ACCRETECH | SBS
PRECISION PROCESS CONTROL

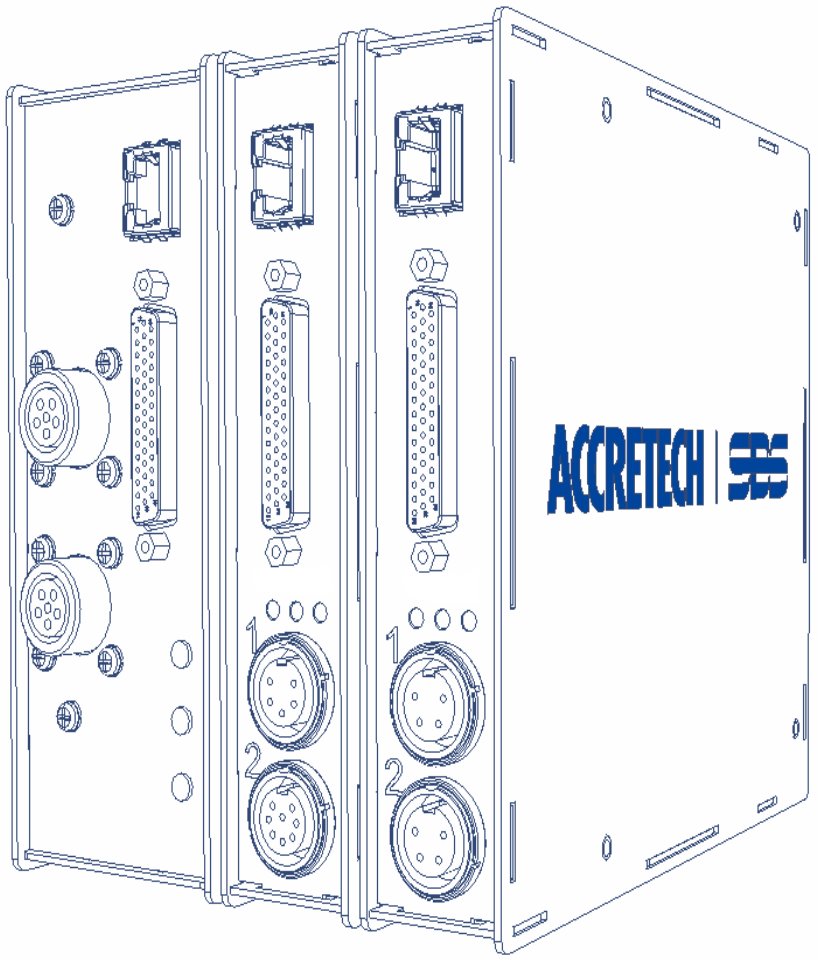
OPERATIONS MANUAL

SB-6522
SB-6522-8

SB 6500

AEMS Module

Engineering Confidence
for Precision Grinding



ENGINEERING CONFIDENCE.
BUILT WORLDWIDE.

DOCUMENT NUMBER
LL-6200

MANUAL REVISION
1.4

SOFTWARE VERSION
1.21.2

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PRECISION PROCESS CONTROL

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User's Guide and Specification

For the

SBS AEMS System

Covering Operation of SB-6522 and SB-6522-8

of Model 6500 series Control Units

LL-6200

Manual Revision # 1.4

Covers operation with product firmware rev 1.21.2

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Benefits of SBS AEMS System with SB-6500 Control:

- Increases throughput by saving setup time
- Improves part quality by providing grind and dress quality monitoring
- 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.
- Multi-channel capability reduces costs by permitting both balancing and AEMS monitoring of multiple machines
- Longer life for grinding wheels, dressing wheels and spindle bearings
- Enhanced digital electronic design with increased operating life and reliability
- Easy to install and operate
- Works with existing SBS installations
- Profinet and OPC UA communication
- International adaptability: voltage, frequency, communication, and display language
- Backed by world-class SBS customer service

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1 System Installation

1.1 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**
- **Close Integration with SBS Balance Systems**
- **Attractive Purchase Price**

1.2 Operator Safety Summary

This summary contains safety information necessary for operation of the SBS AEMS 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 AEMS System, it is necessary to read and understand the entirety of this manual. After reading the Operation Manual, contact Accretech SBS, 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 properly attach SBS Balance System or AEMS sensor components to the grinding machine spindle, including the proper use of provided adaptor lock screws, will result in safety hazard during machine operation.

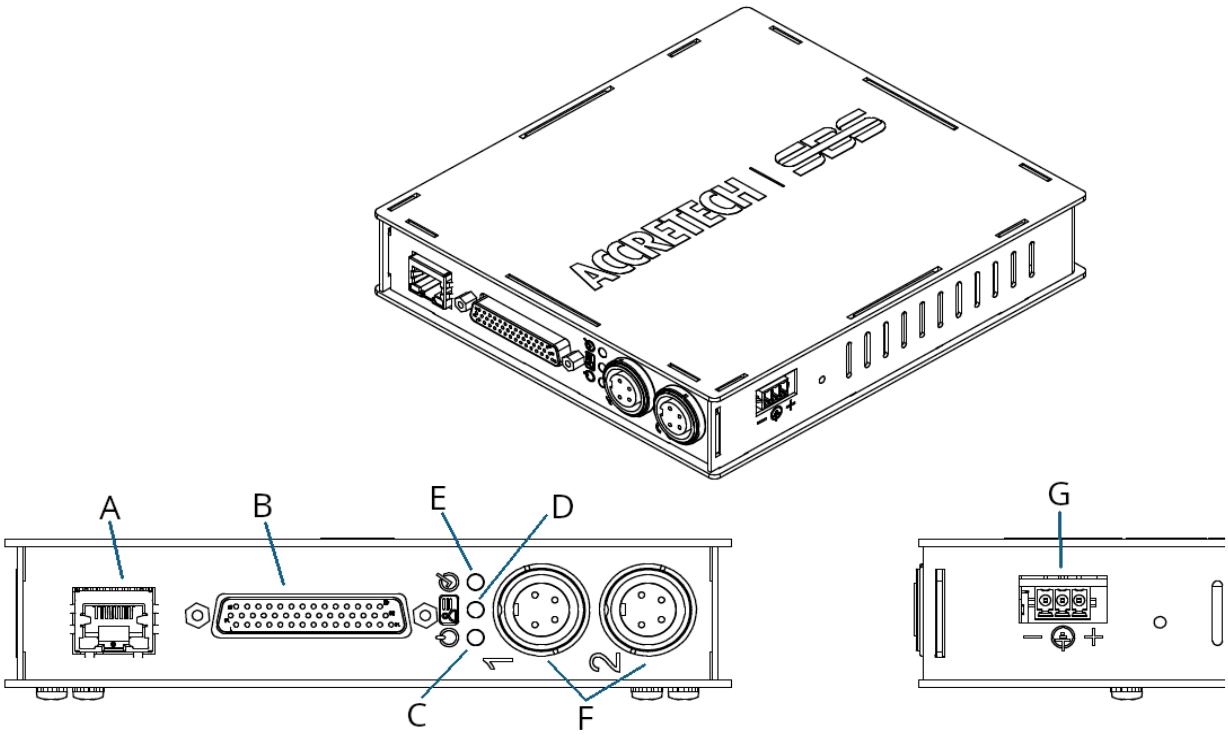
Warning: Never operate a grinding machine without all proper safety guarding in place.

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 SBS System. To avoid electric shock, do not remove the cover of the Control Unit, or remove cables, with power connected.

1.2.1 System Theory

The AEMS system consists of an electronic control and either one or more 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 in either the grinding or dressing process. The level of these signals is monitored and referenced against known background levels at the same frequency, allowing key events to 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 contact between the wheel and these parts (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 then reported via both the hardwire and software interfaces, and the Control's front panel 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.



1.3 Connections

The front and bottom of the SB-6522 AEMS module is shown above. The two circular connectors allow for the attachment of AE sensors. In the SB-6522-8 version, there are eight connector inputs for expanded sensor use.

A) Ethernet. Provides TCP/IP and UDP connection to host device, such as SB-6500 software or OPC UA server.

B) Hardwire I/O. DB-44 connector.

C) LED-Red. On when device is supplied power.

D) LED-Yellow. Device ID. Normally off. Flashes as directed by operator.

E) LED-Green. On when module is fully operational.

F) AE Sensor connection. Sensor number marked as shown.

G) Power supply, DC input. 22 VDC to 26 VDC. 0.9A max at 22 VDC

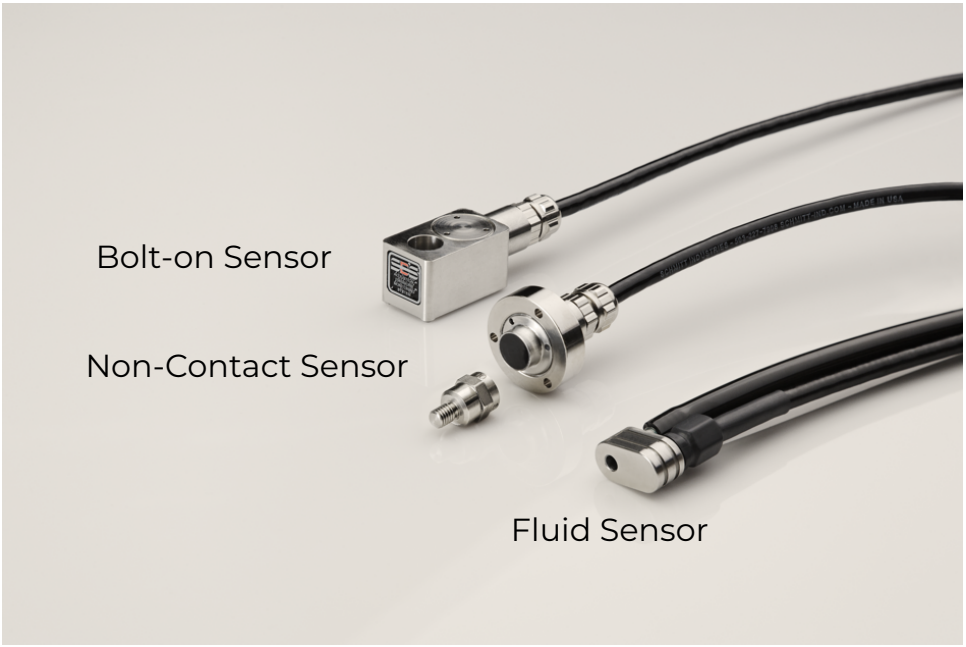
1.4 Acoustic Sensor Location

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 reasonably 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 located 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 a Bolt-on sensor, it is recommended to use superglue (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 connected, but only one is in use at any time by the AEMS system.



1.5 AE Sensor Types

A variety of Sensor configurations are available for your 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 a screw directly to the machine structure, nearest as possible to 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 work spindle 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 and pressure regulated machine coolant) is directed to flow onto the target area. The AE signal transmitted up the fluid stream and is detected by the sensor.

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

2 Basic Software Usage

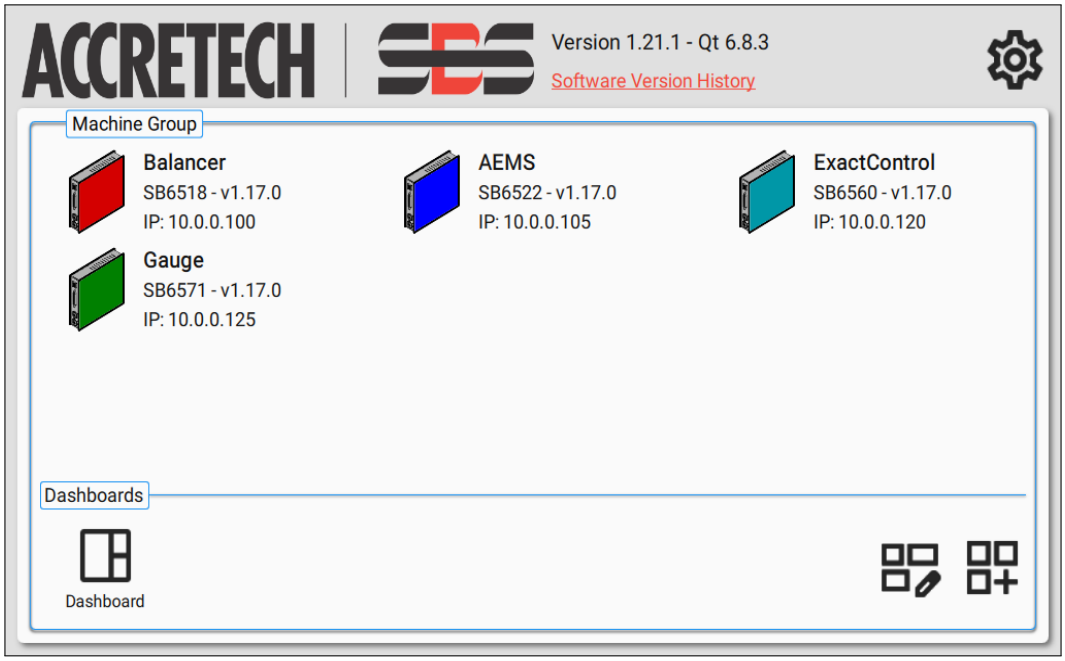
When the software starts up it will load the last connected machine group. If no machine group exists, you will be prompted to create one.

The home page is the primary form of program navigation. Clicking on any module or dashboard graphic will go to its specific visualization. It also provides navigation to the settings page and Module Management interface.



SBS Home Button

Clicking on the SBS Home button from the module main screen returns you to this home screen.



SB6500-Software Home Screen



Module Management



Software Settings



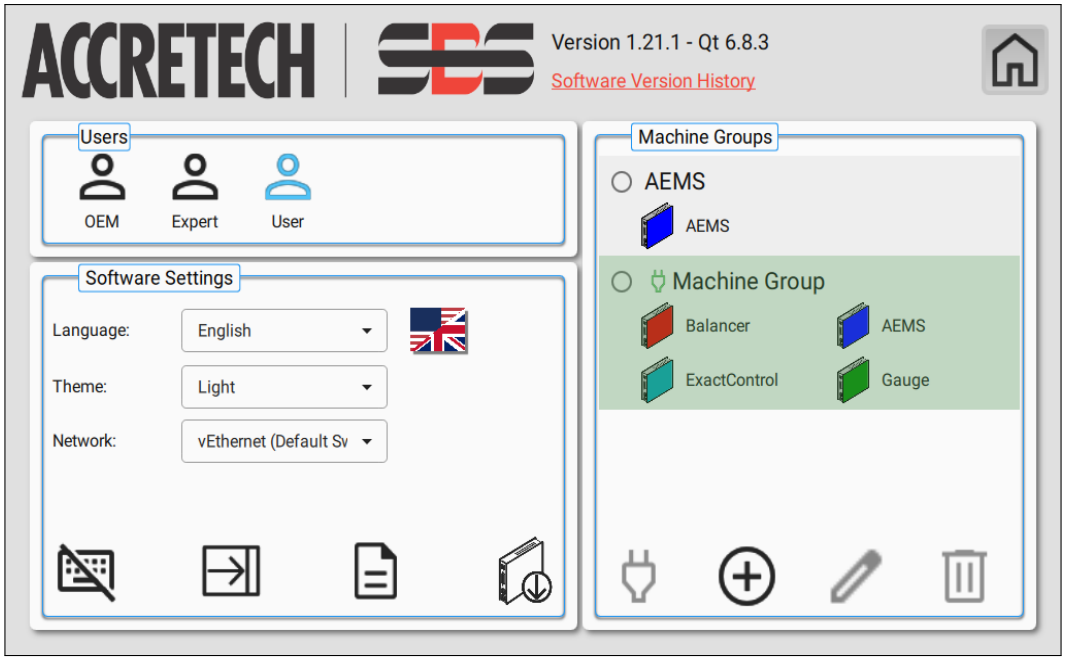
Create New Dashboard



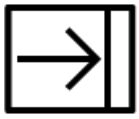
Edit Dashboard

2.1 Software Settings

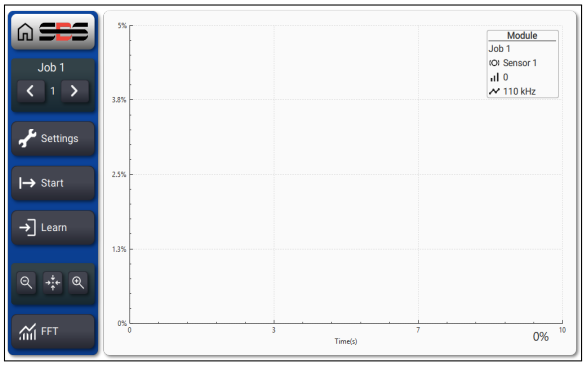
This section allows changes to the overall user experience, including language, color theme, and active network adapter. Custom color themes can be created, using Light or Dark mode as a starting point. Saving a custom theme is currently not supported.



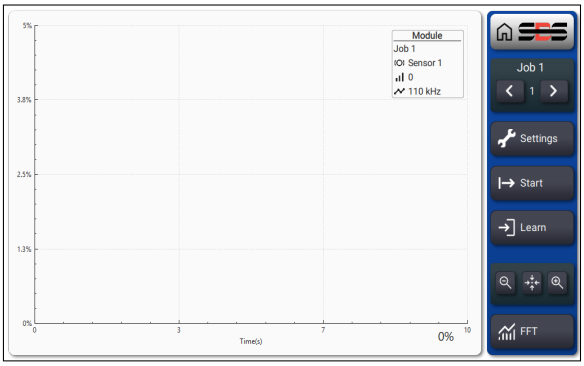
SB6500-Software Settings Page



The placement of the module control bar can be controlled by the operator by toggling the control bar position button.

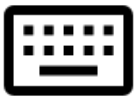


Left Module Control Bar

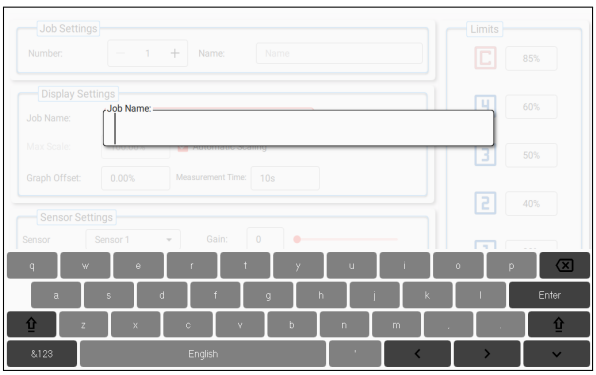


Right Module Control Bar

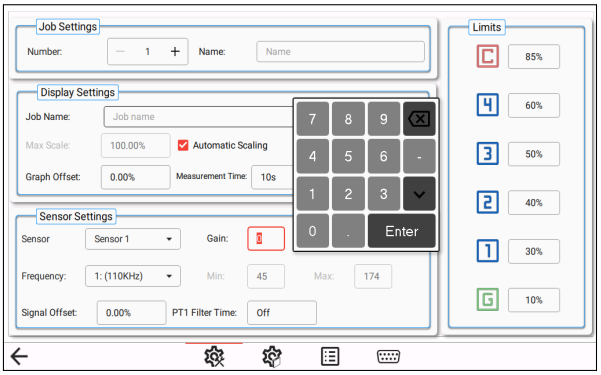
2.1.1 On-Screen Keyboard



The keyboard button enables the onscreen keyboard to appear when contextually necessary. If editing a value that uses alphanumeric characters, the full-sized keyboard will appear. In the case that you are editing a value that only accepts numeric values, a number pad keyboard will appear next to the control.



Full-sized keyboard



Number pad keyboard

2.1.2 Software Event log

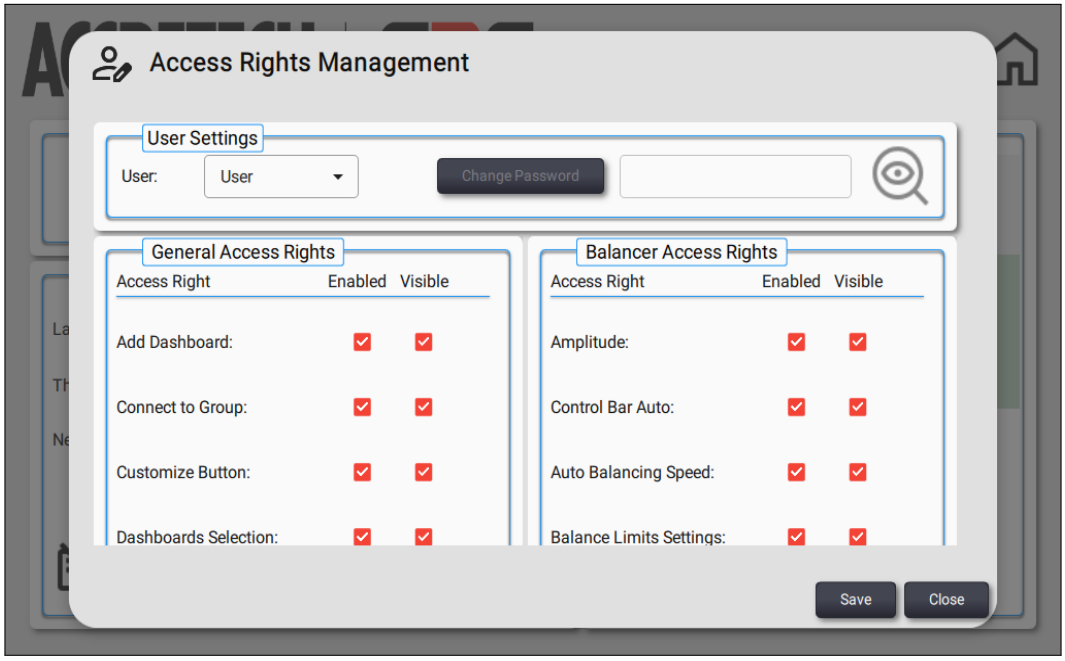


The software event log button shows the events that occur on a global software level. See Event Log for module-specific information.

2.1.3 Network

Select the network adapter to use for connecting to modules. If there are any issues finding modules for machine group creation or connection, it is important to try changing the network adapter to the one that is connected to the network the modules are on.

2.1.4 Access Rights



Access Rights Settings as OEM

Under the user's card are the three available user profiles for the software. Each one is intended to have different access levels to the software but must be configured by the OEM before use. The system remembers the last logged in user and will re-login to that user level on next boot without prompting for a password. The three different levels have these inherent abilities that cannot be changed:

1. OEM
    a. Can edit the access rights of the other two users.
    b. Cannot change access rights for the OEM user. OEMs always have full access to all features.
    c. Can change the password for the OEM, or Expert.
2. Expert
    a. Can have a password assigned by the OEM.
    b. Can have access rights assigned by the OEM.
3. User
    a. Cannot have a password assigned.
    b. Can have access rights assigned by the OEM.

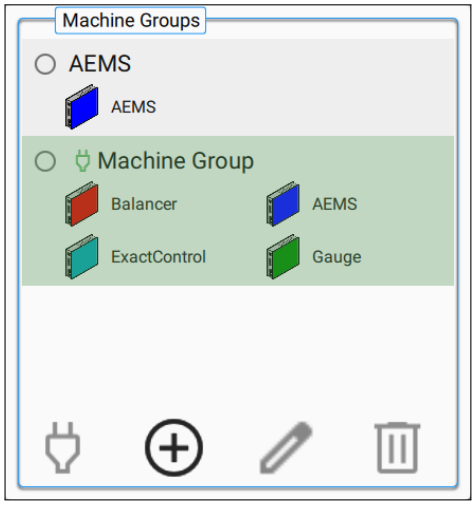
Warning: Losing or forgetting the OEM password can only be fixed by an SBS service provider. If you have been locked out of the system, please contact support for assistance.

2.2 Machine Groups

A Machine Group is a selection of control modules that the operator wishes to display and interact with. To interact with an SBS control module of any type, it must be a member of a Machine Group. Modules may be members of multiple machine groups. The Machine Group currently active is marked with a green plug icon.



Green Plug Icon



Machine Group Manager



Connect to selected Machine Group



Create Machine Group



Edit Machine Group

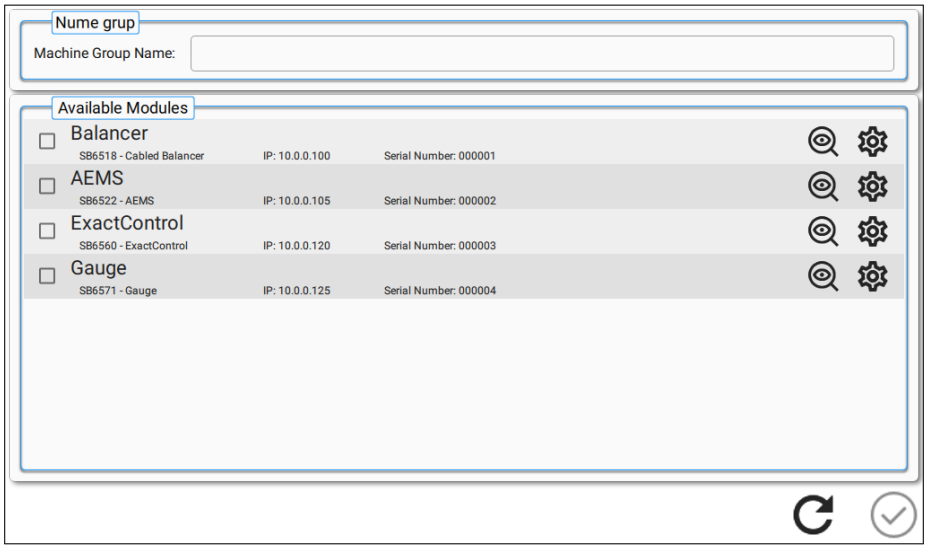


Delete Machine Group

2.2.1 Create Machine Group

Clicking the "Create Machine Group" (+) button initiates a search on the connected network for all SBS control modules. Devices found will be displayed in the Available Modules list. If the module you are looking for does not show on the list, wait 30 seconds, then refresh the list. Mark any modules you wish to add, name the Machine Group, then click "Create".

Some modules may be listed in red text with their IP as "Not on Network". This means that the module is not on the same subnet as the computer's network adapter. The SB-6500 Software cannot connect to the module in this state; however the module's IP can be changed by editing its Network Settings via the "Edit Network Settings" button. By default modules use the "Auto-set IP" setting. This means modules use DHCP for IP assignment, and when DHCP is not available, a link-local address is assigned (169.254.x.x).



Machine Group Creation



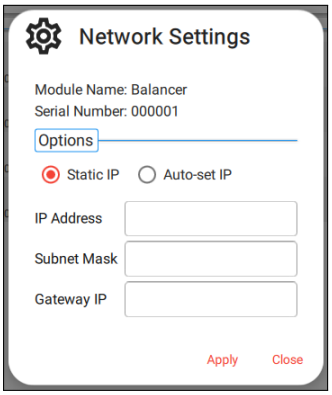
Identify Module: Will flash yellow LED on module three times.



Refresh Module List.



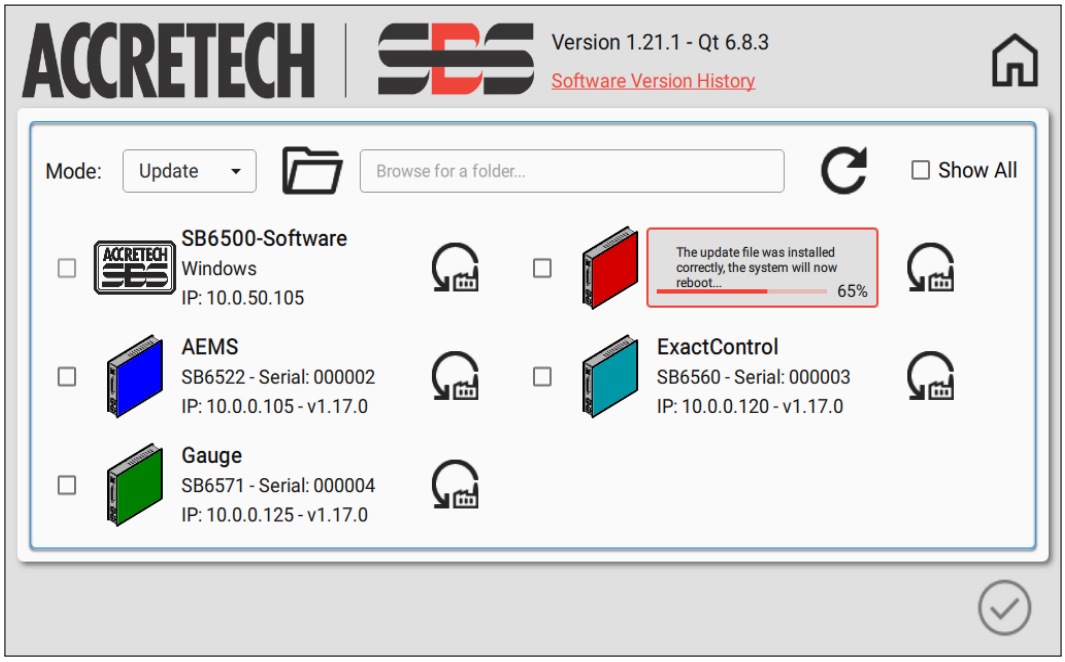
Edit Network Settings.



Network Settings Screen

2.2.2 Software Update

To update the software on the SBS control module, browse to the folder containing the update file. The list of modules displayed will be populated from the active Machine Group. Check the Show All box to show all modules on the network. Select the modules you wish to update, then press the “Start Updating” button.



Module Manager



Go to Module Manager



Select Update Folder



Start Updating

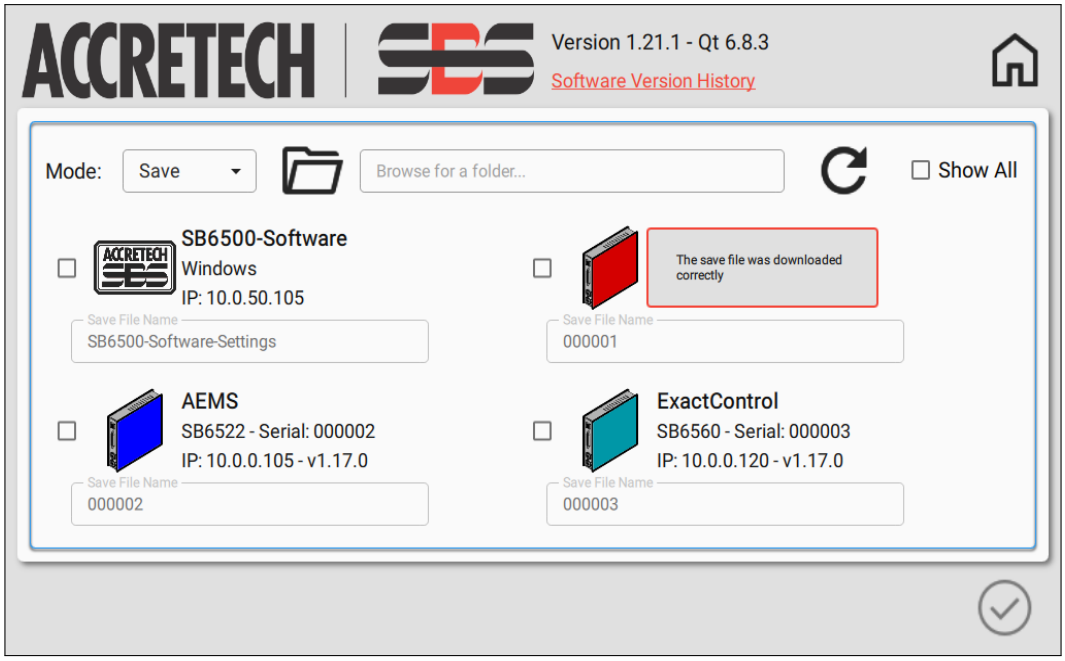


Factory Reset: Resets all module parameters back to default values. Includes network settings.

2.2.3 SB6550 Update

If running on an SB6550 display, the updating screen will include the Display as an option. The display update file should be in the same folder as the module update file.

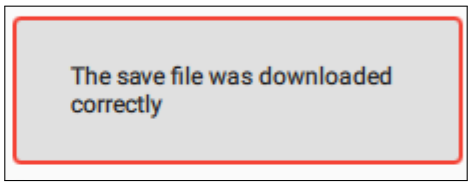
2.2.4 Save / Restore



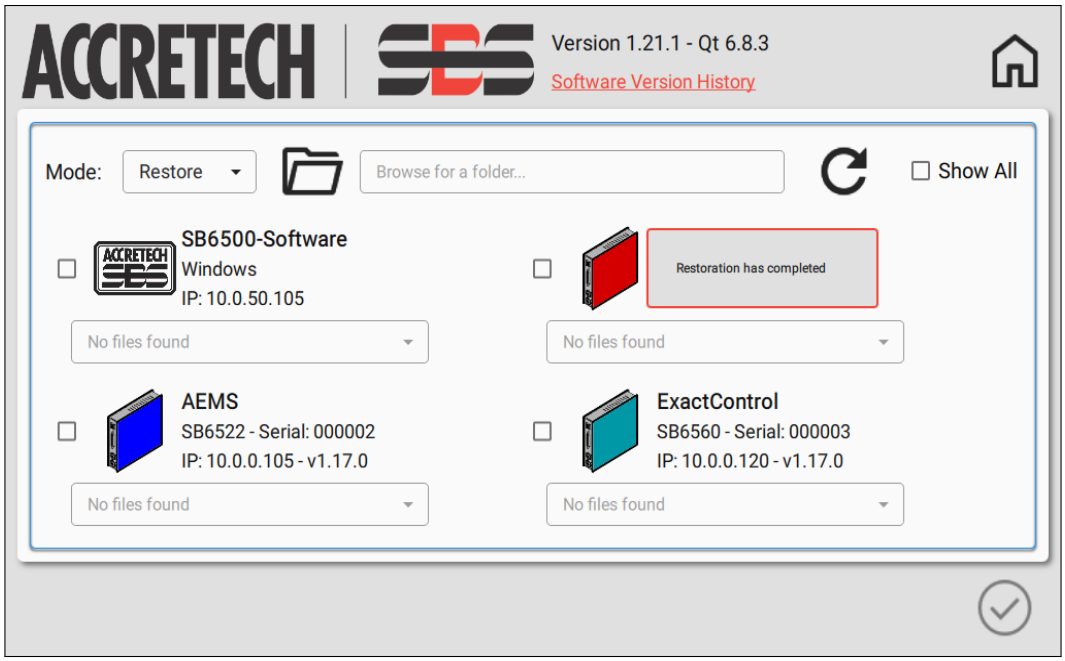
Save Menu

By changing the mode to Save in the module manager, you can save the current settings of any module to a file. That file can then be used to restore those settings to any module of the same type. This Save/Restore function allows you to backup the settings at any time for retrieval later or to copy to a new installation.

On an SB6550 display the save file will automatically be placed on a USB drive inserted into the front USB C port. Do not remove the USB drive until all modules show the saving process as complete.



File saved successfully

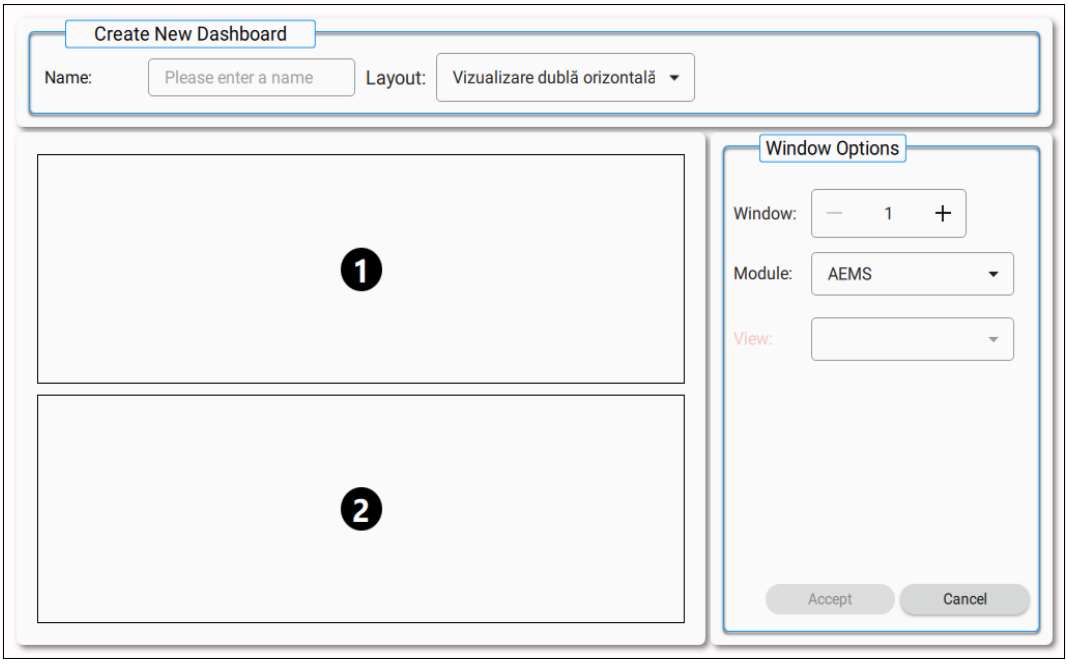


Restore Menu

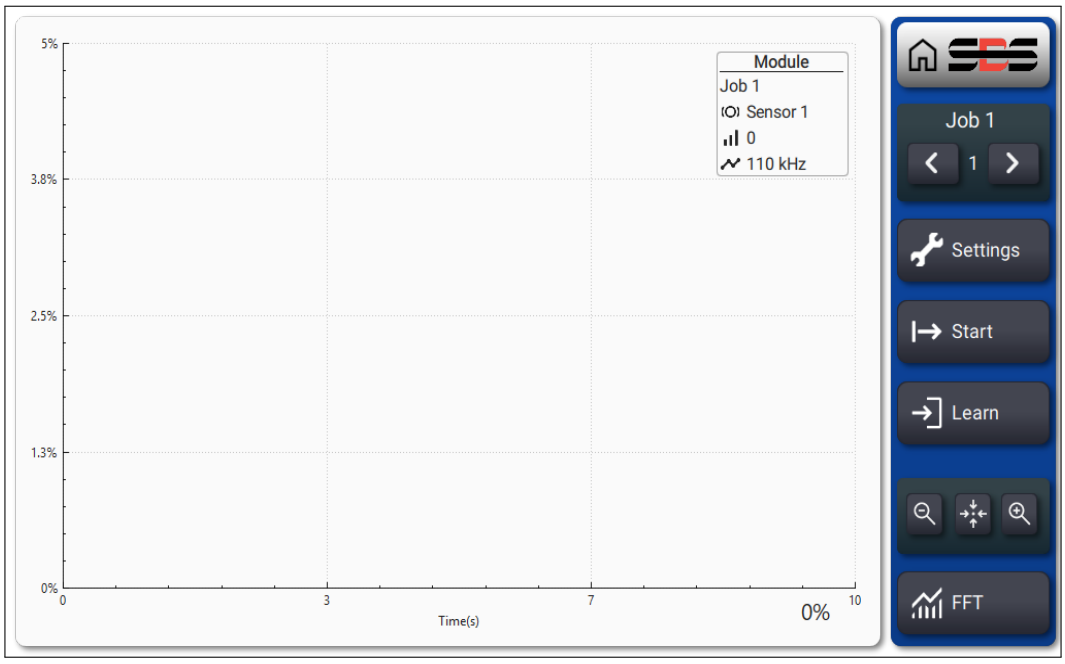
Changing the mode to Restore brings up the restore interface. Select the modules that should be restored from the file in the target folder. If there is only 1 file for that module type in the target folder it will be selected automatically. Otherwise, you must select which file to use for that module using the drop down. Click the Accept button to begin the restore process. This will completely overwrite the module's current settings with the settings in the restore file. Note that there is no way to undo this process.

2.3 Dashboards

Operators may create customized user layouts for monitoring several SBS modules on one screen. From the navigation bar, click Create New Dashboard from the Dashboards option. Select the preferred layout from the list. Assign a module to each numbered window in the Windows Options box. Depending on the size and shape of the window and the module type assigned, further options may be available for you to choose from. When complete, press Accept to launch the dashboard. This dashboard will be added to the list at the bottom of the home page for this machine group.



3 AEMS Operation



AEMS Main View

This is the main screen of the AEMS system. A scrolling, linear scale graph of the AE signal is displayed, along with the Control Bar.

The current AE signal level is shown as a percentage of the full input range at bottom left. The Gap Limit (shown in green), Limits 1, 2, 3, and 4 (shown in blue), and the Crash Limit (shown in red) are all adjusted in **Settings** or by performing a Learn Cycle. Each limit is labeled at the right of the graph with a corresponding Limit label (G, 1, 2, C). These limits can be adjusted to any position and in any order on screen.

The Control Bar for AEMS contains the following features:

3.1 Job Select

This shows the current job number and the name assigned to it. The arrow buttons allow you to change the active job. Jobs that have been marked “hidden” will be skipped.

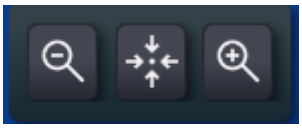
3.2 Settings

Pressing this button allows you to modify any of the parameters in AEMS, access the event log, and the I/O diagnostics screen. See the Navigation Bar section for more information.

3.3 Start/Stop

The START/STOP toggle button controls the display scrolling real-time acoustic signal levels currently being monitored. It is possible to stop or freeze the display, so that target levels can be adjusted against recent signal levels or for review of an event by the operator. Even when the screen is not scrolling, the unit will continue to monitor Gap and Crash events, and provide their status via the CNC Connector.

3.4 Graph Controls



This interface allows you to increase, decrease, or reset the graph scale.

3.5 Learn

The Learn Cycle is a process to assist with setup for proper operation. Initiating the Learn Cycle allows operating parameters to be determined and set for each monitored work process (Job).

During the learn cycle the background AE signal levels for each of the eight frequency bands will be compared with the signal levels that occur during normal dressing or grinding contact, and the frequency band with the best Work/Air signal ratio will be suggested as the frequency to be monitored.

The following parameters will be adjusted at the completion of the Learn Cycle:

- Frequency band
- Gain
- Any active Gap, Crash, or Limit (1-4)

Any limit that was OFF (value set to 0%) will not be adjusted and remain off. Signal Offset value will be reset to 0%.

Important - If the results of the Learn process produce Work/Air ratios that are 1.2 or below, the system has been unable to see any significant difference between the AE signal during wheel contact and prior to wheel contact. This is usually a result of either an improperly performed Learn cycle, or a poor AE sensor location or installation.

A separate Learn Cycle must be run for each Job.

3.5.1 Learn Cycle: Setup



Review the frequency bands and sensitivity multipliers. Deactivated bands will not be evaluated during the Learn cycle.

A custom band can be defined here by checking the Custom Band check box. Note that this will disable all other standard bands for the learn cycle.

Sensitivity multipliers will determine the signal value the limit is set to.

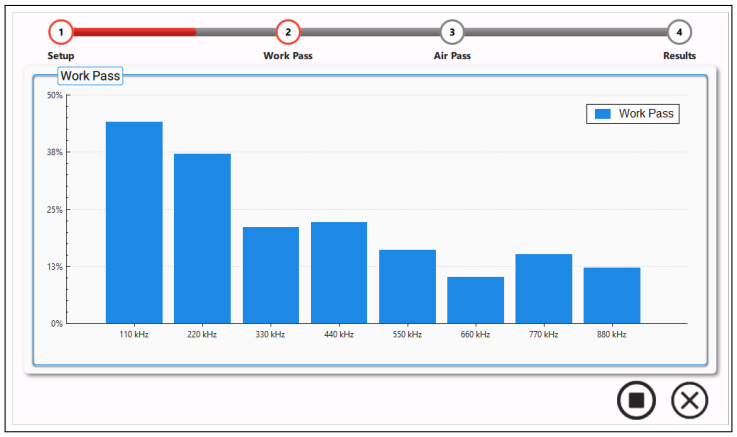
*Gap = Air *(Sensitivity)*

Crash = Work(Sensitivity)*

Limit values are a percentage of the range between Gap and Crash. 1.5 would be 50% of the value between the Gap and Crash values.

The operator should initiate normal wheel contact with the dresser or part and complete one or more cycles until the bar graph is stable. Once it is stable, press the STOP Button.

Learn Work



The second step in performing a learn cycle is to learn the background or AIR signal level. The machine should be operational with all systems running but **without** wheel contact with the part or dresser.

Once the graph has settled, press START ▶ to begin learning. Press Stop when complete.

Learn Air

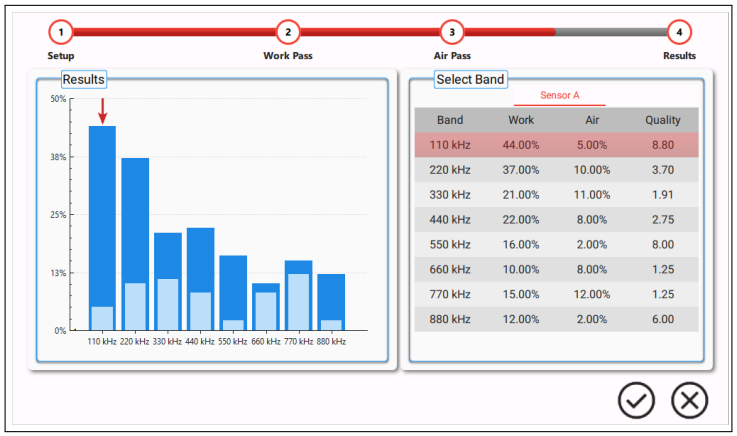


The Results screen will show the AE signal WORK and AIR levels recorded for all eight frequency bands. The resulting ratio between WORK level and the background AIR level (W/A) is displayed.

The frequency band selected by the control unit for optimal monitoring is highlighted. This selection is based on the highest W/A ratio.

Press ENTER to accept this choice or override the AEMS system selection by choosing another frequency band with good results, and then press ENTER.

Results

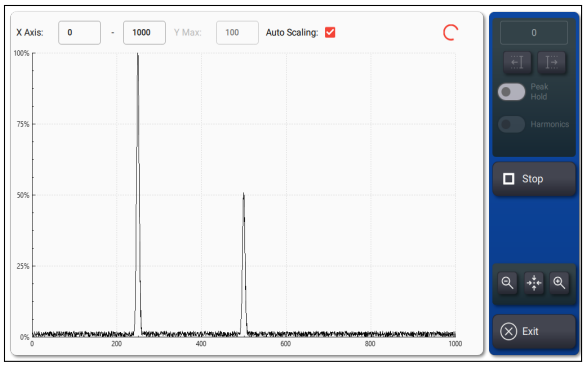


3.6 FFT

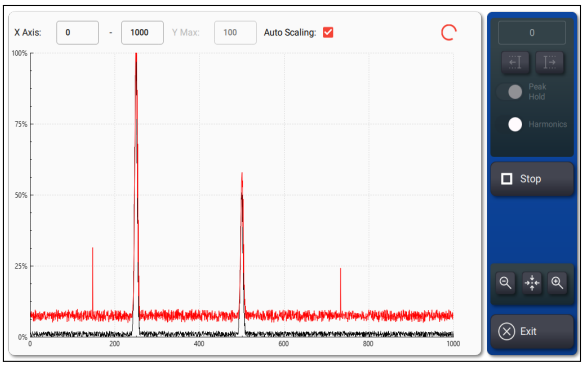
This activates the FFT interface of AEMS. The graph shows the signal output of the currently active sensor up to 1Mhz. The gain applied to the signal is related to the parameter of the active job. Changing the sensor Gain value can affect the amplitude of the data presented.

A graph control interface is available, as well as an option to define the maximum graph scale. Activating the Auto Scaling function will rescale the FFT to ensure all data is shown on screen.

Press Start to activate graphing. Starting the FFT with the Peak Hold option activated will keep the highest peak for any frequency and display it in red. This can make it easier to capture transient events.



FFT example with Record inactive



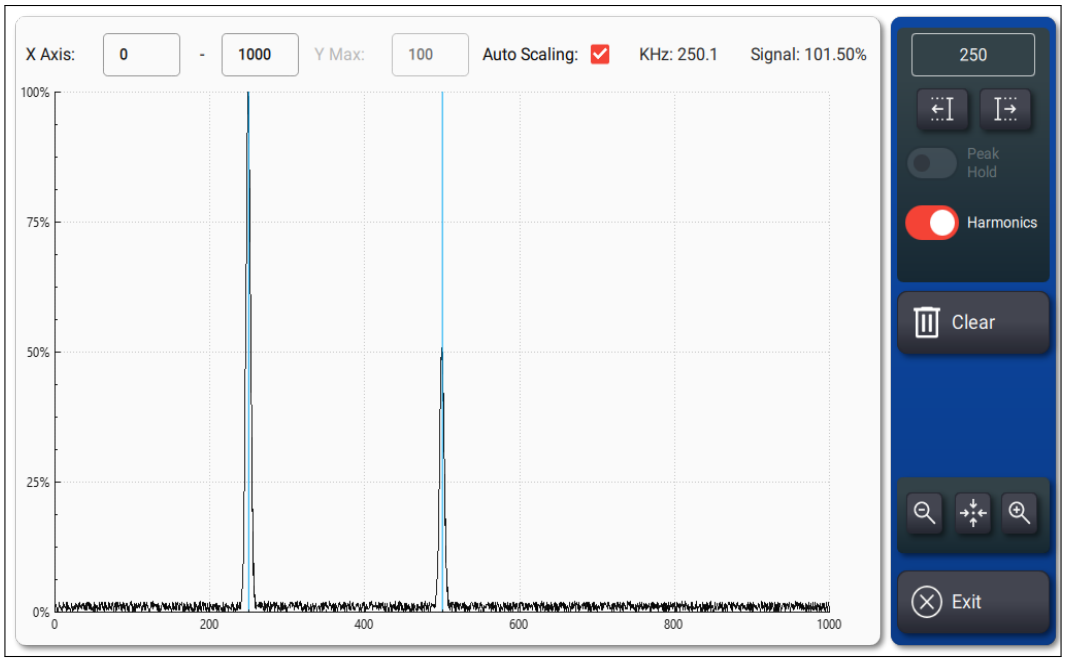
FFT example with Record active

Stopping the FFT activates the on-screen cursor. Use the buttons, mouse or touch interface to move the cursor on the screen. The frequency and signal amplitude are displayed at the top. Activating the harmonic cursor option displays the cursor as well as multiples of the selected frequency on the graph.

4 Navigation Bar

The Navigation Bar, found at the top of the settings menu, contains the user-selectable operation settings for the AEMS system as well as troubleshooting and setup tools for the hardwire interface. Press ← at the top left of the menu bar to return to Main Operation.





FFT Graph with Harmonic Cursor Active

Job Settings

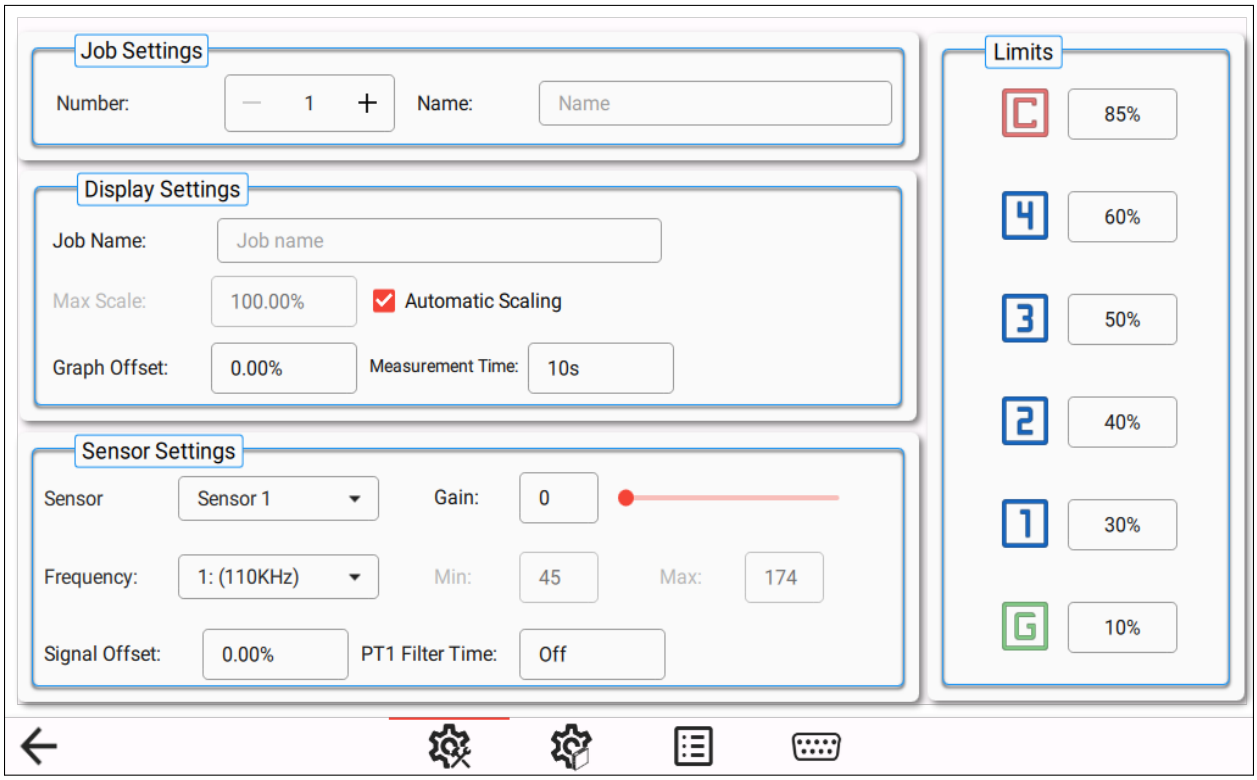
Module Settings

Event Log

I/O Diagnostics

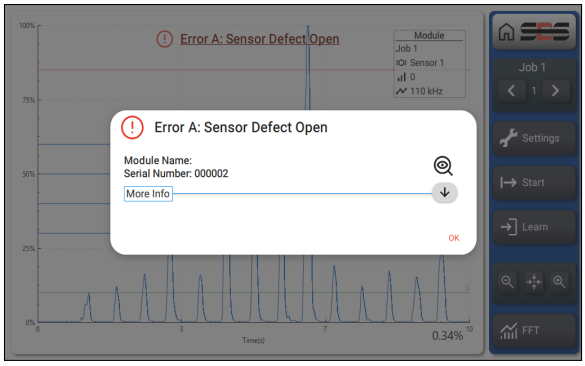
4.1 Module Settings

The Module Settings contains the user selectable operation settings for the AEMS system. It is broken up into three sections: General Settings, CNC, and Jobs.

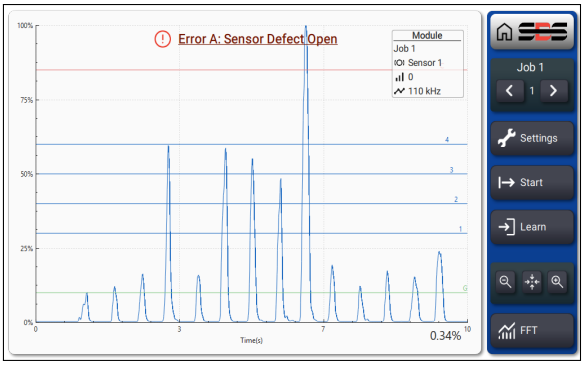


4.1.1 General Settings

The display name of the control unit and sensors can be assigned, as well as deciding to enable or disable notifications to better control the user experience.

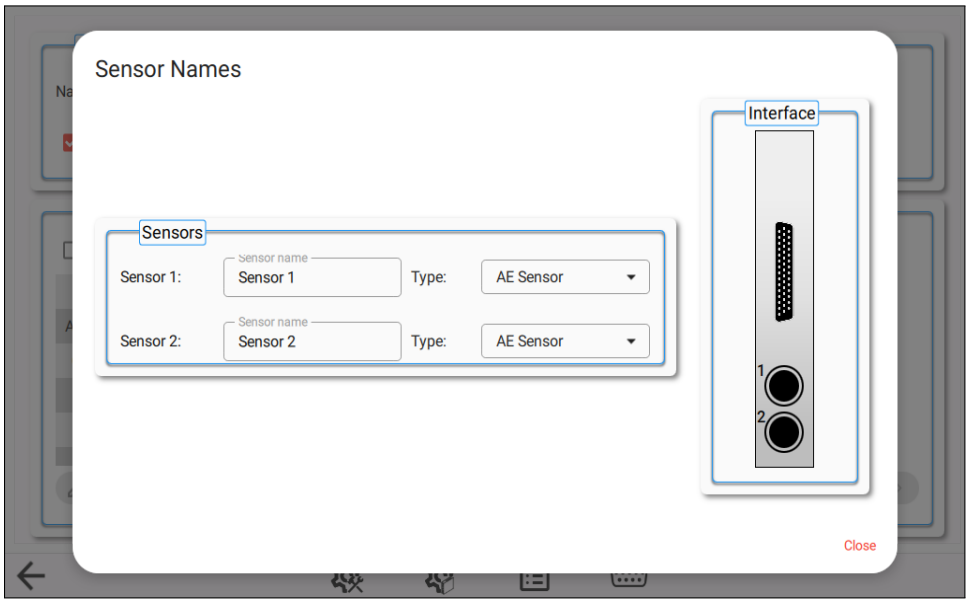


Example with Notifications Enabled



Example with Notifications Disabled

4.1.2 Sensors



If desired, assign a sensor name to AE sensors connected to the AEMS module.

Sensors marked as Fluid will activate the Fluid Sensor Active output whenever the AEMS system is monitoring through that sensor. See Hardwire section for more detail.

4.1.3 CNC Crash Latch

OFF Crash not latched, subject to ON/OFF times like Gap, Limits 1, 2, 3, 4.

ON Crash condition closes the Crash contact until it is reset by: (1) RESET CNC input (2) HOST error clear (3) CLEAR button when Crash error screen is displayed.

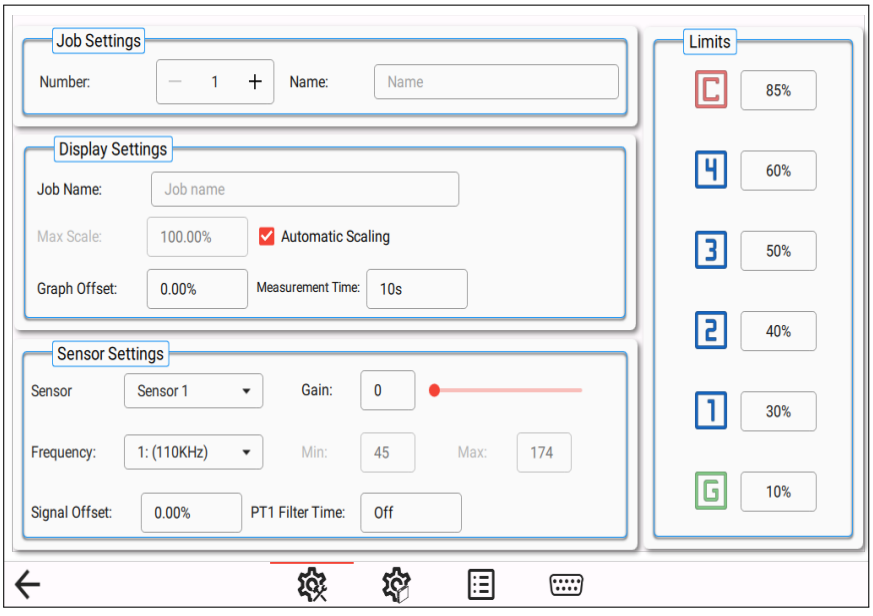
4.1.4 Jobs

Each distinct process monitored on the machine is referred to as a Job. Up to 64 Jobs can be stored on the control for use as needed.

A work process is distinct if there is any variation in the contributing factors that would influence the AE signal intensity 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 or flow. Setup parameters are all stored separately for each parameter set.

Jobs are shown in a table to provide a convenient overview of all parameters. Selecting < or > loads the next group of Jobs onto the screen. The job currently running is highlighted in red with the word **Active** above it.

The blue highlighted job can be manipulated by the five function buttons at the bottom left of the screen.



Jobs Table



Edit parameters of the job.



Copy Job Parameters



Paste Job Parameters



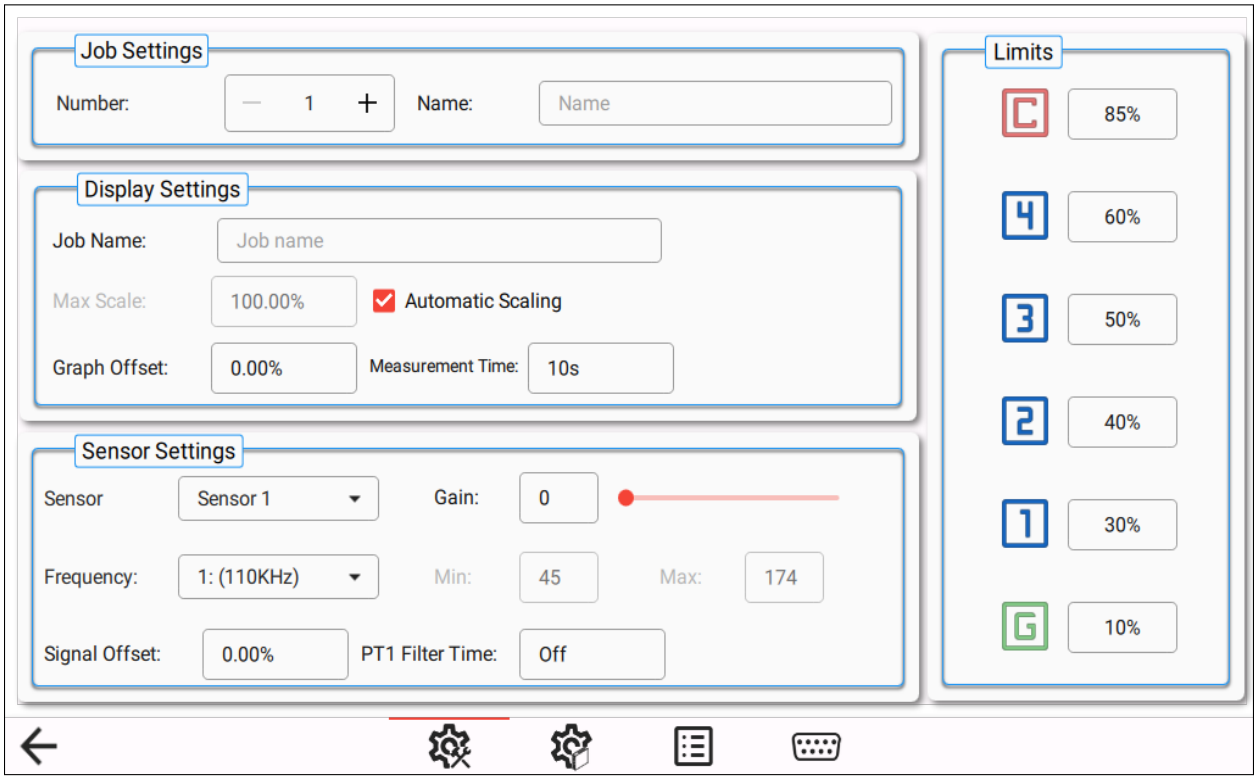
Reset Job parameters to default values.



Hide Job.

4.1.5 Edit Job Parameters

Use this interface to change parameters stored in the job.



4.1.6 Display Settings

Name the job, define the main display graphing time and define the maximum value to display for the graph. If Automatic Scaling is selected, AEMS will automatically adjust the scale to ensure that the maximum signal can be visualized. Press reset on the Graph Control bar to force a readjustment of the scale. Graph Offset adjusts the minimum value to display.

4.1.7 Sensor Settings

Indicates the sensor being used, the Frequency and Gain of the Job, and any Signal Offset being applied to the signal.

If the custom option is selected for the frequency, the min and max options will be available for setting minimum and maximum frequency values. Selecting the custom option here will automatically make it selected in the learn cycle.

4.1.8 Signal Offset

Subtracts the value from the AE signal level. Default value is 0.0%. Signal Offset is applied to the incoming AE signal before any comparison to Limits or being displayed. This can be useful to ensure that small increases in background noise do not unintentionally trigger a limit, instead of performing a Learn Cycle.

This value is reset to default whenever a Learn Cycle is performed or the Signal Offset (Clear) input is activated.

4.1.9 PT1 Filter Time

PT1 is a software low pass filter that can be used to smooth noisy signals and avoid unwanted detection of events caused by signal noise. If this value is set to 0, software filtering is turned off. If software filtering is on, then all limits will be evaluated via software instead of hardware. Filter time in milliseconds.

4.1.10 Copy/Paste Job

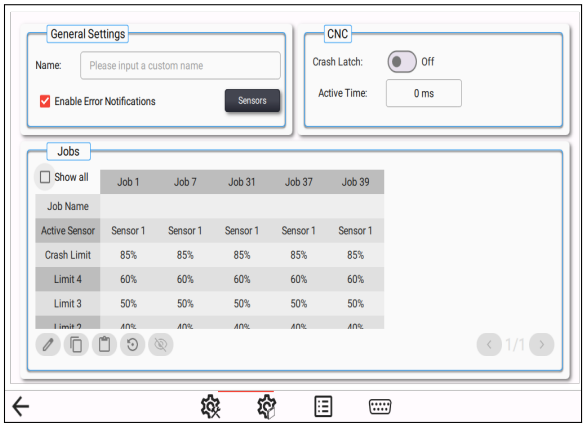
Select the source Job, then press Copy. Select the destination Job and press Paste. This enables quick population of common parameters used in the operation of AEMS. It is recommended that each Job perform a Learn Cycle to calibrate its AE sensor properly.

4.1.11 Reset Parameters

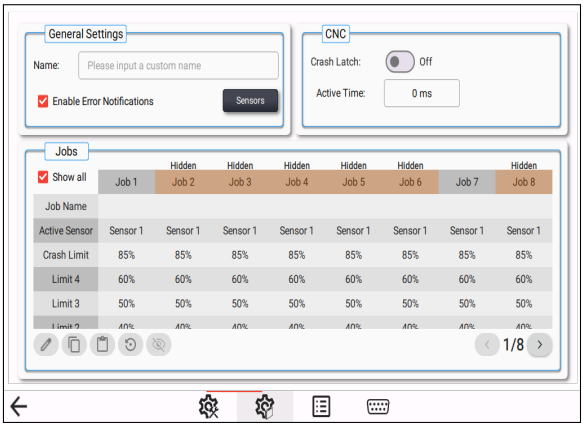
This will change all Job parameters for the selected Job back to the factory settings.

4.1.12 Hiding Jobs

Hiding unnecessary Job numbers can make it easier to find the Jobs needed for operation. Activating the Show All checkbox allows the hidden Jobs to be seen.



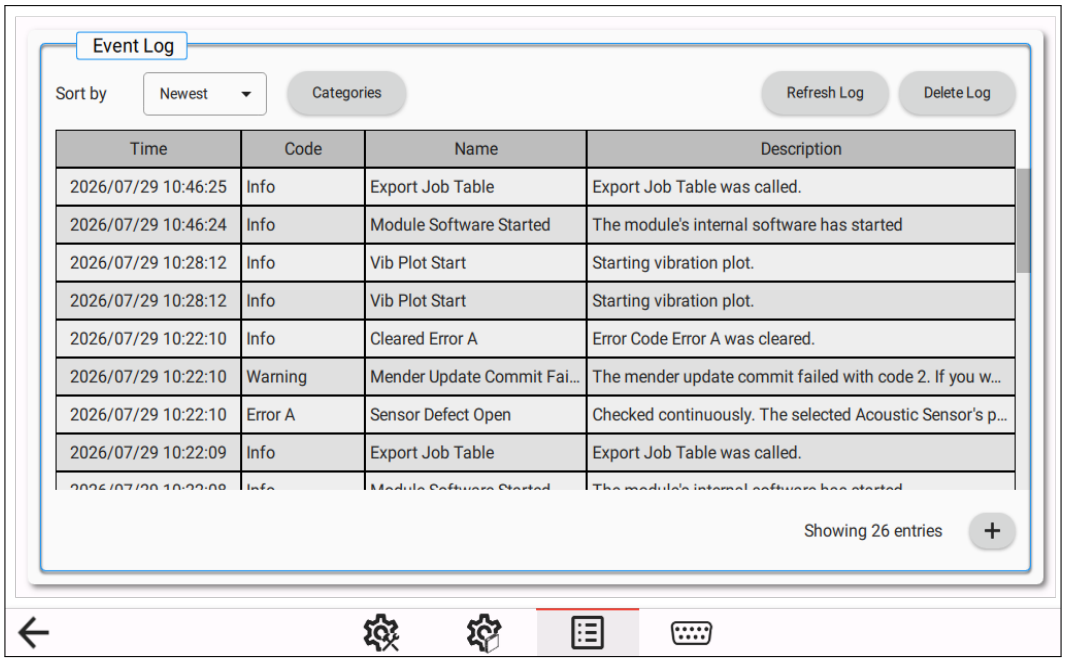
Jobs Hidden



Show All active

4.2 Event Log

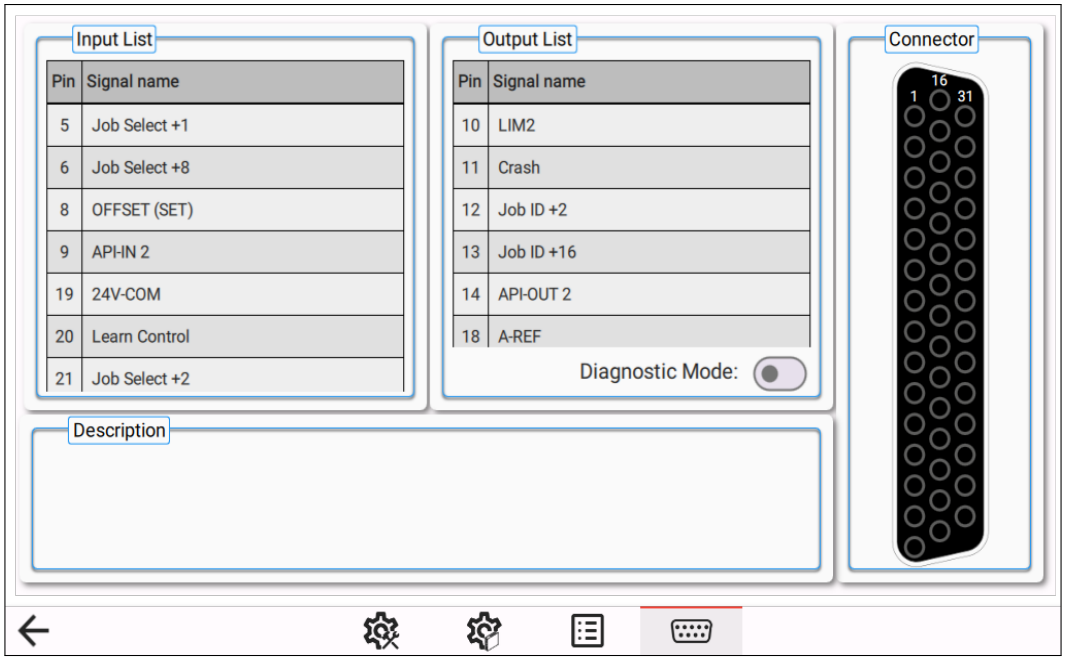
Shows historical data stored on the module. Last 100 entries provided. Additional entries can be viewed by pressing the + button in the lower right corner of the screen. Entries are sortable and can be filtered by their code type. Codes include Info, Warning, Error, and Debug. Clicking on any line will show more information. Clicking on the Refresh log button will refresh this page with the most up to date logs.



4.3 I/O Diagnostics

Shows a list of all inputs and outputs on the AEMS Hardwire I/O interface. A filled green circle indicates the input is being activated, or the output is in an activated state. Entering Diagnostic Mode through the switch at the bottom of the Outputs group allows the operator to manually force a given output pin into an active state for testing connection function with the grinding machine.

Selecting any input/output provides more information in the description box and highlights that pin on the connector image for visual identification.



5 Hardwire Interface

Interfacing the SBS 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-44 connector. It is left to the operator to supply the necessary interface hardware.

When designing an interface for the SBS System, it is important to understand that the grinding machine's controller must operate the SBS System. It is not possible for the SBS System to control the grinding machine.

Carefully read this entire manual before attempting to interface the SBS System with any machine controller.

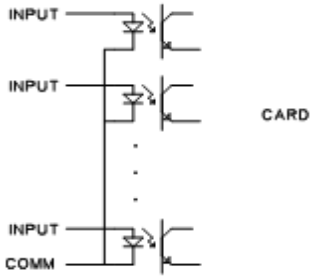
5.1 Digital Supply



An external 24 Volt supply must be connected between I/O common negative (Pin 19) and positive terminals (Pin 30) for the Digital outputs to operate.

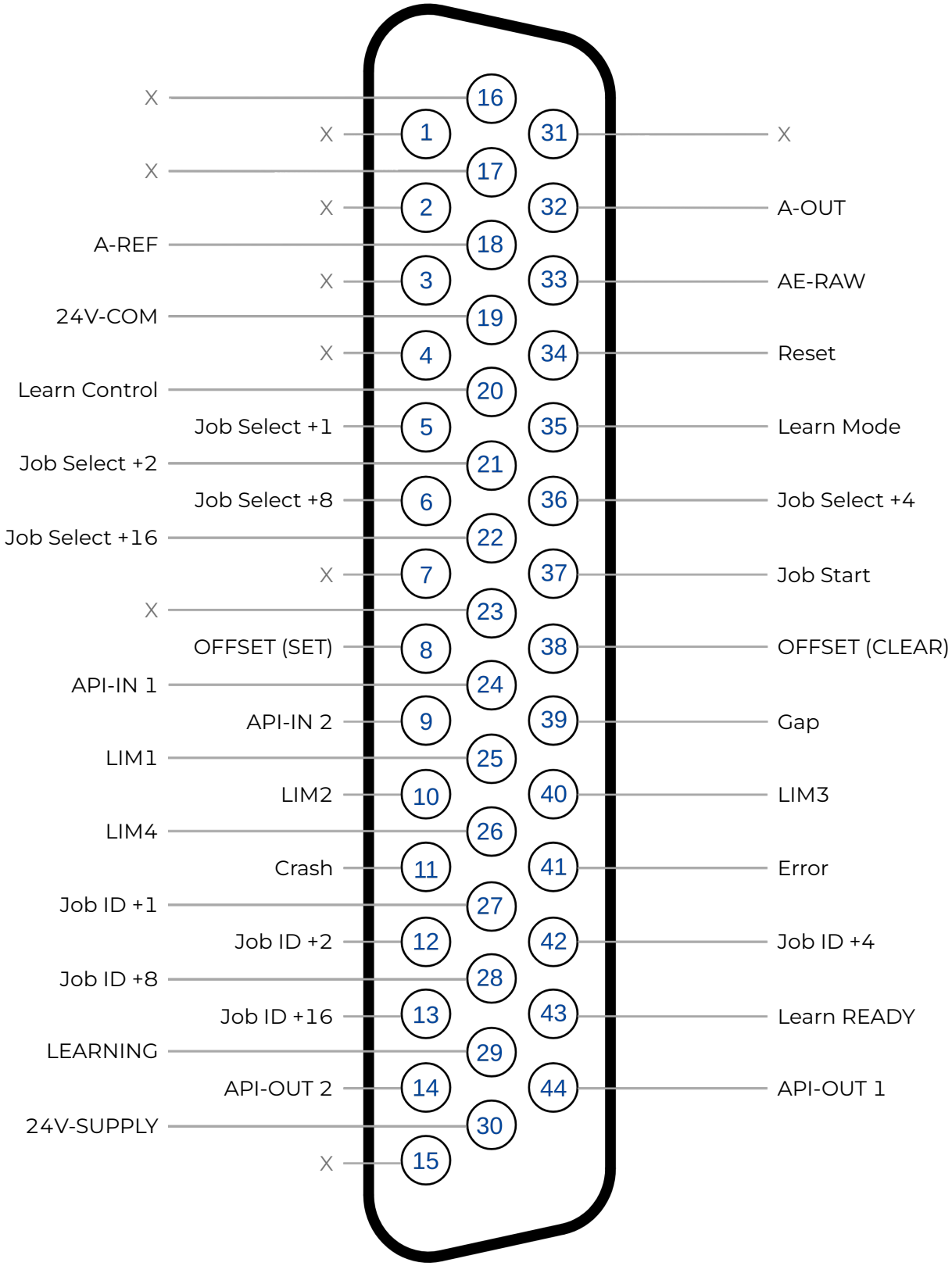
30	24V-SUPPLY	20–28 VDC supply for operation of CNC I/O
19	24V-COM	Reference ground for pin 30.

The Digital IO inputs consist of sixteen transistors with 500 V optical isolation from the system. Each is activated during the application of +24 VDC on its pin relative to the external common pin. Activating the inputs requires 5 mA at a voltage between +18 VDC and 28 VDC. The switching time is less than 1 ms. TTL or other logic-level conversion of input signals will require an external circuit powered by an external logic power supply.

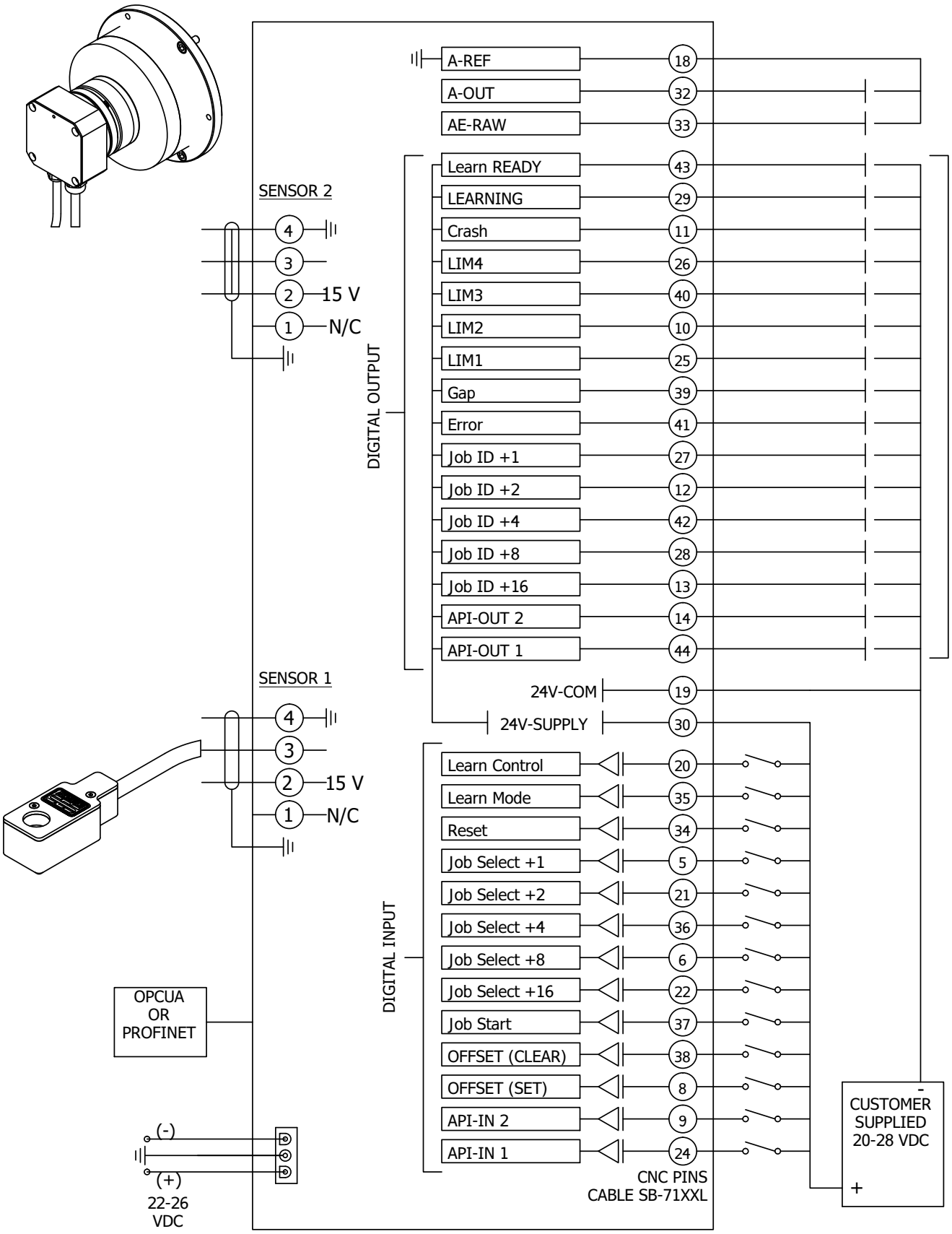


Unidentified pins are reserved for future use.

5.2 CNC DB-44 Pinout

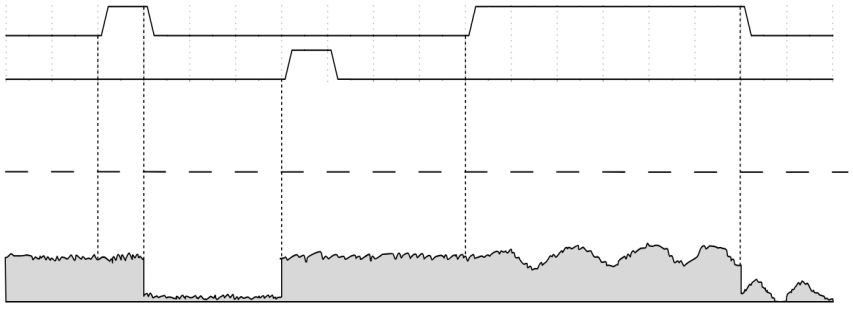


X = Reserved for future use


A-REF
A-OUT
AE-RAW
Learn READY
LEARNING
Crash
LIM4
LIM3
LIM2
LIM1
Gap
Error
Job ID +1
Job ID +2
Job ID +4
Job ID +8
Job ID +16
API-OUT 2
API-OUT 1
18
32
33
43
29
11
26
40
10
25
39
41
27
12
42
28
13
14
44
DIGITAL OUTPUT
SENSOR 2
4
3
2
15 V
1
N/C
SENSOR 1
24V-COM
19
24V-SUPPLY
30
Learn Control
Learn Mode
Reset
Job Select +1
Job Select +2
Job Select +4
Job Select +8
Job Select +16
Job Start
OFFSET (CLEAR)
OFFSET (SET)
API-IN 2
API-IN 1
20
35
34
5
21
36
6
22
37
38
8
9
24
DIGITAL INPUT
CNC PINS
CABLE SB-71XXL
OPCUA
OR
PROFINET
(-)
(+)
22-26
VDC
CUSTOMER
SUPPLIED
20-28 VDC
-
+

5.3 Input Pin Names and Functions

Pin#	Name	ACTIVE	Description
24	API-IN 1	HIGH	Reserved for future use.
9	API-IN 2	HIGH	Reserved for future use.

8	OFFSET (SET)	HIGH	Monitors AE Signal values while active. Upon deactivation, lowest observed AE signal value is set as Signal Offset value.
38	OFFSET (CLEAR)	HIGH	Resets Signal Offset value to 0%.
OFFSET (SET) OFFSET (CLEAR) LIMIT AE SIGNAL			

37	Job Start	HIGH	Sets the active job to match the sum of the Job Set Inputs on the rising edge of the input. Deactivating the input does not stop the job. A Job value of 0 (zero) does nothing.
22	Job Select +16	HIGH	The Job number is the sum of the values of the active Job Select bits. For example, activate Job Select bits +4 and +2 to start Job 6, or activate Job Select bits +1 and +8 to start Job 9.
6	Job Select +8	HIGH	
36	Job Select +4	HIGH	

JOB SELECT INPUTS					
+16	+8	+4	+2	+1	Job Value
0	0	0	0	0	Nothing
0	0	0	0	1	1
0	0	0	1	1	3
1	0	0	0	1	17
1	1	1	1	1	31

Pin#	Name	ACTIVE	Description
21	Job Select +2	HIGH	Jobs 1–31 may be activated through this interface.
5	Job Select +1	HIGH	

34	Reset	HIGH	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.
35	Learn Mode	HIGH	Activates AEMS Learn Cycle through Hardwire Interface. Successful activation will activate Learning Output (Pin 29). Must be held active while Learn Cycle is in process. Deactivation before a complete Learn Cycle cancels the process.
20	Learn Control	HIGH	Initiates the signal capture process for Work Pass then Air Pass when Learn Cycle is being operated through the hardwire interface. AE signal is captured while the input is active and stops when deactivated. After Work and Air passes have been captured, activation will change the parameters associated with a Learn Cycle. Activation of this input does nothing if output pin 29 (Learning) is not active.

5.4 Output Pin Names and Functions

44	API-OUT 1	HIGH	Reserved for future use.
14	API-OUT 2	HIGH	Reserved for future use.

13	Job ID +16	HIGH	The active Job number is the sum of the values of the active Job ID bits. For example, active Job ID bits +4 and +2 indicate that Job 6 is running, while active Job ID bits +1 and +8 indicate Job 9. Jobs 1–30 may be identified through this interface.
28	Job ID +8	HIGH	
42	Job ID +4	HIGH	
12	Job ID +2	HIGH	
27	Job ID +1	HIGH	

JOB ID Outputs					
+16	+8	+4	+2	+1	Job Value
0	0	0	0	0	>31 / OFF
0	0	0	0	1	1
0	0	0	1	1	3
1	0	0	0	1	17
1	1	1	1	1	31

41	Error	LOW	Activates whenever an error condition exists in AEMS control, or the control loses power. When Crash Latch setting is ON, a Crash condition will also activate this pin along with the Crash output pin. Activating the Reset input (Pin 34) will clear any Crash condition, but will not remove other system errors if they exist.

39	Gap	LOW	Activates when the AE signal level exceeds the setting value. Deactivates when the AE signal level drops below the setting value, unless total active time is less than the Active Time Parameter, in which case it will remain active until the Active Time minimum has been achieved.
25	LIM1	LOW	Same behavior as GAP.
10	LIM2	LOW	Same behavior as GAP.
40	LIM3	LOW	Same behavior as GAP.
26	LIM4	LOW	Same behavior as GAP.
11	Crash	LOW	If Crash Latch parameter is OFF, same behavior as Gap. If Crash Latch parameter is ON, activates when the AE signal exceeds the Crash setting value. It must be deactivated by the operator through SB-6500 Software or by activating the RESET input (34) on the Hardwire interface.

29	LEARNING	HIGH	Activates when AEMS is running a Learn Cycle.

43	Learn READY	HIGH	When performing a Learn Cycle through the Hardwire Interface, activation indicates that AEMS is prepared for the next step in the process. It can only activate while LEARNING (pin 29) is also active. In a successful Learn Cycle, it will activate three times: **First Activation**: Ready to record WORK Pass. **Second Activation**: Ready to record AIR pass. **Third Activation**: At least one frequency with a Work/Air ratio of 1.2 or greater was found. Ready to save parameters into the active Job. See the Learn Cycle section for parameters changed. Note: Performing a Learn Cycle through the Hardwire interface is an interactive process between AEMS and the machine control. If the third activation of the Ready output does not occur, AEMS may not have identified a good frequency, or the expected process may not have been followed accurately. In this case, operate the Learn Cycle through the SB-6500 software interface.

32	A-OUT	OTHER	Analog signal output (0–10V, 2mA max.) is referenced to SUP-COM. The signal is not calibrated. It is scaled so that 9.7V is fixed to the Crash value of AEMS. Changing gain or crash parameters, whether manually, through changing Jobs, or through a Learn Cycle, can change the scaling of this output. Referenced against pin 18, A-REF.
33	AE-RAW	OTHER	Unfiltered signal from the active AE sensor in use. Referenced against pin 18, A-REF.
18	A-REF	OTHER	Non-Isolated Ground Reference for use with Analog Outputs.

6 OPC UA Interface

In addition to the hardwire interface, each SBS control module provides an OPC UA server over its Ethernet connection. A machine controller, PLC, or other OPC UA client can use this server to communicate with the module directly, without the SB6500-Software. The module always operates as the OPC UA server; the customer's system connects to it as the OPC UA client. For example, UaExpert from Unified Automation is a free, general-purpose OPC UA client that can be used to browse the module's data and test the connection.

The main OPC UA server always listens on port 4845. The module also runs an OPC UA discovery server on port 4840. To connect, point the OPC UA client to the module's IP address on port 4845:

```
opc.tcp://<module IP address>:4845
```

By default, the module obtains its IP address through DHCP. If no DHCP server is available, it falls back to a link-local IP address (169.254.x.x). A static IP address may be set instead if desired. The module's IP address can be viewed and changed from the Network Settings screen (see Create Machine Group).

Discovery and connection range: Module discovery in the SB6500-Software (used when creating or editing a Machine Group) only works on a single local link. Modules on the other side of a router or on a different subnet will not appear in the Available Modules list. OPC UA connections do not have this restriction. An OPC UA client can connect to a module from any network that can reach the module's IP address, provided that port 4845 is not blocked by a firewall.

7 Troubleshooting Guide

This guide is designed to help you if you experience problems with your SBS AEMS System.

7.1 Displayed Error Messages

Self-diagnostic software has been incorporated into all SB-6500 Series Control Modules. If a problem ever occurs with an SBS system, it is reported on the front panel display as an error code. Below is a listing of these error codes, a description of when the Control Unit automatically runs each test, how each code is cleared, the definition of each error message, and prescribed action to be taken by the user.

Press CLEAR or CANCEL to manually clear a displayed error message. Once an error is cleared, it will be displayed again when the error condition is next detected. To further isolate defective components a series of test operations accompany some of the error codes.

Please indicate the Error Code (letter) of any displayed Errors when returning equipment for repair. Also please provide as much detail as possible regarding the conditions when problems were encountered, and the symptoms experienced.

Error Code	Message	Definition	Action
A	SENSOR 1 DEFECT (SENSOR 2 DEFECT) OPEN – CHECK CABLE AND CONNECTORS – SEE MANUAL	Checked continuously. Acoustic Sensor 1 (2) presence not detected. This could be caused by a defective sensor or by no sensor being connected.	Clears automatically when the sensor is detected. Check sensor connections and try Power-On again. Continued error messages indicate the need to repair or replace the sensor or connecting cable.
B	SENSOR 1 DEFECT (SENSOR 2 DEFECT) SHORT – CHECK CABLE AND CONNECTORS – SEE MANUAL	Checked continuously. Acoustic Sensor 1 (2) short circuit detected.	Clears automatically. Disconnect the Control Unit from power before checking cables and connectors, and inspect the sensor for shorts. If the problem cannot be isolated, the sensor, cable, and/or Control Unit should be returned for repair.
C	ANALOG OUTPUT SIGNAL OUTPUT DAC OUT OF RANGE	Checked continuously. Analog output is out of range.	Analog output (0–10V) of the AE signal cannot track the range set by the current Gain and Crash settings. Reduce the Crash limit or Gain as needed to resolve.
D	LIMIT RELAY RELAY SET BEYOND USABLE RANGE	Checked continuously. One or more Limits are set outside the usable range.	Limits are set beyond the functional range of the hardware. 1. If the input AE signal is too high, it may overwhelm the hardware limits of the AEMS card. In this condition, selecting a different frequency band may resolve the issue. 2. Remove or reduce the zero offset. 3. Try reduced Gain.
E	+15V POWER DEFECT SHORT – CHECK CABLE AND CONNECTORS – SEE MANUAL	Checked continuously. 15V Auxiliary supply low – fuse open.	Check for shorts in Sensor and CNC cables and connectors and re-initialize the system. If the error persists, return the Control Unit and cables for repair. If the SBS system is connected to a CNC controller, verify that the CNC cable is free of electrical shorts. The CNC cable is not supplied with the SBS system, and repair is the responsibility of the user.

Error Code	Message	Definition	Action
F	Crash CONDITION	Checked continuously. Unit has measured an acoustic signal exceeding the set Crash limit.	Cleared manually by pressing the “Clear” button or by CNC RESET. Check for a part crash. Reset the error.
G	CIRCUIT FAILURE UNABLE TO MEASURE AE SIGNAL SEE MANUAL	Checked continuously. Signal acquisition circuit failed.	Clears automatically. No action is required other than clearing it manually from the screen. If the problem persists, the Control Unit should be returned for repair.

7.2 Updating the SB6550 without the SB6500-Software

To update without using the user interface, place the update file for the display in the root directory on a FAT32-formatted USB drive and change the file extension from ".disp" to ".mender" (i.e. "updateFileName.mender"). While the display is powered, insert the USB drive into the front USB-C port of the display. The display will update. Do not remove the USB drive until after completion.

8 Support

For support, contact the machine builder or SBS at:

Accretech SBS, Inc.
2261 NW 28th Avenue
Portland, Oregon 97210 USA

Tel.: +1 503.595.4270
Fax: +1 503.595.4271
CustomerService@accretechSBS.com
https://accretechsbs.com/

9 Appendices

9.1 Appendix A: Specifications

Physical Features
Battery life (clock): 10 years
Service life – 10 years
SB-5500 Compatible
Operates with existing cables and sensors.
Interface adapter required to use SB-5500 hardwire cable.

Communication Interfaces
Ethernet TCP/IP (OPC UA), Profinet DP, CNC/PLC Hardwire Interface (opto-isolated outputs)

Power Supply
Input 22 VDC to 26 VDC. 0.9A max at 22 VDC. Reverse voltage protected.
Connector: Phoenix Contact 1952034 or Eq.

44 Pin DSUB Connector Interface
CNC Digital Inputs and Outputs:
opto-isolated from system signals to at least
500V.
Requires common external 24VDC supply.
Outputs:
active: drive up to 50 mA per output
inactive: high impedance down to -30 V referenced to the common.
Require flyback protection when driving coil.
Inputs:
-3VDC to 30VDC absolute max range.
Inputs are active with +18V to 30V DC applied relative to common
active inputs draw 5mA @ 24V (4.8mA to 5.2mA).
Inputs are inactive with -3VDC to +5VDC applied relative to common.

Environmental and Installation
SB-6522/6522-8
Pollution degree 2
Installation category I
IP30
Environmental temperature range:
5°C to +55°C

SB-6500 Minimum Networking Requirements
Ethernet CAT6 shielded cable.
100Mbit/s unmanaged switch.

SB-6500 Software Minimum Computer System Requirements
- Processor (CPU): 2.8 GHz
- Memory: 8GB RAM
- Storage: 200MB
- Operating System: Windows 11 (x64), Windows 10 (x64) version 22H2, or Windows 10 Enterprise 2018 (x64) or newer.
- OS must be 64 bit.
- Graphics: 4GB Video Memory with 128MB VRAM

SB-6500 Software Features
Multi-language Capability
English, Japanese, Chinese Simplified, Chinese Traditional, Slovak, Czech, German, Polish, Turkish, French

9.2 Appendix B: Replacement Parts List

PN	Description
AE Sensors and Cables	
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

Replacement sensors and cables can be identified by product tags on the product. Contact SBS for further information.

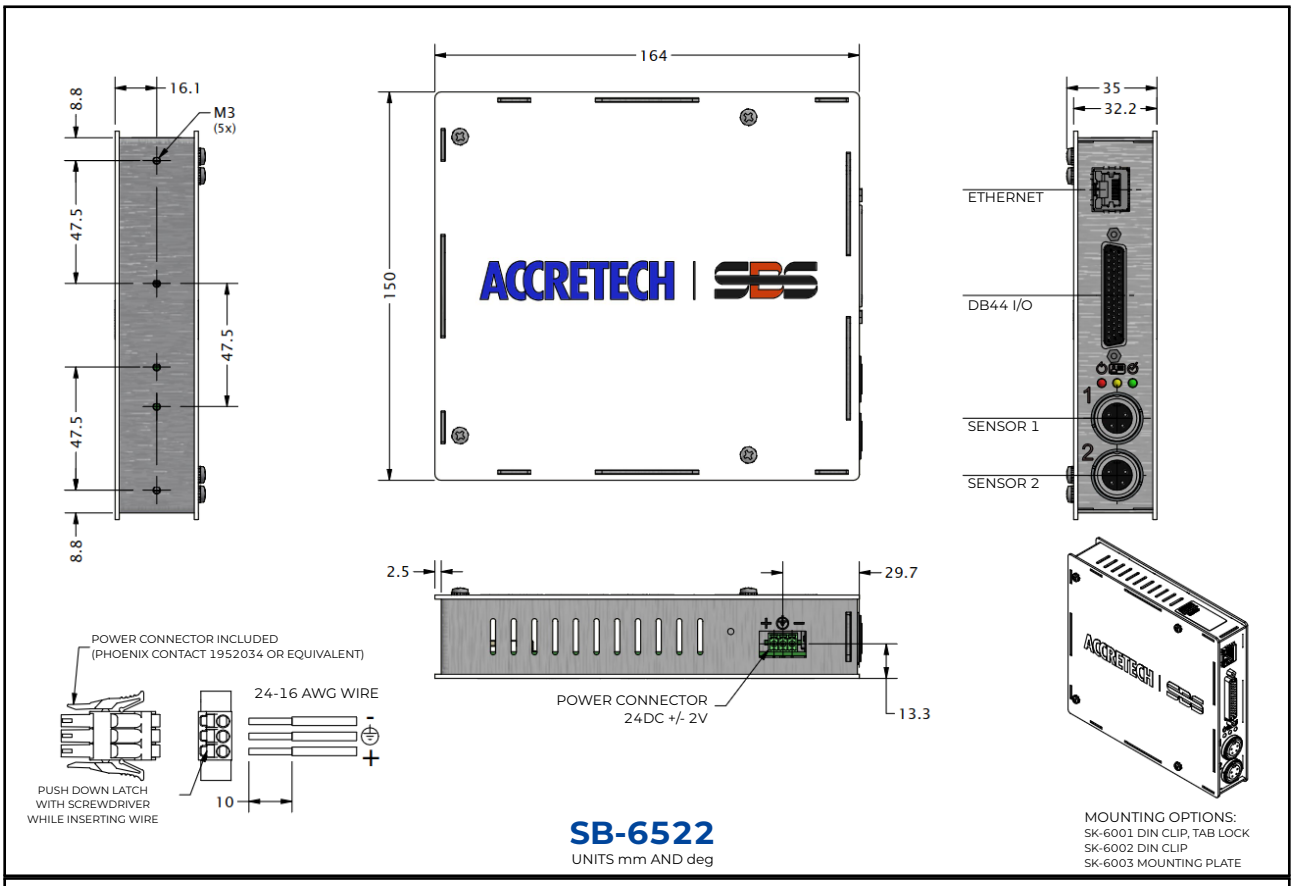
Control Mounting Options	
SK-6001	DIN rail mount clip: pull tab release
SK-6002	DIN rail mount clip: pivot release
SK-6003	Control Module mounting plate kit

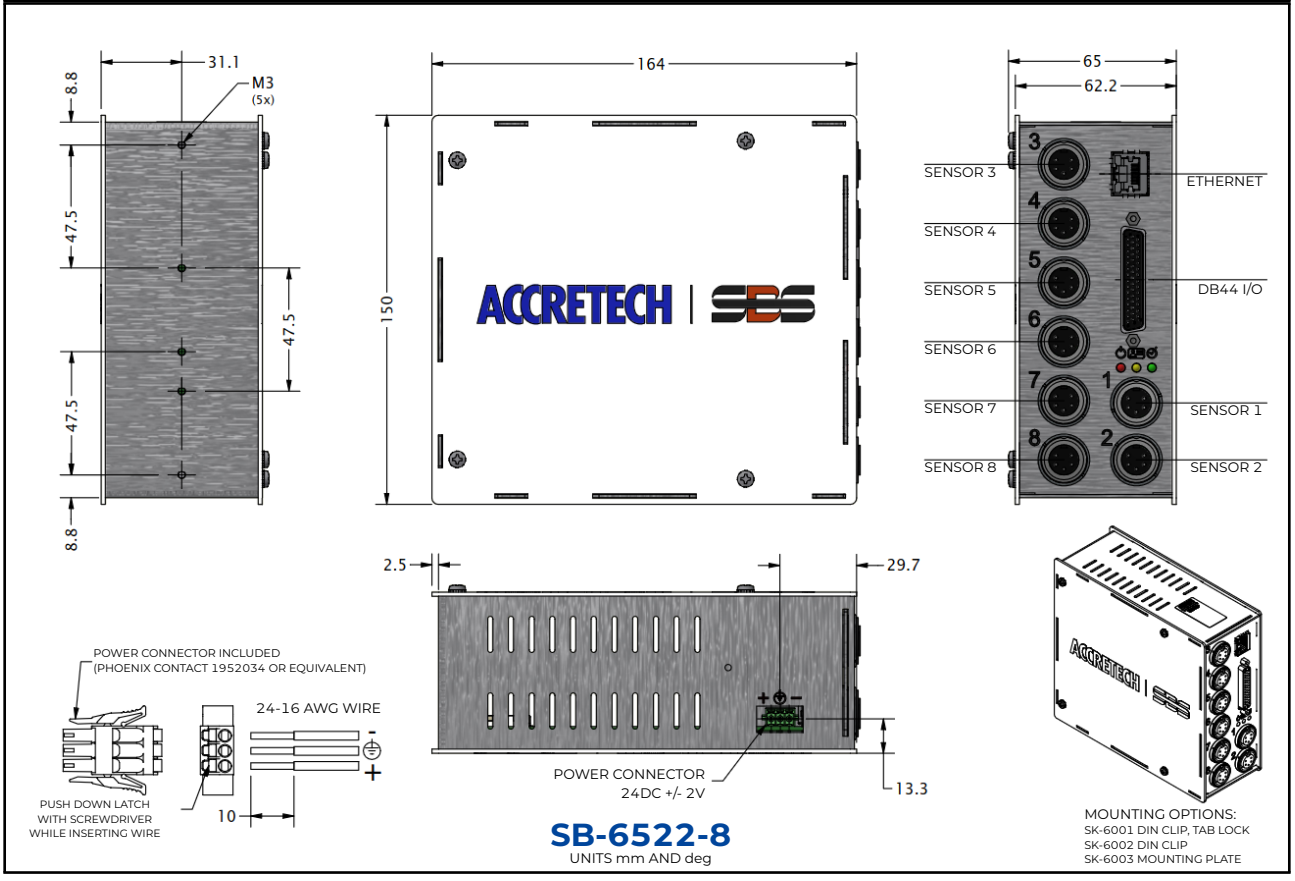
Other Parts	
ED-0218	Power Supply Connector
ED-0154	Replacement Battery CR2032

xx in P/N = cable length in feet

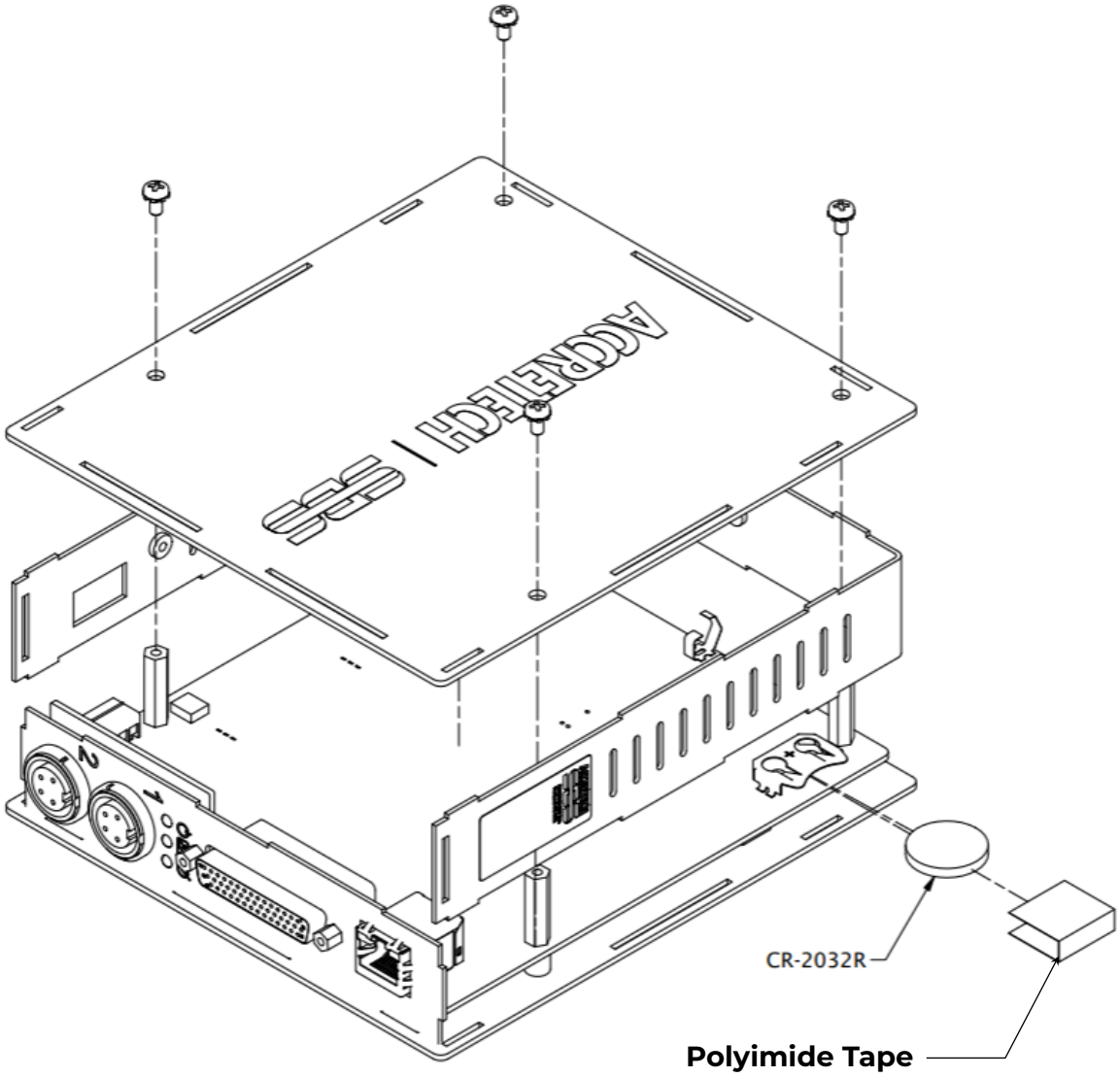
Standard options 11 [3.5m], 20 [6m], or 40 [12m], e.g. SB-4211 = 11ft [3.5m]

9.3 Appendix C: Mechanical Drawings





9.4 Appendix D: Battery Replacement

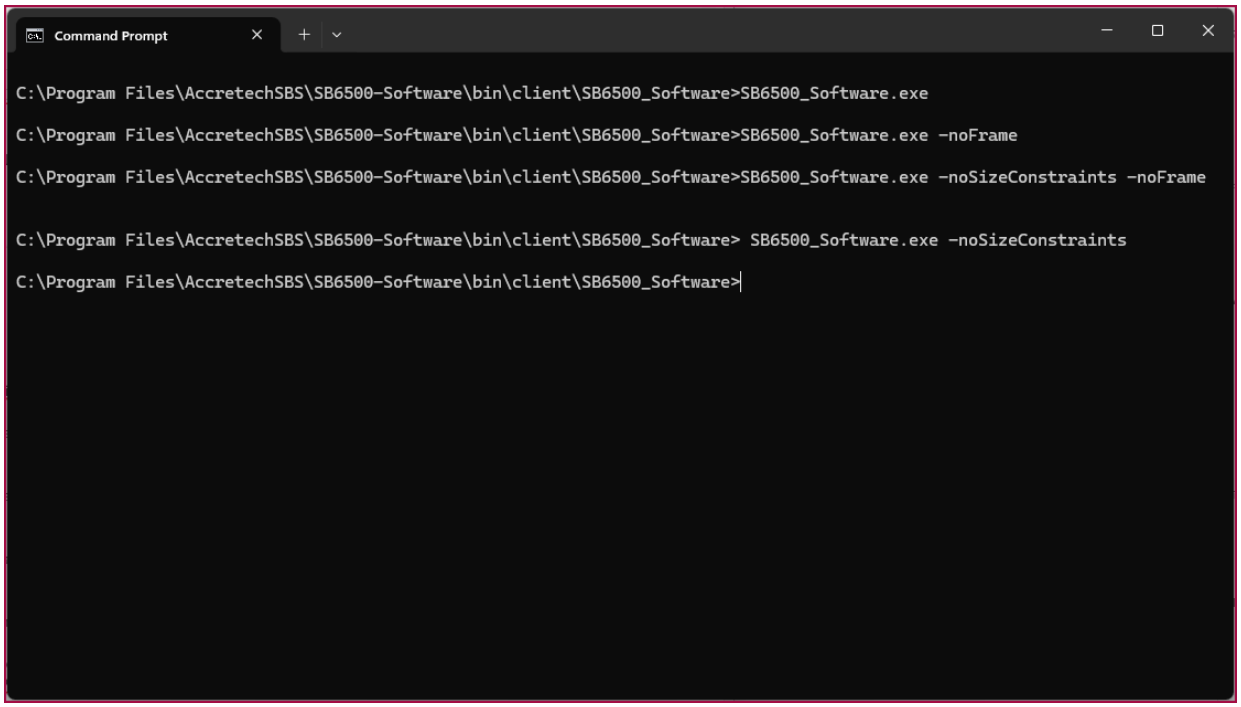


9.5 Appendix E: Command Line Options

If launching the SB-6500 Software from Command Prompt, the following options are available:

-noFrame	Removes the window frame
-alwaysOnTop	Sets the SB-6500 Software to always stay on top of other applications
-ipc	Activates -noFrame, -noAutoPos, -noAutoSize, and -noSizeConstraints
-noAutoPos	Disables the SB-6500 Software using the settings or passed in arguments to automatically position the window. This positioning code occurs after program launch, and this would be needed to manually set a position through other means.
-noAutoSize	Disables the SB-6500 Software using the settings or passed in arguments to automatically size the window. This sizing code occurs after program launch, and this would be needed to manually set a size through other means.
-noSizeConstraints	Removes the SB-6500 Software's size constraints, allowing its window to be resized by clicking and dragging or by setting a width and height through other means.
-fullscreen	Sets the SB-6500 Software to run in full screen. This disables the window frame as well and runs the SB-6500 Software taking up the entire space.
-pos	Followed immediately by 2 values, this sets the SB-6500 Software's position to the values passed directly after this. Example: -pos 400 500 would put the SB-6500 Software's upper-left corner at the coordinates x=400, y=500. Does not work if -noAutoPos is on.
-width	Followed immediately by a value, this sets the SB-6500 Software's width to the passed value in pixels. Note: Requires -noSizeConstraints to work. Does not work if -noAutoSize is on.
-height	Followed immediately by a value, this sets the SB-6500 Software's height to the passed value in pixels. Note: Requires -noSizeConstraints to work. Does not work if -noAutoSize is on.

Example:



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MODELS COVERED IN THIS MANUAL

SB-6522 | SB-6522-8

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BUILT WORLDWIDE.

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