



PRECISION CYCLING

Edmund R. Burke

POLAR®

PRECISION CYCLING

with your Polar Heart Rate Monitor

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FOREWORD

About a decade ago I was first introduced to Polar wireless heart rate monitors and started using these miniature electronic devices with cyclists in preparation for the Los Angeles Olympic Games. Wireless heart rate monitors brought high-tech biofeedback training into the reach of all our athletes. Single-handedly, heart rate monitors allowed our cyclists and coaches to develop sophisticated programs, which led to successful performances in competition.

This tradition continues today with athletes and fitness enthusiasts using heart rate monitors to take the guesswork out of their training. In many ways, training and competing with a Polar wireless heart rate monitor is like having a portable, full-time coach attached to your body.

Why is heart rate monitoring important? Your heart is the most important muscle in your body. In fact, it serves as a barometer for the rest of your body, telling you how hard you are cycling, how fast you are using up energy and even your state of emotions. It pulls these physiological variables together into a single number that reports your overall condition.

Variable factors such as temperature, wind, humidity, altitude, terrain, and fitness levels can affect the intensity of your effort, but the wireless heart rate monitor allows you to measure and control intensity by monitoring your heart rate.

Over the last ten years I have introduced the benefits of heart rate monitoring to thousands of beginning cyclists and Olympians in workshops and in the columns I write for several cycling publications. This booklet will show those of you I can't reach in person how to use a heart rate monitor to improve performance and obtain optimum results while cycling.

A Polar heart rate monitor is a total performance monitoring tool for the exercise enthusiast, cyclist or triathlete. It may be the most important piece of cycling equipment you could own.

Best of luck,
Edmund R. Burke, Ph.D.

About the Author

- *Associate Professor, University of Colorado, Biology Department*
- *Coach for the 1980 and 1984 Olympic Cycling Teams*
- *Director of Sport Science and Technology for the U. S. Cycling Team, 1981 - 1987*
- *Columnist for Winning Magazine, NORBA News, Bicycle Dealer Showcase, American Bicyclist and fitness column in Bicycling.*
- *Executive Editor, Cycling Science Magazine*
- *Author of the following books: Inside the Cyclist, The Science of Cycling, Health and Physiology of Cycling and The Two-Wheeled Athlete*
- *Co-author of the following books: Physiology of Bicycling, Bicycle Injuries: Prevention and Management, The Medical and Scientific Aspects of Cycling and Fitness Cycling*
- *Edmund R. Burke died in autumn 2002. There are many cyclists out there that have become better because of Dr. Ed Burke. His contribution to heart rate training in cycling is unparalleled and is one of the legacies he leaves behind.*



INTRODUCTION



"The wireless heart rate monitor has the potential to revolutionize training for health, fitness and competition. I can't emphasize enough how important it is to get a correct understanding of the subject across to athletes and fitness conscious people everywhere."

Massimo Testa, M.D.

Physician to the Motorola Cycling Team

Cycling is one of the most popular and effective ways to get in shape and stay healthy. About 80 million Americans already enjoy the benefits of cycling, and every day more and more people start their own cycling programs.

There are almost as many reasons to choose cycling as there are people cycling. Some of you cycle for exercise and to stay in shape, for a break from a hectic day, to explore and travel, to rediscover your surroundings, or to compete in organized events. You can cycle almost anywhere: around the neighborhood, at the park, even on a stationary bicycle in the comfort of your home. The more you cycle, the more reasons you'll find to fit cycling into your daily routine.

Our bodies are designed to move. To stay healthy and fit, we must remain active. One of the advantages of cycling is that it offers a balanced approach to fitness. Cycling is a full-body, low-impact, aerobic exercise that can help you:

- Strengthen your heart
- Lower your blood pressure
- Boost your energy
- Burn off extra fat
- Tone your body: thighs, buttocks, stomach
- Reduce stress and tension
- Reach peak performance

How Cycling can Help You Meet Personal Fitness Goals

Achieving any of these personal fitness goals depends on the effectiveness of your cycling program.

The American Heart Association counsels that in order to derive the full benefits of an aerobic workout, a certain level of activity – gauged by frequency, duration and intensity – must be maintained while you exercise.

- Frequency: 3 to 5 times per week
- Duration: 20 to 60 minutes of continuous cycling
- Intensity: Physical activity which corresponds to 60-85% of your maximum heart rate.

Cycling is an excellent aerobic exercise because it allows you to exercise large muscle groups in a sustained fashion that maintains your heart rate at a high enough level to achieve a training effect.

Cycling may well be the most efficient form of human propulsion – better than swimming, running and even walking. Cycling is one of the few sports that combines man and machine in a harmonic whole. The more efficient the body interacting with it, the higher the degree of recreation and fitness one can achieve.

Why Heart Rate Monitoring is so Important

The strength of your heart is the most important reason to maintain fitness; fortunately, it is one of the easiest fitness goals to achieve. The heart is a muscle. The heart is always functioning and, therefore, maintaining itself, unfortunately at a relatively low level in many people. But, like any muscle, when periods of exercise are applied regularly, its capacity will gradually increase so that it can deal with new tasks without strain.

By monitoring your heart rate with a Polar heart rate monitor you can get more benefit out of the time spent on your bicycle. Of the three most important variables in designing a fitness program, frequency and duration are easy to monitor, but intensity can be elusive.

Fortunately, you have a built-in monitor that gives you this information. It's your heart rate. It ranges from a minimum value when you're resting to a maximum level during hard riding or other extreme efforts.

If you work regularly at certain levels of intensity as measured by your heart rate, certain improvements in your fitness levels will occur – from toning muscles or losing weight to building a stronger heart or developing peak performance. These levels of effort are called Target Heart Rate Zones. Here's what they look like on a chart:

TARGET HEART RATE ZONES:	
50-60%	Light Intensity e.g. Daily Activity
60-70%	Light to Moderate Intensity e.g. Weight Management
70-85%	Moderate Intensity e.g. Improved Fitness
85-100%	Heavy Intensity e.g. Competitive Training

Using Target Heart Rate Zones in Training

Working out at heart rates that fall within each zone of effort will help you achieve some specific health and fitness goals:

- **To start improving overall health.** The American College of Sports Medicine and the Centers for Disease Control and Prevention recently recommended that 30 minutes or more of even moderate-intensity physical activity at least three times a week would improve overall health. The "light intensity" zone is indicated by 50-60% of your maximum heart rate. People just starting an exercise program should exercise in this zone.
- **To lose weight or maintain a fit appearance.** This second zone of 60-70% of maximum heart rate is often referred to as the "light to moderate intensity" because the intensity is moderate enough to require your body to use fat as the primary fuel source for the exercise. To lose weight and maintain a fit appearance concentrate on maintaining your heart rate in this zone for 20 to 30 minutes per day, 3 to 5 days per week.
- **To build a healthy heart.** This third zone of 70-85% of maximum heart rate is known as the "moderate intensity." Training in this zone helps you build aerobic endurance and improves cardiovascular fitness. It also constructs a base for more demanding workouts for competition.
- **To develop peak performance for competitive cycling.** At 85-100% of maximum heart rate, this highest level of training can help increase your speed and prepare you to race competitively. It also increases tolerance for the buildup of lactic acid, the primary waste product of anaerobic metabolism in your muscles.

- **Using varied training.** Varied training in all these zones will increase levels of fitness, improve performance, and add more energy to your life. "Most training programs use a combination of training intensities to increase performance capacity," according to J. T. Kearney, Ph.D., Senior Exercise Physiologist at the U. S. Olympic Training Center in Colorado Springs.
- **Beyond Fitness: Stress Management.** Since stress also affects your heart rate, your heart rate can give you valuable feedback for mental well-being. By monitoring your heart rate, you can learn to recognize stressful situations and to control the negative effects with various relaxation exercises.



Using Your Heart Rate Monitor

Your Polar heart rate monitor makes measuring your effort level during cycling workouts convenient and as accurate as an electrocardiogram. The chest band is comfortable and the wireless receiver can be worn like a wristwatch or mounted on handle bars.

Before using your heart rate monitor, you must determine your individual Target Heart Rate Zones. You can do that using the Training Heart Rate Calculator on page 16/17, which takes into account not only your actual or predicted maximum heart rate but also your current fitness level. Methods that use only maximum heart rate can penalize fitter individuals, whose hearts work more efficiently, and go too easy on beginners.

To use the Calculator you need to know two things first:

- 1) your resting heart rate, and
- 2) your maximum heart rate, actual or predicted.

Determining Your Resting Heart Rate

Your resting heart rate indicates your basic fitness level very accurately. The more well-conditioned your body, the less effort and fewer beats per minute it takes your heart to pump blood to your body.

To determine your resting heart rate put on your monitor before you get out of bed in the morning for five days in a row and then average the readings.

Determining Your Maximum Heart Rate

You can determine your maximum heart rate by

- 1) having it tested or
 - 2) using predicted maximum heart rates.
- **Actual testing.** The most accurate way to determine your individual maximum heart rate is to have it clinically tested (usually by treadmill stress testing) by a cardiologist or trained technician. You can test it by time trials supervised by an experienced coach or exercise physiologist. If you are over the age of 35, overweight, have been sedentary for several years, or have a history of heart disease in your family, testing is recommended.
 - **Predicted Maximum Heart Rate.** The easiest option is to estimate your maximum heart rate based on a formula which has been well-established for reliability: take the number 220, and subtract your age in years. If you're 45, for example, 220 minus 45 equals a predicted maximum heart rate of 175.

How to Use the Training Heart Rate Calculator

To use the Calculator to determine your Target Heart Rates for the different levels of effort you will use in your Precision Cycling programs, take a look at the appropriate chart (men or women).



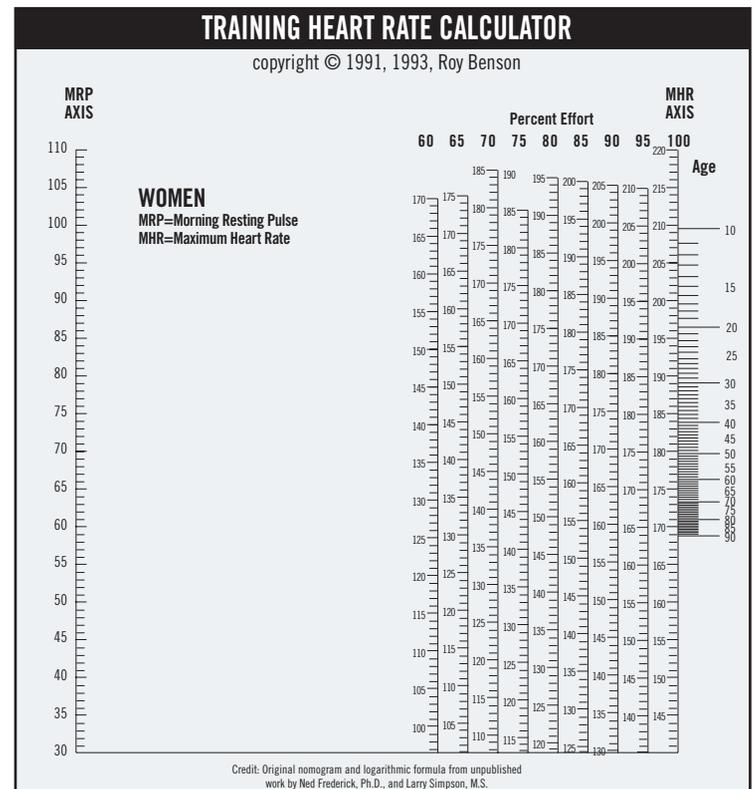
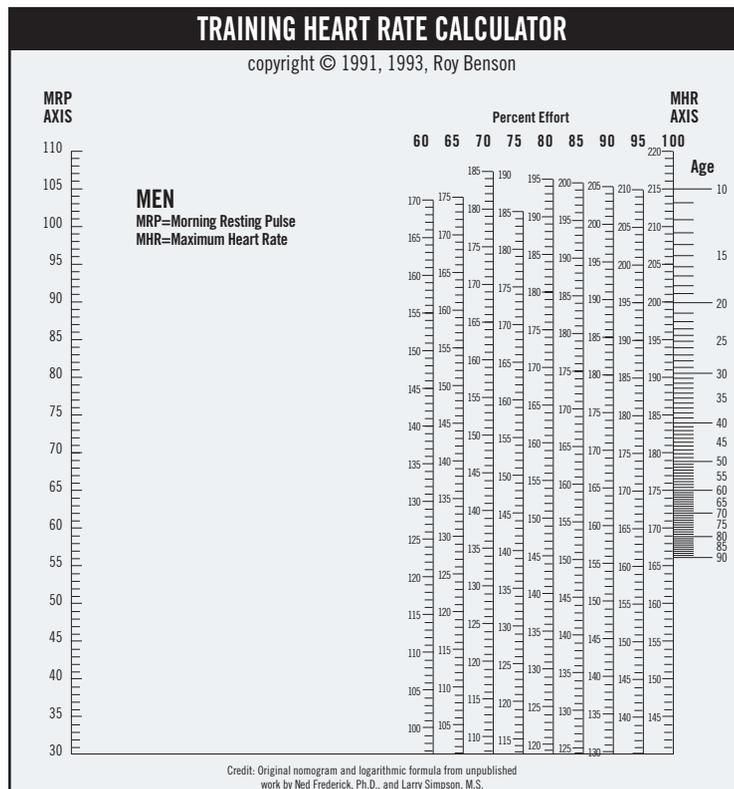
On the far left is an axis labeled "MRP Axis" representing morning resting pulse (heart beat). On the far right is the "MHR Axis" representing "Maximum Heart Rate"; it's been adjusted by age for those using predicted maximums. (Since this calculator has been developed using many recent studies, using the age number will give you a more accurate prediction than the standard formula.) The percentages shown on the vertical axes in the middle of the chart refer to standard Karvonen Intensity Levels and represent the levels of effort recommended in this guide.

To find your individual Target Heart Rates for various levels, draw a line between your morning resting heart rate on the left axis and your age (if using a predicted maximum) or actual maximum heart rate on the right. Where the line crosses the appropriate intensity axis is the approximate heart rate you should target for a workout requiring that intensity level.

Example: As a man, your resting heart rate is 70 bpm and, at age 25 your predicted maximum is 195 bpm. You want to workout at a 60-65% effort. Draw a line from 70 on the left to 195 on the right. It crosses the 60% effort axis at 145 beats per minute, the 65% effort axis at 151 beats per minute. To train at a 60-65% effort, your Target Heart Rate zone is 145-151 beats per minute. Easy.

Use the Calculator to determine your Target Heart Rate zones for the cycling workouts presented in the following pages.

How can you tell if the predicted rates are accurate for you? If, during your workouts, you seem to be working much too hard or not nearly hard enough to reach your target zones, then you may be among the 5-10% of the population whose heart rates are 12-24 beats above or below the average predictions. Get tested and consult with your doctor.



1. PRECISION CYCLING WORKOUTS



Now you're ready to cycle. First some tips for all workouts and then suggestions to help you design your individual workouts.

A Balanced Cycling Workout

Whatever your goals and program for cycling, all your workouts should include three parts:

- Warm-up
- The main aerobic cycling routine
- Cool-down

Together, exercise and recovery comprise fitness conditioning: deny either and you invite injury and minimize benefits. The secret is to know when you are pushing too much or too little. Monitoring your heart rate tells you how much to exercise and when to rest.

Warm-up

A good warm-up will prepare your muscles to cycle, help you perform better, and decrease the aches and pains most people experience. Warm up by cycling slowly until you begin to break a light sweat. Gradually increase your heart rate from a resting level to the target zone level you've selected for the day's workout. This normally takes about 5 to 10 minutes.

In addition, stretching before and after cycling promotes flexibility and decreases the risk of injury and soreness. It also enhances physical performance by allowing you to maintain a comfortable position on the bicycle longer. Stretch your legs, shoulders and lower back before you get on the bicycle.

Aerobic Riding

Vigorous aerobic cycling is the core of your workout program. The intensity of your cycling must be strenuous enough to raise your heart rate into your target zone. For most workouts, this will be between 60% and 80% of your maximum heart rate. Cycling, or any exercise, done in this range is usually called aerobic exercise. It means your body, your heart, and the various exercising muscles are working at a level at which oxygen can be utilized.

One of your challenges as a cyclist will be learning how to ride your bike within the Target Heart Rate Zones that will improve your cardiovascular fitness or help you reach other goals. Chris Carmichael, former professional cyclist and Director of Athlete Development for the U. S. Cycling Team, says that the cadence at which you turn the pedals is critical to keeping your heart rate where you want it.

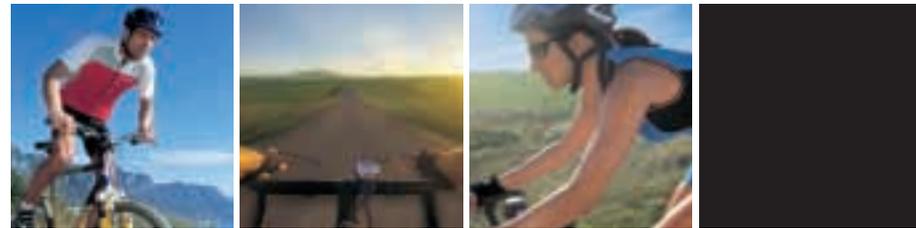
For cardiorespiratory benefit, for example, "You need to pedal close to 90 revolutions per minute," says Carmichael. "When a cyclist first starts, that seems like a lot because you're used to doing 50 to 70 revolutions per minute. So, count your rpm's every now and then."

One revolution is one complete turn of the pedal with one leg. To count your rpm's, simply count how many times one leg turns in a 15-second time period. Your goal is to reach 22 or 23 revolutions in 15 seconds, which is about 90 rpm's.

Maintaining this cadence means you will have to shift your gears. As the terrain or wind changes, you'll move to a larger or smaller gear so you can maintain pedaling at or near 90 rpm's. Experiment to find what cadence keeps you in your target zones. It will take several weeks or months of regular cycling to learn this skill, says Carmichael, but it's worth the effort.

Cool-Down

The cool-down enables your body's cardiovascular system to gradually return to normal, preferably over a 5 to 10 minute period. Bringing your cycling to an abrupt halt can cause light-headedness, since blood will pool in your legs. Lower your cycling intensity and shift to a lower gear and roll around slowly on your bicycle until your heart rate returns to about 20 to 30 beats above your resting level.



What to Wear and Drink

Proper cooling and fluid replacement are crucial to efficient training sessions on a bicycle. Dress not only for comfort, but to deal with heat and cold. Three-quarters of the energy your body is producing is converted to heat rather than energy to help your muscles pedal. On the road, the wind helps you dissipate heat. When the temperature drops below 65°F, use layering and cycling tights. Make sure you drink plenty of fluids during training, ingesting 1 to 1 1/2 bottles per hour depending on the intensity of effort and your sweating rate.

2. CYCLING WORKOUTS FOR BEGINNERS



This training pattern is for those just beginning a serious cycling program. Remember to follow the guidelines for a balanced workout, including warm-up and cool-down.

Day 1: Ride 20-30 minutes at 50-60% Target Heart Rate (THR). Ride a rolling course; keep pedaling on the downhills.

Day 2: Rest.

Day 3: Ride 30-40 minutes at 50-60% THR. Flat road, steady effort, shifting gears as needed to keep the workload constant.

Day 4: Ride 30-40 minutes at 50-60% THR, with 3 three-minute periods of heart rate in the 60-70% THR. Leave at least 5 minutes between the 3 harder efforts. Flat or rolling course.

Day 5: Rest.

Day 6: Ride 20-30 minutes at 50-70% THR. Find a course with two or three hills that will take you about two minutes to climb out of the saddle. You should be close to 70% THR at the top of the hills. Ride easily down the other side, keeping your heart rate above 50% THR.

Day 7: Rest.

3. CYCLING WORKOUTS FOR WEIGHT MANAGEMENT



Regular physical exercise also benefits weight control. If you take in more calories than you use every day, you gain weight. To reduce weight you can take in fewer calories by dieting or increase the amount you use by working harder or exercising.

A combination of cycling and dieting will allow you to stay in caloric balance and is much healthier than just dieting. With cycling, you lose fat, gain some muscle mass and look and feel better. With just dieting, you will feel tired.

With cycling, you can balance your caloric intake with your caloric output. A pound of fat equals 3,500 calories. To lose 1,000 calories per week with exercise, add five sessions in which you burn 200 calories each session.

As you design a cycling training pattern, aim to stay within a Target Heart Rate Zone of about 50-70% of your maximum to maximize your fat burning capacity. You can adjust the sample pattern for beginners or aerobic training to fit your goals.

Here are some general figures for calories burned during cycling. The racing cyclist has a more aerodynamic position, that is why they can go faster for the same metabolic cost.

SPEED (mph)		CALORIES/MINUTE
Racer	Tourist	
27	22.5	24
25	21	19.5
22	18.5	15
19	16	10.5
14.5	12	6
10.5	8.3	3.75

4. CYCLING WORKOUTS FOR AEROBIC TRAINING



This sample training pattern should help you plan your own aerobic cycling program based on the guidelines outlined in "A Balanced Cycling Workout" (p.19).

Day 1: 40 minutes of variable intensity between 60-85% THR. Intense periods closer to 85%, recover fully for about 5 minutes at 60-70% THR, then increase the resistance gradually again. Repeat throughout the workout.

Day 2: Rest.

Day 3: Steady ride for 45-60 minutes at 65-75% THR. Flat terrain.

Day 4: Ride 30 minutes. Terrain with gradual hill. Ride 10 minutes at 75-80% THR; recover the last 20 minutes at 70-75% THR.

Day 5: Rest.

Day 6: Rainy weather. Ride indoors on trainer for 30-45 minutes at 70-75% THR.

Day 7: Club ride of two hours in the 60-85% THR range. Heart rate will vary with terrain, keep the speed steady.

5. CYCLING WORKOUTS FOR INDOOR TRAINING



It's impossible to ride outdoors all the time, and some people prefer stationary cycling. These tips can help you get the most out of cycling indoors.

Getting Started. Cycling indoors is quite different from cycling outdoors. Since there's no wind to keep you cool, set your bike up in the coolest part of the house and use a large fan to blow air across your upper body. Wear lightweight, breathable clothing. Without a cooling system, you'll be overheated in five minutes. Remember to fill your water bottle before the start of your workout.

Music is a personal choice. Make a couple of training tapes of your favorite songs with a strong beat to pedal to. A bike computer to monitor your progress is also highly recommended.

General Suggestions for Workouts. For general conditioning, find a resistance and gear combination that elevates your heart rate into your training zone. After your warm-up, raise your rpm's to 85 to 95 with your heart rate at no more than 85% of your maximum.

For climbing strength and to become accustomed to pushing larger gears, put the bike into a gear or use a mag trainer and increase the resistance that forces you to drop your cadence about 15 rpm's. Maintain this cadence for several minutes and repeat several times during a training session.

For speed work and to work on your anaerobic capacity, intervals on a trainer are just the answer. You can structure interval programs on the trainer similar to those you use on the road. The key is to remember to not overwork.

Specific Workout Examples for Bicycle Trainers

Variations of these workouts can also be used on steppers and rowers.

1. Start with a 10-minute hard effort followed by 2 minutes of easy spinning for recovery. The next interval should be 8 minutes hard, 2 minutes easy. Each hard interval decreases by 2 minutes but increases slightly in intensity. The easy two-minute interval remains the same. The workout ends when you reach 2 minutes hard and 2 minutes easy.
2. Ride progressively harder gears while increasing your heart rate. Start in a relatively low gear for 1 to 2 minutes (keeping the same cadence), then shift to the next higher gear, maintaining your cadence, etc. When you're finished in the highest gear you plan to ride, ride back "down the ladder," one gear at a time. Usually, riding up 4 to 5 gears is sufficient for a good workout. Or raise your heart rate from 60%, to 65%, to 70%, to 75% in two-minute segments.
3. There are dozens of variations on workout 2. Hard gear, easy gear, back to hard, up 2 gears, down 1, etc. You can also vary the cadence, increasing it to 110 to 120 rpm's for a minute or so, but always keeping it above 80 rpm's.
4. To develop speed, throw in some intervals: 10 to 12 all-out 15-second pedaling sprints alternating with 45 seconds of easy pedaling.
5. To develop power, try 3 to 6 repetitions of 3 minutes at 90 rpm's in a big gear, with 3 minutes of low gear spinning between efforts.
6. Do an endurance ride at a specific heart rate zone. For example, to workout at 75-80% of your maximum for a good aerobic workout use the following:

- Warm-up for five minutes, starting with low to moderate gears and gradually raise your rpm's or gearing until your heart rate reaches 75% MHR.
 - For the next 30 minutes keep your heart rate within your 75-80% target heart rate zone.
7. A heart rate hill climbing workout. During this workout you will slowly increase your heart rate at timed intervals as if you were climbing a hill.
 - Warm-up for a few minutes.
 - For the next minute, increase your heart rate until it reaches 60% MHR. (For example, about 120 bpm for someone with a maximum heart rate of 188.) Then for the next five minutes, by increasing rpm's or gearing, increase your heart rate by 1 beat every minute until you reach 65% MHR (125 bpm for our example).
 - After a minute at 65%, return to a lower resistance and wait until your heart rate returns to your base (warm-up) heart rate.
 - Increase the resistance until your heart rate hits 75% MHR in about 1 minute (our example: 145).
 - Ride at a heart rate of 75% MHR for 5 minutes.
 - Increase your heart rate to 80% MHR for about 3 minutes (our example: 150 bpm).
 - Increase your heart rate to 85% MHR for about 1 to 2 minutes (our example: 155 bpm).
 - For the last 30 seconds increase your heart rate to above 85% MHR (our example: 160-170 bpm). You have reached the top of the hill.
 - Lower the resistance as if you were going down the other side, and let your heart rate return to base.
 - Depending upon your experience and fitness you may want to repeat this sequence several times during a workout.

6. ADVANCED TRAINING TIPS



The heart rate monitor is an excellent tool for those in serious training and competition. Like Andy Hampsten and Lance Armstrong, who've used heart rate monitors to help them reach top racing form, it can help you adjust cycling workouts, improve race performance and evaluate equipment.

The Heart Rate Monitor as a Private Coach

Here are some tips to help improve cycling workouts.

Resting Heart Rate: Strap your Polar heart rate monitor on at night, and the next morning you'll have a good baseline to go by. Use this number to monitor your body for signs of overtraining or incomplete recovery. Any major deviations from the norm may indicate that you need extra rest.

Easy Days: Many athletes are more likely to exercise too hard than to under-work in training. But overtraining will ultimately lead to diminished performances rather than success in competition. On days when you should be taking it easy from a hard interval or distance workout, take a tip from Ray Browning, winner of the Vail Mountain Man and Canadian Ironman, and use your Polar heart rate monitor to hold yourself back.

Hard Days: The heart rate monitor can also prevent you from training too hard on hard days. On long climbs, if your heart is working too hard, the wireless heart rate monitor will beep, telling you to slow down to your ideal heart rate range.

Intervals: Get the most from your interval training program by using your heart rate monitor. You will know your maximum speed and cadence during the work interval along with your heart rate. It will also help you recover properly between repeats by telling you exactly when your heart rate has slowed to the proper level of recovery before you begin your next repeat. If you ride your repeats without adequate recovery, you will not be able to ride

each one at your best effort (you'll notice a drop in your speed and cadence), and you'll benefit less from the workout.

Comeback From Injury: If you have been off the bike because of injury or illness, the monitor will help you gradually work your way back to fitness. It helps highly motivated athletes from overdoing it too early.

Post-Exercise Recovery: One of the best indicators of fitness is the ability to recover and return to normal heart rates following exercise. Record your heart rate at one, two and five minutes following exercise. As the weeks pass, you will see a more rapid return to your resting heart rate. Then, if you notice an unusual rate of recovery, (such as your heart rate staying elevated longer than normal), you might conclude that your training effort was more intense than you had planned, and you can adjust your next workout accordingly.

Technique: Find a hill about one mile long. Mark the beginning and end. Ride the hill in your normal riding position and gearing. Time yourself and record your cadence and heart rate during the whole effort. Ride the section again using different techniques. Use a bigger gear, pedal at a higher or lower cadence, climb in and out of the saddle. Through this process you will determine the most efficient technique for climbing (the fastest method for the same energy expenditure). The same procedure can be used for time trial training.

Improved Race Performance

A heart rate monitor is also a valuable tool during competition. During a race, the monitor can be used to judge when you should push and when you shouldn't.

Racing: During time trials, breakaways or hill climbs, use a heart rate monitor to determine if you are going into anaerobic debt or your rpm's are too low. For example, by not pushing too hard you may be able to save yourself from "blowing up" on a climb, which will enable you to catch the group on the descent. In last year's Tour de France many of the big stars added heart rate monitors to their accessory list. Tony Rominger, Andy Hampsten and Lance Armstrong are all using heart rate monitors – and not just in the time trials. "Many times they used them for the long climbs and long stages to gauge their bodies' effort. It's insurance," says Massimo Testa, M. D., physician to the Motorola Cycling Team.

Before the race: On important race days, wear your wireless heart rate monitor from the time you get up until the race is over. Just wearing a monitor will probably remind you to relax, and it will also give you feedback about how uptight you're getting before a race. Remember, it's best to use your limited energy for racing, not worrying about the race before it happens.

Time Trials: Factors such as temperature, wind, humidity, altitude and terrain can vary from course to course and affect intensity. A heart rate monitor allows you to measure intensity by monitoring heart rate along with speed, distance, time and cadence. By riding at your anaerobic threshold you will finish the event with maximum effort and not "blow-up" by riding too fast.

Long Hill Climbs: Pacing yourself on long climbs is important. When the tough climbing begins, you have to stay within your limits. If the group puts you at your maximum threshold right away and then starts pulling away, you have to back off to within your anaerobic threshold. If you are constantly surging and your heart rate closes in on maximum trying to stay with the leaders, you're going to blow up and slow down much more than if you back off just a little but maintain a strong, steady tempo.

Race Feedback: Use the data you collect in racing to better design your training sessions. If you get dropped in breakaways, design your interval training sessions to incorporate longer intervals at higher heart rate intensities. If you get beat in the loss contact on long climbs, work on your power and climbing technique while riding at your anaerobic threshold.

Fast Decisions

Manufacturers often claim that their cycling equipment or how they position you on the bike will make you go faster during competition. In lieu of this, look at the efficiency of your cycling while using a specific piece of equipment. A heart rate monitor can help you evaluate equipment, especially when you use the heart rate and speed data. Following are some ideas:

Equipment: To evaluate new handlebars, wheels or tires on the bike, ride a known loop with different pieces of equipment and review your heart rate while riding at the same speed. This method will give you an idea of which pieces of equipment are faster for the same intensity or energy output.

Position: Use the heart rate monitor to help you find a good all-around aerodynamic position that is both efficient and comfortable, that will improve your speed without increasing your energy cost. While some positions may be more aerodynamic for you, they may restrict your breathing or increase your energy cost because they require you to use more of the muscles of the back to support your position. Once again on a loop, check out various positions against speed and heart rate. The more aerodynamic positions will allow you to ride faster laps, when you ride at a constant heart rate.

Remember to test position changes only after several days or weeks of practice in the new position; testing too soon will probably net a slower performance. If after several weeks you see a significant increase in speed without a rise in heart rate, you are on the right track to a faster position.



7. HOW TO STAY MOTIVATED



Maintaining consistent training habits is the biggest challenge of any training program, especially if the benefits of the program are not apparent until after several weeks of specific training or the next racing season.

While the wireless heart rate monitor is a great motivational training tool, many cyclists and triathletes use additional training incentives such as these:

- A. Keep a Training Diary to help you monitor your progress objectively.** Besides your training information, you can record your morning resting heart rate, your body weight, how you feel and other activity or exercise you incorporate into your exercise program. Record the program ridden, time or distance ridden during the training session and your heart rate.
- B. Establish a Definite Place and Time to Ride.** Write down in your daily appointment calendar when you will exercise – and keep it just like any other appointment. Use exercise to help relax from work or break up the day.
- C. Set Realistic Goals.** You must establish short- and long-range goals for your fitness program to give your yearly program purpose and direction.

Finally, remember that self-discipline must be the base of your training program. There may be days when you feel too busy to fit in your training session. Recognize that those days will come, and that exercise is an important part of your everyday lifestyle.

See you on the road. I hope that you will have your Polar wireless heart rate monitor on, because I'll have mine on for sure.

ABOUT POLAR



Whatever your motivation for exercise is, you'll reach your target best if you measure your heart rate. It's the fastest and most accurate way to get feedback from your body while exercising. A Polar heart rate monitor guides you to do your exercise and training right, in the most effective way.

If you have a reason for exercising or training, you have a reason for Polar.

List of Features

-  Displays your heart rate, average heart rate and exercise duration to keep track of your progress.
-  Displays your heart rate as bpm and % of HR_{max}, average heart rate and exercise duration.
-  Automatic determination of your individual target heart rate zone with high and low options.
-  Automatic determination of your individual heart rate target zone limits.
-  Counts and displays calorie expenditure (M71ti and A5) and the fat % of calories expended (M91ti, M62, M61, M32 and M31).
-  Avoids cross-talk with other heart rate monitors.
-  Measures your fitness level with Polar Fitness Test™ (M-series). Polar Fitness Test™ defines your maximal oxygen uptake (S-series).
-  Settings for two users.
-  Automatic determination of your age-based heart rate target zone limits.
-  The world-famous walking test by UKK-institute and Polar.
-  Body Mass Index. The world-famous weight indicator.
-  Time of day, weekday and alarm function.
-  Sports watch features – ability to record 99 lap times and files (S810i, S720i, S710i, S610i, S410, S210) ability to record 50 lap times and files (S150) and 60 laptimes and files (S120).
-  Exercise profile – Allows you to set 7 exercise profiles for multi-phase exercise sessions with HR target zones and recovery calculation. Records complete files of the exercises.
-  Allows you to set exercise sets for interval training with HR target zones and recovery calculation. Exercise files are recorded for further details.
-  Speed, optional cadence and power output sensors (S720i and S710i). Speed and optional cadence sensors (S520 and S510). Speed and distance (S150).
-  Shows and records altitude and temperature information.
-  Relaxation rate indicates the state of your physical recovery, online connection with PC.
-  Infrared communication allows two-way exchange of exercise sets and exercise data with PC.
-  Allows you to upload exercise settings from computer with UpLink™ and to download exercise data to a computer with SonicLink™.
-  Visit www.polar.fi to upload exercise settings and monitor icons.

Cycling Sports

Running Sports



Fitness

m71 ti™



m91 ti™



a5



a3



m61™



m62™



F2



F1



m31™



m32™



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Polar Bike Mount™

Universal receiver mounting unit.



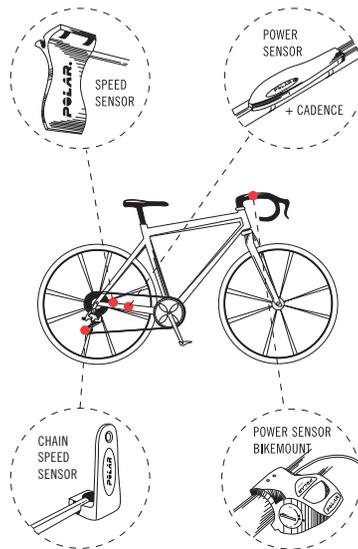
Polar Speed and Cadence Sensors™

Extras for the world of cycling.



Polar Power Output Sensor™

Link technique with sport performance. These Polar S720i and Polar S710i accessories help to control power output.



Polar Precision Performance™ software

STORE, ANALYSE, REPORT, TEST, PLAN, SEND BY E-MAIL AND MORE...

Included in the purchase of Polar S810i, S720i, S710i, S610i, S520, S510 and S410 is Polar's ground-breaking analysis software Polar Precision Performance.

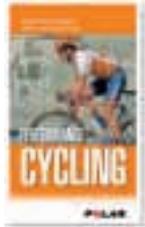
With this software you can

- easily gather and study the data your heart rate monitor provides
- send settings, reminders and other instructions from your PC to your heart rate monitor
- build a personal resource of past routines, reports and performance details
- learn about your Polar S-series heart rate monitor by using Show me demo
- get valuable information by reading Polar Precision booklets (included on CD rom)



Polar Precision Performance software is also available separately.

POLAR LIBRARY



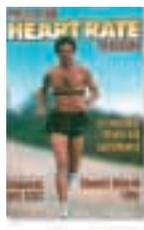
Performance Cycling
by Adrie van Diemen,
Jabik-Jan Bastiaans



Precision Running
by Roy Benson
MPE



Precision Walking
by Mark Fenton,
Dave McGovern



Precision Heart Rate Training
by Edmund R. Burke, PhD



Precision Football
by Paul D. Balsom



Let's beat them in Ice Hockey
by Erkkka Westerlund,
Raimo Summanen

Suggested Readings:

Burke, Edmund. *Cycling Health and Physiology*. Brattleboro, VT, Vitesse Press, 1992.

Burke, Edmund, and Harvey Newton. *Cycling Stronger*. Performance, Inc., 1993.

Carmichael, Chris and Edmund Burke, *Fitness Cycling*. Human Kinetics Publishers, 1994.

Edwards, Sally. *The Heart Rate Monitor Book*. Port Washington, NY, Polar CIC, Inc., 1992.

Sleamaker, Rob. *Serious Training for the Serious Athlete*. Champaign, IL, Human Kinetics Publishers, 1989.



"The wireless heart rate monitor has the potential to revolutionize training for health, fitness and competition. I can't emphasize enough how important it is to get a correct understanding of the subject across to athletes and fitness conscious people everywhere."

Massimo Testa, M.D.

Physician to the Motorola Cycling Team

Cycling is one of the most popular and effective ways to get in shape and stay healthy. About 80 million Americans already enjoy the benefits of cycling, and every day more and more people start their own cycling programs.

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