

214B Patient Simulator

Operator's Manual



214B Patient Simulator

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To order this manual, use part number 9508-0253.

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This instrument was thoroughly tested and inspected and found to meet DNI Nevada's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

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Warranty and Product Support

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Warranty Disclaimer

Should you elect to have your instrument serviced and/or calibrated by someone other than DNI Nevada, please be advised that the original warranty covering your product becomes void when the manufacturer's Quality Seal is removed or broken without proper factory authorization. We strongly recommend, therefore, that you send your instrument to DNI Nevada for factory service and calibration, especially during the original warranty period.

In all cases, including the manufacturer's Quality Seal should be avoided in all cases, as this seal is the key to your original instrument warranty. In the event that the seal must be broken to gain internal access to the instrument (e.g., in the case of a customer-installed firmware upgrade), you must first contact DNI Nevada's technical support department at 702-883-3400. You will be required to provide us with the serial number for your instrument as well as a valid reason for breaking the Quality Seal. You should break this seal only after you have received factory authorization. Do not break the Quality Seal before you have contacted us! Following these steps will help ensure that you will retain the original warranty on your instrument without interruption.

WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock, hazards or improper operation. DNI Nevada will not be responsible for any injuries sustained due to unauthorized equipment modifications.

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Abbreviations

NOTE: This column is alphabetical.

AHA	American Heart Association
A	ampere
BPM	beats per minute
BRPM	breaths per minute
cm	centimeter
°C	degrees Celsius (centigrade)
°F	degrees Fahrenheit
DMM	digital multimeter
EEPPROM	electrically erasable PROM
EGG	electrocardiograph or electrocardiogram
EPROM	erasable PROM
EUT	equipment under test
Hz	hertz
in	inch
IEC	International Electrotechnical Commission
k	kilo- (10^3)
kg	kilogram
KHz	kilohertz
k Ω	kiloohm
LCD	liquid crystal display
L/min	liters per minute
M	meg(a)- (10^6)
MHz	megahertz
m	-meter
μ	micro- (10^{-6})
μ A	microampere
μ s	microsecond

Abbreviations *continued*

NOTE: This column is alphabetized.

μV	microvolt
m	milli- (10^{-3})
mA	milliampere
mm	millimeter
mmHg	millimeters of mercury
ms	millisecond
mV	millivolt
Ω	ohm
p-p	peak-to-peak
lb	pound
PROM	programmable read-only memory
RAM	random-access memory
ROM	read-only memory
PQRST	refers to portions of the ECG waveform
s	second
V	volt
VAC	volts alternating current

General Information

Covered in this chapter:

SAFETY CONSIDERATIONS,
Introduction and Features, Instrument
Specifications, General Specifications, Accessories,
and Instrument Familiarity.

SAFETY CONSIDERATIONS

General

This instrument and related documentation must be reviewed for familiarization with safety markings and instructions before you operate the instrument.

Safety Symbols



The symbol to the left is the operator's manual symbol. When you see this symbol on the instrument, refer to the operator's manual.

WARNING! The “**WARNING!**” sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a “**WARNING!**” sign until the indicated conditions are fully understood and met.

CAUTION: The “**CAUTION!**” sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument. Do not proceed beyond a “**CAUTION!**” sign until the indicated conditions are fully understood and met.

Introduction and Features

The purpose of this manual is to explain the intended operation of the Model 214B Patient Simulator.

The Model 214B is a high-performance patient simulator that generates the following simulations:

- ECG,
- Blood pressure,
- Respiration, and
- Temperature.

The Model 214B is intended for biomedical equipment technicians or service representatives to test the basic operation of physiological monitoring and diagnostic equipment. These tests are typically conducted during routine or scheduled preventive maintenance inspections.

This instrument also verifies calibration to the precision stated in the next section, *Model 214B Instrument Specifications*. For the recommended inspection protocol and the required level of precision, refer to the service or maintenance manual for the actual equipment under test (EUT). The Model 214B is not intended to be used as the primary signal source for the initial validation of patient-related equipment.

Model 214B Instrument Specifications

ECG Waveforms

The Model 214B generates a 12-lead ECG simulation. A single-ended signal is resistively divided to produce a 12-lead ECG simulation. These signals are referenced to the right leg (RL) electrode.

Normal Sinus Rhythms

Rates: 30, 40, 60, 70, 80, 90, 100, 120, 140, 150, 160, 180, 200, 210, 220, 240, 270, 300, and 350 BPM.

Accuracy: $\pm 1\%$

Auto: Automatically steps through the following rates at 30-second intervals: 30, 60, 80, 120, 180, and 240 BPM.

Amplitudes: Lead II: 0.5, 1.0, 1.5, and 2.0 mV.

Accuracy: $\pm 5\%$ 2-Hz square wave at 1.0 mV p-p. (Lead III)

Impedances: Limb-lead impedance selections are 500 or 1000 Ω .

V leads are 1000 Ω .

Accuracy: $\pm 5\%$

ECG Performance

Manual Selections

- Pulse: 4 seconds.
- Square wave: 2 Hz.
- Triangle wave: 2 Hz.
- Sine waves: 0.5, 10, 40, 50, 60, and 100 Hz.

Automated Sequence

A series of the above-listed performance waveforms output in the following sequence: square wave; pulse; sine waves 10, 40, 50, 60, and 100 Hz; and triangle wave.

ECG Arrhythmias

- Atrial fibrillation
- Second-degree AV block, type I
- Right bundle branch block
- Premature atrial contraction
- Premature ventricular contraction, standard
- Premature ventricular contraction, early
- Premature ventricular contraction, R on T
- Multifocal PVCs

ECG Arrhythmias continued

- Bigeminy
- Run of 5 PVCs
- Ventricular tachycardia
- Ventricular fibrillation
- Pacemaker
- Fetal/Maternal

Blood Pressure

The specifications listed below apply to both blood pressure channels. Blood pressure channel 1 and 2 waveforms follow next.

Input/Output Impedance: 300 Ω .

Exciter Input Voltage Range: 2 to 16 V.

Exciter Input Frequency Range: DC to 4 kHz.

Output Sensitivity Selections: 5 or 40 μ V/V/mmHg.

Blood Pressure continued

Output Range: 0 to + 300 mmHg.

Accuracy:

\pm 1% of full range + 1 mmHg.
Dynamic blood pressure waveforms are specified only at 80 BPM normal sinus rhythm ECG.

Rates:

All dynamic pressures track all normal sinus rates and all arrhythmias.

Isolation:

Electrically isolated from the rest of the instrument.

BP Channel 1 Waveforms (mmHg)*Manual Selections*

- Arterial (120/80)
- Left ventricle (120/0)
- Central venous pressure (15/10)
- Right ventricle (25/0)
- Pulmonary artery (25/10)
- Pulmonary artery wedge (10/2)
- Atmosphere (0)
- Static pressures: 20, 40, 80, 100, 200, 250, and 300.
- Artifact BP1/BP2

Automated Sequence

A series of blood pressure static levels output in the following sequence: atmosphere (0), 20, 40, 80, 100, 200, 250, and 300.

BP Channel 2 Waveforms (mmHg)*Manual Selections*

- Atmosphere (0)
- Track BP1*
- Central venous pressure (15/10)
- Swan-Ganz: Insert*
- Swan-Ganz: Inflate*
- Swan-Ganz: Deflate*
- Swan-Ganz: Remove*

Automated Sequence

A series of blood pressure static levels output in the following sequence: atmosphere (0), 20, 40, 80, 100, 200, 250, and 300.

***NOTE**

For descriptions, refer to *BP Channel 2* in the *Settings* section of the *Operating Instructions* chapter.

Respiration

Output Configurations: Lead I, II, and RL to LL.

Baseline Impedances: 500 and 1000 Ω .

Accuracy: $\pm 5\%$

Delta Impedances: 0.1, 0.2, 0.5, 1.0, and 3.0 Ω .

Accuracy: $\pm 10\%$

Normal Physiological Rates: 0, 15, 20, 30, 40, 60, 80, 100, and 120 BrPM.

Accuracy: $\pm 5\%$

Apneas: 12 and 32 seconds.

Temperature

Selections: 30°C (86°F), 37°C (98.6°F), and 40°C (104°F).

Accuracy: $\pm 0.4^\circ\text{C}$

Probe Compatibility: YSI 400 series and YSI 700 series.

Isolation: Electrically isolated from the rest of the instrument.

Lead Test

If the resistance is less than 1 k Ω , the display flashes at the rate of 4 Hz.

Data Interface

Serial Port: RS-232C compatible.

5-pin DIN female connector.
Bi-directional port for controlling the instrument.

Baud Rate: 2400

General Specifications

Parameter	Specification
Power Requirements	9-volt battery for 50-hour life <i>or</i> Line-operated via battery eliminator Domestic (115 VAC) <i>or</i> European (230 VAC)
Temperature Ranges:	() Operating: 15° to 35°C (59° to 95°F) Storage: 0° to 55°C (32° to 131°F)
Display:	2-character LCD
Weight:	0.34 kg (0.75 lb)
Dimensions:	16.0 cm L x 10.4 cm W x 3.8 cm H (6.3 in L x 4.0 in W x 1.5 in H)

Accessories

Standard	DNI Part #
Operator's Manual	9508-0253
Soft Vinyl Carrying Case	9530-0051
ECG Electrode Adapter	9503-0070
Battery Eliminator Domestic (115 VAC) <i>or</i> European (230 VAC)	1201-0019 1201-0023
Battery, 9-volt alkaline (Duracell MN1604)	1001-2001
Optional	
Service Manual	9508-0258
3.2-mm Snap Adapter Kits Domestic (AHA) European (IEC)	9513-0201 9513-0204
4.0-mm Snap Adapter Kits Domestic (AHA) European (IEC)	9513-0202 9513-0205
Temperature Cable for YSI 400 series	3010-0192
Temperature Cable for YSI 700 series	3010-0193

continued on the next page

Accessories *continued*

Optional *continued*

Blood Pressure Cable, unterminated

DNI Part #
3010-0048

Blood Pressure Cables, prewired for selected patient monitors

see **NOTE** below

RS-232 Interface Cables

PC Remote Control

(Right-angle DIN to Female DB25)

3010-0204

Patient Simulator to medTester

(Right-angle DIN to Female DB25)

3010-0260

Blood Pressure Calibration Cable

3010-0205

Replacement Battery Compartment Cover

5023-0159

Test Cable for Troubleshooting the Model 214B

(*two required, refer to the Service Manual*)

3010-0470

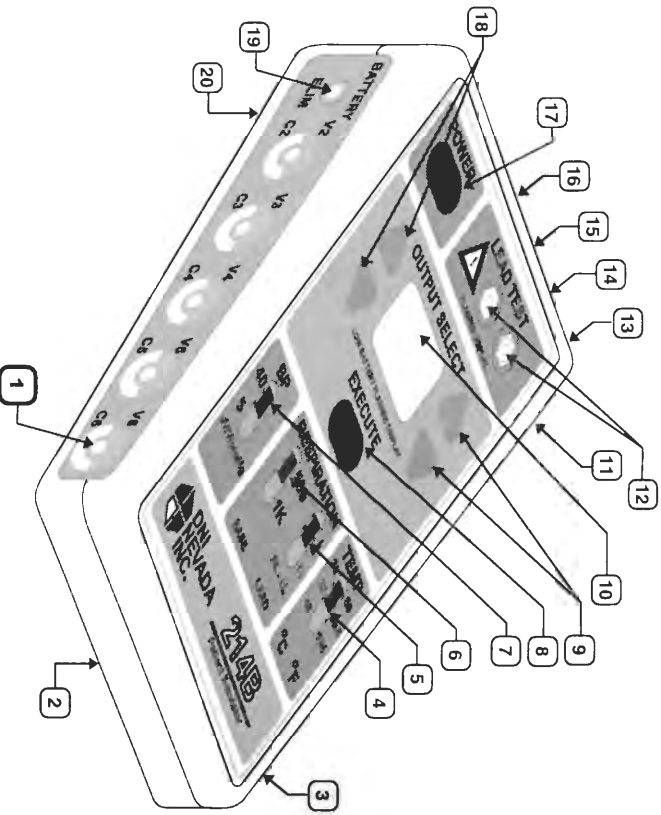
NOTE

Refer to the current DNI Nevada Price List for availability, part number information, and price.

Instrument Familiarity

(on the next page)

Instrument Familiarity



Model 214B Familiarity Illustration

Model 214B Familiarity Illustration Legend

- 1 ECG Snaps: V6, V5, V4, V3, and V2.
- 2 Pullout Card
- 3 ECG Snaps: RL, RA, LA, LL, and V1.
- 4 Temperature Select Switch
- 5 Respiration Lead Select Switch
- 6 Respiration Baseline Impedance Select Switch
- 7 Blood Pressure Sensitivity Select Switch
- 8 Execute Key
- 9 Right Selector Keys (Increment/decrement right display character.)
- 10 Two-Character Display
- 11 High-Level ECG Output
- 12 Lead Test Terminals
- 13 Blood Pressure Channel 1 Output
- 14 Blood Pressure Channel 2 Output
- 15 RS-232 Serial Port
- 16 Temperature Output
- 17 Power-On/Off Key
- 18 Left Selector Keys (Increment/decrement left display character.)
- 19 Battery Eliminator Input
- 20 Battery Compartment

Chapter 2

Installation

Covered in this chapter: Unpacking and Inspection, Claims Warranty Repair, Battery or Battery Eliminator, ECG Output Snaps, High-I and ECG Output, Blood Pressure Outputs, Temperature Output, and RS-232 Serial Port.

Unpacking and Inspection

Follow standard receiving practices upon receipt of the instrument. Check the shipping carton for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but be careful not to damage the instrument when unpacking it. Inspect the instrument for physical damage such as bent or broken parts, dents, or scratches.

Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim.

If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact DNI Nevada or your local sales representative.

Warranty Repair

The warranty statement for this product is at the front of this manual.

When shipping an instrument to DNI Nevada for repair, complete the Service Return Form and attach to the instrument. Completing this form will help to ensure timely repair of your instrument.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double-walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industrial-approved shock-absorbent material around the instrument.

Battery or Battery Eliminator

The Model 214B operates with an internal 9-volt battery or an external battery eliminator. Make sure you have the correct battery eliminator for your geographic area of use—Domestic 115 VAC or European 230 VAC.

You can power up the Model 214B after you install the 9-volt battery that shipped with it or after you connect the Model 214B to the battery eliminator. Step-by-step installation and connection instructions follow in the next two sections.

Battery

Install or replace the battery as explained below:

1. Turn the Model 214B over to reveal its bottom panel and the pullout card.
2. Grasp the front edge of the pullout card and slide it out to expose the rectangular (approximately 1 in x 2 in) battery compartment. Next locate the half-inch notch on the battery compartment cover.
3. Put a small screwdriver into this notch and push toward the cover a sixteenth of an inch to release the latch*. Lift the cover away from the battery compartment and set it aside.

*NOTE

Do not push the latch more than a sixteenth of an inch; otherwise, the latch weakens and it may break. If the latch breaks, you can order a new battery compartment cover with this number: DNI Part # 5023-0159.

Battery continued

4. Lift out the two-terminal snap connector. Attach this keyed connector to the 9-volt alkaline battery (Duracell MN1604 or equivalent*). If the connector won't attach easily, rotate the battery 180 degrees and try again.

***NOTE**

Do not use a mercury, air, or carbon-zinc battery.

5. Put the battery and its attached wires into the battery compartment. Make sure the attached-wires end of the battery is on the side of the compartment where the cover latches.
 6. Pick up the cover and hold the latch a half inch above its receptacle. With the cover held at this angle, insert the small rectangular tab on the cover's opposite end into the indent in the compartment.
 7. Push down on the latch side of the cover until it clicks shut. Slide the pullout card back into place.
- If the cover bulges up and blocks movement of the pullout card, first remove the cover from the battery compartment as explained in step 3. Next lift the battery out and reorganize the wires. Finally, follow steps 5 through 7.

NOTE

If the battery is low, the Model 214B detects this and flashes the display at a rate of 1 Hz.

Battery Eliminator

Insert the battery eliminator plug into the "BATTERY ELIM" receptacle on the power-switch side of the Model 214B. Insert the battery eliminator box into a mains outlet: Domestic 115 VAC or European 230 VAC. Make sure you have the correct battery eliminator for the outlet you are using.

NOTE

Refer to the *Accessories, Standard* section in the *General Information* chapter and to the current DNI Nevada Price List for availability, part number information, and price.

EKG Output Snaps

Ten ECG snaps are located along the right and the left sides of the Model 214B. Adapter kits for 3.2- or 4-mm electrodes are available from DNI Nevada. Output snaps are color-coded with both AHA (American Heart Association) and IEC (International Electrotechnical Commission) standards.

NOTE

Refer to the *Accessories, Optional* section in the *General Information* chapter and to the current DNI Nevada Price List for availability, part number information, and price.

High-Level ECG Output

This output connects to high-level patient monitors. It is labeled "HI-LEVEL ECG" and is located on the right-side panel.

NOTE

A generic or standard test lead, obtainable from any of several suppliers of industrial equipment, can be used for this connection.

The connector is a 3.5-mm phone jack with a Lead II waveform at 0.5 V/mV of the low-level Lead II signal.

NOTE

If Lead II is set to 1 mV, the high-level output will be 0.5 V.

Blood Pressure Outputs

The blood pressure outputs, located on the rear panel of the Model 214B, are two 5-pin DIN female connectors labeled "BP1" and "BP2". Cables prewired for many monitors* and an unterminated cable** are available from DNI Nevada to connect to these outputs.

*NOTE

Refer to the current DNI Nevada Price List for availability, part number information, and price.

**NOTE

See the illustration *Unterminated Blood Pressure Output Cable Assembly* at the end of the *Operating Instructions* chapter and refer to the *Accessories, Optional* section in the *General Information* chapter.

Temperature Output

This output is labeled "TEMP" and is a 4-pin DIN female connector, also on the rear panel of the Model 214B. Temperature cables* are available from DNI Nevada. The type of probe simulated—either the 400 or 700 series YSI—determines the type of cable to use.

*NOTE

Refer to the *Accessories, Optional* section in the *General Information* chapter and to the current DNI Nevada Price List for availability, part number information, and price.

RS-232 Serial Port

The RS-232 serial port can control all test functions except switch settings when used with a personal computer or a compatible terminal device. An RS-232 interface cable*, available from DNI Nevada, connects to a 5-pin DIN female connector labeled "RS-232" on the rear panel of the instrument.

*NOTE

Refer to the *Accessories, Optional* section in the *General Information* chapter and to the current DNI Nevada Price List for availability, part number information, and price.

Chapter 3

Operating Instructions

Covered in this chapter: Power-Up and Initialization, Settings and Serial Port Operation.

Power-Up and Initialization

The Model 214B operates with an internal 9-volt battery or an external battery eliminator. Before you power it up, make sure you've installed the supplied battery or connected the correct battery eliminator for the mains outlet you are using.

NOTE

For battery eliminator connection instructions, refer to the *Battery Eliminator* section in the preceding chapter, *Installation*.

For battery installation or replacement instructions, refer to the *Battery* section in preceding chapter, *Installation*.

Locate the "POWER" switch on the Model 214B's front panel in the upper left corner. Press it once to power up the instrument.

NOTE

If the battery is low, the Model 214B detects this and flashes the display at the rate of 1 Hz.

Upon power-up, the Model 214B performs a self-test. After the self-test, one of the error codes listed below may show on the display.

Error Code	Explanation
E1	RAM has failed.
E2	EPROM or EEPROM checksum is in error.
E3	RAM has failed and EPROM or EEPROM checksum is in error.
E4	Illegal interrupt.

NOTE

If one of the above error codes shows on your Model 214B's display, write down the error code number, and then call us at 702-883-3400 between 8 A.M. and 5 P.M. Pacific time. Ask for a technical support specialist.

During the first couple of seconds after power-up, the display shows either *a)* the error code for one second; then the number "34" or *b)* the firmware version for one second; then the number "34".

The number 34 showing on the display indicates one of the simulation settings present at power-up: ECG normal sinus rhythm at 80 BPM. Listed below, by simulation type, is each simulation setting present at power-up.

Simulation Type	Simulation Setting
ECG	<i>If any/none:</i> Normal sinus rhythm Baseline BPV: 80 Amplitude: 1 mV, Lead II
Blood Pressure	BP channels 1 and 2: Atmosphere
Respiration	<i>If any/none:</i> Normal Rate: 20 BPM Delta impedance: 1.0 Ω

NOTE

The simulations and their two-character settings are listed on the pullout card at the bottom of the instrument as well as in the *Settings* section later in this chapter.

Anytime while the instrument is running, you can review current settings by incrementing the left digit on the display.

- When the left digit has a corresponding right digit showing on the display, the two digits indicate the currently running simulation.
- When a left digit has no corresponding right digit showing (i.e., the right display is blank), no simulation in that group is running.

Settings

Choose a setting by pressing the left and right selector keys until the two-character setting you want appears on the display. Press the <EXECUTE> key to start outputting this setting's simulation.

The two-character settings and their associated output simulations are listed in the sections that follow.

ECG Waveforms

Normal Sinus Rhythm

The following settings set the normal sinus rhythm baseline rate and cancel the prior setting.

Setting	Rate	Simulation
30	30 BPM	Normal sinus rhythm at 30 BPM
31	40 BPM	Normal sinus rhythm at 40 BPM
32	60 BPM	Normal sinus rhythm at 60 BPM
33	70 BPM	Normal sinus rhythm at 70 BPM
34	80 BPM	Normal sinus rhythm at 80 BPM
35	90 BPM	Normal sinus rhythm at 90 BPM
36	100 BPM	Normal sinus rhythm at 100 BPM
37	120 BPM	Normal sinus rhythm at 120 BPM
38	140 BPM	Normal sinus rhythm at 140 BPM
39	150 BPM	Normal sinus rhythm at 150 BPM
40	160 BPM	Normal sinus rhythm at 160 BPM
41	180 BPM	Normal sinus rhythm at 180 BPM
42	200 BPM	Normal sinus rhythm at 200 BPM
43	210 BPM	Normal sinus rhythm at 210 BPM
44	220 BPM	Normal sinus rhythm at 220 BPM
45	240 BPM	Normal sinus rhythm at 240 BPM
46	270 BPM	Normal sinus rhythm at 270 BPM
47	300 BPM	Normal sinus rhythm at 300 BPM
48	350 BPM	Normal sinus rhythm at 350 BPM
49	Auto	Automated sequence each segment runs for 30 seconds in this order: 30, 60, 80, 120, 180, and 240 BPM; then repeats.

ECG Performance

During ECG performance simulations, the blood pressure and respiration simulations are turned off.

Setting	Simulation
70	Pulse at 4 seconds, square
71	Square wave at 2 Hz
72	Triangle wave at 2 Hz
73	Sine wave at 0.5 Hz
74	Sine wave at 10 Hz
75	Sine wave at 40 Hz
76	Sine wave at 50 Hz
77	Sine wave at 60 Hz
78	Sine wave at 100 Hz
79	Automated performance sequence: The 2-Hz square wave outputs continuously. To advance, press the <EXECUTE> key. Next, the pulse outputs for 4 seconds; then the sequence automatically advances. The following sine waves output for 2 seconds each: 10, 40, 50, 60, and 100 Hz; then the sequence automatically advances. The triangle wave outputs continuously until you press the <EXECUTE> key; then the 2-Hz square wave outputs continuously.

NOTE

All ECG performance simulations are referenced to Lead II. The amplitude of Lead II continues at its most recent setting. If you haven't set the amplitude, it will be 1 mV (its setting at power-up).

At anytime, you can change the amplitude of Lead II by entering one of the two-character settings listed in the *ECG Amplitude* section later in this chapter.

ECG Arrhythmias

The following selections that contain normal beats have an 80-BPM rate. Unless otherwise stated, the PR interval is 0.16 seconds.

When an arrhythmia contains one or more abnormal beats within a series of normal beats, the abnormal beat is the second beat of the total series starting after one normal beat.

Setting	Waveform	Simulation
50	AFIB	Atrial fibrillation. Rapid irregular atrial signal with no real P-waves. Irregular ventricular rate.
51	2° BLOCK I	Second-degree AV block, type I. Waveform similar to right bundle branch block except PR interval is 0.25 seconds. Eighteen beats at 80 BPM followed by two missed beats; then repeats.
52	RBB BLOCK	Right bundle branch block. Wide QRS complexes. An 80-BPM rate with a PR interval of 0.16 seconds.
53	PAC	Premature atrial contraction. Normal sinus rhythm except every tenth beat is premature by 25%.
54	PVC Std	Premature ventricular contraction, standard—25% premature.
55	PVC Early	Premature ventricular contraction, early—33% premature.
56	PVC R on T	Premature ventricular contraction, R on T—65% premature (260 ms after R wave).
57	Multifocal PVCs	Normal sinus rhythm except two of every fifteen beats are PVCs of two different types.

continued on the next page

ECG Arrhythmias continued

Setting	Waveform	Simulation
58	Bigeminy	Bigeminy. Normal beat followed by a PVC; then repeats.
59	Run of 5 PVCs	Five PVCs together in a series with eight normal beats; then repeats.
60	VTACH	Ventricular tachycardia. Similar to left focus PVCs at 180 BPM.
61	VFIB	Ventricular fibrillation. Irregular ventricular waveform.
62	Paced	Series of paced beats at 75 BPM.
63	Fetal/Maternal	Maternal ECG with fetal ECG added.

ECG Amplitude

At anytime, you can set the amplitude of Lead II using the settings below. The ECG amplitude setting affects all ECG waveform simulations. At power-up, this setting returns to 1 mV.

Setting	Simulation
A0	Lead II: 0.5 mV
A1	Lead II: 1.0 mV
A2	Lead II: 1.5 mV
A3	Lead II: 2.0 mV

NOTE

Instructions for connecting the Model 214B to a high-level patient monitor are in the *High-Level ECG Output* section in the *Installation* chapter.

The high-level output is approximately 0.5 V/mV of the low-level output. For instance, if Lead II is set to 1 mV, the high-level output will be 0.5 V.

Blood Pressure

There are two blood pressure channels, each programmed separately.

NOTE

Refer to the *Blood Pressure Outputs* section in the *Installation* chapter for information about connecting to these outputs.

Set the blood pressure sensitivity switch to match the patient monitor's input sensitivity—either 5 or 40 $\mu\text{V}/\text{V}/\text{mmHg}$.

The dynamic blood pressures are specified for their systolic and diastolic values for rates of 80 BPM or less. For higher rates, the systolic pressure stays the same but the diastolic pressure increases as the rate increases.

All dynamic pressures are synchronized with all normal sinus rhythm rates and physiologically track all arrhythmias.

Choose a blood pressure setting from those listed on the next two pages.

BP Channel 1

Setting	Waveform	Simulation
00	ART	Arterial at 120/80 mmHg
01	LV	Left ventricle at 120/0 mmHg
02	CVP	Central venous pressure at 15/10 mmHg
03	RV	Right ventricle at 25/0 mmHg
04	PA	Pulmonary artery at 25/10 mmHg
05	PAW	Pulmonary artery wedge at 10/2 mmHg
10	ATM	Atmosphere (0 mmHg)
11	20	Static pressure: 20 mmHg
12	40	Static pressure: 40 mmHg
13	80	Static pressure: 80 mmHg
14	100	Static pressure: 100 mmHg
15	200	Static pressure: 200 mmHg
16	250	Static pressure: 250 mmHg
17	300	Static pressure: 300 mmHg
18	Auto	Automated sequence: each segment runs for 12 seconds in this order: atmosphere (0), 20, 40, 80, 100, 200, 250, and 300; then repeats.
19*	Artifact BP1/BP2	Respiration artifact is superimposed onto any blood pressure waveform. Arterial and left ventricular waveforms are modulated by 50% all others have a respiration artifact of 5 mmHg added to them. To turn this setting on and off, ensure that "19" shows on the display, then press \ll EXIT CTE \gg .

***NOTE**

You can change blood pressure, normal sinus rhythm rate (BPM), or ECG arrhythmia settings before or after you select setting "19".

BP Channel 2

Setting	Waveform	Simulation
20	ATM	Atmosphere (0 mmHg)
21	Auto	Automated sequence: each segment runs for 12 seconds in this order atmosphere (0), 20, 40, 80, 100, 200, 250, and 300; then repeats.
22	Track BP1	Tracks BP Channel 1 setting.
23	CVP	Central venous pressure at 15/10 mmHg
24	Insert*	Swan-Ganz: Insert. The catheter tip advances automatically from atmosphere (ATM) to central venous pressure (CVP), then to right ventricle (RV) pressure, and then to the pulmonary artery (PA). Runs each waveform for 8 seconds.
25	Inflate*	Swan-Ganz: Inflate. The balloon in the catheter inflates to measure the pulmonary artery wedge (PAW) pressure.
26	Deflate*	Swan-Ganz: Deflate. The balloon in the catheter deflates and measures the earlier pulmonary artery (PA) pressure.
27	Remove*	Swan-Ganz: Remove. With the balloon deflated, the catheter is removed and vented to atmosphere.

***NOTES see next page**

BP Channel 2 *continued****NOTE 1****Description of the Swan-Ganz Clinical Procedure**

The Swan-Ganz sequence begins with the Swan-Ganz catheter tip vented to atmosphere, proceeds through the venous side of the circulatory system, and terminates in a distal branch of the pulmonary artery. At this time, the balloon in the catheter inflates to measure the pulmonary artery wedge pressure. The balloon can be either deflated or reinflated, and the catheter can be removed as desired.

***NOTE 2**

Swan-Ganz simulations operate only at 80 BPM. Starting the Swan-Ganz simulation forces the ECG waveform simulation to 80 BPM.

Respiration

The respiration signal is output across the ECG leads.

Set the respiration lead select switch, "LEAD", to the lead configuration expected by the patient monitor: I, II, or RI, to I, I.

Use the respiration baseline impedance select switch, "BASE", to set the impedance between any two limb leads: 500 Ω or 1 k Ω .

Select your settings from the charts below.

Respiration Rate

Setting	Simulation
80	0 BrPPM
81	15 BrPPM
82	20 BrPPM
83	30 BrPPM
84	40 BrPPM
85	60 BrPPM
86	80 BrPPM
87	100 BrPPM
88	120 BrPPM

Respiration Amplitude

Setting	Simulation
90	0.1 Ω
91	0.2 Ω
92	0.5 Ω
93	1.0 Ω
94	3.0 Ω

Respiration Apnea

Setting	Simulation
95	Generates 12 seconds of apnea every time it is selected.
96	Generates 32 seconds of apnea every time it is selected.

Temperature

Select Celsius or Fahrenheit using the temperature select switch: 30°C (86°F), 37°C (98.6°F), or 40°C (104°F).

NOTE

To connect to the patient monitor, see the *Temperature Output* section in the *Installation* chapter.

Lead Test

Connect each end of the lead to be tested* to each lead test terminal. The display flashes at a rate of 4 Hz if the lead is good.

***NOTE**

The lead test connectors are compatible with the older-style electrodes that have the exposed metal pin (1.5-mm (0.06-inch)) and the disposable ECG snaps.

To test the newer insulated "safety-touch proof" type of electrode, use the supplied ECG Electrode Adapter (DNI Part # 9503-0070) to make the connection to the Model 214B.

WARNING! The ECG Electrode Adapter (DNI Part # 9503-0070) is to be used for testing purposes only. It is not intended for clinical use with either ECG or apnea monitoring devices.

Serial Port Operation

You can control remotely all functions except switch settings via RS-232 serial port operation. Use the remote commands to control the Model 214B from a personal computer or other serial device.

NOTE

Specialized cables, available from DNI Nevada, are required for RS-232 remote control. Refer to the *Accessories, Optional* section in the *General Information* chapter for the part numbers.

Baud rate is 2400, parity is off, and there is one stop bit.

Remote Commands

Remote commands can be sent in lower case or in upper case letters and all command strings must be terminated with a carriage return [CR] and/or a line feed [LF]; that is, [command][CR][LF], [command][CR], or [command][LF].

Illegal entries return the error message "WHAT [CR][LF]", legal entries return "OK [CR][LF]", and the entry [CR][LF] alone returns "?[CR][LF]".

To prevent functional inconsistencies, some commands can cause changes in certain parameters: for example, starting Swan-Ganz sets ECG to normal sinus rhythm at 80 BPM.

Waveform Commands

The following remote commands simply turn on the specified waveform; they do not enter a special mode. All of these commands return "OK [CR][LF]".

NOTE 1

Each command must be followed by a carriage return [CR] and/or a line feed [LF].

NOTE 2

If you are using a medTester to control the Model 214B with Sentinel or mT-Link, the letter "Z" must be added to the two-digit remote command.

Normal Sinus Rhythm

Remote Command	medTester Remote Command	Description
30	30Z	30 BPM
31	31Z	40 BPM
32	32Z	60 BPM
33	33Z	70 BPM
34	34Z	80 BPM
35	35Z	90 BPM
36	36Z	100 BPM
37	37Z	120 BPM
38	38Z	140 BPM
39	39Z	150 BPM
40	40Z	160 BPM
41	41Z	180 BPM
42	42Z	200 BPM
43	43Z	210 BPM
44	44Z	220 BPM
45	45Z	240 BPM
46	46Z	270 BPM
47	47Z	300 BPM
48	48Z	350 BPM
49	49Z	Automated sequence*

***NOTE**

For a description of the automated sequence, see the *Normal Sinus Rhythm* section in *Settings* earlier in this chapter.

ECG Performance

Remote Command	medTester Remote Command	Description
70	70Z	Pulse: 4 seconds
71	71Z	Square: 2 Hz
72	72Z	Triangle: 2 Hz
73	73Z	Sine: 0.5 Hz
74	74Z	Sine: 10 Hz
75	75Z	Sine: 40 Hz
76	76Z	Sine: 50 Hz
77	77Z	Sine: 60 Hz
78	78Z	Sine: 100 Hz
79	79Z	Automated performance sequence*
A9	A9Z	fixcut:** Simulates the <EXECUTE> key when using command 79 or 79Z.

***NOTE**

For a description of the automated sequence, see the *ECG Performance* section in *Settings* earlier in this chapter.

****NOTE**

The 2-Hz square wave outputs continuously until the remote command "A9" (or "A9Z") when using a medTester) is received. Then the ECG performance simulations output until the triangle wave. The triangle wave outputs continuously until the remote command "A9" (or "A9Z") is received; then the 2-Hz square wave, again, outputs continuously.

ECC Arrhythmias

Remote Command	medTester Remote Command	Description
50	50Z	Atrial fibrillation
51	51Z	Second-degree AV block, type I
52	52Z	Right bundle branch block
53	53Z	Premature atrial contraction
54	54Z	PVC, standard
55	55Z	PVC, early
56	56Z	PVC, R on T
57	57Z	Multifocal PVCs
58	58Z	Bigeminy
59	59Z	Run of 5 PVCs
60	60Z	Ventricular tachycardia
61	61Z	Ventricular fibrillation
62	62Z	Paced
63	63Z	Fetal/Maternal

ECC Amplitude

Remote Command	medTester Remote Command	Description
A0	A0Z	Lead II: 0.5 mV
A1	A1Z	Lead II: 1.0 mV
A2	A2Z	Lead II: 1.5 mV
A3	A3Z	Lead II: 2.0 mV

Blood Pressure Channel 1 (mmHg)

Remote Command	medTester Remote Command	Description
00	00Z	Arterial (120/80)
01	01Z	Left ventricle (120/0)
02	02Z	Central venous pressure (15/10)
03	03Z	Right ventricle (25/0)
04	04Z	Pulmonary artery (25/10)
05	05Z	Pulmonary artery wedge (10/2)
10	10Z	Atmosphere (0)
11	11Z	Static pressure: 20 mmHg
12	12Z	Static pressure: 40 mmHg
13	13Z	Static pressure: 80 mmHg
14	14Z	Static pressure: 100 mmHg
15	15Z	Static pressure: 200 mmHg
16	16Z	Static pressure: 250 mmHg
17	17Z	Static pressure: 300 mmHg
18	18Z	Automated sequence*
19	19Z	Artifact BP1/BP2

*** NOTE**

For a description of the automated sequence, see the *BP Channel 1* section in *Settings* earlier in this chapter.

Blood Pressure Channel 2 (mmHg)

Remote Command	medTester Remote Command	Description
20	20Z	Atmosphere (0)
21	21Z	Automated sequence*
22	22Z	Track BP1*
23	23Z	Central venous pressure (15/10)
24	24Z	Swan-Ganz: Insert*
25	25Z	Swan-Ganz: Inflate*
26	26Z	Swan-Ganz: Deflate*
27	27Z	Swan-Ganz: Remove*

***NOTE**

For descriptions, see the *BP Channel 2* section in *Settings* earlier in this chapter.

Respiration Rate

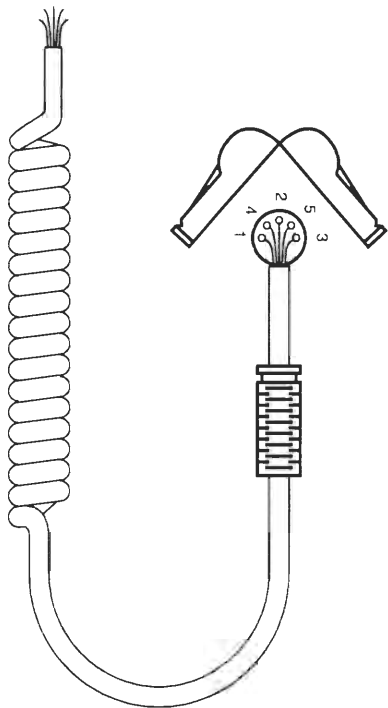
Remote Command	medTester Remote Command	Description
80	80Z	0 BrPM
81	81Z	15 BrPM
82	82Z	20 BrPM
83	83Z	30 BrPM
84	84Z	40 BrPM
85	85Z	60 BrPM
86	86Z	80 BrPM
87	87Z	100 BrPM
88	88Z	120 BrPM

Respiration Amplitude

Remote Command	medTester Remote Command	Description
90	90Z	0.1 Ω
91	91Z	0.2 Ω
92	92Z	0.5 Ω
93	93Z	1.0 Ω
94	94Z	3.0 Ω

Respiration Apnea

Remote Command	medTester Remote Command	Description
95	95Z	12 seconds
96	96Z	32 seconds



WIRING TABLE

FUNCTION	COLOR	PIN NO.
OUTPUT (+)	BLACK	4
OUTPUT (-)	RED	1
EXCITER (+)	WHITE	3
EXCITER (-)	GREEN	5
ECG REF.	BLUE	2

Unterminated Blood Pressure Output Cable Assembly