

AE-1000 AE Monitor Operation Manual

LL-1000, Rev. 1.3

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Operation and Specification Manual

for the

AE-1000 AE Monitor

LL- 1000

Manual Revision # 1.3

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Benefits of SBS AE-1000 AE Monitor:

- Gap Elimination - Increases throughput by reducing unproductive grind infeed.
- Crash Protection - Quick detection of extreme wheel contact to allow feed shutdown and prevent dangerous wheel crashes.
- Enhanced digital electronic design with increased operating life and reliability
- Easy to install and operate
- Icon based User interface for international adaptability
- Backed by world-class SBS customer service

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System Purpose

The SBS AEMS System has been developed to provide process control enhancement to grinding machine operators. “Gap” elimination, Crash Monitoring, and Monitoring of wheel contact in the Grinding and Dressing processes are all provided, with the following objectives in mind:

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

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.
- Warning:** Failure to securely attach AE Sensors and other components to the grinding machine will result in safety hazard during machine operation.
- 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).
- Caution:** Only qualified service technicians should attempt to service the AE-1000. To avoid electric shock do not remove the cover of the product.

Firmware Version and Update

This manual covers operation of firmware version 1.09 and later. The unit’s firmware version is viewable from the power on display screen, described following. It is indicated as “REV x.xx”.

This AE-1000 firmware can be updated if needed by following the AE-1000 firmware update instructions listed on the SBS website at www.sbs.schmitt-ind.com/support/software-firmware/.

System Overview

The AEMS system consists of an electronic control and either one or two acoustic emission (AE) sensors. The AE sensors are mounted on the grinding machine and located to detect high frequency acoustic emissions generated in the machine structure resulting from wheel contact during the grinding or dressing process. By monitoring the level of these signals referenced against known background levels at the same frequency, key events can be automatically and quickly detected on the grinding machine as they occur. These events include: Initial contact of the grinding wheel to the dresser or work-piece (gap control), abnormal or severe wheel contact (crash protection), or assurance of either a maximum or minimum degree of wheel contact throughout the dress or grind cycle (process monitoring). These events are reported by the AE-1000 via both the hardwire and software interfaces, and the unit's display. Machine CNC controls can be programmed to use this information to eliminate Gap dwell time, protect against damage resulting from part crash, and monitor the quality of the grinding and dressing process.

System Installation

System Connections

The Back panel of the AE-1000 is shown below. There are two 4-pin circular connectors on the rear panel for connecting the acoustic sensor(s). The first sensor position (S1) can be used to monitor both M2 and M1, while the second optional sensor connector (S2) can only be used to monitor M2. In cases where one sensor is to be used, connect to S1.



Acoustic Sensor Location

Choose an appropriate sensor location on the grinder for testing. The Sensor must be mounted to the machine casting or some other rigid machine structure. Do not mount acoustic sensors on thin or loosely attached machine components such as wheel guards. The mounting spot should be reasonable flat, and must be free of foreign matter such as swarf. Paint removal is advisable but not required.

The critical issue to be considered in placing the sensor is acoustic transmission quality. The sensor should be location on a rigid part of the grinder so that the high frequency noise resulting from contact between the wheel and work part, or between the wheel and dresser unit, will travel to the sensor with minimal loss of signal. Signal loss will occur both with distance traveled through the machine structure, and especially with each part to part mating junction in the machine. What is desired is a short path of travel for the acoustic

signal, through as few parts of the machine as possible, with all parts of this travel path being rigid, solid, and closely coupled and firmly mated portions of the machine structure.

For Bolt on sensor, it is advisable to use an instant adhesive (Loctite 401 or equiv.) to try some different mounting locations, until the best location is found.

It may be possible to mount one AEMS sensor on the spindle housing, near where the balancer sensor would be located, and use this location for monitoring both Dressing and Grinding. If this does not work on a particular machine structure, the alternative is to mount one sensor on the dresser structure for dressing monitoring, and another sensor on the tailstock, or other rigid portion of the part holding structure of the machine, for grinding monitoring. Two sensors can be used simultaneously by the AEMS system.

AE Sensor Types

A variety of Sensor configurations are available to fit you installation requirements. The Main types of sensors are pictured below. Each sensor type is available in various models and the user should consult the SBS Product catalog for details on all available models.



Bolt-On Sensor – The sensor is attached by use of a screw directly to the machine structure, near the contact point between the grinding wheel and the work piece or the wheel dresser.

Non-Contact Sensor – The sensor comes in two parts to allow mounting directly to the rotating wheel or dresser spindle. A rotating part is mounted to the spindle to pick up the AE signal from wheel contact. A non-rotating part is mounted directly opposite the rotating part, where the AE signal is detected and transferred to the AE monitor.



Fluid sensor – The sensor allows detection of AE signal direct from the work piece or the wheel. A fluid stream (usually the filtered machine coolant) is directed to flow onto the target area. The AE signal transmitted up the fluid stream is detected by the sensor.

Balancer mounted Sensor – The sensor is integrated into Non-Contact mechanical external or internal SBS balancers.










Explanation of M1 and M2

Two separate monitoring parameter sets (M1 and M2) are provided for monitoring the results of distinct processes on the grinder. A process is distinct if any of the contributing factors change that would influence the AE signal intensity or timing generated from wheel contact. This would include a change in any of the following: AE sensor location, grinding wheel size or type, dressing unit, work piece, feed rates, wheel RPM, and coolant type. Setup parameters are stored separately for each parameter set and a single output Trigger Level can be set independently for M1 and M2. M1 will be associated with the S1 (sensor #1), and M2 will be associated with S2 (sensor #2) if connected, or with S1 if only one sensor is installed.





Quick Setup Guide

You can press   and run the Learn Cycle to set Frequency, Gain, and Sensitivity, or you can manually set these using the following instructions.




Set Frequency

- Press  . Use the arrow keys to turn the Gain up to maximum of 77 (this is the factory default).
- Press   (this will save any change to the Gain setting) to enter the Frequency screen. A display of the four selectable frequency bands is shown. Run grind or dress cycles until wheel contact produces a response on the AE signal bars for each frequency. All four bands are likely to saturate the display when contact is first made. This is okay, indicating that the gain should be reduced.
- Press   to return to the Gain setup screen. Adjust the gain down and press  again.
- Run another grind or dress cycle at the new Gain. Repeat the process of reducing gain and running cycles until the most responsive frequency is identified. Change the  to that frequency (1-4). Press .

Set Gain and Crash Sensitivity

- Stay on the  Gain screen. This display shows a full scale (1-100%) AE signal bar graph with the Crash indicator always at 97% of full scale relative to the current Gain setting.
- Keep running cycles with the desired infeed amount and adjust the  Gain setting down or up until you determine the proper gain level. This should be high enough that you see a change in the graph when normal wheel contact is made, but low enough that a normal cycle will not accidentally exceed the Crash limit. The Crash output signal level is also set during this process.
- Press  to save any changed gain settings, then  Cancel to exit to the main screen.

Set Gap Trigger Point

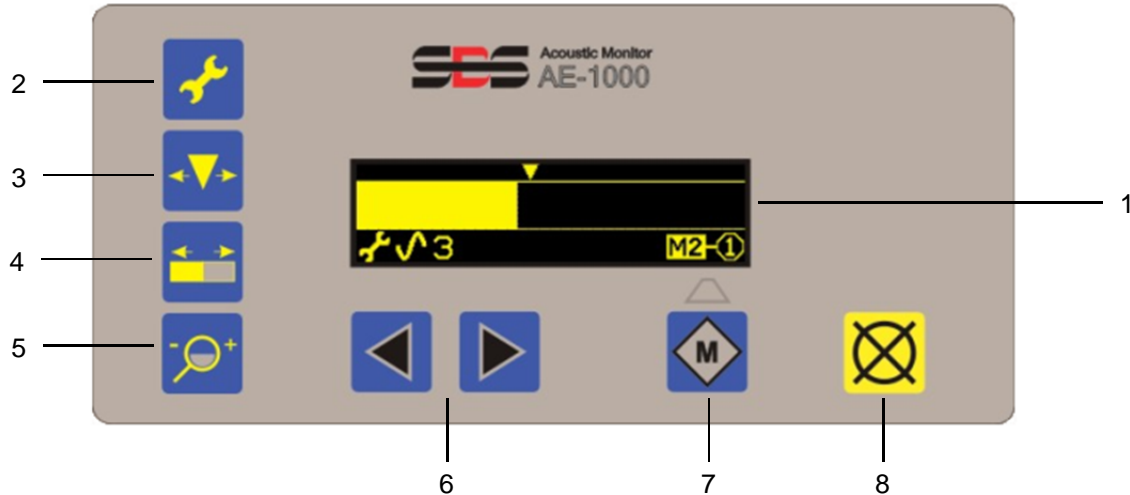
- Manipulate the  Zoom and  Shift settings while running grind cycles to place the sensor's "activity zone" into the screen at an acceptable scale.
- Move the  Trigger Point icon into the screen area by pressing the button, so that the Trigger output will be actuated by the appropriate level of signal level.

Once you've performed this setup, the AE-1000 should operate successfully as a gap/crash monitor.

Control Unit Operating Instructions

Front Panel

Below is the description of the front panel of the AE-1000.



- (1) Display – Indication of the AE signal display bar and other status information.
- (2) Setup button accesses the setup menu, and will also allow selection of menu items, as well as save changes to setup settings.
- (3) Trigger Point button allows adjustment of the output trigger point.
- (4) Shift button allows movement of the viewable portion of AE signal display bar left or right.
- (5) Zoom button allows expanding or reducing the viewable portion of AE signal display bar.
- (6) or Arrow buttons are used to effect changes in settings.
- (7) **M** button is used to toggle the displayed parameter set between M1 and M2.
- (8) Cancel button is used to return the display to the last saved state.

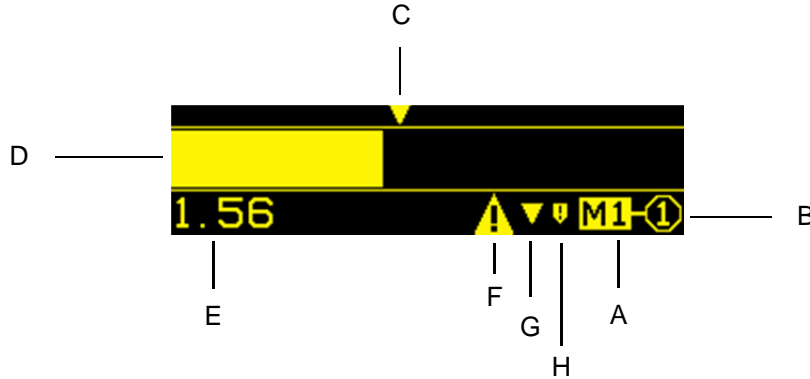
Power on Display Screen



Power on display shown after power is applied for about 2 seconds.


Pressing extends the duration of this display until button is released.

Main Display Screen



- A. The current parameter set (M1 or M2) is displayed.
- B. The current Sensor association (S1 or S2) is shown for the current parameter set.
- C. The Trigger Point is shown above the signal bar.
- D. The AE Signal display bar indicates the AE signal in real time. The Signal bar will display the peak value between screen updates.
- E. The AE signal value is displayed at the bottom left corner with values from 0.001 to 999.9. This same area will display setup status information when in any setup screen (🔧, ⬅️, ➡️, 🔍+, 🔋).

 - a. Setup Screens are detailed in a following section of the manual.

- F. The error symbol is displayed if an error is present, but was hidden with a press of  Cancel.
- G. The Trigger point symbol is displayed when the corresponding solid state relay has recently been closed.
- H. The Crash symbol is displayed when the corresponding solid state relay has recently been closed.




Sensor Association

M1 is always associated with sensor 1 (S1). M2 can be associated with either sensor (S1 or S2). The default association is to sensor S1.

M2 can be associated with sensor S2 by the following method:



- 1) Install a sensor in connector S2.
- 2) From the main screen, press **M** until M2 is selected (**M** must be pressed at least once after the sensor is installed in S2).

M2 can be re-associated with sensor S1 by the following method:

- 1) Enter M2 with S2 disconnected or disconnect S2 while in M2
- 2) Press Cancel as needed to clear all errors.
- 3) Press  Wrench
- 4) Press **M**
- 5) Press  Wrench or another setup button to save the change.
- 6) Press  Cancel to exit setup.

FPI (Front Panel Inhibit)




- Either the hardwire interface or the software interface can inhibit the panel buttons.
- FPI asserted from the USB is not remembered through a power fail or a USB disconnect.
- Whenever power turns on the unit is not in FPI unless the FPI CNC input is active.
- The assertion of FPI cancels any pending setup operation.
- When FPI is on, each press of a button will produce the FPI  indication for 1.5 sec.
- The  button is not affected by FPI.


Setup Options


When the unit is in any setup screen, the hardwire interface output solid state relays will be inactive. Entering any setup screen will clear the Crash solid state relay latch. Setup options other than Gain and Frequency will time out after 2 minutes of inactivity, and the unit will return to the main screen and resume normal operation discarding any unsaved setup changes. Gain and Frequency setup options will time-out after 4 minutes of inactivity to allow extra time for expected machine operations.

1) The most commonly used setup options each have a separate button assigned:






 Trigger Point





 Display Shift

 Display Zoom

2) There are additional setup options under the  Setup menu.



-  Learn Cycle – Will launch a Learn Cycle, prompting the user through a process to record AE signal levels in various conditions, in order to make a best estimate automatic setting of:
AE Gain, Frequency Band, Trigger Point, Display Shift, and Display Zoom settings.
-  AE Gain
-  Frequency Band
-  CNC Output Time
-  Crash Output Latch

Press  to open the Setup menu. In the Setup menu use the arrow keys to highlight a menu item, and press  to select the highlighted item. Press  in any of the settings submenus to save any changes and return to the Setup menu. Press  to exit the Setup menu.

Settings Changes

- 1) Arrow buttons are used to change settings for the currently selected setup.
- 2) With each press of an arrow button, the corresponding ◀ or ▶ symbol will flash briefly at bottom center of the screen. These symbols are not otherwise displayed.
- 3) Holding the arrow button will result in an accelerating repetition of the button press.

Settings Save

- 1) The setup icon (bottom left corner of the screen) blinks whenever setup data has been edited, and is different from the last saved value.
- 2) Data is saved by pressing any of the four setup buttons (🔧, ◀▶, 📏, or 🔍+).
- 3) After saving data, the press of a setup button will display the setup screen according to the setup section above, except:
 - a) If in ◀▶ Trigger Point setup, pressing ◀▶ will also exit setup and display the main screen.
 - b) If in 📏 Shift setup, pressing 📏 will also exit setup and display the main screen.
 - c) If in 🔍+ Zoom setup, pressing 🔍+ will also exit setup and display the main screen.

Cancel Save

Press ☒ Cancel to revert to the previously saved data.

If there is no unsaved data, ☒ Cancel will exit setup and return to the Main screen.

Setup Screens

When in any setup screen, the corresponding button icon is shown at the bottom left of the display. When in a 🔧 setup option, a second icon is also displayed to indicate which setup option is currently selected.



Pressing an arrow button changes the Gain by approximately 10%. The Gain settings range from 0 to 77.

The AE signal bar is always displayed full scale (with no zoom) on this screen. The end-of-scale indicators are always displayed at each end of the output range in this view.

This setting adjusts the amount of signal level that generates a full scale output. This setting also determines the headroom between work signal levels and the Crash level (which is always set at ~97% of full scale).



Arrow buttons are used to select the frequency band of choice. All four frequency bands are displayed at once. This screen is displayed without zoom (like gain).

The selected Frequency band is displayed as a number (1, 2, 3, or 4) corresponding to center frequencies 110, 220, 330, or 440 kHz.



CNC Signal Time   250  


The arrows buttons are used to change the CNC output time, displayed in increments of 5 milliseconds (range 10-250). This sets the minimum hold time that the solid state relays are held opened or closed to indicate an event. Important – The purpose is to make an event's signal last long enough to assure signal detection by the machine control used. The factory default settings are 1 msec, but PLCs or similar devices typically will monitor at timed intervals of about 5 msec. In such cases the signal time must be set to exceed the polling cycle time. This setting will affect the GAP, LIM1, LIM2, and (if not latched) CRASH outputs on the hardware interface.



CNC Crash Latch      




The arrows buttons are used to toggle the Crash output status between latched and unlatched. This option sets how the CRASH output will react to crash conditions.

OFF CRASH solid state relay is not latched, subject to ON/OFF times like GAP, LIM1, and LIM2.

ON Crash condition closes the CRASH N.O. solid state relay until it is reset by any of the following: (1) The hardware interface RESET CNC input (2) The software interface “error clear” command (3) Pressing the  button when the Crash error screen is displayed.





Trigger Point   72.5   M2-1 

The arrow buttons are used to move the Trigger Point relative to the AE signal bar. The trigger point symbol  is at the top edge of the screen and flashes with each arrow button push as it also moves. The corresponding AE signal trigger value is displayed next to the   symbol. This sets the corresponding level at which the CNC hardware TRIGGER output activates.



Shift Display   34.6   M2-1 



The arrow buttons are used to shift the AE signal bar and Trigger Point left or right by 10 pixel (4% of scale) increments. This setting only affects the display and has no effect on the Trigger Point setting.

The shift value is displayed next to the   symbol. The shift value is the signal level which corresponds to the left edge of the screen.






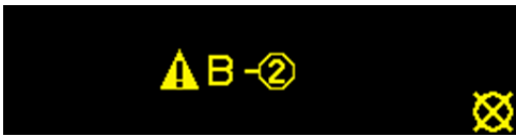






Zoom Display   29   M2-1 

The arrow buttons are used to either expand or contract the AE signal bar by approximately 10% increments. Zoom normally expands or contracts the display about the left edge of the screen. When the zoom expansion includes the maximum scale value, the display will expand and contract about the right edge of the screen.



The zoom value is displayed next to the   symbol. The zoom value represents the expansion above the current gain level (maximum zoom plus gain is 77). The minimum zoom value (0) shows the full scale.

Error Indications

The  screen icon is displayed when the error can be hidden manually by pressing the  button. The Error screen icon blinks for emphasis on these error screens.

Error Code	Message	Description
A		Checked continuously. Clears automatically. Sensor presence not detected, sensor open (sensor number shown).
B		Checked continuously. Clears automatically. Acoustic Sensor short circuit detected (sensor number shown).
C		Checked continuously. Clears automatically. Power Supply Defect. 15V Auxiliary supply low – fuse open.
D		Checked continuously. Clears automatically. Circuit Failure. Signal acquisition circuit failed.
E		Checked at power-up. FPGA NOT PROGRAMMED Factory repair necessary.
F		Checked at power-up. FPGA PLL NOT LOCKED Factory repair necessary.
G		Checked at power-up. FPGA NEWER THAN FIRMWARE Factory repair necessary.
H		Checked at power-up. CHECKSUM ERROR Firmware update required.

Factory defaults

Holding the  button down during power-up resets all configurations back to factory defaults. To confirm the default action, the display will show the  screen icon until the button is released. This action is not allowed if the FPI input is active on the CNC hardwire interface.

Factory default settings are as follows:

Frequency (1), Gain (77), Crash Latch (off), CNC time (10), M2 association (S1), Zoom (0), Display shift (0.000), Trigger point to (0.270)

Hardwire Interface

Interfacing the SBS Balance System with a CNC or PLC machine controller is supported via a hardwire interface or software interface. The hardwire interface is provided via a standard DB-25 connector located on the rear panel of the AE-1000, while the Software interface is supported via the USB connection. 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 the grinding machine's controller must operate the AE-1000. It is not possible for the AE-1000 to control the grinding machine.

Carefully read this entire manual before attempting to interface the AE-1000 with any machine controller.

Hardwire Control Interface

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

The interface power supply is provided exclusively for use with the hardwire interface inputs. It consists of three common pins and one output pin. The common pins are internally connected to chassis and earth ground. The output provides a maximum of 30 mA at approximately +15VDC. Any external power used for interface I/O must be from a SELV (Safety Extra Low Voltage) source or supply.

The three inputs provide noise immunity and robustness. The inputs are activated by being pulled high, either by connection to the AE-1000 hardwire 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 AE-1000 hardwire interface power supply common. The inputs are deactivated by removing the connection to the power or signal source.

The four outputs consist of optically isolated, single-pole/double-throw solid state relays. These solid state relays may be used to supply an output signal by connection to a voltage source supplied by the customer. The 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 to 50VDC.

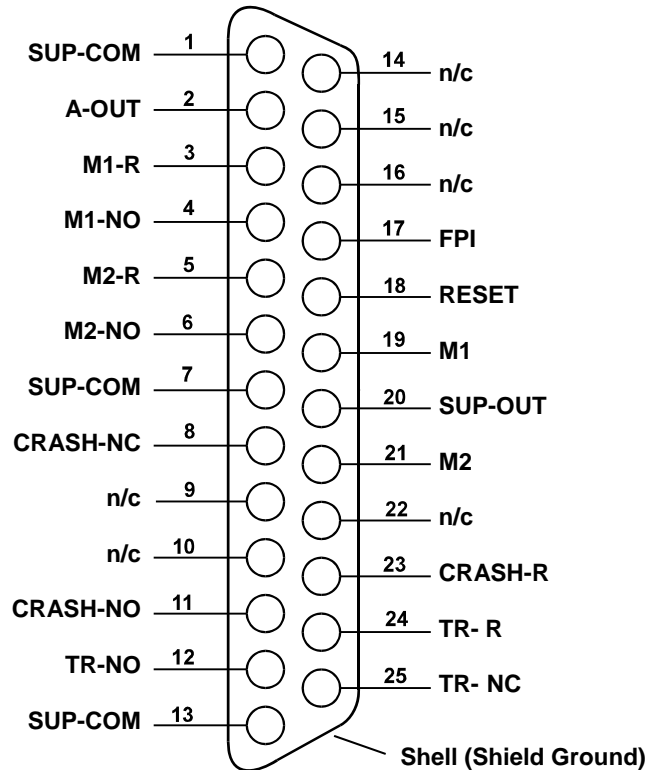
The three contacts of a single-pole/double-throw solid state relay are referred to as “normally open”, “normally closed” and “common”. The term “common” in this sense does not imply connection to power supply commons. The term “return” is used below to indicate the common contact of the relay.

Input Pin Names and Functions

Pin#	Name	Description
17	FPI	Front Panel Inhibit- While this input is held active, most operator actions at the front panel keypad are disallowed. Specifically, the CANCEL button may still be used to show the error conditions. The FPI will cancel any SETUP

Hardwire Interface Connector

Rear Panel of AE-1000



		operation in process.
18	RESET	Crash Reset. The crash status latch will be reset following the rising edge of a voltage applied to this input. A crash that occurs while voltage is applied will not be reset. The voltage must be removed and reapplied. This input is ignored if the CNC Crash latch is set to OFF.
19	M1	Activate this Input to select the M1 parameters to be used for the display and for output operation. Selection will be made following the rising edge of a voltage being applied to this input.
21	M2	Activate this Input to select the M2 parameters to be used for the display and for output operation. Selection will be made following the rising edge of a voltage being applied to this input.

Output Pin Names and Functions

Pin#	Name	Description
2	A-OUT	Analog signal output (0-10V, 2mA max.) referenced to SUP-COM (pin #1). See following section for further details.
4	M1-NO	Closed to indicate the M1 parameters are in use. note: If both Pins 4 and 6 are closed at the same time, this indicates an error code condition on the control. Both pins open at the same time indicate the control is either OFF, or in a SETUP mode.
3	M1-R	Common return connection for the M1 output
6	M2-NO	Closed to indicate the M2 parameters are in use. (see note under pin #4).
5	M2-R	Common return connection for the M2 output.
11	CRASH-NO	Closed to indicate a crash condition. Latches if the CNC crash latch is on.
8	CRASH-NC	Closed whenever CRASH-NO is open (no error condition detected). It is also closed when power is off and during initialization. It is also closed during SETUP unless the output was latched prior to entering SETUP.
23	CRASH-R	Common return connection for the CRASH output.
12	TR-NO	Closed whenever the AE signal is at or above the user's Trigger Point setting.
25	TR-NC	Closed whenever TR-NO is open indicating that the AE signal is below the user's Trigger Point setting. It is also closed when power is off and during initialization, and SETUP modes.
24	TR-R	Common return connection for the TR output.
10	n/c	Make no connections
9	n/c	Make no connections
22	n/c	Make no connections
14	n/c	Make no connections
16	n/c	Make no connections
15	n/c	Make no connections
20	SUP-OUT	A protected supply referenced to the Supply Common connection. It will

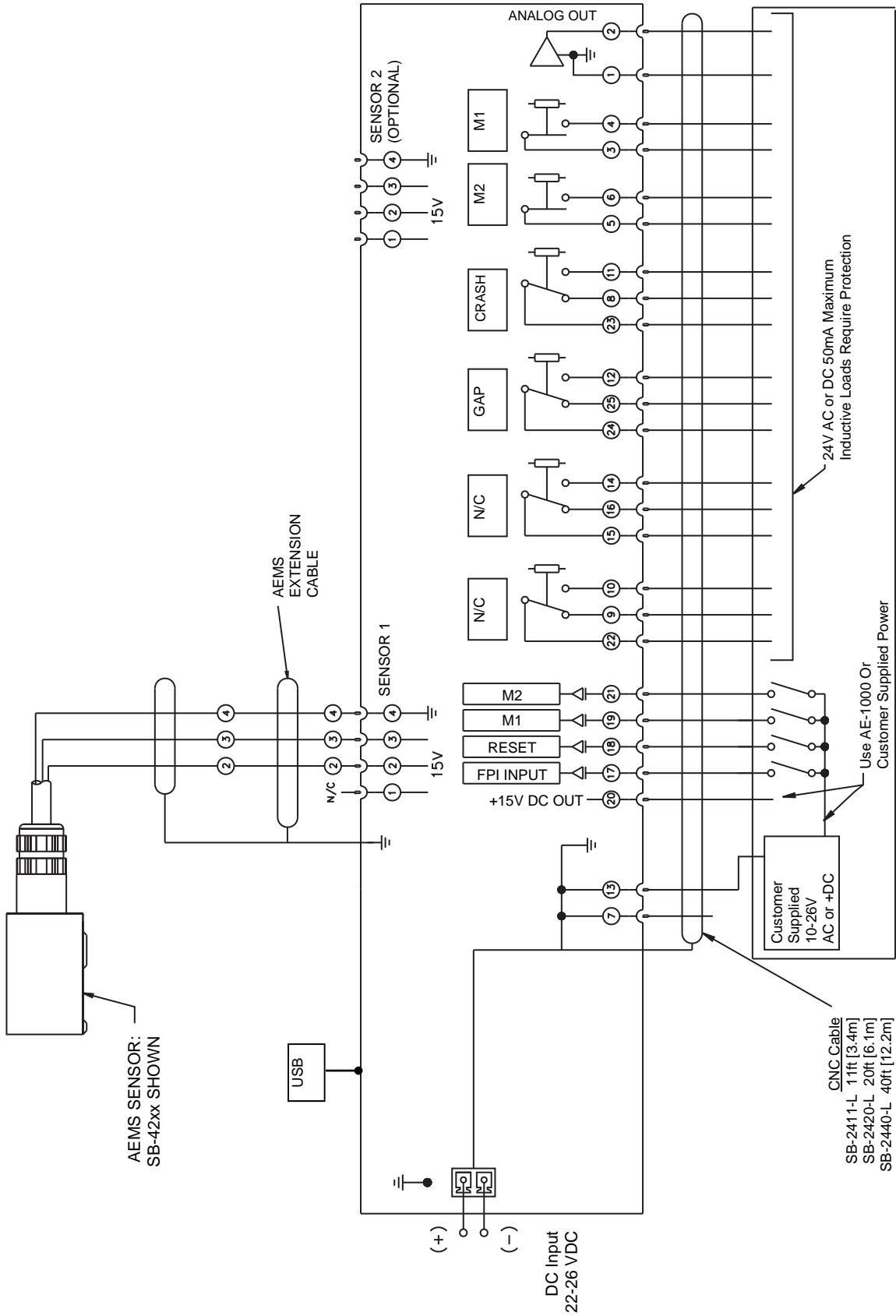
		be adequate to operate any combination of the CNC inputs on the CNC connector.
1,7,13	SUP-COM	Common reference connection for the CNC input pins on all channels, connected to earth and chassis ground. This connection is for the common of the external supply, when one is used to activate the CNC input signals.

AEMS Analog Output

The analog output voltage is presented at pin 2 of the 25 pin CNC connector of the AE-1000 system. Pin 1 is the ground reference for this voltage. The analog output on the AEMS system is not calibrated to a fixed level. The gain of the system is scaled so that the analog signal output always falls in the 0-10 VDC range. This scaled gain is needed to accommodate the huge variation in signal level that can be measured on various types of grinders with different applications and sensor placements. This scaled gain corresponds to the gain used for the display of AE level on the front panel.

The gain is set during the Gain Setup operation. The CRASH output closes when the analog output is at approximately 97% of full scale (about 9.7 V). The TR output closes when the analog output is at a voltage proportional to the Trigger Point location on the display when in the Gain Setup.

AE-1000 System Connection Diagram



Customer CNC / PLC

N/C = Do Not Connect

Software (USB) Interface

The AE-1000 Basic Acoustic Monitoring System provides a software interface via a Full Speed USB device. The software interface allows the same control capability as the hardwire interface plus system status monitoring and setting of parameters.

Interfacing

The software interface provides a serial interface emulation which connects the Control to a Windows computer over USB. When connecting via USB, Windows will assign a COM port to the control. If the AE-1000 is not automatically assigned a COM port, a driver for Windows installation of USB-Serial communication is available on the SBS website at www.grindingcontrol.com. COM port assignment is controlled by Windows. The port assigned can be determined by viewing Windows Device Manager. Use HyperTerminal or other serial communications software to interact with the Control over USB connection.

Software Commands and Responses

When the USB interface is attached, the following message is transmitted via the software interface.

**/AE-1000, Copyright (c) 2010, Schmitt Industries, Inc.<CR>
V0.01<CR>**

The following commands from the Software Interface are available:

Note: all characters must be in upper case.

In this interface, parameter set M1 is indicated by "G" and M2 is indicated by "D"

AE-1000 Commands		
Command	Response	Meaning/ Example:
C		Control Panel Status Inquiry. <Esc>C<CR>
	CI	Control Panel is Inhibited (by Host) CI<CR>
	CE	Control Panel is Enabled (by Host – Hardware interface can override) CE<CR>
CE		Control Panel Enable (from Host – Hardware interface can override) <Esc>CE<CR>
	CE	Control Panel is Enabled (by Host – Hardware interface can override) CE<CR>
CI		Control Panel Inhibit. <Esc>CI<CR>
	CI	Control Panel is Inhibited (by Host) CI<CR>
V		Version Request (main board firmware). <Esc>V<CR>
	Vn.nn	Firmware Version V0.01<CR>
X		Type (of system) Request. < Esc >X<CR> Start Info Request.
	X3.1xVv.vv /text	Device info response. 3.1 is AE-1000 type. x is specific model type. v.vv is firmware revision. Text briefly explains the card type. X3.10V0.01/AE-1000<CR>
S		Status Request command. <Esc>S<CR> Report Status.

AE-1000 Commands		
Command	Response	Meaning/ Example:
	S{D G}aaaa [,FPI] [,TR] [,CRASH], ERR=eee	Status response. D or G indicates current parameter set, D(M2) or G(M1), aaaa is AE level (dynes). FPI is Front Panel Hardwire Inhibit. TR, and CRASH indicate that the corresponding output is closed, eee represent individual error letters representing error conditions. SD2.905,ERR=AC<CR> <ESC>S<CR> Report Status. SD12.91,CRASH,ERR=C<CR>
C{D G S A}		Cycle Command: If D or G, will change to the corresponding parameter set: D(M2) or G(M1). If S or A then will Start or Abort the measurement transmission process, correspondingly. No response to D, G, or A. After a Start, the data value will be transmitted approximately every 100 ms. <ESC>CG<CR> Set Parameter Set to M1. <ESC>CS<CR> Start Cycle.
	{D G}dddd	Cycle data. D or G indicates D(M2) or G(M1) value. dddd is AE level in dynes. These will be sent whenever a cycle is running. There will be no response if the command is not allowed. G0.023<CR> M1 Cycle data. G0.120<CR> M1 Cycle data. G0.134<CR> M1 Cycle data. <ESC>CA<CR> Abort Cycle. (no response)
L{D G}{tttt} [,gg] [,f][,ssss] [,zz][,rrr] [,h]]]]]]		Level request/change of indicated parameter set: D or G must match the current parameter set[D(M2) or G(M1)] or the command will respond with Q. Levels are tttt(dynes) for Trigger level, gg for Gain Level (0-84), f for Frequency Band (1-4), ssss(dynes) for Shift, zz for Zoom level (0-84), rrr for Min output time (10-250), and h for Crash Latch setting (0:off, 1:on). Settings are different for each parameter set: D(M2) or G(M1). Commas indicate which setting(s) to change. Blank settings (those without values) will not be changed. Commas after the last desired setting are not required. <ESC>LD<CR> Request Current Levels of parameter set D(M2).
	L{D G}tttt,gg,f, ssss,zz,rrr,h	Level of current settings response: D or G echos the current parameter set[D(M2) or G(M1)]. Levels are tttt(dynes) for Trigger level, gg for Gain Level, f for Frequency Band, ssss(dynes) for Shift, zz for Zoom level, rrr for Min output time, and h for Crash Latch setting (0:off, 1:on). Settings other than Min output time and Crash Latch are different for each parameter set: D(M2) or G(M1). LG0.023,25,1,1.056,12,10,0<CR> M1 parameter set. <ESC>LG<CR> Request Current Levels of parameter set G(M1). Q<CR> Command not accepted (current parameter set is M2?) <ESC>LG1.234,,,2.45<CR> Set new trigger and shift levels of parameter set G(M1). LG1.234,25,1,2.450,12,10,0<CR> New M1 parameter set.

Appendix A: Specifications

Physical Features

Display

Type: Yellow monochrome OLED
Active area: 256H x 64V pixel
3.11 inch [79mm] x 0.75 inch [19mm]

Communication Interfaces

USB 2.0 Full Speed, CNC/PLC Hardwire Interface
(opto-isolated outputs)

DC Supply: Input 22 VDC to 26 VDC. 0.5A max at 22 VDC. Reverse voltage protected.

Connector: Phoenix 1803578 or equiv.

Environmental and Installation

Pollution degree 2
Installation category II
IP54, NEMA 12
Environmental temperature range: 5°C to +55°C
CE

Appendix B: Replacement Parts List

<u>Part#</u>	<u>Description</u>
<u>AEMS Sensors</u>	
SB-42xx	Bolt-on Sensor
SB-41xx	AE-Extension Cable
SB-3208	AE Sensor: Non-contact spindle mounted Mini-Stud Mount – M6x1.0 LH
SB-3209	AE Sensor: Non-contact spindle mounted Mini-Stud Mount – M6x1.0 RH
SB-3225	AE Sensor/ Sender Package: Non-Contact In-Spindle
SB-3210	AE Sensor: Non-Contact In-Spindle w/ slide tube connection
<u>Control Mounting Hardware Options</u>	
SK-5000	Rack Panel: Full Wide w/ 1/2 Blank, 3U
SK-5001	Rack Panel: Partial Wide 3U w/ Handles
SK-5002	Rack Panel: 1/2 Rack 3U Bracket
SK-5005	Keypad Mount: Flush Panel Frame Kit