

# Five Things to Consider When Selecting Test Equipment

By Gary Breed  
Editorial Director

Here are some suggestions about how to go about choosing the right test instruments, accessories and test systems

**T**est equipment is key to successful products. The ability to make accurate, repeatable measurements in the lab, on the production line or in the field is

essential for the research, design, manufacture, installation and maintenance of all electronic equipment. And high frequency applications have unique requirements that must be accommodated by the test equipment we use.

## Five Things to Think About

The selection of test equipment always involves cost, performance and features. The suggestions in the following list address some of the tradeoffs that you may need to deal with in your particular situation.

### 1. Don't Settle for Less Than You Need

One of the biggest frustrations in an engineer's working life is when the necessary tools are inadequate. In today's difficult economic conditions, there may be extra temptation to save money by choosing test equipment models with mediocre noise performance or limited frequency range. Or you may choose to save money by foregoing a color display or connectivity options.

Many lower-cost instruments lack the ability to be upgraded in the future. Make sure you get the necessary performance and features, with some "headroom" for more demanding requirements in your next design assignment. If the capital simply isn't available for more than a minimally adequate choice, there are some options:

Renting and leasing high performance

equipment may allow you to get by with less-capable instruments for much of the development work. Equipment that is needed regularly can be leased for the expected duration of a major project. Short-term rentals can be useful, with the tradeoff being some extra planning to coordinate timing of the project development cycle to make sure that the expensive instrument is well-used during the rental period.

### 2. Don't Get (Much) More Than You Need

A little extra performance or some added features that can support future work are valuable, but avoid budget-busting overkill! This may never become an issue in a cost-conscious environment, but I've seen some start-up companies spend investment capital on unnecessary test equipment (and other things), ensuring their eventual failure.

I've seen similar over-ambitious behavior in large companies when there is unfortunate internal competition. I've even seen successful companies choose equipment with the idea that a fabulous laboratory will impress customers and/or investors.

Collecting the best toys is never a good alternative to doing great design work! Most companies do not have this problem, but I wanted to be sure it was noted.

### 3. Do Some Planning

Many engineering department purchases are made in response to an immediate need. This is fine for most test accessories and general lab supplies, but major purchases should get some analysis and coordination.

This is especially important with production test systems, which are normally con-

ceived in parallel with the design and development process, not assembled at the same time a product is released to manufacturing. However, when there are design changes, new models, or customer-specific adaptations, production test requirements may also change. When done on short notice, purchasing compatible instruments and incorporating them into automated test procedures increases the risk of trouble.

One thing that can help with future updates is the use of established test platforms, connectivity and control systems. Whether VXI/PXI bus modular systems, Internet protocol (IP) based, or traditional GPIB/IEEE 488 controlled systems, having a standard test system allows additional or upgraded instruments to be incorporated with the least difficulty. Proprietary test setups certainly may offer optimized efficiency, but those companies must accept the extra setup and debugging time by their test engineering staff.

#### **4. Allow Time for Training**

Modern test equipment includes many advanced features, accessed at the instrument via multiple menus, or by computer via programming setup. The controlling computer may even be inside the instrument. Learning to use these features, and how to incorporate them into test pro-

ocols and data collection systems, does not happen instantly.

Manufacturers' training programs can be extremely valuable, and many are offered as online tutorials. Another effective technique is for one or two engineers to become thoroughly familiar with a new instrument, teach the basics to the rest of staff, then be available as resources for questions and setup assistance.

A good guideline is to emulate the kind of training programs used to get staff familiar with complex EDA design tools. Many new instruments—from all companies—are designed to operate in conjunction with design software, as part of the overall design-development-verification process.

#### **5. Include the Cost of Productivity (or Inefficiency)**

Training is essential, but even before learning productive use of an instrument, the overall effect of test equipment choices on productivity must be considered. Will time-consuming tests be done faster? Can one multi-function instrument replace several individual units? What value is higher performance for a company's projects—lower noise floor, higher dynamic range, faster sweep, wider measurement bandwidth, etc.? Will new features save time—built-in setups for common standards, Ethernet connectivity, internal PC controllers, internal analysis tools, etc.?

Another issue is the capability of the engineering staff. Engineers with high frequency competence and experience are not plentiful, so a company may have a wide range of skill levels in its staff. Is it better to have simpler, easy-to-use (and less-expensive) instruments for staff working on less critical portions of a design, reserving the top-end instruments for the advanced staff? Or is it better to have a uniform set of instruments for all staff so there is no need to learn a new setup when a more advanced project is assigned? Both approaches are used successfully—each company needs to decide how its staff operates best, which can vary widely depending on both the range of work performed, and the operating styles of technical and general management.

#### **Summary**

The issues of test equipment choices versus cost, performance and human factors have not changed much since the earliest times of technology. How much precision and which features are essential apply equally well to 19th century galvanometers and 21st century wireless test sets. However, the economic impact of technology in today's world gives the choice more weight. Increasing complexity of both the test systems and the systems they are testing increases the difficulty of understanding the factors involved. Hopefully, these notes will help you at the start of the decision-making process.