Vibro-Block Feeders - How They Work

The Arthur G. Russell Co., Inc.
750 Clark Ave. P.O. Box 237
Bristol, Ct 06011-0237
Phone: 860.583.4109
Fax: 860.583.0686
E-Mail: agr@arthurgrussell.com
Web Site: www.arthurgrussell.com
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HOW TO GET THE BEST PERFORMANCE FROM VIBROBLOCK FEEDERS

How They Work:

VibroBlock Vibratory Feeders are an example of controlled vibration at work. Friction created between the parts and the feeder ramp enables the parts to move forward as the feeder vibrates back and forth. By tilting the VibroBlock Vibrators, the vibration is caused to push the parts slightly upward on the forward stroke. This allows the feeder to slip out from under the parts during the backstroke, resulting in a one-way flow of the parts.

What Is Meant by Tuning:

VibroBlock Feeders owe their efficiency to precise and accurate tuning. This action is much like pushing a child on a swing. When a short, light push is applied at exactly the right time, the swing moves over a large distance. In the VibroBlock Vibratory Feeder this “push” is supplied by a pulse of electric current to the VibroBlock Vibrator coils. The VibroBlock Controller supplies one current pulse for each cycle of the power line. Therefore, by tuning the feeder precisely to the power line frequency, the pulse is timed to produce a large “swing” of the bowl or rail.

Importance of Good Tuning:

If the VibroBlock Feeder becomes detuned, poor performance is the result. Feeders are tuned by adding or removing tuning weights to the bowl rim or rail. VibroBlock Feeders are accurately tuned before they leave the factory and should require no further attention. Often however, users must make changes or additions which change the weight of the bowl or rail. This changes the tuning. Feeders can go out of tune due to loosening, or breakage of parts. They also may become detuned slightly with prolonged use. For this reason a knowledge of tuning methods is essential to good feeder set-up and maintenance.
Types of VibroBlock Vibrators:

<table>
<thead>
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<th>Nomenclature</th>
<th>Approximate Dimensions</th>
<th>Used On</th>
</tr>
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<tbody>
<tr>
<td>VB—6L</td>
<td>1½” x 1½” x 2”</td>
<td>Rails, 6” Bowl Feeders. VB-6C</td>
</tr>
<tr>
<td>VB-l2</td>
<td>2½” x 3” x 2—3/4”</td>
<td>Rails, 12” Bowl Feeders.</td>
</tr>
<tr>
<td>VB-l2L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VB— 1 2C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VB-16</td>
<td>3½” x 4¼” x 3½”</td>
<td>16” (and larger) Bowl Feeders.</td>
</tr>
<tr>
<td>VB—l6L</td>
<td></td>
<td>Some heavy transport rails.</td>
</tr>
<tr>
<td>VB-16C</td>
<td></td>
<td></td>
</tr>
</tbody>
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Types of Controller:

Most feeders (of current manufacture) use one of 2 standard controllers. Either controller is powerful enough to operate any standard feeder. They differ primarily in the manner which the feed rate is set and maintained.

These controllers are:

- VBC-73S Feedback controller, requiring a PET-1 Transducer to regulate feed rate automatically.
- VBC-12MB - Manually adjusted controller, without automatic feed rate.

Older Style Controllers:

Many of the following controllers are yet in service and some are still made for replacement or special feeders. For more information on these types see pages 29 thru 31.

Older Controllers and Their Applications:

<table>
<thead>
<tr>
<th>Controller</th>
<th>Nomenclature</th>
<th>Used On</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBC 12MA*</td>
<td>Rails, 6”, 12” feeders</td>
<td>Manual</td>
<td></td>
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<tr>
<td>VBC 16MA</td>
<td>12” to 16” feeders</td>
<td>Manual with meter</td>
<td></td>
</tr>
<tr>
<td>VBC 30MA</td>
<td>20” (and larger) feeders</td>
<td>Manual with meter</td>
<td></td>
</tr>
<tr>
<td>VBC 16SA</td>
<td>12” to 16” feeders</td>
<td>Self—Regulating (Servo)</td>
<td></td>
</tr>
<tr>
<td>VBC 30SA</td>
<td>20” (and larger) feeders</td>
<td>Self—Regulating (Servo)</td>
<td></td>
</tr>
</tbody>
</table>

*Earlier models do not have the suffix letter “A” after the model number. These units are interchangeable with the latest models in most applications.
VibroBlock Controller VBC-12MB, Installation & Operation

(NOTE: The following also applies to Types 12M, 12MA, 16M, 16MA, 30M and 3OMA Controllers).

To Operate:
Be sure the feeder is mounted on a rigid stand, which sits firmly on a solid floor. Any vibration in the floor or stand may prevent satisfactory operation of the feeder.

Connect controller to a 110-120 volt, 50 or 60-cycle power line and plug in all cables. Turn ‘Amplitude Control” to zero, then switch to “On”. Turn amplitude control knob watching the bowl and parts until desired feed rate is obtained. Check meter (where supplied) and amplitude indicator to be sure that the feeder is operating within safe limits. See tables on page 6.

VibroBlock Controller Model VBC-73S and Transducer Model PET-1 Installation and Operation

General Information:

The Model VBC-73S Controller and PET-1 Transducer form the basis of all VBC—73S VibroBlock Control Systems.

The VBC-73S may be used with either of two meters: 0-3 ampere and 0—10 ampere, depending on the feeder size.

The PET-1 Transducer requires a No. 12 Vane to adapt to the VB-12 VibroBlock Vibrator or a No. 16 Vane to adapt to the VB-16 VibroBlock Vibrator. The basic VBC-73S control and PET—1 Transducer is the same in all systems. The Transducer PET—1—i2 is shown mounted to a VB-12L VibroBlock Vibrator - Page 3B.

VibroBlock Vibrators:

The VBC-73S Control can be used with “L” and “C” type VibroBlock Vibrators. They are however, found most often on the “L” type.

Transducer:

The VBC-73S is designed to work with PET-1 Transducer and normally will not run without one. Provisions have been made to override the PET—1 in case of emergency or for special requirements. See page 4 for details.

Mounting the PET-1:

The PET-1 is normally mounted on one of the VibroBlock Vibrators in a feeder, but can be mounted elsewhere. This is true in the case of rails, where the VibroBlock Vibrators might be “buried” out of reach or on vibratory rails driven with the smaller Model VB-6 VibroBlock Vibrators. Pages 3B, 3C. 3D illustrates mounting details.
PET-1 mounted to clamp bar of VB-12 VibroBlock Vibrator
MODEL VB-12 VIBROBLOCK VIBRATOR
WITH
Stationary Side of VibroBlock
Vibrator (Protractor End)

PET-1-12 TRANSDUCER

Shutter (Vane)
Part No. B-21530

Alternate Offset
Mounting

Direction of
Vibration

Vibrating End

Standard Central Mounting
Of PET-1-12 on Model VB-12
VibroBlock Vibrator
MODEL VB-16 VIBROBLOCK VIBRATOR
WITH
PET-1-16 TRANSDUCER

Stationary Side of VibroBlock
Vibrator (Protractor End)

Vibrating End

Shutter (Vane)
Part No. B-21527

Alternate Offset
Mounting

Standard Central Mounting
Of PET-1-16 on Model VB-16
VibroBlock Vibrator
Views showing an alternate method of mounting PET-1-12 to a vibratory feed rail.
To accommodate the difference in size between the VB—l2 and VB-16 VibroBlock Vibrators, two sizes of Vane assemblies are provided. The same mounting brackets are used for both, as shown in the drawings. For replacement or retrofit specify Part No. B-21530 for the VB—I2 and Part No. B—21527 for the VB—I6.

**Amplitude Adjustment:**

The turnkey or knurled knob on the PET-1 is the only adjustment. If the feeder does not run (at all), turn the screw up to five (5) turns in either direction. If it still does not run, turn the screw the other way. Once the feeder is running, set the screw for the desired amplitude.

**CAUTION:** It is possible to strip the threads on the adjustment screw by turning it too far. If the feeder does not begin to run after 5 turns, reverse direction.

**Optional Manual Control:**

The drawing on page 4A - Fig. #1, shows the normal connections. A further detail shows the addition of an optional adjustment potentiometer (pot.). When used as shown, the pot. will control feed rate up to the limit set by the PET-1. When set below that limit, the PET-1 is not functioning. The pot. is useful when it is desirable to cut back the feeder output temporarily, but for continuous operation the best results are obtained with the PET-1 set for optimum feed rate and the pot. at maximum clockwise position.

**Emergency Operation:**

If the PET-1 should fail, the VBC-73S can be operated by using a potentiometer alone, but you will sacrifice the self—regulating features of the PET-1.

Directions:

1.) Turn power off.
2.) Unplug the PET-1.
3.) Remove the jumper from terminals P and H2 of the VBC-73S controller and connect it between C2 and E. (See page 4A).
4.) Connect a potentiometer as shown in the drawing. A 250K pot. is ideal but any value up to 500K will suffice.
5.) Turn power on and turn the pot. clockwise to increase the feed rate.
VIBROBLOCK CONTROLLER MODEL VBC-73S
MOUNTING AND WIRING

FIG. #1

(2) MOUNTING HOLES ON 3 1/16 CENTERS

PET-1 SOCKET
FEEDER SOCKET

WHT.
GRN.
WHT.
BLK.
BLK.
GRN.
WHT.

SHIELD

M-1: For bowls 17" diameter or smaller, use 0-3 Amps.
For Vibrating Rails 0-3 Amps.
For bowls 20" diameter or larger, use 0-10 Amps.

S-1: Use Specification MS35058-22 or any switch rated
25 Amperes, 120 Volts or greater.

TO SUBSTITUTE A CONTROL POTENTIOMETER IN LIEU OF THE PET-1:

PLACE JUMPER HERE (WHEN USING WITHOUT A PET-1)

REMOVE JUMPER BETWEEN H2 & P

250 K OHM POTENTIOMETER VIEWED FROM SHAFT SIDE
PET-1, INITIAL SET-UP

Mount the PET-1 Transducer and mounting brackets as illustrated on Pages 3B, 3C and 3D. Do not yet mount the corrugated flexible boot. Align the pin so that it is central in the slot. Damage may occur if the pin is allowed to rub on either side of the slot. Remove the transducer mounting screw and mount the boot. These screw holes are made so that alignment should be retained when re-assembled. It is a good idea, however, to push the boot back and check to see that the pin is not hitting either side of the slot.

Turn the feeder “On”. While the feeder is running, adjust for desired feed rate as described below.

If the feeder does not start, turn the adjusting screw either direction, but in any case, not more than five (5) complete turns. If nothing happens, turn the screw the opposite direction. The feeder should start in one of the following two manners:

1.) If the feeder starts at a slow rate, continue turning the screw until the desired rate is achieved.

2.) If the feeder suddenly jumps to maximum rate, continue to turn the screw IN THE SAME DIRECTION. (Do not back off). Continue turning until the desired rate is achieved.

Listed on page 6 are the optimum meter readings for our standard feeders. These apply to “cold” feeders. The meter reading is usually less when the feeder has been operated for an hour or more.

If the meter reading is excessively high and the feed rate is poor, do not adjust the PET-1. This is an indication that the feeder has been damaged or is badly “out-of-tune”. Do not continue to operate under these conditions. See pages 7 thru 17 for repair information.

PET-1 ADJUSTMENT FOR VIBRATORY OUTPUT

Vibratory amplitude is set by turning the amplitude control screw (See page 3A). The direction to turn the screw will depend on how the PET-1 is mounted.

If the feeder is already operating, turn the screw slowly while watching the vibration amplitude indicator. Turn the screw in the direction (and the necessary amount) which produces the desired results.
METER CURRENT FOR VIBROBLOCK VIBRATORY FEEDERS

<table>
<thead>
<tr>
<th>VIBROBLOCK VIBRATORY DRIVER</th>
<th>METER READING</th>
</tr>
</thead>
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<tr>
<td>VBF-6L or C</td>
<td>.19</td>
</tr>
<tr>
<td>VBF-12L or C</td>
<td>0.9</td>
</tr>
<tr>
<td>VBF-16L or C</td>
<td>1.9</td>
</tr>
<tr>
<td>VBF-20L or C</td>
<td>2.5</td>
</tr>
<tr>
<td>VBF-24L or C</td>
<td>3.2</td>
</tr>
<tr>
<td>VBF-24HD, L or C</td>
<td>3.8</td>
</tr>
<tr>
<td>VBF-30L or C</td>
<td>3.8</td>
</tr>
</tbody>
</table>

For vibrating tracks (rails), count the VibroBlock Vibrators and multiply by the following:

<table>
<thead>
<tr>
<th>VIBROBLOCK VIBRATOR NOMENCLATURE</th>
<th>METER READING PER VIBROBLOCK VIBRATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6L or C</td>
<td>0.06</td>
</tr>
<tr>
<td>12L or C</td>
<td>0.2</td>
</tr>
<tr>
<td>16L or C</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Above meter readings are approximate and will vary with different feeders and operating conditions. They represent a standard maximum and should not be exceeded in normal operation.

SAFE AMPLITUDES

<table>
<thead>
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<th>Bowl Size</th>
<th>Maximum Continuous Amplitude (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6”</td>
<td>.125</td>
</tr>
<tr>
<td>12”</td>
<td>.160</td>
</tr>
<tr>
<td>16”, 17”</td>
<td>.160</td>
</tr>
<tr>
<td>20”</td>
<td>.170</td>
</tr>
<tr>
<td>24”</td>
<td>.160</td>
</tr>
<tr>
<td>30”</td>
<td>.160</td>
</tr>
<tr>
<td>34” on 30 Driver</td>
<td>.180</td>
</tr>
<tr>
<td>34” on 24HD Driver</td>
<td>.240</td>
</tr>
</tbody>
</table>

If the Current Is Not Within Recommended Allowances:

All VibroBlock Vibratory Feeders are tuned at the factory to operate within the above current limits. If it is necessary to approach or exceed these limits to maintain required feed rate, something is wrong. DO NOT CONTINUE TO OPERATE THE FEEDER UNDER THESE CONDITIONS. See the pages immediately following for trouble shooting procedures.
TROUBLE SHOOTING PROCEDURE FOR A. G. RUSSELL COMPANY
VIBRATORY EQUIPMENT

Check the control panel meter reading while the equipment is operating at normal vibration amplitude or the maximum amplitude that can be attained. Compare to following chart:

NOTE — Some controls do not have a meter. Excessive current is indicated by an unusually high control knob setting.

<table>
<thead>
<tr>
<th>Feeder Model</th>
<th>Max. Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBF-12L or C Feeder</td>
<td>1.0</td>
</tr>
<tr>
<td>VBF-16L or C Feeder</td>
<td>2.0</td>
</tr>
<tr>
<td>VBF-20L or C Feeder</td>
<td>2.5</td>
</tr>
<tr>
<td>VBF-24L or C Feeder</td>
<td>3.5</td>
</tr>
<tr>
<td>VBF-24HD Feeder</td>
<td>4.0</td>
</tr>
<tr>
<td>VBF-30L or C Feeder</td>
<td>4.0</td>
</tr>
<tr>
<td>Track with 2 vibrators</td>
<td>1.0</td>
</tr>
<tr>
<td>Track with 3 vibrators</td>
<td>1.5</td>
</tr>
<tr>
<td>Storage Bin with 2 vibrators</td>
<td>1.0</td>
</tr>
<tr>
<td>Storage Bin with 3 vibrators</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Note any unusual conditions — This includes excessive noise, dead (or lively) spots in the bowl, erratic vibration levels, etc.

Feeder Fault Symptoms - A

1. Low (Vibration) Amplitude
2. Excessive Panel Meter Reading
3. Quiet operation with no parts in bowl (or rail)

Check to insure that:

1. All shipping straps have been removed from the feeder or rail base.
2. The feeder is mounted on a rigid support stand. Check for any loose/vibrating members or components on the stand.
   3. The leveling feet are not loose.
4. A feeder mounting/leveling stud does not protrude through a shock mount and touch the mounting plate. (This applies to VBF-20, 24HD and 30L or C feeders only).
   5. The bowl mounting screws are tight.
   6. The adjustment setting of the PET-1 (if unit is equipped with VBC-73S controller) is satisfactory.
   7. Product (parts) has not fallen into the feeder base which could interfere with bowl’s movement.
8. One VibroBlock Vibrator is not warmer than the others. (This can be accomplished by merely placing your hand on the individual vibrators). A “hot” vibrator indicates the possibility of a shorted coil. Refer to page 13 for further tests.
9. Tuning weights (mounted around the bowl periphery or along the rail carrier) have not been added or removed.
*NOTE- — On feeders of recent construction, the position and size of the tuning weights have been identified with prick punch marks (i.e.; 1 lb. weight - 3 marks, 8 oz. weight - 2 marks, 4 oz. weight - 1 mark).

10.) Tooling weighing more than 4 oz. has not been recently added to the bowl or rail. If it has, additional springs may be required on the VibroBlock Vibrators. (Refer to pages 14 and 15).

To check tuning:

Adding or removing tuning weights will cause a change in the vibration amplitude or the panel meter reading. Add one tuning weight to bowl periphery and note if performance improves. If performance should worsen, remove tuning weights one at a time, until satisfactory vibration amplitude and proper panel meter reading is attained. Refer to pages 14, 15, 16 and 17 for detailed tuning procedures.

If the preceding checks do not solve or identify the problem, disassembly of the feeder is required for further analysis. Refer to pages 17 through 19.

IMPORTANT: All vibrators should have the same number and color-coding of springs. Substitution of a vibrator with an improper spring compliment is a common problem.

**Symptom - B**

Low Vibration Amplitude  
Excessive Control Meter Reading  
Metallic Noise without parts in bowl (or rail)

Check to insure that:

1.) Bowl is not striking track (or other obstruction), while vibrating.

2.) All bowl hold down screws, tuning weights, bowl tooling devices etc., are securely fastened.

Also, check conditions listed under (preceding section) A-1, -2, -3, —4, -5, -6, -7. Should nothing abnormal be discovered after performing these checks, proceed to pages 17 through 19 for feeder disassembly. (When disassembling feeder, especially check for broken armatures in the VibroBlock Vibrators).

**Symptom - C**  
Inability to maintain (stable) vibration amplitude, (changes slowly/drifts),

1.) VBT-1 Transducer (VBC-16 or 3OSA or SB controls only) -Faulty transducer or interconnecting cord. Disconnecting the transducer cord (connector) or firmly grasping the bowl should cause an immediate increase in vibration amplitude. Otherwise, replace transducer.
2.) PET-1 Transducer (VBC-73S Controls only) - Transducer wire handle may be turning under vibration. Test by securing wire handle by any means or noting position (for changes) during operation. To replace refer to page 3.

3.) Feeder operating without a transducer (Model VBC-12, 16 and 3OMA or MB Controls) - Poor line voltage regulation (common in heavily industrialized areas). Cure - Replace with Model VBC-73S control and Model PET-1 Transducer.

If vibration tends to gradually increase, remove one tuning weight and retest.

If vibration tends to gradually decrease, remove one tuning weight and retest. Under certain conditions, an improvement may be effected by adding one tuning weight.

4.) Adding or removing tuning weights may affect bowl balance, creating “dead spots”. To correct, refer to “E”- 3 & 4.

**Symptoms - D** Unstable Vibration Level (changes rapidly)

1.) Steady beat or change - Add or subtract one tuning weight at a time until condition is corrected. If this causes excessive control meter reading or dead spots, then feeder must be disassembled. Refer to pages 17 through 19. Especially retighten all screws. This may be sufficient to correct condition.

2.) Erratic vibration amplitude - Check for:

   a.) loose electrical connection or loose bowl tooling. b.) Defective Model VBT-l or PET-1A Transducer.

   Refer to page 5.

**Symptoms - E** Parts do not move at some point on bowl ramp (dead spot) Possible causes and solutions:

1.) The feeder is not level - Remove bowl and check that bowl mounting plate is level. (This is a common problem)

2.) The bowl track is polished (from prolonged use) or is oily. Highly polished surfaces (caused by use) can be corrected by sand blasting or sanding. Oily residue can be removed with solvent.

3.) The bowl is “out—of—balance” — See that tuning weights (refer to A—9), bowl tooling fixtures or chute extensions have not been added or removed from unit. See that all shipping clamps have been removed from feeder or rail.
4.) Additional weight, such as a track connected to the feeder base casting, can cause dead spots. Possible cure - Attach a counter weight to the base casting opposite to the addition. Add tuning weights, 8 oz. at a time, in the area of the dead spot. If this causes an excessively high control meter reading, then remove weight from the opposite side, instead. Refer to page 16. If available, use the A. G. Russell Company dynamic bowl balance indicator. Refer to page 16. If the dead spot cannot be eliminated by these means, refer to pages 17 through 19, disassembly procedure. Watch especially for broken screws.

**Symptom – F** Excessive parts bounce in one area of bowl:

1.) Refer to “E”, except now place tuning weights opposite the area where the parts are bouncing (excessively).

**Symptom -G** Feeder operates at high vibration amplitude, control knob has no effect:

1.) On Model VBC-73S control - Test for defective control or transducer. Refer to pages 26 - 28 for test procedure.

2.) On Models VBC-12, 16, 3OMA, MB, SA or SB Controls - Possibly a defective controller usually a defective silicon controlled rectifier. Refer to appropriate schematic.

**Symptom -H** No vibration

Possibly caused by:

1.) No line power, blown fuse (located inside control) or defective controller.

2.) Defective auxiliary control circuit (such as level controls). If the feeder operates for a brief period (time delay) then stops, the auxiliary control circuit is the likely problem. Remove wires connected to any auxiliary control, except transducer wires, from control terminals Cl and C2. Check alignment of photoelectric or other sensors.

3.) Incorrect adjustment of Model PET-1 Transducer - Adjust the wire handle through the complete range to restart the feeder. Visually check the transducer for movement to be sure the adjusting screw has not been stripped.

4.) Unplugged or defective PET-1 - Check to see that the PET-1 is connected (4-prong military connector). Substitute a new PET-1, if available. A coin in the gap of the PET-1 should run the feeder “wide open”. If no PET-1 is available, try operating unit with potentiometer control. See page 4.
**Symptom - I**  Low Vibration

Low Control Panel Meter Reading:
1.) Possibly a defective controller.
2.) One or more vibrators unplugged.

**Symptom - J**  All Tests Normal

Vibration Level Adequate;

Excessive Control Panel Meter Reading:

1.) Vibrator coil armature gaps excessive. Reset, using guide on page 19.

**Symptom - K**  Feeder operation appears normal, however, inadequate (Part) output feed rate or orientation is obtained:

1.) Check air jets (if so equipped) for clogging. Most jets have a swedged tip which can be cleared by a small wire. Also, check other fittings and needle valves for obstructions. A good filter is required for the primary air supply. Check for proper air line pressure and adequate supply line to feeder.

2.) Check orientation tooling for signs of wear. Repair any worn bowl coatings. (Refer to page 13).

3.) Dirty, oily, improperly sized or warped parts, excessive flash, etc.

4.) Improper tooling adjustment.

5.) Too many or too few parts in bowl.
Symptom L  No Vibration

1.) Refer to “E”, (Feeder Fault Symptoms)

Symptom M  Low (Track/Rail) Vibration

1.) Perform checks described under “A’.

2.) On rubber isolated track bases, check to insure that there is not metal to metal contact between the base and mounting plate.

3.) Check length of VibroBlock Vibrator mounting screws. A long screw could contact the vibrator coil and limit vibration.

4.) Insure there is not excessive (vibrator) coil to armature gap. If this condition exists, reset to .062”.

5.) Rail/track assembly must be mounted on an adequate support stand, secured to floor or machine. Check for loose mounting feet or vibrating support elements.

6.) Be sure the track mounting mass is not too light. Weight of this mass must be at least 15 times the weight of the vibrating track.

7.) All vibrators must be equipped with the same number and color code of springs. Position of springs is not important but should be reasonably balanced. Replacing a vibrator with another of improper spring compliment is a common problem.

8.) To determine proper spring compliment, use the formulas found on page 5 of Catalog No. 8002 (VibroBlock Feeder Systems).

Symptom N  Parts Do Not Move in One Area (Dead Spot)

1.) Check VibroBlock Vibrator angle. Increasing vibrator angle closest to the dead spot may eliminate the problem condition. It is normal for the VibroBlock Vibrator closest to track entrance to be mounted at a slightly steeper angle than the vibrator at the exit end.

2.) The parts must not be confined too much within the track. (Some clearance must be allowed for vibration. This varies with different parts).

3.) The track must be adequately secured to the carrier. If it is not, add additional braces.

4.) See M—7.
0 - Testing with A. G. Russell Company Model VT-3 Vibrotuner (NOTE: For more complete instructions, refer to manual which is furnished with each Vibrotuner.)

1.) Unplug the existing control from your feeder (or rail) and plug it into the tuner.

2.) Adjust the frequency control for maximum amplitude. Gradually increase the amplitude control while readjusting the frequency control until maximum vibration amplitude is attained with lowest power control setting. Frequency dial position should range between 61.0 to 62.5 (51.0 to 52.5 for 50 hertz power line). Reconnect feeder to its standard VBC Controller. If the current reading is high, add tuning weights, one at a time and readjust control. If current reading is low, remove weights.

   If proper reading cannot be attained by adding or removing weights, then the VibroBlock Vibrators must be disassembled. (Refer to pages 17 through 19). When proper tuning is attained, refer to “E” and “F” for bowl balancing technique. A brief explanation of this procedure is provided on page 16.

Shorted VibroBlock Vibrator Coil: Turn down the amplitude control knob, all the way. Then, turn it up slowly, while watching the meter. If the current goes to a high value before the feeder operates well, it may indicate a partially shorted coil. Unplug each coil and test with ohmmeter.

VIBROBLOCK VIBRATOR COIL RESISTANCES

<table>
<thead>
<tr>
<th>VibroBlock Vibrator</th>
<th>Cold Resistance Range (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VB-6L or C</td>
<td>120 to 150</td>
</tr>
<tr>
<td>VB-12L or C</td>
<td>11 to 13.5</td>
</tr>
<tr>
<td>VB-16L or C</td>
<td>3.1 to 3.8</td>
</tr>
</tbody>
</table>

CAUTION:

A.) An ohmmeter test does not always pinpoint a partially shorted coil.

B.) Hot coils have higher resistance than cold ones. All coils should have the same resistance. Suspect any coil which has a higher or lower resistance value than the others.

REPAIRING BOWL COATINGS

Sheet Coatings — Neoprene, Urethane, Teflon

1.) Clean surface of bowl with solvent such as Vythane.

2.) Apply one thick coat of any commercially available contact cement to bowl and coating material, allowing both to dry.

3.) Apply one additional coat of cement to bowl and press coating in place. Clamp, if possible.
Molded Coatings - Flexane 94 Durometer Liquid

Purchase From: Devcon Corporation

Danvers, Massachusetts

1.) Clean surface of the bowl with a solvent, such as Vythane.

2.) Mix Flexane according to instructions and apply with a brush. Do not disturb coating after 10 minutes. Allow to cure for 12 hours.

3.) If a large area must be repaired; the bowl must be mounted vertically and rotated during and after application of Urethane by brush. Otherwise, the coating will settle in the bowl ramp corners, eliminating the ramp pitch, which is important to feeding. Apply Flexane quickly and do not disturb after 10 minutes.

**TUNING**

Tuning: All tuning is based on the power line frequency. In the United States this is 60 cycles per second (Hz.), while in most foreign countries, it is 50 Hz. Feeding systems are not tuned exactly to the line frequency. All feeders, with the exception of a few older models, are tuned 1 to 2 Hz above the line frequency.

Tuning: When using VBC controllers which have a meter, tune by VibroBlock Vibrator current. Standard currents at normal feeder settings are as follows:

<table>
<thead>
<tr>
<th>Feeder (Driver)</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBF-6L or C</td>
<td>.14</td>
<td>.19</td>
</tr>
<tr>
<td>VBF-12L or C</td>
<td>.65</td>
<td>.90</td>
</tr>
<tr>
<td>VBF-16L or C</td>
<td>1.4</td>
<td>1.9</td>
</tr>
<tr>
<td>VBF-20L or C</td>
<td>1.8</td>
<td>2.5</td>
</tr>
<tr>
<td>VBF-24L or C</td>
<td>2.4</td>
<td>3.2</td>
</tr>
<tr>
<td>VBF-24HD or C</td>
<td>2.8</td>
<td>3.8</td>
</tr>
<tr>
<td>VBF-30L or C</td>
<td>2.8</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Set the control knob or the PET-1 for the desired feed rate and read the meter. If the feeder is badly out-of-tune, set for the best-feed rate obtainable.

If the Meter Reads Too High: Turn the controller off. Remove a tuning weight from the rim of the bowl. Turn the controller on, reset the feed rate and read the meter again.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Next Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Current within recommended limits</td>
<td>None</td>
</tr>
<tr>
<td>B. Current lower than before, but still too high</td>
<td>Remove one more tuning weight and recheck meter.</td>
</tr>
<tr>
<td>C. Current higher than before</td>
<td>Replace the weight and add another weight. Recheck meter.</td>
</tr>
<tr>
<td>D. Current too low</td>
<td>Remove one more weight and recheck meter.</td>
</tr>
</tbody>
</table>

Repeat the entire sequence if necessary. If the removal or addition of one weight causes the current to go from one extreme to another, try working with a smaller weight.

**If The Meter Reading Is Too Low:** Remove a tuning weight from the rim of the bowl. Turn the controller on. Reset the feed rate and read the meter again.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Next Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Current is within recommended None limits</td>
<td>None</td>
</tr>
<tr>
<td>B. Current is now higher, but still below recommended limits</td>
<td>Remove one more tuning weight and recheck meter.</td>
</tr>
<tr>
<td>C. Current lower than before</td>
<td>Remove one more tuning weight and recheck meter.</td>
</tr>
<tr>
<td>D. Current too high</td>
<td>Replace the weight and remove a smaller one. Recheck</td>
</tr>
</tbody>
</table>

Repeat the entire sequence, if necessary. If the removal or addition of one weight causes the current to go from one extreme to the other, try working with a smaller weight.

**Controllers Without Meters:** A high setting, 9 to 10, on the control knob can be treated as a high meter reading. Normal operation is achieved between 6 and 9. Use the above procedures, substituting knob positions in lieu of meter readings. A D.C. ammeter may be connected in series with the VibroBlock Vibrator Coils. Where there are many VBC-12M, MA or MB controllers in use, it is desirable to obtain a VibroBlock Controller Meter, with connected hopper cords, as a convenient test meter.
For a quick check of any servo (i.e. VBC-16 & 30S or SA and VBC-73S) controller, grasp the rim of the bowl and try slowing it down. The meter needle should rise to a higher reading. The meter needle should return to its original position when you release the bowl rim.

Balancing The Bowl: If parts pause on one side and move too fast on the opposite side of the bowl, it is out-of-balance. Remove weight from the lively side and add the same weight to the dead side. Maintain the same total weight, just shift it around. If moving the smallest weight creates too much reaction, try shifting it only part way around.

The Bowl Balance Indicator: Where bowl balance is critical, the Bowl Balance Indicator is a useful tool. It consists of a concave dish, partially filled with granular particles and capped with a glass cover. Circular lines in the bottom of the indicator, forms a “bulls eye”

While the indicator can be hand held or cemented into place, it is most effective when bolted into place. The underside is tapped - 16. In bowls 16” diameter and larger, it can be secured to the center construction hole by means of a 3/8” — 16 stud and nut.

The bowl must be tuned, prior to checking for balance. As the feeder vibrates, the particles should cluster around the bottom of the indicator. Adjust the vibration amplitude as high as possible without causing the granular pattern to scatter. If the system is in balance, their location should be centered. If not, shift the tuning weights around the rim of the bowl. Take weight from the side where the particles are nearest the center and shift it to the side where particles are farthest off center. Continue this until the particles collect as true to center as practical.

While poor feeding on one side of the bowl is the most obvious disadvantage of unbalance, it is not the worst. Unbalance places heavy overloads on some VibroBlock Vibrators, while favoring others. In high output systems, frequent spring breakage will result, usually being confined to one or two VibroBlock Vibrators.

Helpful Information About Tuning:

1.) When possible, tune a feeder at its normal operating temperature. If it is necessary to tune a hot feeder, go far enough to correct the immediate trouble and check the unit thoroughly, when cooler.

2.) All feeders will drift to a lower frequency when they heat and return to a higher frequency when they cool.

3.) All feeders will automatically become tuned to a lower frequency as the amplitude is increased.
4.) A feeder which is tuned several cycles off the power line frequency will “hunt” violently when a VBC—73S controller is used. With a 12MB (or similar controller), it will produce little vibration, even at high control settings. When this occurs, looks for major changes such as broken or missing parts or jammed clearances before trying to tune to recommended specifications. Refer to “Trouble Shooting Procedures”, pages 7 through 13.

5.) A feeder which is poorly tuned will use too much power (meter current) and in some cases will not be able to keep up with the machine it feeds.

6.) A feeder tuned too low in frequency needs less tuning weight.

7.) If removing all weights still does not tune the feeder, it needs heavier VibroBlock Vibrator springs. Consult THE ARTHUR G RUSSELL COMPANY, INC. for advice.

8.) A feeder on a wobbly or flimsy stand cannot be tuned satisfactorily.

9.) As a general rule, feeders work best with only one layer of parts in the bottom of the bowl, (When the spiral ramp is full).

Tear Down and Reassembly of Feeders:

To Remove Bowl: Remove cap screws (in bottom of the bowl) and lift bowl from mounting plate. In some special feeders, the bowl may be fastened differently. These are individual situations, which cannot be covered by general instructions. Use discretion in these instances.

To Remove Mounting Plate: CAUTION - When removing the mounting plate, mark the position of the mounting plate with respect to the driver casting. Otherwise, the bowl may be out of position when the feeder is reassembled. Remove cap screws inside base (one per vibrator) and lift out mounting plate and secondary spring assembly. Note location of washers (one under cap screw head, one between secondary spring and VibroBlock Vibrator). Save the washers for use during re-assembly.

To Remove VibroBlock Vibrators: Unplug the vibrators. Remove the cap screws around the outside diameter of the base (one per vibrator), holding vibrators so they will not turn. Lift vibrators out.

CAUTION: Before loosening the VibroBlock Vibrators, note the angle at which they are set. This angle can be read on the back of the VibroBlock Vibrator, against the base. A scribed line is provided on the base for this purpose.
*NOTE - Caution #2 (below), prior to proceeding with removal of spring stacks.

To Remove Vibrator Spring Stacks: Clamp the Vibrator firmly in a vise, (holding by the end plate, pages 19A to 19c). Remove all clamp bar screws and lift off springs and spacers.

Replacement of Spring Stack:

CAUTION: 1.) “Ring” each spring by dropping it on a steel plate. A cracked spring will usually produce a noticeable clunk.

2.) Be sure that the springs are replaced in exactly the same order and spring number (SRU) as the original assembly. The spring number is stamped in white on the face of each spring and is further identified by a corresponding color code on the spring edge. See table, page 21.

3.) Be sure to include a spacer between springs. Also, between the spring stack, the end plate and clamp bar. “C” type VibroBlock Vibrators use a wide spacer under a wide clamp bar. In no instance, should metal—to—metal contact be allowed.

4.) If a PET—1 is included on one VibroBlock Vibrator, it must be reassembled in its original position. CAUTION - Recheck all screws for tightness. One loose screw will prevent the feeder from functioning properly.

5.) Assemble springs and spacers as shown on pages 19A to 19C. Insure that the end plate on which the screws are being tightened is securely clamped in a vise so that the wrenching will not distort the springs. CAUTION - Some screws may be longer than others. These are used to mount the transducer. If used elsewhere, the screws could bottom and may not tighten the springs.

Adjusting The Air Gap: Before replacing the nameplate covers on the VibroBlock Vibrator, check the air gap between the coil face and the armature. See table on page 19 for proper gap setting. Gaps can be checked with a feeler gage and should be set as nearly parallel as possible. If the gap is not correct, loosen the armature screws, (Pages 19A to 19C), reset the gap and tighten. Recheck after tightening.

Replacing The VibroBlock Vibrators: Place the end of the VibroBlock Vibrator (which has the angle protractor) against the mounting pad on the inside of the base. Insert the cap screw through the base and tighten to the proper torque. See Torque Table on page 19. Before final tightening, set the VibroBlock Vibrators so that the scribe mark on the base is opposite the correct angle mark on the back plate. CAUTION: Be sure that all VibroBlock Vibrators are tilted at the same angle, in the same direction.
Replacing the Mounting Plate: Before replacing, check ‘ID” shaped springs for cracks or loose screws. Note position of mounting plate and feeder casting, as previously marked. Lower the mounting plate over the top of the base so that the holes in the secondary springs line up with the tapped holes in the end plates of the VibroBlock Vibrators. Place one washer under the head of each cap screw and one between each secondary spring and VibroBlock Vibrator. Insert and tighten the cap screw to the correct torque.

Replacing the Bowl: Clean all dirt and chips off the top of the mounting plate and from the underside of the bowl. Set the bowl on the feeder base with the exit in the proper location. Line up the holes in the bottom of the bowl with those in the mounting plate, insert cap screws and torque to recommended setting.

Tightening VibroBlock Feeder Screws:

<table>
<thead>
<tr>
<th>Screw Size</th>
<th>Used On</th>
<th>Tighten To</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-40</td>
<td>N.C. Vibrator VB-6</td>
<td>24 inch lbs.</td>
</tr>
<tr>
<td>8—32</td>
<td>N.C. Vibrator VB-12</td>
<td>60 inch lbs.</td>
</tr>
<tr>
<td>10—32</td>
<td>N.F. Vibrator VB-16</td>
<td>90 inch lbs.</td>
</tr>
<tr>
<td>1/2-20</td>
<td>N.F. Through Base Into</td>
<td>100 foot lbs.</td>
</tr>
</tbody>
</table>

VibroBlock Feeder Screws:

Vibrator Air Gap Settings

<table>
<thead>
<tr>
<th>Vibrator</th>
<th>Air Gap (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VB-6 &amp; 6C</td>
<td>.047</td>
</tr>
<tr>
<td>*VB-12</td>
<td>.062</td>
</tr>
<tr>
<td>VB-12L or C</td>
<td>.047 (.062 Rails Only)</td>
</tr>
<tr>
<td>*VB-16</td>
<td>.062</td>
</tr>
<tr>
<td>VB-16L or C</td>
<td>.047 (.062 Rails Only)</td>
</tr>
</tbody>
</table>

*Old Style with Green Name Plates
Primary Spring #A-16054
No. 1/2 .018 Thk. Blue
No. 1 .022 Thk. White
No. 2 .028 Thk. Red

Spring Clamp Bar (STANDARD) #A-16053
(OR)
Comp. Spring Clamp Bar #A-16085

Standard Spacer #A-16055S
(OR)
Comp. Spacer #A-16055S

End Plate #B-16052

Armature Assembly #A-16058

Coil Assembly #B-16062

Cord Set CMS 3301

Socket #CMS 3301-CF-2K

All Screws #5-40NC

Spring Clamp Screws 1/2" Long

Cover Plate Screws 1/8" Long

19A

ARTHUR G. RUSSELL CO., INC.
VB-12L VIBRO BLOCK VIBRATOR
COVER PLATES REMOVED

Primary Spring A-12608
No. 1 .032 thk. White
No. 2 .040 thk. Red
No. 4 .050 thk. Green

Standard Spacer A-12837S
(OR)
Comp. Spacer A-12837C

Standard Spring Clamp Bar
#A-12609
Compensated
Spring Clamp
Bar #A-15540

Spacer Block
A-12607-1

Armature
A-12839

Clamp Plate
A-12606

End Plate B-12605-2

Coil Ass'y. B-14269

Primary Spring
A-12608
(See Above)

Cinch Jones
S-202-B

All Screws 8-32 NC
Spring Clamp Screws 3/4
Cover Plate Screws 3/16

ARTHUR G. RUSSELL CO., INC.
A-12863 Primary Spring
No. 2 .048 Thk. - Red
No. 4 .060 Thk. - Green
No. 6 .069 Thk. - Blue
Standard Spacer, A-12869S
(OR)
Comp. Spacer #A-12869C
Spacer Block A-12635-1
Armature A-12865
Clamp Plate A-12634
End Plate C-12864-2
Coil Ass'y. B-14271
Cinch Jones S-202-B

All Screws 10-32 NF
Spring Clamp Screws 1-1/4
Cover Plate Screws 3/16

ARTHUR G. RUSSELL CO., INC.
TORQUE WRENCHES:

Torque wrenches for assembly and mounting of VibroBlock Vibrators are available from:

Sturdevant Richmont Torque Products
Dresser Hand Tool Division
Dresser Industries
3201 N. Wolfe Road
Franklin Park, Illinois 60131

<table>
<thead>
<tr>
<th>Size</th>
<th>Torque</th>
<th>Handle</th>
<th>Head</th>
<th>Drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-32</td>
<td>90 in.</td>
<td>LTC-O</td>
<td>SSDRT-¼</td>
<td>Williams No. MA-5</td>
</tr>
<tr>
<td></td>
<td>lbs.</td>
<td></td>
<td></td>
<td>¼ Drive to 5/32 Hex.</td>
</tr>
<tr>
<td>1/2-20</td>
<td>100 ft.</td>
<td>LTC-3</td>
<td>SSDRT—½</td>
<td>Williams No. SA-12</td>
</tr>
<tr>
<td></td>
<td>lbs.</td>
<td></td>
<td></td>
<td>½ Drive to 3/8 Hex</td>
</tr>
<tr>
<td>8-32</td>
<td>60 in.</td>
<td>LTC-O</td>
<td>SSDRT-¼</td>
<td>Williams No. MA-4½</td>
</tr>
<tr>
<td></td>
<td>lbs.</td>
<td></td>
<td></td>
<td>¼ Drive to 9/64 Hex</td>
</tr>
<tr>
<td>3/8-24</td>
<td>55 ft.</td>
<td>LTC-2</td>
<td>SSDRT—3/8</td>
<td>Williams No. BA-10</td>
</tr>
<tr>
<td></td>
<td>lbs.</td>
<td></td>
<td></td>
<td>3/8 Drive to 5/16 Hex</td>
</tr>
</tbody>
</table>
CONVERTING VIBROBLOCK FEEDERS FOR POWER

FREQUENCIES OTHER THAN 60 HZ.

What Is Meant By Tuning:

All VibroBlock Feeders must be tuned to match the frequency of the power line to which they are connected. This means that if an idle feeder is struck a blow, it will vibrate at the same rate as the power line it is to be connected to. In most cases, this is 60 Hz., but VibroBlock Feeders will operate at any frequency near 60 Hz., if so tuned.

How Tuning Is Done:

Coarse tuning is accomplished by selecting spring—rate-units. (See Page 4, VibroBlock Feeder Systems Catalog 8002). Fine tuning is accomplished by adding or removing tuning weights. This latter is useful only over a small frequency range, so when changing the basic power frequency, the spring—rate—units (or SRU’s) must also be changed.

Determining Existing SRU’s:

First determine the number of existing SRU’s per VibroBlock Vibrator. This is stamped on the face of each spring and also indicated by color on the edge of each spring. The color code is as follows:

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>STAMP</th>
<th>SRU</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>White</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Red</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>4</td>
<td>Green</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Add up all the springs on one Vibrator to determine the total value of SRU’s.

Figuring SRU’s Needed:

Definition:

\[ F = \text{Present Frequency} \]
\[ = \text{Desired (new) Frequency} \]
\[ \text{SRU} = \text{Existing SRU/Vibrator} \]
\[ \text{SRUN} = \text{Necessary SRU/Vibrator to tune at new frequency} \]
General Formula:
\[
SRU_N = \frac{F_N^2}{F^2} \times SRU
\]

Special Formula for going from 60 to 50 Hz.:
\[
SRU_{50} = 0.7 \times SRU_{60}
\]

**EXAMPLE:**

We have a feeder running at 60 Hz. with 44 SRU/Vibrator. We want it to run at 50 Hz.

\[
\begin{align*}
F & = 60 \text{ Hz.} \\
F_N & = 50 \text{ Hz.} \\
SRU & = 44 \\
\text{Find } SRU_N \\
SRU_N & = \frac{50^2}{60^2} \times 44 \\
& = \frac{2500}{3600} \times 44 \\
& = 0.694 \times 44 \\
\text{New } SRU & = 30.5 \text{ SRU/Vibrator}
\end{align*}
\]

**Rounding Off SRU’s:**

Since there is no such thing as 30.5 SRU/Vibrator available, it is necessary to choose the nearest standard number.

**RULE:**

If there are many tuning weights on the feeder, use the next smaller SRU and remove some weight during final tuning.

If there are few tuning weights on the feeder, use the next larger SRU and add some weight during final tuning.
Choose springs and assemble the VibroBlock Vibrator so that the SRU’s on each side of the vibrator are as nearly equal as practical.

**EXAMPLE:**

In the foregoing example, we needed 30.5 SRU/Vibrator. Let’s assume we can add tuning weights.

Then, use two No. 6 and one No. 4 on each side:

```
   6
   6
   4
```

16 X 2 sides - 32 SRU Total

**Final Tuning:**

Tune for best efficiency by adding or removing weights as previously explained on Pages 14, 15, 16 and 17.
What VibroBlock Controllers Do:

All VibroBlock Feeder Controllers perform the same function; specifically, they release a timed pulse of current from the power line through the VibroBlock Vibrator coils. The pulse frequency is the same as the power line, usually 60 Hz. The duration of the pulse is varied to obtain the desired feed rate; i.e. - longer pulse, higher rate.

Final switching is done by a silicon controller rectifier (SCR) which will start conduction when properly triggered and continue as long as forward current runs through it. The SCR is triggered “On” during each positive half cycle, and turns itself off during the negative swing of the power line voltage. By triggering early or late in the positive half cycle, the conduction time is controlled. Due to the forward current induced in the VibroBlock Vibrator coils, the SCR does not shut off at the instant the power line goes negative, but is "held over" until the energy stored in the VibroBlock Vibrators’ iron core is dissipated.

Differences among the Various Models:

The description thus far has applied to all VibroBlock Controllers. Models differ mainly in chassis style and the triggering network.

All VibroBlock Controllers of current manufacture will operate all standard VibroBlock Feeders, to full output. The only exceptions are older models VBC-l2M, 12MA, l6M, 16MA, l6S and SA.

On controllers where meters are used, smaller feeders normally use a 0—3 ampere range and larger feeders use 0—10 amperes. See table below:

<table>
<thead>
<tr>
<th>Meter</th>
<th>Driver Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>0—3</td>
<td>VBF-l2, 16 &amp; Most Rails</td>
</tr>
<tr>
<td>0—10</td>
<td>VBF-20, 24, 24HD &amp; 30</td>
</tr>
</tbody>
</table>
Manual and Servo Controllers:

There are two kinds of triggering circuits, namely the “M” or Manual and "S" or Servo. The manual controller feeds pulses of constant duration as determined by the control knob setting, regardless of feeder load or condition. The Servo controller automatically varies the current pulses, to correct for any condition, which tends to change the feed rate.

How They Work, Manual: (VBC-12MB, also 16 & 30MB)

Refer to Page 25A for the schematic of the VBC-12MB. When power line voltage is applied across L1 and L2 and switch S1 is closed, current tries to run through the load which is connect to H1. and H2, but is blocked by the SCR which has not been triggered. When L1 is positive, a trickle of current flows through R1 and R4, tending to charge C1. Since D1 does not conduct below a nominal 8 volts, and D2 is reverse biased, the charging rate of C1 is determined by R1 and the setting of R4.

D4 is a four layer diode which not only blocks reverse current flow, but also blocks forward current until a critical voltage is reached. At the critical voltage, D4 breaks down (not much different from an automotive spark plug) and becomes nearly a short circuit. When broken down, its’ current is limited by external resistance. It will continue to conduct as long as current is supplied.

The 2N4989 used in all VBC Controllers of current manufacture breaks down at 8 volts. Therefore, C1. continues to charge until the voltage across it (and across D1) reaches approximately 8 volts. When this happens, D1 becomes a closed switch and C1 discharges (through D1, R2 and R3 and the SCR gate circuit) to the break-back” voltage of D1. Not enough current can flow through R1 and R4 to keep D1 conducting so it recovers when C1 is discharged.

The discharge current from C1 flows through R2, (which limits it to about 80 milli-amperes) and splits between R3 and the gate (triggering) circuit of the SCR. This fires the SCR which then “holds” its conduction after the trigger is gone. The SCR continues to conduct until its forward current drops below its minimum holding value. Since the supply for the triggering circuit is the voltage developed across the SCR, this supply disappears when the SCR turns on, preventing C1 from recharging during the rest of the positive half cycle.
C1 CAPACITOR, MYLAR, 0.22 MFD., 100V
D1 DIODE, 4 LAYER SWITCH G.E. 2N4989
D2 DIODE, RECTIFIER, TYPE IN 45T OR EQUAL
R1 RESISTOR, CARB. COMP. 150K ± 5%, ±W
R2 RESISTOR, CARB. COMP. 47K ± 5%, ±W
R3 RESISTOR, CARB. COMP. 1K ± 5%, ±W
R4 RESISTOR, POTENTIOMETER, LINEAR, 250K, ±W
R5 VARISTOR, G.E. V30LA10A
R6 RESISTOR, W.W., 2K ± 5%, 5W
R7 RESISTOR, CARB. COMP. 68K ± 5%, ±W
S1 M.S. 35056-22
F1 FUSE, BUSS GBB10
SCR 35 AMPERE RMS, 300VOLT G.E. C35C X213 OR EQUAL

SCHEMATIC DIAGRAM FOR VBC-12MB
TROUBLE WAVEFORMS

CONNECT OSCILLOSCOPE COMMON TO L2

TEST WAVEFORM       LIKELY CAUSE

A            SCR SHORTED OR H2
            LINE GROUNDED
B            TRIGGER OK BUT SCR
            NOT RESPONDING
B            D2 OPEN AT LOW
            NUMBER SETTING OF R4
B            D2 OPEN AT HIGH
            NUMBER SETTING OF R4
B            DI OPEN
B            DI LEAKY, DOES NOT
            BREAK DOWN

SCHHEMATIC DIAGRAM FOR VBC-16 MB AND VBC-30 MB
When the power line goes negative, D2 becomes forward biased, shunting Cl and preventing its charging to a negative voltage. Thus at the beginning of each positive half cycle, the voltage across Cl starts near zero and rises toward +8 volts. The sooner it reaches +8 volts, the longer the SCR conducts and consequently, the higher the feed rate. The values of C1, R1 and R4 are chosen so that the SCR cannot fire much before 90-degrees power line phase angle.

R5 is a varistor, which acts like a very high resistance at low voltages and changes to nearly a short circuit at higher voltages. It protects the SCR against occasional voltage “spikes”, which are absorbed by R5.

R6 is a minimum-holding-current resistor, which shunts the VibroBlock Vibrator coils. When the SCR is triggered, its current must rise above the holding current value before the trigger pulse dies out. If the inductance of the VibroBlock Vibrator coils does not let the current rise fast enough, R6 provides the needed extra holding current.

**How They Work, Servo: (VBC-73S)**

Basic functioning and circuits of the VBC-73S Controller are the same as the VBC-12MB, described in the foregoing paragraphs. The major difference is elimination of the adjustment potentiometer and substitution of a lower-valued resistor in the Cl charging circuit. This results in a tendency for the SCR to run wide open.

The output of the controller is reduced to operational levels by adding a conductor across terminals Cl and C2. This diverts some (or all) of the charging current to capacitor Cl and thus delays the firing time of the SCR. If the conductor across C1 and C2 is a closed switch, the SCR will not fire at all. This is useful to override the controller for level control applications. (See “LEVEL CONTROL” Page 28).

For normal running, a PET—l Photoelectric Transducer is connected across Cl and C2. The conducting element in the PET-1 is a phototransistor whose conductivity is varied by the amount of light conveyed from the juxtaposed light emitting diode (LED), powered from terminal “E” of the VBC-73S. When the full illumination of the LED falls on the phototransistor, it conducts enough to turn off the controller completely. When the photo—transistor is darkened, the controller runs full on, thus providing control over the entire output range of the VBC-73S.

The PET-1 is attached to the non-moving end plate of a VibroBlock Vibrator and a shutter (or vane) is attached to the moving end plate and located so that it can block the light from the LED. The vane is set so that it blocks the light when the vibrator is standing still. Thus when the VBC-73S Controller is turned on, it tends to run wide open but this causes the moveable end-plate of the vibrator to move the vane and allows light to strike the phototransistor, which cuts down the drive. Equilibrium is established in one or two cycles of the power line frequency. At equilibrium, the following sequence results:
PHOTO ELECTRIC TRANS DUCER MODEL PET-1

OPTIONAL CONTROL POT. 500 K.Ω.
IF NOT USED JUMP H 2 TO P.

C1 CAPACITOR, HYLR. 0.22 MFD ±10%, 100 V.D.C.
C1 CAPACITOR, HYLR. 0.22 MFD ±10%, 100 V.D.C.
4 LAYER DIODE, 2N49,6A
4 LAYER DIODE, 2N49,6A
SILICON DIODE, 1AMP, 600 PR.V.
SILICON DIODE, 1AMP, 600 PR.V.
RESISTOR, 3 WATT, 7.5 K
RESISTOR, 3 WATT, 7.5 K
RESISTOR, CARBON COMP. ¼ W. 100K ±5 %
RESISTOR, CARBON COMP. ¼ W. 100K ±5 %
RESISTOR, CARBON COMP. ¼ W. 10K ±10 %
RESISTOR, CARBON COMP. ¼ W. 10K ±10 %
RESISTOR, CARBON COMP. ¼ W. 47K ±10 %
RESISTOR, CARBON COMP. ¼ W. 47K ±10 %
RESISTOR, 5 WATT 2K
RESISTOR, 5 WATT 2K
MOV VARIATOR, G.E. 130 LA 10A
MOV VARIATOR, G.E. 130 LA 10A
G.E. C 35C OR EQUIVALENT
G.E. C 35C OR EQUIVALENT
SWITCH, HS 3500B-22
SWITCH, HS 3500B-22
HETER, HOYT MODEL 640
HETER, HOYT MODEL 640
FOR FEEDERS VBF-1G OR SMALLER, 0-3A.
FOR FEEDERS VBF-1G OR SMALLER, 0-3A.
VBF-1G OR LARGER, 0-10 A
VBF-1G OR LARGER, 0-10 A
FUSE, BUSS KAW-15
FUSE, BUSS KAW-15
RESISTOR, CARBON COMP. ¼ W. 47K ±10 %
RESISTOR, CARBON COMP. ¼ W. 47K ±10 %
2N53,6B
2N53,6B
ZENER DIODE, 1WATT, 5.1 VOLT ±10 %
ZENER DIODE, 1WATT, 5.1 VOLT ±10 %
RESISTOR 47K ¼ W ±10 %
RESISTOR 47K ¼ W ±10 %

SCHEMATIC DIAGRAM FOR VBC-73S
The Vibrator vibrates at the power line frequency and the vane covers and uncovers the phototransistor once, each cycle. When the power line voltage crosses the zero-axis (going positive), the phototransistor is dark and C1 is charging rapidly. Later in the cycle, the vane starts to uncover the phototransistor and the charging of C1 is slowed. The resultant late firing of the SCR cuts down on the vibratory amplitude. For low amplitude operation, the vane is set so that it barely covers the photo—transistor and a small excursion of the vibrator is sufficient to cut back the drive. For high amplitude operation, the vane is set so that it overlaps the photo—transistor by a wider margin, thus forcing a larger excursion before the regulating action of the photo—transistor becomes effective. The process can be likened to a photoelectric edge—capture effect.

Fail Safety: (Ref. Schematic, page 26A)

From the foregoing discussion, it is apparent that if the PET-1 is unplugged, the VBC-73S is unregulated and runs wide open. This could cause serious damage to the feeding system. The failsafe circuitry prevents this.

Referring to the schematic, we find a transistor, Q1 connected across C1 and C2. In normal operation, it is biased to a non-conducting state and has no effect. Turn—on current is provided through Zener Diode Zulu, which does not conduct below a nominal 5.1 volts. Since it derives its voltage source across the LED “E”, in the PET-1, and since normal voltage across the LED cannot exceed 1.7 volts, it is never high enough to pass current through Z1. If the LED is unplugged, disconnected or burned out however, the voltage input to Z1 exceeds 5.1 volts, Z1 conducts, and Q1 turns on hard. This robs C1 of all of its charging current and shuts off the VBC—73S. Please note that if a wire leading to the photo—transistor, “D”, breaks or the LED shorts out, the VBC-73S will not shut down. These are the only exceptions.

Using the VBC-73S With A Potentiometer:

The application note on Page 4A shows how a potentiometer may be connected to the VBC-73S. This makes the VBC-73S substantially the same as a 12MB. It can be done with or without a connected PET-1. When used with a PET-1, the potentiometer robs the VBC—73S of its top power, resulting in poor or no regulation. It is only useful in turning down the feeder temporarily, for convenience. Without the PET-1, the pot-controlled VBC-73S is just like the VBC-12MB.
Level Control:

It is often necessary to shut off a feeder temporarily when the supply of product being fed, gets ahead of the demand. All VibroBlock Controllers have a built-in provision, which makes it unnecessary to break the full VibroBlock Vibrator current. Thus, even the largest VibroBlock Feeder can be controlled by light duty contacts, photocell or in some cases, by passing current through the part itself.

Connections:

Every VibroBlock Controller has two terminals labeled Cl and C2. A short circuit or low resistance (1,000 Ohms, typical) between these terminals will stop the feeder. The feeder can be held “off” indefinitely without damage.

On Manual and VBC-73S type controllers, terminal C2 is the same as L2, which is usually connected to the grounded side of the 115-volt line. If L2 is ground, grounding terminal Cl will stop the feeder. This way, grounding through an electrically conductive part makes a simple level control. The voltage at the C1 terminal is never over 24 volts peak. Current will be less than 2 milli-amperes.

CAUTION: Don’t try this with older servo (VBC-I6 or 30, S or SA).

If L2 is “hot”, grounding Cl will make the feeder run wide open, but will not cause damage if the power is shut off right away and the condition corrected.

There is no time delay in this method, so the feeder will stop each time a part is contacted. For fast moving parts, contact is so brief that the feeder just skips a few cycles with no harm done. For slower moving parts, it is better to use a time delay switch. The ARTHUR G. RUSSELL CO., INC. CH-12 Photoelectric Control can be used for this purpose by using “feeler” contacts in place of the photoelectric cell, in the “light—on” mode. Since the CH-12 is fully isolated from the power line, it can be grounded at any point in the circuit with safety. Contact voltage is 7-volt max. and contact current will not exceed 7 Ma.

Where metal parts are fed through a gravity tube and an “M” or VBC—73S type controller is used, current can be passed through the whole chain of parts. By using a plastic tube with a contacting segment near the feeder bowl (this segment connected to C1) the feeder will stop when parts back up in the tube, making a solid chain from the contacting segment to machine ground. No time delay is needed.

Older Servo Controllers:

On older servo (VBC-I6 & 30, S & SA) controllers, terminals Cl and C2 must never be grounded, as this will seriously damage the controller. Any isolated switch or relay will do the job. The ARTHUR G. RUSSELL CO., INC. CH-12 or CH—25 Photoelectric Control is especially recommended for this purpose.
OLDER MODEL VBC CONTROLLERS

Many VibroBlock Feeders are operating with the older model controllers. Although some models have been discontinued, they are still capable of satisfactory performance and parts and service are generally available. These controllers are:

<table>
<thead>
<tr>
<th>Controller</th>
<th>SCR</th>
<th>Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>*VBC-12MA</td>
<td>C2OC</td>
<td>Steel Heat Sink</td>
</tr>
<tr>
<td>VBC-16M, 16SA</td>
<td>C2OC</td>
<td>Anodized Alum. Heat Sink</td>
</tr>
<tr>
<td>VBC-30M, 3OSA</td>
<td>2N687</td>
<td>Anodized Alum. Heat Sink</td>
</tr>
</tbody>
</table>

*The “M” and “S.’ models are older versions of the current “MA” and “SA” series. This discussion applies to both new and older models, with the exception of some part numbers.

The anodized aluminum heat sink used in the larger models increases the power handling capacity of the SCR through better cooling.

Load Capacities:

<table>
<thead>
<tr>
<th>Controller</th>
<th>Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Largest Feeder</td>
</tr>
<tr>
<td></td>
<td>VB-12</td>
</tr>
<tr>
<td>12M, 12MA</td>
<td>VBF-12 —</td>
</tr>
<tr>
<td>16M, 16MA, 16S, 16SA</td>
<td>VBF-16</td>
</tr>
<tr>
<td>30M, 3OMA, 30S, 3OSA</td>
<td>VBF-30</td>
</tr>
</tbody>
</table>

Due to availability problems, some part substitutions have been necessitated, both in new manufacture and repaired controllers. These changes may not be noted on the accompanying parts lists and schematics.

How They Work:

Manual: Refer to Page 29A for schematic of the VBC-12MA*. When power line voltage is applied across L1, L2 and switch, S1 is closed. Current tries to run through the load, which is connected to Hi and H2 but is blocked by the SCR, which has not been triggered. When Li is positive, a trickle of current flows through R1 and R4, tending to charge C1. Since D1 does not conduct below a nominal 20 volts and D2 is reverse biased, the charging rate of C1 is determined by R1 and the setting of R4.

*This description also applies to the VBC-16MA and 3OMA Controllers.
R4 FULLY CCW
SCR NOT FIRED

FEEDER RUNNING
SCR FIRED AT 90°

AMPLITUDE
CONTROL

R2

D2

R4

BANDED
END

B

R7 C1

C2

H2

H1

L1

L2

CHASSIS
GROUND

FEEDER RUNNING
SCR FIRED AT 90°

R4 FULLY CCW
SCR NOT FIRED

R1

C1 CAPACITOR, MYLAR, 0.1 MFD., ±10%, 100 V.D.C.

D1 DIODE, 4 LAYER, SHOCKLEY TRANSISTOR CO. #4E20-28

D2 DIODE, RECTIFIER, TYPE IN457 OR EQUAL

R1 RESISTOR, COMP. 150K ±10%, 1/2 W.

R2 RESISTOR, COMP. 100 OHM ±10%, 1/2 W.

R3 RESISTOR, COMP. 39 OHM ±10%, 1/2 W.

R4 RESISTOR, POTENTIOMETER, LINEAR, 350K, 2 W.

R5 VARISTOR, 20K AT 145V, GLOBAR #63 BNR

R6 RESISTOR, W.W., 2K ±10%, 5 W.

R7 RESISTOR, COMP. 10K ±10%, 1/2 W.

S1 SWITCH MS 35058-22

F1 FUSE, BUSS GBB6

SCR RECTIFIER, SILICON CONTROLLED, G.E. CO. #C20C

TROUBLE WAVEFORMS
CONNECT OSCILLOSCOPE COMMON TO L2

TEST POINT WAVEFORM LIKELY CAUSE

A

B

D2 OPEN AT LOW NUMBER SETTING OF R4

D2 OPEN AT HIGH NUMBER SETTING OF R4

D1 OPEN

D1 LEAKY, DOES NOT BREAK DOWN

ALL WAVEFORMS ARE 20V ± 4V PEAK UNLESS OTHERWISE SHOWN

SCHEMATIC DIAGRAM FOR (VBC-12 MA)
C1 CAPACITOR, MYLAR, 0.1 MFD., ±10%, 100 VDC
D1 DIODE, 4 LAYER, SHOCKLEY 2N4006 OR EQUAL
D2 DIODE, RECTIFIER, TYPE IN457 OR EQUAL
R1 RESISTOR, COMP., 150K ±10%, 1/2W
R2 RESISTOR, COMP., 100 OHM ±10%, 1/2W
R3 RESISTOR, COMP., 39 OHM ±10%, 1/2W
R4 RESISTOR, POTENTIOMETER, LINEAR, 350K, 2W
R5 VARISTOR, 20K AT 145V, GLOBAR 2463 BNR
R6 RESISTOR, W.W., 2K ±10%, 5W
R7 RESISTOR, COMP., 10K ±10%, 1/2W
S1 SWITCH, MS 35058-22
F1 FUSE, BUSS KAW, 7 AMP (VBC-16MA), 15 AMP (VBC-30MA)
SCR RECTIFIER, SILICON, CONTROLLED, G.E. 2SC20C (VBC-16MA) — WEST. EN 687 (VBC-30MA)
MI AMMETER, HOYT MODEL 640, 0-3 AMP (VBC-16MA) — 0-10 AMP (VBC-30MA)

SCHEMATIC DIAGRAM FOR VBC-16 MA AND VBC-30 MA
D4 is a four layer diode which not only blocks reverse current flow, but also blocks forward current until a critical voltage is reached. At the critical voltage, D4 breaks down (not much different from an automotive spark plug) and becomes nearly a short circuit. When broken down, its current is limited by external resistance. It will continue to conduct as long as current is supplied.

The 4E20-28, used in older VBC Controllers, breaks down at 20 volts ± 4 volts. Therefore, C1 continues to charge until the voltage across it (and across D1) reaches approximately 20 volts. When this happens, D1 becomes a closed switch and C1 discharges through D1, R2, R3 and the SCR gate circuit, to near zero volts. Not enough current can flow through R1 and R4 to keep D1 conducting so it recovers when C1 is discharged.

The discharge current from C1 flows through R2, (which limits it to about .2 amperes) and splits between R3 and the gate (triggering) circuit of the SCR. This fires the SCR, which then “holds” its conduction, after the trigger is gone. The SCR continues to conduct until its forward current drops below its minimum holding value. Since the supply for the triggering circuit is the voltage across the SCR, this supply disappears when the SCR turns on, preventing C1 from recharging during the rest of the positive half cycle.

When L1 goes negative, D2 becomes forward biased, shunting C1 and preventing its charging to a negative voltage. Thus at the beginning of each positive half cycle, the voltage across C1 starts near zero and rises toward +20 volts. The sooner it reaches +20 volts, the longer the SCR conducts and consequently, the higher the feed rate. The values of C1, R1 and R4 are chosen so that the SCR cannot fire much before 90—degrees.

R5 is a varistor, which acts like a very high resistance at low voltages and drops to 20K Ohms at 145 volts and even lower at higher voltages. It protects the SCR against occasional voltage “spikes”, which are shunted through R5.

R6 is a minimum-holding-current resistor, which shunts the VibroBlock Vibrator coils. When the SCR is triggered, its current must rise above the holding current value before the trigger pulse dies out. The inductance of the VibroBlock Vibrator coils will not let the current rise fast enough, hence the need for R6.

How They Work:

Servo: Refer to Page 29C for schematic of the VBC-16SA. The Servo Controller uses the same triggering circuit as the manual types. (See Section on Manual Controller starting on Page 29). It differs in the way the timing capacitor, C4, is charged. Instead of using an adjustable resistor, the charging current is controlled by transistor Q1. This in turn, under control of the setting of R4 which provides “turn—on” base current, and the output of the feed back network comprised of the transducer, transformer (T1), rectifiers (D1 and D2) and filter (C2) and R1.
When the operator turns up the control knob, he allows more current to flow through R4 and R3. This causes more current to flow through Q1 and charges C4, sooner. The resulting vibration in the VibroBlock Vibrator generates a voltage in the transducer. This is rectified and fed into the base of Q1 in a polarity, which cuts down the current in Q1. A balance thus results between the knob setting and the vibratory amplitude of the VibroBlock Vibrator.

If the conditions change, such as a load increase, which tends to reduce vibration, the transducer output is reduced and the current through Q1 is correspondingly increased until a new balance point is reached. This will be signaled by a higher meter current.

Reverse current is blocked by D5 when the power line voltage goes negative. Zener Regulator, D4, limits the collector voltages of Q1 to 33 volts. R9 limits current through D2 and D3.
CH-25 PHOTOLECTRIC CONTROL SYSTEM


Ratings:

1.) Input Power Requirements:
   95 to 129 Volts RMS, 50/60 Hz.

2.) Output Capabilities:
   With output selector switch to:
   Reed - Single Pole, N.O., 200 volt peak, 0.1 Ampere, 10 V.A. Max.
   Relay - D.P.D.T., 250 volt RMS, 5 Amperes Max. per pole

General Characteristics:

1.) Pulsed Infra—red light system.
2.) High ambient light immunity.
3.) Stable performance at power line voltages ranging from 95 to 129 volts RMS 50 or 60 Hz.
4.) Time delay, symmetrical “ON” - “OFF”
   Dual range, Short — 0.005 to 0.25 Sec. - Long - 0.01 to 5 Sec.
5.) Choice of light intensity by Plug-In resistor; 9.4 to 950 Ma. peak lamp current.
6.) Test socket (std.) to accommodate optional aiming light or DC voltmeter.
7.) Light or dark “On” modes selected by switch.
8.) Interchanging plug—in board (PEC—24) does not affect settings.
9.) Choice of reed or power relay output.
10.) Internal one—ampere fuse protects all but the relay contact circuits.

Connections:

1.) All 115 volt and power output connections are made at the top terminal strip.
2.) All input and low-level connections are made at the bottom terminal strip.
3.) Terminals are identified by printed legends adjacent to the terminals. Wires do not require lugs.

Mounting:

The CH-25 chassis is normally mounted vertically but will operate in any orientation. Adjacent controls can be butted on the long sides forming a convenient ½” x ½” wire way between the chasses. The main circuit board extends well beyond the terminal screws to assure room for wire terminals and harnessing. Four (4) slotted holes, accommodating screws up to No. 10, provide for quick mounting and changing.
LIGHT RESISTOR IN SOCKET

PEC-25, PLUG-IN CIRCUIT BOARD

CONNECTIONS FOR A SCANNER, SUCH AS PEC-16S OR PEC-17S (SHOWN)

CONNECTIONS FOR SEPARATE HEADS, SUCH AS LS-19, 21, 23 AND PEC-18, 20, 22

CH-25 CONNECTIONS
Control Settings:

Standard built-in controls on all CH-25 chassis adapt the system to a wide range of applications without the necessity of rewiring or adding “optional” circuit boards. In addition, it is possible to tailor the light intensity to the application by plugging selected resistors into the “LR” socket. All switch and rotary controls are non-interacting.

Light Dark:

Switch on upper right. When set on “Dark”, the output relay turns on when the photocell goes dark and vice versa.

Sensitivity:

Always adjust sensitivity with the time delay switch on “Short”. For best results, find the lowest and highest settings that meet the requirements and set midway between.

Delay:

Switch on “Short” yields 0.25-second max. Switch on “Long” yields 5 seconds max.

“On” delay delays the turn—on of the relay, thus a fast—moving target will not be noticed.

“Off” delay delays the turn—off of the relay after the target has gone by.

The two controls are matched and non—interacting. Log—taper potentiometers spread the first 20% of the delay over 50% of the travel, giving a smooth, progressive response.

Output Option:

Normally the CH-25 is provided with a plug-in DPDT relay with contacts rated at 5 amperes. For low level, dry circuits, high speed and logic inputs, the reed relay is recommended. With the “Output” switch on “Relay” the power relay option is selected and the reed relay terminals, lower left, are not connected to any terminal. With the switch on “Reed”, the two terminals on the lower left are disconnected from the power relay coil and become the output. The power relay socket may then be left empty.
Lamp Current:

The versatility of the CH—25 system is increased by the “LR” resistor socket, which permits the user to adjust the light intensity. Two component sockets accept a common ½ watt resistor. Any value, including a short circuit jumper, can be plugged in without damage to the CH-25 or the light source.

<table>
<thead>
<tr>
<th>LR Value (OHMS)</th>
<th>Peak Lamp Current (ma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>950</td>
</tr>
<tr>
<td>10</td>
<td>480</td>
</tr>
<tr>
<td>22</td>
<td>300</td>
</tr>
<tr>
<td>39</td>
<td>200</td>
</tr>
<tr>
<td>62</td>
<td>140</td>
</tr>
<tr>
<td>100</td>
<td>125 Most common value</td>
</tr>
<tr>
<td>220</td>
<td>50</td>
</tr>
<tr>
<td>470</td>
<td>30</td>
</tr>
<tr>
<td>1000</td>
<td>20</td>
</tr>
<tr>
<td>No Resistor</td>
<td>9</td>
</tr>
</tbody>
</table>

Figure #3

The above table gives some idea of peak currents for several common values of resistance, but LR values are best determined by cut-and-try. In general low values of LR are best with long range and reflection applications. High values are for close—in and small targets.

Photo Head Alignment, Use of Aiming Devices

The infrared light beam is invisible which makes alignment difficult. To compensate for this, every CH-25 has a test socket, which can be used in conjunction with a D.C., voltmeter or the Arthur G. Russell Company aiming device. This will work with any CH-25 compatible photo head.

Any voltmeter, reading to 10 volts D.C., may be used. The alignment device contains a visible L.E.D. and 10K resistor and brightness corresponds to the light pick-up. The mating connector is a Winchester WIN—COM 56—03S2000 with Pins No. 156-1O18S, or equivalent.

Set—Up Procedure

Connect the CH-25 and selected photo heads as shown in Figure 1. Be sure to plug in the PEC-24 printed circuit board. Connect terminals Li and L2 to a 115-volt A.C. line.

Aiming:

A.) With aiming device or voltmeter:
Plug in the aiming device or connect the voltmeter as shown in Figure 4, page 36. Align the light source and photocell approximately by eye. Realign, watching the meter or aiming—light, and adjust for highest voltage or brightest light. It is sometimes helpful to put a wire jumper into the LR socket when setting up, and replace it with the correct resistor after aiming is complete.
B.) Without aiming device or voltmeter:
   Set the delay switch to “Short”, mode switch to “Lite” and sensitivity control near maximum. Align the photo heads until the CH-25 turns on, as evidenced by the click of the power relay or the lamp on the PEC-24 plug-in circuit board. It may be helpful to plug a juniper wire into the LR socket at first. When the CH-25 turns on, reduce the sensitivity and realign. Best alignment is achieved when the relay turns on at lowest sensitivity settings.

   The PEC-17S, straddle scanner is adjusted, using instruments, at the time of assembly. Do not loosen the set screws which hold the ¼” diameter legs or bend the legs. If they have been moved, they can be readjusted using a CH-25 and voltmeter or aiming device, following the procedure on page 34.

   Lamp Current: (Also see top of page 34)
   Increase Lamp Current (low value LR) for:
   - Maximum range
   - Reflection from dull objects
   - Initial alignment
   - Maximum penetration of dense material

   Decrease Lamp Current for:
   - Very small targets, i.e.: .020” or smaller
   - Close spacing 2” or less
   - Reflecting targets with light backgrounds which give almost as much return as the target.

   General Rule:
   Favor high illumination and low sensitivity settings. Sensitivity Control:

   Always turn the delay switch to “Short” while adjusting sensitivity. Increase sensitivity until the CH—25 turns on (or off) and stays that way, and note the setting. Next reduce sensitivity until the CH-25 stays off (or on). Choose a final setting between the two.

   Delay Control:

   The delay switch selects the range for both on and off delay. The delay controls are independent of each other and each have the same range.

   The log—tapered controls spread the first 20% of the delay over half the control shaft range. This gives a smooth constant—percentage response.
A short “On” delay and long “Off” delay can be used to stretch a rapid input into a pulse long enough to operate slow acting devices, such as a solenoid or motor-driven cam.

In high or low-level control applications, delay both ways can assure a consistent backlog of material while preventing excessive on-off dither.

Relay Selection:

In most applications the plug-in power relay is required to provide current capability and contact multiplicity, at the expense of speed and dry circuit capability. For input to electronic logic circuits, VibroBlock Feeder control and other low level applications, the reed relay on the PEC-24 plug-in circuit board can be used directly. When the output switch is set at “Reed”, the reed contacts are completely disconnected from the coil of the power relay, which may then be removed.
PHOTO HEADS TO USE WITH THE CH-25 SYSTEM

MOUNTING: By two #6 screws thru body. See dimensions, left.

OBJECT SIZE: Smallest about .010". Largest limited by throat dimension.

VARIATIONS: Spacing can be varied. Standard dimensions are tabulated. Throat depth variations require a special design. Maximum size limited to when the scanner becomes flimsy.

PEC-17S
IF REPLACEMENT IS REQUIRED, THIS DIMENSION MUST BE SPECIFIED.

Notches line up with axis of the photo elements. For picking up small diameter objects it is best to align with this axis parallel to the axis of the object.

PEC-16S

Reflectors available \( \frac{1}{4} \)" to 3\( \frac{1}{2} \)" diameter with center mounting hole or adhesive back.

Object interrupts beam. If the object is too close to the PEC-16S, the reflection from the object can be stronger than shadowing effect, and the PEC won't see it. Works best with object near the reflector. Best for larger objects and long distances.

Works best with small diameter objects if axis is aligned with notches on the PEC-16S. Object size .010" diameter and up.

Light beam reflects off the object. This can detect small parts, holes, shiny vs. dark areas etc. Easy to mount from one side of track.

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PHOTOELECTRIC CONTROL SYSTEMS CH-12TR, CH-12TRS, CH-12T, CH-12 AND PEC-12

RATINGS:

1.) COMPATIBLE PHOTOCELLS: Any Photo Resistor, *Diode or *Transistor. Maximum resistance at switching point is 50K.
*(See CONNECTIONS, PAGE 39)

2.) INPUT POWER REQUIREMENTS: CH-12TR, TRS: 115 Volts, 50/60 Hz.
CH-12: 5.5 to 6.0 Volts, 50/50 Hz.

3.) OUTPUT CAPABILITIES: CH-12TR: D.P.D.T. Magnetic Relay, 250 Volts, 5 Amperes Max. per pole.
CH-12TRS: Normally-open, solid-state relay, Model SR-124, 120 Volts, AC, 2 Amperes Max.
CH-12T & CH-12: Normally open reed relay. 200 Volts, peak or DC, 0.1 Amperes, 10 VA Max.

5.7 VOLT AC OUTPUT: All “T” Models supply 5.7 Volts AC for Lamps or Satellite CH—12’ s.
*(See APPLICATIONS, PAGE 41.)

BASIC CHARACTERISTICS:

1.) CH-12TR: Complete self—contained system for operation from 115 Volt A.C. lines. D.P.D.T. relay output for A.C. or D.C. loads. Up to 1,000 operations per minute. Service life at rated load - 100,000 operations.

2.) CH-12TRS: Complete self-contained system for operation from 115 Volt A.C. lines. Triac output for A.C. loads only. Up to 1,000 operations per minute. Service life — 100—million operations.

3.) CH—12T: Complete system for operation from 115 Volt A.C. lines. Use where speed or high activity are more important than heavy load handling capability. Good as a solid-state driver, logic-circuit input, and for VibroBlock feeder level controls. The output is a normally—open reed relay. Up to 10,000 operations per minute. Service life at signal loads — 100—million operations.

4.) CH-12: Made to use where 5.5 to 6.0 Volt A.C. is available, such as in multiple installations fed from one central transformer, or as satellites* of a CH-12T, TR or TRS. Output is a normally—open reed relay. Speed and service life — Same as CH—12T.
*(See APPLICATIONS, PAGE 41.)

5.) TEMPERATURE RANGE: 0 to 65 degrees Centigrade.

CH-12: ½ lb.
CONNECTIONS:

1. **INPUT POWER: CH-12TR, TRS, T**: Connect 115 VAC power to indicated terminals.

   **CH-12**: Connect 5.5 to 6.0 VAC to indicated terminals.

2. **LAMP**: Connect 6 Volt lamp to “5.5” Volt terminals. Lamps other than 6 Volt can be supplied from another source.

   **NOTE**: Terminal marked with ground symbol may be grounded.

3. **PHOTOCELL**: Photo Resistor (Cd S, etc.): Connect to “P.C.” terminals.

   Photo Diodes or Transistors: Connect to “P.C.” terminals, but note polarity.

   For Light “on”, Left P.C. terminal is +.
   For Dark “on”, Right P.C. terminal is +.

4. **TO OTHER Controls**: One CH-12TR, TRS, or T, can supply two satellite CH-12’s. Control outputs can be interconnected to perform simple logic.
ADJUSTMENTS:

1. **LIGHT/DARK**: With the switch on “dark” the reed relay contacts will close when the photocell goes dark. On “light” the contacts close when the photocell goes light.

2. **SENSITIVITY**: Turn clockwise to operate with less illumination or lower-sensitivity photocell.

3. **DELAY**: Switch on “long”, maximum is 5 seconds.
   - Switch on “short”, maximum is 0.25 seconds.
   - **DELAY OPERATE**: Clockwise for increased delay between “on” signal and contact closure.
   - **DELAY RELEASE**: Clockwise for increased delay between “off” signal and contact opening.

SET-UP PROCEDURE:

1. Connect power, lamp, and photocell.

2. Set “Light/Dark” switch as needed.

3. Set delay switch to “short”.

4. Set “sensitivity” so that the pilot light on the PEC-12 plug-in board turns on at the required dark or light condition.

5. Set delay controls for desired delay. The pilot light on the PEC-12 indicates reed relay contact closure.
APPLICATIONS:

CH-12 series photoelectric controls can be used in combinations. By paralleling the “5.5 V” and ground terminals on all controls, one or two CH-12’s can be added to any T, PR, or TRS Model with enough surplus current to supply the lamps of three Model PEC-8S scanners.

Also, on any TR, or TRS Model, the “output” terminals can be externally bridged to hold the power relay closed, whether the photoelectric control is on or off.
HIGH-LEVEL CONTROL FOR VIBROBLOCK FEEDERS:

The CH-12T, used in conjunction with the Arthur G. Russell Company photoelectric scanner, Model PEC-8S, is particularly suitable as a high-level limit control. Connect as shown in FIGURE 3. Set switches dark and ‘long’. Adjust “operate” delay so that the feed will not be interrupted when one or two pieces move past the light. “Release” can be set for a recovery time, which best suits, the process. The pilot light on the printed circuit board (PEC-12), lets you check out the photoelectric control without having to run the feeder. When the light is on, the feeder is stopped.
PEC - 85 Photoelectric Scanner
OS-1 V/S Os-1A:

While the OS-1A supersedes the OS-1, the two are functionally identical, and are interchangeable in any normal control circuit. The OS-1A differs from the OS-1 in that it is totally immune to false triggering from electrical noise encountered in the worst industrial environments.

UNIVERSALLY “TIMED”:

Operation of the OS-1A is substantially independent of time. It is a true One-Shot device depending on sequence only. The following sequence must be followed to operate the OS-1A:

A. Initial conditions: U-P stopped at home station, and firing switch “Normal”.
B. Operate firing switch. U-P starts.
C. Follow-up switch on U-P cam, drops off the cam; U-P continues.
D. Follow-up switch rides back up on cam; U—P stops.
E. Firing switch returns to normal. (This switch can-be released as soon as the U-P starts or can be held indefinitely without affecting the operation of the U-P, thus far).
F. Repeat from Step A.

IMPORTANT: The firing switch and the follow-up switch must each go through a complete ON-OFF cycle before a second U-P cycle can be initiated. It doesn’t matter how long either switch is held down. The firing switch has no effect, if operated while the U-P is running.

OPTIONS:

1. Single-Stroke Button: See Figure 1. This allows the U-P to be cycled manually while the firing switch remains in the normal position.

2. Inhibit: See Figure 2. When it is necessary to prevent operation of the OS-1A, even though the firing switch operates, connect a switch between terminals 10 and 11. Closing this switch prevents initiation of the U-P, but will not stop it once it is running. This is the only recommended way to inhibit the OS-1A.

3. Two U-P’s fired from one switch: See Figure 3. OTHER USES:

The OS-1A can be used on mechanisms other than the Uniplace. Consult the Arthur G. Russell Company Engineering Department if assistance is needed.
YOUR OWN CONTROLLER:

If you have a logical controller, wired or programmed, you may not need an OS-lA. The Arthur C. Russell Company Engineers will be glad to advise you on your application.

TROUBLE SHOOTING:

The most common complaint is that the U-P runs continuously. If so, follow these tips:

1. If you have a spare OS-lA or can borrow one from another machine, substitute it for the suspected one.
2. If this doesn’t correct the problem, check the micro-switch located on the U-P clutch-brake assembly. It should be “Normal” when off the cam and held “Off Normal” when riding up on the cam. A marginal setting can result in occasional coasting past the high portion of the cam and the U-P will repeat.
3. Check the air solenoid for sticking.
4. Check the air-operated clutch-brake on the U-P drive shaft to see that it is shifting properly.

WED/sk
**FIGURE 1**
MANUAL SINGLE-STROKE PUSHBUTTON

**FIGURE 2**
INHIBIT SWITCH

**FIGURE 3**
TWO UNIPLACE'S ON ONE FIRING SWITCH

**PANEL FEATURES:**
- Basic schematic
- Panel features:
- Panel

**115V 50-60Hz**

**IFU 1AMP**

**FOLLOW-UP (CAM)**

**LOAD**

**FIRING SW.**
MOTOR SIZE: 1/50 to 1/8 HP

POWER REQUIREMENTS: 115V, 50/60 HZ, SINGLE PHASE

FUSES: A.C. POWER LINE, 5 AMPERE, SLOW D.C. ARMATURE, 2 AMPERE, SLOW

1. PILOT LITE: INDICATES 115 VAC POWER IS ON.
2. A.C. POWER SWITCH: SWITCHES 115 VAC INPUT.
3. RUN-STOP SWITCH: FOR STARTING AND STOPPING THE MOTOR, WITH DYNAMIC BRAKE.
4. SPEED CONTROL KNOB: SETS MOTOR SPEED.

MINIMUM SPEED TRIM: LOCATED BEHIND THE PANEL. MARKED R8. SETS SPEED AT LOW THE END OF SPEED CONTROL KNOB.

1. PILOT LITE: INDICATES 115 VAC POWER IS ON.
2. A.C. POWER SWITCH: SWITCHES 115 VAC INPUT.
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