

# **ROTORAT™**

SOF-801

USER'S MANUAL

**DOC-037**

**Rev. 3.0**

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## CHAPTER 1 | INTRODUCTION

The RotoRat™ system has been designed to provide the maximum flexibility in both hardware and software for the measurement of rotational movement or activity of a rat.

### Key features include:

- Graphical representation of the animal's position at all times;
- Measure both clockwise and counterclockwise rotations;
- Two levels of sensitivity;
- Records direction changes.

### Requirements:

- Windows 7, 10, 11, 32-bit or 64-bit
- MED-RRS or MED-RRS-USB RotoRat™ Starter Package

*Figure 1.1 - RotoRat™ Chamber*

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## CHAPTER 2 | HARDWARE

### Hardware Guide

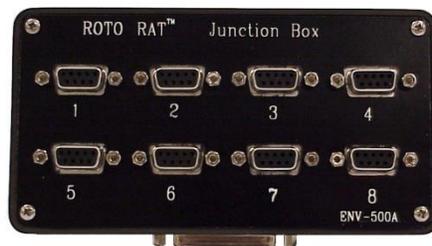
Figure 2.1 - RotoRat™ Chamber



Figure 2.2 - Left: Interface Cabinet with DIG-700G Decoder Card and DIG-713A SuperPort Card  
Right: Interface Cabinet with DIG-705 USB Decoder Card and 2 DIG-713A SuperPort Cards

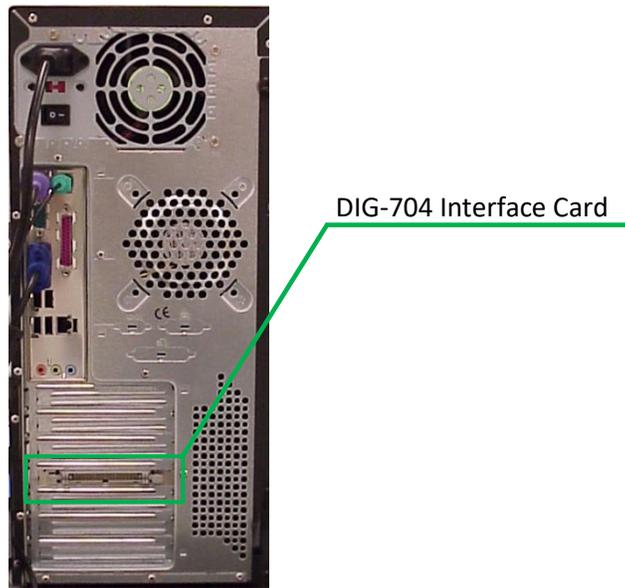


Figure 2.3 - ENV-500A Junction Box



*Figure 2.4 - Computer with DIG-704 Interface Card*

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**Cable Guide**

*Figure 2.5 - DIG-700C Ribbon Cable*

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*Figure 2.6 - SG-218-10 Cable*

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## **Wiring Instructions**

The RotoRat™ software communicates with the RotoRat™ hardware via an “interface and decoder package”. The software supports the DIG-704 and DIG-705 Interface Cards.

### **DIG-704**

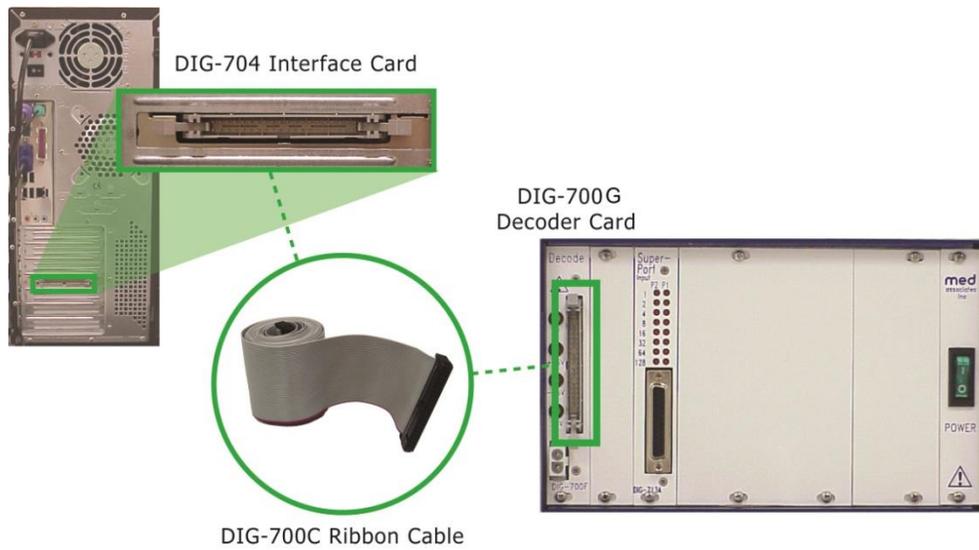
The DIG-704 Interface Card is installed in a PCI or PCIe interface slot on a PC’s backplane (Figure 2.4). Install the DIG-704 drivers from the SOF-MED-DRIVERS installer found on the RotoRat™ software installation media or from the MED Associates website.

Connect the DIG-700G Decoder Card (located in the blue interface cabinet) to the DIG-704 Interface Card (located in the computer) using the DIG-700C Ribbon Cable, as shown in Figure 2.7.

### **DIG-705**

The DIG-705 contains both the interface and decoder components. The DIG-705 card is installed in the blue interface cabinet. Connect the USB type A-B cable to the DIG-705 USB Decoder Card in the interface cabinet and to a USB2.0 or higher port on the computer. Install the DIG-705 drivers from the SOF-MED-DRIVERS installer found on the RotoRat™ software installation media or from the MED Associates website.

Figure 2.7 - Connect the Decoder Card to the Interface Card



Next, connect each RotoRat™ chamber to the ENV-500A Junction Box. Connect Chamber 1 to connector 1, Chamber 2 to connector 2, etc.

Figure 2.8 - Connect Chambers to Junction Box



Connect the ENV-500A Junction Box to the DIG-713A SuperPort Input Card (located in the interface cabinet) using the SG-218-10 Serial Port Cable, as shown in Figure 2.9.

Figure 2.9 - Connect the Junction Box to the SuperPort Input Card

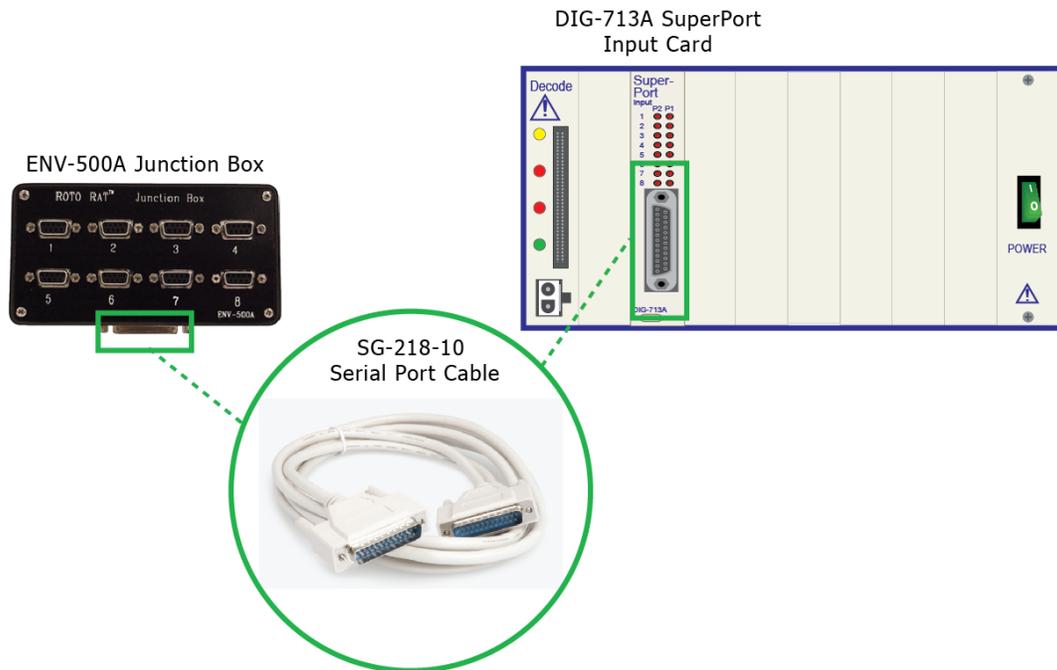


Figure 2.10 - 64-Step Encoder model closeup



Figure 2.11 - 100-Step Encoder model closeup



Figure 2.12 - 100-Step Encoder Cable Assembly

100-step encoder cable assembly  
**ESUB-ENV-500** rev 2.0



## CHAPTER 3 | SOFTWARE

### Installing the RotoRat™ Software

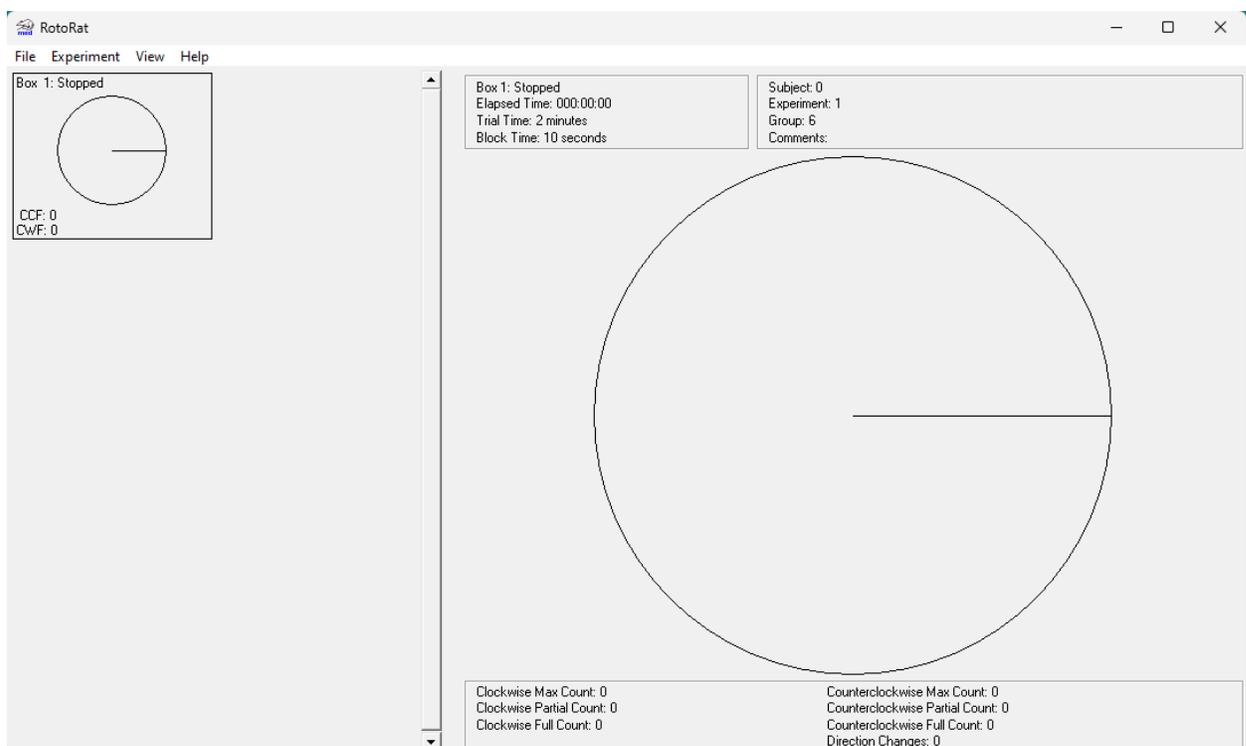
Insert the RotoRat™ CD into the CD-ROM drive or the USB flash drive into a USB port. If the installation program does not automatically start, right-click on the **Start** button and choose “**Explore**” or “**Open Windows Explorer.**” Browse to the CD Rom Drive or USB flash drive and double-click Autorun.exe. Follow the prompts to install the program. Register your software with Med Associates to obtain software password.

### The RotoRat™ Main Window

Double click on the RotoRat™ desktop icon, or open the Windows **Start** menu and select **All Programs | Med Associates | RotoRat.** Select **RotoRat** to start the program.

Upon opening the RotoRat™ software application, the window as shown below will be displayed.

*Figure 3.1 - The RotoRat™ Main Window*



The RotoRat™ menu bar contains four menus. These menus and options are:

Table 3.1 - Main Menu Options Defined

Option	Description
<b>File</b>	Change the Hardware Configuration parameters, import old Hardware/Software configuration files, and Exit the program.
<b>Experiment</b>	Change the Experiment Configuration parameters and Start/Stop Experiments.
<b>View</b>	Select which Box to display in the large graph, select which Boxes to display in the left portion of the Window, and turn on/off the large graph.
<b>Help</b>	Get information about the program version.

## File Menu Options

### Configuration

The Configuration menu option opens the Hardware Configuration window, shown in Figure 3.2.

Figure 3.2 - Hardware Configuration Options

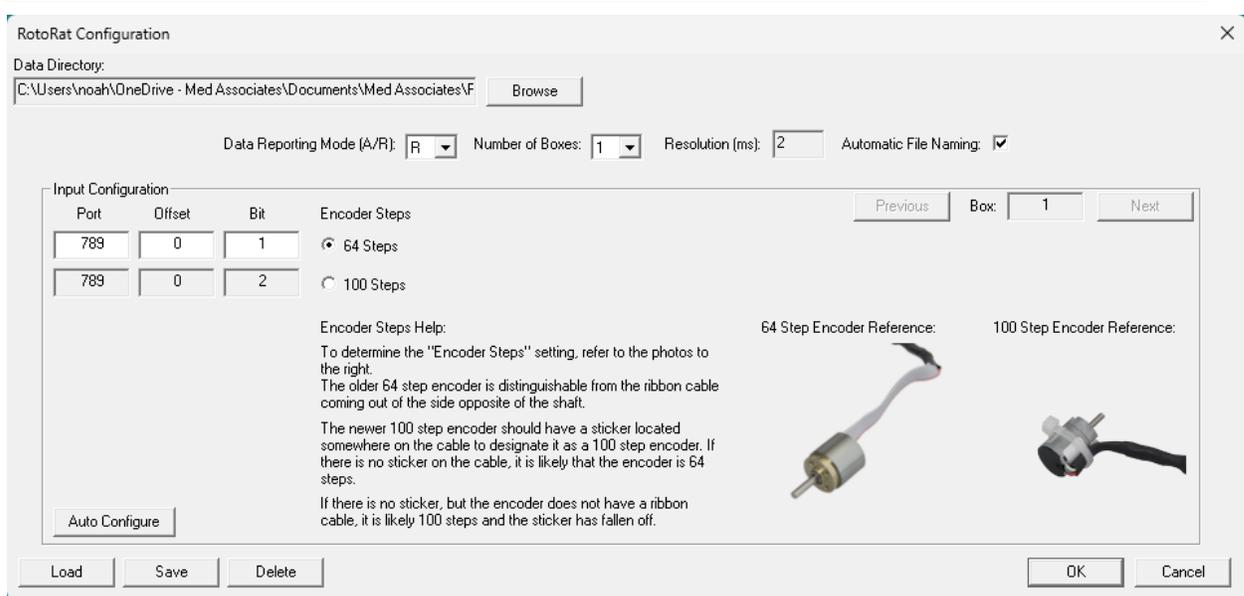
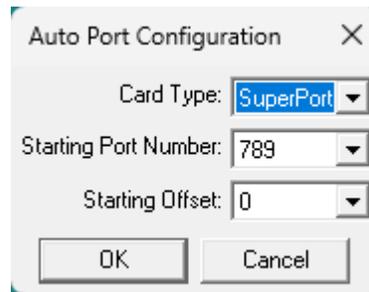


Table 3.2 - Configuration Options Defined

Option	Description
<b>Data Directory</b>	The directory where data files will be saved. Selecting the Browse button and navigating to the desired folder will change the Data Directory.
<b>Data Reporting Mode</b>	Data may be accumulated in either Absolute (A) or Relative (R) modes. In Absolute mode the counters continue to increment in each Time Block with the last Time Block providing a total count for the entire trial time. In Relative mode the counters are reset following each Time Block. Total counts may be obtained by adding the incremental counts in each Block.
<b>Number of Boxes</b>	The number of RotoRat chambers available to run experiments in.
<b>Resolution</b>	Length of time between each measurement. This value is set at 2 ms and cannot be changed.
<b>Automatic File Naming</b>	If selected, then the file name will be automatically generated using the values that are entered in the Subject, Experiment, and Group fields on the Experiment Configuration form. If not selected, then the user may enter the file name in the Experiment Setup Options dialog box.
<b>Box</b>	The chamber for which the Port, Offset, and Bit values is being configured.
<b>Port</b>	The input Port that corresponds to the setting on the interface card. All Superport input cards have the port address of 789.
<b>Offset</b>	The Offset address that corresponds to the setting on the interface cards. Valid values are from 0 – 254 for SuperPort cards. Refer to the Superport manual for information on configuring Superport cards.
<b>Bit</b>	There are two Bit values for each Box that corresponds to the input values on the interface card where the inputs are connected to the control panel. Refer to the Superport manual for bit values. Enter the lower bit value in the top box and the higher bit value in the bottom box.
<b>Encoder Steps</b>	Sets the type of encoder connected to the chamber in the “Box” field. Defaults to a 64-step encoder during auto configuration.
<b>Auto Configure</b>	Opens the Auto Port Configuration window, that allows the user to enter the starting Port and Offset for Box 1. These values are then used to calculate the Port, Offset, and Bit values for the rest of the Boxes. It is recommended that the default values obtained using the Auto Configure button are used.
<b>Previous</b>	Load the Port, Offset, and Bit values for the Previous Box.
<b>Next</b>	Load the Port, Offset, and Bit values for the Next Box.
<b>Load</b>	Load a saved Hardware configuration from the Windows Registry.
<b>Save</b>	Save the current Hardware configuration to the Windows Registry.
<b>Delete</b>	Delete a previously saved Hardware configuration from the Windows Registry.
<b>OK</b>	Save all changes and exit the window.
<b>Cancel</b>	Discard all changes and exit the window.

Figure 3.3 - Auto Port Configuration Options



The Auto Port Configuration window allows the user to enter the starting Port and Offset for Box 1. These values are then used to calculate the Port, Offset, and Bit values for the rest of the Boxes.

**NOTE:** For this to work each Box must be setup in sequential order by Bit, Offset, and then Port. This is the normal setup when using SuperPort cards.

Table 3.3 - Auto Port Configuration Options Defined

Option	Description
<b>Card Type</b>	Select SuperPort if using a SuperPort input card. Select Standard if using a Standard or SmartCtrl card.
<b>Starting Port Number</b>	The Port number of the first Box.
<b>Starting Offset</b>	The Offset address of the first Box.
<b>OK</b>	Calculate the Port, Offset, and Bit values for all Boxes using the entered values.
<b>Cancel</b>	Discard all changes and exit the window.

## Import

The Import command allows the user to import configuration files from DOS versions of the RotoRat™ program. Because the DOS version saved the hardware and experiment configuration information into the same file, the Import command has two menu items:

### Old Configuration

Imports just the hardware configuration from the DOS configuration files.

### Old Experiment

Imports just the experiment configuration from the DOS configuration files.

## Exit

The Exit command closes the program.

## Experiment Menu Options

### Start Experiment

The Start Experiment command opens the Experiment Setup Options window for Box 1. This window allows the user to select the Trial Time, Block Time, etc. for each Box. A different experiment may be run in each box.

Figure 3.4 - Experiment Setup Options

Table 3.4 - Experiment Setup Options Defined

Option	Description
<b>File Name</b>	The file name that will be used to save the data. The file will be saved in the Data Directory that was selected on the Hardware Configuration window. If the Automatic File Naming option was selected, then this field will be filled in automatically using values from the Subject, Experiment, and Group fields listed below. If this option was not selected, then the user may enter in any valid file name.
<b>Subject</b>	Can be up to 25 characters in length and may also be used to help create the File Name above.
<b>Experiment</b>	Can be up to 30 characters in length and may also be used to help create the File Name above.
<b>Group</b>	Can be up to 25 characters in length and may also be used to help create the File Name above.
<b>Comments</b>	Used to help describe the Experiment that is being run. Because this field can be very large it is not saved to the Windows Registry with the rest of the fields. The comments appear in the data file.
<b>Trial Time (min)</b>	The experiment duration in minutes. Note: Data is not saved to the disk until the end of the Trial Time. This means that excessively long trial times may be impractical. At the end of the trial time the data is automatically saved to the specified output file. If more than one Box uses the same File Name, then the data will be appended to the existing file when the trial is completed.

Option	Description												
<b>Block Time (sec)</b>	The time in seconds that RotoRat will continue to increment the data counters before saving them in memory. Each Block produces a single line in the data file. At the end of each Block the data counters are reset to zero if the Relative (R) data option has been selected (See Data Reporting Mode).												
<b>Counts/Rev</b>	<p>In addition to providing a count of complete (<b>Full</b>) revolutions of 360 degrees (without changing direction) and a count representing the smallest degree of movement interpreted by the optical encoder (<b>Max</b>), RotoRat provides a user selectable count which may be set from 2 counts per revolution (one count for a 180 degree rotation) to 4 counts per revolution (one count for a 90 degree rotation). Use the following table to determine the best “sensitivity.” The value of the counter controlled by this setting appears in the data file under the “<b>Partial</b>” heading.</p> <table border="1" data-bbox="532 701 1338 877"> <thead> <tr> <th data-bbox="532 701 797 743">Counts/Revolution</th> <th data-bbox="797 701 1105 743">Degrees Rotation/Count</th> <th data-bbox="1105 701 1338 743">Data File</th> </tr> </thead> <tbody> <tr> <td data-bbox="532 743 797 785">1</td> <td data-bbox="797 743 1105 785">360</td> <td data-bbox="1105 743 1338 785">Full</td> </tr> <tr> <td data-bbox="532 785 797 827">2</td> <td data-bbox="797 785 1105 827">180</td> <td data-bbox="1105 785 1338 827">Partial</td> </tr> <tr> <td data-bbox="532 827 797 877">4</td> <td data-bbox="797 827 1105 877">90</td> <td data-bbox="1105 827 1338 877">Partial</td> </tr> </tbody> </table>	Counts/Revolution	Degrees Rotation/Count	Data File	1	360	Full	2	180	Partial	4	90	Partial
Counts/Revolution	Degrees Rotation/Count	Data File											
1	360	Full											
2	180	Partial											
4	90	Partial											
<b>Retrace</b>	Determines the sensitivity of the system to direction changes. A setting of 1 is the most sensitive, requiring only a single encoder step to register a change. This can happen from random head movements while the animal is rotating and may result in zero full rotations. Any number from 1 to 16 may be entered with each increment adding an additional 5.625 degrees with a 64-step encoder or 3.6 degrees with a 100-step encoder. A setting of 8 requires 8 encoder steps of movement in the opposite direction before a direction change is registered. 8 encoder steps with a 64-step encoder is 45° and 28.8° with a 100-step encoder. Until a direction change is recognized the “zero” reference point for Partial and Full rotations remains fixed. Once a direction change is recognized the “zero” reference point becomes the point at which the direction change began.												
<b>Set All Boxes Like This</b>	Copies all values, except for the Subject value, to the other Boxes.												
<b>Previous</b>	Displays the values from the Previous Box in the sequence.												
<b>Next</b>	Displays the values of the Next Box in the sequence.												
<b>Load</b>	Load a saved Experiment configuration from the Windows Registry.												
<b>Save</b>	Save the current Experiment configuration to the Windows Registry.												
<b>Delete</b>	Delete a previously saved Experiment configuration from the Windows Registry.												
<b>OK</b>	Save all changes and open the Start Boxes window.												
<b>Cancel</b>	Discard all changes and exit the window.												

**Start Boxes**

Allows the User to select which Boxes to start.

**Stop Boxes**

Allows the User to select which Boxes to stop (i.e. End the experiment prematurely).

**View Menu Options****Graph**

Turns on or off the large graph. If the large graph has been turned off, then all of the smaller graphs will be visible at one time.

**Select**

Allows the user to select which Box to display in the large graph. This can also be accomplished by using the shortcut keys or by clicking on the desired Box with the mouse while the large graph is displayed.

**Boxes**

Allows the user to select which set of Boxes (1-8, 9-16, or 17-24) to display while the large graph is also being displayed. This can also be accomplished by moving the scroll bar.

**Help Menu Options****About**

Displays the About RotoRat™ window with information regarding the software version and copyright information.

*Figure 3.5 - About RotoRat™ Window*



## CHAPTER 4 | RUNNING EXPERIMENTS

### Hardware Configuration

Open the software by double-clicking on the RotoRat™ icon on the desktop. Begin by selecting **File | Configuration**. The screen shown in Figure 3.2 will appear. Refer to **Error! Reference source not found.3.2** for definitions of each of the Configuration Menu parameters.

Select the data directory, data reporting mode, number of boxes (or chambers) in the system, resolution and whether Automatic File Naming should be used. These configuration parameters apply to the entire system.

---

**Note: The settings entered in the Input Configuration section of the screen are unique to each box. These settings can be entered automatically by selecting Auto Configure. The menu shown in Figure 3.3 will appear. The options on the Auto Port Configuration screen are defined in Error! Reference source not found.3.3.**

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Select the Input Card Type, Starting Port Number and Starting Offset. Once the Input Card Type is selected, the default values for the Starting Port Number and Starting Offset will automatically appear. These values are acceptable for all standard RotoRat™ systems. Click **OK** and the Input Configuration information for each box will appear on the Configuration Screen.

Once all the necessary information has been entered into the Configuration screen, there are several options. This configuration can be saved for later use by clicking **Save**. The RotoRat™ software allows the user to save multiple configurations. Select **Load** to open a previously saved configuration. Click **OK** to save all changes and exit this screen or click **Exit** to discard all changes and exit this screen. Selecting **Delete** allows the user to remove any previously saved configurations.

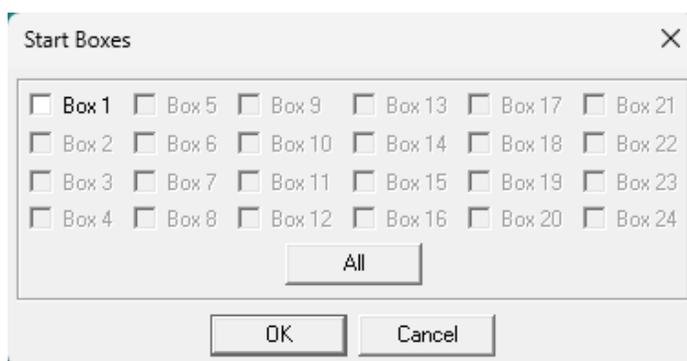
### Experiment Configuration

Select **Experiment | Start Experiment** to define the experiment parameters. The screen shown in Figure 3.4 will appear. Notice that the number of the box being configured, in this case Box 1, appears at the top of the screen. Refer to Table 3.4 for definitions of each of the experiment parameters. These parameters can be different for each box, or they can all be the same. If all the boxes should have the same parameters it is only necessary to enter them once, then select **Set All Boxes Like This**.

If Automatic File Naming was selected on the Configuration screen, a file name will already appear on the Start Experiment screen. If not, enter the desired File Name, and then enter the Subject, Experiment and Group, as well as any desired Comments. Next enter the desired Trial Time, Block Time, Counts/Rev and Retrace values.

Click **Next** to advance to the next Box screen, or **Previous** to go back. Once the experiment parameters have been entered for each box, there are several options. As with the Hardware Configuration, the RotoRat™ software allows the user to save multiple Experiment Configurations. Click **Save** to save this experiment or click **Load** to load a previously saved experiment. Selecting **Delete** allows the user to remove any unwanted experiments. Click **OK** to save all changes and open the Start Boxes screen or click **Exit** to discard all changes and exit this screen.

Figure 4.1 - Start Boxes Screen



The Start Boxes screen allows the user to select which boxes to run. Select individual boxes or select **All** to start all of the boxes in the system. Clicking **OK** will begin the experiment; clicking **Cancel** will close the Start Boxes screen.

**NOTE: Do not start the boxes until the animals are loaded. Refer to the “Loading an Animal” section of this manual.**

### Loading an Animal

The animals should be loaded into the chambers prior to starting the boxes. Begin by removing the swivel from the chamber by loosening the upper set screw, shown in Figure 0.12. Next, select the appropriate rodent harness from **Error! Reference source not found.4.1**. Place the harness on the animal and attach the harness to the Velcro at the end of the swivel. Secure the harness by looping a length of the included string through the hooks on the harness, as shown in Figure 4.2. Place the animal in the chamber and reattach the swivel to the chamber. The boxes may now be started.

Table 4.1 - Rodent Harness Sizes and Part Numbers

Animal Weight (grams)	Rodent Harness Part Number
100 – 150	ENV-500JXS
150 – 250	ENV-500JS
250 – 350	ENV-500JM
300 – 500	ENV-500J

Figure 4.2 - Rodent Harness Side and RearView



### Adjusting the Swivel Spring Length

It may be necessary to adjust the length of the swivel spring. Too much slack in the swivel spring may result in erroneous data. Adjust the length of the spring by loosening the lower setscrew (Figure 0.12) and removing the spring from the coupler. Trim the spring to the desired length and install back into the coupler, being sure to tighten the setscrew adequately.

*Figure 4.3 - Swivel Spring with Too Much Slack*

---



*Figure 4.4 - Properly Adjusted Swivel Spring*

---



### Starting the Boxes

Once the boxes are started, the screen shown in

will appear. All of the boxes that are running will appear down the left side of the screen. The rotational movement will be displayed in real time. Refer to View Menu Options for detailed information regarding different ways of viewing the boxes. At the end of the Trial, the boxes will automatically be stopped.

## CHAPTER 5 | DATA FILES

### Definition of Rotation

The optical encoder used in RotoRat™ divides a 360-degree circle into either 64 equal segments of 5.625 degrees each with a 64-step encoder, or 100 equal segments of 3.6 degrees each with a 100-step encoder. Movement is defined from wherever the encoder is positioned when a Box is “Started.” The direction of movement is sensed when a rotation of 5.625 (or 3.6) degrees occurs, and the “Max” counter is incremented for clockwise or counterclockwise movement as appropriate. If rotation continues in the same direction, the same “Max” counter will continue to increment every 5.625 (or 3.6) degrees, the corresponding “Partial” counter will increment at its set sensitivity (Counts/Revolution), and the “Full” counter will increment every 360 degrees. As soon as the direction is reversed, a new starting point is established, the “Change Direction” counter is incremented, and the “Max,” “Partial,” and “Full” counters corresponding to the new direction.

In the Relative mode, all data counters are zeroed at the end of each Time Block, however, internal counters are not. This means an animal could rotate 350 degrees when a time slice ends and the “Max,” “Partial,” and “Full” counters would be set to zero. In the new time slice an additional rotation in the same direction of 10 degrees would increment 1 on the “Max” counter and would also be sufficient to complete a revolution for the “Full” counter to increment to 1, however, the “Max” counter would have to reach 65 (or 101) before the “Full” counter could reach 2.

### Relative Data File

```
Start Date: 05/17/2004
End Date: 05/17/2004
Start Time: 14:52:17
End Time: 15:02:17
Subject: LEO1
Experiment: AM10
Group: EXP
Comment: Relative Data File
Box #: 1
Enc Steps: 64
Block Time: 120 Seconds
Counts/Rev: 4 (or) 90.00 Degrees/Count
Retrace: 8
Data Mode: Relative
```

Time	CW			CC			Change
Block	Max	Partial	Full	Max	Partial	Full	
120	213	8	0	96	2	0	19
120	177	6	0	96	2	0	15
120	221	11	2	58	2	0	6
120	322	19	4	103	4	1	5
120	129	6	1	20	1	0	5

**Absolute Data File**

Taking the identical input that created the previous data file, except for changing the comment and running RotoRat™ in the Absolute mode, produces the following data file:

```

Start Date: 05/17/2004
End Date:   05/17/2004
Start Time: 14:52:17
End Time:   15:02:17
Subject:    LEO1
Experiment: AM10
Group:      EXP
Comment:    Absolute Data File
Box #:      1
Enc Steps:  64
Block Time: 120 Seconds
Counts/Rev: 4 (or) 90.00 Degrees/Count
Retrace:    8
Data Mode:  Absolute

```

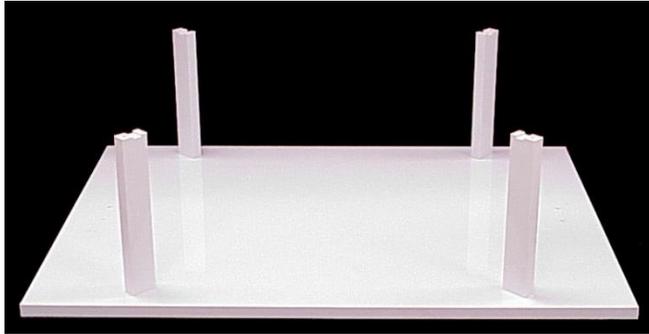
Time	CW			CC			
Block	Max	Partial	Full	Max	Partial	Full	Change
120	213	8	0	96	2	0	19
240	390	14	0	192	4	0	34
360	611	25	2	250	6	0	40
480	933	44	6	353	10	1	45
600	1092	50	7	373	11	1	50

## APPENDIX A | CHAMBER ASSEMBLY

1. Attach the enclosure braces to the base using the predrilled holes and eight of the included 6-32 x ½" screws, as shown in Figure 0.1.

*Figure 0.1 - Base with Enclosure Braces Installed*

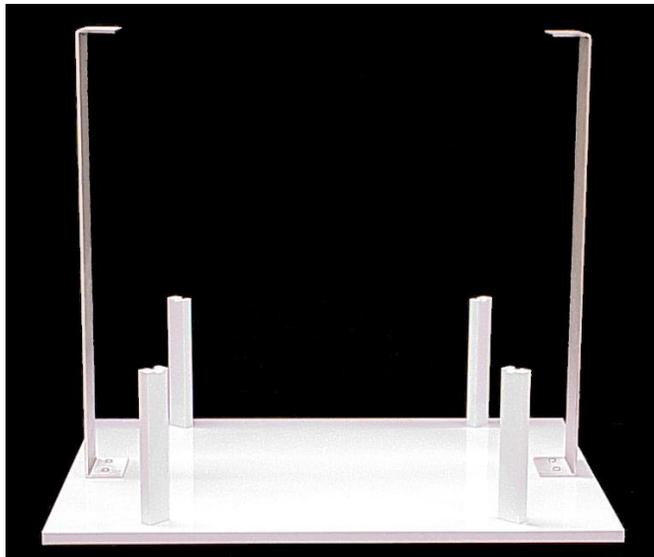
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2. Attach the supports to the base using the predrilled holes and the included #8 x ½" screws, as shown in Figure 0.2.

*Figure 0.2 - Attach Supports to Base*

---



- Place the enclosure (metal bowl) on the enclosure braces and fix in place using the included brackets, the remaining four 6-32 x ½" screws and the four #6 nylon flat washers. The washers go between the bracket and the brace.

*Figure 0.3 - Install Brackets to Secure Enclosure*

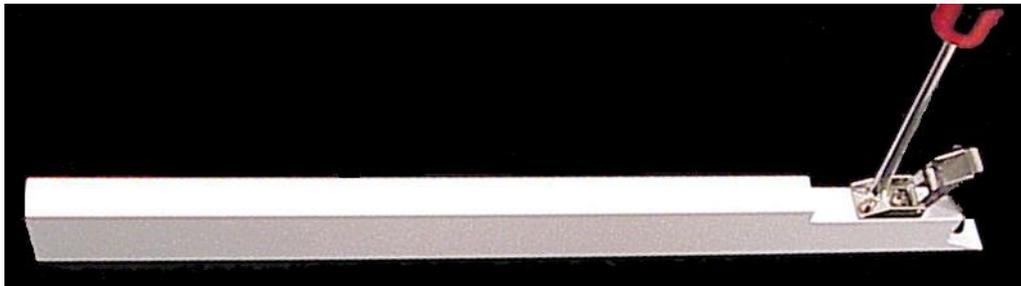
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- Attach the latches to the three shield supports using the six 4-40 x ¼" screws, as shown in Figure 0.4.

*Figure 0.4 - Attach Latches to Shield Supports*

---



- Attach two shield supports to the shield using the predrilled holes and eight of the included 6-32 x 3/8" screws, as shown in Figure 0.5. Be sure that the latches are oriented on the same end of the shield.

*Figure 0.5 - Attach Shield Supports*

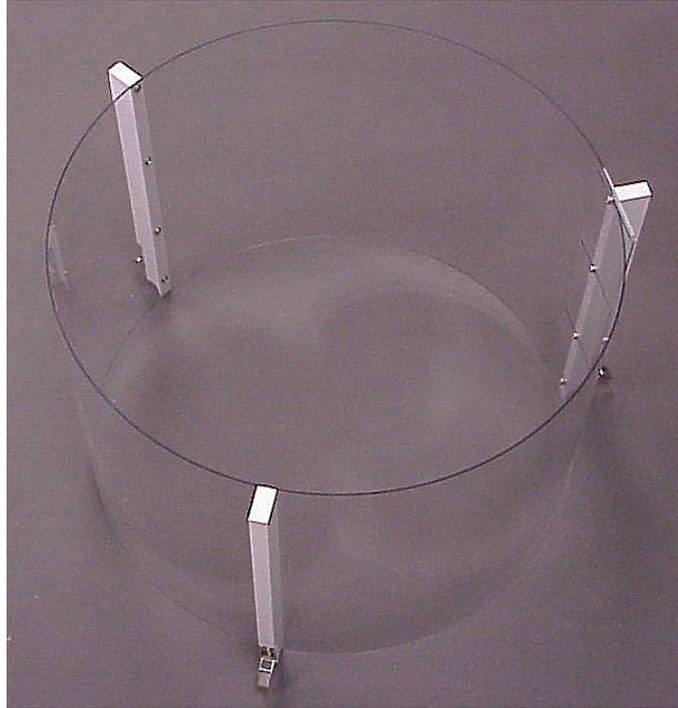
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- Using the remaining shield support, form the shield into a cylinder and close using four of the 6-32 x 3/8" screws. Do not tighten the screws down, as the size of the cylinder may need to be adjusted once it is mounted on the enclosure.

*Figure 0.6 - Complete the Shield Assembly*

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- Place the shield over the enclosure and latch in place, as shown in Figure 0.7.

*Figure 0.7 - Latch Shield in Place*

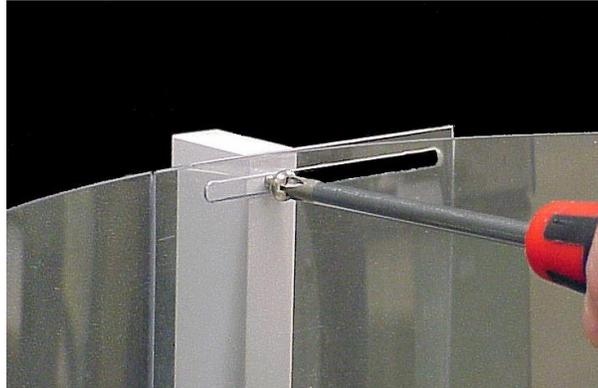
---



- Adjust the size of the shield and tighten the screws to keep in place, as shown in Figure 0.8.

*Figure 0.8 - Tighten Shield Adjustment Screws*

---



- Mount the encoder on the crossbar using the two #2 lock washers and the two 2-56 x 1/4" screws, as shown in Figure 0.9.

*Figure 0.9 - Mount Encoder*

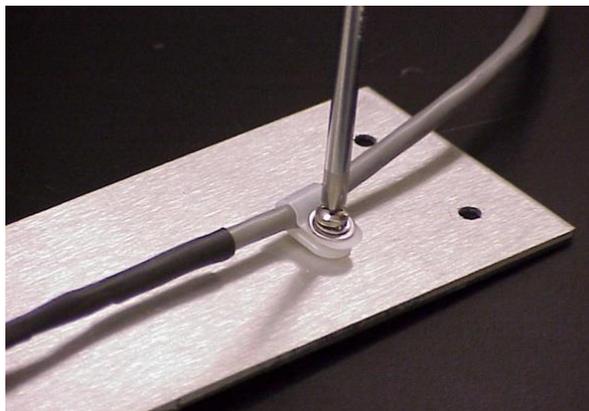
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- Secure the encoder cable with included cable clamp. Place the cable clamp around the encoder cable and fix it in place in the predrilled hole using the 6-32 x 3/8" screw through the #6 lock washer and the #6 flat washer.

*Figure 0.10 - Secure Encoder Cable*

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11. Secure the crossbar to the supports using the four 8-32 x 5/16" screws through #8 lock washers, as shown in Figure 0.11.

*Figure 0.11 - Install Crossbar*

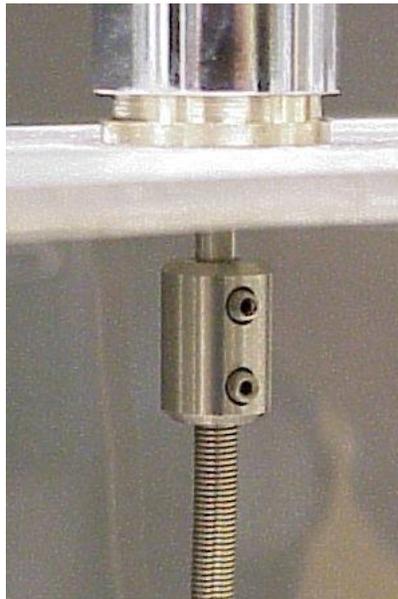
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12. Attach the swivel coupler to the encoder and tighten the top setscrew using the included hex key, as shown in Figure 0.12.

*Figure 0.12 - Attach Swivel Coupler to Encoder*

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13. The chamber is now completely assembled and should appear as shown in Figure 1.1.

## **APPENDIX B | CONTACT INFORMATION**

Please contact Med Associates, Inc. for information regarding any of our products.

For Technical questions, email [support@med-associates.com](mailto:support@med-associates.com).

For Sales questions, email [sales@med-associates.com](mailto:sales@med-associates.com).

Visit our website at [www.med-associates.com](http://www.med-associates.com).