

# *Bearing/Balancing Fault Simulator*

# **BBS**



*Hands-on system to study bearing faults  
and shaft unbalance*



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## *Bearing/Balancing Fault Simulator (BBS)*

### **An ideal tool to learn multi-plane balancing and bearings**



The Bearing/Balancing Simulator (BBS) is specifically designed to demonstrate and support the study of bearing faults and unbalance under controlled conditions. The BBS is a variable speed machine that can be used to generate each type of fault individually or in combinations, providing a stable platform for study. Since bearing related problems are very common, it is essential to have a thorough understanding of the associated fault signatures that occur under a variety of operating conditions. The same can be said for unbalance, where a properly balanced machine will save a factory on machine down time, replacement parts, inventory, and energy consumption. The BBS provides a basic setup for performing experiments and learning vibration signatures of unbalance and bearings malfunctions. Detailed investigation of particular and more advance vibration phenomena will require additional attachments and fixtures which are available through optional kits.

#### **Features:**

- ❖ Portable, robust, cost-effective balance and bearing vibration trainer
- ❖ Ideal for teaching multi-plane balancing with centerhung / overhung rotors
- ❖ Can be setup to exhibit bearing fault frequencies both further away from, and closer to multiples of the shaft rotational speed
- ❖ Develop signal processing techniques to identify bearing fault frequencies in the presence of defects, at multiples of shaft speed, without using high-resolution spectra
- ❖ Use the BBS to recognize the vibration spectra of different bearing faults
- ❖ 11 different application specific study kits available

#### **Basic Balancing/Bearing Fault Simulator Description:**

- ❖ 1/3 HP Variable frequency AC drive with multi-featured front panel programmable controller, 110 or 220 VAC 1 phase supply
- ❖ 3 Phase 1/3 HP motor, pre-wired self-aligning mounting system for easy installation/removal
- ❖ Split bracket bearing housings with features for span reconfiguration
- ❖ Vibration isolators mounts
- ❖ Two balance rotors with two rows of holes
- ❖ Built-in Tachometer with LCD display and analog output
- ❖ One 5/8" TGP straight steel shaft
- ❖ Impact resistant clear safety cover with safety interlock
- ❖ Balance weight kit
- ❖ Allen wrench set
- ❖ Comprehensive operations manual

# Bearing/Balancing Fault Simulator (BBS)

## Option Kits

### Balancing Training Book (B-BK)

- ❖ The Balancing Training Book teaches the basics of machine balancing.
- ❖ Use prescribed laboratory exercises to enhance learning through hands-on experimentation.

### Eccentric Rotor (M-ER-5/8)

- ❖ Learn the effects of rotor eccentricity on vibration spectra.
- ❖ Determine relationships between eccentricity and unbalance.
- ❖ Develop techniques to locate and correct the effects of eccentricity.
- ❖ Learn the effect of varying the mass moment of inertia on vibration amplitude.
- ❖ **The kit consists of one aluminum rotor with an asymmetrically located center and one clamp collar.**



### Cocked Rotor (M-CR-5/8)

- ❖ Learn the effects of a sheave that has not been fitted to the shaft properly.
- ❖ Learn vibration signature of a cocked rotor.
- ❖ Develop methods to correct cocked rotor problems.
- ❖ Learn the effect of varying the mass moment of inertia on vibration amplitude.
- ❖ **The kit consists of a cocked aluminum rotor (0.5 degree off-axis) and one clamp collar**



### Centrally Bent Rotor Shaft for Balance Studies (B-BRS-5/8)

- ❖ Demonstrate the signature of a bent shaft.
- ❖ Observe the difficulty associated with attempting to balance a rotor mounted on a bent shaft.
- ❖ Learn to cope with the alignment issues due to a bent shaft.
- ❖ **The kit consists of one 5/8" shaft centrally bent ~0.020"**

### 1" Shaft Bearing Study Kit (B-BSK-1)

- ❖ Study bearing fault frequencies away from multiples rotational speed. Identify bearing fault frequencies in the presence of defects at multiples of shaft speed without using high-resolution spectra.
- ❖ Understand the signal processing issues such as averaging, spectral resolution, and leakage phenomena.
- ❖ **The kit consists of two split bearing housings, two 1" inside diameter bearings, one 1" diameter shaft, and one couling.**



### 5/8" and 1" Bearing Fault Kit (M-BFK-5/8 and M-BFK-1)

- ❖ Learn waveform and spectra of classic bearing defects.
- ❖ Learn about signal processing issues such as averaging techniques, leakage, and spectral resolution on determining bearing faults.
- ❖ Perform experiments with increasing severity of defects.
- ❖ Learn how a large signal can mask adjoining low amplitude signal due to spectra leakage.
- ❖ **The kit consists of one inner race defect, one outer race defect, one with ball defect, and one combination of defects.**



### 5/8" and 1" Bearing Loader (M-BL-5/8 and M-BL-1)

- ❖ Investigate bearing radial loading effects.
- ❖ Enhance the spectral amplitude of system.
- ❖ **The kit consists of one 5/8" or 1" bore loader weighting 11lb (5kg) and two collars.**



### Cocked Bearing Housing (M-CBM-5/8)

- ❖ Recognize the signature of a cocked bearing due to improper seating or due to inconsistent installation.
- ❖ **The kit consists of one cocked bearing housing**



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### 5/8" Shaft Sleeve Bearing Kit (M-SBK-5/8)

- ❖ Investigate waveform and spectral recognition of worn or loose fitting bearings.
- ❖ Modify the clearance of the split bearings with plastic shims.
- ❖ Perform shaft orbital analysis.
- ❖ **The kit consists of two grease-lubricated babbitt lined sleeve bearings, two bearing pedestals, and various thickness plastic shims.**



### High Value Combination Packages

The BBS provides a basic setup for performing balancing and bearing experiments. However, a detailed investigation will require additional attachments and fixtures which are available through optional kits.

Option kit		PKG 1	PKG 2	PKG 3
Balancing Training Book	B-BK	x		x
Eccentric rotor	M-ER-5/8	x		x
Cocked rotor	M-CR-5/8	x		x
Centrally bent rotor shaft for balance studies	B-BRS-5/8	x		x
5/8" shaft bearing fault kit	M-BFK-5/8		x	x
5/8" shaft bearing loader	M-BL-5/8		x	x
1" shaft bearing study kit	B-BSK-1		x	x
1" shaft bearing fault kit (Requires B-BSK-1)	M-BFK-1		x	x
1" shaft bearing loader (Requires B-BSK-1)	M-BL-1		x	x
Cocked bearing housing	M-CBM-5/8		x	x
5/8" shaft sleeve bearing (grease lubricated) kit	M-SBK-5/8		x	x

### Specifications

<b>Electrical</b>	
Motor	3 Phase, 1/3 HP motor, prewired self-aligning mounting system, easy installation/removal
Drive	1/3 HP variable frequency AC drive with multi-featured programmable controller
RPM range	0 to 4000 rpm variable speed
Tachometer	Built-in tachometer with LCD display and analog TTL output for DAQ purposes
Voltage	115/230 VAC, Single phase, 60/50 Hz
<b>Mechanical</b>	
Shaft Diameter	5/8" diameter; Turned, Ground, & Polished (TGP) steel
Bearing	Two sealed rolling element in aluminum horizontally split bracket housing, tapped for transducer mount and three mounting positions
Rotor Base	10" long
Rotors	Two 6" aluminum with 36 threaded holes at 10 degree intervals for introducing unbalance
Safety Cover	Lockable clear, impact resistant hinged plastic cover with motor interlock switch to shut down motor when cover is raised
Foundation	1/2" (12.7 mm) die cast aluminum base and six rubber isolators
<b>Physical</b>	
Weight	Approximately 50lb (20kg)
Dimensions	L=28" (70cm), W=8" (20cm), H=20" (50cm)

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