Small Animal Physiological Monitoring System

USER'S MANUAL

Small Animal Physiological
Monitoring System 75-1500
75-1501

Harvard Apparatus

a division of **Harvard Bioscience, Inc.**

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Warranty & Repair Information

Manual Description

This manual is designed to provide all operational and program information required to operate the Physiological Monitoring System. The functions and features are described in the Technical Specifications section.

Warranty

Harvard Apparatus warranties this instrument for a period of one year from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or materials. This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident. This warranty extends only to the original consumer purchaser.

IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE.** Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the one-year warranty period, promptly contact *Harvard Apparatus, 84 October Hill Road, Holliston, Massachusetts 01746* using our toll free number 1–800–272–2775, or outside the U.S. call 508-893-8999. Our E-mail address is support@hbiosci.com. Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs or replacement. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

General Safety Summary

Please read the following safety precautions to ensure proper use of your Physiological Monitoring System. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

To Prevent Hazard or Injury

Use Proper Line Cord
Use only the specified line cord for this product and make sure the line cord is certified for the country of use.

Use Proper Power Supply
The unit is supplied with an approved power supply.

Always use the provided power supply for the monitoring system. Cheaper power supplies have been found to add noise in the ECG, SpO_2 and blood pressure signals.

A protection circuit is present on the system. If the detected supply is not between 11V and 14V, the system will not start.

The Android tablet should be kept plugged into its wall charger. Most computer's USB ports don't provide sufficient power to keep a tablet running and the battery will slowly drain.

Ground the Product
This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making any connections to the input or output terminals of the product, ensure that the product is properly grounded.

Make Proper Connections
Make sure all connections are made properly and securely. Any signal wire connections to the unit must be no longer than 3 meters.

Observe All Terminal Ratings
Review the operating manual to learn the ratings on all connections.

Orient the Equipment Properly
Do not orient the equipment so that it is difficult to operate the disconnection device.

Place Product in Proper Environment
Review the operating manual for guidelines for proper operating environments.

Avoid Exposed Circuitry
Do not touch any electronic circuitry inside of the product.

General Safety Summary

Do Not Operate with Suspected Failures

If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

Observe All Warning Labels on Product

Read all labels on product to ensure proper usage.

⚠️ **CAUTION: ANIMAL SHOULD BE MONITORED BY USER AT ALL TIMES.**

⚠️ **CAUTION: FOR RESEARCH USE ONLY. NOT FOR CLINICAL USE ON PATIENTS.**

⚠️ **CAUTION: DO NOT CONNECT TO FIREWIRE DEVICES. DAMAGE MAY OCCUR TO THE HOMEOTHERMIC MONITORING SYSTEM OR COMPUTER.**

⚠️ **CAUTION REFER TO MANUAL**

⏚ **PROTECTIVE GROUND TERMINAL**

Technical Specifications

ECG	Display Leads I, II, III, aVL, aVR & aVF
	Supine or prone position
	1 kHz, 24-bit acquisition
	3 external electrodes connections (2 mm)
Respiration	250 Hz acquisition
Heart & Breath Rate	200 to 800 beats/min
	25 to 330 breaths/min
	Calculated every second
Warming & Temperature	Heated surface up to 45°C
	0.1°C resolution
	Closed loop PID controller keeps the animal within ±0.1°C of set temperature
Blood Pressure	Full waveform display
	Systolic and diastolic numeric values
Exhaled CO_2	Connect ventilator directly to the platform (1/8" tubing)
	1 Hz refresh rate
	0.1% accuracy
SpO_2	80 to 100% saturation
	250 Hz, 24-bit acquisition
	Red & infrared channel display

System Information

Heated Platform	Easy to clean surface
	10 cm X 21 cm X 2.5 cm (mouse)
	12 cm X 30 cm X 2.5 cm (rat & mouse)
Tablet	8" Android tablet (10.1" available)
	High resolution touchscreen display
	Capacity of over 400 hours of saved data
	5-8 hours battery life
	USB cable and charger
Communication Module	Bluetooth and analog outputs are in a separate enclosure to avoid interference
	9 cm X 11 cm X 2.5 cm
	100-240V power supply
Bluetooth	15 to 25 meters typical range between the communication module and the display unit
Analog Outputs	4 configurable outputs
	BNC connectors, ±5V range
	1 kHz, 16-bit refresh rate
Data Analysis	.csv conversion tool
	MATLAB® & Excel® import and display scripts
	Compatible with third-party analysis software (LabChart)

Introduction

The Small Animal Physiological Monitoring System from Harvard Apparatus is an instrument integrating multiple physiology parameters on one single small platform.

The platform integrates monitoring of the rectal temperature, electrocardiogram (ECG), respiration, oxygen saturation (SpO_2), blood pressure and exhaled CO_2 ($EtCO_2$). It also includes a controlled heating surface to maintain the animal's body temperature at the desired level.

The system has many benefits regarding surgery procedures. It demands less installation time at the beginning of procedures and it reduces the required space and the number of wires around the animal. A single data/power cable connects to a small wireless communication module. All data is transferred to an Android tablet by Bluetooth for display and saving.

The Physiological Monitoring System features a real-time display which provides numeric values as well as waveforms that can be customized by the user. Multiple signals can be displayed on each of the three graphs.

The Physiological Monitoring System comes complete with a heated platform, an Android tablet with a protective sleeve and stand, Bluetooth communication module, a rectal probe and electrode gel. These components are all supplied in a sturdy case for storage and transport.

At the end of experiments, recorded data can easily be transferred to any computer for analysis. Scripts and utilities are provided to convert data in LabChart or CSV format and to display signals in Excel and Matlab

Physiological Monitoring System

Operation

MINIMUM REQUIREMENTS

Main Voltage

The monitoring system must be plugged to a 100-240 VAC 50-60 Hz main supply. The Android tablet comes with a USB charger, requiring a main supply as well. As stated in the Warning section, only use the power supplies sent with the system.

Android Device

While an Android tablet is supplied with the system, any other Android device can be used, as a replacement or in conjunction. It must have Android 4.0.3 or above, a Bluetooth antenna and a high resolution display (720 x 1280 and above).

Computer

A computer is required only for advanced data analysis.

A USB port is required to connect the Android tablet for data transfer. Drivers are already installed for Windows Vista and above.

Java (JDK 1.6 and above) is required to run the LabChart and .csv conversion script.

Microsoft Excel on Windows is required to run the Excel display script.

Matlab is required to run the Matlab display script.

Operation

GETTING STARTED

Installing the Monitoring System

The power switch is located on the communication module to power up the whole system. Plug in the power supply and make sure that the cable between the communication module and the monitoring platform is screwed tightly on both sides.

It is recommended to start the system 5 to 10 minutes prior to positioning the animal, to ensure that the platform is fully heated. It is important to note that the platform remembers the last target temperature, even if it was unplugged. This means that if the last user turned off the heating, the platform will not heat by default and the heating feature must be turned back on.

Android Tablet

The Android tablet should be kept plugged into its wall charger. The majority of tablets have their USB port under the tablet. To use the provided stand, put the tablet on the side or upside down and the screen will automatically rotate.

The Android tablet comes with the "Monitoring Station" application pre-installed. When started, it will automatically connect to the monitoring platform.

Positioning the Animal

After anesthesia induction, place the animal on the monitoring platform with its paws on the metal pads and make sure to have a good contact by covering them with conductive gel. Insert the rectal temperature probe and set the desired temperature from the "Monitoring Station" application's settings menu. See the section Theory of Operations for more information.
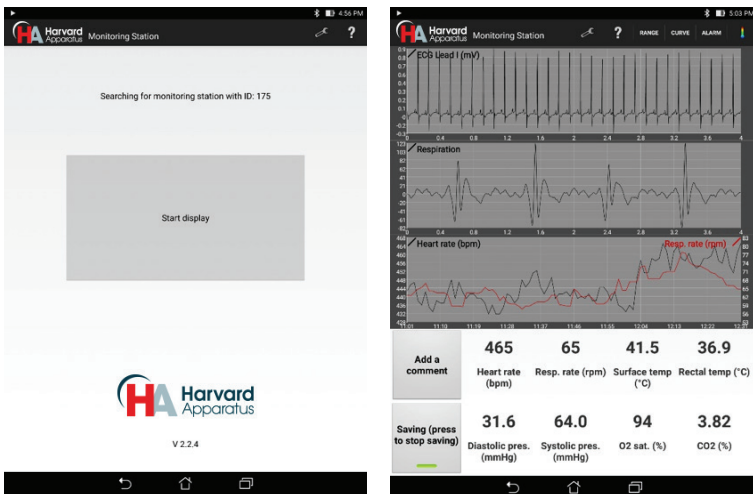
Operation

ANDROID APPLICATION

Windows

The Android application has two main windows:

A: Connection interface
The first window appears at software opening. It informs user about connection status with the monitoring station. At the top of this window, there is a tool menu (⚒) to access all the settings. The help menu ("?") links to the User Manual that can be found on the tablet.

B: Monitoring interface
The second window automatically appears after the connection is established. User can find all the information about the animal's physiology, displayed either as numbers at the bottom of the screen, or on three configurable graphs. Furthermore, multiple options are available at the top of the window.

Reminder: This user manual can be accessed with the "?" button at the top of the window.

Operation

To select which signals to be displayed on the graphs, select the "Curve" menu at the top of the window.


Graphs

Each of the 3 graphs can display up to 4 different signals each: 2 on the left axis and 2 on the right axis. The bottom graph displays low frequency signals and the two others are for high frequency signals.

It is possible to zoom on the signals by pinching on the graphs with two fingers:

- On the top 2 graphs, the duration can be adjusted from 1 to 5 seconds, by increments of 1 second.
- For the bottom graph, it can be adjusted from 30 seconds to 30 minutes, by increments of 30 seconds.
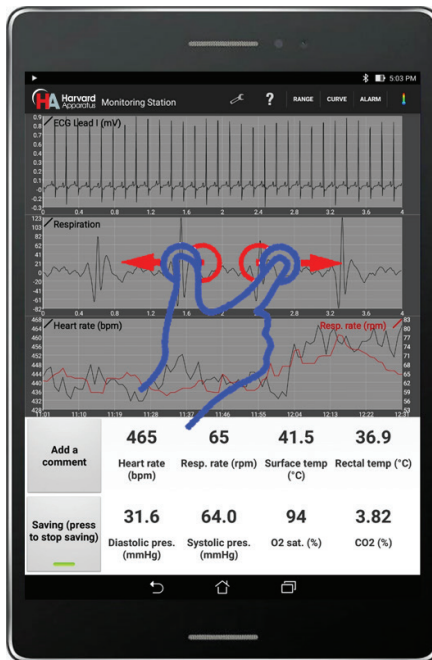
Operation

Closing the Application

To close the application, press the back button at the bottom of the window. It is also possible to close the application from the notification bar, when swiping down from the top of the screen, as shown below.

The application will automatically be closed if the system is turned off.

Pressing the home button will just put the application in background and **will not** close it. This is useful to navigate to other apps, while monitoring an animal and saving data.

Settings Modifications

While data saving is activated, advanced settings under the "Tool" menu cannot be modified for stability considerations and to preserve data integrity.

Temperature settings can be modified from the display window, even while data saving is on.

Operation

Signal Range

By default, the range of the signals displayed is automatically set. For ECG, respiration, blood pressure, heart rate, respiration rate, temperatures and CO_2, the range menu offers the possibility to set axis limits manually and avoid automatic rescaling.

Saving

On the display page, there is a button to save the results. As soon as the button is pressed, data starts to be saved. When pressed a second time, a popup will ask user to confirm if they really want to stop saving data. One minute of data uses approximately 0.5 MByte. Data is saved as a stream, meaning that unexpected shutdowns (e.g.: drained battery) will not affect prior acquired data.

Adding Comments

Comments can be linked to the saved data file during acquisition. When adding a comment, a new file named comments.txt is created in the results folder. Each comment is preceded by a time marker, in order to refer the comment with the saved data. If a comment is added when saving is not enabled, this comment is added to the previous saved results.
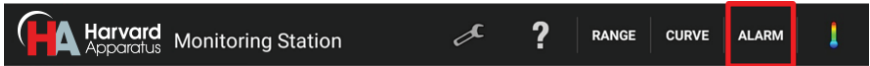
In the dialog window that appears when adding a comment, there will be a list of the last 10 comments added during the acquisition.

Operation

Alarms

Multiple alarms are available to inform the user when physiological parameters are out of the desired ranges.

When an alarm is ON, a popup window is shown on the screen and a noise signal can be played by the tablet. The sound on the Android tablet must be activated to hear the sound signal. Also, numerical values of these off limit parameters, at the bottom of the screen, turn red and blink as long as their value is abnormal, as shown in the following image.

To prevent false alarms, fault condition must last at least 10 seconds before alarm activation.


Beeper

In the Alarm menu, an option enables a sound marker following either heart or respiration rate. This setting is used when user might not be able to keep an eye on the tablet's screen (e.g. during surgery or experimentation). With this feature, users can be notified of changes in physiology without looking at the display. The sound on the Android tablet must be activated to hear the noise.

Operation

Screen Rotation

The Android tablet can be used in portrait or landscape mode, depending on preference.
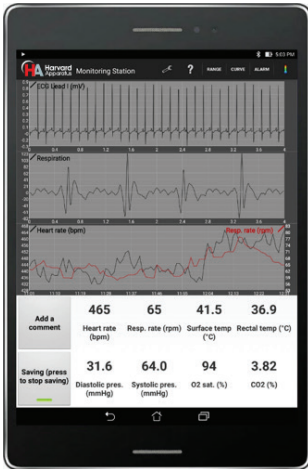

Language

Monitoring software can be set to either English or French. To change language, go in "Settings Menu" -> "General Settings".

Bluetooth Connection

Each monitoring station has a unique ID that can be found on the communication module. The purpose of this ID is to link the tablet Bluetooth communication with one specific device. To change it, go in "General Settings", in the "tool" menu.
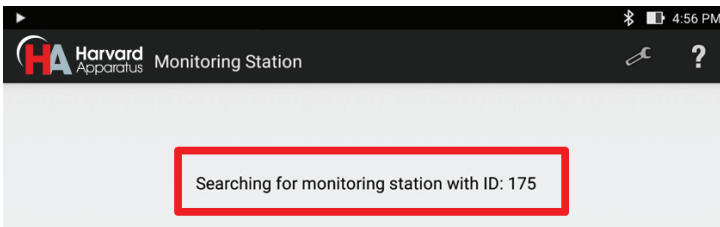
It is possible to use up to 2 Android devices to monitor a single monitoring station. If a setting is modified on one device, it will automatically be transferred to the other devices. Be careful when using 2 devices at the same time: if one of them gets out of the Bluetooth range, glitches might occur in the data communication. To prevent this, make sure to close the application from the notification bar or by using the back button before leaving Bluetooth emission radius.

Operation

THEORY OF OPERATION

ECG

To improve the signal, place a small amount of the provided conductive gel on each of the surface ECG sensors before positioning the animal; no additional adhesive is necessary, the gel is adequate to ensure a good electrical connection. All four of the animal's paws much be placed on the corresponding sensor, even if only Lead I (Left Arm – Right Arm) is measured. This is important to ensure that the Right Leg Drive circuit which helps with 50/60 Hz noise reduction properly works.

If the animal is in the supine position, it is strongly urged that that external ECG leads be used rather than the surface ECG sensors. The external ECG lead connectors follow the American Heart Association (AHA) color coding. Below is a pictorial and table description of this color coding and how it compares to the European (IEC) color coding. The external ECG ports on the platform are 2 mm; adapters are available to 1.5 mm touch proof connectors. When the animal is in the supine position it is recommended that the ECG Electrodes Inversion Option be activated in the advanced setting menu. By turning on this option, hardware switches are activated that ensure that the correct leads are acquired and displayed.
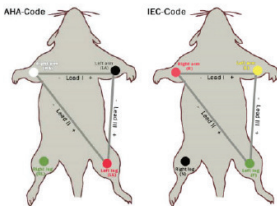
		AHA		IEC
Right Arm	RA	White	R	Red
Left Arm	LA	Black	L	Yellow
Right Leg	RL	Green	N	Black
Left Leg	LL	Red	F	Green

Six main derivations are available (leads I, II & III, aVR, aVL, aVF), as well as external leads. Right Leg Drive (RLD) is activated by default in the settings, to reduce 50/60 Hz noise. When using external leads, RLD should be changed to "External Leads". RLD can also be turned off, but it would usually add 50/60 Hz noise.

Operation

The ECG gain can also be changed. In the unlikely event where the ECG signal would be saturated and not visible on the screen, the gain can be reduced. The default gain value is 3. The ECG display and saved data represents the value before the amplifier. Thus, the signal amplitude will not change when changing the gain.

An additional cut-band (50/60 Hz, 4th order Butterworth) filter can be applied on all ECG signals before display. It should be enabled when the RLD is not sufficient to reduce the noise. It has no effect on saved data nor heart rate calculation since they use raw data.

The larger platform for rat and mouse includes two sets of surface ECG electrodes – one for adult rat and tone for mouse and rat under 20 days old. Select the correct set of electrodes in the ECG settings.

Respiration
The respiration sensor is the black diamond on the middle of the device. To work efficiently, it must be placed under the abdomen of the animal.

Two filters are available for the respiration signal before display: a low-pass filter (25 Hz, 4th order Butterworth), and a high-pass filter (2 Hz, 4th order Butterworth). Both filters can be individually disabled and they have no effect on saved data. It also has no effect on breathing rate, which is computed from raw data.

As an alternative to the respiration sensor, the respiration waveform can be derived from the ECG leads (both internal and external) by selecting the desired option in the respiratory settings. ECG derived respiration is useful during a surgery when the sensor detects noise originating from the surgeon.

Temperature
The rectal probe should be inserted in the rectum of the animal so that the metal part is completely inside it. A lubricant is recommended to ease the insertion. Also, for better stability, the probe's cable should be taped to the platform.

Operation

For long experiments, it is recommended to cover the animal with a few gauze pads to keep the temperature stable across its body.

The temperature of the heating platform can be controlled in two different modes:

1. A target surface temperature is set, which will fix the temperature of the surface of the platform.

2. A target rectal temperature is set, and the platform temperature will be automatically controlled. Note that in this mode, if the rectal temperature is under 28°C, the system will consider that there is no animal on the platform and the surface temperature will be fixed to 40°C. The controller will maintain the rectal temperature within a tolerance of ±0.2°C.

In all modes, the surface temperature is limited to 45°C.
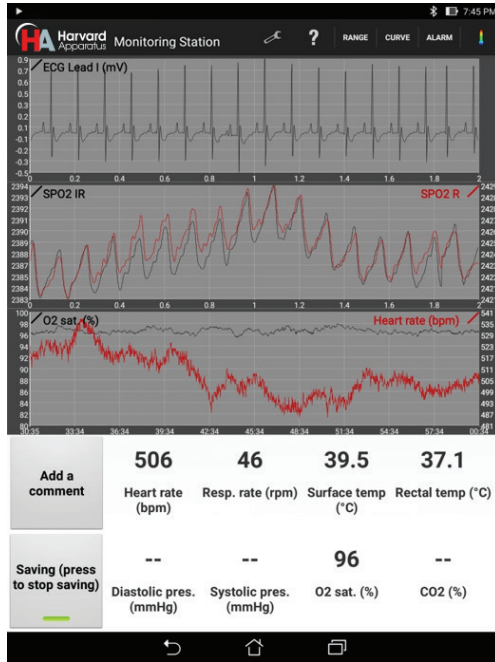
Oxygen Saturation

Oxygen saturation measurement is one of the options available on the monitoring platform. A sensor clip with an optical source – detector pair is supplied.

It is recommend to place the sensor on the left hind leg of the animal. Prior to placement of the sensor, the animal's leg should be carefully shaved so that any fur in the area of contact with the sensor is removed. The clip should be taped to the platform to avoid movement artifacts in the signal. In the same way, the force applied on the spring (through the adjustment of the screw) should be sufficient to stop any leg movements without blocking blood circulation. ECG acquisition of Lead I will continue to work even if the left paw is not on the sensor.
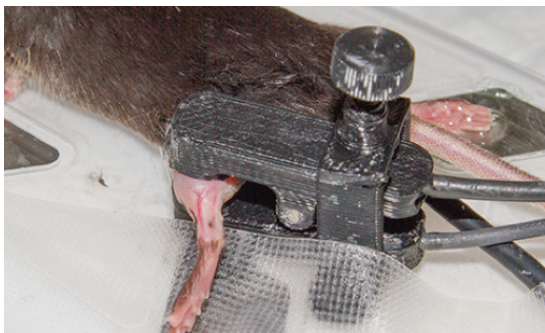
To make sure that the clip is installed properly, display ECG Lead I, SpO_2 IR (infrared) and SpO_2 R (red) on the graphs, as shown on the tablet on the next page. The DC amplitude of the SpO_2 signals should be between 1000 and 10,000 with the default parameters. The AC amplitude should be 2 or more.

Operation

A low-pass filter (45 Hz, 4th order Butterworth) is applied by default on the SpO₂ signals before display. It can be disabled and it has no effect on saved data. It also has no effect on oxygen saturation calculation, which is computed from raw data. Multiple parameters are available in the settings to change gains, filters and LED amplitudes. These parameters should only be modified by experienced users.

Blood Pressure

Blood Pressure is one of the options available on the monitoring platform. A bridge amplifier is built into the platform and the connector is a Redel 5-pin, used on Millar bridge amplifiers. A pressure transducer is not included with this option and must be purchased separately. The APT300 Blood Pressure transducer is available with the appropriate connector to the interface with the system (73-4905). Alternatively, adapters are available for DIN 8-pin connectors (used on AD Instruments bridge amplifiers) and for Millar's Low Profile (used on Millar catheters).

Blood pressure catheters can have a zero offset of up to ±50 mmHg. For this reason, it is recommended to perform a calibration each time the catheter is changed by placing it at room pressure. An option is available in the advanced settings for calibration.
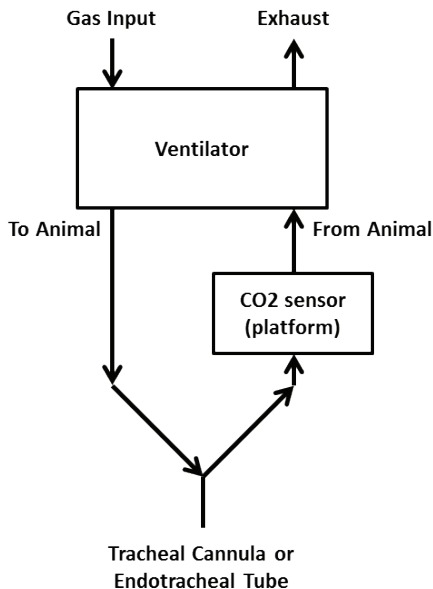
Operation

Exhaled CO_2

Exhaled CO_2 is one of the options available on the physiological monitoring platform. If this option is added on after the initial purchase of the system, the platform must be returned for modification.

To measure the exhaled CO_2, an external ventilator must the used. The ventilator must be connected in series with the CO_2 module. The exhaled gas from the animal must be connected to the input port of the CO_2 module on the platform, which is the one on the right side of the animal. The other port, on the left side, must be connected to the ventilator.

The CO_2 module is factory calibrated. However, a manual calibration can be performed in the advanced settings. To do so, supply a flow of 10 mL/minute of nitrogen to the sensor and activate the calibration option. It is recommended to do a manual calibration every year to get the most accurate CO_2 level.

The CO_2 measurement can be displayed in either percentage or mm Hg, as selected in the CO_2 setting.

Operation

Stereotaxic Device

Two Stereotaxic Kits are options available on the monitoring platform; Stereotaxic Kit with Gas Anesthesia Mask and Stereotaxic Kit with Nose Clamp. Each of those options are available for the mouse platform and the rat and mouse platform. The options that fit on the rat and mouse platform are for use with mouse only. The stereotaxic device is fixed to the platform with M3 screws and it can be easily removed depending on the application.

Other accessories can be used with the stereotaxic device, such as jaw holders and cages for awaken monitoring. Contact Technical Service for information about additional accessories.

Analog Outputs

There are 4 BNC analog outputs on the communication module. The outputs are short circuit protected.

ECG signals are encoded from -5V to 5V, where 5V is 12.5 mV at the default ECG gain of 3. If the ECG gain is changed, the ratio will also change. For example, at a gain of 6, 5V will represent 6.25 mV.

Temperatures are encoded from -5V to 5V where -5V is 25°C, 0V is 35°C and 5V is 45°C. They increase by 50mV per 0.1°C.

Expired CO_2 is encoded from 0 to 5V, where 0V is 0% and 5V is 10%.

Blood pressure is encoded from -5V to 5V, where 0V is 0 mmHg and 5V is 400 mmHg.

The rest of the signals (respiration and SpO2) are in arbitrary units.

In the advanced settings on the Android tablet, it is possible to select the signals for each the analog outputs.

Cleaning of the Device

The platform's surface and the rectal probe can be cleaned with alcohol based solutions, such as ethanol and isopropanol, and peroxide solutions.

The system is not watertight, but is splash proof. Avoid spilling liquids on the side of the platform as it could leak inside.

The communication module, the cables, the oxygen saturation sensors can be cleaned with warm water and a small amount of light detergent.

Operation

DATA TRANSFER AND ANALYSIS

Transfer Saved Data

To recover saved data, plug the device on a computer and browse to the "MonitoringStation" folder. In this folder, there will be multiple folders named with the date: YYMMDD. In this sub-folder, folders are named with the starting time: HHMMSS. The whole folder should be copied on the computer. It contains all the saved data in multiple binary files.

If an external SD card is present, data is automatically saved to it.

The following table shows information about each saved file.

File name (.bin)	Corresponding data	Data format	Sampling frequency
ECGAux	ECG external leads (μV)	Int16	1000 Hz
ECGLeadI	ECG LA-RA (Lead I) (μV)	Int16	1000 Hz
ECGLeadII	ECG LL-RA (Lead II) (μV)	Int16	1000 Hz
Respiration	Respiration	Int16	250 Hz
SpO_2Infrared	SpO2 Infrared	Int32	250 Hz
SpO_2Red	SpO2 Red	Int32	250 Hz
BloodPressure	Blood pressure (1/100th mmHg)	Int16	250 Hz
CO_2	Exhaled CO2 (1/1000th %)	Int16	1 Hz
SurfaceTemperature	Surface temperature (1/100th °C)	Int16	10 Hz
RectalTemperature	Rectal temperature (1/100th °C)	Int16	10 Hz
RespirationRate	Calculated breathing rate (BPM)	Int16	1 Hz
HeartRate	Calculated heart rate (BPM)	Int16	1 Hz
SpO_2	Calculated saturation (1/10th %)	Int16	1 Hz

ECG data is in μV. ECG lead III can be obtained by subtracting lead I from lead II. Respiration vary from -512 to 511. Temperatures can be converted in °C by dividing by 100. Blood pressure can be converted in mmHg by dividing by 100. Exhaled CO_2 can be converted in % by dividing by 1000 or in ppm by multiplying by 10.

Matlab and Excel Scripts

Scripts are available to load, analyze and display all the saved signals in Excel and Matlab. Contact Technical Service for more information.

The Excel script will load binary files saved by the tablet into separate worksheets of an Excel document. Data can then easily be exported in .csv or displayed on a graph. A simple display code is also provided. This script can import up to 90 minutes of data.

Matlab is a powerful and flexible mathematic tool that can analyze complex waveforms. The provided script will load binary files in Matlab workspace and will display signals chosen by the user

Operation

LabChart and .csv Conversion Tool

A cross-platform Java program (Windows, Mac & Linux) is also provided to automatically convert the saved files into a LabChart binary file (.adibin) or .csv files. Java must be installed on the computer. The software asks the user to choose a folder containing the saved files and it creates the desired files inside a subfolder called "csv". A batch conversion can also be done when choosing a folder containing multiple folders of results.

On average, data will use 4 MB/minute for csv conversion and 3 MB/minute for LabChart conversion. An option is available to select certain signals to convert, in order to reduce file size.

When all the signals are selected, the conversion is limited to 3.5 hours of data. Note that Excel will not be able to load very large .csv files with more than 1 million lines (for example, when loading raw ECG signals of more than 17 minutes). In these situations, use the provided Excel script.

Android Limitations

On some devices, if the application is not displayed on the screen, Android might stop it at any moment to free up memory. When saving important results, it is important not to turn off the screen or navigate to other apps. When displaying results, the application prevents the device to go to sleep and the screen will not automatically turn off.

Bluetooth Range

The Bluetooth connection is typically limited to a range of 15 to 30 meters, depending on the environment. Note that Wi-Fi signals can interfere with Bluetooth. If there is wireless router close to the system or a high Wi-Fi activity, the range could be decreased. For these reasons, especially when saving important results, it is recommended to keep a maximum distance of 5 meters between the Android device and the communication module.

Data will be lost if the system is too far away. Display and saving will be paused until the system is brought closer. At a certain distance the connection can also be lost and the application will be closed.

There is a 10 second buffer on the system, which prevents any data loss even if the tablet is out of range for some time.

Demo Mode

A demonstration mode is available on the Android application. It allows displaying previously acquired data when the platform is not connected. Contact Technical Service for more information.

Troubleshooting Guide

ECG signal is weak	The most common reason for this problem is that there is not enough conductive gel between the paws and the pads of the platform. The gel can dry out during long experiments, so it is recommended to use more gel.
	Even if only Lead I is measured, it is important to connect all the paws of the animal to the platform, because the Right Leg Drive circuit that helps reduce 50/60 Hz noise will not work properly.
Respiration signal is weak	The sensor on the platform must be placed under the abdomen of the animal for better results. If it is placed under the rib cage, the sensor might also detect the heartbeat.
The tablet is not connecting to the system	Each system has an ID, which is written on top of the communication module. Make sure that the tablet is searching for that ID when trying to connect. If not, change it in Settings ⟶ General.
	If the problem is still present, make sure the system is powered on. There should be a green LED on the communication module. Check that the cable between the communication module and the platform is connected and screwed in.
	If this problem occurs after a software update or with a new tablet, the Bluetooth device needs to be paired. On some devices, a "Smart Lock" notification will appear asking to add the Bluetooth device as a trusted device. Simply confirm this request. Pairing can also be performed from the Android's Bluetooth settings. Note that pairing sometimes cannot be done while another Bluetooth device is connected to the monitoring system
The system is not powering	Make sure you are using the correct power supply. A protection circuit is present on the system. If the detected supply is not between 11V and 14V, the system will not start.
The tablet is not recognized by the computer	On the tablet, go in Settings ⟶ Storage, touch the Menu icon and then choose MTP connection. Also, make sure that the tablet is not in USB debugging mode (an icon would appear in the notification bar when the tablet is connected to a computer).
	If you are using a Mac, you will need to install Android File Transfer.
	If you are using Windows XP or Linux, ask technical services for assistance.
There is 50/60 Hz noise in the signals	Using a power bar or an extension cable has been found to increase the background noise in critical signals, such as ECG, SpO_2 and blood pressure. Try connecting the system directly in the wall. Make sure the outlet has three prongs, with an earth ground connection. Also make sure you are using the provided power supply.
	For noise in the ECG signal, make sure that the option Right Leg Drive is activated in the Settings.

Ordering Information

Order #	Product
System and Options	
75-1500[1]	Physiological Monitoring System for Mouse (10 g to 100 g)
75-1501[1]	Physiological Monitoring System for Mouse & Rat (10 g to 600 g)
75-1502[2]	Blood Pressure Option
75-1503	End Tidal CO_2 Option
75-1504	SpO_2 Option
Accessories	
73-4905	APT3000 Pressure Transducer for Physiological Monitoring System
77-0207	ECG 3-Needle Electrodes, 2 mm pin
75-1539	Nose Cone Holder
75-1540	Stereotaxic Kit with Gas Anesthesia Mask for 75-1500 Platform
75-1541	Stereotaxic Kit with Nose Cone for 75-1500 Platform
75-1542	Stereotaxic Kit with Gas Anesthesia Mask for 75-1501 Platform
75-1543	Stereotaxic Kit with Nose Cone for 75-1501 Platform
75-1552	BP Adapter to DIN-8

Note[1]**:** At the end of the part number add EU for Europe, UK for United Kingdom and CN for China versions.
Note[2]**:** Blood pressure transducer needs to be purchased separately.

For more complete product details and part number listings please visit our website www.harvardapparatus.com

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