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## User Manual - Norprim Dispensing Unit V4

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### Abbreviations and Acronyms

<b>Ah</b>	Ampere-Hour
<b>CSV</b>	Comma Separated Values
<b>K-Factor</b>	The number of pulses a flowmeter produces per volume of liquid.
<b>L/M</b>	Litres/Minute
<b>LCD</b>	Liquid Crystal Display
<b>LED</b>	Light Emitting Diode
<b>NDUC-V4</b>	Norprim Dispensing Unit Controller, Version 4
<b>PPL</b>	Pulses Per Litre

### Version History

<b>Date</b>	<b>Author</b>	<b>Comment</b>
27/08/07	CR	Version 1.0

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### 1. Concept of Operation

The Norprim Dispensing Unit Controller, Version 4 (NDUC-V4) is designed for installation in remote locations to provide automatic nutrient dosing into water. Applications include viticulture, hydroponics and dosing cattle or sheep.

Figure 1 on page 2 illustrates a typical application - to dose cattle drinking water. The cattle drink from a water trough which has a sensor to measure the water level. As the cattle consume water from the trough:

- the sensor causes more water to be fed into the trough (this is independent of the Dosing Unit Controller); and
- the Controller causes cattle nutrient to be dispensed into the water, according to a proportion set by the user. Nutrient is not dispensed continuously, but only when a selected amount of water has flowed into the trough; and
- optionally, if the installation has an acid pump, the Dosing Unit Controller causes Nutrient 2 (acid) to be dispensed into the water, according to a proportion set by the user.

The user can easily configure the Controller to set up:

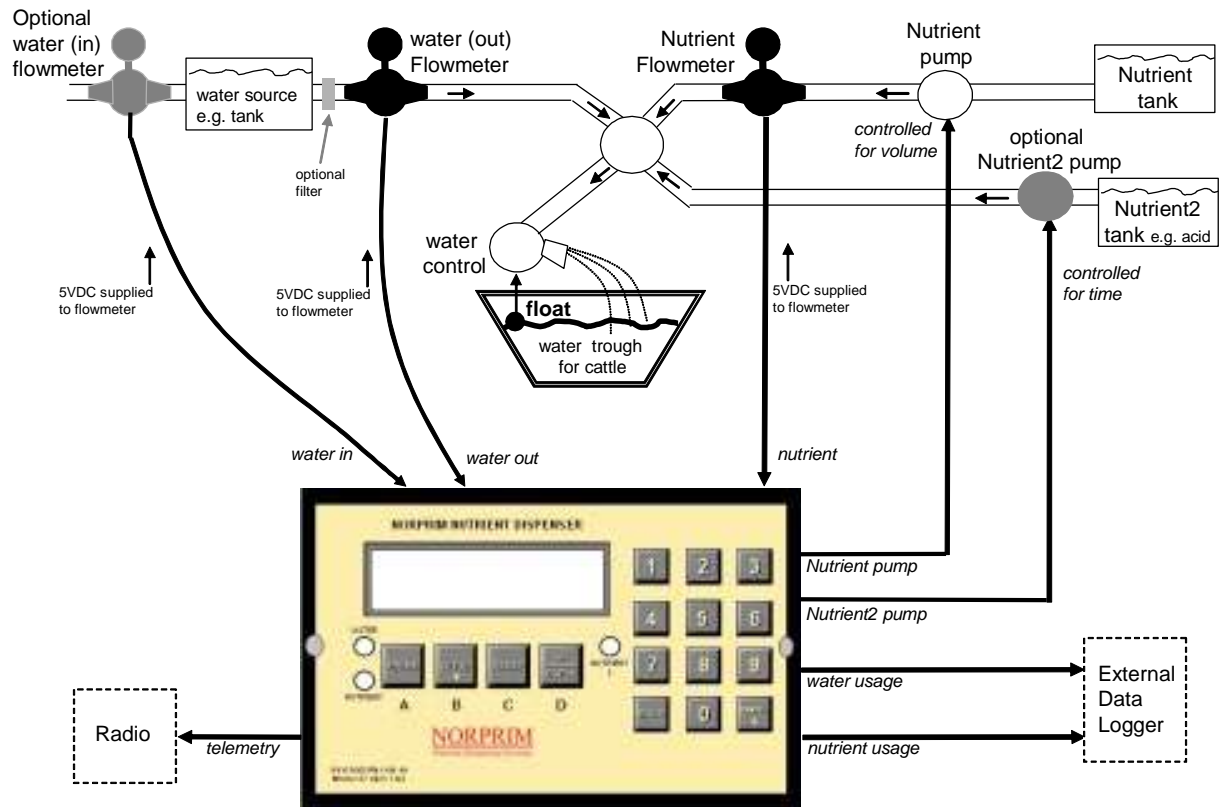
- the proportion of nutrient to water and, if applicable, the proportion of acid to water.
- parameters for the connected flowmeters.
- alarm levels and safety parameters.
- time and date.

The Controller displays to the user:

- alarms.
- tank levels.
- Totals and Grand Totals of water and nutrient.
- flowrate of water out of the water supply.
- time and date.

**To prevent overdose, the Controller has inbuilt safeties that stop the dispensing of nutrient if an alarm situation occurs.**

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**Figure 1. Inputs and Outputs**

The Doser is illustrated used in a cattle dosing application.

Note that the optional items are:

- a flowmeter measuring flow into the water supply e.g. into a water tank.
- a pump for a second chemical (e.g. another nutrient, or Acid).
- an external Data Logger (not part of the Dosing Unit).

## 2. Control Panel

### 2.1 Layout

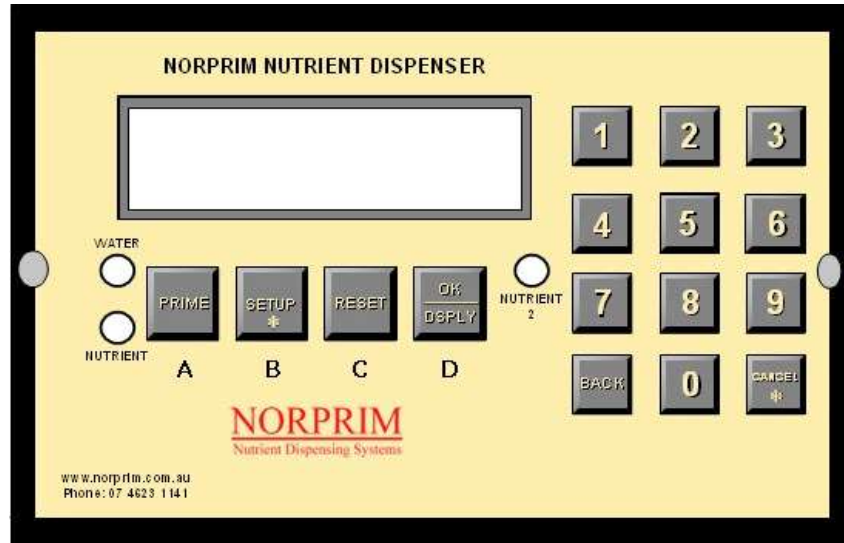


Figure 2. Control Panel Layout

### 2.2 LEDs

The control panel contains three LEDs to provide flow status:

LED	Meaning when lit
WATER	Pulses are being received from the flowmeter which is at the output of the water source i.e. Water is flowing out of the water source.
NUTRIENT	Pulses are being received from the Nutrient flowmeter i.e. Nutrient is flowing.
NUTRIENT 2	The Nutrient 2 pump is being commanded to be ON i.e. Nutrient 2 should be flowing.

Table 1. Status LEDs.

### 2.3 Buzzer

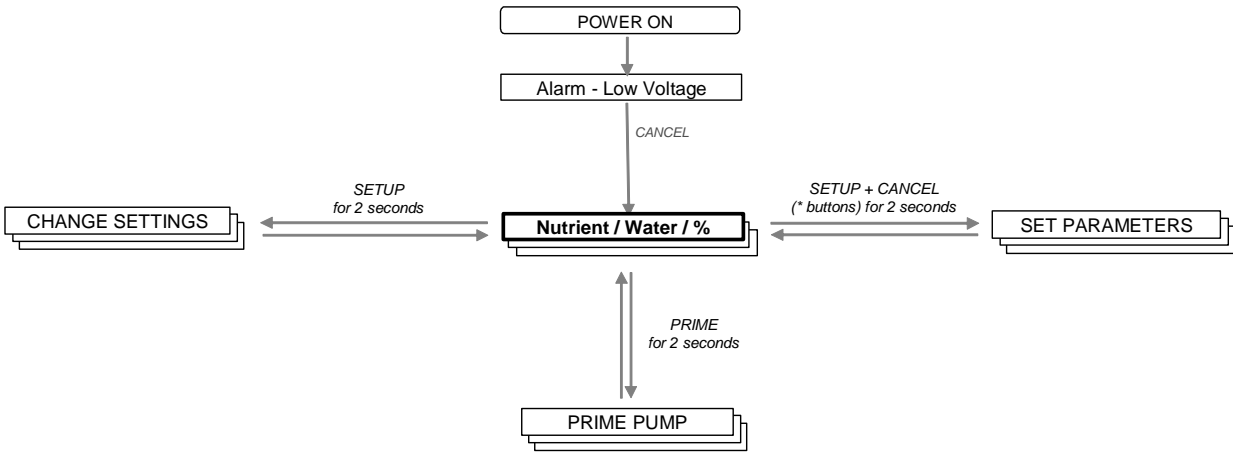
The Controller has an internal buzzer, which:

- makes a *click* sound when a valid button is pressed;
- makes a *blaaap* sound when a button press is invalid;
- beeps repeatedly whenever there is an unacknowledged alarm.

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## 3. Displays

### 3.1 Overview



**Figure 3. Display/menu structure overview**

The *Nutrient/Water/%* display is the main display, and is shown after the power-on sequence completes.

From the *Nutrient/Water/%* display, other sub-menus are reached by pressing buttons, or combinations of buttons, as described in detail in the following sections.

### 3.1 Power-On

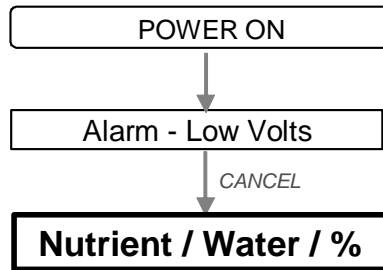


Figure 4. Power-on sequence

As shown in Figure 4 above, upon power-on, an alarm is displayed (and the beeper sounds) to indicate that there was a previous loss of power.

#	#	#		A	L	A	R	M		P	O	W	E	R	
L	O	W		I	N	P	U	T		V	O	L	T	S	

Press the CANCEL button to acknowledge and clear the alarm.

The *Nutrient/Water/%* display is then shown.

N	U	T	R	T		W	A	T	E	R					%
1	0	0	m	l		0	1	0	L		1	.	0	0	0

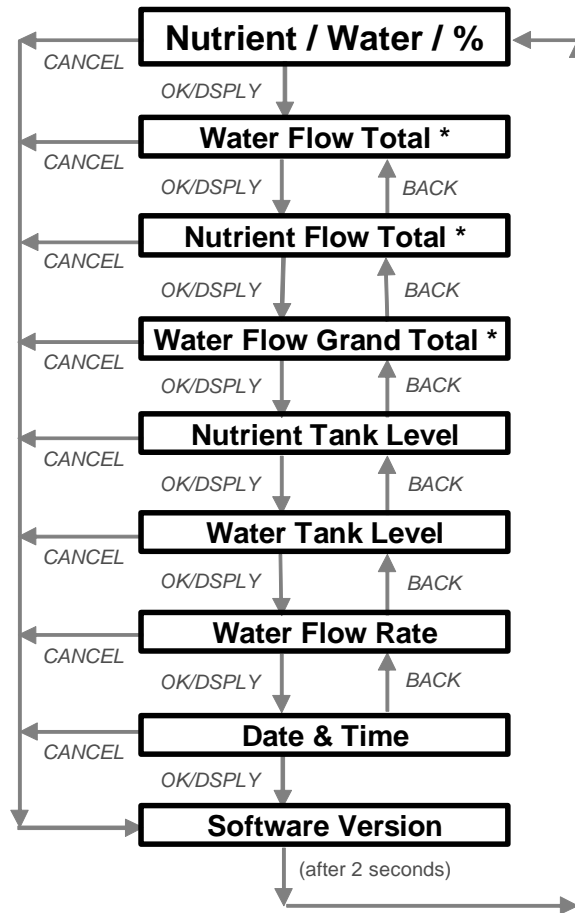
The *Nutrient / Water / %* display shows

- the set volume of nutrient (ml) to the volume of water (Litres); and
- the set nutrient:water ratio expressed as a percentage  
e.g. 100ml nutrient in 10L water =  $(0.1 \text{ L} / 10 \text{ L}) \times 100\% = 1\%$

The Nutrient to Water ratio can be modified via the User Setup Settings submenu (see section 3.3).



### 3.2 Main Displays



**Figure 5. Main Display Sequence**

Note: For each display marked with an asterisk (\*):  
pressing the RESET button for 2 seconds whilst that display is showing  
will reset that display's total to zero.

Figure 5 above shows the structure of the main displays.

- Pressing the OK / DSPLY button moves to the next display in the sequence.  
Pressing the OK / DSPLY button repeatedly will step through the sequence to eventually return to the *Nutrient / Water / %* display (via the *Software Version* being shown momentarily).
- Pressing the BACK button moves back to the previous display in the sequence.
- Pressing the CANCEL button from any display in the sequence returns to the *Nutrient / Water / %* display (via the *Software Version* being shown momentarily).

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The displays in the sequence (with example data) are:

N	U	T	R	T		W	A	T	E	R					%
1	0	0	m	l		0	1	0	L		1	.	0	0	0

Nutrient volume to water volume as a %, according to the volume of nutrient (ml) to volume of water (Litres).

The Nutrient to Water ratio can be modified via the User Setup Settings submenu (see section 3.3).

W	A	T	E	R		F	L	O	W		T	O	T	A	L
											7	3	6		L

Total volume of water (in Litres) that has flowed out of the water supply, since this total was last reset.

Whilst Water Flow Total is displayed, if the RESET button is pressed for 2 seconds then this total is reset to zero.

N	U	T	R	I	E	N	T		F	L	O	W			
T	O	T	A	L									1	0	L

Total volume of Nutrient (in Litres) that has been dispensed, since this total was last reset.

Whilst Nutrient Flow Total is displayed, if the RESET button is pressed for 2 seconds then this total is reset to zero.

W	A	T	E	R		F	L	O	W		G	R	A	N	D
T	O	T	A	L										8	K L

Grand Total volume of water (in KiloLitres) that has flowed out of the water supply, since this total was last reset.

Whilst Water Flow Grand Total is displayed, if the RESET button is pressed for 2 seconds then this total is reset to zero.

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```
N U T R I E N T   T A N K
L E V E L           1 2   L
```

The current level (in Litres) of the Nutrient Tank.

```
W A T E R   T A N K   L E V E L
                1 2 3   L
```

The current level (in Litres) of the Water supply (based on initial volume minus consumption)

```
W A T E R   F L O W R A T E
                2   L / M
```

The current flowrate (in Litres/minute) of water from the water supply.

```
      D A T E           T I M E
D D - M M M - Y Y   H H : M M
```

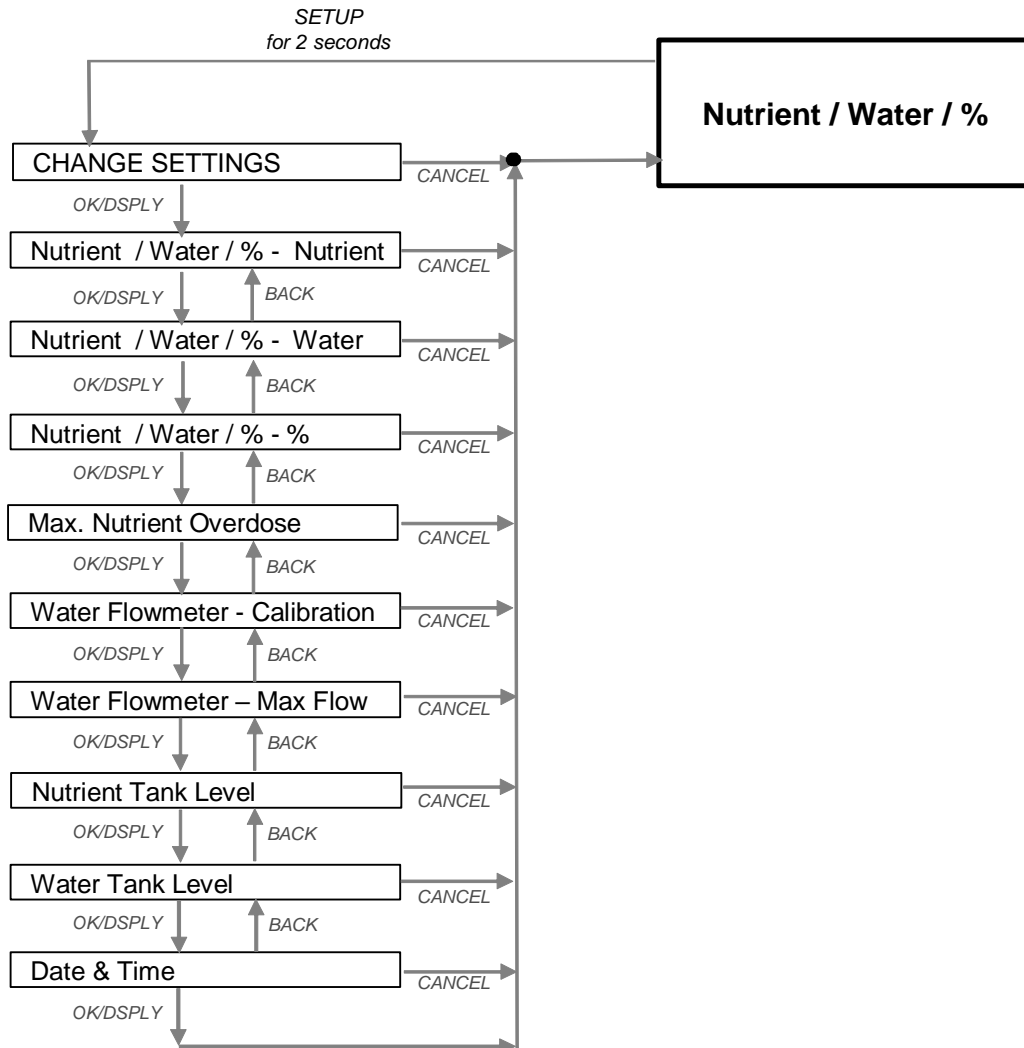
The current date, and the time (in 24 hour format).

The date and time is used to timestamp events in the Event Log.  
Note: the time does not adjust automatically for Daylight Saving.

```
N O R P R I M   V 0 1 . 0 0
N U T R I E N T   D S P N S R
```

The Software version number  
e.g. Version 1.00

### 3.3 User Setup Settings



**Figure 6. User Setup Settings**

The User Setup Settings submenu is entered from the *Nutrient / Water / %* display, by pressing the **SETUP** button for 2 seconds.

Figure 6 above shows the displays that enable the user to change the setup settings.

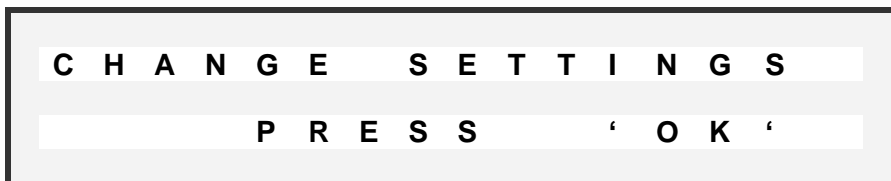
- Pressing the **OK / DSPLY** button moves to the next display in the sequence. Pressing the **OK / DSPLY** button repeatedly will step through the sequence to eventually return to the *Nutrient / Water / %* display.
- Pressing the **BACK** button moves back to the previous display in the sequence.
- Pressing the **CANCEL** button from any display in the sequence returns to the *Nutrient / Water / %* display.

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In the User Setup Settings submenu, where a setup value can be changed, the display shows the value flashing (in the display descriptions that follow, values shown on a black background indicate digits that would be flashing e.g. **123**). You can then either:

- press the OK/DSPLY button to leave the flashing value unchanged and move to the next display in the sequence; or
- press the BACK button to leave the flashing value unchanged and move to the previous display in the sequence; or
- press CANCEL to leave the flashing value unchanged and return to the *Nutrient / Water / %* display; or
- change the value by:
  - pressing the number keys to enter a new value (the digits will still flash). (At this point, pressing CANCEL will revert the flashing digits to the value they had before you entered the change); and then
  - press OK/DSPLY to lock in the new value and move to the next display in the sequence.

The displays in the User Setup Settings sequence (with example data) are:



- Press the OK/DSPLY button to proceed; or
- Press the CANCEL button to return to the *Nutrient / Water / %* display.

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N	U	T	R	T	W	A	T	E	R	%			
1	0	0	m	l	0	1	0	L	1	.	0	0	0

User can change the Nutrient value (which is shown flashing).

In the above example, for every 10 Litres of water that flows from the water source, 100 millilitres of nutrient will be dispensed.

N	U	T	R	T	W	A	T	E	R	%		
1	0	0	m	l	1	0	L	1	.	0	0	0

User can change the Water value (which is shown flashing).

N	U	T	R	T	W	A	T	E	R	%			
1	0	0	m	l	0	1	0	L	1	.	0	0	0

The % value is shown flashing (but cannot be directly changed).

To change the % value, user must change either the Nutrient or Water value (press the BACK button to go to the previous displays).

M	A	X	N	U	T	R	I	E	N	T		
O	V	E	R	D	O	S	E	1	0	0	m	l

The maximum excess volume (in mls) of nutrient that can be dispensed before an overdose alarm occurs.

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```
W A T E R   F L O W M E T E R
C A L       1 0 0 0 . 0   P P L
```

The water flowmeter calibration value (its pulse output rate in pulses/Litre) should be found in the flowmeter's datasheet.

```
W A T E R   F L O W M E T E R
M A X F L O       7 0   L / M
```

The water flowmeter's maximum allowed flowrate should be found in the flowmeter's datasheet.

```
N U T R I E N T   T A N K
L E V E L       1 2   L
```

For the flowmeter that measures water out of the water source: calibration value for the flowmeter (i.e. the flowmeter's pulse output in Pulses/Litre ).

For the flowmeter that measures water in of the water source: maximum allowed flowrate (in Litres/minute) before an alarm occurs.

The current known level of the nutrient tank (in Litres).

```
W A T E R   T A N K   L E V E L
1 2 3   L
```

The current known level of the water supply (in Litres).

```
DATE           TIME
0 1 / 0 1 / 0 7   1 4 : 1 0
```

Current date (in format DD-MMM-YY), and time (in 24-hour HH:MM format).

The date and time is used to timestamp events in the Event Log. Note: the time does not adjust automatically for Daylight Saving.

### 3.4 Factory Parameters

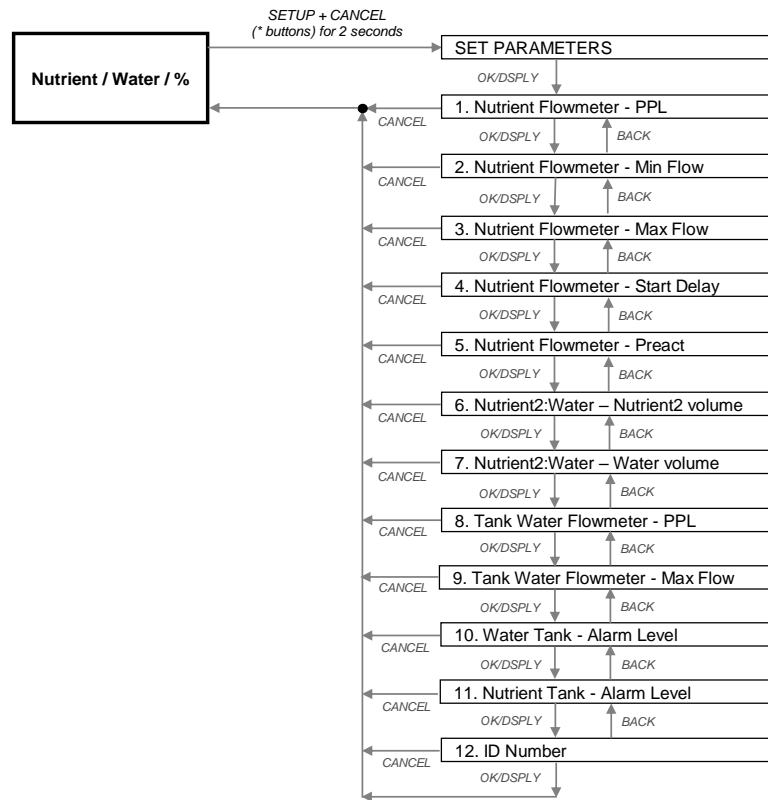


Figure 7. Factory Parameters

The Factory parameters submenu is entered from the *Nutrient / Water / %* display, by pressing the SETUP and CANCEL buttons (the buttons with an asterisk ‘\*’ on them) simultaneously for 2 seconds.

Figure 7. Factory Parameters above shows the displays that change factory settings.

- Each of the factory setting displays has a number.
- Pressing the OK / DSPLY button moves to the next display in the sequence. Pressing the OK / DSPLY button repeatedly will step through the sequence to eventually return to the *Nutrient / Water / %* display.
- Pressing the BACK button moves back to the previous display in the sequence.
- Pressing the CANCEL button from any display in the sequence returns to the *Nutrient / Water / %* display.



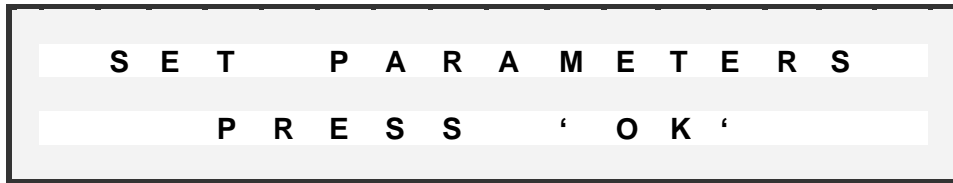
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In the Factory Parameters submenu, where a value can be changed, the display shows the value flashing (in the display descriptions that follow, values shown on a black background indicate digits that would be flashing e.g. **123**). You can then either:

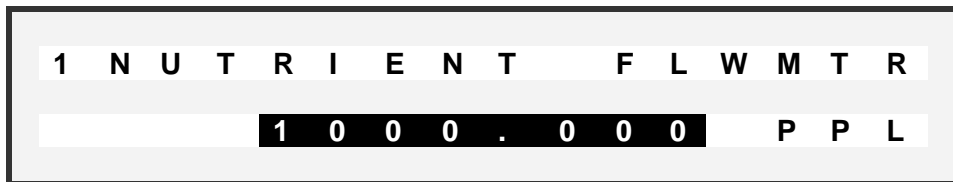
- press the OK/DSPLY button to leave the flashing value unchanged and move to the next display in the sequence; or
- press the BACK button to leave the flashing value unchanged and move to the previous display in the sequence; or
- press CANCEL to leave the flashing value unchanged and return to the *Nutrient / Water / %* display; or
- change the value by:
  - pressing the number keys to enter a new value (the digits will still flash).  
(At this point, pressing CANCEL will revert the flashing digits to the value they had before you entered the change);  
and then
  - press OK/DSPLY to lock in the new value and move to the next display in the sequence.

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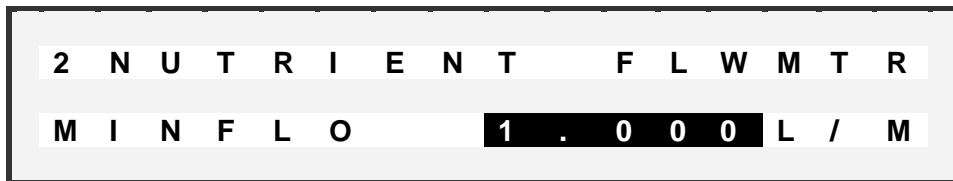
The displays in the Factory Parameters submenu sequence (with example data) are:



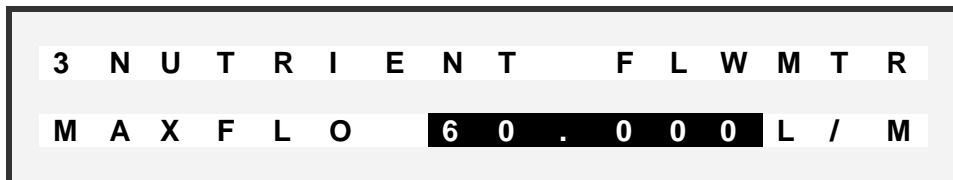
Press the OK/DSPLY button to proceed.



Nutrient Flowmeter calibration value (i.e. the flowmeter's pulse output rate in Pulses/Litre).



Minimum allowed flowrate (in Litres/minute) for the nutrient flowmeter before an alarm occurs.



Maximum allowed flowrate (in Litres/minute) for the nutrient flowmeter before an alarm occurs.

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4	N	U	T	R	I	E	N	T	F	L	W	M	T	R
S	T	A	R	T	D	E	L	A	Y	2	S			

Start Delay for the nutrient flowmeter (in seconds).

The Start Delay is the time period the controller waits before checking if the flow of nutrient through the nutrient flowmeter is within allowed limits. This delay is necessary to allow the nutrient pump to reach its operational speed.

5	N	U	T	R	I	E	N	T	F	L	W	M	T	R
P	R	E	A	C	T				2	2	m	l		

Preact for the nutrient flowmeter (in millilitres).

Because the nutrient pump cannot stop instantly, it must be signalled to stop slightly before the required quantity of nutrient has been dispensed. The Preact value sets how early the stop signal is sent e.g. if preact is 22ml, then the nutrient pump will be signalled to stop when the nutrient volume is 22ml short of the required quantity to be dispensed.

6	N	U	T	R	I	E	N	T	2	1	S			
W	A	T	E	R					5	0	L			

Sets the number of seconds that Nutrient 2 will be dispensed for the given quantity of water that flows.

e.g. in the above example, for every 50 Litres of water that flows, Nutrient 2 will be dispensed for 1 second.

If there is no Nutrient 2, then set this value to 0 (zero), in which case there will also not be an option to prime the Nutrient 2 pump (see Figure 9).

7	N	U	T	R	I	E	N	T	2	1	S			
W	A	T	E	R					5	0	L			

Sets the quantity of water that determines when Nutrient 2 will be dispensed.

e.g. in the above example, for every 50 Litres of water that flows, Nutrient 2 will be dispensed for 1 second.

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T	A	N	K	W	A	T	E	R	F	L	M	T	R	
8				1	0	0	0	.	0	0	0	P	P	L

The flowmeter calibration value (its pulse output rate in pulses/Litre) should be found in the flowmeter's datasheet.

For flowmeter that measures water into the water source: calibration value for the flowmeter (i.e. flowmeter's pulse output rate in Pulses/Litre).

T	A	N	K	W	A	T	E	R	F	L	M	T	R
9	M	A	X	F	L	O			7	5	L	/	M

The water flowmeter's maximum allowed flowrate should be found in the flowmeter's datasheet.

For flowmeter that measures water into the water source: maximum allowed flowrate (in Litres/minute) before an alarm occurs.

1	0	W	A	T	E	R	T	A	N	K			
A	L	A	R	M					1	0	0	0	L

In the above example, if the calculated level of the water supply falls below 1000 Litres, then an alarm will be raised.  
If the alarm threshold is set to 0 (zero), then the level of the water source will NOT be monitored, and a low water level alarm will never be raised.

The alarm threshold for the water supply level, below which a low water level alarm will be raised.

1	1	N	U	T	R	I	E	N	T	T	A	N	K
A	L	A	R	M						5	L		

In the above example, if the calculated level of the nutrient supply falls below 5 Litres, then an alarm will be raised.  
If the alarm threshold is set to 0 (zero), then the level of the nutrient will NOT be monitored, and a low nutrient level alarm will never be raised.

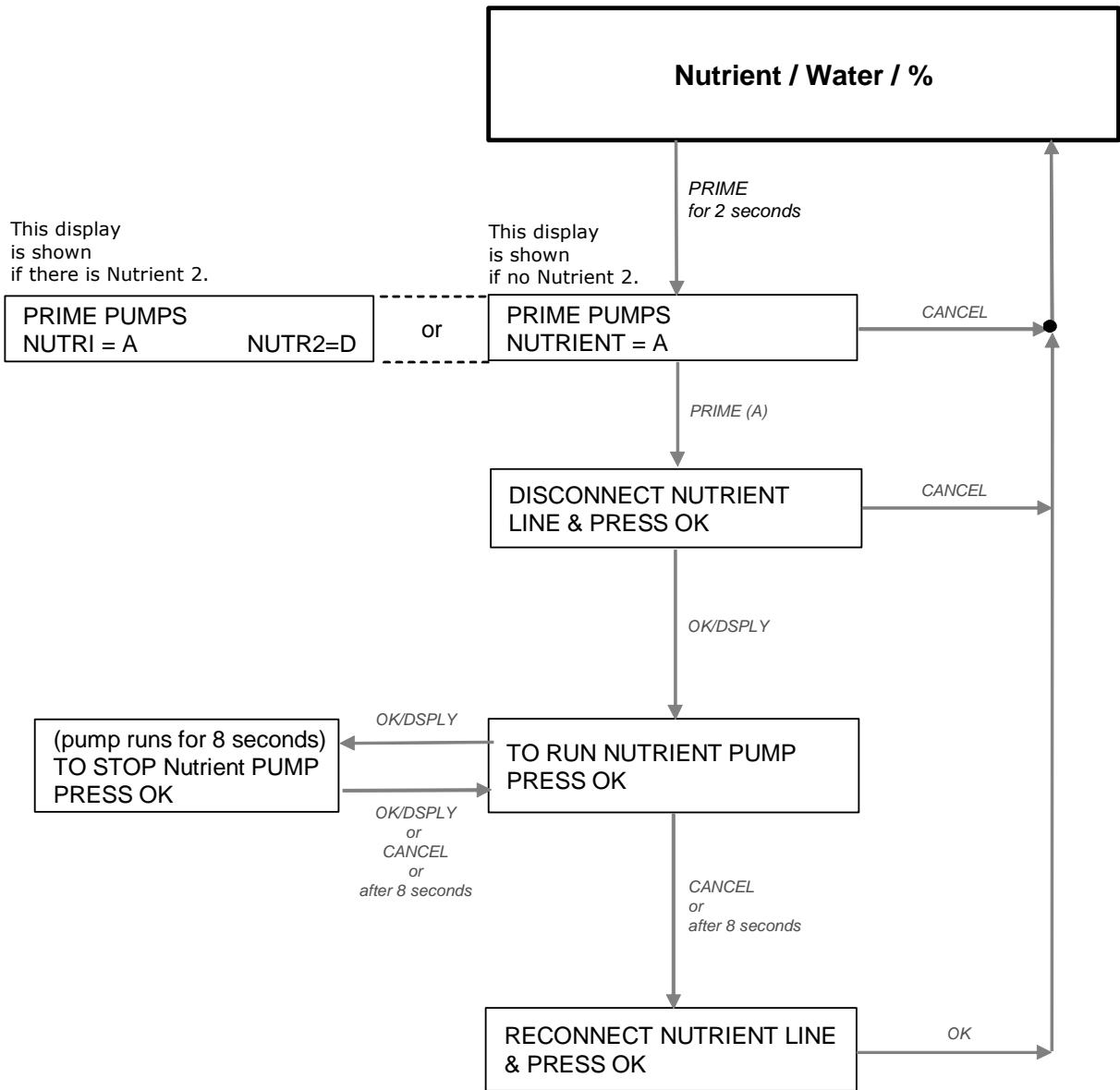
The alarm threshold for the nutrient tank, below which a low nutrient level alarm will be raised.

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1	2	A	L	A	R	M	I	D	
I	D	N	U	M	B	E	R	0	

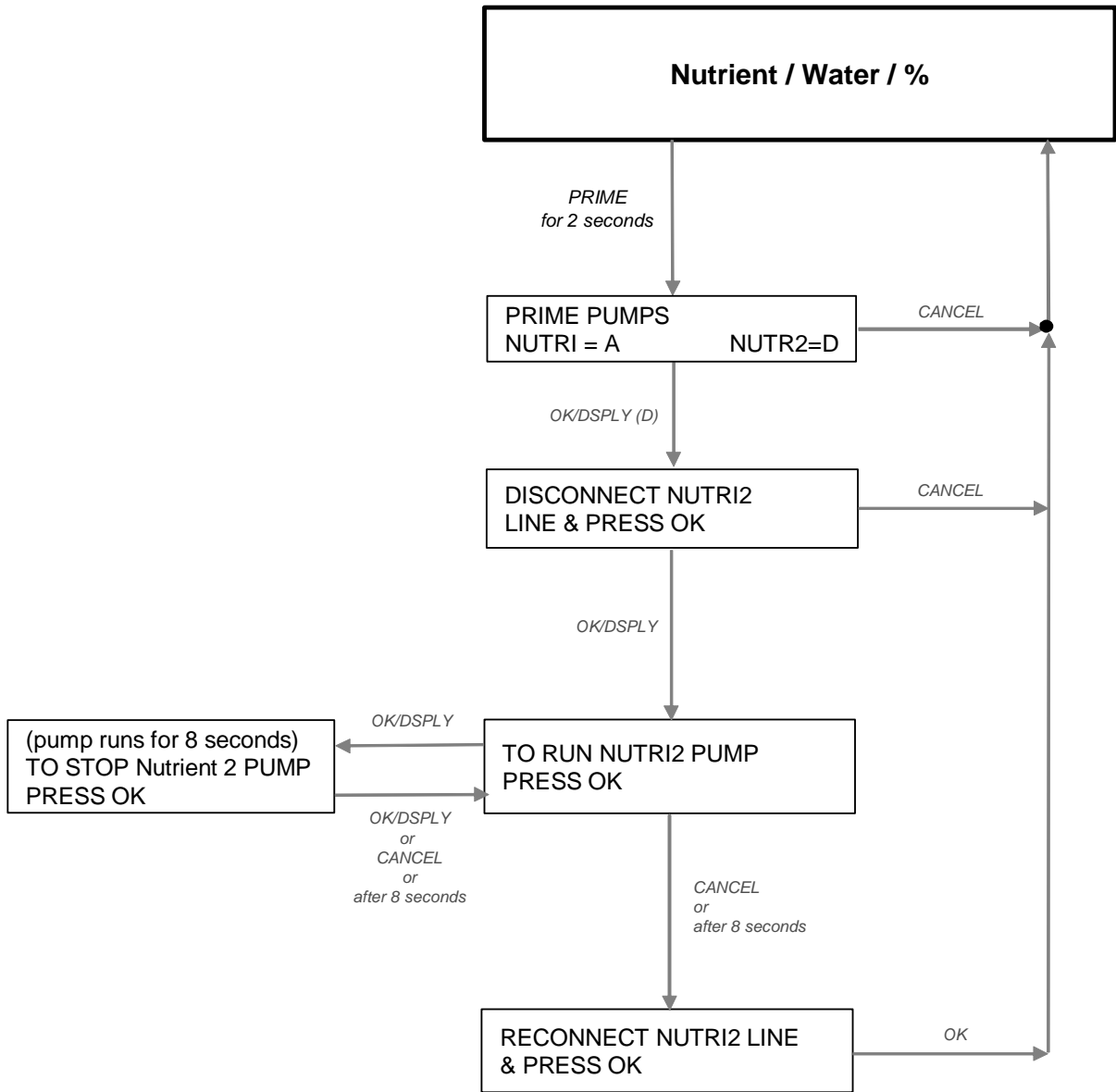
The ID number is used to identify a site, where multiple sites report to a central base via telemetry.

### 3.5 Prime Pumps



**Figure 8. Priming Nutrient Pump**

The option to prime Nutrient 2 only appears if, in the Factory Parameters menu number 6, the Nutrient 2 seconds have a non-zero value (see section 3.4).



**Figure 9. Priming Nutrient 2 Pump**

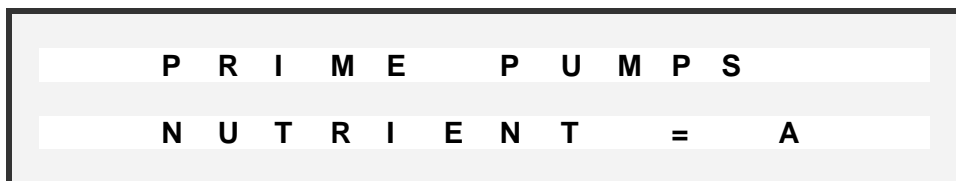
The option to prime Nutrient 2 only appears if, in the Factory Parameters menu number 6, the Nutrient 2 seconds have a non-zero value (see section 3.4).

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The submenu to prime the Nutrient (and optionally the Nutrient 2) pump is entered from the *Nutrient / Water / %* display, by pressing the PRIME button for 2 seconds.

Next, either one of two displays will be shown:

(1a) if there is no Nutrient 2:

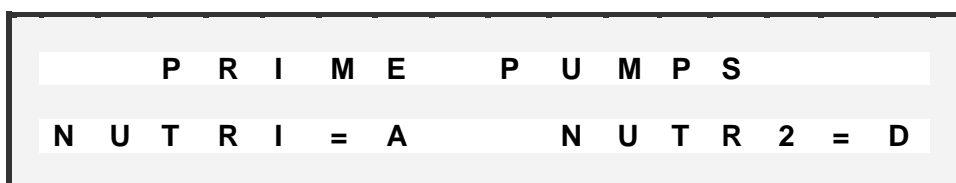


The display shows two lines of text. The first line reads "P R I M E P U M P S" with spaces between letters. The second line reads "N U T R I E N T = A" with spaces between letters.

To continue to prime the Nutrient pump, press the button marked 'A' (the PRIME button).

- This display only allows the Nutrient pump to be primed. This version is shown if, in the Factory Parameters menu number 6, the Nutrient 2 seconds have a value of zero (see section □3.4).
- Pressing the CANCEL button will return to the Nutrient / Water / % display.

(1b) else, if there is Nutrient 2:



The display shows two lines of text. The first line reads "P R I M E P U M P S" with spaces between letters. The second line reads "N U T R I = A N U T R 2 = D" with spaces between letters.

To prime the Nutrient pump, press the button marked 'A' (the PRIME button).

- This display allows either the Nutrient pump, or the Nutrient 2 pump, to be primed.
- This version is shown if, in the Factory Parameters menu number 6, the Nutrient 2 seconds have a non-zero value (see section □3.4).
- Pressing the CANCEL button will return to the Nutrient / Water / % display.

To prime the Nutrient 2 pump, press the button marked 'D' (the OK/DSPLY button).

(2) The following describe priming the Nutrient Pump (priming the Nutrient 2 pump is similar, except that the display text is different to refer to Nutrient 2).



The display shows two lines of text. The first line reads "D I S C O N E C T N U T R ' T" with spaces between letters. The second line reads "L I N E & P R E S S O K" with spaces between letters.

The user is instructed to disconnect the Nutrient line.

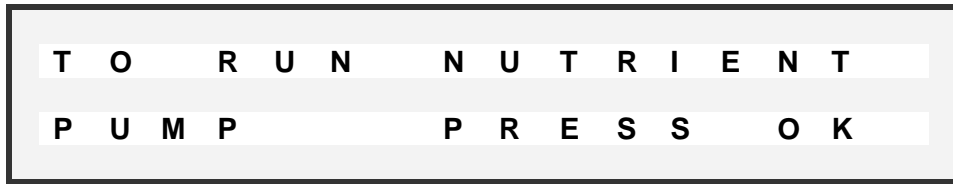
Either:

- press the OK/DSPLY button after the Nutrient line has been disconnected; OR
- press the CANCEL button to return to the Nutrient / Water / % display.



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(3)



The pump can be started by pressing the OK/DSPLY button.

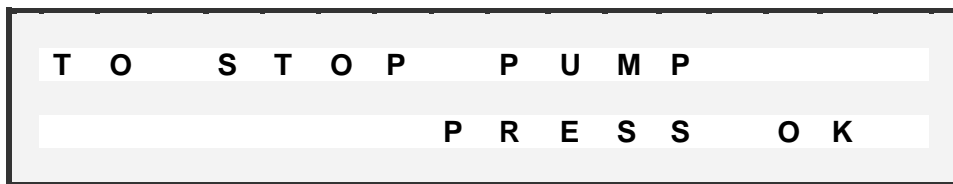
Either:

- press the OK/DSPLY button to start the Nutrient pump (which will then run for 8 seconds);

OR, to avoid running the pump:

- press CANCEL, or do nothing for 8 seconds, and the display will then change to (5).

(4) If the user selects to run the pump, then this display will be shown whilst the pump is running:

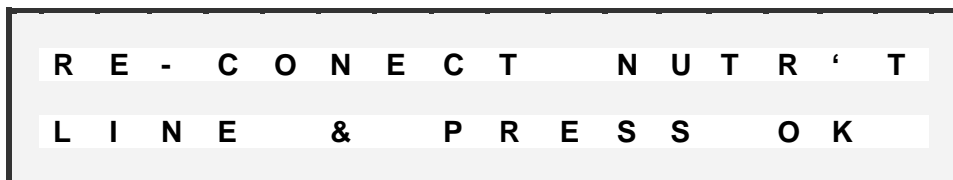


Whilst the pump is running, it can be stopped by pressing the OK/DSPLY button.

Either:

- allow the pump to run (it will run for 8 seconds); OR
- to stop the pump whilst it is running, press the OK/DSPLY button or the CANCEL button, and the display will return to (3).

(5)



The user is instructed to re-connect the Nutrient line.

After re-connecting the Nutrient line, press the OK/DSPLY button to return to the *Nutrient / Water / %* display.

#### 4. Telemetry

If any alarm exists, and if a radio is connected, then an audio signal is sent via the radio to indicate that there is an alarm.

The audio pattern is shown in

Figure 10 below.

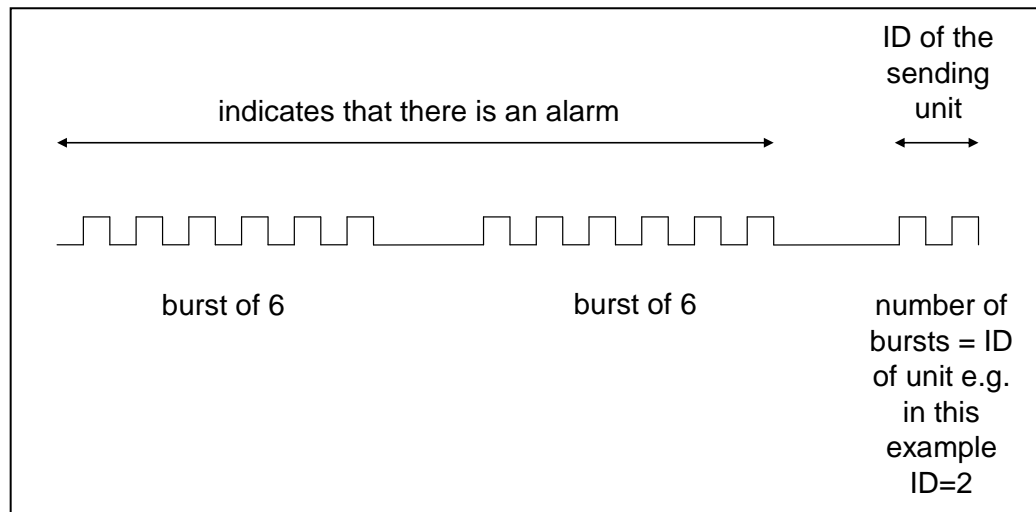


Figure 10. Telemetry Alarm Audio Signal

The audio pattern continues for 15 minutes, and then repeats every hour, until there is no longer an un-cancelled alarm.

## 5. Alarms List

The possible alarms are listed in Table 2 on page 25.

**An alarm is cancelled by the user pressing the CANCEL button.**

An alarm message appears until:

- the alarm is cancelled by the user; AND
- the associated alarm condition no longer exists (otherwise the alarm will be re-raised).

The only exception is that after cancelling a Low Water or Low Nutrient alarm, the Dispensing Unit will keep beeping without an alarm message showing, to indicate that:

- the level of the nutrient tank is still below the nutrient level alarm threshold; and/or
- the level of the water supply is still below the water supply level alarm threshold.

In this case, the beeping will only stop after:

- the user replenishes the water/nutrient supply (as applicable); and
- changes the Water/Nutrient supply level (as applicable) via the User Setup menu to indicate the replenished level (see section 3.3).

For some alarms, the nutrient pump is locked, meaning that the pump is stopped and cannot be operated again (automatically or manually), until the alarm is cancelled (by the user pressing the CANCEL button).

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Alarm	Meaning	Nutrient pump locked *
### ALARM MAX FLOW WATER SUPPLY OUT	The flowrate of water out of the water supply exceeds the maximum limit.	yes
### ALARM MAX FLOW TANK SUPPLY IN	The flowrate of water into the water supply exceeds the maximum limit.	no
### ALARM MAX FLOW NUTRIENT	The flowrate of nutrient exceeds the maximum limit.	yes
### ALARM ERROR NUTRT OVERDOSE	The volume of nutrient dispensed exceeds the programmed amount by more than the allowed overdose threshold.	yes
### ALARM OVR RUN NUTRIENT PUMP	The nutrient pump was operated <u>automatically</u> for a time exceeding the timeout period (the timeout is not configurable by the user).  Note: if the pump is primed <u>manually</u> (see section 3.5), then when the timeout period is exceeded the pump will be stopped, but this alarm will not be raised.	yes
### ALARM NUTRIENT NO FLOW	Signal pulses from the nutrient flowmeter (that indicate the flow of nutrient) were not received when expected.	yes
### ALARM TANK LOW WATER LEVEL	The level of water in the water source is less than the allowed low level.	no
### ALARM TANK LOW NUTRT LEVEL	The level of nutrient in the nutrient tank is less than the allowed low level.	no
### ALARM NUTRIENT LEAKAGE	Nutrient is flowing when it should not be.	yes
### ALARM PUMP LOCKOUT	Due to a critical problem, the nutrient pump has been prevented from operating when it normally would. <b>To unlock the pump after this alarm, the alarm must be cancelled AND the Dispensing Unit must be switched off for a few seconds and then switched back on again.</b>	yes

**Table 2. The Possible Alarms.**

\* For some alarms, the nutrient pump is locked, meaning that the pump is stopped and cannot be operated again (automatically or manually), until the alarm is cancelled (by the user pressing the CANCEL button).

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### 6. Technical Specifications

	Number	Type	Rating	Comments
<b>Enclosure</b>			IP54 (facia only)	With panel mounting gasket.
<b>Power</b>		DC	12V, 15A	Sourced from 18 Ah battery.
<b>Operating Temperature</b>			0 - 50 °C	
<b>Inputs</b>	3	digital pulse inputs, accepting reed, coil or NPN.	<= 1 kHz	<ul style="list-style-type: none"> <li>• From Nutrient flowmeter.</li> <li>• From Water flowmeter, at tank output.</li> <li>• <i>(optional)</i> From Water flowmeter at tank input.</li> </ul>
<b>Outputs</b>	3	Relay	12VDC, 10A	<ul style="list-style-type: none"> <li>• To Nutrient pump.</li> <li>• <i>(optional)</i> To Nutrient solenoid.</li> <li>• <i>(optional)</i> To Nutrient 2 pump.</li> </ul>
	2	Open Collector	<= 100Hz	<ul style="list-style-type: none"> <li>• For data logging of Water usage (1 pulse / 10 Litres).</li> <li>• For data logging of Nutrient usage (1 pulse / 1 Litre).</li> </ul>
<b>Display</b>	1	LCD		<ul style="list-style-type: none"> <li>• 28 x 102mm</li> <li>• 2 lines x 16 characters</li> </ul>
	3	LEDs		<ul style="list-style-type: none"> <li>• pulses from Water (out) Flowmeter.</li> <li>• pulses from Nutrient Flowmeter.</li> <li>• Nutrient 2 pump is on.</li> </ul>
<b>Telemetry</b>	3			<ul style="list-style-type: none"> <li>• Audio output</li> <li>• Talk Contact</li> <li>• Talk Contact (Ground)</li> </ul>