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PERFORMANCE SPECIFICATION

TECHNICAL MANUALS: CALIBRATION PROCEDURES - PREPARATION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This performance specification covers the requirements for preparing technical manuals containing manual or automated calibration procedures. It does not apply to calibration procedures written for the exclusive use of the service's primary standards laboratories.

1.2 Applicability. This performance specification contains paragraphs and requirements which are not applicable to all Services. Such paragraphs or requirements are prefixed to indicate the Services to which they pertain: (A) for Army; (N) for Navy; and (F) for Air Force.

1.3 Detail. The level of detail contained in this performance specification is necessary to comply with the requirements of the Joint Computer-aided Acquisition and Logistics Support (JCALS) system.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure completeness of this list, document users are cautioned that they must meet all specified

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Det 2, HQ ESC/AV-2, 4027 Col Glenn Hwy, Suite 300, Dayton, OH 45431-1672, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC F6901 AREA TMSS

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requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-38784 - Standard Practice for Manuals, Technical: General Style and Format Requirements

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other government documents, drawings, and publications. The following other government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

PUBLICATIONS

Technical Manuals

Army:	SC 6695-92-A05	Calibration Set, Secondary Transfer Standards (Basic)
	SC 6695-92-A06	Calibration Set, Secondary Transfer Standards (Augmented)
	SC 4931-92-CL-A04	Sets, Kits, and Outfit Component Lists, Calibration Sets: Secondary Reference Set
Navy:	NAVAIR 17-35NCE-1	Navy Calibration Equipment List
	NAVAIR 17-35TR-03	Technical Requirements for Calibration Test Program Sets (CTPS) for Automated Test Equipment (ATE)
Air Force:	TO 33K-1-101	Calibration Standards and Associated Equipment.

(Copies of documents required by manufacturers in connection with specific acquisition functions should be obtained from the acquiring activity, or as directed by the contracting officer.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General requirements. The general style and format of preparation shall be in accordance with the requirements of MIL-STD-38784. Calibration procedures shall be provided in a separate manual for each test instrument (see 6.4.7). When specified by the acquiring activity (see 6.2), similar test instruments (see 6.4.9), or variations of the same type or model of test instrument, may be covered in the same manual. The manuals shall be delivered in electronic or paper format as specified by the acquiring activity (see 6.2). Document type definitions (DTDs) have not been included at this time. When electronic delivery of the manuals is required by the acquiring activity, the contractor shall contact Det 2, HQ ESC/AV-2 prior to developing any DTDs.

3.1.1 Numbering of paragraphs and procedural steps. All paragraphs and procedural steps shall be numbered using the decimal numbering requirements of MIL-STD-38784.

3.1.2 Text content. A calibration procedure shall include the essential information required by technicians to perform calibration of one or more test instruments. Each procedure shall include instructions or reference data in sufficient detail to enable calibration technicians to determine if the test instrument(s) is(are) operating within the prescribed performance limits without requiring reference to other publications.

> NOTE: This may result in some of the data being duplicated, or partially duplicated, in other procedures; however, this is required so that each specialist will have, in one procedure, all instructions required to calibrate the test instruments.

If specified by the acquiring activity, another publication may be referenced in a calibration procedure (see 6.2) when the following conditions are met:

(a) Calibration of the test instrument requires classified data which is available in the referenced publication, thereby eliminating the need to classify the calibration procedure, or

(b) The test instrument (see 6.4.7) is actually composed of commercial off-the-shelf (COTS) or general purpose equipment which is already supported by existing Department of Defense (DOD) approved calibration procedures.

3.1.2.1 Development of text. In accordance with the requirements of MIL-STD-38784, procedures shall be written in simple practical language (see 6.4.10). All terminology, symbols, and abbreviations shall be readily understandable by calibration technicians. New or unusual terms, symbols, or abbreviations shall be avoided, if possible, or explained at the first usage in each procedure. Action verbs shall be used (see 6.5). Instructions shall use the imperative mode, direct sentences, (e.g., "Set the FUNCTION switch to SQUARE WAVE.").

3.1.2.2 Types of instructions to be excluded. Calibration procedures shall not include maintenance instructions (for example: complete disassembly and assembly instructions of any instrument,

subassembly, accessory, or plug-in unit; or reconditioning, realignment, repair, or replacement instructions for work that is accomplished by maintenance activities).

3.1.2.3 Security classification. Inclusion of classified matter in the calibration procedures shall be held to a minimum. When classified information is included, it shall be identified in accordance with the requirements of MIL-STD-38784. Special precautions shall be taken to assure that the selection of calibration equipment or settings of calibration equipment and test instruments, do not inadvertently reveal or provide supplemental information which would allow determination of frequencies or other test instrument parameters, resulting in a compromise of classified information.

3.2 Detailed requirements. Calibration procedures manuals shall be arranged as follows:

Front Matter	
Section I	Identification and Description
Section II	Equipment Requirements
Section III	Preliminary Operations
Section IV	Calibration Process
Calibration Performance Tables	
Appendices (if required)	

3.2.1 Front matter. The front matter shall be in accordance with the requirements of MIL-STD-38784.

3.2.2 Section I - Identification and description. The identification and description section shall include the following information.

3.2.2.1 Test instrument identification. Commercial test instruments shall be identified by manufacturer, model number, and nomenclature. Military test instruments shall be identified by model number, nomenclature, and principle function, if not evident from the nomenclature. Component identification shall include the following information as applicable:

a. Set and component [(7603) and (7B53A)].

b. Military item and commercial counterpart [(ANUSM205) and (Hewlett-Packard 650A)].

c. Model variations (ANPSM45, A).

d. Any other identification specified by the acquiring activity, such as manufacturer's part number (see 6.2).

e. The various configurations, such as cabinet and rack-mount models (i.e., Tektronix 545 and RM545) or those using Zener reference or standard cells, such as Fluke 801 H or 801 HG.

3.2.2.2 Calibration description. The test instrument characteristics, performance specifications, and test methods pertinent to the calibration, shall be presented in tabular form (see FIGURE 1). The test method description shall clearly indicate how each test instrument performance

specification is verified, and shall refer to alternate methods if utilized in the procedure. Variations in test instrument characteristics or performance between models shall be identified.

3.2.2.2.1 Characteristics. Test instrument characteristics shall include those characteristics identified by the Manufacturer as critical characteristics that require periodic calibration to ensure the test instrument performance specifications are met. The Calibration Requirements Test List of the applicable Calibration Requirements Document (CRD) should be reviewed for any service specific test that may be required (see 6.4.11).

3.2.2.2.2 Performance specifications. Performance specifications shall be consistent with the item manufacturer's specifications, whenever possible. If they are not, the calibration procedure shall identify any deviations from the manufacturer's specifications.

3.2.2.3 Accessories. All peculiar accessories that require calibration with the test instrument shall be identified and described (see 6.4.4).

3.2.3 Section II - equipment requirements. This section shall include a list of the calibration equipment and peculiar accessories required in the calibration process (see FIGURE 2). The list shall include the generic name, minimum use specifications (characteristics, range, and accuracy required by the procedure), and one or more recommended equipment items selected from the equipment lists specified below:

Army:	SC 6695-92-A05 SC 6695-92-A06 SC 4931-92-CL-A04
Navy:	NAVAIR 17-35NCE-1
Air Force:	TO 33K-1-101

3.2.3.1 Calibration equipment table.

3.2.3.1.1 Reference item number. The first column shall include a reference item number assigned during the preparation of the procedure and the generic or common name for the equipment.

3.2.3.1.2 Minimum use specifications. The second column shall include the minimum use specifications (see 6.4.3).

3.2.3.1.3 Equipment selection. The third column shall include one or more examples of equipment which meets or exceeds the second column minimum use specifications and which are adequate for the performance of the procedure. Selection of the items in this column shall be made as described in paragraph 3.2.3.

3.2.3.1.4 Subsequent identification of equipment. Subsequent identification of the calibration equipment shall be general, so as to facilitate equipment substitution. The calibration equipment shall be identified by generic terms, (e.g., signal generator, direct voltage source, power meter, etc.), as long as no confusion exists. Item numbers, where needed for understanding, shall be used throughout the text.

3.2.3.1.5 Note and footnote. (N) If specified by the acquiring activity, the note and footnote shown in FIGURE 2 shall be used in all procedures (see 6.2).

3.2.3.2 Measurement system. A measurement system shall be used consisting of all recommended calibration equipment or combinations thereof. It shall have an uncertainty equal to or better than one-fourth of the uncertainty of the test instrument for each characteristic tested, (i.e., a test accuracy ratio (TAR) (see 6.4.5) equal to or better than four-to-one). Measurement systems of better TAR may be used for reasons of equipment availability, reduced complexity, or reduced calibration time. If a TAR equal to or better than four-to-one is not feasible because of state-of-the-art or other technical considerations, the best TAR available shall be used. In such cases, the actual TAR shall be stated in the procedure. Where several items of equipment are applicable, preference shall be given to the equipment affording the simplest, quickest, and most efficient test method.

3.2.3.3 Equipment list deviation. Contractors shall not deviate from the specified equipment list and from the TAR stated in paragraph 3.2.3.2, without prior approval of the procuring activity. The actual TAR shall be stated in the procedure, if the TAR is worse than four-to-one.

3.2.4 Section III - Preliminary operations. This section shall include test instrument, accessory, and calibration equipment connections, warmup instructions, setup instructions, or other operations that are preliminary to the complete calibration process.

3.2.4.1 Familiarization. Instructions, directing the technician to become familiar with the procedure before beginning calibration, shall be included.

3.2.4.2 Special environmental conditions. Environmental conditions, beyond those normally specified in facility requirements documents, affecting the accuracy or validity of measurements, shall be described. An explanation of the reasons for the requirement shall also be included.

3.2.4.3 Test jigs and fixtures. When special test jigs and other test fixtures are required in the calibration process, the necessary instructions, drawings, and schematics for the fabrication of these jigs and fixtures, shall be included. The acquiring activity shall determine if they shall be in the preliminary operations or in an appendix (see 6.2).

3.2.5 Section IV - Calibration process. This section shall describe the details (text, fixtures, illustrations, and tables) essential to the calibration of the test instrument and peculiar accessories.

3.2.5.1 Division of calibration process. The calibration process shall be divided into well identified divisions that cover each general calibration area. Each division shall be arranged in a logical sequence that will keep changes in connections, equipment setups, and control positions to a minimum. The necessary equipment connections, control settings, and operations which comprise the calibration process shall be described.

3.2.5.2 Procedure methods. The procedure shall utilize overall performance testing. Calibration methods by measurement of the test instrument output, or end product, shall be employed. (For example, power supplies of items such as signal generators, oscilloscopes, and electronic voltmeters are tested indirectly by monitoring the output frequency or amplitude, or both).

3.2.5.2.1 Connection to internal components. The calibration shall be conducted without connection of equipment to internal components of the test instrument unless such connection is absolutely unavoidable.

3.2.5.2.2 Criteria for including characteristics. The contractor shall develop calibration procedures if any of the following apply:

a. Characteristics (capabilities) that have performance limits which can reasonably be expected to change with time, use, or handling shall be included.

b. Characteristics (capabilities) whose performance limits are described as "approximate" shall not be verified.

c. Characteristics whose values are fixed and not subject to change with time, use, or handling shall not be included.

d. Functional tests shall be omitted when a related discrepancy or malfunction would be revealed during normal operation of the test instrument.

3.2.5.3 Interconnection instructions. The procedure shall specify the type, length, and dress of leads, grounding, and relative equipment placement, whenever such factors must be controlled to assure the success of the calibration. Interconnection information shall be described in words or shown in a simple line drawing, block diagram, or combination thereof, as required, for clarity (see FIGURE 3).

3.2.5.4 Control settings. Control settings shall be included, as necessary, to ensure complete understanding of the instructions. This information shall be specific for control and panel markings on the test instrument, and shall be in general terms for the calibration equipment and accessories. Series of control settings shall be presented in tabular form, when required, for clarity. Test instrument controls and control settings shall be identical to the markings on the equipment, and shall be in uppercase characters.

3.2.5.5 Adjustment instructions.

3.2.5.5.1 Criteria for including adjustments. Adjustment instructions shall be included if the following criteria is satisfied:

a. The adjustments apply to all test instruments/serial numbers covered by the calibration procedure.

b. Reasonable assurance exists that an out-of-tolerance condition can be corrected by the adjustment, without need for other maintenance/repair action.

c. The adjustment can be included, without unduly increasing the length and complexity of the procedure.

d. Interaction with other tests or adjustments are adequately covered.

e. The adjustment is compatible with the calibration equipment setup being used, and test sequence being followed.

f. The adjustment is readily accessible.

3.2.5.5.2 Additional adjustment instructions. When adjustment instructions are included in a procedure, the following additional instructions shall also be included in Section III:

a. Adjustments shall not be made prior to making measurements.

b. A characteristic shall not be adjusted when the measurement of that characteristic is within tolerance.

c. The calibration process shall be repeated for that characteristic, if a characteristic is adjusted.

3.2.5.6 Verification and corrective action. The following note shall be placed at the beginning of Section IV:

"NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding."

In those cases where an individual measurement will be affected by a corrective action, the following instruction shall be added: "Do not take corrective action until step ____ has been performed."

3.2.5.7 Calibration curves and charts. Instructions for preparation of calibration curves, charts, and tables shall be included, when required, for the use of the test instrument.

3.2.5.8 Performance limits. Performance limits shall be included in the text wherever instructions for tests or measurements appear. When a series of related measurements are indicated, the performance limits shall be shown in tabular form. Limits shall conform to the following:

a. Performance limits shall be expressed in the same units as nominal values whenever feasible.

b. Tolerances shall be expressed as upper and lower limits (for example, 49 to 51 volts), rather than plus or minus a quantity or percentage. Where the nominal value is not predictable, or is derived during calibration, the tolerance shall be given as plus or minus a quantity, rather than plus or minus a percentage of the nominal value.

c. Performance limits shall be expressed as single minimum or maximum values (for example, 2 cm min.) when required by the test instrument specification.

d. Nominal values and performance limits shall be expressed in the same units as the expected test data. Nominal values shall be omitted for quantities such as distortion, noise, ripple, etc., and quantities which are ideally zero. The processing of data or other computations, when required, shall be simplified as much as possible.

3.2.6 Calibration performance tables (CPT). When the technical specifications are not summarized in the procedure, each calibration procedure shall include a calibration performance table (CPT).

3.2.6.1 Contents of the CPT. The CPT shall be located after the calibration process (Section IV). It shall consist of all calibratable characteristics listed in TABLE 1 of FIGURE 1, showing procedure step number, range, values applied to the test instrument for each measurement characteristic. The performance limits for each measurement, as specified in paragraph 3.2.5.8 shall also be included. The performance limits shall be expressed in units of the same characteristic as the test instrument capability listed in the calibration description (see 3.2.2.2 and FIGURE 1).

3.2.6.2 Number of CPTs. CPTs shall be provided for all instruments covered by the calibration procedure. A separate CPT shall normally be provided for each test instrument; however, if two or more test instruments have identical characteristics, or have minor differences which can be readily and unambiguously handled on one CPT, one CPT may be used (see 6.4.12). All applicable instruments shall be identified in the heading (see FIGURE 4).

3.2.7 Appendices. Appendices shall be used, if necessary, to present supplementary or reference material, extracts from National Institute of Standards and Technology bulletins, dimensional tolerances for coaxial fittings, alternate test or calibration methods, or other essential information which has no logical location in the preceding instructions.

3.2.8 Automated Procedures. If specified by the acquiring activity, automated procedures shall be developed in accordance with NAVAIR 17-35TR-03 (see 2.2.2).

4. VERIFICATION

4.1 Verification. (F) Unless otherwise specified in the contract or purchase order:

a. Validity of the accuracy of the calibration procedures manual's technical content, and user interface functionality shall be the responsibility of the contractor (see 6.2).

b. The contractor shall provide suitable facilities to perform the validation functions specified herein.

c. The contractor's existing quality assurance (QA) procedures shall be used.

d. The government reserves the right to review any of the verifications, when such reviews are deemed necessary, to ensure supplies and services conform to the prescribed contractual requirements.

4.1.1 Minimum verification requirements. As a minimum, verification shall ensure the following:

a. Suitability of the manuals for the intended environment.

b. Usability by the intended users.

c. Compatibility with other government systems.

4.1.2 Compliance. All calibration procedures manuals shall meet all requirements of sections 3 and 5 of this specification as required by the acquiring activity (see 6.2). The requirements set forth in this specification shall become a part of the contractor's overall inspection system or quality

program. The absence of any requirements in this specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies, submitted to the Government for acceptance, comply with all requirements of the contract. Use of sampling inspections shall be at the discretion of the contractor, and in accordance with commercially acceptable quality assurance procedures. However, use of sampling in QA procedures does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

5. PACKAGING.

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES.

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Calibration procedures prepared in accordance with this specification are intended to provide the necessary instructions for periodic calibration of test and measurement equipment (see 6.4.6). These procedures are complete step by step instructions that enable the calibration technicians to verify the original accuracy of the test instrument.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of the DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1, 2.2.2, 2.3).

c. When similar test instruments are to be covered in the same manual (see 3.1).

d. If the manuals are to be delivered in electronic or paper format (see 3.1).

e. If another publication may be referenced in a calibration procedure (see 3.1.2).

f. If any other identification is required (see 3.2.2.1d).

g. If the note and footnote in FIGURE 2 are to be used in all procedures (see 3.2.3.1.5).

h. If instructions, drawings, and schematics for fabrication of jigs and test fixtures are to be included in text or an appendix (see 3.2.4.3).

i. If the calibration procedures is to be automated or manual (see 3.2.8).

j. If performance of inspections is to be other than as specified in this document (see 4.1).

k. Packaging requirements (see 5.1).

6.3 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, specifications and standards that have been cleared and listed in DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.4 Definitions. To clarify the terms used throughout this specification, the following definitions are given:

6.4.1 Calibration equipment. Calibration equipment is equipment, other than the test instrument, required to perform the calibration.

6.4.2 Functional check (test). A functional check is performed to verify correct functioning of a test instrument or some feature of a test instrument which is independent of the accuracy of the test instrument. The requirement is usually a condition to be met, rather than comparison with numerical tolerance limit values. (Examples of functional checks are: oscilloscope position control range and centering, multi-meter battery check, and oscilloscope sweep time vernier range check).

6.4.3 Minimum use specification. Minimum use specifications are the principal characteristics, accuracy, range, input impedance, and any other pertinent factors which are required during the performance of the tests and measurements described in the procedure. This information is intended to assist in the selection of suitable alternate equipment, which may be used if the equipment listed in column 3 of the calibration equipment table is not available, or at the discretion of the using laboratory. Satisfactory performance of alternate items will be verified by the calibration technician prior to use. All applicable equipment must bear evidence of current calibration (see 3.2.3.1.2).

6.4.4 Peculiar accessories. Peculiar accessories are those items furnished with a test instrument and only used with that test instrument, but not physically part of it. For example, a high voltage plug-in probe that is used specifically to extend the range of a particular voltmeter (see 3.2.2.3).

6.4.5 Test accuracy ratio. The TAR is the maximum allowable error of the unit to be measured or calibrated, divided by the maximum known error of the measuring or generating device used to perform the measurement. For example, if it is required that a system or equipment output parameter be accurate to 8% (maximum permitted error), and the known accuracy (maximum known error) of the measuring device used to measure the output parameter is 2%, then the TAR is 4 (see 3.2.3.2).

6.4.6 Test and measurement equipment. Test and measurement equipment are those devices which are used to measure or evaluate the characteristics of materiel or natural phenomena.

6.4.7 Test instrument. A test instrument is the item of equipment to be calibrated (see 3.1.2).

6.4.8 Verification. (F) Verification (section 4), in the context of this specification, equates to the contractor's quality assurance program for validating the content of the manuals.

a. Actual performance. Using production configured equipment, hands-on performance of the procedure using the technical instructions as written.

b. Simulation. Using production configured equipment and the manual procedures, simulate the actions required by the task steps.

c. Table top analysis. Primarily for nonprocedural data, compare the technical content to source data to ensure the technical accuracy and depth of coverage.

6.4.9 Similar test instruments. Similar test instruments are considered as those having similar characteristics, controls, displays, and performance limits to the degree which allows combination of calibration instructions without undue complications (see 3.1).

6.4.10 Text development. Division of procedures into discrete steps comprising one or more closely related operations contributes to ease of understanding. Short sentences and steps enable the operator to remember the entire operation (see 3.1.2.1).

6.4.11 Calibration requirements documents. Calibration requirements documents are joint service approved technical manuals which describe the test parameters that are necessary and proper for the calibration of a generic class of instruments (see 3.2.2.2.1). The following list of technical manuals are calibration requirements documents that provide necessary information to the Air Force, Army, and Navy concerning equipment calibration.

PUBLICATIONS

Technical Manuals

Army:	TB 43-180	Calibration and Repair Requirements for Maintenance of Army Materiel
Navy:	NAVAIR 17-35CR	Calibration Requirements Document Series
	NAVAIR 17-35MTL-1	Metrology Requirements List
	NAVAIR 17-35TR-04	Requirements for Preparation of Instrument Calibration Procedures (ICP)
	SSP OD 62476	Metrology Information & Document Automation System (MIDAS CD-ROM)
	SSP OD 62477	DOD Metrology Information & Document Automation System (DOD MIDAS CD-ROM)
Air Force	AFI 41-201	Managing Clinical Engineering Programs

TO 00-20-14	Air Force Metrology and Calibration Program
TO 00-24-234	Electrostatic Discharge Control
TO 33K-1-100-1	TMDE Calibration Notes, Maintenance Data Collection Codes, Calibration Measurement Summaries, Transportable Field Calibration Unit Configurations, and Automatic Calibration System Supportable Equipment
TO 33K-1-100-2	TMDE Calibration Interval, Technical Order, and Work Unit Code Reference Guide
TO 33K-1-100-CD-1	TMDE Calibration Interval, Technical Order, Work Unit Codes, Data Codes, Calibration Codes Reference Guide

6.4.12 Calibration performance tables. General procedures, which are used during the calibration of many test instruments, do not require a separate CPT for each test instrument (see 3.2.6.2).

6.5 Preferred action verbs:

a. The verb "adjust" refers to the action of a continuously variable control, dial, etc.

b. The verb "set" refers to the action of a detent device having two or more detent positions.

c. The verbs "press" and "release" refer to the action of a spring-loaded plunger or lever device.

d. The verbs "push in" and "pull out" can be used for any type control that would require that particular action to enable it's function. This would differ from pressing a pushbutton, in that it could relate to a dual function control or dial that provides one function while pushed in, and another function while pulled out (e.g., push in and set the VARIABLE/FREQUENCY DIAL for a frequency reading on the digital display (control is detent in the pushed-in mode, and functions as a digital readout dial); pull out VARIABLE/FREQUENCY control and adjust control to 1.0 (control is no longer detent, but can be adjusted to various settings on the dial to affect another function)). It would not be just a press and release action, as it would require a definite effort to push in or pull out.

e. The verb "touch" is used for equipment having electronic response "keys" that are "touch-activated" and respond to light finger pressure not considered to be a pressing action.

f. The phrase "adjust --- to ---" is used when the instruction means to align a mark on the control within an index on the panel, or the index on the control with a mark on the panel (i.e., Adjust the ATTEN control to -10dB.).

g. The use of "set --- to ---" follows the same rule applicable to switches or controls with detent positions (i.e., "Set the RANGE switch to X10.").

h. The phrase "adjust --- for ---" is used when the instruction means to adjust a control, to achieve a given condition or result indicated on another instrument, or on the same instrument in such a way as not to be directly associated with the dial or switch (i.e., "Adjust the FREQUENCY dial to obtain (for) a minimum DMM indication.").

i. The phrase "set --- for ---" follows the same rule applicable to switches or controls with detent positions (i.e., "Set the DMM range switch to obtain (for) an upscale indication.").

6.6 Subject term (key word) listing.

Calibration curves and charts
Calibration performance tables (CPT)
Equipment certification
Test Accuracy Ratio (TAR)
Test, Measurement, and Diagnostic Equipment (TMDE)

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

TABLE I CALIBRATION DESCRIPTION:

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Output	Range: 245 to 1050 MHZ; 50 kHz or 6 MHZ reference Accuracy: ±2%	Measured with an Electronic Counter
Amplitude Output	Range: 0.5 to 4 V p-p Accuracy: ±3% at reference output	Measured with a Digital Voltmeter
Amplitude Flatness	Range: 50 kHz to 1050 MHZ Accuracy: Within ±4% of the 50 kHz or 6 MHZ reference frequency amplitude (Equivalent to an 8% power change).	Monitored with a P-P Detector and with a Power Meter.

FIGURE 1. Typical Calibration Description.

NOTE

(N) Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the calibrating activity. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

TABLE II EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment[1]
2.1 Electronic Counter W/Heterodyne Converter	Range: 0.05 to 1050 MHZ Accuracy: ±0.01%	Hewlett-Packard 5345A w/5254C
2.2 Digital Voltmeter	Range: 0 to 2.0 VAC; 0 to 1 VDC Accuracy: ±0.5%	Fluke 8840A
2.3 P-P Detector	Range: 0.05 to 245 MHZ Accuracy: AGMC calibrated for flatness	Tektronix 067-0625-00
2.4 Resistor	Range: 2MΩ Accuracy: ±5%	As available
2.5 Power Meter W/Power Sensor	Range: 0 to 10 mW; 245 to 1050 MHZ Accuracy: Amplitude flatness within ±4%	Hewlett-Packard 432A w/8478B
2.6 Power Module	Range: Suitable for use with TI	Tektronix TM 500 Series
2.7 Termination	Range: 50Ω Accuracy: ±0.1%	Tektronix 011-0129-00

(N) [1]The calibration equipment utilized in this procedure was selected from those known to be available at Department of Defense facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval by the Department of Defense for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in the procedure.

FIGURE 2. Typical Equipment Requirements.

NAVAIR 17-20ICP-000

TRIPLE SPACE

4.10.2 This step is typed here in order to illustrate the correct spacing between this step, the procedure number (above), and the figure (below). Leave a triple space between the procedure number and the running text: quadruple space if a section heading starts the page.

ALLOW SPACE FOR FIGURE PLUS ONE HALF INCH ABOVE AND BELOW

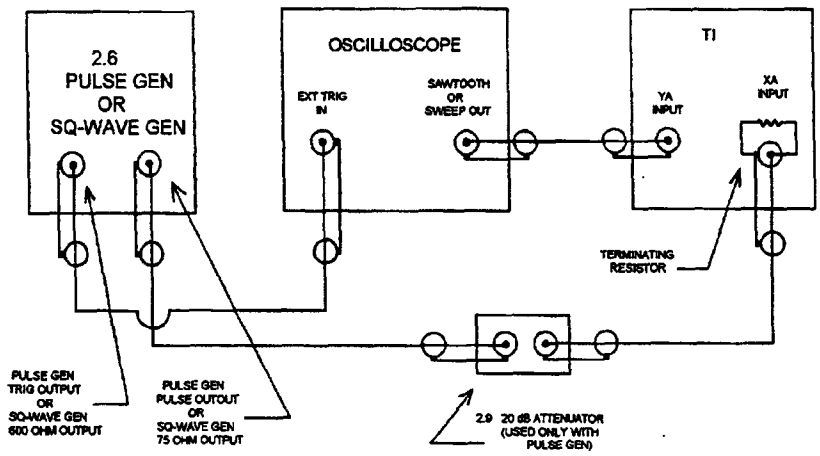

Figure 1. X Attenuator Compensation Test Configuration

TRIPLE SPACE

NOTES

1. If the pulse generator is being used, connect the 20 dB attenuator between the pulse output and the TI. Adjust the pulse generator controls for a repetition rate of approximately 4000 pps, the pulse width control for a width of 5 ms, and adjust the delay and amplitude controls for a stable TI CRT display 10 cm in amplitude.

2. If the square-wave generator is being used, adjust the frequency control for approximately 20 kHz, and adjust the 75 ohm amplitude control for a TI CRT display 10 cm in amplitude.

TRIPLE SPACE

4.10.3 Set the TI X VOLTS/CM switch to 5 (green marking).

FIGURE 3. Typical Interconnection Diagram.

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CALIBRATION PERFORMANCE TABLE

Test Inst(s): SG-504

Procedure Para. No.	Parameter	Range	Applied	Limits
4.1	Frequency	LOW	245 MHZ	240.1 to 249.9 MHZ
			250	245.0 to 255.0
			300	294.0 to 306.0
			.	
			.	
			.	
			550	539.0 to 561.0
		HIGH	500	490.0 to 510.0
			600	588.0 to 612.0
			700	686.0 to 714.0
			800	784.0 to 816.0
			900	882.0 to 918.0
			1000	980.0 to 1020.0
			1050	1029.0 to 1071.0
		0.05 MHZ	0.05	0.049 to 0.051
		6 MHZ	6	5.88 to 6.12
4.2	Output Amplitude	0.5 to 4 V p-p	4.0 V p-p	1.371 to 1.456 Vrms
			3.0	1.028 to 1.092
			2.0	0.685 to 0.728
			1.0	0.342 to 0.364
			0.5	0.171 to 0.182
4.3	Leveled Amplitude	50 kHz to 1050 MHZ	50 kHz	Reference
			245 to 1050 MHZ	Within ±4% of Ref amplitude

FIGURE 4. Typical Calibration Performance Table.

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CONCLUDING MATERIAL

Custodian:
Air Force - 16
Army - TM
Navy - OS

Preparing Activity:
Air Force - 16

(Project TMSS-O309)

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