7 Mistakes to Avoid When Buying an Interferometer

In Brief

Buying an interferometer is a major purchase of an important tool required to manufacture today's optics.

Interferometers can last 30 years, therefore taking a little time to consider some mistakes to avoid is time well spent.

Interferometers are a major investment. They provide essential insight into your manufacturing process and quality control. Avoiding common buying mistakes will maximize your investment and keep your manufacturing from becoming obsolete. Here are seven common buying mistakes to avoid.

#1 "We've always done it this way..."

Yesterday's interferometer will not make tomorrow's optics. A particular interferometer has worked well. Its purchase was based on good past decisions so "let's just buy another like it". Also there is pressure from users who want to stay with what is familiar. This mistake occurs by not thinking through the present and future requirements. Interferometers are a 30-year purchase. You desire to be served by the best system that meets your present and future needs. Until you catalogue your needs you do not know what you need.

Consider the present and future needs before making a decision.

#2 Not Considering What Needs Measurement (The Measurand[1])

There are two needs: Your manufacturing needs and your customer's needs. If moving from lap to CNC polishing an interferometer with higher image resolution (not just more pixels) for mid-spatial frequency control, plus low image distortion to "hit" the right spot, and low retrace errors to measure accurately even when the part is far from perfect, will provide accurate data to converge rapidly on the final form. Your customer might need you to report surface form to mid-spatial frequency data no matter your internal processes. Or a software analysis like PVr might be required.

What performance, parameters and reports are needed?

#3 What Output Data Do You Need?

Output consists of displayed Results, Data Files, and in-process and final "printed" Reports. An interferometer is only as good as the data it produces AND communicates. Are the screen results ISO compatible? Does it output data files to drive a CNC polisher to final figure? Does it provide shop floor feedback for a technician? Does the system support a library of reports any user can select so customer reports are the same, always? When buying look at the entire suite.

How will this interferometer interact with machinery, technicians and customers?

#4 In-Use Performance Not Considered

The simplest interferometer reports accurate results on perfect parts, perfectly aligned, in a quiet environment. Therefore specification sheet performance does not always indicate actual use performance. Real-world users set the system up to what they think is best. For example plus/minus three fringes of power, or some tilt fringes to "see" the surface better. These setups are *off-perfect* and can induce errors. Plus vibration and air-turbulence create uncorrected ripples in the data degrading accuracy. Or different operators use filters and masks inconsistently causing variation in the data. These variables that are hard to control and anyone of them can scrap good parts or pass failed parts.

[1] "Particular quantity subject to measurement"; International Vocabulary of Basic and General Terms in Metrology. Includes image resolution, masking, filters (spatial frequency range), reported results

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Is the interferometer tolerant to these variations? Is the software designed to provide consistency with stored setups and standard and customized reports?

Is it robust against environmental and user variations to repeatably provide the accuracy needed?

#5 Is the Interferometer "Future Proof"

No one knows the future. The hardware tends to be "locked in stone" and is typically single purpose, but not always. Different applications utilize various data acquisition techniques and here are a few examples:

- Shop floor: Vibration Tolerant PSI.
- Long cavities (>2 meters), like telescopes: Vibration insensitive PSI, like Carrier Fringe.
- Large aperture systems: Wavelength Modulated PSI.
- Windows and substrates: Low coherence illumination, with vibration tolerant PSI.

Can it easily switch between these acquisition modes; an aspect of future proofing. Being "future proof" saves you hundreds of thousands of dollars from having to purchase multiple single-purpose systems.

Software can evolve rapidly to produce new results enabling new capabilities. The operating system though determines future viability. Is the interferometer using the latest 64-bit operating system or obsolete 32-bit?

Is an interferometer choice "future proof"?

#6 Lifetime Cost of Ownership Not Counted

- **Future Proof**: Does a system give you a hardware path to new applications?
- **Software Updates**: Always needed. What is the ongoing cost?
- **Simplicity**: The more moving parts, cables, electronics boards, etc. the lower reliability potentially will be
- **Uptime**: Can the system be remotely diagnosed? Can the user service it?
- **Training**: Software is always changing. Is training easy to access with videos, online training, etc.
- **Hardware Upgrades**: Simpler electronics and standard cables equals less expensive to upgrade
- **Price**: Consider price in light of a 10 to 30 year operational life and emerging needs

Did I consider the lifetime cost of ownership?

#7 Buying a New Interferometer, When An Upgrade Will Do

Your interferometer is dying. The computer crashes, the optics dirty and the software have not been updated in 10 years. Overall it measures what you need to measure, (see #2 Mistake). Should you buy a new interferometer? Not necessarily if the interferometer meets your needs. Upgrading is the least expensive and fastest path to a reliable system with many years of future use.

Is an upgrade the economical choice?

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