Model HT-91000
Microplate Orbital Shaker

Product Manual

BigBear Automation

Big Bear Automation, Inc.
Pleasanton, CA USA 94566
Tel: 510-333-4338
Fax: 925.397.3148
Email: Sales@BigBearAutomation.com
Web: www.BigBearAutomation.com

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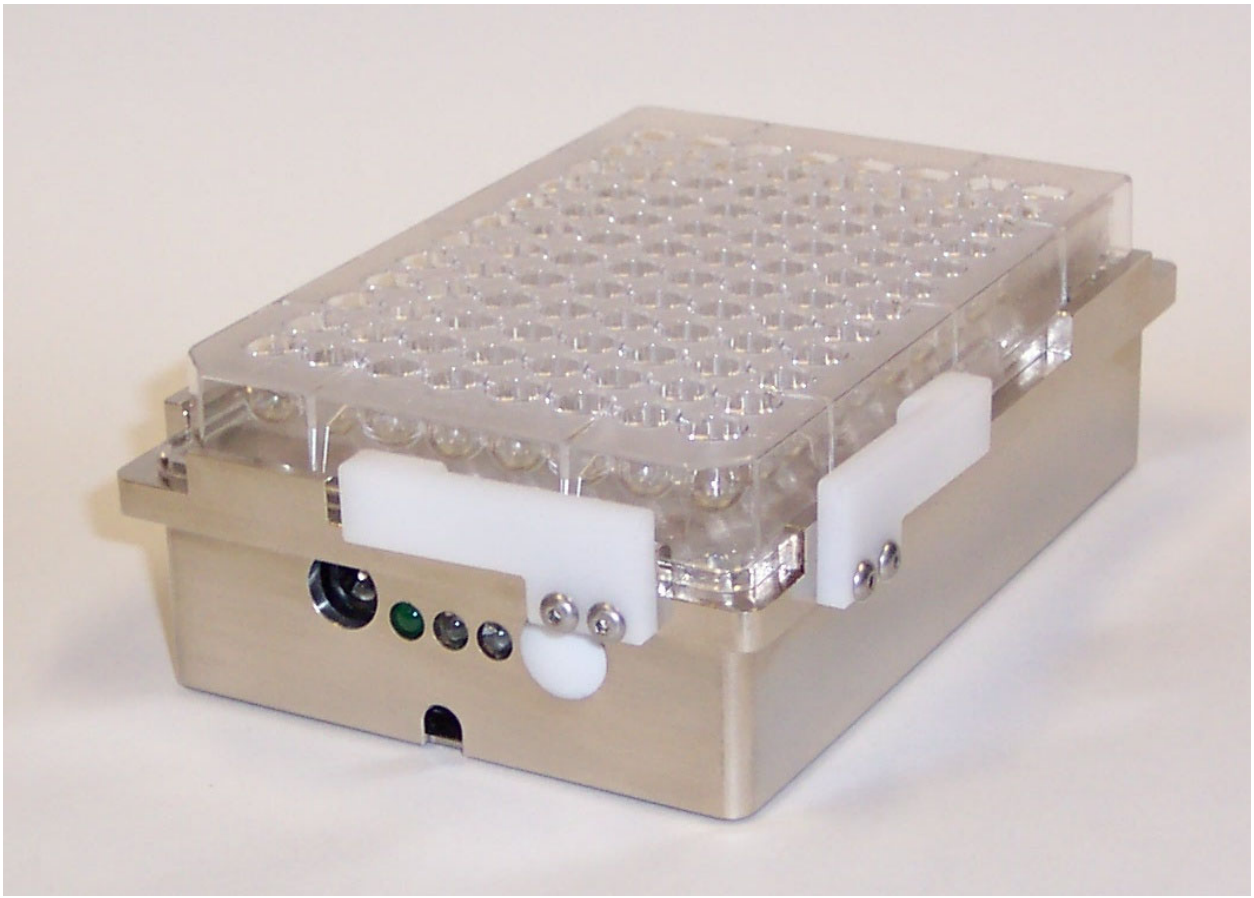
Description

Congratulations on your purchase of Big Bear Automation's Microplate Orbital Shaker. This precision laboratory instrument will provide years of reliable operation for you. The HT-91000 Microplate Orbital Shaker is designed to provide an orbital shaking motion for a single microplate, keeping liquids either gently stirred or fully mixed and in suspension. Its thin profile and same footprint dimensions as a standard well-plate makes it ideal for use on robotic deck plates wherever you might set a microplate.



HT-91000 Microplate Orbital Shaker

Features

- Rotationally shakes a single microplate.
- 1 mm orbital motion. Small enough not to spill liquids at high speed.
- 2 selectable & adjustable speeds.
- Low stirring speed to ultra-vigorous vortex speeds for viscous liquids.
- 24 VDC power for safe and easy integration with other automation.
- Green LED power indicator, two blue LEDs for speed selection indicator.
- Solid aluminum block base with rubber feet provides stable platform. No walking
- Cold running motor allows continuous operation, weeks at a time.
- Small number of precision components for extreme reliability over years of use.
- Spring clips secure microplate; easy on and off for robots or people.
- Base is same size as microplate & fits onto robotic decks.

Specifications
Model HT-91000 Microplate Orbital Shaker

Orbital Motion	1 mm diameter, circular shape, constant everywhere on well plate
Speed	60 RPM to 3500 RPM, 2 separately adjustable potentiometers for two independent speeds. Speeds can be selected using external switches, relays or solid state switches.
Power Required	24 VDC, 225 mA
Connection for Power	Internal terminal block or supplied 100-220 VAC power adapter.
Base Dimension	3.350" width, 5.030" length
Shaker Platform Dimension	3.650" width, 5.300" length, centered on top of base. Secures a single 96 or 384 micro well plate with SBS footprint.
Height	1.215" height from bottom of rubber feet to top surface of shaker table platform. 1.775" height from bottom of rubber feet to the top surface of a standard well plate. 0.995" from bottom of rubber feet to bottom of shaker platform.
Weight	1.58 pounds
Operating Temperature	0° F to 120° F (-17.5° C to 49.0° C), non-condensing, RH to 90%
Start-up Time	1.5 seconds to set speed
Mixing Speed	Speed varies based on your liquid viscosity. For 96 well plates water fully mixes in each microplate well at 1300 RPM, 2000 RPM for 384 well plates.
Indicators	Green LED for power indicator, two blue LEDs indicating Speed A or Speed B activation.
Material	Aluminum, nickel plated, stainless steel hardware, white Delrin clips.
Warranty	Two year limited replacement warranty.

Set-up Instructions

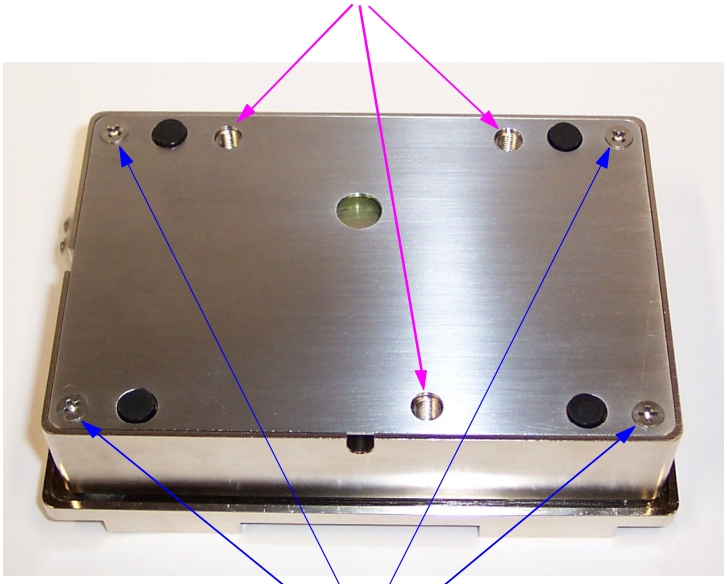
Included in your package is:

- HT-91000 Microplate Orbital Shaker
- 100-240 VAC 50-60 Hz Power Adapter with cables
- CDROM with this manual in pdf format.

After unwrapping your new shaker, place flat and upside down on a table top. You will be removing the four screws in each corner to access the electrical wiring terminal block inside the shaker.

The shaker will not run on its own by plugging in the 24 VDC power adapter. You must at least select a particular speed channel by installing a wire loop. For installation into your particular application, you should review the wiring configuration and operational set-up described in the following pages to find a configuration that matches your needs.

10/32 tapped holes (3) for deck plate mounting



Bottom plate screws, (4) medium Philips

Bottom View Showing Mounting Holes and Bottom Cover Plate Screws

Controls Overview

This illustration shows the main control and power connections on the shaker. The two small speed adjustment potentiometers are located behind the plastic or chrome plug. Gently pry off the plug to see the pots. The pots can be adjusted while the shaker table is in motion.

In some applications, the customer will be supplying the required 24 VDC power supply to the internal wiring terminals instead of the external power plug shown here. In that case, do not use the AC power adapter that is included with the shaker.

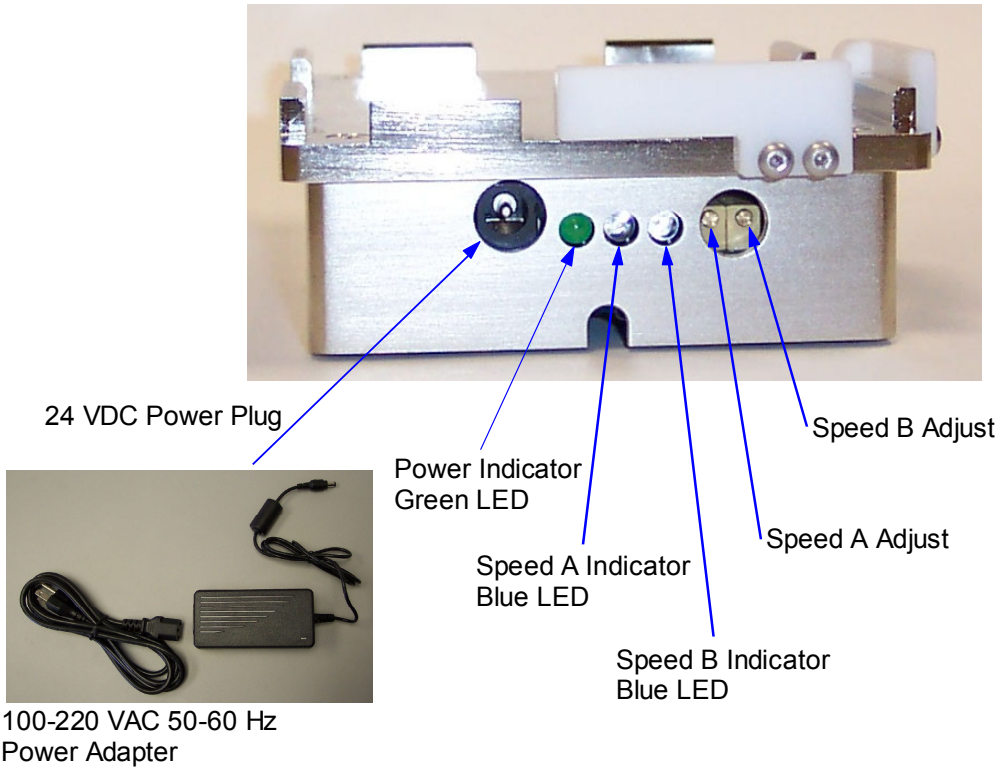


Illustration Showing External Power Connector, LED Indicators and Speed Adjustment Pots

Speed Adjustment

On the HT-91000 model there are two miniature potentiometers allowing adjustment of the slow and fast shaking speeds. They are accessible by gently prying off the chromed metal or plastic plug in the end of the shaker.

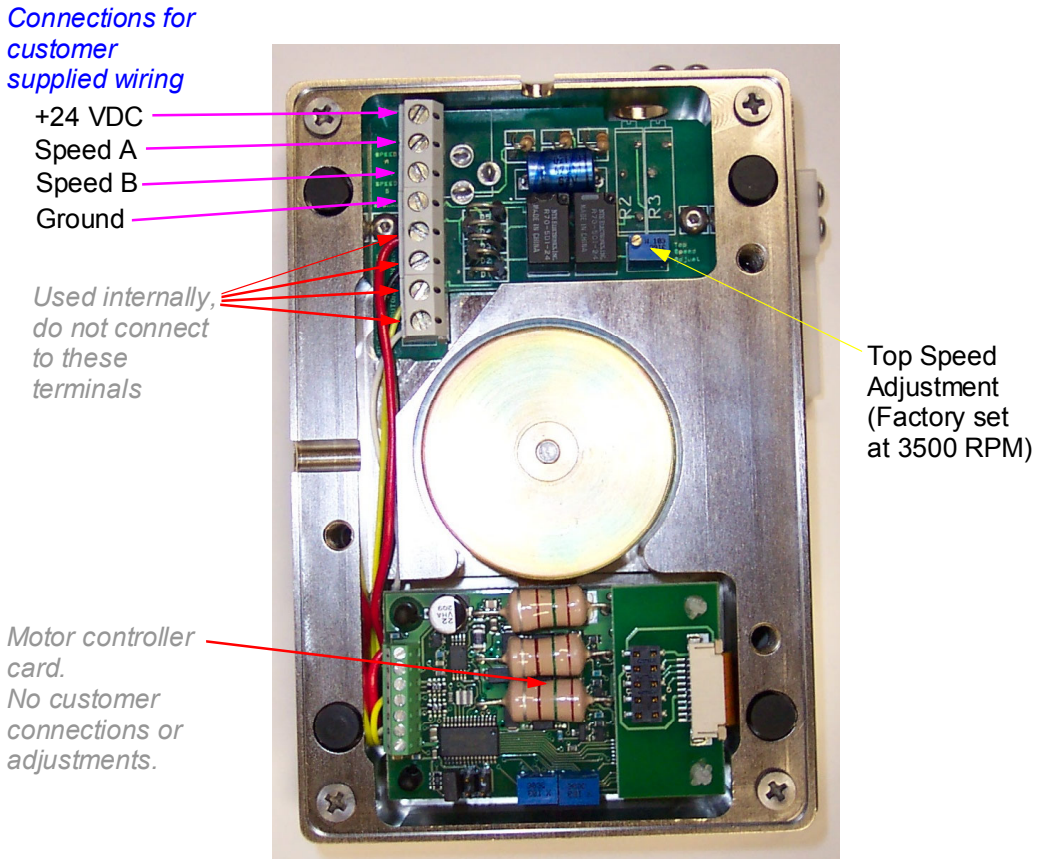
The speed adjustment potentiometers control the two speed conditions. Each pot can control the entire range of 60 RPM through 3500 RPM. Therefore, the difference between the Speed A and Speed B shaking speeds can vary by any amount, including a zero difference. You may adjust the pot while the

unit is running. Adjusting the pots clockwise will provide faster speeds, while adjustment counter-clockwise is a slower speed. There is a condition at the extreme ends where no more speed adjustment occurs, but the pots will continue to turn.

Speed range is 60 RPM to 3500 RPM. Adjust each potentiometer to the speed you want while power is applied for that particular speed selection.

Customer Wiring Location

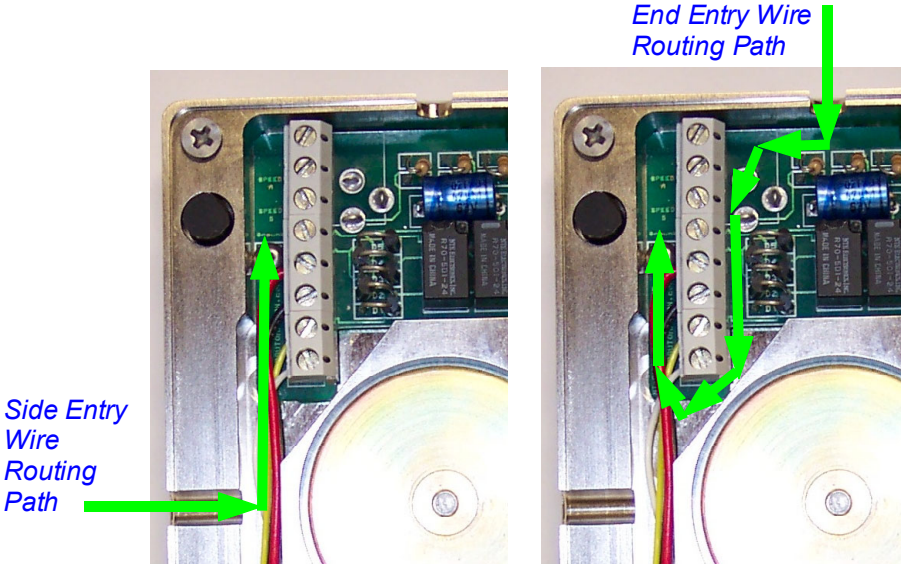
This bottom view illustration shows where the terminal block is placed on the printed circuit card. Please note that only the top four screw terminal positions are available for your usage. Do not use the other terminals as they are connections for the motor control card.



Bottom View Illustration Showing Internal Components and Wiring Terminal

Wire Routing Inside Shaker

When wiring your shaker into your application, you may need to route your control or power wires/cable into the shaker. There are two routing channels for your supplied wires. One channel is on the side of the shaker, the other is on the end. The illustrations below show the recommended wiring path for your wires inside the shaker unit.



Recommended Wire Routing Paths Inside Shaker

Wiring Configuration and Operation

The HT-91000 Orbital Shaker can be wired to operate in a number of flexible configurations. There are two possible speed adjustments, and you are able to select either speed. The other selection you have is the source of the shaker's power, using either the included AC power adapter, or a 24VDC power supply source you provide.

Using the AC power adepter is as simple as plugging the low voltage power plug directly into the end of the shaker, and plugging the AC adapter into a 100 to 220 VAC, 50-60 Hz outlet.

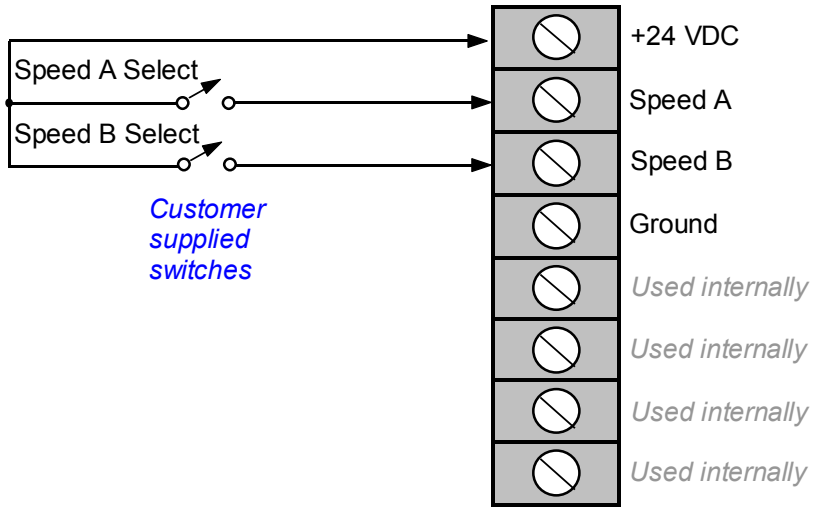
Whenever power is applied to the shaker, the green LED illuminates. There are two blue LEDs to indicate which speed has been selected.

Following are a number of possible wiring configurations for your consideration.

Configuration #1
Power Source: AC Adapter
Speed Select: 2 Possible Speeds, External Switches

Use this configuration to use your externally supplied switches to select one of the two possible speeds that the shaker can operate at. You'll use the included AC power adapter, so you do not need any customer supplied external 24 VDC supply source.

In this configuration, the switches can be mechanical switches wired to a remote panel, relay contacts, or sourcing solid state circuitry. The current demand on the switch is approximately 10 mA, and it must be rated for at least 24 VDC.



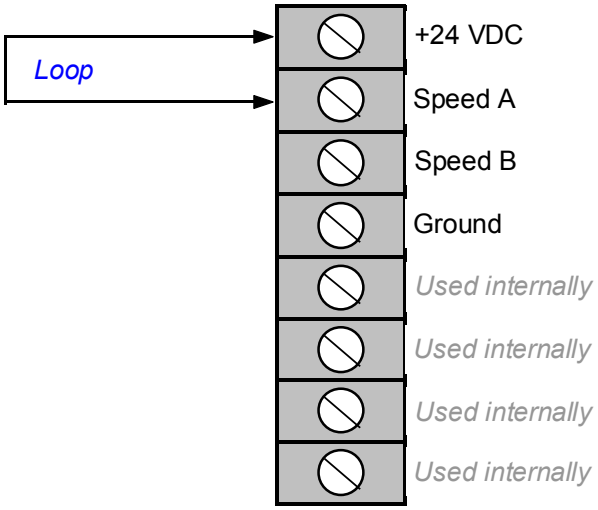
You don't need to supply two switches if only one will work for your application.

In the event both Speed selections are accidentally activated, only Speed B will be functional.

Configuration #2
Power Source: AC Adapter
Speed Select: 1 Speed, Activated by AC power

Use this configuration to turn the shaker on and off using line power to the AC adapter. For example, when 120 VAC power is applied to the AC adapter, Speed A is immediately activated and the shaker begins orbital motion. When you remove the AC power, the shaker stops.

In this instance, only one speed is possible.

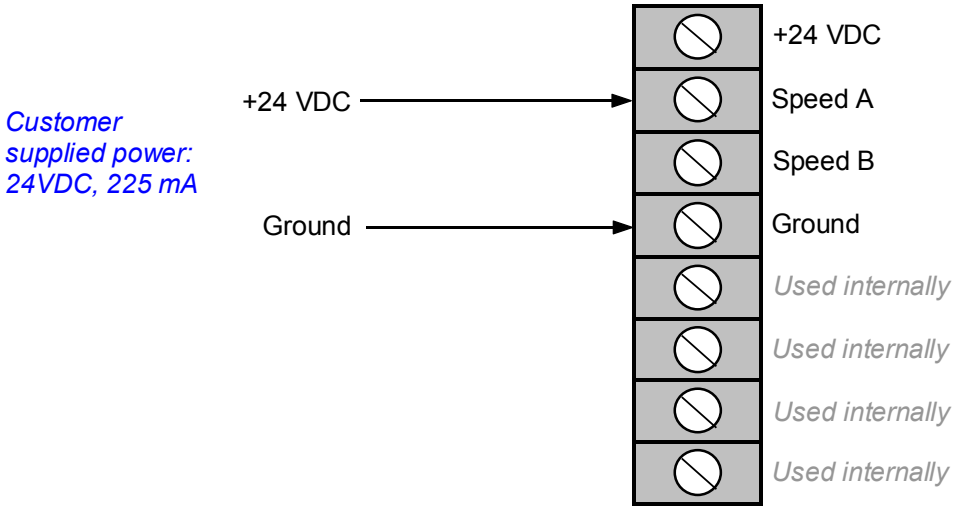


Configuration #3
Power Source: Customer Supplied 24 VDC
Speed Select: 1 Speed, Activated by Supplied 24 VDC

You can apply your switched source of 24 VDC power supply directly to the shaker, at the terminal for either Speed A or Speed B.

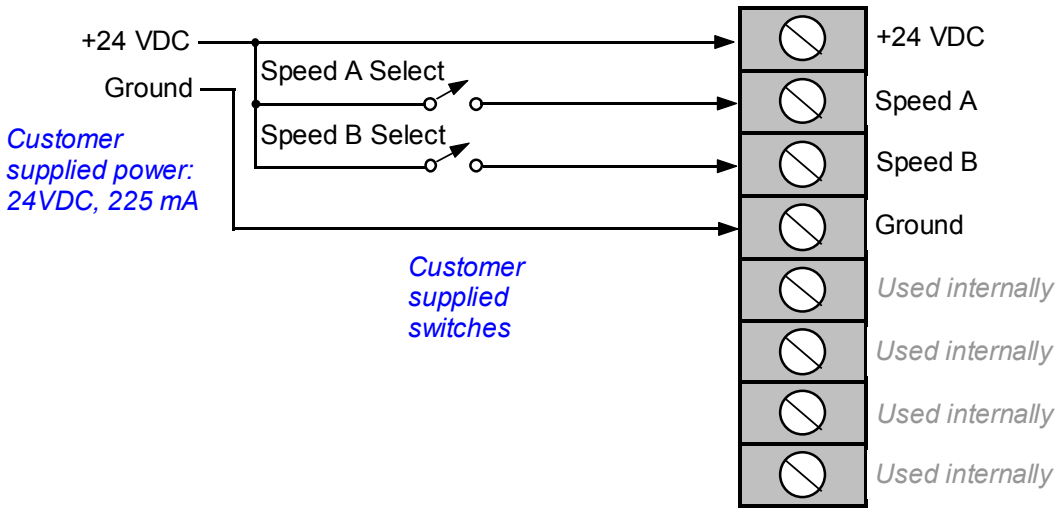
Do not use the AC adapter in this configuration.

When you supply 24 VDC, 225mA power to either Speed terminal, the shaker will operate, and will stop when you remove power.



Configuration #4
Power Source: Customer Supplied 24 VDC
Speed Select: 2 Possible Speeds, External Switches

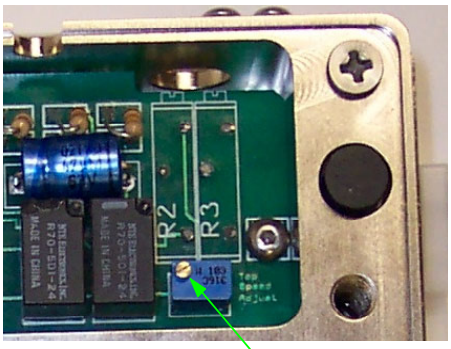
In this configuration, you supply a constant source of 24 VDC, 225 mA power. And you supply external switches, relays, or sourcing solid state switches to activate a particular speed. The switches must handle approximately 10 mA of current. Do not use the included AC adapter as a power source if you are supplying your own power to the shaker.



Top Speed Adjust

There is an adjustment potentiometer accessible from the bottom inside of the shaker unit that is used for setting the top speed limit of operation. It has been set by the factory for a top speed of 3500 RPM.

To adjust it to another speed, first turn either Speed A or B pot, accessible from the end of the unit, to its full limit while in operation. Now adjust the Top Speed Adjustment pot until you reach the speed value you wish. Our factory uses a precision non-contact optical RPM meter measuring the motor spinning, with loaded shaker table, to establish exact speed adjustments. While the shaker's motor and controller is capable of speeds in excess of 7500 RPM, we recommend you do not exceed 4000 RPM. Speeds in excess of the specified 3500 RPM may void the warranty.



Top Speed Adjustment (Factory set at 3600 RPM)

Finishing Set-up and Powering Up Shaker

After you have wired the shaker unit with your configuration, install the shaker's bottom panel again with the four screws. Turn the shaker over right side up and place on a flat hard surface. If you are using the included AC power adapter, you may plug it into the shaker now, and then plug the input power end into your source of AC power. If not using the adapter, apply your own external source of 24 VDC power now. The green LED should illuminate.

Selecting either Speed will illuminate one of the blue LEDs. You can adjust the individual speed of each channel using the small potentiometer accessible through the end plug cap, described in an earlier paragraph.

Application Information

The HT-91000 Microplate Orbital Shaker is capable not only of gently stirring liquids, but also of vigorously mixing liquids, and maintaining suspension, for each and every well. Mixing occurs at differing speeds based on the viscosity of the liquid. The orbital motion is of a small enough diameter that liquid motion is contained within the well, and no spillage occurs even at the higher speeds. Gentle stirring is useful for preventing surface skimming, while mixing completely disperses one soluble liquid within another, or maintains suspension of particles within a liquid while precluding settling.

96 well-plate water mixing occurs at approximately 1250 RPM, and occurs within 2 seconds of activating that speed.

384 well-plate water mixing occurs at approximately 2000 RPM.

The unit has been designed for use in robotic applications. The base is the same size as a standard microplate, and will fit most robotic deck plates. In this manner, you can leave the Orbital Shaker in the deck plate, and simply program the robot to grip the actual microplate a set distance above where it used to be grasped from on the deck. The very small 1 mm orbital shaking distance is within the compliance of most robotic grippers, so the stage does not need to be positioned in a registered mechanical position around the orbital diameter. The unit also has special plastic containment clips designed to allow straight up and down microplate placement by a robotic gripper system. There are plastic containment clips available that will also allow a microplate's lid to also be captured on the shaker platform.