KEYS TO SUCCESSFUL SAWMILL SCANNING

TRIMMING OUT ERROR

ON YOUR TRIMMER SORTER LINE

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JoeScan
MADE FOR SAWMILLS

Getting Started

Hi there!

Welcome to the JoeScan guide to scanning for your trimmer sorter line.

Feel free to read straight through this paper, it's not as long as it looks from here (there are plenty of pictures).

Or if you'd prefer, you can skip ahead to the sections that most interest you. If you're reading the digitial version, just click **the page numbers** to the right to jump right to that page. You can also click the **JoeScan logo** at the top of each page to come back here to the Table of Contents.

This paper was adapted from a presentation I gave at OptiSaw West 2018, in Richmond, British Columbia.

From everyone at the JoeScan team, we hope you enjoy this paper, and we hope you learn some new lessons about scanning that you can take back to your sawmill.

Thanks for reading,

Joey

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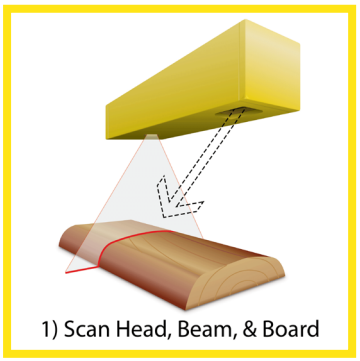
Sawmill Scanning Basics

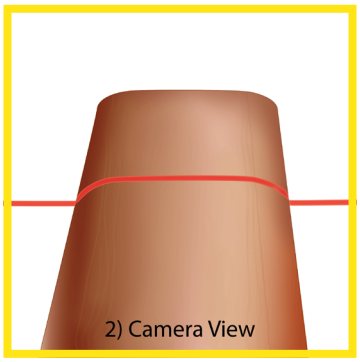
What is 3D Laser Scanning?

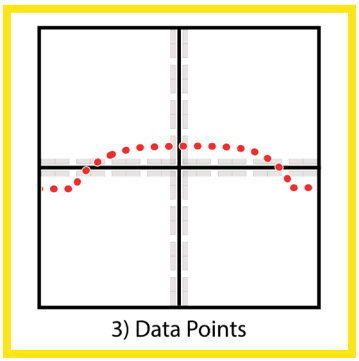
3D Laser Scanning, or geometric scanning, is a process used to measure the shape of logs or boards in a sawmill. Simple as that.

How Does it Work?

Geometric scanning works by using a device called a scan head to project a laser light onto the surface of the wood. A camera inside the scan head analyzes the shape of the laser to generate coordinates of points along this surface. These coordinates represent a cross-section of the exterior shape of the wood at different points along the board.







The Scanning Process
(These images depict a lineal scanning application, but the general concept is the same as you would use for your transverse trimmer sorter)

The coordinates are then fed into an external computer program, referred to as an optimizer. From there, the optimizer will combine the points into a 3D model of the board to make decisions about the best cuts for each piece of wood. The optimizer then sends these decisions to the machine center and the wood is cut.

3D laser scanning can be utilized for almost every machine center in the green and/or dry sawmills. For the purpose of this paper, we will be focusing on the application of scanning for boards on the trimmer sorter line. However, many of the concepts discussed here may be useful in other areas of your mill as well.

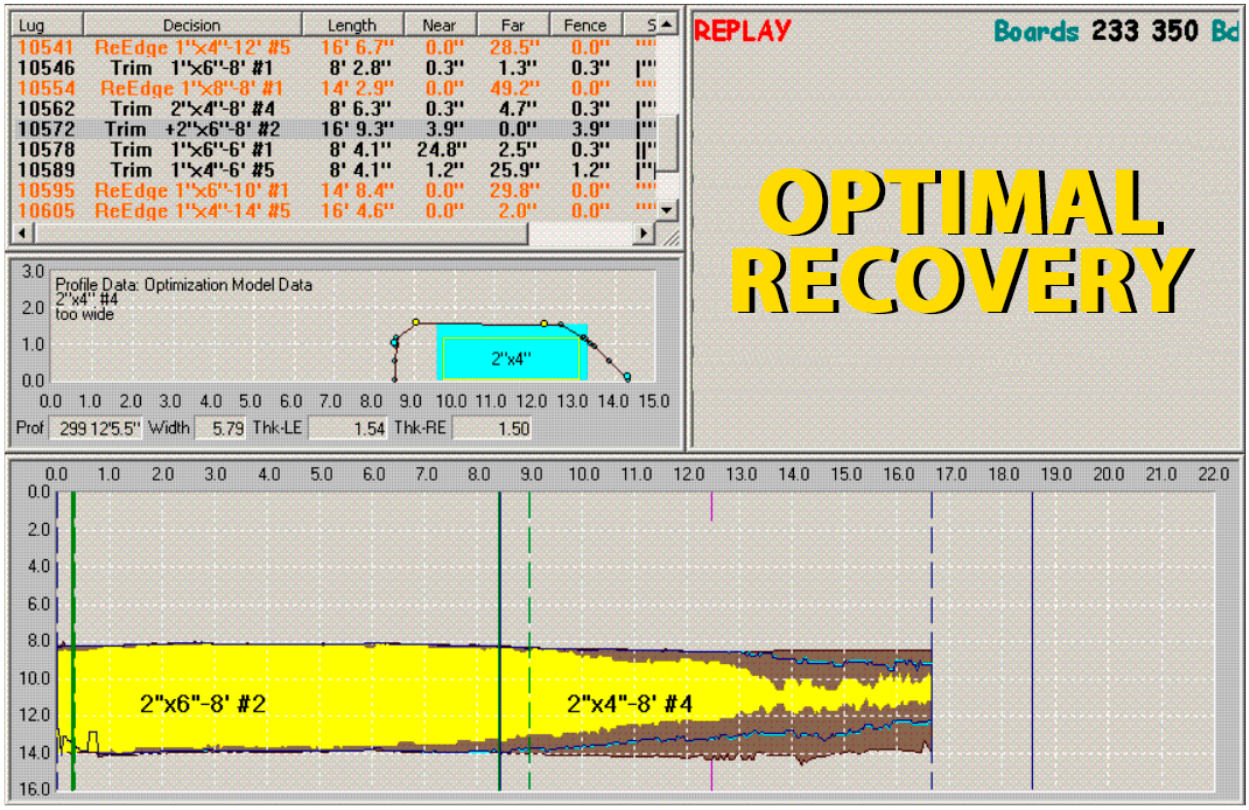
Why Scan?

In general, scanning is one of the best tools available to improve quality, increase yields, reduce waste, and generally ensure that sawmills are getting the maximum value out of each and every cut. Scanning systems deliver incredibly accurate information to the optimizer at production speeds. This allows your optimizer to consider every possible cut, and to select the best option to maximize your return.

SAWMILL SCANNING DONE RIGHT

- ☑ Improve Quality
- ☑ Increase Yields
- ☑ Reduce Waste
- ☑ Maximize Value

Overall, scanning gives you better control over the products that leave your mill.



Example of an Optimization Software Suite.

Geometric scanning can also be used to verify the accuracy of cuts made *before* the scan, thus ensuring that your entire line is operating the way it was designed to.

Why the Trimmer Sorter Line?

The trimmer sorter line is one of the most important locations for scanning in your sawmill, because it is often the last chance you have to adjust your product before it goes out to customers. The trimmer sorter line has also traditionally been one of the toughest places to implement successful scanning. This is due to the high speeds and large volumes of boards that pass through it. After all, all of the wood in your sawmill will make its way through the trimmer eventually.

What's the Bigger Picture?

Scanning is just one part of the optimization system, which in turn is just one part of your sawmill as a whole. Because our expertise is in designing scanners for the sawmill industry, in this paper we will focus on the factors directly affecting the scanning process.

It is important to remember to think of your sawmill as a series of interconnected systems. The interactions between these different systems can often be complex and confusing (much like having a conversation with a teenager these days).

The expertise of a trusted systems integrator and optimization vendor can go a long way in helping you to navigate these connections for the specifics in *your* mill. A list of extremely well-qualified systems integrators can be found on our website at:

https://joescan.com/about/resellers/

Why Should You Listen to Me?

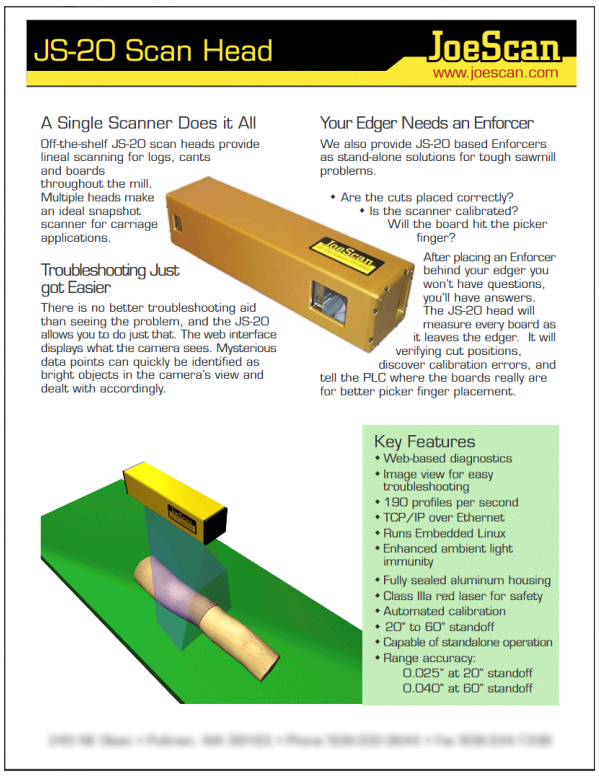
You may be asking yourself, "Why should I listen to this Joey guy about trimmer scanning? What makes him such a %@#&*ing expert?"

Here I am with Robert Cecil at Starfire Lumber in 2002.

Where does the time go?

The short answer is that I've been studying ways to improve 3D laser scanning for nearly twenty years now, and I've kept my focus on the sawmill industry throughout this entire process.

Growing up, the sawmill industry played a big role in my family and in my life. When I founded JoeScan and built my first laser scanner in 2002, scanning was already being used in sawmills. However, this primitive form of scanning had a lot of growing up to do. It was extremely expensive, it was unnecessarily complex, and it was far too unreliable.



JS-20 Scan Head

JoeScan
www.joescan.com

A Single Scanner Does it All

Off-the-shelf JS-20 scan heads provide lineal scanning for logs, cants and boards throughout the mill. Multiple heads make an ideal snapshot scanner for carriage applications.

Troubleshooting Just got Easier

There is no better troubleshooting aid than seeing the problem, and the JS-20 allows you to do just that. The web interface displays what the camera sees. Mysterious data points can quickly be identified as bright objects in the camera's view and dealt with accordingly.

Your Edger Needs an Enforcer

We also provide JS-20 based Enforcers as stand-alone solutions for tough sawmill problems.

- Are the cuts placed correctly?
- Is the scanner calibrated?
- Will the board hit the picker finger?

After placing an Enforcer behind your edger you won't have questions, you'll have answers. The JS-20 head will measure every board as it leaves the edger. It will verifying cut positions, discover calibration errors, and tell the PLC where the boards really are for better picker finger placement.

Key Features

- Web-based diagnostics
- Image view for easy troubleshooting
- 190 profiles per second
- TCP/IP over Ethernet
- Runs Embedded Linux
- Enhanced ambient light immunity
- Fully sealed aluminum housing
- Class IIIa red laser for safety
- Automated calibration
- 20" to 60" standoff
- Capable of standalone operation
- Range accuracy:
  0.025" at 20" standoff
  0.040" at 60" standoff

One of the earliest JoeScan flyers.

Our contact info has changed, but our commitment to quality sawmill scanning has not!

Back in those days, mills were willing to pay obscene amounts of money for scanners that were complex and broke frequently. My vision was to produce inexpensive scanners that were both reliable and easy to use.

I made it my mission to help 3D laser scanning become less expensive, simpler, and more reliable, so that it could be used in more sawmills, more efficiently. Together with a team of top engineers, we've spent the last sixteen plus years achieving these goals, and these are the values that JoeScan still lives by today.

3D laser scanning is significantly better for sawmills in 2018 than it was in 2002, and JoeScan is here to ensure that the bar continues to rise. Read on to learn some of the best practices we've discovered on our journey. Hopefully you'll find some ways to improve scanning on the trimmer sorter line in your sawmill as well.

In this Document

This whitepaper is intended to be used as a guide to improve your knowledge of how scanning works on the trimmer sorter line, and to provide you with key takeaways to consider when designing or upgrading your scanner system.

Because we want you to enjoy the read, we may have injected a little humor here and there. We apologize in advance for any bad jokes (and promise not to quit our day jobs for a career in stand-up).

Ultimately though, we want you to use scanning to optimize the value of your trimmer sorter line, and see the best ROIs at your sawmill.

We'll breakdown our key takeaways into three main buckets to help you get there:

Part 1) Scanning Features for Best Recovery

Part 2) Conveyance Features for Best Scanning

Part 3) Reliability Features for Best Value

Scanner Features for Best Recovery

Introduction to Scanner Features

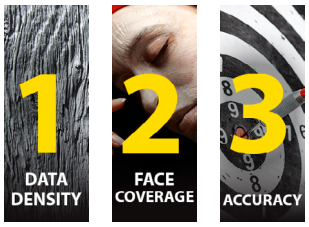
We'll begin by looking at the scanner features that are most important for optimizing the recovery you can get out of each and every cut. In this section, you'll learn about the specifications and features you should prioritize in a scan head.

The scanner feature topics we will cover are:

1) Data Density

2) Face Coverage

3) Accuracy



Data Density

Definition & Overview of Data Density

Think of data density as the number of geometric points a scan head collects in a given area.

In general, higher data density is better for all scanning applications, because it provides the optimizer with a more complete picture of the boards or logs being scanned.

Why is Data Density Important?

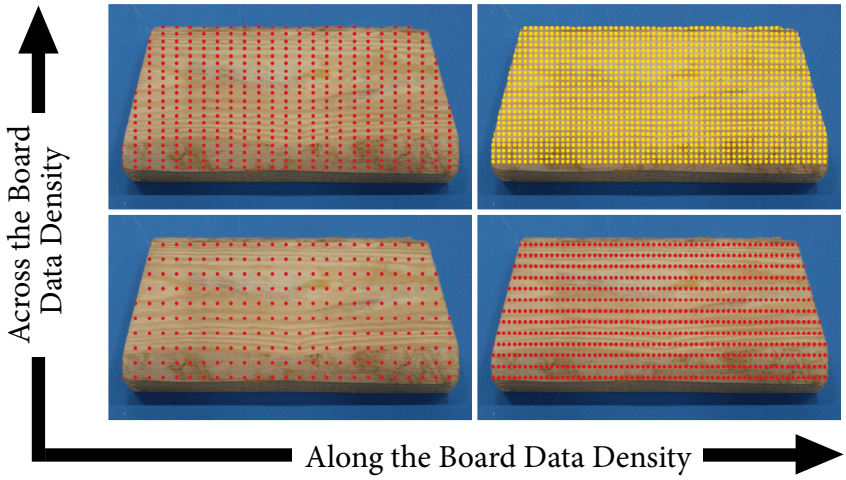
For the trimmer line in particular, data density is a crucial feature to identify wane in boards.

If data density is not high enough, steep wane can hide in the "blind spots" between a scanner's data points. When these data points aren't close enough together, what looks like a perfectly square board in the optimizer may in fact be a hot, wane-y mess! Poor data density can also lead to overtrim (trimming square sections from boards) and undertrim (not trimming enough of the wane-y sections).

Discussing Data Density

Data density is defined either by data points per unit of length, (points per inch/millimeter) or by the spacing between data points (either thousandths of an inch, or fractions of a millimeter). You may hear of a scanner with a data density of ½ millimeter, or another with 50 points per inch, but these two measurements are actually equivalent.

Data density can be measured both along the board, and across the board. You may have a different density of data for each of these two measurements.



The tighter the pattern, the better the data you'll get out of your scanning solution.

Note: These images represent the concept only. Actual data density for modern scanners is much higher.

For trimmer sorter lines, data density measured **across the board** is the most critical. This is because the changes in wane across the board are typically much more dramatic than changes in shape along the board (ie, there are greater changes in shorter distances, like your waistband after thanksgiving dinner).

The presence or absence of wane is also a very important factor in determining the grade, and thus the value, of a particular board.

Data Density allows you to say "Goodbye, Wane. Hello, Value!"

Factors affecting Along the Board Data Density

Data Density along the board is determined by a few different factors.

The type of laser used in the scan head is a primary driver of along-the-board data density. Once upon a time, sawmills' only choice was to use multi-point lasers for trimmer sorter lines, or any other transverse scanning application. This is because they were historically great at spanning the wide distances along the length of a board (versus the relativity short widths of lineal scanning, like you'd see on a log).

Multi-point lasers function by projecting multiple single points of light onto the board. The data density along the board can never be smaller than the physical distance between these points of light. Modern multi-point lasers are typically on the order of 3 points per inch.

Sheet of light lasers work by projecting continuous lines of light along the board. They can also be referred to as continuous line lasers (Where could that name possibly have come from?) The data density of scan heads using this type of laser is determined by the resolution of the camera sensor. These will typically offer data densities in the 10 to 50 points per inch range. For this reason, JoeScan exclusively uses sheet of light lasers.

Factors affecting Across the Board Data Density

Although it may be unintuitive, the primary driver of across-the-board data density is actually the **scan speed** of the scan head. This can be thought of as the rate at which the scanner is taking snapshots as the board travels through the scan zone.

$$\frac{\text{SCAN SPEED}}{\text{LUG RATE}} = \text{ACROSS THE BOARD DATA DENSITY}$$

When determining the across-the-board data density, compare the scan speed to the lug rate.

Basically, the higher the lug rate, the higher the scan speed you will need to return the same amount of data.

Key Takeaways for Data Density

1) *Data density is crucial for identifying wane.*

2) *Higher scan speed is the most important metric for improving the across-the-board density used to find wane.*

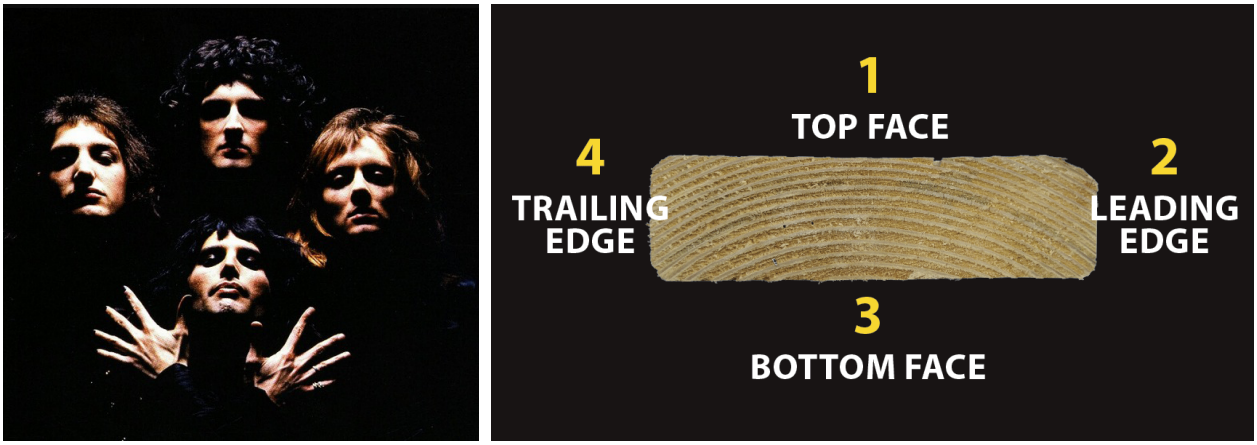
Face Coverage

Definition & Overview of Face Coverage

Think of face coverage as the number of board faces your scanning solution can see.

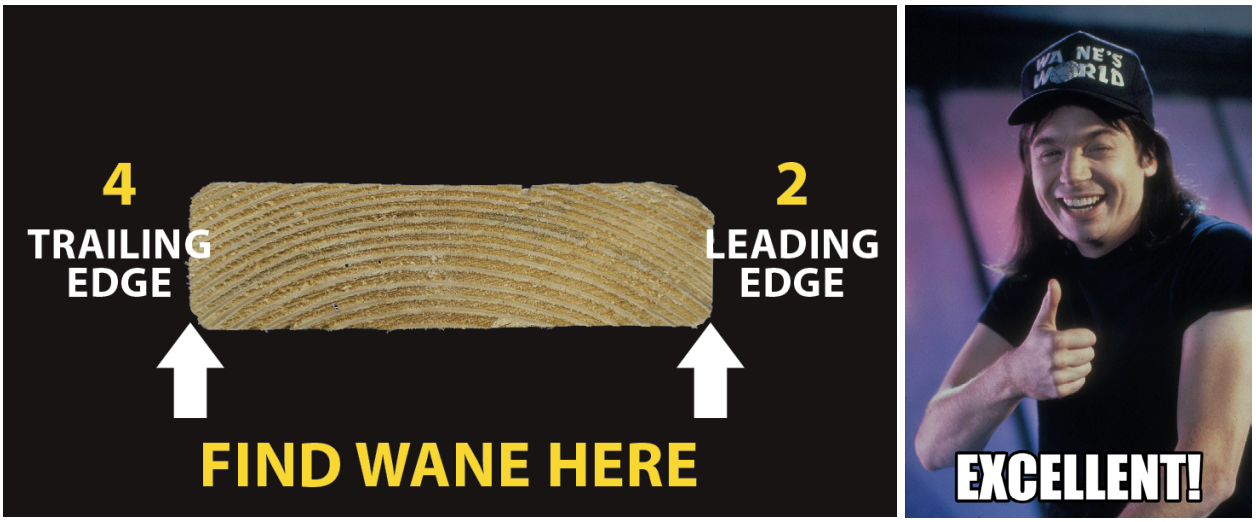
Why is Face Coverage Important?

In general, you want access to scan data on all four faces of the board. This will provide you with the most complete picture of each board to make trimming decisions.



Much like Queen in the Bohemian Rhapsody music video, we want to see four faces on our boards.

Providing data on the leading and trailing edges is especially important for trimmer applications, because these faces contain the best data for identifying wane. In fact, providing quality data for these edges can help reduce the need for high across the board data density.



Also like Queen, not all four faces are equal (when it comes to scanning boards on the trimmer).

Measuring Face Coverage

You can measure face coverage simply by counting the number of faces your scan heads can see. Not too tricky there.

1) Top face	2) Leading edge	3) Bottom face	4) Trailing edge

However, other factors such as data density may come into play, as not every scanning solution can see each face of a board equally. Thus, it may be better to measure face coverage by counting the number of faces for which your scan heads can provide quality data for.

Determining how much data density is appropriate for each face in your system is a complex calculation, but ultimately will come down to finding a balance between speed, and the ability to see steep wane. For example, if you are only scanning top and bottom faces, you may want data density as hight as 100 points per inch. But with better face coverage of the leading and trailing edges, you can be good with density in the range of 20 points per inch.

A trusted optimization vendor can help you design a solution that will maximize the value in your specific trimmer setup.

Factors Affecting Face Coverage

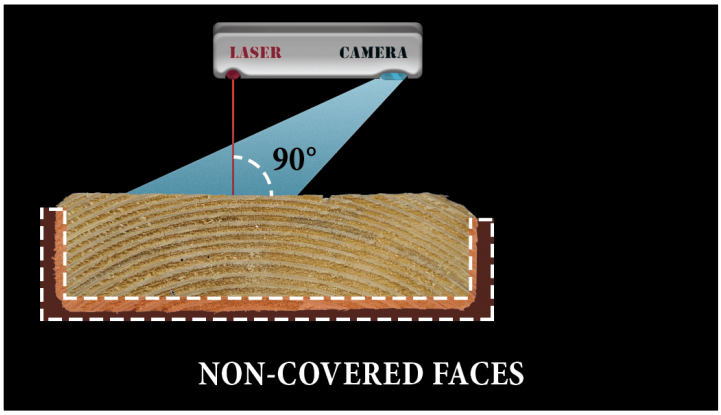
Face coverage capabilities will be determined by the specs of your individual scan heads, as well as their placement and the layout and number of scanning banks in your system.

Scan head specs affecting face coverage

As we saw in the previous section, the scan speed of a head is important for generating enough data to find wane. This is especially true for the smaller physical size of leading and trailing edges. Thus, increased scan speeds will also improve the data quality of the most important faces to cover for the trimmer.

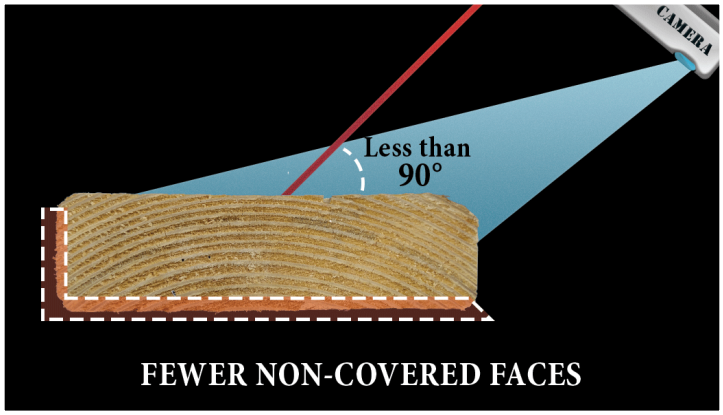
Placement and Bank Layout factors affecting face coverage

Imagine a single bank of scanners looking straight down, directly above your trimmer sorter line. This system will have a hard time seeing any faces beyond the top of the board, because the angle between board and scanner will create occlusion for the other three faces. Remember, the scanner can only collect data when its camera can see the laser on the board you are scanning. In this scenario, the laser may not even touch the leading and trailing edges at all!



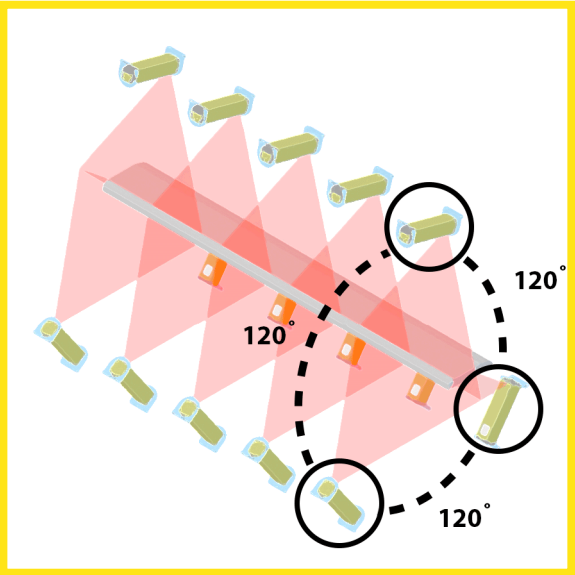
In the example above, the angle between the board, the lasers, and the cameras creates problems.

Although the scan heads can get great data for the top face, they will have a hard time seeing any others.



If this system is instead designed so that the scanners are looking down at the board from an angle in front of the board, the system will now have a good view of booth the top face and the leading edge.

In fact, the best designed scanning solutions for the trimmer sorter line will often have three banks of scanners, spaced 120° apart. This allows each bank to focus on a smaller area, and provide better data for each face.



Three evenly spaced banks provide great coverage for multiple faces.

In general, these banks are laid out so that two banks are positioned *under the chain*, because there will be more occlusion added by the conveyance equipment there. Positioning two banks under the chain allows the scanning system to provide redundant coverage for areas that may be occluded from one bank, but not the other.

Key Takeaways for Face Coverage

3) *You want face coverage for all four faces of your boards on the trimmer sorter line, but the leading and trailing edges are the most crucial for identifying wane.*

4) *Scanner placement and bank layout are the most important design factors that will improve your ability to see these leading and trailing edges.*

Accuracy

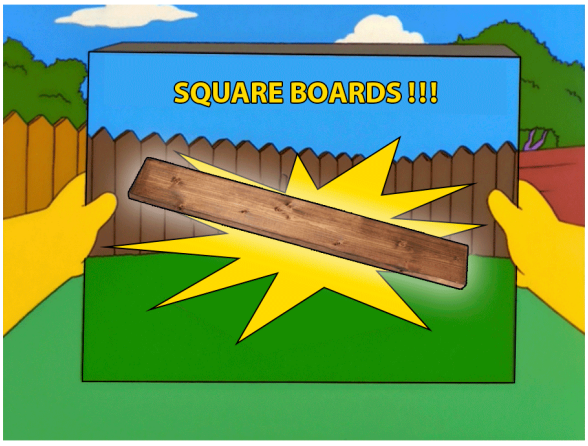
Definition & Overview of Accuracy

You can think of accuracy as how closely our scan data matches the actual board geometry.

Why is Accuracy Important?

Accuracy is incredibly important because it is the basis for all optimizer decisions. Good data accurately represents the size and shape of the boards moving through your trimmer, which is the whole point of scanning in the first place!

Inaccurate scanning data can lead to under or over trim, which will directly reduce the value of your boards. We know how frustrating it can be to see perfectly square boards get trimmed because your optimizer is working with bad data!



*Just because your optimization system **thinks** you're producing square boards, it doesn't mean that's what you'll actually get if your accuracy isn't up to snuff.*

Measuring Accuracy

Ultimately, accuracy is limited by the scanner's resolution. However, as we'll soon see, if you want to improve the system's accuracy, scanner resolution is usually not the best place to start.

Measuring accuracy requires testing of your system as a whole, to compare your scanners' data to the actual geometry of boards leaving your trimmer sorter line. Accuracy will not always be constant across every board. It may fluctuate over time, or change depending on the type of boards on the line. It may even be affected by other production factors upstream from the trimmer.

Factors Affecting Accuracy

Although it can be tempting to look only at the resolution specification provided by your scan heads, there are other, frequently more important factors that can affect the accuracy of your optimization system as a whole.

Some of the other factors that can affect accuracy include:

1) Board stability : the scanner assumes it is looking at a board that is moving smoothly.

2) Scanner calibration : An uncalibrated scanner can produce inaccurate data.

3) Scanner frame design : A scanner that is bent, vibrating, or warping due to temperature extremes will deliver inaccurate data.

4) : Chain travel encoder errors : The scanner needs an accurate point of reference.

Board stability in particular will often be the limiting factor for accuracy. This is because a scan head will always assume that it is measuring a stable board. Any bounce or jostle will be interpreted as a change in geometry.

The resolution differences between modern scanner models will often be very small, compared to the errors added by other components in your system as a whole. The important thing to remember when it comes to accuracy, is that your optimization system will never be more accurate than its most inaccurate component, and errors from different sources will add up.

Key Takeaways for Accuracy

5) *You're never more accurate than your worst component.*

6) *Errors across components add up.*

Conveyance Features for Best Scanning

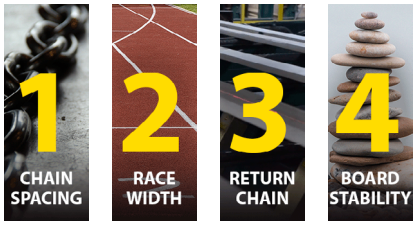
Introduction to Conveyance Features

Next we'll examine the conveyance features that are the most likely to affect the quality of your scanning system. In this section, you'll learn about the design factors that you should aim for in your trimmer sorter conveyance system.

Because we don't design conveyance systems here at JoeScan, this section will be less detailed than the scanning features that came before it. However, we do have to design our scanners to operate within the constraints of typical conveyance packages, so we are able to offer some best practices for designing your chains and transfers to play nice with scanning and optimization systems.

The conveyance feature topics we will cover are:

1) Chain Spacing
2) Race Width
3) Return Chain
4) Board Stability



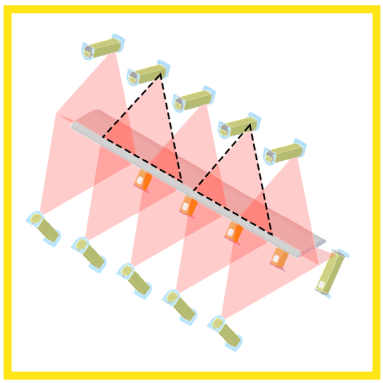
Chain Spacing

Chain spacing can affect your ability to get a complete picture of your boards, especially for the bottom face, and the leading and trailing edges that are most crucial to detecting wane.

As we discussed before in the face coverage section, typical trimmer scanning systems feature at least one bank of scan heads below the chain. This means that the chains themselves are often positioned between the scanner and the boards they are trying to see.

So the closer together chains are placed, the greater the board area they will occlude from the scanner's vision. Conversely, the farther apart the chains are spaced, the less stable the boards will be as they move through the trimmer line.

The sweet spot to hit with chain spacing is to balance this platform stability with the scanner vision. In many cases, this balance can be achieved by utilizing a chain spacing that is equal to the width of the scan zone covered by a single scan head.



Ideal chain spacing:

width of one scanner's scan zone

Key Takeaways for Chain Spacing

7) *Chain spacing represents a balance between scanner vision (wide spacing) and platform stability (narrow spacing).*

8) *The sweet spot is to match the chain spacing with the width of the scan zone.*

Race Width

Similar to the chain spacing, the race width is another conveyance feature that can obstruct scanner views of boards above the banks.

In general, narrower races will provide less occlusion of scanner vision. However, the tradeoff here is that narrow races reduce the strength of the conveyance platform.

Narrow races reduce occlusion.

Key Takeaways for Race Width

9) *The narrowest race width possible will offer your scanning system the best view of boards.*

Return Chain

Once again, the position of return chains along your trimmer sorter conveyance setup can obstruct the vision of your scan heads.

Because the return chains can potentially run just above scanning banks, they can be especially problematic and obstruct a large portion of a scanner's field of view. To prevent this, return chains should be positioned below the scanner banks to prevent this occlusion. This is easy enough to accomplish when designing a new conveyance platform.

In practice however, it is often uneconomical or infeasible to reposition return chains in an existing conveyance setup, for instance when upgrading an older system. To overcome this, scan heads with a shorter standoff distance may offer a greater range of placement options, and allow you to install your scanning banks above return chains of a fixed height.

Scanners with shorter standoff distances provide more flexibility when placing banks below conveyance systems.

Key Takeaways for Return Chain

10) *Whenever possible, return chain should run below the scanning banks.*

11) *Scan heads with shorter standoff distance allow greater flexibility in placement for existing conveyance systems.*

Board Stability

As discussed earlier in the accuracy section, board stability plays a huge role in the overall effectiveness of your optimization system. And similarly, your conveyance system plays the biggest role in achieving and maintaining stable boards as they move through your trimmer sorter line.

A scanning system's worst nightmare. Board stability is very important!

Every conveyance system will produce some jostle or bounce as boards are transferred onto the trimmer. However, there are some best practices for reducing this instability's effect on your scanning solution.

Quality of Transfer

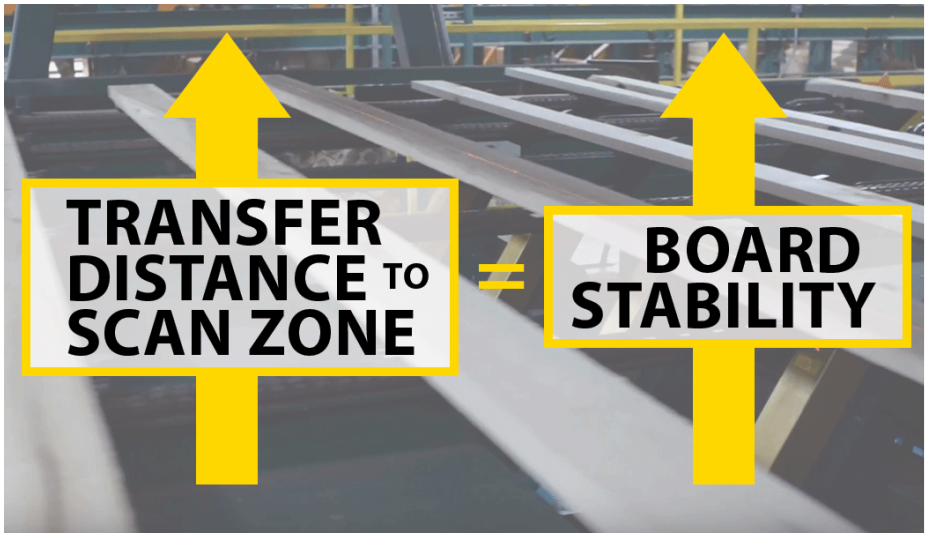
You can start by considering the quality of the transfer as your boards are moved onto the trimmer sorter conveyance. Making sure boards are transferred smoothly onto the scan zone chains will significantly reduce the bounce.

Smoother transfers result in more stable boards.

This makes scanners happy.

Scan Zone Distance

Next, the distance the scan zone is placed from the transfer point plays an important role in giving time for the boards to settle. In general, greater distances provide more time, and thus result in more stable boards once the scanners see them.



Greater distances result in more stable boards as they are being scanned.

This also makes scanners happy.

Chain Surge

Finally, reducing surges in chain speed can also improve board stability. A constant chain speed is a scanner's best friend. The more stable you can keep your chain, the more stable your boards traveling along it will be. It's as simple as that!

Key Takeaways for Board Stability

12) *To offer an optimal scanning environment, your conveyance system should provide a quality transfer, with plenty of distance for boards to stabilize.*

13) *Reducing chain surge improves stability.*

Reliability Features for Best Value

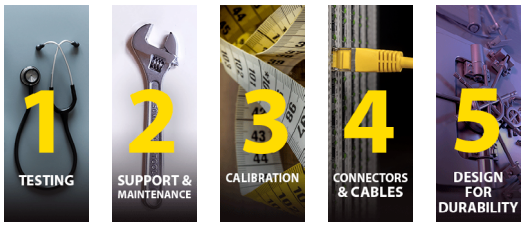
Introduction to Reliability Features

Our last section will cover the reliability features that will keep your scanning system running at peak performance over a long period of time. A quality scan head should deliver consistent results for many years.

Here, we'll look at some operational strategies for maximizing the return on your optimization investment, then circle back to the design and specifications of the scan heads themselves.

The reliability feature topics we will cover are:

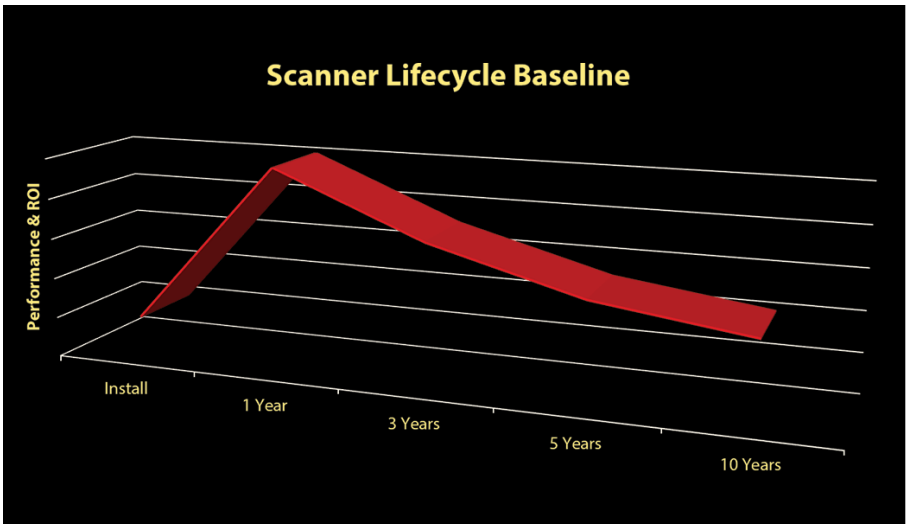
1) Testing
2) Support & Maintenance
3) Calibration
4) Connectors & Cables
5) Design for Durability



Testing

There is always a lot of testing that goes into any new or upgraded scanner setup. After all, you want to ensure that you are actually hitting those metrics promised in the sales pitch! However, in almost twenty years, we've seen many sawmills fall short in testing *after* that initial peak performance has been achieved.

Left untested, any system will begin to see performance degradation over time. So to make sure you are getting the most out of your investment, testing needs to be a priority beyond this "honeymoon" phase.



While it's easy to think of that peak performance as a constant, this is what your return on investment will look like with little or poor testing.

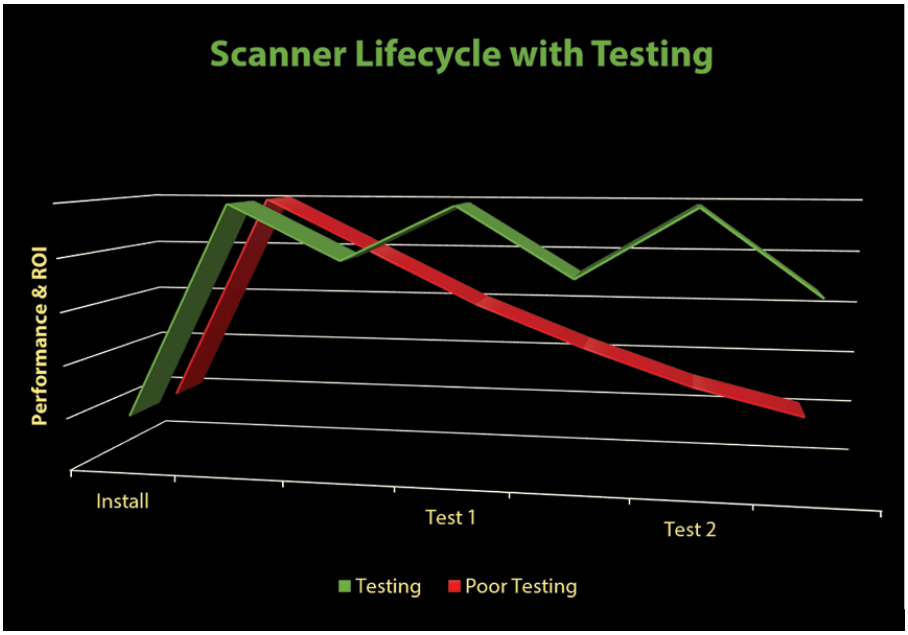
These are the best practice to successful testing of the scanning system on your trimmer sorter line:

1. Continue to test.

Don't assume your system will provide the same results as that initial peak. Make testing a priotity!

2. Test regularly.

Set a testing schedule that fits with your operation. This may be once a week, or even more often than that on a high volume line. But the important thing is that the testing gets done. Each time you test, you have an opportunity to push that performance back towards the peak you saw when your scanning system was shiny and new.



Regular testing will help you return to that peak performance over and over again.

In most cases, "poor testing" really means no testing at all.

3. Test your whole system.

Your scanning system works as just one part of your entire trimmer sorter line. Reduced performance may pop up from any one of the components, or even the interface between components, so testing everything as it actually operates in your sawmill is the only way to truly identify the root cause of problems.

4. Test a random selection of boards.

It may *seem* best to only test boards that look like they may be difficult to scan, for example, boards with steep wane. However in reality, there is no reliable way to know which type of boards will cause problems running through your trimmer. Wouldn't you like to know if your optimization system was having difficulty scanning boards that already appear to be square?

Key Takeaways for Testing

14) *Continue to regularly test your whole system, using a random selection of boards.*

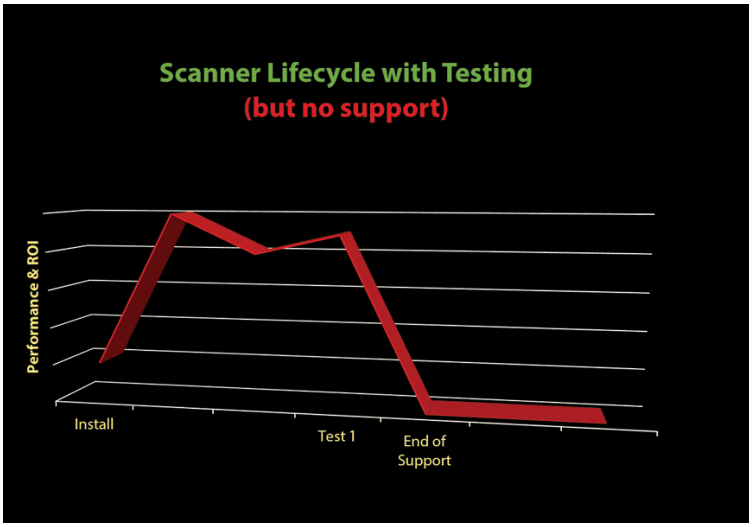
Support & Maintenance

Who's got your back if a critical component of your scanning system goes down?

Plenty of events can cause scan heads to fail, and we've seen them all: everything from fires, to electrical surges, to optimization software bugs, to boards being thrown through scanner windows. Any of these can take a scanner out of operation, even after years of perfect performance (you've been testing right?).

As such, it's important to select a scanning vendor that doesn't just want to sell you the shiniest, feature-packed piece of hardware. You need a partner that will stand by that scan head and offer you support throughout the full lifecycle of your purchase. At JoeScan we prioritize the long term support we offer our end-users. That's why we provide an industry leading five year warranty on every scanner that leaves our doors.

And to take it a step further, we also include a ten year support window for JoeScans; not from our product line inception, but from the purchase date. You don't want to have to replace an entire bank of scanners because the parts are no longer available to repair a single scan head. This support window gives you the peace of mind to know that we'll be there to keep you sawing if an emergency should come up, even nine-and-a-half years down the road.



All the testing in the world won't help you if your hardware provider can no longer support the scan heads you've purchased.

We also have the flexibility to provide lightning fast turnarounds, with 95% of repairs shipping out within four working days of receipt.

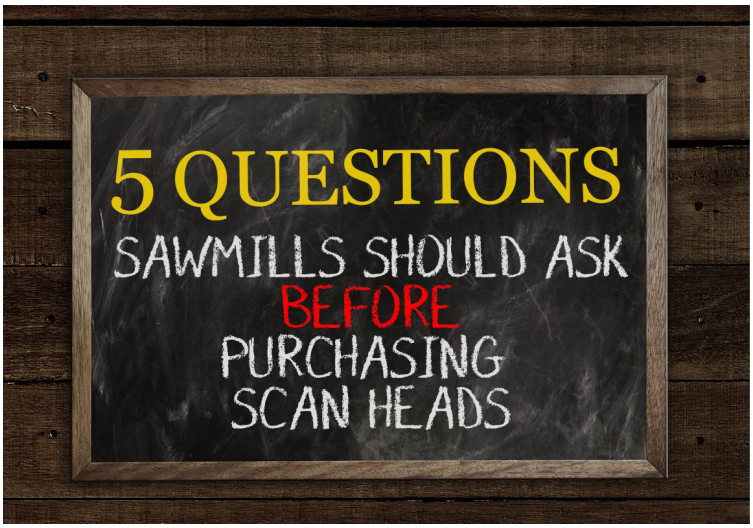
Finally, we don't want sawmills to be left in the dark during the repair process. That's why we make our engineers and design team available to you, to call up or email whenever you have an issue. This personal approach can often save you from having to send in a scanner at all, as we can walk you through some quick fix solutions to get you back up and sawing in no time.

But enough about us. In general, when considering the support and maintenance of your scan head manufacturer, ask the vendor the following questions:

1) What kind of warranty is provided with my new scanners?

2) How long will this product be supported?

3) Will I have engineering support? Or will I have to struggle through a complex customer service process?



For more questions you should ask your hardware vendor, check out our handy dandy blog post on the subject at:

joescan.com/blog/five-questions/

Key Takeaways for Support & Maintenance

15) *Upgrade decisions should be up to you and your particular business case, not scanner obsolescence.*

16) *Choose a scanning vendor that will provide you with a high level of support throughout the entire lifecycle of your hardware.*

Calibration

Calibration is not often a primary driver for selecting your new scanning hardware, so it can lead to a lot of unforeseen issues later.

As such, we at JoeScan recommend asking just one question about the calibration of a particular scan head: ***how simple is this scanner to calibrate?***

In particular, the simplicity of a calibration process can be broken down into the following criteria:

1) How much downtime does calibration add?

Complex calibration processes inevitably lead to more downtime. And as we all know, downtime directly takes money out of your bottom line.

2) Does the scanner require proprietary cal-bars?

Complicated calibration bars can be difficult to use, again adding to your downtime. And searching for a specific cal-bar to use on one part of your line is nobody's idea of time well spent. Furthermore, proprietary cal-bars can be difficult to replace, especially years after the scanners are installed.

3) How difficult is the calibration process?

How many steps are involved? The specific process of calibrating a particular scan head often becomes the responsibility of just a few key sawmill employees. So what happens when these employees move on to new roles or retire? How easy is it to transfer the knowledge for the calibration process to new employees?

What we've often seen over the past eighteen years is that this knowledge transfer turns into a game of telephone. Steps are forgotten or changed along the way. Crucial details are left out as each new employee takes over. Until years later, your calibration process is a hodgepodge of half-remembered, inaccurate information jotted down on a coffee-ringed napkin taped inside a locker beside a Molly Hatchet poster. This is not a knock against Molly Hatchet, but a firm reminder that the simplest calibration process will lead to the best results.

Any scan head features that can reduce the complexity of your calibration will pay off in the long run. We've always strived to make our scanning solutions as simple and easy to calibrate as possible.

This has been the driving force behind some of the innovative new technology that we're looking to include in our next line of scanners, including a new mounting mechanic that may allow for scanners to inherit calibration data through software alone. This means no calibration at all for you in the sawmill, even for repaired or replaced heads.

Key Takeaways for Calibration

17) *Although infrequently performed, complex calibration can become a major headache.*

18) *Simple calibration processes lead to less downtime and easier transfer of knowledge.*

Don't let this become the final resting place of your calibration process.

Connectors & Cables

The connectors and cabling are another scan head feature that is often left unexamined when considering new hardware. And while they may be less sexy than higher resolution camera sensors or quantum phase-induced turbo lasers, the connectors and cables that link your scan heads to the optimizing computer are the one feature that you will physically interact with the most during the full lifecycle of your scanners.

In general, you want two things out of your scanners' connectors and cables: you want industry standard connections, and you want as few connections as possible.

Industry Standard Connectors & Cables

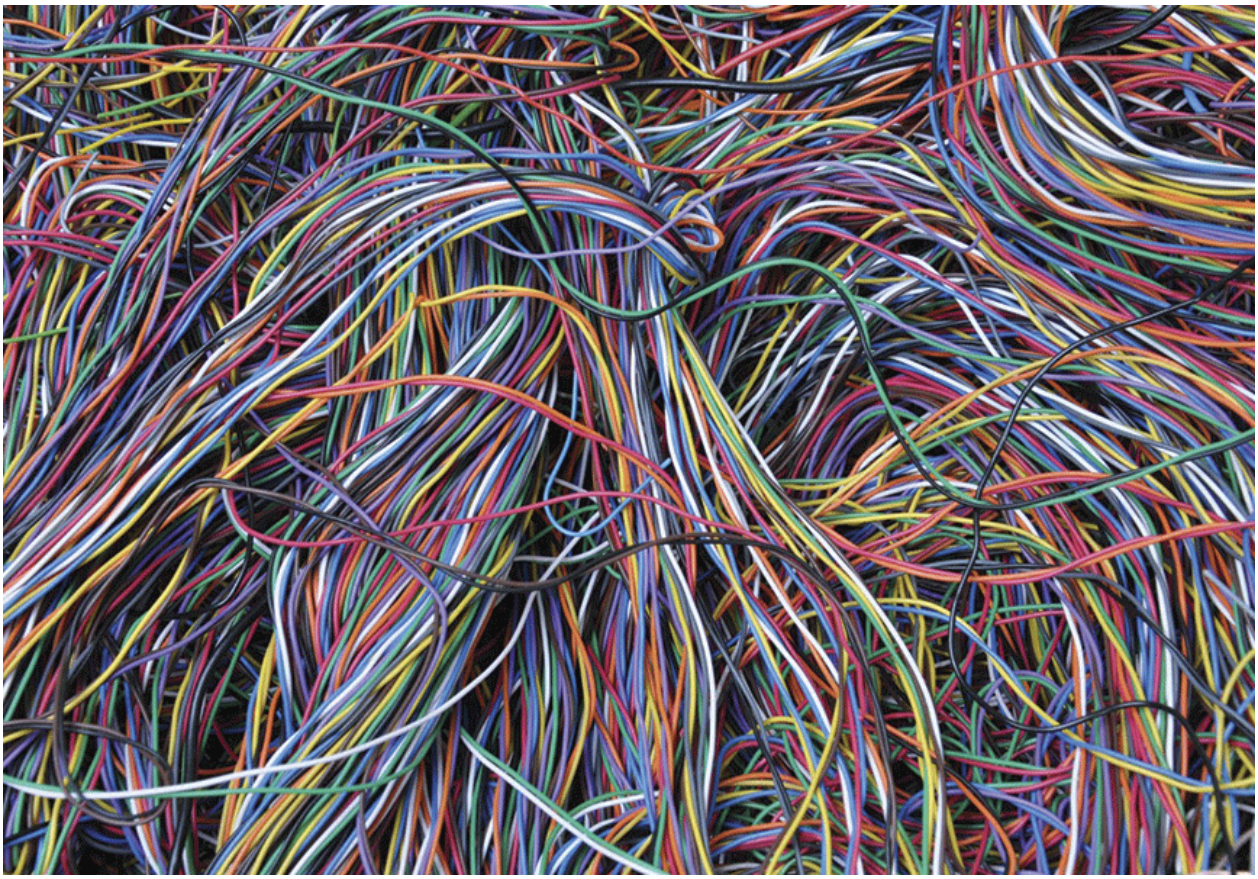
Industry standards are important for a few reasons. First of all, these are tried and true solutions that have proven their worth in the field. With industry standards, there are no flimsy plastic pieces to break or lose, and no inconsistent data transfer rates.

The second benefit of industry standards is that they are easier to repair and replace. In fact, a lot of industry standard cables can even be cut to length and terminated in your mill.

Fewer Connectors & Cables

Limiting the amount of connections and cables coming out of your scanner is another way to simplify your setup. Fewer cables mean fewer items you will have to troubleshoot in case something isn't working right.

It happens, cables get accidently cut, torn, or otherwise treated like a piece of wood (it is a sawmill, after all). And isn't it easier to check just a couple of cables rather than three or four when this tragedy occurs? You'll definitely appreciate the simplicity when checking multiple runs of 100+ feet, for a bank of twenty-four scanners.



"Ummm, I think it's the blue one."

The current industry standard is two connections per scan head: one ethernet cable for data, and a second cable to provide power.

Our current line of JS-25 scanners use this model. However, we're hard at work integrating a new industry standard into our next generation scan heads. The newest JoeScans will feature just a single PoE (power over ethernet) cable to deliver the juice, and the highest data transfer rates available to sawmill optimizers everywhere. Look for them later in 2018, and you too can reduce the number of connections from each of your scan heads by half!

Key Takeaways for Connectors & Cables

19) *Look for industry standard connectors and cables, and look for the fewest number of each.*

Design for Durability

Sawmills are probably one of the toughest environments in which to operate precision optical devices. They can be pretty rough places to work, especially for carefully calibrated electronics. So you'll need scan heads that are as rugged as you are to ensure that you'll be up and sawing full-time.

Specifically, sawmills are dangerous for scanners because they often feature:

1) Logs and boards zipping through at superhero speeds

2) Earthshaking heavy machinery

3) Steam-room humidity and pneumatic fluid dripping from every surface

4) Hottest August heat AND coldest February chill

5) More sawdust and wood debris than you can shake a 2x4 at

Long story short, your sawmill needs scan heads that provide sub-millimeter accuracy, all while withstanding a constant assault from:

1) Shock

2) Vibration

3) Moisture

4) Extreme temperatures

5) Dust and debris

This looks like a tough challenge, and it certainly is. So we learned a long time ago to take design cues from another precision tool that needs to deliver results in a variety of difficult environments: the main battle tank. Ooh-Rah!

Filed Under: Design Inspiration for Durability.

In short, your scan heads need to share durability characteristics with well-designed weapons of war. The features that allow a scanner to withstand this kind of abuse while maintaining peak performance are typically found within the mechanical design of the hardware. These include:

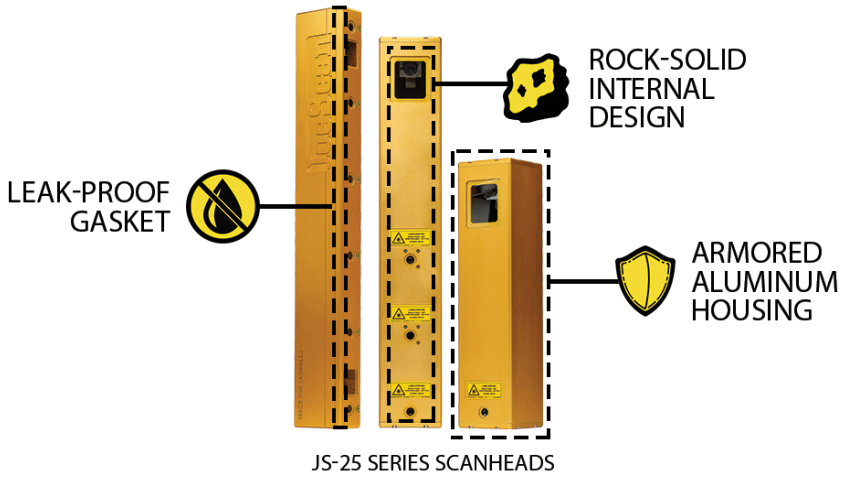
1) An armor-like housing :
providing evenly distributed protection to prevent weak spots. This delivers protection from shock.

2) Solid internal construction :
with sturdy integration for interior components. This keeps vibration from shaking apart the electronics inside.

3) A leak-proof gasket design :
keeping moisture out of the interior components and preventing fog on the laser and camera windows. This offers resistance to both ambient moisture and any other liquids that may get sprayed onto your trimmer line. It also prevents dust and debris from entering the hardware and shorting out or otherwise damaging the important "guts" of your scanners.

All of these design requirements come natural to the JoeScan team, because we've only ever designed our scanners to be deployed to the rough-and-tumble sawmill front.

You may find that this is not always the case (no pun intended) with other manufacturers. Many scanners get created for use in a variety of industries, and these devices may **not be designed** with durability factors as a primary driver. However, you can rest assured that each and every JoeScan is made for sawmills first, and made for sawmills only.



Durability features of the JoeScan lineup.

Key Takeaways for Design for Durability

20) *A sawmill is a dangerous environment for precision optical equipment.*

21) *Your scanners should be built as tough and impervious as possible.*

Summary of Key Takeaways

1 Scanner Features for Best Recovery

Data Density

1) Data density is crucial for identifying wane.

2) Higher scan speed is the most important metric for improving the across-the-board density used to find wane.

Face Coverage

3) You want face coverage for all four faces of your boards on the trimmer sorter line, but the leading and trailing edges are the most crucial for identifying wane.

4) Scanner placement and bank layout are the most important design factors that will improve your ability to see these leading and trailing edges.

Accuracy

5) You're never more accurate than your worst component.

6) Errors across components add up.

2 Conveyance Features for Best Scanning

Chain Spacing

7) Chain spacing represents a balance between scanner vision (wide spacing) and platform stability (narrow spacing).

8) The sweet spot is to match the chain spacing with the width of the scan zone.

Race Width

9) The narrowest race width possible will offer your scanning system the best view of boards.

Return Chain

10) Whenever possible, return chains should run below the scanning banks.

11) Scan heads with shorter standoff distance allow greater flexibility in placement for existing conveyance systems.

Board Stability

12) To offer an optimal scanning environment, your conveyance system should provide a quality transfer, with plenty of distance for boards to stabilize.

13) Reducing chain surge improves stability.

3 Reliability Features for Best Value

Testing

14) Continue to regularly test your whole system, using a random selection of boards.

Support and Maintenance

15) Upgrade decisions should be up to your particular business case, not scanner obsolescence.

16) Choose a scanning vendor that will provide you with a high level of support throughout the entire lifecycle of your hardware.

Calibration

17) Although infrequently performed, complex calibration can become a major headache.

18) Simple calibration processes lead to less downtime and easier transfer of knowledge.

Connectors & Cables

19) Look for industry standard connectors and cables, and look for the fewest number of each.

Design for Durability

20) A sawmill is a dangerous environment for precision optical equipment.

21) Your scanners should be built as tough and impervious as possible.

Finishing Up

These are just a few of the lessons we've learned at JoeScan over the last eighteen years of delivering sawmill scanning solutions for the trimmer sorter line. And rest assured, there will be more to come. We'll continue to make scanning easier to use and more affordable, so it can bring improved quality, increased yields, and better recovery to more sawmills.

We've covered a lot of ground here, so we've got a quick 1,2,3 punch to help you make the right decisions when you're ready to make a decision. They're easy to remember; so easy that we use them as our mission statement:

JoeScan

SIMPLE

Is the scanning solution as simple as possible?

RELIABLE

Can you count on the scan head to deliver the results you need over the full lifecycle of the product?

MADE FOR SAWMILLS

Was the scanner specifically designed for the environmental rigors and precise demands of the sawmill industry?

We hope that these lessons and key takeaways have been useful, and we encourage you to reach out with any specific questions or topics we may have missed. You can get a hold of us anytime at:

 info@joescan.com

 +1.360.993.0069

We love hearing from our end-users, because ultimately it's your input that helps us to keep raising the bar in terms of what scanning can deliver to sawmills all over the world.

If you enjoyed the quality of the information contained here, we invite you to follow us on social media. We'll be regularly sharing from our vault of scanning knowledge, as well as sharing new tips and tricks we learn along the way. And not every lesson will be this wordy, we promise. We've got a whole slate of videos, short form blog posts, infographics, and more, ready to release out into the sawmill universe.

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