ADINSTRUMENTS
RODENT NIBP CODA® MONITOR

Owner's Guide
Non- invasive animal hemodynamics

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Contents

Chapter 1
Overview

ADInstruments Rodent NIBP CODA® Monitor is designed to provide non-invasive blood pressure (NIBP) measurements from a single mouse or rat using Volume Pressure Recording (VPR), reputed to be the best NIBP technology that uses an occlusion tail-cuff as part of its methodology. An occlusion tail cuff is inflated to impede blood flow to an animal's tail. The cuff is deflated slowly and a second tail cuff, incorporating the VPR sensor, measures the physiological characteristics of the returning blood flow. As the blood returns to the tail, the VPR cuff sensor measures the tail swelling that result from arterial pulsations from the blood flow. Systolic blood pressure is measured automatically at the first appearance of tail swelling. Diastolic blood pressure is measured automatically when the rate of swelling stops increasing in the tail. Measured data is then streamed into LabChart for Windows for recording and analysis using the USB to mini-USB Cable and ADInstruments CODA Monitor Device Enabler software.

Set Components

An ADInstruments Rodent NIBP CODA® Monitor Set consists of several components, which are listed in Table 1–1.

The components of ADInstruments Rodent NIBP CODA® Monitor Set

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WARNING:

The ADInstruments Rodent NIBP CODA Monitor Set is not designed, intended, or authorized for use in human applications.

NOTE:

The type of CODA Rodent Cuff Kit supplied depends on your selection at time of purchase, and contains the corresponding Occlusion Cuff, VPR Cuff Sensor and accessories.

Component	Qty	Image
ADInstruments CODA Monitor (Controller)	1	
USB Pen Drive	1	
Far Infrared Warming Pad (20.3 x 25.4 cm)	1	
Rodent NIBP CODA RightTemp Sensor	2	
Non-Sterile Disposable Sleeve Protectors	10	
Warming Cover (Blanket)	1	
Non-Contact Infrared Thermometer with Laser Sight	1	
CODA Rodent Cuff Kit	1	

NOTE:

Supplied documentation includes the Quick Start and Data Management Guide.

Component	Qty	Image
Blood Pressure Cuff Storage Case	1	
Red controller test cap	2	
Oxygen absorber sachet	1	
USB to mini-USB Cable	1	
Power Adaptor	1	
Power Cord	1	

The Front Panel

The front panel of the controller has a touch screen display, two dial controls, ports for VPR Cuff Sensor and Occlusion Cuff.

Dial Controls

Touch Screen Display

VPR Cuff Sensor Port

RightTemp Module
• Pad Power
• Animal Sensor
• Pad Sensor

O-Cuff Port

The Side Panel

The side panel provides the serial number of the device and connection ports to the computer and power supply.

USB to mini- USB cable

Power Supply Adaptor

CODA Rodent Cuff Kit

There are three types of CODA Rodent Cuff Kits, each containing its specific selection of Occlusion Cuffs, VPR Cuff Sensors and accessories (latex bladders, end caps, o-rings and connection tubings). A kit is supplied with the ADInstruments Rodent NIBP CODA® Monitor Set and specified at the time of purchase. Additionally, you can purchase these kits separately to enable measurements on other animal types, as spare parts or as replacements.

- CODA Mouse Cuff Kit that contains:
    o   Rodent NIBP CODA VPR Cuff Sensor (Sml)
    o   Rodent NIBP CODA Occlusion Cuff (XSml)
    o   Rodent NIBP CODA Occlusion Cuff (Sml)
- CODA Rat Cuff Kit that contains:
    o   Rodent NIBP CODA VPR Cuff Sensor (Med)
    o   Rodent NIBP CODA VPR Cuff Sensor (Lrg)
    o   Rodent NIBP CODA Occlusion Cuff (Med)
    o   Rodent NIBP CODA Occlusion Cuff (Lrg)
- CODA Extra Large Rat Cuff Kit that contains:
    o   Rodent NIBP CODA VPR Cuff Sensor (Lrg)
    o   Rodent NIBP CODA VPR Cuff Sensor (XLrg)
    o   Rodent NIBP CODA Occlusion Cuff (Lrg)
    o   Rodent NIBP CODA Occlusion Cuff (XLrg)

![warning symbol]

WARNING:

Please store your spare bladders in a cool, dark and dry place. Bladders have a shelf life of approximately one year.

Figure 1–3

A CODA Mouse Cuff Kit (left), a CODA Rat Cuff Kit (right) and a CODA Extra Large Cuff Kit (bottom).
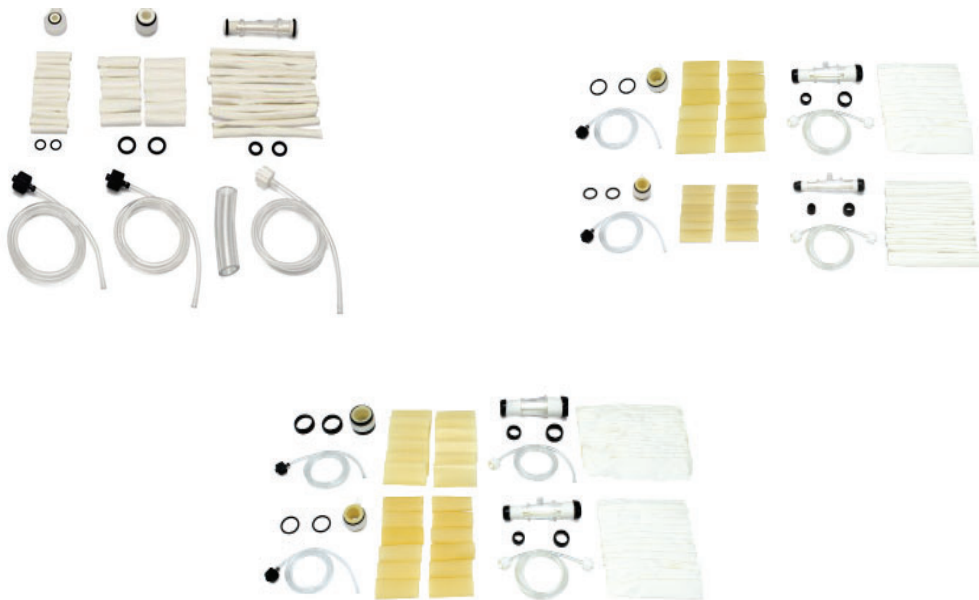
VPR Cuff Sensor and Occlusion Cuff

There are 4 VPR Cuff Sensor sizes, but 5 Occlusion Cuff sizes, since the VPR Cuff Sensor (Sml) is designed to function with both Occlusion Cuff (XSml) and Occlusion Cuff (Sml). You can use the measurement guide (see Figure 1-4) to determine the size of cuff that you will need.

VPR Cuff Sensor (Sml)   VPR Cuff Sensor (Lrg)   VPR Cuff Sensor (Med)   VPR Cuff Sensor (XLrg)

Figure 1–4

Range of VPR Cuff Sensor and Occlusion Cuff sizes that are fitted with respective bladders, o-rings and end caps.

O-Cuff (XSml) on left and (Sml) on right   O-Cuff (Med)   O-Cuff (Lrg)   O-Cuff (XLrg)

Measurement Guide
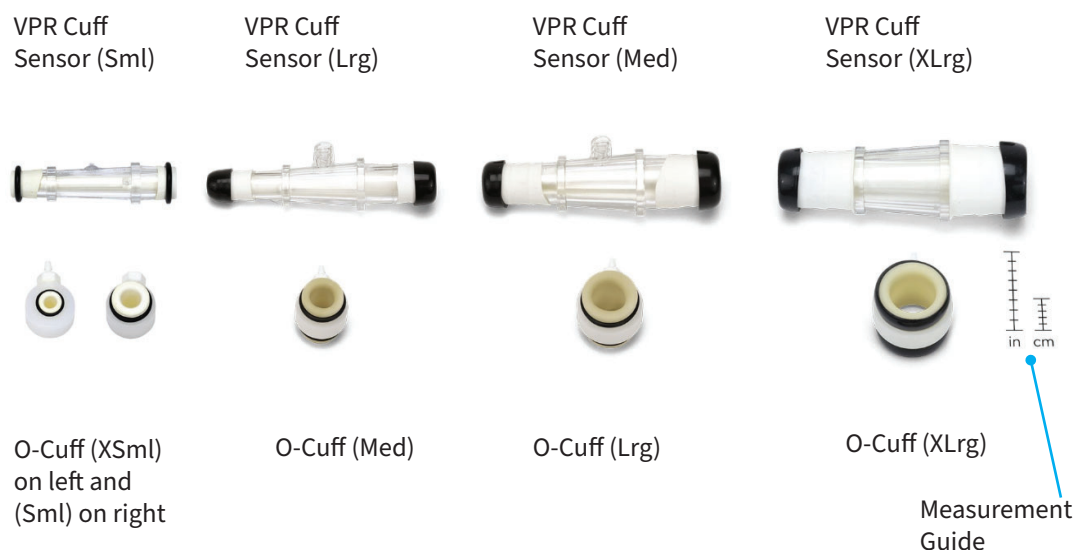
CODA NIBP Rodent Holders

A suitable rodent holder is required in conscious rodent experiments to restrain the animal. There are seven (3 for mice and 4 for rats) available rodent holders for purchase that are specifically designed for noninvasive tail blood pressure measurements. They are cylindrical in shape that sit securely on a common designed tray. Its clear acrylic design provides you with complete visibility, while its nose cone design allows for unrestricted breathing for the animal. You are recommended to use the animal body weight as a guide when selecting a holder.

CODA NIBP Mouse Holders:

•   Small (1.00" inside diameter; 3.50" Holder length) for < 25 g mice

•   Medium (1.25" inside diameter; 4.25" holder length) for 25-50 g mice

•   Large (1.50" inside diameter; 5.25" holder length) for 50-75 g mice

CODA NIBP Rat Holders:

•   Small (2.00" inside diameter; 6.50" holder length) for 75-200 g rats

•   Medium (2.25" inside diameter; 7.00" holder length) for 200-300 g rats

•   Large (3.00" inside diameter; 7.50" holder length) for 300-500 g rats

•   Extra-large (3.50" inside diameter; 8.00" holder length) for > 500 g rats

Figure 1–5

Range of CODA NIBP Rodent Holders, mice (top row) and rats (middle and bottom row).

Mouse (Sml)   Mouse (Med)   Mouse (Lrg)

Rat (Sml)   Rat (Med)

Rat (Lrg)   Rat (XLarge)

Chapter 2

Install Software

LabChart Installation

1. Ensure that you have separately purchased a licensed version of LabChart software.

2. You can install LabChart from a purchased CD by placing the LabChart CD in the CD drive of your computer. Alternatively, you can download the latest version of LabChart software from ADInstruments' website

    (https://www.adinstruments.com/support/downloads/windows/labchart).

3. Follow the on-screen instructions to install LabChart.

4. Launch LabChart by double-clicking on the desktop icon. Enter the activation code when prompted.

5. Check for updates (Help > Check for Updates…) and install the latest LabChart if required.

License Registration

1. When you start LabChart for the first time, a dialog will appear asking you to enter your license code. Your license code can be found on the LabChart CD case. If you additionally purchased LabChart Pro then both codes on the back of your CD case should be entered in turn to unlock all the features of LabChart Pro.

2. Enter your license details.

License Activation

1. Activation is only required once per machine. If you have a supported PowerLab already connected and turned on, your license will activate automatically. Otherwise, you may choose online or manual activation.

Welcome to LabChart

1. LabChart's Welcome Center opens automatically when LabChart is launched.

2. If you have previously installed an older version of LabChart, you can double-click the Feature Manager icon in the Welcome Center to update to the latest LabChart.

CODA Monitor Device Enabler Installation

1. After installing LabChart, you can install the ADInstruments CODA Monitor Device Enabler via

    a. Inserting USB Pen Drive into your computer's USB port and double clicking the CODA.msi file

    b. Using Feature Manager in LabChart software (see Figure 2-1) and then ensuring that it is enabled

    c. Or downloading from Software Downloads on ADInstruments website (https://www.adinstruments.com/support/labchart#software-downloads).

2. Exit LabChart software.

Owner's Guide

CODA Monitor Device Enabler Installation

1. Connect and power the ADInstruments Rodent NIBP CODA Monitor Set as mentioned in Hardware Setup later on (see page 15). The controller's touchscreen should then present a Standby Display until successful recognition by LabChart software.

2. Double click on the LabChart icon to open LabChart software.

3. On start-up, LabChart performs a Device Discovery process. It should automatically detect the controller, which will be indicated by a green tick mark.

Figure 2–2

Detected controller and its serial number.
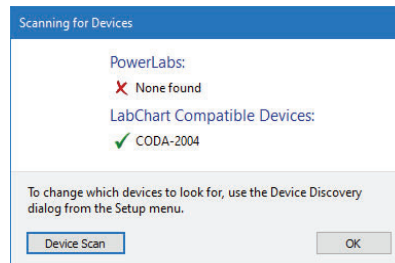
NOTE:

If the device is not detected immediately click Device Scan. If detection continues to fail after repeated device scans see Troubleshooting.

4. Select the CODA Monitor device and click the OK button.

5. Open a new document in LabChart software, which will automatically setup ten recording channels in Chart View.

6. You should also see that the controller's display automatically changed to its Start Display with the Start button in its center.

7. Click Start in LabChart software if you are ready and to begin recording in LabChart. If the hardware is fully setup, you can touch "Start" on the device to begin measurements on the device, or touch "Warm" or "Menu" for further configuration changes as outlined in Navigating the CODA Monitor later on (see page 23).

Figure 2–3

Controller's Standby Display (left) before and Start Display (right) after successful recognition by LabChart software.
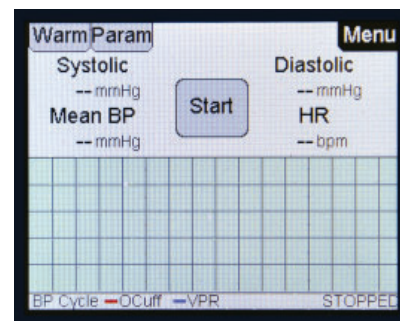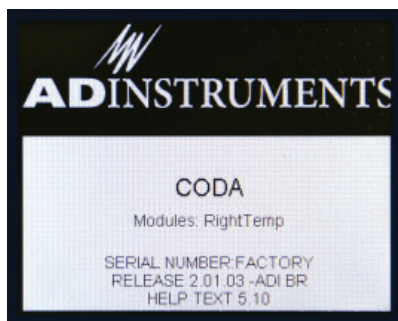
Figure 2–4

An example of a recording in LabChart software with DVM mini windows and Data Pad features enabled.
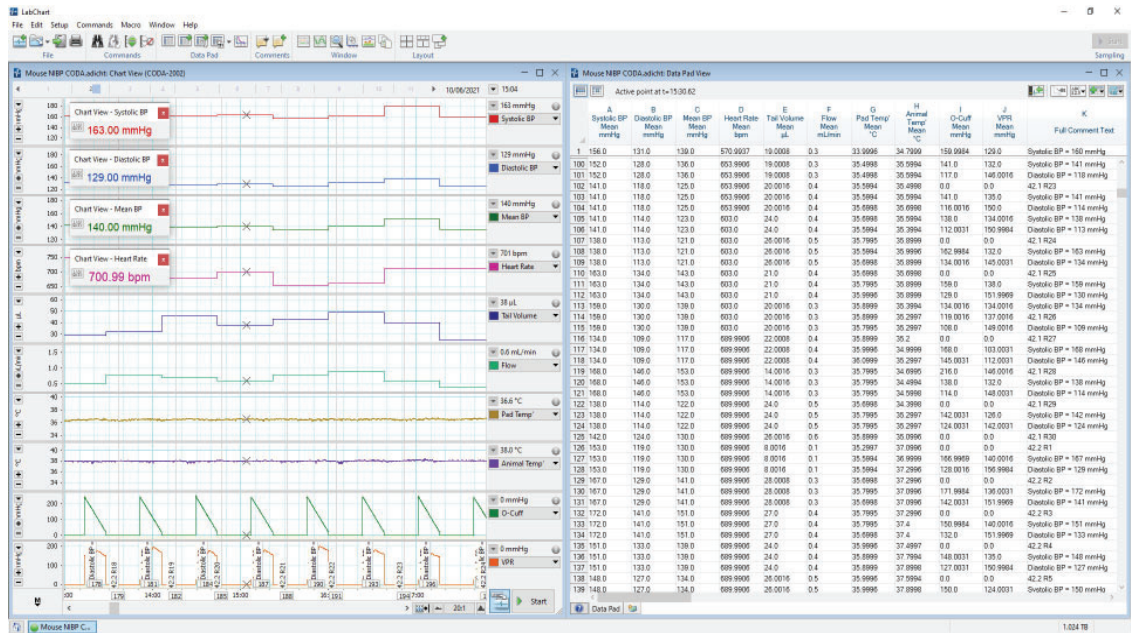
8. Additionally, before starting to record data in LabChart software, you can also enable or customize some of its recording and analysis features. LabChart has many useful features that can enhance your data recording and analysis experience, which include

   a. Digital readouts via DVM mini windows

   b. Adding and managing comments

   c. Splitting the Chart View

   d. Tabulating recorded data via Data Pad

   e. Managing data regions within the recording via Analysis Manager

9. Please refer to LabChart Help within the software for further information.

Chapter 3

Hardware Setup

Hardware Connections

Figure 3–1

Connecting the Hardware

Hardware Setup

Power Supply USB

ADInstruments CODA® Monitor

from VPR Cuff Sensor

from Occlusion Cuff

from Animal

Rodent NIBP CODA RightTemp Sensor

from Pad

Rodent NIBP CODA RightTemp Sensor

Far Infrared Warming Pad
(203 x 254 mm)

1. Connect the ADInstruments CODA Monitor to the computer via supplied USB to mini-USB Cable.

2. Connect the ADInstruments CODA Monitor to mains power via supplied power cable.

3. Attach the tubing of the Occlusion Cuff to the O-Cuff port.

4. Attach the tubing of the VPR Cuff Sensor to the VPR Port.

5. Connect the warming pad to the "Pad Power" port on the front of the CODA Monitor.

NOTE:

It is recommended that you secure the pad sensor to the warming pad using tape or something similar.

6. Choose any of the Rodent NIBP CODA RightTemp Sensors as the animal or body temperature sensor, and the other as the pad temperature sensor. The sensors are fully interchangeable.

7. Connect the two chosen RightTemp Sensors to the CODA Monitor.

   a. Connect the animal or body temperature sensor to the "Animal Sensor" port.

   b. Connect the pad temperature sensor to the "Pad Sensor" port.

8. Place the pad temperature sensor in the center of the warming pad, directly beneath the animal or the tray of the rodent holder.

   a. Secure using tape or other suitable temporary adhesives.

   b. Ensure that the tape is only applied to the black portion of the cable. Taping over the white portion of the sensor may result in damage to the sensor.

Figure 3–2
Sensor end of a RightTemp Sensor.

Black portion   White portion

c. If using the Non-Sterile Disposable Sleeve Protectors or any other covering, make sure the sensor is secured on top of the cover itself and not on the warming pad underneath the cover.

WARNING:

Do not tape over the white portion of the temperature sensor as it may damage the sensor!

9. Place the animal or body temperature sensor either between the rodent holder and its tray underneath the animal for a conscious animal preparation or into the rectum of the animal for an anesthetized animal preparation. Secure the sensor as mentioned.

Animal Preparation

Conscious Animal Preparation

1. Place the animal in the corresponding sized CODA NIBP Rodent Holder.

    a. Remove the rear gate of the rodent holder.

    b. Adjust the nose cone to the front of the holder and tighten the screw.

    c. Place the animal into the holder. Allow the animal to enter the holder freely, using as little force as possible.

    d. Replace the rear gate, ensuring that the animal's tail extends beyond the end of the hatch.

    e. Adjust the nose cone so that the animal appears comfortable but movement is limited.

2. Place the rodent holder with the animal on the Far Infrared Warming Pad. Ensure the entire length of the animal's tail rests on the warming pad. You can use the Non-Sterile Disposable Sleeve Protectors to prevent soiling the warming pad.

3. Place the body temperature sensor between the rodent holder and its tray and the pad temperature sensor on the pad or protector beneath the rodent holder as mentioned (see page 16).

4. Position the Occlusion Cuff (O-Cuff) on the animal's tail.

    a. Place the O-Cuff first so that it is near the base of the tail by sliding the O-Cuff towards the base of the tail until you begin to encounter resistance.

    b. Do not force the cuff onto the tail. It should fit closely, but still able to slide freely. A properly fitting cuff moves freely and fits firmly during inflation.

    c. If a cuff feels tight or cannot reach the tail base, try using a larger O-Cuff. If the cuff slides up the entire length of the tail or fits loosely, try using a smaller O-Cuff.

Figure 4–1

O-Cuff placed on animal tail

5. Similarly, next slide the VPR Cuff Sensor up the tail, with the larger diameter end first, until you reach the O-cuff. Measurements can be detected from any part of the tail as long as a sufficient portion of the tail is inside the VPR Cuff Sensor.

Figure 4–2
VPR Cuff Sensor and O-Cuff placed on animal tail.
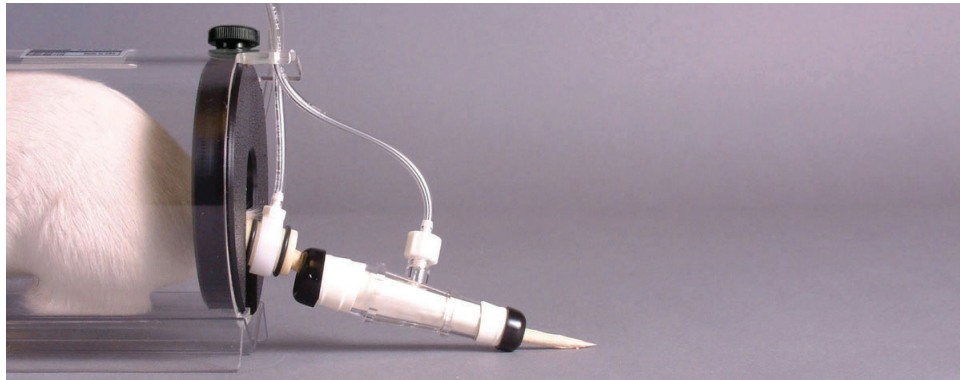
6. Allow the animal to acclimatize.

7. Ensure that the animal has acclimated to the holder and that the tail temperature has reached 32 to 35 degrees Celsius (°C) before taking any measurements. You can measure and confirm the temperature at the base of the tail using the provided Non-Contact Infrared Thermometer with Laser Sight.

8. Place the warming cover over the setup if required, ensuring that the animal still has access to breathable air.

Anesthetized Animal Preparation

1. Similarly, prepare infrared warming pad. You can use the Non-Sterile Disposable Sleeve Protectors to prevent soiling the warming pad.

2. Place the anesthetized animal on the warming pad.

3. Place and secure the pad temperature sensor beneath the animal as mentioned previously (see page 16).

4. Insert the body temperature sensor into the rectum of the animal. Secure the sensor as mentioned.

5. Slide the corresponding Occlusion Cuff and then VPR Cuff Sensor onto the tail of the animal. They should fit closely, but still be able to slide freely along the tail.

Tips & Maintenance

1. Choose a warm, quiet room for blood pressure measurements. Avoid high-traffic or noisy locations.

2. Blood pressures may vary throughout the day. If repeated measurements are necessary, schedule them for approximately the same time each day.

3. Bladders can deteriorate over time. To prolong the life of the cuffs and bladders, store them in the provided storage case when not in use.

4. If you are using an animal holder, ensure that the animal fits snugly. If the animal appears overly constrained, adjust the nose cone or use a larger-size holder.

5. Training sessions may be beneficial for some animals.

    a. If training is required, we recommend three to four 15-minute training sessions in the days prior to beginning your study.

6. When you are measuring blood pressure in anesthetized animals, induce the anesthesia slowly and at the lowest possible dose to minimize the depressant effects of the anesthetic agents.

    a. We strongly recommend inhalant anesthetics at low doses.

7. Cuffs should be neither too tight nor too loose. If the cuffs feel tight, try using a larger size. Properly fitting cuffs will move freely and fit firmly during inflation.

    a. The need for a larger O-Cuff does not necessarily mean a larger VPR Cuff Sensor is required.

8. Before beginning the experiment, verify that the animal's tail temperature is between 32 °C and 35 °C.

    a. Do not start the experiment if the animal's tail temperature is less than 32 °C.

9. Once the experiment has begun, refrain from manipulating the animals.

NOTE:

Prolong the life of your cuffs and bladder by storing them in an air tight container when not in use. Bladder shelf life is approximately a year.

Cuff and Bladder Maintenance

Bladders in both the O-Cuffs and VPR Cuff Sensors require periodic replacement. Replacement bladders are included with your CODA Monitor.

1. Remove the external rubber washers (o-rings) that secure the bladder at each end.

2. Slide the old bladder out through either end of the cuff and discard it.

3. Insert the new bladder into the cuff.

4. Fold the bladder over each end of the cuff.

5. Secure the bladder to the cuff by sliding the o-ring over the ends and toward the middle of the cuff. Be careful not to overstretch the bladder material.

WARNING:

Use only fresh approved pre-measured cuff-bladder replacements. Other materials or replacement bladders could seriously affect blood pressure readings.

Warming Pad and RightTemp Sensor Maintenance

1. Use the Non-Sterile Disposable Sleeve Protectors to prevent soiling the warming pad.

2. Wipe the warming pad clean with a damp cloth if needed. Never saturate the warming pad.

3. Gently wipe the RightTemp Sensors clean between uses.

Cleaning and Decontamination

1. ADInstruments CODA Monitor (Controller)

   a. Keep the controller away from areas of potential contamination. If it becomes soiled, gently spot clean with a damp wipe or towel. Never use liquids directly on the controller.

2. VPR Cuff Sensors and Occlusion Cuffs

   a. Rinse the cuffs with water or clean gently using a germicidal or antiseptic soap and water. Do not use organic solvents or alcohol.

3. Far Infrared Warming Pads

   a. Gently clean the warming pads with a germicidal or antiseptic soap and water. Do not use organic solvents or alcohol.

WARNING:

Do not use any Alcohol (except as indicated) or Abrasive Detergents!

4. Non-Contact Infrared Thermometer with Laser Sight

    a. The sensor lens is the most delicate part of the thermometer. Keep the lens clean at all times. Clean the lens carefully, using only a soft cloth or cotton swap with water or medical alcohol. Allow the lens to dry fully before using it. Do not submerge any part of the thermometer.

5. Rodent NIBP CODA RightTemp Sensors

    a. Gently clean the sensors with a germicidal or antiseptic soap and water.

6. CODA NIBP Rodent Holders

    a. Gently clean these animal holders with a germicidal or antiseptic soap and water. Do not use organic solvents or alcohol.

Chapter 6

Navigating the CODA Monitor

Dial Control

There are two dials, A and B. The function of a dial varies based on where you use it and how you use it (turning or rotating, pressing or holding down). Dials can have specialized uses in a few specific locations, which the display of the controller will provide on-screen instructions in those locations

Table 6-1

Dial functions

| ACTION	DIAL	FUNCTION
Press	A	Back one level from Main Menu Screens
		To Run Screen from Main Menu
		To Run Screen from Touch Button Screens
	B	Select a highlighted Menu item
		To Main Menu from Home Screen
		Clear Alarms if they are enabled
Turn	A	Move through Menu choices
	B	Change setting values at Menus
Hold down	A	To Main Menu from Run Screen
		To Help at any Menu screen
	B	Not Applicable

Touch Screen

The CODA Monitor Touch Screen display offers quick access to features and settings. The Start Display (see Figure 6-1a) is by default after successful recognition by LabChart software.
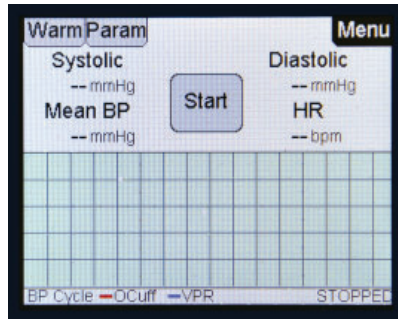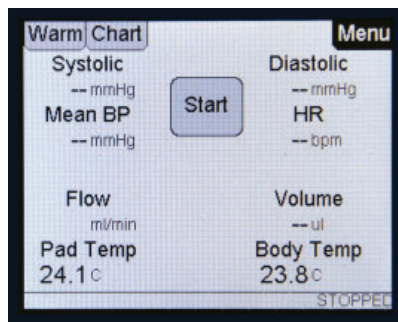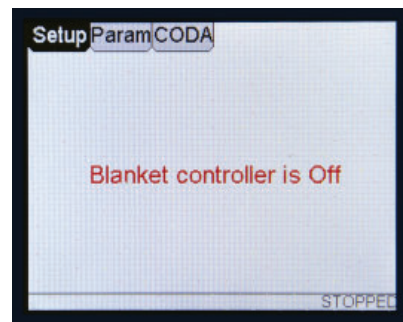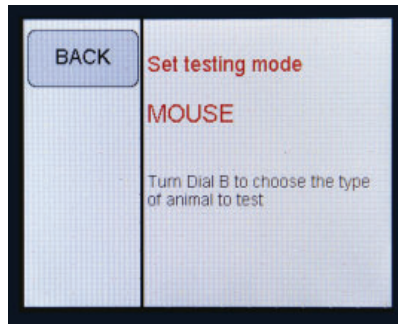
a) Start Display (default)
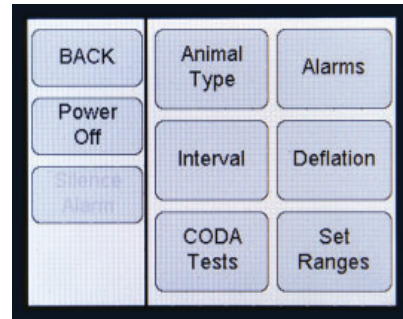

b) Menu Display

c) Parameter Display

d) Warming Display

1.   Touch "Menu" in top right corner of the Start Display to access the Menu Display (see Figure 6-1b), which provides access to several display options (see Figure 6-2):

    a.   "Animal Type" to select either mouse or rat.

    b.   "Interval" to set the time between measurement cycles.

    c.   "CODA Tests" to check if there are any leaks in Occlusion Cuff and/or the VPR Cuff Sensor (see page 36)

    d.   "Alarms" to set various parameter thresholds to trigger alarm notifications.

    e.   "Deflation" to set how long the cuff remains inflated.

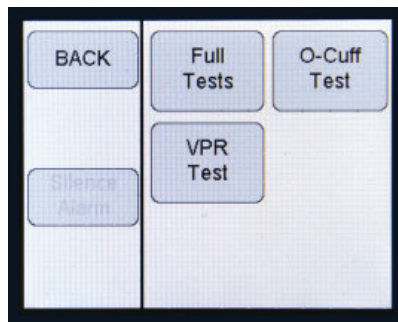   f.   "Set Ranges" to set measurement ranges of certain parameters.
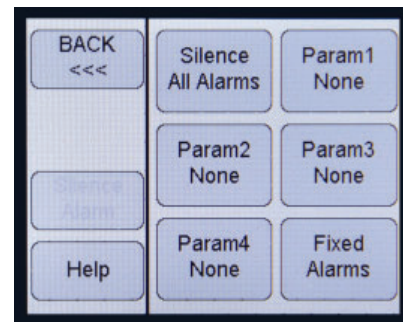
Figure 6–2
Menu
Options

a) Animal Type Display
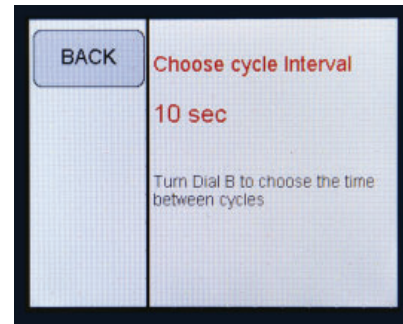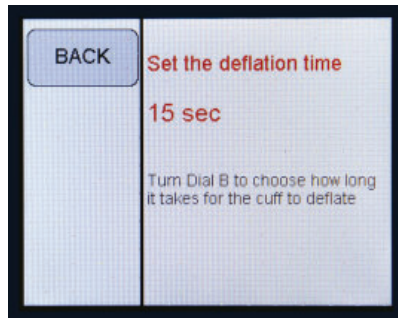

b) Interval Display

c) CODA Tests Display

d) Alarms Display

NOTE:

Set the deflation
time to 15 seconds
for large rats and 20
seconds for mice or
rat pups.

e) Deflation Display
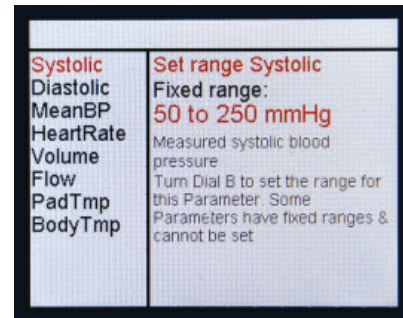
f) Set Ranges Display

2.   Touch "Param" in second from the top left of the Start Display to access the
        Parameter Display (see Figure 6-1c), which is a display that allows you to check
        and compare if the controller has accurately measured and calculated
        the parameters. It has several options:

   a.   "Menu" to access the Menu Display.

   b.   "Chart" to access the Start Display.

   c.   "Warm" to access the Warming Display (see Figure 6-1d).

   d.   "Start"/"Stop" to either start or stop recording within the Parameter
           Display.

3. The Warming Display can also be accessed via "Warm" in the top left of the Start Display, which provides access to its warming options (see Figure 6-2):

   a. "Setup" to access the Warming Setup Display to select and configure warming options.

   b. "Param" to access the Parameter Display.

   c. "CODA" to access the Start Display.

Figure 6–3
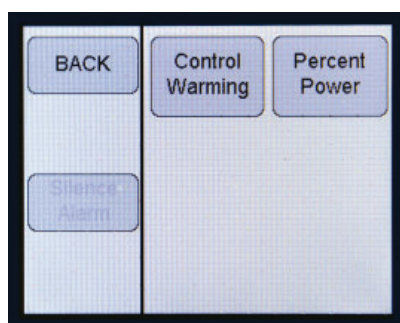Warming Setup Displays with no selected warming.
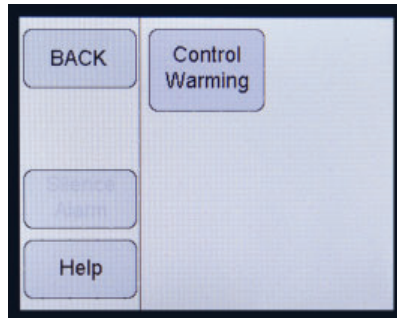
Warming Displays

The ADInstruments CODA Monitor provides two warming options, which are Warming Pad and Homeothermic modes. In Warming Pad mode, the controller provides power to the pad for it to start warming and its warming level is controlled by setting the percentage of maximum power going to the pad, from 0% to 100%. Pad and animal temperatures measured by Rodent NIBP CODA RightTemp Sensors do not offer any control, even if they are used.

The Homeothermic mode provides temperature regulation, which requires the use of both pad and animal temperature sensors that must be first connected to the controller. It allows setting the desired target body temperature (default is 37 °C) and the temperature limit of the warming pad. Once set, the pad will automatically begin warming at 65% warming power until the animal's body temperature is within 6 °C of the target body temperature setting, which will then be appropriately maintained.
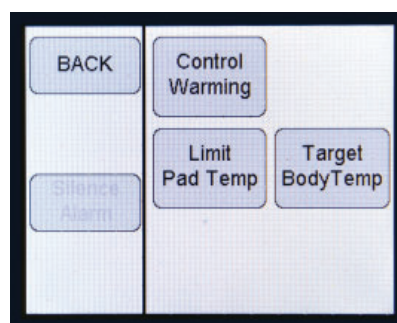
1. To configure the warming options, touch "Warm" in top right corner of the Start Display (see Figure 6-1a).

2. Next touch "Setup" of the Warming Display (see Figure 6-1d).

3. Select "Control Warming" (see Figure 6-3) to choose the type of warming control. Turn Dial B until the desired type of warming is displayed.

    a. "Off" provides temperature monitoring with no warming.

    b. "WarmingPad" provides temperature monitoring with warming by power adjustment and no temperature sensor control. Provides "Percent Power" setting in the Warming Setup Display (see Figure 6-4a).

    c. "Homeothermic" provides temperature monitoring with warming that is controlled by animal temperature sensor. Provides "Limit Pad Temp" and "Target Body Temp" settings in the Warming Setup Display (see Figure 6-4b).

a) Options after selecting
WarmingPad

b) Options after selecting
Homeothermic

⚠️

WARNING:

Warming Pad mode does not include any temperature control. Thus, the pad can become very hot if high power percentages are used!

NOTE:

Animal body temperature can only be regulated when using both sensors in Homeothermic mode. The warming pad temperature limit should be generally higher than the target body temperature.

Figure 6–4
Changes in Warming Setup Display after "WarmingPad" (left) or "Homeothermic" (right) selections..

4. After making your warming selection in "Control Warming", touch "BACK" and the corresponding further options will appear on the Warming Setup Display, which will allow you   to make further settings.

5. If "WarmingPad" was selected, touch "Percent Power".

   a. Turn Dial B to set the percent power for the pad warming. Touch "BACK" to exit.

   b. Touch "BACK" again to return to the Warming Display, which has been updated accordingly (see Figure 6-5).

6. If "Homeothermic" was selected, first touch "Target Body Temp".

   a. Turn Dial B to set the target animal body temperature to be maintained. Touch "BACK" to exit.

   b. Next touch "Limit Pad Temp". Turn Dial B to set the maximum pad temperature, which should be generally higher than the target animal body temperature. Touch "BACK" to exit.

   c. Touch "BACK" again to return to the Warming Display, which has been updated accordingly (see Figure 6-5).

7. After the appropriate warming mode is selected and configured, you can quickly check and make some changes in the Warming Display:

   a. If "WarmingPad" was selected, it will show the set percent power and the text "Unregulated with fixed power" (see Figure 6-5a). Pad and animal temperatures are also properly displayed if Rodent NIBP CODA RightTemp Sensors are used. You can make further changes to the percent power using the "+" and "-" or with turning Dial B. Touch "CODA" to return to the Start Display.

   b. If "Homeothermic" was selected, it will show both measured "Body Temperature" and "Set Target" temperature with the warming status (see Figure 6-5b). "Body Temperature" is color coded to also indicate the warming status (see Table 6-2). You can make further changes to target body temperature using the "+" and "-". Touch "CODA" to return to the Start Display.

Figure 6–5
Temperature monitoring with different warming modes, Warming Pad (left) and Homeothermic (right), which shows that "Body Temperature" is blue because it is below "Set Target" temperature.
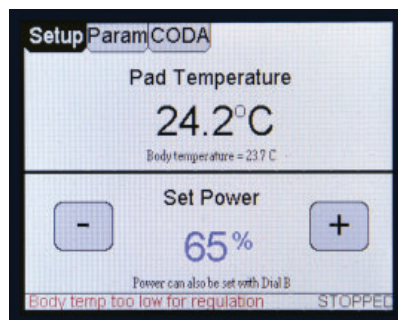
a) WarmingPad Temperature Display
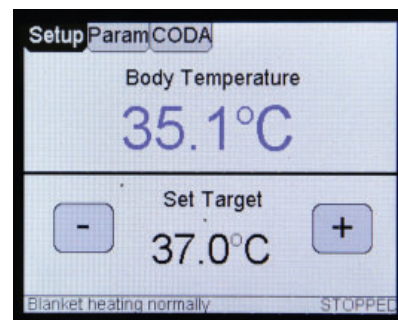
b) Homeothermic Temperature Display

Table 6-2
Color of
body temperature
reading and
associated
warming status.

COLOR	MEANING	AUTOMATED ACTION
Blue	• The "Body Temperature" is below target by at least 1°C.	• The warming pad will actively warm to reach "Set Target" temperature.
Green	• The "Body Temperature" is within the "Set Target" temperature by 1 °C.	• The warming pad will maintain "Set Target" temperature.
Red	• The "Body Temperature" is above "Set Target" temperature by at least 1 °C.	• The warming pad will decrease warming until it reaches "Set Target" temperature.

Figure 6–6
"Body Temperature" is within "Set Target" temperature (left) and above "Set Target" temperature (right).
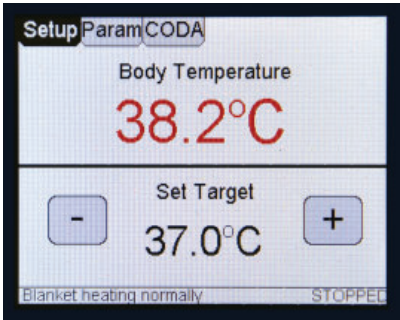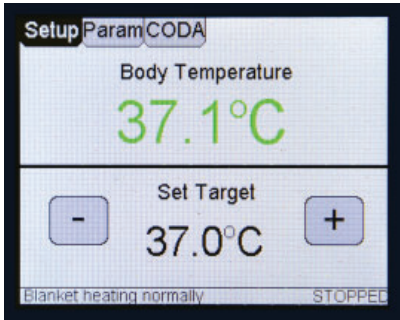
Chapter 7
Troubleshooting

General Issues

ISSUE	POSSIBLE CAUSE	SOLUTIONS
No measurements are recorded.	• Tail temperature is too low.	• Ensure that the base of the tail measures at least 32 °C.
	• Cuffs are wrong size.	• Ensure that the cuffs are not too loose or too tight on the tail.
	• Cuff bladders are leaking.	• Replace the cuff bladders.
Measurements are significantly higher than expected.	• Cuffs are too tight.	• Use a larger cuff. • Slide the cuffs down the tail until they are no longer tight.

Controller's Error Messages

The CODA Monitor Touch Screen display also provides error messages, which are summarized in Table 7-2.

MESSAGE	POSSIBLE CAUSE	SOLUTIONS
Main Line press error CODA cannot reach initial pressure.	• Cuff and/or VPR ports are open or not connected to the cuffs. • Cuff or cuff bladders are leaking.	• Ensure the cuffs are connected tightly to the CODA Monitor. • See "Diagnostic Procedures" to diagnose and determine the source of potential leak.
SBP & DBP unknown VPR curve fails Signature shape test. **SBP, DBP < 1sec** SP & DP separated by less than 1 second. **SBP, DBP > 1/2 cyc** SP & DP separated by more than half data collection time.	• Tail temperature is too low. • Animal is moving during measurement. • Cuff bladders are leaking. • Cuff size is too large or too small.	• Ensure animal's tail temperature measures between 32°C and 35 °C. • Confirm that the cuffs are placed properly on the tail. • Ensure that the cuffs are not too loose or too tight on the tail. • See "Diagnostic Procedures" to diagnose and determine the source of potential leak.
Tail volume too low	• Tail temperature is too low. • Cuff size is too large or too small.	• Ensure animal's tail temperature measures between 32 °C and 35 °C. • Ensure that the cuffs are not too loose or too tight on the tail.

Temperature Control

| ISSUE	POSSIBLE CAUSE	SOLUTIONS
Pad is not heating.	• Settings are incorrect.	• Ensure that all settings are properly enabled for warming and that target temperatures are selected.
	• Connections are loose or incorrect.	• Ensure that the connection on the front of the CODA Monitor is tight.
Pad is overheating.	• Settings are incorrect.	• Ensure that all settings are properly enabled for warming and that correct target temperatures are selected. • Enable a "Maximum Pad Temp" when type of warming is "Body temp regulated" to prevent overheating
	• Sensor placement is incorrect.	• Place pad sensors directly beneath the animal. • Confirm animal sensor is properly placed in rectum
"Lost Sensor" alarm.	• Sensors has been disconnected.	• Reconnect the temperature sensors.
	• Sensors have failed.	• Replace with new sensors. Contact ADInstruments for further assistance.

Detecting Cuff leaks in Controller Display

The CODA Monitor Touch Screen display provides traces indicating the performances of the VPR Cuff Sensor (blue line) and Occlusion Cuff (red line) during an occlusion cycle. Figure 7-1 provides comparisons between a correct occlusion cycle and incorrect occlusion cycles with leaks in either the VPR Cuff Sensor or Occlusion Cuff. The traces in displays that show a nearly horizontal blue line at the start (top and bottom display), indicate no leaks in the VPR Cuff Sensor. However, the middle display shows a sharp drop at the beginning of the cycle, thus indicating a probable VPR Cuff Sensor leak.

Meanwhile, the red line for the Occlusion Cuff drops smoothly in both the top and middle displays, indicating no leaks in the Occlusion Cuff. However, the bottom display shows a sharp drop at the beginning of the cycle, thus indicating a probable Occlusion Cuff leak.
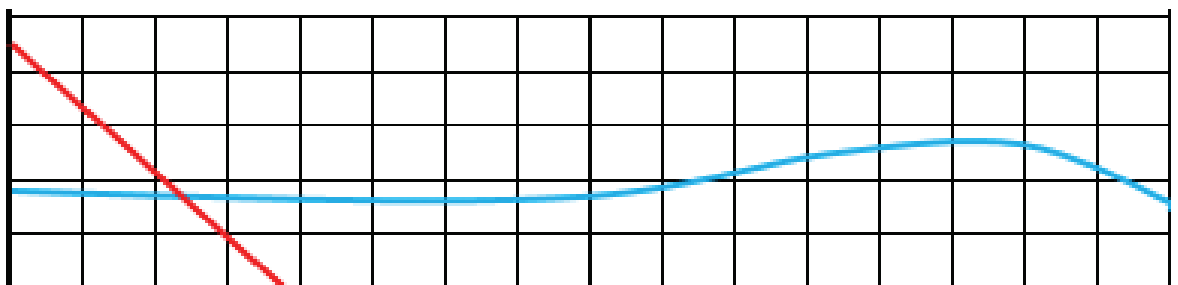
Figure 7–1

Comparing CODA Monitor Touch Screen displays with and without cuff leaks.
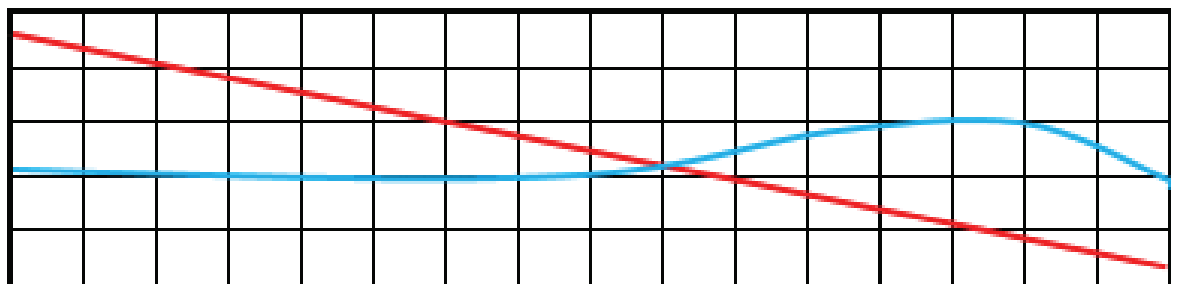
Correct BP Curve
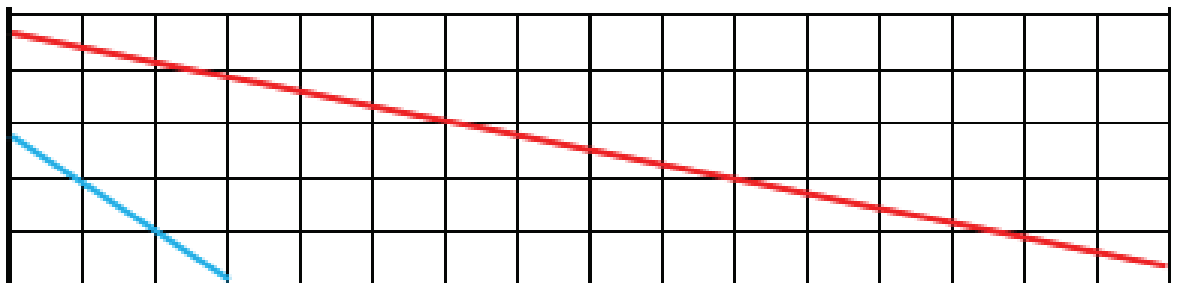
VPR Cuff Leaks

O- Cuff Leaks

Detecting Cuff leaks in Controller Display

1. Ensure that the hardware is properly setup and connected.

2. Touch "Menu" in top right corner of the Start Display to access Menu options (see Figure 6-1a).

3. Touch "CODA Tests" (see Figure 6-1b) to access the test options (see Figure 6-1h).

   a. "Full Tests", provides full pressure test.

   b. "O-Cuff Test", provides Occlusion Cuff test.

   c. "VPR Test", provides VPR Cuff Sensor test.

4. Select the desired test and press the Dial B to start the test.

5. If the resulting message from any of the tests is "Success", then is means that no leaks were found and no action is required.

6. However, if the resulting message from any of the tests is "Fail", then see Table 7-4 for the appropriate action.

Table 7-4
Meaning of failure in the diagnostic tests and the corresponding possible actions.

TESTS	FAILURE MEANING	POSSIBLE ACTION
• Full Tests	• Air Leak.	• Use O-Cuff and VPR Cuff tests to locate the cause of the leak.
• O-Cuff Test	• Air Leak in Occlusion Cuff or bladder.	• Replace the bladder within the Occlusion Cuff and test again.
• VPR Test	• Air Leak in VPR Cuff Sensor or bladder.	• Replace the bladder within the VPR Cuff Sensor and test again.

7. If you are unable to correct the problem, please contact your nearest ADInstruments' representative.

Specifications

CODA Monitor (Controller)

Dimensions (h × w × d):	290 mm x 200 mm x 76 mm (11.41" x 7.87" x 2.97")
Weight:	1.7 kg (3 lb 12 oz)
Voltage:	12 V, 2.5A

Power Supply

Input:	100 to 240 V, 50 to 60 Hz, 1.0 A
Output:	12 V, 2.5A

RightTemp Sensors

Resistance:	2,252 Ω
Operating Temperature:	-60 °C to 150 °C (-76 °F to 30 2°F)
Sensor Ball Tip diameter:	1.65 mm (0.065") max
Sensor Shaft diameter:	1.5 mm (0.059")
Time constant in air:	15s
Dissipation constant:	0.75 m/W (°C)