



Electronic Cow Management

# eBolus Software

## User Guide

V2.0.0  
November 2011

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## eBolus Software – User Guide

### 1. Switch on the Computer

The computer has been set up to automatically load the pHBolus software from login. If this does not occur then double click on the pHBolus icon on the desktop.



If the shortcut doesn't work, pH bolus will be found in C:\Program Files\eCow Ltd\pHBolus

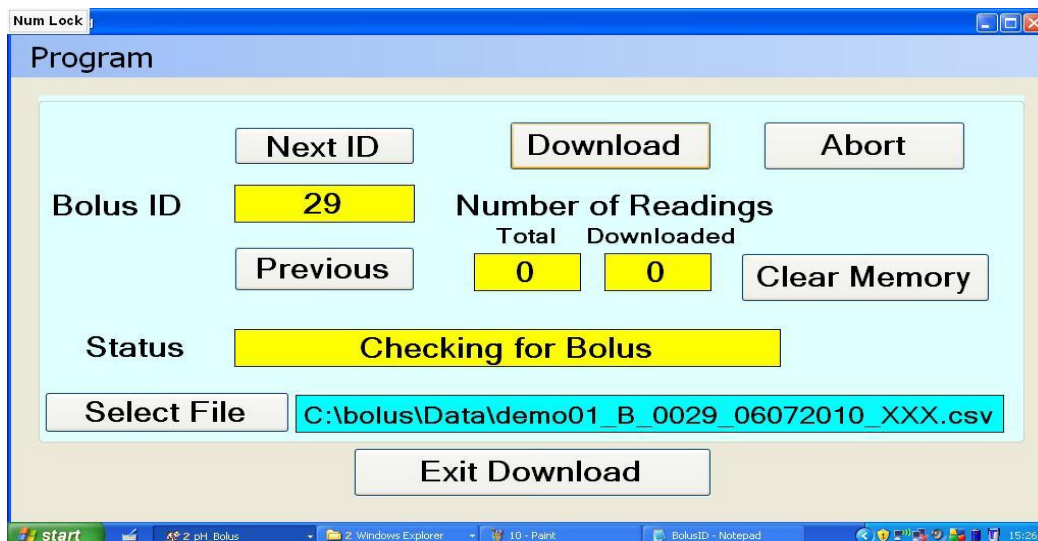
A record of all calibrations and configurations are sent to the bolus and this is kept in C:\Bolus\Uploads folder and the file is called Bolus followed by the ID number. It is a .CSV format file which will load directly into Excel. A record of all downloads is also kept in the same file.

### 2. Download Data

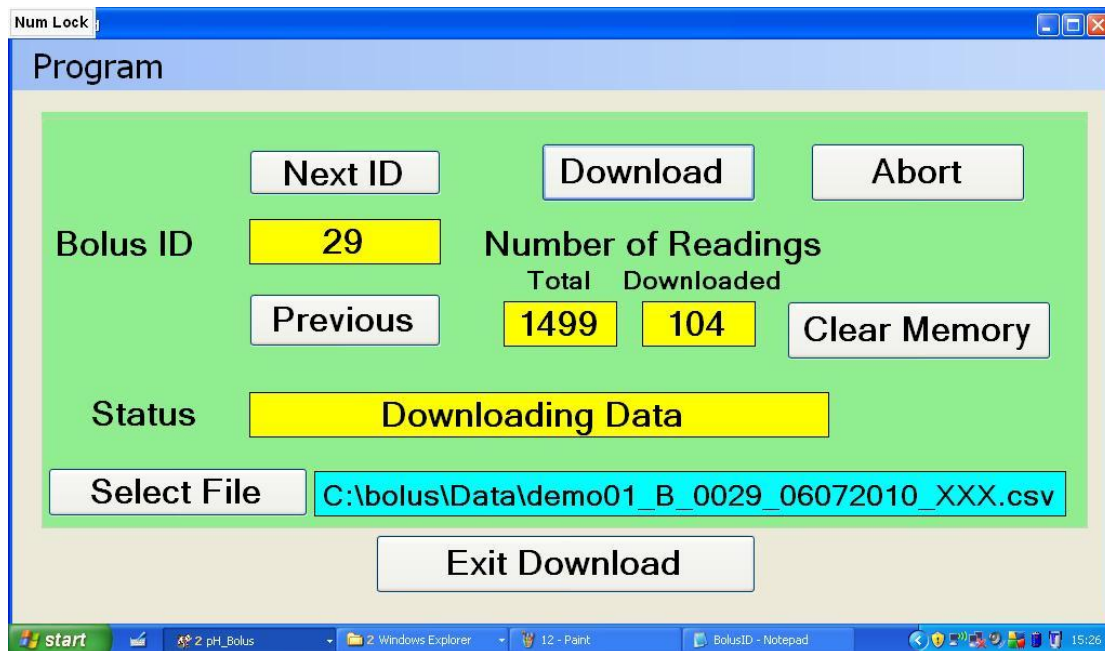
Press the **Download** button.

Change the ID of the bolus to that within the cow.

Press **Download** - the system will do everything until download has failed or succeeded.



First the message **Checking for Bolus** will appear followed by a number relating to the data points stored.



If the number of points downloaded does not equal the number of points stored then you should press **Download** and repeat until all the data is downloaded.

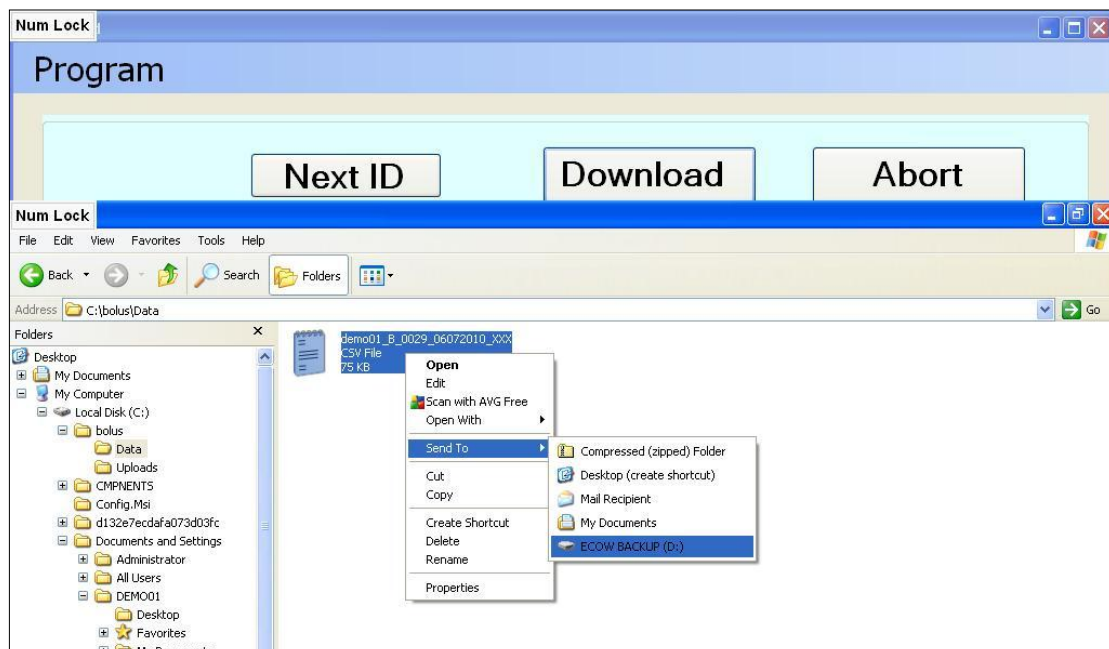
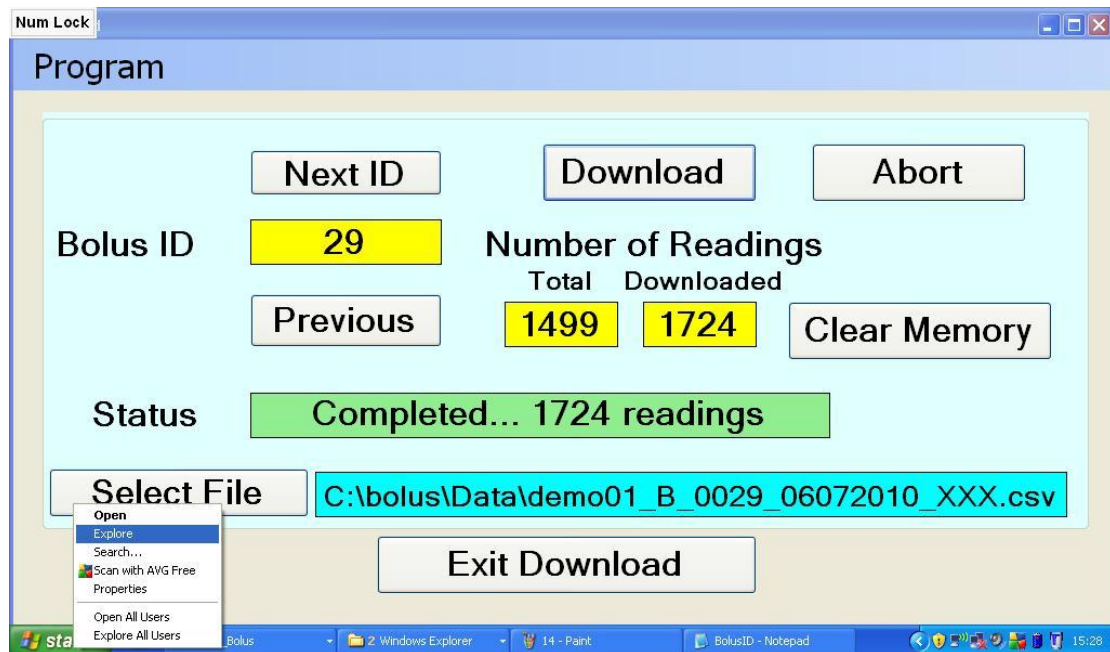
Examine the file in C:\bolus\Data

It will be named with your site name, the bolus number and the date terminating in .csv. It can be opened with Notebook, or in a spreadsheet. Examine the last line, it should be close to the current time. Back this file up.

You can now press **Clear Memory**

### 3. Transfer Data

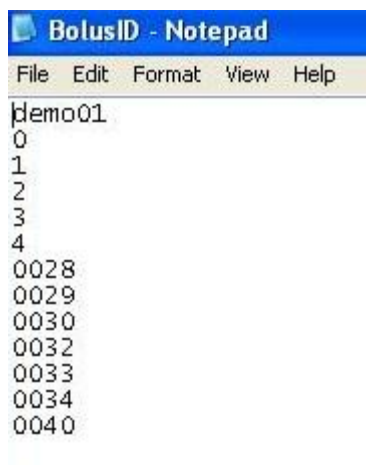
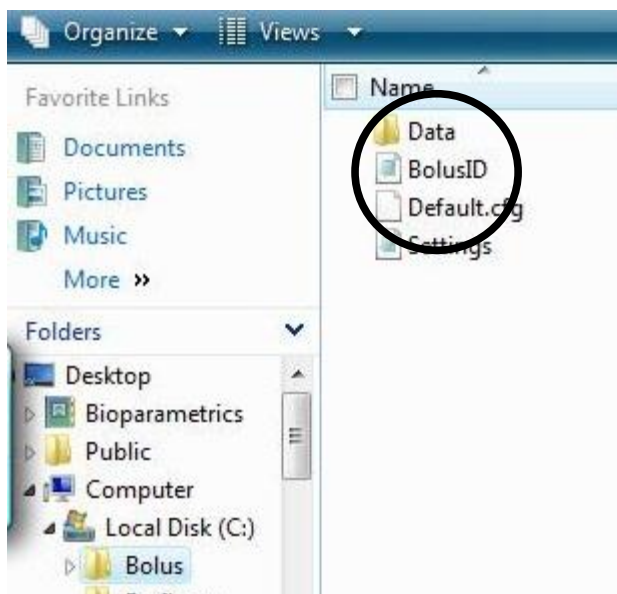
Right click over the Start icon and select explore. Select the Data folder from the bolus folder and copy to a UBS stick. Copy the files created onto a USB stick and email them to info@ecow.co.uk.



#### 4. Adding More Boluses

The system was set up with bolus identities specific to your site. To add boluses you need to either replace the file C:\bolus\BolusID.DAT with one we send you or edit the file using Notepad or another text editor.

To edit the BolusID.DAT file browse to C:\Bolus\BolusID.dat and right click to 'open with' Notepad. Add the ID numbers found on the side of the new boluses and close the file. Save on exit. The ph\_Bolus software will need to be closed and re-opened to enable the new ID numbers to be available.

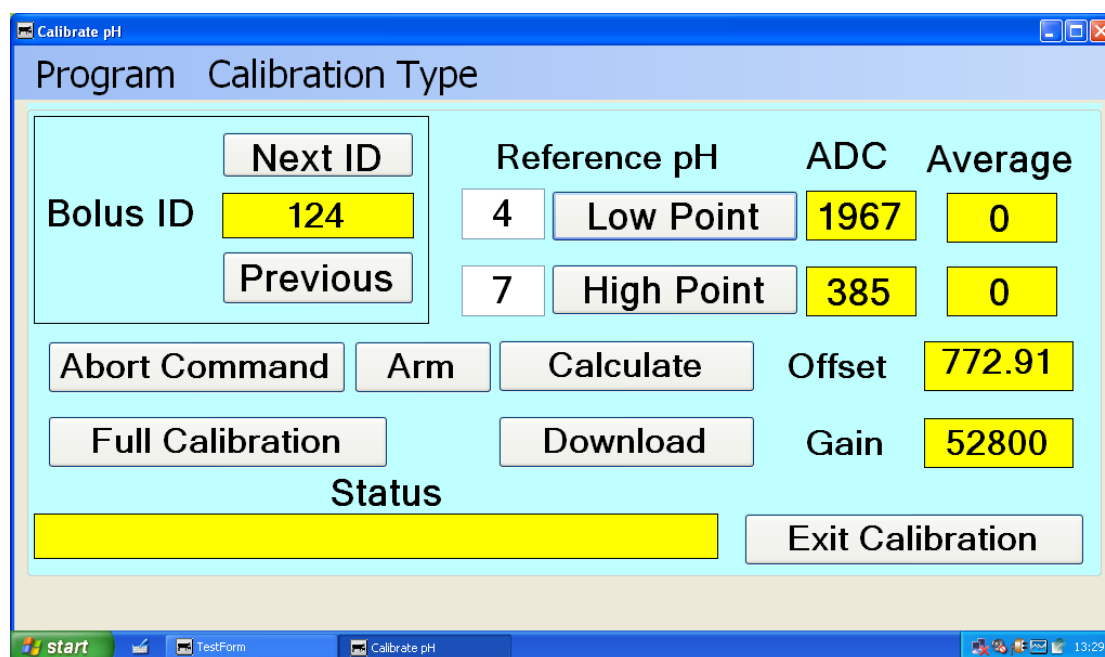


## 5. Calibrating the Sensor

For this you will need a warm water bath or other means of raising the temperature of the bolus and calibration buffers to above 25C. You will also need standard buffers of 4 and 7 pH.

Place the bolus into pH buffer 4 and raise to a temperature above 25C, this will activate the bolus although a few minutes may elapse before the sensing system wakes and decides that it is in this state.

Press **Full Calibration** (taking 25 minutes per bolus) and follow the instructions **or** conduct a manual calibration as follows (this is quicker).

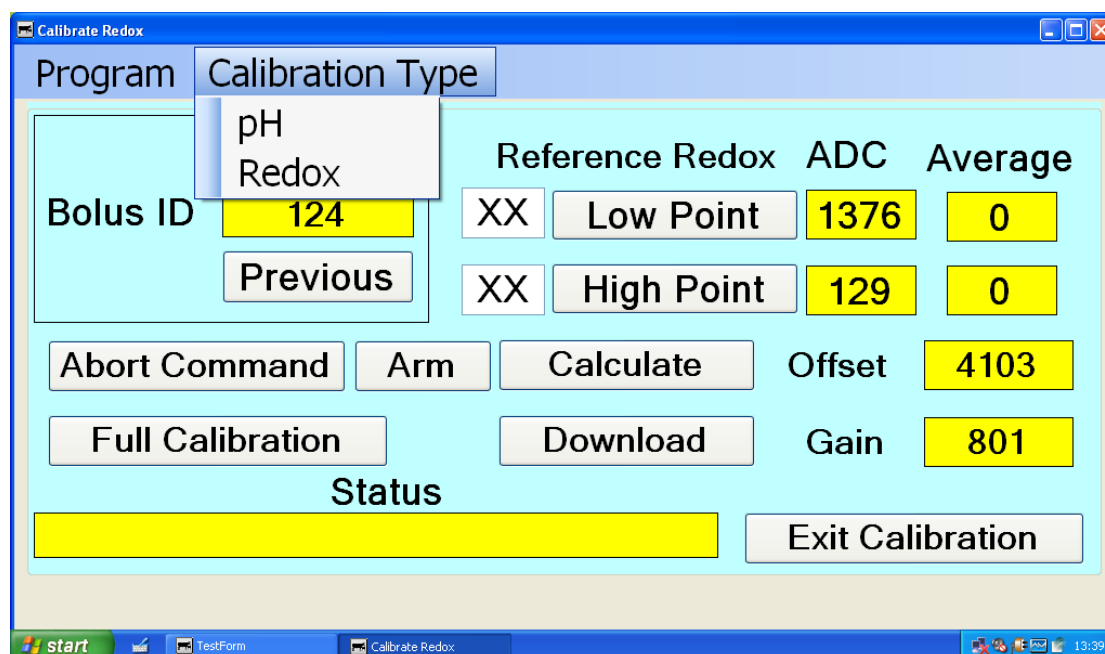


On the **Calibrate Bolus** tab select the bolus ID. Press the **Low Point** button, after a while a number will appear in the box. This is the value read by the ADC, it should be between 1700 and 2000. Repeat this process until the number is not varying by more than 5.

Take the bolus out and place it in Buffer 7 for a few minutes. Then repeat the process of collecting a number for the **High Point** this number should be between 250 and 550. When it stabilises press **Calculate** to set the Offset and Gain. Press **Arm** to prepare the bolus. When the status says Armed press **Download**, when the status message says Completed your bolus is ready to use.

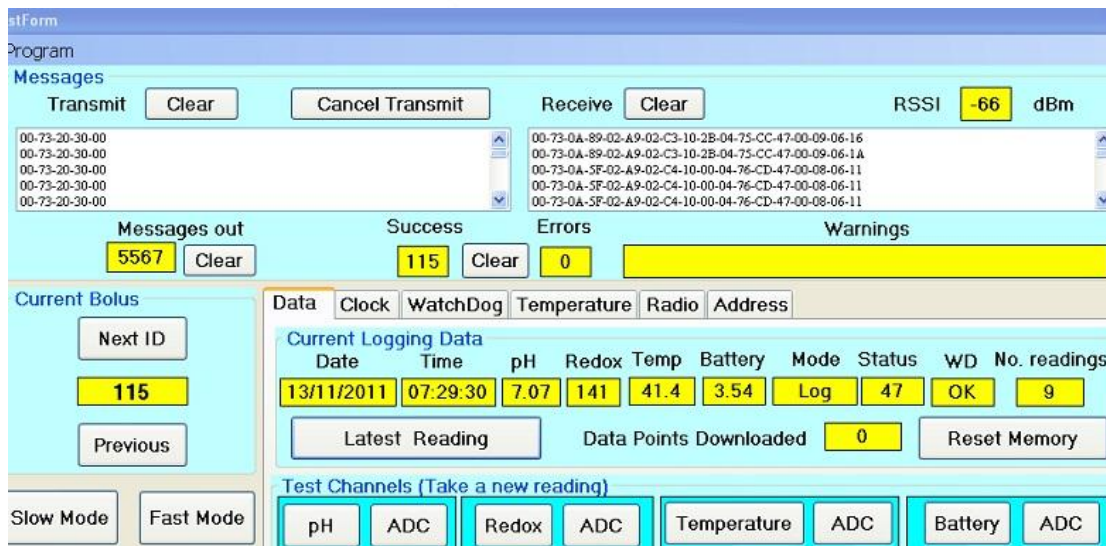
## 6. Calibrating the Redox Sensor if enabled

To calibrate the Redox sensor select Redox from the Calibration Type menu.



Our software sets up a two point calibration that enables the software to know the slope and gain for each of the sensors. However, many authorities only use a single point calibration (or standardisation) for redox on theoretical grounds.

To do this select the test form and press *latest reading* and you will see the Redox value in the relevant box. Do this in a known Redox solution for a single point standardisation or if you have two solutions go to the calibrate bolus page and follow the procedure similar to Ph. You will have to enter your Redox standard values into the *low* and *high* points as these will differ between manufacturer and temperature. Follow the specification of your buffer for the value to enter here.



The screenshot shows the eCow software interface with the following sections:

- Messages:** Transmit (Clear), Cancel Transmit, Receive (Clear), RSSI -66 dBm. Lists of messages sent and received with timestamps and IDs.
- Summary:** Messages out (5567), Success (115), Errors (0), Warnings (0).
- Current Bolus:** Next ID (115), Previous.
- Current Logging Data:**

Date	Time	pH	Redox	Temp	Battery	Mode	Status	WD	No. readings
13/11/2011	07:29:30	7.07	141	41.4	3.54	Log	47	OK	9
- Test Channels (Take a new reading):** pH (ADC), Redox (ADC), Temperature (ADC), Battery (ADC).
- Other controls:** Slow Mode, Fast Mode, Latest Reading, Data Points Downloaded (0), Reset Memory.

## 7. Troubleshooting and things to remember when calibrating

Calibration and setup files relating to the bolus reside in the C:/bolus directory under normal circumstances these are not needed by the user.

Data files are automatically labelled and stored in the C:/bolus/data directory

If the antenna is accidentally pulled out when the software is running, the program cannot work until the antenna is reconnected and the computer is restarted.

Never dip the bolus into your stock buffers, decant a small amount from stock and assume that it will quickly become contaminated.

Rinse the sensors between tests with deionised water by washing the the water through the crossholes ideally with a squeeze bottle.

Redox solution can poison the pH electrode for several hours so do the pH calibration last

Ideally immerse the end cap of the bolus in rumen liquor or an analogue (a recipe for this is in Appendix A) to condition the pH probe for several days but keep the liquor below 30C to keep the bolus inactive.

Redox potential is very sensitive to temperature so maintain the bolus at a stable temperature of 35 C for calibration. pH is less sensitive to temperature but our process ensures that the bolus is in the correct zone.



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The best guide to temperature is that given by the bolus. Go to the test form page and press the temperature button and you will see the current temperature this may differ from your bath setting because of heat loss from the surface

On extraction from the cow the bolus will be heavily contaminated and the crossholes may need to be swilled out of rumen debris

The crossholes restrict the flow of buffer to the sensors so do move the bolus about to ensure flow through.

Radio does not travel well through water or steel so do not fill your bath too deep and mount the antenna in line of sight of the bolus for best results.

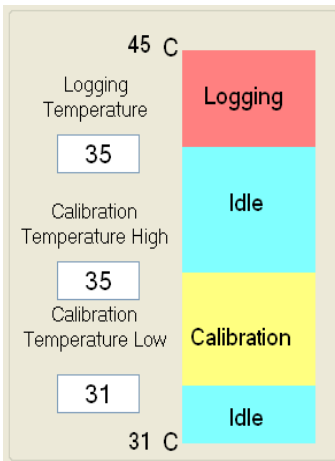
Any problems please get in touch on +44 8458681298 or email [jayne@ecow.co.uk](mailto:jayne@ecow.co.uk).

## Appendix A

### Configuration

**Your system has been factory configured for reliability. No responsibility can be accepted should you wish to make any changes to the configuration settings and the like for like replacement warranty will be invalid.**

The software has three operating modes, Idle, Calibration and Logging and the mode the bolus operates in depends on the temperature.



The temperature settings for the modes are :-

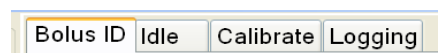
**Logging temperature**, lower temperature at which data logging occurs. No upper point (Recommended 35 degrees)

**Calibration Temperature High**, upper limit for calibration mode (Recommended 35 degrees)

**Calibration Temperature Low**, lower limit for calibration mode. (Recommended 31 degrees) If the temperature of the bolus falls below this it will enter idle mode to save power (no radio!)

It is also possible to configure an idle mode between calibration and logging by selecting different temperatures although this isn't recommended.

The operating parameters for each mode can be set by selecting the appropriate tab.



#### Idle

The only parameter for idle mode is the *Temperature Check Interval*. At this interval the bolus switches on and checks the temperature to see if the mode has changed before returning to sleep. No radio communication is possible in this mode. Maximum time interval is 34 minutes. Recommended interval is 5 minutes.

## Calibrate

Calibrate mode has a *Temperature Check Interval* used to check the temperature and change modes. Unlike idle mode this is not used for a sleep time, see below.

*Radio Interval* (fast and slow modes) sets the sleep time, the longer the sleep time the longer battery life.

There are two modes, fast and slow. Normally it operates in slow mode because fast communication is not required. If fast communication is required then the software switches to fast mode.

### Recommended settings

Bolus ID	Idle	Calibrate	Logging
Temperature Check Interval <input type="text" value="1"/> Minutes			
Radio Interval (Slow Mode) <input type="text" value="60"/> Seconds			
Radio Interval (Fast Mode) <input type="text" value="10"/> Seconds			

## Logging

*Temperature Check Interval*, *Radio Intervals* are the similar to those used for calibration mode.

*Logging Time* sets how often pH readings are stored. The stored readings are an average taken since the last reading, with each individual reading time being set by the *Temperature Check Interval*. E.g. If the Temperature Check Interval is set to 3 minutes and the Logging Time to 15 minutes then five readings will be taken (3 minutes apart) and the average stored.

### *Radio Check Time Window*

To save power the bolus can be programmed so it doesn't check the radio during the night when it's unlikely that the operator would need to download any data. A check is made on the radio between the Start and End Times (at the Radio Interval). Note only Hours and minutes are used, no seconds

Bolus ID	Idle	Calibrate	Logging
Temperature Check Interval	<input type="text" value="1"/>	Minutes	
Radio Interval (Slow Mode)	<input type="text" value="60"/>	Seconds	
Radio Interval (Fast Mode)	<input type="text" value="1"/>	Seconds	
Logging Time (Multiple of TCI)	<input type="text" value="15"/>	Minutes	
<b>Radio Check Time Window</b>			
Start (Hrs:Min:Sec *)	<input type="text" value="00:00:00"/>	End (Hrs:Min:Sec *)	
		<input type="text" value="23:59:00"/>	
		<small>Only Hrs:Min used</small>	

Press the Download Settings button to transfer the settings to the bolus

## Appendix B

<b>Description:</b>	Preparation of artificial rumen fluid
<b>Scope:</b>	Define the preparation of 1000 mL of artificial rumen fluid
<b>Purpose:</b>	Preparation of artificial rumen fluid for conditioning pH boli

### EQUIPMENT

CODE	DESCRIPTION	QUANTITY
	Analytical balance	1
	Magnetic stirrer	1
	pHmeter	1

### MATERIAL AND SOLUTIONS

CODE	DESCRIPTION	QUANTITY
	Acetic acid 5M	5 mL
	NaHCO <sub>3</sub>	9.8 g
	Na <sub>2</sub> HPO <sub>4</sub> .12H <sub>2</sub> O	9.3 g
	NaCl	0.47 g
	KCl	0.57 g
	CaCl <sub>2</sub> (anhyd.)	0.04 g
	MgCl <sub>2</sub> (anhyd.)	0.06 g
	NaOH 5N	
	HCl 5N	

### MAIN STEPS

	ACTION	NAME
1.	Using an analytical balance weight the following constituents: NaHCO <sub>3</sub> 9.80 g  Na <sub>2</sub> HPO <sub>4</sub> .12H <sub>2</sub> O 9.30 g  NaCl 0.47 g  KCl 0.57 g  CaCl <sub>2</sub> (anhyd.) 0.04 g  MgCl <sub>2</sub> (anhyd.) 0.06 g	
2.	Dissolve the CaCl <sub>2</sub> in about 10 mL of deionised water before adding to the other constituents.	
3.	Dissolve the other constituents in 750 mL of deionised water using the magnetic mixer	
4.	Add the 10 mL of CaCl <sub>2</sub> solution	
5.	Add 20 mL of 5M acetic acid	
6.	Complete the volume to 1000 mL with deionised water.	
7.	Final pH should be in the range of 5.5 to 6.5. If it is not, adjust pH using either HCl 5N or NaOH 5N.	

## Appendix C

### **Bolus acceptance protocol**

This is the protocol (to be operated by the customer) to demonstrate that the boluses are operating correctly.

Switch on the hand held eCow computer and login as the nominated user (this is not password protected but can be at the customer's discretion) This is a touch screen computer but it is not waterproof and will not operate in the rain. Put it into a clear plastic bag if working in wet conditions.

The eCow software should start automatically and the green bar state "Connected". If this bar is red or says "Not Connected" check the usb port is connected to the antenna and try again.

Press the screen button that says Configure Bolus and also calibrate the bolus and set the bolus clock to computer time.

Insert the bolus into the cow by fistula. It will take up to 2 hours to migrate to its final resting place in the rumen reticulum. The bolus will rest approximately 100 mm inside the cow at a point approximately 300 mm tailwards from the front legs about 100 mm from the centreline of the cow. A metal detector tuned to maximum range will be provided for demonstration purposes to aid in its location.

The software must be given the correct identity of the bolus. If set running it will continue working for 10 minutes before timeout. If data has not been downloaded repeat the process. Most data will download within a few minutes of contact being established. However, breaks in transmission can occur and the process may need to be repeated.

pH sensors do drift – principally due to different ionic status. Accurate results will only be achieved if the sensor is recalibrated after being kept either in rumen liquor for 24 hours or preferably removed from the cow and calibrated at 39C.

### **Download success criteria :**

A complete file of data downloaded within 1 hour of starting download.

Accuracy. An approximate check on accuracy involves passing a rigid sample tube into the rumen via the fistula and drawing a sample from close to the end cap of the sensor and measuring it immediately.

### **Accuracy Success Criteria – quick test**

The sample drawn from near the bolus end when compared to the immediate pH value will be **within 0.2 pH units of that recorded by the comparative instrument.**

### **Accuracy Success Criteria 2 – formal test**

After the agreed period of measurement (say 1 week for a new customer) the eBolus should be removed, rinsed in warm water and placed in a vessel of 4 pH buffer at 39 C. On interrogation after 5 minutes the bolus output should be between **3.8 and 4.2 pH**. The process should be repeated in buffer 7 and after 5 minutes the bolus output should be between **6.8 and 7.2 pH**. After this the bolus can be recalibrated and placed in another cow.

If there is a difference you may want to apply a linear adjustment to the data file but this is at your own risk as the drift may not be linear.