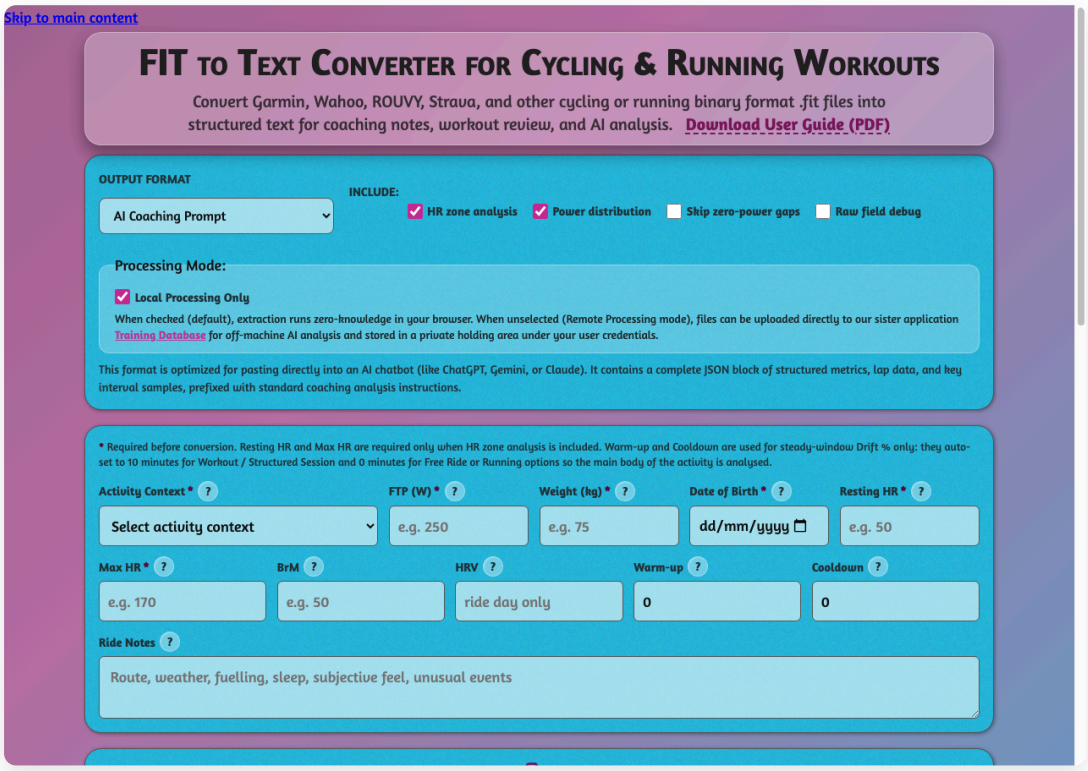
FIT to Text Converter & Performance Dashboard

USER GUIDE

Guide Version 1.2 – covers development application version 8.9.04

Welcome to the **FIT to Text Converter & Performance Dashboard**. This document serves as your comprehensive operational manual and scientific reference guide.



This utility bridges the gap between binary training files and deep, structured training analysis. It is designed to process physical activity records and translate them into visual feedback, human-friendly coaching summaries, and highly structured prompts for artificial intelligence.

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I. Overview

The **FIT to Text Converter** is a browser-based, client-side utility designed to process binary workout files (.fit) exported from modern cycling computers, smart fitness equipment, sports watches, or indoor training applications.

1. Privacy First & Processing Modes (Local vs. Remote)

Most fitness analysis platforms require you to upload your personal activity data to remote cloud servers. This utility uses a **Privacy-First Architecture** with explicit user control over data processing and transmission modes.

Under **Report Options**, you can toggle the **"Local Processing Only"** setting:

- **Local Processing Only (Checked / Default):**
- **Zero Cloud Transit:** Parsing, physiological calculations, and dashboard rendering execute entirely inside your web browser via client-side JavaScript. Your binary files, physiological baselines, and GPS coordinates never leave your device.
- **Local Download Action:** Clicking **"Download ALL files"** packages and downloads your telemetry prompt `.txt` and graphic dashboard `.png` directly to your local file system.
- **Local Storage:** Athlete profiles and settings are saved locally in your browser's secure cache.
- **Remote Server Processing Mode (Unselected):**
- **Sister Application Staging Intake:** Unchecking "Local Processing Only" allows transmitting activity telemetry directly to our sister application **Training Database** for off-machine AI analysis and long-term activity staging.
- **Remote Upload Action:** The action button dynamically switches to **"Upload ALL Files to Training Database"**, opening an explicit privacy consent boundary dialog prior to any payload transmission.

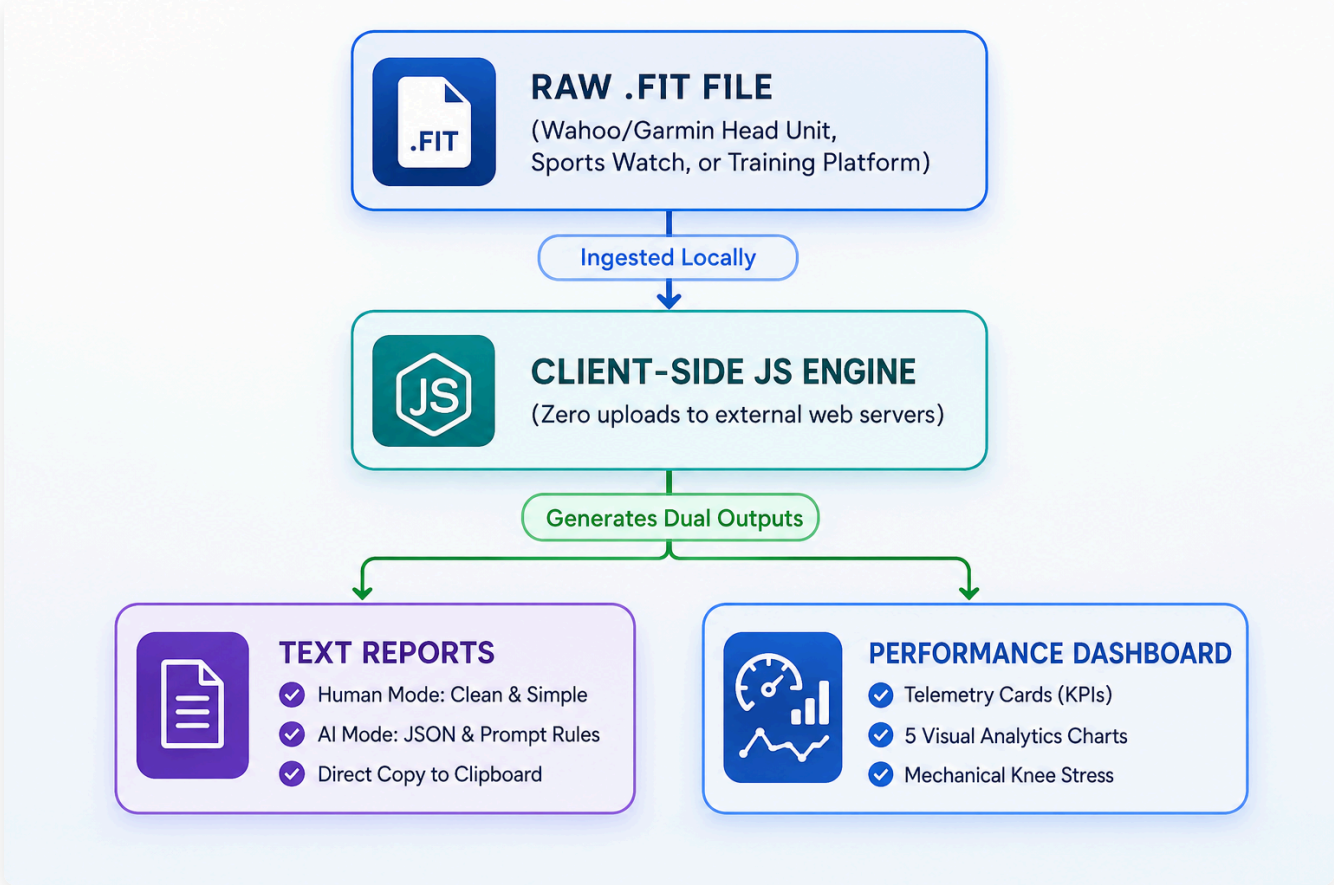
2. Gender-Neutral Baseline Model

The physical calculations, zone ranges, and coaching templates used in this tool are currently **Gender Neutral**. While the parsing engine and default prompts may be updated in a future release to tailor physiological evaluations, recovery curves, or relative performance metrics to specific gender profiles, the current version applies a unified mathematical standard to all uploaded activities.

3. The Dual-Output Engine

Upon ingesting your training file, the tool splits the data into two distinct, high-value interfaces:

- **The Text Reports (Dual Human & AI Options):** The tool generates two completely separate text configurations depending on who is reviewing the ride:
- **Human-Readable Report:** A clean, classic markdown layout detailing your performance metrics and subjective ride notes. It is entirely stripped of code formatting, JSON data blocks, or machine instructions, making it ideal for on-screen reading, printing, or emailing directly to your human coach.
- **AI-Ready Text Report:** An optimised, machine-readable payload designed to be pasted directly into Large Language Models (LLMs) like ChatGPT, Claude, or Gemini. Unlike the human version, this option includes a structured JSON metadata block and a set of default system-level instructions that guide an AI agent on how to correctly interpret and analyze your performance.



- **Interactive Performance Dashboard:** A visual analytical suite featuring clear telemetry cards, cardiovascular and muscular zone distributions, and a specialised joint-health stress model.

4. Output Format "Include Options"

Next to the output selection, you will find a series of checkboxes that allow you to customise what data is calculated, displayed, and packaged.

- **HR Zone Analysis:** Controls whether heart rate zone analysis is calculated and included in your output summaries.
- *Behaviour:* When active, the tool maps your heart rate data to your 5 target training zones (Z1 Recovery up to Z5 VO2 Max) to show exactly how much time you spent in each cardiovascular range.
- *UI Impact:* Unchecking this box hides the Heart Rate Zone Distribution pie chart on the dashboard. It also updates the profile settings, making the "Resting HR" and "Max HR" fields optional rather than required.
- **Power Distribution:** Controls whether power zone analysis is processed and rendered.
- *Behaviour:* When checked, the engine compares your ride power telemetry against your configured FTP to calculate your training time across the 7 Coggan power zones (Z1 Active Recovery to Z7 Neuromuscular).
- *UI Impact:* Unchecking this box removes the Power & FTP Zones distribution chart from the dashboard and hides the corresponding power tables in the text reports.
- **Skip Zero-Power Gaps:** Excludes coasting periods (any records where power is 0 Watts) from your averages and intensity scores.
- *Behaviour:* When enabled, any second of the ride where you are not actively turning the pedals (0 W power) is filtered out of your average power and training intensity calculations.
- *Coaching Value:* This is incredibly useful for real-world outdoor rides. Stops at traffic lights, busy junctions, and long descents would otherwise drag down your average power, skewing your Intensity Factor (IF) and Training Stress Score (TSS). Checking this option allows coaches to analyse your true active pedalling intensity.
- **Raw Field Debug:** Appends a raw binary developer log to the very bottom of the generated text reports.
- *Behaviour:* When active, it outputs parser warnings, raw file structure details, and byte-level diagnostic data.
- *Practical Use:* This is intended for developer troubleshooting when a custom or corrupted FIT file (ie from an obscure third-party application) behaves erratically. It helps identify corrupted data points or unrecognised manufacturer fields. Keep this unchecked for normal coaching exports to optimise and reduce your AI token usage.

II. On-Screen Settings & Inputs

The accuracy of your dashboard's charts and the validity of any coaching advice depend entirely on your configuration. To ensure your metrics align with your physiology, configure the following inputs in the order they appear on your screen:

1. Primary Athlete Profile & Limits

- **Activity Context (Mode):** Governs how mathematical averages are filtered based on your environment.
- **Cycling - Free Ride (Indoor Simulation) & Free Ride (Outdoor / Real World):** Two variants of unstructured riding, selected depending on whether the session was recorded on an indoor smart

trainer/simulator or outdoors in the real world. Both apply the same filtering logic: if power telemetry is available, the engine calculates average cadence only when power is greater than 0 Watts to filter out "coasting." If power is missing, it falls back to averaging all non-zero cadence points. On the dashboard, the sixth KPI card shows Gear Shifts (F/R) whenever an electronic groupset is detected in the file; if no electronic shifting data is present, both Free Ride variants fall back to an Avg/Max Speed card instead.

- **Cycling - Workout / Structured Session:** Tailored for structured interval sessions. Cadence calculations include all zero values to ensure rest intervals are factored into the session workload. On the dashboard, the sixth KPI card shows Gear Shifts (F/R) when an electronic groupset is detected; otherwise it falls back to showing ride Duration.
- **Running - Outdoor Running:** Unstructured, GPS-tracked outdoor runs utilising pace-based metrics.
- **Running - Treadmill / Indoor Running:** Indoor treadmill runs, which typically lack GPS data and instead rely on the treadmill's own pace/speed and incline readings.

> **NOTE:** Running analysis is currently in a baseline phase. Further enhancements to metrics like gait dynamics and running power correlation are planned for future updates once cycling analytics have fully matured.

- **FTP (Functional Threshold Power) (W):** This is your primary metabolic datapoint. It represents the maximum steady-state power you can theoretically maintain for one hour. This baseline governs your training intensity boundaries, Intensity Factor (IF), and Training Stress Score (TSS).
- *Critical Notice:* If you do not know your current FTP, **you must perform a standard FTP test** (such as a 20-minute field test or a ramp test) to establish this baseline. Guessing or estimating your FTP will invalidate your visual power zones, stress scores, and downstream AI coaching analysis.
- **Athlete Weight (kg):** The primary mass metric used across multiple equations. It acts as the denominator for calculating your power-to-weight ratio (W/kg), pedal force distribution, and relative joint load.
- *Example:* For a 75kg athlete, a steady output of 225W equates to exactly 3.0 W/kg.
- **Date of Birth (DoB) / Age (years):** Used to calculate your age to build demographic baseline summaries and perform safety checks. If your Max HR settings differ significantly from the age-predicted Max HR (using the Tanaka formula: Max HR = 208 – 0.7 × Age), the app will display a sanity check modal to confirm your parameters.
- **Resting Heart Rate (bpm):** Your lowest heart rate measured at complete rest.
- **Max Heart Rate (bpm):** The highest heart rate you can safely achieve under maximum physical exertion.
- *Linking Resting & Max HR:* The tool links your Resting HR and Max HR together using the Heart Rate Reserve (HRR) formula to establish your heart rate training zones. This method (the Karvonen method) calculates zones based on your available "working range" rather than just a flat percentage of Max HR, providing highly customised cardiovascular thresholds.
- **BrM (Breathing Rate Max):** Maximum breathing rate (respiration rate) reached during the hardest intervals of the ride (in breaths per minute). Leave blank if you do not track it. The value is typically obtained from a compatible heart rate strap or physiological sensor that tracks respiration rate, or by manually counting your breaths during the last 60 seconds of a maximal effort.

2. Advanced Settings

Clicking the "Advanced Settings" button opens a pop-up window split into two tabs: **Bike Gearing** (Crank Length and Chainring/Cassette) and **Personal Limits** (all the cadence, drift, torque, and HRV fields below). Click Submit to save your changes and close the window.

- **Crank Length (mm):** The physical length of your bicycle's crank arms (defaults to 172.5mm). The crank arm acts as a lever; the engine combines this physical geometry with your power (Watts) and cadence (RPM) to calculate the actual equivalent kilogram-based load placed on your knees. (The detailed physical formulas and conversion constants are kept in Section IV.)
- **Chainring (Max/Min) & Cassette (Max/Min):** Four fields to set the outer bounds of your gearing (largest/smallest chainring tooth count, largest/smallest cassette sprocket tooth count). These are not necessary as the electronic groupset data in the .FIT file should include accurate sizes, and the tool merges whatever it detects in the file with these settings automatically. However, if a specific cassette has been fitted for a time trial or particularly hilly route and the configuration has not been updated in the appropriate application, the data may be incorrect, and entering values here ensures the Time in Gear Ratio chart still shows the full range of gears you actually have available.
- **Outdoor Cadence:** Target average cadence for outdoor rides. Defaults to 78 RPM. Lower values indicate grinding, while higher values promote cardiovascular efficiency (sensible range: 70-100 RPM).
- **Indoor Cadence:** Target average cadence for indoor virtual rides. Defaults to 83 RPM. Indoor rides lack coasting and momentum, which naturally leads to a higher cadence target (sensible range: 75-105 RPM).
- **Standing Cutoff:** Cadence limit below which you are assumed to be standing. Defaults to 55 RPM. Standing exempts you from knee joint strain flags since body weight supports the load (sensible range: 45-65 RPM).
- **Outdoor Drift Max:** Max acceptable cardiovascular drift (decoupling) for outdoor rides. Defaults to 3.0%. Outdoor drift is more variable due to wind, routing stops, and ambient temperature (sensible range: 2.0-6.0%).
- **Indoor Tempo Drift:** Max acceptable cardiovascular drift (decoupling) for indoor tempo rides. Defaults to 3.0%. Higher drift indicates fatigue, low ventilation, or dehydration under load (sensible range: 2.0-5.0%).
- **Indoor Endurance Drift:** Max acceptable cardiovascular drift (decoupling) for indoor endurance rides. Defaults to 1.5%. Highly adapted athletes should show minimal decoupling during base work (sensible range: 1.0-3.0%).
- **Torque Threshold (Fraction of Body Weight):** Represents your target limits of torque force relative to your body weight.
- *Why is the default 33% (0.33)?* Biomechanical studies show that applying pedal force greater than one-third of your body mass per pedal stroke shifts the effort from your cardiovascular system to your skeletal and joint structure, increasing mechanical stress.
- *Adjustment Ranges:*
  - 25% to 30% (Low): Lower this setting if you have sensitive joints, are recovering from a knee injury, or naturally prefer high-cadence spinning (90+ RPM).
  - 35% to 40% (High): Raise this setting if you are doing low-cadence strength training ("grinding"), track cycling, or naturally produce high torque.

- **HRV Baseline:** Your established, long-term baseline Heart Rate Variability (usually a rolling 7-to-21 day average). Establishing a baseline requires wearing an HRV-tracking device (like a smart ring, sports watch, or sleep tracker) during sleep, or taking a consistent waking morning reading for at least 7 to 14 consecutive days. This baseline is stored as your personal standard.
- **Climbing Grade:** The Grade threshold above which climbing gear depletion is checked. Defaults to 6%. Set to the slope steepness where you typically run out of gears on local climbs (sensible range: 4-12%).
- **Standing Cadence:** Cadence limit below which you are assumed to be standing (when position sensor data is absent or flat). Defaults to 70 RPM. Also used as the climb target cadence for gear depletion checks (sensible range: 60-80 RPM).

3. Ride-Specific Data

- **Current HRV (ms):** Your acute, single-day Heart Rate Variability measured on the day of the ride. Your autonomic nervous system controls your heart rate. It consists of two branches: the "fight-or-flight" sympathetic branch and the "rest-and-digest" parasympathetic branch. When you are fully recovered, relaxed, and ready for high physical workloads, your parasympathetic nervous system is highly active, resulting in a higher variation (a higher HRV value) between beats. When you are fatigued, stressed, or dehydrated, the sympathetic branch dominates to keep the heart beating at a more rigid, metronome-like pace, resulting in a lower variation (a lower HRV value).
- **Method A (Highly Recommended – Overnight Average):** Use the overnight sleep average HRV from the night immediately preceding the ride. This is automatically measured and displayed by modern fitness trackers, sports watches, or smart rings, providing a stable, baseline reading free from immediate morning stress.
- **Method B (Waking Morning Reading):** Take a structured, resting 1-to-3 minute HRV reading immediately upon waking up using a heart rate strap paired with a dedicated HRV phone application.
- **What NOT to use:** Do not input active post-workout readings, daytime stress checks, or randomised real-time measurements taken during the day.

> While your HRV Baseline represents your long-term norm, your Current HRV represents your readiness today. When you paste your data into an AI, the prompt instructs the AI to compare these two numbers. If your Current HRV is significantly lower than your Baseline HRV, the AI will recognise that your nervous system is in a fatigued, sympathetic-dominant state and will automatically tailor its training recommendations toward active recovery.

- **Warmup Minutes & Cooldown Minutes:** Training sessions often start with a progressive warm-up and end with a gentle cool-down. Setting these values (e.g., 10 minutes warmup, 5 minutes cooldown) instructs the engine to exclude these initial and final time windows from Aerobic Decoupling calculations. This prevents early-session heart rate adjustments or post-workout recovery curves from skewing your cardiovascular drift measurements.

4. Ride Notes

- **Context and Subjective Notes:** An open text field where you can input real-world variables such as weather, wind, mechanical issues, nutrition, sleep quality, and how you felt. These subjective notes are injected directly into the final text summary, providing vital context for your human coach or the AI analysis.

III. System Outputs & Interface

Once your FIT file is imported and your settings are configured, the web interface populates two distinct sections on your screen:

1. The Text Output Pane

This section features a single generated text report, controlled by the "Output Format" dropdown at the top of the page. Depending on your target viewer, select the appropriate option before using the control buttons:

- **"Human Readable Summary" option:** Generates a clean, simple report. This view is completely clear of technical code snippets, metadata parameters, or prompt configurations. It features standard ride metrics, your notes, and your parsed data in an uncluttered format that is ready to print, export, or email to a coach.
- **"AI Coaching Prompt" option (Default):** Specifically designed to run as a feed for an AI Agent. Selecting this option injects two structural blocks that are hidden in the Human version:
- **The JSON Metadata Block:** Converts your age, weight, crank length, FTP, and heart rate baselines into a compact, standardised JSON object. This ensures the AI reads your settings perfectly without making formatting assumptions.
- **The Default AI Interpretation Rules:** A pre-written prompt wrapper. This block acts as "system-level instructions" explaining to the AI how to interpret key calculations (such as how a high average ambient temperature affects cardiovascular drift, and how cadence affects mechanical knee stress) to ensure the AI's analysis is scientifically accurate.
- **Copy Button:** Click this to instantly copy the currently selected text report (either Human-Readable or AI-Ready) to your clipboard.
- **Download Button:** Saves your active text selection as a plain text file (.txt) directly to your local storage.
- **Dashboard Button:** Toggles the layout to display the interactive graphic dashboard.

2. The Performance Dashboard

A visual layer featuring clear metrics and interactive distribution charts.

> **Note:** Several advanced analytics and distribution charts (such as Power Zones or Knee Stress) will only be generated if your ride file contains power and cadence data, and your profile configurations are completed in the settings panel.

- **KPI Header Cards:** Displays raw performance metrics in both metric and imperial values:
- Distance: Total track length (kilometres and miles).
- Ascent: Cumulative elevation gain (meters and feet).
- Avg/NP Power: Average power vs. Normalised Power (NP). NP estimates the metabolic cost of your ride by prioritising intense surges over steady pacing.
- Avg/Max HR: Average vs. Maximum Heart Rate (bpm).
- Avg Cadence: Average pedalling speed (RPM), applying the zero-exclusion rules dictated by your selected Activity Context.

- Sixth Card (context-dependent): Shows Gear Shifts (F/R) whenever an electronic groupset is detected in the file. If no electronic shifting data is present, it falls back to Avg/Max Speed (km/h and mph) for either Free Ride mode, or Duration for Workout/Structured Session mode.
- **Power & FTP Zones (7-Zone FTP Distribution):** A horizontal distribution chart showing the percentage of your ride spent in each of the 7 Coggan training zones (Recovery, Endurance, Tempo, Threshold, VO2 Max, Anaerobic, and Neuromuscular).
- **Heart Rate Zone Distribution:** A pie chart breaking down cumulative training time spent across 5 cardiovascular zones calculated via your Resting and Max HR.
- **Time in Gear Ratio (or Cadence Distribution):** When your FIT file contains electronic groupset shifting data, this chart shows Time in Gear Ratio: a bar chart of minutes spent in each front/rear gear combination, sorted from easiest to hardest ratio. If no electronic shifting data is detected, the chart automatically falls back to a Cadence Distribution histogram instead, grouping your active pedalling time into six operational bins: <60 rpm (heavy grinding), 60-70 rpm, 70-80 rpm, 80-90 rpm (aerobic efficiency), 90-100 rpm, and 100+ rpm.
- **Knee Stress Distribution (Centred at Limit):** A specialised mechanical stress bar chart. The bins centre directly around your specified Torque Threshold percentage (default 33%), helping you see if your pedalling style placed excessive force on your joints.

3. Remote Server Processing & Training Database Intake

When **Local Processing Only** is unselected, FIT_to_TEXT acts as an intake client for the **Training Database** staging pipeline:

- **Explicit Privacy & Consent Boundary:**
- Clicking **"Upload ALL Files to Training Database"** opens an explicit consent confirmation dialog (`upload-consent-modal`).
- The dialog informs you of the privacy boundary, zero password retention policy, and the payload manifest to be transmitted:
  1. **Telemetry & AI Prompt:** `*_AI_Coaching_Prompt_v8_9_04.txt` (Structured telemetry and coaching prompt text).
  2. **Graphic Dashboard Image:** `*_Dashboard_v8_9_04.png` (High-resolution rendered PNG dashboard).
  3. **Raw FIT Binary (Optional):** Optional checkbox (`#manifest-include-raw-fit`) to include the original `.fit` binary file for archive holding.
- Files land in a private, user-scoped holding area on the remote server: `private_uploads/{user_id}/{job_id}/` .
- **SHA-256 Activity Fingerprint Deduplication:**
- To prevent folder clutter when tweaking options or athlete notes, FIT_to_TEXT computes a cryptographic SHA-256 fingerprint (`activity_hash`) from the raw activity binary buffer.
- If an uncommitted draft job matching the same activity fingerprint already exists in your staging folder, the intake API automatically **overwrites and updates the existing draft job** (`job_...`) instead of creating redundant duplicate subfolders.
- **Upload Confirmation & Direct Database Launch:**
- Upon successful transmission, a rich confirmation modal pops up displaying the generated **Job Reference ID**, **Holding Path**, and staged file manifest.

- A direct launch button (`🚀 Open Training Database`) allows you to jump directly to the Training Database login and review portal in a new tab.

IV. The Core Math & Science

To help you understand the physics running behind your dashboard, the engine uses the following calculations:

1. Knee Stress Calculations

Mechanical joint wear is a product of torque (twisting force) rather than aerobic strain. Grinding up a steep hill in a heavy gear at a low cadence generates significantly higher joint stress than spinning at a high cadence.

The tool calculates this stress using a two-step sequence:

Step A: Pedal Force (kg-f)

Calculates the average physical force exerted per pedal stroke. This calculation is only run on data points where Power is greater than 5 Watts and Cadence is greater than 0 RPM.

- **Formula:** `Pedal Force (kg-f) = (Power (W) / Cadence (RPM)) * pedalForceMultiplier`
- Where: `pedalForceMultiplier = 9549 / (Crank Length * 9.80665)`
- *The Rotational Conversion Constant (9549):* A standard rotational physics constant used to translate linear power (Watts) and rotational speed (RPM) into rotational force (Torque in Newton-metres).
- *Standard Gravity (9.80665):* The standard acceleration of Earth's gravity in metres per second squared, used to convert force from raw Newtons into kilograms-force (kg-f).

Step B: Knee Stress Percentage (%)

Compares the pedal force directly against your total body weight to normalise the joint stress.

- **Formula:** `Knee Stress (%) = (Pedal Force (kg-f) / Weight (kg)) * 100`

2. Aerobic Decoupling (Cardiovascular Drift)

Aerobic Decoupling evaluates your structural aerobic fitness. Rather than a simple half-and-half split of the entire ride, the engine scans the active records (excluding your warmup and cooldown minutes) to locate steady-state windows of at least 10 minutes where power or pace remains stable within a narrow tolerance. For each found window, it splits the block into two halves, calculates the ratio of power (or speed) to heart rate for both halves, and measures the percentage shift. The final Aerobic Decoupling score is the weighted average of the decoupling across all identified steady-state windows.

- **Formula:** `Decoupling Ratio (%) = ((Efficiency Factor First Half - Efficiency Factor Second Half) / Efficiency Factor First Half) * 100`
- **Important Note on Application:** Aerobic Decoupling metrics are **only useful on long, steady-state efforts**, such as Recovery (Zone 1) or Endurance (Zone 2) training rides. Decoupling calculations are highly variable and not meaningful for interval training, punchy group rides, or races where frequent power surges and natural heart rate lag distort the mathematical relationship.
- **Interpretation:**

- *Stable Aerobic Base:* A drift percentage of 5% or less indicates stable conditioning on a steady-state run. Your cardiovascular system is supplying oxygen efficiently without needing to beat faster to maintain power.
- *Elevated Drift:* A drift greater than 5% indicates fatigue, dehydration, or potential aerobic decoupling.
- *Temperature Mitigating Factor:* When it is warm, your body pumps blood to your skin to sweat and cool down, leaving less blood to carry oxygen to your muscles. To compensate, your heart rate must rise. If your FIT file records an average ambient temperature of 24°C (75.2°F) or higher, the tool's AI-Ready output automatically triggers custom instructions. These instructions guide AI models (and inform coaches) to treat the elevated drift as a normal thermoregulatory cooling response rather than a structural fitness issue.

3. Record-Level Fallbacks

If your FIT file's session summary header is missing or corrupted, the engine scans the raw time-series data records to calculate these fallback metrics:

- **Average Speed Fallback:** Total parsed distance divided by total duration, or the mean of the speed telemetry records.
- **Maximum Speed Fallback:** The highest speed value found in the record list.
- **Average Cadence Fallback:** The mathematical average of all non-zero cadence records.

V. Understanding the Embedded AI System Prompts

When you select the **AI Coaching Prompt** option in the Output Format dropdown and copy the contents, the clipboard payload automatically combines your parsed data with high-level system prompt instructions.

This section details how the tool's internal coaching prompts (for both "Workout" and "Free Ride" modes) work under the hood so you know how the AI will analyse your file.

It's worth being clear about what these built-in instructions are for. The prompt bundled into the AI Coaching Prompt option is a generic, general-purpose starting point, designed to produce a reasonably useful analysis with any AI chatbot, for any rider, straight out of the box. It is functional, but intentionally basic — it is not a substitute for a real coaching relationship, and it won't reflect your own training philosophy, terminology, or priorities.

If you use a specific AI client regularly — a custom Gemini Gem, a ChatGPT Custom GPT, a Claude Project, or "skills" on another platform — you can write your own persistent system prompt that consumes the structured data this tool produces and tailors the analysis entirely to you. Subsections 1–4 below explain how the built-in prompt works; subsection 5 gives a few sample building blocks you could use as a starting point for your own.

1. Data Integrity and Source Prioritisation Rules

The embedded instructions explicitly program the AI to prioritise data integrity and prevent "AI math hallucinations" (common when large language models try to calculate complex averages on raw numbers):

- **JSON as the Source of Truth:** The AI is instructed to look strictly at the structured JSON metadata block for all macro metrics, zone distributions, aerobic decoupling calculations, and physical

constraints.

- **No Manual Recalculation:** The AI is forbidden from trying to recalculate Normalised Power (NP), TSS, IF, VI, average cadence, or W/Kg. It must read the pre-calculated metrics directly from the JSON.
- **Timeline Resolution:** The raw data tables are strictly reserved for high-resolution timeline lookups and identifying acute power surges.

2. Standardised Coaching Output Structure

Both workout and free-ride modes program the AI to output its coaching analysis in a clean, four-part professional structure:

1. **Workout Summary:** Evaluates the session's overall training objective, metabolic intensity, execution quality, and physiological cost (TSS and Intensity Factor).
2. **Key Efforts & Achievements:** Details key milestones of the ride, such as climb profiles, peak power interval blocks, or sudden muscular surges.
3. **Physiological Adaptation:** Reviews cardiac drift (aerobic decoupling), average heart rate response, recovery speed, and pre-workout recovery indicators (using your current pre-ride HRV).
4. **Actionable Coaching Takeaways:** Provides 2-3 highly specific, professional training recommendations for upcoming recovery windows and your next physical session.

3. Environment-Specific Logic Gates

The tool changes its internal prompting instructions depending on whether the activity context is set to a structured Workout or a Free Ride:

A. Structured Workout Mode Logic

- **ERG Mode Detection:** The AI is warned that the session was an indoor workout where automated smart-trainer resistance (ERG mode) controlled power output. It is explicitly instructed not to praise steady power lines as "rider pacing discipline," but rather to look at how smoothly the rider transitioned cadence during resistance steps.
- **Heart Rate Recovery (HRR):** The AI focuses on evaluating recovery efficiency and heart rate drops immediately following intense work intervals.
- **Strict Aerobic Drift Targets:** The AI evaluates stability targets under tighter constraints (< 1.5% drift for Endurance, < 3.0% drift for Tempo intervals).

B. Free Ride Mode Logic

- **Real-World Topography:** The AI is instructed to evaluate how the athlete managed changing gradients, wind resistance, and group dynamics (such as draft pacing or high-cadence climbing).
- **Speed/Distance Inclusion:** Unlike indoor mode where speed and distance are ignored, outdoor free rides prompt the AI to review pacing discipline across variable terrain profiles.

4. Advanced Physiological Guardrails

The default prompt instructions contain precise mathematical limits to prevent the AI from generating "false positive" alerts:

- **The Standing Exemption for Joint Strain:** If the rider's cadence drops to or below your configured Standing Cadence threshold (set in Advanced Settings, default 70 RPM), the engine and AI assume the athlete stood up on the pedals (when position sensor data is absent or flat). Standing allows you

to use your body weight rather than pure muscle and joint leverage to turn the cranks, so the system is programmed not to flag joint strain in these moments.

- **Seated Torque Threshold Check:** For cadences above your designated Standing Cutoff (default 55 RPM) up to the target cadence benchmark, the system evaluates seated efforts. If position sensor data is missing or flat, this check runs only for cadences above Standing Cadence (default 70 RPM). The AI will only flag joint strain if your power output exceeds a calculated safe torque threshold (based on your body weight and crank length). If your power remains below this safety limit, no knee strain warning is triggered.
- **High-Heat Exemption:** If the ambient temperature averages 24°C (75.2°F) or higher, the AI is explicitly told that increased cardiovascular drift is likely due to cutaneous vasodilation (blood pumping to the skin to cool down) and is forbidden from interpreting high drift as a loss of fitness.

5. Customising Your Own AI Prompt

If you'd like more tailored output than the built-in prompt provides, you can write your own system prompt for whichever AI client you use, and point it at the structured data this tool produces. Below are a few sample building blocks illustrating the kind of instructions that work well, written around an example 30-year-old rider with a 250W FTP. Adjust the numbers, terminology, and tone to fit your own profile.

- **Persona & Tone:** Define who you want the AI to be and how it should speak to you, for example:

  > "You are an expert, encouraging cycling coach. Speak directly to the rider by name. Analyse the ride telemetry provided and produce a structured analysis, a training recommendation, and a short social-media-ready summary."

- **Custom Personal Benchmarks:** Rather than relying on generic defaults, you can give the AI your own fixed reference points, for example:

  > "This rider is 30 years old with an FTP of 250W. Use an outdoor cadence benchmark of 85 RPM and an indoor benchmark of 90 RPM. Treat cardiovascular drift above 3% on outdoor rides, or above 2% on indoor endurance rides, as a sign of fatigue rather than normal variance."

- **Anti-Hallucination Grounding:** Large language models will sometimes recalculate or estimate figures instead of reading them directly from your data, which can introduce small but confusing errors. A simple grounding rule helps prevent this:

  > "Every metric you report (NP, TSS, Intensity Factor, average cadence, W/kg, HRV) must be read directly from the STRUCTURED METADATA BLOCK (AI ONLY) JSON in the provided text. Do not recalculate, round, or estimate these values yourself — quote them exactly as given."

Keeping a Historical Log: Many riders keep an ongoing spreadsheet of past and planned training sessions, similar to the structured training log referenced elsewhere in this guide. If you maintain one, you can feed relevant rows into your custom AI prompt alongside a ride's parsed data, giving the AI a wider view of your recent training load, upcoming sessions, and longer-term trends — producing a more holistic analysis than a single ride in isolation. Setting up that kind of spreadsheet integration is a

personal workflow choice and beyond the scope of this guide, but it's a natural next step once you're comfortable customising your own prompts.

VI. Quick-Reference Summary

- **Local Processing:** Your data stays on your device. No files or personal metrics are ever uploaded to external servers.
- **Two Reports in One Tool:** Use the Human Readable Summary option for a clean, classic, zero-code printout or email, and the AI Coaching Prompt option to instantly bundle structured JSON metrics and system instructions for a virtual AI coach.
- **Check Settings First:** Always confirm your weight, FTP, and heart rate limits are correct before loading a file. If you do not know your FTP, perform an FTP test first to ensure downstream accuracy.
- **Current HRV Input:** Use your waking morning HRV or sleep average HRV from the day of your workout to represent your pre-ride recovery state.
- **Keep Warmup/Cooldown Updated:** Adjust these values in the settings panel so that your Aerobic Decoupling calculations reflect your actual training intervals.

VII. Frequently Asked Questions (FAQ)

1. What is a FIT file?

A FIT file is a compact binary workout data format developed by Garmin and widely used across cycling computers, sports watches, smart trainers, and fitness apps (e.g. Wahoo, Strava, ROUVY). It stores telemetry records including power, heart rate, cadence, speed, elevation, laps, and groupset shifting.

2. Why convert a FIT file to text?

Because FIT files are binary, they cannot be read by human coaches or pasted directly into AI assistants (like ChatGPT, Claude, or Gemini). Converting the binary file into structured text translates raw data into human-friendly coaching notes and machine-readable JSON prompts.

3. Can I use the text output with ChatGPT, Claude, or Gemini?

Yes. The default **AI Coaching Prompt** option is specifically formatted with structured JSON metadata and system-level interpretation rules so any major LLM can generate immediate, scientifically sound coaching advice.

4. Can I convert Garmin, Wahoo, ROUVY, or Strava FIT files?

Yes. The parser conforms to the official Garmin FIT Protocol standard. It parses binary records exported from Garmin, Wahoo, Strava, ROUVY, Zwift, and major sports watches. If a device omits specific sensors (such as indoor trainers without GPS), non-existent fields are marked as `N/A` rather than guessed.

5. Does the application upload my personal workout data?

- **In Local Processing Only Mode (Default):** No. The entire parsing, calculation, and graphic dashboard rendering runs 100% locally inside your web browser via client-side JavaScript. Zero

activity data or GPS coordinates leave your device.

- **In Remote Server Processing Mode (Unselected):** Transmits your extracted telemetry text, rendered dashboard image, and optional raw `.fit` file directly to our sister application **Training Database** for off-machine AI analysis and holding area staging under your logon credentials. An explicit consent dialog is displayed prior to transmission.

6. What metrics are extracted from my FIT file?

The engine extracts summary statistics (duration, distance, ascent, calories, average/max speed, power, HR, cadence), Coggan 7-zone power distributions, 5-zone cardiovascular heart rate distributions, lap-by-lap breakdowns, electronic gear shifting ratios, and mechanical knee stress models.

7. Why are some metrics displayed as N/A?

If a metric is shown as `N/A`, your recording device or fitness app did not record that specific sensor data (e.g., an indoor smart trainer ride without GPS, or a ride recorded without a heart rate strap or power meter). The engine never invents or estimates missing telemetry points.

8. What is the difference between Human-Readable Summary and AI Coaching Prompt?

- **Human-Readable Summary:** A clean, classic markdown summary containing only your ride metrics and subjective notes—ideal for printing or emailing directly to a human coach.
- **AI Coaching Prompt:** Includes a structured JSON metadata block and embedded AI interpretation rules that instruct AI models how to evaluate physiological drift, temperature effects, and mechanical knee stress.

9. How does Activity Fingerprint Deduplication work in Remote Mode?

When uploading in Remote Processing mode, FIT_to_TEXT computes a cryptographic SHA-256 fingerprint (`activity_hash`) from the raw workout binary. If you modify your athlete notes or FTP settings and re-upload, the server recognizes the workout and automatically updates your existing staged draft job (`job_...`) without creating duplicate holding folders. - **Monitor Mechanical Load:** Use the Time in Gear Ratio (or Cadence Distribution) chart alongside the Knee Stress Chart to monitor your mechanical joint load, helping you stay injury-free.