

Weighbatch

DS-20 Gravimetric Doser

Operating Manual

Software Version 1.42

Operating Manual

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Introduction

This manual describes the installation and operation of the Weighbatch DS-20 Gravimetric Doser. While we have taken care in designing your Doser to make it easy to use we encourage you to read this manual to fully understand how it operates and to benefit from the experience of ourselves and previous users.

This manual contains information of use to everybody who uses the Doser but is written particularly for the person who installs it, sets it up and probably teaches others how it is to be used.

Not everyone likes reading manuals. If you are the sort of person who likes to try first and ask questions later please read the short section **“At the very least, Read This!”**.

The instructions in this manual are designed for the Doser as a stand alone unit. If you have other Weighbatch products used with your Doser, such as the Weighbatch Weight Control, the manuals accompanying these products should be read in conjunction with this manual.

How this manual is organised

The manual is grouped into four main areas. The first group (Read This, Principle of Operation, Safety and Layout) is a general introduction to the Doser and how it works.

The next group (Specification, Installation, Setup and Applications) describes how the Doser is installed and made ready to operate. The Applications section covers setup options available for different ways you may want to use the Doser for your own application.

The next group (Operation, Alarms and Service) describe the day-to-day operation of the Doser and any regular maintenance requirements.

The final group (Troubleshooting, Tests, Warranty, Circuit Boards and Wiring) we hope you don't need to refer to very often. It covers what to look for when things go wrong and how to get things fixed.

If it doesn't work !

If you experience any problems with your unit, please refer to the **Operating** and then **Trouble Shooting** sections of this manual, particularly the **Alarms** section. We have attempted to cover the most likely problems. This will help you gain a better understanding of the Doser and may result in a quicker solution than going straight to your supplier.

If you think something needs to be fixed make sure you read the **Warranty** section before doing anything.

At the very least, Read This !

Sorry, a Gravimetric Doser isn't just "plug-and-play" and there are a few things you need to do in order to get it running. This section lists the minimum things you need to do.

- The default operating mode is **Shot**. If you are running a continuous process go to the **Change Setup** menu and change the mode to **Continuous**.
- Use the **Calibrate** menu to perform a loadcell calibration. Do this after installation.
- For Shot mode you must connect an Extruder Running input so the Doser knows when each cycle starts.
- For Continuous mode an Extruder RPM input is optional.
- If you have an RPM sensor or Loader connected to the Doser then these must be enabled in the **Change Setup**. Menu.

Other than that you just need to enter the Shot Weight (Shot mode) or Extruder Throughput (Continuous mode) and the additive % and push **Run**.

Don't forget to put some additive in the hopper and **open the slide at the bottom of the hopper !**

Principle of Operation

The Doser is designed to feed a stream of granules directly into the primary material path of an extruder. The Doser is a gravimetric unit, that is, it maintains a constant mass feed rate regardless of variations in granule shape or density.

The Doser operates in one of two modes depending on the application. The first mode is **Shot** and is used for injection type applications. The second mode is **Continuous** and is used for film and profile extrusion type applications. The standard Doser can operate in either mode.

Shot Mode

In Shot mode a signal is fed into the Control Unit of the Doser to tell the Doser when the extruder is running. An amount of additive is specified to be added each time the extruder runs. The Doser measures for how long the extruder runs and feeds the required amount of material into the extruder evenly over this time. In order to assist the operator the Control Unit has entries for the total amount of material extruded (the "shot weight") and the additive percent.

The amount of additive material dosed is the constant parameter. If the running time of the extruder changes the same amount of material will be spread over a longer or shorter period.

Continuous Mode

In Continuous mode the extruder is running all the time and the Doser feeds additive at a constant rate specified by the operator. Again, to assist the operator the Control Unit has entries for the total extruder throughput (Kgs/hr) and the additive percent. However there is a problem if the extruder changes speed because the Doser should also change its feed rate in order to keep the same additive percentage.

This is done by allowing a speed signal from the extruder to be fed into the Dosing Unit. This signal is used to determine the extruder RPM and hence the extruder specific output (g/rev). Now when the extruder speed changes the actual extruder throughput can be estimated and the correct additive rate applied. This can be particularly useful when slowing the extruder to idle as you do not have to remember to turn off the Doser.

This speed signal is optional and the Doser will run without it but will not be able to compensate for extruder rate changes.

Regrind

In order to further assist the operator the Control Unit allows the direct input of regrind percentage in the main material. This allows the additive feed rate to be reduced to allow for additive already in the regrind.

Dual Dosers

A single Control Unit is able to control two Dosing Units, ie. to feed two separate additives. In this case the Regrind function can not be used.

Safety

The Doser is a very safe piece of equipment operating at low voltage and low torque. It is much more likely to be damaged by you than the other way round.

The following is a list of safety points that should be adhered to at all times:

- Do not open the Control Unit without disconnecting it from the mains supply.
- If the Doser is used with any of the available loading options ensure that the safety provisions for those options are followed.

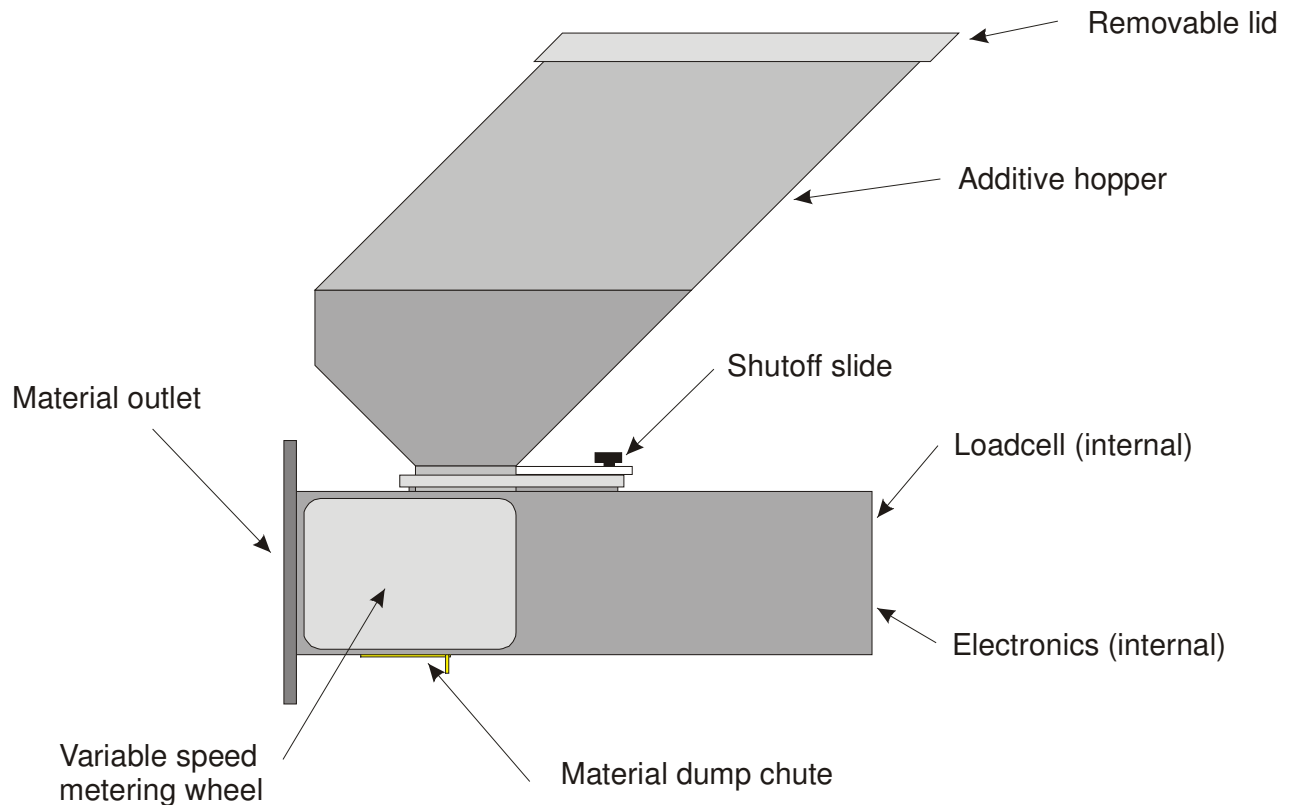
Specification

Parameter	Value	Condition
Maximum feed rate	6 g/sec	Bulk density 600 kg/m ³
Minimum feed rate	0.02 g/sec	Flow restrictor installed
Feed rate adjustment period	Each 20g additive	
Feed accuracy	1%	1) After auto adjustment 2) Over 200g additive
Maximum additive ratio	30%	With standard Adaptor

Layout

The Weighbatch Doser consists of two separate units. The Dosing Unit contains the motorised feeding mechanism and the weighed additive hopper. The Control Unit contains the power supply, controller (the “brains”) and the operator display. The two are linked by a cable which plugs into the Dosing Unit.

Dosing Unit



The Dosing Unit consists of the metering wheel, the weighed material hopper and the interface electronics for both.

Additive Hopper

The Additive Hopper holds about 2 kgs of material and is suspended on a loadcell. As material drains from the hopper the reduction in weight is used to calculate the mass additive rate. The hopper is attached to the loadcell by two stainless steel pins and can be removed for cleaning if required.

Removable Lid

Use of the lid is optional although for best use of the low level alarms you should either use it all the time or not. It is just a press fit on the hopper.

Shutoff Slide

Allows the additive flow to be shut off in order to remove the hopper.

Loadcell and Electronics

Both are contained within the body of the Doser. Access to the circuit board is by removing the two screws at the rear of the Doser. The base of the Doser then hinges down.

Material Dump Chute

Under the metering wheel is a section of the base of the Doser which hinges down to allow additive material to flow through the Doser. This is used to purge material from the Doser when cleaning.

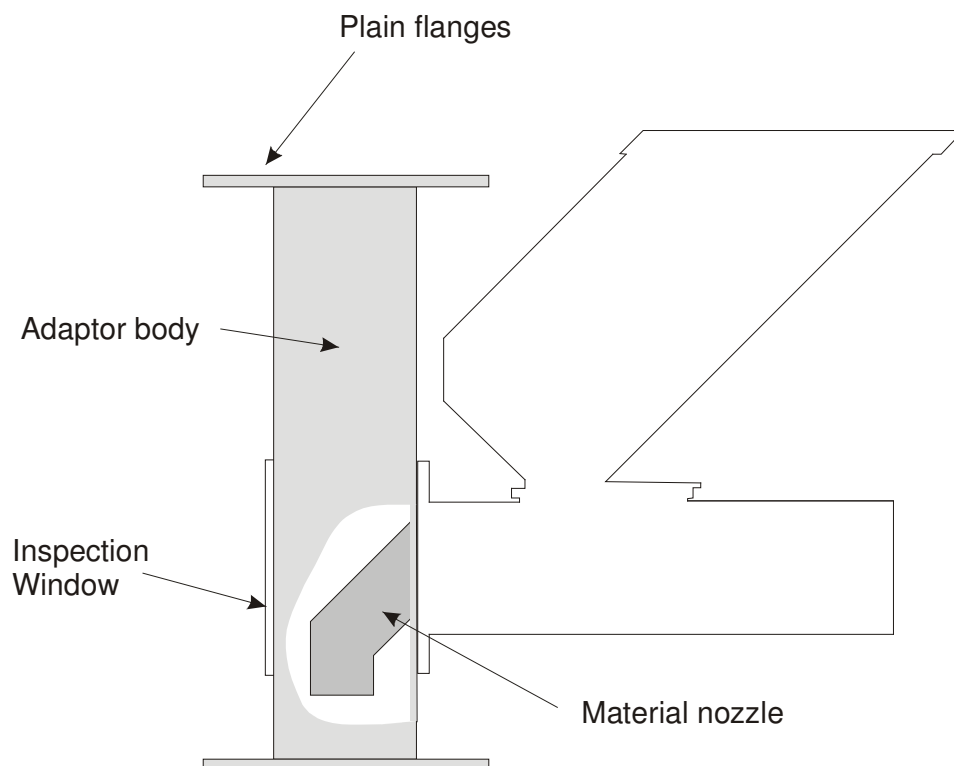
Variable Speed Metering Wheel

The Doser uses a variation of Weighbatch's stepper motor driven metering wheel to achieve the wide range of feed rates needed. The metering wheel will run from 6 grams/sec (20 Kg/hr) down to zero speed.

Material Outlet

Additive from the metering wheel passes out through the front of the Doser. Typically this runs through the feed chute of the mounting adaptor and mixes with the main material flow.

Mounting Adaptor



The Doser is supplied with a Mounting Adaptor which is placed between the extruder and the main material storage hopper. The adaptor body is made from 75mm square section stainless steel and is supplied with 150mm square plain flanges.

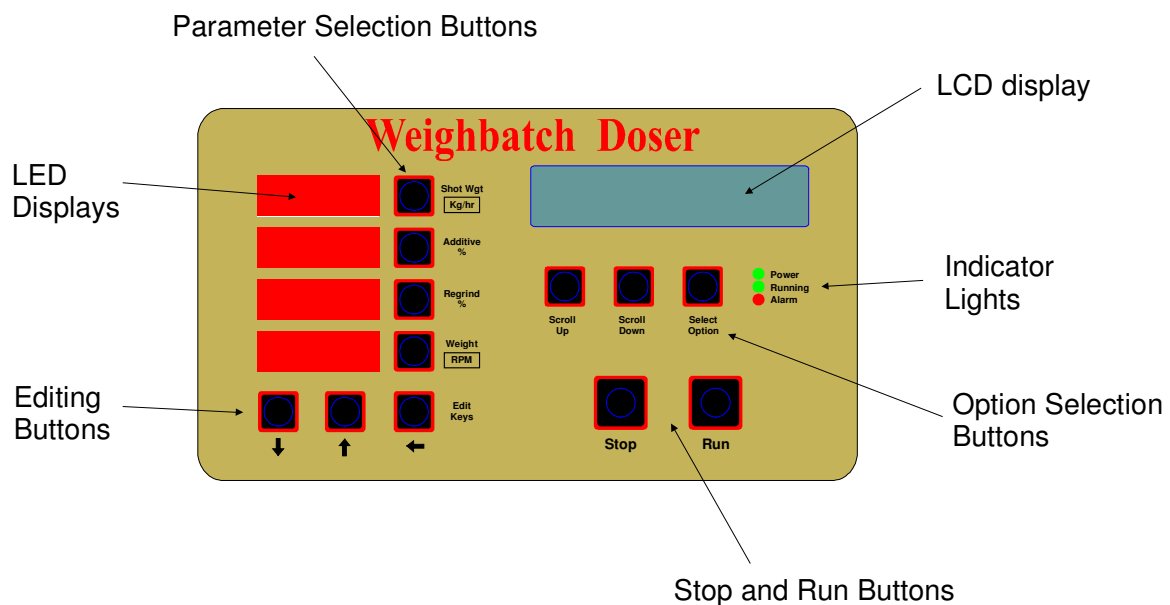
Material from the doser flows through the Material Nozzle inside the Adaptor where it is drawn into the main material flow.

Note: Because the main and additive materials flow at the same vertical speed there is a limit to the maximum additive ratio. This is limited by the relative cross-sectional areas of the main material and the additive. For a standard Adaptor this will give a maximum additive ratio of about 30%.

Dual Doser Adaptor

If you have purchased a secondary doser (to feed two additives) then you will have been supplied with a dual adaptor. This Adaptor has positions for two Dosers at right angles with one slightly higher than the other to increase clearance between the internal nozzles.

Control Panel



The Doser is run from a simple control panel that is part of the Control Unit. The control panel is used to set-up and calibrate the Doser, enter the additive and regrind ratios and to monitor the Doser's progress.

Input Selection Buttons

Are used to select a parameter for input.

LED Displays

Displays the various input parameters. In Shot mode the first parameter is the shot weight (in grams), ie. the total material weight extruded per cycle. In Continuous mode the first parameter is the total throughput (in Kg/hr).

In both modes the second parameter is the additive percent and the third is the regrind percent. The regrind is optional and is only used if you wish to incorporate the additive already in the regrind into the calculations.

In Shot mode the fourth parameter is the current hopper weight. In Continuous mode the fourth parameter is the extruder RPM.

LCD Display

Displays additional features, operational data, error messages and set-up parameters.

Editing Buttons

Are used to edit settings on both the LED and LCD Displays.

Indicator Lights

Indicate current status of the Doser. Power On, Running and Alarm. The top green light will be on when the Doser's power is on. The main power switch is located at the top of the Control Unit.

The middle green light will be on when the Doser is running.

The bottom red light will be on when the Doser is in alarm status, i.e. an error has occurred. The LCD Display will give an error description. The errors are listed in the **Alarms** section.

Option Selection Buttons

Scroll Up and **Scroll Down** are used to scroll through the different LCD Displays available. The **Select Option** button is used to select or edit an option.

Stop and Start Buttons

Are used to stop and start the Doser.

Installation

The Doser is supplied with a Mounting Adaptor which must be installed between the extruder throat and the main material hopper. The Adaptor is supplied with plain flanges which will require drilling to suit. The Dosing Unit should be bolted to the extension piece using the screws provided.

Mount the Control Unit in a convenient location. The supplied cable between the Control Unit and the Dosing Unit is 10m.

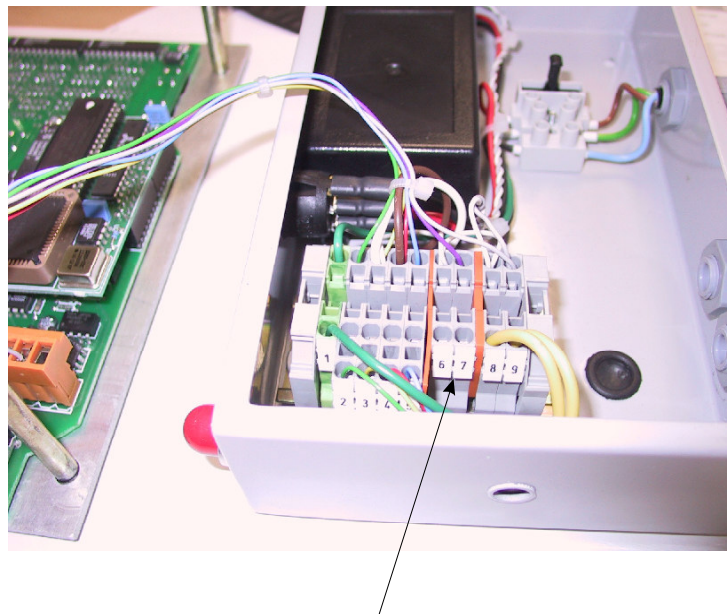
Connect the Control Unit to mains power. The Doser is supplied with 2m of mains cable and a New Zealand power plug (used for setup and testing). The plug may need to be replaced.

Connect the Control Unit to the Dosing Unit using the supplied cable and 5 pin plug. It is good practice when the installation has been completed to shorten this cable to the minimum practical length in order to reduce spurious noise pickup.

Shot Mode

For Shot mode the Control unit needs to be provided with a signal which is active when the extruder is running. This should be in the form of a potential-free switch. This could be an opto-isolator output or relay contact.

The switch must be connected between connections 6 and 7 within the Control Unit.



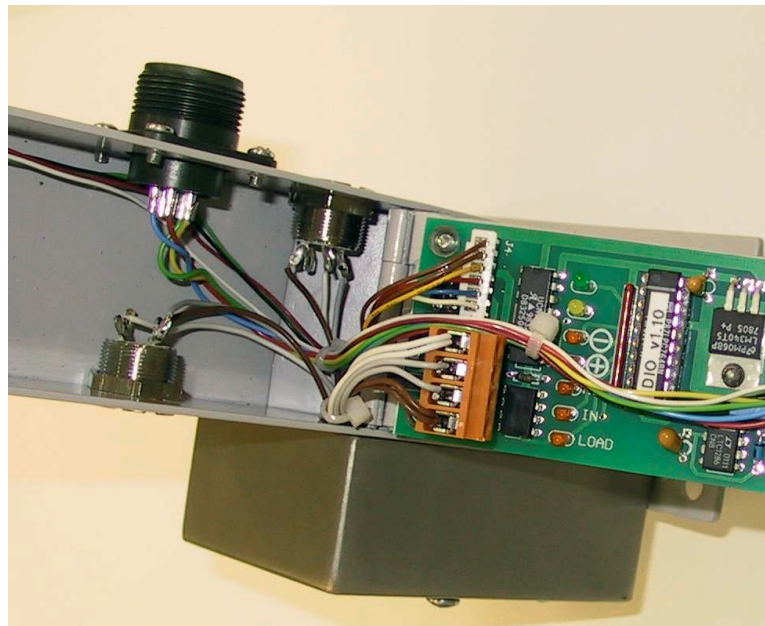
Extruder Run Input

Continuous Mode

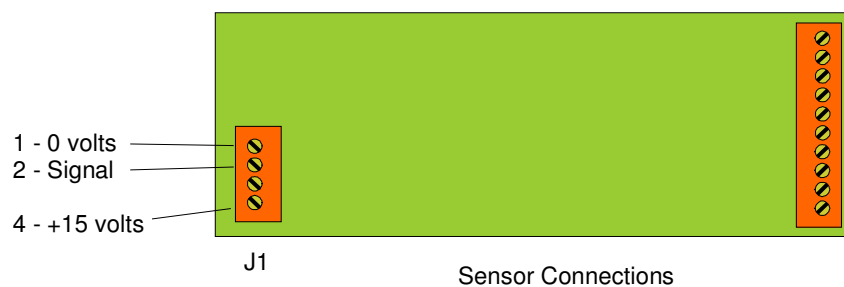
For Continuous mode no external input is required however it is advantageous to provide an extruder speed signal. The standard way to do this is to use an inductive sensor mounted near to the extruder shaft generating one or more pulses per revolution. The sensor must be an NPN, normally open type.

A sensor is provided with the Doser and connects to the Dosing Unit through a 4-way DIN plug. If you wish to use an alternative sensor it can be wired either to a DIN plug or directly to the circuit board within the Dosing Unit as follows:

Signal	DIN connection	Board Connection (J1)
0V	1	1
Pulse signal	2	2
+V	4	4



Hinge end



Doser Type

The Doser is shipped with the Controller set up for a single standard doser. It will also be set up to run metric or imperial units depending on your supplier. If you are installing dual dosers or a DS-200 auger doser or you wish to switch between metric/imperial units you will need to alter these through the **Doser Type** menu.

If you are installing a standard doser you can ignore this section.

Entering Doser Type Menu

Press the **←** and **Select Option** buttons together to enter the Control Options menu:

CONTROL OPTIONS:
TARE

Then press the **Scroll UP** button three times to reach the Doser Type option:

CONTROL OPTIONS:
DOSER TYPE

Press the **Select** button to enter the Doser Type menu:

DOSER TYPE:
FEED=WHEEL

Changing Doser Type Options

Within the Doser Type menu you can use the **Scroll UP** or the **Scroll DOWN** buttons to move from one type option to another. The options are in a continuous list. Pressing **Scroll UP** on the last option will take you back to the first option again.

To change a particular option press the **Select Option** button. Continuing to press **Select Option** will cycle through all possible values. For example, if the option displayed is

FEED=WHEEL

then pressing **Select Option** will change this immediately to:

FEED=DUAL

Leaving Doser Type Menu

Press the **Stop** button to leave the Doser Type menu and return to the Control Options Menu. Press the **Stop** button again to return to normal operation.

The last option in the Doser Type menu is

DOSER TYPE:
EXIT

Selecting this option will also leave the Doser Type menu.

When you leave the modified type options are saved to the non-volatile memory on the Control Unit Board.

Type Options

The remainder of this section describes each of the type options in the order in which they appear in the Doser Type menu. The values shown are the default values.

FEED=WHEEL

The basic feed mechanism of the Doser. Options are **Wheel**, **Dual** and **Screw**. The **Wheel** and **Dual** options are used for standard DS20 dosers with paddle wheel type feeders. The **Dual** option is used when you have two dosers connected to one controller. The **Screw** option is used for the DS200 auger feed doser.

NOTE: Changing the option between Screw and non-Screw will require the setup data to be reinitialised.

UNITS=METRIC

The units system used. Options are **Metric** and **Imperial**. The default option will depend on your supplier. The units used are listed below.

NOTE: Changing the units will require the setup data to be reinitialised.

Item	Metric	Imperial
Hopper weight	G	Oz
Material usage	Kg	Lb
Feed rate	G/sec	Oz/sec
Extruder throughput	Kg/hr	Lb/hr

RESET SETUP DATA

Pressing **Select Option** for this option will cause the setup data to be reinitialised. The message:

RESET SETUP DATA ?
PRESS SELECT TO OK

will be displayed. Press **Select Option** to continue, any other button to quit:

Setup

The Doser has a series of set-up parameters used to alter the way the it performs. During normal operation it will not be necessary to access these parameters and care is necessary when viewing or editing them.

Entering Setup Menu

Press the **←** and **Select Option** buttons together to enter the Control Options menu:

```
CONTROL OPTIONS:  
TARE
```

Then press the **Scroll UP** button twice to reach the Setup Data option:

```
CONTROL OPTIONS:  
SETUP DATA
```

Press the **Select** button to enter the Setup Data menu:

```
SETUP DATA:  
MODE=SHOT
```

Changing Setup Options

Within the Setup Data menu you can use the **Scroll UP** or the **Scroll DOWN** buttons to move from one setup option to another. The options are in a continuous list. Pressing **Scroll UP** on the last option will take you back to the first option again.

To change a particular option press the **Select Option** button. Where there is a limited choice of values this will change the option value immediately. Continuing to press **Select Option** will cycle through all possible values. For example, if the option displayed is

```
MODE=SHOT
```

then pressing **Select Option** will change this immediately to:

```
MODE=CONTINUOUS
```

Where the option value is a number then pressing **Select Option** will display the number by itself and allow you to change it with the **↑**, **↓** and **←** buttons. For example, if the option displayed is

```
CAL.WEIGHT=2000G
```

Then pressing **Select Option** will display this as

```
CAL.WEIGHT:  
02000.0 SEC
```

One digit is underlined. Pressing the **←** button will move the underline to another digit. Pressing the **↑** button will increase the underlined digit by 1. Pressing the **↓** button will decrease it by 1. Pressing any other button will save the changes and return to the normal display.

Leaving Setup Menu

Press the **Stop** button to leave the Setup Data menu and return to the Control Options Menu. Press the **Stop** button again to return to normal operation.

The last option in the Setup Data menu is

**SETUP DATA:
EXIT**

Selecting this option will also leave the Setup Data menu.

When you leave the modified setup options are saved to the non-volatile memory on the Control Unit Board.

If for some reason you do not wish to save the changes you should turn off power to the Doser before leaving the Change Setup Data menu.

Setup Options

The remainder of this section describes each of the setup options in the order in which they appear in the Setup Data menu. The values shown are the default values.

MODE=SHOT

The basic operating mode of the Doser. Options are **Shot** and **Continuous**. Refer to Operating Section.

**SHOT DECIMALS=1
KG/HR DECIMALS=1
RPM DECIMALS=1
ADD.DECIMALS=1
REG.DECIMALS=1**

The number of decimals places to be displayed in the red LED displays for each of the four parameters displayed.

CAL.WEIGHT=2000G

The weight used during loadcell input calibration. This can also be altered during the calibration process itself.

LOW WEIGHT=600G

The weight at which a Low Level alarm is triggered.

FEED FILTER=20

The number of weight loss calculations which are averaged to determine the metering wheel throughput. Increasing this value results in less fluctuation during operation but also results in less responsiveness to changes of material.

WGT FILTER=20

This is the amount of filtering applied to the hopper weight input to give the hopper weight displayed by display <3>. It should be set so that the displayed weight fluctuates by less than 1 gram with the Doser not running (10g for DS200).

WGT INVALID=2G

If the measured hopper weight varies by more than this value between readings (about 100 milliseconds) then the hopper weight is deemed to be "invalid" for weight loss purposes. It stays invalid for 5 seconds to allow time for weight readings to stabilise. With the doser running, if display <3> occasionally flashes INVALID then increase the value. This allows the doser to tolerate larger amounts of machine vibration.

TIMEOUT WGT=10G

A “not feeding” condition is detected by measuring the actual weight loss in the hopper after feeding this amount of material. An alarm is raised if less than half the expected weight has been dosed. For example, if the additive weight per shot is 1g then after 10 shots if the actual hopper weight loss is less than 5 grams the alarm will be raised. For slow feeding speeds the time taken to detect a not-feeding condition can be long. In this instance you may wish to reduce the timeout weight. However making it too small may prevent a not-feeding problem from being detected due to weight changes caused by vibration.

MIN SPEED=1.0%

The slowest speed the feed motor is allowed to run.

ACT%FILTER=0

If set to a non-zero value then the Additive% display will show the actual additive % dosed. This actual value is calculated by averaging the weight of additive dosed over N adjustment periods where N is the value entered. Typically each adjustment period corresponds to about 20g of additive.

LOADER=NONE

Specifies whether or not a loader is fitted to automatically load material into the hopper. The options are **None**, **Weight** and **Time**. **Weight** is used for venturi type loaders where the material continuously discharges into the hopper while filling and the hopper fills slowly. **Time** is used for vacuum or slide operated loaders where the loader fills and then drops the material into the hopper.

In **Weight** mode the loader is started when the hopper weight drops to the **Low Weight** level and turns off when the hopper weight reaches the **Load Weight** level. If this does not happen within **Load Time** seconds then an alarm is raised.

In **Time** mode the loader is started when the weight drops to the **Low Weight** level and turns on for **Load Time** seconds. The doser then waits a few seconds more and checks that the hopper has reached the **Load Weight** level. If it has not then an alarm is raised.

LOAD TIME=30sec

The time allowed for an attached loader to fill.

LOAD WEIGHT=2000g

The required weight of material loaded by an attached loader per cycle.

RPM INPUT=NONE

(Continuous mode) Indicates whether an RPM input should be used to monitor extruder throughput. The options are **None**, **Doser** and **Module**. The **Doser** option is used for an RPM pulse input sensor working through the DIN connection on the Dosing Unit (refer Installation). The **Module** option is used if a general purpose Weighbatch Speed Input Module is being used for RPM input. This is an optional module which can use 0..10V, 0..200V or high frequency pulse inputs directly from the extruder motor drive.

PULSE/REV=1

(RPM input from Doser) If RPM input from the Dosing Unit is enabled then this value specifies the number of pulses per extruder screw revolution.

MIN RPM=0.0

(RPM input enabled) If the extruder RPM falls below this value then the production line is considered to have been turned off and the doser is stopped.

AUX INPUT=NONE

Used to specify the use of the auxiliary input on the Dosing Unit. The options are **None** and **Regrind**. If

set to **Regrind** then any Regrind% entered will only be effective when the auxiliary input is on.

MAT.LIB=NO

Specifies whether default wheel efficiency rates can be entered for up to 5 materials. Refer to the Application section for advice on this facility.

MAT n NAME=xxxxx

The names of the specified materials. Each name can be up to 5 characters long.

MAT n MAX=0.0g/sec

The default maximum feed rates for the specified materials. This becomes the basis of the doser's automatic rate adjustment.

DIAG=NONE

If a printer is connected to the Doser Controller then this parameter is used to specify how frequently diagnostic information is printed. The options are

None, Minute and **Update**. The **Minute** option forces one line to be printed every minute. The **Update** option prints one line after each rate update.

Applications

This section covers some typical applications for the Doser or special operating situations and highlights the setup parameters need to be altered to suit. It also lists some dos and don'ts which may not be obvious.

Loader Options

The Doser has been designed to be used with a number of different types of material loader. Because the material usage is small the typical loader is a venturi type controlled by the Doser itself which blows material into the hopper. However other loader types can be used with the addition of a loader bracket incorporating a slide valve.

One of the problems of a standard venturi is that with dusty or powder additive it blows the additive everywhere. Using a slide valve under a venturi loader isolates the loader during the blowing phase and controls the dust or powder.

Vacuum loaders can be used with the slide valve by mounting the loader on a small storage transition above the slide. When the Doser opens the slide the material drains from the loader. The loader will refill when required as it normally does independent of the Doser.

High Additive Ratio

It has been mentioned elsewhere in this manual about ensuring that the exit from the Doser is large enough when running high additive ratios. The problem is that the Doser does not force additive into the primary material stream, rather the primary material drags it away. It is therefore impossible for the additive to move faster than the main material and so the maximum ratio you can dose is limited by the ratio of the cross sectional area of the additive to the cross sectional area of the primary material.

This can require a surprisingly large exit chute. For example, if the adaptor between the extruder and main material hopper is 100mm square and you install the Doser feeding into a 40 x 25mm RHS chute the ratio of the areas is 1000 to 10000 and so the maximum additive ratio would be only 10%. Even if you used 50mm square RHS you could still only get 25%.

Alarm Options

The Doser Controller has an internal piezo sounder. This is adequate for most injection or blow-moulding applications because they are relatively quiet areas but is not always effective in larger continuous extrusion factories.

The Controller has a 24VDC alarm output which can be used to drive an external siren or other alarm device.

If required the internal piezo sounder can be disabled by removing the circuit board jumper next to it.

RPM Input Options

For continuous extrusion applications it is useful to have an RPM input so that the Doser can make changes to the addition rate in response to changes in the extruder speed. The standard method of doing this is to mount a proximity sensor on the extruder to give one or more pulses for each screw revolution. The sensor output is fed into the Dosing Unit which is typically close by. Using this approach the pulse rate is limited to about 15Hz.

The alternative is to use a remote Speed Input Module mounted inside the electrical cabinet of the extruder drive. The module can use a variety of inputs either analog (0..10V or 0..200V) or a pulse

input (up to 200KHz). These are typically available from the drive. Often the signal used for the RPM meter can be used.

One of the useful things from having an RPM input is that you can set a Minimum RPM so that when the extruder is stopped the Doser automatically stops feeding.

Low Feed Rates

In many applications the amount of additive dosed per shot or per second can be very very small. As little as a few granules. There are two problems with such low feed rates. Firstly the metering wheel runs slowly and does not have good control over the additive. Secondly it takes a very long time to adjust to changes in the material density to achieve the required feed rate.

Slow Wheel

The first problem can be relieved by reducing the efficiency of the wheel so it has to turn faster to get the same throughput. This can be done in two ways. The first approach is to install the flow restrictor which is supplied with the Doser. This restrictor narrows the gap through which the granules exit the Doser. If this is not sufficient then the second approach is to cut away part of the metering wheel blades. Typically the outside 10mm on each side of each blade is removed leaving a wheel only 10mm wide.

The wheel is run between 1% and 100% of full speed. For the normal Doser with a normal type additive this gives between 0.2 and 10 g/sec. (The doser is more efficient at low speed). With the restrictor installed this drops to 0.07 and 3 g/sec. With the wheel cut down as well the rate drops to between 0.02 and 1 g/sec, i.e. a 10 fold reduction.

Wonderful you think! However there are some downsides. The restrictor narrows the exit gap and can cause problems with materials which do not flow well. Cutting down the wheel can reduce its ability to break up blockages of material within the Doser. Also these are permanent reductions in Doser throughput and so the maximum additive rates are also reduced which may limit the maximum additive ratio which the doser will achieve.

Long Adjustment Time

The second problem of long adjustment times is more difficult, particularly in injection applications. The combination of milligram additive weights and clamping induced shock loads do not mix well. The Doser cannot measure each additive dose so instead it measures the weight loss over a number of shots or a long time period. In fact it measures the wheel revolutions required to feed 20g of additive. However even this measurement can vary and so the wheel efficiency is calculated by averaging a number of these 20g lots. The default filtering value is 20, i.e. it takes 20 lots of 20g to get an accurate measure of the material feed rate. (better than 1%).

Now 400g at 0.2g per shot is 2000 shots and so it could take the whole job for the Doser to reach the correct feed rate. This is obviously unacceptable so there are some shortcuts the Doser takes automatically. The first is not something the Doser does but a fact of life. Most additives have similar bulk density so when changing from one to another the Doser only needs to correct for the difference between the materials. The second is that when the doser is turned off or when it detects that the hopper has been removed and replaced it goes into a fast update mode. In this mode it uses the rate from the first 20g as-is, i.e. with no filtering, in order to get a close first estimate. It then refines this estimate over subsequent 20g lots with increasing amounts of filtering until it gets back to normal running.

The operator can assist this fast update process. If you scroll to display <8> which shows the maximum feed rate and press the **Select Option** button you can force the Doser into fast update mode at any time.

If you wish to allow the operator more input into the rate setting process you can set the **Material Library** flag in the setup data to **Yes**. This option allows you to predefine up to 5 material codes and their maximum feed rates. Now when the operator presses **Select Option** to trigger a fast update they can select a material code to be used as the first estimate which then gets refined on each 20g lot.

Even if you don't predefine any material codes simply having the flag set will give the operator options to manually enter an estimated maximum rate. If you had a large number of additives with widely varying rates then this could be used to allow the operator to enter the first estimate from a printed list.

There is one other simple technique for triggering a fast update. **Turn off the power.** On power up the Doser always goes into a fast update mode and always starts with a sensible first estimate of maximum rate.

Dos

Try to control the build up of static around the Doser and Controller. The Controller LCD module can be damaged by being touched by statically charged operators.

Don'ts

Don't put very large main material hoppers on top of the standard Mounting Adaptor on injection machines. The shock loads are too high and the weld will eventually fatigue.

Calibration

Loadcell Calibration

This section describes calibration of the weigh hopper. In order to obtain accurate feed rates from the hopper the loadcell input must be correctly calibrated.

Calibration is necessary:

- When first installed
- 3 months after installation
- Every 12 months
- When a new Dosing Unit circuit board is installed
- When a loadcell is replaced
- When a Loadcell Error alarm occurs

The calibration process will take less than 2 minutes and can be done while in production. When calibration has been completed record the date and new calibration number.

To calibrate the loadcell do the following:

Press the **←** and **Select Option** buttons together to enter the Control Options menu:

**CONTROL OPTIONS:
CALIBRATE**

Press the **Scroll Up and Select Option** buttons to enter the Calibration menu:

**CALIBRATE:
CALIBRATION=0.07512**

The current calibration number is displayed. You can note this number and subsequently compare it with the new calibration number to check for loadcell drift. Press **Select Option** to recalibrate. The message:

**RECALIBRATE ?
PRESS SELECT TO OK**

will be displayed. Press **Select Option** to continue, any other button to quit. The calibration weight is then displayed:

**CALIBRATION WEIGHT
02000.0 G**

and can be adjusted to suit the weights available if required using the **↑**, **↓** and **←** buttons. Press **Select Option** to continue:

**HOPPER IS EMPTY ?
PRESS SELECT TO OK**

Ensure that the hopper is empty and is in its normal operating position on the Doser. Press **Select Option**. The Doser will wait for the loadcell input to settle and will then read the weight.

**PLACE 2KG WEIGHT ?
PRESS SELECT TO OK**

Place the specified calibration weight in the hopper. Press **Select Option**. Again the Doser will wait for the loadcell input to settle and will then read the weight. The Doser then recalculates the new

calibration parameters and if all is Ok returns to the calibration display:

CALIBRATE:
CALIBRATION=0.07516

CALIBRATE:
+2001G 85.0%FS

At this point you can either press **Stop** to exit from the Calibration menu or press **Scroll UP** to display the current weight and analog input percentage:

Don't forget to remove the calibration weight!

Calibration Errors

If there is a fault in the loadcell input then one of the following errors may be displayed at the end of the calibration procedure.

LOADCELL ERROR
NO CHANGE IN WEIGHT

This error means that there was too little difference in loadcell input between the empty hopper and with the calibration weight. You may have forgotten to empty the hopper or to place the calibration weight.

It may indicate a fault in the loadcell or the Doser board. Refer to the **Checks/Loadcell Input** section.

LOADCELL ERROR
INPUT TO LOW
INPUT TOO HIGH

These errors mean that the loadcell input is too far from the ideal to provide reliable weight readings over the full range of weights. The Doser may still be able to operate but two conditions in particular may cause problems. If the input is too low the Doser may not be able to determine if the hopper is

empty. If the input is too high it may not be able to determine if the hopper is overfull.

Always check the loadcell input if any Loadcell Error message appears.

Tare Adjustment

This section describes adjustment of the loadcell input for changes in the tare weight of the hopper. The Doser should read a weight of zero when the hopper is empty. Due to temperature changes or minor mechanical changes it is usually not exactly zero. This is not a problem as all gravimetric control is based on changes in weight. If the hopper is knocked the loadcell may be overstressed and the tare weight shifted by many grams. If it shifts too far the Doser cannot determine if the hopper is empty or not. In this case (or whenever you wish) the weight can be re-tared to return to zero.

Taring is necessary:

- When the empty weigh chamber weight becomes significantly non-zero
- When you wish to change your use of the hopper lid.

The tare process will take less than 1 minute and can be done while in production.

To tare do the following:

Press the ← and **Select Option** buttons together to enter the Control Options menu:

CONTROL OPTIONS:
TARE

Press the **Select Option** button to enter the Tare option. The message:

RETARE ?
PRESS SELECT TO OK

will be displayed. Press **Select Option** to continue, any other button to quit:

HOPPER IS EMPTY ?
PRESS SELECT TO OK

Ensure that the hopper is empty and is in its normal operating position on the Doser body. Press **Select Option**. The Doser will wait for the loadcell input to settle and will then read the weight.

RPM Calibration

(Continuous mode only)

This section describes calibration of the RPM input signal if this has been enabled in the Setup data. Calibration should only be necessary when first installed.

To calibrate the RPM input do the following:

Press the **←** and **Select Option** buttons together to enter the Control Options menu:

```
CONTROL OPTIONS
TARE
```

Press the **Scroll Up** and **Select Option** buttons to enter the Calibration menu:

```
CALIBRATE
CALIBRATION=13150
```

Press the **Scroll Up** button twice:

```
CALIBRATE:
RPM=0.000
```

The current RPM calibration number is displayed. Press **Select Option** to recalibrate. The message:

```
RECALIBRATE ?
PRESS SELECT TO OK
```

will be displayed. Press **Select Option** to continue, any other button to quit. The current RPM is then displayed:

```
CUR. RPM
009.98 RPM
```

Enter the correct RPM using the **↑**, **↓** and **←** buttons. Press **Select Option** to continue.

Operation

Your Doser will be initially set-up and calibrated to run in Shot Mode. To change your Doser set-up refer to the **Setup** section. It is important to document any changes done to this standard setup.

Starting the Doser

Step 1

Ensure that your Doser has power connected to it.

Step 2

Turn the power on with the switch mounted on top of the Control Unit.

The Power On indicator light on the front panel should now be on and the LCD Display will show:



WEIGHBATCH NZ LTD
DOSER MB20

This display will only last a few seconds, then the Alarm warning light will come on to indicate that the Doser has been restarted:



5 > RESTARTED
SELECT TO ACK

If the Dosing Unit has not been connected then the alarm message for this will be displayed.

Step 3

Press the **Select Option** button to ACK (acknowledge) that the Doser has restarted. The display will then switch to the Stopped display.



1 > STOPPED

Step 4

Enter the Shot Weight or current extruder Kg/Hr. Enter the Additive Percent. If required enter the Re grind Percent.

The entered values are displayed on the red LED Displays. A blank display represents a zero entry. For Continuous mode a blank fourth parameter indicates zero RPM and this will also result in zero calculated throughput if RPM input is being used.

Step 5

Press the **Run** button to start the Doser.

The Doser will now feed additive material at the rate calculated from the first three parameters. It will remain running until the **Stop** button is pressed or the Doser is switched off.

1 > FEEDING

10.0%

1387G

The LCD Display will indicate the current status of the Doser as it operates. To find out more about these messages refer to the **Operation / LCD Displays** section.

Step 6

To refill the hopper you simply tip some more material into it. The control software continually monitors the hopper weight and whenever it sees some unexpected weight change it temporarily stops adjusting its gravimetric control data. The weight changes associated with handling the hopper are very much greater than normally occur and the software has no problem detecting the refilling action.

Entering The Parameters

The input parameters are changed by first selecting the parameter you wish to change. The **Param** button (ie. **Shot Wgt, Additive%** etc) next to each of the red LED Displays will select that parameter.

When a parameter is selected the right hand digit will blink and any left hand zeros will appear.

Use the **↑** and **↓** buttons to increment and decrement the digit that is blinking. If a digit to the left is the digit to be changed press the **←** button, this will move the blinking digit to the next left position.

When the value has been changed to the required value press the **Param** button again. Pressing any other **Param** button will also complete the entry as will doing nothing for 30 seconds. The blinking digit will stop blinking and any left hand zeros will vanish.

Example

If the current additive ratio is 6.0%, then to change to 4.0% do the following.

1. Select the Additive parameter, using the **Additive%** button. The display will read '006.0' and the furthest right '0' will blink.
2. Move the blinking digit to the '6' by pushing **←** button once. The display will read '006.0' and the '6' will blink.
3. Change the '6' to a '4' by pushing the **↓** button twice. The display will read '004.0' and the '4' will blink.
4. Complete the entry by pushing the **Additive%** button, the display will read 4.0. The left hand zeros will have gone and no number will blink.

Stopping the Doser

Press the **Stop** button. This will cause the Doser to stop immediately unless in the middle of a shot when it will stop at the end of the extruder running time. The Running light will go off and the Stopped alarm will be displayed.

5 > STOPPED

SELECT TO ACK

- Press **Select Option** to clear the alarm.

Continuous Mode Extruder Kgs/Hr

(Continuous mode only)

If you have extruder RPM input enabled in Continuous mode the Doser will calculate the extruder throughput from which the additive rate is determined. In order to do this the Doser calculates the extruder's specific output or grams per revolution.

This calculation is made whenever you enter a new figure for the current throughput. For example if the extruder is currently running at 30 RPM and you enter a value of 45 Kg/Hr the specific output will be calculated as 25 g/rev. If the extruder speed changes to 35 RPM the throughput will now display as 52.5 Kg/Hr.

There is an alternative way of changing the displayed throughput which is to enter the specific output directly. This is done using display number 9 which is described later. This may be a better option if you have no way of determining the actual extruder throughput.

LCD Displays

During normal operation the LCD Display, on the right hand side of the operator panel, shows the current status of the Doser as well as other operating data. This information is displayed in a number of formats each prefixed by a display number. All are accessible for viewing during normal operation by the operator.

The current display number is displayed on the first position of the first line.

```
1 >
```

The **Scroll UP** and **Scroll DOWN** buttons are used to increment and decrement the display number. For some displays, the **Select Option** button is used to change some value. The **↑**, **↓** and **←** buttons are used to edit the value in the same way as for the additive parameters.

1> STATUS

Display <1> shows the current status of the Doser. The display can take one of the following formats. In some cases the current hopper weight is shown on the bottom line.

```
1 > STOPPED
1387G      UNLOADED
```

Indicates that the Doser is not running. If the display shows "UNLOADED" this indicates that the Doser has detected that the hopper has been removed. This situation normally occurs during a material

change. The doser makes use of this information to do a fast update of throughput calculations when the doser is restarted. This allows a faster adaptation to a new material.

```
1 > WAIT OK
12.00g     5.4SEC
```

(Shot mode) Indicates that the Doser is running but is waiting for the extruder running signal before starting a shot dose. The additive weight to be dosed is shown and the previous extruder running

time. The general status of the Doser is also shown. **WAIT OK** indicates everything is ok. **WAIT** alone indicates the current update cycle has had a problem and will not be used for a feed rate update. **WAIT LO** indicates the hopper weight is low. **WAIT MX** indicates that the doser is running at maximum rate. This means that the feed time will be longer than the extruder running time in order to dose the required amount of additive.

1 > FEEDING
12.3% OK 5.4SEC

display.

(Shot mode) Indicates that the Doser is running and is in the middle of a shot. The motor speed (12.3%) is shown and the expected shot time (5.4SEC). The doser status (**OK, LO, MX**) is shown as for the **WAIT**

1 > WAIT MIN RPM
5.0 1430g

shown and the current hopper weight.

(Continuous mode) Indicates that the Minimum RPM setup parameter has been set to a non-zero value and the Doser is waiting for the measured RPM value to reach this. The Minimum RPM is

1 > FEEDING
12.3% max 1387G

(Continuous mode) Indicates that the Doser is running. The motor speed (12.3% maximum) is shown and the current hopper weight (1387G).

2> ADDITIVE

2 > ADDITIVE:
6.2G

Display <2> shows the Doser target weight for the additive (shot mode) or the target Kg/hr (Continuous mode).

2 > ADDITIVE:
0.54 KG/HR

3> KGS USED

3 > KGS USED: 23.4
SELECT TO CLEAR

Display <3> shows the total Kgs of additive used since the total was last reset. Press **Select Option** to reset the total. The message:

CLEAR KGS USED ?
PRESS SELECT TO OK

will be displayed. Press **Select Option** to confirm that you wish to reset the total.

4> HOPPER WEIGHT

4 > HOPPER: 1387
VALID

after a rapid change of weight is detected. In normal operation it should remain valid. If the display keeps showing intermittent **INVALID** due to vibration of the machine then the Invalid Weight setup parameter needs to be increased.

Display <4> shows the current hopper weight. It also shows if the current weight is **VALID** or **INVALID**. The weight becomes invalid during loading, when it is below the Low Level weight and for a few seconds

5> ALARMS

5> NO ALARMS

Display <5> is used to show the current alarms, if any. For the full list of alarms refer to the **Alarms** section.

6> WARNINGS

6> NO WARNINGS

Display <6> is used to show any warnings, ie. Alarms which have been acknowledged.

7> FEED SPEED

7> FEED SPEED
12.3%

Display <7> shows the current metering wheel speed as a percentage of full speed.

8> FEED RATE

8> FEED g/sec
CUR=0.982 MAX=6.321

Display <8> shows the current metering wheel feeding rate in grams per second. The current rate is shown (0.982) as well as the “maximum” rate (6.321). This maximum rate is an estimate based on

the current rate at a motor speed of 100%. This number should be relatively constant and provides useful diagnostic information if the Doser appears to have miscalculated the throughput rate.

Pressing the **Select Option** button allows the operator to adjust the Maximum Rate. The display:

UPDATE RATE
PRESS SELECT TO OK

will be shown. Press **Select Option** to continue or any other button to exit. Continuing will display the Update Rate menu which is described at the end of this section.

9> FEED RATE (Doser #2)

As for Display <8> but for the secondary doser in a dual doser installation.

10> SOFTWARE

19> SOFTWARE
DSR v1.42

Display <10> shows the current version number of the Doser software.

NOT CONNECTED

NOT CONNECTED

This message is displayed by the Operator Panel when it has lost communication with the Dosing Unit. Refer to the **Troubleshooting** section.

Update Rate Menu

As shown above, display <8> shows the maximum estimated throughput rate of the metering wheel. This is the single most important number in the Doser and the basis for all feed rate settings. The fact that the Doser can automatically adjust it to suit the material is the Doser's greatest strength and the fact that it takes time to do so its greatest weakness. However the operator can help to speed up the adjustment process.

If you press **Select Option** on display <8> you force the Doser into Fast Update mode. In this mode the amount of additive required to determine the maximum wheel rate is greatly reduced and so happens a lot faster. If the Material Library parameter in the setup data has been set to **Yes** then the Update Rate menu will be displayed which allows the operator to specify an initial estimate of the maximum wheel rate directly.

UPDATE RATE:
BLKMB (8.7)

If one or material codes have been set up then the code and the corresponding maximum wheel rate are displayed. Press **Select Option** to select this material.

UPDATE RATE:
CURRENT (12.3)

Displays the current maximum wheel rate. Press **Select Option** to use this. This is the same as exiting from the menu.

UPDATE RATE:
ENTER VALUE=12.3

Displays the current rate but pressing **Select Option** allows you to enter a new maximum wheel rate directly.

Alarms

Acknowledging Alarms

During operation of the Doser, alarms may be raised to indicate equipment faults, error conditions or critical events. When an alarm is raised the Doser switches to display <5> and displays the alarm, eg:

5> STOPPED
SELECT TO ACK

The alarm will continued to be displayed on display <5> until it is acknowledged by pressing the **Select Option** button. Pressing **Select Option** as soon as the alarm is displayed will result in the alarm being cleared and the display returning to the previous display number. Alternatively you may use the normal **Scroll** buttons to view other displays before returning to display <5> to acknowledge the alarm. You can only acknowledge the alarm when it is displayed. If more than one alarm is active the most recent one is displayed first although you can use the **Scroll** buttons to view the other active alarms.

Alarm messages

This section lists all possible alarm messages in alphabetic order. Each alarm message is followed by things to check to determine the cause of the alarm.

DOSER N/C

5> DOSER N/C
SELECT TO ACK

Means the Controller cannot communicate with the Dosing Unit.

Check:

- Dosing Unit is plugged in
- Refer Troubleshooting section.

IO BOARD N/C

5> IO BOARD N/C
SELECT TO ACK

(DS200 only) Means that the CPU board cannot communicate with the I/O board.

Check:

- Almost certainly an I/O board fault. Refer Troubleshooting section.

LOADCELL ERROR

5> LOADCELL ERROR
SELECT TO ACK

Means that the loadcell input has fallen to zero, or risen too high, indicating a possible fault with the loadcell input.

LOW LEVEL

5 > LOW LEVEL
SELECT TO ACK

Means that the weight of additive material in the Doser hopper has fallen below the low level specified in the Setup Data.

Check:

- Refill with material.

MAXIMUM SPEED

5 > MAXIMUM SPEED
SELECT TO ACK

(Continuous mode only) Means that the Doser needs to run the Metering Wheel at more than the maximum speed.

Check:

- The additive ratio and extruder throughput entries are correct.
- Use display <8> to check the maximum grams/sec. Press **Select Option** to allow this to readjust if required.
- Check the Metering Wheel is feeding smoothly.

MINIMUM SPEED

5 > MINIMUM SPEED
SELECT TO ACK

(Continuous mode only) Means that the Doser needs to run the Metering Wheel at less than the slowest allowable speed.

Check:

- The additive ratio and extruder throughput entries are correct.
- Use display <8> to check the maximum grams/sec. Press **Select Option** to allow this to readjust if required.

NOT FEEDING

5 > NOT FEEDING
SELECT TO ACK

Means that some problem with feeding has caused too small an amount of material to be fed, i.e. half of the amount expected or less.

Check:

- Have you run out of material? Is there a blockage in the hopper?
- Is the metering wheel rotating?

NOT FILLING

5 > NOT FILLING
SELECT TO ACK

Means that the loader cannot load the required amount of material in the required time.

Check:

- Have you run out of material?
- Is the loader working?

OVERFULL

5 > OVERFULL
SELECT TO ACK

Check:

- Slide valve stuck open

(DS200 only) Means that the weigh hopper has been flooded with material. While overfull the weight loss readings are suspect and no rate adjustment will be done.

RESTARTED

5 > RESTARTED
SELECT TO ACK

If power was not turned off check:

- Static charge building up in the Hopper

Means that the Doser has been restarted. Normally occurs only when power is first turned on but can occur if the CPU board resets due to a power supply problem.

SPEED N/C

5 > SPEED N/C
SELECT TO ACK

Check:

Probably a faulty speed module or faulty communications wiring. Refer Troubleshooting section.

Means that the Doser has been set up to use a Speed Module input for extruder RPM but the Controller cannot communicate with the Module.

STOPPED

5 > STOPPED
SELECT TO ACK

Means that the Doser has been stopped.

Maintenance

Weekly

- Remove and empty hopper.
- Remove loadcell cover and clean loose material from around loadcell.
- Refit hopper and check mechanical clearance between hopper and Dosing Unit body.
- Check empty hopper weight is between -50g and $+50\text{g}$ and retare if necessary.
- Check calibration and recalibrate if necessary. Place 2 kg calibration weight in hopper and check displayed weight increases by 2000g ($\pm 20\text{g}$).

Monthly

- Empty material from Dosing Unit body
- Check condition of metering wheel blades.
- Check wheel turns freely. The stepper motor has some inductive resistance which can be felt as a fine jerky resistance but the wheel should still turn easily by pressing on one rubber blade. If stiff remove motor and check for material between wheel and motor body.

Troubleshooting

Problems with the Doser usually fall into one of three areas:

- Electronic. Are all the circuit boards, modules and communication links working ?
- Loadcell. Is the hopper giving the correct weight ?
- Material feed. Is the material being feed consistently.

If these are all ok then the doser should run correctly so the troubleshooting procedure typically is to identify which area the problem is in or to systematically work through them all.

Before you do anything! Unless the problem is obviously an electronic failure it is probably to do with the doser's feed rate adjustment. Go to display <8> and make a note of the MAX feed rate. This will be a useful guide for later.

If you just want to get working again! Turn the power off, wait a few minutes and then turn back on. This will allow any static induced hang-up in the electronics time to dissipate and also resets some of the internal software filters and timers. It may be sufficient to get the Doser running again but obviously will not help determine why the problem occurred in the first place.

Electronics

Firstly verify that the Doser electronics are working. These initial checks just establish that the main boards are at least running and the communications links are ok. There may be some specific functions not working but these will be picked up in later tests.

Power Supply

Green Power light on the Controller front panel should be on.

LCD backlight should be on and not flickering.

If in doubt, check voltage on internal connectors 3 (0V) and 4 (+15V). Check mains supply and fuse.

Control Board (DOP)

If the LCD display on the Controller is working and can you use the buttons to change the display then control processor is working. If not try disconnecting the Dosing Unit in case this is causing a communications problem. The same communication bus is used between the processor and the display.

Dosing Unit I/O Board (DIO)

If you get a Doser N/C alarm then check the wiring between the Controller and the Dosing Unit and check that it is plugged in. Otherwise the problem could be a faulty DOP or DIO board and swapping with spare boards is the only way to find out which.

Loadcell

Empty the hopper and replace. Check the weight reading is about zero (+/- 20g). Place the 2 Kg calibration weight in the hopper. Check for a 2000g increase (+/- 20g).

If the weight readings are almost right then the loadcell probably just needs recalibrating. Otherwise use the Test / Loadcell / Show AD Input display. This should show about 0% with no hopper, about 15% with the empty hopper and should increase by about 15% with the addition of the 2Kg weight.

Again if these numbers are about right then the loadcell should be recalibrated. If the input with no hopper is high (but less than 90%) then this indicates the loadcell has had a knock and its zero point has shifted. The loadcell should be replaced but you may be able to operate so long as the input with a hopper full of material is less than 100%.

If the loadcell input is stuck on 0% or 100% then there is either a major with either the loadcell or the analog input on the DIO board.

Material Feed

Use the Test / Motor display to run the metering wheel motor. Check that the motor runs without stalling. If the motor does not run at all check it will turn by hand. There may be material wedged between the motor body and paddle shaft. If the motor turns freely then the problem could be a failed motor or the output driver on the DIO board. Check the motor wiring and plug.

Check for material blocking in the throat of the hopper.

Check that material is not building up in the exit nozzle inside the mounting adaptor. This can happen if too high an additive % is requested.

Tests

In order to help resolve problems with the Doser there is a menu of tests which enable individual operations to be manually controlled.

To enter the Test menu press the **←** and **Select Option** buttons together to enter the Control Options menu:

CONTROL OPTIONS:
TARE

Press **Scroll UP** four times to move to the Tests option.

CONTROL OPTIONS:
TESTS

Press **Select Option** to enter the Tests menu. The following options are then available with the **Scroll UP** and **Scroll DOWN** buttons.

LOADCELL

Allows you to test the operation of the loadcell input. You can:

- Display the current weight in grams.
- Display the current loadcell input as % of full scale and the minimum and maximum values.

MOTOR

Allows you to test the operation of the metering wheel motor. You can:

- Turn the motor on or off.
- Set the speed of the motor

LOADER

Allows you to turn the loader output on or off.

INPUTS

Allows you to view the current status of the input signals. You can check:

- Run input (Shot mode)
- Extruder Pulse input and RPM (Continuous mode)
- Auxiliary input

I-BUS

Allows you to check for communication with any of the boards or modules connected to the I-Bus serial communications link. The first menu option **IBUS**

ERRORS shows the packet error rate and is very useful in showing communications problems.

Warranty

Service

Weighbatch machines carry a limited parts warranty as stipulated in Weighbatch's Terms and Conditions of Sale.

If your service request is not covered by this warranty you will be charged for parts, time and disbursements accordingly.

This manual is set out to cover most situations but should you require further assistance please call your supplier. Quote the model number of your Doser (DS-20) when requesting service. In the case of a fault with the unit, please describe clearly the symptoms of the problem.

Warranty Procedure:

If you believe the fault is a warranty problem you need to advise Weighbatch as soon as possible and supply the following details of the fault:

- Company Name
- Contact Name
- Date Fault Occurred
- Model Number
- Your machine name/number
- Description of Fault (Please describe accurately nature of fault)
- Description of circumstances when fault occurred (throughput of your machine etc)

Circuit Boards and Modules

Recommended Spares

Part No	Description	Qty

Appendicies

Electrical Wiring

