Operation and Specification Manual

for the

SBS Balance System

covering the following:

— model 2400 Control Unit
— model 2500 Control Unit
— model 3500 Control Unit

Manual Revision #4

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System Purpose

A grinding wheel is the cutting tool of a grinding machine. In order for the grinding wheel to make accurate cuts, and produce smooth surface finishes, it is necessary to prevent vibration in the grinding process. One of the primary causes of vibration in an operating machine, is the existence of imbalance in the grinding wheel.

Imbalance is often due to the heterogeneous nature of grinding wheel construction. A wheel contains great numbers of unevenly distributed grains which cause an intrinsic imbalance. This imbalance will be compounded by eccentric mounting of the wheel, varying width of the wheel, imbalance in the arbor, and coolant absorption into the pores of the wheel. Even a carefully established balance, considering all these factors, will not last long. Due to wheel wear and frequent dressing of the wheel periphery, the rotational dynamics of a grinding wheel are always changing. For these reasons, balancing of grinding wheels has long been recognized as an important step in the production process.

The SBS Balance System has been developed to provide dynamic balancing to grinding machine operators with the following objectives in mind:

- **Attractive Purchase Price**
- **Ease and Usefulness of Operation**
- **Maximum Grinding Machine Efficiency**
- **Minimal Installation Requirements**
- **Minimal Maintenance Requirements**

Operator Safety Summary

This summary contains safety information necessary for operation of the SBS Balance System for grinding machines. Specific warnings and cautions are found throughout the Operation Manual where they apply, but may not appear in this summary. Before installing and operating the SBS Balance System, it is necessary to read and understand the entirety of this manual. After reading the Operation Manual, contact Schmitt Industries Inc. for any additional technical assistance required.

Warning
Observe all safety precautions for operation of your grinding machinery. Do not operate your equipment beyond safe balance limits.

Caution
To avoid equipment damage, do not drop or mistreat.

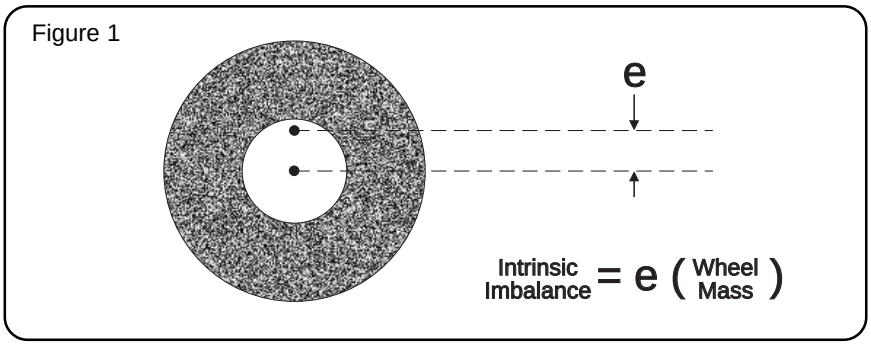
Warning
Only qualified service technicians should attempt to perform service on the SBS Balance System. To avoid electric shock, do not remove the cover of the Balance Control Unit, or remove umbilicals, with power connected.

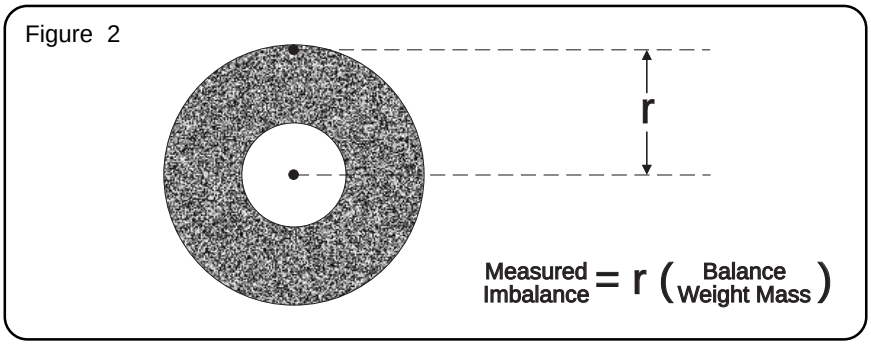
Caution
To avoid equipment damage, set the line voltage selector to the appropriate voltage position.

Warning
Never operate a grinding machine without all proper safety guarding in place.

System Theory and Connection

The SBS Balance System operates on a principle of mass compensation for a given grinding wheel imbalance. The Intrinsic Imbalance of a grinding wheel is equal to the product of the wheel's mass multiplied by the distance between the wheel's center of mass and the wheel's center of rotation *(figure 1)*.





The imbalance of a grinding wheel is determined in practice by use of the Measured Imbalance of the wheel. The Measured Imbalance is equal to the product of a mass, affixed to the grinding wheel to balance it, multiplied by the distance between that mass's center and the center of rotation of the grinding wheel *(figure 2)*. In both cases, the imbalance is given in terms of a mass multiplied by a distance, with (grams)(centimeters) being the units utilized for reference by the system.

In order to correct for various and changing imbalances which occur on a user's grinding machine, the SBS Balance System uses two movable weighted masses, which can be independently positioned so that their resulting compensation will counter any imbalance which is within the specifications of the system. These weights, located in the balance head, are driven by high torque electrical motors through a precision gear train.

Figure 3 is a simplified block diagram of the SBS Balance System.

The system consists of the Balance Head, a Balance Head Cable, a Vibration Sensor, and the SBS microprocessor-driven, balance Control Unit. Imbalance is expressed as spindle movement or vibration and is detected from the grinding machine by the sensor in peak to peak units of measure. The vibration signal from the sensor is transmitted to the control unit, which filters the signal by RPM. The control unit then drives the two balance head masses in the direction that reduces the amplitude of the incoming vibration signal.

When the balance weights are positioned so that minimum vibration is achieved, the balance cycle is complete. Figure 4a shows a rotating grinding wheel that is imbalanced, with an SBS Balance System installed. The imbalance is represented by the dot located on the circumference of the wheel. The other two dots represent the weighted masses located in the balance head. By incrementally repositioning the weights, a triangulation is achieved which cancels out the imbalance, as shown in Figure 4b.

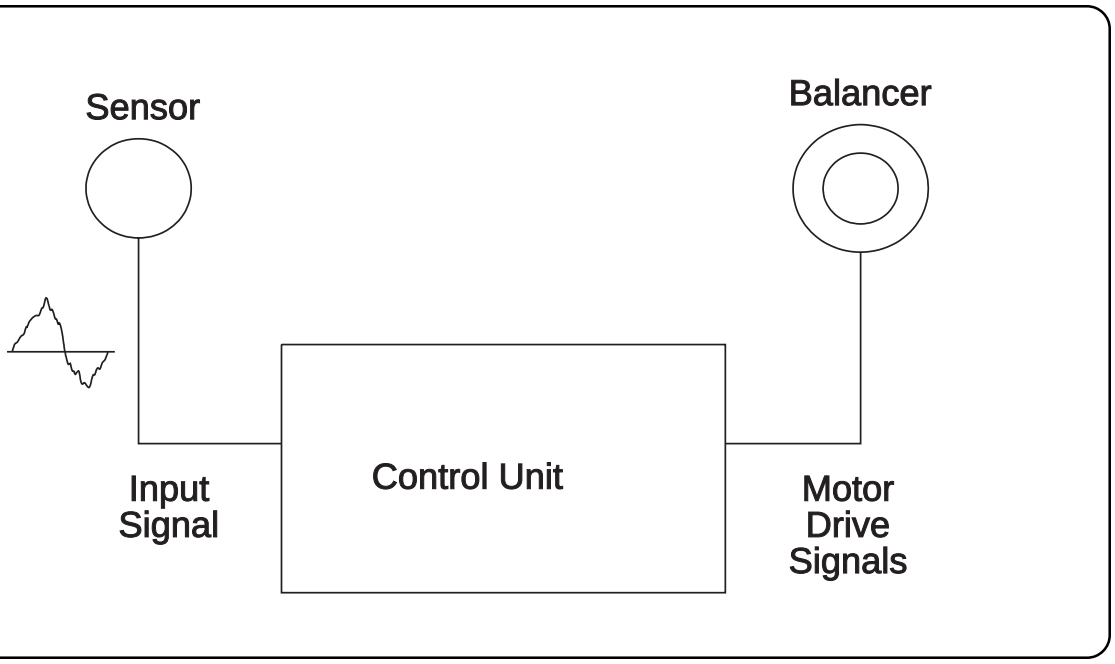


Figure 3

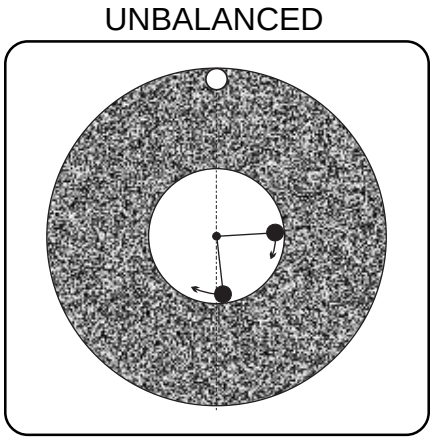


Figure 4a

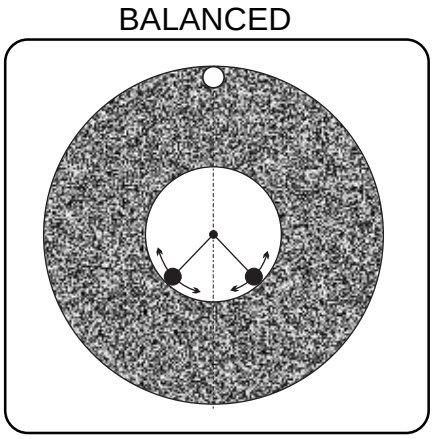


Figure 4b

Environmental Considerations

The SBS Balance System is designed to dynamically correct for grinding wheel imbalance, with its detrimental effects on quality of surface finish, accuracy of shape production, wheel life, and machine bearing life. The system cannot correct for other environmental problems which may also impact these areas. This section is intended as a discussion of some common environmental problems, which may influence grinding quality and the ability of the SBS Balance System to fully demonstrate its benefits.

Other Sources of Vibration

A most common source of vibration is adjacent machinery. It is therefore important that a grinding machine be properly shock mounted or otherwise isolated if vibration producing machinery is operating nearby.

The SBS Balance System may not operate as well under the influence of certain external vibrations. The system filters the vibration signal it detects from the grinding machine by the frequency of the spindle RPM. This means that vibrations occurring at other frequencies than that of the rotating wheel will be ignored by the system. In the case of adjacent machinery operating at the same frequency, or in beat with that frequency, the system will be unable to distinguish vibrations occurring from wheel imbalance with those originating in the adjacent machine.

An excellent test for environmental vibration is to monitor the vibration level on the grinding machine while the spindle is not turning. The vibration level should be checked in various locations on the grinding machine, but in particular at the location the vibration sensor is to be mounted. All surrounding equipment, including any auxiliary pumps or attachments on the grinding machine should be operating during this test. The SBS Balance System can quickly let you accomplish this test *(see: Manual Filter section pg. — 16)*. The SBS Balance System does not remove these vibrations.

Machine Condition

The grinding machine's condition is important in determining the balance level which the SBS Balance System can achieve. The spindle itself should be balanced, as well as all components in the drive train of the spindle (i.e. belts, pulleys, motor, etc.). The balance system can readily determine if any significant imbalance exists in the machine itself. Simply use the same method as described above for checking environmental vibration, except test with the spindle running and with no wheel mounted. The SBS Balance System does not remove these vibrations.

System Installation

The SBS Balance System is easily installed in a relatively short period of time. This section provides instructions for mounting of the system hardware on the grinding machine. Included are sections pertaining to installing the balance head, making system connections, installing the vibration sensor, and selecting the proper line voltage setting.

Balance Head

1) **The Balance Head is mounted to the spindle end, with the adaptor provided** *(figure 5a)*. This Mounting Adaptor is specifically designed to accommodate the particular machine's spindle configuration. Use of a lubricating compound between the Balance Head and Mounting Adaptor is recommended, to ensure ease of future disassembly. Be sure that there is no interference zone between the Balance Head and machine, (workhead, tailstock, etc.), especially with the wheel worn to it's smallest diameter.

2) **The Balance Head Cable should be restrained to prevent the cable from being caught up in the rotating machine** *(figure 5c*, but should allow for the cable's removal as necessary during wheel changes. These components are designed for the harshest environments and the most aggressive coolants. However, common sense dictates that where possible, machine guarding should be modified to allow the rotary junction and cable to extend outside the guard. Optimally, the cable should be secured so that the connector on the Balance Head points down. This position will minimize the chance of contamination during wheel changes. If heavy wheels are being changed, remove the Balance Head from the area during wheel changes. Most adaptors for larger machines are of a two piece design which simplifies this process.

Figure 5a

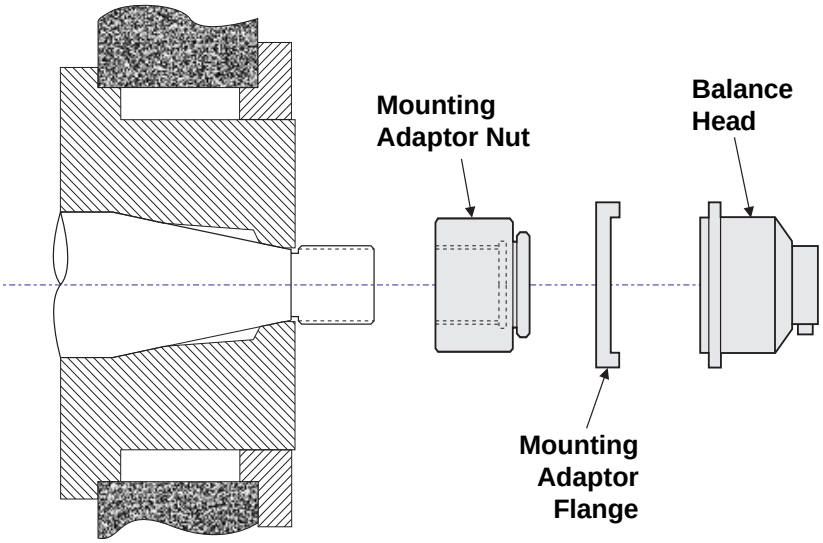


Figure 5b

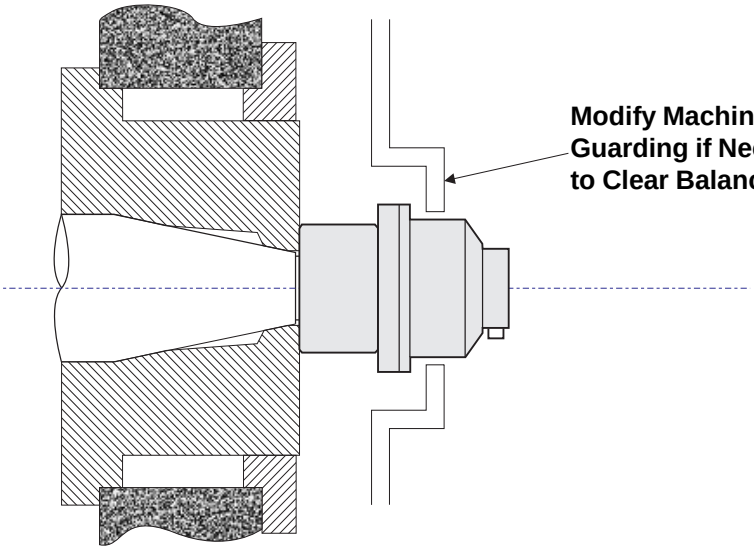
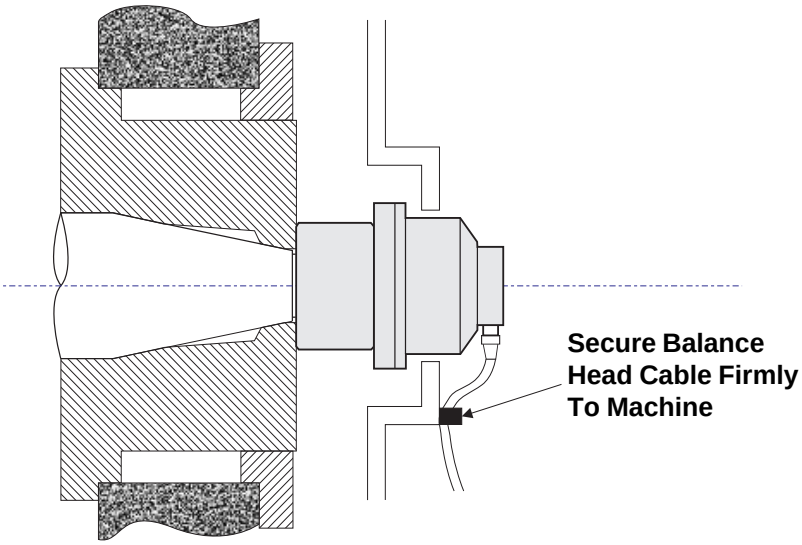


Figure 5c



SBS Control Unit

The SBS Control Unit should be mounted in a location that allows observation of the display by the machine operator. Mounting hardware is available for installation on horizontal surfaces or for rack mounting in standard 19" racks. Cabling connections to the control unit include the Vibration Sensor Cable, the Balance Head Cable, the power cord, and CNC Interface Cable if applicable. All connections are clearly labeled on the rear of the control unit. Be sure that the voltage selector under the power connection is switched to the appropriate position, and the proper fuse value is installed *(see: Rear Panel Controls — pg. 10)*.

Vibration Sensor

The location and installation of the sensor are crucial to successful operation of the SBS Balance System. The balance system relies on vibration signals received from the Vibration Sensor to accurately display the current vibration level, in peak to peak units, and to balance the grinding wheel. The system employs narrow bandwidth filters that prevent vibration at non-spindle frequencies from being detected. However, in applications where the motor and spindle are running at the same RPM, a rough motor can cause problems. Careful experimentation with the sensor's location goes a long way in mitigating this source of interference.

The Vibration Sensor can be mounted on the grinding machine either by use of the magnetic mount provided, or by permanent stud mount. The magnetic mount should be used during initial system start up, and until a good permanent location is found on the grinding machine for the sensor. The sensor can then be permanently stud mounted at that location.

Sensor Location

Because of differing machine characteristics, Vibration Sensor location is specific to machine model. There are some general principles that should assist in finding a proper sensor location for your grinding machine.

The best place to start is a vertical machine surface on the spindle housing over the outboard bearing, and perpendicular to the spindle's centerline. For center-type cylindrical grinders this location is usually good. On some machines, the part of the wheel guard sometimes referred to as the "wheel fender" can be a good location to mount the transducer if it is heavy enough and not too "live". The reason a vertical machine mounting surface is preferable on most cylindrical grinding machines is that the sensor is in line with the grinding wheel and the workpiece. **The general principle is to locate the Sensor in the same direction as the centerline between the grinding wheel and the workpiece**. This way, you are most directly measuring the vibration that effects the grinding process. For this reason, on surface grinders and creep feed grinders, a horizontal surface is generally best.

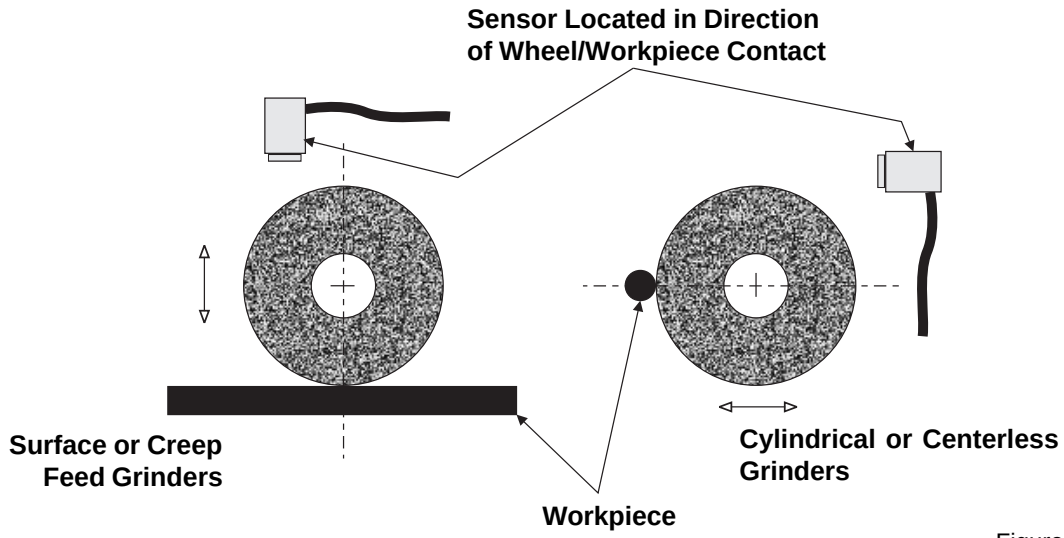


Figure 6

Common Machine Installations

Cincinnati Microcentric with Filmatic Spindle

The best locations on these machines are the vertical surface on the far right side of the casting supporting the spindle housing and dresser, or the horizontal surface on the guard, directly above the wheel and next to the dresser. Possibly the best location on some of the newer Microcentrics is the vertical surface directly behind the wheel, away from the operator. Sensor location is very important to success in Microcentric applications. If balance cycles are long, try a different location.

Cincinnati Milacron #2 and #3 Centerless

On these machines, again with the Filmatic spindle, a good location to try is on the guard periphery (wheel fender) back by the dresser. There is frequently a flat surface here that is often a good location. Some machines have a machined surface on the top of the spindle housing on the wheel side. Do not mount the Vibration Sensor towards the rear or belt side of the spindle housing. The Filmatic spindle is effective at dampening out vibration from the belts, so let it do it's job. This is very important if running at 12,000 SFPM where the wheel RPM and the motor and belt RPM are approximately the same. The farther away from the belts that the Vibration Sensor is mounted, the less motor vibration will affect wheel balancing.

Cincinnati TwinGrip Grinders

On Cincinnati Twingrip models such as the 230-10, 340-20, 350-20, and others, most often the best sensor location is on a vertical surface of the machine base, under the dresser. Some users have reported success in mounting the sensor directly on the bearing housing itself. Again, the best result will be obtained by trying several locations, and using the best one.

Operating Instructions

The SBS Balance System, once installed, is easily configured to the particular needs of your grinding setup. The following section includes an overview of the control and interface features of the SBS Balance System. Description is given of the function and operation of the various features of the system which will allow the user to perform auto-balancing, manual balancing, and vibration analysis, as well as CNC interface to the system.

Separate sections detail the operation of each specific model of the SBS Control Unit. Sections cover the SB-2500 single channel unit, the SB-3500 two and four channel multiplexer, and the SB-2400 dedicated CNC unit.

Model SB-2500 Front Panel Controls

Figure 7 illustrates the controls and indicators on the front panel of the Balance Control Unit. Following is a description of these features:

1) POWER. This switch turns on the operating power for the system. When the system is turned on, the unit initiates a Power-On Display.

2) VIBRATION DISPLAY. Indicates the measured vibration level of the grinding machine in either microns or micro-inches of displacement, or in millimeters/second or mills/second of velocity. The displayed units are selectable from the Menu Bar.

3) RPM DISPLAY. Displays Spindle RPM measured by the balance head. CNC Baud Rate setting, and Pulse length setting are shown here during menu selection. Display also indicates RPM frequency during a Manual Filter vibration test.

4) MENU BAR. When the MENU button is depressed, this display shows the menu selectable operating parameters of the control unit. The currently selected option is indicated by a flashing light.

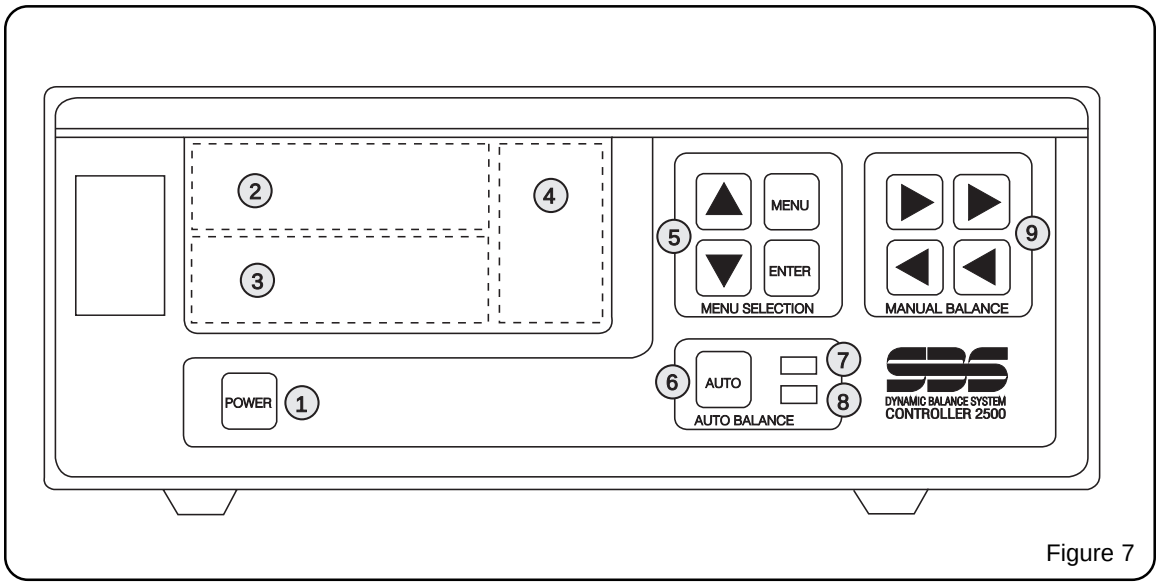


Figure 7

5) MENU SELECTION. This key pad controls the selection of operating parameters for the control unit. Depressing the MENU button initiates this mode. The flashing option is currently selected. Subsequent pressing of the MENU button selects each option in turn. To choose vibration units, select the desired option using the MENU button, then press ENTER. To set other operating parameters, select the appropriate menu option, then use the up/down toggle buttons to select the desired setting. Pressing the ENTER button then initiates this new setting. Outside of the menu mode, the up/down toggle buttons control Manual Filter setting, if no balance head is attached to the control unit *(see: Manual Filter section — pg. 16)*.

6) AUTO BUTTON. Initiates an auto-balance cycle. Depressing the button a second time will halt the auto-balance cycle
(see: Automatic Balancing — pg. 14).

7) BALANCE OUT OF TOLERANCE. This red LED is lit when the measured vibration level is above the TOLERANCE level selected in the Menu Bar. While the system is performing an auto-balance, the LED will blink.

8) BALANCE IN TOLERANCE. This green LED is lit when the vibration level of the grinding machine is at or below the selected TOLERANCE limit. While the system is performing an auto-balance, the LED will blink.

9) MANUAL BALANCE BUTTONS. These buttons move each of the two weighted masses in the Balance Head. Each mass can be moved in one of two directions. These buttons are used only during a Manual Balance operation

Model SB-3500 Front Panel Controls

Front Panel controls on the SB-3500 Multiplexer Unit are identical in location and operation to the controls for the single channel unit, with the addition of the Select and Monitor buttons (not pictured).

10) SELECT BUTTON. Pressing this button will light the switch's LED, and put the control unit into "select mode". In this mode, actual control of a particular grinding machine is possible. Initially, no channel is selected, and "CH. 0" is displayed. By repeatedly pressing the SELECT BUTTON, the unit will toggle to each available channel in turn. After a delay of 2-3 seconds with no activity, the unit will then switch to the selected channel, and display vibration and RPM for that channel. The channel number will also be displayed at the far left of the Vibration Display window. The unit will remain switched to this channel, in select mode, until the monitor button is pressed, or another channel is selected.

11) MONITOR BUTTON. Pressing this button will light the switch's LED, and put the control unit into "monitor mode" In this mode, the control unit will automatically toggle between available channels, according to the cycle time schedule set through the Menu for each channel. Monitor mode does not initiate balance cycles, but simply monitors each channel in turn for a user-defined period of time. To balance, it is necessary to select the desired channel, using the select button. By setting the monitor time period to zero, any channel, other than number one, can be locked out of monitor mode. The unit will remain in Monitor mode until the Select Button is pressed.

Model SB-2400 Front Panel Controls

This dedicated CNC Control Unit does not have a front panel, and can be activated only through the CNC port on the Control Unit.

Model SB-2500 Rear Panel Controls

Figure 8 illustrates the controls and connections located on the rear panel of the Balance Control Unit. Following is a description of these features:

1) SENSOR CONNECTION. The receptacle through which the Vibration Sensor cable makes connection to the Control Unit.

2) BALANCER CONNECTION. The receptacle with which the Balance Head Cable makes connection to the Control Unit.

3) POWER SUPPLY. Connection for line power input.

4) FUSE HOLDER. Contains the line fuse. To replace fuse, remove line plug from receptacle and use small screwdriver to draw out fuse holder from plug body. An equivalent of the supplied 1 amp fuse should be used.

5) VOLTAGE. Line voltage selector switch. Selects either 110V or 220V nominal line input voltage. **Caution - before applying power to the Control Unit, the correct line voltage setting must be selected.** Also check the line fuse, and if necessary change the fuse to meet the requirements of the intended line voltage.

6) CNC INTERFACE. Standard DB-25 connector receptacle for use in making connection between the Control Unit and any grinding machine CNC control. A complete description of CNC Interface protocol is given in the CNC Interface section of this manual.

Model SB-3500 Rear Panel Controls

Rear panel controls for the Multiplexer Control Unit are identical to the controls on the single channel unit, only with the addition of multiple Sensor Connection, and Balancer Connection plugs. There are a total of either two or four each of the Sensor and Balancer Connections, depending on whether you have purchased a two channel or four channel Multiplexer Control Unit.

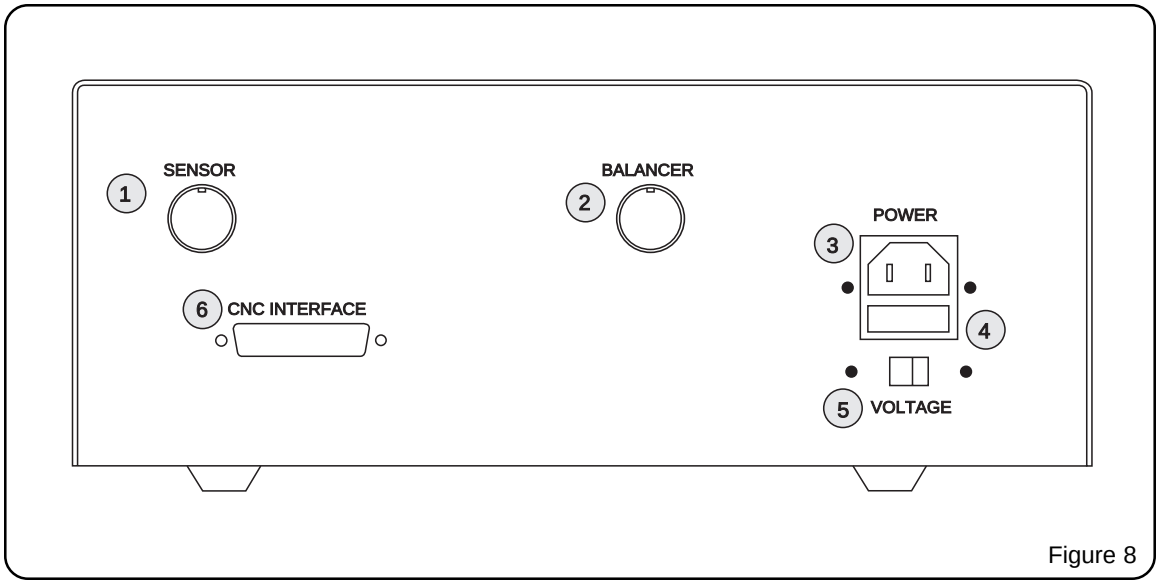


Figure 8

Model SB-2400 Rear Panel Controls

Rear panel controls for the dedicated CNC Control Unit are identical to the controls on the single channel unit

Power-On Display for the model SB-2500

After the Voltage switch has been correctly set and the fuse verified to be correct, the system can be turned on. When the POWER button is depressed on the front panel of the Control Unit, and power is applied to the unit, the Control Unit performs a series of self checks which define its status, and the setting of various operating parameters. Operator information regarding these parameters is displayed using the Control Unit's Digital Display. The sequence follows this order:

1) First all display segments and lights on the front panel are illuminated to verify their operation.

2) Any error conditions detected by the self checks are displayed as "Er" followed by the reference code of the error detected.

Er01 Displayed if the RPM signal coming from the Balance Head exceeds 9999 RPM and the true RPM number cannot be displayed.

Er02 Displayed during the Power-On sequence if the Vibration Sensor output signal is incorrect. This could be caused by a defective sensor or by no sensor being connected. Check sensor connections and try Power-On again. Continued error messages indicate the need for repairs.

Er03 Indicates failure of battery backup to internal RAM memory. The operating parameters stored in memory, such as Balance Limit, may have been lost.

After the above sequence is completed, the unit begins normal operation, displaying RPM on the RPM Display and vibration level on the Vibration Display. For detailed description of these error codes, *(see: Displayed Error Messages — pg. 27)*.

Power-On Display for the model SB-3500

After the above described sequence, the SB-3500 Control Unit initially powers up in monitor mode, with factory defaults for monitor time on each channel. Upon subsequent power-on, the unit comes up in the mode it was in when powered down, and on the channel it was on when powered down.

Power-On Display for the model SB-2400

The only power-on display for this unit is the standard CNC RS-232 menu and command prompt. *(see: RS-232 Commands and Responses — pg. 19)*

Preparing to Set Operating Parameters

An understanding of the function and operation of the Control Unit's front panel controls is assumed in the following section. The following numbered steps provide a quick outline for system set-up.

Background Vibration

A check of the ambient vibration level must be performed, in order to correctly set up the system.

1) Mount the Vibration Sensor in the position to be used during operation *(see: Vibration Sensor Location — pg. 6)*. Install the Balancer, Control Unit, and all cables as indicated in the installation section of the manual, and turn the Control Unit power on. Press the Menu button until METRIC is lit, and then press the Enter button to set the Control Unit in metric display mode. This setting is required while setting the operation parameters.

2) Start the machine spindle, and note the displayed RPM of the machine for future reference.

3) Stop the machine spindle, but leave all other machine systems (such as hydraulics) functioning. Set the manual RPM filter to the operationg spindle RPM you just noted. The vibration level displayed without the spindle running is the ambient or background vibration level for the machine. Make note of this background vibration level for future reference in setting the operating parameters of the system. Refer to the section on Environmental Vibration for explanation of possible sources of background vibration.

Verifying Balance Head Sizing

4) Using the manual motor buttons, rotate the masses in the Balance Head, while the machine is operating at speed. By running each of the two weights in opposite directions simultaneously, the operator should be able to introduce more than three microns of vibration in the grinding machine, but not more than thirty microns. If results do not fall in this range, it may be a sign that the Balance Head needs to be re-sized for your application. Contact your SBS Balance System source for consultation. In the interim, do not allow the grinder to operate for extended periods with high vibration levels.

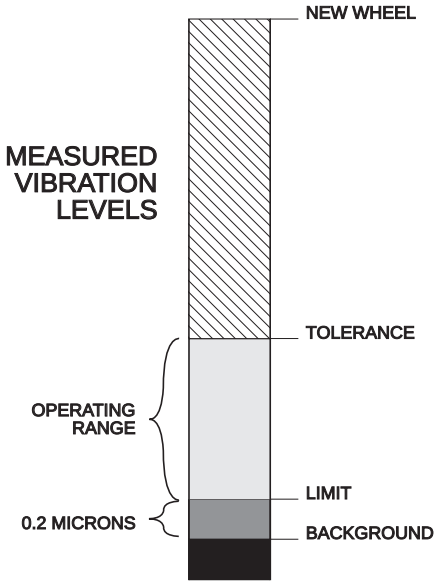
Setting Operating Parameters

The following section details the menu-selectable operating parameters of the Control Unit, in the order which they appear. When the menu button is pressed, the menu bar will light up in the display window. By repeatedly pressing the menu button, the user may select each menu item in turn. When an item is selected, it is flashing on the menu bar, and the current setting is displayed. Use the up and down arrows to change the current setting. When all desired changes are made, press the ENTER button to accept the changes, and exit the menu mode.

Vibration Display

The units used by the Control Unit, to display machine vibration levels, are selectable between metric or english units. Also, the Control Unit can display vibration in terms of velocity or displacement. The factory setting of displacement most directly reflects the movement of the grinding wheel, and therefore impact of vibration on the work piece. The first four options in the Menu Bar allow the operator to select the desired display mode.

Auto-Balance LIMIT



The SBS Balance System is designed to balance quickly and automatically to a level of vibration specified by the user, the Auto-Balance LIMIT. The Auto-Balance Limit is factory set at 0.4 microns of displacement. A balance level of 1 micron or less is generally considered adequate for most applications. If the user wishes, this limit can be set any where from 0.1 microns and up. **The lower the Auto-Balance Limit is set, the more time the system will typically require to achieve balance.** Some experience may be necessary to determine the appropriate Auto-Balance Limit for a particular installation.

5) To reset the Auto-Balance Limit, the MENU button should be pressed, until LIMIT is selected from the menu area. The Auto-Balance Limit is set using the up/down arrow switches nearest to the Menu Bar. Typically you should set the LIMIT at a level that is 0.2 microns higher than the highest background vibration level you noted is step #3. Press the ENTER button to enter the selected level. **Note:** While the Velocity and English display modes may be selected for monitoring machine vibration, the LIMIT setting can only be made in microns of displacement.

The Auto-Balance Limit should be set at least 0.2 microns higher than the ambient vibration level. **NO BALANCE SYSTEM IS CAPABLE OF BALANCING THE GRINDING WHEEL TO A VALUE BELOW THE AMBIENT OR BACKGROUND LEVEL**. The results of trying to set the balance limit below ambient levels will be long or failed balance cycles. Since the background vibration level is often a product of floor transmitted vibrations, these levels may change as adjacent machines are put into or out of service. Set the balance limit during periods which reflect the maximum floor transmitted vibration the system will receive.

Auto-Balance TOLERANCE

6) Related to the Auto-Balance Limit, is the Auto-Balance Tolerance setting. This operator defined setting establishes the vibration level which acts as an "upper limit" for the system. When reached, this setting will indicate the need to perform a re-balance operation. This indication is given both by the BALANCE OUT OF TOLERANCE LED on the front panel, as well as via the CNC interface. The Tolerance level is menu selectable in the same manner as the Auto-Balance Limit. It should be set **at least** 0.2 microns above the LIMIT setting, and 0.4 microns above the background vibration level.

PULSE Length Selection

This menu setting toggles the Control Unit's response between two automatic ranges. The purpose of this adjustment is to maximize the speed and accuracy of the SBS Balance System when installed on various sizes and types of grinders. Pulse length refers to the duration of electrical pulses sent to the Balance Head in order to drive the weighted masses during an Auto-Balance cycle.

To determine the correct setting for this switch it is necessary to observe the operation of the system on its first few balances. With the system installed on the grinding machine, and the machine running, initiate an Auto-Balance cycle. Check to see that the system makes steady and timely progress to a balance point. Unbalance the system two or three times, using the manual motor control switches located on the front panel. Each time initiate an Auto-Balance and check the results. Then select the opposite Pulse Length setting and run two or three more tests. An error message "Er 04" displayed during this test indicates that the PULSE setting should be reset to "LOW" *(see: Displayed Error Messages — pg. 27)*. This quick check will give a clear indication of the proper setting. Your SBS Balance System is now "tuned" to your grinding machine.

CNC Baud Rate Setting

The CNC Baud Rate should also be selected, if applicable, while in the MENU SELECTION mode. Once these selections are made, the control unit is ready for Auto-Balance operation.

Model SB-3500 Control Unit

For the Multiplexer Control Unit, the user should select the desired channel, and then enter the menu mode. **Many of the menu settings are independently set for each channel**. Where this is the case, the channel number will be displayed, along with the current setting for the selected menu item. Where the channel number is not displayed, the setting takes effect for all channels. The above menu items which are individually set by channel are: LIMIT, TOLERANCE, and PULSE.

In addition to the above, a new menu item appears on the menu of a Multiplexer Control Unit, called CYCLE TIME. This setting is individually set by channel, and allows the user to set the length of time (in fractions of a minute) which the Control Unit will monitor a particular channel, while in the monitor mode. By setting the monitor CYCLE TIME to zero, any channel, other than number one, can be locked out of monitor mode.

Model SB-2400 Control Unit

All operating parameters are set through the CNC RS-232 port. Default settings of 2400 baud and Metric/Displacement vibration units can be changed only with the use of the optional Remote Keypad supplied by Schmitt Industries, Inc.

Automatic Balancing

Once all operating parameters are set, the SBS Control Unit can perform automatic balance cycles, which are initiated by pressing the Auto button on the front panel, or by a Start Balance command via. the CNC interface. It is important to understand that Auto-Balance is an automatic cycle, which is initiated by the user, which performs according to the operating parameters set, and then ends. **Between balance cycles, the system will report vibration levels, and RPM, but will not self-initiate an Auto-Balance cycle**.

The operator (or CNC controller) needs to understand when it is appropriate to initiate an Auto-Balance cycle. **Auto-Balance should be performed with the machine running, and coolant flowing, but not while the wheel is in contact with the workpiece**. The process of grinding a part, dressing the wheel, moving the wheelhead, etc. can introduce vibrations into the machine which are unrelated to wheel balance. Attempting to balance during such processes will not work, and will have detrimental effect on the grinding or dressing results.

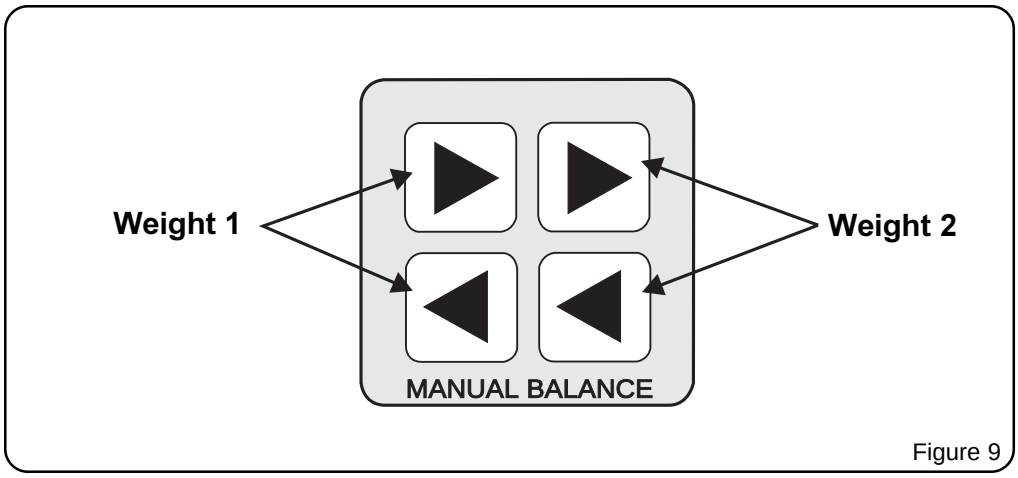


Figure 9

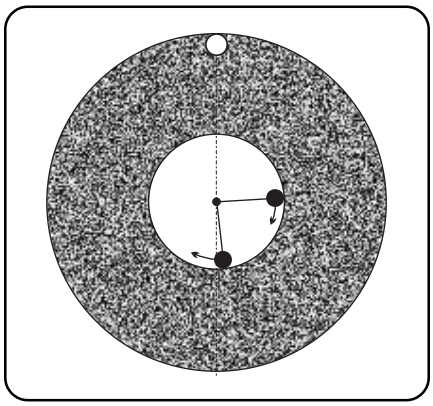


Figure 10a

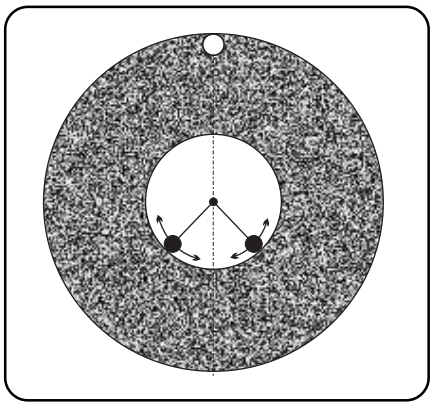


Figure 10b

Manual Balancing

The SBS Balance System is fully automatic, but also provides the capability for manual operation. The ability to move the weighted balance masses in the Balance Head by hand can be utilized in various situations. Purposefully unbalancing the system to a given vibration level can be useful for performing diagnostic tests of the grinding machine. Occasionally operator preference may dictate that the balancing procedure be performed manually.

Figure 9 shows the Manual Balance buttons located on the front panel of the Control Unit. The buttons are divided into two groups, each controlling one of the two masses in the balance head (M1 and M2). Each mass can be moved in one of two directions, forward and backward with reference to the rotation of the grinding wheel. To manually balance, the operator must move the two masses in the direction which reduces the vibration reading on the Vibration Display. This should be accomplished in three stages.

First move the two masses together in the same direction, either forward or backward. If moving them forward increases the vibration, then choose the opposite direction. Continue this way until the vibration level can no longer be reduced. This movement has the purpose of positioning the two masses equally about the line through the center of the wheel and the center of the imbalance *(figure 10a)*.

The next stage is to find the correct angle for position of the masses in relation to the "center line" *(figure 10b)*. Do this by moving the masses simultaneously in different directions (one forward and one

backward). Again, if the vibration level is increased, the opposite movement should be tried. This stage is complete when the vibration level can no longer be reduced. Finally the balance level can be fine tuned by moving the masses individually, in very short "bursts", in order to minimize the vibration reading.

It should be realized that any change in vibration level of the machine will lag behind the movements of the masses by one or two seconds. This is due to a "settling effect" of the machine. For this reason, when the correct direction of movement is not yet clear, or the vibration level itself is small (2.0 microns or less), any movement of the masses should be performed in short bursts, with a delay of two seconds afterward to evaluate the movement's effect.

Manual Filter

The system has application as a vibration measurement and analysis tool, aside from its purpose as a dynamic balancing system. To facilitate this function, the Control Unit has the capability of manual adjustment of the vibration frequency filter. Any filter RPM from 500 to 9990, incremented in units of ten, can be manually implemented. This function allows the Control Unit to operate independently of the Balance Head, to measure vibration levels occurring at different frequencies.

To set the Manual Filter, the Control Unit should be powered off, and the Balance Head Cable detached from the Control Unit. Upon power-on, and completion of the self test, the up/down toggle buttons in the Menu Selection area should be depressed. This displays the RPM filter level. Beginning with the initial setting, the desired level is set by use of the up/down toggle buttons. The vibration level can be checked at this RPM by reading the Vibration Display. If desired, the RPM filter level can be adjusted again to display the vibration level at another frequency. In this way many different frequencies of vibration can be analyzed. A complete analysis of all frequencies from 200 to 9950 is also available using the CNC Interface port *(see: command "G" under CNC Interface section — pg. 20)*.

CNC Interface Protocol

There are two different options available for interfacing the SBS Balance System with a CNC control. Either a hardwire interface or software interface is supported, via a standard DB-25 connector located on the rear panel of the unit. Because of the many possible variations and configurations of cabling required for such an interface, it is left to the operator to supply the necessary cable. **When designing a CNC interface for the SBS System, it is important to understand that it is intended that the grinding machine's CNC control operate the SBS System**. It is not possible, or advisable, for the SBS System to control the grinding machine. The following interface is provided as a means to that end, with the CNC control using information provided by the system, to maintain the desired balance parameters. The whole of this manual should be read before attempting to interface the SBS System with any CNC control.

Hardwire Control Interface - model SB-2500/ SB-2400

The following is a list of pin assignments regarding the DB-25 connector used by the SBS Balance System for hardwire CNC Interface.

Pin Name	Description
COM	Signal/Power common connection. These pins should be between customer's CNC power supply common and/or computer serial port common.
TXD	Transmitted data from the controller RS-232 serial port. Baud rate may be selected from front panel Menu.
RXD	Received data from customer's remote computer RS-232 serial port.
BOT **BOTR**	Balance out of tolerance and return. This SPST relay closes to signal that the wheel may need re-balancing. These two pins are electrically connected when the sensed vibration level exceeds the operator defined Auto-Balance Tollerance. The relay contacts are rated for 24VDC/AC, 0.4A maximum signal. This signal should be sampled only while the grinder is idle. Vibration induced by grinding, dressing, wheel head movement, etc. may exceed the Tollerance level, even though the wheel is balanced *(see: Automatic Balancing — pg. 14)*.
FBSI **FBSIR**	Failed Balance/ System Inoperative relay and return. This SPST relay is closed when power is applied to the Control Unit. It opens if a balance cycle fails, or if any error condition is encountered *(see: Displayed Error Messages — pg. 27)*.
BIP **BIPR**	Balance In Progress relay and return. This SPST relay closes within five milliseconds of the start of an Auto-Balance cycle. These two pins remain electrically connected for the duration of the balance cycle. The relay opens within two seconds of the end of the balance cycle, either when the Limit is achieved, or the four minute time-out is reached (error condition 4). The relay contacts are rated for 24VDC/AC, 0.4A maximum signal.
FPI **VCC**	Front Panel Inhibit and VCC. Connecting these two pins renders most front panel buttons inoperative. The Power button is excepted from this lockout. Also the Auto button is available, but only to abort a balance cycle. The FPI pin should not be connected to any other source. The VCC pin is to be used only with FPI.
SBC	Start Balance Command. This input must be pulled LOW by momentary connection to COM to start balancing operation.
STS's	Special Test Signals, make no connections to these pins.

Hardwire Control Interface - model SB-3500

The following additional inputs to the Multiplexer Control Unit are activated by connecting to COM (ground). CNCCH (pin4) signals that the channel is to be selected by the CNC. CHB1 (pin5) and CHB2 (pin6) then determine which channel is to be selected, according to the following scheme:

CNCCH	CHB1	CHB2	Channel Selected
COM	High	High	1
COM	COM	High	2
COM	High	COM	3
COM	COM	COM	4
High			No Action

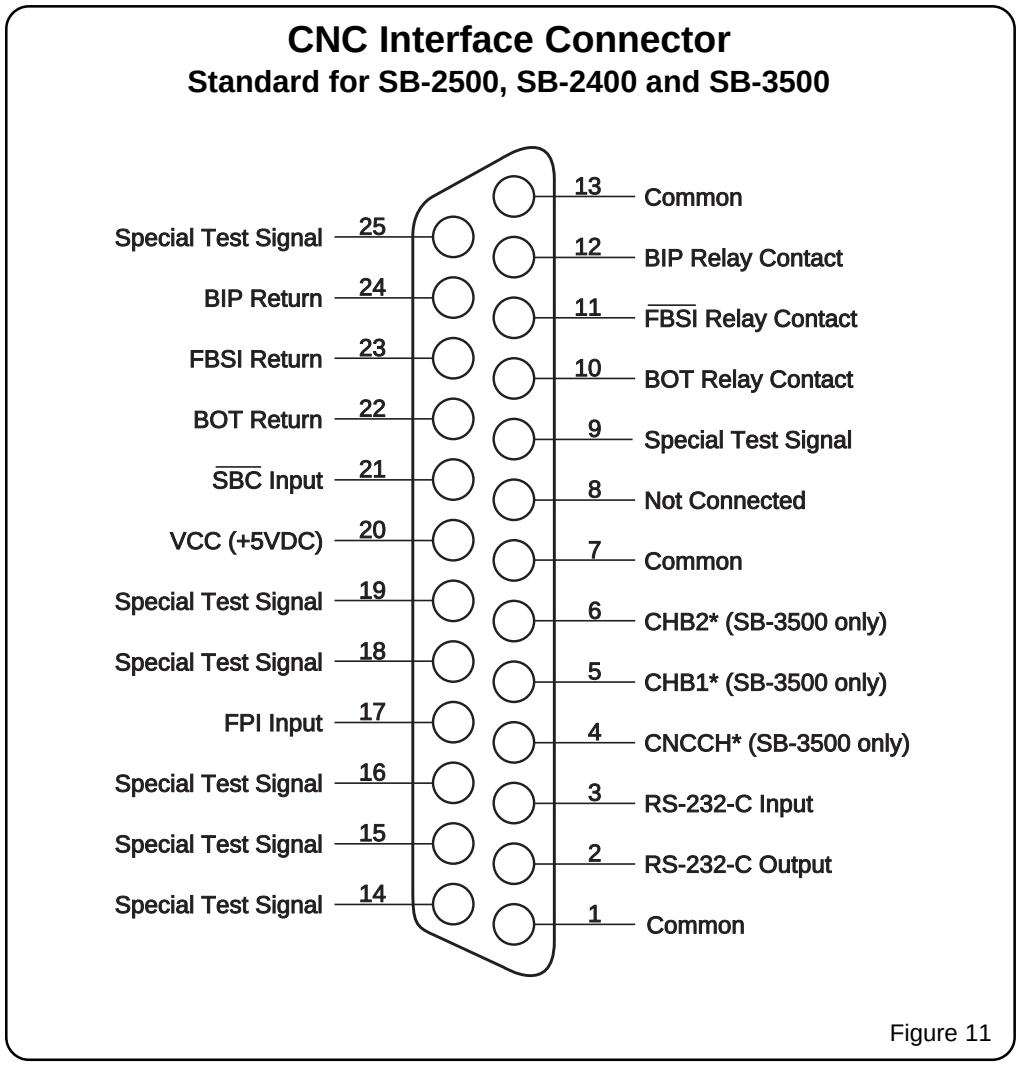


Figure 11

Software (RS-232) Interface

The SBS Balance System provides an alternate CNC interface using the RS-232 signal lines on the DB-25 connector. The RS-232 interface allows the same control capability as the hardwire CNC interface with the additional capability of monitoring the system status, setting of the Auto-Balance Limit, and performing a vibration spectrum analysis. The following description applies to all models of SBS Control Units. The interface is identical for the SB-2500 and SB-2400 units. Commands specific to the SB-3500 Control Unit are marked with an asterisk (*), and will not appear with the other units.

Interfacing

The RS-232 interface is a subset of the complete RS-232 specification, and uses only three wires for communication. When connecting to this interface, some systems will require several additional jumper wires on the control unit end of the cable in order to successfully operate with this three wire interface. The following pins on the DB-25 connector are used for the RS-232 interface.

Pin #	Pin Name	Description
1,7	COM	Signal/Common
2	TXD	Transmitted Data RS-232-C
3	RXD	Received Data RS-232-C

Setting Baud Rate

The baud rate of the RS-232 interface is set using the MENU SELECTION keypad on the front of the Control Unit. The factory setting for baud rate is 2400 baud, which should be adequate for most applications. To change the baud rate, select the BAUD option from the Menu Bar. The baud rate can be set from 150 to 19200 baud. Use of the optional Remote Keypad is necessary to change the baud setting for an SB-2400 Control Unit.

RS-232 Commands and Responses

When the Control unit is first powered up or reset, the following message is transmitted out the RS-232 interface:

SBS BALANCE SYSTEM

Copyright (c) 1989

Schmitt Industries Inc.

(1,2*,3*,4*,6,7,8,9,A, B,C*, I, G, L, M*,P, R, S, T, U, ?) ?*

The last line of this response is the RS-232 Command Prompt. The letters listed are all the command letters that the unit accepts. For a list of the definitions of these command letters, send a question mark "?" followed by a carriage return.

The following list will be displayed:

RS-232 Command Menu

1= Select Channel 1*
2= Select Channel 2*
3= Select Channel 3*
4= Select Channel 4*
6= Pulse Motor (weight) 1 Forward
7= Pulse Motor (weight) 1 Reverse
8= Pulse Motor (weight) 2 Forward
9= Pulse Motor (weight) 2 Reverse
A = Abort Balance Command
B= Balance Command
C##.#=Set Cycle Time*
I = Inhibit Front Panel
G = Graph Vibration Spectrum
L##.# = Set Balance Cutoff Limit
P = Set Pulse Length
R = Reset Control Unit
S = Status Report
T##.# = Set Auto-Balance Tolerance
U = Un-inhibit Front Panel Display

(1,2*,3*,4*,6,7,8,9,A, B,C*, I, G, L, M*,P, R, S, T, U, ?) ?*

This RS-232 command menu gives a brief description of the available commands, followed by the command prompt. The following is a more complete discussion of the commands:

A = Abort Balancer Command, is used to interrupt and terminate the balancing operation. To issue this command, the letter "A" should be sent to the Control Unit in either upper or lower case, followed by a carriage return. When the command is complete, the unit responds with the command prompt.

B = Balance Command, is sent to initiate an automatic balance cycle. After this command is issued, the unit returns to the command prompt while the Auto-Balance cycle is in progress. Sending the "S" command during a balance cycle will return "BIP = 1 to indicate the cycle in progress. Monitoring the system status for "BIP = 0" will indicate when this command has been completed.

I = Inhibit Front Panel, is used to inhibit the operation of the push button keypad on the front panel of the Control Unit. This command prevents the operator from initiating a local operation, but does not prevent the operator from using the AUTO button to abort a balance cycle. This function is retained for safety reasons.

G = Plot Vibration Spectrum, is used to analyze the vibration spectrum of the grinding machine in the area the Vibration Sensor is attached. Since normally the Control Unit only detects vibrations occurring at the rotational speed of the machine, this option can be helpful in determining possible causes of environmental vibration and remedying them. The "G" command, when used with a graphics plotting program on a host computer, can plot a graph of the vibration level of the machine versus RPM (frequency). The response to the "G" command is a series of 196 two number plot points that look similar to this:

00200,00000
00250,00001
00300,00002
09950,00000

The first number is the RPM value, the second is the vibration level in tenths of a micron. The range of the plot is from 200 RPM to 9950 RPM. The series takes about five minutes to complete. When the operation is complete, the command prompt is displayed.

L##.# Set Balance Cutoff Limit, is a five character command used to set the "Auto-Balance Limit". This limit must be entered exactly as "L" followed by two numbers, a period, a single number, followed by a carriage return. The limit can be set from 00.1 micrometer to 99.9 micrometers of vibration. The balancing operation will stop when the vibration level is at or below this limit. To verify the setting, use the "S" status command, and look for "Balance Cutoff Limit" BCL = ##.#.

P = Set Pulse Length command, is used to toggle between the HIGH and LOW setting for Pulse Length. The Pulse Length is verified in the status line as PUL = LO or PUL= HI.

R = Reset Command, is used to reset the Control Unit to its initial power-on conditions. This command can be used as a software confidence check by verifying the sign-on message.

S = Status Report, displays the internal status of the Control Unit. The "S" command produces the following line of data:

#####RPM, ##.#uM, BCL = ##.#uM, TOL = ##.#uM,
FBSI = #, BIP = #, FPI = #, PUL = ##

With the "#" signs being the current values of the above variables.

T##.# Tolerance command, sets the "Auto-Balance Tolerance" limit in micrometers of vibration. If the vibration level rises equal to or higher than this limit, a "Balance-out-of-Tolerance" is indicated by the red LED on the front panel, and the opening of the BOT relay contacts. To set this limit to another value, the command must be entered exactly as "T", followed by two numbers, a period, a single number, and a carriage return. To verify this setting, use the "S" status command and look for "Tolerance Limit" TOL = ##.# uM. This condition can be verified by comparing the current vibration level to this tolerance limit.

U = Un-inhibit Front panel, performs the opposite function of the "I" command and re-enables the operation of the front panel AUTO balance button. Operation can be verified by checking for FPI = 0 in the Status display.

RS-232 Operation Summary

The RS-232 capability of the SBS Balance System, when used in conjunction with a capable host computer, can provide a completely automated testing and balancing capability for a grinding machine. If the vibration spectrum is recorded at a point in time (perhaps when the machine is new), that record can then become a reference for the gauging of bearing condition, spindle balance, and overall machine condition. The RPM and vibration level readouts from the status line can be used to provide a remote indication of the machine operating speed, and characteristics. On some machines this data may be interpreted to indicate when a grinding wheel needs to be changed or other maintenance performed.

Comparative Methods of System Control

Comparative Methods of System Control

Commands For SBS Control Unit (SB-2500/SB-2400)			
RS-232	**Hardwire**	**Control Unit Panel**	**Action**
?	-NA-	-NA-	Help Prompt
6	-NA-	Manual Bal. Button	Pulse Motor 1 Forward
7	-NA-	Manual Bal. Button	Pulse Motor 1 Reverse
8	-NA-	Manual Bal. Button	Pulse Motor 2 Reverse
9	-NA-	Manual Bal. Button	Pulse Motor 2 Forward
A	SBC,COM	AUTO Button	Abort Balance Cycle
B	SBC,COM	AUTO Button	Start Balance Cycle
I	FPI,VCC	-NA-	Inhibit Front Panel
G	-NA-	-NA-	Graph Vibration Spectrum
L##.#	-NA-	Menu Selection	Set Lower Balance Limit
P	-NA-	Menu Selection	Toggle Pulse Length
R	-NA-	-NA-	Reset Control Unit
T##.#	-NA-	Menu Selection	Upper Balance Tolerance
U	FPI,VCC	-NA-	Uninhibit Front Panel
S	-NA-	-NA-	Send Status Report
Commands For Multiplexer Only (SB-3500/SB-3500-2)			
M	CNCCH,CHB1,CHB2	Monitor Button	Monitor Mode
1	$\overline{\text{CNCCH}}$,CHB1,CHB2	Select Button	Select CH 1
2	$\overline{\text{CNCCH}}$,$\overline{\text{CHB1}}$,CHB2	Select Button	Select CH 2
3	$\overline{\text{CNCCH}}$,CHB1,$\overline{\text{CHB2}}$	Select Button	Select CH 3
4	$\overline{\text{CNCCH}}$,$\overline{\text{CHB1}}$,$\overline{\text{CHB2}}$	Select Button	Select CH 4
C##.#	-NA-	Menu Selection	Set Cycle Time

Signals OutPut From Control Unit (SB-2500/SB-2400)			
RS-232	**Hardwire**	**LED Display**	**Status Report**
#####RPM	-NA-	Digital Readout	Wheel RPM Indicator
##.#uM	-NA-	Digital Readout	Vibration Level
BLC=##.#um	-NA-	Readout, Menu Mode	Lower Balance Limit
FBSI=#	FBSI, FBSIR	Error Message	Error Condition
BIP=#	BIP, BIPR	Flashing AUTO LED	Balance in Progress
FPI=#	-NA-	-NA-	Front Panel Inhibited
PUL=#	-NA-	Readout, Menu Mode	Motor Pulse Length
-NA-	BOT, BOTR	Red/Green AUTO LED	Balance out of Tolerence
ERROR=#	FBSI, FBSIR	Error Message	Error Condition
Signals OutPut From Multiplexer Only (SB-3500/SB-3500-2)			
CYC=##.#	-NA-	Readout, Menu Mode	Monitor Cycle Time
CH=#	-NA-	Readout, Upper Left	Selected Channel

CNC/System Timing Diagram

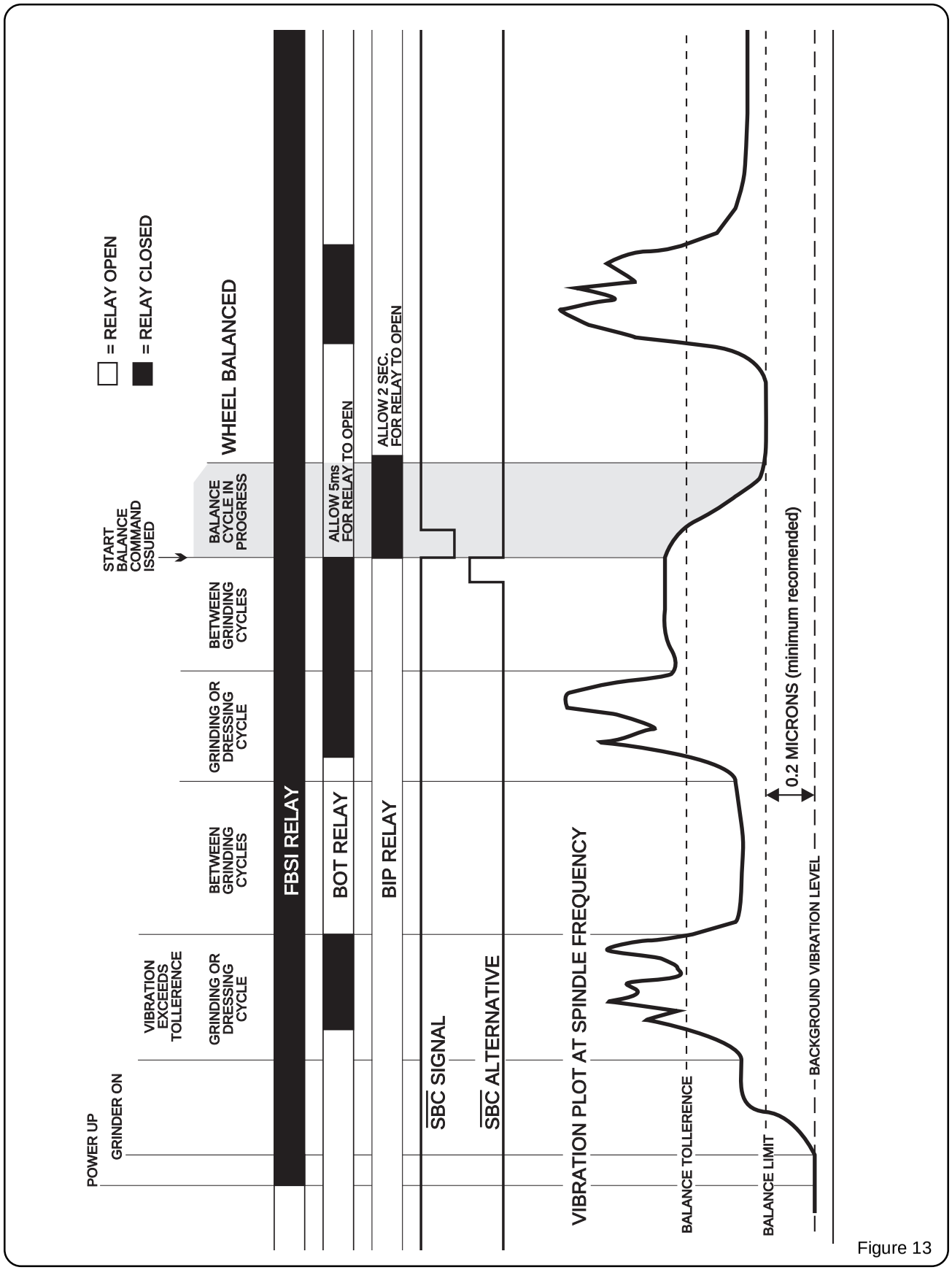


Figure 13

System Maintenance

Operator maintenance of the SBS Balance System consists of replacement of the line fuse in the Control Unit, and replacement of Balance Head slip ring assembly as necessary. Instructions are available with the replacement parts below. If further service is required, contact your SBS Balance System source, or Schmitt Industries Inc.

SBS Return/Repair Policy

Schmitt Industries policy is to give highest priority to the service needs of our customers. We recognize the cost of machine downtime, and strive to deliver same day repair of items arriving at our facility, whenever possible. Because of the complication and delays involved with international shipments, customers outside the continental U.S. should contact their local SBS source for service support. Before return of any equipment for repair, it is necessary for you to contact Schmitt Industries, Inc. for a Return Materials Authorization (RMA) number. Without this tracking number, Schmitt Industries can not ensure prompt and accurate completion of your repair needs. Failure to obtain an RMA number will likely result in substantial delay.

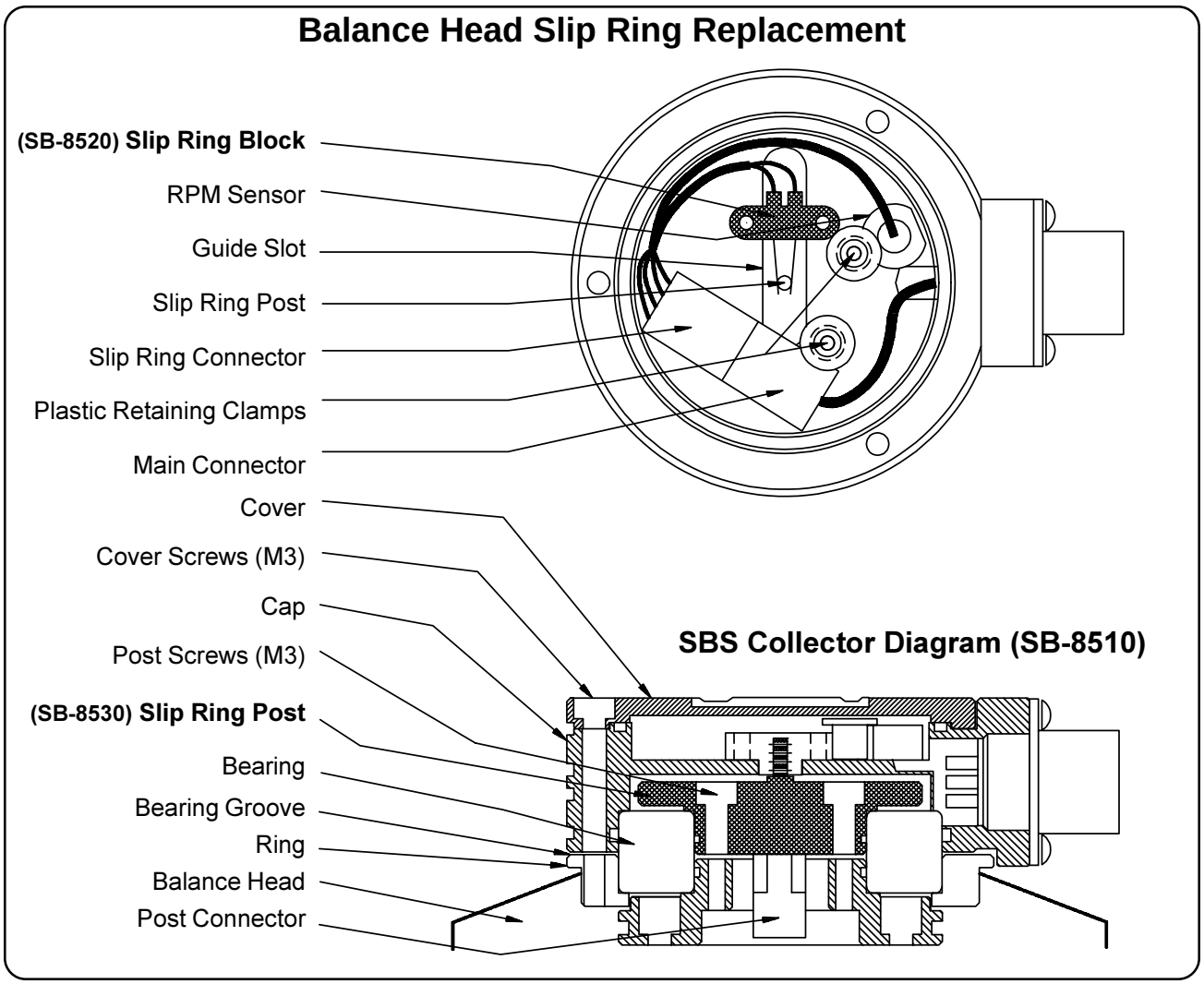


Figure 14

Balance Head Cable Schematic

For Part Numbers SB-25XX

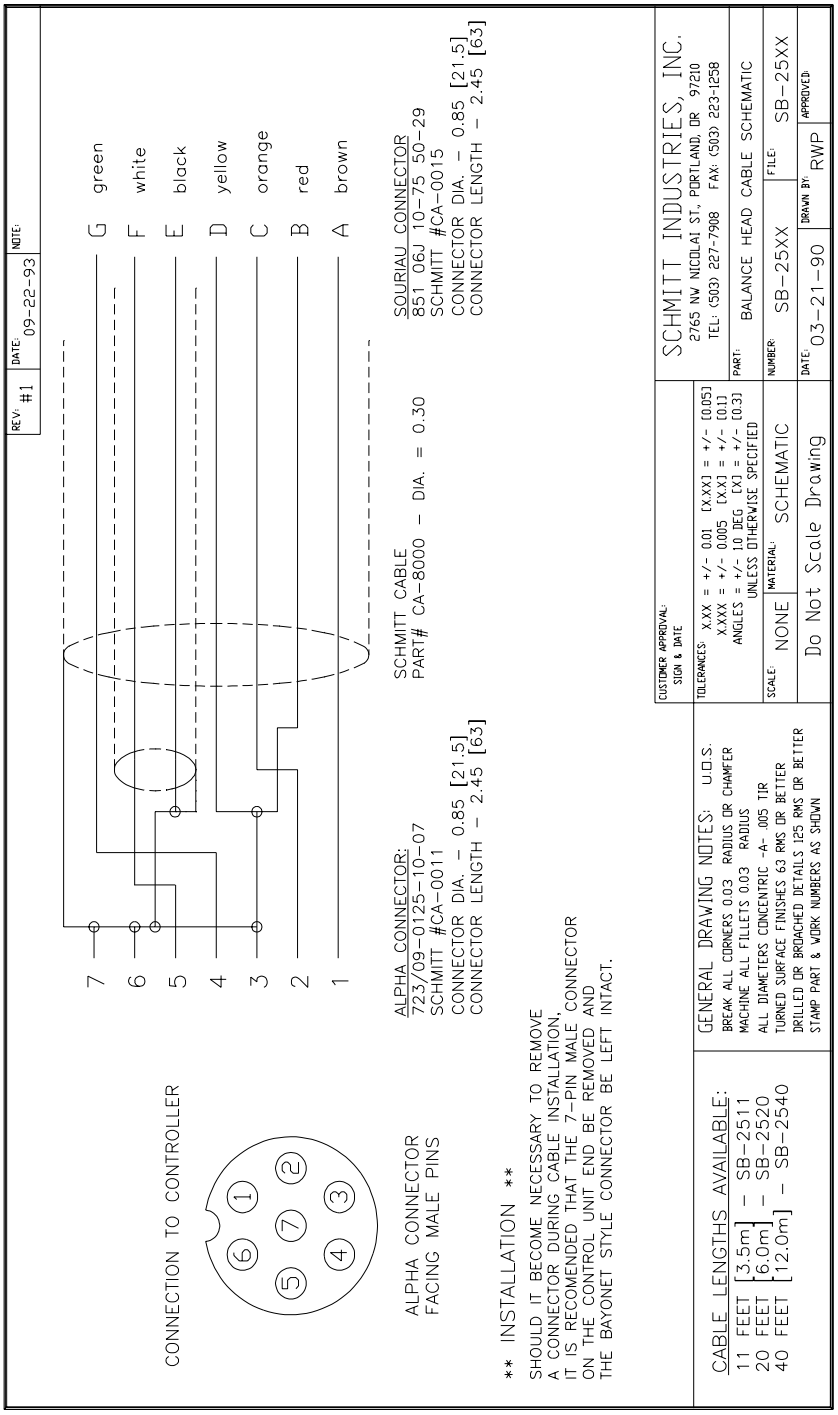


Figure 15

Trouble Shooting Guide

If you experience trouble with the operation of the SBS Balance System, the following guide is designed to help in determining the source of the problem.

Step 1

If the balance Control Unit is displaying any error messages, note the message(s) displayed, and contact Schmitt Industries for assistance.

Step 2

If you are experiencing problems, with no displayed error messages, then check the Vibration Sensor, and verify that the Sensor is firmly seated on the machine, with its magnet firmly tightened in place, and is properly connected to the Control Unit. Also check that the Sensor's position on the grinding machine accurately reflects machine balance *(see: Sensor Location — pg. 6)*.

As a final check, set the RPM manually on the Control Unit to the operating speed of the grinder, and verify that there is an incoming vibration signal. If you receive a zero reading from the Sensor during this test, the Vibration Sensor and Control Unit should be returned for repair. Contact Schmitt Industries for a return materials authorization (RMA) number.

Step 3

Once the Vibration Sensor's function is verified, the next step is to perform an integrity check of the rest of the system. This test should be performed with the machine running, but not in a grinding or dressing cycle. Simply depress each of the four manual motor buttons, one at a time, for a period of about 15 seconds. With each movement of the Balance Head weights, the system should register a change in the displayed vibration level on the Control Unit. If this does not happen for any of the four buttons, there is a service problem with the system. The Balance Head, Control Unit, Vibration Sensor, and Balance Head Cable should all be returned as a unit. Contact Schmitt Industries for a return materials authorization (RMA) number.

Step 4

If the integrity check shows no service problem with the SBS System, then the final area to investigate is environmental/application issues. The background vibration level on the machine should be monitored under operation, and the Balance Limit setting checked against this level. *(see: Environmental Considerations — pg. 3) (see: Setting Operating Parameters — pg. 12)*

Also, the sizing of the Balance Head to the application should be checked. *(see: Verifying Balance Head Sizing — pg. 12)*

If you continue to have problems after using this guide, contact Schmitt Industries, or your SBS Balance System source for assistance.

Displayed Error Messages

New self-diagnostic software has been incorporated into all SBS Balance Control Units. If a problem ever occurs with an SBS system, It is quickly reported on the front panel display in the form of an error code. Below is a listing of these codes, a description of when the Control Unit automatically runs each test, how each code is cleared, the definition of each error message, as well as the prescribed action to be taken by the user of the system.

Er01— Checked at Power-up .....
Cleared only by power-down.
definition: Displayed if the RPM signal coming from the Balance Head exceeds 9999 RPM and the RPM number cannot be displayed.
action: Verify operating speed of the grinding machine. If the machine is running above 9999 RPM, contact your SBS Balance System source for application consultation. If the machine is running at speeds below the operating limit, and error messages persist, this indicates a failure of the RPM sensor in the Balance Head. The Balance Head should be returned for service.

Er02— Checked at Power-up .....
Automatically clears after power-up display.
definition: Displayed during the Power-On sequence if the Vibration Sensor output signal is incorrect. This could be caused by a defective sensor or by no sensor being connected.
action: Check sensor connections and try Power-On again. Continued error messages indicate the need for repairs to the Sensor.

Er03— Checked at Power-up .....
Cleared by pressing Auto button.
definition: Indicates failure of battery backup to internal RAM memory.
action: The operating parameters stored in memory, such as Balance Limit, may have been lost and need to be reset from the front panel. In the short term, these settings will remain in effect until the Control Unit is powered down again. For long term ease of use, the Control Unit should be returned for repair.

Er04— Checked every Balance Cycle .....
Cleared by pressing Auto button.
definition: Failed Balance, displayed if the system is not able to achieve the Balance LIMIT before a four minute time-out is reached.
action: Reset the PULSE setting to "Low", and verify system integrity as OK (*see: Trouble shooting Guide — pg. 26*). If this error continues, there are two possible causes of this error.

1) LIMIT set too Low - The LIMIT must be set 0.2 higher than the Measured background vibration (*see: Other Sources of Vibration — pg. 3*).
2) It is a signal that the Balance Head supplied is sized incorrectly for the application. Conduct the test described in the Verifying Balance Head Size section. If test results are outside suggested levels, contact your SBS Balance System source to discuss replacement.

Er05— Checked with every Balance Head motor movement .....
Cleared by pressing Auto button.
definition: Electrical short detected in the Balance Head or Balance Head Cable, or Control Unit motor driver circuit.

action: Determine which is the defective component by swapping with another system, or by using the following diagnostic test. Return defective component for repairs. If in doubt, return all items.

test: Disconnect the Balance Head Cable from the Balance Head, but not from the Control Unit. Press and hold down both forward manual motor buttons for 15 seconds. Repeat with both reverse manual motor buttons. If no error messages are displayed until the buttons are released, and error 6 is displayed at release, then the problem is with the Balance Head. If error 5 or 7 is displayed prior to release of the buttons, then perform part two of this test.

Disconnect the cable from the Control Unit, and repeat the above test, using all four manual motor buttons. If error 6 is displayed upon button release, with no other error codes, then the problem is with the Balance Head Cable. If error 5 or 7 is displayed, the problem is with the Control Unit.

Er06— Checked with every Balance Head motor movement .....
Cleared by pressing Auto button.

definition: Electrical "open" detected in the Balance Head or Balance Head Cable.

action: Verify that both end of the Balance Head Cable are properly attached. If connector pins are contaminated, clean with electrical contact cleaner. If problem persists, determine if the Balance Head Cable is the defective component by swapping with another system, or by using a voltmeter, and the enclosed Balance Head Cable Schematic. Return defective cable or Balance Head for repairs. If in doubt, return both items.

Er07— Checked with every Balance Head motor movement .....
Cleared by pressing Auto button.

definition: Internal defect in motor driver circuit in Control Unit, or electrical short detected in the Balance Head or Balance Head Cable.

action: Determine which is the defective component by swapping with another system, or by using the following diagnostic test. Return defective component for repairs. If in doubt, return all items.

test: Disconnect the Balance Head Cable from the Balance Head, but not from the Control Unit. Press and hold down both forward manual motor buttons for 15 seconds. Repeat with both reverse manual motor buttons. If no error messages are displayed until the buttons are released, and error 6 is displayed at release, then the problem is with the Balance Head. If error 5 or 7 is displayed prior to release of the buttons, then perform part two of this test.

Disconnect the cable from the Control Unit, and repeat the above test, using all four manual motor buttons. If error 6 is displayed upon button release, with no other error codes, then the problem is with the Balance Head Cable. If error 5 or 7 is displayed, the problem is with the Control Unit.

Er08— Checked at Power-up .....
Cleared by pressing Auto button.

definition: Internal power supply defect in electronic control unit.

action: Return Control Unit for repair.

Er09— Checked at Power-up .....
Cleared by pressing Auto button.

definition: Short in system five volt output. Three possible causes: Defect (short) in Balance Head, Balance Head Cable, or CNC cable.

action: If you have the SBS system cabled to your CNC controller, verify that the CNC cable is free of electrical shorts. The CNC cable is not supplied with the SBS system, and repair is the responsibility of the user.

Next determine if the Balance Head Cable is the defective component by swapping with another system, or by using a voltmeter and the enclosed Balance Head Cable Schematic. Return defective cable or Balance Head for repairs. If in doubt, return both items.

Electronic Specifications

Control unit

RPM Reporting 0 to 9999 RPM to accuracy of + /- two digits.

Vibration Reporting from 0 to 50.0 microns displacement (by peak to peak measure) or 0 to 5.0 millimeters/second velocity. Accuracy is + /- 5% at 10.0 microns, + /- two digits at the center of the RPM frequency.

Auto-Balance accuracy + /- 0. 1 microns displacement.

Power Requirements:

110V nominal range	(95V to 125V)
220V nominal range	(190V to 250V)
Frequency Range	48-66 Hz
Power Consumption	70 watts max.

Environmental Conditions:

-10C to + 50C, 0 to 95% relative humidity

Vibration Sensor

Sensitivity Range	+ /- 50g
Sensitivity Resolution	0.001g
Voltage Sensitivity	100 mv/g
Excitation Current	2 to 20 ma
Frequency Response	1 to 3000 Hz
Operating Temperature	10 to +93 C

Replacement Parts List

Part#	Description
SB-2511	Balance Head Cable—3.5m
SB-2520	Balance Head Cable—6m
SB-2540	Balance Head Cable—12m
SB-2620	Head Cable Extension—6m
SB-2640	Head Cable Extension—12m
SB-1411	Vibration Sensor 3.5m Cable (5-Pin)
SB-1420	Vibration Sensor 6.0m Cable (5-Pin)
SB-1440	Vibration Sensor 12.0m Cable (5-Pin)
SB-1411-4	Vibration Sensor 3.5m Cable (4-Pin)
SB-1420-4	Vibration Sensor 6.0m Cable (4-Pin)
SB-1440-4	Vibration Sensor 12.0m Cable (4-Pin)
SB-1520	Sensor Extension Cable 6.0m (4-Pin)
SB-1540	Sensor Extension Cable 12.0m (4-Pin)
SB-1620	Sensor Extension Cable 6.0m (5-Pin)
SB-1640	Sensor Extension Cable 12.0m (5-Pin)
SB-0405	4-Pin/ 5-Pin Sensor Conversion Cable
CA-0009	Power Cordset
CA-0009-G	Power Cordset (Germany)
MC-8250	Mount Plate For model SB-2500 Control
SB-0201	Rack Mount Package For SB-2500 Control
SB-8510	SBS Low Profile Collector
SB-8520	Slip Ring Block Replacement—L/P
SB-8530	Slip Ring Post Replacement—L/P
MC-8516	RPM Sensor Replacement—L/P
MC-8515	7-Pin Connector w/ Wire Harness (Balance Head)
CA-0011	7-Pin Male DIN Connector for Head Cable
CA-0015	7-Pin Female Bayonet Connector Head Cable
SB-0010	1 1/2" Hex Wrench
SB-0020	1" Hex Wrench (Large Adaptor Nuts)
SB-1300	Adjustable Pin Spanner (Adaptor Flanges)
SB-1311	Adjustable Face Pin Spanner (Small Adaptor Nuts)
SB-1321	Adjustable Face Pin Spanner (Large Adaptor Nuts)
SB-3500	MULTIPLEXER CONTROL UNIT (4 Channel)
SB-3500-2	MULTIPLEXER CONTROL UNIT (2 Channel)

Cabling Notes:

- 5-Pin Sensor Cables and Sensor Extensions are current models.
- 4-Pin versions are supplied for use with older systems.

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Schmitt Industries Incorporated
2765 NW Nicolai St.
Portland, Oregon 97209 USA

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Ordering the SBS Balance System

The SBS Balance System is sold as a set matched to the requirements of the users grinding machine. The system includes a Balance Head, a microprocessor based Balance Control Unit, a Balance Head Cable, a Vibration Sensor, and all necessary attachments and tools for installation on the grinding machine.

Selection of your balance system requires only a few moments of your time:

1) Complete the Application Questionnaire provided by your SBS Balance System dealer.

2) Based upon response to the questionnaire, your dealer selects the appropriate mounting adaptor and determines the mass compensation required by your application based on American and European specifications regarding wheel balance.

3) Your SBS Balance System is delivered, matched to your exact needs. The system comes with complete operating instructions, which makes operator training and system use simple, and helps bring immediate return to your investment.

Dynamic Balance System
Application Questionnaire

(Please provide complete information to ensure proper installation)

Company Info

Company Name: _____ Contact Person: _____

Mailing Address: _____ Phone: _____

_____ Fax: _____

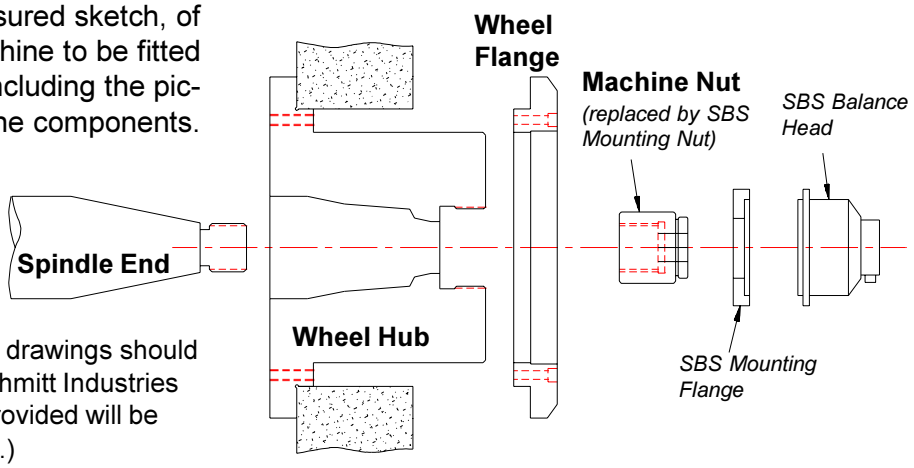
_____

Sales Agent: _____

Grinding Machine Information

Machine Make _____ Model# _____ Serial# _____
(not required)

Please attach drawings, or a measured sketch, of the spindle end of the grinding machine to be fitted with the SBS Balance System, including the pictured machine components.



Information Checklist: (The provided drawings should include the following information, or Schmitt Industries cannot ensure the mounting adaptor provided will be appropriate to your grinding application.)

- ☐ Method of locating Balancer concentric to spindle rotation (spindle threads or tight tollerance bore)
- ☐ Method of attaching Balancer to grinding machine (spindle threads or cap screws present)
- ☐ Clearance of Wheel Hub Co-bore or other machine features

Application Information

Direction of wheel rotation, facing wheel end *(clockwise/counter-clockwise)* _____

Does grinder have a speed control or spindle brake? _____

Is pulley-end mounting required? _____

	Maximum	Minimum
Wheel Inside Diameter	_____	_____
Wheel Outside Diameter	_____	_____
Wheel Thickness	_____	_____
Wheel RPM's	_____	_____

If this application requires use of a CNC interface, please refer to the CNC Interface Specification Sheet published by Schmitt Industries.

Your SBS Balance System source:

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Phone: (503) 227-7908 Fax: (503) 223-1258
Sales Office Phone: (503) 590-0182