

Auto-sensitivity mode (Autosens)

Wouldn't it be great if the system knew when you were running sensitive or resistant? That's what we thought, so we created "auto-sensitivity mode". If you explicitly configure this additional feature (again by enabling it through features in setup script), it will allow the system to analyze historical data on-the-go and make adjustments if it recognizes that you are reacting more sensitively (or conversely, more resistant) to insulin than usual. Autosens will then make temporary adjustments to the basal, ISF, and targets used for calculating temp basals, in order to keep BG closer to your configured target.

When you watch your autosens log (shortcut command is `autosens-looplog`) and sensitivity changes is going to be detected, you might see something like this:

```
Calculating sensitivity using 8h of non-excluded data
Setting lastSiteChange to Tue Dec 19 2017 09:42:24 GMT-0600 (CST) using timestamp 2017-12-19T09:42:24-06:00
u(xxxxxxxxxxxx11xxxxxxxxxxxx12h=43g(xxxxxxxxxxxx13xxxxxxxxxxxx14h=xxx45gxxxxxxxx15xxxxxxxxxxxx
x-x-x-x-x-x-22h=x-x-x-x-x-xxxxxxx23hxx0gx
Using most recent 18 deviations since Tue Dec 19 2017 09:42:24 GMT-0600 (CST)
Adding 15 more zero deviations
36% of non-meal deviations negative (>50% = sensitivity)
Sensitivity normal.
ISF adjusted from 120 to 120
Calculating sensitivity using all non-excluded data (up to 24h)
Setting lastSiteChange to Tue Dec 19 2017 09:42:24 GMT-0600 (CST) using timestamp 2017-12-19T09:42:24-06:00
u(xxxxxxxxxxxx11xxxxxxxxxxxx12h=43g(xxxxxxxxxxxx13xxxxxxxxxxxx14h=xxx45gxxxxxxxx15xxxxxxxxxxxx
x-x-x-x-x-x-22h=x-x-x-x-x-xxxxxxx23hxx0gx
Using most recent 18 deviations since Tue Dec 19 2017 09:42:24 GMT-0600 (CST)
Adding 15 more zero deviations
36% of non-meal deviations negative (>50% = sensitivity)
Sensitivity normal.
ISF adjusted from 120 to 120
Using 24h autosens ratio of 1 (ISF 120)
Autosens refreshed: {"ratio":1}
```

Here's what each symbol above means:

"x" : deviation is excluded. All deviations are excluded when there is COB through the time that COB drops to zero (carbs are fully absorbed) and deviations go negative once again. This is appropriate to eliminate the impact of rising BG due to carb absorption from sensitivity

calculations and not falsely attribute it to insulin resistance. Deviations may also be excluded because of an unexplained high deviation (site failure, etc).

“+” : deviation was above what was expected

“-” : deviation was below what was expected. In addition, if a high temp target is running (i.e. activity mode), a negative deviation is added every 5 minutes, to nudge sensitivityRatio downward to reflect the sensitivity likely to result from activity.

“=” : BGI is doing what we expect. Neutral deviations are also added every 2h to help decay sensitivityRatio back toward 1 if all data is excluded.

“4h” : time stamp to mark hour of day - i.e. 4h = 4am, 22h = 10pm, etc.

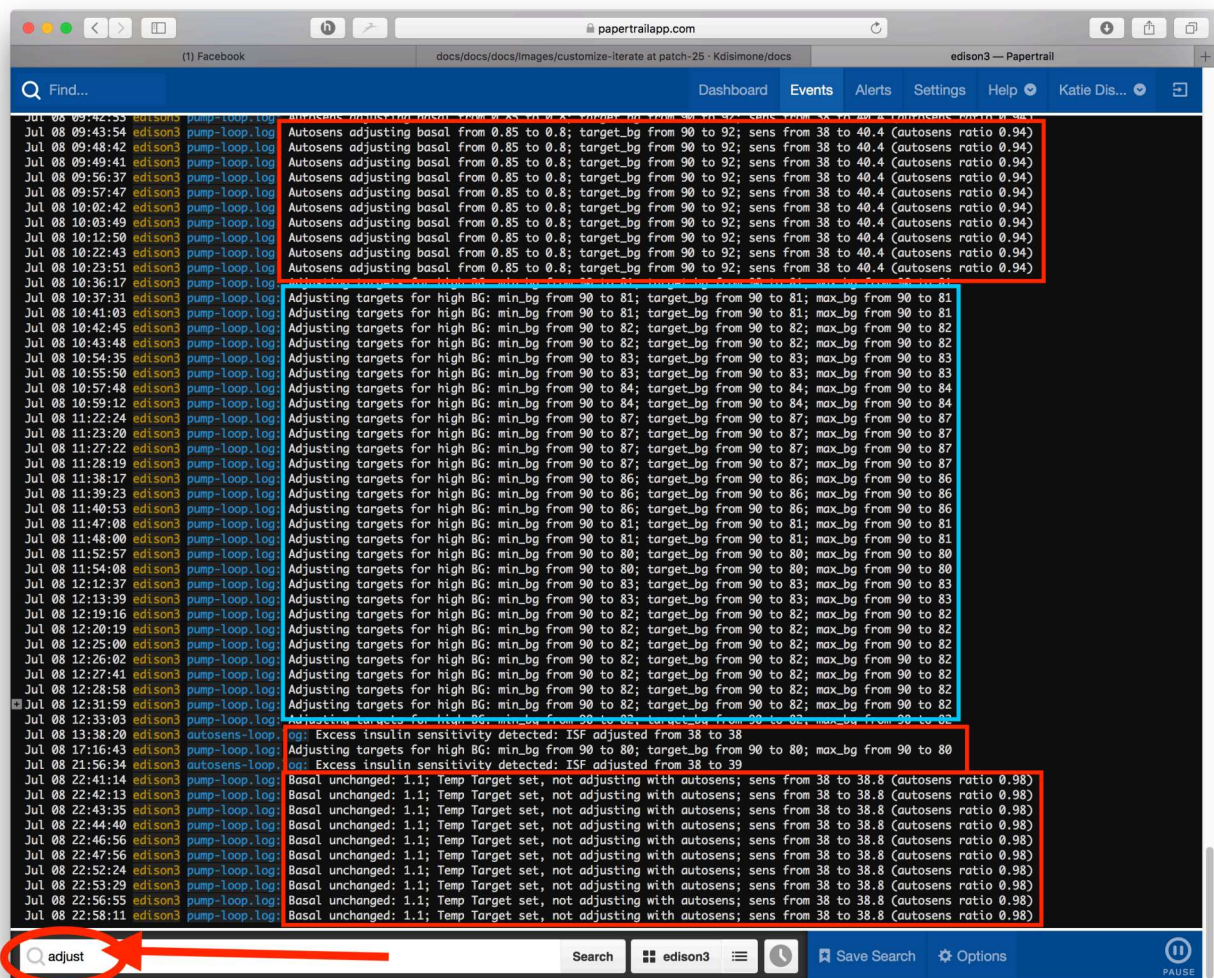
“8g” : COB is displayed at any time a new carbs are recorded. Initial carb entry will show as full carbohydrate count followed by “(” with subsequent COB notes (4g) as calculated net COB at any time when additional carbs are entered.

“u” : UAM check is based on total IOB as compared to normal basal rates. If IOB is > 2 hours of basal, UAM will be triggered and will remain until deviations turn negative again (with IOB < 2h basal).

The symbols are in chronological order, moving from oldest to newest. As there are typically CGM readings every 5 minutes, there are usually 12 comparisons each hour

Autosens adjustments

If you have papertrail setup (or are watching similarly through your rig itself), you can get an idea of how often, how much, and what autosens is adjusting. For example, here's a screen capture using “adjust” as the search filter for one of my rigs.



As you can see, there are several types of adjustments that have occurred during the day.

- In the morning, autosens was detecting some excess insulin sensitivity...so basals, targets, and ISF were adjusted down (by multiplier of 0.94).
- Later in the day (the blue boxed section), another adjustment was made to her BG targets because of a persistent high. While not an adjustment by autosens itself, this is similar and can be set in preferences.json by setting the “adv_target_adjustments” to true. Basically this preference will automatically lower BG targets (to as low as “eating soon” mode target of 80 mg/dl) for persistent high BGs.
- Later in the day, a couple brief periods of insulin sensitivity were short-lived.
- Finally at night, we had a low-treatment for a BG. We use an IFTTT button to enter our low treatments and at the same time, the IFTTT sets up a temp target of 110 mg/dl for 60 minutes to make sure the loop doesn’t want to correct much on the recovery. That temp target is being respected by autosens and basals and targets are not being adjusted (even though autosens may like to).

Notes about autosensitivity:

- “Autosens” works by reviewing the both the last 8 hours and last 24 hours of data (so it’s a rolling calculation with a moving window of 24 hours) and assessing deviations to determine if you are more sensitive or resistant than expected. If a pattern of such deviations is detected, it will calculate the adjustment that would’ve been required to

bring deviations back to normal. It will then use the more conservative between the rolling 8 hour calculation or the 24 hour calculation.

- Autosens does NOT take into account meal/carb deviations; it only is able to assess the impact of insulin, and thus will adjust ISF, basals, and targets to help compensate for changes in sensitivity.
- Most users will notice the changed ISF numbers in their OpenAPS pill, along with autosens-adjusted targets.
- Note that a Nightscout care portal or IFTTT temp target (for activity/exercise as an example) will override the autosens-adjusted target but IT WILL NOT override an advance target adjustment to bring high BG down. This is because in 0.5.x, the temp target is honored, but the advanced target adjustment is applied after the temp target. So, if current BG is high, the advanced target adjustment will be applied starting from the activity temp target, so if BG is high enough it will still reduce the active target to 80 mg/dL / 4,4 mmol/L. Consequently, be cautious of activity periods that follow a high BG; your IOB could be quite significant and cause you to go low quite fast as you start moving. If you do not want OpenAPS to apply advanced target adjustment that can be turned off by editing preferences.json (shortcut command edit-pref) and setting the "adv_target_adjustments" to false. Finally, if you do not want autosens to adjusted target that can be turned off by editing preferences.json (shortcut command edit-pref) and setting the "autosens_adjust_targets" to false. In oref0 0.6.0, adv_target_adjustments is set to false by default, as its functionality has been replaced by instead using the (safer) zero-temp BG predictions to decide when it's safe to dose additional insulin when high. The 0.6.0 exercise_mode feature also helps improve OpenAPS' response to high temp targets.
- The reason for autosens automatically adjusting targets in 0.5.x is because the other adjustments it makes can't be fully applied without creating a feedback loop, so automatically adjusting the target it thinks it's shooting for lets autosens get BG closer to your actual target most of the time. When autosens needs to adjust basal and ISF, it can very straightforwardly use that for adjusting the temp basal it's about to set, by assuming a higher or low neutral temp basal to start from, and by calculating a bigger or smaller expected impact of current IOB. What it can't do is calculate IOB in a way that reflects the adjusted basals and ISF, because doing so would change the autosens result, which would require recalculating IOB again, which would further change the result, in an unpredictable feedback loop. So instead, we simply acknowledge that the IOB calculation doesn't reflect sensitivity or resistance, and instead adjust the target to compensate. These limitations have been addressed in oref0 0.6.0.
- Autosens is limited by the safety multipliers in preferences.json. The defaults are:

```
"autosens_max": 1.2, <----multiplier for adjustments during insulin resistance  
"autosens_min": 0.7, <----multiplier for adjustments during insulin sensitivity
```

We do not recommend widening these multipliers; but an easy way to turn "off" autosens after you've enabled it is to adjust the safety multipliers to 1. However, note that this will also disable autotune adjustments if you are running autotune.

Autosens vs Autotune

Autosens will make adjustments to whatever basal, ISF, and target profiles are currently set for the loop. If autotune is not enabled, that means autosens will be making on-the-go adjustments based on the settings read from your pump. If autotune is enabled, that means autosens will be using the autotuned-profile as the basis for making adjustments.

Since SMBs require a minimum basal rate of 0.3 U/hr, it is possible that your auto-adjusted basal rate used by the loop may end up being lower than what is programmed in your pump. If you expect to see SMBs enacting, but your pump basal rate is very close to 0.3 U/hr...adjustments by autosens and/or autotune may change your basal rate to be less than 0.3 U/hr.

Prev.: [iPhone Shortcuts Integration](#)

Next: [Autotune](#)