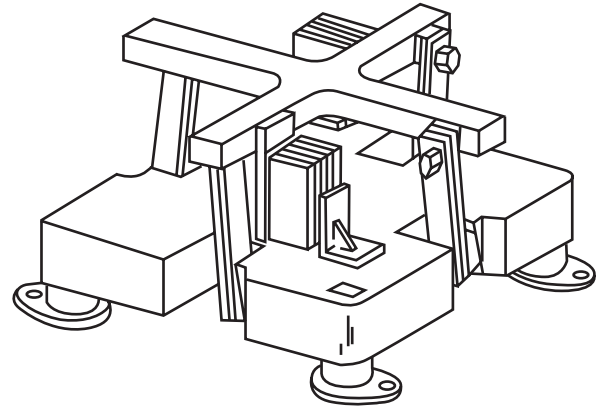


Riley Automation Ltd

SERVICE INSTRUCTIONS SYNTRON[®] VIBRATORY PARTS FEEDER

MODEL: EB-A SERIES



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Riley Automation Ltd, reserves the right to alter at any time, without notice and without liability or other obligation on its part, materials, equipment specifications and models. Riley Automation Ltd also reserves the right to discontinue the manufacture of models, parts and the components thereof.

Please refer to this Service Manual prior to installing, adjusting or performing any maintenance on the EB-A Series parts feeders.



WARNING: Failure to follow these service instruction procedures could result in unsatisfactory performance, shortened service life or personal injury.

INTRODUCTION

The EB-A Series parts feeder drive, when coupled with a matching parts feeder bowl, is a dynamically balanced, tuned, two mass vibratory parts feeder. The EB parts feeder is built to accept parts in bulk, then feed and discharge them in oriented positions. Drives are furnished for either AC or RC operation in the EB-112A through the EB-252A models, and for RC operation only in the EB-322A through the EB-372A models.

A typical drive consists of the following:

1. A heavy base.
2. A bowl mounting cross arm.
3. Four banks of springs, arranged in a circular fashion, which connect the base to the cross arm.
4. Two electromagnets mounted to the base.
5. Two armatures mounted to the cross arm.
6. Either four or eight adjustable elastomer isolators (mounting feet) mounted to the underside of the base.

The above, combined with the bowl, now becomes a two-mass vibrating system, where the base components form the drive mass and the upper components form the driven mass.

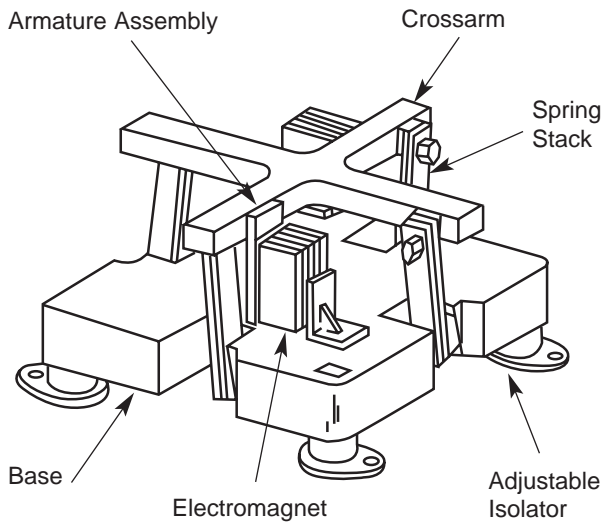


Figure 1 - EB Drive Unit Components

Power is supplied to the coils of an EB-A drive unit through a separate controller. Although the a-c drive may be operated by a traditional triac or powerstat type control, and the r-c drive may be operated through an SCR (silicon controlled rectifier) type control, Riley Automation Ltd recommends the advance model R6-439 or R15-469 control. The main features of this control are:

1. Switchable from a-c to r-c. Drive must have the proper magnet assemblies (AC or RC) installed and the spring system must be tuned accordingly. See page 10 for tuning.
2. Soft Start.
3. Adjustable current limiting.

During a-c operation the triac passes alternating current in both the positive and negative directions - producing 100 cycles per second operation. An adjustable, optically coupled phase control provides for linearly variable drive output.

When switched for r-c operation, an integrated circuit controls the triac so that current only flows in one direction, thus producing 50 cycles per second operation.

See the controller instruction manual for further information.

The soft start feature allows the feeder to start gently, eliminating overstroking, which may cause

“striking”. Refer to air gap adjustment section on page 8 for further explanation.

The adjustable current limiting feature provides two benefits:

1. It reduces the power consumption by matching the current of the coils with the requirements for various bowl styles and tooling variations.
2. Drive tuning for a wide range of bowl inertias is simplified, since the applied coil current can be adjusted to match the driven inertia. Refer to page 10 for Tuning.

PARTS FLOW

The following will provide a general description of parts flow and how it is achieved by the vibrating stroke of the bowl.

Figure 2 illustrates the action of a part moving along the bowl surface. During one vibration cycle the bowl surface travels from point (A) to point (B) and back to point (A). The part continues to travel upwards on a trajectory as shown, coming to rest on the bowl surface at a position further forward.

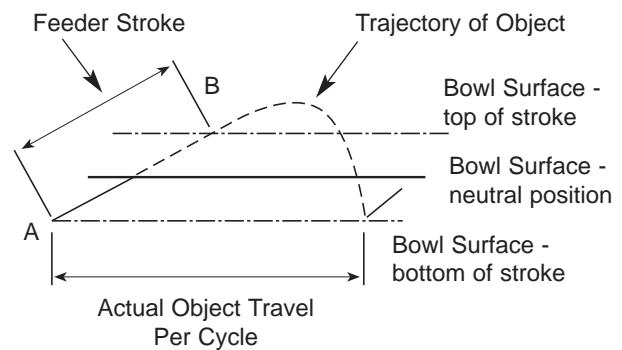


Figure 2 - Material Flow on Bowl Surface

Each cycle imparts a forward and upwards flight to the part, forcing it to land further along the bowl track towards the discharge. For equipment operating on a 50 cycle rectified power supply, this cycle of parts flow is repeated 3000 times per minute; 6000 times per minute on 100 cycle operation.

The rate of feed is controlled by adjusting or varying the stroke of the bowl. The number of strokes will remain constant with respect to the power supply, but the stroke length can be varied by adjusting the control knob.

LONG TERM STORAGE

When received, the equipment should be carefully uncrated. Give the equipment a thorough visual inspection to reveal any damage that may have occurred during shipment. If damage is found, contact Riley Automation Ltd and the shipping carrier at once.

When storing the drive unit, plug all openings in the control box to prevent dirt, rodents and insects from entering. Riley Automation Ltd advises placing a corrosion preventive inside the control box. Cover the drive unit and place in an area protected from extreme heat. Do not drop the drive unit, the force of the impact may damage the components.

INSTALLATION

The feeder and controller, when received, should be carefully uncrated. All packing bands, paper, etc., must be removed.



CAUTION: Riley Automation Ltd recommends lifting the unit by the base.

NOTE: Never make any alterations or additions to the parts feeder assembly without first contacting Riley Automation Ltd.

Riley Automation Ltd will not assume responsibility for unauthorised alterations or additions to the bowl or basic drive base.

When selecting a location for the feeder, consideration must be given to the area of support.

Larger units can weigh over 300 kg and a support must be selected that will safely carry the full weight of the unit under load conditions.

The operating frequency of the unit versus the natural frequency of the support structure is most important, and the following points must be carefully observed.

The support structure must have a natural frequency of at least 1 1/2 times the operating frequency of the parts feeder. Any supporting structure having a natural frequency close to the operating frequency of the feeder, is evidenced by excessive dynamic deflections at the points of support, and can result in poor performance of the feeder. These conditions can be corrected by stiffening the structure with bracing, etc.

It is important to bolt the EB-A parts feeder isolator mounting plates to the support structure so that the feeder discharge location is maintained.

The discharge location may be adjusted as follows, referring to Figure 3.

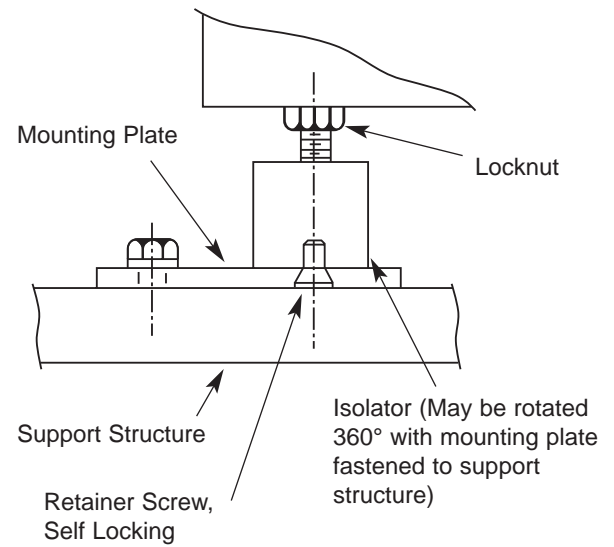


Figure 3 - EB-A Isolator

Vertical Adjustment - With the isolator mounting plate secured to the support structure, loosen each isolator locknut. Lift the unit slightly at each corner in succession and turn the isolator at each corner; into the base to lower the discharge, out of the base to raise the discharge. Adjust all isolators equally to ensure that the unit remains level.

Horizontal Adjustment - Loosen the screws (not supplied with drive) that fasten the isolator structure and slide the drive to the desired location. Be certain to tighten these screws before running the feeder.

NOTE: Because the isolators are free to rotate on their mounting plates for vertical adjustment, the isolators may have a tendency to slide on their mounting plates if oil or similar fluids get between them. Any heat build-up generated by this sliding action may result in failure of the isolators. To prevent any sliding of the isolators, the retainer screw in each isolator should be tightened to create a rigid connection between the isolators and their mounting plates.



WARNING: Do not operate the unit without first securing the rubber isolator mounting plates to the support surface.

The feeder must never come into contact with any rigid object or adjacent surface that could hamper the vibratory action of the feeder.

The separate controller assembly should be installed as close to the feeder as possible, preferably on a wall in a clean, dry location, free from excessive vibration.

Install the controller at a location where it will receive adequate ventilation, as this will ensure prolonged component life.

Refer to the controller service manual for detailed controller installation instructions.



WARNING: The electrical power supply connection to the controller must be made through a customer supplied safety disconnect switch which must be mounted next to the controller.

AIR JETS

Bowls equipped with air jets for orientation or feed rate assist require a regulated dry air supply. This supply system should consist of a shutoff valve, an air filter, regulator, and flexible air line. Standard filtration is normally satisfactory, but oil coalescing filters should be included where oil contamination cannot be tolerated. Unless otherwise specified, the air pressure supply at the manifold should always be set at 50 p.s.i.

Important: All air jets are equipped with needle valves for controlling the flow of air. In most cases the air jet position and the air flow relationship are critical for maintaining efficient orientation. All air jets are factory set with air pressure regulated at 50 p.s.i.

OPERATION

With the equipment properly installed in its operating location and all wiring completed, the equipment is now ready for operation.



WARNING: Before operating the feeder check that the controller is closed and secured.

Before energising the unit, check that all bolts are tight. Check the method of feeder support, making certain that it is substantial and that the feeder is not touching any rigid objects. Rotate the control knob anti-clockwise to zero setting. Turn the control power switch on and gradually increase the control knob setting.

When operating normally the feeder should perform with a smooth, even stroke.



CAUTION: If a loud striking noise occurs, immediately turn the control knob anti-clockwise to zero.

The striking should stop. If the striking continues, turn the unit off immediately. Striking is the result of the armature and core making contact. Continued striking can result in serious damage to the unit. Refer to the Air Gap section, page 8 to correct a striking condition.

If the feeder fails to operate satisfactorily, thoroughly review the installation, operation and maintenance sections of this manual. For further information contact Riley Automation Ltd.

Load the bowl with the parts to be conveyed. Riley Automation Ltd recommend that the quantity of parts loaded in the bowl is determined so that it does not interfere with the feed rate or orientation features of the bowl. Usually one layer of parts is satisfactory. The use of a Flow Switch is recommended when automatic bulk loading of the bowl is desired. Adjust the control knob to the desired output. Clockwise rotation will increase feed rate, while anti-clockwise rotation will decrease the feed rate.

Many units incorporate bowls designed with special clips, rejecters, wipers, air jets, track modifications, etc., for positioning and orienting parts for a specific application. These devices, placed along the track and bowl wall, are installed to exacting measurements.

NOTE: Any damage or mechanical change to these features may stop the flow of parts or alter their function. Instructions for these special features are not included in this manual. These applications are described in special instructions furnished with the particular unit.

The EB-A series parts feeder drives are capable of driving tooled bowls at the strokes shown in Table 3, when the drive base to bowl (total driven) inertia WR^2 is 1 to 1. However, Riley Automation Ltd recommends drive to bowl ratios of 1.5 to 1 and higher.



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Riley Automation Ltd bowls will usually be in this, or higher, ratio range.

The 1 to 1 ratio capability provides a 33% safety margin when operating with the 1.5 to 1 ratio.

Higher bowl strokes will cause proportionally higher reactionary strokes of the base, resulting in higher stresses in the drive isolators and increased vibration transmission into the drive support structure. Although the isolators are capable of absorbing base strokes equivalent to the bowl strokes shown, Riley Automation Ltd recommends that base strokes be kept to a minimum. This can be accomplished by maintaining a high base to bowl inertia ratio.

The stable operating characteristic of the EB- A Series drive is made possible, in part, by the large coils. Current ratings shown are maximum values required for operating in the higher than normal 1 to 1, base to bowl inertia range. For standard bowls, power requirements are much lower. Therefore for reduced power consumption and ease of tuning lighter inertia loads, it is highly recommended that an adjustable current limiting type control, such as the R6-439 or R15-469 be used. The soft start and other unique features are described on page 2 of this manual.

Maximum total spring stroke is given in Table 3.

Drive Model	Maximum Tooled Bowl Strokes				Operating Frequency Cycles Per Second	Recommended Maximum Tuned Natural Frequency Cycles Per Second	Maximum Allowable Total Spring Stroke Inch. (mm)
	Outside Track Bowl		Cascade Bowl				
	Diameter Inch. (mm)	Stroke Inch. (mm)	Diameter Inch. (mm)	Stroke Inch. (mm)			
EB-112A	10 (254)	.065 (1.65)	14 (355.6)	.090 (2.29)	60	59	.108 (2.74)
		.032 (0.81)		.045 (1.14)	120	118	.054 (1.37)
		.078 (1.98)		.109 (2.77)	50	49	.130 (3.30)
		.039 (0.99)		.055 (1.4)	100	98	.066 (1.68)
EB-132A	12 (304.8)	.065 (1.65)	18 (457.8)	.098 (2.49)	60	59	.108 (2.74)
		.032 (0.81)		.049 (1.24)	120	118	.054 (1.37)
		.078 (1.98)		.117 (2.97)	50	49	.130 (3.30)
		.039 (0.99)		.059 (1.5)	100	98	.066 (1.68)
EB-162A	15 (381)	.065 (1.65)	24 (609.6)	.104 (2.64)	60	59	.108 (2.74)
		.032 (0.81)		.052 (1.32)	120	118	.054 (1.37)
		.078 (1.98)		.125 (3.17)	50	49	.130 (3.30)
		.039 (0.99)		.063 (1.6)	100	98	.066 (1.68)
EB-192A	18 (457.8)	.065 (1.65)	-	-	60	59	.124 (3.15)
		.032 (0.81)			120	118	.062 (1.57)
		.078 (1.98)			50	49	.150 (3.81)
		.039 (0.99)			100	98	.074 (1.88)
							continued...

Table 3 - Performance Characteristics

Table 3 continued...

Drive Model	Maximum Tooled Bowl Strokes				Operating Frequency Cycles Per Second	Recommended Maximum Tuned Natural Frequency Cycles Per Second	Maximum Allowable Total Spring Stroke Inch. (mm)
	Outside Track Bowl		Cascade Bowl				
	Diameter Inch. (mm)	Stroke Inch. (mm)	Diameter Inch. (mm)	Stroke Inch. (mm)			
EB-222A	21 (533.4)	.065 (1.65)	30 (762)	.093 (2.36)	60	59	.106 (2.7)
		.032 (0.81)		.047 (1.19)	120	118	.054 (1.37)
		.078 (1.98)		.112 (2.48)	50	49	.128 (3.25)
		.039 (0.99)		.056 (1.42)	100	98	.064 (1.63)
EB-252A	24 (609.6)	.065 (1.65)	36 (914.4)	.098 (2.49)	60	59	.112 (2.84)
		.032 (0.81)		.044 (1.1)	120	118	.056 (1.42)
		.078 (1.98)		.117 (2.97)	50	49	.134 (3.4)
		.039 (0.99)		.059 (1.5)	100	98	.068 (1.73)
EB-322A	30 (762)	.075 (1.91)	-	-	60	59	.135 (3.43)
		.090 (2.28)	-	-	50	49	.162 (4.11)
EB-372A	36 (914.4)	.075 (1.91)	-	-	60	59	.148 (3.75)
		.090 (2.28)	-	-	50	49	.178 (4.52)

Table 3 - Performance Characteristics

Exceeding these values may result in failure of the springs and spring clamping system. The stroke may be measured as follows.

1. Attach a stroke gauge (available from Riley Automation Ltd on the cross arm, as shown in Figure 3 as close to the spring stack as practical.
2. Attach a second gauge onto the base of the drive, as close to the spring stack as practical.
3. Turn the unit on and set control knob at its highest setting.
4. Add the stroke of the cross arm (top of free length of spring) to the stroke of the base (bottom of free length of spring). The results are maximum total spring stroke.

Maximum bowl stroke for O.T. (outside track) bowls is measured on the outer wall of the bowl core assembly. Maximum bowl stroke for cascade bowls is measured on the outer wall of the bowl near the discharge. Higher bowl strokes than shown are permissible if bowl attachment points and bowl construction will withstand the additional

stress, and if maximum total spring stroke is not exceeded. In general, higher base to bowl ratios will allow proportionally higher bowl strokes resulting in proportionally lower base strokes.

Should it become necessary to reduce maximum bowl stroke, one or more of the following should be done:

1. Adjust the max pot (located on the printed circuit board), of the control to a lower setting by turning it anti-clockwise.
2. Increase the air gap on each magnet.
3. Reduce the tuned natural frequency of the drive by removing one or more springs.

MAINTENANCE



SAFETY INSTRUCTIONS: Product safety labels must remain highly visible on the equipment. Establish a regular schedule to check visibility. Should safety labels require replacement contact Riley Automation Ltd.



WARNING: Before performing any maintenance work, the electrical power supply must be disconnected at the safety disconnect switch.

EB-A parts feeders require minimum preventive maintenance when installed properly and under normal operating conditions. However, the following points should be given careful consideration.

1. Some materials tend to adhere to the bowl surfaces. This is especially true of materials coated with grease or dust. Material build-up on the bowl should be removed as a daily practice. Look for material build-up, particularly around and under hopper openings.

Diluted household ammonia or most common

detergents are effective cleaning agents. Do not use cleaners containing chloride or chemical solvents.

2. All details of the feeder magnet and controller should be kept reasonably clean.



CAUTION: A clean, dry compressed air supply is recommended for general cleaning of these units. The use of water may result in shorting of electrical components.

3. Never oil the spring assemblies. This destroys the clamping effect of the spring pads.

NOTE: If the spring stacks are repainted, do not paint between the springs.

4. The controller door should always be kept closed and secured.

TROUBLE SHOOTING

Problem	Cause	Correction
Feeder operating below capacity (too slowly)	Bowl overloaded	Reduce bowl load
	Low voltage	Check power supply
	Air gaps too wide	Reduce air gaps
	Feeder in contact with rigid object	Remove restriction
	Loose bowl	Tighten bowl attachments
	Broken or dirty leaf springs	Clean or replace
	Spring bolts not torqued sufficiently	See separate instructions for proper torque values
	Bowl or cross arm cracked or broken	Repair or replace as required
Unit improperly tuned	Refer to tuning instructions in this manual	
Feeder operating below capacity (amplitude correct, but feed rate low)	Bowl overloaded	A single layer of parts should be sufficient
	Bowl worn out	Repair or replace as required
	Improper air pressure at manifold (if air jets are used)	Unless otherwise noted, air pressure at manifold should be 50 p.s.i.
	Air flow needle valves improperly set	Adjust as required
	Special orientation feature if supplied, are improperly adjusted	Adjust as required

continued...

TROUBLE SHOOTING continued...

Problem	Cause	Correction
Feeder hums - will not vibrate	Defective SCR or triac	Replace with correct control
	Wrong control	Replace with correct control
	Control set for wrong operating frequency	Set control for correct operating frequency
Feeder fails to operate (no response)	Coil failure	Replace
	Blown fuse	Replace
	Faulty switch gear	Replace or repair
	Short in electrical wiring	Repair

Replace only with parts supplied, or recommended, by Riley Automation Ltd.

AIR GAP ADJUSTMENTS

The air gap of a vibratory feeder is the spacing between the armature face and the face of the magnet core assembly (see Figure 1, page 2). Proper adjustment is critical for optimum feeder performance.

If the air gap is too close, the armature and core will make contact during feeder operation.

This "striking" condition will cause severe mechanical damage; (broken springs, cracked bowl, cross arm, armature or magnet core).

If the air gap is adjusted so that the armature and core are too far apart, the unit will draw a high current and result in coil burn-out, failure of control components or lack of bowl stroke and part feed rate.

The air gap is properly set at the factory. (The recommended air gaps are listed in the manuals

containing the specifications for specific model feeders). However, if high voltage is applied to the feeder or if the air gap has been moved due to improper handling, an adjustment may be necessary.

To properly adjust the air gap, follow the outlined procedure below whilst referring to the illustration shown in the instructions for the specific model.

NOTE: The feeder must not be operating whilst the air gap is being adjusted.

1. Turn the power to the unit off and loosen the cap screws which secure the magnet core assembly to the base (loosen just enough to relieve holding pressure).
2. Adjust the magnet assembly in the required direction (either towards or further away from the armature assembly) a little at a time and equally on each side.

NOTE: The air gap should be tapered slightly towards the centre of the unit for optimum performance. Field setting can be made with the magnet core and armature pole faces parallel. Do not exceed the current rating.

- When adjusting the air gap, never set the gap so close that a "striking" condition results. Never set the gap too far apart, since an excessive current- draw could result. Keep the gap as close as possible without "striking".

After the air gap is adjusted satisfactorily, tighten the cap screws securing the magnet to the base. Air gap specifications are noted in the separate instructions pertaining to the specific feeder model.

A-C Feeder Current - When reading the current of an a-c unit with a tong meter, the actual current is read directly from the meter. The tong meter reading reveals the same current as stamped on the equipment name plate.

R-C Feeder Current - When measuring the current of an r-c feeder, a tong meter does not reveal the same current as stamped on the equipment name plate. This is due to the wave form characteristics of the feeder operation. To obtain a true current, multiply the tong meter reading by 1.7.

PARTS FEEDER STROKE

Feeder stroke is the distance the bowl surface travels in one complete cycle of vibration. See page 2. This is measured from the forward, upward limit of the vibrating stroke to the downward, backward limit of the vibrating stroke.

The bowl stroke can be read by applying a stroke gauge (available from Riley Automation Ltd), to the bowl as illustrated in Figure 4. For most accurate results, the stroke gauge should be applied to the bowl so that the graduated lines of the gauge are parallel to the motion line of the bowl. If the stroke gauge is placed at the same distance from the centre of the drive as the outer edge of a spring stack, the graduated lines should be perpendicular to the springs. As the distance from the drive centre increases, relative to the springs, the angle of the motion line proportionately decreases and the graduated lines

should be placed in a more horizontal plane. As the gauge is placed closer to the drive centre the angle of the motion line proportionately increases.

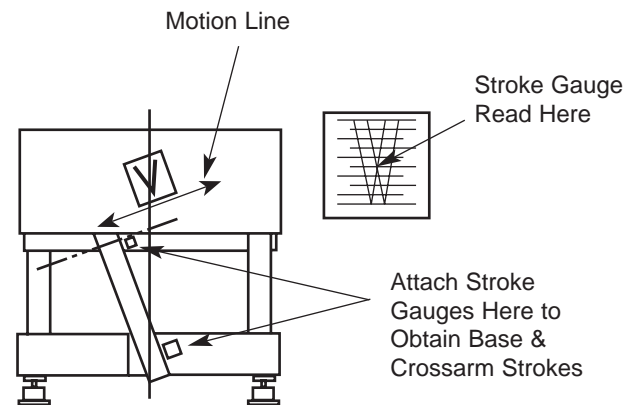


Figure 4 - Location of Stroke Gauges

Under vibration, the two black lines on the gauge "V" widen. As the stroke of the bowl is increased, the lines widen until at some stroke the black lines appear as a double "V". The two black lines at the inner edge form an inner "V" and as the stroke is increased, appears as an "X". The stroke is read in the black line an estimated 0.10" (0.25mm) below the white apex of the inner, upper "V". When the inner lines appear as an "X", the stroke should be read at the intersection of the "X". Variations in position and quality of the individual stroke gauge will cause errors as much as 0.10" (0.25mm), but this is generally an acceptable reading.



CAUTION: Stroke gauge results are interpreted differently by different viewers. It is important that they are interpreted properly in critical parts orientation and feed rate applications, or when maximum safe strokes are being approached.

If lines do not remain sharp during operation and appear "fuzzy" the stroke gauge is improperly positioned. When the gauge is properly positioned the image width and the apex of the inner lines will be at the maximum conditions observed if various positions have been tried.

TUNING

To operate at peak efficiency, each feeder must be “tuned” for its particular application. Two factors must be taken into consideration; the “natural” frequency of the unit and the “applied” frequency of the operating unit.

Natural frequency is the frequency of vibration observed when the power is turned off. The unit will oscillate for a fraction of a second at its natural frequency with a declining amplitude until it comes to rest. Natural frequency is determined by the masses (and the radial location of the masses) above and below the spring system, and the stiffness of the spring system.

EB-A feeders are tuned super-resonant, or slightly below the operating frequency. Refer to Table 3, page 5.

To check the tuning condition of a feeder the following steps may be taken.

1. Apply a stroke gauge to the feeder bowl as outlined on page 6.
2. Turn on the unit and observe the reading on the stroke gauge.
3. Whilst observing the reading on the gauge, gradually loosen the bolt on one spring clamp. Note the change on the stroke gauge as you loosen the springs. The stroke gauge reading will decrease if the unit is tuned properly.
or
4. Rigidly clamp small weights to the bowl and observe the change on the gauge after the weights have been attached. The stroke gauge reading should decrease.

If the feeder stroke increases as the spring clamp bolt is gradually loosened, or weight is added to the bowl, the feeder is tuned sub-resonant, or above operating frequency. Whilst feeders may operate satisfactorily when tuned several cycles above operating frequency (resonance), Riley Automation Ltd recommends super-resonant (below operating frequency) tuning to protect the drive components from damage caused by excessive feeder stroke, which could occur if a spring or clamp bolt fails or loosens.

If it is determined that a tuning correction is required to increase or decrease the bowl stroke, refer to the separate manual supplied with each unit and proceed as follows.

From super resonant conditions If the bowl stroke is to be increased, more springs must be added and/or existing springs must be replaced with thicker springs.

If the bowl stroke is to be decreased, existing springs must be removed and/or replaced with thinner springs. Any spring alterations should be in small increments when changing springs, a symmetrical pattern should be kept on the spring stacks, if possible.

After each alteration to the spring arrangement, the air gap should be rechecked and readjusted if required and the drive current draw should be checked.

The logo for Riley Automation Ltd features a stylized black waveform on the left side. To the right of the waveform, the word "Riley" is written in a bold, sans-serif font. Below "Riley", the word "Automation Ltd" is written in a larger, bold, italicized sans-serif font.

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