

Maximizing Output: 3 Ratios to Maximize Production Revenue

Revenue is generated by machines that are running. Use these three ratios to ensure your machines are running at an optimal level.



While our precision machining shops sell much, much more than just the time on our machines, if our machines are not running, we have nothing to sell. If they are not running optimally, nor producing conforming product, we similarly are losing opportunity. If you are looking to improve the revenue earned by production in your shop, here are three ratios to help you “triangulate” to find the most important area to target operational improvements.

Performance Ratio: Actual Output (AO) to Theoretical Output (TO)

Revenue is driven by the sales dollars received for parts produced and sold. So, looking first at the gross production of parts in our shops makes perfect sense when trying to determine from where the revenue shortfall from operations is coming.

The Actual Output (AO) is the numeric count or weight of the number of parts in the pan per shift. **The Theoretical Output (TO)** is based on the layout cycle time and hours planned to produce at that rate. It is what your estimator calculated when quoting the job. Routine in-process tool changes, bar loading and routine adjustments — are already planned for in the estimate. Unexpected tool changes needed because of tool failures and breakage, slowed speeds, clearing stringy chips — anything that increases cycle times or reduces available production time from plan — can reduce this ratio. Make sure that you account for all factors that are reducing your expected operating time.

The Performance Ratio is the ratio of Actual Output (gross parts produced) divided by Theoretical Output (planned parts produced). This can be expressed as a percentage if you wish — just multiply the ratio times by 100 and add the percentage sign.



Availability Ratio: Running Time (RT) to Scheduled Time (ST)

If the machine is not running, it is not making any production. And no production means no revenue for sales. This makes **Running Time** the most crucial factor for our revenue improvement efforts. **Scheduled Time** is the time that the company plans to have the machine in production. Typically, machines are scheduled to operate for a full shift or for multiple shifts. Scheduled time gives us our planned, maximum expected production output.

Running time is defined as power to the machine and spindles that results in value added (i.e., production). This can be collected from on-machine devices or recorded by operators. Idle time is time when the machine may, in fact, be under power, but not making any production. Idle time can include downtime, setup time, warm-up time, coffee or lunch breaks, operator time away from machine chasing tools or looking for the supervisor — any time

where sellable production is not being created. Machine monitoring equipment and software can give more reliable data on both Running Time and Idle Time than operator logs.

Calculate the Availability Ratio by dividing the minutes of Running Time by the minutes that were Scheduled.

Availability Ratio: Running Time (RT) to Scheduled Time (ST). Make sure to keep your units (minutes or hours) consistent. Again, this can also be expressed as a percentage by multiplying the ratio by 100 and adding the percentage sign.

Quality Ratio:

Conforming Parts (CP) produced to Total Parts (TP) produced

Converting parts produced into sales (revenue dollars)

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takes more than simply dropping parts off the machine. Those parts must conform to customer's requirements. Having machines busy as heck making scrap is not doing anyone any good. At the end of the shift, you are

able to invoice only those parts which conform to quality requirements to get paid. As you can see, this is where rejects can instantly reduce your cash flow — not just your bottom line.

Quality Ratio is the ratio of **Conforming Parts (CP)** which are parts that meet customer requirements divided by **Total Parts (TP)** produced. As setup parts are necessary (often first one or two pieces from each bar per stock up) as well as parts needed for destructive testing, this ratio is never at 100%. However, a departure from the high 90s is a signal that you are losing money by the cost of the wasted parts as well as the fewer parts sold to recover the cost of your operations.

If your Quality Ratio declines, it is a sign to examine your work processes more closely to see where controls and practices need to be improved. Retraining may be required.

Maximize Output

When faced with unexpected low revenues — despite a normal or full schedule of operations — the confirmation of these three easy ratios can help you identify the proper action to take. By triangulating on the actual causes of the revenue shortfall and communicating process feedback rather than unfounded opinion, you get actionable insight into your operations. If the Performance Ratio (which measures actual output) is less than expected from your layout and engineering estimate, you will never make the revenue expected from your quote. Examine the factors given to determine where to start looking for improvements and differences from how you originally planned to produce these parts. What is different? Why?

When the Availability Ratio drops, your shop is cutting air rather than creating parts. These can be the result of unexpected issues in process, but typically I have found these to be largely administrative in nature. Failing to keep machines running over breaks, waiting for material because the material stocker is somewhere else or the crane or lift truck is unavailable are examples I have experienced. When cycle times are measured in seconds, minutes of missed production can be dollarized — and those sums come off your top line first.

Finally, making parts that will not ship creates the maximum loss for your operations. The materials consumed, the labor paid, the manufacturing cost — all of these are unrecoverable if the part fails to meet customer requirements. The worst time to detect a problem in your shop, from a cost standpoint, is after you have produced the part. Even trying to salvage by additional operations creates further loss by what you spend to rework. Attention to Quality Ratio will help you stay alert to the health of operations and minimize the waste and cost of producing nonconforming parts. ⊕

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