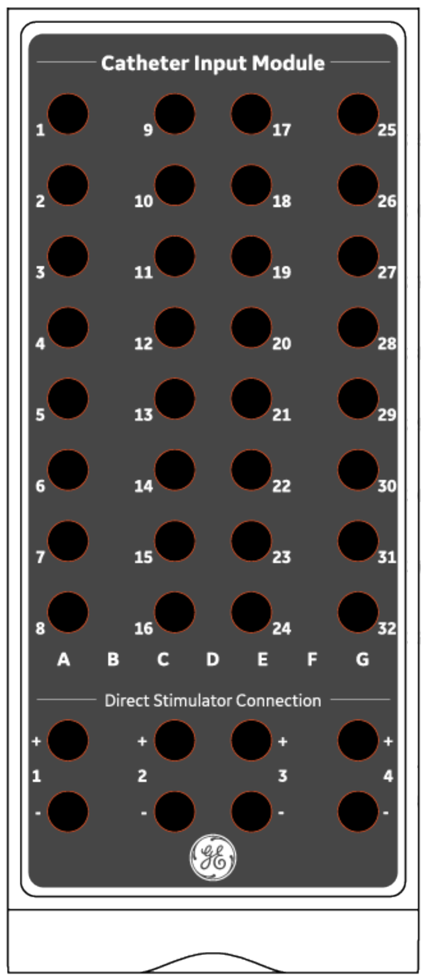
NOTE
The image shown is the 128 channel amplifier. Amplifiers with fewer channels will have fewer intracardiac ECG input connections.

Item	Amplifier component	Description
1	Invasive blood pressure inputs	Connection for pressure input cable and pressure transducer. **IMPORTANT** Pressure transducers must be 5uV/V/mmHg sensitivity.
2	Intracardiac ECG input	Connections for catheter input modules and catheters.
3	Auxiliary input	Connection for auxiliary input cable and catheter.
4	Communication indicators	For service and troubleshooting use.
5	Power indicator	A green light indicates that the amplifier is receiving power.
6	Stimulation input	Connection for stimulator input cable.
7	ECG input	Connection for ECG input cable and ECG leadwires

3.2.6.3 Catheter input modules

Catheter input modules (CIMs) connect patient catheters and ablation catheter data cables to the amplifier. Each CIM supports 32 inputs and four direct stimulator connection channels. Input poles are labeled on the CIMs and used for reference when configuring a study in the software.





The location of the CIM connection to the amplifier is identified with a letter, A through G. The appropriate letter illuminates on the CIM when it is connected to the amplifier.

NOTE
The system will display noise on channels displaying unused catheter inputs.

3.2.6.4 Accessory parts list

Refer to the Mac-Lab/CardioLab/ComboLab™/SpecialsLab Accessories Supplement (PN 2102845-001) for ECG and invasive blood pressure accessories used with the CardioLab amplifier.

Table 3-1 Accessories for use with the Prucka™ 3 Amplifier

Input type	Accessories
Intracardiac ECG	Catheter Input Module, 5875572
	Auxiliary Input Cable, 301-00205-08
Surface ECG	CLAB ECG TRUNK CABLE, 12 LEAD, AHA 3.0M/10FT, 2744200-001
Stimulator	CABLE STIM INPT TCHPRF 3FT CLABII+ , 301-00204-03
	CABLE STIM INPT TCHPRF 15FT CLABII+, 301-00204-15
	CABLE STIM INPT TCHPRF 30FT CLABII+, 301-00204-30
Ablation Recording	Stim Extender Cable - 3 ft, 2083472-001

Table 3-2 Accessories for use with the CardioLab II Plus Amplifier

Input type	Accessories
Intracardiac ECG	Catheter Input Module, 301-00202-08
	Auxiliary Input Cable, 301-00205-08
Surface ECG	CABLE , ECG, 10LEAD, SHIELDED 10FT, 2003419-001 CABLE, ECG, 10LEAD, SHIELDED 15FT, 2003420-001
Stimulator	CABLE STIM INPT TCHPRF 3FT CLABII+ , 301-00204-03
	CABLE STIM INPT TCHPRF 15FT CLABII+, 301-00204-15
	CABLE STIM INPT TCHPRF 30FT CLABII+, 301-00204-30
Ablation Recording	Stim Extender Cable - 3 ft, 2083472-001

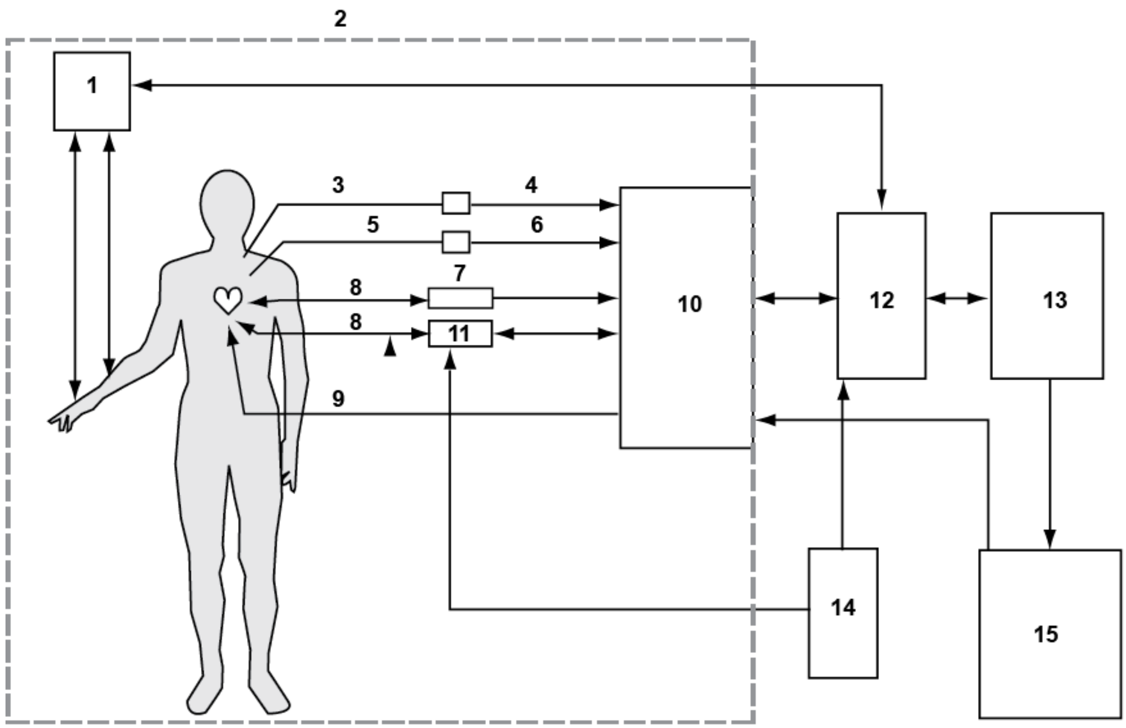
IBP are accessories not sold by GE HealthCare. Transducers are 5uV/V/mmHg.

WARNING

SHOCK HAZARD

Defibrillator protection is only guaranteed when approved accessories are used. Do not use unspecified accessories.

3.2.6.5 CardioLab amplifier diagram



1	PDM	9	Auxiliary input cable
2	Isolated	10	CardioLab amplifier
3	ECG leads	11	RF interface module
4	12 lead cable	12	Acquisition system
5	Pressure transducer	13	Analog IO box
6	Pressure cable	14	Ablation device
7	Catheter input modules	15	Stimulator
8	Catheters		

3.2.6.6 Data acquisition

Sample rates

The amplifier can acquire data at sample rates of 1,000, 2,000, or 4,000 Hz. A higher sample rate gives more detailed signals but decreases the number of recording intracardiac channels. If sample rates above 1,000 Hz are selected, the available input poles will be limited. Check configuration settings before connecting catheters to the CIMs.

Samples per second	Total number of available channels		
	Prucka™ 3 Amplifier 128	CardioLab II Plus Amplifier 128	CardioLab II Plus Amplifier 64
1,000	128	128	64
2,000	64	64	64

Samples per second	Total number of available channels		
	Prucka™ 3 Amplifier 128	CardioLab II Plus Amplifier 128	CardioLab II Plus Amplifier 64
4,000	32	32	32

Filters

You can filter data that the amplifier acquires with one of the following three filters: high pass, low pass, or power line.

Table 3-3 Filters

Filter name	Description	Typical ECG setting
High pass	Removes signals that are below the filter setting.	0.05 Hz
Low pass	Removes signals that exceed the filter setting.	100 Hz
Power line	Removes signals that have 50- or 60-cycle frequency when configured to **Fixed**. The default value for this filter is **on** for all ECG signals. **NOTE** • For the CardioLab II Plus Amplifier: In the select amp utility, a software notch filter also exists for ECG channels. When enabled, this filter applies either a 50 Hz or 60 Hz adaptive power line filter to all ECG channels. • For the Prucka™ 3 Amplifier: The adaptive filter is selectable for each ECG channel in the *Study Configuration* window. When selected, this filter applies either a 50 Hz or 60 Hz adaptive power line filter to the selected ECG channel.	N/A

Filter settings are chosen based on signal type and display preference, and they can help with noise issues. Settings and configurations are described in 6.3.3 Changing channel properties on page 98.

Gain

Each intracardiac ECG and ECG channel measurement has a configurable gain setting. The standard gain is 2,500. Gain in each signal ranges from 500 to 10,000. Changing the gain will increase or decrease signal sensitivity. Settings and configurations are described in 6.3.3 Changing channel properties on page 98.

3.3 Review workstations

CardioLab software runs on hardware provided by GE HealthCare (GE HealthCare Client Workstation).

3.3.1 Nurse's workstation components

The nurse's workstation is a system used in the procedure room during a study.

Isolation transformer

Provides isolated power for components.

Monitor

Used to display the *Review* window. One monitor is standard.

Wired barcode scanner (optional)

Used to scan in supplies and medication used in a procedure.

Wireless barcode scanner (optional)

Used to scan in supplies and medication used in a procedure.

The wireless barcode scanner must be in proximity of the acquisition computer and/or the barcode scanner base to scan items into the procedure. It is recommended to place the barcode scanner back in the cradle when not in use to ensure that the wireless barcode scanner is charged. The wireless barcode scanner used with the Mac-Lab/CardioLab system includes a label to ensure that the proper scanner is used in the event that there are multiple wireless barcode scanning devices in the lab environment.

Workstation desk (optional)

Provides storage and workspace for nurse's workstation components.

3.3.2 Remote review workstation components

The remote review workstation is a system installed in the physician's office or an area outside the laboratory.

GE HealthCare client workstation

Used to review previously acquired procedure data and generate reports.

Isolation transformer

Provides isolated power for components.

Monitor

Used to display the *Review* window. One monitor is standard.

3.3.3 Pre/post-review workstation components

The pre/post-review workstation is a review workstation typically located in a holding area for the entry of basic patient demographics, clinical data, and patient events prior to, or after, the patient's entry into the laboratory.

CARESCAPE/Dash/Solar Monitor:

Connected to the pre/post-review workstation to acquire patient vitals during pre- or post-procedure recording.

GE HealthCare client workstation

Used before and after the procedure to record patient information.

Isolation transformer

Provides isolated power for components.

Mobile workstand (optional)

Provides portable support for pre/post-review workstation components.

Monitor

Used to display the *Review* window. One monitor is standard.

Wired barcode scanner (optional)

Used to scan in supplies and medication used in a procedure.

Wireless barcode scanner (optional)

Used to scan in supplies and medication used in a procedure.

The wireless barcode scanner must be in proximity of the acquisition computer and/or the barcode scanner base to scan items into the procedure. It is recommended to place the barcode scanner back in the cradle when not in use to ensure that the wireless barcode scanner is charged. The wireless barcode scanner used with the Mac-Lab/CardioLab system includes a label to ensure that the proper scanner is used in the event that there are multiple wireless barcode scanning devices in the lab environment.

3.4 Supported peripheral devices

The following peripheral devices are supported for use on the CardioLab system:

- **CARESCAPE:** B650 and B450
- **Dash:** 3000/4000/5000
- **Solar:** 8000i and 8000M connected with a PDM

NOTE
The CARESCAPE, Dash, and Solar monitors must only be connected to pre/post-review workstations. Do not connect a CARESCAPE, Dash, or Solar monitor to an acquisition, nurse's, or remote workstation.

- **PDM:**
    - PDM MASIMO SPO2
    - PDM NELLCOR SPO2
    - For a list of compatible PDM firmware, refer to the software compatibility matrix on the Security Portal for Mac-Lab/CardioLab: https://securityupdate.gehealthcare.com/

    NOTE
    Accessing the Mac-Lab/CardioLab/INW specific information on the security portal requires registering to the portal and navigating to the appropriate product in the portal.
- **Ablation:** See 3.4.1 Ablation devices on page 63.
- **Cardiac Stimulator:** MicroPace EPS 320, Bloom, Bloom 2 Stimulator, and Biotronik Qubic Stim
- **Mapping System:** CARTO® 3 System
- **X-ray systems:** Refer to the product's DICOM conformance statement on the following GE HealthCare website: http://www3.gehealthcare.com/en/Products/Interoperability/DICOM/Cardiovascular_Info_Systems_DICOM_Conformance_Statements

WARNING

This system is designed to comply with the applicable IEC/EN 60601-1 series safety standards when connected and powered as specified. Connecting additional devices, parts, or accessories that are not recommended by GE HealthCare could lead to a reduced level of safety. Before connecting supported interfaced devices to the system, ensure that the devices and system configuration meet the requirements of the applicable IEC 60601 series safety standards. Refer to the Service Manual for equipment connection and service information. Contact GE HealthCare if questions arise.

WARNING

SHOCK HAZARD

Do not power unspecified devices from the system equipment outlets.

WARNING

SHOCK HAZARD

To ensure patient safety, all equipment connected to the system must be powered from an isolated power source.

WARNING

SHOCK HAZARD

Defibrillator protection is only guaranteed when approved accessories are used. Do not use unspecified accessories.

3.4.1 Ablation devices

The CardioLab system is compatible with the following ablation devices:

- Atakr II (Model: 4803) RF (Radio frequency) ablation device
- EPT-1000 (Model: 800T) RF ablation device
- Stockert RF ablation device
- SmartAblate
- IBI 1500 (Model T6 and T12) RF ablation device
- HAT 300S RF ablation device
- HAT 500 RF ablation device

  NOTE
  HAT 500 uses `Hat300s.dll`.

- CryoCath (Model: Gen3) cryoablation device
- JLLCABL-IT RF ablation device
- Maestro 3000

NOTE
Device availability varies by region. Consult with the GE HealthCare sales representative regarding a specific device.

3.4.1.1 Monitor mode

For ablation devices that support monitor mode where the ablation device sends ablation data while not actively ablating, the CardioLab system continuously displays temperature and impedance values sent by the device within the *Ablation* window. The waveforms do not update with these values and no events are logged in the *Log* window.

NOTE
Some devices require a button press to activate this monitor mode:

- IBI 1500T (software version: v1.25) RF ablation device
- CryoCath (model: Gen3) cryoablation device
- Maestro 3000

WARNING

This system is designed to comply with the applicable IEC/EN 60601-1 series safety standards when connected and powered as specified. Connecting additional devices, parts, or accessories that are not recommended by GE HealthCare could lead to a reduced level of safety. Before connecting supported interfaced devices to the system, ensure that the devices and system configuration meet the requirements of the applicable IEC 60601 series safety standards. Refer to the Service Manual for equipment connection and service information. Contact GE HealthCare if questions arise.

3.5 Mobile workstand

The following procedures are for basic height adjustments and transport of the mobile workstand. For detailed instructions about how to position and connect equipment on the mobile workstand, refer to the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN).

CAUTION

OVERLOAD HAZARD

The maximum load of the utility basket on the Mobile Workstand is not to exceed 5 lbs / 2.25kg.

CAUTION

OVERLOAD HAZARD

Only use the hooks on the Mobile Workstand to hold or organize cables.

3.5.1 Adjust the mobile workstand height

1. Push and hold the foot pedal and raise or lower the handle.
2. Release the foot pedal to lock the height in place.

3.5.2 Transport the mobile workstand

1. Ensure that the wheel locks are upright and move the mobile workstand to the desired location.
2. Press down on the wheel locks to lock the mobile workstand in position.

CAUTION

UNINTENDED MOTION

Ensure the wheels on the Mobile Workstand are locked before using the Mac-Lab or CardioLab application.

WARNING

TIPPING HAZARD

Do not attempt to transport the Mobile Workstand while the wheels are locked.

Chapter 4 Workflow

This chapter describes the tasks required to progress an active study in a networked CardioLab environment.

NOTE
In a networked system, GE HealthCare recommends leaving the **Track offline backups** check box unchecked on networked acquisition systems. Studies on networked acquisition systems are automatically transferred to the Centricity Cardiology INW server, where they are stored. Because studies may be edited from other systems on a Centricity Cardiology INW network, the Mac-Lab/CardioLab system cannot ensure that the study backup copy is current.

4.1 Multi-path documentation workflow

In the multi-path documentation workflow, you create each new study on the acquisition system in the procedure room where the study will be performed. When you use a pre/post-review workstation to create studies, select the host catalog (see Host catalog(s) on page 75) for the acquisition system in that procedure room. If you do not know in which room the procedure will occur, choose the most likely room. The study data automatically moves to the correct procedure room when it is needed if you choose the wrong room. This workflow allows review workstations to join or leave any study without needing to know where else that study may be open. For example, a pre/post-review workstation in the pre-procedure area can continue documentation for the study as the patient moves to the procedure room, closing the study only when all necessary documentation is complete.

NOTE
A single acquisition system can support simultaneous access for a maximum of five studies from multiple systems.

4.1.1 Pre-procedure area

1. Open the pre/post-review workstation *Navigator* window.
2. Choose the most likely room where the study will resume in the **Navigator Catalog** drop-down list. The study can move if the room changes.
3. Choose **New Study** (or **Continue Study** if the patient's study for the same procedure was started earlier in the **same** day and the patient is returning to complete the procedure).
4. Enter patient demographics, clinical data, and patient events. This information can include vitals data from an interfaced CARESCAPE, Dash, or Solar monitor.
5. Generate reports and print as desired.
6. Move the patient to the procedure room.

   NOTE
   It is **not** necessary to close the study when it is time to move the patient to the procedure room. Documentation can be completed while the case is continued in the procedure room.

7. Close the study when the pre-procedure case documentation is complete.

4.1.2 Procedure room

1. On the acquisition system, select the **System** view in the *Navigator* window, then highlight the patient's study. If you started the study on the pre/post-review workstation but it is not in the **System** view, switch to the **Network** view and select the study there.

   The study appears in the **Network** view if it is currently stored on another system.

2. Click **Continue Study**.

   From the **Network** view, the study automatically moves to the acquisition system for this procedure room if needed. This only happens if the study is not open on another system. An error message appears if the study is open on another system. Close the study on the other system and repeat this step. Except when the study must be moved using the **Network** view, you do not need to exit from the pre/post-review workstation prior to continuing or reviewing the study in the procedure room.

3. On the nurse's workstation in the procedure room, choose the study in the *Navigator* window and click **Review Study**.

   NOTE
   The nurse's workstation can open the study prior to the acquisition system. After you continue the study on the acquisition system, you can open it on multiple workstations without limit. This includes pre/post-review workstations, review workstations, and other acquisition systems.

   Use **Review Study** instead of **Continue Study** to open the study on an acquisition system other than the one in use.

4. Generate reports and print as desired.

5. When the case is complete, close the study. The order in which you close the study on the other systems (pre/post-review workstations, review workstations, or other acquisition systems) does not matter. However, the study cannot be copied or moved to the Centricity Cardiology INW server until all systems have closed it.

   NOTE
   If the patient does not go to a post-procedure area, the study will be transferred to the Centricity Cardiology INW server automatically shortly after close.

4.1.3 Post-procedure area

1. On the pre/post-review workstation, highlight the patient's study in the *Navigator* window. If the study is not shown in the *Navigator* window, switch to the **Network** view and select the study there.

2. With the patient's study highlighted, click **Continue Study**.

   NOTE
   If **Review Study** is used instead of **Continue Study**, the study will open but the application will not show vitals data from a connected CARESCAPE, Dash, or Solar monitor.

3. Generate reports and print as desired.

4. When documentation is complete, close the study.

5. The study automatically moves to the Centricity Cardiology INW server shortly after close. The study is then located in the **Network Catalog**'s *Navigator* window instead of the *Host Catalog* or *System Catalog* windows.

   NOTE
   If no signal data is saved in the study, the study remains on the acquisition system for eight hours before it moves to the Centricity Cardiology INW server. This allows you to restart a case later in the day from the pre/post-review system or acquisition system, prior to procedure start, without pulling the study from the Centricity Cardiology INW server.

4.2 Network catalog workflow

The network catalog workflow refers to the method used to create and continue studies in a network environment prior to the development of the multi-path documentation workflow. In this workflow, each new study that is not created directly on an acquisition system is created directly on the Centricity Cardiology INW server. Before the acquisition system can continue the study in the procedure room, all systems with this study currently open must first close the study. When no system has the study open, the acquisition system can continue the study in the procedure room, and the study data automatically moves to that acquisition system. This workflow forces a pre/post-review workstation that is currently using the study to close the study when the patient is transferred to the procedure room, but somewhat simplifies the process of creating studies in the pre-operation area.

4.2.1 Pre-procedure area

1. Choose the **Network Catalog** in the *Navigator* window drop-down list.
2. Choose the most likely room where the study will resume in the **Navigator Catalog** drop-down list. The study can move if the room changes.
3. Enter patient demographics, clinical data, and patient events. This information can include vitals data from an interfaced CARESCAPE, Dash, or Solar monitor.
4. Generate reports and print as desired.
5. Close the study when it is time to move the patient to the procedure room.

   NOTE
   You must close the study before it can be continued in the procedure room on the acquisition system.

4.2.2 Procedure room

1. Highlight the patient from the **Network Catalog** in the *Navigator* window on the acquisition system **first** and then click **Continue Study**.

   NOTE
   The study automatically moves when it is continued. All workstations must close the study for the the move to occur.

2. When the study is opened and in progress on the acquisition system in the procedure room, the nurse's workstation can join the study. Choose the study in the *Navigator* window and click **Review Study**.

   NOTE
   After you continue the study on the acquisition system, you can open it on multiple workstations without limit. This includes pre/post-review workstations, review workstations, and other acquisition systems.

   Use **Review Study** instead of **Continue Study** to open the study on an acquisition system other than the one in use.

3. When the case is complete, close the study. The order in which you close the study on the other systems (pre/post-review workstations, review workstations, or other acquisition systems) does not matter.

   NOTE
   If the patient does not go to a post-procedure area, the study will be transferred to the Centricity Cardiology INW server automatically shortly after close.

4.2.3 Post-procedure area

The case can be reviewed at any time after the study is opened on the acquisition system.

1. On the pre/post-review workstation, highlight the patient's study in the *Navigator* window. If the study is not shown in the *Navigator* window, switch to the **Network** view and select the study there.
2. With the patient's study highlighted, click **Continue Study**.

   NOTE
   If **Review Study** is used instead of **Continue Study**, the study will open but the application will not show vitals data from a connected CARESCAPE, Dash, or Solar monitor.

3. Generate reports and print as desired.
4. When documentation is complete, close the study.
5. The study automatically moves to the Centricity Cardiology INW server shortly after close.

4.3 Backup workflow

The following sections describe methods that can be used to back up study data, depending on the configuration of the system.

4.3.1 Standalone systems

Standalone acquisition systems (systems not connected to the Centricity Cardiology INW server) automatically back up information each time you close a study. You may manually back up information to SD media, USB storage drive, or network share. When you use removable media or storage devices, GE HealthCare recommends that you leave the media or storage device in the appropriate drive or port at all times to facilitate the automatic backups. The system provides notification when the media or storage device is full. See 19.1.1 File paths on page 265 for instructions on how to set the backup location.

4.3.2 Network systems

In a network environment, you are not required to back up information. You may manually back up information from acquistion systems only. See 5.5.1.6 Create backup on page 80 for additional information.

NOTE

In a networked system, GE HealthCare recommends leaving the **Track offline backups** check box unchecked on networked acquisition systems. Studies on networked acquisition systems are automatically transferred to the Centricity Cardiology INW server, where they are stored. Because studies may be edited from other systems on a Centricity Cardiology INW network, the system cannot ensure that the study backup copy is current.

- One or more studies can be selected to back up.
- You can back up information to SD media, USB storage drive, or network share. See 19.1.1 File paths on page 265 for information on setting the backup location. When you use removable media or storage devices, GE HealthCare recommends that you leave the media or storage device in the appropriate drive or port at all times, or insert the media or storage device before you initiate the backup. The system provides notification when the media or storage device is full.
- GE HealthCare recommends that you back up information from the **Network Catalog** rather than the **System Catalog**. Studies only stay in the **System Catalog** for a short time.
- If **Track Offline Backups** is enabled, then the **Backup Location** column displays in the *Navigator* window. This column shows the label for the media or storage location where the most recent backup copy is stored for each study in the system. If no label is shown, there is no backup for that study. Only turn the **Track Offline Backups** option on if you plan to back up every study that is created in the network environment. See 5.3.4 Configure backup study path on page 74 for more information.
- You cannot back up a study while it is open on a system in the network.
- **Resolve Backups** finds every study without a backup in the currently displayed catalog (**System** or **Network**) and will back up those studies immediately. If this is done from the **Network Catalog**, it will attempt to create a backup of every study on the network that does not have a backup. Unless backups are made on a regular basis (for example, daily), this operation may take a long time to complete. A backup operation that is in progress may be canceled at any time. See 5.5.1.10 Resolve backups on page 82 for more information.

Chapter 5 *Navigator* Window

This chapter describes the *Navigator* window and its functions.

The *Navigator* window opens after launching the application. The *Navigator* window is the general access point for study records and allows opening patient studies, searching for study records, copying patient records, deleting patient records and so on.

5.1 General workflow

Use the *Navigator* window to access patient records in a particular location and do actions on either that location or the selected patient records in that location. Here are a few examples:

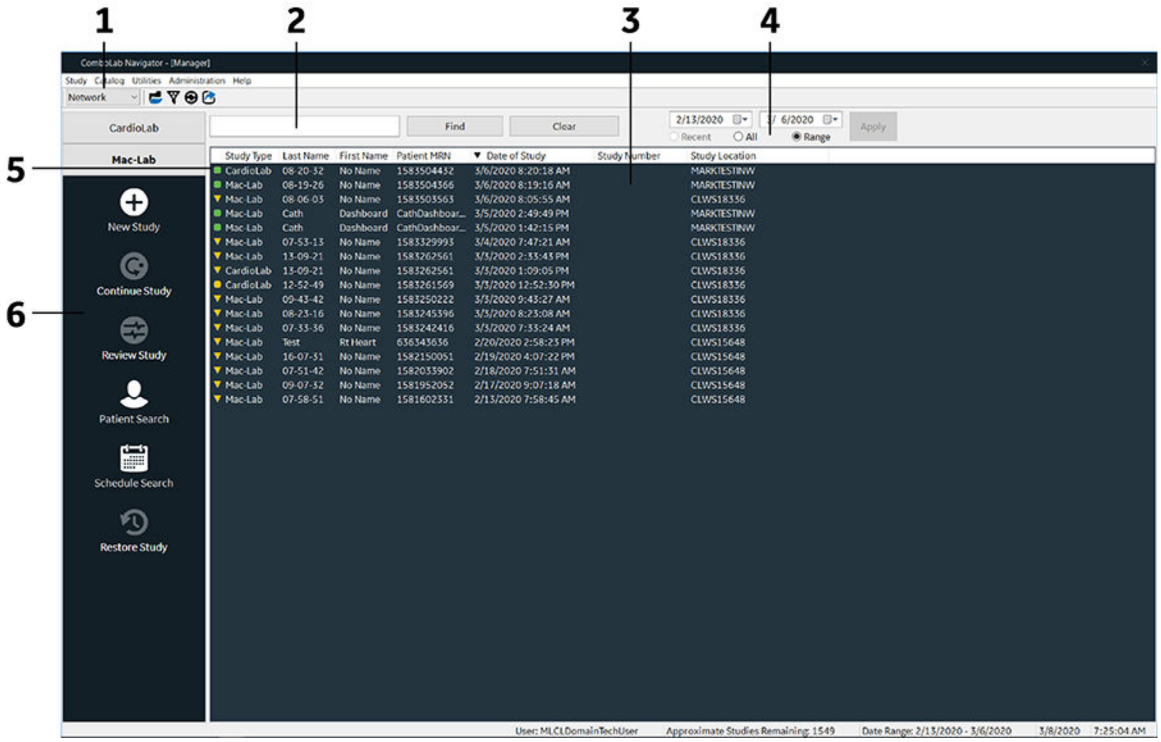
- Access the local catalog and create a new study. This patient record will be created on the local system.
- Use a pre/post-review workstation to access the catalog on an acquisition system. The records displayed in the study catalog are the studies currently hosted by the acquisition system.
- Click the **Browse** icon at an acquisition system and browse to the SD media or USB that contains the studies. The studies are shown in the catalog and can be imported into the system catalog for review (see 5.5.2.1 Import study on page 83).

The *Navigator* window shows the available actions for the location being viewed in the menus and the shortcut bar to the left of the study catalog.

NOTE
A single acquisition system can support simultaneous access for a maximum of five studies from multiple systems.

5.2 *Navigator* window elements

Figure 5-1 Elements



Item	Name	Description
1	Catalog selector	Used with the **Browse** button to point the study catalog to the desired location. See 5.4.3 Catalog selection on page 75.
2	Catalog search	Used for searching the currently displayed study list using a text-matching search. See 5.5.3.1 Search for studies on page 85.
3	Study catalog	Shows information about the studies in the current view. See 5.3 Study catalog on page 72.
4	Catalog filter	Used to constrain the list of displayed studies based on when the study was performed. See 5.5.3.2 Filter studies by time on page 85.
5	Color indicators	Provides information about the study. See 5.3.1 Study status indicator on page 73.
6	Shortcut bar	Provides direct access to some commonly used actions based on which catalog is being viewed.

5.3 Study catalog

The study catalog displays a list of studies on the system. The information may include the following:

- Study status indicator: A colored icon showing the status of the study (see 5.3.1 Study status indicator on page 73).
- Study type: Mac-Lab or CardioLab study

- Last name, first name: The name of the patient.
- Patient MRN: The medical record number of the patient.
- Date of study: The date that the study was performed.
- Study number: A number that identifies the study.
- Study location: The name of the system on which the study data currently resides.
- Backup location: The label of the offline media on which the most recent copy of the study was placed. In a network environment, this information is only displayed if **Track Offline Backups** is enabled.

5.3.1 Study status indicator

The study status indicator is a small icon that can be one of three colors. The meaning of each color is determined by the type of catalog being viewed.

- Standalone acquisition system online catalog:
  - Green down arrow: The study is online, not encrypted, and backed up.
  - Green circle: The study is online, encrypted, and backed up.
  - Yellow down arrow: The study is online, not encrypted, and not backed up.
  - Yellow circle: The study is online, encrypted, and not backed up.
  - Gray: The study is not available on the system and would need to be restored from the offline copy. The label of the offline storage is listed in the **Backup Location** field.
- Network acquisition system online catalog:
  - Green down arrow: The study is on the Centricity Cardiology INW server and is unencrypted.
  - Green circle: The study is on the Centricity Cardiology INW server and is encrypted.
  - Yellow down arrow: The study is available on the networked acquisition system and is unencrypted.
  - Yellow circle: The study is available on the networked acquisition system and is encrypted.
  - Gray: The study is not available on the Centricity Cardiology INW server and must be restored from the offline copy.
- Offline catalog:
  - Green: The study is a regular offline copy.
  - Yellow: The study is a patient master record (see 5.3.5 Patient master record on page 74).

5.3.2 Purge studies

To purge a study deletes all of the study data from an online study, leaving only a catalog entry. To purge a study is only allowed when the study has a valid backup location. The remaining catalog entry will show the label of the backup media, which should be used to locate the media if the study needs to be imported for access. Purged studies can be hidden from the study list using the *Recent Catalog Setup* screen. Purged studies will show with a gray icon in the study list.

5.3.3 Configure remote host

In a network environment, review workstations can view the studies that are hosted on an acquisition system with the **Host Catalog** feature. To access the **Host Catalog**, select the desired acquisition system in the catalog selector drop-down list.

To configure the hosts in the drop-down list:

1. Select **Administration** > **System Settings** (requires administrative access).
2. Switch to the **Network** setup page.
3. Click **Refresh**.
4. In the **Allowed Study Hosts** section, select the checkbox by the desired acquisition system.

NOTE
You must sign in to the computer as an application administrator to change the Allowed Study Hosts settings.

5.3.4 Configure backup study path

1. Select **Administration** > **System Settings** (requires administrative access).
2. Select the **File Paths** tab.
3. Click the **Browse** button to configure the backup study path.

NOTE
GE HealthCare recommends against changing the original value of `E:\`

Networked acquisition systems only

To hide or display both the **Backup Location** column in the study catalog and the **Create Backup** button on the shortcut bar:

1. Select **Administration** > **System Settings** (requires administrative access).
2. Select the **File Paths** tab.
3. Select or clear the **Track Offline Backups** check box.
4. Click **Close** to close the *System Settings* window.
5. Select **Study** > **Exit** at the *Navigator* window to close the application.
6. Double-click **Mac-Lab CardioLab** on the desktop to run the system application.

5.3.5 Patient master record

A patient master record is an offline study that is the sole copy of the study data. Care should be taken with media that contains the record. If the media is lost or damaged, the study record is permanently gone. The media that contains the patient master record should be taken to the destination system and imported immediately after it is created to minimize the potential for data loss.

5.4 Catalog views

The available actions in the *Navigator* window vary, whether you view online catalogs or offline catalogs.

5.4.1 Online catalogs

- Online catalogs are hosted on systems where the data is recoverable.
- Online catalogs contain studies that are directly accessible to continue or review in most cases.
- You can use online catalogs to create new studies.

5.4.2 Offline catalogs

- Offline catalogs are hosted on any computer-accessible media, such as an SD card, USB drive, or a network location.
- These catalogs may contain studies that are not directly accessible and must be imported before they can be continued or reviewed.
- You cannot use offline catalogs to create new studies.

5.4.3 Catalog selection

To select the operating catalog, use the catalog selector drop-down list or the browse catalog icon. There are online and offline catalogs.

5.4.3.1 Online catalogs

System catalog

The system catalog is the list of studies and is available only on an acquisition system. Select the system catalog from the catalog selector drop-down list.

NOTE
On networked acquisition systems, studies in the system catalog automatically move to the INW server. If studies on networked acquisition systems remain in the system catalog for more than one day, see the troubleshooting steps in 18.6.13 Clear studies stuck in the system catalog on networked acquisition systems on page 261.

Network catalog

The network catalog is the list of studies on a Centricity Cardiology INW network. This list contains both studies that are hosted on the Centricity Cardiology INW server and studies that are hosted on acquisition systems in the network. The hosting location is indicated by the **Study Location** column of the study catalog. Select the network catalog from the catalog selector drop-down list.

Host catalog(s)

A host catalog is a list of studies that are hosted on another acquisition system in the Centricity Cardiology INW network. A review workstation or pre/post-review workstation can view a host catalog to create studies or review studies on an acquisition system (see 5.3.3 Configure remote host on page 74). Select the host catalog from the catalog selector drop-down list.

5.4.3.2 Offline catalogs

When the system access an offline catalog, it checks for uncataloged studies and patient master records.

Uncataloged studies

If the offline catalog contains uncataloged studies, the system prompts you to regenerate the catalog. You can also regenerate catalogs from the **Utility** menu.

Patient master records

If the catalog contains any patient master records, the system prompts you to import this record into the system catalog. You can also manually import patient master records when you select a record and click **Import**. See 5.3.5 Patient master record on page 74 for more information.

Backup catalog

The backup catalog is the offline storage location that is configured using the backup path. Select the backup catalog from the catalog selector drop-down list.

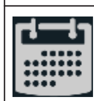
Browse catalog

The browse catalog is any media storage location that can contain patient studies. This could be SD media, a network location, a USB drive, or any other file system location. Click the browse icon to the right of the catalog selector drop-down list.

5.5 *Navigator* window actions

5.5.1 Online catalog

The following actions are available in the *Navigator* window when you view an online catalog.

Icon	See section
	5.5.1.1 New study on page 77
	5.5.1.2 Patient search on page 77
	5.5.1.3 Schedule search on page 78
	5.5.1.4 Continue existing study on page 79
	5.5.1.5 Review study on page 80
	5.5.1.6 Create backup on page 80
--	5.5.1.7 Offline transfer study on page 81
--	5.5.1.8 Purge study on page 81

Icon	See section
	5.5.1.9 Delete study on page 82
--	5.5.1.10 Resolve backups on page 82
--	5.5.1.11 Purge oldest study data on page 82
	5.5.1.12 Restore study on page 83

5.5.1.1 New study

Real-time data acquisition begins when you create a new study.

1. In the *Navigator* window, select the **New Study** icon or select **Study** > **New**.
2. If User Tracking is set to non-authenticated or authenticated with user selection, enter or select a name in the *Choose Name for User Tracking* window. See 8.1.11.2 Choose the user on page 139 for more information.

   A new study opens and the *Patient Information* window appears.
3. Enter the last name, first name, and MRN of the patient in the appropriate fields. All other fields, including the **Contact** or **Worklist** tabs, are not required to begin a new study and can be completed at any time during the study.

   NOTE
   To duplicate patient information if the patient returns to the catheterization laboratory for an additional study, highlight the patient name in the catalog and select **New Study**. This patient’s demographic information is transferred to the new study and is available for editing.
4. Select **OK**.

   NOTE
   For emergency cases, you can bypass the *Patient Information* window by pressing **Shift** + **Enter** on the keyboard. The *Patient Information* window disappears and patient information can be edited at a later time. The following information is entered in the *Patient Information* window when it is bypassed:

   - **Last name:** = current time (for example, 02-04-56).
   - **First name:** = No name.
   - **MRN** = a generated number.
   - **Study date:** = current date and time.

5.5.1.2 Patient search

This action is only available if using a CVIS (Cardiovascular Information System) that supports the patient search feature, such as the Centricity Cardio Workflow (CCW).

See 5.7 Patient information from CVIS on page 88 for information about using a CVIS that supports active patient search.

1. From the *Navigator* window, select the **Patient Search** icon or select **Study** > **Patient Search**.

The *Search for Patient* window appears.

2. Search by **Patient** or **Date of Admission**.

   To search by **Patient**:

   - Enter any known information such as the **Last Name**, **First Name** or **Patient ID/MRN**. Last Name and First Name search for names starting with letters entered. For example, entering a Last Name of **Jon** finds a patient with the last name of Jones.
   - Select the **Match exact name only** check box to force exact matches, so that searching for Jon does not return Jones.

   NOTE
   Patient ID/MRN field does not support wildcard searches (partial entry of the desired data). If a **Patient ID/MRN** is entered, only an exact match is returned.

   To search by **Date of Admission**, use one of the following:

   - **Start Date**: any admission date on or after that date
   - **End Date**: any admission date up to and including that date
   - A range of any two dates

3. Select **Search** to begin the search, **Cancel Search** to cancel, or **Clear All** to clear all fields.

   NOTE
   To initiate a search, you must define at least one parameter. Some systems will not return results unless you define the patient's date of admission. Whenever possible, include the patient's date of admission in your search. If your search is unsuccessful, define the patient's date of admission and either the MRN or part of the patient's name and search again.

   A list of patients that have been admitted into the CVIS scheduling module and match the search criteria are returned. The return list includes the **Name**, **PID/MRN**, **Date of Birth**, **Sex**, **Account Number**, **Admit Date**, and **Order Number** to discern which entry is the desired patient.

4. Select the desired patient.
5. Select either **Start New Study** or **Close** to exit.

When you begin a patient study from the CVIS scheduling module, the *Patient Information* window is automatically populated with the information provided by the CVIS system. The system prompts you to enter the information and correct it, as needed.

5.5.1.3 Schedule search

The ability to search the schedule is only supported on certain CVIS (Cardiovascular Information System) versions, such as the Centricity Cardio Workflow (CCW).

See 5.7 Patient information from CVIS on page 88 for information about using a CVIS that supports active patient search.

1. From the *Navigator* window, select the **Schedule Search** icon or select **Study** > **Schedule Search**.

   The *Schedule Search* window opens.

2. To search by **Patient**:

   - Enter any known information such as the **Last Name**, **First Name** or **Patient ID/MRN**. Last Name and First Name search for names starting with letters entered. For example, entering a Last Name of **Jon** finds a patient with the last name of Jones.
   - Select the **Match exact name only** check box to force exact matches, so that searching for Jon does not return Jones.

   NOTE
   Patient ID/MRN field does not support wildcard searches (partial entry of the desired data). If a **Patient ID/MRN** is entered, only an exact match is returned.

3. Select the **Procedure Type** and **Scheduled Lab**.

   NOTE
   On a ComboLab™ system:

   - Select **Cath** if you want to search for and start a Cath study.
   - Select **EP** if you want to search for and start an EP study.

   If you search for the wrong procedure type, the system may report unexpected results and create the wrong study type.

4. Optionally, enter the **Scheduled Physician Last Name** or **Order Number**.
5. Select the **Match exact name only** check box if the search should return only exact matches.
6. Select **Search** to begin the search.

   A list of patients that have been scheduled for a procedure into the CVIS scheduling module and match the search criteria are returned. The return list includes the **Name**, **PID/MRN**, **Scheduled Date**, **Order Number**, **Scheduled Physician**, and **Lab Name** to discern which entry is the desired patient, as well as where and when the procedure is scheduled.

   NOTE
   You can also select **Clear All** to clear all fields or **Cancel Search** to cancel the search.

7. Select an entry from the list and select **Start New Study** to begin the study, or select **Close** to exit.

   NOTE
   - If the **Procedure Type** selected was **Cath** when you did the search, selecting **Start New Study** creates a new Cath study.
   - If the **Procedure Type** selected was **EP** when you did the search, selecting **Start New Study** creates a new EP study.

   The application may be configured to match the scheduling system's definition of Cath or EP procedures.

   See Modality Worklist Host settings on page 272 for more information.

5.5.1.4 Continue existing study

1. Highlight the patient's name in the *Navigator* window.
2. Click the **Continue Study** icon or select **Study** > **Continue Study**.

   The selected study opens and can be continued.

NOTE

For The Joint Commission (TJC) drug compliance, when a study from earlier versions (5.x/6.0/6.1/6.5) is continued:

- The amount and total fields of Medication items in the Medications used list will be TJC formatted.
- The amount and total fields of Contrast items in the Contrast used list will be TJC formatted.
- The O_2 saturation states in Conscious Sedation will not have "<" and ">" symbols.
- Exception: The medication amount in the medication event entry in the *Log* window will not be TJC formatted for studies from earlier versions (5.x/6.0/6.1/6.5).

Refer to E.1 The Joint Commission on page 315 for more information.

5.5.1.5 Review study

Review a study to access saved patient data, edit the patient information log, or generate a report.

NOTE

Users may add additional signatures to a report after it is signed. If new content is added to a report, regenerate the report and add the signatures to it.

1. Highlight the patient's name in the catalog study information window.
2. Click the **Review Study** icon or select **Study** > **Review Study**.

   The selected study opens for review.

NOTE

For The Joint Commission (TJC) drug compliance, when a study from earlier versions (5.x/6.0/6.1/6.5) is continued:

- The amount and total fields of Medication items in the Medications used list will be TJC formatted.
- The amount and total fields of Contrast items in the Contrast used list will be TJC formatted.
- The O_2 saturation states in Conscious Sedation will not have "<" and ">" symbols.
- Exception: The medication amount in the medication event entry in the *Log* window will not be TJC formatted for studies from earlier versions (5.x/6.0/6.1/6.5).

Refer to E.1 The Joint Commission on page 315 for more information.

5.5.1.6 Create backup

Use this feature to create offline study copies that are stored in the configured backup path. The backup path media label appears in the study catalog.

1. From the *Navigator* window, select the study to be backed up.
2. Select **Study** > **Create Backup** or click the **Create Backup** icon (available only if **Track Offline Backups** is enabled [see 5.3.4 Configure backup study path on page 74]).

A `Please wait while study data is copied` message appears.

Simultaneously press **Shift** and click the **Create Backup** icon to create an offline study copy. The system prompts you to select a location to store the offline study copy. This action does not change the backup location for the study.

3. Click **OK** to close the message screen.

5.5.1.7 Offline transfer study

This feature allows you to create an offline patient master record (see 5.3.5 Patient master record on page 74) to transfer a study between acquisition systems when the hospital network is unavailable. The system removes the selected study from the online catalog and puts the valid copy in the target location.

The system can transfer one offline study at a time.

1. Ensure that removable media (SD card, DVD, or USB) is available and connected to the computer.
2. Select the study to be transferred.
3. Select **Study** > **Offline Transfer Study**.

   The *Browse For Folder* window appears. Browse to the location of the removable media that will be used to transfer the study.
4. Highlight the folder in which the study will be placed.
5. Click **OK**.

   The study moves from the acquisition system to the selected folder. A message displays that says that the study now exists only on the removable media.
6. Remove the media that contains the study, carry it to the destination lab, and insert the media into the appropriate drive on the acquisition computer.
7. Select either the **Backup** catalog (if the SD card is the configured backup location) or browse to the media using the **Browse Catalog** icon on the **Study** toolbar.

   The message `The following patient master record has been found at this location: <patient name and MRN> Do you wish to receive this patient into the system catalog at this time?` displays.
8. Click **Yes**.

   The study is imported into the local catalog and can be continued. See 5.5.2.1 Import study on page 83.

5.5.1.8 Purge study

This feature deletes all of the study data from an online study and leaves only a catalog entry (indicated by a gray icon in the study catalog). You can only purge a study that has a valid backup location.

NOTE
This feature is only available on standalone acquisition systems. In a network environment, the Centricity Cardiology INW server is configured to archive and purge studies automatically.

To purge a study:

1. Select the study to be purged.

2. Select **Study** > **Purge Study Data**.

   A The selected studies will have their study data removed … message appears.

3. Click **Yes**.

   The study is removed from the acquisition system.

5.5.1.9 Delete study

This feature permanently removes the online copy of a study from the system and requires administrative access to do. Do not delete a study unless it was created in error. Use purge instead of delete when you want to remove valid studies to create additional space.

1. Select the study to be deleted.
2. Select **Study** > **Delete**.

   A Delete the selected study? message appears.

3. Click **Yes**.

   The study is removed from the acquisition system and network.

NOTE
This feature permanently removes a study from the system. All waveform and patient study data is lost. You cannot recover a deleted study.

5.5.1.10 Resolve backups

This feature creates offline copies of any studies in the displayed study list that do not have a backup location. The system puts the offline copies in the current backup path and then updates the backup location of the studies to the media/storage label of the backup path. This feature is available on standalone acquisition systems. It is also available on network systems if **Track Offline Backups** is enabled (see 5.3.4 Configure backup study path on page 74).

1. Select **Utilities** > **Resolve Backups**.

   A This operation will attempt to back up <number> studies message displays.

2. Click **Yes**.

   The system begins to back up studies to the designated location.

   The window *Operation Completed* window appears after the studies are copied.

3. Click **OK**.

5.5.1.11 Purge oldest study data

This feature is only available on standalone acquisition systems. Use it to quickly select and purge the oldest studies on the system to free up online study storage (see 5.5.1.8 Purge study on page 81). The default setting is to purge the oldest 30 percent of backed-up studies on the system. You can adjust this setting to increase or decrease the number of studies to purge. You can also purge studies since a selected date.

1. Select **Utilities** > **Purge Oldest Study Data**.

   The *Purge Oldest Study Data* window appears.

2. Under **Purge studies starting from**, either select the date from the drop-down calendar or select the number of studies to purge.

   NOTE
   A `This selection will purge <number> studies.` message appears at the bottom of the screen. To increase the number of studies to be purged, select an earlier date or drag the slider to the left to increase the number of studies.

3. Click **OK**.
4. When prompted to proceed, click **Yes**.

   The studies are removed from the acquisition system.

5.5.1.12 Restore study

Restore study is only available when you view the network catalog. This action moves the selected archived studies from the offline copy to the Centricity Cardiology INW server to be reviewed or continued.You cannot restore accessible studies (as indicated by the colors green and yellow) that already exist in the network catalog.

1. Use **Recent catalog** to filter the archived studies to be restored.
2. In the *Navigator* window, highlight the archived studies to be restored.
3. In the shortcut bar, click the **Restore Study** icon.

   A `Restore from Archive` message box appears.

4. Click **OK**.

   The restore action begins.

   NOTE
   The operator can do other tasks while the restore is in progress. When the restore action is complete, the system displays a completion message if the *Navigator* window is open.

   A study is successfully restored when its color indicator changes from gray to green.

5.5.2 Offline catalog

These actions are available in the *Navigator* window when you view an offline catalog.

5.5.2.1 Import study

When you import an offline study, it moves to the system (online) catalog so that it can be reviewed or continued. You cannot import studies that already exist in the system or network catalogs. If the offline study may contain data that the online does not, first delete the online copy of the study and then import the offline study.

1. Use either the backup catalog action or the browse catalog action to locate the study to import (see 5.4.3.2 Offline catalogs on page 75).
2. Select the desired study or studies.
3. Select **Study** > **Import** or click the **Import Study** icon.

   A dialog appears that shows the study import progress.

4. When the operation is complete, the system automatically changes the catalog to the system catalog. The system prompts you to change the catalog display settings to **All** if the study is not visible.

5.5.2.2 Copy study

This feature copies a selected offline study to a new location.

1. Select the study or studies.
2. Select **Study** > **Copy** or click the **Copy Study** icon.

   The *Browse For Folder* window appears.
3. Highlight the target location.
4. Click **OK**.

   The study or studies are copied from the current catalog to the target location.

5.5.2.3 Delete study

This feature permanently removes the offline copy of a study from the system and requires administrative access to do.

1. Select the study or studies to be deleted.
2. Select **Study** > **Delete** or click the **Delete Study** icon.

   A `Delete the selected study?` message appears.
3. Click **Yes**.

   The study is removed from the selected location.

NOTE
This feature permanently removes a study from the system. All waveform and patient study data is lost. You cannot recover a deleted study.

5.5.2.4 Regenerate catalog

This feature scans the system for pre-v6.9 studies and displays them in the study catalog. You can import, delete, or copy the studies. Select **Catalog** > **Regenerate** to initiate the scan.

5.5.2.5 Storage information and media label

From the **Catalog** menu, select **Storage Information** to open the *Study Data Storage Location Information* window. Use this window to view storage information about the current offline catalog and edit the label of the associated media.

NOTE
You can only edit the media label if the media is empty.

- For removable media: The device cannot contain any studies or other non-study directories.
- For a shared path: The root of the shared path cannot contain any directories.

5.5.3 Common *Navigator* window actions

These actions apply to both online and offline catalogs within the *Navigator* window.

5.5.3.1 Search for studies

To search for a patient record in the list of displayed studies, enter any text into the **Catalog Search** box and click **Find**. The text in all fields is searchable. Click **Clear** or push **Esc** to clear the search results and re-display all of the records in the catalog.

5.5.3.2 Filter studies by time

The application provides a way to easily filter the currently displayed study list to a range of studies based on the study time.

- To display studies from a specific date range, select **Range** in the catalog filter area, select a start and end date, and click **Apply**.
- To display all studies regardless of study date, select **All** in the catalog filter area and click **Apply**.
- To display the most recent studies, select **Recent** in the catalog filter area and click **Apply**.

NOTE
The application will always default to **Recent** when it starts.

5.5.3.3 Recent catalog filter

The recent catalog filter helps to improve the slow performance associated with large study catalogs. To configure, click the **Study Filter Setup** icon or select **Catalog** > **Study Filter Setup**. The system displays a setup screen with the following settings:

- The **Recent Catalog** setting determines the age of studies displayed when the recent catalog filter is selected.
- The **Archived (Inaccessible) Studies** setting shows or hides studies that have been removed from the system and must be restored from backup (5.5.2.1 Import study on page 83).

5.6 Import and export custom data

On standalone and networked acquisition systems, you can import and export the following data:

- Lists
- Report formats
- Registries
- Custom form layouts

On review systems, you can only import and export report formats.

Only administrators can import and export custom data.

To import or export custom data, select **Utilities** from the main menu in the *Navigator* window.

The following table shows the data that may be imported or exported. When you import some data items, it is possible to merge the imported data with data that already exists on the system. For others, existing data is overwritten after import.

In the network environment, some imported data items automatically propagate to other systems on the network. This is referred to as replication. You do not need to import replicated items on other systems that are in the same network environment.

Item	Merge supported	Overwrite supported	Replicate
Complications Contrast Level Of Consciousness Level Of Pain Medication Types Medications Phases Procedures Staff Supplies Cath labels EP lists Macros	Yes	Yes	Yes, must be imported and/or exported at a single acquisition system.
Study configurations	No	Yes	No, must be imported and/or exported at each acquisition system
Report formats	Yes	Yes	No, must be imported and/or exported at each acquisition and review system
Forms registries	Yes	No	Yes, must be imported and/or exported at a single acquisition system.
Custom form layouts	Yes	Yes	Yes, must be imported and/or exported at a single acquisition system.

NOTE
GE HealthCare recommends that you regularly back up all custom data.

NOTE
When you import study configurations from previous version, the filtering settings for each channel are set to the Default filter preset. This can result in changes to the previous filtering settings.

NOTE
In a network environment, custom form layouts replicate after you select **Save Data** in the *Forms Navigator* window or after you import custom forms. Registry forms replicate after they are imported into an acquisition system.

5.6.1 Export custom data

After you change or import any of the items in the table in Import and export custom data, create a backup.

1. Select **Utilities** > **Export [Lists, Report Formats, Registries, or Custom Form Layouts]**.
2. Click **Next** at the *Data Export Wizard*.

3. Navigate to the export location (for example, a removable disk or network location).

   NOTE
   If necessary, create a new folder that indicates the item exported and the date (for example, `Report_Formats_15MAR2005`).

   The export can take up to several minutes. A confirmation displays when the export completes.

4. Click **OK** to finish.

5.6.2 Import custom data

When you import report formats, ensure that the report format version and the application version are the same.

1. Select **Utilities** > **Import [Lists, Report Formats, Registries, or Custom Form Layouts]**.
2. Click **Next** at the *Data Export Wizard*.
3. Navigate to the import location (for example, a removable disk or network location).
4. If necessary, select the items to import.

   Lists and registries may have multiple selections

5. Select either **Merge** or **Overwrite existing data**.

   NOTE
   - A registry can only overwrite the existing registry. The existing registry is deleted and replaced with the imported registry.
   - For custom form layouts:
     - To replace a single form, delete the form and then select **Merge**.
     - To add all new forms but not change existing forms, select **Merge**.
     - To replace all forms, do not select **Merge** (that is, the existing forms are deleted and replaced with the imported forms).

   The import can take up to several minutes. A confirmation displays when the import completes.

6. Click **OK** to finish.

5.6.3 Configure backup study path

1. Select **Administration** > **System Settings** (requires administrative access).
2. Select the **File Paths** tab.
3. Click the **Browse** button to configure the backup study path.

   NOTE
   GE HealthCare recommends against changing the original value of `E:\`

Networked acquisition systems only

To hide or display both the **Backup Location** column in the study catalog and the **Create Backup** button on the shortcut bar:

1. Select **Administration** > **System Settings** (requires administrative access).
2. Select the **File Paths** tab.

3. Select or clear the **Track Offline Backups** check box.
4. Click **Close** to close the *System Settings* window.
5. Select **Study** > **Exit** at the *Navigator* window to close the application.
6. Double-click **Mac-Lab CardioLab** on the desktop to run the system application.

5.6.4 Patient master record

A patient master record is an offline study that is the sole copy of the study data. Care should be taken with media that contains the record. If the media is lost or damaged, the study record is permanently gone. The media that contains the patient master record should be taken to the destination system and imported immediately after it is created to minimize the potential for data loss.

5.7 Patient information from CVIS

The system allows retrieval of patient demographics, account and order information from the Cardiovascular Information System (CVIS) database.

NOTE
The system DICOM configurations must be specifically configured to connect to the CVIS database. See 19.1.8 Connectivity on page 268.

See 5.5.1.2 Patient search on page 77 and 5.5.1.3 Schedule search on page 78 for details about getting patient information from a CVIS that supports those features.

5.7.1 Active patient search

A CVIS that supports active patient search allows entry of patient demographics and exam history prior to beginning a case study. The CardioLab case can also be started from the CVIS. At that time, the study and patient data is transferred to the CardioLab. At completion of the study on the CardioLab, the study data can be transferred back to the CVIS.

To transfer study data from a CVIS that supports active patient search to the CardioLab system, refer to the CVIS operator manual.

The Centricity Cardio Workflow (CCW) supports active patient search.

To use active patient search when the CVIS client is not installed on the system, do the following steps:

1. At the *Navigator* window, select **Study** > **Get Active Patient**.

   The *Get Active Patient* window appears and is populated with the study data from the CVIS.

2. Select **Start New Study**.

   The *Patient Information* window appears with the demographics information from the CVIS.

3. Select **OK** and begin the study.

5.7.2 Switch between systems

To switch between the CVIS system and the CardioLab system, push the **Action** + **TAB** keys on the keyboard. Push the **Action** key and tab to the appropriate system.

5.8 Administration menu

Lists

See Chapter 12 Lists on page 165.

Intervals

See 19.3 Customize intervals on page 276.

Column Formats

See 19.4 Customize column formats on page 277.

Protocols

See 19.5 Customize protocols on page 278.

Study Configurations

See 19.2 Customize study configurations on page 275.

System settings

See 19.1 Configure *System Settings* on page 265.

Reports

See Chapter 15 Reports on page 197.

Design custom forms

See Chapter 14 Forms on page 187.

Online manual

Select **Help** > **CardioLab Help** to view an electronic copy of the user manual on the system. You can also download the latest version of the user manual from the customer documentation portal (https://www.gehealthcare.com/support/documentation) .

6

Chapter 6 *Real-Time* and *Review* Windows

This chapter describes the *Real-Time* and *Review* windows.

The system displays the *Real-Time* and *Review* windows when you begin a new study or continue an existing a study.

The *Real-Time* window displays all real-time ECG and pressure waveforms.

The *Review* window displays all saved ECG signals and pressure waveform data.

NOTE
Changes to the display are window specific. Make sure to select the appropriate window when you use keyboard shortcuts or select menu commands. The title bar of the window darkens when it is selected.

NOTE
During periods of device start up or shut down, waveform display performance may be impacted while data is scrolling. The waveform data is fully recorded and will display as the scrolling of signals continues to animate the frames in succession.

WARNING

NOT A PATIENT MONITOR

The system is intended to be used as a recording system for catheterization, electrophysiology and related specialty laboratories. A defibrillator or ECG monitor should be attached for patients in need of uninterrupted ECG display. An additional means to display SpO_2 should be attached for patients in need of uninterrupted SpO_2 display. A temporary pacemaker needs to be available for patients in need of uninterrupted delivery of pacing. An additional means to display CO_2 should be attached for patients in need of uninterrupted CO_2 display.

6.1 *Real-Time* window

The *Real-Time* window consists of eight pages of the following types of signal data: ECG signals, intracardiac signals, invasive pressures, and stim channel signals.

All signals may be shown in either a sweep or scrolling display.

6.1.1 *Real-Time* window screen elements

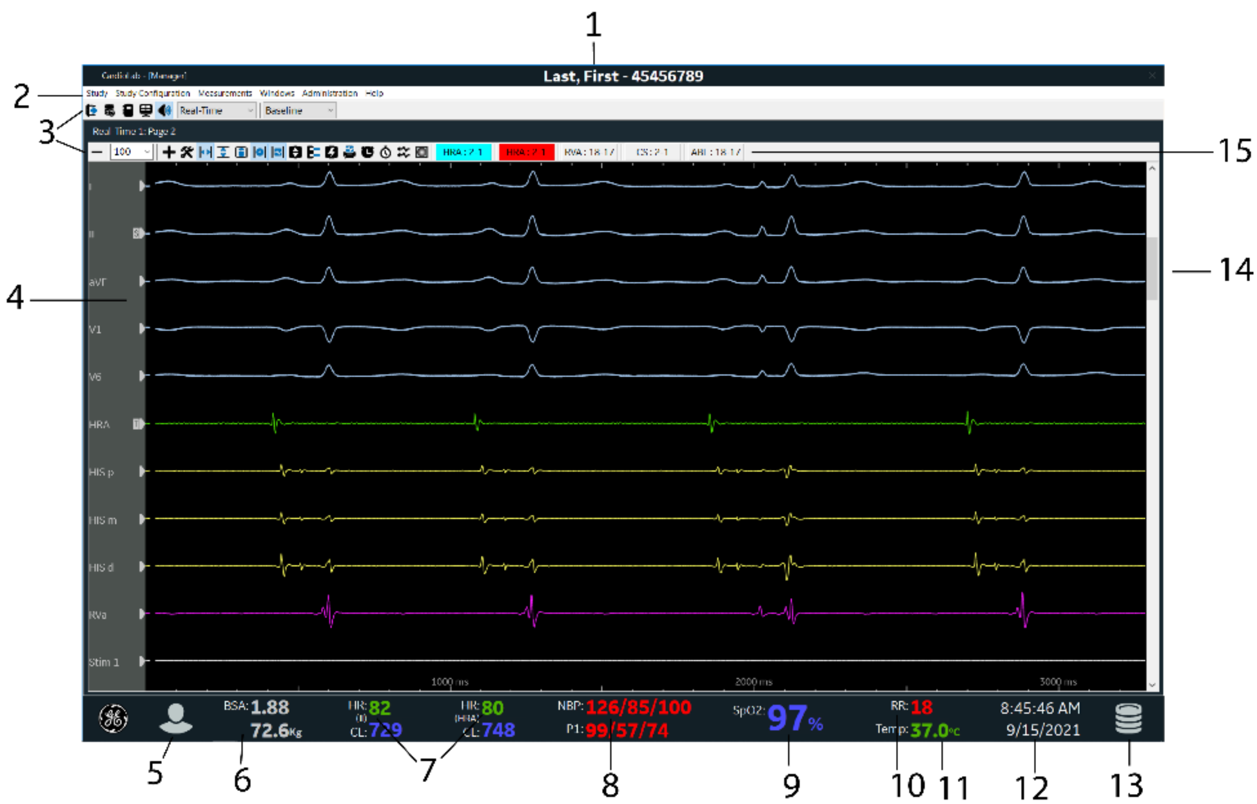


Table 6-1 *Real-Time* window screen elements

1	Window title	Displays the patient's name. Display of the patient's MRN and date of birth is optional.
2	Menu bar	Contains drop-down menus for managing the *Real-Time* window.
3	Toolbar	Displays icons for easy access to certain functions.
4	Intracardiac, ECG, and pressure display	Displays selected real-time intracardiac ECGs, surface ECG, and pressure waveforms.
5	Patient icon	Click to display the patient information.
6	BSA	Displays patient's BSA and weight in kilograms.
7	Heart rate (HR) and cycle length (CL)	Displays the patient's current heart rate and average cycle length in milliseconds.
8	BP	Displays selected blood pressure values in mmHg or kPa.
9	SpO_2 display	Displays the patient's current SpO_2.
10	Respiration rate (RR)	Displays the patient's current respiration rate.
11	Temperature (Temp)	Displays the patient's temperature in degrees Celsius.
12	Current time and date	Displays the current time and date.
13	Save/data icon	Displays the save status of the study.
14	Scroll bar	Slide up or down to scroll through *Real-Time* window pages.
15	Stim enable buttons	Enables and disables the selected stim channel.

6.1.2 Save data

Save key

To start or stop saving signal data:

- Push the **Save** key on the keyboard or
- Select the **Data** icon.

The **Data** icon changes color, depending on the function it does.

- When the **Data** icon is red, full disclosure save is active and the system is saving data.
- When the **Data** icon is light blue, the system is in a transition period from saving to not saving. This is a 10-30 second period in which the system still saves data.
- When the **Data** icon turns gray, it is not active and the system is not saving data.
- When the **Data** icon displays a circular arrow, autosave is active.
- When the **Data** icon turns royal blue, the system is saving due to autosave.

Ctrl + **Save** key

To skip the transition period and go directly from full disclosure save to inactive, or from a red **Data** icon to a grey **Data** icon, press **Ctrl** + **Save**.

Update key

1. Push the **Update** key on the keyboard to save 10 seconds of signal data in the *Real-Time* window to the *Review* window. A corresponding entry appears in the *Log* window (green timestamp).
2. When the system updates signal data in the *Review* window and saves data, the **Data** icon in the patient status area turns light blue.

Emerg Save

The emergency save function moves back in time approximately 25 to 30 seconds.

1. Push the **Emerg Save** key (red key) on the keyboard.
   The data icon turns red when activated, blue before the emergency save option turns off, and gray when deactivated.
2. Select the data icon or push the save hot key to deactivate.

6.1.3 Trigger mode activation mapping

Trigger mode expedites point-to-point mapping that resembles the trigger sweep of an oscilloscope. A signal, which serves as the reference, is set as the trigger channel. The reference signal appears on the *Real-Time* window at the same point for every cardiac cycle.

The other signals appear on the *Real-Time* window in relation to this reference signal. As a mapping catheter moves throughout an area in the heart, you can view activation changes with respect to a constant reference signal.

Activation times are calculated quickly and easily by using the calipers in the *Real-Time* window. Trigger mode decreases the amount of data saved during a lengthy mapping procedure.

6.1.3.1 Select trigger channel

1. Select the **Study Configuration** icon in the *Real-Time* window.

2. Select the **Measurements** folder on the left side of the window.
3. Select the **Measurements** tab and the **Trigger Channel** option from the drop-down menu.

   You can also use a keyboard shortcut to change the trigger channel. Highlight the channel in the *Real-Time* window and push the **Trig** key (letter T) on the keyboard.

6.1.3.2 How to use trigger mode

1. Click the **Trigger Mode** icon in the *Real-Time* window.

   NOTE
   If scrolling is selected, the display changes to sweeping during trigger mode.

2. Increase the sweep speed to at least 200.

   Three lines appear.

   - A dashed, horizontal, trigger level line appears in the *Real-Time* window. The trigger level line must cross the signal of the trigger channel for the trigger mode to function properly. The line should intersect the peak of the signal designated.
   - A dashed, vertical line also appears. This line adjusts the reference point of the trigger mode. You can move the line to the left of the second vertical line reference.
   - A solid, vertical line also appears. This line adjusts the time offset displayed on the *Real-Time* window while in trigger mode.

   To move a line, click and drag the white triangle.

3. Select the **Trigger Mode** icon again to return to normal acquisition mode.

6.1.4 *Real-Time 2* window (Prucka™ 3 Amplifier only)

If your configuration includes the Prucka™ 3 Amplifier, you can display live signal data on the *Real-Time 2* window.

NOTE

- Changes to the display are specific to each *Real-Time* window.
- You can put this window on any display.
- Both of the *Real-Time* windows use the same set of channel configuration pages.
- The *Real-Time* windows are independent of each other. Each can display a different page of channels with a different display speed.

To show the *Real-Time 2* window, select **Windows** > **Real-Time 2**.

6.1.5 Cycle length (Prucka™ 3 Amplifier only)

If your configuration includes the Prucka™ 3 Amplifier, cycle length displays the beat-to-beat cycle length in ms on the real-time waveforms. Cycle length uses a pattern-matching learning algorithm that adapts to changing morphologies in the waveform.

NOTE

- A maximum of 10 channels can have cycle length enabled.
- When cycle length is enabled for a channel, the letter **L** precedes the signal in the label area of the window.
- Vertical tick marks are displayed to indicate the start and end of a beat. Tick mark placement varies between signal channels, based on the learned pattern.

To use cycle length, highlight a channel in a *Real-Time* window and push the **D** (**Cycle Length**) key. The system displays the cycle length after a delay.

To add cycle length to the configruation for the selected channel(s), select **Study Configuration** > **Save**. It can take up to 10 seconds for the algorithm to adapt to changing morphologies.

6.2 *Review* window

The *Review* window displays all saved surface ECG, intracardiac signals, and pressure waveform data. Signal and waveform data are saved whenever a save command is executed.

You can do similar functions in both the *Real-Time* window and the *Review* window.

NOTE

Changes to the display are window specific. Make sure the appropriate window is selected (the title bar darkens) when using keyboard shortcuts or selecting menu commands.

Review window screen elements

NOTE

On a pre/post-review workstation connected to a CARESCAPE patient monitor, the CARESCAPE monitor may display more than one value for either heart rate (HR) or respiration rate (RR), depending on which devices are connected to the patient monitor.

The HR value displayed on the *Review* window will be selected using the following hierarchy:

1. ECG
2. Invasive pressure
3. SpO_2
4. NIBP
5. Other HR value

The RR value displayed on the *Review* window will be selected using the following hierarchy:

1. Spirometry
2. CO_2
3. ECG
4. Other RR value

6.2.1 *Review* window screen elements

Table 6-2 *Review* window elements

1	Window title	Displays the patient's name. Display of the patient's MRN and date of birth is optional.
2	Menu bar	Contains drop-down menus for managing the *Review* window.
3	Toolbar	Displays icons for easy access to certain functions.
4	Intracardiac, ECG, and pressure display	Displays selected saved intracardiac, surface ECG, and pressure waveforms.
5	Patient icon	Click to display the patient's information.
6	BSA	Displays the patient's BSA and weight in kilograms.
7	Heart rate (HR) and cycle length (CL)	Displays the patient's current heart rate and average cycle length in milliseconds.
8	BP	Displays selected blood pressure values in mmHg or kPa.
9	SpO_2 display	Displays the patient's current SpO_2.
10	Respiration rate (RR)	Displays the patient's current respiration rate.
11	Temperature (Temp)	Displays the patient's temperature in degrees Celsius.
12	Current time and date	Displays the current time and date.
13	Save/data icon	Displays the save status of the study.

Table 6-2 *Review* window elements (Table continued)

14	Scroll bar	Slide the side scroll bar up or down to scroll through *Review* window pages. Slide the bottom scroll bar left and right to scroll through saved *Review* window data.
15	Rename this window icon	Rename the *Review* window. The new name appears in the window title.

6.2.2 Locate saved data

The *Review* window displays all data saved throughout the case. Therefore, it is important to understand how to locate data in the *Review* window. It is possible to move backwards in time to look at and re-evaluate signals. This can be done anytime after a case, even after a patient has been discharged from the system.

There is a time-stamp in hours, minutes and seconds running along the bottom of the *Review* window. This serves as an essential navigation guide.

NOTE
Clicking on the time stamp of an event in the *Log* window will display the signal data recorded at that time.

1. Click in the gray box on the horizontal scroll bar to open a time scale and subsequently update, depending on where the box is moved, either forward or backward in time.
2. At the desired time, release the mouse button and the corresponding signals appear in the *Review* window.
3. Use the directional arrows, pointing to the left and right in the horizontal scroll bar, to move a small amount in either direction in time.
4. To move a full page in either direction in time, click anywhere between the appropriate arrow button and gray box in the horizontal scroll bar.
5. To scroll through saved data, click and hold the arrow buttons in the horizontal scroll bar to scroll through data forwards or backwards in time.
6. To bring up a menu list of options to help navigate through the *Review* window, right-click the *Review* window scroll bar.
7. To move the smallest possible increment, use the **Shift** + left arrow and **Shift** + right arrow key combinations for the desired direction.

6.2.3 *Review* window 2

Review window 2 allows the user to display saved data from the study at two different points in time.

1. Select **Windows** > **Review 2** on the *Real-Time* or *Review* window.
2. To control which *Review* window is updating, click the **Toggle Active Review Window** icon in the respective *Review* window. If the icon is active, updates will appear on the window.

6.2.4 *Review* window 3, *Review* window 4, and *Review* window 5

If your configuration includes the Prucka^{TM} 3 Amplifier, you can display historical information in up to three additional *Review* windows. Do this task to use these windows.

1. Choose the following windows, as applicable.

Window	Task
***Review* window 3**	**Select Windows > Review 3.**
***Review* window 4**	**Select Windows > Review 4.**
***Review* window 5**	**Select Windows > Review 5.**

2. To control which *Review* window updates, select the **Toggle Active Review Window** icon in the desired *Review* window. If the icon is active, then the system displays updates in that window.

6.3 Other *Real-Time* and *Review* window screen element functions

6.3.1 Changing pages

To change the *Real-Time* or *Review* window from one page to another page:

1. Press the **Page Up** or **Page Down** keys.
2. Use the vertical scroll bar (up and down) arrows, located on the right side of the *Real-Time* or *Review* window.
3. Use the mouse wheel.

   The page number is located in the title bar of the *Real-Time* or *Review* window.

6.3.2 Shortcut to turn channels on or off

Channels can be turned on or off quickly using the following shortcut:

1. Place the cursor inside the signal window to be updated.
2. Press and hold the **Ctrl** + **Shift** keys simultaneously.
3. While continuing to hold the keys down, type the channel number of the channel to turn on or off.
4. Release the **Ctrl** + **Shift** keys.

Channels that are currently displayed show their channel number in the **Channel Label** area when holding **Ctrl** + **Shift**. Channel numbers for all channels are found in the study configuration screen.

6.3.3 Changing channel properties

You can change the properties of any channel that appears in the *Real-Time* or *Review* windows in the *Channel Properties* window.

1. Right-click the channel label of the desired channel.

   The *Channel Properties* window appears.
2. Change any of the displayed parameters.

NOTE
The channel is updated immediately.

NOTE
Not all parameters can be changed.

3. Select the **Close** button to close the window.

   For more information on the channel properties, see 7.1 *Study Configuration – Real-Time* window on page 113 and 7.2 Study Configuration – *Review* window on page 129 .

6.4 Real-Time and Review window menu functions

6.4.1 Study menu

Patient information

To review or edit patient information, select **Study** > **Patient Information** or click the patient's name on the bottom left corner of the *Real-Time* or *Review* screen. The *Patient Information* window appears for additional data entry.

Master list items

To access master lists, select one of the following from the **Study** menu:

- Conscious Sedation
- Procedures
- Staff
- Supplies
- Medications
- Radiology
- Complications
- Contrast
- Orders

For more information on master list usage, see 12.1 Master lists on page 165.

Forms navigator

To use a registry or custom form, select **Study** > **Forms Navigator**. See Chapter 14 Forms on page 187 for instructions on building and using forms.

6.4.1.1 Case event

The CardioLab allows you to link a case to a primary physician and to track the supplies and medications used by that physician during the case. This information is primarily used for statistical purposes.

The following is the workflow recommended when using the **Case Event** function.

1. Add the primary physician to the staff master list (**Study** > **Staff**) prior to the start of the case event. If desired, add the supplies and medications. See 12.1 Master lists on page 165 for instructions on how to select staff, supplies and medication.

2. After the lists have been chosen, begin logging time for the case study by selecting **Study** > **Case Event**.

   The *Case Event* window opens.

3. Select the **Case Type** and **Primary Physician**. Select **OK**.

   An entry appears in the *Log* window that indicates that the case has started. The system links any medication or supply used by the primary physician to that case.

4. To change the primary physician or to track supplies or medications for an additional diagnostic or interventional case:

   4.1. Select **Study** > **Case Event**.

   The logging of the current case stops and a new case begins. The log is updated with a new case start entry.

   4.2. The *Case Event* window appears. Select a different **Primary Physician** or **Case Type**. Every supply or medication used after you select **OK** is linked to that physician.

   NOTE
   Add the physician to the staff list if that physician has not previously been used in the case and does not appear in the **Primary Physician** field.

   To change the physician or case type, double-click in the **Summary** column of the *Log* window at **Case Event**. The *Case Event* window appears. Choose a different physician or case type.

   To launch a new case event using a macro instead of selecting **Study** > **Case Event**, see Chapter 13 Macros on page 179 for instructions.

6.4.1.2 Reports

1. Select **Study** > **Reports** or click the **Reports** icon.

   The *Reports* window appears.

2. Reports can be generated, viewed, edited, or deleted from this window. See Chapter 15 Reports on page 197 for information about reports.

6.4.1.3 Real-time display

Choose between Sweep mode and Scroll mode.

6.4.1.4 Export data

To manually export HL7 data to a third party device, select **Study** > **Export Data**.

NOTE
To export study reports selectively in PDF format, you must include the **#** at the beginning of the report format name when you generate the report. Reports that are generated in this format are included in the exported data when active translations include the **Selective Reports in PDF** option.

6.4.1.5 Close study

To close the study, select **Study** > **Close Study**.

NOTE
If the **Data export on study close** option is set, wait at least 5 minutes to ensure completion of the export. During the wait period, do not log off Windows or turn off the machine.

6.4.2 Study Configuration menu

Switch

See 7.1.3 Switch study configurations on page 113.

Save/Save As

See 7.1.2 Save study configurations on page 113.

Intervals

See 19.3 Customize intervals on page 276.

Column formats

See 19.4 Customize column formats on page 277.

Selected protocols

See 19.5 Customize protocols on page 278.

6.4.3 Measurements menu

6.4.3.1 Conduction intervals

To obtain computer assisted conduction interval measurements on signals displayed in the *Review* window, perform the following steps:

1. Select **Measurements** > **Conduction Intervals** or press **Action + Cond Intvls** (letter Q) keys on the keyboard.
2. Select the beat to measure in the *Review* window.
3. The appropriate intervals are marked on the signals.
4. Click **Done** when finished measuring.
5. The interval values are placed in the appropriate **Log** columns.
6. A **Conduction Intervals** event is also created in the log.
7. Highlight the marker to move the interval markers and move the reference line to the corrected position.
8. Right-click the marker to delete the interval markers.
9. The value displayed in the *Log* window reflects the changes.

6.4.3.2 Sinus node recovery time (SNRT)

1. Select **Measurements** > **SNRT** or press the **Action + SNRT** keys (letter W) on the keyboard.

   The *Sinus Node Recovery Time* window appears.

   A value automatically appears in the **Sinus cycle length** field and is derived from a prior baseline measurement. The **Sinus cycle length** value can be manually edited.

2. To populate the **Start time** and **Stop time** fields, select the appropriate time entries in the *Log* window.
3. Select the **Detect** button to enable the system to automatically detect SNRT events in the designated time frame.

   A SNRT event automatically appears in the log, corresponding to the Max SNRT. A SNRT measurement appears in the report if the SNRT section is part of the generated report format.

   The following table lists measurements and formulas that can be used to calculate SNRT:

   Table 6-3 Calculate SNRT

Description	Interval marks
Pacing interval	S1 - S1
Sinus node recovery time	Aa1 – Aa1
Corrected sinus node recovery time	CSNRT

6.4.3.3 Antegrade refractory period (ARP)

1. Select **Measurements** > **Antegrade Refractory Periods** or press the **Action + ARP** (letter E) keys on the keyboard.

   The *Antegrade Refractory Period* window appears.
2. To populate the **Start time** and **Stop time** fields, select the appropriate time entries from the *Log* window.
3. Select **Detect** to enable the system to automatically detect ARP events in the designated time interval.

   An ARP event automatically appears in the log, which corresponds to a trial or an AVN ERP. The refractory period event appears in the report if the refractory period section is part of the generated report format.

6.4.3.4 Retrograde refractory period (RRP)

1. Select **Measurements** > **Retrograde Refractory Periods** or press the **Action + RRP** (letter R) keys on the keyboard.

   The *Retrograde Refractory Periods* window appears.
2. To populate the **Start time** and **Stop time** fields, select the appropriate time entries from the *Log* window.
3. Select **Detect** to enable the system to automatically detect RRP events in the designated time interval.

   An RRP event automatically appears in the log, which corresponds to a retrograde or ventricular ERP. The refractory period event appears in the report if the refractory period section is part of the generated report format.

6.4.3.5 Manual measurements

To manually measure signals displayed in the *Review* window, perform the following steps:

1. Select **Measurements** > **Manual Measurements**.

   The *Manual Measurement* window appears.

2. Create a caliper in the *Review* window on the signal to be manually measured.
3. In the *Log* window, click the appropriate log column, anywhere beneath the column label.

   Interval markers are then placed on the appropriate signals in the *Review* window.
4. Click **Exit** when manual measurements are complete.
5. Move an interval marker by highlighting the marker and moving the reference line to the corrected position.
6. Delete an interval marker by highlighting and right-clicking the marker.
7. The value displayed in the *Log* window reflects the changes.

6.4.3.6 Stat vitals

WARNING

AUDIBLE INDICATORS MALFUNCTION

The audible indicators are for reference only. The audible indicators are not designed for use as a patient alarm.

WARNING

VISUAL INDICATORS MALFUNCTION

The visual indicators are for reference only. The visual indicators are not designed for use as a patient alarm.

To perform a stat vitals measurement, select **Measurements** > **Stat Vitals** or press the **Action** + **L** keys on the keyboard.

NOTE
The current heart rate, SpO_2, respiration rate, temperature, and optional inspired and/or expired CO_2 are recorded in the *Log* window. If a pressure was configured to record, it will also be included in the stat vital measurement.

6.4.3.7 Start/Stop NBP

NOTE
The NBP key toggles the action of the blood pressure cuff (inflate/deflate) from any acquisition or review system. To avoid confusion, initiate NBP from one designated system only. Ensure all users understand that an NBP request may be initiated from any acquisition or review system and once initiated, will be cancelled if the NBP key is pressed again.

NOTE
NBP inflation pressures are displayed on both the acquisition and review systems, but cuff inflation error message windows are only displayed on the acquisition system.

1. To do a stat NBP measurement, select **Measurements** > **Start/Stop NBP** or press the **NBP** key on the keyboard. The cuff inflates and the measurement, heart rate, SpO_2, respiration rate and temperature are recorded into the *Log* window.
2. To stop a cuff in the middle of an inflation, select **Measurements** > **Start/Stop NBP** or press the **NBP** key on the keyboard.

6.4.3.8 Auto-log vitals

To automatically log vitals at time intervals defined in the *Measurement Configuration* window (see 7.1.22.1 Measurements on page 124), select **Measurements** > **Auto-Log Vitals**.

NOTE
The current heart rate, SpO_2, respiration rate, temperature, and optional inspired and/or expired CO_2 are recorded in the *Log* window. If a pressure was configured to record, it will also be included in the stat vital measurement.

6.4.3.9 Auto-log NBP (optional)

To automatically log non-invasive blood pressure measurements with vitals, select **Measurements** > **Auto-Log NBP**. Set the vitals configuration to **Auto-Log NBP** when using NBP as the vital logging pressure source.

Auto-Log Vitals is most useful when you use an invasive blood pressure as the blood pressure channel.

Double-click the vitals event in the *Log* window to open a vitals event window. You can enter a level of consciousness and a level of pain in the vitals event window. Because the auto-log NBP records a set of vitals with each reading, this information may be redundant.

6.4.3.10 Measurements Configuration

Do this task to set the signals used for computer-assisted measurements.

1. In either the *Real-Time* or *Review* windows, select **Measurements** > **Measurements Configuration** and select the **Measurements** tab. Alternately, click the **Study Configuration** icon in the *Real-Time* screen and select the **Measurements** folder.
2. In order to calculate conduction intervals, the signals selected must be displayed on the *Real-Time* window.

   Designate the following signal types:

   - Three surface leads
   - Atrial channel
   - HIS bundle channel
   - Ventricular channel
   - Mark position (onset, amplitude, or max dV/dT)

6.4.3.11 Audible indicators

NOTE
The following instructions only apply when audible indicators are enabled from the *Vital Configuration* tab (see Chapter 7 Study Configuration on page 113).

WARNING

AUDIBLE INDICATORS MALFUNCTION

The audible indicators are for reference only. The audible indicators are not designed for use as a patient alarm.

1. Perform one of the following to silence the audible indicator:
   - Click the **Turn On Or Off Audible Indicator** icon in the toolbar.
   - Select **Measurements** > **Silence Audible Indicator** from the *Real-Time* or *Review* screen.
   - Press **Ctrl** + **D** on the keyboard.
2. Click **Yes** at the confirmation window.

NOTE
A confirmation window is not displayed if the icon is selected from the toolbar.

6.4.3.12 Data extraction

All channels of data can be exported from the system for a user-selectable time. The data is extracted in either binary or text.

On large data sets, the data extraction operation may take several minutes to complete. During this time, the application does not respond to other user inputs. If you attempt to interact with either the application or the *Data Extraction* window, the system displays an error message and the data extraction bar stops advancing. If this happens, ignore the message. The operation will complete successfully even if the data extraction bar stops advancing.

To avoid this issue, try to extract large data amounts when the operation does not create a workflow issue. Use the data sizes in the extraction window to determine the least-disruptive timeframe to schedule the extraction. Remember to consider your unique user workflow and the speed of the data extraction.

NOTE
Data extraction always exports blood pressures in units of mmHg, regardless of whether the system is in mmHg mode or kPa mode.

To extract data for a case:

1. From the *Real-Time* window, select **Measurements** > **Data Extraction**.

   The *Data Extraction* window appears.
2. To populate the **Start time** and **Stop time** fields, select the appropriate time entries in the *Log* window.
3. Enter a brief description of the data being extracted.
4. Select the file type (**Mode**) desired and the pages to extract.
5. To keep the default location for the files, select **Extract**. To modify the default location for the files, select **Browse** to choose a new location, and then select **Extract**.

NOTE
Data extraction files may be very large.

6.4.4 Windows menu

The administrator logon is required to save any changes to the Windows settings, or to delete Windows settings. Contact the site network administrator for administrative privileges.

6.4.4.1 Save or Save As

1. To save changes to the current window layout, select **Windows** > **Save (Name)**, where **Name** is the name of the current window setting.
2. To save the window layout with a new window setting name, select **Windows** > **Save As**. The *New Window Setting Name* window appears.
3. Enter the new window setting name in the text field and select **OK** to save the window setting. The **OK** button is disabled until you enter a name that does not already exist in the system.

6.4.4.2 Switch

1. To switch to a new window setting, select **Windows** > **Switch**. The *Select a Window Setting to Switch* window appears.
2. Highlight the name of the window setting and select **OK**. Click **Cancel** to exit without selecting a window setting.

6.4.4.3 Delete

1. To delete a window setting, select **Windows** > **Delete**. The *Select a Window Setting to Delete* window appears.
2. Highlight the setting to delete and click **OK**. The highlighted window setting is deleted. Click **Cancel** to exit without deleting a window setting.

6.4.4.4 Timer

To activate the timer on the *Real-Time* or *Review* screen:

1. Select **Windows** > **Timer** or the **Timer** icon. The *Timer* window appears.
2. Select the title bar to drag the timer to the desired location.
3. Select **Set**, and enter the amount of time for the timer to count down in HH:MM:SS (hours:minutes:seconds) format. Select **OK**.
4. Select **Start**. The timer begins counting down the amount of time entered. The timer display is bright green when the time expires.
5. Select **Stop** to stop the timer at any time.
6. Select **Rename** to open a window allowing the timer name to be changed. Enter the new name for the timer and select **OK**.
7. Select **X** to close the *Timer* window at any time.

NOTE
The system can simultaneously display a maximum of 5 timers.

6.4.4.5 Stopwatch

To activate the stopwatch on the *Real-Time* or *Review* screen:

1. Select **Windows** > **Stopwatch** or the **Stopwatch** icon. The *Stopwatch* window appears.
2. Select the title bar to drag the stopwatch to the desired location.
3. Select **Start**.

The stopwatch starts counting forward.

4. Select **Stop** to stop the counting.
5. Select **Reset** to clear the stopwatch display.
6. Select **Rename** to change the stopwatch name. Enter the new name for the stopwatch and select **OK**.
7. Select **X** to close the stopwatch.

NOTE
The system can simultaneously display a maximum of 5 stopwatches.

6.4.4.6 *Real-Time* or *Review*

To view the *Real-Time* or *Review* screen, select **Windows** > **Real-Time** or **Windows** > **Review**.

6.4.4.7 *Log*

To view the *Log* window, select **Windows** > **Log**. Place the *Log* window on any monitor. See 8.1 *Log* window on page 133 for additional information.

6.4.4.8 Ablation

To view the *Ablation* window, select **Windows** > **Ablation** or select the *Toggle Ablation Window* icon in the *Real-Time* window. See 8.3 *Ablation* window on page 142.

6.4.4.9 Alignment (optional)

To view the *Alignment* window, select **Windows** > **Alignment**. See 20.2 Alignment on page 288.

6.4.4.10 Map (optional)

To view the *CardioMapp* window, select **Windows** > **Map**. See 20.1 CardioMapp on page 283.

6.4.4.11 *Holter* (optional)

To view the *Holter* window, select **Windows** > **Holter**. See 8.2 *Holter* window on page 142.

6.4.4.12 Plot (optional)

To view the *Plot* window, select **Windows** > **Plot**. See 8.4 *Plot* window on page 143.

6.4.4.13 *Macro*

To view the *Macro* window, select **Windows** > **Macro**. Place the *Macro* window on any monitor. See 13.1 *Macro* window on page 179.

6.4.4.14 Image windows (optional)

To view an image window, click **Windows** and select:

- **Image 1**
- **Image 2**
- **Image 3**
- **Image library**

- **PruckaStream**

See Chapter 9 X-Ray Image Capture on page 151 and Chapter 10 Ultrasound Image Capture on page 159.

6.4.4.15 *End Tidal CO2*

To view the *End Tidal CO2* window, select **Windows** > **End Tidal C02**. See 11.2 *End Tidal CO2* window on page 161.

6.4.5 Administration menu

System Settings

See 19.1 Configure *System Settings* on page 265.

Print Setup

To open the Windows Printer Configuration, select **Administration** > **Print Setup**.

Reports

See Chapter 15 Reports on page 197.

Amplifier Test

To test communication from the system to the amplifier, select **Administration** > **Amplifier Test**.

6.4.6 Help menu

To view the online version of the CardioLab user manual, select **Help** > **CardioLab Help**.

Select **Help** > **About CardioLab** to view information regarding the CardioLab system.

6.5 *Real-Time* and *Review* window toolbar functions

Sweep/Scroll Speed

To adjust the waveform's sweep/scroll speed (in mm/sec) in the *Real-Time* or *Review* window, highlight the respective window and perform one of the following:

- Press the **Sweep (Up)** or **Sweep (Down)** keys on the keyboard.
- Select the **-** and **+** icons in the toolbar.
- Select a sweep speed from the drop-down menu.

To add a custom sweep speed to the drop-down list:

1. Highlight the sweep speed and type the new sweep speed number in the white area.
2. Deselect the area or press **TAB**.

NOTE
The new sweep speed will not be added to the **Change Speed** menu option and only the last entered custom speed will be saved for the next study.

6.5.1 Study Configuration

See Chapter 7 Study Configuration on page 113.

6.5.2 Time and amplitude calipers

Time calipers are used to measure the time interval of a signal in milliseconds (ms) or beats per minute (BPM). Amplitude calipers measure the amplitude of ECG signals in millivolts (mV).

NOTE
A maximum of 10 calipers can be displayed in the *Real-Time* or *Review* window at one time.

Amplitude and time calipers can be displayed at the same time.

To perform an amplitude or time measurement in either the *Real-Time* or *Review* window:

1. Click the **Time Calipers** or **Amplitude Calipers** icon in the respective windows.
2. Click a signal in the respective window to drop the first caliper leg.
3. Drag the calipers horizontally (time calipers) or vertically (amplitude calipers) to the desired location and release the mouse button to drop the second caliper leg.
4. To move the caliper without changing the measurement distance, click the caliper crossbar (not the label) and drag the entire caliper to the new location.
5. To move a single caliper leg and change the measurement, click the leg to move and drag it to a new location.
6. To add an additional caliper leg, double-click the existing leg (the anchor) and drag the second leg to the new position.

6.5.3 Delete all calipers

You can simultaneously delete all calipers from the *Real-Time* or *Review* windows.

1. Click the **Delete all calipers** icon.
2. To delete a single caliper, highlight the caliper and right-click.

6.5.4 Caliper Value in ms

Select the **Caliper Value in ms** icon to toggle the display of the millisecond value of the caliper in the *Real-Time* or *Review* window.

6.5.5 Caliper Value in BPM

Select the **Caliper Value in BPM** icon to toggle the display of the beats per minute value of the caliper in the *Real-Time* or *Review* window.

NOTE
When starting a new study, the caliper settings will be the same as the last used settings from the previous case. This applies to both the *Real-Time* and *Review* window calipers.

6.5.6 Active Review Menu

When multiple *Review* windows are open, select the **Toggle Active Review Window** icon to control which *Review* window is active. Multiple *Review* windows cannot be active at the same time.

6.5.7 Update On/Off

Select the **Update** icon in the *Review* window to continuously update it with the latest events.

If the **Update** icon is turned off, the *Review* window does not reflect the most recent events, such as the last beat of a stim train.

6.5.8 Offset Signals

To reorganize the signals in proportion to each other in the *Real-Time* or *Review* window, do one of the following:

- Click the **Offset Signals** icon.
- Press the **O** key on the keyboard.
- Highlight the signal, left-click and drag it to the proper position.
- For channel groups, press **SHIFT** + **O** to offset the selected channels. All unselected channels will remain in the same position.

6.5.9 Triggered mode – *Real-Time* window

See 6.1.3 Trigger mode activation mapping on page 93.

6.5.10 Toggle *Ablation* window – *Real-Time* window

See 8.3 *Ablation* window on page 142.

6.5.11 Snapshot

Snapshot is available in the *Review* window.

- If you use ClearMatch, then the snapshot creates a color picture of the event.
- If you do not use ClearMatch, then the snapshot creates a black-and-white picture of the event.

You can annotate and print this picture.

1. In the *Review* window, navigate to the desired event.
2. Click the **Snapshot** icon. A *Snapshot* dialog box opens.
3. To print the snapshot, enter a name and select **Print**.

NOTE
Notes may be entered onto the snapshot before it is printed or saved. To do this:

3.1. Click **Annotate** in the *Snapshot* dialog box. An *Image Viewer* opens.

3.2. Enter text, lines, or arrows to highlight the event as desired.

3.3. When complete, select **File** > **Exit**. Click **Yes** to save changes.

NOTE
The snapshot is time-stamped in the *Log* window.

6.5.12 Screen capture

Screen capture is available in any window. A screen capture takes a capture of the entire monitor screen, resulting in a picture containing everything on the monitor screen.

1. During a study, place the cursor on the monitor containing the screen to capture and press the key on the keyboard. A capture of that screen will be added to the current study in the *Log* window.
2. Open the snapshot for editing in the *Image Viewer* by double-clicking on it in the *Log* window. See 8.5 Image Viewer on page 144 for instructions on editing the image.
3. To capture error message boxes, dialog boxes and windows, press the **Action** + **Print Scrn** keys on the keyboard. The screen capture is saved to the clipboard. Paste the capture in another application to view and save it.

6.5.13 Real-Time 12 lead print

1. Click the **Real-Time 12 Lead** icon in the *Real-Time* window or press the **12 Lead** key.

A 12 lead event is added to the *Log*, signal data is saved to the *Review* window, and a 12 lead will be printed to the default printer.

NOTE
All PR intervals less than 20 or greater than 1500 will be represented as "****" on the 12 lead printout.

6.5.14 Review 12 lead print

Select **Review** > **12 Lead**, or, in the *Review* window, click the **Review 12 Lead** icon.

A review 12 lead event is added to the *Log* window and a 12 lead will be printed to the default printer.

NOTE
All PR intervals less than 20 or greater than 1500 will be represented as "****" on the 12 lead printout.

6.5.15 Print (*Review* window)

To print the *Review* window:

1. Select **Review** > **Print**, click the **Print** icon in the *Review* window, or press the **Print** key on the keyboard.

   The **Comment for Printout** dialog box appears.
2. Type a comment in the field if desired.
3. Click **OK**. This prints the data currently displaying in the *Review* window.

6.5.16 Timer

See 6.4.4.4 Timer on page 106.

6.5.17 Stopwatch

See 6.4.4.5 Stopwatch on page 106.

6.5.18 Create Event at Review Window Time

The following events are available in the *Review* window:

- Arrhythmias
- Conduction Block
- Note
- Pacing Site
- Phase
- Refractory Period
- SNRT

To create an event in the *Review* window:

1. Click the **Create Event at Review Window Time** icon, then select an event from the list.

   NOTE
   The time in the *Note* window correlates with the time at the bottom of the*Review* window.

2. Enter the requested data for the event.
3. Click **OK** to close the window. The event is time stamped in the *Log* window.

6.5.19 Turn scrolling on or off

This function toggles the *Real-Time* waveform display between **Sweep** and **Scrolling**. Also, the mode selected remains active for the current study (and future studies) until toggled again.

NOTE
Scrolling at higher speeds on an LCD monitor may result in unacceptable blurring.

NOTE
Scrolling should not be selected when the LDM is connected as the remote display.

6.5.20 Rename this window (Prucka™ 3 Amplifier configuration only)

This function allows you to rename the *Review* window to reflect the current morphology or clinical situation. This name disappears when you close the window or the study.

NOTE
If you rename the window and scroll to a different time, the new location might not reflect the name of the window. Rename the window to reflect the updated situation, or update it to a generic value such as **Review Window 1**.

This feature is for your convenience. You are responsible for accurately naming the window. The system cannot determine if the name that you provide accurately represents the morphology or medical condition that is present in the selected situation.

7

Chapter 7 Study Configuration

This chapter describes the study configurations for the *Real-Time* and *Review* windows and provides information about analog input. See 19.2 Customize study configurations on page 275 for additional information.

7.1 *Study Configuration – Real-Time* window

To view or edit channel, vital, and other real-time system settings, access the **Study Configuration** options in the *Real-Time* window.

NOTE
To make modifications to the real-time and acquisition settings (configurations), press the **Setup** key or select the **Study Configuration** icon in the *Real-Time* window and not in the *Review* window. The *Review* window **Study Configuration** icon changes the display for saved waveforms in the *Review* window only.

7.1.1 Access the *Study Configuration* window

1. Start a new study or continue an existing study from the *Navigator* window (see Chapter 5, Navigator Window on page 71).
2. Verify the patient information and click **OK**.

   The *Real-Time* window opens.
3. Click the **Study Configuration** icon.

   The *Study Configuration* window opens.

7.1.2 Save study configurations

The administrative logon is required to save study configurations. Contact the site network administrator.

7.1.3 Switch study configurations

To switch to a different study configuration after starting a procedure:

NOTE
Save of signal data must be off.

1. Select **Study Configuration** > **Switch**. The *Select a Study Configuration to Switch* window appears.
2. Select the study configuration to switch and click **OK** or click **Cancel** to cancel the task.
3. An event is added to the *Log* indicating the study configuration name change.

   NOTE
   Invasive blood pressures must be re-zeroed after switching study configurations.

NOTE
The monitor screens will turn gray for a few seconds while the system reconfigures with the amplifier.

7.1.4 ECG display settings

The system may report erroneous values when pacemaker spikes, arrhythmias, or significant noise are present.

1. Select the **ECG** branch from the list. The *Display Settings* tab appears.
   The **Channel** column lists the channel numbers.
2. Configure the channel display as follows:
   - Use the **Scale** pull-down menu in the top right corner of the window to set the scale of all channels.
   - In the **Clip** column, click the corresponding drop-down box to set the clipping for each channel, or highlight the channel and press C.
     - **C1:** Signal is clipped to the full size of its lane. For example, in the case of 12 signals, each signal has 1/12 of the vertical height of the signal display.
     - **C2:** Signal is clipped to 2/3 the size of its lane.
     - **Blank (none):** Signal is not clipped.

     NOTE
     When a signal is clipped, the letter **C** precedes the signal in the label area of the window.
   - In the **Color** column, click the cell to define the signal color for the corresponding channel.
   - In the **Display Pages** grid, configure the channels to show or hide on a page:
     - To show or hide a channel on a page, click in the cell corresponding to that channel and page.
     - To show all displayed channels on a page, click in the cell for that page number.

     NOTE
     The number of signals displayed on a page are listed at the bottom of the **Display Pages** column.
   - Turn **Always Save** on or off for individual channels by clicking in the **Always Save** cell for that channel.

     NOTE
     If saving is enabled, the **Always Save** option saves signals in the background when they are not displayed.

NOTE
To set any of the previous settings on an individual channel, right-click the channel label in the *Real-Time* or *Review* window and adjust the settings appropriately.

7.1.5 ECG hardware settings

1. Select the **ECG** branch from the list.

2. Select the **Hardware Settings** tab.
3. Select the **Gain**, **High Pass**, **Low Pass** and **Power Line** filter settings by clicking on the individual cell and selecting from the drop-down menu.

NOTE
In CardioLab, **Power Line** filters are always configured to **Fixed**, by default.

4. For an electrophysiological procedure displaying a 12 lead, all ECG signals should be active. To make the signal active, click the **Active** cell for each channel to be displayed.
5. Set the display scale to 1/16 (recommended) from the **Scale** pull-down menu.

7.1.6 Pressure Display Settings

The system may report erroneous values when pacemaker spikes, arrhythmias or significant noise are present.

1. Select the **Pressure** branch from the list. The **Display Settings** tab appears.
2. Set the **Scale** from the pull-down menu.
3. Define the signal color for each channel from the pull-down menu in the **Color** cells.
4. Use the **Display Pages** grid to configure channels to display on the *Real-Time* pages. To show or hide a channel on a page, click in the cell corresponding to that channel and page. To enable or disable all displayed channels on a page, click in the cell for that page number.

   The number of signals displayed on a page are listed at the bottom of the **Display Pages** columns.

7.1.7 Pressure Hardware Settings

High Pass and Low Pass Filters default to standard settings for the type selected and do not normally need to be adjusted. High Pass filters cannot be changed.

1. Select the **Pressure** branch from the list.
2. Select the **Hardware Setting** tab.
3. Select the appropriate **Label** and **Low Pass** filter settings from the pull-down menus.

7.1.8 Configuring the pressure gridPressure Grid Setup

Use this feature to turn on a visual grid, set the scale and select the number of lines contained in the grid.

1. Select the **Pressure** branch from the list. Select the **Grid Setup** tab.
2. In the **Grid** column, click in the cells to turn the grid under the pressure signals on or off.
3. Set the **Scale** from the pull-down menu.

NOTE
Scale values are listed in kPa when in kPa mode.

4. In the **Lines** column, select the number of graticules (lines).

7.1.9 Setting catheter blocks

The number of catheter blocks listed varies depending on which type of amplifier is connected to the system.

- Prucka™ 3 Amplifier (128 channel) — blocks A, B, C, D, E, F, and G
- CardioLab II Plus Amplifier (64 channel) — blocks A, B, and C
- CardioLab II Plus Amplifier (128 channel) — blocks A, B, C, D, E, F, and G

Channel types with the CardioLab amplifier include:

- Bipolar
- Unipolar — WCT (Wilson Central Terminal)
- Unipolar — auxiliary reference
- Ablate and record using auxiliary reference poles

7.1.10 Intracardiac block display settings

WARNING

INACCURATE WAVEFORM DISPLAY

To avoid incorrect waveform display, ensure intracardiac catheter connections and settings are configured as intended.

1. Click the **Display Settings** tab.
2. Select a **Catheter Block** from the list.

   The **Display Settings** tab appears.
3. The page number is in the **Display Pages** column of the corresponding channel. The number in the **Channel** column is the channel on which the signal resides on the amplifier.
4. Set the display scale to 1/16 (recommended) from the **Scale** pull-down menu.
5. Set the clip settings by selecting the pull-down menu under the **Clip** column. Choose C1 or C2, or leave blank for none.
6. Define the signal color from the pull-down menu in the **Color** cells.
7. Use the **Display Pages** grid to configure channels to display on the **Real-Time** pages. To show or hide a channel on a page, select the cell that corresponds to that channel and page. To enable all displayed channels on a page, select the cell for that page number.

   The number of signals displayed on a page is listed at the bottom of the **Display Pages** columns.
8. Turn **Always Save** on or off for individual channels by selecting the **Always Save** cell for that channel.

NOTE
If saving is enabled, the **Always Save** option saves signals in the background when they are not displayed.

7.1.11 Configure intracardiac block hardware settings

WARNING

INACCURATE WAVEFORM DISPLAY

To avoid incorrect waveform display, ensure intracardiac catheter connections and settings are configured as intended.

1. Select a **Catheter Block** from the list. Select the **Hardware Settings** tab.
2. Select the appropriate **Type**, **Label**, **Inputs**, **Gain**, **High Pass**, **Low Pass**, and **Power Line** filter settings from the corresponding drop-down menus.

> **NOTE**
> For CardioLab II Plus Amplifier only: To assist in quickly removing DC offset due to pace pulse energy, the CardioLab amplifier automatically applies a 14.2 Hz high pass filter to any channels defined as **Pace** and **Record**.

3. Set the display scale from the **Scale** drop-down menu.

7.1.12 Adding a catheter signal

> **NOTE**
> The system will display noise on channels displaying unused catheter inputs.

1. Select the appropriate intracardiac block from the *Study Configuration* window to add the catheter signal.
2. Select the **Hardware Settings** tab.
3. When adding a new signal or channel, the signal **Type** (bipolar, unipolar, etc.) must be selected first and then the rest can be built.
4. Choose the appropriate **Label**.
5. Select a **Label**.
6. Enter the **Inputs** where the catheters are plugged into the catheter input module.
7. Select an appropriate **Gain**.
8. Select the catheter signal display **Color**.
9. Choose the **Display Pages** on which to display the signal.
10. Select the **Always Save** option.

> **NOTE**
> The **Always Save** option is usually turned off for catheter signals.

11. Adjust the **Filter Settings** accordingly.

NOTE
- The **Power Line** options are designed to be used on catheter signals only to mitigate power line noise.
  If you see power line noise at either 50 Hz or 60 Hz, use one of the following filters:
  - **AUTO Power Line** (recommended): This filter automatically switches between the **Fixed** and **Adaptive** power line filters, where the fixed is used when pacing, and adaptive is used in all other situations.
  - **Fixed Power Line**: Use this option for signals that are pacing, ablating, or experience frequent railing. You can apply this option to all signals.
  - **Adaptive Power Line**: Use this option for signals that are not pacing, ablating or experience frequent railing.
  - **Off**: Use this option when no power line filtering is desired. No power line filter is active on the signal.

12. Select the **Display Settings** tab.
13. Select the appropriate **Clip Level** (C1, C2, or off).
14. Select the catheter signal display **Color**.
15. Choose the **Display Pages** on which to display the signal.
16. Select the **Always Save** option.

NOTE
The **Always Save** option is usually turned off for catheter signals.

17. Click **Save** to save changes.

7.1.13 Configure the stimulator (CardioLab amplifier)

You can configure the stimulator (or stim) either in the *Study Configuration* window or by right-clicking one of the **Enable/Disable Stim** icons in the *Real-Time* window.

To configure the stimulator in the *Study Configuration* window:

1. Select **Stim** from the list. The **Pacing Settings** tab appears.
2. Select the appropriate + and - poles from the **Inputs** column.
3. To enable pacing, select the cells of the **Pacing Enabled** column to display **Yes**. To disable pacing, leave the cells blank.
4. Define the pacing site by selecting the appropriate site labels from the drop-down menu in the **Site** column.
5. To enable multiple stims, select the check box next to **Multiple stims enabled**.
6. Select **Apply** to set changes.

NOTE
Each catheter input module is divided accordingly.

Customarily, each pacing channel requires one positive and one negative pole. To maximize the flexibility of pacing channels, only one positive and one negative connection should be made for each group (for example, 1-16, 17-32 A; 1-16, 17-32 B).

NOTE
Pacing and ablating simultaneously can cause noise. To reduce the amount of noise, see 18.6.11 Signal noise on page 244.

NOTE
For the CardioLab II Plus Amplifier:To assist in quickly removing DC offset due to pace pulse energy, the CardioLab II Plus Amplifier automatically applies a 14.2 Hz high pass filter to any channels defined as **Pace** and **Record**.

7.1.14 Pacing shortcuts

7.1.14.1 Change pacing poles

1. Highlight the signal and press the **Pace** key (letter **P**).

   The system opens a window prompting for the stimulator channel (1-4), according to which stimulator channel is used to pace to the designated poles.

   The system does not update the pacing poles unless the channel is selected.
2. After the selection is made, the appropriate poles are updated in the **Stim Enable** buttons at the top of the *Real-Time* window.

7.1.14.2 Review pacing data

1. With the focus on a stim train in the *Log* window, press the **Action** + **Prev** and **Next** keys.
2. The appropriate data is displayed in the *Review* window for that pacing interval.

NOTE
Stimulus trains that contain 5 pacing pulses or less will be documented in the system log starting with an S2-S3 interval up to an S5-S6 interval.

Stimulus trains must contain at least 4 (up to 10) S1 pulses to be recognized as a pacing train and be logged with the following intervals: S1-S1, S1-S2, S2-S3 up to S5-S6.

Stimulus trains that fall outside the preceding boundaries will be considered decremental pacing. All stimulus intervals will be reported as S1-S1. Extended pacing trains, such as those performed during SNRT testing, are considered a special form of decremental pacing, and will be appropriately marked as S1-S1.

7.1.15 Stimulus Inputs for the CardioLab amplifier

Table 7-1 Stimulus Inputs for the CardioLab amplifier

Stimulus Input 1	Blocks A - G: 1-32
Stimulus Input 2	Blocks A - G: 1-32
Stimulus Input 3	Blocks A - G: 1-32

Table 7-1 Stimulus Inputs for the CardioLab amplifier (Table continued)

Stimulus Input 4	Blocks A - G: 1-32

7.1.16 Stim display and hardware settings

7.1.16.1 Enable Auto Detection

The **Auto Detection** setting detects the onset of pacing and initiates a log entry. To enable this setting:

1. Select **Stim** from the list. Select the **Display and Hardware Settings** tab.
2. Select the **Auto Detect** check box for each stim channel to enable automatic detection during pacing.

7.1.16.2 *Display Settings* area

1. In the **Clip** and **Color** column, click in the cells to select the appropriate values from the pulldown menu.
2. In the **Display Pages** column, click in the cells to enable the stim channels to display on various pages.
3. Turn **Always Save** on or off for individual channels by clicking in the **Always Save** cell for that channel.

NOTE
If saving is enabled, the **Always Save** option saves signals in the background when they are not displayed.

4. The stim channel displayed in green at the bottom of the *Display Settings* area is the stim channel toggle channel.

   The system detects which channel is being used to pace, and it fills in this channel row automatically. This channel is also reflective of the data in the stim toggle button in the *Real-Time* window toolbar.

NOTE
The stim toggle channel is usually the only stim channel displayed on any of the pages, unless simultaneously pacing two different stim sites.

7.1.16.3 *Hardware Settings* area

1. In the **Filter Settings** column, click in the **High Pass** and **Low Pass** cells to select the appropriate filter setting in the pull-down menu.

NOTE
The filters settings are defaults and should not need to be adjusted.

NOTE
For CardioLab II Plus Amplifier only:To assist in quickly removing DC offset due to pace pulse energy, the CardioLab amplifier automatically applies a 14.2 Hz high pass filter to any channels defined as **Pace** and **Record**.

2. In the **Gain** column, click in the cells to select the appropriate gain values.

   NOTE
   A typical gain setting is 50.

3. To change **Power Line** filtering of pacing data to **Fixed** or **Off** for individual channels, choose the corresponding value from the drop-down menu in the **Power Line** cell.
4. When the settings are modified, select the **Close** button to save only for the case, or select **Save/ Save As** to permanently save with the administrator password.

7.1.17 Emergency pacing/direct stimulator/connecting pacing poles

The system may report erroneous values when pacemaker spikes, arrhythmias or significant noise are present.

Each catheter input module (CIM) contains direct connections to the stimulator. These connections are labeled + and - on the CIM, and provide a direct connection to the stimulator. This connection does not fully rely on the CardioLab system, and should be used in the event of CardioLab system failure to allow pacing to occur. If there are any problems with pacing, perform the following steps:

1. Place the distal catheter pins into the appropriate + and - inputs of the direct stimulator connections on the front of the CIM.
2. Use the appropriate channel of the stimulator to pace directly to that catheter.
3. During this process, the system is bypassed, and the signal is not displayed on the CardioLab system.

7.1.18 Analog input (CardioLab II Plus Amplifier only)

Analog inputs enable the system to input non-isolated, high-level signals as one of the normal CardioLab channels during a case.

Signals must be in the range of +/- 5V. A low pass filter set at 500Hz is automatically applied to all input signals. To connect analog inputs, connect the high-level signal into one of the analog inputs (1 through 4) on the back of the analog IO box.

To configure analog input settings:

1. Select the **Input Channel** branch from the list. The **Display Settings** tab appears.

   If **Input Channel** does not appear, contact GE service personnel.
2. Select the scale from the pull-down menu in the **Scale** column.
3. Select the clip from the pull-down menu in the **Clip** column. Choose C1 or C2, or blank for none.
4. Define the signal color from the pull-down menu in the **Color** cells.
5. Select the channels to be displayed on each page.

   5.1. Select the cells in the **Display Pages** column. For example, select the cell for channel 1 in the **Display Pages** field to display the channel on page 1.

   To display all available channels on a page, click the page number at the top of the **Display Pages** column. The number of signals displayed on a page is listed at the bottom of the display page columns.

6. Channel labels can be changed by selecting the corresponding cell and pressing the **Backspace** key and then edit the label.
7. Turn **Always Save** on or off for individual channels by clicking in the **Always Save** cell for that channel.

7.1.19 Analog out

Analog output signals are signals that are digitally acquired by the CardioLab amplifier, and distributed by the CardioLab system in analog form. The system can output a maximum of 16 analog out signals.

The signals are sent out of analog channels 2 through 16, starting with the first signal displayed on the page. Analog out channel 1 is reserved for use by the **Protocol Sense Channel** setting.

To set the analog out settings:

1. Select **Analog Out** from the list. The **CardioLab EP Analog Output Configuration** tab appears.
2. The **Single Sense Channel** option sends the sense channel from the *Real-Time* window to the external stimulator. Select the **Single Sense Channel** option in the Mode pull-down menu to have the CardioLab system output a single channel of analog out. The signal sent by the system is controlled by the **Protocol Sense Channel** setting. This is the channel on the *Real-Time* window that has the **S** next to the label. To switch the **Analog Out Sense Channel**, highlight the desired channel and press **S** on the keyboard.
3. Select **Track Monitor Channel(s)** to output up to 16 analog out channels.
   3.1. Select from the **On page** drop-down menu to select the channels to be sent out. If displaying more than 16 channels, the analog out function begins counting from the top signal sequentially down until it reaches the maximum of 16. Any additional channels will not be sent out, but will appear on the screen. These channels can be ECG, Blood Pressure, or intracardiac signals.
   3.2. If **Dynamic Page** is selected, the system will change pages to send via analog out based on the page currently displayed on the *Real-Time* screen.

NOTE
The maximum range of analog out output is +/- 5 V. Most clipping starts at +/- 4.5 V.

The output voltage level is equal to what is being input into the amp channel times the gain of that channel, therefore, the output levels are adjustable by amp channel gain. For example, if a 40 mVp-p signal is input into a channel with a gain of 50, the corresponding analog output would be 2 Vp-p. For blood pressure, a 100 mmHg signal corresponds to a 1V analog output.

The Analog IO box allows output of system signals to other devices. Set the switches to the **CLAB AMP** position to use the CardioLab amplifier as the source for the outputs CH2 – CH4 and CH13 – CH16.

Label	Description
1	Input from the CardioLab amplifier (from computer)
2	Input from PDM

NOTE
The CH SEL switch selects one of the first 12 outputs (CH1 – CH12) to be accessed through the 4 CH SEL OUT connectors.

7.1.20 Ablation module

1. Select **Ablation** from the list. The **Configuration** tab appears.
2. Use the drop-down menus in the **Real-Time** field to set the **Time range (S)**, **Number of temps**, **Power scale (W)**, and **Imp scale (Ohms)**.
3. Select the check boxes in the **Review (Plot Window)** field to enable data for **Impedance**, **Power**, **Voltage**, **Current**, and a maximum of four temperatures.
4. Select the **Ablation device type**, **Serial port** where the ablation device is connected and **Minimum time for Ablation** in the **Device settings** field.
5. After the ablation device and its parameters have been entered, select **Apply** to activate them (must be done when no ablation is in progress).

   NOTE
   See 7.1.21 Switch ablation devices on page 124 for information about switching devices in a case.

7.1.21 Switch ablation devices

1. Select the **NULL** ablation device driver.
2. Select **Apply** and wait five seconds for the selection to be processed.
3. Switch ablation cables, as necessary.
4. Select the new ablation device.
5. Select **Apply** and wait five seconds for the selection to be processed.
6. Proceed with the case.

7.1.22 Measurements settings

7.1.22.1 Measurements

1. Select **Measurements** from the list.

   The **Measurements** tab appears.
2. Select the **Trigger Channel** from the pull-down menu. See 6.1.3 Trigger mode activation mapping on page 93 to start the triggered sweep task.

   To change the trigger channel, highlight the signal and press the **Trig** key (letter **T**).
3. In the **Computer assisted measurements** field:

   The channel selected from the pull-down menus must be displayed on the *Real-Time* window for the computer-assisted measurements to measure the intervals.

   3.1. Select the **Surface lead channels** from the pull-down menus.

   3.2. Select the **Atrial channel** from the pull-down menu.

   3.3. Select the **His bundle channel** from the pull-down menu.

   3.4. Select the **Ventricular channel** from the pull-down menu.

   3.5. Select the **Mark position** from the pull-down menu.
4. Set the **Minimum interval between stim trains** in ms.

7.1.22.2 Configure Autosave Setting

1. Select the **Autosave Setting** tab.
2. Select the high and low threshold in the **Heart rate channel one** and **Heart rate channel two** fields.
3. Select **Save criteria**.

7.1.22.3 Vital Configuration

WARNING

AUDIBLE INDICATORS MALFUNCTION

The audible indicators are for reference only. The audible indicators are not designed for use as a patient alarm.

WARNING

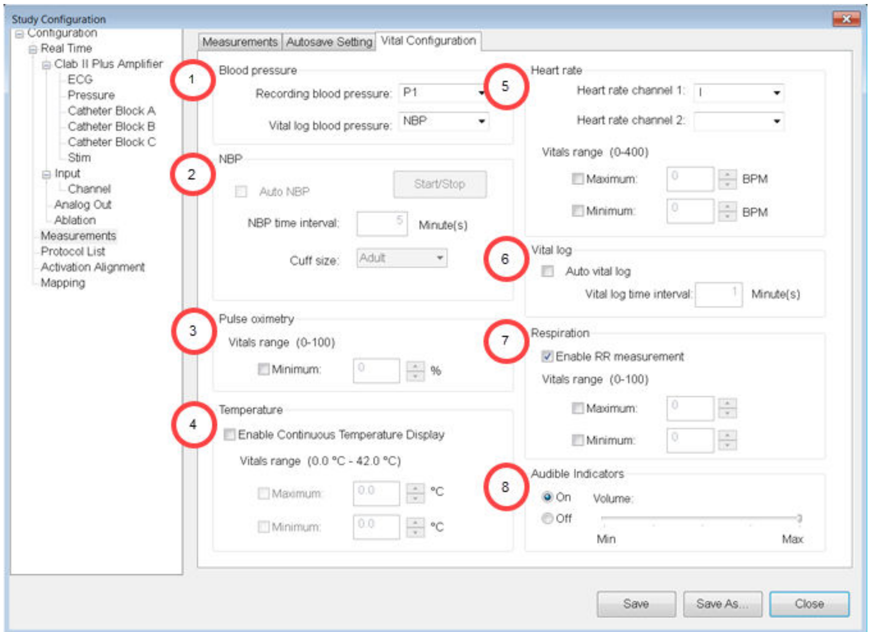
VISUAL INDICATORS MALFUNCTION

The visual indicators are for reference only. The visual indicators are not designed for use as a patient alarm.

1. Access **Vital Configuration** using one of the following ways:
   - On the **Measurements** menu, select **Measurements Configuration** and then select the **Vital Configuration** tab.
   - Select the **Study Configuration** icon. Then, in the **Study Configuration** navigation tree, select **Measurements**.
2. Use Figure 7-1 Vital Configuration tab (Real-Time window display) on page 126 and Table 1 to configure the settings for each section on the **Vital Configuration** tab.
3. When finished, select **Close**.

NOTE
The acquisition system controls the **Vital Configuration** parameters. A review workstation that is joined to the same study can see, but cannot change, the settings from the acquisition system. Changes made on the acquisition system are applied to the review workstation only when the **Close** button is pressed.

Figure 7-1 Vital Configuration tab (Real-Time window display)



NOTE

Options for **Vital Configuration** are the same for both the *Real-Time* and *Review* windows.

Table 7-2 Vital Configuration tab sections

Callout	Description	See section
1	Set up for logging a non-invasive (NBP) or invasive blood pressure (P1, P2, P3, or P4). The pressures selected here are displayed in the status bar.	Blood pressure on page 127
2	Enable or disable the auto non-invasive blood pressure measure-ment, set up the NBP acquisition time interval, and select the blood pressure cuff size. **NOTE** Using automatic NBP logging causes the system to take automatic NBP readings at the configured interval. The blood pressure reading is placed into a vitals event in the *Log* window when the NBP reading is complete. Using auto vital log also inserts vitals events into the *Log* window at a configurable interval. Auto NBP and auto vital log should not be used at the same time because this can cause double documentation in the patient study. Use auto NBP for non-invasive pressure from the cuff. Use auto vital log to record an invasive pressure.	NBP on page 127
3	Enable display of the SpO_2 reading with a yellow background when the pulse oximetry value drops below a specified percent.	Pulse oximetry on page 127
4	Enable display of the patient temperature recorded by the cath amplifier, updated every second.	Temperature on page 128
5	Configure features related to heart rate display.	Heart rate on page 128

Table 7-2 Vital Configuration tab sections (Table continued)

Callout	Description	See section
6	Automatically log invasive blood pressure measurements with vitals for patients not using the NBP. **NOTE** Auto NBP and auto vital log should not be used at the same time because this can cause double documentation in the patient study. Use auto NBP for non-invasive pressure from the cuff. Use auto vital log to record an invasive pressure.	Vital log on page 128
7	Enable display of the patient respiration rate recorded by the cath amplifier.	Respiration on page 128
8	Enable or disable the audible indicators.	Audible Indicators (Optional) on page 129

Blood pressure

1. Select the **Recording blood pressure** from the drop-down list box:
2. - **NBP:** Log a non-invasive blood pressure.
   - **P1–P4:** Log an invasive blood pressure.
3. Select the **Vital log blood pressure** from the drop-down list box:
   - **NBP:** Log a non-invasive blood pressure.
   - **P1–P4:** Log an invasive blood pressure.

NBP

1. Select the **Auto NBP** check box to enable automatic NBP readings.
2. In the **NBP time interval** field, type the time in minutes.
3. In the **Cuff size** field, select the appropriate value from the drop-down menu.
4. Click the **Start/Stop** button to start or stop a NBP measurement.
5. **NOTE**
   To stop a cuff in the middle of an inflation press the **NBP** key, or select the **Start/Stop** button in the **Measurement** tab and the **NBP** area.

Pulse oximetry

1. Select **Minimum** in the **Pulse oximetry** section.
2. Type the desired value to set the minimum range.

   NOTE
   When the pulse oximetry value drops below the specified minimum value, the SpO_2 reading is displayed with a yellow background .
3. If the SpO_2 cable is connected to the PDM, but a cabling or signal or device error occurs, the SpO_2 display in the **Patient Status** area shows asterisks (`** %`) and the indicators turn on (if enabled).

Temperature

1. Select **Enable Continuous Temperature Display** to display patient temperature in the **Patient Status** area.
2. To set upper or lower boundary temperature limits, select the **Maximum** and/or **Minimum** check boxes and enter the limits. The limits must be between 0.0°C and 45.2°C.
   - If the temperature exceeds the upper limit or falls below the lower limit, the audible indicator turns on (if enabled) and the temperature display changes from green numbers on a gray background to black numbers on a yellow background.
   - If continuous temperature is enabled and the cable is not connected, the temperature display in the **Patient Status area** remains blank.
   - If continuous temperature is enabled with the cable connected, but a cabling or device error occurs, the temperature display in the **Patient Status** area shows asterisks (** °C) and audible indicators turn on (if enabled).

Heart rate

1. In the **Heart rate channel 1** field, select the value from the drop-down menu (only ECGs).
2. In the **Heart rate channel 2** field, select the value from the drop-down menu (only invasive catheter channels).
3. To set upper or lower boundary limits for **Heart rate channel 1**, select the **Maximum** and/or **Minimum** check boxes and enter the limits. The limits must be between 0 and 400 BPM.
   If **HR1** exceeds the upper limit or falls below the lower limit, the audible indicator turns on (if enabled) and the heart rate display changes from green numbers on a gray background to black numbers on a yellow background.

Vital log

1. Select the **Auto vital log** check box to enable the system to log vitals. This setting acquires an invasive blood pressure from the vital logging pressure source chosen from the **Blood Pressure** > **Vital log blood pressure** drop-down list.
2. Enter the desired minutes in the **Vital log time interval** field. Vitals events appear in the *Log* window at the selected time intervals.

NOTE
Activating this area does not take a new NBP. It logs a vitals event with asterisks (***/***/ ***).

Respiration

1. Select the **Enable RR measurement** check box to display patient respiratory rate in the **Patient Status area**.
2. To set upper or lower boundary respiration rate limits, select the **Maximum** and/or **Minimum** check boxes and enter the limits. The limits must be between 0 and 100.

NOTE
If the respiration rate exceeds the upper limit or falls below the lower limit, the audible indicator turns on (if enabled) and the respiration rate is displayed with a yellow background.

Audible Indicators (Optional)

- Select **On** or **Off** to enable or disable audible indicators. You can also press **Ctrl** + **D** to toggle the audible indicator on or off.
- Adjust the volume of the indicator by sliding the **Volume** bar from **Min** to **Max**.

NOTE
Audible indicators may only be enabled, disabled, or adjusted at the acquisition system.

7.1.23 Protocol List

To edit the protocol list, select the **Protocol List** folder. The **Edit Protocol List** tab appears. Available protocols may be selected. See 19.5 Customize protocols on page 278.

7.1.24 Activation Alignment settings

See 20.2 Alignment on page 288.

7.1.25 Mapping

See 20.1.3.1 Static maps on page 285.

7.2 Study Configuration – *Review* window

To view or edit *Review* window settings, access the study configuration options in the *Review* window.

In the *Review* window, select the **Study Configuration** icon. The *System Settings* window appears.

7.2.1 ECG Display Settings

1. Select **ECG** from the list. The **Display Settings** tab appears.
2. The channel numbers appear in the **Channel** column
3. Select the desired scale using the pull-down menu in the **Scale** column to set the display scale of an individual channel.
4. Use the **Display Pages** grid to configure channels to display on the *Review* window pages. To show or hide a channel on a page, click in the cell corresponding to that channel and page. To enable all displayed channels on a page, click in the cell for that page number.

   The number of signals displayed on a page is listed at the bottom of the display page columns.
5. The signal clip cuts off the tops and bottoms of the signals. To enable/disable clipping:

   5.1. Select clip settings **C1** or **C2** (or none - blank) for the desired channel or highlight the signal to clip, and press the letter **C** key on the keyboard. The **C** key cycles between C1, C2, and none each time the key is pressed.

   5.2. When an ECG signal is clipped, the letter **C** precedes the signal in the label area of the *Review* window.

6. Select the color of the ECG signal by clicking on the cell in the **Color** column and picking the color from the pull-down menu.

   NOTE
   Channel, **Label** and **Always Save** columns are disabled in the *Review* window.

7.2.2 ECG Hardware Settings

1. Select **ECG** from the list. Select the **Hardware Settings** tab.
2. The hardware settings cannot be changed from the *Review Study Configuration* window.

7.2.3 Pressure Display Settings

1. Select **Pressure** from the list. The **Display Settings** tab appears.
2. To turn on the pressure channel in a page, click the display page cell for the appropriate channel.
3. To display all available channels on a page, click the page number at the top of the column. The number of signals displayed on a page is listed at the bottom of the display page columns.
4. Select the scale settings of an individual channel from the pull-down menu in the Scale column.

   NOTE
   Channel, **Label** and **Always Save** columns are disabled in the *Review* window.

5. Select the color settings of an individual channel from the pull-down menu in the **Color** column.

7.2.4 Pressure Hardware Settings

1. Select **Pressure** from the list.
2. Select the **Hardware Settings** tab.
3. Select the appropriate **Label** settings from the drop-down menus.

   NOTE
   The **Channel** and **Filter Settings** columns are disabled in the *Review* window.

7.2.5 Configure the pressure grid

1. Select **Pressure** from the list. Select the **Grid Setup** tab.
2. In the **Grid** column, click in the cells to turn the grid under the pressure signals on or off.
3. Set the **Scale** from the pull-down menu.

   NOTE
   For a blood pressure channel, the **Scale** value in the **Grid** column is shown in kPa when in the kPa mode.

4. In the **Lines** column, select the number of graticules (lines).

   NOTE
   The **Channel** and **Label** columns are disabled in the *Review* window.

7.2.6 Configure intracardiac block display settings

WARNING

INACCURATE WAVEFORM DISPLAY

To avoid incorrect waveform display, ensure intracardiac catheter connections and settings are configured as intended.

1. Select a **Catheter Block** from the list. The **Display Settings** tab appears.
2. Use the **Display Pages** grid to configure channels to display on the *Review* window pages. To show or hide a channel on a page, select the cell that corresponds to that channel and page. To enable all displayed channels on a page, select the cell for that page number.

   The number of signals displayed on a page is listed at the bottom of the display page columns.

   NOTE
   The **Always Save** column is disabled in the *Review* window.

3. Set the display scale from the drop-down menu for each channel in the **Scale** column.
4. Set the clip settings by selecting the drop-down menu under the **Clip** column. Choose C1, C2 or leave blank for none.
5. Define the signal color from the drop-down menu in the **Color** cells.

7.2.7 Configure intracardiac block hardware settings

WARNING

INACCURATE WAVEFORM DISPLAY

To avoid incorrect waveform display, ensure intracardiac catheter connections and settings are configured as intended.

Select a **Catheter Block** from the list. Select the **Hardware Settings** tab.

NOTE
The hardware settings are disabled in the *Review* window.

7.2.8 Configure stimulator settings

Do this task to configure the stimulator (or, stim) settings for use with the CardioLab amplifier.

1. Select **Stim** from the list. The **Display and Hardware Settings** tab appears.
2. Set the clip settings by selecting the drop-down menu under the **Clip** column. Choose **C1** or **C2**, or leave blank for none.
3. Define the signal color from the drop-down menu in the **Color** cells.
4. Use the **Display Pages** grid to configure channels to display on the *Review* window pages. To show or hide a channel on a page, select the cell that corresponds to that channel and page. To enable all displayed channels on a page, select the cell for that page number.

   The number of signals displayed on a page is listed at the bottom of the display page columns.

5. Turn **Always Save** on or off for individual channels by clicking in the **Always Save** cell for that channel.

   NOTE
   If saving is enabled, the **Always Save** option saves signals in the background when they are not displayed.

6. The stim channel displayed in green at the bottom of the *Display Settings* area is the stim channel toggle channel.

   The system detects which channel is being used to pace, and it fills in this channel row automatically. This channel is also reflective of the data in the stim toggle button in the *Real-Time* window toolbar.

   NOTE
   The stim toggle channel is usually the only stim channel displayed on any of the pages, unless simultaneously pacing two different stim sites.

7.2.9 Configure analog inputs (CardioLab II Plus Amplifier only)

The CardioLab is equipped with four analog inputs that can be connected to devices, such as real-time NIBP, pacemakers, and ablation devices. The analog input signal can be used to add information to the record, but the clinical evaluation of this information should be done on the originating system. Do this task to configure the display settings.

1. Select **Analog In** from the list. The **Display Settings** tab appears.
2. Select the scale from drop-down menu under the **Scale** column.
3. Set the clip settings by selecting the drop-down menu under the **Clip** column. Choose **C1** or **C2**, or leave blank for none.
4. Define the signal color from the drop-down menu in the **Color** cells.
5. Use the **Display Pages** grid to configure channels to display on the *Review* window pages. To show or hide a channel on a page, select the cell that corresponds to that channel and page. To enable all displayed channels on a page, select the cell for that page number.

   The number of signals displayed on a page is listed at the bottom of the display page columns.

6. Turn **Always Save** on or off for individual channels by clicking in the **Always Save** cell for that channel.

   NOTE
   If saving is enabled, the **Always Save** option saves signals in the background when they are not displayed.

Chapter 8 Other CardioLab System Windows

This chapter describes the *Log*, *Holter*, *Ablation*, *Plot*, *Image Viewer*, *Map*, *Alignment*, *Macro* and *End Tidal CO2* windows.

8.1 *Log* window

The *Log* window is essentially the case notebook. It is an area where the system automatically populates data and where data can be manually entered and edited.

The *Log* window contains a time-stamped record of all events saved throughout the case. These time-stamps are linked to the signals and pressure waveforms saved in the *Review* window. In this way, the log can help locate data in the *Review* window.

The log can either be printed at the end of the case or included as a separate section in the report.

8.1.1 R column

The first column of the *Log* window is the **R** (report) column.

The **R** column allows you to select the items to include in the report. A check mark that preceds a log entry indicates that the entry is included in the report. The report includes most log entries by default. The report does not include pacing intervals and manual measurements with calipers by default.

You can include or exclude multiple items from a report at a time.

To select multiple items at a time for the report:

1. Select the first item, then press and hold **Shift**. While you hold **Shift**, select the last item in the log.
2. Select the first item, then press and hold **Ctrl**. While you hold **Ctrl**, select each additional item.

To either include or exclude item(s) from the report:

1. Select the item(s), then select an **R block** check box to include all of the selected items in the report.
2. Select the item(s), then uncheck an **R block** check box to exclude all of the selected items from the report.

8.1.2 Time column

CAUTION

INACCURATE VALUES

Do not change the system time. Doing so may cause the Log window not to reflect the events as they actually happened. An apparent lag time may be introduced, events may appear out of order, or medication values could be affected. Confirm that the times between the acquisition system and the clients are the same prior to system use. Contact a GE HealthCare representative for system clock issues.

The second column in the *Log* window is the **Time** column. The time is attached to every event entered in the case. The time serves as a marker, tagging events throughout a case, and assists in locating specific saved signal data at any point in time.

Selecting a time in the *Log* window causes the waveform signals saved at that point to appear in the *Review* window.

Some timestamps are color coded in the *Log* window. The colors are defined as follows:

- Green - a break in saved data
- Blue - a change in protocol or phase or study configuration
- Yellow - a Vitals Event
- Magenta - a change in pacing sites
- Tan - CARTO® 3 System points
- Red - Ablation data
- Black - all other events
- Light blue - the highlighted or active row

8.1.3 Summary column

The **Summary** column contains a description of the event data. The system automatically populates data in the **Summary** column. Some summary events can be edited. To edit a summary event, double-click the event.

NOTE
The summary for a blood pressure event displays the blood pressure units in either mmHg or kPa, depending on the mode that was active when the event was created or edited.

8.1.4 Comment column

The **Comment** column is used to enter additional information about the data event. The **Comment** field may be populated using macro commands. The use of macros facilitates consistent information through automation. See Chapter 13 Macros on page 179 for information about macro commands.

8.1.5 User Tracking-specific elements

The following elements apply only when User Tracking is enabled on the system. See 8.1.11 User Tracking on page 138 for information about User Tracking.

8.1.5.1 Author column

The **Author** field contains the name of the user who initiated or last edited the event. This field is blank for events that contain only system-generated data. To hide or display the **Author** column, select the **Toggle Author Display** toolbar icon.

8.1.5.2 Location column

The **Location** column contains the name of the workstation where the event was created or last edited. To hide or display the **Location** column, select the **Toggle Location Display** toolbar icon.

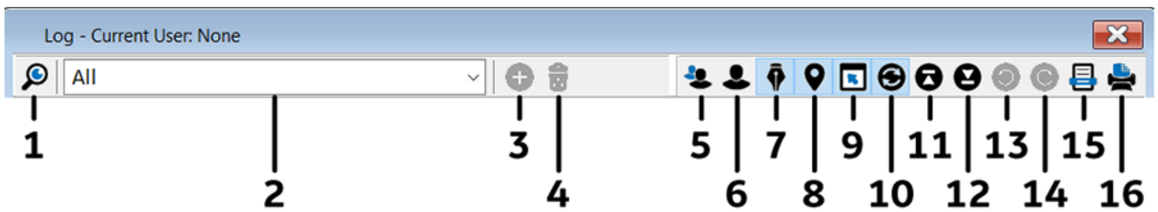
8.1.5.3 *Log* window title bar

When User Tracking is enabled, the *Log* window title bar displays the current workstation user. If no user is selected for non-authenticated User Tracking, the title bar displays a message that states that there is no user.

8.1.6 Adjust the column format

Drag the gray bar above the column and drop it at a new width to adjust the size of a column interval. If User Tracking is enabled, select either the **Toggle Author Display** or **Toggle Location Display** toolbar icons to hide or display the **Author** and **Location** columns.

8.1.7 *Log* window toolbar



Item	Description
1	**Search log**: Toggles between filtering the log by event type or by search string
2	**Filter log view**: Selects the log events to display
3	**New log filter group**: Creates a new filter group
4	**Delete log filter group**: Deletes a user-created filter group
5	**Switch user**: Provides a separate window in which to change the current user. This button only displays for non-authenticated User Tracking or for authenticated User Tracking with user selection. See 8.1.11.1 Set User Tracking on page 138 for user selection information.
6	**Take ownership of events**: Provides a separate window in which to change the author of selected events (User Tracking only)
7	**Toggle author display**: Toggles whether the author column is hidden or displayed (User Tracking only)
8	**Toggle location display**: Toggles whether the location column is hidden or displayed (User Tracking only)
9	**Edit comments in separate window**: Toggles whether comments are entered in a separate window or directly in the comment column of the log
10	**Update**: Continually updates the *Log* window with current data
11	**First log entry**: Moves the cursor to the first log entry
12	**Last log entry**: Moves the cursor to the last log entry
13	**Undo delete event**: Reinserts the last deleted event in the *Log* window
14	**Redo delete event**: Deletes the last reinserted event in the *Log* window
15	**Create event at selected log time**: Inserts a specified event at the time currently highlighted in the *Log* window
16	**Print log**: Prints the log

8.1.7.1 Filter

Filter the data in the *Log* window to quickly locate trends or sections of data. You can filter the data in the *Log* window by event type or by search string.

Filter by event type

1. Ensure that the **Search Log** icon on the toolbar is deselected.
2. Select the **Filter Log View** drop-down menu from the toolbar.
3. The *Filter Log View* window is divided into two sections:
    - The section with the radio buttons consists of **Filter Groups**, which are collections of individual filters.
    - The bottom section with the check boxes contains individual event-type filters.
4. The application allows the user to select one or more types of events to be shown in the *Log* window.
5. To easily select one or more event types to view in the *Log* window, select the **None** option at the top of the *Filter Log View* window.
6. When a group of event types are selected, the user can create a new **Filter Group** with the **New Log Filter Group** icon.
7. Select **New Log Filter Group**. Type a name for this new filter group and press **Enter**.
8. To delete a user-created **Filter Group**, select the **Delete Log Filter Group** icon.
9. To rename a user-created **Filter Group**, first delete it and then create a new **Filter Group** with a new name.

NOTE
Custom **Filter Groups** are saved on a per-system basis.

Filter by search string

1. Select the **Search Log** icon on the toolbar.
2. Type the desired search string in the **Filter Log View** text box. To search for log entries that contain multiple strings (e.g., String1, String2, String3), type `String1 String2 String3` in the text box, with each string separated by spaces.
   Only those events that include the specified string in the **Time**, **Summary**, **Comment**, **Author**, or **Location** columns appear in the *Log* window.
3. To filter by event type, select the **Search Log** icon again.

8.1.7.2 Insert an event

To insert an event in the *Log* at a selected time, do one of the following:

- Right-click the event time and select **Insert Event**
- Put the cursor on the appropriate event and click the **Create Event at Selected Log Time** icon.

8.1.7.3 Update view

Use the **Update** icon in the *Log* window to control how events update in the log.

1. The **Update** icon is depressed when the update function is turned on.
2. If the **Update** icon is turned off, the *Log* window does not reflect the most recent log events.

8.1.7.4 Print the log

Select the **Print Log** icon in the *Log* window toolbar to print the contents of the log.

NOTE
The medication amount in the medication event entry in the *Log* window is formatted per E.1 The Joint Commission on page 315.

8.1.8 Delete an event

You can delete some or all of the events in the log in a single action.

Action	Procedure
To select multiple items at a time for the report	1. Select the first item, then press and hold **Shift**. While you hold **Shift**, select the last item in the log. 2. Select the first iem, then press and hold **Ctrl**. While you hold **Ctrl**, select each of the items that you want to remove.
To delete multiple events at a time from the log	1. Select the events to be deleted and right-click in the **Comment** column. 2. Select **Delete Event**. A message appears that asks if the events should be deleted from the log. Select **Yes**.
To delete all events from the log with the menu option	1. Select an event and right-click in the **Comment** column. 2. Select **Select All Events...** 3. Right-click the highlighted events. 4. Select **Delete Event**. A message appears that asks if the events should be deleted from the log. Select **Yes**.
To delete all events from the log with shortcut keys	1. Select an event in the log. 2. Press **Ctrl** + **A**. 3. Right-click the highlighted events. 4. Select **Delete Event**. A message appears that asks if the events should be deleted from the log. Select **Yes**.

NOTE
- You cannot retrieve events that are deleted using group a delete operation.
- You can only select all of the events in the log when a filter is applied.
- You cannot delete data break events and ablation events from the *Log* window.
- You cannot delete phase events in a group delete operation.

8.1.9 Edit event time

Time can be edited for 12 lead, case, complication, contrast, mark, medication, note, procedure, supply, phase, and vitals events in the *Log* window. To immediately change the time to the current time, select the time cell while you press **Ctrl** + **T** on the keyboard.

To edit the time of an event:

1. Highlight the event and right-click in the **Time** column.
2. Select **Edit Time**. A cursor appears in the time column.
3. Manually make the appropriate time change. That event moves to the appropriate time in the *Log*.

8.1.10 Edit comments

1. Highlight the event and do one of the following:
   - Double-click the **Comment** column of the event.
   - Right-click the **Comment** column and select **Edit Comment**.
   - Press the **Enter** key in the **Comment** cell.

   A cursor appears in the **Comment** column.
2. Manually make the appropriate changes to the comment.
3. Press the **Enter** key to complete the comment.

When the **Edit comments in separate window** icon is active, editing a comment opens a window for free text entry in the *Log*. This allows for simultaneous documentation at two systems in a networked environment.

8.1.11 User Tracking

User Tracking feature records the system user on each system that is joined to a study. Events created or edited by one system user can be differentiated from events created by another user. This information can be included in generated Word reports to identify the author of medical record entries.

8.1.11.1 Set User Tracking

1. Select **Administrator** > **System Settings** from the *Navigator* window (administrator privileges are required to access **System Settings**).
2. On the **Audit Log** page, select one of the following User Tracking settings:

Option	Description
None	**No User Tracking.**
Non-authenticated	**Allows a user name to be typed or chosen from the staff list. The user name may be changed during a study.**
OS Full Name	**Authenticated User Tracking that uses the full name of the user currently logged into the operating system as the user name. The user name is not chosen and cannot be changed.**

Option	Description
OS Full Name with User Selection	**Authenticated User Tracking that uses the full name of the user currently logged into the operating system as the default user name. The user name may be changed by entering valid credentials of another operating system user.**
OS User ID	**Authenticated User Tracking that uses the user ID of the user currently logged into the operating system as the user name. The user name is not chosen and cannot be changed.**
OS User ID with User Selection	**Authenticated User Tracking that uses the user ID of the user currently logged into the operating system as the default user name. The user name may be changed by entering valid credentials of another operating system user.**

NOTE
In a network environment, the User Tracking setting should be the same on all Mac-Lab/CardioLab systems.

8.1.11.2 Choose the user

Non-authenticated User Tracking

When a study is created, continued, or reviewed, a window automatically appears that prompts the user to enter or select their name. The prompt allows the user name to be selected from the **Staff** list, selected from a list of the most recent users of the system, or to be typed in a text box. The user name is limited to 112 characters. If you select **OK** or **Cancel** while the user name text box is blank, the system has no assigned user.

Authenticated User Tracking without user selection

There is no window to choose the user name. The user name is the current operating system full name or user ID.

Authenticated User Tracking with user selection

When a study is created, continued, or reviewed, a window automatically appears prompting the user to enter their name. The default name is the current operating system full name or user ID. To choose a different user, select **New User** and enter the credentials of the new user.

8.1.11.3 User name display

The title bar of the *Log* window indicates the system's current user. If no user was selected for non-authenticated user tracking, the title bar indicates **Current User: None**.

8.1.11.4 Switch users

Non-authenticated User Tracking

If a new operator starts using a system while a study is in progress, the user should select the **Switch User** icon in the *Log* window toolbar. The prompt appears, allowing the user to type or select a name. Any events created or edited after this point record the new user as the author.

If a user leaves the workstation and does not want subsequent events to carry their name, they can select **Switch User** > **OK** with the **User Name** field blank. If the user selects **Cancel** in the **Choose Name for User Tracking** dialog, the current user remains unchanged.

Authenticated User Tracking without user selection

There is no **Switch User** icon in the *Log* window. User switching is not allowed without closing the study and changing the operating system user.

Authenticated User Tracking with user selection

If a new operator starts using a system while a study is in progress, the user should click the **Switch User** icon in the *Log* window toolbar. The prompt appears, allowing the user to enter their user credentials. Any events created or edited after this point record the new user as the author.

8.1.11.5 Author and Location columns

If User Tracking is enabled, the **Author** and **Location** columns appear in the *Log* window. To hide or display the **Author** column, select the **Toggle Author Display** icon in the toolbar. To hide or display the **Location** column, select the **Toggle Location Display** icon in the toolbar.

The **Location** column displays the computer where the event was created or last edited. The **Location** column should never be empty. The **Author** column displays the name of the user on the computer where a user event was created or where any event was last edited.

For non-authenticated User Tracking: If no user is selected when a user event is created or an event is edited, the **Author** column in the *Log* window displays ****, which indicates that the event should have an author, but no user was selected on the system and the author is unknown.

8.1.11.6 System events and user events

The events in the event log are divided into system events and user events. User events are created with user input. A medication event or a note is an example of a user event.

System events are created using system-generated or system-calculated data. A vitals event or a snapshot is an example of a system event.

A user event has an author associated when it is created. A system event has no author associated when it is created, and the author field will be blank.

8.1.11.7 Edit events

When an event is edited, the user who did the edit becomes the author of the event. Any prior author information is overwritten.

The following actions are considered editing an event:

- Changing the time of an event (if applicable).
- Adding or changing a comment.
- Changing the description of an image or snapshot.
- Changing and saving an image or snapshot.
- Adjusting measurement marks.
- For a supply, medication or contrast, changing any value in the used list.
- Editing a phase event.
- Selecting **OK** or pressing **Enter** in the summary dialog for any of the following events: ablation, alignment, arrhythmia, case, conduction block, map, note, pacing site, refractory period, SNRT, and vitals. Opening these dialogs and selecting **Cancel** or pressing **Esc** to close them is not considered editing the event.

8.1.11.8 Take ownership of events

It is possible to manually change the event author for a single event or for a group of events. To change the author for a single event, double-click the **Author** field of the event. A prompt appears allowing the desired author name to be selected or entered.

For authenticated User Tracking, the user is prompted to enter the user credentials of the new author before being allowed to take ownership of any events.

To manually change the author for a group of events, select the **Take Ownership of Events** icon in the *Log* window toolbar. A prompt appears allowing the author name to be selected or entered. The prompt also contains fields for specifying the range of events to update. To choose the first and last events to update, select their time fields in the event log.

To illustrate which events in the *Log* window have the **Author** field changed, the *Log* window highlights those events. By default, ownership is only taken on events that already have an **Author** entry, which might be either a name or ****. To take ownership of even the events that have a blank **Author** entry, select the check box to **Select all events**. Select **OK** to take ownership of the highlighted events, and select **Yes** when prompted to confirm the operation.

The **Search Log** feature can be used in combination with the **Take Ownership** feature to easily take action when a different user should be associated with the event. For example, the log could be searched for all entries containing **** or for all entries created or edited at a specific location. The **Take Ownership** functionality would then allow the user to be updated for this subset of events within a desired time range.

8.1.11.9 Word reports

If User Tracking is enabled, the event log and event log-M report sections include an author column. The author field in the Word report matches the author field in the event log, with one exception: when the event log displays ****, which indicates that no user was selected for non-authenticated User Tracking, the report displays the location in the author column. This is to provide some information about where the event was created or last edited.

8.1.11.10 Conscious sedation, radiology, and forms

The User Tracking feature records the author and location only for events that are recorded in the *Log* window. Data that are not recorded in the *Log* window are not tracked. This includes, but is not limited to, conscious sedation, radiology, and forms data.

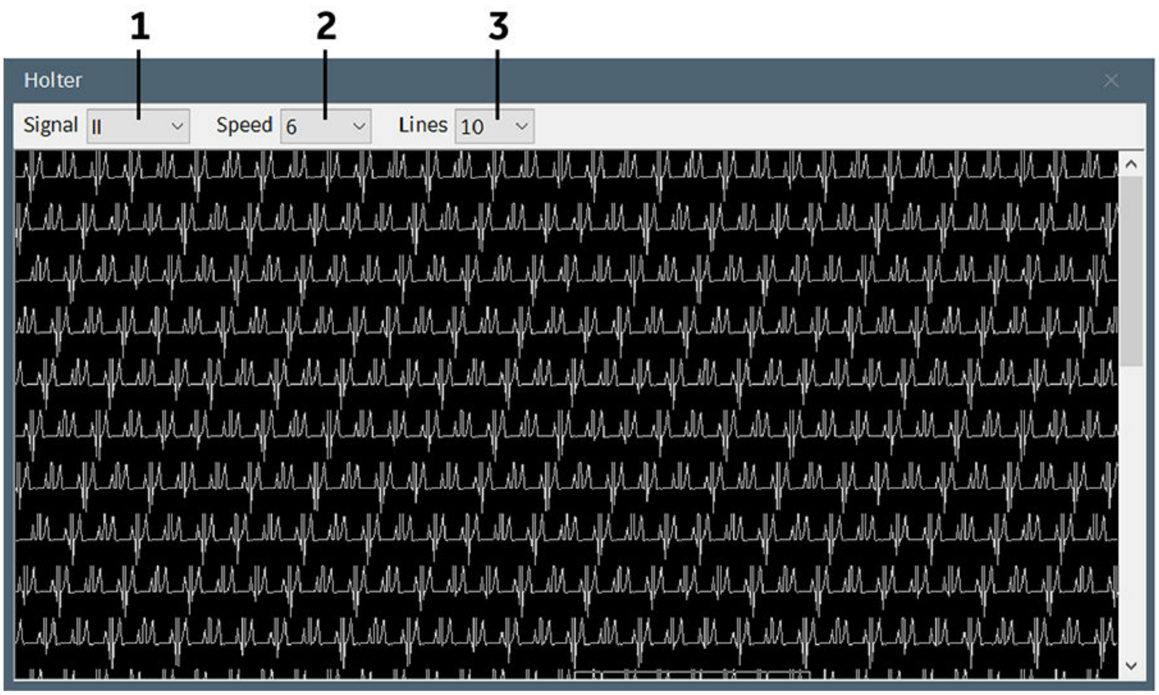
You can create a macro that opens the *Conscious Sedation*, *Radiology*, or *Forms Navigator* windows and adds a corresponding note event to the log.

- This note, the author name, and location appear in the *Log* window whenever the macro is executed.
- The author name does not automatically update if the data on the *Conscious Sedation*, *Radiology*, or *Forms Navigator* windows change.
- The system creates the note only when the macro is executed and not through any other mechanism (e.g., opening a window through a shortcut key or switching between forms on the *Forms Navigator* window).

8.2 *Holter* window

The *Holter* window displays data saved throughout the case for a particular signal. To launch the *Holter* window, select **Windows** > **Holter** and place the *Holter* window on the *Review* screen. To isolate a portion of a signal, select the desired signal. The isolated information is displayed on the *Review* window.

Figure 8-1 *Holter* window



Item	Name	Description
1	**Signal**	Select the desired signal from the **Signal** drop-down menu.
2	**Speed**	You can control how much of the signal is visible from the **Speed** drop-down menu. A smaller number displays the beats closely together. A larger number displays the beats further apart.
3	**Lines**	You can select the desired number of lines to display in the *Holter* window.

8.3 *Ablation* window

During an ablation, the *Ablation* window displays the impedance, temperature, and other parameters in numerical and graphical form.

If using an ablation device that supports monitor mode, the *Ablation* window will display temperature and impedance values in numerical form even when not actively ablating. See 3.4.1.1 Monitor mode on page 63.

1. To open the *Ablation* window, select the **Toggle Ablation Window** icon from the *Real-Time* window or select **Windows** > **Ablation**. The *Ablation* window may be placed anywhere on any of the monitors. It may be moved or resized in the same way as other CardioLab windows.

2. To close the *Ablation* window, click the **Toggle Ablation Window** icon from the *Real-Time* window, uncheck **Windows** > **Ablation**, or select the **X** in the top right-hand corner of the window.
3. To view or change the properties of the *Ablation* window, right-click in the window and select **Properties**.
   Some of the settings that may be changed are:
   - The **Time range (S)** for ablation display may be set to 15, 30, 60, or 120 seconds. If the ablation duration exceeds the time range selected, the range is automatically extended to show the most current data.
   - The **Power scale (W)** and **Imp scale (Ohms)** (impedance) settings used for the graphical display may be changed. The *Ablation* window indicates the currently selected scale.
   - Up to four temperature values may be displayed if supported by the ablation device. The temperature scale for the graphical display is indicated in the *Ablation* window. For the CryoCath device, temperature values displayed are negative.

All ablation events are automatically saved and entered in the log. Ablation events cannot be deleted from the log. If the time of the ablation is less than the minimum time set to record the ablation event, the event does not appear in the log. The minimum time for recording an ablation may be changed from the *Ablation* window *Properties* page.

NOTE
See 7.1.21 Switch ablation devices on page 124 for information about switching devices in a case.

NOTE
When an ablation is stopped, a minimum two-second delay is needed before the start of the next ablation. If less than a two-second delay is given, it is possible that one of the following may occur:
- A single ablation event may be seen in the log for these two ablations.
- The start on the second ablation may be processed but the end missed on the first ablation. In this case, there is a `Start 1, Start 2, End 2` notation in the log.

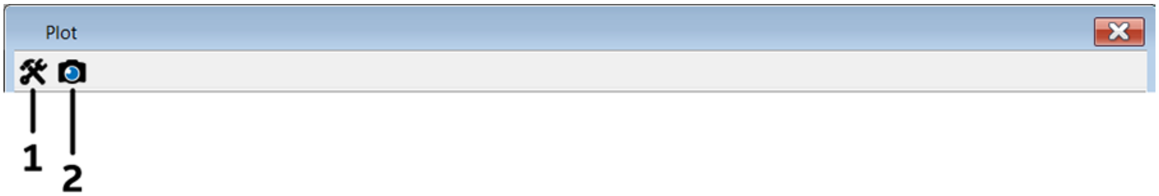
NOTE
The time displayed on the CryoCath device may not match the time displayed in the *Ablation* window because of different handling of cooling and thawing time periods.

NOTE
The Hat 300 device sends flat line data for approximately five seconds at the end of ablations before sending the actual “ablation end” message. Because the serial data stream extends beyond where the device display has stopped, the system will record ablations as about five seconds longer than shown on the device.

NOTE
The Stockert device sends data for a few additional seconds after **Stop** is pressed on the device. This can cause the system to record “ablation end” up to four seconds after the end of ablation.

8.4 *Plot* window

8.4.1 *Plot* window toolbar



Item	Name	Description
1	Plot setup	Chooses which ablation parameters appear in the *Plot* window.
2	Snapshot	Saves a picture of the *Plot* window to annotate or print.

8.4.2 Open the *Plot* window

1. Select **Windows** > **Plot** on the *Real-Time* or *Review* screen.
2. Place the pointer in the desired location and click to open the window.

8.4.3 Configure the *Plot* window

1. Select the **Plot Setup** icon on the *Plot* window toolbar.
2. Select the appropriate parameters to display.

8.4.4 Review ablation data

1. Open the *Review* window concurrently with the *Plot* window.
2. In the *Log* window, select an ablation event to display associated ablation data in the *Plot* window.
3. Select the *Plot* window.

   A vertical blue line appears across all plots.
4. Move the line to the left and right to update the signal data.
5. Maximum, average, and minimum values appear to the right of each plot.
6. A gray section with parameters is displayed at the bottom of the *Plot* window.

8.4.5 Print the *Plot* window

1. Select the **Snapshot** icon in the *Plot* window to generate a printout of the graph that is displayed in the *Plot* window.
2. This *Plot* window snapshot is also included in the **Snapshot** section of the report.

8.5 Image Viewer

Use Image Viewer to view and annotate snapshots and images in a study.

During a study, you can annotate a captured image to highlight unique characteristics of the captured data. Annotations can be saved with the image as part of the study. The image and annotations can also be saved to a file or copied to the clipboard.

8.5.1 Annotation

8.5.1.1 Add annotation objects

Add lines, rectangles, ellipses, polylines, polygons, pointers, freehand drawings, highlights, text, and notes to the image.

1. Select an annotation type in the annotation toolbar, then left-click and drag.
2. When adding a text or note annotation, press `Ctrl + Enter` to create a new line of text below the current line.
3. To complete adding a text or note annotation, press `Enter` or left-click outside of the object.

8.5.1.2 Select annotation objects

Copy, paste, move, resize, delete, and change properties of annotations.

- To select an individual object, move the cursor over the object until the cursor turns into a circle, then left-click.
- To select multiple objects:
    2.1. Hold down the shift key.
    2.2. Move the cursor over an object until the cursor turns into a circle, then left-click.
    2.3. Repeat the previous step for each object you want to select.
    2.4. Release the shift key.
    - Alternatively, draw a focus box around the objects by holding down the left-mouse button while dragging.
- To select all objects, right-click in the image and choose **Select All**.

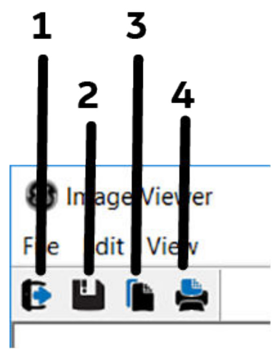
8.5.1.3 Change properties of annotation objects

Change foreground and background color, line thickness, fill mode and pattern, font size, and font type of annotations.

- Individual object: move the cursor over an object until the cursor turns into a circle, then right-click and choose **Properties**.
- Multiple objects:
    2.1. Select multiple objects (see 8.5.1.2 Select annotation objects on page 145).
    2.2. Move the cursor to the outer border of the selected objects until the cursor turns into a 4-headed arrow.
    2.3. Right-click and choose **Properties**.
- If changing properties of a text or note annotation while adding or editing, complete the object by pressing `Enter` or left-clicking outside of the object, then right-click and choose **Properties**.
- To change default properties, right-click within the image and choose **Default Properties**.

- **NOTE**
  Properties changes will also apply to newly created objects. However, property changes are not persistent and will reset when a new image is annotated.

8.5.2 Image Viewer toolbar



Item	Description
1	Exit from the Image Viewer.
2	Save a copy of the image, including any annotations to a file in TIF or BMP format.
3	Copy the image including any annotations to the Windows clipboard. The image can then be pasted into another application.
4	Print the image, including any annotations.

8.5.2.1 Exit Image Viewer

1. Select the **Exit** icon.
2. If the *PEIImageViewer* window appears, select **Yes** or **No** to save or ignore the changes made, as applicable.

8.5.2.2 Save an annotated image

1. Select the **Save to File** icon from the toolbar.

   The *Save to File* window appears.
2. Navigate to the target folder and select the image format (.tif or .bmp).
3. Select **Save**.

8.5.2.3 Copy an image

Select the **Copy** icon. This action copies the image to the Microsoft Windows clipboard. You can then paste the image within another application, such as Microsoft Office PowerPoint or Word. The use of Microsoft Office PowerPoint, Excel, Word, and other applications is limited to opening the application locally and creating new documents, which can then be saved to removable media. You should only use Microsoft Office PowerPoint, Excel, Word, and other non-Mac-Lab/CardioLab applications outside of an active study.

WARNING

SYSTEM INSTABILITY

Do not open files from external media on the system. This could introduce malware and result in system instability or failure.

8.5.2.4 Print an image

Select the **Print** icon. The image prints to the system printer.

8.5.3 Menu commands

The menu commands offer additional and supplemental controls for the Image Viewer.

Table 8-1 File

Function	Description
Save	Saves the annotated image within the study.
Save as	Saves the annotated image to an external image file.
Print	Prints the image with annotations.
Exit	Closes the Image Viewer and returns to the application. When exiting the Image Viewer, if the image annotations have not been saved, the system prompts at this time to save the image with its annotations.

Table 8-2 Edit

Function	Description
Undo	Undoes the last edit operation.
Copy Image	Copies the image to Microsoft Windows clipboard.

Table 8-3 View

Function	Description
Fit	Adjusts the image size.
Normal	Shows the image at the original size.
Zoom	Zooms to the chosen percentage.
Fit Image to window	Sizes and places the image evenly in the window.
Center Image	Centers the image in the window.
Annotation Toolbar	Toggles the annotation toolbar on or off from the display.
Toolbar	Toggles the toolbar on or off from the display.

8.6 *Map* window

See 20.1 CardioMapp on page 283.

8.7 *Alignment* window

See 20.2 Alignment on page 288.

8.8 *Macro* window

See Chapter 13 Macros on page 179.

8.9 *End Tidal CO2* (optional) window

See 11.2 *End Tidal CO2* window on page 161.

8.10 Workspace Integrator display

Your acquisition system may be equipped with Workspace Integrator. This feature provides an additional display on which you can simultaneously view a third-party application. When you launch the Mac-Lab/CardioLab application, the application fills all displays except for the Workspace Integrator display. The display that doesn't show the Mac-Lab/CardioLab application is the Workspace Integrator display. Workspace Integrator also allows you to use the same keyboard and mouse to interact with both applications.

This section refers to the second application as a third-party application. However, the second application may be a GE HealthCare application, such as the CCW Client.

8.10.1 Set up the Workspace Integrator display

Some third-party applications require additional configuration to launch them. To simplify launch of these applications, you may want to pin the application to the **Start** menu, pin the application to the taskbar, or put a shortcut to the application on the desktop.

For example: If you use the Remote Desktop Connection tool to access your third-party application, do the following to pin Remote Desktop Connection to the **Start** menu or taskbar:

1. Select the **Start** button on the taskbar.
2. Select **Windows Accessories**.
3. Right-click **Remote Desktop Connection**.
    - If you want to pin this application to the **Start** menu, select **Pin to Start**.
    - If you want to pin this application to the task bar, select **More** > **Pin to taskbar**.

    You may need to work with your site network administrator to prepare your system to launch the third-party application.

    If you are using Citrix™ with Workspace Integrator, you may need to contact your site network administrator to install and configure Citrix to work with third-party applications.

Make sure to launch, close, and re-launch the application running on the Windows Integrator display to confirm that it opens on the correct display. Also confirm that the appplication's dialogs only open on the Windows Integrator display. It is the customer's responsibility to set up the Workspace Integrator's application, and any dialogs, so that they appear only on the Workspace Integrator display.

8.10.2 Use the Workspace Integrator display

1. Launch your third-party application.

   You may need to provide application credentials or other information to access the third-party application.

2. Launch the Mac-Lab/CardioLab application.

   The Mac-Lab/CardioLab application is in all of the displays except one. The third-party application is in the remaining display.

   All keyboard input goes to the active application. When you switch between the two applications, you must first select the application before you use a shortcut key or type information. The text on the title bar of the application or window that is active is black, and the inactive applications or windows are gray.

3. When you are done using the two applications, close both applications and sign out of the system.

9

Chapter 9 X-Ray Image Capture

Systems with the Matrox OrionHD board installed can capture video output from an X-ray fluoroscopy system for display inside the Mac-Lab/CardioLab application. Users can capture and store single-frame images in the study as part of case documentation along with the corresponding cardiac signal waveforms.

9.1 Configurations

Systems may be in one of the following configurations:

- Non-imaging systems: Review workstations and base acquisition systems do not have image capture capability. These systems support review of images and image loops captured on another system.
- Image capture systems: These systems allow the capture of static images and the display of live images from X-ray and ultrasound systems. The X-ray and ultrasound images can be displayed live, simultaneously, in separate windows.

9.2 X-ray image capture

X-ray image capture is connected to a laboratory's fluoroscopy system, integrating fluoroscopy image data with a patient's electrograms for better case documentation. Captured images are also saved as part of the patient's study, along with the corresponding cardiac signals. Both live and stored images can be viewed simultaneously.

X-ray image capture features include:

- Display real-time and saved fluoroscopic images on a dedicated monitor.
- Capture images at any time and correlate each image with patient electrograms.
- Special support for capturing images from biplane X-ray systems.
- Print acquired images on the system printer.
- Store saved images with the study. The size of the image depends on the resolution of the fluoro video output from the X-ray system.
- Automated image storage, for example, with ablations and/or mapping events. Image storage can be automated with macros.
- Fluoroscopic image management feature that builds a library of images as they are acquired. Clicking an image in the *Image Library* window causes the associated fluoroscopic image and electrograms to be recalled for review.
- Save and review images during mapping cases, providing guidance in procedures such as ablation.

9.3 *Image 1* and *Image 2* windows

Use the *Image 1* and *Image 2* windows to view live images from the X-ray system and to capture and save X-ray images as part of study documentation. You can also use these windows to review stored images and image loops in a study.

You can open these windows during a study. This is useful for viewing live and stored images side by side.

Normally, the system is configured to capture images from a single input channel (for example, the video output from the X-ray system). When used with a biplane X-ray system, two input channels can be configured to correspond to the two video outputs from the X-ray system. These windows can then be set to different input channels, for viewing images from the two channels on separate windows. Only one *Image* window shows a live image at any time.

9.4 *Image 1* and *Image 2* window toolbar

9.4.1 Live Image

When you select the **Live Image** icon on either the *Image 1* or *Image 2* windows, that window displays a live image from the specified input channel. The window title indicates that the image is live.

NOTE
If the input video is stopped or disconnected during live capture, the image window displays a blank image. The window automatically displays the live capture when the input signal is available.

9.4.2 Freeze

When you select the **Freeze** icon, the system captures an image from the input channel and displays it in the active *Image* window. If a live capture was previously in progress in the same window, it will be stopped.

NOTE

- The **Freeze** operation causes signal data to be saved if the **Save signal data with images** option is enabled and the system is not already saving signal data. The system saves at least 10 seconds of signal data.
- (CardioLab only) If the **Enable Gating on Trigger** option is enabled, the image is captured only after the specified trigger level is reached for the trigger signal in the *Real-Time* window.

The keyboard shortcut **Action** + **~** captures an image from the currently active *Image* window.

NOTE
This shortcut is not supported on Japanese language systems.

9.4.3 Active

When the *Image 1* and *Image 2* windows are open, the active window indicator determines which image window is used for reviewing images and image loops. Use this icon to toggle the active status of the *Image* windows.

9.4.4 Settings

To configure the *Image 1* and *Image 2* windows, select the **Settings** icon. The *Image Window Settings* dialog appears.

Configure the *Image Window Settings* dialog settings upon installation. Do not modify these settings after they are established. If the image quality changes, call technical support for assistance in modifying these settings.

Setting	Description
Image Channel	A maximum of two individual channels may be used. Select the box to enable a channel. Only enabled channels will be listed in the input selectors for the *Image* windows.
Video Format	Select from the list of supported formats on the drop-down menu. This can be changed only for the first channel. The video format for the second channel, if enabled, will be the same as that of the first channel.
Save signal data with images	Allows signal and waveform data to be saved any time an image is saved. This applies if manual (continuous) save is not selected throughout the case. If manual (continuous) save is on throughout the case, the corresponding signal and waveform data are saved automatically.
Enable gating on trigger (CardioLab only)	If this setting is enabled, the image is captured only after the specified trigger level is reached for the trigger signal in the *Real-Time* window.
Capture color image	Enable this setting if a color video output is available from the X-ray system and it is connected to the acquisition computer using appropriate cabling. If this setting is enabled, only one image channel is available, and biplane mode is not available.
Enable biplane mode	Enable this setting when connecting to a biplane system. If biplane mode is enabled, note the following considerations: • If an image is captured from either the *Image 1* or *Image 2* windows, the system captures two images from the two biplane channels. If the image is saved, both images are saved. • If both image windows are open and are set to different channels, upon capturing an image in one window, both windows will be updated to show the images captured from the respective channels.
Save images on ablation (CardioLab only)	This setting automatically saves an image at the start of each ablation.
Save images on activation alignment (CardioLab only)	This setting automatically saves an image with each activation alignment window grab.
Save images on Mapping System event (CardioLab only)	This setting automatically saves an image when a mapping system event occurs. This setting applies only if interfacing with a CARTO® 3 System.
Save images on FFR measurement	If the optional FFR feature is enabled for Mac-Lab, enable this setting to save an image automatically with each FFR measurement.

9.4.5 Save

Click the **Save** icon to save an image displayed on an *Image* window in the following cases:

- After a freeze operation is performed or when a live image is being displayed
- When an image loop is paused

When captured images are saved, the title of the image indicates the name of the channel and the time at which the image was captured.

The macro step **Display** > **Image** > **Save** from the *Macro* window can also be used to capture and save an image automatically.

9.4.6 Print

Click the **Print** icon on either of the *Image* windows to print an image while reviewing single-frame images.

NOTE

- The images print to the default Windows printer.
- Images may be printed in color if a supported color printer is installed on the system.

9.4.7 Annotate

1. Click the **Annotate** icon to annotate a stored image displayed in the window. The *Image Viewer* window appears.
2. The tools supplied in the application can be used to annotate the image. After annotating, the image can be saved to the hard drive, copied to the clipboard or printed.

See 8.5 Image Viewer on page 144 for more information.

9.4.8 Play

Click the **Play** icon to play an image loop repeatedly.

9.4.9 Pause

Click the **Pause** icon to pause a playing image loop.

9.4.10 Stop

Click the **Stop** icon when playing an image loop to stop playing and return to the first frame of the image loop.

9.4.11 Previous Frame

Click the **Previous Frame** icon when the image loop is paused to go back one frame in an image loop.

9.4.12 Next Frame

Click the **Next Frame** icon when the image loop is paused to go forward one frame in an image loop.

9.4.13 Input

If more than one input channel is configured, use this drop-down menu to select the input channel for either the *Image 1* or *Image 2* windows. The selected input channel is used when the freeze or live operations are performed in the selected window. The channel associated with the selected image window is automatically saved.

NOTE

The names of the input channels are configured on the *Image Window Settings* dialog (see 9.4.4 Settings on page 152).

9.4.14 Zoom

To zoom in or zoom out of the image, select the appropriate setting from the drop-down menu:

Setting	Description
Auto	Resize the image to fit the size of the window while keeping the original aspect ratio.
X 1	Display the image at original size.
X 2	Resize the image by a factor of 2 (not available for image loops).
X 3	Resize the image by a factor of 3 (not available for image loops).

The image will be centered if it is smaller than the window and will have horizontal or vertical scrollbars if it is larger than the window.

Zoom settings are not persistent. The selection will be reset if the window is reopened.

9.4.15 Contrast and brightness

To adjust the brightness and contrast of live and saved images:

- Move the markers on the **Contrast** and **Brightness** bars in the *Image 1* window or *Image 2* window toolbar to the left or right.
- The **Brightness** bar lightens and darkens the image. The **Contrast** bar widens and narrows the range of black and white used to display the image.

The default settings for contrast and brightness will show the original image without any adjustments to contrast or brightness. Changes made to contrast or brightness settings for live images are automatically saved and are associated with the input channel used. These settings are used only for live and freeze operations.

NOTE
For live color images, brightness and contrast cannot be changed in the image windows. Adjust these on the X-ray system.

Changes made to contrast or brightness settings while viewing saved images are temporary and will not be saved.

9.5 How to view images

9.5.1 *Image Library* window

The system generates a thumbnail image and adds it to the *Image Library* window when any of the following are acquired:

- Images captured from the *Image 1*, *Image 2*, or *Image 3* windows
- Images or image loops received from the CARTO® 3 System

9.5.2 Display images

Select a thumbnail in the *Image Library* window to load the associated image or image loop on the active image window.

If the image has associated signal data, the *Review* window updates to show the signal waveforms that correspond to the timestamp of the image.

NOTE
If the image has no associated signal data, the *Review* window may update with the signals nearest in time to the acquired image.

9.5.3 Delete images

Images can be deleted from the *Image Library* window or from the *Log* window.

1. Right-click the thumbnail image and select **Delete**.
2. Confirm the deletion. When confirmed, the image event is deleted.

Once deleted, the image cannot be recovered.

9.5.4 Rename images

Images can be renamed from the *Image Library* window or from the *Log* window. To rename an image, right-click the thumbnail image and select **Rename**.

9.5.5 Images in the report

All saved images can be included in generated reports. Select the **Image Capture X-Ray**, **Image Capture Ultrasound**, or **Imported images** sections as part of the report format, depending on the desired content. See Chapter 15 Reports on page 197 for details on including these sections in reports.

9.6 *Log* window

When the system acquires an image, it generates a corresponding entry in the log and stores it as part of the study.

The *Log* window documents the time an image was saved and the title of the image. The *Log* window, the *Image 1* window, and the *Image 2* window are integrated dynamically. This section covers the *Log* window as it relates to images.

9.6.1 *Log* window columns

For image events in the *Log* window, the display includes the following:

- **R** (report) column check box: If selected, the image or image loop will be included in report sections. For image loops, this will be unchecked by default. For single-frame images, this will be checked by default. This can be checked manually for image loops, but only the first frame of the image loop is included in the report.
- **Time**: Time at which image or image loop was acquired.

- **Summary**: This column contains the image title. The image title may be edited by the operator. The default titles for the different image types are:
    - For images captured from the *Image 1*, *Image 2*, and *Image 3* windows, the title includes the channel name and the time at which the image was captured.
    - For images and image loops received or imported from external systems, the title includes a number that indicates the order in which it was received.
    - For images and image loops received from the CARTO® 3 System, the title includes the name CARTO® and a number that indicates the order in which it was received.
- **Comment**: Editable text field.

9.6.2 Display images

Select the **Time** column for an image event in the *Log* window to load the associated image or image loop on the active *Image* window.

If the image has associated signal data, the *Review* window updates to show the signal waveforms that correspond to the timestamp of the image.

NOTE
If the image has no associated signal data, the *Review* window may update with the signals nearest in time to the acquired image.

9.6.3 Delete images

Right-click the **Time**, **Summary**, or **Comment** fields of an image event in the *Log* window and select the **Delete Event** option to delete an image. This action displays a message prompting the operator to confirm the operation. When confirmed, the image event is deleted. Once deleted, the image cannot be recovered.

9.6.4 Rename an image

To rename the title of the image from the *Log* window:

1. Double-click the **Summary** column to display the image title.
2. Type the new **Title** and select **OK**.

9.6.5 *Log* window toolbar

The user may select an **Image** filter from the dropdown menu. When selected, this filter displays only image events.

10

Chapter 10 Ultrasound Image Capture

This chapter describes the interface between an ultrasound system and the Mac-Lab/CardioLab system.

Systems with the Matrox OrionHD board can capture video from an ultrasound system for display inside the Mac-Lab/CardioLab application. Captured video is shown in the *Image 3* window. Users can capture and store single-frame images in the study as part of case documentation along with the corresponding cardiac signal waveforms.

10.1 *Image 3* window

The *Image 3* window always displays a live image if the ultrasound image source is active. If the ultrasound image source is not active, the *Image 3* window displays a blank image. Live capture of ultrasound images can be performed in the *Image 3* window even when a live fluoroscopic image is being displayed on the *Image 1* or *Image 2* windows.

The input channel for the *Image 3* window is automatically set to the ultrasound image source. The input source cannot be changed.

During live capture on the *Image 3* window, if the input video is stopped or disconnected, the *Image 3* window displays a blank image. Live capture automatically resumes when the input signal is available.

10.1.1 Settings

To configure the *Image 3* window, select the **Settings** icon. The settings dialog appears.

Configure the *Image Window Settings* tab upon installation. After these settings are established, do not change them. If changes are required, contact technical support for assistance.

- **Image Channel**: This is used to name the images saved from the *Image 3* window.
- **Video Format**: Select from the list of supported formats on the drop-down menu.
- **Input Source** (Matrox ClarityUHD only): Select the physical input connector that the source is plugged into.
- **Save signal data with images**: If enabled, the system saves signal data with every save operation.
- **Enable gating on trigger**: If enabled, the image is captured only after the specified trigger level is reached for the trigger signal in the *Real-Time* window.
- **Save images on ablation**: This setting automatically saves an image at the start of each ablation.
- **Save images on activation alignment**: This setting automatically saves an image with each activation alignment window grab.
- **Save images on Mapping System event**: This setting automatically saves an image when a mapping system event occurs. This setting applies only if interfacing to a CARTO® 3 System.

10.2 View images

See 9.5.1 *Image Library* window on page 155 for information about how to view images that are saved in a study.

10.3 *Log* window

See 9.6 *Log* window on page 156 for information about how to use the *Log* window with ultrasound image capture.

Chapter 11 *End Tidal CO2* Window

This chapter describes the *End Tidal CO2* window, the CO_2 module, and the system interface.

When using PDM as the cath amplifier

Refer to your sales representative for availability of CO_2 options with PDM.

See the Respironics CO_2 Operator's/Service Manual Option for Mac-Lab/CardioLab (PN 2093700-001) for specific safety information and cleaning and use instructions.

11.1 End Tidal CO_2 overview

End Tidal CO_2 ($EtCO_2$) is a continuous, noninvasive technique for determining the concentration of CO_2 (carbon dioxide) in respiratory gas by measuring the absorption of infrared light of specific wavelengths.

The light generated in the analyzer bench is passed through respiratory gas samples. The amount of absorption by CO_2 in the sample is measured and digitized by the photodetector. The module processes the electronic signal and displays a waveform and digital values for expired CO_2 (EXP), inspired CO_2 (INSP) and respiratory rate (RR) on the display.

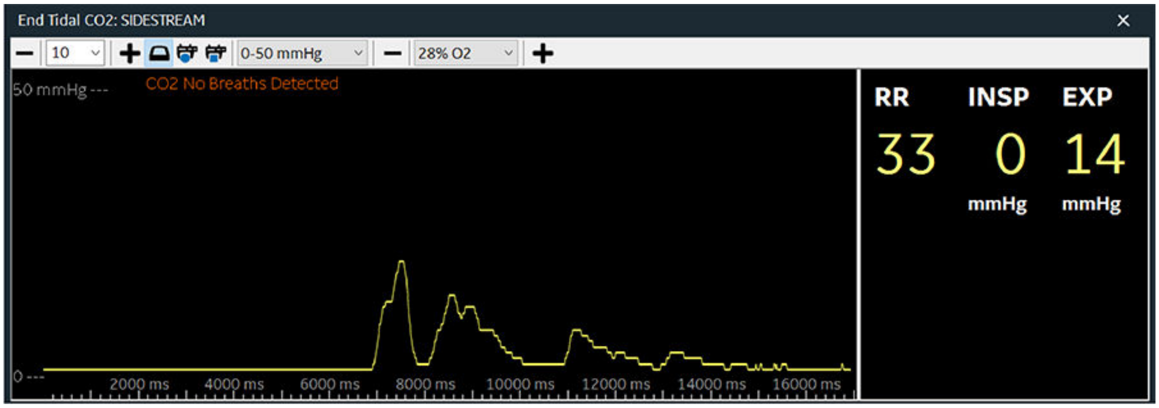
The absolute levels for inspiratory and expiratory values reported in the $ETCO_2$ window will vary based on atmospheric conditions, including but not limited to, temperature and altitude. The Mac-Lab and CardioLab systems provide no provisions to compensate for differences in atmospheric conditions and the values reported should be used as a reference only.

NOTE
If there is no CO_2 input detected, the values for respiration, inspired CO_2, and expired CO_2 are blank. If there is an error condition, the display shows two asterisks (**).

11.2 *End Tidal CO2* window

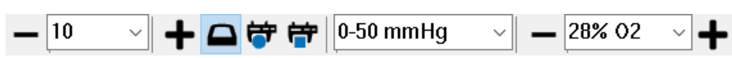
CO_2 information is displayed in a separate window in the Mac-Lab/CardioLab application. To launch the *End Tidal CO2* window, from either the *Real-Time* or *Review* windows, select **End Tidal CO2** from the **Windows** menu. The *End Tidal CO2* window opens.

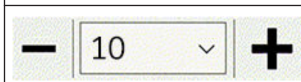
Figure 11-1 *End Tidal CO2* window



Window component	Description
Title bar	*End Tidal CO2* window title displays the following: • **SIDESTREAM** when the CO_2 module is operating in sidestream mode. • **MAINSTREAM** or blank when the CO_2 module is operating in mainstream mode.
End Tidal CO2 window tool-bar	See 11.3 End Tidal CO_2 toolbar on page 162.
RR	Indicates respiratory rate (in breaths per minute)
INSP	Inspired CO_2 value (in mmHg)
EXP	Expired CO_2 value (in mmHg)

11.3 End Tidal CO_2 toolbar



	**Display speed** This option selects sweep speed for the displayed CO_2 waveform.
	**Start or stop EtCO_2 pump** (Capnostat dual module only) This icon turns the module pump on and off. The pump must be on when using the sidestream method. A blocked line condition may cause the pump to shut off automatically. To restart the pump, clear or replace any blocked lines and select the **Start or stop EtCO_2 pump** icon.
	**Calibrate EtCO_2 sensor** Zeros the Capnostat sensor. This is required whenever a new sensor is connected to the module.
	**Calibrate EtCO_2 adapter** Calibrates the Capnostat airway adapter if required. If the CO_2 module in use does not require calibration, this button will operate the same as the **Calibrate EtCO_2 sensor** icon.

0-50 mmHg	**$EtCO_2$ range** (scale) Selects the waveform display range in mmHg. If the waveform is too big, it will be clipped on the display. Adjust the scale to reduce the waveform size.
28% O2 0-60% O2	**O_2 compensation** The presence of a high concentration of oxygen causes the CO_2 value to appear lower than the actual value. Use this option to compensate for the presence of O_2. Depending on the CO_2 module in use, this may display either 0-60% O_2 and greater than 60% O_2 selections or allow selection of O_2 in 1% increments. O_2 concentration can be obtained from the anesthesia system.

11.4 CO_2 compensations

The system only allows configuration of the O_2 compensation value as described above. Other CO_2 parameters are not user selectable and are set to the following values:

- ETCO2 Time Period (time over which to average $ETCO_2$ values): 1 breath
- No Breaths Detected Timeout: 20 sec
- Zero Gas Type: room air
- Balance Gas Compensations: room air
- Anesthetic Agent Compensations: 0%
- Gas Temperature: 35 degrees C

11.5 CO_2 and *Log* window

The inspired CO_2, respiration rate, and expired CO_2 can be recorded in the *Log* window using the **AutoLog Vitals** and **AutoLog NBP**. The recorded events can be inserted in a report. See Chapter 15 Reports on page 197.

To edit the vitals event, double-click in the **Summary** column on the event (or right-click in the **Summary** column and choose **Edit Event**). The *Edit Vitals Event* window appears.

12

Chapter 12 Lists

12.1 Master lists

The system can maintain master lists that relate to hospital procedures. Data collected in master lists can be used to populate reports generated in the system or other databases.

Staff members, medications, and supplies are automatically exported from the CVIS to the system if the system is on an INW network. When these lists are sent to the INW network, each acquisition and review system will automatically be updated with the new lists. For instructions on central list setup, refer to the CVIS and DICOM interfaces section in the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN).

NOTE
If operating a CVIS, any changes to master lists must be done at the CVIS. Refer to the CVIS operator manual for instruction on editing master lists.

12.1.1 Using master lists during a study

Most of the master lists can be accessed using a keyboard shortcut or by selecting the **Study** menu in the *Real-Time* or *Review* window.

- Conscious Sedation (**Action** + **A**)
- Procedures (**Action** + **X**)
- Staff (**Action** + **C**)
- Supplies (**Action** + **V**)
- Medications (**Action** + **B**)
- Radiology (**Action** + **N**)
- Complications (**Action** + **M**)
- Contrast
- Orders

Once any of the master lists are open, the user can navigate to all other master lists by selecting the tabs at the top of the window.

To quickly search for a master list item, within the *Master List* window, click the name heading in the list item window to alphabetize the list. Begin typing the item to be searched.

To delete a selected item within a master list, highlight the item and click the **Delete** icon.

12.1.1.1 Conscious Sedation

The **Conscious Sedation** tab is used to document pre- and post-conscious sedation information before and after the procedure. There is also an area to type an assessment.

To enter conscious sedation information:

1. Press the **Action + A** keys on the keyboard or select **Study** > **Conscious Sedation**. The *Master Lists* window appears with the **Conscious Sedation** tab active.
2. Choose the appropriate pre- and post-case selections from the pull-down menus. A score is automatically calculated in the **Score** field.
3. Type assessment comments in the **Assessment** field.
4. Click **Close** when finished.

12.1.1.2 Procedures

The **Procedures** tab should contain a list of procedures and charge codes.

To select a procedure:

1. Press the **Action + X** keys or select **Study** > **Procedures**.
2. Select the desired procedures category in the **Root** directory.
3. Select the procedure type by double-clicking that procedure or highlight the procedure and press the **Enter** key.
4. The selected procedure is displayed in the *Procedures used list* window.
5. To delete a procedure, highlight that item and click the **Delete** icon.

NOTE
To quickly search for a procedure, click on the **Name** heading in the list item window to alphabetize the list. Begin typing the name of the item.

The **Procedures pick list** category window can be displayed or hidden by clicking the **Show Tree List** icon.

12.1.1.3 Staff

The **Staff** tab contains a catalog of personnel and duties performed during a procedure. Staff members can only be added at the CVIS. Refer to the CVIS operator manual for instructions on adding staff members to the master lists. If the CVIS option is not purchased, see 12.1.2.2 Customizing master lists - systems without CVIS on page 171.

To select a staff member:

1. Press the **Action + C** keys or select **Study** > **Staff**.
2. Select the desired staff category in the **Root** directory.
3. Select the staff member by double-clicking the name or highlight the name and press the **Enter** key.

   The selected staff is displayed in the *Staff used list* window.
4. To delete a staff member highlight the person and click the **Delete** icon.

NOTE
To quickly search for a staff member, click the **Name** heading in the list item window to alphabetize the list. Begin typing the item to be searched.

The **Staff pick list** category window can be displayed or hidden by clicking the **Show Tree List** icon.

12.1.1.4 Supplies

The **Supplies** tab contains a catalog of supplies that are consumed during a procedure. Supplies should be added at the CVIS. Refer to the CVIS operator manual for instructions on adding supplies to the master lists. If the CVIS option is not purchased, see 12.1.2.2 Customizing master lists - systems without CVIS on page 171.

To select a supply item:

1. Press the **Action + V** keys or select **Study** > **Supplies**.
2. Select the desired supplies category in the **Root** directory.
3. Select the supply item by double-clicking the item or highlight the item and press the **Enter** key.

   The selected supply is displayed in the *Supplies used list* window and sent to CVIS. The supply part number is automatically populated from the CVIS system where it was previously entered.
4. Press the **Enter** key to confirm or select the **Check** icon next to the time column.
5. To delete a supply item highlight that item, and select the **Delete** icon.

NOTE
To quickly search for a supply, click on the **Name** heading in the list item window to alphabetize the list. Begin typing the name of the item.

12.1.1.4.1 Supplies (with CVIS)

If the CVIS option is present, new supplies are entered at the CVIS and then pushed to the system. During a case study, a new supply item may be entered, but that supply item will not be part of the master list and will appear only in that particular case.

NOTE
If a CVIS supply item contains a supplier name, that data will be imported to the manufacturer name field on the system.

To enter a new supply:

1. Click the **Insert Item** icon in the **Supplies used list** field or the **Insert** key.
2. Text boxes open for all of the columns. Enter the appropriate text. A part number must entered in the **Part Number** field. Press the **Enter** key or select the green check mark. The new entry appears under the **Supplies used list**.

   After a new supply item is entered and the case is closed, the supply item part number will go into the Inventory Module of the CVIS. The hospital administrator will then have an option to set up the supply item to be pushed back into the system and appear as a Master List item, or delete the item from the Inventory Module. If the item is deleted from the Inventory Module, it will appear only in the study that it was entered.

12.1.1.4.2 Barcode scanner

An optional barcode scanner can be used to quickly scan in supply items. Scan the barcode of the supply package. The barcode must be pre-entered into the master list before the scanner will recognize the item.

A dialog opens to allow the lot number or serial number to be scanned when

- the first barcode does not contain the lot and/or serial number, and
- the CVIS setting requires the lot and/or serial number, or barcode parsing is enabled

Refer to the Mac-Lab/CardioLab/Centricity Cardiology INW 2D Barcode Scanner Configuration Service Manual (PN 5123031-199) for information on configuring the scanner.

12.1.1.5 Medications

The **Medications** tab contains information on the medications available and used during a procedure. Medications can only be added at the CVIS. Refer to the CVIS operator manual for instructions on adding medications to the master lists. If the CVIS option is not purchased, see 12.1.2.2 Customizing master lists - systems without CVIS on page 171.

To select a medication item:

1. Press the **Action + B** keys or select **Study** > **Medications**.
2. Select the desired medication category in the **Root** directory.
3. Select the medication item by double-clicking the item or highlight the item and press the **Enter** key.

   The selected medication is displayed in the *Medications used list* window.
4. Type the dosage in the **Amount** column.
5. If required, select appropriate staff member in the **Ordered By** drop-down list.
6. If required, select appropriate staff member in the **Given By** drop-down list.
7. If appropriate, type the time the medication was stopped in the *Time Stop* window.
8. Press the **Enter** key to confirm or click the **Check** icon next to the time column.
9. To delete a medication item, highlight the item and click the **Delete** icon.

NOTE
To quickly search for a medication, click the **Name** heading in the *Medication pick list* window to alphabetize the list. Begin typing the item to be searched.

The *Medication pick list* category window can be displayed or hidden by clicking the **Show Tree List** icon.

NOTE
An optional barcode scanner can be used to quickly scan in medication items. Scan the barcode on the medication package. The barcode must be pre-entered into the master list before the scanner will recognize the item.

NOTE
The **Amount**, **Subtotal**, and **Selection Total** fields of Medication items in the Medications used list will be formatted according to the E.2 Do Not Use List on page 315.

NOTE
The **Administered Unit** for a medication indicates whether the medication is dispensed per unit of time, by patient weight, or both. The **Subtotal** for a medication will be blank if a medication is dispensed per unit of time and the **Time Stop** has not been set. Similarly, the **Subtotal** will be blank for medications dispensed by weight if the patient's weight has not been entered. When the **Subtotal** is blank, the **Selection Total** will indicate that the total is unavailable due to missing data. When all required medication data has been entered, the **Subtotal** and **Selection Total** will indicate these values for the selected medication.

12.1.1.6 Radiology

The **Radiology** tab provides a location to enter information regarding patient radiation exposure. This information can be printed as a report section.

To access the **Radiology** list:

1. Press the **Action** + **N** keys or select **Study** > **Radiology**.
2. The **Exam Record DAP**, **Exam Fluoro DAP**, **Exam Total DAP**, **Total Fluoro Time** and **Total runs** will automatically be populated with information from select GE HealthCare X-ray systems if the X-ray interface option is present. **Exam Total Dose** will also be automatically populated if the x-ray system provides this information.

   It is possible to manually populate the **Interventional Fluoro time**, **Diagnostic Fluoro time**, **Cine ID**, **Archive ID** and **CD ID**. **Exam Total Dose** may be manually populated. The **Exam Total DAP** will automatically be calculated if the manual calculation is entered in the **Exam Record DAP** and **Exam Fluoro DAP** information.

   To populate those fields, place the cursor in the appropriate field and manually enter the information. Make sure to manually calculate the **Total Fluoro Time**. The **Exam Total DAP** will automatically be calculated if the manual calculation is entered in the **Exam Record DAP** and **Exam Fluoro DAP** information.
3. The information of each cine run will appear on the bottom half of the *Radiology* window if the X-ray interface option is present.
4. Click **Refresh** to refresh the current values displayed by the X-ray system.
5. Click **Close** when finished.

12.1.1.7 Complications

The **Complications** tab contains information on complications that may have occurred during a procedure.

To select a complication item:

1. Press the **Action + M** keys or select **Study** > **Complications**.
2. Select the desired **Complication** category in the **Root** directory.
3. Select the complication item by double-clicking the item or highlight the item and press the **Enter** key.
4. The selected complication is displayed in the *Complications used list* window.
5. To delete a complication, highlight that item and click the **Delete** icon.

> **NOTE**
> To quickly search for a complication, click the **Name** heading in the list item window to alphabetize the list. Begin typing the item to be searched.
>
> The **Complications pick list** category window can be displayed or hidden by clicking the **Show Tree List** icon.

12.1.1.8 Contrast

The **Contrast** tab contains information on contrast agents that were used during a procedure.

To select a contrast item:

1. Select the **Contrast** tab in the *Master Lists* window or select **Study** > **Contrast**.
2. Select the desired contrast category in the **Root** directory.
3. Select the contrast item by double-clicking the item or highlight the item and press the **Enter** key.
4. The selected contrast is displayed in the *Contrast used list* window.
5. Type the dosage in the **Amount** column.
6. Press the **Enter** key to confirm or click the **Check** icon next to the time column.
7. To delete a contrast item, highlight that item and click the **Delete** icon.

NOTE
To quickly search for a contrast item, click the **Name** heading in the list item window to alphabetize the list. Begin typing the item to be searched.

The *Contrast pick list category* window can be displayed or hidden by clicking the **Show Tree List** icon.

NOTE
The **Amount** and **Selection Total** fields of Contrast items in the Contrast used list will be formatted according to the Joint Commission E.2 Do Not Use List on page 315.

NOTE
The information regarding contrast used during a procedure is available in the contrast master list window and as a standard report section on the Mac-Lab/ CardioLab system.

NOTE
The **Selection Total** shows the total amount for all entries for the contrast that is currently selected in the **Contrast used list**.

12.1.1.9 Orders

The *Orders* tab contains information regarding orders created for a procedure. Selected fields in the *Orders* window may be pre-populated if the study was started from the CVIS using **Schedule Search** or **Get Active Patient** from the *Navigator* window.

1. Select the **Orders** tab in the *Master Lists* window or select **Study** > **Orders**.
2. Type the information in the desired fields.
3. Click **Close** when finished. The **Filler order number** will automatically be populated.

NOTE
When a study is started by selecting **Schedule Search** or **Get Active Patient** in the *Navigator* window, the **Placer order number** is provided by the CVIS and cannot be changed.

12.1.2 How to work with lists

12.1.2.1 Customizing lists - system with CVIS

If operating a system with a Centricity Cardiology INW server, CVIS updates occur automatically.

If operating a standalone system (a system with no Centricity Cardiology INW server) with a CVIS, update lists by performing the following:

1. Double-click **Service Console** on the desktop.

   The *Service Console* window appears.

2. Select **GEMS Central List Management Control** from the menu tree.

   The *Central List Control* window appears. If the **CCW** and/or **Third-Party CVIS** congifurations are not present, contact your GE HealthCare service representative.

3. Select **Update Lists**.

12.1.2.2 Customizing master lists - systems without CVIS

If the CVIS option has not been purchased, lists can be edited from the *Navigator* or *Real-Time*/*Review* windows.

NOTE
The administrator must be logged on to customize lists. Contact the hospital system administrator.

NOTE
GE HealthCare recommends that lists ARE NOT customized during a case.

12.1.2.2.1 Add a folder

Adding a folder requires the administrator logon. Contact the site network administrator for administrative privileges. Make sure to log out as administrator after completion of adding the folder.

To add a folder:

1. When editing lists from the *Real-Time* or *Review* windows, select **Study** > **[list to edit]**. The *Master List* window appears. Click **Edit**.
2. When editing lists from the *Navigator* window, select **Administration** > **Lists** > **[list to edit]**. The *Master List* window appears.
3. Highlight the word **Root** and click the **Insert Folder** icon or press the **Shift** + **Insert** keys. A text box appears.
4. Type the name of the new folder.
5. Press the **Enter** key or select the green check mark.
6. The new folder appears in the list.

12.1.2.2.2 Add a new entry

To add a new entry to a list:

1. When editing lists from the *Real-Time* or *Review* windows, select **Study** > **[list to edit]**. The *Master List* window appears. Click **Edit**.
2. When editing lists from the *Navigator* window, select **Administration** > **Lists** > **[list to edit]**. The *Master List* window appears.
3. Select the name of the folder where the entry will be added.
4. Click the **Insert Item** icon or press the **Insert** key.
5. Text boxes open for all of the columns.

6. Enter the appropriate text.
7. Press the **Enter** key or select the green check mark.
8. The new entry appears under the selected folder.

12.1.2.2.3 Edit an entry

To edit an existing entry:

1. When editing lists from the *Real-Time* or *Review* windows, select **Study** > **[list to edit]**. The *Master List* window appears. Click **Edit**.
2. When editing lists from the *Navigator* window, select **Administration** > **Lists** > **[list to edit]**. The *Master List* window appears.
3. Highlight the folder containing the item to be edited.
4. Double-click the entry to be edited.
5. Enter the desired changes.
6. Press the **Enter** key or select the green check mark.
7. Highlight an existing entry and click the **Delete**, **Cut**, **Copy** or **Paste** icons to remove and rearrange the steps in the list.

12.1.2.2.4 Delete a folder

NOTE
Once a folder is deleted, it cannot be recovered.

To delete a folder:

1. When editing lists from the *Real-Time* or *Review* windows, select **Study** > **[list to edit]**. The *Master List* window appears. Click **Edit**.
2. When editing lists from the *Navigator* window, select **Administration** > **Lists** > **[list to edit]**. The *Master List* window appears.
3. Highlight the **Root** folder.
4. Highlight the name of the folder to delete.
5. Click the **Delete** icon or press the **Delete** key.

12.2 Custom lists

In addition to master lists, the system can maintain custom lists, which relate to hospital procedures. Data collected in custom lists can be used to populate reports generated in the system or other databases.

When these lists are sent to the INW network, each acquisition and review system will automatically be updated with the new lists.

Channel labels

The system provides a default list of labels for Intracardiac and Invasive Pressure Waveforms. The user can also define their own list of labels.

Phases

The system provides the ability to organize groups of information to indicate some change in patient condition.

Pacing sites

The system provides a default list of pacing site labels. The user can also define their own list of labels.

Arrhythmia types

The system provides a default list of arrhythmia types. The user can also define their own list.

Arrhythmia tolerances

The system provides a default list of arrhythmia tolerances to identify how the patient tolerated the induced arrhythmia during the procedure. The user can also define their own list.

Block description

The system provides a default list of block descriptions. The user can also define their own list.

Refractory locations

The system provides a default list of refractory locations. The user can also define their own list.

Level of pain

Use the level of pain (LOP) entry to document patient pain along with a vitals event. The LOP index is displayed in the *Log* window and in the event log and vital signs reports sections. The LOP description is displayed in the edit vitals event dialog.

Level of consciousness

Use the level of consciousness (LOC) entry to document patient consciousness along with a vitals event. The LOC index appears in the *Log* window and in the event log and vital signs reports sections. The LOC description is displayed in the edit vitals event dialog.

You can also use LOC to document pre-case and post-case conscious sedation. Both the LOC index and description appear in the *Conscious Sedation* window and conscious sedation report section.

NOTE
The *Conscious Sedation* window does not display values with negative indices as choices for LOC.

Medication types

Use the medication types entry to populate the choices in the medications master list's **Type** column.

Customizing lists

Edit custom lists from the *Navigator* window.

- The administrator must be signed in to customize lists. Contact the site network administrator for more information.
- You cannot edit custom lists during a case.

12.2.1 Channel label configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Channel Labels**. The Channel Labels list appears.
2. Click **Edit**.
3. To add a new entry:
   3.1. Click the **Insert Item** icon.
   3.2. Enter or choose the desired values.
4. To edit an existing entry:
   4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icons or press `spacebar`.
   4.2. Enter or choose the desired values.
5. Press `Enter` or select the green check mark. The new or updated entry appears.
6. To delete an entry:
   6.1. Highlight the entry to delete.
   6.2. Click the **Delete** icon or press `Delete`.

12.2.2 Phases configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Phases**.
   The phases list appears.
2. Click **Edit**.
3. To add a new entry:
   3.1. Click the **Insert Item** icon.
   3.2. Enter or choose the desired phase description.
4. To edit an existing entry:
   4.1. Double-click the phase to edit. You can also select the **Edit Item** or **Folder** icon or press the space bar.
   4.2. Enter or choose the desired phase description.
5. Press **Enter** or select the green checkmark.
   The new or updated entry appears in the window.
6. To delete an entry:
   6.1. Highlight the entry to delete.
   6.2. Click the **Delete** icon or press the **Delete** key.

12.2.3 Pacing sites configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Pacing Sites**. The Pacing Sites list appears.
2. Click **Edit**.

3. To add a new entry:
    3.1. Click the **Insert Item** icon.
    3.2. Enter or choose the desired site description.
4. To edit an existing entry:
    4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icons or press `spacebar`.
    4.2. Enter or choose the desired site description.
5. Press `Enter` or select the green check mark. The new or updated entry appears.
6. To delete an entry:
    6.1. Highlight the entry to delete.
    6.2. Click the **Delete** icon or press `Delete`.

12.2.4 Arrhythmia types configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Arrhythmia Types**. The Arrhythmia Types list appears.
2. Click **Edit**.
3. To add a new entry:
    3.1. Click the **Insert Item** icon.
    3.2. Enter or choose the desired type description.
4. To edit an existing entry:
    4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icons or press `spacebar`.
    4.2. Enter or choose the desired type description.
5. Press `Enter` or select the green check mark. The new or updated entry appears.
6. To delete an entry:
    6.1. Highlight the entry to delete.
    6.2. Click the **Delete** icon or press `Delete`.

12.2.5 Arrhythmia tolerances configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Arrhythmia Tolerances**. The Arrhythmia Tolerances list appears.
2. Click **Edit**.
3. To add a new entry:
    3.1. Click the **Insert Item** icon.
    3.2. Enter or choose the desired tolerance description.
4. To edit an existing entry:
    4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icons or press `spacebar`.

4.2. Enter or choose the desired tolerance description.

5. Press `Enter` or select the green check mark. The new or updated entry appears.
6. To delete an entry:
   6.1. Highlight the entry to delete.
   6.2. Click the **Delete** icon or press `Delete`.

12.2.6 Block descriptions configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Block Descriptions**. The Block Descriptions list appears.
2. Click **Edit**.
3. To add a new entry:
   3.1. Click the **Insert Item** icon.
   3.2. Enter or choose the desired description value.
4. To edit an existing entry:
   4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icons or press `spacebar`.
   4.2. Enter or choose the desired description value.
5. Press `Enter` or select the green check mark. The new or updated entry appears.
6. To delete an entry:
   6.1. Highlight the entry to delete.
   6.2. Click the **Delete** icon or press `Delete`.

12.2.7 Refractory locations configurations

1. In the *Navigator* window, select **Administration** > **Lists** > **Refractory Locations**. The Refractory Locations list appears.
2. Click **Edit**.
3. To add a new entry:
   3.1. Click the **Insert Item** icon.
   3.2. Enter or choose the desired location description.
4. To edit an existing entry:
   4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icons or press `spacebar`.
   4.2. Enter or choose the desired location description.
5. Press `Enter` or select the green check mark. The new or updated entry appears.
6. To delete an entry:
   6.1. Highlight the entry to delete.
   6.2. Click the **Delete** icon or press `Delete`.

12.2.8 Level of pain configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Level of pain**.

   The level of pain list appears.

2. Click **Edit**.
3. To add a new entry:
   3.1. Click the **Insert Item** icon.
   3.2. Enter or choose the desired index and pain description.
4. To edit an existing entry:
   4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icon or press the space bar.
   4.2. Enter or choose the desired index and pain description.
5. Press **Enter** or select the green checkmark.

   The new or updated entry appears in the window.

6. To delete an entry:
   6.1. Highlight the entry to delete.
   6.2. Click the **Delete** icon or press the **Delete** key.

NOTE
Any vitals events will maintain their original level of pain values (index and description) unless they are edited.

12.2.9 Level of consciousness configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Level of consciousness**.

   The level of consciousness list appears.

2. Click **Edit**.
3. To add a new entry:
   3.1. Click the **Insert Item** icon.
   3.2. Enter or choose the desired index and consciousness description.
4. To edit an existing entry:
   4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icon or press the space bar.
   4.2. Enter or choose the desired index and consciousness description.
5. Press **Enter** or select the green checkmark.

   The new or updated entry appears in the window.

6. To delete an entry:
   6.1. Highlight the entry to delete.

6.2. Click the **Delete** icon or press the **Delete** key.

NOTE
Any vitals events will maintain their original level of consciousness values (index and description) unless they are edited.

Any conscious sedation entries will maintain their original consciousness values (index and description) unless they are edited.

12.2.10 Medication types configuration

1. In the *Navigator* window, select **Administration** > **Lists** > **Medication types**.

   The medication types list appears.
2. Click **Edit**.
3. To add a new entry:
   - 3.1. Click the **Insert Item** icon.
   - 3.2. Enter or choose the desired medication type description.
4. To edit an existing entry:
   - 4.1. Double-click the entry to edit. You can also select the **Edit Item** or **Folder** icon or press the space bar.
   - 4.2. Enter or choose the desired medication type description.
5. Press **Enter** or select the green checkmark.

   The new or updated entry appears in the window.
6. To delete an entry:
   - 6.1. Highlight the entry to delete.
   - 6.2. Click the **Delete** icon or press the **Delete** key.

NOTE
Any medication will maintain its type unless it is edited.

12.3 Export lists

See 5.6 Import and export custom data on page 85.

12.4 Import lists

See 5.6 Import and export custom data on page 85.

13

Chapter 13 Macros

Macros consolidate routine actions into a single command and build automation into the case. Macros can change a pressure label, change the pressure scale and make a measurement all in a single command. Macros are also helpful for entering notes into the *Log* window. This chapter describes executing, building, adding, editing and exporting/importing macros.

NOTE
Building or editing a macro requires the administrator sign in. Make sure to sign out as administrator after building or editing the macro.

Macros can only be created while in a study.

NOTE
Macros should not be edited while studies are in progress anywhere on the Centricity Cardiology INW network. Editing macros while live studies are in progress elsewhere on the network may cause permanent loss of macro folders and/or commands.

13.1 *Macro* window

To open the *Macro* window:

1. Select the **Windows** menu in the *Real-Time* or *Review* window.
2. Select the **Macro** option, position the cursor where the user would like the *Macro* window to appear and left-click. The *Macro* window will open. The *Macro* window can be resized or removed.

- The *Macro* window title bar indicates which macro folder is being displayed. To navigate to the parent folder, select the **Folder Up** icon, or put the cursor on the last line (with the up arrow) and double-click or select **Enter**.

13.2 Execute macros

1. Select the folder that contains the macro to execute.
2. Select the macro and press **Enter**.

   You can also double-click the macro to execute it and the steps.

   NOTE
   Ensure that the **Edit** icon is not active.

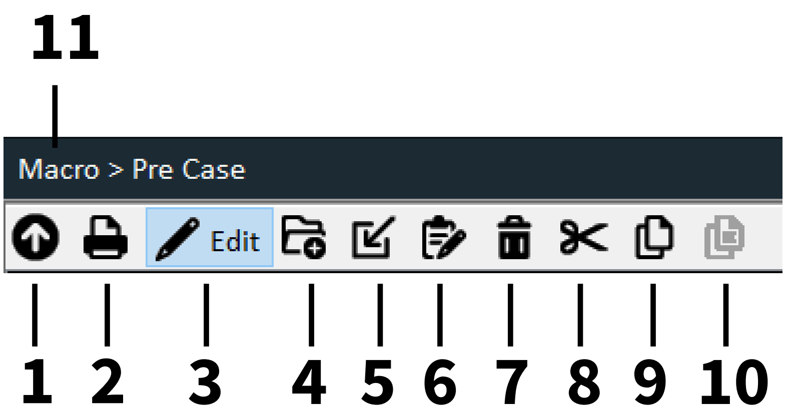
   The text of the macro changes color when the macro is executed. The color change appears on all workstations that are joined to the study. The color change persists when the study is continued or reviewed.

   NOTE
   When an executed macro entry is deleted from the *Log* window, the macro is unhighlighted in the *Macro* window, and, the color change is visible on all the workstations that are joined to the study.

13.3 Macro toolbar

When the edit mode is on, icons to the right of the **Edit Mode** icon become active.

Figure 13-1 Macro toolbar



Item	Name	Description
1	Folder Up	Navigates to the parent folder. This button is disabled at the top-level macro folder.
2	Print	Prints all of the items in a selected folder or all of the items in all selected folders.
3	Edit Mode	Turns edit mode on and off.
4	Insert Folder	Creates a new folder.
5	Insert Item	Inserts a new macro item in a selected folder.
6	Edit Item/Folder	Edits item descriptions or folder descriptions.
7	Delete	Deletes an item in a list or deletes an entire folder and all the contents.
8	Cut	Removes an item from a folder to be placed in another folder or in a different location in the folder.
9	Copy	Copies an item in a folder to be placed in another folder.
10	Paste	Places an item that was cut or copied into another location.
11	Navigation path	Shows the ancestry for the current folder location.

13.4 Customize macros

NOTE
Always build macros in the sequence that they will be used. For example, do not build a macro command that says “Prepped Patient” before building the macro command that says “Patient in Room”.

Edit mode must be on to modify any macro functions. Click the **Edit Mode** icon and the edit mode icons appear.

13.4.1 Create macro folders

1. To create a new macro folder, click the **Insert Folder** icon. A text box appears in the **Macro** column.

   NOTE
   To insert the new folder to the **Categories** directory, select the **Categories** folder.

   To add the new macro folder in a specific place, highlight the folder below where the new macro folder should appear before clicking the **Insert Folder** icon. For example, to locate the new folder above the pre-case folder, highlight the pre-case folder and click the **New Folder** icon. The new folder will appear above the pre-case folder.

2. Type the name of the new macro folder in the text box. The new macro folder appears in the macro category window.

13.4.2 Delete macro folders

1. To delete a macro folder, click **Categories** from the *Macro* window.
2. Select the folder to be deleted and click the **Delete** icon.
3. Confirm the deletion of the folder.

13.4.3 Create a new macro

1. Select the name of the desired macro folder in the **Macro** list.
2. Click the **Insert Item** icon in the toolbar. The *Macro Builder* window appears.

Field	Description
Macro name	Enter the macro name or comment or note text. This text box has a 64 character maximum limit.
No Log entry	Check this box to prevent **Macro Name** text from being entered into the *Log* window. If this box is checked, the macro name will display in parenthesis, for example, (**Patient Arrives**). This macro statement will not be entered into the *Log* window.
Execute next macro	Check this box to execute the next macro without additional clicks.
Macro commands	Folder list of available commands. Some folders have a plus sign (+) to the left which indicates there are sub-choices.
Command	Actual command actions that can executed by the macro are displayed in the *Command* window.
Step	List of the actions performed by the macro.

3. Type the name of the macro in the **Macro name** text box.

   NOTE
   The **Macro name** text box has a 64 character maximum limit. It is possible to type more than 64 characters but only 64 characters will appear in the Macro name when displayed in the *Macro* window.

NOTE
When a macro is executed, the color change is visible for all the macros that have the same macro name. it is advised to give your macro a distinct name.

4. To create a simple text macro (for example, a standard comment or note):
   4.1. Type the macro name and click **OK**.
   4.2. Select or deselect the **No Log entry** and/or **Execute next macro** text boxes as desired.
   4.3. Click **OK** to close the *Macro Builder* window. The new macro appears in the macro folder in the *Macro* window.
5. To create a more complex macro:
   5.1. Choose a parameter from the **Macro commands:** window (on the left). The available macro command displays in the *Command* window (on the right).
   5.2. Double-click the macro command in the *Command* window to add it to the macro.

   NOTE
   Some of the parameters have a dialog that displays after the parameter is double-clicked that may require text (for example, **Lead On** prompts for the name of the Lead).

   5.3. Select or deselect the **No Log entry** and/or **Execute next macro** text boxes as desired (see the Forms Macro table on page 181 for information about these text boxes).
   5.4. Complete steps a and b to add more macro commands to the macro, if desired.

   NOTE
   Use the **Delete**, **Cut**, **Copy** and **Paste** icons to remove and rearrange the macro steps in the **Step** list as desired.

   5.5. Click **OK** to close the *Macro Builder* window. The new macro appears in the macro folder in the *Macro* window.

   NOTE
   To add a standard or custom form macro, see 14.3.1 Forms macro on page 194.

13.5 Edit macros

NOTE
Macros should not be edited while studies are in progress anywhere on the Centricity Cardiology INW network. Editing macros while live studies are in progress elsewhere on the network may cause permanent loss of macro folders and/or commands.

1. Click the **Edit Mode** icon in the *Macro* window.
2. Select the macro folder containing the macro to edit.
3. Double-click the macro or click the **Edit Item/Folder** icon. The *Macro Builder* window appears.
4. See 13.4.3 Create a new macro on page 181 to make any necessary edits to the macro.
5. Click **OK** to close the *Macro Builder* window.
6. Click **Edit Mode** to exit the edit mode.

13.6 Import/export macros

For additional information about importing/exporting custom data, see Import and export custom data.

13.7 Macro commands

Channels	**Pressures**	**Real-Time**	**P1**	**Change Label:** Set or change a specific channel label.
			P1	**Zero:** Zero this individual channel.
		P2 – P4 **Real-Time:** All the same commands and functions.		
		Review	**P1**	**Change Label:** Set or change a specific channel label.
		P2 – P4 **Review:** All the same commands and functions.		

Measures	**Antergrade Refractory Period**	Prompt the user to enter a start time and a stop time to detect an antergrade refractory period.
	Arrhythmia Event	Prompt the user to enter an arrhythmia description for a specific time in the log.
	BSLC	Initiate computer-assisted conduction interval measurements. After the macro is executed, it prompts the user to select a beat.
	Conduction Block Event	Prompt the user to enter a block description for a specific pacing interval.
	Manual	Initiate manual measurements. After the macro is executed, it prompts the user to insert calipers on the screen.
	Refractory Period Event	Prompt the user to document a refractory period, the pacing interval field will automatically populate. A refractory region, description, and period can be entered, as well.
	Retrograde Refractory Period	Prompt the user to enter a start time and a stop time to detect a retrograde refractory period.
	SNRT	Prompt the user to enter a start time and stop time to detect the SNRT.

Results	**Report**	**Generate**	Generate specific report formats by name of customization.
		Print	Print a specific report that has been generated.
		Print All	Print all report formats in the *Reports* window.

Vitals	**Log NBP On/Off* (Auto NBP On/Off)**	Start the NBP cuff inflation and begin logging vitals per interval set. **NOTE** Set the **Auto NBP** interval from the **Measurements** tab in Set-Up.
	Log Vitals Interval	Prompt user for the number of minutes between vital logging. **NOTE** Do not use this command if auto-logging NBP.

	Log Vitals On/Off	Turn on and off the auto-logging of vitals.
	Set Vital Pressure	Allow selection of P1, P2, P3, P4, or NBP for blood pressure logging.
	Start/Stop NBP*	Immediately start or stop the NBP cuff. (STAT NBP).
		*To execute any macro involving NBP, a cath amplifier is necessary.

Study	**Autosave**	Turn Autosave on and off (toggles)
	Case Event	Open the **Case Event** dialog box.
	Complications	Open the **Complications** master list.
	Conscious Sedation	Open the pre/post *Conscious Sedation* window for documentation.
	Contrast	Open the **Contrast** master list.
	Forms	Open the selected registry form or custom form from the drop-down list.
	Medications	Open a dialog box with a specific drug selected and allows input of drug amount and time. **NOTE** The medication must already exist in the medication master list. When setting this macro, enter the medication exactly as it is entered in the master list.
	Medications List	Open the **Medication** master list.
	Patient Info	Open the *Patient Information* window.
	Phase	Open the **Phase List** for changes during a procedure.
	Procedures	Open the **Procedures** master list.
	Radiology	Open the **Radiology** master list.
	Report	Open the *Reports* window.
	Save On/Off	Turn save on and off (toggles).
	Staff	Open the **Staff** master list.
	Supplies	Allow the user to enter a specific supply (for example, 6F Sheath). **NOTE** The supply must already exist in the supply master list. When setting this macro, enter the supply exactly as it is entered in the master list. When the macro is executed, a dialog box will appear stating **Item Found**. Click **Insert**.
	Supplies List	Open the **Supply** master list.

Display	**Real-Time**	**Print 12 Lead**	Print a real-time 12-lead.
		Sweep Speed	Allow user to set or change sweep speed in the *Real-Time* window.
	Clock	**Close Stopwatch**	Close the *Stopwatch* window.
		Close Timer	Close the *Timer* window.
		Reset Stopwatch	Reset the stopwatch (counts forward).
		Set Stopwatch Title	Allow the user to label the stopwatch.

		Set Timer	Allow the user to set the timer (in minutes).
		Set Timer Title	Allow the user to label the *Timer* window.
		Start/Stop Stopwatch	Start or stop the stopwatch.
		Start/Stop Timer	Start or stop the timer (counts down).
	Review	**Active Review 1**	Allow selection of the active page for *Review* window 1.
		Active Review 2	Allow selection of the active page for *Review* window 2.
		Print	Do a quick print of the *Review* window.
		Print Active Review	Print the active *Review* window.
		Sweep Speed	Allow user to set or change the sweep speed in the *Review* window.
		Update	Save 10 seconds of data and update the *Review* window.
	Image	**Save**	Grab an image from the *Image 1*or *Image 2* windows (optional feature) and save to the study.
		Save ICE	Grab an image from the *Image 3* window (optional feature) and save to the study.

Macro Tools	**Delay**	Allow user to initiate a specific delay in seconds before continuing to run the rest of the macro.
	Note	Open the *Note* window for a real-time comment to be charted.
	Pause	Create a pause in the macro command. **NOTE** The user must select the **OK** box on the *Review* screen in order to continue the macro.

Chapter 14 Forms

This chapter describes registry and custom forms.

Forms are standardized selections that allow documentation of patient data. There are two types of forms: registry forms (including ACC Cath PCI and ACC ICD forms) and custom forms. Registry forms are provided with the system comprised of ACC and CVIS fields. An asterisk (*) next to the data field in the forms indicates that this is a diagnostic cath data set (DDS).

The system does not verify that all ACC data fields are entered.

14.1 Registry forms - U.S. only

Registry forms are included with the system. They can be opened from a drop-down selection or through a macro command. Registry form information is not documented in the *Log*, but it is documented in the report if that section exists in the report format.

14.2 Custom forms

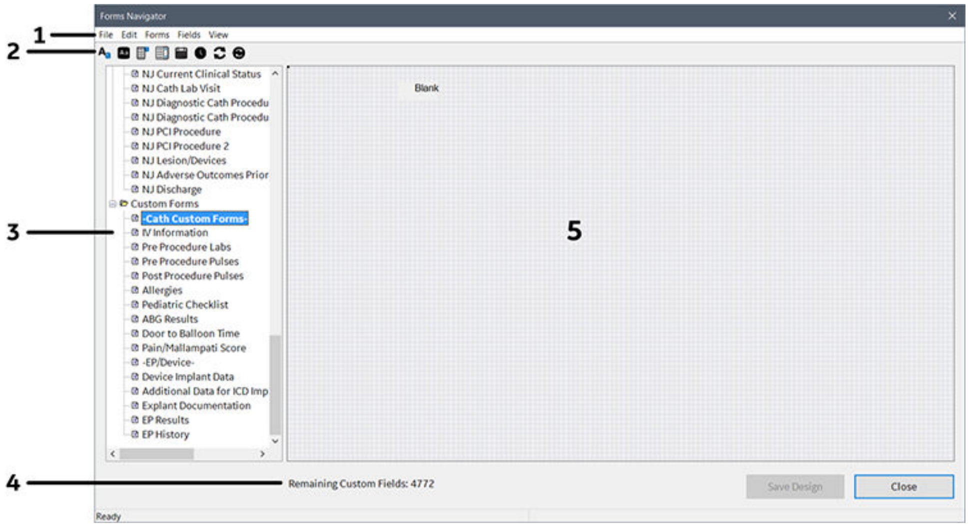
Custom forms are used to create custom data entry screens. Custom forms can only be created by a user with Administrative privilege. All other users will have access to the custom forms during a case study via drop-down menu or macro command.

14.2.1 *Forms Navigator* window

The administrative logon is required to create custom forms.

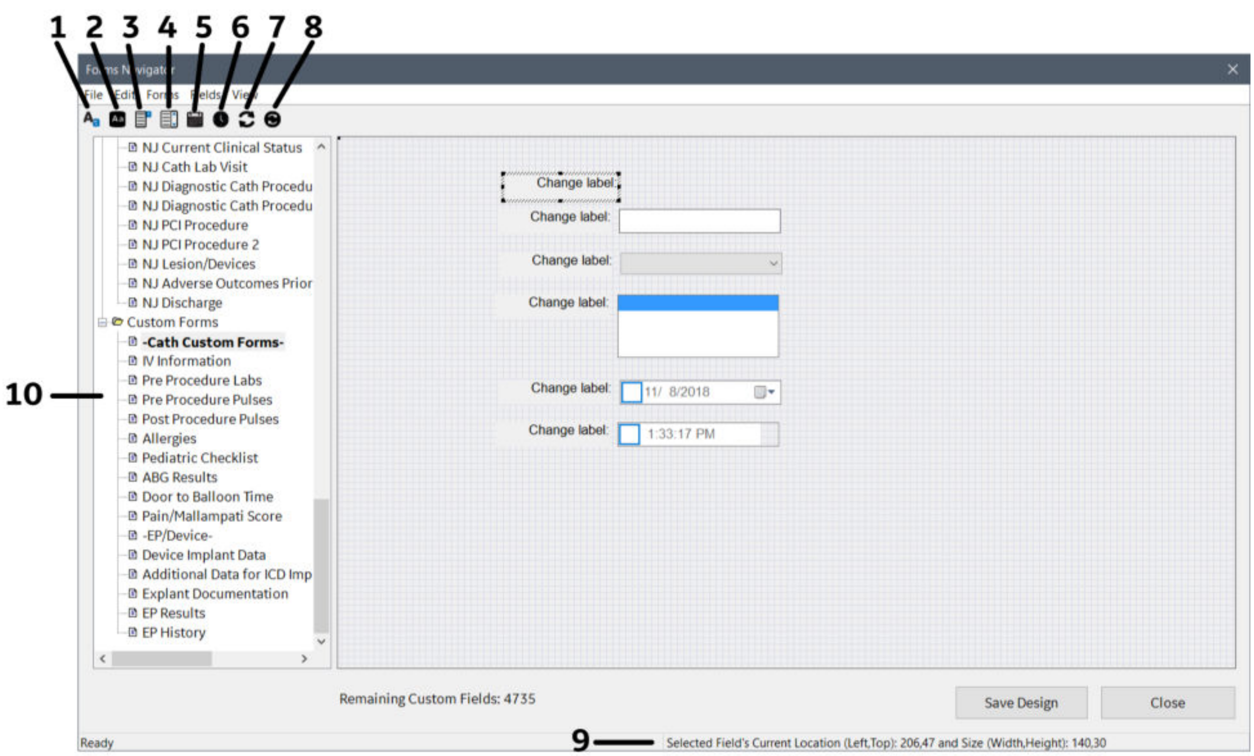
From the *Navigator* window, select **Administration** > **Design Custom Forms**. The *Forms Navigator* window is displayed.

NOTE
If **Registry Forms** are shown in the registries and forms list, select **Custom Forms** from the list in order to display a blank custom form window or select an existing custom form to edit.



Item	Description
1	Menu.
2	Custom forms toolbar.
3	Registries and forms list. Each registry (folder) contains a group of forms. Registries may be shown or hidden (select **Forms** > **Display Options**).
4	Total remaining custom fields.
5	Main work area to create a custom form.

14.2.2 Custom forms toolbar



Item	Name	Description
1	Text	Used to create a statement or title for the custom form.
2	Text box	Used to enter values or create a free-text area for documentation.
3	Drop-down box	Used to create a drop-down list of items from which to choose.
4	List box	Used to create a list box of items from which multiple or single sections can be made.
5	Date	Used to include a calendar date with an entry or to include a documentation date.
6	Time	Used to create a time stamp for documentation.
7	Reorder forms	Used to rearrange the order of the forms in the forms list.
8	Reorder tabs	Used to rearrange the order of the tabs on the form.
9	Status bar	Displays the selected custom form field dimensions and location.
10	Forms list	Includes all custom forms and registry forms (if shown).

Text

Used to create a statement or title for the custom form.

1. To create a simple text entry, click the **Text** icon. A **Change Label** field opens in the customization area.
2. Right-click to update the label. Enter the new label name in the window.
3. Click **Update** and click **Yes** to accept the new label name.

Text box

Used to enter values or create a free-text area for documentation.

1. To create a text box, click the **Text Box** icon. A **Change Label** field and a blank field for free-text entry open in the customization area.
2. Right-click the **Change Label** field to update the label. Enter the new label name in the window.
3. Click **Update** and click **Yes** to accept the new label name.
4. To expand the text box, move the cursor over the border until the cursor changes. Click to make the text field active. Click and drag the text field to the desired size.

Drop-down box

Used to create a drop-down list of items from which to choose.

1. To create a drop-down box, click the **Drop-down box** icon. A **Change Label** field opens in the customization area.
2. Right-click the **Change Label** field to update the label. Enter the new label name in the window.
3. Click **Update** and click **Yes** to accept the new label name.
4. To enter selections within the drop-down box, right-click and select **Add Values**. Type the appropriate item in the drop-down box and click **Apply**. Repeat this process until all desired items have been added to the list. Click **Close** when the list is complete. Click the drop-down arrow to confirm that all entries are in the list.

List box

Used to create a list box of items where multiple or single sections can be made.

1. Click the **List Box** icon. A **Change Label** field opens in the customization area.
2. Right-click the **Change Label** field to update the label. Enter the new label name in the window.
3. Click **Update** and click **Yes** to accept the new label name.
4. To enter selections within the drop-down box, right-click and select **Add Values**. Type the appropriate item in the drop-down box and click **Apply**. Repeat this process until all desired items have been added to the list. Click **Close** when the list is complete. Click the scroll bar to confirm that all entries are in the list. Right-click the list box to choose a single or multiple selection list.

Date

Used to include a calendar date with an entry or to date when documentation is done.

1. Click the **Date** icon. A **Change Label** field opens in the customization area.
2. Right-click the **Change Label** field to update the label. Enter the new label name in the window.
3. Click **Update** and click **Yes** to accept the new label name.

Time

Used to create a time stamp for documentation.

1. Click the **Time** icon. A **Change Label** field opens in the customization area.
2. Right-click the **Change Label** field to update the label. Enter the new label name in the window.
3. Click **Update** and click **Yes** to accept the new label name.

Reorder forms

Used to rearrange the order of custom forms in the **Forms List** panel (see 14.2.5 Reorder custom forms in the Forms list on page 193).

1. Highlight a custom form title in the **Forms List** panel.
2. Click the **Reorder Forms** icon. The *Forms Reorder* window opens.
3. Highlight the form title to be moved and click the up or down arrows on the right side of the page to move the form title up or down in the list.
4. Click **Update**. The message `After updating the forms order the Forms Navigator will be closed. You need to reopen it to see the updated order. Click Yes to continue with update Or No to cancel the update.` opens. Click **Yes**.

Reorder tabs

Used to rearrange the order of the tabs on the forms (see 14.2.6 Rearrange fields on page 193).

1. Click the **Reorder Tabs** icon.
2. Click the **Clear Tab Order** icon at the bottom of the window. The message `Clicking 'Yes' will erase the existing tab order so that you can re-assign the tab order` opens.
3. Click **Yes** and the numbers in the green boxes will disappear.
4. Click the green box that will be number 1, then the box that will be 2 and so on. When reordering is complete, click **Save**. The new tab-through order of the form fields is saved.

14.2.3 Design a custom form to print

A custom form is divided into three areas for printing. Area 1 prints on top, area 2 prints in the middle, and area 3 prints at the bottom of the page.

When you design the custom form, the left position of each label indicates where on the printed form it is located.

Table 14-1

Grid area	Location on printed form	Coordinates on X-axis
Area 1	Top	0–319
Area 2	Middle	321–640
Area 3	Bottom	641 and greater

NOTE
Labels that have a left position at exactly 320 print at the end of the report. To avoid misplacement on printed pages, avoid placing a label exactly at 320. If there is more than one label in an area, the top label is printed first, the second highest printed next and so forth.

NOTE
If there is more than one label in the same area at the same top level, the printed order between these labels could be random. To avoid this situation, use one of the following two methods.

Set up the label fields in vertical columns in the *Forms Navigator* window as shown in the following illustration:

The printed order for this form would be:

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Set up the label fields horizontally across the *Forms Navigator* window as shown in the following illustration:

The printed order for this form would be:

1	1
4	4
7	7
2	2

5	5
8	8
3	3
6	6
9	9

14.2.4 Create a custom form

To create a new custom form:

1. Go to the *Navigator* window and select **Administration** > **Design Custom Forms**.
2. In the *Forms Navigator* window, select the **Custom Forms** registry from the tree in the left pane.
3. Select **Forms** > **New Form**.

   Enter a new name in the confirmation window. A clear work area is displayed.

   NOTE
   The form name is also used when building macro commands or adding the form to a report.

4. Click a toolbar icon to add one of the following to the new form:
   - Text
   - Text box
   - Drop-down box
   - List box
   - Date
   - Time

   Once an icon is clicked, the cursor changes to show the selection.

5. Move the cursor anywhere on the work area and click to add the selected field (a maximum of 5000 fields are allowed in the custom form registry). Use the status bar to precisely align the inserted fields. Fields may also be moved by moving the cursor over the edges (when the cursor changes to a four-sided arrow, click and hold the left mouse button and move the field into the desired location). Fields may also be copied and pasted on the same form and between other custom forms. To copy and paste:

   5.1. Select an inserted field.

   5.2. Right-click in the label area and select **Copy**.

   5.3. Move the cursor to the desired location, right-click and select **Paste**.

   NOTE
   The paste function remains active until **Cancel Paste** is selected.

6. Right-click the label area or text field to display a conditional menu. Select the required operation (for example, change the label name or add an item to a drop-down box).

   NOTE
   To ensure queries work as expected, always give the field label a unique name.

7. Once all fields have been added to the form, the tab order may be updated if required:
   7.1. Click the **Reorder Tab** icon.
   7.2. Click the **Clear Tab Order** icon at the bottom of the screen. Accept the confirmation to delete tab order. All tab labels are cleared.
   7.3. Click on each label in the order desired.
8. Click **Save Design** to save the Custom Form.

> **NOTE**
> To delete a custom form, select the form in the **Custom Forms Registry**, right-click and select **Delete this form**.

9. To use the form during a study, see Forms navigator on page 99.

14.2.5 Reorder custom forms in the Forms list

To reorder the custom forms in the **Forms** list:

1. Right-click the custom form name and click **Reorder Forms**. The *Custom Forms Reorder* window opens.
2. Reorder the custom forms using the up/down arrows.
3. Click **Update** when complete. Accept the acknowledgment to update the forms order.

14.2.6 Rearrange fields

To rearrange the newly created fields in a custom form:

1. Click, hold and drag the cursor to create a box that encompasses the desired field or fields to be moved. Select the associated label field to move both at the same time.
2. Release the mouse button, a border with black dots around its edges appears around the chosen field. With the field active, move the cursor over the border until it changes to a foursided arrow. Left-click the border, hold the mouse button down, drag the active field to the desired location on the form and drop. Move the cursor off the active field and left-click to deactivate the field. When the custom form design is complete, click **Save Design** at the bottom of the window.
3. When the message `The layout has been saved successfully` opens, click **OK** and click **Close** to return to the *Navigator* window.

14.2.7 Edit custom forms

Editing custom forms is not recommended (except for reordering tabs or adding new fields). Changing field names may result in data gathered incorrectly.

For example: A field labeled **Smoker (yes or no)** changed to **Previous Heart Attack (yes or no)** retains the same database identification number. Therefore, the smoker and heart attack data collected will be included under the same ID number in the database.

Do not change the name of a custom form. Forms are imported and exported by **Form ID** and not the name.

For example, Form A is exported as a backup and then after the backup the name is changed on the system to Form B. If the backup is later imported (and merge is selected), the system form will remain Form B and the backup Form A will not be imported.

14.2.8 Managing changed forms

When reviewing a study, the exact form used with that study may not be available. This could happen because:

- The study is being reviewed on a system without the registry form
- The form was deleted
- The fields on the form were changed

When this happens a **Previously Acquired Data** registry form or form under an existing registry is created. The **Previously Acquired Data** form contains a table with the missing forms, fields, and data. This information is for the current study only and can only be reviewed.

NOTE
Previously Acquired Data can be printed as a section in a report.

14.2.9 Delete custom forms

To delete a custom form:

1. Select the custom form to be deleted.
2. Right-click and select **Delete this form**.

14.3 Use or access forms

From within a study, select **Study** > **Forms Navigator**.

14.3.1 Forms macro

To create a macro to launch a specific form or a series of forms, select **Windows** > **Macro** and place the *Macro* window as desired.

1. Within the *Macro* window, click the appropriate Macro Category folder.
2. Click the **Edit** icon in the menu bar.
3. Identify where the new Macro command line will be inserted, and click the **Insert Item** icon.

   The *Macro Builder* window opens.
4. Type the title of the new macro in the **Macro name** field.
5. Select the **No Log entry** check box, if desired, to prevent the new Macro command line name from appearing in the *Log* window when used during the procedure.
6. Select the **Study** folder in the *Macro commands* window.
7. Double-click **Forms**.
8. Select **Custom Forms** or a registry form from the **Registry** pull-down menu.
9. Select the desired form from the **Forms** drop-down menu.
10. Click **OK**.

    The *Macro Builder* window opens with the macro command line appearing in the bottom window. To add additional forms, repeat Step 6 through Step 8.

11. Click **OK**.

    A new command line is displayed in the *Macro* window.

12. Click the *Edit* icon to exit Edit mode.

For further macro information, see Chapter 13 Macros on page 179.

14.3.2 Forms in reports

To add, edit or delete a form to a report format, see the steps in 15.1.10 Manage report formats on page 202. A form may be added from the **Available sections** list.

14.3.3 Export/import custom form layouts

On a standalone system, export or import custom forms layouts from one standalone system to another by the using the export/import wizard. See 5.6 Import and export custom data on page 85.

In a network environment, custom form layouts are replicated to systems on the network after **Save Data** in the *Forms Navigator* window is selected. There is no need to import custom forms into other Acquisition or Review systems in the same network environment.

14.3.4 Export/import registry forms

On a standalone system, export or import registry forms from one standalone system to another by the using the export/import wizard. See 5.6 Import and export custom data on page 85.

In a network environment, there is no need to import registry forms into other acquisition or review systems in the same network environment.

15

Chapter 15 Reports

This chapter describes how to generate and manage new reports, report formats, report sections, and report templates.

You can create, edit, and view data reports, which are generated by Microsoft Word.

An administrator password is required to create new report formats and edit or delete existing report formats. An administrator password is also required to edit or copy or delete existing report sections. Contact the site network administrator for administrative privileges. Sign out as administrator after these tasks are completed.

NOTE
Default system sections (All) cannot be edited or deleted but can be copied. The copies can be edited or deleted.

15.1 Manage reports

15.1.1 Generate new reports

1. Select **Study** > **Reports** > **New**. The *Generate New Reports* window appears.
2. In the **Report Formats** list, select the check box to place an **X** preceding the formats to generate.

   NOTE
   More than one report can be generated at one time.

3. After selecting the report format, click **Generate**.

   The message **Done** appears at the bottom of the report window when all reports have been generated.
4. Select the report to display.
5. Select **View** to display the report in a read-only mode in Microsoft Word.
6. Select **Edit** to open edit mode and make changes to the report.

15.1.2 Images in a report

The following report sections are available for including images in a report.

- Image Capture X-Ray: Images from a fluoroscopy system.
- Image Capture Ultrasound: Images from an ultrasound system.

The user can include or exclude images in these report sections by selecting or deselecting the **R** field in the *Log* window for those images, respectively. If a multi-frame image is selected, the generated report contains only the last frame of the image.

15.1.3 Barcode fonts in a report

If the optional barcode fonts are installed, they can be used in reports.

NOTE
Check with the site network administrator to procure the **Code 39 Barcode Fonts** for usage in reports.

NOTE
The barcode font can be used in the report template header, the patient history section or any report section after the report has been generated. The barcode font **cannot** be used in the report footer.

After a report is generated at the end of a study, item numbers in the study (for example a supply item number) can be highlighted and changed to barcode font. After the report is printed, the barcodes can be scanned and the items can be inserted into another system.

For configuration and usage of the barcode fonts in Word documents, refer to the help provided by the barcode font vendor.

15.1.4 Print a report

1. In the Microsoft Word report, on the **File** menu, select **Print**.
2. Verify the default printer and all settings and enter the number of copies to print.
3. Click **Print**.

   The report is printed at the default printer.

15.1.5 Save changes to an edited report

When opening a report in Edit mode, ensure that any changes made are saved before exiting. To open a report in Edit mode, see Step 6 in 15.1.1 Generate new reports on page 197.

To save changes:

- Click **File** > **Save**, or
- Click the **X** (Close) on the top right and click **YES** in the *Report – Save the changes?* dialog box, or
- Click **File** > **Exit**, and click **YES** in the *Report – Save the changes?* dialog box.

The report is saved to a default location consistent with the patient electronic record.

NOTE
Do not use **Save As** because this action may result in changes not being saved to the default location consistent with the patient electronic record.

15.1.6 Sign a Microsoft Word report electronically (not applicable to all languages)

The Mac-Lab/CardioLab system allows you to electronically sign a report that you generate from the Mac-Lab/CardioLab application. You can only use this electronic signature with a Microsoft Word report that is created within the Mac-Lab/CardioLab application.

NOTE
This electronic signature functionality is not intended to provide compliance to 21 CFR Part 11.

NOTE
You cannot sign a report both by using this function and Microsoft Word's built-in e-signature functions that are described in this procedure and in 15.1.7 Insert a signature line using Microsoft Word on page 200 and 15.1.8 Add a digital signature using Microsoft Word on page 201. It is recommended to sign a report either with the Mac-Lab/CardioLab application E-signature function that is described in this procedure or with Microsoft Word's built-in e-signature functions.

After a report is signed:

- You cannot modify or edit the report.
- You cannot retract the signature from the report.
- You can add signatures to the report.

1. Go to **Study** > **Reports**.

   The *Reports* dialog opens.

2. In the *Reports* dialog, select the generated report that you want to sign.
3. In the *Reports* dialog, select **E-Sign**.

   The *Add E-Signature* dialog appears.

4. In the *Add E-Signature* dialog, add the required information, as shown below.

Option	Description
Full Name (optional)	**The user can either add their full name or the name can be obtained from the windows account Full Name setting that is associated with the Login ID used to sign the report when Full name is blank.**
Login ID (required)	**This is the login ID of the user account to validate the user credentials.**
Password (required)	**This is the password that is assigned to the login ID.**
Domain (required, auto-populated)	**On a standalone system, this is the local computer name.** **On a networked system, this is auto-populated with the network domain. You can change this to the required domain that is configured on the system or to the local computer name.**
Comment (optional)	**This is for additional comments that the signer wants to add to the signature information in the report.**

5. Select **Approve** to add the signature information.

   The signature information is appended to the selected report, as shown below:

Electronically Signed by:	<Full Name>
Date:	<Date Time>
Login credentials:	<Login ID>@<Domain>
Comments:	<Comment>

NOTE
You may experience a delay after you select **Approve**, especially in a networked environment. Wait for the application to respond before you proceed.

15.1.7 Insert a signature line using Microsoft Word

Microsoft Word allows documents to be signed electronically. Signature lines are visible in the report. Digital signatures are not visible. See 15.1.8 Add a digital signature using Microsoft Word on page 201 for information on digital signatures.

NOTE
The Microsoft Word-provided signatures comply with 21 CFR Part 11.

To use visible signature lines, first add one signature line for every person who needs to sign the report. Do not sign the document until all signature lines have been added. When the first person signs the report, the report is marked as final and it cannot be changed except to sign the report or add a digital signature. Visible signature lines cannot be added to a report that is marked as final.

NOTE
If you need multiple signatures on this report, the other user may open the report on another system to sign the document. If users have personally assigned PIV cards that are certificate based and an SD card reader connected to the system, then another user can use their PIV card to sign the document without singing in to the system. Or, when the case is complete, you can sign out of the system to allow another user to sign in and sign the document.

NOTE
It is not recommended to save a signed report in another format, such as PDF. Electronic signatures are valid only if the report remains unchanged.To save a report in a new format effectively creates a new report. Electronic signatures are not transferred into the new report. Visible signature lines may be still be present, but, invisible signatures are gone.

1. Edit the Microsoft Word report from within the Mac-Lab/CardioLab application.

   NOTE
   If you cannot sign the document, it is possible that your ID does not have the correct digital certificate. Contact your site network administrator for the correct digital certificate.

2. Put the cursor in the Word document where you want the signature line to be inserted.
3. On the Microsoft Word ribbon toolbar, select **Insert** > **Signature Line** > **Microsoft Office Signature Line**.

   The *Signature Setup* dialog box appears.

4. Enter the signer details and click **OK**.

   A signature line appears in the Word document.

5. Repeat steps 2-4 for each additional signature, if necessary.

6. Double-click the signature line to open the *Sign* dialog box.

   NOTE
   Mac-Lab/CardioLab uses Microsoft's built-in e-signature feature. If the system displays a message that says you need a Digital ID, the correct certificates are not installed. Contact the site network administrator for a Digital ID.

7. Sign the document by one of the following ways:
   - Type your name in the text box to sign the document.
   - Select **Select Image** to insert an image that contains your signature.

15.1.8 Add a digital signature using Microsoft Word

Digital signatures are electronic signatures that are not visible in the report. Use digital signatures if you do not want visible signature lines. If a report was already signed and you need additional signatures, you cannot add new signature lines, but, you can add digital signatures.

NOTE
The Microsoft Word-provided signatures comply with 21 CFR Part 11.

You can view all signatures, even digital signatures, at **File** > **View Signatures**.

1. On the **File** menu, select **Protect Document** > **Add a Digital Signature**.

   NOTE
   Mac-Lab/CardioLab uses Microsoft's built-in e-signature feature. If you see a dialog box that instructs you to get a Digital ID, then no correct certificates are installed. Contact your site network administrator to obtain a Digital ID.

2. In the *Sign* dialog box, complete the fields, as applicable.
3. Select **Details** to add more signer information to the digital signature.
4. Select **Sign**.

   NOTE
   After a signature is added, the document is finalized. If you make any changes to the document after signing, the signature becomes invalid.

5. To view all signatures associated with the document, select **File** > **View Signatures**.

   A list of signatures appears.

   NOTE
   If you cannot sign the document, it is possible that your ID does not have the correct digital certificate. Contact your site network administrator for the correct digital certificate.

15.1.9 Close a report imported from a previous version

When a report from a previous version of CardioLab is closed, a save changes prompt might display. This might occur whether the report was opened in view or edit mode, and whether or not changes were made. Choose **Save** to make the report compatible with the current software version.

15.1.10 Manage report formats

A report format typically consists of one or more sections constructed and displayed in a certain order in the report. Report formats can be set up and deleted. For example, the following reports can be created:

- Pre-Admission
- Basic Cath: Diagnostic
- Basic Cath: Intervention
- Conscious Sedation
- Ancillary data
- List procedure
- Staff and supplies

Each format is created by choosing from a list of available sections. Any report format can be edited if needed.

NOTE
Report sections ending with “-M” are formatted according to TJC style.

NOTE
Report sections ending with “-M” must not be used on non-English systems. Medication amounts may be documented incorrectly in the report. Medication amounts will still be correctly displayed in the study and in report sections not ending with “-M”.

15.1.11 Create a PDF report

When you configure the HL7 translations, you can choose to export study reports in either Word or PDF format. You can also choose to export selective reports in PDF format.

To export study reports selectively in PDF format, you must include the # at the beginning of the report format name when you generate the report.

PDF reports are included in the exported data when active translations include the options **Reports In PDF** or **Selective Reports in PDF**.

15.1.12 Create a new report format

To create a new report format:

1. Select **Administration** > **Reports** > **Manage Formats**. The *Report Format Editor* window appears.
2. Select **Add New**.
3. Type the name of the report format to create in the **Format Name** field.

   Add # to the beginning of the report format if the report needs to be part of the option **Selective Reports in PDF** in the data export's active translations.

   Example: #Patient Summary Report
4. From the **Available Sections** list, highlight the section desired and select the rightward pointing arrow (**>**). This moves the chosen section to the **Selected Sections** field. The order in which each

section is brought over is not important as it is possible to rearrange the selected sections in any order at a later point.

5. Repeat step 4 until all desired sections are present in the **Selected Sections** field.
6. When all sections are selected, the order of these sections can be rearranged. When one section is highlighted it can be moved either up or down in the list, depending on which arrow is selected. In the **Selected Sections** field, highlight that section and click the up or down arrows on the right. Repeat this process for as many moves as are desired.
7. To remove a section from the **Selected Sections** field, highlight that section and choose the left pointing arrow (**<**). That section will be moved to the **Available Section** list.
8. Select **Save** to permanently save the format and all changes to the system.
9. When managing sections, the section can be active or inactive. Select the **Show Inactive Section** check box and all available sections can be viewed in the **Available Sections** area.
10. Repeat Steps 2 through 8 to create another new report format.

NOTE
To display blood pressure units in kPa in a report, select a report section specifically labeled **kPa**. Report sections not labelled **kPa** show blood pressure in units of mmHg. Being in kPa mode has no effect on this.

15.1.13 Edit an existing report format

To edit an existing report format:

1. Select **Administration** > **Reports** > **Manage Formats**. The *Report Format Editor* window appears.
2. Use the pull-down arrow to display the list of saved report formats.
3. Select the one to edit. That report format name and its sections appear in the *Report Format Editor* window.
4. Add additional sections, remove selected sections, or rearrange selected sections in a different order.
5. From the list of **Available Sections**, highlight the section desired and then select the rightward pointing arrow (**>**). This moves the chosen section to the **Selected Sections** area. The order in which each section is brought over is not important as it is possible to re-arrange the selected sections in any order at a later point.
6. Continue until all sections desired are present in the **Selected Sections** field. When all sections are selected, the order of these sections can be rearranged.
7. When one section is highlighted it can be moved either up or down in the list, depending on which arrow is selected. In the **Selected Sections** field, highlight that section and click the up or down arrows on the right. Repeat this process for as many moves as are desired.
8. To remove a section from the **Selected Sections** field, highlight that section and chose the leftward pointing arrow (**<**). This returns that section to the **Available Section** list.
9. Select **Save** to save the format and all changes permanently to the system.
10. When managing sections, the section can be active or inactive. Select the **Show Inactive Section** check box to view all sections available in the **Selected Sections** field.

15.1.14 Delete a report format

1. Select **Administration** > **Reports** > **Manage Formats**. The *Report Format Editor* window appears.
2. Use the pull-down arrow to display the list of saved report formats.
3. Select the format to delete.
4. Click **Delete** to remove the displayed report format permanently from the system.

15.2 Manage sections

You can create and edit report sections that always appear within report formats. You can also control the sections that appear in the **Report Sections** and **Report Format Editor** windows with these two filters: **Include The Joint Commission** and **Include kPa** in the **Report Sections** window. These filters are used to turn off/on the JACHO compliant sections and kPa sections respectively. Contact the clinical applications department for further assistance.

15.2.1 Edit a section

To edit a report section:

1. Select **Administration** > **Reports** > **Manage Sections**.

   The *Report Sections* window appears.
2. To copy a section, highlight that section and select **Copy**.
3. Type the section name at the **Enter the New Section Description** field.

   Each section must have a unique name. The system recognizes duplicate names and prompts for a different name.
4. Select **OK**.

   The system displays a message that the section has been successfully copied. The new section now appears in blue in the list. The blue indicates that this section can now be edited.
5. To edit the section, highlight the section and select **Edit**.

   For information about editing sections, see 15.2.2 Notes for editing sections on page 204.

15.2.2 Notes for editing sections

NOTE
Default system sections (All) cannot be edited or deleted but can be copied and the copies can be edited or deleted.

Note the following when editing sections:

- All sections except the **Patient History** section automatically populate study data. Altering the section can, unintentionally, affect the ability to populate the study data for that section and cause an error when generating the report. For this reason, it is suggested to copy and edit only the **Patient History** section. If you want copy and edit other sections, follow these guidelines when editing the copied section:
  - Section headings can be edited.
  - Table column headings can be edited.

    - It is not recommended to delete existing table or rows and columns of existing table in the report section.
    - It is not recommended to edit the transient text which would be replaced by study data in the final report.
- To add a section for text use only:
  Copy the **Patient History** section; this is the only text based section in the Report. This is the section to copy for the Methods example provided in the proceeding section.
- To delete a section, highlight that section name, and select **Delete**. This permanently deletes the section from the system.
- To start a section on a new page, open the section in Edit mode.
    - Highlight the title of the section. Select the **Format** menu and the **Paragraph** option.
    - Select the **Line and Page Break** tab. Select the **Page Break** check box, and click **OK**. This starts the section at a new page.
- The copied Event Log or Event Log-M section contains the **Author** column only if **User Tracking** was enabled when the copy was performed.

15.2.3 Available sections

The following are various Available Sections as they may appear in a report.

NOTE
The following report sections will be TJC (JCAHO) Compliant:

- CARTO Mapping-M
- Cath Summary-M
- Contrast-M
- Contrast By Case-M
- Contrast Summary-M
- Event Log-M
- Medications-M
- Medications By Case-M
- Medication Summary-M

NOTE
Report sections ending with "-M" must not be used on non-English systems. Medication amounts may be documented incorrectly in the report. Medication amounts will still be correctly displayed in the study and in report sections not ending with "-M".

15.3 Manage templates

The template holds the header and footer for the report. The header contains the hospital name, address and perhaps the hospital logo. The footer of the report contains the Patient Name, Study Date, MRN and Admission ID. The footer of the report is not customizable. Generally, when the template has been customized, the only reason to return to it would be if there was any change to the hospital information.

15.3.1 Edit the header

1. Select **Administration** > **Reports** > **Templates**.
2. The **Template Editor** appears.
3. Select the **Insert** tab and click on the **Header** drop-down on the ribbon and select the **Edit Header** option. Edit the hospital information as needed.
4. Save changes before closing:
   - Click the **X** (Close) on the top right and click **YES** in the *Report – Save the changes?* dialog box or
   - Click the **File** tab and then click **Save** or
   - Click the **File** tab and then click **Exit** and click **YES** in the *Report – Save the changes?* dialog box.
     The report is saved to a default location consistent with the patient electronic record.

   NOTE
   Do not use **Save As** because this action may result in changes NOT being saved in the default location consistent with the patient electronic record.

Chapter 16 CARTO® 3 System Interface

This chapter describes the CARTO® 3 System and how it operates with the CardioLab system.

The CARTO® 3 System from Biosense Webster, a Johnson and Johnson Company, is designed to acquire, analyze, and display 3D electroanatomical maps of the human heart. Refer to the “CARTO User Manual” shipped with the system for instructions on how to operate the CARTO® 3 System.

When operating with both the CardioLab and CARTO® 3 System the following features are enabled:

- Store and display mapping points in a CardioLab report.
- Share patient demographics data.

> **NOTE**
> Patient demographics are shared only between English CardioLab systems and CARTO® 3 System. For non-English CardioLab systems, the demographic data must be entered manually.

- Store and display CARTO® 3 System movies in a CardioLab study.
- Insert CARTO® 3 System 3D maps as a snapshot event for annotation, printing, and inclusion in a CardioLab Word report.

When the systems are actively interfaced, selecting a data point on either system, will cause the other system to display the same point.

16.1 System states

When the CARTO® 3 System software option is purchased, the CardioLab system indicates the connection status: Disconnected, Stand-By, Passive Interfaced or Active Interfaced state. The **CARTO** icon turns a different color each time the system state changes. See the following table for a description of each state:

Icon Color	System State	Description
Gray	Disconnected	• No physical connection exists between systems. • The CARTO® 3 System is not connected.
Blue	Standby	• Both systems are connected and the CARTO® 3 System can import patient demographic information from the CardioLab system. • Transition from Disconnected to Standby occurs automatically when connecting the systems. • Transition from Passive or Active Interface to Standby is initiated from the CardioLab system.
Green	Passive Interface	• Data points saved on the CARTO® 3 System populat the CardioLab log. • Transition from Standby to Passive Interface is initiated from the CardioLab system. • Transition from the Passive Interface to Active Interface is initiated from the CARTO® 3 System.

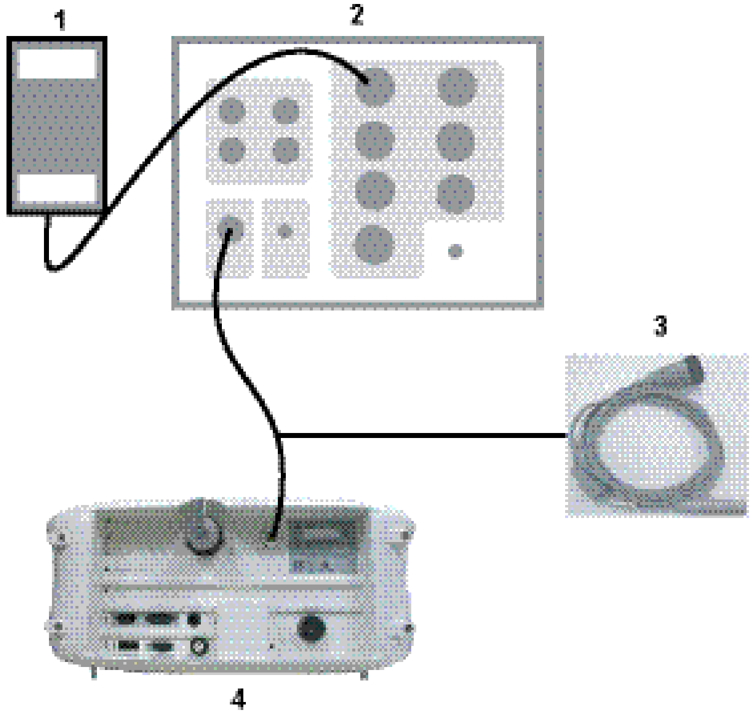
Icon Color	System State	Description
Yellow	Active Interface	• Both systems are being updated according to the data point (or event) selected on either system, unless Auto-Update is turned off (**Update** icon, see 6.5.7 Update On/Off on page 110. • Users reviewing mapping points from the CARTO® 3 System will see the updates from both systems. • Transition from Active Interface to Passive Interface is initiated from the CARTO® 3 System. • Because the mapping interface allows sharing of *Log* focus between the two systems, the CardioLab system handles mapping point events in a different way from other *Log* events. When the *Review* window **Update** icon is turned off, review waveforms will not be updated when the user clicks on and focuses mapping point events. This is to prevent unintended updating of the review waveforms when events are brought into focus through selection on the mapping system.

16.2 CARTO® 3 System

16.2.1 System connections

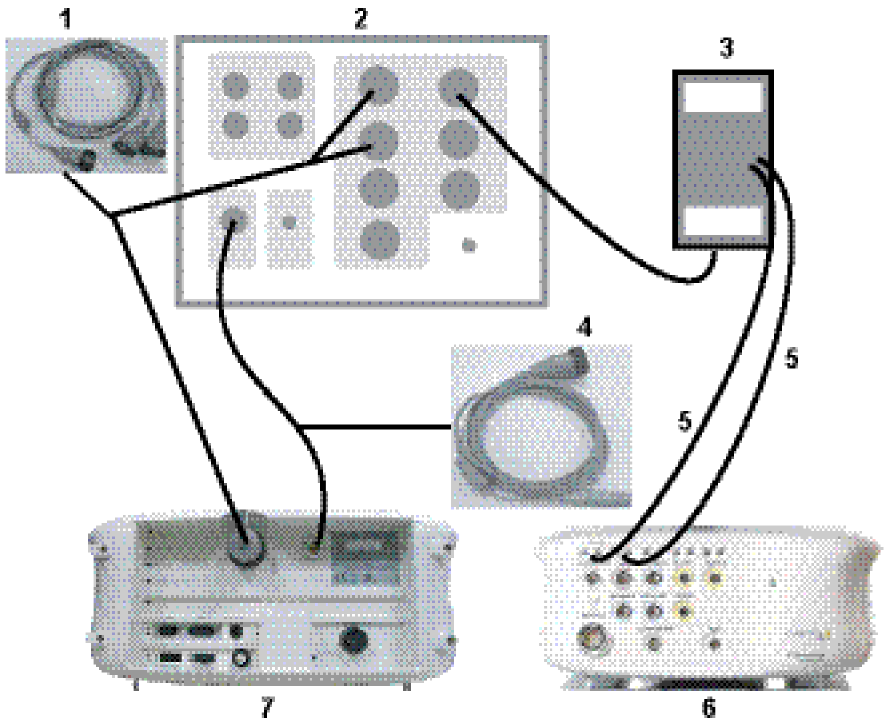
The CARTO® 3 System may be connected in one of two ways:

- Configuration 1 (see the following illustration) to acquire:
  - HIS, RVA, and HRA signals with the catheter input module.
  - Surface ECG via the CARTO® 3 System using the ECG connectivity cable.



Item	Description
1	Catheter input module
2	CardioLab amplifier
3	ECG connectivity cable
4	CARTO® 3 System PIU

- Configuration 2 (see the following illustration) to acquire:
  - HIS, RVA, and HRA signals, Navistar Cath (mapping), Coronary Sinus, or other signals via the CARTO® 3 System using the ICEG connectivity cable.
  - Surface ECG via the CARTO® 3 System using the ECG connectivity cable.



Item	Description
1	ICEG connectivity cable
2	CardioLab amplifier
3	Catheter input module
4	ECG connectivity cable
5	Stimulation cables
6	CARTO® 3 System PIU front
7	CARTO® 3 System PIU back

NOTE
Refer to the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN) for network connections between the CardioLab and CARTO® 3 System.

NOTE
The CardioLab amplifier remains connected to all body surface leads even if the CARTO® 3 System PIU is turned off.

16.2.1.1 Quick-connect configuration

16.2.1.1.1 Pacing and stim information

Connect the stimulator device directly to the CardioLab system and configure the stimulation channels and study configurations accordingly. This section provides some sample study configurations and stimulation settings.

Because CardioLab routes the stim signals to a CIM that is connected to Block B, two stim sites need to be created (that is, C-a and C-b). For the Stim Trains to be documented, the CARTO Pace Channels

(CPC) need to remain active during all pacing. This is achieved by setting the Stim Channel for C-a or C-b to active at the top of the Live Window during the electrophysiology study.

CAUTION

UNINTENTIONAL PACING

If catheters are placed too close together, unintentional pacing may occur.

CAUTION

UNINTENTIONAL PACING

To avoid unintentional cardiac stimulation, ensure the stim configuration has been set correctly before attempting to pace.

NOTE

It is possible to pace simultaneously from a catheter connected to the CARTO system and another catheter connected to the CardioLab system. Therefore it is recommended that the Study Configurations be set up exactly as described in this document.

To create a CPC pacing site, a pacing site label for CARTO needs to be created. To create this label:

1. Set a label for CARTO pacing from outside a case on the CardioLab *Navigator* window. Select **Administration** > **Lists** > **Pacing Sites**.
2. Select **Edit** > **Insert Item** to add the label **C-a**, then **C-b**.

16.2.2 Study configurations

The following are recommended CardioLab study configuration templates for CARTO® 3 System connections. CardioLab uses CIMs A and C for catheters to gain the extra Halo channels and divides CIM B for the Stim configurations to allow for dual chamber pacing.

(CIM) block A – ablation, HRA, HIS, and RV catheters

Table 16-1 Hardware settings

Channel	Label	Type	Inputs		Gain	Filter settings		Power Line
			+	-		High pass	Low pass	
17	Abl d	Bipolar	2	1	2500	30.00 Hz	500 Hz	
18	Abl p	Bipolar	4	3	2500	30.00 Hz	500 Hz	
19	HRA d	Bipolar	6	5	2500	30.00 Hz	500 Hz	
20	HRA p	Bipolar	8	7	2500	30.00 Hz	500 Hz	
21	RVa d	Bipolar	10	9	2500	30.00 Hz	500 Hz	
22	RVa p	Bipolar	12	11	2500	30.00 Hz	500 Hz	
23	HIS d	Bipolar	14	13	2500	30.00 Hz	500 Hz	
24	HIS m	Bipolar	15	14	2500	30.00 Hz	500 Hz	
25	HIS p	Bipolar	16	15	2500	30.00 Hz	500 Hz	
26		Not used						
27		Not used						

Table 16-1 Hardware settings (Table continued)

Channel	Label	Type	Inputs		Gain	Filter settings		Power Line
			+	-		High pass	Low pass	
28		Not used						
29		Not used						
30		Not used						
31	Stim 1	Stim 1						
32	Stim 2	Stim 2						

Table 16-2 Display settings

Chan-nel	Label	Clip	Color	Display pages								Always save
				1	2	3	4	5	6	7	8	
17	Abl d						4	5	6			
18	Abl p						4	5	6			
19	HRA d											
20	HRA p				2	3	4	5				
21	RVa d											
22	RVa p				2	3	4	5	6			
23	HIS d				2	3	4	5	6			
24	HIS m				2	3	4	5	6			
25	HIS p				2	3	4	5	6			
26												
27												
28												
29												
30												
31	Stim 1											
32	Stim 2											
Number of signals per page												

(CIM) block C "CS and HALO" catheters

Table 16-3 Hardware settings

Channel	Label	Type	Inputs		Gain	Filter settings		Power Line
			+	-		High pass	Low pass	
49	CS 1,2	Bipolar	2	1	2500	30.00 Hz	500 Hz	
50	CS 3,4	Bipolar	4	3	2500	30.00 Hz	500 Hz	
51	CS 5,6	Bipolar	6	5	2500	30.00 Hz	500 Hz	
52	CS 7,8	Bipolar	8	7	2500	30.00 Hz	500 Hz	

Table 16-3 Hardware settings (Table continued)

Channel	Label	Type	Inputs		Gain	Filter settings		Power Line
			+	-		High pass	Low pass	
53	CS 9,10	Bipolar	10	9	2500	30.00 Hz	500 Hz	
54	DD 1	Bipolar	12	11	2500	30.00 Hz	500 Hz	
55	DD 2	Bipolar	14	13	2500	30.00 Hz	500 Hz	
56	DD 3	Bipolar	16	15	2500	30.00 Hz	500 Hz	
57	DD 4	Bipolar	18	17	2500	30.00 Hz	500 Hz	
58	DD 5	Bipolar	20	19	2500	30.00 Hz	500 Hz	
59	DD 6	Bipolar	22	21	2500	30.00 Hz	500 Hz	
60	DD 7	Bipolar	24	23	2500	30.00 Hz	500 Hz	
61	DD 8	Bipolar	26	25	2500	30.00 Hz	500 Hz	
62	DD 9	Bipolar	28	27	2500	30.00 Hz	500 Hz	
63	DD 10	Bipolar	30	29	2500	30.00 Hz	500 Hz	
64	DD 11	Bipolar	11	30	2500	30.00 Hz	500 Hz	

NOTE
In the preceding table, DD represents Dual Deca catheters. When creating study configurations, replace for HALO or LASSO as required.

Table 16-4 Display settings

Chan-nel	Label	Clip	Color	Display pages								Always save
				1	2	3	4	5	6	7	8	
49	CS 1,2					3	4	5				
50	CS 3,4					3	4	5				
51	CS 5,6					3	4	5				
52	CS 7,8					3	4	5				
53	CS 9,10					3	4	5				
54	DD 1							5				
55	DD 2							5				
56	DD 3							5				
57	DD 4							5				
58	DD 5							5				
59	DD 6							5				
60	DD 7							5				
61	DD 8							5				
62	DD 9							5				
63	DD 10							5				
64	DD 11							5				
Number of signals per page								5				

NOTE
In the preceding table, DD represents Dual Deca catheters. When creating study configurations, replace for HALO or LASSO as required.

Stimulation setup

Table 16-5 Stimulation setup

Input	+		-		Pacing enabled	Site
	Block	Pole	Block	Pole		
1	B (1–16)	16	B (1–16)	15	YES	C-a
2	B (17–32)	32	B (17–32)	31	YES	C-b
3						None
4						None

NOTE
CARTO stims A and B (that is, C-a and C-b) are separated to allow for simultaneous dual chamber pacing.

16.2.3 How to use the CARTO® 3 System

16.2.3.1 Begin a new study

1. Begin a new CardioLab study. At the *Navigator* window, select **Study** > **New Study**.
2. Select an appropriate study configuration for this study, and then click **OK**.
3. If User Tracking is set to non-authenticated or authenticated with user selection, enter or select a name in the *Choose Name for User Tracking* window. See 8.1.11.2 Choose the user on page 139 for more information.
4. In the *Patient Information* window, enter the appropriate data as described in 5.5.1.1 New study on page 77.

   NOTE
   To continue a CardioLab study that was closed and reestablish the interface to the CARTO® 3 System, continue the study on CardioLab and open the corresponding study on the CARTO® 3 System. If the studies on both systems were not previously opened as described in this section, an interfaced connection between CardioLab and the CARTO® 3 System cannot be established. Only matched studies are allowed to be interfaced.
5. Select **OK**.
6. Begin a new study on the CARTO® 3 System. The system is now in Standby mode. Work can continue on either system while in Standby.
   6.1. At the **Patient Screen** select **Patient List** > **Import**.
   6.2. Select a template and click **OK**.

   The patient demographics entered in the CardioLab system will appear. They include the **Last Name**, **First Name**, **ID** (the MRN number), **Date of Birth** and **gender**.

NOTE
Import will only import patient demographics from English-language CardioLab systems. For CardioLab systems using other languages, manually enter the **Last Name**, **First Name**, **ID** (the MRN number), **Date of Birth** and **gender**.

NOTE
The Study ID entered at the CardioLab system must match the Study ID imported to the CARTO® 3 System or an interfaced connection will not be made.

7. At the CARTO® 3 System, if no errors appear, click the **Map** tab and click **Initialize** to begin a study.

   If errors appear, the **Initialize** button is disabled until the errors are cleared. Select **Initialize** when no errors are present.

   Select **Tools** > **EP Recording** > **Passive Interface** (green) or **Active Interface** (yellow). The CARTO® 3 System menu for CardioLab functions contains the following:

   - Passive Interface
   - Active Interface
   - Re-Synchronize
   - Import Patient Data
   - Preferences...

8. To begin sharing data at both systems, at the CardioLab system, select the **CARTO** icon. It will turn from blue to green or yellow, depending on which state the CARTO® 3 System is in, indicating the systems are connected and Passive or Active Interfaced. At this time, *Log* window data can be shared and collected from the CARTO® 3 System.
9. If the **CARTO** icon is yellow, data is exchanged on both systems including sharing the data and highlights of the point list. If the **CARTO** icon is green data is exchanging on both systems, but not the highlights of the point list.
10. Each time a connection is established between the CardioLab and CARTO® 3 System, an entry appears in the event log. If the systems are disconnected for any reason, an error message will appear and the icon will turn from blue/green/yellow to gray within 5 seconds of the disconnect. Once the connection is established again at the CARTO® 3 System, the **CardioLab** icon will go back to the last state.

NOTE
CardioLab can always function as a standalone system, regardless of the connection state (disconnect or connect).

16.2.3.2 Edit mapping point data

Mapping point data may be edited, moved, renamed, deleted, restored and copied at the CARTO® 3 System. Refer to the CARTO® 3 System user manual for instructions. Mapping data is not editable at the CardioLab system.

When a mapping point is edited, moved or renamed at the CARTO® 3 System, the CardioLab log is updated automatically to show the corresponding event.

When a mapping point is deleted at the CARTO® 3 System, the event entry is removed automatically from the CardioLab *Log* window.

When a mapping point is restored at the CARTO® 3 System, the event entry is added automatically to the CardioLab *Log* window.

When a mapping point is added at the CARTO® 3 System, a new event entry is added automatically to the CardioLab *Log* window.

16.2.3.3 Mapping points

To exchange mapping point data, ensure there is a connection between both systems. See the previous sections to make connections.

Mapping point data is displayed in the CardioLab *Log* window. The CardioLab *Log* window will display the map name, point index, comments and local activation time. Double-click the mapping point data event in the log to view the mapping point data.

The CardioLab system displays the same beat that is defined as the reference point of a local activation time window of the same cardiac cycle.

When a point is grabbed on the CARTO® 3 System, a total of 30 seconds of waveform data will be captured on the CardioLab system, 20 seconds prior and 10 seconds after. When a point is grabbed on a CARTO® 3 System, the CardioLab *Review* window will be updated to approximately the time of the CARTO® 3 System grab. When the point is accepted in the CARTO® 3 System, the CardioLab *Log* window will be updated with a mapping point event.

16.2.3.4 CARTO® 3 System snapshots

Snapshots may be exported from the CARTO® 3 System to the CardioLab. On the CARTO® 3 System:

1. Select **Tools** > **EP Recording** > **Preferences** and make sure the check box next to **Send Snapshots** is selected.
2. Click **Close**.
3. Click the **Camera** icon to take a snapshot.
4. Enter the capture file name and click **OK**.

   On the CardioLab system, click the log entry to select the snapshot. The snapshot can be edited, annotated, or printed from the Image Viewer.

   To include the snapshot in a report, the report format must include the **Snapshots** section. See Chapter 15 Reports on page 197 for more information.

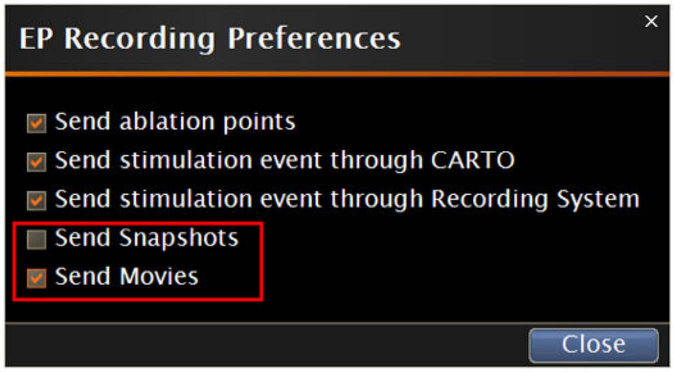
> **NOTE**
> Snapshots cannot be printed on the CARTO® 3 System color printer from the CardioLab.

16.2.3.4.1 CARTO® 3 System workflow example

16.2.3.4.1.1 Configure the CARTO® 3 System preferences

1. Connect the CARTO® 3 System to the CardioLab system.
2. Start the CARTO 3 application on the CARTO® 3 System.

3. On the CARTO® 3 System, click **Tools** > **EP Recording** > **Preferences**. The *EP Recording Preferences* window appears.

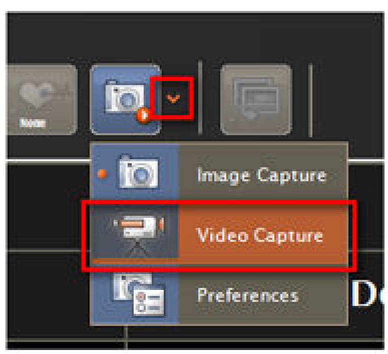


NOTE
If no communication is established between the CardioLab system and the CARTO® 3 System, the preferences are disabled.

4. Enable the **Send Snapshots** check box to transfer any snapshot taken in CARTO® 3 System to the CardioLab system.
5. Enable the **Send Movies** check box to transfer the videos saved on the CARTO® 3 System to the CardioLab system.

16.2.3.4.1.2 Video acquisition in the CARTO® 3 System

1. Ensure that the correct CardioLab study is open in CardioLab.
2. On the CARTO® 3 System, in the CARTO 3 application, locate the image/video button and click the **Down Arrow** icon to open the drop-down menu.

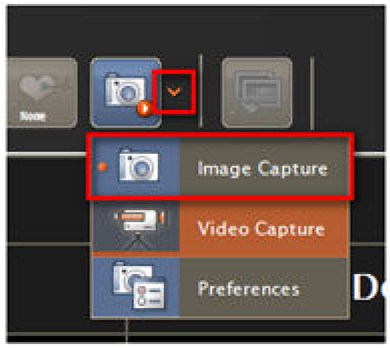


3. Verify that the **Video Capture** option is active.
4. Click **Video Capture** to start video capturing.
5. Click **Video Capture** again to stop the video recording.
6. The CARTO® 3 System prompts for a file name when video recording is stopped.
7. After entering the name for the video file, the video file will be saved on the CARTO® 3 System and will also be transferred to the CardioLab system.

8. The video file sent from the CARTO® 3 System will be visible in the CardioLab study in the *Image Library* window. Clicking the thumbnail plays the video file in the *Image* window.

16.2.3.4.1.3 Snapshot acquisition in the CARTO® 3 System

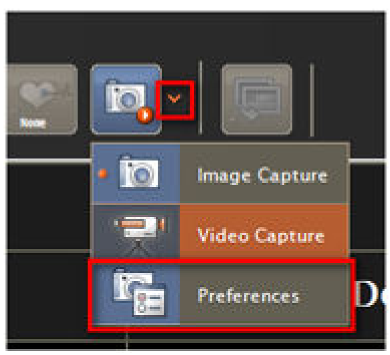
1. On the CARTO® 3 System, in the CARTO 3 application, locate the image/video button and click the **Down Arrow** icon to open the drop-down menu.



2. Verify that the **Image Capture** option is active.
3. Click the **Image Capture** button to immediately take a snapshot.
4. The CARTO® 3 System prompts for a file name for the snapshot.
5. After entering the name for the snapshot file, the snapshot file will be sent to the CardioLab system.

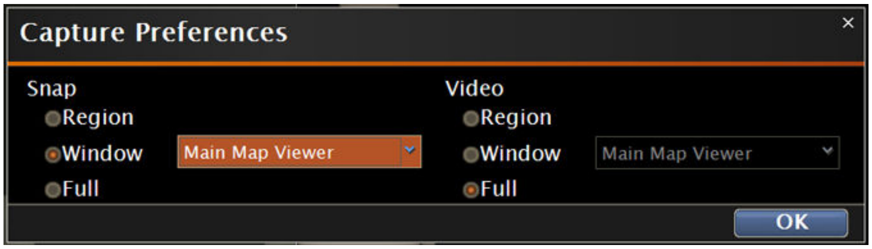
16.2.3.4.1.4 Settings for image and video contents

1. On the CARTO® 3 System, in the CARTO 3 application, locate the image/video button and click the **Down Arrow** icon to open the drop-down menu.



2. Click **Preferences**.

   The *Capture Preferences* window appears.



3. In the *Capture Preferences* window, the following options are available for snapshots and video capturing:
   3.1. Region – This option allows the selection of the contents for the snapshot or video.
   3.2. Window – This option allows the selection of the desired control from a pre-defined list of controls.
   3.3. Full – This option takes snapshot or video of the entire screen.
4. Click **OK**.

16.2.3.4.1.5 View images

See 9.5.1 *Image Library* window on page 155 for information about viewing images.

16.2.3.4.1.6 *Log* window

See 9.6 *Log* window on page 156 for information about using the *Log* window with acquired images.

16.2.3.4.2 CARTO® 3 System and CardioLab integration information

16.2.3.4.2.1 Display and images

Note the following when using the CARTO® 3 System with CardioLab:

1. The recorded video from the CARTO® 3 System is sent to the currently active study on the CardioLab system. Open the correct study in CardioLab before recording with the CARTO® 3 System.
2. The CardioLab system can acquire both snapshots and movies from the CARTO® 3 System.
3. When the CardioLab system acquires an image from the CARTO® 3 System, the CardioLab system creates a corresponding thumbnail image in the CardioLab system Image Library indicating the time the image was acquired on the CARTO® 3 System.
4. When the CardioLab system acquires an image from the CARTO® 3 System, the CardioLab system creates a corresponding event entry in the *Log* window indicating the time the image was acquired on the CARTO® 3 System. This event entry indicates whether the image is a snapshot or a video (loop).
5. Selecting a CARTO thumbnail image from the Image Library causes the associated snapshot or video to be displayed in the active image window.
6. Selecting a CARTO image acquisition event in the *Log* window also causes the associated snapshot or video to be displayed in the active image window.

16.2.3.4.2.2 Communication between the CARTO® 3 System and CardioLab system

The CARTO® 3 System and CardioLab systems communicate with each other in the following manner:

1. The CardioLab system provides a single domain or local user account for use by the CARTO® 3 System. The credentials for this user account are configured during system setup and must match the credentials on the CARTO® 3 System.
2. The CardioLab system provides a shared directory in which the CARTO® 3 System may store its images. This shared directory is restricted to allow only the CARTO® 3 System to store files in this directory.
3. In case of error, the CardioLab system indicates when it cannot successfully process an incoming image from the CARTO® 3 System. This error is recorded in the application log window.

17

Chapter 17 ClearMatch (Prucka^{TM} 3 Amplifier Only)

ClearMatch compares the current waveform with a previously captured waveform in the active *Review* window. Users can compare the waveforms both visually and with correlation coefficients that are available for each channel. The system also calculates an overall correlation coefficient, which is the average of either ECG signals (if ECG signals are present) or the displayed signals.

ClearMatch event

This is the midpoint of the previous waveform length that you tag to compare with the current waveform.

ClearMatch waveform

This is the waveform that you tag to compare with the current waveform. The system compares this ClearMatch waveform with the currently displayed waveform.

17.1 *ClearMatch* window

The *ClearMatch* window displays all of the ClearMatch-tagged events. To dock the *ClearMatch* window, select **Windows** > **ClearMatch**.

17.2 Tag the ClearMatch event

Do this task to tag a waveform to compare with the current waveform.

1. In the *Review* window, use the time caliper to select the desired waveform length.
2. Push **Shift** + **Mark** (**Shift** + F6)
3. In *New ClearMatch Event*, type the ClearMatch name.
   - The time caliper disappears.
   - The ClearMatch mark appears at the midpoint of the waveform.

17.3 Relocate the ClearMatch event

Do this task to move existing ClearMatch events to a different time.

1. In the active *Review* window, adjust the caret time to the desired location of the ClearMatch event.
2. In the *Log* window, select the summary of the ClearMatch event.
3. Push **Ctrl** + **K**.

   The selected ClearMatch event moves to the time that is indicated by the caret of the active *Review* window.

17.4 ClearMatch commands

The following table explains the ClearMatch commands.

Action	**In the *ClearMatch* window...**	**In the *Log* window...**	**About this action**
Display the ClearMatch waveform	Select the associated event.	N/A	The system can display one waveform as an overlay at any point in time. The *Review* window displays both the ClearMatch waveform and the correlation coefficients. To achieve the maximum overall correlation coefficient, the *Review* window automatically scrolls within the ClearMatch waveform length on either side of the waveform.
Rename the ClearMatch event	Right-click the event and select **Rename**. In the *Edit* window, type the desired name.	Double-click Summary or Comment of the event. In *Edit ClearMatch Event*, type the desired name.	N/A
Delete the ClearMatch event	Right-click the event and select **Delete**.	Right-click the event and select **Delete Event**.	N/A
Navigate to the ClearMatch event in the active *Review* window	Right-click the event and select **Navigate**.	Select the time stamp of the event.	N/A
Automatically align the displayed waveform	Right-click the event and select **Auto Align**.	N/A	When you select the ClearMatch event or change the length of the ClearMatch waveform, the *Review* window automatically scrolls to achieve the maximum overall correlation coefficient.
Move to the next or previous beat in the displayed ClearMatch waveform.	Click the **Next Beat** or **Previous Beat** arrows in the ClearMatch window.	N/A	This action scrolls the *Review* window to the next or previous pattern-matched beat. If there are no valid beats before or after the current beat, the system shows a `Valid beat not found` message.
Change the lengh of the displayed ClearMatch waveworm	Select the predefined length in the combo box on the tool bar.	N/A	This action temporarily changes the length of the ClearMatch waveform to the selected value. To display the waveform with the original length, deselect the ClearMatch event and select it again.

Chapter 18 Planned Maintenance and Troubleshooting

This chapter describes the functional checkout procedure, maintenance and troubleshooting for the CardioLab system.

18.1 Safety

Before performing any maintenance or service procedure, read and follow all applicable safety information in 1.2 Safety information on page 25 in this manual.

The maintenance and troubleshooting procedures listed in this section may be performed by nontechnical personnel. Any other procedure must be performed by GE HealthCare authorized service personnel. Unauthorized service may void the equipment warranty.

A regular maintenance schedule is highly recommended to ensure proper equipment operation and patient safety.

WARNING

SHOCK HAZARD

Do not modify or attempt to service any system equipment. This equipment contains no user serviceable parts. Refer servicing to qualified service personnel.

WARNING

Do not open the acquisition computer when power is on. This will cause the computer to automatically shut down.

WARNING

SHOCK HAZARD

Damaged cables and loose connections present a shock hazard and could cause signal noise or impaired device operation. Ensure all cables are in good condition, protected from potential sources of damage, and securely connected before powering on equipment. Replace damaged cables immediately.

WARNING

EQUIPMENT HAZARD

Do not attempt to service the UPS or replace the battery. Doing so could result in equipment damage. Contact qualified GE HealthCare Service personnel for service or replacement.

NOTE

If the system components are not fully operational, contact GE HealthCare technical support.

18.2 Before you begin

Before performing any maintenance or service procedure, ensure the following conditions are met:

- Follow all applicable facility safety procedures when cleaning or servicing cabling or equipment that may have been exposed to bio-hazard material.
- Turn off power to the system and any applicable auxiliary equipment before connecting or disconnecting cables.
- Turn off power to the system and disconnect the power cord to the isolation transformer and any applicable auxiliary equipment before cleaning or servicing.
- When cleaning or servicing equipment, DO NOT:
    - Immerse any part of the equipment in any liquid or allow liquids to drip into equipment.
    - Use organic solvents, strong ammonia-based solutions, or abrasive cleaning agents.
    - Use cleaning solutions or solvents in any disk drive.

18.3 Functional checkout procedure

Refer to the applicable service manuals for additional information.

1. Connect a simulator to the CardioLab amplifier, which is located in the procedure room.
2. If a GE HealthCare or Bio-Tek simulator is being used, connect the P1 output to the P1 input of the amplifier.
3. Connect the P2 output to the P2 input of the amplifier. These two pressure simulations provide a realistic representation of pressure waveforms.
4. Connect the ECG lead wires.
5. Connect the simulator to the intracardiac inputs of the Catheter Input Module.
6. Turn on the isolation transformer and acquisition system (see Chapter 2 Getting Started on page 39 for additional information).
7. Log on to the custom shell as **mlcluser**.
8. Enter the appropriate password. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for additional information.
9. Launch the Mac-Lab/CardioLab application.
10. Select **CardioLab**.
11. Adjust the simulator to zero the blood pressure waveforms.
12. Readjust the simulator to simulate blood pressures. If the simulator is connected correctly, the blood pressure waveforms should be displayed.
13. Verify that the correct ECG waveforms are present at the top of the window.
14. Hook simulator ECG outputs to catheter input modules to verify intracardiac inputs.

18.4 Planned maintenance

GE HealthCare recommends performing planned maintenance. Use the following procedures when performing planned maintenance.

18.4.1 General cleaning and inspection

WARNING

SHOCK HAZARD

If liquids or foreign materials have entered a device, take it out of service and have it checked by qualified service personnel to verify safety and functionality before it is used again. Ingress of foreign substances may result in shock, fire, excess leakage current, or device failure.

WARNING

SHOCK HAZARD

Use caution when cleaning the environment near equipment. Fluid ingress may damage devices or compromise electrical safety.

General inspection

Before cleaning, inspect components, cables, and accessories. If signs of damage or degradation are present, contact a GE HealthCare representative to determine if equipment needs to be replaced.

General cleaning

See each specific equipment subsection in this portion of the manual for specific equipment cleaning and disinfection instructions. For other system components and cables, use the following:

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Do not pour or spray any liquid directly on the device, cables or leadwires or permit fluid to seep into connections or openings.
- Pay attention to mated surfaces, recessed areas, ridges and other difficult to clean features. Inspect the device to ensure the complete removal of soil from surfaces. If soil is present, clean the device again.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- Do not make patient connections until the equipment is thoroughly dry.

Cautions

- Never immerse the device in any liquid.
- Do not pour or spray any liquid directly on the device, cables or leadwires or permit fluid to seep into connections or openings.
- Mild dishwashing detergent is used for cleaning several system components.

- Never use solutions or products that contain the following ingredients:
  - Acetone
  - Ketone
  - Betadine
  - Solutions that contain wax or wax compounds
- Do not use abrasive cleaners or solvents of any kind.
- Never autoclave or steam clean the device, cables or leadwires.
- Do not make patient connections until equipment is thoroughly dry.

Avoid products that contain active ingredients and solutions similar to these products.

NOTE
Always apply the cleaner to the cleaning cloth and wring out any excess if necessary. If too much cleaner is used, it may run inside the case and cause damage.

NOTE
Automated cleaning is not available with the Mac-Lab/CardioLab system.

18.4.2 Monitors

Tools

- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent

Clean LCD Monitors

- Turn off the monitor and disconnect power before cleaning.

  NOTE
  Do not rub any part of the LCD monitor with hard or coarse material.

- Monitor Screen — Clean the LCD monitor screen (the viewing area of the screen) with a dry soft, lint-free cloth. Do not use any cleaning solution or glass cleaner.

  NOTE
  Do not apply pressure to the LCD monitor screen.

- LCD cabinet (plastic components) — Dampen a soft, lint-free cloth with a mild dishwashing detergent diluted in water, wipe the plastic surfaces and then dry with a dry, soft, lint-free cloth.
- Unpacking — use a soft cloth to gently wipe off the monitor after unpacking. A white powder may occur during the shipping of the monitor. Handle the monitor with care because darker colored plastics may scratch and show white scuff marks more than lighter-colored plastics.

  NOTE
  Many plastics are used on the surface of the cabinet. DO NOT clean with benzene, alkaline, alcohol, detergent, glass cleaner, waxes of any kind, polish cleaner, soap or Office Automation (OA) cleaner. Do not place rubber or vinyl against the cabinet for long periods. These types of fluids and fabrics can cause the paint to deteriorate, crack, or peel.

18.4.3 CardioLab amplifier

Daily	• Perform the daily cleaning of the amplifier as shown in the following sections. • Check the case for cracks or other damage. • Inspect all cords and cables for fraying or other damage. • Inspect all plugs, cables, and connectors for bent prongs or pins. • Verify that all cords and connectors are securely seated. • Inspect controls for proper operation.
Monthly	• Clean all dust and debris from the fiber optic cable connectors with a dry cotton swab.

Precautions

- Do not open the CardioLab amplifier unless instructed to do so by qualified technical personnel.
- Do not immerse any part of the amplifier in water.
- Do not use organic solvents, ammonia-based solutions, or abrasive cleaning agents that may damage equipment surfaces.

Tools

- Cotton swabs
- Multiple soft, lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution
- Isopropyl alcohol

Cleaning and disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.4 PDM Base Station Plus or PDM Slim Connect

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

  NOTE
  Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.5 PDM Base Station Plus or PDM Slim Connect mount

Tools

- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and Disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- The surface finish is permanently damaged by strong chemicals and solvents such as acetone or trichloroethylene.
- Never submerge or allow liquids to enter the mounting assemblies. Wipe any cleaning agents off the mounting assembly immediately using a water-dampened cloth. Dry the equipment thoroughly with a clean, dry, soft, lint-free cloth.

18.4.6 PDM

Perform the daily cleaning of the PDM as shown in the following sections.

Tools

- Multiple soft, lint-free cloths
- Cellular urethane cleaning swab
- Cotton swab, gauze pad
- Water, soap
- Mild dishwashing detergent
- Sagrotan (dilution 3:100, containing 75 mg tartaric acid per 100 ml solution).
- Sodium hypochlorite (5.2% household bleach) minimum 1:500 dilution (minimum 100 ppm free chlorine) and maximum 1:10 dilution.

Visual inspection

- Remove power and all cables before inspecting or cleaning the equipment.
- Inspect the equipment and its component carefully prior to installation, once every 12 months thereafter each time the equipment is serviced. Do not use the equipment if damage is determined. Refer damaged equipment to qualified service personal.
- Inspect the case for cracks or other physical damage.
- Inspect cables for fraying or other damage.
- Inspect all plugs and connectors for bent pins or other damage.
- Check for loose or missing screws on the mounting hardware.

NOTE
Damaged cables or equipment should be replaced by qualified service personnel.

Cleaning and disinfection

1. Remove power, all cables and batteries.
2. Close the battery door.
3. Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.

4. Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
5. To disinfect, wipe exterior with a soft lint-free cloth lightly dampened with any one of the permitted cleaning agents as follows:
    - Household bleach (Active ingredient: 5.2% Sodium Hypochlorite-off the shelf) Mix 1:10 with H2O.
    - Sagrotan (dilution 3:100, containing 75 mg tartaric acid per 100 ml solution).

    NOTE
    - Wring excess disinfectant from lint free cloth before using.
    - Contact of disinfectant solution with metal parts may cause corrosion.
    - Do not damage or bend connector pins when cleaning or drying.
6. Allow solution to remain on device for a minimum of one minute or per hospital guidelines.
7. Take care not to let fluid “pool” around connection pins. If this happens, blot dry with a soft, lintfree cloth or cotton swab. Shake out excess liquids from connector recesses.
8. Dry the equipment thoroughly with a clean, dry, soft, lint-free cloth after disinfecting.

NOTE
Drying times may vary based on environmental conditions.

Storage

- Remove batteries when the device is not in use, even for short period of time.
- Store in a dry, well-ventilated area.
- Hang the device using a holder if available.
- If leadwires or cables are attached, hang them straight.
- Do not coil leadwires or cables tightly around the device.

Consequences of Using Improper Cleaning Product

- Case may become brittle or may break.
- Overall system performance degradation.
- Melting, dulling or distorting the case.
- Total medical device failure requiring replacement.
- Unit malfunction.
- Void warranty.

Cleaning products to avoid

Cleaning products known to cause the types of problems listed in the previous section include, but are not limited to:

- Sani-cloth wipes
- Ascepti wipes
- HB Quat
- Disinfectant wipes (they do not contain bleach)

- Over the counter detergents (for example, Fantastic, Tilex and so on)

Products that contain active ingredients and solutions similar to these products should also be avoided.

Expansion cover cleaning

1. Use a cellular urethane cleaning swab lightly moistened with the following solution as recommended in the APIC guidelines for selection and use of disinfectants (1996): Sodium hypochlorite (5.2% household bleach) minimum 1:500 dilution (minimum 100 ppm free chlorine) and maximum 1:10 dilution.
2. Insert the cotton swab under the expansion interface to clean.

Battery compartment cleaning

Under normal operation, the battery compartment should not require cleaning. If the battery compartment does require cleaning, follow these instructions.

1. Remove the battery from the battery compartment.
2. Clean the device with a gauze pad or cloth lightly moistened with one of the following:
    - Water
    - Soap
3. Use a cloth lightly moistened with distilled water to rinse away the cleaning solution. Make sure moisture does not enter the electronics area below the battery compartment floor.
4. Dry thoroughly with a soft, lint-free cloth. Allow the battery compartment to air dry completely prior to closing the compartment door.

18.4.7 PDM bedrail and mount

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfection

1. Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents.
2. Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
3. To disinfect, wipe exterior with a soft lint-free cloth lightly dampened with any one of the permitted cleaning agents as follows:
    - Household bleach (active ingredient: 5.2% sodium hypochlorite-off the shelf) Mix 1:10 with H_2O.
    - Sagrotan (dilution 3:100, containing 75 mg tartaric acid per 100 mL solution).

NOTE
- Wring excess disinfectant from lint-free cloth before using.
- Contact of disinfectant solution with metal parts may cause corrosion.

4. Allow solution to remain on device for a minimum of one minute or per hospital guidelines.
5. Take care not to let fluid “pool” around connection pins. If this happens, blot dry with a soft, lint-free cloth or cotton swab. Shake out excess liquids from connector recesses.
6. Dry the equipment thoroughly with a clean, dry, soft, lint-free cloth after disinfecting.

NOTE
Drying times may vary based on environmental conditions.

18.4.8 RF filter box (CardioLab II Plus Amplifier only)

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.9 Analog IO box

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent

- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

  NOTE
  Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.10 Catheter input module

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfection

Remove all cables from the catheter input module.

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

  NOTE
  Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.

- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.11 System interconnect cables

System interconnect cables are cables that connect between the equipment. Examples of system interconnect cables include the following:

- Power cables
- Video cables
- Network cables
- Speaker cables
- Ethernet cables
- RMOT cables
- Grounding junction box
- USB extender, two-port

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent

Cleaning

- Remove system interconnect cables from the devices or systems before cleaning.
- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- Inspect and clean the leads of the plug on the interconnect cables with a dry cotton swab.

18.4.12 Printer planned maintenance

Tools and environment

- Cotton swabs, soft cloth, mild cleaning detergent (or equivalent)

Cleaning and inspection

Exterior cleaning

- Clean exterior surfaces of the printer with a clean damp cloth.
- Use a dry, soft, lint-free cloth to dry the printer.

NOTE
Do not use ammonia-based cleaners on or around the printer.

NOTE
While cleaning the printer, do not touch the transfer roller. Skin oils can cause print quality issues.

Visual inspection

- Check the case for cracks or other damage.
- Inspect cables for fraying or other damage.
- Inspect all plugs, cables, and connectors for bent prongs or pins.
- Ensure all cables and connectors are securely seated.

NOTE
Only qualified service personnel should replace components.

Clean printer as recommended by manufacturer

Using the printer model number, search the printer manufacturer's website for the user guide to determine the recommended printer cleaning method.

18.4.13 Uninterruptible power supply (UPS)

The uninterruptible power supply is used with the acquisition system only.

WARNING

EQUIPMENT HAZARD

Do not attempt to service the UPS or replace the battery. Doing so could result in equipment damage. Contact qualified GE HealthCare Service personnel for service or replacement.

WARNING

EXPLOSION HAZARD

Do not incinerate the battery or store at high temperature. Serious injury or death could result.

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent

Clean the uninterruptible power supply (UPS)

- Power off the UPS.
- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Clean each UPS connector port with a dry cotton swab.
- Do not pour or spray any liquid directly on the UPS or permit fluid to seep into connections or openings.

- Wipe the surfaces with a clean, dry, soft, lint-free cloth, until the equipment is thoroughly dry.

Inspect the uninterruptible power supply (UPS)

- Check the case for cracks, leaks, or other damage.
- Inspect all cords and cables for fraying or other damage.
- Inspect all plugs, cables, and connectors for bent prongs or pins.

Battery test

To test the UPS battery charge, perform the following steps monthly:

1. Ensure the acquisition system is plugged into the UPS.
2. If not already on, turn on the acquisition system.
3. Unplug the UPS so the acquisition system is powered by the UPS battery.
4. **Verify** the acquisition system stays powered for 10 seconds under battery power.
5. Plug the UPS back into the AC power outlet.

18.4.14 Mobile workstation

Tools

- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution
- 3/16" hex wrench (provided with workstand)
- 1/8" hex wrench (provided with workstand)
- Phillips screwdriver

Cleaning and disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- The surface finish is permanently damaged by strong chemicals and solvents such as acetone or trichloroethylene.

- Never submerge the roll stand or allow liquids to enter the mounting assemblies. Wipe any cleaning agents off the mounting assembly immediately using a water-dampened cloth. Dry the equipment thoroughly with a clean, dry, soft, lint-free cloth.

Routine maintenance

Periodically inspect all mounting hardware. Tighten or adjust as necessary for optimal operation and safety.

18.4.15 Desk

Tools

- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfection

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect the desk, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

  NOTE
  Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- The surface finish will be permanently damaged by strong chemicals and solvents such as acetone or trichloroethylene.

18.4.16 Stimulator Cable

Perform the monthly cleaning of the Stimulator Cable as shown in the following sections.

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and Disinfecting

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.

- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.17 Ablation stimulator extender cable

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfecting

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.18 Auxiliary cable

Tools

- Cotton swabs

- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- 5.25% sodium hypochlorite (household bleach) 1:10 dilution

Cleaning and disinfecting

- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.
- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- To disinfect, wipe exterior with a soft lint-free cloth, using the following solution as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996): 5.25% sodium hypochlorite (household bleach) 1:10 dilution.

NOTE
Wring excess disinfectant from lint-free cloth before using.

- Treated surfaces must remain wet for a minimum of 5 minutes.
- If surface becomes dry before contact duration time is met, re-wipe with a fresh wet cloth.
- Do not make patient connections until equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.19 Barcode scanner

Tools

- Multiple soft, dry lint-free cloths

Cleaning

- Wipe down the component with a soft, dry lint-free cloth.

18.4.20 HD Hub

Tools

- Cotton swabs
- Multiple soft, dry lint-free cloths
- Mild dishwashing detergent
- Vacuum cleaner

Cleaning

- Power off the HD Hub.
- Vacuum the component externally to remove the dust.
- Wipe down the component with a soft, lint-free cloth lightly dampened with mild dishwashing detergent diluted in water. Wring excess fluid from lint-free cloth before using. Avoid contact with open vents, plugs, or connectors.

- Wipe the surfaces with a clean, dry, soft, lint-free cloth until the equipment is thoroughly dry.
- Clean each connector port with a dry cotton swab.
- Do not let fluid pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

18.4.21 Other GE HealthCare peripheral devices

To do the planned maintenance for the following devices/accessories, refer to the respective supplier service manual for the proper cleaning and disinfection procedure.

- Respironics Capnostat 5 CO_2 sensor (refer to the Respironics CO_2 User and Service Manual for AltiX BT22 [5222370-199])
- Respironics LoFlo CO_2 module (refer to the Respironics CO_2 User and Service Manual for AltiX BT22 [5222370-199])
- CARESCAPE
- Dash
- Solar
- Stimulator
- Innova Central Touch Screen Unit (ITU)
- Accessories
  - CardioLab leadwires and ECG cables
  - Invasive blood pressure accessories
  - Non-invasive blood pressure accessories
  - Temperature accessories
  - Pulse oximetry accessories
  - CO_2 accessories (refer to the Respironics CO_2 User and Service Manual for AltiX BT22 [5222370-199])

18.5 Database maintenance

The database maintenance job is executed on acquisition and review systems on a weekly basis to provide better performance, to check consistency and integrity errors in the databases, and to back up the data on the system. The database maintenance job is scheduled to run during off-peak hours. Based on the default schedule the database maintenance job is scheduled to run at 2 AM every Sunday. The acquisition and review system should remain powered on when the database maintenance job is scheduled to run.

The current schedule of the **Database Maintenance Job** can be accessed by the following steps:

1. Select **Start** > **Programs** > **Microsoft SQL Server Tools 17** > **Microsoft SQL Server Management Studio 17**.
2. In the window that opens, select or type the following:
   - Server Type: **Database Engine**
   - Server Name: Computer name

NOTE
To view the computer name, on the desktop, right-click **This PC** and select **Properties**. The computer name appears in the **Computer name, domain and workgroup settings** section.

- Authentication: **Windows Authentication**

3. Click **Connect**.
4. On the left in the *Object Explorer* window, expand **SQL Server Agent** > **Jobs**.
5. Right-click **Database Maintenance**, then select **Properties**.
6. In the window that opens, click **Schedules**.
7. The Schedule is visible in the Schedule list.
8. Click **Cancel**.
9. Close the **Microsoft SQL Server Management Studio**.

18.6 Troubleshooting

WARNING

SHOCK HAZARD

Damaged cables and loose connections present a shock hazard and could cause signal noise or impaired device operation. Ensure all cables are in good condition, protected from potential sources of damage, and securely connected before powering on equipment. Replace damaged cables immediately.

18.6.1 Initial inspection

NOTE
Do not disconnect or reconnect any cables while the system is powered.

Before performing any troubleshooting procedure, check the following:

- The isolation transformer is plugged in and power and ground are available at the wall outlet (also check the outlet circuit breaker).
- The isolation transformer, computer, monitors, keyboard and any optional equipment are properly connected and all connections are tight. Be sure to check for:
  - Frayed cables
  - Exposed conductors
  - Bent prongs or pins
  - Damaged cable housings
  - Loose plug screws
- The isolation transformer power switch is on.
- Computer power switch is on.
- All monitors are turned on and set to the appropriate brightness and contrast.
- Equipment housing for cracks, overheating, or other damage.

18.6.2 System locked up

WARNING

NOT A PATIENT MONITOR

The system is intended to be used as a recording system for catheterization, electrophysiology and related specialty laboratories. A defibrillator or ECG monitor should be attached for patients in need of uninterrupted ECG display. An additional means to display SpO_2 should be attached for patients in need of uninterrupted SpO_2 display. A temporary pacemaker needs to be available for patients in need of uninterrupted delivery of pacing. An additional means to display CO_2 should be attached for patients in need of uninterrupted CO_2 display.

- While recording patient information – If still able to record, contact your GE HealthCare service representative.
- Not recording patient information – Reboot the computer. Contact your GE HealthCare service representative if rebooting does not correct the problem.

18.6.3 System does not boot

1. Check to see if there is a disk in the DVD drive (if available). If a disk is in the DVD drive, remove the disk. Turn the system off and wait 10 seconds before turning the system on again.
2. Check the isolation transformer and then the other hardware for loose power and connections.

18.6.4 UPS is beeping

When the UPS battery is low, it will beep. If this happens, do not attempt to replace the battery. Contact a GE HealthCare representative.

18.6.5 Monitor not working

A monitor may not work because it has either lost signal or power.

1. Check other monitors. If all monitors are not working, check for system power.
2. Check the power light on the affected monitor. If it is off, ensure the monitor is plugged in and power is available at the outlet. Try plugging into a different outlet or using a different power cable.
3. If the power light is on, ensure the video cable is connected properly (refer to the connection diagrams in the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual [PN 5222010-1EN]) and all connections are undamaged and tight.
4. Confirm that the monitor input source is set to HDMI.
5. Plug the monitor into another system, if the monitor works, then the monitor is functional. Otherwise, use a known working monitor on the system in question.
6. Check the power light on the video splitter and video switch (if applicable).
7. Check the signal lights on the splitters to determine if a valid video input and output are present.
8. Check Windows 10 Display Settings to ensure monitor output is enabled.

18.6.6 Missing or noisy waveforms

- Ensure the desired waveform traces are on.
- Ensure blood pressure waveforms are zeroed.
- Verify the pressure gain (right-click label and select **Scale**).
- Click the **Offset** icon in the *Real-Time* window to offset the signal.
- Ensure all power lights are illuminated. Check power cords.
- If the power lights are illuminated, ensure the cables to the modules are properly connected and that all connections are undamaged and tight. Refer to the connection diagrams in the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual (PN 5222010-1EN).
- Verify sensor pads are applied to properly prepared skin. Reapply or replace if necessary.
- If the problem persists, contact your GE HealthCare Service Representative.

18.6.7 Missing Vitals (with PDM)

No vitals can be acquired from the PDM until it is registered.

If the vitals from the PDM (such as NIBP, RR, and SpO2) are missing, and the PDM was not previously registered with the CardioLab system, contact GE HealthCare Service personnel to perform the PDM registration.

18.6.8 Ablation device data

Table 18-1 Ablation device data

Issue	Resolution
The system does not appear to receive ablation device data.	Select the NULL ablation device, and then re-select the desired ablation device driver in the ablation setup screen. This resets the COM port and may resolve the ablation data reception issue.

18.6.9 Missing amplifier inputs

1. Initial checks (from within a CardioLab study):
   - 1.1. Highlight the label area and check the *Real-Time* window for the signal. Highlighted traces are orange.
   - 1.2. Ensure blood pressure waveforms are zeroed.
   - 1.3. Verify the pressure gain (right-click the label and select **Scale**).
2. 2. From the *Navigator* window, make sure the study is set up correctly.
   - 2.1. From the *Navigator* window, select **Administration** > **Study Configuration** > **Edit**. The *Study Configuration* window appears.
   - 2.2. Select the appropriate **Catheter Block**.
   - 2.3. Select the **Hardware** tab.
   - 2.4. Ensure the numbers on the catheter input module (CIM) that the catheter is plugged into correspond to the numbers listed in the **Input** column.

2.5. Check the gain and filter settings:

- Gain should be between 1000 and 10,000.
- Bipolar filter setting should be: high pass 30 Hz, low pass 500 Hz, or power line filter off.
- Unipolar filter setting should be: low pass 0.05 Hz, high pass 150 Hz, power line filter off.
- Select the **Display Settings** tab.
- Ensure the signal is not turned off.

3. Check the hardware.

3.1. Ensure power is on to the amplifier

3.2. If the power light is on, ensure the amplifier fiber optic cable is properly connected (refer to the connection diagrams in the Mac-Lab/CardioLab/Centricity Cardiology INW Service Manual [PN 5222010-1EN]) and all connections are undamaged and tight.

3.3. Assign an unused channel on the amplifier to the same location on the CIM and check to make sure it displays. If it does, the problem is with the channel in the amplifier.

3.4. Plug the pins from the catheter into a spot on the CIM that is confirmed to be working. If there is no display, the problem may be in the catheter connecting cable.

3.5. If the cable seems to be good, the problem may be with the catheter.

NOTE
Catheters are rarely defective. Ensure all troubleshooting options have been exhausted before pulling the catheter from the patient.

4. If the problem persists, contact your GE HealthCare Service Representative.

18.6.10 Log Entries Caused by Noise Spikes on Stim Channels

When pacing is enabled on a noisy stim channel, noise spikes on the stim channel sometimes are mistaken as pacing pulses even when they are not actually paced. This causes log entries in the S1/S2 columns if **Auto Save** is also enabled or **Manual Save** is turned on.

Recommended corrective actions:

1. Make sure the study is set up correctly.

1.1. In the *Real-Time* window, click the **Study Configuration** icon. The *Study Configuration* window appears.

1.2. Select the **Stim** tab.

1.3. Ensure the numbers on the CIM that the catheter is plugged into correspond to the numbers listed in the **Input** column.

2. Check the physical connections of the stim channels.
3. Disable pacing on the stim channels not paced.

18.6.11 Signal noise

This section identifies basic causes of signal noise and suggested solutions. Noise can be caused by a number of different factors that may interact with each other. Only GE HealthCare approved accessories and supplies should be used with the system to avoid noise issues. Contact your GE

HealthCare service representative if the noise cannot be corrected. Be sure to keep notes about the noise type and what was tried to correct the noise.

NOTE
The use of electrocautery may cause noise on waveforms.

For CardioLab, over filtered “Blocky” signals can be improved by adjusting filter settings, screen resolution, sampling rate and contrast / brightness as listed in the following:

- Select 0.05Hz or 0.5Hz for ECG signals; a high-pass filter setting too high (5Hz) will distort the waveform.
- The power line filter options are designed to remove this noise.
- Increasing sample rate from 1K to 2K can improve signal quality.

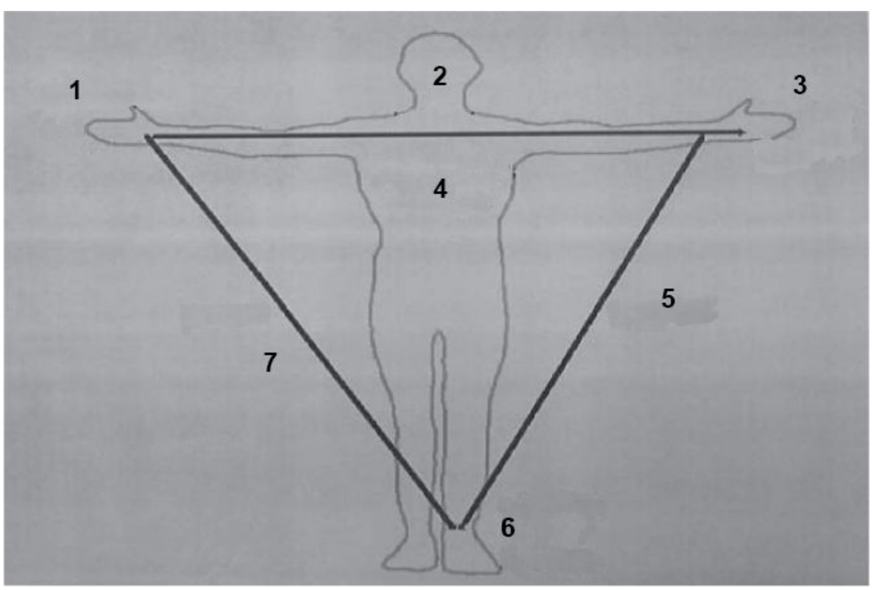
The following actions can be taken to reduce electromagnetic disturbances:

- Assess the environment of the healthcare facility for potential sources of electromagnetic interference (EMI) (for example, identify radio transmitters in and around the facility).
- Increase the distance between sources of EMI and susceptible devices.
- Lower power transmitted from electrical and electronic equipment (EMI sources) under hospital control (that is, paging systems).
- Educate healthcare facility staff (nurses and doctors) to be aware of and to recognize potential EMI-related problems.

18.6.11.1 Surface ECG Noise

Proper placement of electrodes and good skin preparation are vital to getting ECG signals free of noise. The Right Leg electrode is the reference lead of the CardioLab system and good contact with the patient is critical to all ECG and Intracardiac signals.

Surface ECG noise can appear on some traces but not others. To help troubleshoot the cause of noise, Einthoven's Theorem can be used to determine the problem electrode or lead wire.



1	Right Arm (-) Negative

2	LEAD I
3	Left Arm (+) Positive
4	Einthoven's Triangle
5	LEAD III
6	Left Leg (+) Positive
7	LEAD II

Examples of how Einthoven's Theorem can be used:

- If Lead I and II are noisy but Lead III is normal, look for a bad electrode / lead wire at Right Arm.
- If Lead I and III are noisy but Lead II is normal, look for a bad electrode / lead wire at Left Arm.
- If Lead II and III are noisy but Lead I is normal, look for a bad electrode / lead wire at Left Leg.
- If all leads are noisy, look for a bad electrode / lead wire at Right Leg (or multiple electrodes / lead wires).

ECG noise can be categorized into several different types of noise including power line frequency, baseline drift, ablation, pacing artifact, and muscle artifact.

18.6.11.1.1 Power Line Frequency Noise - ECG

The Power Line Frequency noise is the most common type of noise with traces becoming fuzzy, thick, or dull. Power Line Frequency Noise can appear on one or all ECG traces. The source of the noise is derived from the local AC power frequency, 60Hz or 50Hz. The power line frequency noise can be measured by turning up the display speed and measuring the period of corresponding sine wave (1000ms/60 = 16.7ms for 60Hz or 1000ms/50 = 20ms for 50Hz). The power line filter is designed to remove this noise.

Example of Power Line Frequency Noise - 60Hz noise on all ECG traces:

Typically, Power Line Frequency noise is the result of a difference in ECG lead wire impedance (poor connection with the patient), inducing noise on the CardioLab amplifier. Possible contributing factors of Power Line Frequency noise include:

- Power line filter turned off
- Bad lead wires

- Bad patient cables
- Poor electrode connection with the patient

Recommended corrective actions include:

- On all ECG traces, turn on the power line filter by changing the power line filter option to **Fixed** or **Adaptive**. If noise is still present, select **Fixed+** to apply additional filtering.
- Replace bad or worn out lead wires
- Replace bad or worn out patient cables
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.

18.6.11.1.2 Baseline Drift Noise - ECG

The Baseline Drift noise appears as if the entire ECG trace is moving vertically. The frequency of this noise is a variable. The ECG trace can move with some physical movement in the lab.

Example of Baseline Drift Noise:

The Baseline Drift noise is often the result of differences in ECG lead wire impedance (poor connection with the patient) inducing noise from some physical movement near the patient. Possible contributing factors of Baseline Drift noise include:

- Bad lead wires
- Bad patient cables
- Poor electrode connection with the patient
- Electrode location susceptible to respiration movement
- Patient movement
- Patient drape movement
- Patient table not grounded properly

Recommended corrective actions include:

- Adjust the High Pass Filter to a higher setting to filter out this noise (for example, change from 0.05 Hz to 0.5 Hz).
- Replace bad or worn out lead wires.
- Replace bad or worn out patient cables.
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Limit patient movement.
- Ground the patient table with a common ground shared with the PDM Base Station Plus, PDM Slim Connect, or CardioLab amplifier.

18.6.11.1.3 Muscle Artifact Noise - ECG

The Muscle Artifact noise is a variable noise riding on a trace or multiple traces. This noise can be traced to movement of the patient such as shivering or snoring. The Muscle Artifact noise is often the result of a difference in ECG lead wire impedance (poor connection with the patient).

Example of Muscle Artifact Noise:

Possible contributing factors of Muscle Artifact noise include:

- Bad lead wires
- Bad patient cables
- Poor electrode connection with the patient
- Electrode location
- Patient movement caused by patient being cold, reaction to medications, or snoring

Recommended corrective actions include:

- Replace bad or worn out lead wires
- Replace bad or worn out patient cables
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Limit patient movement.

18.6.11.1.4 Pacing Artifact Noise - ECG

The Pacing Artifact noise occurs while the pace generator (stimulator) is actively pacing the heart and disappears after the pacing pulses are turned off. Generally, the higher the pacing current, the higher the amplitude of noise will be generated on the ECG trace. Some pacing artifact is considered normal operation.

NOTE
Stimulators are constant current sources. If the resistance is higher than the normal due to bad or corroded cables/connections, the voltage delivered by the stimulator will be higher and therefore more likely to generate larger spikes/artifact. To help troubleshoot a possible problem, the CardioLab amplifier can be bypassed using the direct stimulator connection on the CIM module.

Example of Pacing Artifact Noise:

Possible contributing factors of Pacing Artifact noise include:

- Excessively high pacing current settings on the stimulator (“milliamp” output and “duration” settings).
- Bad stimulator cables.
- Loose fitting or bad stimulator connections.
- Stimulator Isolation / Interface box (low batteries).
- Pacing for long periods of time causing a charge build-up on the pacing poles of the catheter. This will lead to a natural occurring event of a long decay back to baseline after each pacing spike.

Recommended corrective actions include:

- Reduce the pacing current (Common settings: 1-5mA @ 2.0ms)
- Replace bad or worn out stimulator cables
- Replace batteries present in Stimulator Isolation / Interface box
- Use a bi-phasic stimulator

18.6.11.1.5 Ablation Noise - ECG

The Ablation noise occurs while the RF generator is actively ablating the heart and disappears after the generator is turned off. A large spike on the waveform may occur at the time the RF generator changes its power output (turned on or turned off). This spike could be confused with a pacing spike.

Example of Ablation Noise - With RF Generator On:

Possible contributing factors of Ablation noise include:

- Bad lead wires
- Bad patient cables
- Poor electrode connections with the patient
- Bad ablation grounding pad
- Proximity of electrodes / lead wires to RF source
- Grounding of equipment

Recommended corrective actions include:

- Replace bad or worn out lead wires.

- Replace bad or worn out patient cables.
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Replace bad or worn out grounding pad.
- Ground the Ablation Device (RF Generator) and patient table with a common ground shared with the CardioLab amplifier.

18.6.11.2 Intracardiac Signal Noise

Proper placement of catheters and good electrical contact are vital to maintaining Intracardiac signals free of noise. The Right Leg electrode is the reference lead of the CardioLab system, and good contact with the patient is critical to all ECG and Intracardiac signals.

When troubleshooting Intracardiac signal noise issues, it is possible to configure a new channel of the amplifier and move the poles of the catheter to different poles of the CIM module. If the same noise is seen on two identical channels of the CardioLab amplifier, the problem is likely not the amplifier but the signal or ground wiring.

Intracardiac signal noise can be categorized into several different types of noise including power line frequency, baseline drift, pacing artifact, ablation, unipolar high frequency, and mapping systems.

18.6.11.2.1 Power Line Frequency Noise - Intracardiac

The Power Line Frequency noise is the most common type of noise (when not ablating) with traces becoming fuzzy, thick, or dull. Power Line Frequency Noise can appear on one or all Intracardiac traces. The source of the noise is derived from the local AC power frequency, 60Hz or 50Hz. The power line frequency noise can be measured by turning up the display speed and measuring the period of corresponding sine wave (1000ms/60 = 16.7ms for 60Hz or 1000ms/50 = 20ms for 50Hz). The power line filter is designed to remove this noise.

Example of Power Line Frequency Noise - 60Hz noise on all Intracardiac traces:

Possible contributing factors of Power Line Frequency noise include:

- Grounding of devices (bad electrical grounds: power outlets at the patient table / wall outlet, power strips, equipment in the lab, power cords)
- Bad Ablation Device cabling (Personality module/wires)
- Poor routing of wires / cables around other equipment
- Poor electrode connection with the patient - Right Leg lead
- High Gain (>5000) will amplify signal as well as noise

Recommended corrective actions include:

- Ground the Ablation Device (RF Generator) and patient table with a common ground shared with the CardioLab amplifier
- Replace Ablation Device cabling (personality module/wires)

- Improve routing of wires / cables away from other equipment
- Replace bad or worn out lead wires
- Replace bad or worn out patient cables
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- On the impacted channels, apply 1 of the 5 power line filter options: **Fixed**, **Fixed+, Adaptive**, **AUTO**, or **Off**.
    - **Fixed**: Use this filter for channels that are pacing, ablating, or experience frequent railing. The **Fixed** filter implements a hardware power line notch filter on the specified channel to remove power line noise at the configured frequency (50 Hz or 60 Hz).
    - **Fixed+**: Use this filter for channels if noise is still present after applying the **Fixed** or **Adaptive** power line filters.
      The **Fixed+** filter applies either a 50 Hz or 60 Hz fixed power line filter as well as the filters for the 2nd through 5th harmonics of the power line frequency.
    - **Adaptive**: Use this filter for channels that are not pacing or ablating, or experience frequent railing.
      The **Adaptive** filter learns the pattern of a good signal and then eliminates power line noise from the configured frequency (50 Hz or 60 Hz).
    - **AUTO**: This filter is recommended for channels that are not ablating or experience frequent railing.
      The **AUTO** filter implements the **Fixed** filter when the channel becomes a **Pace & Record** channel type. If the channel is not a **Pace & Record** channel, then this option implements the **Adaptive** filter.
    - **Off**: Use this option when no power line filtering is desired. No power line filter is active on the signal.

18.6.11.2.2 Baseline Drift Noise - Intracardiac

The Baseline Drift noise appears as if the entire trace is moving vertically. The frequency of this noise is a variable but low, similar to Baseline Drift Noise - ECG.

Possible contributing factors of Baseline Drift noise include:

- Bad lead wires
- Bad patient cables
- Poor electrode connection with the patient
- Electrode location susceptible to respiration movement
- Patient movement
- Patient drape movement
- Patient table not grounded properly

Recommended corrective actions include:

- Adjust the High Pass Filter to a higher setting to filter out this noise (for example, normal setting: 30 Hz for Intracardiac signal)
- Replace bad or worn out lead wires

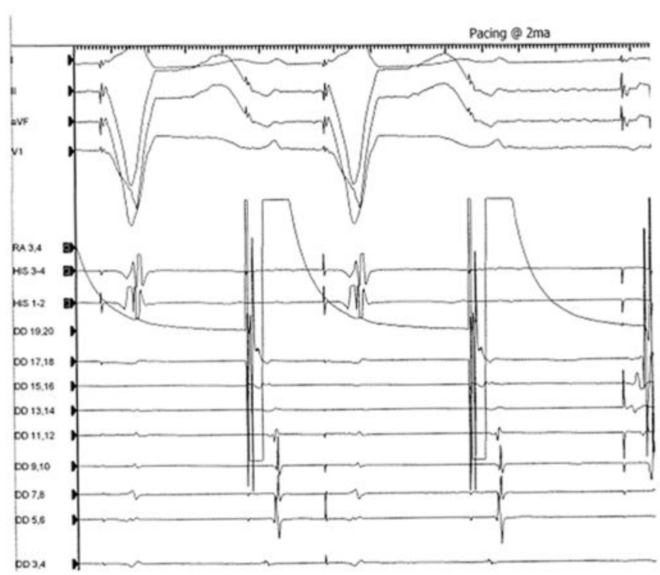
- Replace bad or worn out patient cables
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Limit patient movement
- Ground the patient table with a common ground shared with the CardioLab amplifier

18.6.11.2.3 Pacing Artifact Noise - Intracardiac

The Pacing Artifact noise occurs while the pace generator (stimulator) is actively pacing the heart and disappears after the pacing pulses are turned off. Generally, the higher the pacing current, the higher the amplitude of noise will be generated on the trace.

NOTE
Stimulators are constant current sources. If the resistance is higher than the normal due to bad or corroded cables/connections, the voltage delivered by the stimulator will be higher and therefore more likely to generate larger spikes/artifact. To help troubleshoot a possible problem, the CardioLab amplifier can be bypassed using the direct stimulator connection on the CIM module.

Example of Pacing Artifact Noise:



Possible contributing factors of Pacing Artifact noise include:

- Excessively high pacing current settings on the stimulator (“milliamp” output and “duration” settings)
- Bad stimulator cables
- Loose fitting or bad stimulator connections
- Stimulator Isolation / Interface box (low batteries)
- Pacing for long periods of time causing a charge build-up on the pacing poles of the catheter. This will lead to a natural occurring event of a long decay back to baseline after each pacing spike.

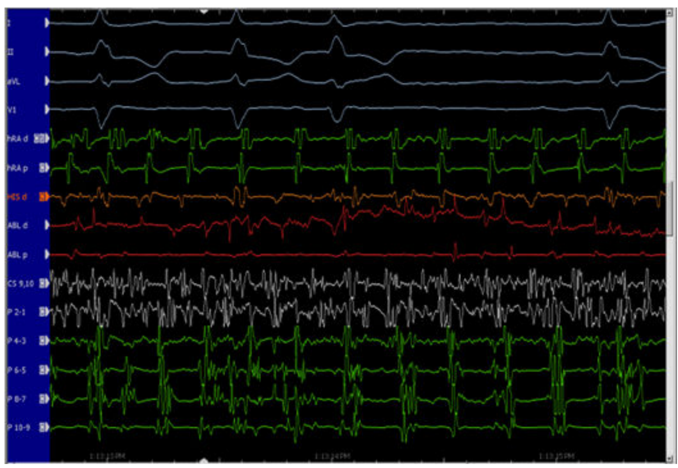
Recommended corrective actions include:

- Reduce the pacing current (Common settings: 1-5mA @ 2.0ms)
- Replace bad or worn out stimulator cables
- Replace batteries present in Stimulator Isolation / Interface box
- Use a bi-phasic stimulator

18.6.11.2.4 Ablation Noise - Intracardiac

The ablation noise occurs while the RF generator is actively ablating the heart and disappears after the generator is turned off. Generally, the higher the power setting of the RF generator, the higher the amplitude of noise. Noise on the **Ablation Distal** signal is the most difficult noise to eliminate. With power settings above 35W, noise is expected on the **Ablation Distal** signal. Using the pacing enabled RF filter box kit (PN 2082432-001) will help filter out the ablation noise.

Example of ablation noise:



Possible contributing factors of ablation noise include:

- Poor electrode connections with the patient
- Bad ablation grounding pad
- Proximity of electrodes or lead wires to RF source
- Grounding of equipment
- Old versions of EPT personality module are not designed for **Ablate and Record** capability
- No pacing enable RF filter box kit in use

Recommended corrective actions include:

- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Replace bad or worn out grounding pad.
- Ground the ablation device (RF generator) and patient table with a common ground that is shared with the CardioLab amplifier.
- Replace **Ablate and Record** personality module and associated cables.
- Use the pacing enabled RF filter box kit.

18.6.11.2.5 Unipolar High Frequency Noise - Intracardiac

The Unipolar High Frequency noise is the result of a difference in noise level on the catheter pole and the channel reference (either the surface Intracardiac Wilson Central Terminal (WCT) or Auxiliary Reference). Unipolar signals are more susceptible to noise because a catheter pole and a channel reference affect the common mode rejection of the system.

Possible contributing factors of Unipolar High Frequency noise include:

- Bad lead wires
- Bad patient cables
- Poor electrode connection with the patient
- Placement of Intracardiac cable near the other devices (when WCT is used as channel reference)

Recommended corrective actions include:

- Adjust the Low Pass Filter to a lower setting to filter out this noise (for example, change from 1000Hz to 150Hz)
- Replace bad or worn out lead wires
- Replace bad or worn out patient cables
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Route the Intracardiac cable away from other electrical devices

18.6.11.2.6 Mapping System Noise - Intracardiac

Mapping System noise is typically associated with power line frequency noise or magnet generated noise. The power line frequency noise can be measured by turning up the display speed and measuring the period of corresponding sine wave (1000ms/60 = 16.7ms for 60Hz or 1000ms/50 = 20ms for 50Hz). The power line filter is designed to remove this noise.

Example of Mapping System Noise:

Possible contributing factors of Mapping System noise include:

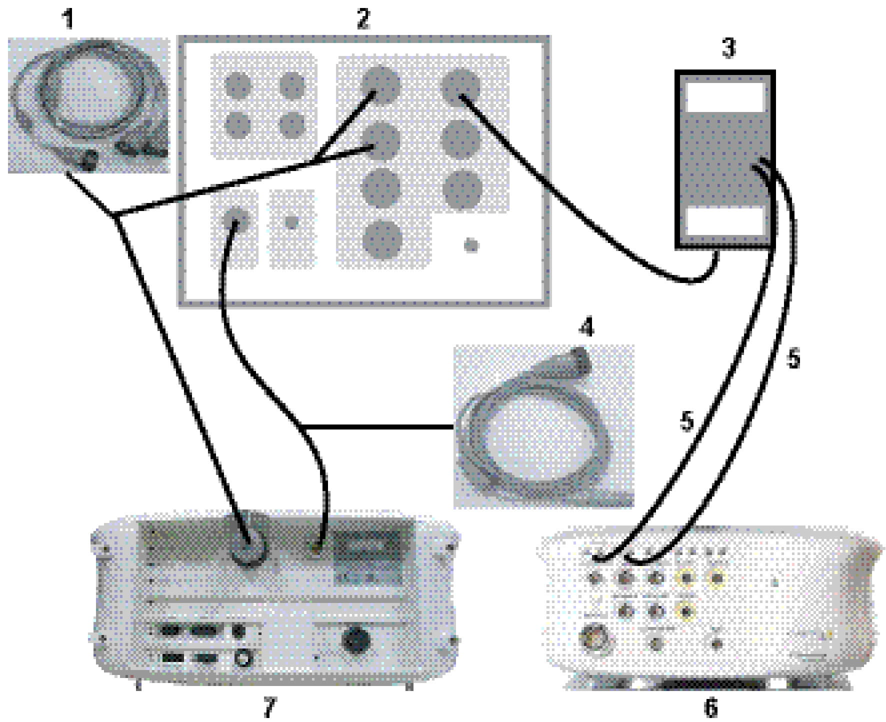
- Poor electrode connections with the patient
- Grounding of equipment
- Magnet interference
- 5.6KHz End Guide Signal (a signal emitted from the top of the ESI catheter used for catheter location)

Recommended corrective actions include:

- Adjust the Low Pass Filter to 150 Hz to filter out magnet interference or 5.6 KHz End Guide signal interference.
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient.
- Ground the Mapping System and patient table with a common ground shared with the CardioLab amplifier.
- On the impacted channels, apply 1 of the 5 power line filter options: **Fixed**, **Fixed+, Adaptive**, **AUTO**, or **Off**.
    - **Fixed**: Use this filter for channels that are pacing, ablating, or experience frequent railing. The **Fixed** filter implements a hardware power line notch filter on the specified channel to remove power line noise at the configured frequency (50 Hz or 60 Hz).
    - **Fixed+**: Use this filter for channels if noise is still present after applying the **Fixed** or **Adaptive** power line filters.
      The **Fixed+** filter applies either a 50 Hz or 60 Hz fixed power line filter as well as the filters for the 2nd through 5th harmonics of the power line frequency.
    - **Adaptive**: Use this filter for channels that are not pacing or ablating, or experience frequent railing.
      The **Adaptive** filter learns the pattern of a good signal and then eliminates power line noise from the configured frequency (50 Hz or 60 Hz).
    - **AUTO**: This filter is recommended for channels that are not ablating or experience frequent railing.
      The **AUTO** filter implements the **Fixed** filter when the channel becomes a **Pace & Record** channel type. If the channel is not a **Pace & Record** channel, then this option implements the **Adaptive** filter.
    - **Off**: Use this option when no power line filtering is desired. No power line filter is active on the signal.

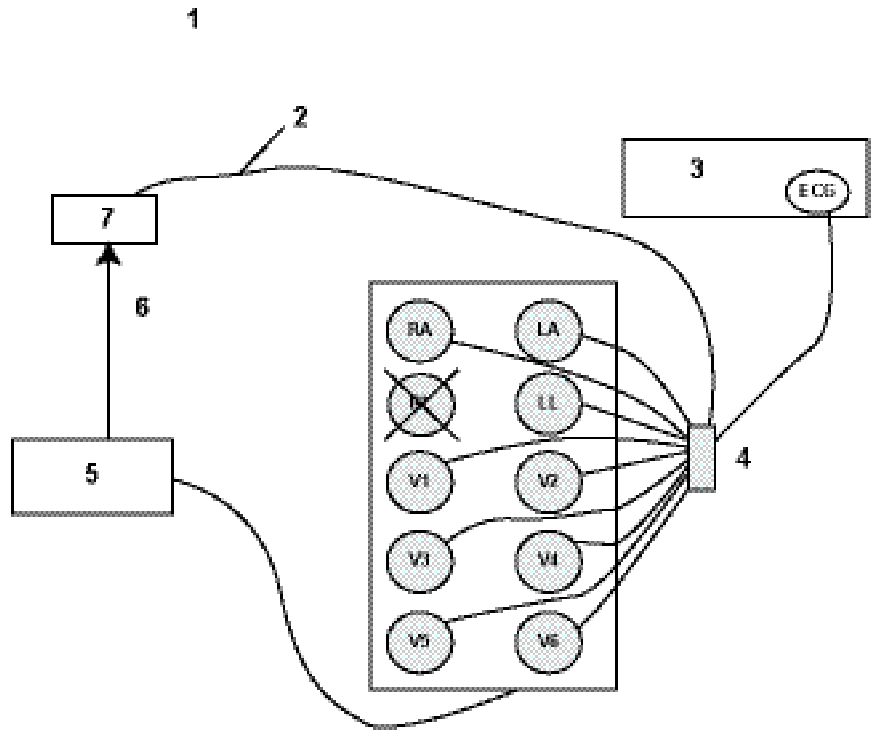
18.6.11.3 CARTO 3 Signal Noise

With the CARTO 3, the CardioLab's Surface ECG lead wires are commonly routed through the CARTO PIU box then to the CardioLab amplifier. This CARTO PIU box will filter out the noise from the magnet used with the CARTO system.



1	ICEG connectivity cable
2	CardioLab amplifier
3	Catheter input module
4	ECG connectivity cable
5	Stimulation cables
6	CARTO 3 PIU front
7	CARTO 3 PIU back

The mapping company representative may route signals through their junction box for additional processing. Below is a diagram that shows the use of the ECG junction box in line with the CardioLab amplifier.



1	CARTO ECG out connection unit CardioLab right leg lead direct connect
2	Right leg lead from CardioLab connected directly to patient
3	CardioLab amplifier
4	CardioLab ECG patient cable
5	CARTO patient interface box
6	CARTO ECG cable
7	Patient

18.6.11.3.1 Mapping System Noise - Surface

The Power Line Frequency and magnet noise is the most common type of noise with traces becoming fuzzy, thick, or dull. Power Line Frequency and magnet noise can appear on one or all ECG traces. The source of the noise is derived from the local AC power frequency, 60Hz or 50Hz.

The Power Line Frequency noise can be measured by turning up the display speed and measuring the period of the corresponding sine wave with the time calipers (1000ms/60 = 16.7ms for 60Hz or 1000ms/50 = 20ms for 50Hz). The power line filter is designed to remove this noise..

Recommended corrective actions include:

- Use a direct connection from the CardioLab ECG Cable Right Leg Lead to the patient to improve surface signals with the CARTO 3 when using the ECG connection box. This requires a double patch for the right leg only.
- Ground the mapping system and patient table with a common ground shared with the CardioLab amplifier. The connection would be made to the equipotential plug.

- Use the lowest gains possible when performing a case. Recommended setting is 2500 or lower. The standard is 1000.
- Some mapping systems do not allow for a direct connection of the Right Leg Lead. In this case, GE HealthCare recommends not using the junction box provided by the mapping system and connecting both sets of ECGs separately. (Contact BioSense/Webster for the correct connection system to allow only having to connect the Right Leg Lead twice.)

18.6.11.3.2 Mapping System Noise - Intracardiac

Mapping System Noise is typically associated with Power Line Frequency noise or magnet generated noise. The Power Line Frequency noise can be measured by turning up the display speed and measuring the period of corresponding sine wave (1000ms/60 = 16.7ms for 60Hz or 1000ms/50 = 20ms for 50Hz). The power line filter is designed to remove this noise.

Example of Mapping System Noise:

Possible contributing factors of Mapping System Noise include:

- Poor electrode connections with the patient.
- Grounding of equipment.
- Magnet interference.
- 5.6KHz End Guide Signal (a signal emitted from the top of the ESI catheter used for catheter location). Refer to manufacturer's documentation.

Recommended corrective actions include:

- Adjust the Low Pass Filter to 150 Hz to filter out magnet interference or 5.6 KHz End Guide signal interference.
- Ensure electrodes have been placed in the correct location where the skin was properly prepared. Typically, this noise source improves with no intervention after 10 minutes of contact with the patient. Patch resistance can occur when patients use body lotion prior to the procedure. Removing the body lotion prior to patch placement is an important part of the patch placement technique.
- Ground the Mapping System and patient table with a common ground shared with the CardioLab amplifier. The connection would be made to the equipotential plug.
- Use CardioLab calipers to determine if noise source is 60 Hz (16 ms time base peak to peak) or from the mapping magnet.
- Request mapping company representative for help with troubleshooting cases.
- Use a direct connection from the CardioLab ECG Cable Right Leg Lead to the patient to improve surface signals with the CARTO 3 when using the ECG connection box.This requires a double patch for the right leg only.

- If possible, try using the electrical ground of the patient table as common ground for all devices connected to the patient.
- Avoid using power strips. Power strips tend to degrade the earth grounding of the equipment.
- Use the lowest gains possible when performing a case. Recommended setting is 2500 or lower. The standard is 1000.
- Power line noise is mainly found on Abl ds signal. Do not confuse power line noise with magnet interference.
- If noise exists on unfiltered ECG channels, then that suggests a noisy lab environment, and improvement opportunities are available to address noise, such as following the suggestions above.
- On the impacted channels, apply 1 of the 5 power line filter options: **Fixed**, **Fixed+, Adaptive**, **AUTO**, or **Off**.
    - **Fixed**: Use this filter for channels that are pacing, ablating, or experience frequent railing. The **Fixed** filter implements a hardware power line notch filter on the specified channel to remove power line noise at the configured frequency (50 Hz or 60 Hz).
    - **Fixed+**: Use this filter for channels if noise is still present after applying the **Fixed** or **Adaptive** power line filters.
      The **Fixed+** filter applies either a 50 Hz or 60 Hz fixed power line filter as well as the filters for the 2nd through 5th harmonics of the power line frequency.
    - **Adaptive**: Use this filter for channels that are not pacing or ablating, or experience frequent railing.
      The **Adaptive** filter learns the pattern of a good signal and then eliminates power line noise from the configured frequency (50 Hz or 60 Hz).
    - **AUTO**: This filter is recommended for channels that are not ablating or experience frequent railing.
      The **AUTO** filter implements the **Fixed** filter when the channel becomes a **Pace & Record** channel type. If the channel is not a **Pace & Record** channel, then this option implements the **Adaptive** filter.
    - **Off**: Use this option when no power line filtering is desired. No power line filter is active on the signal.

18.6.12 Lab suggestions for noise reduction

18.6.12.1 Daily Inspections

ECG Cables

- Examine the lead clasp for dirt, blood, contrast, presence of brass clip.
- Operate the clasp for performance.
- Examine the cables for frays, breakage or wear.

ECG Harness

- Examine the lead connection within the harness.
- Examine the cable for fray, breakage, or wear.

- Examine the harness connection to the amplifier for security.

CIM Blocks

- Examine the overall cleanliness of the block.
- Examine the inputs and ensure they are free of blood, dust, or contrast.
- Examine the cable connection at the amplifier for security.

18.6.12.2 Table Preparation

ECG Stickers

- ONLY clean, fresh leads should be used.
- Use smaller packs of leads to avoid wasting those not used within a 72 hour period.

ECG Cables

- Untangle and stage ECG cables to lie alongside the left side of the patient.
- Upper Limb leads (RA, LA, V1 and V2) should approach patient from the superior aspect.
- Remaining V-leads (V3, V4, V5 and V6) should approach from inferior aspect.
- Lower limb leads (RL, and LL) should approach from the left side of the patient.

CIM Blocks

- Position the blocks as needed.
- Design a flat carrier to hold the CIM blocks fast and attached to the table side, to prevent the pulling of the blocks upon the EP catheters.

Connection Cables for the EP Catheter

- The preferred method is to use new connection cables for each case.
- Establish a counting system for the amount of sterilizations the catheter has undergone and discard them after the number of sterilizations recommended by the manufacturer. (A counting system example is to use small Zip Ties applied after each use.)

18.6.12.3 Patient Preparation

Skin Preparation

- Skin preparation should consist of an alcohol cleanse of the skin for each lead position, unless patient has allergy to ETOH. This is followed by a light abrasion to the site with a 2x2 or 4x4 gauze.
- Remove non-mechanical watches.
- Assess patient for the presence of electrical implants such as nerve stimulators.

18.6.12.4 Room standards

Electrical

- Ensure the proper power cables are used with all equipment. Refer to the manufacturer's specifications.
- Dedicated electrical circuit for the room (preferred).

- Universal earth (common) grounds for all equipment to which the patient is attached (amplifier, RF generator, flow pumps, PDM Base Station Plus or PDM Slim Connect, 3D mapping systems, warmers, etc.).
- Unplug any electrical device within the room that does not have a grounding post in its plug (DC chargers, electric shavers, etc.).

Power cable maintenance

- Avoid power strips.
- Remove unused power cables.
- Reduce cables to only those essential to case performance.
- Avoid binding electrical cables in circles. This creates a magnetic field that will cause interference.
- Always use the shortest electrical cable needed.

Lighting

- Use LED lighting for the room (preferred).
- Avoid fluorescent lighting due to EMI (electromagnetic interference) from ballasts.

Flooring

- Use non-conductive flooring.
- Use no wax flooring and remove wax if present. If the removal of the floor wax is not possible, use anti-static floor mats in the areas around the procedure table. This prevents the build-up of static charge, which can be coupled to the patient causing noise.
- Avoid plastic style shoes for the staff to avoid static.
- Electrical routing – have dual passage ways for the video and electrical cabling.

Amplifier

- Raise the amplifier from the floor to avoid housekeeping accidents.
- Locate the amplifier more than 4 feet away from any RF generator or isolation transformer to avoid the generated EMI or magnetic field.

Environmental Conditions

The Mac-Lab/CardioLab system operating conditions should be within the following range:

- Ambient temperature range of + 15 °C to + 30 °C
- Relative humidity range of 30% to 70%
- Atmospheric pressure range of 70 kPa to 106 kPa

18.6.13 Clear studies stuck in the system catalog on networked acquisition systems

Studies in the system catalog automatically move to the INW server after 10 minutes if they contain signal data and after eight hours if they do not. If the study fails to move to the INW server after this time frame, the study is marked and the server does not attempt to move it again until the mark is cleared. Both **Continue Study** and **Create Backup** fail on marked studies.

This procedure clears the mark on the study so the INW server can attempt to move the study again and **Continue Study** and **Create Backup** work for that study.

1. Select the study to review by highlighting the patient's name in the *Navigator* window.
2. Click the **Review Study** icon or select **Study** > **Review**.

   The selected study opens for review.
3. Close the study.

Once the study is closed, the mark on the study is removed. **Continue Study** and **Create Backup** should work immediately. If no further action is taken on the study, it moves to the INW server after 10 minutes or eight hours, depending on the presence of signal data in the study.

If studies remain in the system catalog for several days after clearing the marks as described above, contact GE HealthCare technical support.

18.6.14 Data export failures

If you initiate a data export command and a failure occurs either creating or sending the HL7 file and attachments, then the system displays a notification. The data export `audit.log` file also records information about the specific failure that occurred. You may be able to resolve this error if you retry the export operation.

- In a networked environment, retry the export operation when the network is in a working state.
- If the system is configured to export data on study close, open the study in review mode and then close it to initiate a data export operation and send the HL7 file and attachments to the configured destinations.
- You can also initiate a data export operation from within a study. Open the study in review mode and select **Study** > **Export Data**.

If consistent data export failures persist, contact GE HealthCare technical support.

18.6.15 Missing desktop icons (tablet mode)

Windows 10 can run on devices that function as both a laptop computer and a tablet. For example, if you have a laptop with a detachable keyboard, Windows 10 can run in the standard configuration when the keyboard is attached and automatically switch to tablet mode when the keyboard is disconnected. You may also manually configure your computer to run in tablet mode.

Tablet mode is intended for use on devices with a touchscreen display. In this mode, Windows adjusts the user interface to optimize for a tablet display, which includes:

- Hide the desktop and all icons
- Spread out content like the **Start** menu to simplify touchscreen access
- Show only one application at a time

The Mac-Lab/CardioLab application was not designed for use on tablet computers. All instructions provided in this manual assume that the Mac-Lab/CardioLab application is running in the standard configuration.

If the Mac-Lab/CardioLab is accidentally configured to run in tablet mode, do the following to switch the system back to the standard configuration:

1. On the Windows taskbar, select the **Action Center** icon on the far right.
2. In the *ACTION CENTER* window, select the **Tablet mode** button at the bottom.

18.6.16 Force restart the app

1. Power on and login to the system.
2. Start the Mac-Lab/CardioLab application.
3. Continue the study that was in progress.
4. Zero the pressures.
5. Zero the CO_2.
6. Zero the IBP.
7. The NIBP starts automatically.

Page intentionally left blank

19

Chapter 19 System Administration

All system settings are set by trained personnel. Contact the site network administrator if changes are required. An administrative password is required to change the system settings.

This chapter describes the system administration functions.

19.1 Configure *System Settings*

From the *Navigator* window, select **Administration** > **System Settings**. The *System Settings* window appears.

19.1.1 File paths

1. Select **File Paths** in the *System Settings* window.
2. Configure the acquisition system to make an offline backup of study data.
   2.1. Select **Browse** to set the **Backup study path** where backup copies of studies will be stored (usually, the SD drive).
   2.2. On standalone systems, the system automatically creates a backup on the **Backup study path** when a study is closed. On networked systems, the system does not automatically create backups, but studies can be backed up manually, if needed. See 4.3 Backup workflow on page 68 for details.
3. Select **Enable file export on study close** to export HL7-formatted study data to other systems, as specified in the data export configuration.

19.1.2 Network settings

Configure network settings only on networked acquisition or review systems.

To access network settings, go to **Network** in the *System Settings* window.

NOTE
The **Enable Network Storage** check box is automatically selected.

Task	Procedure
Configure study storage location	In the **INW Server** text box, enter the name of the Centricity Cardiology INW server used to store studies, or use the **Browse** button to select the server.
Enable pre/post-case monitoring (pre/post-workstation only)	Select the **Enable Pre/Post monitoring interface** check box, and then select the type of patient monitor from the list to the right of the box. **NOTE** If the selection for the type of patient monitor is changed, restart the system to apply this change.

Task	Procedure
Configure review workstation to show and create studies that are on other acquisition systems	**NOTE** You must sign in to the computer as an application administrator to change the **Allowed Study Hosts** settings. 1. Select **Allowed Study Hosts** > **Refresh** to list all available study hosts on the network. 2. From the list of available study hosts, select the desired system(s). Each selected study host will be available as a separate Catalog view at the Navigator window.
Configure review workstation to allow the operator to initiate NIBP cuff inflation while they view an in-progress study	Select the **Allowed From This Station** check box to configure this function.

19.1.3 EP System Settings

Select **EP System Settings** from the *System Settings* window to adjust the way signals are displayed.

Use the settings in this section to adjust the width of the signal waveforms displayed in the *Real-Time* and *Review* windows. The settings can be changed independently for **Intracardiac** signals, **Surface Leads** signals, and **Pressure** signals. For each type of waveform, there are separate sliders provided for each of the following parameters:

- **Horizontal width**: This adjusts the width of the signal in horizontal portions of the waveform.
- **Vertical width**: This adjusts the width of the signal in vertical portions of the waveform.
- **Boldness**: This adjusts the brightness of the color used to draw the signal. It is especially useful when the signal width is set to low.

19.1.4 Cath System Settings

Select **Cath System Settings** from the *System Settings* window to choose the **Blood pressure display unit**.

Do not use the **Signal Adjustment**, **Cath mode**, or **Quality check** options shown on this tab. These settings do not apply to CardioLab systems.

19.1.4.1 Blood pressure display unit (mmHg or kPa)

Leave these units in the default value of millimeters of mercury (mmHg) or change these units to kilopascals (kPa).

NOTE
kPa mode and mmHg are configured separately on each system. If the kPa mode is used in a network, all acquisition and review systems in the network must be set to kPa mode.

1. Select the **kPa** radio button to select kPa mode.
2. For kPa mode, note the following:
   - A change to either mmHg mode or kPa mode takes effect only when the next study is opened.
   - The **Blood pressure display unit** cannot be changed while a study is open.
   - In kPa mode, **-kPa** is displayed on the title bar of each monitor. In mmHg mode, no indication is displayed on the title bar.

- To display blood pressure units in kPa in a report, select a report section specifically labeled **kPa**. Report sections not labeled **kPa** shows blood pressure in units of mmHg. Being in kPa mode has no effect on this.
- Any supported legacy CardioLab study may be reviewed in kPa mode.

  NOTE
  The *Log* window summary will still show blood pressure values for existing vitals events using the blood pressure unit (either mmHg or kPa) that was selected when the event was created or edited.

- In kPa mode, when the operator edits a pressure event, the blood pressure values must be entered in mmHg.
- Blood pressures are always exported for HL7 in mmHg.
- The **CardioLab Data Extraction** option is used for researchers to collect acquired data points into a file for further analysis. For this option, blood pressures are always exported in mmHg.

19.1.5 General system settings

Select **General Settings** in the *System Settings* window.
Set the **Snapshot resolution** to **Low**, **Medium**, or **High**.

When the **Enable Barcode Parsing** checkbox is selected, the system parses the lot number and/or serial number from GS1-128 and HIBC barcodes.

NOTE
When the barcode setting changes, the barcode scanner must be re-configured to function correctly. Refer to the Mac-Lab/CardioLab/Centricity Cardiology INW 2D Barcode Scanner Configuration Service Manual (PN 5123031-199) for information on configuring the scanner.

Set the patient information that appears in the title bar when a study is open by checking the checkboxes under **Patient Information Display**. By default, the patient's name appears.

- Check **Display MRN** to show the patient's MRN.
- Check **Display Date of Birth** to show the patient's date of birth.
- Check **Anonymize Patient Information** to show asterisks instead of patient information.

19.1.6 Print Format

1. Select **Print Format** in the *System Settings* window.
2. In the **12 Lead print options** field, set the options by selecting values from the following drop-down menus.
   2.1. **Format**: Standard or Continuous
   2.2. **Resolutions**: 5, 10, 15, or 25 mm/mV
   2.3. **Sweep speed**: 25 or 50 mm/sec
   2.4. **Rhythm lead**: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6
3. Select the check boxes for **Grids**, **Cal pulse**, and **Cabrera**.
4. Set the **Signal pen width** by selecting the desired setting.

5. Select the **Display hospital name** check box, if applicable.
6. Select **Printer Setup** to choose the print setup options.

19.1.7 Hospital Information

Select **Hospital Info** in the *System Settings* window.

These settings store the name of the site, address of the site, and lab location. This information is used on window prints, snapshots, and is exported to cardiovascular information systems. It is not automatically imported into reports.

Hospital information is stored locally on standalone systems. In networked environments, hospital information is stored on the INW server and on each acquisition system to allow unique lab locations to be specified. Review workstations do not have their own **Hospital Info** settings.

For networked environments, the system state determines where hospital information is taken from, when it is used.

System state	Hospital Info settings taken from
At *Navigator* window with **System**, **Host**, or **Backup** catalog selected	Acquisition system
At *Navigator* window with **Network** catalog selected	INW server
In study that has **Study Location** of acquisition system	Acquisition system
In study that has **Study Location** of INW server	INW server

Configure Hospital Info on an acquisition system

1. From the *Navigator* window, select the **System** catalog.
2. Select **Administration** > **System Settings** to open the *System Settings* window.
3. Select **Hospital Info** in the *System Settings* window.
4. Enter hospital information in the fields provided. **Lab location** refers to the location of the acquisition system (e.g., **Lab 2**).

Configure Hospital Info on an INW server

1. From the *Navigator* window, select the **Network** catalog.
2. Select **Administration** > **System Settings** to open the *System Settings* window.
3. Select **Hospital Info** in the *System Settings* window.
4. Enter hospital information in the fields provided. **Lab location** refers to the general location for all of the labs in the network (e.g., **3rd Floor of North Tower**).

19.1.8 Connectivity

Select **Connectivity** in the *System Settings* window.

19.1.8.1 Local system

DICOM settings

Use the information in the following table to populate the fields on the **Local System** tab.

<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>AE Title</td><td>Enter the name of the system. You can change the name based on the number of systems (e.g., two or more systems can be renamed CLab A, CLab B, etc.).

NOTE
AE Title is not necessarily the same as the machine or host name. AE Title refers to the DICOM name, not the machine name.</td></tr>
<tr><td>Listen Port</td><td>The default is 1225 for normal transport and 2762 for secure transport. This value is typically only changed if it causes a conflict.</td></tr>
<tr><td colspan="2">DICOM server security

The DICOM server can run in one of three security modes: None, Legacy, or Enhanced. Choose the option that accommodates all remote DICOM systems that use the Mac-Lab/CardioLab system's DICOM services. For example, if the X-ray system supports Legacy mode but the ultrasound system does not support secure transport, select None.

The remote DICOM system must be configured to use the same security mode. If the configurations do not match, the systems cannot communicate with each other.

Certificate validation may require configuring both the Mac-Lab/CardioLab system and the remote DICOM system with the other system's certificate data. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.</td></tr>
<tr><td>Server Security > None</td><td>Transport security is disabled. Select this option if any remote DICOM host that uses the Mac-Lab/CardioLab system's DICOM services does not support secure DICOM transport.</td></tr>
<tr><td>Server Security > Legacy</td><td>This is the secure transport compatibility mode. Select this option if any remote DICOM host that uses the Mac-Lab/CardioLab system's DICOM services supports only the retired DICOM transport methods.</td></tr>
<tr><td>Server Security > Enhanced</td><td>This transport mode utilizes certificate validation. Select this option if every remote DICOM host that uses the Mac-Lab/CardioLab system's DICOM services supports the current DICOM transport methods and certificate validation.</td></tr>
<tr><td>Maximum search responses to accept</td><td>Enter the appropriate number. The default is 150. The maximum search responses returned is 999. This setting prevents the system from being overrun by broad queries. For example, if this value is set to 150, a search for all patients on the CVIS system displays no more than 150 results.</td></tr>
</table>

When starting a case study using demographics provided by the CVIS, the following fields in the *Patient Information* window are disabled by default in order to ensure consistency of data among the CVIS, CardioLab, and X-ray systems: **Last Name**, **Middle Name**, **First Name**, **MRN**, and **Date of Birth**. When a case is started from a scheduled study, the **Requested Procedure Identifier** and **Scheduled Procedure Identifier** fields on the **Worklist** tab are also disabled.

If the demographic fields listed previously need to be changed, uncheck the **Lock required patient demographics fields from Modality Worklist Host** check box at any time before or during a case.

After demographic information in the *Patient Information* window is changed, the system displays a message that states that these fields are required to ensure consistency with associated systems, such as the x-ray or CVIS. When prompted, you may choose to apply these changes or not as follows:

- Select **Yes** to apply changes made to any field in the *Patient Information* window.
- Select **No** to apply changes to any field except **Last Name**, **Middle Name**, **First Name**, **MRN** and **Date of Birth**.
- Select **Cancel** to return to the *Patient Information* window without changing anything.

It is recommended to return to the *System Settings* window and select the **Lock required patient demographics fields from Modality Worklist Host** check box after the changes have been made. If the setting remains unchecked, any operator will be able to change these required demographics in every subsequent study done on this system.

INNOVA CENTRAL/Touch Screen settings

For INNOVA CENTRAL/Touch Screen configuration, refer to Appendix C INNOVA CENTRAL/Touch Screen on page 309.

19.1.8.2 Remote hosts

X-Ray System Settings

Select the *Incoming Remote Hosts* tab to access the **X-Ray System Settings**.

Use the information in the following table to populate the **X-Ray System Settings** fields.

Field	Description
AE Title	Enter the DICOM name of the X-ray system in the laboratory. **NOTE** **AE Title** is not necessarily the same as the machine or host name. **AE Title** refers to the DICOM name, not the machine name.
Hostname or IP Address	Enter the host name or IP address of the x-ray system in the laboratory.
Port Number	Enter the appropriate connection port.
Modality	The default is **XA**. Contact your service representative to change this field.
Text Encoding	Determines what character set to use to package data sent to the X-ray system in the laboratory. To change the default, pick one that the X-ray system supports from the drop-down menu. Refer to the DICOM Conformance Statement for the X-ray system for a list of its supported character sets.
Client Security Outgoing connections to the remote host are made in one of three security modes: **None**, **Legacy**, and **Enhanced**. The remote DICOM system must be configured to use the same security mode. If the configurations do not match, the systems cannot communicate with each other. Certificate validation may require configuring both the Mac-Lab/CardioLab system and the remote DICOM system with the other system's certificate data. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.	
Client Security > **None**	Transport security is disabled. Select this option if the remote DICOM host does not support secure DICOM transport.
Client Security > **Legacy**	This is the secure transport compatibility mode. Select this option if the remote DICOM host supports only the retired DICOM transport methods.
Client Security > **Enhanced**	This transport mode utilizes certificate validation. Select this option if the remote DICOM host supports current DICOM transport methods and certificate validation.
Automatic Exam Start	Select this option to enable the Mac-Lab/CardioLab system to initiate a study on the Innova system. **NOTE** Only select this option if the Innova system supports the automatic exam start feature.

Field	Description
Append Mode	When this option is not selected, the Mac-Lab/CardioLab system replaces old dosage and run information when it receives new dosage and run information. When this option is selected, the Mac-Lab/CardioLab system adds new dosage and run information to any previously received dosage and run information. If the Mac-Lab/CardioLab system will connect to an Innova system with the **MPPS** feature, this option should be selected. For any other X-ray system, including an Innova with the **Exam Data Export** feature, the option should not be selected.

Ultrasound System Settings

Select the *Incoming Remote Hosts* tab to access the **Ultrasound System Settings**.

Use the information in the following table to populate the **Ultrasound System Settings** fields.

Field	Description
AE Title	Enter the DICOM name of the ultrasound system in the laboratory. **NOTE** **AE Title** is not necessarily the same as the machine or host name. **AE Title** refers to the DICOM name, not the machine name.
Hostname or IP Address	Enter the host name or IP address of the ultrasound system in the laboratory.
Port Number	Enter the appropriate connection port.
Modality	The default is **US**. Contact your service representative to change this field.
Text Encoding	Determines what character set to use to package data sent to the ultrasound system in the laboratory. To change the default, pick one that the ultrasound system supports from the drop-down menu. Refer to the DICOM Conformance Statement for the ultrasound system for a list of its supported character sets.
Client Security Outgoing connections to the remote host are made in one of three security modes: **None**, **Legacy**, and **Enhanced**. The remote DICOM system must be configured to use the same security mode. If the configurations do not match, the systems cannot communicate with each other. Certificate validation may require configuring both the Mac-Lab/CardioLab system and the remote DICOM system with the other system's certificate data. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.	
Client Security > **None**	Transport security is disabled. Select this option if the remote DICOM host does not support secure DICOM transport.
Client Security > **Legacy**	This is the secure transport compatibility mode. Select this option if the remote DICOM host supports only the retired DICOM transport methods.
Client Security > **Enhanced**	This transport mode utilizes certificate validation. Select this option if the remote DICOM host supports current DICOM transport methods and certificate validation.

Remote Host 1 and 2 Settings

The **Remote Host 1** and **Remote Host 2** settings may optionally be used to provide patient and study data to one or two devices in addition to the x-ray and ultrasound systems.

Select the *Incoming Remote Hosts* tab to access the settings for both **Remote Host 1** and **Remote Host 2**.

Use the information in the following table to populate the **Remote Host 1** and **Remote Host 2** fields.

Field	Description
AE Title	Enter the DICOM name of the remote host in the laboratory. **NOTE** **AE Title** is not necessarily the same as the machine or host name. **AE Title** refers to the DICOM name, not the machine name.
Hostname or IP Address	Enter the host name or IP address of the remote host in the laboratory.
Port Number	Enter the appropriate connection port.
Modality	Enter the **Modality** of the remote host. You may need to consult the DICOM Conformance Statement for the device to get this information. If this field is blank, requests from the remote host will be ignored.
Text Encoding	Determines what character set to use to package data sent to the remote host in the laboratory. To change the default, pick one that the remote host supports from the drop-down menu. Refer to the DICOM Conformance Statement for the remote host for a list of its supported character sets.
Client Security Outgoing connections to the remote host are made in one of three security modes: **None**, **Legacy**, and **Enhanced**. The remote DICOM system must be configured to use the same security mode. If the configurations do not match, the systems cannot communicate with each other. Certificate validation may require configuring both the Mac-Lab/CardioLab system and the remote DICOM system with the other system's certificate data. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.	
Client Security > **None**	Transport security is disabled. Select this option if the remote DICOM host does not support secure DICOM transport.
Client Security > **Legacy**	This is the secure transport compatibility mode. Select this option if the remote DICOM host supports only the retired DICOM transport methods.
Client Security > **Enhanced**	This transport mode utilizes certificate validation. Select this option if the remote DICOM host supports current DICOM transport methods and certificate validation.

Modality Worklist Host settings

The **Modality Worklist Host** is typically the CVIS, such as the Centricity Cardio Workflow (CCW) or the Centricity Cardiology DMS.

Select the *Outgoing Remote Hosts* tab to access the **Modality Worklist Host**.

Use the information in the following table to populate the **Modality Worklist Host** fields.

Field	Description
Enable check box	Select the **Enable** check box to enable this interface. The box can be selected only when all fields are completed. If the **Enable** option is not selected, then the interface will be disabled.
AE Title	Enter the DICOM name of the **Modality Worklist Host**. **NOTE** **AE Title** is not necessarily the same as the machine or host name. **AE Title** refers to the DICOM name, not the machine name.
Hostname or IP Address	Enter the host name or IP address of the **Modality Worklist Host**.
Port Number	Enter the appropriate connection port.

Field	Description
Cath Modality **EP Modality**	This value indicates the type of study to request from the Modality Worklist Host. The default value for a Cath study is **HD** (Hemodynamics). The default value for an EP study is **EPS** (Cardiac Electrophysiology). This value should be changed only if the Modality Worklist Host does not support the default Modality value. A blank value may be used to request all study types from the Modality Worklist Host.
Text Encoding	Determines what character set to use to package data sent to the Modality Worklist Host. To change the default, pick one that the Modality Worklist Host supports from the drop-down menu. Refer to the DICOM Conformance Statement for the Modality Worklist Host for a list of its supported character sets.
Client Security Outgoing connections to the remote host are made in one of three security modes: **None**, **Legacy**, and **Enhanced**. The remote DICOM system must be configured to use the same security mode. If the configurations do not match, the systems cannot communicate with each other. Certificate validation may require configuring both the Mac-Lab/CardioLab system and the remote DICOM system with the other system's certificate data. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.	
Client Security > **None**	Transport security is disabled. Select this option if the remote DICOM host does not support secure DICOM transport.
Client Security > **Legacy**	This is the secure transport compatibility mode. Select this option if the remote DICOM host supports only the retired DICOM transport methods.
Client Security > **Enhanced**	This transport mode utilizes certificate validation. Select this option if the remote DICOM host supports current DICOM transport methods and certificate validation.

MPPS Host settings

The **MPPS Host** is typically the CVIS, such as the Centricity Cardio Workflow (CCW) or the Centricity Cardiology DMS.

Select the *Outgoing Remote Hosts* tab to access the **MPPS Host**.

Use the information in the following table to populate the **MPPS Host** fields.

Field	Description
Enable check box	Select the **Enable** check box to enable this interface. The box can be selected only when all fields are completed. If the **Enable** option is not selected, then the interface will be disabled.
AE Title	Enter the DICOM name of the **MPPS Host**. **NOTE** **AE Title** is not necessarily the same as the machine or host name. **AE Title** refers to the DICOM name, not the machine name.
Hostname or IP Address	Enter the host name or IP address of the **MPPS Host**.
Port Number	Enter the appropriate connection port.
Cath Modality **EP Modality**	This value is sent to the MPPS Host to indicate the type of study that was created. The default value for a Cath study is **HD** (Hemodynamics). The default value for an EP study is **EPS** (Cardiac Electrophysiology). This value should be changed only if the MPPS Host does not support the default Modality value. This value may not be blank.
Text Encoding	Determines what character set to use to package data sent to the **MPPS Host**. To change the default, pick one that the **MPPS Host** supports from the dropdown menu. Refer to the DICOM Conformance Statement for the **MPPS Host** for a list of its supported character sets.

Field	Description
Client Security Outgoing connections to the remote host are made in one of three security modes: **None**, **Legacy**, and **Enhanced**. The remote DICOM system must be configured to use the same security mode. If the configurations do not match, the systems cannot communicate with each other. Certificate validation may require configuring both the Mac-Lab/CardioLab system and the remote DICOM system with the other system's certificate data. Refer to the Mac-Lab/CardioLab Privacy and Security User Manual (PN 5222004-1EN) for details.	
Client Security > **None**	Transport security is disabled. Select this option if the remote DICOM host does not support secure DICOM transport.
Client Security > **Legacy**	This is the secure transport compatibility mode. Select this option if the remote DICOM host supports only the retired DICOM transport methods.
Client Security > **Enhanced**	This transport mode utilizes certificate validation. Select this option if the remote DICOM host supports current DICOM transport methods and certificate validation.

19.1.9 Audit Log

The system is equipped with security features to help comply with the Health Insurance Portability and Accountability Act (HIPAA). For a detailed description of these features, contact the site network administrator.

Select the **Audit Log** tab in the *System Settings* window and set the **Audit Log Configuration** from the fields provided. GE HealthCare recommends that all available categories are selected for audit.

The audit log configuration can be set up to track events in the **Windows Application Event** Log based on several categories of events that may take place while using the system application. Each category, when selected for audit, will cause the application to generate informational events related to that category within the **Windows Application Event Log**. For example, when **Study** is selected, information events such as when a study was started, reviewed or closed will be listed in the audit log, with the date/time that the event occurred. The system will log any warnings or errors that occur while using the application regardless of the audit log settings selected.

The categories of events available for audit are as follows, including some examples of the types of events logged:

- Application: Informational events related to actions taken within the application
- Configuration: Changes made to the configuration of the system, such as changing the file path for study backup
- Data Export: Data Export started, Data Export Finished
- Data Extraction: Data Extraction Started, Data Extraction Finished
- DICOM: DICOM Receive, DICOM Send
- Network: Loss of network connection
- Report: Report Generated, Report Printed, Report Viewed
- Security: Switch User, User Login
- Study: New Study, Review Study, Continue Study, Close Study
- Disable Navigator Inactivity Timeout:
    - When this box is checked, the Mac-Lab/CardioLab screen does not lock when it displays the *Navigator* window.

    - When this box is not checked, the Mac-Lab/CardioLab screen locks when the system reaches the inactivity timeout limit, regardless of what screen it displays.
- User Authentication on launch
    - When this box is checked, the system displays a separate authentication window when it launches the Mac-Lab/CardioLab application. Only valid Mac-Lab/CardioLab users can launch the application.
    - When this box is not checked, the system does not prompt users to authenticate when it launches the Mac-Lab/CardioLab application.

Select the desired **User Tracking** option. In a network environment, the **User Tracking** setting should be the same on all Mac-Lab/CardioLab systems. See 8.1.11 User Tracking on page 138 for more information.

19.2 Customize study configurations

Sign in to the system as an administrator to make any permanent changes to the study configurations. Contact the site network administrator.

19.2.1 Creating a new study configuration

1. From the *Navigator* window, select **Administration** > **Study Configurations**.
2. Select **New**.
3. Type the name of the study configuration in the **Name** field (defaults to **New Study Configuration**).
4. Select **OK**.

   The review/setup mode opens.
5. Customize the study configuration:
    - ECG - Display/Hardware Settings
    - Pressure - Display/Hardware/Grid Settings
    - Intracardiac Blocks - Display/Hardware Settings
    - Stim - Pacing Settings/Display/Hardware Settings
    - Input Channel - Display Settings (CardioLab II Plus Amplifier only)
    - Analog Output Configuration
    - Measurements - Measurements/Autosave Setting/Vital Configuration
    - Protocol List
    - Activation Alignment - Configuration/Channels
    - Mapping - Configuration/Isochronal/Isopotential
6. Select **Close** to exit the *Study Configuration* window.
7. Select **Study** > **Close Study**.

   The message `Are you sure you want to close the current study?` appears. Select **Yes** to return to the *Navigator* window.

19.2.2 Editing study configurations

1. From the *Navigator* window, select **Administration** > **Study Configurations**.
2. Highlight the appropriate study configuration and click **Edit**.
3. Verify the name of the study configuration to edit. Click **OK**. The review/setup mode opens.
4. Customize the study configuration as desired.
5. Select **Close** to exit the *Study Configuration* window.
6. Select **Study** > **Close Study**.

   The message `Are you sure you want to close the current study?` appears. Select **Yes**to return to the *Navigator* window.

19.2.3 Copying study configurations

1. From the *Navigator* window, select **Administration** > **Study Configurations**.
2. Highlight the appropriate study configuration and select **Copy**.
3. Verify the name of the **Study Configuration** to copy and select **OK**.

   The review/setup mode opens.
4. Customize the study configuration, as desired.
5. Select **Close** to exit the *Study Configuration* window.
6. Select **Study** > **Close Study**.

   The message `Are you sure you want to close the current study?` appears. Select **Yes** to return to the *Navigator* window.

19.2.4 Deleting study configurations

1. From the *Navigator* window, select **Administration** > **Study Configurations**.
2. Highlight the appropriate **Study Configuration** and select **Delete**.
3. The message `Important! The selected item(s) will be permanently deleted and no longer available for future use. Do you wish to continue?` appears. Select **Yes** to permanently delete the study configuration or **No** to cancel.

19.3 Customize intervals

An interval is the time period between marks on a waveform. The user can define the start and end point of an interval by selecting from a list of labeled marks.

Sign in to the system as an administrator to make changes to the intervals. Contact the site network administrator for administrative privileges.

19.3.1 Create new intervals

1. From the *Navigator* window, select **Administration** > **Intervals**.

   The *Intervals* window appears.

2. Select **New**.

   The *New Interval Type* window appears.
3. Enter the name of the new interval in the **Name** field.
4. Select **Mark 1** and **Mark 2** from the drop-down menu.

   For example, if you want to create a post-pacing interval (PPI), **Mark 1** is **PPIon** and **Mark 2** is **PPIoff**.
5. Type the column width (standard five characters).
6. Select **OK** to save the interval.
7. Select **Close** to exit intervals.

19.3.2 Edit intervals

1. From the *Navigator* window, select **Administration** > **Intervals**.
2. Highlight the appropriate interval and select **Edit**.
3. Edit the intervals marks or column width.
4. Select **OK** to save the changes.
5. Select **Close** to exit intervals.

19.3.3 Delete intervals

1. From the *Navigator* window, select **Administration** > **Intervals**.
2. Highlight the appropriate interval and select **Delete**.
3. The message `Important! The selected item(s) will be permanently deleted and no longer available for future use. Do you wish to continue?` appears. Select **Yes** to permanently delete the changes or **No** to cancel.
4. Select **Close** to exit intervals.

19.4 Customize column formats

Column formats define which column intervals appear in the *Log* window for documentation, and in which order.

Sign in to the system as an administrator to make changes to the column formats. Contact the site network administrator for administrative privileges.

19.4.1 Create new column formats

1. From the *Navigator* window, select **Administration** > **Column Formats**.
2. Click **New**.
3. Enter the name of the new column format.
4. Highlight the appropriate items in the **Available Items** list box and click the right (>) or left (<) arrow buttons to move the individual items between the **Available Items** list and the **Selected Items** list.

5. Click the all right (>>) or all left (<<) arrow button to move all of the items from the **Available Items** area to the **Selected Items** list, or vice versa.
6. Click **OK** to save the new column format.
7. Click **Close** button to exit column formats.

19.4.2 Edit column formats

1. From the *Navigator* window, select **Administration** > **Column Formats**.
2. Highlight the column format to edit.
3. Select **Edit**.
4. Highlight the appropriate items in the **Available Items** list box and select either the right (>) or left (<) arrow button to move the individual items between the **Available Items** list and the **Selected Items** list.
5. Select **OK** to save the changes.
6. Select **Close** to exit column formats.

19.4.3 Copy column formats

1. From the *Navigator* window, select **Administration** > **Column Formats**.
2. Highlight the column format to copy.

   The copied **Column Format** name defaults to **Copy of Column Format Name**.
3. Change the **Column Format** name, as desired.
4. Highlight the appropriate items in the **Available Items** list box and select either the right (>) or left (<) arrow button to move the individual items between the **Available Items** list and the **Selected Items** list.
5. Select **OK** to save the changes.
6. Select **Close** to exit column formats.

19.4.4 Delete column formats

1. From the *Navigator* window, select **Administration** > **Column Formats**.
2. Highlight the target column format and click **Delete**.

   The message `Important! The selected item(s) will be permanently deleted and no longer available for future use. Do you wish to continue?` appears.
3. Select **Yes** to permanently delete the column format or **No** to cancel.
4. Select **Close** to exit column formats.

19.5 Customize protocols

A protocol is a group of software settings for CardioLab that provides the ability to easily change several key settings at the same time. These settings include window layout, column layout and review window focal point positions.

Sign in to the system as an administrator to make changes to the protocol settings. Contact the site network administrator for administrative privileges.

19.5.1 Create new protocols

1. From the *Navigator* window, select **Administration** > **Selected Protocols**.
2. Select **New**.
3. Enter name of new protocol.
4. Select an entry for each of the following fields if applicable:
    - Sense channel label
    - Column format
    - Window settings
    - Macro category
    - Update review (on or off)
    - Focal point
    - Display page
5. Select **OK** to save the protocol.
6. Select **Close** to exit protocols.

19.5.2 Edit protocols

1. From the *Navigator* window, select **Administration** > **Selected Protocols**.
2. Highlight the protocol to edit.
3. Select **Edit**.
4. Change the protocol settings, as desired.
5. Select **OK** to save the protocol.
6. Select **Close** to exit protocols.

19.5.3 Copy protocols

1. From the *Navigator* window, select **Administration** > **Selected Protocols**.
2. Highlight the **Protocol** to copy.
3. Select **Copy**.

    The **Protocol Name** defaults to **Copy of Protocol Name**.
4. Edit the **Protocol** name, as desired.
5. Edit the **Protocol** fields, as desired.
6. Select **OK** to save the protocol under the new name.
7. Select **Close** to exit protocols.

19.5.4 Deleting protocols

Delete protocols from the *Navigator* window.

1. From the *Navigator* window, select **Administration** > **Selected Protocols**.
2. Highlight the **Protocol** to delete and select **Delete**.

   The message `Important! The selected item(s) will be permanently deleted and no longer available for future use. Do you wish to continue?` appears.
3. Select **Yes** to permanently delete the protocol or **No** to cancel.
4. Select **Close** to exit protocols.

19.5.5 Edit the protocol list

Edit the protocol list from **Study Configuration** > **Acquire mode** in the *Real-Time* or *Review* windows or when you create a **Study Configuration**.

To edit the protocol list from within a study:

1. In the *Real-Time* or *Review* window, select **Study Configuration** > **Selected Protocols**.
2. Select **Edit List**.

   The *Edit Protocol List* window opens.
3. Highlight the appropriate items in the **Available Items** list box and select the right (>) or left (<) arrow buttons to move the individual items between the **Available Items** list and the **Selected Items** list.
4. Select **Close** when finished editing the protocol list.

19.6 Customize window settings

Sign in to the system as an administrator to make changes to the window settings. Contact the site network administrator for administrative privileges.

To create new window settings, save changes to existing window settings, or delete window settings, see 6.4.4 Windows menu on page 105.

19.7 Electronic signature

To use the electronic signature feature, the administrator needs to create a unique Windows account for each user authorized to sign Word reports.

System type	Account
Standalone system	The Windows account is on the local system.
Networked system	It is recommended to create the Windows account on the Domain Controller so that it is accessible from all Mac-Lab/CardioLab systems.
NOTE These users can be existing site user accounts.	

When a Word report is signed, the Word report records the **Full Name** of the operator. The system takes the **Full Name** from the operator's Windows user account. A system administrator controls all user accounts, including the **Full Name** attribute. The administrator needs to set each operator's **Full Name** to a meaningful name to properly represent the signer. If the organization account policy does not allow **Full Name** field changes, the electronic signer can manually enter their full name in the electronic signature dialog window.

20

Chapter 20 CardioMapp and Alignment

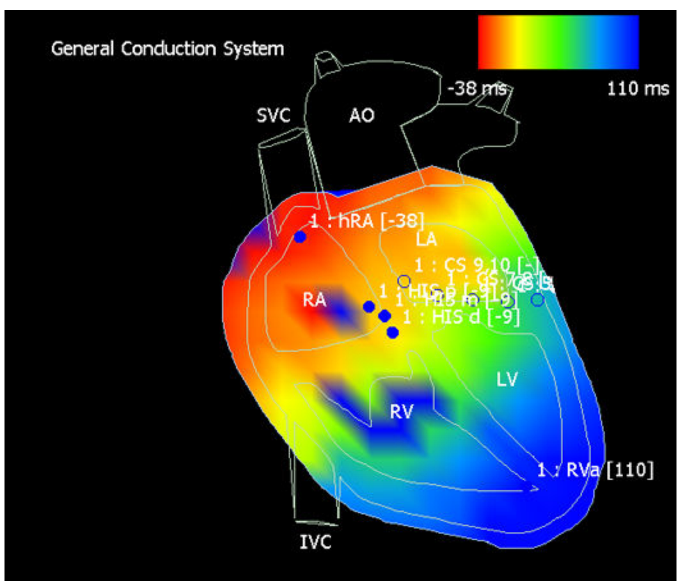
This chapter describes CardioMapp and the *Alignment* window. CardioMapp is an optional feature that allows a representation of an electrical activation sequence as it spreads across a mapped surface. The activation sequence can be recorded in sequential steps, as in traditional clinical mapping with a roving catheter. It can also be recorded simultaneously with the use of basket catheters or high-density electrode arrays. The *Activation* window is a useful tool for saving and analyzing mapping location notably for focal atrial tachycardia. Activation times are displayed on the left side of the window. If image capture is also available, an image is saved at the time of the grab, and catheter position is clearly shown with the signals.

NOTE
CardioMapp at this time provides only two-dimensional mapping as opposed to the three-dimensional, anatomical mapping. While this is limited to two-dimensional mapping, it is still an inexpensive and valuable tool to provide the EP attending physician with a convenient way to analyze the sequence of cardiac activation.

20.1 CardioMapp

The integrated CardioMapp module spatially presents an electrical activation sequence as it spreads across a mapped surface. The activation sequence can be recorded in sequential steps, as in traditional clinical mapping with a roving catheter. It can also be recorded simultaneously with the use of basket catheters or high-density electrode arrays.

The map may be printed and placed in the patient's report.



With integrated CardioMapp, many options are available for making maps. Most maps are generally made from signals acquired in real time. Maps can also be created in review mode, using signals that have previously been saved.

As the recorded signals display different types, map types may vary. In general, one type of map may be optimal for a specific situation and criteria for analysis, while it may be poor for another.

Maps can be made from a single set of data acquired simultaneously, or they can be made from data acquired sequentially. The maps generated can be of different types: isochronal or isopotential.

20.1.1 Map template generation

All operations pertain to the model view. Use the icons at the top of the window to draw or modify any existing map.

Item	Description
1	Map Setup: Opens the mapping configuration window.
2	Zoom In: Increases the image size.
3	Zoom Out: Decreases the image size.
4	New Model: Creates a new model.
5	Open Model File: Allows the opening of an existing model file.
6	Save Model File: Saves current model file.
7	Edition: Allows the moving of a frame or region of interest.
8	Mapping Frame: Allows the designation of the shading boundaries. In most cases, the frame is set around the region. The drop-down menu makes it possible to draw a line, line loop, circle, ellipse, square, or rectangle.
9	Mapping Region of Interest: Allows the drawing of an anatomical figure of interest. The drop-down menu makes it possible to draw a line loop, circle, ellipse, square, and rectangle.
10	Electrode Marker: Allows to setup of catheter sites and establishes location on the map.
11	Anatomical Reference: Allows the designation of an anatomical reference.
12	Text Annotation: Allows text comments to be added to the map.

20.1.2 Practical application

Models are representations of the heart or specific chambers within the heart. Although they do not represent the patient's exact anatomy, they can be helpful in determining the activation patterns of the intracardiac signals. Several models are included with the software. Existing heart models can be modified and new models can be created.

A model consists of several components:

- Region of Interest: The area where the map is contained. This is typically the outer most line on the map.
- Frame: Details in the Region of Interest that do not affect the mapping area. This is useful for drawing anatomical details.
- Electrode Marker: Catheter electrodes are placed within the Region of Interest. The electrode name is the same as the name of the channel that is being mapped.
- Anatomical Reference: A marker is placed to note anatomical reference points. These references do not affect the overall Isochronal or Isopotential Map.

- Text Annotation: Text is placed anywhere within the map.

20.1.2.1 Modify a model

1. Select **Windows** > **Map**.
2. Place the *Map* window in the desired location.
3. In the pull-down menu on the left of the *Map* window, select the **Model** mode.
4. To open an existing model, select the **Open Model File** icon.
5. Select an .MMF file.

20.1.2.2 Create a model

1. To create a new model, click the **New Model** icon.
2. Click the **Mapping Region Of Interest** drawing icon.
3. Select the pull-down menu next to the icon. This list displays the various drawing tools. These drawing tools help to design a clear and neat map.
4. Design the Region of Interest (ROI) using the following guidelines:
   - The ROI must be a completely enclosed area. No opening can exist in the ROI outline. Isochronal maps require a completely enclosed area, no matter how elaborate.
   - The system cannot accept an ROI within another ROI, for example the shape of a doughnut.
   - The system can accept two completely separate ROIs on the same map.

20.1.3 Maps

20.1.3.1 Static maps

Static maps can be used to analyze a single picture. This information may be presented discretely, with data corresponding only to each recording site, or the map may employ interpolation.

Interpolation involves the estimation of values at points in between known recording sites. Interpolation only provides a good estimate of the map if the number of recording sites is judged to be of sufficient density (in two dimensions).

Static maps possess the advantage of mapping data to be condensed into one single view. The static map may result in relevant information being compressed or discarded.

20.1.3.1.1 Isochronal maps

The most common type of map used for clinical diagnosis is the isochronal map. Isochronal maps are two-dimensional projections on which site-specific activation times have been superimposed upon the mapped surface. The signals used in mapping can be either bipolar (more common) or unipolar. The data acquisition can be either simultaneous or sequential. When the signals are recorded, the only information the map uses from each signal is the discrete time of activation at that site. Over the course of a cardiac cycle, an isochronal map can potentially display the path of activation across the mapped surface.

Isochronal maps should be used with caution. A full understanding of the criteria and assumptions associated with these maps is essential.

For isochronal maps to be valid, the following criteria must be met:

- The isochronal map must span a time period consisting of no greater than one cardiac cycle.
- The overall cardiac signal from which it was chosen must be stable and periodic.
- The density of recording sites on the map must be judged to be adequate.
- Each recorded signal must possess a discrete time of activation.
- The window of time over which the cardiac cycle is mapped must begin at the appropriate time.

When their limitations and conditions are understood, isochronal maps are a convenient way to analyze the sequence of cardiac activation. This is particularly true when there are a large number of channels.

20.1.3.1.2 Configure isochronal maps

To configure isochronal maps, first click the **Map setup** icon from within the *Map* window, then click the **Isochronal** tab.

Field		Description
Time range		Evaluate the time period marked from the reference point established in the Alignment Activation.
Electrode label display		Set the label display by the channel number, channel label or both.
Color settings	Color spectrum	Choose a default or customized color scheme.
	Start hue	To customize the scheme, choose **Specify Hues** as the **Color spectrum** and choose the start and end hue.
	End hue	

20.1.3.1.3 Create an isochronal map

The isochronal map uses designated colors to represent the different activation times, as compared to a reference during a single cardiac cycle. Used in conjunction with the *Activation Alignment* window, the map displays the same information graphically.

To create an isochronal map, perform the following steps:

1. Open the *Map*, *Alignment*, and *Review 1* windows.
2. Choose a map type that depicts the correct anatomical structures. Select the **Model** view in the *Map* window and click the **Open Model File** icon.
3. When the model is loaded, switch the view to Isochronal.
4. Use the *Alignment* window to grab signals from either the *Review* or *Real-Time* window.

   NOTE
   If the map contains the exact labels as designated in the Alignment channel configuration, the site labels display the appropriate data. Any labels that do not appear on the map previous to the alignment grab are placed in the upper left corner of the *Map* window.

5. To set up a new map or properly position additional labels, switch the map view back to **Model** and place the labels in the appropriate position.
6. To move the label, click the label, move it to the desired location and click again to drop the label.
7. Click the **Save Model File** icon and save the map with an appropriate name.

8. Switch the view back to Isochronal. The colors represent early and late activation times in accordance with the *Alignment* window.
9. If adjustments are made to the marks in the *Alignment* window, click the **Rebuild Map** icon to update the map with the changes.
10. Click the **Snapshot** icon to display a picture of the map which can be printed.

20.1.3.1.4 Isopotential maps

Similar to the isochronal map, the isopotential map involves two-dimensional rendering of the cardiac surface. However, instead of superimposing activation times at points across the surface, isopotential maps involve the display of voltages recorded at a given instance on those sites.

For an isopotential map to be valid, the following criteria must be met:

- The recordings must be unipolar.
- Each of the unipolar recordings must share a common reference.

Without any calculations or assumptions about activation time, a single isopotential map provides very detailed information about the voltage distribution of the mapped surface.

It is necessary to observe a sequence of isopotential maps taken at different times throughout the cardiac activation sequence. This is best accomplished by viewing the isopotential maps dynamically.

20.1.3.1.5 Configure isopotential maps

To configure isopotential maps, first click the **Map setup** icon from within the *Map* window, then click the **Isopotential** tab.

Field			Description
Map settings	Electrode label display		Set the label display by the channel number, channel label or both.
	Map type	Voltage	Map the maximum voltage seen.
		dV/dt	Map the voltage/time differential.
	Map display	Continuous	Range: evaluate the time period marked from the reference point established in the Alignment Activation.
		Threshold	Amount in mV that should be excluded from the rendered data. Used to ignore background noise.
Movie settings	Step size		The increment of time that establishes the length of one frame.
	Speed		Establishes the sweep speed of the movie.
	Delay		Interval of time observed between the beginning and end of a time loop.
Color Settings	Color Spectrum		Choose a default or customized color scheme.
	Start hue		To customize the scheme, choose **Specify Hues** as the **Color spectrum** and choose the start and end hue.
	End hue		
Interpolation (selected from the *Map* window toolbar)			Specify if interpolation is used in the rendered information.

20.1.3.1.6 Create an isopotential map

The Isopotential map is used to view voltage levels at particular catheter sites over a period of time.

To create an Isopotential map, perform the following steps:

1. Open the *Map*, *Alignment* and *Review 1* windows.
2. Set the map view to **Model** and select a model from the list.
3. Switch to the **Isopotential** view.
4. Use the *Alignment* window to grab signals from either the *Review* or *Real-Time* window.

   NOTE
   If the map contains the exact labels as designated in the Alignment channel configuration, the site labels display the appropriate data. Any labels that do not appear on the map previous to the alignment grab are placed in the upper left corner of the map window.

5. To set up a new map or properly position additional labels, switch the map view to **Model** and place the labels in the appropriate position.
6. To move the label, click on the label, move it to the desired location and click again to drop the label.
7. Click the **Save Model File** icon and save the map with an appropriate name.
8. Switch the view back to **Isopotential**.

20.1.3.2 Dynamic maps

Dynamic maps, similar to moving pictures, are pictures that must be viewed in a temporal sequence. Viewing a dynamic map involves stepping through a sequence of snapshots either in real time or in slow motion.

A sequence of isopotential maps represents a good case presentation as a dynamic map. In this case, a sequence of isopotential maps can be viewed one after another, to display the potential distribution as it changes with time.

20.1.3.2.1 Play a dynamic map

1. To observe the data over a period of time, click the **Play** icon and a scroll bar moves from left to right on the *Alignment* window.
2. To set a particular frame of time to view the movie, establish boundaries by placing a caliper in the *Alignment* window.
3. To pause the movie or move frame by frame to view points of interest, use the appropriate icons.
4. To convert the Isopotential map to an Isochronal map, switch the views to Isochronal and the map reflects the changes.

20.2 Alignment

Activation Alignment window

CardioLab provides an *Activation Alignment* window designed especially for use in point to point/ sequential catheter mapping and signal alignment. The *Activation Alignment* window may be used to display the data from specific mapping locations simultaneously. The data is aligned on a common reference, such as the onset of the QRS beat. In this way, all of the activations may be viewed on the perception of simultaneous occurrences. To compliment this feature, CardioLab offers a **Triggered Sweep** mode (see 6.1.3 Trigger mode activation mapping on page 93), Switched Video and the *Ablation* window (optional) (see 8.3 *Ablation* window on page 142).

20.2.1 Measuring activation time and aligning the signals

Configure the system as follows:

1. Select the **Windows** menu and select the *Real-Time*, *Review 1*, *Log* and *Alignment* windows so that they display on the screen.
2. Verify that the *Alignment: Interval* window title bar displays **Activation**. If the title bar displays **Interval**, click the **Switch to Activation Alignment** icon on the left side of the icon bar.

20.2.2 Configuration

1. Select **Windows** > **Alignment** and place the *Alignment* window anywhere in the application.
2. Click the **Configuration** icon in the *Alignment* window.
3. Select the **Configuration** tab in the *Study Configuration* window.
4. Edit each of the following fields in the **Configuration** tab as described in Table 20-1 Configuration fields on page 289.

Table 20-1 Configuration fields

Field	Description
Associated Map	This field shows the file name of the default mapping model that is used to create an isochronal or isopotential map. CardioMapp is an optional feature.
Reference Channels	Select the Reference Channel field to choose an available channel. This signal is a constant (for example, HRA, RVA and surface lead).
Mark Type	This field controls the method of determining activation times. The Mark Types are: • Amplitude: This places the mark on the maximum positive or negative amplitude. • Maximum dV/dT: This places the mark on maximum positive or negative slope. • Onset: This places the mark at the detected onset of depolarization.
Sort Type	Select a sort type for aligned signals to be displayed: • Grab Order: in the chronological order the data was collected • Earliest -> Latest: Latest activation times • Latest -> Earliest: Earliest activation times Select an appropriate sort criterion. In point to point mapping, the Earliest to Latest selection is most often used.
Number of Signals Per Page	Select the number of signals to be displayed simultaneously in the Alignment window. A scroll bar appears for additional signals. The value range is from 2 to 80; the recommended value is 12.

20.2.3 Channels

1. Select **Windows** > **Alignment** and place the *Alignment* window anywhere in the application.
2. Click the **Configuration** icon in the *Alignment* window.
3. Select the **Channels** tab in the *Study Configuration* window.
4. Choose the channels to be grabbed. A maximum of 80 channels can be grabbed.

20.2.4 Grabbing channels for activation times

When the Configuration is set properly, begin grabbing channels for analysis.

Click the **Real Time Grab** icon to grab the channels as they are occurring.

The vertical line on the window represents the 0 ms, or reference point. This line can be moved to different positions on the screen depending on user preference.

Click the white focal points at the top or bottom of the line and drag to the desired location (increments of 1/4 page).

20.2.5 Displaying the reference channel

Click the **Reference** icon to change how the reference channel is displayed. The **Reference** icon toggles between:

- All References: Every grab displays both the Grab Channels and the corresponding reference channel.
- One Reference: Only the last grab displays the reference channel. Since the reference is by definition a stable channel, this is often a preferred setting.
- No References: The reference channel is not displayed for any of the grabs.

20.2.6 Starting a new map

The *Activation Alignment* window can be cleared by pressing the **New Map** icon. The previous activation marks are deleted, but subsequent grabs start on a new window. The index for new Alignment events starts over at 1.

20.2.7 Measuring activations

Alignment Activation mapping may also be performed from saved data in the *Review* window.

1. With the *Review* window open, in the *Alignment Activation* window, click on the **Review Grab** icon.
2. The message `Please select a beat` displays. Click on the desired mapping signal and it will populate into the *Alignment Activation* window.
3. Click **Done**.

20.2.8 Interval Alignment window

The *Alignment: Interval* window may be configured to align a channel based on a pacing reference.

Configuration

1. Select the **Windows** menu and the *Real-Time*, *Review 1*, *Log* and *Alignment* windows so that they display on the screen.
2. Verify that the *Alignment* window title bar displays **Interval**. If the title bar displays **Activation**, click the **Switch to Interval Alignment** icon on the left side of the icon bar.
3. Click the **Configuration** icon in the *Alignment: Interval* window to open the *Interval Alignment Configuration* window.

Field	Description
Reference channel	Typically the Stim Toggle Channel. This is the channel that triggers an update.
Aligned channel	Typically the HIS channel, or any channel to be compared after pacing.
Number of signals per page	Controls the number of signals to be displayed simultaneously in the *Alignment* window. A scroll bar appears for additional signals. The value range is from 1 to 80. The recommended value is 12.

20.2.9 Aligning signals

When pacing is initiated, the *Alignment: Interval* window automatically updates if all of the following conditions are true:

- **Autosave** is turned **On**.
- **Update** is turned **On**.
- **Stim** detection is turned **On**.

Appendix A Shortcuts and Icons

NOTE

For ComboLab^{TM} users, the Mac-Lab and CardioLab function keys may be different. Refer to the user manuals and Quick Reference Guides for function key definitions.

A.1 Keyboard shortcuts

The following is an explanation of the color coding system used by the system keyboards, a detailed table of each combination, the text on each key and the function of the key.

Color coding

Green background	Press **Action** + the key to activate the function printed in small white text on the face of keys with a green background.
Blue text	Press **Shift** + the key to activate the function printed in blue text on the face of the key.
Red text	Press a key with red text (**Save**, **Update**) to save data signals.
Pink text	Indicates that the key behaves in a context sensitive way (for example, works only on a highlighted signal in either the *Review* or *Real-Time* window).
Red background	**Emerg Save** key. This key immediately starts saving signals. The **Emerg Save** key saves as much data as possible from memory.

Keyboard layout

A.2 Icons

The following table shows the available system icons, their functions, and detailed descriptions.

Table A-1 *Navigator* toolbar icons

Icon	Function	Detailed description
	Browse catalog	Browses for patient studies.
	Study filter setup	Defines the parameters for the study filter.
	Refresh view	Updates the catalog view to display new studies.
	Export	Exports the study parameters to a user-specified location.

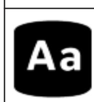
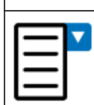
Table A-2 *Navigator* online catalog icons

Icon	Function	Detailed description
	New study	Creates a new study.
	Continue study	Continues the selected study.
	Review study	Opens the selected study for review.
	Patient search	Create a new study using patient demographics from the CCW or another cardiovascular information system.
	Schedule search	Create a new study for a procedure scheduled on the CCW or another cardiovascular information system.
	Create backup	Creates a backup of the currently selected studies and places the backup in the configured backup path. Updates the backup location to the disk label of the backup path.
	Restore study	In the network catalog, restore the selected studies from the archive onto the INW server. When the restore is complete, these studies can be reviewed.

Table A-3 *Navigator* offline catalog icons

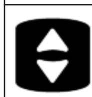
Icon	Function	Detailed description
	Import study	In the offline catalog, moves the selected offline study into the system (online) catalog, so that it can be reviewed or continued.
	Copy study	In the offline catalog, copy the selected studies, typically to another SD media. The system prompts you to select a location to store the offline study copy.
	Delete study	In the offline catalog, permanently removes the offline copy of the study from the backup media.

Custom forms icons

Icon	Function	Detailed description
	Text	Inserts a text only field. This field will not be shown in the report.
	Text box	Inserts a text field and a text box.
	Drop-down box	Inserts a text field and a single selection field with multiple options.

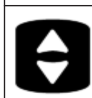
Icon	Function	Detailed description
	List box	Inserts a text box and a multiple or single selection list box.
	Date	Inserts a text box and a date field. The date field automatically uses the current system date, but can be changed.
	Time	Inserts a text box and a time field. The time field automatically uses the current system time, but be can changed.
	Reorder forms	Reorders the list of custom forms.
	Reorder tabs	Changes the tab order within the custom form.

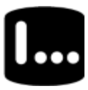
Real-Time window icons

Icon	Function	Detailed description
	Display speed	Use the + or - buttons to change the waveform display speed, or select a speed from the drop-down list or type the desired display speed. The choices are 5, 10, 25, 50, 100, 200, 400, or 800.
	Study configuration	Opens the *Real-time Study Configuration* window.
	Time calipers	Measures the signal in milliseconds or BPM.
	Amplitude calipers	Measures the amplitude of the ECG signal in mV.
	Delete all calipers	Removes all displayed calipers.
	Caliper value in ms	Displays the millsecond value of the caliper.
	Caliper value in BPM	Displays the beat per minute value of the caliper.
	Offset signals	Evenly distributes signal waveforms. For channel groups, press **Shift** + **Offset** to offset the selected channels. All unselected channels will remain in the same position.
	Triggered mode	Toggles triggered mode on or off.
	Toggle *Ablation* window	Opens/closes the *Ablation* window.

Icon	Function	Detailed description
	Real-time 12 lead	Prints a formatted 12 lead printout of the *Real-Time* window.
	Timer	Opens a *Timer* window.
	Stopwatch	Opens a *Stopwatch* window.
	Scrolling on or off	Turns *Real-Time* waveform scrolling on or off.

Review window icons

Icon	Function	Detailed description
	Display speed	Use the + or - buttons to change the waveform display speed in the *Review* window, or select a speed from the drop-down list or type the desired speed. The choices are 5, 10, 25, 50, 100, 200, 400, 800, or 1600.
	Study configuration	View or edit ECG or pressure configuration settings for the *Review* window.
	Time calipers	Measures the signal in milliseconds or BPM.
	Amplitude calipers	Measures the amplitude of the ECG signal in mV.
	Delete all calipers	Removes all displayed calipers.
	Caliper value in ms	Displays the millsecond value of the caliper.
	Caliper value in BPM	Displays the beat per minute value of the caliper.
	Toggle active re-view window	Indicates which window will receive updates if two review windows are open.
	Update	Select to continuously update the *Review* window.
	Offset signals	Evenly distributes signal waveforms on page 2 or page 3.
	Snapshot	Creates a snapshot of current window contents. The snapshot can be anno-tated and added to a report.

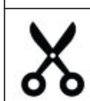
Icon	Function	Detailed description
	Review 12 lead print	Prints a formatted 12 lead printout of the *Review* window.
	Print	Prints the *Review* window.
	Create event at *Review* window time	Inserts an event at the time in the *Review* window.
	Timer	Opens a *Timer* window.
	Stopwatch	Opens a *Stopwatch* window.
	Rename this window	Renames the window to the desired name.

Log window icons

Icon	Function	Detailed description
	Search log	Toggles between filtering the log by event type or search string.
	Filter log view	Selects the log events to display.
	New log filter group	Saves the custom log filter using a specified name.
	Delete log filter group	Deletes the currently selected custom log filter.
	Switch user	Provides a separate window in which to change the current user. This button only displays for non-authenticated User Tracking or for authenticated User Tracking with user selection. See 8.1.11.1 Set User Tracking on page 138 for user selection information.
	Take ownership of events	Provides a separate window in which to change the author of selected events (User Tracking only).
	Toggle author display	Toggles whether the author column is hidden or displayed (User Tracking only).
	Toggle location display	Toggles whether the location column is hidden or displayed (User Tracking only).
	Edit comments in separate window	Opens the *Comment* box in the *Review* window to enable edit mode.

Icon	Function	Detailed description
	Update	When active, provides view of most current entry in the log.
	First log entry	Moves to the first entry in the *Log* window.
	Last log entry	Moves to the last entry in the *Log* window.
	Undo delete event	Restores most recently deleted log entry.
	Redo delete event	Deletes most recently restored log entry.
	Create event at se-lected log time	Inserts an event at the time in the window.
	Print log	Prints the log.

Macro window icons

Icon	Function	Detailed description
	Folder Up	Navigates to the parent folder. (This button is disabled at the top-level macro folder.)
	Print	Prints all items in the highlighted categories folder.
	Edit mode	Enables the edit mode.
	Insert folder	Inserts a folder into the selected category.
	Insert item	Inserts item into specified folder location.
	Edit item or folder	Opens selected macro item for editing.
	Delete	Deletes the selected item.
	Cut	Removes the highlighted macro.

Icon	Function	Detailed description
	Copy	Copies the highlighted macro.
	Paste	Inserts cut or copied macro into specified location.

Image window icons

Icon	Function	Detailed description
	Live image	Displays live image.
	Freeze	Freezes the image in the window.
	Active	Makes the selected *Image* window active when two *Image* windows are open.
	Settings	Configures the *Image* window settings.
	Save	Save the image displayed in the window to the study.
	Print	Prints image in window.
	Annotate	Annotates saved image.
	Play	Starts playback of currently displayed image loop.
	Pause	Pauses playback of currently displayed image loop.
	Stop	Stops playback of currently displayed image loop.
	Previous frame	Goes backward one frame in currently displayed image loop.
	Next frame	Goes forward one frame in currently displayed image loop.

NOTE
Playback controls (play, pause, stop, previous frame, and next frame) can only be used on acquired image loops. These controls have no effect on live image display or frozen images.

Icon	Function	Detailed description
X-Ray #1	Input select	Selects input channel if multiple channels have been configured.
Zoom Auto	Zoom	Increases or decreases image size.
Contrast	Contrast	Adjusts the image contrast (for monochrome images only).
Brightness	Brightness	Adjusts the image brightness (for monochrome images only).

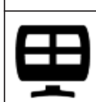
Holter window icons

Icon	Function	Detailed description
Signal V1	Signal	Selects signal to display in the *Holter* window.
Speed 6	Speed	Selects sweep speed of the *Holter* window.
Lines 10	Lines	Selects the number of lines displayed per page.

End Tidal CO2 window icons

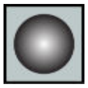
Icon	Function	Detailed description
− 25 +	Display speed	Use the + or - buttons to change the waveform display speed, or select a speed from the drop-down list or type the desired speed
	Start or stop $EtCO_2$ pump	Turns the module pump on and off.
	Calibrate $EtCO_2$ sensor	Zeroes the Capnostat sensor.
	Calibrate $EtCO_2$ adaptor	Calibrates the Capnostat airway adaptor.
0-50 mmHg	$EtCO_2$ range	Adjusts the waveform display scale in units of mmHg.
28% O2	O_2 compensation	Compensates for the presence of oxygen.

Toolbar icons

Icon	Function	Detailed description
	Close study	Closes the selected study and exits to the *Navigator* window.
	Auto-save	Enables or disables auto-save.
	Switch window settings	Opens the Select a Window Setting to switch window.
	Turn on or off audible indicators	Turns audible indicators on or off.

Icon	Function	Detailed description

Other icons

Icon	Function	Detailed description
	Connect with CARTO® 3 System	Turns a different color each time the system state changes.

Appendix B Abbreviations

This section lists and describes the abbreviations used in this manual.

B.1 Electrical and product abbreviations

Abbreviation	Description
Cal	Calibration
CCW	Centricity Cardio Workflow
CIM	Catheter Input Modules
Clin Proc	Clinical Procedures
Comp	Complications
Cond Intvls	Conduction Intervals
Cons Sed	Conscious Sedation
CPU	Central Processing Unit
CVIS	Cardiovascular Information System
DICOM	Digital Imaging and Communication in Medicine
DMS	Data Management System
dp/dt	Change in Pressure Per Unit in Time
EMC	Electromagnetic Compatibility
EMD	Electromagnetic Disturbances
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
GB	Gigabytes
Hz	Hertz
IEC	International Electrotechnical Commission
IMG	Image
INW	Invasive Network
kB	Kilobytes
kV	Kilovolts
LCD	Liquid Crystal Display
LDM	Large Display Monitor
LED	Light Emitting Diode
MB	Megabytes
Meds	Medications
MHz	Mega Hertz
MWL	Modality Work List

Abbreviation	Description
MPPS	Modality Performed Procedure Step
ms	Milliseconds
mV	Millivolts
OS	Operating System
PDM	Patient Data Module
RF	Radio frequency
RMOT	Remote Operators Terminal
ROI	Region of Interest
Trig	Trigger
UPS	Uninterruptible Power Supply
V	Volts

B.2 Hospital staff

Abbreviation	Description
CNS	Clinical Nurse Specialist
CRNA	Certified Registered Nurse Anesthetist
CVT	Cardiovascular Technologist
DO	Doctor Of Osteopathic Medicine
DR	Doctor
LPN	Licensed Practical Nurse
LVN	Licensed Vocational Nurse
MD	Doctor Of Medicine
NA	Nursing Assistant
NP	Nurse Practitioner
PA	Physician's Assistant
PhD	Doctor Of Philosophy
RCIS	Registered Cardiovascular Invasive Specialist
RCPT	Registered Cardiopulmonary Technologist
RCS	Registered Cardiac Sonographer
RN	Registered Nurse
RRT	Registered Respiratory Therapist
RT	Radiology Technologist/Respiratory Therapist
RT(R)	Registered Technologist In Radiology/Radiology Technologist Registered
RTRCV	Radiologic Technologist Registered Cardiovascular

B.3 Medical abbreviations

Abbreviation	Description
A-VO_2 diff	Arterial - Venous Oxygen difference
ACC	American College of Cardiology
ADT	Admission Discharge Transfer
AREA	Area - No Valve
ARP	Antegrade Refractory Period
ATM	Atmospheres
ATPS	Ambient Temperature and Pressure where Gas is Saturated with Water Vapor
aVF	Left Foot Augmented Lead
AVG	Aortic Valve Gradient
AVI	Aortic Index or Aortic Valve Area Index
aVL	Left Arm Augmented Lead
AVN ERP	Atrio-Ventricular Node Effective Refractory Period
aVR	Right Arm Augmented Lead
BIM	Bioelectric Impedance Measurement
BMI	Body Mass Index
BP	Blood Pressure
BPM	Beats Per Minute
BSA	Body Surface Area
Cath	Catheterization
CCU	Coronary Care Unit
CSNRT	Corrected Sinus Node Recovery Time
DFP	Diastolic Filling Period
DFPm	Mitral Diastolic Filling Period
DFT	Diastolic Filling Time
Dias	Diastolic
dPR	Diastolic Pressure Ratio
ECG	Electrocardiogram
ED	Emergency Department
EDP	End Diastolic Pressure
Emerg	Emergency
EP	Electrophysiology
ER	Emergency Room
ERP	Effective Refractory Period
ESU	Electrosurgical Unit
$EtCO_2$	End Tidal CO_2

Abbreviation	Description
FEO_2	Oxygen of Expired Air
FFR	Fractional Flow Reserve
FIO_2	Oxygen of Inspired Air
FLOW	Flow - No Gradient
Gy-cm_2	Gray-centimeter Squared
Hb	Hemoglobin
HIPAA	Health Insurance Portability and Accountability Act
HIS	Hospital Information System
HR	Heart Rate
HRA	High Right Atrium
HRU	Hybrid Resistance Units
HRVA	High Right Ventricular Apex
I/O	Intake/output
IABP	Intra-Aortic Balloon Pump
IC	Intracardiac
ICU	Intensive Care Unit
IM	Internal Mammary
INDEX	Valve Index or Area Index - No Valve
INSP CO_2	Inspired CO_2
LaM	Mean Left Atrial Pressure
LBAO	Low Abdominal Aorta
LCA	Left Coronary ArteryLeft Carotid Artery Left Circumflex Artery
LOC	Level of Consciousness
LOP	Level of Pain
LVEDP	Left Ventricular End Diastolic Period
LVET	Left Ventricular Ejection Time
LVFT	Left Ventricular Filling Time
MMF	Mean Maximum Flow
MRA	Mid Right Atrial
MRN	Medical Record Number
MV	Mixed Venous
MVG	Mitral Valve Gradient
MVI	Mitral Index or Mitral Valve Area Index
NIBP/NBP	Non-Invasive Blood Pressure
O_2	Oxygen
OP	Operation
Pa	Pressure Aortic

Abbreviation	Description
PAm	Mean Pulmonary Arterial Pressure
PCI	Percutaneous Coronary Intervention
Pd	Pressure Distal
PER	Period - No Value
PID	Patient Identification
PO_2	Dissolved Oxygen Tension or Partial Pressure of Oxygen
PVG	Pulmonary Valve Gradient
Rad	Radiology
RaM	Mean Right Atrial Pressure
RPVC	Right Pulmonary Vein Chamber in Cor Triatriatum
RRP	Retrograde Refractory Period
RVET	Right Ventricular Ejection Time
RVFT	Right Ventricular Filling Time
RVTRA	Right Vertebral Artery
SA	Systemic Artery
SAm	Mean Systemic Arterial Pressure
Sat	Saturation
SCL	Sinus Cycle Length
Sep/Dfp	Systolic Ejection Period divided by Diastolic Filling Period
SNRT	Sinus Node Recovery Time
SpO_2	Peripheral Capillary Oxygen Saturation
Stat	statim (Latin for immediately)
Stim	Stimulus
STPD	Standard Temperature and Pressure of Dry Gas
STS	Society of Thoracic Surgeons
Sync	synchronis
Sys	Systolic
TDCI	Thermodilution Cardiac Index
TDCO	Thermodilution Cardiac Output
TVG	Tricuspid Valve Gradient
VE ATPS	Minute volume at ATPS
VF	Valve Flow or Ventricular Fibrillation
WCT	Wilson Central Terminal
WU	Wood Units

B.4 Miscellaneous abbreviations

Abbreviation	Description
C	Centigrade
cm	Centimeters
cm^2	Centimeters squared
CO_2	Carbon Dioxide
F	Fahrenheit
gm/dl	Grams per deciliter
Grad	Gradient
Ht	Height
HH:MM:SS	Hours:Minutes:Seconds
ID	Identity or identifier
Info	Information
kgs	Kilograms
kPa	Kilopascal
lbs	Pounds
l/min	Liters per minute
$l/min/m^2$	Liters per minute per meter squared
mcg	Micrograms
ml/dl	Milliliters per deciliter
ml/min	Milliliters/minute
ml/s	Milliliters per second
mmHg	Millimeters of mercury
mm/sec	Millimeters per second
RAID	Redundant Array of Independent Disks
µA	Microamperes
UL	Underwriter's Laboratory

Appendix C INNOVA CENTRAL/Touch Screen

This chapter describes the INNOVA CENTRAL/Touch Screen and its functionality with the CardioLab system.

NOTE
When used with the Mac-Lab/CardioLab Systems, the INNOVA CENTRAL/Touch Screen is intended for use in the procedure room only.

C.1 Overview

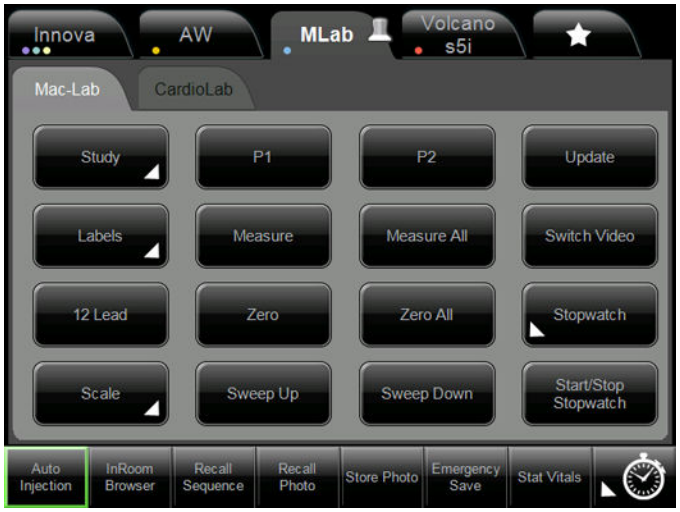
The INNOVA CENTRAL/Touch Screen provides an additional operator interface at the bedside.

The joystick to the right side of the screen controls the cursor movement on the Mac-Lab/CardioLab system when needed. The table side controller is intended only for operator convenience and should not take the place of an operator at the Acquisition system.

NOTE
To avoid loss of data, full-disclosure must be enabled if using the INNOVA CENTRAL/Touch screen when an operator is not present at the Acquisition system.

Exit the software application properly before turning off the system to ensure data integrity.

C.2 Screen layout



To access the CardioLab interface, choose the MLab tab at the top of the Touch Screen, and the CardioLab tab below. For information about the other tabs at the top of the Touch Screen, refer to the Innova operator manual. For the Mac-Lab tab, refer to the Mac-Lab User Manual (PN 5222001-1EN).

At the bottom of the Touch Screen, a row of permanent buttons is always available, regardless of which menu is selected.

When a small joystick is displayed on a button, it indicates that the Touch Screen joystick needs to be used to interact in the selected function.

NOTE
To prevent unintended operation, do not leave the Mac-Lab/CardioLab tabs selected when not performing Mac-Lab/CardioLab functions with the INNOVA CENTRAL/Touch Screen.

NOTE
To avoid loss of data, full-disclosure must be enabled if using the INNOVA CENTRAL/Touch screen when an operator is not present at the acquisition system.

C.3 Functions

Label	Description
Close Study	Closes the current CardioLab study in progress. • Yes/No confirmation on the INNOVA CENTRAL/Touch screen. • No confirmation from the CardioLab application.
Mark	Creates a new mark at the current time with the Mark text in the *Log* window.
12 Lead	Prints a Real-Time 12 lead. Also adds 12-Lead event to the log.
Pace	Switches the pacing settings to the highlighted channel poles.
Page Up	Displays the Real-Time window up one page at a time.
Page Down	Displays the Real-Time window down one page at a time.

Label	Description
Gain Up	Increases the gain for the selected ECG, intracardiac, or high-level input channels.
Gain Down	Decreases the gain for the selected ECG, intracardiac, or high-level input channels.
Auto Save	Enables/Disables the automatic saving option.
Manual Save	Starts/Stops saving the signals in the Real-Time window.
Sweep Up	Increases the scroll/sweep speed in the active window to the next scroll/sweep speed value up in the list.
Sweep Down	Decreases the scroll/sweep speed in the active window to the next scroll/sweep speed value down in the list.
Update	Saves about 10 seconds of signal data in the *Review* window (the actual time of data saved is dependant on the number of channels displayed). A corresponding entry appears in the Log (green time-stamp).
Switch Video	Toggles the video signal sent to the monitor in the procedure room.
Image Freeze	Freezes an image.
Emergency Save	Immediately starts saving signals in the *Real-Time* window to the study and saves as much data as possible from memory.
Stat Vitals	Performs a Stat Vitals measurement. The current HR, SpO_2, RR, temperature, Inspired CO_2, and Expired CO_2 are recorded as-is from the Patient Status area into the *Log* window.

Appendix D Pre-6.9 to 7.0 Study Converter Utility Operation

This section explains the procedures needed to use the optional pre-6.9 to 7.0 study converter utility. This utility converts studies that were created or saved using a Mac-Lab/CardioLab system older than v6.9, allowing them to be viewed on a Mac-Lab/CardioLab system that uses AltiX BT22.

NOTE
After the pre-6.9 studies are converted, they will no longer be readable by the pre-v6.9 Mac-Lab/CardioLab system. Create a copy of the study before conversion if the study has to be accessed on a pre-6.9 system.

1. Move the pre-6.9 compatible Mac-Lab or CardioLab studies to be converted to an accessible folder.
    1.1. Ensure that the user has read and write permissions for the folder.
    1.2. Ensure that the `Study.bak` file is not read only.

    NOTE
    The utility converts all the studies that are found in the selected folder and searchs all the subfolders one level down.
2. Open the study converter utility.
    - On Windows 7 systems: Right-click `Pre69 to 70 Study Converter.exe` and select **Run As Administrator**.
    - On all other systems: Double-click `Pre69 to 70 Study Converter.exe` on the desktop or go to **Start** > **Programs** > **Pre69 to 70 Study Converter**.
3. Enter the username `sa` in the *Pre6.9 to 7.0 Study Converter Utility* window.
4. Enter the correct password. Contact the site network administrator for the current password.
5. Select **Browse** and navigate to the folder where the studies are located.
6. Select **OK**.
7. Select **Convert**.

    When the conversion is complete, the studies are ready to use.

If the conversion fails, refer to the appropriate log file for more details.

Log file location	Description
`[Program Files Folder]` `\Pre69To70StudyConverter\Logs\Summary[timestamp].log`	[timestamp] is the time the log file was generated.

D.1 Retrieve pre-6.9 studies from an INW server

Archived study folders must be accessible from the system on which the pre-6.9 to 7.0 study converter utility is installed. The system on which the pre-6.9 studies reside must be brought into the same network of the system on which the pre-6.9 to 7.0 study converter utility is installed.

D.2 Retrieve pre-6.9 studies from an acquisition system

If the pre-6.9 studies are on an optical drive, then the customer must have an external MO drive. The pre-6.9 to 7.0 study converter utility can then convert the pre-6.9 studies to be compatible with the current Mac-Lab/CardioLab version. If the customer does not have the external MO drive, then the customer must move the pre-6.9 studies to a network location so the pre-6.9 studies can be accessed from the system on which the pre-6.9 to 7.0 study converter utility is installed.

D.3 Import and restore converted studies

To import the converted studies to an acquisition system, see 5.5.2.1 Import study on page 83.

To restore the converted studies to an INW server, refer to the restore archived files instructions in the Centricity Cardiology INW User Manual (PN 5222003-1EN).

Appendix E The Joint Commission (TJC)

This chapter describes The Joint Commission (previously known as JCAHO) and the Do Not Use List and provides links to relevant websites.

E.1 The Joint Commission

The Joint Commission (TJC) is an independent, not-for-profit organization based in the United States that evaluates and accredits health care organizations. Its mission is to continuously improve health care for the public, in collaboration with other stakeholders, by evaluating health care organizations and inspiring them to excel in providing safe and effective care of the highest quality and value.

Please see The Joint Commission website: http://www.jointcommission.org/ for more information.

E.2 Do Not Use List

In 2001, The Joint Commission issued a Sentinel Event Alert on the subject of medical abbreviations, and just one year later, its Board of Commissioners approved a National Patient Safety Goal which required accredited organizations to develop and implement a list of abbreviations that were not to be used. In 2004, TJC created its "do not use" list of abbreviations as part of the requirements for meeting that goal. In 2010, NPSG 02.02.01 was integrated into the Information Management standards as elements of performance 2 and 3 under IM 02.02.0.

For more information, see The Joint Commission website: http://www.jointcommission.org/.

The Mac-Lab/CardioLab systems are compliant with the required Do Not Use list. The Do Not Use list can be found on The Joint Commission website: http://www.jointcommission.org/.

Please see the official Joint Commission website for the most up to date lists: http://www.jointcommission.org/.

Appendix F mmHg to kPa Conversion Chart

This chapter provides a mmHg to kPa conversion chart.

The following table shows several common blood pressure scales in the default unit of mmHg (for example, 10 mmHg, 20 mmHg, etc.) along with the corresponding scale values in units of kPa.

mmHg	kPa	mmHg	kPa	mmHg	kPa	mmHg	kPa	mmHg	kPa	mmHg	kPa	mmHg	kPa
10	1.33	20	2.67	50	6.67	100	13.33	200	26.66	300	40.00	400	53.33
9	1.20	18	2.40	45	6.00	90	12.00	180	24.00	270	36.00	360	48.00
8	1.07	16	2.13	40	5.33	80	10.67	160	21.33	240	32.00	320	42.66
7	0.93	14	1.87	35	4.67	70	9.33	140	18.67	210	28.00	280	37.33
6	0.80	12	1.60	30	4.00	60	8.00	120	16.00	180	24.00	240	32.00
5	0.67	10	1.33	25	3.33	50	6.67	100	13.33	150	20.00	200	26.66
4	0.53	8	1.07	20	2.67	40	5.33	80	10.67	120	16.00	160	21.33
3	0.40	6	0.80	15	2.00	30	4.00	60	8.00	90	12.00	120	16.00
2	0.27	4	0.53	10	1.33	20	2.67	40	5.33	60	8.00	80	10.67
1	0.13	2	0.27	5	0.67	10	1.33	20	2.67	30	4.00	40	5.33
0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

NOTE
kPa mode and mmHg are configured separately on each system. If the kPa mode is used in a network, all acquisition and review systems in the network must be set to kPa mode.

Appendix G Glossary

Action Keys

The keys located on the keyboard with green lettering. Pressing the **Action** key and the desired green-labeled key simultaneously activates the action named on the face of the key.

Backup

Additional copy of patient study data. In a networked environment, data is backed up to the Centricity Cardiology INW server. On a stand-alone system, the data is backed up to external media.

Calipers

Used to measure the time between two points or the amplitude of a signal.

Catalog

A list of patient studies from the system, the network or other media including the following information: Study Type, Patient name, Medical Record Number, Study Date, Study Number and Location.

Clip

Limits the amount of signal displayed vertically.

Cursor Control Keys

The four arrow keys that manipulate the cursor to a specific location within the text area of the display.

Event Log

The electronic flow sheet that provides time and event documentation for all saved information within a case.

Full or Complete Disclosure

The storage of saved case data onto the computer, network or external media. Saved information can be reviewed, relabeled, remeasured and reprinted at any time after the information has been saved within the system.

Function Keys

The keys located across the top of the keyboard. Pressing a function key activates the function named on the top of the key. Pressing the **Shift** (blue) and a function key simultaneously activates the function named on the front face of the key.

Gain

Increases the amplitude of a displayed ECG or intracardiac signal.

Macros

A series of events that are expected to occur during a case. These can be programmed within the system to be performed with a single keystroke.

Master Lists

The lists that are stored in multiple databases within the system. These include Medications, Complications, Procedures, Contrast, Supplies and Staff.

Menu Bar

A list of word commands located at the top of the Real-Time or Review window that enable quick performance of specific tasks.

Nurse's Workstation

The Nurse's Workstation allows on-line review of cases. Simultaneous data entry can be performed at a Nurse's Workstation during an ongoing study. The Nurse's Workstation accesses the real-time data with a slight delay.

Offset

Vertically spaces the signals displayed on the window.

Phases

Organized groups of information to identify a change in patient condition.

Pre/Post Review Workstation

The Pre/Post Review Workstation is a Review workstation typically located in the Holding Area for the entry of basic patient demographics, vitals and medications prior to, or after, the patient's entry into the Laboratory. This information can be accessed from the procedure room. A CARESCAPE, Dash, or Solar patient monitor may be used to monitor and record patient vitals.

Real-Time Window

The window that displays signal data as it is occurring.

Review Window

The window that is used to review and manipulate all saved signal data.

Scroll

Real-time waveforms are updated across the width of the screen. Waveforms move from right to left.

Server

A networked computer that allows files, devices or other resources to be shared by network users.

Stopwatch

A clock that counts forward. It appears in the Real-Time window and can be used to time events.

Scroll/Sweep Speed

The speed at which signals are displayed on the Real-Time and Review windows.

Sweep

Real-time waveforms updated in a vertical column (moment in time). Update moves from left to right.

Timer

A countdown clock that appears in the Real-Time window used to time events.

Toolbar

A list of commands located at the top of the Real-Time or Review window that contain buttons with images, enabling quick performance of specific tasks.

Vitals

A set of measurements of a patient's condition. These measurements include heart rate, respiration rate, SpO_2 and invasive or non-invasive blood pressure.

Workstation Desk

The desk that holds the Mac-Lab or CardioLab computer and all of its components.

Page intentionally left blank

Appendix H Technical Specifications

H.1 Electrical power

WARNING

SHOCK HAZARD

Incorrect power connections could result in an electrical hazard. Power the isolation transformer only as specified. Do not use extension cords or power strips.

WARNING

SHOCK HAZARD

To reduce the risk of electric shock or damage to equipment, the equipment must only be connected to a properly installed power outlet with protective ground contacts.

NOTE
To ensure an adequate system power supply, GE HealthCare recommends using a dedicated circuit to power the isolation transformer.

H.2 Atmospheric conditions

	Temperature	Relative humidity	Pressure	Maximum altitude
Operating	15°C – 30°C 59°F – 86°F	30% to 70%	700 hPA to 1060 hPA	3000 m 9843 ft
Non-operating	-10°C – 50°C 14°F – 122°F	15% to 85%	700 hPA to 1060 hPA	N/A

H.3 Intracardiac and surface ECG

- Gain accuracy: +/- 10%
- Time base accuracy: +/- 10%
- ECG heart rate range: 30 to 300 bpm
- ECG heart rate accuracy: +/- 10% or +/- 5bpm
- Effective gain selections: 50, 100, 250, 500, 1000, 2500, 5000, 10000
- Sweep speed options: 5, 10, 25, 50, 100, 200, 400, 800
- Common mode rejection ratio: 120 dB (Prucka 3)
- Typical baseline RMS noise: 1 µV

H.4 Invasive blood pressure

- Measurement range: -30 to 350 mmHG
- Measurement accuracy: +/- 4% or +/- 4 mmHg
- Sweep speed options: 5, 10, 25, 50, 100, 200, 400, 800

H.5 Validated third party software

The following third party software has been validated for use with the Mac-Lab/CardioLab system:

- Operating system updates: refer to the Security Portal for Mac-Lab/CardioLab: https://securityupdate.gehealthcare.com/

  NOTE
  Accessing the Mac-Lab/CardioLab/INW specific information on the security portal requires registering to the portal and navigating to the appropriate product in the portal.

- Anti-virus software: refer to the Security Portal for Mac-Lab/CardioLab: https://securityupdate.gehealthcare.com/

  NOTE
  Accessing the Mac-Lab/CardioLab/INW specific information on the security portal requires registering to the portal and navigating to the appropriate product in the portal.

- Enterprise backup software: No specific enterprise backup software has been validated. It is the customer's responsibility to acquire, install, and maintain the enterprise backup software.
- PedCath: refer to the Mac-Lab/CardioLab/Centricity Cardiology INW Options Installation Manual (PN 5222013-1EN).
- Centricity Cardiology DMS: 4.2.10, 4.2.11, 4.2.13, 4.2.15, 4.2.16, 4.3, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.4
- Centricity Cardio Workflow: 6.0, 6.0 SP4.0.3, 6.0 SP4.3, 6.0 SP4.3.1, 6.0 SP5, 6.0 SP6, 6.0 SP6.2.1, 7.01, 7.0 SP2.2, 7.0 SP3.0.1, 7.0 SP3.1, 7.0 SP3.1.1, 7.0 SP3.2, 7.0 SP3.2.1, 7.0 SP3.3, 7.0 SP3.3.1, 7.0 SP4, 7.0 SP4.0.1, 7.0 SP4.1.1, 7.0 SP5, 7.0 SP6, 7.0 SP7.

WARNING

SYSTEM INSTABILITY

Do not install or use anti-virus software that does not meet the requirements mentioned in the ICAR security website. Doing so may result in system instability or failure.

Refer to the Mac-Lab/CardioLab/Centricity Cardiology INW Pre-Installation Manual (PN 5222007-1EN) for the GE HealthCare policy on non-validated software applications.

Appendix I Battery Maintenance

I.1 PDM Battery

The Patient Data Module (PDM) uses one Rechargeable lithium-ion battery that supplies power when used with a transport monitor or whenever AC power is interrupted.

WARNING

EXPLOSION OR FIRE HAZARD

Using non-recommended batteries could result in injury/burns to the patients or users.

Only use batteries recommended or manufactured by GE HealthCare. The warranty can be voided if non-recommended batteries are used.

I.1.1 Storage recommendations

Store the battery outside of the device at a temperature between 20 C and 25 C (68 F to 77 F). Storing the battery inside the PDM is not recommended.

I.1.2 Battery maintenance

Charging the battery

Charge the PDM battery by inserting it into the PDM and connecting the PDM to an AC-powered host.

Testing the battery

1. Press the **TEST** button on the PDM battery to check the approximate percentage of charge remaining in the battery.

2. Observe how many LEDs are illuminated. Note the following:

Number of illuminated LEDs	Full charge capacity remaining
4 LEDs	75% – 100%
3 LEDs	50% – 74.9%

Number of illuminated LEDs	Full charge capacity remaining
2 LEDs	25% – 49.9%
1 LED	10% – 24.9%

NOTE
1 LED flashing = less than 10% of full charge capacity remaining

I.1.3 Replacing the battery

I.1.3.1 Safety

WARNING

EXPLOSION OR FIRE HAZARD

Using non-recommended batteries could result in injury/burns to the patients or users.

Only use batteries recommended or manufactured by GE HealthCare. The warranty can be voided if non-recommended batteries are used.

WARNING

EXPLOSION HAZARD

Do not incinerate the battery or store at high temperatures. Serious injury or death could result.

I.1.3.2 Replace the battery

1. Open the battery door by gently pulling on the battery door pull tab.

2. Pull the battery tray out of the PDM using the battery tray strap and remove the battery from the battery tray.

3. Insert the new battery with the test button facing up and the arrow pointing into the PDM.

4. Press the battery door closed until it seals the battery compartment.

WARNING

PHYSICAL INJURY

Do not install the device above a patient. Make sure the battery is completely inserted and the battery door is completely closed. Falling batteries could seriously or fatally injure neonatal or other vulnerable patients.

5. Press the **Power** button on the PDM.
6. Verify that the power indicator illuminates amber while the PDM boots up, then illuminates green.

I.2 Recycling lithium-ion batteries

WARNING

EXPLOSION HAZARD

Do not incinerate the battery or store at high temperatures. Serious injury or death could result.

This product contains lithium-ion batteries. At the end of their service life, batteries in this product must be recycled or disposed in accordance with local or national regulations. Do not dispose of batteries as trash or unsorted municipal waste. Requirements and services for recycling of batteries vary between countries.

- USA: You may follow the battery manufacturer's instructions on the battery to recycle it. Alternatively, you may return GE HealthCare product batteries to GE HealthCare for recycling. For information about returning batteries to GE HealthCare, contact your authorized GE HealthCare Service representative or contact GE HealthCare Equipment Services at 1-800-437-1171.
- Canada: Contact the approved battery stewardship program in your province for information on recycling your batteries.
- Other countries: Recycle batteries through your local, regional or national collective scheme in accordance with your local or national regulations.

Appendix J Regulatory Markings: Software UDI Labels

UDI (Unique Device Identification) is a system to adequately identify medical devices through their distribution and use. This system applies to all medical devices.

This manual supports the following medical devices:

- GE client software
- GE client workstation
- INW server

To access the UDI for any of the devices listed above, click **Help** > **About...** from within the Mac-Lab or CardioLab application. The UDI marking appears in the UDI section of the *About…* screen.

On the INW server, click **Archive Utility** > **Help** > **About GEMS Utilities...** to access the UDI.

NOTE
All medical devices may not be available in all regions.

GE HealthCare

www.gehealthcare.com