



**MODEL 17508
RESISTANCE STANDARD**

**OPERATION & SERVICE
MANUAL**

Publication Date: June 2000
Document Number: 17508-900-01 Rev. B

SAFETY SUMMARY

DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this manual.



WARNING

Highlights an operating or maintenance procedure, practice, statement, condition, etc., which, if not strictly observed, could result in injury and/or death of personnel. Do not proceed beyond a WARNING symbol until all the indicated conditions have been fully understood and/or met.



CAUTION

Highlights an operating or maintenance procedure, practice, statement, condition, etc., which, if not strictly observed, could result in damage or destruction of the equipment. Do not proceed beyond a CAUTION symbol until all the indicated conditions have been fully understood and/or met.

NOTE

Highlights an essential operating or maintenance procedure, condition, or statement that must be highlighted.

GENERAL PRECAUTIONS

The following are general precautions that are not related to any specific procedure and, therefore, do not appear elsewhere in this publication. These are precautions that personnel must understand and apply during various phases of instrument operation or service.



WARNING

Potentially lethal voltages are present in this instrument. Serious shock hazards from voltages above 70 volts may exist in any connector, chassis, or circuit board. Observe the following precautions:

- Use the buddy system any time work involving active high voltage components is required. Turn OFF the power before making/breaking any electrical connection. Regard any exposed connector, terminal board, or circuit board as a possible shock hazard. DO NOT replace any component or module with power applied.
- If test conditions to live equipment are required, ground the test equipment before probing the voltage or signal to be tested.
- Personnel working with or near high voltage should be familiar with modern methods of resuscitation.
- DO NOT wear jewelry (rings, bracelets, metal watches, and/or neck chains) while working on exposed equipment. Be very cautious about using hand tools near exposed backplanes, bus bars, and/or power supply terminals. Use properly insulated tools. When making test connections to the power supply terminals and bus bars; use only insulated probe tips.
- Verify that the instrument is set to match the available line voltage and the correct fuse is installed.
- DO NOT install substitute parts or perform any unauthorized modification to this

instrument. Contact TEGAM to acquire any information on replacement parts or returning the instrument for repair. Unauthorized modification can cause injury to personnel and/or destruction of the instrument.


- Operating personnel must not remove instrument covers. Component replacement adjustments **MUST BE** performed by qualified service personnel.
- **DO NOT** operate the instrument near or in the presence of flammable gases or fumes.

DETAILED PRECAUTIONS

The following **WARNINGS**, **CAUTIONS** and **NOTES** appear throughout the text of this manual and are repeated here for emphasis.



CAUTION

- All procedures and steps identified as  must be followed exactly as written and according to ESDS device handling procedures in IM-211 or other accepted ESDS procedures. Failure to comply **WILL RESULT** in ESDS damage.
- **DO NOT** use a nylon bristle brush in the solvent as the bristles may dissolve and cause damage to the circuit card or component.
- **DO NOT** use ultrasonic cleaning on parts or assemblies containing electrical or electronic components.
- **DO NOT** bend pins of electrical connectors when using fiber-bristle brush.
- Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles/faceshields should be worn. **DO NOT** direct air stream towards self or other personnel. Pressure should be restricted to a maximum of 15 psi to avoid personal injury.
- Under no circumstances should a wire brush, steel wool, or abrasive compound be used on any surface. Using these items will cause extensive damage to the instrument surface.

NOTE

DO NOT return any instrument or component to TEGAM without receiving prior factory authorization.

SAFETY SYMBOLS

The following symbols are used to identify safety hazards found throughout this publication and/or located on the instrument.

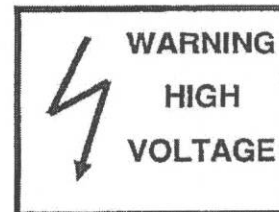
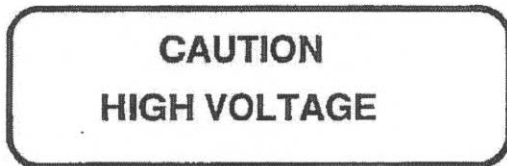


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SECTION I GENERAL INFORMATION

PURPOSE

This manual provides instructions necessary to install and operate the TEGAM Model 17508 Resistance Standard.

MANUAL SUMMARY

This manual contains the information required by the user to operate and maintain the TEGAM Model 17508 Resistance Standard. The manual is organized to make quick reference of information easy, while providing overall detail needed by operating personnel.

The manual is divided into four self-contained sections. Some sections provide learning and working information and will be used frequently. Other sections are dedicated to general types of information and are intended for reference.

Since the depth of coverage of this manual is limited, previous knowledge on the part of the reader is assumed. The TEGAM Model 1750 Resistance Measurement System Instruction Manual (part number 17509) should be used to supplement the information presented in this manual.

ARRANGEMENT

The information contained in this manual is tabulated in the Table of Contents, List of Illustrations, and List of Tables. The manual is divided into sections, listed as follows:

- SECTION I General Information
- SECTION II Installation and Shipment
- SECTION III Applications
- SECTION IV Maintenance

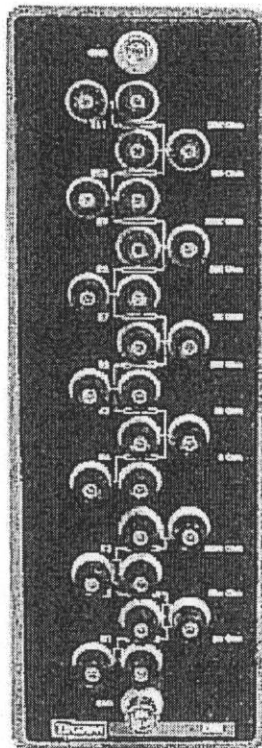


Figure 1-1 Model 17508 Resistance Standard

CONTACTING TEGAM

In the event of a malfunction, contact TEGAM. An apparent malfunction of the standard may be corrected over the phone by contacting TEGAM. **DO NOT** send the Resistance Standard back to the factory without prior authorization. When it is necessary to return an item, state the symptoms or problems, catalog and type number of the instrument or component, serial number of the item, and date of original purchase. Also write the company name, your name, and phone number on an index card. Then attach the card to the instrument or component to be returned. Or contact TEGAM using the following:

TEGAM, INC.
TEN TEGAM WAY
GENEVA, OH 44041 USA

800-666-1010 toll-free
440-466-6100 phone
440-466-6110 fax

DESCRIPTION OF EQUIPMENT

The Model 17508 is a Resistance Standard designed for full-scale calibration of the TEGAM Model 1750. The Model 17508 comprises eleven precision resistors ranging from 2 milliohms to 20 megohms connected in series, in two groups. Each resistor is connected to four individual binding post terminals so that separate current and potential connections can be made (Kelvin Connection). The 0.2, 0.02, and 0.002 ohm resistors are connected in one group and the 2 ohm to 20 megohm resistors are connected in a second group. Separate GND binding posts are provided to shield or guard the resistors during measurement. Each Model 17508 has a calibration chart attached that gives the nominal value of each resistor and the deviation from nominal for this particular standard.

The excellent stability and low temperature coefficient of the resistors used in the Model 17508 assure the maintenance of high accuracy between calibration periods within nominal temperature ranges. Most of the higher value resistors are unifilar wound on processed mica cards, and use modern alloy resistance wire, which has excellent stability, low temperature coefficient and negligible thermal emf to copper. Each resistor is carefully built and inspected to insure maximum control of quality. The complete transfer standard is given additional stabilization treatment, followed by an extended series of tests to ensure that every Model 17508 conforms to the highest standards of quality.

Specifications

The specifications for the Model 17508 are listed in Table 1-1. These specifications are the performance standards or limits against which the unit can be tested.

Accessories

The Model 17508 is shipped with:

Dust Cover	Part Number 8537
PC Test Software	Part Number SFW-1750
Manual	Part Number 17508-900-01

Outline Drawing

The outline drawing for the Model 17508 is presented in Figure 1-2.

Table 1-1 Specifications

Resistance Step Ohms	Initial Adjustment Accuracy ± ppm	Short Term Stability, 6 month, Typ. ± ppm	Calibration Uncertainty ± ppm	Temperature Coefficient ± ppm	Accuracy Ratio 1750 to 17508 22°C to 24°C	Max Current Rating in Amps
0.002	60	25	10	65	2.00	1.0 A
0.02	75	25	10	45	2.00	1.0 A
0.2	65	25	10	25	2.00	1.0 A
2	65	20	10	20	2.22	100 mA
20	30	20	10	7.5	4.00	10 mA
200	30	20	10	7.5	4.00	10 mA
2K	30	20	10	7.5	4.00	1 mA
20K	30	20	10	7.5	4.00	100 µA
200K	30	20	10	7.5	4.00	10 µA
2M	70	20	20	7.5	4.00	1 µA
20M	70	20	20	7.5	4.00	100 nA
Measurement Configuration:				4-wire terminations compatible with Model 17501 Kelvin Clip.		
Operating Temperature:				22°C to 24°C		
Humidity:				50 ± 5%		
General:				Shielded enclosure with separate ground connections.		
Dimensions (hwd):				12.2 x 4.4 x 4 inches 31 x 11.2 x 10.15 cm		
Weight:				3.9 lb 1.77 kg		

these are the same as the 17508 default current levels

Special Tools and Test Equipment

All recommended special tools and test equipment to be used with the Resistance Standard are listed in Table 1-2.

Table 1-2 Special Tools and Test Equipment

TOOL/EQUIPMENT/ MODEL NUMBER	NOMENCLATURE	USE AND APPLICATION
TEGAM Model 1750	Resistance Measurement System	Unit Under Test
Personal Computer	Windows® 95/98 Compatible	Measurement Controller
Any	RS-232 Cable 9-pin, Male to Male	PC to Model 1750 interconnect
TEGAM 17501	Kelvin Klip test leads	Model 1750 to Model 17508 interconnect
TEGAM SFW-1750	PC Software	Model 1750 Performance verification

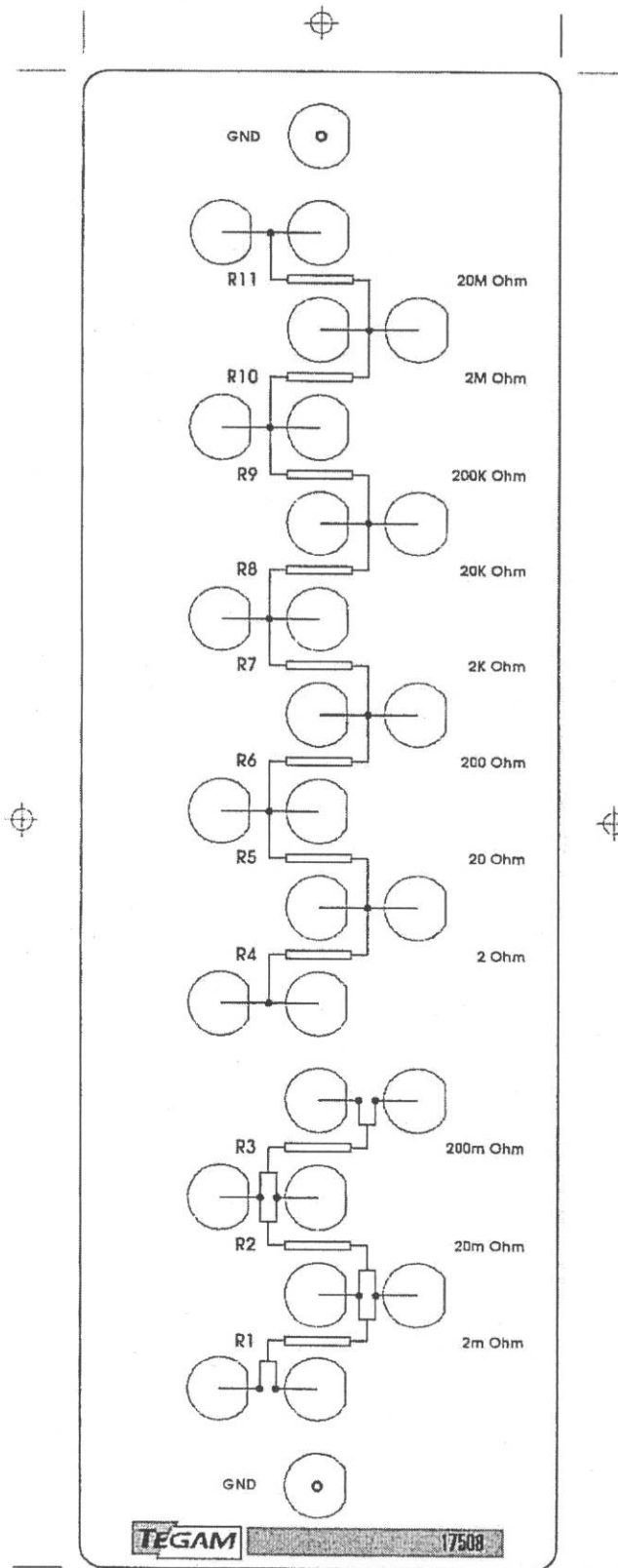


Figure 1-2. Model 17508 Outline Drawing

Operation & Service Manual
Model 17508 Resistance Standard

Section I
General Information

SECTION II INSTALLATION AND SHIPMENT

GENERAL

This section contains information and instructions necessary to install and operate the Model 17508 Resistance Standard. Included in this section are initial inspection; preparation for use; and shipping instructions.

INITIAL INSPECTION

The Model 17508 was carefully inspected both mechanically and electrically before shipment. It should be free of marks or scratches and in perfect electrical order upon receipt. After unpacking the instrument, do not discard the shipping and packing material until the instrument has been visually inspected and it is determined that reshipment is not necessary. Perform initial inspection in accordance with the following paragraphs.

Inspection

Perform the following procedures before removing any item from the shipping container:

- a. Visually inspect the shipping container for any discoloration; stains; charring; or any other signs of exposure to heat, moisture, or liquid chemicals.
- b. Check for any physical damage to the shipping container such as dents, large snags or rips, crushed sections or areas, and/or similar signs of excessive shock caused by careless handling.
- c. Carefully remove the instrument and all other items from the shipping container.
- d. Inventory all items against the packing list to ensure all items have been received.
- e. Inspect the instrument for any dents, cracks, deep scratches, damaged or loose hardware, and any other signs of careless handling.

Damage

If it has been determined that shipping damage has occurred, immediately contact the delivering carrier to perform an inspection and prepare a concealed damage report. Do not destroy any shipping or packing material until it has been examined by an agent of the carrier. Also notify TEGAM to report the nature and extent of damage to the instrument. When contacting TEGAM, please provide model and serial number of instrument received, so that the necessary actions can be taken. DO NOT return the instrument until a claim for the damages has been established. If there is mechanical damage (not from shipping), the contents are incomplete, and/or the instrument does not function properly, refer to Section I and notify TEGAM.

ENVIRONMENTAL REQUIREMENTS

The Model 17508 operates within its specifications at an ambient temperature of +22°C to +24°C, and relative humidity of 50 ± 5%. Operating beyond these limits will affect the accuracy of the standard and the equipment calibrated with the standard.

RECOMMENDED OPERATING ENVIRONMENT

Normal Calibration Laboratory best practice dictates that the environment should be closely controlled. This will minimize errors introduced by temperature and humidity changes. A nominal temperature of +23°C (+73.4°F) and relative humidity of 50 ± 5% provides a good working condition. A tolerance of ±0.5°C gives allowable temperature spread. Controlled temperatures also stabilize the aging process of the standards.

It is recommended that the other equipment used with the Model 17508 be supplied with power from stabilized power supplies.

PREPARATION FOR USE

The following paragraphs provide mounting instructions and Initial Setup options for the Model 17508 Resistance Standard.

MOUNTING INSTRUCTIONS

The Resistance Standard is shipped with four plastic feet attached to the bottom cover. This allows the user to place the standard on a bench or counter top next to the instrument being calibrated. The Model 17508 can be connected to the Model 1750 or other equipment as required.



CAUTION

- The Model 17508 must be connected to the unit under test using 4-wire (Kelvin) connection. Model 17501 Kelvin Klips are recommended.
- Avoid placement on or above a heat source.
- The equipment current output must not exceed max current ratings on 17508.

PERFORMANCE VERIFICATION

The initial accuracy and resistance range of the Model 17508 preclude direct measurement with typical test equipment and standards. If it is suspected that the Model 17508 is out of tolerance, arrange to return it to TEGAM for verification. Alternately, an accredited laboratory can verify the accuracy of the standard using precise equipment in an accurately controlled environment.

PREPARATION FOR RESHIPMENT OR STORAGE

RESHIPMENT

Perform the following procedures when reshipping an instrument or component:

NOTE

- DO NOT return any instrument or component to TEGAM without receiving prior factory authorization (RMA Number).
 - Use the best available packing materials to protect the instrument during reshipment. When possible, use original shipping container and packing materials.
- a. Wrap the standard with sturdy paper or plastic.
 - b. Place all accessories, cables and loose hardware into a plastic bag.
 - c. Place the wrapped standard into a strong container with a layer of shock absorbing material (3/4 inch thickness) to wrap around all sides of the instrument to provide a firm cushion and to prevent movement inside the container.
 - d. Place bag of accessories and hardware into container.
 - e. If shipping the standard for service, attach a tag to indicate the following:
 - Model and serial number
 - Service required
 - Description of malfunction
 - Return address
 - Authorization to conduct repairs
 - Instrument repair authorization
 - f. Thoroughly seal shipping container and mark it FRAGILE.
 - g. Ship to an authorized sales representative or:

TEGAM, INC.
TEN TEGAM WAY
GENEVA, OH 44041 USA

STORAGE

When Model 17508 is to be stored for extended periods, pack instrument into a container using procedure described above. Place container into a clean, dry, temperature-controlled location. If instrument is to be stored in excess of 90 days, place desiccant with items before sealing container. The safe environmental limits for storage of Model 17508 are as follows:

Temperature:	32° to +122°F (0° to +50°C)
Humidity:	less than 95%
Altitude:	less than 40,000' (12,192 m)

SECTION III APPLICATIONS

The primary function of the Model 17508 is to provide a suitable standard to fully calibrate full-scale accuracy of the TEGAM Model 1750 Resistance Measurement System. However, the Model 17508 can be used in other applications where a precise resistance standard is needed. Caution must be taken when using the 17508 in other applications to not exceed the maximum current ratings on the 17508.

Model 1750 Performance Verification

This automated procedure ensures that the Model 1750 is operating within the published specification. For a manual procedure refer to the Model 1750 manual.

NOTE

Performance verification should be conducted at $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and $50 \pm 5\%$ relative humidity. Equipment required is listed in Table 1-2.

Procedure:

- a. Connect PC to the Model 1750 using the 9-pin serial cable from an available serial port on your PC to the RS-232 port (J4) on the rear of the 1750. Connect the GUARD terminal on the rear panel of the Model 1750 to one of the GND terminals on the Model 17508. Start the 17508 Test Software.
- b. Allow the Model 1750 to be operated for at least 30 minutes after power on, and without a device under test, before proceeding.
- c. Setup the Model 1750 as follows:
 - MENU, TRIGGER, DELAY CONTINUOUS
 - AUTORANGE
 - MENU, DELAY, 1 1 1, ENTER
- d. Select Performance Verification from the PC Software menu.
- e. Enter the serial number of the unit under test, the date and any notes in the fields provided.
- f. Depress the $20\text{M}\Omega$ key on the Model 1750 to select the 20 Megohm range.
- g. Connect the Kelvin Klips to the appropriate terminals on the Model 17508 Resistance Standard.
- h. Press the ENTER key on the PC to read the standard value. The reading will appear in the reading column of the Performance Verification spreadsheet followed by either PASS or FAIL.
- i. Repeat the above steps f through h using the additional range values in the following table. This table also lists the test limits for a PASS indication.

Range	Test Limits for PASS Indication
$20\text{M}\Omega$	$20\text{M}\Omega \pm 10$ counts
$2\text{M}\Omega$	$2\text{M}\Omega \pm 10$ counts
$200\text{K}\Omega$	$200\text{K}\Omega \pm 6$ counts
$20\text{K}\Omega$	$20\text{K}\Omega \pm 6$ counts
$2\text{K}\Omega$	$2\text{K}\Omega \pm 6$ counts
200Ω	$200\Omega \pm 6$ counts
20Ω	$20\Omega \pm 6$ counts
2Ω	$2\Omega \pm 6$ counts
$200\text{m}\Omega$	$200\text{m}\Omega \pm 6$ counts

20mΩ	20mΩ ± 8 counts
2mΩ	2mΩ ± 9 counts

Save or print the test results as desired using the print option on the PC software menu. A suggested filename convention would be D2020199 (the first eight digits of the serial number) followed by the numeric date (042900) followed by the test number (A). So the filename would be D2020199042900A.

Test Record

The performance verification test record lists all resistance ranges, test currents, low limits, and high limits specified along with the data. The following test record is displayed at the end of the above test procedure:

Range	Specification	Low Limit	Reading	High Limit	Pass/Fail
20MΩ	± 10 counts	19.990		20.010	
2MΩ	± 10 counts	1.9990		2.0010	
200KΩ	± 6 counts	199.94		200.06	
20KΩ	± 6 counts	19.994		20.006	
2KΩ	± 6 counts	1.9994		2.0006	
200Ω	± 6 counts	199.94		200.06	
20Ω	± 6 counts	19.994		20.006	
2Ω	± 6 counts	1.9994		2.0006	
200mΩ	± 6 counts	199.94		200.06	
20mΩ	± 8 counts	19.992		20.008	
2mΩ	± 9 counts	1.9991		2.0009	

SECTION IV MAINTENANCE

GENERAL

This section provides general maintenance practices for daily operation of the Model 17508 Resistance Standard. The section also provides instructions for contacting TEGAM should a problem or more information be needed.

MAINTENANCE

The following paragraphs contain procedures outlining inspection, preventive maintenance, and special cleaning instructions for the Model 17508 Resistance Standard.

INSPECTION

Perform a visual inspection in conjunction with the maintenance activities schedule when a malfunction is suspected, or whenever an assembly is removed or replaced.

PREVENTIVE MAINTENANCE

While the Model 17508 Resistance Standard requires very little preventive maintenance, it should not be subjected to physical abuse, severe mechanical shock, high humidity, or operating temperatures outside the specification range. The instrument should be kept free of excessive dirt and dust, since these can interfere with connector functions and with normal heat dissipation. Refer to Special Cleaning Instructions below. The following paragraphs provide the preventive maintenance that is to be performed on the Model 17508 Resistance Standard.

Connectors

Care should be taken to prevent strain on interconnecting cables, since damage here may not always be apparent. Occasionally check the external cables and connections for signs of cracked insulation and bent or worn posts. Tests show that connectors must be clean for accuracy and stability. This requires an inspection and possible cleaning of each connector immediately before use.

SPECIAL CLEANING INSTRUCTIONS

The cleaning procedures for Model 17508 Resistance Standard include those for painted surfaces and connectors.

Painted Surfaces

To remove light dirt and dust from mechanical parts such as castings, covers and other hardware, proceed as follows:



WARNING

Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles or face shields should be worn. Do NOT direct air stream towards self or other personnel. Pressure should be restricted to a maximum 15 psi to avoid personal injury.



CAUTION

- Under no circumstances use a wire brush, steel wool, or abrasive compound. Using these items will cause extensive damage to the painted surface.
- Do NOT use nylon bristle brush in solvent as the bristles may dissolve and cause damage to the painted surface.
- a. Use 5 psi of clean, moisture-free compressed air or preferably dry nitrogen to blow loose dirt and dust from surface of item.

- b. Briskly brush isopropyl alcohol onto area to be cleaned with a fiber-bristle brush.
- c. Remove residue with lint-free cloth and repeat step "b" as a rinse.
- d. When parts are thoroughly clean, dry parts using 5 psi of clean, moisture-free compressed air or preferably, dry nitrogen.
- e. Clean smaller removable mechanical parts or hardware by dipping into a container of isopropyl alcohol. Remove dirt by brushing with fiber-bristle brush after parts have been immersed for several hours.
- f. Remove parts from isopropyl alcohol and rinse by immersing into a different container of isopropyl alcohol.
- g. When parts are thoroughly cleaned, dry parts using 5 psi of clean, moisture-free compressed air, or preferably, dry nitrogen.

Connector Cleaning

Where small amounts of corrosion, and/or oxide deposits are present on connectors, clean with a soft-bristle brush or aluminum wool, then wash with a non-corrosive solvent. MIL-C-83102 is recommended. Exercise care to ensure that no metal filings or residue remain on the connector and that the connector is thoroughly dry.

CALIBRATION INTERVAL

The recommended calibration verification interval is 6 months. Each six months the Model 17508 should be measured to insure that the nominal resistance values have not changed significantly. These measurements can be done by TEGAM or a calibration facility that has the equipment necessary to verify the specifications in Table 1-1.