OPERATIONAL EXCELLENCE NEWSLETTER

The Hidden Cost of Bad Measurements: Getting Gage R&R Right

Separating the noise from true process variation on your shop floor.

Six Sigma · Quality Control · Measurement System Analysis · Process Capability

> The newsletter for quality engineers who prefer statistically sound diagnosis over quick, convenient assumptions.

The problem: When your gauge is lying to you

I have spent enough time on manufacturing floors to know that a "pass" on a Gage R&R study is often treated like a trophy—something to be checked off the list so the team can move on. But here is the hard truth: a measurement system that passes an audit isn't necessarily one that gives you clear information.

We have to distinguish between **The Precision Illusion** and actual process control.

A gauge might "pass" because it is consistent enough to stay within your tolerance limits, but if its internal noise is too high relative to the variation of your process, it is still lying to you. It’s like trying to see a small ripple in a pond while standing behind a thick pane of glass. You can see that things are "within bounds," but you cannot see the subtle drifts that signal a tool is wearing out or a temperature is climbing.

A measurement system's job isn't just to tell you if a part is good; it’s to tell you how your process is behaving today compared to yesterday. If the gauge’s "noise" masks those small changes, the data becomes useless for prevention. We aren't looking for a pass grade; we are looking for clarity of signal.

Why we get fooled by 'acceptable' numbers

The most common trap in Measurement System Analysis (MSA) is falling in love with a percentage. In many shops, if the Gage R&R study shows less than 10% variation from the gauge, it's celebrated as a win. This leads to what I call **The Acceptance Trap**.

Just because a number is "under ten" doesn't mean you can trust the data for high-precision work. If your tolerance window is narrow—say, only 0.5mm—a measurement system that takes up 9% of that space might be technically acceptable by some textbooks, but it leaves you with very little room to see a process starting to drift toward the edge.

The Comfortable Rationalization	The Underlying Reality
"The study says we are under 10%, so the gauge is good."	We can't tell if the part is drifting until it's already out of spec.
"It passed the audit, so we don't need to worry about it."	The measurement noise is masking small but critical process shifts.
"The operators are consistent enough for this check."	Operator technique varies just enough to hide a failing tool from our view.

We must stop looking at these numbers as badges of success and start looking at them as a measure of how much of the "truth" we can actually see through the noise.

The math behind reliability: Moving1passing simple averages

To get this right, we have to move past simply calculating an average. If you only look at whether your measurements are "close enough," you aren't doing MSA; you're just guessing.

We need to partition the variation. We want to know exactly where the noise is coming from: Is it the tool? The person holding the tool? Or the inherent differences in the parts themselves? This is why we use ANOVA (Analysis of Variance) as our primary lens. It allows us to strip away the "noise" so we can see what remains.

When you look at a Gage R&R through this lens, you aren't just asking "is it accurate?" You are asking:

1. **Is the gauge stable?** (Does it give the same reading on the same part over time?)
2. **Are the operators consistent?** (Do they all use the measurement tool in the exact same way?)
3. **Is the process capable?** (Can we see the difference between Part A and Part B?)

If you can't distinguish between a variation caused by a shaky hand and a variation caused by a worn-out drill bit, your data is polluted. We don't care about "good enough" averages; we care about being able to identify exactly what part of the system is failing when something goes wrong.

What happens when you trust bad data

When we settle for a measurement system that is merely "acceptable," we pay for it in three specific ways: **False alarms, wasted effort, and eroded confidence.**

First, if your gauge has too much noise, you will chase ghosts. You'll see a spike in the data and call a maintenance technician to fix a machine that isn't broken—the measurement was just "noisy" that day. Second, when we can't trust our gauges, we waste time over-adjusting processes that are actually stable because we are trying to compensate for the fact that we can't see clearly.

Finally, and most importantly, you lose the trust of your people on the floor. When an operator tells you a part looks right, but the "noisy" gauge says it's wrong—or when they tell you something is wrong and the "lazy" gauge says it's fine—the data loses its authority.

If the guys at the machines don't believe the numbers on the screen, they will stop using them to make decisions. They will go back to using their own eyes, their own experience, and their own workarounds. Once you lose that trust, no amount of "Standard Work" will bring it back.

Four steps to an honest measurement system audit

To move from a "passing grade" to a reliable system, follow these four steps during your next review:

1. **Define the True Tolerance.** Don't just look at what the customer allows; look at what you need for process control. If your internal goal is tighter than the spec, your measurement system must be even more precise than that goal.
2. **Isolate the Tool.** Perform a "master" check where one person measures a known standard multiple times. This isolates whether the problem is the equipment or the human element.
3. **Standardize the Grip.** If two different operators get different results on the same part, it isn't a process problem; it's a training and technique problem. You must eliminate "style" from the measurement process until only the data remains.
4. **Calculate the Resolution Gap.** Determine how much of your total tolerance is consumed by measurement error. If that number is high (e.g., over 10-20%), you are flying blind on the edges of your window.

Quick checklist: What to ask on your next Gemba walk

Next time you are walking the line, don't just look at the parts. Look at how they are being measured. Ask these three questions:

- **"Show me a part that was rejected last week. Now show me the gauge used to measure it."** (Check if the gauge is actually capable of seeing the defect or if we got lucky.)
- **"If this measurement drifted by 5% today, would you notice on your screen?"** (This forces them to think about whether they have enough "headroom" in their data to see a problem before it becomes scrap.)

- **"Who else knows how to set up and calibrate this specific gauge?"** (A measurement system is only as good as the continuity of its use. If only one person can do it, you don't have a process; you have a hero-dependent workaround.)

If the answer to any of these questions reveals a gap between "passing" and "knowing," it’s time to tighten your requirements for what constitutes an acceptable measurement system.

Call to Action

What measurement system in your plant feels like it’s giving you bad data? Share this article with an engineer who needs to read this.

Newsletter replies: newsletter@sixsigmakaizen.com · X: @kaizen_6sigma

Stay curious, stay improving,

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References: Measurement System Analysis & Gage R&R Guide