CompuTrainer® by RacerMate

Bicycle Training Technology for World Class Performance

Basic Hardware and Electronics

Stand-Alone Users Guide

May 2014

READ THIS MANUAL FIRST
along with the INSERT ME FIRST! CD.

Basic Hardware and Electronics

Stand-Alone Users Guide

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Congratulations!

Welcome! Thank you for the purchase of the *RacerMate CompuTrainer* - what many claim to be the best investment they've ever made in the sport of cycling.

CompuTrainer is a high performance indoor ergometer and trainer. With proper use and care it will give you many years of performance pleasure. Using RacerMate One or any other software designed by or supported by Racermate, CompuTrainer will provide limitless capability to fashion your workouts according to your individual needs. Furthermore, the performance and motivational qualities of your new CompuTrainer will move you to a level of fitness that can only be obtained in the controlled conditions available indoors, while also knowing the workouts are using the correct load curves equal to an outdoor ride.

Please read through this, and other accompanying documentation thoroughly to take full advantage of the capabilities your CompuTrainer provides. Certain items in the manual are constantly overlooked and cause the majority of service calls. You will find a  (hand) indicating these potential areas of concern.

To access any software updates, go to: *www.racermateinc.com/#software* -softwaresupport
You are also invited to join the RaceMate Forum, which is also a great resource for information on troubleshooting your CompuTrainer, communicating with other users, and contacting technical support.

Thank you for purchasing the CompuTrainer and please keep this manual in a safe place for quick reference!

Before Proceeding...

Included with CompuTrainer is an **Insert Me First!** CD-ROM. If you haven't done so yet, please insert that disc into your computer prior to proceeding on with the hardware setup portion of this software manual.

Thank you!

IMPORTANT PRECAUTIONS

! WARNING: To reduce the risk of burns, fire, electric shock, or injury to persons, read the following important precautions and information before operating your CompuTrainer.

1. **Please ensure that all CompuTrainer users are adequately informed of all warnings and precautions and use the CompuTrainer only as described in this manual.**
2. **Use of chemical and some household cleaners can damage the hard anodizing of the trainer roller. Be sure to cover the Load Generator and clean the tires with only Isopropyl Alcohol when cleaning is needed. Stand should only be cleaned of sweat with mild soap and water.**
3. **Place the CompuTrainer on a level surface, and to protect the floor or carpet from sweat damage, use a platform built according to the supplied instructions.**
4. **Keep the CompuTrainer indoors, away from moisture and dust. Avoid damp areas, or areas with the potential for water to pool.**
5. **Keep young children and pets away from the CompuTrainer while in use.**
6. **Shock Hazard! DO NOT open the case of any component or attempt any repair or modification yourself without instructions to do so specified by the manufacturer.**
7. **When connecting the power cord, plug the power cord into a surge suppressor (not included) and plug the surge suppressor into a grounded circuit capable of carrying 15 or more amps. Avoid extension cords.**
8. **Keep the power cord and the surge suppressor away from heated surfaces.**
9. **Unplug the power cord before connecting or disconnecting any cables. Failure to do so could cause a short circuit. The power supply is fuse protected, and is only serviceable at the factory.**
10. **Always plug and unplug cables by gripping the connector and not the cord. Route the cords in such a way as to avoid moving parts of the bicycle, such as derailleurs and crank arms.**
11. **Align Cable Ends Visually First. The alignment notches must be aligned before inserting cables. Visually locate the notch and align it to the indent on the cable or jack. Failure to do so will result in a short circuit causing the fuse in the power supply to blow.**
12. **Any supplied heart rate sensor is not a medical device. Various factors, including the users movement or cadence, may affect the accuracy of heart rate readings. Any supplied heart rate sensor is intended only as an exercise aid in determining heart rate trends in general.**
13. **Electrical Interference while using some wireless heart rate monitors with CompuTrainer may result.**
14. **Static Electricity from some bike tires and clothing may affect the operation of either the Handlebar Controller or the external PC-based CompuTrainer software. Static in general is worst in cold, dry climates. If you suspect a static problem, contact technical support.**
15. **Use the correct replacement parts supplied by RacerMate. Use of any outside engineered product may void your warranty. All replaceable items are available on-line at www.computrainer.com**
16. **Never insert or drop any object into any opening of any part of your CompuTrainer.**
17. **Back up all software before installing any new software onto your PC, as it is always advisable to backup important files before installing new software.**
18. **Occasionally, you may want to upgrade your CompuTrainer system when a new version arrives. In these cases you may be asked to open some part of your CompuTrainer. This will not void the warranty if you follow the instructions supplied with the upgrade.**

Caution: *Consult your doctor before beginning any exercise program*

Riding Indoors vs. Riding Outdoors

CompuTrainer is a high performance, microprocessor controlled, indoor trainer designed for use with your bike and a Personal Computer. Though developed in 1988, it is still the only trainer technology providing physics formulas that rival an outdoor ride. Though not intended as a total replacement for training outdoors, it has the motivational qualities necessary to propel you to your desired goals in the shortest amount of time possible, without the distractions associated with riding on the road.

It has been said, "An hour on a CompuTrainer is worth two on the road". You will soon see why.

Basic Trainer Functions

Stand Alone Mode Operation

(The CompuTrainer Hardware and Electronics without any External PC-based software connected.)

The CompuTrainer consists of:

1) an ultra-stable, rear-axle mount **Trainer Stand** to support the bike,
2) a proprietary **Load Generator** driven by the rear bicycle tire,
3) a **Handlebar Controller processor** with sophisticated physics controls for the **Load Generator** calculations, and heart rate and SpinScan calculation functions.
4) a **Cadence Sensor** (magnetic or optical) to operate Cadence (RPM) and trigger SpinScan.
5) a heart rate sensor (optional)

By monitoring your speed, together with the load settings within the various programs, the **Load Generator** will create the appropriate resistance to follow precision load curves. In the **Stand-Alone Mode** all changes to the Load Generator are controlled solely from the **Handlebar Controller.**

External, PC-based CompuTrainer Software Operation

(CompuTrainer Basic Hardware interfaced with a Personal Computer and CompuTrainer Software)

External PC-based Software consists of:

1) RacerMate One, Real Course Video, or MultiRider **software** for a Windows PC. Actual system requirements vary depending on the CompuTrainer version you run, so see the System requirements page (supplied) for more information
2) a **USB-to-Stereo adapter** plugs into an USB port
3) a **Stereo Cable** which connects the CompuTrainer to the USB-to-Stereo adapter.

While racing using the PC-based software, the **Handlebar Controller** will only display the word ***Pro*** along with Heart Rate and RPM. All control while using External software is coming from the Personal Computer, but the Controller, though seemingly mute, is running all of the physics control internally.

Our goal at RacerMate is to develop CompuTrainer and CompuTrainer software to suit the demanding needs of CompuTrainer users; therefore, your comments or suggestions are always welcome.

Please be sure to fill out and mail your Warranty Registration Card to stay informed of all of the new and exciting features your new CompuTrainer will incorporate in the years to come.

What's in the box?

Before you begin, please check the contents of your boxes against the list found below. If anything is missing, please contact the RacerMate sales department at 800-522-3610.

Parts List - Basic CompuTrainer

Misc. Hardware (supplied)

1 - M8 x 1.25 x 20mm Allen Screw
1 - Large Washer
1 - 6mm Allen Wrench
2 - 4mm Phillips Pan Screws
3 - feet Velcro Cable Wrap
1 - Literature Package

Tools Needed

Small Phillips Screw Driver
Knife or Scissors to cut Velcro

Optional Items (not shown or supplied)

- **Continental Hometrainer Tire**
- **Travel Case**
- **Handlebar Controller Stand**
- **Aerobar Controller Mount**
- **Polar™ Wireless Heart Rate system**
- **Optional Software** ***(i.e. Real Course Videos)***

Quick Setup Guide - *(detailed instructions found by referring to page number and step shown)*

Step 1 -- Place the Insert Me First! disc into your computer and view the *Setup Guide* to familiarize yourself with the parts supplied with your CompuTrainer (see preceding page) and to guide with setup.

Step 2 -- (Page 10, step 1) Attach the Load Generator using the 6 mm Allen wrench, Allen bolt, and large washer. Place the large washer over the 6 mm bolt and place the Load Generator onto the stand hinge and thread the bolt upwards, through the hinge, into the Load Generator - cables facing forward. Slide the Load Generator forward in the hinge slot and tighten the bolt snug. Do NOT overtighten.

Step 3 -- (Page 11, step 2) Replace the quick-release on your bike. Most factory quick-releases do not work well on indoor trainers, so use the quick-release supplied to assure a stable ride.

Step 4 -- (Page 11, step 3 - though refer to the image on page 10 for descriptions) Loosen the Adjusting Knobs until the quick-release fits between the Take-ups. Tighten the Adjusting Knobs until the bike is lightly held in place. Rotate both Adjusting Knobs one direction or the other to center the tire over the Load Generator Friction Roller. Once centered, tighten each Adjusting Knob ONE ADDITIONAL TURN to firmly hold the bike. You DO NOT need to overtighten the Adjusting Knobs. Doing so only forces the Stand outward, but will not hold the bike any better. When satisfied the bike is secure, tighten the Lock Knobs firmly.

Step 5 -- (Page 11, step 4) Set the preliminary Press On Force. Before doing so, first clean and fully inflate the bike tire. Now raise the Load Generator using the Rear Adjusting Knob until tire slip on the roller is at a minimum.

Step 6 -- (Page 12, step 5) Attach the Handlebar Bracket to the Handlebar Controller using a phillips screwdriver and the two 4MM screws. Afterwards, attach the Handlebar Controller to the handlebars of the bike.

Step 7-- (Page 12, step 6) Attach the DIN Cable by aligning the cables and connectors and plugging each end into the Load Generator and the Handlebar Controller.

Step 8 -- (Page 13, step 7) Connect the Power Supply by aligning the cable end and inserting it into the Load Generator. DO NOT plug the Power Supply into AC power until all power cable connections have been completed. When all cables are inserted, along with the Power Supply cable, you can then plug the power cord into a wall outlet or the recommended surge suppressor.

Step 9 -- (Page 13, step 8) Attach your Cadence Assembly to the left chain stay or place the Puck optical sensor sensor on floor under right pedal. Please refer to the instructions provided with each type of sensor for full details on adjusting. Plug the cable from either type into the Handlebar Controller 'RPM Jack'. Use the supplied Velcro Wrap to fasten any cable attached to the bike.

Step 10 -- (Page 13, step 9) Attach the Polar® Heart Rate Adapter and cable (if purchased) into the Handlebar Controller 'Pulse Jack' Have its label end pointing up towards your Polar-compatible chest strap.

Step 11 -- Now actuate the power switch on the Load Generator into the ON position (the red light next to the switch should now be on).

Step 12 -- (Page 14-15) Calibrate your CompuTrainer.

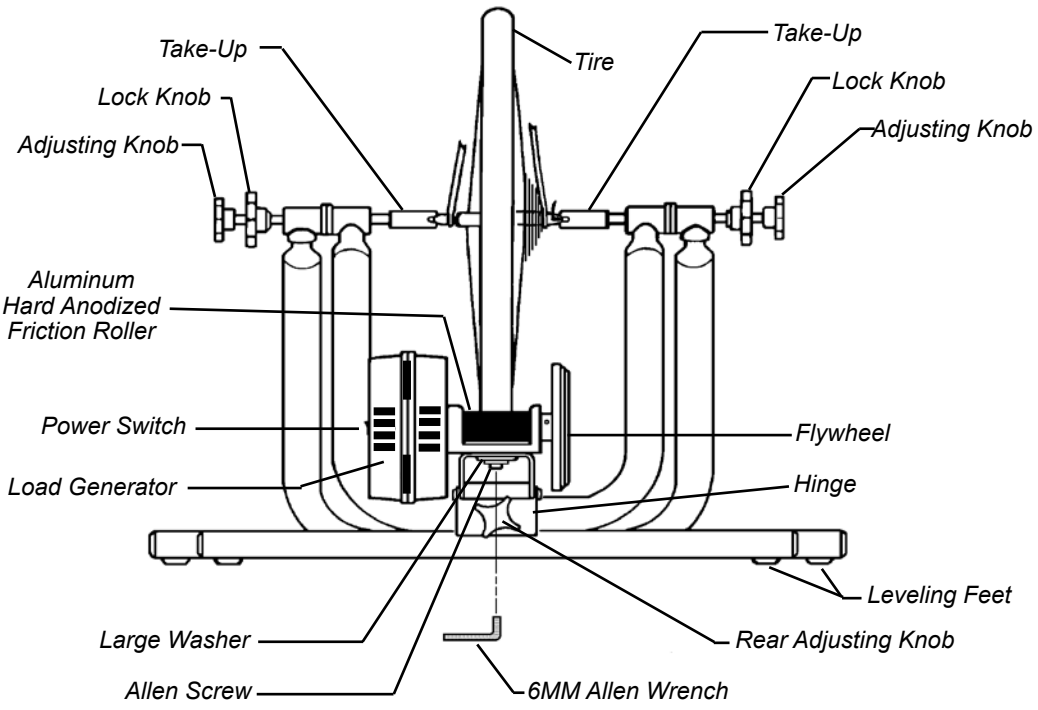
Step 13 -- You are now ready to use your CompuTrainer in Stand-Alone Mode or in PC Mode. Until you install PC software and connect the trainer to the computer, you are in 'Stand-Alone Mode.'

Step 1.....Assemble Trainer Stand *(refer to the Insert Me First! disc for added details)*

Tools Required:
6mm Allen Wrench (supplied)
Phillips Screwdriver
Scissors or a sharp knife

Using the illustration below attach the Load Generator to the Training Stand 'Hinge' by placing the Large Washer onto the M8 Allen Screw and threading it upwards into the Load Generator. Tighten using the 6MM Allen Wrench provided. The hinge slot is elongated, but slide the Load Generator into the forward position (closer to the stand) to give you greater precision of adjustment. For 650c wheels the outermost position will increase the range upwards when turning the Rear Adjusting Knob, allowing the roller to reach the smaller size wheel.

Smaller or larger Stands are available on a custom build basis to accommodate 20", 24", and perhaps 29" fat tires.



Trainer Stand
(Rear View)

The Trainer Stand comes with all Leveling Feet installed. If the Trainer Stand is to be screwed permanently to a platform *(using plans provided)*, remove the Leveling Feet and cosmetic stickers (located on the holes in the upper side of the cross members). Use countersunk screws 1¾ long to fasten Trainer Stand to the platform *(not provided)*.

Step 2.....Replacing Your Quick-Release

Locate the replacement Quick-Release *(provided)*. Remove the quick-release from your bike and replace it with the one provided with CompuTrainer. The replacement is designed to fit tightly into training stands and will provide superior support while riding out of the saddle on your CompuTrainer.

If you are uncertain on how to replace a quick-release, please have a local bike shop do this for you. Failure to correctly tighten or align your quick-release can cause injury or damage to your bicycle.

Step 3.....Mounting Your Bike to the CompuTrainer Stand

Loosen the Adjusting Knobs until the Quick-Release fits between the Take-ups. Tighten the Adjusting Knobs until the bike is lightly held in place. Rotate both Adjusting Knobs one direction or the other to center the tire over the Load Generator Friction Roller. Once centered, tighten each Adjusting Knob ONE ADDITIONAL TURN to firmly hold the bike. You DO NOT need to overtighten the Adjusting Knobs. Doing so only forces the Stand outward, but will not hold the bike any better. When satisfied the bike is secure, tighten the Lock Knobs firmly.

Step 4.....Set Press-On Force

Press-On Force determines the rolling drag between the tire and the friction roller of the Load Generator. Lack of adequate *Press-On Force* may cause tire slip and too much may make loads seem difficult and unrealistic. Press-On Force will set the lightest load you will feel. If set too much, the bike will always feel as though you are climbing a hill, when in fact you may be descending. If you set too little you may have tire slip, which is work (wattage) unaccounted for.

For accuracy, rolling drag is used in load calculations. See Rolling Resistance Calibration (page 14).

Set Press-On Force using the Rear Adjusting Knob. Increase or decrease Press-On Force until (while holding the Flywheel with one hand to keep the Friction Roller stationary and using the other hand to pull the rim and tire across the friction roller) the tire no longer slips when reasonably strong force is applied.

Check to insure the tire is running true on the friction roller by rotating the tire, by hand, forwards and then backwards while watching what the tire does. It should stay in the same spot on the friction roller in both directions. If the tire moves left and right across the roller when it is rotated forth and back, the Load Generator Assembly is slightly rotated on the Hinge. Slightly loosen the Allen Screw and straighten the Load Generator assembly until the tire tracks perfectly.

Tips to prepare for and properly adjust Press-On Force:

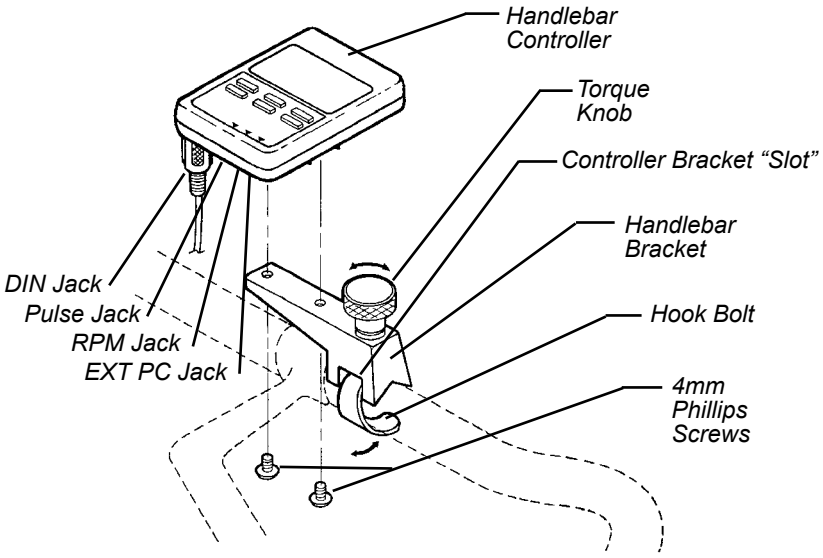
1) You should clean the tire *daily* with Isopropyl Alcohol *(available at any drug store)*. This will remove any dirt, mold release *(a compound used to allow easy removal of tire from the mold during its manufacturing process)*, or road oils. *You should clean the tire before every training session and especially after riding outdoors.*

2) Daily check and inflate your tire to its maximum rated tire pressure.

3) Use a tire with the least amount of visible tread for the most 'tire to friction roller' contact. Smooth tires are preferable. A Continental™ Hometrainer tire is a perfect tire.

4) Set the Press-On according to the anticipated maximum workload. More press-on for hill climbing and less for time-trial (flat) courses. For advice on optimal Press-On Force, please refer to the Technical Appendix found at the rear of this manual.

Step 5.....Attach the Handlebar Controller



Using a phillips screwdriver, fasten the **Handlebar Controller** to the **Handlebar Bracket** with the two 4MM screws provided.

Loosen the **Torque Knob to** allow the **Hook Bolt** to pivot into the **Controller Bracket Slot.** Place Handlebar Bracket over handlebar and loosen Torque Knob until the Hook Bolt slips under the handlebar. Position the **Handlebar Controller** for the best visibility and tighten the **Torque Knob**.

A remote Handlebar Controller Stand and aerobar adapters are available optionally by ordering them online at: www.racermateinc.com

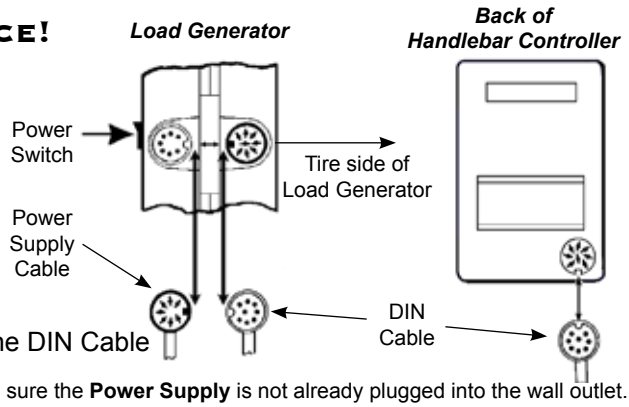
- There are 4 connections on the rear of the Handlebar Controller and access to all four must be maintained. The DIN Cable must have straight/direct access into its jack.
- The Handlebar Controller is sweat resistant, but not sweat proof. To protect the unit from sweat mount it outside the sweat zone or cover it whenever possible. Clear plastic kitchen wrap can be used to provide a clear, protective cover, which can also be quickly replaced when needed.

Step 6.....Connect DIN Cable Between Load Generator and Handlebar Controller

CABLE CONNECTIONS NOTICE!

Please note the position of the alignment notches and/ or arrows affixed to the label between the connectors. Improperly inserting any cable may cause a short circuit and lead to a system failure!

Disregard the TOP or ARROW molded into the DIN Cable

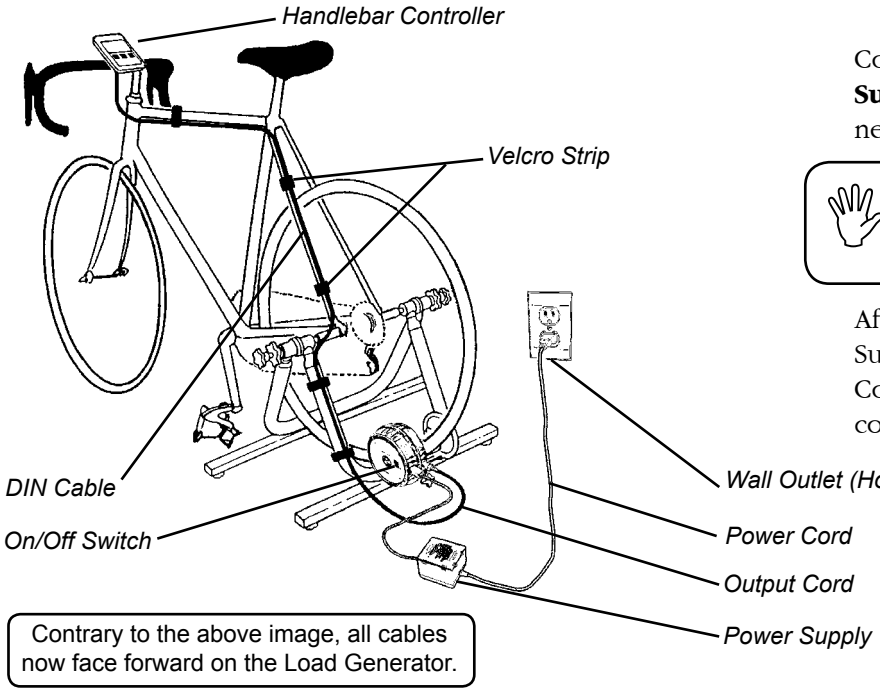


Caution: Before proceeding with these next steps make sure the **Power Supply** is not already plugged into the wall outlet. Failure to do so may cause the fuse in the Power Supply to blow. Also, avoid routing cables near moving parts of bicycle.

The **DIN Cable** is identical on both ends. Plug one end into the Load Generator connector nearest the tire and the other end into the Handlebar Controller.

Route the DIN Cable onto the **Training Stand** and then onto the bicycle *(see image on the following page)* and secure with pieces of **Velcro Strip** cut to length as needed to wrap both the bike tubes and DIN Cable.

Step 7....Connect the Power Supply to the Load Generator and Wall Outlet



Contrary to the above image, all cables now face forward on the Load Generator.

Connect the **Output Cord** of the **Power Supply** into the jack on **Load Generator** nearest to the **ON/OFF switch**.

Do NOT connect the Output Cord or DIN Cable if the Power Cord is already plugged into the wall outlet.

After both DIN Cable AND Power Supply Output Cord are plugged in the CompuTrainer you can plug the power cord into household power.

Step 8.....Attach Cadence Sensor

CompuTrainer is supplied with either The Puck or a magnetic **Cadence Sensor.** Instruction sheets are supplied with either sensor kit for up-to-date installation details.

Things to consider:

- Placement of, or no signal from, either sensor will directly effect the function of the *SpinScan Pedal Stroke Analyzer*.
- Attach the chain-stay Cadence Sensor to the left *chain stay* as near the end of the crank arm (pedal end) as possible. Other pre-existing cadence sensors should be relocated, if necessary, to accommodate this.
- The Puck is placed forward of the crank under the right pedal.
- The Magnet of the chain-stay cadence sensor mounts to the crank arm directly opposite the Cadence Sensor using the o-ring, which you pull around the crank and insert into the groove of magnet
- Maximum clearance of the Magnet and Cadence Sensor should be 1/8" - 3/16".
- It may be necessary to move the sensor or magnet forward, backward, closer to, or further from each other until an RPM signal is received on the Handlebar Controller.
- Be sure Magnet does not interfere with any part of the bicycle.
- Route any cadence sensor cable safely away from moving parts of the bike until it reaches the Handlebar Controller RPM Jack - then secure with Velcro strips cut from the supplied Velcro material.

Step 9.....Attach Heart Rate Sensor

If you purchased a **Wireless Heart Rate Adapter** plug it into the **Pulse Jack** of the Handlebar Controller using the **HR Adapter extension Cable** (extension cable required).

If you are wanting to use ANT+ heart rate, this works only within the RacerMate One software package - and no heart rate will be displayed on the Handlebar Controller.

Congratulations!.....Your CompuTrainer is now ready to ride.

Stand-Alone Mode -- What Is It?

"Stand-Alone Mode" means the CompuTrainer is **NOT** connected to an external PC. It is functioning as a self-contained unit using the software programs imbedded into the Handlebar Controller and these are displayed on the LCD display. The Handlebar Controller programs consist of:

- **Rolling Resistance Calibration** *(initial start-up screen, or accessed using + / - at the same time)*
  CompuTrainer generates the most accurate, repeatable loads, and displays the correct wattage, only when it is calibrated. You should calibrate in order for the software to account for rolling resistance. In an uncalibrated state, the CompuTrainer defaults to a rolling resistance value of 2.00 lbs.
- **Ergometer Mode** *(press F2 from Calibration screen)*
  Maintains a set load (wattage) regardless of speed or cadence. The software will adjust torque to maintain the watt constant from 50 to 995 watts in 5 watt increments.
- **General Exercise Mode** *(press F1 from Calibration screen)*
  Simulates an outdoor ride without graphics. 0-10 levels similar to grade. Preset 1, 3, and 10 mile rides w/10 levels of difficulty. Plus a random course setting, 10 difficulty levels, with unlimited length.

Stand-Alone functions occur only when the **Communication Cable** is not plugged into the **Ext. PC** jack. While using external software Rolling Resistance Calibration can be accessed by pressing F3 before a race start (Race Screen active) or from pausing a race using using F1 followed by F3.

Rolling Resistance Calibration

Rolling Resistance, or rolling drag, is the effort (measured in foot pounds) required to rotate the tire when pressed against the Load Generator roller. The pressure against the roller is called Press-on Force. Other factors, such as bearing friction, tire pressure, tire type, spoke windage, and temperature all contribute to rolling resistance. ***Rolling Resistance Calibration*** is used to measure Rolling Resistance (drag). The software uses this value (when saved into memory) along with other mathematical formulas to accurately produce workloads and calculate wattage in both *Stand-Alone Operation* and while using external software.

Using the ***Rolling Resistance Calibration Program*** before every training session will insure accuracy and high repeatability from one training session to the next. Once measured, the rolling resistance value will remain in the Handlebar Controller memory until the power is turned off. When the power is turned off and then on again, the measured rolling resistance value will be replaced by the default rolling resistance value of 2.00 lbs and recalibration will again become necessary.

It is commonly misunderstood that the "optimum rolling calibration number" is 2.00 lbs. This is not true. This is simply the default value. With conventional road tires 2.00 lbs. might be considered a minimum value when riding a flat course, but higher values may be needed to eliminate tire slip if grades exceed that of a level road.
For an in-depth discussion on this issue, refer to the technical appendix on page 23.

Rolling Resistance Calibration -- The Procedure

The calibration procedure involves pedaling the bike up to 25 M.P.H. (about 40 K.P.H.) and then coasting to a stop. During the coast down, the Rolling Resistance is measured electronically. Make sure you've sufficiently warmed up the **Load Generator** and bike tire as described before proceeding.

You can calibrate while using RacerMate One as well (see the RacerMate One Help manual for further details). If you plan to use the RacerMate One calibration screen, you might want to do a preliminary "cold" calibration first to get you into the ballpark. Because accuracy of load and wattage depends on calibration, you will want to calibrate before running any important tests.

Step 1 -- Warm-Up. Turn your CompuTrainer ON and press **F2** to enter Ergometer mode. Begin to pedal and using the [+] key increase the wattage to 150. Ride for about 10 minutes. This should sufficiently warm the tire and **Load Generator** to equilibrium temperature.

Step 2 -- After warm up, press the **[+]** and **[–]** keys simultaneously to return to the Calibration Program. In Calibration Mode the lower left of the display will show *"U 2.00"* (for uncalibrated default @ 2.00 lbs). *"0.00"* will display in upper right of the display and indicates MPH.

Step 3 -- Quickly pedal and once **12 m.p.h.** is reached the word *"UP"* will appear on the bottom right of the display and will remain until 25 mph is reached. When *"UP"* disappears stop ***all*** pedaling and let the wheel coast to a stop. The rolling resistance measured during this test will appear at the top of the screen. Quickly repeat this step about 2 or 3 times to make sure the number repeats +/- a few hundredths of a pound. Try to minimize the time spent calibrating, since the warm-up will soon begin cooling.

Step 4 -- When satisfied, save the calibration value by pressing **F3**. The number will automatically replace the default value of *U 2.00* at the bottom of the screen. Calibration is now complete. Once saved, the calibration number will remain in memory until the CompuTrainer power switch is turned OFF.

A value above *4.99* is considered excessive and cannot be saved. Make adjustments to reduce the rolling resistance and calibrate again. Be sure to warm up the system again if too much time elapses. An excessive value (very high or very low) may be an indicator of a system failure. If you see these excessive values, but the Press-on force seems normal, contact technical support for assistance.

Important Notes regarding CompuTrainer Accuracy

An error during calibration of 0.01 lb. equates to 1/2 watt at 25 mph. Repeat Step 3 to confirm your rolling resistance value repeats to within .05-.10 lbs. If the value continues to drop for two consecutive measurements, this may indicate that the tire and/or Load Generator may not be at a stabilized operating temperature. Warm up the system several more minutes and repeat Step 3 again.

It is **not** necessary for calibration numbers to read *exactly* the same on a daily basis, assuming the values don't vary more than a couple tenths of a pound. 2.00 lbs one day and 3.00 lbs the next day for the same course is not ideal. Because rolling drag determines the minimum work, setting too much rolling drag for a flat course would make loads feel like hill climbs and too little may cause tire slip. You should always set the press-on force appropriate to the course. If a flat course, then less press-on force. Hill climbs will require more. For advice on setting an optimum Press-On Force number, see the technical appendix on page 23.

Switching Between Stand-Alone Programs

The Rolling Resistance Calibration Program is the "path" between the Ergometer Mode and the General Exercise Mode. When you are in the Rolling Resistance Calibration Mode press **F2/Ergo** to enter the Ergometer Mode program, then **+/-** simultaneously to go back the Calibration Mode, then **RESET/GEM** to enter General Exercise Mode.

Ergometer (ERG) Mode -- Watt Testing

The CompuTrainer Ergometer maintains a constant load, which can be adjusted from 50 to 995 watts in 5 watt increments. These values appear in the upper right corner of the display window and can be changed by pressing the **[+]** or **[–]** key. The torque varies with speed changes to maintain the watt constant *(torque x speed = watts)*. As you slow down torque increases (feels harder to pedal) to maintain the watt constant - and vice versa, speeding up lessens the torque to make it seem easier to pedal.

A flashing Watt number indicates the system is NOT calibrated. If flashing, the wattage value displayed is calculated using the default 2 pound setting. Run the Rolling Resistance Calibration program to eliminate the wattage errors this condition will produce.

The CompuTrainer, while in ERG mode, is torque limited at or below 14 MPH. Watt testing is NOT dependent on gearing (changing gears does not make it easier or harder to pedal). For best results choose a gear that allows you to maintain 14 MPH or more - and don't shift gears.

Training with Watts - Stand-Alone Mode Limitations

Tests, like Anaerobic Threshold and FTP (Functional Threshold Power™), can easily be accomplished using Stand-Alone Ergometer Mode mode or while using RacerMate One software. There are many pre-programmed, automated tests supplied when using external software. These automated tests allow for much greater flexibility of load control; allowing for ramp tests, step changes of load, duration and distance between changes. Stand-Alone will only allow small incremental changes in load, whereas the external software will allow any change you can program in.

Training with Watts - Using the RacerMate One "Power Training" App

Automated tests using time/distance and watts can be easily created and performed using the Power Training app (an application module of the RacerMate One software supplied with your CompuTrainer). The Power Training app allows you to run any time/distance-based, slope/power-based (grade, watts or %AT) workout. Unlike Stand-Alone mode, which is 100% manual control, Power Training will automatically make adjustments in load.

For more information on using the Power Training app, refer to the RacerMate One "Help" from within the RacerMate One software.

Speed Display - Switching between MPH and KPH

While you are within the Rolling Calibration application you can switch the Controller display to read either Miles Per Hour (MPH) or Kilometers Per Hour (KPH) by pressing the [F1] key.

This setting will revert back to MPH when the power is turned off to the Controller and will need to be set anytime you power up the system. Also the speed selected works only within the Ergo Mode or General Exercise Mode.

General Exercise Mode -- Switching Between Stand-Alone Programs

As stated on the previous page, the Rolling Resistance Calibration Program is the "path" between the Ergometer Mode and the General Exercise Mode. When you are in the Rolling Resistance Calibration Mode press **RESET/GEM** to enter the General Exercise Mode program.

General Exercise Mode -- Program Selection

In this program there are 51 preset and random course selections. The selection number appears in the upper right hand corner of the LCD display just above the word PRGM.

To select a course, press the **[+] / [–]** key until the program number is displayed in the upper right corner of the display.

These selections are: *(all lower numbers are easier than higher numbers)*
#0-10 ..... 10 fixed load levels from 0 (no load) to 10 (high load) *
#20-29..... 1 mile course / 10 difficulty levels
#30-39..... 3 mile course / 10 difficulty levels
#40-49..... 10 mile course / 10 difficulty levels
#50-59..... Endless course made from random selections of the 10 mile course. 10 levels of difficulty
* With Programs #0-10, the **[+] / [–]** keys will manually change the load at any time.

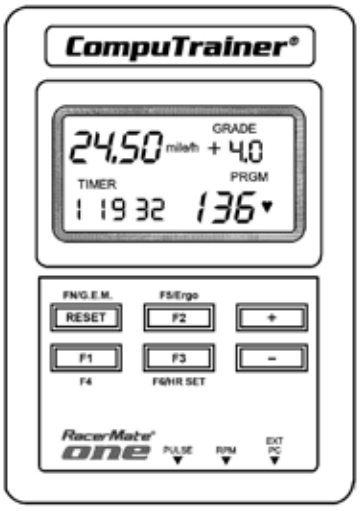
Body weight is not available using Stand-Alone mode. General Exercise courses, though displayed as "GRADE" are not equivalent to grades encountered while riding outside or when using RacerMate One software. These courses are intended as a general means of exercise and you should use RacerMate One if you are needing to train on an actual road course.

General Exercise Mode -- Starting the Program Timer

Once a program is selected you may start pedaling and press the **[F1]** key to start the program. The timer at the bottom left will begin and 'grade' changes will replace the program number.

To warn of an impending grade changes, the new value will appear and flash a few seconds before it changes. You may want to anticipate a gear change at that time.

You can change the program difficulty level once you've pressed **[F1]**, (i.e. from level 29 to level 25), using the **[+] / [–]** keys, but you will be unable to change the length of the course during the race (i.e. from level 29 to level 39).



Handlebar Controller
in General Exercise Mode

Display Options - Manual Operation

Pressing the **[F2]** key will change the display of SPEED, DISTANCE, WATTS and CALORIES once for each key press.

Pressing the **[F3]** key will change the display of LO heart rate limits, HI heart rate limits, HEART RATE, and RPM once with each key press (heart rate or cadence sensor must be attached to activate this feature)..

Display Options - Automatic Scan

For automatic scanning of either of the two display functions, press and hold either **[F2]** or the **[F3]** key until the LCD Display flashes. These two **Scan** functions will scroll through their display metrics every few seconds. To stop Automatic Scan press and hold the **[F2]** or the **[F3]** key until the LCD Display flashes, which stops **Scan** functions.

Please Note: Scan functions using [F3] SET are overridden if heart rate limits are reached.

Heart Rate Monitor - Setting Your Target Heart Rate Zone

The CompuTrainer Controller allows use of an optional Polar™ coded wireless heart rate monitor. A chest strap is also available as an optional purchase. Plug the Polar™ Adapter and Adapter Cable into the **Handlebar Controller** and then pair the adapter to the chest belt by holding the Adapter near your chest strap**.** Once a heart rate signal appears, you can place the adapter on the bike using the supplied Velcro attachment. Avoid direct sweat drip zones or protect the sensor with plastic wrap.

A heart rate must appear in order to change heart rate limits. To enter your Target Heart Rate, press the **F3/ HR SET** key until "LO" appears. Pressing the **[+] / [–] keys** will set the low alarm. The lowest number allowed is 40 beats per minute. Press **HR SET** again and "HI" will appear. Pressing the **[+] / [–] keys** will set the high alarm. The highest number allowed is 199 beats per minute. Press **SET** again to exit alarm setup function.

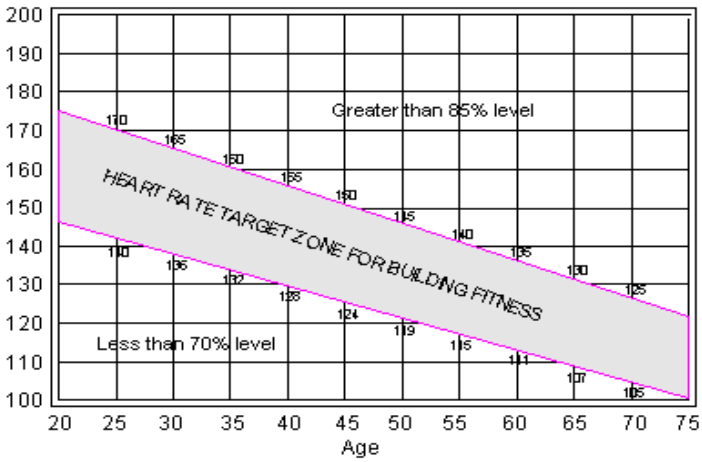
Please note: You will not be able to set the high alarm lower than the low alarm.

If an **"E"** appears on the display, either wet the back side of the chest strap and/or readjust the position of the Wireless Adapter in order to produce a better signal.

Optimum Target Heart Rate

Medical fitness research studies show that in order to increase fitness, you need to perform exercise that elevates your heart rate to at least 60% of maximum. Most fitness authorities agree that the most desirable heart rate is between 70% and 85% of maximum.

Recommended Heart Rate Zones for Cardiovascular Fitness



Maximum heart rates decrease with age as shown in the chart.

Heart Rate Monitor - Alarm Functions

An individual's maximum heart rate may sometimes vary from the theoretical prediction and exercising at an elevated heart rate may be dangerous for some people. Please consult your doctor for help in determining your proper heart rate limits.

While you are exercising, and as long as you have the **Polar™ Wireless Heart Rate Adapter and Adapter Cable** attached to the **Handlebar Controller**, and you are wearing an approved Polar™ chest belt transmitter•, your heart rate will be displayed on the LCD Display. If you are using ANT+ while riding with external software, like RacerMate One, heart rate will only be displayed on the external race screen.

If your heart rate rises above your preset high, a fast high pitched alarm will emit from the Handlebar Controller; if you are below your preset low a slow low pitched alarm will emit. You should change speed or gears to maintain your heart rate within preset limits.

*Approved Polar™ chest belts are any coded or non-coded straps with the exception of Polar™ W.I.N.D. chest belts.

A Place for Notes

Care and Maintenance

For long life and continued service with no interruptions in your training, the following items should be maintained. Some failures are not covered under warranty, so please follow these suggestions.

1) Training Stand Lubrication

Lubricate the **Threaded Axles, Take-Up pins, and Hinge Rear Adjusting Knob** often.

2) Training Stand Paint Finish

The CompuTrainer is finished in a highly durable *powder coating*. Some areas are impossible to coat; like the intersection between the floor members and the U-portion of the stand, and should be treated regularly with a liquid spray wax or perhaps a wax or oil-based lubricant to penetrate into this crevice. This will minimize premature failure due to rust. Sweat damage is not covered under warranty.

3) Training Stand Take-Up - Damage Prevention

The **Take-Ups** are attached using small *External Snap Rings*. DO NOT rotate the Adjusting Knobs counterclockwise until the Take-Ups contact the frame and then continue to turn the knob. Doing so will force the snap ring off the end of the pin allowing the Take-Up to fall off. This type of damage is not covered under warranty.

4) Load Generator Care

- Protect the Load Generator from being used as a piggy bank by children, or as a fire hydrant by the dog or cat (yes, these things have happened).
- Internal cooling is dependant upon your speed. When doing long, slow, hill climbs, be sure to pause the ride every 5 minutes and spin up 30 seconds or so (with less resistance) to allow the system to cool. Adjusting the course with lower grades or wattages to add interval cooling is also an option.
- Rocks, chemicals, rider sweat, and household cleaners can attack the hard-anodizing of the Friction Roller. Wipe bike tires with only Isopropyl Alcohol and cover the Load Generator if cleaning products are used nearby to protect the Friction Roller. Friction Roller wear and pitting of any kind is not covered by warranty.

5) Handlebar Controller Care

- The **Handlebar Controller** may only need to be covered with clear plastic wrap to protect it from sweat.
- The connections inside the Handlebar Controller are fragile and can be broken if the the connectors plugged into them are forced sideways while inserted. This failure will require factory service and/or replacement.

6) Power Supply Care

The **Power Supply** contains two fuses: one electrical and one thermal. The electrical fuse can fail from hot-socketing the DIN Cable or Power Cord while the Power Supply is plugged into the wall outlet. You can minimize the need to replace the electrical fuse by simply following the precaution of plugging in cables only when the Power Supply plug is NOT plugged into the wall outlet. Fuse replacement should be done by RacerMate or by a reputable electronics repair facility. The thermal fuse will fail when temperature inside the transformer exceeds its limit of 130˚C, but will reset after the temperature returns to normal. Heart Rate or Cadence sensor cables can be plugged in at any time without fear of blowing a fuse.

Troubleshooting CompuTrainer Hardware

The following issues are our most frequently asked, but if you have a problem not addressed here -- do not hesitate to call or email our technical support department for help.

Q: The red light on my Load Generator won't come on.
A: The fuse in the Power Supply has blown. Notify the RacerMate Service Department for fuse replacement recommendations.

Q: The resistance has either become more or less difficult - and the watts value is no longer making sense. Rolling calibration values also no longer make sense.
A: This is either the failure of the DIN Cable or Load Generator. Resistance (what your feel) is calculated on-the-fly based upon things such as your weight, the grade, and speed. Calculations assume a functioning, calibrated, Load Generator. If, in fact, this isn't case, the resistance will be wildly different than what you're used to. The software will still display a wattage based upon the speed you are traveling and the grade you are on even if the Load Generator isn't producing the appropriate load. For example, being able to ride 20 MPH up a 15% grade would produce very high wattages - and the software would display this high wattage if the Load Generator was broken allowing you to do 20 MPH up a 15% grade. You will need to contact RacerMate Service for further information on repairing this.

Q: The heart rate reading has stopped or has gone intermittent.
A: Try wetting the back side of the Chest Strap or relocate the Wireless Adapter in closer proximity to the Chest Strap. Verify other wireless devices on the bike, or in the room, are not conflicting with it. Contact RacerMate Service if the problem persists.

Q: My cycle computer speed does not match CompuTrainer speed measurement. Why?
A: The speed of the CompuTrainer is determined mathematically using the speed and the diameter of the Load Generator Friction Roller. Your cycle computer measures speed based upon tire circumference, which is difficult to calculate. The Friction Roller presses into the tire more than the weight of a cyclist would indent the tire while riding on the road. Therefore the actual tire circumference value for a cycle computer will be slightly smaller while on the CompuTrainer than on the road.

Q: I keep blowing tubes in my tire. Why?
A: A good thread on this subject is available on our web forum. You can find this here: http://www.racermate.net/forum/viewtopic.php?f=4&t=4405

Keypad Shortcuts - Stand-Alone Operation only

While in Rolling Resistance Calibration Program (RRC)

[F3]	Enters measured Rolling Resistance into memory
[F2] Ergo	Shifts to Ergometer Program from RRC
[RESET] G.E.M.	Shifts to General Exercise Mode from RRC
[F1]	Toggles Display between MPH and KPH

Access to Rolling Resistance Calibration Program (RRC)

[+] & [-]	When in either Ergometer Mode or General Exercise Mode, press both keys simultaneously to enter Calibration Mode

Ergometer Mode Program

Enter Ergometer Mode using F2 key from within the Rolling Resistance Calibration Program

[+]	Raises load in 5 Watt steps
[-]	Lowers load in 5 Watt steps Flashing values indicate an un-calibrated system.
[F1]	Starts and stops timer

General Exercise Mode (G.E.M.)

Enter General Exercise Mode using RESET from within the Rolling Resistance Calibration Program

[+]	Raises program numbers and heart rate values
[-]	Lowers program numbers and heart rate values
[RESET]	Stops & resets a running program Programs #0-59
[F1]	Starts & pauses a running program Programs #20-59 Starts and stops timer on all programs
[F2]	Scrolls through MPH, Miles, Watts, and Calories Starts Scan when pressed and held Stops Scan when pressed and held
[F3]	Scroll through Heart Rate HI/LO Alarms, HR, and RPM Starts Scan when pressed and held Stops Scan when pressed and held

Rolling Calibration and Press-on Force

Failure to apply adequate Press-On Force (bike tire to Load Generator Roller contact) can result in inaccurate readings from your CompuTrainer due to tire slip.

Tire Slip

To obtain the greatest accuracy from your CompuTrainer, tire slip must be avoided. The problem is that tire slip is very hard to perceive unless it is extreme. In the operating instructions found on page 11 regarding Press-On Force, RacerMate has given specific suggestions to avoid tire slip. These should be followed prior to calibrating your CompuTrainer. Keep in mind... the tire to roller interface and press-on force of the same, combined with doing a rolling calibration to measure this, are the only user controlled components of CompuTrainer setup where accuracy can be lost or attained.

To eliminate errors from slip while adjusting and calibrating your CompuTrainer, RacerMate derived the following chart to help, as a guideline, in establishing minimum Press-On Force values. You should adhere to these values give or take 2 tenths of a pound (+/- .20). The chart on the left is for typical road courses and the chart on the right should be used in the event of a Sprint or MAX test where quick, short bursts of power will be seen. Use of a trainer tire, like the optional Continental Hometrainer tire, can significantly reduce the required Press-on Force significantly!

Flat Course - use 2lbs† Press-On Force
Up to 2.5% Grade - use 2.5 lbs† Press-On Force
Up to 5.0% Grade - Use 3.0 lbs† of Press-On Force
Up to 7.5% Grade - Use 3.5 lbs† of Press-On Force
Up to 10.0% Grade - Use 4.0 lbs† of Press-On Force
Up to 12.5% Grade - Use 4.5 lbs† of Press-On Force
Up to 15.0% Grade - Use 4.99 lbs† of Press-On Force*

†Plus/minus .20 lbs acceptable.
*5.0 lbs exceeds the maximum value you can save.

Rolling Drag for Road Courses

Up to 250 Watts - use 2lbs† Press-On Force
Up to 300 Watts - use 2.5 lbs† Press-On Force
Up to 400 Watts - Use 3.0 lbs† of Press-On Force
Up to 500 Watts - Use 3.5 lbs† of Press-On Force
Up to 650 Watts - Use 4.0 lbs† of Press-On Force
Up to 700 Watts - Use 4.5 lbs† of Press-On Force
800 Watts and Higher - Use 4.99 lbs† of Press-On Force*

†Plus/minus .20 lbs acceptable.
*5.0 lbs exceeds the maximum value you can save.

Rolling Drag/Press-On for Sprint/MAX tests

Remember: the main goal is to avoid tire slip, which is power (watts) lost and not be displayed.

Rolling Calibration

The Rolling Calibration Procedure is the second essential element in obtaining accurate results with your CompuTrainer; giving the CompuTrainer micro-computer the key ingredient needed to determine when, and how much, to apply load for a given condition. If this procedure is overlooked, or done incorrectly, there will be no reference point to derive all the complex calculations CompuTrainer must use for both its load creation and wattage display calculations.

What can you do to assure greatest accuracy? First would be to set enough Press-On Force as established above. Second, and key, is to warm the system up to a stabilized temperature prior to calibration. The standard suggestion is to warm up at about 150 watts for 10 minutes. As stated on page 15, if the values obtained during the Rolling Calibration test continue to drop on successive runs, then the system is not warm enough to calibrate.

Rider Power, Training and Winning Races

Force and power versus bike speed. A rider must supply force and power to overcome the forces that slow the bike. Two slowing forces, usually small on flat roads, are rolling resistance of the tires on the road and slope if you ride uphill, both of which are independent of bike speed. On flat roads, the most important force that slows the bike is from the rider and bike pushing through air, called aerodynamic or wind drag. Wind drag force is greatly affected by speed and increases with the square of speed: twice the speed gives 4 times drag; 3 times the speed gives 9 times drag. For a flat road, rolling resistance and wind resistance are equal at about 15 km/hr. As bike velocity increases, rolling resistance stays constant but wind drag increases with the square of the speed and reaches 4 times rolling resistance at 35 km/hr. Power is the measure of how hard a rider must work to drive a bike forward against the slowing forces. Power is calculated by multiplying force times velocity. Because air drag increases with the square of speed, power required to overcome air drag increases with the cube of speed. Two figures at the end of this document show plots of drag and power versus speed. An internet site has information on these forces that act to slow a bike[1].

It is the goal of training to increase the power you can maintain over the length of the race. Considering the required rider power versus bike velocity shows us how to ride to cover the distance in the minimum time and win your race. Because required power increases very rapidly with speed, riding with constant speed minimizes the average power required of the rider over a race.

To understand this, imagine two racers, both riding at an average speed of 25 km/hr. One rides at a constant speed of 25 km/hr and the other alternates equal periods of resting and riding at 50 km/hr. From the plots at the end of this article, the constant speed rider must produce ~110 watts of power and the rest/ride contestant must produce 0 watts at rest and ~690 watts when riding for an average of 345 watts (the average of 0 and 690 watts). The constant speed rider will produce only about 1/3 the power of the rest/ride contestant. This extreme example shows that maintaining a steady pace is extremely important. In a race over a flat course, a steady rider can win against a stronger rider who puts out higher average watts but doesn't maintain constant speed. It seems the old adage "Slow and steady wins the race" is true after all.

Hill climbing is different in that most of the slowing force is due to the slope and this force is independent of speed. Slope force equals rise/run times the sum of rider + bike weight and is independent of velocity. For slope of 10% (rise/run = 0.1) and a combined bike plus rider weight of 90 kg, the required rider wattage at 10 km/hr is 247 watts and at 12.5 km/hr wattage increases to 277. A speed change of 12.5% requires a power increase of 13%, nearly the same as the speed change. This shows that for hill climbing where speed is closely proportional to power, the rider who can produce higher average power per weight will ride a faster race. The measure that predicts rider speed is power divided by the sum of rider + bike weight. The strategy of winning hill-climbing races is to increase rider power and decrease the total weight, rider + bike, to be carried up the hill.

Winning races requires strategies that include riding at constant speed on flat, low wind races, training to increase rider output power and endurance, taking advantage of drafting and other race circumstances and practice, practice, practice.

SpinScan.

CompuTrainer's high speed data acquisition system can measure pedaling force many times during each cycle of the pedal crank and as a result CompuTrainer can generate the SpinScan display of force versus crank angle. This data allows a rider to increase power and efficiency, balance leg force, learn smooth and efficient riding, use of front and back force on the pedals and to adjust rider position for optimum power.

Bike Power Meters.

There are two types of bike power meters or ergometers, those on mobile bikes and those on stationary bikes with electronically controlled drag systems. Power meters on mobile bikes are useful to monitor and especially to record rider on-track performance in terms of power output but much less useful for real-time race strategy. The pace of a race is often dictated by the behavior of other competitors, drafting or in a pack. For training, two major disadvantages of a mobile bike are that you are exposed to bad weather and you are limited to the race-courses you can visit. Stationary bike power measurement with electronic control of load such as the Racermate CompuTrainer have a major training advantages in that any course can be simulated, including slope of various segments, head and tail wind, and the rapid increase in wind drag with bike speed. You can ride comfortably in any weather and also record your performance. You can ride the same course with different strategies to find the winning combination.

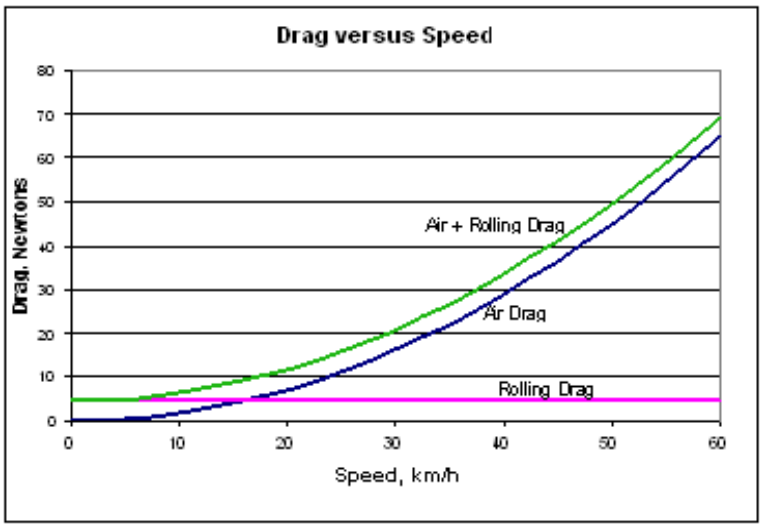
Bike Power Meter Accuracy

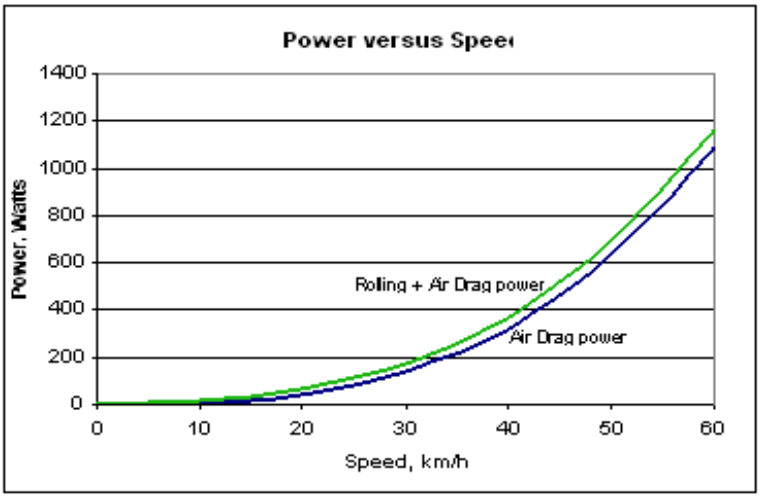
The mobile bike power measurement systems from products like SRM and Power Tap use strain gages to measure torque or twisting force on the crank arm or on the rear hub. Torque is multiplied by axle RPM to determine rider power. Strain gage technology and accuracy are discussed on an internet site[2]. Strain gages are subject to both zero drift and span drift. To understand these two types of drift, think of a bathroom scale. Zero drift is the failure of the scale to read zero when you get off. Span drift is an incorrect reading of weight when you step on the scale. Both forms of drift, zero and span, result from change in strain gage properties with temperature and with aging of the glue used to attach the gage element to the measurement point. Strain gage systems can be calibrated using weights to produce a known force on the bike pedals. There are potential errors in weight calibration because the force can both twist the measurement element and also bend it. Strain gage signals due to twist or torque is data and any due to bending is an error. Reported accuracy in terms of mean error scores for SRM and Power Tap factory calibration over a range of 50 - 1000 W were 2.3 +/- 4.9% and -2.5 +/- 0.5%, respectively[3]. Accuracy for SRM and PT was not largely influenced by time and cadence; however, power output readings were noticeably influenced by temperature (5.2% for SRM and 8.4% for PT). During field trials, SRM average and max power were 4.8% and 7.3% lower, respectively, compared with PT. Calibration and strain gage errors are also discussed in reference 4, which reports also a comparison of SRM, Power Tap and Polar mobile bike power measurement systems. This article[4] suggests checking zero on each ride and checking span calibration at frequent intervals.

CompuTrainer Accuracy

The CompuTrainer system uses the bike rear wheel to drive a copper flywheel, spinning in the field of an electromagnet. The accuracy depends on knowing the rolling drag of the bike wheel driving the flywheel and the accuracy of calibration of the drag versus rpm versus magnet electrical current. The rolling drag is determined by a calibration procedure from the rate of slowing of the known mass flywheel at a given force on the friction roller and determined by user test. The drag generated by the electromagnet on the spinning copper disk depends only on the electrical properties of copper, RPM and the intensity of the magnetic field. The electrical and magnetic properties of copper are predictable functions of temperature and compensated for in software. The drag versus RPM versus current are constant because the geometry of the electromagnet and the location of the copper flywheel are unchanging. The drag versus RPM versus current were initially calibrated during development of this product with literally thousands of measurements for an accuracy of better than +/-2.5%.

Load Curves for CompuTrainer





Conversion Information

Multiply Newtons by 4.45 to determine pounds force
Multiply km/hr by 0.6214 to determine mph
Multiply watts by 0.001341 to determine horsepower

References

1. http://www.slowtwitch.com/Tech/The_Physics_of_Moving_a_Bike_163.html

2. http://www.omega.com/literature/transactions/volume3/strain.html

3. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15235334

4. http://biketechreview.com/archive/pm_review.htm

Credits

Allen Waggoner, Phd
Former Research Staff Member, University of Washington

One Year Limited Warranty

RacerMate Electronic Components are warranted to the original purchaser for a one-year period from the original purchase date against defective material and workmanship. Any implied warranties are also limited in duration to one year from the original purchase date. Some states do now allow limitation on how long an implied warranty lasts, so the above limitations may not apply to you.

During the warranty period RacerMate will repair, or at its option replace any part that proves upon inspection to be defective. Products subject to industrial use, improper installation, misuse, neglect, accident, alteration, or unauthorized repair shall be excluded from this warranty. To obtain warranty service, proof of original purchase date must be furnished.

RacerMate shall not be liable for shipping cost to the factory, consequential costs, expenses or damages incurred by the purchaser. Some states do not allow the exclusion of incidental or consequential damages so the above exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Lifetime Limited Warranty

RacerMate Training Stands are warranted to the original purchaser for a lifetime of service against defective material and workmanship. One year for MultRider applications.

During the warranty period RacerMate will repair, or at its option replace any part that proves upon inspection to be defective. Products subject to industrial use (i.e., MultiRider applications), improper installation, misuse, neglect, accident, alteration, or unauthorized repair shall be excluded from this warranty. To obtain warranty service, proof of original purchase date must be furnished.

RacerMate shall not be liable for shipping cost to the factory, consequential costs, expenses or damages incurred by the purchaser. Some states do not allow the exclusion of incidental or consequential damages so the above exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

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