

# DELTA 4

## Calibration and Operating Instructions

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**Software Issue:** ..... **302-113**

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## Conventions

This document uses the following conventions:

**Bold** indicates emphasis or an action to be taken.

**LCD** typeface indicates specific data-entry or visual display on the instrument.

### **NOTE**

Text containing important additional information.



Caution messages appear where procedures which, if not observed, could result in loss of data or in damage to equipment.

### **WARNING!**

Warning messages alert you to specific points which if not observed, could cause serious personal injury.

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RDS *Delta 4* is a sophisticated **monitoring and automatic rate control** system suitable for any type of sprayer or slurry applicator. The *Delta 4* system uses a forward speed sensor, a **pressure** sensor and an interface with the sprayer control unit to provide the basic data.

It displays the following information in either metric or imperial units,

- ▣ Instantaneous Application Rate
- ▣ Spraying pressure (Analogue+ Digital display)
- ▣ Total Volume sprayed
- ▣ Total Area worked
- ▣ Part (Trip) Area worked
- ▣ Tank Contents
- ▣ Forward Speed

### Automatic Rate Control

The *Delta 4* is a fully automatic rate control system which regulates the application rate irrespective of the forward speed.

A '**Target' application rate** is programmed in *Delta 4* and the system regulates to this setting.

The target application rate can be easily altered during normal operation in 10% steps by a single switch on the *Delta 4* front panel, for example when small areas require special application rates.

### Manual Rate Control

*Delta 4* can also be operated in manual mode and the sprayer output can be altered from the front panel.

*Delta 4* will also warn the sprayer operator if the forward speed is outside acceptable limits for the spray nozzles and the application rate used.

As the *Delta 4* control system is based on a pressure/speed relationship, the instrument must be programmed with the nozzle output characteristic. Data for up to eight different types of spray nozzle can be stored in memory. It is then simple to select the desired nozzle type, setting the instrument with the appropriate Target Application Rate, Target Speed, and Target Pressure for that nozzle.

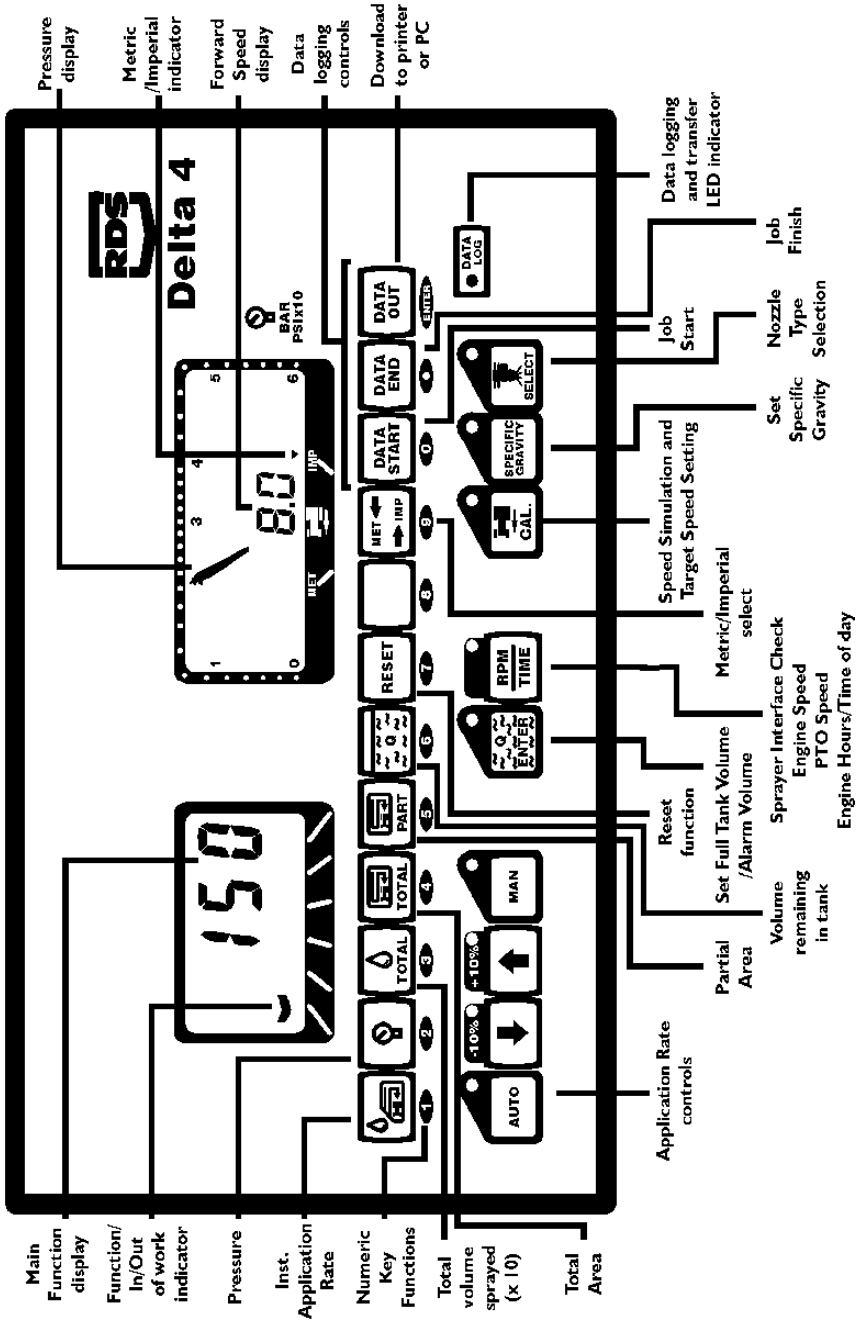
*Delta 4* offers additional functions by connecting the following,

- ❑ **A Flow Sensor** installed in the filling hose to monitor and if a solenoid valve is fitted, automatically control the tank filling.
- ❑ **Engine Speed Sensor** and **PTO Speed Sensor**.  
The instrument can be programmed with minimum and maximum ground speeds at which an audible alarm will alert the operator.
- ❑ **Data logging and Data Transfer** via an RS 232 serial interface directly to a desktop PC, an RDS ICP100 *In-cab printer*, or to a 'PSION Organiser'.

*Delta 4* is primarily used with agricultural sprayers, but in combination with suitable sensors, may be used on slurry application systems.

### Programme Modes

Calibration procedures in Modes 'CAL 1', 'CAL 2' and 'CAL 3' are described in this manual and include the above options.



## 2.1 Switch On

*Delta 4* is normally powered through the vehicle ignition switch.

**When the instrument is powered, both displays will come on momentarily as a display test is run.**

After the display test has ended, *Delta 4* displays the last function selected.

Both displays are permanently illuminated.

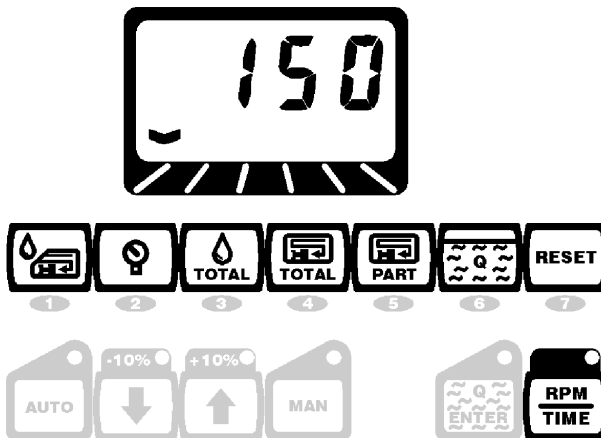
All programmed and accumulated information is secure when the instrument is switched off. It can be totally disconnected from the vehicle and will still retain all its stored data.

### The lefthand display

The lefthand display is the main information display. Any one of up to ten primary display functions and Reset can be selected by pressing the appropriate **blue** touch switch.

The selected function is indicated by the small chevron indicator at the bottom of the display, a red L.E.D indicator on the switch or a message on the righthand display.

Lefthand Display/Primary Function switches





## In work/Out of Work Indicator

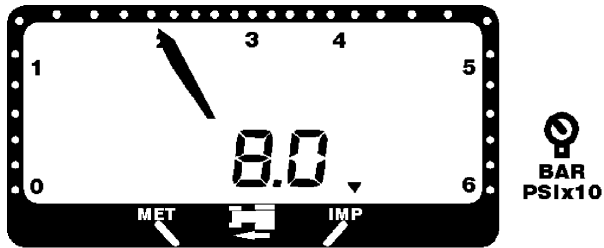
Area normally accumulates only when the implement is in work.

If an automatic override switch, or sprayer control interface is connected then the area accumulation is automatically stopped and started.

When the implement is out of work, the chevron indicator on the lefthand display will flash.

When the implement is in work, the chevron indicator will be on continuously.

## The righthand display



**Spraying pressure** is displayed in the range 0 to 6 bar (or 0 to 60 p.s.i.). The pressure is displayed as an analogue display.

**Forward speed** is displayed (km/h or miles/hr) as a digital display.

## 2.2 Main Functions (Blue)



### Instantaneous Application Rate

Displayed in litres/hectare or gallons/acre.



### Spraying pressure

Displayed in bar or p.s.i (x 10).



### Total Volume Sprayed

Displayed in litres or gallons x 10.



### Total area

Displayed in hectares or acres



### Partial area

Displayed in hectares or acres



### Volume remaining in tank


Displayed in litres or gallons



### Sprayer Interface Check, Engine/P.T.O. R.P.M., Engine Hours, Time

*Delta 4* displays the number of nozzles which are recognized as being switched 'on'.

The other four functions can be displayed if the optional speed sensors are installed on the vehicle.

1 **Press**  to cycle through the five functions.

**The lefthand display** shows the current value.

**The righthand display** will indicate the function selected, in the following order,

**'No'** Number of active nozzles

**'Pt0'** P.T.O. R.P.M.

'EnG' Engine R.P.M.

'HrS' Engine Hours

'Hr' Time of Day



### Reset main functions

The Area and Volume registers can be reset to zero. The 'Volume Remaining In Tank' register will reset to the original 'Full Tank' volume.

1 **Select** the appropriate function

2 **Press and hold** 


## 2.3 Secondary Functions (Red)



### Metric - Imperial

*Delta 4* can operate in either metric or imperial units.

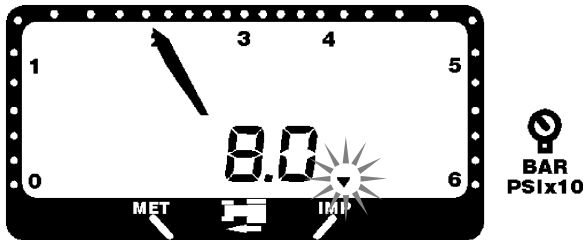
#### Change units

1 **Press and release** 

The small arrow indicator at the bottom of the righthand display (below) shows which mode is selected.

All displayed and stored information is converted appropriately. Check whether Metric or Imperial mode is set before entering any programme data such as Target Speed or Application Rate.

#### Units Display



#### NOTE

When French language is selected, only metric units are displayed.




### Full Tank Volume

This switch is used to programme the instrument with a,

- Full tank volume, whether the tank is filled manually or is to be filled automatically.
- Low volume threshold for an audible alarm.
-

### To set Full Tank Volume (Manual filling)

1 **Fill** the tank to the desired level.

2 **Press and release** 

The lefthand display scrolls the message

'Full tAnk Vol.xxxx', where 'xxxx' is the previously set tank volume in litres or gallons.

The righthand display shows 'Ent'.

If the volume shown is **correct**,

3 **Press** 

or if the volume shown is **incorrect**,

3 **Key-in** the new value.

4 **Press** 

The lefthand display scrolls the message

'ALArm Vol.xxxx', where 'xxxx' is the previously set tank low volume threshold in litres or gallons and is usually set to the volume sufficient to spray the length of the field.


The righthand display shows 'Ent'.

### To set the alarm volume

5 Repeat Steps **3** and **4** above.

### To set Full Tank Volume (Automatic filling)

If an optional flow sensor is installed in the filling hose,

1 **Press and release** 

The lefthand display scrolls the message

'Full tAnk Vol.xxxx', where 'xxxx' is the previously set tank volume in litres or gallons.

The righthand display shows 'Ent'.

If the volume shown is **correct**,

2 **Press** 

or if the volume shown is **incorrect**,

2 **Key-in** the new value.

3 **Press** 

The lefthand display scrolls the message

'Litres in tAnk.xxxx', where 'xxxx' prompts the operator to programme the instrument with the volume remaining in the tank

To set the volume left in tank

5 Repeat Steps 2 and 3 above.

The lefthand display scrolls the message

'Litres to fill.xxxx', where 'xxxx' is the volume calculated to fill the tank to the 'Full Tank Volume'.

6 Repeat Steps 2 and 3 above.

The lefthand display scrolls the message

'ALArm Vol.xxxx', where 'xxxx' is the previously set tank low volume threshold in litres or gallons and is usually set to the volume sufficient to spray the length of the field.

The righthand display shows 'Ent'.

To set the alarm volume

5 Repeat Steps 3 and 4 above.

The righthand analogue display will now act as a tank contents gauge. As the tank is filled both the digital and analogue displays will accumulate, with the 'Full Tank Volume' being the full scale of the display.

### Filler hose solenoid valve (optional)

If installed, a solenoid valve on the filling hose will be opened and closed automatically. The instrument will monitor and **control** the flow into the tank until the 'Full tank Volume' has been filled.

The audible alarm will sound when the tank has filled to the required volume.



### Speed Simulation/Target Speed

#### Simulating a speed

A calibration check of the spray nozzles may be done while the vehicle is stationary in the yard. By programming the instrument to **simulate** the speed desired in the field, the application rate is calculated and displayed based on the simulated speed. The nozzle test then serves as a cross-check with the *Delta 4* display.

A discrepancy may be attributable to variation in Specific Gravity of the tank contents and may be corrected with the 'Specific Gravity Correction' function. Refer to 'Liquid Fertiliser S.G. Correction' (p. 18) for further instructions.

#### Target Speed

By programming the instrument with the vehicle speed desired in the field, the application rate is calculated and displayed based on this **target** speed.

*Delta 4* audibly warns the sprayer operator if the actual forward speed is outside acceptable limits (based on the target speed), for the spray nozzles and the application rate used.


When speed is simulated, the switch L.E.D. flashes, whereas during motion it is on permanently.

### Setting Simulation/Target Speed

- 1 **Press and hold** 



The lefthand display shows the Simulated/Target speed (km/h or miles/h).

**If the speed is correct,**

- 2 **Press**  and then release both switches.

The righthand display shows the simulated speed and the switch L.E.D. flashes.

**If the speed is incorrect,**

- 2 **Continue to hold**  **and key-in** the correct speed using the top row of data entry keys.
- 3 **Press**  and then release both switches.

#### NOTE

The Area function does not accumulate when a simulated speed is programmed.

Automatic Rate Control, Flow and Application Rate operate normally.

To exit the simulated speed,

- 1 **Press** 

or,

- 1 **Drive** the vehicle forwards a short distance. The simulation will stop automatically.



### Liquid Fertiliser S.G. Correction

The nozzle-calibration chart information programmed into *Delta 4*, is likely to be based on clean water (Specific Gravity = 1.000).


If liquid fertiliser is sprayed, this calibration information may be wrong. It can be corrected by programming the *Delta 4* with the Specific Gravity (S.G.) of the fertiliser mixture.

#### NOTE

**Some fertiliser nozzle charts are calibrated for fertiliser.**

Please check with the nozzle supplier.


### Alter Liquid Fertiliser Specific Gravity

- 1 **Press and hold** 

The lefthand display shows the Specific Gravity. It is normally '1.000' for water based chemical solutions.

- 2 **Key-in** the desired S.G. (e.g. 1.200) using the top row of data entry keys.

The righthand display flashes 'Ent'.

- 3 **Press**  to confirm the entry.

The lefthand display will stop flashing and the new S.G. value is displayed.


The switch L.E.D. will flash when the S.G. is set greater than 1.000.



### Select nozzle

*Delta 4* may be programmed with the flow characteristics of up to eight types of nozzle.

**To select a nozzle types previously programmed,**

- 1 **Press and hold** 

The lefthand display cycles through the sequence 'A', 'b', 'C', 'd', 'E', 'F', 'G', and 'h'.

When the desired nozzle reference is displayed,

- 2 **Release** 

## 2.4 Application Rate Controls

*Delta 4* can be set to operate with either manual or automatic application rate control. The sprayer output can be altered from the front panel. These switches are also used to set the **Target Application Rate** and the **Target Speed/Pressure** when in **automatic** mode.





### Manual Application rate control

**To select manual application rate control,**

1 **Press** 

The switch L.E.D will light.

2 **Press**   to increase or decrease the application rate (l/ha or gallons/acre).

**The lefthand display** shows the application rate selected.



### Automatic Application rate control

**To select automatic application rate control,**

1 **Press** 

The switch L.E.D will light.

Automatic control will be in operation whenever the sprayer is switched on. *Delta 4* will monitor the forward speed of the sprayer and the **spraying pressure**. The flow rate will then be automatically adjusted to ensure that the application rate matches the **Target Application Rate**.

If for some reason this cannot be achieved, the left-hand display will flash **'high'** or **'lo'** as appropriate, and the audible alarm will bleep.

The **'lo'** error may be caused by,

- ❑ insufficient pump capacity or output.
- ❑ low or empty tank.
- ❑ blocked filters.

- ❑ incorrect jets fitted.
- ❑ low pump speed
- ❑ too high a forward speed, etc.

The 'high' error may be caused by the control valve being unable to dump sufficient flow back to the tank. This could be caused by,

- ❑ over capacity of the pump.
- ❑ too small or too few nozzles in use.
- ❑ too small a control valve (1" instead of 2").
- ❑ too slow a forward speed (or stationary) etc.

## Target Application Rate

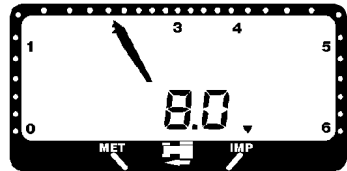
View 'Target' conditions

- 1 **Press and hold** 

**The lefthand display** shows the Target Application Rate (l/ha or gallons/acre).

**The righthand display** shows the Target Speed and Target Pressure for the application rate.

'Target' display



### Set Target Application Rate

When programming a target rate to which the instrument will default,

- 1 **Press and hold** 
- 2 **Key-in** the Target Application Rate using the top row of data entry keys.

The righthand display flashes 'Ent'.

- 3 **Press** 


The lefthand display shows the new application rate set.



The righthand display shows the Target Speed and pressure for the rate set.

### Adjust Target Application Rate

The default rate may be increased or decreased in 10% steps to suit specific conditions.



With the 'AUTO' switch 'on',

- 1 **Press**  to increase or decrease the target rate (l/ha or gallons/acre).

The 'AUTO' switch L.E.D. flashes and the L.E.D. on either the  or  switch is lit, when the current target rate differs from the default target rate.

### Change Target Speed and Pressure

If either the target speed or pressure for the application rate set are inappropriate,

- 1 **Press and hold** 
- 2 **Press**  to increase or decrease either value.

The righthand display shows the new values set.

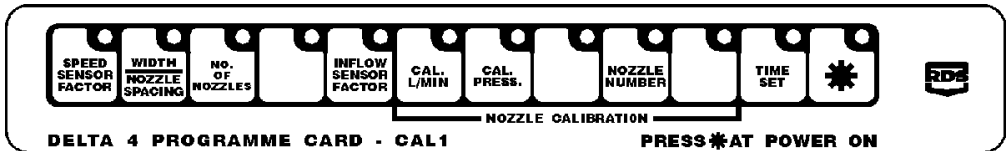
### 3.1 Programme Modes

There are various inputs which must be **programmed** into *Delta 4*, relating to the machine and sensors installed. This data can only be viewed or changed when *Delta 4* is changed from its normal 'Operating Mode' to one of three 'Programme Modes'.

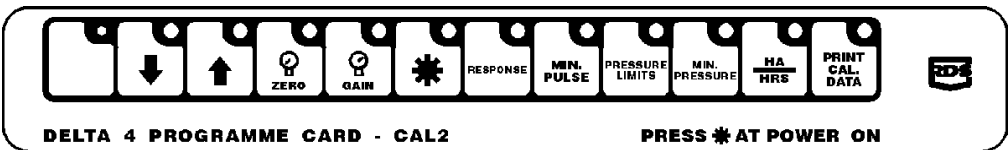
All programme data which will not need to be altered after initial setting up is held secure in the instrument memory.

The overlay cards provided (shown below), are marked 'CAL 1', 'CAL 2', or 'CAL 3', and are placed over the lower half of the instrument panel. This shows how **each of the pushbutton switches is re-defined** and takes on a new function in the respective Mode.

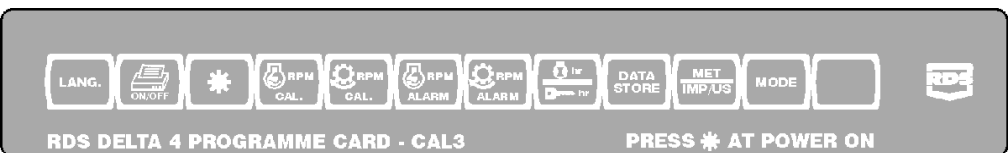
Programme Card - CAL 1

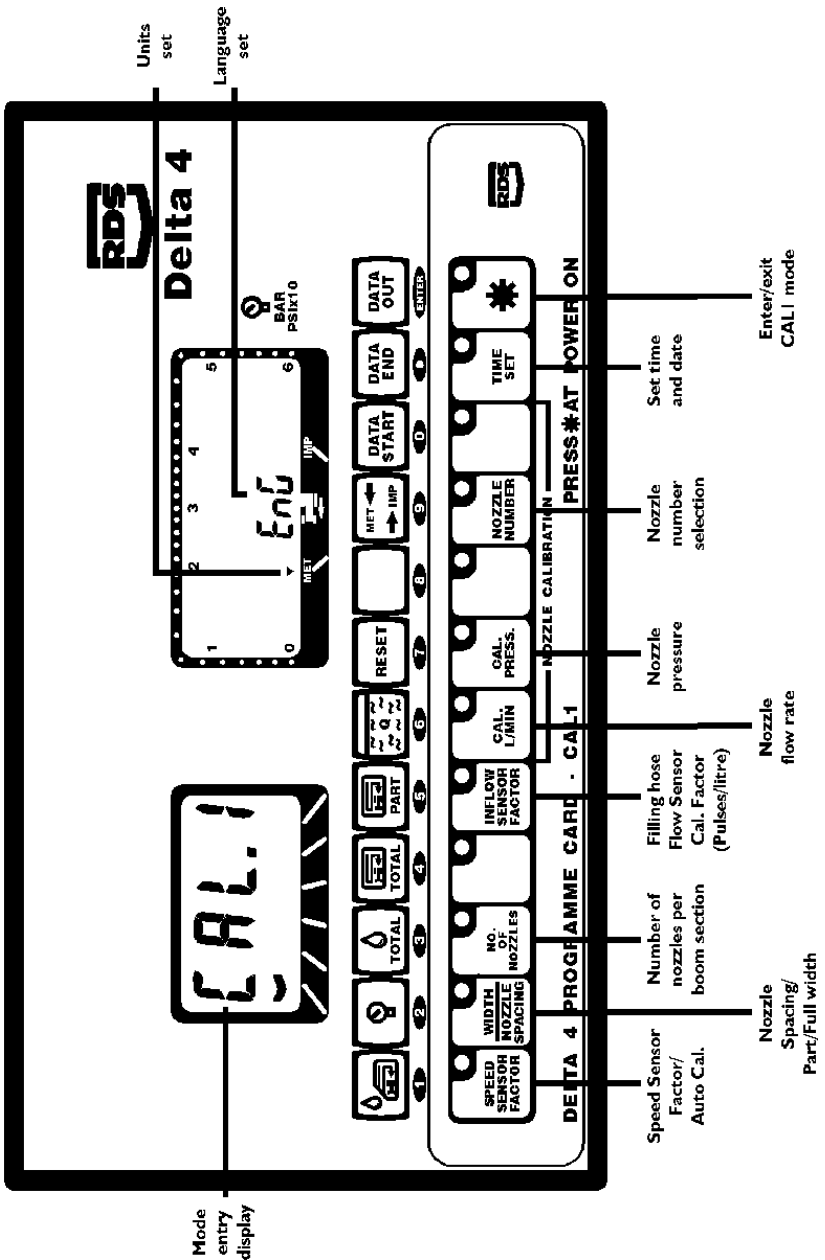


Programme Card - CAL 2



Programme Card - CAL 3





## 3.2 Entry into a Programme Mode

With *Delta 4* in Normal Operating Mode, ensure that the Metric/Imperial switch selection is correctly set.

### 1 **Switch the instrument off.**

Position the Programme Card 'CAL 1', 'CAL 2', or 'CAL 3' on the front panel of the instrument, ensuring that it is located with its lefthand edge flush with the lefthand edge of the instrument front panel. The bottom edge should be located in the groove between the bezel and the front panel.

### 2 **Press and hold** **while switching the instrument on.**

**The lefthand display** will show 'CAL.1', 'CAL.2' or 'CAL.3'.

**The righthand display** chevron will indicate whether Metric or Imperial mode is currently selected. This confirms that *Delta 4* is now in Programme Mode 1, Mode 2, or Mode 3.

**The functions of the 12 lower switches** have all now changed to those functions indicated by the overlay card. The lefthand display will show the value/option of any of these programme functions currently set in the instrument, simply by pressing the appropriate programme function switch.

**The functions of the 12 upper switches** have also changed to become data entry keys having, from left to right, numerical values 1 to 0, decimal point and ENTER.

## 3.3 Data Entry Procedure

### Numerical Data Entry

All **numerical data** is set by the following procedure.

- 1 **Select** the programme function to be checked or entered, by pressing the appropriate key on the overlay.

The **lefthand display** will show the numerical value currently stored for that function.

The **righthand display** will show only the Metric/Imperial chevron. Check that the appropriate mode is selected.

**NOTE**

**To change the Metric/Imperial selection, revert to normal Operating Mode by switching the unit off and back on again.**


**If the programming data is correctly set,** then simply select the next programme function on the overlay.

**To change the programme data;**

- 2 **Key in** the desired value for that function.


As the first key is pressed, the lefthand display will flash that number and the righthand display will flash 'Ent'. As the full value is keyed in, it appears in the lefthand display. Each keystroke is accompanied by an audible beep.

**When the number is correctly set;**

- 3 **Press**  to confirm the entry.

The lefthand display will stop flashing and the new data value is displayed.

If an error is made in setting the data;

- 4 **Press**  and key in the correct value.

4

## Non-numerical data entry

Some programme functions are non-numerical e.g. Data Output Mode, but allow various options to be selected. When these functions are selected, the display indicates one of the available options.

**If the correct option is displayed,** then simply select the next programme function on the overlay.

**To change the option;**

- 1 **Press** and hold the function key repeatedly to cycle the display between each option.

**When the correct option is displayed;**

- 2 **Release** the function key.

## Entering Secondary Programme Data

Some programme functions have a secondary piece of programme data which may be either numerical or non-numerical.

**To access the Secondary Data;**

- 1 **Press** and hold the appropriate function key for three seconds.

The display will change to show the secondary data or option.

**To change the Secondary Data;**

- 2 Follow exactly the same procedure as for entering primary numerical or non-numerical data. After pressing ENTER the display will revert to show primary data after 2 seconds.

2

## 3.4 Mode 1 Functions



### Speed Sensor Factor



The **primary** data to be set on this function switch is the distance the vehicle travels forward over two intervals between speed sensor pulses. The units of measurement are either metres or inches.



**This data must be determined under practical operating conditions to allow for any wheel slip, sinkage or tyre deformation.**

#### Auto-Calibration of Speed Sensor Factor

The best way to establish the Speed Sensor Factor is to do an 'AUTO CAL' over a measured distance, as follows;

- 1 **Place two markers** in a field (not on a tarmac or concrete driveway) exactly 100 metres apart.
- 2 **Position the vehicle** with the first marker level with some reference point on the vehicle, e.g. a wheel hub centre.
- 3 **Place the Programme Card 'CAL 1'** on the front panel of the instrument.
- 4 **Press and hold**  while switching the instrument on.
- 5 **Select and hold**  until the lefthand display flashes alternately 'AUtO' and 'CAL'.
- 6 **Drive the 100 metres** test distance and stop when the reference point on the vehicle is exactly opposite the 100 metre marker.

The righthand display shows the number of sensor pulses received over the test distance.

**NOTE**

Do not reverse the vehicle if you overrun the 100 metre marker. Repeat the test from Step 2.

7 Press 

The display will first flash 'End CAL AUtO' and then show the calculated Speed Sensor Factor.



## Width/Nozzle spacing

The **primary** data is the full working width of a fertiliser distributor, or the individual nozzle spacing on a spray boom.

The **secondary** data is the instruction that 'Full' or 'Part' width has been programmed.

### Set full working width

If a simple *override switch* is installed to engage and disengage area accumulation when the implement is in and out of work,

- 1 Set secondary data to 'Full'.
- 2 Set the full implement width (metres or inches).

### Set individual nozzle spacing

Individual nozzle spacing may only be programmed if a *Sprayer Control Interface Lead* is installed, linking the sprayer (or spreader) on-off and section control box, to the *Delta*.

- 1 Set secondary data to 'Part'.
- 2 Set individual nozzle spacing (metres or inches).



## Number of nozzles

The primary data is the number of nozzles on **each** boom section of the sprayer.

If 'Full' width has been set on the Width function, the 'Number of Nozzles' function must be programmed with the number of nozzles on the **full** boom (e.g. 48).

If '**Part**' width has been set on the Width function, the 'Number of Nozzles' function must be programmed with the number of nozzles on **each** sprayer boom **section**.

Switch each boom section switch on the sprayer control unit 'on' individually, and programme *Delta* with the number of nozzles on that particular section. The analogue display will indicate which boom section input is on. (It is not important which boom section operates which segment).

If none, or more than one boom section is recognised as being switched on, or there is no electrical power to the sprayer control unit, then the display will show '**1.SEC**' and no data can be entered.



## Inflow Sensor Factor

This is the calibration factor for the flow sensor (optional) on the filling hose. If this option is **not** installed, the calibration factor should be set to '**0000**'.

It is the number of pulses per litre (or per gallon) given by the flow sensor. This changes according to the size of the turbine assembly and may require adjustment due to the characteristics of the particular installation.

The calibration factor suggested is based on clean water and will need to be adjusted when using liquids with a specific gravity significantly greater than 1.0.

### Initially set as follows:

Turbine	Metric	Imperial	U.S.
1¼"	165.0	749.1	624.5
2"	100.0	454.6	378.5

### Subsequent recalibration

If there is a **consistent discrepancy** between the indicated tank contents and the **known** tank contents the calibration factor can be adjusted as follows:

$$\text{New Cal. Factor} = \frac{\text{Old Cal. Factor} \times \text{Indicated Tank Contents}}{\text{Known Tank Contents}}$$

**Example:**

Old flow sensor factor = 100 pulses per litre

If the *Delta* shows that 1900 litres have been loaded but the tank volume is known to be 2000 litres then,

$$\text{New Factor} = \frac{100 \times 1900}{2000} = 95$$

1 **Adjust** the Calibration Factor to the new Factor calculated.

**NOTE**

**Do not base your calculations on the sprayer sight gauge. To calibrate the tank, use,**

- ▣ a weighbridge.
- ▣ a calibrated flow meter.
- ▣ refill the sprayer tank using a calibrated measuring bucket.

Carry out this calibration using **clean water**. Any adjustment required for spraying liquid fertiliser may be done with the 'Specific Gravity Correction' function. Refer to 'Liquid Fertiliser S.G. Correction' (p. 18) for further instructions.

**Nozzle Calibration**

These functions are used to programme the pressure-flow relationship for each of up to eight type of nozzle.

Refer to the nozzle manufacturers nozzle charts for pressure-flow data.

**NOTE**

The **nozzle performance must be verified** by carrying out a jug test on a number of nozzles.

**The entire performance of the *Delta 4* control system relies upon accurate data being entered.**

To programme a nozzle type,

- 1 **Press and hold** 

The lefthand display cycles through the sequence 'A', 'b', 'C', 'd', 'E', 'F', 'G', and 'h'.

When the desired nozzle reference is displayed,

- 2 **Release** 


- 3 **Press** 

- 4 **Key-in** the 'calibration pressure' from the nozzle charts **and press** 

**NOTE**

'Calibration pressure' is a reference value and has no relevance to actual spraying pressure.

- 5 **Press** 

- 6 **Key-in** the 'flow rate' (l/min or gallons/min) from the nozzle charts **and press** 

Repeat steps 1 to 6 for up to 8 nozzle types.



### Time Set

This function is used to set the Clock and Calendar when the data logging option is installed.

- 1 **Press** 

The lefthand display will show the time in 24 hour format and the righthand display will show 'HrS'.

- 2 **Key-in** the correct time as HH.MM.

- 3 **Press** 

The lefthand display will show the date in UK format 'Date.Month', and the righthand display will show 'dAt'.


- 4 **Key-in** the correct date as DD.MM.

Be sure to set all four digits using zeros as required, e.g. for 2nd March, set '0203'.

5 **Press** 

The lefthand display will show the Year and Day of the week, and the righthand display will show 'Y d'. Monday is Day 1 and Sunday is Day 7.

6 **Key-in** the correct date as YY.DD.

Be sure to set all four digits using zeros as required, e.g. for Thursday  March 1994, set '9404'.

7 **Press**

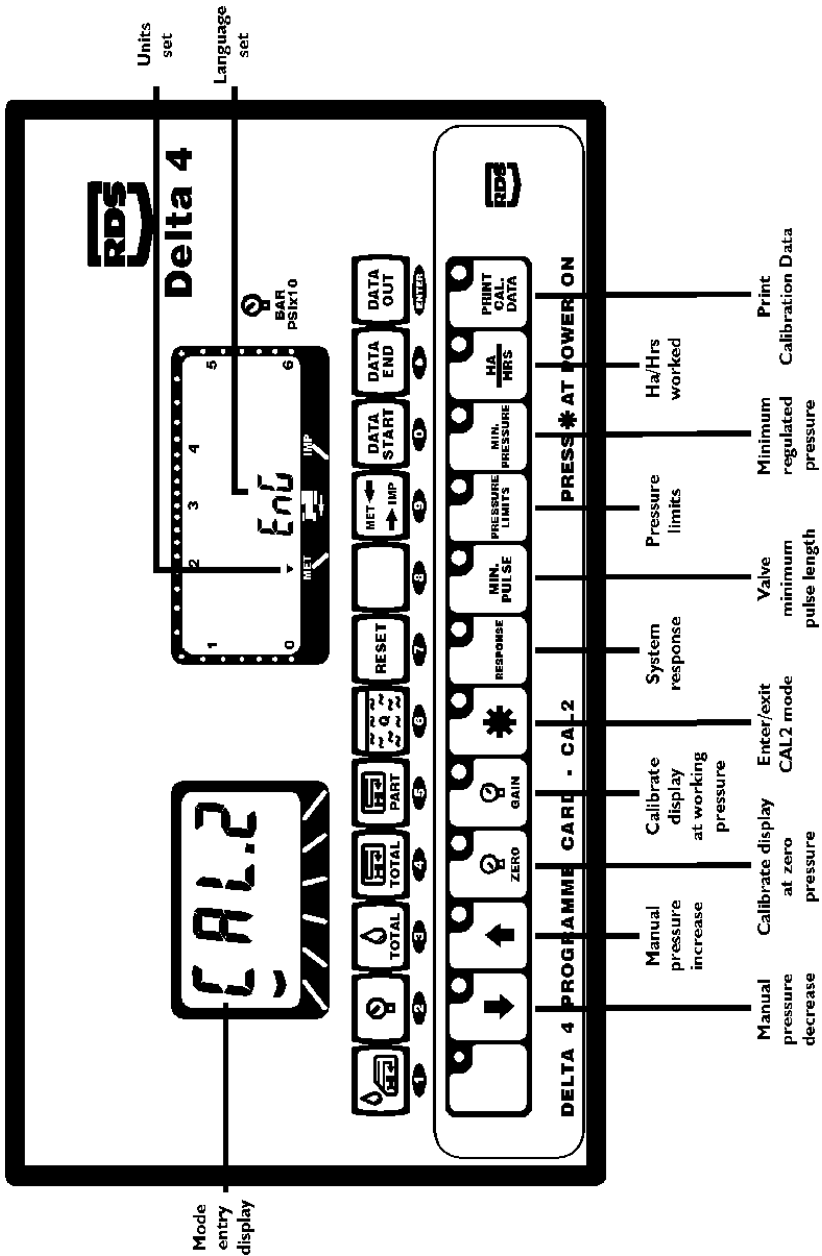


## Revert to Normal Operating Mode

*Delta* 'Operating Mode' can be restored either by switching the power off and on again, or;

1 **Press and hold** 

Remove the 'CAL 1' Programme Mode overlay card and store safely.



## 4.1 Mode 2 Functions



### Manual pressure Decrease/Increase

To adjust the spraying pressure when calibrating the pressure sensor at a typical working pressure.



### Zero pressure Calibration


To calibrate *Delta* at zero pressure,

1 Ensure there is no pressure in the sprayer manifold. If necessary, slacken the pipe connection to the sensor.

2 **Press** 

The lefthand display shows '0000'.

The righthand display flashes 'Ent'.


3 **Press**  to confirm a zero pressure reading.




### Working pressure Calibration

To calibrate *Delta* at a typical working pressure,


1 **Start the engine.** If *Delta 4* reverts to 'Operating mode', re-enter the programme mode, as described in Section 3.2.

2 **Start the sprayer pump** and set the spray pressure on the pressure **gauge** to a typical working pressure, using the  keys.

3 **Press** 

The lefthand display shows a pressure reading which may or may not be correct. If necessary,

4 **Key-in** the pressure indicated by the pressure **gauge**.

5 **Press**  to confirm the calibration of the instrument reading to the pressure gauge.

5



## System Response

The System Response can be set to any number between 0001 and 9999. If the number is small, the control valve movements will be small, and vice-versa.

**Small valve movements** may cause the automatic control to appear sluggish, and take longer to reach the Target Application Rate.

**Large valve movements** may cause the automatic control to overshoot, be unstable and hunt around the Target Application Rate.

The *Delta* is factory set with a System Response value of 100 and this will normally give good performance. It is unlikely to need setting lower than 5 or greater than 200.



## Valve minimum pulse length

This function also relates to the automatic control performance. The minimum pulse length can be set to any value between 1 and 128.

The pulse driving the flow control valve will become shorter in length as the application rate gets closer to the target rate. If the minimum pulse length is **too** short, there may not be any change to the flow rate.

The *Delta* is factory set with a minimum pulse length of 4 and this will normally give good performance.



## Pressure Limits

For any nozzle type and application rate, the *Delta 4* is programmed with a 'Target Pressure' which is the optimum spraying pressure.



The control system will adjust the pressure either side of this target as the speed changes either side of the Target Speed.

If the speed (and therefore the pressure) vary too much from the Target, the droplet size and/or spray pattern may deteriorate.

The 'pressure limits' are programmed so as to warn the operator that, although the application rate is still being controlled correctly, the system is near the end of its acceptable pressure range.

The pressure limits are normally set between 0.5 and 1.0 bar (7 -15 p.s.i.) either side of the target.

### To set the pressure limits,

- 1 Press 
- 2 Key-in the desired value and press 





### Minimum Pressure

Most nozzles have a diaphragm check valve or anti-drop valve, which stops the flow to the nozzle if the pressure drops below a certain level.

The *Delta 4* can be programmed with a 'Minimum pressure', below which the system will not regulate. This ensures a full spray pattern at very low speeds, although there will be some over-application **close** to the 'minimum pressure'.

The minimum pressure is normally set between 0.5 and 1.0 bar (7 -15 p.s.i.).

### To set the minimum pressure,

- 1 Press 
- 2 Key-in the desired value and press 



### Ha/Hrs

This function displays total area worked, or total hours worked since the instrument was commissioned.



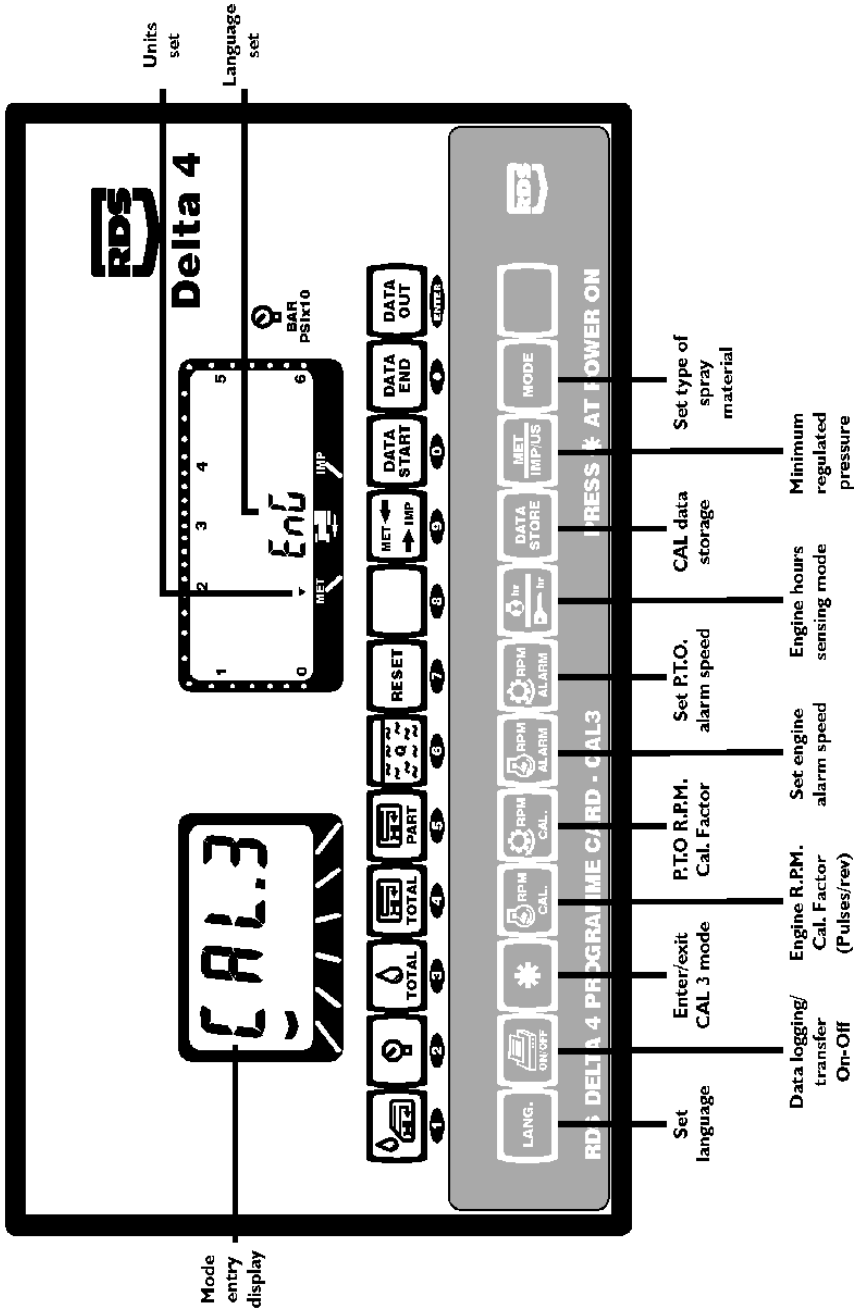
## Calibration Data Printout

If *Delta* includes the optional Data Logging and Transfer output lead, all the programmed data can be printed out or transferred to an office computer. This is good practice if possible, as permanent records can then be kept.

Connect the ICP100 *In-Cab Printer*, PSION or other output device to the *Delta*.

1 **Press and hold**





## 5.1 Mode 3 Functions





### Language

*Delta* will print data and give display messages in English or French.

- 1 **Press** 

The lefthand display shows 'Eng' or 'Fra'.

- 2 **Press**  again to select the option.

- 3 **Press**  to accept the option.





### Data Logging On-Off

If *Delta* includes the optional Data Logging and Transfer output lead, the Data Logging function must be switched 'on'.

- 1 **Press** 

The lefthand display shows 'Off' or 'ON'.

- 2 **Press**  again to select the option.

- 3 **Press**  to accept the option.



### Engine R.P.M. - Pulses per Rev

This function is the number of pulses received by the engine r.p.m. sensor, per revolution of the engine.

Engine r.p.m. is measured indirectly by an electronic sensor connected to the 'W' terminal of the **alternator**.

An R.P.M. Calibration Factor must be programmed for the display to show **engine crankshaft** r.p.m. It must be determined by experiment and calculation, measuring engine r.p.m. using a hand held tachometer.

- 1 **Set** an initial calibration factor of **10.00**.

- 2 **Revert** to 'Operating Mode' (by switching the ignition off and back on again.)

2

- 3 **Run** the engine at a steady r.p.m. noting the instrument display reading.
- 4 **Measure** the true r.p.m. of the engine using a hand held tachometer
- 5 **Set** *Delta* back into 'Programme Mode 2'
- 6 Calculate a new R.P.M. Calibration Factor

**New Cal. Factor =  $\frac{\text{Initial Factor} \times \text{Instrument display reading}}{\text{Hand-held Tachometer reading (Engine)}}$**

An example calculation would be:

Initial Factor = 10

Instrument display reading = 1780 r.p.m

Hand-held tachometer reading = 1500 r.p.m.

New Factor =  $\frac{10 \times 1780}{1500} = \mathbf{11.87}$

- 7 **Adjust** the Calibration Factor to the new value.



### P.T.O. R.P.M - Pulses per rev/Sensor input



The **primary** data is the number of pulses received by the P.T.O. r.p.m. sensor, per revolution of the P.T.O. shaft.

The **secondary** data is the sensing option, either a P.T.O. shaft sensor ('IP2') or indirectly from the engine r.p.m. sensor ('IP1').

To select the sensing option

- 1 **Press and hold** 

The lefthand display shows 'IP1' or 'IP2'.

- 2 **Press**  again to select the option.
- 3 **Press**  to accept the option.

### Set P.T.O. R.P.M. Calibration Factor

If a **P.T.O. sensor is fitted** ('IP2'), accept a default factor of '1.000'.

If **no P.T.O. sensor is fitted** ('IP1'), the instrument can still display P.T.O. speed determined indirectly from the engine speed sensor, using a suitable R.P.M. Calibration Factor (pulses per rev). This must be programmed for the display to show **P.T.O.** speed It must be determined by experiment, as for Engine R.P.M.

$$\text{Cal. Factor} = \frac{\text{Initial Cal. Factor} \times \text{Instrument display reading}}{\text{Hand-held Tachometer}}$$

reading (P.T.O)

An example calculation would be:

Initial Factor = 10

Instrument display reading = 1780 r.p.m

Hand-held tachometer reading = 540 r.p.m.

$$\text{New Factor} = \frac{10 \times 1780}{540} = \mathbf{32.96}$$


7 **Adjust** the Calibration Factor to the new value.



### Engine Alarm Speed

The **primary** data is the engine speed (r.p.m.) at which an audible alarm will be triggered. If this facility is not required, set a value of '0.0'.



Continue to hold  to enable selection of either **overspeed** ('HIGH') or **underspeed** ('LO') alarm.



### P.T.O. Alarm Speed

The **primary** data is the P.T.O. shaft speed (r.p.m.) at which an audible alarm will be triggered. If this facility is not required, set a value of '0.0'.



Continue to hold  to enable selection of either **overspeed**



## Engine Hours sensing mode

If an **engine speed sensor is installed**, set 'Eng'. The instrument will accumulate engine hours only when the engine is running.

If **no engine speed sensor is installed**, set 'Ign'. The instrument will accumulate engine hours whenever the ignition is switched on.



## Store-Restore-Exchange

*Delta* is despatched with pre-programmed, calibration data. This data is set to typical values for any sprayer and will produce displays and readings for installation checks only.

On installation, *Delta* will probably be pre-programmed by the technician with some data relating to the individual sprayer and nozzles. Once *Delta* has been set up with all the correct calibration data, this full set of data can be stored in a **backup memory**.

### To Store Data in Backup Memory

- 1 Press  **once**.

The lefthand display will show 'Stor'.

- 2 Press and Hold  until three beeps occur.

The active calibration data is now stored in the backup memory.

This calibration data may subsequently be modified or adjusted again during the season, but the original set of data can be **restored** at any time to overwrite the data currently programmed.

### To restore Data to Current Memory

- 1 Press  **twice**.

The lefthand display will show 'rEst'.

- 2 Press and Hold  until three beeps occur.

The two sets of data - Backup and Current, may also be **exchanged** between the current memory and the backup memory. This is useful where two sets of data are required for different sprayer setups.

### To Exchange Data in Memory

1 **Press**  **three times.**

The lefthand display will show 'wCHG'.

2 **Press and Hold**  until three beeps occur.



### Metric/UK/US

This switch is used to change between Metric and either UK Imperial or US units. It is not functional if French language is selected.



### Mode

*Delta* can be configured with appropriate display units for different types of spray material.

1 **Press** 


The lefthand display shows one of the following,


'SPrY' (Crop Spraying)

'SLur' (Slurry)

'SALT' (De-icing)

'blt' (Bitumen)

2 **Press**  again to select the option.

3 **Press**  to accept the option.

3

## Units of measurement


Mode	Volume	Area	Rate
Crop spraying	litres or gallons	ha or acres	litres/ha or gallons/acre
Slurry	m <sup>3</sup> or kilogallons	ha or acres	m <sup>3</sup> /ha or kilogallons/acre
De-icing	litres	ha	millilitres/m <sup>2</sup>
Bitumen	litres or gallons	m <sup>2</sup> or yds <sup>2</sup>	litres/m <sup>2</sup> or gallons/yd <sup>2</sup>



### Revert to Normal Operating Mode

*Delta* 'Operating Mode' can be restored either by switching the power off and on again, or;

#### 1 Press and hold

Remove the 'CAL'  programme Mode overlay card and store safely.

*Delta 4* instruments have built-in Data Logging functions operative when supplied with an **optional** Data Logging and Transfer output lead.

After installation, the Data Logging Option must be switched 'on' in 'Programme Mode 3'. Refer to Section 5.1 for further details.

*Delta 4* can log and store the recorded data on a field by field (or plot by plot) basis. Jobs can be started and ended at any time and can be printed out in full or individually whenever it is convenient.

The data can be downloaded to :

- A RDS ICP100 *In-Cab Printer*.
- A 'laptop' or desktop PC using a direct link or via a 'PSION Organiser', to be printed on the computer printer or for use with the '*Optimix*' crop record software package.

Refer to the separate '*Data Logging Handbook*', for further instructions on the use of the Data Logging functions.



Record the following Calibration values/Operating parameters set for *Delta*, for future reference :

**Programme Mode 1**

**1 Speed Sensor Factor**

<b>Tyre size:</b>				
<b>Factor:</b>				

**2 Width/Nozzle spacing .....**

**3 Number of nozzles**

<b>Boom Section</b>								
<b>No. of nozzles:</b>								

**4 In-flow sensor factor.....**

**5 Nozzle calibration**

	A	B	C	D	E	F	G	H
<b>Nozzle Manufacturer:</b>								
<b>Type:</b>								
<b>Cap colour:</b>								
<b>Calibration pressure (bar):</b>								
<b>Calibration flow rate (l/min)</b>								
<b>Application rate (l/ha)</b>								

**6 System response .....**

**7 Valve minimum pulse length .....**

**8 Pressure limits .....**

**9 Minimum pressure .....**



**Programme Mode 3**

- 10 Engine R.P.M. (Pulses/Rev) . . . . . Sensor input**
- 11 P.T.O. R.P.M. (Pulses/Rev). . . . . Sensor input**
- 12 Engine Alarm Speed (r.p.m.) . . . . . High/Low ..**
- 13 P.T.O Alarm Speed (r.p.m.) . . . . . High/Low**
- 15 Engine Hours Sensing . . . . . Engine/Ign.**

Your local distributor is:



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Cirencester Road, Minchinhampton,  
STROUD, Gloucestershire,  
GL6 9BH, UK  
Telephone: +44 (0) 1453 733300  
Fax: +44 (0) 1453 733311  
Email: [info@rdstec.com](mailto:info@rdstec.com)