



## 0. Introduction

### 1. Pre-Requisites for FCL

*Case study 1.1: Occlusion*

*Case study 1.2: Comparing insulins for FCL*

*Case study 1.3: Jumpy CGM*

*Case study 1.4: Lost pump connection*

### 2. General Settings for Full Closed Loop

2.1 Range Extension (smb\_max\_range\_extension)

2.2 Max and Min autoISF Ratio (autoISF\_min / autoISF\_max)

2.3 SMB Delivery Ratio (smb\_delivery\_ratio)

2.4 iobTH (see also 3.3 and 6.1)

2.5 Eating Soon TT

### 3. Description of autoISF 3.0 features

3.1 Overview

3.2 ISF modulation flowcharts

3.3 dynamic iobTH and exercise button

3.4 Automation options with autoISF parameters

3.5 Activity monitor

### 4. Meals: Setting ISF\_weights in AAPS/Preferences

4.1 Getting started

4.2 bgAccel\_ISF\_weight

4.3 pp\_ISF\_weight

4.4 bgBrake\_ISF\_weight

4.5 dura\_ISF\_weight

4.6 profile helper

*Case study 4.1: Pizza*

*Case study 4.2: Low carb meal (NN)*

*Case study 4.3: (iAPS): (NN, meal example iAPS FCL)*

### 5. Temp. Modulation of autoISF Aggressiveness

5.1 Automatic modulation of loop aggressiveness

5.1.1 autoISF off outside of meal windows

5.1.2 SMB off @ odd profile target

5.1.3 SMB off @ odd temp. target

5.1.4 Automatic diff. of FCL aggressiveness via Automations

5.1.5 Automatic diff. of FCL aggressiveness via Activity Monitor

5.1.6 Pro/con completely hands-off FCL

- 5.2 **Manual** modulation of FCL aggressiveness via DIY cockpit
  - 5.2.1 Grey DIY cockpit buttons for **pre-programmed** FCL responses
  - 5.2.2 Status recognition
  - 5.2.3 **Manual** modulation of FCL
  - 5.2.4 Temporary exit from FCL
- 5.3 **Manual** modulation of FCL aggressiveness via **improved cockpit**
  - 5.3.1 **Violet FCL icon and underlying buttons**
  - 5.3.2 Bottom buttons “insulin” etc.
  - 5.3.3 Top three fields
    - 5.3.3.1 **TT dialogue field**
    - 5.3.3.2 Exercise button / **dialogue field**
    - 5.3.3.3 Profile dialogue field
- 5.4 Recognizing loop state from the AAPS home screen
  - 5.4.1 Color scheme (grey/yellow) of the top 3 fields (profile, exercise, TT)
  - 5.4.2 Info on the top 3 fields (profile, exercise, TT)
  - 5.4.3 FCL related indicator fields
  - 5.4.4 Overall AAPS home screen

*Case study 5.1: Night after late fatty dinner*

*Case study 5.2: Sweet snacks / Glühwein w/ DIY cockpit*

*Case study 5.3 (iAPS): (NN)*

## **6. Temp. Modulation for Exercise and light (In-)Activity**

- 6.1 Dynamic iobTH and sensitivity ratio
  - 6.1.1 Manual (direct) iobTH modulation
  - 6.1.2 Automations for iobTH modulation
  - 6.1.3 Dynamic iobTH
- 6.2 Temp. % profile switch
- 6.3 DIY cockpit based on User action Automations
- 6.4 **Improved FCL cockpit**
  - 6.4.1 Manual (direct) iobTH modulation
  - 6.4.2 **Improved FCL cockpit with pre-set 4 kinds of exercise**
  - 6.4.3 **optional meal pre-sets**
  - 6.4.4 **optional Hypo management pre-sets**
- 6.5 Mastering the exercise after meal challenge

72	6.5.1 Manual mode
73	6.5.2 DIY cockpit button for User action Automation(s)
74	6.5.3 Using pre-sets in improved FCL cockpit
75	6.6 Activity monitor based on stepcounter
76	Case study 6.1: <i>Exercise mgd. in FCL w/sports button and TT</i> ( NN)
77	Case study 6.2 <i>Biking day with hi carb lunch; DIY cockpit</i>
78	Case study 6.3 (using the Activity Monitor – (NN?)
79	Case study 6.4 (iAPS): (NN) ( exercise example )
80	<b>7. Kids: Mastering additional challenges...</b> (NN) ..... ..
81	Case study 7.1: <i>Active kid on med/hi carb</i> ( NN)
82	Case study 7.2: <i>Kid on low carb</i> ( NN )
83	<b>8. Performance Monitoring and Tuning</b>
84	Case study 8.1: ( NN )
85	Case study 8.2: <i>Futility of tuning based on 1 extreme meal</i>
86	<b>9. Trouble shooting</b>
87	<b>10. Emulator on PC to Determine Settings</b> ( NN)
88	10.1 Logfile Analysis
89	10.2 What-if investigations
90	
91	<b>11. Emulator on the Smartphone</b> ( NN)
92	11.1 AAPS home screen access to table, chart of ISF contributors for last 3 hours
93	11.2 „what-if“: Real time alternative suggestions with speech synthesis
94	Case study 11.1: <i>Real-time checking out an alternative setting</i> ( NN )
95	<b>12. Remarks for users of previous autoISF versions</b>
96	<b>13. Other avenues to FCL</b>
97	13.1 FCL using AAPS Master and Automations
98	Case study 13.1: <i>Comparison 1 mo FCL Automation vs autoISF</i>
99	13.2 dynISF used for FCL
100	Case study 13.2: <i>Using dynISF for FCL</i> ( NN )
101	13.3 Methods involving simple Meal Announcement that might be stretched into a FCL
102	13.3.3.1 AIMI, 13.3.3.2 Boost, 13.3.3.3 EatNow 13.3.3.4 Tsunami
103	13.4 no-bolus looping with precise carb inputs
104	Case study 13.3: (example w/ carb inputs)

105	13.5 Machine Learning (AI)
106	13.6 Dual Hormone systems
107	

## 0. Introduction

readme.md in github/ bernie4375 V.2.1

### Exploring Full Closed Loop potential of-autoISF-3.0



#### Disclaimer – Important to read and understand

Authors are no medical professionals but T1 diabetics (or parents of a T1D child) who report their limited - understanding and experience, in an effort to contribute to a growing body of knowledge, and to facilitate development of patient centered solutions.

**Nothing in this site is medical advice**, but meant to stimulate patient-driven self-responsible research, and is meant also to stimulate product developments by the medical industry. Anything you try to conclude for yourself you do on own risk. **This is by no means a medical product but what is offered is a toolset for participating in development.**

Never copy what others report to use, but **investigate and adjust to your data**. Neglecting safety instructions, and just using the “buttons” that are made available in a supposed “learning by doing” mode, would be very dangerous with the early development stage tools this research paper is about.

In case you choose to get deeper involved, **run the system disconnected**, parallel to your current glucose management, to learn its behavior before eventually considering (on own risk) to go any further. Please stay connected and share experiences, too.

#### Introduction

**Full Closed Loop using Automations** is represented in AAPS Master and in the related readthedocs since autumn 2023. (<https://androidaps.readthedocs.io/en/latest/Usage/Full-ClosedLoop.html> ).

Pre-requisites and the principal function of a Full Closed Loop, *without the user ever giving a bolus and without entering any carb info* are explained, also in a couple of other languages, there.

The essential points are summarized also below, in section 1.

**autoISF** is being developed as a much more sophisticated alternative for FCL, aiming at higher %TIR performance and/or higher degree of daily „freedom“ than simpler approaches to FCL could. However, this demands much higher degree of involvement by the user - as you shall see, following us through this paper. Of note, parts of this paper marked in green color, notably sections 5.3 and 6.3 describing functions of the "FCL cockpit" are not implemented at launch because development focus had to be on more core functions. For most of these “missing elements”, work arounds

141 are described, often involving a similarly ease to use (but requiring some extra work in your set-up)  
142 DIY FCL cockpit (see [section 5.2](#) and [6.2](#) and [case studies 5.2](#) and [6.2](#))

143

144 With autoISF, and especially with the intention to use it for Full Closed Loop, you are in the early  
145 development area. It is therefore important to observe the disclaimer given above, and the warn-  
146 ings given below, as well as the hints given by the developers in the respective manuals (readme  
147 files on their Github pages. For autoISF with AAPS the main ones are [https://github.com/T-o-b-i-a-](https://github.com/T-o-b-i-a-s/AndroidAPS/)  
148 [s/AndroidAPS/](https://github.com/T-o-b-i-a-s/AndroidAPS/) and <https://github.com/ga-zelle/autoISF/> ).

149 autoISF has also been ported into an early development branch of iAPS (oref(1) for i-Phone)  
150 (<https://github.com/mountrcg/iAPS>).

151

152 First of all, a tip: If the following looks too complicated for you - and it's not just about understand-  
153 ing, but also about time requirements and discipline during experimentation and data analysis - you  
154 would be well advised to first try the Full Closed Loop in a simpler form with Automations (refer-  
155 ence see above, and [section 13.1](#)): Depending on the quality of their HCL tuning they are starting  
156 from, their expectations for %TIR, and on rapid carb contents of their diet, an increasing number of  
157 people succeed in making a respectable start the first time they try using AAPS in that much sim-  
158 pler Full Closed Loop mode.

159 See also the first published medical study that included 16 patients using AAPS, who found, on av-  
160 erage, comparable %TIR performance when using a basic Full Closed Loop mode: [https://pub-](https://pub-med.ncbi.nlm.nih.gov/36826996/)  
161 [med.ncbi.nlm.nih.gov/36826996/](https://pub-med.ncbi.nlm.nih.gov/36826996/)

162

163 Alternatively you can use some techniques used in hybrid closed loop, such as using a pre-bolus  
164 with autoISF, or explore other early-DEV-variants mentioned in [section 13.3](#), which also undergo  
165 permanent further development (Boost, AIMI, EatingNow, Tsunami).

166

167