VitalView®

Data Acquisition System

Instruction Manual

Software Version 5.1

This document is Part Number 910-0004-08 Rev A

Starr Life Sciences
Warranty Policy

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b) **Duration of Warranty** – The goods sold hereunder are warranted for a period of twelve months, except PDT-4000 and PDT-4000HR, which are warranted for two years.

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   b. that the media on which the Software is distributed is substantially free from significant defects in b) materials and workmanship.

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Thank You! .....for purchasing the VitalView Data Acquisition System from Starr Life Sciences

If you need assistance with VitalView, remember that Starr Life Sciences support continues after the purchase. If you have any problems or questions, please call our Technical Support Staff consisting of technicians, engineers, and scientists. We are available by telephone, fax, e-mail, or website.

Contacting Starr Life Sciences Technical Support

Mailing and Shipping Address

Starr Life Sciences
333 Allegheny Ave, Suite 300
Oakmont, PA 15139
USA

Telephone **(866) 978-2779**
(412) 828-3932

Fax **(866) 978-2779**
(412) 828-3932

E-Mail **technicalsupport@starrlifesciences.com**

Getting Started

This manual is written in the same order as you should assemble and configure your system. To ensure everything works properly, pay particular attention to sections 2 through 5. These sections will guide you through connecting the hardware, installing the software, and most important, properly configuring your experiment.

- Section 1 – *Introduction and Specification* is an overview and specification of the product.
- Section 2 - *PC Interface Card and Software Installation* will help you prepare your computer and load VitalView into your computer.
- Section 3 – *Hardware Installation* tells you how to assemble your system.
- Section 4 – *System Setup* will assure the software will communicate with the hardware.
- Section 5 – *Animal &Group Setup* is the portion of VitalView that will "customize" it to your particular experiment, and define which data VitalView will collect.
- Section 6 – *Data Collection Monitor* is the heart of the actual data collection. You will begin your experiment, and watch as the data are collected.
- Section 7 – *Data Load & Analysis* prepares the raw data for analysis.
- Section 8 – *Appendices* -Details to guide you through specific procedures.

Safety

Some products within the Starr Life Sciences VitalView system contain electronically active components. Examples of safety conventions follow. Please take these precautions seriously, and keep your project safe.

WARNING! *– A warning indicates danger of harm to yourself or your subject, and recommends steps to avoid the problem.*

CAUTION! *– A caution indicates the danger of damage to the hardware, or loss of data, and recommends steps to avoid the problem.*

NOTE: Handy information important enough to highlight, and that may save you time and consternation.

Laboratory Practices

Humidity and Moisture

External VitalView electronic components are not designed to be water-resistant. Receivers and other electronic devices should be kept away from sources of water and high humidity, or wrapped in plastic to provide moisture protection.

Animal Wastes

Animal wastes are extremely corrosive. It is therefore necessary to safeguard against exposing components to their effects. For small animal applications, receivers are not contained within the animals's cage but underneath, providing adequate protection. For applications requiring the receiver to be placed in the cage, please contact Starr Life Sciences for additional information and precautions.

UV and IR Exposure

The enclosures for the VitalView receivers should not be exposed to direct sunlight for long periods. A common sense approach to placement will prevent breakdown of the plastics, overheating of the components, skewing of temperature data, and hyperthermia of the subject.

Connectors

Cables and connectors can be damaged if the cables are improperly seated, or pulled without releasing the fastening screws or latches. Bent pins and broken conductors are a common cause of system failure.

Cleaning

Keeping the enclosures of the receivers clean can be accomplished with a wipe of a damp cloth. Avoid getting water into the end connectors and inside electronics.

Transmitters require special cleaning. Requirements for cleaning and sterilization are discussed fully in the "Implantation Procedure" in the appendix section.

Shipping Requirements

Transmitters

These devices radiate electrical energy and may require special shipping procedures.

Other Devices

Please contact us first for a Return Authorization (RA) number. This will alert us when your shipment arrives, and we will have procedures in place to expedite turnaround.

A VERY IMPORTANT REQUEST!!

Please clean all equipment before returning it to Starr Life Sciences.

For the protection and health of our staff, please sterilize all transmitters and E-Mitters prior to returning to the factory. Sterilization procedures may be found in *"Implantation Procedure" in the appendix section.*

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SECTION

1

INTRODUCTION AND SPECIFICATION

VitalView

VitalView is a software and hardware system specifically designed for controlling data acquisition in laboratory monitoring of physiological parameters. The VitalView System consists of an application program known as VitalView and several types of acquisition hardware, including the Series 4000 transponder/ receiver systems, QA-4 activity input modules, DP-24 digital multiplexer, and more.

VitalView is a system of integrated components cohesively working together as a unit. Depending on your research needs, you may have in your possession a variety of the components. This section explains the function of each product, and will introduce you to the versatility of VitalView. For additional illustrations on system assembly, see Appendix B, "Hardware Configurations."

This manual is organized in the same general order in which you will likely set up your project. This section introduces you to the components of the VitalView System.

Hardware Introduction

VitalView is a data acquisition system that integrates multiple radio telemetry technologies as well as switch-closure activity monitoring into one comprehensive laboratory tool. VitalView is comprised of two systems, each defined according to the topology used for physiological monitoring. Since many customers integrate both systems into a hybrid system, this manual includes instructions on both the Series 3000 and the Series 4000 products.

PCI Interface

VitalView will support the PCI (Peripheral Component Interconnect) interface cards based upon the operating systems listed below:

- Windows 7 (32 and 64 bit)
- Windows Vista (32 and 64 bit)
- Windows XP SP2 (32 bit)

Series 3000 Overview

The VitalView Series 3000 sytem is capable of independently monitoring up to 240 running wheel and motion detecting inputs.

Series 4000 Overview

This system uses PDT-4000 and G2 E-Mitters to acquire animal temperature and activity data. The PDT-4000 and G2 HR E-Mitters acquire temperature, activity, and heart rate data. E-Mitters utilize a technology unique in the physiological monitoring field. These transponders collect data on temperature, heart rate, and gross motor activity for the of the animal. No batteries are required. E-Mitters obtain power from a radio frequency field produced by the ER-lifetime 4000 Energizer/Receiver. VitalView is capable of monitoring 32 individually housed subjects implanted with E-Mitters.

System Specification

Computing Platform

Element	Specification	Condition
Computer platform	Pentium 500 MHz or higher	
System RAM	512 MB or higher	
Hard disk drive	500 MB	Minimum free space
CD Drive		Required
Card bus PCI		Required
Serial bus	19.2 Kbaud	One required for Series-4000 receivers*
Display	Super VGA, 256 color	Minimum
Operating System	Windows 7 (32 and 64 bit), Vista (32 and 64 bit), and XP SP2 (32 bit)	
Computer enclosure	Standard ATX	Full height required for PCI card

*Serial to USB adapter available.

Series 4000 System

Element	Specification	Condition
ER-4000 receiver size	56 cm x 29 cm x 7 cm	
ER-4000 receiver weight	2.6 kg	
Communications type	RS-232 serial	
Communications speed	19.2 Kbaud	
Polling rate	1 per second	
Number of receivers in chain	32	Maximum
Number of receivers per power supply	4	Maximum
Distance between ER-4000 receivers	20 cm	Minimum
Averaging buffer size	2 to 256 seconds	For temperature and heart rate
E-Mitter range	12 cm	Minimum, at center of ER-4000 with E-Mitter oriented longitudinal to receiver.

Series 3000 System

Element	Specification	Condition
DP-24 dimensions	20.5 cm x 25 cm x 6.5 cm	
DP-24 weight	1.8 kg	
DP-24 Communications type	50-pin parallel	
Polling rate	20 times per second	Maximum
Number of input sockets on DP-24	6	Total
Number of receivers per DP-24	6 12	Maximum, when not using dual input module Maximum, when using dual input module
Number of channels per DP-24 socket	4	Maximum
Number of DP-24 channels	24	Maximum
Power supply for DP-24	1	Required
TR-3000 receiver dimensions	30 cm x 22.5 cm x 3 cm	
TR-3000 weight	1 kg	
Distance between TR-3000	20 cm	Minimum
Averaging buffer size	1 to 256 seconds	For temperature
QA-4 dimensions	16 cm x 9.5 cm x 3.5 cm	
QA-4 weight	197 g	
QA-4 input jacks	4	Maximum
QA-4 channels per DP-24	24	Maximum, when using four-each QA-4 modules

Hardware Introduction

PCI Hardware Interface Card

The PCI Hardware Interface Card provides communication between the computer and Series 3000 hardware, such as DP-24 DataPort. The PCI card is plug and play compatible when used with the included drivers.

DP-24 DataPort

This device accumulates activity counts for each channel that is on-line. Samples are continuously taken or counted by the DP-24 DataPort until the PC reads them and clears the storage site for the next sample or count accumulation period. Because of this arrangement, the amount of time the PC must spend accumulating samples is greatly reduced. This allows the system to sample data channels very quickly, and makes possible independent sampling intervals for individual data channels. For more information on integration into the system, see the "DP-24 DataPort" section in Section 3 and Appendix B.

QA-4 Activity Input Modules

The QA-4 allows four switch-closure devices to be monitored using only a single data jack on the DP-24 DataPort. The device has four inputs and four LEDs. Each closure activates a front panel LED. For installation information, see this section in Section 3 and Appendix B.

Running Wheels

Running wheel revolutions are monitored by the system as switch closures. The number of revolutions per sampling interval or "bin" is accumulated by the DP-24 DataPort and communicated to the PC when the sampling time is completed.

Running wheels are typically outfitted with either a magnetic or optical switch. Both allow for silent monitoring to reduce the entrainment effect. Details on running wheels can be found in Section 3 and Appendix B.

Infrared Motion Detectors

Motion detectors may be used with VitalView. Typically these are the types of devices used in security, where motion of an object within the field triggers a switch closure. They may be thought of as switch-type devices similar to running wheels. See Section 3 for more information.

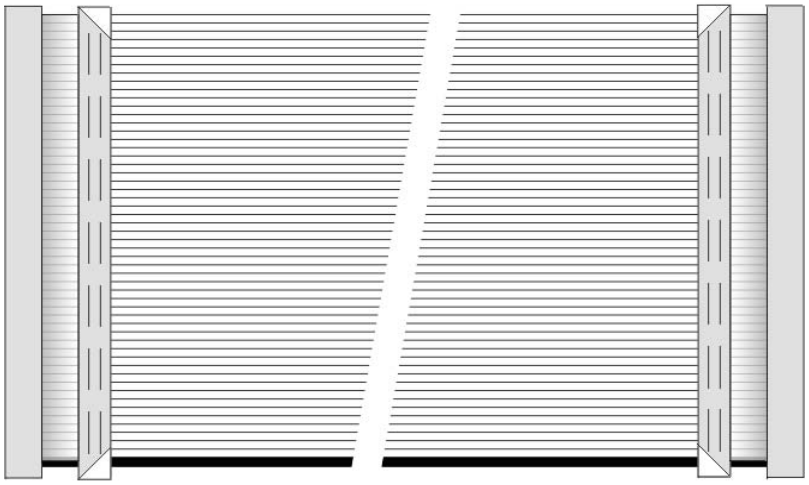
Cabling

Depending on which system you have purchased, several cables may be required to complete a system. The Series 3000 system runs on a parallel platform; Series 4000 runs on a serial platform. Each cable is unique to its application, and can easily be connected properly. Following is a brief description of VitalView cabling.

C-50 Cable

The C-50 cable assembly is a 50-conductor ribbon cable required to connect the DP-24 DataPorts to the Hardware Interface Card, or to interconnect the DP-24's in a "daisy-chain" configuration. Both ends of the cable are female, and are polarized. Care must be taken to insure correct polarity from the Computer Interface Card to the receiver.

C-50 Cable - Note red stripe to ensure correct polarity



NOTE: Maximum length of this cable from PC to the first DataPort is 50 meters. Maximum length of this cable between any two DataPorts is 10 meters. Care should also be exercised to keep these cables away from external noise sources, such as fluorescent lamps, power supplies, etc.

C-8 Cable

The C-8 cable assembly is an 8-conductor "telephone type" ribbon cable required for signal input to the DP-24 DataPort. The connectors on both ends are male, telephone-type RJ-45 plugs. The standard length of this cable as shipped from Starr Life Sciences is 14 feet. When installing C-8 cables, observe the EMI precautions listed in Section 3.

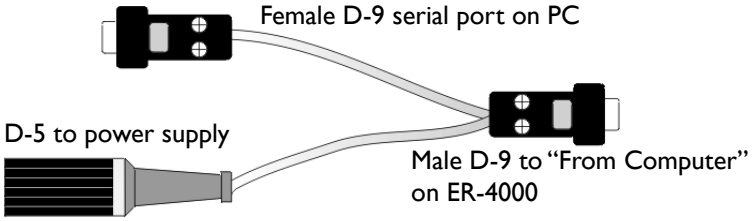
C-8 Cable. Polarity determined by connector

NOTE: This cable is wired straight through, i.e., "A to A," "B to B."

Y-Cable Connector Set

The Y-Cable Connector Set is used to connect power and signal to an ER4000 Energizer/ Receiver, and begin the first unit of a "daisy chain" of serial VitalView monitors. More on the use of this cable can be found in Section 3.

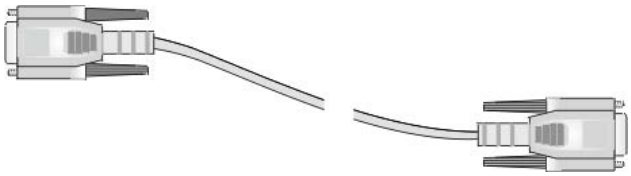
Y-Cable Connector Set



ER Interlink Cable

ER Interlink Cable assembly connects ER-4000 Energizer/Receivers together in serial combination. This cable carries the data and power from one D-9 port to the next unit.

ER Interlink Cable



Dual Input Module

This product allows two dual-channel devices to be connected to one port of a DP-24. The feeding monitor is dual-channel (feeding frequency and feeding duration), and the TR-3000 is dual channel (activity and temperature). The Dual Input Module allows all four channels to be connected to one port of a DP-24. Connection of this product is detailed in Section 3 and in Appendix B.

Series 3000 Receiver*

The TR-3000 is capable of monitoring a radio transmitter as well as switch closures. Temperature and gross motor activity are the two telemetric functions supported, and switch closure data are received via the two auxiliary inputs.

All functions are discussed in Section 2 - Hardware Installation. Further connection details are in Appendix B.

**NOTE: The TR-3000 receiver is no longer available. This manual includes information on the TR-3000 receiver as support for customers who puchased these receivers in the past.*

Series 4000 Energizer/ Receiver

The ER-4000 Energizer/Receiver is capable of monitoring one PDT-4000 E-Mitter/G2 E-Mitter, or PDT-4000HR/G2 HR heart rate E-Mitter. Thirty-two of these units may be placed in a single serial chain connected to the PC serial port. One ER-4 Power Supply may supply up to four ER4000s.

Series 4000 E-Mitters

E-Mitters are able to capture energy from the field of radio waves generated by the coils of the ER-4000 Energizer/Receiver. The energy captured from the electrical field powers the circuitry in the E-Mitter, resulting in a return signal to the receiver. The receiver and E-Mitter are tuned to maximize the efficiency of this exchange.

Depending on the E-Mitter, heart rate, temperature, and activity can be monitored. The E-Mitter has no battery and so may be used indefinitely. More information on selecting an E-Mitter can be found in Section 3.

SECTION

2

PC INTERFACE CARD AND SOFTWARE INSTALLATION

Windows XP Users

The procedures in this manual assume that you are using the "classic start menu" view. To switch to the classic view, right-click on the Start button, select Properties, and click "Classic Start menu." Click OK. to change the Control Panel to classic view, open the Control Panel (Start > Settings > Control Panel) and click "Switch to Classic View."

NOTE: A judicious and systematic approach to setting up the system is imperative. We remind you our Technical Support numbers and addresses are listed in the front of this manual.

Introduction

NOTE: For instructions on how to install VitalView Series 3000 and Series 4000 hardware, see Section 3 "Hardware Installation."

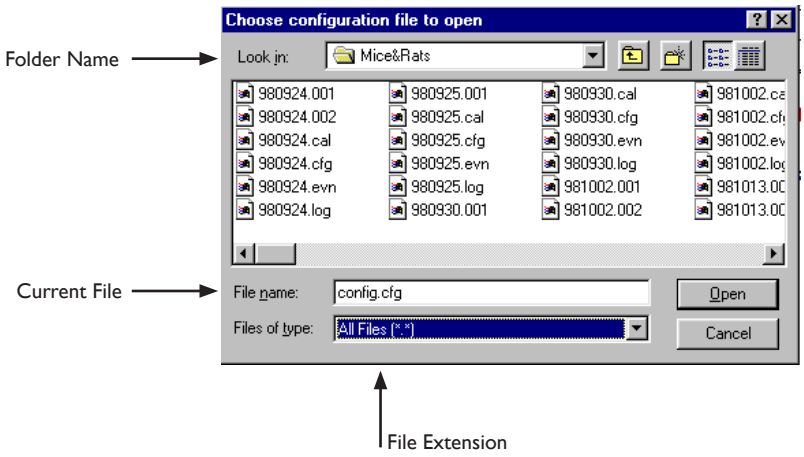
This section describes how to prepare your personal computer for VitalView. This includes adjusting operating system settings, physically installing the PCI Hardware Interface Card in your computer, and installing the VitalView Data Acquisition software.

The VitalView software enables the researcher to incorporate multiple radio telemetry technologies in addition to activity monitoring using switch closures. Although the Series 3000 and Series 4000 systems utilize different technologies for physiological monitoring, both may be used simutaneously as one cohesive system.

Before You Begin - Assumptions

We assume you have a fundamental knowledge of computers, such as Windows operation, and file manipulation and organization. VitalView does not require skills beyond common knowledge such as double-clicking, using pop-up menus, control arrows, click-and-type, etc. Unless you are told differently, "click" means pressing the left mouse button.

Recommended computer skills.



PC Preparation

It is important to configure your PC prior to installing the VitalView software. With your PC set up properly, VitalView will install and run at top performance.

It is recommended that you use the following display settings when using VitalView software. Please see the help documentation for your operating system, or contact Product Support, if you need assistance making these changes.

-Screen Saver: None

-Font (DPI): 96 DPI/Small Fonts

-Screen Resolution: 800 x 600 pixels or higher
1024 x 768 recommended

-Color Resolution: 256 colors or higher

Daylight Savings/Standard Time Changes

CAUTION! Unless this function is disabled, Windows will automatically reset the PC time to reflect changes between standard and daylight time. This may interfere with data collection. One hour of data may be lost and all data time after the time change may be shifted one hour.

Most experiments will not require data collection to span the period in which time changes are experienced due to daylight/standard time. However, it will be desirable to disable the automatic updating of the PC clock in response to daylight/standard time changes.

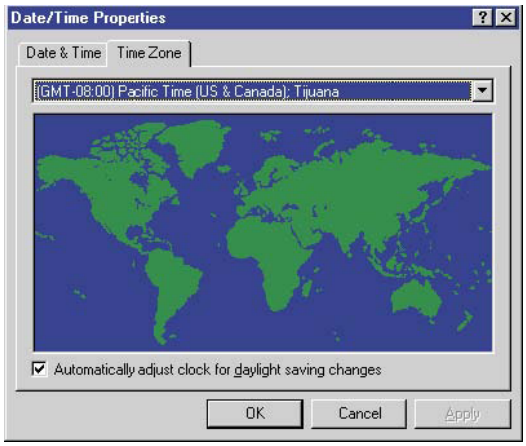
Windows XP

1 From the Windows Desktop click Start > Settings > Contro Panel.

2 Double-click on Date\Time.

3 Select Time Zone tab. The following display will appear.

Access: Start > Settings > Control Panel > Date/Time



4 Uncheck Automatically adjust clock for daylight savings changes.

5 Check for other real clock parameters such as correct time, time zone, etc.

6 Click the OK button.

Windows Vista

1 From the Windows Desktop click Start > Control Panel.

2 Click Classic View.

3 Double click 'Date and Time'.

4 Click 'Change Time Zone'.

5 Uncheck 'Automatically adjust clock for Daylight Saving Time'.

6 Click 'OK', then click 'OK' again.

Windows 7

1 From the Windows Desktop click on the time/date display (typically in the lower right corner).

2 Click 'Change Date and Time Settings.'

3 Click 'Change Time Zone.'

4 Uncheck 'Automatically adjust clock for Daylight Saving Time.'

5 Click 'OK', then click 'OK' again.

An Important Note

It is important while preparing your PC for VitalView research that the above steps are completed, the PC clock set to the correct time, and Daylight Savings clock changes disabled. Once an experiment begins, be aware of the following:

- Do not change the PC time clock once the experiment begins.
- If your experiment spans a Daylight/Standard time change, do not reset your PC clock. At the beginning of the experiment, set your PC clock to whatever time you prefer, and leave it for the duration of the experiment.

Installing VitalView

PC requirements are listed in Section 1. The program and associated files require 50 MB of disk storage space.

Be sure your PC is properly configured as per the procedure at the beginning of this section.

CAUTION! VitalView requires many PC resources; it is strongly recommended a dedicated system be used for data collection. Running other programs while VitalView is collecting data can result in irregularities in system performance, or possible loss of data.

Uninstalling VitalView

Uninstalling VitalView 2.20 or earlier (Windows XP or Vista)

To properly install an upgrade, you should use the following procedure to remove any previous versions of VitalView.

Use Windows Explorer to review the contents of folders with VitalView configuration and data files. In order to load data that has been collected with version 2.20 and earlier into VitalView 3.0, 3.1, or 4.0, it will be convenient to have a record of the times of the first and last data points from the existing VitalView files. You may also use the earlier VitalView version to load data to find these times.

It is recommended all VitalView 2.20 or earlier data be kept separate from version 3.0, 3.1, or 4.0 data.

1. Click the Start button, select Programs, VitalView, and click on Uninstall VitalView.
2. Click Yes to any "Warning! Attempt to erase file with read-only attribute" messages.
3. Wait for the "VitalView uninstalled successfully" message, and click OK.
4. If you had VitalView set up for crash recovery, use Window Explorer to delete the crash.exe shortcut from the Windows > Start Menu > programs > StartUp folder. Also delete any desktop icon shortcuts you created.
5. Use Windows Explorer to check if the installation folder still exists. If it does, it means there are configuration and data files remaining in the folder. (The VitalView installation files will have been removed by the uninstall program.) Rename the folder, or move the configuration and data files to a different folder, then delete the original installation folder.

This completes the uninstall process.

Uninstalling Version 3.0 or 4.0 (Windows XP or Vista)

1. Click on Start, select Settings, click Control Panel, and double click Add/Remove Programs.
2. Select VitalView from the list box, and click the Add/Remove button.
3. Click "Yes" to each of the "Warning! Attempt to erase file with read-only attribute" messages.
4. Wait for the "VitalView uninstalled successfully" message, then click OK.
5. Select NI LabVIEW Run-Time Engine 6.0 from the list box, and click the Add/Remove button.
6. If you had VitalView set up for crash recovery, use Window Explorer to delete the crash.exe shortcut from the Windows > Start Menu > Programs > StartUp folder. Also delete any desktop icon shortcuts you created for VitalView.
7. Use Windows Explorer to check if the installation folder still exists. If it does, this means there are configuration and data files remaining in the folder. (The VitalView installation files will have been removed by the uninstall program.) Rename the folder, or move the configuration and data files to a different folder, then delete the original installation folder.

VitalView Installation - PCI Interface Card

For Windows 7, Vista, or XP.

NOTE: Installation of the PCI Interface Card is only necessary if your system includes Series 3000 hardware (such as DataPorts, TR3000 Receivers, and QA-4 Input Modules). If your VitalView system will only be used to control Series 4000 hardware then proceed to "VitalView Installation for Series 4000 without PCI" in Section 2.

NOTE: Do not install the PCI Interface Card until instructed to do so. The InstaCal drivers must be installed prior to installing the hardware card.

Preliminary

1. If you are upgrading from an earlier version of VitalView already installed on your computer, uninstall the previous version of VitalView. Refer to "Uninstalling VitalView" in Section 2.
2. The CD is set to auto run. Insert the VitalView installation CD into your drive, and wait for the setup menu to appear. The Main Menu includes options to:
   - Install VitalView
   - View Instruction Manual
   - Read about Actiview, a companion program to VitalView
3. If the setup menu does not appear after a few minutes, click Start, select Run, and type:

   D:\cdmenu.exe
4. At the CD Main Menu, click on Install the VitalView Data Acquisition System Software.
5. Click on Install VitalView for PCI Interface Card.
6. Click on 1. Install InstaCal Driver Software and follow the instructions as prompted.

NOTE: When asked to Choose Destination Location, you must select C:\CB or D:\CB for VitalView to operate properly."

7. If the InstaCal installation software prompts you to reboot your computer, allow it to do so.
8. Once the computer has rebooted, shut down the computer completely by clicking Start and selecting Shut Down.
9. Once the computer has powered down completely, proceed with the installation of the PCI Interface Card as shown below. (These instructions can also be accessed from item 2 in the CD setup program under "Install ViewView for PCI Interface Card."

PCI Hardware Interface Card Installation

The PCI Hardware Interface Card plugs into a standard PCI expansion slot in your computer. Expansion slots "expand" the functionality of your computer to run VitalView. the PCI Hardware Interface Card expands the ability of your computer to communicate with Series 3000 hardware devices, such as DataPort and QA-4 Input Modules.

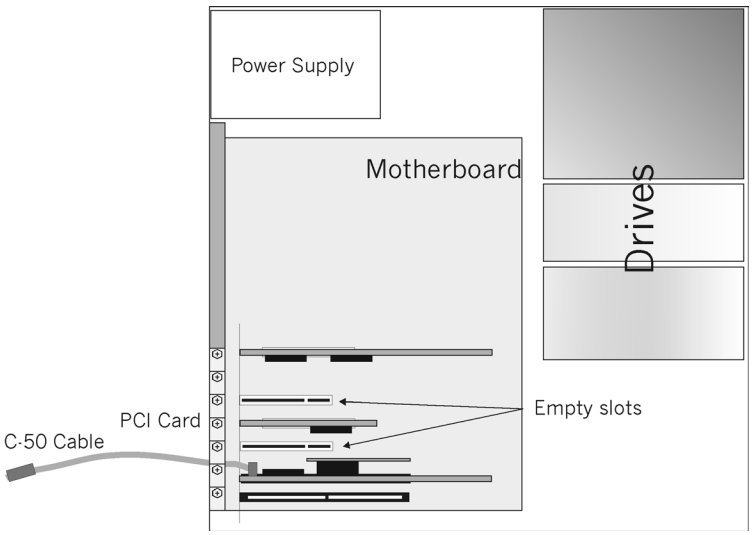
If your system will not include Series 3000 hardware, then the PCI Interface Card is not necessary, and you may proceed to "VitalView Installation for Series 4000 without PCI" in Section 2.

The only tools you should require is a Phillips screwdriver and a static strap.

WARNING! *- Unplug the AC power cord to the computer prior to opening the case. Follow all applicable manufacturer's precautions as well.*

CAUTION! - Hardware Interface cards, like most circuit boards, may be damaged by static discharge. Keep the card in the protective bag until you are ready to insert it. Always handle the card by the edges. We strongly recommend the use of the ESD (electrostatic discharge) suppression strap included with your card. The strap is worn around the wrist, and the other end is attached to a non-painted, metallic part of the PC's frame. It will drain static electricity to the computer's frame preventing ESD damage. Failure to take precautions may result in the destruction of the interface card and the computer.

Consult the illustration which follows for a common PC tower configuration. Computer layouts vary, but most will be configured similarly whether desktop or tower style.



1. Turn off the PC, unplug the power cable, and make sure you are wearing a static strap. Connect the lead from the static strap to the metallic frame of the computer.
2. Remove the cover from the PC. Consult your PC owner's manual for detailed information about your computer.
3. Locate the PCI expansion slots in your computer. These slots are usually white connectors residing on the main circuit board of the computer. Different makes and models of PCs will have a differing number of available expansion slots.
4. Select an available expansion slot. Due to the C-50 cable, the VitalView card may be thicker than other expansion cards. Select an expansion slot that has adequate space.
5. Remove the metal cover from the mounting bracket that corresponds to the expansion slot you have chosen. This cover is typically a narrow metal band attached to the back panel of the PC by a single screw. Save this screw. It will be used later.
6. Carefully remove the PCI Hardware Interface Card from the protective bag. Make sure to grasp it only by the edges. A short, 50-pin pigtail cable is connected to the card. It should not be necessary to remove this connector for installation.

7 Insert the free end of this cable through the mounting bracket on the Hardware Interface card. This cable will exit the back of the PC and connect to the C-50 cable allowing for communication with Series 3000 components. A drawing of this cable can be found in Section 1, Hardware Components.

8 For insertion, the card must be oriented so the metal mounting bracket is directed toward the back frame and the tab connector is down.

9 Grasping the card by the corners so the tab on the card that contains the bus connector points downward, position it over the socket.

10 Insert the free end of the 50-pin pigtail cable through the back of the PC.

11 Gently insert the tab into the socket and press straight down into place.

12 The card should be level when properly placed in the socket, and the metal mounting bracket should be aligned for attachment to the frame with a screw.

13 Permanently mount the card with the screw previously set aside.

14 Replace computer cover.

15 Proceed to software installation below.

NOTE: The VitalView PCI Hardware Interface Card is a plug and play compatible device. When used in conjunction with the InstaCal drivers, this card will find and use free I/O addresses based on your computer's hardware configuration

Final PCI Interface Card Software Installation

1 Turn the computer on. With some operating systems, you should see the Found New Hardware message has appeared, indicating that the PCI-DIO48H board (PCI Interface Card) was found.

2 Once the operating system has loaded, reinsert the CD-ROM, or click Start, select Run, and type:

D:\cdmenu.exe

3 At the CD Main Menu, click on Install the VitalView Data Acquisition System Software.

4 Click on Install VitalView for PCI Interface Card.

5 Click on 3. Run InstaCal Driver Software. The InstaCal program should run.

6 The InstaCal program should automatically detect the new card and display a message. Click "OK" and select File > Exit.

7 Click on 4. Install VitalView Software for PCI and follow the instructions as prompted.

NOTE: You may be prompted to accept a license agreement from National Instruments. This is required to install auxiliary runtime software to allow VitalView to run.

VitalView Installation for Series 4000 without PCI

This procedure should be used only if you are going to use Series 4000 Receivers and you do not intend to use Series 3000 devices, or you are installing VitalView for data analysis purposes. In this case the PCI Interface Card need not be installed. You need only to install the VitalView software.

1. If you are upgrading from an earlier version of VitalView already installed on your computer, uninstall the previous version of VitalView. Refer to "Uninstalling VitalView" in Section 2.
2. The CD is designed to auto run. Insert the VitalView installation CD into your drive, and wait for the setup menu to appear. The Main Menu includes options to:
   - Install VitalView
   - View Instruction Manual
   - Read about Actiview, a companion program to VitalView
3. If the setup menu does not appear after a few minutes, click Start, select Run, and type:

   D:\cdmenu.exe
4. At the CD Main Menu, click on Install the VitalView Data Acquisition System Software.
5. Click Install VitalView for Series 4000 Hardware and follow the instructions as prompted.

NOTE: You may be prompted to accept a license agreement from National Instruments. This is required to install auxiliary runtime software to allow VitalView to run.

Uninterrupted Power Supply (UPS)

It is recommended that the PC be connected to a UPS. Although VitalView has programming that allows it to automatically recover its data collection configuration after a power interruption, a UPS provides a definite margin of security in case of power interruption. It is also recommended that other hardware devices be provided with a UPS as well.

Second Installation of VitalView

This would be an ideal time to install VitalView on a second computer.

With VitalView running while data are being collected, a substantial amount of memory may be being used. If you need to analyze data on an on-going basis, you should install VitalView on a second computer. This will allow you to copy experiment files and perform analysis on one computer without running the risk of interrupting the collection of data on the other computer.

NOTE: If data were collected over a fall or spring daylight savings time change, and a second installation of VitalView is used to load this data, this second computer also needs to be set to not automatically adjust its clock for daylight savings changes.

Adding Crash Recovery

NOTE: Although these modifications are minor, they will alter the way that the computer re-boots from a hard crash such as after a power failure. Following this procedure will result in the computer being able to ***login automatically****, no longer providing password security. If you do not feel comfortable making these changes or are unsure if they should be made, it is recommended that you seek the assistance of a computer technician or information systems administrator.* ***For the automatic recovery feature to properly reboot your system in the event of a crash, you must follow these instructions***

CAUTION! DP-24 devices must always be properly initialized as described in Section 3. If main power is lost to a DP-24 and the device is not properly re-initialized, it will power up in an undetermined state when main power is restored.

Activation of Crash Recovery

To enable the crash recovery program, the PC must be provided with instructions to check for the crash recovery files at startup. This is accomplished by placing a shortcut in the Windows Startup folder.

NOTE: This procedure assumes that only one profile (username, password, domain combination) is used for running VitalView for data collection. Be sure to use the user-name and password combination from this procedure with "Enabling Automatic Logon" which follows.

For Windows 7

1. Use Windows Explorer to navigate to the VitalView installation folder (typically C:\ Program Files (x86)\VitalView). Double click on the folder.
2. Select "crash.exe" and right click on it. Select "Create Shortcut" from the pop-up menu.
3. Select "crash.exe-Shortcut" and right click on it. Select "Cut" from the pop-up menu.
4. Navigate to C:\ProgramData >Microsoft > Windows > Start Menu > Programs > Startup
5. Open the Startup folder and right click on an empty space. Select "Paste" from the pop-up menu.
6. Close Windows Explorer.
7. Click the Start button and type "User Account Control" in the search box.
8. Click "Change User Account Control Settings."
9. Adjust the slider bar on the window all the way to the bottom so that "Never notify" is selected.
10. Click OK.
11. If prompted, reboot your computer.

For Windows Vista and XP

1. Open "Control Panel."
2. Open "Taskbar & Start Menu."
3. Click 'Start Menu' tab, then select 'Classic Start Menu', and then click 'Customize.'
4. Click on Add.
5. Click on Browse.
6. Use the scroll bar or expand the folders to find the VitalView installation folder (typically C:\VitalView or C:\Program Files\VitalView). Double-click on that folder.
7. Select crash.exe and click Open or OK.
8. Click on Next.
9. Use the scrollbar to find the Startup folder. Click the Startup folder and click Next.
10. Click on Finish and OK.

NOTE: The enabling of automatic logon removes password security. If you do not feel comfortable making these changes or are unsure if they should be made, we recommend that you seek the assistance of a computer technician or Information Systems Administrator.

The procedure for enabling automatic logon for the following operating systems can be found on the World Wide Web at the Microsoft Support website under the Knowledge Base articles indicated.

- Windows XP -"How to Enable Automatic Logon in Windows XP "Q315231)" http://support.microsoft.com/default.aspx?scid=kb;en-us;Q315231
- Windows Vista or Windows 7 -"Turn on automatic logon" http://windowshelp.microsoft.com/Windows/en-US/Help/e224c60c0708-48ba-ae97-fcdaddb3dd9d1033.mspx

Launching VitalView

Once installation is complete, you may start VitalView.

- Select the VitalView program icon from the list of programs found with the Start button (Start > Programs > VitalView > VitalView.exe).

NOTE: If you have installed VitalView as an upgrade, your previous data and configuration files will be residing in the folder you renamed per the upgrade installation procedure.

We suggest at this time you review "VitalView Terminology" in Appendix A in the back of this manual. It will familiarize you with the terms used in VitalView.

SECTION

3

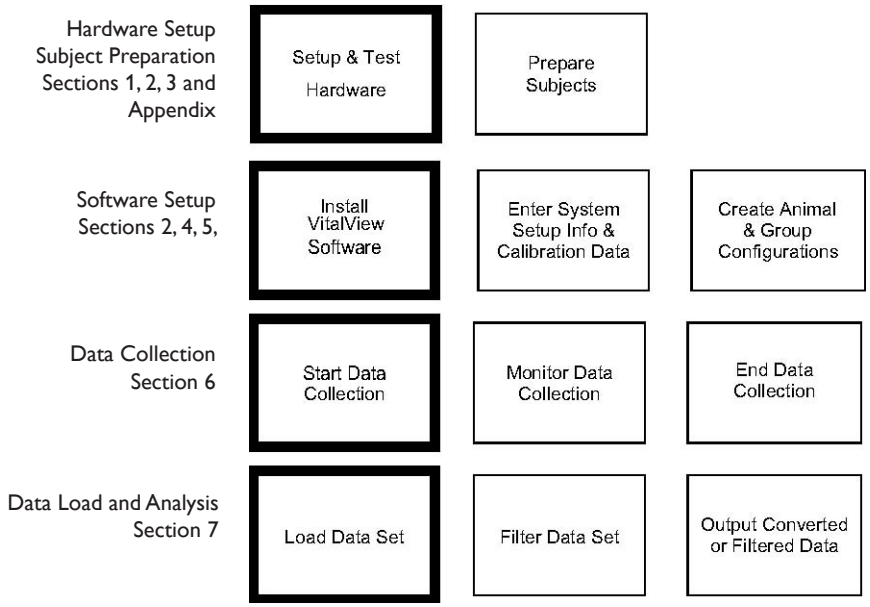
HARDWARE INSTALLATION

This section describes the function of each hardware product, how it is installed, the basic principles of operation, and the means to integrate everything into a working system. This section assumes that, if necessary, you have already installed the Hardware Interface Card as indicated in Section 2, and that you possess basic hardware skills.

Whether you are assembling a Series 3000, Series 4000, or a hybrid system, this section will guide you through the installation process. For illustrations on individual component installation, see Appendix B, "Hardware Configurations."

Flow Chart

The diagram below illustrates the order of events required to complete data collection with VitalView.



VitalView Hardware

DP-24 DataPort

VitalView is capable of supporting ten DP-24 DataPorts. Each DataPort can accept 24 input channels from QA-4 Activity Input Modules, or other switch closure devices. Therefore, many systems will require only a single DP-24.

DP-24 DataPort

Installing the First DP-24

1 Connect one end of the C-50 cable to the 50-conductor pigtail, part of the Hardware Interface Card. Observe polarity. Either match the little triangle on the connectors, or the red stripe on the cable itself.

CAUTION! The following DP-24 connections (Steps 2 and 3) must be made in the specified order to ensure proper initialization. If power is lost to a DP-24 and it is not properly initialized, it may power up in an undetermined state.

2 Connect the 9-volt power supply. The LED on the front panel will confirm power.

3 Plug the free end of the C-50 cable into either of the "Computer Interface" connectors on the back of the DP-24 DataPort. Again, observe polarity.

NOTE: Maximum length of this cable from PC to the first DataPort is 50 meters. Maximum length of this cable between any two DataPorts is 10 meters.

4 Set the ID switch to "0". This will be the DP-24 you can assign to all parameters monitored by the first six receivers, or to other inputs connected to the DP-24 DataPort.

NOTE: Keep the receivers away from the power supply! When planning your system setup, always plan to keep the DP-24 DataPort power supply as far from the receivers as possible with a minimum of 18-inches between them. This will reduce the chances of electrical noise from the power supply interfering with proper telemetry reception.

Installing DP-24s in Series

Because many systems will require more than six receivers or other inputs, connection of additional DP-24 DataPorts will be necessary. For these systems it is necessary to attach the DP-24 DataPorts in a "daisy chain." It is important to observe cable polarity and ID numbers for each unit to insure proper data sampling. Units must be assigned ID values in numerical order from 0 through 9 in order to take advantage of the automatic hardware setting

features of the VitalView software. When all connections are made properly, both 50-pin connectors on all DP-24 DataPorts will be used (with the exception of the last one in the chain). Make the connections in the order described below.

CAUTION! C-50 cables must be kept separate from power cords. These cables are unshielded, and susceptible to interference. It is recommended that C-50 cables not be bundled or occupy the same run with power cables or telephone cables.

1. Connect the first DP-24 as described above in steps 1 through 4.

   (Observe the caution in Section 3.)

2. Connect a new C-50 cable to the remaining open 50-pin connector on the back panel of the installed DP-24 DataPort (DataPort 0).
3. Connect the power supply to the DP-24.
4. The other end of the C-50 cable will be plugged into either of the 50 pin connectors on the second DP-24 DataPort.
5. Set the ID switch on the second DataPort to 1. This will now be referred to as DataPort 1.

   Repeat these steps for every DP-24 added, incrementing the ID switch by one for each additional DP-24.

Connecting the TR-3000 to DP-24*

If using Dual Input Modules, up to twelve receivers such as a TR-3000 can be connected to a single DP-24 DataPort using C-8 cables. One end of the C-8 cable is inserted into the Data Output port on the receiver. The other is inserted into one of the two, 8-pin input connectors on the Dual Input module. The 8-pin plug from the Dual Input module is inserted into one of the input connectors on the DP-24 Dataport.

CAUTION! Keep C-8 cables away from external noise sources, such as power supplies (including the DP-24 power supply), florescent light fixtures, electric motors, high capacity relays and switches, and other sources of electromagnetic interference. EMI may produce erratic signals and erroneous data.

**NOTE: The TR 3000 receiver is no longer available. This manual includes this information on the TR-3000 receiver as support for customers who purchased these receivers in the past.*

Receiver Description and Layout

Complete specifications on the TR-3000 can be found in Section 1.

TR-3000

Activity

This LED indicates any change in transmitter signal strength detected by the receiver. Fluctuations in signal strength are interpreted as activity counts.

Data Out

This 8-pin telephone-type (RJ-45) connector is the source of data output from the receiver to the DP-24. A C-8 cable is plugged into this connector and one of the six connectors on the DP-24 rear panel.

Aux Inputs

These two auxiliary inputs and associated LEDs are for switch closure input from activity monitoring devices such as running wheels. The LEDs will flash with every switch closure.

Range Adjust

This potentiometer allows the user to adjust the operational range of the receiver to fit the specific needs of their monitoring equipment. Adjusting the control clockwise decreases the reception range; counterclockwise increases the range. Before making any adjustments, we recommend you contact a Technical Support Specialist at Starr Life Sciences.

NOTE: Increasing the range is useful for subjects housed in larger cages. However, this increases the susceptibility of the system to electrical noise. Decreasing the range reduces the impact of noise on reception. When the control is turned fully clockwise, the range of the receiver is slightly larger than its footprint. When turned completely counterclockwise, the range is increased to about 3inches from the outside edge of the receiver.

Antenna Inputs

Two external antenna inputs can be installed if the loop antenna input option is specified at the time of ordering. If you would like these connectors enabled, please contact us.

Receiver Functions and Accessories

Temperature Monitoring

Temperature is determined by decoding a string of digital pulses from an implanted transmitter. The frequency of these pulses is temperature dependent. The VitalView system calculates a mean for the frequency of these incoming pulses and places this value into an equation. The equation is further discussed in Appendix D under "Transmitter Sampling Theory."

Activity Monitoring

Any change in the signal strength from an E-Mitter is interpreted by the system as an indication that the transmitter has moved. This is scored as an activity count. The total number of these counts during a sampling period interval or "bin" is recorded by the system. This measure of movement is purely qualitative. There is no quantification of magnitude or direction of movement. Up to ten counts per second can be recorded.

Auxiliary Inputs

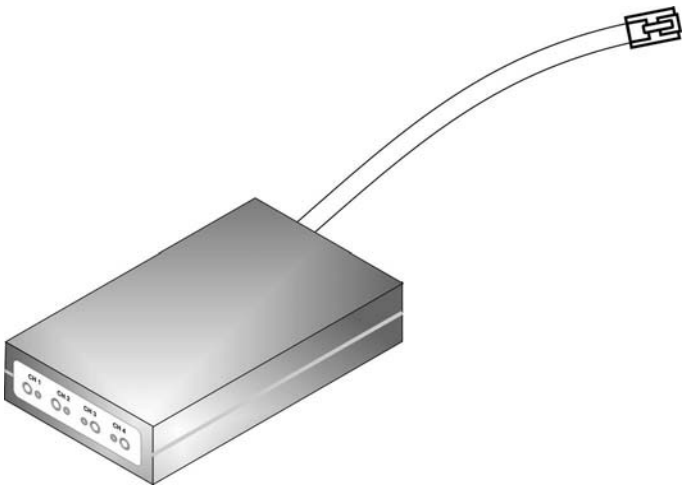
Various types of switch closures can be monitored using the receiver. The most common type is from running wheels. Cables from the monitoring device can be plugged into either of the auxiliary input jacks on the front panel. The switch closures from the sensors are recorded identically to activity counts. No more than ten closures per second can be recorded per sampling interval, or "bin." If these devices are to be monitored alone, it is possible to attach running wheels to a DP-24 input jack through the use of a QA-4 Activity Input Module (see below).

QA-4 Activity Input Module

The QA-4 is a device that accepts switch closures and TTL level inputs. The primary use of a QA-4 is to enable connection of switch closure devices to the VitalView system. The QA-4 accepts closures (up to 10 per second), and converts them into logic level pulses. Active circuitry within the QA-4 rejects switch bounce and ringing, resulting in a clean logic output.

The four input jacks accept two conductor micro-miniature phone plugs. The output is a C-8 cable.

QA-4 Activity Input Module



Dual Input Module

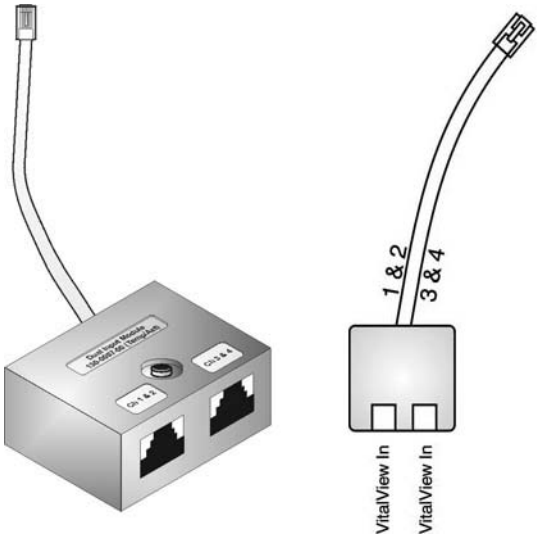
These two accessories are passive devices that enable the consolidation of two, 2-channel devices into one 4-channel DP-24 DataPort input.

The primary uses of the Dual Input Module are:

- Connecting two feeding monitors into one input of a DP-24.
- Connecting two TR-3000s into one input of a DP-24.
- Connecting a feeding monitor and a TR-3000 into one input of a DP-24.

There are two models of Dual Input Modules, each with unique configurations.

Dual Input Module



Dual Input Module – Model A

Jack	Input VitalView Channel Number	Output VitalView Channel Number	Data Type
1	1	1	Temperature
1	2	2	Activity
2	1	3	Temperature
2	2	4	Activity

Dual Input Module – Model B

Jack	Input VitalView Channel Number	Output VitalView Channel Number	Data Type
1	1	1	Temperature
1	3	2	Auxiliary II
2	1	3	Temperature
2	3	4	Auxiliary II

ER-4000 Description and Layout

The input and output connectors as well as the LED indicators are located on the front panel of the ER-4000 Energizer/Receiver. The functions of each are listed below.

ER-4000 Receiver/Transmitter

Signal LED

This green LED will remain illuminated during signal lock with an operating E-Mitter. If it remains off, it indicates loss of signal lock. A momentary on-off indicates an activity count.

Power LED

This red LED indicates whether power has been successfully supplied to the ER-4000. It normally flashes approximately twice per second when power is connected.

From Computer

This is a female C-9 connector. C-9 cable connectors from the ER-4 power supply Y-cable, or a previous daisy-chained ER-4000 may be connected here.

To Next ER-4000

This is a male C-9 connector. The C-9 interlink cable for the next Energizer/Receiver is plugged in here. The last ER-4000 in the serial chain will have nothing attached here.

ID Sticker

Each ER-4000 is assigned an ID number at the factory. This ID number must be set between 1 and 32, and must be unique for each Energizer/ Receiver that is included in a serial chain.

We recommend that you not change ER-4000 ID numbers. If you suspect a different internal ID than what is seen on the ID label, refer to "ER-4000 ID Problems" in Section 4.

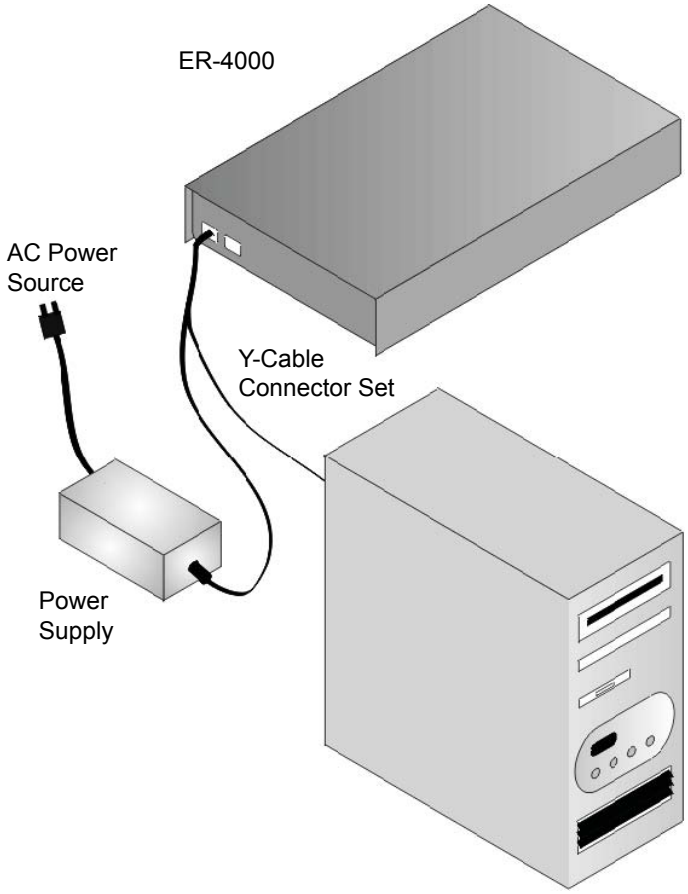
When planning a layout involving multiple ER-4000s, observe the precautions in Section 3.

Single ER-4000 Installation

CAUTION! Before connecting, disconnecting, or reconnecting any of the cables in a single or serial ER-4000 system, remove power from the system by disconnecting the power supply from the AC source. Connecting or disconnecting "live" cables to an ER-4000 may damage the input circuits of the receiver.

A single ER-4000, or the first in a series of ER-4000s requires a Y-cable Connector Set. The female D-9 is connected to the PC, the other D-9 to the ER- 4000, and the D-5 is connected to the power supply. A drawing of this cable can be seen in Section 1.

Single ER-4000 connections



Serial ER-4000 Installation

The serial chain consists of ER-4 Power Supplies and a string of ER-4000 Energizer Receivers connected to the PC serial port or use a USB to serial port adapter. One power supply must be placed in the chain for every four ER-4000s. The first link in the chain must have a Y-cable connector set connected to a power supply and a PC. An additional power supply unit must be "inserted" into the chain for every four ER-4000s. See the illustration, "Connecting the ER-4000 in Series" in Appendix B.

CAUTION! Before connecting, disconnecting, or reconnecting any of the cables in a single or serial ER-4000 system, remove power from the system by disconnecting the power supply from the AC source. Connecting or disconnecting "live" cables to an ER-4000 may damage the input circuits of the receiver.

CAUTION! The horizontal distance between ER-4000 receivers must be no less than 8-inches (20 cm). ER-4000 receivers must not be placed near sources of electromagnetic energy, such as computers and televisions displays, electronic power supplies, telephone cables, etc.

Each ER-4000 has an identification number which can be found on a front panel label. Receivers in the chain do not have to be in a specific order, however, it is recommended that you use an ascending or descending order of the receivers in each experiment. This practice will avoid confusion as to which data belongs to which subject assigned to which receiver. Although this order is not imperative, it is essential that the identification numbers of the receivers in a chain be different. If there is no identification label on the receiver, the ID number can either be recalled or reset.

It is highly recommended that ER-4000s be installed one at a time and verified before installing the next device. If the ID numbers are incorrect, or ER-4000s with the same number are connected in the same chain, problems may result. See "ER-4000 ID Problems" in Section 4.

Tecniplast Running Wheels

Assembling the Wheel

Illustrations and directions on assembling the running wheel and magnetic switch can be found on "Connection for Running Wheel Magnetic Switch" in Appendix B.

Connecting to VitalView

All mechanical switches used for monitoring must be connected to VitalView through an electronic circuit to insure a switch closure is counted as a single event. When mechanical switches are activated, they typically close several times in rapid succession. This property of switches is called switch-bouncing, and the circuits used to keep the multiple closures from being recorded by the computer system are called de-bounce circuits. Two such circuits are available for use with VitalView systems.

If the animal is being monitored by a TR-3000 telemetry receiver, the magnetic switch cable can be plugged into one of the auxiliary input jacks on the receiver. These inputs include de-bounce circuits.

If TR-3000 receivers are not being used (or if both auxiliary inputs are assigned to lick sensors or other units), a QA-4 Activity Input Module can be used to de-bounce the magnetic switch signal.

In either case, an LED indicator next to the jack will light when the switch closes. Each QA-4 Activity Input Module has four input jacks and its output cable is connected to one of six available inputs on a DP-24 Dataport. Therefore, one DP- 24 Dataport equipped with six QA-4 Activity Input Modules can accommodate 24 magnetic switches from running wheels.

1. Plug the cable from the magnetic switch into either an auxiliary input jack on a TR-3000 Receiver, or a jack on a QA-4 Activity Input Module.
2. Verify that the power is turned on to the DP-24 Dataport.
3. Rotate the running wheel and verify that the indicator LED flashes once (and only once) with each turn of the running wheel.

For manual monitoring, magnetic running wheel switches can be connected to individual wheel counters.

Connecting Infrared Motion Detectors

Infrared Motion Detectors

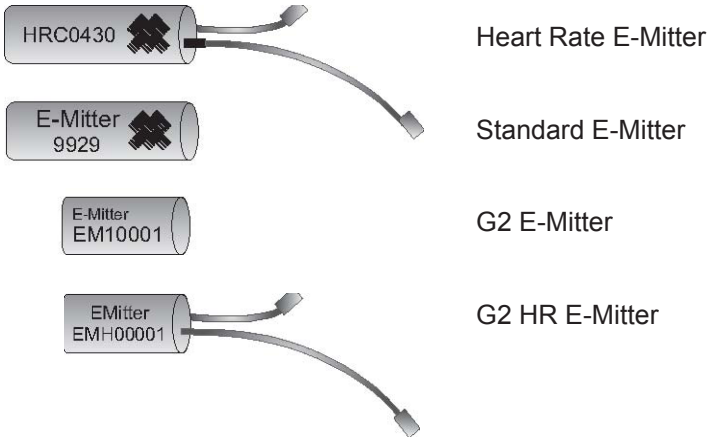
Motion detectors can be connected to either auxiliary input connector on a TR-3000 Receiver. For activity-only systems they can be connected to a QA-4 Activity Input module.

1. Plug the detector cable into one of the two auxiliary input jacks on a TR-3000 Receiver. Connect the motion detector power supply. The installation is complete.
2. If using a QA-4, plug the motion detector cable into one of the four input jacks on a QA-4.
3. The 8-pin connector from the QA-4 plugs directly into one of the six, 8-pin input jacks on the back panel of a DP-24 DataPort.
4. Test by noting if the LED on the receiver or QA-4 flashes when motion is detected.

Series 4000 E-Mitters

These devices are designed for wireless monitoring of activity, temperature, and heart rate. E-Mitters capture energy from the field of radio waves that is set up over the coils of the ER-4000 Energizer/ Receiver. Because the receiver energizes them, these devices do not require batteries to operate. The energy captured from the electrical field powers the circuitry in the E-Mitter and results in a return signal to the receiver. The signal returned to the receiver consists of a train of pulses whose period is dependent on temperature. Circuits in the receiver convert this pulse frequency into a serial bit stream that can be read by a computer.

Series 4000 Heart Rate E-Mitter and Standard E-Mitter



NOTE: The G2 & G2 HR E-Mitters are miniaturized versions of the Standard & Heart Rate E-Mitter. All functions are identical.

E-Mitter Storage

Since E-Mitters have no batteries, they can be stored indefinitely without further consideration. Simply store in a location free from excess moisture and vibration. E-Mitters do not need refurbishment.

Series 4000 Transmitter Selection

E-Mitters and HR E-Mitters are nearly identical in size. The primary difference is the HR E-Mitter has two sensor leads for heart rate data acquisition. The encapsulation process is designed for long-term implantation. The G2 and HR G2 E-Mitters are identical in function to their respective counterparts, except much smaller in size. The performance is identical.

The E-Mitter and G2 E-Mitter gather activity and temperature data. The G2 HR and HR E-Mitter also collects heart rate data.

Implantation

Implantation procedures for both series of devices are located in "Implantation Procedure" in Appendix E.

Principles of Operation

Operational details and description of data acquisition can be found in "Transmitter Sampling Theory" in Appendix D.

SECTION

4

System Setup

Introduction

Before conducting the hardware and software setups and beginning your experiment, it is important to understand the basic concepts of VitalView.

VitalView is organized in a modular fashion, with each module accessed from the Main window. There are also a number of links between the windows. All the windows are arranged in essentially the same order you will most likely use them.

Now that the PC is configured and the VitalView software is ready to run on your PC, the VitalView system must be set up.

VitalView can be thought of as two systems working together. Each one requires configuration, or setup. The hardware system assures all the data sensors are communicating with the PC. The software system controls the experiment and gathers data. Included in the software setups are animal identification and the list of parameters recorded from each animal.

There are four windows on the VitalView Main Window. Each window will be covered in an individual section in this manual.

The Four Windows of VitalView

- System Setup -*Covered in this section*
- Animal & Group Setup - *Refer to Section 5*
- Data Collection Monitor – *Refer to Section 6*
- Data Load & Analysis – *Refer to Section 7*

The Five Primary Files of VitalView

These files are discussed fully in Section 6 - "Data Collection Monitor."

- .cfg - *Configuration*
- .cal – *Temperature calibration*
- .evn -*Event configuration*
- .log – *List of data files*
- .001, .002, .003, .004, etc. – *Data files*

VitalView Filenames

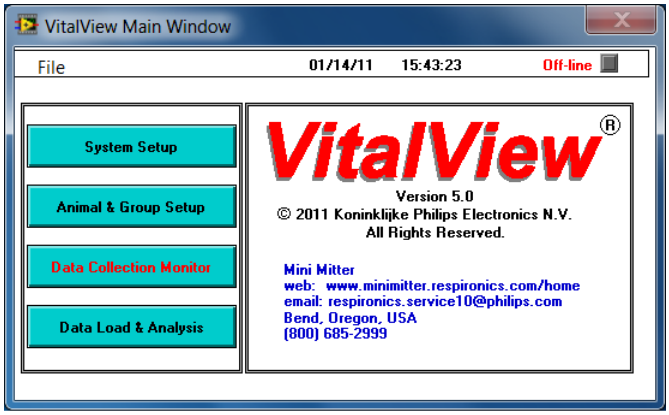
The conventions for naming VitalView files are consistent with Windows operating systems.

NOTE: The .evn file is obsolete in VitalView version 5, but is still produced by VitalView version 5 to maintain file compatibility with older versions of VitalView.

Main Window

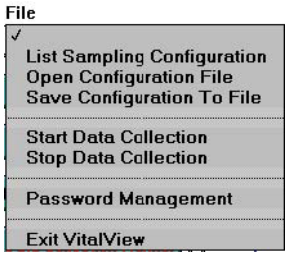
There are several important functions which take place from the Main window.

VitalView Main window



Main Window File Menu

Access: Main window > File



List Sampling Configuration

This selection displays a table containing a list of the current set of animal configuration data for the currently loaded configuration file. This table contains ID, hardware channel, parameter and clipping limit, and interval information for each enabled parameter. This information may be printed or saved to disk using buttons at the bottom of the display. At VitalView startup, this list will be empty until a previously saved configuration file has been opened, or new configuration information has been entered.

Open Configuration File

Opens previously saved VitalView configuration files for use or editing. A file dialog will appear showing all the .cfg files that are available in the current folder.

Save Configuration to File

This command saves the current VitalView configuration. This configuration file will include the current temperature calibration values (*.cal file) and event setup (*.evn file). Whenever a configuration is saved, a file dialog will appear showing all of the previously saved .cfg files in the current folder. A name for the file may be entered, and the .cfg extension is automatically added by the system.

Start Data Collection

After creating (or opening) a configuration for VitalView, this command starts data collection at the beginning of an experiment.

Stop Data Collection

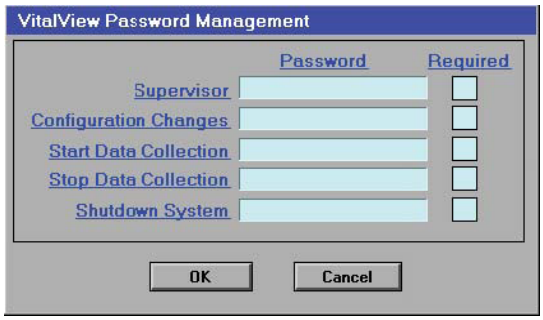
This command halts data collection. A confirmation prompt will be issued prior to shutting data collection off in case a mistake was made in selecting this option. In the future if you restart data collection using the same configuration, give the new experiment .log file a new name.

NOTE: If you persist in choosing an existing filename, the previous file will be overwritten.

Password Management

Password protection is provided to prevent unauthorized persons from tampering with the data collection process.

Access: Main window > File > Password Management



Supervisor Password

This is used to restrict access to the Password Management dialog box (above). Once a password has been entered and the checkbox activated, VitalView will require correct entry of the password to edit any of the subordinate passwords.

Configuration Changes

When the checkbox is activated, this password protects the system from unauthorized editing by restricting access to System Setup and Animal & Group Setup. It also restricts Open Configuration File and Save Configuration File from the Main window file menu.

Start Data Collection

When this checkbox is activated, data collection may only be started after entering the correct password.

Stop Data Collection

When this checkbox is activated, data collection may only be stopped after entering the correct password.

Shutdown System

When this checkbox is activated, VitalView may only be shut down after entering the correct password.

Exit VitalView

Leaves VitalView and enters the Windows operating environment. This will stop active data collection. If this is attempted while data collection is on, the system will produce a confirmation prompt.

On/Off-Line Indicator

This indicator informs you whether VitalView is gathering data or has been taken off-line.

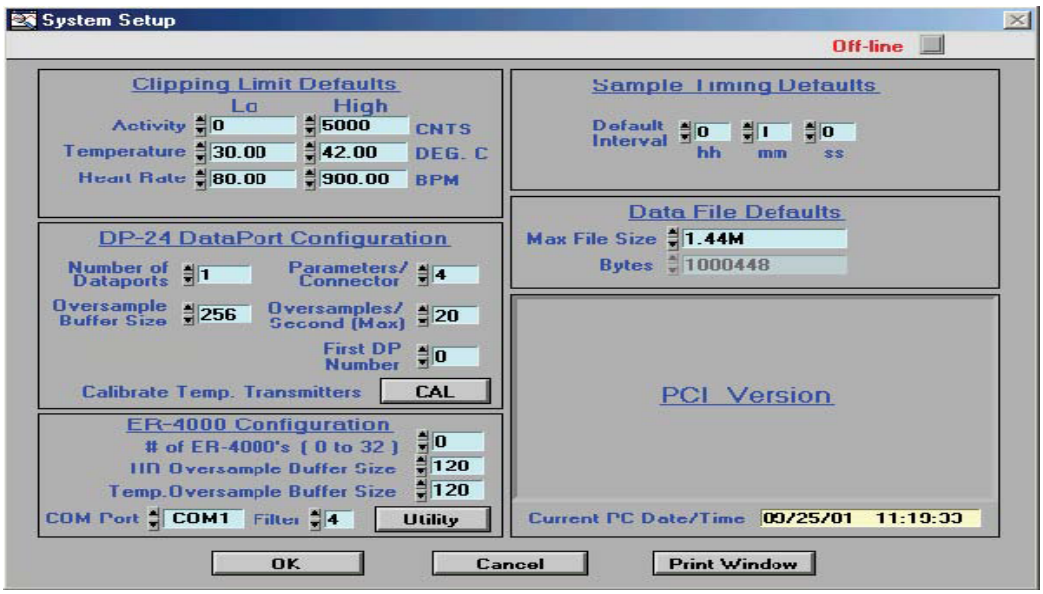
System Setup Main Window

Introduction

System Setup provides access to system-wide default settings to setup the sampling routine and automatically configure the hardware. These settings are critical to the operation of the system. It is essential that they be properly set prior to the initiation of data collection. After they have been initiated, the settings will automatically be used for any new animal configuration or data collection as part of a .cfg file. They can be manually over-ridden by using Animal & Group Setup.

System Setup consists of five panels, each one related to a specific area.

Access: Main window > System Setup



NOTE: Values may be changed by clicking in the field and typing in the value, or using the arrows. Holding down the shift key will accelerate the change in value.

Clipping Limit Defaults

Clipping limits specify the acceptable data range for each of the parameters that can be monitored by the system. Typically these are set to the physiological limits for that parameter.

These values will automatically be inserted into new animal configurations as they are created. Later, if you wish to change clipping limits for any particular parameter, you may do so in the Animal & Group Setup display. Activity is measured in counts; temperature in degrees Celsius; heart rate in beats per minute.

Out of Range Values

Samples that fall outside the clipping limits will not be recorded in the data file. Instead they will be noted by a -10 in the data record. Later, during data analysis, you may elect to "filter" data to remove these values.

NOTE: Clipping limits are designed to remove data values that are not relevant to the physiology of the animal, and replace them with a –10 value. Setting the values too wide may allow for some irrelevant data points to be recorded in the data set. Setting the values too narrow will exclude relevant data. If you are testing the system with temperature transmitters at room temperature, please be certain that clipping limits are set accordingly.

DP-24 DataPort Configuration

The DataPort Configuration panel is for use with Series 3000 hardware. The information entered is used by the system for automatic configuration and temperature calculation purposes. Series 4000 users will only need to use this panel to access the temperature calibration display.

Number of Data Ports

The number of DP-24 DataPorts that are connected to VitalView is entered here.

Oversample Buffer Size

This is a buffer that influences the way in which temperature samples are taken for the Series 3000 temperature inputs. Unless you are planning to sample from a large number of transmitters at a fast rate, we recommend leaving this value at the default value of 256 samples. For details on temperature acquisition, see "Transmitter Sampling Theory" in Appendix D.

Parameters/ Connector

This is the maximum number of different parameters that will be input to the DP-24 on a single connector. Up to four parameters may be selected. Usually this number will be set to two or four.

This value is used during automatic configuration to assign hardware channels for Series 3000 components. Therefore it is important that this value be set properly prior to copying animal configurations.

Oversamples/ Second (Max)

This sets the rate at which VitalView will sample from a single Series 3000 temperature transmitter. Twenty is the maximum number of samples that can be recorded per second by VitalView. Unless you are planning to sample from a large number of transmitters at a fast rate, we recommend leaving this value at the default of 20 samples per second. (At a rate of 20 samples per second, it will require 13 seconds for VitalView to fill the buffer to capacity with 256 samples.)

NOTE: Over-sampling is recommended. This will reduce the number of artifacts found in data records as a result of sudden changes in body position, or electrical noise which can interfere with the reception of radio signals from the implanted transmitters. If you are recording data points every few minutes, then default settings for the buffer size and fast sampling rates are recommended. These values should be changed if you are recording points from a large number of animals every few seconds.

First DP Number

This setting determines the first DP-24 ID that will be available for data collection. Each DP-24 must have a unique ID value in order to properly report data. This value will automatically be written into the DP-24 ID number field of new animal configurations when they are created.

Calibrate Temp Transmitters

This button opens the Transmitter calibration display. All temperature.parameters must have calibration information assigned to them prior to data collection. Instructions for entering calibration settings can be found in the Animal & Group Setup in Section 5.

ER-4000 Configuration

The ER-4000 Configuration panel is for use with Series 4000 hardware.

Number of ER-4000s

This is the total number of Energizer/Receivers that will be placed in the serial chain. A maximum number of 32 ER-4000 Energizer/Receivers may be monitored by the system.

HR Oversample Buffer Size

This setting determines the number of samples that can be contained in the sampling buffer. The default is 120, and it is recommended it not be set to less than 20. For details on Series 4000 heart rate sampling, see "Transmitter Sampling Theory" in Appendix D.

Temp. Oversample Buffer Size

This setting determines the number of samples that can be contained in the sampling buffer. The default is 120, and it is recommended it not be set to less than 20. For details on Series 4000 temperature sampling, see Appendix D.

COM Port

This setting determines the COM port VitalView will use to communicate with the serial chain of ER-4000 Energizer/Receivers.

Filter

This value sets the exponential filter in ER-4000 Energizer/Receivers. The default is 4, and this is the recommended setting. This filter is described in detail in "Transmitter Sampling Theory" in Appendix D.

There are also post-collection data filters available in VitalView. These are described in "Data Filtering" in Appendix F.

Utility

This activates the ER-4000 utility. This function is described in Section 4.

Sample Timing Defaults

This panel allows you to set the default sampling interval. This value will automatically be written into the sampling interval field of new animal configurations when they are created.

Data File Defaults

This defines the maximum size of the data file.

Data files will automatically be closed when they reach the size you specify here. A new file will begin with the next data record and the same data set name. This has been included to make system backup more efficient. Select the file length that best fits your backup requirements, or you may select the unlimited option shown above which will create only one data file for the current experiment.

It is possible for the investigator to arrange a variety of sampling intervals, number of data collection channels, and experiment durations. However, under the condition that many

channels are programmed, the sampling interval is short, and the experiment duration is long, an extremely large data set can be developed. This may lead to huge, unwieldy files. The longer an experiment runs, the more valuable the data become, so it is well to have several shorter data files rather than one large data file.

Determining File Size

If all channels have the same sampling interval (as recommended), you can calculate the file size, in kilobytes, for a given file size:

$$\text{File size (KB)} = 800 \times \frac{(\text{Number of Channels}) \times (\text{\# days})}{(\text{Sampling interval in seconds})}$$

The maximum file size is recommended to be no more than about five days worth of data based on the above formula.

Example #1

If 20 days of data are required and the sampling interval is 300 seconds (5 minutes), and there are 24 channels configured, then the file size would be 1,280 KB (1.25 MB) if the file were not segmented. This is a small file. However, considering the number of days involved, it would be safer for the investigator to limit the file segments to 240 KB . This would segment the entire data session into 5 segments of about 4 days each.

Example #2

If there are 72 channels configured, the sampling interval is 5 seconds, and the experiment session is to last 24 hours, the total file size will be 11,520 KB (11.25 MB). Other recommendations apply to extended or long-term data collection:

- Copy (never move or rename) closed data files to another PC.
- Use a second computer to load and analyze data files, rather than the computer that is being used to collect data.
- If a crash recovery occurs, stop data collection afterward, archive the data, and start the session again with different file names.

NOTE: VitalView can collect a large amount of data in a very short time. For example, sampling at one-minute intervals produces 1440 points per day per channel. In most cases this number exceeds what is required. When selecting a sampling interval, consider the data resolution you will require when reporting data. This will indicate the longest sampling interval you should select. We recommend that you sample twice as often as this maximum interval in order to allow for some missed samples.

While VitalView allows sampling intervals from one second to 99 hours, system performance will be best at sampling intervals above 15 seconds, and under two hours. A long sampling interval (24 hours or more) is useful to count activity over a long period. However, the same result can be accomplished with a one or two hour sampling interval, and using the decimation and scale filters after the data are collected. Sampling intervals below four seconds are not recommend.

NOTE: If sampling with an interval less than 15 seconds, VitalView may produce variable results. Performance will vary between computers and hardware layouts. We do not recommend you sample at these faster intervals unless it is a requirement of your research protocol. Sampling at less than four seconds is especially not recommended due to the possibility of missed or invalid samples.

The total number of samples should not exceed three million. If the total number of samples expected exceeds three million, one of the following actions should be taken:

- The number of channels should be reduced.
- The number of days the experiment runs should be reduced.
- The sampling interval should be increased until the previous equation shows the total number of samples to be less than three million.

Communication with ER-4000 Energizer/Receivers

Introduction

ER-4000 Energizer/Receivers communicate with the PC via an RS-232 serial communications port. These units can be connected in a chain. A diagram of serial installation can be found in "Connecting the ER-4000 in Series" in Appendix B. Software functions are explained below.

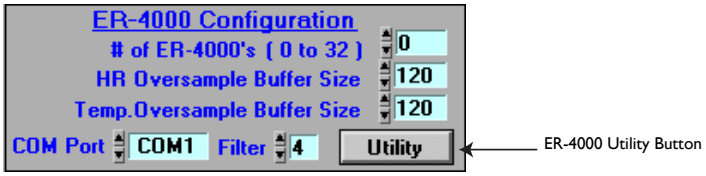
Initialization of the serial port and communication with the ER-4000 Energizer/Receivers is accomplished automatically whenever data collection is started. If the COM port and the ER-4000 ID values are already set correctly, communication will be initiated when data collection is started. If you are not sure if you have selected the proper port, or you wish to check the ID values of your ER-4000 Energizer/Receivers, use the ER-4000 Utility button.

Utility Button

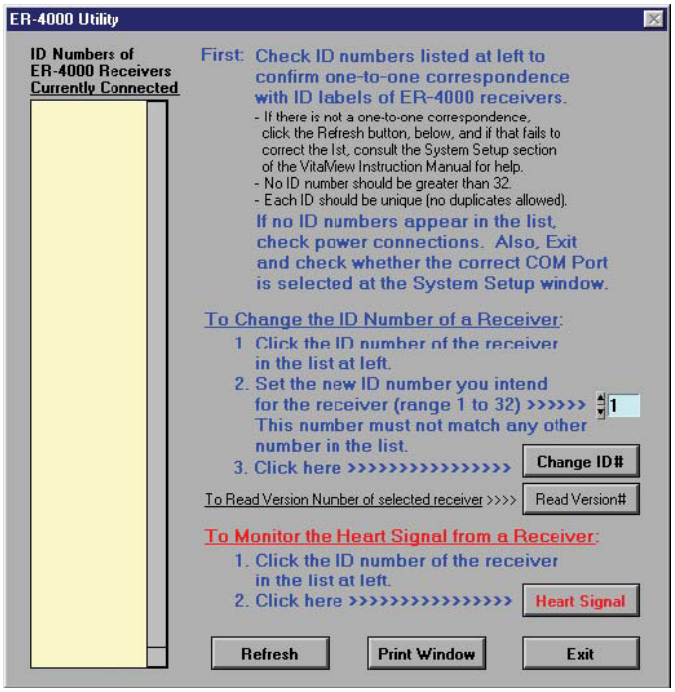
This button activates the ER-4000 Utility. This display prompts you to check the communication between VitalView and the ER-4000s in your system.

NOTE: At least a 1 must be entered in the "# of ER-4000's" field.

Access: Main window > System Setup



Access: Main window > System Setup > Utility



Each ER-4000 should have a front panel label denoting its ID number. If the label is missing, the internal memory of the ER-4000 will still list it on the display. All ER-4000s must have a unique ID number. Follow the display instructions and prompts to change the ID number of a receiver.

NOTE: ER-4000 ID numbers appear in arithmetical order, not necessarily in the order in which they are connected in the chain.

CAUTION! Before connecting, disconnecting, or reconnecting any of the cables in a single or serial ER-4000 system, remove power from the system by disconnecting the power supply from the AC source. Connecting or disconnecting "live" cables to an ER-4000 may damage the input circuits of the receiver.

ER-4000 ID Problems

There are a variety of reasons an ER-4000 will not appear on the identification list. If the list is incomplete or the numbers do not match, first click Refresh to reacquire the list. If the list is still incorrect, check the following. Usually, there is a "physical" problem.

- The power is off. Check the AC supply, plug strip switches, breakers, etc. Verify that each ER-4000 has power connected to it, and the red LED is lit on each device.
- The Y-Cable connector set is connected improperly, or is faulty.
- Too many ER-4000s connected in series to one power supply, causing an excessive current drain. A maximum of four devices may be connected to one power supply. It is likely none of the ER-4000s connected will appear on the ID list.
- The wrong com port is selected on the PC. Refer to Section 4.
- If the power connections appear correct, it is possible that two ER-4000 devices have an ID #1 assigned to them, or two ER-4000s have the same ID number. To correct this problem, do the following:
  1. Disconnect all but the ER-4000 that has been assigned ID #1. Click on Refresh.
  2. Verify that ID #1 *only* appears on the ER-4000 list.
  3. Repeat this process for all ER-4000 receivers, one by one, verifying that each one has its correct ID. If any receiver has the wrong ID, change it by clicking on Change ID #. *Remember to re-label that device.*
  4. Reconnect the ER-4000 receivers in the system, and verify that all numbers now appear correctly.
- If the red LED blinks, the green LED lights in the presence of an E-Mitter, but the PC will not communicate with the ER-4000, there is a possibility the ER-4000 com port circuitry has been destroyed. Although these devices are protected, they are the interface to the outside world. Improper use of connectors, short-circuited cabling, environmental contamination, etc., could cause external voltages to destroy these circuits.

If you continue to have problems with ER-4000 communication, call Starr Life Sciences Technical Support. Also check the Troubleshooting section, Appendix I.

Heart Signal Monitor

General Description

The Starr Life Sciences PDT-4000HR and G2 HR transponders feature wireless monitoring of temperature, activity, and heart rate in freely-moving, small laboratory animals. The PDT- 4000HR and G2 HR E-Mitters are used together with the VitalView Series-4000 data acquisition system to continuously monitor the heart rate.

The rate of the heart beat is determined by counting the number of R wave pulses within a given interval. Accurate rate detection is obtained when good heart beat signals are detected by the HR E-Mitter. When implanting the HR E-Mitter, it is important to establish good contact between the heart rate leads and the tissue at the contact site. The effectiveness

of this contact should be determined prior to closing the incision while the subject is anesthetized. In addition, it may be useful to monitor the heart signal following surgery to make sure that the lead contact is still secure. The procedure is in the Implantation Procedure appendix located under "Confirming the Implant" in Appendix E.

To assure instantaneous success of the implantation procedure, VitalView provides a qualitative monitor of the heart signal via the Heart Signal Monitor utility. The waveform displayed with this utility will resemble an ECG waveform. The purpose of the monitor is to determine the quality of the lead contact. VitalView filters out all but the Q-T segment of the ECG waveform and displays primarily a broadened R wave.

Accessing the Heart Signal Monitor

To access the Heart Signal Monitor, the VitalView system must be off- line. From the System Setup window, click Utility. (Utility may also be accessed from Animal & Group Setup and VitalView Animal Configuration). Before accessing the Heart Rate Monitor, check that the com port is set properly, and the number of ER-4000s is set to 1 or the appropriate number. VitalView will then initialize the chain of ER-4000 receivers and display the ID numbers of all ER-4000 receivers connected in the chain.

To monitor the heart signal from an ER-4000, click on the ID number in the list for the desired receiver. Then click on the Heart Signal button. When an HR E-Mitter is properly implanted, a waveform will be displayed that is similar to the one below.

Access: Main Window > System Setup > Utility > Heart Signal

Implant Lead Quality

Consecutive heart beats are shown as complex pulses progressing along the X-axis. In this figure, the R-wave is represented by the relatively strong signal peak rising above the baseline. This displayed waveform represents good lead contact. Conversely, if the peak is poorly defined, broadened, has low amplitude above the baseline, or spikes appear below the baseline, either the lead contact is poor or the subject is not well. Therefore, the investigator should try to achieve a lead contact that provides an R-wave with good definition.

When sutured appropriately into place, the lead contact should not degrade over time. In fact, the lead contact can often improve over a period of one to two days after surgery and remain constant afterward. It is wise to check the lead contact of each subject on a periodic basis, perhaps once per month or at least at the beginning of sequential experiments.

Description of the Monitor

The Heart Signal Monitor is essentially a two-axis graph that continually sweeps and refreshes the signal detected by the heart rate E-Mitter. The X-axis (horizontal axis) is the time-domain axis and the Y-axis (vertical axis) is directly related (but not equal) to the ECG voltage.

When the Heart Signal Monitor is activated from the Utility display, the Monitor will automatically begin to sweep the signal from the selected ER-4000 receiver. If your setup is proper and there is good lead contact, a signal should appear within a few seconds.

Heart Signal Monitor Panel

Sweep Buttons

The three colored buttons at the lower edge of the Monitor control the sweep function. Stop halts the sweep indefinitely; Continue resumes the sweep; Exit returns to the Utility display.

Scroll bar

The scroll bar below the X-axis provides a means to scroll backwards to view pulses already detected by the system. Use this feature only when the display is "stopped."

Status window

The window on the lower right provides information about the status of the Monitor. The active ER-4000 is indicated in this window as well as instructions on what functions can be changed by the operator.

Styles

This button changes the "style" of the charted portion of the display, including point size, color, chart type, line width and more. These settings will default to the factory settings when VitalView is shut down and restarted.

SECTION

5

ANIMAL & GROUP SETUP

Introduction

Animal & Group Setup tells VitalView which animals are in the experiment, which data will be gathered from those animals, and directs the data to the PC.

Custom Configuration Disk

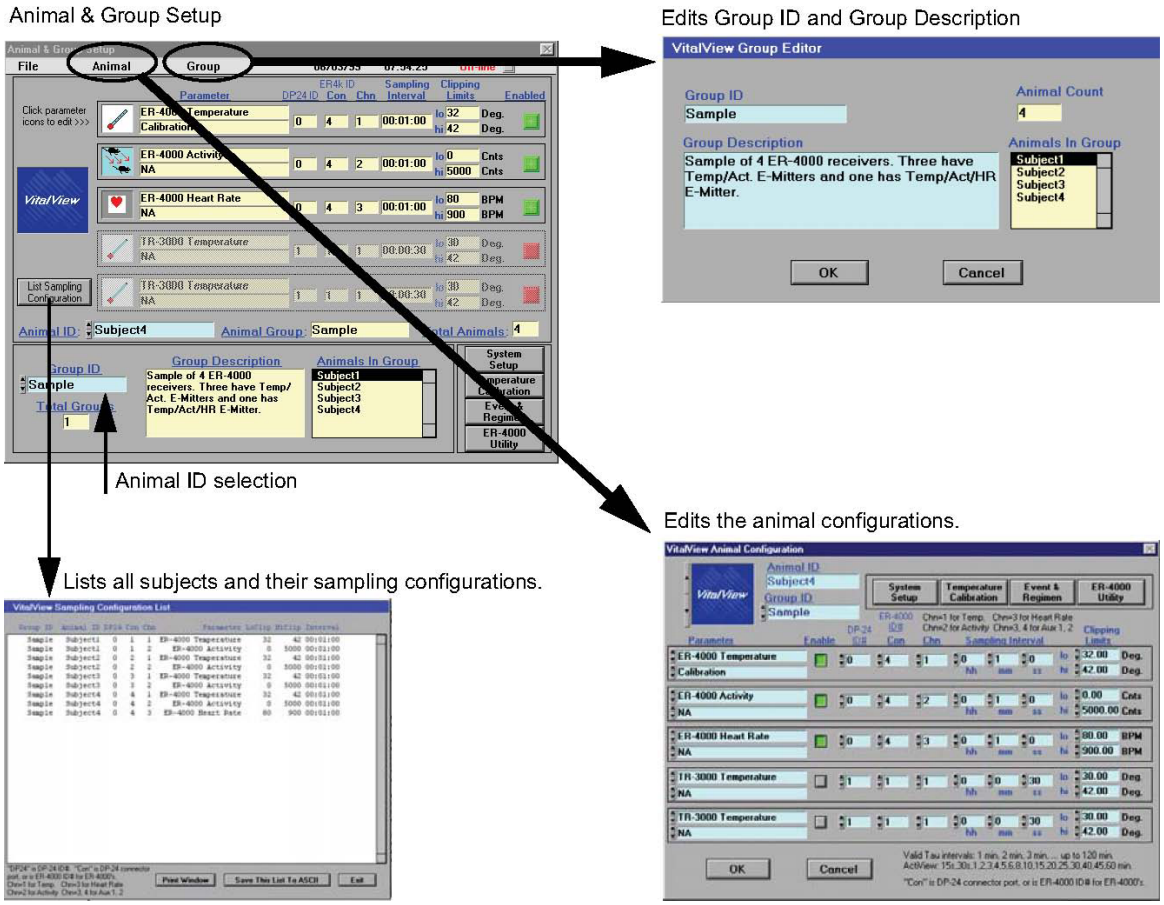
VitalView, when first opened and no configuration file is loaded, has a Default Group assigned as a "placeholder." Group ID will read "Unassigned", and Group Description will read "Default Group."

There are sample files included with VitalView.

To adequately cover Animal & Group Setup, there should be some configuration information to observe. For first-time users, we suggest loading the Sample file first. The Surgery file is for your convenience for use during the implantation procedure.

To load and view a configuration file, follow the directions provided in this section.

Animal & Group Setup Overview



Parameter Icons

There are several parameters graphically represented by icons that are used frequently throughout VitalView.

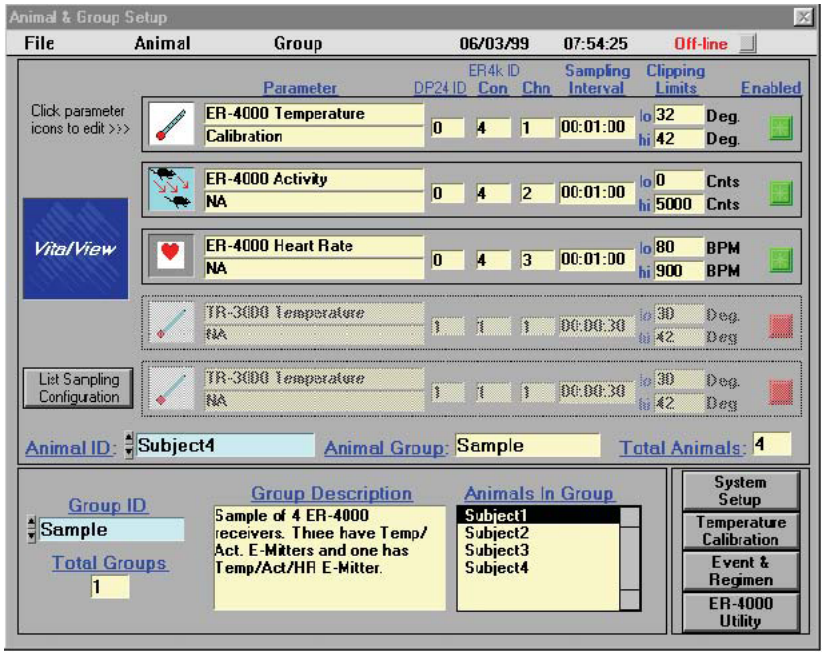
Convenience Buttons

Note that two of the displays have convenience buttons, enabling immediate access to other windows, such as System Setup, and functions such as Temperature Calibration and ER-4000 Utility.

Animal & Group Setup Main Display

A diagram of the animal configuration displays is above. On your color monitor, any field in yellow is informative only, and may be edited or affected elsewhere. Blue fields may be edited either by typing text directly into the field, or by pop-up lists where the function is selected.

Access: Main window > Animal & Group Setup

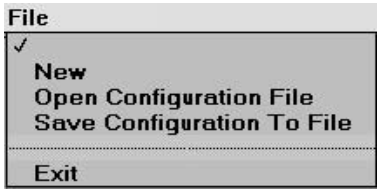


This is the current animal configuration for the selected animal. This animal is selected using Animal ID located under the parameter panels, and via Animal Group. Until animal configurations are created, these panels will be grayed out.

Animal & Group Setup Main Menu Items

File

Access: Main window > Animal & Group Setup > File



New

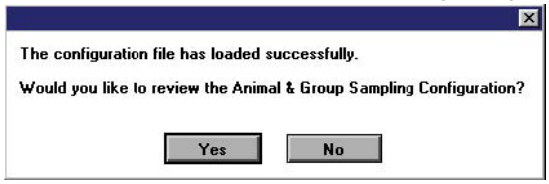
This command clears any currently configured animals and groups and allows you a fresh start to create a new sampling configuration.

Open Configuration File

Opens an existing configuration file. Configuration files end with the .cfg extension. The command is identical to the one in the Main window. The Sample configuration file is being used as an example in this section.

NOTE: Any time you open a configuration file and load it, you will receive a prompt (below) asking if you wish to review a summary of it. Clicking on Yes will produce a table with the animal and group parameters you have loaded. Other configurations, such as temperature calibration, will be detailed later. Check the index for specific locations.

.Access: Main window or Animal & Group Setup> File > Open Configuration File > (Load)



NOTE: A box will appear listing the available .cfg files. Select the file and click to open.

You may also access the configuration details from the Main window by accessing the File menu, and selecting List Sampling Configuration, or the button on Animal & Group Setup.

Save Configuration to File

Saves the current Animal & Group configuration along with System Setup information and temperature calibration values.

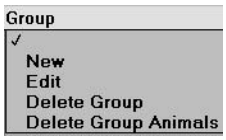
Exit

Returns to the VitalView Main window.

NOTE: To exit, you may also use the Escape key.

Group

Access: Main window > Animal & Group Setup > Group



It may be beneficial to keep selected animals in groups. A typical experiment might consist of two groups, "control" and "experimental," or "daytime" and "nighttime."

New

This command creates a new group in which to place animal configurations. It is advised to create experimental groups prior to the animal configurations. It is easier to assign them to experimental groups as they are created than it is to assign them later.

Edit

Edit opens a group, and enables you to change the Group I.D. and Group Description. It also displays the number of animals in the group. When the group values are changed, all the animals in that group will be affected.

Delete Group

This will delete the active Group I.D. The Delete All Animals in Group option enables you to delete all animals in the group. If the animals are not deleted, they will be placed in the default group. (The default group cannot be deleted even if it has been renamed.)

Delete Group Animals

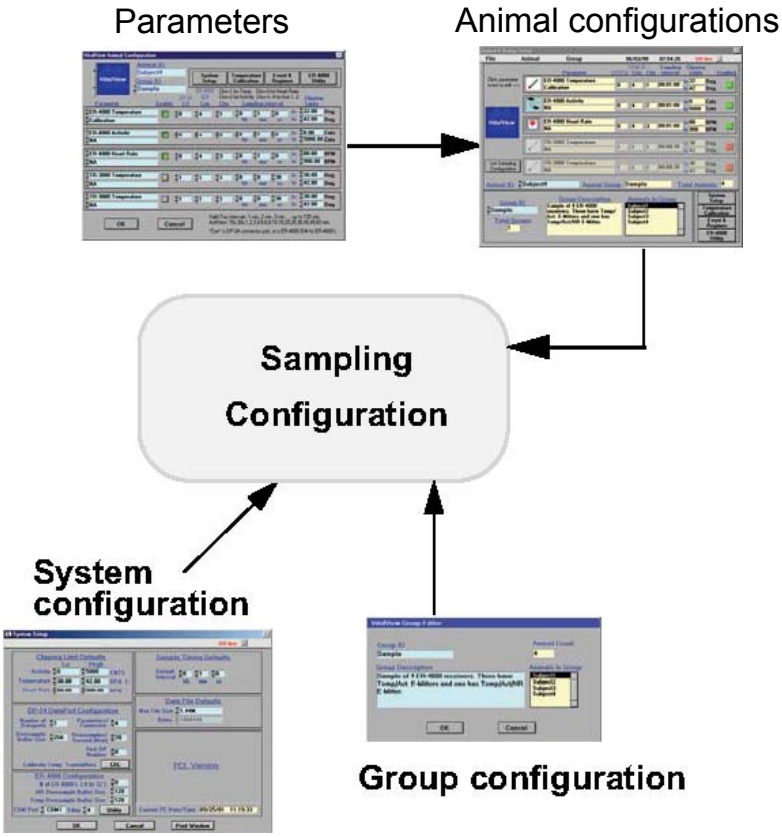
This command deletes all the animals in an experimental group, but leaves the Group I.D. and Group Description unchanged.

Setting Up a Sampling Configuration

Introduction

A **sampling configuration** is a complete set of sampling instructions for the VitalView System. It includes the **system configuration** information from the System Setup as well as all individual sampling instructions for each animal. Each subject will have its own

Animal ID and sampling instructions called an **animal configuration**. Within an animal configuration are individual **parameters**, or measurements. Subjects may be organized into an **experimental group**.



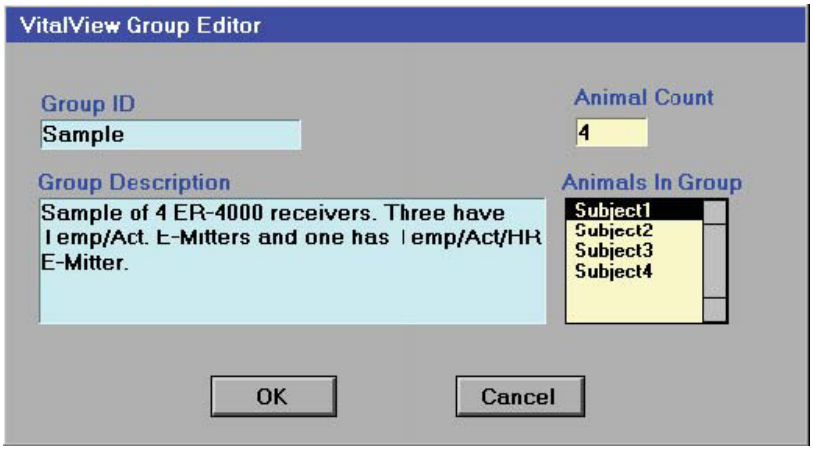
This system is capable of monitoring up to five parameters per animal configuration. In many cases a single parameter will be monitored for each animal, therefore only a single parameter will be set up in the animal configuration.

NOTE: Before you begin, enter the System Setup settings for hardware, sample times, and clipping limits. Assignment of the hardware channels, as well as defaults for sampling interval and clipping limits, will be determined using these settings as a guideline.

Creating or Editing a Group

1 From Animal & Group Setup, Group > New or Edit.

Access: Main window > Animal & Group Setup > Group > New



2 In the Group ID box, click and type in the Group ID, or edit the existing ID. For example, you might first create the "Experimental" Group.

3 In the Description field, you can enter any details or leave it blank.

4 When you are finished, click OK.

5 You may repeat this process to create additional groups.

Creating or Editing an Animal

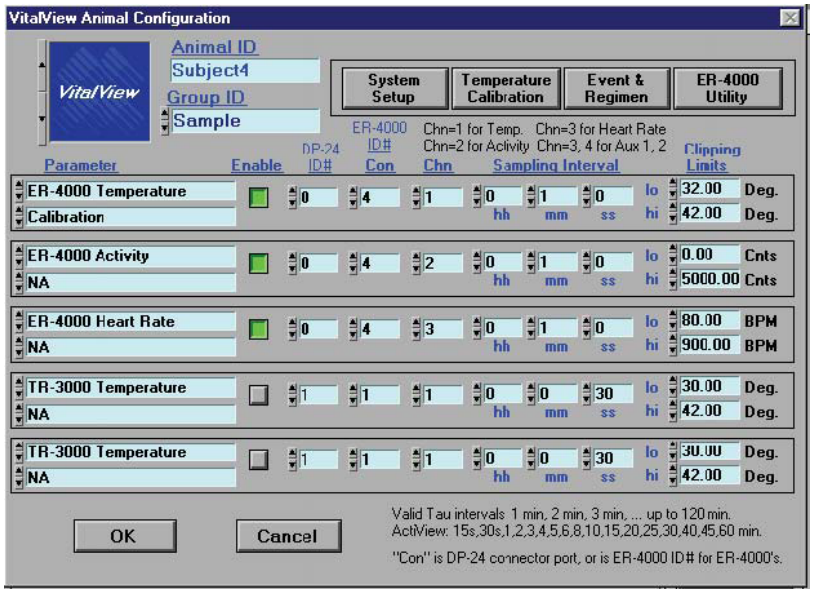
Animal configurations consist of information such as the Animal ID and Group ID values as well as all of the parameter settings that direct VitalView to sample appropriately.

Your first configuration may serve as a template that can be copied. Large numbers of animal configurations can be created with a few clicks of the mouse.

The Animal Editor may be accessed in two ways:

- From the Animal menu item, select New or Edit.
- From Animal & Group Setup, click anywhere within a parameter panel.

Access: Main window > Animal & Group Setup > (click within any parameter panel)



Animal ID

Identification may be assigned with the Animal ID dialog box. For now this will not be important. Wait to assign the actual ID for your subject when you have created the sampling configuration and have actually assigned cages and transmitters.

Access: Main window > Animal & Group Setup > Animal > New

Group ID

The Group ID assigns the above animal to an experimental group. If no group has been created, the animal will be assigned to the default group "Unassigned." If you wish to create experimental groups, refer to "Creating or Editing a Group" in this section.

Animal Icon

There are several animal icons from which to choose. They can be used to organize the animals.

Changing Parameters

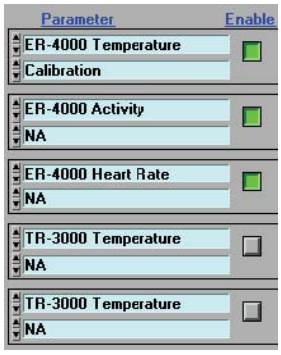
Animal parameter settings may be changed by using the arrows, click and-wipe, or double-clicking.

In VitalView Animal Configuration, there will be five panels as illustrated below. These correspond to the five possible parameters that may be monitored for any single animal ID.

Parameters may be entered individually for each animal, or entered for the first animal and copied for all subsequent animals.

Each parameter has its own panel. Begin with the top panel. If you require additional parameters for the selected animal, use the remaining panels.

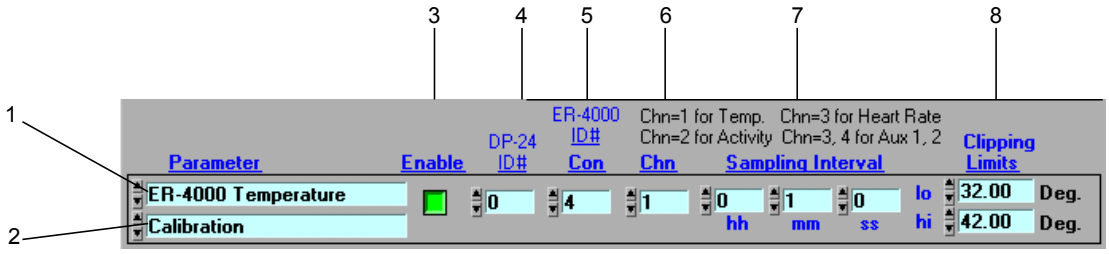
Access: Main window > Animal & Group Setup > (click within any parameter panel)



In the example above, data are being collected on "Subject 4" (see "Animal ID") from an ER-4000. Temperature, activity, and heart rate are enabled. Note the parameters that are not used are disabled.

Parameters that require transmitters or E-Mitters will include the serial number and calibration data (see "Temperature Calibration Values" in this section).

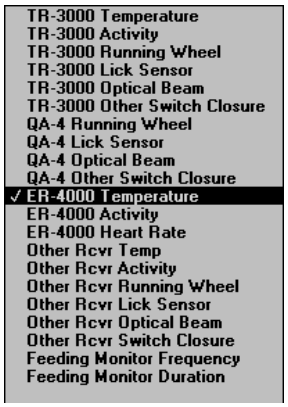
Access: Main window > Animal & Group Setup > (double click within any parameter panel)



1 - Selected Parameter

There are a variety of data collection devices listed. Access by clicking the parameter selection field.

Access: (There are multiple access methods. See text.)



2- Calibration

Access: Main window > Animal & Group Setup > (multiple access methods)

If transmitters or E-Mitters are used, their serial numbers are shown here. If no serial numbers are listed in this menu, click on the convenience button Temperature Calibration, and load serial numbers and calibration values (see "Temperature Calibration Values" in this section).

3 - Enable

Clicking this button will notify the system that this parameter is available for data collection. The button will turn green when enabled.

4 -DP-24 ID#

Enter the ID for the DP-24 DataPort that will receive the input for that parameter. A maximum of ten DataPorts with ID's 0-9 can be serviced in one system. Assign ID values to the DataPorts in the order of attachment to the PC bus. The first DataPort should be 0, the second one 1, and so forth.

5 - Con

Selects the number that corresponds to the port on the DP-24 into which you plugged the receiver cable. There are a total of six connectors per DataPort, labeled "Data Inputs."

If you are using ER-4000s, enter the ID number of the ER-4000. This number (1 - 32) should be on the front panel of the ER-4000. If it is not, you may find the ID number in the on-board memory using the ER-4000 utility. See Section 4 for details.

6 - Chn

Selects the channel number on the connector selected above. If the first parameter is temperature, set the field to channel one.

Each connector of a DataPort is capable of monitoring four channels, 1 through 4. One channel should be assigned to each parameter in an animal configuration.

The following chart shows the correlation between parameters, sensors, and available channels.

The following table lists the parameters, the sensor types, and the channels that are available.

Parameter	Sensor Type	Available Channels
TR-3000 Temperature	Transmitter	1,3*
TR-3000 Activity	Transmitter	2,4*
TR-3000 Lick	Lick Sensor	3,4**
TR-3000 Running Wheel	Magnetic Switch	3,4**
QA-4 Lick Sensor	Lick Sensor	1,2,3,4
QA-4 Running Wheel	Magnetic Switch	1,2,3,4
Feeding Frequency	IR Feeding Monitor	1,3*
Feeding Duration	IR Feeding Monitor	2,4*
Other Switch Closure	IR Montion Detector	1,2,3,4

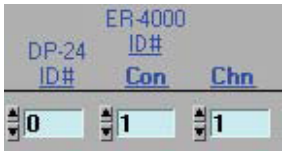
*Second channel available with Dual Input Module

**Channel 3 available when connected to Aux 1, and channel 4 available when connected to Aux 2.

The following table defines the field values used in building a configuration.

Field Label	Series-3000 Receiver, FH-Series Transmitter	Series-4000 Receiver, E-Mitter Transponders
DataPort Numbr "DP-24 ID#"	0 through 9	Placeholder only. Use 0 through 9 buth not a DP-24 ID number already used
Connector Number "Con"	1 through 6	1 through 32
Channel Number "Chn"	1 through 4	1 through 3

Access: Main window > Animal & Group Setup > (double click within any parameter panel)



If you are using model FH transmitters:

First field corresponds to the DP-24 DataPort ID, labeled "DP #" on the DP-24. Valid numbers are 0-9.

Second field is the connector (socket) number on the DP-24, labeled "Data Inputs" on the DP-24. Valid numbers are 1-6.

Third field indicates the channel in the C-8 cable the data signal will travel from the receiver to the DataPort. Valid numbers are 1 through 4.

If you are using model PDT or G2 E-Mitters:

First number is a place holder only. This number can be any digit from 0 to 9 but cannot be a digit assigned to a DP-24 ID number.

Second number is the ER-4000 ID number. Unless reassigned, this number will be on a front panel label of the ER-4000. Valid numbers are 1-32.

Third number is the data source in the ER-4000. Valid numbers are 1 through 3, corresponding to temperature, activity, or heart rate.

The following table organizes the previous information differently to show the relationship between the channels and the type of data carried.

Device	Channel 1	Channel 2	Channel 3	Channel 4
TR-3000 Receiver	Temperature	Activity	Aux 1 (switch device only)	Aux 2 (switch device only)
ER-4000 Receiver	Temperature	Activity	Heart rate (only with HR E-Mitters)	
QA-4 Activity Input Module	Ch 1 input (switch device only)	Ch 2 input (switch device only)	Ch 3 input (switch device only)	Ch 4 input (switch device only)
Dual Input Module	Input 1 ("Ch 1 & 2")	Input 1 ("Ch 1 & 2")	Input 2 ("Ch 3 & 4")	Input 2 ("Ch 3 & 4")
Infrared Feeding Monitors	Feeding frequency	Feeding frequency		

Five Channel Selection

Each connector on a DataPort is capable of monitoring a maximum of four parameters. However, each animal configuration can contain five parameters. It will be necessary to connect one of the parameters to a different DataPort connector.

1 In System Setup, select four channels per connector.

2 Create your first animal configuration with only four parameters enabled. Make sure that all telemetric parameters are accounted for via one of the first four parameters, with consecutive channel numbers (from top to bottom) 1, 2, 3, 4.

3 Copy this configuration as many times as required. (You may use the auto-index feature.) The physical connection for additional behavioral inputs such as running wheels or motion detectors is made using a QA-4 behavioral input module. These parameters can be added to existing animal configurations, but must be assigned to different connectors using the QA-4.

Hardware Channels for Series 4000

The same fields are used to assign the hardware channels for Series 4000 systems. The following are instructions for setting up the Series 4000 hardware to monitor PDT-4000 and G2 E-Mitters. If you wish to monitor behavioral inputs such as running wheels or montion detectors, some Series 3000 hardware is required. These inputs would be configured as previously described. Both series may be simultaneously run using the same system.

Series 4000 is a serial system requiring a COM port for communication. You may wish to test the ports on your PC to establish or confirm their ID. Few PC manufacturers accurately label these ports. To test the COM port, please refer to *System Setup* in Section 5.

1 The first field has no direct function for Series 4000 hardware. It is only necessary to enter a digit in the range from 0 to 9. However, the digit entered must not be a digit used for any DP-24 ID number.

2 Enter 1 in the Con field to set the first Energizer/Receiver ID in the chain. ER-4000's are assigned an ID at the factory. This number is noted on a front panel label. To limit confusion, we recommend that the units be placed successively in the chain as they extend from the PC serial port.

NOTE: If it is necessary to change an ER-4000 ID, it can be done through the ER-4000 Utility. See Section 4.

3 There are requirements for channel (Chn) assignment:

- Temperature must be assigned to channel one
- Activity must be assigned to channel two,
- Heart rate must be assigned to channel three.

The first temperature channel for the first animal configuration should have hardware settings as follows:

- Con = 1
- Chn = 1

Default Values

When a new parameter is selected, VitalView will automatically fill in the clipping limits and sampling interval fields. These default values may be changed via the System Setup window. Any parameters that are entered after these defaults are set will use the new values.

NOTE: VitalView can collect a large amount of data in a very short time. For example, sampling at one-minute intervals produces 1440 points per day per channel. In most cases this number exceeds what is required. When selecting a sampling interval, consider the data resolution you will require when reporting data. This will indicate the longest sampling interval you should select. We recommend that you sample twice as often as this maximum interval in order to allow for some missed samples.

NOTE: If you must sample with an interval that is less than 15 seconds in length, you may find that VitalView may produce variable results. VitalView performance will vary between computers and hardware layouts. We do not recommend you sample at these faster intervals unless it is a requirement of your research protocol. Sampling at less than four seconds is especially not recommended due to the possibility of missed or invalid samples.

Unequal Sampling Intervals

Normally, investigators will find it reasonable and prudent to configure all channels of an experiment with the same sampling interval. We encourage the use of equal sampling intervals for all channels. However, VitalView offers improved flexibility allowing some channels to be sampled with different sampling intervals. When this option is used, there are some restrictions that apply:

- The Data Load and Analysis function will only allow you to load channels with the same sampling intervals.
- If you want all data from all channels to load as one data set, you must assign the same sampling interval to each channel.
- Since the various channels are sampled concurrently, the channels displayed in the Data Collection Monitor window will not be updated simultaneously. The channels with the shorter sample intervals will be updated more often than those channels with longer sample intervals.
- Various error checking and data collection pace preserving facilities of VitalView only apply when all enabled channels are configured with the same sampling interval. If you set different sampling intervals on different channels, you will be giving up the ability that VitalView otherwise has to preserve the pace of data collection across a stop and restart of data collection.

Long-Duration Data Collection

Through the use of VitalView, it is possible for the investigator to arrange a variety of sampling intervals, number of data collection channels, and experiment durations. However, under the condition that many channels are programmed, the sampling interval is short, and the experiment duration is long, a very large data set can be developed. This may lead to large data files. The longer an experiment runs, the more valuable the data become, so it is well to have several shorter data files rather than one large data file.

Fortunately, VitalView contains a feature that allows the investigator to split or segment data files into any number of equal-size files. This feature can be invoked from the System Setup window by entering a number for the maximum file size (see Section 4 for details).

8 - Setting Clipping Limits

Clipping limits are boundaries for acceptable data. Default settings can be chosen in System Setup. If you wish to change them for a single Animal ID, use VitalView Animal Configuration. The units automatically update to those appropriate for the parameter being monitored. Data values outside the clipping limits will be replaced with –10.

NOTE: Clipping limits are designed to prevent the recording of data values that are not physiologically reasonable for the subject. These unreasonable data points are replaced with a –10 value. Setting the clipping limits too widely may allow some unreasonable data to be recorded. Setting the clipping limits too narrowly may exclude reasonable data.

NOTE: Series 4000 E-Mitters and G2 E-Mitters respond to temperature values in the range of 25° C to 42° C. If an E-Mitter is monitored in an ambient environment colder than 25° C, spurious data may result. HR and G2 HR E-Mitters will not provide heart rate signals when used at temperatures below 25° C.

Temperature Calibration Values

For those researchers who are monitoring temperature with model FH transmitters, PDT 4000 E-Mitters, or G2 E-Mitters, it is necessary to enter temperature calibration values to ensure maximum measurement accuracy.

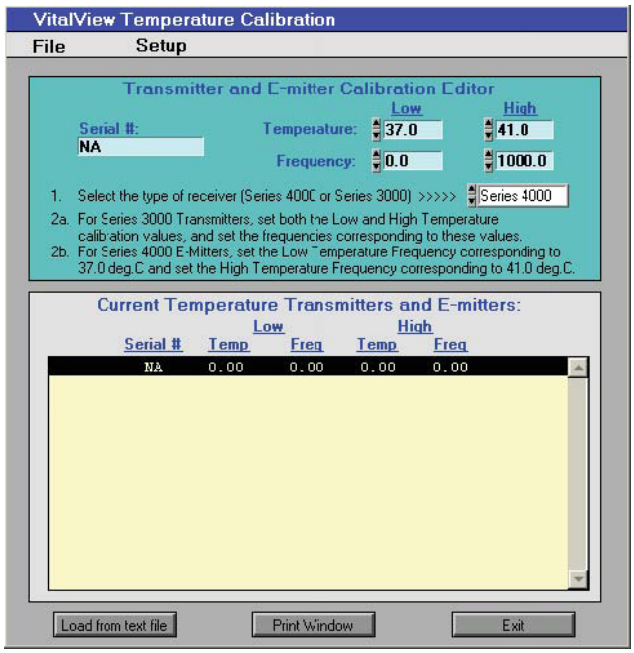
You may elect to enter calibration values and assign the transmitters to specific Animal ID's at any time prior to the start of data collection. These values will be saved in a .cal file when data collection is started, or when the VitalView configuration is saved. Temperature data displayed in the Data Collection Monitor or the Data Load & Analysis displays will be calculated using the calibration values entered here so it is important that they are entered correctly.

NOTE: Calibration values are used to convert transmitter frequency values to ° C. If the incorrect values are assigned to a temperature channel, data values can vary significantly. Check each transmitter serial number and calibration information before starting data collection. Transmitters must be recalibrated each time the battery is changed. E-Mitters and G2 E-Mitters should be recalibrated periodically to maintain 0.1° C accuracy.

Entering Temperature Calibration Values

You may enter the Temperature Calibration display from several "convenience panels" throughout VitalView. From the Animal and Group Setup, click on Temperature Calibration. (If in System Setup, press the CAL button in the DataPort Configuration panel.) The VitalView Temperature Calibration panel will appear.

Access: Main window > Animal & Group Setup (or Configuration > Temperature Calibration



If you are editing a previously used configuration, any transmitters for which calibration values have been entered previously will be displayed in the Current Temperature Transmitters and E-Mitters list. If you are creating a new configuration, the list will be empty.

NOTE: Do not delete the default line: NA 0.00 0.00 0.00.

1 Select the type of receiver (Series 3000 or Series 4000).

2 Locate the calibration values on the temperature calibration sheet.

3 Enter the Serial Number for the first transmitter in the Serial # box. This number may be found at the top of the temperature calibration sheet.

4 Enter the low calibration temperature value. For E-mitters, this value must be 37° C.

5 Enter the frequency that appears on the calibration sheet next to the low temperature you have selected.

6 Enter the high calibration temperature value. For E-Mitters, this must be 41° C.

7 Enter the frequency that appears on the calibration sheet next to the high temperature that you have selected.

8 When the chosen values are entered, open the Setup menu and select "Add Current Transmitter." The transmitter just entered will be added to the list.

Repeat the process for any additional transmitters. If you have selected the same calibration temperatures for all the transmitters, you will only need to change the Serial Number and frequency values.

Once values have been entered, the serial numbers for these transmitters will now be available in the Animal & Group Setup when you are ready to assign transmitters to animals.

Saving Temperature Calibration Values

When you have entered all the transmitters to be used for the current experiment and their proper calibration values, you may save them.

NOTE: When saving .cal files from the Cal Display, you must assign it the same name as the associated .cfg file. You may also save the .cal file from the Main window, or Animal & Group Setup.

1 Activate the File menu.

2 Select Save Calibration Info.

3 The calibration information will be saved in a .cal file that can be used later. These files are always saved automatically when data collection begins. They are assigned a file name matching the experimental .log file.

Editing Calibration Values for a Transmitter

If you wish to enter new data for a transmitter already in the list:

1 Highlight the transmitter or E-Mitter that you wish to edit.

2 Enter the new values.

3 Activate the Setup menu.

4 Select Replace Highlighted Transmitter.

Removing a Transmitter from the Calibration List

1 Highlight the transmitter or E-Mitter that you wish to delete.

2 Activate the Setup menu.

3 Choose Delete Highlighted Transmitter.

4 The selected transmitter or E-Mitter will be removed from the list.

Loading Saved Temperature Calibration Values

To load a previously saved set of values:

1 Activate the File menu.

2 Select Load Calibration Info. A list of the .cal files in the current folder will be displayed.

3 Select the file containing the calibration data you require and click on Open. The values contained in that file will appear in the list.

Accepting the Animal Configuration

Once you have completed the parameter settings, exit and return to the Animal & Group Setup display.

Note the following:

- The animal panel has been updated to reflect the parameters that are now enabled.
- The parameter settings are all filled with values set by the user.
- Green indicator lights will show which parameters are enabled.

If all of your experimental animals will be sampled identically to the configuration you have created, proceed to Copying Animal Configurations which follows. If you require additional animal configurations, you may create additional templates before proceeding.

Copying Animal Configurations

To fill experimental groups for your project, you can create each animal configuration manually or copy a template. If several animals have similar settings, you will avoid repeating steps by copying a template. Any animal configuration can serve as a template. The

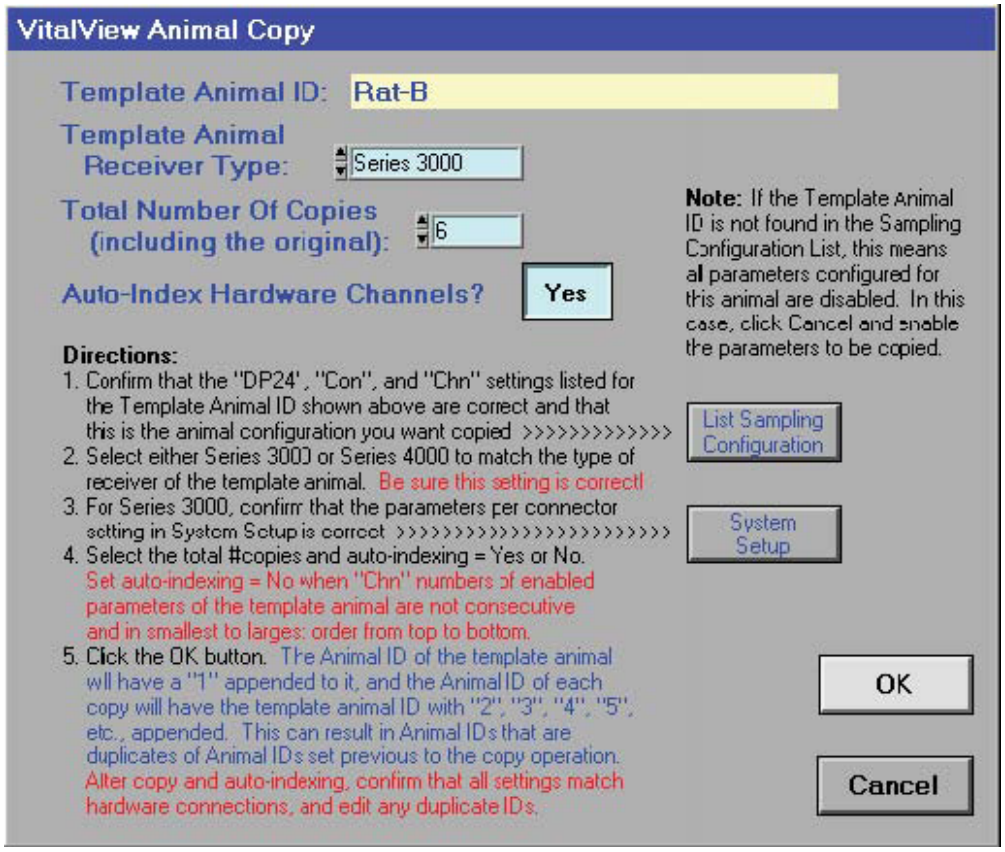
configuration you choose must be the active animal configuration in the Animal & Group Setup display. To determine which Animal ID is active, check the Animal ID field.

1 From the Animal & Group Setup display click and hold on the blue Animal ID field and select an ID from the pop-up list.

2 Activate the Animal menu and select the Copy command.

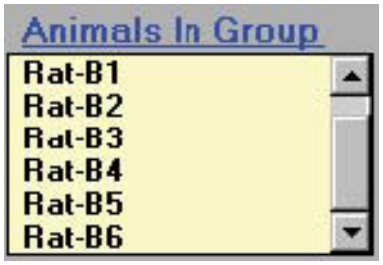
3 Follow the instructions from the display.

Access: Main window > Animal & Group Setup > Animal > Copy



4 Click OK.

5 The ID values for all animals produced by copying will be altered slightly from the template. A number will be appended to each name. The template will receive a one, the first copy a two, and so on.



6 Assign transmitters to each temperature parameter.

Multiple Experiment Groups

It will be necessary to do multiple copy procedures. For example, here is the procedure to copy a template to two groups.

The first group is filled as previously described. Make sure to include one additional copy.

The additional copy will be the template for making the other group.

It will be necessary to change the group ID in the template configuration to be used for the second group. After this has been completed, make as many copies as needed.

Saving, Loading, and Editing Configurations

Saving Configurations

After creating a set of animal configurations, you should save this information to a disk file. Do this from the File menu of either Animal & Group setup, or the VitalView Main window. The configuration will be saved in a .cfg file for use later.

Any time you start data collection, the current configuration will also be automatically saved. It will be saved under the same filename as the .log file, but have a .cfg extension.

VitalView automatically adds the extension. This command saves temperature calibration values in a .cal file, and event schedules in a .evn file. These files will all have the same file name. They will be saved wherever you have set the path.

Loading Previously Saved Configurations

Previously saved sampling configuration files can be opened and loaded from the Animal & Group Setup display, or from the File menu of the Main window. Select Open Configuration File from the File menu and follow the prompts.

Editing an Experimental Group

The ID and description of any group can be edited, including the default or "unassigned." (Follow the directions on in Section 5).

Deleting an Experimental Group

You can delete any experimental group (except the default group) from the list of groups in the Animal & Group Setup display.

1. Click and hold on the Group ID field. Highlight the Group ID you wish to delete in the pop-up list and release the mouse button.
2. The selected Group ID will appear in the group panel. The on-line status, description and list of animals in the group will be indicated.
3. From the Group menu, select Delete Group. In the Delete Group window, the Group ID will be displayed. If you wish to delete all of the animals in this group, remove the checkmark from the box labeled Delete All Animals in Group.

NOTE: The Unassigned group is the Default Group. This group cannot be deleted from the sampling configuration. It can be renamed if you wish to make one of your experimental groups the default. If animal configurations are kept when a group is deleted by deactivating the Delete All Animals in Group box, they will be placed in the default group by the system (see below for details). This will occur even if you have changed the default group name or ID.

Editing Animal Configurations

Any setting for an animal configuration can be edited using the Animal & Group Setup editor.

1. Open the Animal & Group Setup display.
2. Click and hold on Animal ID.
3. Move the highlight bar in the scrolling pop-up list to the Animal ID you want to edit. The configuration for that animal will appear.
4. From the Animal menu select the Edit command or click on the parameter icon to edit.

5 Edit the parameter settings as required.

6 When finished, click OK.

Deleting Animal Configurations

There are three ways to delete animal configurations. They can be deleted one at a time, multiple animals deleted at once, or all animals in one group can be deleted.

Deleting One Animal Configuration

1 Enter the Animal & Group Setup display.

2 Click in the Animal ID field and hold.

3 Highlight the Animal ID you wish to delete.

4 From the Animal menu, select Delete Current.

5 Confirm the deletion by selecting OK at the prompt confirmation.

Deleting Whole Groups of Animals

1 Enter the Animal & Group Setup display.

2 Click and hold on Group ID.

3 Highlight the Group ID you want to delete. This Group ID and all information about this group will be displayed in the group panel of the Animal & Group Setup display.

4 From the Group menu, select Delete Group Animals.

5 Confirm the deletion by selecting Delete at the prompt confirmation.

Deleting a Selection of Animals

1 In the Animal menu of the Animal & Group Setup display, select the Delete Multiple command. A list of currently defined animals will be displayed.

2 Any single animal may be chosen for deletion by highlighting it with the mouse. By holding the shift key and clicking, multiple animals may be highlighted.

3 Select OK to delete the highlighted animal configurations.

4 Confirm the deletion by selecting OK at the confirmation prompt.

SECTION

6

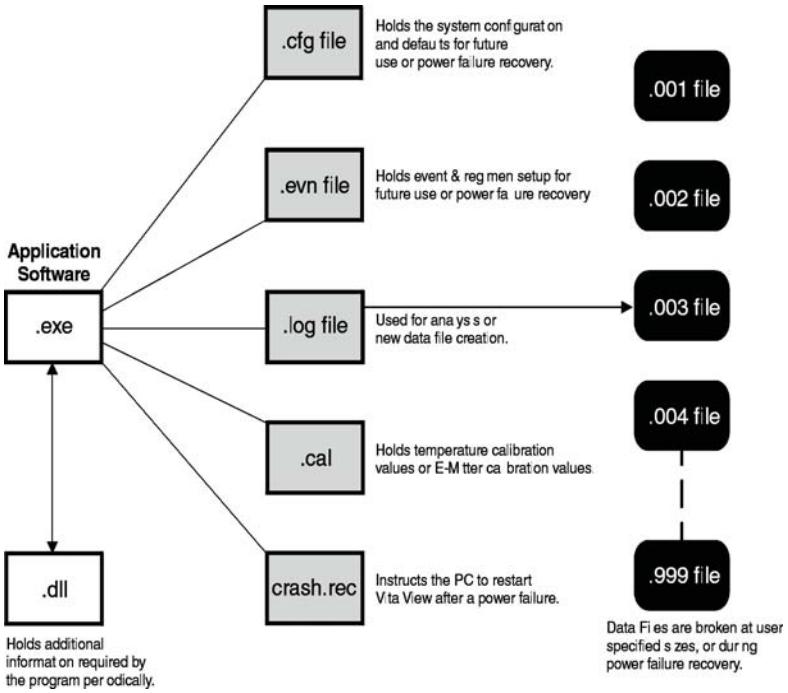
DATA COLLECTION MONITOR

Introduction

This is where the actual experimentation begins. This section covers collection of data, the storage of data, and monitoring the experiment. VitalView file types were introduced in Section 4, System Setup. The following details the application of these files, and how they relate to data collection.

Prior to beginning the actual experiment, it is recommended you run a test to confirm proper setups. See Appendix C, "Pre-Experiment Test."

File Types



Executable File (*.exe)

These files are the VitalView application itself as well as supporting applications that are required for power failure recovery and loading.

System Configuration File (*.cfg)

These files contain saved animal configurations and System Configuration information. They can be saved, edited, and reloaded as required. System configuration files may be stored in any location, but it is recommeneded they be stored in a sub-folder dedicated to data collection. System configuration files have the .cfg extension.

When data collection is started, the current system configuration is saved as a .cfg file automatically by the system. This file is assigned a name to match the .log file name you select when you start data collection. This information will be preserved for automatic recovery in case of a system crash.

Event File (*.evn)

These files contain all event schedules and links between event schedules and parameters and/or control relays for an experiment (VitalView 4.2 or earlier).

Experiment File (*.log)

Experiment files are ASCII files with the .log extension. Each time a new data acquisition session is started, a new experiment file is written. It is named according to the filename you enter when prompted by the system. The role of the experiment file is to act as a pointer for the VitalView system during analysis. In the file is the name of the experiment, its start and stop times, and the names of all the files to which data have been written. It directs the data loading activities, and helps keep track of data files. This information will be preserved for automatic recovery in case of a system crash.

If an experimental .log file is deleted or overwritten accidentally, data files may still be accessible. Refer to "Restore VitalView Log File" in Section 8. **Do not edit this file.**

Data File (*.###)

Data files are designated by a file name with a three-digit extension (e.g. datafile.001). VitalView creates data files by attaching a three-digit extension to the experiment name selected at the start of data collection. The first data file, which is designated with the extension .001, is continually written as data are collected. When the first data file reaches a preset size, VitalView automatically closes that file and creates a second data file with the extension .002., as shown in the illustration at the beginning of this section.

This process is continued indefinitely throughout the experiment. The circumstances that determine the file segment length are:

- The file length set in the System Setup window.
- A power failure or crash recovery closes the previous data file and creates a new one in the series.
- A data file analysis load closes the current data file and creates a new one in the series.
- A disk write error closes the current data file and creates a new one in the series.

Temperature Calibration File (*.cal)

These files contain all transmitter or E-Mitter calibration information entered from the Temperature Calibration display. When you select the Save Calibration Info command from the File menu of the Temperature Calibration display, a .cal file is created. This file may be loaded later for use, or used with the current sampling configuration and event configuration to form a complete VitalView system configuration.

Autorecovery File (crash.rec)

This file is written by the system when you initiate data collection. It will be erased if VitalView is exited normally, or data collection is stopped. Should the system be shut down

without exiting normally, this file is not erased. Its presence will automatically trigger the automatic recovery module to initiate data collection when the computer is rebooted.

DLL File (*.dll)

These files are data link library files containing information that is not always required for system operations. They are commonly used for application software because they allow the system to utilize less RAM than it would otherwise require. When the information in these files is required, they are read by the system.

CAUTION! All files created by VitalView are integral to the security of collected data. NONE of the .exe, .cfg, .evn, .log, .###, .cal, .rec, .dll, .lrm, .ini, and serpdrv files should be modified in any way after the start of data collection or after data collection is terminated. Doing so will almost certainly result in the loss of some or all collected data.

Before Data Collection Can Begin

NOTE: In order to remove the possibility of program or resource conflicts during data collection, it is strongly recommended that you dedicate the PC to data collection operations exclusively. Before starting data collection, it is wise to shut down any other programs that are running.

Before beginning data collection, there are pre-experiment requirements:

- The VitalView hardware must be installed and connected as instructed in Section 2.
- There must be a complete system setup, including the following:
  - System setup data as instructed in Section 4.
  - Animal & Group Setup, including temperature calibration values and transmitter or E-Mitter assignment, as covered in Section 5 (see note below).

NOTE: VitalView will not begin data collection until each temperature parameter has been assigned a set of calibration value. If this information is missing, VitalView will prompt you. Instructions are in the Animal & Group Setup section in Section 5.

Suggestions for Long Term Data Collection

For customers performing data collection sessions that extend past one month or 500,000 data records, we recommend the following steps be taken.

Uninterruptable Power Supply

- Use an uninterruptable power supply (UPS) for all VitalView components.

Separate collection and analysis computers

- Your VitalView license agreement allows you to install VitalView on the PC used for Data Collection, and to be installed on a PC used for Data Analysis.

Check Data Collection clock status weekly

- Activate the System Setup display and confirm that the clock settings for the PC clock are updating and are accurate.

Use a separate PC for Data Analysis review

- It is highly recommended that the data be moved to another computer for viewing and analysis if VitalView is still collecting data. VitalView will tolerate viewing and collection at the same time, but there is a risk that more resources may be required than are available. This may lead to irregularities in the data collection. Read this section thoroughly for more information.

Weekly data backups are recommended

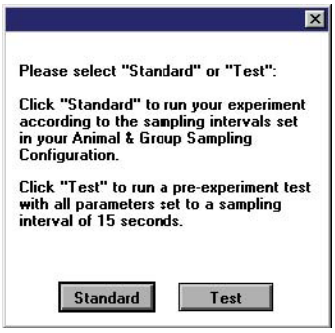
- Backing up your data is always recommended in long-term research. Refer to "Backing up Data Files" in Section 7.

To Start Data Collection

NOTE: Prior to beginning data collection, it is highly recommended that a test of all equipment and parameters be conducted as detailed in "Pre-Experiment Test" in Appendix C.

1 From the File menu, in the Main window, click on Start Data Collection.

Access: Main window > File > Start Data Collection



2 An alert window will appear that lists two choices.

- Test Option

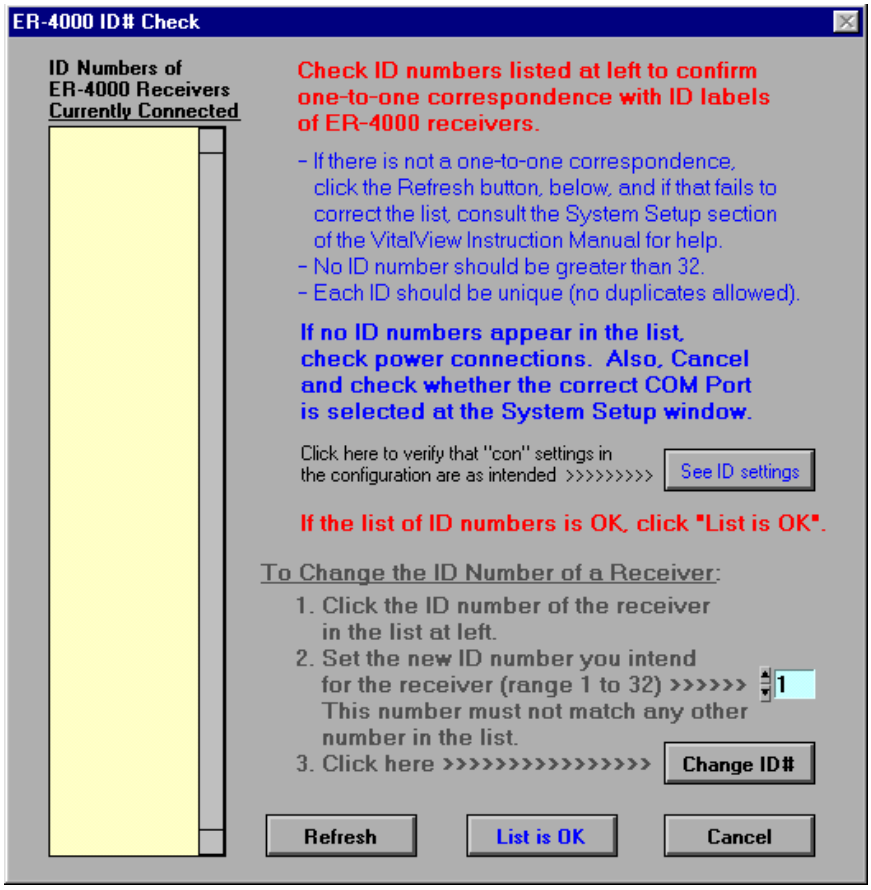
If this option is selected, VitalView will start data collection with a test configuration in which all sampling intervals have been set to 15 seconds. This test will continue until you stop data collection. For this reason, this option should only be selected if you expect to be present long enough to check the setup, stop data collection, and restart with the standard configuration.

- Standard Option

If this option is selected, VitalView will start data collection with the configuration that was set up for the actual experiment.

Without regard to which option has been chosen, VitalView will attempt to communicate with all ER-4000 receivers that are configured in the system.

Access: Main window > File > Start data collection > Test or Standard



3 If ER-4000 receivers are included in the system, VitalView will communicate with each one and list all receivers that were identified. Verify that all receivers in the chain have been identified and listed in the window.

4 If necessary, you may change the ID numbers of any ER-4000 receivers in the chain. Click Change ID #. When you are sure that all ER-4000s are listed correctly, click on List is OK.

If there are no ER-4000 receivers assigned to this experiment, VitalView will skip steps 3 and 4.

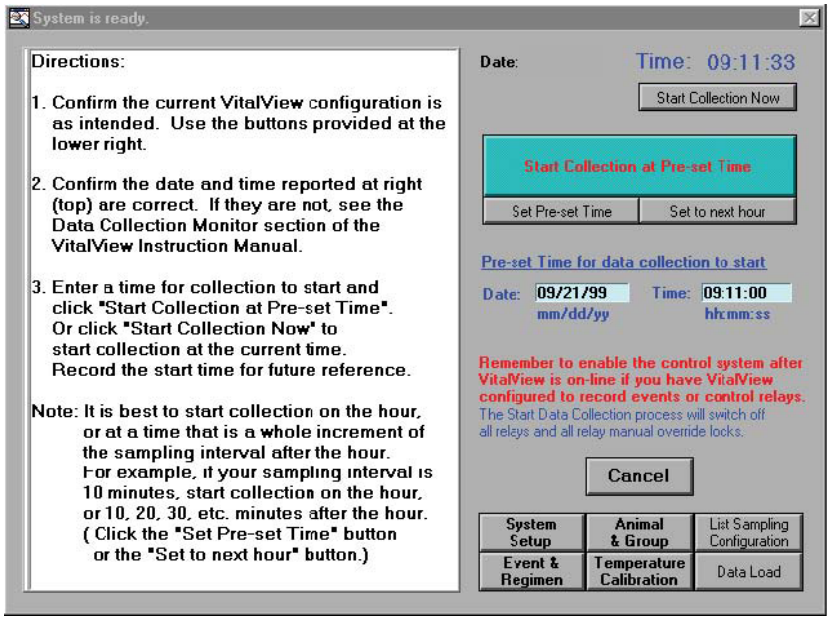
NOTE: If you have neglected to assign transmitter or E-Mitter calibration values, VitalView will not go on-line. A prompt will direct you to assign proper values.

5 When prompted, enter a text comment, e.g. Experiment B, Session 2, relating to the experiment description, and click OK. (This name will appear in several displays, such as the head of the ASCII file data outputs, etc).

6 At the File Dialog, use the "Up One Level", "Open", and "Create New Folder" buttons as necessary to navigate to and create a folder for the experiment log file and data files. We recommend that this folder not be the same as the folder containing VitalView installation files. Click on the File name field and type a name for the experiment log file. It is not necessary to type the .log extension. This will be added automatically. When satisfied with the location and name you have chosen, click the Save button.

A display will appear to control the start of data collection.

Access: (see procedure)



7 Confirm the current configuration is as intended by using the buttons provided in the lower right of the "System is ready" display (not including the Data Load button, which has a different purpose - see Appendix G).

8 Confirm the date and time reported by the "System is ready" display are correct. If they are not, the next step depends on whether you are starting the first session for an experiment or a subsequent session for a continuing experiment.

First session

- Reset the PC clock via the taskbar or by clicking the Start button, and selecting Settings > Control Panel > Date/Time. You do not need to cancel from the "System is ready" display to reset your PC clock.

Subsequent session

Do not reset your PC clock unless it is extremely inaccurate. See "Starting a Seamless Second Session" in Appendix G.

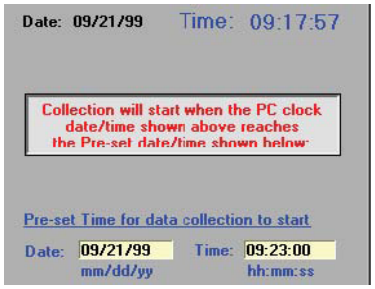
9 If the Pre-set Time shown is not appropriate for data collection to start, change it by clicking either of the two buttons just below "Start Collection at Pre-set Time", or by entering directly into the blue Date and Time entry fields. Set Pre-set Time results in a pre-set time that is recommended based on the longest sampling interval configured in Animal & Group Setup. "Set to next hour" will also set a recommended pre-set time, but may be further in the future than is practical for short sampling intervals. Click Start Collection Now to start data collection immediately. This is not recommended except for quick pre-experiment tests where the data collected will not be joined to any other data.

NOTE: There is an important reason to start data collection on the hour, or at a time that is a whole increment of the sampling interval after the hour. This will preserve the pace of the data collection from one session to a subsequent session. Realistically, in a typical long duration experiment, there is a probability that VitalView will need to be stopped before the experiment has been completed. In this event, data collection will have to be re-started (see "Starting a Seamless Second Session" in

Appendix G). If all sessions are begun with data samples taken on the hour (or at times that are whole increments of the sampling interval after the hour) then all sessions will have the same "pace" of data collection. If all sessions have the same number of parameters configured and the same sampling interval for each parameter, the sessions can be joined into one contiguous or "seamless" set of data with a constant pace of data collection throughout the experiment. (See "Joining Files" in Appendix H)

10 Click on "Start Collection at Pre-set Time". The following display will be seen until the PC clock catches up to the Pre-set Time.

Access: (see procedure)



11 When the PC clock passes the Pre-set Time, VitalView will go on-line and begin collecting data, as indicated by the green flashing indicator in the Main window. If possible (i.e., your sampling interval is not long), confirm the readings for all parameters are reasonable (via the Data Collection Monitor button from the Main window).

If the Test option was selected in step 2, see "Pre-Experiment Test" in Appendix C. After verifying that VitalView is collecting data as intended (according to Appendix C), stop data collection and re-start beginning at step 1. At step 2, select the "Standard" option for the first session of the actual experiment.

File Management

Backing up Data Files

All data files will be given the experiment filename plus a numerical extension. The maximum size for data files is set in System Setup. All data files will be uniformly sized, unless the system has been shut down due to a disk write error, power outage, or if the data have been loaded to the analysis buffer during data collection.

Which Files to Keep

You may want to occasionally tidy up the VitalView folder. We suggest that you back up any data files, .log files, .cfg, .cal, .evn, and .cal files prior to deleting any files. We also suggest that data be kept in folders not in the VitalView installation folder.

You may elect to save certain .cfg, .cal, and .evn files for future use. However, if these are lost, you can rebuild them from within the program. This is also true of the .log file (Main Window > Data Load & Analysis > File > Restore VitalView Log File). Data files cannot be restored.

CAUTION! Deleting any of the following files will cause VitalView to cease functioning.

Do not delete:

- Files with an .exe extension.
- Files with a .dll extension.
- Files with an .lrm
- Files with an .ini.
- serpdrv
- crash.rec file.
- The folder named "tmp_lvrteinstalldir"

Copying Files While On-Line

This procedure may be used at any time from any VitalView window. During long experiments, it is recommended data be backed up approximately every seven days.

1 Click Start on the Windows taskbar.

2 From the Programs menu, start Windows Explorer.

3 Navigate to the folder that holds the files for the current experiment, and open the folder.

4 Sort the files by name, e.g. Windows Explorer > View > Arrange Icons > Name.

5 From the list, find the five file-types for the current experiment. They will be labeled per the following format (these are examples):

990924.cfg System Setup and Animal & Group Setup file
990924.cal Supplementary configuration file - temperature calibration values
990924.evn Supplementary configuration file - event setup information
990924.log Log file for the experiment - a list of data files
990924.001 1st data file
990924.002 2nd data file
990924.003 3rd data file
990924.004 4th data file, etc.

6 While holding down Ctrl, click on each file of the current experiment. As an alternative, you may use the Windows Explorer or the method of your choice.

NOTE: Be sure to copy all the data files, from .001 through the last .xxx file. If the last file is missing, the data loading process will be more difficult.

7 When the appropriate files are highlighted, use the drag and drop method to copy them to a safe place.

NOTE: Make sure the Ctrl key is depressed during the entire copy process. It is very important that the files be copied rather than moved.

8 When the copy process is completed, confirm that the copies exist both in the original and the destination folder. If they do not exist in the original folder, they were likely moved rather than copied. Copy them back to the original folder immediately.

It is highly recommended that the data be moved to another computer for analysis if VitalView is continuing to collect data. Although VitalView will tolerate viewing and analysis at the same time as data collection, it is not recommended because analysis of large data files may require more resources than are available, leading to irregularities in data collection.

Loading Data for Viewing, Analysis, and Export

While VitalView is on-line, the most recently collected data may be used.

1. From the VitalView Main window, click Data Load and Analysis.
2. Click on File, and Load From VitalView File.
3. Open the experiment .log file. If VitalView is currently on-line, you will receive a *CAUTION*.
4. If you click Continue, VitalView will close the data file currently being written, and automatically start a new data file. This will allow you to load, view, analyze, and export the most recent data.

NOTE: These activities can consume excessive PC resources and are not recommended while VitalView is on-line. The recommended procedure is to copy the data files to another PC.

Further information on data analysis is located in Data Load and Analysis, Section 7 of this manual.

Crash Recovery File

Should your PC lose power, VitalView Crash Recovery will immediately initialize when the PC is restarted (see "Adding Crash Recovery" in Section 2). This module will direct data collection to resume. In addition, the previous data file will be closed and a new one started. The new file will have an incremental extension, e.g., .001 to .002.

If the VitalView program is exited in an abnormal fashion while data collection is underway, the crash.rec file will not be deleted. This file is written when data collection is initiated and contains the names of all the system files needed to restart data collection. Its presence in the program folder will trigger the automatic recovery executable file to restart the program and re-initiate data acquisition. The .cfg, .evn, and .cal files that were last utilized will be reloaded and a new data file will be started automatically. When you are ready to analyze data, the break in data collection will be recognized by the system. To set up Crash Recovery, see "Adding Crash Recovery" in Section 2.

Data Collection Monitor Display

The Data Collection Monitor provides an overview of the current data collection process. Usually this display will be left on your monitor when the system is collecting data.

Access: Main window > Data Collection Monitor

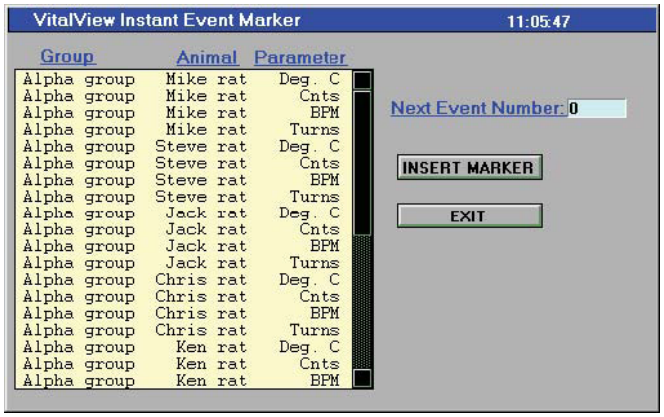
The Data Collection Monitor consists of two columns of 12 panels each, creating a "page." If you are collecting data for more than 24 parameters, you can scroll through the pages. Panels may be sorted by Animal ID, Group ID, or parameter.

File Menu

Insert Event Marker

This option inserts an instant event marker during data collection into the Marker current data file. No text other than an event number may be added. Therefore, it is important that you keep a manual log of each event.

Access: Main window > Data Collection Monitor > File > Insert Event Marker



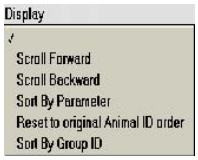
To insert an event marker:

1. Highlight the parameter you wish to mark.
2. Enter the event marker number to represent this event.
3. Click Insert Marker.
4. Click Exit.
5. Instant event markers can be viewed after data loading from the VitalView Analysis zoom display (see "Analysis Zoom" in Section 8).

Display Menu

These commands enable you to either scroll through multiple pages of panels, or direct a sort of the panels.

Access: Main window > Data Collection Monitor > Display



Scroll Forward

Enables you to move forward through the pages of indicator panels.

Scroll Backward

Enables you to move backward through the pages of indicator panels.

Sort By Parameter

This command places all the parameters of one type together. For example, all activity parameters may be grouped.

Reset to Original Animal ID Order

This command enables you to reset the indictor panels to the order originally set via Animal & Group Setup.

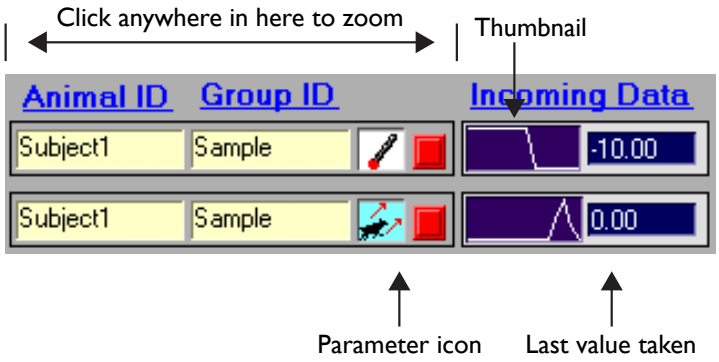
Sort By Group ID

This command enables you to sort the indicator panels according to the Group ID.

Monitoring Data Collection

NOTE: We strongly recommend that you close all other applications when VitalView is collecting data. It is possible for other programs to interfere with data collection.

Access: Main window > Data Collection Monitor

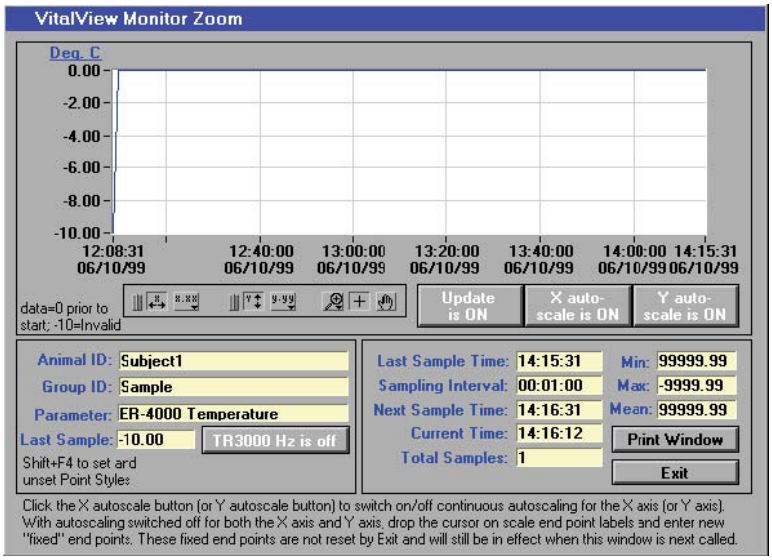


NOTE: VitalView will replace any data values that exceed clipping limits with a –10 value. Clipping limits should always be checked prior to beginning data collection to insure that valid data values are not unintentionally excluded from the parameter (see Section 5, "Setting Clipping Limits").

Data Collection Zoom Display

To activate the Zoom function, click *anywhere left of the thumbnail* in any of the parameter panels within the Data Collection Monitor display.

Access: Main window > Data Collection Monitor > (click within a parameter)



Data Chart

This display shows a graph of the last 128 data samples recorded for a single parameter. When a data value is recorded, it is placed at the right edge of the display. You may use the "grasping hand" to tug the chart to the left. As each new point is added, the chart scrolls to the left. When the system has recorded the 128th value the chart will be full, and the data values move off the chart. Therefore, the number of points will never exceed 128 in the monitor.

If you wish to view data values collected prior to the time displayed on the left edge of the chart, refer to Section 7, Data Load and Analysis.

Update is ON/OFF

The chart will automatically add newly collected points as they are recorded. The last 128 points can be displayed in the chart window. Updating is on by default when VitalView is first run. All chart controls and scaling settings will remain until the zoom window is exited. Even though the display is "frozen," data continue to accumulate.

X-Axis Autoscale is ON/OFF

The X-axis will automatically be set to include 128 samples across the chart without regard to the sampling rate. Automatic scaling will remain active unless you turn it off by toggling the Autoscale button.

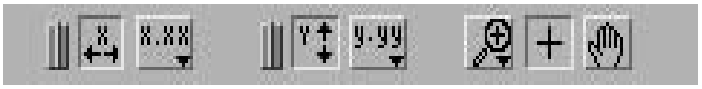
Y-Axis Autoscale is ON/OFF

The Y-axis will automatically be set to include the entire range of the 128 points of collected data. Automatic scaling will remain active unless you turn it off by toggling the Autoscale button.

Tool Pallet

The functions of the toolbar in the zoom display are explained below. Before using the Magnifying Glass and Grasping Hand, the X-Axis and Y-Axis Autoscale should be toggled off.

Access: Main window > Data Collection Monitor > (disk within parameter)



1 and **2** - X & Y Axis Autoscale Defaults

To avoid confusion with the autoscale buttons on the far right side of the panel, it is best not to use (1) and (2) as *controls*. Instead, use the autoscale buttons on the far right side of the panel.

3 Magnifying Glass

This tool is for changing the chart resolution by clicking, or clicking and dragging on a region of the chart for closer study. When you click on this tool button, a pop-up menu appears. Any of the Magnifying Glass modes modify the chart window. The selected mode will remain active until you choose another. When active, the magnifying glass button will be depressed.

4 Undo Zoom

Click this button to avoid changing the scale or chart position inadvertently. It is still possible to manually change the scale of the chart by inserting the cursor in the field containing the maximum or minimum values.

5 Panning Tool (Grasping Hand)

Enables you to grasp a portion of the data and drag it to any place in the chart. The axis scaling automatically adjusts to accommodate the change. This is a preferred tool to center the data of interest within the chart window prior to zooming. When the area of the chart is selected, the open hand changes to the grasping hand.

For additional information on the tool pallet, see Section 8.

Manually Entered Scaling Values

- First, toggle the X and Y Auto Scale buttons so they are OFF.
- Click on either the minimum or maximum value in either the X or Y-axis, and enter the value.
- To return to the Data Collection Monitor, click the X in the upper right corner.

TR3000 HZ is OFF

This function is used when calibrating transmitters used with the TR-3000 receiver. By default, frequency values are converted to temperature values using the calibration information assigned during configuration. When this button is activated, VitalView will display the incoming frequency rather than the temperature. Click the button to turn off the conversion. It will read TR3000 Hz is On when frequencies are displayed.

Min, Max, Mean, Statistics

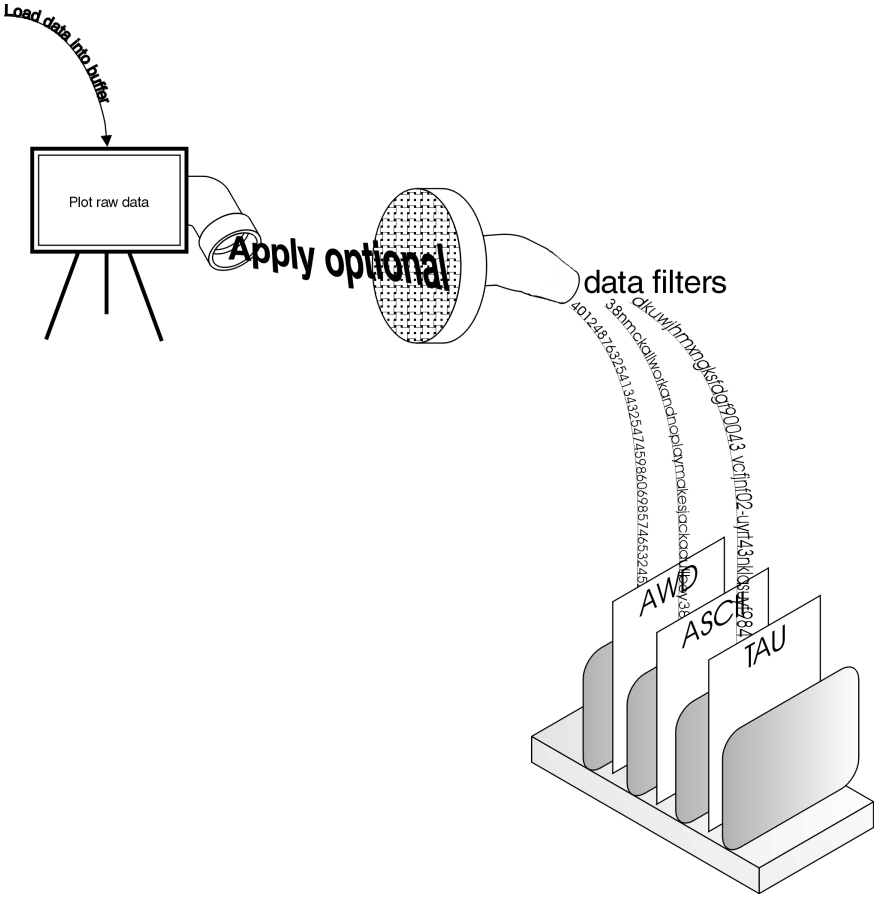
These statistics are for all valid data collected for the parameter since the start of data collection (or since a power failure recovery). Data samples detected as invalid or that have been clipped are not included.

SECTION

7

DATA LOAD & ANALYSIS

VitalView loads, filters and analyzes multiple data sets. A data set may contain the data for a single parameter or multiple parameters from one, or a whole experimental group of animals.



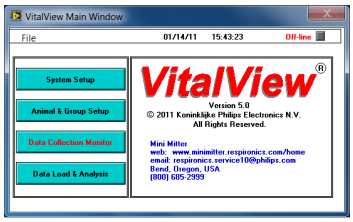
Four steps to data analysis in VitalView:

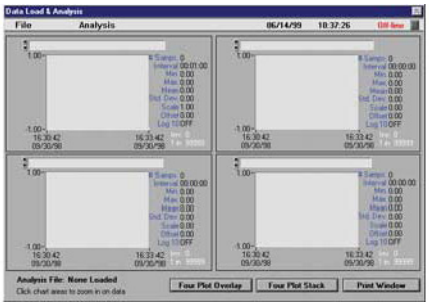
- Load data from data files.
- Examination of data charts.
- Application of optional data filters.
- Output of processed data to other file formats.

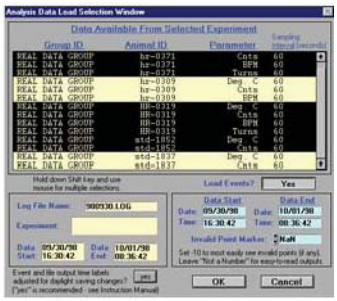
NOTE: Analysis operations are very different from the others in VitalView. There are some new terms that will be used frequently in this chapter. If unfamiliar with a particular term, refer to Appendix A, VitalView Terminology.

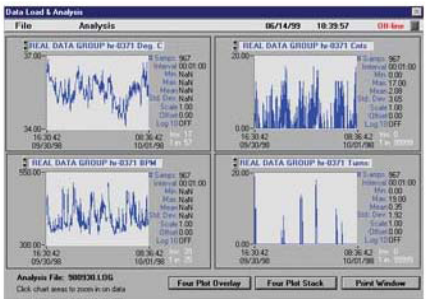
Loading Data

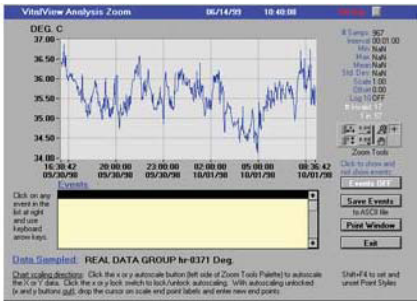
Step 1 - Open Data Load & Analysis **Step 2** - Data Load & Analysis Display **Step 3** - Choose Data











Step 4 - Wait for loading **Step 5** - Data displayed **Step 6** - Zoom Display

The data loading procedure is accomplished from the Data Load & Analysis display.

1 Open Data Load & Analysis (step 1 above). The four plot display will appear (step 2). From the File menu, select Load From VitalView Data File. With the file dialog, navigate to and choose the experiment log file to open.

2 Once an experiment log file has been opened, the data set(s) of the experiment will be displayed (step 3). Select parameters that all have equivalent sampling intervals. Multiple parameters can be loaded by holding down the shift key or the control key and selecting with the cursor. Press and hold down the control key while typing "a" to select all parameters (the parameter selection list must be clicked on first).

3 Select the Invalid Point Marker value. This is an important field to note for several reasons.

If there were any clipped or invalid data points detected during data collection, these will be set to the Invalid Point Marker value. Use the default "Not a Number" (NaN) setting if you do not care to see the time distribution of invalid points in the VitalView charts displayed after loading.

An advantage of the NaN setting is that the charts will be appropriately auto-scaled. This permits you to see your data immediately without having to manually adjust the chart scales or use zoom functions. NaN will treat invalid data points as "blanks" in the data.

The number of invalid points in each channel, and the ratio of valid to invalid points will be displayed in the lower right of each chart.

If you want to see the time distribution of invalid points, set the Invalid Point Marker to a value of –10 (-10 to -9999.99 is allowed).

NOTE: If NaN is in the Invalid Point Marker field, you will have to click on the field and enter a number. The scrolling arrows will only work with numbers. To accelerate scrolling, press the shift key.

4 Carefully check the following statements. If they are all true, you may click OK and proceed (a and b are mutually exclusive).

a If the current time is Daylight Saving Time and the log file creation date/time is also Daylight Saving Time.

b If the current time is Standard Time and the log file creation date/ time is also Standard Time.

c The data you are loading were collected in your time zone rather than mailed to you from another time zone where the data were collected.

d The sampling interval of the parameters you have selected for loading is 2 minute or longer, or 5 minutes or longer if you have more than 50 parameters selected.

e The data you are loading spans more than 1 day and less than 6 months, and you want to load the full time span of the data.

f You think you have less than 1,000,000 data samples selected for load (total samples = number of parameters multiplied by number of days, multiplied by 86400, divided by the sampling interval in seconds).

If all of the above are true, click OK, follow the prompts, and wait for VitalView to load the data.

If one or more of the previous statements are not true, follow the directions below *in the order given*.

- If (a) applies and is not true: Click the "Spring time change?" button to Yes.
- If (b) applies and is not true: Click the "Fall time change?" button to Yes.
- If (c) is not true: Click the "Time zone offset" control arrows until the Log File Creation Time matches that displayed by the PC that collected the data. This only matters if you want your data outputs to match the times shown by outputs produced by the data collection PC in the other time zone. (If you leave the Time zone offset control at its default of 0 hours, the timestamps of the data samples will be interpreted as though they were being collected by your PC at the exact real time they were being collected in the other time zone.)
- If (d) is not true, and any of (a) through (c) that apply to you have already been addressed: Click the "Special span" button to "Yes". Then click on the blue "Date" field under "To" to drop the cursor there, and enter a date that is much closer to the true data end time than is the default 6 months from data start (this assumes that if your sampling interval is this short, you have much less than 6 months of data).
- If (e) is not true, and any of (a) through (c) that apply to you have already been addressed: Click the "Special span?" button to "Yes". Then click on the blue "Date" field under "To" to drop the cursor there, and enter a date for the end of the data load. If wanted, do the same for the "Time" field, and also the "Load Data From" date and time fields. Data will load from the entered "From" data/time to the entered "To" date/time.
- If (f) is true, we recommend you load a single parameter first to get some idea of how long the full set of data will take to load. this will also allow you to see the exact start and end date/times of the data.

Click OK, and follow the prompts if they apply, and wait for VitalView to load the data.

Once the data are loaded, the first four data sets in the list of loaded parameters will be displayed in the four panels of the Analysis display. These panels allow you to preview the loaded data, or to compare between data sets.

NOTE: Raw data charts may look different than you expect. Most often this will be due to the chart scale. VitalView will automatically set the X and Y-axes to include the minimum and maximum values. These values may be changed at any time, by simply typing new values on the axis of your choice.

It is likely that you will need to load data from more than four parameters at once. You may choose which data set to display in each panel of the Analysis display by simply clicking any of the four chart titles. Each shows a pop-up list that contains all the currently loaded data.

Analysis Display

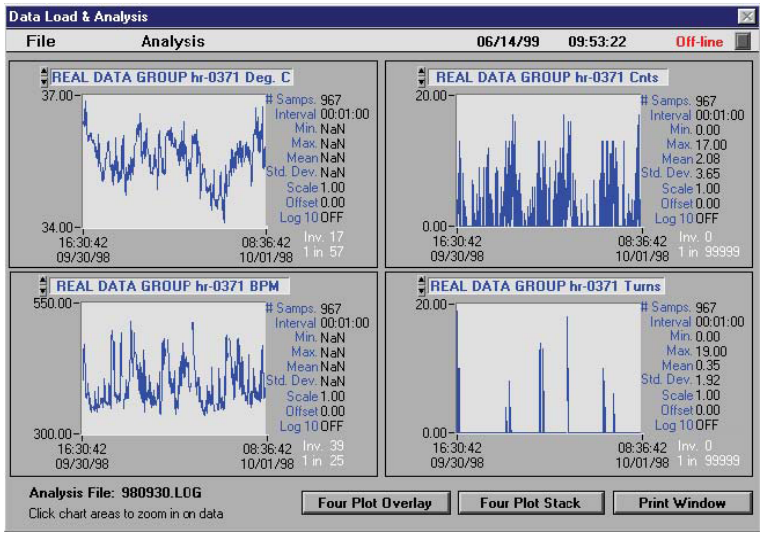
The Analysis display consists of four analysis panels into which different data may be loaded. These panels allow you a cursory view of the data as well as a listing of statistics. The title of each chart is a pull down menu that zooms in on that particular parameter.

The .log file from which the data have been loaded will be displayed in the lower left corner of the display.

Physiological parameter statistics are displayed beside each of the four plots in the Analysis Display. These statistics are:

- Number of samples
- Sampling interval
- Minimum of the data
- Maximum of the data
- Standard deviation of the data
- Scale Factor
- Data Display Offset

Access: Main window > Data Load & Analysis

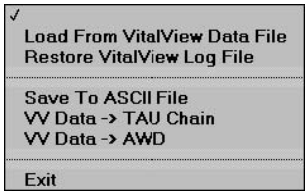


It is important to remember that these statistics are calculated using all data for that particular parameter, including occurrences of "-10", or "NaN". If NaN was selected as the invalid data marker during data load, then several statistics will have values of NaN. To re-calculate the statistics, all occurrences of the invalid marker must be removed using the

Invalid Points Filter (see "Invalid Points" in Appendix F), and the data for that parameter re-displayed.

File

Access: Main window > Data Load & Analysis > File



Load From VitalView Data File

This command loads data from files stored in the VitalView format. Data may be converted to ASCII, Actiview (.awd), and tau (.chn) after loading.

Restore VitalView Log File

This command is used as part of the file joining process (see "Joining Files" on page H-1), for rebuilding the .log file from an original log file that has become lost, or was inadvertently deleted or corrupted.

Save to ASCII File

This command converts data currently in the Analysis Buffer into a comma or tab delimited ASCII file. Most PC programs can read these files.

View Data to TAU Chain

This command converts data from VitalView data files to TAU .chn files format. TAU files contain data from a single parameter only. Therefore, this operation will produce multiple files that may each be loaded to TAU for circadian rhythms analysis.

View Data to ActiView File

This command converts VitalView data to ASCII files modified for use by the ActiView utility. ActiView generates actograms and performs circadian analyses. These files all have the .awd extension.

Exit

Select this command to return to the Main window.

Analysis

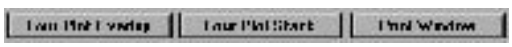
Filter Data

This command enables the application of various mathematical filters and other data operations to the specified data set(s). Data filtering will be important to those users who are monitoring radio transmitters or E-Mitters in order to remove the effects of electrical interference or other artifacts affecting the raw data.

The filters are explained more fully in "Data Filtering" on page F-1.

Plot Buttons

Access: Main window > Data Load & Analysis



Four Plot Overlay

This command will produce a plot in which the four data sets displayed inthe Analysis display will be superimposed upon one another for comparison on the same set of axes.

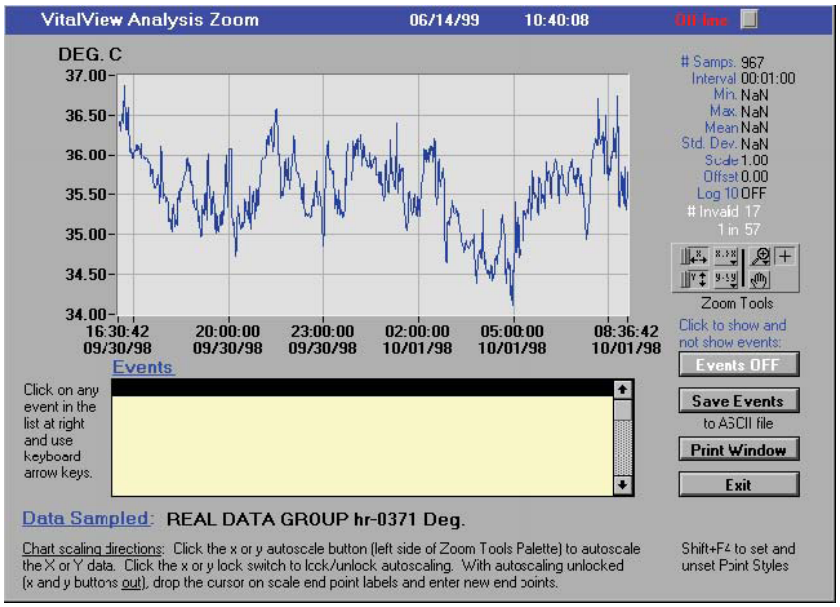
Four Plot Stack

When clicked, this command will produce a plot in which the four active data sets displayed in the Analysis display will be stacked in a column, each with its own set of axes.

Analysis Zoom

By clicking on a chart panel, Analysis Zoom is enabled. A data chart for the chosen data set will appear for closer inspection.

Main window > Data Analysis > (click on chart panel)



The Chart Window displays all data collected during the interval specified when loading the data. Unless auto scaling has been switched off (see below under zoom pallet), both X and Y-axes will automatically scale to accommodate the full range of data. It is important to set the clipping limits for each parameter before starting data collection to eliminate the inclusion of data points that are outside the physiological limits.

You may change the X or Y axis scale by simply clicking on either the minimum or maximum value and entering the one of your choice. Before you do this, unlock the X or Y autoscale.

Zoom Tool Pallet

The zoom tool pallet is the small display of tools to the right of the chart.

The pallet has controls for panning and for zooming in and out of sections of the graph.

If you press the X autoscale button (b), VitalView autoscales the X data of the graph. If you press the Y autoscale button (e) VitalView autoscales the Y data of the graph. If you want the graph to autoscale either of the scales continuously, click on the lock switch (a) to lock autoscaling on.

The scale format buttons (c and f) give you run-time control over the format of the X and Y scale markers respectively.

Normally you are in standard operating mode, indicated by the plus (h). Click this button to avoid changing the chart scale inadvertently.

If you click on the grasping hand (i) (panning tool), you switch to a mode that enables you to scroll the visible data by clicking and dragging sections of the graph.

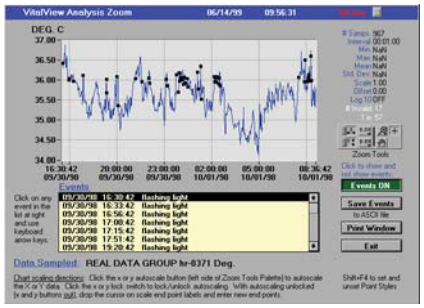
If you choose the magnifying glass (g) (zoom tool), you can zoom in on a section of the graph by dragging a selection rectangle around that section. If you click on the magnifying glass, you get a pop up menu you can choose the various methods of zooming.

Events On/ Off

This function toggles recorded events on or off and displays them on the chart. If there are many events, this may take a moment to generate.

- Each event is represented by a black dot on the chart. Clicking on an event in the list will change the dot to red.
- If there are numerous events in one area, it may be necessary to zoom on the group to single out an event.
- You may save the event list for any data set to an ASCII file. The contents of the file may be viewed using Notepad, Wordpad, or any other text editor.

Access: Main window > Data Load & Analysis > (click within chart panel) > Events On/Off

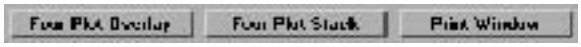


Viewing Data Charts

In addition to viewing the four data panels in Data Load & Analysis, there are three options for viewing data.

The options are accessed via the buttons in the Data Load & Analysis display.

Access : Main window > Data Load & Analysis



Scaling

The Y axis in either display may be adjusted by inserting the cursor in the minimum or maximum value, and typing in the new value. Press Enter and the scale will automatically update.

Printing

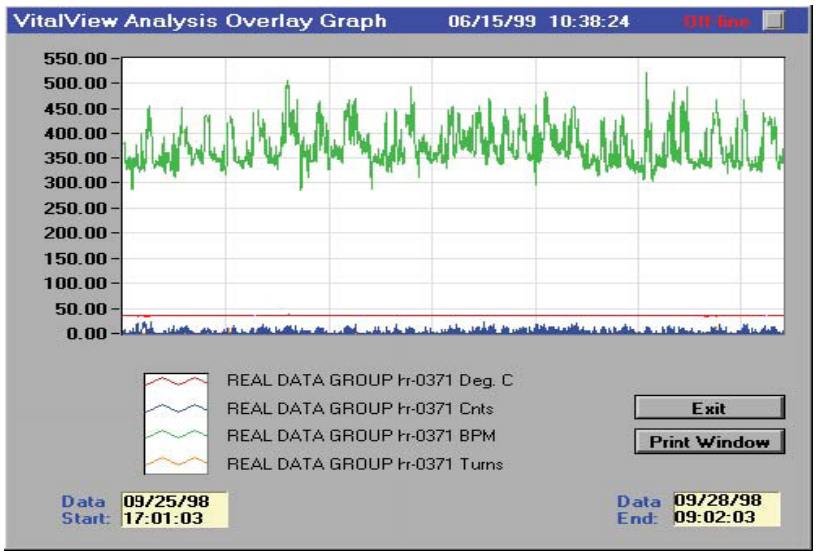
Print the stacked charts by clicking Print Window.

Zoom Display

This is detailed in "Analysis Zoom" in Section 8.

Four-Plot Overlay

Access: Main window > Data Load & Analysis> Four Plot Overlay

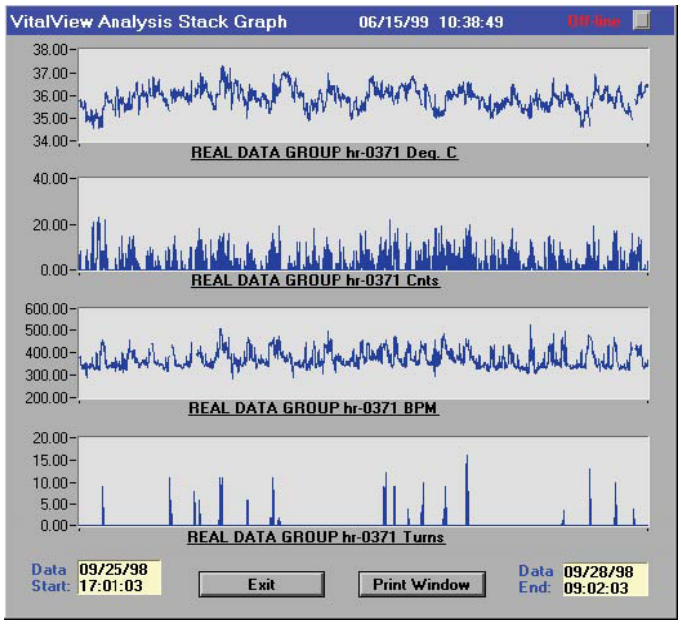


By placing more than one data set on the same axes, differences between them may become evident. You may plot up to four parameters in four colors. The legend appears at the bottom of the chart.

Stacking Charts

Stacking the charts of multiple parameters permits visual comparison.

Access: Main window > Data Load & Analysis > Four Plot Stack



Converting VitalView Data Files to ASCII

VitalView data files are a specialized format that cannot be read directly by other programs. The format is specific to the requirements of the VitalView program. These files can easily be converted to ASCII format for importation to other programs. Instructions are included below. Instructions for importing an ASCII file generated by VitalView into Microsoft Excel® are included in the next section.

1 Load the data of interest into Data Load & Analysis (see Section 7).

2 Apply any applicable filtering (see Appendix F).

3 From File, select Save To ASCII File.

4 Follow the on-screen directions to select the format in which to save the data.

5 Select the destination drive and folder for the ASCII file.

6 Enter a filename for this file. The .asc extension will automatically be appended.

When the conversion is completed, the file will be given an .asc extension, and the program will return to the Data Load & Analysis display.

It is possible to save several versions of the data to file as you apply different filters, or include different combinations of parameters.

Importing ASCII Files into Excel

ASCII text files generated by VitalView can be imported into most programs. The instructions below are for importing an ASCII file into Microsoft Excel, however most programs will have a similar series of commands.

1 Open the Excel application.

2 From the File menu, select Open.

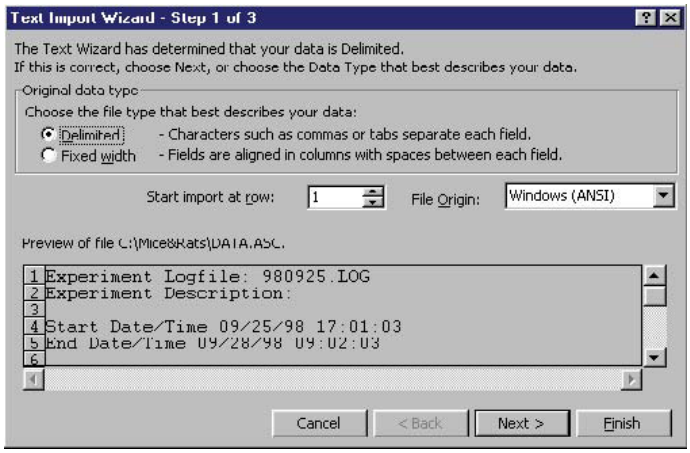
3 Navigate to the folder in which the VitalView data files are saved.

4 Direct the browser to list All Files (*.*).

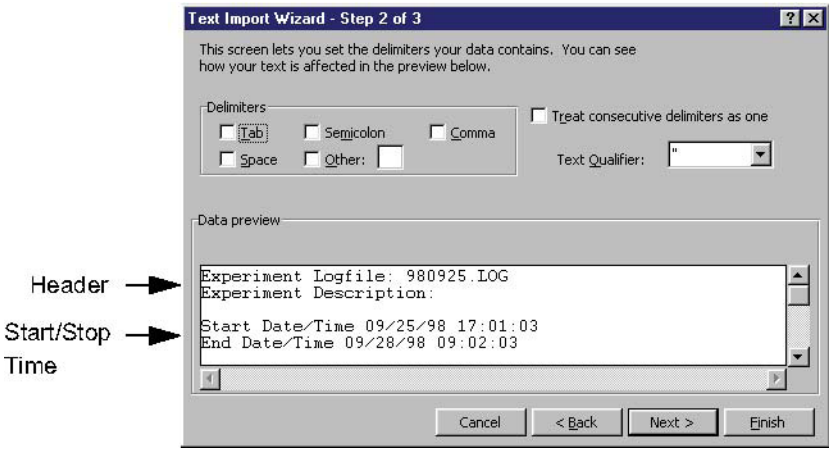
5 Select the .asc file to be opened and click Open.

6 The Excel Text Import Wizard will open.

Access: Excel > File > Open > (ASCII data file)



7 Select the Delimited button, and click Next. The next Wizard step will appear.



8 Select either Comma or Tab delimited, depending on how the ASCII file has been saved. Click Finish.

The data will appear in Excel in column format.

The header information at the top of the file keeps track of the origin of the data file and provides basic information including start and stop times as well as the text description entered when data collection was started.

A block of information for each data set is also included at the beginning of the file. This contains the ID values, sampling intervals, clipping limits, and number of records. There will be a header for each of the data sets.

39	Animal ID: hr-0309		
40	Group ID: REAL DATA GROUP		
41	Units Measured: Deg. C		
42	Sampling Interval: 00:01:00		
43	Low Clipping Limit: 5.000000		
44	High Clipping Limit: 50.000000		
45	Number Of Records: 3842		

Data sets are ordered according to the number of records they contain. The data set containing the largest number of records will be listed first in the ASCII file. The data set containing the least number of records will be listed last. This convention handles data sets with parameters sampled at different intervals.

Each data set will have three columns of information. The first column will contain the date for each record. The second column will contain the time of each record. The third column will contain the data value.

Date Time Data value

C2462 = 98/9/27 7:55:3

	A	B	C	D
2460	98/9/27 7:53:3	36.27	98/9/27 7:53:3	12
2461	98/9/27 7:54:3	36.37	98/9/27 7:54:3	0
2462	98/9/27 7:55:3	36.47	98/9/27 7:55:3	1
2463	98/9/27 7:56:3	36.47	98/9/27 7:55:3	0
2464	98/9/27 7:57:3	36.38	98/9/27 7:57:3	11
2465	98/9/27 7:58:3	36.23	98/9/27 7:53:3	6

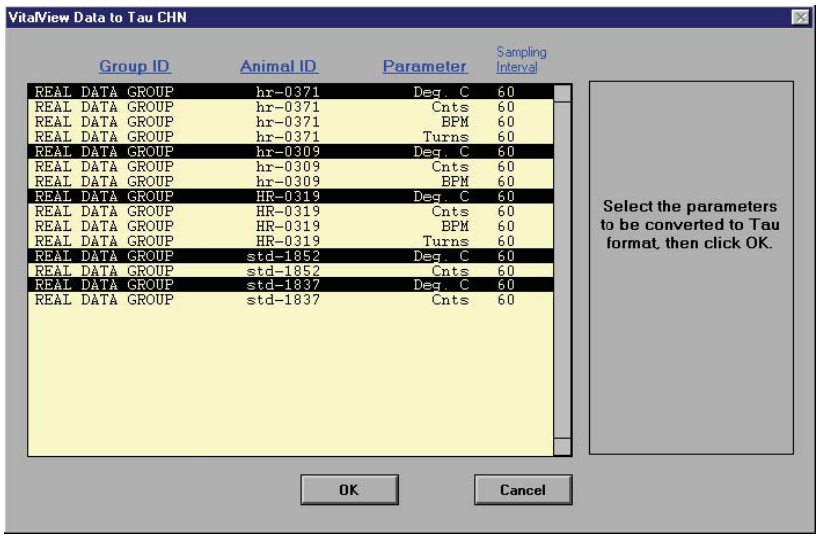
The header for each data column will be truncated to save space. By clicking on a cell, the entire contents may be read. By double-clicking on a column, the column may be resized to fit the largest entry.

Converting Data to TAU Chain Files

The TAU export function allows you to convert data from VitalView data files to the TAU .chn files format. TAU files contain data from a single parameter only. Therefore, this operation will produce multiple files that may each be exported to TAU for circadian rhythms analysis.

1 From Data Load & Analysis, select File > VV Data ? TAU Chain.

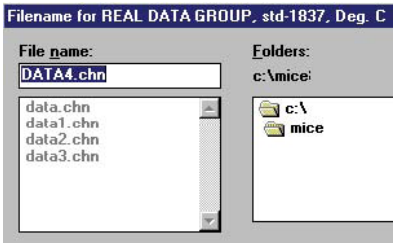
2 From the list, select the data sets to be converted. Click OK.



3 Navigate to where the chain files are to be saved, name the file, and click OK. The file will be converted, given an extension, and saved.

In the above example, several files are highlighted. As the files are converted and saved, each one is automatically incremented.

Access: Main window > Data Load & Analysis > File > VV Data ? TAU Chain



Converting VitalView Data to ActiView Format

The ActiView export function included with VitalView enables the conversion of data files to the .awd ASCII format required by the ActiView program. ActiView is a program that provides several different forms of circadian rhythm analyses.

1 From Data Load & Analysis, select Load Data From VV File. Load the data files to be converted to the ActiView format.

2 Select File > VV Data ? AWD.

3 Navigate to where the .awd files are to be saved, name the file, and click OK. The files will be converted, labelled with the .awd extension, and saved.

4 These files can now be opened in ActiView for analysis.

APPENDIX

A

VITALVIEW TERMINOLOGY

Animal Configuration

An animal configuration is a complete collection of parameter settings for a single Animal ID. For example, the configuration for the Animal ID "Animal1" might include settings for three parameters: heart rate, activity, and temperature.

Auto-Indexing Hardware

This feature will automatically assign a hardware channel for each parameter in each of a given number of animal configurations copied from a template animal configuration. Auto-indexing provides an easy method to set up a complex experiment in an orderly fashion. System setup must be properly established before copying animal configurations.

.awd file

A modified ASCII file used by the ActiView utility for generating actograms and performing circadian analysis.

Channels

Channels are pathways for the data signal of a single parameter. Each parameter must be assigned its own path. This "path" contains three numbers. For example, a complete channel designation might be **2,5,1**. Each number has a special definition, depending on the hardware used.

Connector

A connector is defined as any jack (female) or plug (male) on a VitalView hardware component or cable.

Control Fields

Control fields are colored light blue, and can be edited by the researcher using common tools, such as clicking on arrows, etc. *(see Indicator Fields)*

Data Filter

A mathematical manipulation of raw data for purposes of smoothing, increasing resolution, or changing scale.

Data Set

Data records for one parameter that have been loaded for plotting, filtering, or other purposes.

Events

Events are occurrences that the user wishes to note in the data record during an experiment. An event may relate to one or more animals.

Files Organization

You may elect to save any file in any directory while in VitalView. We suggest that you develop a system of file organization so that it will be easy to locate saved files when you wish to use them later. Horizontal order (many folders and few files) is easier to access, but tends to get cluttered. Vertical order (fewer folders, but many files) is tidier, but fewer files are visible.

Hardware Configuration

The layout and interconnection of hardware components, including interface cards, DataPorts, receivers, and other system components needed for a research project. More information on hardware configurations can be found in Section 2, Hardware Installation.

Indicator Fields

Indicator fields are colored yellow, and cannot be edited. (see Control Fields).

.log file

An ASCII file used by the system to coordinate data analysis for a single data collection. *Also see Section 6.*

.log file vs data file

A *.log* file is an ASCII file that contains a list of the data files created during a data collection session. The filename for this list is determined when data collection is started. VitalView automatically appends the *.log* extension to the filename. One of these files must be selected in order to instruct VitalView where to look for data to load.

Data for a single experiment are actually contained in a series of numerically ordered files. You will never open one of these files directly. Their length corresponds to the system configuration setting for file length made prior to initiating data collection.

Parameter Settings

Sampling instructions for one physiological or behavioral parameter, such as temperature. Settings are controlled by one of the five boxes within the Animal and Group Configuration display. This is discussed in detail in Section 5, Animal & Group Setup.

Sampling Configuration

A sampling configuration is a complete collection of animal configurations and experimental group information for VitalView. Sampling configurations may be saved to disk for repeated use when an experiment is replicated. Activating Save Configuration from the File menu in the Animal and Group Setup display or the Main window can save the current sampling configuration. Sampling configurations are saved in files with a .cfg extension

System Setup

The system setup is a set of default instructions for VitalView. Default instructions set characteristics such as the sample buffer size and data file limits. These settings are saved in a file with a .cfg extension. These settings originate in System Setup.

Temperature Calibration Values

Calibration values are empirically determined frequency values acquired from model -FH transmitters or E-Mitters at known temperatures. These values are used by the system to accurately determine temperature. Before beginning data collection, calibration values must be entered in the transmitter list. These values will be saved in a file with the .cal extension.

VitalView Configuration

A VitalView configuration is a comprehensive term consisting of the system setup and sampling configuration settings and temperature calibration information.

APPENDIX

B

HARDWARE CONFIGURATIONS

The following illustrations may be of help in setting up the VitalView hardware. A large, complete VitalView system can be intimidating if seen as a whole picture. However, when broken down into the fundamental components, VitalView is quite simple.

Included in the following pages are a few representative devices and layouts commonly found in customer facilities.

- Running wheel with magnetic switch
- QA-4
- Feeding monitors
- DP-24 in Series
- Dual input module
- TR-3000
- Lick sensors
- Transmitters

Connection for Running Wheel Magnetic Switch

Assembling the Wheel

1. Place the two halves of the stainless steel cage lid on the plastic cage. One half is the sheet lid; the other side is the activity wire lid containing the food hopper and water bottle compartment.
2. Slide the running wheel onto the axle of the wheel hub and support unit. Secure by threading the knurled stainless steel retaining nut snugly onto the end of the shaft. Assure that the wheel spins freely on the shaft. Lower the complete wheel assembly into the opening in the sheet lid until it rests securely.
3. Test the wheel by spinning it to make sure it turns freely. If it touches the top of the sheet lid, bend the lid slightly away from the wheel to provide clearance. Note that the weight of the wheel will keep the animal from pushing its way out through this opening as long as the wheel turns freely. If rotation of the wheel is blocked, e.g., excess bedding in the cage, the animal can climb the wheel and possibly escape.

How the Wheel Turns are Counted

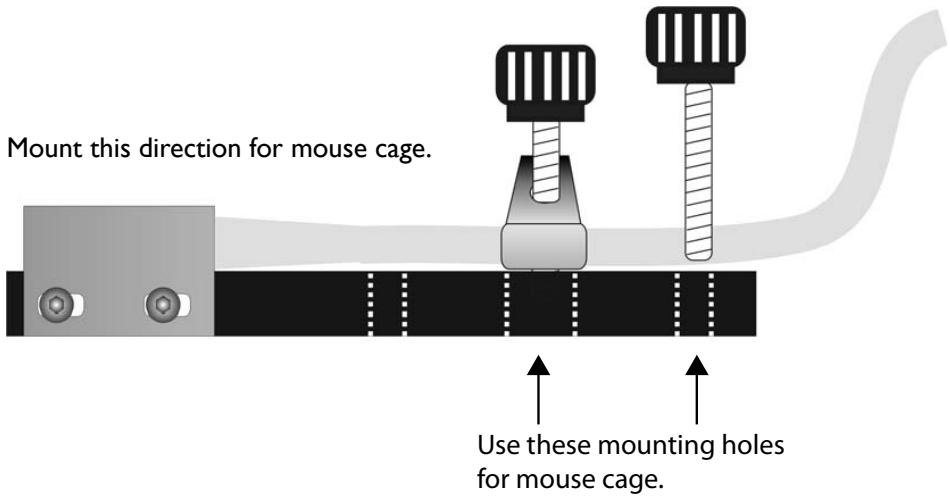
The Starr Life Sciences system for counting wheel turns consists of a magnet attached to the flat back part of the wheel, and a magnetic switch mounted on the wheel support unit. Each time the wheel rotates the magnet within range, the switch closes and a turn is counted.

Attaching Magnetic Switch and Magnet

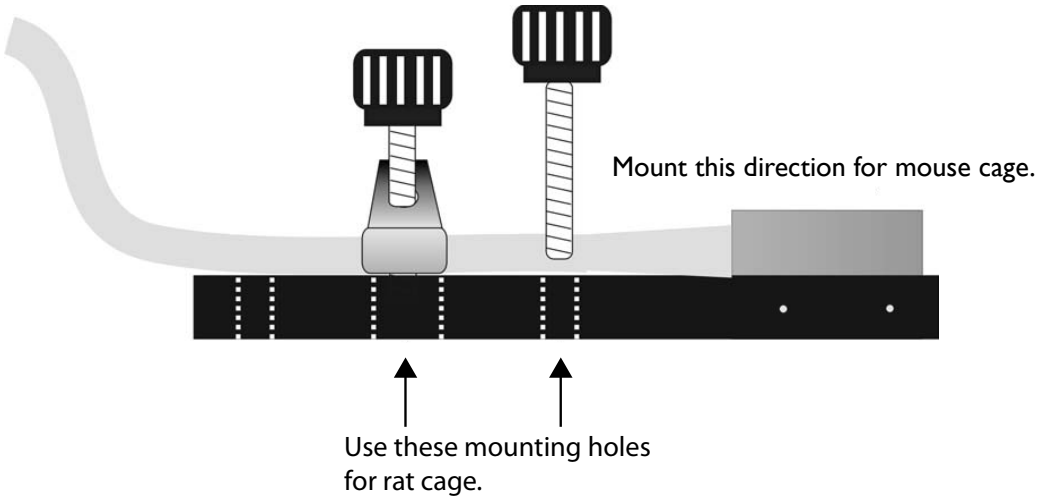
NOTE: The position of the magnet as it passes the switch is important for proper turn counting. If the magnet is too far away from the switch as it passes, the switch will not close and no activity will be recorded. If the magnet is too close, the switch will close once as the magnet approaches, and again as it departs. This will result in a double count. Follow the instructions carefully.

1. Mount the magnetic sensor to the wheel support unit with the thumbscrews provided.
2. The strain relief cable clamp is mounted in the center screw position as shown below.
3. The bracket is universal for either rat or mouse cages. Shown below are the two ways in which to mount the sensor.

Mouse Mount



Rat Mount

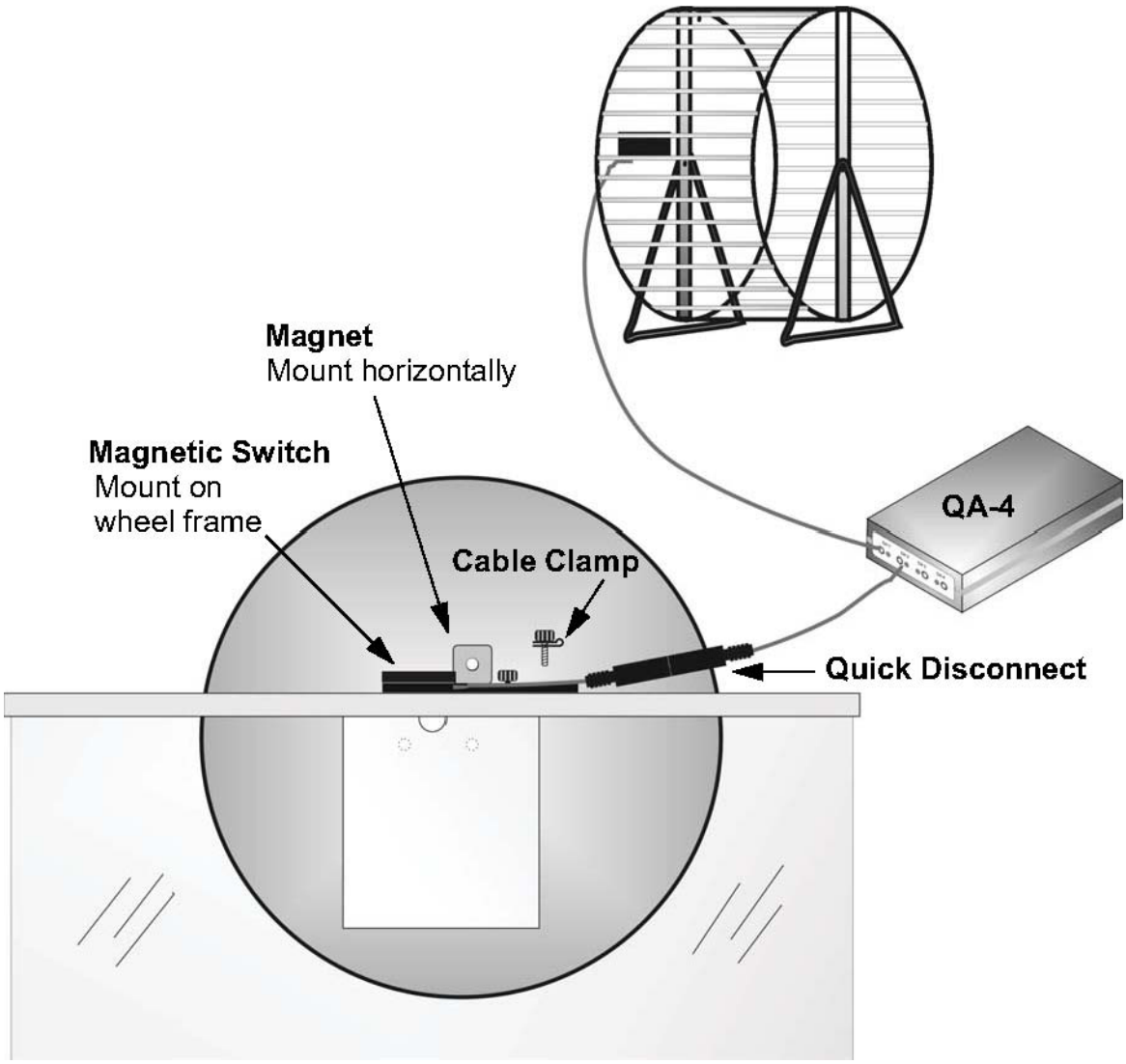


NOTE: Mount with the cable strain relief clamp so that the cable is held away from the cage. This will reduce the risk of cable damage due to rodent chew.

4 Mount the magnet on the wheel. Remove the paper from the adhesive square. Mount the magnet horizontally over one of the holes in the wheel per the illustration on the following page.

5 Plug the connection cable into the sensor. There is only one way in which the cable can be inserted into the sensor.

Sensor Mount for Rat Running Wheel



Connecting Running Wheels to VitalView

All mechanical switches used for monitoring must be connected to VitalView through an electronic circuit to insure a switch closure is counted as a single event. When mechanical switches are activated, they typically close several times in rapid succession. This property of switches is called switch bouncing, and the circuits used to keep the multiple closures from being recorded by the computer system are called de-bounce circuits. Two such circuits are available for use with VitalView systems.

If the animal is being monitored by a TR-3000 telemetry receiver, the magnetic switch cable can be plugged into one of the auxiliary input jacks on the receiver. These inputs have de-bounce circuits included.

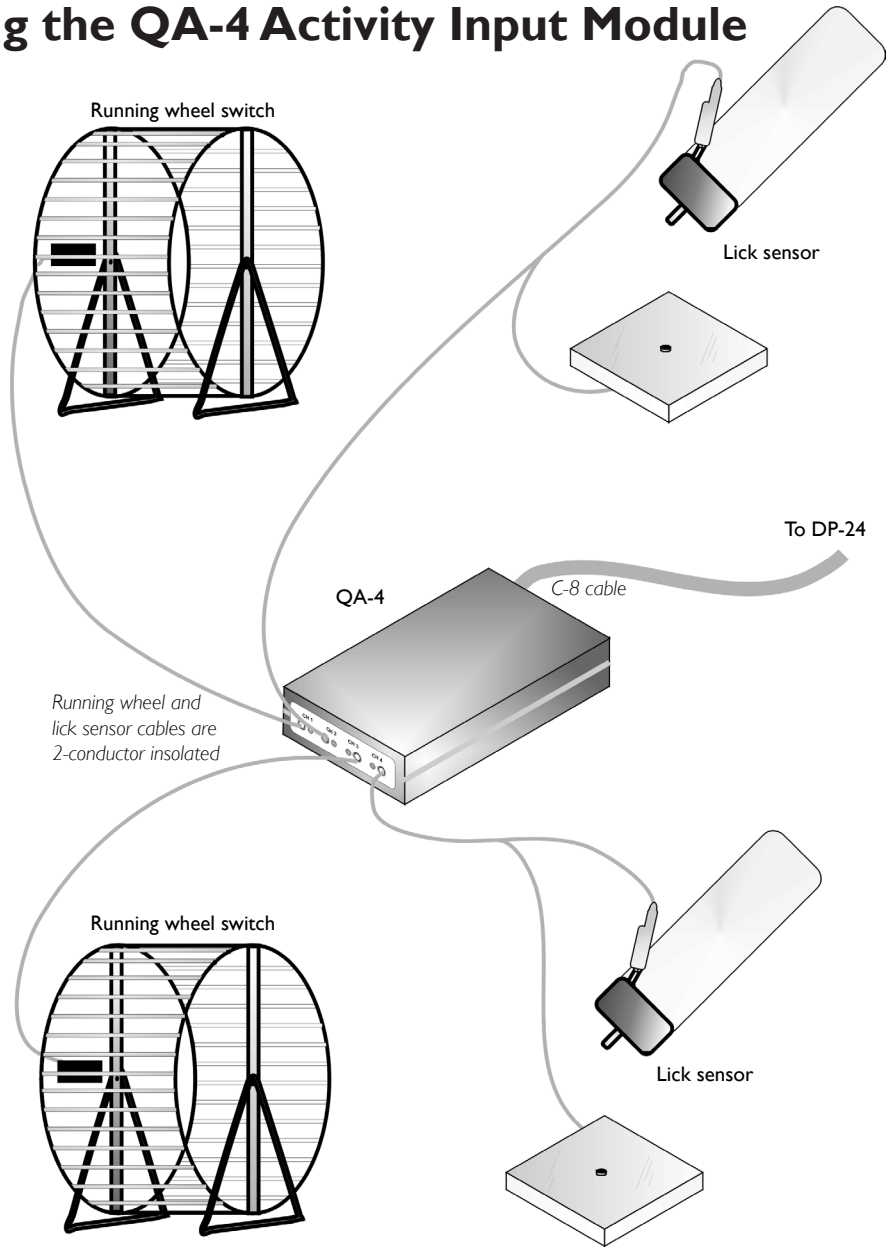
If TR-3000 receivers are not being used (or if both auxiliary inputs are assigned to lick sensors or other units), a QA-4 Activity Input Module can be used to de-bounce the magnetic switch signal.

In either case, an LED indicator next to the jack will light when the switch closes. Each QA-4 Activity Input Module has four input jacks and its output cable is connected to one of six available inputs on a DP-24 Dataport. Therefore, one DP-24 Dataport equipped with six QA-4 Activity Input Modules can accommodate 24 magnetic switches from running wheels.

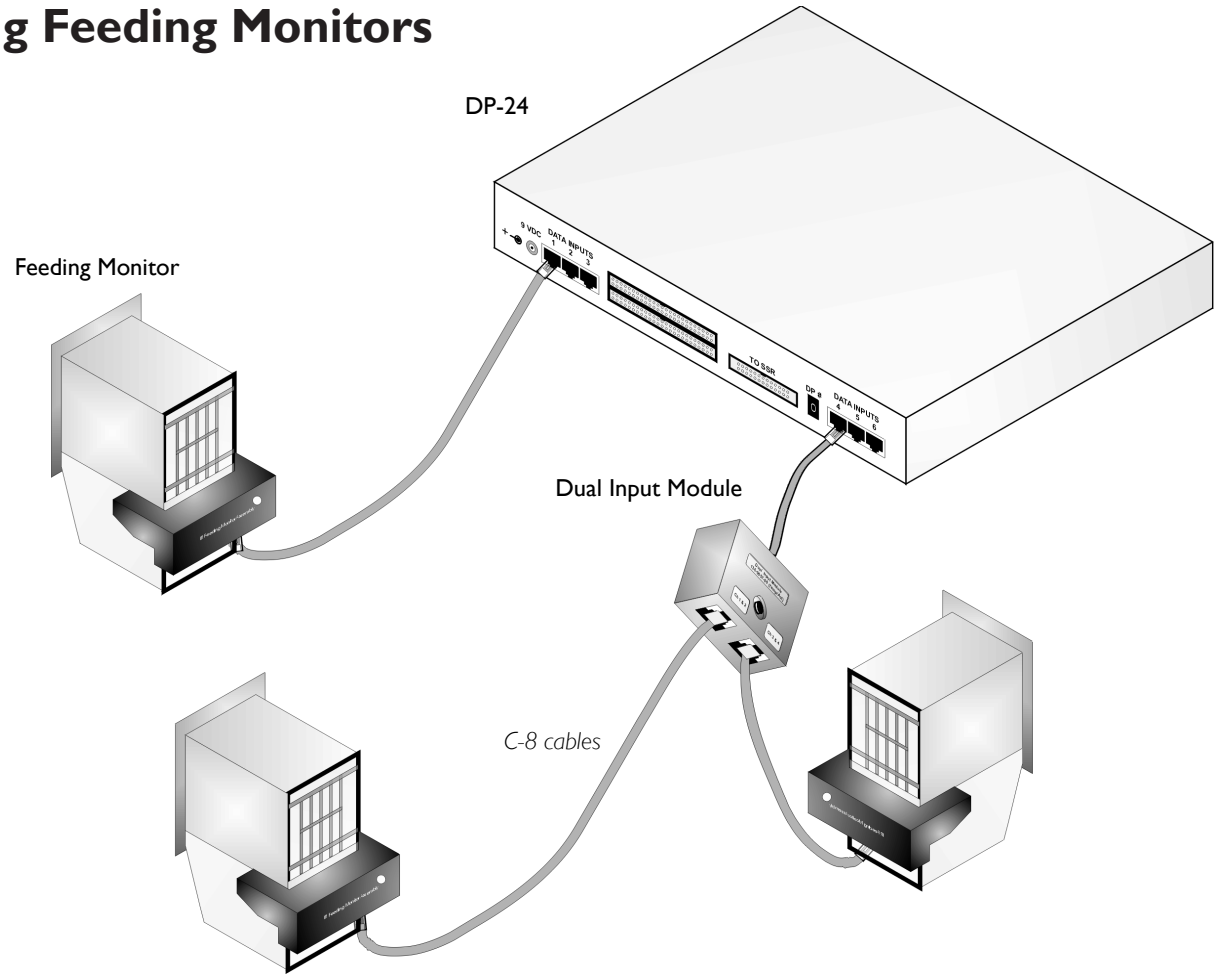
1. Plug the cable from the magnetic sensor into either an auxiliary input jack on a TR-3000 Receiver, or a jack on a QA-4 Activity Input Module.
2. Verify that the power is turned on to the DP-24 Dataport.
3. Rotate the running wheel and verify that the indicator LED flashes once (and only once) with each turn of the running wheel.

For manual monitoring, magnetic running wheel switches can be connected to individual wheel counters.

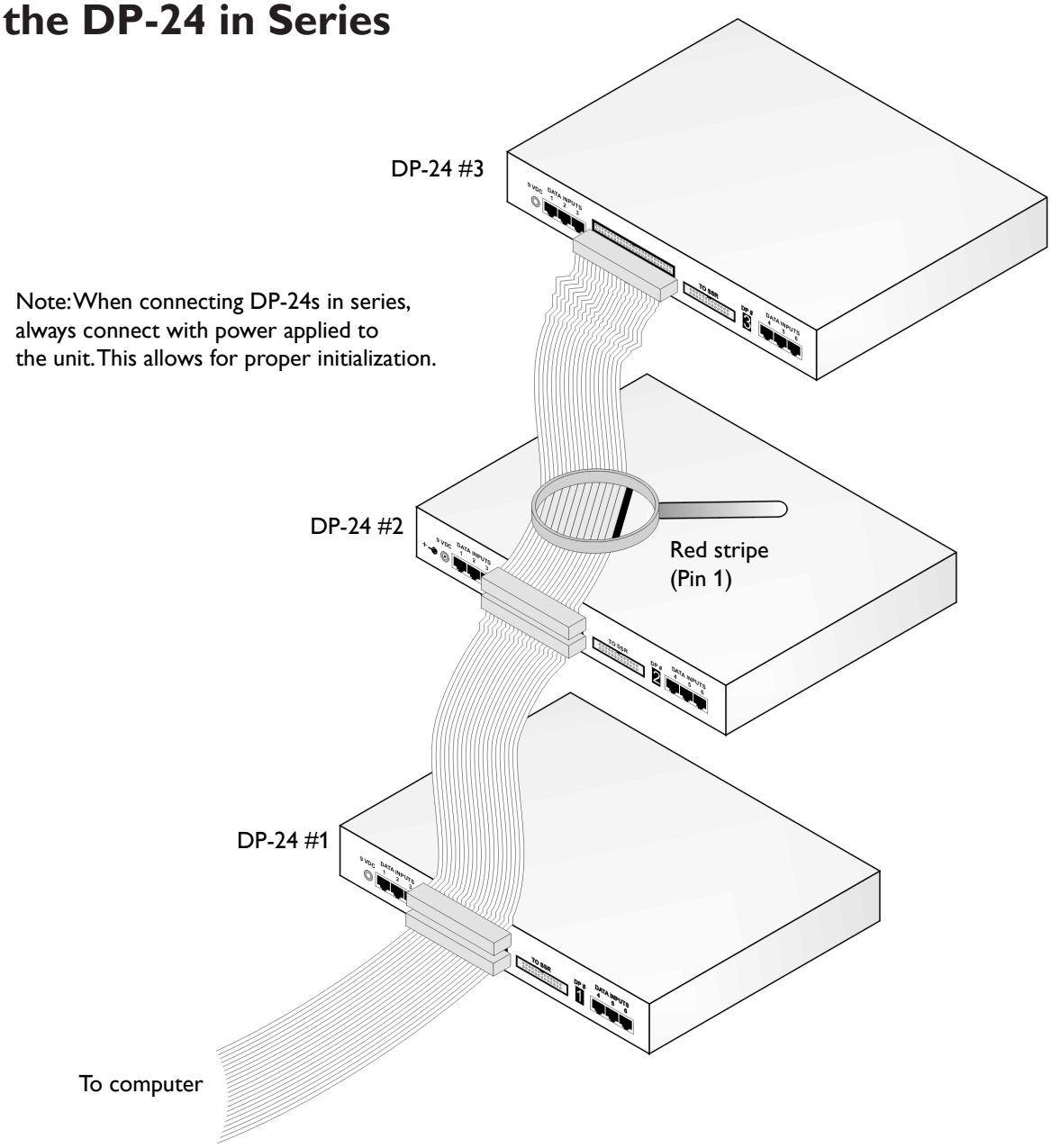
Connecting the QA-4 Activity Input Module



Connecting Feeding Monitors

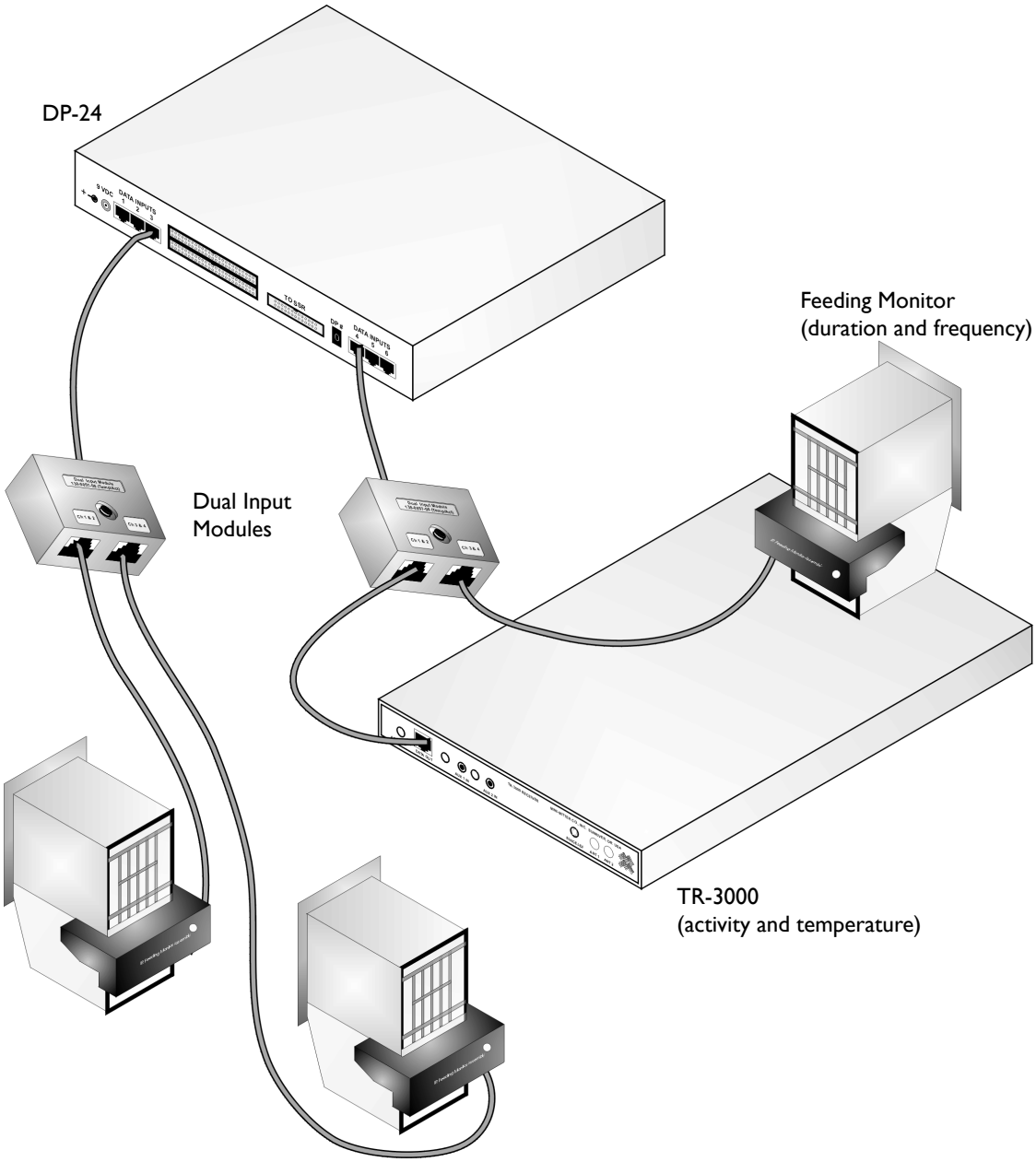


Connecting the DP-24 in Series

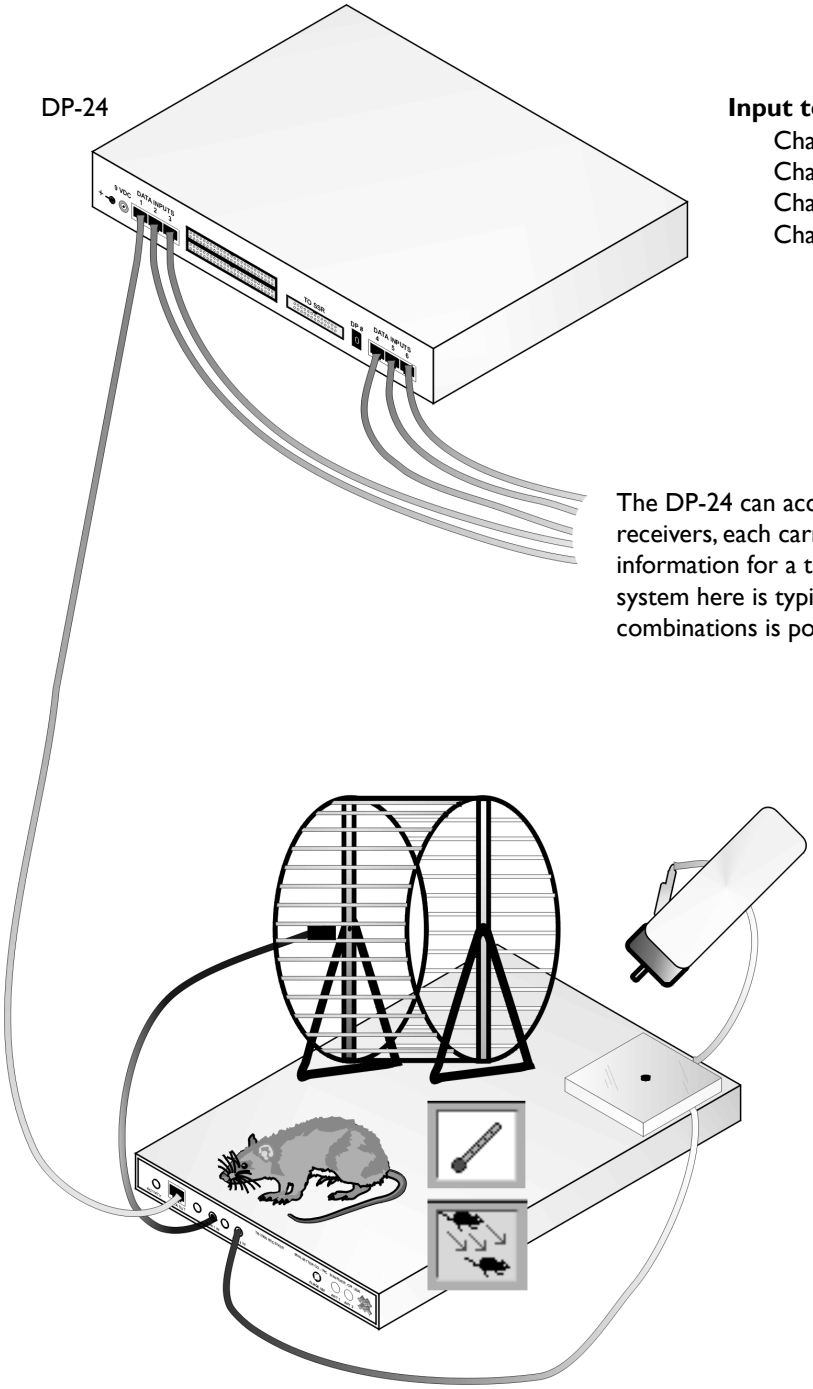


Connecting the Dual Input Module

Dual Input module will accept any input device that has two channels of data.



Connecting the TR-3000

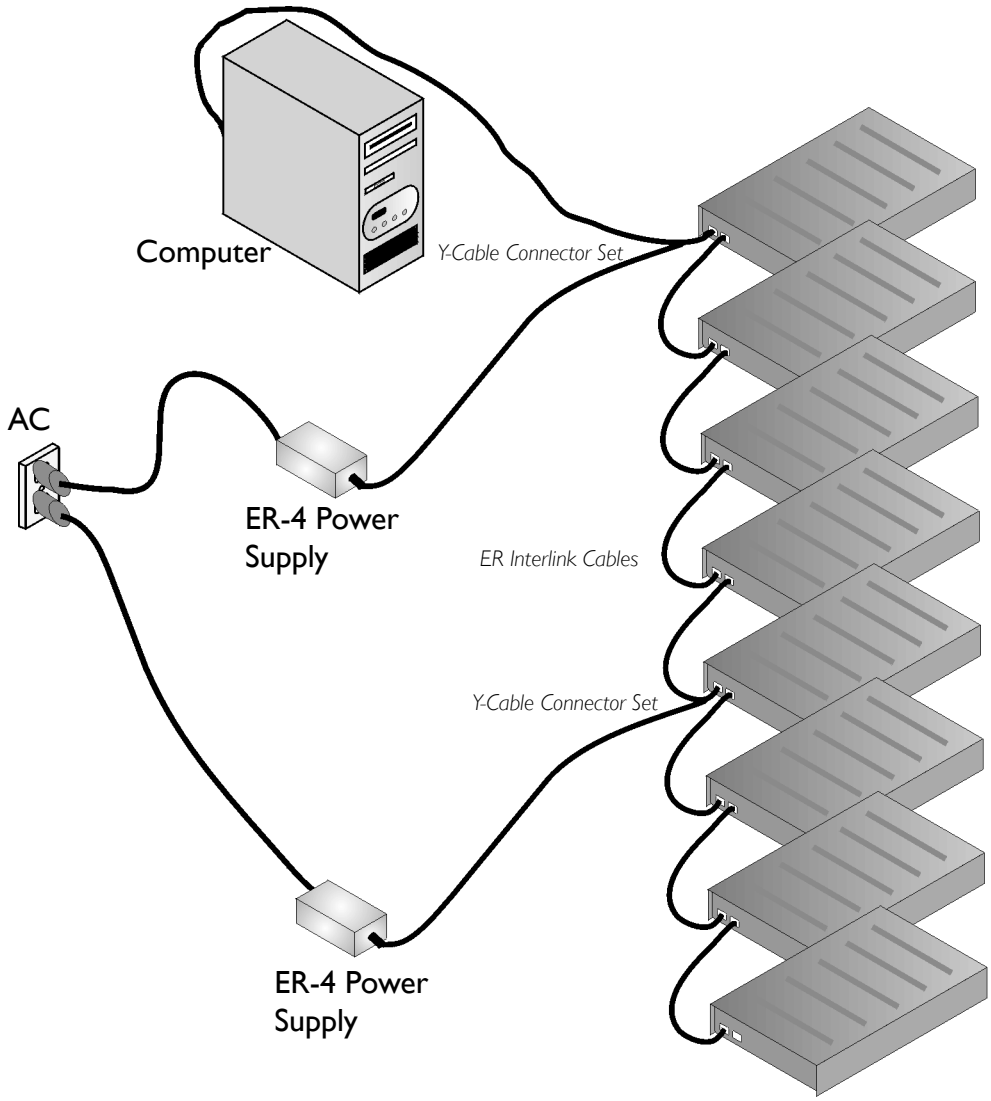


Input to DP-24

Channel 1 - Temperature (transmitter)
Channel 2 - Activity (transmitter)
Channel 3 - Running wheel
Channel 4 - Lick sensor

The DP-24 can accept up to six TR-3000 receivers, each carrying four channels of information for a total of 24 channels. The system here is typical, but a variety of combinations is possible.

Connecting the ER-4000 in Series



NOTE: AC supply should include a UPS.

APPENDIX

C

PRE-EXPERIMENT TEST

Introduction

Prior to running an experiment, it is recommended that you run a test of the system first. This will direct a performance check of the following:

- Hardware connections are properly made
- PC software is correctly installed
- Animal and group setup is done properly
- Calibration values are correctly entered

Assumptions

- The hardware is connected, properly configured, and powered up according to Section 2.
- The PC is properly set up according to Section 3.
- A configuration file has either been loaded, or created, per Sections 4 and 5.

This test will essentially "speed-test" your system, generate some data files for checking, and see that the system is operating as expected.

Procedure

Steps 3 and 4 are only applicable if you are using ER-4000s in your system.

1. From the VitalView Main window, click File and Start Data Collection.
2. When prompted, click on Test. This selects an experimental test option.
3. The ER-4000 Utility display will check for ER-4000 ID numbers. Follow the instructions.
4. Click See ID Settings to verify that the Con settings are as intended. If correct, click List is OK.
5. At the prompt, enter text that identifies the data collection session.
6. At the file dialog, enter a filename. The extension will be .log, and will be appended automatically. Click OK when you have named the file.
7. Follow the directions on the "System is Ready" window.
8. Wait until VitalView is on-line. From the Main window, click on Data Collection Monitor.
9. Click on a parameter panel to enter the Monitor Zoom display. Data should begin to stream from the right side of the chart. A value of -10 will indicate invalid or clipped data. Check the sample time information near the bottom of the display, and confirm. Exit back to the Main window.

Leave VitalView on-line for a minimum of ten minutes.

10 From the File menu, select Stop Data Collection.

11 Click Data Load and Analysis. Click File. Click Load from VitalView Data File.

12 Refer to "Data Load & Analysis" in Section 7 for the procedure to open the experiment log file of the data you just collected.

13 Using the instructions in Section 7, check for the validity of data.

If all of the data looks good, start data collection and begin the experiment.

APPENDIX

D

TRANSMITTER SAMPLING THEORY

Temperature Theory

E-Mitters and Transmitters

E-Mitter transponders and battery powered transmitters (Mini-Mitters) use a thermistor to control an oscillator circuit whose frequency is related to thermistor temperature. The frequency, F, is a nonlinear function of temperature, T. The frequency of E-Mitters is approximately 800 Hz at 37° C. Battery-type transmitters have a characteristic oscillation frequency of about 400 Hz at 37° C. We can approximate the F(T) vs. T curve as an exponential. Equivalently, the logarithm of the frequency has a linear relationship to temperature as indicated in the following equation:

$$\ln(F) = \beta + \alpha T$$

When E-Mitters and Mini-Mitters are calibrated at the factory, the slope and intercept of this equation are determined with extremely high precision (approximately 0.1% uncertainty). This is accomplished by immersing each E-Mitter in a temperature-controlled water bath and scanning the temperature over a range of values. For each temperature point pulse, the oscillation frequency is measured. A mathematical algorithm is then used to derive the calibration values from the temperature data. These calibration values are the frequencies at 37° C and 41° C. These values are recorded and provided to the customer with each device. Prior to data collection, these calibration frequencies must be entered into the system configuration through Animal & Group Setup.

For E-Mitter devices only

VitalView enables the user to provide either a two-point or a single-point calibration. When two points are used, the calibration frequencies for 37° C and for 41° C must be entered. Alternatively, when only a single calibration frequency is used, the calibration frequency corresponding to the 37° C point must be entered. If only the 37° C value is entered, VitalView will substitute a default value for the 41° C point. However, improved accuracy will be obtained when the calibration frequencies are entered for both the 37° C and 41° C points. Starr Life Sciences strongly recommends the two-point calibration set be used. Battery-type devices require a two-point calibration.

On-Line Filtering

Introduction

VitalView is a software and hardware system specifically designed for controlling data acquisition in laboratory monitoring of physiological parameters. VitalView consists of an application program known as VitalView and several types of acquisition hardware, including the Series3000 transmitter/receiver systems, Series-4000 transponder/receiver systems, QA-4 activity input modules, and the DP-24 digital multiplexer. This note describes the data filtering schemes used for the Series-3000 and Series-4000 temperature and heart rate data acquisition systems.

Series-3000 Systems

A VitalView Series-3000 system consists of the VitalView program, a DP-24 digital multiplexer, one or more TR-3000 receivers, and a transmitter for each receiver. The VitalView Series-3000 system is capable of acquiring temperature data at a constant acquisition rate (number of samples per unit time). These data are sampled when the VitalView program sends a command to the DP-24 to send a current datum point. The rate of sampling can be adjusted from a minimum of once per second to a maximum of 20 times per second.

In the Series-3000 system, as VitalView acquires individual temperature data points, they are stored in a first-in-first-out (FIFO) linear software buffer, whose size (length) is adjustable from a minimum of one (1) up to a maximum of 256 individual points. There is a buffer provided for each temperature data channel to be measured. As data acquisition begins, VitalView fetches each data point and retains it in the buffer until the buffer is completely filled. After that, each subsequent datum is placed in the buffer in the "last in" position, and the "first in" point is discarded, so that the length is preserved at the constant, set value. The default setting for the buffer length is 256. The operator can adjust the length to any value between 1 and 256 from within the System Setup window.

The Series-3000 system software also filters the raw data using a threshold discriminating filter. In this filter, a running average and standard deviation are continuously calculated. All data points that are more than one standard deviation away from the mean are discarded.

Individual data points stored in the VitalView Series-3000 buffers are not displayed, nor are they stored in the .log file by the VitalView application program. However, an average of these points is displayed and stored in the .log file. The rate at which this display and storage occurs is known as the sample interval and is adjustable within the VitalView Program Animal and Group Setup Window. The sample interval can be adjusted over a wide range starting from a minimum of one (1) second. When a parameter datum is to be displayed or stored, it is the average value of the total data within the buffer that is used. The average that is calculated is based on the buffered data just prior to the moment that the sample was requested. This datum, therefore, represents a moving average of a set of data points equal to the buffer length.

In the Series-3000 system, it is possible to turn averaging off completely by reducing the buffer size to one (1). In this way, each datum that is fetched from the TR-3000 receiver represents the last temperature value that was measured. This is useful when the operator wishes to watch data being collected in an almost "real time" fashion.

Series-4000 Systems

A VitalView Series-4000 system consists of the VitalView program, at least one ER-4000 receiver, and one transponder for each receiver. The Series-4000 system is capable of acquiring temperature and heart rate data at a constant acquisition rate of once per second. Within the ER-4000 receiver, data are averaged over many samples in a single averaging "bin", but a weighting scheme is applied to accomplish time-averaging. This weighted scheme is represented in the following equation.

$$AVG_N = AVG_{N-1} + \frac{Last - AVG_{N-1}}{2^M}$$

Where, in this equation, N is the current datum, Last is the current sampled point, and M is the filter power. In this exponential filter, a particular datum is a weighted average of several previous data points, but the most recent data are given the greater emphasis. The default value of M is four (4), and it can be changed by the operator within System Setup.

In addition to the exponential weighting average, the Series-4000 system hardware also filters the raw data using a threshold discriminating filter. In this filter, a running average and standard deviation are continuously calculated. All data points that are more than one standard deviation away from the mean are discarded.

When using Series-4000 equipment with the VitalView program, the operator can, in addition to the exponential average, apply a boxcar average to sequential data points derived from the 1-second-sampled, exponentially-filtered data. Sequential data points can be accumulated into a software buffer whose minimum length is 2 and whose maximum length is 256. The system averages these data by adding up all the data in the buffer and dividing by the buffer length. In this scheme, a single datum is the result of having averaged the previous X data points, where X is between 2 and 256. The default setting for the buffer length is 120. The operator can adjust the length to any value between 2 and 256 from within the System Setup window.

In the Series-4000 system, it is possible to turn averaging off almost completely by reducing the filter power to 2 and reducing the buffer size to 2.

Data Validation

When temperature and heart rate data are sensed, they are combined together and transmitted simultaneously to the receiver. It sometimes happens that when the animal moves, the temperature or heart rate transmission is momentarily interrupted. When this happens, the data just after the movement can be considered invalid or corrupted with movement artifacts. In both the Series-3000 and Series-4000 systems, the VitalView program performs continual data validation to reduce the occurrence of data artifacts. When data are accumulated in the buffers, each datum is compared to a running standard deviation of the data in the buffer. Data that are more than one standard deviation away from the mean are not counted in the average process.

Activity data

Both the Series-3000 and Series-4000 systems have the ability to register various types of activity counts. The Series-4000 system can measure movement activity, whereas the Series-3000 system can measure movement activity as well as other types of activity sensors

such as running wheel turns, feeding monitors, and lick sensors. In none of these cases is activity data filtered. Rather, the activity count datum is the total number of activity counts that have transpired since the last query was made.

Summary

Data averaging capabilities vary between the Series-3000 and Series-4000 VitalView systems. The Series-3000 system allows boxcar averaging on the accumulated data in the buffer. The Series-4000 system provides exponential filtering on raw data and also allows boxcar averaging on the accumulated data in the buffer. The Series-3000 and Series-4000 systems allow up to 256-time-bin averaging. In both systems, data validation provides a method to reduce the occurrence of artifacts in the data. To summarize the averaging features of both systems, the following table is useful.

Averaging Parameter	Series-3000	Series-4000
Sampling rate	From 1 to 20 per second	1 per second
Sampling interval	1 second or greater	1 second or greater
Raw data averaging	Boxcar	Exponential + boxcar
Sample buffer length	From 1 to 256	From 2 to 256

APPENDIX

E

IMPLANTATION PROCEDURE

Preparation for Implantation

Introduction

This manual describes the implantation of E-Mitters (PDT-4000), HR E-Mitters (PDT-4000 HR), G2 E-Mitters, and G2 HR E-Mitters.

The procedure for implantation of E-Mitters/G2 E-Mitters and HR/G2 HR E-Mitters is generally the same. The only difference is the surgical placement of HR E-Mitter heart rate leads, and a slightly different test procedure prior to closure.

This manual assumes you have read the appropriate sections of the VitalView manual. This will give you a better understanding of the operation of the products.

This section also assumes you are qualified in proper techniques including sterilization, anesthesia, surgery, recovery, and have the proper instruments. If you have questions concerning any of these procedures, call us at Starr Life Sciences Our technical staff will assist you.

Make sure you are prepared for surgery well in advance. In addition to animal requirements, there are hardware and software preparations that must be made to the VitalView System.

- You must have VitalView Version 2.20 or later.
- E-Mitters must be sterilized prior to implantation. Do not leave them immersed longer than required for sterilization, but make sure they are sterile. Sterilization techniques are covered in this section.
- Heart Rate E-Mitter leads may need advanced preparation. See "Preparing the Heart Rate Leads" in this section.
- Depending on the species, it is often important not to feed the animal for 5 to 8 hours prior to surgery. For species specific information consult a veterinarian.
- A heating pad or other suitable heat source must be provided for the animal.
- Prepare a clean, disinfected work area with good lighting. Cold sterilants can be utilized as well as sterile surgical draping to insure a sterile work area.

Instruments and Materials Required

Non-Sterile Materials

- Anesthetic agent recommended for your study species.
- Hair clippers
- Betadine or other surgical scrub
- Zephiran, Alcide, or other liquid sterilant
- Furacin
- Adhesive tape
- Heating pad - for smaller species

Sterile Materials

- Scalpel handle (#3) and blade (#10)
- Surgical scissors (Metzenbaum)
- Toothed forceps (Adson)
- Suture materials such as stainless steel, silk, Vicryl®
- Suture needles
- Needle holder or straight six-inch heavy duty hemostat
- Mosquito hemostat
- Wound clips and applicator
- Gauze sponges and cotton-tipped applicators
- Stainless steel ferrules (if using heart rate E-Mitters)

An Implantation Kit is available from Starr Life Sciences. Call the factory for details.

Surgical Information & References

Starr Life Sciences E-Mitters can be implanted intraperitoneally or subcutaneously with a minimum of risk to the study animal, if common surgical guidelines are followed. Anesthesia and surgical procedures for each species will vary. In this section we have provided general information on preparation for surgery and a list of the surgical materials required. We recommend that VitalView system users consult with their local animal care professional and reference materials for specific guidelines. Explantation of E-Mitters will require the same advance preparation, anesthesia and surgical materials as implantation.

Many references are available that may be of assistance in establishing animal care and use protocols:

Guide to the Care and Use of Experimental Animals (ISBN 0-919087)

Selection and Handling of Animals in Biomedical Research by Svendsen (ISBN 084934378X)

The Laboratory Rat by Sharp and La Regina (ISBN 0-8493-2565-1)

Sterilants

E-Mitters should be sterilized prior to surgery. Ethylene oxide gas and chemical sterilants such as activated glutaraldehyde (Cidex) and benzalconium chloride (Zephiran) can be used effectively. Avoid leaving the transmitters in chemical solution any longer than necessary. Be certain to properly aerate implants after gas sterilization. Rinse chemically sterilized implants in sterile saline just prior to implantation.

CAUTION! Do not autoclave or exceed 60° C in gas sterilizers. Destruction of the E-Mitter may result.

Sterilize the usual instruments including the lead placement trochar provided with your

Heart Rate E-Mitters. This tool consists of a 1/8" diameter stainless steel rod and a close fitting sleeve. It is used to create a tunnel under the skin and to pass the sensing lead to the proper location on the chest.

Anesthesia

If you are unfamiliar with lab animal anesthesia, you should consult an animal care professional or text references for information on recommended agents and dosages.

Configuring the ER-4000 Prior to Surgery

The VitalView system should be fully operational prior to implantation surgery. If possible, locate the system with an ER-4000 Energizer/Receiver near the surgery area so that subjects can be checked for a proper signal prior to closing. The configuration procedure is nearly identical for the E-Mitter, G2 E-Mitter, HR E-Mitter, and the G2 HR E-Mitter. All devices should be checked for proper communication with the ER-4000. The HR E-Mitter needs to be verified for heart rate signal.

It will be necessary to use a valid configuration file for testing E-Mitter communication and data transfer. A configuration file called "Surgery" is included with the VitalView software package. If you do not have a configuration file, it will be necessary to make one. If you use an existing file, make sure the settings are changed to match the following configuration.

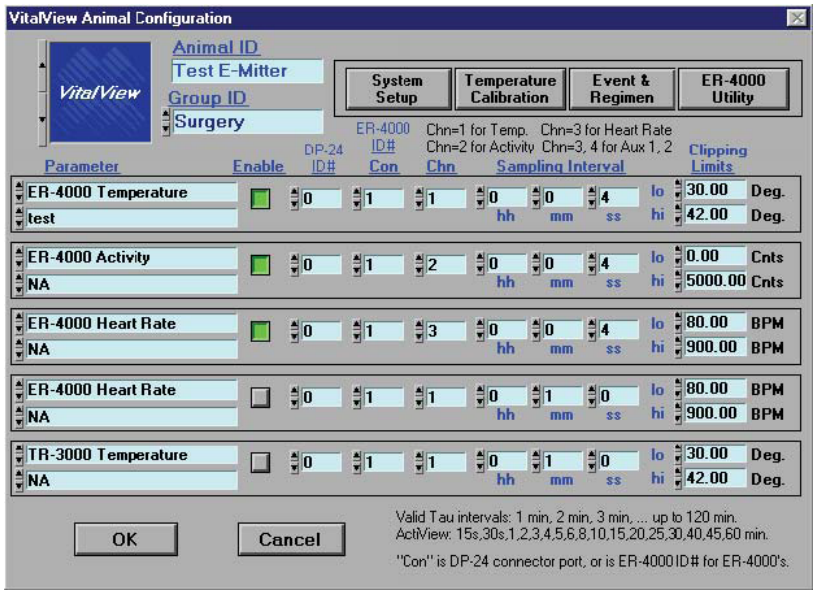
1 From the Main window, click on Animal & Group Setup.

2 In the Animal & Group Setup display, under Group menu, click on New.

3 At the prompt, label this group appropriately, e.g. Surgery, etc. Click OK.

Access: Main window > Animal & Group Setup > Group Menu > New

4 Click within any of the parameter panels. This will open the VitalView Animal Configuration display. Enter in the following values:



NOTE: If you are using the standard E-Mitter or G2 E-Mitter, you do not need to enable Heart Rate.

Note that the parameters are enabled, values entered, channels assigned, etc. Also note that the transmitter calibration values must be entered. This information can be obtained from the calibration sheet supplied with your E-Mitter.

5 After all the values have been entered in the above display, click on OK.

6 Under the File menu, choose Save Configuration, and save this file as "Test E-Mitter", "Surgery", or some other appropriate name. Exit to the Main VitalView window.

7 Make sure the ER-4000 is connected and operating (red LED is illuminated). Under File from the Main Window, click on Start Data Collection, and follow the prompts.

NOTE: It is advantageous to have the ER-4000 operational or near-operational prior to surgery so a minimum number of steps is necessary to monitor the E-Mitter signal.

General Implantation Preparation

Introduction

The implant procedure for E-Mitters is not difficult for those with basic surgical experience on laboratory animals. It is recommended that individuals review these procedures carefully prior to surgery.

The E-Mitter is a very reliable product. However, it is recommended that the unit be checked prior to surgery. This will assure you that the E-Mitter and ER-4000 are operational.

NOTE: The G2 E-Mitter is a miniaturized version of the standard temperature and activity E-Mitter. The implantation procedure as well as functionality is identical.

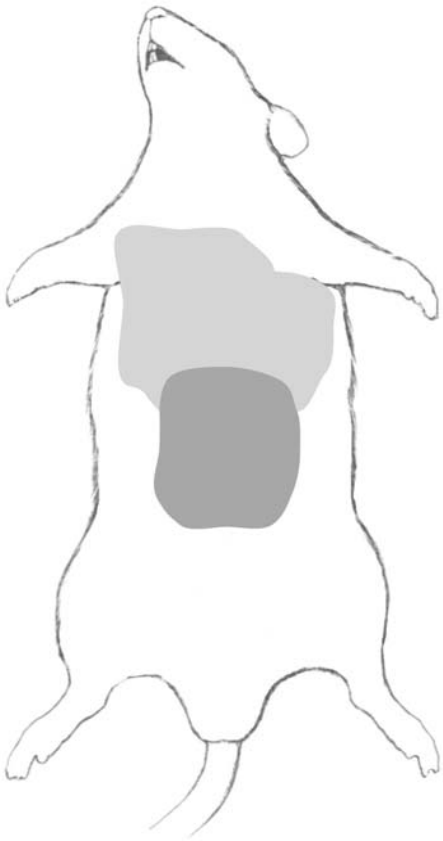
Preparation of the Implant

E-Mitters should be sterilized and kept warm prior to surgery.

The use of sterile technique, including sterile instruments, a drape, and gloves must be employed. E-Mitters offer an implant life surpassing that of the animal, so it is important not to compromise this advantage by the risk of infection.

Animal Preparation

1. Anesthetize the animal prior to preparation. Depth of anesthesia may be ascertained by using the pedal reflex technique. Pinch the toe of the animal. The lack of a withdrawal reaction means the depth of anesthesia is adequate.
2. Shave the ventral surface of the abdomen for both E-Mitter and HR E-Mitter devices (dark gray area). If implanting HR E-Mitters, shave the thorax to the area of the axilla, slightly cranial on the right side (light gray areas illustrated below).

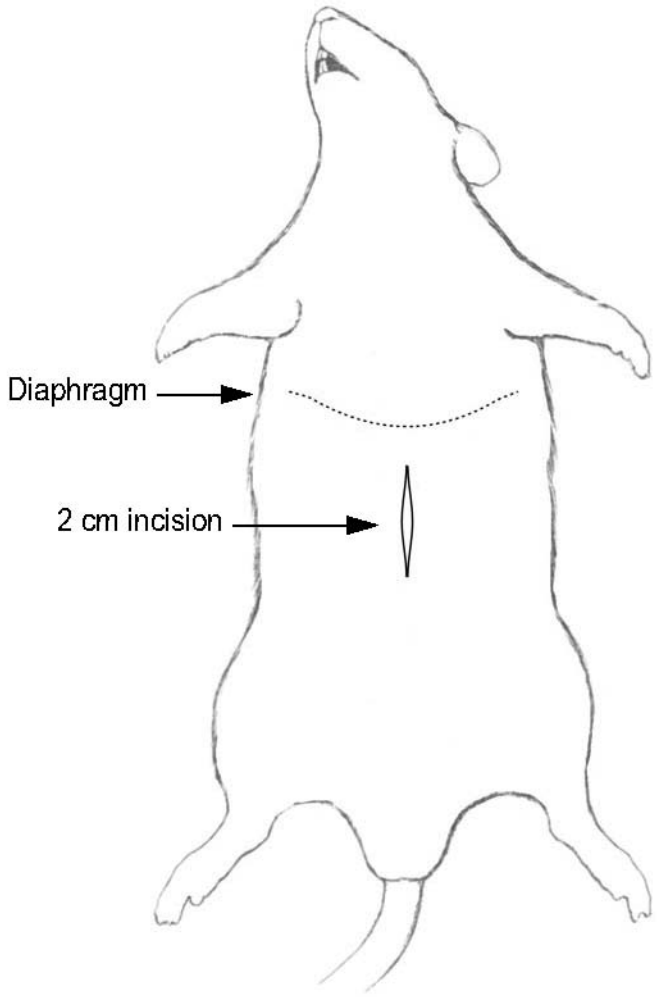


3. Scrub the shaved area with Betadine or other surgical scrub.
4. Secure the animal to a sterile surgical surface with adhesive tape. Make sure the surgical surface is heated.

CAUTION! For smaller species, a heating pad or other device is mandatory. Keeping the animal warm is essential for prompt and thorough recovery.

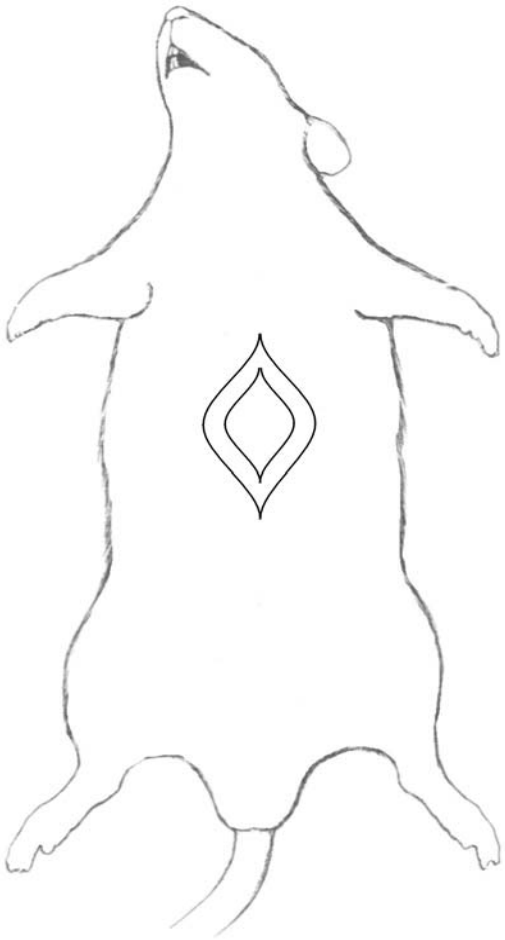
E-Mitter Implantation Technique

1 Make a midline abdominal skin incision 1 cm below the diaphragm, and no more than 2 cm in length.



2 Open the abdomen by making a 2 cm incision along the linea abla (the "white line" of fascia where the abdominal muscles join on the midline).

CAUTION! Take care not to cut the bowel. As the skin incision is made, the abdominal muscles tend to relax, resulting in the bowel being immediately under the surface.



3 Positioning of the E-Mitter in the abdominal cavity is important to acquire accurate temperature data. If it is too close to the surface of the skin, it may be affected by room temperature.

4 Gently reflect the intestines and colon. Slip the body of the E-Mitter into the abdominal cavity along the sagittal plane, placing it in front of the caudal arteries and veins, but dorsal to the digestive organs.

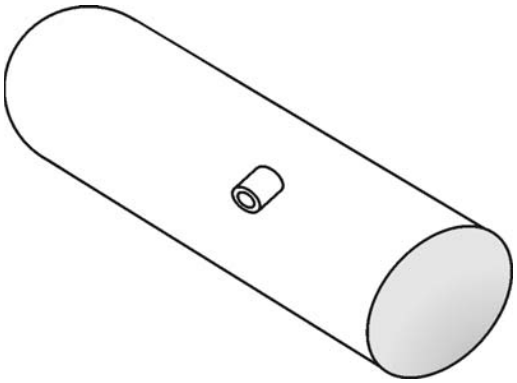
Silastic Suture Sleeve Procedure

Experience has shown that in some cases, the PDT4000 E-Mitter may migrate within an animal. The migration may allow excursions of temperature data. For example, if the E-Mitter migrates near the outside of the peritoneal cavity and the animal lies down on a cold cage surface, the temperature may register lower than the actual core temperature.

In order to reduce migration of the E-Mitter a silastic sleeve has been attached to the surface (illustration is exaggerated). This sleeve is designed to be used as an anchor point through which suture material may be passed. Its use is recommended for all temperature monitoring applications.

These instructions only apply to the PDT4000 and G2 transponder. The PDT4000HR and G2 HR do not require this additional implantation step.

Standard E-Mitter shown



Implantation Using the Silastic Sleeve

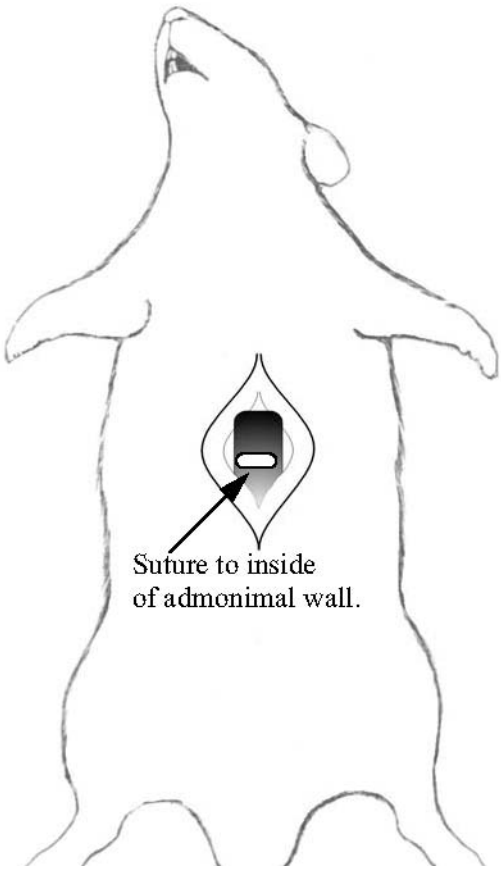
5 Pass suture material through the silastic tubing that is attached to the outer wall of the E-Mitter capsule.

6 Suture the capsule to the body wall.

Making use of the sleeve to anchor the E-Mitter to the body wall will reduce the likelihood of hte E-Mitter moving freely within the peritoneal cavity. This may also decrease the need of the ER-4000 Energizer/Receiver to re-acquire a signal lock from the implanted transponder.

7 Replace the organs, effectively "burying" the E-Mitter.

8 Massage and lightly jostle the abdominal cavity to allow the internal organs to settle. Examine the small intestine and colon for kinks.



9 If you wish to check for data prior to closure, place the animal on the ER-4000. Check for a green LED, confirming signal lock. If there is no green LED, move the animal to a

different spot on the ER-4000, or raise the animal slightly above the receiver surface. A green LED assures that a signal is being received.

10 From the Main window, click on Data Collection Monitor. You should see data coming from the activity and temperature channels. Remove the animal.

11 Place simple interrupted absorbable sutures as needed to close the abdominal incision. See "Closure" in this Section for typical closure procedure.

HR E-Mitter Implantation Preparation

The VitalView system should be fully operational prior to beginning surgery. See the Hardware Installation section of the VitalView manual for installation details.

You will place the animal on the ER-4000 during surgery so that proper heart rate signal can be checked prior to closing. Remember to put a heating pad between the receiver and the animal. A simple household heating pad should not interfere with the signal.

It will be necessary to use a valid configuration file for testing the E-Mitter. If you do not have a configuration file, it will be necessary to make one. Follow the directions in the E-Mitter section. If you use an existing file, make sure the settings are appropriate for monitoring the heart rate signal.

NOTE: The heart rate leads will need preparation prior to surgery. See "Preparing the Heart Rate Leads."

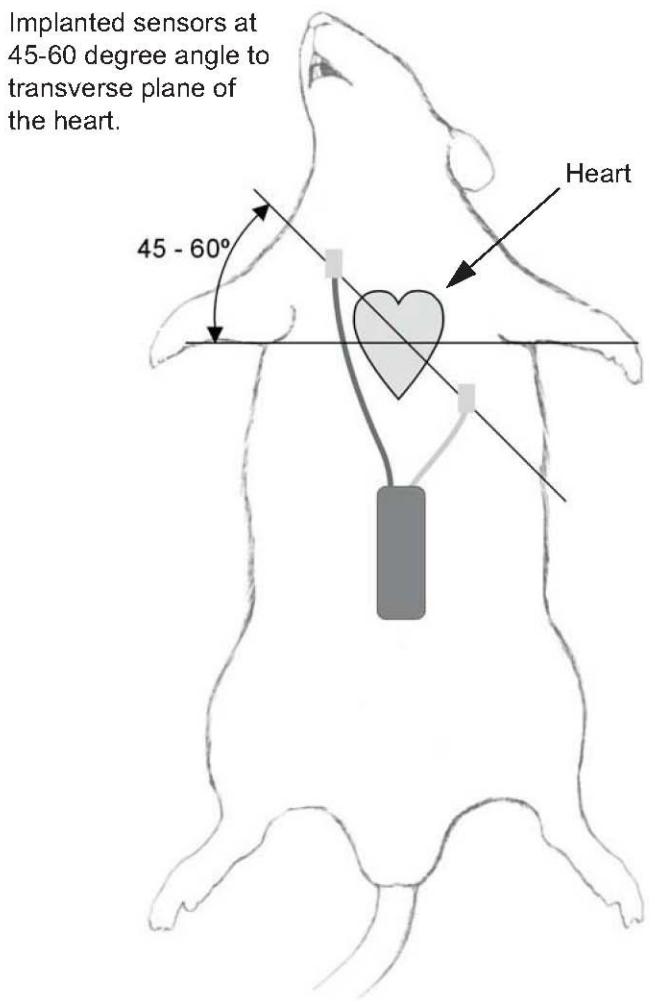
Lead preparation is important. The electrode leads must be cut to length to position them near the heart in a specific plane. To assist in fixation, a small tab is attached to the end of the heart rate lead. This tab also prevents the sharp electrode from injuring the animal. Proper lead preparation also assures good contact with the chest muscle.

CAUTION! It is very important that the two electrode lead wires be placed subcutaneously on the chest wall at a 45-60 degree angle relative to the transverse plane of the heart. Improper lead placement will result in low signal pickup and unreliable heart rate detection. Rectifying this problem will require another surgical procedure.

CAUTION! Do not pull on the leads. Although the lead attachment has been designed to withstand considerable tension, the leads can become detached from the header elements.

NOTE: If implanting an explanted HR or G2 HR E-Mitter, make sure the leads are thoroughly cleaned of all organic artifacts. Lack of cleaning may cause degradation of the heart rate signal, particularly during pre-testing.

Proper placement allows the voltage created by the R wave of the QRS complex (a phase of the cardiac electrical cycle) to trigger a pulse detected by the ER-4000 Energizer/Receiver. The heart rate is then reported by the VitalView system as a beats-per-minute value based on a computation from the R-R interval.



Preparing the Heart Rate Leads

For proper heart rate detection the sensor lead length must be taken into account. To accommodate size differences in animals, the following procedure may be used to shorten lead length.

NOTE: If the leads are too short, heart rate detection may be impaired. If the leads are too long, the spring action of the leads may push the HR E-Mitter to the bottom of the abdomen.

Be certain to allow 1 to 2 cm of excess lead wire to act as a strain relief for animal movement. Excess lead wire should be left under the skin in an 'S' curve where the leads exit the abdominal cavity. This allows for growth and flexing of the body from side to side.

*NOTE: The following are **approximate** lengths of the HR E-Mitter leads measured from E-Mitter body to end of lead before attachment. Animals sizes vary greatly; careful measurement is highly recommended.*

	Mice	Rats
Negative lead (longer, black)	35 mm	75 mm
Positive lead (shorter, clear)	20 mm	45 mm

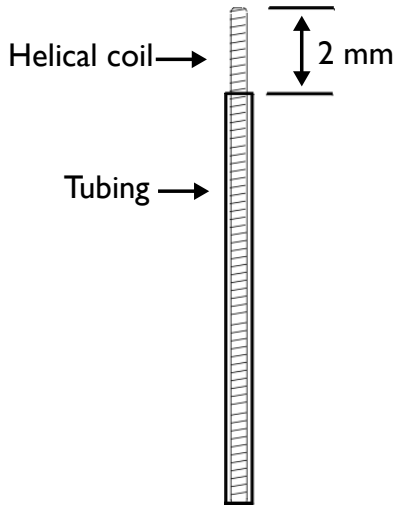
The **negative** lead (black) is directed to the anterior right (animal's right) side of the chest wall near the clavicle. It is the longest lead.

The **positive** lead (clear) is placed on the posterior chest wall to the left of the sternum and anterior to the last rib. It is the shorter of the two leads.

NOTE: The tubing acts as an insulator, and must be left in place as shown in the next illustration. Removing too much of the tubing may result in a low signal from the heart.

To prepare the leads, use the following procedure.

1. Place the HR E-Mitter on the abdomen midline of the subject as in the previous illustration. Direct the leads to the implant sites, and then mark the lead for proper length.



2. Leads should be cut cleanly across with small, sharp wire cutters or sturdy scissors. Again, be certain to leave some excess lead length to allow for growth and body movement.
3. Using a scalpel blade cut around the lead to aid in removing the insulation. Strip 2 mm of tubing from the tip of the lead to bare the helical coil inside. Pull the coating off, leaving the tip section bare. Be certain not to nick or cut through the coil wire. The leads are now prepared for implantation.

Monitoring the HR E-Mitter heart rate signal

1. From the Main window File menu, choose Open Configuration File. Highlight the E-Mitter test file previously saved from "Configuring the ER-4000 Prior to Surgery," or your own configuration file. Click OK.
2. From the Main window, click on System Setup.

3 In the ER-4000 Configuration panel, click on Utility. Follow the prompts and wait for the ER-4000 to initialize.

After the ER-4000 initializes, click on Heart Signal Monitor. Your system is ready to monitor signals from the Heart Rate E-Mitter. You may leave it in this mode during surgery to test the E-Mitter prior to closing.

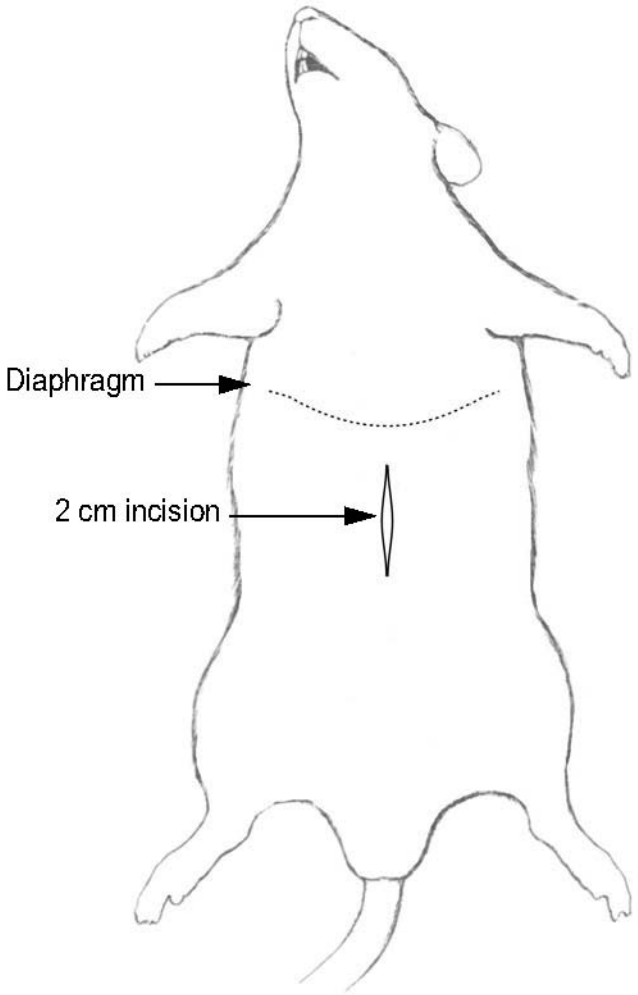
If you have any questions, refer to the System Setup section of the VitalView manual.

Animal Preparation

See the previous "Animal Preparation" section.

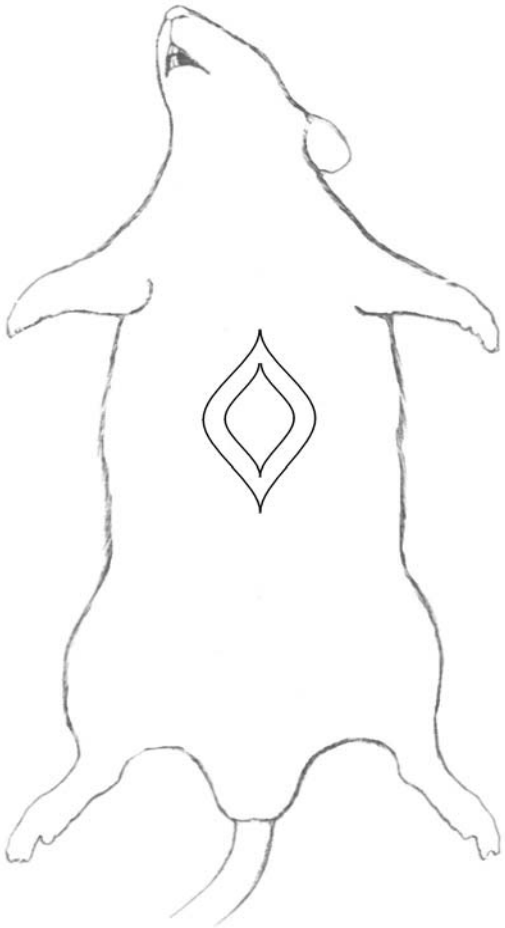
HR E-Mitter Implantation Technique

1 Make a midline abdominal skin incision 1 cm below the diaphragm, and no more than 2 cm in length.



2 Open the abdomen by making a 2 cm incision along the linea alba (the 'white line' of fascia where the abdominal muscles join on the midline).

CAUTION! Take care not to cut the bowel. As the skin incision is made, the abdominal muscles tend to relax, which results in the bowel being immediately under the surface.

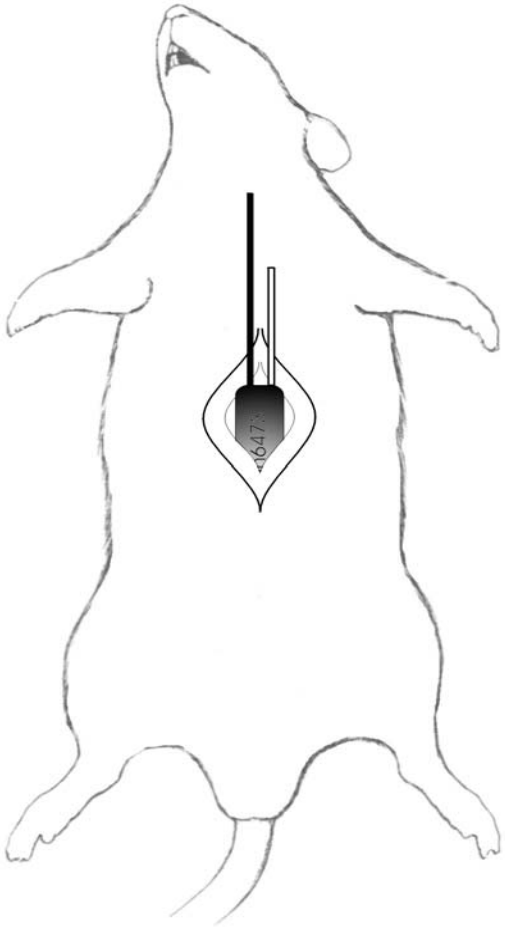


3 Positioning of the HR E-Mitter in the abdominal cavity is important to acquire accurate temperature data. If it is too close to the surface of the skin, it may be affected by room temperature.

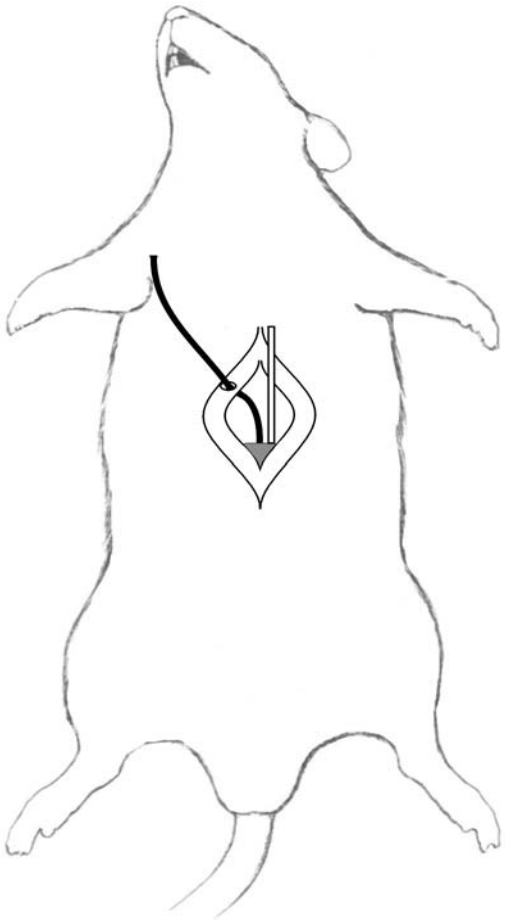
Gently reflect the intestines and colon. Slip the body of the HR E-Mitter into the abdominal cavity along the sagittal plane (with the lead wires facing toward the animal's head), placing it in front of the caudal arteries and veins, but dorsal to the digestive organs. Replace the organs, effectively "burying" the "rear" portion of the HR E-Mitter (without the leads). This is the portion of the HR E-Mitter that contains the temperature sensor.

4 Bring both leads out of the abdominal incision as shown below. The negative (black) lead should be on the animal's right; the positive (shorter - clear) lead should be on the animal's left.

5 Massage and lightly jostle the abdominal cavity to allow the internal organs to settle. Examine the small intestine and colon for kinks.



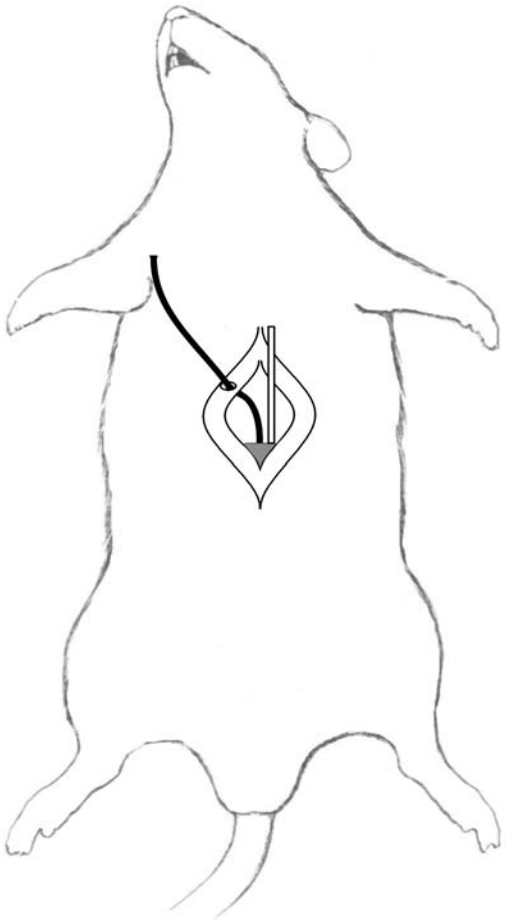
6 With a small mosquito hemostat, bluntly make a small hole through the abdominal wall (*external oblique*). This hole should be to the right of the incision (see below). Push the positive lead from the abdominal cavity through this hole.



7 On the other side of the abdominal incision, make a similar hole through the abdominal wall (as was made in step 4). Push the positive lead from the abdominal cavity through this hole.

8 At this time, to prevent tissue necrosis, close the abdominal wall with 5-0 absorbable suture material, using a continuous interlocking mattress stitch.

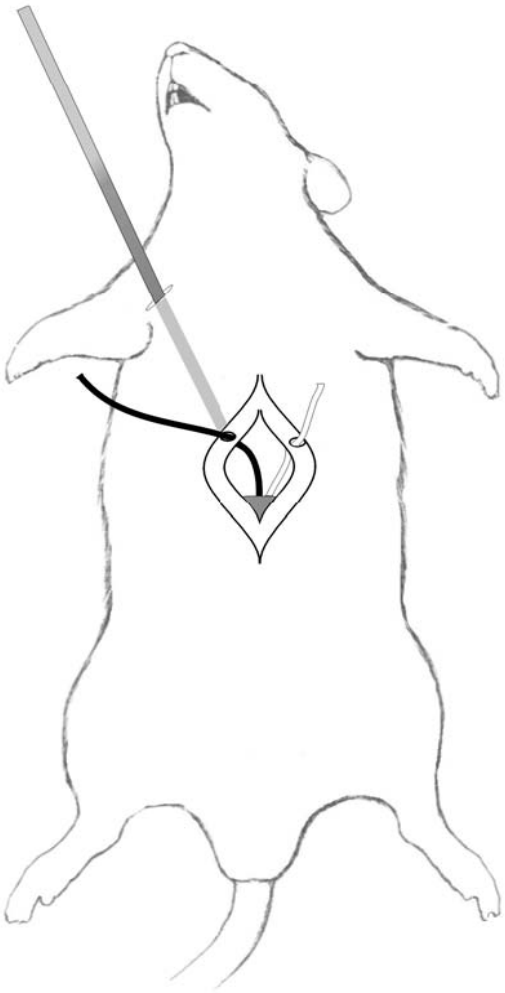
NOTE: For clarity of polarization, the following illustrations do not show the abdomen closed.



Negative Lead Attachment

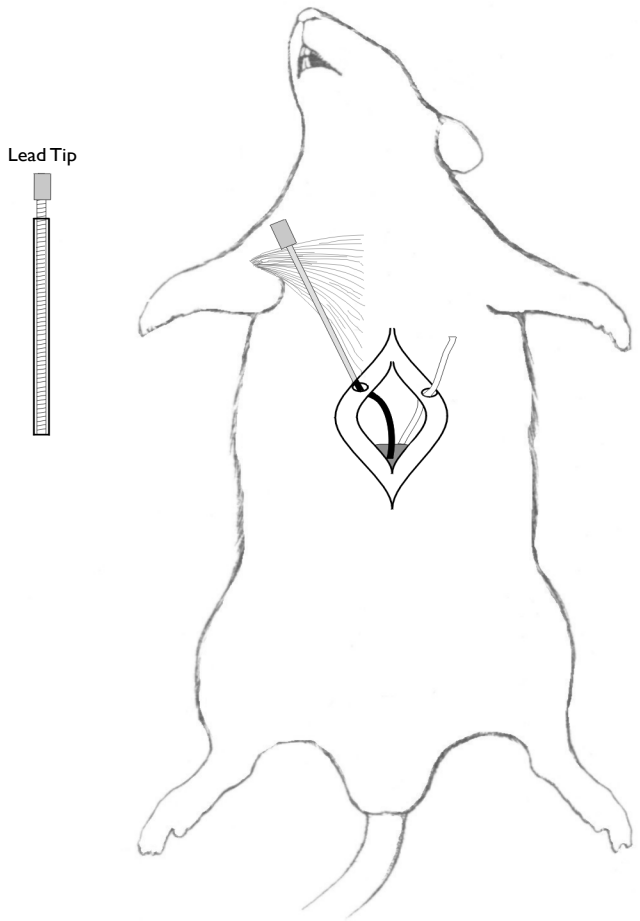
1 Make a small incision (0.5 cm) in the skin near the clavicle. Make sure the two-part lead insertion tool (trochar) consisting of sleeve and probe, is assembled. Push the trochar through the hole in the skin. Push the tool subcutaneously until it reaches the area of the lead. Pull the inside probe out of the trochar sleeve.

NOTE: When placing the leads in small animals, it may be possible to insert a hemostat in the incision and "tease" under the skin and pull the lead through subcutaneously.



2 Push the entire lead through the trochar sleeve. When the lead is completely inserted into the sleeve, remove the sleeve. The lead will remain in place between the skin and muscle wall. The end of the lead should be near the clavicle, and resting on the *pectoralis superficialis*.

3 Slip a metal ferrule over the tip of the lead, and crimp into a "tab" with a non-serrated pliers (or needle holder) (see detail below).

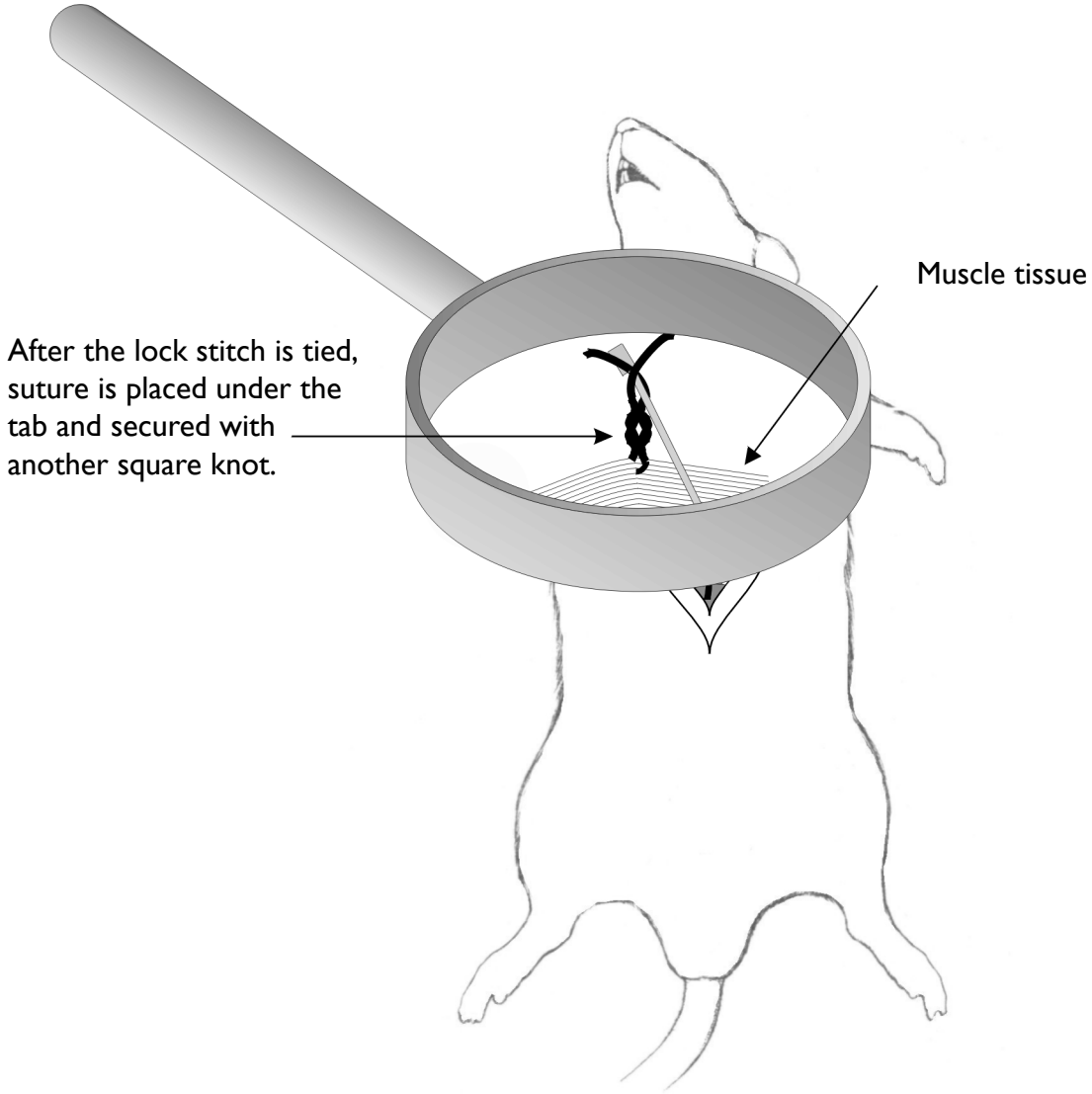


NOTE: In the following procedure, placing the lead in the thin layer of subcutaneous tissue will NOT provide adequate contact for a reliable heart rate signal. It must be held fast against muscle tissue with metal suture material.

4 With metal suture material (000 or 34 gauge), place a small lock stitch at the top of the *pectoralis superficialis*, located near the clavicle. Take a rather large "bite", leaving a loop approximately 2 mm in diameter. Tighten the knot, but DO NOT TIGHTEN the loop that is through the muscle.

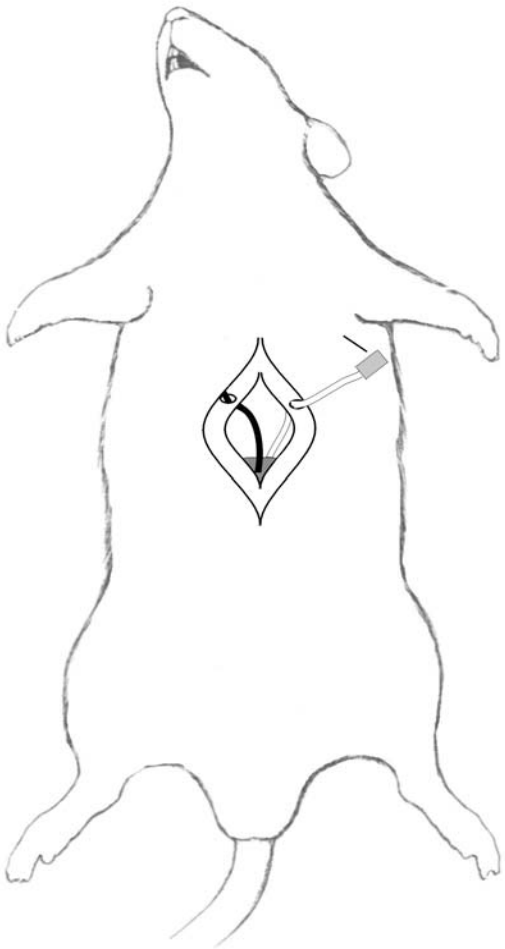
CAUTION! You are very near the subclavian artery and vein. Puncturing will likely cause an instant fatal hemorrhage.

5 Place a length of suture material around the lead tip just behind the tab and complete the second throw of the suture knot to hold the lead tip firmly in place. Trim the excess.



Positive Lead Placement

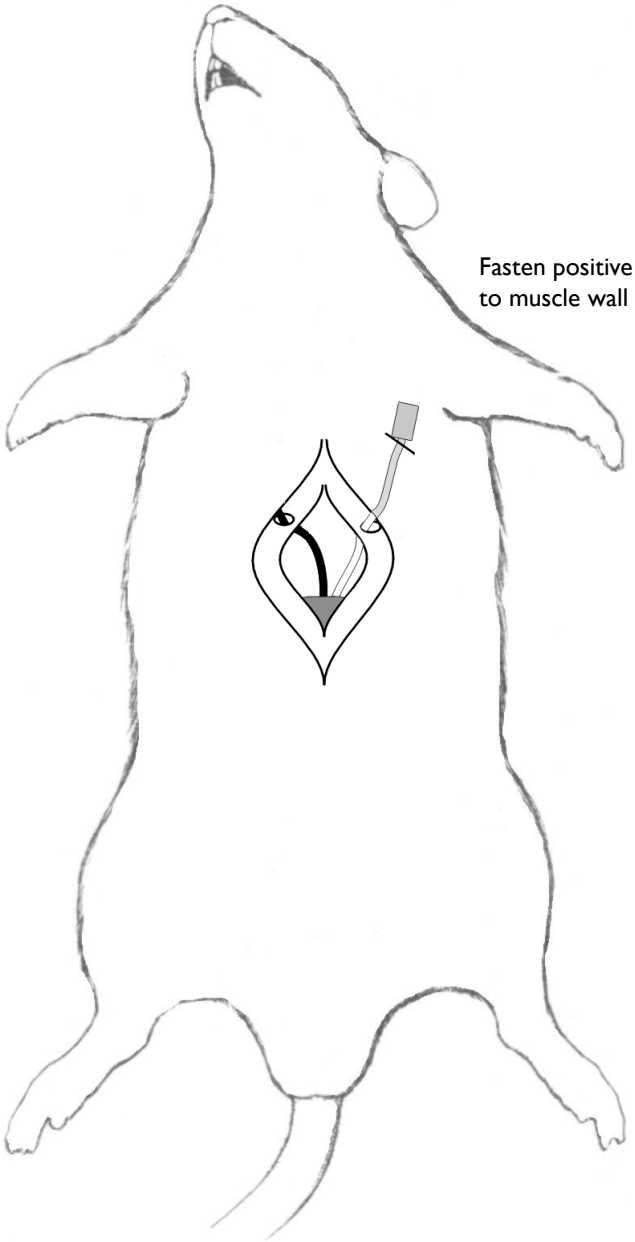
1 Make a small incision (0.5 cm) to the left of the xiphoid process and cranial to the last rib.



2 You may use the trochar to place the positive lead using the same technique as the negative lead, or use a mosquito hemostat to tease it into place. (If you choose not to use the trochar, it may be more convenient to attach the metal ferrule now as described in step 3.) Work the muscle wall away from the skin, and push the heart rate lead between the skin and muscle. Keep the lead as flat as possible.

3 Attach a metal ferrule using the same procedure as the negative lead.

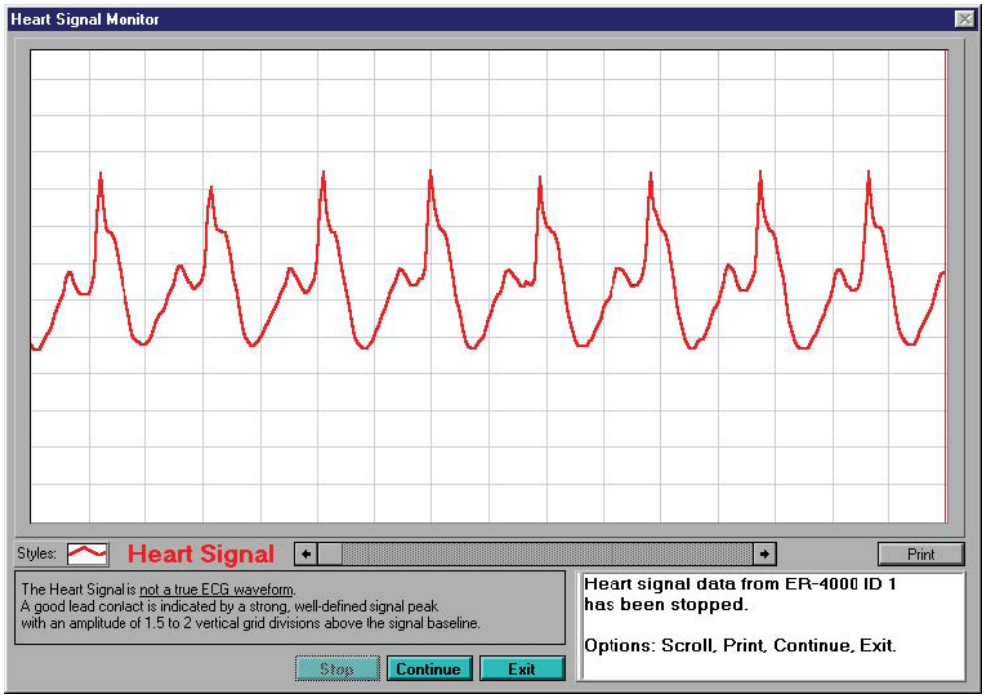
4 Secure the lead against a chest muscle (*cutaneus trunci, pectoralis profundus,* posterior *pectoralis superficialis,* etc.) in the same manner as the negative lead, attaching the suture just behind the tab.



Confirming the Implant

1 At this time, check the heart rate signal. Place the animal on the ER4000 with VitalView operational and in Heart Signal Monitor mode. Check the strength of the signal. It should be 1 ½ to 2 vertical grids in amplitude. If lower than this, reorient the subject on the ER-4000.

Access: Main window > System Setup > Utility > Heart Signal



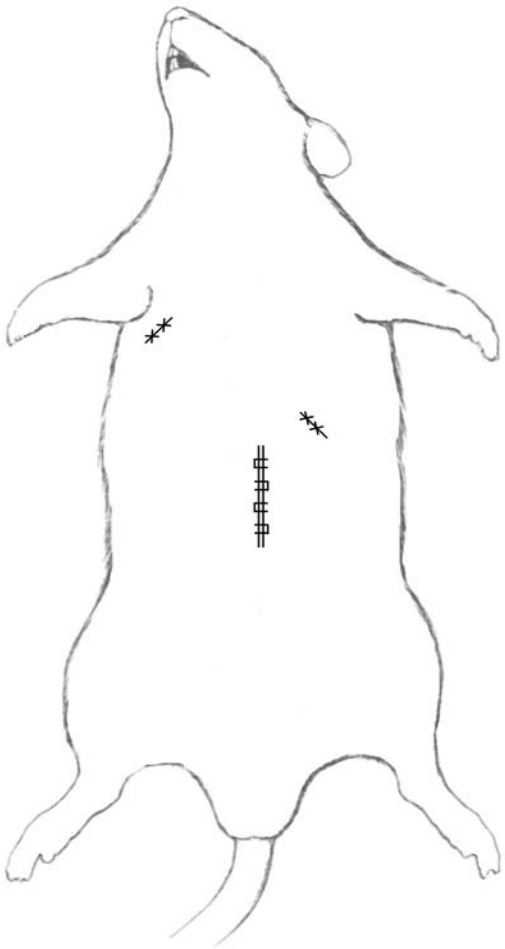
2 If no improvment, the lead placement may need to be changed. Reposition the leads slightly. Check to see if the leads were placed in superficial connective tissue. If they were, dissect through the connective tissue and take a bigger "bite" into the chest muscle tissue when placing the anchoring sutures.

Closure

1 Close the smaller two-lead access points with 34-gauge stainless steel suture material.

2 Close the abdominal opening with 5-0 Vicryl® absorbable suture material using a continuous interlocking running stitch.

3 Close the skin with 34-gauge stainless steel suture material using interrupted mattress stitches.



4 Clean the skin surface with Betadine solution, and puff on a little Furacin powder.

CAUTION! During the animal's recovery period, pay particular attention to the temperature of the cage and surrounding environment. A lamp, cage heater, or heating pad may be used until the animal is fully ambulatory. Remember, the animal is now carrying more non-biological mass that must be heated during this recovery period.

Allow the animals to recover, and place them in their home cages positioned on top of the ER-4000 Energizer/Receivers.

The heart rate signal may be intermittent at times during the anesthesia recovery phase when the animals are hyperactive and uncoordinated in their movements.

Signal quality will generally improve within 2 to 3 days post-operatively as fibrous connective tissue forms around the lead tips.

APPENDIX

F

DATA FILTERING

The data that have been collected with VitalView may require additional processing in order to be included in a final research report. For example, the sampling interval may need to be changed, and out of range data replaced. This is the purpose of the data filter.

Filters are mathematical manipulations of a data set which function to change the scale, offset, or perform averaging or smoothing to remove artifacts. Often this will result in the uncovering of a useful pattern or trend. These processed data sets may then be exported as ASCII files for use in statistical programs, spreadsheets, or graphics packages.

NOTE: The data filters available in VitalView do not change the original VitalView data files. Only data loaded in the Analysis Buffers are altered. If you have applied a filter and want to save the manipulated data set, you may do so as an ASCII file for later loading into other programs.

We suggest that data filters be applied prior to employing statistical routines or calculating group means. For example, removing the -10 values that may have been placed in the data by VitalView when the clipping limits have been exceeded, will make a difference in the results of a "t" test analysis.

Available Filters

Invalid Points

This filter will replace any invalid or missing data point with the value of the last valid data sample previous to the invalid or missing point. Before applying the Invalid Points filter, a message will appear listing the criteria for its use. This statement should be read carefully.

Decimation

This filter averages a user-determined number of data points to produce a new data value. This is also known as bin or bucket average, or windowing. This type of data filter is often used to reduce the impact of spurious data on further statistical analysis. This also can be used to collapse a data set containing a large number of points into a smaller one. No weighting scheme is applied to data points as they are averaged.

For this filter the value entered in the Analysis Filters display refers to the number of points that are averaged together to produce one average value in the resulting data set.

When the decimation function is activated, an explanatory message appears which contains the following information:

SPECIAL INSTRUCTIONS: If you have selected to decimate less than the full number of currently loaded data channels, please be aware that the Save To ASCII File function is not fully compatible with this.

The Save To ASCII File function expects all channels to have the same number of data samples and the same time interval between data samples. Applying decimation to only some of the channels, or applying a different decimation value to some and not others, violates this condition.

For best ASCII file results, select all currently loaded data arrays so that all channels are decimated equally.

If you decimate only some of the channels that are loaded, note that:

- The ASCII file produced by VitalView will report an incorrect End Date/Time for the data set.
- Those channels with larger post-decimation sampling intervals will be listed in the ASCII file at the right of those channels with shorter sampling intervals.
- The data columns for those channels with larger post-decimation sampling intervals may show data that are time-stamped with times that are greater than the true End Date/Time for the data set. Such data in these columns should be ignored (it is the original "raw" data from prior to the decimation).

It may be inappropriate to decimate all channels that are loaded. In this case, it is best to re-load, selecting to load only those channels that can appropriately have the same decimation value applied to them before using the Save to ASCII function.

NOTE: Decimation produces an average value for the number of points entered in the value field. If you wish to accumulate a sum of all counts rather than an average, also select the scale and set it to the same value as the decimation. This will produce a sum over the period. This technique is appropriate for activity parameters like running wheel turns, or licks, but not for variables like temperature or heart rate.

Scale

Multiplies each data value by the scaling factor entered. This can be used to change the vertical resolution of the data chart.

For this filter, the value entered in the Analysis Filters display refers to the scaling factor by which every data value will be multiplied. The data after the scale operation equals data at scale 1 multiplied by the new scale factor entered.

Offset

Adds the entered offset value to each data point in a data set. This is useful if a baseline value has changed during the course of an experiment.

For this filter, the value entered refers to a number which, if positive, will be added to each data point, if negative, will be subtracted from each data point. Adds or subtracts from the original data. It is not cumulative.

Log 10

Converts the Y-Axis to a logarithmic scale. This operation cannot be reversed. You must reload the data to view the original values.

Clipping

This data filter is intended to remove non-physiological values from the data set. This filter will replace any data that are outside the clipping limits. The replacement that occurs is an

interpolated straight line between points that are within the clipping limits and that bound the subset of data that are outside the clipping limits. Use with caution on activity and wheel turn data.

ER-4000 Activity Filter

This data filter enhances or emphasizes the sleep/wake patterns in activity data from ER-4000 receivers. This is done first by clipping, then smoothing the high-sensitivity data. The smoothing is accomplished by passing an averaging window across the data.

When using this filter, the Filter Window (see the illustration "Data files analysis display") may be adjusted for various amounts of data. The 1.000 hour default setting will usually suffice. Care must be taken when adjusting this setting. Less than one hour and the filter may not have any significant effect. More than one hour, and the filter may smooth the data too much, in addition to requiring a long processing time.

Processing time may be quite long. This time can be reduced by doing the following:

- Select fewer channels when in the Analysis Filters window.
- Load less data. Select less than the full collection time.
- Select a smaller filter window in the Analysis Filters window.
- Apply the decimate operation (see "Decimation") to reduce the time between points.

Consider selecting a single channel with about five days of data loaded, and experiment with the filter window size before processing all the channels and all the data.

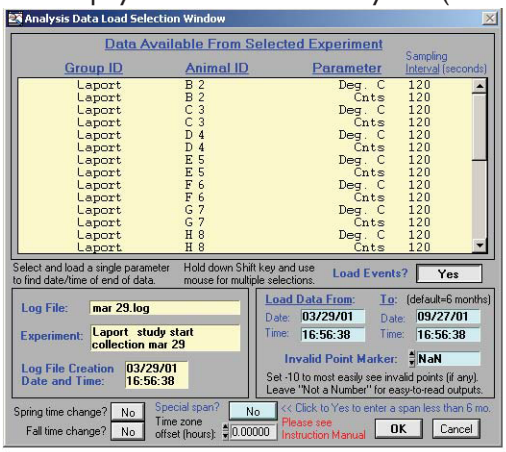
Applying Data Filters

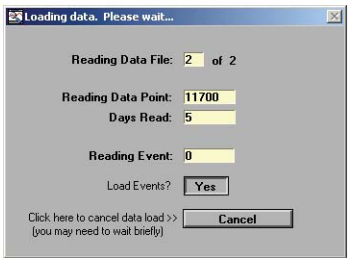
All data sets that are currently loaded in VitalView Analysis may have filters applied to them. This may be done as a batch process with several filters applied. However, we recommend they be done singly until familiarity is gained with the effects of each filter. The order of application is fixed by the program when multiple operations are selected, and the order of application can make a difference to the final output in some cases.

The following is an example of applying a filter to data. This uses the ER4000 Activity Filter as an example. The same process applies to other filters as well.

1 Using Data Load and Analysis from the Main display, load in the subject files (see details in "Data Load & Analysis" in Section 7). Hold down the shift key and click to choose multiple selections. Progress will be noted in a pop-up prompt.

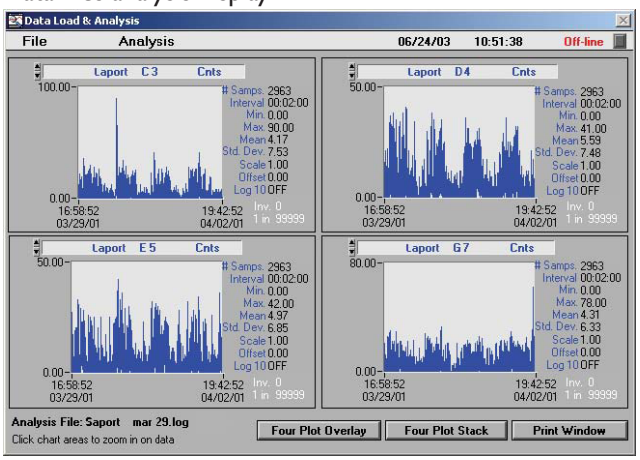
Main display > Data Load and Analysis > (file of choice)



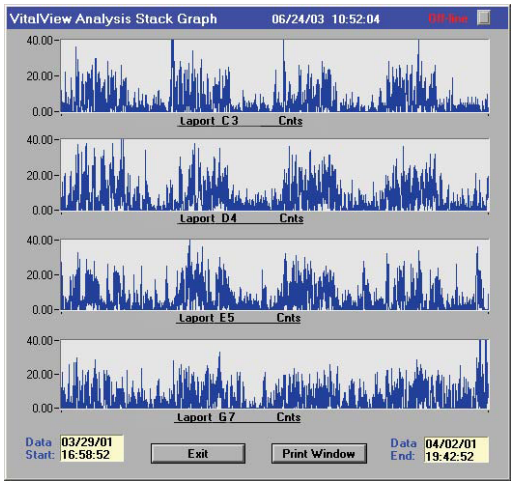


2 Once the file is loaded, click on Four Plot Stack to see the original, unfiltered data.

Data files analysis display



Unfiltered data

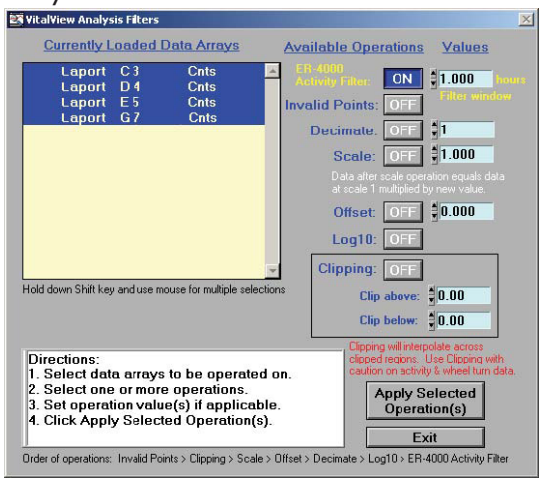


3 To filter the data, click on Exit, and return to the original Data Analysis display.

4 From the Analysis menu, choose Filter Data. The window (below) will show the filter choices available and the files that are currently loaded. In this case, ER-4000 Activity Filter is chosen, and the files of interest are highlighted. Click on Apply Selected Operation(s).

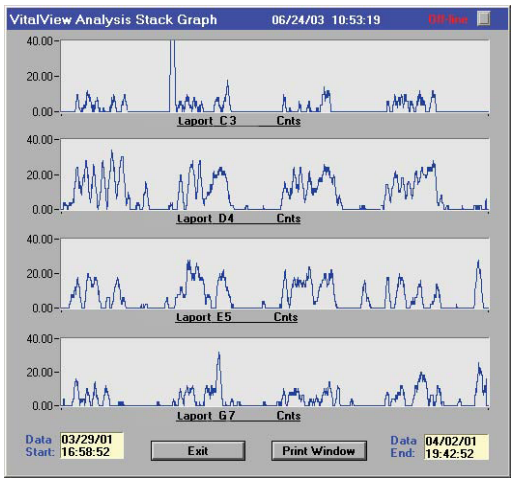
NOTE: Multiple filter choices may be made.

Analysis > Filter Data



5 The following Four Plot Stack Graph shows the results of the ER-4000 Activity Filter. The filter data shown below may be compared with the unfiltered data displayed above.

ER-4000 Activity Filtering



Data may be passed through a filter multiple times, with a variety of filters applied to the data.

Order of Application

When more than one of the data filters is selected, VitalView will apply them in the order listed below:

- Invalid points
- Clipping
- Scale
- Offset
- Decimate
- Log 10
- ER-4000 Activity Filter

For information on saving filtered files so they may be used in other applications, such as Excel or Actiview, see Section 7.

APPENDIX

G

STARTING A SEAMLESS SECOND SESSION

If data collection has been stopped, either accidentally or by a need to change the configuration, this procedure should be used to restart the data collection.

Before Continuing

If you have changed configurations

If a parameter is added or deleted, or if the sampling interval of any parameter is changed, the files from before and after the configuration change will not join properly into a contiguous data set. This will result in an experiment represented by at least two different sets of files. The number of parameters and the sampling interval for each parameter must remain the same for sessions to properly join.

The following procedure should be used when restarting VitalView.

Procedure

1. Save any configuration files that were made.
2. From the Main window File menu, click Exit VitalView, and wait for VitalView to shut down.
3. When ready to start VitalView again. Use Start > Programs > VitalView > Vitalview.exe.
4. When the Main window appears, choose the File menu, and select Open Configuration File.
5. Click Load.
6. Navigate to the folder that holds the files for the previous session, select and open the configuration file for that session.
7. Click Yes to review the Animal & Group Sampling Configuration and confirm this is the correct configuration.

NOTE: Although some changes may be made to this file, the number of parameters and the sampling interval must be the same across both sessions to properly join.

8 Click Exit to return to the Main window.

9 Under the File menu select Start Data Collection, and click on Standard.

10 If ER-4000 receivers are included in the system, VitalView will communicate with each one and list all receivers that were identified. Verify that all receivers in the chain have been identified and are listed. When you are sure that all ER-4000s are listed correctly, click on List is OK.

11 When prompted, enter a text comment, e.g. Experiment B, Session 2, relating to the experiment description, and click OK. (This name will appear in several displays, such as the head of the ASCII file data outputs, etc).

12 At the File dialog, use the "Up One Level" and "Open" buttons as necessary to navigate to the folder containing the experiment log file and data files of the previous session. Select the log file for the previous session, edit the name slightly to denote it from the previous session, then click the Save button.

13 If you are not already thoroughly confident that VitalView is configured correctly, confirm the current configuration is as intended by using the buttons provided in the lower right of the "System is ready" display (not including the Data Load button, which has a different purpose - see step 15).

14 Confirm the date and time reported by the "System is ready" window are correct. If they are not, you probably do not want to reset them unless they are wildly inaccurate. If you reset your PC clock, then the pace of data collection between this session and the previous session will likely be broken. Depending on the nature of your research, it may be better to have incorrect timestamps on the data (all with the same offset to the correct time) than to have a pace breaking time offset between this session and the previous session. To reset your PC clock, refer to "To start data collection" in Section 6, beginning with step 9.

15 If you started the previous session as recommended at a Pre-set Time that was "on the hour" or that was "a whole increment of the sampling interval after the hour" (i.e., by clicking the "Set to next hour" or "Set Pre-set Time" buttons), then do this again for this session.

You may find it helpful to review step 9 under "Subsequent session" in Section 6.

NOTE: If you did not start the previous session at a recommended Pre-set Time, and you must have the pace of data collection preserved from the previous session across and through this session, click the Data Load button on the "System is ready" window. Read and follow the directions given in the message that pops up.

16 With the correct Pre-set Time set, click on "Start Collection at Pre-set Time". A "countdown" window will appear and stay on the display until the PC clock catches up to the Pre-set Time from step 15.

17 When the PC clock passes the Pre-set Time, VitalView will go on-line and begin collecting data, as indicated by the green flashing indicator in the Main window. If your sampling interval is short, you may confirm the readings for all parameters are reasonable. Use the Data Collection Monitor from the Main window. (See "Data Collection Monitor Display" in Section 6).

APPENDIX

H

JOINING FILES

Files from two or more data collection sessions can be joined.

If a parameter is added or deleted, or if the sampling interval of any parameter is changed, the files from before and after the configuration change will not join properly into a contiguous data set. This will result in an experiment represented by at least two different sets of files. The number of parameters and the sampling interval for each parameter must remain the same for sessions to properly join.

In the following example, the data from three experiments will be joined into one contiguous file.

The three folders of data should look similar to the following:

ratslp1.cfg	.....the main configuration file (1st session of experiment)
ratslp1.cal	.....supplementary configuration file holding temperature calibration values
ratslp1.evn	.....supplementary configuration file holding event schedules (and links)
ratslp1.log	.....the log file for the experiment (a list of data files)
ratslp1.001	.....the first data file
ratslp1.002	.....the second data file
ratslp1.003	.....the third data file
ratslp2.cfg	.....the main configuration file (2nd session of experiment)
ratslp2.cal	.....supplementary configuration file holding temperature calibration values
ratslp2.evn	.....supplementary configuration file holding event schedules (and links)
ratslp2.log	.....the log file for the experiment (a list of data files)
ratslp2.001	.....the first data file
ratslp2.002	.....the second data file
ratslp3.cfg	.....the main configuration file (3rd session of experiment)
ratslp3.cal	.....supplementary configuration file holding temperature calibration values
ratslp3.evn	.....supplementary configuration file holding event schedules (and links)
ratslp3.log	.....the log file for the experiment (a list of data files)
ratslp3.001	.....the first data file
ratslp3.002	.....the second data file

In the previous example, three data files were collected in the first session, and two data files were collected in each of the second and third sessions.

In order to join these sessions, it is necessary to rename the data files of the second and third sessions as follows:

ratslp2.001	to	ratslp1.004
ratslp2.002	to	ratslp1.005
ratslp3.001	to	ratslp1.006
ratslp3.002	to	ratslp1.007

This results in the following file set for the full experiment:

ratslp1.cfg	.....the main configuration file with Animal & Group and System Setu
ratslp1.cal	.....supplementary configuration file holding temperature calibration values
ratslp1.evn	.....supplementary configuration file holding event schedules (and links
ratslp1.log	.....the log file for the experiment (a list of data files)
ratslp1.001	.....the first data file
ratslp1.002	.....the second data file
ratslp1.003	.....the third data file
ratslp1.004	....the fourth data file
ratslp1.005	.....the fifth data file
ratslp1.006	.....the sixth data file
ratslp1.007	.....the seventh data file

If the ratslip1.log file is loaded into VitalView, only the first three data files will load. This is because the ratslp1.log file lists only those three files. The log file must be updated to include all seven files.

To update the log file, run the Restore VitalView Log File function from the Data Load & Analysis File menu. The log file will list all seven files, the data from all seven files, and all three sessions.

- At the Choose Logfile to Restore dialog, the log file that must be selected is ratslp1.log.
- Click on save.
- Replace

APPENDIX

I

TROUBLESHOOTING

Introduction

This appendix is written with a decision tree format. The problems are divided into those dealing with data acquisition and those associated with data analysis. The most basic problems are covered first, followed by more complex ones. Find your symptom and go from there until you find the solution. If, after trying the suggestions in this section, you are still unable to solve your problem, do not hesitate to contact Starr Life Sciences Technical Support. We will work with you to understand your problem and provide the solution to it.

Problem	Symptom	Procedure
System tries to go on-line, but fails during initialization of ER-4000s	Blank list of receivers in ER-4000 utility panel.	Be sure Y-cable connector from the ER-4000 series is connected to the proper COM port identified in the software. To verify which COM ports your computer has installed: Start > Settings > Control Panel > System > Device Manager tab > click +next to Ports. Check power to the ER-4000s. Red lights should be blinking twice per second. Check power strip, outlet, UPS. Too many ER-4000s per supply (maximum 4)? Everything plugged in?

Problem	Symptom	Procedure
Green on-line indicator flashing in VitalView Window, but not data.	-10 on all channels	TR-3000 System Are the DP-24s powered up? Are the green lights on? If not, check power to devices. Check that DP-24s are connected to the computer. Check C-50 cables. Check DP-24 IDs. **Be sure to connect the power supply to the DP-24 *before* connecting the C-50 cables.** This will ensure proper initialization. Are the TR-3000s receiving power? Test by moving a transmitter within range while watching the activity indicator. It should blink when activity is detected. If not, there is likely a power problem. Check the C-8 cable connections. If there are QA-4s, check for power. Close the switch (rotate running wheel, touch lick sensor, etc.). The red light should indicated a switch closure. The most common cause of no data is faulty hardware setup. Verify power and communication cabling.
		ER-4000 System Is E-Mitter within range of ER-4000? If VitalView is on-line and the ER-4000 detects a working E-Mitter, the green LED will light. If the animal moves, the green light will go out momentarily, but should re-ligh within 2 to 3 seconds depending on animal movement. If the green light does not light, move cage to center the animal over the ER-4000. Does the green light stay out? There may be a problem with the E-Mitter or the ER-4000. Try a E-Mitter or ER-4000 to verify which is at fault.

Problem	Symptom	Procedure
Inconsistent data on channels	Excessively high temperature data on some channels.	High values are usually the result of some type of interference, including another E-Mitter close by (minimum 20 cm spacing). Check by moving adjacent animals further away from affected animal and watch for correct temperature data. Check for EMI from electronic motors, mass spectrometers, diathermy machines, MRI devices, etc. Listen for interference with a small AM radio set for 500 KHz. Place radio near TR-3000. If static is heard, move the radio around to find the source. Check cable routing. EMI may be picked up by interaction of system cabling. Route C-8 and C-50 cables away from power cords, telephone cables, etc. As in previous procedure, use an AM radio to find the source of noise. Route cables away from each other. When signal cables must cross power cables, cross them at a 90° angle.
	Low or no temperature values.	May be the result of poor signal pickup by the receiver because a fraction of the pulses are being detected. The cage may be too large for the E-Mitter implanted in the animal. The receiver may have Range Adjustment set too low, effectively reducing the range. Before adjusting, contact Starr Life Sciences Technical Support for directions. This symptom may also be the result of a low battery, poor battery contact, or damaged E-Mitter.
	Unusually high activity data. (For example, several thousand counts in a five minute period.)	Usually the result of noise. Look for cales running close to computers, DP-24 and ER-4000 power supplies, and other sources. DP-24 DataPorts are very sensitive to external noise through their input cables.
PC performance is suspect	Unusual crashes or "hangs." Memory limitation warnings.	Check "Computing Platform" in Section 1 to ensure you have enough computing power, hard disk space, RAM, and other platform characteristics. To prevent application conflicts, see that no programs are running other than VitalView. Make sure the virtual memory is set to approximately 2.5 times the amount of actaul RAM. Consult your system documentation for this procedure.
Disk write error	Computer error message. VitalView error message. In Data Collection Monitor, disk write error YES indicator will be yellow.	Exit Data Collection Monitor back to the Main Window. This will reset the error indicator from YES to NO. Enter the Data Collection Monitor again. If the error repeats (YES indicator), run ScanDisk's Thorough setting. If ScanDisk reports OK, open VitalView and begin collecting data again. For further information on restarting, see "Starting a Seamless Second Session" in Appendix G, and "Joining Files" in Appendix H.
Crash Recovery	"Has there been a power failure?" indicator in Data Collection Monitor turns to yellow.	See note on following page.

Crash Recovery

A "Crash Recovery" (or power failure) is a programmed process the PC executes after power comes back following a power loss while VitalView was on-line. A crash recovery will also take place after something causes the VitalView program to abort execution (such as Ctrl+Alt+Delete is entered, and Shutdown or End Task is selected). If the PC is powered through a UPS, and the power comes back before the UPS's batteries have discharged, there is much less need for the crash recovery process. However, to cover the unlikely event of a PC hardware or software error that causes a program to abort, it is recommended to set up the PC to take advantage of VitalView's automatic crash recovery feature.

After crash recovery, the "Has there been a power failure?" indicator at the top of the Data Collection Monitor will be a yellow "Yes."

Verify if good data are being collected for all parameters (wait a number of sampling intervals before evaluating). If data are OK for all parameters, then let VitalView continue. The crash recovery process should have maintained the pacing of the data collection. For example, if the initial start time was 9:30, and the sampling interval is 10 minutes, samples should still be reporting in the VitalView Monitor Zoom display at 0, 10, 20, 30, 40, or 50 minutes after the hour. If the system shows any sign that the PC or VitalView did not recover, see Appendix G.

To clear the "Has there been a power failure?" indicator, exit the Data Collection Monitor to the Main window, and click the Data Collection Monitor button. The indicator will have changed to "No."

Disk Write Errors

Sometimes portions of hard disks become unfit to record data. When data Errors are being recorded to the disk and there is a bad sector, the disk may not be able to correctly record the data, and a disk write error is generated. VitalView detects this type of hardware error.

The first time VitalView detects a disk write error, it will close the data file to which it was writing when the error occurred, and start a new data file. This is likely to clear the error, since a different portion of the hard disk will be used. However, VitalView will only do this one time. Any subsequent disk write error will be indicated by the yellow "Yes" in the Data Collection Monitor display. Similar to the power failure indicator, it may be cleared by exiting the Data Collection Monitor, and re-entering it from the Main window. If the disk write error indicator is still "Yes" when the Data Collection Monitor is re-entered, it means the error is continuing and it is likely the data are no longer being written to the hard disk. It is recommended you stop data collection, exit VitalView, and run a hard disk evaluation utility such as ScanDisk. If the utility reports the disk is good following its test, restart VitalView and begin data collection (refer to Appendix G).

Initialization Error Messages

NOTE: The following error message may be ignored if you intend to collect data via Series 4000 devices only, and not via Series 3000 devices.

Initialization error number 1

Explanation

There was an error generated when the VitalView program attempted to open the CB.CFG file. The CB.CFG file is the text file that is generated during the installation of the PCI interface card InstaCal driver software (see "PC Interface Card and Software Installation" Section 2). The CB.CFG file tells VitalView shortly after program launch what the PCI board number is.

Possible causes

1 File not found
- CB.CFG file was inadvertently moved or deleted since VitalView installation, or it was not installed because the "Install InstaCal Driver Software" step (item 1 of "Install VitalView for PCI Interface Card" on the CD) was not run as part of the VitalView installation process.
- Possibly the "Install InstaCal Driver Software" step was run, but neither C:\CB or D:\CB was selected as the installation folder, as required for the VitalView program to find the CB.CFG file.

2 File has become corrupted
- CB.CFG file.

3 System error
- File Input/Output
- Operating system
- Hard-disk drive hardware/firmware

Recommendation

Exit VitalView, run VitalView one more time, and if initialization error number 1 comes up on this run also, exit VitalView, remove the VitalView installation with Add/Remove programs, and re-install VitalView (see "PC Interface Card and Software Installation" in Section 2). If this does not work to move VitalView past initialization error number 1, call Starr Life Sciences, and ask for VitalView technical support. If in fact all installation instructions were followed exactly, the likelihood is high there is a system error or PC fault preventing proper disk file read operation, or the CD installation process is corrupted or prevented by a system error (possibly a PCI board error) from occurring as it normally does on the vast majority of PCs.

NOTE: An additional "capability not supported" error message may come on screen after "OK" is clicked from the initialization error number 1 message. In this case, ignore the additional error message, and click the "X" or close buttons until all VitalView windows disappear from the screen (and task bar).

Running ER-4000 Receivers - No PCI Interface Card

Shortly after VitalView is launched, there will be the "Initialization error number 1" message. In this case of running ER-4000 receivers only (no Series 3000 devices or DP-24 data collection), ignore this error message, and click the OK button. Then configure VitalView for ER-4000 receivers and start data collection.

Initialization error number 2

Explanation

The CB.CFG file was found, opened, and read successfully, but the CB.CFG file did not contain the expected "Board Type: PCI-DIO48H" text within the first 10,000 characters of the file, as is required. The CB.CFG file is the text file that is generated during the installation of the PCI interface card InstaCal driver software (see "PC Interface Card and Software Installation" in Section 2). The text "Board Type: PCI-DIO48H" and numeric text for the board number is appended to the CB.CFG file during step 3 of the Install VitalView for PCI Interface Card procedure (when the InstaCal driver software is run). Initialization error number 2 can only come on screen if VitalView has successfully made it past initialization error 1 (see above).

Possible causes

1. Step 3 of the Install VitalView for PCI Interface Card was not run, or did not complete its execution, or executed with an effect on the CB.CFG file inconsistent with what VitalView requires.
2. File has become corrupted
   - CB.CFG file
3. System error
   - File Input/Output
   - Operating system
   - Hard-disk drive hardware/firmware

Recommendation

Exit VitalView, run VitalView one more time, and if initialization error number 2 comes up on this run also, exit VitalView, remove the VitalView installation with Add/Remove programs, and re-install VitalView. See "PC Interface Card and Software Installation" in Section 2. Be sure to run all steps of the Install VitalView for PCI Interface Card, in the order specified on the CD installation program menu. If this does not work to move VitalView past initialization error number 2, call Starr Life Sciences and ask for VitalView technical support. If all installation instructions were followed exactly, the likelihood is high there is a system error or PC fault preventing proper disk file read operation, or the CD installation process is corrupted or prevented by a system error from occurring as it normally does on the vast majority of PCs.

NOTE: An additional "capability not supported" error message may come on screen after "OK" is clicked from the initialization error number 2 message. In this case, ignore the additional error message, and click the "X" or close buttons until all VitalView windows disappear from the screen (and task bar).

Initialization error number 3

Explanation

The CB.CFG file was found, opened, and read successfully, and the CB.CFG file was found to contain the text "Board Type: PCI-DIO48H" within its first 10,000 characters. However, the CB.CFG file did not contain the expected "Board #" text within the first 15 characters behind the text "Board Type: PCI-DIO48H", as is required. The CB.CFG file is the text file that is generated during the installation of the PCI interface card InstaCal driver software (see "PC Interface Card and Software Installation" in Section 2). The text "Board Type: PCI-DIO48H" and numeric text for the board number is appended to the CB.CFG file during step 3 of the Install VitalView for PCI Interface Card procedure (when the InstaCal driver software is run). Initialization error number 3 can only come on screen if VitalView has successfully made it past initialization errors 1 and 2 (see above).

Possible causes

1 Step 3 of the Install VitalView for PCI Interface Card did not complete its execution, or executed with an effect on the CB.CFG file inconsistent with what VitalView requires.

2 File has become corrupted
- CB.CFG file).

3 System error
- File Input/Output
- Operating system
- Hard-disk drive hardware / firmware

Recommendation

Exit VitalView, run VitalView one more time, and if initialization error number 3 comes up on this run also, exit VitalView, remove the VitalView installation with Add/Remove programs, and re-install VitalView (see "PC Interface Card and Software Installation" in Section 2). Be sure to run all steps of the Install VitalView for PCI Interface Card, in the order specified on the CD installation program menu. If this does not work to move VitalView past initialization error number 3, call Starr Life Sciences and ask for VitalView technical support. If all installation instructions were followed exactly, the likelihood is high there is a system error or PC fault preventing proper disk file read operation, or the CD installation process is corrupted or prevented by a system error from occurring as it normally does on the vast majority of PCs.

NOTE: An additional "capability not supported" error message may come on screen after "OK" is clicked from the initialization error number 3 message. In this case, ignore the additional error message, and click the "X" or close buttons until all VitalView windows disappear from the screen (and task bar).

Initialization error number 4

Explanation

The CB.CFG file was found, opened, and read successfully, and the CB.CFG file was found to contain the text "Board Type: PCI-DIO48H" within its first 10,000 characters, and also the text "Board #" within the first 15 characters behind the text "Board Type: PCI-DIO48H". However, the numeric text in the CB.CFG file following the "Board #" text was found to be outside the range 0 to 255, or was unreadable as a valid numeric value. The CB.CFG file is the text file that is generated during the installation of the PCI interface card InstaCal driver software (see "PC Interface Card and Software Installation" in Section 2). The text "Board Type: PCIDIO48H" and numeric text for the board number is appended to the CB.CFG file during step 3 of the Install VitalView for PCI Interface Card procedure (when the InstaCal

driver software is run). Initialization error number 4 can only come on screen if VitalView has successfully made it past initialization errors 1, 2, and 3 (see above).

Possible causes

1 Step 3 of the Install VitalView for PCI Interface Card did not complete its execution, or executed with an effect on the CB.CFG file inconsistent with what VitalView requires.

2 File has become corrupted
- CB.CFG file

3 System error
- File Input/Output
- Operating system
- Hard-disk drive hardware / firmware

Recommendation

Exit VitalView, run VitalView one more time, and if initialization error number 4 comes up on this run also, exit VitalView, remove the VitalView installation with Add/Remove programs, and re-install VitalView (see "PC Interface Card and Software Installation" in Section 2). Be sure to run all steps of the Install VitalView for PCI Interface Card, in the order specified on the CD installation program menu. If this does not work to move VitalView past initialization error number 4, call Starr Life Sciences and ask for VitalView technical support. If all installation instructions were followed exactly, the likelihood is high there is a system error or PC fault preventing proper disk file read operation, or the CD installation process is corrupted or prevented by a system error from occurring as it normally does on the vast majority of PCs.

NOTE: An additional "capability not supported" error message may come on screen after "OK" is clicked from the initialization error number 4 message. In this case, ignore the additional error message, and click the "X" or close buttons until all VitalView windows disappear from the screen (and task bar).

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