GE Healthcare

ApexPro™ Telemetry System

Operator's Manual

Software Version 4

ApexPro™
English
2028341-001 (CD)
2028340-001E (paper)

NOTE

Due to continuing product innovation, specifications in this manual are subject to change without notice. The information in this manual applies to ApexPro software version 4 or later.

NOTE

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CE marking information

Compliance

The ApexPro telemetry system bears CE mark CE-0459 indicating conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices, and fulfills the essential requirements of Annex I of this directive. The product is radio-interference protection class A in accordance with EN 55011.

The country of manufacture can be found on the equipment labeling.

The product complies with the requirements of standard EN 60601-1-2 “Medical electrical equipment - Part 1-2: General requirements for safety - Collateral standard: Electromagnetic compatibility - Requirements and tests.”

The safety and effectiveness of this device has been verified against previously distributed devices. Although all standards applicable to presently marketed devices may not be appropriate for prior devices (i.e. electromagnetic compatibility standards), this device will not impair the safe and effective use of those previously distributed devices.

Exceptions

The CIC Pro Clinical Information Center and telemetry server are suitable for use in the specified electromagnetic environment. For more information, refer to the appropriate service manual.

R&TTE directive

The ApexPro 420-460 MHz transmitters and receiver system conform to the R&TTE Directive 1999/5/EC.

For more information, refer to the appropriate service manual.

General information

- This manual is an integral part of the product and describes its intended use. It should always be kept close to the equipment. Observance of the manual is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.
- The symbol  means ATTENTION: Consult accompanying documents.
- Information which refers only to certain versions of the product is accompanied by the model number(s) of the product(s) concerned. The model number is given on the nameplate of the product.
- The warranty does not cover damages resulting from the use of accessories and consumables from other manufacturers.
- GE is responsible for the effects on safety, reliability, and performance of the product, only if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE;
- the electrical installation of the relevant room complies with the requirements of the appropriate regulations; and,
- the device is used in accordance with the instructions for use.

- All publications conform with the product specifications and applicable IEC publications on safety and essential performance of electromedical equipment as well as with applicable UL and CSA requirements and AHA recommendations valid at the time of printing.
- The quality management system complies with the international standards ISO 9001 and ISO 13485, and the Council Directive on Medical Devices 93/42/EEC Annex II.

Contents

1 Introduction

Manual information

Purpose

This manual contains the instructions necessary to operate the ApexPro telemetry system safely and in accordance with its function and intended use.

It also contains limited instructions necessary to operate the telemetry system when used with the CIC Pro Clinical Information Center. For more information, refer to Related documents on page 1-2.

Intended audience

This manual is intended for clinical professionals. Clinical professionals are expected to have a working knowledge of medical procedures, practices, and terminology, as required for monitoring of critically ill patients.

Related documents

This manual assumes that you are familiar with the operating procedures of the CIC Pro Clinical Information Center. It uses the CIC Pro software version 5 (or later) user interface for procedures, navigation and illustration purposes.

If your system uses an earlier CIC Pro software version, you may notice minor discrepancies between what you see on the equipment and the information presented in this manual. Refer to the documentation provided with your system for the most accurate operator's and service instructions.

Conventions used

Equipment terms

This manual uses the following terms to simplify common equipment names.

Term	Description
CIC Pro center	Refers to the CIC Pro Clinical Information Center.
Monitor	Refers to a bedside monitor, transport monitor, blood pressure monitor, or a wireless monitor on the Unity Network.
Printer	Refers generically to a direct digital writer or a laser printer.
Transmitter	Refers to the ApexPro and/or ApexPro CH transmitter.
Writer	Refers to the PRN 50-M digital writer.

Text styles

This manual uses the following text styles to identify hardware terms, software terms and the correct way to enter data.

Style	Definition
Bold	Indicates hardware items, such as keys, labels or connectors.
Bold and italicized	Indicates software items, such as menus, menu options or screen text.
Italics	Emphasizes a word.
>	Indicates menu options or control settings to select consecutively.
+	Indicates keyboard keys to select simultaneously.

Illustrations and names

In this manual, all illustrations are provided as examples only. They may not necessarily reflect your monitoring setup or data viewed on your monitoring device.

All names appearing in examples and illustrations are fictitious. The use of any real person's name is purely coincidental.

Ordering manuals

A paper copy of this manual will be provided upon request. Contact your local GE representative and request the part number on the first page of the manual.

Revision history

Each page of the document has the document part number and revision letter at the bottom of the page. The revision letter changes whenever the document is updated.

Revision	Comments
A	Release of ApexPro software version 4.
B	Updated equipment symbols, EMC warning and covers.
C	Corrected UL equipment symbol text, updated ***Change Battery*** information and corrected ApexPro telemetry server certifications.
D	Updated for new hardware and updated Intended use, Optional components, Electrode placement, Infants and pulse oximetry, and Technical specification sections.
E	Updated SPO2 information, added Loss of Alarms Warnings, updated R&TTE, added definition of minimize/maximize buttons, clarified infant/ pediatric terms.

Equipment information

Intended use of this equipment

The ApexPro telemetry system is intended for use under the direct supervision of a licensed healthcare practitioner. The system is designed to acquire and monitor physiological data for ambulating patients within a defined coverage area. The system processes this physiological data to detect various ECG arrhythmia events and select physiological parameter limit violations.

The ApexPro telemetry system is intended to be installed in the hospital or clinical environment in order to provide clinicians with patient physiological data, while allowing for patient mobility. These systems are typically deployed in sub acute care areas in hospitals or clinical sites where patient mobility can enhance the effectiveness of the medical procedures administered.

The physiological parameters monitored include ECG, non-invasive blood pressure, non-invasive temperature and SpO2. The ApexPro telemetry system is intended to provide ECG data via Ethernet to the computer platform for processing. The ApexPro is also intended to provide physiologic data over the Unity network to clinical information systems for display.

Safety statements

The safety statements presented in this chapter refer to the equipment in general and, in most cases, apply to all aspects of the device. There are additional safety statements in other chapters which are specific to that chapter content.

The order in which safety statements are presented in no way implies the order of importance.

Dangers

Danger statements identify an imminent hazard which, if not avoided, will result in death or serious injury. No danger statements apply to this system.

Warnings

Warning statements identify a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

The following warning statements apply to this system.

WARNING
Do not monitor pacemaker patients with a 3-leadwire set when reliable pacer detection is required. Pacer pulse detection can be erratic when only a single vector is monitored. Always use a 5- or 6-leadwire set when reliable pacer detection is required.

WARNING
ACCESSORIES (SUPPLIES) — To ensure patient safety, use only parts and accessories manufactured or recommended by GE.

Parts and accessories used must meet the requirements of the applicable IEC 60601 series safety standards and essential performance standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

WARNING
ACCESSORIES (EQUIPMENT) — The use of accessory equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the patient vicinity; and
- evidence that the safety certification of the accessory has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

WARNING
ACCIDENTAL SPILLS — To avoid electric shock or device malfunction, liquids must not be allowed to enter the device. If liquids have entered a device, take it out of service and have it checked by a service technician before it is used again.

WARNING
ACCURACY — If the accuracy of any value displayed on the monitor, central station, or printed on a graph strip is questionable, determine the patient's vital signs by alternative means. Verify that all equipment is working correctly.

WARNING
ADJUSTING SYSTEM ALARM LEVELS — The ***Leads Fail*** alarm indicates that one or more electrodes are not connected to the patient and, as a result, there is loss of all waveforms and arrhythmia analysis. The ***ARR SUSPEND*** alarm indicates that arrhythmia conditions are not being detected and therefore alarms associated with arrhythmias will not occur. The ***Leads Fail*** and ***ARR SUSPEND*** alarms should be adjusted to a lower priority level only by experienced qualified personnel and with great caution. Adjusting these alarms to a lower priority level may result in reduced awareness of conditions that indicate the loss of patient monitoring.

WARNING
ALARMS — Do *not* rely exclusively on the audible alarm system for patient monitoring. Adjustment of ***Alarm Volume*** to a low level or off during patient monitoring may result in a hazard to the patient. Remember that the most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.

After connecting the monitor to the central station, nurse-call system, and/or network, verify the function of the alarm system.

The functions of the alarm system for monitoring of the patient must be verified at regular intervals.

Do not rely exclusively on the ***Alarm Pause Breakthrough*** feature for alarm notification during an alarm pause. This may result in a hazard to the patient. Only crisis alarms break through an alarm pause.

WARNING
BEFORE INSTALLATION — Compatibility is critical to safe and effective use of this device. Please contact your local sales or service representative prior to installation to verify equipment compatibility.

WARNING
BEFORE USE — Before putting the system into operation visually inspect all connecting cables for signs of damage. Damaged cables and connectors must be replaced immediately.

Before using the system, the operator must verify that it is in correct working order and operating condition.

Periodically, and whenever the integrity of the product is in doubt, test all functions.

WARNING
CABLES — Route all cables away from patient's throat to avoid possible strangulation.

WARNING
CONDUCTIVE CONNECTIONS — Extreme care must be exercised when applying medical electrical equipment. Many parts of the human/machine circuit are conductive, such as the patient, connectors, electrodes, transducers. It is very important that these conductive parts do not come into contact with other grounded, conductive parts when connected to the isolated patient input of the device. Such contact would bridge the patient's isolation and cancel the protection provided by the isolated input. In particular, there must be no contact of the neutral electrode and ground.

WARNING
DEFIBRILLATION — Do not come into contact with patients during defibrillation. Otherwise serious injury or death could result.

WARNING
DISCONNECTION FROM MAINS — When disconnecting the system from the power line, remove the plug from the wall outlet first. Then you may disconnect the power cord from the device. If you do not observe this sequence, there is a risk of coming into contact with line voltage by inserting metal objects, such as the pins of leadwires, into the sockets of the power cord by mistake.

WARNING
DISPOSAL — Dispose of the packaging material, observing the applicable waste control regulations and keeping it out of children's reach.

WARNING
DUST COVERS — If the dust covers for the interface connectors become detached from the transmitter, they may pose a choking hazard for pediatric patients. Inspect the dust covers before each use to verify that they are securely attached. If the dust covers become detached and cannot be reinserted into their retaining slot, do not use them on the transmitter, and keep them out of pediatric patients' reach.

WARNING
ELECTRODES — Whenever patient defibrillation is a possibility, use non-polarizing (silver/silver chloride construction) electrodes for ECG monitoring. Polarizing electrodes (stainless steel or silver constructed) may cause the electrodes to retain a residual charge after defibrillation. A residual charge will block acquisition of the ECG signal.

WARNING

ELECTROMAGNETIC INTERFERENCE — Operation of transmitters outside the designated WMTS frequency band (608-614 MHz) is at increased risk for electromagnetic interference. WMTS is protected in the U.S. only. This interference could lead to lapses in patient monitoring and missed alarm events, putting the patient at risk and compromising patient safety.

WARNING

EMC INTERFERENCE— Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason make sure that all external devices operated in the vicinity of the monitoring system comply with the relevant EMC requirements. X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.

Interference may cause changes to ECG baseline waveform, which may not be obvious to a clinician.

WARNING

EMC— Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason make sure that all external devices operated in the vicinity of the monitoring system comply with the relevant EMC requirements. X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.

Changes or modifications to this device/system not expressly approved by GE may cause EMC issues with this or other equipment. This device/system is designed and tested to comply with applicable standards and regulations regarding EMC and needs to be installed and put into service according to the EMC information stated as follows:

Use of known RF sources, such as cell/portable phones, or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation of this device/system. Consult qualified personnel regarding device/system configuration.

The device/system should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the device/system should be tested to verify normal operation in the configuration in which it is being used. Consult qualified personnel regarding device/system configuration.

The use of accessories, transducers and cables other than those specified may result in increased emissions or decreased immunity performance of the device/system.

This device/system is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. Mains power should be that of a typical commercial or hospital environment. Device is compliant to Class A.

WARNING

EXPLOSION HAZARD — Do not use this equipment in the presence of flammable anesthetics, vapors or liquids.

WARNING

IMPROPER TRANSMITTER/LEADWIRE APPLICATION — Applying a transmitter and/or leadwire that is not thoroughly dry to a patient can result in an electrically conductive path being established and a ***Leads Fail*** alarm not being provided if leadwires come off the patient.

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING AND CALCULATIONS BASED ON PATIENT AGE — After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

WARNING
INTERFACING OTHER EQUIPMENT — Devices may only be interconnected with each other or to parts of the system when it has been determined by qualified biomedical engineering personnel that there is no danger to the patient, the operator, or the environment as a result. In those instances where there is any element of doubt concerning the safety of connected devices, the user must contact the manufacturers concerned (or other informed experts) for proper use. In all cases, safe and proper operation should be verified with the applicable manufacturer's instructions for use, and system standards IEC 60601-1-1/EN 60601-1-1 must be complied with.

WARNING
LEAKAGE CURRENT TEST — When interfacing with other equipment, a test for leakage current must be performed by qualified biomedical engineering personnel before using with patients.

WARNING
LOSS OF ALARMS—Do not use transmitter accessory devices such as SpO2 and NBP without ECG cables attached. Failure to use accessory devices in the prescribed manner may result in a loss of alarms.

WARNING
LOSS OF DATA — Should the monitor at any time temporarily lose patient data, the potential exists that active monitoring is not being done. Close patient observation or alternate monitoring devices should be used until monitor function is restored.

If the monitor does not automatically resume operation within 60 seconds, power cycle the monitor using the power on/off switch. Once monitoring is restored, you should verify correct monitoring state and alarm function.

WARNING
LOSS OF DATA — Caregivers and telemetry patients should be made aware of antenna coverage areas. Movement outside of the coverage area may result in loss of patient monitoring.

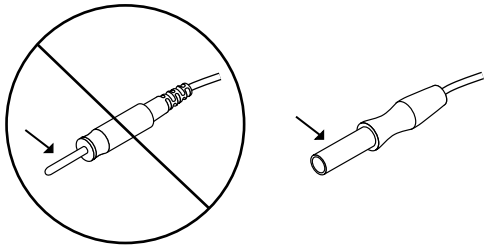
WARNING
NETWORK INTEGRITY — The telemetry server resides on the Unity network. It is possible that inadvertent or malicious network activity could adversely affect patient monitoring. The integrity of the Unity network is the responsibility of the hospital.

WARNING
OPERATOR — Medical technical equipment such as this monitor/monitoring system must only be used by persons who have received adequate training in the use of such equipment and who are capable of applying it properly.

WARNING
POWER SUPPLY — All power line devices must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect the device from the power line and operate it on battery power, if possible.

All devices of a system must be connected to the same power supply circuit. Devices which are not connected to the same circuit must be electrically isolated when operated (electrically isolated EIA232 interface).

WARNING
PROTECTED LEADWIRES — Only use protected leadwires and patient cables with this device. The use of unprotected leadwires and patient cables creates the potential for making an electrical connection to ground or to a high voltage power source which can cause serious injury or death to the patient.



Unprotected Leadwire Protected Leadwire

322C

WARNING
RATE METERS — Keep pacemaker patients under close observation. Rate meters may continue to count the pacemaker rate during cardiac arrest and some arrhythmias. Therefore, do not rely entirely on rate meter alarms.

WARNING
SINGLE PATIENT USE —This transmitter is designed for use on one patient at a time. Using this equipment to monitor different parameters on different patients at the same time compromises the accuracy of data acquired.

WARNING
SITE REQUIREMENTS — For safety reasons, all connectors for patient cables and sensor leads are designed to prevent inadvertent disconnection, should someone pull on them. Do not route cables in a way that they may present a stumbling hazard. For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

Cautions

Caution statements identify a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

The following caution statements apply to this system.

CAUTION
ADJUSTING WAVEFORM COLORS — For an unlocked patient bed, the waveform color changes remain in effect until the bed is removed from the display, discharged, or until the bed is moved to a different location on the display. At this time, the waveform colors return to the default settings.

For locked patient bed, the color changes remain in effect until a user manually changes the colors. Moving or discharging a patient bed does not return the waveform colors to the default settings.

CAUTION

DEFIBRILLATOR PRECAUTIONS — Patient signal inputs labeled with the CF and BF symbols with paddles are protected against damage resulting from defibrillation voltages. To ensure proper defibrillator protection, use only the recommended cables and leadwires.

Proper placement of defibrillator paddles in relation to the electrodes is required to ensure successful defibrillation.

CAUTION

DELAY IN LEAD DETECTION— When using a 3-leadwire set, there may be up to a 10 second delay in detection of the ECG waveform. A ***Leads Fail*** or ***No Telem*** alarm may be temporarily displayed.

Wait for 10 seconds the ECG waveforms will be displayed.

CAUTION

DISPOSABLES — Disposable devices are intended for single use only. They should not be reused as performance could degrade or contamination could occur.

CAUTION

DISPOSAL — At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have questions concerning disposal of the product, please contact GE or its representatives.

CAUTION

ELECTROCAUTERY PRECAUTIONS — To prevent unwanted skin burns, apply electrocautery electrodes as far as possible from all other electrodes, a distance of at least 15 cm/6 in. is recommended.

CAUTION

FALSE ALARMS—If clinical workflow includes pre-admitting telemetry transmitters, attach ECG leadwires to patient prior to attaching ECG leadwires to transmitter. Failure to follow this sequence may result in false alarms or interruption in ECG waveform.

CAUTION
FALSE ALARMS—Low amplitude QRS beats may impair paced beat detection. This may result in false positive asystole alarms.

Keep pacemaker patients under close observation.

CAUTION
INSTRUCTIONS FOR USE — For continued safe use of this equipment, it is necessary that the listed instructions are followed. However, instructions listed in this manual in no way supersede established medical practices concerning patient care.

CAUTION
MAINTENANCE — Regular preventive maintenance should be carried out annually. You are responsible for any requirements specific to your country.

CAUTION
MPSO — Do not use a multiple portable socket outlet (MPSO) for a system because it could result in unacceptable enclosure leakage currents.

CAUTION
NEGLIGENCE — GE does not assume responsibility for damage to the equipment caused by improperly vented cabinets, improper or faulty power, or insufficient wall strength to support equipment mounted on such walls.

CAUTION
POWER REQUIREMENTS — Before connecting the device to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the unit's label. If this is not the case, do not connect the system to the power line until you adjust the unit to match the power source.

In the U.S.A., if the installation of this equipment will use 240 V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

This equipment is suitable for connection to public mains as defines in CISPR 11.

CAUTION
RESTRICTED SALE — U.S. federal law restricts this device to sale by or on the order of a physician.

CAUTION
SECURITY — The web browser which runs in conjunction with the telemetry server is intended for hospital INTRANET use only. If confidential patient information is made available from the hospital intranet, the security of the data is the responsibility of the hospital.

CAUTION
SUPERVISED USE — This equipment is intended for use under the direct supervision of a licensed health care practitioner.

CAUTION
UNINTENTIONAL RADIO FREQUENCY (RF) INTERFERENCE — Unintentional RF interference could degrade the reliability and performance of the wireless data link. The facility must maintain an RF environment free from unintentional interference. Refer to the service manuals for more information.

CAUTION
VENTILATION REQUIREMENTS — Set up the device in a location which affords sufficient ventilation. The ventilation openings of the device must not be obstructed. The ambient conditions specified in the technical specifications must be ensured at all times.

CAUTION
When using the ApexPro transmitter with a 3-leadwire set, an RF signal continues to be transmitted upon removal of ECG leadwires. A ***Leads Fail*** alarm appears at the central station however the system does not transition to a ***No TELEM*** alarm.

Please take appropriate measures as explained in this manual for the leads fail condition.

If an SpO2 and/or NIBP device is connected to the transmitter, an NIBP or SpO2 limit alarm with warning or advisory as configured by the user will supersede the existing ***Leads Fail*** system warning alarm.

Notes

Note statements provide application tips or other useful information.

The following note statements apply to this system.

- Put the CIC Pro center in a location where you can easily see the screen and access the operating controls.
- This product is not likely to cause abnormal operation of other patient-connected equipment such as cardiac pacemakers or other electrical stimulators. Exceptions are noted in the pacemaker monitoring section, if applicable.
- This product is protected against the effects of cardiac defibrillator discharges to ensure proper recovery, as required by test standards.
- This equipment is suitable for use in the presence of electrosurgery.

Equipment symbols

NOTE

Some symbols may not appear on all equipment.

	ATTENTION: Consult accompanying documents.
	TYPE B APPLIED PART: Non-isolated applied part suitable for intentional external and internal application to the patient excluding direct cardiac application. [Medical Standard Definition:] Applied part complying with the specified requirements of IEC/EN/UL 60601-1 Medical Standards to provide protection against electric shock, particularly regarding allowable leakage current.
	TYPE CF APPLIED PART: Isolated (floating) applied part suitable for intentional external and internal application to the patient including 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/EN/UL 60601-1 Medical Standards to provide a higher degree of protection against electric shock than that provided by Type BF applied parts.
	Interface connector(s)
IPX3	Complies with IPX3 standards (IEC 60529) for protection against water ingress under test conditions; water sprayed at an angle up to 60 degrees on either side of the vertical axis shall have no harmful effects, with device not in actual use.
IPX7	Complies with IPX7 standards (IEC 60529) for protection against water ingress under test conditions; immersion in one meter of water for 30 minutes, with device not in actual use.
	R&TTE equipment class 2 identifier: An alert sign, indicating that transmitting radio equipment operates in non-harmonized frequency bands and can cause interference.
	Non-ionizing electromagnetic radiation: To indicate elevated, potentially dangerous, levels of non-ionizing radiation. Note - In case of application in a warning sign the rules according to ISO 3864-1 shall be adhered to. IEC 60878 note: See safety sign ISO 7010 - W005 “Warning, non-ionizing radiation”.

	This symbol 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 your equipment.
	This symbol indicates the date of manufacture of this device. The first four digits identify the year and the last two digits identify the month.
	Medical Equipment With respect to electric shock, fire and mechanical hazards only in accordance with UL 60601-1, CAN/CSA C22.2 NO. 601.1, IEC 60601-1, IEC 60601-1-1, IEC 60601-2-27 and IEC 60601-2-49.
	Manufacturer name and address.
	European authorized representative.

Equipment compliance

IEC, UL, and EN 60601-1 device classification

Type of protection against electrical shock	Transmitter — Internally powered Receiver system — Class I
Degree of protection against electrical shock	ApexPro transmitter — Type CF Defibrillation proof applied part ApexPro CH transmitter — Type CF Defibrillation proof applied part
Degree of protection against harmful ingress of water	ApexPro transmitter — IPX3 (IEC 60529)[1] ApexPro CH transmitter — IPX7 (IEC 60529)[2] Receiver system — Ordinary Equipment (enclosed equipment without protection against ingress of water)
Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide	Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide
Method(s) of sterilization or disinfection recommended by the manufacturer	Not applicable
Mode of operation	Continuous operation

[1]The ApexPro transmitter is designed to be IPX3 compliant, so it can withstand inadvertent exposure to sprays. The transmitter should not be exposed to spray or shower during patient monitoring

[2]The ApexPro CH transmitter is designed to be IPX7 compliant, so it can withstand inadvertent submersion. The transmitter should not be exposed to spray or shower during patient monitoring.

FCC compliance information statement

The ApexPro CH transmitter complies with Part 95 Subpart H of the FCC rules to be used in wireless medical telemetry service. Operation of this equipment requires prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service. This device is also certified for RSS-210 of Industry Canada.

Installation and maintenance of this transmitter should be performed by a person certified as technically qualified to perform such operations. Replacement of any transmitter component or modifications to the transmitter could result in a violation of the rules. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Use only GE approved replacement parts, non-approved parts may result in a violation of the FCC rules.

RF Exposure

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. The RF transmission power from the antenna conforms to the general public FCC limit of Specific Absorption Rate (SAR) 1.6 W/kg. The maximum SAR value measured from this device was 0.01 W/kg. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada

Industry Canada

Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) RSS-210

This telemetry device is only permitted for installation in hospitals and health care facilities. Devices shall not be operated in mobile vehicles (even ambulances and other vehicles associated with health care facilities). The installer/user of this device shall ensure that it is at least 80 km from the Penticton radio astronomy station (British Columbia latitude: 49° 19' 12" N, longitude: 118° 59'56" W).

For medical telemetry systems not meeting this 80 km separation (e.g. the Okinagan valley, British Columbia) the installer/ user must coordinate with and obtain the written concurrence of the Director of the Penticton radio astronomy station before the equipment can be installed or operated. The Penticton contact is Tel: 250-493-2277/ fax 250-493-7767. (In case of difficulty, the Manager, Radio Equipment Standards, Industry Canada, may also be contacted, see section 2.3).

2 Equipment overview

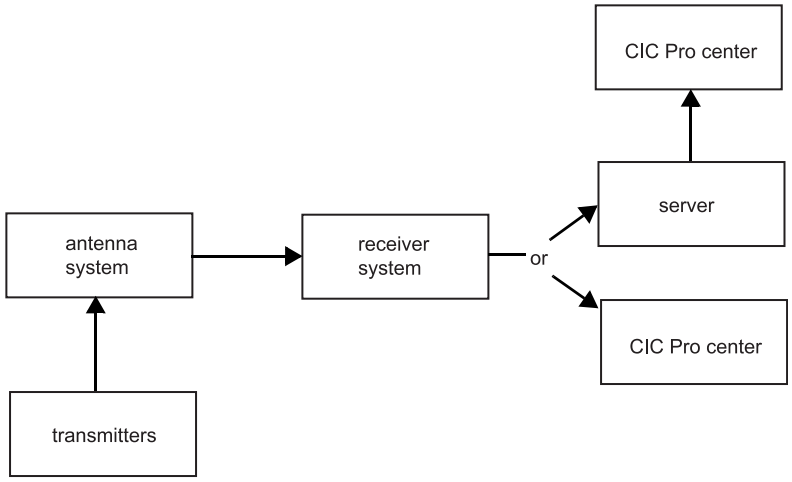
Introduction

This chapter provides an overview of the equipment used in the ApexPro telemetry system. For detailed installation instructions, refer to the appropriate service manual.

ApexPro telemetry system

The ApexPro telemetry system provides clinicians with patient data while allowing for patient mobility. The system consists of the following components:

- ApexPro and/or ApexPro CH transmitters
- ApexPro antenna system
- ApexPro receiver system
- Server hosting the ApexPro software
- CIC Pro center
- Apex oximeter
- Xpod oximeter
- Accutracker DX blood pressure monitor
- Dinamap Pro 100, 200, 300, and 400 series monitor



ApexPro telemetry system

Transmitters

NOTE

All references to transmitters are intended to include both the ApexPro and ApexPro CH transmitters, unless otherwise noted.

A transmitter connects to a patient, acquires ECG data, and converts it to digital format to send the patient data and RF status signals to the antenna system. For setup information, refer to Transmitter setup on page 3-2.

There are three transmitter configurations that define the ECG lead analysis option and determine whether other devices, such as oximeters, can be connected to the transmitter's interface connector ports.

- ***Single-Lead*** with inactive interface connector ports (blue dust covers).
- ***Single-Lead*** with active interface connector ports (gray dust covers).
- ***Multi-Lead*** with active interface connector ports (gray dust covers).

For more information on ECG lead analysis options, refer to Lead analysis on page 7-16.

The two **INTFC** (interface) connector ports are used for connecting serial interface devices. The ports are labeled **1** and **2** (on the dust covers).

- **2** is the inside port, closest to the leadwire set. It is for use with continuous monitoring serial devices, such as oximeters.
- **1** is the outside port, furthest from the leadwire set. It is for use with episodic monitoring serial devices, such as blood pressure monitors.

For more information on connecting devices to the transmitter, refer to Optional components on page 3-7.

Antenna system

The antenna system sends data to the receiver system. Data is then transmitted via a dedicated Ethernet connection to the server for further processing and viewing. For more information, refer to the ApexPro CH Telemetry System Antenna Equipment Reference manual.

Receiver system

The receiver system sends data via a dedicated Ethernet connection to the server for further processing and viewing. For more information, refer to ApexPro Receiver System Service Manual.

Server

A server hosts the ApexPro software. The server can be a telemetry server or a CIC Pro center.

If your system includes a telemetry server, it receives and analyzes patient and transmitter data from the receiver system, runs the ApexPro software, stores the data and sends the data to the CIC Pro center for display. For more information, refer to the appropriate telemetry server service manual.

If your system includes a CIC Pro center, it receives and analyzes patient and transmitter data from the receiver system, runs the ApexPro software, stores and displays all telemetry patient data. For more information, refer to the appropriate CIC Pro center service manual.

CIC Pro center

The CIC Pro center displays real-time data acquired from up to 16 networked GE monitors or transmitters. The CIC Pro center displays this telemetry bed patient data along with the patient data acquired from other monitors. The transmitter number is displayed under the ***ECG*** parameter window.

The CIC Pro center is also used to define telemetry defaults. For more information, refer to System setup on page 4-1.

Optional components

Apex oximeter

CAUTION
Do not use the Apex oximeter on neonatal patients. It is not designed for use on neonates.

An Apex oximeter can be connected to a transmitter in order to monitor the patient's pulse oximetry data and send the SpO2 data for display at the CIC Pro center. Only digital data is available; no waveforms are generated or transmitted. Digital data is stored in ***Graphic Trends*** and ***Vital Signs***. For setup information, refer to Apex oximeter on page 3-8.

Xpod oximeter

CAUTION
Do not use the Xpod oximeter on neonatal patients. It is not designed for use on neonates.

An Xpod oximeter can be connected to a transmitter in order to measure arterial oxygen saturation (SpO2), peripheral pulse rate (PPR), and perfusion quality and send the data for display at the CIC Pro center. For setup information, refer to Xpod oximeter on page 3-7.

Accutracker DX noninvasive blood pressure (NBP) monitor

NOTE

The Accutracker DX noninvasive blood pressure monitor has been modified by SunTech Medical Instruments to operate with the ApexPro system.

An Accutracker DX noninvasive blood pressure monitor can be connected to a transmitter in order to measure the systolic and diastolic blood pressure. The transmitter sends the measurement data for display at the CIC Pro center. Digital values are stored in ***Graphic Trends*** and ***Vital Signs***. For setup information, refer to Accutracker DX on page 3-10.

Dinamap PRO monitors

NOTE

The Dinamap PRO monitors' alarm limits are not configurable at the CIC Pro center, but they can be silenced at the CIC Pro center. However, alarms that are silenced at the CIC Pro center will not be silenced at the monitor. Refer to the Dinamap Pro 100–400 Operation Manual for detailed information.

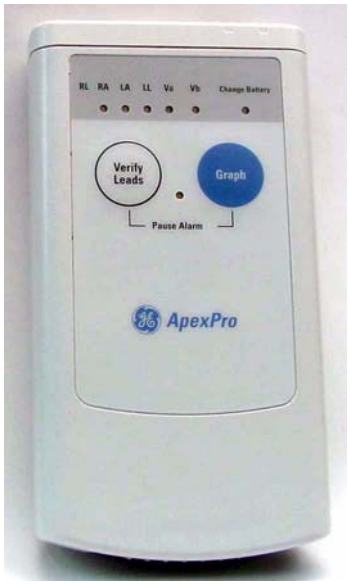
A Dinamap PRO 100, 200, 300, and 400 monitor can be connected to a transmitter in order to monitor SpO2, NBP, and temperature and send the data for display at the CIC Pro center. For setup information, refer to Dinamap PRO monitors on page 3-9.

3 Equipment setup

Transmitter setup

Views

The transmitters have the following buttons and LEDs:



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ApexPro Transmitter and ApexPro CH Transmitter

ApexPro	ApexPro CH	Function
RL RA LA LL Va Vb	**RL RA LA LL Va Vb** **N R L F Ca Cb**	When first powered up, the lead LEDs flash rapidly, followed by two slow flashes. The transmitter begins functioning after the two slow flashes. When any of the transmitter's buttons are pushed, the lead LEDs flash twice.
Change Battery		When the battery power is running low, the change battery LED flashes.
Verify Leads		When pressed, the lead LEDs flash twice. If a lead is valid, its LED stays lit for one minute.
Pause Alarm		When the ***Pause Alarm*** condition occurs, the pause alarm LED flashes until the condition ends. See Pausing alarms at the transmitter on page 5-5.

ApexPro	ApexPro CH	Function
Graph		When pressed, a 20-second graph strip is printed on the writer or printer. When pressed with an IMPACT.*wf* paging system (version II or later) also available in the same care unit, the ***View on Demand*** feature (also called the Apex Graph Button Push feature) is enabled. The IMPACT.*wf* server generates a sample page of the patient's ECG waveform and any other enabled/monitored non-arrhythmia parameters. If pressed again, it generates both an IMPACT.*wf* update and a standard ECG waveform graph at the CIC Pro center. The IMPACT.*wf* update is labeled ***Sample*** for display on the IMPACT.*wf* receiver and stored in history. Additionally, all receivers assigned to the patient receive an update/ sample.
(not available)		When pressed, a blue border displays around the event bed and an alarm tone sounds at the CIC Pro center. The message ***Remote Event*** displays under the ***ECG*** parameter window for approximately ten seconds.It also generates a 20-second graph and saves the event.

Battery installation

WARNING
INGESTION OF BATTERIES— Make sure the battery compartment is closed completely and closely observe patients to prevent ingestion of batteries.

CAUTION
Never store the transmitter with the batteries inside. Storing the transmitter with the batteries inside may result in damage to the transmitter.

CAUTION
GE recommends that you always replace both batteries at the same time. Re-using old batteries or using a combination of old and new batteries in the transmitter will compromise functionality of the transmitter and increase the risk of fire hazard.

CAUTION

LED INDICATOR — Replace the transmitter batteries promptly when the ***Change Battery*** message is displayed at the central station or when the **Change Battery** LED flashes on the transmitter. Failure to replace the batteries before they are completely depleted will result in interrupted patient monitoring and may cause damage to the transmitter.

NOTE

- When new batteries are installed, all LEDs on the transmitter flash, then flash again twice to acknowledge the new battery installation. The flashing LEDs do not indicate good leads. You must press the **Verify Leads** button to check lead status.
- When the **Change Battery** LED starts flashing, the transmitter has approximately one hour of reserve power before the unit shuts down.
- When a low battery condition occurs, approximately two hours before the battery loses power, the ***Change Battery*** message displays at the CIC Pro center with an audible ***System Warning*** alarm. When the battery is dead, the ***Change Battery*** message displays at the CIC Pro center with an audible ***System Warning*** alarm and the patient goes into ***NO TELEM***.

NOTE

When replacing batteries, remove the old batteries and follow your local recycling or disposal guidelines.

For optimum performance, follow these guidelines:

- Install two new AA alkaline batteries when you begin monitoring a new patient.
- Install two new AA alkaline batteries when the **Change Battery** LED flashes.
- Do not use rechargeable batteries.

To install batteries in the transmitter, follow these steps.

1. Locate the battery cover at the bottom of the transmitter.
2. Slide the cover over to open the battery compartment.
3. Insert the batteries according to the polarity signs on the lower back side of the transmitter.

4. Close the battery cover.

Leadwire installation

CAUTION
FALSE ALARMS—If clinical workflow includes pre-admitting telemetry transmitters, attach ECG leadwires to patient prior to attaching ECG leadwires to transmitter. Failure to follow this sequence may result in false alarms or interruption in ECG waveform.

The transmitter can use the following Multi-Link leadwire sets:

- Multi-Link 6-leadwire set
- Multi-Link 5-leadwire set
- Multi-Link 3-leadwire set

To install a leadwire set into the transmitter, align the leadwire pins with the connector on the top of the transmitter, then push the leadwire set firmly into the transmitter.

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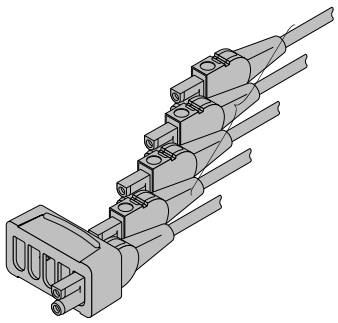
To disconnect the leadwire set from the transmitter, grasp the molded end or the combiner firmly and pull away from the transmitter.

Electrode attachment

1. Attach leadwires to the transmitter by plugging the Multi-Link leadwire set into the transmitter.

   To use sets of Multi-Link individual leadwires, firmly press the individual leadwires into their appropriate locations on the combiner. Use the colors on the leadwires to place them in corresponding order with the colors that appear on the back of the transmitter.



308B

2. Attach leadwire clip to the terminal on the electrodes. Take care to attach the color-coded clips to the corresponding electrode locations.
3. Loop the leadwires and secure them to the patient with tape. Stress loops prevent the connection to the electrode from being loosened or pulled apart as the patient moves.

NOTE

Do not tape across the electrode.

Verify transmitter/leadwires status

CAUTION
IMPROPER TRANSMITTER/LEADWIRE APPLICATION — Applying a transmitter and/or leadwire that is not thoroughly dry to a patient can result in an electrically conductive path being established and a ***Leads Fail*** alarm not being provided if leadwires come off the patient.

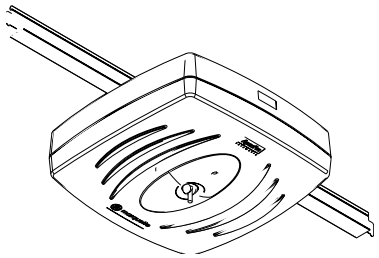
Use the following procedure to verify transmitter/leadwires status before applying to a patient:

1. Connect the leadwire to the transmitter, but do not connect the leadwire to a patient.
2. Insert batteries in the transmitter and close the battery door.
3. Wait for the transmitter to start up. The LEDs will first flash rapidly and then flash slowly twice. Wait until the LEDs are done flashing.
4. Press the **Verify Leads** button. All the LEDs flash twice to indicate the button was pushed.
5. Look for LEDs that light up and stay lit.
   - If the transmitter is dry, none of the LEDs light up.
   - If you are using a 5- or 6-leadwire and it is dry, none of the LEDs light up.
   - If you are using a 3-leadwire and it is dry, only the reference LED will light up and stay lit.
   - If the transmitter is wet and an electrically conductive path is established, some of the LEDs will light up.
6. If any of the LEDs stay lit, make sure the transmitter is dry. Allow the transmitter to air dry if other methods are not effective.

   Do not attach the transmitter/leadwire to a patient until the transmitter/leadwire is thoroughly dry.

Antenna system

Patient and transmitter status data are dependent on the telemetry system transmission coverage area. For more information on the telemetry coverage area in your institution, contact your biomedical or information technology engineers.



417A

Optional components

WARNING
LOSS OF ALARMS—Do not use transmitter accessory devices such as SpO2 and NBP without ECG cables attached. Failure to use accessory devices in the prescribed manner may result in a loss of alarms.

ECG cables must be attached to the transmitter while using any accessory device such as oximeter, Dinamap Pro monitors, etc.

Xpod oximeter

CAUTION
Use only Nonin SpO2 probes with the oximeter. The reliability of SpO2 data obtained with any other probe has not been verified.

The Xpod oximeter uses the battery power supplied by the transmitter. Connect the oximeter to the **INTFC** connector (labeled **2** on its dust cover) on the transmitter and to the Nonin SpO2 probe. Once connected, follow your unit's protocol for attaching the transmitter and the oximeter to the patient.

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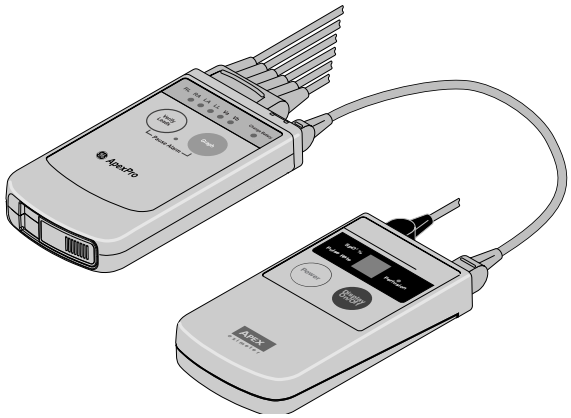
Apex oximeter

CAUTION
Use only Nonin SpO2 probes with the Apex oximeter. The reliability of SpO2 data obtained with any other probe has not been verified.



400C

The perfusion LED indicates the strength of the patient's SpO2 signal.

To turn the digital display on or off at any time, press the **Display On/Off** button. To turn the display on continuously, press and hold the **Display On/Off** button for 2 seconds. The flashing **Power** LED turns off.

NOTE

Using the Apex oximeter with the display on continuously will result in reduced battery life.

Battery installation

CAUTION
GE recommends that you always replace both batteries at the same time. Re-using old batteries or using a combination of old and new batteries in the Apex oximeter will compromise functionality of the transmitter and increase the risk of fire hazard.

NOTE

When replacing batteries, remove the old batteries and follow your local recycling or disposal guidelines.

NOTE

When the digital display starts flashing, there is approximately one hour of reserve power left before the unit shuts down.

The Apex oximeter runs on two AA alkaline batteries. Battery life is approximately 60 hours. For optimum performance, follow these guidelines:

- Install two new AA alkaline batteries when you begin monitoring a new patient.
- Install two new AA alkaline batteries when the digital display starts flashing.

To install two new AA alkaline batteries:

1. Locate the battery cover at the bottom back of the oximeter.
2. Press the latch tab and lift up to open the battery compartment.
3. Insert the batteries as indicated with the polarity signs within the battery compartment.
4. Close the battery cover.

Transmitter connection

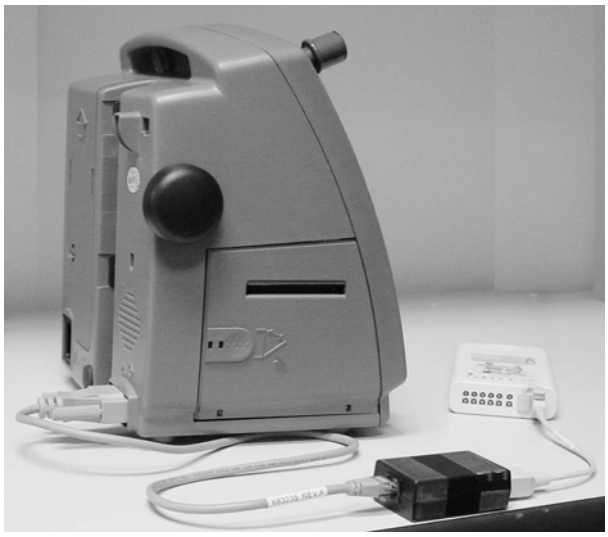
WARNING
DUST COVERS — If the dust covers for the interface connectors become detached from the transmitter, they may pose a choking hazard for pediatric patients. Inspect the dust covers before each use to verify that they are securely attached. If the dust covers become detached and cannot be reinserted into their retaining slot, do not use them on the transmitter, and keep them out of pediatric patients' reach.

1. Connect the non-sensor end of the SpO2 probe into the 9-pin connector on the top of the oximeter.
2. Plug one end of the interconnection cable into the **INTFC** connector on the oximeter. Plug the other end into the **INTFC** connector (labeled **2** on its dust cover) on the transmitter. See Interconnection cables on page 3-10.
3. Turn the oximeter on. The digital display turns on and the power LED (horizontal bar) flashes. The digital display stays on for one minute.

Once connected, follow your unit's protocol for attaching the transmitter and the oximeter to the patient. A common method is to place them back-to-back in the same pouch and belt them on the patient.

Dinamap PRO monitors

A DINALink serial cable is used to connect the transmitter to the Dinamap PRO 100–400 series monitors. The interconnect cable connects to either of the interface ports on the transmitter.



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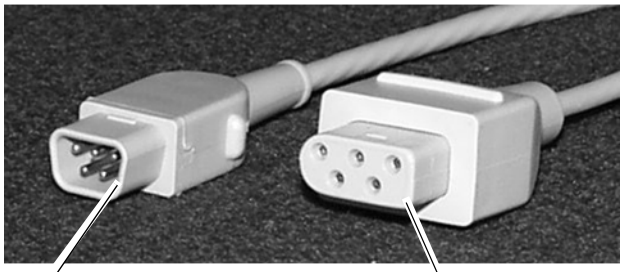
Interconnection cables

The interconnection cables used to connect the transmitter with the Apex oximeter and/or the blood pressure monitor are not the same as those used with the Apex S transmitter (CD Telemetry-LAN monitoring system). The connector ends that are plugged into the transmitters are different and are not interchangeable.



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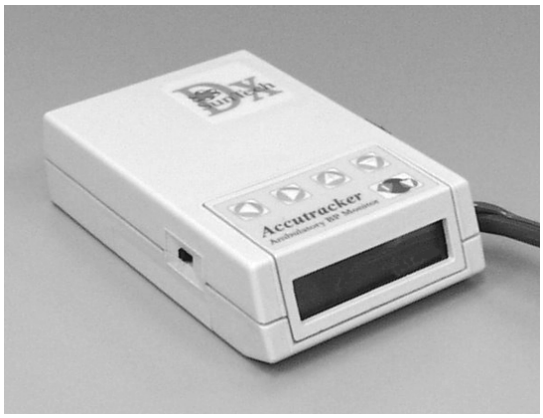
Accutracker DX

The blood pressure monitor allows telemetry monitoring of a patient's NBP data. The blood pressure cuff is connected to the blood pressure monitor, which measures and displays systolic and diastolic blood pressures using the auscultatory method. Digital values are also displayed at the CIC Pro center, and stored in ***Graphic Trends*** and ***Vital Signs***.



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The **START/STOP** button starts and stops blood pressure readings. During the monitoring period, it can be used by the patient at the clinician's discretion. Pressing the **START/STOP** button once while a patient is being monitored wakes up the blood pressure monitor from sleep mode and offers the options to change the measurement interval, view the time left until the next measurement, or perform a manual reading by pressing the **START/STOP** button a second time.

Battery installation

The blood pressure monitor contains an internal lithium battery capable of sustaining a maximum, cumulative period of 9 months (6400 hours) *without* AA alkaline batteries installed, over the life of the monitor. The four AA alkaline batteries will last for approximately 250 blood pressure readings, taken at an average interval of 15 minutes.

If the lithium battery is completely drained, the unit will not function. The internal lithium battery is *not* user replaceable. The unit must be returned for service if the lithium battery needs to be replaced.

For optimum performance, follow these guidelines:

- Store with four good AA alkaline batteries installed.
- Change the batteries when the message ***Low Batt*** displays.
- Install four new batteries when you begin monitoring a patient.
- Install new batteries and replace them every four months for long-term storage.
- Service the lithium battery every three to five years.

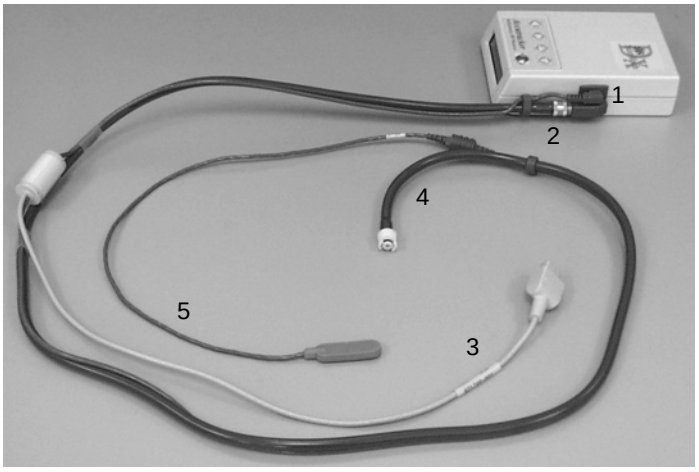
To install four new AA alkaline batteries:

1. Locate the battery cover on the back of the monitor.
2. Press down and gently slide off the cover.
3. Remove the old batteries by lifting up on the ribbon in the battery case. Dispose of the old batteries properly, following your local ordinances.
4. Insert the new batteries, being careful to follow the polarity signs. Be sure to place the batteries on top of the ribbon.
5. Slide the battery cover back on securely.

Connection

The patient cable, microphone cable, and interconnection cable are attached to one another in one assembly. See Interconnection cables on page 3-10. To connect the blood pressure monitor, follow this procedure:

1. Attach the brass end of the patient cable to the brass air hose connector on the side of the monitor.
2. Connect the microphone cable to the 6-pin connector on the side of the monitor, near the air hose connector.



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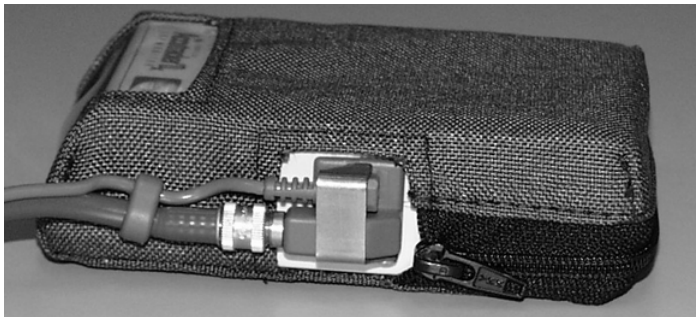
1	Microphone cable connection
2	Patient connection cable
3	ApexPro transmitter interconnection cable
4	Blood pressure cuff connection cable
5	Microphone cable

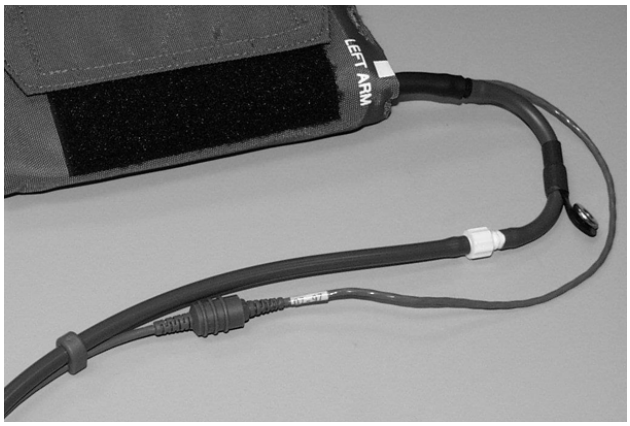
3. Secure the cable by screwing on the metal cable cap, then insert the monitor into the nylon pouch.



411A

4. Attach the blood pressure cuff hose to the white plastic fitting on the patient cable. Turn the fitting to the right approximately one quarter turn. Some connector models will click when they are connected. Make sure that it is

securely tightened. Then plug the 3-pin microphone connector into the 3-pin connector on the microphone cable.



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5. Connect the 5-pin end of the interface cable to the inside 5-pin **INTFC** connector on the transmitter (labeled **1** on its dust cover). The interface cable is already connected to the blood pressure monitor because it is a branch of the patient cable. Ensure that the transmitter's patient leadwires are properly connected. The leadwires must be connected for telemetry transmission of NBP data.

NOTE

- Use a microphone pad to maintain the best microphone position.
- Use a cuff anchor to maintain the blood pressure cuff's position.
- Advise the patient not to shower or bathe while being monitored.

4 System setup

Bedside monitor setup

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING AND CALCULATIONS BASED ON PATIENT AGE — After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

CAUTION
BEDSIDE MONITOR ECG COMPATIBILITY— The minimum software version of the following GE bedside monitors are required for ECG monitoring in ***Rover*** or ***Rover Combo*** modes:

- Dash 3000/4000 patient monitor v2B or later
- Dash 5000 patient monitor v6 or later
- Eagle 4000 patient monitor v5B or later
- Solar 7000 patient monitor v6 or later
- Solar 8000i patient monitor v4F or later
- Solar 8000M patient monitor v3D
- Tram critical care monitor (Tramscope) v7D or later

Monitoring other parameters is not compatible. Erroneous patient data may result.

NOTE

When the monitor is set for ***Combo*** mode, the second V lead can *not* be viewed or manipulated.

NOTE

Users should be aware of a possible time discrepancy between the waveforms from the telemetry device and the waveforms hard-wired to the display device. Users should not consider these waveforms to be synchronous. If absolute synchronicity is desired, ***Combo*** mode should be discontinued and the ECG waveforms should be acquired via the hard-wired bedside device.

ApexPro system patient data can be viewed on most GE patient monitors. The monitor and the ApexPro system must be connected to the same Unity network. The telemetry patient can be viewed on the bedside monitor using the monitor split screen view.

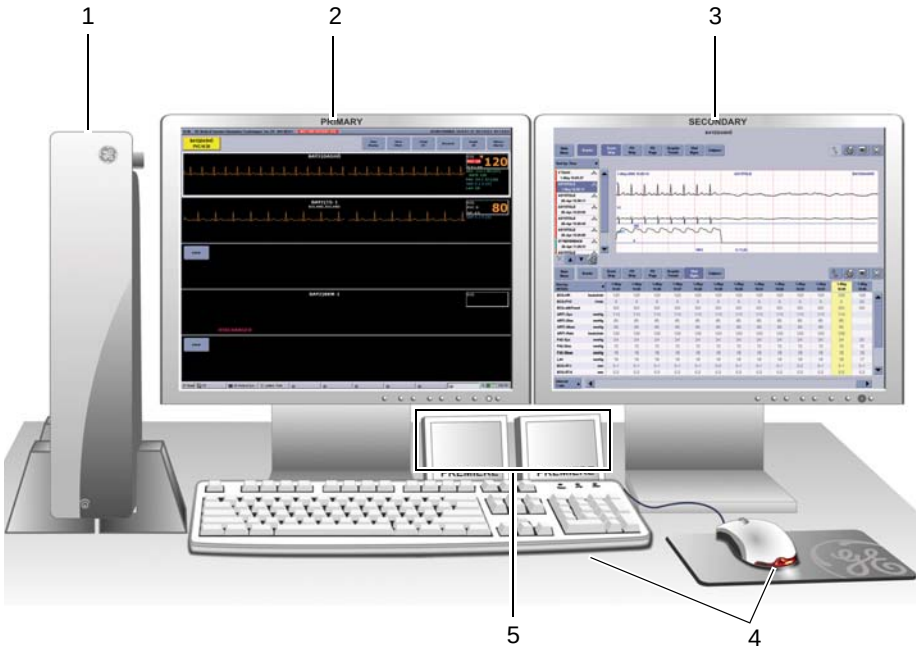
To obtain an ECG source from telemetry, the source must be set to telemetry on the bedside monitor while in either ***Combo*** or ***Rover Combo*** monitoring mode. Contact your biomedical/service department for configuration.

Refer to the appropriate monitor's operator's manual for more information. Contact your sales/service representative if you have questions regarding compatibility.

CIC Pro center setup

Standard components include the following items:

- Processor box
- Primary display
- External speakers
- Standard keyboard
- Standard mouse



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	Item	Function
1	Processor box	Run the CIC Pro center application.
2	Primary display	Display real-time and stored patient data, control windows, and various system level operations. Up to two displays may be connected to the CIC Pro center simultaneously.
3	Secondary display (optional)	Display stored patient data.
4	Standard mouse and keyboard	Enter data, navigate menus, and choose options.
5	External speakers	Sound audible patient status and system status alarm tones.

Configuring the CIC Pro center

WARNING
Before using this device for the first time, refer to the CIC Pro Clinical Information Center Operator's Manual for safety information.

WARNING
UNTESTED SOFTWARE—Do not load any software other than that specified by GE onto the CIC Pro center. Installation of software not specified by GE may cause damage to the server or loss or corruption of data.

Before use, qualified personnel must configure the CIC Pro center for use within your monitoring environment:

- Service personnel must configure the CIC Pro center to work with your patient monitor. For more information, refer to the appropriate CIC Pro center service manual.
- Clinical personnel must configure the clinical applications of the CIC Pro center. For more information, refer to the appropriate CIC Pro center operator's and/or service manual.

Verifying proper operation

Before using this device, you should confirm that the CIC Pro center application and alarms are operating properly:

1. Check that the CIC Pro center is displaying waveforms and numerical data from selected patient monitors and telemetry beds.
2. Check that the CIC Pro center notifies you of an alarm condition when you verify the alarm function. For more information, refer to the CIC Pro Clinical Information Center Operator's Manual.

Customizing the system

Three configuration levels control the features and functions of your CIC Pro center. For more information, refer to the appropriate CIC Pro center operator's and/or service manual.

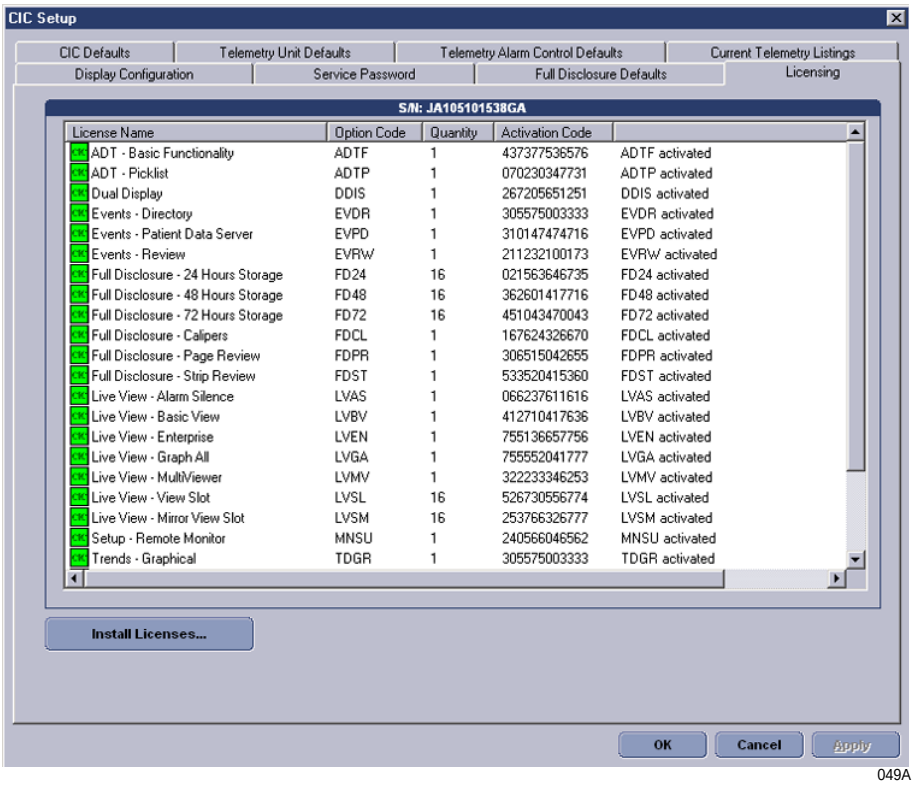
- Licenses (instituted): Licenses control the standard and specialized features available for your CIC Pro center. These licenses are instituted during installation, but can be changed by qualified personnel.
- Defaults (persistent): Defaults control the network, system, and clinical application settings of the CIC Pro center. Defaults are persistent, meaning they are recalled after a patient is discharged.

- Control settings (temporary): Control settings allow you to make temporary adjustments to some of the system and clinical application settings of the CIC Pro center. Control settings are temporary, meaning they apply to a selected patient and are erased when the patient is discharged.

Licenses (instituted)

Licenses control the standard and specialized features available for your CIC Pro center. These licenses are instituted during installation, but can be changed by qualified personnel.

To view the licenses installed on your CIC Pro center from the multi-patient viewer, click ***Setup CIC*** > ***Licensing***.



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Licenses are divided into the following categories:

- View: View real-time patient information for a maximum of 16 patients from the multi-patient viewer and one patient from the single patient viewer.
- Monitor: Admit and discharge patients, modify parameter limits, manage ***Alarm Control***, and silence alarms.
- Review: Review historical patient information (e.g., events, trends, and full disclosure).
- Central surveillance: View single viewer applications from a secondary display, navigate multiple configured centralized CIC Pro centers using a single mouse and keyboard, and connect to your facility's Citrix server to view any CIC Pro center or Hospital Information System (HIS).
- Service: Remote service tools.

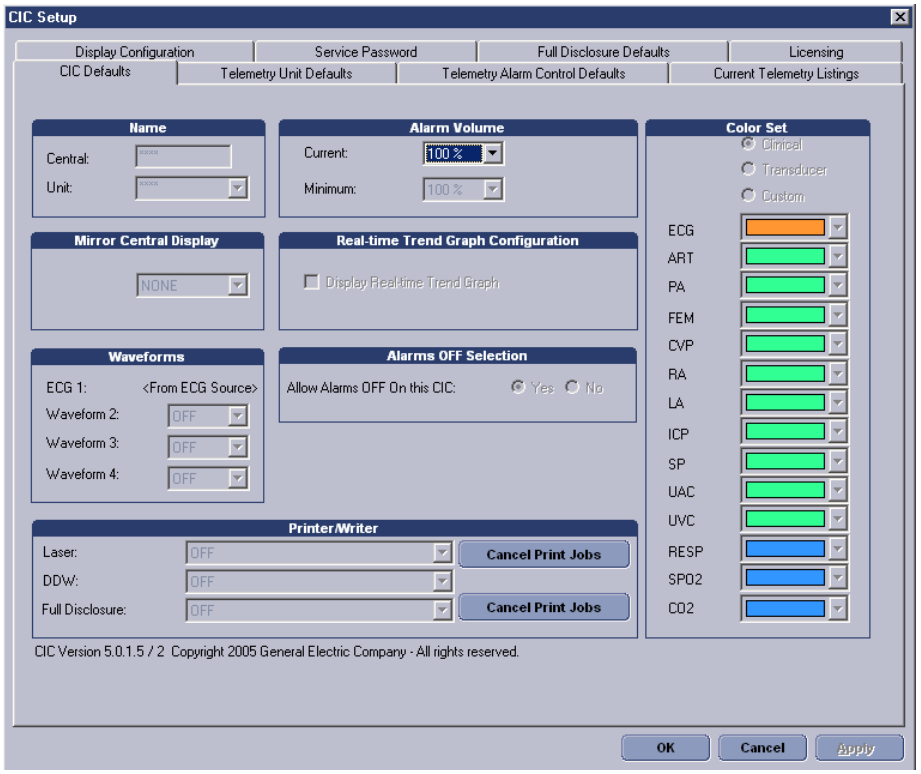
Defaults (persistent)

Defaults control the network, system and clinical application settings of the CIC Pro center. Defaults are persistent, meaning they are recalled after a patient is discharged.

Defaults are divided into two categories:

- Service-level defaults: Service-level defaults are password protected and should be configured by qualified service and clinical personnel.
- User-level defaults: User-level defaults are not password protected and can be configured by any qualified user.

To view the ***CIC Defaults*** window, from the multi-patient viewer, click ***Setup CIC*** > ***CIC Defaults***.



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Service-level defaults

CAUTION
QUALIFIED PERSONNEL — The service mode is intended for use only by qualified personnel with training and experience in its use. The consequences of misuse include loss of alarm configuration, loss of patient data, corruption of the CIC Pro center's operating system software, or disruption of the entire Unity Network.

Unless you are using the password protected CIC Pro center service mode, the service-level defaults appear in light, dimmed text. For more information, refer to the appropriate CIC Pro center service manual.

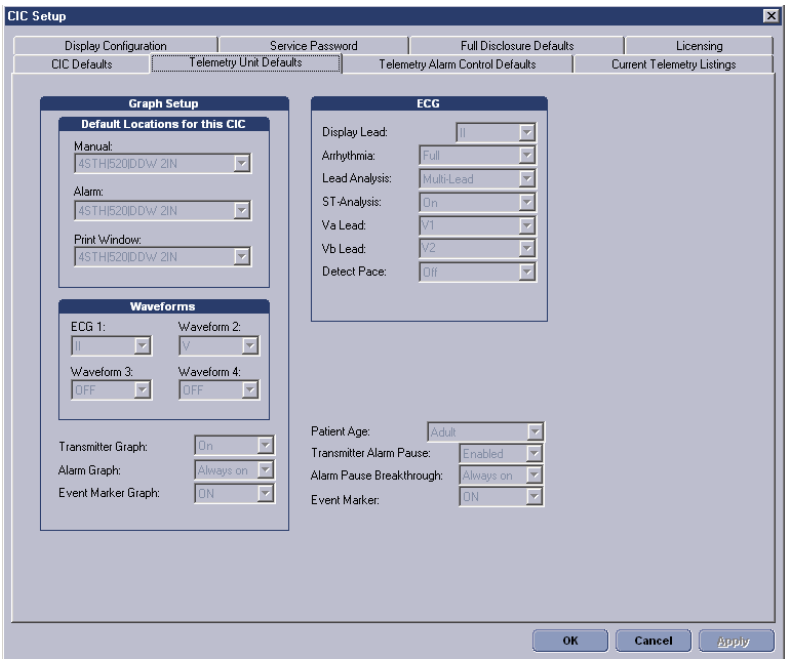
User-level defaults (persistent)

In user mode, all of the controls except alarm volume are view-only. You must be in the Service mode to set defaults. For more information, refer to the appropriate CIC Pro center service manual.

Telemetry unit defaults

This option sets telemetry unit default settings. You must be in the Service mode to set the ***Telemetry Unit Defaults*** at the CIC Pro center.

To view the telemetry unit default settings, click ***CIC Setup*** > ***Telemetry Unit Defaults***.



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Option	Function
Graph Setup	**NOTE** When changing the ***Graph Setup*** options for admitted patients, the changes do not take effect until the patients are discharged. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***Graph Setup***.
Default Locations for this CIC	Set the print location for ***Manual***, ***Alarm*** and ***Print Window***. **NOTE** These default locations are only used for telemetry beds and determine where patient data prints for either manual or alarm conditions. Since a telemetry patient is not linked to a patient monitor, these defaults are necessary to specify the destination for alarm and manual graph printouts. Graph location can be changed for individual patients in ***Monitor Setup*** > ***Graph Set up***.
Waveforms	Designate the primary ECG lead for printing and enable or disable printing from subsequent ECG leads. ***ECG 1***: Designate the primary ECG lead for printing. Lead II is the default. ***Waveform 2*** to ***4***: Choose other ECG leads to print or choose ***Off*** to disable printing an ECG lead. Choices are: ***Off***, ***I***, ***II***, ***III***, ***V***, ***aVR***, ***aVL*** and ***aVF***. Selecting option ***V*** indicates the V lead being monitored, e.g., V2. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***Graph Setup***.
Transmitter Graph	Turn on or off the ***Transmitter Graph*** printing. When this option is set to ***On***, a telemetry patient can initiate a graph by pressing the **Graph** button on the transmitter. When this option is set to ***Off***, graphs cannot be initiated at the transmitter. This option sets the unit default for all telemetry patients admitted to the CIC Pro center. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***Graph Setup***.
Alarm Graph	Turn on or off ***Alarm Graph*** printing. Choices are: ***Always on*** or ***Always off***. On is the default. This option sets the unit default for all patients admitted to the CIC Pro center. It cannot be changed on an individual patient basis.

Option	Function
Event Marker Graph	Turn on or off ***Event Marker Graph*** printing. ***Off*** is the default. This option allows you to select whether a graph will be printed when a patient's event is marked using the event marker button on the transmitter. **NOTE** This feature is not applicable to all transmitters.
Display Lead	Set the primary ECG lead for display in the patient's waveform window. Choices are: ***I***, ***II***, ***III***, ***V***, ***aVR***, ***aVL*** and ***aVF***. Lead ***II*** is the default. Selecting option ***V*** indicates the V lead being monitored, e.g., Va or Vb. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***ECG***.
Arrhythmia	Enable or disable an arrhythmia processing program. Choices are: ***Full***, ***Lethal***, and ***Off***. Full is the default. Selecting ***Off*** means arrhythmia detection remains off until you choose another option. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***ECG***.
Lead Analysis	Designate ***Single-Lead*** or ***Multi-Lead*** analysis for ECG and arrhythmia analysis. ***Multi-Lead*** is the default. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***ECG***.
ST Analysis	Enable or disable ***ST Analysis***. Choices are: ***On*** or ***Off***. ***Off*** is the default. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***ECG***.
Va Lead ***Vb Lead***	Set the default for the V leads that will be monitored in these positions. A 6-leadwire set is required for multiple V-lead monitoring. Choices for ***Va***: ***V1*** to ***V6***. Choices for ***Vb***: ***V2*** to ***V6***. V1 is recommended for arrhythmia detection. V5 is recommended for ST depression monitoring[1]. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***ECG***. **NOTE** Correctly labelling V leads is important to facilitate correct ECG analysis when viewing real-time waveforms, histories or printouts.

Option	Function
Detect Pace	Enable or disable pacer detection. Choices are: ***Pace 1***, ***Pace 2***, and ***Off***. ***Off*** is the default. **NOTE** Selecting ***Off*** turns pacemaker detection off. It does *not* perform pacemaker detection. ***Pace 1*** or ***Pace 2*** *must* be used with pacemaker patients. See Monitoring pacemaker patients on page 7-13. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Monitor Setup*** > ***ECG***.
Patient Age	Set ***Patient Age***. Choices are: ***0-2 Years***, ***3-11 Years***, ***11-13 Years***, and ***Adult***. See Patient age on page 4-10. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Admit***.
Transmitter Alarm Pause	Enable or disable transmitter alarm pausing. Choices are: ***Enable, Disable*** or ***Off***. This option sets the unit default for all telemetry patients admitted to the CIC Pro center. **NOTE** Temporary changes may be made for a specific patient via the single patient viewer > ***Alarm Control.***
Alarm Pause Breakthrough	Turn on or off ***Transmitter Alarm Pause*** breakthrough. Choices are: ***Always On*** or ***Always Off***. ***Always On*** is the default. This option sets the unit default for all telemetry patients admitted to the CIC Pro center. It cannot be changed on an individual patient basis.
Event Marker	(ApexPro CH transmitter only) Turn on or off ***Event Marker*** alert. ***Off*** is the default.

[1]Barbara J. Drew, RN, PhD, FAAN (2000). *Value of Monitoring a Second Precordial Lead for Patients in a Telemetry Unit*, GE Medical Systems (order document number M04243ME0)

Patient age

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING AND CALCULATIONS BASED ON PATIENT AGE — After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

NOTE

The ***Telemetry Unit Defaults*** tab sheet settings take precedence when the ***Patient Age*** chosen in the ***Admit*** tab sheet and the age default setting from the ***Telemetry Unit Defaults*** tab sheet match.

WHEN THE AGES DO NOT MATCH, THE ***Admit*** TAB SHEET AGE SETTING TAKES PRECEDENCE.

The options found in the pull-down list for the ***Patient Age*** field are:

- ***0-2 years***
- ***3-10 years***
- ***11-13 years***
- ***Adult*** (factory default selection)

The ***Patient Age*** setting chosen in the ***Telemetry Unit Defaults*** tab sheet affects the alarm settings.

Telemetry Unit Defaults Tab Sheet Setting	Age Chosen In The Admit Tab Sheet When Patient Admitted	Resulting Limits	Unit Default Alarm Level (Brady)	Resulting Alarm Level
Adult	***Adult***	50, 150	***Advisory***	***Advisory***
	0-2 years	90, 200	***Advisory***	***Crisis***
	3-10 years	60, 180	***Advisory***	***Crisis***
	11-13 years	50, 150	***Advisory***	***Advisory***
0-2 years	***Adult***	50, 150	***Advisory***	***Advisory***
	0-2 years	90, 200	***Advisory***	***Advisory***
	3-10 years	60, 180	***Advisory***	***Crisis***
	11-13 years	50, 150	***Advisory***	***Advisory***
3-10 years	***Adult***	50, 150	***Advisory***	***Advisory***
	0-2 years	90, 200	***Advisory***	***Crisis***
	3-10 years	60, 180	***Advisory***	***Advisory***
	11-13 years	50, 150	***Advisory***	***Advisory***
11-13 years	***Adult***	50, 150	***Advisory***	***Advisory***
	0-2 years	90, 200	***Advisory***	***Crisis***
	3-10 years	60, 180	***Advisory***	***Crisis***
	11-13 years	50, 150	***Advisory***	***Advisory***

Factory defaults

These factory defaults are in effect, depending upon the patient's age, unless they have been modified through ***Telemetry Unit Defaults***.

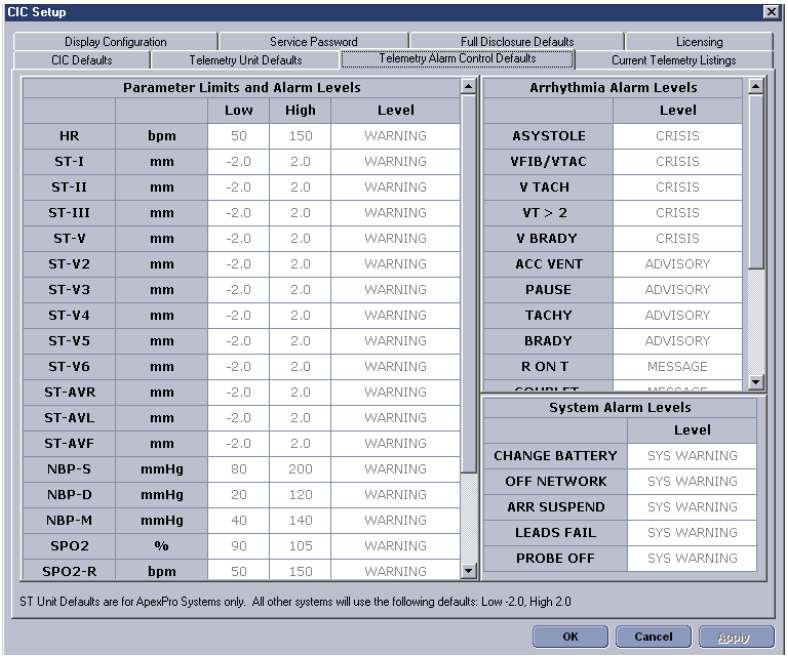
- ECG ***Display Lead*** is II
- ***Multi-Lead*** analysis

- Heart rate alarm limits (high/low):
  - ***Adult***—150/50
  - ***0–2 years***—200/90
  - ***3–10 years***—180/60
  - ***11–13 years***—150/50
- ST measurement:
  - ***Adult***— J+ 60ms
  - ***0–2 years***— J+ 30ms
  - ***3–10 years***— J+ 40ms
  - ***11–13 years***— J+ 50ms
- PVC limit is 6
- 1X size
- Pace off
- ***Arrhythmia On*** (arrhythmia changes with age)
- ST off
- Graph leads II and V
- 25 millimeters per second speed (fixed)
- Display aspect ratio of 0.4 (fixed)
- ***Alarm Graph*** location at the CIC Pro center where patient was admitted
- TTX (manual) graph location at the CIC Pro center where patient was admitted
- Print window location at the CIC Pro center where patient was admitted

Telemetry alarm control defaults

This option sets the telemetry default alarm limits and alarm level settings. In user mode, all of the controls are view-only. You must be in Service mode to set the ***Telemetry Alarm Control Defaults*** at the CIC Pro center.

To view the telemetry unit default settings, click ***CIC Setup*** > ***Telemetry Alarm Control Defaults***.



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Parameter Limits and Alarm Levels		**Low**	**High**	**Level**
HR	bpm	50	150	***Warning***
ST-I	mm	-2.0	2.0	***Warning***
ST-II	mm	-2.0	2.0	***Warning***
ST-III	mm	-2.0	2.0	***Warning***
ST-V	mm	-2.0	2.0	***Warning***
ST-V2	mm	-2.0	2.0	***Warning***
ST-V3	mm	-2.0	2.0	***Warning***
ST-V4	mm	-2.0	2.0	***Warning***
ST-V5	mm	-2.0	2.0	***Warning***
ST-V6	mm	-2.0	2.0	***Warning***
ST-aVR	mm	-2.0	2.0	***Warning***
ST-aVL	mm	-2.0	2.0	***Warning***
ST-aVF	mm	-2.0	2.0	***Warning***
NBP-S	mmHg	80	200	***Warning***
NBP-D	mmHg	20	120	***Warning***
NBP-M	mmHg	40	140	***Warning***
SPO2	%	90	105	***Warning***
SPO2-R	bpm	50	150	***Warning***
RR	breaths/min	5	30	***Warning***

Parameter Limits and Alarm Levels		Low	High	Level
RR-APNEA	seconds		30	***Warning***
PVC	#/min		6	***Advisory***

Arrhythmia Alarm Levels	Levels
ASYSTOLE[1]	***Crisis***
VFIB/VTAC	***Crisis***
V TACH	***Crisis***
VT > 2	***Crisis***
V BRADY	***Crisis***
ACC VENT	***Advisory***
PAUSE	***Advisory***
TACHY	***Advisory***
BRADY	***Advisory***
R ON T	***Message***
COUPLET	***Message***
BIGEMINY	***Message***
TRIGEMINY	***Message***
PVC	***Message***
IRREGULAR	***Message***
ATRIAL FIB	***Message***

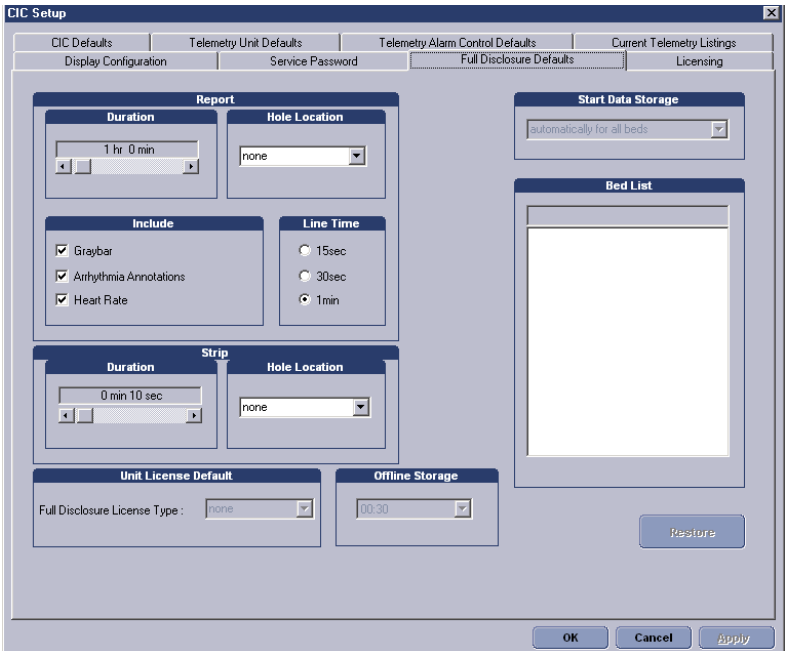
[1]The default alarm level for Asystole and VFIB/VTACH cannot be moved from the ***Crisis*** level.

System Alarm Levels	Levels
CHANGE BATTERY	***System Warning***
OFF NETWORK	***System Warning***
ARR SUSPEND	***System Warning***
LEADS FAIL	***System Warning***
PROBE OFF	***System Warning***

Full disclosure defaults

This option sets the full disclosure settings. In user mode, only the full disclosure Report and Strip settings can be configured. You must be in the Service mode to set the other full disclosure settings at the CIC Pro center.

To view the full disclosure default settings, click ***CIC Setup*** > ***Full Disclosure Defaults***.



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Option	Function
Report	
Duration	Designate how much data is included in the report. The maximum report duration is 72 hours, depending upon licensing. To set the report duration, place the cursor on the scroll bar below the ***Report Duration*** display field. Move the scroll bar to the left for shorter duration or to the right for longer duration.
Hole Location	Provide space for binding printed reports. Choices are: ***none***, ***top***, ***bottom***, ***left***, and ***right***.
Include	Set print characteristics. You may set any or none of these options. Choices are: ***Graybar***, ***Arrhythmia Annotations***, and ***Heart Rate***.
Line Time	Designate how much data shows on an individual report line. Choices are: ***15sec***, ***30sec***, and ***1min***.
Strip	
Duration	Designate how much data is included in the strip. The maximum strip duration is 60 minutes. To set the strip duration, place the cursor on the scroll bar below the ***Strip Duration*** display field. Move the scroll bar to the left for shorter duration or to the right for longer duration.
Hole Location	Provide space for binding printed reports. Choices are: ***none***, ***top***, ***bottom***, ***left***, and ***right***.

Option	Function
Unit License Default: Full Disclosure License Type	**NOTE** You must be in the Service mode at the CIC Pro center to modify this setting. Display a list of the full disclosure license type. Choices are: ***none***, ***24 hours***, ***48 hours***, and ***72 hours***. **NOTE** If the default does not match the actual license, full disclosure does *not* work.
Offline Storage	Select a time period to store full disclosure data if contact with a monitor has been lost. Choices are: ***5 mins, 30 mins***, ***1***, ***2***, ***4***, ***8*** and ***12 hours***. **WARNING** POTENTIAL DATA LOSS — Do *not* allow a ***NO COMM*** (patient offline) event to exceed the time limit selected in the ***Offline Storage*** setting. The patient's full disclosure data is deleted if the time limit is exceeded. For more information, refer to the appropriate CIC Pro center service manual.
Start Data Storage	**NOTE** You must be in the Service mode at the CIC Pro center to modify this setting. Designate how full disclosure is enabled for patients at the time of admission. Choices are: ***automatically for all beds***, ***automatically if listed***, and ***manually***.
Bed List	**NOTE** You must be in the Service mode at the CIC Pro center to modify this setting. Lists beds for which full disclosure data is automatically stored.
Restore	Clear any changes you made to the full disclosure default settings and revert to the previous settings.

Current telemetry listings

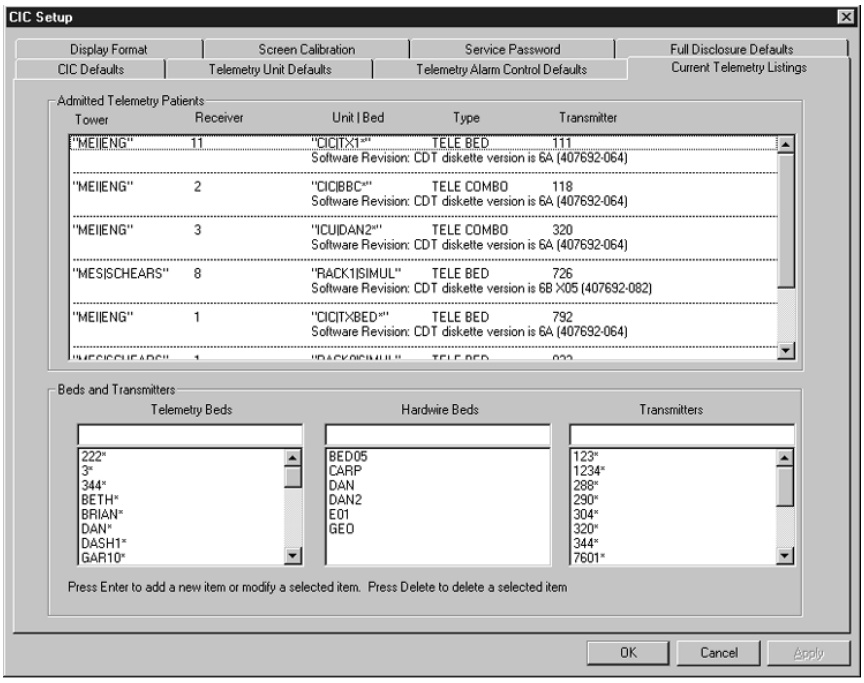
NOTE

For important configuration information, refer to the appropriate CIC Pro center service manual.

NOTE

Telemetry beds are distinguished from monitoring beds by an asterisk appended to the end of the bed number.

To view the ***Current Telemetry Listings***, click ***CIC Setup*** > ***Current Telemetry Listings***.



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Option	Function
Admitted Telemetry Patients	Provide a view-only overview of the admitted telemetry patients. **NOTE** Each row contains information for one telemetry patient. The second line of an entry shows the current software level for the patient bed in question. ■ ***Tower***: The telemetry server system for this patient ■ ***Receiver***: The receiver slot assigned to this patient. ■ ***Unit|Bed***: The unit and bed assigned to this patient. ■ ***Type***: The type of patient; ***Tele Bed*** or ***Tele Combo***. ■ ***Transmitter***: The transmitter's identification number.
Telemetry Beds	Add, modify or delete a telemetry bed name (in service mode only).
Hardwire Beds	Add, modify or delete a hardwire bed name (in service mode only).
Transmitters	Add, modify or delete a transmitter (in service mode only).

Control settings (temporary)

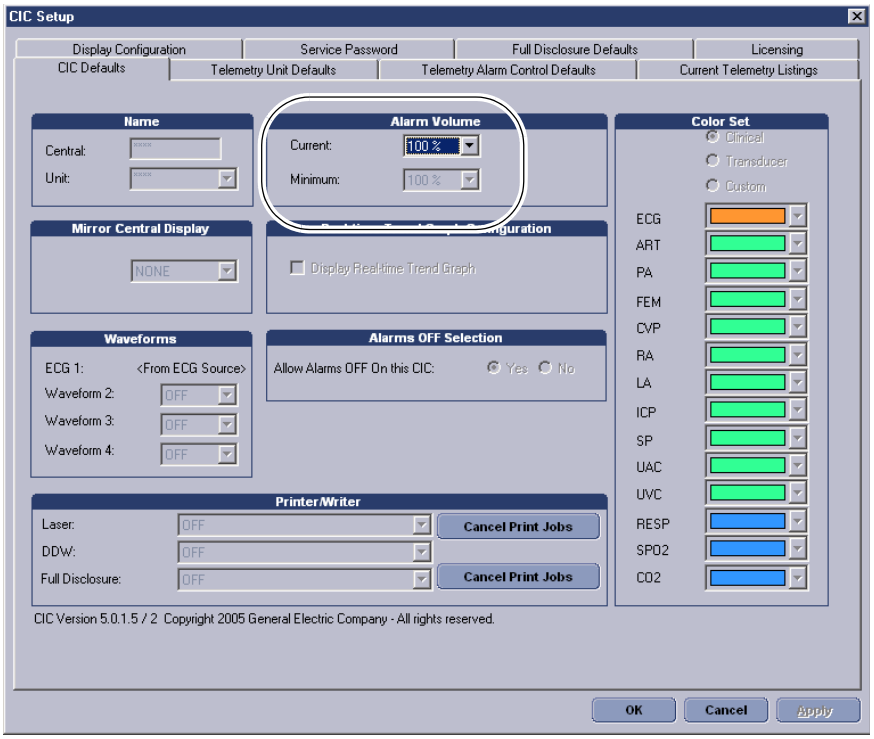
Control settings allow you to make temporary adjustments to some of the system and clinical application settings of the CIC Pro center. Control settings are temporary, meaning they apply to a selected patient and are erased when the patient is discharged. However, alarm volume changes apply to the CIC Pro center and cannot be changed on an individual patient basis.

For detailed control setting information, including displayed waveform, ***Alarm Control***, parameter control and print settings, refer to the CIC Pro Clinical Information Center Operator's Manual.To adjust the ***Alarm Volume***, refer to Alarm volume on page 4-18.

Alarm volume

To adjust the ***Alarm Volume*** for a telemetry patient at the CIC Pro center, follow these steps:

1. From the multi-patient viewer, click ***CIC Setup*** > ***CIC Defaults*** to display the current alarm volume.



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2. Click the down arrow next to ***Current*** and select the desired volume setting. The current alarm level determines the actual alarm volume.

NOTE

The ***Minimum Alarm Volume*** is set between ***OFF*** and ***100%*** in the service mode. The ***Current Alarm Volume*** cannot be set below the ***Minimum Alarm Volume***.

3. Click the down arrow next to ***Minimum*** and select the desired ***Alarm Volume***. The minimum ***Alarm Volume*** can be set between OFF and 100%.

4. Click ***Apply***.

5 Alarms

Alarm notification

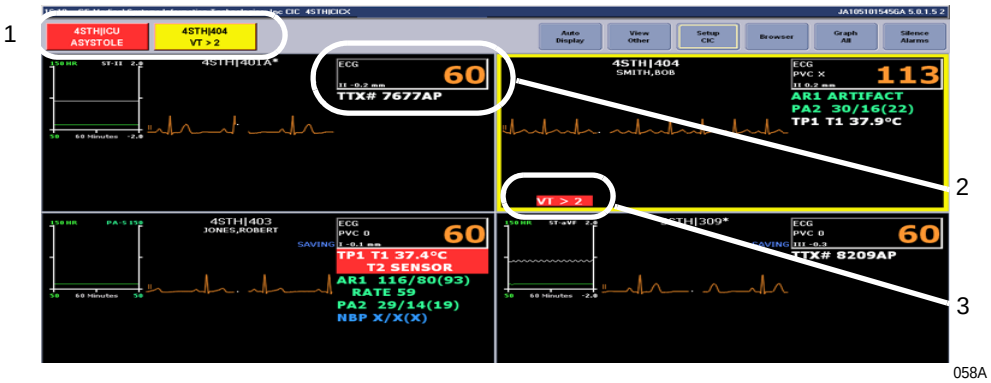
WARNING
ALARM ACTIVATION—No alarms sound or display on the CIC Pro center until a monitored patient is admitted to the CIC Pro center. The CIC Pro center will *not* alarm if an unadmitted patient enters an alarm condition. You must admit the patient to activate the alarms, automatic alarm printing, and the ***Events*** directory.

WARNING
OUT-OF-UNIT ALARMS—No audible alarms sound on the CIC Pro center for any viewed out-of-unit patient beds. The CIC Pro center only displays on-screen alarm indicators for viewed out-of-unit patient beds.

The CIC Pro center notifies you of patient or system status alarm conditions using audible tones, on-screen indicators, or both audible tones and on-screen indicators.

The alarm tones used to identify alarm conditions are identified in Patient status alarms on page 5-3 and System status alarms on page 5-4.

The following picture shows examples of on-screen alarm indicators:



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	On-screen alarm indicators
1	ADU Alarm buttons **NOTE** Clicking the alarm button displays detailed real-time parameter data for the alarming patient in a single patient viewer.
2	Parameter window
3	Waveform area alarm message

Alarm categories

The CIC Pro center categorizes alarms into patient status or system status alarms.

NOTE

The system will enunciate the system ***Warning*** and system ***Advisory*** fog horn for ***Leads Fail***, as it takes priority over any active patient status ***Warning***, ***Advisory*** and ***Message*** alarms.

NOTE

Crisis alarms are never superseded.

NOTE

When in ***Combo*** mode, alarm priority may be affected by the monitoring mode, i.e., ***USER DEFINED*** or ***TELE DEFINED***. For more information, refer to Combo and Rover Combo monitoring on page 6-19.

Patient status alarms

Patient status alarms are the highest priority alarm. They are triggered by a patient condition which exceeds a parameter's alarm limits or by an arrhythmia condition.

There are four severity levels of patient status alarms:

- ***Crisis***: Life-threatening events. ***Crisis*** alarms sound until silenced by the user.
- ***Warning***: Serious but non-life-threatening events. ***Warning*** alarms sound until the condition is resolved.
- ***Advisory***: Events that require monitoring, but are not serious or life threatening. ***Advisory*** alarms sound until the condition is resolved.
- ***Message***: Additional information only.

The CIC Pro center's response to patient status alarms is as follows:

Indicator	*Crisis*	*Warning*	*Advisory*	*Message*
Alarm tone	Three beeps	Two beeps	One beep	No
On-screen message	Yes	Yes	Yes	Yes
Colored patient window border[1] [2]	Red	Yellow	No	No
Automatic graph[3]	Yes	Yes	No	No
Events	Yes	Yes	Yes	No

[1]When using the multi-patient viewer, the patient window border briefly flashes on and off at the start of the alarm and then stays on until the alarm is silenced or the alarming condition ends.

[2]Only patient status ***Crisis*** and ***Warning*** alarms and system status ***Warning*** alarms activate the colored border. Patients selected for single patient view have a white border in the multi-patient viewer.

[3]For telemetry patients only, the factory default for this setting is ***Always on***. To change this setting, see the ***Telemetry Unit Defaults*** in the appropriate CIC Pro center service manual.

When configured, a graph prints automatically when a patient experiences a ***Crisis*** or ***Warning*** alarm. Arrhythmia alarm graphs run until the end of the alarm event or manually stopped by the user. The printer prints the 10 seconds of data that occurred immediately before the event, and prints for the duration of the event. The printer stops printing when the patient returns to a normal rhythm. If a printer is not available at the time of the alarm event, a 20-second graph is saved. This saved graph will print when a printer becomes available.

You can temporarily adjust patient status alarm levels and limits. See Adjusting alarm control settings on page 5-8.

System status alarms

System status alarms are triggered by network or equipment problems. They are of lesser priority than patient status alarms.

There are three severity levels of system status alarms:

- ***System Warning***: Serious network or equipment problems.
- ***System Advisory***: Network or equipment problems.
- ***System Message***: Additional information only.

The CIC Pro center's response to system status alarms is as follows.

Indicator	*System Warning*	*System Advisory*	*System Message*
Alarm tone	Repeating foghorn	Single foghorn	No
On-screen message	Yes	Yes	Yes
Colored patient window border[1] [2]	Yellow	No	No

[1]When using the multi-patient viewer, the patient window border briefly flashes on and off at the start of the alarm and then stays on until the alarm is silenced or the alarming condition ends.

[2]Only patient status ***Crisis*** and ***Warning*** alarms and system status ***Warning*** alarms activate the colored border. Patients selected for single patient view have a white border in the multi-patient viewer.

Managing patient alarms

To support a patient's unique arrhythmia or parameter condition, you can temporarily adjust a patient's ***Parameter Limits And Alarm Levels***. See Adjusting alarm control settings on page 5-8.

The bedside monitors automatically stores a 10-second strip for all ***Advisory***, ***Warning***, or ***Crisis*** arrhythmia events. The CIC Pro center can retrieve and display the 10-second strip stored at the bedside monitor.

When configured for it, your CIC Pro center automatically prints patient alarm graphs. See Printing patient alarm graphs on page 5-16.

Enable transmitter pause

The ***Enable Transmitter Pause*** check box, when checked, allows alarms to be paused by pressing both transmitter buttons simultaneously.

To enable the transmitter pause option for a telemetry patient admitted to the CIC Pro center, click in the ***Enable Transmitter Pause*** check box. A check mark appears in the check box.

To disable the transmitter pause option, click in the ***Enable Transmitter Pause*** checkbox. The check mark is removed from the check box and the option is disabled.

NOTE

If ***Off*** is selected for the ***Transmitter Alarm Pause*** option in the ***Telemetry Unit Defaults*** tab sheet, no check box appears on the tab.

To make the ***Enable Transmitter Pause*** option active (check box available), either ***Enabled*** or ***Disabled*** must be selected for the ***Transmitter Alarm Pause*** option in the ***Telemetry Unit Defaults*** tab sheet.

Pausing alarms at the transmitter

WARNING
Alarms do not sound and alarm graphs do not print during an ***ALARM PAUSE*** condition.

CAUTION
All alarms, except ***Crisis*** alarms, are ignored while the alarm pause is active.

NOTE

The ***Enable Transmitter Pause*** option for a telemetry patient admitted to the CIC Pro center must be enabled before the patient can initiate an alarm pause from the transmitter.

To pause the alarms for five minutes, press the **Verify Leads** and **Graph** buttons simultaneously. When the **Pause Alarm** combination is pushed, the following takes place:

- The top row of LEDs will flash twice, indicating the buttons were pushed.
- The **Pause Alarm** LED will flash at a 1 second rate until the pause alarm condition times out (5 minutes by default, but settable through the programming box).
- ***ALARM PAUSE*** displays in the patient's waveform window on the CIC Pro center screen.

After five minutes, the LED on the transmitter will no longer flash and alarms will be reactivated.

Reactivating alarms at the transmitter

To reactivate the alarms before the five minute time period has elapsed, press both transmitter buttons simultaneously again.

Alarm pause breakthrough

NOTE

For more information on the ***Alarm Pause Breakthrough*** feature in ***Combo*** mode, refer to Combo and Rover Combo monitoring on page 6-19.

NOTE

The ***Alarm Pause Breakthrough*** feature defaults to ***Always On***. It can be set to ***Always Off*** in the ***Telemetry Unit Defaults*** tab (in service mode only) sheet BEFORE admitting a telemetry patient if you do not wish to have ***Crisis*** level alarms break through alarm pauses.

This feature cannot be set on an individual patient basis. It is either on or off for all telemetry patients admitted to the CIC Pro center. A status message on each patient's ***Alarm Control*** tab sheet indicates whether it is enabled (on) or disabled (off).

The ***Alarm Pause Breakthrough*** feature allows any ***Crisis*** level alarm to break through (interrupt) an alarm pause and sound at the CIC Pro center.

In other words, when this feature is turned on in the ***Telemetry Unit Defaults*** tab sheet, ***Crisis*** level alarms will sound at the CIC Pro center, even if an alarm pause is in effect.

The chart below illustrates the function of the ***Alarm Pause Breakthrough*** feature during the various alarm states.

Alarm Pause State	***Alarm Pause Breakthrough* Feature Enabled**
Alarms on	No ***Alarm Pause Breakthrough***; all alarms are on.
Alarms off	No ***Alarm Pause Breakthrough***; all alarms are off.
Alarm off reason (X-ray, shower, etc.)	Alarms are paused; ***Crisis*** level alarms will break through the alarm off reason if the patient is in antenna range.
Alarms paused from the transmitter	Alarms are paused; ***Crisis*** level alarms will break through the alarm pause.

After a ***Crisis*** level alarm has broken through an alarm pause, the telemetry system does *not* return to an alarm pause state. All alarms at any alarm level will sound at the CIC Pro center.

If you wish to continue pausing alarms after an ***Alarm Pause Breakthrough*** occurs, you must re-initiate the alarm pause:

1. To re-initiate an alarms off with reason condition, select the alarms off reason in the telemetry patient's ***Alarm Control*** tab sheet.
2. To re-initiate an alarm pause from the transmitter, press both transmitter buttons simultaneously twice.

NOTE

The transmitter buttons must be pressed once to end the alarm pause at the transmitter, then a second time to start a new alarm pause at the transmitter (see below).

The **Pause Alarm** LED on the transmitter continues to flash after an ***Alarm Pause Breakthrough*** occurs. This is because there is no communication from the CIC Pro center back to the transmitter to indicate that the alarm pause has ended.

After an ***Alarm Pause Breakthrough*** occurs, you can turn off the flashing **Pause Alarm** LED by pressing both transmitter buttons simultaneously.

Silencing alarms

Temporarily silencing alarms from the CIC Pro center

WARNING
Do *not* continuously try to silence audible alarms. You may inadvertently silence new patient alarms.

Once you are notified of an alarm condition, you can silence audible alarms from the CIC Pro center for one minute by clicking the ***Silence Alarms*** button located on the display screen or by pressing the **Silence Alarms** key located on the keyboard.

This sends a silence notification to the bedside monitor. For most GE monitors, this silence notification will silence the alarms for up to one minute. However, the viewed bedside monitors must be configured to allow bedside alarms to be silenced from the CIC Pro center.

NOTE

The following conditions apply when you silence alarms at the CIC Pro center:

- The alarms remain silent for one minute unless a new patient alarm condition occurs.
  - ApexPro telemetry beds: If a patient alarm condition of any severity level occurs, the alarm silence condition is cancelled and the alarm will break through.
  - Monitors and CD Telemetry-LAN telemetry beds: If a patient alarm condition of equal or greater severity level occurs, the alarm silence condition is cancelled and the alarm will break through.
- The alarms for all patients are silenced simultaneously. You cannot silence patient alarms one at a time.
- The CIC Pro center displays a filled alarm silence icon when alarms are silenced at the CIC Pro center or at a monitor.

Alarm silence indicator

When active alarms are silenced at the CIC Pro center or at a monitor, the CIC Pro center displays an alarm silence icon in the ECG parameter window.

This icon remains displayed for the duration of the alarm silence condition or until a new alarm condition occurs.

Adjusting alarm control settings

When viewing a single, in-unit patient from the CIC Pro center, you may temporarily adjust the monitor ***Alarm Control*** settings.

WARNING
ALARM CONTROL SETTINGS—If you adjust parameter limits or alarm levels at the CIC Pro center, these setting changes are also implemented by the bedside monitor. You must notify the bedside caregiver that you changed the parameter limit or alarm levels of that bedside monitor.

NOTE

The following guidelines apply to changing ***Alarm Control*** settings at the CIC Pro center:

- The changes you make to the settings apply to the selected patient only and are adopted by the patient's monitor.
- Some control settings for non-GE acquisition devices that are interfaced via the Unity Network Interface Device or the OCTANET interface device are not adjustable.
- It may be necessary to use the scroll bar at the right side of the window to view the appropriate alarm.
- The control settings that are blue in color indicate this setting has already been adjusted from the default value.
- The patient or the acquisition device must be located in-unit.
- Any out-of-unit patient alarm settings can be viewed, but not changed.

NOTE

The Dinamap PRO monitors' alarm limits are not configurable at the CIC Pro center, but they can be silenced at the CIC Pro center. However, alarms that are silenced at the CIC Pro center will not be silenced at the monitor. Refer to the Dinamap Pro 100–400 Operation Manual for detailed information.

Monitor alarm control settings

Complete the following procedures to temporarily adjust the following monitor ***Alarm Control*** settings for a selected patient:

- Low/high parameter alarm limits and alarm levels.
- ***Arrhythmia Alarm Levels***.

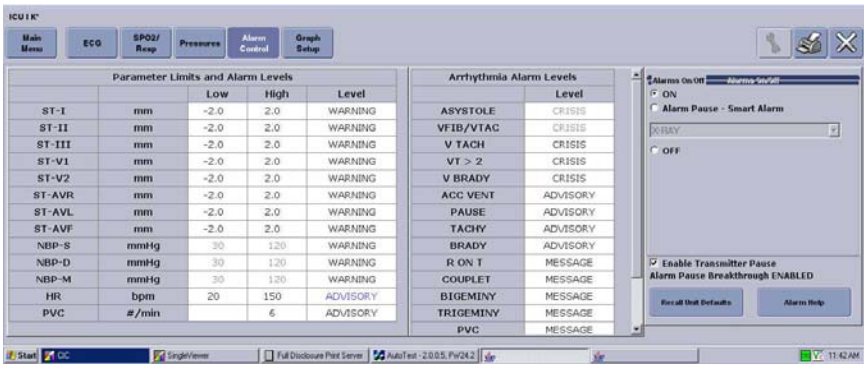
NOTE

All changes are temporary and return to the default settings when the patient is discharged.

To permanently change the ***Alarm Control*** settings for telemetry patients, see the ***Telemetry Alarm Control Defaults*** section of the appropriate CIC Pro center service manual.

Displaying the alarm control window

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Monitor Setup*** > ***Alarm Control***. The ***Alarm Control*** window displays.



056A

You may change any of the undimmed setting options. When an option appears dimmed, you cannot change it.

Adjusting the parameter limit values

WARNING
ALARM CONTROL SETTINGS—If you adjust parameter limits or alarm levels at the CIC Pro center, these setting changes are also implemented by the bedside monitor. You must notify the bedside caregiver that you changed the parameter limit or alarm levels of that bedside monitor.

1. From the ***Alarm Control*** window, click on the alarm limit ***Low*** or ***High*** field.
2. Click the up or down arrows to increase or decrease the alarm limit value. You may also type the values directly into the highlighted data field.
3. Repeat the previous steps to adjust additional alarm limit values.
4. After making your selections, complete one of the following tasks:
   - Choose a different control setting to adjust.

- Click the  (close button) on the top right side of the window to close the window.

5. A message window with the information regarding the last change made. Select ***Yes*** to accept the change or ***No*** to cancel the change.

Adjusting the alarm levels

WARNING
ALARM CONTROL SETTINGS—If you adjust parameter limits or alarm levels at the CIC Pro center, these setting changes are also implemented by the bedside monitor. You must notify the bedside caregiver that you changed the parameter limit or alarm levels of that bedside monitor.

1. From the ***Alarm Control*** window, click on the alarm ***Level*** field.
2. Click the down arrow to display a list of alarm levels.
3. Select the desired alarm level.
4. Repeat step 1 to step 3 to adjust additional alarm level settings.
5. After making your selections, complete one of the following tasks:
   - Choose a different control setting to adjust.
   - Click the  (close button) on the top right side of the window to close the window.
6. A message window with the information regarding the last change made. Select ***Yes*** to accept the change or ***No*** to cancel the change.

Adjusting telemetry Alarms On/Off control settings

WARNING
Alarms do not sound, alarm histories are not stored, and alarm graphs do not print during an alarms off with reason condition.

NOTE

The patient must be in antenna range for the alarm pause state to cease. After the patient has returned to antenna range and/or alarms have been turned back on, verify that the patient's waveforms are displayed at the CIC Pro center or bedside monitor

NOTE

Refer to Alarm pause breakthrough on page 5-6 for important alarm pause information.

The telemetry ***Alarm Pause - Smart Alarms*** feature reduces false patient alarms and works as follows:

- When a patient is re-connected to the telemetry device and continuous ECG data is recorded, the alarm pause condition automatically clears.

- Selecting any reason establishes an alarm pause state for 5 minutes in the presence of a valid waveform. After 5 minutes, alarms will reactivate if the patient is within range of the antenna system for 15 seconds or longer and continuous ECG data is detected. If the patient remains out of antenna range, the alarm pause state will continue until the patient re-enters antenna range for 15 seconds or longer.
- When a patient is re-connected to the telemetry device and continuous ECG data is recorded, the ***Alarm Pause*** condition automatically clears.
- If the patient is in ***LEADS FAIL*** or ***NO TELEM*** and an alarms off reason is selected, the reason is displayed in the waveform window.

Complete the following procedure to adjust the ***Alarms On/Off*** control settings:

1. To temporarily pause this telemetry patient's alarm to complete a procedure, click ***Alarm Pause - Smart Alarms***. Then, complete the following steps:

   a. Click the down arrow to display a list of reasons for pausing the alarm.

   b. Select the desired reason. This text is displayed in addition to the ***ALL ALARMS OFF*** message in the patient's window at the CIC Pro center.

Alarms Off **Reason**	**Text Displayed At CIC Pro center**	**Text Printed On Graph**
On	(no text)	(no text)
Off[1]	***ALL ALARMS OFF***	***Alarm Off***
X-ray	***X-RAY***	***at X-RAY***
Shower	***SHOWER***	***at SHOWER***
Surgery	***SURGERY***	***at SURGERY***
Physical therapy	***P.T.***	***at PHYSICAL THERAPY***
Cardiac rehab	***CAR REHAB***	***at CARDIAC REHAB***
GI Lab	***GI LAB***	***at GI LAB***
Occupational therapy	***O.T.***	***at OCCUPATIONAL THERAPY***
Off unit	***OFF UNIT***	***OFF UNIT***
Cath Lab	***CATH LAB***	at ***CARDIAC CATH LAB***

[1]OFF appears dimmed and is not selectable when the following service-level default is set: ***CIC Setup*** > ***CIC Defaults*** > ***Allow Alarms OFF on this CIC*** > ***No***. To be able to turn off alarms for a telemetry patient, you must change the ***Allow Alarms OFF*** on this CIC service-level default to ***Yes***. For more information, refer to the appropriate CIC Pro center service manual.

2. To turn off alarms for this telemetry patient, click ***OFF***.

WARNING
The telemetry alarms remain off until you manually select ***ON*** again.

Alarm unit default settings

Telemetry alarm control defaults

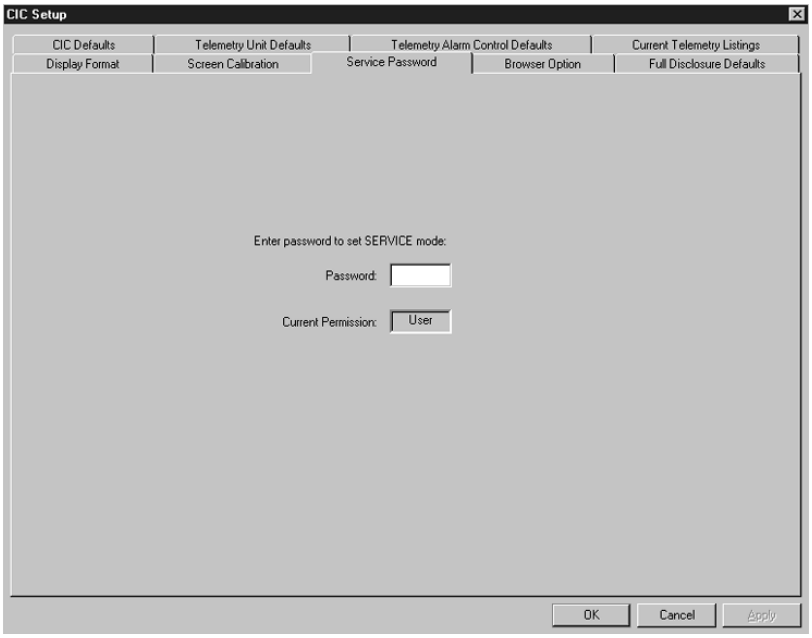
You can set ***Telemetry Unit Defaults*** for ***Parameter Limits And Alarm Levels***, as well as for ***Arrhythmia Alarm Levels***. These defaults are in effect for all telemetry patients admitted to your unit, unless they are modified in an individual patient's ***Alarm Control*** tab sheet.

To set ***Telemetry Alarm Control Defaults***, follow the steps below:

NOTE

These settings are service-level defaults and are password protected.

1. Click ***CIC Setup***. A set of tabs displays.
2. Click on the ***Service Password*** tab to bring it to the front.

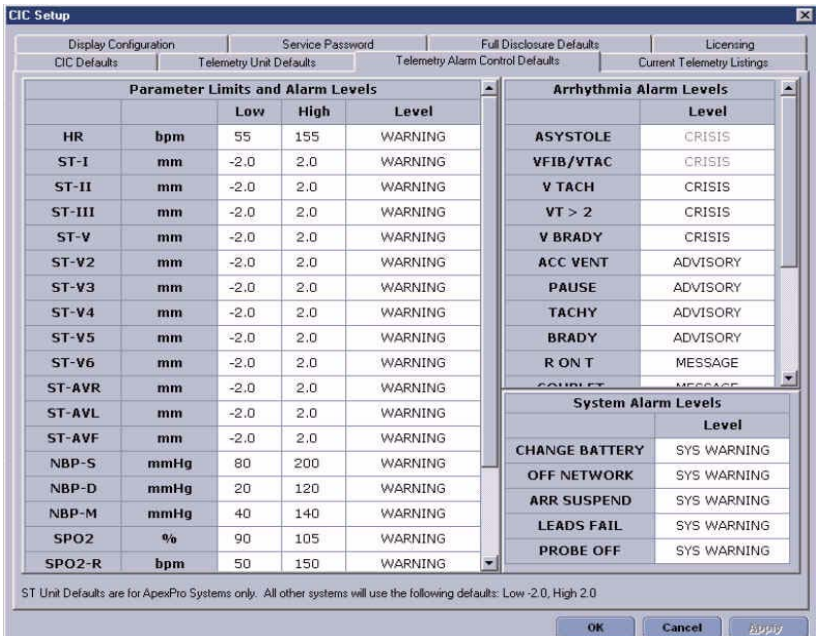


318B

3. Use the keyboard to enter the service password, then click the ***Apply*** button. The ***Current Permission*** entry changes from ***User*** to ***Service***.

CAUTION
The service mode is intended for use only by qualified personnel with training and experience in its use. The consequences of misuse include loss of patient data, corruption of the CIC Pro center operating system software, or disruption of the entire Unity network.

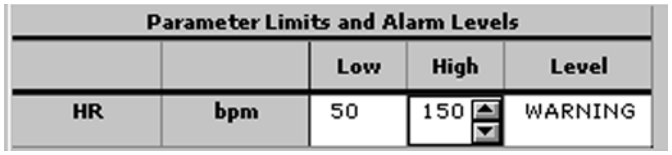
4. Click on the ***Telemetry Alarm Control Defaults*** tab to bring it to the front.



319E

Parameter limits

1. To change the unit defaults for ***Parameter Limits and Alarm Levels,*** use the mouse to click in the ***Low*** or ***High*** field for the parameter you wish to edit. The field is framed by a rectangle, and up and down arrow buttons appear in the field.



329A

2. To increase or decrease the limit by 5, click on the up or down arrow button.

   To increase or decrease the limit in increments other than 5, use the keyboard to enter a new limit value.

3. Once you have set the desired limit, click on the ***Apply*** button for the changes to take effect.

   NOTE

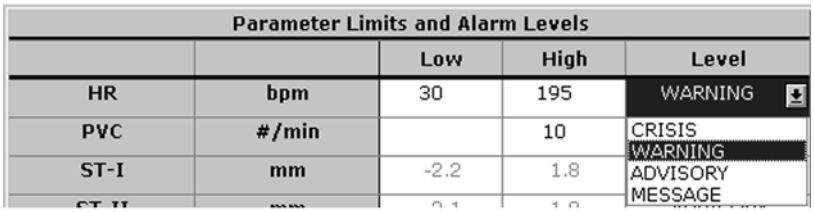
   If you make only one change, you do not need to click on the ***Apply*** button. The change will take effect automatically, and the ***Apply*** button will appear dimmed.

4. If you are finished making changes to the ***Telemetry Alarm Control Defaults*** tab sheet, click the ***OK*** button.

Parameter alarm levels

To make a change in the telemetry unit default alarm level for a parameter, first access the ***Telemetry Alarm Control Defaults*** tab as described in the ***Telemetry Alarm Control Defaults*** section in this chapter. Then follow the procedure below.

1. In ***Telemetry Alarm Control Defaults*** tab, use the mouse to click in the ***Level*** field of the parameter for which the alarm level is to be changed. A down arrow button appears in the field.
2. Click on the down arrow button. A popup list of alarm level selections appears.



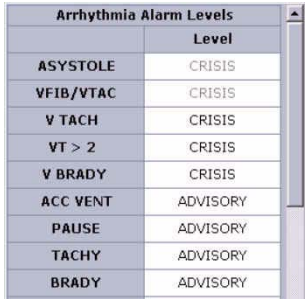
331A

3. Click on the desired alarm level to select it.
4. Once you have set the desired level, click the ***Apply*** button for the changes to take effect.
5. If you are finished making changes to the ***Telemetry Alarm Control Defaults*** tab sheet, click the ***OK*** button.

Arrhythmia alarm levels

To make a change in the telemetry unit default alarm level for arrhythmia alarms, first access the ***Telemetry Alarm Control Defaults*** tab as described in the ***Telemetry Alarm Control Defaults*** section in this chapter. Then follow the procedure below.

1. In the ***Telemetry Alarm Control Defaults*** tab, the ***Arrhythmia Alarm Levels*** for which unit defaults can be set appears on the right side of the window:



333D

2. Click in the ***Level*** field of the arrhythmia alarm you wish to modify. A down arrow button appears in the field.

NOTE

The ***Arrhythmia Alarm Levels*** for ***ASYSTOLE*** and ***VFIB/VTAC*** cannot be changed. Therefore, the text in the ***Level*** field for these alarms always appears dimmed.

3. Click on the down arrow button. A popup list of alarm level selections appears.
4. Click on your choice to select it.
5. Once you have set the desired level, click the ***Apply*** button for the changes to take effect.

If you are finished making changes to the ***Telemetry Alarm Control Defaults*** tab sheet, click the ***OK*** button.

System alarm levels

WARNING
ADJUSTING SYSTEM ALARM LEVELS — The ***Leads Fail*** alarm indicates that one or more electrodes are not connected to the patient and, as a result, there is loss of all waveforms and arrhythmia analysis. The ***ARR SUSPEND*** alarm indicates that arrhythmia conditions are not being detected and therefore alarms associated with arrhythmias will not occur. The ***Leads Fail*** and ***ARR SUSPEND*** alarms should be adjusted to a lower priority level only by experienced qualified personnel and with great caution. Adjusting these alarms to a lower priority level may result in reduced awareness of conditions that indicate the loss of patient monitoring.

NOTE

Some alarm conditions may have a higher priority level at the bedside monitor. In ***Combo*** mode, the alarm levels come from the telemetry settings. For example, ***LEADS FAIL*** can be set to ***Crisis*** at a bedside monitor, but the telemetry setting is a system ***Warning***.

To make a change in the telemetry unit default alarm level for system alarms, first access the ***Telemetry Alarm Control Defaults*** tab as described in the ***Telemetry Alarm Control Defaults*** section in this chapter. Then follow the procedure below.

1. In the ***Telemetry Alarm Control Defaults*** tab, the ***System Alarm Levels*** for which unit defaults can be set appears on the right side of the window:

System Alarm Levels	
	Level
CHANGE BATTERY	SYS WARNING
OFF NETWORK	SYS WARNING
ARR SUSPEND	SYS WARNING
LEADS FAIL	SYS WARNING
PROBE OFF	SYS WARNING

430B

2. Click in the ***Level*** field of the system alarm you wish to modify. A down arrow button appears in the field.
3. Click on the down arrow button. A popup list of alarm level selections appears.
4. Click on your choice to select it.

5. Once you have set the desired level, click the ***Apply*** button for the changes to take effect.

If you are finished making changes to the ***Telemetry Alarm Control Defaults*** tab sheet, click the ***OK*** button.

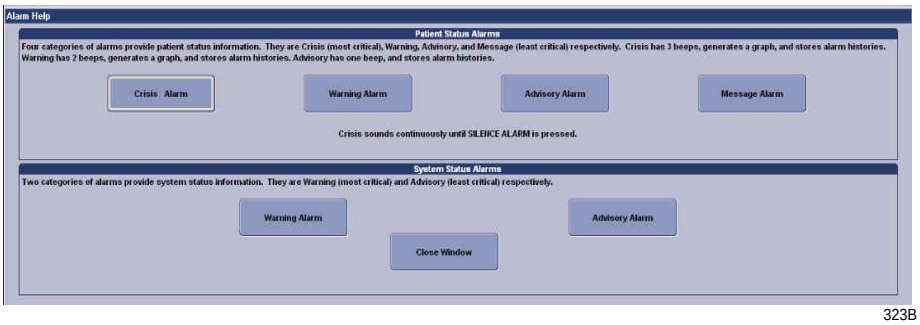
Recalling unit defaults

To recall the preset telemetry patient unit defaults for all options in the ***Alarm Control*** tab, simply click on the ***Recall Unit Defaults*** button on the bottom right side of the ***Alarm Control*** tab sheet. All data on the tab sheet will clear, and after a moment the preset unit defaults will appear.

In addition, clicking on the ***Recall Unit Defaults*** button also restores the default graph locations and settings on the patient's ECG tab sheet.

Alarm help

For additional information about alarms, click on the ***Alarm Help*** button at the bottom right side of the ***Alarm Control*** tab sheet. An ***Alarm Help*** window displays.



323B

You can click on the buttons in this window to hear how each type of alarm sounds. When you are finished browsing the window, click on the ***Close Window*** button to close the window and return to the single patient viewer.

Printing patient alarm graphs

An automatic alarm graph prints the 10 seconds of data that occurred before the alarm event, then continues to print for the duration of the event. When the printer is not available, the bedside monitor stores the event data until the printer becomes available.

Configure the automatic printing of alarm graphs

The automatic printing of alarm graphs for telemetry beds must be enabled in the Service mode. For more information, refer to User-level defaults (persistent) on page 4-7.

Printing alarm settings

A telemetry patient's ***Alarm Control*** tab sheet can be printed, showing all current alarm settings and limits. Click on the ***Print*** button in the main menu to start a printout of the ***Alarm Control*** tab sheet.

The ***Alarm Control*** tab sheet prints at the Print Window location. For more information about setting the Print Window location, refer to Chapter 9 in this manual.

NOTE

The ***Alarm Control*** tab sheet must be the front tab of the single patient viewer in order to print it. Click on the ***Alarm Control*** tab to bring it to the front if necessary.

Stop printing an alarm graph

You can stop the printing of an alarm graph from any in-unit CIC Pro center displaying the alarming patient bed.

Stop printing to a laser printer

Complete the following procedure to stop printing all print jobs sent to the laser printer:

1. From the multi-patient viewer, click ***CIC Setup*** > ***CIC Defaults***. The ***CIC Defaults*** window displays.
2. Under ***Printer/Writer***, click ***Cancel Print Jobs*** for the printer you want to stop printing to.
3. After making your selection, complete one of the following tasks from the ***CIC Defaults*** window:
   - Click ***OK*** to apply your changes and close the ***CIC Defaults*** window.
   - Click ***Cancel*** to cancel your changes and close the ***CIC Defaults*** window.
   - Click ***Apply*** to apply your changes without closing the ***CIC Defaults*** window.

Stop printing to a local digital writer

Complete the following procedure to stop printing the current print job sent to a local digital writer:

1. Locate the digital writer.
2. Press the  (**Graph Stop**) button located on the front of the digital writer to stop the print job.

6 Managing patients

Introduction

Prior to admitting a telemetry patient to the CIC Pro center, several steps need to be performed:

1. Transmitter setup on page 3-2.
2. Skin preparation on page 6-2.
3. Electrode placement on page 6-2.

You can manage in-unit patients from the CIC Pro center or from a networked monitor. When managing in-unit patients from the CIC Pro center, you can complete the following tasks:

- Admit patients.
- Change patient demographic information.
- Adjust parameter settings.
- View stored data.
- Move patients to different beds.
- Discharge patients.

Skin preparation

The quality of ECG information displayed on the monitor is a direct result of the quality of the electrical signal received at the electrode. Proper skin preparation is necessary for good signal quality at the electrode.

Choose flat, non-muscular areas to place electrodes, then follow the established prep protocol for your unit. Below is a suggested guideline for skin preparation:

1. Shave or clip hair from skin at chosen sites.
2. Thoroughly cleanse the site with alcohol or a mild soap and water solution. Be sure to remove all oily residue, dead skin cells, and abrasives.
3. Dry the skin completely before applying the electrodes.

Regardless of patient age, all electrodes should be replaced on a regular basis, AT LEAST every 48 hours, to maintain quality signals during long-term monitoring. If they are not, increased noise can occur. Over the course of 48 hours, the electrode gel will start to dry out and the adhesive will age. After a long period of time, the patient's skin may also be irritated by the gel or adhesive, causing discomfort.

Electrode placement

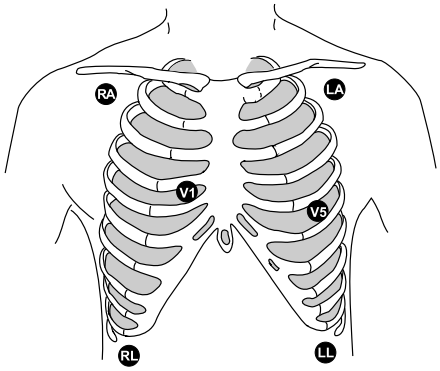
WARNING
CONTAMINATED LEADWIRES— Contaminated leadwires may cause infection. Always follow the skin preparation guidelines and leadwire cleaning instructions provided in this manual.

The following chart shows the label used to identify each leadwire. Included also is its associated color code per AHA (American Heart Association) and IEC (International Electrotechnical Commission) standards.

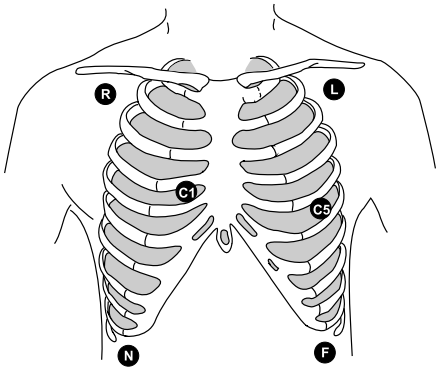
Leadwire (Software Label)	AHA Color	AHA Label	IEC Color	IEC Label
RA (right arm)	white	RA	red	R
LA (left arm)	black	LA	yellow	L
RL (right leg)	green	RL	black	N
LL (left leg)	red	LL	green	F
V1 (precordial)	brown	V1	white	C1
V2 (precordial)	yellow	V2	yellow	C2
V3 (precordial)	green	V3	green	C3
V4 (precordial)	blue	V4	brown	C4
V5 (precordial)	orange	V5	black	C5
V6 (precordial)	purple	V6	purple	C6

6-leadwire electrode placement

The following is a suggested configuration for a 6-leadwire electrode placement for all patients, including pacemaker and implantable cardiac defibrillator (ICD) patients:



6-leadwire AHA Electrode Placement



6-leadwire IEC Electrode Placement

100B, 101B

Right arm and left arm electrodes should be placed just below the right and left clavicle.

Right leg and left leg electrodes should be placed on a non-muscular surface on the lower edge of the rib cage.

NOTE

When using a 6-leadwire set, the V leads must be labelled correctly. Choices for ***Va***: V1 to V6. Choices for ***Vb***: V2 toV6. For more information, refer to User-level defaults (persistent) on page 4-7.

NOTE

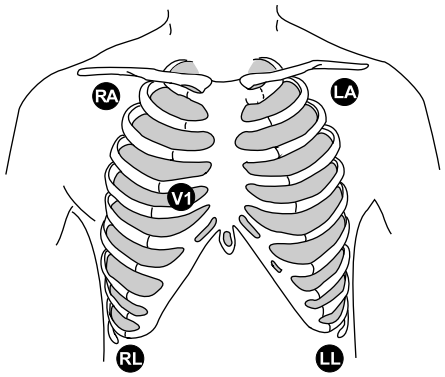
The ***V1*** lead is recommended for arrhythmia detection, and the ***V5*** lead is recommended for ST depression monitoring.[1]

NOTE

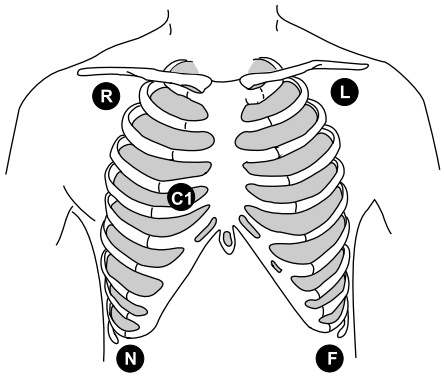
For telemetry monitoring, any two precordial electrodes may be placed according to the clinician or physician's preference.

5-leadwire electrode placement

The following is a suggested configuration for a 5-leadwire electrode placement:



5-leadwire Electrode AHA Placement



5-leadwire Electrode IEC Placement

633B, 634B

Right arm and left arm electrodes should be placed just below the right and left clavicle.

Right leg and left leg electrodes should be placed on a non-muscular surface on the lower edge of the rib cage.

The precordial electrode should be placed according to the clinician or physician's preference.

3-leadwire electrode placement

WARNING
Do not monitor pacemaker patients with a 3-leadwire set when reliable pacer detection is required. Pacer pulse detection can be erratic when only a single vector is monitored. Always use a 5- or 6-leadwire set when reliable pacer detection is required.

[1]Barbara J. Drew, RN, PhD, FAAN (2000). Value of Monitoring a Second Precordial Lead for Patients in a Telemetry Unit, GE Medical Systems (order document number M04243ME0).

CAUTION

DELAY IN LEAD DETECTION— When using a 3-leadwire set, there may be up to a 10 second delay in detection of the ECG waveform. A ***Leads Fail*** or ***No TELEM*** alarm may be temporarily displayed.

Wait for 10 seconds the ECG waveforms will be displayed.

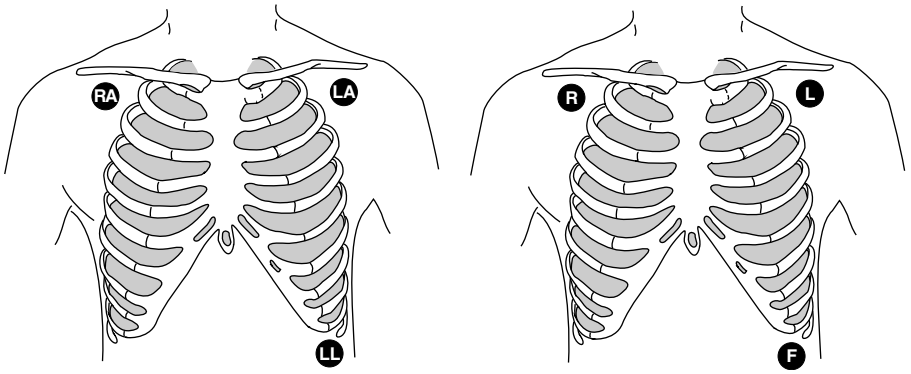
CAUTION

When using the ApexPro transmitter with a 3-leadwire set, an RF signal continues to be transmitted upon removal of ECG leadwires. A ***Leads Fail*** alarm appears at the central station however the system does not transition to a ***No TELEM*** alarm.

Please take appropriate measures as explained in this manual for the leads fail condition.

If an SpO2 and/or NIBP device is connected to the transmitter, an NIBP or SpO2 limit alarm with warning or advisory as configured by the user will supersede the existing ***Leads Fail*** system warning alarm.

When a 5-leadwire electrode configuration is not desirable, a 3-leadwire set can be used. The following is a suggested configuration for a 3-leadwire electrode placement:



3-leadwire AHA Electrode Placement

3-leadwire IEC Electrode Placement

370A, 373A

Right arm and left arm electrodes should be placed just below the right and left clavicle.

Left leg electrode should be placed on a non-muscular surface on the lower edge of the rib cage.

When using the standard 3-leadwire configuration, the following operating conditions occur:

- ***Lead Analysis*** automatically switches to ***Single-Lead*** analysis. If an attempt is made to change to ***Multi-Lead*** analysis, a message will appear briefly on the monitor, indicating that ***Multi-Lead*** analysis is not possible, and no change will occur.

- The choices for displayed leads are limited to I, II, and III. Any options usually allowing more than one ECG lead selection are disallowed.
- Respiration can be monitored from either lead I or II. It is not dependent on the displayed lead. Respiration is not available for telemetry patients. For more information, refer to SpO2 control settings on page 7-25.

Electrode placement for pediatric patients

Typically, pediatric patients are large enough for a 5- or 6-leadwire electrode configuration. This is the preferred monitoring setup for receiving the benefits of ***Multi-Lead*** analysis. However, if the patient is too small for five or six electrodes, the 3-leadwire electrode configuration can be used. The right arm and left arm electrodes are positioned on the right and left sides of the chest. The right leg electrode can be placed on either the right or left side of the abdomen. Refer to 3-leadwire electrode placement on page 6-4.

Verify status

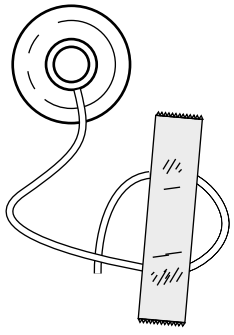
After the transmitter leadwires have been properly attached to the patient's electrodes, verify lead quality, electrode status and transmitter function.

- For more information, refer to Maintaining quality ECG signal on page 6-6.
- For more information, refer to Transmitters on page 2-2.

Maintaining quality ECG signal

Electrodes are disposable and applied only once. Attempts to replace a loose electrode guarantees excessive motion artifact and results in false alarms. Regardless of patient type, electrodes should be replaced at least every 48 hours to maintain quality signals during long-term monitoring. Over the course of 48 hours, the electrode gel will start to dry out and the adhesive will age. This may irritate the patient’s skin.

The transmitter must be carried securely on the patient. Stabilize the electrode and leadwire with a leadwire stress loop near the electrode. Tape the stress loop to the patient. A secured stress loop prevents the leadwire rotation about the electrode snap, leadwire tugging at the electrode and ECG artifact.



306A

If the transmitter is allowed to dangle or jostle as the patient moves, then the weight of the device will tug on the electrodes, causing degradation of the signal. Even if the electrodes are in good contact, excessive tugging on the electrodes will change the

physical structure of the gel, thereby generating motion artifact signals. Transmitters can be carried securely is inserted into pouches or placed into a patient's gown pocket.

Special considerations for 6-leadwire monitoring

V FAIL message

CAUTION
The CIC Pro center does not detect 6-leadwire monitoring until a signal from the sixth lead is received at the CIC Pro center. Therefore, if the sixth lead on the transmitter has failed before the telemetry patient is admitted to the CIC Pro center, the CIC Pro center will *not* generate a ***V FAIL*** message for the sixth lead.

At the patient's transmitter, verify that the sixth lead on the transmitter is good. Press the **Verify Leads** button on the transmitter and ensure that all the good lead LEDs illuminate.

Relearn

If a telemetry patient is switched from 6-leadwire monitoring to 5-leadwire monitoring while admitted to the CIC Pro center, a ***V FAIL*** message will appear. The CIC Pro center assumes that the telemetry patient is being monitored for six leads and that the sixth lead has failed.

In situations where the admitted telemetry patient has been switched from 6- to 5-leadwire monitoring, the associated ***V FAIL*** message can be cleared by clicking on the ***Relearn*** button in the telemetry patient's ECG tab sheet. For more information, refer to ECG on page 7-11.

Admitting

CAUTION
FALSE ALARMS—If clinical workflow includes pre-admitting telemetry transmitters, attach ECG leadwires to patient prior to attaching ECG leadwires to transmitter. Failure to follow this sequence may result in false alarms or interruption in ECG waveform.

Prior to admitting a telemetry patient to the CIC Pro center, several steps need to be performed:

1. Transmitter setup on page 3-2.
   - Battery installation on page 3-3.
   - Leadwire installation on page 3-5.
   - Electrode attachment on page 3-5.

- Verify transmitter/leadwires status on page 3-6.

2. Skin preparation on page 6-2.
3. Electrode placement on page 6-2.

Terminology

CAUTION

ADJUSTING WAVEFORM COLORS — For an unlocked patient bed, the waveform color changes remain in effect until the bed is removed from the display, discharged, or until the bed is moved to a different location on the display. At this time, the waveform colors return to the default settings.

For locked patient bed, the color changes remain in effect until a user manually changes the colors. Moving or discharging a patient bed does not return the waveform colors to the default settings.

Term	Definition
Locked bedside	■ Bed names are permanently allocated to a particular slot on the CIC Pro center. ■ Users are unable to move the bed to another slot. ■ When a telemetry patient is discharged from a locked patient window, the message “DISCHARGED” is displayed in the patient window.
Unlocked bedside	■ The bed names are temporarily allocated to a particular slot on the CIC Pro center. ■ An admitted bed can be moved to another available slot at the CIC Pro. ■ When a telemetry patient is discharged from an unlocked patient window, an Admit button is displayed in the patient window.
Telemetry monitoring	Telemetry monitoring occurs when patient vital signs data is transmitted by a transmitter to a telemetry receiver system over an established antenna system and viewed at a CIC Pro center. The CIC Pro center identifies a telemetry bed by placing an asterisk next to the bed name (e.g., IMC|BED4*). ECG data is processed by the telemetry receiver system.
TTX ID number	Each transmitter has a transmitter TTX ID number that corresponds to a frequency and service type. The TTX ID number is found in parenthesis on the back of the transmitter. When the TTX ID number is entered for a patient at the CIC Pro center, the CIC Pro center recognizes the transmitter type and translates the information into an alpha-numeric number. The alpha-numeric number of the transmitter is displayed under the ECG parameter window. **NOTE** The TTX ID number is a four digit number.

Term	Definition
Bedside monitoring (hard-wired)	**WARNING** INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING AND CALCULATIONS BASED ON PATIENT AGE — After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied. A bedside monitor is a stationary monitor (user-configured or factory-configured). These monitors are connected directly to the patient via an ECG cable. They are set up with a unit name as well as a bed name (e.g., IMC|BED4). For a user-configured monitor, ECG data is processed by an acquisition module. For a factory-configured monitor, ECG data is processed within the monitor itself. For more information, refer to the CIC Pro Clinical Information Center Operator's Manual.
Combo monitoring	This application provides the option to acquire ECG from either the monitor or from a telemetry receiver system. This ECG data acquisition capability enhances basic telemetry monitoring by providing additional access to all of the available parameters from the monitor. A Unity Network connection is required.

Factors guiding the admit process

WARNING
ALARM ACTIVATION—No alarms sound on the CIC Pro center until a patient is admitted to the monitor or CIC Pro center. The CIC Pro center or monitor will *not* alarm if an unadmitted patient enters an alarm condition. You must admit the patient to activate alarms, alarm graphs, and the ***Events*** directory.

A telemetry patient must be admitted from the CIC Pro center. If using Combo monitoring, a telemetry patient may be admitted from either a networked bedside monitor or the CIC Pro center. You only have to admit a patient once.

The steps you must complete to admit a patient at the CIC Pro center may vary resulting from the following factors:

- The source of the ECG data.
- The source of the patient demographic information.
- The mobility level of the monitor. Does the monitor move (rove) from room-to-room?
- The permanent assignment (locking) of beds in the multi-patient viewer.

The source of the ECG data

You can admit patients to the CIC Pro center when the source of their ECG data comes from either a monitor or a transmitter.

The source of the ECG data determines the monitoring mode the CIC Pro center uses. The monitoring mode is configured during installation.

The CIC Pro center supports one of the following monitoring modes:

Monitoring Modes	
Mode	**Description**
Standard	■ The monitor and patient always stay in one room. ■ The patient is not connected to a transmitter.
Rover	■ The monitor moves (roves) from room to room. ■ The patient is not connected to a transmitter.
Combo	■ The monitor (or transmitter) and patient always stay in one room. ■ The patient is connected to either a stationary monitor or to a transmitter.
Rover Combo	■ The monitor (or transmitter) moves (roves) from room to room. ■ The patient is connected to either a stationary monitor or to a transmitter.

The source of the patient demographic information

Depending on the configuration of your CIC Pro center, you may use one of the following methods to enter patient demographic information:

- Enter search criteria (e.g., patient name) to retrieve matching patient demographic information from a networked database.
- Manually type patient demographic information into data entry fields and choose demographic information from a list.

The monitor moves (roves) from room to room

When the monitor moves (roves) from room to room and is not a transmitter, always admit the patient at the monitor.

NOTE

Before you admit a patient at a monitor that moves (roves), you must complete the following procedure (in the order it is presented) to ensure the correct bed number is identified at the CIC Pro center:

1. Turn off the monitor when you are storing it.
2. Keep the monitor turned off when you bring it into the patient room.
3. Verify the monitor is on the network.

4. Connect the monitor to an appropriate power outlet.
5. Turn on the monitor.
6. Wait 30 seconds, then verify the monitor displays the correct ***Unit Name*** and ***Bed Name***. If the ***Unit Name*** and ***Bed Name*** do not appear, refer to To manually enter the patient demographic information on page 6-14.
7. Admit the patient to the monitor following the monitor's operator instructions.

The permanent (locked) beds in the multi-patient viewer

During the installation of the CIC Pro center, qualified personnel may configure the CIC Pro center to permanently display bed names in specific multi-patient viewer locations (windows). These beds are locked into position and are always displayed whether a patient is admitted to them or not. To change the display of locked beds, contact your biomedical engineering department.

Admitting a patient

This section covers the following tasks:

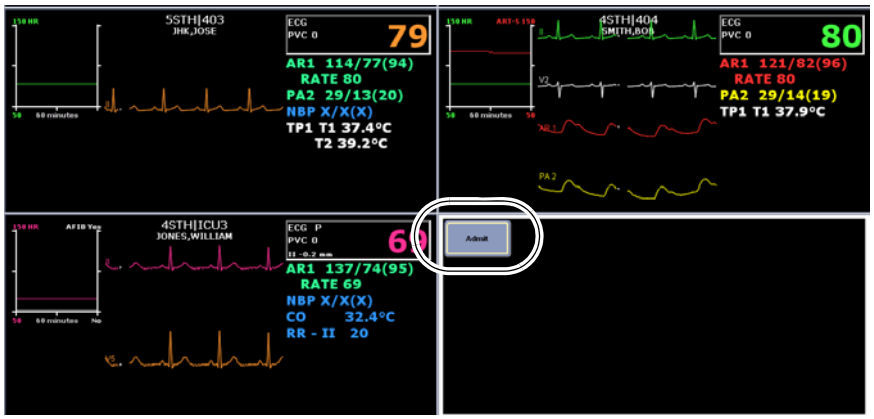
- Look for an empty patient window displaying an ***Admit*** button.
- Enter the patient demographics.
- Enter the bed number.
- Enter the source of the ECG data.
- Admit the patient.

NOTE

When the monitor moves from room to room and is not a transmitter, always admit the patient at the monitor. See The monitor moves (roves) from room to room on page 6-10.

Look for an empty patient window displaying an Admit button

1. From the multi-patient viewer, look for an empty patient window displaying an ***Admit*** button.



a. When you see an empty patient window displaying an ***Admit*** button, go to step 2.

b. If you do not see an empty patient window displaying an ***Admit*** button, click ***Auto Display*** in the menu bar. When the ***Auto Display*** button is enabled, the multi-patient viewer rearranges itself and should add at least one empty patient window with an ***Admit*** button:

NOTE

To enable or disable the ***Auto Display*** feature, from the multi-patient viewer, click ***Setup CIC*** > ***CIC Defaults*** > ***Display Configuration*** > ***Auto Display.***

i. When you see an empty patient window displaying an ***Admit*** button, go to step 2.

ii. If the message, ***Reconfiguration Failed*** appears, the multi-patient viewer is full of admitted patient windows and no empty patient windows are available. Use the following procedures (in the order presented) to remove displayed patient beds from the multi-patient viewer before you can admit a new patient:

- See Removing viewed out-of-unit patient beds on page 7-6.
- See Viewing patient beds from another in-unit CIC Pro center on page 7-5.
- See Discharging an admitted patient on page 6-19.

c. When a ***Discharged*** message is displayed in an unlocked patient window, you must clear the discharged bed from this unlocked window before you can admit a patient to this window. To clear the discharged bed, complete the following procedure:

i. Right click in the patient window you need to clear. The right click menu displays.

ii. From the right click menu, click ***Select Care Unit then Bed Number*** > ***None***. The patient window should now be empty except for an ***Admit*** button. Go to step 2.

2. Click ***Admit*** to display the ***Admit*** window.

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To automatically enter the patient demographics

To bypass the manual entry of the patient demographic information, you can search for and retrieve the information from a networked database.

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING, AND CALCULATIONS BASED ON PATIENT AGE—After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

NOTE

Retrieving patient demographic information from a networked database requires a Hospital Information System (HIS). You may also know the HIS as an Aware Gateway or as a Quantitative Sentinel (QS).

NOTE

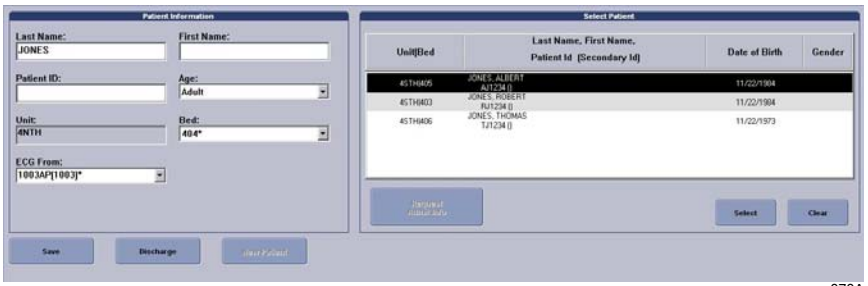
When using the patient's last name as your search criteria, remember to delete the default patient identification number ***999999999*** from the ***Patient ID*** data field.

NOTE

When using a patient identification number as your search criteria, the CIC Pro center cannot successfully search for and match patient identification numbers containing lowercase letters. The CIC Pro center can successfully search for and match patient identification numbers containing all numbers or a combination of numbers and *upper case* letters.

Complete the following procedure to retrieve patient demographic information from a networked database:

1. From the ***Admit*** window, type one of the following patient search criteria into the appropriate data field:
   - Medical record number (patient identification number)
   - Last name
   - Bed number
2. Click ***Request Admit Info*** to display a list of possible patient matches and their demographic information.



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NOTE

If the message, ***Server off network*** is displayed, the Hospital Information System (HIS) is either not available or not present.

3. Review the displayed list of patients and demographic information to find the demographic information that matches the patient you are admitting.

4. When the demographic information from the list does not match your patient, click ***Clear***. You must now manually enter the patient demographic information. See To manually enter the patient demographic information on page 6-14.

5. When demographic information from the list matches your patient, complete the following steps:

   a. Click on the patient to highlight it.

   b. Click ***Select*** to retrieve the demographic information.

   WARNING
   INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING, AND CALCULATIONS BASED ON PATIENT AGE—After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

   c. Verify you selected the correct information by reviewing the displayed demographic information.

      i. When this is the correct demographic information, go to Enter the bed number on page 6-15.

      ii. When this is not the correct demographic information, click ***Clear***.

      iii. Repeat step 2 to step 5 of this procedure.

To manually enter the patient demographic information

Complete the following procedure to manually enter patient demographic information into data entry fields or select options from a list:

NOTE

Patient information entered here may be truncated on the CIC Pro center display based on limitations of the associated monitoring device.

1. Under ***Last Name***, type the patient’s last name.

2. Under ***First Name***, type the patient’s first name.

3. Under ***Patient ID***, type the patient’s medical record number (patient identification number).

4. Under ***Age***, click the down arrow to display the list of age ranges. Choose the patient’s age range from the displayed list.

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING, AND CALCULATIONS BASED ON PATIENT AGE—After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

Enter the bed number

Complete the following procedure to enter the bed number:

NOTE

You must choose a bed number before you can admit a patient. Make sure the bed you want to select is on the network.

1. Next to ***Bed***, click the down arrow to display a list of available patient beds.
2. Choose a bed number from the displayed list:
   - When the patient windows in the multi-patient viewer are assigned to specific windows (locked), only the current bed number is displayed. Complete the procedure, To automatically enter the patient demographics on page 6-12 or To manually enter the patient demographic information on page 6-14.
   - When the bed is a telemetry bed, select the bed name displaying an asterisk (e.g., ICU4*).
   - When the bed is a monitor, select the bed number identifying the monitor.
   - When the bed is a monitor or in ***Combo*** mode, select the bed number identifying the monitor.

Enter the source of the ECG data

Complete the following procedure to enter the source of the ECG data:

NOTE

You must choose the source of the ECG data before you can admit a patient.

1. Under ***ECG From***, click the down arrow to display the list of ECG data sources.
2. Choose the source of the ECG data:
   - When the source of the ECG data is a transmitter, choose the TTX ID number matching the TTX ID number label located on the back of the transmitter.
   - When the source of the ECG data is a monitor, choose ***Monitor***.

Admit the patient

Complete the following procedure to admit the patient:

1. Click ***Admit*** to admit the patient.

2. If the message ***Would you like to start Full Disclosure?*** is displayed, the full disclosure data collection method is set to ***Manual***. To complete the admit process, you must select ***Yes*** or ***No***.

3. If an ***Admit Information Mismatch*** window displays while you are trying to establish the ***Combo*** monitoring mode, the CIC Pro center has detected a mismatch of patient data between the hardwired bed and the telemetry bed. To resolve this issue, complete the following steps:

   a. Compare the patient data displayed in the ***Admit Information Mismatch*** window.

   b. To choose the correct patient information, click ***Select*** under the correct patient information.

   c. To cancel admitting this patient, click ***Cancel*** to close this window and return to the ***Admit*** window. Make any necessary corrections to the patient information before trying to re-establish the ***Combo*** monitoring mode.

4. Verify the patient's window (located in the multi-patient viewer) is displaying parameter data and waveforms:

   - When the patient's data appears in the patient window, the patient is being monitored by the CIC Pro center.
   - When no patient information is displayed in the patient window, the patient is not being monitored by the CIC Pro center. See Troubleshooting on page D-1.

Changing patient demographic information

Once a patient is admitted, you may add or change patient demographic information:

1. From the multi-patient viewer, click on the patient you want to change. The single patient viewer displays.

2. From the single patient viewer, click ***Admit*** to display the ***Admit*** window.

3. Make changes to the patient demographic information.

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING, AND CALCULATIONS BASED ON PATIENT AGE—After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

4. Click ***Save***.

Moving a patient to a different bed

You can move a patient to another bed in the same care unit.

The following guidelines apply when moving an in-unit patient between locked and unlocked beds:

- You can move an unlocked bed to another available unlocked bed.
- You can move a locked bed to another available locked bed.
- You can move an unlocked bed to an available locked bed.

NOTE

You cannot move a patient to an unlocked bed if an empty patient window is not available. When the message ***Change disallowed - patient would be unmonitored*** displays, you will not be allowed to move the patient.

Move a patient to a different bed

Complete the following procedure to move an in-unit patient to a different bed:

1. From the multi-patient viewer, click on the patient you want to move. The single patient viewer displays.
2. From the single patient viewer, click ***Admit*** to display the ***Admit*** window.
3. Click on the down arrow next to ***Bed*** to display a list of available beds. Choose the bed you want to move the patient to:
   - Make sure the bed is on the network.
   - When the bed is a telemetry bed, select the bed name with an asterisk appended to the name (e.g., ICU4*).
   - When the bed is a monitor, select the bed number identifying the monitor.
4. Click ***Move*** to move the patient to the bed you selected. The message ***Are you sure you want to move this patient?*** displays.
5. Verify you are moving the correct patient:
   - When this is the patient you want to move, click ***Yes***.
   - When this is not the patient you want to move, click ***No*** to cancel this action and display the multi-patient viewer.

Move a patient to telemetry monitoring

To discharge a patient from the bedside monitor, but remain on telemetry monitoring, complete the following procedure:

1. From the multi-patient viewer, click on the patient you want to move. The single patient viewer displays.
2. From the single patient viewer, click ***Admit*** to display the ***Admit*** window.
3. Click on the down arrow next to ***Bed*** to display a list of available telemetry beds.
4. Choose the bed you want to move the patient to. Be sure to choose a bed name with an asterisk appended to the name (e.g., ICU4*).
5. Click ***Move*** to move the patient to the bed you selected. The message ***Are you sure you want to move this patient?*** displays.
6. Verify you are moving the correct patient:
   - When this is the patient you want to move, click ***Yes***. This will discharge the patient from the monitor.
   - When this is not the patient you want to move, click ***No*** to cancel this action and display the multi-patient viewer.

Move a telemetry patient to a different transmitter

At some time, you may need to replace an admitted patient's transmitter with a different transmitter.

Complete the following procedure to start telemetry monitoring using a replacement transmitter:

1. Exchange the transmitters.
2. From the ***Admit*** window, under ***ECG From***, click the down arrow to display a list of ECG data sources.
3. Choose the TTX ID number matching the TTX ID number label located on the back of the transmitter.
4. Click ***Save***.

Switching transmitters

If you wish to switch an transmitter while a patient is admitted from a CD Telemetry-LAN transmitter (Apex S, Apex 5, Apex 3 or CD transmitter) or vice versa, you must follow this procedure:

- Discharge the patient (losing stored data).
- Switch transmitters.
- Re-admit the patient.

Monitoring will stop if you switch transmitters while a patient is admitted. Attempting to change the TTX ID number for an admitted telemetry patient at the CIC Pro center with generate the message ***Invalid TTX***.

Discharging an admitted patient

Discharging a patient at the CIC Pro center completes the following tasks:

- Discharges a telemetry patient from CIC Pro center.
- Discharges a hard-wired patient from both the CIC Pro center and from the monitor.
- Deletes the discharged patient's locally stored patient data from the CIC Pro center.

Complete the following procedure to discharge an admitted patient from the CIC Pro center:

1. Disconnect all patient cables.
2. From the multi-patient viewer, click in the patient's window you want to discharge. The single patient viewer displays for this patient.
3. From the single patient viewer, click ***Admit*** to display the ***Admit*** window.
4. Click ***Discharge***. A window displays the patient name, patient ID, and bed number. The message ***Are you sure you want to DISCHARGE this patient?*** also displays.
5. Verify you are discharging the correct patient:
   - When this is the patient you want to discharge, click ***Yes***. This will discharge the patient.

     The CIC Pro center displays a message similar to the following in the patient window, ***Discharging patient...*** and then displays the multi-patient viewer. In the multi-patient viewer, the discharged patient window displays one of the following types of information:
     - When a telemetry patient is discharged from a locked patient window, the message ***Discharged*** is displayed in the patient window.
     - When a telemetry patient is discharged from an unlocked patient window, an ***Admit*** button is displayed in the patient window.
     - When a hard-wired patient is discharged, the message ***Discharged*** and the bed name are displayed in the patient window.
   - When this is not the patient you want to discharge, click ***No*** to cancel this action and display the single patient viewer.

Combo and Rover Combo monitoring

Guidelines

The following are guidelines to remember when monitoring in ***Combo*** or ***Rover Combo*** monitoring modes.

- When monitoring ECG from telemetry:
  - ECG limits and ***Arrhythmia Alarm Levels*** are not your monitor defaults, but are the telemetry defaults from the central station. You can adjust these settings at the monitor.

- The ***Alarm Pause*** feature (if available on your transmitter) is honored at the monitor.
- You should not turn off the monitor until you have discharged the patient from the monitor.
- Second V lead data is not sent to the monitor from the transmitter. If you wish to see telemetry second V lead data, you must view the telemetry patient.

- When switching ECG monitoring from the monitor to telemetry:
  - Arrhythmia alarm histories from the monitor are merged in the telemetry system. CD Telemetry-LAN software version 5 or later is required.
  - If you discharge the monitor, the telemetry ***Arrhythmia Alarm Levels*** will be the same as the ***Arrhythmia Alarm Levels*** supported by the monitor.

    Therefore, when the monitor uses the BASIC software package, only lethal ***Arrhythmia Alarm Levels*** will be detected from telemetry. If the monitor has the ***CARDIAC*** software package, full ***Arrhythmia Alarm Levels*** will be detected from telemetry.
- When switching ECG monitoring from telemetry to the monitor:
  - Telemetry is automatically discharged and the most recent 36 alarm histories are transferred to the monitor.
  - The ECG limits, ***Arrhythmia Alarm Levels*** and display defaults are recalled from the monitor defaults.

NOTE

It is not likely that the ***Combo*** or ***Rover Combo*** monitoring modes are used when the patient-monitor type is ***OPERATING ROOM***.

NOTE

Users should be aware of a possible time discrepancy between the waveforms from the telemetry device and the waveforms from the monitor. Users should not consider these waveforms to be synchronous. If absolute synchronicity is desired, ***Combo*** mode should be discontinued and the ECG waveforms should be acquired via the hard-wired monitor.

NOTE

SpO_2 monitoring with an X-Pod does not occur in combo mode. If SpO_2 monitoring is required while in combo mode, the patient's SpO_2 sensor must be attached to an SpO_2 device at the monitor.

Constraints

For bedside monitors that allow the ECG parameter to be turned off, the following constraints apply.

- SpO_2 becomes the primary parameter for patient monitoring.
- The patient’s heart rate is determined from pulse oximetry.
- The SpO_2 and SpO_2 Rate parameter alarm levels become ***Warning***.
- The SpO_2 pulse search and probe off system status alarm levels become ***Warning***.
- Connecting the ECG cable to the monitor will *not* automatically turn the ECG parameter on.

- When the monitor is connected to a Dash Responder defibrillator, the ECG parameter will either automatically turn on or remain turned on.
- When the monitor alarms are paused *and* the ECG parameter is turned off, the following network devices will *not* display an ***ALARM PAUSE*** text message for that monitor.
  - CIC Pro center using software version 3.0 or earlier.
  - Centralscope central station using any version of software.

ECG setting source

Selecting ECG setting source

When the monitor is in ***Combo*** mode, you can select whether the monitor uses its own ECG settings or the telemetry ECG settings.

- ***TELE DEFINED*** — Use the telemetry ECG settings. This is the factory default.
- ***USER DEFINED*** — Use the monitor's ECG settings if telemetry is *not* admitted. Use the telemetry ECG settings if telemetry IS admitted.

The following ECG settings are affected when you select an ECG setting source:

- ***Arrhythmia Alarm Levels***
- ***HR***, ***PVC*** and ***ST*** parameter alarm levels
- ***ECG SIZE***
- ***DETECT PACE***
- ***ARRHYTHMIA***
- ***ST ANALYSIS***
- ***LEAD ANALYSIS***
- ***HR HIGH LIMIT*** and ***HR LOW LIMIT***
- ***PVC LIMIT*** and PVC state
- Beat ***Pause*** interval
- ***ST*** Limits

For more information, refer to the appropriate bedside monitor's operator's manual.

ECG setting source when entering Combo mode

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING AND CALCULATIONS BASED ON PATIENT AGE — After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

NOTE

It is possible (but not a normal operation), to admit a patient to both a telemetry bed and a hardwired bed before entering ***Combo*** mode. For example, bed101* (telemetry) *and* bed101 (monitor) are two separate beds for the same patient. When you enter ***Combo*** mode in this situation, the ECG setting source is always telemetry.

The following tables indicate the source (monitor or telemetry) of ECG settings when entering ***Combo*** mode.

Tele Defined			
Monitor	**Telemetry**	**Entering *Combo* Mode**	**ECG Setting Source**
Not admitted	Not admitted	>	Telemetry
Admitted	Not admitted	>	
Not admitted	Admitted	>	

User Defined			
Monitor	**Telemetry**	**Entering *Combo* Mode**	**ECG Setting Source**
Not admitted	Not admitted	>	Monitor
Admitted	Not admitted	>	
Not admitted	Admitted	>	Telemetry

Notice that selecting ***Tele Defined*** means the ECG setting source is always telemetry when entering ***Combo*** mode, while the ECG setting source for ***User Defined*** depends on whether the patient is admitted to the monitor or telemetry when entering ***Combo*** mode.

ECG setting source when exiting combo mode

When discharging from telemetry, but remaining admitted to the monitor (exiting ***Combo*** mode), the ECG setting source (monitor or telemetry) depends on the ***COMBO DEFAULT SOURCE*** selection.

- ***TELE DEFINED*** — When exiting ***Combo*** mode, the ECG settings return to the monitor's ECG custom defaults.
- ***USER DEFINED*** — When exiting ***Combo*** mode, the ECG settings for the current patient persist until the patient is discharged from the monitor.

For both the ***TELE DEFINED*** and ***USER DEFINED*** options, when discharging from the monitor (exiting ***Combo*** mode), but remaining admitted to telemetry, the ECG settings for the current patient persist until the patient is discharged from telemetry.

7 Viewing real-time patient data

Real-time patient views

You can view real-time data for patients located in your care unit, and when networked with other CIC Pro centers, you may also view real-time data for patients located outside of your care unit.

The CIC Pro center allows you to view real-time patient data from two different patient viewers. Each viewer provides a different level of data granularity:

- Multi-patient viewer
- Single patient viewer

CAUTION
TREATMENT — Do not treat a patient based solely on the alarm messages and/or numerics presented via the connectivity device to the monitor. You must verify the accuracy of the alarm message and/or numerics at the peripheral device itself before initiating treatment. Treatment should be based on the information presented at the peripheral device.

Data synchronization

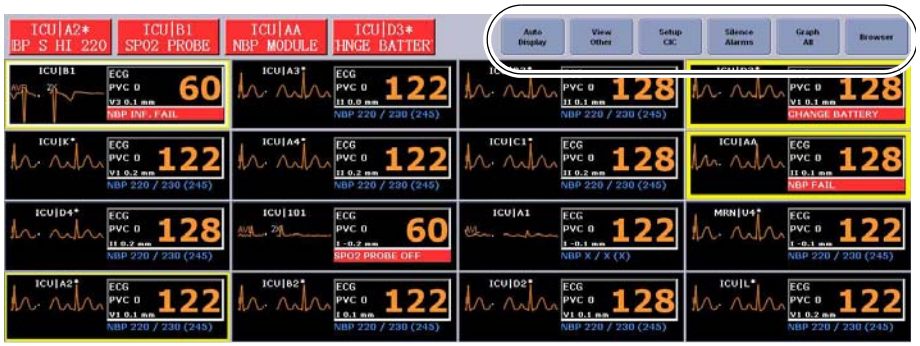
Information displayed on the ECG tab sheet is synchronized with the source (transmitter) every two seconds. If differences are detected, the display is refreshed with new patient data.

Multi-patient viewer

The multi-patient viewer displays a snapshot of real-time parameter data for a maximum of 16 patients. You can do the following real-time tasks from the multi-patient viewer:

- View abbreviated real-time patient data.
- View a snapshot of real-time ***Graphic Trends*** data for a maximum of two different parameters. See Configuring the real-time trend window on page 7-6.
- Print parameter limits or waveform data for all patients in the care unit. See Printing parameter limits or waveforms for all in-unit patient beds on page 7-9.
- View a single patient's detailed real-time parameter data. See Single patient viewer on page 7-3.
- View a single patient experiencing an alarm condition. See Viewing in-unit patients experiencing an alarm condition on page 7-5.
- Admit or discharge a patient. See Chapter 6.
- View beds outside your care unit. See Out-of-unit patient beds on page 7-6.
- Silence all alarms. See Silencing alarms on page 5-7.

The multi-patient viewer displays ***menu bar*** options similar to the following:



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Multi-patient viewer menu bar options	
Option	**Function**
Auto Display	When enabled, the ***Auto Display*** button is selectable from the menu bar. Clicking the ***Auto Display*** button while viewing the multi-patient viewer automatically completes the following tasks: ■ Removes any un-locked, unoccupied beds. ■ Adds at least one empty patient window with an ***Admit*** button. ■ Resizes the remaining patient windows to maximize the amount of displayed patient data.
View Other	View any patient bed on the Unity Network that is inside or outside of the care unit, floor, or hospital. See In-unit patient beds on page 7-5. See Out-of-unit patient beds on page 7-6.
CIC Setup	View the CIC Pro center default settings. You can customize some of the user-level defaults. See Customizing the system on page 4-4.
Silence Alarms	Silence audible alarm tones for one minute. See Silencing alarms on page 5-7.
Graph All	Print the parameter limits or the waveform data for all patients in the care unit.
Browser	Access stored patient data from the web access server.

Single patient viewer

The single patient viewer displays detailed real-time parameter data for a selected patient. You can complete the following tasks from the single patient viewer:

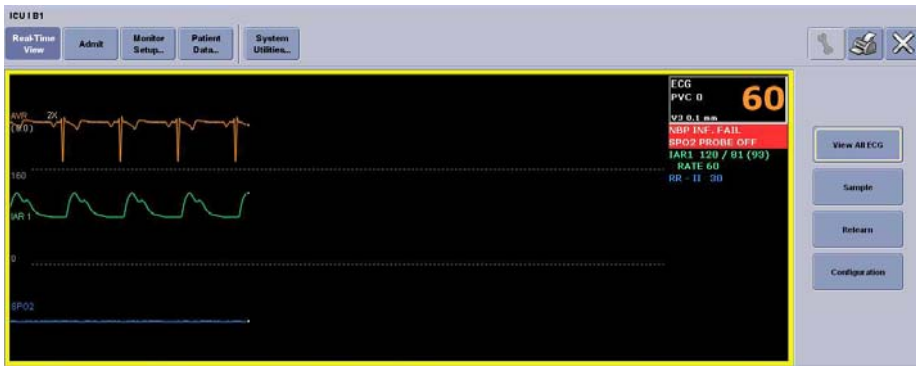
- View detailed real-time parameter data.
- View, change, or print ***Alarm Control*** or parameter control settings for any in-unit patient. These changes are also adopted by the monitor. See Adjusting alarm control settings on page 5-8. See Adjusting parameter control settings on page 7-11.
- View ***Alarm Control*** or parameter control settings for out-of-unit patient beds on the Unity Network. See Adjusting alarm control settings on page 5-8. See Adjusting parameter control settings on page 7-11.

NOTE

You cannot change the ***Alarm Control*** or parameter control settings of an out-of-unit patient.

- Adjust the real-time trend window for any in-unit patient. See Configuring the real-time trend window on page 7-6.
- Print real-time parameter data and waveforms for any in-unit patient. See Printing real-time data on page 7-8.

The single patient viewer displays menu bar options similar to the following:



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Single patient viewer menu bar options	
Option	**Function**
Real-Time View	Return to the real-time display of patient data.
Admit	Display the ***Admit*** window.
Monitor Setup...	Temporarily adjust a patient's parameter, alarm, or print control settings.
Patient Data...	Display stored patient data. See Chapter 8.
System Utilities...	Access web access server data.
View all ECG	Display waveforms for ECG leads ***I***, ***II***, ***III***, ***V***, ***aVR***, ***aVL***, and ***aVF***. If a 6-leadwire set is connected, ***Vb*** waveforms also display.
Sample	Record and store a 10-second sample of a patient's real-time ECG data. Data samples are stored in ***Events*** directory. ■ ***Monitor***: Parameter numeric data and up to three waveforms. ■ ***Telemetry***: ECG waveforms only.
Relearn	Relearn the selected patient's ECG rhythm after changes occur to heart rate or rhythm. The CIC Pro center uses 14 current complexes to relearn the patient's ECG pattern. The heart rate value appears briefly as ***X***s during the relearn process and returns to numerics when the relearn process is complete.
Configuration	Configure the selected patient's real-time trend window. See Configuring the real-time trend window on page 7-6.

In-unit patient beds

You can view any in-unit patient bed that is on the Unity Network.

Viewing in-unit patients experiencing an alarm condition

When an in-unit patient experiences an alarm condition, you can quickly display this patient's data by displaying the single patient viewer.

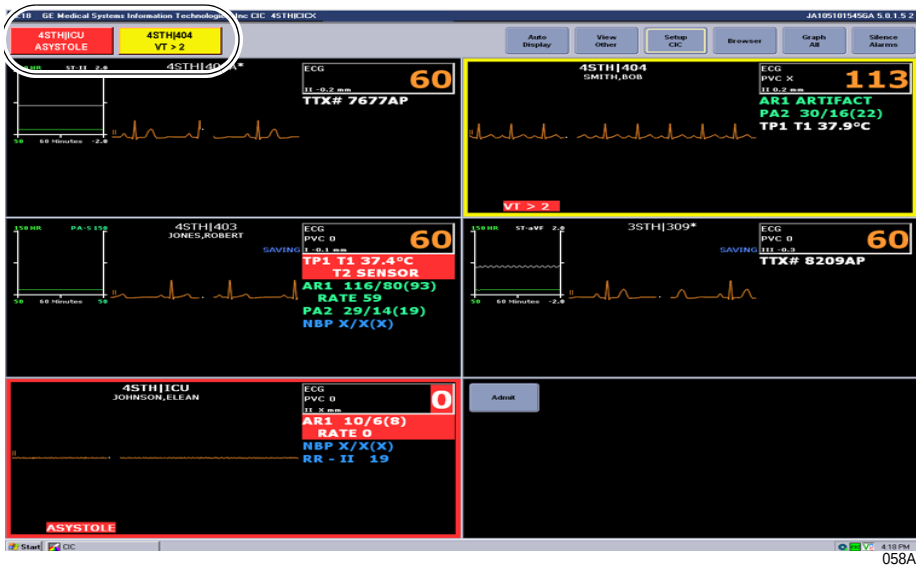
You can use one of the following methods to display the single patient viewer of an alarming patient bed:

- Click in the patient window.
- Click the alarm button.

The CIC Pro center can display an alarm button for a maximum of four patients. This row of alarm buttons display across the top of the multi-patient viewer and show the unit name, bed number, and the cause of the alarm.

The color of the alarm button indicates the severity of the patient alarm condition. Red indicates a ***Crisis*** alarm condition, yellow indicates a ***Warning*** alarm condition, an ***Advisory*** alarm condition, or a ***System Warning***.

Another name for this row of alarm buttons is the Alarm Display Unit (ADU) line.



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Alarm buttons, also known as Alarm Display Unit (ADU) line

Viewing patient beds from another in-unit CIC Pro center

When you have more than one CIC Pro center in your care unit, you can view (monitor) a patient bed from another in-unit CIC Pro center.

Complete the following procedure to view (monitor) in-unit patient beds from another in-unit CIC Pro center:

1. Go to the CIC Pro center in your care unit that has room to view additional admitted patient beds.
2. From the multi-patient viewer, right click in an empty patient window displaying an ***Admit*** button. The right click menu displays.
3. From the right click menu, choose ***Select Care Unit then Bed Number***. A list of networked care units displays.
4. From the list, choose the care unit and bed name you want to view. The patient bed is displayed in the multi-patient viewer.

Out-of-unit patient beds

You can view out-of unit patient beds that are not displayed at your CIC Pro center. The bed you wish to view must be on the Unity Network.

NOTE

You cannot change the ***Alarm Control*** or parameter control settings of an out-of-unit patient.

Viewing an out-of-unit patient bed

Complete the following procedure to view networked out-of-unit patient beds:

1. From the multi-patient viewer, click ***View Other***. A list of networked care units, floors, or hospitals displays.
2. Click the + sign next to the desired unit, floor, or hospital to display the list of viewable beds.
3. Select the bed you want to view and click ***OK***. The single patient viewer displays for this patient.
4. To close the single patient viewer, click the  (close button) on the top right side of the window.

Removing viewed out-of-unit patient beds

Complete the following steps to remove out-of-unit patient beds you are viewing from the multi-patient viewer:

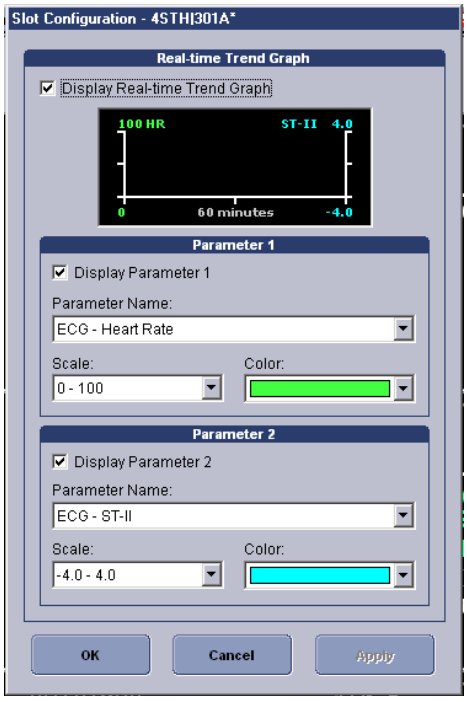
1. From the multi-patient viewer, right click on the patient bed you want to remove.
2. From the right click menu, choose ***Select Care Unit then Bed Number*** > ***None***.

Configuring the real-time trend window

You can configure the display of a real-time trend window in the multi-patient viewer. The real-time trend window displays the recent patient trends for a maximum of two parameters.

Complete the following procedure to configure a patient's real-time trend window:

1. Choose one of the following methods to access the ***Real-time Trend Graph*** configuration window from the multi-patient viewer:
   - Right-click on the patient you want to configure and select ***Configuration***. The ***Real-time Trend Graph*** window displays.
   - Click on the patient you want to configure. The single patient viewer displays. From the single patient viewer, click ***Real-time View*** to display the real-time window.
2. Click ***Configuration*** to display the ***Real-time Trend Graph*** window.
3. Ensure that the ***Display Real-time Trend Graph*** checkbox is checked.



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4. Change any of the undimmed setting options.

***Real-time Trend Graph* control settings**	
Option	**Function**
Display Real-time Trend Graph	Display a real-time trend window with a maximum of two real-time parameter trends. To display the ***Real-time Trend Graph***, click in the empty check box to fill the box with a check mark.
Display Parameter 1	Display the first real-time parameter trend. To display one real-time parameter trend, click in the empty check box to fill the box with a check mark. Then, click the down arrow to set the display properties: ■ ***Parameter Name***: Set the displayed parameter. ■ ***Scale***: Set the size of the displayed waveform trend. ■ ***Color***: Set the color of the displayed parameter text and waveform trend.
Display Parameter 2	Display the second real-time parameter trend. To display a second real-time parameter trend, click in the empty check box to fill the box with a check mark. Then, click the down arrow to set the display properties: ■ ***Parameter Name***: Set the displayed parameter. ■ ***Scale***: Set the size of the displayed waveform trend. ■ ***Color***: Set the color of the displayed parameter text and waveform trend.

5. After making your selections, complete one of the following tasks:

   - Click ***OK*** to apply your changes and close the window.
   - Click ***Cancel*** to cancel your changes and close the window.
   - Click ***Apply*** to apply your changes without closing the window.

See Viewing stored patient data on page 8-1.

Printing real-time data

While viewing the in-unit real-time patient data from the multi-patient viewer, you can manually print a continuous ECG strip for a single patient bed or print the parameter limits and waveforms for all displayed patient beds.

Printing a continuous ECG strip

From the multi-patient viewer, you can click in the ECG parameter window of any displayed patient bed to print a continuous ECG strip. A print icon appears as you position the cursor over the ECG parameter window.

NOTE

When using a digital writer, click in the ECG parameter window of any displayed in-unit patient bed.

Then, press the  (**Graph Stop)** button on the front of the digital writer to stop printing a continuous ECG strip.

NOTE

The printing formats are controlled by the data source device (monitor or telemetry system). This includes printed waveforms, speed, and graph location. See the operating instructions for the devices you are using.

Printing parameter limits or waveforms for all in-unit patient beds

You can print the parameter waveform data for all in-unit patients displayed at a CIC Pro center by using the ***Graph All*** function. In addition, you can also print the parameter limits for telemetry beds.

Selecting the ***Graph All*** function results in printing a 10-second graph for each admitted telemetry bed and a 20-second graph for hard-wired beds. The graph speed of a telemetry graph is 25 millimeters per second and the graph speed of a hard-wired graph is determined by the monitor.

NOTE

Close any open single patient viewer windows before selecting the ***Graph All*** function. Otherwise, only the single patient viewer data prints.

The following conditions apply when using the ***Graph All*** function:

- When you press the  (**Graph Stop)** button on the local digital writer, the current patient's graph stops and the writer begins to print a 10-second graph for the next patient.
- When a patient's data is currently graphing or is being saved to graph when a ***Graph All*** function request is started, this patient's data is not included in the ***Graph All Patients*** graph. This patient's data graphs independently of the ***Graph All Patients*** graph.
- When you click in the ECG parameter window of a patient whose data is saving, this cancels the ***Graph All Patients*** request for that patient.
- When an arrhythmia alarm sounds for a patient while a ***Graph All Patients*** request is running, the alarm data replaces the data that was saved for the ***Graph All Patients*** request.
- When a telemetry patient initiates a graph from a transmitter while a ***Graph All Patients*** request is running, the ***Graph All Patients*** graph for that patient is replaced by a ***Transmitter Graph***.

Complete the following procedures to print parameter limits or waveforms for all patient beds displayed in the multi-patient viewer:

Printing limits

NOTE

The ***Limits*** option only prints parameter limits for telemetry beds.

Complete the following procedure to print telemetry bed parameter limits:

1. From the multi-patient viewer, click ***Graph All***. The ***Graph All Patients*** window displays.
2. From the ***Graph All Patients*** window, click ***Limits***.
3. Click ***OK*** to begin printing.

Printing waveforms

Complete the following procedure to print parameter waveforms for all displayed patient beds:

1. From the multi-patient viewer, click ***Graph All***. The ***Graph All Patients*** window displays.
2. From the ***Graph All Patients*** window, click ***Waveforms***.
3. Click ***OK*** to begin printing.

Stopping a print job

You must stop a print job from the same CIC Pro center you used to send the print job to the printer.

Stop printing to a laser printer

Complete the following procedure to stop printing all print jobs sent to the laser printer:

1. From the multi-patient viewer, click ***CIC Setup*** > ***CIC Defaults***. The ***CIC Defaults*** window displays.
2. Under ***Printer/Writer***, click ***Cancel Print Jobs*** for the printer you want to stop printing to.
3. After making your selection, complete one of the following tasks from the ***CIC Defaults*** window:
   - Click ***OK*** to apply your changes and close the ***CIC Defaults*** window.
   - Click ***Cancel*** to cancel your changes and close the ***CIC Defaults*** window.
   - Click ***Apply*** to apply your changes without closing the ***CIC Defaults*** window.

Stop printing to a local digital writer

Complete the following procedure to stop printing all print jobs sent to a local digital writer:

1. Locate the digital writer.
2. Press the  (**Graph Stop**) button located on the front of the digital writer to stop the print job.

Monitored parameters

The CIC Pro center can display data for many monitoring parameters.

NOTE

For a complete list of supported parameters, refer to the CIC Pro Clinical Information Center Operator's Manual.

Adjusting parameter control settings

The following guidelines apply to adjusting parameter control settings at the CIC Pro center:

- You may view and adjust parameter settings for any in-unit patient. Any changes are temporary and return to the default settings when a patient is discharged. These changes are also adopted by the monitor.
- You may not be able to adjust some of the control settings for non-GE acquisition devices that are interfaced via the Unity Network Interface Device.
- You may view parameter settings for any out-of-unit patient. However, you cannot adjust these settings.
- To permanently change the parameter default settings, refer to the appropriate CIC Pro center service manual.

NOTE

The Dinamap PRO monitors' alarm limits are not configurable at the CIC Pro center, but they can be silenced at the CIC Pro center. However, alarms that are silenced at the CIC Pro center will not be silenced at the monitor. Refer to the Dinamap Pro 100–400 Operation Manual for detailed information.

This section briefly covers adjusting control settings for the following parameters:

- ECG
- SpO_2
- Non-invasive pressures
- Invasive pressures

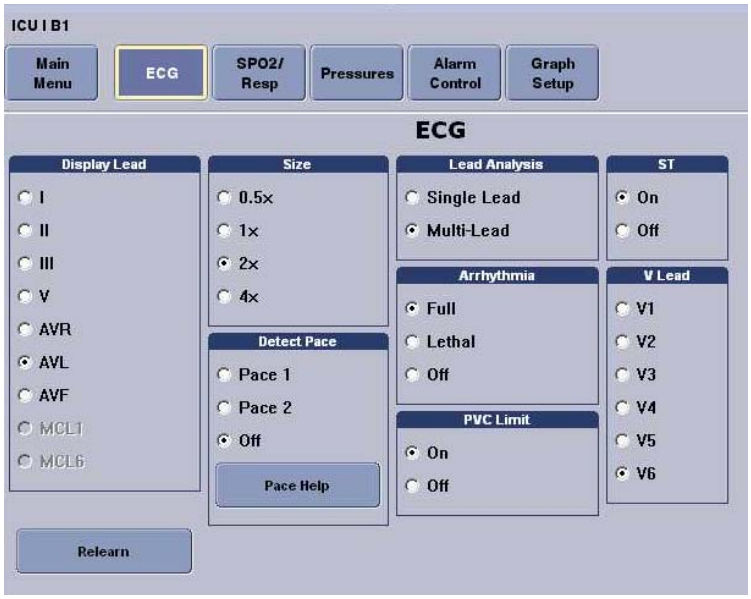
ECG

ECG control settings

Complete the following procedure to adjust the control settings.

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Monitor Setup***.
3. Click ***ECG*** to display the control window.

4. Change any of the undimmed setting options. When an option appears dimmed, you cannot change it unless you enter the service-level password.



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***ECG* control settings**	
Option	**Function**
Display Lead	Set the top or first lead displayed on the monitor and on the CIC Pro center. This is the lead data that prints during an alarm or manual graph.
Relearn button	Relearn the selected patient's ECG rhythm after changes occur to heart rate or rhythm. The CIC Pro center uses 14 current complexes to relearn the patient's ECG pattern. Remove the ***V Fail*** message or activate the second V-lead when changing between a 5-and 6-leadwire set on the ApexPro CH transmitter. **NOTE** The heart rate value appears briefly as ***X***s during the relearn process and returns to numerics when the relearn is complete.
Size	Set the waveform size. ***1X*** is standard.
Detect Pace	Set the pacemaker detection mode: ■ ***Pace 1***: Alternate pacemaker detection mode when ***Pace 2*** does not adequately detect pacemaker spikes. ■ ***Pace 2***: Normal pacemaker detection mode. For more information, refer to Monitoring pacemaker patients on page 7-13.
Pace Help button	View solutions to common pacemaker detection problems.
Lead Analysis	Set the leads for ECG and arrhythmia data processing: ■ ***Single-Lead***: Use the top ***Display Lead***. ■ ***Multi-Lead***: Use leads I, II, III and V lead.

ECG control settings	
Option	**Function**
Arrhythmia	Set the arrhythmia detection level: ■ ***Full***: Detect all arrhythmia conditions defined by the software. ■ ***Lethal***: Detect lethal arrhythmia conditions. ■ ***Off***: Turn off arrhythmia detection. Arrhythmia detection remains off until you choose ***Full*** or ***Lethal***, or the patient is discharged. **NOTE** ***OFF*** appears dimmed and is not selectable when the following option is set: ***CIC Setup*** > ***CIC Defaults*** > ***Allow Alarms OFF on this CIC*** > ***No***. The ***Allow Alarms OFF on this CIC*** setting is a service-level default and is protected by the ***Service Password***.
PVC Limit	Turn ***On*** to count PVCs per minute. A PVC counter appears in the ECG parameter window. **NOTE** To display the PVC counter, the ***Arrhythmia*** detection level must be set to ***Full***.
ST	Turn ***On*** to display, store, and enable ST alarms.
V Lead	Label the ***V Lead*** position.

5. After making your selections, complete one of the following tasks:
   - Click a different ***Monitor Setup*** option to apply your changes without closing the ***Monitor Setup*** window.
   - Click the  (close button) on the top right side of the window to apply your changes and close the ***Monitor Setup*** window.

Monitoring pacemaker patients

Be aware of the following when monitoring a patient with a pacemaker.

WARNING
FALSE CALLS—False low heart rate indicators or false asystole calls may result with certain pacemakers because of electrical overshoot.

WARNING
MONITORING PACEMAKER PATIENTS—Monitoring of pacemaker patients can only occur with the pace program activated.

WARNING
PACEMAKER SPIKE—An artificial pacemaker spike is displayed in place of the actual pacemaker spike. All pacemaker spikes appear uniform. Do not diagnostically interpret pacemaker spike size and shape.

WARNING
PATIENT HAZARD—A pacemaker pulse can be counted as a QRS during asystole in either pace mode. Keep pacemaker patients under close observation.

WARNING
RATE METERS—Keep pacemaker patients under close observation. Rate meters may continue to count the pacemaker rate during cardiac arrest and some arrhythmias. Therefore, do not rely entirely on rate meter alarms.

CAUTION
FALSE ALARMS—Low amplitude QRS beats may impair paced beat detection. This may result in false positive asystole alarms.

Keep pacemaker patients under close observation.

CAUTION
FDA POSTMARKET SAFETY ALERT—The United States FDA Center for Devices and Radiological Health issued a safety bulletin October 14, 1998. This bulletin states “that minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmed rate.”

The FDA further recommends precautions to take into consideration for patients with these types of pacemakers. These precautions include disabling the rate responsive mode and enabling an alternate pace mode. For more information contact:

Office of Surveillance and Biometrics, CDRH, FDA
1350 Piccard Drive, Mail Stop HFZ-510
Rockville, MD 20850
U.S.A.

NOTE

ECG monitoring with patients on non-invasive transcutaneous pacemakers may not be possible due to large amounts of energy produced by these devices. Monitoring ECG with an external device may be needed.

The ***Detect Pace*** option enables/disables the pacemaker detection program. It must be used whenever the monitored patient has a pacemaker.

There are two pacemaker processing modes, ***Pace 1*** and ***Pace 2***. The modes use different algorithms for pacemaker artifact rejection. The clinician must be the judge as to which mode is better for each patient. The pacemaker detection program defaults ***OFF***, so if you have a patient with a pacemaker, you will have to select a mode. For more information, refer to ECG control settings on page 7-11.

The ***Pace 1*** mode allows successful detection of the largest variety of paced QRS morphologies. As a direct consequence, this mode does have a higher risk of counting pacemaker artifact as QRS complexes during ***ASYSTOLE***. For this reason, it is imperative that the user keep patients with pacemakers under close observation. It is also recommended that the user set the low heart rate limit on the monitor close to the minimum pacing rate, and that the ***BRADY*** arrhythmia alarm level be elevated to a ***Warning*** or ***Crisis*** level.

The ***Pace 2*** mode is much more conservative in recognizing paced QRS morphologies and is recommended for use whenever possible. It is designed to minimize the possibility of counting pacemaker artifact as QRS complexes during ***ASYSTOLE***. If the monitor does not adequately detect paced beats in the ***Pace 2*** mode, then the user may wish to try the ***Pace 1*** mode.

When either pace mode is enabled, the software places an artificial spike on the waveform whenever the pacemaker triggers. When pacemaker detection is on, it is indicated by a ***"P"*** in the patient's ECG parameter window.

For successful monitoring of pacemaker patients follow these suggestions:

- Use recommended electrode placement.
- ***Brady***, ***Pause***, and Low Heart Rate are additional alarms available for use when monitoring pacemaker patients.
- Problems you may experience are:
  - heart rate double counting;
  - inaccurate alarms for low heart rate or asystole;
  - pacemaker spikes not recognized by the software.
- Possible solutions to above problems are:
  - relearn arrhythmia;
  - try an alternate electrode placement;
  - try ***Single-Lead*** analysis;
  - try switching to the other pace detection mode.

Multi-vector pace detection

The ApexPro CH transmitter uses multi-vector pace detection. Here are some additional guidelines for successful monitoring pacemaker patients when using the ApexPro CH transmitter.

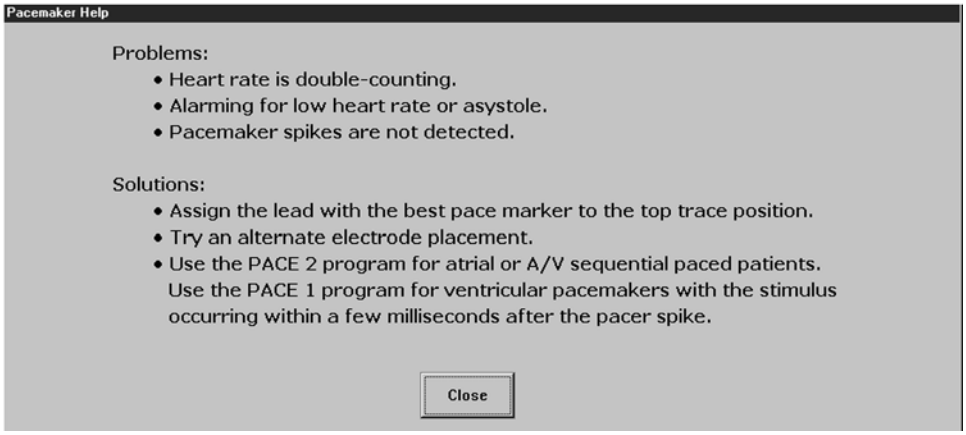
- When using the 5- or 6-leadwire set with all the electrodes attached, pace detection occurs on two ECG leads simultaneously.
- The default leads used for detection are II and V. If these leads are not available, multi-vector pace detection switches to available leads.

- Pace detection switches to ***Single-Lead*** when using a 3-leadwire set.

For more information, refer to "Pacemaker troubleshooting" on page D-3.

Pace help

Clicking on the ***Pace Help*** button opens a window that shows common problems and solutions in regard to pacemaker detection. This window is shown below.



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Lead analysis

The ***Lead Analysis*** control signals the transmitter to process the ECG in ***Single-Lead*** or ***Multi-Lead*** mode. Use the mouse to click on your selection. ***Multi-Lead*** analysis is the default setting for ***Adult***.

NOTE

ECG is relearned whenever ***Lead Analysis*** is changed.

Multi-Lead analysis

Multi-Lead analysis simultaneously examines ECG leads I, II, III, and V (whether they are displayed or not) to help eliminate false alarms and improve the ability of the system to:

- Detect beats which occur isoelectric to a single chest lead.
- Discriminate artifact that appears in one lead compared to the other lead vectors.
- Provide a smart-lead fail feature, where the failed lead is identified, and if available, another lead is provided for display.
- Continue arrhythmia processing even after a lead change.

Single-Lead analysis

Single-Lead analysis uses only the lead displayed on the CIC Pro center screen to process ECG and arrhythmia information. To change the lead used for ***Single-Lead*** analysis, you must change the displayed lead.

Single-Lead ECG may be acquired using a 3-, 5-, or 6-leadwire set. However, only a ***Single-Lead*** ECG is transmitted or processed.

Single-Lead analysis is beneficial when troubleshooting pacemaker detection and/or arrhythmia detection. ***Single-Lead*** analysis must always be used when monitoring with a 3-leadwire set. ***Single-Lead*** analysis can be set up as a unit default. Refer to Customizing the system on page 4-4 for more information.

Single-Lead ECG telemetry data

NOTE

When acquiring ***Single-Lead*** ECG data using a 5- or 6-leadwire set, it is *not* necessary to connect the V leads or the right leg lead to the transmitter or to the patient.

The following constraints apply when using ***Single-Lead*** ECG telemetry data.

Function	***Single-Lead*** Constraints
change the displayed lead	■ The factory default ***Display Lead*** is lead II. ■ Contact your local service representative to change the default displayed lead. ■ ***Display Lead*** appears to be selectable at the CIC Pro center. However, your selection is temporary and will revert back to the transmitter's default displayed lead. **NOTE** When the clinical situation dictates monitoring a lead other than the default lead, you can move the leads and/or electrodes to view a different lead. Be aware that the label on the display and on the printout will show the default lead label.
Lead Analysis	■ ***Multi-Lead*** analysis may appear to be selectable at the CIC Pro center. However, your selection is temporary and will revert back to the ***Single-Lead*** analysis mode.
select a V lead	■ V leads may appear to be selectable at the CIC Pro center. However, your selection does not change the transmitter's default displayed lead.
select displayed leads from a single viewer	■ Leads other than the default displayed lead may appear to be selectable at the CIC Pro center. However, your selection is temporary and will revert back to the transmitter's default displayed lead.
select graph waveforms	■ Leads other than the default displayed lead may appear to be selectable at the CIC Pro center. However, you must select the transmitter's default displayed lead to obtain a graph of the waveform.

Arrhythmia

WARNING
INCORRECT ALGORITHMS, ARRHYTHMIA PROCESSING AND CALCULATIONS BASED ON PATIENT AGE — After manually updating or automatically retrieving patient demographic information from a network database, *always* confirm that the entered patient's date of birth matches the patient's actual date of birth. Otherwise the appropriate age-related algorithms, arrhythmia detection, and calculations will not be applied.

WARNING
SUSPENDED ANALYSIS—Certain conditions suspend arrhythmia analysis. When suspended, arrhythmia conditions are not detected and alarms associated with arrhythmias do not occur. The messages which alert you to the conditions causing suspended arrhythmia analysis are: ***ALL ALARMS OFF, ALARM PAUSE, ARR OFF, ARR SUSPEND, DISCHARGED, LEADS FAIL,*** and ***NO TELEM.*** Additionally, the alarms off with reason options and disabling the ***Alarm Pause Breakthrough*** feature also suspend arrhythmia analysis.

WARNING
VENTRICULAR ARRHYTHMIAS—The arrhythmia analysis program is intended to detect ventricular arrhythmias. It is not designed to detect atrial or supraventricular arrhythmias, with the exception of atrial fibrillation. Occasionally it may incorrectly identify the presence or absence of an arrhythmia. Therefore, a physician must analyze the arrhythmia information in conjunction with other clinical findings.

The arrhythmia control signals the CIC Pro center to ignore or accept arrhythmia calls. To modify arrhythmia settings, use the mouse to click on ***Full, Lethal,*** or ***Off***.

NOTE

Full arrhythmia processing is suspended when the level 1 ***ARTIFACT*** message is displayed. Lethal arrhythmia is still active but its accuracy may be hindered by the artifact.

NOTE

When arrhythmia program is in ***Full*** mode, the program counts the number of PVCs that occur within a minute.

Turning arrhythmia on automatically starts a relearn procedure.

When arrhythmia is turned off, ***ARR OFF*** appears in the ECG parameter window.

No arrhythmia detection with 7015 software level patient monitors

If an ApexPro system patient is admitted to a patient monitor at the 7015 software level (ECG source is telemetry, not the monitor), the following scenario may occur when monitoring in ***Combo*** or ***Rover Combo*** monitoring modes:

- Since the 7015 software level does not support arrhythmia processing, arrhythmia detection for the telemetry patient is reduced from full arrhythmia detection to no arrhythmia detection (arrhythmia OFF). This occurs because the software is designed to take on the attributes of the bedside monitor when in ***Combo*** or ***Rover Combo*** monitoring modes.

  CAUTION
  Under these conditions, arrhythmia detection is OFF. There is NO INDICATION of this at the bedside monitor, central station or CIC Pro center.

- If the patient is later discharged from the monitor, and monitoring continues from telemetry, the message ***ARR OFF*** will then appear at the central station or CIC Pro center. Arrhythmia monitoring remains OFF.

  NOTE

  Solar 7000 monitors, Solar 8000 monitors, Dash monitors, and Eagle monitors may include the 7015 software level.

Full arrhythmia conditions

The following is an alphabetical list of the ***Arrhythmia*** messages that are displayed when full arrhythmia is selected and the condition occurs. Definitions of each condition are included. The CIC Pro center's response to each condition is determined by the alarm level to which the arrhythmia has been assigned.

ACC VENT	■ **Adult**—Accelerated ventricular occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 50 and 100 beats per minute. ■ **0-2 years**—Occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 60 and 160 beats per minute. ■ **3-10 years**—Occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 60 and 140 beats per minute. ■ **11-13 years**—Occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 60 and 130 beats per minute.
Atrial FIB	Atrial fibrillation identification occurs when random. chaotic, low-amplitude deflections of the supraventricular component of the ECG waveform. This results in irregular timing of QRS complexes and the absence of uniform P waves proceeding the QRS complex. **NOTE** AFIB alarms can take up to 90 seconds to display while the algorithm verifies the event.
ASYSTOLE	Ventricular asystole occurs whenever the displayed heart rate drops to zero.

BIGEMINY	Occurs when three or more bigeminal cycles (a ventricular beat followed by a non-ventricular beat) are detected.
BRADY	Bradycardia is the average of the most recent eight R-to-R intervals at a heart rate less than the set LOW heart rate limit. **NOTE** The Brady limit matches the low heart rate limit. If the low heart rate limit is changed, the Brady limit changes.
COUPLET	Occurs when two ventricular beats are detected and have non-ventricular beats before and after the couplet. The coupling interval must be less than 600 milliseconds.
IRREGULAR	Occurs when six consecutive normal R-to-R intervals vary by 100 milliseconds or more.
PAUSE	Occurs when a 3-second interval without a QRS complex is detected. **NOTE** Some bedside monitors allow the ***Pause*** time interval to be adjusted. For more information, refer to the appropriate bedside monitor's operator's manual.
PVC	Isolated premature ventricular complexes occur when a premature ventricular beat is detected and has non-ventricular beats before and after.
PVC limit	When on, the PVC Limit control displays a PVC counter in the ECG parameter window. When off, the PVC counter is not displayed. Use the mouse to turn the PVC Limit control ***On*** or ***Off***. The PVC limits are preset in ***Alarm Control*** defaults.
R ON T	Occurs when a ventricular complex is detected within the repolarization period of a non-ventricular beat.
TACHY	Tachycardia is four R-to-R intervals at a heart rate greater than the set HIGH heart rate limit. **NOTE** The Tachy limit matches the high heart rate limit. If the high heart rate limit is changed, the Tachy limit changes.
TRIGEMINY	Occurs when three or more trigeminal cycles (a ventricular beat followed by two non-ventricular beats) are detected.
V BRADY	**Adult**—Ventricular bradycardia occurs when a run of three or more ventricular beats is detected with an average heart rate that is less than or equal to 50 beats per minute. **0-2, 3-10, and 11-13 years**—Occurs when a run of three or more ventricular beats is detected with an average heart rate that is less than or equal to 60 beats per minute.
VFIB/ VTAC	Ventricular fibrillation occurs when the ECG waveform indicates a chaotic ventricular rhythm. **WARNING** ***VFIB/VTAC*** should not be considered a substitute for the ***V TACH*** arrhythmia call. Efforts to lower the ***V TACH*** alarm level can result in missed ventricular tachycardia alarms.

V TACH	■ **Adult**—Ventricular tachycardia occurs when a run of six or more ventricular beats is detected with an average heart rate greater than or equal to 100 beats per minute. ■ **0-2 years**—Occurs when a run of six or more ventricular beats is detected with an average heart rate greater than or equal to 160 beats per minute. ■ **3-10 years**—Occurs when a run of six or more ventricular beats is detected with an average heart rate greater than or equal to 140 beats per minute. ■ **11-13 years**—Occurs when a run of six or more ventricular beats is detected with an average heart rate greater than or equal to 130 beats per minute.
VT > 2	■ **Adult**—Ventricular tachycardia >2 occurs when a run of ventricular beats is detected with a duration of less than six beats but longer than two beats and with an average heart rate that is greater than or equal to 100 beats per minute. ■ **0-2 years**—Occurs when a run of ventricular beats is detected with a duration of less than six beats but longer than two beats and with an average heart rate that is greater than or equal to 160 beats per minute. ■ **3-10 years**—Occurs when a run of ventricular beats is detected with a duration of less than six beats but longer than two beats and with an average heart rate that is greater than or equal to 140 beats per minute. ■ **11-13 years**—Occurs when a run of ventricular beats is detected with a duration of less than six beats but longer than two beats and with an average heart rate that is greater than or equal to 130 beats per minute.

Lethal arrhythmia conditions

When ***Lethal*** arrhythmia is selected, the following conditions (as defined for ***Full*** arrhythmia) are detected:

- ***ASYSTOLE***
- ***VFIB/VTAC***
- ***V TACH*** (defaults to the ***Crisis*** level, but can be moved to a different level)
- ***BRADY*** (if the ***Patient Age*** range selected is ***0-2 years*** or ***3-10 years***)

AFIB identification

NOTE

While in combo mode, AFIB trending is only available when the bedside monitor supports this feature. If your bedside monitor does not support AFIB trending, this feature is not available. Contact your sales/service representative for more information.

Atrial fibrillation (AFIB) is characterized by random, chaotic, low-amplitude deflections of the supraventricular component of the ECG waveform, resulting in irregular timing of QRS complexes and an absence of uniform P waves preceding the QRS complex.

The AFIB algorithm feature identifies atrial fibrillation arrhythmias for the transmitter. When an AFIB event is detected, the ***ATRIAL FIB*** alarm text is displayed at the CIC Pro center.

AFIB event patient data is stored for review in the ***Graphic Trends*** and ***Vital Signs*** tab sheets.

Alarms

A patient status alarm is triggered when an AFIB arrhythmia is detected. The message ***ATRIAL FIB*** is displayed in the message area of the display.

NOTE

There is approximately a 90 second delay while the AFIB algorithm verifies the AFIB arrhythmia condition.

The AFIB alarm defaults to a ***Message*** alarm level but can be changed under ***Arrhythmia Alarm Level***, in the ***Telemetry Alarm Control Defaults*** tab sheet on the CIC Pro center. How the monitor responds to each condition is determined by the alarm level to which the AFIB arrhythmia detection has been assigned. When set for ***Advisory*** or greater, AFIB alarms will be recorded and displayed in the alarm area on the CIC Pro center.

NOTE

AFIB alarms can only be adjusted at the CIC Pro center. If AFIB is not available/ enabled at a bedside monitor in ***Combo*** mode, you will not be able to immediately adjust the alarm. You must discharge the patient from the bedside monitor, adjust the alarm setting at the CIC Pro center and then admit the patient at the bedside monitor.

ST analysis

The patient's most dominant, normal beat is used for ST measurement. This beat is identified by the arrhythmia analysis program. Turn ST ***ON*** to display the numerics calculated for ST at the CIC Pro center.

GE identifies the ST segment of the QRS complex as beginning at the J point and ending 60 milliseconds following the J point in ***Adult*** mode. The ST measurement factory defaults are:

- ***Adult***— J+ 60ms
- ***0–2 years***— J+ 30ms
- ***3–10 years***— J+ 40ms
- ***11–13 years***— J+ 50ms

The ST numeric displayed (millimeters) indicates either a positive or negative elevation in relation to the isoelectric reference point (which is also determined by the arrhythmia program and the patient's age).

When ST is on, numerics are displayed under each ECG lead label on the screen. (A negative deflection is preceded by a minus sign.) These numerics are updated about every 15 seconds.

The ST value shown in the ECG parameter window is the lead with the greatest ST deviation. This may or may not be the lead that is in alarm, since a lead with a lesser deviation from the isoelectric line may have changed more than the lead with the greatest deviation.

NOTE

ST numerics are always calculated with reference to 1X size. Displaying the ECG waveform at a different size does *not* affect the ST values.

NOTE

When a new dominant beat is detected or a relearn occurs, the arrhythmia program calculates ST based on the new beat. This could affect the ST values displayed. This may not necessarily represent a change in the patient's condition. The clinician needs to assess the patient any time there is an ST change.

NOTE

Adjustable ST alarms are only available when using a CIC Pro center running software version 5 or later. If your CIC Pro center is running an earlier version of software, this feature is not available. Contact your sales/service representative for more information.

ST deviation alarm

When any individual ST value is beyond the limit, an ST deviation alarm occurs. It is considered a parameter alarm, and the default alarm level is ***Warning***. This can be modified in the parameter alarm level setup.

- When the ST program is turned on, or a relearn is done with ST on, the ST deviation values are set for all leads of ST.
- The current ST value is determined in all eight leads.
- The ST value in the ECG parameter window turns red to indicate an alarm.
- ST limits can also be adjusted individually in the patient's ***Alarm Control*** tab.

NOTE

ST limits can also be adjusted at the CIC Pro center from ***Monitor Setup*** > ***ECG***.

Adjusting ST limits

ST alarm limits and levels for telemetry patients are typically controlled by the default ST alarm levels from the CIC Pro center. Some bedside monitors allow users to adjust ST alarm limits and levels at the bedside when the patient is admitted in combination monitoring mode. For more information on adjusting ST limits, refer to the bedside monitor operator's manual.

SpO2

Introduction

WARNING
LOSS OF ALARMS—Do not use transmitter accessory devices such as SpO2 and NBP without ECG cables attached. Failure to use accessory devices in the prescribed manner may result in a loss of alarms.

NOTE

SpO2 and SPO2 are used interchangeably throughout this manual to refer to pulse oximetry.

The transmitter supports the Apex oximeter, the Xpod oximeter, and Dinamap Pro monitors. Unless specified, oximeter refers to both Apex oximeter and Xpod oximeter units.

The oximeters and Dinamap Pro monitors connect to the transmitter and provide the following oximetry vital signs for display at the CIC Pro center:

- arterial oxygen saturation (SpO2)
- peripheral pulse rate (PPR)
- perfusion quality indicator

The Apex oximeter functions as a stand-alone device, and displays digital values for SpO2 and pulse rate. When the Apex oximeter is connected to the transmitter, digital values for SpO2 and pulse rate are also displayed at the CIC Pro center.

NOTE

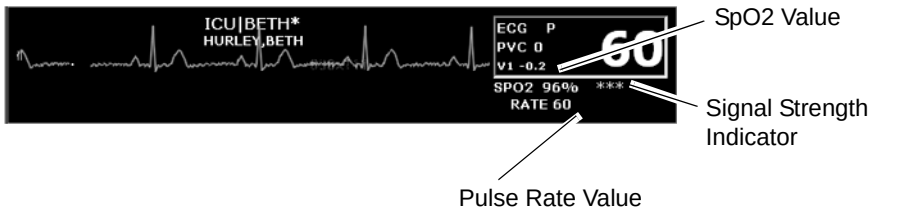
When monitoring SpO2 using an transmitter, an SpO2 waveform is neither generated nor displayed on the Apex oximeter or CIC Pro center. Additionally, no alarm histories are generated or stored.

NOTE

SpO_2 monitoring with an X-Pod does not occur in combo mode. If SpO_2 monitoring is required while in combo mode, the patient's SpO_2 sensor must be attached to an SpO_2 device at the monitor.

SpO2 in the multi-patient viewer

In the multi-patient viewer, the bed window for a telemetry patient being monitored for SpO2 displays the current SpO2 value; one, two, or three asterisks indicating signal strength; and, if turned on, the derived pulse rate for the patient. The following figure is an example of a telemetry patient’s bed window in the multi-patient viewer.



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SpO_2 control settings

NOTE

An SpO2 monitoring device must be connected to transmitter to configure settings.

Complete the following procedure to adjust the control settings.

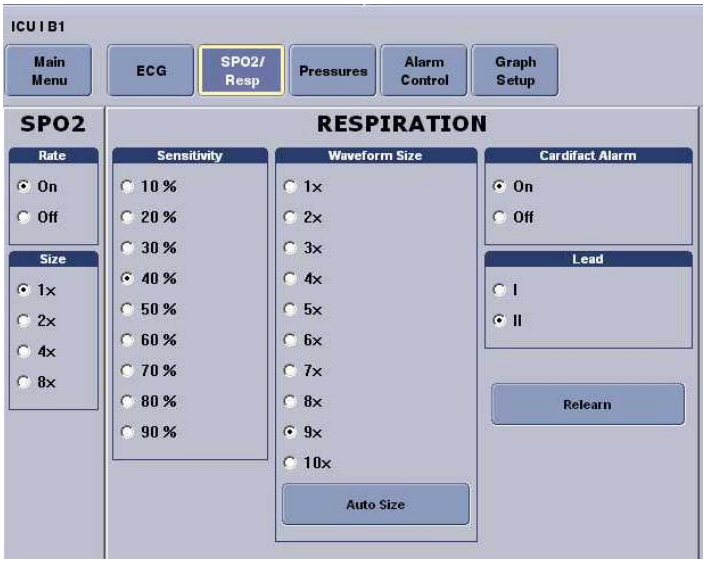
1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Monitor Setup***.
3. Click ***SPO2/Resp*** to display the control window.

   NOTE

   The SpO2 tab is labeled ***SpO2/Respiration*** because respiration monitoring settings are available on this tab sheet for bedside monitored patients only.

   Respiration monitoring is not an option for telemetry patients. Therefore only SpO2 information appears on this tab sheet when monitoring a telemetry patient.

4. Change any of the undimmed setting options.



064A

SpO2 control settings	
Option	**Function**
Rate	Turn ***On*** to display the SpO_2 heart rate.
Size	Set the waveform size. No waveform is displayed for telemetry patients. This option will appear dimmed.

5. After making your selections, complete one of the following tasks:

   - Click a different ***Monitor Setup*** option to apply your changes without closing the ***Monitor Setup*** window.
   - Click the  (close button) on the top right side of the window to apply your changes and close the ***Monitor Setup*** window.

SpO2 probe safety

Be sure to read all literature accompanying probes for specific safety information. Be aware of the following safety precautions when using SpO2 probes.

WARNING
DATA VALIDITY—Do not expose probe detector to strong ambient light while monitoring a patient. A poor signal may result.

Do not allow tape to block the probe light detector.

WARNING
PATIENT SAFETY—Prolonged monitoring may require changing the probe site periodically. Move the probe if there is any sign of skin irritation or impaired circulation. Change the probe site AT LEAST every four hours to prevent ischemic skin necrosis. If required, reduce the application periods to HALF the times recommended above.

If a probe is damaged in any way, discontinue use immediately.

CAUTION
Use only approved Nonin SpO2 probes (refer to the Additional Product Information addendum) with the Apex oximeter and Xpod oximeter. The reliability of SpO2 data obtained with any other probe has not been verified.

Pediatric patients and pulse oximetry

WARNING
The display of inaccurate pulse oximetry (SpO2) values has been linked to the presence of poor signal strength or artifact due to patient motion during signal analysis. This condition is most likely to be encountered when the equipment is used on pediatric patients. These same conditions in adults do not impact the SpO2 values to the same extent.

When using pulse oximetry on pediatric patients, *always* observe the following precautions.

Precautions

We recommend the application of the following criteria when using the pulse oximetry function on pediatric patients:

1. The peripheral pulse rate (PPR) as determined by the SpO2 function must be within 10% of the heart rate, and
2. the SpO2 signal strength indicator must have 2 or 3 asterisks displayed, and
3. stable SpO2 values are displayed for six seconds.

Procedures or devices previously applied in your facility for SpO2 monitoring should be used in the event that the SpO2 value from the equipment cannot be validated by the above criteria.

CAUTION
Do not use the Apex or Xpod oximeter on neonatal patients. It is not designed for use on neonates.

Signal and data validity

It is extremely important to determine that the probe is attached to the patient correctly and the data is verifiable. To make this determination, the signal strength indicators on the CIC Pro center, Apex oximeter device, and Dinamap Pro monitors are of assistance.

Signal strength indicator

A signal strength (perfusion) indicator is displayed on the Apex oximeter display and at the CIC Pro center in the appropriate patient window.

On the Apex oximeter, this indicator is a perfusion LED that blinks with each SpO2 pulse detected. The LED blinks green for each acceptable strength pulse. It blinks yellow for SpO2 signals of marginal quality, and blinks red when the SpO2 signal is too weak or the quality is very poor. When the perfusion LED blinks red, the numeric data displayed on the Apex oximeter will be replaced by dashes within 10 seconds.

At the CIC Pro center, the signal strength indicator consists of 0, 1, 2, or 3 (strongest) asterisks, depending on the strength of the signal.

Proper environmental conditions and probe attachment help ensure a strong signal.

WARNING
In the monitoring of patients the coincidence of adverse conditions may lead to a disturbed signal going unnoticed. In this situation artifacts are capable of simulating a plausible parameter reading, so that the monitor fails to sound an alarm. In order to ensure reliable patient monitoring, the proper application of the probe and the signal quality must be checked at regular intervals.

Error messages

If the probe is not correctly attached to the patient and data is not verifiable, one of the following error messages may appear in the patient's bed window at the CIC Pro center:

- Oximeter device
  - ***SPO2 PROBE OFF***
  - ***SPO2 PROBE***
- Dinamap Pro monitors
  - ***SPO2 NO DATA***
  - ***SPO2 PROBE***

If any of the listed messages appear, check the position of the probe or replace the probe. See SpO2 messages on page D-5. If the problem persists, call GE Service or contact your sales/service representative.

Pressures

The Pressures tab sheet allows you to view and modify settings specific to the viewed telemetry patient's NBP display. Settings may be viewed for any patient. However, you can only modify settings for patients who are admitted to a bed in your unit.

NOTE

The NBP tab is labeled ***Pressures*** because other invasive pressures settings are available on this tab sheet for bedside monitored patients only.

Invasive pressure monitoring is not an option for telemetry patients. Therefore, only NBP information appears on this tab sheet when monitoring a telemetry patient.

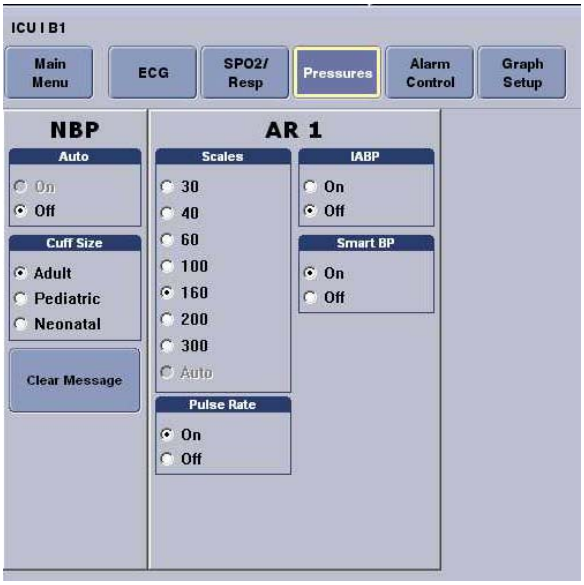
Non-invasive blood pressure control settings

NOTE

A non-invasive blood pressure device must be connected to transmitter to configure settings.

Complete the following procedure to adjust the control settings.

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Monitor Setup***.
3. Click ***Pressures*** to display the control window.
4. Change any of the undimmed setting options.



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Non-invasive blood pressure control settings	
Option	**Function**
Auto	Turn ***Off*** automatic NBP measurements. When turned ***On*** at the monitor, NBP measurements are acquired automatically at regular intervals. **NOTE** This option does not apply to telemetry beds and cannot be turned on from the CIC Pro center.
Cuff Size	Set the inflation pressure used during the first NBP measurement and for calculating the NBP pressure: **NOTE** For more information, refer to the appropriate bedside monitor's operator's manual. **NOTE** Cuff size cannot be changed on telemetry beds.
Clear Message button	Clear the display of inflation messages and current NBP readings.

5. After making your selections, complete one of the following tasks:

- Click a different ***Monitor Setup*** option to apply your changes without closing the ***Monitor Setup*** window.
- Click the  (close button) on the top right side of the window to apply your changes and close the ***Monitor Setup*** window.

NBP monitoring with telemetry

WARNING
LOSS OF ALARMS—Do not use transmitter accessory devices such as SpO2 and NBP without ECG cables attached. Failure to use accessory devices in the prescribed manner may result in a loss of alarms.

WARNING
The following conditions may affect the accuracy of noninvasive blood pressure readings: seizures, tremors, extreme hypotension or hypertension, arrhythmias, or extremely high or low heart rate.

NBP monitoring via telemetry is done with an Accutracker DX or Dinamap Pro blood pressure monitor connected to the transmitter. The blood pressure cuff is connected to the blood pressure monitor, which measures and displays systolic and diastolic blood pressures (and mean blood pressures with Dinamap Pro) using the auscultatory method. When the blood pressure monitor is connected to an transmitter, digital values are also displayed at the CIC Pro center.

Patient preparation

Blood pressure cuff selection and application are important. Inappropriate selection or improper application of the cuff will result in erroneous measurements.

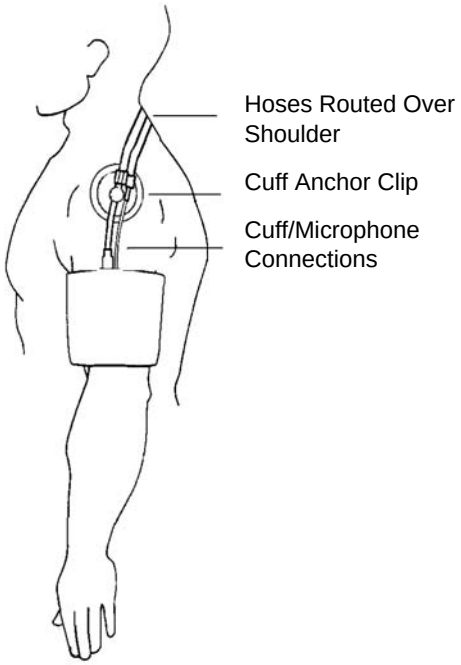
Most people use their non-dominant arm for acquiring ambulatory noninvasive blood pressure readings.

Follow these steps to prepare the patient for NBP monitoring:

1. Place the K-sound microphone in the microphone pad (or blood pressure cuff). For more information on microphone placement, refer to Microphone placement on page 7-31.
2. Locate the patient’s brachial artery on the inside of the arm, just above the elbow. Mark the location with a pen for easy microphone placement.
3. Remove the backing from the microphone pad and adhere it in the location marked on the patient’s arm. Do not bend or squeeze the microphone. Route the microphone cable up, toward the patient’s shoulder.
4. Wrap the blood pressure cuff around the arm. Be sure that the artery marker is aligned over the brachial artery.

5. Drape the cuff hose over the patient's shoulder and attach an adhesive cuff anchor to the snap on the cuff hose. Do not adhere the cuff anchor to the patient at this time.
6. Place the blood pressure monitor in its pouch and attach it to the patient using the belt or shoulder strap provided.
7. Adhere the cuff anchor to the patient's upper arm by removing the adhesive backing and pressing firmly.

When attached, the blood pressure cuff and hoses should be positioned like those in the following illustration.



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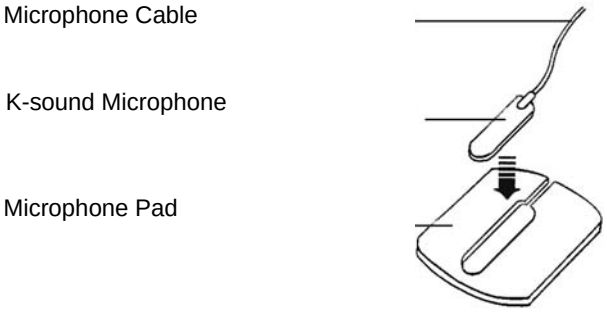
Microphone placement

A microphone is used to hear the Korotkoff sounds (K-sounds) that the blood pressure monitor uses to determine the systolic and diastolic pressure readings. The microphone can be placed in a microphone pad and adhered to the patient's arm under the blood pressure cuff, or alternatively, it can be placed directly into the microphone pocket inside the blood pressure cuff.

Placement in the microphone pad

Using a microphone pad is recommended. Place the microphone in the pad as illustrated below. Do not bend or squeeze the microphone when placing it in the pad, or when adhering the pad to the patient's arm.



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Placement in the blood pressure cuff

As already stated, using the microphone pad is recommended, especially in the case of ambulatory patients or patients with weak K-sounds. However, as an alternative, the microphone can also be placed directly in the blood pressure cuff. Follow the directions below.

NOTE

Blood pressure readings taken with the microphone in the blood pressure cuff may not be as accurate as readings obtained when using the microphone pad.

1. Remove the bladder from the cuff.
2. Turn the cuff bladder pouch inside out to expose the microphone pocket.
3. Open the Velcro pocket flap and gently insert the microphone into the pocket.
4. When the microphone is completely inserted, close the Velcro flap over the microphone cable and turn the cuff right side out.
5. Replace the bladder and exit the bladder hose and microphone cable out of the same exit site, either right arm or left arm, as marked on the cuff.

Safety considerations

WARNING

The Accutracker DX blood pressure monitor is designed for use with adult patients only. Do not use on neonates or on patients known to be susceptible to bruising.

Do *not* attach the blood pressure cuff to a limb being used for IV infusions as the cuff inflation can block the infusion, causing harm to the patient.

CAUTION

The blood pressure monitor's safety and effectiveness in neonates has not been established.

Blood pressure measurements may be affected by the patient's position, physical condition, and other factors.

Do not use the blood pressure monitor if it has failed its diagnostic self test or if it displays a pressure greater than zero with no cuff attached. The values displayed by such a unit may be inaccurate.

If you must ship the Accutracker DX blood pressure monitor for service or other reasons, place it in a sealable plastic bag, seal it tightly, then package it in a cardboard box. Label the shipping container –20 to +50° C and ship appropriately. Failure to follow these instructions can result in device failure due to improper shipping/storage conditions.

Setting the measurement interval

When the blood pressure monitor is turned on, it performs a battery voltage check, then the display shows the following:

INT= 5 (***)

INCR DECR START?

NOTE

The number ***5*** above represents any measurement interval, including ***MAN*** (manual). When the blood pressure monitor is turned on, the number displayed is the last measurement interval set as the default.

Use the **YES +** button or the **NO –** button on the blood pressure monitor to increase or decrease the interval (***INT***) at which the blood pressure readings are taken.

The available measurement intervals are: ***MAN*** (manual), or ***5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 90, 120***, or ***240*** minute intervals.

When the desired measurement interval is reached, press the **START/STOP** button. The blood pressure monitor immediately begins a measurement cycle. It will attempt one retry if the first measurement cycle fails.

Measurements are taken at the selected interval. A measurement may be initiated in between intervals by pressing the **START/STOP** button. This wakes up the blood pressure monitor from sleep mode, and offers the option to change the measurement interval as described above, as well as the option to view the time left until the next measurement. A manual measurement is initiated by pressing the **START/STOP** button a second time. The next measurement will then be taken at the scheduled interval (X number of minutes) after the manual measurement is complete.

The patient's blood pressure is displayed for one minute on the blood pressure monitor and for two hours on the CIC Pro center. The blood pressure reading is updated each time a measurement is successfully completed.

Measurements are taken at the selected interval until the blood pressure monitor is turned off, or until the monitor determines that the batteries are too weak for additional measurements.

A measurement may be stopped by pressing the **START/STOP** button while the measurement is in progress.

Setting test parameters

The maximum and minimum inflation pressures, dynamic or fixed inflate, and deflate rate can be adjusted. Follow these steps:

1. Turn the blood pressure monitor on while holding down the **NO –** button. The display shows:

   CHANGE TEST

   PARAMETERS?

2. Press the **YES +** button to change the parameters.

3. The ***MAXIMUM PRESSURE*** can be set to: ***250, 240, 230, 220, 210, 200, 190, 180, 170, 160, 150, 140, 130, 120, 110***, or ***100*** mmHg using the **YES +** and **NO –** buttons. A setting of 200 to 250 mmHg is recommended for the maximum cuff inflation pressure.

4. When the maximum pressure has been set, press the **NEXT** button to set the ***MINIMUM PRESSURE***. It can be set to: ***100, 90, 80, 70, 60, 50, 40, 30, 20,*** or ***10*** mmHg using the **YES +** and **NO –** buttons. A setting of 40 mmHg is recommended for the minimum cuff deflate pressure.

5. When the minimum pressure has been set, press the **NEXT** button to select ***DYNAMIC INFLATE*** or ***FIXED INFLATE***. Press the **YES +** button to turn dynamic inflate on, or press the **NO –** button for fixed inflate.

   When dynamic inflate is turned on, the blood pressure cuff inflation pressure automatically ranges 30 mmHg above the most recent systolic reading.

   Fixed inflate always inflates the blood pressure cuff to the set maximum inflation pressure.

   Dynamic inflate is recommended for most patients. However, if a patient's systolic pressure readings vary by 25 mmHg or more, fixed inflate may be more comfortable for the patient. In all likelihood, dynamic inflate would not inflate the cuff high enough for such a patient, prompting the blood pressure monitor to retry, and causing the patient to endure two inflations for each reading. A fixed inflation to the set maximum pressure eliminates the double inflation and increases the patient's comfort. Reducing the maximum cuff inflation pressure setting for a patient being monitored with fixed inflate will also increase the patient's comfort.

6. After selecting dynamic or fixed inflate, the ***DEFLATE RATE*** can be set. It can be set to: ***6, 5, 4, 3***, or ***2*** mmHg, using the **YES +** and **NO –** buttons. A deflate rate of 3 mmHg per second is recommended.

NOTE

A patient with a slow heart rate requires a slower deflation rate than a patient with a faster heart rate. If the cuff deflates too quickly, it may not be possible to determine a blood pressure. If the cuff deflates too slowly, it may be uncomfortable for the patient. The recommended deflate rate of 3 mmHg per second meets most patients' requirements, but it can be adjusted when needed.

7. Press the **NEXT** button to return to the ***CHANGE TEST PARAMETERS?*** prompt, then press the **NO –** button to return to:

   INT= 5 (***)

   INCR DECR START?

Setting limits

It is possible to set the maximum and minimum values, as well as the change (delta) limit, at which the blood pressure monitor will reject a systolic, diastolic, or pulse pressure reading and attempt a new measurement. Contact technical support for more information about setting these limits.

Software and hardware versions

To verify what software and hardware versions your blood pressure monitor has, turn on the blood pressure monitor while holding down the **LAST** button. A display similar to the following appears:

Vsn: XX/ZZ

K3: 0 PR: 0

Your hardware version appears in place of the ***XX*** in the above example; your software version appears in place of the ***ZZ*** in the above example.

NOTE

Although it is not shown on the blood pressure monitor display, both the software and hardware version have a period in them. For example, if the hardware version reads 11 on the display, this actually indicates that it is hardware version 1.1.

8 Viewing stored patient data

Stored data

The CIC Pro center can retrieve in-unit parameter data from patient monitors connected to the Unity Network and retrieve parameter data from secondary devices connected through a Unity Network Interface. Stored events, parameter numeric data, graphic trends, and full disclosure patient data is identified by the date and time the data was collected. As a result, stored data is linked to a specific time focus.

You can review or print stored patient data from the following data review tools:

- ***Events*** directory
- ***Event Strip***
- ***FD Strip*** (full disclosure) (purchased option)
- ***FD Page*** (full disclosure) (purchased option)
- ***Graphic Trends***
- ***Vital Signs*** (parameter numeric data)
- ***Calipers***

NOTE

When using a second display, the second display will always open the most recently used data review tool.

NOTE

Solar 9500 information monitor parameters not supported by the CIC Pro center will not be available for viewing or printing at the CIC Pro center. However, this data will be available locally at the Solar 9500 monitor.

Time focus data

When parameter data is collected and stored, the stored patient data is linked to a specific time focus. When viewing an area of interest for one type of patient data (e.g. ***Vital Signs***), you can view another type of patient data (e.g. ***Graphic Trends***) that was collected and stored at that same time focus.

As a result, when viewing a patient's parameter numeric data (vital signs) that was collected and stored at 7:28 pm on January 10, you can select ***Graphic Trends*** to view the graphic trend data that was also collected and stored at 7:28 pm on January 10.

NOTE

When reviewing stored ECG data samples or strips, the degree of linking between time focus and the data is determined by your Full Disclosure license. You can only view full disclosure data that was stored within the time span identified by your Full Disclosure license. If you attempt to view data that exceeds your Full Disclosure license, the CIC Pro center displays the following message: ***No data is available for requested time***.

NOTE

When using a second display, you can display data from two different data review tools using the same time focus in the top and bottom halves of the display screen.

Events directory

From the ***Events*** directory, you can view information about any ***Crisis***, ***Warning***, or ***Advisory*** level arrhythmia or ST event that is stored at a bedside monitor. You can also view any ECG data sample that is also stored at a bedside monitor from the ***Events*** directory.

Up to 131 alarm events are stored for each admitted patient, with the following maximum number of event types:

- 100 arrhythmia alarm events
- 20 ***ST*** limit alarm events
- 10 samples
- 1 ***ST*** reference

NOTE

The ***Events*** directory can be displayed along with the other data review tools. If it is not displayed, you can display the directory by clicking ***Events***.

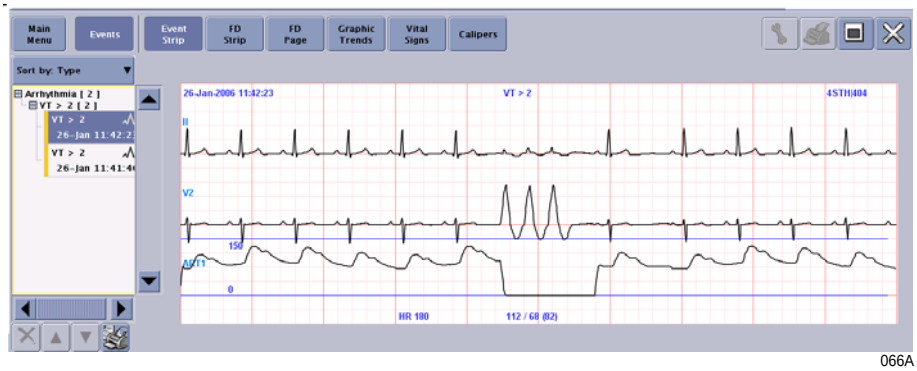
NOTE

To review stored non-ECG parameter data, use the ***FD Strip*** and ***FD Page*** data review tools.

Viewing the Events directory

Complete the following procedure to view the ***Events*** directory:

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Patient Data...*** > ***Events***. The ***Events*** directory window displays.



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	Event list. When the list is sorted by type, click the plus sign to expand the list or the minus sign to collapse the list.
	Sort tool. Click the down arrow to sort stored events and data samples by the date and time the event occurred or by the type of event (e.g. arrhythmias).

	Scroll bar. Move up or down through the directory.
	Print directory button. Print the list of events displayed in the ***Events*** directory.
	Up and down buttons. Move up or down through the directory one event at a time.
	Delete event button. Delete the selected event or data sample from the ***Events*** directory.

Printing the Events directory

Complete the following procedure to print a list of events and data samples stored in the ***Events*** directory:

1. From the single patient viewer, click ***Patient Data...*** > ***Events***. The ***Events*** directory displays.
2. Sort the data by event time or by event type.
3. Click  (print directory button) located under the ***Events*** directory to print the displayed list of events.

Counting how many events occurred

Complete the following procedure to identify how many events occurred in each event category (e.g. ***V TACH*** or ***VFIB/VTAC***):

1. From the single patient viewer, click ***Patient Data...*** > ***Events***. The ***Events*** directory displays.
2. When the ***Events*** list is not sorted by type, click the down arrow next to ***Sort by: Time*** and choose ***Sort by: Type*** from the displayed list. The list sorts itself by event category.
3. Use the scroll bar to move up or down through the list. The quantity of each event category is listed in square brackets next to the event name (e.g. ***V TACH [2]***).

Identifying the most recent occurring event

Complete the following procedure to identify the most recent occurring event:

1. From the single patient viewer, click ***Patient Data...*** > ***Events***. The ***Events*** directory window displays.
2. When the ***Events*** list is not sorted by date and time, click the down arrow next to ***Sort by: Type*** and choose ***Sort by: Time*** from the displayed list. The list sorts itself by event time.
3. To move up or down through the list of events one at a time, click  arrows located under the ***Events*** directory.

4. Use the scroll bar to move up or down through the list of events and data samples.

Deleting a stored event or data sample

NOTE

- Deleting an event or data sample from the CIC Pro center ***Events*** directory also deletes the corresponding data from the monitor or telemetry system.
- When the Patient Data Server (***PDS***) is active, the delete events button is dimmed and you cannot delete any events or data samples from the ***Events*** directory.
- To delete a stored event or data sample, use the  (delete event button) with the red X.

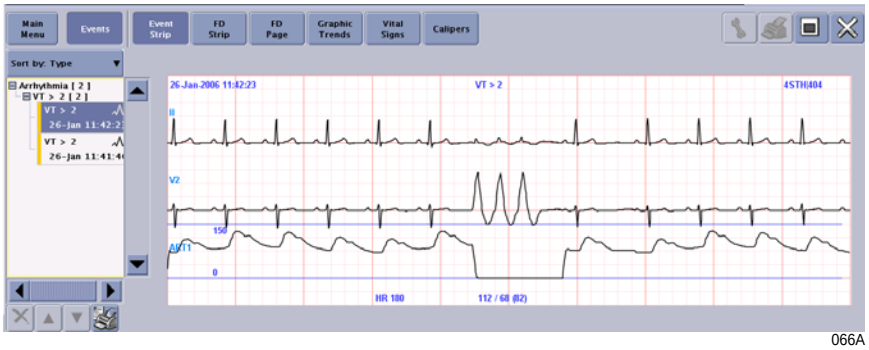
Complete the following procedure to delete an event or data sample stored in the ***Events*** directory:

1. From the single patient viewer, click ***Patient Data...*** > ***Events***. The ***Events*** directory displays.
2. Sort the data by event time or by event type.
3. Use the scroll bar to move up or down through the list of events and data samples.
4. Click the single event or data sample you want to delete, or hold down **CNTRL** and continue to click the left mouse button to select multiple events or data samples.
5. Click the  (delete event button). This button is located under the ***Events*** directory and has a red-colored X on it. A window displays a message similar to the following, ***Are you sure you want to delete this event?***
6. Verify you selected the correct event or data sample for deletion:
   - Click ***OK*** to delete this event or data sample.
   - Click ***Cancel*** if you do not want to delete this event or data sample.

Viewing or printing an Event strip

You can view or print a maximum of a 10-second strip for any arrhythmia event or ECG data sample stored in the ***Events*** directory. You can also view or print the current and reference ST complexes for all available ECG leads.

The following is an example of an ***Event Strip***.



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Complete the following procedure to view or print an event strip or data sample stored in the ***Events*** directory:

1. From the single patient viewer, click ***Patient Data...*** > ***Events***. The ***Events*** directory displays.
2. Sort the data by event time or by event type.
3. Use the scroll bar to move up or down through the list of events and data samples.
4. Click on a single event or data sample you want to view or print.
5. From the patient data menu, click ***Event Strip***. The selected event strip displays.
6. To print this strip, click  (print button) located in the upper right corner of the single patient viewer.

Full disclosure data

NOTE

This section provides a brief overview of the Full Disclosure function. For more information, refer to the CIC Pro Clinical Information Center Operator's Manual.

An admitted patient's parameter waveforms and numeric data is continually collected for a maximum of 72 hours (license dependent). After the maximum hours of data collection have elapsed, the oldest data is deleted to accommodate newer data.

NOTE

The amount of full disclosure data collected for a patient is determined by the type of licenses installed on the CIC Pro center. One hour of full disclosure data collection and storage is standard without additional licensing.

You can view full disclosure data using the following data review tools:

- Full disclosure strip: Automatically scan forwards and backwards through full disclosure data for specific areas of interest.
- Full disclosure page: View full disclosure waveform data in a full page format and view specific areas of interest.

Full disclosure strip

A full disclosure strip displays a maximum of 10-seconds of available full disclosure parameter waveforms and numeric data. You can choose to view the waveforms and numeric data for all monitored parameters or all of the ECG waveforms and numeric data.

You can automatically scroll backward or forward through the displayed data, view, and print a selected full disclosure strip.

For more information, refer to the CIC Pro Clinical Information Center Operator's Manual.

Viewing or printing a full disclosure strip

NOTE

Requires a laser printer to print.

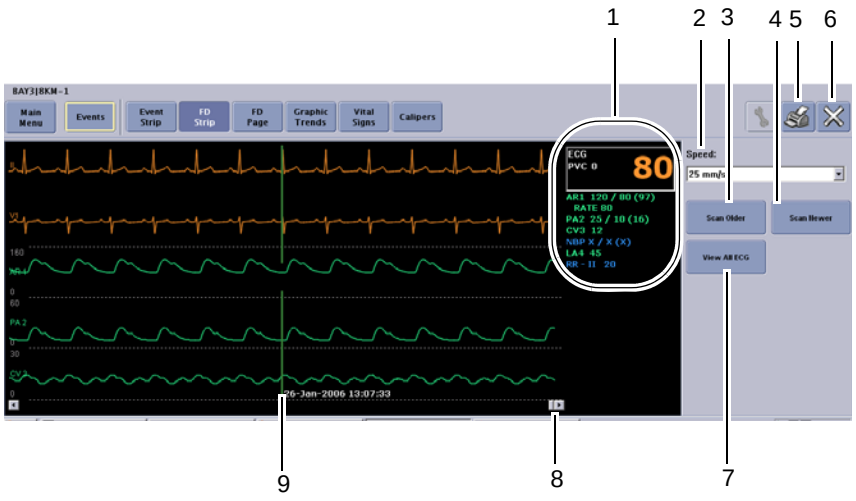
NOTE

When viewing the full disclosure strip, the arrhythmia label text follows the waveform event and is displayed to the left of the cursor.

Complete the following procedures to view or print a full disclosure strip:

Display the full disclosure strip window

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Patient Data...*** > ***FD Strip***. The full disclosure strip window displays.



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***FD Strip* window**	
Item	**Description**
1	Parameter numeric data corresponding with the cursor's time focus.
2	***Speed***. Adjust the sweep speed of the scanned waveforms. For example, when you choose ***25 mm/s***, the displayed data scrolls in 8-second increments.
3	***Scan Older***. Scan through the older full disclosure data. When the end of the data has been reached, the scan automatically stops. During the scanning process, this button function changes to ***Stop***. Click ***Stop*** to stop the scan at any time.
4	***Scan Newer***. Scan through the newer full disclosure data. When the end of the data has been reached, the scan automatically stops. During the scanning process, this button function changes to ***Stop***. Click ***Stop*** to stop the scan at any time.
5	Print button. Print the full disclosure waveform and parameter numeric data displayed in the ***FD Strip*** window. The print duration of the ***FD Strip*** is determined by the in the ***Strip*** > ***Duration*** setting in the ***Full Disclosure Defaults*** window.
6	Close button. Close the ***FD Strip*** window.
7	***View All ECG***. Display all of the available ECG leads and parameter numeric data. Once selected, this button function and label changes to ***Monitor***. ***Monitor***. Display all of the parameter waveforms and numeric data displayed at the monitor when the CIC Pro center collected the full disclosure data. Once selected, this button function and label changes to ***View All ECG***.
8	Scroll bar. Move backward or forward in time. **NOTE** The scroll bar and the scroll bar arrows move the displayed data at different rates of speed: ■ Clicking inside the scroll bar moves the displayed data in time increments defined by the ***Speed*** setting. ■ Clicking the scroll bar arrows moves the displayed data in one-second increments.
9	Cursor. Identify the date and time of the parameter waveform and parameter numerics data you are currently viewing. You can move the cursor by using the scroll bar or by clicking on the waveform to move the cursor to that position.

Print a full disclosure strip

Once you have placed the cursor on an area of interest, you can print a strip of this full disclosure data. The printed strip displays the parameter waveform and numeric data for the selected time focus.

The duration of the printed ***FD Strip*** is determined in the ***Strip*** > ***Duration*** setting in the ***Full Disclosure Defaults*** window.

Complete the following procedure to print a full disclosure strip:

1. Position the cursor on the waveform area of interest.
2. Click  (print button) located in the top right corner of the ***FD Strip*** window. The full disclosure strip prints.

Full disclosure page

The full disclosure page allows you to view and examine the full range of stored waveforms, zoom in on areas of interest, and print a customized full disclosure report.

Viewing or printing a full disclosure page

NOTE

Can print to a laser printer.

Complete the following procedures to view the stored full disclosure waveforms:

Display the FD Page window

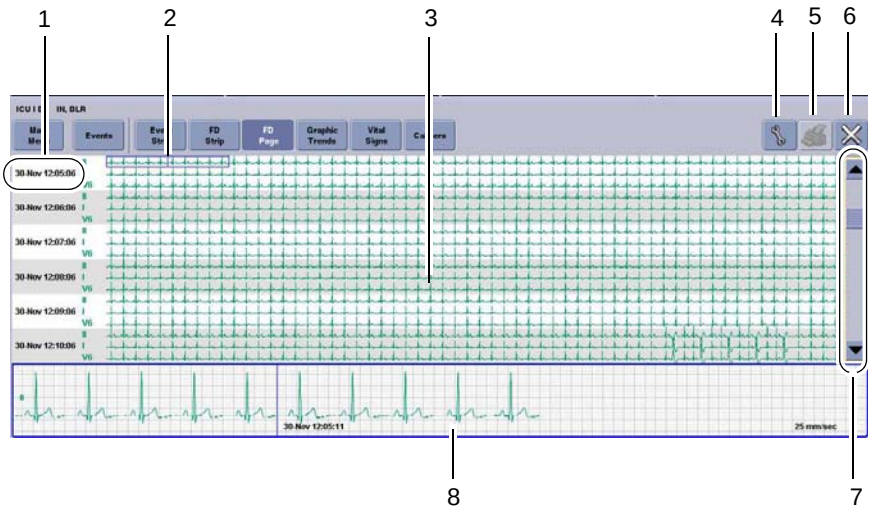
1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Patient Data...*** > ***FD Page***. The full disclosure page displays.

NOTE

When you select a specific time focus or an alarm event from the ***Events***, ***Event Strip***, ***Graphic Trends***, or ***Vital Signs*** data review tools, the ***FD Page*** automatically displays the available full disclosure data for that time focus or event. Otherwise, the most current full disclosure data displays.

NOTE

When an event or ECG data sample occurs outside of the time limit of your full disclosure license, a message similar to the following displays: ***No patient data is available for the selected time***.



FD Page window	
Item	**Description**
1	Time and date stamp for this row of waveform data.
2	Zoom box. ■ Click inside the small blue-colored zoom box to display an enlarged view of the selected waveform area. ■ Click on another area of interest to re-position the zoom box.
3	Waveform data.
4	Tools icon. Customize the on-screen display of full disclosure data.
5	Print icon. Customize and print a full disclosure report.
6	Close icon. Close the ***FD Page*** window.
7	Scroll bar. Display older or newer data.
8	***Zoom Window***. View the enlarged waveform selected in the small blue-colored zoom box.

Graphic trends data

The CIC Pro center can retrieve parameter numeric data from patient monitors connected to the Unity Network and retrieve parameter numeric data from secondary devices connected through a Unity Network Interface. The CIC Pro center can display this collected data in a graphical format, over a specified period of time. Depending how your CIC Pro center is configured, you can view a maximum of six graphic trends in half-screen mode and a maximum of 12 graphic trends in the full-screen mode. You can view graphic trends in varying time scales and print them at a laser printer or a digital writer.

A patient's parameter numeric data is continually collected for a maximum of 24 hours. After the maximum hours of data collection have elapsed, the oldest data is deleted to accommodate the newer data.

The CIC Pro center retrieves non-episodic parameter data at one-minute resolution from the patient monitor and displays it at one-minute resolution. Episodic parameter events (e.g. NBP) are retrieved every time episodic events are recorded. If more than one episodic event occurs during the same minute, the more recent episodic event overwrites the older episodic event.

The CIC Pro center also retrieves AFIB trend data from telemetry patients. AFIB event patient data is stored for review in the ***Graphic Trends*** and ***Vital Signs*** tab sheets.

Viewing graphic trends

NOTE

From the multi-patient viewer, you can click in the real-time trend window to automatically display the current ***Graphic Trends*** window for this patient.

NOTE

When two trends are displayed across from each other in the ***Graphic Trends*** window and both trends have the same data values, those graphic trend waveform areas will overlap each other. The overlapping waveform colors will not blend together. This is a normal behavior. As the trend values change, the waveform shape will also change, allowing its individual waveform color to become visible.

NOTE

If you position the time cursor inside a visible gap of trended data, parameter numerics are displayed. Depending upon the position of the time cursor within the gap, the displayed parameter numerics are either the last known parameter values before the gap or the first known parameter values after the gap.

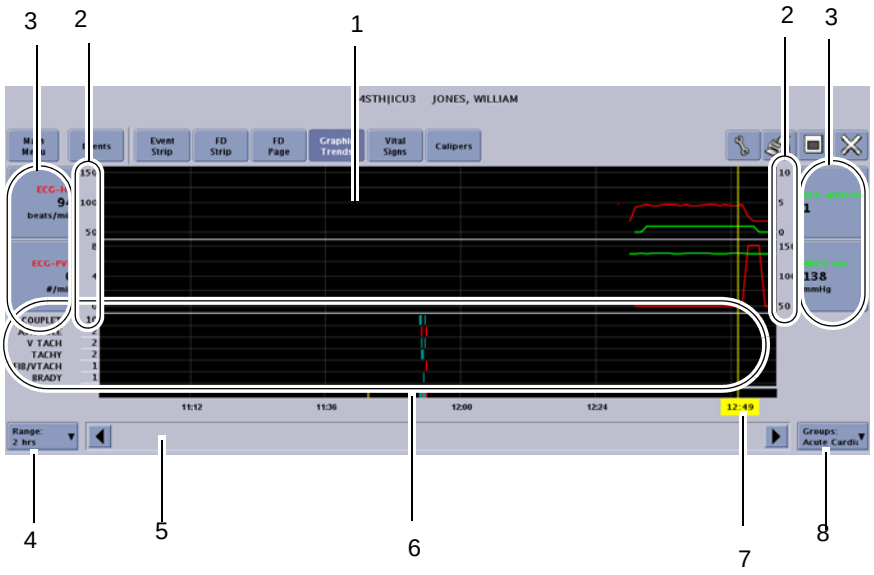
NOTE

When viewing episodic telemetry data, any data reading collected after the minute mark will display in the next trended minute.

Complete the following procedures to view the graphic trends of parameter numeric data:

Display the graphic trends window

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Patient Data...*** > ***Graphic Trends***. The ***Graphic Trends*** window displays the current parameter trends.



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***Graphic Trends* window**	
Item	**Description**
	Tools button. Display the trend ***Groups*** configuration (view-only).
	Print button. Print the displayed trends.
	Close button. Close the window.
	Maximize button. Use to toggle to full screen format.
	Minimize button. Use to toggle to half screen format.
1	***Graphic Trends*** window.
2	Graphic trend scales.
3	Graphic trend buttons. Identify the trended data and the associated parameter numeric values. Click on a graphic trend button to change the scale of this graphic trend.
4	***Range***. Display the selected time range from 15 minutes to 24 hours.
5	Scroll bar. Move backward or forward in time.
6	Event summary. Display a brief overview of the type and number of events that occurred during a specific time focus.

***Graphic Trends* window**	
Item	**Description**
7	Time focus cursor (yellow line) and time focus label (yellow label). Landmark the date, time, and parameter numeric data corresponding to the cursor placement. **NOTE** If it is not the current day the day-month and time will appear in the cursor label (e.g., 3-Apr 18:49). When it is the current day then only the time will appear.
8	***Groups***. Display the selected customized group of parameters. Trend Groups are configured during installation. For more information, contact your biomedical department.

Choose the trend group you want to display

Complete the following procedure to display trends from a preset group of parameters:

1. From the ***Graphic Trends*** window, click ***Groups***. A list of trend groups displays.
2. Choose the trend group you want to display.

Adjust the displayed time period

NOTE

The ***Graphic Trends*** window displays the current trends.

Complete the following steps from the ***Graphic Trends*** window to adjust the start and stop time of the displayed graphic trends:

1. To make minor time adjustments, use the scroll bar to move backward and forward in time.
2. To display a specific time range (e.g. ***30 Minutes***), complete the following steps:
   a. Click ***Range*** to display a list of time ranges.
   b. Choose the time range for the displayed trended data. You can choose from ***15***, ***30*** minutes or ***1, 2, 4***, ***8***, ***12***, ***24*** hours.

Adjust the trend scale size

Complete the following steps to adjust the scale size of a parameter trend:

1. From the ***Graphic Trends*** window, click on the parameter trend you want to adjust. A window displays the parameters scales available for the selected parameter trend.
2. Choose the desired scale. The window closes and the scale setting is automatically applied.
3. Repeat step 1 and step 2 for each parameter trend scale you want to adjust.

Printing graphic trends data

When printing graphic trends data, the following factors apply:

- Graphs print in the same scale as displayed on screen.
- A maximum of four graphs can be printed on each page.
- The event trend prints on its own page and includes all the event calls that occurred during the report period.
- Trend values that exceed the displayed trend scale print as a red-colored dashed line.
- For monitor patients, graphic trend printouts that are initiated from a CIC Pro center print only to a laser printer. If the graphic trend printout is initiated from a patient's bedside, it can print to a digital writer or to a laser printer (depending on how the print functions are configured on the monitor).
- For telemetry patients, graphic trend printouts can print to a laser printer or to a digital writer.

  NOTE

  In order to print to a digital writer, a laser printer cannot be connected to the CIC Pro center.

  NOTE

  When printing graphic trends data from telemetry patients to a digital writer, the time duration of the printed output is as follows:

Digital writer output for stored telemetry graphic trends data	
Displayed data	**Printed output**
15 minutes, 30 minutes, 1 hour	90 minutes
2 hours	2 hours
4 hours	4 hours
8 hours	8 hours
12 hours	12 hours
24 hours	24 hours

To print the displayed graphic trends data, click  (print button) located in the top right corner of the ***Graphic Trends*** window.

Vital signs data

The CIC Pro center can continuously retrieve parameter numeric data (vital signs) from in-unit or out-of-unit patient monitors connected to the Unity Network and retrieve parameter numeric data from secondary devices connected through a Unity Network Interface.

You can view trended parameter numeric data for varying time intervals. When the CIC Pro center is connected to a laser printer, you can also print the trended parameter

numeric data. Telemetry beds can print to a writer if a laser printer is not connected to the CIC Pro center.

For non-episodic parameters (e.g., HR), a median value is determined and stored for display at one-minute resolution. Episodic parameters (e.g., NBP) are stored every time one occurs. If more than one episodic event occurs during the same minute, the more recent event overwrites the earlier one.

NOTE

When the first parameter on the list is an episodic parameter (e.g. NBP), all other parameters on the list only display data at the episodic measurement points. For example, when NBP is the first parameter on the list, and NBP measurements were taken at 10:10, 10:15, and 10:20, then data for all other parameters on the list is only available for the same times.

NOTE

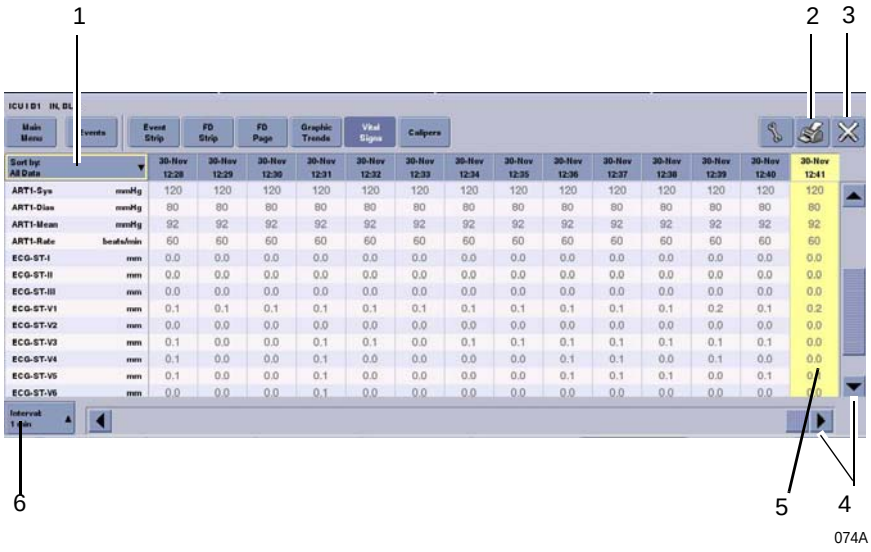
Episodic data is displayed at the closest time interval for the selected time. If the time for the measurement occurred before or after the displayed time, an ellipses symbol (...) is appended after the episodic value.

The CIC Pro center also retrieves AFIB trend data from telemetry patients. AFIB event patient data is stored for review in the ***Graphic Trends*** and ***Vital Signs*** tab sheets.

Viewing vital signs data

Complete the following procedure to view periodic and episodic trend data in a tabular format:

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Patient Data...*** > ***Vital Signs***. The ***Vital Signs*** window displays.



***Vital Signs* window**	
Item	**Description**
1	***Vital Signs*** sort tool. Click the down arrow to choose the data group you want to display.
2	Print button. Print the list of events displayed in the ***Events*** directory.
3	Close button. Close this window.
4	Scroll bars. Move up and down or left and right through the displayed data.
5	Focus indicator. Highlights one event for easier viewing.
6	Interval button. Click the down arrow to choose the time interval of the displayed data.

3. Click the down arrow next to the ***Vital Signs*** sort tool and choose the data group you want to display. The data sorts itself by your chosen category.

   NOTE

   When reviewing data in the ***Vital Signs*** window, be aware that if you changed to monitoring a different V lead, both the current and previous V lead data is trended and both V lead labels will appear in the ***Vital Signs*** window. In addition, the V lead numeric data appears at the time the V lead data was collected.

4. Click the ***Interval*** button to choose the time interval of the displayed data. You can choose from ***1***, ***5***, ***15***, ***30***, or ***60*** minutes.

5. Use the up and down or left and right scroll bars to move through the displayed data.

Printing vital signs data

NOTE

Up to five events of the ***Vital Signs*** data for telemetry patients can be printed to a digital writer.

Complete the following procedure to print periodic and episodic trend data in a tabular format to a laser printer:

1. From the single patient viewer, click ***Patient Data...*** > ***Vital Signs***. The ***Vital Signs*** window displays.

2. Click the down arrow next to the ***Vital Signs*** sort tool and choose the data group you want to display. The data sorts itself by your chosen category.

3. Click the ***Interval*** button to choose the time interval of the displayed data.

4. Click  (print button) located in the top right corner of the ***Vital Signs*** window.

Measuring ECG waveform intervals and amplitude

NOTE

This section provides a brief overview of the calipers function. For more information, refer to the CIC Pro Clinical Information Center Operator's Manual.

When full disclosure data is collected and stored at the CIC Pro center, you can use the ***Calipers*** measurement tool to measure the PR, QRS, QT, and R-R waveform intervals and the ST waveform amplitude.

Viewing or printing a waveform from the Calipers window

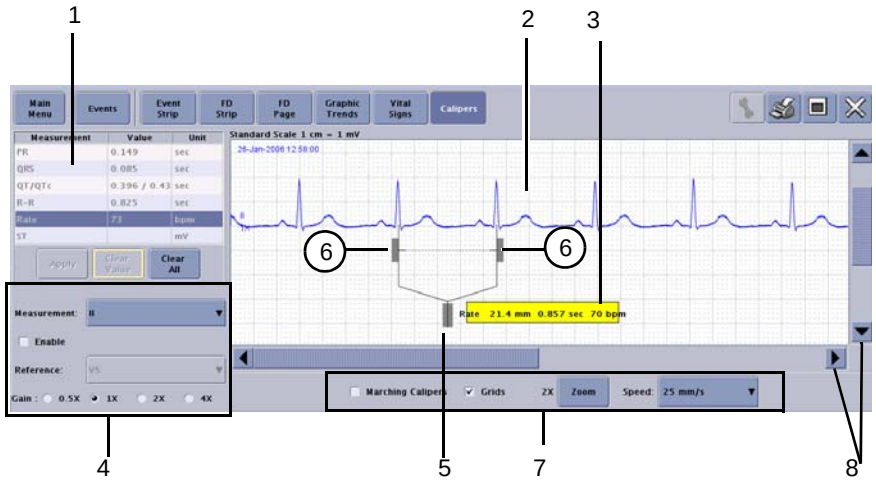
Complete the following procedure to print or view a waveform from the ***Calipers*** window:

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Patient Data...*** Then, choose the data review tool you want to use to locate a waveform segment or waveform strip you want to measure.

   NOTE

   When an event or ECG data sample occurs outside of the time limit of your full disclosure license, the data will not be available to view from the ***Calipers*** measurement tool.

3. Click ***Calipers*** to display the ***Calipers*** window. Ten seconds of waveform data displays.



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Calipers window	
Item	**Description**
	Print button. Print the displayed trends.
	Close button. Close the window.
1	Measurement table. Enter or clear the waveform measurement values for the PR, QRS, QT, R-R, and ST intervals or amplitudes. **NOTE** The QTc value is a calculated value.
2	Measurement window. View, measure time intervals and amplitude for displayed waveforms, and compare the interval of multiple waveform complexes.
3	Calculated measurement label. Click and drag to reposition.
4	Measurement options: ■ ***Measurement***: Choose one of the following leads to measure: I, ***II***, ***III***, ***V***, ***AVR***, ***AVL***, and ***AVF***. For telemetry only, a second ***V*** lead would be available for display. ■ ***Reference***: Fill the ***Enable*** box with a check mark and choose one of the following reference leads for display: I, ***II***, ***III***, ***V***, ***AVR***, ***AVL***, and ***AVF***. For telemetry only, a second ***V*** lead would be available for display. ■ ***Gain***: Adjust the gain of the displayed waveform.
5	Calipers central handle. Click and drag this handle to position the caliper on a desired waveform complex.
6	Caliper arm handles. Click and drag these handles to resize or reposition the caliper arms over the waveform.
7	Waveform display options: ■ ***Marching Calipers***: Compare the rate of multiple waveforms. ■ ***Grids***: Apply a background grid. ■ ***Zoom:*** Zoom in for a closer look at the waveform. ■ ***Speed:*** Change the sweep speed of the displayed waveform.
8	Scroll bars. Move up and down or left and right through the displayed data.

4. From the measurement table, click on the type of measurement you want to record. You can choose from ***PR***, ***QRS***, ***QT***, and ***R-R*** waveform intervals and the ***ST*** waveform amplitude

5. Position the calipers and calipers arms over the waveform complex you want to measure.

   a. Click and drag the center calipers handle (grey-colored rectangle) to position the calipers over the waveform complex.

   b. Click and drag the left or right caliper handles (grey-colored rectangles) to move the caliper arms closer together or farther apart.

NOTE

You can also use the left or right mouse buttons to click on the waveform to move the left or right caliper arm to this position.

6. Click ***Apply*** to calculate the measurement. The measurement result displays in the measurement table.
7. Repeat step 4 to step 6 to calculate other measurements.
8. To print with the measurements, click  (print button) located in the top right corner of the ***Calipers*** window. All measurements are lost when the window is closed.

Reports

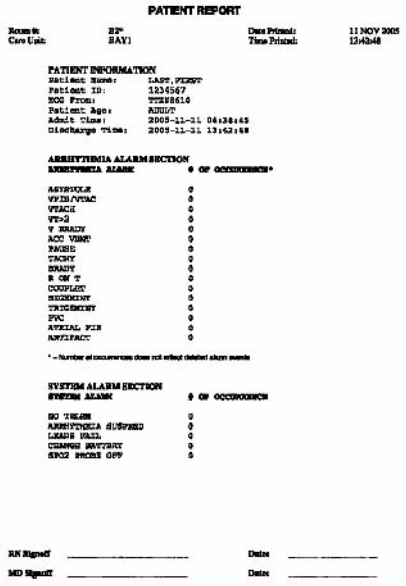
The following reports are available for telemetry patients if a laser printer is configured for the CIC Pro center. These reports are enabled and configured through Webmin. For more information, refer to the appropriate CIC Pro center service manual.

Patient discharge summary report

The Patient Discharge Summary report automatically prints to a configured laser printer for the CIC Pro center when a telemetry patient is discharged. The report provides general patient, system status alarm and patient status alarm information.

NOTE

Contact biomed/service department for configuration of laser printer for patient discharge summary report.



PATIENT REPORT

Room #: ICU
Care Unit: BAY1
Date Printed: 11 NOV 2005
Time Printed: 13:43:48

PATIENT INFORMATION
Patient Name: LAST,FIRST
Patient ID: 1234567
ECG From: TCH98610
Patient Age: ADULT
Admit Time: 2005-11-11 06:28:45
Discharge Time: 2005-11-11 13:42:48

ARRHYTHMIA ALARM SECTION

ARRHYTHMIA ALARM	# OF OCCURRENCES*
ASYSTOLE	0
VFIB/VTAC	0
VTACH	0
VT>2	0
V RHADY	0
ACC VENT	0
PAUSE	0
TACHY	0
BRADY	0
R ON T	0
COUPLET	0
BIGEMINY	0
TRIGEMINY	0
PVC	0
AVERAGE PVR	0
ANYLEADS	0

* -- Number of occurrences does not reflect deleted alarm events

SYSTEM ALARM SECTION

SYSTEM ALARM	# OF OCCURRENCES
NO TELEM	0
ARRHYTHMIA disabled	0
LEADS FAIL	0
CHANGE BATTERY	0
SPO2 PROBE OFF	0

RN Signoff _____ Date _____
MD Signoff _____ Date _____

Transmitter battery status report

The Transmitter Battery Status report prints to a configured laser printer for the CIC Pro center on a user demand basis. The report lists all transmitters with admitted telemetry patients, the associated unit and bed name and transmitter's current battery level.

NOTE

Contact biomed/service department for configuration of laser printer for transmitter battery status report.

Print transmitter battery status report

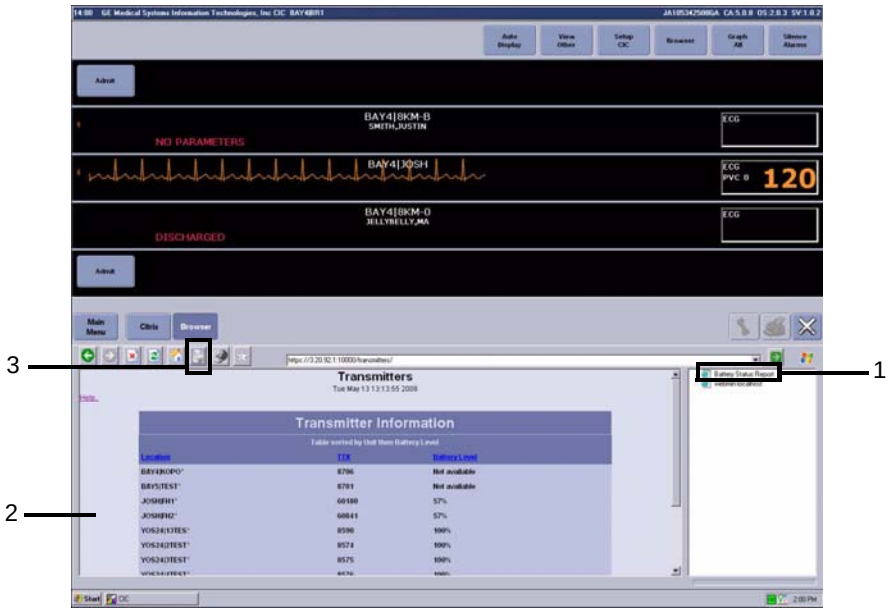
Once the report has been configured, perform the following steps to print on demand.

1. Click on the ***Browser*** button on the CIC Pro center display.
2. Select the ***Battery Status Report*** from the favorites window in the lower right-hand corner of the screen.

   NOTE

   The favorite may be named different depending on how the system was configured.

3. The report is displayed in the browser window. Click the column heading links to sort the data by ***Location***, ***TTX*** or ***Battery Level***.
4. Click the print icon from the browser window to print the report.



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Item	Description
1	Favorites link
2	Transmitter Battery Status Report
3	Print icon

9 Printing

Print devices

You can print real-time and stored parameter data to the following Unity Network print devices:

- PRN 50-M digital writer
- Laser printer

Print output

You can print displayed real-time or stored parameter data from a CIC Pro center or from other GE patient monitors that are connected to the Unity Network.

The type of parameter data available to print depends on the source of the patient data (e.g., hardwired bed, ***Combo*** bed, or telemetry bed) and from where you choose to initiate the printing of this information (e.g., CIC Pro center or patient monitor).

Telemetry bed parameter data

The following table identifies the telemetry bed parameter data available to print from a CIC Pro center or GE patient monitor.

Telemetry bed parameter data				
	Data printed from a CIC Pro center		**Data printed from a monitor**	
Parameter data	**Writer**	**Printer**	**Writer**	**Printer**
Vital Signs	Yes	Yes	Yes	Yes
Graphic Trends	Yes	Yes	Yes	Yes
Alarm history	Yes	Yes	Yes	Yes
Events directory	Yes	Yes	Yes	Yes
Alarm control	Yes	Yes	Yes	Yes
View patient	Yes	Yes	Yes	Yes
Alarm graph	Yes	Yes	Yes	Yes
Full disclosure strip	--	Yes	--	--
Full disclosure report	--	Yes	--	--
Calipers	--	Yes	--	--

Graph location

The ***Graph Setup*** for an individual patient determines where the data prints out (graph location). Other operating conditions may exist that affect the graph location.

Use the following guidelines to identify the operating conditions that determine where your data prints out (graph location):

- Manual graphs and print windows: These print at the CIC Pro center where the graph was requested, provided that CIC Pro center has the same type of writer or printer as the graph location set for the patient for that type of graph. If the CIC Pro center where the graph was requested does not have the same type of writer or printer, the graph prints to the patient's specified graph location.
- When the CIC Pro center is not connected to a printer: When viewing a patient on a CIC Pro center that is not connected to a printer, the graph settings default to the graph location configured in the ***Graph Setup*** defaults.
- Patient moved to a different bed: When you move a patient bed, the patient's graph settings are retained as set on the CIC Pro center where the patient was first admitted.
- Duplicated telemetry patient: When a telemetry patient is duplicated on another CIC Pro center, alarm graphs continue to print at the CIC Pro center where the patient was first admitted.
- No graph location for a telemetry patient: When no graph location is defined for a telemetry patient at the time of admission, the message ***Saving*** displays. Graphs are not sent to printers outside the unit.

Printing real-time data

In addition to patient alarm graphs printing automatically, you can print a continuous strip for a single patient, or print parameter waveforms or parameter limits for all patients displayed in the multi-patient viewer.

To print real-time data, see the following sections of this manual:

- Printing a continuous ECG strip on page 7-8.
- Initiating a graph all patients request on page 9-5.

Printing stored patient data

You can print patient data that has been collected and stored at this CIC Pro center.

To print stored patient data, see the following sections of this manual:

- Printing the Events directory on page 8-4.
- Viewing or printing an Event strip on page 8-5.
- Viewing or printing a full disclosure strip on page 8-7.
- Printing graphic trends data on page 8-14.
- Printing vital signs data on page 8-16.

Initiating a manual graph

If you click on a patient's ECG parameter window, a continuous graph is initiated for the patient. Clicking on the ECG parameter window again will stop the graph.

The PRN 50 digital writer and the Direct Digital Writers (DDW) print patient data (generally referred to as a graph or graph strip). Data can also be printed on a laser printer.

The waveforms graphed and graph speed are controlled in the individual patient's ***Graph Setup*** tab sheet. Unit defaults for telemetry patients can be set in the ***CIC Defaults*** tab sheet and the ***Telemetry Unit Defaults*** tab sheet. Refer to Telemetry unit defaults on page 4-7 for more information on setting ***Telemetry Unit Defaults***.

Transmitter initiated graphs (manual graphs)

When the graph button on the transmitter is pressed, a 20-second graph strip is printed at a speed of 25 millimeters per second and the event is stored in alarm history.

When an IMPACT.*wf* paging system (version II or later) is also available in the same care unit, pressing the graph button enables the View on Demand feature (also called the Apex Graph Button Push feature). The IMPACT.*wf* server generates a manually initiated sample page or snapshot of the patient's ECG waveform and any other enabled/monitored non-arrhythmia parameters.

When you press the graph button on the transmitter, it generates both an IMPACT.*wf* update page as well as a standard ECG waveform graph at the CIC Pro center. The IMPACT.*wf* page is labeled ***Sample*** when this data is displayed on the IMPACT.*wf* receiver and stored in history. Additionally, all pagers assigned to the patient receive a page.

Automatic alarm graphs

When configured, a graph prints automatically when a patient experiences a ***Crisis*** or ***Warning*** alarm condition. Arrhythmia alarm graphs run until the end of the alarm event unless manually stopped by the user. The printer prints up to 10 seconds of data that occurred immediately before the event, and prints for the duration of the event. The printer stops printing when the patient returns to a normal rhythm.

If a printer is not available at the time of the alarm event, a 20-second graph is saved. This saved graph will print when a printer becomes available.

Graph messages

One of the following messages is displayed on the CIC Pro center screen during graphing:

GRAPH ALARM—An alarm graph was initiated and is running.

GRAPH MANUAL—A manual graph was requested and is running.

GRAPH TTX—The graph button on the transmitter was pressed and a 20-second graph strip is running.

PRINTING—A non-real time graph is currently being printed.

SAVING—An alarm or a manual graph has been requested but the writer is in use; the writer door is open; the writer is out of paper; or a writer is not connected. The graph is being saved until the writer is available. The most recent 20-second alarm or

manual graph will be saved in alarm history. Additional data maybe available with Full Disclosure.

Graph all patients

Clicking on the ***Print*** button on the CIC Pro center display sends a Graph All Patients request to all beds displayed on the CIC Pro center, initiating a 10-second graph for all telemetry and ***Combo*** patients and a 20-second graph for all bedside patients. When this option is selected for telemetry patients, graph requests always print at a speed of 25 millimeters per second.

NOTE

This Graph All Patients function is only available when the single patient viewer is closed. If a single patient viewer is open, selecting ***Print*** from the main menu initiates a printout of whichever tab sheet is in front.

The print process stops automatically. If the **Graph Stop** control key is pressed on the external DDW, the current patient's graph stops and the writer begins to print a graph for the next patient.

If a patient's data is currently printing or is being saved to print when a Graph All Patients request is initiated, this patient's data will not be included in the Graph All Patients graph. This patient's data will print independently of the Graph All Patients graph.

Clicking on the ECG parameter window for a patient whose data is saving will cancel the Graph All Patients request for that patient.

If, while a Graph All Patients request is in progress, an arrhythmia alarm occurs for a patient, the alarm data will replace the data that was saved for the Graph All Patients request. The alarm data will then appear on the graph printout.

If, while a Graph All Patients request is running, a telemetry patient initiates a graph from his or her transmitter, the saved data for the Graph All Patients graph will be replaced by data from the patient's transmitter. The data from the transmitter will then appear on the graph printout.

Initiating a graph all patients request

To initiate a Graph All Patients request, follow these steps.

1. Click on the ***Print*** button on the CIC Pro center display. The Graph All Patients window opens.
2. Click on ***Limits*** or ***Waveforms***.
   - Selecting ***Limits*** graphs all patient limits.
   - Selecting ***Waveforms*** graphs all patient waveforms.
3. Click on the ***OK*** button to complete the Graph All Patients request.

Stopping a print job

You must stop a print job from the same CIC Pro center you used to send the print job to the printer.

Stop printing to a laser printer

Complete the following procedure to stop printing all print jobs sent to the laser printer:

1. From the multi-patient viewer, click ***CIC Setup*** > ***CIC Defaults***. The ***CIC Defaults*** window displays.
2. Under ***Printer/Writer***, click ***Cancel Print Jobs*** for the printer you want to stop printing to.
3. After making your selection, complete one of the following tasks from the ***CIC Defaults*** window:
   - Click ***OK*** to apply your changes and close the ***CIC Defaults*** window.
   - Click ***Cancel*** to cancel your changes and close the ***CIC Defaults*** window.
   - Click ***Apply*** to apply your changes without closing the ***CIC Defaults*** window.

Stop printing to a local digital writer

Complete the following procedure to stop printing all print jobs sent to a local digital writer:

1. Locate the digital writer.
2. Press the  (**Graph Stop**) button located on the front of the digital writer to stop the print job.

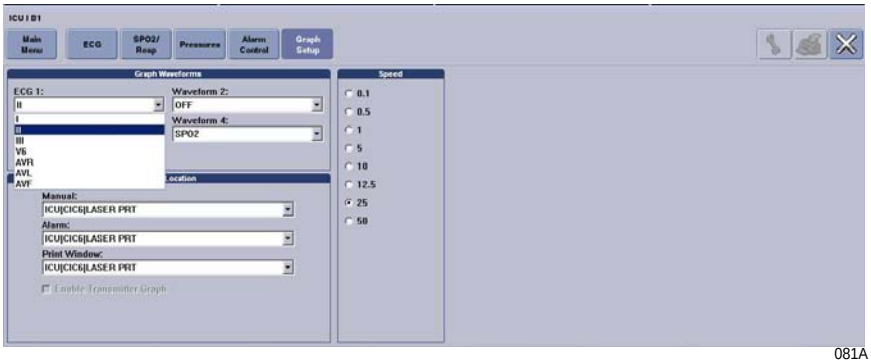
Adjusting print control settings

To temporarily adjust the graph location and settings for a specific patient, complete the following procedure:

NOTE

All changes are temporary and return to the default settings when the patient is discharged. To permanently change these settings, refer to the appropriate CIC Pro center service manual.

1. From the multi-patient viewer, click on the patient you want to view. The single patient viewer displays.
2. From the single patient viewer, click ***Monitor Setup*** > ***Graph Setup*** to display the ***Graph Setup*** window.



081A

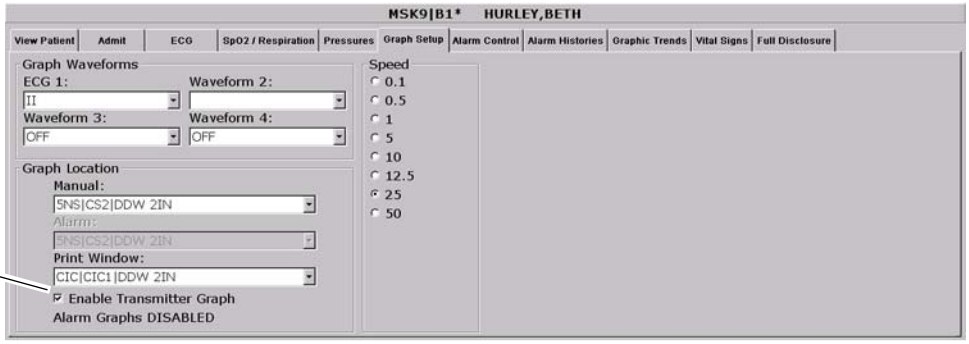
3. Change any of the undimmed setting options.

Option	Function
Graph Waveforms	Set the print order of the ECG waveforms: ■ ***ECG 1:*** Set the lead and its associated waveform to print first. ■ ***Waveform 2***: Set the ECG lead or parameter and its associated waveform to print second. ■ ***Waveform 3***: Set the ECG lead or parameter and its associated waveform to print third. ■ ***Waveform 4***: Set the ECG lead or parameter and its associated waveform to print fourth.
Graph Location	Choose from available printers to set the graph location of the manual, alarm, and print window graphs: ■ ***Manual***: Any real-time patient data you initiate the printing of. ■ ***Alarm***: An alarm graph that is triggered by a patient ***Crisis*** or ***Warning*** alarm condition. ■ ***Print Window***: Any stored patient data you initiate the printing of. This graph location also prints the ***Graph All*** > ***Limits*** data.
Enable Transmitter Graph	Turn on or turn off the ability to initiate graph printing from a transmitter.
Speed	Set the print speed. The slower the speed, the more condensed the data. 25 mm/second is standard.

Enable transmitter graph

The ***Enable Transmitter Graph*** option allows you to turn off/on the ***Transmitter Graph*** function for telemetry patients. When this option is enabled at the CIC Pro center, you can initiate a graph by pressing the graph button on the transmitter. When this option is disabled at the CIC Pro center, no graph can be initiated from the transmitter. To enable or disable this option, follow this procedure:

1. To enable the ***Transmitter Graph*** option, point and click with the mouse to place a check mark in the ***Enable Transmitter Graph*** check box.



Enable Transmitter Graph Check Box

2. To disable the ***Transmitter Graph*** option, point and click with the mouse to remove the check mark in the ***Enable Transmitter Graph*** check box.

Alarm graphs enabled/disabled

This message line indicates whether the graph on alarm feature is on (***Alarm Graph ENABLED***) or off (***Alarm Graph DISABLED***). This feature cannot be set on an individual patient basis. Use the ***Alarm Graph*** option in the ***Telemetry Unit Defaults*** tab sheet to set it for all patients admitted to the CIC Pro center.

NOTE

You must be in service mode to change the telemetry unit defaults.

Graph paper out indicator

When there is no graph paper in the writer (or the door is open), the message ***Graph Paper Out/Door Open*** is displayed at the top of the screen.

When printing to a laser printer, a similar status message is displayed if the printer is unable to print.

NOTE

Because the CIC Pro center can communicate with many laser printers, specific status messages are not documented in this manual.

A Abbreviations and symbols

Abbreviations

Abbreviations and symbols that you may encounter while reading this manual are listed below with their meanings.

12SL	12-lead ECG analysis
A	
AC	alternating current
Acc	accelerated
ACI	acceleration index
AD	adult
ADU	alarm display unit
AFIB	atrial fibrillation
ALRM	alarm
AMI	acute myocardial infarctions
ANT	anterior
Arr, Arrhy	arrhythmia
ART	arterial
Auto	automatic
Aux	auxiliary
A-V	arterial venous
AVG	average
AVOA	automatic view on alarm
B	
BIS	bispectral index
BP	blood pressure
Brady	bradycardia
BT	blood temperature
C	
C	celsius
Cal	calibrate
Calc, calcs	calculation(s)
cc	cubic centimeter
CC	computation constant
CCO	continuous cardiac output
CD	compact disc

CI	cardiac index
CIC	CIC Pro Clinical Information Center
cm	centimeter
CO	cardiac output
CO	carbon monoxide
CO_2	carbon dioxide
comm	communication
CP	cardiopulmonary
CPP	cerebral perfusion pressure
CRG	cardiorespirogram
CSA	Canadian Standards Association
CVP	central venous pressure
D	
D	diastolic
DES	desflurane
DIDCA	direct interface device connection adapter
DSC	digital signal converter
E	
E	expired
e.g.	for example
ECG	electrocardiograph
eDO2I	estimated delivered oxygen index
EEG	electroencephalograph
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ENF	enflurane
ESU	electrosurgical cautery unit
et al	and others
ET CO_2	end-tidal carbon dioxide
etc.	etcetera
ETO	ethylene oxide
EXP	expired
F	
F	Fahrenheit
FEM	femoral

G	
g	gram
gHz	gigahertz
gtt	drops
H	
HAL	halothane
Hb	hemoglobin
HR	heart rate
Hz	hertz
I	
I	inspired
IABP	intra-aortic balloon pump
ICG	impedance cardiography
ICP	intracranial pressure
ICU	intensive care unit
ID	identification
in	inches
INDV	individual
INF	infusion, inferior
Inject	injectate
INSP	inspired
INT	interior
ISO	isoflurane
IT	injectate temperature
IV	intravenous
J	
J	ST measurement point
K	
kg	kilogram
L	
L, LD	lead
L	left
l	liter
LA	left arm
LA	left arterial
LAN	local area network

LAT	lateral
lbs	pounds
LCWI	left cardiac work index
LED	light emitting diode
LIS	lab information system
LL	left leg
LVET	left ventricular ejection time
LVSWI	left ventricular stroke work index
M	
M	mean
MAC	minimum alveolar concentration
MAP	mean arterial pressure
Min	minimum
mm	millimeters
mmHg	millimeters of mercury
MPSO	multiple portable socket outlet
MRI	magnetic resonance image
ms	milliseconds
mV	millivolt
N	
N/A	not applicable
N_2O	nitrous oxide
NBP, NIBP	non-invasive blood pressure
Neo	neonatal
O	
O_2	oxygen
O_2CI	oxygen consumption index
OR	operating room
P	
P	pace
PA	pulmonary artery
PAD	pulmonary artery diastolic
Par	parameter
PAW	pulmonary artery wedge
PC	personal computer

pCO_2	partial pressure of arterial carbon dioxide
PED	pediatric
PEP	pre-ejection period
pO_2	partial pressure of arterial oxygen
PVC	premature ventricular resistance
Q	
QRS	interval of ventricular depolarization
Qty	quantity
R	
R	right
R	rate
R&TTE	Radio and Telecommunication Terminal Equipment
RA	right arm
RA	right artial
REF	reference
Reprep	re-prepare
RES	resistance
Resp	respiration
RF	radio-frequency
RHY	rhythm
RL	right leg
RR	respiration rate
S	
S	systolic
sec	second
SEV	sevoflurane
SIM	simulator
Sol	solution
SP	special
SpO_2	arterial oxygen saturation (pulse oximetry)
SQI	signal quality index
ST	interval of ventricular repolarization
Stat	right away
STR	systolic time radio
SV	stroke volume

SvO2	mixed venous oxygen saturation
SVR	systemic vascular resistance
SVRI	systemic vascular resistance index
Sync	synchronized
T	
T1, T2	temperature sites
Tachy	tachycardia
TC	transcutaneous
Tech	technical
Temp, TMP, TP	temperature
TFC	thoracic fluid content
TIR	technical information report
U	
UAC	umbilical artery catheter
UO	urometer
UVC	umbilical venous catheter
V	
V	volt
V	version
V	ventrical lead
Vent	ventilator
VFib	ventricular fibrillation
VI	velocity index
VOA	view on alarm
Vol	volume
VTach	ventricular tachycardia
W	
WF, WFS	waveform(s)
X	
X	multiplier (2X)
X	invalid data

Symbols

&	and
°	degree(s)
>	greater than
<	less than
-	minus
#	number
%	percent
±	plus or minus
"	inches
µ	micro

B Customized defaults worksheet

NOTE

Before filling out this worksheet, you should make additional copies for future use.

Use this worksheet to record customized settings for the following defaults:

Alarms Off selection

This telemetry setting is located in ***CIC Setup*** > ***CIC Defaults***.

Allow ***Alarms Off On this CIC***? (Circle one) Yes No

Telemetry Unit Defaults

Telemetry unit default		Default setting
Graph Setup		
Default Locations for this CIC	***Manual***	
	Alarm	
	Print Window	
Waveforms	***ECG 1***	***II***
	Waveform 2	***V***
	Waveform 3	***Off***
	Waveform 4	***Off***
	Transmitter Graph	***On***
	Alarm Graph	***Always On***
	Event Marker Graph	***On***
ECG		
	Display Lead	***II***
	Arrhythmia	***Full***
	Lead Analysis	***Multi-Lead***
	ST Analysis	***On***
	Va Lead	***V1***
	Vb Lead	***V2***
	Detect Pace	***Off***

Telemetry unit default		Default setting
	Patient Age	***Adult***
	Transmitter Pause	***Enabled***
	Alarm Pause Breakthrough	***Always On***
	Event Marker[1]	***On***

[1]The ***Event Marker Graph*** and ***Event Marker*** features are not applicable to all transmitters.

Telemetry parameter limits and alarm levels

Parameter Limits and Alarm Levels		Low	High	Level
HR	bpm	50	150	***Warning***
ST-I	mm	-2.0	2.0	***Warning***
ST-II	mm	-2.0	2.0	***Warning***
ST-III	mm	-2.0	2.0	***Warning***
ST-V	mm	-2.0	2.0	***Warning***
ST-V2	mm	-2.0	2.0	***Warning***
ST-V3	mm	-2.0	2.0	***Warning***
ST-V4	mm	-2.0	2.0	***Warning***
ST-V5	mm	-2.0	2.0	***Warning***
ST-V6	mm	-2.0	2.0	***Warning***
ST-AVR	mm	-2.0	2.0	***Warning***
ST-AVL	mm	-2.0	2.0	***Warning***
ST-AVF	mm	-2.0	2.0	***Warning***
NBP-S	mmHg	80	200	***Warning***
NBP-D	mmHg	20	120	***Warning***
NBP-M	mmHg	40	140	***Warning***
SPO2	%	90	105	***Warning***
SPO2-R	bpm	50	150	***Warning***
RR	breaths/min	5	30	***Warning***
RR-APNEA	seconds		30	***Warning***
PVC	#/min		6	***Advisory***

Arrhythmia Alarm Levels	Levels
Asystole	***Crisis***
VFIB/VTAC	***Crisis***
V Tach	***Crisis***
VT > 2	***Crisis***
V Brady	***Crisis***
Acc Vent	***Advisory***
Pause	***Advisory***
Tachy	***Advisory***
Brady	***Advisory***
R on T	***Message***
Couplet	***Message***
Bigeminy	***Message***
Trigeminy	***Message***
PVC	***Message***
Irregular	***Message***
Atrial Fib	***Message***

System Alarm Levels	Levels
CHANGE BATTERY	***System Warning***
OFF NETWORK	***System Warning***
ARR SUSPEND	***System Warning***
LEADS FAIL	***System Warning***
PROBE OFF	***System Warning***

C Maintenance

Biocompatibility

When used as intended, the parts of the product described in this operator manual, including accessories that come in contact with the patient during the intended use, fulfill the biocompatibility requirements of the applicable standards. For more information, contact your local sales/service representative.

Supplies

To ensure patient safety, use only supplies manufactured or recommended by GE. For more information, contact your local sales/service representative.

Inspection

An effective maintenance schedule should be established for your monitoring equipment and reusable supplies. This should include inspection as well as general cleaning on a regular basis. The maintenance schedule must comply with the policies of your institution's infection control unit and/or biomedical department.

CAUTION
Failure on the part of the responsible hospital or institution employing the use of this monitoring equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Check with your biomedical department to be sure preventive maintenance and calibration is complete. Qualified service personnel should repair or replace damaged equipment or reusable supplies. Refer to the appropriate service manuals for detailed maintenance and repair information.

Use the following guidelines when inspecting the equipment:

- Inspect the equipment for obvious physical damage.
- Inspect all cords for fraying or other damage.
- Inspect all plugs and connectors for corrosion, contaminants, bent prongs or pins.
- Inspect all cable insulation for cracks, tears, or other damage.

In the U.S., GE Service is available 24-hours a day by calling 800-558-7044. Outside the U.S., please contact your local sales/service representative.

NOTE

Refer to the appropriate service manuals for more comprehensive checkout procedures.

Disposal

WARNING
PACKAGING DISPOSAL—Dispose of all packaging material, observing all applicable waste control regulations and keeping out of children's reach.

WARNING
DISPOSAL—At the end of its service life, the products described in this manual, as well as its accessories, must be disposed of in compliance with guidelines regulating the disposal of each product. If you have any questions concerning disposal of a product, please contact GE or its representatives.

Cleaning

All equipment should be cleaned on a regular basis. Comply with the policies of your institution's infection control unit and/or biomed department. The decision to disinfect or sterilize must be made per your institution's requirements with an awareness of the effect on the integrity of the transmitter and leadwire.

WARNING
Disconnect AC-powered equipment from the power line before cleaning or disinfecting its surface. Turn off the power to battery-powered equipment before cleaning or disinfecting its surface.

WARNING
CONTAMINATED LEADWIRES— Contaminated leadwires may cause infection. Always follow the skin preparation guidelines and leadwire cleaning instructions provided in this manual.

WARNING
IMPROPER TRANSMITTER/LEADWIRE APPLICATION — Applying a transmitter and/or leadwire that is not thoroughly dry to a patient can result in an electrically conductive path being established and a ***Leads Fail*** alarm not being provided if leadwires come off the patient.

CAUTION
Never immerse devices, cables, or leadwires in any liquid.

CAUTION
Do not pour or spray any liquid directly on cables or leadwires or permit fluid to seep into connections or openings.

CAUTION
Never use conductive solutions, solutions that contain chlorides, wax, or wax compounds to clean devices, cables or leadwires.

CAUTION
Never use solutions or products that contain the following:

- Any type of Ammonium Chloride such as, but not limited to:
  - Dimethyl Benzyl Ammonium Chloride
  - Quaternary Ammonium Chloride solutions
- Abrasive cleaners or solvents of any kind
- Acetone
- Ketone
- Betadine
- Alcohol-based cleaning agents
- Sodium salts

CAUTION
Never autoclave or steam clean devices, cables or leadwires.

CAUTION
Do not attach the device to a patient until it is thoroughly dry.

Results of improper cleaning

- Appearance of waveforms when the device is not connected to a patient, causing false alarms instead of a ***Leads Fail*** alarm and may not provide a visual and/or audible ***Leads Fail*** alarm.
- Brittle and breaking device case.
- Overall system performance degradation.
- Melting, dulling, or distorting the case.
- Total handheld medical device failure requiring replacement.
- Unit malfunction.
- Void warranty.

Cleaning products to avoid

Cleaning products known to cause the types of problems listed above include, but are not limited to:

- Sani-Cloth Wipes
- Ascepti Wipes
- HB Quat
- Clorox Wipes (they do not contain bleach)
- Over-the-counter detergents (e.g. Fantastic, Tilex, etc.)

Products that contain active ingredients and solutions similar to these products should also be avoided.

Transmitter/device cleaning

These instructions apply to transmitters and any other devices, such as oximeters, blood pressure monitors, etc.

Cleaning/disinfecting

1. Remove all batteries and leadwires.
2. Close the battery door before cleaning the device.
3. Wipe the exterior of the device with a soft lint-free cloth, using 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.
   - Any sodium hypochlorite wipe product that meets the above guidelines of can be used.

     NOTE

     Wring excess disinfectant from wipe before using.

     NOTE

     Any contact of disinfectant solutions with metal parts may cause corrosion.
4. Allow disinfectant solution to remain on device for a minimum of one minute or per hospital guidelines.
5. Wipe off cleaning solutions with a clean, moist cloth.
6. Dry thoroughly with a dry lint-free cloth and let air dry for at least 30 minutes.

   NOTE

   Drying times may vary based on the environmental conditions.
7. Take care not to let fluid pool around connection pins. If this should happen, blot dry with a soft, lint-free cloth.

Storage

- Always remove batteries when the device is not in use (even for short periods of time).
- Store in a dry well-ventilated area.
- Hang the device, use a holder if available.
- If leadwires/cables are attached, they should hang straight.
- Do not coil leadwires/cables tightly around the device.

ECG cable/leadwire cleaning

Results of improper cleaning

- Product discoloration.
- Metal part corrosion.
- Brittle wires.
- Brittle and breaking connectors.
- Reduced cables and leadwires life.
- Unit malfunction.
- Void warranty.

Cleaning/disinfecting

1. Remove cables and leadwires from the handheld device or system before cleaning.
2. Use care in cleaning leadwires to prevent pulling the long wires from the connector ends. Metal connections can be pulled away from the connectors.
3. For general cleaning of cables and leadwires, wipe using a lightly moistened cloth with a mild soap and water solution. Then wipe and air dry.
4. For disinfecting the cables and leadwires, 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):
   - Sodium hypochlorite (5.2% household bleach) minimum 1:500 dilution (minimum 100 ppm free chlorine) and maximum 1:10 dilution.
   - Any sodium hypochlorite wipe product that meets the above guidelines of can be used.

   NOTE

   Wring excess disinfectant from wipe before using.

   NOTE

   Any contact of disinfectant solutions with metal parts may cause corrosion.
5. Do *not* immerse either end of a cable or leadwire connector. Immersing or soaking the connector ends may corrode metal contact ends and affect signal quality.

6. Wipe off cleaning solutions with a clean, lightly moistened cloth.
7. Dry thoroughly with a dry lint-free cloth and let air dry for at least 30 minutes.

   NOTE

   Drying times may vary based on the environmental conditions.

8. Take care not to let fluid pool around connection pins. If this should happen, blot dry with a soft, lint-free cloth.
9. Do *not* use excessive drying techniques, such as oven, forced heat or sun drying.

Sterilizing

NOTE

EtO sterilization is *not recommended*, but may be required for cables and leadwires. Frequent sterilization will reduce the useful life of cables and leadwires.

Sterilize with ethylene oxide gas (EtO) at a maximum temperature of 50° C (122° F). After EtO sterilization, follow the recommendations from the sterilizer manufacturer for required aeration.

Storage

- Store in a dry well-ventilated area.
- Vertically hang cables and leadwires.
- Do not coil leadwires or cables tightly around any medical device.

D Troubleshooting

ECG

Arrhythmia troubleshooting

Problem: Inaccurate heart rate and/or false asystole

Solution: Check ECG signal from patient:

1. Check/adjust lead placement.
2. Check/perform skin preparation.
3. Check/replace electrodes.

Check amplitude of ECG waveform:

1. Click on the patient's ***ECG*** tab.
2. Click on all ECG leads in the Display section and check for 0.5 mV amplitude at normal (1X) size. (At least 0.5 mV amplitude is required for QRS detection.) For borderline signals, validate on a graph.
3. If amplitudes are low, electrodes may need to be repositioned or replaced.

Relearn arrhythmia:

1. Click on the patient's ***ECG*** tab.
2. Click on the ***Relearn*** button.

IF PROBLEM CONTINUES: Change to ***Single-Lead*** ECG detection and processing:

1. Click on the patient's ***ECG*** tab.
2. Click on ***Single-Lead*** in the ***Lead Analysis*** section.
3. Click on the ECG leads in the Display section and change top ECG waveform to display the lead with the greatest amplitude. (At least 0.5 mV amplitude is required for QRS detection.)

Problem: False ventricular calls

Solution: Check ECG signal from patient: (V leads may exhibit polarity changes which may occasionally cause an inaccurate call.)

1. Check/adjust lead placement.
2. Check/perform skin preparation.
3. Check/replace electrodes. (If V lead is a problem, move the V lead to another V position.)
4. Relearn ECG:
   - Click on the patient's ***ECG*** tab.
   - Click on the ***Relearn*** button.

IF PROBLEM CONTINUES:

1. Remove the V lead(s).

2. Click on the patient's ***ECG*** tab.
3. Click on the ***Relearn*** button.

Problem: ARR Suspend

Solution: Check ECG signal from patient.

1. Check/adjust lead placement.
2. Check/perform skin preparation.
3. Check/replace electrodes.
4. Correct artifact source.

Pacemaker troubleshooting

There are two general things that occur when the pace mode is activated for pacemaker patients:

1. Beats that would otherwise be classified as ventricular are instead classified as V-paced if a ventricular pacemaker event is detected.
2. Residual pacemaker energy that might otherwise appear in the ECG is removed, and a white pacemaker enhancement spike is artificially placed in the ECG.

Pace detection is indicated visually in the ECG parameter box. When watching the ECG waveform, pace detection is indicated by uniform, upright pacemaker enhancement spikes in the ECG data (both displayed and graphed).

NOTE

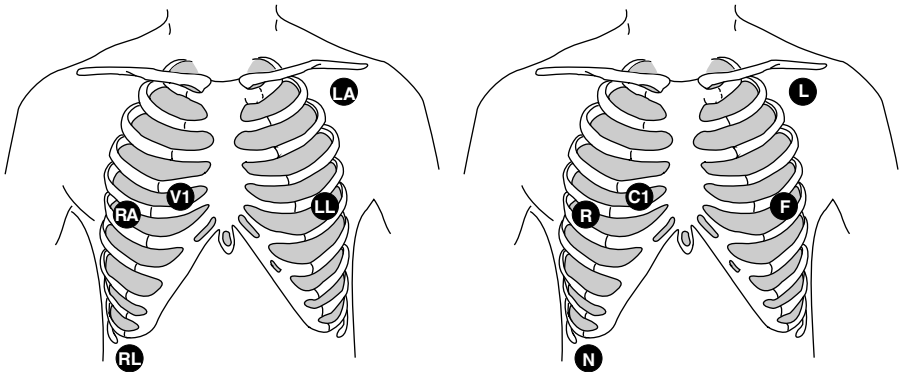
To improve pacemaker detection, reposition the electrodes and ensure a good skin preparation to maximize R-wave detection. Perform a relearn any time lead positions are changed. For more information, refer to Electrode placement on page 6-2.

During telemetry monitoring, the pacemaker signal is acquired from lead II or on II and V simultaneously when using the ApexPro CH transmitter. Changing the displayed lead has no effect on pacemaker detection.

NOTE

With all leads connected, pacemaker signal acquisition occurs on lead II or on II and V simultaneously when using the ApexPro CH transmitter. In a ***Leads Fail*** condition, signal acquisition occurs on any available lead. When a 3-leadwire set is used, single channel acquisition occurs on the programmed lead.

To improve pacemaker detection, reposition the electrodes and assure a good skin preparation to maximize R-wave detection. The following is a suggested configuration:



369B, 374B

The right arm electrode is moved down to the fifth intercostal space, and the left leg electrode is moved up to the fifth intercostal space.

NOTE

After all electrodes are in place, ensure that a minimum of 1/2 mV of signal is present on each lead (I, II, III, V).

Interface connector ports

Pace detection performance is optimized with proper lead application and correct use of the serial interface connector ports. If you are experiencing degraded pace detection performance, verify that all leads are properly attached to the patient and verify that any connected serial device(s) are in the appropriate serial interface connector ports.

- The inside port, labeled **2** on the dust cover, is for use with continuous monitoring serial devices, such as SpO2.
- The outside port, labeled **1** on the dust cover, is for use with episodic monitoring serial devices, such as NBP.

Problem: Inaccurate pacemaker detection

Solution: Use pacemaker processing:

1. Click on the patient's ***ECG*** tab.
2. In the ***Detect Pace*** section, select either ***Pace 1*** or ***Pace 2***.

Solution: Exchange the right and left arm leads and perform a relearn.

Notes

- In general, BE AWARE that a pacemaker pulse could be falsely counted as a QRS during asystole.
- ***Pace 1*** mode analyzes the presence of a pacer spike, assesses the waveform for residual pacemaker energy, and determines the presence of an R wave following the pacer spike. If an event occurs during the first few milliseconds following the pacer spike, it will be counted.

- ***Pace 2*** mode analyzes waveforms with the added capability of minimizing the chance of counting severe residual pacemaker energy as QRS complexes. In relation to the event rejection capability of Pace 2 pace mode, certain morphologies may not be detected. Arrhythmia calls like asystole or pause may be made with heart rate identified as less than actual.

Again, pacemaker patients should be kept UNDER CLOSE OBSERVATION. The appropriate pace mode may be determined at the time the pacemaker patient is admitted to the monitoring system. The ***Pace 2*** mode is recommended for use whenever possible.

Check ECG signal from patient:

1. Check/adjust lead placement.
2. Check/perform skin preparation.
3. Check/replace electrodes.

ST troubleshooting

Problem: ST numerics changed to Xs

Solution: An ST value changes to Xs when the patient's dominant morphology has not been detected 16 times in the last 30 seconds. The program waits one minute and then automatically relearns. ST numerics will be displayed after the relearn.

IF PROBLEM CONTINUES:

1. Check for morphology change.
2. Check for noise on ECG.
3. Relearn:
   a. Click on the patient's ***ECG*** tab.
   b. Click on the ***Relearn*** button.

SpO2 messages

WARNING
LOSS OF ALARMS—Do not use transmitter accessory devices such as SpO2 and NBP without ECG cables attached. Failure to use accessory devices in the prescribed manner may result in a loss of alarms.

NOTE

The Xpod oximeter can display the same SpO2 system status messages as the Apex oximeter, except for the ***CHANGE BATTERY*** message. For the Xpod oximeter ***CHANGE BATTERY*** message, refer to Transmitter-related messages on page D-10. The Xpod oximeter uses the battery power supplied by the transmitter and therefore does not support this message.

Below is a list of system status alarm messages that may be displayed in the patient's bed window during monitoring with the oximeters. SpO2 messages appear in abbreviated form in graph headers. If you are unable to resume SpO2 monitoring, contact your sales/service representative.

Device	Message	Description
Oximeters and Dinamap Pro monitors	***The saturation value is X*** (No data being received)	This message remains on the CIC Pro center for up to 5 seconds. If no data is detected after 5 seconds, the SpO2 parameter window is no longer displayed at the CIC Pro center. Possible causes include but are not limited to: ■ disconnection of oximeter/Dinamap Pro monitor from transmitter ■ faulty SpO2 device ■ ambient light ■ excessive motion ■ faulty SpO2 sensor
	The saturation value is X (Out of range)	The oximeter/Dinamap Pro monitor is still connected, but no valid data is being received at the receiver. The patient may be in an area of poor antenna reception, where some, but not all data is being transmitted. This message remains on the CIC Pro center for up to 5 seconds. The CIC Pro center will also display a ***NO TELEM*** system message alarm. After approximately 30 seconds the CIC Pro center displays ***NO TELEM*** alarm with system warning level.
	SPO2 PROBE	The probe has been disconnected from the oximeter (no data is displayed).
	SIGNAL	SpO2 data continues to be displayed, but the quality of the signal is questionable. Check the patient and the probe.
	NO TELEM	The ***NO TELEM*** alarm occurs in two situations: 1. The patient moves out of range. If the transmitter is out of range for more than 30 seconds, the ***NO TELEM*** message displays. Should a ***LEADS FAIL*** condition occur prior to a ***NO TELEM*** condition, the ***LEADS FAIL*** condition takes priority. The ***LEADS FAIL*** message is displayed along with the ***NO TELEM*** message. 2. Transmitter batteries are extremely low or dead. If batteries are extremely low or completely dead, the ***NO TELEM*** message appears, a ***CHANGE BATTERY*** message appears in the patient's bed window, and the audible alarm sounds. Activating the ***ALL ALARMS OFF*** feature prevents the audible alarm from sounding.
Oximeters only	***CHANGE BATTERY*** (Apex oximeter ONLY)	Message displayed with SPO2 data displayed—The batteries in the Apex oximeter are low. There is approximately 1 hour of reserve power left in the batteries. Change the batteries.
	SPO2 CHANGE BATTERY (Apex oximeter ONLY)	Message displayed, no SPO2 data displayed—The batteries in the Apex oximeter are depleted. Replace the batteries. This is a system ***Warning*** alarm. The alarm will sound, and a red alarm button will appear on the CIC Pro center display. If the batteries are not replaced within 20 minutes, all SPO2 parameter information will be removed from the display. If the batteries are replaced within 20 minutes, SpO2 monitoring will resume.
	SPO2 PROBE OFF	The probe is off the patient. Check the probe.
Dinamap Pro monitors only	***CHANGE BATTERY***	Message displayed with SPO2 data displayed—The batteries in the Dinamap Pro monitor are low. There is approximately 1 hour of reserve power left in the batteries. Change the batteries.
	SPO2 NO DATA	The probe is off the patient. Check the probe.

NBP

Troubleshooting

WARNING
LOSS OF ALARMS—Do not use transmitter accessory devices such as SpO2 and NBP without ECG cables attached. Failure to use accessory devices in the prescribed manner may result in a loss of alarms.

Problem: Erroneous NBP measurement

Solution:

1. Check for proper cuff size:
   - Too small a cuff can give an erroneously high value.
   - Too large a cuff can give an erroneously low value.

   NOTE

   For proper fit of an NBP cuff, the arm should be measured from the top of the shoulder joint to the elbow. Divide the length by 2 and measure from the middle of measurement on the arm. Measure the circumference in centimeters around the arm. Refer to the NBP cuffs for proper fitting size.
2. Check for residual air left in the cuff from a previous measurement. This could indicate a hardware problem that may require service.
3. Make sure the cuff is not too tight or too loose.
4. Make sure the cuff and the heart are at the same level; otherwise hydrostatic pressure will offset the NBP value.
5. Watch for pulsus paradoxis.
6. Check for leak in cuff or tubing.
7. Patient may have a weak pulse.
8. Calibration may be necessary.

NBP status messages

NBP status messages appear in abbreviated form in graph headers, when applicable.

A message will clear when the next measurement is initiated, or a message can be cleared manually with the ***Clear Message*** option on the NBP tab sheet.

The following system status alarm messages may be displayed in the patient's bed window during monitoring.

CHANGE BATTERY	An NBP measurement was attempted with low batteries. Change the batteries in the blood pressure monitor and try another measurement.
FAIL	A hardware failure has been detected in the blood pressure monitor. In the U.S., contact GE Service. Outside the U.S., contact your local sales/service representative.
LEAK	The NBP cuff is loose or there is an air leak in the cuff or tubing. Check that the cuff is on snugly. Check the connection between the cuff and the tubing. Check the connection between the tubing and the blood pressure monitor. Try another measurement. If the problem persists, contact your local sales/service representative.
LOW INFLATION PRESS	This message appears when K-sounds are detected immediately upon inflation. The inflation pressure is too low for proper NBP measurement. Try another measurement or adjust dynamic/fixed inflate. If the problem persists, contact your local sales/service representative.
MOVEMENT	This message appears when there is excessive patient arm movement, or if the patient's arm was bent during the measurement. Check the patient and try another measurement.
SENSOR?	This message appears when the K-sounds on the measurement were too weak, or not enough sounds were detected. Reposition the microphone and try another measurement. This message can also appear if the deflate rate is not properly adjusted. If the problem persists, contact your local sales/service representative.
WEAK PULSE	The patient's heart rate is erratic. Check that the microphone cable is plugged firmly into the patient cable, and check that the microphone is positioned correctly on the patient. Try another measurement. If the problem persists, it could indicate a defective microphone, microphone cable, or patient cable. Contact your local sales/service representative.

Messages

Alarm messages

The following messages appear in the patient's bed window at the CIC Pro center.

ALARM PAUSE	All alarms for this patient have been turned off for five minutes. This is initiated from the transmitter by pressing both the **Verify Leads** and **Graph** buttons simultaneously. See Pausing alarms at the transmitter on page 5-5..
ALL ALARMS OFF	All alarms for this patient have been turned off. No graph strips run, arrhythmia events are not stored, and no audible tones sound if an alarm condition should occur.
ARR OFF	The arrhythmia program for a selected patient has been turned off. No arrhythmia messages are displayed, arrhythmia event s are not stored, no graph strips run, and no audible tones sound if an arrhythmia alarm condition occurs.

ARTIFACT ARR SUSPEND	All artifact begins at level 1. Sustained artifact progresses to level 2 when noise on ECG lasts for 20 of the last 30 seconds. ■ Level 1 — Upon immediate detection of artifact, the message ***ARTIFACT*** is displayed. There is no alarm tone. Only lethal arrhythmia processing is available. ■ Level 2 — Arrhythmia monitoring is suspended in this condition. A system warning alarm sounds, no arrhythmia messages are displayed, no graph strips run and no arrhythmia events are stored. Heart rate and PVC values change to X, an additional message, ***ARR SUSPEND***, is displayed.
LEADS FAIL	All leads have failed, right leg lead failed, lead wires unplugged or reference lead failed. If set to ***Warning*** or ***Advisory*** level, a system alarm is heard. This will self-silence if condition is corrected, or the user can silence for one minute with the ***Silence Alarms*** button at the bottom of the CIC Pro center display.
NO TELEM	The ***NO TELEM*** alarm occurs in two situations: 1. The patient moves out of range. If the transmitter is out of range for more than 30 seconds, the ***NO TELEM*** message displays. Should a ***LEADS FAIL*** condition occur prior to a ***NO TELEM*** condition, the ***LEADS FAIL*** condition takes priority. The ***LEADS FAIL*** message is displayed along with the ***NO TELEM*** message. 2. Transmitter batteries are extremely low or dead. If batteries are extremely low or completely dead, the ***NO TELEM*** message appears, a ***CHANGE BATTERY*** message appears in the patient's bed window, and the audible alarm sounds. Activating the ***ALL ALARMS OFF*** feature prevents the audible alarm from sounding.
OFF NETWORK	In the ***Combo*** mode, telemetry patient data is provided from the bedside monitor to the CIC Pro center. If the bedside monitor is removed from the network or becomes otherwise unavailable, the ***NO COMM*** message displays first on the CIC Pro center and there is a loss of monitoring for about 45 seconds, then waveforms return and the ***OFF NETWORK*** message is displayed below the HR parameter window. The CIC Pro center will then display patient data directly from the telemetry bed along with this message in that CIC Pro center bed window. Should the bedside monitor reappear on the network, the ***Combo*** monitoring application will automatically resume and the alarm will be cleared. This alarm is also generated if the receiver system is removed from the network or becomes otherwise unavailable. The bedside monitor does not sound alarms, but the alarms must be turned back on at the bedside monitor if they were previously paused or off.

Graph messages

The following messages appear in the patient's bed window on the CIC Pro center display. These relate to running graphs at the printer.

GRAPH ALARM	An alarm graph was initiated and is running.
GRAPH MANUAL	A manual graph was requested and is running.
GRAPH TTX	The graph button on the transmitter was pressed and a 20-second graph strip is running.
PRINTING	A non-real time graph is currently being printed.
SAVING	An alarm or a manual graph has been requested but the writer is in use, the writer door is open, the print location is not correct, or the writer is out of paper. The request is saved and will run as soon as the writer is available.

Transmitter-related messages

The following messages appear in the patient's bed window on the CIC Pro center display.

CHANGE BATTERY	This message flashes when the batteries are low. There is approximately 1 hour of use left after this message appears. If the batteries are extremely low or completely dead, a ***NO TELEM*** message flashes, and an audible alarm sounds.
LEADS FAIL	All leads have failed, right leg lead failed, right arm lead failed, leadwires unplugged or reference lead failed. If set to System ***Warning*** or System ***Advisory*** level, a system alarm occurs. This will self-silence if condition is corrected, or user can silence for one minute with ***Silence Alarms*** button at the bottom of the CIC Pro center display. **NOTE** ***LEADS FAIL*** will not result in a ***NO TELEM*** alarm message after 30 seconds.
RA (LA, LL, V) FAIL	One of these may appear, indicating failure of a lead.
NO TELEM	The transmitter was out of range for more than 30 seconds. If this condition persists, contact GE Technical Support. If a ***LEADS FAIL*** condition occurs prior to a ***NO TELEM*** condition, the ***LEADS FAIL*** condition takes priority
TTX number is already in use	This message displays when attempting to admit a transmitter that is sequentially numbered with another admitted transmitter. For example, you cannot admit TTX ID number 54078 and 54079 at the same time. Use another transmitter with a non-sequential TTX ID number to admit the patient.

System status messages

System status alarms (generated by mechanical conditions) are displayed at the top of the CIC Pro center screen. Each message is preceded by the receiver system's name, if it has been entered, or a name created by using the last six numbers of the receiver system Ethernet address.

DUPLICATE TOWER NAME	A network problem exists. Restart the system. If this condition persists, contact GE Technical Support.
DUPLICATE NAME	A network problem exists. Restart the system. If this condition persists, contact GE Technical Support.

Patient status messages

Patient status messages are also displayed at the top of the CIC Pro center screen. They are not, however, preceded by the receiver system name or Ethernet address.

"Unit/Bed" IS UNMONITORED	A telemetry patient is admitted but is not displayed (and therefore is unmonitored) on any CIC Pro center. If an alarm occurs on an unmonitored bed, the information will appear in the alarm text line and an audible tone will sound. You must view the patient first if you would like to silence the alarm. To view an unmonitored bed, click on the ***View Other*** button.
"Unit/Bed": DUPLICATE NAME	There is another device on the network with the same bed name. The duplicate device must be renamed.

E Technical specifications

NOTE

Specifications are provided to help you determine the space, ventilation, air conditioning and power requirements to ensure proper operation of your system. Specifications are approximate and may change with the actual unit shipped. Specifications are subject to change without notice. Contact your sales or service representative for more information.

ApexPro and ApexPro CH transmitters

Power requirements

Battery type	ANSI/NEDA 15 A, 1.5V AA alkaline (2 required)
Battery life	ApexPro: 40 hours ApexPro CH: 120 hours typical, without accessories
Polarity	Electronic reverse polarity protection

Alarms and controls

Battery integrity	Transmitted and indicated via LED
Leads Fail indication	Transmitted and indicated via LED

Transmission

Channel spacing	25 kHz
Frequency stability	± 0.0001% of assigned channel frequency
Bit rate	10 kbps
Antenna	Formed by leadwire shield

ECG

Multi-channel configuration (5- or 6- leadwire)	I, II, III, Va, Vb, aVR, aVL, aVF
Leads analyzed simultaneously	Four (I, II, III, V)
Single-channel (3-leadwire) configuration	I, II or III, configurable
Heart rate detection	30 to 300 BPM
QRS detection range	0.5 to 5 mV
Frequency response	0.05 to 40 Hz (-3 dB)

A/D converter resolution	10 bits, 9.75 µV (RTI)
Sample rate	240 samples/seconds

Environmental specifications

Operating conditions

Temperature	5 to 40° C
Relative humidity	15 to 95% (non-condensing)

Transport and storage conditions

Temperature	-20 to 70° C
Relative humidity	15 to 95% (non-condensing)
Pressure	700 to 1060 hPa

Device specifications

Water resistance	ApexPro: IEC 60529 IPX3 rating (spray and wipe only) ApexPro CH: IEC 60529 IPX7 rating (can survive inadvertent submersion)
Input configuration	3, 5 or 6 electrodes
Frequency range	ApexPro: 420 to 460 MHz or 584 to 613.975 MHz (programmable synthesizer) (The frequency range depends on the PCB installed) ApexPro CH: 608.025—613.975 MHz
Modulation	ApexPro: GMSK ApexPro CH: GFSK
Serial I/O ports	2
Alarm pause	Transmitted and indicated via LED
Graph request	Transmitted
Event Marker	ApexPro: Not transmitted ApexPro CH: Transmitted
Maximum transmitters	239 active within WTMS at a single facility
Dynamic range	± 5 mV (RTI)
Input offset	± 300 mV (RTI)
Input impedance	15 M ohm minimum differential @ 10 Hz
ECG gain selection	5, 10, 20, 40 mm/mV (RTI)

ECG gain accuracy	± 5% @ 15 Hz
Common mode rejection	100 dB minimum @ 60 Hz
Defibrillator protection	± 5000 VDC, 360 joules into 100 ohm
Defibrillator recovery time	Defibrillator recovery time recovers within 5 seconds
Pacemaker detection	ApexPro: ± 2 mV to ± 700 mV (RTI); 100 µsec to 2 msec; either polarity ApexPro CH: ± 2 mV to ± 700 mV (RTI); 100 µsec to 2 msec; either polarity; on multiple leads
Patient leakage current	Meets UL/IEC 60601-1
Serial communications	2 ports at 9600 baud asynchronous

Physical specifications

Height	13.7 cm (5.38 in)
Width	7.3 cm (2.875 in)
Depth	2.3 cm (0.91 in)
Weight	141.8 g (0.275 lb) without battery; 170.1 g (0.375 lb) with battery

FCC compliance information

This device complies with Part 95 of the FCC Rules and RSS-210 of Industry Canada.

Operation of this equipment requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.

Certifications

- UL/IEC/EN 60601-1
- CAN/CSA C22.2 No.601.1
- IEC/EN 60601-1-1
- IEC/EN 60601-1-2
- IEC/EN 60601-1-4
- IEC/EN 60601-2-27
- IEC/EN 60601-2-49
- CE marked to the Medical Devices Directive 93/42/EEC
- 608.025 to 613.975 MHz - FCC Part 95 (ApexPro CH)

Telemetry server

Display specifications

Video output	1024 X 768 @ 75 Hz

Power specifications

Power supply	300 watt ATX dual-redundant

Environmental specifications

Operating conditions

Temperature	10 to 35° C (50 to 95° F)
Relative humidity	15 to 80% (non-condensing)
Altitude	0 to 3048m (0 to 10000 ft)
Acoustic noise	Less than 52 dB sound pressure at 5 to 28° C (41 to 82° F)

Transport and storage conditions

Temperature	-23 to 49° C (-10 to 120° F)
Relative humidity	10 to 90% (non-condensing)

Physical specifications

Height	8.8 cm (3.46”)
Depth	45 cm (17.7”)
Width	48.2 cm (19”)
Weight	15.8 kg (35 lb)

FCC compliance information

This device complies with Part 95 of the FCC Rules and RSS-210 of Industry Canada.

Operation of this equipment requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.

Certifications

- IEC/EN/UL 60950-1
- CAN/CSA C22.2 No.950
- IEC/EN 60601-1-4
- EN 55022 (Class A)
- EN 55024
- EN 61000-3-2
- EN 61000-3-3
- CE marked to the Medical Device Directive 93/42/EEC

ApexPro receiver system

Performance specifications

RF module type	GFSK and GMSK digitally demodulated
UHF frequency range	560.025 to 613.975 MHz (U.S.) 420 to 460 MHz (International)
Frequency step resolution	Synthesized tuning to any transmitter; 25 kHz spacing
Receiver system capacity	1 to 4 quad receiver modules (4 to 16 receivers)
Frequency stability	± 0.0003% (3 PPM) of assigned channel frequency
Bit rate	10 kbps
Sensitivity	8.7 µV (-90 dB) minimum for 1 bit error/million bits received

Network requirements

Physical	IEEE 802.3 compatible, physical connector via 10 base T
Serial protocol	19200 baud, 1 stop bit, 8 data bits, no parity, XON/XOFF flow control
System status indicators	7 bicolor LEDs

Power requirements

Input voltage	100 to 240 VAC
Input frequency	50/60 Hz
Power consumption	25 watts maximum with 4 quad receiver
Cooling	Free air convection

Environmental specifications

Operating conditions

Temperature	5 to 40° C
Relative humidity	15 to 90% (non-condensing)

Transport and storage conditions

Temperature	-20 to 50° C
Relative humidity	15 to 90% (non-condensing)
Pressure	700 to 1060 hPa

Physical specifications

Height	17.0 cm (6.7 in)
Width	32.5 cm (12.8 in)
Depth	25.0 mm (9.8 in)
Weight	6.4 kg (14 lb)

FCC compliance information

This device complies with Part 95 of the FCC Rules and RSS-210 of Industry Canada.

Operation of this equipment requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.

Certifications

- UL/IEC/EN 60601-1
- CAN/CSA C22.2 No.601.1
- IEC/EN 60601-1-2
- IEC/EN 60601-1-4
- CE marked to the Medical Device Directive 93/42/EEC

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