COTSWOLD MECHANICAL LTD

CMW 2000
USER MANUAL

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Basic Overview:

Cotswold Mechanical's entire range of weighing machines have the same basic mode of operation and whilst the format, style, size and specification may differ to suit different products, weights and speed requirements basic principles are valid throughout.

1. Product is placed into a holding hopper and is then fed automatically, at a fast speed, into a pan that is attached to a weighing mechanism until the target weight is almost reached at which point the feed rate slows to a trickle. On achieving the required weight feed stops altogether and, after checking that the weight is correct, the weighed product is released into a waiting container.

2. The product infeed hopper normally has adjustable gates to regulate the depth of product allowed out on to the feed system

3. The feed system normally comprises a series of vibratory feeders (sometimes referred to as feed trays)

4. There are normally two vibratory feeders; one to take the bulk product out of the hopper (bulk or primary tray) and one to feed the product under strict control into the weighpan (fine or secondary tray). The exception to this is the CMW2000 which only uses one vibratory feed tray.

5. At the outfeed end of the feed system there are normally some "gates". These are designed to assist in the precise feed of the product. In the case of the bulk gate, this closes to shut off the bulk feed tray when "fine" feed is taking place. Similarly, the fine feed gate closes when the correct weight is in the weighpan making sure that no further product is allowed in, thus minimizing the possibility of over-weights being produced. Again, the CMW2000 is an exception, only using one gate. This acts to shut off the bulk flow of product. Fine feed of product is achieved by product 'spilling' around the shut bulk gate, and the feed tray running at low speed.

6. The type and design of feed system is determined by the characteristics of the product to be handled.

7. A suitable receptacle is placed beneath the Outlet Chute of the machine – usually specified by the machine operator. When the correct signal is given, (usually via an operator footswitch or ancillary piece of equipment such as a vertical form fill and seal bagmaker), weighed product is discharged down the Outlet Chute and into the waiting container.

8. The weighing function of the machine is performed by a precision weighing mechanism (normally a loadcell)

9. The gating system is located above a chute that transfers the product into the container to be filled. These outlet chutes are designed to suit the application and may be fitted with different size and style of extensions to adapt them to various sizes and styles of packaging.

10. All aspects of the machine operation including, target, bulk and fine weights, the speed (amplitude) of the vibratory feeders, the frequency of the auto-tare facility etc. are all set and held in the "Product Code Memory" of the control system - along with all other information necessary for the correct operation of the machine.

11. Once the correct settings for a particular product and weight combination have been determined they can be retained in the control system memory and simply recalled the next time they are required to be used.

Hints on Successful Operation:

THE SECRET OF ACCURATE AUTOMATIC WEIGHING IS IN OBTAINING A CORRECT AND RELIABLE PRODUCT FEED INTO THE BOX OR CONTAINER.

1. The amount of product on the bulk (primary) tray is determined by:
    i) The position of the adjustable sliding gate on the front of the hopper.
    The correct position of this gate is determined by:
    a) The type of product being handled
    b) The throughput and depth of product deemed necessary

2. The level of product on the fine (secondary) tray is determined by:
    i) The position of the adjustable sliding gate on the front of the hopper.
    The correct position of this gate is determined by:
    a) The type of product being handled
    b) The throughput and depth of product deemed necessary

IT IS ESSENTIAL TO HAVE A SMALL - BUT SUFFICIENT – FINE FEED.

3. If there is none, or it is too little, invariably over-weights will be produced.
    i) If it is too long product may build up behind the bulk gate resulting in erratic weights (correct weight followed by an overweight etc.)

FINE FEED TOO SHORT - DECREASE the BULK WEIGHT SETPOINT

FINE FEED TOO LONG - INCREASE the BULK WEIGHT SETPOINT

4. It is important that the depth and speed of movement of the product are in keeping with the weight being made and the accuracy required. In general the higher the target weight and the smaller the product piece size the greater the depth of product and the faster the movement can be.

It is impossible to give exact advice on actual settings, they will only be determined by running the actual product through the machine and by using trial and error along with experience gained in the best method of operation for your own particular products and requirements.

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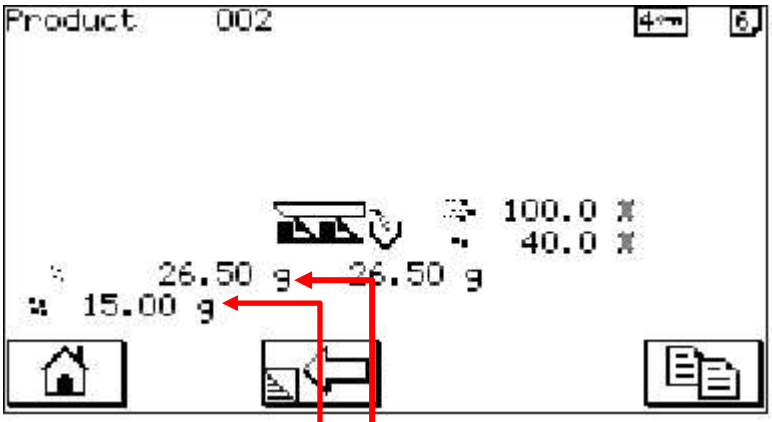
Hints on Successful Operation: (Continued)

Before starting the machine:
Set the desired Target weight *(Example 1000g)*
Set the Fine set point to equal the Target Weight *(Example 1000g)*
Set the Bulk set point to Target Weight minus 10% *(Example 900g)*
Set the Fine vibrator fast speed to 50% and the slow speed to 40%
Set the Bulk vibrator fast speed to 40%

Switch the machine in to run mode.
Place a small amount of product in to the Fine vibrator tray; check the product is transferred along the vibrator with a smooth and consistent flow rate.
If the transfer of product is too slow or too fast adjust the Fine vibrator fast and slow speeds accordingly.

Place a small amount of product in to the Bulk vibrator tray; check the product is transferred along the vibrator with a smooth and consistent flow rate.
If the transfer of product is too slow or too fast adjust the Bulk vibrator fast speed accordingly.

Stop the machine
Close the hopper slide gate, and then fill the hopper with product.
Now open the hopper slide gate, only a sufficient amount to allow the product to flow from the gate. Re-start the machine.



Bulk Cut-off Weight----
range 0 – target weight
Enter the weight at which the vibrators will switch from fast to slow feeding.
Fine Cut-off Weight---------
range 0 – target weight
Enter the weight at which the vibrators will stop feeding and the weigher start to settle.
Use the COPY button to copy the entered settings to all weighers.

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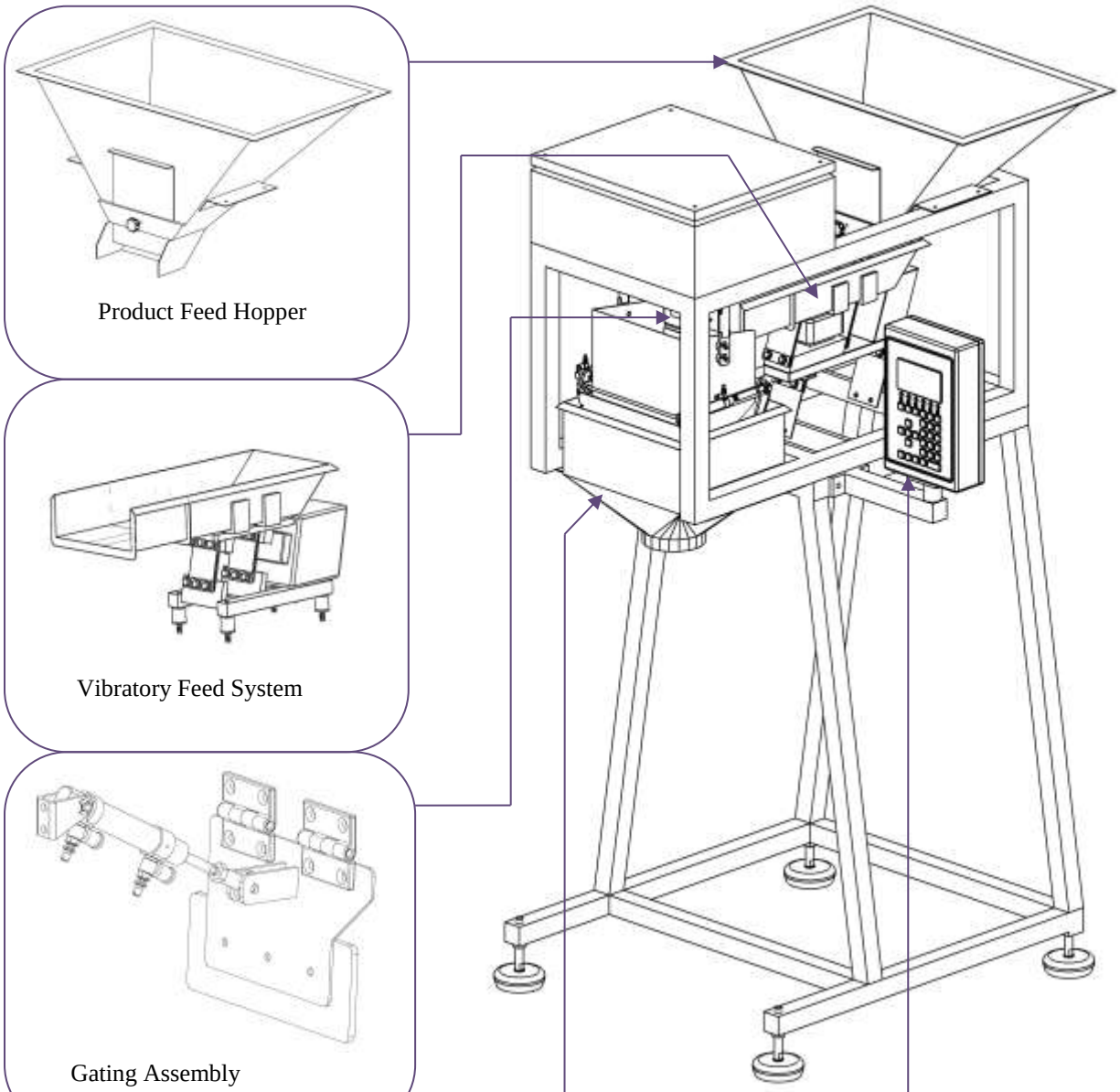
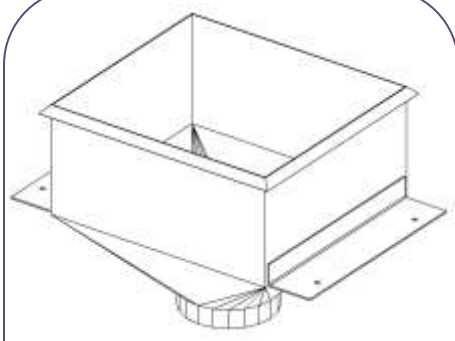
Machine Overview- 1:



Product Feed Hopper

Vibratory Feed System

Gating Assembly



Outlet Chute Assembly

CMW Controls

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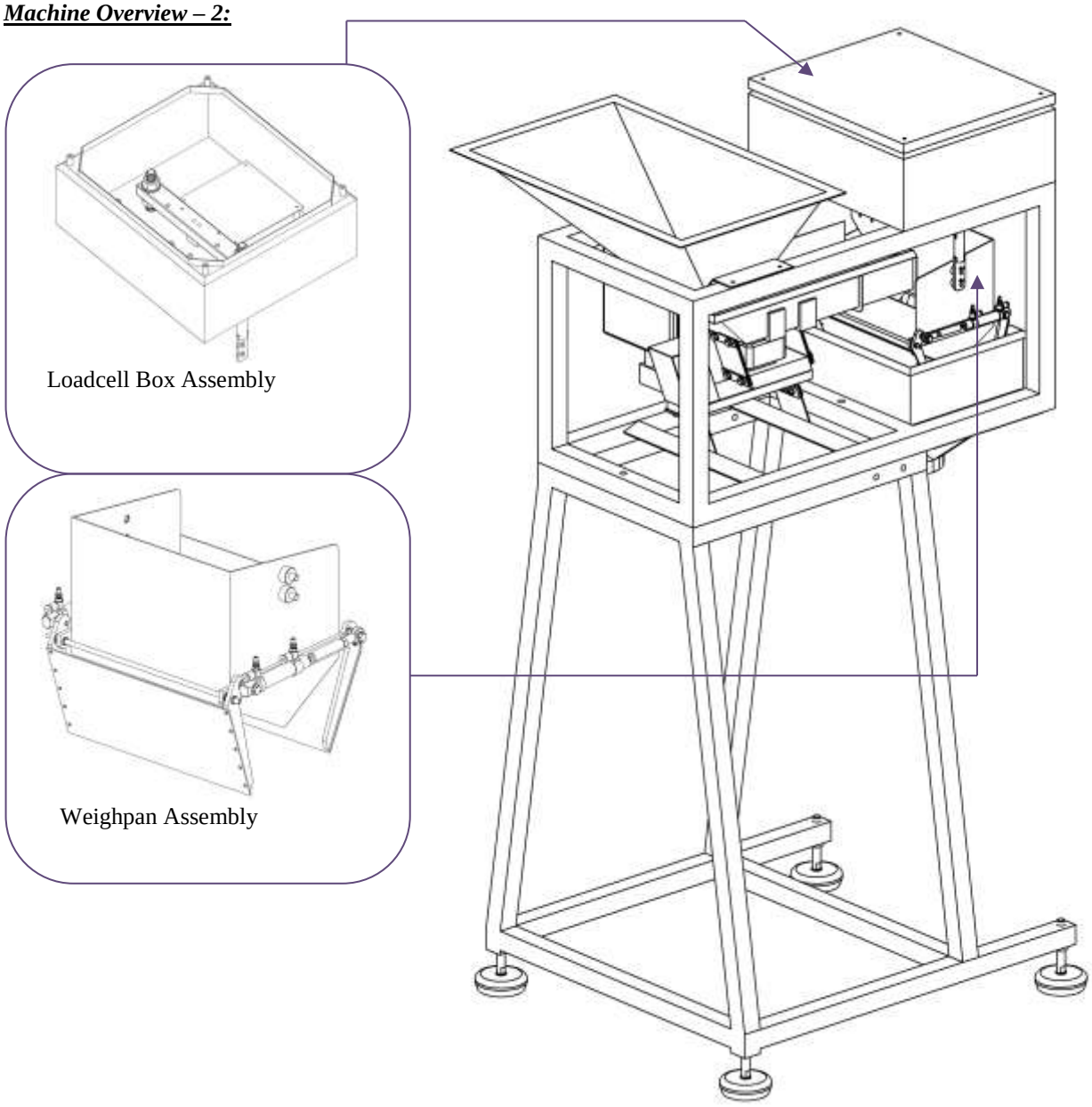
Machine Overview – 2:



Loadcell Box Assembly

Weighpan Assembly

Machine Overview – 3:

Description:

A single lane automatic linear weighing machine which utilises the highest quality components and materials and combines a precision loadcell weighing mechanism with the latest electronic technology.

Weight Range:

0.5kg upto 2.0kg, although versions may vary. Applications are also dependent on the product bulk density.

Capacity:

Upto 4.5 litres per weighment depending on application - versions may vary

Function:

The machine utilises a hopper system that is filled with the product to be weighed. By means of a vibrating tray, product is fed in a controlled manner to the weigh-pan assembly. A pneumatically actuated gate ensures that the weigh-pan is filled to the correct target weight with no excess product overspill. The product weights are continuously monitored by the electronic controls, and once the target weight has been achieved, the weigh-pan pneumatically discharges the weighed product upon receipt of an electronic volt free signal. This is usually done via an operator footswitch, or is given by an ancillary piece of equipment such as a vertical form fill and seal bag-maker. Alternatively, the machine can give an output volt free signal to indicate that a weight is complete and ready for discharge. As the weigh-pan discharges, the product falls down a chute that is usually custom made to suit an individual application. This ensures that the weighed product falls into a suitable receptacle placed or positioned beneath the outlet chute.

Machine Overview:

The CMW2000 comprises of the following sub-assemblies:

1. Product Feed Hopper……
2. Vibratory Feed System …….
3. Gating Assembly……..
4. Outlet Chute Assembly……..
5.. CMW Controls……..…….
6. Loadcell Box Assembly)……...
7. Weighpan Assembly …….

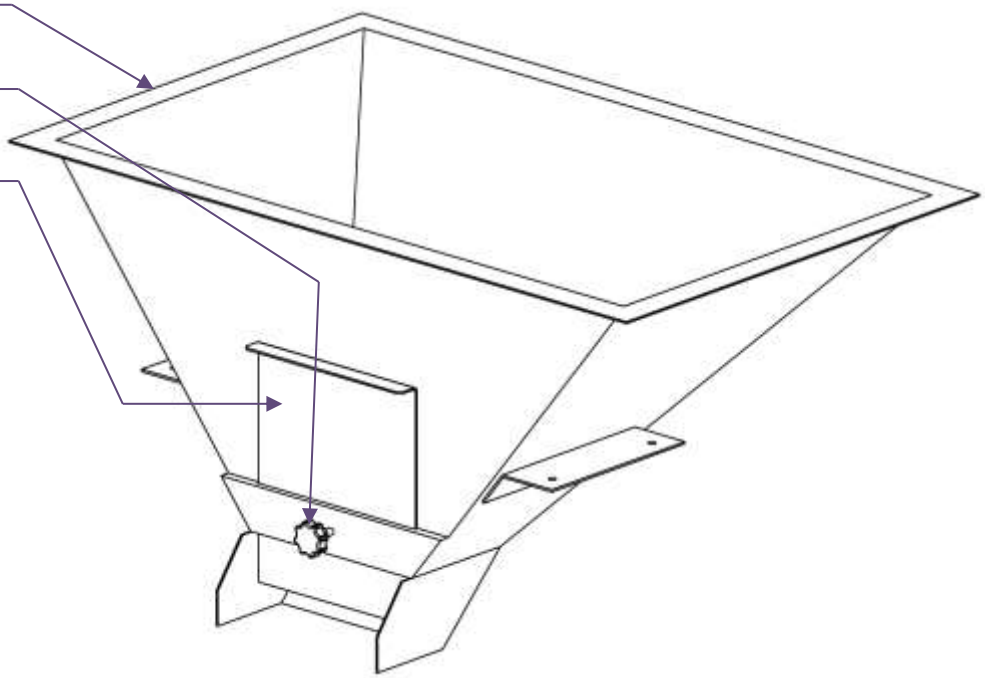
Product Feed Hopper:

Product Feed Hopper (x1)

Hopper Gate Adjusting Hand wheel (x2)

Hopper Gate (x1)

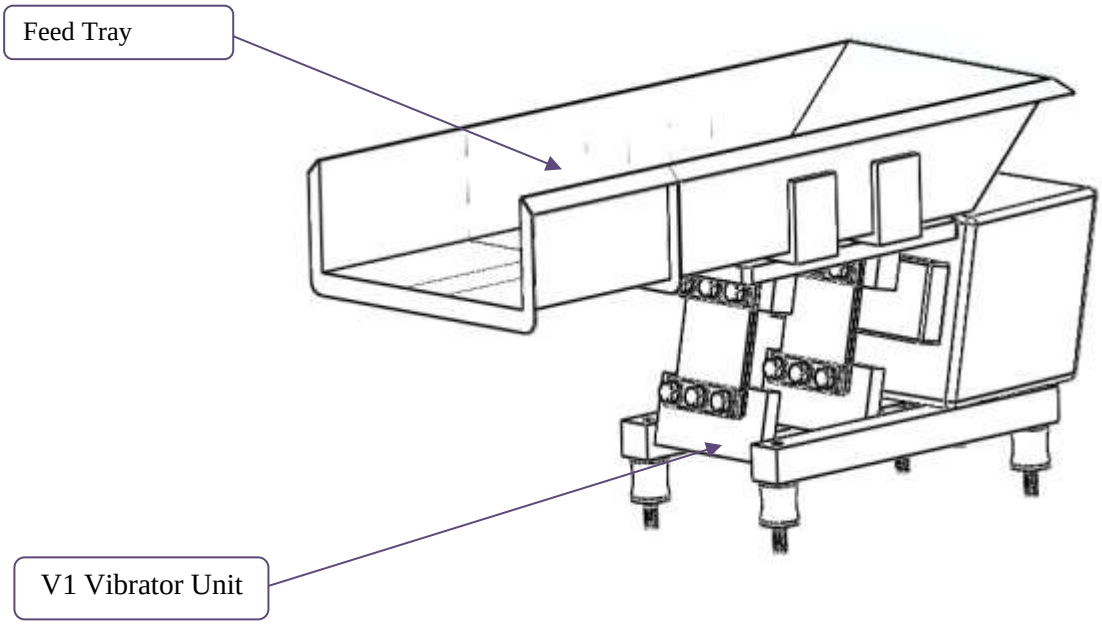
Note: Some Hoppers are fitted with various sound deadening panels as an optional extra to dampen product noise when product enters the hopper. These panels are permanently adhered and sealed to the Hopper. Under no circumstances should they be removed.



The Product Hopper is usually custom designed to suit the individual product requirements. It is normally mounted by means of four bolts into the top of the machine frame. Product feed from the hopper is controlled via a hopper feed control gate. The volume and depth of product that exits the hopper can be adjusted by loosening the hand-wheel then raising or lowering the hopper slide gate and re-tightening the hand-wheel once the correct level has been achieved. Normally this is set to the minimum gap that will allow the product to flow freely from the hopper.

Due to the fact that the Hopper is bolted to the machine frame, it is normally cleaned in position and not intended for removal.

Vibratory Feed System:



The Vibratory Feed System:

The system comprises a vibratory feed tray mounted on an electromagnetic vibrator. During normal operation, the tray transfers product in a controlled fashion from the product hopper to the weighpan via a pneumatically controlled bulk gate. The tray has two product feed speeds; fast or bulk speed and slow or fine speed. Typically, when a new weighment of product is to be made, the tray operates at fast speed so that the majority of product enters the weighpan in the shortest possible time. As the weighment approaches the target weight, the feed tray switches to the slow or fine feed to fill up the weighpan with the last minority of product required to achieve the target weight.

The Feed Tray is manufactured from high grade 304 food quality stainless steel and is permanently attached to the vibrator unit. The Tray will easily withstand cleaning with most food standards approved cleaning agents.

Vibratory Feed System: (Continued)

Method Of Adjustment:

(See CMWControl Instruction Manual, Product Feed Section 3.4)

Each Vibrator has two speed settings, fast and Slow speeds.

Each speed is digitally set within the Product Code Menu, values 0-100%

Fast Speed:

This speed settings is used to when feeding the majority (Bulk) of the product through the feed system and in to the Weighing system.

Normally the Primary Vibrator, this will allow thinning of the level of product as it progresses through the system.

Example: Primary fast speed = 45%.

The Fast Speeds continue to be used until the "Bulk" set point is achieved.

Slow Speed:

This speed settings is used to when feeding the final (Fine) or top up of the product to achieve the desired target weight.

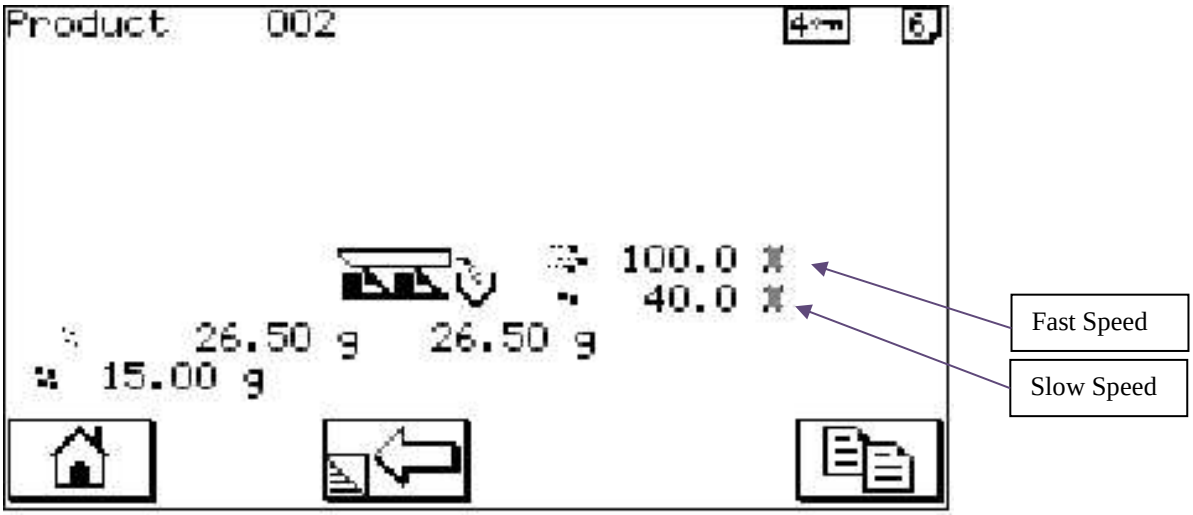
.

Example: Primary slow speed = 40%

The Slow Speeds continue to be used until the "Fine" set point is achieved.

The "Fine" set point is normally set to slightly below the desired target weight, this allows for product in flight.

If the "Fine" set point value is set low the system will stop early and the target weight will not be achieved. The feed system will then begin to top up, again using the slow speed settings.



Vibratory Feed System: Vibrator Tuning

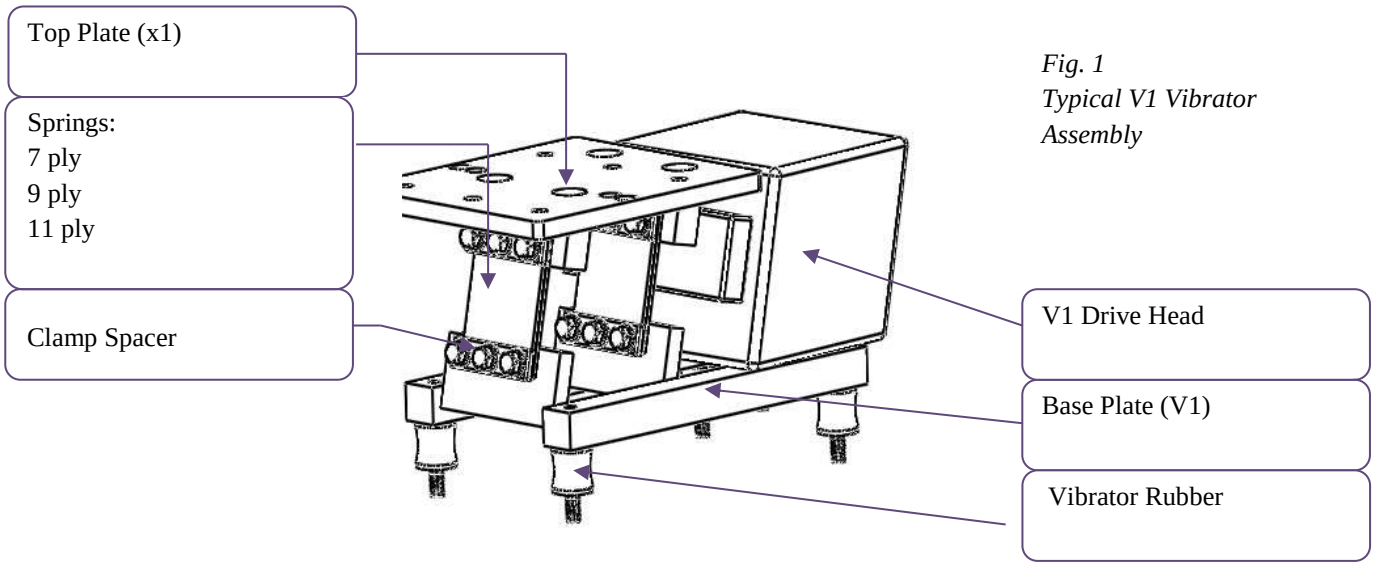


Fig. 1
Typical V1 Vibrator Assembly

Over a period of time, the performance of the V1 Vibratory feed unit may diminish. This is usually after a period of eight months or more and is more noticeable on weighing applications requiring high vibration speed and amplitude to move the product. Leaving the vibrator running at full load speed when the machine is empty or during a wash down can also exacerbate the condition.

Tuning is a relatively simple process and basically involves selecting the correct combination of fiberglass springs to replace those already on the unit. The springs are supplied in three varying thicknesses; 7, 9 and 11 ply. The object of successful tuning is two fold:

1. To obtain approximately 4.5mm – 5.0mm of displacement / movement on the top plate of the vibrator unit WHEN A TRAY IS BOLTED IN POSITION and the unit is running at 100%.
2. To obtain good linear vibration range. This is determined by reducing the vibrator speed in the machine controls in intervals of 10% from the full load speed of 100%. If the speed of the vibrator experiences a larger than 10% decrease in speed when a 10% speed reduction is inputted via the machine controls, the vibration range is deemed as bad. However, often there is little vibration below 40% and these low end values are largely ignored.

The procedure for tuning the vibrator units are as follows

Vibratory Feed System: Vibrator Tuning (Continued)

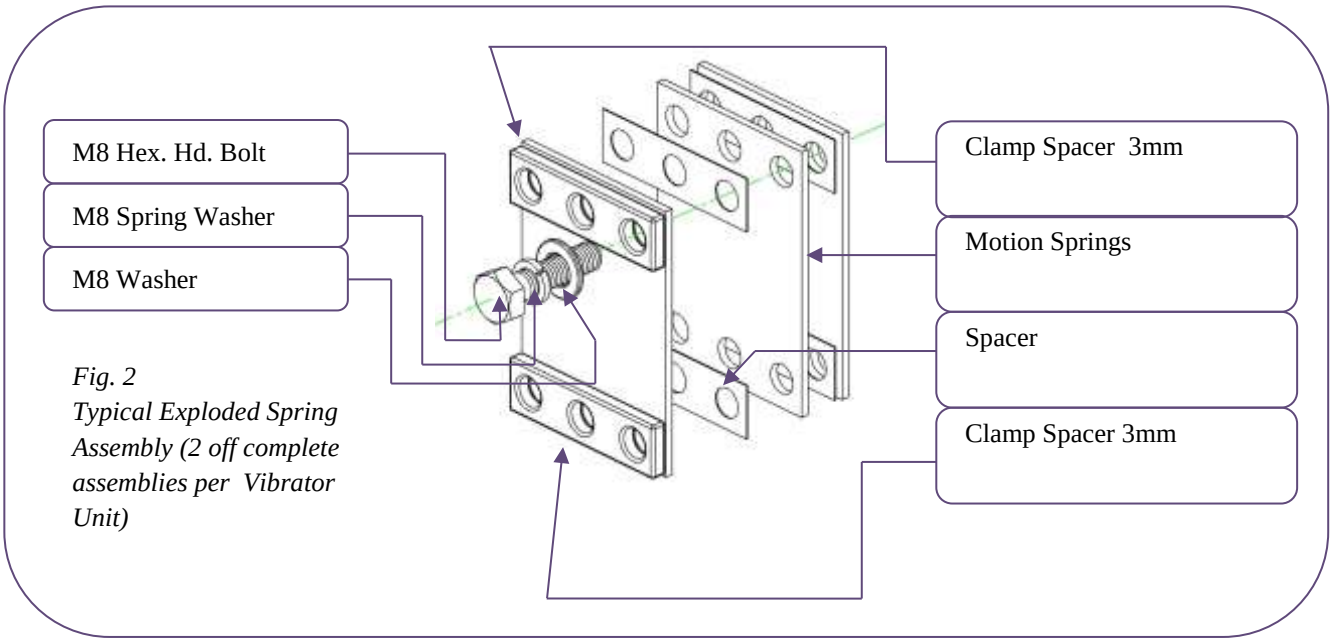
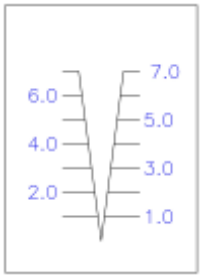


Fig. 2
Typical Exploded Spring Assembly (2 off complete assemblies per Vibrator Unit)

Step 1.
Assemble the vibrator springs in two separate assemblies as shown in Fig. 2 using two 11 ply springs in each position. Make sure that all the bolts are tight! Bolts that are not properly tightened will result in false linear vibration range readings later.

Step 2.
Make sure that the product feed tray is bolted into position on the vibrator unit. Set the vibrator speed in the machine control parameters to 100% and switch the system into test mode. Make a note of the current vibrator amplitude. This is best achieved by holding a steel rule as close to the feed tray as possible and measuring the 'ghost' profile created by the movement of the tray (see Fig. 3).

Note: Some vibrating trays are fitted with a vibration motion label (see below) which will indicate clearly how much tray displacement occurs. It completely negates the need to use a rule to measure the tray movement.



As the label vibrates with the tray, the two diagonal lines will appear to converge. The point of convergence can be read off the scale, indicating precise tray displacement.

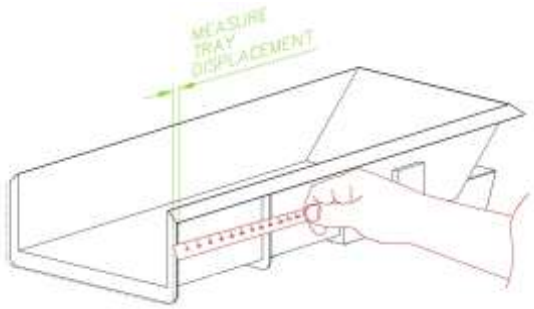


Fig. 3.
Vibrator Unit running at 100% - steel rule used to measure tray displacement left by 'ghost' image of tray when vibrating.

Vibratory Feed System: Vibrator Tuning (Continued)

Step 3.

If the amplitude of the tray measures approximately 4.5mm to 5.0mm, then proceed to step 7 to ensure good linear vibration range.

Step 4.

If the amplitude of the tray measures less than 4.5mm to 5.0mm, loosen one of the lower vibrator spring M8 bolts. It is important to loosen the bolt as the vibrator unit is running. As the bolt is loosened, a change in amplitude should be easily detected. If no change is discernable, gradually loosen a second bolt.

Step 5.

If the tray amplitude increased when the bolts were slackened, then the vibrator springs are too stiff. The overall spring thickness needs to be decreased by either removing / changing the spring thickness combinations. If the tray amplitude decreased when the bolts were slackened, then the vibrator springs are too weak and the overall spring thickness needs to be increased, again by adding / changing the spring combinations.

Step 6.

Vibrator springs are available in three thicknesses; 7, 9 & 11 ply. Adding or replacing springs should take place one at a time. When a spring combination has been altered, check that the M8 retaining bolts are tight and repeat the amplitude measurement test again (return to step 2) as many times as necessary until the correct amplitude is achieved.

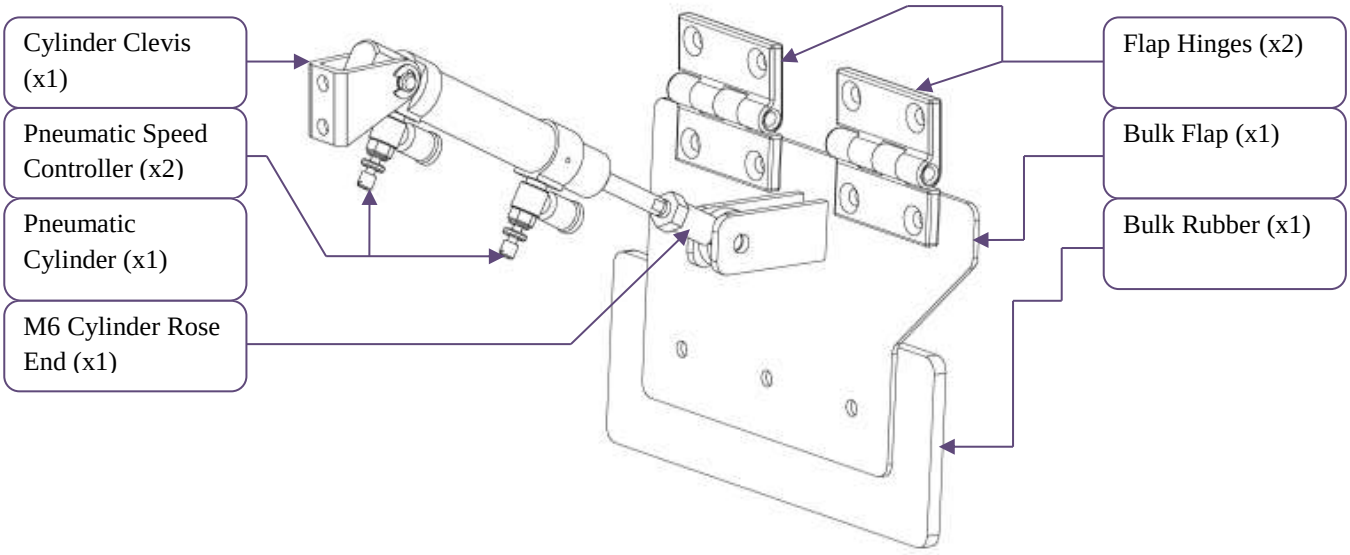
Step 7.

Once the correct amplitude has been achieved, reduce the vibrator load speed in increments of 10% in the machine controls. If the speed of the vibrator experiences a larger than 10% decrease in speed when a 10% speed reduction is inputted via the machine controls, the vibration range needs altering. This is achieved by altering the combination of springs used to that of a slightly thinner combination i.e. remove one 11 ply spring and add two 7 ply or one 7 and one 9 ply. Essentially, having previously achieved good amplitude of vibration, the vibrator is now being restricted or de-tuned in its overall performance in order to gain good linear range of control. Overall tray speed is therefore, a trade off over good linear range of control. Be aware that below 40% load speed on the controls usually results in little or no vibration so generally, these low end results are largely ignored.

The extent to which a vibrator unit is tuned is largely dependent on the flow characteristics of the product. For instance, an awkward product such as diced lettuce, requires a high / fast amplitude. In such a case, it is not so important that the vibrator exhibits good vibration range. However, a free flowing granular product such as grass seed requires little vibration to start it moving along the tray. We would therefore suggest, that a high / fast amplitude is not that important. Good range of control however, is. It is important that these characteristics are duly taken into consideration when tuning.

Note: The two sets of lower mounting springs are not intended to be interchanged. For the purposes of vibrator tuning, only the upper motion springs are meant for replacement and it is only the upper motion springs that have a direct effect on vibrator performance.

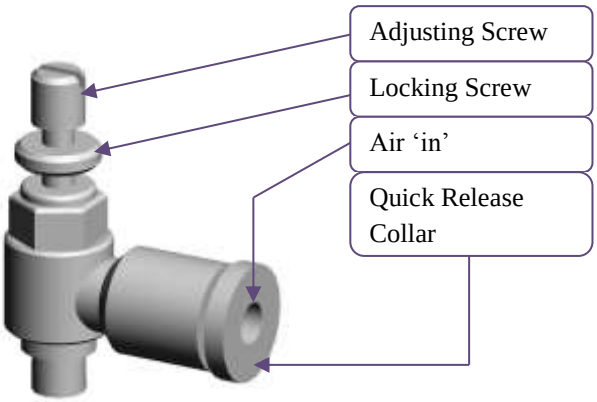
Gating System:



The Gating System consists of a pneumatically operated Bulk gate. It is located beneath the Loadcell Box Assembly. The gate opens at the start of the weighing cycle. The Bulk gate closes when the Bulk set point is reached, effectively reducing the amount of product able to feed into the weigh pan by approximately eighty per cent. The product continues to feed at slow speed, spilling past the now closed Bulk Gate, until the fine set point is reached. If the weight of product in the weigh-pan is less than the target (minimum weight system) or less than the under weight tolerance (Average weight system), then the product feed will resume (at slow speed) until the target weight is achieved.
The Gating system is Factory set and will not normally require any adjustments.

The entire Gating Assembly is permanently located on the machine main frame and is not intended for removal for cleaning.

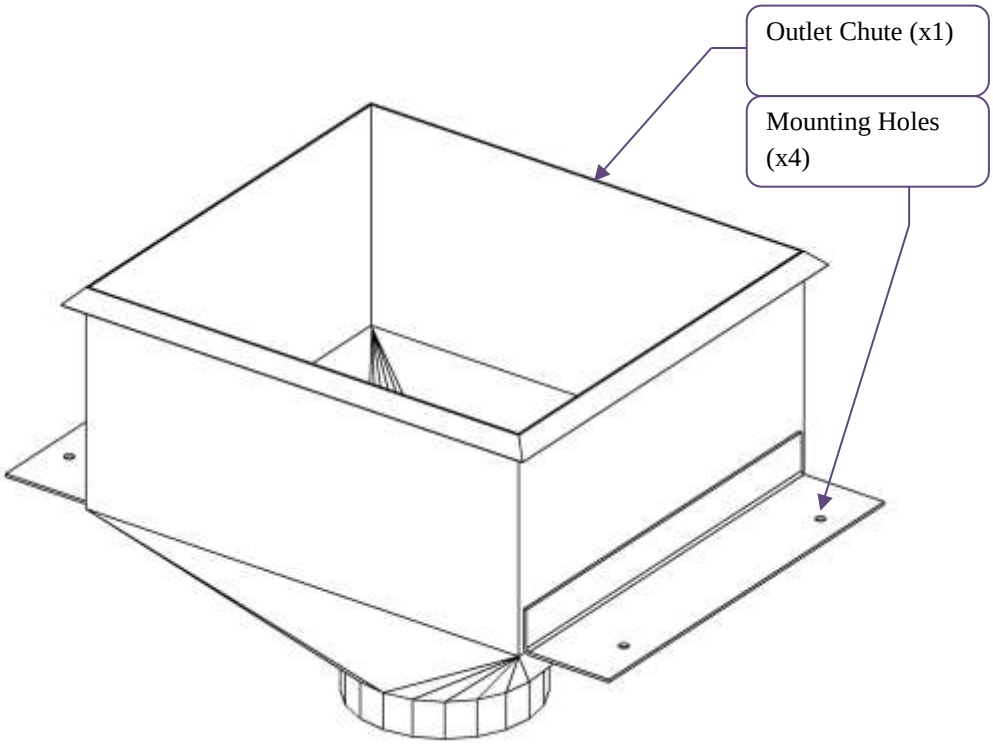
IMPORTANT: The air supply must first be switched off and the air supply pipes to the pneumatic cylinder actuators disconnected by a suitably qualified person before any maintenance can take place.



The illustration immediately left shows a typical speed controller as found on the pneumatic cylinder. By winding the adjustment screw in or out will accelerate or decelerate the speed at which the bulk gate opens and closes. It is important to tighten the locking screw once the correct position of the adjusting screw has been ascertained. To remove the air pipe from the speed controller, first depress the quick release collar, and then pull the pipe free (disconnect air supply first).

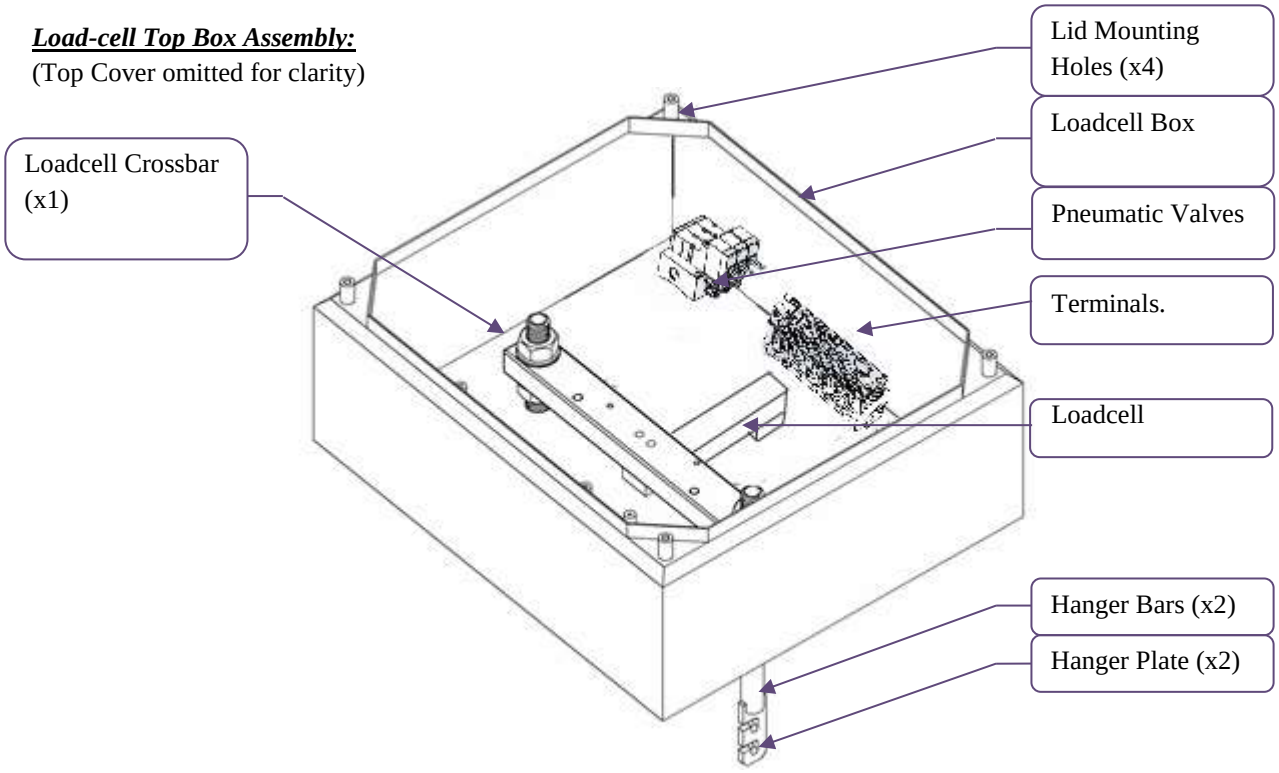
Outlet Chute Assembly:

Note: Some Outlet Chutes are fitted with various sound deadening panels as an optional extra to dampen product noise when product enters the Chute. These panels are permanently adhered and sealed to the Unit. Under no circumstances should they be removed.



The Outlet Chute, as its name suggests, provides an outlet of product that has been weighed in the weighpan. It is located at the front of the machine and permanently fixed to the machine frame via four bolts. It is not intended for removal and should only be cleaned in situ. Outlet Chutes can vary in shape and size as often they are configured such that the exit diameter of the chute matches a given container or bag.

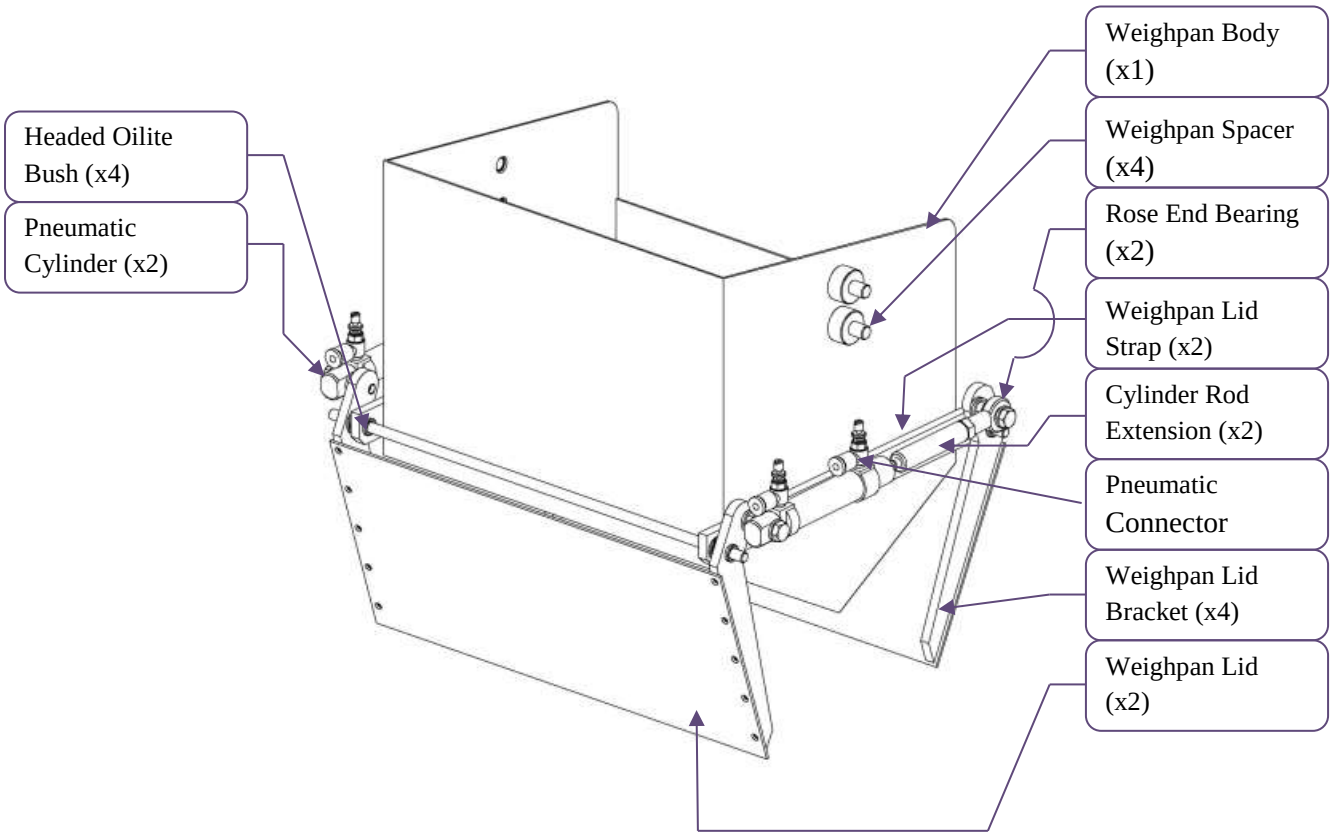
Load-cell Top Box Assembly:
(Top Cover omitted for clarity)



The Load-cell Top Box Assembly, houses a precision load-cell mechanism. The load-cell is a precision electronic weighing instrument and provides all the fundamental weight signals to the machine controls. It incorporates an integral overload facility that helps to avoid accidental damage due to excessive loading. The overload system is factory set, but may require future adjustment. This is largely dependent on the loading exerted on the weighpan and should only be adjusted by an Trained Engineer. The overload system **will not protect** against shock loading, therefore the Load-cell unit should be treated with care. The Load-cell is a sealed unit; no user adjustments are required for the Load-cell Mechanism.

Always ensure that prior to moving the machine, the Weighpan Assembly is removed from the Hanger Plates. Failure to do so can result in shock loading on the load-cell component which will severely impair the machines performance.

Weigh-pan Assembly:



The Weighpan Assembly is a pneumatically operated storage container; it is attached to a precision load-cell weighing system via two weighpan hanger plates. These facilitate quick release of the weighpan for cleaning purposes. Removal of the pan should only commence once appropriately qualified personnel have isolated the air supply to the machine. Before removal of the Weighpans, the air supply pipes must also be disconnected from the pneumatic cylinders. This is achieved by pressing the release collar on the pneumatic speed controller fitting, and pulling the air pipe out (see illustration below). To re-assemble, simply push the air pipe firmly back into the fitting. Care should be taken when removing the weighpan for cleaning that no liquid gets into the pneumatic fitting as water ingress can seriously damage the pneumatic cylinders. For cleaning purposes, it is advisable to 'blank off' the 'air in' aperture left when the air supply pipes are removed.

The weigh-pan is filled with product to the correct weight, via the vibratory feed trays and gating system. The product is held in the weigh-pan until an external discharge input is received, at this point the pneumatic cylinder opens the two weigh-pan lids, discharging the weighed product. The Weigh-pan is factory set and normally requires no further adjustment.

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1.
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1.0 INTRODUCTION

This manual has been compiled to assist the machinery manufacturer in the basic operation of the CMW Control System .
The controller utilises a backlit high contrast LCD display and operator keypad to enable the display and modification of all areas of the linear weigher operation.
The weighing characteristics of up to 100 different products can be pre-set into the product library and then products may be called up for use by either their name or optional product code.
The unit is easily cleaned, being housed with a stainless steel enclosure, sealed to the IP65 standard.
The controller can be configured to control one or two weighers and up to four vibrators. Depending upon the configuration of your machine, not all options shown in this manual may be accessible or appear on the screen layouts.

2.0 OPERATION

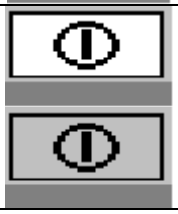
In this part you will be guided through the operation of the basic functions of the controller. This manual assumes that the machine is correctly installed and powered on. Below is a summary of the following sections in this part.
Section 0 is a guide to the user interface.
Section 0 shows the security features for protecting data entry.
Section 0 shows the layout of the normal operating home display screen.
Section 0 explains the settled weights screen.
Section 0 explains the statistics screens.
Section 0 shows the main menu screen.
Section 0 is a detailed guide to the product library.
Section 0 explains how to statically calibrate the weigher.
Section 0 explains how to manually zero the weigher.
Section 0 explains how to empty the weigher.
Section 0 explains the diagnostic fault reporting.

2.1 USER INTERFACE

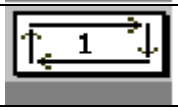
The user interface is designed to allow simple set-up of the linear weigher and display clear weighing and statistical information during operation.
Numerical data is entered via the 0-9 and '.' keys with the data being accepted with the ENTER key. These same keys can also be use to enter alphanumeric characters in a similar fashion to that of a mobile phone.
The four ARROW keys are used to select specific screen entries and to move around the screens quickly.
The four keys at the bottom right hand side of the keypad are used for the machine operation. Each of these keys contains a red LED lamp to indicate when they are active.
Directly below the LCD screen are six keys whose functions depend upon the screen displayed. The bottom of the screen contains a row of display icons that indicate the function of each key. See Button Table for meanings.

BUTTON TABLE	
	Go to main menu.
	Go to configuration menu.
	Go to test menu
	Return to home screen. Main operating screen.
	Return to previous screen from home screen.
	Show statistics screens.
	Show batch statistics
	Show shift statistics
	Show histogram to +/- T1 limits.
	Show histogram to _/- T2 limits
	Show settled weights screen. Shows weighing status.
	Go to monitor screen.

BUTTON TABLE

	Go to previous screen.
	Go to next screen.
	Select product to run, change product.
	Edit current product.
	Accept.
	Cancel.
	Copy item to another location.
	Delete selected product.
	Change entry font to lower case.
	Change entry font to upper case.
	Run / Enable Stop / Disable

BUTTON TABLE

	Start next calibration stage.
	Run To empty.
	Empty.
	Reset data.
	Test output on / off.
	Cycle selected test output.

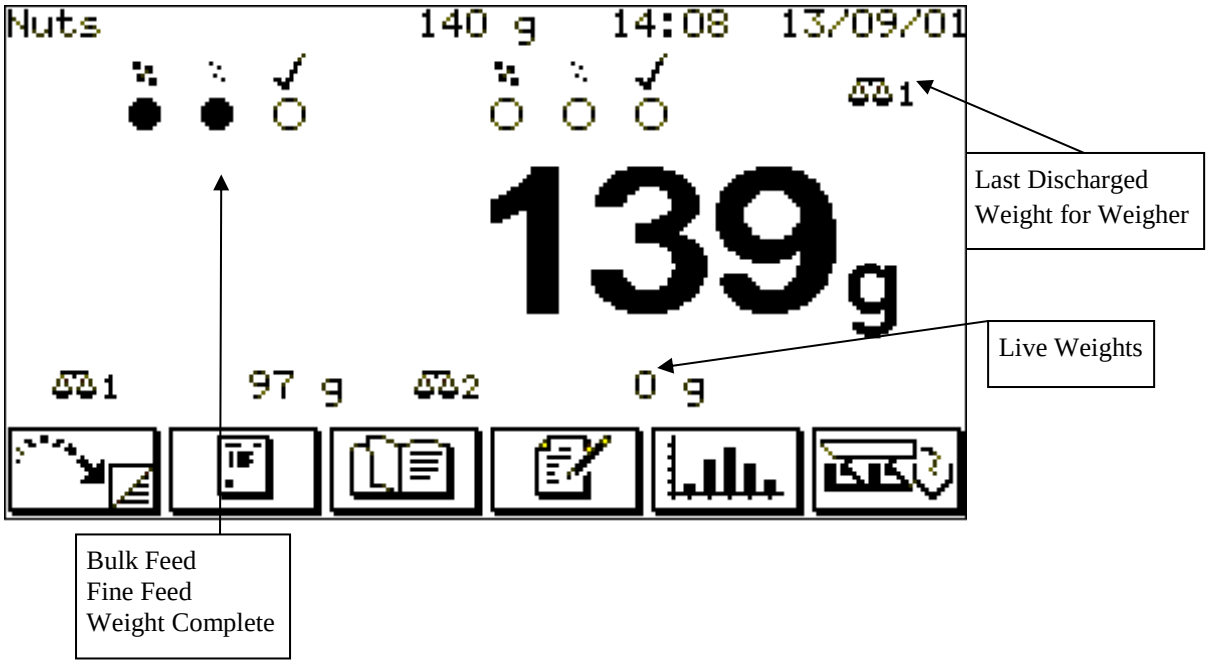
2.2 SECURITY

Data within the controller is protected from unauthorised access by means of three levels of password :-

1. Supervisor (lowest)
2. Engineer
3. Manufacturer (highest)

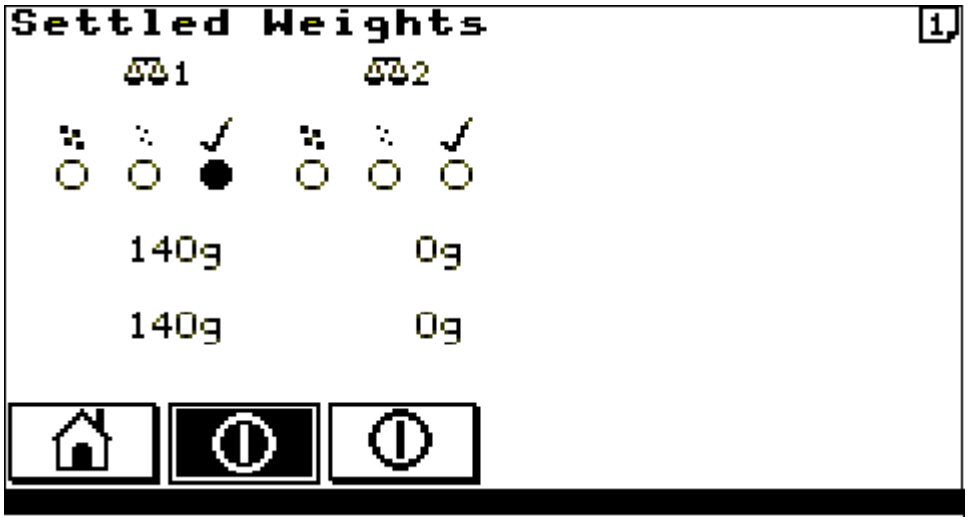
When access code is required the screen above will pop up. At this point the user should enter their 4-digit code followed by 'ENTER'.

2.3 HOME SCREEN



Main operating screen shows status for one or two weighers.

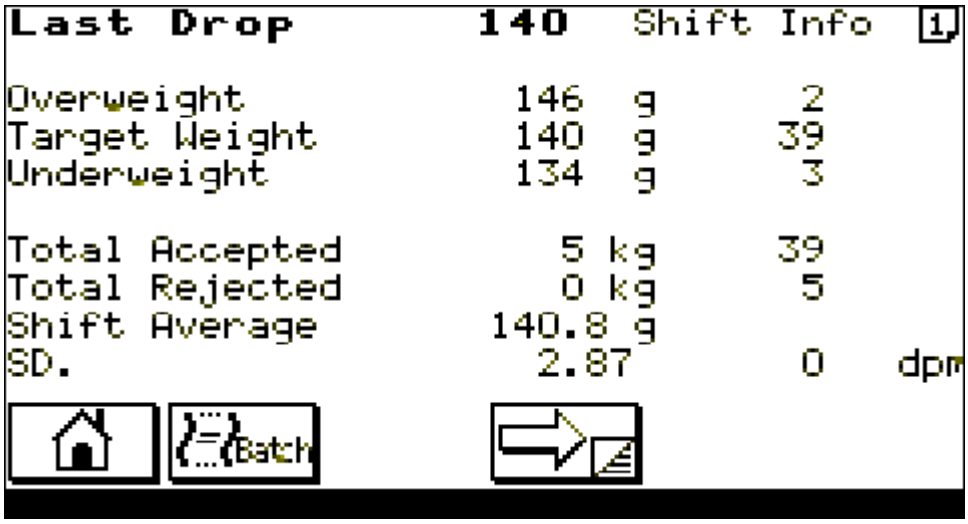
2.4 SETTLED WEIGHTS SCREEN



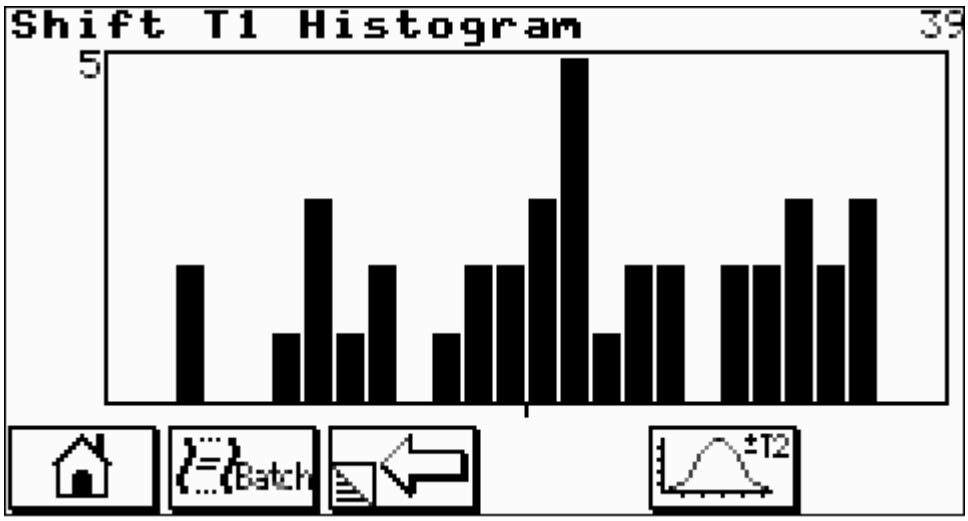
/ to ENABLE / DISABLE the weighing stations.

Shows the live weight against the settled weight for each weigher such that when weighing is complete this will provide an indication of how accurate the weighing settle parameters are.

2.5 STATISTICS SCREENS

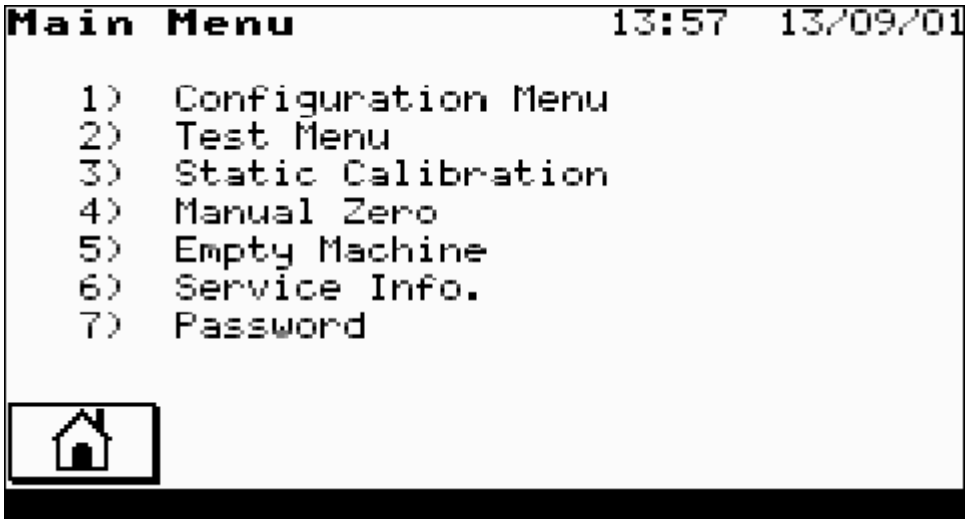


Shows weights, occurrences and standard deviation for batch and shift statistics. Use batch/shift button to move between the two statistics sets. See section **0** **SHIFT / BATCH CONFIGURATION** to set up batch statistics over time or number of weighings and shift statistics for one to three shifts.



Shows weight histogram for batch or shift. Use batch/shift button to move between the two statistic sets. Use T1/T2 button to select histogram spread displayed.

2.6 MAIN MENU



Main menu allows entry into the main control topics.

Configuration Menu	access set up overall machine operation
Test Menu	access test functions of the machine
Static Calibration	calibration section
Manual Zero	manual zero
Empty Machine	to run the machine until empty
Service Info.	Service contact details, program monitoring
Password	enable/disable current password

Data within the controller is protected from unauthorised access by means of three levels of password.

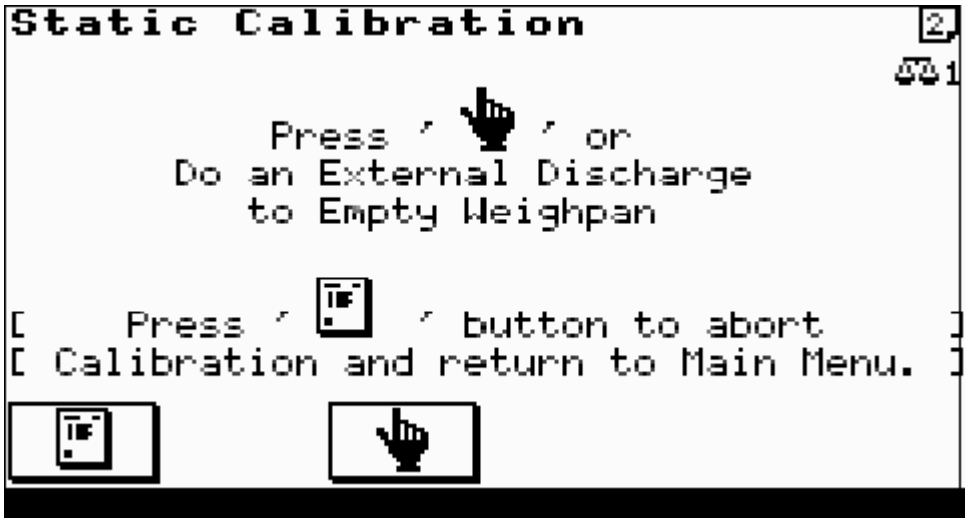
2.7 PRODUCT LIBRARY

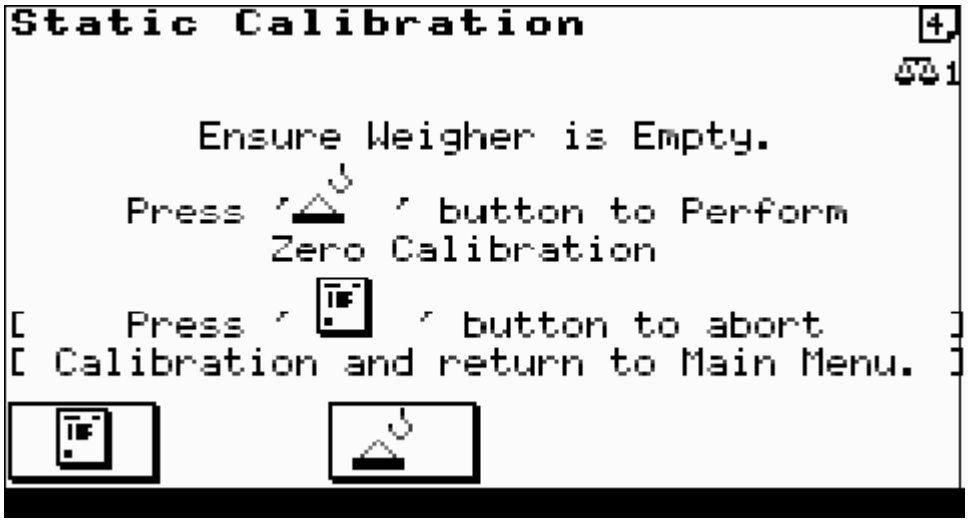
The machine allows the details for up to 100 different products to be held in non-volatile memory.
Use UP / DOWN ARROWS to select current product to run or edit. Confirm selection with OK button.
Use COPY button to copy selected product to a new location. This is also used to create a new product.
Use DELETE button to delete the currently selected product.

2.8 STATIC CALIBRATION

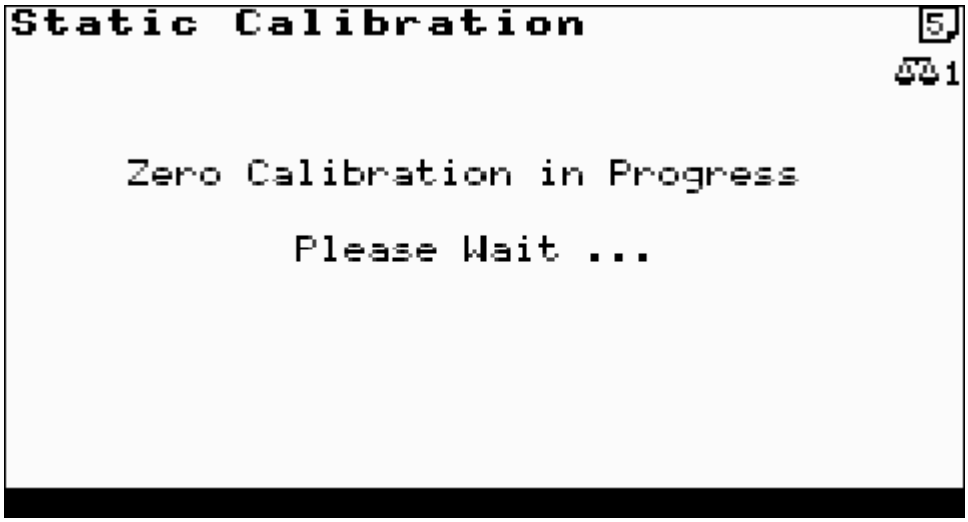
1. Before commencing for multi-weigher machines select the weigher to calibrate with the ENTER key. The **Calibration Counter** displayed on this first screen is a non-resettable counter that increments after each successful calibration. It is a weights and measures requirement to ensure no unauthorised calibrations can be performed.
2. Ensure weigher is warmed up; allow at least 15 minutes for this.
3. Ensure the weigher is empty and clean of product.
4. Press [redacted] to begin calibration. Next screen is displayed. Follow screen instructions until successful calibration.

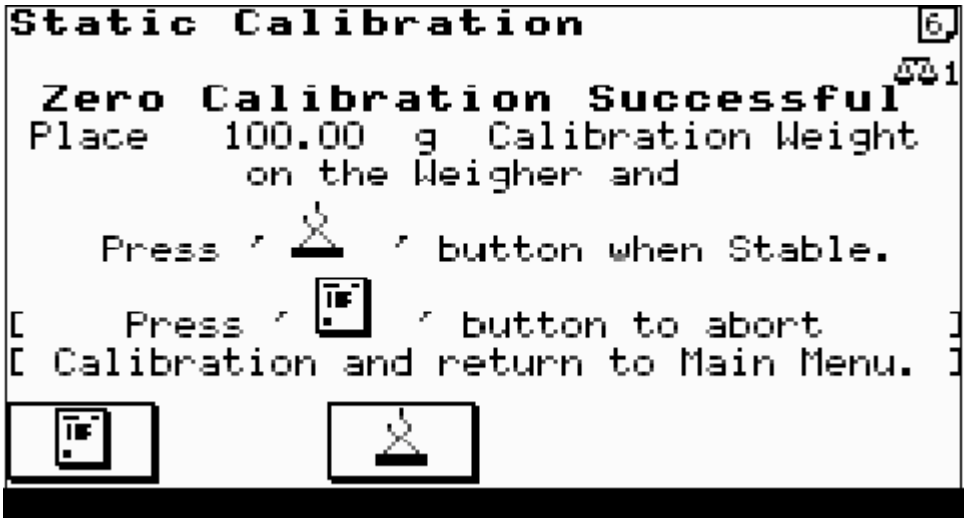
STATIC CALIBRATION CONTINUED





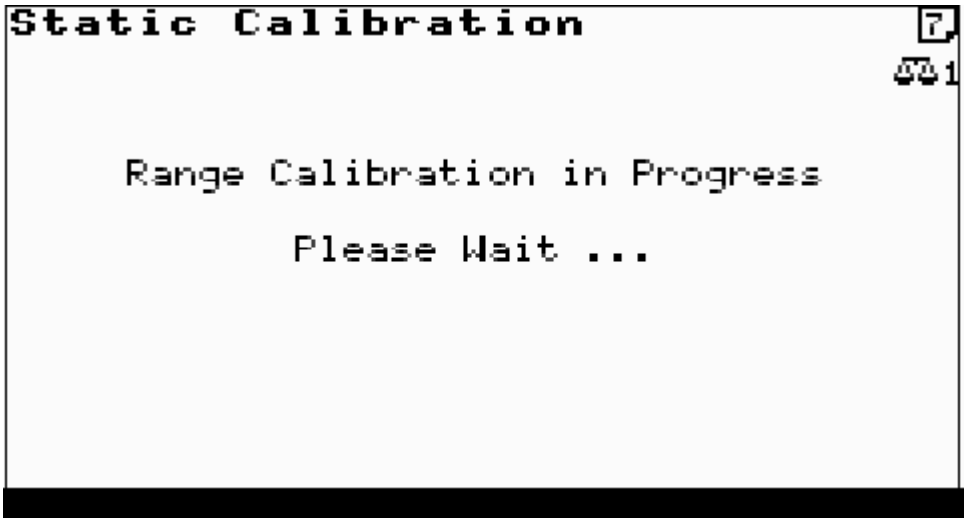
STATIC CALIBRATION CONTINUED

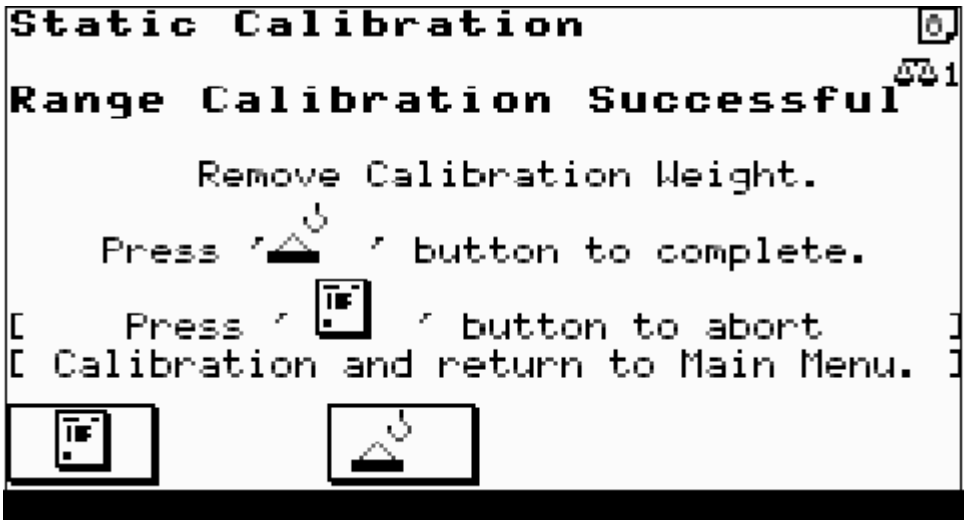




5. Place calibration weight value as shown on the weigher and follow screen instructions.

STATIC CALIBRATION CONTINUED



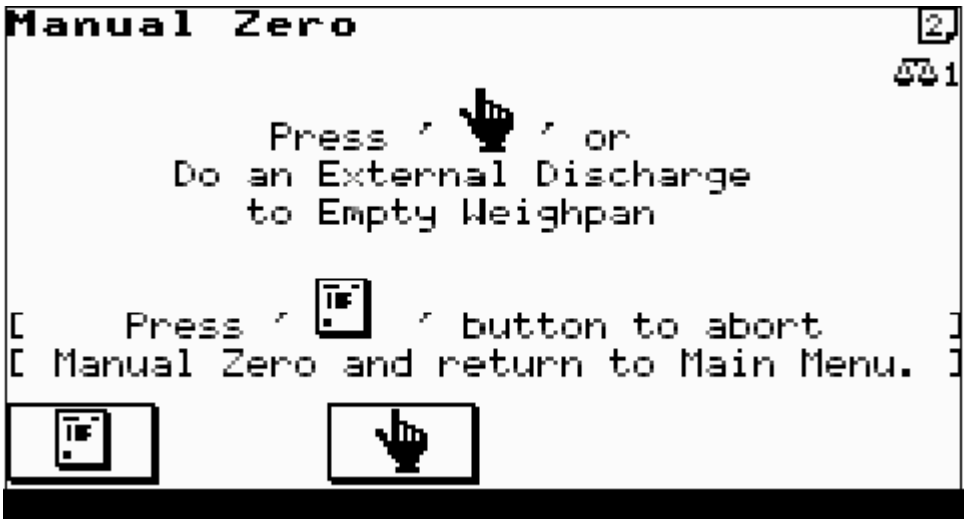


STATIC CALIBRATION CONTINUED

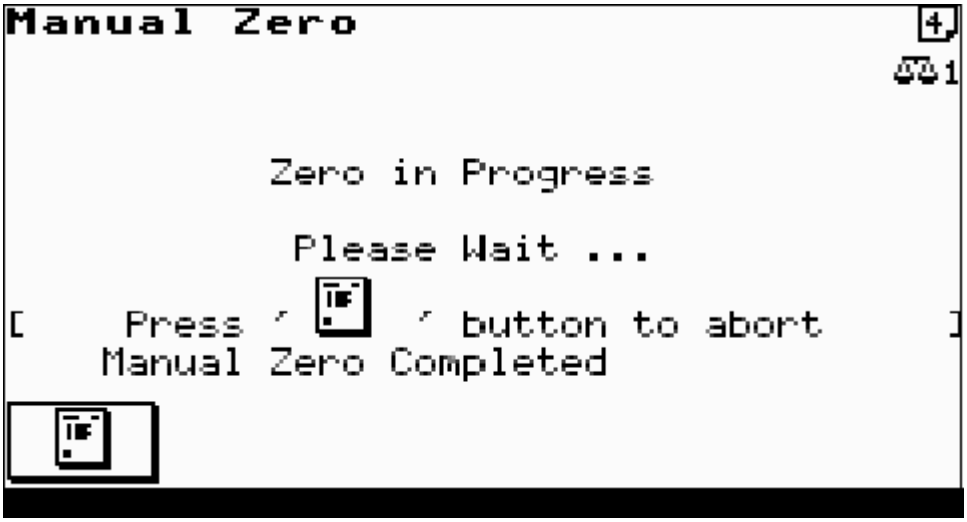
6. Check successful calibration by displayed weight agreeing with actual weight on weigher.

2.9 MANUAL ZERO

Before commencing for multi-weigher machines select the weigher to manually zero with the ENTER key.
Ensure the weigher is empty and clean of product. Follow screen instructions.



MANUAL ZERO CONTINUED



Return to main menu.

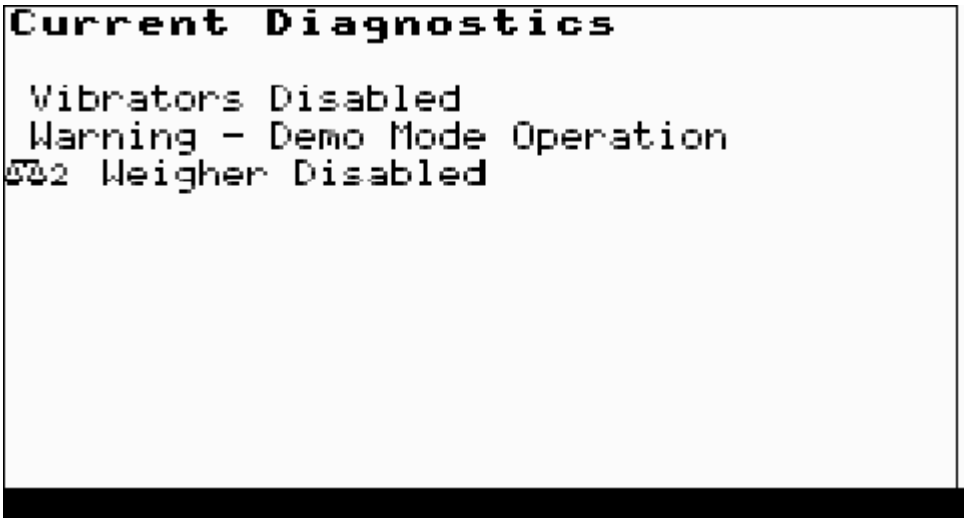
2.10 EMPTY MACHINE

To empty the machine of residual product.
Before commencing for multi-weigher machines select the weigher to empty with the ENTER key.

Press to run normally until no product left in the machine. Low product probe is ignored.

Press to empty the machine. Runs vibrators at fast speed with all the doors open.

2.11 DIAGNOSTICS



When any machine faults exist, the red lamp in the '?' key [HELP] flashes. Pressing the '?' will list the current diagnostic faults (press again to return to previous screen).
The diagnostic types are either general or weigher specific. Weigher specific diagnostic include the weigher number as an icon within the message. The possible diagnostics are listed below together with a brief explanation of their meaning.
GENERAL

1. "Memory Loss"
   The program memory has been corrupted. Either the battery is switched off or exhausted or there is a program fault.
2. "Reset DIL On"
   The reset DIL switch has been left on and should be switched off. This is DIL switch 4. With this switch on the program memory is cleared to all zeros at power on.
3. "Invalid System Parameters"
   There are inconsistencies within the machine configuration settings.
   a. Incorrect Checksum of Data
   b. Maximum In-Flight Adjustment > 75%
4. "Invalid System Shift Times"
   There are inconsistencies within the shift times settings.
   a. End of Shift Times must be in ascending order.

DIAGNOSTICS CONTINUED

5. "Invalid System Refill Control"
   There are inconsistencies within the refill control settings.
   a. If 'infeed' output is selected then 'full hopper' input must be selected
   b. and if Refill is controlled by Low Hopper condition then a 'low hopper' input must be selected.
6. "Invalid Product Parameters"
   The current product code settings are incorrect.
   a. Incorrect Checksum of Data
   b. Invalid Product Weights
7. "Invalid Product Weight(s)"
   The current product code weights settings are incorrect.
   a. Target Weight < Underweight
   b. Target Weight > Overweight
8. "Printer Busy"
   The printer buffer is full up and further printouts cannot be done until it has emptied.
9. "Emptying"
   Machine emptying is in progress.
10. "Refilling Hopper"
    Hopper refilling is in progress.
11. "Hopper Low in Product"
    The 'hopper low level' input indicates low product and the vibrators are disabled.
12. "Re-Sample Required"
    No Piece Weight Sample information exists for the current product. Perform a Piece Weight Sample procedure or enter a new Item Weight within the product code.
13. "Vibrators Disabled"
    There is no Mains Power supplied to the vibrator drive card or it is disconnected.
14. "Warm Up Period"
    The machine has just been switched on and is warming up. Weighing may be slightly inaccurate during this period.
15. "Emergency Stop Input"
    The 'emergency stop' input is ON.

DIAGNOSTICS CONTINUED

16. "Line Stop Input"
    The ‘line stop’ input is ON.
17. "Warning - Low Air Pressure"
    The ‘low air pressure’ input is ON.
18. "Low Air Pressure Timed Out"
    The ‘low air pressure’ input has been ON for a maximum time and the machine is stopped.
19. "Warning - Demo Mode Operation"
    The demonstration mode has been selected. The machine cannot run in this mode.

WEIGHER DIAGNOSTICS

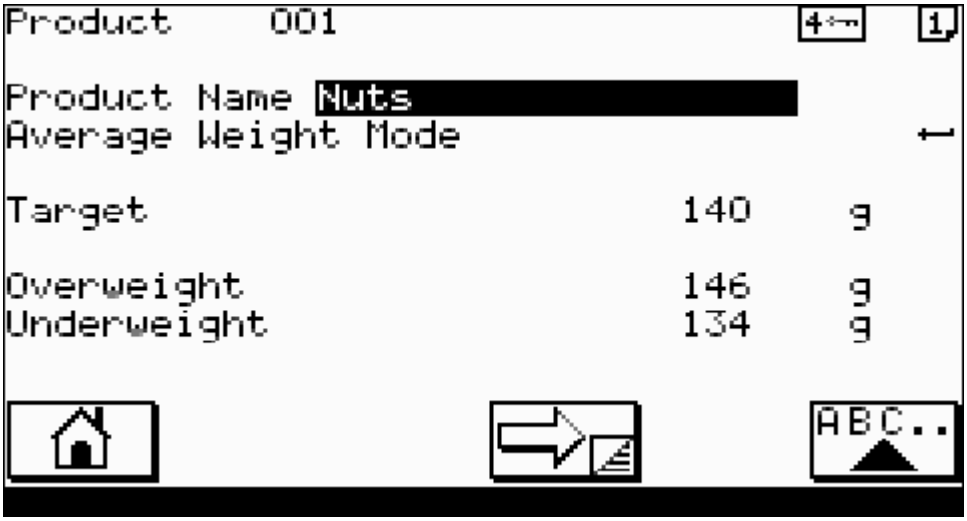
1. Loadcell Not Communicating"
   The loadcell amplifier is not working or disconnected.
2. Re-Calibration Required"
   The operator has changed important weighing parameter(s) or the weighing information is corrupt.
3. "Weigher At Lower Limit"
   The weighing analogue to digital converter is giving its minimum output.
4. "Weigher At Upper Limit"
   The weighing analogue to digital converter is giving its maximum output.
5. “Zero Weight too Low"
   During the zero phase of the static calibration routine, the analogue to digital converter output is below a sensible minimum value. Check loadcell and LDU connections.
6. "Zero Weight too High"
   During the zero phase of the static calibration routine, the analogue to digital converter output is above a sensible maximum value. Check loadcell and LDU connections.
7. "Calibration Span too Low"
   For an Approved machine the span of the calibration weight must be above a certain percentage of the loadcell output.
8. “Calibration Weight too Low"
   The chosen calibration weight is too small for the size of loadcell.
9. "Calibration Weight too High"
   The chosen calibration weight is too large for the size of loadcell

WEIGHER DIAGNOSTICS CONTINUED

10. "Invalid Weight Resolution"
    For an Approved machine the selected resolution is invalid for the calibration.
11. "Unable to Settle"
    During the weighing operation settling period, the a/d output was not stable within the set parameters. Check weighing parameters in machine configuration
12. "Unable to Tare"
    During the weighing cycle tare the weigher was unable to achieve a settled zero level within the time allocated.
13. "Tare Weight too Low"
    During the weighing cycle tare the tare weight level was below the zero calibration level. Check weigher with test weights to ensure it is operating correctly.
14. "Tare Weight too High"
    During the weighing cycle tare weight was so high that the target weight is not achievable within the range of the machine. Check weigher with test weights to ensure it is operating correctly.
15. "Zero Span Exceeded"
    For an Approved machine only, during a manual zero operation the zero level has drifted more than 4% of the range since the last static calibration.
16. "Weigher Disabled"
    The weigher has been disabled from the front panel.
17. "Feed Disabled"
    The ‘feed enable’ input is OFF.
18. "Weigher Not Feeding"
    The ‘feed fault’ input was detected during a weighing cycle.
19. "Weighpan Open"
    The ‘weighpan open’ input is ON and the weighing cycle is aborted.
20. "Weight Not Removed"
    A new ‘discharge call’ input is received before the last weight has been removed. This only applies to machines, which do not have a weighpan.
21. "Low in Product"
    The ‘low hopper’ input for the given weigher indicates low product and the vibrators are disabled.

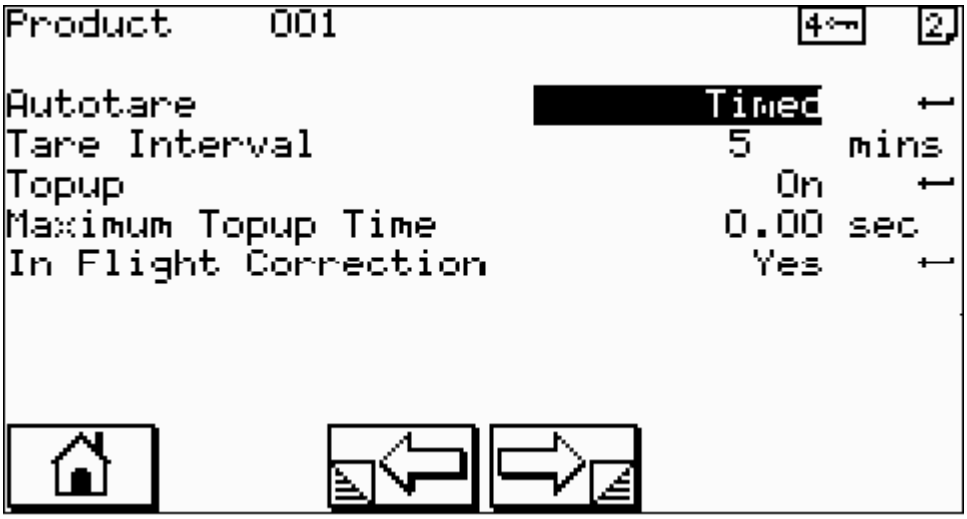
3.0 PRODUCT PARAMETERS

3.1.1 PRODUCT WEIGHT



Product Name:
Enter up to 20 characters to describe the current product. Use the upper/lower case button to change between capital and miniscule letters and the ‘0’ to ‘9’ keys to enter alphanumeric characters. The space character is located on the ‘0’ key and the ‘CANCEL’ key may be used to correct mistakes.
Average/Minimum Weight Mode:
Use the ENTER key to toggle between the two modes of weighing operation.
Target:
Product target weight
Overweight:
Weight before which the weighing is to be rejected as overweight.
Underweight:
Weight before which the weighing is to be rejected as underweight in an AWS system.
Note: Overweight >= Target >= Underweight.

3.2 PRODUCT OPTIONS 1



Autotare
Use the ENTER key to toggle between the tare modes.

OFF	autotare is not enabled
EVERY CYCLE	The weighpan is tared at the beginning of every weigh cycle.
TIMED	The autotare is performed on a timed basis. (See next parameter.)

Tare Interval
range 0 – 20 minutes
Frequency at which autotare is performed.
Topup
Turn topup operation ON/OFF.
When topup is turned ON:
In **Average Weight Mode** if during the time that the weight is settling after feed, the settled weight falls below the **Underweight** then the feed is restarted in an attempt
to achieve the minimum target weight.
In **Minimum Weight Mode** if during the time that the weight is settling after feed, the settled weight falls below the **Target weight** then the feed is restarted in an attempt
to achieve the minimum target weight.
Feed will run up to the **Maximum Topup Time.** (see next page)

3.2.1 PRODUCT OPTIONS 1 CONTINUED

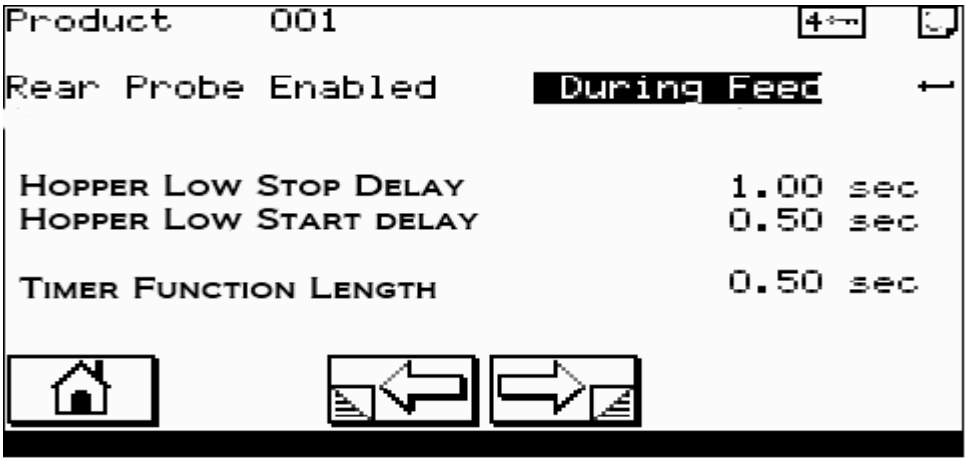
Maximum Topup Time
range 0.00 – 5.00 seconds
The maximum time allowed for an individual topup. A time of zero limits topup only to the threshold weight.
In-Flight Correction
Turn In-Flight Correction operation ON/OFF.
If the In-Flight Correction is turned ON:
In **Average Weight Mode** an error correction weight is calculated as 50% of the difference of the average weight collected over the **Sample Size** batch and the **Target Weight**. If the average weight is below the **Target Weight** then the Bulk and Fine Cut-off weights are moved up by the error correction weight. If the average weight is below then the Bulk and Fine Cut-off weights are moved down.

In **Minimum Weight Mode** an error correction weight is calculated as 50% of the difference of the minimum weight collected over the **Sample Size** batch and the **Target Weight**. If the minimum weight is below the **Target Weight** then the Bulk and Fine Cut-off weights are moved up by the error correction weight. If the minimum weight is below then the Bulk and Fine Cut-off weights are moved down.

This operation attempts to correct for any product falling (In-Flight) from the vibrator feeders after the feed has stopped
Sample Size
range 1 - 100
Number of discharges over which the in-flight correction calculations are performed.

3.3 PRODUCT OPTIONS 2

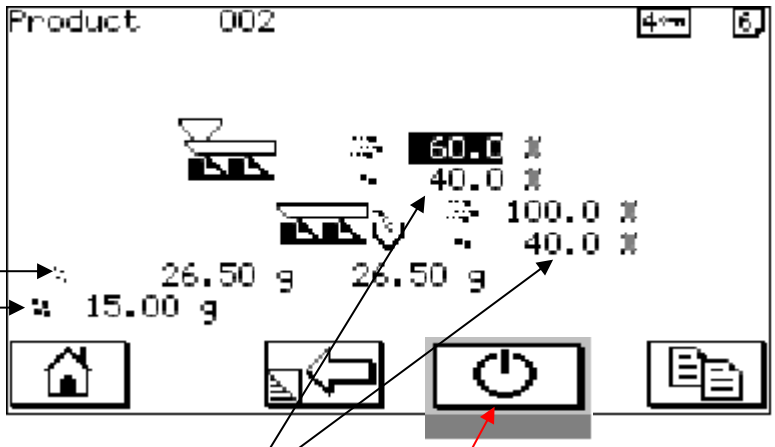
Drops Per Bag
range 1 – 100
Enter the number of discharges required to fill a bag.
Weighpan Open Time
range 0.00 – 5.00 seconds
Time for which weighpan remains open during product discharge upon completion of a weighing.
Weighpan Close Time
range 0.00 – 5.00 seconds
Time after starting to close the weighpan when the next feed cycle commences. Time is to allow the weighpan doors to completely close before restarting feed.



Rear Probe Enabled
Use the ENTER key to select when the rear probe is enabled
Hopper Low
Start & Stop delays only if LOW LEVEL PROBE FITTED
Timer Function

Length (Duration of Function Output)
Example Use, Product Settling Duration Time

3.4 PRODUCT FEED



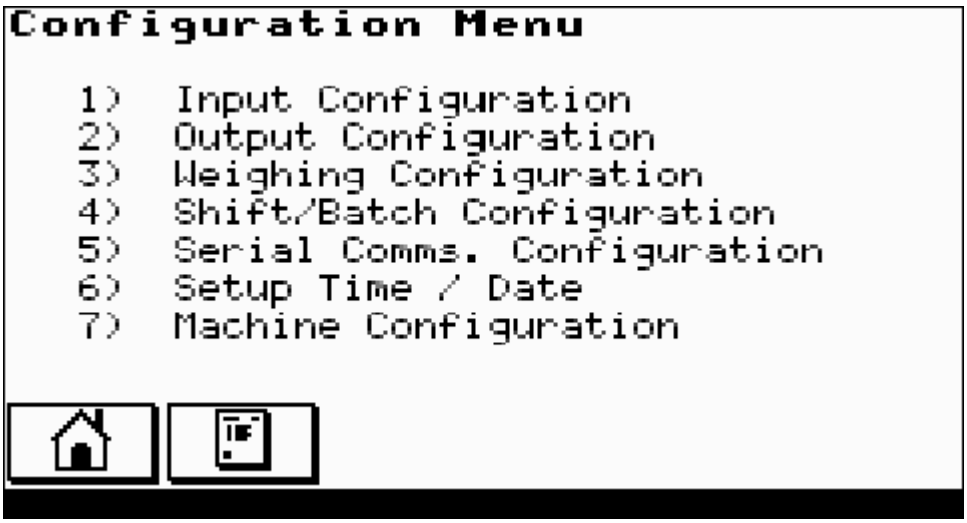
Vibrator Speeds
range 0.0% - 100.0%
Enter the fast and slow vibrator amplitudes for controlling the feed rate of the current product.

Bulk Cut-off Weight
range 0 – target weight
Enter the weight at which the vibrators will switch from fast to slow feeding.

Fine Cut-off Weight
range 0 – target weight
Enter the weight at which the vibrators will stop feeding and the weigher start to settle.
Use the COPY button to copy the entered settings to all weighers.

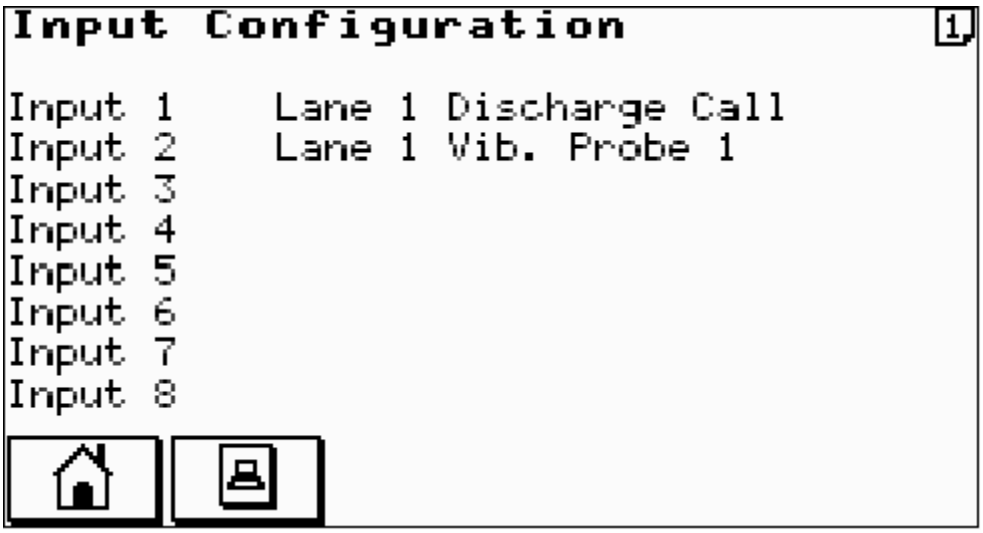
If Accelerometers Are Enabled
This button memorises the current vibrator amplitude

4. MACHINE CONFIGURATION



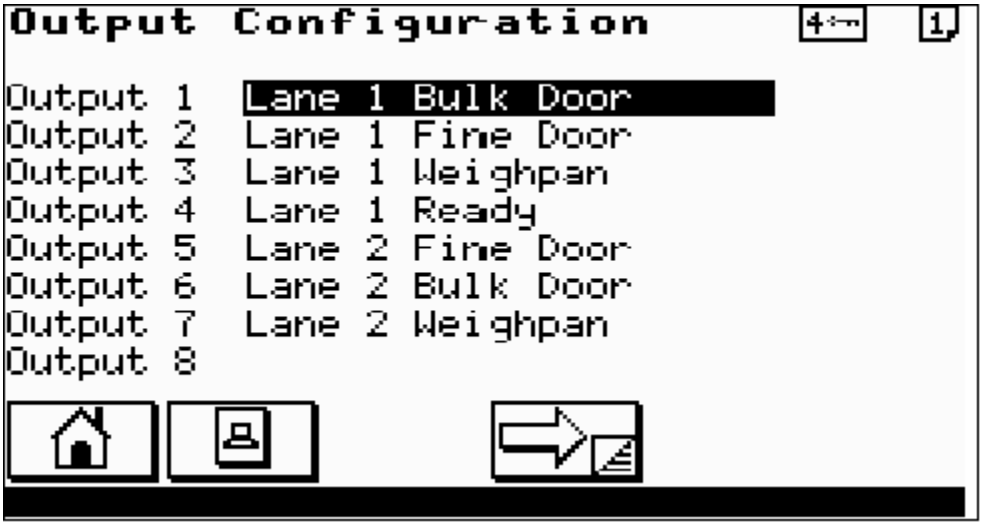
The detailed setup of the machine is done from these screens. Usually this is only done when the machine is first installed.

4.1 INPUT CONFIGURATION



This screen allows each digital logical input to be assigned to a physical input. Use the ENTER key to select the logical input and the UP/DOWN ARROW keys to select the physical input.

4.2 OUTPUT CONFIGURATION

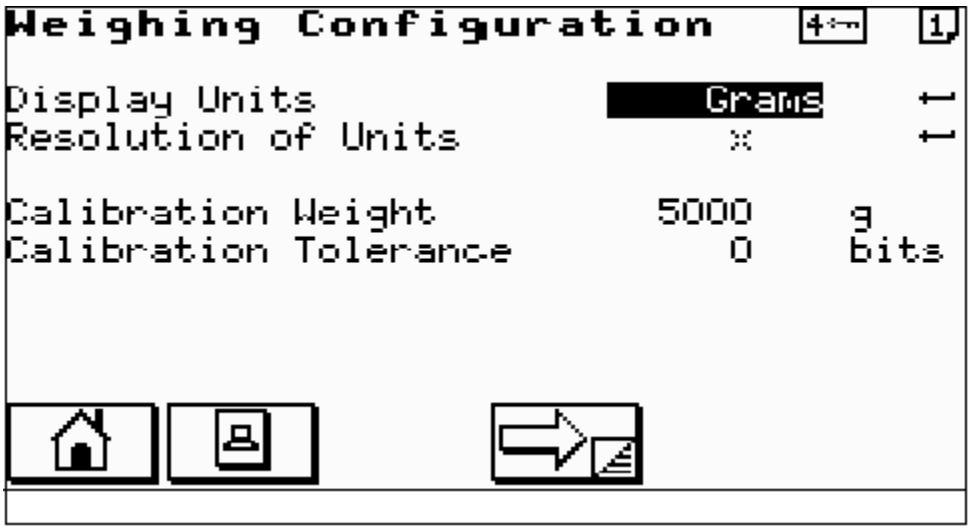


This screen allows each digital logical output to be assigned to a physical output. Use the ENTER key to select the logical output and the UP/DOWN ARROW keys to select the physical output.

This screen allows the sense of each individual digital output to be inverted. Use the ENTER key to toggle between YES/NO.

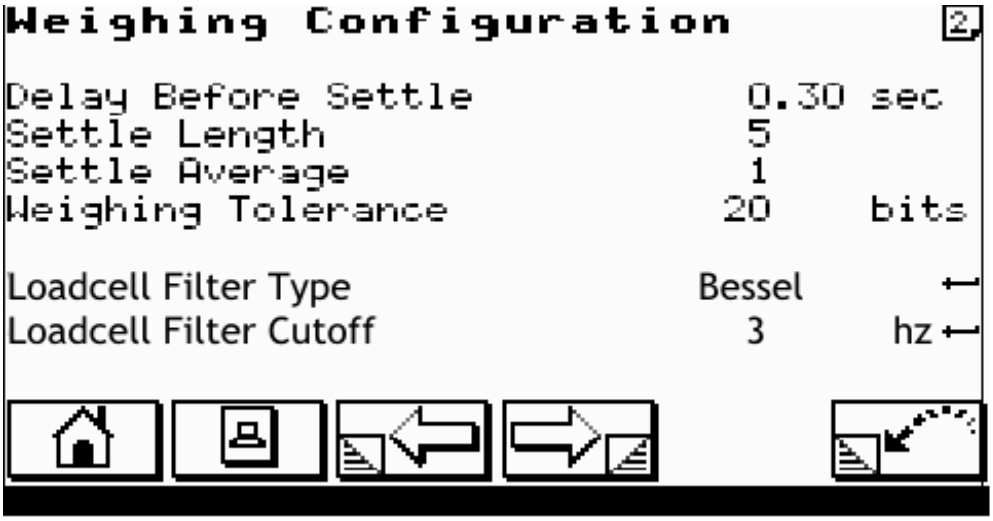
4.3 WEIGHING CONFIGURATION

4.3.1 WEIGHING UNITS



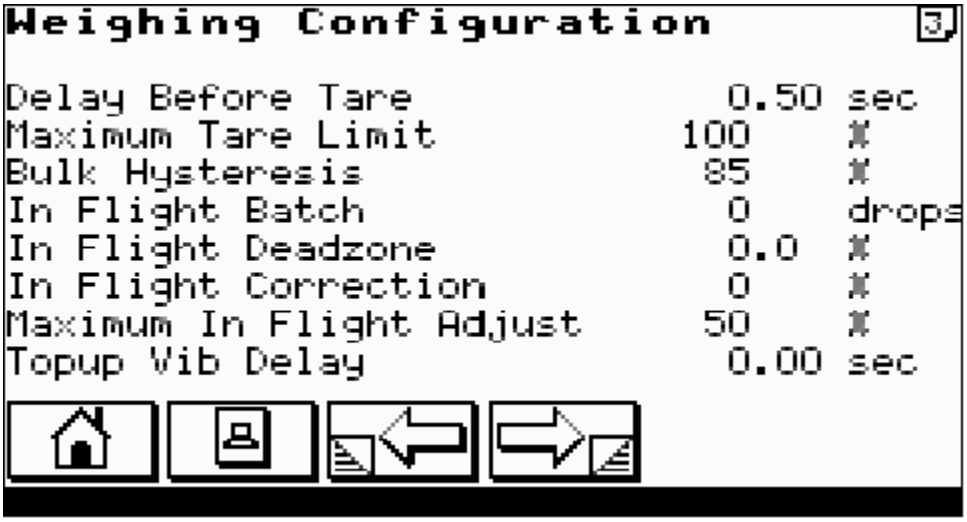
Display Units
Select the weighing units Grams or Kilograms with which the machine will operate.
Resolution of Units
X / X.X / X.XX / X.XXX
Select how the units are to be displayed.
Calibration Weight
Enter the calibration weight with which the weighers are to be statically calibrated.
Calibration Tolerance
Enter the calibration tolerance in a/d bits used in determining when the weighing is settled and stable during calibration.

I. WEIGHING SETTLE



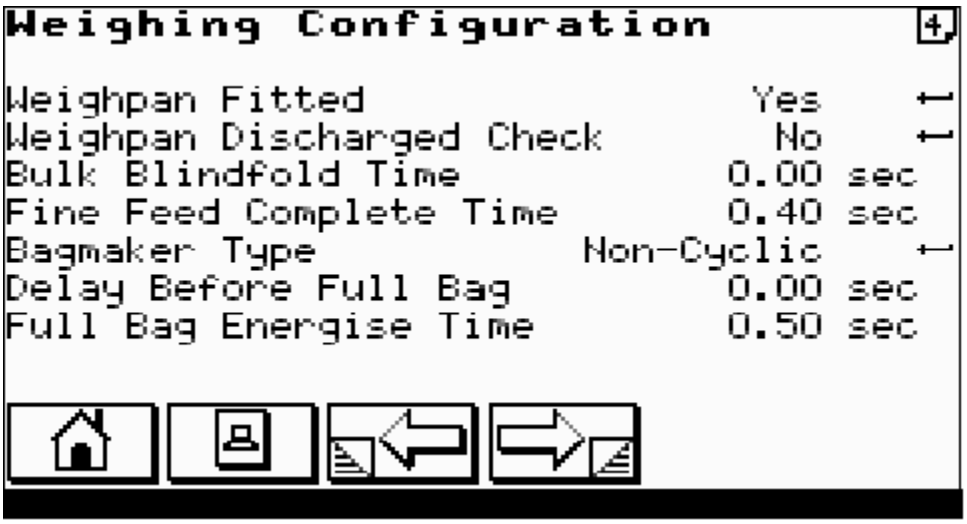
Delay Before Settle *range* 0.00 – 5.00 seconds
This time is the delay after the feed has stopped before the program looks for a settled weight.
Settle Length *range* 1 – 126
Enter the number of values which determine the length of the settle buffer.
Settle Average
Enter the frequency at which values are placed in the settle buffer. The frequency is defined in multiples of 20 milliseconds.
Weighing Tolerance *range* 0 – 1000
Enter the weighing tolerance in a/d bits used in determining when the weighing is settled and stable.
Loadcell Filter Type *range* Off, 7.3 – 1.1 *Typical Bessel*
Select the digital filter Type. Bessel, Butterworth, Fast Bessel or gaussian
Loadcell Filter Cutoff *range* 1 – 14 *Typical 1*
Enter the required filter setting for the loadcell Digitiser, a higher filter equals less damping and a lower frequency equals heavier damping.

II. WEIGHING OPTIONS



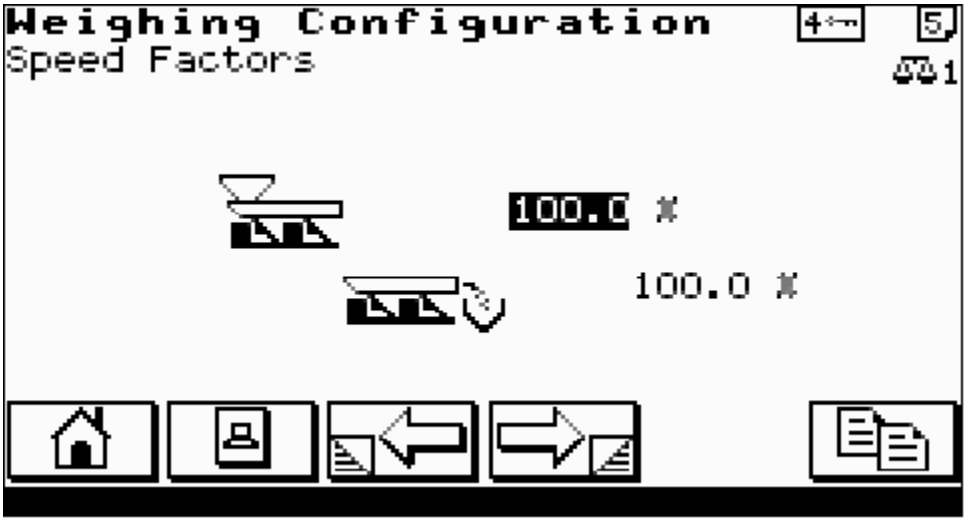
Delay Before Tare
range 0.00 – 5.00 seconds
This is the time between starting a tare and checking for a settled weight within the calibration tolerance.
Maximum Tare Limit
range 0 – 100 %
Enter maximum tare level as a percentage of the Target Weight.
Bulk Hysteresis
range 0 – 100 %
Enter the bulk hysteresis as a percentage of the bulk weight. If during the fine feed of a weighing cycle the weight falls below this percentage of the bulk weight, the machine will revert to bulk feeding.
Maximum In-flight Adjust
Enter the maximum in-flight adjustment as a percentage of the target weight. When performing in-flight correction this is the maximum amount the cut-off points will be adjusted by for any one correction.

III. WEIGHING BAGMAKER



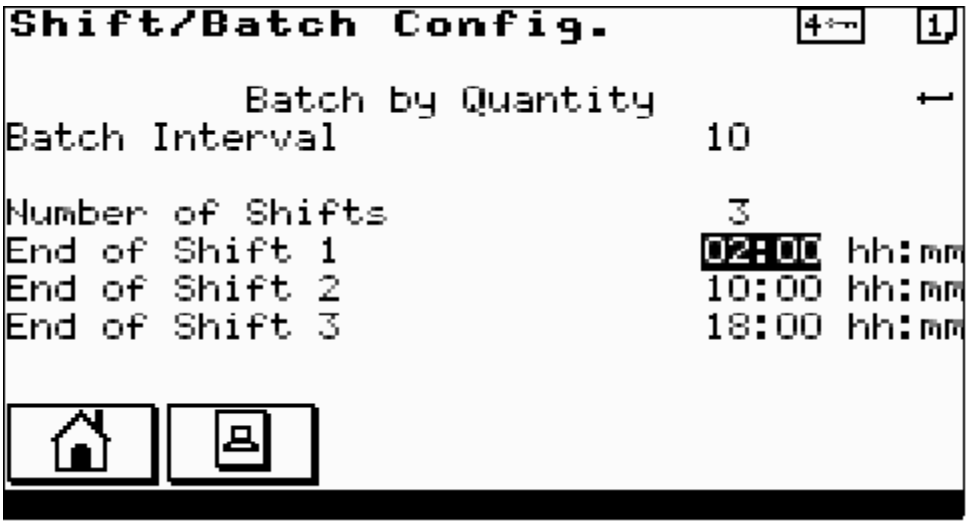
Weighpan Fitted
Select whether a weighpan is fitted or not. If no weighpan selected the machine will assume it is feeding directly onto a weigh platform.
Bagmaker Type
Type of bagmaker fitted to the weigher.
CYCLIC
NON-CYCLIC
Delay Before Full Bag
range 0.00 – 5.00 seconds
Enter the time between discharging the weighpan and issuing the full bag signal.
Full Bag Energise Time
range 0.00 – 5.00 seconds
Pulse time to the bagmaker.

IV. WEIGHING VIBRATOR FACTORS



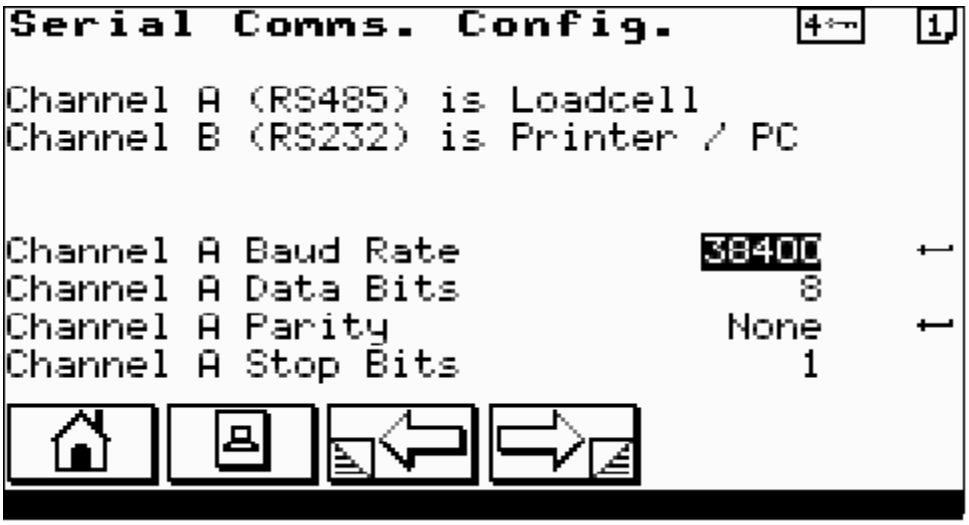
Vibrator Speed Factors
This percentage scales the vibrator amplitudes as set in the product code. It is used to balance the vibrator outputs so that they feed at the same rate for the same amplitude.

B. SHIFT / BATCH CONFIGURATION



No Batch Statistics / Batch By Time / Batch By Quantity
Toggle ENTER to select type of batch statistics required.
Batch Interval
Frequency of batch statistics printout.
For **Batch By Time**, ENTER
For **Batch By Quantity**, ENTER number of drops.
Number of Shifts
Enter the number of shifts required, followed by their start times as hours:minutes.

C. SERIAL COMMUNICATIONS SETUP



For each of the serial communications channels shown, setup the following parameters.

Baud Rate
Press ENTER key until correct baud rate for the device is shown

Data Bits
Select either 7 or 8 data bits as required by the device.

Parity
ODD EVEN or NONE.

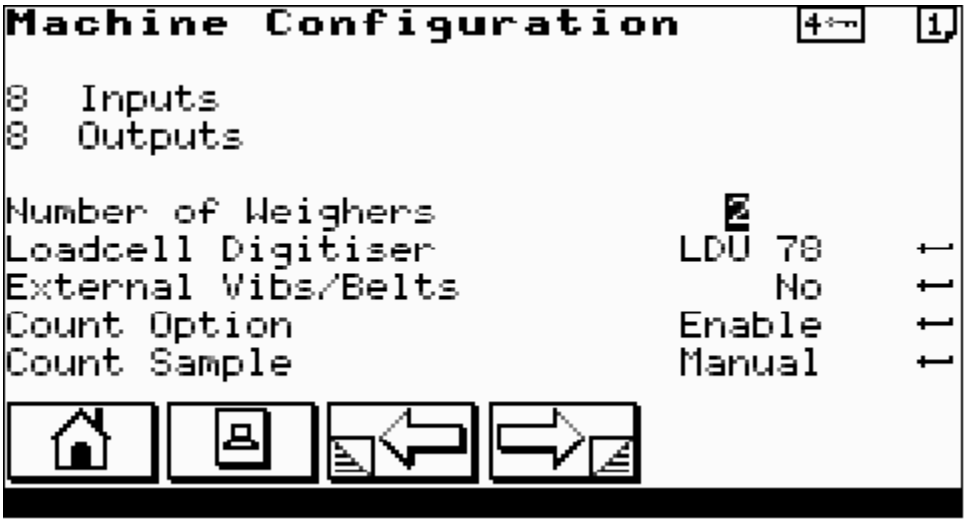
Stop Bits
Select 0 or 1.

D. SETUP TIME / DATE

Setup current time and date. The system clock is battery backed and will maintain the correct time even when the machine is switched off.

4.7 MACHINE CONFIGURATION

4.7.1 MACHINE SINGLE / TWIN



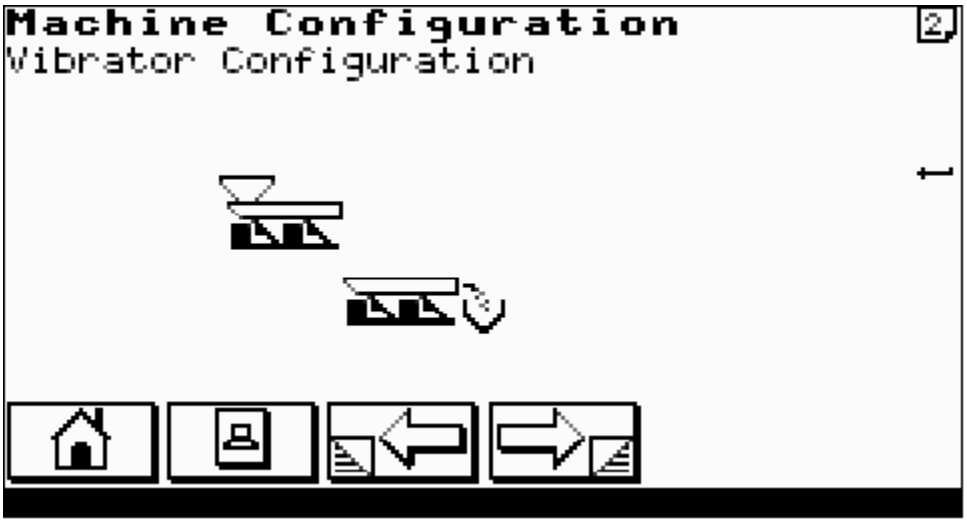
8 Inputs / 16 Inputs
Select number of physical inputs fitted to the machine. On simple machines this entry cannot be changed.

8 Outputs / 16 Outputs
Select number of physical outputs fitted to the machine. On simple machines this entry cannot be changed.

Number of Weighers
Toggle ENTER to select between a single or a twin weigher.

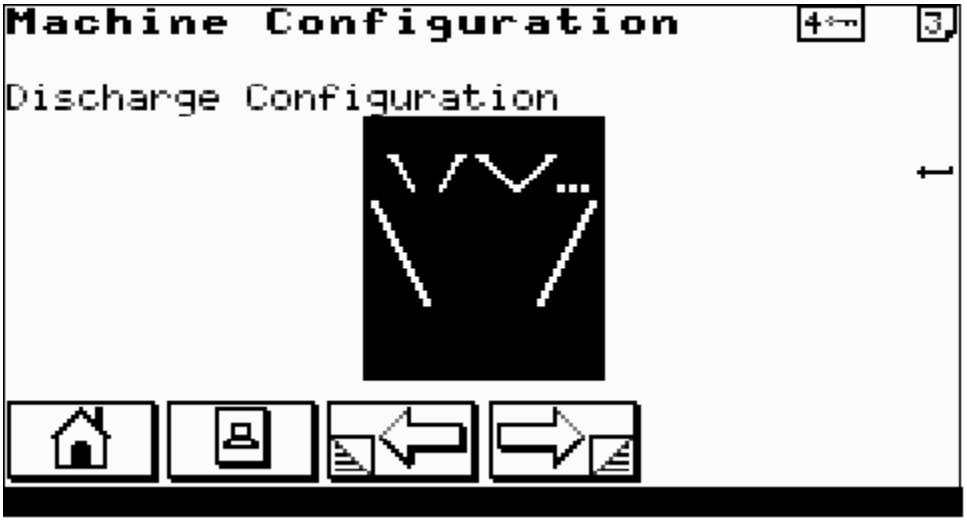
Count Option
Toggle ENTER to ENABLE / DISABLE the count option.

4.7.2 MACHINE VIBRATOR CONFIGURATION



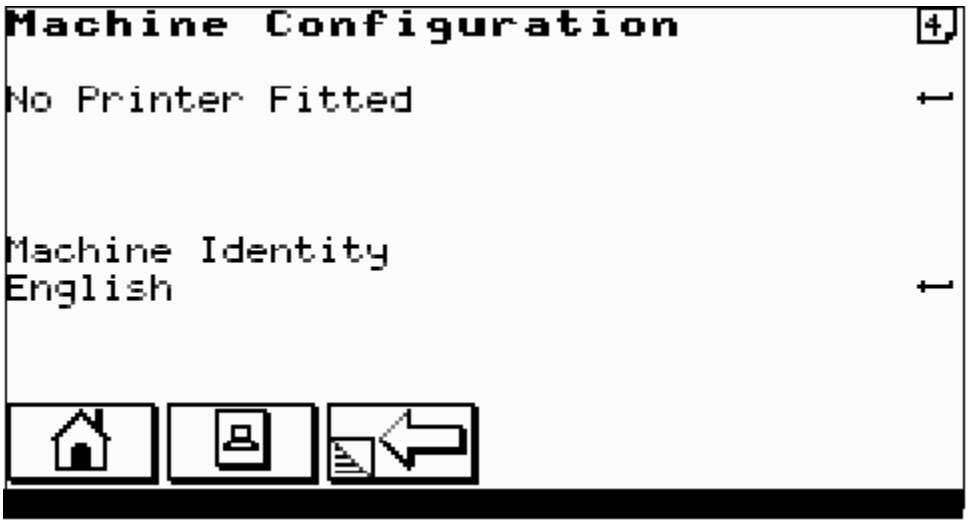
Vibrator Configuration
Select the allocation of vibrator channels. Select the image to represent the particular layout of the vibrator configuration.

4.7.3 MACHINE DISCHARGE CONFIGURATION



Discharge Configuration
Select the method of discharge. The weighers can be discharged by a common call input, where the first weigher which was ready is discharged, or each weigher can have an individual call.

4.7.4 MACHINE USER LANGUAGE

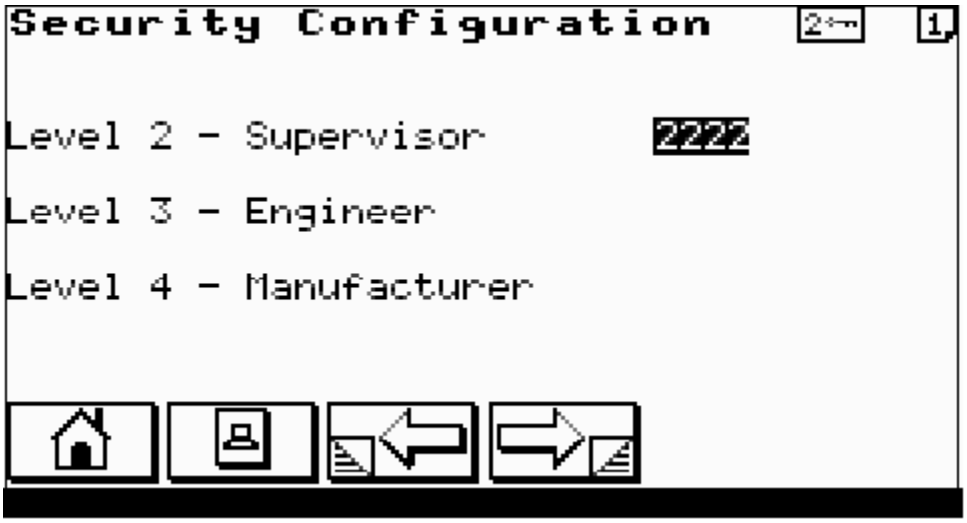


Printer
Choose 40 COLUMN / 80 COLUMN or NO PRINTER.

Machine Identity
Enter identity name of up to 20 characters. Used on printouts to identify weighing machine.

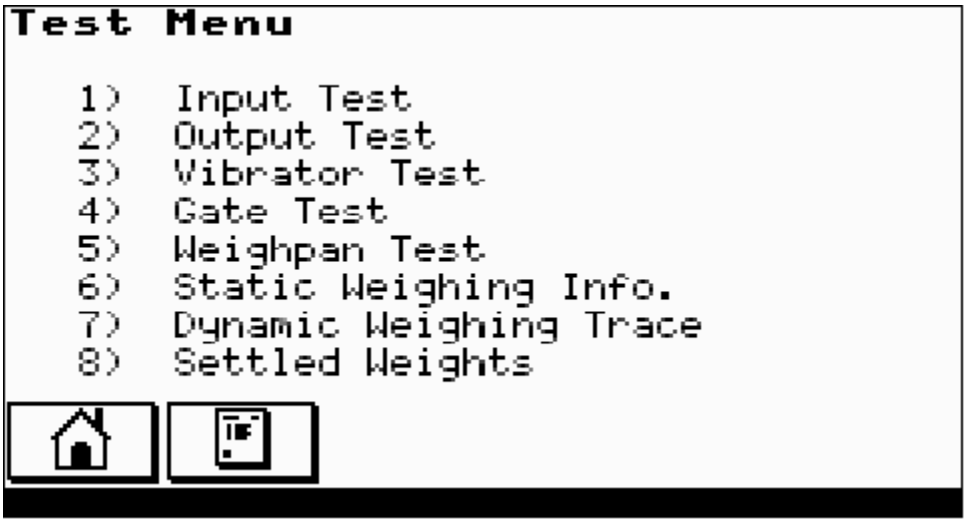
Language
Select language for display and printouts.

4.7.4 MACHINE PASSWORD SETUP



This screen can only be selected by the current level 4 password holder. Enter or reassign the password level codes.

5.0 TESTING THE MACHINE

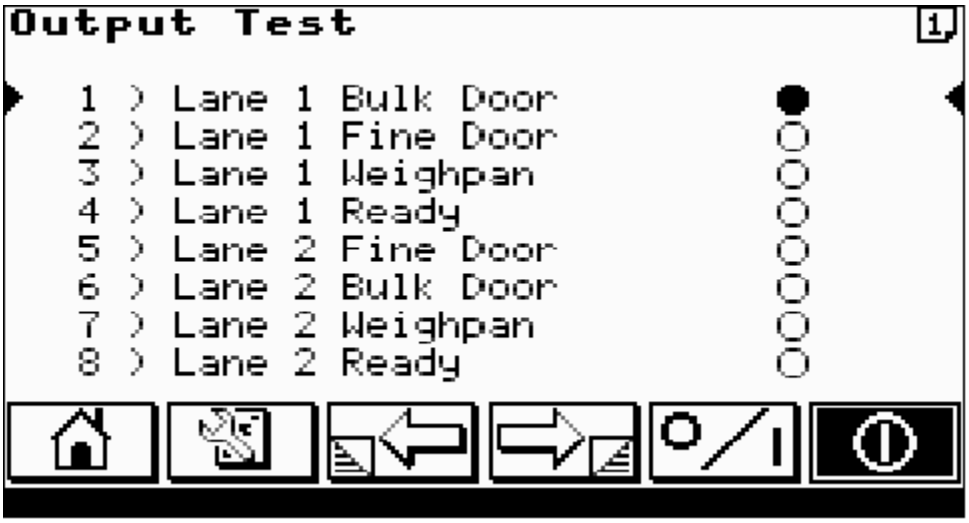


From the test menu select test area of interest.

5.1 INPUT TEST

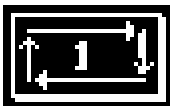
Circle indicators show state of inputs ON/OFF.

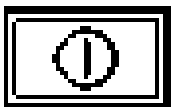
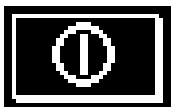
5.2 OUTPUT TEST



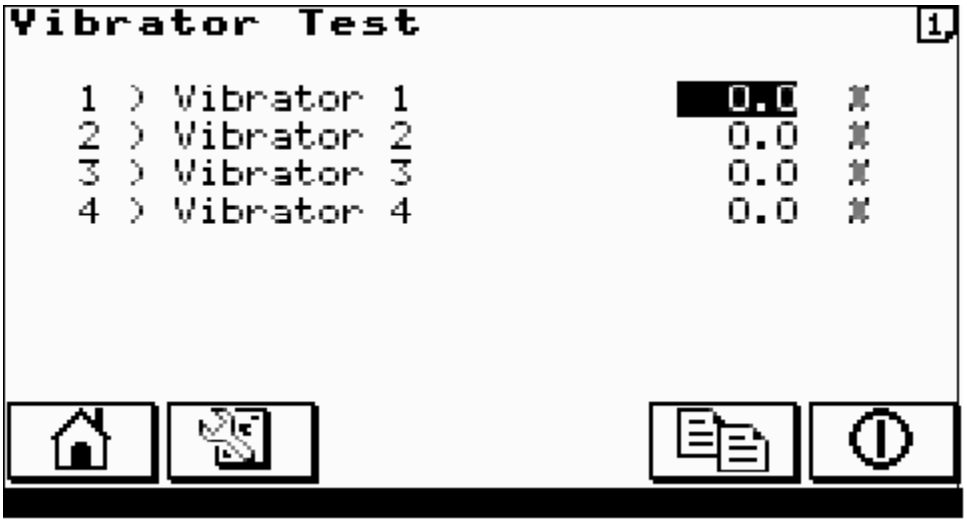
Use UP/DOWN ARROWS to select output.

Select to turn on/off selected output.

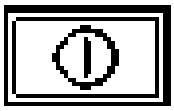
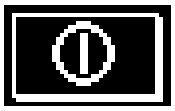
Select  to cycle the selected output.

Press  /  to RUN / STOP the test.

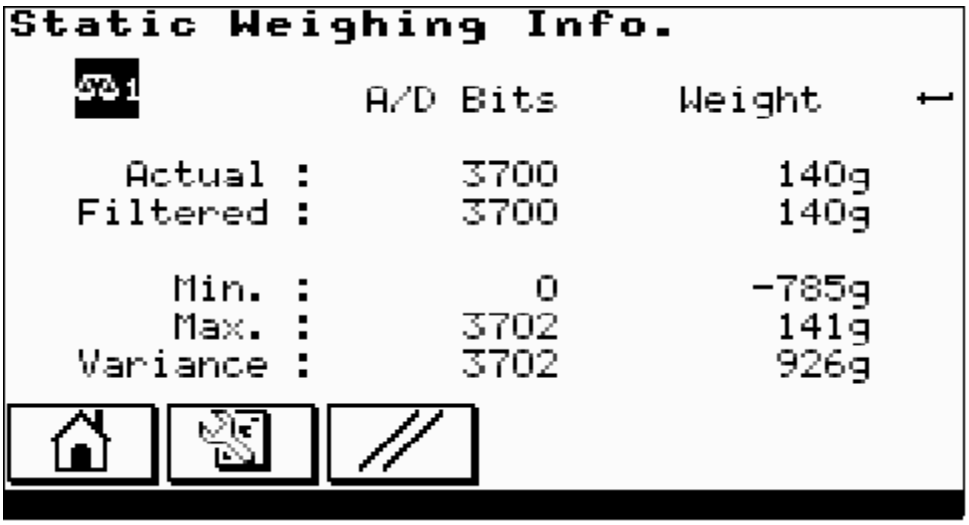
5.3 VIBRATOR TEST



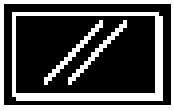
Enter test vibrator amplitudes.

Press  /  to RUN / STOP the vibrators.

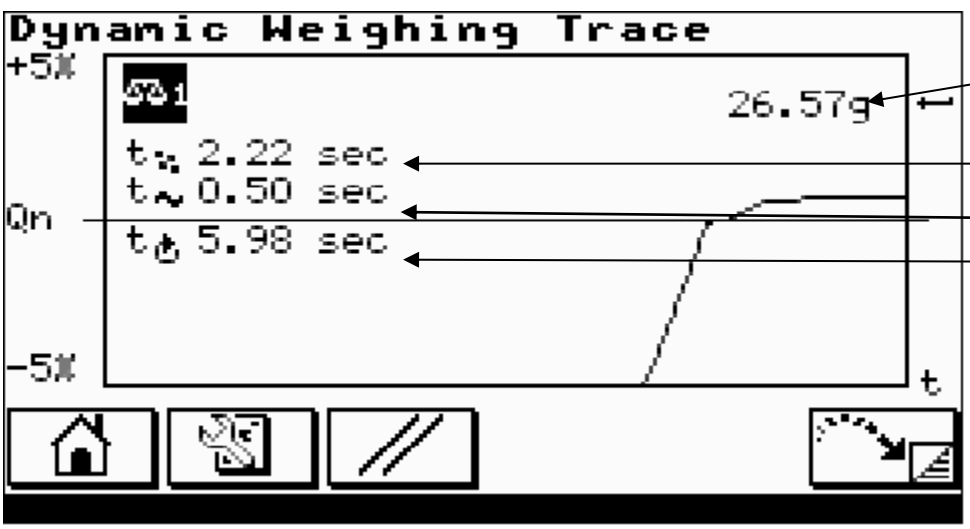
5.4 STATIC WEIGHING INFO



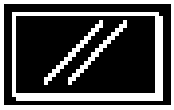
Shows current state of the loadcell a/d output and its conversion into weight.

Press  to reset the Minimum, Maximum, Variance information.

5.5 DYNAMIC WEIGHING TRACE

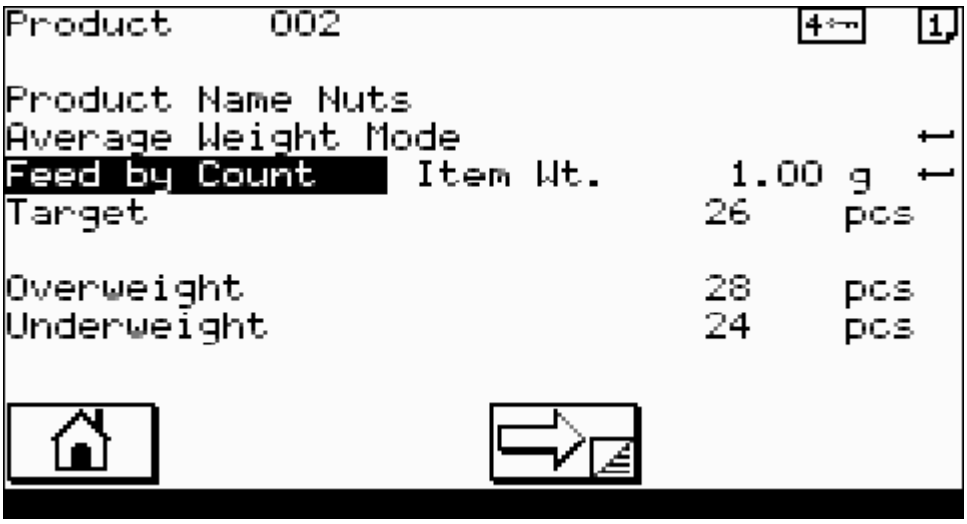


Press ENTER to select weigher of interest.

Press  to reset the weighing trace information.

PRODUCT CODE OPTION FOR COUNTING

FEED BY COUNT



When the Count Option is Enabled (See Section **0 4.7.1 MACHINE SINGLE /** TWIN) then the **Feed by Count** option may be selected within the product setup. The entries below apply to **Feed by Count.**

Item Weight
Weight of single item of the pieces to be counted.

Target
Number of items to be counted as the target. Based upon the **Item Weight** entered above the weigher calculates a target weight based upon this count.

Overweight
Number of items to be rejected as overcount.

Underweight
Number of items to be rejected as undercount.

End

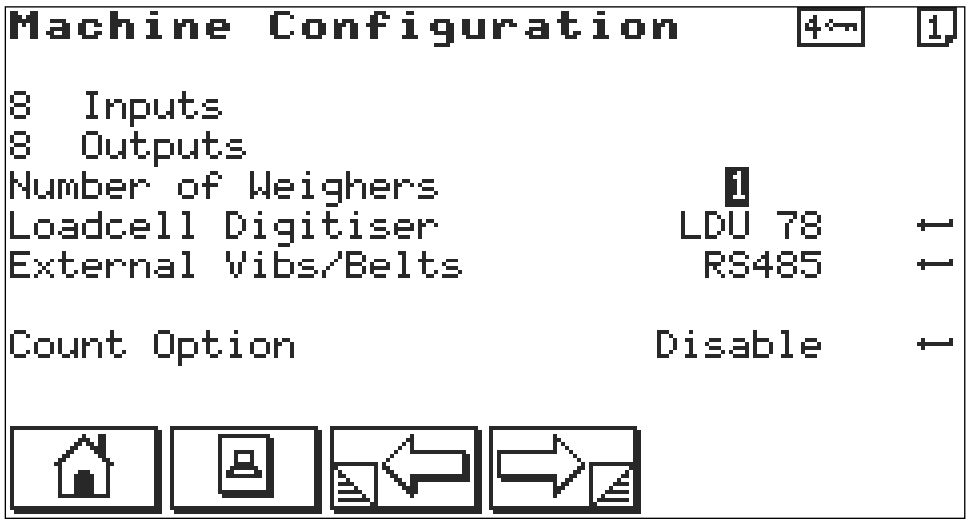
VARIABLE FREQUENCY VIBRATOR OPTION

The variable frequency vibrator option, allows the vibrator control frequency to be adjusted to maximize the vibrator performance.

This reduces the need to manually tune vibrators, by replacing springs.

There is also an increase in usable life of the springs, by adjusting the control frequency to compensate for spring wear.

When variable frequency control boards are fitted:
The Machine Configuration Screen (1) will appear as below:



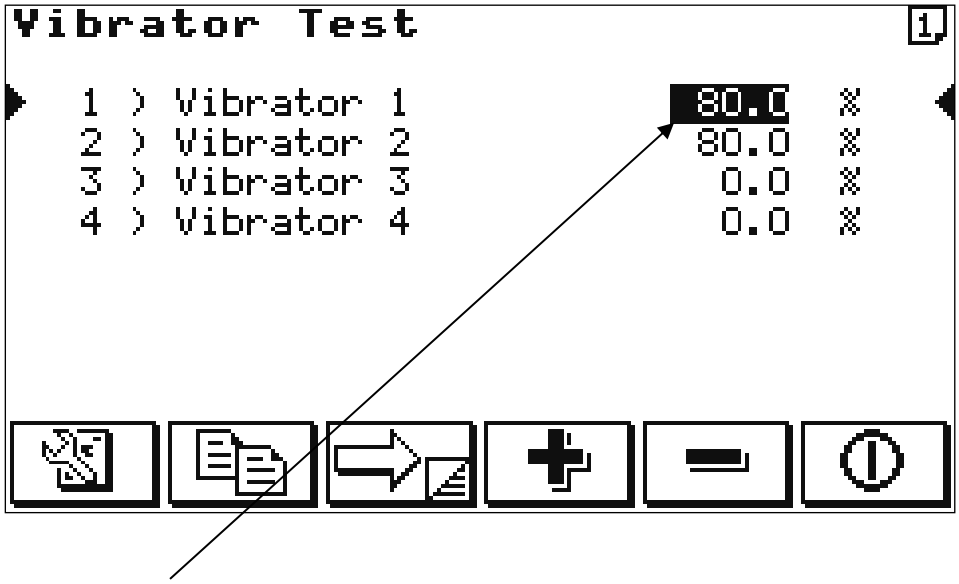
External Vibs/Belts will be set to RS485.

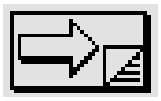
VARIABLE FREQUENCY VIBRATOR OPTION

Setting up Vibrators using frequency control:

Go Test Menu (Main Menu Option 2), Vibrator Test (Option 3)

Vibrator Test Screen (1):

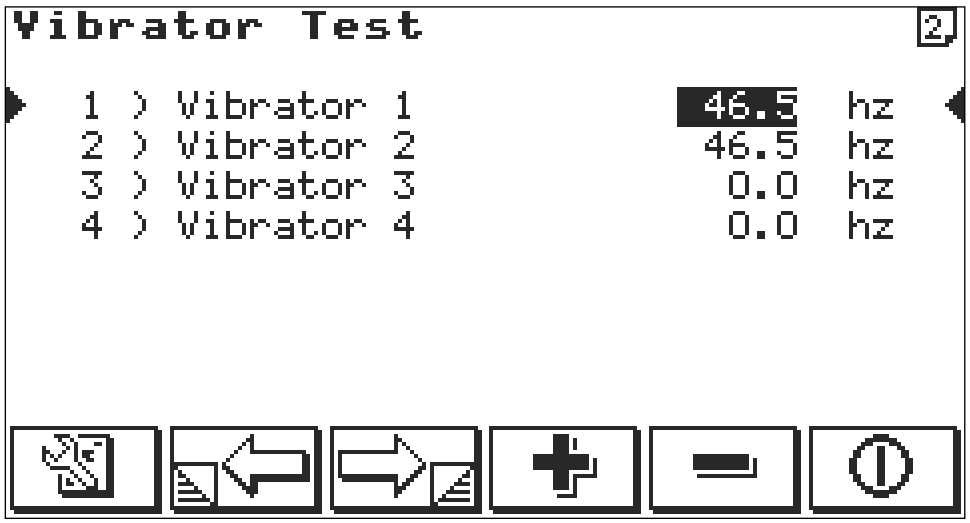


1. Set the Vibrator 1 amplitude to 80.0 %.
2. Set the Vibrator 2 amplitude to 00.0 %
3. Use  to go to Vibrator Test Screen (2)

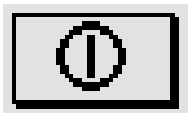
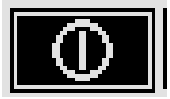
VARIABLE FREQUENCY VIBRATOR OPTION

Setting up Vibrators using frequency control: (Continued)

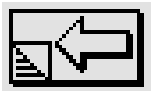
Vibrator Test Screen (2)



4. Set Vibrator 1 Frequency to 50.0 hz

5. Use  to enable Vibrator Test ---  = Test on

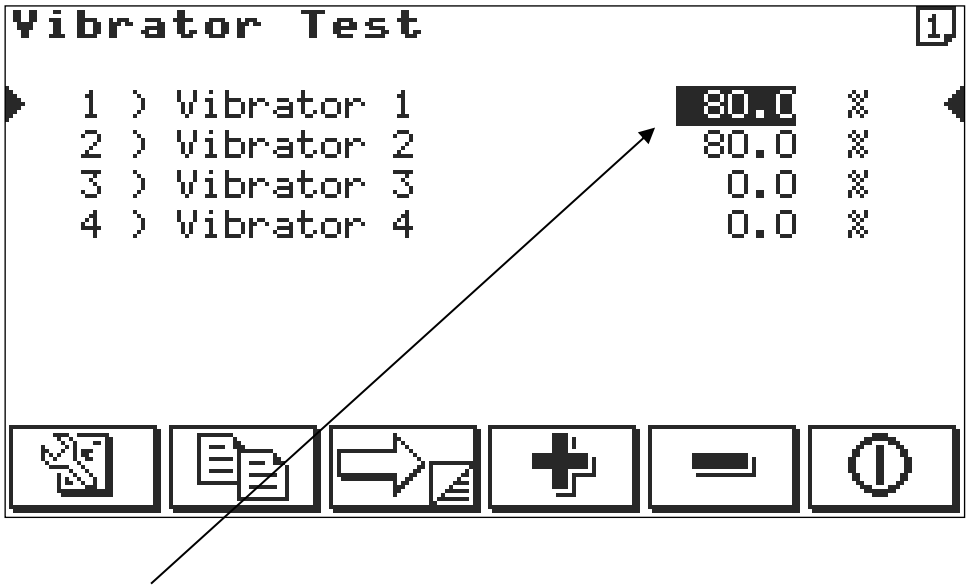
6. Adjust the frequency by 0.1 hz increments / decrements until the required vibrator amplitude is achieved

7. Use  to go back to Vibrator Screen (1)

VARIABLE FREQUENCY VIBRATOR OPTION

Setting up Vibrators using frequency control: (Continued)

Vibrator Test Screen (1):



8. Ensure that the vibrator 1 dose not hammer (Noisy) when the amplitude is set to 100.0 %.
9. If hammering occurs, then re-adjust the frequency until hammering stops.
10. When desired settings have been achieved, and then note the Frequency values (ie. 48.6 hz).
11. Repeat the process from step 1, substituting vibrator 1 with the Next vibrator until all Vibrators have been set and their frequency values recorded.

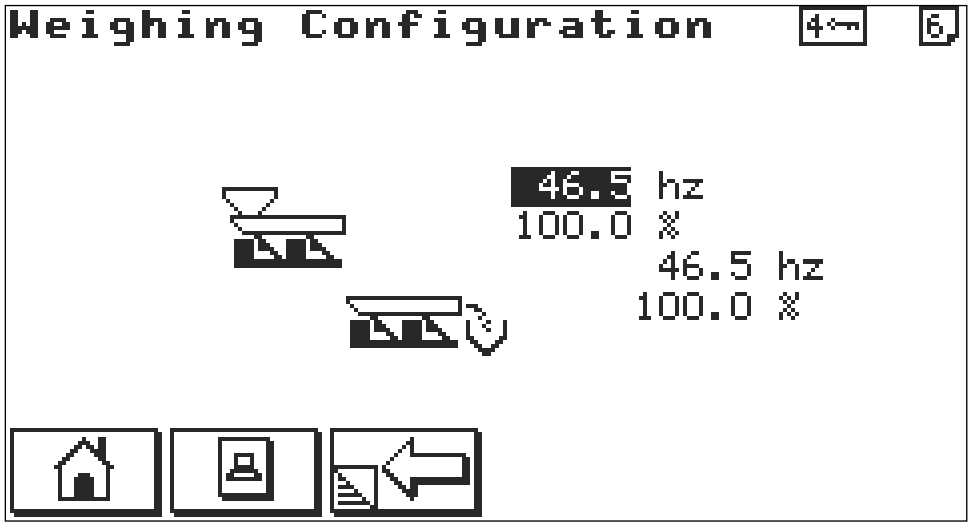
Now go to Configuration Menu, Weighing Configuration Screen (6)

VARIABLE FREQUENCY VIBRATOR OPTION

Saving the frequency Values:

Engineer's level of password is required to enable changes.

The following Weighing Configuration screen (6) shows the option for two Vibrators.

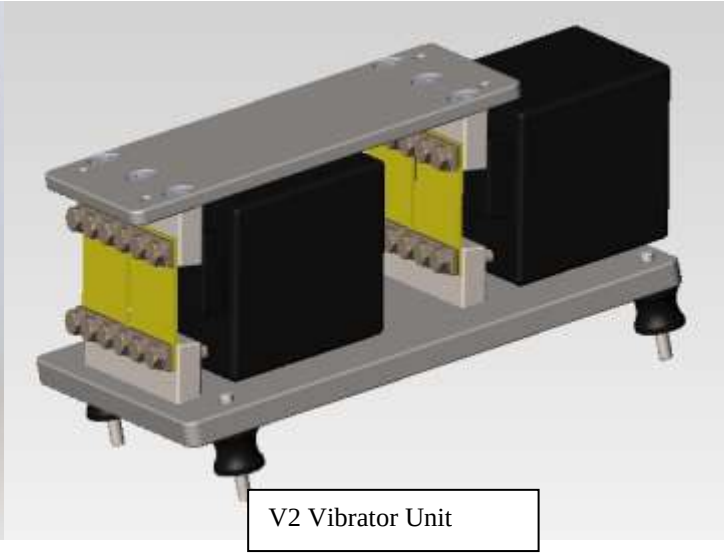


Enter the recorded frequency values from the previous section
The Frequency values are now saved.

COTSWOLD MECHANICAL LTD

V1 & V2 VIBRATOR UNITS

V1 Vibrator Unit



V2 Vibrator Unit

The V1 and V2 Vibrator Units are high precision, quality engineered products, treated and maintained correctly, should give many years of trouble free operation. It is therefore essential that these instructions are understood completely prior to installation and operation. Any electrical work, maintenance or service, should be carried out by suitably qualified personnel.

The information contained herein is based on our present knowledge and experience and is given in good faith..

As the product detailed herein may be used for a wide variety of purposes and as the Cotswold Mechanical Ltd has no control over its use,.

Before proceeding further, it is strongly advised that the operator / qualified personnel familiarise themselves with the essential parts of the unit as outlined below. Doing so will make crucial parts of the unit's setup considerably more straightforward.

COTSWOLD MECHANICAL LTD

Overview

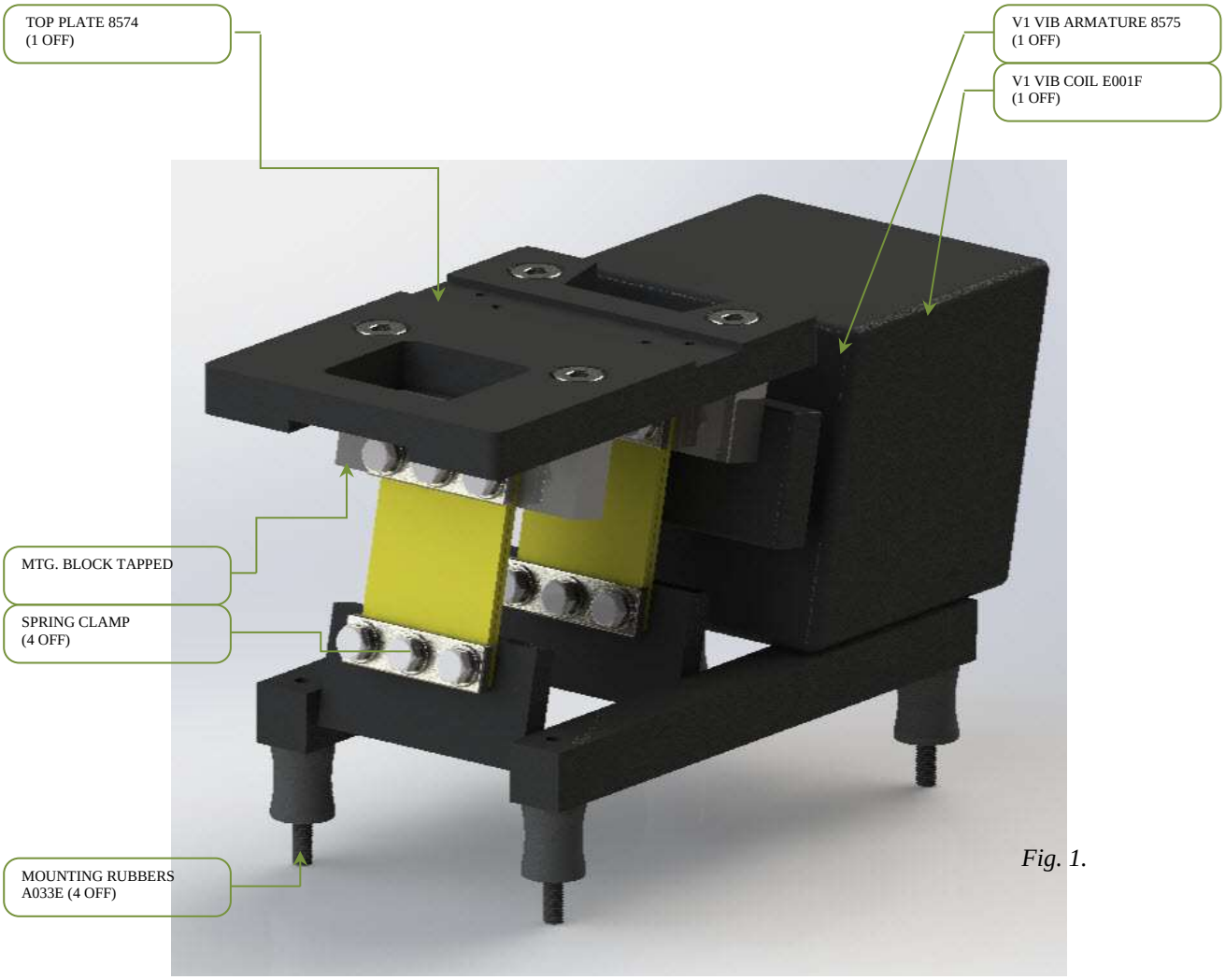


Fig. 1.

Overview: (continued)

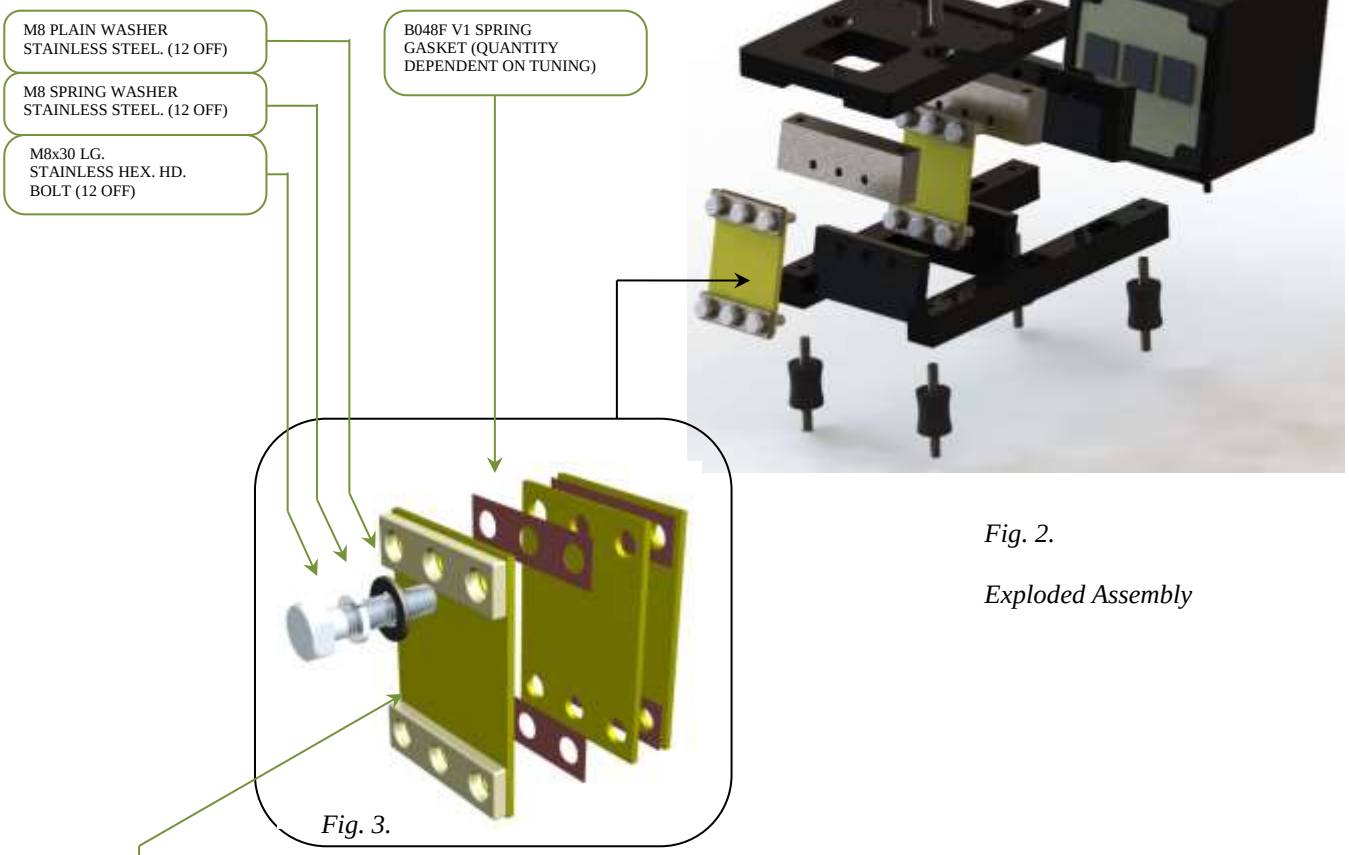


Fig. 2.

Exploded Assembly

Fig. 3.

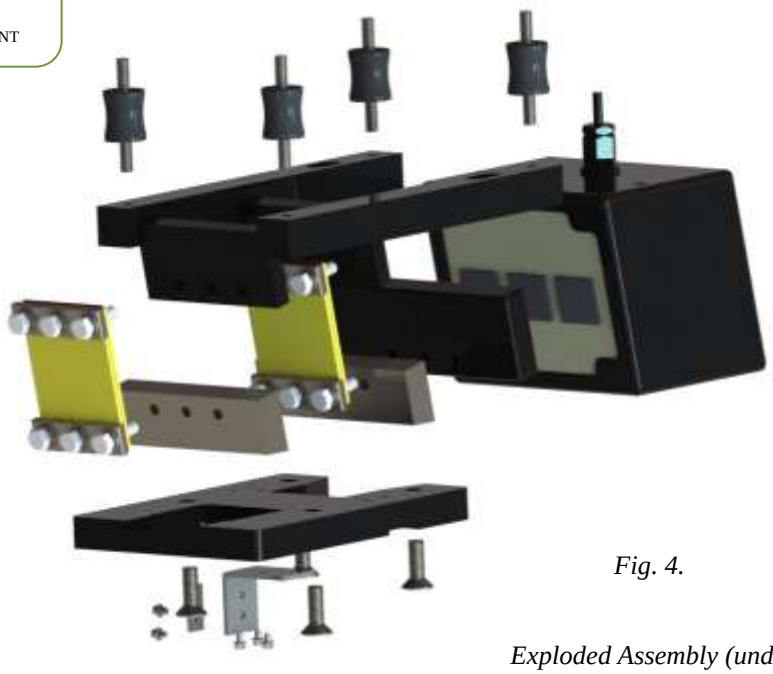


Fig. 4.

Exploded Assembly (underside)

COTSWOLD MECHANICAL LTD

Getting Started – Setup:

The V1 Vibrator Unit is generally intended, but not exclusively, to be used in conjunction with the Cotswold CMW Controls Unit. This set of controls is then used to govern the primary functions of the V1 Vibrator Unit such as speed, amplitude and run times. For further information, see 'CMW Controls Manual'.

Fig. 5.

CMW Controls

Connection of the three core power supply lead from the V1 Vibrator Unit should only be carried out by a suitably qualified electrician! Ensure that all power to any equipment being worked on has been switched off and fully isolated.

Getting Started – Vibrator Tuning:

The V1 Vibrator Unit will have been tuned prior to leaving the factory and should not require adjustment. However, over a period of time, the performance of the Vibratory V2 feed unit may diminish. This is usually after a period of eight months or more and is more noticeable on applications requiring high vibration speed and amplitude to move the product. Leaving the vibrators running at full load speed when a machine is empty or during a wash down can also exacerbate the condition.

Tuning is a relatively simple process and basically involves selecting the correct combination of fiberglass springs to replace those already on the unit. The springs are supplied in three varying thicknesses; 7, 9 and 11 ply. The object of successful tuning is twofold:

1. To obtain approximately 4.5mm – 5.0mm of displacement / movement on the top plate of the vibrator unit WHEN A TRAY IS LATCHED IN POSITION and the unit is running at 100%.
2. To obtain good linear vibration range. This is determined by reducing the vibrator speed in the machine controls in intervals of 10% from the full load speed of 100%. If the speed of the vibrator experiences a larger than 10% decrease in speed when a 10% speed reduction is inputted via the machine controls, the vibration range is deemed as bad. However, often there is little vibration below 40% and these low end values are largely ignored.

The procedure for tuning the vibrator units are as follows:

Step 1.
Assemble the vibrator springs as a separate assembly as shown in Fig. 6 using three 11 ply springs in each position. Make sure that all the bolts are tightened wherever possible, with a torque wrench set at 40N.m (29.5 lbf.ft) as shown in fig. 7. Bolts that are not properly tightened will result in false linear vibration range readings later.

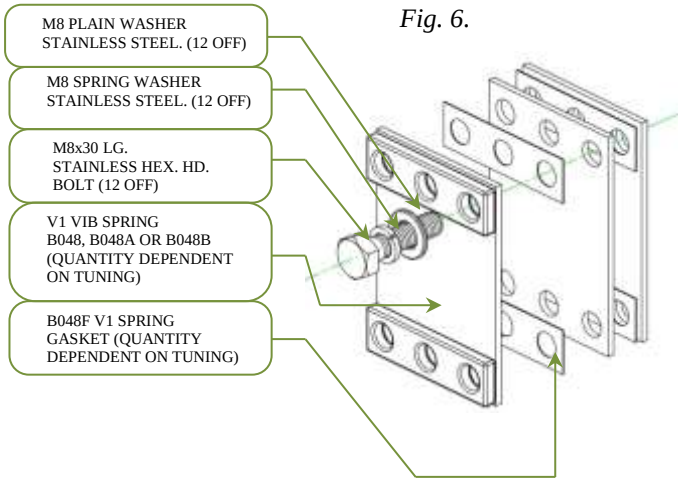


Fig. 6.

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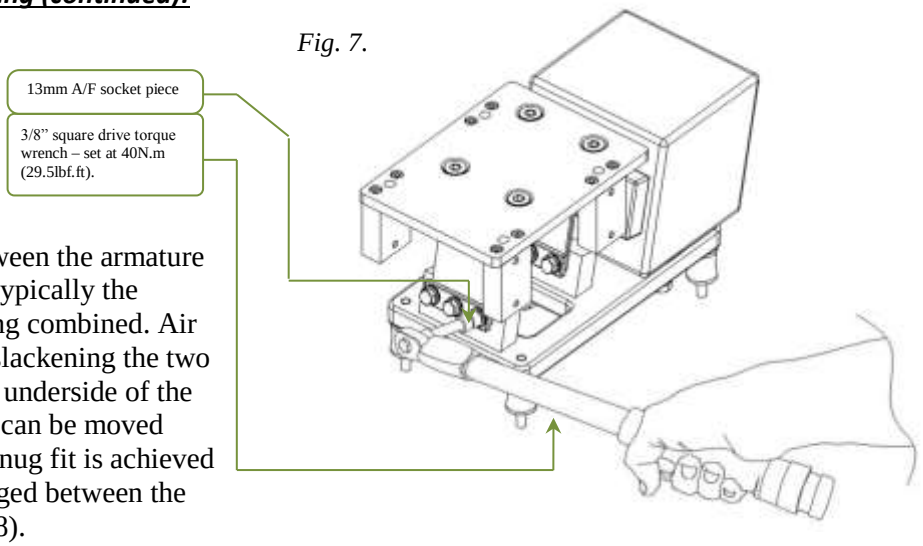
Getting Started – Vibrator Tuning (continued):

Fig. 7.



Step 2.

Set the correct gap between the armature and the coil. This gap is 6mm, typically the thickness of an 11 & 9 ply spring combined. Air gap adjustment is achieved by slackening the two bolts per coil (see fig. 4) on the underside of the base plate. Once loose, the coil can be moved backwards or forwards until a snug fit is achieved with the 11 & 9 ply spring wedged between the coil and the armature (see Fig. 8).

Step 2. (Continued)

Once the correct air gap has been set up, the retaining bolts on the underside of the base plate should be fully tightened

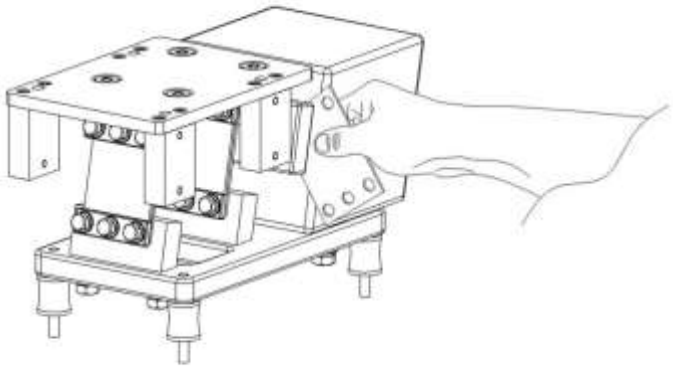


Fig. 8.
V1 Vibrator Unit with 11 & 9 ply springs wedged between coil & armature to create 6mm air gap

Step 3.

Make sure that the product feed tray is latched / bolted into position on the vibrator unit. Set the vibrator speed in the machine control parameters to 100% and switch the system into test mode. Make a note of the current vibrator amplitude. This is best achieved by holding a steel rule as close to the feed tray as possible and measuring the 'ghost' profile created by the movement of the tray (see Fig. 9).

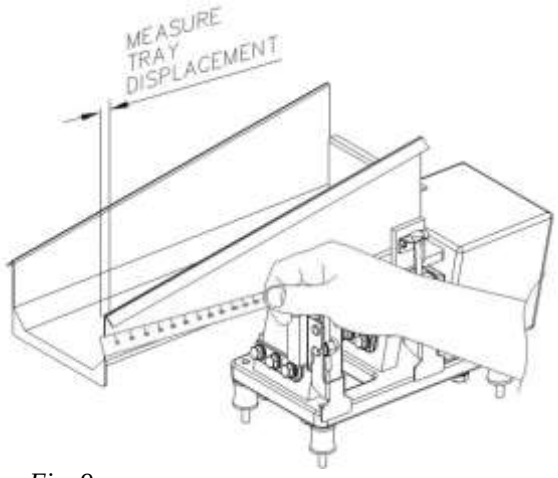
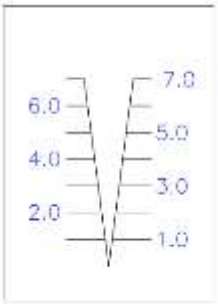


Fig. 9.
V1 Vibrator Unit running at 100% - steel rule used to measure tray displacement left by 'ghost' image of tray when vibrating.

Note: Some vibrating trays are fitted with a vibration motion label (see below) which will indicate clearly how much tray displacement occurs. It completely negates the need to use a rule to measure the tray movement.



As the label vibrates with the tray, the two diagonal lines will appear to converge. The point of convergence can be read off the scale, indicating precise tray displacement.

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Getting Started – Vibrator Tuning (continued):

Step 4.

If the amplitude of the tray measures approximately 4.5mm to 5.0mm, then proceed to step 8 to ensure good linear vibration range.

Step 5.

If the amplitude of the tray measures less than 4.5mm to 5.0mm, loosen one of the lower vibrator spring M8 bolts. It is important to loosen the bolt as the vibrator unit is running. As the bolt is loosened, a change in amplitude should be easily detected. If no change is discernable, gradually loosen a second bolt.

Step 6.

If the tray amplitude increased when the bolts were slackened, then the vibrator springs are too stiff. The overall spring thickness needs to be decreased by either removing / changing the spring thickness combinations. If the tray amplitude decreased when the bolts were slackened, then the vibrator springs are too weak and the overall spring thickness needs to be increased, again by adding / changing the spring combinations.

Step 7.

Vibrator springs are available in three thicknesses; 7, 9 & 11 ply. Adding or replacing springs should take place one at a time. When a spring combination has been altered, check that the M8 retaining bolts are correctly tightened and repeat the amplitude measurement test again (return to step 3) as many times as necessary until the correct amplitude is achieved.

Step 8.

Once the correct amplitude has been achieved, reduce the vibrator load speed in increments of 10% in the machine controls. If the speed of the vibrator experiences a larger than 10% decrease in speed when a 10% speed reduction is inputted via the machine controls, the vibration range needs altering. This is achieved by altering the combination of springs used to that of a slightly thinner combination i.e. remove one 11 ply spring and add two 7 ply or one 7 and one 9 ply. Essentially, having previously achieved good amplitude of vibration, the vibrator is now being restricted or de-tuned in its overall performance in order to gain good linear range of control. Overall tray speed is therefore, a trade off over good linear range of control. Be aware that below 40% load speed on the controls usually results in little or no vibration so generally, these low end results are largely ignored.

The extent to which a vibrator unit is tuned is largely dependent on the flow characteristics of the product. For instance, an awkward product such as diced lettuce, requires a high / fast amplitude. In such a case, it is not so important that the vibrator exhibits good vibration range. However, a free flowing granular product such as grass seed requires little vibration to start it moving along the tray. We would therefore suggest, that a high / fast amplitude is not that important. Good range of control however, is. It is important that these characteristics are duly taken into consideration when tuning.

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Vibratory Feed System: Vibrator Tuning

Over a period of time, the performance of the Vibratory V2 feed unit may diminish. This is usually after a period of eight months or more and is more noticeable on weighing applications requiring high vibration speed and amplitude to move the product. Leaving the vibrators running at full load speed when the machine is empty or during a wash down can also exacerbate the condition.

Tuning is a relatively simple process and basically involves selecting the correct combination of fiberglass springs to replace those already on the unit. The springs are supplied in three varying thicknesses; 7, 9 and 11 ply. The object of successful tuning is two fold:

1. To obtain approximately 4.5mm – 5.0mm of displacement / movement on the top plate of the vibrator unit WHEN A TRAY IS LATCHED IN POSITION and the unit is running at 100%.
2. To obtain good linear vibration range. This is determined by reducing the vibrator speed in the machine controls in intervals of 10% from the full load speed of 100%. If the speed of the vibrator experiences a larger than 10% decrease in speed when a 10% speed reduction is inputted via the machine controls, the vibration range is deemed as bad. However, often there is little vibration below 40% and these low end values are largely ignored.

The procedure for tuning the vibrator units are as follows:

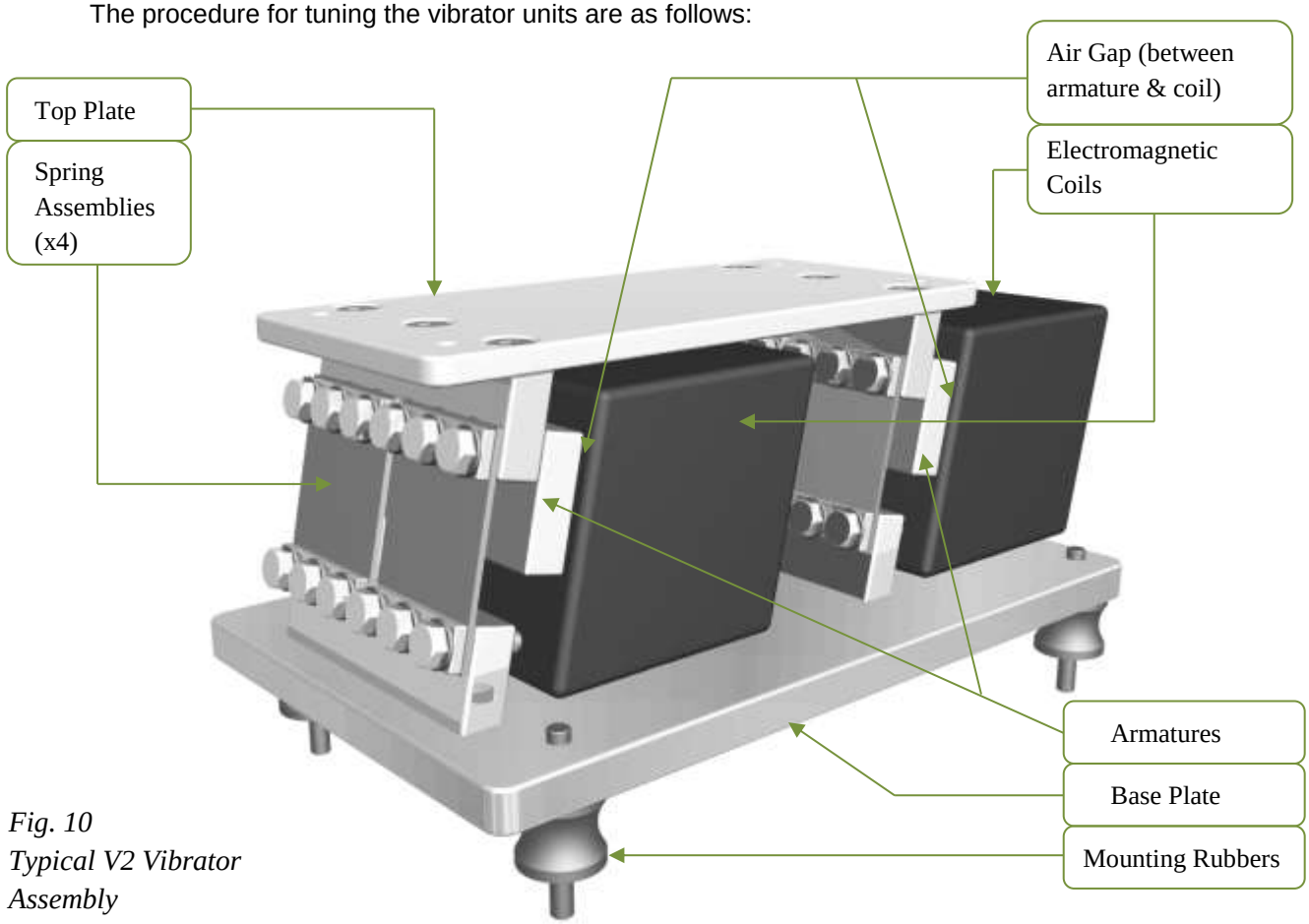


Fig. 10
Typical V2 Vibrator Assembly

V2 Vibrator : Vibrator Tuning (Continued)

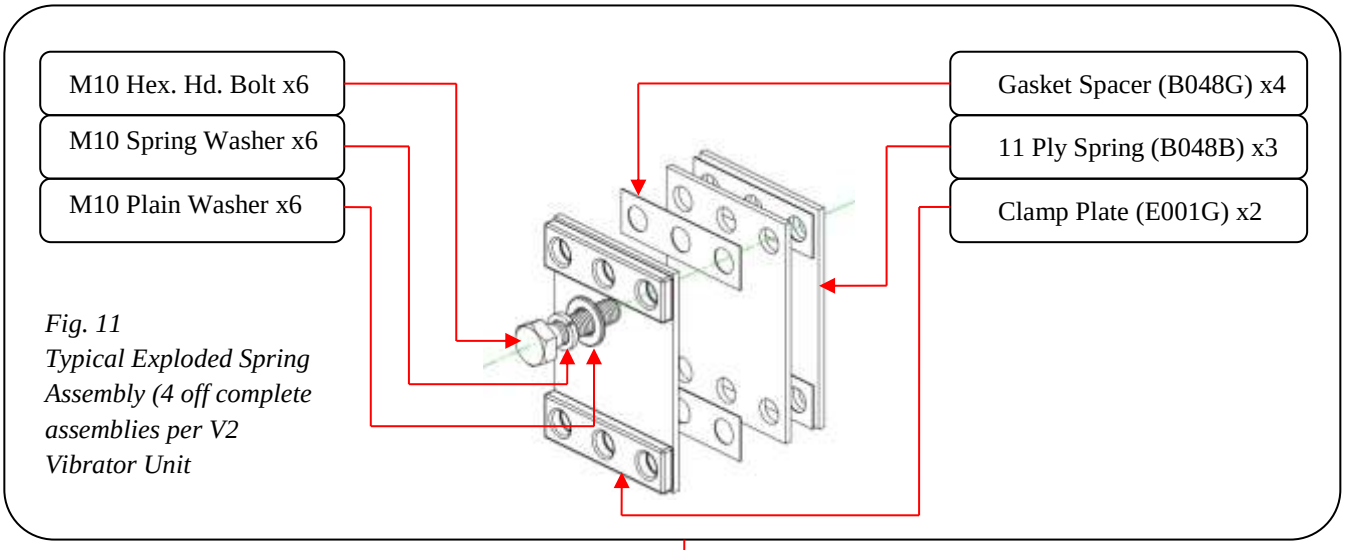
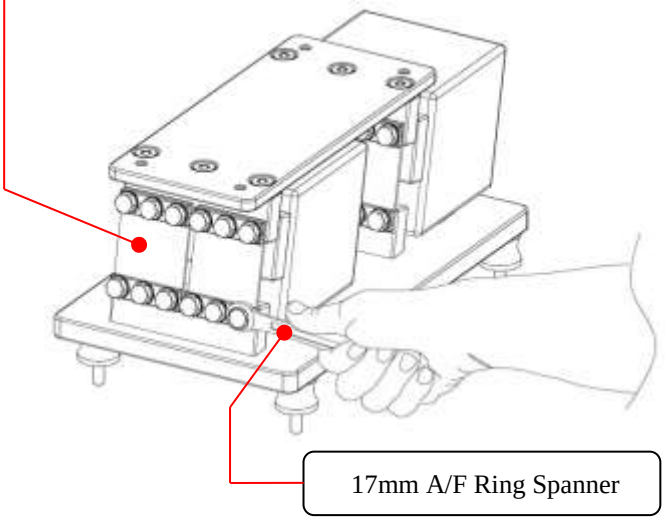


Fig. 11
Typical Exploded Spring Assembly (4 off complete assemblies per V2 Vibrator Unit

Step 1.
Assemble the vibrator springs in four separate assemblies as shown in Fig. 11 using three 11 ply springs in each position. Make sure that all the bolts are tight! Bolts that are not properly tightened will result in false linear vibration range readings later.

Step 2.
Set the correct gap between the armatures and the coils in two places. This gap is 6mm, typically the thickness of an 11 & 9 ply spring combined. Air gap adjustment is achieved by slackening the two bolts per coil on the underside of the base plate. Once loose, the coils can be moved backwards or forwards until a snug fit is achieved with the 11 & 9 ply spring wedged

Fig. 12
Typical V2 Vibrator Unit with Spring Assemblies bolted in position



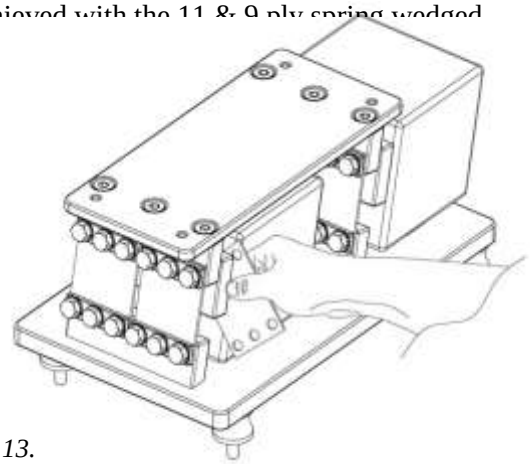


Fig. 13.
V2 Vibrator Unit with 11 & 9 ply springs wedged between coil & armature to create 6mm air gap

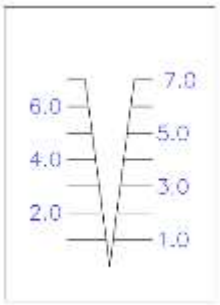
Step 2. (Continued)
Once the correct air gap has been set up, the retaining bolts on the underside of the base plate should be fully tightened

V2 Vibrator :: Vibrator Tuning (Continued)

Step 3.

Make sure that the product feed tray is latched / bolted into position on the vibrator unit. Set the vibrator speed in the machine control parameters to 100% and switch the system into test mode. Make a note of the current vibrator amplitude. This is best achieved by holding a steel rule as close to the feed tray as possible and measuring the 'ghost' profile created by the movement of the tray (see Fig. 14).

Note: Some vibrating trays are fitted with a vibration motion label (see below) which will indicate clearly how much tray displacement occurs. It completely negates the need to use a rule to measure the tray movement.



As the label vibrates with the tray, the two diagonal lines will appear to converge. The point of convergence can be read off the scale, indicating precise tray displacement.

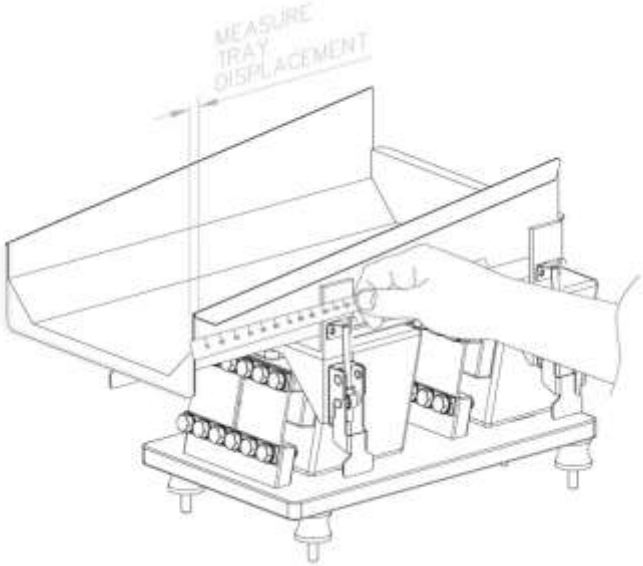


Fig. 14.
V2 Vibrator Unit running at 100% - steel rule used to measure tray displacement left by 'ghost' image of tray when vibrating.

Step 4.

If the amplitude of the tray measures approximately 4.5mm to 5.0mm, then proceed to step 8 to ensure good linear vibration range.

Step 5.

If the amplitude of the tray measures less than 4.5mm to 5.0mm, loosen one of the lower vibrator spring M10 bolts. It is important to loosen the bolt as the vibrator unit is running. As the bolt is loosened, a change in amplitude should be easily detected. If no change is discernable, gradually loosen a second bolt.

V2 Vibrator :: Vibrator Tuning (Continued)

Step 6.

If the tray amplitude increased when the bolts were slackened, then the vibrator springs are too stiff. The overall spring thickness needs to be decreased by either removing / changing the spring thickness combinations. If the tray amplitude decreased when the bolts were slackened, then the vibrator springs are too weak and the overall spring thickness needs to be increased, again by adding / changing the spring combinations.

Step 7.

Vibrator springs are available in three thicknesses; 7, 9 & 11 ply. Adding or replacing springs should take place one at a time. When a spring combination has been altered, check that the M10 retaining bolts are tight and repeat the amplitude measurement test again (return to step 3) as many times as necessary until the correct amplitude is achieved.

Step 8.

Once the correct amplitude has been achieved, reduce the vibrator load speed in increments of 10% in the machine controls. If the speed of the vibrator experiences a larger than 10% decrease in speed when a 10% speed reduction is inputted via the machine controls, the vibration range needs altering. This is achieved by altering the combination of springs used to that of a slightly thinner combination i.e. remove one 11 ply spring and add two 7 ply or one 7 and one 9 ply. Essentially, having previously achieved good amplitude of vibration, the vibrator is now being restricted or de-tuned in its overall performance in order to gain good linear range of control. Overall tray speed is therefore, a trade off over good linear range of control. Be aware that below 40% load speed on the controls usually results in little or no vibration so generally, these low end results are largely ignored.

The extent to which a vibrator unit is tuned is largely dependent on the flow characteristics of the product. For instance, an awkward product such as diced lettuce, requires a high / fast amplitude. In such a case, it is not so important that the vibrator exhibits good vibration range. However, a free flowing granular product such as grass seed requires little vibration to start it moving along the tray. We would therefore suggest, that a high / fast amplitude is not that important. Good range of control however, is. It is important that these characteristics are duly taken into consideration when tuning.

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Health & Safety Information:

The V1 Vibrator Unit as illustrated on page one, has been designed & built to accurately perform for many years. When handling the unit, it is the responsibility of the user to exercise good lifting techniques! The complete unit weighs approximately **30.0kg.**

The V2 Vibrator Unit as illustrated on page one, has been designed & built to accurately perform for many years. When handling the unit, it is the responsibility of the user to exercise good lifting techniques! The complete unit weighs approximately **60.0kg.**

The unit requires 230v A.C at 50Hz, 1.5 amp supply – IT IS ESSENTIAL THAT THE ELECTRICAL SUPPLY TO THIS EQUIPMENT BE ISOLATED BEFORE ANY WORK IS CARRIED OUT BY APPROPRIATLEY QUALIFIED PERSONNEL.

Only suitably trained personnel should operate this equipment. **This machinery has been designed and manufactured where possible in accordance with the following transposed harmonised European standards:**

BS EN ISO 12100:2010 safety of machinery – basic concepts, general principles for design.
EN ISO 13857:2008 safety of machinery – safety distances to prevent danger zones being reached by the upper limbs
EN349:1993+A1 2008 safety of machinery – minimum gaps to avoid crushing of parts of the body
EN13850:2005 + BS EN 60947-5-5 safety of machinery – emergency stop equipment, functional aspects – principles for design
BS EN 60204-1:2006 + A1 2009 safety of machinery – electrical equipment of machines – specification for general requirements
NEN-EC-IEC 61000-6-4: 2007:Generic Emissions standard and Generic Immunity standard: Industrial environments

In addition this machinery has been designed and manufactured in accordance with:
British Standard PD 5304:2005 Safety of Machinery
The Plastics Materials and Articles in contact with Food Regulations 2011

The equipment is supplied with a suitable mains lead and must be properly connected to a mains supply which is adequate for the unit's requirements and correctly protected by fuses or circuit breakers. Provision must be made by the end user for quick, safe disconnection of the supply. The equipment must be connected to a good, reliable, low impedance, noise free earth to ensure correct, safe operation and compliance with EMC regulations.

Optional Data Recorder

Data Recorder

1. “Active” LED should be on when power applied
2. Insert Compact Flash Card
3. Press “Stop/Record” Button “R” LED Will Light
4. During Recording “D” LED Will Flash
5. To Stop Recoding Press Stop/Record” Button “R” LED Will Go Out
6. Press Card Eject Button To Remove Card
7. Insert Compact Flash Card into the Card Reader & Connect the Card Reader to a PC,The file Type is *.DAT use Notepad to Open.

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Cleaning Schedule:

The weighing system is designed such that most of the component parts that come into contact with the product can easily be removed for cleaning purposes. This includes: Hopper, Feed Trays Weighpan, Rise & Fall Chutes & Outlet Chute.

BEFORE REMOVAL OF THESE COMPONENT PARTS CAN COMMENCE, IT IS ESSENTIAL THAT BOTH THE AIR SUPPLY & THE ELECTRICAL SUPPLY TO THE MACHINE BE ISOLATED BY AN APPROPRIATLEY QUALIFIED PERSON.

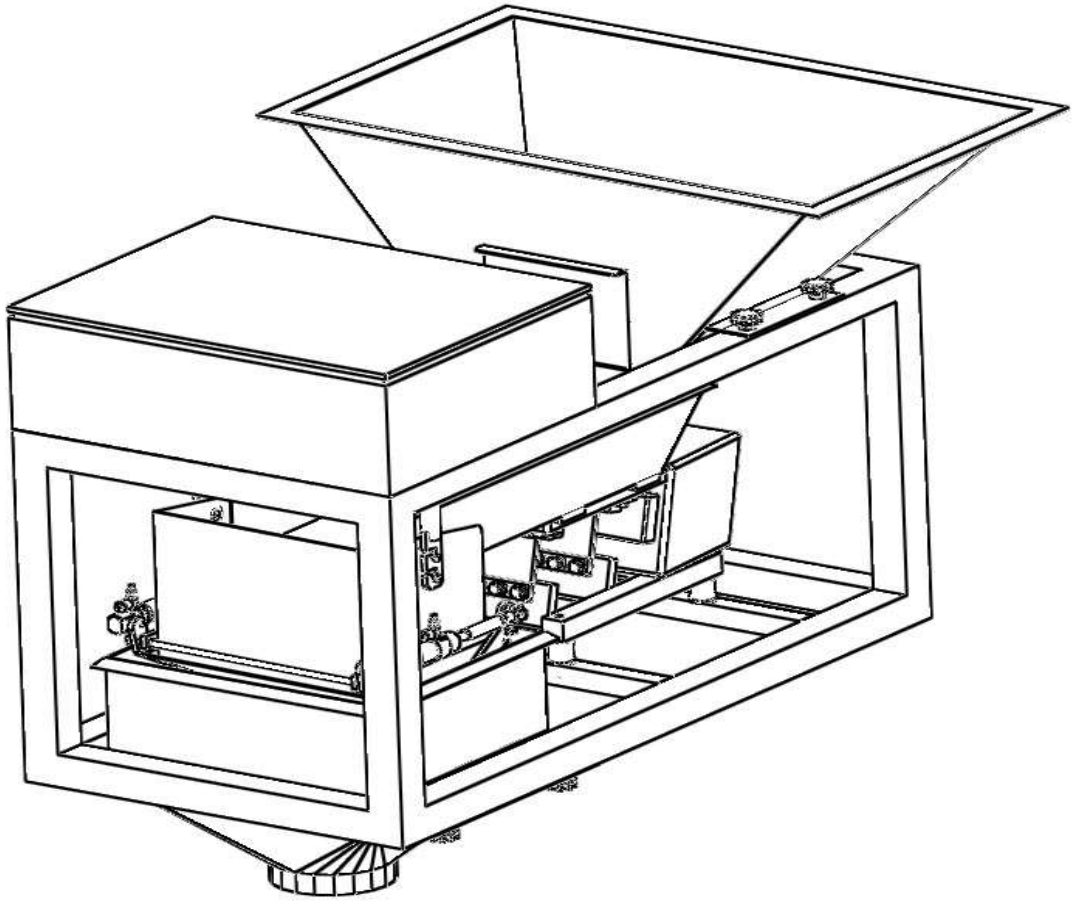
All the contact parts are manufactured from grade 304 or 316 stainless steel and will easily withstand cleaning with most food industry approved sanitary cleaning fluid.

It is recommended that the machine is stripped down and cleaned at least once per eight hour shift. It is also essential that cleaning take place when there is a change of product to be run through the machine. During any clean down procedure, it is vital to ensure the cleansing of the entire machine and not just the removable contact parts.

The entire range of weighing machines have the same basic mode of operation and whilst the format, style, size and specification may differ to suit different applications.

All contact parts, once removed can be washed and sanitized and then dried before re-assembly.

Contact parts removal procedure for cleaning is generally as follows:



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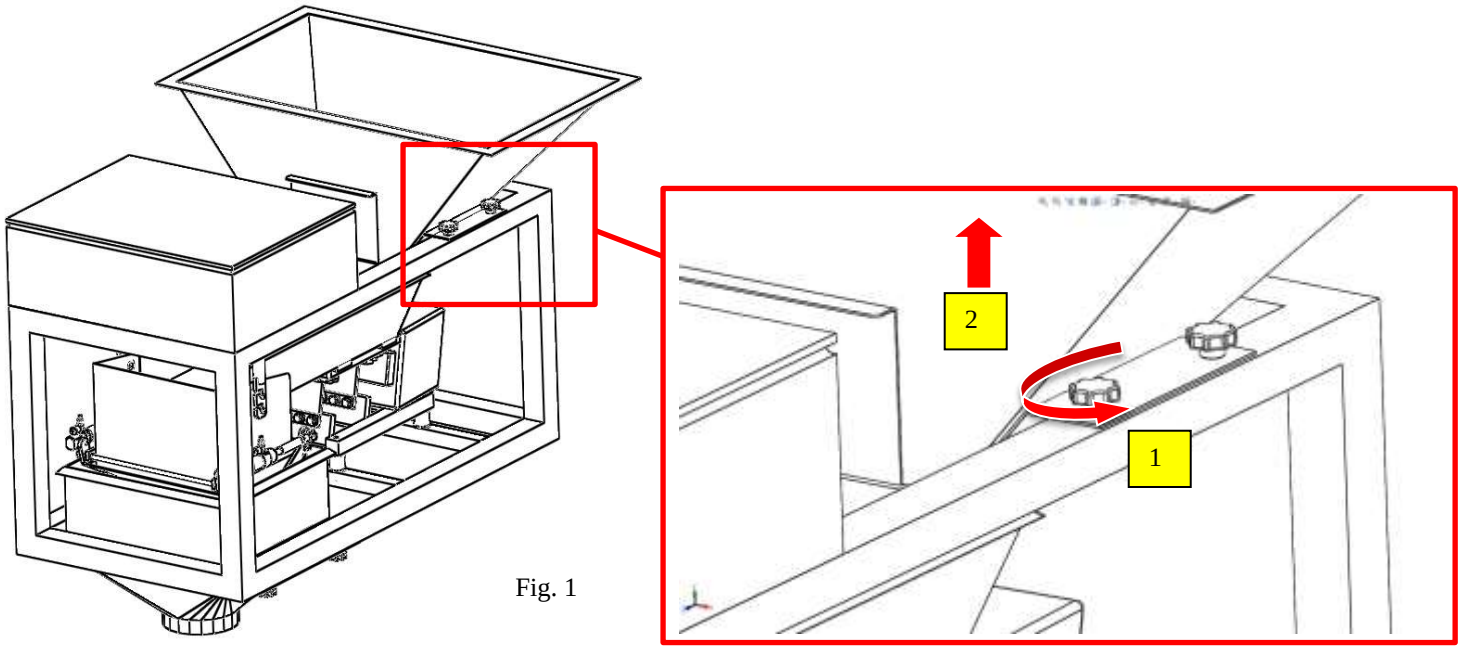

Fig. 1

1. Removal of hopper.
   Unscrew the four hand wheels / nuts in an anticlockwise direction and remove (1) Fig. 1
   Then lift the Hopper upwards to remove (2)
   It can also be cleaned in its normal working position.

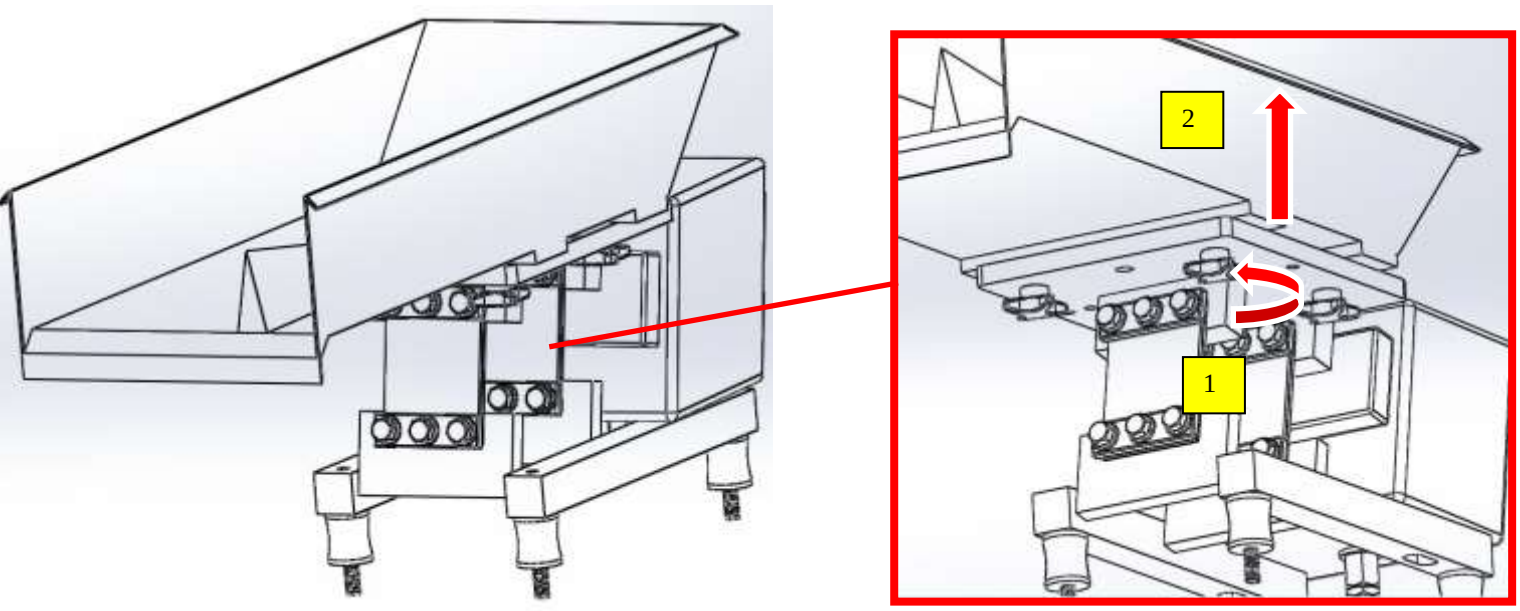

Fig. 2

2. Removal of Vibrator Tray Fig. 2
Release the four hand wheels / nuts (1) unscrewing in an anticlockwise direction and lift (2) the vibratory feed tray upwards to remove. The Vibratory Tray can be cleaned in its normal working position.

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Cleaning Schedule:

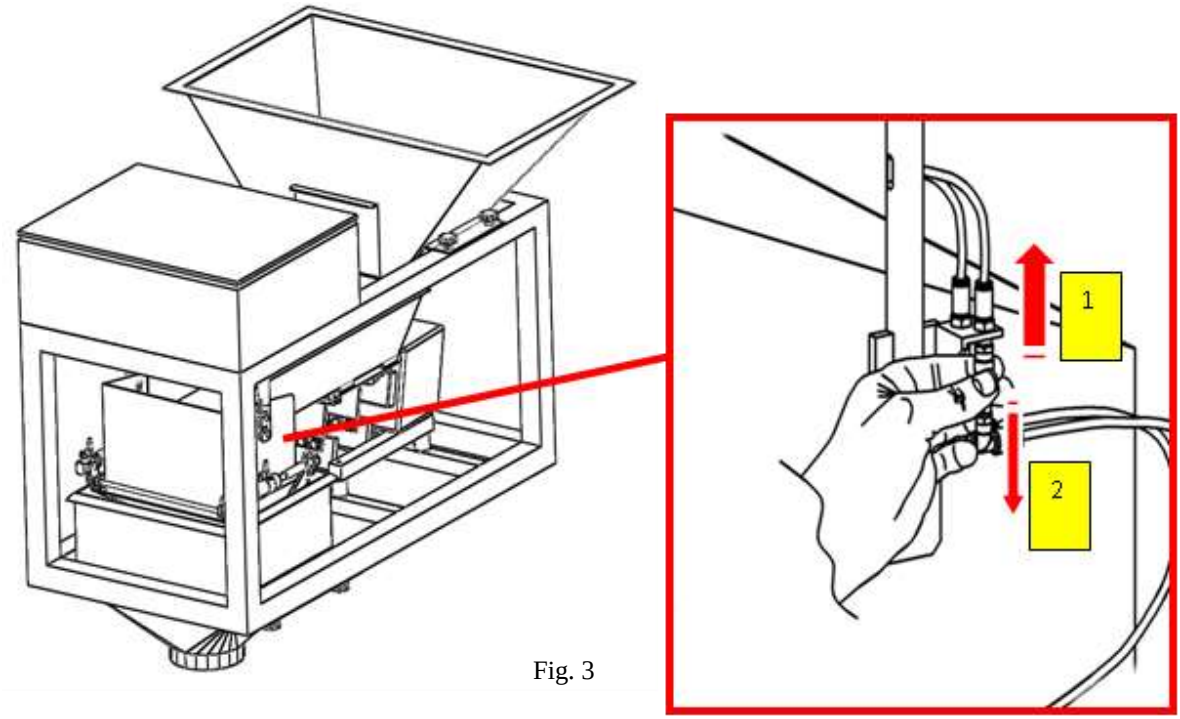

Fig. 3

3. Release the air pipes by pushing the outer ring upwards (1) Fig. 3
And pulling the pipe downward (2)

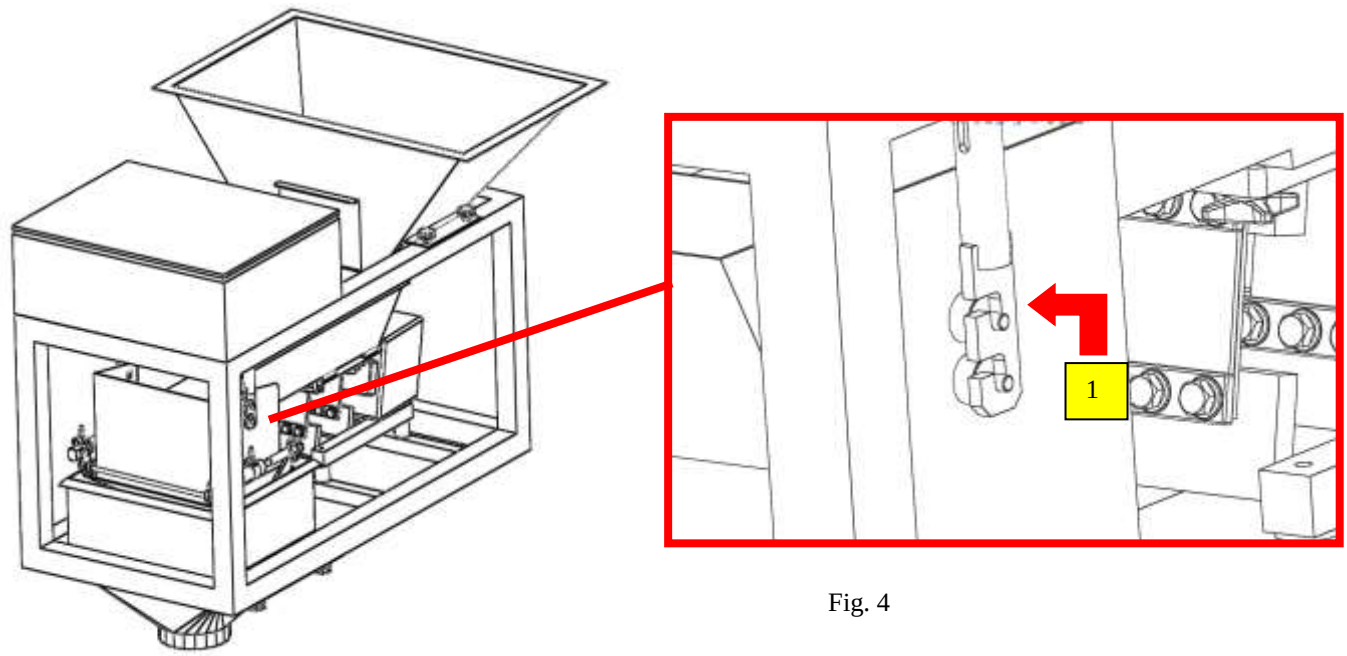

Fig. 4

4. Weigh-pan removal Fig. 4
Firstly release the quick release air fitting as shown in (Fig 3) then
Lift the Weigh-pan clear of the slots upwards and then forwards to remove (1)

Cleaning Schedule:

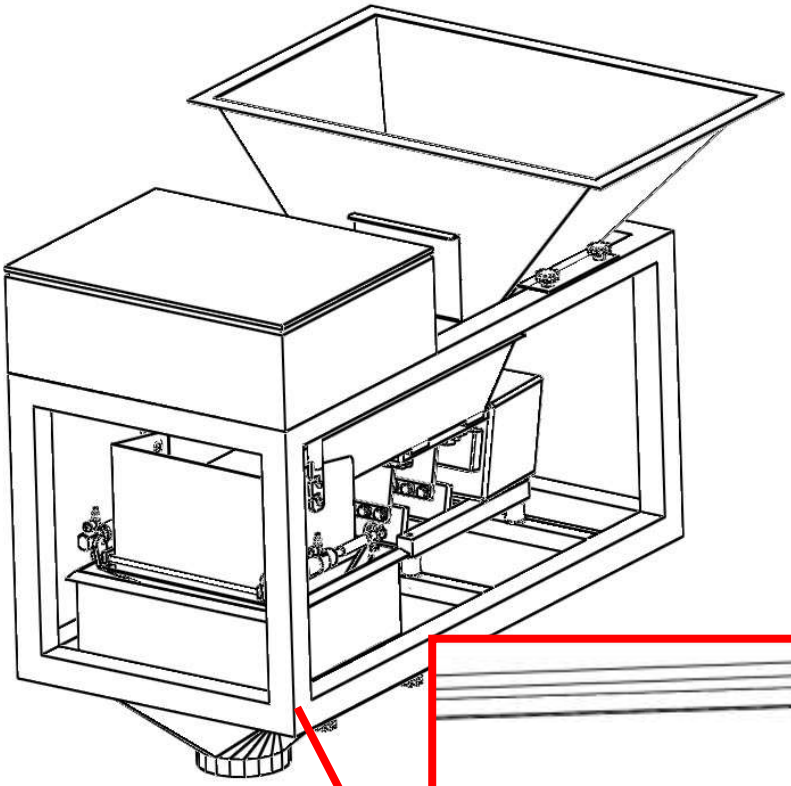

Fig. 5

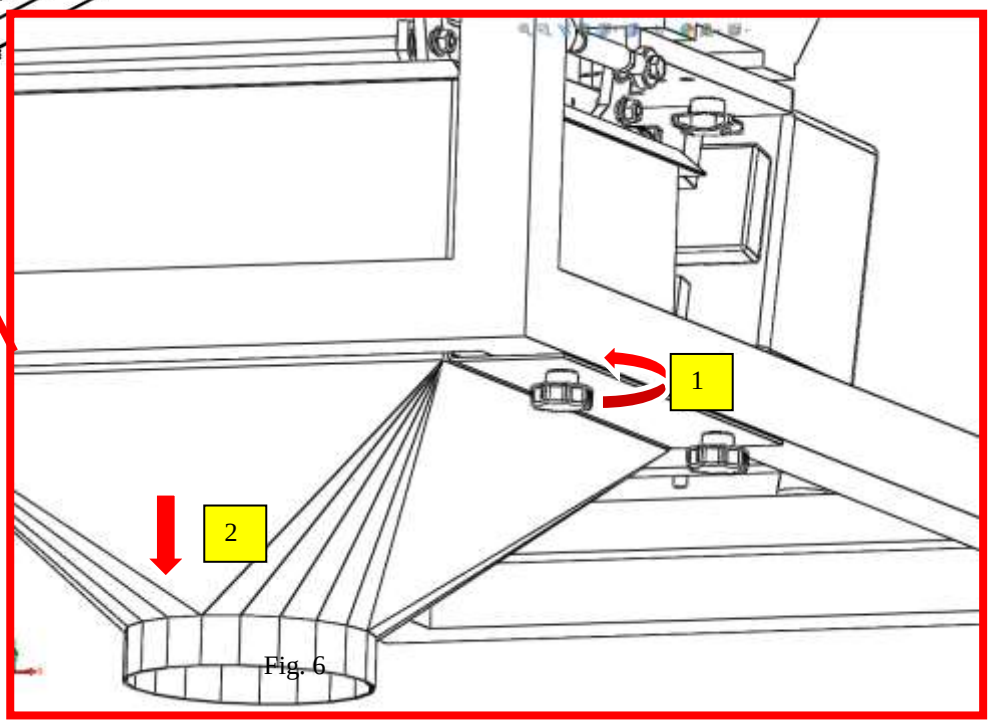

Fig. 6

5. Outlet Chute removal
Release the four hand wheels / bolts (1) unscrewing in an anticlockwise (1)
And lower the outlet cute (2) to remove

Fig. 5

Cleaning Schedule:

6. Remove any Ancillary Equipment (If fitted). This usually comprises Rise and Fall Funnels or Product Diverting Chutes. Release over centre latches (where fitted) and remove each assembly. If latches are not fitted, the chute or funnel is usually cleaned in its normal working position, but can be un-bolted for complete removal. Fig. 6 shows a typical example of a rise & fall funnel. Obviously, there are a great number of funnel variations as these are designed and built to match specific applications.

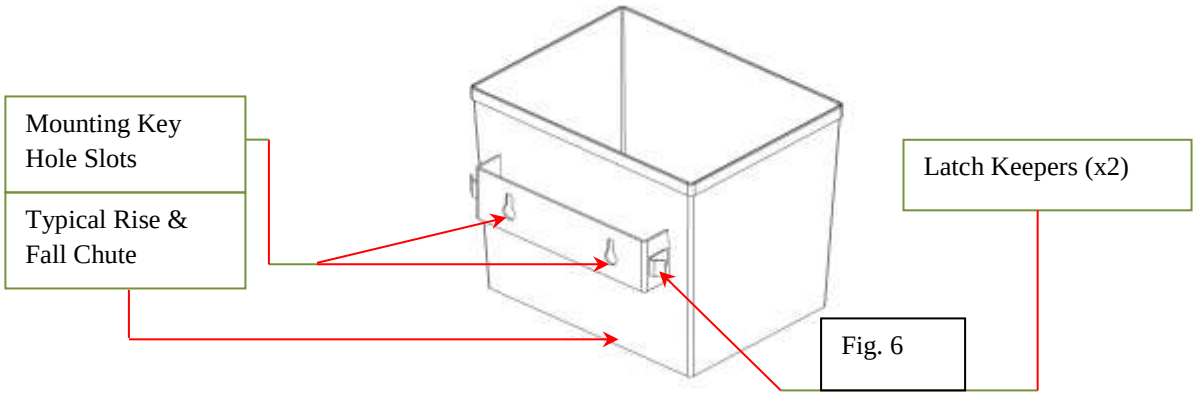

Fig. 6

As a precautionary measure, it is also a good idea to cover the CMW Controls with a waterproof hood, ensuring that the opening is tied securely once the hood is in place. This will offer a greater measure of protection from liquid ingress into the controls box.
Exact cleaning schedules however, are usually determined by the end user and are largely dependent on the characteristics of the product to be weighed and the end user's operational procedures.

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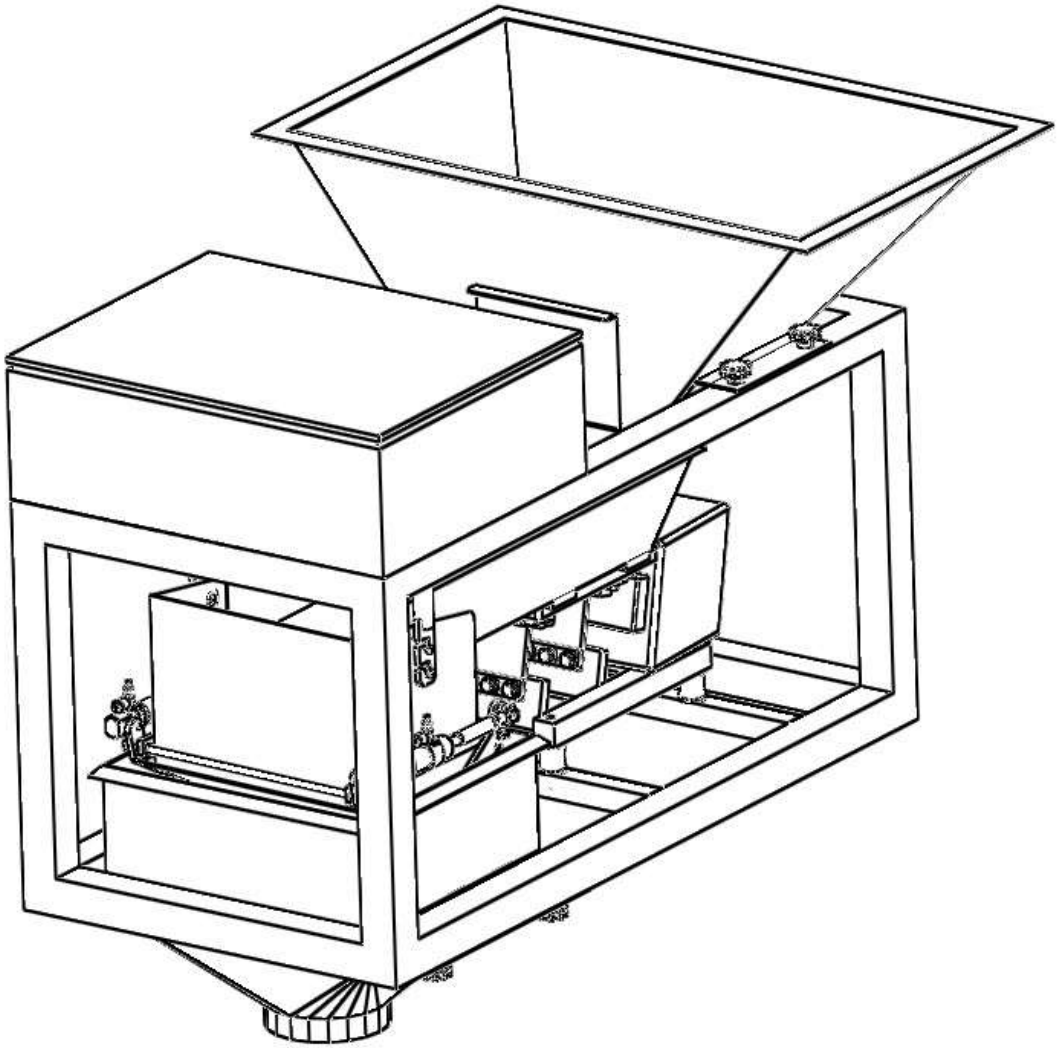

CMW2000
Maintenance Schedule

There is very little routine maintenance required on any Cotswold Mechanical Ltd machines other than routine adjustments and occasional calibration.
The equipment is extremely reliable and breakdowns are rare, but they can sometimes occur.
Even after the warranty period has expired our fully trained and experienced engineers are at your service giving both telephone and on-site support, backed up by our comprehensive spare parts inventory if necessary.

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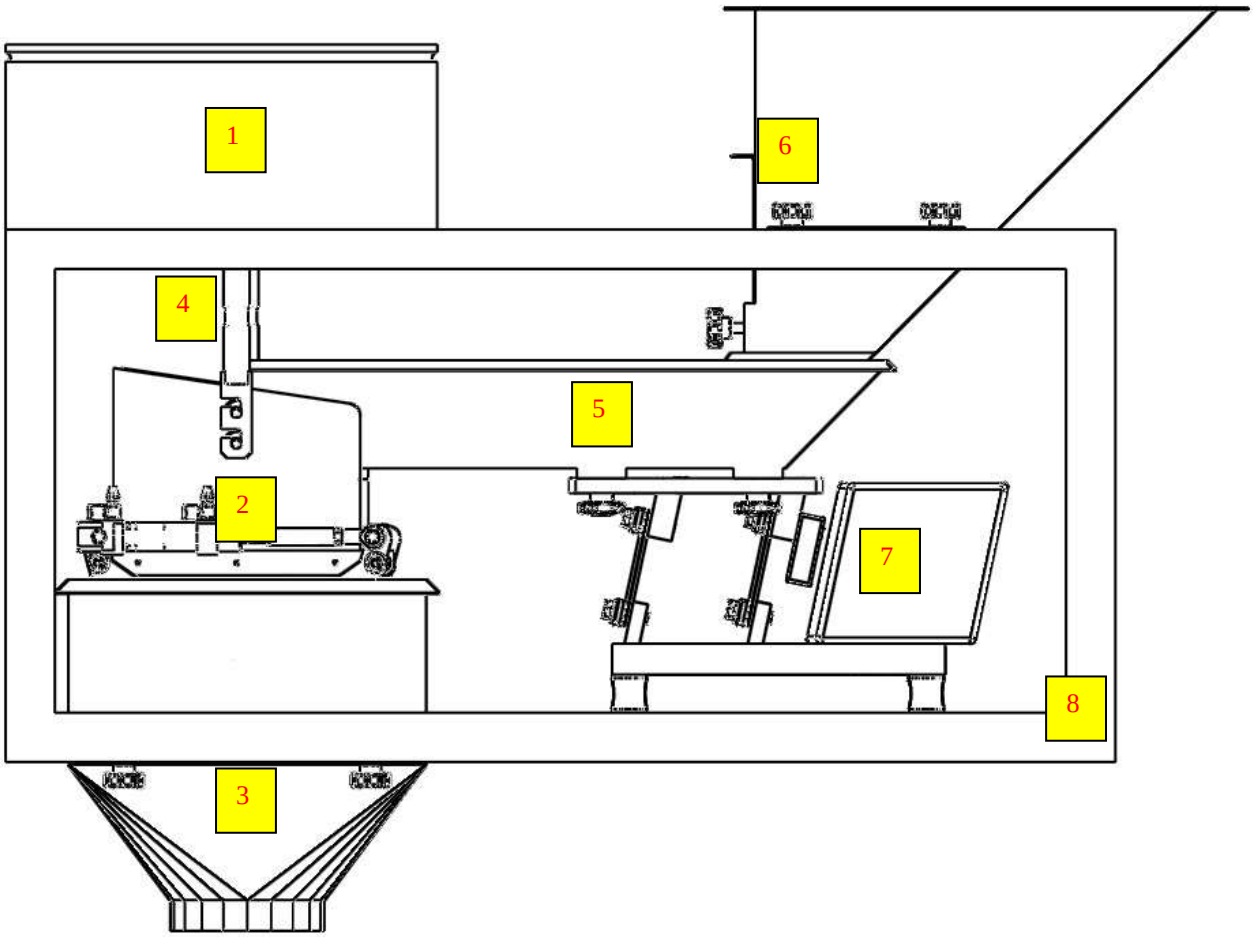
CMW2000
Maintenance Schedule



1. Precision load-cell weighing mechanism (Maintenance free)
2. Weigh-pan with pneumatically operated lids
3. Outlet chute
4. Bulk feed gate (pneumatic operation)
5. Primary feed tray
6. Product hopper with adjustable gate
7. Encapsulated vibratory feeders (electro-magnetic)
8. Stainless steel Base Frame

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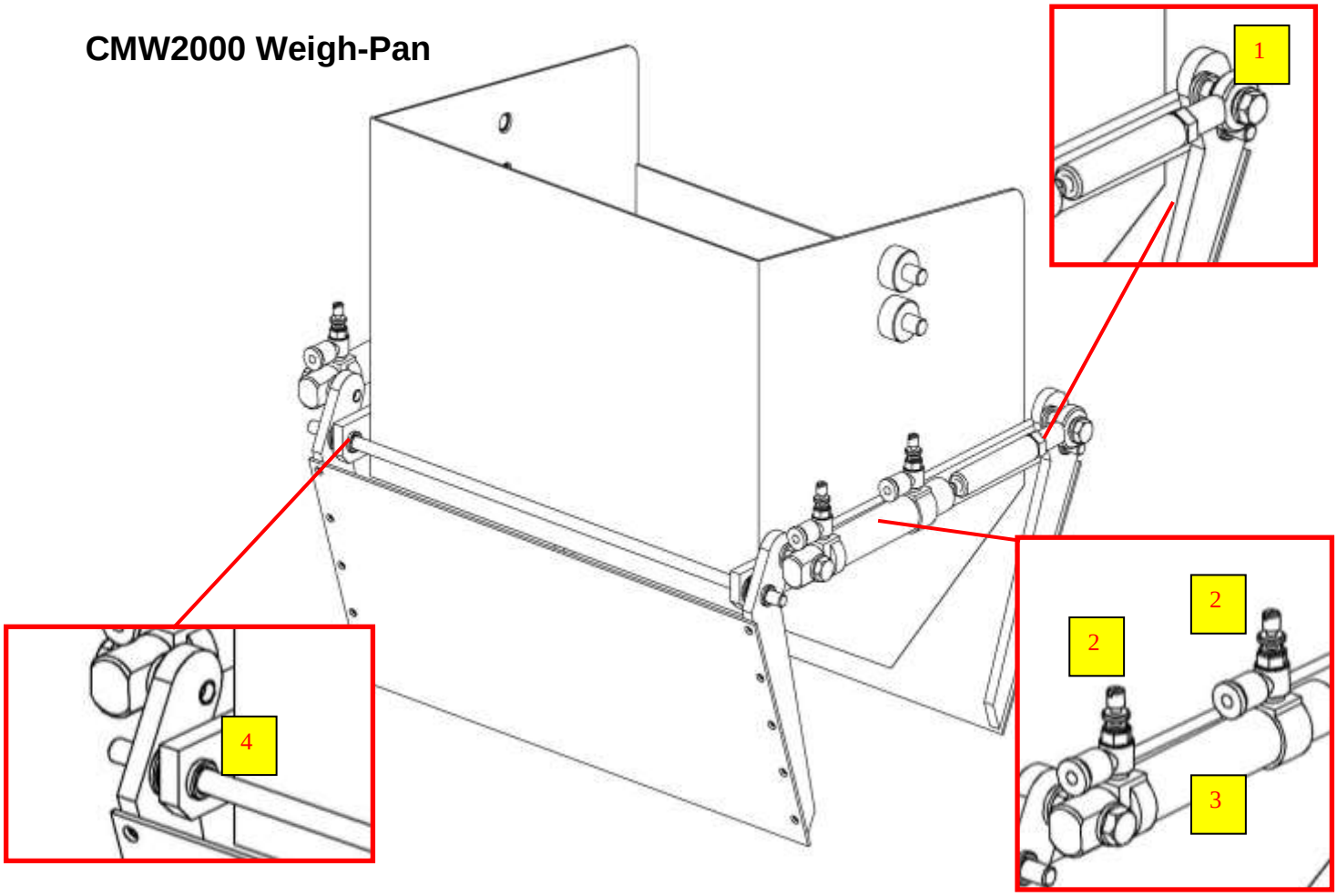
CMW2000
Maintenance Schedule

CMW2000 Weigh-Pan



Item	Description	Action	Interval
1	Rose-end Bearing	Check for Wear / Damage	Monthly
2	Speed Controller	Check Air flow Adjustment	Weekly
3	Cylinder	Check for Wear / Damage	Monthly
4	Oilite Bushes	Check for Wear / Damage	Monthly

(2) Speed Controller Adjustment, Clockwise to decrease airflow and slow the action of the weigh-pan lids, anticlockwise to increase airflow and speed up the action of the weigh-pan lids.

Adjust speed controllers to give a smooth open and close action of the weigh-pan lids

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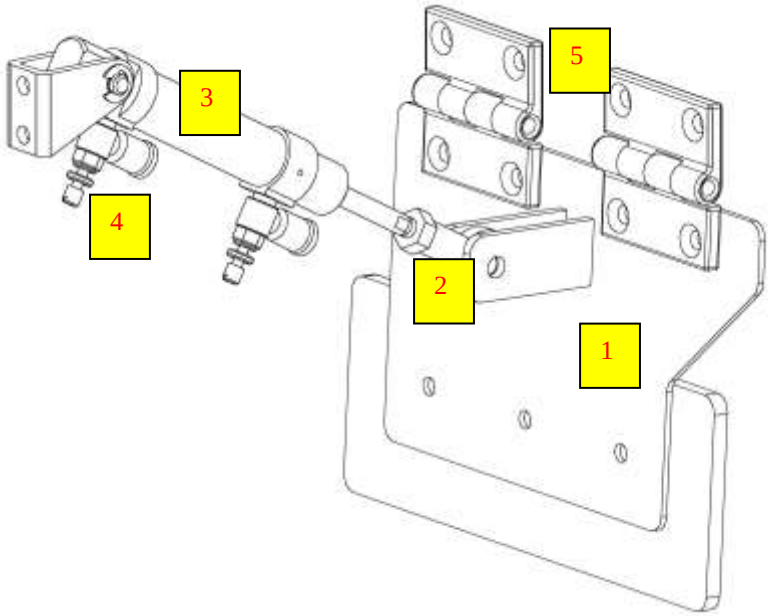
CMW2000
Maintenance Schedule

CMW2000 GATING



Item	Description	Action	Interval
1	Bulk Gate	Check for Wear / Damage	Monthly
2	Rose-end Bearing	Check for Wear / Damage	Monthly
3	Cylinder	Check for Leaks / Damage	Monthly
4	Speed Controllers	Check Air flow Adjustment	Weekly
5	Hinges	Check for Wear / Damage	Monthly

(4) Speed Controller Adjustment, Clockwise to decrease airflow and slow the action of the bulk gate, anticlockwise to increase airflow and speed up the action of the bulk / fine gates.
Adjust speed controllers to give a smooth open and close the action of the bulk / fine gates.

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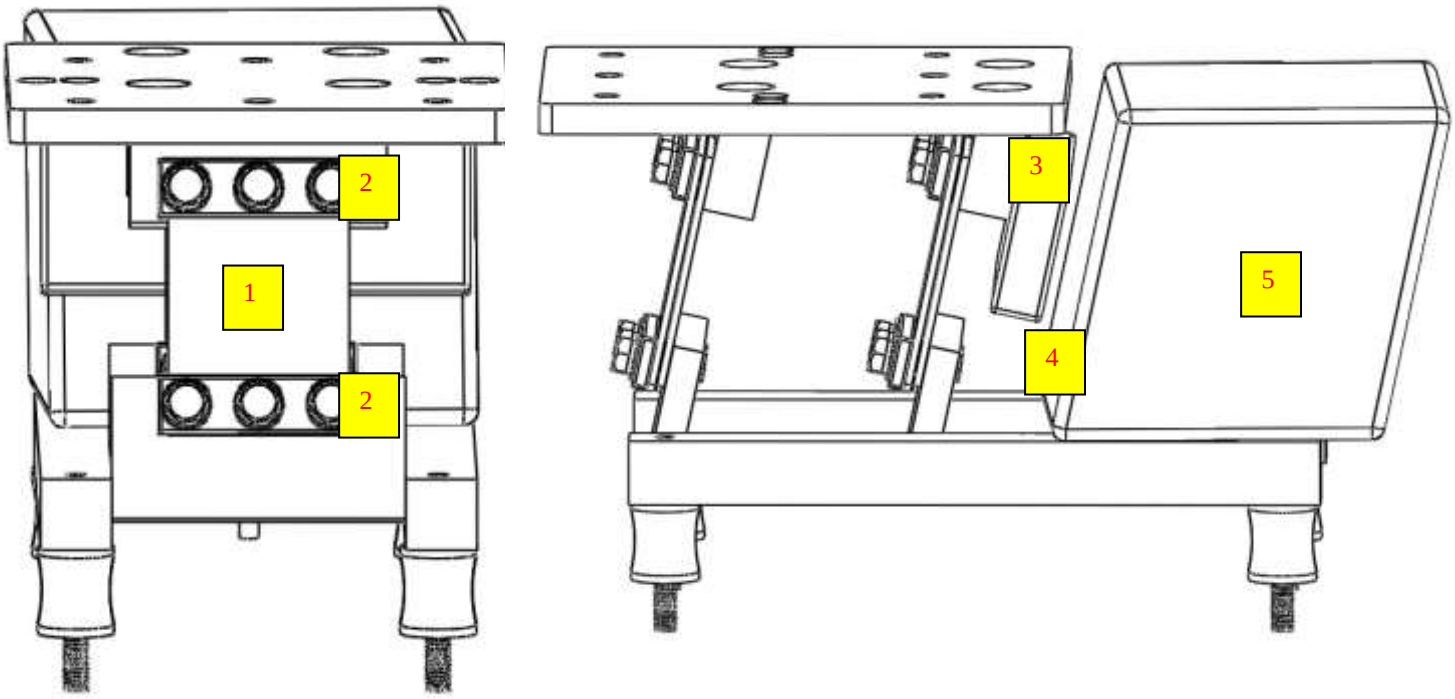
CMW2000
Maintenance Schedule

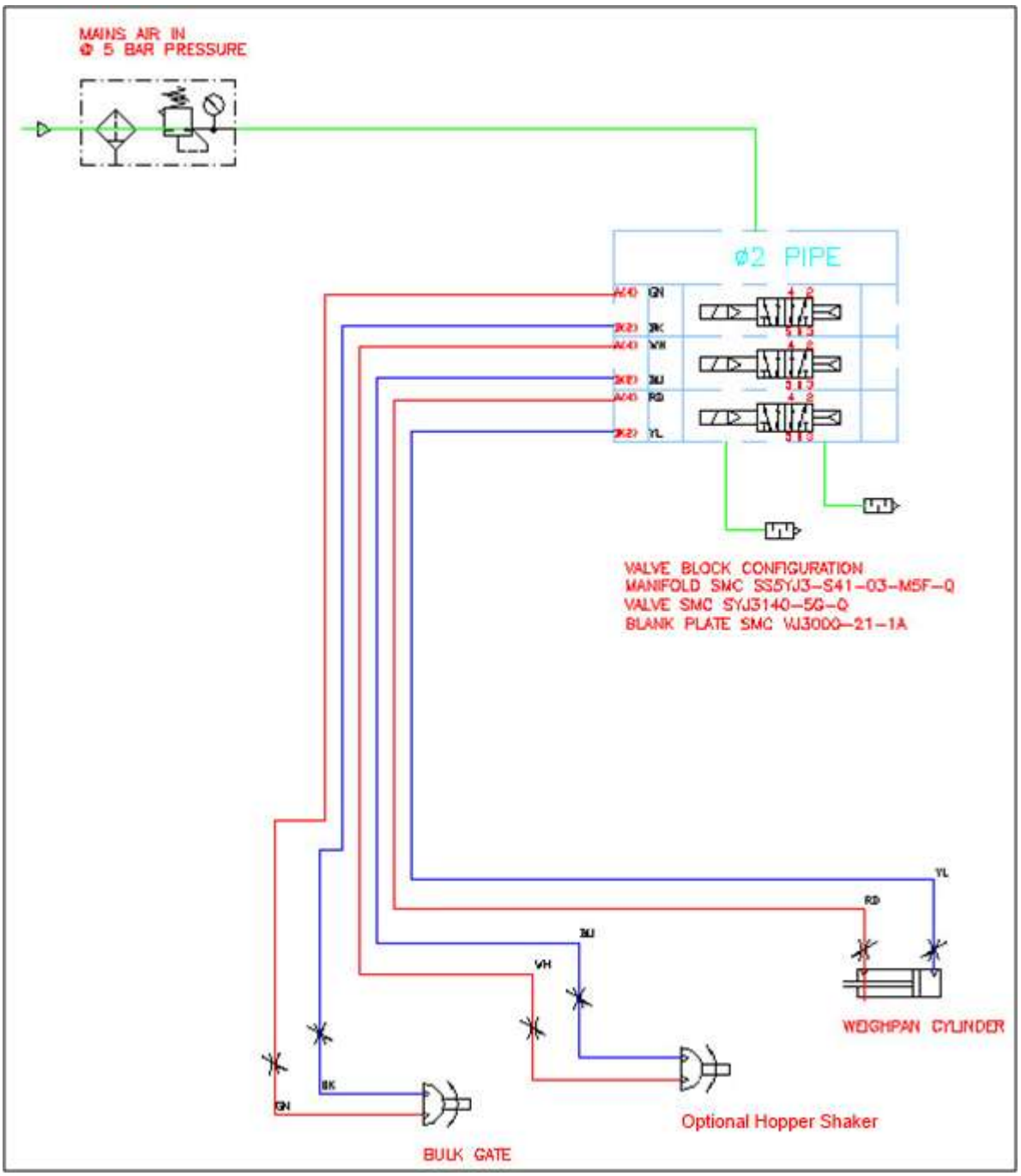
Vibrator



Item	Description	Action	Interval
1	Vibrator Spring	Check for Wear / Damage	3 Monthly
2	Vibrator Spring Retaining Bolts	Check Bolt Tension / Damage	Monthly
3	Vibrator Armature	Check for Damage	3 Monthly
4	Air Gap	Check Air Gap Adjustment (Approx 5 - 6mm)	3 Monthly
5	Vibrator Coil	Check for Damage	3 Monthly

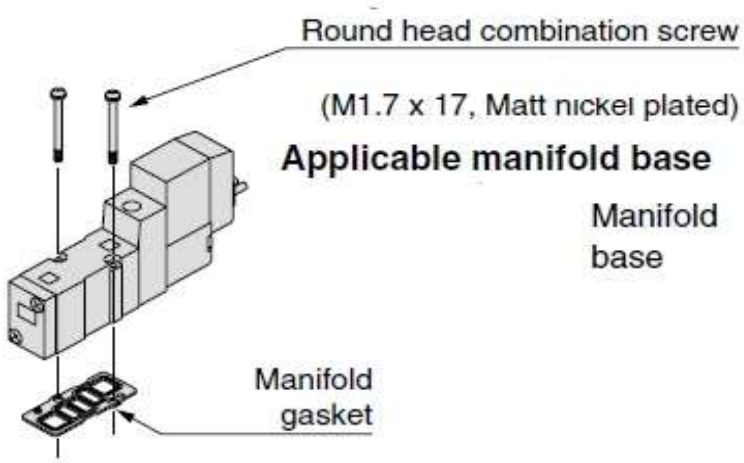
Pneumatics

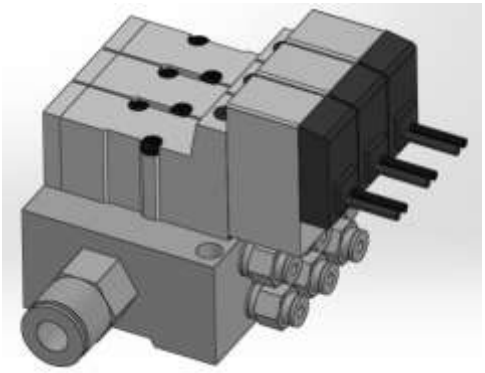
Pneumatic Circuit



Pneumatics

Solenoid Value Fitting





Valve model		Type of actuation		Port size 1, 5, 3 (P, EA, EB)	Port size 4, 2 (A, B)	Weight (g) Note 3, 4) Grommet	Weight (g) L/M plug connector	Weight (g) M8 connector	Effective area (mm^2)	Flow characteristics Note 2) 1→4/2 (P→A/B) C [dm³/(s·bar)]	b	Cv	Q[l/min(ANR)]	4/2→5/3 (A/B→EA/EB) C [dm³/(s·bar)]	b	Cv	Q[l/min(ANR)]
5 port Base mounted (with sub-plate)	SYJ314□	2 position	Single	M5	M5	62 (36)	63 (37)	67 (41)	—	0.46	0.36	0.12	122	0.46	0.35	0.12	121
	SYJ324□		Double			79 (53)	81 (55)	89 (63)									
	SYJ334□	3 position	Closed center			82 (56)	84 (58)	92 (66)	—	0.47	0.33	0.12	122	0.47	0.31	0.12	120
	SYJ344□		Exhaust center						—	0.36	0.39	0.10	97	0.59 [0.40]	0.43 [0.33]	0.16 [0.11]	164[104]
	SYJ354□		Pressure center						—	0.58 [0.32]	0.42 [0.33]	0.16 [0.060]	160[83]	0.46	0.32	0.11	118

Base Mounted

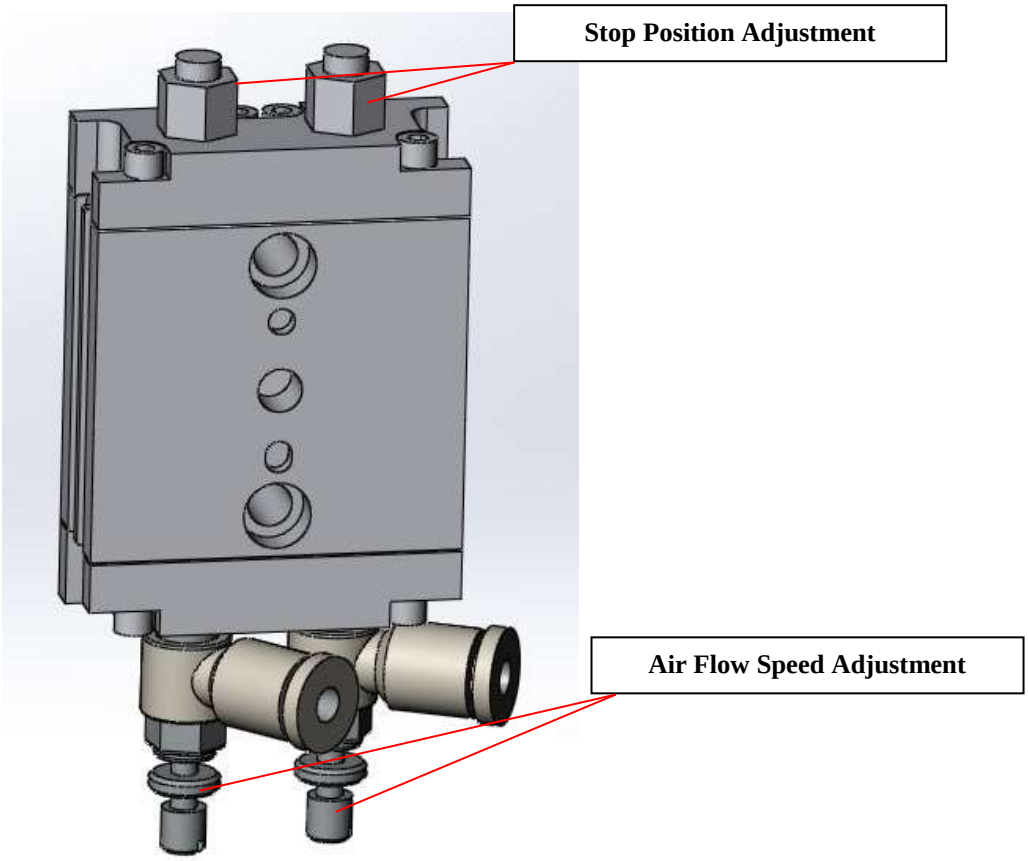
Series	Average speed (mm/s)	Bore size: Series CJ2 Pressure 0.5 MPa Load rate: 50% Stroke 60 mm — ø6	ø10	ø16	Series CM2 Pressure 0.5 MPa Load rate: 50% Stroke 300 mm — ø20	ø25	ø32	ø40
SYJ3140-M5	800							
	700							
	600							
	500							
	400							
	300							
	200							
	100							
	0							

Perpendicular, upward actuation
Horizontal actuation

- Cylinder is in extending. Speed controller is meter-out, which is directly connected with cylinder and its needle is fully opened.
- Average speed of cylinder is obtained by dividing the full stroke time by the stroke.
- Load factor: ((Load weight x 9.8) /Theoretical force) x 100%

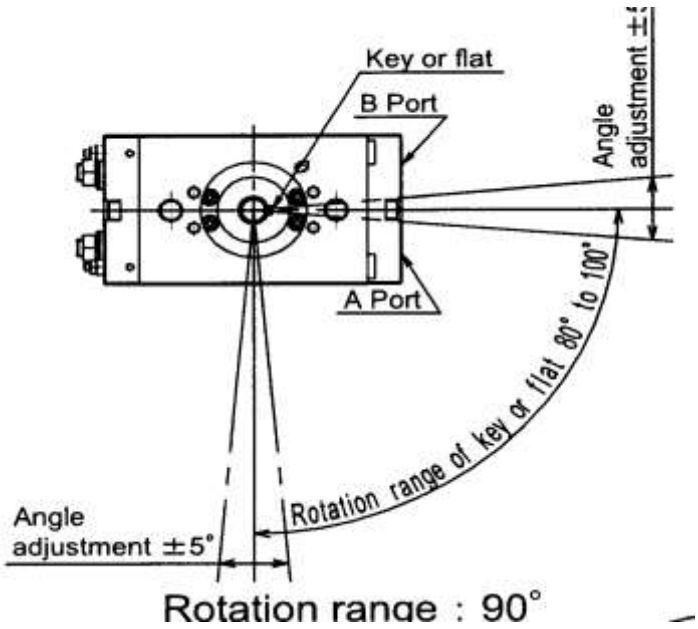
Pneumatics

Rotary Actuator



3 Rotation range

When pressurized from the Port A, the shaft will rotate clockwise.
Flat face and parallel key position indicate B port is pressurized.



Pneumatics

Rotary Actuator

1-1 Specification

Table 1 Specification-1

Size	10	15	20	30	40
Operating fluid	Air (Non-lube)				
Max. operating pressure	0.7 MPa		1 MPa		
Min. operating pressure	0.15 MPa		0.1 MPa		
Ambient temp. and operating fluid temp.	0~60℃ (No freeze)				
Cushion	Rubber cushion		No. Air cushion		
Angle adjustment	±5°				
Rotation angle	80° ~100° 、170° ~190° 、350° ~370°				
Port size	M5×0.8		Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8		
Supporting style	Basic type				
Output(N·m)	0.3	0.75	1.8	3.1	5.3

Table 2 Specification-2

Size	Allowable kinetic energy			Cushion angle	Safe adjustment range of rotating time
	Allowable kinetic energy (mJ)				
	No air cushion	Rubber cushion	Air cushion		Rotation time (s/90°)
10	–	0.25	–	–	0.2~0.7
15	–	0.39	–	–	0.2~0.7
20	25	–	120	40°	0.2~1
30	48	–	250	40°	0.2~1
40	81	–	400	40°	0.2~1

Allowable kinetic energy of cushion type is the max. adsorbing energy when the cushion needle adjustment is optimum. Operation with the speed lower than adjustment range lead to cause stick clip or termination of operation.

Table 3 Specification-3

Size	Weight (g)			Internal capacity (cm^3)		
	90°	180°	360°	90°	180°	360°
10	120	150	200	1.2	2.2	4.3
15	220	270	380	2.9	5.5	10.7
20	600	700	1000	7.1	13.5	26.3
30	900	1100	1510	12.1	22.9	44.7
40	1400	1600	2280	20.5	39	76

Technical Details

CMW2000	(Typical Machine)
Power Requirements	230 Vac 1 Phase 50 Hz 5 Amp 1150 w – 1 Kw – 1 kVA.
Air Consumption	Approximately 15 Litres per Minute @ 5 Bar (60 PSI)
Approximate Dimensions	L 900mm W 375mm H 800mm
Weight	80 Kg

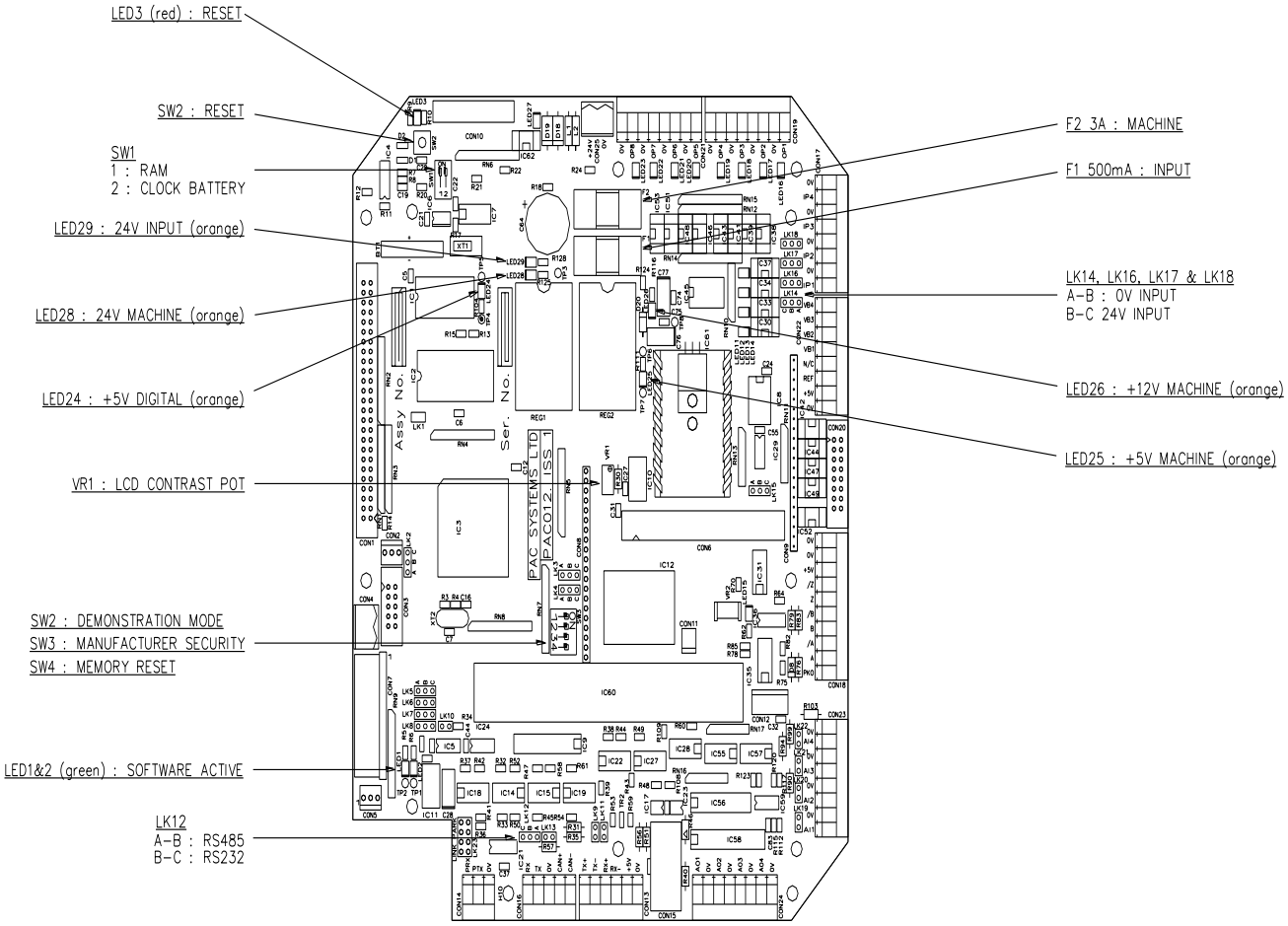
The above machinery complies with the essential health and safety requirements of the Machinery Directive 2006/42/EC and the protection requirements of the Electromagnetic Compatibility Directive 2004/108/EC

This machinery has been designed and manufactured in accordance with the following transposed harmonised European standards

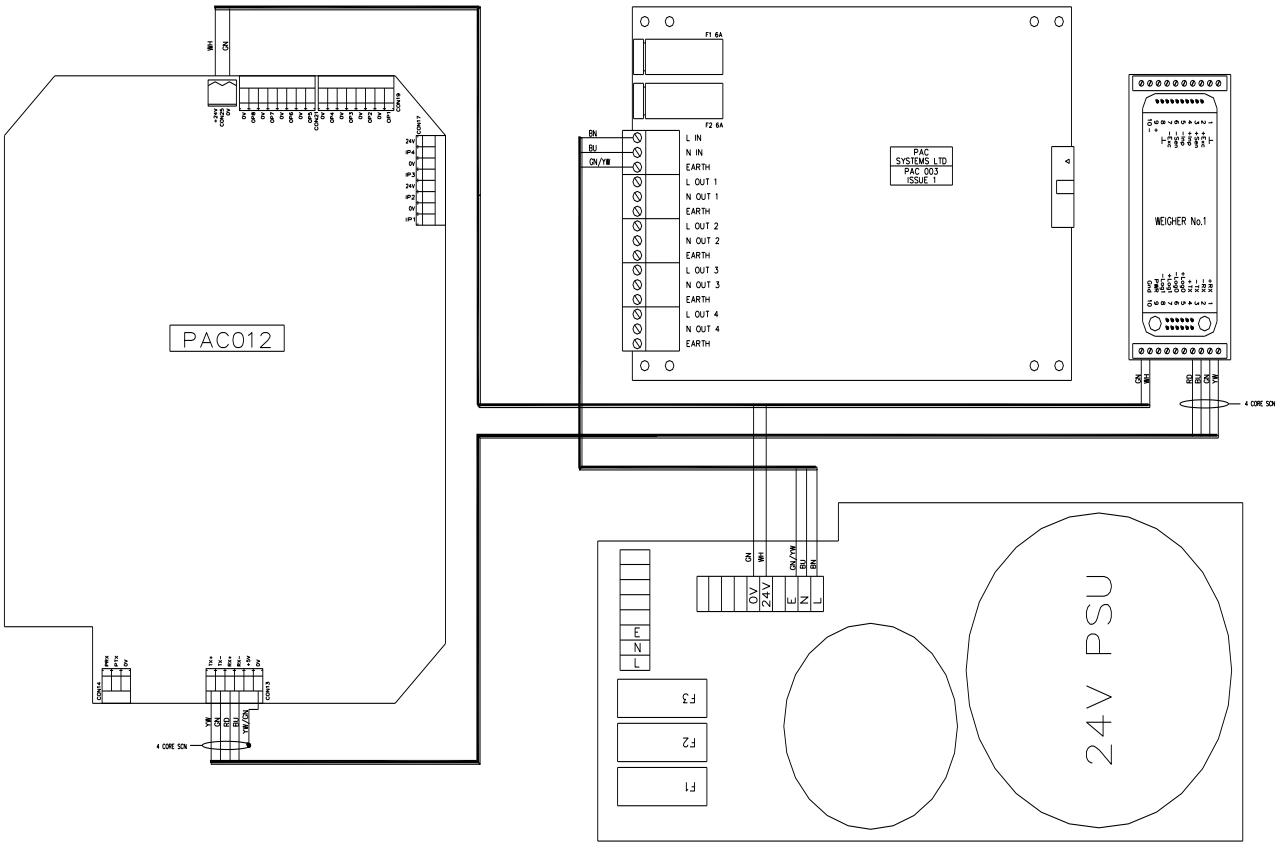
BS EN ISO 12100:2010 safety of machinery – basic concepts, general principles for design.
EN ISO 13857:2008 safety of machinery – safety distances to prevent danger zones being reached by the upper limbs
EN349:1993+A1 2008 safety of machinery – minimum gaps to avoid crushing of parts of the body
EN13850:2005 + BS EN 60947-5-5 safety of machinery – emergency stop equipment, functional aspects – principles for design
BS EN 60204-1:2006 + A1 2009 safety of machinery – electrical equipment of machines – specification for general requirements
NEN-EC-IEC 61000-6-4: 2007:Generic Emissions standard and Generic Immunity standard:
Industrial environments

In addition this machinery has been designed and manufactured in accordance with:
British Standard PD 5304:2005 Safety of Machinery
The Plastics Materials and Articles in contact with Food Regulations 2011

ELECTRICAL DRAWINGS



ELECTRICAL DRAWINGS



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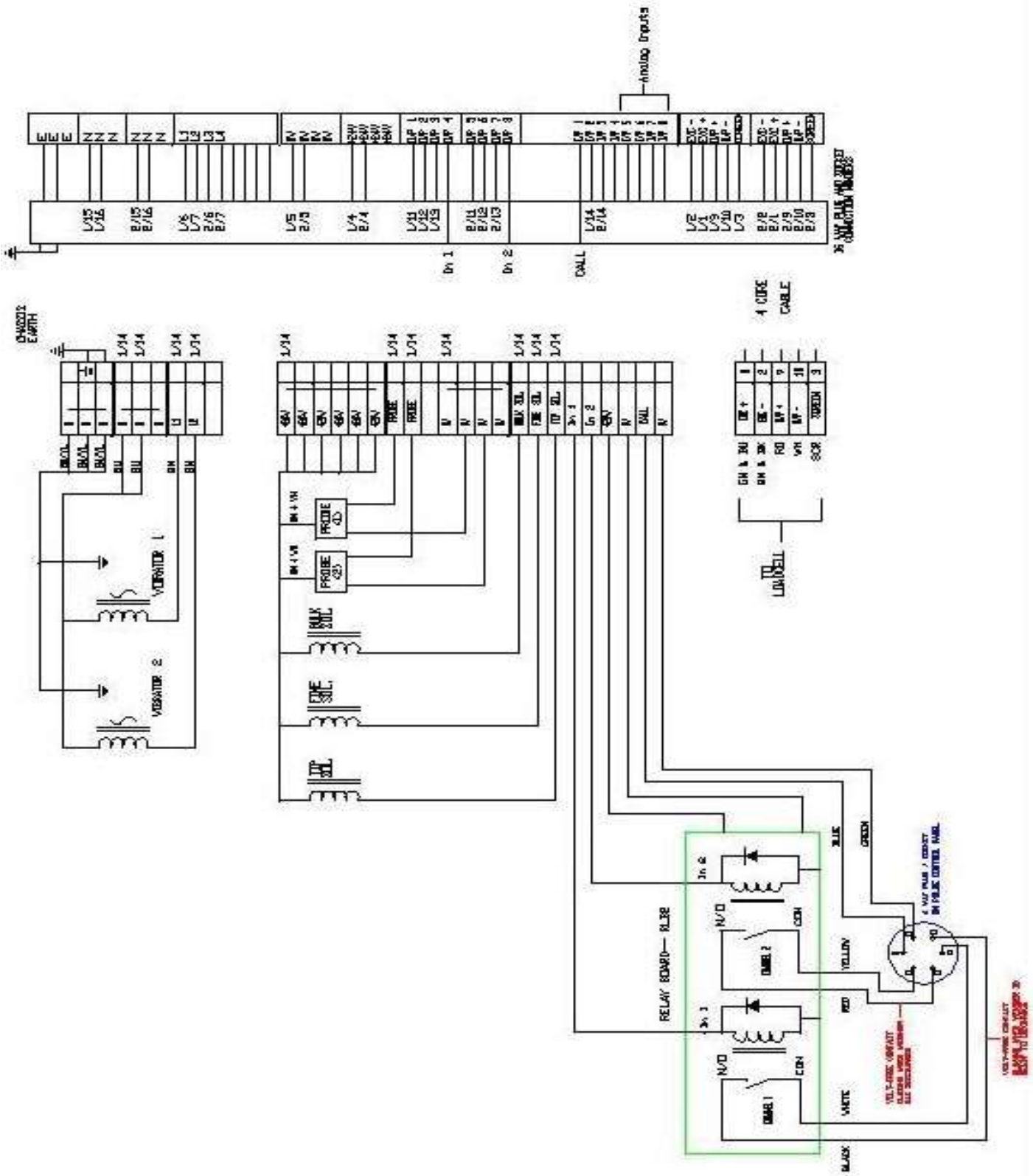

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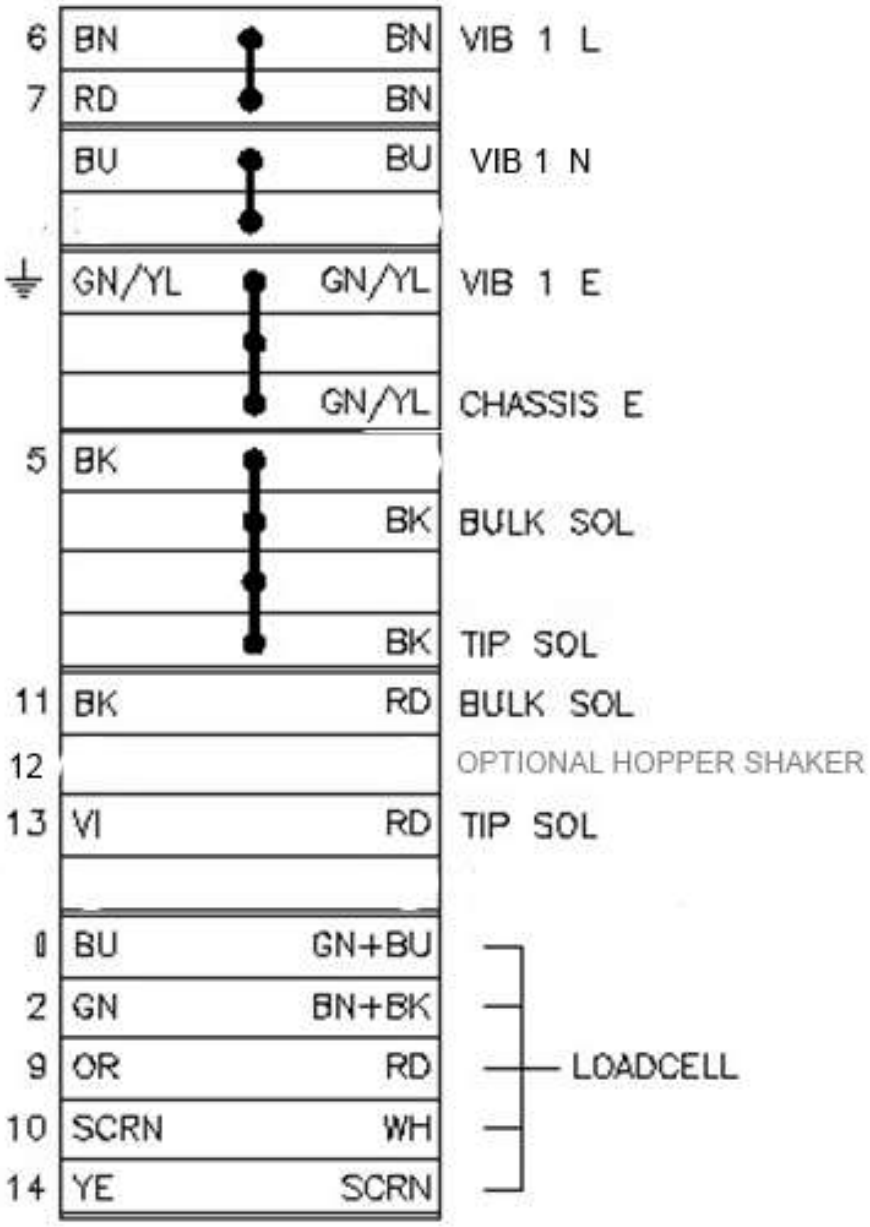

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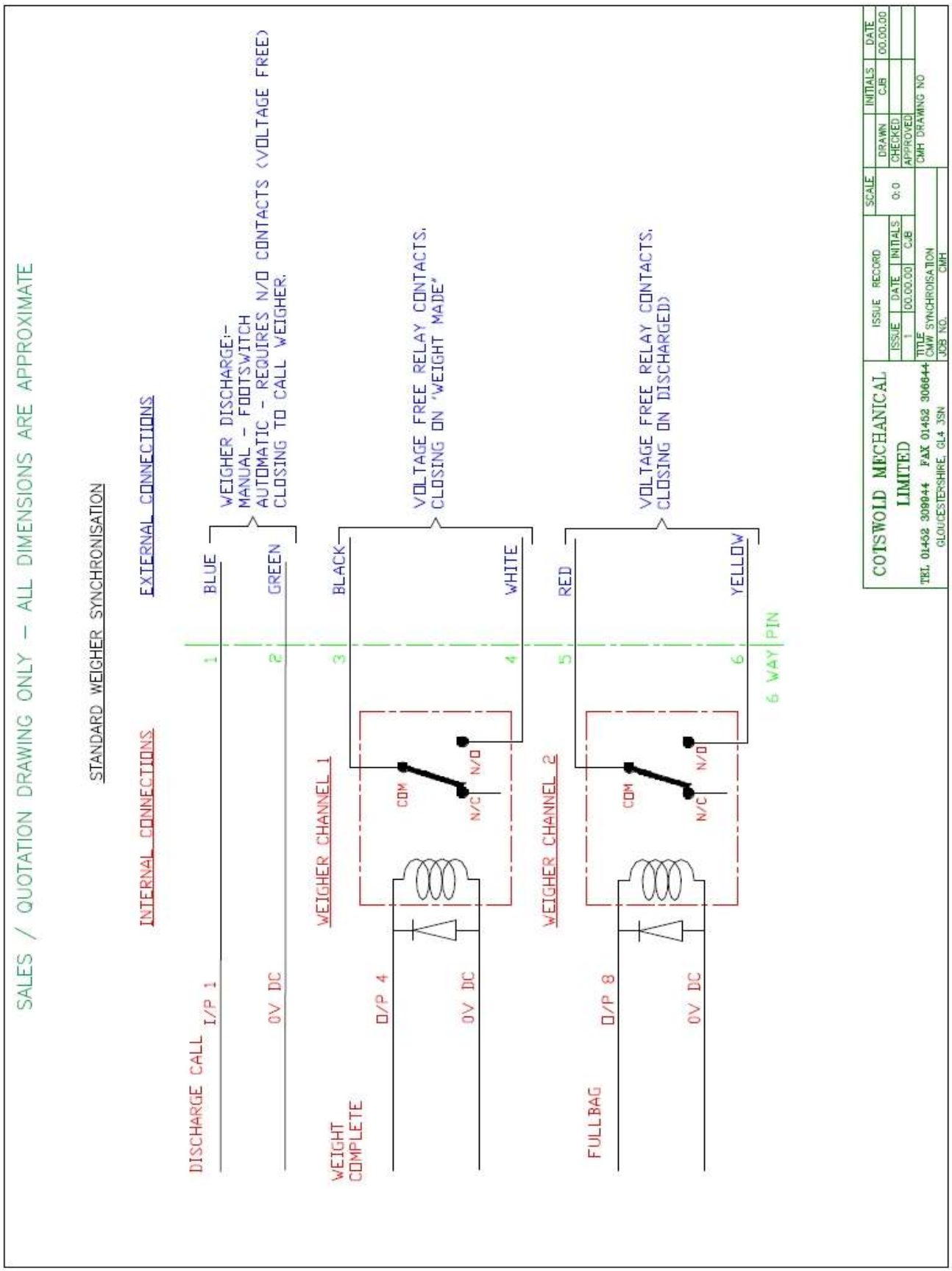


CMW CONTROL (WITH 16 WAY CONNECTORS)

16 WAY CONNECTOR

1 LOADCELL	(BU)
2 LOADCELL	(GN)
3 LOADCELL	(SCRN)
4 +24 VDC	(RD)
5 0 VDC	(BK)
6 LINE 1 VIB L (FRONT)	(BN)
7 LINE 1 VIB L (REAR)	(RD)
8 SPARE	
9 LOADCELL	(RD)
10 LOADCELL	(YL)
11 BULK O/P 1	(WH/BK)
12 FINE O/P 2	(YL)
13 TIP O/P 3	(VI)
14 PROBE I/P 2	(BN)
15 VIBRATOR FRONT N	(BU)
16 VIBRATOR REAR N	(BK)
⏚ ALL POINTS - VIBRATORS & CHASSIS	(GN/YL) ⏚

3 WAY CONNECTOR

1 = SUPPLY LIVE	(BN)
2 = SUPPLY NEUTRAL	(BU)
3 = SUPPLY EARTH	(GN/YL)

6 WAY CONNECTOR

1 CALL I/P 1	(BU)	CALL
2 0 VDC (CONN 17)	(GN)	
3 RELAY 1 21	(BK)	WEIGHT READY (O/P 4 & 0 VDC CONN 19)
4 RELAY 1 24	(WH)	
5 RELAY 2 21	(RD)	(FULLBAG) (O/P 8 & 0 VDC CONN 21)
6 RELAY 2 24	(YL)	

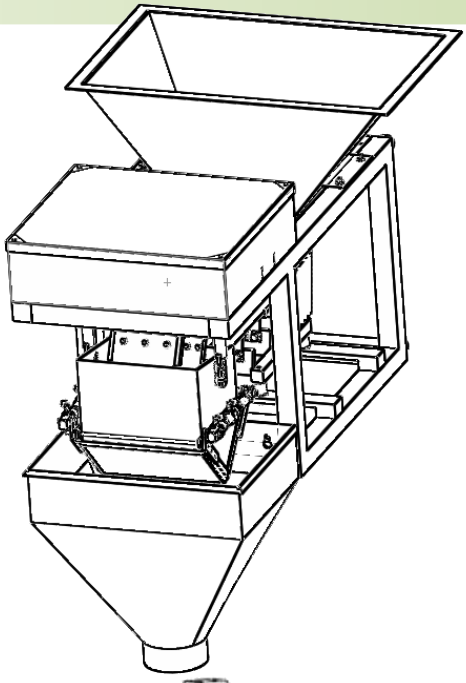
COTSWOLD MECHANICAL LIMITED
TEL 01452 309944 FAX 01452 306644
GLOUCESTERSHIRE, GL4 3SN

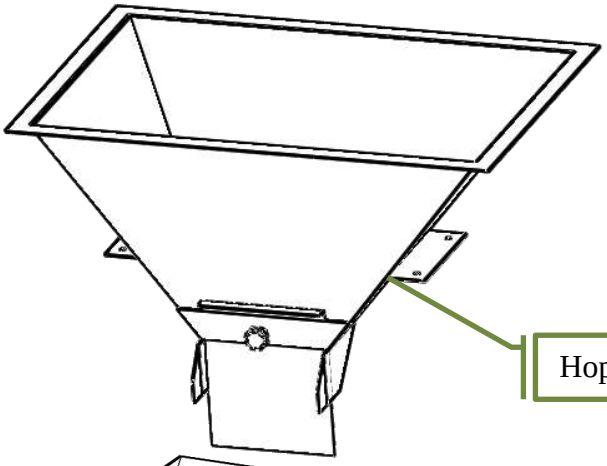
ISSUE RECORD			SCALE
ISSUE	DATE	INITIALS	0:0
$	00.00.00	T.G.H	

TITLE
JOB NO. CMH

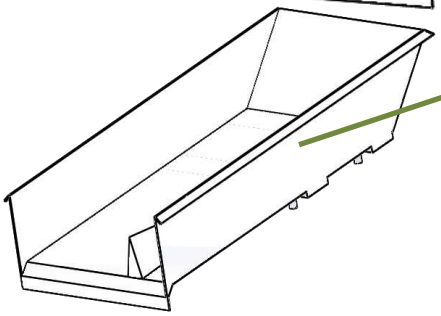
	INITIALS	DATE
DRAWN	T.G.H	00.00.00
CHECKED		
APPROVED		

CMH DRAWING NO
$

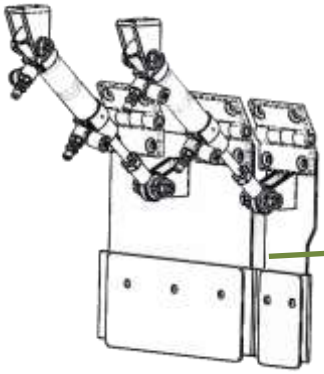




Hopper

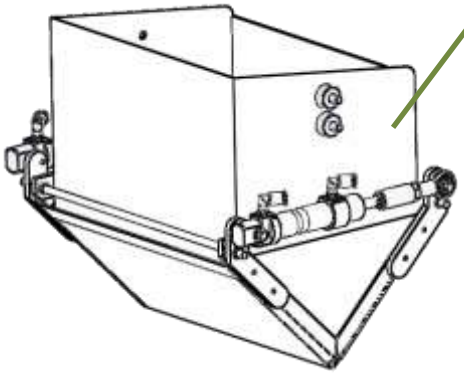


Vibrator Tray

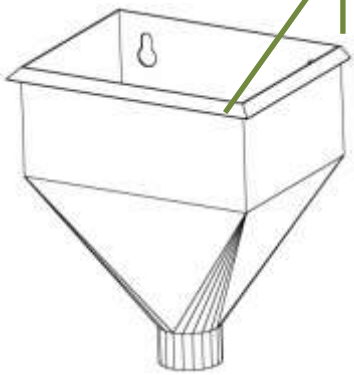


Gating

Weighpan

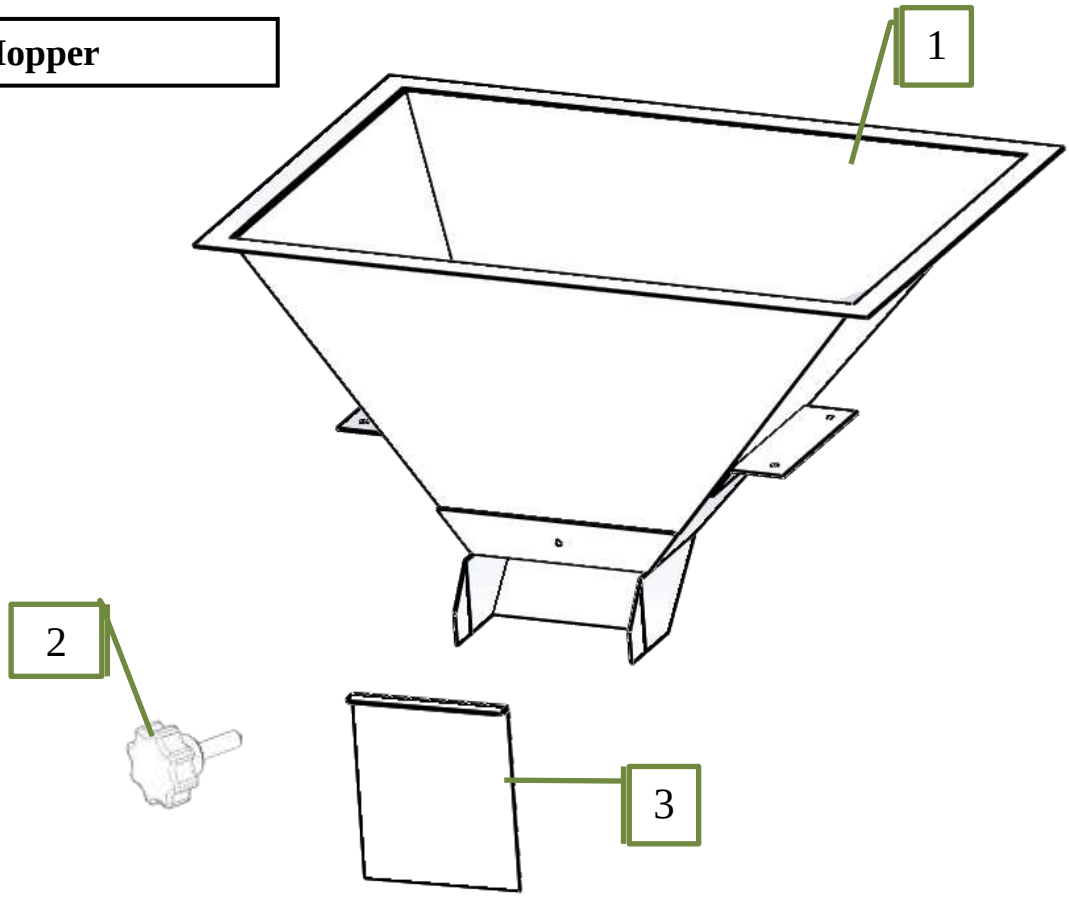


Outlet Chute



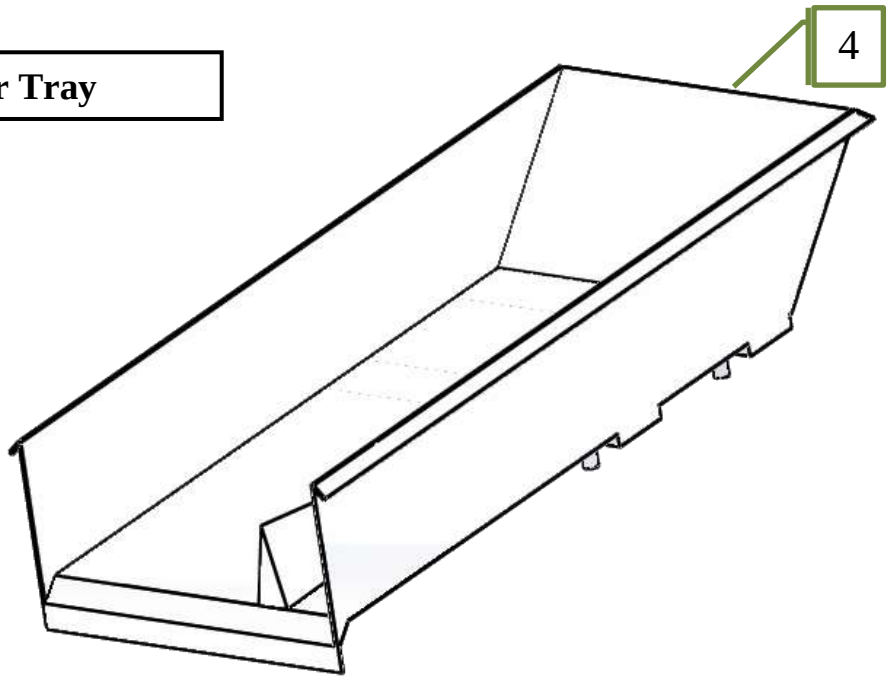
CONTACT PARTS

Hopper



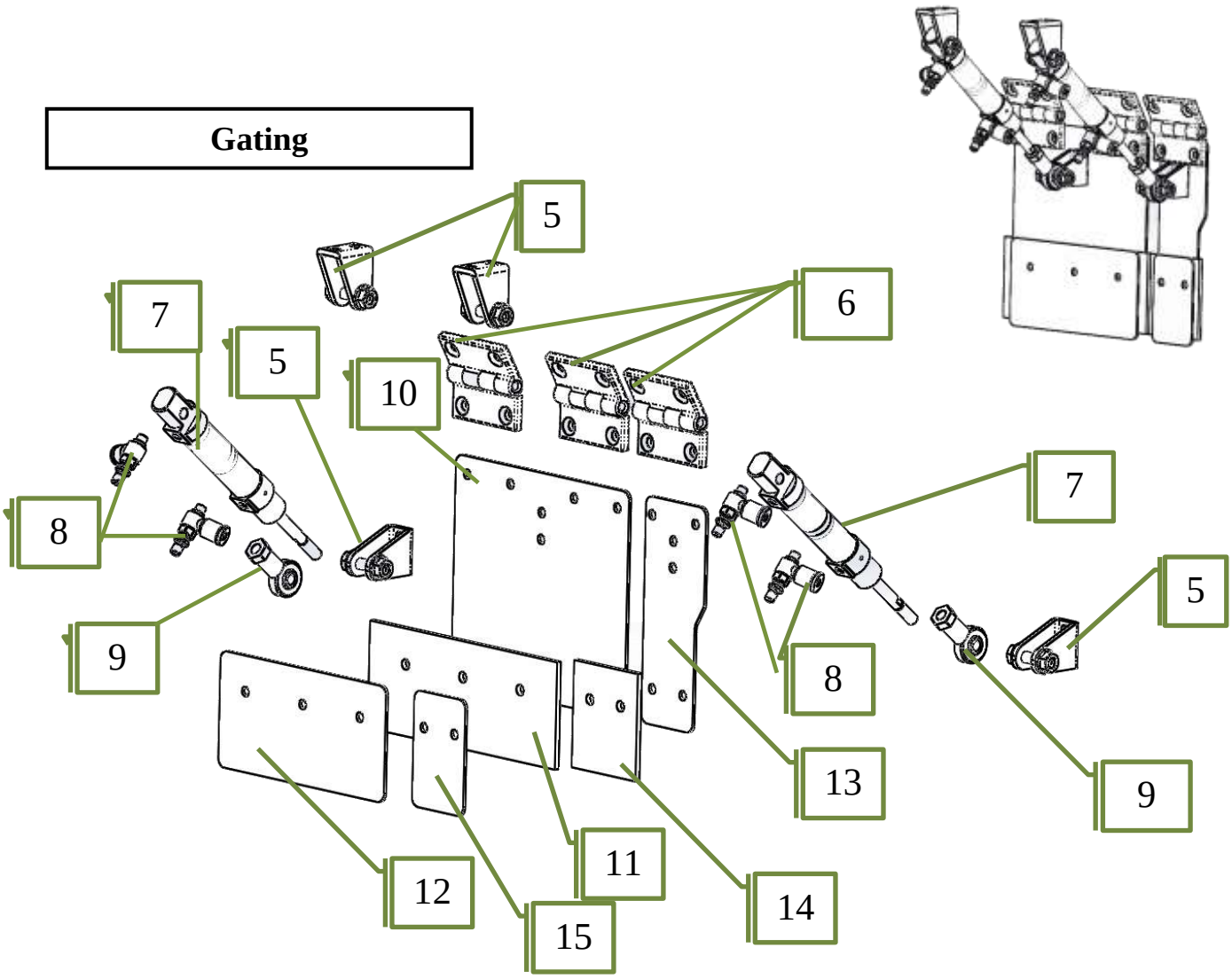
CMW2000-1	Hopper	Quantity Fitted	1
CMW2000-2	M6 Hand Wheel	Quantity Fitted	1
CMW2000-3	Hopper Gate	Quantity Fitted	1

Vibrator Tray



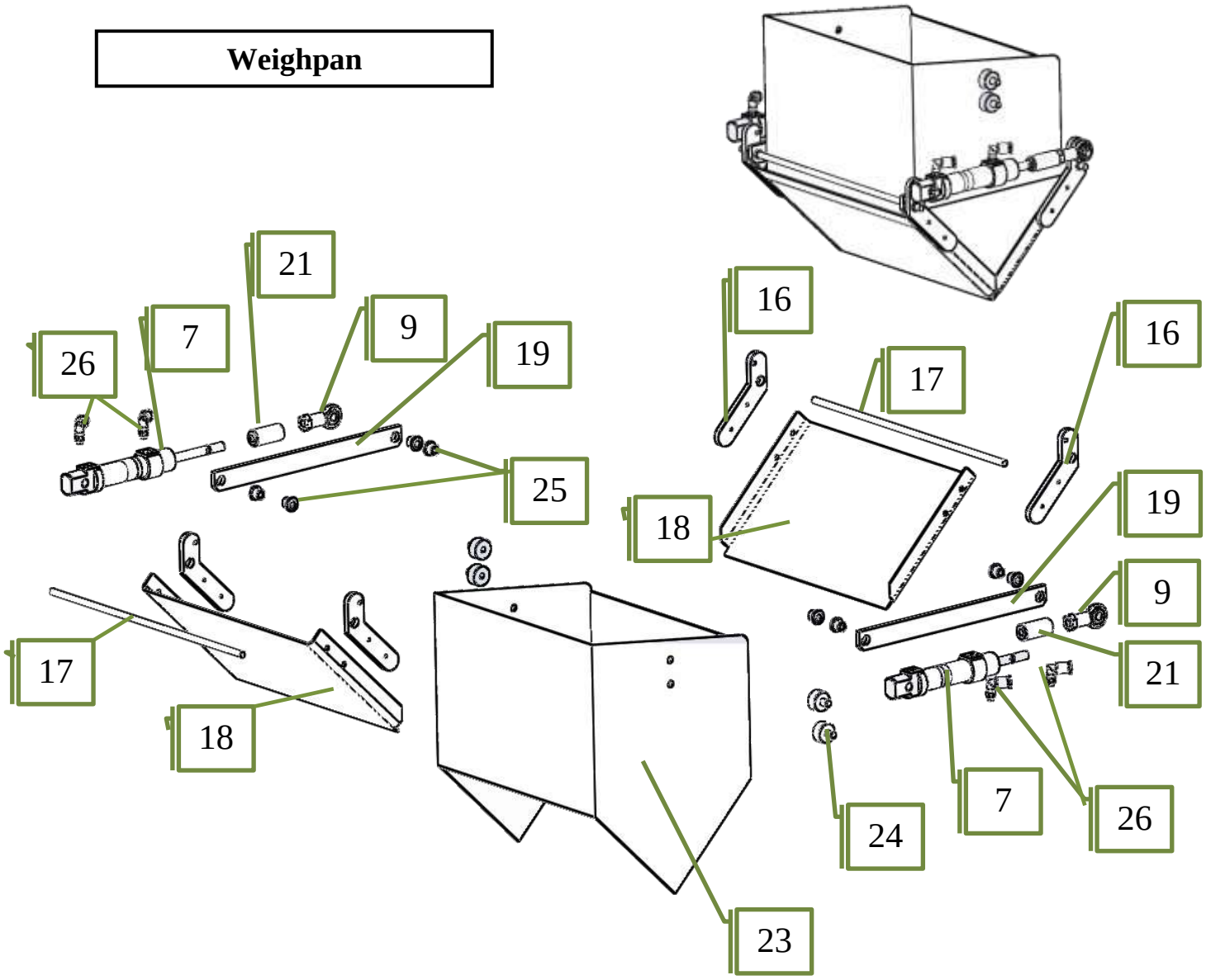
CMW2000-4	Rear Vibrator Tray	Quantity Fitted	1

Gating



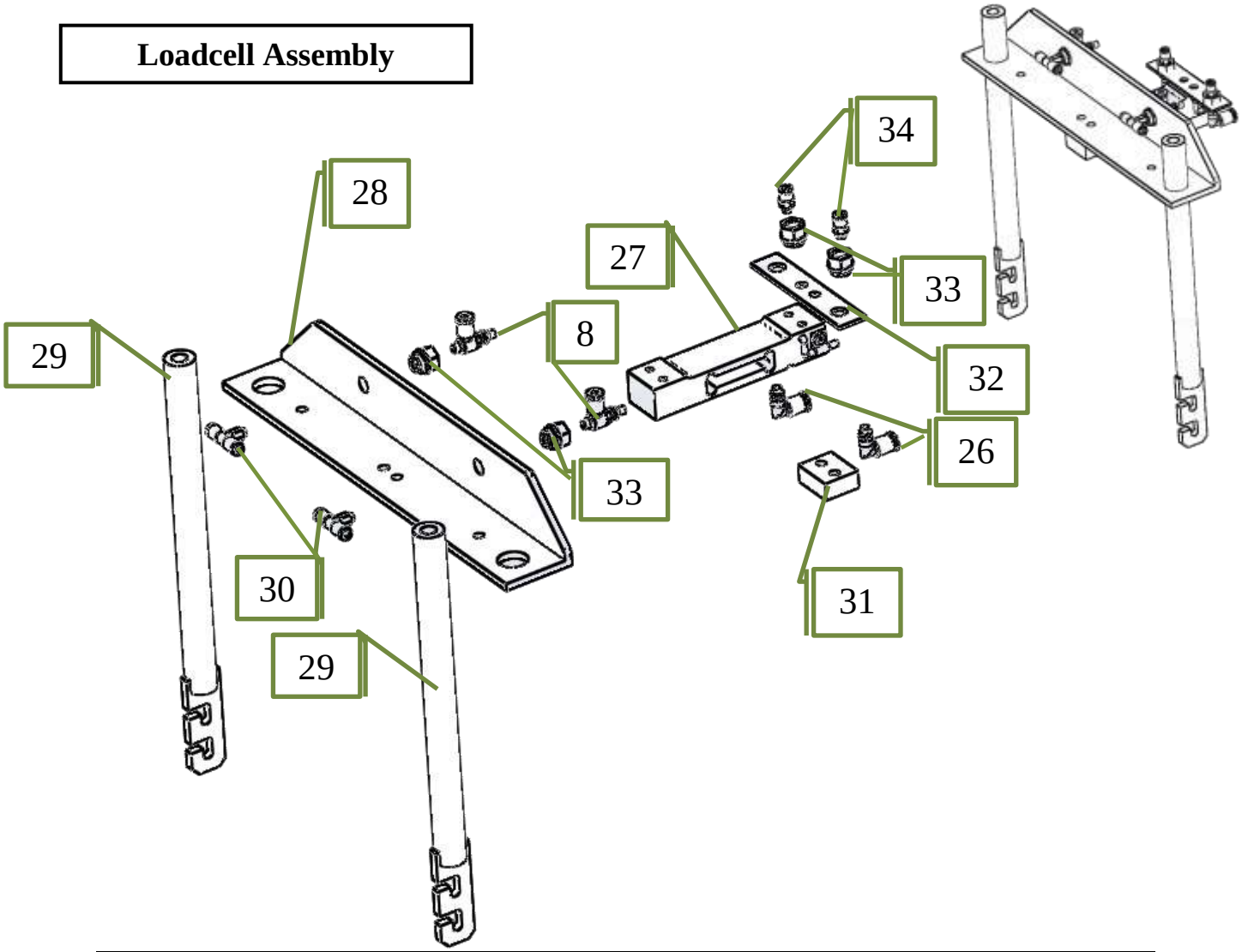
CMW2000-5	Clevis Cylinder Mount	Quantity Fitted	4
CMW2000-6	Hinge	Quantity Fitted	3
CMW2000-7	Cylinder	Quantity Fitted	2
CMW2000-8	Speed Controller	Quantity Fitted	4
CMW2000-9	Cylinder Rod End	Quantity Fitted	2
CMW2000-10	Bulk Gate Plate	Quantity Fitted	1
CMW2000-11	Bulk Gate Rubber	Quantity Fitted	1
CMW2000-12	Bulk Gate Rubber Clamp Plate		1
CMW2000-13	Fine Gate Plate		1
CMW2000-14	Fine Gate Rubber		1
CMW2000-15	Fine Gate Rubber Clamp Plate		1

Weighpan



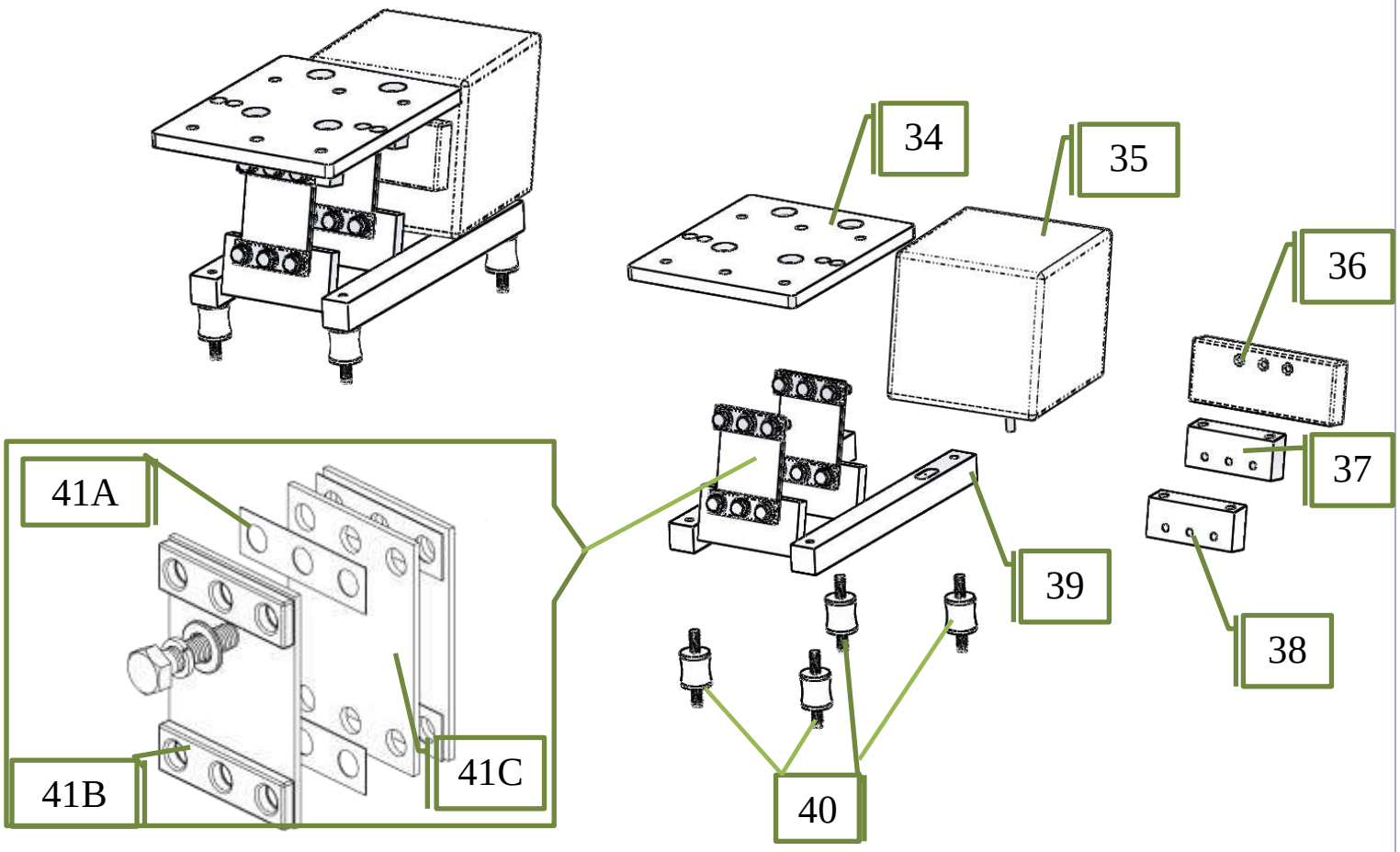
CMW2000-16	Lid Mounting Bracket	Quantity Fitted	4
CMW2000-17	Weigh Pan Spindle	Quantity Fitted	2
CMW2000-18	Weigh Pan Lid	Quantity Fitted	2
CMW2000-19	Weigh Pan Side Bar	Quantity Fitted	2
CMW2000-7	Weighpan Cylinder	Quantity Fitted	2
CMW2000-21	Weigh Pan Cylinder extension	Quantity Fitted	2
CMW2000-9	Cylinder Rod End	Quantity Fitted	2
CMW2000-23	Weigh Pan Body	Quantity Fitted	1
CMW2000-24	Weigh Pan Spacer	Quantity Fitted	4
CMW2000-25	Flanged Bush	Quantity Fitted	8
CMW2000-26	Swivel Elbow	Quantity Fitted	4

Loadcell Assembly



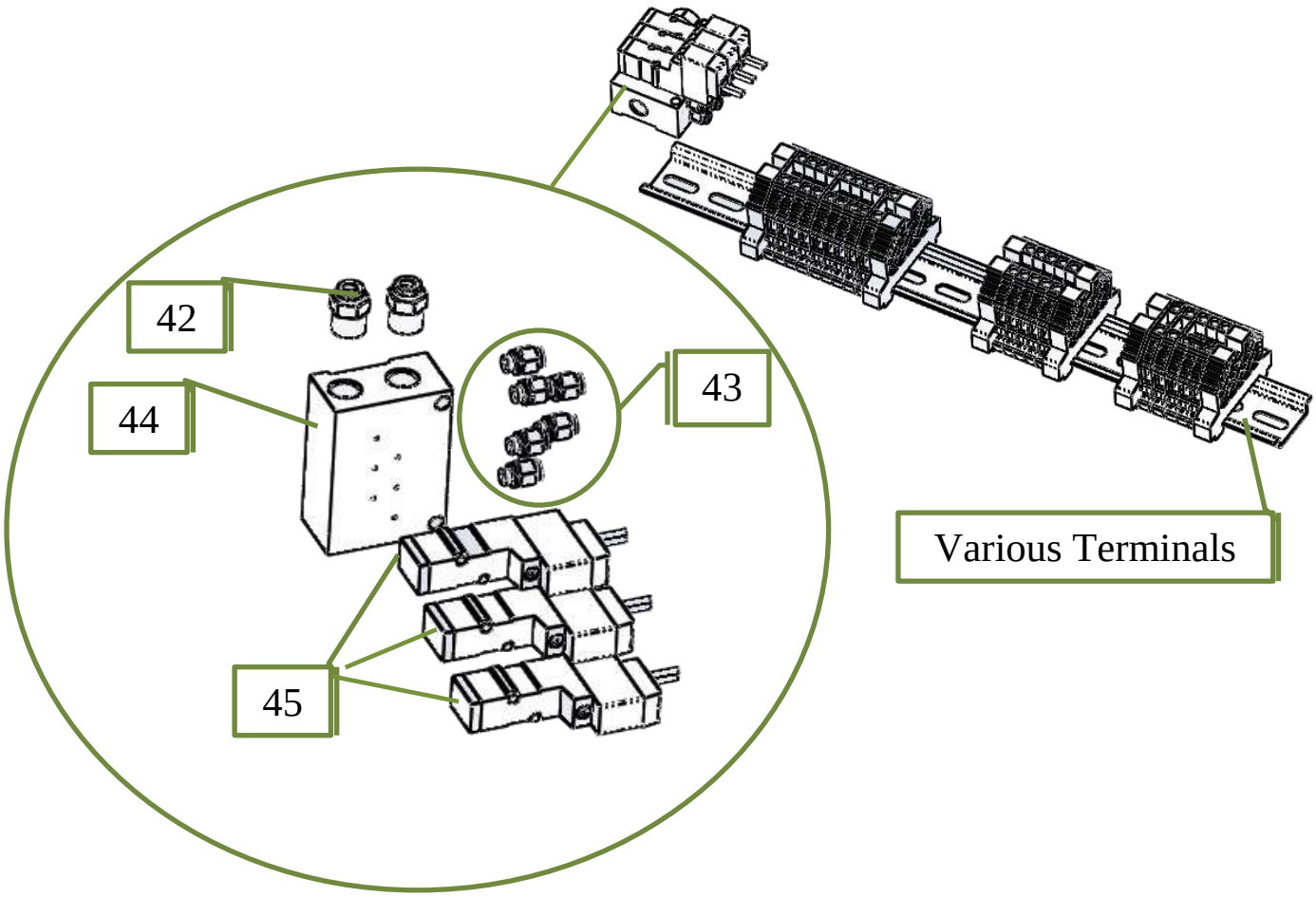
CMW2000-8	Speed Controller	Quantity Fitted	2
CMW2000-26	Swivel Elbow	Quantity Fitted	2
CMW2000-27	Load-cell	Quantity Fitted	1
CMW2000-28	Load-cell Cross Bar	Quantity Fitted	1
CMW2000-29	Weigh Pan Hanger Bar	Quantity Fitted	2
CMW2000-30	M5-4mm Tee	Quantity Fitted	2
CMW2000-31	Loadcell Spacer	Quantity Fitted	1
CMW2000-32	Load-cell Fitting Support	Quantity Fitted	1
CMW2000-33	M10-M5 Thread Adaptor	Quantity Fitted	4
CMW2000-34	M5-4mm Straight Fitting	Quantity Fitted	2

Vibrator Assembly



CMW2000-34	Top Plate	Quantity Fitted	1
CMW2000-35	V1 Coil	Quantity Fitted	1
CMW2000-36	V1 Armature	Quantity Fitted	1
CMW2000-37	Upper Spring Block Rear	Quantity Fitted	1
CMW2000-38	Upper Spring Block Front	Quantity Fitted	1
CMW2000-39	V1 Base Frame	Quantity Fitted	1
CMW2000-40	Anti-Vibration Rubber	Quantity Fitted	4
CMW2000-41A	Spring Spacer	Quantity Fitted	Varies
CMW2000-41B	Spring Clamp Bar	Quantity Fitted	4
CMW2000-41C-7	V1 Spring 7ply	Quantity Fitted	Varies
CMW2000-41C-9	V1 Spring 9ply	Quantity Fitted	Varies
CMW2000-41C-11	V1 Spring 11ply	Quantity Fitted	Varies

Top Box Terminals



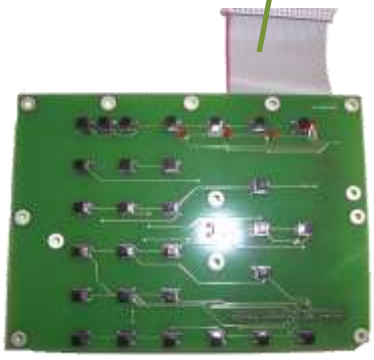
CMW2000-42	Silencer (1/8”)	Quantity Fitted	2
CMW2000-43	STRIGHT MALE ADAPTOR (4mm/M5)	Quantity Fitted	6
CMW2000-44	MANIFOLD (3 STATION)	Quantity Fitted	1
CMW2000-45	SOLENOID VALVE(SYJ3140-5G)	Quantity Fitted	3

ELECTRONICS

CMWC-12

CMWC-20

CMWC-LCD

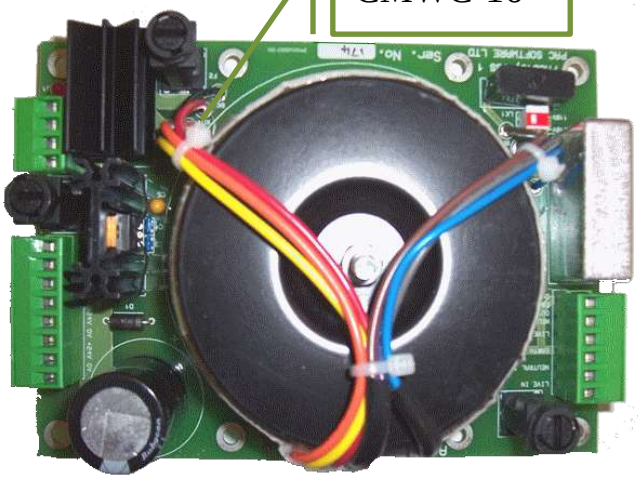


CMWC-15

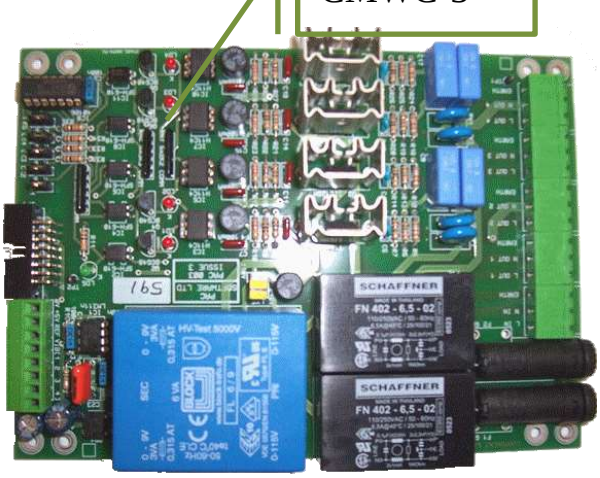
CMWC-12	Main I/O Board	Quantity Fitted	1
CMWC-20	Load-cell Digitiser	Quantity Fitted	Varies
CMWC-LCD	Back Light LCD	Quantity Fitted	1
CMWC-15	Key Pad & Connector	Quantity Fitted	1

ELECTRONICS

CMWC-16

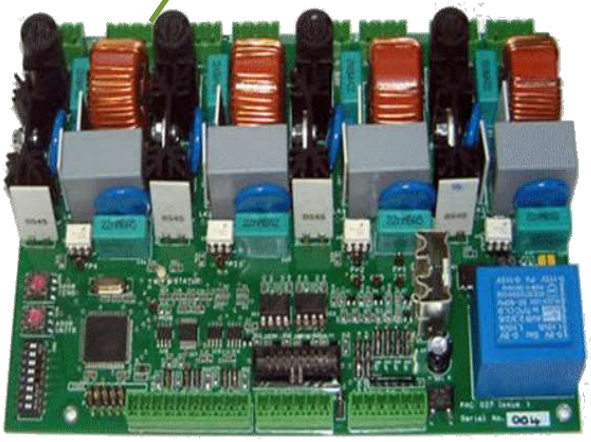


CMWC-3



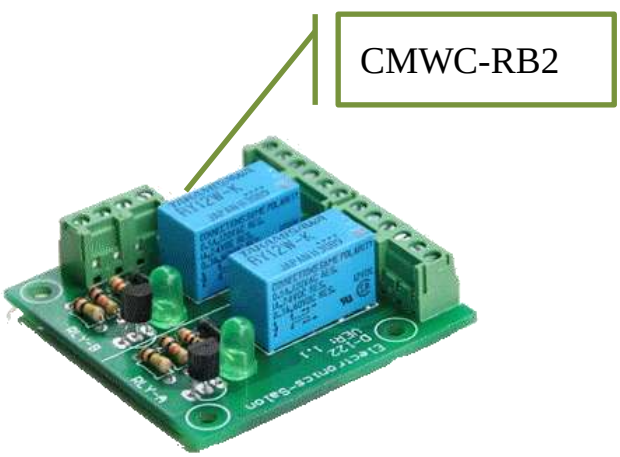
CMWC-31

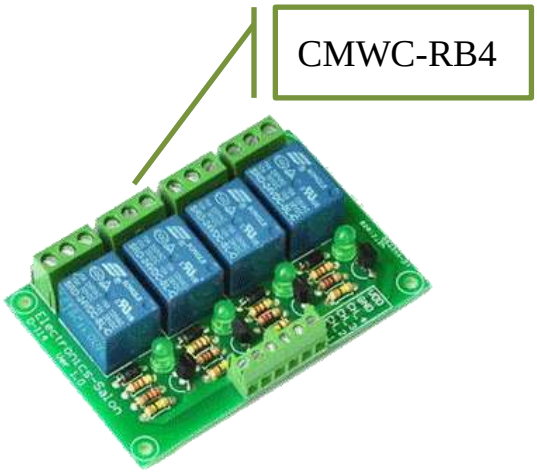
CMWC-37

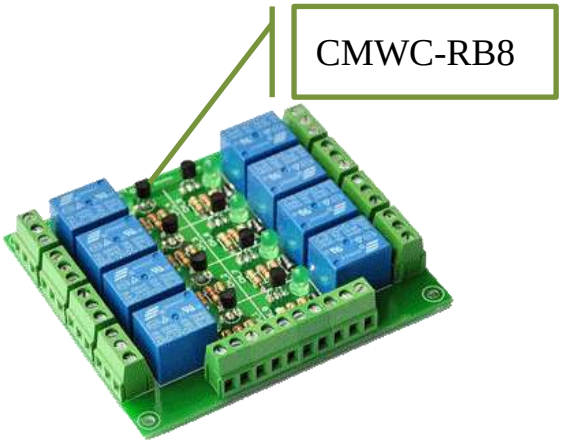


CMWC-16	Power Supply Board	Quantity Fitted	Varies
CMWC-3	Four Channel Vibrator Board	Quantity Fitted	Varies
CMWC-31	Two Channel Variable Frequency Vibrator Board	Quantity Fitted	Varies
CMWC-37	Four Channel Hi-Load Vibrator Board	Quantity Fitted	Varies

ELECTRONICS







CMWC-RB2	Two Channel Relay Board	Quantity Fitted	Varies
CMWC-RB4	Four Channel Relay Board	Quantity Fitted	Varies
CMWC-RB8	Eight Channel Relay Board	Quantity Fitted	Varies

CMW 2000 RECOMMENDED SPARES

Item no	Description	Qty	
CMW2000-27	LOADCELL 1022 30KG	1	
CMW2000-8	SPEED CONTROLLER ELBOW (4mm/M5)	1	
CMW2000-26	MALE ELBOW (4mm/M5)	1	
CMW2000-34	STRAIGHT MALE ADAPTOR (4mm/M5)	1	
CMW2000-7	CYLINDER (D/A Ø16 BORE x 25 STROKE, ISO)	1	
CMW2000-45	SOLENOID VALVE (SYJ3140-5G)	1	
CMW2000-25	FLANGED BUSH (OILITE)	1	
CMW2000-41C-7	VIB SPRINGS V1 7 PLY	1	
CMW2000-41C-9	VIB SPRINGS V1 9 PLY	1	
CMW2000-41C-11	VIB SPRINGS V1 11 PLY	1	
CMW2000-41A	M8 VIB SPRING SPACER	1	
CMW2000-35	V1 COIL	1	
CMW2000-9	IGUBAL ROD END BEARING (M6)	1	

ELECTRONIC SPARES

Item no	Description	Qty.	
CMWC-20	PAC020 LOADCELL DIGITIZER	1	
CMWC-16	PAC016-160 24V P/SUPPLY 160VA	1	
CMWC-15	PAC015 KEYPAD & CONNECTORS	1	
CMWC-LCD	PAC LCD	1	

ELECTRONICS SINGLE / TWIN

CMWC-12	PAC012-3002 LCD BOARD	1	

ELECTRONICS TRIPLE / QUAD

CMWC-11	PAC011- 24XI/O CONTROLLER BOARD	1	
CMWC-12A	PAC012-3008 REMOTE LCD BOARD	1	

ELECTRONICS OPTIONS

CMWC-3	PAC003 4 CHANNEL VIBRATOR DRIVE	1	
CMWC-37	PAC037 4 CHANNEL VIBRATOR DRIVE	1	
CMWC-31	PAC031 2 CHANNEL FREQUENCY VIBRATOR DRIVE	1	
CMWC-RB2	RLB2 2 CHANNEL RELAY BOARD	1	
CMWC-RB4	RLB4 4 CHANNEL RELAY BOARD	1	
CMWC-RB8	RLB8 8 CHANNEL RELAY BOARD	1	