The Calibration System at Cirris

In the past suppliers of cables for military contracts were required to use test and measurement equipment that had been calibrated by a calibration laboratory meeting the requirements of MIL-STD-45662A. In February of 1995 the United States Department of Defense cancelled MIL-STD-45662A in favor of either ANSI/NCSL Z540-1 or ISO 10012-1. Although cancelled in 1995, MIL-STD-45662A continued in many cases to be an interim standard while calibration laboratories made the transition to Z540-1 and ISO 10012-1.

Many commercial cable suppliers also want evidence of compliance to formal calibration standards.

At present, Cirris Systems is in compliance with both the MIL-STD-45662A and Z540-1 standards, and all certificates of calibration issued at this time reflect this calibration status. In June 1995 Cirris' quality system was registered by KEMA to ISO 9001:2000. As of May 2009 we have met the requirements of the standard ISO 9001:2008 (registration #110125.001). Therefore, Cirris' quality procedures, including calibration, are continually reviewed by both internal Cirris auditors and the external auditors representing KEMA.

Cirris Cable testers are designed and manufactured to function within published specifications, without the need of adjustments in the calibration process. If a Cirris tester fails to pass calibration, there are no adjustable components that can bring the cable tester back into calibration. Rather, the faulty tester module must be repaired or replaced before the unit will pass calibration.

Measurement Uncertainty

Cirris follows the guidance in ANSI/NCSL Z540-1-1994, paragraph 10.2(b) " *The laboratory shall ensure that the calibration uncertainties are sufficiently small so that the adequacy of the measurement is not affected. Well-defined and documented measurement assurance techniques or uncertainty analyses may be used to verify the adequacy of a measurement process. If such techniques or analyses are not used, then the collective uncertainty of the measurement standards shall not exceed 25% of the acceptable tolerance (that is, manufacturer's specification) for each characteristic of the measuring and test equipment being calibrated or verified ";* they will have traceable measurement.

What this means is that any standard used (in this case Cirris Performance Check Kits) to calibrate a tester, in the absence of more formal analysis as described in the paragraph above, must have at least 4 times more accuracy than the measurement specs of the Cirris tester being verified, including the tolerance "stack up" the accuracy of any NIST traceable instruments used and the accuracy impact of the least significant digit recorded by said instruments. Cirris' Performance Check Kits are maunfactured and verifed to meet or exceed this 4:1 ratio requirement.

Cirris provides calibration services for its test equipment; however, Cirris customers may elect to personally verify performance of their own cable testers by purchasing the appropriate performance check kit. Each performance check kit consists of verification adapters made with passive components, which have values traceable to the National Institute of Standards and Technology (NIST) in the United States and ensures the 4:1 ratio of accuracy to comply to the ANSI/NCSL Z540-1-1994 standard. The performance check kits used for verification of Cirris *hipot* cable testers require an adequate customer supplied voltmeter. Since the verification

adapters in performance check kits have only passive components and receive minimal wear in the field, a 2-year calibration interval is assigned to these adapters. At the end of the calibration interval, the verification adapters can be either re-verified annually or replaced. Damaged or worn verification adapters are not re-repairable and must be replaced.

The Cirris line of continuity testers; 1000M, 2000, 500 and 1000LC have a calibration interval of 2 years. This is due to the fact that continuity testers, which distinguish between opens and shorts, essentially are making very basic resistance measurements. More advanced Cirris testers; 1000R+, 1000RX, 1000HN, 1000H+, 1100R+, 1100H+, CR, CH+, CH2, Touch1 and Touch1 Ultra have been assigned a standard 1-year calibration period. These testers perform very accurate resistance, voltage, and/or capacitance measurements requiring a shorter interval.

General Elements of Calibration Programs

Calibration programs, such as those described in MIL-STD-45662A, Z540-1, and ISO 10012-1, require that the procedure used to test and calibrate test equipment be *written* and that the *personnel follow* the written procedure. Generally any test instrument used to calibrate another must be *at least four times as accurate* as the instrument being calibrated. In addition, an instrument used to test another instrument must be *traceable* to the NIST standards. MIL-STD-45662A defines traceability as, “The ability to relate individual measurement results to national standards, or nationally accepted measurement systems through an unbroken chain of comparisons.”

Each year calibration labs throughout the U.S. send a relatively small number of test instruments back to the NIST (National Institute of Standards & Technology) for calibration to extremely accurate specifications. Having the government provide the standard assures, in essence, that everyone uses the same yardstick. When the NIST confirms the accuracy of a test instrument’s ability to measure a given unit, a NIST number is assigned to that instrument for that unit of measure. When returned to the calibration labs, these *highly accurate* test instruments are used by the calibration labs to calibrate other pieces of test equipment, which in turn are often used to test still other instruments, and so forth.

Maintaining the chain of traceability back to the NIST is more complex than what might seem on the outset. For example, detailed calibration records must be kept, and the four-to-one accuracy ratio described above must be insured. Calibration intervals for each piece of equipment in the traceability chain must be maintained current. In addition, successive calibrations must be made under controlled conditions, with qualified personnel, who use valid and well-defined procedures.

NIST numbers are sometimes displayed on calibration certificates to demonstrate some evidence of NIST traceability. In recent years some calibration laboratories have discontinued displaying NIST numbers on calibration certificates in order to reduce calibration costs. At this time Cirris does not receive NIST numbers on certificates for instruments used in calibration, and therefore cannot provide NIST numbers on calibration certificates for Cirris test equipment. Please note there is nothing in MIL-STD-45662A, Z540-1, or ISO 10012-1 that requires NIST numbers be maintained for each successive calibration to demonstrate traceability.

Assuring Traceability to NIST

If you desire to audit the calibration system at Cirris, you may fax us the certificate of calibration for the Cirris cable tester you wish to be audited. Cirris will return to you the

paperwork trail of Z540-1/MIL-STD-45662A calibration certificates for that Cirris cable tester, back to a reputable calibration lab, such as Fluke or Hewlett Packard, which calibration laboratory Cirris has found in compliance with Z540-1and MIL-STD-45662A. These calibration laboratories are traceable to the NIST, thus completing the calibration links back to the NIST. The fee for this service, along with the fee for replacing lost calibration certificates is listed below. Procedures are frequently reviewed by Cirris internal auditors as well as by KEMA. Cirris customers may also arrange to visit Cirris for an on-site audit.

Fee Schedule for Special Calibration Services

Traceability audit of Tester or PCHK Adapter to NIST	$50.00
Replace lost calibration certificate	$25.00

Sincerely,

Gene Vought
Calibration Supervisor (801) 973-4600