Giga-tronics

Technical Publication Change Instructions

Updated replacement pages and/or drawings are attached to these Change Instructions. Please remove and discard the corresponding pages and/or drawings, and replace them with the attached pages and/or drawings. Failure to make these replacements may result in loss of product efficiency and possible failure.

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For record purposes, you are encouraged to retain these Change Instructions as a permanent part of the manual.

Product:	Model 58542 VXIbus Universal Power Meter
Manual Part Number:	21555
Manual Revision:	D
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Update your product technical manual, please replace the page(s) indicated below:

PCN	Current Page No.	Replacement Page No.	Remarks
N/A	v thru vi	va thru vi	Correction to page of Table of Contents because of update. Previous Technical Publication Change Instructions (TPCI) 58542-D1 which altered the Table of Contents is not affected because Chapter 5 and Appendix B are completely replaced in this TPCI.
7420	Entirety of Chapter 5	New Format Chapter 5	Remove old Chapter 5, including TPCI 58542-D1, if updated, and replace with new Chapter 5.
7420	Entirety of Appendix B	New Format Appendix B	Remove old Appendix B, including TPCI 58542-D1, if updated, and replace with new Appendix B.

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Maintenance

5.1 Introduction

This chapter defines maintenance practices and calibration and troubleshooting checks that assist in fault isolation. Problems can occur that might be produced by peripheral equipment or components. Preliminary checks should be made to ensure that peripheral equipment or components are not causing what appears to be a malfunction within the power meter.

The maintenance and calibration procedures in this chapter should be performed at least once each year unless the power meter is operated in an extremely dirty or chemically contaminated environment, or is subject to severe abuse (such as being dropped). In such cases, more frequent maintenance (immediate, if the unit is dropped or severely abused in some way) is required. The front panel and housing of the unit can be cleaned using a cloth dampened in a mild detergent. Do not use abrasive cleaners, scouring powders, or any harsh chemicals. Wipe the soap residue off with a clean, damp cloth, then dry with a clean dry cloth.

Make a performance verification check in accordance with the procedures given in Chapter 4, Performance Verification Tests, of this manual. If the unit will pass all of the performance tests, there is no need for calibration.

5.2 Power Supply Voltage Checks

There are six power supplies. They are all located on the A1 Analog PC board. In case there is a regulated voltage failure, check the corresponding unregulated supply with reference to schematic diagram #21360 on page 7-5. The unregulated voltage must be at least 2 volts more than the required regulated output. To measure the supplies, turn the unit on and let it stabilize for a minute or so. Then proceed as follows:

1. Connect the DVM from A1TP3 (ground) to A1TP2 (+) on the Analog assembly. Measure +14.25 V to +15.75 V.
2. Connect the high side of the DVM to A1TP4. Measure -14.25 V to -15.75 V.
3. Connect the high side of the DVM to A1TP5. Measure +4.75 V to +5.25 V.
4. Connect the high side of the DVM to A1TP9. Measure +11.4 V to +12.6 V.
5. Connect the high side of the DVM to A1TP10. Measure -11.4 V to -12.6 V.
6. Connect the high side of the DVM to A1U14, pin 1. Measure -9.1 V to -10.9 V.

5.3 Lithium Battery

The power meter contains a 3.6 V lithium battery to maintain the test setups and calibration data when the unit is turned off. This battery should last in excess of five years. To check the battery, connect a voltmeter between A2TP1 and the frame of the instrument.

Battery replacement is recommended every three years or sooner if the battery voltage drops below 3.1 V. The lithium battery should be removed if the instrument is to be placed in long-term storage of two years or more.

The battery can be replaced without losing the data stored in RAM if the old battery is removed and the new battery installed in less than 10 seconds with main power off, or if power is left on while changing the batteries.

CAUTION

Since this procedure requires removing the cover from the instrument and restoring power before removing the battery, it should be performed only by qualified personnel.

Lithium batteries can supply substantial current and, depending on factors such as the state of charge, can overheat when shorted.

The following replacement procedure is intended for users knowledgeable in the use and care of equipment using non-rechargeable lithium batteries.

Recommended Replacement Battery: Tadiran Type TL-5242, Giga-tronics Part Number 21212.

Replacement Procedure:D

1. Turn OFF the 58542.
2. Remove the cover.
3. Note the orientation of the battery, which is located on the side of the analog input cover. The battery is held in place with a hook and loop fastener. Peel the battery free of the PC board.
4. Turn the 58542 on to maintain memory power while replacing the battery. You can leave the 58542 turned off while changing the battery, but you install the new battery within ten seconds to avoid losing RAM data.
5. Disconnect the battery wires. The connector is polarized so it can be inserted only one way, with the red wire toward the rear of the instrument.
6. Install the new battery and connect the wires.
7. Turn the 58542 off and measure the battery voltage between TP13 (common) and TP17 (bat). It must be at least 3.6 V.
8. Connect a voltmeter between A2TP1 & TP2. The voltage must settle to <3 mV. If above this level, the battery life will be shortened. The only load on the battery is the static RAM. It might be necessary to find out which chip is drawing too much current, and replace it if the current is excessive.
9. Replace the cover and secure.
10. If desired, attach a label indicating when the next battery replacement is due.
11. Test for satisfactory operation of the new battery. Turn on the 58542 and calibrate a sensor. Turn the 58542 off, wait ten seconds, and turn on the 58542. The sensor calibration should still be valid as indicated by proper measurement of a power level.

5.4 GPIB Test Functions

If the unit will not calibrate its sensors, there are some test functions available through the GPIB. Using these functions, it is possible to check out the operation of the different parts of the calibrator system.

1. If the calibrator output power as measured in Chapter 4 is within tolerance but the unit will still not complete a sensor calibration, perform the following test to determine if the calibrator is operating correctly:

    a. Send DIAG:CAL:SOUR 10 from the controller, followed by DIAG:CAL:ATTEN 0.

    b. The calibrator output should be +20 dBm ± 0.8 dB.

    c. Send DIAG:CAL:ATTEN 10.
    This will insert the 10 dB attenuator into the calibrator output. The power should measure a decrease of 10 dB ± 1 dB.

    d. Repeat Step b, substituting 20, 30 and 40 successively in the command. The power should be attenuated by the attenuation level specified in the command ± 1 dB. This will verify the condition of all attenuators.

2. This step verifies the oscillator power control circuits. This is done by setting the power to higher and lower levels and measuring the results.

    a. Send the command DIAG:CAL:ATTEN 0, followed by DIAG:CAL:SOUR X where X is -3 to +13. The resulting power output should range between -13 dB from the first reading taken in Step 1.a to at least +21 dBm.

    b. This checks the calibrator control circuits completely. If the unit still will not calibrate a sensor, the problem is in the measurement circuits, not the calibrator. Proceed to Section 5.4.1.

5.4.1 58542 Channel 2 Troubleshooting

If only one channel will calibrate, troubleshoot the circuits associated with the channel that fails. The separate channels are shown on Sheet 1 (Ch 2) and Sheet 2 (Ch 1) of Schematic #21360. If the unit will calibrate Channel 1 but not Channel 2, proceed as follows:

1. If the unit fails to turn on the TRIGGER LED when the sensor is connected, the problem is in the temperature sensing thermistor circuit which connects to U39-3.

    Measure the voltage at U5-12. It should be about 2 or 3 volts. If it is above 5 or below 0.3 volts, the thermistor circuit is faulty.

2. Reverse the two sensors to determine if one of them is bad.

5.4.2 Diagnostic Test Commands

Table 5-1 lists the VXI Diagnostic commands for testing and adjusting the Model 58542 VXI Power Meter. A typical example is shown after the command syntax. Some commands are described in the maintenance/calibration section.

It is necessary to disable channels 1 and 2 from taking measurements before using these diagnostic commands. This is accomplished with the following commands:

CALC1:STAT OFF
CALC2:STAT OFF

Table 5-1: Diagnostic Commands

Command Syntax Typical Example	**Function**
DIAGnostic:ADC? OUTPUT @Pwr_Mtr;DIAG:ADC?	Query analog to digital converter reading (return: 0 to 32767)
DIAGnostic:AVADC?*space***16** OUTPUT @Pwr_Mtr;DIAG:AVADC? 16	Query analog to digital reading with 16 average (average from 1 to 512) (return: 0 to 32767)
DIAGnostic:AVOLT?*space***16** OUTPUT @Pwr_Mtr;DIAG:AVOLT? 16	Query analog to digital reading in volts with 16 average (average from 1 to 512) (return: 0 to 10)
DIAGnostic:BNC:ANAlog*space*5.5 OUTPUT @Pwr_Mtr;DIAG:BNC:ANA 5.5	Set analog BNC port output to 5.5 V (-10 to 10)
DIAGnostic:BNC:TRIGger? OUTPUT @Pwr_Mtr;DIAG:BNC:TRIG?	Query EXT trigger input high, 5 V or low, 0.00 V, status (1: triggered, 0: no trigger)
DIAGnostic:BNC:VPROpf? OUTPUT @Pwr_Mtr;DIAG:BNC:VPRO?	Query V_{PROP}F port reading (0 to 32767)
DIAGnostic:CALibrator:ATTenuator*space***10** OUTPUT @Pwr_Mtr;DIAG:CAL:ATT 10	Set calibrator attenuator to 10 dB (0 to 40)
DIAGnostic:CALibrator:ATTenuator? OUTPUT @Pwr_Mtr;DIAG:CAL:ATT?	Query calibrator attenuator value
DIAGnostic:CALibrator:EEPROM*space***100** OUTPUT @Pwr_Mtr;DIAG:CAL:EEPROM 1800123,30,9,23,6,92,0,123456	Set calibrator EEPROM data: cal fac, s/n, min, hr, day, month, yr, password flag (0:disable, 1:enable), password
DIAGnostic:CALibrator:EEPROM? OUTPUT @Pwr_Mtr;DIAG:CAL:EEPROM?	Query calibrator eeprom data
DIAGnostic:CALibrator:POWer*space***-23.5** OUTPUT @Pwr_Mtr;DIAG:CAL:POW-23.5	Set calibrator power to -23.5 dBm
DIAGnostic:CALibrator:PTEMperature? OUTPUT @Pwr_Mtr;DIAG:CAL:PTEM?	Query calibrator temperature (in Celsius)
DIAGnostic:CALibrator:SOURce*space***9.5** OUTPUT @Pwr_Mtr;DIAG:CAL:SOUR 9.5	Set calibrator internal power to 9.5 dBm (power output in dBm assuming perfect 10 dB pad)
DIAGnostic:CALibrator:VAMB? OUTPUT @Pwr_Mtr;DIAG:CAL:VAMB?	Query calibrator bridge volts (0 to 10)
DIAGnostic:CTABle?*space***<Sensor 1 or 2>** OUTPUT @Pwr_Mtr;DIAG:CTAB? 1	Query sensor 1 calibration data
DIAGnostic:GAIN*space***A-B,0-1,-2-3-4-5-6,N-I-G-O** **OUTPUT @Pwr_Mtr;DIAG:GAIN**	Set gain circuit; Channel, Gain, Mode, A,B Channel, Gain 0 to 6; N: non_invert, I: Invert, G:ground, O:Option

Table 5-1: Diagnostic Commands (Continued)

Command Syntax Typical Example	**Function**
DIAGnostic:LED*space***ON-OFF** OUTPUT @Pwr_Mtr;DIAG:LED ON	Turn trigger led on
DIAGnostic:MULtiplexer*space***MA-MB-MC .... MO-MP** OUTPUT @Pwr_Mtr;DIAG:MUL MA	Set multiplexer
DIAGnostic:MEASurement*space***STARt-STOP** OUTPUT @Pwr_Mtr;DIAGMEAS STAR	Resume measurement process
DIAGnostic:OFFSet*space***3.5** OUTPUT @Pwr_Mtr;DIAG:OFFS 3.5	Set ADC offset to 3.5 V (-5 to +5)
DIAGnostic:RAM? OUTPUT @Pwr_Mtr;DIAG:RAM?	Query ram destructive test result (0 = pass; 1 = fail)
DIAGnostic:ROM? OUTPUT @Pwr_Mtr;DIAG:ROM?	Query rom test result (0 = pass; 1 = fail)
DIAGnostic:RAWdata*space***<ON or OFF>** OUTPUT @Pwr_Mtr;DIAG:RAW ON	Enable measurement raw data output
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:READ OUTPUT @Pwr_Mtr;DIAG:SENS1:READ	Read eeprom table data from sensor 1 into editor memory
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:WRITe 123456 OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:WRIT 123456	Write eeprom sensor 1 editor data into sensor (using password)
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:TYPE 80301,0,59,9,22,12,92,0 OUTPUT @Pwr_Mtr;DIAG:SENS2:TYPE 80301,0,59,9,22,12,92,0	Edit sensor 2 eeprom type table data: model, s/n, cal location, min, hour, day, month, year, password flag (0:disable, 1:enable)
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:SPEC 1e7,18e9,4100,3900 OUTPUT @Pwr_Mtr;DIAG:SENS2:SPEC 1e7,18e9,4100,3900	Lower frequency, upper frequency video R+, R-
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:TYPE? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:TYPE?	Query sensor 1 eeprom type table data
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CORRection OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CORR 1.1,2.1,3.1,4.1,5.1,6.1,7	Edit sensor 1 eeprom correction table: A,B,C,D,E,H
DIAGnostic:SENS<sensor 1 or 2>:EEPROM CORRection? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CORR?	Query sensor 1 eeprom correction table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange 2e9,1e9,17,1 OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CALFR 2e9,1e9,17,1	Edit sensor 1 eeprom cal factor range table:standard:start:cf freq, step cf freq, cf number, special cf number
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CALFR?	Query sensor 1 eeprom cal factor range table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSTandard? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:FREQST?	Query sensor 1 eeprom cal factor standard freq table
DIAGnostic:SENS<sensor 1 or 2>:FREQSPecial? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:FREQSP?	Query sensor 1 eeprom cal factor special freq table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSPecial *space double quote***one or more frequencies 1e7 to 40e9***double quote* OUTPUT @Pwr_Mtr;DIAG:SENS1 :EEPROM:FREQSP “”1e9,2.2e9""	Add special cal factors at 1 GHz and 2.2 GHz
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSTandard? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CALFST?	Query sensor eeprom cal factor standard table

Table 5-1: Diagnostic Commands (Continued)

Command Syntax Typical Example	**Function**
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSTandard "0.20,0.30,0.40,0.50,0.60,0.70,0.80,0.90,0,0.10,0.11,0.12,0.13,0.14, 0.15,0.16,0.17,0.18" OUTPUT @Pwr_Mtr;DIAG:SENS1:CALFST "0.20,0.30,0.40,0.50,0.60,0.70,0.80,0.90,0,0.10,0.11,0.12,0.13,0.14,0.15. 0.16,0.17,0.18"	Edit sensor 1 eeprom cal factor standard table: 2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18. Standard Cal Factor frequencies Match Start,Step and #
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSPecial *space double quote* **one or more calfactor values-99.9***double quote* OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CALFSP “”0.03,-0.04""	Added sensor 1 cal factors, # of items matches # of Frequencies
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSPecial? OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CALFSP?	Query sensor 1 special frequency cal factor
DIAGnostic:SENVolt*space***<ON or OFF>** OUTPUT @Pwr_Mtr;DIAG:SENV ON	Turn on sensor 5 volt line
DIAGnostic:VOLT? OUTPUT @Pwr_Mtr;DIAG:VOLT?	Query ADC reading in volts
DIAGnostic:ZTABle?*space***<sensor 1 or 2>** OUTPUT @Pwr_Mtr;DIAG:ZTAB? 1	Query sensor 1 zeroing data

B

Power Sensors

B.1 Introduction

This appendix contains the selection, specifications and calibration data for power sensors used with Giga-tronics power meters. This appendix is divided into the following sections:

- Power Sensor Selection
- Modulation Sensor Specifications
- Peak Power Sensor Selection
- Remote Calibration Factors

B.2 Power Sensor Selection

The Standard 80300A Series Sensors measure CW signals from -70 to +20 dBm; and the 80400 Series Sensors measure modulated or CW signals from -67 to +20 dBm; the 58542 Universal Power Meters also use Peak Power Sensors for measuring radar and digital modulation signals.

Giga-tronics True RMS sensors are recommended for applications such as measuring quadrature modulated signals, multi-tone receiver intermodulation distortion power, noise power, or the compression power of an amplifier. These sensors include a pad to attenuate the signal to the RMS region of the diode's response. This corresponds to the -70 dBm to -20 dBm linear operating region of Standard CW Sensors. The pad improves the input VSWR to ≤1.15 at 18 GHz.

High Power (1, 5, 25 and 50 Watt) and Low VSWR sensors are also available for use with the power meter.

Table B-1 lists the Giga-tronics power sensors used with the power meters. Refer to applicable notes on page B-4. See Figures B-1 for modulation-induced measurement uncertainty.

If the 80350A Series sensors will be used with a Model 8542 (dual channel) Power Meter, the 8542 must be configured to code 06 or higher or an asterisk (*) must be appended to the code number. The code number is printed next to the serial number on a label affixed to the rear panel of the instrument.

B.2.1 Modulation Power Sensors

Table B-1: Power Sensor Selection Guide

Model	Freq. Range/ Power Range	Max. Power	Power Linearity[4] (Freq >8 GHz)	RF Conn	Length	Dia.	Wgt	VSWR
Modulation Sensors(-70 to +20 dBm)								
80401A	10 MHz to 18 GHz -67 to +20 dBm	+23 dBm (200 mW)	-67 to -20 dBm ±0.00 dB -20 to +20 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.29:12.4 - 18 GHz
80402A				APC-7 50Ω				
80410A	10 MHz to 18 GHz -64 to +26 dBm, CW	+29 dBm (800 mW)	-61 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.05 dB/10 dB	Type K(m)[1] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.13:0.01 - 2 GHz 1.16:2 - 12 GHz 1.23:12 - 18 GHz
80420A	10 MHz to 18 GHz -60 to +30 dBm	+30 dBm (1 W)	-57 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.05 dB/10 dB					1.11:0.01 - 2 GHz 1.12:2 - 12 GHz 1.18:12 - 18 GHz
80421A	10 MHz to 18 GHz -50 to +37 dBm	+37 dBm (5 W)	-47 to +0 dBm ±0.00 dB 0 to +37 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.20:0.01 - 6 GHz 1.25:6 - 12.4 GHz 1.35:12.4 - 18 GHz
80422A	10 MHz to 18 GHz -40 to +44 dBm	+44 dBm (25 W)	-37 to +10 dBm ±0.00 dB +10 to +44 dBm ±0.05 dB/10 dB		230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.20:0.01 - 6 GHz 1.30:6 - 12.4 GHz 1.40:12.4 - 18 GHz
80425A	10 MHz to 18 GHz -40 to +47 dBm	+47 dBm (50 W)	-34 to +10 dBm ±0.00 dB +10 to +47 dBm ±0.05 dB/10 dB					1.25:0.01 - 6 GHz 1.35:6 - 12.4 GHz 1.45:12.4 - 18 GHz
Standard CW Sensors								
80301A	10 MHz to 18 GHz -70 to +20 dBm	+23 dBm (200 mW)	-70 to -20 dBm ±0.00 dB -20 to +20 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.29:12.4 - 18 GHz
80302A				APC-7 50Ω				
80303A	10 MHz to 26.5 GHz -70 to +20 dBm		-70 to +20 dBm ±0.00 dB -20 to +20 dBm ±0.1 dB/10dB	Type K(m)[1] 50Ω				1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.38:12.4 - 18 GHz 1.43:18 - 26.5 GHz 1.92:26.5 - 40 GHz
80304A	10 MHz to 40 GHz -70 to 0 dBm		-70 to -20 dBm ±0.00 dB -20 to 0 dBm ±0.2 dB/10 dB					
Low VSWR CW Sensors								
80310A	10 MHz to 18 GHz -64 to +26 dBm	+29 dBm (800 mW)	-64 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.05 dB/10 dB	Type K(m)[1] 50Ω	127mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5lb)	1.13:0.01 - 2 GHz 1.15:2 - 12 GHz 1.23:12 - 18 GHz 1.29:18 - 26.5 GHz 1.50:26.5 - 40 GHz
80313A	10 MHz to 26.5 GHz -64 to +26 dBm		-64 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.1 dB/10 dB					
80314A	10 MHz to 40 GHz -64 to +6 dBm		-64 to -14 dBm ±0.00 dB -14 to + 6 dBm ±0.2 dB/10 dB					

Table B-1: Power Sensor Selection Guide (Continued)

Model	Freq. Range/ Power Range	Max. Power	Power Linearity[4] (Freq >8 GHz)	RF Conn	Length	Dia.	Wgt	VSWR
1W CW Sensors								
80320A	10 MHz to 18 GHz -60 to +30 dBm	+30 dBm (1 W)	-60 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.05 dB/10 dB	Type K(m)[1] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.11:0.01 - 2 GHz 1.12:2 - 12 GHz 1.18:12 - 18 GHz 1.22:18 - 26.5 GHz 1.36:26.5 - 40 GHz
80323A	10 MHz to 26.5 GHz -60 to +30 dBm		-60 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.1 dB/10 dB					
80324A	10 MHz to 40 GHz -60 to +10 dBm		-60 to -10 dBm ±0.00 dB -10 to +10 dBm ±0.2 dB/10 dB					
5W CW Sensor[2]								
80321A	10 MHz to 18 GHz -50 to +37 dBm	+37 dBm (5 W)	-50 to +0 dBm ±0.00 dB 0 to +37 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.20:0.01 - 2 GHz 1.25:6 - 12.4 GHz 1.35:12.4 - 18 GHz
25W CW Sensor[3]								
80322A	10 MHz to 18 GHz -40 to +44 dBm	+44 dBm (25 W)	-40 to +10 dBm ±0.00 dB +10 to +44 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.20:0.01 - 2 GHz 1.30:6 - 12.4 GHz 1.40:12.4 - 18 GHz
50W CW Sensor[3]								
80325A	10 MHz to 18 GHz -40 to +47 dBm	+47 dBm (50 W)	-40 to +10 dBm ±0.00 dB +10 to +47 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	230mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.25:0.01 - 2 GHz 1.35:6 - 12.4 GHz 1.45:12.4 - 18 GHz
True RMS Sensors (-30 to +20 dBm)								
80330A 80333A 80334A	10 MHz to 18 GHz 10 MHZ to 26.5 GHz 10 MHz to 40 GHz	+33 dBm (2 W)	-30 to +20 dBm ±0.00 dB	Type K(m)[1] 50Ω	152.5 mm (6.0 in)	32 mm 1.25 in)	0.27 kg (0.6 lb)	1.12:0.01 - 12 GHz 1.15:12 - 18 GHz 1.18:18 - 26.5 GHz 1.29:26.5 - 40 GHz
80340 Series Peak Power Sensors (-30 to +20 dBm)								
80340A	50 MHz to 18 GHz	+23 dBm (200 mW)	-30 to -20 dBm ±0.13 dB 0 to +20 dBm	Type N(m)[1] 50Ω	146 mm (5.75 in)	37 mm (1.44 in)	0.3 kg (0.6lb)	1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.37:12.4 - 18 GHz
80343A 80344A	50 MHz to 26.5 GHz 50 MHz to 40 GHz		±0.13 dB ±0.01 dB/dB	Type K(m)[1] 50Ω				1.50:18 - 26.5 GHz 1.92:26.5 - 40 GHz

Notes:

1. The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors.
2. Power coefficient equals <0.01 dB/Watt.
3. Power coefficient equals <0.015 dB/Watt.
4. For frequencies above 8 GHz, add power linearity to system linearity.
5. Peak operating range above CW maximum range is limited to <10% duty cycle.
6. Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NIST.
7. Square root of sum of the individual uncertainties squared (RSS).
8. Cal Factor numbers allow for 3% repeatability when connecting attenuator to sensor, and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination. Attentuator frequency response is added to the Sensor Cal Factors which are stored in he sensor's EEPROM.

Table B-2: Power Sensor Cal Factor Uncertainties

Freq. (GHz)		Sum of Uncertainties (%)[6]						Probable Uncertainties (%)[7]					
Lower	Upper	80301A 80302A 80340 80401A 80402A 80303A 80304A 80343 80344	80310A 80313A 80314A	80320A 80323A 80324A	80321A[8] 80322A[8] 80325A[8]	80330A 80333A 80334A	80301A 80302A 80340 80401A 80402A 80303A 80304A 80343 80344	80310A 80313A 80314A	80320A 80323A 80324A	80321A[8] 80322A[8] 80325A[8]	80330A 80333A 80334A	80321A[8] 80322A[8] 80325A[8]	80330A[8] 80333A[8] 80334A[8]
0.1	1	1.61	3.06	2.98	2.96	7.61	2.95	1.04	1.64	1.58	1.58	4.54	1.58
1	2	1.95	3.51	3.58	3.57	7.95	3.55	1.20	1.73	1.73	1.73	4.67	1.73
2	4	2.44	4.42	4.33	4.29	8.44	4.27	1.33	1.93	1.91	1.91	4.89	1.90
4	6	2.67	4.74	4.67	4.63	8.67	4.60	1.41	2.03	2.02	2.01	5.01	2.01
6	8	2.86	4.94	4.87	4.82	8.86	4.80	1.52	2.08	2.07	2.06	5.12	2.06
8	12.4	3.59	6.04	5.95	5.90	9.59	5.87	1.92	2.55	2.54	2.53	5.56	2.53
12.4	18	4.09	6.86	6.76	6.69	10.09	6.64	2.11	2.83	2.80	2.79	5.89	2.78
18	26.5	——	9.27	9.43	9.28	——	9.21	——	3.63	3.68	3.62	——	3.59
26.5	40	——	15.19	14.20	13.86	——	13.66	——	6.05	5.54	5.39	——	5.30

Notes:

1. The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors.
2. Power coefficient equals <0.01 dB/Watt.
3. Power coefficient equals <0.015 dB/Watt.
4. For frequencies above 8 GHz, add power linearity to system linearity.
5. Peak operating range above CW maximum range is limited to <10% duty cycle.
6. Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NIST.
7. Square root of sum of the individual uncertainties squared (RSS).
8. Cal Factor numbers allow for 3% repeatability when connecting attenuator to sensor, and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination. Attentuator frequency response is added to the Sensor Cal Factors which are stored in he sensor's EEPROM.

B.2.2 Modulation Sensor Specifications

Table B-3: Modulation Sensor Specifications

Sensor Measurement Capabilities		
Signal Type	**Test Conditions**	**Typical Error[1]**
CW	Power level -67 to +20 dBm	none
Single Carrier with AM	Power level -67 to +20 dBm, f_m < 40 kHz Power level -67 to -20 dBm, f_m > 40 kHz Power level -20 to +20 dBm, f_m > 40 kHz	none none see note[2]
Two-Tone	Power level -67 to +20 dBm, max carrier separation <40 kHz Power level -67 to -20 dBm, max carrier separation >40 kHz Power level -20 to +20 dBm, max carrier separation >40 kHz	none none see note[2]
Multi-Carrier	Power level -67 to +10 dBm, max carrier separation <40 kHz, ten carriers Power level -67 to -30 dBm, max carrier separation >40 kHz, ten carriers Power level -30 to +10 dBm, max carrier separation >40 kHz, ten carriers	none none see note[2]
Pulse Modulation	MAP or PAP mode, power level -67 to +20 dBm, pulse width >200 µs MAP or PAP mode, power level -67 to -20 dBm, pulse width <200 µs BAP mode, power level -40 to +20 dBm, pulse width >200 µs BAP mode, power level -40 to -20 dBm, pulse width <200 µs	none see note[2] none see note[2,3]
Burst with Modulation	MAP or PAP mode, power level -67 to +20 dBm, pulse width >200 µs, $f_{m <}$ 40 kHz MAP or PAP mode, power level -67 to +20 dBm, pulse width <200 µs, $f_{m >}$ 40 kHz MAP or PAP mode, power level -67 to -20 dBm, pulse width <200 µs BAP mode, power level -40 to +20 dBm, pulse width >200 µs, $f_{m <}$ 40 kHz BAP mode, power level -40 to +20 dBm, pulse width <200 µs, $f_{m >}$ 40 kHz BAP mode, power level -40 to -20 dBm, pulse width <200 µs	none see note[2] see note[2] none see note[2,3] see note[2,3]

Notes:

1. Error is in addition to sensor linearity and zero set accuracy.
2. See Figure B-1 for modulation-related uncertainty.
3. The BAP mode does not function at input levels below -40 dBm.
4. The power levels quoted in the table are for Model 80401A. For other modulation sensors, add the values listed below to all power levels shown Table B-3:

   For Model 80410A, add 6 dB.
   For Model 80420A, add 10 dB.
   For Model 80421A, add 20 dB.
   For Model 80422A, add 30 dB.
   For Model 80425A, add 33 dB.

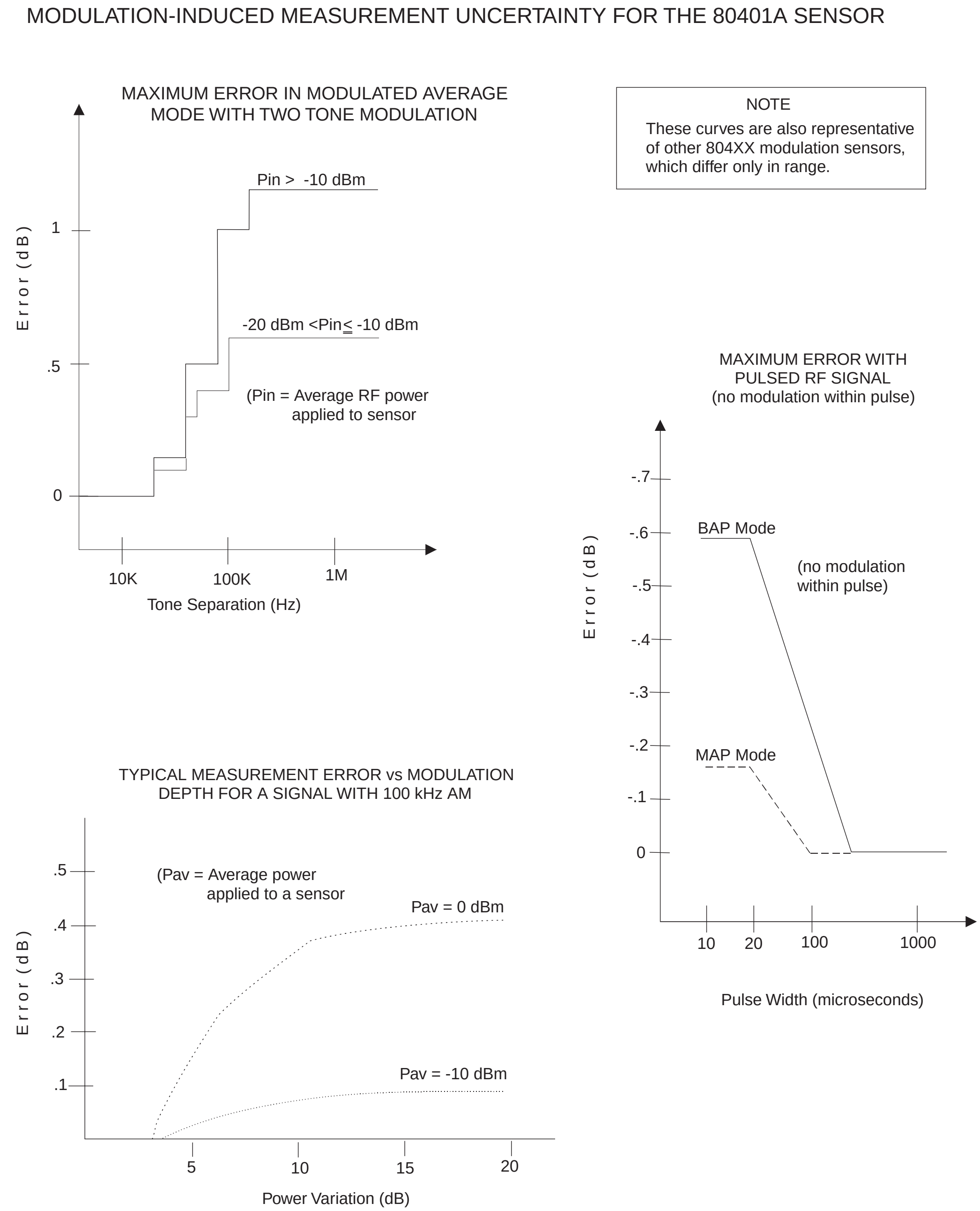


Figure B-1: 80401A Modulation-Related Uncertainty

BAP Mode Limitations

The minimum input level is -40 dBm (average); the minimum pulse repetition frequency is 20 Hz. If the input signal does not meet these minima, **BURST AVG** LED will flash to indicate that the input is not suitable for BAP measurement. The power meter will continue to read the input but the BAP measurement algorithms will not be able to synchronize to the modulation of the input; the input will be measured as if the power meter were in MAP mode. In addition, some measurement inaccuracy will result if the instantaneous power within the pulse falls below -43 dBm; however, this condition will not cause LED to flash.

B.2.3 Peak Power Sensors

Table B-4: 8035XA Peak Power Sensor Selection Guide

<table>
<tr><th colspan="9">Peak Power Sensors</th></tr>
<tr><th rowspan="2">Model</th><th rowspan="2">Freq. Range/
Power Range</th><th rowspan="2">Max.
Power</th><th rowspan="2">Power Linearity[4]</th><th rowspan="2">RF
Conn</th><th colspan="2">Dimensions</th><th rowspan="2">Wgt</th><th rowspan="2">VSWR</th></tr>
<tr><th>Length</th><th>Dia.</th></tr>
<tr><td colspan="9">Standard Peak Power Sensors</td></tr>
<tr><td>80350A</td><td>45 MHz to 18 GHz
-20 to +20 dBm, Peak
-30 to +20 dBm, CW</td><td rowspan="3">+23 dBm
(200 mW)
CW or Peak</td><td>-30 to -20 dBm ±0.00 dB
-20 to +20 dBm ±0.05 dB/
10 dB</td><td>Type N(m)
50Ω</td><td rowspan="3">165 mm
(6.5 in)</td><td rowspan="3">37 mm
1.25 in)</td><td rowspan="3">0.3 kg
(0.7
lb)</td><td>1.12:0.045 - 2 GHz
1.22:2 - 12.4 GHz
1.37:12.4 -18 GHz</td></tr>
<tr><td>80353A</td><td>45 MHz to 26.5 GHz
-20 to +20 dBm, Peak
-30 to +20 dBm, CW</td><td>-30 to -20 dBm ±0.00 dB
-20 to +20 dBm ±0.1 dB/
10 dB</td><td rowspan="2">Type K(m)[1]
50Ω</td><td>1.12:0.045 - 2 GHz
1.22:2 - 12.4 GHz
1.37:12.4 -18 GHz
1.50:18 - 26.5 GHz</td></tr>
<tr><td>80354A</td><td>45 MHz to 40 GHz
-20 to +0.0 dBm, Peak
-30 to +0.0 dBm, CW</td><td>-30 to -20 dBm ±0.00 dB
-20 to 0.0 dBm ±0.2 dB/
10dB</td><td>1.12:0.045 - 2 GHz
1.22:2 - 12.4 GHz
1.37:12.4 -18 GHz
1.50:18 - 26.5 GHz
1.92:26.5 - 40 GHz</td></tr>
<tr><td colspan="9">5W Peak Power Sensor [2,5]</td></tr>
<tr><td>80351A</td><td>45 MHz to 18 GHz
0.0 to +40 dBm, Peak
-10 to +37 dBm, CW</td><td>CW: +37 dBm
(5 W Avg.)
Peak: +43 dBm</td><td>-10 to +0 dBm ±0.00 dB
+0 to +40 dBm ±0.05 dB/
10 dB</td><td>Type N(m)
50Ω</td><td>200 mm
(7.9 in)</td><td>37 mm
(1.25 in)</td><td>0.3 kg
(0.7
lb)</td><td>1.15:0.045 - 4 GHz
1.25:4 - 12.4 GHz
1.35:12.4 -18 GHz</td></tr>
<tr><td colspan="9">25W Peak Power Sensor [3,5]</td></tr>
<tr><td>80352A</td><td>45 MHz to 18 GHz
+10 to +50 dBm, Peak
0.0 to +44 dBm, CW</td><td>CW: +44 dBm
(25 W Avg.)
Peak: +53 dBm</td><td>0.0 to +10 dBm ±0.00 dB
+10 to +50 dBm ±0.05 dB/
10 dB</td><td>Type N(m)
50Ω</td><td>280 mm
(11.0 in)</td><td>104 mm
(4.1 in)</td><td>0.3 kg
(0.7
lb)</td><td>1.20:0.045 - 6 GHz
1.30:6 - 12.4 GHz
1.40:12.4 -18 GHz</td></tr>
<tr><td colspan="9">50W Peak Power Sensor[3,5]</td></tr>
<tr><td>80355A</td><td>45 MHz to 18 GHz
+10 to +50 dBm, Peak
0.0 to +47 dBm, CW</td><td>CW: +47 dBm
(50 W Avg.)
Peak: +53 dBm</td><td>0.0 to +10 dBm ±0.00 dB
+10 to +50 dBm ±0.05 dB/
10 dB</td><td>Type N(m)
50Ω</td><td>280 mm
(11.0 in)</td><td>104 mm
(4.1 in)</td><td>0.3 kg
(0.7
lb)</td><td>1.25:0.045 - 6 GHz
1.35:6 - 12.4 GHz
1.45:12.4 -18 GHz</td></tr>
</table>

Notes:

1. The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors.
2. Power coefficient equals <0.01 dB/Watt (AVG).
3. Power coefficient equals <0.015 dB/Watt (AVG).
4. For frequencies above 8 GHz, add power linearity to system linearity.
5. Peak operating range above CW maximum range is limited to <10% duty cycle.

Table B-5: Peak Power Sensor Cal Factor Uncertainties

Freq. (GHz)		Sum of Uncertainties (%)[1]					Probable Uncertainties (%)[2]		
Lower	Upper	80350A	80353A 80354A	80351A[3]	80352A[3]	80355A[3]	80350A	80353A 80354A	80351A[3] 80352A[3] 80355A[3]
0.1	1	1.61	3.06	9.09	9.51	10.16	1.04	1.64	4.92
1	2	1.95	3.51	9.43	9.85	10.50	1.20	1.73	5.04
2	4	2.44	4.42	13.10	13.57	14.52	1.33	1.93	7.09
4	6	2.67	4.74	13.33	13.80	14.75	1.41	2.03	7.17
6	8	2.86	4.94	13.52	13.99	14.94	1.52	2.08	7.25
8	12.4	3.59	6.04	14.25	14.72	15.67	1.92	2.55	7.56
12.4	18	4.09	6.86	19.52	20.97	21.94	2.11	2.83	12.37
18	26.5	——	9.27	——	——	——	——	3.63	——
26.5	40	——	15.19	——	——	——	——	6.05	——

Notes:

1. Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NIST.
2. Square root of sum of the individual uncertainties squared (RSS).
3. Cal Factor numbers allow for 3% repeatability when connecting attenuator to sensor, and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination. Attenuator frequency response is added to the Sensor Cal Factors which are stored in the sensor's EEPROM.

For additional specifications, see the Series 80350A manual and data sheet.

B.2.4 Directional Bridges

The 80500 CW Directional Bridges are designed specifically for use with Giga-tronics power meters to measure the Return Loss/SWR of a test device. Each bridge includes an EEPROM which has been programmed with Identification Data for that bridge.

Table B-6: Directional Bridge Selection Guide

Bridge Selection Guide								
Model	**Freq. Range/ Power Range**	**Max. Power**	**Power Linearity[4]**	**Input**	**Test Port**	**Direct-tivity**	**Wgt**	**VSWR**
80501	10 MHz to 18 GHz -35 to +20 dBm	+27 dBm (0.5W)	-35 to +10 dBm ±0.1 dB +10 to +20 dBm ±0.1 dB ±0.005 dB/dB	Type N(f) 50 Ω	Type N(f) 50 Ω	38 dB	0.340 kg	<1.17:0.01 - 8 GHz <1.27:8 - 18 GHz
80502					APC-7(f) 50 W	40 dB		<1.13:0.01 - 8 GHz <1.22:8 - 18 GHz
80503	10 MHz to 26.5 GHz -35 to +20 dBm			SMA(f) 50 Ω	SMA(f) 50 W	35 dB		<1.22:0.01 - 8 GHz <1.22:8 - 18 GHz <1.27:18 - 26.5 GHz
80504	10 MHz to 40 GHz -35 to +20 dBm			Type K(f) 50 Ω	Type K(f) 50 W	30 dB	0.198 kg	<1.35:0.01 - 8 GHz <1.35:8 - 18 GHz <1.35:18 - 26.5 GHz <1.44:26.5 - 40 GHz

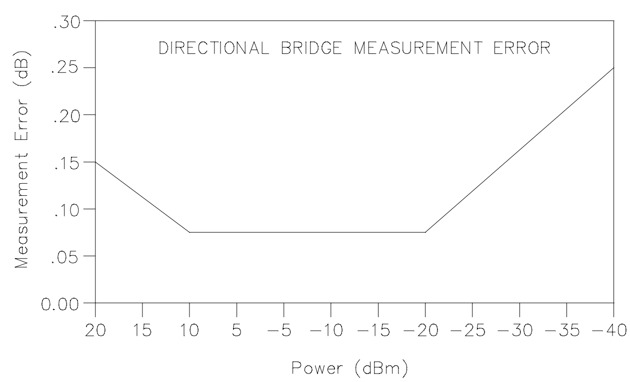
The Selection Guide in Table B-6 shows primary specifications. Additional specifications are:

Bridge Frequency Response: Return loss measurements using the 8541/2 power meter can be frequency compensated using the standard *Open/Short* supplied with the bridge.

Insertion Loss: 6.5 dB, nominal, from input port to test port

Maximum Input Power: +27 dBm (0.5 W)

Directional Bridge Linearity Plus Zero Set & Noise vs. Input Power (50 MHz, 25 °C ±5 °C):



Dimensions:
80501: 76 x 50 x 28 mm (3 x 2 x 1 1/8 in)
80502: 76 x 50 x 28 mm (3 x 2 x 1 1/8 in)
80503: 19 x 38 x 29 mm (3/4 x 1 1/2 x 2 1/8 in)
80504: 19 x 38 x 29 mm (3/4 x 1 1/2 x 2 1/8 in)

Weight:
80501: 340 g (12 oz)
80502: 340 g(12 oz)
80503: 198 g (7 oz)
80504: 198 g (7 oz)

Directional Bridge Accessories: An Open/Short is included for establishing the 0 dB return loss reference during path calibration.

B.3 Power Sensor Calibration

This procedure is for calibrating a power sensor by remote control with a Model 58542 Universal Power Meter over the IEEE 488 interface bus. This procedure writes the cal factors to the sensor EEPROM.

Power sensors have built-in EEPROM data that manage the cal factors by a set of frequencies entered during calibration of the sensor at the factory. You can program additional cal factors with special data for user-specific frequencies.

A cal factor expressed in dB is programmed for each factory-calibrated frequency. The calibration process compares the measurement to the frequency standard and applies the cal factor to offset frequency deviations.

Equipment Required

58542 Universal Power Meter
GPIB Controller
Power Sensor

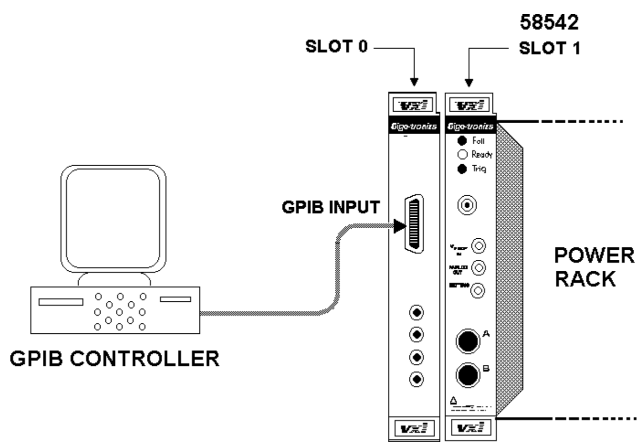


Figure B-2: Power Sensor Calibration Setup

Procedure

Connect the power sensor to Channel A or B on the Series 58542 front panel and perform the following steps. In this procedure, bold letters are commands; the query form of a command has a question mark (?) at the end of the command. This form returns the data in the EEPROM.

1. **DIAG:SENS1 (or 2):EEPROM:READ**

   Read sensor 1 (or 2) EEPROM data into the 58542 editor buffer.

   Example: OUTPUT@ Pwr_mtr; DIAG:SENSl:EEPROM:READ

2. **(Optional) DIAG:SENSl (or 2):EEPROM:CALFREQST?**

   a.) Query the sensor 1 (or 2) standard cal factor frequency table.

   b.) Read the standard cal from the input buffer and parse the return string for the start frequency and number of standard frequencies.

   c.) Calculate and set the frequencies of the cal factor table.

3. DIAG:SENSl (or 2):EEPROM:CALFST?

a.) Query sensor 1 (or 2) standard cat factor table.

b.) Read the standard cal from the input buffer and parse the return string for the standard cal factors.

c.) Modify the standard cal factor string to new cal factor table.

d.) Write new cat factor table into 58542 editor buffer.

4. DIAG:SENS1 (or 2):EEPROM:WRIT 0

Commit 58542 to write new cal factor table from editor buffer to sensor 1 (or 2) EEPROM. The sensor EEPROM routine will complete momentarily. Trigger LED will activate during sensor write routine. 0 (zero) at end of command string indicates no password is set for sensor write routine. If a password (numerical code) has been previously set, the 0 is replaced with password. The password is used to prevent unauthorized entry of cal factors. Password factory default is 0.

i.e. DIAG:SENSl:EEPROM:WRIT 4369 Send new cal factors to EEPROM

Short program example

```
ASSIGN @ Pwr_mtr to 70101 'set Pwr_mtr to primary address 1 and secondary address 1
CLEAR @ Pwr_mtr
OUTPUT @ Pwr_mtr; DIAG:SENS1:EEPROM:READ
OUTPUT @ Pwr_mtr; DIAG:SENS1 :CALFST "0.20,0.30,0.40,0.50,0.60,0.70,0.80,
0.90,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18"
OUTPUT @ Pwr_mtr; DIAG:SENS1:EEPROM:WRIT 0
```

☛ ***NOTE:*** *Because the DIAG:SENS1:CALFST requires quotation marks within the string, some programming languages (i.e. Visual BASIC) will report compile errors. In this case, the command string can be generated as a string variable using chr$(34) as a replacement for the quotation mark. See example below.*

Example: wrt$ = "DIAG:SENS1 :CALFST " + chr$(34) + "0.20,0.30,0.40,0.50,0.60,0.70,0.80, 0.90,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18" + chr$(34)

where wrt$ is the string variable.