

MODEL 1805B

RF Control Unit

Instruction Manual

P/N IM-200-CD

Rev. F

This owner's manual was as current as possible when this product was manufactured. However, products are constantly being updated and improved. Because of this, some differences may occur between the description in this manual and the product you received.

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Publication Date: December 2003

SAFETY SUMMARY

DEFINITIONS

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



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.



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.



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 or 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 WARNING, CAUTIONS and NOTES appear throughout the text of this manual and are repeated here for emphasis.



CAUTION

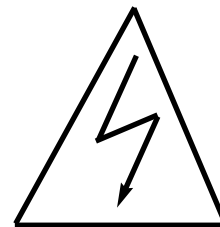
- All procedures and steps identified as  be followed exactly as written and according to ESDS device handling procedures. Failure to comply **WILL RESULT IN ESDS damage**.
- **DO NOT** use a nylon bristle brush in the solvent as the bristles may dissolve and cause damage to the circuit card or component.
- **DO NOT** use ultrasonic cleaning on parts or assemblies containing electrical or electronic components.
- 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.



**Caution,
Risk of Electrical Shock**



**Protective Conductor
Terminal**

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SECTION INTRODUCTION AND GENERAL DESCRIPTION

INTRODUCTION PURPOSE

This manual provides Operation and Service instructions necessary to install, service, test, and operate the TEGAM Model 1805B RF Control Unit (P/N 138-415-1).

SCOPE

This manual is to be used in conjunction with the operation and maintenance of the RF Control Unit. The manual also provides a description of each assembly; testing of the unit; maintenance procedures to maintain the instrument.

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 four sections, listed as follows:

- SECTION I Introduction and General Description
- SECTION II Installation and Shipment
- SECTION III Theory and Operation
- SECTION IV Testing



Figure 1-1 RF Control Unit, Model 1805B

RELATED MANUALS

The following manuals contain information that may be used in conjunction with this manual to operate, or calibrate the RF Transfer Standard.


<u>Manual</u>	<u>Title</u>
IM128	Models 1109, 1109H and 1110 Coaxial Power Standards, Operation and Service Manual
IM198	System IIA, Automatic Power Meter/Sensor Calibration System, Operation and Service Manual
IM199	Model 1807A RF Transfer Standard, Operation and Service Manual
IM205	Models 1111 and 1116 Coaxial Power Standards, Operation and Service Manual
IM241	Models 1119, 1119H and 1120 Coaxial Power Standards, Operation and Service Manual
IM245	Models 1117A, 1117A and 1118 Coaxial Power Standards, Operation and Service Manual
IM249	Operation Manual, SWR Measurement Kit (P/N 187-4003)
IM255	Operation Manual, 50-75 W Minimum Loss Matching Pad (P/N 138-650)
IM267	Model 1727A, Amplifier, Operation and Service Manual

CONTACTING TEGAM


In the event of an instrument malfunction, contact TEGAM. An apparent malfunction of an instrument or component may be corrected over the phone by contacting TEGAM. **DO NOT** send the instrument or component 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.	800-666-1010 toll-free
TEN TEGAM WAY	440-466-6100 phone
GENEVA, OH 44041 USA	440-466-6110 fax

ELECTROSTATIC DISCHARGE SENSITIVE

The equipment documented in this manual contains certain Electrostatic Discharge Sensitive (ESDS) components or parts. Therefore, certain procedures/steps are identified by the use of the symbol . This symbol is used in two ways:



All procedures and/or steps identified as  must be followed exactly as written and according to ESDS device handling procedures. Failure to comply **WILL RESULT IN** ESDS damage.

- When the ESDS symbol  is placed between a paragraph number and title, all of that paragraph, including all subparagraphs, is considered an ESDS device handling procedure.
- When the ESDS symbol  is placed between a procedure/step number and the text, all of that procedure is considered an ESDS device handling procedure.

ABBREVIATIONS AND ACRONYMS

The following list contains all abbreviations used throughout this manual. Abbreviations and acronyms that are not listed conform with MIL-STD-12D.

DUT	Device Under Test
ESDS	Electrostatic Discharge Sensitive

SAFETY CONSIDERATIONS

The RF Control Unit and all related documentation must be reviewed for familiarization with safety markings and procedures before performing any operation and/or service. Refer to the SAFETY SUMMARY located at the beginning of this manual for a summary of safety information and procedures. Following these simple safety precautions will ensure safe operation and service of the RF Control Unit.

GENERAL DESCRIPTION

DESCRIPTION OF EQUIPMENT

The following paragraphs provide a general description of the RF Control Unit (shown in Figure 1-1).

Functional Description

The Model 1805B RF Control Unit is a solid state, microprocessor-controlled RF control unit designed for precise control of dc substituted power. When used with thermistor mounts such as the TEGAM Model 1109,1109H, 1116,1117A, 1119 and 1119H Feedthrough Thermistor Mounts and a stable RF generator, a system is obtained which allows rapid and accurate calibration of power meter/sensors and other thermistor mounts from 100 KHz to 26.5 GHz. Model 1805B also provides:

- IEEE-488 Bus or front panel selection of precise dc power levels. These levels are 0.5 mW and 1-10 mW in 1 mW steps.
- IEEE-488 Bus or front panel RF ON/OFF switching.
- Elimination of ac/dc error by using dc for both bias and substituted power.
- Automatic control of dc level to within $\pm 0.1\%$ +1 mW.
- Constant dc level over an ambient temperature range of from +10° to +40°C.
- Capability to correct RF source level variations of ± 3 dB.
- Internal temperature controller for controlling internal temperature of thermistor mount.

Physical Description

Refer to Table 1 -1 for all the physical dimensions for the RF Control Unit, Model 1805B. The RF Control Unit features a POWER ON/OFF/STANDBY switch/indicators, a TEMPERATURE control meter, a RF ON/OFF switch/indicator, DC SUBSTITUTED POWER (mW) control, BRIDGE BALANCE meter, MOUNT BIAS connectors, REMOTE/LISTEN/ERROR indicators, and FINE/COARSE NULL ADJUST controls, which are all located on the front panel. The rear panel contains the input power connector and fuse selector assembly, INPUT/OUTPUT REMOTE PROGRAM connectors, ADDRESS selector switch, IEEE 488 INTERFACE BUS connector, and +/- AM MODULATION connectors. The RF Control Unit can be easily stacked with other TEGAM instruments or mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate hardware. Figure 1-2 and the following list are provided as an aid in identifying and locating modules and assemblies within the Models 1805B RF Control Unit.

A1	MICROPROCESSOR PC BD ASSEMBLY
A2	DC SUBSTITUTION PC BD ASSEMBLY
A3	RF POWER BD ASSEMBLY
A4	(NOT USED)
A5	(NOT USED)
A6	POWER SUPPLY/MOTHER BD ASSEMBLY

- A7 +30 V POWER SUPPLY ASSEMBLY
- A8 FRONT PANEL ASSEMBLY
- A9 REAR PANEL ASSEMBLY
- W1 RF CABLE ASSEMBLY
- W2 RF CABLE ASSEMBLY
- W3 ADDRESS SWITCH CABLE ASSEMBLY
- W4 CABLE BAND SELECT ASSEMBLY
- XF1 INPUT POWER ASSEMBLY

Specifications

Table 1-1 lists specifications to be considered when using the RF Control Unit.

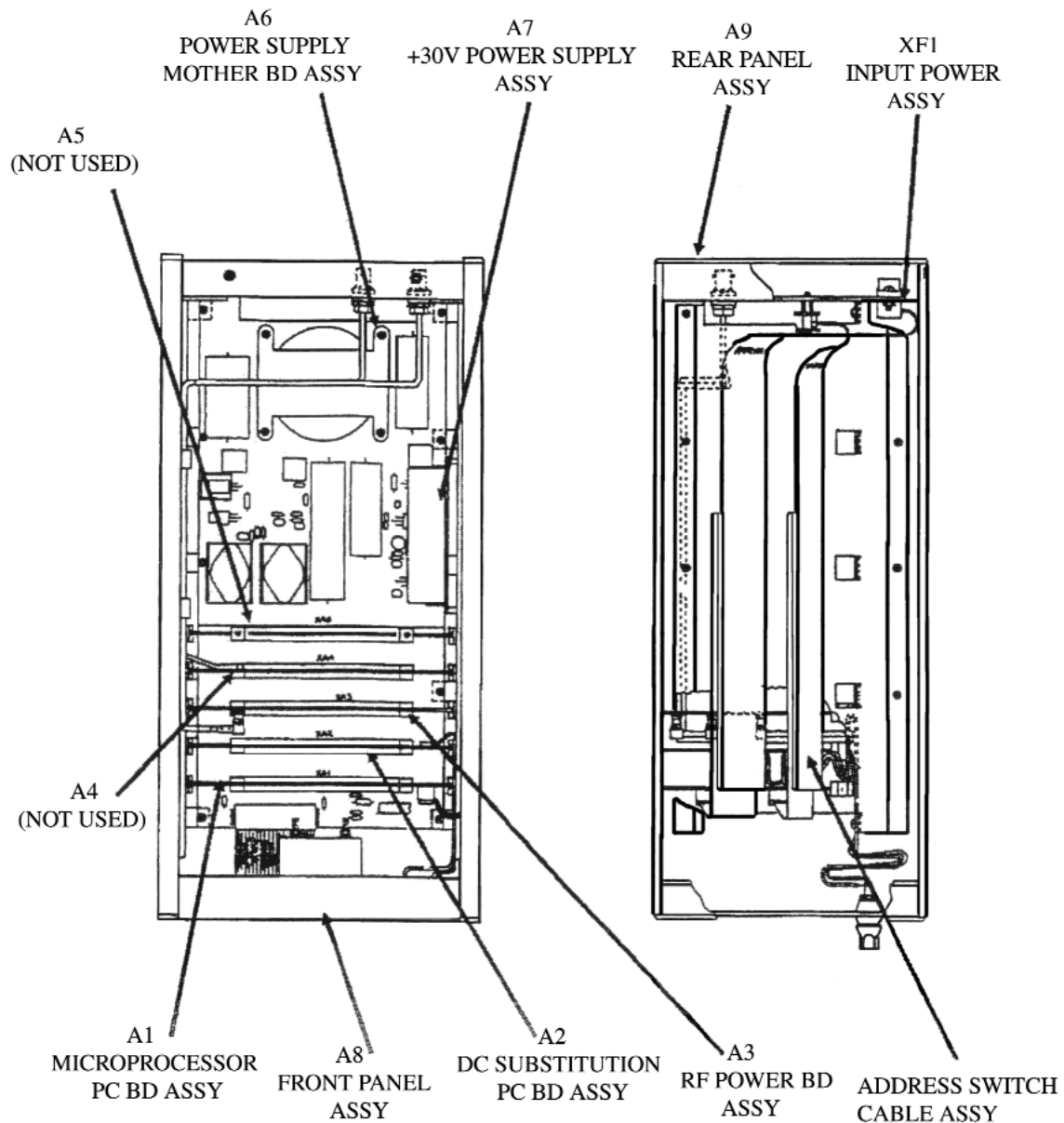


Figure 1-2 Model 1805B Assembly Location

Table 1-1 Specifications

Specification	Description
Temperature Range	Operating: +10 to +40°C (+ 50 to + 104°F) Storage: -40 to +75°C (- 40 to + 167°F)
Power Requirements	100/120/220/240 Vac ±10%, 48-66 Hz 40 Watts nominal
Physical Dimensions (Figure 1-9)	Depth: 17.5" (44.45 cm) Width: 8.4" (21.33 cm) Height: 7" (17.78 cm) Weight: 13 lbs. (5.9 kg net)
Construction	Cabinet or Standard Rack (1/2-Rack) Mount
Operating Modes	Remote: IEEE-488-1978 full function Bus Control of RF ON/OFF and Substituted dc Power Levels (0.5mW and 1-10 mW in 1 mW steps) Local: Manual front panel control of all function such as RF ON/OFF and Substituted dc Power Levels (0.5mW and 1-10 mW in 1 mW steps)
DC Substitution	DC Substituted Power Level Range: 0.5,1,2,3,4,5,6,7,8,9,and 10 mW. DC Substituted Power Accuracy (at 30±0.7 mW bias power):±0.1% +5µW Bias Power Range: 29-31 mW, automatic with error indication for out-of-range balance condition Power Level Control Range: Approximately 3-23 dB minimum (dependent upon specific signal source) Leveled RF Power Dynamic Range: ±3 dB (Referenced to DC Substituted Power) Unbalanced Detector: Sensitivity: 2 mW/division Resolution: 0.2 mW Level Control Loop Gain: 80dB minimum
Temperature Controller	Ambient Temperature Range: (50° to 104°F) Loop Gain: 80 dB minimum Open Loop Frequency Response: 0.1 Hz Warm-Up Drive (saturated): 8 ~ 10 V at 200 mA min. Indicator: Voltmeter with marked operating point *Bias Power Temperature Sensitivity: 2 mW/C°/hr *Mount Warm-Up Time: 2 hours nominal *Internal Temperature: +46°C nominal
Connectors	*Related thermistor mount specifications Mount Bias: Binding Post, standard 0.75" spacing for Banana plugs +AM MODULATION: BNC female -AM MODULATION: BNC female CONTROL (Temperature): four pin threaded IEEE-488 INTERFACE BUS: 24 pin connector per IEEE-488-1978

Recommended Materials

Table 1-2 provides a list of recommended consumables to be used when cleaning or servicing the RF Control Unit.

Special Tools and Test Equipment

All recommended special tools and test equipment to be used with the RF Control Unit are listed in Table 1-3.

APPLICATIONS

The primary function of the Model 1805B is to function as part of the TEGAM System IIA Precision Power Source for the transfer of calibration factors to power meter sensors. Figure

1-3 shows a typical configuration for calibrating coaxial power sensors. Using other TEGAM Coaxial Feedthrough mounts and the appropriate generator, an operator can easily calibrate other power sensors with frequency ranges as follows:

Model 1109	0.01-18 GHz
Model 1116	100kHz-100MHz
Model 1117A	0.05 GHz-26.5 Ghz
Model 1119	100 kHz-4.2 GHz

However, the Model 1805B can be used in many other System IIA applications such as comparing power standards; spectrum analyzer calibration, and to measure effects of noise on linearity at low signal levels. Virtually any application requiring a precision leveled power source is a prime candidate for the Model 1805B and the System IIA. The following paragraphs outline several applications for System HA.

Figure 1-4 shows a calibration setup using a TEGAM Model 1727A RF Amplifier and a +10 dBm RF Signal source to increase the output power so that the Model 1805B and System IIA Precision Power Source can perform calibrations from 1 mW to 10 mW in the 100 kHz to 26.5 GHz frequency range. Refer to the Model 1727A Operation and Service Manual for more information.

Figure 1-5 shows a setup to using the Model 1805B as part of the System IIA Precision Power source and the TEGAM SWR Measurement Kit to measure Return Loss/SWR. The SWR Measurement Kit includes a return loss bridge with an "open" and "short". Using the System IIA Precision Power Source, the DUT's impedance to 50 ohms can be checked by measuring return loss through the return loss bridge. The actual measured return loss can be readily converted into SWR by the system software. Refer to the SWR Measurement Kit manual for more information.

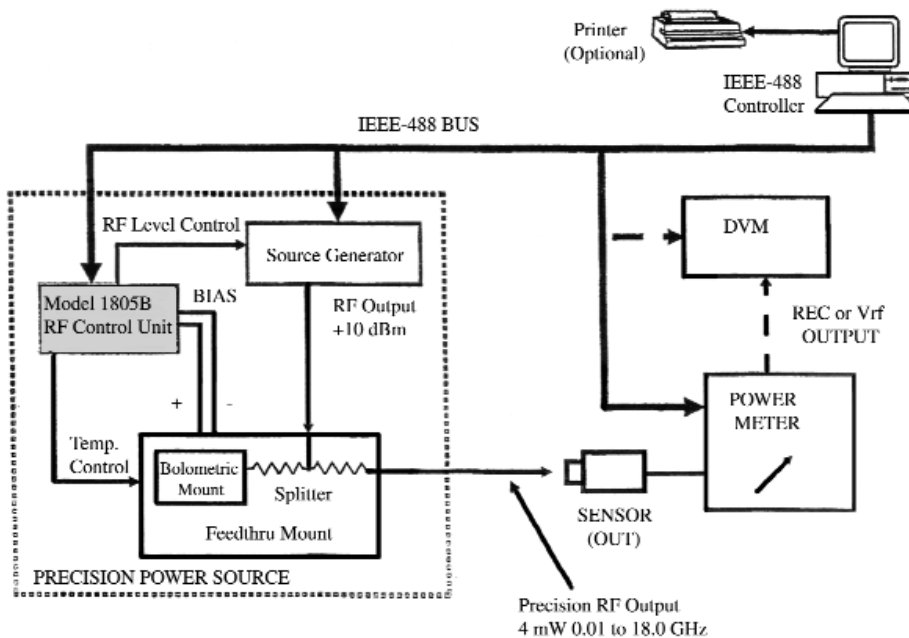


Figure 1-3 Typical Coaxial Power Sensor Configuration

Table 1-2 Recommended Consumable Materials

1	Acid Brush (Fiber Bristle)		H-B-643 Type II CLASS I
2	Aluminum Wool		MIL-A-4864A
3	Brush, Soft Bristle		H-B-420 Type II
4	Cleaner/Solvent	Isopropyl Alcohol	TT-1-735A (3)
5	Cloth, Lint Free		MIL-C-85043 Type IIA
6	Filter Coat Adhesive		
7	Permanent Polymer Coating (Solder Mask)		IPC-SM-840 Class III

Table 1-3 Special Tools and Test Equipment

TOOL/EQUIPMENT/ MODEL NUMBER	NOMENCLATURE	USE AND APPLICATION
Gigatronics GT9000 or equivalent	Synthesized Signal Generator, 0.01-18 GHz+10 dBm	Operational Checkout/Calibration
HP3458 or equivalent	Digital Voltmeter, 8 1/2 digits	Operational Checkout/Calibration
HP436/437/438 or equivalent	Power Meter	Operational Checkout/Calibration
HP8481 or equivalent	Power Sensor, Type N, 0.01-18 GHz	Operational Checkout/Calibration
Weinschel 44-10 or equivalent	10 dB Fixed Attenuator, Type N, dc-18 GHz	Operational Checkout/Calibration
Weinschel 56-10 or equivalent	10 dB Fixed Attenuator, 3.5mm, dc-26.5 GHz	Operational Checkout/Calibration
SYSIIA-SureCal	System IIA Windows Software (SureCAL)	Operational Checkout/Calibration
Any	Windows TM Compatible Printer with GPIB interface card and Windows TM 3.1 Operating System	Operational Checkout/Calibration
Any	Windows TM 3.1 Compatible Printer	Calibration Report/Graph/Test Report Printout
Weinschel 1915 or equivalent	Torque Wrench, 14±1 inch pounds (Type N)	Connector Coupling Torque Type N Connectors
Weinschel 080-502 or equivalent	Torque Wrench, 7±1 inch pounds (SMA, 3.5mm)	Connector Coupling Torque SMA. 3.5 mm Connectors
TEGAM 138-417	AC Extender Board	Calibration Adjustment
TEGAM 138-417	AC Extender Board	Calibration Adjustment

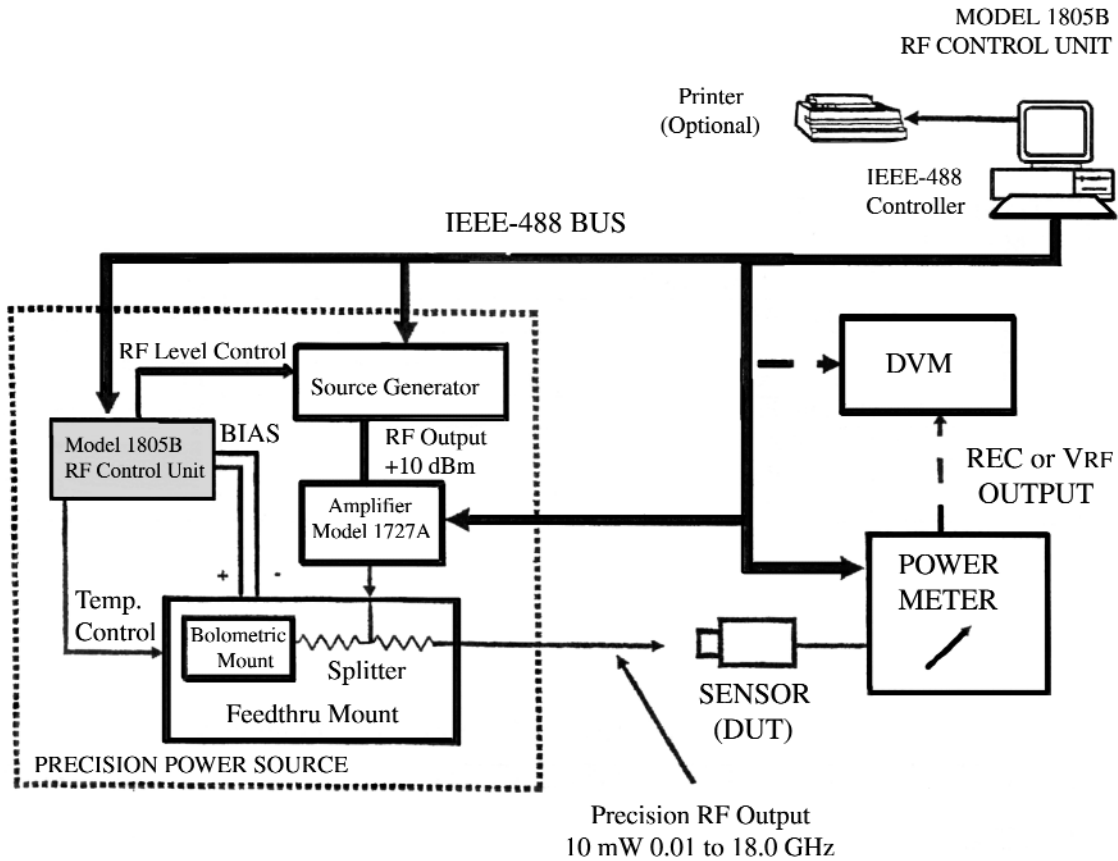


Figure 1-4 10 mW Configuration Using Model 1727A

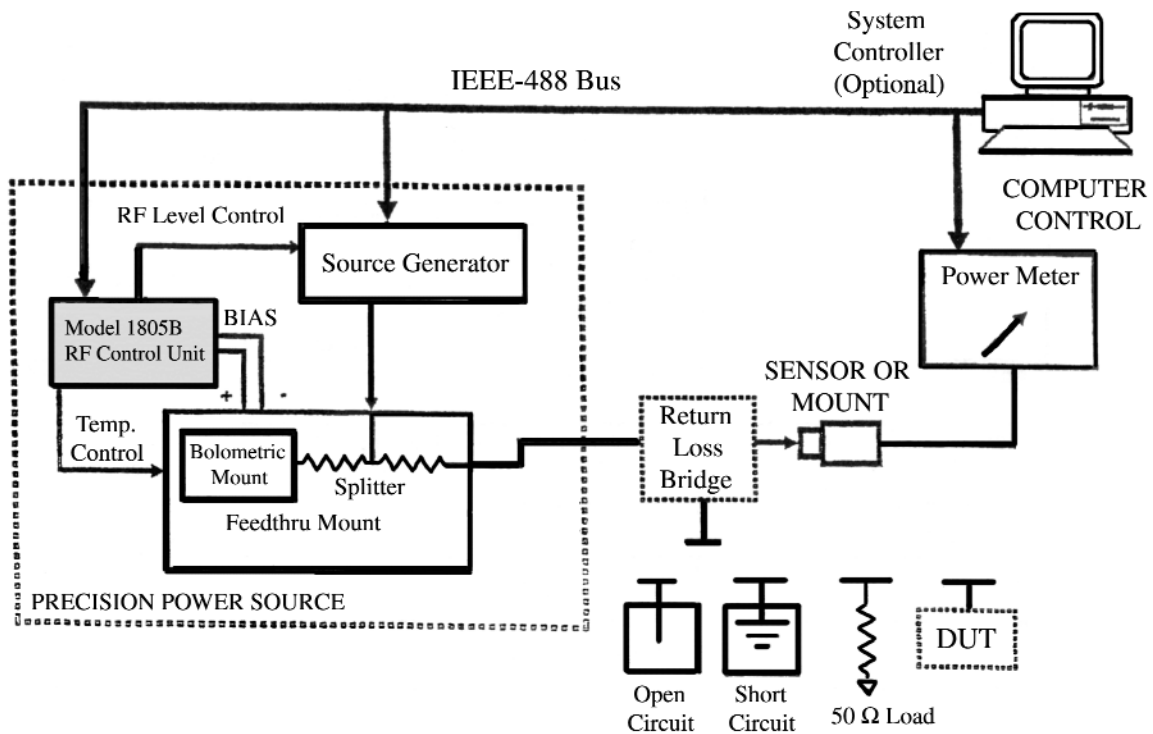


Figure 1-5 SWR Measurement Configuration

Figure 1-6 shows a setup to using the Model 1805B as part of the System IIA Precision Power source and the TEGAM 50-75 Ohm Minimum Loss Matching Pad (PN 138-650) to calibrate 75 ohm power sensors over the 0.1 MHz-2.7 GHz frequency range.

Figure 1-7 shows the Model 1805B using a 1109H or 1119H to perform calibrations on higher power terminating sensors from 1 W to 5 W.

Figure 1-8 shows how a System IIA Precision Power Source using the Model 1805B can be configured with a Weinschel Model 8300-2 Programmable Attenuator to perform reference verification over the 0.01-18 GHz frequency range.

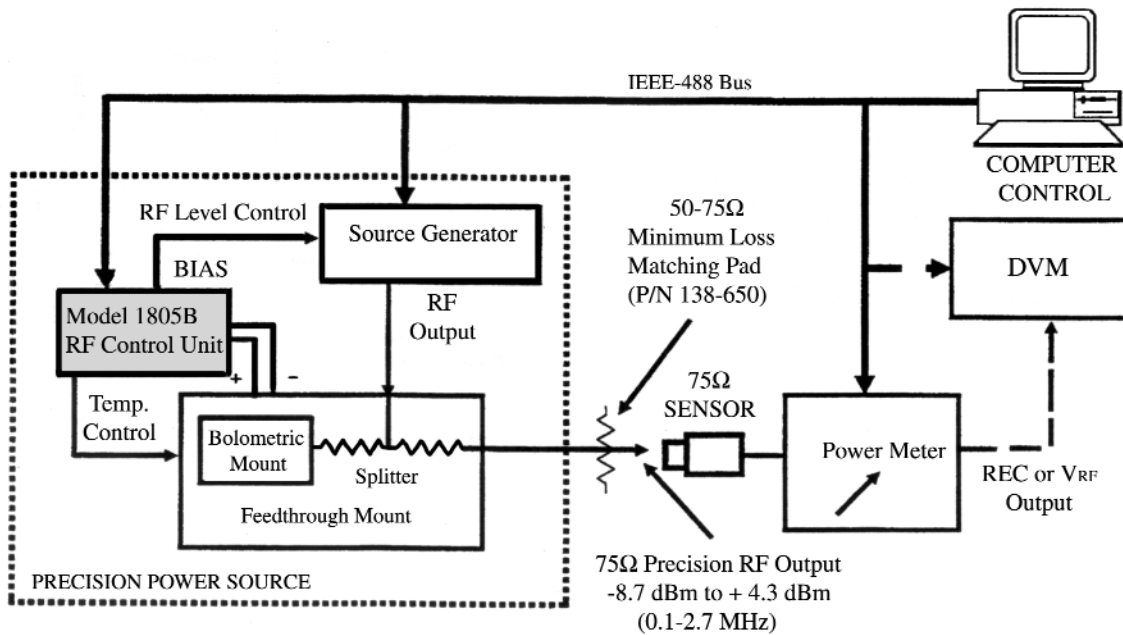


Figure 1-6 75 Ohm Sensor Calibration Setup

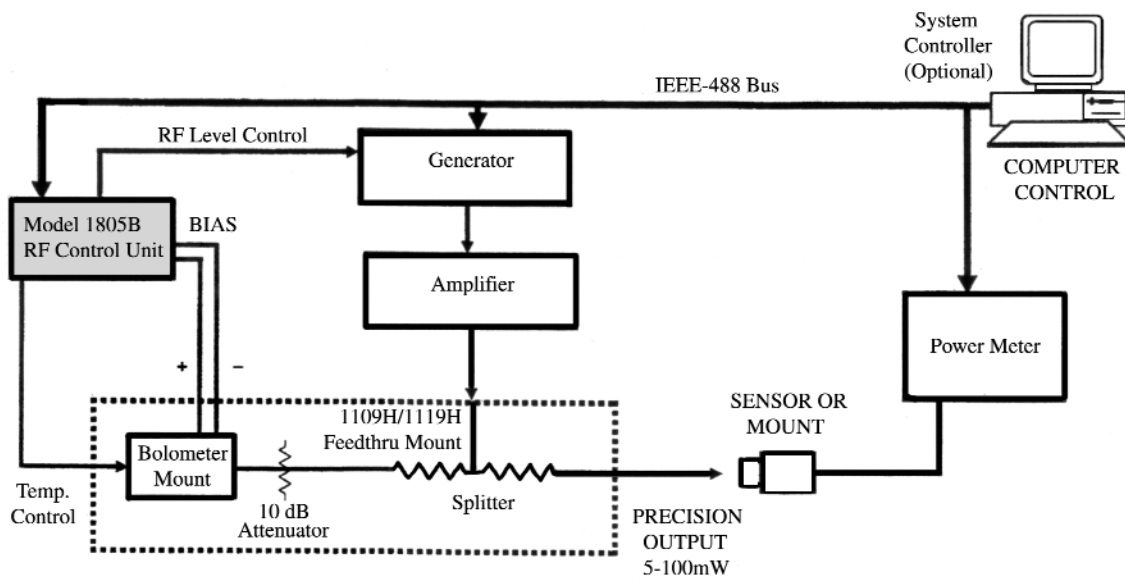


Figure 1-7 Typical Higher Power Calibration Setup

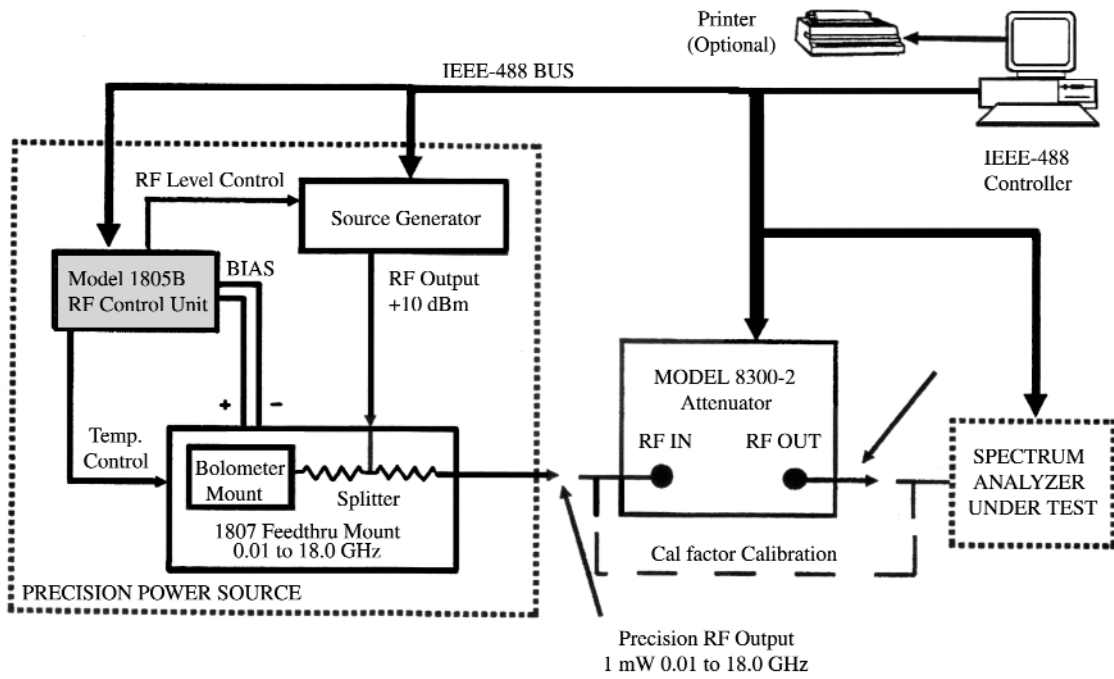


Figure 1-8 Spectrum Analyzer Calibration Setup

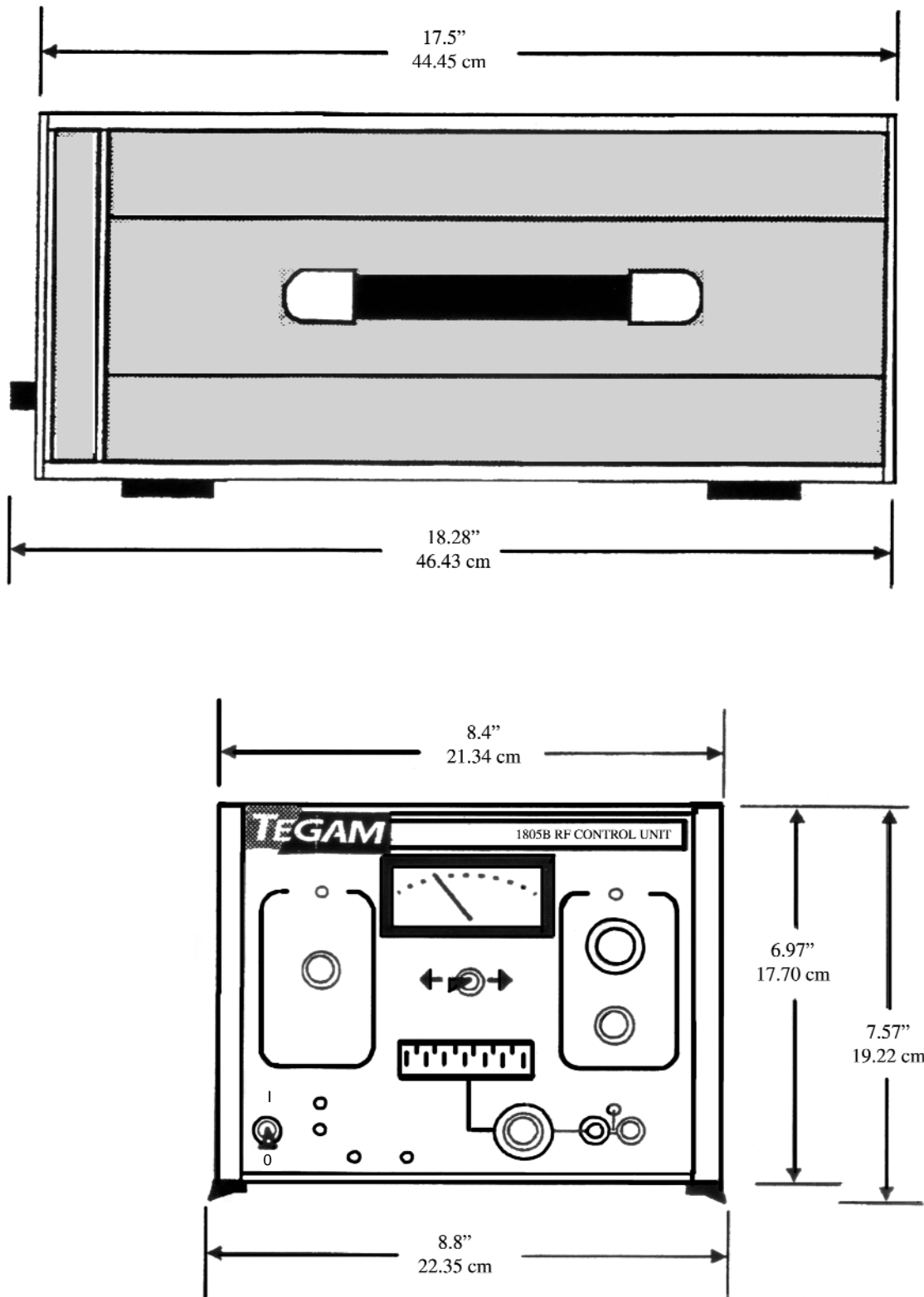


Figure 1-9 Model 1805B Physical Dimensions

SECTION II, INSTALLATION AND SHIPMENT

GENERAL

This section contains information and instructions necessary to install and interface the Model 1805B RF Control Unit. Included in this section are initial inspection; power requirements; preparation for use; and shipping instructions.

INITIAL INSPECTION

The instrument 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 switches and/or knobs, 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.

POWER REQUIREMENTS

TEGAM supplies a detachable power cable (P/N 068-21) to connect a 100, 120, 220, or 240 Vac ($\pm 10\%$) power source with a frequency between 48 to 66 Hz to the Model 1805 B. To minimize shock hazard, the instrument chassis must be connected to an electrical ground. Using the supplied three-conductor power cable ensures that the instrument can be firmly connected to the ac power source and electrical ground (safety ground) at a grounded power outlet. Refer to Initial Setup (below) before applying any power to the instrument.

ENVIRONMENTAL REQUIREMENTS

The Model 1805B operates best within its specifications at an ambient temperature of $+10^{\circ}$ to $+40^{\circ}\text{C}$. Operating beyond these limits can affect the accuracy of the instrument and damage internal circuitry.

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 $+23^{\circ}\text{C}$ ($+73.4^{\circ}\text{F}$) provides a good working condition. A tolerance of

$\pm 1^{\circ}\text{C}$ gives allowable temperature spread. Controlled temperatures also stabilize the aging process of the standards. It is recommended that the Model 1805B and other equipment be supplied with power from stabilized power supplies.

PREPARATION FOR USE

The following paragraphs provide mounting instructions, Initial Setup, line voltage and fuse selection, and input/output options for the Model 1805B RF Control Unit.

MOUNTING INSTRUCTIONS

The RF Control Unit is shipped with four plastic feet mounted to the bottom cover. This allows the user to place the instrument on any bench or to stack the Model 1805B with other TEGAM instruments. When the instrument is placed on a bench or table, these feet provide a level support. Model 1805B can be connected to the Model 1807A or other TEGAM half-rack instruments to create a 19 inch stackable bench instrument (Figure 2-1) or can be mounted in any cabinet or rack according to EIA RS-310 or MIL-STD-189 using Model 1919 Rack Adapter Kit

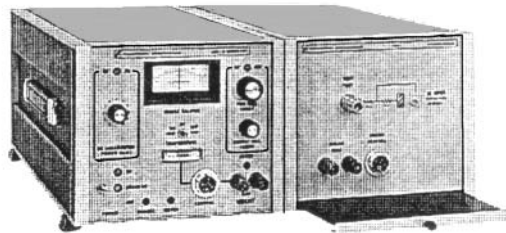


Figure 2-1 Model 1805B/1807A Bench Configuration

INITIAL SETUP

The initial setup procedure for operating the Model 1805B RF Control Unit is as follows;

- a. Perform inspection prior to connecting the Model 1805B to any power source.
- b. Ensure the Voltage Selector/Fuse Assembly is adjusted to the proper voltage setting.
- c. Check that the external power source outputs to the Model 1805B are in accordance with Table 1-1, RF Control Unit Specifications.
- d. Connect equipment using Figures 2-6 and 2-7 as a guideline. Consult other instrument manuals, or IM-198 for other specific connection and setup information for configuring the Model 1805B as part of the System IIA Precision Power Source.

INPUT/OUTPUT OPTIONS

The following paragraphs provide a description of the connections that can be made to the Model 1805B RF Control Unit. Figures 2-2 and 2-3 show the location of these connectors.



Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the Model 1805B power cord is DISCONNECTED before attempting to change fuses.

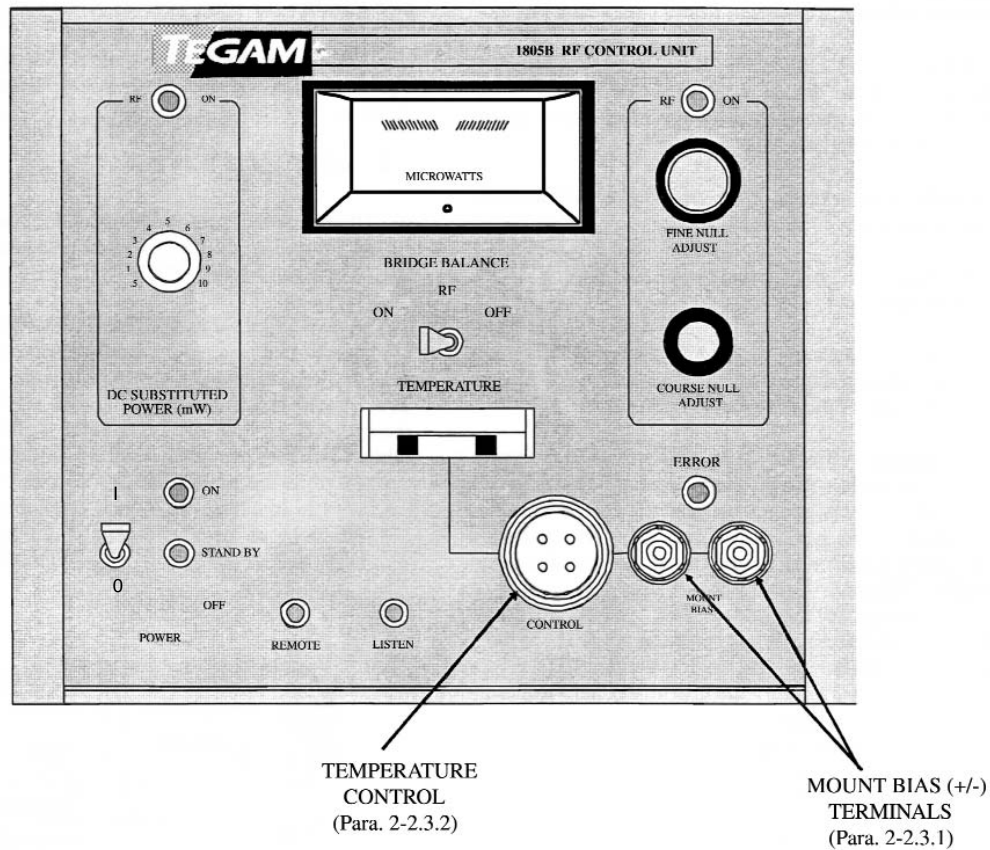


Figure 2-2 Model 1805B Connector Location (Front)

MOUNT BIAS (+/-) Terminals (E1 and E2)

These MOUNT BIAS Terminals (E1 and E2) are spade lug connecting posts which are located in the lower right-hand corner of the front panel (Figure 2-3). Present at these connectors is the dc bias voltage to be applied to the thermistor mount. Per convention, red is +dc while black is -dc.

TEMPERATURE CONTROL Connector (J1)

The TEMPERATURE CONTROL Connector (J1) is located near the lower right-hand corner of the front panel (Figure 2-2) and is a four-pin threaded connector which provides the current required to control the internal temperature of the thermistor mount.

+AM MODULATION Connector (J2)

The +AM MODULATION Connector (J2) is a BNC-type female connector which is located in the upper left-hand corner of the rear panel (Figure 2-3). The signal present at this connector is the power leveling output voltage which controls the power output level of signal generators whose power increases with a positive-going signal and decreases with a negative-going signal.

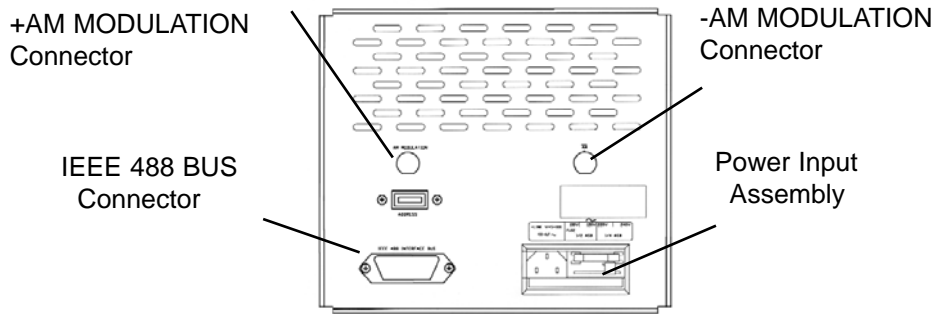


Figure 2-3 Model 1805B Connector Location (REAR)

ICCC-488 INTERFACE BUS (J3)

Joining the Model 1805B to a system controller requires the connection of IEEE-488 control bus to the IEEE-488 INTERFACE BUS connector located on the rear panel (Figure 2-3). The IEEE-488 INTERFACE BUS connector carries program command and data signals passing between the RF Control Unit and a system controller. Figure 2-4 shows the connector's contact pin numbering scheme and Table 2-1 lists the signal designator for signal present at each contact pin.

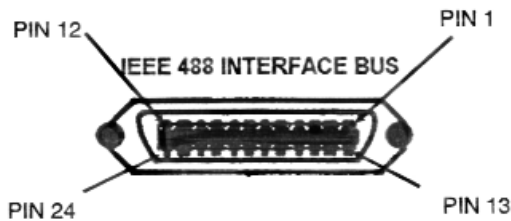


Figure 2-4 IEEE-488 INTERFACE BUS Pin Location

AM MODULATION Connector (J6)

Connector (J6) is a BNC-type connector which is located near the upper right-hand corner of the rear panel. The signal present at J6 is a control voltage which provides RF level control to signal generators, whose power output decreases with positive-going signal and increased with negative-going signal.

Power Input Assembly (XF1)

The Power Input Assembly contains a three-prong ac power input connector and a voltage selector/fuse assembly (Figure 2-3). The design of the Power Input Assembly prevents access to the Voltage Selector PC Board or the Fuse Assembly while an ac power cord is connected to the instrument. This design is not to be modified.

The AC Power Connector, located on the left side of XF1 (Figure 2-3), is a plug-type prong insert connector with three conductors for connection of the power cord (P/N 068-21) to the Power Supply Assembly located within the instrument. This connector also grounds the chassis when the AC power cord is connected to a grounded wall outlet. If necessary, use a three prong to two prong adapter and connect the adapter's ground lead to the outlet plate retaining screw.

The voltage Selector/Fuse Assembly on the right side of XF1 reconfigures the RF Control Unit to different operating voltages. This assembly contains a line voltage fuse and voltage selector PC board. Refer to following paragraph for replacement of the fuse and/or proper alignment of

the voltage selector drum to change the operational power requirements to either 100, 120, 220, or 240 Vac.

Table 2-1 IEEE-488 INTERFACE BUS Signal Designators

Pin No.	Signal Line	Pin No.	Signal Line
1	DIO1	13	DIO 5
2	DIO2	14	DIO 6
3	DIO3	15	DIO 7
4	DIO4	16	DIO 8
5	EOI (24)	17	REN (24)
6	DAV	18	GND (6)
7	NRFD	19	GND (7)
8	NDAC	20	GND (8)
9	IFC	21	GND (9)
10	SRQ	22	GND (10)
11	ATN	23	GND (11)
12	SHIELD	24	GND, LOGIC

LINE VOLTAGE AND FUSE SELECTION

When shipping with the U.S., TEGAM configures the 1805B for 120-Volt operation. Overseas shipments may vary. The following steps provide procedures to reconfigure the line voltage and replace the Fuse Assembly (Figure 2-5). Table 2-2 lists fuse requirements for the available operational voltages. Model 1805B accepts either American (0.25" x 1.250") or European (5mm x 20mm) fuses.



Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the power cord is DISCONNECTED before attempting to change fuses.

Table 2-2 Line Voltage Fuse Requirements

Operational Line Voltage	Fuse Requirement	TEGAM Part No.
100 or 120 Volts ±10% at 48 to 66 Hz.	1/2 AMP Slo-Blo	052-1-1/2SB
220 or 240 Volts ±10% at 48 to 66 Hz	1/4 AMP Slo-Blo	052-1-1/4SB



DO NOT connect or apply power to this instrument until the Power Input Assembly has been adjusted to the operational line voltage.

- a. Disconnect the power cord from the Voltage Selector/Fuse Assembly (Figure 2-5).
- b. Slide plastic window to the left and pull to the back and left on the fuse pull lever to eject the fuse.
- c. Remove the Voltage Selector PC Board from the assembly by pulling it out carefully.

- d. Position the Voltage Selector PC Board so that the desired voltage appears readable (right-side-up) on the left-hand side of the wafer as it faces you. The "X" on the board in the diagram depicts this location.
- e. Slide the board back into the module, as shown in the diagram, with the desired voltage still appearing as set in Step d.
- f. Replace the fuse with the proper fuse according to Table 2-2. Reinsert the new fuse by placing it in the fuse brackets.
- g. Slide the Voltage Selector/Fuse Assembly door shut and reconnect AC power cord.

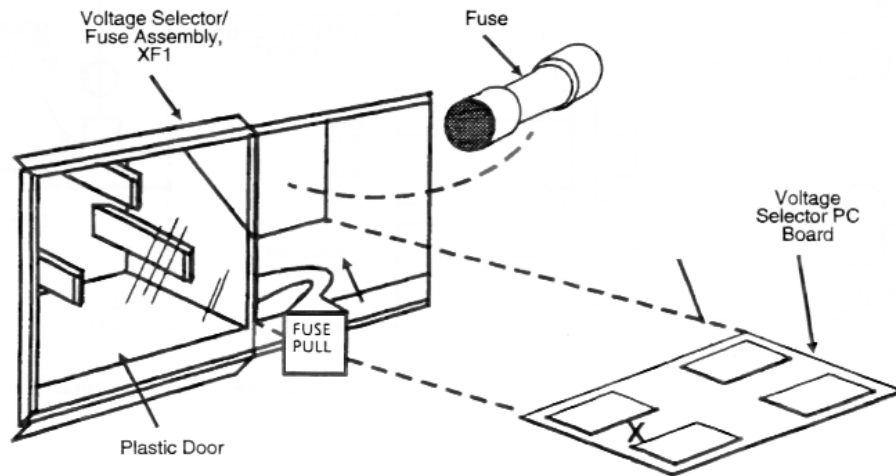
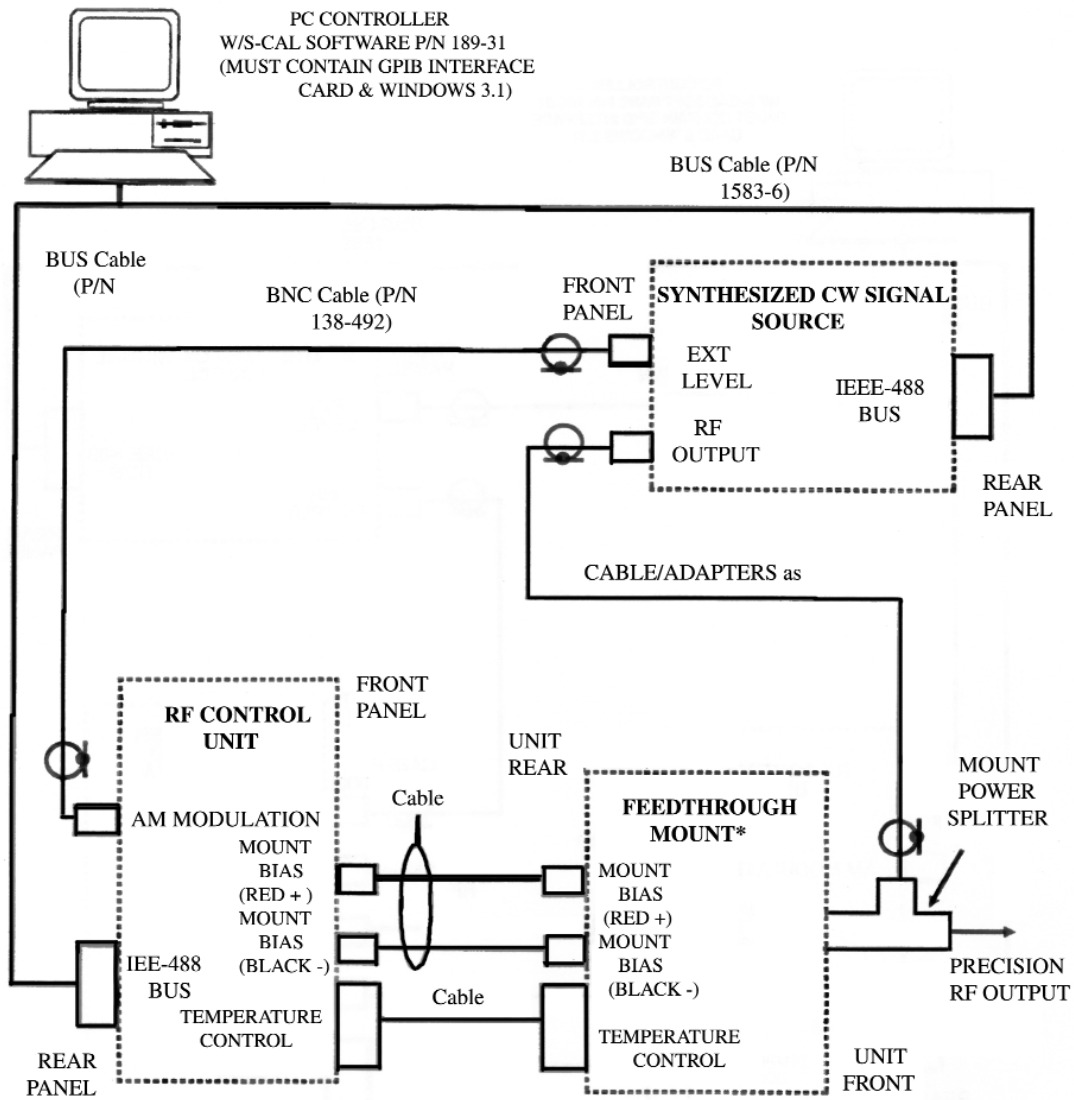
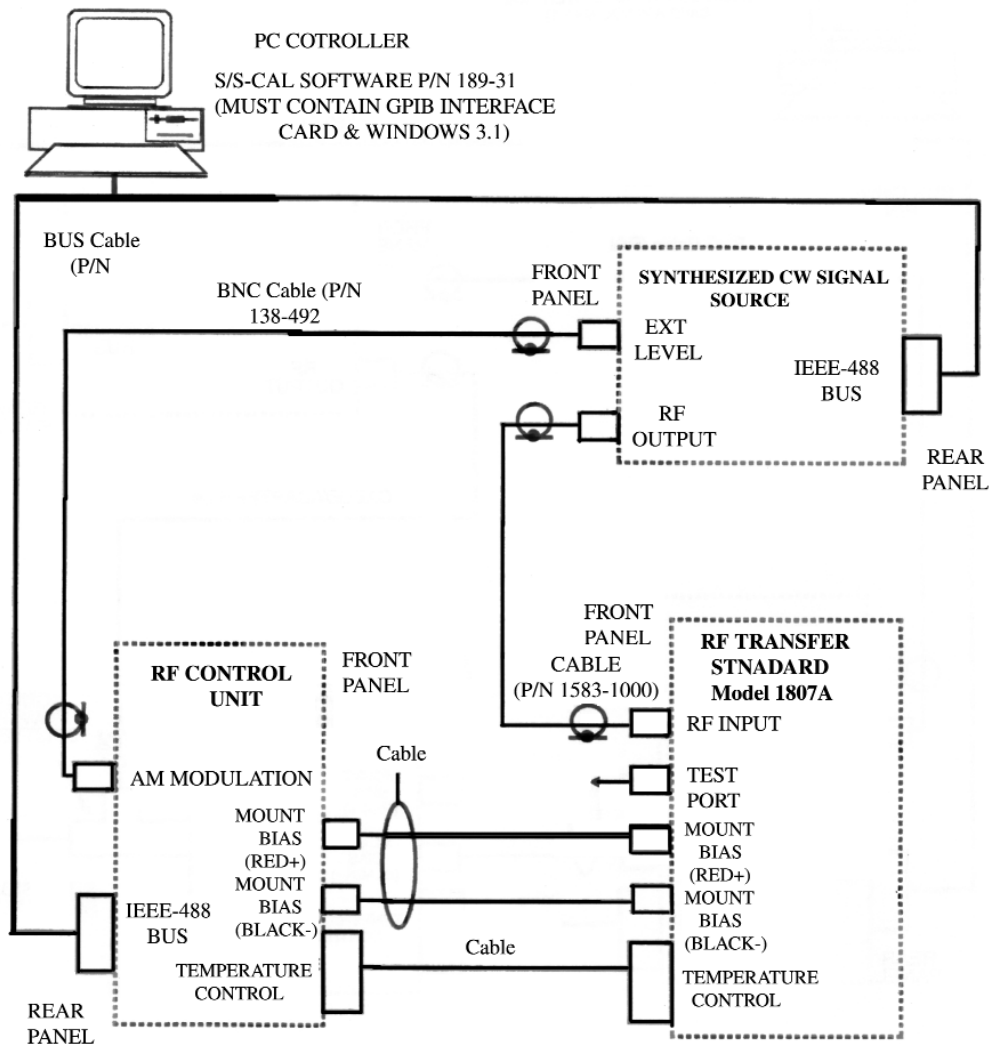


Figure 2-5 Voltage Selector/Fuse Assembly



*Models 1109, 1109H, 1116, 1117A, 1119H or 1119

Figure 2-6 Precision Power Source Setup



7 Precision Power Source Setup

Figure 2-

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. Cover the front panel connectors with plastic connector covers.
- b. Wrap instrument with sturdy paper or plastic.
- c. Place all accessories, cables and loose hardware into a plastic bag.
- d. Place the wrapped instrument 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.
- e. Place bag of accessories and hardware into container.
- f. If shipping the instrument 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
- g. Thoroughly seal shipping container and mark it FRAGILE.
- h. Ship to an authorized sales representative or:

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

STORAGE

When Model 1805B 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 1805B are as follows:

Temperature:	(-40° to + 75°C) -40° to +167°F
Humidity:	less than 95%
Altitude:	less than 40,000' (12,192m)

SECTION III, THEORY & OPERATION

GENERAL

This section contains all the theory and operating instructions necessary to perform power measurements and calibrations using the Model 1805B RF Control Unit.

OPERATION

The primary purpose of the Model 1805B RF Control Unit is to provide fast, reliable, and accurate leveled RF power when used in a closed-loop feedback arrangement. The unit provides automatic dc substitution at 0.5 mW and 1 mW to 10 mW in 1 mW steps using local or IEEE-488 bus control for easy and accurate transfer of calibration factors.

When used with the TEGAM Model 1109 RF power standard, the 1805B permits the accurate transfer of up to 132 calibration frequencies traceable to NIST from 0.01 to 18.0 GHz. The 1805B is also compatible with other TEGAM System IIA components including the 1109H, 1116, 1117A, 1119, and 1119H series RF Transfer Standards (refer to applicable mount manual for specifications).

An internal temperature controller raises and maintains the temperature of the mount chamber above ambient. This minimizes the effects of changes in ambient temperature for all TEGAM RF Transfer Standards.

The 1805B operates in a closed loop configuration for leveling the RF output of compatible signal sources. They are controlled directly using an analog signal applied to a dc coupled AM input connector.

Ultra stable dc high precision metal film resistors provide dc power increments across a TEGAM patented self-balancing bridge. The front panel bridge meter provides visual indication that closed loop stabilization has been achieved and enables rapid system operation. Coarse and fine adjustments are provided to obtain a meter null reading with no RF applied.

In addition to the bridge balance and temperature indicator, the 1805B contains several operational and performance checks. A front panel Mount Error indicator blinks if the voltage across the mount is not within a specified range. This alerts the operator of a mount fault such as open or shorted leads, or improper mount temperature. DC supply voltages are monitored by PC B-mounted LEDs which illuminate with an active power supply.

A standby mode switch allows mount heater circuit operation to maintain mount temperature at all times. This ensures full performance capability and long term stability of the bolometer mount.

The Model 1805B provides automatic dc level control to within $\pm 0.1\%$, $+1\ \mu\text{W}$, with an RF source variation of $\pm 3\ \text{dB}$ and an ambient temperature range of $+10$ to $+40^\circ\text{C}$. The dc substitution level is held to an accuracy of $+0.1\%$, $+5\ \mu\text{W}$. Maximum accuracy is achieved by using DC power for both bias and substitution signals.

This instrument employs LEDs to inform the user of RF power ON/OFF condition, ac power on/standby, mount error, and remote/listen functions. Easy-to-read meters are used to monitor temperature stability and bridge balance.

For more information on the use of the 1805B in a typical system, refer to the TEGAM System IIA Automatic Power Meter Calibration System operation and Service Manual (IM-198).

GENERAL OPERATING CONSIDERATIONS

All equipment should be operated from a regulated ac supply. Allow at least one hour for electronic equipment to warm up before any measurements are made. When operated from a cold start, the RF Transfer Standard used with the Model 1805B will require at least two hours to reach temperature stability under control of a temperature controller. This is accomplished by placing the POWER switch in the STANDBY position for the first hour and a half and then the ON Position for the last half hour with the RF ON/OFF switch in the OFF position.

During calibration runs, ensure that the Model 1805B BRIDGE BALANCE meter is zeroed prior to each calibration with the RF ON/OFF switch in the OFF position. Temperature variations within the laboratory should be held to a minimum to avoid excessive temperature fluctuations within the sensor or instrument under test

All equipment should be operated on a laboratory work bench as firm and solid as possible. The thermistor mounts should be used on a smooth surface, such as 1/8" sheet of nylon plastic, to improve ease of positioning. Components should be supported at proper intervals to avoid misalignment.

Connectors must be properly aligned. Center lines must be coaxial; connector faces must be parallel and must meet neatly and firmly. When the coupling nuts are engaged and the connector starts to seat, the mount should be wiggled slightly as the connector is tightened to ensure accurate seating. The recommended torque applied to the coupling nut is 7-10 inch/pounds.

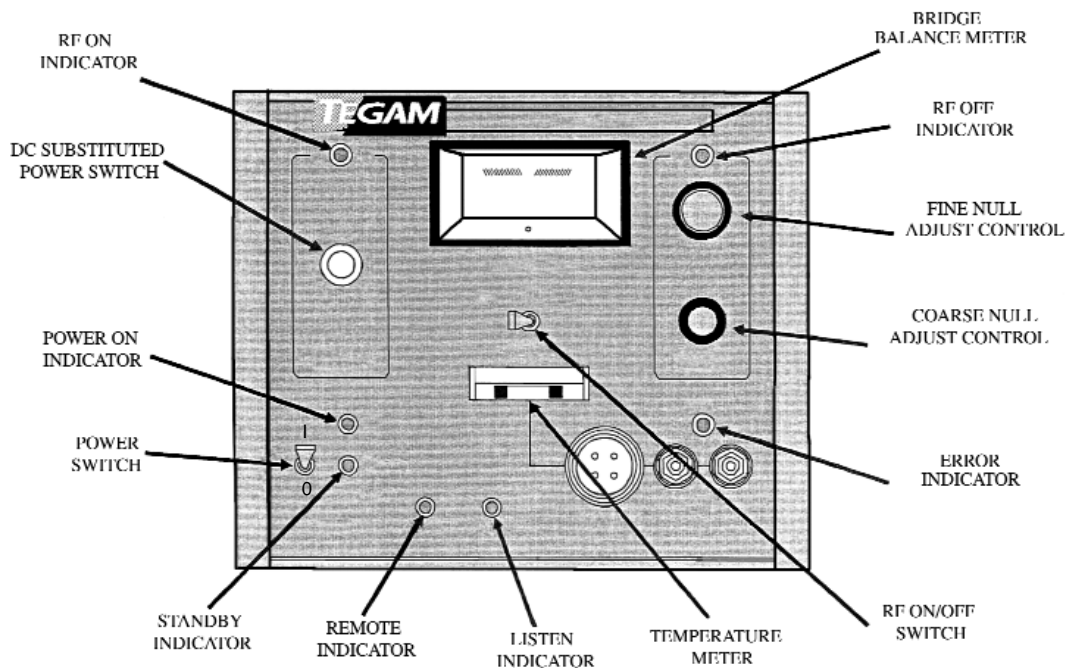


Figure 3-1 Controls and Indicators (Front)

CONTROLS AND INDICATORS

The following paragraphs provide a description of all controls and indicators located on the Model 1805B. Figure 3-1 shows the location of all the switches and indicators on the Model 1805B.

LISTEN INDICATOR.

The LISTEN indicator (DS6) is a red LED located in the bottom center of the front panel. This indicator is only illuminated when the Model 1805B is addressed as a listener via the IEEE-488 bus.

REMOTE INDICATOR

The REMOTE indicator (DS7) is a red LED located in the bottom center of the front panel. This indicator is only illuminated when the Model 1805B is under IEEE-488 bus control.

STANDBY INDICATOR

The STANDBY indicator (DS5) is an amber LED located near the lower left-hand corner of the front panel. When the POWER switch is toggled to the STANDBY position (middle position), This Indicator illuminates, indicating that +30V power has been applied to allow pre-heating of the precision resistor network within the Model 1805B, and that the +20V temperature controller circuit for the thermistor mount has been activated.



Ensure that input connector and voltage selector/fuse assembly is set for the proper voltage before switching the POWER Switch to ON or STANDBY; otherwise, damage may result to internal circuitry.

POWER SWITCH

The POWER switch (S1) is a three (3) position toggle switch located near the lower left-hand corner of the front panel. In the down or OFF position all power is removed from the Model 1805B internal and controlled external circuitry. In the middle or STANDBY position, +30V is applied for pre-heating the internal precision resistor network, +20V is applied to the temperature controller circuit for pre-heating the thermistor mount, and the amber STANDBY indicator is illuminated. In the up or ON position, all required power for operation is applied to the Model 1805B, and the green ON indicator is illuminated.

ON INDICATOR

The ON indicator (DS4) is a green LED located near the lower left-hand corner of the front panel. When the POWER switch is toggled to the ON position, this indicator illuminates to indicate that all Model 1805B internal power supplies have been activated.

DC SUBSTITUTED POWER SWITCH

The DC SUBSTITUTED POWER switch (S3) is an eleven (11) position limited-rotation rotary switch located in the left-hand center of the front panel. When the Model 1805B is under manual control this switch controls the level of the dc substituted power being supplied. The selectable levels are 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 milliwatts. Under IEEE-488 bus control, this switch is inactive.

RF ON INDICATOR

The RF ON indicator (DS2) is a green LED located in the upper left-hand corner of the Model 1805B front panel. When the RF ON/OFF switch is toggled to the left (ON) position, this indicator illuminates, indicating that the selected dc substituted power level is supplied to the bridge, and the appropriate RF control signals are routed from the rear panel of the Model 1805B. If the Model 1805B is under remote IEEE-488 bus control, this indicator illuminates when the RF ON functions have been performed by the software and system controller.

BRIDGE BALANCE METER

The BRIDGE BALANCE meter (MI) is located at the top center of the front panel, and is scaled from a low of -10 microwatts to a high of +10 microwatts relative to a mid-meter scale reference of zero (0). A 0 reference level reading on the meter indicates that the level controlled by the Model 1805B corresponds exactly to the dc substituted power level selected on the DC SUBSTITUTED POWER switch. Any deviation from the selected level is read on

the meter as a low or high indication in microwatts. In operation, COARSE NULL ADJUST control and FINE NULL ADJUST control are adjusted to achieve a 0 or "null" reading on MI prior to application of RF power. After applying RF power (either manually via the RF ON/OFF switch or automatically via the IEEE-488 control bus) the meter should, after a momentary deviation, again achieve a null reading to indicate that the Model 1805B has "locked on" to the RF source and is applying the proper amount of dc substituted power for calibration purposes.

RF OFF INDICATOR

The RF OFF indicator (DS1) is a green LED located in the upper right-hand corner of the front panel. When RF ON/OFF switch is toggled to the right (OFF) position, this indicator illuminates, indicating that 30 mW dc power is supplied to the mount, and the appropriate RF control signal is routed to the rear panel. If the 1805B is under remote IEEE-488 bus control, DS1 illuminates when the functions of RF OFF (0) have been performed by the automatic system controller.

FINE NULL ADJUST CONTROL

The FINE NULL ADJUST control (RI) is a continuously-variable, knob-controlled potentiometer located near the upper right-hand corner of the front panel. This control provides a fine adjustment of the bridge balance reading on BRIDGE BALANCE meter prior to application of RF power.

COARSE NULL ADJUST CONTROL

The COARSE NULL ADJUST control (R2) is a continuously-variable, knob-controlled potentiometer located in the right-hand center portion of the front panel. This control provides coarse null adjustment of the bridge balance reading on the BRIDGE BALANCE meter prior to the application of RF power.

ERROR INDICATOR

The ERROR indicator (DS3) is a red LED located near the lower right-hand corner of the front panel. This indicator is active only when RF power is NOT applied, and when illuminated, indicates either an open circuit (hookup or thermistor), or failure of the bridge to balance at $30 \pm 1\text{mW}$.

RF ON/OFF SWITCH

The RF ON/OFF switch (S2) is a two-position toggle switch located near the center of the front panel. During manual operation, placing this switch in the left (ON) position applies RF power, activates the 1805B circuitry to subtract the chosen dc substitution power from the thermistor elements in the mount, deactivates the RF OFF indicator and activates the RF ON indicator. During remote IEEE-488 bus controlled operation, this switch is left in the OFF position and the automatic system controller performs its function.

TEMPERATURE METER

The TEMPERATURE meter is located in the lower center of the front panel, and provides a dc voltage analog reading of temperature and temperature stability within the thermistor chamber. A green band on the meter scale provides a visual indication of normal operating temperature limits. Although some mounts may cause the meter to indicate above or below this green band, this does not affect the normal operation of Model 1805B, if the ERROR is not illuminated and the needle is stable and does not drift or vibrate erratically.

ADDRESS SWITCH

Remote operation of the 1805B requires settings its IEEE-488 ADDRESS switch for a unique five-bit address. The ADDRESS switch is located to the left of the IEEE-488 BUS connector on the rear panel. Refer to Figures 3-2 & 3-3.

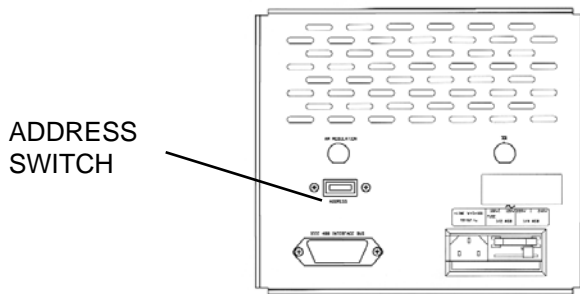


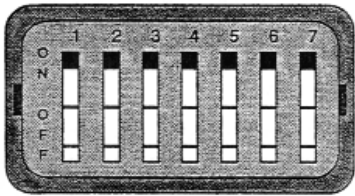
Figure 3-2 Controls and Indicators (Rear)

The ADDRESS switch contains seven small switches that are numbered from left to right; however, only switches 1 through 5 are used for selecting the unit address. Switch 1 is the least significant bit (LSB). Addresses 0 through 30 are valid. Address 31 is invalid. Figure 3-3 is a view of the ADDRESS switch showing the switches' numbering scheme. Also included is a truth table that lists switch 1 through 5 positions (0 or 1) for addresses 1 through 10, 20, and 30.

To code a particular address, set switches 1 through 5 to either ON (push top of switch in) or OFF (push bottom of switch in) to code a binary 1 or 0, respectively. Notice that when the ON position is selected, a red band appears in the ON position.

OPERATING INSTRUCTIONS

The Model 1805B RF Control Unit was primarily designed as one component of the TEGAM System IIA whose purpose is to accurately transfer the calibration factors of NIST standards to feedthrough and terminating bolometer mounts, thermistor mounts, and power sensors. The following paragraphs provides general operating instructions for the Model 1805B such as Initial Power-up and checkout procedures. Manual operating Instructions, IEEE-488 Bus operation and a overview of using the System IIA Windows™ (SureCAL) Software with the Model 1805B. More detailed operating instructions and application information for the various System IIA configurations can be located in the System IIA Automatic Power Meter Calibration System operation and Service Manual (IM-198).



ADDRESS

Note: All switches are shown in the ON position.

1 = ON
0 = OFF

Address Truth Table

Switch Number	1	2	3	4	5
Decimal Weight	1	2	3	4	5
Address:					
0	0	0	0	0	0
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	1	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
20	0	0	1	0	1
30	0	1	1	1	1

Figure 3-3 Address Switch

INITIAL POWERUP AND CHECKOUT PROCEDURES

After performing the installation instructions in Section II and all system cabling has been connected as desired, apply power to the 1805B as follows:

- a. Read over the General Operating Considerations before proceeding.
- b. Ensure that the RF ON/OFF switch is in the OFF position.
- c. Place the POWER switch in the STANDBY position. (The amber STANDBY indicator should illuminate).
- d. After 1 and 1/2 hours of warm-up time, ensure that the TEMPERATURE meter is in the green range and the meter needle is stable.
- e. Place the POWER switch in the ON position. Verify the following:
 - The STANDBY indicator should extinguish, the ON indicator and RF OFF should be illuminated.
 - The BRIDGE BALANCE meter will register a slight deflection; the TEMPERATURE meter should remain unchanged (in the green range) and the ERROR indicator should NOT illuminate.

NOTE

If the ERROR indicator illuminates, attempt to obtain a null reading on the BRIDGE BALANCE meter using the COARSE and FINE NULL ADJUST controls. If the ERROR indication persists, then return the POWER switch to the STANDBY position and check system cabling and thermistor continuity. If, after performing these checks, subsequent power application continues to result in an ERROR indication, power should be removed from the system and the Model 1805B removed for troubleshooting.

- f. After the system has had the additional 1/2 hour of warm-up with the POWER switch in the ON position, and if all indications are normal (as outlined above), the 1805B is ready for operation.

MANUAL OPERATION

After the initial warm-up period has been completed, the Model 1805B can be operated manually (under local control) as follows:

- a. Leave the POWER switch in the ON position.
- b. Select the desired dc substituted power level using the DC SUBSTITUTED POWER switch.
- c. With the RF ON/OFF switch in the OFF position, use the COARSE NULL ADJUST control to obtain a close-to-zero (0) reading on the BRIDGE BALANCE meter.
- d. Use the FINE NULL ADJUST control to obtain a precise zero (0) "null" reading on the BRIDGE BALANCE meter.
- e. Switch the RF ON/OFF switch to the ON position. Verify the following:
 - The RF ON indicator should immediately illuminate, and the RF OFF indicator should immediately extinguish.
 - The BRIDGE BALANCE meter should momentarily deflect and then quickly revert to zero (indicating a locked condition) where the indicator should remain stable.

If the meter remains deflected to the left, increase the RF level provided by the signal generator or decrease the DC Substituted Power setting. If level control adjustments do not result in a lock, fault isolate the problem using the system-level troubleshooting procedures given in the System IIA Automatic Power Meter Calibrator System Manual (IM-198). Failure to renull (obtain lock) results in inaccurate calibrations.

- f. After the appropriate calibration reading(s) have been taken, switch the RF ON/OFF switch to the OFF position and verify the the RF OFF indicator illuminates and the BRIDGE BALANCE meter momentarily deflects and then quickly returns to zero (indicating a locked condition) where the indicator should remain stable. If the meter remains deflected to the left, increase the RF level provided by the signal generator or decrease the DC Substituted Power setting. If the meter remains deflected to the right, decrease the RF level provided by the signal generator or increase the DC Substituted

Power setting. If level control adjustments do not result in a lock, fault isolate the problem using the system-level troubleshooting procedures given in the System IIA Automatic Power Meter Calibration System Operation and Service Manual (IM-198).

Failure to renull (obtain lock) results in inaccurate calibrations.

- g. For subsequent calibrations, repeat Steps b through f above.
- h. When calibrations have all been completed terminate operation of the Model 1805B.

REMOTE OPERATION

The Model 1805B can be remotely controlled over an IEEE-488 bus by a standard bus controller. Connect the controller to the IEEE-488 bus interface connector located on the rear panel according to Section II. Set the Model 1805B's bus address using the rear panel ADDRESS switch.

The Model 1805B recognizes commands sent via the IEEE-488 in the form of mnemonics composed of a single ASCII character. Table 3-1 lists these mnemonics and provides an explanation of each command. All commands must be terminated by ASCII codes for Line Feed (OA) and/or an EOI with the last character. For more information on bus structure, management, and terminology, refer to the IEEE Standard 488-1978, "Digital Interface for Programming Instrumentation."

The REMOTE indicator is lit when the 1805B is placed into remote mode by the bus controller. When the 1805B is addressed by the bus controller, the LISTEN indicator illuminates and stays lit until another device on the bus is addressed. Set the desired DC Substituted Power level using one of the mnemonics listed in Table 3-1. Monitor the 1805B's BRIDGE BALANCE meter to ensure that the signal is locked. This is indicated by a momentary deflection of the BRIDGE BALANCE meter followed quickly by a return to zero (indicating a locked condition). If the meter deflection persists, rectify the condition. There is no feedback to the bus controller that signals whether the 1805B is properly locked.

Table 3-1 Mnemonics for Remote Control

MNEMONIC	ACTION
0	Sets RF OFF
*	Sets RF ON and DC Substituted Power to .5 mW
1	Sets RF ON and DC Substituted Power to 1 mW
2	Sets RF ON and DC Substituted Power to 2 mW
3	Sets RF ON and DC Substituted Power to 3 mW
4	Sets RF ON and DC Substituted Power to 4 mW
5	Sets RF ON and DC Substituted Power to 5 mW
6	Sets RF ON and DC Substituted Power to 6 mW
7	Sets RF ON and DC Substituted Power to 7 mW
8	Sets RF ON and DC Substituted Power to 8 mW
9	Sets RF ON and DC Substituted Power to 9 mW
X	Sets RF ON and DC Substituted Power to 10 mW

TERMINATING OPERATION

The following procedures may be used to terminate 1805B operation at any time under either local or remote control:

- a. Place (or ensure that) the RF ON/OFF switch is in the OFF position.
- b. Place the POWER switch to either of the following:
 - STANDBY position (if more calibrations are to be performed and avoiding the warm-up period is desired). Leaving it in the STANDBY position allows the temperature of the mount to remain stabilized. The STANDBY indicator should illuminate; the TEMPERATURE meter should stay in the green range; and all other indicators should extinguish.
 - OFF position (to terminate all 1805B operation). All indicators should extinguish; the TEMPERATURE meter should indicate zero (0) volts; and the BRIDGE BALANCE meter should indicate a zero (0) mid-scale reading.

THEORY OF OPERATION

The following paragraphs contain the theory of operation for the Model 1805B RF Control Unit. The following paragraphs explain the principles upon which the Model 1805B's design is based and provides a systematic explanation of the RF Control Unit's internal components and circuitry.

The TEGAM Model 1805B RF Control Unit combines with a temperature-stabilized feedthrough thermistor mount and an RF generator to form a closed loop RF control system (Figure 3-5) that achieves precise control of dc substitution power levels. At the core of this system are two thermistor beads with negative temperature coefficients whose resistances total 200 ohms when biased at 30 mW. The temperature-stabilized feedthrough thermistor mount/power splitter contains these thermistor beads.

These thermistor beads, whose resistance decreases as a function of increasing power, comprise a leg of self-correcting, de-biased, Wheatstone bridge circuit, which originates in the TEGAM Model 1805B RF Control Unit. When a precise level of dc bias is removed from this bridge circuit by manual or bus-controlled switching of the Model 1805B, an unbalanced bridge condition occurs. The output of this unbalanced bridge is directly related to the precise level of dc bias removed. After amplification and filtering, the voltage output of this unbalanced bridge drives a voltage-controlled attenuator. This component varies the attenuation of RF power incident upon a feedthrough thermistor mount in a manner that makes the RF power proportional to the decrease in dc bias that created the unbalanced condition. Application of the attenuated RF power via one port of a power splitter restores the total 200 ohm bias to the thermistor beads and thus bridge balance. The resistance of the thermistor pair is directly related to the sum of RF power applied from one output port of the power splitter and the dc power from the bridge. Since an equal RF power level is present at the second output port of the power splitter, this port sources a precision level of RF power. The Model 1805B primarily consists of four circuit groups consisting of a Motherboard/Power Supply Section, a Microprocessor Section, a DC Substitution Section, and a RF Amplifier Section.

POWER SUPPLY/MOTHERBOARD SECTION

The input power source is routed through the Power Entry Module Assembly (XF1) before being applied to the Power Supply/Motherboard Assembly (A6). The Power Entry Module Assembly allows the user to select between the two operational voltage ranges that can be accepted by the Power Supply/Motherboard Assembly (A6). This Power Supply/Motherboard

Assembly (A6) provides a +20 \pm 2V, +5 \pm 0.5V, and \pm 15V \pm 2V outputs to all the Model 1805 Assemblies connected to the Motherboard section of this assembly. The +30V for the DC Substitution PC Board Assembly (A2) is generated by the +30 V Power Supply Assembly (A7). The +30 V Power Supply Assembly receives its operational power from the T1 Transformer located on the Power Supply\Motherboard Assembly (A6). A front panel POWER ON (DS1) and STANDBY (DS5) indicator is provided to allow the user to verify that an external power source is applied to the Model 1805B.

MICROPROCESSOR SECTION

The microprocessor board, functionally depicted in Figure 3-5 reads control information from either the front panel (local control) or the rear panel IEEE-488 bus interface (remote control). The board decodes this control information and performs the tasks needed to implement the control function. The 1805B's functions include switching of the substitution levels to eleven possible settings and the control of the RF ON/OFF switching.

The heart of the microprocessor board is U1, an INTEL eight-byte 8085 parallel microprocessor with a 6-MHz clock. U1 interprets instructions stored in EPROM (erasable electrically programmable ROM) U10. Programmable logic array, U9, interfaces the microprocessor to the program memory, U10 as well as providing I/O port capability. Serial EPROM U11 contains the instrument program for U9 which is loaded at instrument power up. These instructions in program memory U10 guide the microprocessor in its operation through two main modes: local and remote operation. In local mode the user programs the instrument by switching front panel controls that switch status receivers that are part of I/O chip U7. The program instructions stored in EPROM U2 continuously update these status receivers, which are scanned by the microprocessor to derive local mode instructions. If the front panel status changes, the microprocessor outputs the proper bits to the board drivers through the output latches of U7 or U9. The board drivers (U8 and U6) energize the relays associated with the 1805B circuits responsible for this function. Due to the continual scanning of the microprocessor, detection of any front panel function change occurs unless the 1805B is set to remote mode in which case the microprocessor switches to a new set of instructions.

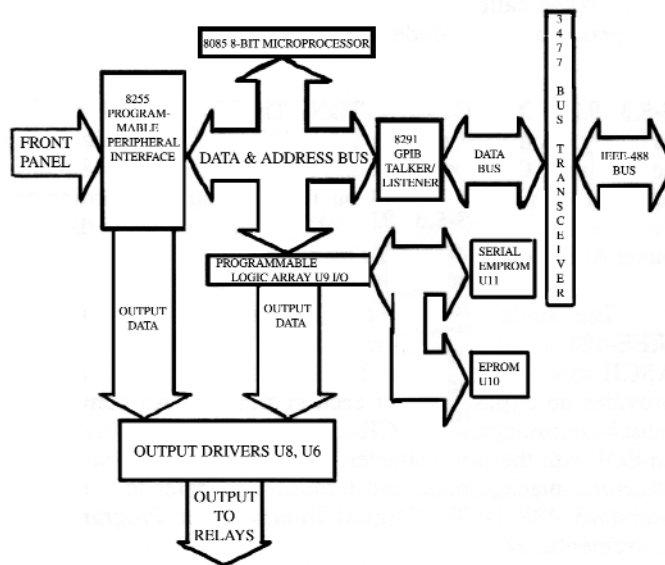


Figure 3-4 Simplified Microprocessor Block Diagram

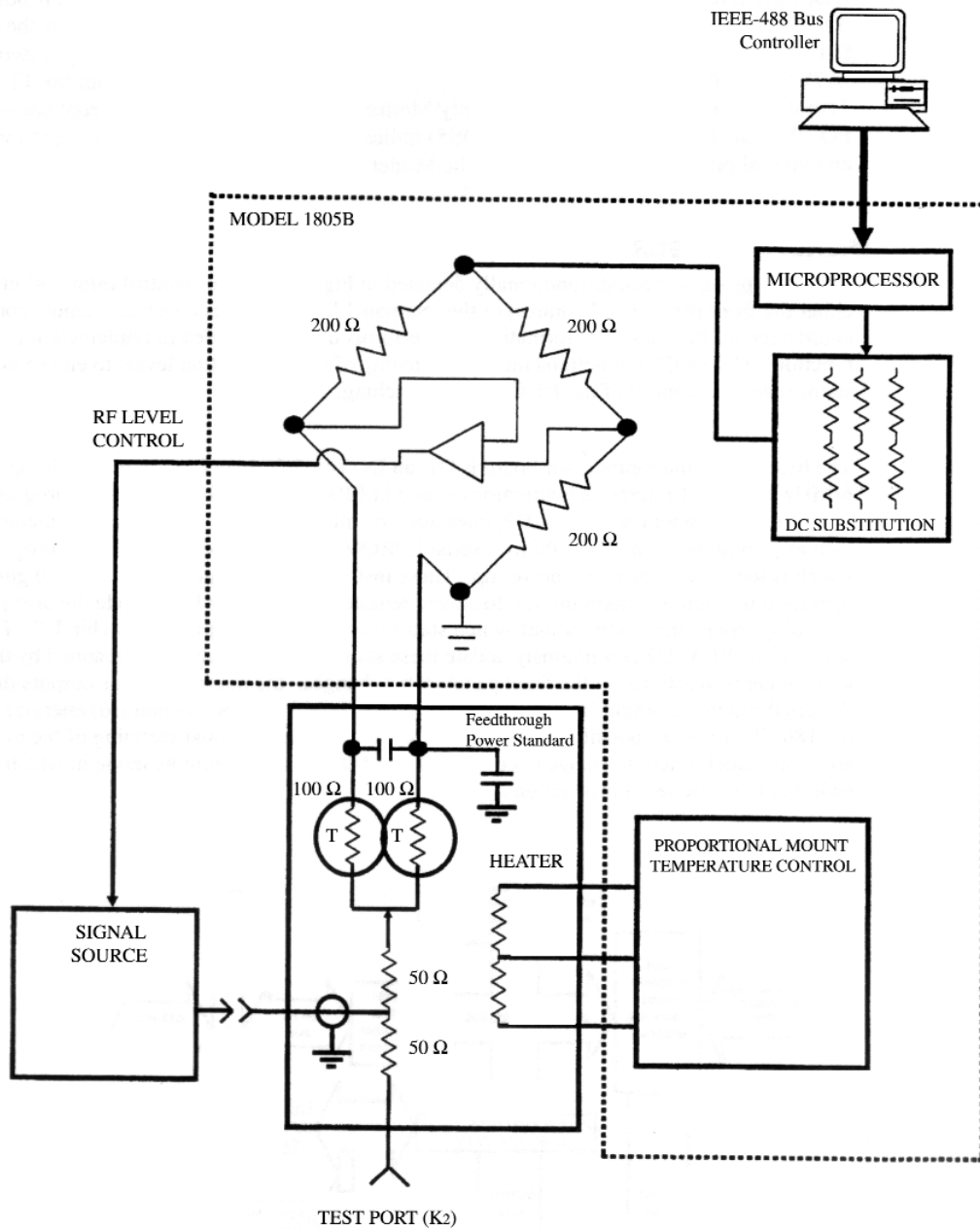


Figure 3-5 Precision Power Source Schematic

In remote mode the microprocessor, U1, follows remote operation instruction stored in EPROM U2. These instructions tell the processor to scan U3, the IEEE talker/listener chip status register for function changes. U3 is a microprocessor-controlled with eight read and eight write registers that interfaces the Model 1805B to an IEEE-488 interface bus via two operation, i.e., the processor outputs the correct bits to the driver chips to implement the required function.

Since the microprocessor is scanning U3, the front panel is deactivated. Therefore, switching front panel controls does not cause a functional change by the unit. Once in the remote mode U3 handles all bus protocol. If the external controller requires status information, U3 asks the microprocessor for the instruments status. The processor informs U3 of its current status which U3 outputs to the external controller. An addressing scheme allows multiple instrument control on the same IEEE-488 bus. Each instrument has its own unique address. U3 decodes the IEEE addresses sent by the common bus until it sees its unique address, which tells it the information to follow is for that unit. U3 fetches its unique address from the I/O portion of the dual-purpose EPROM-I/O chip, U2.

RF AMPLIFIER SECTION

The RF Amplifier PC Board Assembly (A3), functionally depicted in Figure 3-6 contains two circuits that are instrumental in closed loop leveling in the RF ON mode. These circuits are a thermistor temperature controller and a bridge-sense high-gain differential amplifier. RF amplifier board circuitry also provides RF switching according to RF ON/OFF signals from the microprocessor board and bridge offset sensing that drives the front panel bridge balance meter.

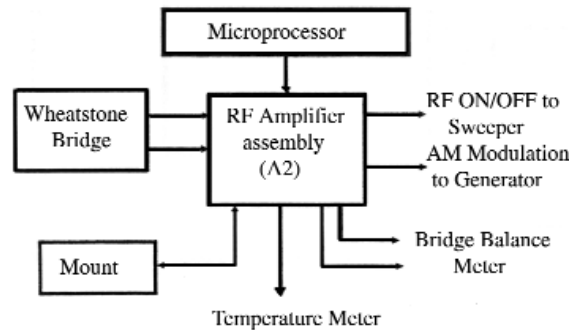


Figure 3-6 RF Amplifier Functional Diagram

Thermistor Mount Proportional Temperature Controller

The thermistor mount temperature controller senses the imbalance of a thermal bridge and drives the mount heater in proportion to the imbalance signal to compensate for temperature variations. This board also controls two indicators. The first of these two indicators is temperature meter M2, which is located in the center of the front panel (Figure 3-1). The green band on this meter indicates the proper operating temperature range. The second is the light-emitting diode DS1, located internally on the RF Amplifier board, that indicates a near steady-state temperature condition. Figure 3-7 presents a simplified schematic of the thermistor mount temperature controller circuitry.

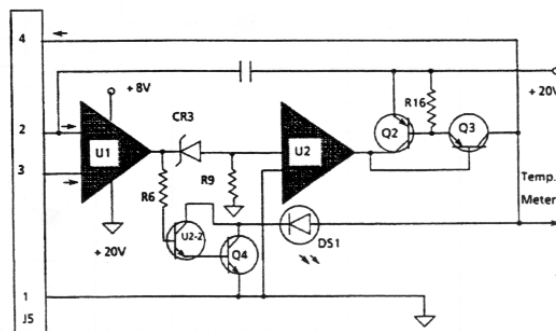


Figure 3-7 Temperature Control Circuitry

U1, a high-gain amplifier with excellent offset drift characteristics, senses the imbalance of a thermal bridge located in the temperature-stabilized feedthrough thermistor mount via pins 2 and 3 of board connector J5. This thermal bridge, which is composed of two types of resistance with differing temperature coefficients, balances at approximately 60 C. U1/U2 interaction provides a varying response to the thermal bridge imbalance signal according to the relationship between the voltage differential inputs. U1/U2 amplifies an imbalance signal from a cold thermal bridge that forces the series pass transistor Q3 to pass a current proportional to the imbalance signal. This current acts to drive the mount heater to restore thermal bridge balance. As the thermal bridge nears the steady-state condition, Q3 causes DS1 to illuminate. If the mount is cold, DS1 does not illuminate since the Darlington pair configuring made up by U2-2 and Q4 is not a conducting state. U1/U2 responds to an imbalance signal from an overheated mount by turning off Q3 so that it does not pass current to drive the heater or DS1.

Transistor Q2 and resistor R16 combine to provide circuit protection by limiting current in the event of an output short circuit.

Bridge Offset Sensing Circuit

The bridge offset sensing circuit drives the 1805B front panel bridge balance meter by providing a total circuit gain sufficient to realize a 200 Ω per division sensitivity in the front panel meter reading. To achieve this, instrumentation amplifier U3 senses the bridge differential and sources the amplified difference to a transconductance amplifier made up of amplifier U4, U5B and associated components. The transconductance amplifier sources the meter with a current proportional to the amplified difference seen from amplifier U3. The high-gain differential amplifier senses the Wheatstone bridge imbalance. This circuit gives the 1805B the required gain to achieve the high sensitivity to the level of dc bias substituted for RF levels. Three operational amplifiers make up this circuit. U6 senses the bridge differential and provides high gain, U7 conditions signals, and U8 drives the RF generator AM Modulation signal (via board connector J4 and rear panel connector J2). Relay K1 forces the output signal to the maximum attenuation level assuring that the RF power always starts from a low power state when the RF power is first switched on. This prevents the thermistor mount from seeing high power transients at switch points.

RF Switching Circuitry

The board also derives the switching signals required by most RF switches. The microprocessor board generates an RF ON/OFF signal that enables or disables Relay K1. This relay in turn opens or closes a 5-volt loop that drives a switch in the RF generator.

DC SUBSTITUTION SECTION

The dc Substitution PC Board Assembly, A2 contains precision dc circuits which give the 1805B its primary accuracy. These circuits have two functions: dc substitution and error detection. Figure 3-8 depicts a simplified schematic of the dc substitution circuit. It is comprised of three legs of a resistive Wheatstone bridge, whose fourth leg is contained in a feedthrough thermistor mount. This fourth leg containing thermistor beads links to the 1805B via board connector J1. Relay K12 allows this circuit board to operate in two states. If Relay K12 is not energized, the RF OFF functions operate; if K12 is energized, the RF ON functions operate. Switching of precise resistive sections across the Wheatstone bridge, according to the desired dc substitution level, cause a change in the bridge currents. This change in current is called the dc substitution.

Without application of RF power (RF OFF) to the system thermistor mount, dc substitution provides the current through the bridge sufficient to bias this thermistor mount at 30 mW. The 200 ohm equivalent resistance of the TEGAM Model 1109 Feedthrough Mount, which makes up one leg of the Wheatstone bridge, dictates the 1805B's 30 mW operating point. Relay K12 in this state allows the resistive section consisting of R21 and R22 to shunt the bridge circuit. This causes the correct current to flow for 30 mW bias. Fine and coarse adjustments to the bridge current front panel potentiometers correct small errors in the thermistor bias operating point.

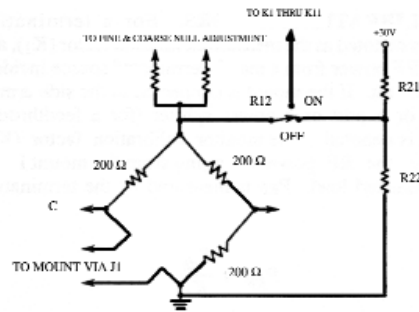


Figure 3-8 Simplified dc Substitution Circuit

With the RF power applied to the system thermistor (RF ON), the mount requires less bias current to hold its operating point of 30 mW. In fact, by decreasing the dc bias by a known amount, RF can be applied until the original operating point is again achieved. The amount of RF power needed to find this operating point is proportional to the dc current removed. The dc substitution board gets its name from this substitution of dc power for RF power. Resistive sections bias the bridge for eleven different calibrated bias currents which correspond to eleven separate power substitutions. Switching of one of the eleven relays (K1-K11) selects the corresponding resistive sections and shunts the sections across the bridge via relay K12.

The dc substitution board also contains the bridge error circuit which senses an error condition directly across the thermistor. The error detection circuit is only active during the RF OFF state. This circuit senses that the 30 mW operating bias point is within .7 mW by comparing the sensed potential found across the thermistor to two reference voltages. These reference voltages are equivalent to those required to produce 29.3 mW and 30.7 mW across the thermistor. If the thermistor fails to bias within .7 mW of the 30 mW bias point, the front panel indicator illuminates.

CALIBRATION

The following paragraphs provide theory used to perform calibration on the Model 1805B and its associated thermistor mount.

DC SUBSTITUTION

A calibration system, such as the TEGAM System IIA, utilizes the principle of dc substitution. This method involves substituting a precise amount of dc power for some amount of RF power where the two powers are proportional. Thus, the calibration factor, K, is determined by the formula:

$$K = \frac{P_{dc}}{P_{RF}}$$

- K = the calibration factor of the mount,
- P_{dc} = the substituted dc power that is precisely derived and measured, and
- P_{RF} = RF power into a matched load.

CALIBRATION FACTORS

For a terminating mount, K is denoted as the measure calibration factor (K_1), and P_{RF} is the RF power from a match-terminated source incident upon the mount. If the mount is connected to the side arm of a coupler or a port of a power splitter (for a feedthrough mount), K is denoted as the monitor calibration factor (K_2), and P_{RF} is the RF power emerging from the mount into a match-terminated load. P_{RF} is measured by the terminating mount as:

$$P_{RF} = \frac{P_{dc}}{K_1}$$

where:

- P_{RF} = the RF power emanating from the feedthrough mount,
- $P_{dc 1}$ = the dc substituted power as measured at the Model 1806 or other instrumentation as configured,
- $P_{dc 2}$ = the dc substituted power as set at the Model 1805B,
- K_2 = the calibration factor for the feedthrough mount, and
- K_1 = the calibration factor for the terminating mount.

The system determines the calibration factor of the tested mount in terms of the known calibration factor of the previously calibrated thermistor mount and the precision measurement of the substituted dc power.

SOURCES OF CALIBRATION ERROR

The thermistor mount/power splitter combination is calibrated for K_2 . Since the mount calibration factor is traceable to NIST, and the precise level of dc substituted power is known, mismatch error accounts for the largest portion of measurement uncertainty. The equation:

$$K = \frac{P_{dc}}{P_0}$$

where:

- K = the calibration factor for the device under test,
- P_{dc} = the dc substituted power as measured at the 1806 or other instrumentation as configured, and
- P_0 = the RF power available for calibration.

is defined when the equivalent source impedance is an exact 50 ohms. For an imperfect source, the measured incident power is defined by the formula:

$$P_{inc} = \frac{P_0}{|1 - \Gamma_g \Gamma_L|^2}$$

where:

- P_{inc} = actual effective power incident upon the device under test,
- P_0 = measured power available to the device under test,
- Γ_g = the reflection coefficient of the source, and
- Γ_L = the reflection coefficient of the load.

CALIBRATION FACTOR IN dB

When transferring calibration to an active device it is also an alternative practice to define the device calibration factor in dB rather than in %. In this case the basic equation becomes:

$$K_{1dB} = 10 \log \left(\frac{P_m}{P_{RF}} \right)$$

where:

- K_{1dB} = the calibration factor of device under test in dB,
- P_m = the power level as registered by the device or system under test, and
- P_{RF} = RF power into a matched load.

Note that with active devices such as spectrum analyzers, no absolute accuracy device or system is used e.g. dc substitution, thermistors etc., so that uncalibrated power measurement values can be quite arbitrary. The calibration factor can thus be up to several dB and have either sign. A negative sign indicates a system that is reading a level lower than actual. A positive sign indicates a system that is reading a level higher than actual. The true level is given by:

$$P_A = P_m - K_1 \text{dB}$$

Where P_A is the actual power, and P_m is the power level as registered by the device or system under test, and both are in dBm.

SECTION IV, TESTING

GENERAL ,

This section provides general maintenance practices for daily operation of the Model 1805B RF Control Unit. Also included are calibration and adjustment procedures for the internal thermistor mounts and other assemblies located in the Model 1805B. The section 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 1805B RF Control Unit.

INSPECTION

Perform a visual inspection (Table 4-1) 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 1805B RF Control Unit 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 1805B RF Control Unit.

Connectors

Care should be taken to prevent strain on the interconnecting cables, since damage here may not always be apparent. Occasionally check the external cables and connectors for signs of cracked insulation and/or bent or worn pins. Tests show that connectors must be clean for accuracy and stability. This requires an inspection and cleaning of each connector immediately before use. When cleaning precautions are observed regularly, connectors can maintain their stability for over several thousand connection cycles. Refer to Appendix A for more information about cables and connectors.

Calibration Data Record

Keeping a record of all the instrument and mount calibration data can provide a reference for periodic calibration, troubleshooting of the Model 1805B, after repair testing, and to obtain maximum factory assistance.

SPECIAL CLEANING INSTRUCTIONS

The cleaning procedures for Model 1805B Control Unit are divided into five general groups: microwave coaxial cable assemblies, circuit card and modules, machined surfaces and hardware, chassis cleaning, and connector cleaning. Table 1-3 provides a list of consumables recommended to perform these procedures.

Microwave Coaxial Cable Assemblies

Appendix A (located at the end of this manual) provides all the necessary procedures for care, cleaning, and handling of microwave coaxial cable assemblies.

Circuit Cards and Modules

A protective coating (Table 1-3) is applied to circuit cards for protection from moisture, arcing, short-circuiting, and abrasion. To remove light dirt from circuit cards and modules proceed as follows:



CAUTION

- 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 (Table 1-2).
 - a. Briskly brush isopropyl alcohol (Item 4 on Table 1-2) onto area to be cleaned with fiber-bristle brush (Item 1 on Table 1-2).
 - b. Carefully remove residue with clean lint-free cloth (Item 5 on Table 1-2).



WARNING

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 15 psi to avoid personal injury.

- c. When parts are thoroughly clean, dry parts using 5 psi of clean moisture free compressed air or preferably dry nitrogen (pressured spray will work well).

Machined Surfaces and Hardware

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/faceshields 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 instrument's surface.
- Do NOT use nylon bristle brush in solvent as the bristles may dissolve and cause damage to the circuit card or component.
 - 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 (Table 1-2) onto area to be cleaned with 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 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.

Table 4-1 Inspection

ITEM	INSPECTION
Capacitors	Cracked, blistered, or dented; broken or loose seals or leads; signs of leakage (polarized tantalum capacitors); loose or missing mountings.
Castings, Housings	Dents, cracks, scratches, or other damage; loose or missing handles, brackets, or mounting hardware; damaged mounts; corrosion or excessive dirt.
Connectors	Bent, broken or corroded pins; Cracked or broken inserts; cracked or broken shell; loose or missing mounting nuts, washers, or screws; improper saddle clamp installation.
Diodes	Signs of overheating; cracked or broken case; seals or leads.
Hardware	Stripped threads, missing washers, corrosion, or other signs of damage.
Integrated Circuits	Signs of overheating; cracked or broken case; broken seals or leads.
Internal Wiring	Frayed, broken, or abraded insulation; improperly dressed or tied cables; broken, corroded, or poorly soldered conductors at the terminals; missing or damaged sleeving at connector terminals.
Painted Surfaces	Scratches, chips, or peeling.
Performed Packing	Nicks, burrs, or foreign materials present.
Printed Circuit Boards	Broken or loose wires; damaged circuit traces (clad); damaged components or chassis; loose, missing, or damaged wires, cables, or hardware; poorly soldered connections; bent or broken connector pins.
Relays	Damaged castings; loose or missing terminals or connectors.
Resistors	Cracked, broken, blistered, or charred body; broken or corroded leads; loose or missing mountings.
Switches	Signs of overheating; loose or broken terminals; lack of positive action.
Terminal Boards	Cracked, broken, blistered, or charred body; broken, loose, or corroded leads.

Chassis Cleaning

Clean chassis using a lint-free cloth (Table 1-3) moistened with water and mild detergent. For harder to clean areas, such as inside corners of chassis, use a vacuum cleaner.

Connector Cleaning

Where small amounts of rust, corrosion, and/or oxide deposits are present on connectors, clean externally with a soft-bristle brush (Table 1-3), aluminum wool, or internally with an acid brush; then wash with a non-corrosive solvent. MIL-C-83102 is recommended. Exercise care to ensure no metal filing or residue remains inside the connector and the connector is thoroughly dry. Where rust, corrosion, and/or oxide deposits are present in large quantities, replace the connector.

PERFORMANCE TESTING

The following paragraphs provides all the necessary information to verify that the TEGAM Model 1805B is operating within its specifications as listed in Table 1-1. These tests can be used as part of an incoming quality control inspection, as a periodic operational check, or after maintenance or service has been performed.

INITIAL TEST SETUP

The following procedures establish the initial test setup for the Model 1805B. Listed below is the necessary equipment to perform the setup.

MODEL

HP3458A
 TEGAM SR1 - 100 ohm
 TEGAM 1109

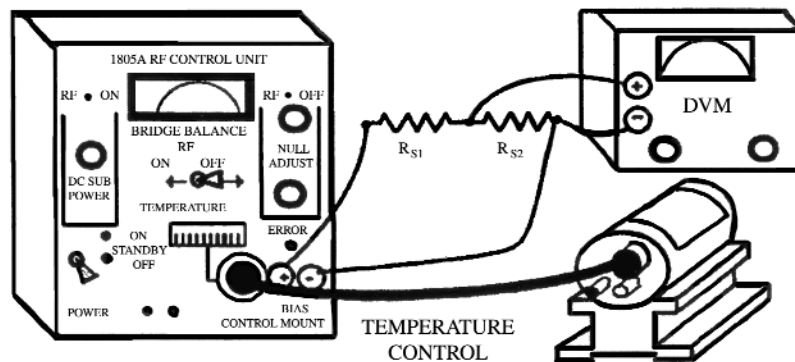
NOMENCLATURE

Digital Voltmeter, 8 1/2 digits
 100 ohm Resistance Standards (2)
 Feedthrough Thermistor Mount

- a. Connect the two 100 ohm resistance standards in series and designate them R_{S1} and R_{S2} . Use the following method to obtain the dividing factor (DF):
 - (1) Measure total series resistance of R_{S1} and R_{S2} with a multimeter and make note of measured value.
 - (2) Measure resistance of R_{S2} with an ohmmeter and make note of measured value.
 - (3) Calculate the dividing factor as follows:

$$DF = \frac{R_{S1} + R_{S2}}{R_{S2}}$$

- b. Connect the two resistance standards to the 1805B BIAS MOUNT terminals (E1 and E2) and DVM terminals as shown below. If desired, link the Model 1109 Temperature CONTROL connector (J1) to the 1805B Temperature CONTROL connector (J1) via a temperature control cable (P/N 138-477).



- c. Set 1805B RF ON/OFF switch (S2), located in the center of the front panel, to the OFF position.
- d. Turn 1805B POWER switch (S1), located on the bottom right side of the front panel, to the STANDBY and ON positions ensuring that the proper LED's (DS5 or DS4) illuminate. Allow one hour for the feedthrough thermistor mount (TEGAM Model 1109) to stabilize.

DC SUBSTITUTION ACCURACY TEST

The following procedures will determine the accuracy of dc substituted power levels. Using the initial test setup, proceed with the following steps:

- a. Obtain a reading of $1.22474 \text{ V} \pm 10 \text{ mV}$ (E_j) on the DVM by adjusting the 1805B FINE NULL ADJUST (R1) and COARSE NULL ADJUST (R2) knobs on the right front panel.
- b. Set the 1805B RF ON/OFF switch (S2), located on the center of the front panel, to the ON position.
- c. Turn the 1805B DC SUBSTITUTED POWER switch (S3), located on the left front panel, to each position (.5 and 1-10 mW) and record the voltage on the DVM (E_F)
- d. For each dc substituted power setting, calculate the substituted power levels (P_s) using the following formula:

$$P_S \text{ (mW)} = (E_j^2 - E_F^2) \frac{DF}{R_{S2}} \times 10^3$$

- e. Determine that the calculated substituted power level (P_s) is within $\pm 0.1\%$ of the selected DC SUBSTITUTED POWER SWITCH (S3) position. If the calculation is out-of-tolerance refer to calibration and adjustment procedures.

BIAS POWER RANGE TEST

The following procedures will determine that the 1805B bias power range is within specification listed in Table 1-1. Using the initial test setup, proceed with the following steps:

- a. Set the 1805B RF ON/OFF switch to the OFF position. Set the 1805B FINE NULL ADJUST (R1) and COARSE NULL ADJUST (R2) knobs fully clockwise and record the DVM reading (E_1).
- b. Set the FINE NULL ADJUST (R1) and COARSE NULL ADJUST (R2) knobs fully
- c. Calculate the bias range using the following formula:

$$P_{\text{BIASMIN}} = \frac{(E_2)^2}{200\Omega} \text{ and } P_{\text{BIASMAX}} = \frac{(E_1)^2}{200\Omega}$$

- d. Ensure that the calculated bias power range meets specifications; i.e., the minimum bias power is less than 29 mW and the maximum bias power is greater than 31 mW. An out-of-range condition should light the front panel ERROR indicator DS3 and indicates a need for calibration.

TEMPERATURE CONTROL CIRCUIT VERIFICATION

To verify the performance of the 1805B temperature control circuit, monitor the TEMPERATURE Control Meter (M2) located on the lower center of the front panel. When a cold thermistor mount is first connected to the 1805B and the 1805B is in POWER STANDBY mode, the needle of the TEMPERATURE Control Meter should provide an approximate full-scale reading (9.2 to 10.2). Once the mount has been heated by the 1805B's temperature controller for a period of one hour, the needle should not vibrate and should remain well within the green shaded area of the TEMPERATURE Control Meter. If the TEMPERATURE Control Meter fails to perform as indicated, the temperature control circuit requires adjustment. Perform the TEMPERATURE Control Meter alignment procedure described below.

CLOSED LOOP STABILITY TEST

The following provides a step-by-step procedure to check the Model 1805B's ability to control the power level and closed loop stability of a precision source subsystem, which is composed of a signal generator, a Model 1805B, and a Model 1807A RF Transfer Standard or Feedthrough Thermistor Mount. An amplifier will also be used in this procedure to obtain system lock at higher 1805B dc substitution power settings. This test may be easily automated by use of an optional IEEE-488 bus controller and SureCAL Windows™ software. Listed below is the necessary equipment to perform the setup.

MODEL	NOMENCLATURE
Any	PC Controller with National Instruments IEEE-488 (GPIB) interface
Any	Windows Compatible Printer
TEGAM SYSIIA-SureCal	SureCAL Windows™ Software
TEGAM 1109/ 1807A/1116/1117A/1119	Feedthrough Thermistor Mount
Any	Windows Compatible Printer
Any	PC Controller with National Instruments IEEE-488 (GPIB) interface
Any	Windows Compatible Printer
Any	Windows Compatible Printer
Any	Windows Compatible Printer

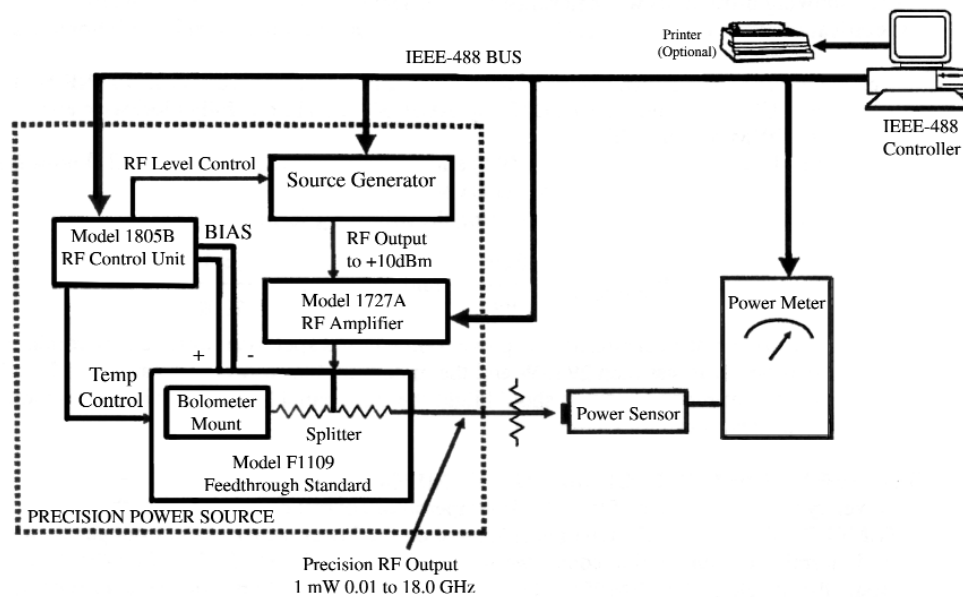


Figure 4-1 Closed Loop Stability Setup

- a. Setup equipment as shown in Figure 4-1. Listed below are the point-to-point connections:
 - Connect the RF output of the frequency generator to the input of the Model 1727A amplifier.
 - Connect the output of the amplifier to the RF IN connector of the Feedthrough Standard (1109 or 1807A)
 - Connect the 1805's red and black MOUNT BIAS connectors (E1 and E2) to the feedthrough thermistor mount's Mount Bias inputs (on the 1109-J2 and J3; on the 1807A - MOUNT BIAS connectors J3 and J4).
 - Connect the 1805's Temperature CONTROL output J1 to the Feedthrough Thermistor Mount's Temperature Control input (on the 1109, link to Temperature Control connector J1; on the 1807A, link to the MOUNT Heaters connector J9).

- Connect a 10-dB attenuator (such as the Weinschel Model 44-10) to the RF output of the thermistor mount (on the 1109, link the attenuator to its test port; on the 1807A, link the attenuator to its front panel TEST PORT J5).
 - Connect the opposite end of the 10-dB attenuator to the input of a power sensor head (such* as the Hewlett-Packard 8481 A).
 - Connect the output of the power sensor head to a power meter.
 - If desired, bus the frequency source, amplifier, power meter, and the 1805B to an IEEE-488 bus controller and control the procedure remotely. If desired, connect a printer to the bus controller and control the procedure remotely. If desired, connect a printer to the bus controller to obtain a hard copy of the dc substituted power and frequency levels at which variances in the stability test occurs.
- b. Place all Test Equipment Power switches to ON. Allow for a 3-24 hour warm-up period for the Feedthrough Power Standard and Power Meter to Stabilize.
 - c. Zero and calibrate the power meter and sensor.
 - d. Set the Signal generator to a desired frequency. For example, if using a F 1109, select a frequency between 0.01 and 18 GHz.
 - e. Reset the dc substituted power level of the Model 1805B according to the value of P and Table 4-2.
 - f. Wait for stabilization and then take 10 random power readings in a one-minute time period and record results.

Table 4-2 dc Substituted Power Settings

P	1805B SETTING
0	0.5 mW
1	1 mW
2	2 mW
3	3 mW
4	4 mW
5	5 mW
6	6 mW
7	7 mW
8	8 mW
9	9 mW
10	10 mW

- g. Verify that all power readings are within $\pm 3 \mu\text{W}$. If YES, repeat step f for all power levels listed in Table 4-2. If NO, refer to the RF Amplifier Board calibration procedure. If the test fails subsequent to calibration, troubleshoot the board for component failures.

CONTACTING TEGAM

Do NOT return any instrument or component to the factory without prior authorization. When an instrument or component has to be returned to the factory. Section I provides the necessary information to contact and return the instrument or component to TEGAM.

Warranty

TEGAM, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, we will at our option, either repair or replace any product that proves to be defective.

TEGAM, Inc. warrants the calibration of this product for a period of one year from date of shipment. During this period we will recalibrate any product that does not conform to be published accuracy specification.

To exercise the warranty, contact TEGAM, Inc. Ten Tegam Way, Geneva, Ohio 44041, phone 440-466-6100, fax 440-466-6110, M-F, 8 a.m. - 5 p.m. ET. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty, or at least 90 days, whichever is longer.

Limitation of Warranty

TEGAM, Inc. warranty does not apply to defects resulting from unauthorized modification or misuse of any product or part. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. TEGAM, Inc. shall not be liable for any indirect, special or consequential damages.

Statement of Calibration

This instrument has been inspected and tested in accordance with specifications published by TEGAM, Inc.

The accuracy and calibration of this instrument are traceable to the National Institute of Standards and Technology through equipment that is calibrated at planned intervals by comparison to certified standards maintained in the Laboratories of TEGAM, Inc.

How to Contact TEGAM

TEGAM, Inc.
Ten Tegam Wy
Geneva, OH 44041

Phone: 440-466-6100
Fax: 440-466-6110
email: sales@tegam.com

APPENDIX A

CARE AND HANDLING OF MICROWAVE COAXIAL CABLE ASSEMBLIES

CARE AND HANDLING OF ASSEMBLIES

To ensure accurate measurements and optimal performance of TEGAM products, the microwave coaxial cable assemblies used in system and test setups must be properly used and maintained. Proper connections, routine inspection of all cables, and cleaning of the connectors are extremely important procedures which can prolong the longevity and accuracy of equipment.

CABLE INSPECTION

Routinely check external cables for signs of cracked insulation, dents, twists, flattening, signs of jacket abrasion, or other signs of abuse. Wrinkles in the jacket indicate that the minimum bend radius has been exceeded. Most often, this occurs near the marker tubes and connectors. Also inspect the connector interfaces for the following:

- Bent pins (male)
- Bent or missing tines (female)
- Worn or chipped plating
- Damaged or displaced dielectric inserts
- Thread damage
- Folded or mushroomed outer interface rims
- Mushroomed pin shoulders (male) or tine ends (female)
- Score lines on pins and outer interface rims visible to the unaided eye
- Recessed or protruding pins

It is advisable to clean the connectors prior to inspection to make subtle damage more apparent. If any of the above is noted, replace the assembly before its further use results in equipment damage. Also inspect the mating connectors for similar damage.

Table A -1 provides both TEGAM specifications and MIL-C39012C data for the pin height of the various types of connectors. Pin height is defined as the vectorial distance along a horizontal axis of the pin shoulder from the electrical/mechanical reference plane.

Table A-1 Pin Height Specifications

CONNECTOR TYPE	MALE	FEMALE	SEXLESS	MIL-C-39012C
7mm	NA	NA	0.000 + .000 - .002 ²	See Fig. A-1
N type	0.208 min.	0.207 MAX	NA	See Fig. A-2
SMA	0.000 + .000 - .010	0.000 + .000 - .030	NA	See Fig. A-3
WPM	0.000 + .000 - .010	0.000 + .000 - .010	NA	See Fig. A-3
WPM-3	0.000 + .000 - .005	0.000 + .000 - .005	NA	See Fig. A-3
WPM-4	0.000 + .000 - .005	0.000 + .000 - .005	NA	See Fig. A-3
BNC	+ .210 + .230	+ .186 + .206	NA	See Fig. A-4
TNC	+ .210 + .230	+ .186 + .206	NA	See Fig. A-5

Inspect the connector interface for signs of debris. Debris may be in the form of:

- Plating chips or other metal particles
- Dust or dirt
- Oily films
- Other miscellaneous foreign particles

If signs of debris are present, clean the connector interface as directed below in Cleaning Connector Interfaces.

MAKING INITIAL CONNECTIONS

Exercise caution when mating cables. Poor connections lead to poor system performance. They can also damage not only the cable assembly, but more significantly, front or rear panel connectors on the equipment itself which may be more difficult to repair.

Aligning Connectors

Align the center lines of two connectors before actual mating. Male retaining nuts contain a small amount of necessary play which may make it possible to mate the threads without the pins being properly aligned. Pin misalignment can damage pins and dielectric inserts.

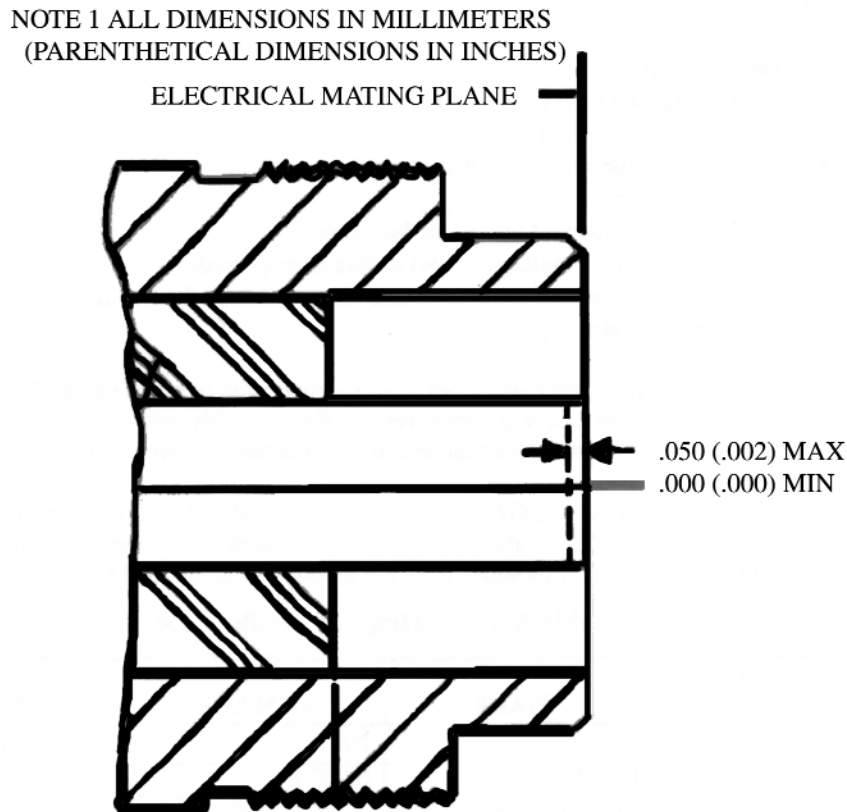


Figure A-1 Important Interface Dimensions for Type 7 MM, Precision Connectors (IEEE Std 287)

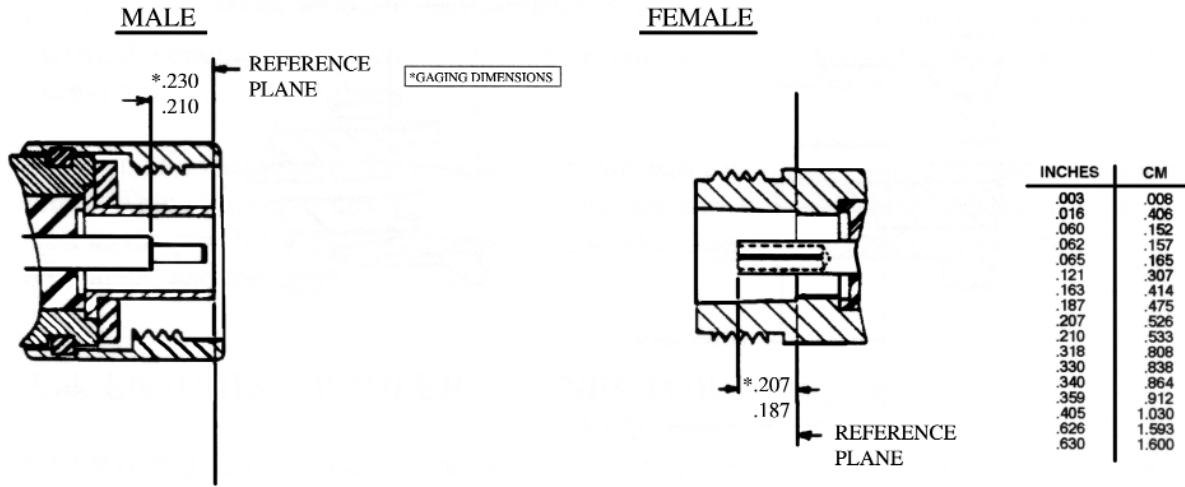


Figure A-2 Important Interface Dimensions for Type 7 MM, Precision Connectors (IEEE Std 287)

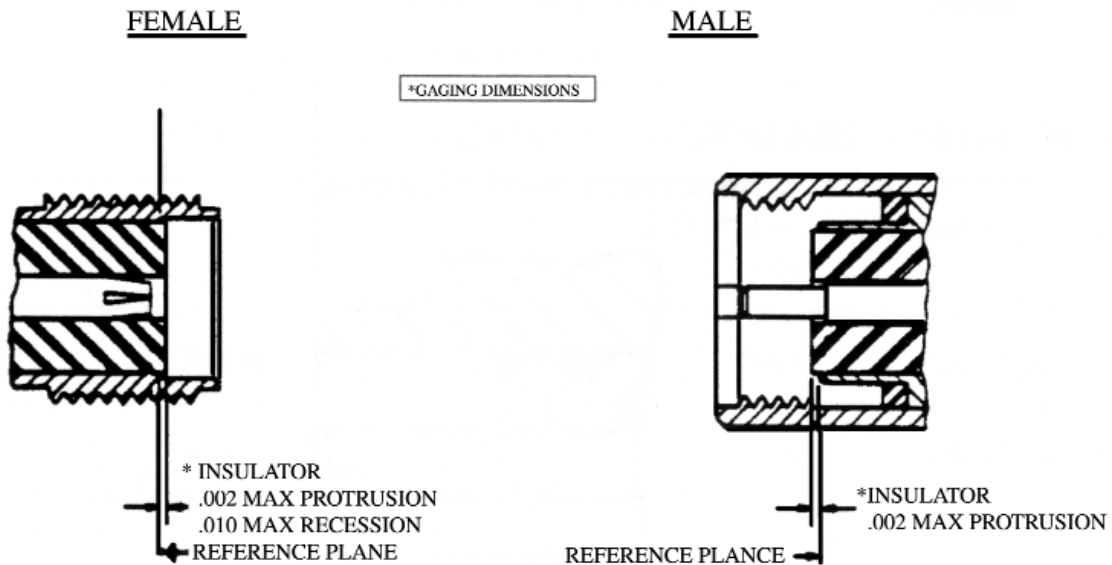


FIGURE A-3. IMPORTANT INTERFACE DIMENSIONS FOR TYPE BNC, CLASS II CONNECTORS (MIL-C-39012/16 & 17)

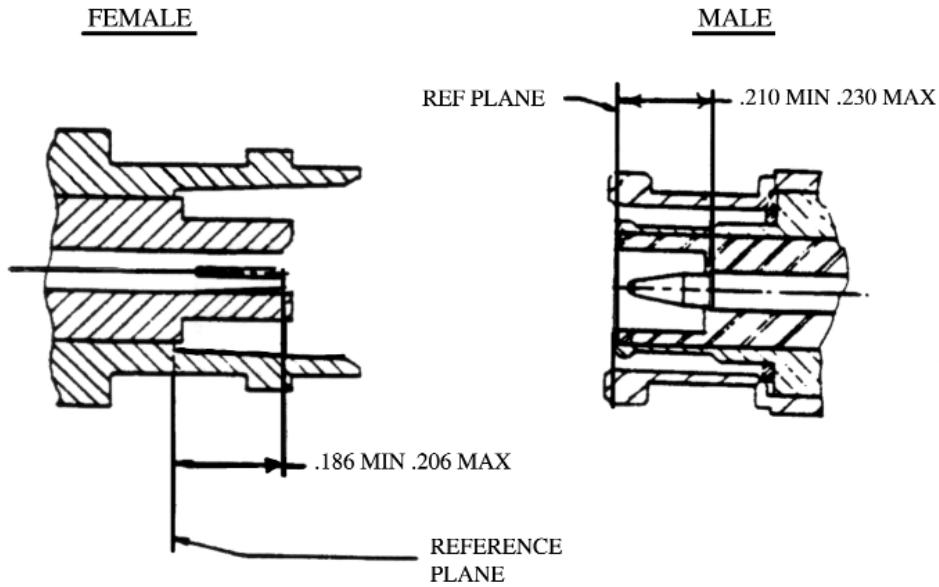


Figure A-4 Important Interface Dimensions for Type BNC, Class II Connectors (MIL-C-39012/16&17)

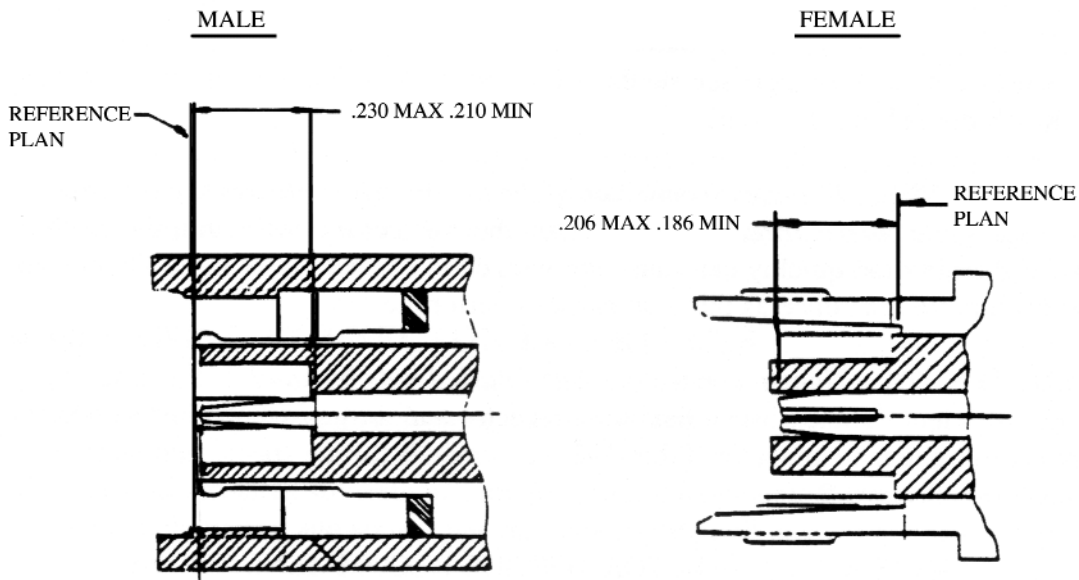


Figure A-5 Important Interface Dimensions for Type TNC, Class II Connectors (MIL-C-39012/26&27)

MATING CONNECTORS

Gently mate the connectors by hand, taking care not to force the coupling nut at the slightest resistance. It is often possible to feel whether or not the pins are mated. If the coupling nut is

difficult to turn, either the pins are not mated, the coupling nut is cross-threaded, or one of the connectors has been damaged by excess torque.

Never hold a male connector coupling nut stationary while screwing a female connector into it. This rotation can erode the plating and damage both the outer interface rim as well as the pin. If the pins become locked, serious damage can result to both the equipment and the cable assembly.

ENSURING PROPER CONNECTOR TORQUE

OVERTORQUING

Once connectors have been properly mated, apply only the proper amount of torque. Overtorquing damages both connectors involved. Also, a connector which has been damaged by overtorquing, in turn, damages every connector to which it is subsequently mates. It usually leads to poor system performance as well. Overtorque can cause:

- Bent pins
- Recessed or protruding pins
- Recessed or protruding dielectrics
- Chipped plating
- Damaged coupling threads
- Coupling nut retaining ring damage
- Mushroomed outer interface shells
- Mushroomed pin shoulders

HEX-NUT TYPES

To mate a connector of the hex-nut type, always use a torque wrench set to the correct torque value. Tighten the connector slowly until the wrench snaps. Tightening too quickly can cause the wrench to exceed its set limit. Do not snap the wrench more than once as this also causes overtorque.

KNURLED NUTS

Tighten connectors with knurled nuts by hand. If this does not provide sufficient tightness use a hex-nut connector and torque wrench instead. Never use pliers to tighten a connector. Table A-2 recommends torque specifications for the various types of connectors.

Table A-2 Connector Torque Recommendations

CONNECTOR TYPE	RECOMMENDED TORQUE
7 mm connector with hex nuts	14.0 in/lbs \pm 1 in/lbs
Type N connector with hex nut	14.0 in/lbs \pm 1 in/lbs
SMA connector	7.5 in/lbs \pm 0.5 in/lbs
WPM	7.5 in/lbs \pm 0.5 in/lbs
WPM-3	7.5 in/lbs \pm 0.5 in/lbs
WPM-4	7.5 in/lbs \pm 0.5 in/lbs
Type N connector (knurled)	hand-tight
TNC connector (knurled)	hand-tight
BNC	hand-tight

PROPER CABLE HANDLING

Never exceed the minimum bend radius specified for a cable. Guard against tight bends at the end of connector strain relief tubing, or at the ends of marker tubing where they may be less noticeable. Although cable bend may seem slight, the actual radius of the bend at the point of angular departure may be far smaller than the acceptable radius.

Never pinch, crush or drop objects on cable assemblies. Also, do not drag a cable over sharp edges as this will pinch it and cause it to exceed the minimum bend radius.
Never use a cable assembly to pull a piece of equipment. Cables and connectors are not designed to support or move equipment.

SECURING CABLES

Use toothed, rubber-lined "P-clamps" to hold cables in place. If it is necessary to use tie-wraps, use the widest possible wrap and the lowest setting on the gun to ensure the minimum pressure on the cable.

STORING CABLES

When storing cables, minimize cable "set" by coiling them in large diameters (lor 2 feet). Unroll the cable properly when it is ready to be used; do not pull the loops out hastily. Similarly, re-roll them when storing them away again.

CLEANING CONNECTOR INTERFACES

Use the following guidelines in cleaning connector interfaces:

- A. Do not use chlorinated solvents including common tap water. These solvents are extremely penetrating and sometimes ruin otherwise good devices and assemblies.
- B. Moisten a cotton swab with isopropyl alcohol. Roll the swab on a paper towel to remove excess.
- C. Use the moistened cotton swab to wipe away debris. Do not try to dissolve the debris by overwetting the swab.
- D. Repeat the cleaning process using additional swabs as necessary. If metallic particles are embedded in the dielectric, use an eyeglass and a sharp pick in an attempt to dislodge them. Swab again.
- E. When satisfied that the interfaces are clean, blow them dry with dry compressed air, or preferably dry nitrogen (pressurized spray cans work well). Do not use breath.
- F. Clean the mating connectors. These may be the source of debris.