

Pump Failure Guidelines

Planning Ahead

All technology, including pumps, can fail occasionally, even within their warranty period. It is important to be able to independently initiate injection treatment if required. The aim of this guide is to assist you in this process.

Remember: More than 2 hours without insulin delivery can lead to Diabetic Ketoacidosis (DKA).

Be prepared - All families on pump therapy should ensure they have:

- ▶ Novorapid or Humalog pens with penfill cartridges or disposable pens
- ▶ Pen needle tips
- ▶ A prescription (in date) for long-acting insulin (i.e. Lantus)
- ▶ A plan of how to calculate doses if you need to revert back to injections

To be able to calculate doses you will need to refer to the pump's programmed settings. The best way to ensure you have your child's latest data is to **upload the pump regularly**. There is one page which gives you all the settings you will need.

Medtronic Carelink Professional settings page (below):

Basal			Bolus			Sensor					
Maximum Basal Rate: 1.80 U/Hr Basal 1 (active) 24-Hour Total: 30.900 U			Bolus Wizard: On Units: g., mmol/L Active Insulin Time: 3:00 Maximum Bolus: 25.0 U			Easy Bolus: Off Bolus Increment: 0.1 U Bolus Speed: Quick Dual/Square: On/Off					
			Carbohydrate Ratio: (g/U) Time: 0:00 Ratio: 7.0 17:30 Ratio: 7			Insulin Sensitivity: (mmol/L per U) Time: 0:00 Sensitivity: 1 5:00 Sensitivity: 1 17:30 Sensitivity: 1 21:00 Sensitivity: 5			Blood Glucose Target (mmol/L) Time: Low: 5.0 High: 5.5		
			Preset Bolus Name: Bolus 1, Breakfast, Dinner, Lunch, Snack Name: Bolus 2, Bolus 3, Bolus 4						High Alerts Off (Snooze 1:00)		
									Start Time: High (mmol/L) Alert On High Alert Before High Rise Alert Limit (mmol/L)		
									Low Alerts Off (Snooze 0:20)		
									Start Time: Low (mmol/L) Suspend Alert On Low Alert Before Low Resume Basal Alert		
									Auto Calibration: Off Calibration Reminder: On Calibration Reminder Time: 1:00		
									Notes		

Animas settings/rates page (below)

Insulin: Pump settings

Bolus	General	I:C ratio settings	ISF programs	BG target range settings
Setting Value	Setting Value	Start I:C [g]	Start ISF [mmol/L]	Start Target [mmol/L] Range [mmol/L]
Audio Bolus Enable Disabled	Language Selection Index English	1 00:00:00 6	1 00:00:00 9	00:00:00 5.5 +/- 0.5
Audio Bolus Stepsize per program keypress 1.0 U	Last Keypress to display timeout 60 s	2 10:00:00 11	2 08:30:00 7	
Advanced Bolus Options enable Enabled	Auto-Off Enable Disabled	3 11:30:00 12	3 21:00:00 8	
Bolus Reminder Options enable Enabled	Auto-Off Timeout 12 h	4 15:30:00 12		
Bolus Delivery Speed Slow	Max 2-Hr limit 12 U	5 18:00:00 12		
Max Bolus 14 U	Occlusion Sensitivity Level High			
Basal	Insulin-On-Board			
Setting Value	Enabled			
Max Basal 5 U/h	Insulin-On-Board Duration 3 h			
Max Total Daily Dose 29 U	Sick days, BG over limit 15 mmol/L			
Active basal program 1	Sick days, check ketones 2 h			
	Sick days, check BG 2 h			
	Low Cartridge Warning Level 20 U			
	Time format 24 h			
	BG unit mmol/L			
Basal profiles	CGM Settings			
Program 1	Program 2	Program 3	Program 4	
Start Rate	Start Rate	Start Rate	Start Rate	
1 00:00:00 0.300	1 00:00:00 0.000	1 00:00:00 0.000	1 00:00:00 0.000	
2 02:00:00 0.300				
3 08:00:00 0.375	Sum: 0.000 U	Sum: 0.000 U	Sum: 0.000 U	
4 11:00:00 0.350				
5 12:00:00 0.350				
6 13:00:00 0.325				
7 15:00:00 0.350				
8 19:00:00 0.350				
9 21:00:00 0.300				
Sum: 7.875 U				

Settings will be required to be able to calculate injection doses, and to enter into a replacement pump if needed.

It is worth spending the time on the phone to the pump company's helpline to enable uploading of the pump.

*The green circles highlight the ICR and ISF you can use for injection doses if the pump fails. The blue rectangles highlight additional settings required for when you need to reprogram a replacement pump.

You will need to know:

- 1 Current Insulin to Carbohydrate Ratio (**ICR**) – there may be multiple at different times of the day
- 2 Current Insulin Sensitivity Factor (**ISF**) - there may be multiple at different times of the day
- 3 24 hour basal total dose

Calculating your insulin dose:

- Your Lantus dose should be equal to your 24 hour basal total (round to the nearest whole number) and is to be given at the same time every day.
- If your pump screen is still working, you may be able to use it to calculate how much insulin to give as a rapid-acting insulin bolus by entering in the current Blood Glucose Level (BGL) and carbohydrate amount if eating, and giving the calculated dose via injection.
- If your pump screen is not working, doses can be manually calculated as below:

To calculate insulin dose for carbs

1. Check to see what the ICR is set at for the current time of the day
2. Divide carbohydrate amount to be eaten by ICR

E.g. I am about to eat 50g of carbs for lunch. My ICR for lunch is 10g

$$50 / 10 = 5 \text{ Units}$$

Therefore I will need 5 units of rapid acting insulin for my food

To calculate insulin dose for high BGL

1. Check to see what the ISF is set at for the current time of the day
2. Check BGL. We are aiming for a BGL = 5mmol/L when doing corrections
3. Minus 5 (target BGL) from the current BGL
4. Divide the result by the ISF

E.g. My pre-lunch BGL = 10mmol/L. My ISF for lunch is 5mmol/L

$$10\text{mmol/L (current BGL)} - 5\text{mmol/L (target BGL)} = 5\text{mmol/L}$$

$$5 / 5 \text{ (ISF)} = 1 \text{ Unit}$$

Therefore I will need 1 unit for my elevated BGL

Add the results together and round to the nearest whole or half number (depending if you have a half or full unit pen) to determine dose

$$\textbf{5 Units + 1 Unit = 6 Units}$$

To give 6 units of rapid acting insulin pre-meal via injection

***Remember there must be a 2 hour gap between rapid-acting insulin injections to avoid insulin stacking.**

What if you haven't done a recent pump upload?

- It is strongly recommended you use Appendix A to record rates at least once per month, and when changes are made to rates.
- Use the pump history and record the Total Daily Dose (TDD) for the past 5 days.
- Add the 5 days together and divide by 5 to get an average TDD

Insulin to Carbohydrate Ratio (ICR)

Under 5yrs

To get a general idea of what the ICR should be, use the **300 RULE**:

- Divide **300** by the average amount of insulin given over the last 5 days (average TDD)
- This gives you the carbohydrate part of the ratio

For example-

If the average daily dose of insulin over the last 5 days is 15 units, the calculation is
 $300 / 15 = 20$ and the ICR is 1:20.

≥ 5 years

To get a general idea of what the ICR should be, use the **500 RULE**.

- Divide **500** by the average amount of insulin given over the last 5 days
- This gives you the carbohydrate part of the ratio

For example-

If the average daily dose of insulin over the last 5 days is 50 units:
Calculation is therefore 500 divided by 50 units, the calculation is $500 / 50 =$ ICR of 10.

Insulin Sensitivity Factor (ISF)

To get a general idea of what the ISF should be, use the **100 RULE**:

- Divide **100** by the average daily amount of insulin given over the last 5 days

For example-

If the average daily dose of insulin over the last 5 days is 20 units, the calculation is $100 / 20 = 5$ (1 unit lowers the blood glucose level by 5 mmol/L).

The total basal dose on the pump will give you a good guide of how much Lantus your child will require. If you are not sure what the total basal dose is, give 40% of the average TDD.

PUMP FAILURE CHECKLIST & PLAN

Action if the pump fails

Checklist:

- Novorapid or Humalog penfill cartridges
- Pen needle tips
- Intermediate or long-acting insulin or an in-date prescription (e.g. Levemir, Lantus)

Action if your pump fails:

-  Test BGL
-  Test ketones if BGL > 15 mmol/l
-  Give insulin if needed
-  Give **long-acting** insulin via injection – either total basal daily dose, or if not sure what this is, give 40% of total daily dose
-  Give **short-acting** insulin via injection before meals
-  Call the pump company helpline or representative

Medtronic: 1800 777 808 (24 hour global helpline)

Animas: 1300 851 056 (technical support)

Accu-chek Roche: 1800 633 457 (pump hotline)

Note: in general a pump failure can be managed by the family at home and should not require a call to the emergency service.

If no long-acting insulin is immediately available, short-acting insulin will be required every 2-3 hours via injection.

Going back onto insulin pump therapy

After receiving a replacement pump, it is important to plan going back onto pump therapy.

The Lantus dose, this should be halved the night prior to going back onto the pump.

If you are unsure about any of the information given in this guide,
please **call your diabetes team for assistance**

INSULIN PUMP RATES

Standard Basal Rate (s)

Total Daily Dose (last 5 days)

Insulin Sensitivity

Insulin / Carb Ratio(s)

Time	No. of grams covered by 1 unit of insulin

Target BGLs