CODA™ Noninvasive Blood Pressure System

User's Guide for High Throughput Systems

Kent Scientific
C O R P O R A T I O N

CODA™ Noninvasive Blood Pressure System

User's Guide for High Throughput Systems
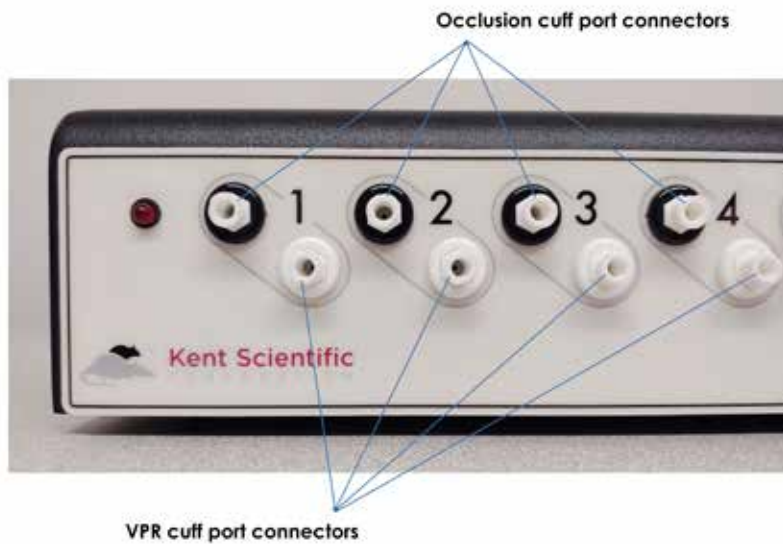
Technical Help: 860-626-1172

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Introduction

The CODA is not designed, intended, or authorized for use in human applications.

System Components

Front Controller Panel

Rear Controller Panel
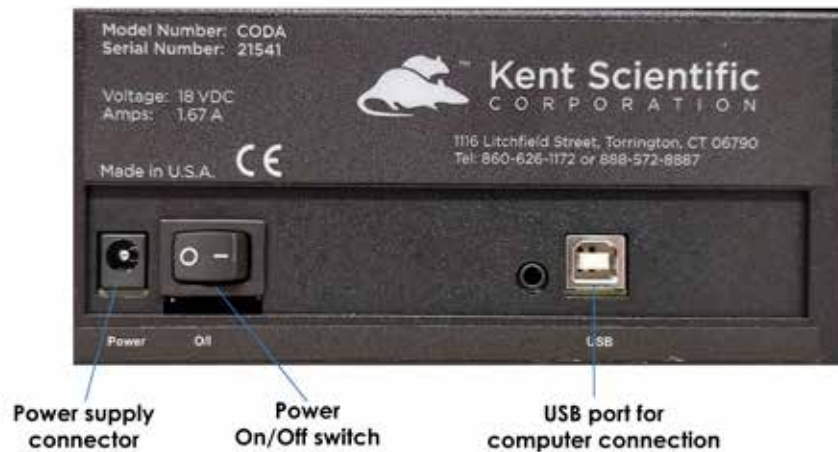
About the CODA Noninvasive Blood Pressure System

The Method

An occlusion tail cuff is inflated to momentarily impede blood flow to an animal's tail. The cuff is deflated slowly and a second tail cuff, incorporating Volume Pressure Recording (VPR) technology, measures the physiological characteristics of the returning blood flow. As the blood returns to the tail, the VPR cuff measures the tail swelling that results 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.

CODA PC Software

The CODA PC software controls the system and allows you to set up, run, and monitor blood pressure from a desktop or laptop computer.

Software System Requirements

Operating System: Windows® 7, 64 bit
                           Windows® 8, 64 bit
                           Windows® 10, 64 bit
Processor: 2.0 GHz or higher
RAM: 2 GB for 64 bit
USB Ports: 1
Cards: Video card, 1024x768 resolution
Internet Connection: Yes

> **If you purchased your PC outside of the US, some of your Regional and Language settings will require adjustment:**
>
> 1. **Open the Windows Control Panel and select Regional and Language Options.**
>
> 2. **At the Regional Options tab, select the language that most closely matches your location, and click Customize.**
>
> 3. **In both the Numbers and Currency tabs, set Decimal Symbol to be a point (.).**

Installing the CODA Software

1. Ensure that your account has full administrative rights.
2. Close all open applications on the PC.
3. Connect your CODA to the PC.
4. Open provided CODA software link.
   (The CODA Software is provided via email link with the subject line "CODA Software Link and Shipping Details". If no link is provided, contact Kent Scientific.)
5. Follow the on-screen instructions to install the CODA software.

> **The CODA software installer cannot be used across multiple accounts on a shared computer system. It must be installed on a single computer under only one account log-in.**

Using the CODA Software

1. Open the CODA Software and select the CODA device.

   o When you open the CODA Software, the Device Manager appears. Click Use All Displayed Devices to proceed using the detected CODA.

   Device Manager Screen:

   Selects displayed CODA system
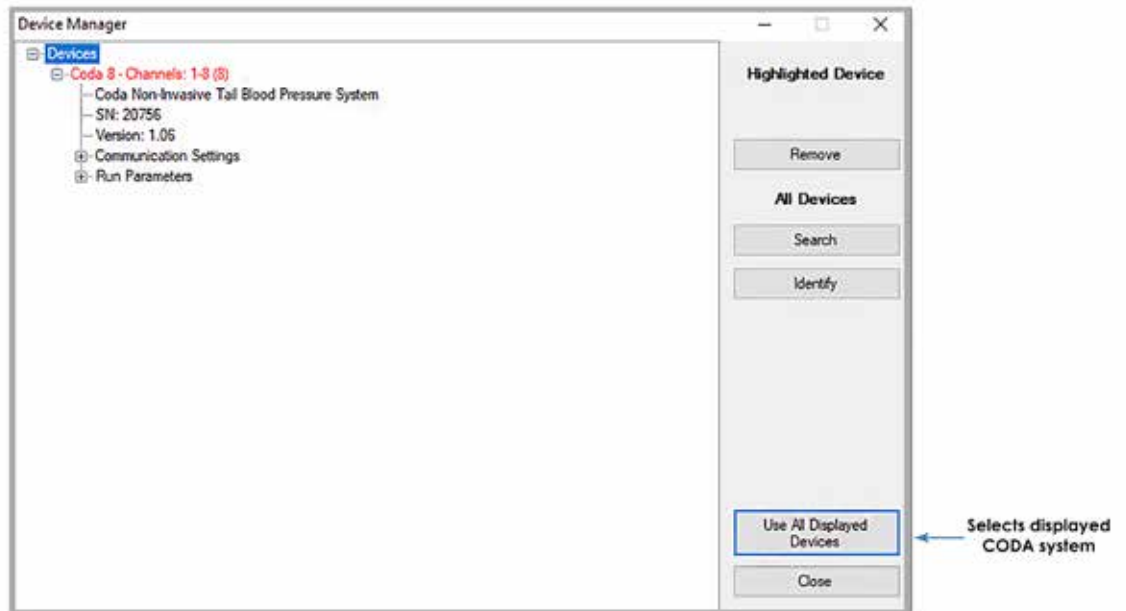
2. Create or add to your list of Users, if necessary.

   o You must create a database of Users, Animals, and Animal Groups for your experiments. You will select items from these categories for each individual experiment you create. Create your database with the User and Animal Manager. You may enter the information for your upcoming experiment only or the information that you plan to use for future experiments.

User and Animal Manager Screen 1:

Add New Record

User and Animal Manager   ?   ✕
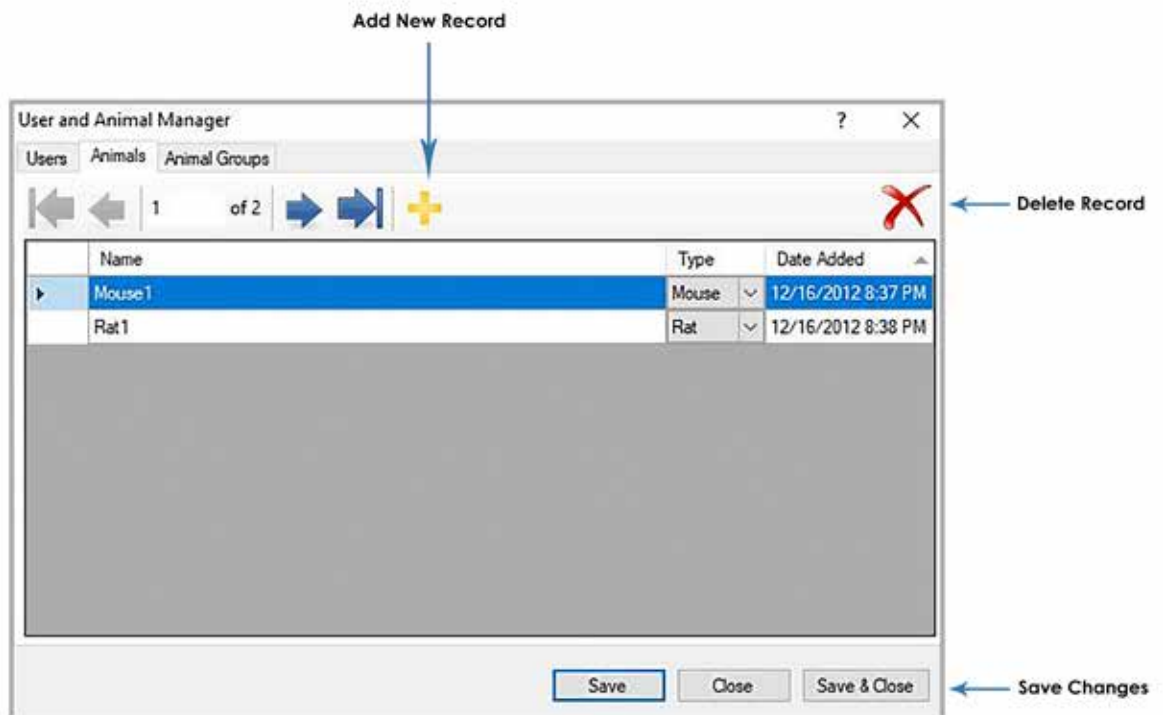
Users   Animals   Animal Groups

|◄ ◄ 1 of 2 ► ►| ➕   ✖ ← Delete Record

Name	Date Added
▸ Researcher1	2/9/2008 5:15 PM
Technician1	1/13/2010 5:30 PM

Save   Close   Save & Close ← Save Changes

User and Animal Manager Screen 2:

Add New Record

User and Animal Manager   ?   ✕

Users   Animals   Animal Groups

|◄ ◄ 1 of 2 ► ►| ➕   ✖ ← Delete Record

Name	Type	Date Added
▸ Mouse1	Mouse ⌄	12/16/2012 8:37 PM
Rat1	Rat ⌄	12/16/2012 8:38 PM

Save   Close   Save & Close ← Save Changes

Add New Record

User and Animal Manager   ?   ✕

Users   Animals   Animal Groups

|◄   ◄   [0.   ] of 0   ►   ►| ✚   ✗ ◄─── Delete Record

Name	Description	User

Animals   **Animals In Group**

Empty Channel 1   No Group Selected
Empty Channel 2   ►
Empty Channel 3
Empty Channel 4   ◄
Empty Channel 5
Empty Channel 6
Empty Channel 7
Mouse1

                              Save   Close   Save & Close ◄─── Save Changes
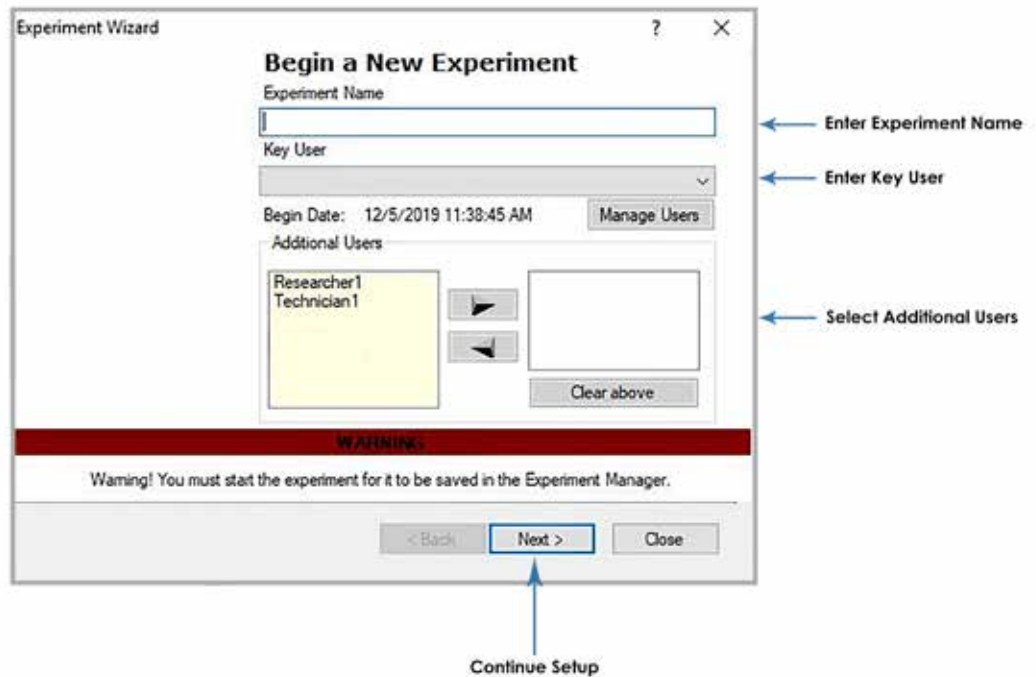
3. Create a new Experiment, and run a new Session of that experiment. Once you have created an experiment, you can return to it later to add additional sessions.

    o Before you can run an experiment, you must create it by giving it a name and assigning Users and Animals. Once you have created the experiment, you can return to it at any time for additional sessions.

Experiment Wizard   ?   ✕

Begin a New Experiment

Experiment Name

[   ]   ◄─── Enter Experiment Name

Key User

[▼]   ◄─── Enter Key User

Begin Date: 12/5/2019 11:38:45 AM   [Manage Users]

Additional Users

| Researcher1
Technician1 | ►
◄ | | ◄─── Select Additional Users |

                                        [Clear above]

WARNING

Warning! You must start the experiment for it to be saved in the Experiment Manager.

        [< Back]   [Next >]   [Close]

Continue Setup

Best Data Practices

- Kent Scientific strongly recommends that you back up your database regularly, and also Export your sessions to a PDF or .csv file after every run.

- Take extra care when deleting records, including Animals, Users, Experiments, or Sessions. In certain cases, this will delete all data associated with that record from your software. Confirm that you have made a PDF or .csv backup of any associated data before deleting records.

- After each session is complete, take an average of the session readings. Be sure to use at least 10 'accepted' readings and increase your cycles as needed. If you are unable to collect 10 accepted readings per session, see Troubleshooting on page 13 and contact Kent Scientific for assistance.
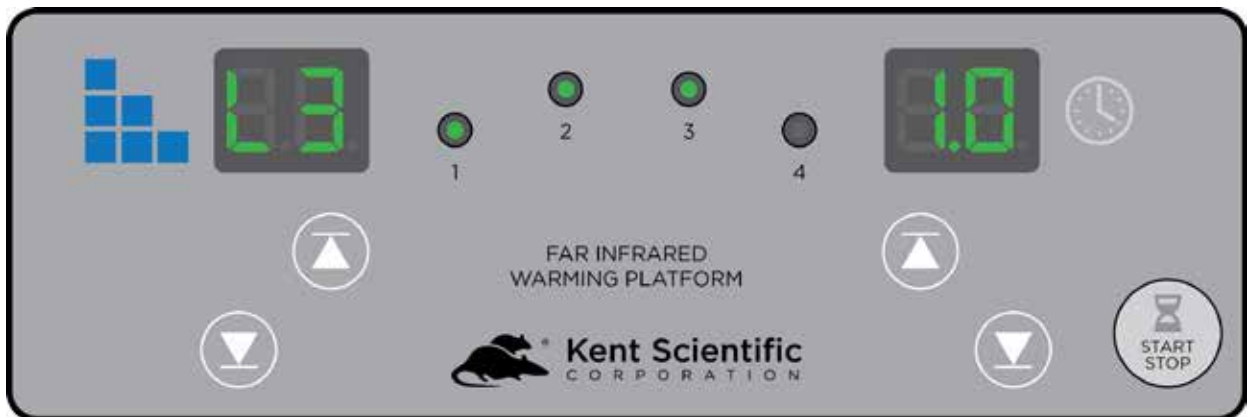
Using the CODA

Set Up Hardware

Cuffs:

1. Attach the VPR cuffs to the white VPR ports.
2. Attach the Occlusion cuff to the black O-Cuff ports.
3. Power on the CODA Warming Platform.

Configure Settings

Warming Platform Settings

1. Press the Up and Down buttons to select a warming level.

> There are 6 warming levels available. Press the Up and Down buttons to scroll through Levels 1-3. Press and Hold the Up button for approximately 10 seconds to access higher levels 4-6.
>
> Tip: Set your platform to Level 3, then adjust as needed.

2. If you are using animal holders, place the empty holders on the warming platform and cover them with the CODA Warming Cover to pre-warm them.

3. Start the warming platform by pressing the START/STOP button on the platform.

4. Allow empty holders to pre-warm while configuring software settings.

CODA Software Settings

1. Open the CODA software.

2. Select the CODA device, then click File > New > Experiment or File > New > Session.

3. Enter session settings:

Experiment Wizard Screen 1:

Tip:

o   **For conscious mice and all anesthetized animals, select a Deflation Time of 20 seconds and a Minimum Volume of 15uL.**

o   **For conscious rats, select a Deflation Time of 15 seconds and a Minimum Volume of 20uL.**

Connect the Animals

1. Once software settings are configured, restrain animals by placing them in holders or inducing anesthesia.

   If you are using the holders:

   a. Remove the rear hatch of the animal 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 hatch, 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.

   > **Tip: If your animal can turn around in the holder, use a smaller holder size.**

2. Place the animals on the Warming Platform.

   > **Tip: Make sure the entire length of the animal's tail rests on the warming platform.**

3. Position the cuffs on the animal's tail:

   • Place the O-cuff first so that it is near the base of the tail. It should slide freely, but fit closely.

   > **Slide the O-cuff towards the base of the tail until you begin to encounter resistance. Do not force the cuff onto the tail.**
   >
   > **A properly fitting cuff moves freely and fits loosely when the cuff is deflated, but firmly when inflated. The O-cuff does not need to reach the base of the tail.**
   >
   > **A cuff that is too tight compresses underlying blood vessels, resulting in poor blood pressure readings.**
   >
   > **If a cuff feels tight, try using a larger O-cuff. If the cuff slides up the entire length of the tail or fits very loosely, try using a smaller O-cuff.**

Occlusion Cuff
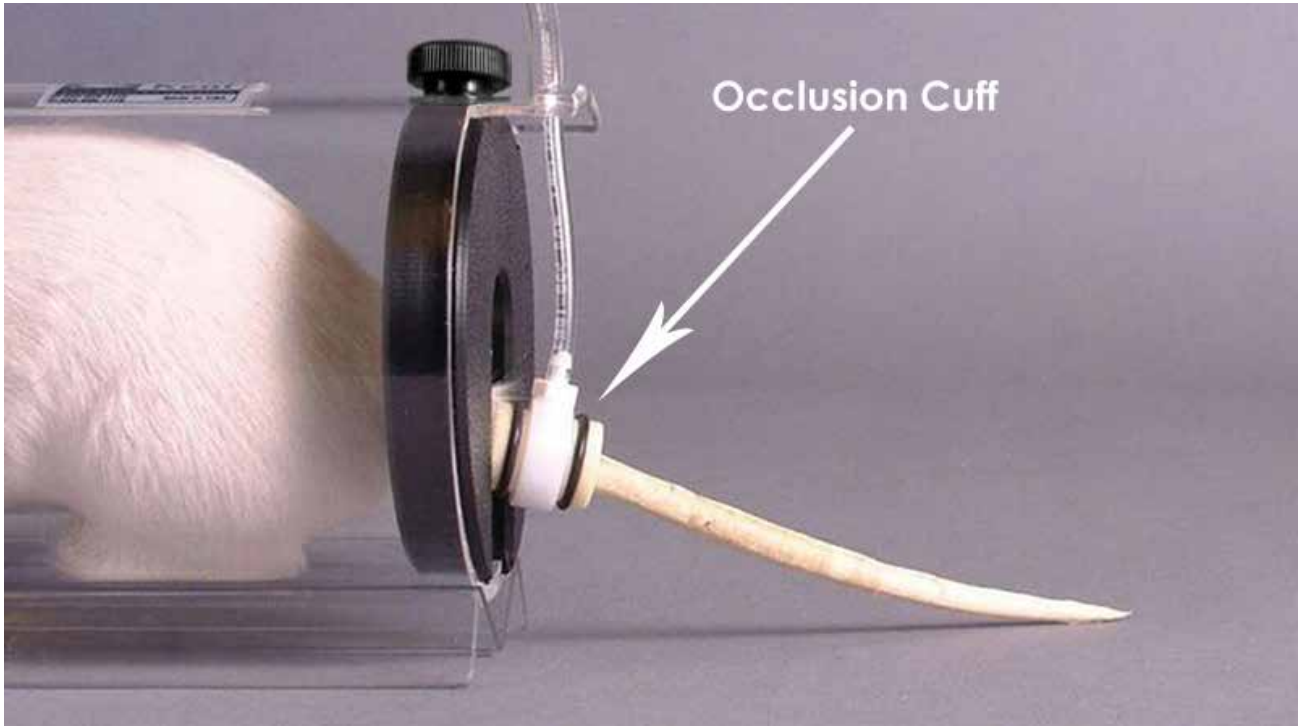
- Slide the VPR cuff up the tail, with the larger diameter end first.

Occlusion Cuff

Volume Pressure
Recording (VPR) Cuff
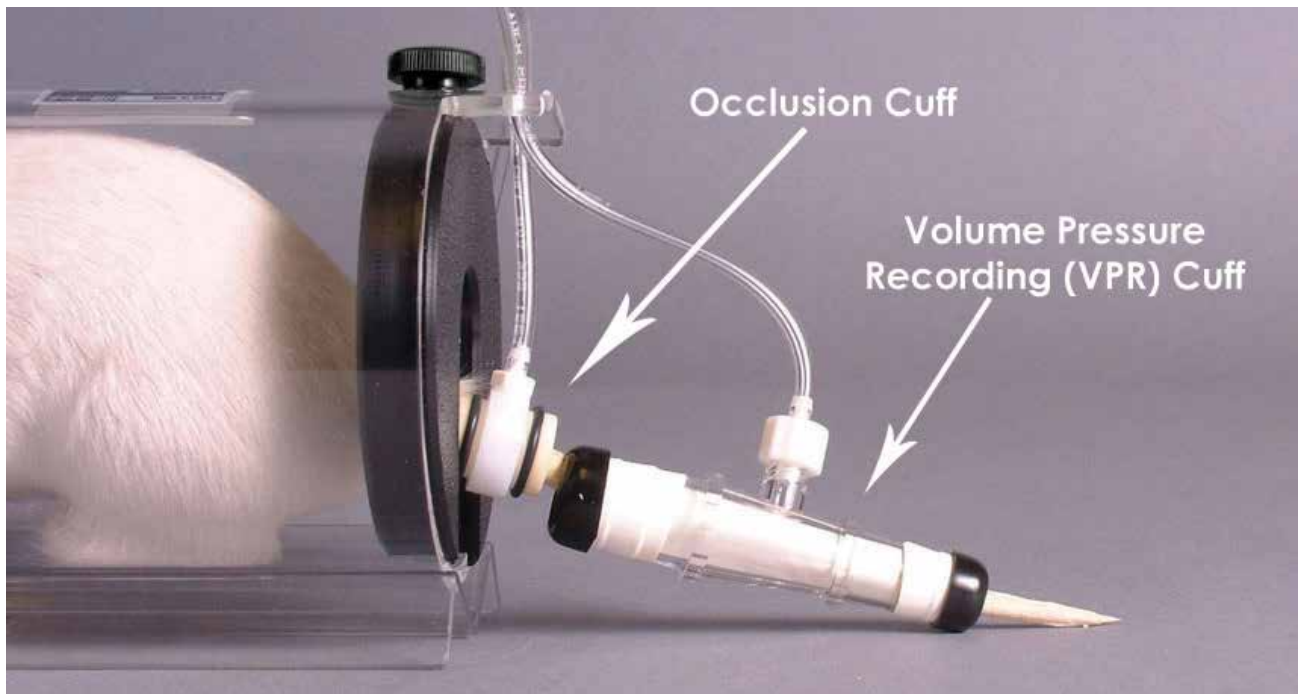
> **Do not force the cuff onto the tail. The VPR cuff does not need to reach the O-cuff. Measurements can be detected from any part of the tail as long as a sufficient portion of the tail is inside the VPR cuff.**

4. Before you begin blood pressure measurements, measure the temperature at the base of the tail with the provided non-contact infrared thermometer. The tail temperature should be between 32° and 35°C.

> **Note: Do not start the experiment if any tail temperature is below 32°C. It may take several minutes for the animals' tails to reach the proper temperature.**
>
> **Animal behavior and physiology, ambient room temperature, and experimental protocols can affect an animal's tail temperature. Some animals may require more warming than others. Closely monitor the animals and adjust warming settings as necessary.**

5. Click Start to begin measurements.

Expected Graph Shape:
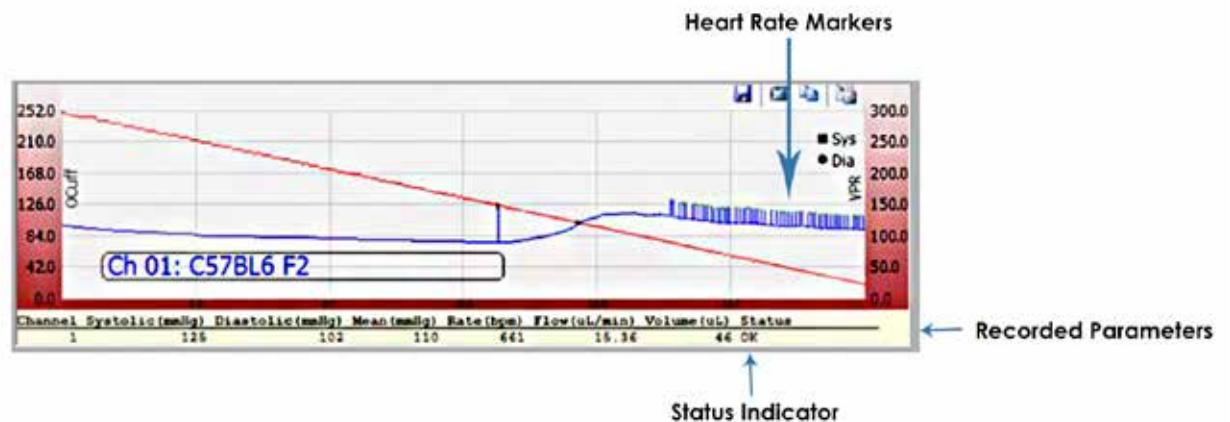
CODA Tips

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

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

- Cuff 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.

- 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.

- Training sessions may be beneficial for some animals.
  - o If training is required, we recommend three to four 15-minute training sessions in the days prior to beginning your study.

- When you use the CODA in anesthetized animals, induce slowly and at the lowest possible dose to minimize the depressant effects of the anesthetic agents.
  - o We strongly recommend inhalant anesthetics at low doses.

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

- Before beginning the experiment, verify that the animal's tail temperature is between 32°C and 35°C.
  - o Do not start the experiment if the animal's tail temperature is less than 32°C.

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

- Be sure to use at least 10 'accepted' readings and increase your cycles as needed. A total of 15-20 cycles per session may be necessary to achieve 10 'accepted' readings.

Diagnostic Procedures / Troubleshooting

CODA Cuff and Bladder Maintenance

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

> **Bladder shelf life is approximately a year. Use only fresh Kent Scientific pre-measured cuff-bladder replacements. Other materials or replacement bladders could seriously affect the accuracy of your CODA system.**

1. Remove the external rubber washers (O-Rings) or caps 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. Be careful not to overstretch the bladder material.
5. Secure the bladder to the cuff by sliding the O-rings or caps over the ends and toward the middle of the cuff.

> **If needed, trim excess material from the ends of the bladders.**
>
> **Avoid twists or wrinkles in the bladder as much as possible.**
>
> **Prolong the life of your cuffs and bladder by returning them to their re-sealable bags and storing them in an air tight container when not in use.**

Device Tests and Other Diagnostic Procedures

To test the CODA controller for internal leaks:

1) Remove the cuffs, and place all of the caps very tightly on each of channels.
2) Set up a new experiment as if you were measuring animals.
3) Start the experiment.

In the event of an error message or deviation from the expected graph shape, contact Kent Scientific Corporation.
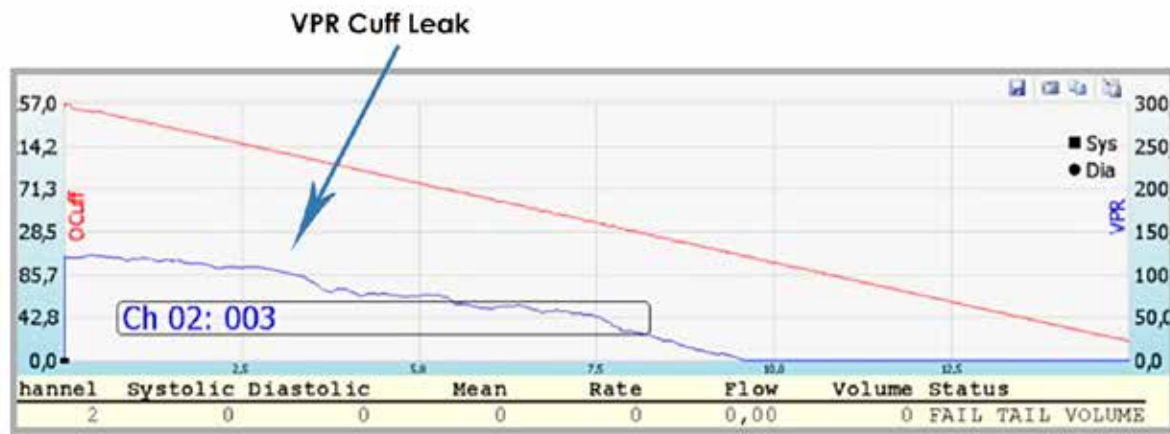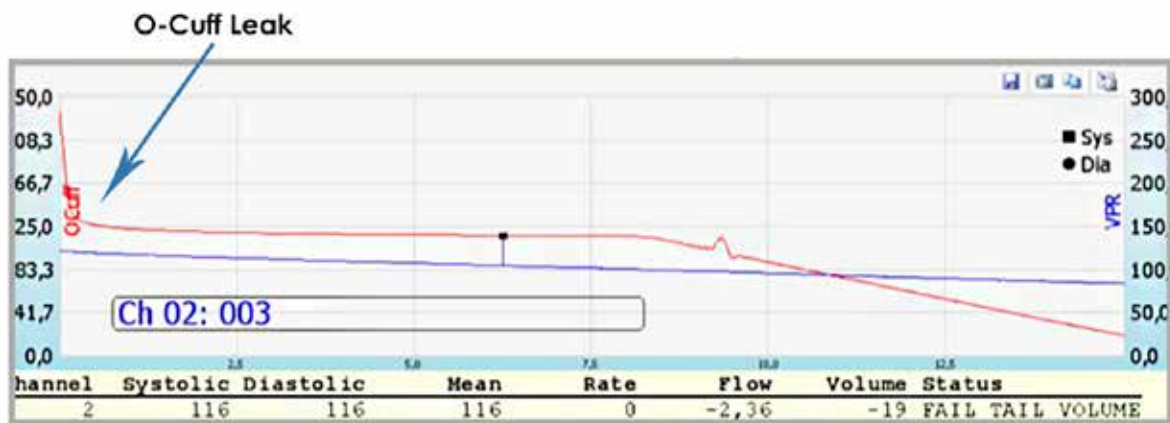
To test the cuffs for leaks:

1) Remove the cuffs, and place all of the caps very tightly on each of the channels.

2) Connect the first set of cuffs to be tested on Channel 1, leaving all other channels capped.

3) Set up a new experiment as if you were measuring animals.

4) Start the experiment.

   a. In the event of an error message or deviation from the expected graph shape, replace the bladders and repeat.
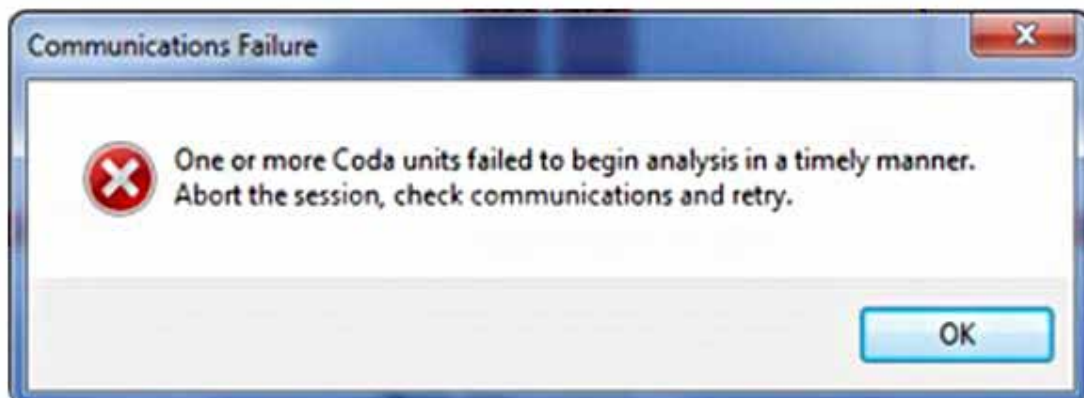
5) Pause the experiment and connect the second set of cuffs, leaving the other channels capped.

6) Resume the experiment and repeat until all cuffs have been connected and tested.

Examples of Cuff Leaks:

O-Cuff Leak

50,0							300
08,3						■ Sys	250
66,7						● Dia	200
25,0							150
83,3							100
41,7	Ch 02: 003						50,0
0,0							0,0

hannel	Systolic	Diastolic	Mean	Rate	Flow	Volume	Status
2	116	116	116	0	−2,36	−19	FAIL TAIL VOLUME

VPR Cuff Leak

57,0							300
14,2						■ Sys	250
71,3						● Dia	200
28,5							150
85,7							100
42,8	Ch 02: 003						50,0
0,0							0,0

hannel	Systolic	Diastolic	Mean	Rate	Flow	Volume	Status
2	0	0	0	0	0,00	0	FAIL TAIL VOLUME

Improving your Data

Problem	Possible Cause	Solutions
Measurements are significantly lower than expected.	Tail temperature is too low.	• Ensure that the base of the tail measures at least 32°C. Increase warming if necessary.
	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.
	Cuff bladders are installed too tightly.	• Re-install new bladders, ensuring that the bladders do not have excess tension inside the cuff.
The graphed blue line is flat with invalid blood pressure values.	Cuffs are wrong size.	• Ensure that the cuffs are not too loose or too tight on the tail.
	Animal is dead or under physiological stress.	• Monitor animal, ensure the tail temperature measures at least 32°C. • If anesthetized, reduce anesthetic dosage when possible.
	Cuffs are no longer on animal's tail.	• Pause the Software and replace the cuffs.
Heart rate values are not detected, or read 0bpm.	Cuffs are wrong size.	• Ensure that the cuffs are not too loose or too tight on the tail.
	Tail temperature is too low.	• Ensure that the base of the tail measures at least 32°C. Increase warming if necessary.
	Software is installed incorrectly.	• Confirm PC requirements for software, and verify all Regional Settings are correct.
	System is detecting outside vibration.	• Ensure that the equipment is in a quiet area, away from any causes of white noise or vibrations.

CODA Software Error Messages

Pop-Up Error Messages:

Error Text	When It Appears	Solutions
No CODA Device was found after examining all available serial ports. Please verify that USB cables are connected and power is ON.	In Device Manager, immediately after launching CODA software.	• Be sure that the CODA is connected and powered on. • Confirm that the CODA is plugged in with the 18V power supply.
One or more CODA units failed to begin analysis in a timely manner. Abort the session, check communications, and retry.	During a reading in an experimental session.	• Test the CODA controller and cuffs for leaks. See Cuff and Bladder Maintenance on page 13.
The path is not valid. Check the directory for the database. [File Path].	When a new experiment or session is created or opened.	• The CODA software installer cannot be used across multiple accounts. Uninstall the software from other accounts on this computer and reinstall on a single user's account.
Could not load file or assemble 'System.Data. SqlServer. [Version information].	When a new experiment or session is created or opened.	• The CODA Software requires SQL Server or Server Express. You may need assistance from your IT department to verify the SQL version on your PC.
The entry format is incorrect.	During a reading in an experimental session.	• Verify that the PC Regional options are set to use decimal point (.) instead of (,).

Problem	Meaning	Solutions
Fail_Tail_Volume	Tail volume is less than the minimum accepted value.	• Ensure that the base of the tail measures at least 32°C and cuffs fit properly. Increase warming if necessary.
Too_Short	The time between the diastolic and systolic readings is too short.	• Reduce the frequency of animal movement by ensuring that the animal is not uncomfortable in the holder. • Ensure that the base of the tail measures at least 32°C. Increase or decrease warming if necessary.
Wrong_Shape	The diastolic value is lower than the systolic value.	• Verify that there is not a leak in the VPR channel. • Reduce the frequency of animal movement by ensuring that the animal is not uncomfortable in the holder.

Cleaning and Decontamination

CODA Controller:

Position the controller away from areas of potential contamination or excessive dust particles. Should the controller become soiled, gently spot clean with a damp wipe or towel. Never use liquids directly on the controller box.

Warming Platform and Animal Holders:

Gently clean with soap and water. Do not use organic solvents or concentrated alcohols.

Occlusion and VPR Cuffs:

Remove the bladders and rinse cuff body and tubing with soap and water. Do not use organic solvents or concentrated alcohols.

General Information

Thank you for purchasing a CODA Noninvasive Blood Pressure System. We truly appreciate your business. We strongly advise that you read and study this Owner's Manual to appreciate the features, benefits, and capabilities of the CODA Noninvasive Blood Pressure System.

Contact Information

Kent Scientific Corporation
1116 Litchfield Street
Torrington, Connecticut 06790
E-mail: sales@kentscientific.com

Toll-Free: 888-5RATTUS (888-572-8887)
Outside US: 860-626-1172
Fax: 860-626-1179
Internet: www.kentscientific.com

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This product is not designed, intended, or authorized for use in human applications.

Product Warranty

The CODA Noninvasive Blood Pressure System has a one (1) year warranty including all parts and labor charges. This warranty does not cover damage by any cause including, but not limited to, any malfunction, defect or failure caused by or resulting from unauthorized service or parts, improper maintenance, operation contrary to furnished instructions, shipping or transit accidents, modifications or repair by the user, harsh environments, misuse, neglect, abuse, accident, incorrect line voltage, fire, flood, other natural disasters, or normal wear and tear. Changes or modifications not approved by Kent Scientific Corporation could void the warranty. The foregoing is in lieu of all other expressed warranties. Kent Scientific Corporation does not assume or authorize any party to assume for it any other obligation or liability.

Satisfaction Guarantee

Should you experience difficulty with the CODA, our Technical Support Group will assist you in trouble-shooting and determining if the product needs to be returned to our facility. We will issue you a Return Manufacturer Authorization (RMA) number before the product is shipped back for repair. It is at the discretion of the manufacturer to replace or repair a defective part or product. Please call Customer Service at 888-572-8887 to obtain a Return Manufacturer Authorization number. Shipments without a RMA number will not be accepted. Please note that after our 30-day return policy period ends, we will be happy to assist you with your application, but cannot issue any credit or refund for a returned CODA.

Prior to shipment, please clean and decontaminate the product of any chemical, biological, or isotopic contamination. Please include a completed Product Return Form with the shipment. The form can be found on page 68 of this Owner's Manual. For additional copies, call Kent Scientific Customer Service at 888-572-8887.

Specifications

Controller

Voltage	18VDC, 1.67A
Max O-cuff Pressure	300mmHg (factory set at 250mmHg)
Dimensions	20.3cmW x 8.9cmH x 19.1cmD
Weight	3.5kg

Power Supply

Input	100 to 240V, 50 to 60Hz, 1.0A
Output	18VDC, 1.67A

CODA Warming Platform

Platform Size	50cmL x 39.37cmW x 5.08cmH
Power	12VDC, 25W

Infrared Thermometer

Measuring Range	-22°F to 482°F (-30°C to 250°C)
IR Accuracy	±3.6% of reading or ± 2°C, whichever is greater
Units	Centigrade or Fahrenheit
Emissivity	Fixed at 0.95
Distance/Target Ration	4:1 (1" target diameter at 4" distance)
Battery	2x CR2032, included

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