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## SPECTRON TEST SYSTEM BENEFITS

### LOW COST

Despite its many benefits, a Spectron Display Test System costs much less to buy than historic test systems, and will require far less maintenance. This is a result of using modern "off-the-shelf" components combined with the versatile technologies Spectron itself has developed over the last 25 years.

A standard PC takes the place of the test control bench, and that alone removes more than a million dollars from the cost. Compact power supplies are buried in the ITA (Interface Test Adaptor) as needed. Since a customized ITA is needed for each UUT supported (to address the specialized connector needs) this adds little to system complexity. Spectron's automated "Optical Test Bench" system is price competitive with manual commercial tools which will do the range of testing required although slower and more labor intensive. Spectron's automated system also has an integrated self testing capability.

With Spectron's long history in display testing and related electro-optic technology, TPS software and fixture hardware can usually be assembled by adapting existing test modules and procedures. This avoids the long learning curve a new team faces and the TPS cost for each new UUT supported is thus a fraction of what a typical team would charge.

### LOW TRAINING

Spectron's systems automate all of the tricky steps in optical testing which make training so difficult. An optical engineer may immediately grasp the problems of "vignetting, centration, interpolation, alignment and veiling glare" which are present. Yet these are only the basics before the details of calibrating and operating a specific instrument can be mastered. And, if specific tests are done infrequently, the details must be correctly relearned each time.

Just as the calculator has eliminated the need to do arithmetic quickly, and the GPS system has eliminated the need for spherical trigonometry and has made global navigation trivial, so Spectron's optical instruments have made accurate optical measurements easy. Spectron's engineers have dealt with all these issues so that the user doesn't need to.

The user of Spectron's integrated display test systems needs only to be able to read instruction on the computer screen, and to properly handle the UUTs.

## SPECTRON TEST SYSTEM BENEFITS (continued)

### RAPID TESTING

Traditional display test procedures often take from two to eight hours to complete (particularly if adjustments are to be made and verified). A significant part of this time is spent using calibration tools to assure that the results are meaningful. Spectron's automated systems radically reduce this time.

With a well crafted TPS procedure, the Spectron system can often complete far more than the required tests in two minutes. The user must still mount and remove the UUT, open and close access plates for adjustment, etc.

A one half hour test cycle should be a leisurely pace, even with adjustments, so that at least sixteen UUT tests could be scheduled in a day.

### BETTER RESULTS

The Spectron test systems will typically collect several hundred data points in a two minute test. Since only a half dozen results may be desired, this may seem ridiculously fast, yet this is a typical situation for modern instruments. A series of measurements are often collected, compared and averaged, for example, to get one result. The automated system looks for stability of the data and other anomalies. An optical engineer would know to look for stability of an optical feature before trusting a test result. Similar expertise is embedded in the Spectron system.

Human operators have trouble handling numbers, with transposed digits and other errors occurring with significant frequency. Many optical instruments also have range selection features which can produce erroneous data. The direct link between the measuring head and the test computer eliminates many of these possible errors. Similarly, the computer controls the test head position and operating mode, so that many possible operator errors are avoided.

Given the high test speed, it is no burden to add additional tests and to identify subtle problems as they are recognized. For example, HUD systems are often checked for image focus (Parallax). This is a single number. Yet in the more difficult HMD optical systems, it may be necessary to collect and evaluate 16 "focus" parameters, which include astigmatism and field curvature, to adequately characterize the image presented to the pilot. This could add hours to a manual test procedure, but would add less than 15 seconds to the Spectron test procedure.

## SPECTRON TEST SYSTEM BENEFITS (continued)

### BETTER RECORDS

In many fields, computer "data mining" has yielded large productivity and cost benefits. Quantities of data, which would never be manually recorded let alone analyzed, can be crunched by patient computers to identify patterns which lead to costly problems. Just as a chart of lab data can allow a doctor to identify impending problems, stored test results can plot the degradation in display units and anticipate failures.

This is an application which develops over time, as a history is built up on each UUT. But the Spectron Test System's ability to collect and log a wealth of data at zero cost, makes future analysis possible.

A quick use of such data would be to verify that returned units were in fact being properly repaired. Historically "Lemons" are well known which show a pattern of defects and failures and resist normal repair efforts. The indirect costs of struggling with such units suggests weeding them out, or scheduling such an extensive overhaul that hidden defects are finally fixed.