FIRSTBEAT
NEW FEATURES ON GARMIN
FENIX 5, FR935
## FIRSTBEAT PHYSIOLOGICAL FEATURES IN NEW GARMIN PRODUCTS

<table>
<thead>
<tr>
<th>Feature</th>
<th>fenix 5</th>
<th>FR935</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaerobic Training Effect (new)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aerobic Training Effect</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Training load (new)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Training status (new)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Calories burned</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>VO2max</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Performance condition</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lactate threshold</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Functional Threshold Power (FTP)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Recovery Time Advisor</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>HRV Stress Test (3min Stress Score)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
AEROBIC & ANAEROBIC TRAINING EFFECT

The complete picture of your workout
TRAINING EFFECT

Key benefits:
Understand how different workouts influence your performance
Ensure that training activities match desired outcomes

Aerobic Training Effect
Reveals the benefit of the exercise to your aerobic fitness level (VO2max).
Best improved with steady paced, longer duration efforts below VO2max.

Anaerobic Training Effect
Reveals the benefit of the exercise for your ability to perform efforts at very high intensity.
Best improved with high intensity (above VO2max) interval training.

Improving Aerobic Fitness
You improved your cardiorespiratory fitness during this activity. Well done!

Maintaining Economy and Anaerobic Fitness
Moderate periods of anaerobic effort during this activity helped you maintain your anaerobic fitness and economy of motion.

Aerobic

Anaerobic

Training Effect
4.0 Aerobic | 2.5 Anaer.
WHY TO MONITOR ANAEROBIC EFFECT OF TRAINING?

For endurance performance, aerobic training is the most important...

...but it is not only about VO2max and lactate threshold

Speed, power, economy of movement and anaerobic capacity are important

Improving these requires explosive training, e.g., high intensity intervals

Athletes need to be able to measure and understand all the effects of the workout to make well-informed training decisions

Modified from Paavolainen et al Journal of Applied Physiology 1999
## TRAINING EFFECT: IMPORTANT NOTES

<table>
<thead>
<tr>
<th><strong>Aerobic TE</strong></th>
<th><strong>Anaerobic TE</strong></th>
<th><strong>Both anaerobic &amp; aerobic TE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Aerobic metabolism can be best impacted with steady paced efforts or long intervals (&gt;3min) at moderate to hard intensity below VO2max</td>
<td>• Anaerobic metabolism can be best impacted with repeated high-intensity intervals of 10 to 120 seconds (above VO2max)</td>
<td>• Can provide feedback for any type of activity where HR is available</td>
</tr>
<tr>
<td>• These type activities produce aerobic TE</td>
<td>• These type of activities produce anaerobic TE.</td>
<td>• Can be calculated using optical or ECG (chest belt) sensors.</td>
</tr>
<tr>
<td>• Aerobic TE is the same TE that already existed in Garmin devices</td>
<td>• Anaerobic TE can be calculated using only HR. When available, running speed / cycling power can enhance the calculation by fine-tuning the identification of time spent above VO2max</td>
<td>• Feedback becomes increasingly personalized over time based on VO2max and training activity data.</td>
</tr>
<tr>
<td>• 19 different verbal phrases for detailed interpretation</td>
<td>• 16 different verbal phrases for anaerobic effect</td>
<td>• Both TE’s are based on modeling of EPOC (excess post exercise oxygen consumption), which describes the general disturbance of homeostasis brought on by the activity.</td>
</tr>
</tbody>
</table>
EXAMPLE: ANAEROBIC TE ACCUMULATION

1. Reps well below VO2max intensity = No Anaerobic TE accumulation
2. Reps at VO2max intensity = Some Anaerobic TE accumulation
3. Reps well above VO2max intensity = High Anaerobic TE accumulation
# Example Workouts and Expected Aerobic & Anaerobic TE

<table>
<thead>
<tr>
<th>Workout</th>
<th>Expected Aerobic TE &amp; Feedback</th>
<th>Expected Anaerobic TE &amp; Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long slow distance</td>
<td>2.0-2.9&lt;br&gt;Maintaining Aerobic Base</td>
<td>Below 1.0&lt;br&gt;No Anaerobic Benefit</td>
</tr>
<tr>
<td>Steady pace close to lactate threshold</td>
<td>3.5 or higher&lt;br&gt;Improving Lactate Threshold</td>
<td>Below 2.0&lt;br&gt;Minor Anaerobic Benefit</td>
</tr>
<tr>
<td>Lactate threshold intervals</td>
<td>3.0 or higher&lt;br&gt;Improving Lactate Threshold</td>
<td>Below 3.0&lt;br&gt;Maintaining Anaerobic Fitness</td>
</tr>
<tr>
<td>Speed training&lt;br&gt;10 x 50m x 150-200%VO2max / 3min recovery</td>
<td>Below 2.0&lt;br&gt;Minor Aerobic Benefit</td>
<td>2.0-2.9&lt;br&gt;Maintaining Fast Force production</td>
</tr>
<tr>
<td>Extensive intervals&lt;br&gt;10 x 400m at 100-105%VO2max / 2min recovery</td>
<td>Below 4.0&lt;br&gt;Improving Aerobic Fitness</td>
<td>3.0-3.9&lt;br&gt;Improving Economy and Anaerobic Base</td>
</tr>
<tr>
<td>Intensive intervals&lt;br&gt;10 x 400m at 110-115%VO2max / 2-3min recovery</td>
<td>Below 4.0&lt;br&gt;Improving Aerobic Fitness</td>
<td>4.0 or higher&lt;br&gt;Highly Improving Anaerobic Fitness</td>
</tr>
<tr>
<td>800m run race</td>
<td>2.0 or higher&lt;br&gt;Maintaining Aerobic Fitness</td>
<td>2.5 or higher&lt;br&gt;Maintaining/Improving Anaerobic Fitness</td>
</tr>
<tr>
<td>5K run race</td>
<td>3.5 or higher&lt;br&gt;Improving VO2max</td>
<td>Below 2.0&lt;br&gt;Minor anaerobic benefit</td>
</tr>
<tr>
<td>10 run race</td>
<td>4.0 or higher&lt;br&gt;Highly improving VO2max / Overreaching</td>
<td>Below 2.0&lt;br&gt;Minor anaerobic benefit</td>
</tr>
</tbody>
</table>
BACKGROUND PHYSIOLOGY: ENERGY FOR EXERCISE

IMMEDIATE ALACTIC (Pc + ATP)

1. Shot put
2. 100m run
3. 400m run
4. 800m run
5. 3000m run
6. 10K run
7. ½ marathon
8. Marathon

VO2max intensity
Lactate threshold intensity / FTP

% OF MAXIMAL ENERGY PRODUCTION

100% 0%

IMMEDIATE ALACTIC (Pc + ATP)

ANAEROBIC (GLYCOLYSIS: LACTATE)

1. Shot put
2. 100m run
3. 400m run
4. 800m run
5. 3000m run
6. 10K run
7. ½ marathon
8. Marathon

OVERALL ENERGY

AEROBIC (OXIDATIVE)

10s 30s 2min 30min 60min 3h TIME
TRAINING LOAD

Train hard and smart
TRAINING LOAD

Training load
A single metric that reports the combined total load of your recent training activities. Measures load from all sessions, both aerobic and anaerobic.

Key benefit
See when your training efforts are optimal or if sessions are consistently too easy or hard.
WHY MONITOR TRAINING LOAD?

- Workouts stimulate your body
- Between workouts your body recovers and adapts to better prepare for future efforts

**EXAMPLE A:** Consistently high loading does not allow recovery
Fitness does not increase.

**EXAMPLE B:** No workouts, no stimulus, no fitness level improvements

**EXAMPLE C:** Optimal load via workouts
Optimal amounts of rest
Optimal fitness improvement
TRAINING LOAD: IMPORTANT NOTES

Where does it apply?

• Training Load accounts for all monitored activities where HR data is available
• Accounts for both aerobic and anaerobic workouts
• VO2max and training histories are used to reveal your personalized optimal Training Load

Technical

• Requires a stable VO2max estimate established over the course of a few runs / rides
• Reports total physiological impact (EPOC) of all workouts recorded during the past 7-day rolling window
• Optimal Training load range is personal: More fit and trained will have higher requirement for optimal range, and vice versa.

• Optimal range is adjusted automatically in the background.

**TRAINING LOAD EXAMPLE**

![Graph showing weekly training load from 1 to 17 days with different EPOC values for Low, High, and Optimal ranges.](image-url)
Know your
TRAINING STATUS
Coach yourself effectively
TRAINING STATUS

Training Status
Objective analysis of your recent training load and fitness level
Tells you how effectively your body is responding to training

Key benefit
Know your current Training Status and plan future training smarter...
...and continue improving your fitness level

Your Training Status can be:
TRAINING PLANNING: WHY KNOWING CURRENT STATUS IS IMPORTANT?

Training planning is simple in theory...

...but difficult in practice

Typical problems
- Is training productive or not?
- Are you overtrained or undertrained?
- Why performance plateaus, decreases?
- No variation in training, too monotonous?
- Other life stress, illness, injury?
- How and when to plan recovery periods?
- Is recovery sufficient to peak performance?

Important training decisions should be based on measured results – not just instincts
SUPERCOMPENSATION THEORY OF TRAINING

1. Each workout temporarily decreases performance (fatigue)
2. Performance increases occur during recovery
3. Trained athletes need bigger impacts to improve through overreaching
4. High prolonged loading with insufficient recovery may lead overtraining
Ultimately, only measured changes in fitness level can tell if training is productive or not. That’s why we need to measure 4-week Training Load history.
Where does it apply?

- All workouts in all sports with HR are accounted for Training Status
- Fitness level trend taken from runs/rides with VO2max estimate
- Minimum of two such runs/rides with VO2max estimate during past 14 days is required to calculate your Training Status

Technical

- Requires one week of training with two runs/rides producing VO2max estimate
- Available with optical HR
- For mixed running/riding, VO2max trend is based on the dominant sport with most VO2max estimates
TRAINING STATUS EXAMPLE

- Optimal Training Load + Increase in fitness = Productive
- High Training load + decrease in fitness = Overreaching
- Decreasing Training load after a higher load + increase in fitness = Peaking
<table>
<thead>
<tr>
<th>STATUS</th>
<th>DESCRIPTION</th>
<th>FITNESS</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detraining</td>
<td>Detraining occurs when you are training much less than usual for a week or more, and it is affecting your fitness level.</td>
<td><img src="#" alt="Graph" /></td>
<td>You can try increasing your training load to see improvement.</td>
</tr>
<tr>
<td>Unproductive</td>
<td>Your training load is at a good level, but your fitness is decreasing. Your body may be struggling to recover.</td>
<td><img src="#" alt="Graph" /></td>
<td>You should pay attention to your overall health including stress, nutrition, and rest.</td>
</tr>
<tr>
<td>Productive</td>
<td>Your current training load is moving your fitness level and performance in the right direction.</td>
<td><img src="#" alt="Graph" /></td>
<td>It is important to plan recovery periods into your training to maintain your fitness level.</td>
</tr>
<tr>
<td>Peaking</td>
<td>Peaking means that you are in ideal race condition. Your recently reduced training load is allowing your body to recover and fully compensate for earlier training.</td>
<td><img src="#" alt="Graph" /></td>
<td>You should plan ahead, since this peak state can only be maintained for a short time.</td>
</tr>
<tr>
<td>Maintaining</td>
<td>Your current training load is enough to maintain your fitness level.</td>
<td><img src="#" alt="Graph" /></td>
<td>To see improvement, try adding more variety to your workouts or increasing your training volume.</td>
</tr>
<tr>
<td>Overreaching</td>
<td>Your training load is very high and counterproductive. Your body needs a rest.</td>
<td><img src="#" alt="Graph" /></td>
<td>You should give yourself time to recover by adding lighter training to your schedule.</td>
</tr>
<tr>
<td>Recovery</td>
<td>Your lighter training load is allowing your body to recover, which is essential during extended periods of hard training.</td>
<td><img src="#" alt="Graph" /></td>
<td>You can return to a higher training load when you feel ready.</td>
</tr>
<tr>
<td>No status</td>
<td>The device needs one or two weeks of training history, including activities with VO2 max. results from running or cycling, to determine your training status.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Firstbeat is the leading provider of physiological analytics for sports and well-being. We transform heartbeat data into personalized information on exercise, stress and recovery.

Hundreds of elite sports teams, wellness professionals, and millions of consumers worldwide trust Firstbeat to enhance performance and well-being.

Firstbeat has developed revolutionary analytics technology that creates a digital model of user’s physiology through advanced modelling of heart function and heart rate variability (HRV).

The background of Firstbeat is in exercise and physiological sciences and our products are based on physiology research.

Read more: