



OPERATIONS MANUAL

SB-4500 Series w/
**Manual
Balance
Control**

L-4900-1

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Operation and Specification Manual
for the
SBS Manual Balance Control

Covering the Following

- Model 4500-M series Control Unit
- Model 4400-M series Control Unit

L- 4900-1

Manual Revision # 1.0

© 2003 Schmitt Industries, Inc.
2765 NW Nicolai St.
Portland, OR 97210 USA
Phone: (503) 227-7908
Fax: (503) 223-1258
www.schmitt-ind.com

Table of Contents

System Purpose	1
Operator Safety Summary	1
System Theory and Connection	2
Environmental Considerations	4
Other Sources of Vibration.....	4
Machine Condition	4
Balance System Installation	5
SBS Control Unit.....	5
Vibration Sensor Location.....	5
RPM Sensor Installation	6
Control Unit Operating Instructions	7
Front Panel Controls	7
Balancer Main Screen Elements	8
Rear Panel Controls.....	9
Models without Front Panel	9
Card Rear Panel Connections	10
Power-On Display	10
SETUP Option	11
Balancer Slot Status LED	11
MENU Settings and Selections	11
Balance Settings	11
Vibration units	12
Plot Vibration.....	12
Channel Name	13
Menu Entry.....	13
RPM Sensor.....	13
Factory Settings	13
Critical RPM.....	13
Models without Front Panel	14
Selecting Balance Settings	14
Background Vibration.....	14
Balance LIMIT	14
Balance TOLERANCE	15
Balance CRITICAL.....	15
Balancing	15
Balance Process	15
Position Weights Screen.....	16
Check Vibration Screen	17
Plotting Vibration	18
Hardwire Interface	19
Hardwire Interface Protocol	19
Input Pin Names and Functions.....	20
Output Pin Names and Functions.....	20
Software (RS-232) Interface	21
RS-232 Commands and Responses	22
RS-232 Operation Summary	24
System Maintenance	26
SBS Return/Repair Policy.....	26
Sensor Cable Schematic	26
Trouble Shooting Guide	27
Displayed Error Messages	28
Appendix A: Electronic Specifications	30
Appendix B: Replacement Parts List	31
Appendix C: Balancer Card Installation	32
Appendix D: System Connection Diagram	33

System Purpose

A grinding wheel is the cutting tool of a grinding machine. In order for the grinding wheel to accurately cut, produce smooth surface finishes, and generate correct part geometry, it is necessary to prevent vibration in the grinding process. One of the primary causes of vibration in an operating grinding 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 wheel. Even a carefully established wheel balance, considering all these factors, will not last long. Due to wear and frequent dressing of the wheel periphery, the rotational dynamics of a grinding wheel are always changing. For these reasons, dynamic balancing of grinding wheels has long been recognized as an important step in the production process.

The SBS Manual Balancer 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 Manual Balancer 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 Manual Balancer, 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: Failure to properly attach SBS Manual Balancer components to the grinding machine, will result in safety hazard during machine operation.

Caution: Only qualified service technicians should attempt to perform service on the SBS Manual Balancer. To avoid electric shock, do not remove the cover of the Control Unit, or remove cables, with power connected.

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

Caution: To avoid equipment damage, make sure the line voltage is within the range specified for the system (see specification section).

System Theory and Connection

The SBS Manual Balancer 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*).

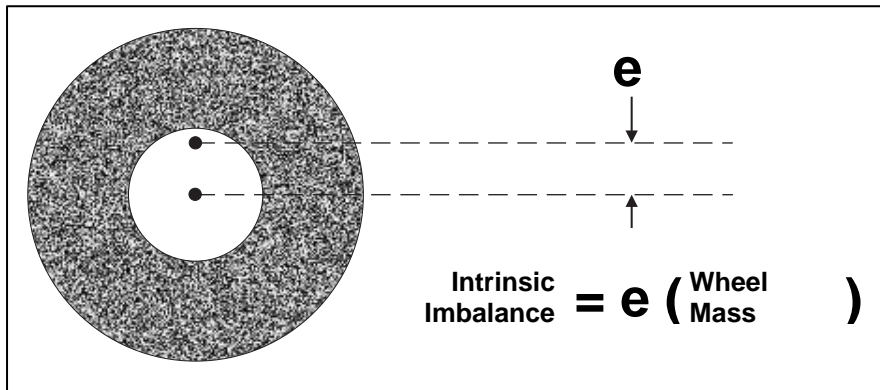


Figure 1

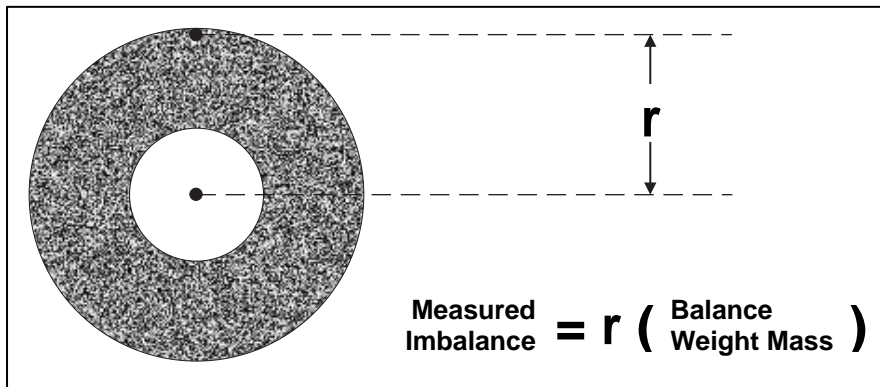


Figure 2

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 Manual Balance Control uses two or three movable variable angle balance weights, which can be independently positioned. These weights are usually supplied by the grinder manufacturer, and are typically located in grooves in the wheel flange or wheel hub.

Figure 3 is a simplified block diagram of the SBS Manual Balancer. The system consists of the SBS microprocessor-driven balance Control Unit, a Vibration Sensor, and an RPM Sensor. 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 guides the user in positioning the grinder's balance weights manually, so that the amplitude of the incoming vibration signal is lowered to a user set level of acceptable balance.

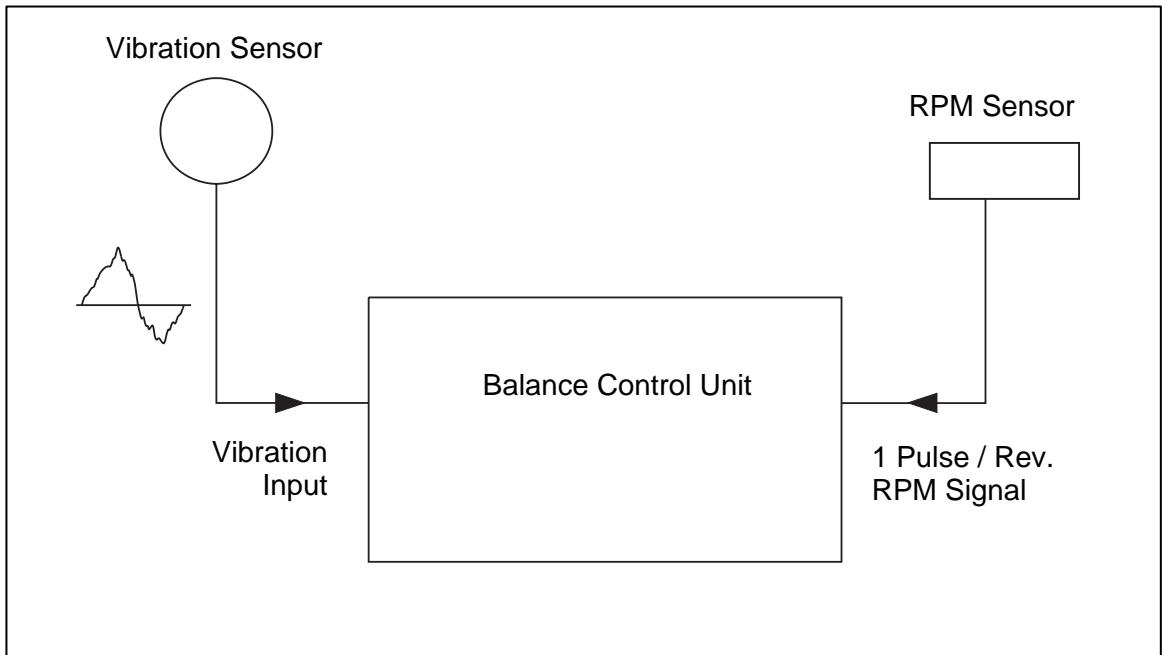


Figure 3

Figure 4a shows a rotating grinding wheel that is unbalanced, with balancing weights attached. The imbalance is represented by the white dot located on the circumference of the wheel. The other two black dots represent two balance weights located in the wheel hub assembly. The Manual Balance Control calculates the required position of the weights to achieve a triangulation offset which cancels out the imbalance, as shown in Figure 4b.

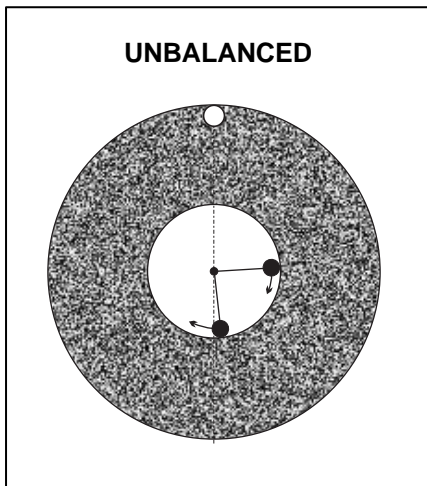


Figure 4a

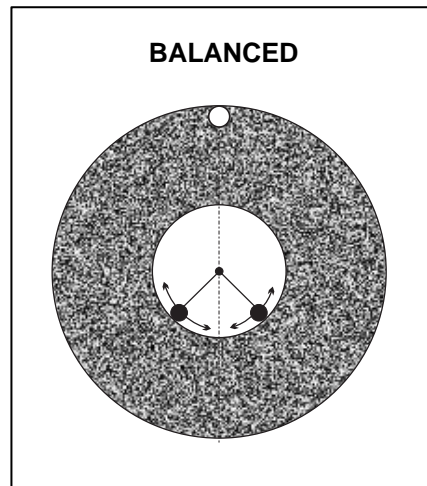


Figure 4b

Environmental Considerations

The SBS Manual Balancer 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 Manual Balancer 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. Another source of vibration may be components mounted on the machine, such as pumps, motors, drives, etc.

The SBS Manual Balancer 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 Manual Balancer can quickly let you accomplish this test (*see: Background Vibration section*). The SBS Manual Balancer can not remove these vibrations.

Machine Condition

The grinding machine's condition is important in determining the balance level, that the SBS Manual Balancer 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 Manual Balancer does not remove these vibrations.

Balance System Installation

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 RPM Sensor, the power cord, and hardwire Interface Cable if applicable (*see: System Connection diagram*). All connections are clearly labeled on the rear of the control unit. Be sure that the proper fuses (Two 3 Amp Time Lag) are installed. (*see: Rear Panel Controls section*).

Vibration Sensor Location

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, 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. When stud mounting the sensor, a machined flat should be supplied at the mounting location on the machine.

The location and installation of the sensor are crucial to successful operation of the SBS Manual Balancer. 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.

1. The first general principle is to **locate the Sensor in the same direction as the centerline between the grinding wheel and the workpiece**. The best place to start is a flat machined surface on the spindle housing over the bearing closest to the wheel, and perpendicular to the spindle's centerline (*figure 7a*). A vertical mounting surface is preferable on most cylindrical grinding machines because the sensor is in line

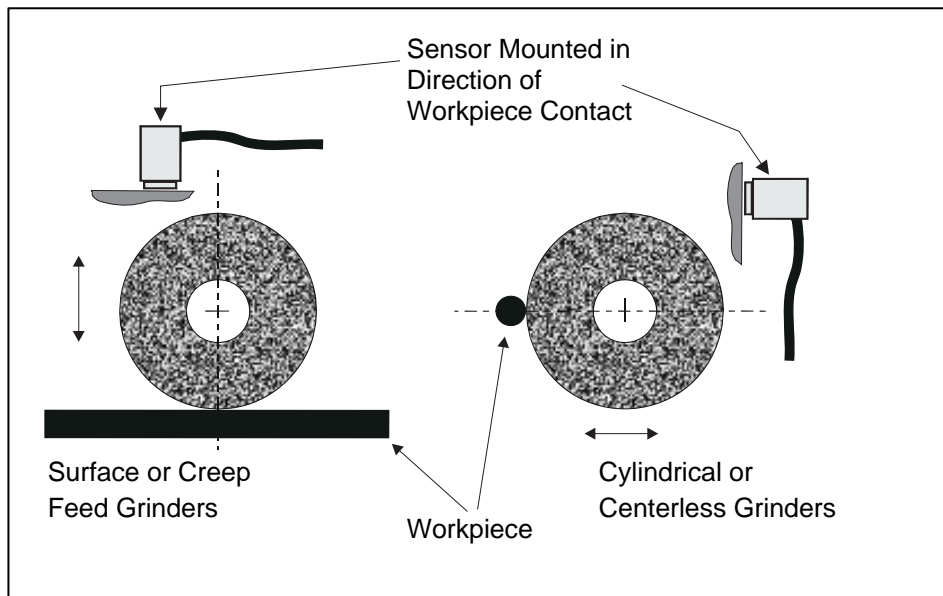


Figure 5

with the grinding wheel and the workpiece. For this same reason, on surface grinders and creep feed grinders, a horizontal mounting surface is generally best. Although the balancer itself may be mounted either on the wheel or pulley end of the machine, the Sensor should always be aligned at the wheel end of the machine (*figure 5*).

2. The second general principle is to **locate the sensor on a rigid part of the machine structure, where vibration from the spindle will be accurately transmitted.** On some machines, the wheel guard can be a good location to mount the sensor, if it is heavy enough and rigidly attached to the spindle housing. 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 or other machine components are running at the same speed or frequency as the spindle, interfering vibrations may result. Careful experimentation with the sensor's location goes a long way in minimizing sources of interference.

RPM Sensor Installation

The RPM sensor is an inductive proximity sensor. The RPM Sensor must be located in position to detect a one per revolution hole or protrusion in the spindle or attached rotating parts such as pulley, wheel hub, etc. A simple hole drilled in a face or OD is often the simplest method of providing such a feature. The Sensor should be mounted using the supplied mount bracket, and positioned so that the face of the sensor is about 1mm from the high surface, and placed so that the hole or protrusion will pass directly under the sensor. The RPM SENSOR alignment feature under MENU will assist in verifying proper position. CAUTION – Once the sensor is positioned, clamp the mount bracket tightly to the sensor body to lock it in place, and prevent movement under vibration which might allow the sensor to contact the rotating surface.

Control Unit Operating Instructions

The SBS Manual Balancer, 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 Manual Balancer Control Unit.

Front Panel Controls

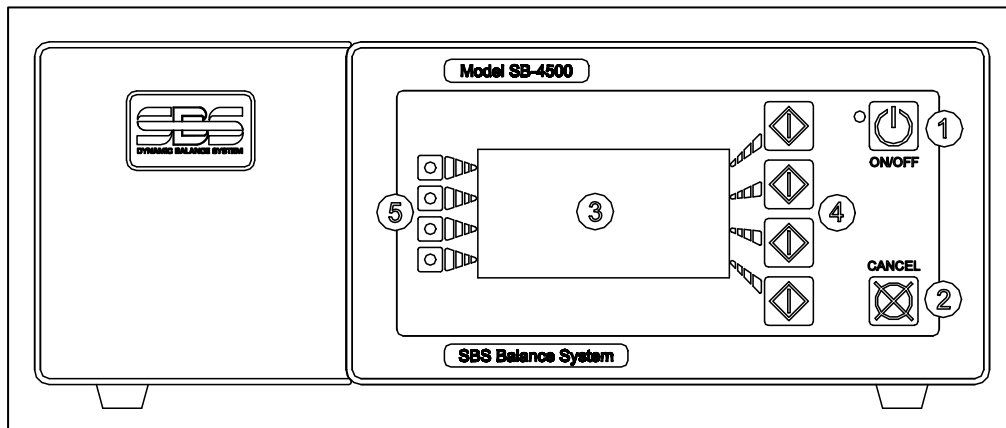


Figure 6

Figure 6 illustrates the controls and indicators on the front panel of the Balance Control Unit. The following is a description of these features:

- 1) **ON/OFF.** This button turns on the operating power for the system. When the system is turned on, the unit initiates a Power-On Display, and the green LED to the left of the button will be illuminated. When turned OFF, the unit is in the stand-by mode, and the green LED is blinking. This indicates power is connected to the unit, but the control is inactive.
- 2) **CANCEL BUTTON.** Pressing this button will cancel the operation in progress, or the last selection or entry made.
- 3) **LUMINESCENT DISPLAY.** This display is not a touch screen. Do not attempt to operate the control unit by pressing on the display.
- 4) **FUNCTION BUTTONS.** The display is not a touch screen. Operation of the Control unit is primarily accomplished via these four multi-function buttons. The Menu Bar area of the display, to the left of these buttons, assigns the current function to each button.
- 5) **SLOT STATUS LED.** An LED indicator of three colors on the left side of the keypad display the operational status of the balancer card or other device installed in that card slot.

Balancer Main Screen Elements

The following items are elements displayed on the Balancer Card Main Screen (*figure 8*).

- a) MENU BAR. The right side of the display is used to indicate the current function of the four corresponding function buttons to the right of the display. This includes menu selections and direction arrows.

These function buttons are defined as follows for the main screen of each Balancer Channel. See Function Button Map (*figure 12*) for an overview of the balancer functions available.

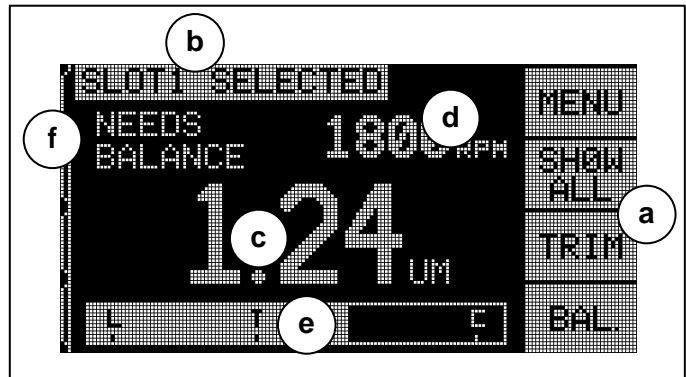


Figure 8

MENU – When this button is depressed, the display shows a menu listing with selectable operating parameters and other functions for the control unit. The displayed arrow selection buttons are used to move the highlighted selection bar up and down the listing. Press the ENTER button once the menu item has been highlighted.

SHOW ALL – This selection will only be displayed on the Menu Bar when more than one manual balancer card is installed in the control unit. Pressing the corresponding button will display the monitored status of all balancer channels, or other devices.

TRIM – Initiates a Trim Balance run, which is a truncated balance cycle useful for rebalancing slightly out of balance machines. (*see: Balancing section*).

BAL. – Initiates a full manual balance cycle. (*see: Balancing section*).

- b) IDENTIFICATION TAG. The upper edge of the display is used to identify the five digit name given by the user to the channel currently selected, and the current position in the menu structure.
- c) VIBRATION DISPLAY. Indicates the measured vibration level of the grinding machine in either microns or mils of displacement, or in millimeters/second or mils/second of velocity. The displayed units are selectable from the Menu.
- d) RPM DISPLAY. Displays Spindle RPM measured by the system.
- e) BAR GRAPH. The bar graph reflects the monitored vibration level compared to the LIMIT, TOLERANCE, and CRITICAL levels.
- f) STATUS. This text label is used to indicate the current status of the selected balancer channel.

Rear Panel Controls

Figure 7 illustrates the rear of the control. The following four connections are located on the rear panel of the Balance Control Unit, and are common to any cards installed in the control.

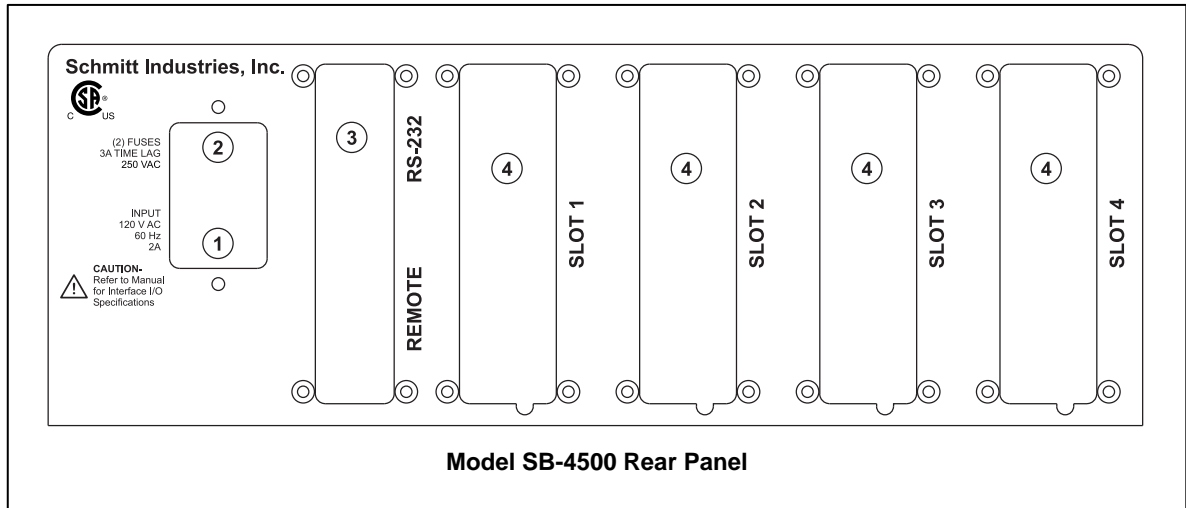


Figure 7

- 1) **POWER SUPPLY.** Connection for line power input. **Caution - before applying power to the Control Unit, make sure the voltage is within specified voltages for the balancer (AC INPUT 90-260, 47-63Hz).**
- 2) **FUSE HOLDER.** Contains the line fuses. To replace fuses, remove the line plug from receptacle and use a small screwdriver to draw out fuse holder from the plug body. An equivalent of the two supplied 3 Amp Time Lag 5x20 fuses should be used.
- 3) **RS-232 PORT.** A DB-9 connector receptacle is used to provide external communication for serial transfer of data.
- 4) **DEVICE SLOTS.** These numbered Slots are available for installation of balancer channel cards or other devices supplied by Schmitt Industries. Factory configuration of the control unit will include a balancer channel card installed in Slot 1, with unused Slots being sealed with blank cover panels.

Models without Front Panel

These are dedicated hardwire interface Controls which do not have a front panel, and can be activated only through the hardwire port on the Control Unit, or by use of an optional remote front panel. Operation of the unit via the remote front panel is identical to that described above.

Rear panel control and connections for models without front panel are identical to those on the standard SB-4500 channel unit, except for the addition of the REMOTE plug, located directly below the RS-232 port. This DB-15 connector receptacle is used to connect the optional remote front panel unit (SB-4450) to the control, where remote panel mounting is desired.

Card Rear Panel Connections

Figure 11 illustrates the rear of the individual balancer card (part SB-4543) installed in the manual balance control. The control unit comes standard with one such card. Other device cards can be purchased and added to the control unit as required, to upgrade the system to allow full automatic Balance Control with any of our balance systems, or to add AEMS acoustic monitoring capability. The following three connections are located on the rear panel of the manual balance control card.

- 1) **RPM Sensor Connection.** The receptacle through which the RPM Sensor cable makes connection to the Control Unit.
- 2) **Sensor Connection.** The receptacle through which the Vibration Sensor cable makes connection to the Control Unit.
- 3) **Hardwire 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 hardwire interface protocol is given in the Interface section of this manual.

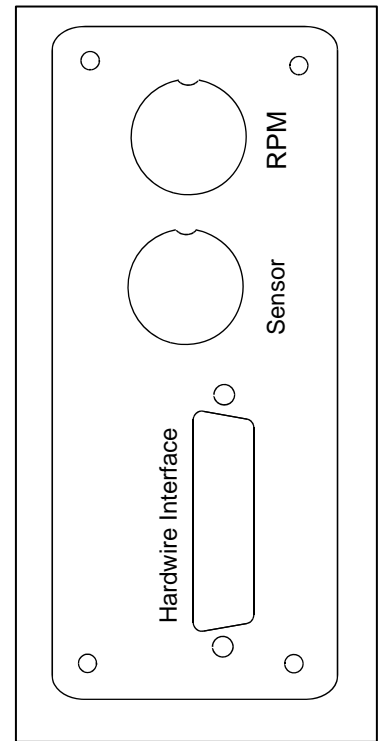


Figure 11

Power-On Display

When the ON/OFF 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 graphic display. The sequence follows this order:

- 1) The company logo screen will be displayed and lights on the front panel are illuminated to verify their operation. During this time, a SETUP function button is available. Pressing this button will allow language selection, and RS-232 Baud Rate selection. These settings are common to all installed card slots.
- 2) After a few seconds, the company identification screen will clear and the unit will display information related to each slot or slots where card devices are installed, indicating each type of device, and relevant identifying information. To extend the time that this information is displayed, press any one of the function buttons while the slot information is on the screen. Each press will add six seconds to the display time, providing additional time to read the information.
- 3) After a few more seconds, the slot information screen will clear, and the unit will display the initial operational screen for the control unit. Where one balancer channel is installed, this first screen will be the main screen. Where more than one device is installed, the unit will display either the SHOW ALL monitor screen, or one channel's main screen, whichever was selected when the unit was last turned off.
- 4) Any error conditions detected by the self-checks are displayed as "ERROR - *code*" where *code* lists the reference code of the error detected. For detailed description of error codes, see Displayed Error Messages section of this manual, or other additional product instruction addendum manuals.

SETUP Option

This option allows the user to select the language used by the control unit for display, and the RS-232 baud rate used by the control for RS-232 communication. During Power-up, while the company logo screen is displayed, pressing the SETUP button, changes the screen, first allowing the option of changing the language used by the control for display. Use the arrow buttons to scroll through the available languages and press the ENTER button to switch the control unit to the desired language. After pressing the ENTER button, a screen for changing the baud rate for the RS-232 port is displayed. Use the arrow buttons to scroll through the available baud rates and press the ENTER button to make the selection. Pressing the START button at any time during this process will bypass SETUP and resume normal operation.

Balancer Slot Status LED

The status indication for installed Balancer channels is as follow:

Balance Level **ABOVE CRITICAL**. The LED is lit **RED** when the measured vibration level is above the CRITICAL level selected by the user.

Balance Level **OUT OF TOLERANCE**. The LED is lit **YELLOW** when the measured vibration level is above the TOLERANCE level selected by the user.

Balance Level **BELOW TOLERANCE**. The LED is lit **GREEN** when the vibration level of the grinding machine is at or below the selected TOLERANCE limit.

MENU Settings and Selections

Note: All menu items are set independently for each installed balancer card, or other device.

Pressing the MENU button listed on the display will produce a listing of menu items. This menu provides a means of specifying system settings for individual balancer channels, and for performing certain optional functions. Use the buttons corresponding to the up and down arrows to move through the menu items. Press the ENTER button to select an individual menu item for edit or operation. Pressing the EXIT or CANCEL buttons will exit the Menu screen, and return to the Main Screen for the channel. Description of each MENU listing follows:

Balance Settings

Use the button corresponding to the backward arrow to move the cursor from one digit to the next. Use the buttons corresponding to the up and down arrows to increase or decrease the value of the selected digit. When finished press the ENTER button to store any change in value, and move to the next balance setting. Each of the following three balance settings are presented consecutively. Pressing CANCEL will return to the Menu.

1. **LIMIT** target level - This is a target balance level that the user will try to achieve during a Balance cycle, and is provided as a reference for the user only. The Balance system will always perform a “best possible balance”, and results will depend on accuracy of weight location during the entire balance cycle.
2. **TOLERANCE** level - This level sets the high end of the acceptable operating balance range. When this level is exceeded a Balance Out of Tolerance (BOT) error condition is reported. This signals the operator or PLC/CNC control to re-balance the machine. This level needs to be determined by process considerations. It should usually be 1 micron or more above the limit.
3. **CRITICAL** level - This level can be set at a value that provides a secondary warning of an extreme out of balance condition that may be damaging to the grinding machine or process. When this level is exceeded a Critical Balance out of Tolerance (BOT2) error is reported. This signals the operator or

PLC/CNC control to shut down the machine. This same error can also be triggered by excessive RPM (see: *Critical RPM section*).

4. BALANCE TYPE – 2 or 3 spread weights

- 2 Spread Weights – Supports balance using two (2) equal fixed mass weights, which can be positioned at any specific angle on the wheel holder. An angle scale must be provided for location of the weights relative to some zero point. (0-360 degrees).
- 3 Spread Weights – Supports balance using three (3) equal fixed mass weights, which can be positioned at any specific angle on the wheel holder. An angle scale must be provided for location of the weights relative to some zero point. (0-360 degrees).

5. WHEEL ROTATION/ SCALE DIRECTION – Sets the direction of the angle scale on the machine, used to position the balance weights. This is a relative direction **in relation to the rotation direction of the wheel**. The angle scale direction is the direction (clockwise or counterclockwise while facing the scale) in which the angle references (0°, 90°, 180° etc.) increase. The system must know if this direction is the same or opposite the direction of the wheel's rotation. The system can determine this automatically, but to do so requires one extra balance run at the beginning of the balance cycle, which may not be desired in situations where this direction relationship remains constant. The following four settings are available.

- Automatic Always – With every balance operation, the direction will be determined automatically by having the operator run the extra direction run. This can be useful where the spindle swivels or otherwise changes directions.
- Automatic Once – On the first balance cycle ran after selecting this option, the system will automatically determine the direction by having the operator run the extra direction run, and will store the result, and not run the auto-determination cycle again.
- Same – This setting allows the operator to manually input the direction as SAME, without running the auto-determination cycle.
- Opposite – This setting allows the operator to manually input the direction as OPPOSITE, without running the auto-determination cycle.

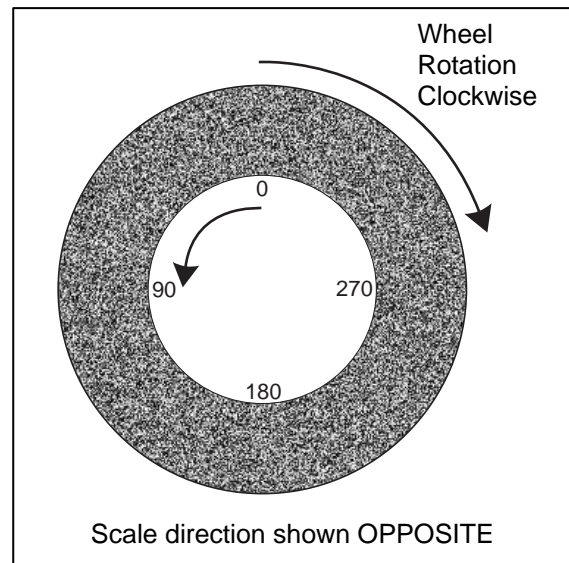


Figure 9

Vibration units

Press the corresponding button to select from the available vibration units that may be displayed (UM, MIL, MM/S, or MIL/S). The currently selected units are highlighted on the screen. When the unit button has been pressed, the display will change, giving the opportunity to select the desired display resolution for that choice. The buttons corresponding to the up and down arrows are used to set the resolution, and pressing the ENTER button stores the selection.

Plot Vibration

This function allows the user to perform a vibration spectrum sweep in a selected RPM range. This operation will take several minutes. It will generate an on-screen graphical representation of the amplitude of vibration monitored at each RPM range in the form of a bar graph. It will also produce a text listing of the

top twenty vibration peaks encountered during the spectrum sweep. See the Plot Vibration section for operational details.

Channel Name

Select a name or label to identify the balancer channel. This name is used on the various screens to identify which channel is currently selected. SLOT1 is the factory default name assigned to all channels, until the user selects a unique name.

Menu Entry

This selection on the menu list provides for use of a standard access code for menu protection. Setting the channel to the protected mode denies access to the menu list unless the access code is entered. This setting ensures that system settings will not be accidentally compromised. The screen displays ENABLED when Menu access is available, and PROTECTED when menu access is controlled by the access code. Function buttons are assigned the numbers 1, 2, 3, and ENTER, which are used to input the access code. The standard access code is **232123**. Once the code has been entered and the ENTER button has been pressed the MENU selection is protected. Re-entry to the menu list will now require entry of this code. The message MENU ACCESS PROTECTED will be displayed notifying the user that the menu is password protected, and the user will be given the opportunity to enter the code. Entering a code other than the correct number will produce a message INCORRECT CODE ENTERED TRY AGAIN/ CANCEL.

To disable menu protection, enter the correct code to access the menu, select the MENU ENTRY item from the menu, and enter the code again to turn off the protection. The display for MENU ENTRY will display ENABLED when protection has been disabled.

RPM Sensor

The speed sensor can be automatically calibrated the first time the unit is operated. After installation of all system components and cables, switch on the controller and wait for it to display the main menu. Do not switch on the spindle. Loosen the mounting bolts and shift the speed sensor, so that it touches the metal of the mating face on the part that normally rotates (spindle or chamber). Then pull the speed sensor or Nozzle Block back to the specified gap of 1 to 3 mm. The system should have recognized and calibrated the speed sensor. If this is not the case, chose “RPM SENSOR” from the MENU. A graphics appears (figure 10) depicting the gap between speed sensor and chamber or spindle. Position the speed sensor so that the graphic shows the correct distance.

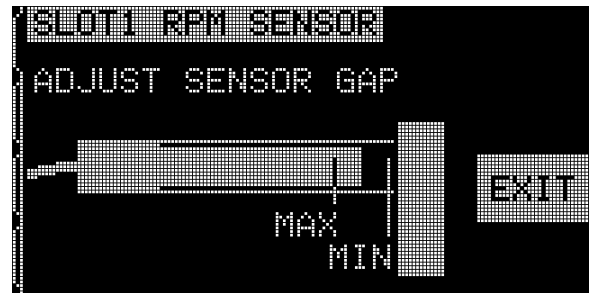


Figure 10

Factory Settings

Returns all user selectable parameters to the default factory settings.

Critical RPM

This setting allows the user to select a maximum RPM level, which when exceeded will cause the Balance Control to indicate an error condition. Toggle the selection cursor with the up and down arrow buttons to highlight the CRITICAL RPM selection, and press the ENTER button. The screen now displays the CRITICAL RPM entry screen. Any RPM level set using this screen will act as a maximum limit, and if this limit is exceeded, the controller will indicate an error in two ways. The SLOT STATUS LED will illuminate **RED**. In addition, the BOT2 Relay contacts will be tripped. This is an alternate cause of the BOT2 error condition. This relay can be monitored by the machine PLC/CNC, and if desired can be used to

set off additional warning systems or interrupt the operation of the grinding machine. To set the desired RPM for the Critical level, use the left arrow button to select digits, and the up and down arrow buttons to change the selected digit. Press ENTER to save the setting and return to other screens. To disable the Critical RPM feature, simply reduce the CRITICAL RPM level to zero.

Models without Front Panel

All operating parameters are set through the RS-232 port. Default settings of 9600 baud and Metric/Displacement vibration units can be changed only with the use of the optional Remote Keypad supplied by Schmitt Industries, Inc.

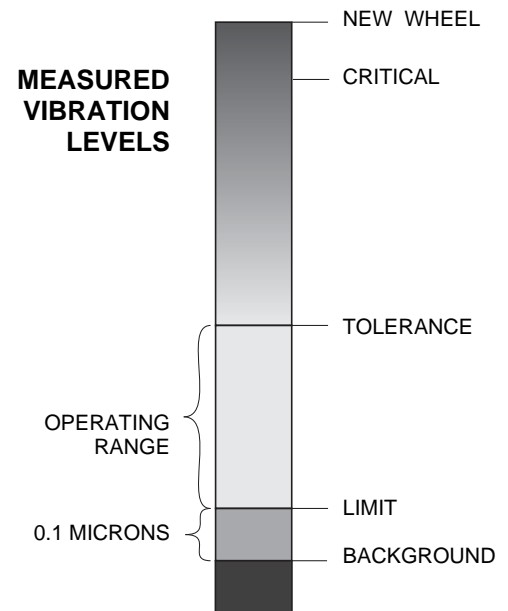
Selecting Balance Settings

Background Vibration

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

Mount the Vibration Sensor in the position to be used during operation (*see: Vibration Sensor Location section*). Leaving the grinding wheel off the machine, turn on the spindle and all secondary machine systems (such as hydraulics, and motors). The vibration level displayed without the grinding wheel is the 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 Environmental Vibration section for explanation of possible sources of background vibration.

The following section details the user selectable LIMIT, TOLERANCE, and CRITICAL levels. For controls where more than one balancer card is installed, the user should select the desired channel, and then enter the MENU list. **All menu settings are independently set for each channel.**



Balance LIMIT

The SBS Manual Balancer is designed to balance quickly to a calculated “best balance” point. The Limit is used only as a benchmark by the user to determine if balance cycles performed achieve a predetermined target result. The Balance system will always perform a “best possible balance”, and results will depend on accuracy of weight location during the entire balance cycle. The 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. **The lower the balance Limit is set, the more likely it is that environmental noise and slight errors in weight placement will prevent the Limit from being reached.**

To set the balance Limit, the MENU button is pressed, and BALANCE SETTINGS is selected from the menu. The balance Limit is set using the arrow buttons, followed by pressing the ENTER button. Typically you should set the Limit at a level that is 0.2 micron higher than the highest background vibration level you noted in the background vibration check above. Press the ENTER button to enter the selected Limit. **Note:** While Velocity display modes may be selected for monitoring machine vibration, the balance settings (Limit, Tolerance, Critical) can only be made in units of displacement.

NO BALANCE SYSTEM IS CAPABLE OF BALANCING THE GRINDING WHEEL TO A VALUE BELOW THE AMBIENT OR BACKGROUND LEVEL. 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.**

Balance TOLERANCE

Related to the balance Limit, is the balance Tolerance setting. This operator defined setting establishes the vibration level, which acts as an “upper limit” for acceptable balance levels. When vibration reaches this setting, the system will indicate the need to perform a re-balance operation. This indication is given both by the **yellow** color of the SLOT STATUS LED on the front panel, as well as via the hardwire interface. The Tolerance level is selectable in the same manner as the balance Limit. It must be set **at least** 0.2 microns above the LIMIT setting. Typically it is set at least 1 micron above LIMIT setting.

Balance CRITICAL

Related to the balance Tolerance is the balance Critical setting. This operator defined setting establishes the vibration level, which will act as an indicator of the operational vibration safety limit for the system. When reached, this setting will indicate the critical need to perform a re-balance operation. This indication is given both by the **red** color of the SLOT STATUS LED on the front panel, as well as via the hardwire interface. The Critical level is selectable in the same manner as the Tolerance setting. It must be set **at least** 2.0 microns above the TOLERANCE setting.

Balancing

Balance Process

A balance cycle is an iterative or repetitive process of manually positioning the grinder’s balance weights according to the system’s directions, and then checking the results of each move. **Important** – successful balance cycles depend on careful and accurate placement of balance weights at the locations specified by the balancer. The user must provide the following markings on the grinder in order to allow for successful balancing:

1. An accurate angle scale must exist on the grinder which references the position of the balance weights. The scale accuracy and resolution will determine how accurately the balance weights can be placed, which will determine how well the machine can be balanced. SBS can provide angle scales for users which lack one. Contact your SBS representative for details.
2. Each of the balance weights should be marked with a center line (center of mass) indication. This centerline is to be used to position each balance weight against the angle scale on the machine.

A full Balance Cycle will consist of the following separate balancing steps or runs:

- **Zero Run** – Determines the balance status of the wheel, without the effect of the manual balance weights. This is achieved by positioning the weights at known null balance positions, so the weights effectively balance each other.
- **Trial Run** – Determines the change in balance produced by moving a known amount of weight to a known position.
- **Direction Run** – This run is optional, and only occurs when automatic direction detection is enabled from the balance settings menu. Determines the angle scale direction, relative to the rotation direction. The phase change produced by moving the balance weight introduced in the trial run to a new predetermined location is monitored.

- **Final Run** – Purpose is to determine the “best balance” positions for the balance weights, based on the information provided in the previous runs above.
- **Trim Run** – The TRIM button is available both from the main screen and from the Final Run results screen. A Trim run is simply an additional Final Run (attempt at a best balance), based on information from previous balance runs. Trim is normally not needed following a full balance cycle with accurate weight placement, but may be useful to correct for slight errors in the previous balance runs.

TRIM Button/ Main Screen

A Trim Run can be useful as a shortened balance cycle where the wheel has worn or otherwise become slightly out of balance, but the fundamental balance state of the wheel has not changed. A Trim Run will assume that information from the last Zero Run and Trial Run are still valid, and re-calculate best balance based on that information. If a Trim Run does not achieve the balance desired, the user should run a full balance cycle, so the system can determine updated Zero Run and Trial Run information.

BAL. Button/ Main Screen

To begin a full balance cycle, press the BAL. button from the main screen. The following screen will be displayed. There are two types of screens for each step or run in the balance cycle. The position weights screen will look like figure 12, and tells the user where to place the balance weights. Pressing Next on this screen will bring up the check vibration screen (*see figure 13*). The elements of these two screens are consistent for each run of the balance cycle, and are described below.

Position Weights Screen

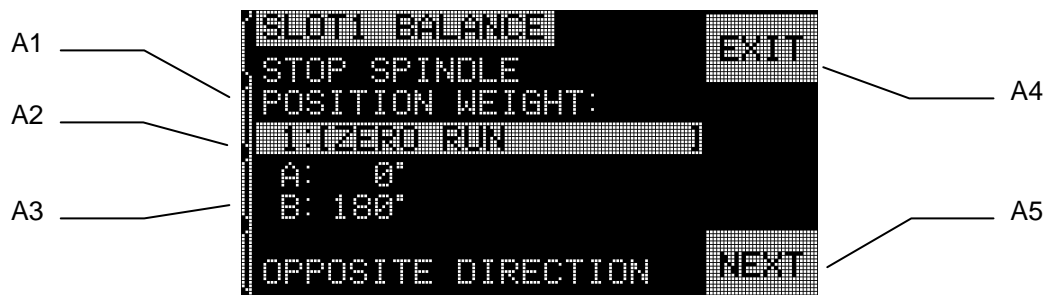


Figure 12

- A1) Instruction Section – This part of the screen tells the user what to do next. The “STOP SPINDLE” text will flash until the unit detects no incoming RPM signal. The NEXT button will also not be available until this condition is met. **The user is instructed to stop the spindle, position balance weights as shown in the location detail, then press the NEXT button.**
- A2) Run Identification Bar – The highlighted bar shows the run reference number, followed by a descriptive label for the run. A list of labels follows:
- 1: ZERO RUN – On the first run the user will position the weights at specified null positions.
 - 2: TRIAL RUN – On the Second run, the user will move a balance weight to a specific location so the system can determine the effect.
 - 3: DIRECTION RUN – This run is optional and only occurs when the control is set to auto-determine the Scale Direction setting.
 - 4: FINAL RUN. This run tells the user where to position weights for a best possible balance.

- 5: TRIM RUN – This run is optional, and is initiated by pressing the TRIM button from the Final Run Check Vibration screen. Trim runs allow slight adjustment in weight positions in an attempt to improve balance. This can sometimes correct for small errors in previous balance runs.
- A3) Location Detail – For two spread weight balancing, this area will look like the screen above, with each weight position (A, B) listed, along with the location each weight should be positioned at.
- A4) EXIT – will always exit the balance process, back to the Main Menu. When Exit is pressed from a check vibration screen, any current balance run information is saved. The CANCEL button will accomplish the same without saving any information.
- A5) NEXT – This button will only be available when the spindle has stopped. Pressing this button will display the Check Vibration screen, so the unit may determine the balance level achieved.
- A6) BACK – (not pictured) Available only on screens beyond the Zero Run, located above the Next button. Pressing this button will display a history screen, which allows the user to use arrow buttons to scroll back through each of the balance runs conducted, and even allows the user to choose one of these earlier reference points as their current start point to continue the balance process from. This allows the user to “go back” to an earlier point in the balance cycle if desired, without having to start over from the beginning.

Check Vibration Screen

Figure 13 shows the elements of the second balance screen, the “Check Vibration” screen. This screen will be displayed after each Position Weight screen, and has the purpose of showing the balance or vibration level which has resulted from the prior placement of weights. The system will use the results found at this point for calculation of balance. Many of the screen elements are the same as on the Position Weight screen, with the critical differences described below.



- B1) Instruction Section – This part of the screen tells the user what to do next. The “RUN SPINDLE” text will flash until the unit detects a stable incoming RPM signal. The NEXT button will also not be available until this condition is met. **The user is instructed to start the machine spindle, check the vibration level to determine if the balance level is adequate, then press the NEXT button to continue with the next step in the process.**
- B2) Below the run identification bar, the screen now shows the measured vibration level, in the units selected by the user. To the right of the vibration level, the measured phase angle is also displayed to interested users.
- B3) Reference – The bottom line of the screen displays the current measured RPM level.
- B4) NEXT – This button will only be available when the spindle is running. Pressing this button will display the next Position Weight screen, so the user may begin the next run in the balance cycle.

Plotting Vibration

RPM RANGE – After selecting the PLOT VIBRATION menu item, the first screen displayed allows the user to press this button to select the RPM range. The RPM Range is the frequency range that will be evaluated during the spectrum sweep of vibration amplitude. Once this selection is made, use the arrow buttons to first set the low end of the RPM range, press ENTER to store the value, and then select the high end of the range in the same manner. When setting the RPM range, use the up and down arrow buttons to increase or decrease values, and the left arrow button to move the cursor to the desired digit. While the RPM RANGE screens are displayed, the number preceded by T= indicates the amount of time in seconds estimated to perform the sweep, given the current RPM settings.

START – This button begins a vibration sweep for the selected RPM Range. This function will perform an automated vibration sweep of a specified RPM (frequency) range, and display the results as a graph on screen. This function can be very useful in diagnosing machine condition induced vibration or discovering environmental problems, which may have adverse effects on the grinding process. The RPM range to be evaluated will vary by machine and process. On constant surface speed machines, the minimum and maximum RPM should be determined. The suggested range to evaluate is from 0.4 x (minimum RPM) up to 2.0 x (maximum RPM). This range is important because it includes all the likely frequencies, which will have harmonic influence on the operating RPM range.

Select the PLOT VIBRATION item from the MENU list. Press the RPM RANGE button to change the currently displayed RPM range as desired. Pressing the START button will initiate a vibration spectrum sweep of the currently selected RPM range. The rotating hour glass figure on the right hand side of the display signifies that the controller is sweeping through the RPM range and recording the maximum value in each monitored RPM range. During this process, all recorded RPM, Vibration level pairs are sent out the serial RS-232 port, in ASCII format.

When the RPM sweep is complete, the display will change to the screen shown (figure 15). The area necessary to display the incremented RPM range is dependent on the RPM range selected, divided by the number of available pixels across the horizontal axis. The vertical scale is based on the peak value, displayed at the top of the plot. The horizontal scale is logarithmic.

- 1) **VIEW DATA.** Pressing this button will change the display to a listing of peak vibration values (figure 20). These are the top 20, or less, values recorded in the selected range. The VIB./RPM button on this screen switches the order of these values, allowing them to be ordered either by vibration level or RPM. The arrow buttons are used to scroll up or down through the peak values. The VIEW PLOT button returns to the screen showing the last recorded graph.
- 2) **SEND DATA.** Pressing this button will export the vibration peak values, and corresponding RPM levels out the serial RS-232 port, in ASCII format. This information can then be captured and used as needed by the user.

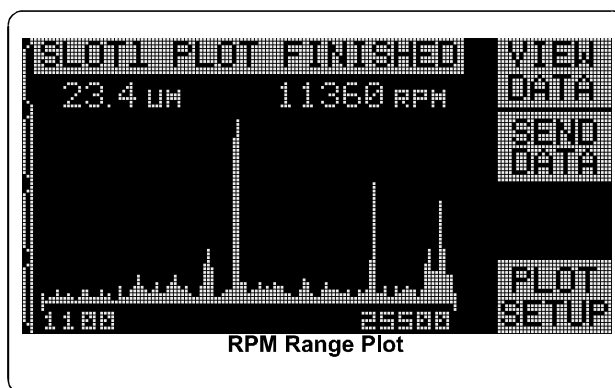


Figure 14

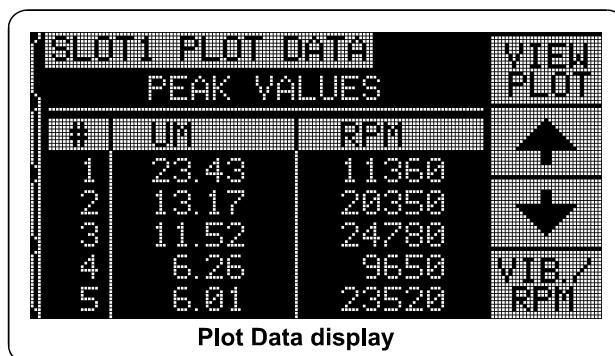


Figure 15

-
- 3) PLOT SETUP. This button returns the user to the setup screen for performing a vibration plot, where alternate RPM settings can be input for plotting, or the plot process can be exited, by pressing the EXIT button.

Hardwire Interface

There are two different options available for interfacing the SBS Manual Balancer Card with a machine controller. Either a hardwire interface or RS-232 software interface is supported. The hardwire interface is supported via a standard DB-25 connector located on the rear panel of the Balancer Card, while the Software interface is supported via the DB-9 connector located on the rear panel of the SBS Control Unit's Main Card, which is common to the whole control 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 an interface for the SBS System, it is important to understand that it is intended that the grinding machine's PLC/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 connecting with the SBS 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 PLC/CNC control. Sections covering the interface of other SBS products installable in the SBS Control, are covered separately in the manuals for such products.

Hardwire Interface Protocol

The hardwire interface consists of three parts: the interface power supply, the inputs, and the outputs.

The interface power supply is provided exclusively for use with the inputs of the hardwire interface. It consists of three common pins and an output pin. The common pins are internally connected to chassis and earth ground, while the output is intended to provide a maximum of 30 mA at approximately +15VDC. Any external power used for interface I/O must be from a SELV source or supply.

The three inputs provide optical isolation between input signals and the rest of the controller circuitry. The inputs are activated by being pulled high, either by connection to the SB-4500/4400 interface power supply output or by connection to a customer supplied signal. Activating the inputs requires at least 8 mA at a voltage between 10 and 26 volts, AC or +DC, referenced to the SB-4500/4400 interface power supply common. The common pins are internally connected to chassis and earth ground. The inputs are deactivated by removing the connection to the power or signal source.

The four primary outputs consist of optically isolated, solid state, single-pole/double-throw relays. These relays may be used to supply an output signal by connection to the SB-4500/4400 interface power supply output or by connection to a voltage source supplied by the customer. The relay contacts are electrically isolated from all other circuits and are rated for 24 Volts DC or AC, 50 mA maximum. Inductive loads must be protected against flyback.

The three contacts of a single-pole/double-throw relay are often referred to as “normally open”, “normally closed” and “common”. The term “common” in this sense does not imply connection to power supply commons. The term “return” will be used below to indicate the common contact of the relay.

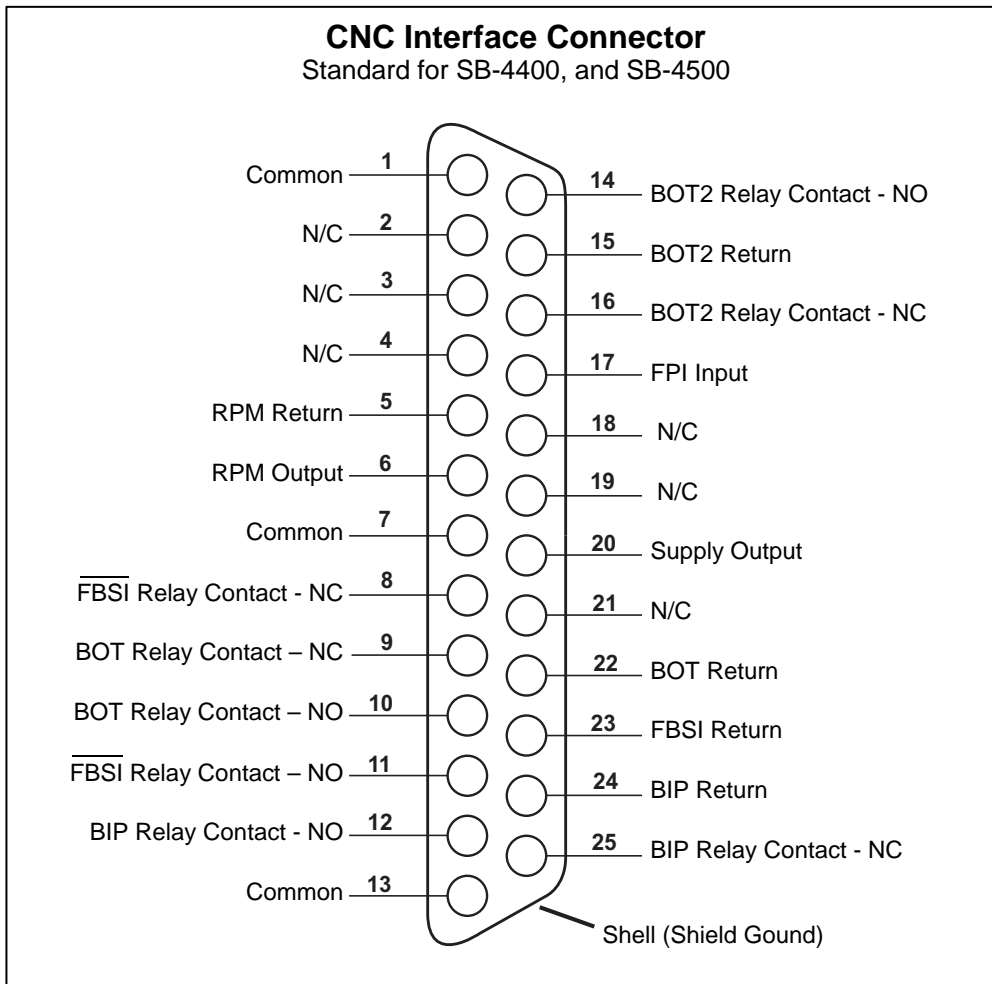


Figure 16

Input Pin Names and Functions

<u>Pin#</u>	<u>Name</u>	<u>Description</u>
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17	FPI	Front Panel Inhibit- While this input is active, most operator actions at the front panel keypad are disallowed. Specifically, the Menu button, the Manual button, and the Auto Button are disabled. Still enabled are the Power button and the Cancel button, which can be used to stop an automatic balance operation.
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Output Pin Names and Functions

<u>Pin#</u>	<u>Name</u>	<u>Description</u>
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22	BOT-R,	Balance Out of Tolerance: Return, Normally Open, and Normally Closed contacts. This relay is energized when the sensed vibration level exceeds the operator defined Tolerance. This relay is de-energized during an automatic balance operation.
10	BOT-NO	
9	BOT-NC	
15	BOT2-R	Balance Out of Tolerance Two: Return, Normally Open, and Normally Closed contacts. This relay is energized when the sensed vibration level exceeds the operator defined Critical Tolerance, or when the spindle RPM exceeds the operator defined Critical RPM. The vibration level sensing operation of this relay is de-energized during an automatic balance operation.
14	BOT2-NO	
16	BOT2-NC	
24	BIPR	Balance In Progress: Return, Normally Open, and Normally Closed contacts. This

12	BIP-NO	relay is energized while a balance operation is in progress.
25	BIP-NC	
23	/FBSI-R	Failed Balance/ System Inoperative: Return, Normally Open, and Normally Closed
11	/FBSI-NO	contacts. This relay is energized after a successful Power On Self Test. It is de-
8	/FBSI-NC	energized if a fault condition arises.
6	RPM	This relay closes once per revolution. This is a buffered output of the RPM signal
5	RPM-R	generated by the balancer.

Software (RS-232) Interface

The SBS Manual Balancer provides an alternate RS-232 interface using the DB-9 connector. The RS-232 interface allows the same control capability as the hardwire interface with the additional capability of monitoring the system status, setting of the 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-4500 and SB-4400 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 additional jumper wires on the control unit end of the cable for successful operation with this three-wire interface. The following pins on the DB-25 connector are used for the RS-232 interface.

<u>Pin #</u>	<u>Pin Name</u>	<u>Description</u>
5	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 at unit power-up, by selecting the SETUP option. The factory setting for baud rate is 9600 baud, which should be adequate for most applications. To change the baud rate, turn the Controller on by pressing the button marked **ON/OFF** in the upper right corner of the membrane keypad, and immediately after the unit is powered up, press the **SETUP** button. When the language setting screen appears press the **ENTER** button again to change to the Baud Rate screen. To select the Baud rate, use the up and down arrow buttons, to select from the displayed list. Once the correct baud rate is highlighted press the **ENTER** button, to choose the new setting. The baud rate can be set from 300 to 19200 baud. Use of the optional Remote Keypad is necessary to change the baud setting for a SB-4400 Control Unit.

RS-232 Commands and Responses

When the Control unit is first powered up, the following messages are transmitted out the RS232 Port. The first two lines are from the System Controller, the first is identifying text and the second is the firmware version. The remaining lines identify the functions plugged into the Slot Card positions and the firmware revision associated with each. The last five messages may be transmitted in any order:

```

/SB-4500, Copyright (c) 1998, Schmitt Industries, Inc.<CR>
V0.02<CR>
2X1.00V0.09[GR1]/Standard Balancer<CR>
1X0/No Card<CR>
3X0/No Card<CR>
4X0/No Card<CR>

```

Commands - A message preceded with the digit '1' through '4' will be a command or response referring to Slot Cards 1 through 4, respectively. A message starting with any other character refers to the System Controller.

The following commands from the RS232 Port are available:

Control Unit Commands		
Command	Response	Meaning/ Example:
C		Control Panel Status Inquiry. <Esc>C<CR>
	CI	Control Panel is Inhibited CI<CR>
	CE	Control Panel is Enabled CE<CR>
	CX	Control Panel is not installed CX<CR>
CE		Control Panel Enable. <Esc>CE<CR>
	K	Command Acknowledged K<CR>
	CX	Control Panel is not installed CX<CR>
CI		Control Panel Inhibit. <Esc>CI<CR>
	K	Command Acknowledged K<CR>
	Q	Command Not Accepted (Panel in use?) Q<CR>
	CX	Control Panel is not installed
V		Version Request (main board firmware). <Esc>V<CR>
	Vn.nn	Firmware Version V1.00<CR>

Balancer Card Commands (Cards are Individually Controlled)		
Command	Response	Meaning/ Example:
X		Type (of slot card) Request. < Esc >1X<CR> Start Slot 1 Info Request.
	Xz.xxVv.vv [sss]/text	Slot info response. z indicates Slot Card type: 5 is Manual Balancer. xx is specific hardware or balancer category. v.vv is balancer firmware revision. sss is the user specified name for this card. The slash delineates a text comment that briefly explains the card type. 1X5.00V0.55[SLOT1]/Manual Balancer<CR>
	X0/No Card	No card is installed in the slot. 1X0/No Card<CR>
	XX/Not Responding	A card is installed in the slot, but is not responding to the system. 1XX/Not Responding<CR>
G[sss][,][eee]		Graph Vibration Spectrum. This takes vibration readings as a function of the rpm of the vibration. Optionally specify sss as starting rpm and eee as ending rpm. <Esc>1G500,2000<CR> Start Slot 1 Vibration Spectrum Program. Scan from 500 to 2000 RPM.
	U=units	Spectrum program started (units given) 1U=UM<CR>
	Grrr,vv.vvv	Graphic Vibration Point. One line is generated for each RPM measured. rrr is the current rpm. vv.vvv is the measured vibration at the specified RPM. 1G500,0.04<CR> 1G550,0.05<CR>
	GE	Graphic Spectrum End. The graphics vibration spectrum routine is finished. 1GE<CR>
GX		Cancel Vibration Spectrum. <Esc>1GX<CR> Stop Slot 1 Vibration Spectrum Program.
	GE	Graphic Spectrum End
L[x.xx[,][y.yy][,][z.zz]]]		Limits Command. x.xx is Limit, y.yy is Tolerance, z.zz is Critical Vibration level, all in microns. If x.xx is not present then the Limit level will not be changed. If y.yy is not present then the Tolerance level will not be changed. If z.zz is not present then the Critical Vibration level will not be changed. <Esc>1L<CR> Get Slot 1 Balance Limits.
	Lx.xx,y.yy, z.zz	Balance limit response (new values). x.xx is Limit, y.yy is Tolerance, z.zz is Critical Vibration level, all in microns. 1L0.40,1.20,20.00<CR> <Esc>1L0.08,,15<CR> Set Slot 1 Limit to .08, Critical level to 15.00, don't change Tolerance. 1L0.08,1.20,15.00<CR>
S[C]		Status Request command. If 'C' present then previously reported errors condition will be cleared before the status is reported. <Esc>1S<CR> Report Slot 1 Status.
	S rrr,v.vv, [FBSI,] [BIP,][FPI,] ERR=eee	Status response. rrr is RPM, v.vv is vibration level in microns, FBSI indicates balance failed/system inoperative, BIP indicates balance in progress, FPI indicates front panel is inhibited. eee represent individual error letters representing error conditions. If the first letter is '@' then an error condition requires clearing (use SC command or press clear on front panel). 1S 1590,0.23,ERR=@GI<CR> <Esc>1SC<CR> Report Slot 1 Status. 1S 1590,0.24,ERR=G<CR>

RS-232 Operation Summary

The RS-232 capability of the SBS Manual Balancer, 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.

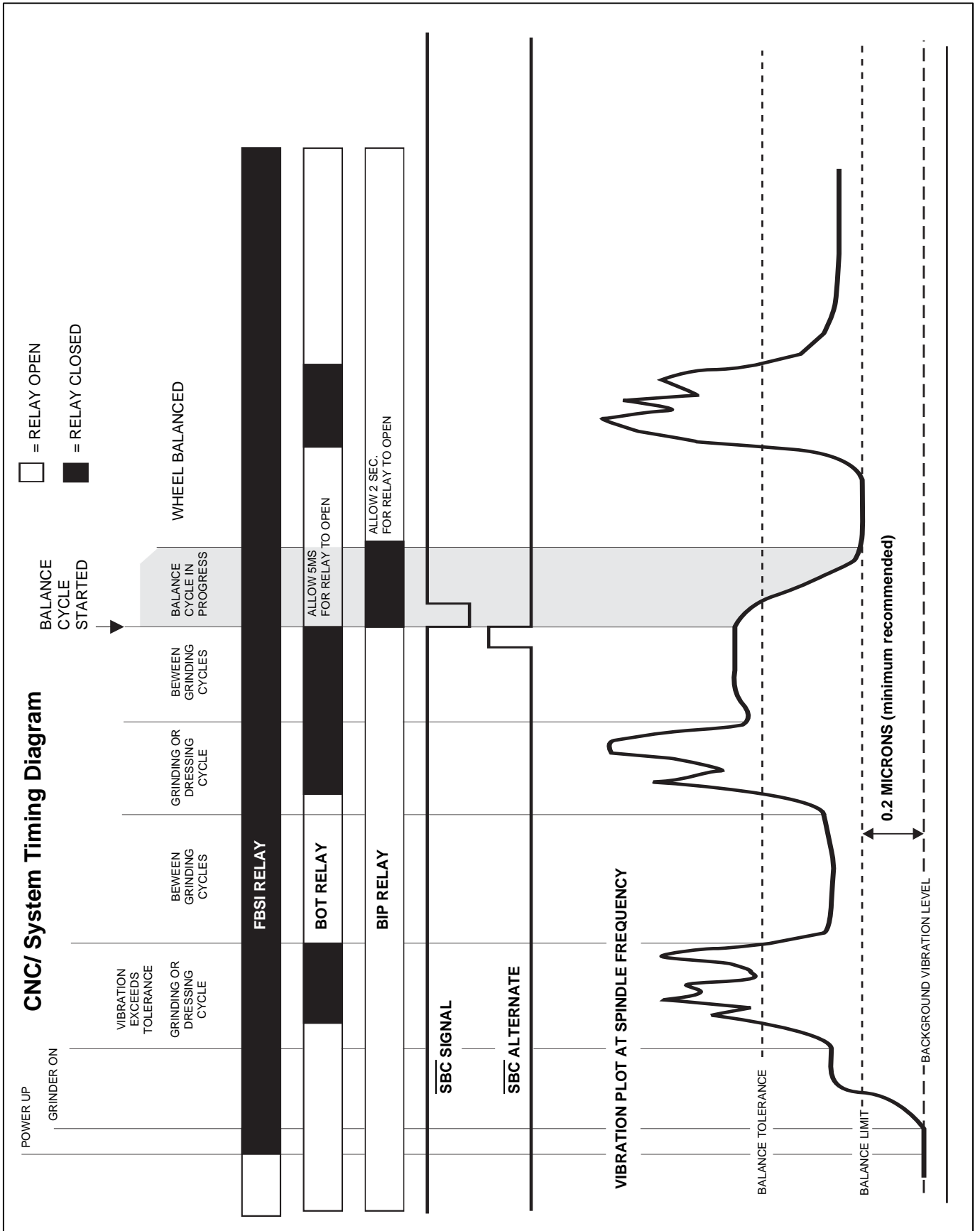


Figure 17

System Maintenance

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.

Sensor Cable Schematic

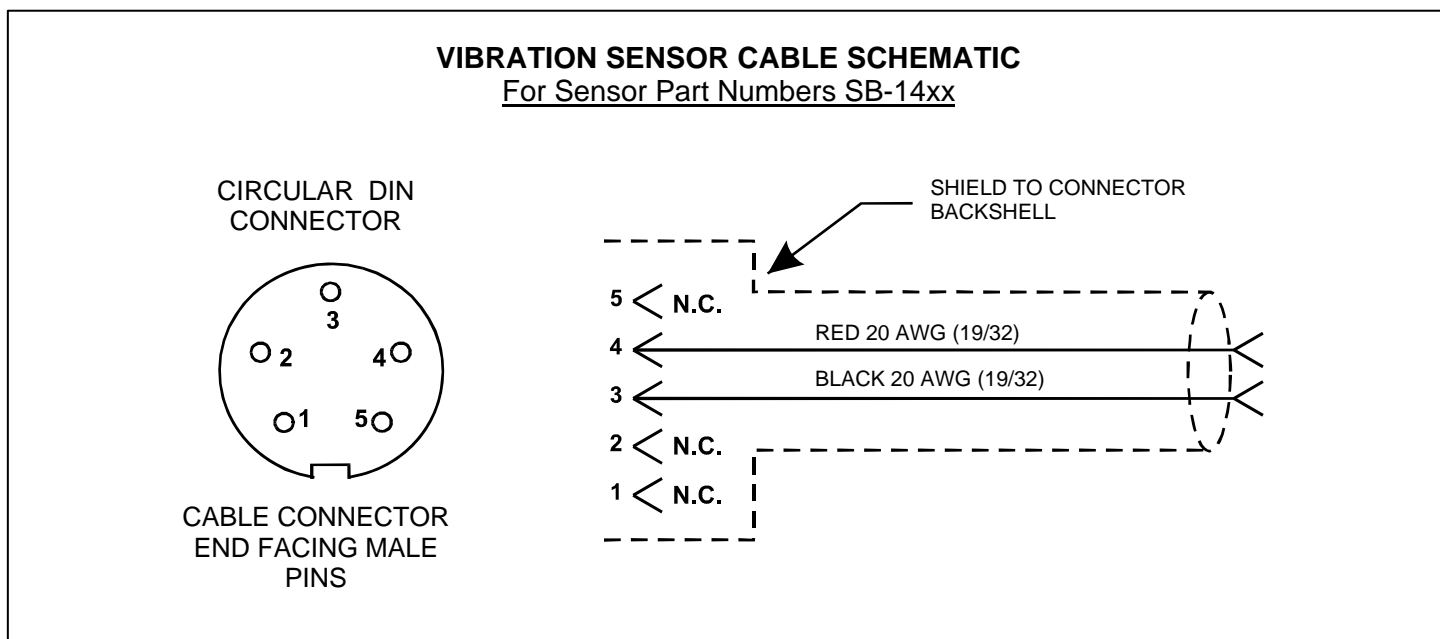


Figure 18

Trouble Shooting Guide

If you experience trouble with the operation of the SBS Manual Balancer, 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, refer to the Displayed Error Messages section of this manual for explanation of the message(s) displayed. Contact Schmitt Industries for assistance as required.

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: Vibration Sensor Location section*).

Also verify that there is an incoming vibration signal. If you receive an RPM signal, but zero reading from the vibration 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 If the above checks 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 section*)

If you continue to have problems after following these steps, contact Schmitt Industries, or your SBS Manual Balancer source for assistance.

Display Test Option

During control power-up, while the company logo screen is displayed, a functional test of the display can be initiated by pressing one of the function buttons above the SETUP button followed by the SETUP button. The screen will display a DISPLAY TEST message, and list buttons for TEST, START, and SETUP. Pressing TEST will reverse the light and dark text areas. Pressing TEST again will display a full screen with all pixels lit. Pressing again will turn all screen pixels off. Pressing again returns the screen to Display test. Also displayed are the revision reference numbers for the system main board and display board. The LED status indicators on the left side of the display will sequence through the three colors to check operation. Press the START button to bypass SETUP and resume normal operation. Press the SETUP button to continue to system setup.

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. To further isolate defective components a series of test operations accompany some of the error codes.

A— Checked continuously.....

message: **RPM OUT OF RANGE**
OPERATION RANGE IS
300-30000
CHECK RPM SENSOR

Clears automatically.

definition: Displayed if the RPM signal coming from the RPM Sensor is below 300 RPM or exceeds 30,000 RPM and the RPM number cannot be displayed.

action: Verify operating speed of the grinding machine. Verify that the RPM sensor is properly aligned to detect a **once per revolution** feature on the machine. If the machine is actually running above 30,000 RPM, contact your SBS Manual Balancer source for application consultation. If the machine is running within the operating speed limits with a properly aligned RPM Sensor, and this error message persists, this indicates a failure of the RPM sensor. The RPM Sensor should be returned for service.

B— Checked Continuously.....

message: **VIB SENSOR DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS -
SEE MANUAL

Clears automatically.

definition: Vibration Sensor presence not detected. 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.

C— Checked Continuously.....

message: **VIB SENSOR DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS –
SEE MANUAL

Clears automatically.

definition: Vibration sensor short circuit detected.

action: Disconnect the balancer from AC power before checking cables and connectors, and sensor for shorts. If the problem can not be isolated, the sensor, cable, and/or Control Unit should be returned for repair.

G— Checked continuously

message: **AUX POWER DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS -
SEE MANUAL

Clears automatically.

definition: 24V Auxiliary Supply low – fuse open.

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: Check for shorts in cables and connectors and re-initiate system check. If the error persists return Control Unit and cables for repair.

H— Checked Continuously

message: **RPM/CNC POWER DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS -
SEE MANUAL

Clears automatically.

Cleared by pressing Auto button.

definition: 15V Auxiliary supply low – fuse open.

action: Check for connector contamination or other shorts in the RPM Sensor and any extension cables and re-initiate system. If the error persists, return the Control Unit and RPM Sensor cables for repair. If you have the SBS system cabled to your PLC/CNC controller, verify that the interface cable is free of electrical shorts. The interface cable is not supplied with the SBS system, and repair is the responsibility of the user.

J— Checked Continuously during Balance Cycle.....

message: **NO RPM SIGNAL**
CHECK CABLES
CHECK SPINDLE

Cleared automatically.

Cleared by pressing Auto button.

definition: No incoming RPM signal, possible open in RPM sensor circuit.

action: Ensure that spindle is running, with balancer cable attached at both balancer and control ends. Determine which is the defective component by swapping with another system. Return defective component for repairs. If in doubt, return all items.

L— Checked when Auto Balance Cycle Completed

message: **CIRCUIT FAILURE**
UNABLE TO MEASURE
VIBRATION
SEE MANUAL

definition: Signal acquisition circuit failed.

action: Clears automatically, no action required other than clearing manually from the Balancing screen. If the problem persists, the Control Unit should be returned for repair.

Appendix A: Electronic Specifications

Control Unit

Installation: Pollution degree 2, Installation category II

RPM Reporting: 300 to 30,000 RPM

Vibration Range: 120 μ G to 25 G

Vibration Display Resolution:

One of three options are selectable by the user over the operational range	0.1 μ m	0.01 mil	0.01 mm/s	1 mil/s
	0.01 μ m	0.001 mil	0.001 mm/s	0.1 mil/s
	0.001 μ m	0.001 mil	0.001 mm/s	0.01 mil/s

Vibration Display Repeatability:

6,000 RPM

$\pm 1\%$ @ 5.0 μ m

300 – 30,000 RPM

$\pm 2\%$ @ 50:1 signal to noise

Vibration Display Accuracy:

6000 RPM

$\pm 2\%$ @ 5.0 μ m

300 – 30,000 RPM

$\pm 4\%$ @ 50:1 signal to noise

Vibration Filter

3% width

60 dB per decade drop-off

modified Butterworth (SBS proprietary)

Balance accuracy

+/- 0.1 microns displacement.

Power Requirements:

Supply: 120-220V ac, 50-60 Hz, 2A

Mains supply voltage fluctuations not to exceed +/- 10% of nominal supply voltage.

Environmental Conditions:

Intended for indoor use only.

Temperature: 5°C to +45°C

Humidity: 0 to 95% relative humidity (non-condensing) throughout temperature range.

Altitude: \leq 2000 m

Cleaning Instructions:

Wipe unit off with clean cloth. May use mild detergent or water. Do not spray or immerse unit.

Vibration Sensor

Sensitivity Range + /- 25g

Sensitivity Resolution 0.0001g

Voltage Sensitivity 100 mv/g

Excitation Current 2 to 8 ma

Frequency Response 0.5 to 5000 Hz

Operating Temperature 0 to +70 C

Appendix B: Replacement Parts List

<u>Part#</u>	<u>Description</u>
<u>Controls/ Options</u>	
SB-24xx-L	Hardwire Interface cable (standard lengths)
SB-4475-M	Control Unit w/ front panel (Expandable to 2 Channels)
SB-4400-M	Control Unit w/o front panel (Expandable to 2 Channels)
SB-4450	Remote Keypad (option for SB-4400)
SB-43xx ¹	Remote Keypad connection cable (option for SB-4400)
SB-4543	Additional Manual Balance Channel Card
SB-4512	Additional Mechanical Auto-Balancer Channel Card
SB-4518	Additional Hydrokompenser (water balancer) Channel Card
SB-4522	Additional AEMS Gap/Crash Monitoring System Card
<u>Vibration Sensors ¹</u>	
SB-14xx	Sensor Cable (standard lengths)
SB-16xx	Sensor Ext. Cable (standard lengths)
<u>Control Mounting Hardware Options</u>	
SB-0451	Rack Mount Panel: SB-4500 – 19”
SB-0441	Rack Mount Panel: SB-4400 ½ Rack DIN 3U
MC-0400	Control Mount Bracket: SB-4500
SB-0442	Control Mount Bracket: SB-4400
<u>Other Parts</u>	
EC-5605	Control Unit Fuse, 3 amp slow-blo 5x20 (2 required)
CA-0009	Power Cordset
CA-0009-G	Power Cordset (Germany)
CA-0009-B	Power Cordset (British)

1) xx = cable length in feet - standard options 11, 20, or 40 at standard price

Appendix C: Balancer Card Installation

Note: All Service (including card installation) should be performed by a qualified technician, or the unit returned to Schmitt Industries Inc. for service.
(Unit is shown upside down with the cover removed.)

Tools Required:

1. 1/16" Allen Wrench
2. Grounding Wrist Strap

Procedure:

1. Unplug Unit, Invert, And Lay On A Non-Marring Surface.
2. Remove Back Cover Screws (1).
3. Loosen Front Cover Screws (2) A Few Turns.
4. Remove Bottom Cover (3) and Attach Grounding Wrist Strap (4) To Rear Lip Of Panel
5. Remove Slot Cover Screws (5) And Slot Cover (6).
6. Plug Balancer Card (7) Into Back Plane Board (8).
7. Install Slot Cover Screws (5) Into Balancer Card (7).
8. Remove Grounding Wrist Strap (4)
9. Install Cover (3) And Tighten Cover Screws (1 & 2).

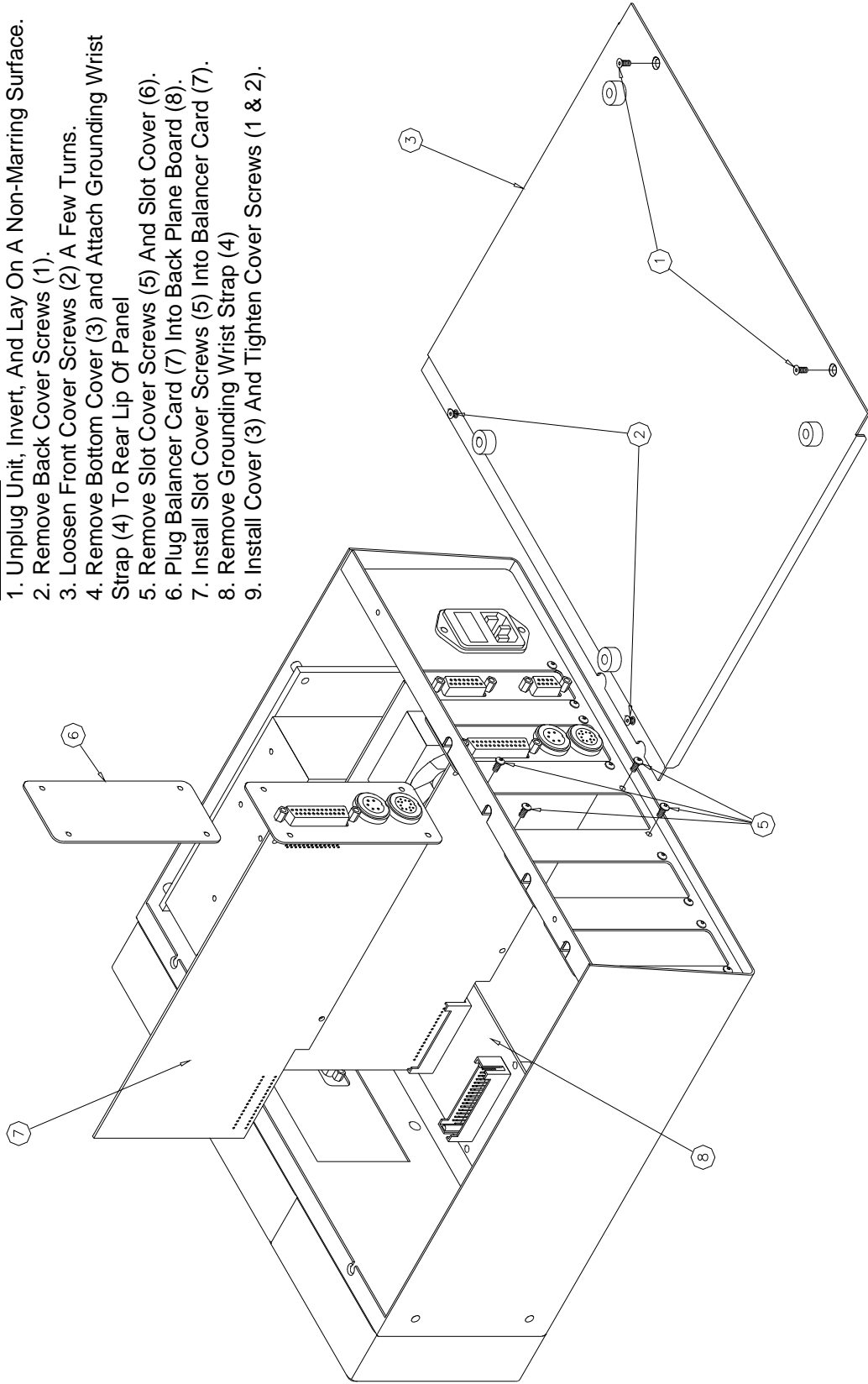
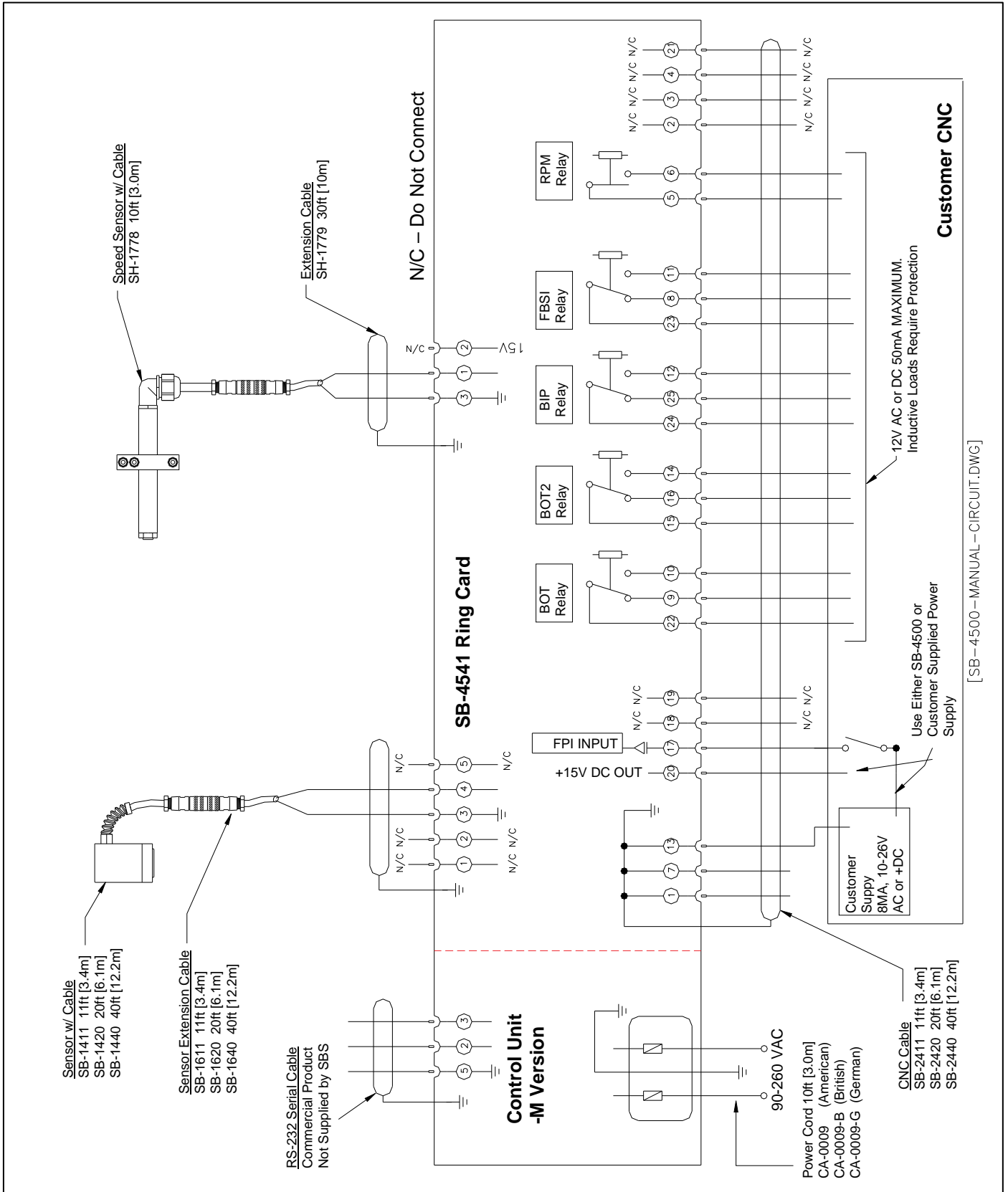


Figure 19

Appendix D: System Connection Diagram



[SB-4500-MANUAL-CIRCUIT.DWG]

Figure 20