Installation & Operation Manual

Contents

SAWADD™ Installation Manual

Introduction

SawADD turns the bottom guide into a force sensor, with a range greater than what would be seen when sawing within deviation limits. The resolution of SawADD is a thousand increments just in the range of deviation limits. This means it can measure the forces on the saw that steer it into deviation, allowing for a corrective action to stop it. The earlier detection allows for a substantially higher chance of corrective action. Keep in mind, SawADD measures the force that drives deviation, before actual deviation occurs.

Another SawADD innovation is the use of two force sensors per guide holder. One on the leading edge and one on the trailing edge of the guide block. This allows the differential of the two sensors to provide a normalizing of the deviation force measurement or common mode rejection. This allows a gain to be applied for an even faster response. The two sensors also provide a more accurate measurement of the bandmill strain and the percent of strain on the tire line of the saw. These additional diagnostics will help in determining the health of the bandsaw blade and the bandmill strain.

The advancement of the new SawADD technology compared to the old technology makes the difference needed to close the loop for quality control. The old upper guide proximity sensors measure the displacement of the saw blade proximate to the point where a tooth enters the cut. However, any displacement of the saw blade at the top of the cut is preceded by a change in lateral force at the bottom of the cut. Displacement of the blade inherently cannot occur until the tooth has sawn through the cut. Therefore, displacement measurements made above the cut are, "trailing" or, "lagging" measurements.

Lagging signals are inadequate for closed loop control of velocity, particularly at higher feed speed where incipient deviation occurs in microseconds. Thus, all the upper guide systems are ineffective in supporting a rigorous log size control program for optimal yields per log. Only SawADD will react in time to save deviation from occurring and thus is the only Anti Deviation system available today.

Patent Numbers

AU 2014360100

CA 2931545

CL   201900413

EU 3077153

NZ 721991

US 10,245,660

US 10,369,643

Preparation

Saw ADD LLC will provide:

1. The SawADD guide holders built to the same dimensions as your current guide holders, or within acceptable adjustments in size. They are to receive the guide blocks of your choice.
2. Sensors and drivers with 0 to 10-volt output.
3. If required for performance, a ControlLogix PLC with 80 series processor and IO.
4. Saw ADD PLC program and HMI display installation and startup assistance.

Our customer will provide:

1. Dimensional drawing, or sketch of existing guide holder.
2. Four high speed analog input channels for a Twin and 8 for a Quad with RTS of 1 ms (to the PLC that is controlling the log feed speed and in a high-speed task of less than 10ms update).

3. Three twisted-pair shielded signal wires in conduit from the PLC analog inputs to a J-box, to be mounted on each saw within eight feet of the lower saw guide.
4. A J-box on each saw, large enough to hold 2 of the 5x4.5x1 inch din rail mounting sensor driver modules.
5. Half inch flexible conduit (max 8 ft. length), to each lower guide from the J-boxes and pulling in the sensor cable with prewired connector to the sensor drivers.
6. Mounting of the SawADD guides, which may require welding a new sub-base to the band mills.

7. Sufficient drive horsepower and braking capacity (braking resistors or regen), to decelerate the log feed at a rate of 150 inches per second squared.
8. If required, mounting and wiring a ControlLogix PLC in a 1756-A7 chassis for SawADD.

The installation can be done in one weekend. Installation will require removal of existing guides, welding new guide sub-bases, guide alignment, mounting J-boxes, and electrical termination.

Mounting the electrical J-boxes, ControlLogix PLC, and the conduit can be accomplished in advance.

SAWADD™ Installation Manual

Guide Installation

The installation includes removal of the existing guide holder, then may require welding the SAWADD™ guide holder sub-base in its place. The procedures should be followed closely to prevent any problems with operation of SawADD.

The SAWADD™ guide holder may be provided with a sub-base for welding to the bandmill frame so that the heat from the welding is not transferred to the stress-relieved guide holder. If a bolt in replacement is provided, then skip to 5.

1. Position the SAWADD™ guide holder on the bandmill as close as possible to final position, while bolted to the sub-base, and tight against the alignment lip on the sub-base.
2. Tack weld the sub-base or mounting bracket in place.
3. Remove the guide holder by unbolting it from the sub-base.
4. Stitch weld the sub-base solid by alternating sides to prevent any distortion of the sub-base.
5. Replace the guide holder, tightly against the alignment lip or face if a sub-base is used, and bolt in place.
6. A final alignment to the feed mechanism should be done by the filers with laser alignment equipment.
7. If bolting to existing holes in bandmill base, then use gibbing to hold guide in place.

The guide holder should be ready for mounting the SAWADD™ sensor assemblies if not shipped with sensors mounted.

PLC Interface

The PLC interface requires an analog input module that will accept 0 - 10 volt or 0 – 20 ma. The analog input module should have 4 channels, be capable of an RTS (Real Time Sample rate) of 2 milliseconds or less, and an RTI (Real Time Interval) communications with the Processor of 5 milliseconds or less. The ControlLogix 1756-IF4FXOF2F or the Flex module 1794-IF4I will provide the fast analog update. The 1756-IF4FXOF2F is preferred.

The J-boxes should be pre-mounted within 8 feet of conduit to the lower guide, and DIN rail mounted in it for two 5" deep by 4.5" high by 1" wide sensor drivers. The sensor cable plugs into the front of the module, requiring a total of 5 inches of depth. The sensor cable will be pulled from the guide to the J-box.

SAWADD™ Installation Manual
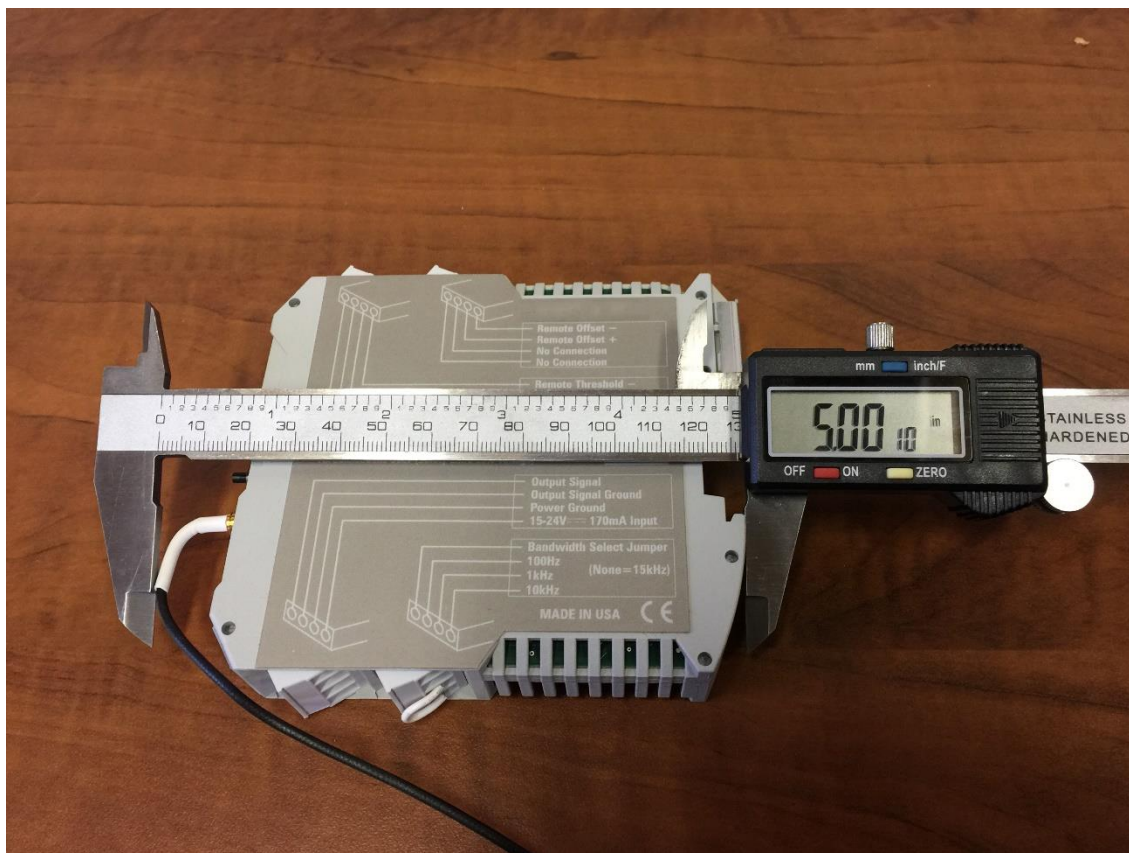
If the distance from the J-box to the PLC analog input is more than 200 feet or not in its own conduit, then a voltage to current converter is recommended but will cause a considerable delay and should not be used if not necessary.

A very convenient converter that is DIN mounted, 24 volts, and about the same size as the driver module, is the Phoenix Contact model MCR-C-UI-UI-DCI, however it will have a lag time of 10ms. The part number for pre-configuration is 2810913/IN03/OUT01/NONE.

A twisted shielded signal pair will be connected from the driver modules (2 per saw) or the converter modules to each PLC analog input. The shield should be grounded at the PLC. A third pair will be used for 24 volt DC to power the modules.

Wiring on the analog modules may be different for current than voltage signal as it is with the ControlLogix 1756-IF4FXOF2F fast analog module.

Sensor Mounting & Adjustment

The guide holder will normally come with the probes mounted and targets adjusted. To replace the probe the target will need to be backed out then the probe unscrewed from in the slot with the thin 11/16 wrench provided. Then the new probe can be mounted to the SawADD guide holder, and the target adjusted into the measurement range.

1. The probe assembly will consist of a threaded body with a hex on the sensor end and a pigtail connector on the threaded end.
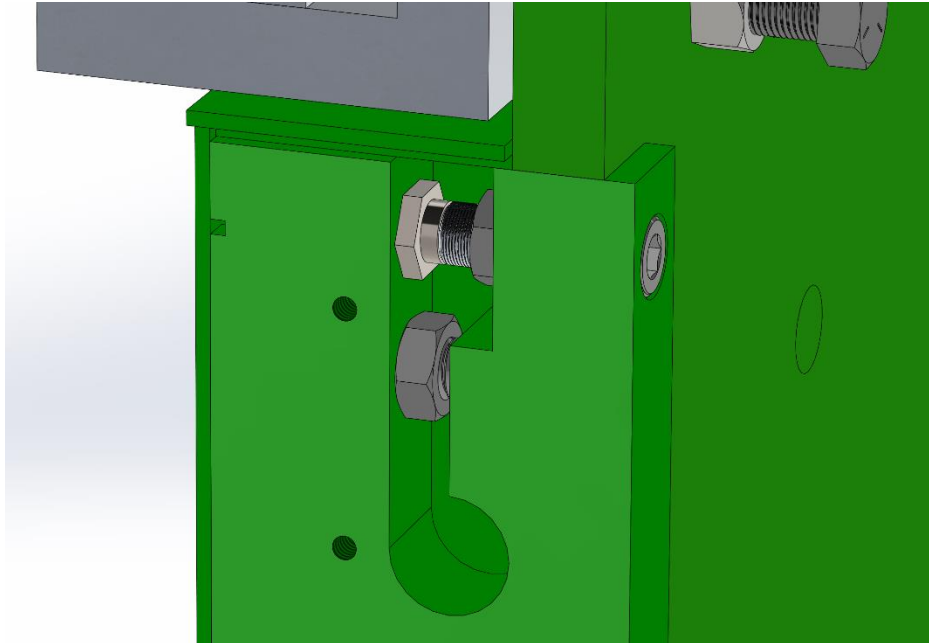
2. Apply blue Loctite and assemble the threaded body sensor into the half inch threaded hole in the open end of the slot in the side of the guide holder and gently tighten down. Caution, excess tightening of the sensor will stretch it out of calibration. The sensor pigtail will need to be pulled through to the inside of the SawADD.

3. Pull the sensor cable and a signal pair through conduit into the driver junction box. Plug the sensor cable into the driver module. Put the twisted pair on the screw terminals for the driver voltage output, along with the signal cable to the PLC analog input or converter module. The twisted pair to the guide will be used with a voltmeter to adjust the sensor into range at the guide and then capped off.

4. Power up the driver 24-volt DC supply, and the near or far LED on the driver module should illuminate red.

5. Connect a DC voltmeter to the twisted pair with probe clips (connected to the driver output voltage from step 3).

6. With the bandmill strain down, apply blue Loctite and install the threaded cylinder target until the voltage reading is between 2.5 and 3.0 volts for direct acting sensors and 7.0 and 7.5 for reverse acting sensors. The gap between the sensor and target will be between 8 and 10 Thousandths of an inch. Be aware that the voltage may wraparound to 10 volts when the target is touching the sensor. While backing off the reading will drop to zero and then begin to climb again.

7. Apply blue Loctite to the target and locking nut threads and gently lock down the target adjustment (shown here without the side plate on) with the locking nut, using the two supplied wrenches (1/4-inch Allen and 11/16-inch open end), while watching the meter to keep the reading as described above. Caution, the target threads are extra fine aluminum and can be stripped very easily.

The bottom surface of the guide holder is machined very flat and if the bandmill mounting surface is also very flat then no field

adjustment will be necessary on installation. In some cases, if the bandmill surface is not flat when the guide holder is bolted down to the bandmill the guide holder will be deflected enough to move the sensor out of range. In this case the steps 5 through 7 above will need to be done to put the sensor back into range.

An adjustable hard stop travel limit is incorporated with a setscrew and jamb nut on reverse acting guide holders (decreasing distance between target and probe with increasing guide pressure) to protect the sensor probe. It is factory set to allow approximately 0.005 inches of clearance toward the probe. After mounting the clearance should be checked with a feeler gauge. If it is less than 0.003 or greater than 0.007 inches after the guide holder is bolted down, then it will need to be re-adjusted with a feeler gauge. On direct acting guide holders, a hard stop may be incorporated with a very small slot on the compression side on the guide holder which will not require an adjustment.

Configuration & Scaling

The scaling of the analog input can be done by the PLC module properties input configuration if using the ControlLogix 1756 module. A window from RSLogix 5000, Input Configuration is shown below.
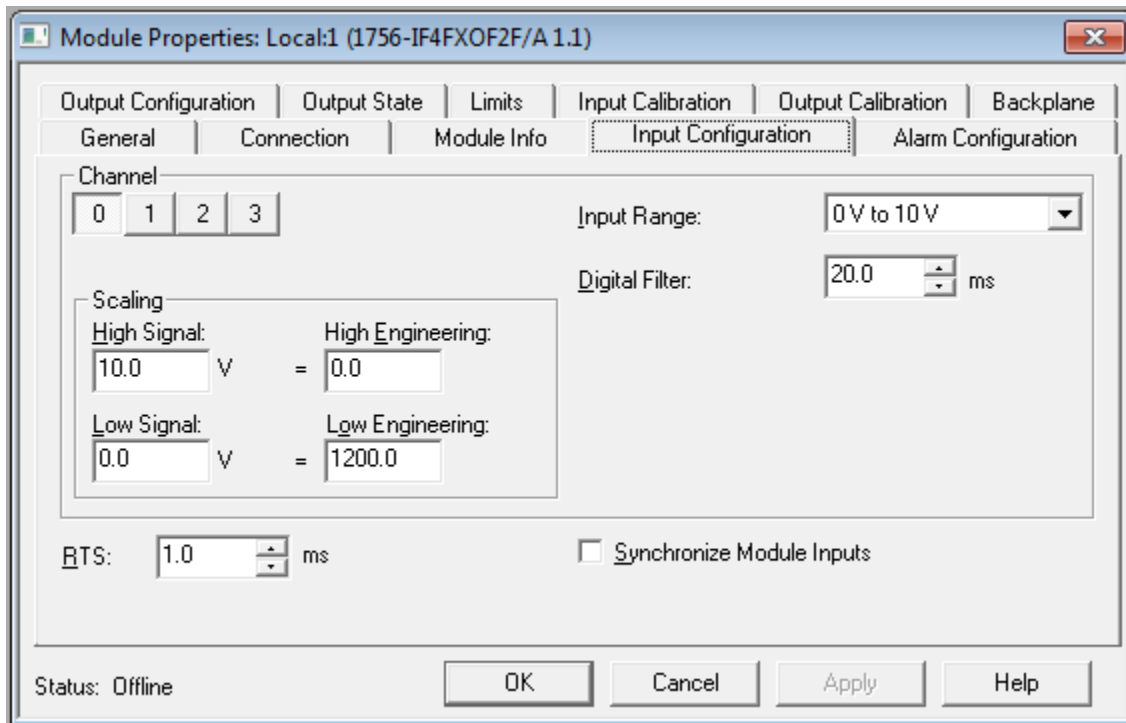
- In some cases, the distance to the controller will require a voltage to current converter, and the input range, be set for 0 ma to 20 ma.
- The Scaling of the input range is to engineering units of pound force on the guide. On reverse acting sensor configuration the engineering units are inverted by the High Engineering units set to 0.0, and the Low set to a number that is determined by the design and factory calibration of the guide holder and should not be changed. In the screen shot above it was set to 1200.0 but could be as low as 600 and as high as 2000.

- The RTS should be set as low as the module will achieve. This will allow the Digital Filter of as much as 60.0 ms, to provide some smoothing.

In the Connection tab of the configuration, the RTI should be set at least as fast as the periodic task that the SawADD program is running in. That way, the data is freshed each time the program is executed.


SAWADD™ Installation Manual
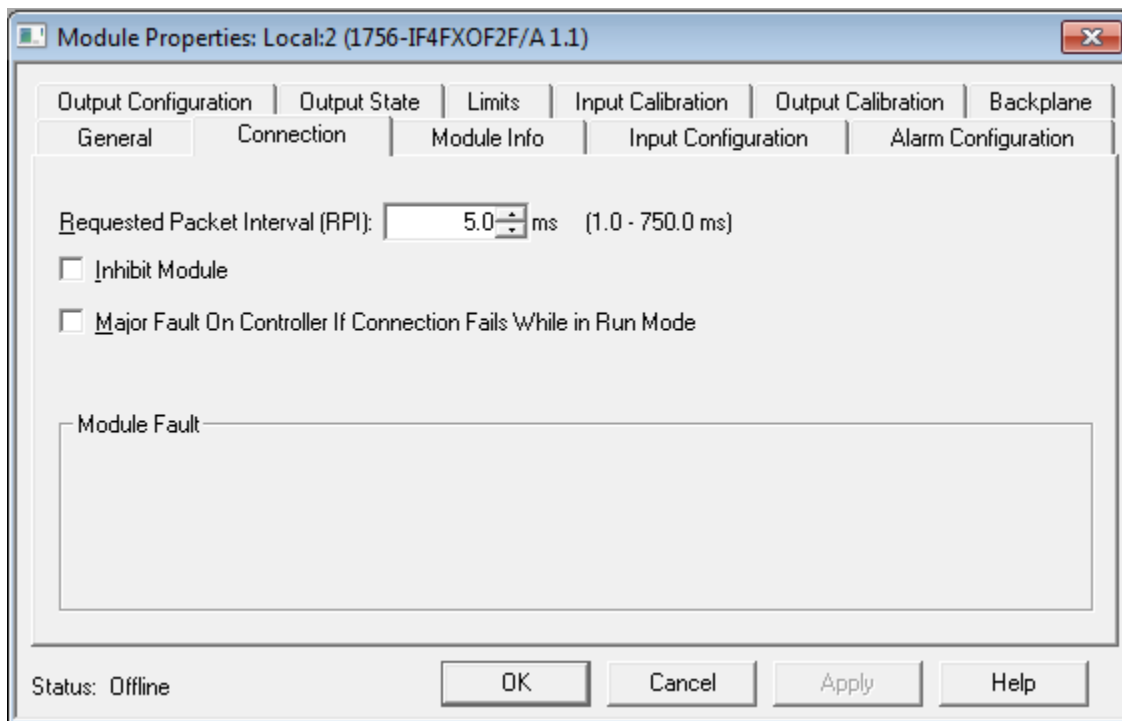
PLC Program

A PLC program for SawADD is provided in ControlLogix Ladder format. The program should be put in a Periodic Task, with an update of 5ms and a high priority.
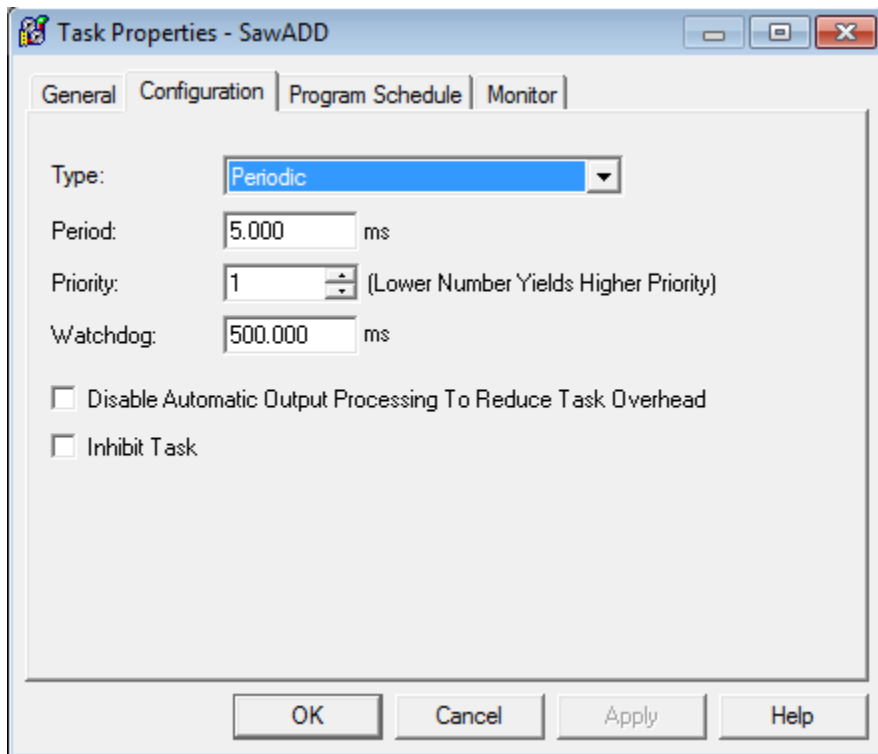

The SawADD program will be supplied in an .LK5 format to be imported into the SawADD Periodic task. Right click on the SawADD task to import the program.


SAWADD™ Installation Manual
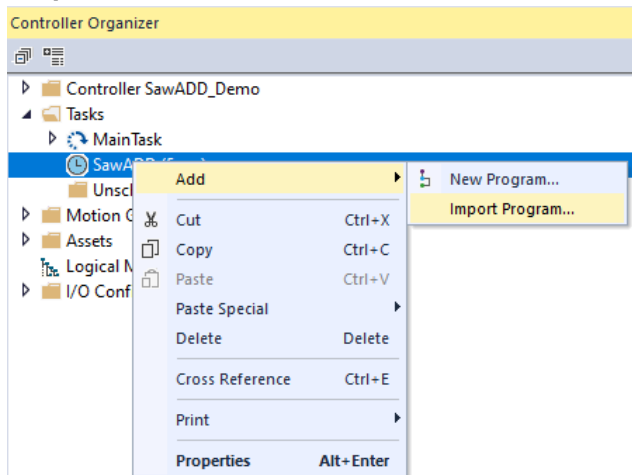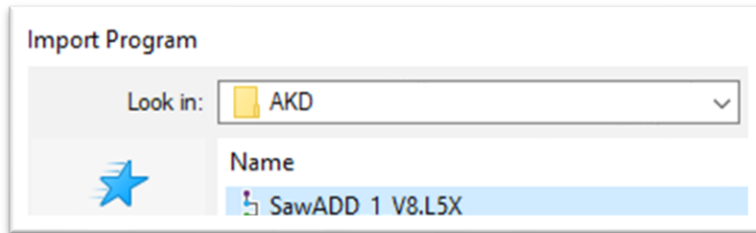
A program in .LK5 format is provided that works for each of the Twin bandmills. The program has program local tags so that it can be imported for each twin and function as two separate programs for a Quad. The one for saws 1 and 2 should be named SawADD_1 and a second for saws 3 and 4 as SawADD_2. A routine called Inputs, in each of the programs, is where the physical inputs and control tags associated with each of the twins will have controller tags needed to resolve inputs unique to each twin. You will need to import the program with

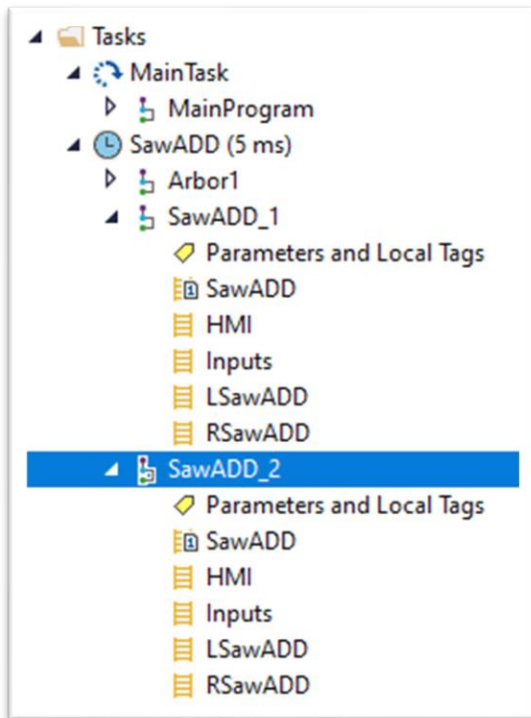"Import Logic Edits as Pending" selected since the analog IO is not yet addressed to the correct physical card slot.
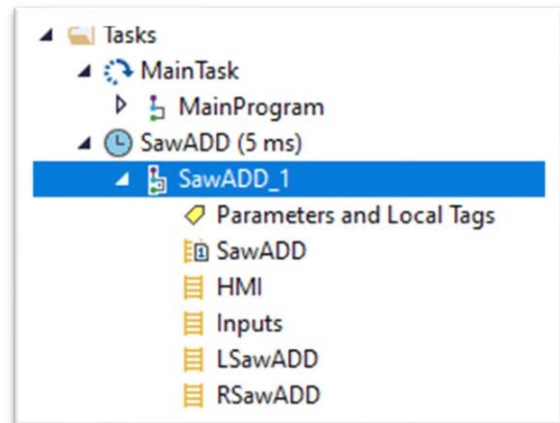
The input tags unique to each bandmill will need to be addressed in the Input program for each of SawADD_1 and SawADD_2. To add the second program select add new program.

SAWADD™ Installation Manual
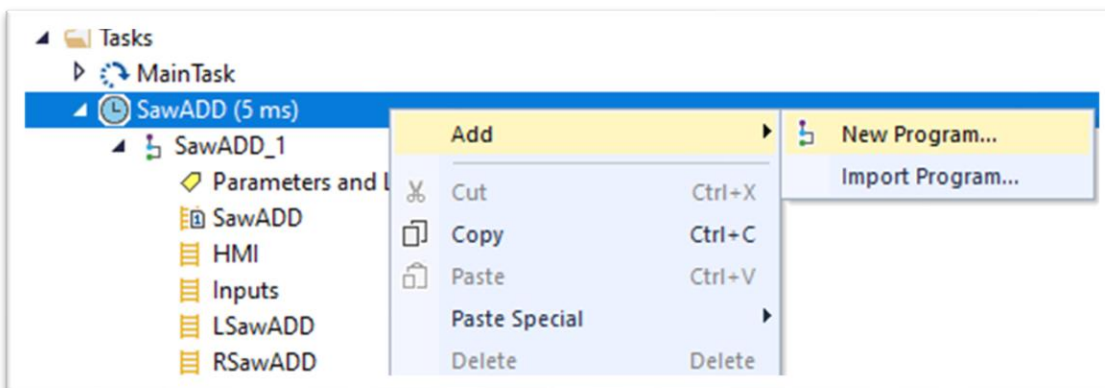
The SawADD program will read the analog inputs for the SawADD sensors, along with limits provided from an HMI, to produce a proportional multiplier Controller tag SawADD_12_Reduction that will be used to increase and reduce the Optimizer or scanned depth of cut feed speed when necessary. See more in the section on Feed Speed. Each twin will have an HMI for making adjustments and monitoring the results. The Controller tag multiplier for the second twin will be SawADD_34_Reduction. The limit adjustments and reduction maximums will be described in the following sections on the HMI Display and Limit Setup. All tag values that should be in the HMI for information or adjustment will have HMI_ at the beginning of the tag.

In the case of a single bandmill, it will be a left or a right and the unused routine can be deleted or just not call from the main SawADD routine. The check for sensors in range in the Inputs routine will need to be bypassed for the unused sensors.

In the case of a double cut bandmill the direction of the actual speed will be detected, and the function of analog inputs switch between front and rear sensors.

SAWADD™ Installation Manual

HMI Display

An HMI Displays for adjustments, meters and trends are supplied in a FactoryTalk RSView SE importable .xml format. The import files use a PLC shortcut name of "SC" to link to the PLC tags. This shortcut will need to be added to the FactoryTalk Linx Communications Setup. The xml files are imported by creating a new display page in the existing RSView project for each xml file and then importing into the display. This combined HMI, SawADD Trend display and Report Trend display requires a large display screen and should be added to your Production HMI, Filing Room HMI and the Operators HMI.

The display shown above is for a twin. It would be repeated for a quad. The Speed Settings could be common or not. The slowest speed from the two should be used when a log is in the associated saws.

The Left Saw and Right Saw bar meters and SawADD trend will be zero when no log in the cut and only saw strain pressure is present

SAWADD™ Installation Manual

on the guides. The bars will change color when the sawing pressure reaches the limit settings. The trend shown is running in simulation mode. The buttons used for simulation and testing will disappear when the ControlEnable tag is active.

The HMI above can be broken down into components like the parameters for better visibility and entry, as shown below.
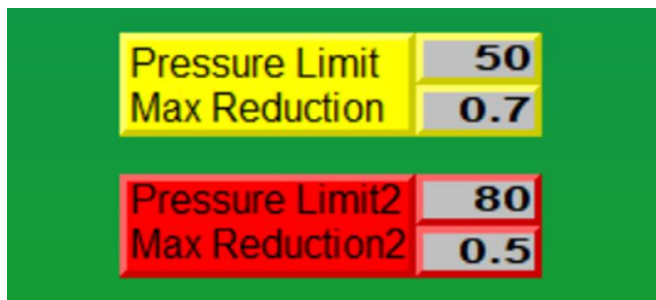

SAWADD™ Installation Manual

1. **Saw Pressure Limits**

The Pressure Limit 1 is in a yellow box on the RSView HMI and the bar meter will turn yellow when the pressure on that saw exceeds the Limit 1. The speed reduction begins when this limit is exceeded and is limited to the Max Reduction box value in the box of the same color below it.

The purpose of the Max Reduction with Limit 1 is to allow a quick response to excessive pressure but not overcompensate. It should be set to reduce only to a very conservative speed that will minimize deviation.

A Pres Limit 2 is in a red box on the RSView HMI and the bar meters will turn red when the pressure exceeds Limit 2. The Max Reduction for Limit 2 will need to be lower than for Limit 1. This will allow a greater reduction to save a saw in an extreme pressure without coming to a stop to allow sawing out of the log.

SAWADD™ Installation Manual

2. Sensor Readings

The display for each saw shows the front and rear SawADD sensor reading and is scaled in the analog input card to pounds between 0 and around 1200. These values are converted to a percent of range for the HMI display by entering the scale value into the SensorScale tag in the Input program Local Tags. For reverse acting sensors the increasing direction can be flipped for the HMI display by toggling on the corresponding DirectActSensor or ReverseActSensor local tag, to have the display increasing with pressure or following the sensor voltage. The former seems the most intuitive and is recommended.

When the sensors are within range the HMI Strain UP % values should be between 5% and 80% (direct acting, DA) or 20% and 95% (reverse acting, RA). If it is not the label will flash red. The HMI also shows the Front and Rear Strains, Total Strain and % Diff.

Front Sensor (DA)

Strain Up %	5 to 80
Strain Down %	1 to 75
Front Strain lbs	75 to 150

Rear Sensor (DA)

Strain Up %	5 to 80
Strain Down %	1 to 75
Rear Strain lbs	50 to 100
Total Strain lbs	125 to 200
% Dif	20 to 40

Front Sensor	
Strain Up %	42
Strain Down %	34
Front Strain lbs	92

Rear Sensor	
Strain Up %	42
Strain Down %	38
Rear Strain lbs	45

Total Strain lbs	137
% Dif	35

SAWADD™ Installation Manual

1. Strain Down %, when strain down is initiated the Strain Down reading is zeroed, ready to receive a new reading. It is updated only when strain up is first initiated so that a reading with no guide pressure is taken right before strain pressure is applied.

2. Strain Up %, is a live indication of sensor position in its measurement range, updated when there is no log in the saws. This number should be greater than the Strain Down but not greater than 80%. If the value becomes greater than 80% or less than 5% then the label will flash red and SawADD will not attempt to get the Speed Adjust percent increase but will still slow the

Front Sensor	
Strain Up %	105
Strain Down %	34
Front Strain lbs	852
Rear Sensor	
Strain Up %	105
Strain Down %	38
Rear Strain lbs	805
Total Strain lbs	1657
% Dif	3

feed speed to save saws and deviation. If this happens, then the sensor should be readjusted as described in the Sensor Mounting and Adjustment section. It is not necessary and not advisable to adjust them to recommended setting more often as this will wear out the fine adjustment thread.

3. Front Strain lbs, Rear Strain lbs, are the Strain Up minus the Strain Down for the front and the rear sensors while no log is in the saws. These values are readings of real force on the front and rear of the saw guide in pounds. The Front Strain should be between about 75 to 150 lbs and always be higher than the Rear Strain of about 50 to 100 lbs, because the front of the saw is benched with a smaller circumference than the rear.

4. Total Strain, is the sum of the Front Strain and the Rear Strain, or about 125 to 250 updated while no log is in the saws. This value should be close to the actual force generated by the bandmill strain system pushing the wheels apart, with the amount the guide pushes the saw out of plumb between the wheels. The calculation is as follows: the bandmill strain divided by 2 (split between sawing and return side of saw) (ex 16,000/2 = 8000 lbs. per side) multiplied by the ratio of the guide push out of plumb (ex 0.8 in.) divided by the distance from the lower guide to the bottom wheel resulting in the formula, 0.8/48 * 8000 = 133 lbs. This is what the Total Strain reading should be. Since the distribution of the pressure across the face from top to bottom of the guide will change the SawADD reading. The angle of the face to plumb should be adjusted with the bottom alignment bolts to produce a Total Strain reading of close to the actual calculated, or at least so all saws are close to the same. This will produce a similar sensitivity to side pressure.

5. % Dif, is the front Strain minus the rear Strain divided by the Total Strain. This provides an indication of how much tighter the front tire line is compared to the back. Generally this value should run between 30% and 40% but depends on the desired saw characteristics. While sawing this can provide an indication that the saw has been stretched and should be changed. This value can also be an indication that the guide or wheel alignment is not parallel to the feed direction. At minimum it can be used to check for consistency in benching and guide dressing.

3. Speed Control Settings

SawADD's HMI allows your production personnel to easily make changes to the feed-speed on the fly, without having to change complex tables. With SawADD you simply type a single number into **Speed Adjust** % for the desired percentage speed increase above optimizer feed speed, across the board.
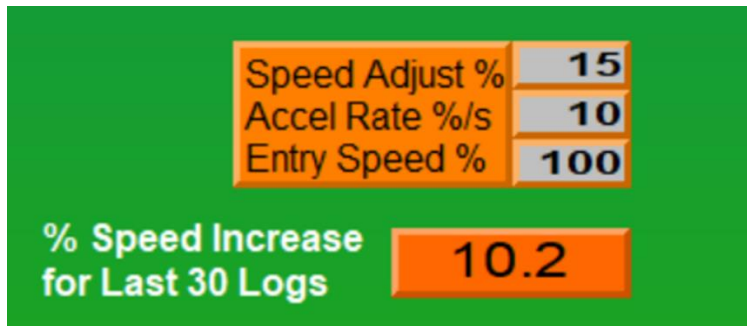
The **Accel Rate %/s** is the rate of increase of the feed speed, (if not being reduced by excess pressure) to the Speed Adjust increase setting or to the speed before being reduced by excess pressure. It should be run as high as possible without causing oscillation in the feed speed.

The **Entry Speed** % is available for those that want to reduce the entry speed. The number entered will be the percent of the optimizer feed speed and will begin increasing to the Speed Adjust percent increase after entering the cut.

SawADD's HMI also has an **Avg Speed Increase** % meter, for the last 30 logs, to gage your saw performance above the optimizer speed table. When the average goes below a predetermined level or negative (less than before SawADD) then you are losing potential production to keep the saws running and an alarm can be set to change a saw.

A SawADD HMI trend is provided using the SawAvg program which takes an average of the last 5 samples providing some smoothing but not missing any data at the HMI slower update of 50ms. It also takes the highest of the front and rear sensor differential and the saw pressure to reduce the number of pens for clarity. With RSView the trends can also light up the area over the limit for visual alert.

Feed Speed

The feed speed multiplier Controller tag, SawADD_12_Reduction, is a real number from 1.0 plus **Speed Adjust** % to a reduction limit (i.e. 0.8). It must be used in your existing program to multiply times the feed speed before it is output to the drives. It is important to multiply this reduction with all the drives that will be affecting the log motion while in the saws. If the multiplier is used on the sawing speed for the log in the saws, then the gap control logic should handle the drives that are in contact with the log.

The program tag, SawADD_Reduction, is moved into a controller tag SawADD_12_Reduction in the HMI program so it can be used in the speed control programs. In the case of a Quad a second controller tag SawADD_34_Reduction is needed for saws 3&4 in SawADD_2 and logic to use the lowest.

The feed speeds can generally be increased by as much as 15%, with SawADD feedback to slow down to the conservative speed when necessary to preserve lumber sizes. If the reduction in speed is too much and affecting production, then a saw change should be considered.

The deceleration rate for the drive should be set as high as possible without being too aggressive, at least 150 in/sec/sec. A controller tag is provided in the HMI program, SawADD_Reducing_Speed, to be used if needed for the feed drive to switch to a higher decel rate. The higher the decel rate the more deviation that will be prevented. Since switching takes time it is best to leave the drive in a high decel mode.

The acceleration rate while in the cut should be limited to a much lower rate (25 in/sec/sec or 125fpm/sec) as a method of providing some damping to prevent repeated decel and accel oscillation. The Accel Rate is handled in the SawADD program and should be a parameter in the HMI. The decel rate must be set in the drive control and may be a ramp time for decel from max drive speed to zero speed.

Limit Setup

The guide pressure limits for accurate sawing, good size control, and reducing target size is typically set to around 50 pounds and 100 pounds. Increase the limits when pushing for more production, allowing for a larger variation or standard deviation, and hence larger target size. Tougher sawing species like Douglas Fir may require a high limit.

A speed limit max reduction is used to prevent over correcting. We will typically use two sets of pressure limits and two sets of reduction limits. That way the primary Limit 1 (40 to 80) can be associated with a conservative Limit 1 Max Reduction to about 80% (down to speeds that would be run without SawADD). A second limit may be set higher than normal operation, to provide a safety net for extremes… Which may save a saw. For example, the sawing pressure Limit 2 can be 100 pound and Max Reduction limit to 30%, but never to 0% which would stop the feed without the ability to recover.

Diagnostics and Trending

The SawADD program also provides diagnostic data on the saws. These tag names are preceded with RPT_ and they can be put into an HMI screen for report purpose. Counts are kept of each time a saw pressure exceed a limit in positive and negative directions to help diagnose problems with individual saws.

A ControlLogix trend is available on the PLC that shows plus and minus Pressure Limit-1 along with the right and left saw front sensor press, differential press and top guide deviation. All together they are hard to read, however right clicking on the trend and selecting Chart Properties and then the Pens tab will allow turning off visibility of some pens. Below is a trend for one log. Note that the Top Guide Deviation sensor signal is opposite in polarity to the SawADD pressure. SawADD is negative away from the guide.

SAWADD™ Installation Manual
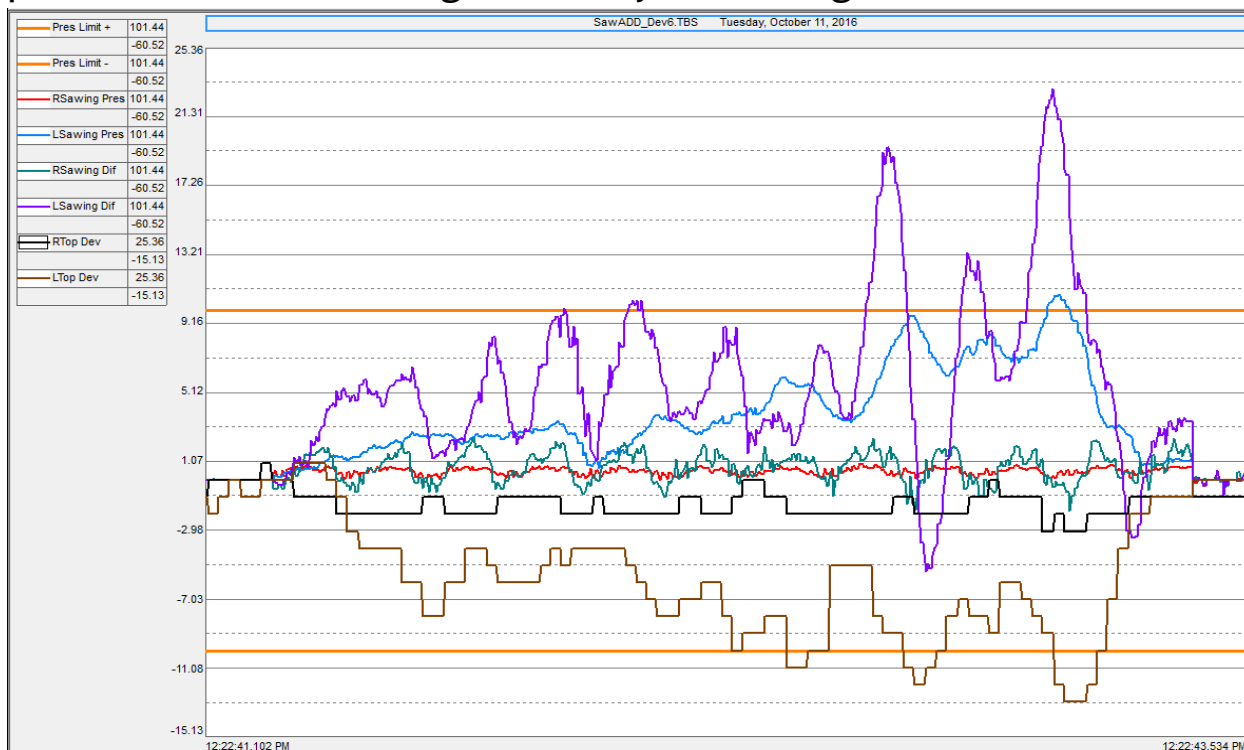
It is very evident that the SawADD LSawingDif exceeds the limit substantially before the LTop-Dev Sensor. This provides the ability to react and minimize the deviation but relies on minimal latency in the PLC command to the drive and the drive response, which may require a faster PLC or more drive horsepower.

Another invaluable diagnostic of trending is the detection of a log moving in the cut. This can be seen in the following trend from the almost symmetrical and opposite polarity of the pressure on the right and left saws.
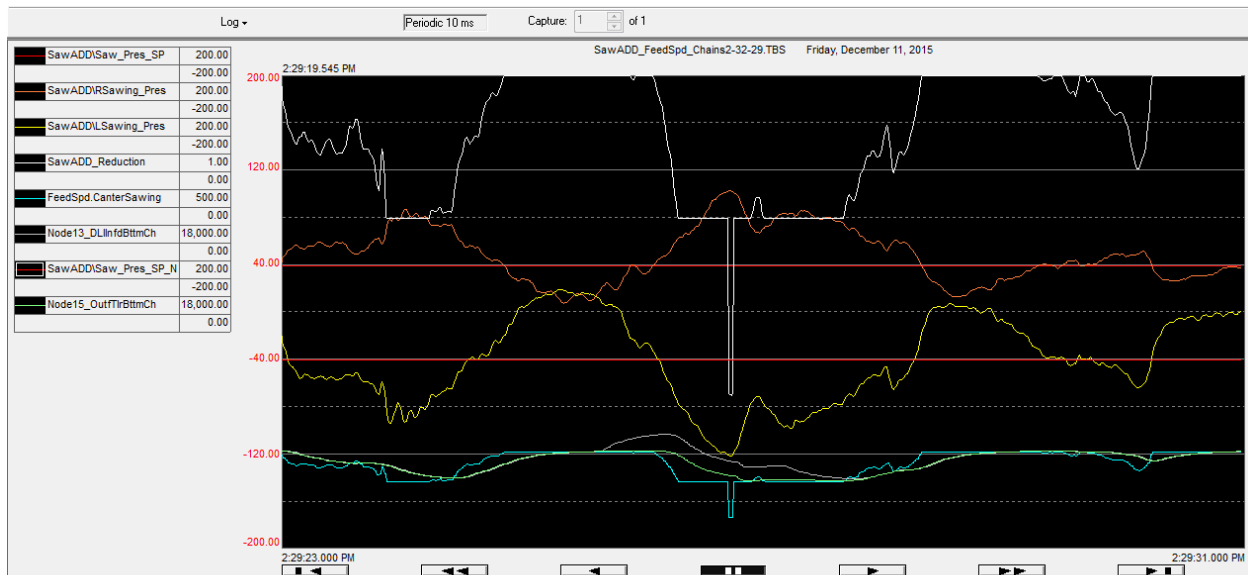
It is also good to put the drive commanded and actual velocity on the same trend as the SawADD Reduction Multiplier to measure the reaction time of the PLC and the drive actual to commanded.

Shift Reporting

The Shift Report data shown below is collected in tags that are preceded by RPT_ and are reset when the system log count is reset or the Shift_Run_Reset tag is cycled.

| Limit 1			SHIFT REPORT		Limit 1	
Total Over Limit	767		Total Logs Sawn	79	Total Over Limit	760
Over Limit Pos	767		Avg Spd Increase	9.62	Over Limit Pos	0
Over Limit Neg	0				Over Limit Neg	761
Limit 2			% Time Sawing	59.7	**Limit 2**	
Total Over Limit	0		Shift Increase	5.74	Total Over Limit	0
Over Limit Pos	0				Over Limit Pos	0
Over Limit Neg	0				Over Limit Neg	0

The "AvgSpd Increase" is the increase achieved by SawADD above the preselected speed. This average of the SawADD speed command multiplier is done for the entire shift, averaged every 5 ms execution of the periodic task. SawADD will attempt to increase the speed by the requested "Speed Adjust" and decrease the speed when the sawblade forces exceed the limit. A controller tag, SawADD_Speed_Used, is provided in the HMI program to provide feedback when another machine section is controlling speed lower than SawADD, in order to keep the AvgSpd Increase accurate.

The counts of over limit positive and negative will give an indication of the performance of the saws and point to the one that is reducing the average increase.

Each time the Shift report is reset the RPT_ tag data is moved into tags preceded by LOG_.   These tags are then logged as described in Shift Data Logging.

Shift Data Logging

To create data logging for the tags from the Shift Report, a Data Log Model must be created in the FactoryTalk View Studio, Data Log branch of the Project Explorer. To create a model right click on Data Log Models and selecting "New". The Data Log Model names shown here must be used to match those used for the pens in the HMI Trends supplied.
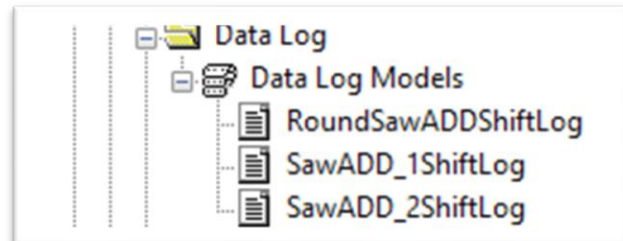
Select the tags to log by selecting the tab "Tags in Model". The Tag Browser can be invoked (button with 3 dots), then the PLC Short Cut selected and then the PLC program selected. All the tags beginning with LOG_ can be selected, then click the "Add Tags to List" button, then the "Add" button and finally the "OK" button.

The Shift Data Log Trend shown below appears on the main SawADD HMI display with only 3 selected traces for clarity.
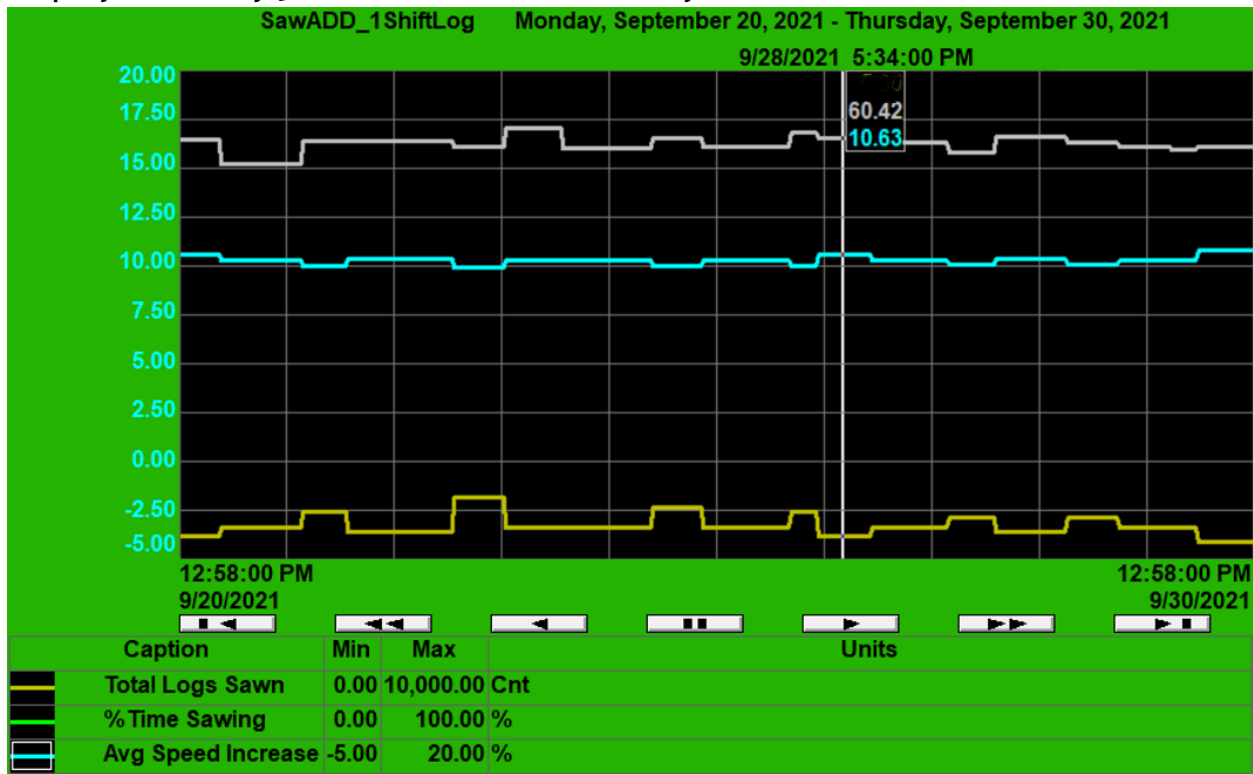
For a closer look a Zoom button is provided to open a full-page version of this

SAWADD™ Installation Manual

trend with all of the data from the Shift Report. The pens shown on a trend are selected by turning them on from the chart properties by right clicking on the trend and selecting Pens.

This trend is setup with 10-day span which should have a data change only twice a day. A longer span can be set in the trend properties. A line cursor can be put on the trend by clicking anywhere on the data and the date and time the data was captured will be shown above the cursor line. This will allow tracking the shift and the saws run on that shift if kept in a logbook.

Clicking on a pen in the legend will change the left scale to the one for that pen. The trend can be scrolled back for as long as the trend has been kept.

To start data logging in Factory Talk View Studio do the following:

- In the **Display Settings** dialog box, in the **Behavior** tab, specify the **DataLogOn** command as the startup command or the **DataLogOff** command as the shutdown command.

Advanced Tuning

The SawADD PLC program provides some advanced tuning adjustments that should only be attempted by someone experience in closed loop control.

The proportional gain algorithm is reverse acting, in order to provide a speed reduction multiplier. It uses the saw pressure error compared to the saw pressure limit and scaled by the limit times a P-Gain parameter. The default value for the P-Gain is 0.3 to provide a minimal over correction.

The two-sensor differential pressure is multiplied by a D-Gain parameter to provide a faster reacting process variable that can also be used with the same limits and P-Gain. The default value of the D-Gain is 5.0.

The highest value of the front (leading edge) sensors and the front to rear differentials, for the right and left guides is used to compare with the limits and produce the speed reduction multiplier tag, SawADD_Reduction.