

HRV Formula Sheet

PolarH10 short-term RR-derived HRV

Data path

- Input stream: accepted RR intervals from live BLE heart-rate measurement packets.
- Physical H10: RR intervals are derived inside the strap from ECG beat timing.
- Synthetic transport: RR remains the source for the HRV solve, while synthetic PMD ECG is emitted on the same synthetic beat schedule for operator review.

Rolling short-term window

The app uses a rolling RR window with a default length of 300 s. That default tracks the conventional short-term setting discussed by Shaffer and Ginsberg. The first solve is intentionally delayed until the rolling window is nearly full enough to avoid publishing an early headline value from a partial capture.

Time-domain formulas

For accepted RR intervals $NN_1 \dots NN_n$:

Here NN_i means the i -th accepted beat interval in milliseconds, n is the number of accepted intervals in the current rolling window, and an overline means a window average. These formulas are applied to the accepted short-term series the tracker keeps for the HRV solve, not to every raw packet value.

$$\overline{NN} = \frac{1}{n} \sum_{i=1}^n NN_i$$

This is the average accepted beat interval over the current short-term window.

$$\overline{HR} = \frac{60000}{\overline{NN}}$$

This converts the mean interval into beats per minute using 60000 ms = 1 minute.

$$SDNN = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (NN_i - \overline{NN})^2}$$

$SDNN$ measures how widely the accepted intervals are spread across the whole window.

$$RMSSD = \sqrt{\frac{1}{n-1} \sum_{i=2}^n (NN_i - NN_{i-1})^2}$$

$RMSSD$ focuses on beat-to-beat change by differencing neighboring intervals before averaging.

$$\ln RMSSD = \ln(RMSSD)$$

$\ln RMSSD$ is the natural-log form of $RMSSD$; it compresses the scale and is often easier to compare across sessions.

$$pNN50 = 100 \times \frac{\#\{|NN_i - NN_{i-1}| > 50\text{ ms}\}}{n - 1}$$

$pNN50$ is the percentage of adjacent interval pairs whose absolute difference exceeds 50 ms.

$$SD1 = \frac{RMSSD}{\sqrt{2}}$$

$SD1$ is the short-axis Poincare equivalent of short-term variability and is shown because many readers know HRV through that geometric view.

Alignment status

The implementation is aligned to the cited short-term HRV guidance for $RMSSD$, $SDNN$, $pNN50$ with a fixed 50 ms threshold, $SD1$, mean NN , mean HR , and $\ln RMSSD$.

The app does not claim to reproduce 24 h norms, clinical artifact adjudication, or full Holter-style NN editing. It is therefore documented as short-term RR -derived telemetry rather than a clinical HRV workstation.

References

- Shaffer and Ginsberg, “An Overview of Heart Rate Variability Metrics and Norms” (2017).
- <https://doi.org/10.3389/fpubh.2017.00258>
- <https://mesmerprism.github.io/PolarH10/reference/hrv-workflow.html>
- <https://mesmerprism.github.io/PolarH10/reference/references.html>