# DATA ITEM DESCRIPTION

**Title**: CALIBRATION AND MEASUREMENTS REQUIREMENTS SUMMARY (CMRS)

**Number**: DI-QCIC-80278C

**Approved Date**: 20170123

**AMSC Number**: F9765

**Limitation**: N/A

**DTIC Applicable**: No

**GIDEP Applicable**: No

**Preparing Activity**: 36

**Project Number**: QCIC-2016-003

**Applicable Forms**: N/A

**Use/Relationship**: The Calibration and Measurements Requirements Summary (CMRS) details the measurement requirements of the system, subsystem, or equipment; the Test, Measurement, and Diagnostic Equipment (TMDE); and the calibration standards and equipment required to assure traceability of all measurements through the individual military department metrology and calibration programs to approved national standards. The summary identifies and validates the adequacy of TMDE and the need for calibration standards and equipment.

a. The CMRS DID satisfies the requirements of the 5000-series DoD directives; AFI 21-113, *Air Force Metrology and Calibration (AFMETCAL) Management*; AR 750-43, *Army Test, Measurement, and Diagnostic Equipment*; NAVELEX 4355.2 and MCO 4733.1B, *Marine Corps Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Maintenance Program (CAMP)*.

(Copies of DoD Directives are available online at http://www.dtic.mil/whs/directives/index.html; the AFI is available online at http://www.e-publishing.af.mil/; the AR is available online at http://www.apd.army.mil; the MCO is available online at http://www.marines.mil/News

b. This DID contains the format, content, and intended use information for the data deliverable resulting from the work task described in MIL-STD-1839, *Calibration and Measurement Requirements*, and is applicable to the acquisition of all military systems, subsystems and equipment.

(Copies of this document are available online at http://quicksearch.dla.mil.)

c. This DID supersedes DI-QCIC-80278B.

**Requirements**:

1. Reference documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as specified in the contract.

2. Format. Contractor format is acceptable. The Summary Data Table shall be in electronic format using Access or Excel. Contact AFLCMC/WNMM/AFMETCAL/Technology Applications for sample formats, templates or related guidance.

3. Content. The CMRS shall document in detail the measurement requirements of the system, subsystem or equipment; the test, measurement and diagnostic equipment (TMDE); and the calibration standards and equipment required to assure traceability of all measurements to approved national standards. The data presented in the CMRS requires periodic updating to include changes in design, changes in engineering, changes required as a result of proposals (ECPs), etc., which affect system measurement requirements or TMDE. The CMRS shall ensure:

3.1 All operational system, subsystem and equipment calibration and measurement requirements are identified and traceable to the National Institute of Standards and Technology (NIST) or other DoD approved measurement sources.

3.2 All supporting TMDE identified are adequate to support the operational system, subsystem and equipment measurement requirements.

3.3 All supporting TMDE that require calibration are calibrated with calibration and measurement equipment of higher known accuracy.

3.4 Administrative information. Classified information shall not be listed in the CMRS. Classified parameters and information shall be addressed in a classified supplement or appendix and that document shall be appropriately controlled.

3.5 The CMRS shall be structured as follows:

a. Cover page.

b. Revision status.

c. Introduction.

d. Table of contents.

e. List of abbreviations, symbols and acronyms.

f. Table of Category II TMDE.

g. Table of Category III calibration equipment and standards.

h. Table of Category IV (if applicable) highest level of calibration standards.

i. List of manufacturer's code to name (CAGE).

j. Summary data table of contents.

k. Summary data.

3.5.1 Cover page. The cover page (see sample CMRS, 3.6e below) shall include descriptive information such as system or program name, contract number, contractor's company name, current CMRS revision, date of submittal, Contract Data Requirements List (CDRL) number, etc.

3.5.2 Revision status. This section shall be included in the CMRS (see sample CMRS, 3.6e below). The initial CMRS submittal shall specify "original" on the revision status pages. Subsequent revisions shall be recorded on the cover page, in the revision status section and on pages affected by the revision. Other CMRS pages which are not affected by a revision shall not be resubmitted. Change bars on the revised CMRS pages may be used.

3.5.3 Introduction. This section (see sample CMRS, 3.6e below) contains general information, remarks or other information about the system, equipment or the CMRS which the preparer feels would be beneficial.

3.5.4 Table of contents. This table (see sample CMRS, 3.6e below) shall reflect the contents and page location numbers of each structural part of the CMRS identified in 3.5 (above).

3.5.5 List of abbreviations, symbols and acronyms. This list (see sample CMRS, 3.6e below) shall include all abbreviations, symbols and acronyms used in the CMRS with their meanings. Abbreviations shall be in accordance with ASME Y14.38, *Abbreviations and Acronyms for Use on Drawings and Related Documents*, where applicable.

(Copies of this document are available online at www.asme.org.)

3.5.6 Table of Category II TMDE. This table shall include an alphanumerical listing of the equipment identified in the Category II column of the summary data section. Items of TMDE that are component parts of test stations or other TMDE shall be shown as an indenture under the overall test station or TMDE. Calibration intervals shall be recommended if they are not already established or if a different interval is recommended other than those established in Air Force TO 33K-1-100-1, *Calibration Procedure for Maintenance Data Collection Codes and Calibration Measurement Summaries*, Army TB 43-180, *Calibration and Repair Requirements for the Maintenance of Army Materiel*, NAVAIR 17-35MTL-1 or Marine Corp TM-10510. The table shall include the following:

a. TMDE model, type or part number.

b. Nomenclature

c. Commercial and Government Entity Code (five-digit CAGE Code)

d. National Stock Number (NSN) if assigned.

e. Calibration interval in months

f. Calibration procedure applicable to contracting Military Department

g. Support Equipment Recommendation Data (SERD) number, if assigned.

h. Maintenance document applicable to contracting Military Department

3.5.7 Table of Category III calibration equipment and standards. This table shall include an alphanumerical listing of equipment identified in the Category III column of the summary data section. The table shall include the same type of information described in 3.5.6 a through h (above).

3.5.8 Table of Category IV (if applicable) calibration standards used for in-station transfer standards. This table shall include an alphanumerical listing of equipment identified in the Category IV column of the summary data section. The table shall include the same type of information described in 3.5.6 a through h (above).

3.5.9 List of manufacturers' code to name. This list (see sample CMRS, 3.6e below) shall contain the DoD assigned, five-digit CAGE code (reference DLA Cataloging website) and manufacturer's name for each equipment item identified in the CMRS.

3.5.10 Summary data table of contents. This table shall immediately precede the summary data section and shall reference the content number and hardware item for each system, subsystem and equipment entry shown in the summary data Category I column (see sample CMRS, 3.6e below).

3.5.11 Summary data. This section is an inline presentation of system, subsystem and equipment; TMDE; and calibration equipment and standards parameters which require measurement or calibration support (see sample CMRS, 3.6e below). The summary data are prepared as follows:

3.5.11.1 Category I operational equipment. These columns are for displaying the description, function, operational range or value and accuracy and test interval of the operational system, subsystem, equipment, assembly, module or component that has parameters that require measurement as specified in MIL-STD-1839.

3.5.11.2 Content number. Each Category I hardware entry shall be identified by a sequential locator and reference number. Sequential alphanumeric or decimal reference numbers shall be used. When Logistics Support Analysis Records (LSAR) are a contractual requirement the LSA control number shall be used.

3.5.11.3 Function. The Category I function which must be measured, tested, verified, checked, adjusted or supplied shall be shown in the description column in a logical sequence.

3.5.11.4 In-line presentation. As each Category I function and measurement parameter is listed, complete the Category II, Category III and Category IV summary data before proceeding to the next Category I hardware measurement parameter. The parameters and tolerances in each line shall be expressed in consistent units of voltage, frequency, power, current, etc., or percentages. Where this is not the case, explain the inconsistency in an appropriate footnote.

3.5.11.5 Category II TMDE. This summary data represents the support TMDE used to measure, test, verify, check or adjust the Category I equipment as specified in MIL-STD-1839. The summary data Category II columns shall list the nomenclature and part or model number of the TMDE and its' specifications.

3.5.11.6 Peculiar TMDE. Items of TMDE developed specifically to support Category I measurement requirements. The first time an item of Category II peculiar TMDE is listed in support of a Category I measurement parameter, the complete measuring, generating and accuracy capabilities of the peculiar TMDE shall be listed. For subsequent requirements for the same item of Category II peculiar TMDE, only those capabilities required to satisfy the Category I measurement parameters shall be listed. Complete Category III requirements in 3.5.11.9 below before proceeding to the next Category II entry. First time entries for Category II peculiar TMDE may be listed in contractor elected format in a separate section of the CMRS.

3.5.11.7 ATE. The first time an item of Category II ATE is listed in support of Category I measurement requirements; all minimum use specifications of the replaceable TMDE in the ATE shall be listed. First time entries for Category II ATE may be listed in contractor format in a separate section of the CMRS. For subsequent requirements for the same ATE, only the most stringent of minimum use requirement and the specific replaceable TMDE need to be listed in the inline presentation. Complete Category III requirements in 3.5.11.9 below before proceeding to the next Category II entry. Integral items of ATE used for self-testing or ATE calibration shall be identified.

3.5.11.8 Common TMDE. Items of Category II common TMDE that do not have DoD approved calibration procedures, technical orders or maintenance technical orders shall be handled like the peculiar TMDE in 3.5.11.6 above.

3.5.11.9 Category III calibration equipment and standards. This summary data represents the common and peculiar calibration equipment, standards and TMDE used for calibration, testing, troubleshooting or maintenance of Category II TMDE as specified in MIL-STD-1839. The summary data Category III columns shall list the description of the calibration equipment, standards and TMDE, and its specifications or the DoD approved calibration procedure, technical order or maintenance technical order for the Category II TMDE. Where no approved method of support exists for the Category II TMDE, all of the equipment and parameters required to show measurement traceability, will be listed in the Category III column. For subsequent entries, reference notes may be used where the requirements are duplicated.

Where multiple items of calibration equipment and standards are required to accomplish measurement traceability, the overall systematic error shall also be known.

3.5.11.10 DoD approved calibration procedures. For items of Category II TMDE that have an approved method of support, list the applicable military department approved calibration procedure, technical order or maintenance technical order in the Category III column opposite the Category II TMDE.

3.5.11.11 Category III peculiar calibration equipment and standards. Items developed specifically to support Category II TMDE measurement requirements. This equipment shall first appear in the Category III column opposite the Category II TMDE it is designed to support. It shall also be listed in the Category II column so the method of support and traceability can be established in the Category III column.

3.6 Additional information.

a. When two or more identical items of TMDE are required for a specific measurement, it shall be so noted in the applicable Category II or III item description column and tables of TMDE.

b. Transistor-Transistor Logic (TTL) level test requirements shall not be listed in the Category I or Category II summary data.

c. When Category I input torque calibration requirements are listed, the test uncertainty ratio (TUR) of the Category II torque tool shall not be less than 1:1 and the need not be greater than 1:1. The TUR of the Category III torque calibration standard shall be 4:1 or better.

d. When Category I input stimuli requirements are listed and being supplied by Category II TMDE, the test accuracy ration shall not be less than 1:1 and need not be greater than 1, unless conducting pass, fail or fault tolerance test.

e. A sample CMRS template follows.

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# CALIBRATION & MEASUREMENT REQUIREMENTS SUMMARY

# FOR

# SAMPLE SYSTEM

Contract Number _____
Date _____

Prepared by: _____ Approved by: _____

_____ _____

Company Name

and

Address

Document Number _____
Revision _____
Revision Date _____

**CMRS Revision Status**

Date: _____
Revision: _____

| Page | Revision | Page | Revision | Page | Revision | Page | Revision |
|---|---|---|---|---|---|---|---|
| i | B | 41 | Original | | | | |
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| iii | Original | 43 | A | | | | |
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| 4 | Original | 49 | Original | | | | |
| 5 | A | 50 | Original | | | | |
| 6 | A | | | | | | |
| 7 | A | | | | | | |
| 8 | A | | | | | | |
| 9 | A | | | | | | |
| 10 | A | | | | | | |
| 11 | B | | | | | | |
| 12 | B | | | | | | |
| 13 | A | | | | | | |
| 14 | A | | | | | | |
| 15 | B | | | | | | |
| 16 | B | | | | | | |
| 17 | B | | | | | | |
| 18 | Original | | | | | | |
| 19 | Original | | | | | | |
| 20 | Original | | | | | | |
| 21 | Original | | | | | | |
| 22 | Original | | | | | | |
| 23 | Original | | | | | | |
| 24 | Original | | | | | | |
| 25 | Original | | | | | | |
| 26 | Original | | | | | | |
| 27 | Original | | | | | | |
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# INTRODUCTION

# FOR

# SAMPLE SYSTEM

# CALIBRATION & MEASUREMENT REQUIREMENTS SUMMARY

[Company Name] submits a Calibration & Measurements Requirement Summary (CMRS) in accordance with the [Sample System Name] contract Statement of Work and Contract Data Requirements List (CDRL) Item number [number] for Data Item Description (DID) for CMRS.

This CMRS identifies the [Sample System] stimuli and measurement parameters; the common and peculiar Test, Measurement and Diagnostic Equipment (TMDE) parameters and the measurement parameters of the supporting TMDE. These data are required to assure measurement traceability through the services base or depot measurement laboratories to the National Institute of Standards and Technology (NIST).

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# CALIBRATION & MEASUREMENT REQUIREMENTS SUMMARY

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## LIST OF ABBREVIATIONS, SYMBOLS AND ACRONYMS

| TERM | DESCRIPTION |
|---|---|
| A or AMP | Ampere |
| A/D or ADC | Analog to Digital Converter |
| AC | Alternating Current |
| ATE | Automatic Test Equipment |
| BITE | Built-in Test Equipment |
| BTI | Bus Test Instrument |
| CAGE | Commercial and Government Entity |
| CAL | Calibrate |
| CC | Constant Current |
| CITA | Calibration Interface Test Adapter |
| CMRR | Common Mode Rejection Ratio |
| CMRS | Calibration & Measurement Requirements Summary |
| Co | Company |
| Cont | Continued |
| CPU | Central Processing Unit |
| CR | Constant Resistance |
| CV | Constant Voltage |
| CW | Continuous Wave |
| D/A or DAC | Digital to Analog Converter |
| dB or DB | Decibel |
| DC | Direct Current |
| DEG or Deg | Degree |
| DMM | Digital Multimeter |
| DTI | Digital Test Instrument |
| DTS | Digital Test Station |
| FS or F.S. | Full Scale |
| GHz | Gigahertz |
| HV | High Voltage |
| Hz | Hertz |

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| | |
|---|---|
| I | Current |
| kHz | Kilohertz |
| Kohms | Kilo ohms |
| kV | Kilovolts |
| kW | Kilowatts |
| LVDT | Linear Variable Differential Transformer/Transducer |
| MAX or max | Maximum |
| MHz | Megahertz |
| Mohms | Mega ohms |
| MIN or min | Minimum |
| MA or mA | Milliamps |
| MV or mV | Millivolts |
| mVDC | Millivolts Direct Current |
| NCR | No Calibration Required |
| ns or nS | Nanosecond |
| NO | Number |
| Pmax | Power Maximum |
| p-p or pp | Peak-to-Peak (example: Vpp) |
| ppm | Parts Per Million |
| Pwr Sup or P.S. | Power Supply |
| R | Resistance |
| SQ CM | Square Centimeters |
| TDR | Time Domain Reflectometer |
| TMDE | Test, Measurement, and Diagnostic Equipment |
| V | Volt |
| Vrms | Volt Root Mean Square |
| VAC or Vac | Volt Alternating Current |
| VDC or Vdc | Volt Direct Current |
| W | Watt |
| Us or uS | Micro Seconds |
| uV | Micro Volts |

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Table of Category II [III, IV] TMDE

| Model, Type or Part Number | Nomenclature | CAGE | National Stock Number (NSN) | Cal Int | Calibration Procedure | SERD Number | Maintenance Document |
|---|---|---|---|---|---|---|---|
| 123B | Digital Multimeter | 12345 | 1234-56-789-1011 | 12 | 33K3-4-1234-1 | 123456 | 33D1-23-456-78 |
| XYZ2 | Oscilloscope | 56789 | 1234-56-789-1011 | 6 | AB123CD* | 123456 | Commercial Manual |

* Commercial or Manufacturer's Number

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# LIST OF MANUFACTURER'S CODE TO NAME

| CODE | NAME |
|---|---|
| 03LB1 | VXI Technology |
| 0VGU1 | North Atlantic Instruments Inc. |
| 1LQK8 | Agilent Technologies |
| 21793 | Racal Instruments |
| 23350 | Teradyne Inc. |
| 25965 | Elgar Electronics Corp. |
| 57487 | Ametek |
| 57798 | Trek Inc. |
| 64667 | National Instruments |
| 89536 | Fluke Corp. |
| ODRX9 | ATTI |
| 1RPN6 | Maury Microwave |
| 15542 | MiniCircuit Labs |

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**CALIBRATON AND MEASUREMENT REQUIREMENTS SUMMARY**

**SUMMARY DATA TABLE**

| CATEGORY I Operational/System Equipment | | | | | CATEGORY II TMDE | | | CATEGORY III Calibration Equipment/Standards | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Content No. | Description of Item | Operational Range/Value | Operational Tolerance | Cal Intervals | Description of Item | Specific Range/Value | Specific Tolerance | Description of Item | Range or Value | Tolerance |
| 1.0 | Radar System AN/FPS-XXX | | | | | | | | | |
| 1.1 | Transmitter Assy P/N 12345 | | | 6 | | | | | | |
| | Output Power (kW) | 1 kW | ±25% | | Power Meter Model 1234 w/Power Sensor P/N 12345 | 0 to 5 W | ±4% FS | 33K3-4-1234-1 (AF Procedure) | | |
| | | | | | Directional Coupler Model 1234 | 30 dB | ±2% FS | AB1234CD (Commercial Manual) | | |
| | Pulse Width (microseconds) | 1µS | ±0.1 µS | | Oscilloscope P/N 12345 | 0.2 µS per/div | ±3% rdg | 17-20WW-222 (Navy Procedure) | | |
| | Transmitter High Voltage Power Supply P/N 12345 | | | 12 | | | | | | |

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| | CATEGORY I Detailed Specification from Performance Specs | | | CATEGORY II Test/Measurement & Diagnostic Equipment | | | | CATEGORY III Calibration Equipment/Standards | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Detailed Specification Reference | Description of Item | Operating Range or Spec Value | Operating Tolerance | Description of Item | Operating Range or Spec Value | Operating Tolerance | Test Uncertainty Ratio | Description of Item | Operating Range or Spec Value | Operating Tolerances | Test Uncertainty Ratio |
| **2.0 ADTS** | | | | | | | | **PATEC** | | | |
| **2.1 DC** Power Supply | | | | **Agilent 3458A** | | | | **Fluke 5700A Calibrator** | | | |
| | DC Voltage | ±0.1 to ±512 V ±0.05% Range or 100µ V min | | DC Voltage | | | * | DC Voltage | | | |
| | | -0.1 Vdc | ±100 µV | | -0.1 Vdc | ±50 µV | 2 | | -0.1 Vdc | ±12.5 µV | 4 |
| | | +0.1 Vdc | ±100 µV | | +0.1 Vdc | ±50 µV | 2 | | +0.1 Vdc | ±12.5 µV | 4 |
| | | -1 Vdc | ±500 µV | | -1 Vdc | ±50 µV | 10 | | -1 Vdc | ±12.5 µV | 4 |
| | | +1 Vdc | ±500 µV | | +1 Vdc | ±50 µV | 10 | | +1 Vdc | ±12.5 µV | 4 |
| | | -2 Vdc | ±5 mV | | -2 Vdc | ±250 µV | 20 | | -2 Vdc | ±62 µV | 4 |
| | | +2 Vdc | ±5 mV | | +2 Vdc | ±250 µV | 20 | | +2 Vdc | ±62 µV | 4 |
| | | -10 Vdc | ±5 mV | | -10 Vdc | ±500 µV | 10 | | -10 Vdc | ±125 µV | 4 |
| | | +10 Vdc | ±5 mV | | +10 Vdc | ±500 µV | 10 | | +10 Vdc | ±125 µV | 4 |
| | | -20 Vdc | ±50 mV | | -20 Vdc | ±1.50 mV | 33 | | -20 Vdc | ±375 µV | 4 |
| | | +20 Vdc | ±50 mV | | +20 Vdc | ±1.50 mV | 33 | | +20 Vdc | ±375 µV | 4 |
| | | -31 Vdc | ±50 mV | | -31 Vdc | ±3.35 mV | 14 | | -31 Vdc | ±837 µV | 4 |
| | | +31 Vdc | ±50 mV | | +31 Vdc | ±3.35 mV | 14 | | +31 Vdc | ±837 µV | 4 |
| | | -114 Vdc | ±50 mV | | -114 Vdc | ±10 mV | 5 | | -114 Vdc | ±2.5 mV | 4 |
| | | +114 Vdc | ±50 mV | | +114 Vdc | ±10 mV | 5 | | +114 Vdc | ±2.5 mV | 4 |
| | | -512 Vdc | ±256 mV | | -512 Vdc | ±256 mV | 1 | | -512 Vdc | ±64 mV | 4 |
| | | +512 Vdc | ±256 mV | | +512 Vdc | ±256 mV | 1 | | +512 Vdc | ±64 mV | 4 |
| | | | | * TUR > 1 is for use as On-Station Standard for 3.7.4, 3.7.7, 3.7.8, 3.7.9, and 3.7.1 | | | | | | | |

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| Category I Operational System | | | | | Category II Test/Measurement & Diagnostic Equipment | | | Category III Calibration Equipment/Standards | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sec. | Description of Item | Operational Range or Value | Operational Tolerance | Interval | Description of Item | Specific Range or Value | Specific Tolerance | Description of Item | Specific Range or Value | Specific Tolerance |
| 1.0 | | | | | Self-Test/ Calibration Adapter (SK16850-727-1) | | | *PMEL* | | |
| 1.1 | Nitrogen Pressure System | 30 to 50 psig | ±1.0% of reading psig | 6 mos | Pressure Transducer (AP121BN): (0 to 50 psig at ±0.1% full scale accuracy) | 30 to 50 psig | ±0.22% of reading psig | Nitrogen Pressure Standard (2465) | 30 to 50 psig | ±0.073% of reading psig |
| 1.2 | Vacuum Pressure System | 1 to 1000 Torr | ±6.25% of reading Torr | 6 mos | Vacuum Pressure Transducer (626A): (0 to 1000 Torr at ±0.25% full scale accuracy) | 1 to 1000 Torr | ±1.67% of reading Torr | Vacuum Pressure Standard (690)<br>Voltage Output (8840A) | 1 to 1000 Torr<br>0 to 10 Vdc | ±0.556% of reading Torr<br>±0.0556% of reading Vdc |
| 1.3 | Hydraulic Pressure System | 0-4500 psig | ±0.25% of full scale | 6 mos | Pressure Transducer (HPO-5000-GAUGE-10Vdc-1/4NPT M-2): (0 to 5000 psig at ±0.05% full scale accuracy) | 0-4500 psig | ±0.05% of full scale | Hydraulic Pressure Standard (2485) | 0-4500 psig | ±0.0125% of full scale |

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