Model 214A

Patient Simulator

Operator's Manual

DYNATECH NEVADA

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1-800-648-7952 702-883-3400 Fax: 702-883-9541

New Instruments

90 days on parts
90 days on labor
Physical damage is not covered

Repair Instruments

90 days on calibration
90 days on labor
90 days on parts replacement
Physical damage is not covered

WARRANTY

The terms and conditions of warranties made by Dynatech Nevada, Inc. with respect to its products are as set forth in its standard terms and conditions of sale included herein by reference. Pursuant to these provisions, Dynatech Nevada Inc., warrants that all products are to be free from defects in workmanship and materials as set forth in the warranty policy to follow, unless a different period is specified, after delivery to the customer. If notice of the defect is timely given, Dynatech Nevada will either modify the product or part to correct the defect, replace the product or part with either new or factory reconditioned complying products, or refund the amount paid for the defective product or part. The standard terms and conditions of sale are printed on the reverse side of the company's invoice and acknowledges of customer's order forms. Additional copies thereof may also be obtained from the company's offices.

CERTIFICATION

This instrument was thoroughly tested and inspected and found to meet our manufacturing specifications as published when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (N.I.S.T.)

COPYRIGHT RELEASE

Shipping Damage and Shortage

Before you fully unpack any unit *READ THIS* for your protection. (This information applies only to shipments within the United States).

DAMAGE

This shipment was packaged and delivered to the carrier with the utmost care to insure safe delivery of goods. When shipment is received and signed for by the transportation company, consignor's responsibility ceases. Do not accept shipment which evidences damage or shortage until agent of carrier endorses a statement of the irregularity on the face of the transportation receipt. Without documentary evidence, a claim cannot be filed.

CONCEALED DAMAGE

The Interstate Commerce Commission has indicated that a carrier is as much responsible for concealed damage as for visible damage in transit. Upon receipt of shipment, promptly unpack it and check thoroughly. If concealed damage is discovered, cease further unpacking and request immediate inspection by local agent of carrier. A written report of the agent's findings, with signature, is necessary to support claim.

SHORTAGE

Check shipment against shipping papers. Do not discard packing materials or packing cases until contents have been found to be correct. The removal of items before shipment has been checked may create a shortage. Check all possibilities before reporting a shortage.

CLAIMS

If your agent or carrier has been given an opportunity to inspect the shipment, any claim for a shortage or damaged merchandise can be handled as a simple and routine procedure. Claims must be filed by consignee. Shipping terms are F.O.B. Carson City, Nevada unless otherwise specified.

Shipping Damage and Shortage

LOSS

In the event of complete loss, claim will be handled in the same manner as for Shipping Damage or Shortage.

AIR FREIGHT

A claim must be initiated at point of destination. A claim must be filed by submitting a letter on company stationery with an explanation of the extent of damage or loss and forwarded with a copy of the original* air bill, and original invoice or photostat of same, to the airline which carried the shipment.

*Upon request, photostatic copies of original papers held by Dynatech Nevada required in support of claims will be made available.

DAMAGE CLAIMS

For those shipments insured by Parcel Post, the addressee initiates the claim by filling out Post Office Dept. Form 3812, "Request for Payment of Domestic Postal Insurance". Item 12 is to be other than Post Office of Address for inspection. A new purchase order is required by Dynatech Nevada to cover the cost of repairs (or in the case of loss or refiling-replacement order). Damaged material will be repaired and returned. Party named in item 12 of form 3812 will receive reimbursement for repair cost from Post Office Department.

LOSS CLAIMS

In the event of a report to consignor of loss or refiling, Post Office Department Form 3812 will be initiated by Dynatech Nevada at point of origin. If, after Post Office investigation, the material is not located, disposition from this point will be the same as stated in the previous paragraph - "Placing claim for damage".

Shipping Damage and Shortage

CLAIM FOR DAMAGE TO UPS SHIPMENTS

The addressee must notify Dynatech Nevada, who will notify United Parcel Service, giving the shipper's number and date parcel was shipped. United Parcel Service will send a representative to inspect the damage and advise proper disposition. A new purchase order is required by Dynatech Nevada to cover the cost of repairs or in the case of loss or refiling, a replacement order. Damaged material will be repaired and returned.

UNPACKING AND INCOMING INSPECTION

Standard receiving practices should have been followed upon delivery of the instrument, i.e., the shipping carton should have been checked for damage and if damage was found, the carrier's agent should have been asked to be present while the instrument was unpacked. There are no special unpacking instructions, but care should be taken not to damage the unit. Inspect CuffLink for physical damage, such as bent or broken parts, dents, or scratches.

CLAIMS

If physical damage is found or operation is not within specifications when the instrument is received, notify the carrier immediately. If Dynatech Nevada Inc. or the factory representative is notified, arrangements will be made for repair or replacement of the instrument without waiting for settlement of carrier's claim. However, a new purchase order must be issued to cover this work.

WARRANTY REPAIR

The warranty statement for all Dynatech Nevada products is printed on page 3 of this manual.

The warranty does not cover the cost of transportation. No C.O.D. shipment will be accepted without prior authorization. All transportation charges will be billed to the customer.

It is recommended that United Parcel Service, Federal Express, or Air Parcel Post be used to return the instrument to the factory. Please follow the guidelines given above when packaging the instrument to avoid delay or damage.

REPACKAGING FOR SHIPMENT

When shipping an instrument to Dynatech Nevada, attach a tag describing the required services and include Model number, Serial number, purchase order number, contact name and phone number, and return address.

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

a) Use a double walled carton of sufficient strength for the weight to be shipped.

b) Use heavy paper or cardboard to protect all instrument surfaces. Use a non-abrasive material around all projecting parts.

c) Use at least four inches of tightly packed industrial approved shock-absorbant material around the instrument.

214A Patient Simulator

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Chapter 1

Specifications

Chapter 1 Specifications

INTRODUCTION

The Model 214 is a high performance patient simulator which includes simulation of ECG, respiration, dynamic blood pressure and static temperature. All functions are set from a 2-digit display operated by a 5-switch keyboard and 5 slide switches. The unit has 3 electrically isolated sections. The main section contains ECG and respiration. Blood pressure is in another isolated section. Temperature is in the third isolated section.

ECG

ECG configuration is 12 lead with independent outputs for each signal lead referenced to RL. A HIGH LEVEL ECG output is also included. Waveforms include NSR from 30 to 240 BPM, performance waveforms, paced, and a selection of arrhythmias. Amplitude is adjustable on all waveforms.

Normal ECG

RATES: 30, 60, 80, 120, 160, 200, 240 BPM. Accuracy is 1%. Auto steps through the rates at 30 second intervals.

AMPLITUDES: 0.5mV, 1.0mV, 1.5mV and 2.0mV on lead II. Accuracy is 5%. The high level output is approximately 0.5V per mV of the low level output.

IMPEDANCE: Limb leads are selectable at 500Ω and 1000Ω. V leads are 1000Ω. Accuracy is 5%.

ECG Performance

Amplitudes set by ECG AMPLITUDE.

SQUARE: Rate is 2 Hz.

PULSE: 4 Seconds.

TRIANGLE: 2 Hz

SINE: 0.5, 10, 40, 50, 60 and 100 Hz

AUTO: Starts at a 2 Hz square wave. Depress the execute key to advance the waveform to pulse. After one pulse, it automatically steps through the sine waves at 2-second intervals. The sequence holds at the triangle wave until the execute key is pressed again. The square wave will then resume.

Other Waveforms

AFIB, 2°BLK II, RBBB, PAC, PVC EARLY, PVC STD, PVC R ON T, MF PVC, BIGEMINY, RUN OF 5 PVC, VTACH, VFIB, PACED, and FETAL/MAT.

BLOOD PRESSURE

INPUT/OUTPUT IMPEDANCE: 300 ohms

EXCITER INPUT VOLTAGE RANGE: 2 to 16 V

EXCITER INPUT FREQUENCY RANGE: DC to 4000 Hz

OUTPUT SENSITIVITY: 5 or 40 uV/V/mmHg

OUTPUT RANGE: 0 to +300 mmHg

ACCURACY: 1% of range + 1 mmHg at 80 BPM, normal sinus ECG only.

RATES: All dynamic pressures track all normal sinus rates and physiologically track all arrhythmias.

ISOLATION: BP is electrically isolated from the rest of the unit.

WAVEFORMS:
- ATM (0 mmHg)
- ARTERIAL (120/80 mmHg)
- LEFT VENTRICLE (120/0 mmHg)
- RIGHT VENTRICLE (25/0 mmHg)
- PULMONARY ARTERY (25/10 mmHg)
- PAW (10/2 mmHg)
- STATIC: 0, 20, 40, 80, 100, 200, 250, 300 mmHg

RESPIRATION

OUTPUT CONFIGURATION: Lead I, II or RL-LL

BASELINE IMPEDANCE: 500 or 1000 ohms. Accuracy is 5%.

DELTA IMPEDANCE: 0, 0.1, 0.2, 0.5, 1.0 and 3.0 ohms. Accuracy is 10%.

RATES: APNEA, 15, 20, 30, 40, 60, and 120 BrPM. Accuracy is 5%.

Chapter 1 Specifications

TEMPERATURE

SELECTIONS: 30°, 37°, 40°. Accuracy is .4°C.

PROBE COMPATIBILITY: 400 and 700 series YSI types

ISOLATION: Electrically isolated from the rest of the instrument.

POWER REQUIREMENTS

9V battery. 50 hour life. Battery eliminator optional.

STANDARD ACCESSORIES

Soft Vinyl Carrying Case

Instruction Manual

Battery Eliminator (UL approved)

OPTIONAL ACCESSORIES

BP Cable, unterminated. DNI part no. 3010-0048.

BP Cable, prewired for selected patient monitors. Consult current price list.

Temperature Cable for 400 YSI. DNI part no. 3010-0192.

Temperature Cable for 700 YSI. DNI part no. 3010-0193.

Calibration Cables

Blood Pressure, DNI part no. 3010-0205.
Temperature, DNI part no. 3010-0288.

PHYSICAL CHARACTERISTICS

HEIGHT: 1.8 inches

WIDTH: 4.0 inches

LENGTH: 7.4 inches

WEIGHT: 2.0 pounds

TEMPERATURE REQUIREMENTS

OPERATING: 59°F to 95°F (15°C to 35°C)

STORAGE: 32°F to 131°F (0°C to 55°C)

STORAGE

Store in the supplied carrying case with the battery removed. Store in dry area within storage temperature limits. There are no other storage requirements.

PERIODIC MAINTENANCE

It is recommended that the unit be calibrated at 6-month intervals.

INTENDED USE

The model 214A is intended for use in hospitals to check the operation of patient monitors. It is not intended for calibration purposes.

Note: Specifications are subject to change without notice.

Chapter 2

Installation

Chapter 2 Installation

INTRODUCTION

This section contains information for making a visual and electrical inspection of the instrument, processing a claim, repackaging for shipment, and installation procedures.

UNPACKING AND INCOMING INSPECTION

Standard receiving practices should have been followed upon delivery of the instrument; i.e., the shipping carton should have been checked for damage and if damage was found, the carrier's agent should have been asked to be present while the instrument was unpacked. There are no special unpacking instructions, but care should be taken to not damage the unit. Inspect the unit for physical damage, such as bent or broken parts, dents or scratches.

CLAIMS

If physical damage is found or operation is not within specifications when the instrument is received, notify the carrier immediately. Please read the sheet on damage and shortage in the back of the manual. If Dynatech Nevada or the factory representative is notified, arrangements will be made for repair or replacement of the instrument without waiting for settlement of carrier's claim; however, a new purchase order must be issued to cover this work.

WARRANTY REPAIR

The warranty statement for all Dynatech Nevada products is printed on the back side of the title page of this manual.

The warranty does not cover the cost of transportation. No C.O.D. shipment will be accepted without prior authorization. All transportation and phone charges will be billed to the customer.

It is recommended that United Parcel Service or Air Parcel Post be used to return the instrument to the factory. Please follow the guidelines given above when packaging the instrument to avoid delay or damage.

REPACKAGING FOR SHIPMENT

When shipping an instrument to Dynatech Nevada, attach a tag describing the required services and include Model number, Serial number, and return address. Use the original carton and packaging material for shipment. If they are not available, use the following guide for repackaging:

a) Use a double walled carton of sufficient strength for the weight to be shipped.

b) Use heavy paper or cardboard to protect all instrument surfaces. Use a non-abrasive material around all projecting parts.

c) Use at least four inches of tightly packed industrial approved shock-absorbent material around the instrument.

PREPARATION FOR USE

The Model 214A is a portable instrument designed for battery operation.

Contact Dynatech for special cables.

Chapter 3

Operation

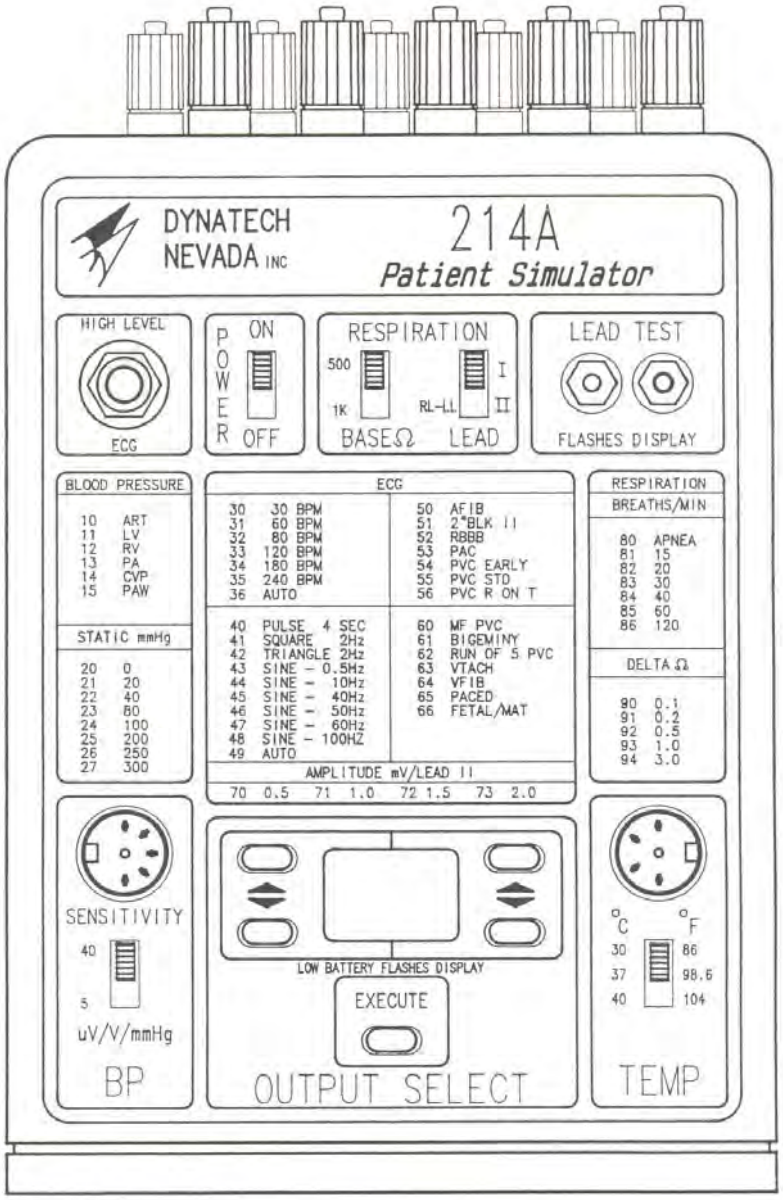


FIGURE 3-1
CONTROLS and FUNCTIONS

Chapter 3 Operation

INTRODUCTION

This section contains operating instructions and explanations of the controls and indicators (Figure 3-1) for the Model 214A Patient Simulator.

POWER

The power switch is a slide switch located on the top panel. To increase battery life, turn the instrument off when not in use. The display will indicate a low battery condition by flashing.

BATTERY REPLACEMENT

The battery compartment is accessible from the bottom of the unit. Replace with one 9 Volt alkaline battery (Duracell MN1604 or equivalent).

Note: Do not use mercury, air, or carbon-zinc batteries.

TOP PANEL CONTROLS AND CONNECTORS

Display and Keyboard

The 214A has a two-digit display. Above the display on the top panel is a list of the available waveforms and an associated 2-digit number. To execute a waveform, set its number in the display using the 4 increment/decrement keys directly to the left and right of the display. Then execute the waveform with the execute key.

High Level ECG Output

A lead II waveform at .5V per mV of the low level lead II signal is output at the High Level ECG jack (a 1/4-inch standard phone jack), located on the top panel of the 214A. For use with high level input monitors.

Respiration

The respiration signal is contained within the ECG leads. The LEAD SELECT switch determines which lead it is on. This must be set to correspond to the type of patient monitor used. The BASELINE IMPEDANCE switch sets the impedance between any two limb leads. Respiration parameters (breaths/min) are set and executed from the keyboard of the 214A.

Blood Pressure

Cables to connect to the blood pressure connector are available from Dynatech (Figure 3-2). For many monitors, the cables are available pre-wired. Unterminated cables are available for other monitors. The SENSITIVITY switch must be set to match the patient monitor's input sensitivity (either 5 or 40 uV/V/mmHg). Waveform is determined by the 214A keyboard.

Temperature

Cables to connect to the temperature connector are available from Dynatech. The type of cable used determines the type of probe simulated, either 400 or 700 series YSI probes. Temperature is selectable by a slide switch.

Lead Test

Tests continuity of ECG leads. Connect each end of the lead to be tested to the two lead test terminals. Display flashes if the lead is good.

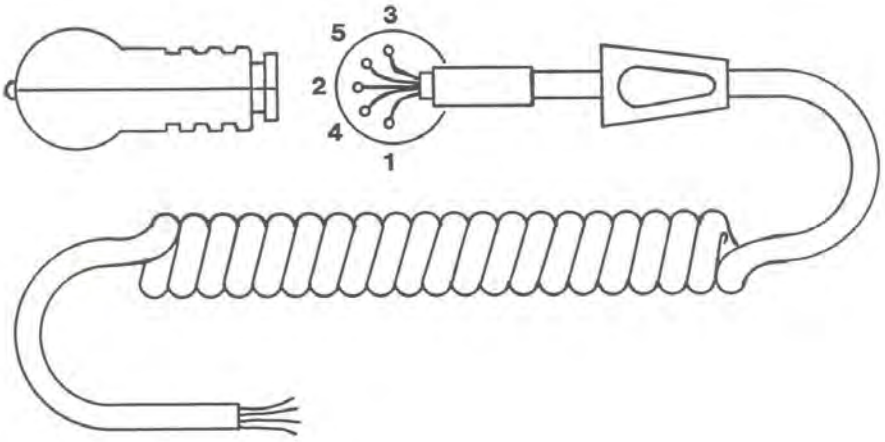
REAR PANEL CONNECTORS

ECG Leads

Ten special binding posts are compatible with disposable snaps and 3.2mm or 4mm electrodes and banana plugs. Waveform parameters are selectable from the keyboard.

Batt Elim

The unit has a micro jack for the battery eliminator. Use only eliminators supplied by Dynatech.



WIRING TABLE

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

Patient Simulator
B.P. OUTPUT CABLE ASSEMBLY

FIGURE 3-2

Chapter 4

Performance Check and Calibration

Chapter 4 Performance Check/Calibration

PERFORMANCE CHECK

The following procedure completely checks out the operation of the Model 214A.

Equipment Required

PATIENT MONITOR with ECG, respiration, blood pressure, temperature, and cardiac output.

INTERCONNECT CABLES for the above functions. These are available from Dynatech for most monitors.

DIGITAL MULTIMETER.

The 214A operating modes are selected from the keyboard on the 214A. See the operating procedure for details. See specifications for tolerances.

1) Install a battery and turn the 214A on. The display will read the software revision, then after a few seconds it reads 32.

2) Short the LEAD TEST terminals together and the display should flash.

3) Check the resistance between RL and each of the other limb leads (RA, LA, LL) in both BASELINE IMPEDANCE switch positions. When measuring LL, set the sead switch to I, and when measuring LA, set the sead switch to II. Resistance tolerances: 475-525 and 950-1050. Return the BASELINE IMPEDANCE switch to 500Ω.

4) Check that the resistance between V1 and each of the other V leads is 950-1050Ω.

5) Connect the ECG posts on the 214A to the monitor. Set the Model 214A to 80BPM and 1mV. Check the rate and amplitude on the monitor.

6) Set the monitor to measure respiration. Set the LEAD SELECT SWITCH for the lead the monitor uses. Set the Model 214A for 20BrPM and 1Ω. Check the rate on the monitor.

7) Connect the BLOOD PRESSURE to the monitor. Set the SENSITIVITY SWITCH as required for the monitor. Set the 214A to ATM and zero the monitor. Set the 214A to 300mm and the monitor should read 300mm.

8) Connect the monitor to the temperature channel. Check the monitor reading in all three temperature switch settings.

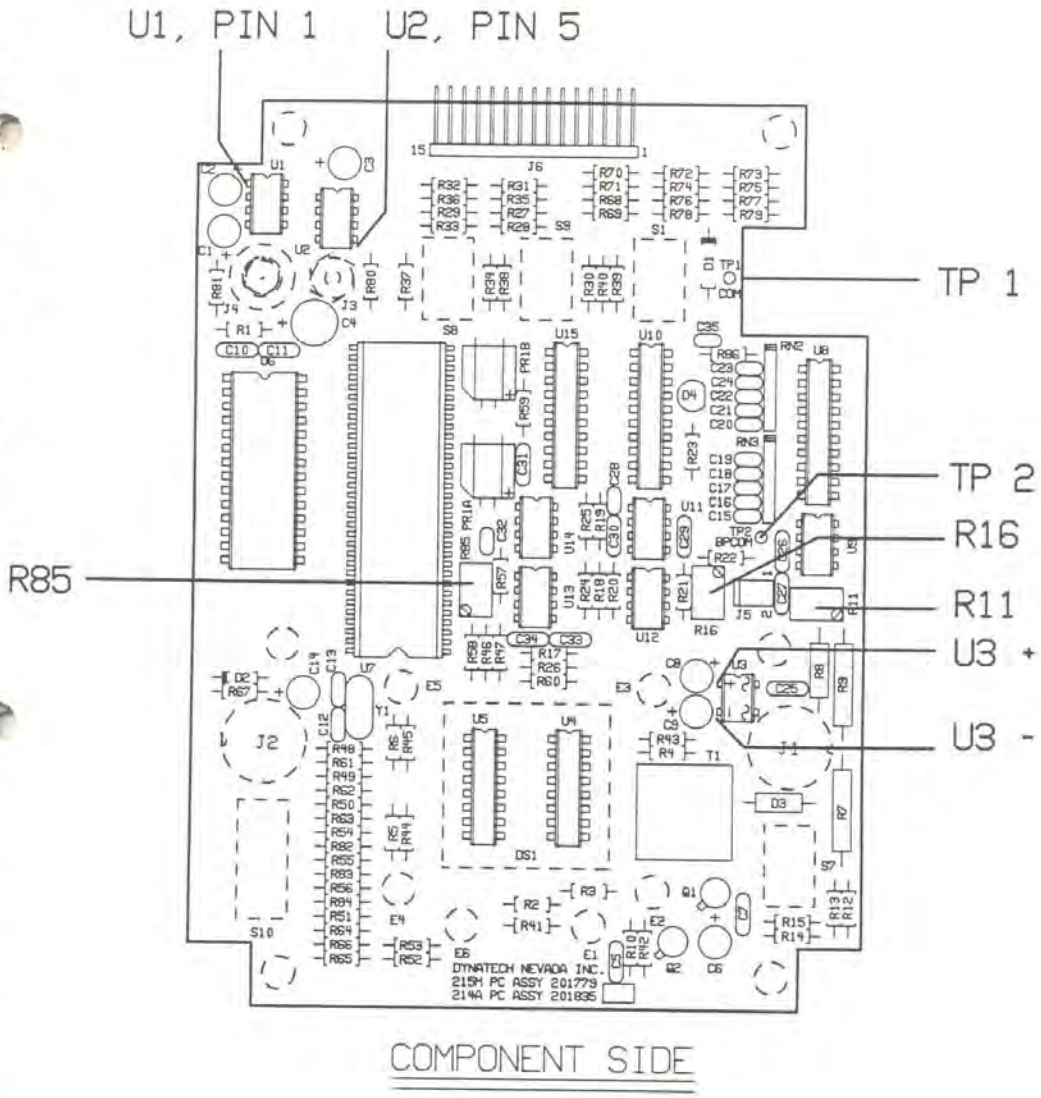


FIGURE 4-1
ADJUSTMENT LOCATOR

CALIBRATION

This section includes the procedure for a complete calibration of the 214A. Refer to Figure 4-1 for the location of all adjustments.

Equipment Required

DIGITAL MULTIMETER: 5 1/2 digit

DC VOLTAGE SOURCE: 10V ± 10mV @ 30mA

CALIBRATION CABLES: available from Dynatech Blood Pressure DNI part no. 3010-0205.

Setup

Remove the four screws on the bottom cover. Pull the bottom cover off.

Set the top panel switches as follows.

BASELINE IMPEDANCE..... 500
LEAD SELECT II
SENSITIVITY 40

Calibration Procedure

1) Turn the Model 214A on. Test the power supplies using the following chart. All readings in volts.

Test Points	Low Limit	High Limit
U1 pin1 - TP1 (low)	+4.75	+5.25
U2 pin5 - TP1 (low)	-5.00	-10.00
U3 pin+ - TP2 (low)	+4.70	+5.20
U3 pin- - TP2 (low)	-4.70	-5.20

2) Check for at least 1MΩ between TP1 and TP2.

3) Turn the power off. While depressing the EXECUTE switch, turn the power back on. This enters the calibration procedure. The display should read 00.

4) Connect a DMM to LL and RA (low). Execute a display setting of 00. Record the DMM voltage reading (typically < .1mV).

5) Set the display to 01 and execute it. Adjust R16 for the voltage to be 2mV plus the voltage measured in step 4. Be sure to include the voltage polarities when adding the readings. The adjustment tolerance is ±.020mV.

6) Connect the DMM to LL and RA (low). Set the display to 02 execute it. Record the DMM resistance reading (typically 500 ± 25Ω).

7) Set the display to 03 and execute it. Adjust R85 for the reading in step 6 plus 3Ω.

8) Repeat steps 6 and 7 until the difference between the reading is 3 ± .03Ω.

9) Move the DMM to LA and RA. Set the BASELINE IMPEDANCE SWITCH to lead I. Remeasure the resistance using the procedure in steps 6 and 7 but do not readjust R85. The result should be 3 ± .3Ω.

10) Connect a blood pressure calibration cable (DNI# 3010-0205) to the blood pressure connector. Connect the other end of the cable to a +10V power source and the DMM as shown in the following chart.

Cable Wire	Connection
GRY	+10 V
GRN	GND FOR 10V
BLK	+DMM
RED	-DMM

With the cable connected check that the +10V voltage source is 10 ± .01V.

11) Set the display to 04 and execute it. Record the DMM voltage reading (typically < 1mV).

12) Set the display to 05 and execute it. Adjust R11 for the reading in step 12 plus 120mV. The adjustment tolerance is .2mV.