

Manual Part Number: 21555
Revision Level: D
Configuration Code: 20
Print Date: June 1999

Giga-tronics

Operation & Maintenance Manual

**Model 58542 VXIbus
Universal Power Meter**

CE **Certified Product**
ISO 9001..... **Certified Process**
Registra: BSI, Certification No. FM 34226, Registered 04 June 1996

Giga-tronics Incorporated ♦ 4650 Norris Canyon Road ♦ San Ramon, California 94583
Telephone (925) 328-4650, or (800) 726-4442 ♦ Telefax (925) 328-4700
Customer Service: Telephone (800) 444-2878 ♦ Telefax (925) 328-4702
Web Site: www.gigatronics.com

All technical data and specifications in this manual are subject to change without prior notice and do not represent a commitment on the part of Giga-tronics Incorporated.

©Copyright Giga-tronics Incorporated 1999. All rights reserved.

Printed in U.S.A.

WARRANTY

Giga-tronics instruments are warranted against defective materials and workmanship for one year from date of shipment. Giga-tronics will at its option repair or replace products that are proven defective during the warranty period. This warranty DOES NOT cover damage resulting from improper use, nor workmanship other than Giga-tronics service. There is no implied warranty of fitness for a particular purpose, nor is Giga-tronics liable for any consequential damages. Specification and price change privileges are reserved by Giga-tronics.

Table of Contents

About This Manual	vii
Conventions	ix
Record of Manual Changes	xi
Special Configurations	xiii

1 • Introduction

1.1 Description	1-1
1.1.1 Items Furnished	1-2
1.1.2 Items Required	1-2
1.1.3 Tools and Test Equipment	1-2
1.1.4 Storage	1-2
1.1.5 Cooling	1-2
1.1.6 Receiving Inspection	1-2
1.1.7 Safety Precautions	1-2
1.1.8 Product Returns	1-2
1.2 Performance Specifications	1-4
1.2.1 Range	1-4
1.2.2 Accuracy	1-4
1.2.3 Zeroing Accuracy (Standard CW Sensors)	1-4
1.2.4 Meter Functions	1-5
1.2.5 Measurement Speed	1-5
1.2.6 Inputs/Outputs	1-6
1.2.7 Power Requirements	1-6
1.2.8 Environmental Specifications	1-6

2 • Operation

2.1 Preparation for Use	2-1
2.2 Installation	2-1
2.3 Initial Setup	2-2
2.3.1 Logical Address	2-2
2.3.2 Data Transfer Bus Arbitration	2-3
2.4 Sensor Precautions	2-4
2.5 Operation	2-5
2.5.1 SCPI Command Interface	2-5
2.5.2 Sensor and Channel Configuration	2-5
2.5.3 Measurement TRIGgering	2-6
2.5.4 MEMory Functions	2-6
2.5.5 IEEE-488.2 Commands	2-6
2.5.6 DIAGnostic Commands	2-6
2.5.7 CALCulate Subsystem Commands	2-7
2.5.8 SENSE Subsystem Commands	2-8
2.5.9 TRIGger Subsystem Commands	2-9
2.5.10 GPIB Command Syntax	2-10
2.5.11 Sensor Calibration and Zeroing	2-19
2.5.12 Reading Power Measurements	2-21
2.5.13 Instrument Triggering	2-23
2.5.14 Arming the TRIGgering Cycle	2-27
2.5.15 Channel Configuration	2-29
2.5.16 Cal Factor Correction	2-31
2.5.17 High Speed Measurements	2-35

2.5.18	Peak Power Sensor Triggering	2-40
2.5.19	Averaging	2-43
2.5.20	Relative or Referenced Measurements	2-45
2.5.21	Offsets	2-47
2.5.22	SRQ & Status Monitoring	2-48
2.5.23	Min/Max Configuration & Monitoring	2-52
2.5.24	Limit Line Configuration & Monitoring	2-54
2.5.25	Analog Output	2-56
2.5.26	Saving & Recalling Configurations	2-59
2.5.27	Halting Operation	2-59
2.5.28	Preset Configuration	2-60
2.5.29	Identification Commands	2-62
2.5.30	Calibrator Controls	2-63
2.5.31	Sensor EEPROM Commands	2-64
2.5.32	Self-Test	2-65
2.5.33	Error Messages	2-68

3 • Theory of Operation

3.1	Introduction	3-1
3.2	Circuit Description	3-1
3.3	Analog PC Board (A1)	3-2
3.4	Calibrator Module	3-4
3.4.1	50 MHz Oscillator	3-5
3.4.2	RF Output	3-5
3.4.3	Oven	3-5
3.4.4	Thermistor Bridge	3-5
3.4.5	Track & Hold and DAC	3-6
3.4.6	Correction Thermistor Circuit	3-6
3.4.7	Calibrator NVRAM Control Circuit	3-6
3.4.8	Sensor NVRAM	3-6
3.4.9	Sensor Interrupt	3-6
3.4.10	Digital Control Circuit	3-6
3.5	Digital PC Board (A2)	3-7
3.6	VXI Processor PC Board (A3)	3-8
3.6.1	VXI Interface	3-8
3.6.2	CPU and Memory	3-9

4 • Calibration & Testing

4.1	Introduction	4-1
4.2	Equipment Required	4-1
4.3	Calibration Procedures	4-2
4.3.1	Calibrator Output Power Reference Level	4-2
4.3.2	Calibrator Output Power	4-4
4.3.3	Calibrator Voltages	4-6
4.3.4	Calibrator Frequency Check	4-6
4.4	Performance Tests	4-7
4.4.1	GPIB Port Check	4-7
4.4.2	Power Sensor Linearity	4-8

5 • Maintenance

5.1	Introduction	5-1
5.2	Power Supply Voltage Checks	5-1
5.3	Lithium Battery	5-2
5.4	GPIB Test Functions	5-3
5.4.1	58542 Channel 2 Troubleshooting	5-3
5.4.2	Diagnostic Test Commands	5-4

6 • Parts Lists

6.1	Introduction.....	6-1
	58542 VXI POWER METER.....	6-1
	21383-A00 58542,VXI CHASSIS ASSY.....	6-1
	21359 PCB ASSY, ANALOG VXI (A1).....	6-2
	21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI.....	6-3
	21356 PCB ASSY DIGITAL (A2).....	6-10
	21356-A00 PCB ASSY PRE-WAVE DIGITAL VXI.....	6-11
	21418 PCB ASSY VXI PROCESSOR (A3).....	6-12
6.2	List of Manufacturers.....	6-13

7 • Diagrams

7.1	Introduction.....	7-1
	Model 58542 VXIbus Power Meter, Drawing # 21359.....	7-3
	Analog PC Assembly (A1), Drawing # 21359.....	7-4
	Analog Circuit Schematic (A1), Drawing # 21360.....	7-5
	Digital PC Assembly (A2), Dwg 21356.....	7-11
	Digital Circuit Schematic (A2), Dwg 21357.....	7-12

A • Program Examples

A.1	Introduction.....	A-1
A.2	Sensor Calibration Examples.....	A-1
	A.2.1 Sensor Calibration Example 1.....	A-1
	A.2.2 Sensor Calibration Example 2.....	A-2
	A.2.3 Sensor Calibration Example 3.....	A-4
	A.2.4 Sensor Calibration Example 4.....	A-6
	A.2.5 Sensor Calibration Example 5.....	A-6
A.3	Sensor Zeroing Examples.....	A-7
	A.3.1 Sensor Zeroing Example 1.....	A-7
	A.3.2 Sensor Zeroing Example 2.....	A-7
	A.3.3 Error Control Examples.....	A-8
A.4	Reading Power Measurement Examples.....	A-12
	A.4.1 Reading Power Measurements Example 1.....	A-12
	A.4.2 Reading Power Measurements Example 2.....	A-13
	A.4.3 Reading Power Measurements Example 3.....	A-14
	A.4.4 Reading Power Measurements Example 4.....	A-15
	A.4.5 Reading Power Measurements Example 5.....	A-16
	A.4.6 Reading Power Measurements Example 6.....	A-17
	A.4.7 Reading Power Measurements Example 7.....	A-18
	A.4.8 Reading Power Measurements Example 8.....	A-19
	A.4.9 Reading Power Measurements Example 9.....	A-20
A.5	Instrument Triggering Examples.....	A-22
	A.5.1 TRIGgering Example 1.....	A-22
	A.5.2 TRIGgering Example 2.....	A-23
	A.5.3 TRIGgering Example 3.....	A-24
	A.5.4 TRIGgering Example 4.....	A-24
	A.5.5 TRIGgering Example 5.....	A-25
	A.5.6 TRIGgering Example 6.....	A-27
A.6	Channel Configuration Examples.....	A-29
	A.6.1 Single Sensor Power Measurement.....	A-29
	A.6.2 Ratio Measurement.....	A-29
	A.6.3 Difference Measurement.....	A-29
A.7	Cal Factor Examples.....	A-30
	A.7.1 Cal Factor Example 1.....	A-30
	A.7.2 Cal Factor Example 2.....	A-31
	A.7.3 Cal Factor Example 3.....	A-32

A.7.4	Cal Factor Example 4	A-33
A.7.5	Cal Factor Example 5	A-34
A.8	High Speed Measurement Examples	A-37
A.8.1	High Speed Measurement Example 1	A-37
A.8.2	High Speed Measurement Example 2	A-38
A.8.3	High Speed Measurement Example 3	A-40
A.8.4	High Speed Measurement Example 4	A-41
A.8.5	High Speed Measurement Example 5	A-42
A.8.6	High Speed Measurement Example 6	A-44
A.9	Relative or Referenced Measurement Examples.....	A-46
A.9.1	Relative or Referenced Measurements Example 1	A-46
A.9.2	Relative or Referenced Measurements Example 2	A-47
A.10	SRQ Interrupt Examples.....	A-49
A.11	Instrument & Sensor Identification Examples.....	A-51
A.11.1	Instrument Identification	A-51
A.11.2	Sensor Model Identification	A-52
A.11.3	Sensor Serial Number Identification	A-54

B • Power Sensors

B.1	Introduction	B-1
B.2	Power Sensor Selection.....	B-1
B.2.1	Modulation Power Sensors	B-2
B.2.2	Modulation Sensor Specifications	B-5
B.2.3	Peak Power Sensors.....	B-7
B.2.4	Directional Bridges	B-9
B.3	Power Sensor Calibration	B-10

C • Options

C.1	Introduction	C-1
C.2	Option 02: 256K Buffer	C-1

Index

Index.....	Index-1
------------	---------

List of Figures

Figure 1-1	Instrument Linearity	1-5
Figure 2-1	Setting the Logical Address	2-2
Figure 2-2	Default Bus Arbitration Settings	2-3
Figure 2-3	SCPI Subsystem Model	2-5
Figure 2-4	CALCulate Subsystem Command Tree	2-7
Figure 2-5	SENSe Subsystem Command Tree	2-8
Figure 2-6	TRIGger Subsystem Command Tree	2-9
Figure 2-7	Measurement Data Output Format	2-10
Figure 2-8	TRIGger Subsystem Command Tree	2-23
Figure 2-9	VPROpf Configuration	2-32
Figure 2-10	SCPI Status Structure Registers	2-50
Figure 3-1	VXI Power Meter System Block Diagram	3-1
Figure 3-2	Analog PC Assembly Block Diagram	3-2
Figure 3-4	Digital PC Assembly (A2) Block Diagram	3-7
Figure 3-5	VXI Processor (A3) Block Diagram	3-8
Figure 4-1	Calibrator Reference Level Test Setup	4-2
Figure 4-2	GPIB Port Test Setup	4-7
Figure 4-3	Power Sensor Linearity Test Setup	4-8
Figure B-1	80401 modulation-related uncertainty	B-6
Figure B-2	Power Sensor Calibration Setup	B-10

List of Tables

Table 2-1	VXI GPIB Command Syntax	2-6
Table 2-2	VXI GPIB Command Syntax	2-11
Table 2-3	Approximate Measurement Speeds	2-38
Table 2-4	Reset and Power On Default Commands	2-60
Table 2-5	Self-Test Error Indications & Limitations	2-65
Table 2-6	Standard SCPI Error Messages	2-68
Table 2-7	Device Specific Error Messages	2-69
Table 3-1	VXI Power Meter Circuit Assemblies	3-1
Table 4-1	Calibration and Test Equipment List	4-1
Table 5-1	Diagnostic Commands	5-4
Table B-1	Power Sensor Selection Guide	B-2
Table B-2	Power Sensor Cal Factor Uncertainties	B-4
Table B-3	Modulation Sensor Specifications	B-5
Table B-4	8035XA Peak Power Sensor Selection Guide	B-7
Table B-5	Peak Power Sensor Cal Factor Uncertainties	B-8
Table B-6	Directional Bridge Selection Guide	B-9

About This Manual

This manual contains the following chapters to describe the operation and maintenance of the Model 58542 VXIbus Universal Power Meters.

Preface: In addition to a comprehensive Table of Contents and general information about the manual, the Preface also contains a record of changes made to the manual since its publication, and a description of Special Configurations. If you have ordered a user-specific manual, please refer to page xiii for a description of the special configuration.

Chapter 1: Introduction: This chapter is an introduction to the instrument and its performance parameters.

Chapter 2: Operation: This chapter is a guide to the instrument's front panel keys, display and configuration menus.

Chapter 3: Theory of Operation: This chapter provides a block diagram level description of the instrument and its circuits for maintenance and applications.

Chapter 4: Calibration and Testing: Procedures for inspection, calibration, and performance testing are outlined in this chapter.

Chapter 5: Maintenance: This chapter contains procedures for maintenance and troubleshooting.

Chapter 6: Parts Lists: This chapter lists all components and parts, and their sources.

Chapter 7: Diagrams: This chapter contains schematics and component diagrams for all circuits.

Appendix A: Program Examples: Examples of programs for controlling the Model 58542 remotely over the GPIB.

Appendix B: Power Sensors: Specifications and technical data for the selection and application of power sensors.

Appendix C: Options: This appendix describes options available for the Model 58542.

Manual changes that occur after publication of the manual, and special configuration data will be inserted as loose pages in the manual binder. Please insert and/or replace the indicated pages as detailed in the Technical Publication Change Instructions included with new and replacement pages.

Conventions

The following conventions are used in this product manual. Additional conventions not included here will be defined at the time of usage.

Warning

WARNING

The **WARNING** statement is enclosed in double lines and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in injury or death of personnel. An example is the proximity of high voltage.

Caution

CAUTION

The **CAUTION** statement is enclosed within a single heavy line and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in temporary or permanent damage to the equipment, or loss of effectiveness.

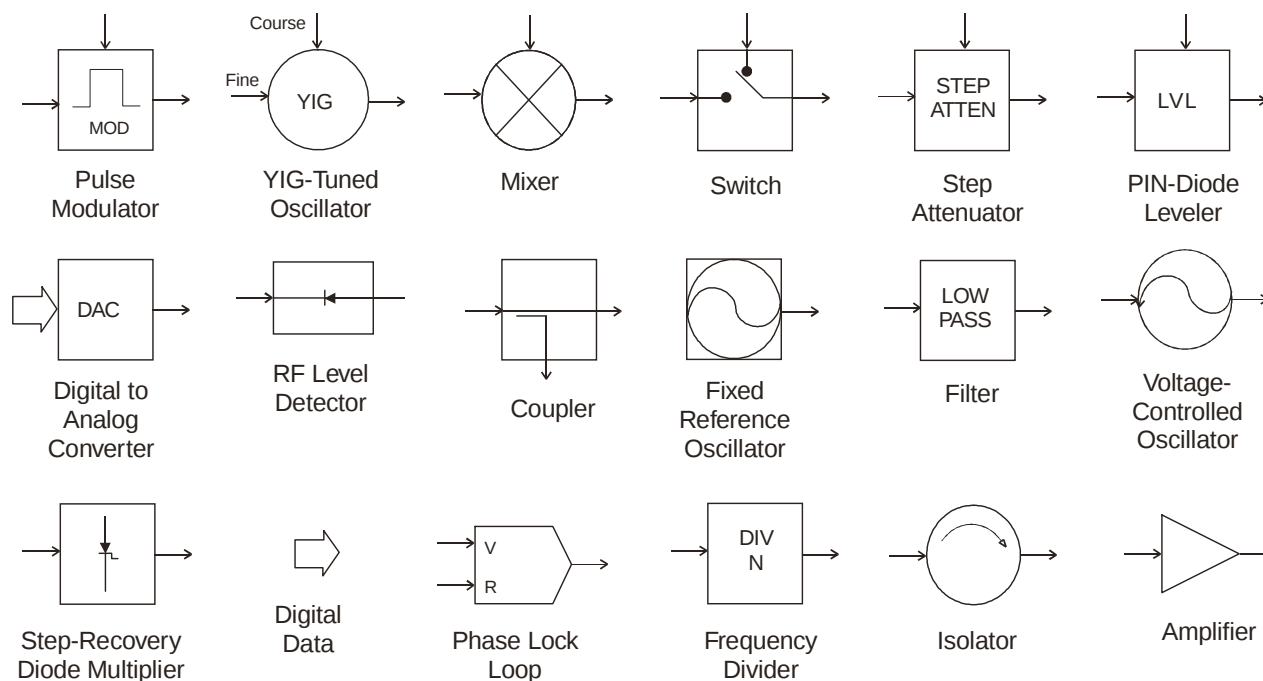
Notes



NOTE: A NOTE highlights or amplifies an essential operating or maintenance procedure, practice, condition or statement.

SYMBOLS

Block diagram symbols frequently used in the manual are illustrated below.



Special Configurations

When the accompanying product has been configured for user-specific application(s), supplemental pages will be inserted at the front of the manual binder.

When applicable, remove this page and replace it with the furnished Special Configuration supplemental page(s).

Introduction

1.1 Description

The Giga-tronics Model 58542 VXI Universal Power Meter offers high accuracy with an ultra-fast reading rate and dual power inputs. Depending on the sensor used, the frequency range is from 10 MHz to 40 GHz for CW signals, and 50 MHz to 40 GHz for pulsed signals. The unit is optimized for fast measurements over the VXI bus. Maximum measurement speed is achieved with an internal data buffer, which logs a user-specified number of measurements for subsequent transfer over the VXI bus.

The Model 58542 is optimized for the fast measurements required by ATE systems. The 58542 diode-based sensors have response times significantly faster than thermal sensors. The high measurement speeds are available over a wider dynamic range than with thermal sensors. The power meter uses the Standard Commands for Programmable Instruments (SCPI) language. It is a message-based instrument that responds to high level ASCII character SCPI commands. The commands are parsed and interpreted by the power meter. Their standardized (English) language format makes SCPI program development fast and easy.

The power sweep calibrator incorporates a built-in thermistor-based power meter bridge. The thermistor oven stability provides a standard 1 mW power reference at 50 MHz, traceable to the National Institute of Standards and Technology (NIST). The thermistors inherent linearity produces 51 precisely controlled power levels from -30 to +20 dBm for linearizing the diodes in the power sensors.

The excellent resulting linearity of $\pm 0.5\%$ (± 0.02 dB) complements the low VSWR of the sensors and tightly specified Cal Factor uncertainty. The Cal Factors are stored in EEPROMs in each sensor so that you need only to enter a frequency of operation to the power meter to obtain frequency corrected power readings.

The Model 58542 power meter is a standard C-size (single-width) VXI module. It weighs 2.5 kg (5.5 lbs). Power requirements are +5 Vdc @ 800 mA, +24 Vdc @ 250 mA, and -24 Vdc @ 250 mA.

The Model 58542 uses Giga-tronics Series 80300 Schottky diode-based sensors for fast measurements with a dynamic range of up to 90 dB, depending on the sensor. Excellent linearity of $\pm 0.5\%$ is assured through a built-in power sweep calibrator. Special purpose CW sensors are available, including low VSWR sensors, four high-power versions (1W, 5W, 25W, and 50W), and True rms sensors with 50 dB dynamic range. Peak power sensors are available for making true instantaneous power readings on pulsed signals such as radar and digital communications. The sensors sample pulsed RF signal amplitude directly, therefore a duty cycle correction is not required.

Refer to Appendix B in this manual for power sensor selection and specifications data. Appendix C contains technical data for options available for the 58542.

1.1.1 Items Furnished

In addition to options and/or accessories specifically ordered, items furnished with the instrument are as follows:

- Operation & Maintenance Manual
- Two sets of power sensor cables

1.1.2 Items Required

A VXI mainframe which meets the power and cooling requirements of the modules is required. Two sensor cables are furnished with the Model 58542 to fit the dual-channel female output connectors.

1.1.3 Tools and Test Equipment

Test equipment required for calibration and testing is described in Chapter 4 of this manual.

1.1.4 Storage

Giga-tronics VXIbus modules should be stored in an environment free from excessive dust and dirt and in the temperature range of -40 °C to +70 °C.

1.1.5 Cooling

No special cooling is required. If the module is to be operated outside of a properly ventilated VXI frame, auxiliary air circulation is required, such as a small fan directed at the module.

1.1.6 Receiving Inspection

Use care in removing the instrument from the carton and check immediately for physical damage, such as bent or broken connectors on the front and rear panels, dents or scratches on the panels, broken extractor handles, etc. Check the shipping carton for evidence of physical damage and immediately report any damage to the shipping carrier.

Each Giga-tronics instrument must pass rigorous inspections and tests prior to shipment. Upon receipt, the instrument's performance should be promptly checked to ensure that operation has not been impaired during shipment.

1.1.7 Safety Precautions

When installing modules into the mainframe, be sure that the connectors are properly aligned before pushing the modules into place. Apply gentle but firm pressure to insert the modules and make sure they are fully seated for proper operation.

1.1.8 Product Returns

Should it be necessary to return the product to Giga-tronics, use the following procedures to protect the instrument during shipment. If possible, use the original shipping container. If this is not possible, use a strong carton (350 lbs/in² bursting strength), or a wooden box. Wrap the instrument in heavy paper or plastic before placing it in the shipping container. Completely fill the areas on all sides of the instrument with packaging material, taking extra precautions to protect the front and rear panels. Seal the package with strong tape or metal bands. Mark the outside of the package "FRAGILE — DELICATE INSTRUMENT".

If corresponding with the factory or the local Giga-tronics sales office regarding product return, please refer to the full model number and serial number. If the instrument is being shipped for repair, be sure to enclose all available pertinent data regarding the problem that has been found.



NOTE: If you are returning an instrument to Giga-tronics for service, first contact Customer Service at **(800) 444-2878** or Fax at **(925) 328-4702** so that a return authorization number can be assigned. You can also contact Customer Service over their e-mail address ***repairs@gigatronics.com***

1.2 Performance Specifications

Performance specifications describe the Model 58542 warranted performance, and apply when using the Series 80300A Power Sensors. Typical performance (shown in *italics*) is non-warranted.

1.2.1 Range

Frequency Range	10 MHz to 40 GHz ¹
Power Range	-70 dBm to +47 dBm (100 pW to 50 Watt) ¹
Single Sensor Dynamic Range:	CW Sensors: 90 dB ¹ Peak Power Sensors: 40 dB, Peak 50 dB, CW ¹

1.2.2 Accuracy

Calibrator:	Power Sweep calibration signal to dynamically linearize the sensors
Frequency:	50 MHz nominal
Settability:	The 1 mW (0.0 dBm) level in the Power Sweep Calibrator is factory set to $\pm 0.7\%$ traceable to the National Institute of Standards and Technology (NIST). Measure within 15 seconds of setting calibrator to 0.0 dBm.
Accuracy:	$\pm 1.2\%$ worst case for one year, over temperature range of 5 °C to 35 °C
Connector:	Type N(f) connector, 50 Ω
VSWR:	<1.05 dB (Return Loss >33 dB)
System Linearity (at 50 MHz for Standard CW Sensors):	± 0.02 dB over any 20 dB range from -70 to +16 dBm ± 0.02 dB + (0 dB, -0.05 dB/dB) from +16 to +20 dBm ± 0.04 dB from -70 to +16 dBm
Temperature Coefficient of Linearity:	<0.1%/ °C temperature change following Power Sweep Calibration, 24-hour warm-up required.

1.2.3 Zeroing Accuracy (Standard CW Sensors)

Zero Set:	< ± 50 pW ²
Zero Drift:	< ± 100 pW during 1 hour ²
Noise:	< ± 50 pW measured over any 1 minute interval ²
Averaging:	Auto-averaging or user-selectable averaging from 1 to 512 readings per measurement

Notes:

¹ Depending on sensor used.

² Specified performance applies with maximum averaging and 24-hour warm-up at constant temperature.

Figure 1-1 illustrates the instrument Linearity plus Typical Noise and Zeroing Error vs Input Power. (The X-axis scale is sensor dependent)

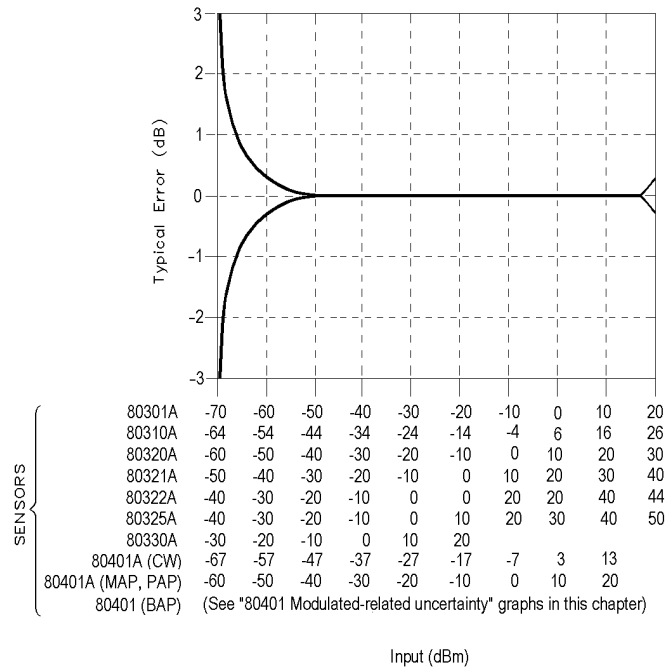


Figure 1-1. Instrument Linearity

1.2.4 Meter Functions

dB Offset and Relative:	Allows both relative readings and offset readings. Power readings can be offset by -99.999 dB to +99.999 dB to account for external loss/gain.
Configuration Storage Registers:	Up to ten instrument configurations can be stored and recalled from non-volatile memory for fast configuration changes.
Power Measurements:	Any two of the following channel configurations, simultaneously: 1, 2, 1/2, 2/1, 1-2, 2-1.

1.2.5 Measurement Speed

Measurement speed increases significantly using the meter's data storage capabilities. Storing data in memory for later downloading to the controller reduces word serial protocol and protocol conversion overhead. Up to 128,000 readings can be buffered. The measurement rate depends on several factors, including controller speed and number of averages. Burst Mode speed does not include bus communication time. The following lists typical maximum measurement rates for CW power sensors or Series 80340 Peak Power Sensors.

Normal Mode Non-Buffered	Swift Mode Buffered Data	Burst Mode Buffered Data
55 rdgs/sec	150 rdgs/sec	5100 rdgs/sec

Individual data points are read immediately after measurement in the Normal Mode. Swift Mode allows triggering of individual data points, and stores the data in the 58542 memory. Burst Mode also buffers measurement data: measurement timing of individual data points is controlled by setting the time interval (0.001 to 5.000 sec) between the data points following a single group burst trigger event.

1.2.6 Inputs/Outputs

Analog Output:	Provides an output voltage (at the Analog Out BNC) that is configurable from -10 to +10 V from either Channel 1 or Channel 2 in either Lin or Log units ¹
Accuracy:	1.0% ±32 mV, -10 to +10 V
Linearity:	<0.3%
Trigger Input:	Connects EXT trigger (at the EXT TRIG BNC). TTL level input signal for fast reading of buffered data modes
Voltage proportional to Frequency (in GHz):	Automated Cal Factor correction. Input the analog VpropF signal level from the microwave signal source to the VpropF IN BNC ¹
Input Range:	0 to 10 V
Accuracy:	1.0% ±32 mV (14 bit) (0.6 mV resolution)

Note:

¹ Operates in Normal Mode only.

1.2.7 Power Requirements

+5 Vdc @ 800 mA
+24 Vdc @ 250 mA
-24 Vdc @ 250 mA

1.2.8 Environmental Specifications

Temperature Range

Operating:	0 °C to 50 °C (32 °F to 122 °F)
Storage:	-40 °C to 70 °C (-40 °F to 158°F)

Physical Characteristics

Dimensions:	C-size, single slot VXI standard 30 mm (1.2 in) wide, 234 mm (9.2 in) high, 340 mm (13.4 in) deep.
Weight:	2.5 kg (5.5 lbs)

Accessories Included

Two detachable sensor cables.

Operation

2.1 Preparation for Use

This chapter describes how to operate the Model 58542 VXI Universal Power Meter. The first part of the chapter explains how to set up and install the unit. This is followed by operating procedures using the General Purpose Interface Bus (GPIB) command reference, with the Standard Commands for Programmable Instruments (SCPI) command language.

The following topics are presented in this chapter:

- Initial Setup
- Installation
- Sensor Precautions
- Operation
- Error Messages

2.2 Installation

Before installing the power meter, ensure that the logical address and data transfer bus arbitration have been set according to the procedures in Section 2.3.

The power meter installs into any slot of a VXI mainframe except slot 0 (zero). When inserting the instrument into the mainframe, rock it gently back and forth to fully seat the connectors into the backplane receptacles. The ejectors will be at right angles to the front panel when the instrument is properly seated. The two captive screws above and below the ejectors secure the instrument into the chassis.

The power meter contains three printed circuit assemblies: (1) The Analog board, (2) VXI Processor board, and (3) Digital board.

The Analog board contains the front panel connectors, the Power Sweep Calibrator (beneath the top metal cover), and the dual measurement channels (beneath the lower metal cover). The memory backup battery is attached to this lower metal cover.

The VXI Processor board contains the 68000 processor, connection to the VXIbus backplane, and two EEPROMs containing communications software. The operational software must be compatible with the EEPROMs on the Digital board. The EEPROMs will be replaced whenever operational software upgrades are performed.

The Digital board connects to the VXI backplane for access to TTL triggering and the main operational software.

2.3 Initial Setup

The logical address and data transfer bus arbitration must be set up in the power meter before installing the unit in a VXI mainframe and applying power. The following procedures define how to complete the initial setup.

2.3.1 Logical Address

The VXI chassis Resource Manager identifies each unit in the system by its logical address. The VXI logical address can range from 0 to 255. Addresses 0 and 255 are reserved for special functions: Address 0 identifies the Resource Manager (slot and controller); address 255 permits the Resource Manager to dynamically address the unit based on the chassis VXI slot.

To change the logical address, set the respective sections on the eight position DIP switch. The switch is accessible after removing the right cover (see Figure 2-1).

The address is set with binary values of 0 to 255. Switch position 1 is the least significant bit of the address. Figure 2-1 illustrates logical address values of 3 (binary 00000011) and 255 (binary 11111111). Giga-tronics ships the power meter with a logical address of 255 for dynamic configuration.

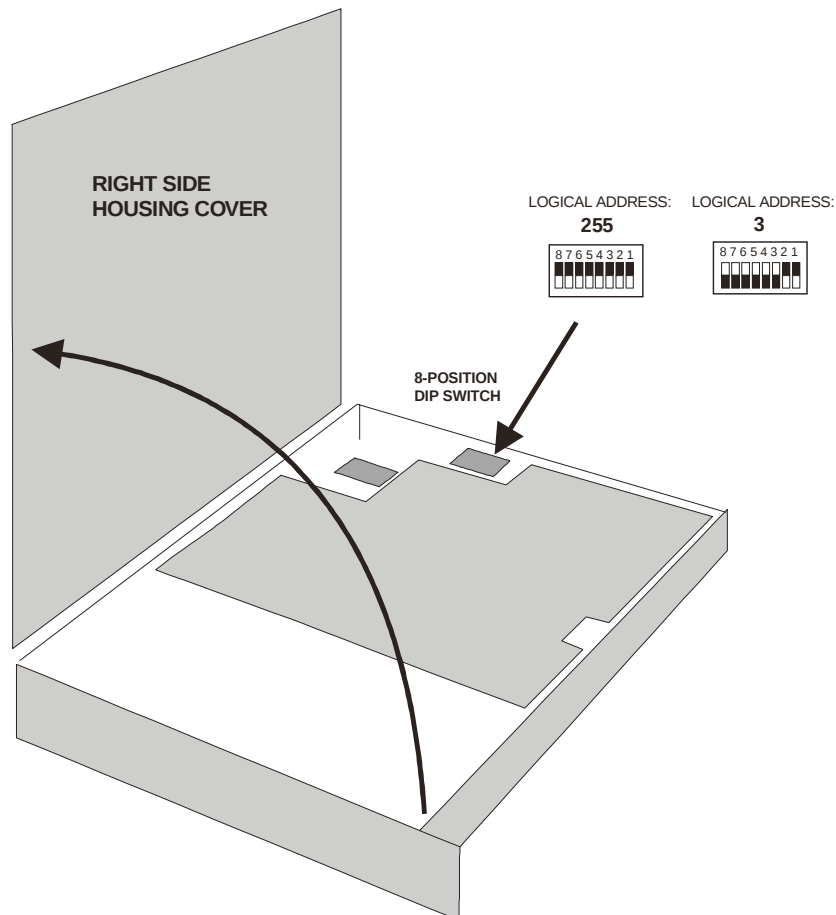


Figure 2-1. Setting the Logical Address

2.3.2 Data Transfer Bus Arbitration

The power meter has VMEbus Mastership capability. When enabled, it sends responses and events as signals (software interrupts) to its Commander Signal Register. The power meter cannot drive the interrupt lines.

The power meter is configured as a level 3 requester by the factory. The level 3 Bus Request and Bus Grant lines (BR3*, BG3IN*, and BG3OUT*) are used. The other Bus Grant lines are daisy-chained by jumpers (see Figure 2-2).

The VMEbus specifications describe three priority schemes: (1) Prioritized, (2) round-robin, and (3) single level. Prioritized arbitration assigns the bus according to a fixed priority scheme where each of four bus lines has a priority from highest (BR3*) to lowest (BR0*). Round-robin arbitration assigns the bus on a rotating basis. Single level arbitration accepts requests only on BR3*.

The jumpers must be changed if a different requester level is required. Figure 2-2 will aid in reconfiguring the power meter to a new level. Refer to the VMEbus specification for more information on data transfer bus arbitration.

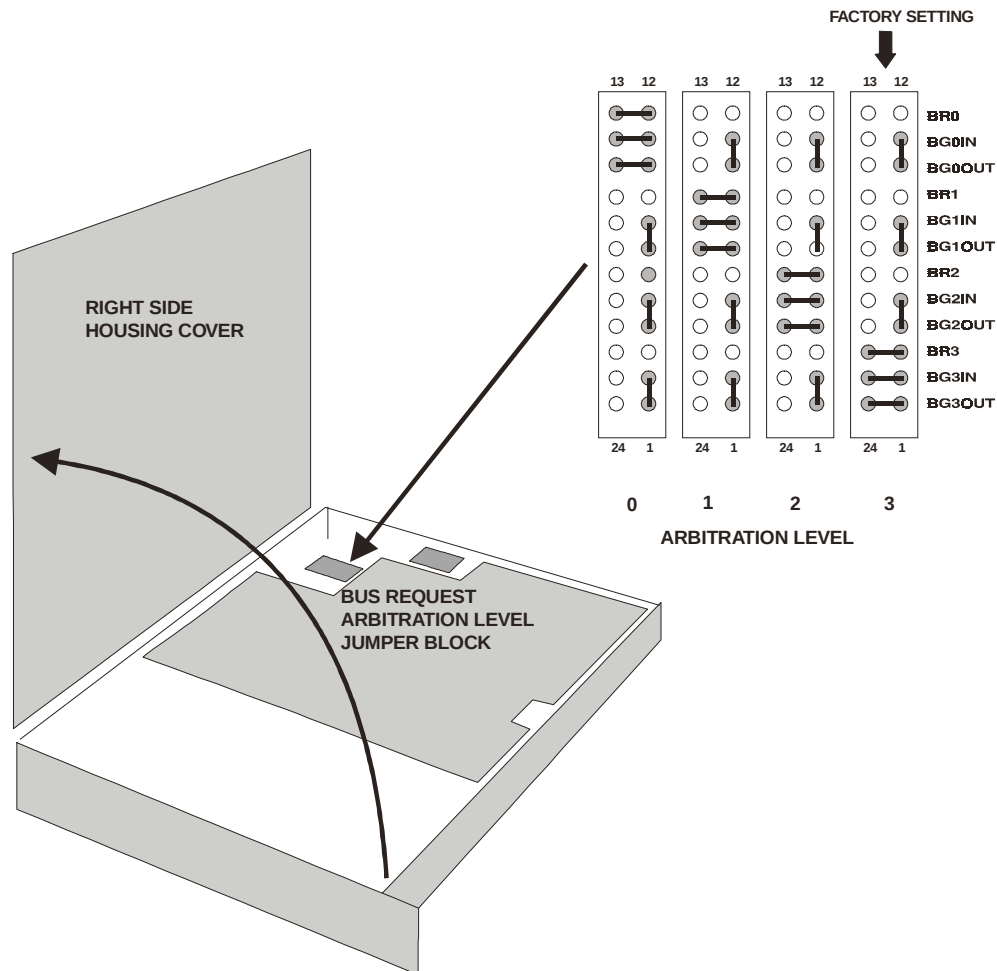


Figure 2-2. Default Bus Arbitration Settings

2.4 Sensor Precautions

Sensors used with the 58542 are configured in metal housings for superior mechanical performance as well as excellent shielding.

CAUTION

When connecting the sensors to other devices or components, the body of the sensor should never be turned to tighten the RF connection. Mechanical damage to the connector can result if improperly handled when connecting the sensors. Scratched or damaged connector mating surfaces can lead to inaccurate measurements.

If a sensor is connected to CW or peak power devices with power output in excess of +23 dBm (200 mW), degradation or destruction of the diode can occur.

Diodes degraded or destroyed in this manner will not be replaced under warranty. Destructive signal levels are higher for High Power, TrueRMS, and Low VSWR sensors.

2.5 Operation

2.5.1 SCPI Command Interface

This section details operation of the power meter using the SCPI interface commands. A SCPI Command Reference is presented in Table 2-2 and the sections that follow.

The power meter is compatible with the Standard Commands for Programmable Instruments (SCPI) standard. SCPI promotes consistency in its definition of a common instrument control and measurement command language. The structured approach of the SCPI standard offers test system design engineers a number of system integration advantages that achieve considerable efficiency gains during control program development.

SCPI compatible instrument commands are structured from a common functional organization or model of a test instrument (see Figure 2-3). Most of the power meter configuration and measurement functions fall within the Measurement Function Block and the Trigger Subsystem of the SCPI instrument model.

The 58542 uses the SENSE Subsystem of the Measurement Function Block to implement commands that apply specifically to the individual power sensors; sensor 1, and sensor 2. For example, the SENSE2:CORRection:OFFSet command corrects for the attenuation of a signal that passes through an attenuator or coupler before it is measured by power sensor 2. Figure 2-3 illustrates the SCPI subsystem model.



NOTE: Throughout this manual, some commands will be in both upper- and lowercase, such as CALCulate and MEMory. The uppercase is the required input. The whole word can be used if desired.

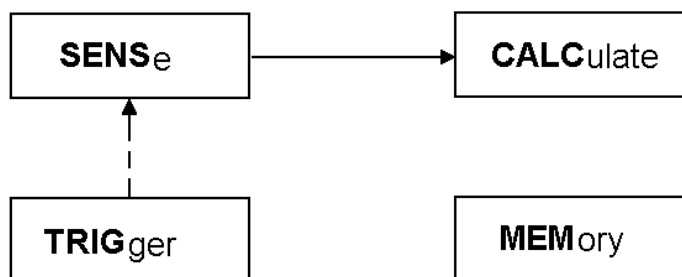


Figure 2-3. SCPI Subsystem Model

2.5.2 Sensor and Channel Configuration

The CALCulate Subsystem of the Measurement Function Block contains commands that define the form of the measured data from sensor 1 and sensor 2. CALCulate commands define the configuration of the two Software Calculation Channels (channels). For example, the CALC1:POW 1 command configures channel 1 to report the power level as measured by sensor 1. CALC2: RAT 2,1 configures channel 2 to report the ratio of power levels, sensor 2 over sensor 1.

2.5.3 Measurement TRIGgering

The power meter uses the TRIGger Subsystem to trigger measurements in two different operational modes - a normal mode which maximizes the instrument's functionality, and swift and burst modes that maximize the power measurement rate.

2.5.4 MEMory Functions

The MEMory commands control the configuration of the automated Voltage-Proportional-to-Frequency (VpropF), sensor Cal Factor correction, and the Analog Output on the front panel. Each of these connectors is used with external devices. The VpropF can be configured to match the VpropF output of your microwave source. The Analog Output is used with a variety of devices including chart recorders, oscilloscopes, voltmeters, and microwave source leveling inputs.

2.5.5 IEEE-488.2 Commands

Consistent with SCPI compliance criteria, the power meter implements all the common commands declared mandatory by IEEE-488.2. These commands are listed in Table 2-1.

Table 2-1. VXI GPIB Command Syntax

Mnemonic	Name
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*RST	Reset Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TST?	Self-Test Query
*WAI	Wait-to-Continue Command

2.5.6 DIAGnostic Commands

DIAGnostic commands are used for a variety of instrument specific maintenance and calibration functions. Unless you are performing instrument calibration functions, it is unlikely that you will need to use the DIAGnostic command sets. For calibration laboratory metrology professionals, the DIAG commands will allow you to completely automate instrument and sensor calibration functions. The commands program EEPROMs inside the meter and individual sensors. If desired, a password function is incorporated to prevent unauthorized personnel from altering calibration information. Table 5-1 in Chapter 5 lists available Diagnostic commands.

2.5.7 CALCulate Subsystem Commands

CALCulate: commands specify and query the configuration of power measurement channels, known in SCPI references as Software Configuration Channels, and in this manual as “channels.” (For sensor specific configuration and measurement function control, see Section 2.5.8).

The query form of CALC#? with the appropriate modifier (1 or 2) inserted ahead of the ? will return the current configuration status for that channel. This can be used to verify configuration commands or return current status information following data acquisition or power measurements.

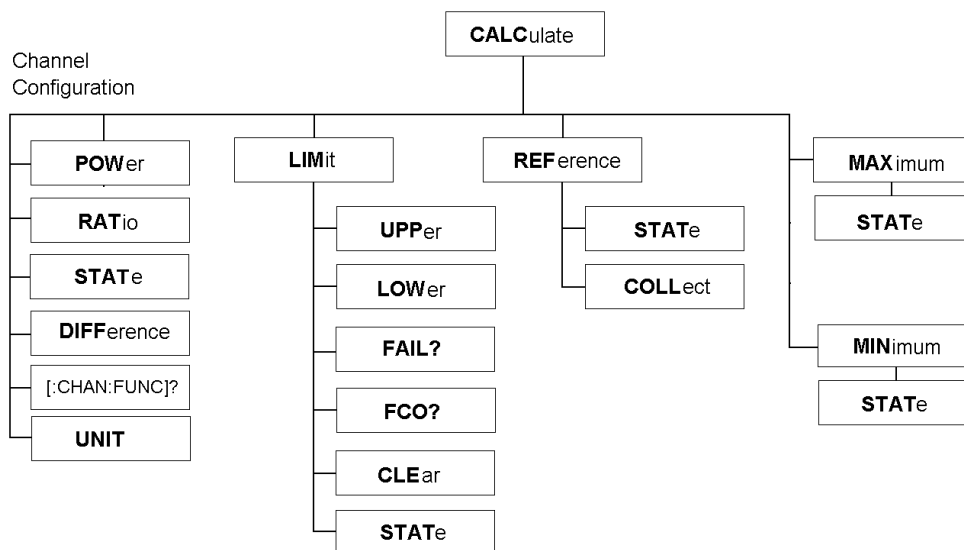


Figure 2-4. CALCulate Subsystem Command Tree

Limit Lines are set on a channel basis. The LIMit commands set limits, monitor the number of violations, and allow the violation counter to be cleared.

The REFerence command allows channel based offset values. For example, using CALC#:REF:COLL automatically converts the inverse of the current channel measurement value to an offset - simplifying the 1 dB compression testing of amplifiers.

MIN and MAX commands monitor deviation of measured values over a user controllable time period.

The two software calculation channels can individually and simultaneously perform the internal instrument functions that calculate final measurement data for output over the VXI bus to the controller. The final measurement data is calculated from SENSE Subsystem processed sensor data as well as the CALC subsystem channel configuration data.

This means that only two measurement configurations can be obtained from the 58542 simultaneously. For example, the controller can obtain measurements for sensor 1 plus sensor 2/sensor 1 simultaneously, but not sensor 1 plus sensor 2 plus sensor 2/sensor 1 simultaneously.

2.5.8 SENSE Subsystem Commands

The SENSE subsystem configuration commands, illustrated in Figure 2-5, apply specifically to individual sensors. These commands alter the value of the measured power level according to the sensor's characteristics. For example, measured power levels can be offset for attenuators or couplers in the measurement path so that the power data reading reflects the power level at the measurement point of interest.

Use SENSE for:

- Averaging power measurements in the 58542 rather than the controller
- Offsetting power measurements for attenuation or amplification
- Entering the operating frequency of the measured signal (automatically computes and applies sensor specific Calibration Factor corrections) which compensates for sensor frequency response characteristics
- Controlling Peak Power Sensor triggering

SENSE subsystem commands control functions that are related directly to the individual power sensors. For example, these commands control items that would not apply to numerical alteration of a ratio measurement of Sensor1/Sensor2. Controls that would apply to that type of a configuration are channel functions, not sensor functions, and would therefore be located in the CALCulate subsystem.

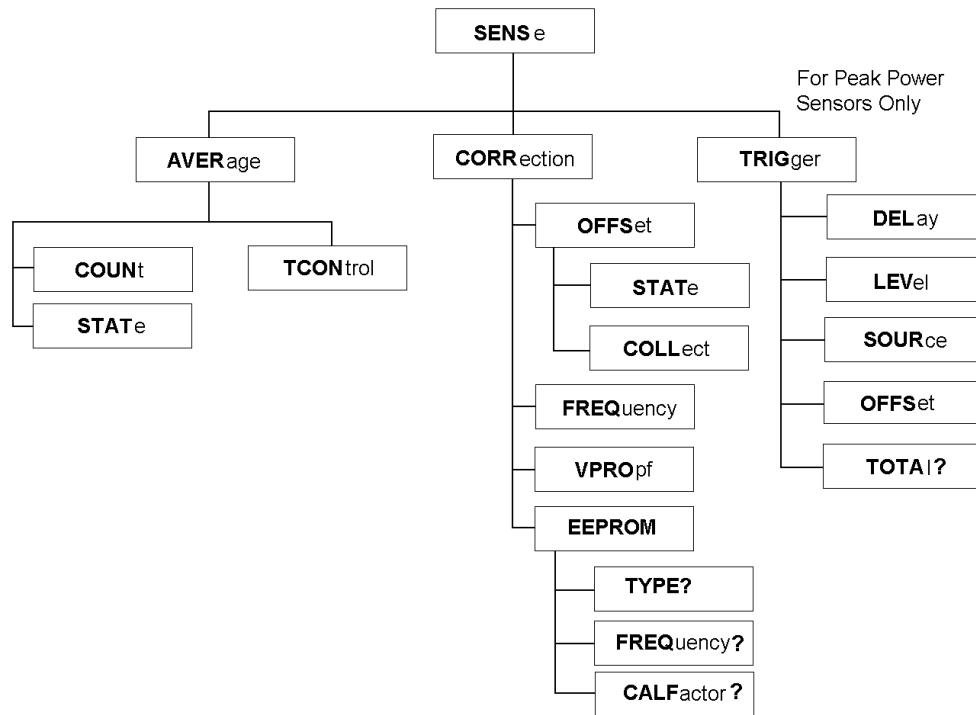


Figure 2-5. SENSE Subsystem Command Tree

SENSe:AVERage functions control the number of data samples for each measurement and the manner in which those numbers are accumulated. COUNT determines the averaging number or AUTO-averaging. TCONtrol determines whether each new sample is added to previous COUNT # of samples or if COUNT #

of samples are taken each time the 58542 instrument is triggered. Please note that the SENSE:TRIGger commands are not instrument triggers, but Peak Power Sensor configuration controls.

SENSe:TRIGger functions apply only to Giga-tronics Peak Power Sensors. The DELay and LEVel functions of these Peak Power Sensor controls apply to the 80350A Peak Power Sensors, not the 80340 Peak Power (Triggerable Pulse) Sensors. The AVERage and CORRection commands apply to all 80300 Series CW & Peak Power Sensors.

STATe ON OFF controls for COUNT and DELay, above, are not shown.

2.5.9 TRIGger Subsystem Commands

The TRIGger Subsystem is divided into two sections; Instrument Measurement Event Triggering, and Special Triggering Configuration commands for the fast reading buffered data modes, Burst Mode and Swift Mode. The TRIGger command tree is illustrated in Figure 2-6.

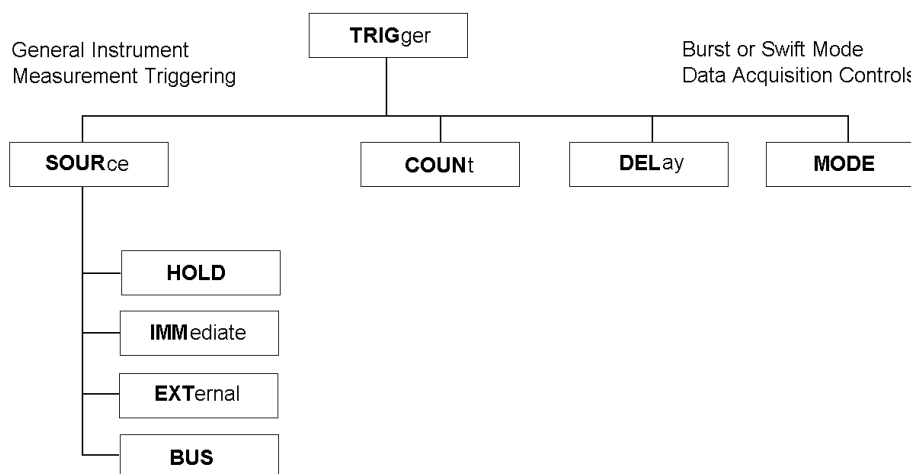


Figure 2-6. TRIGger Subsystem Command Tree

The query form of these commands, TRIGger? with the appropriate modifier inserted ahead of the ?, will return the instrument's current configuration status. This can be used to verify triggering configuration or return status information following command errors which are commonly caused by using illegal configuration commands during SWIFt or BURSt Modes.

SOURce:IMMEDIATE triggering allows the 58542 to control measurement triggering; this is the default configuration. EXTernal triggering is performed using a TTL signal into the front panel connector. There is provision for connecting this trigger signal to the backplane TTL Triggering, but the ASCII software command syntax remains EXT. BUS allows software controlled triggering.

COUNT refers to the number of data points to store in the meter's 5000 reading buffer (128,000 with option 02) before the measurement data is requested by the controller. DELay controls the time interval between Burst Mode data samples, and the MODE command controls whether the data is taken after receipt of the instrument trigger or if data is collected (in a FIFO buffer) immediately preceding receipt of an instrument trigger.

2.5.10 GPIB Command Syntax

The following conventions are used with the GPIB commands in this manual. Throughout this manual, some commands will be in both upper- and lowercase, such as CALCulate and MEMory. The uppercase is the required input. The whole word can be used if desired. Table 2-2 lists in alphabetical order all of the VXI GPIB commands supported by the power meter. A typical example is shown, the basic function performed by that command is given, and the page numbers of this chapter where descriptions of each command can be located.

Commands in Brackets []

Commands and command separators within brackets, such as [COMManD:], are optional. These portions of the commands may be used in your program command strings, but are not required for proper operation of the power meter.

Programmer Selectable Parameters < >

Command descriptions enclosed in angle brackets (< and >) show the syntax placement of configurable or settable parameters. A description of the necessary parameter and the range of values or mnemonics which are valid for that parameter are located enclosed in angle brackets.

Italics in Syntax Descriptions

Some command syntax descriptions show certain words in italics such as *space* and *comma* to indicate where the character must be included within a command string.

Query Format ?

Except where specifically noted, all query commands are formed by adding a question mark (?) to the command header. Be sure to omit command parameters when you are using the query format. Some commands have only a query format. With the exception of the CALibration queries, sending query commands will not change the status of the power meter. The CALibration1? and CALibration1:ZERO? queries automatically begin the power meter's calibration and zeroing process, respectively.

Linking Command Strings

The 58542 uses ASCII strings for commands. When sending more than one command in a single string, a semi-colon must be used as a delimiter between commands. No spaces or other characters are necessary. Use only a semi-colon (;) to link commands in a string.

Measurement Data Output Format

The examples shown in this chapter are written in HTBasic™ format. Different languages will use different commands, but the string sent or received will always be the same. In HTBasic, the OUTPUT command sends a string to the GPIB bus. The number or variable after the word OUTPUT is the GPIB address of the power meter.

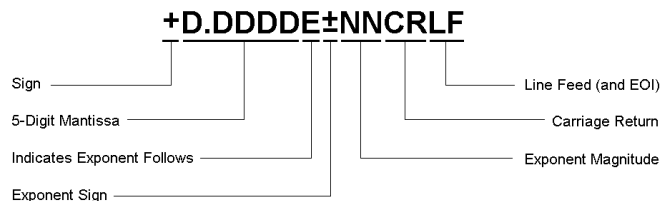


Figure 2-7. Measurement Data Output Format

™ HTBasic is a trademark of TransEra Corporation

Table 2-2. VXI GPIB Command Syntax

Command Syntax Typical Example	Function	Ref Page
ABORt OUTPUT @Pwr_mtr;ABOR	Halts measurement & triggering	2-59
CALCulate<channel 1 or 2>:DATA? OUTPUT @Pwr_Mtr;CALC1:DATA? Response is comma delimited data. Number of points equals # from TRIG:COUN#. 0<#<128000	Query channel 1 & 2 burst mode data	2-35
CALCulate<channel 1 or 2>[:CHANnel]:Difference<space><sensor 1 or 2>comma<sensor 2 or 1> OUTPUT @Pwr_Mtr;CALC1:DIFF 2,1	Configures channel 1 to measure Sensor 2 minus Sensor 1 power	2-29
CALCulate<channel 1 or 2>[:FUNCTION]? OUTPUT @Pwr_mtr;CALC2? Response is: POW 1, POW 2, RAT 2,1, RAT 2,1, DIFF 1,2, or DIFF 2,1	Query channel 2 sensor mode	2-30
CALCulate<channel 1 or 2>:LIMit:CLEar[:IMMediate] OUTPUT @Pwr_mtr;CALC1:LIM:CLE	Reset channel 1 limit violation indicator to 0	2-54
CALCulate<channel 1 or 2>:LIMit:FCOunt? OUTPUT @Pwr_mtr;CALC1:LIM:FCO? Response is a single number - the number of times the limit lines were exceeded	Query number of channel 1 limit failures	2-54
CALCulate<channel 1 or 2>:LIMit:FAIL? OUTPUT @Pwr_mtr;CALC1:LIM:FAIL?	Check for channel 1 limit line violation (Output 0 = OK; 1 = fail)	2-54
CALCulate<channel 1 or 2>:LIMit:LOWer<space><numeric value in dB from -299.99 to 299.99> OUTPUT @Pwr_mtr;CALC1:LIM:LOW -50.0	Set channel 1 lower limit line to -50 dBm	2-55
CALCulate<channel 1 or 2>:LIMit:LOWer? OUTPUT @Pwr_mtr;CALC1:LIM:LOW? Response is a single number - the lower limit setting	Query channel 1 lower limit line setting	2-55
CALCulate<channel 1 or 2>:LIMit:STATe<space><ON or OFF> OUTPUT @Pwr_mtr;CALC1:LIM:STAT ON	Enable channel 1 upper and lower limit checking. (0 = off; 1 = on)	2-55
CALCulate<channel 1 or 2>:LIMit:STATe? OUTPUT @Pwr_mtr;CALC1:LIM:STAT? Response is 1 for ON or 0 for OFF	Query channel 1 ON or OFF status	2-55
CALCulate<channel 1 or 2>:LIMit:UPPer<space><numeric value in dB from -299.99 to 299.99> OUTPUT @Pwr_mtr;CALC1:LIM:UPP 17.0	Set channel 1 upper limit line to 17 dBm	2-55
CALCulate<channel 1 or 2>:LIMit:UPPer? OUTPUT @Pwr_mtr;CALC1:LIM:UPP? Response is a single number - the upper limit setting	Query channel 1 upper limit line setting	2-55
CALCulate<channel 1 or 2>[:CHANnel]:POWer<space><sensor 1 or 2> OUTPUT @Pwr_Mtr;CALC2:POW 1	Configures channel 2 to measure Sensor 1 power	2-29
CALCulate<channel 1 or 2>[:CHANnel]:RATio<space>< sensor 1 or 2>comma<sensor 2 or 1> OUTPUT @Pwr_Mtr;CALC1:RAT 2,1	Configures channel 1 to measure Sensor 2 over Sensor 1 power	2-29

Command Syntax Typical Example	Function	Ref Page
CALCulate<channel 1 or 2>:MODEspace <NORMAl, BURSt or SWIFt Mode Selection> OUTPUT @Pwr_mtr;CALC2:MODE SWIF CAUTION: This command sets the operating mode for both channels regardless of CALC# 1 or 2	Set measurement mode to SWIFt	2-35
CALCulate<channel 1 or 2>:MODE? OUTPUT @Pwr_mtr;CALC1:MODE? Response is a NORM, BURS or SWIF	Query channel 1 measurement mode	2-36
CALCulate<channel 1 or 2>:MAXimum:STATespace<ON or OFF> OUTPUT @Pwr_mtr;CALC2:MAX:STAT ON	Enable channel 2 max. value monitoring	2-52
CALCulate<channel 1 or 2>:MAXimum:STATe? OUTPUT @Pwr_mtr;CALC2:MAX:STAT? Response is 1 for ON or 0 for OFF	Query channel 2 max. mon. ON/OFF status	2-52
CALCulate<channel 1 or 2>:MAXimum[:MAGnitude]? OUTPUT @Pwr_mtr;CALC2:MAX? Response is highest power reading since CALC2:MAX:STAT ON was sent	Query channel 2 maximum value in dBm	2-52
CALCulate<channel 1 or 2>:MINimum:STATespace<ON or OFF> OUTPUT @Pwr_mtr;CALC1:MIN:STAT ON	Enable channel 1 min. value monitoring	2-52
CALCulate<channel 1 or 2>:MINimum:STATe? OUTPUT @Pwr_mtr;CALC1:MIN:STAT? Response is 1 for ON or 0 for OFF	Query channel 1 min. mon. ON/OFF status	2-52
CALCulate<channel 1 or 2>:MINimum[:MAGnitude]? OUTPUT @Pwr_mtr;CALC1:MIN? Response is lowest power reading since CALC2:MIN:STAT ON was sent	Query channel minimum value in dBm	2-53
CALCulate<channel 1 or 2>:REFerence:STATespace<ON or OFF> OUTPUT @Pwr_mtr;CALC2:REF:STAT ON	Activate level reference for relative measurements	2-45
CALCulate<channel 1 or 2>:REFerence:STATe? OUTPUT @Pwr_mtr;CALC2:REF:STAT? Response is 1 for ON or 0 for OFF	Query ON or OFF status	2-45
CALCulate<channel 1 or 2>:REFerence[:MAGnitude]<dB Offset value from -299.999 to 299.999> OUTPUT @Pwr_mtr;CALC2:REF -30.11 OUTPUT @Pwr_mtr;CALC2:REF 0.00	Set channel 2 reference offset value in dB Reset channel 2 Relative meas. operation	2-45
CALCulate<channel 1 or 2>:REFerence[:MAGnitude]? OUTPUT @Pwr_mtr;CALC1:REF? Response is a single number reporting the reference value	Query current channel 1 reference value	2-45
CALCulate<channel 1 or 2>:REFerence:COLlect OUTPUT @Pwr_mtr;CALC2:REF:COLL ! Current Rdg.==> Ref level	Take channel 2 reading as reference value. Reset with CALC:REF 0.0	2-45
CALCulate<channel 1 or 2>:STATespace<ON or OFF> OUTPUT @Pwr_mtr;CALC1:STAT OFF	Disable channel 1 measurement	2-30
CALCulate<channel 1 or 2>:STATe? OUTPUT @Pwr_mtr;CALC1:STAT? Response is 1 for ON or 0 for OFF	Query channel 1 measurement status	2-30
CALCulate<channel 1 or 2>:UNIT[:POWER]space<data units selection, DBM or Watt> OUTPUT @Pwr_mtr;CALC1:UNIT W OUTPUT @Pwr_mtr;CALC1:UNIT DBM	Selects channel 1 linear units in Watts Selects channel 1 Log Units in dBm	2-30

Command Syntax Typical Example	Function	Ref Page
CALCulate<channel 1 or 2>:UNIT[:Power]? OUTPUT @Pwr_mtr;CALC1:UNIT? Response is DBM or W	Query channel 1 Units Configuration	2-30.
CALibrate<sensor 1 or 2>[:SENSOR] OUTPUT @Pwr_mtr;CAL1	Calibrate Sensor 1	2-19
CALibrate<sensor 1 or 2>[:SENSOR]? OUTPUT @Pwr_mtr;CAL1? Response is 1 or 0 immediately upon power sweep calibration failure or completion, respectively	Cal. Sensor 1 & return Pass/Fail status (0 = pass; 1 = fail)	2-19
CALibrate<sensor 1 or 2>:ZERO OUTPUT @Pwr_mtr;CAL1:ZERO	Zero Sensor 1	2-20
CALibrate<sensor 1 or 2>:ZERO? OUTPUT @Pwr_mtr;CAL1:ZERO? Response is a 1 or 0 immediately upon power sensor zeroing failure or completion, respectively	Zero Sensor 1 & return Pass/Fail status	2-20
CALibrate<sensor 1 or 2>:STATe? OUTPUT @Pwr_mtr;CAL1:STAT? Response is 1 if sensor is calibrated or 0 if sensor is not calibrated	Query sensor for calibration status	2-19
*CLS OUTPUT @Pwr_mtr;*CLS	Clear SRQ and status byte registers	2-48
*ESEspace<event status register value, 0 to 255> OUTPUT @Pwr_Mtr;*ESE 16	Enable bit 4 of event status register mask	2-48
*ESE? OUTPUT @Pwr_Mtr;*ESE? Response is the sum of the enabled bit numbers n from 0 to 7 expressed as the sum of the enabled $2n$	Query currently enabled bits of event status register mask	2-48
*ESR? OUTPUT @Pwr_Mtr;*ESR? Response is the sum of the active bit numbers n from 0 to 7 expressed as the sum of the enabled $2n$	Return event status register value	2-48.
FETCh<channel 1 or 2>? OUTPUT @Pwr_Mtr;FETC1?	Read previously triggered channel 1 power, Normal, Swift or Burst mode data	2-21
*IDN? OUTPUT @Pwr_Mtr;*IDN? Response is Giga-tronics 58542,0,### where ### is the software version	Query instrument mfgr & model #	2-62
INITiate[:IMMediate] OUTPUT @Pwr_Mtr;INIT	Initiate instrument triggering cycle	2-28
INITiate:CONTInuous<ON or OFF> OUTPUT @Pwr_mtr;INIT:CONT ON	58542 self-triggers continuously	2-27
INITiate:CONTInuous? OUTPUT @Pwr_mtr;INIT:CONT? Response is 1 for ON or 0 for OFF	Query ON or OFF status;	2-27
MEASure<channel 1 or 2>[:SCALar:POWer]? OUTPUT @Pwr_Mtr;MEAS2?	Configure triggering and measure Channel 2 power in NORMAl mode	2-21
MEMory[:TABLe]:CHANnel<space><channel 1 or 2> OUTPUT @Pwr_mtr;MEM:CHAN 2	Set analog out to channel 2	2-56

Command Syntax Typical Example	Function	Ref Page
MEMory[:TABLE]:CHANnel? OUTPUT @Pwr_mtr;MEM:CHAN? Response is channel 1 or channel 2	Query analog out channel number	2-56
MEMory[:TABLE]:FREQuency < Start frequency> OUTPUT @Pwr_mtr;MEM:FREQ 1e9	Set v_prop_f start frequency to 1 GHz	2-33
MEMory[:TABLE]:FREQuency? OUTPUT @Pwr_mtr;MEM:FREQ? Response is the frequency value you set that corresponds to your source VpropF output at 0.0V	Query v_prop_f start frequency	2-33
MEMory[:TABLE]:POWerspace<start value from -80 to +20 dBm>comma<stop value from -80 to +20 dBm> OUTPUT @Pwr_mtr;MEM:POW -70,20	Set analog out power range (in dBm) from -70 to 20 dBm	2-57
MEMory[:TABLE]:POWer? OUTPUT @Pwr_mtr;MEM:POW? Response is two dBm values separated by a comma indicating analog output range	Query analog out power range	2-57
MEMory[:TABLE]:POWerspace<start value from 0 to 0.01W>comma<stop value from 0 to 0.01W> OUTPUT @Pwr_mtr;MEM:POW 0,1e-2	Set analog out power range (in Watts) from 0 to 0.01 Watts	2-57
MEMory[:TABLE]:POWer? OUTPUT @Pwr_mtr;MEM:POW? Response is two Watt values separated by a comma indicating analog output range	Query analog out power range	2-57
MEMory[:TABLE]:SElectspace<ANALOGout,VPROPF1,VPROPF2> OUTPUT @Pwr_mtr;MEM:SEL VpROPF1	Select memory table VpROPF1 for editing in following lines	2-32 2-56
MEMory[:TABLE]:SElect? OUTPUT @Pwr_mtr;MEM:SEL? Response is the table currently editable ANALOGout, VPROPF1 or VpROPF2	Query selected memory table	2-32 2-56
MEMory[:TABLE]:SLOPespace<Volts per Hz> OUTPUT @Pwr_mtr;MEM:SLOP 1e-9	Set v_prop_f slope in 1V/GHz	2-33
MEMory[:TABLE]:SLOPe? OUTPUT @Pwr_mtr;MEM:SLOP? Response is the voltage to frequency value you set that corresponds to your source VpropF output	Query v_prop_f slope value	2-33
MEMory[:TABLE]:UNITspace<Units for analog output configuration, DBM or Watt> OUTPUT @Pwr_mtr;MEM:UNIT DBM	Set analog out power unit	2-57
MEMory[:TABLE]:UNIT? OUTPUT @Pwr_mtr;MEM:TABL:UNIT? Response is the units used for analog output configuration, DBM or W	Query analog out power unit	2-57
MEMory[:TABLE]:VOLTagespace<start value from -10 to +10 V>comma<stop value from -10 to +10 V> OUTPUT @Pwr_mtr;MEM:VOLT -8,2	Set analog out voltage range from -8 to 2 volts corresponding to power	2-58
MEMory[:TABLE]:VOLTage? OUTPUT @Pwr_mtr;MEM:VOLT? Response is two Voltage values separated by a comma indicating analog output range	Query analog out voltage range	2-58

Command Syntax Typical Example	Function	Ref Page
*OPC OUTPUT @Pwr_mtr;*OPC	*OPC allows one time SRQ enable	2-22 2-49
*OPC? OUTPUT @Pwr_mtr;*OPC? Response to this one time operation complete query is a 0 or a 1	send a 1 upon operation complete	2-22 2-49
OUTPut[:BNC]:ANALog[:STATe]space<ON or OFF> OUTPUT @Pwr_mtr;OUTP:ANA ON	Enable analog out function	2-58
OUTPut[:BNC]:ANALog[:STATe]? OUTPUT @Pwr_mtr;OUTP:ANA? Response is a 1 for ON or 0 for OFF	Query analog out function status	2-58
OUTPut:ROSCillator[:STATe]space<ON or OFF> OUTPUT @Pwr_mtr;OUTP:ROSC ON	Turn ON 0.0 dBm Calibrator Oscillator	2-63
OUTPut:ROSCillator[:STATe]? OUTPUT @Pwr_mtr;OUTP:ROSC? Response is 1 for ON or 0 for OFF	Query ON or OFF status	2-63
*RCLspace<memory location number 0 to 20> OUTPUT @Pwr_mtr;*RCL 19	Recall 58542 register 19	2-59
READ<channel 1 or 2>[:POWER]? OUTPUT @Pwr_Mtr;READ2?	Trigger measurement and read Channel 2	2-22
*RST OUTPUT @Pwr_mtr;*RST	Reset 58542 configuration	2-60
*SAVespace<memory location number 1 to 20> OUTPUT @Pwr_mtr;*SAV 20	Save at 58542 register 20	2-59
SENSe<sensor 1 or 2>:AVERage:COUNTspace<averaging value 1,2,4,8,16,32,64,128,256,or512> OUTPUT @Pwr_mtr;SENS1:AVER:COUN 16	Set sensor 1 average number to 16	2-43
SENSe<sensor 1 or 2>:AVERage:COUNT? OUTPUT @Pwr_mtr;SENS1:AVER:COUN? Response is a 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512	Query sensor 1 current averaging value	2-43
SENSe<sensor 1 or 2>:AVERage:COUNT:AUTOspace<ON or OFF> OUTPUT @Pwr_mtr;SENS2:AVER:COUN:AUTO ON	Select sensor 2 Auto-average mode	2-43
SENSe<sensor 1 or 2>:AVERage:COUNT:AUTO? OUTPUT @Pwr_mtr;SENS2:AVER:COUN:AUTO? Response is 1 for ON or 0 for OFF	Query sensor 2 Auto-Average mode ON or OFF status	2-43
SENSe<sensor 1 or 2>:AVERage:TCONtrolspace<data acquisition averaging method, MOVing or REPeat> OUTPUT @Pwr_mtr;SENS1:AVER:TCON REP	Set sensor 1 to acquire fresh measurement data before averaging	2-43
SENSe<sensor 1 or 2>:AVERage:TCONtrol? OUTPUT @Pwr_mtr;SENS1:AVER:TCON? Response is MOV or REP	Query sensor 1 average method	2-44
SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE? OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:TYPE? Response is two integer numbers separated by a comma indicating model number and serial number	Query sensor 1 eeprom type	2-64
SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency? OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:FREQ? Response is a series of comma delimited frequency values. Number of values is sum of the number of standard sensor frequency calibration factors and the number of special frequency calibration factors	Query sensor 1 eeprom frequency table;	2-64

Command Syntax Typical Example	Function	Ref Page
SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor? OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:CALF? Response is a series of comma delimited sensor frequency calibration factors or Cal Factors. Cal Factors correspond to the frequencies in the output of SENS#:CORR:EEPROM:FREQ?	Query sensor 1 eeprom cal factor table	2-64
SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7 OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 5e7	Set sensor 2 frequency to 50 MHz	2-31
SENSe<sensor 1 or 2>:CORRection:FREQuency? OUTPUT @Pwr_mtr;SENS1:CORR:FREQ? Response is a single frequency in Hz which is the frequency of the signal incident upon the sensor	Query sensor 1 current frequency value	2-31
SENSe<sensor 1 or 2>:CORRection:OFFSet:COLlect OUTPUT @Pwr_mtr;SENS1:CORR:OFFS:COLL	Take sensor 1 current reading as offset value	2-47
SENSe<sensor 1 or 2>:CORRection:OFFSet [:MAGnitude]space<offset value in dB -99.99 to 99.99> OUTPUT @Pwr_mtr;SENS2:CORR:OFFS 10.2	Compensate sensor 2 for 10.2 dB attenuation	2-47
SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]? OUTPUT @Pwr_mtr;SENS2:CORR:OFFS? Response is a single value in dB for the sensor offset value	Query sensor 2 offset value	2-47
SENSe<sensor 1 or 2>:CORRection:OFFSet:STATespace<ON or OFF> OUTPUT @Pwr_Mtr;SENS2:CORR:OFFS:STAT ON	Enable sensor 2 offset correction	2-47
SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe? OUTPUT @Pwr_Mtr;SENS2:CORR:OFFS:STAT? Response is 1 for ON or 0 for OFF	Query sensor 2 offset function status	2-47
SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]space<ON or OFF> OUTPUT @Pwr_mtr;SENS1:CORR:VPRO:ON	Enable sensor 1 v_prop_f function	2-33
SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]? OUTPUT @Pwr_mtr;SENS1:CORR:VPRO? Response is 1 for ON or 0 for OFF	Query v_prop_f function status	2-33
SENSe<sensor 1 or 2>:TEMPerature? OUTPUT @Pwr_mtr;SENS1:TEMP?	Query sensor 1 temperature (in centigrade)	2-20
SENSe<sensor 1 or 2>:TRIGger:SOURcespace<PEak Sensor triggering INTERNAL, EXTERNAL or CW> OUTPUT @Pwr_mtr;SENS1:TRIG:SOUR CW	Set sensor 1 peak trigger mode to CW mode	2-40
SENSe<sensor 1 or 2>:TRIGger:SOURce? OUTPUT @Pwr_mtr;SENS1:TRIG:SOUR? Response is INT, EXT or CW	Query sensor 1 peak trigger mode	2-40
SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]:space <Peak Sensor sample delay in seconds from -20e-9 to 104e-3> OUTPUT @Pwr_mtr;SENS1:TRIG:DEL 1e6	Set sensor 2 peak delay value to 1e6 seconds	2-40
SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]? OUTPUT @Pwr_mtr;SENS1:TRIG:DEL? Response is Peak Sensor sample delay in seconds from 20e-9 to 104e-3	Query sensor 1 peak delay value	2-41
SENSe<sensor 1 or 2>:TRIGger:DELay:STATespace<ON or OFF> OUTPUT @Pwr_mtr;SENS1:TRIG:DEL:STAT ON	Enable peak sensor 1 delay function	2-41
SENSe<sensor 1 or 2>:TRIGger:DELay:STATe? OUTPUT @Pwr_mtr;SENS1:TRIG:DEL:STAT? Response is 1 for ON or 0 for OFF	Query peak sensor 1 delay function	2-41

Command Syntax Typical Example	Function	Ref Page
SENSe<sensor 1or2>:TRIGger:LEVel[:MAGnitude]space <trigger level of peak power sensor. In EXT triggering use 0.1 to 5.1 V. In INT triggering use -30 to +20 dBm> OUTPUT @Pwr_mtr;SENS1:TRIG:LEV 1.7	Set peak sensor 1 trigger level to 1.7 volts	2-41
SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]? OUTPUT @Pwr_mtr;SENS1:TRIG:LEV? Response is the current peak power sensor trigger level setting - a single value in volts or dBm	Query peak sensor 1 trigger level	2-41
SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude] OUTPUT @Pwr_mtr;SENS1:TRIG:OFFS 0	Set peak sensor 1 trigger offset time to 0 second	2-41
SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]? OUTPUT @Pwr_mtr;SENS1:TRIG:OFFS? Response is the current peak power sensor trigger offset setting - a single value in seconds	Query peak sensor 1 trigger offset time	2-42
SENSe<sensor 1 or 2>:TRIGger:TOTAL[:MAGnitude]? OUTPUT @Pwr_mtr;SENS1:TRIG:TOTA? Response is the current peak power sensor total trigger delay setting - a single value in seconds	Query peak sensor 1 total trigger delay time	2-42
*SREspace<event status register value, 128, 64, 32, 16, 8, 4, 2, 1> OUTPUT @Pwr_mtr;*SRE 32	Enable bit 5 of Status Byte register	2-49
*SRE? OUTPUT @Pwr_mtr;*SRE? Response is the status register mask value	Query Bits Enabled of Status Byte register	2-49
STATus:OPERation[:EVENT]? OUTPUT @Pwr_mtr;STAT:OPER? Response is Operation Status Register value. Sum of on bits 0 to 14 expressed as 2^n	Query operation event register result	2-49
STATus:PRESet OUTPUT @Pwr_mtr;STAT:PRES	Clears all the status register value	2-49 2-60
*STB? OUTPUT @Pwr_mtr;*STB? Response is status byte value. Sum of on bits 0 to 7 expressed as 2^n	Query status byte register	2-50
SYSTem:ERRor? OUTPUT @Pwr_mtr;SYST:ERR? Response is an error number value followed by a comma followed by an error information string in quotes	Query system error message	2-68
SYSTem:PRESet OUTPUT @Pwr_mtr;SYST:PRES	Reset 58542 configuration	2-60
SYSTem:VERSion? OUTPUT @Pwr_mtr;SYST:VERS? Response is the SCPI command set version, 1990.0	Query SCPI version	2-62
*TRG OUTPUT @Pwr_mtr;*TRG	VXI cont. BUS Trigger Event	2-24
TRIGger[:IMMediate] OUTPUT @Pwr_mtr;TRIG:IMM	Trigger measurement cycle	2-24
TRIGger:SOURcespace<instrument triggering source IMMediateBUS, HOLD, or EXTernal> OUTPUT @Pwr_mtr;TRIG:SOUR IMM	Set instrument measurement trigger source to IMMediate	2-24

Command Syntax Typical Example	Function	Ref Page
TRIGger:SOURce? OUTPUT @Pwr_mtr;TRIG:SOUR? Response is instrument triggering source IMM, BUS, HOLD, or EXT	Set instrument measurement trigger source	2-24
TRIGger:MODEspace<burst mode data gathering POST trigger receipt or PRE trigger receipt> OUTPUT @Pwr_mtr;TRIG:MODE POST	Set Burst or Swift mode data collection relative to Timing of event trigger post	2-25
TRIGger:MODE? OUTPUT @Pwr_mtr;TRIG:MODE? Response is PRE or POST	Query Burst or Swift mode returns PRE or POST	2-25
TRIGger:DELayspace<delay time between buffered readings in sec 0.000 to 5.000> OUTPUT @Pwr_mtr;TRIG:DEL 5e-3 OUTPUT @Pwr_mtr;TRIG:DEL 0	Set Burst mode measurement time to 5 ms between measurements (resolution, one msec)	2-25
TRIGger:DElay? OUTPUT @Pwr_mtr;TRIG:DEL? Response is a single number indicating the number of seconds between readings. Resolution to 0.001	Query Burst mode measurement time returns delay value	2-25
TRIGger:COUNtspace<number of data values to buffer in memory from 1 to 5000 for standard 58542s from 1 to 128,000 on one channel with option 02; from 1 to 64000 for two channels with option 02> OUTPUT @Pwr_mtr;TRIG:COUN 100	Set Burst or Swift mode buffer reading number to 100	2-26
TRIGger:COUNt? OUTPUT @Pwr_mtr;TRIG:COUN? Response is a single number - the number of data points stored in memory during Burst or Swift modes	Query Burst or Swift mode buffer number	2-26
*TST? OUTPUT @Pwr_mtr;*TST? Response is a 0 when self test passes	Query self-test result	2-65
*WAI OUTPUT @Pwr_mtr;*WAI	Wait, following command completion	2-26

2.5.11 Sensor Calibration and Zeroing

CALibrate<sensor 1 or 2>
CALibrate<sensor 1 or 2>:ZERO
CALibrate<sensor 1 or 2>:STATe?
SENSe<sensor 1 or 2>:TEMPerature

Sensor Calibration

The CALibration commands for sensor calibration and zeroing are important for accurate power measurement results. Be sure to perform the sensor calibration prior to beginning measurement operation or channel configuration. Sensors must be calibrated to the meter before performing measurements.

Zeroing of all active sensors should always be performed whenever a second sensor (whether calibrated or not) is added or removed. Zeroing should also be performed prior to measurement of low signal levels — generally within the lower 15 dB of a sensor's dynamic range. For Standard Sensors, this is -55 dBm.

CAL#

CALibration<sensor 1 or 2>[:SENSor]
OUTPUT @Pwr_mtr;CAL1 ! Calibrate Sensor 1

Description

This command will begin the sensor power sweep calibration process. Power sweep calibration can only be performed during Normal mode. The sensor must be attached to the front panel CALIBRATOR (use an adapter for high frequency sensors with Type K connectors). If the sensor is not connected or if the sensor is disconnected during the power sweep calibration procedure, the calibration automatically fails and the sensor power sweep calibration table is restored to its previous values.

CAL#?

CALibration<sensor 1 or 2>[:SENSor]?
OUTPUT @Pwr_mtr;CAL1? ! Cal. Sensor 1 & return Pass/Fail status

Response is 0 = pass; 1 = fail

Description

This command executes the same procedure as above except a pass fail flag is automatically output at either the completion of power sweep calibration or detection of failure. A 0 indicates a successful completion of power sweep calibration for the sensor attached to the calibrator port or a cable leading to the calibrator port. A 1 indicates that something has caused a failure. The most common cause is forgetting to connect the sensor to the calibrator.

CALibrate<sensor 1 or 2>:STATe?
OUTPUT @Pwr_mtr;CAL1:STAT? ! Query sensor for calibration status

Response is a 1 if sensor is calibrated, or 0 if sensor is not calibrated.

Description

This command can be used to determine whether or not a particular sensor has been calibrated.

Sensor Zeroing

Zeroing automatically accounts for ground noise and other noise in your measurement system. Measurements will be sensitive to noise induced errors only in the lowest 15 dB of the sensor dynamic range. Be sure to turn off the signal going into the sensor during zeroing, otherwise a failure will be indicated.

CAL#:ZERO

CALibration<sensor 1 or 2>:ZERO
OUTPUT @Pwr_mtr;CAL1:ZERO ! Zero Sensor 1

Description

This command begins the zeroing process. Since you want to offset for measurement circuit noise during zeroing, you want the sensor to remain attached to the measurement circuit during zeroing. Disable the signal source into the sensor. If you cannot disable the signal source, connect the sensor to a grounded connector (preferably RF grounded) or leave the sensor disconnected. Do not connect the sensor to the power meter front panel calibrator port. If the meter detects excessive RF power at the start of the zeroing process (generally above -50 dBm for standard sensors), zeroing will automatically fail.

CAL#:ZERO?

CALibration<sensor 1 or 2>:ZERO?
OUTPUT @Pwr_mtr;CAL1:ZERO? ! Zero Sensor 1 & return Pass/Fail status

Response is 0 = pass; 1 = fail

Description

This command executes the same procedure as above except a pass/fail flag is automatically output at either the completion of zeroing or detection of failure. The most common cause is not turning off the source power before beginning the zeroing process.

SENS#:TEMP?

SENSe<sensor 1 or 2>:TEMPerature?
OUTPUT @Pwr_mtr;SENS1:TEMP? ! Query sensor 1 temperature (in centigrade)

Response is current sensor temperature in degrees centigrade

Description

This command reports sensor temperature. If the temperature varies in your operating environment, monitor the relative temperature variations. If the variation since the previous power sweep calibration exceeds $\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$), perform the power sweep calibration for that sensor.



NOTE: Example programs for Sensor Calibration and Zeroing are contained in Appendix A of this manual.

2.5.12 Reading Power Measurements

FETCh?
MEASure?
READ?
***OPC**

These commands return measurement data from the 58542. During NORMAl Mode the data will be single measurement values. During SWIFt or BURSt Modes, the data will be an array of values. Generally, it is a single array if one sensor is connected and calibrated and a dual array if two sensors are connected and calibrated.

FETC?

FETCh<channel 1 or 2>?
OUTPUT @Pwr_Mtr;FETC1?

! Read previously triggered channel 1 power
! Normal, Swift, or Burst mode data.

Response will be whatever is in the output buffer whether it is a new measurement or an old one.

Description

The FETCh? query command returns postprocessed measurement data from the active channels of the 58542. After receiving FETCh? the 58542 will output the contents of it's active data output buffer. The data size and output format of the buffer is dependent upon channel and measurement mode configuration.

For example, if channel 1 is defined as sensor 1 and channel 2 is defined as sensor 2/1, the FETCh? query command will return the power level incident upon sensor 1 and the ratio of the power levels incident upon sensor 2 and 1. FETCh? is used with NORMAl mode measurements when INITiate:IMMEDIATE is active, and for reading SWIFt and BURSt Mode measurement data from the meter's data buffer.

MEAS?

MEASure<channel 1 or 2>[:SCALar:POWER]?
OUTPUT @Pwr_Mtr;MEAS2?

! Arm, Trigger, and Measure Channel 2
! power in NORMAl mode.

Response is a power measurement.

Description

The MEAS? command returns measured data from the active software calculation channels of the 58542. The MEAS? command will also initiate the trigger cycle and will turn on the Auto Averaging mode; that is, measurement will be triggered and the data will be transmitted from the power meter. This is in contrast to the FETCh? command which is capable of causing immediate output of the measurement data, but not initiating the triggering cycle.

READ?

**READ<channel 1 or 2>[:POWer]?
OUTPUT @Pwr_Mtr;READ2?**

! Trigger measurement and read Channel 2

Response is a power measurement.

Description

The READ[:POWer]? query command triggers measurement and sends the data to the controller. Sending the READ? command will enable the power meter to acquire data at the next instrument trigger and return post-processed measurement data from the active channels of the 58542. READ uses the current sensor averaging setup.

***OPC**

OUTPUT @Pwr_mtr;*OPC

! *OPC allows one time SRQ enable

Description

The *OPC command determines when an operation is completed. This command is generally used to monitor the completion of long measurement sequences. It sets the operation complete bit in the event status register upon completion of operation.

OUTPUT @Pwr_mtr;*OPC?

! send a 1 upon operation complete

Response to this one time operation complete query is a 0 or a 1.

Description

Query responds by sending a 1 or a 0, respectively, to indicate operation complete or not complete.

Special Errors

If you are seeing an unusual or non-sense numeric response, such as 9e+40, it indicates that you are getting an error response. For instance, if you have not performed the power sweep calibration procedure to calibrate the sensor to the power meter, the response to a MEAS#? command will be 9.0000e+40.

Selected basic SCPI syntax and execution errors apply to these commands.

If you are using the READ#? measurement query and INIT:CONT is ON, you will get a bad value returned, 9e+40. If you send SYST:ERR? error query, -213, Init ignored will be returned. READ#? contains the low level function INIT, since INIT:CONT is ON the INIT within READ#? generates an error. Set INIT:CONT to OFF when using READ#?.

There are no device-specific errors for the preset configuration or status reset commands except the high level -300, Device-specific error response.



NOTE: Example programs for Reading Power Measurements are contained in Appendix A of this manual.

2.5.13 Instrument Triggering

***TRG**

TRIGger[:IMMediate]

TRIGger:SOURce

TRIGger:MODE

TRIGger:DELay

TRIGger:COUNt

INITiate:CONTinuous

INITiate[:IMMediate]

***WAI**

These SCPI commands are used to trigger the measurement cycle. They do not configure or provide triggering for Peak Power Sensors. Those commands are defined in Section 2.5.18. For power meter operation, the TRIGger Subsystem is divided into two sections; Instrument Measurement Event Triggering, and Special Triggering Configuration commands for the fast reading buffered data, Burst, and Swift modes.

The query form of these commands returns the configuration status. This verifies triggering configuration or returns current status information following command errors.

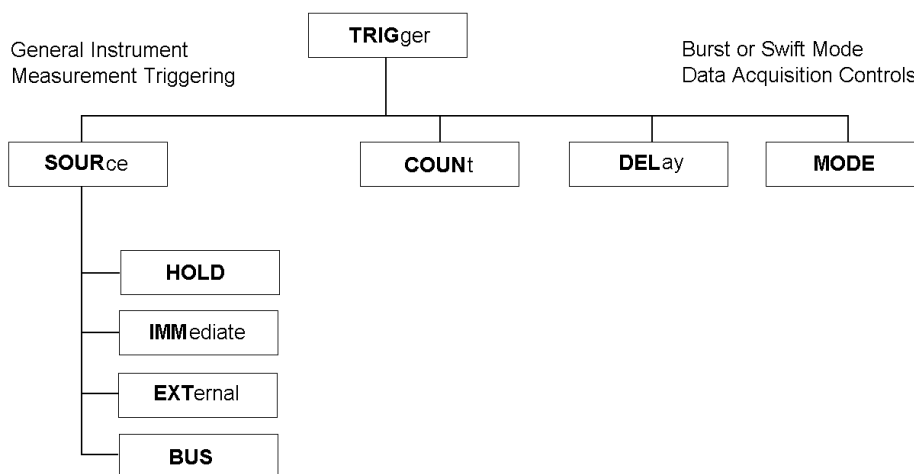


Figure 2-8. TRIGger Subsystem Command Tree

EXT triggering is performed with the front panel BNC connector and functions only in the BURSt and SWIFt Modes. EXT triggering is not available in the NORMAl Mode. Provision has been made for a hardware ready for new trigger type handshaking capability using the analog output.

BUS triggering is available for all operating modes, BURSt, SWIFt, and NORMAl.

IMMediate triggering allows the 58542 to free run and continuously perform measurements. This is the default setting. You may also want to INITiate on IMMediate to increase measurement speed. During Normal Mode, with both of these controls set to IMM, power measurements can be read with MEAS, READ, or FETCh. IMMediate triggering is not compatible with the BURSt Mode. If you send the CALC#:MODE BURS command to enter the BURSt Mode, IMM instrument triggering for NORMAl Mode will automatically be switched to TRIG:SOUR BUS. If you send the CALC#: MODE SWIF command to enter the SWIFt Mode, IMM instrument triggering will remain IMM but a device-specific error will be generated whenever you specify a TRIG:COUN# higher than 1.

***TRG**

***TRG**
OUTPUT @Pwr_mtr;*TRG ! VXI BUS Trigger Event

Description
*TRG is an IEEE-488.2 compatible programming command to initiate BUS triggered measurements. The power meter interprets *TRG as a BUS source for instrument triggering events. This command will not trigger Peak Power Sensors. It is the same as the TRIG command.

TRIG

TRIGger[:IMMediate]
OUTPUT @Pwr_mtr;TRIG ! Trigger measurement cycle

Description
TRIG is the SCPI command form of *TRG. The power meter interprets TRIG as a BUS source for instrument triggering events. If INIT:CONT is OFF, measurements using FETCh#? will not proceed until triggering is armed and instrument triggering is actuated.

TRIG:SOUR

**TRIGger:SOURcespace<instrument triggering
source IMMediate, BUS, HOLD, or EXternal>**
OUTPUT @Pwr_mtr;TRIG:SOUR IMM ! Set instrument measurement trigger
! source to IMMediate

Description
TRIG:SOUR IMM sets trigger control to the 58542. BUS triggering sets the triggering control to the controller software using TRIG or *TRG commands. HOLD halts triggering sequences. EXternal sets triggering control to the front panel BNC connector. The following data shows triggering and operating mode compatibility.

Operating Mode	IMM	BUS	HOLD	EXT
NORMal	X	X	X	
SWIFt	X	X		X
BURSt		X		X

If the power meter has been configured for EXT triggering in the BURSt or SWIFt modes and the operating mode is switched to NORMal, the triggering configuration remains EXT. However, if the configuration is IMM in NORMal mode and the meter is switched to BURSt, it automatically switches to BUS. As a general rule, when a measurement subroutine switches operating modes, you should send the triggering configuration.

TRIGger:SOURce?
OUTPUT @Pwr_mtr;TRIG:SOUR? ! Set instrument measurement trigger
! source

Response is instrument triggering source IMM, BUS, HOLD, or EXT.

Description
This query responds with the current setting of the TRIG:SOUR command.

TRIG:MODE

TRIGger:MODE*space*<burst mode data gathering
POST trigger receipt or PRE trigger receipt>
OUTPUT @Pwr_mtr;TRIG:MODE POST

! Set Burst or Swift mode data collection
! relative to Timing of event trigger post

Description

This command is only for BURSt Mode measurements. Send this command only immediately after CALC#:MODE BURS. TRIG:MODE controls the operation of the FIFO data buffer inside the power meter. When set to POST, the burst of data points is taken after the receipt of a valid instrument trigger. When set to PRE, the burst of data is assumed to be those data points that have arrived immediately preceding the valid instrument trigger event. Using PRE requires some caution: The single processor inside the 58542 is constantly performing data acquisition. If you send any configuration commands while it is collecting the PRE trigger data, you may interrupt the timing of the data point collection.

TRIGger:MODE?
OUTPUT @Pwr_mtr;TRIG:MODE?

! Query Burst or Swift mode returns

Response is PRE or POST.

Description

This query command responds with the current setting of the BURSt mode pre- or post-triggered data collection. The query can be used in any operating mode.

TRIG:DEL

TRIGger:DEL*ayspace*<delay time between
buffered readings in sec, 0.000 to 5.000>
OUTPUT @Pwr_mtr;TRIG:DEL 5e-3

! Set Burst mode measurement time to
! 5 ms between measurements.

OUTPUT @Pwr_mtr;TRIG:DEL 0

! Max. measurement rate (resolution, 1 msec)

Description

This command applies only to the BURSt Mode. It sets the time interval between the measurements and is accurate to about 5%. This is the only way to control the data acquisition of individual data points in a burst measurement. Burst measurement data is taken following or just prior to a single instrument trigger event. The number of measurements taken is controlled by TRIG:COUNt. Timing can be set in 0.001 second increments from 0.000 to 5.000 seconds, inclusive. Setting this control to 0.000 activates the highest reading rate (5100 rdgs/sec) possible with the 58542.

Triggering of the Peak Power Sensor occurs independently from instrument triggering. Therefore, there is a moderate ability to control triggering at the Peak Power Sensors. Generally, if you require control of individual data point triggering, the SWIFt mode will provide the highest measurement rates, with or without SRQ or hardware handshaking.

TRIGger:DEL*ay?*
OUTPUT @Pwr_mtr;TRIG:DEL?

! Query Burst mode measurement time
! returns delay value

Response is a single number indicating the number of seconds between readings. Resolution to 0.001.

Description

This query returns the current setting of the delay time interval between burst mode data points.

TRIG:COUN

TRIGger:COUNT*space***<number of data values to buffer in memory from 1 to 5000 for standard 58542s, from 1 to 128,000 on one channel with option 02, and 1 to 64000 for two channels with option 02>**

OUTPUT @Pwr_mtr;TRIG:COUN 100

! Set Burst or Swift mode buffer reading
! number to 100

Description

The power meter has an internal and expandable data buffer for storing measurement data until the slot 0 controller/resource manager is ready to read the data. During the SWIFt or BURSt modes, this command controls the number of power readings that are stored in the 58542 data buffer.

The value specified here applies to each individual channel. That is, if two sensors are attached and calibrated, the 58542 will perform the specified measurement and buffering for both channels. In the example shown below for this command, that would be 100 points per channel. Option 02 adds additional memory for 128,000 data point buffering. When two sensors are attached and calibrated, the maximum is 64,000 readings per channel.

During BURSt mode, the COUNT# of readings will be taken with just one instrument trigger. During the SWIFt Mode however, you can control the triggering of individual data points. If you set triggering to EXT, the power meter will perform one measurement each time it detects a TTL level signal. The value is then stored in the data buffer. This continues until the meter has received and processed a COUNT# of triggers and also read in a COUNT# of data points to the buffer.

TRIGger:COUNT?

OUTPUT @Pwr_mtr;TRIG:COUN?

! Query BURSt or SWIFt mode buffer number

Response is a single number - the number of data points to be stored in memory during Burst or Swift modes.

Description

This query returns the current setting of the number of data points to collect in the meter's internal data buffer during BURSt or SWIFt Mode.

*WAI

OUTPUT @Pwr_mtr;*WAI

! Wait, following command completion

Description

The *WAI command causes the power meter to wait until all previous commands and queries are completed before continuing operation. It functions only when using the Normal mode of operation.



NOTE: Example programs for Instrument Triggering are contained in Appendix A of this manual.

2.5.14 Arming the TRIGgering Cycle

INITiate:CONTinuous INITiate[:IMMEDIATE]

The INITiate commands enable the power meter to acquire measurement data at the next instrument trigger. In the absence of an instrument signal, the 58542 is placed in the waiting-for-trigger-state. The default configuration is continuous initiation, INIT:CONT ON.

INITiate[:IMMEDIATE] causes the power meter to exit the idle state and causes the trigger system to initiate and complete one full trigger cycle, returning to the idle state upon completion. For example, INITiate[:IMMEDIATE] can be used with Peak Power Sensors to measure the power level of transient or one-shot pulsed microwave signals. After execution of the triggering sequence, send the FETCh? query command to return the measurement data from the 58542.

Triggering configuration is performed with the TRIGger Subsystem commands. When TRIGger:SOURce is IMMEDIATE, the measurement will start as soon as INITiate is sent to the 58542 and executed (or INITiate:CONTinuous ON sent and executed).

INIT:CONT

INITiate:CONTinuous $\langle$ space $\langle$ ON or OFF $\rangle$
OUTPUT @Pwr_mtr;INIT:CONT ON

! Continuous Triggering

Description

This allows user control of measurement cycle arming. When INIT:CONT is set to ON, measurement cycle arming occurs automatically. The default setting is OFF. When you need to take control of arming the triggering of the measurement cycle, set this control to OFF and use MEAS#? or INIT with READ#? to perform the measurement. Another legal measurement control option would be INIT with TRIG: IMM and FETC#?

When INITiate:CONTinuous is ON, the instrument triggering cycle resets continuously. That is, upon instrument triggering, data is constantly being acquired and updated. Upon completion of a trigger cycle, the meter will immediately enter the wait-for-trigger state rather than the idle state, as is the case with INITiate:CONT OFF.

INITiate:CONTinuous?
OUTPUT @Pwr_mtr;INIT:CONT?

! Query ON or OFF status.

Response is 1 for ON or 0 for OFF.

Description

This query returns the current setting of the measurement cycles continuous initiation. This command will quickly identify if initiation is under the control of the power meter or the slot 0 controller/resource manager.

INIT:IMM

INITiate[:IMMEDIATE]

OUTPUT @Pwr_mtr;INIT

! Initiate instrument triggering cycle

Description

The INITiate[:IMMEDIATE] command places the power meter in the wait-for-trigger-state. When used with EXT (TTL levels) instrument triggering, this command is useful for measuring signals that are asynchronous with programming (BUS triggered) sequences. When INITiate:CONTinuous is set to OFF, INITiate[:IMMEDIATE] enables the instrument triggering cycle. Sending INITiate[:IMMEDIATE] when INITiate:CONTinuous is set to ON will cause a -123 command error. The INITiate[:IMMEDIATE] command is an event; no query form exists for this command.

This command enables the triggering cycle. Instrument triggering will not occur unless INIT has been enabled, even when you are sending BUS or EXT triggers to the 58542. Either this command or INIT:CONT ON performs measurements with FETCh? and READ?. MEAS? is a high level function which contains the INITiation enabling function. Arming occurs automatically when using the MEAS#? command to automatically INITiate, TRIGger and FETCh the measurement data. However, if you are using READ#? or FETCh#? to read data, this command arms the 58542 for triggering upon the occurrence of the next valid trigger.



NOTE: Example programs for Arming the TRIGgering Cycle are contained in Appendix A of this manual.

2.5.15 Channel Configuration

CALCulate:POWer
 CALCulate:RATio
 CALCulate:DIFFerence
 CALCulate?
 CALCulate:UNIT
 CALCulate:STATE

CALC#:POW

CALCulate<channel 1 or 2>[:CHANnel]:POWerspace
 <sensor 1 or 2>

OUTPUT @Pwr_mtr;CALC2:POW 1

! Configures channel 2 to
 ! measure Sensor 1 power

Description

This command configures a sensor to an individual channel, and the channel measures the sensor power level. This command does not have a query format. For the example above, the response to a CALC2? query is POW 1. This command should be executed only after the designated sensor has been calibrated.

CALC#:RAT

CALCulate<channel 1 or 2>[:CHANnel]:RATiospace
 <sensor 1 or 2>comma<sensor 2 or 1>

OUTPUT @Pwr_mtr;CALC1:RAT 2,1

! Configures channel 1 to measure
 ! Sensor 2 over Sensor 1 power

Description

This command configures a channel as a ratio of the power levels present at the two sensors. When UNITS are dBm, RATio configuration produces measurements in dB. When UNITS are W, RATio configuration measurements are percentage. This command does not have a query format. For the above example, the response to a CALC1? query is RAT 2,1. This command should be executed only after the designated sensor has been calibrated.

CALC#:DIFF

CALCulate<channel 1 or 2>[:CHANnel]:DIFFerencespace
 <sensor 1 or 2>comma<sensor 2 or 1>

OUTPUT @Pwr_mtr;CALC1:DIFF 2,1

! Configures channel 1 to measure
 ! Sensor 2 minus Sensor 1 power

Description

This command configures a channel as the difference between the power levels present at the two sensors. UNITS are dBm or Watts. This command does not have a query format. For the above example, the response to a CALC1? query is DIFF 2,1. This command should be executed only after the designated sensor has been calibrated.

CALC#?

**CALCulate<channel 1 or 2>[:FUNCTION]?
OUTPUT @Pwr_mtr;CALC2?**

! Query channel 2 sensor Configuration

Response is POW #, RAT #,#, or DIFF #,#

Description

This command returns the current channel configuration. This command is a query format only.

CALC#:UNIT

**CALCulate<channel 1 or 2>:UNIT[:POWER]space<
data units selection, DBM or Watt>**

OUTPUT @Pwr_mtr;CALC1:UNIT W

! Selects channel 1 Linear Units, Watts

OUTPUT @Pwr_mtr;CALC1:UNIT DBM

! Selects channel 1 Log Units, dBm

Description

This command configures a channel to report power measurements in either linear Watts units or logarithmic dBm units. When UNITs are dBm, the RATio configuration produces measurements in dB and POWER and DIFF measurements in dBm. When UNITs are Watts, the RATio configuration measurements are percentages, and POWER and DIFF measurements are in Watts.

**CALCulate<channel 1 or 2>:UNIT[:POWER]?
OUTPUT @Pwr_mtr;CALC1:UNIT?**

! Query channel 1 Units Configuration

Response is DBM, or W.

Description

This command is the query format of the command above.

CALC#:STAT

**CALCulate<Channel 1 or 2>:STATspace<ON or OFF>
OUTPUT @Pwr_mtr;CALC1:STAT OFF**

! Disable channel 1 measurement

Description

This command turns a channel off or on. Default is ON. During Normal and Swift modes, measurement speed increases when only one sensor (Channel configuration is CALC#:POW) is performing measurements.

**CALCulate<channel 1 or 2>:STATe?
OUTPUT @Pwr_mtr;CALC1:STAT?**

! Query channel 1 measurement status

Response is 0 = off, 1 = on.

Description

This command is the query format of the command above.



NOTE: Example programs for Channel Configuration are contained in Appendix A of this manual.

MEM:SEL

MEMory[:TABLE]:SElectspace
<ANALOGout,VPROPF1,VPROPF2>

OUTPUT @Pwr_mtr;MEM:SEL VpROPF1

! Select memory table VpROPF1
! for editing in following lines

Description

This command selects between one of three editable tables. Using the meter's automated VpropF capability to correct for Cal Factor requires that you configure the VpropF IN connector to match the signal that your source will output. This is performed by setting the frequency so that your source's VpropF output is 0.0 V. Then the slope relationship is entered in the form of a value representing the V/Hz relationship. If your source is a Giga-tronics GT 9000 Series Signal Generator, this relationship is 0.5 V/GHz or 5e-8 V/Hz.

VpropF Configuration

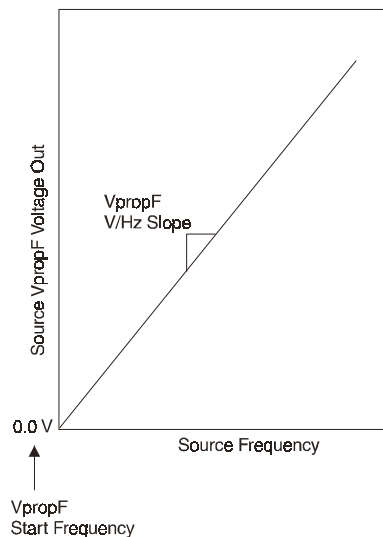


Figure 2-9. VPROpf Configuration

MEMory[:TABLE]:SElect?
OUTPUT @Pwr_mtr;MEM:SEL?

! Query the selected memory table

Response is the table currently editable; ANALOG, VPROPF1 or VPROPF2.

Description

This command reports the currently active, editable table.

MEM:SLOP

MEMory[:TABLE]:SLOPe*space*<Volts per Hz>
OUTPUT @Pwr_mtr;MEM:SLOP 1e-9 ! Set VpropF slope to 1 V/Hz

Description

This command sets the V/Hz relationship for automated Cal Factor correction.

MEMory[:TABLE]:SLOPe?
OUTPUT @Pwr_mtr;MEM:SLOP? ! Query VpropF slope value

Response is the voltage to frequency value you set that corresponds to your source's VpropF output.

Description

This command returns the V/Hz slope relationship for VpropF frequency correction.

MEM:FREQ

MEMory[:TABLE]:FREQuency*space*<Start frequency>
OUTPUT @Pwr_mtr;MEM:FREQ 1e9 ! Set VpropF frequency to 1 GHz.

Description

This command sets the automated VpropF correction start frequency. The frequency at which the voltage input into the 58542 is 0.0 V.

MEMory[:TABLE]:FREQuency?
OUTPUT @Pwr_mtr;MEM:FREQ? ! Query VpropF start frequency

Response is the frequency value you set that corresponds to your source's VpropF output at 0.0 V.

Description

This VpropF command reports the start frequency setting.

SENSe<sensor 1 or 2>:CORRection:
VPROpf[:STATe]*space*<ON-OFF>
OUTPUT @Pwr_mtr;SENS1:CORR:VPRO ON ! Enable sensor 1 VpropF function

Description

Setting this control to ON activates VpropF and deactivates SENS#:CORR:FREQ.

SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]?
OUTPUT @Pwr_mtr;SENS1:CORR:VPRO? ! Query VpropF function status

Response is 1 for ON or 0 for OFF.

Description

This command reports the ON or OFF status of VpropF correction for the Sensor.

Frequency response variations (which are reflected in Cal Factors in Giga-tronics sensors) do not change appreciably over small frequency ranges. That is, the frequency that you send to the power meter does not need to be exact. If the actual measurement frequency is within about 40 MHz of the value sent to the power meter, your measurement variation due to this discrepancy will typically be less than 0.02 dB, well below typical RSS measurement accuracy levels.

Return Loss Bridges do not have Cal Factors loaded into their built-in EEPROMs. Because operation of return loss bridges require relative or referenced measurements, frequency response correction is unnecessary. Therefore, Giga-tronics Precision Return Loss Bridges are not programmed with Cal Factor data.



NOTE: Example programs for Cal Factor Corrections are contained in Appendix A of this manual.

Cal Factor Error Control

See Error Messages in Section 2.5.33.

Selected basic SCPI syntax and execution errors apply to these commands.

Device-specific errors include the following and other -300 level errors.

A common device-specific error occurs when the frequency sent to the 58542 in the SENS#:CORR:FREQ ### command is outside the sensor operating frequency range. For example, sending SENS1:CORR:FREQ 18.4e9 when an 18 GHz max. 80301A CW Power Sensor is attached will yield a device-specific error.

2.5.17 High Speed Measurements

CALCulate:DATA?

CALCulate:MODE

TRIGger:MODE

TRIGger:DELay

TRIGger:COUNt

Measurements in Normal mode are fastest with only one sensor attached. When two sensors are attached, the Normal mode measurement rate is reduced. This applies for all three major measurement commands, FETCh, READ, and MEASure. Both of the averaging types, MOVing and REPeat, slow down when in the Normal mode. MOVing provides faster averaging; the speed is equivalent to REPeat whenever the Averaging number is 1.

When performing measurements in either Swift or Burst modes, measurement rates are the same with two sensors as with one sensor. Approximate measuring speeds are listed in Table 2-3.

CALC:DATA?

CALCulate<channel 1 or 2>:DATA?

OUTPUT @Pwr_mtr;CALC1:DATA?

! Query channel 1 & 2 BURSt mode data

Description

This command interrupts the burst measurement and dumps the measurement buffer. All empty locations will be filled with -300 before the data dump. The Burst mode remains active after this command so that a trigger will start a new measurement reference.

The command returns measurement data (while the measurement is completing) during BURSt mode only. This command is not used in NORMal or SWIFt Modes. Operation is similar to using FETCh? Both are instrument (not channel) commands. That is, when both sensors are connected, calibrated, and the channel set to ON, this command will return power level data for both channels.

Operating Mode Control

The Operating mode is controlled through the CALC#:MODE command. The choices are NORMal, BURSt, and SWIFt. Sending CALC1:MODE will set the operating mode for the entire instrument, not just for channel 1. For example, you cannot send CALC1:MODE BURS, and then CALC2:MODE SWIF to get channel 1 in BURSt mode and channel 2 in SWIFt mode. After the CALC2:MODE SWIF command, both channels are in SWIFt mode.

CALC:MODE

**CALCulate<channel 1 or 2>:MODEspace<NORMal,
BURSt, or SWIFt Mode Selection>**

OUTPUT @Pwr_mtr;CALC2:MODE SWIF

! Set measurement mode to SWIFt

Description

This command sets the measurement mode. This is NOT a channel-specific command; it is an instrument configuration command. Selecting one channel changes both channels to the desired mode. Use this command to select the level of functionality and performance for your unique applications. NORMal Mode is full functioned. SWIFt Mode allows individual data point triggering. BURSt Mode allows the fastest measurement rates.

CALCulate<channel 1 or 2>:MODE?
OUTPUT @Pwr_mtr;CALC1:MODE?

! Query 58542 measurement mode

Response is NORM, SWIF, or BURS.

Description

This query returns the current operating mode.

The following commands are duplicates of those given in the Instrument Triggering section of this chapter, and are shown here for convenience. These commands must be used with BURSt mode operation.

TRIG:MODE

TRIGger:MODEspace<burst mode data gathering POST trigger receipt or PRE trigger receipt>
OUTPUT @Pwr_mtr;TRIG:MODE POST

! Set Burst or Swift mode data collection

! relative to Timing of event trigger post

Description

This command is only for BURSt Mode measurements. Send this command only after CALC#:MODE BURS. TRIG:MODE controls the operation of the FIFO data buffer in the 58542. When set to POST, the burst of data points is taken after the receipt of a valid instrument trigger. When set to PRE, the burst of data is assumed to be those data points that have arrived immediately preceding the valid instrument trigger event. Using PRE requires some caution: the single processor inside the 58542 is performing data acquisition constantly. If you send any configuration commands while the 58542 is collecting the PRE trigger data, you may interrupt the timing of the data point collection.

TRIGger:MODE?
OUTPUT @Pwr_mtr;TRIG:MODE?

! Query Burst or Swift mode returns

Response is PRE or POST.

Description

This query command responds with the current setting of the BURSt mode pre- or post-triggered data collection. Query can be used in any operating mode.

TRIG:DEL

TRIGger:DELayspace<delay time between buffered readings in sec, 0.000 to 5.000>
OUTPUT @Pwr_mtr;TRIG:DEL 5e-3

! Set Burst mode measurement time to

! 5 ms between measurements.

OUTPUT @Pwr_mtr;TRIG:DEL 0

! Max. measurement rate, 5100/sec.
(resolution, one msec)

Description

This command applies only to BURSt Mode. It sets the time interval between the measurements; it is accurate to about 5%. This is the only way to control the meter's data acquisition of individual data points in a burst measurement. Burst measurement data is taken following or just prior to a single instrument trigger event. The number of measurements taken is controlled by TRIG:COUNt. Timing can be set in 0.001 second increments from 0.000 to 5.000, inclusive. Setting this control to 0.000 activates the highest reading rate possible with 58542; 5100 readings per second.

Triggering of the Peak Power Sensor occurs independently from instrument triggering. There is a moderate ability to control triggering at the Peak Power Sensors. Generally, if you require control of individual data point triggering, SWIFt mode will provide the highest measurement rates, with or without SRQ or hardware handshaking. The 58542 controls its gain ranges transparently by verifying

internal range changes just before and just after individual measurement points. If the internal range does not remain the same, the data point will be discarded as invalid.

TRIGger:DELAy?

OUTPUT @Pwr_mtr;TRIG:DEL?

! Query Burst mode measurement time

! returns delay value

Response is a single number indicating the number of seconds between readings. Resolution to 0.001.

Description

This query returns the current setting of delay time interval between burst mode data points.

TRIG:COUN

TRIGger:COUNTspace<number of data values to buffer in memory from 1 to 5000 for standard 58542s, from 1 to 128,000 on one channel with option 02 and 1 to 64000 for two channels with option 02>

OUTPUT @Pwr_mtr;TRIG:COUN 100

! Set Burst or Swift mode buffer reading

! number to 100

Description

The 58542 has an internal and expandable data buffer for storing measurement data until the slot 0 controller/resource manager is ready to read the data. During SWIFt or BURSt modes, this command controls the number of power readings that are stored in the 58542 data buffer.

The value specified here applies to each channel. If two sensors are attached and calibrated, the 58542 will perform the specified measurement and buffering for both channels. In the example above, that would be 100 points per channel. Option 02 adds additional memory for 128,000 data point buffering. This applies only to a single channel. When two sensors are attached and calibrated, the maximum is 64,000 readings per channel.

During BURSt mode, the COUNT # of readings will be taken with just one instrument trigger. During SWIFt Mode however, you can control the triggering of individual data points. If you set triggering to EXT, the 58542 will perform one measurement each time a TTL level signal is detected by the 58542. Then the value is stored in the data buffer. This continues until the 58542 has received and operated the COUNT # of triggers and also read in the COUNT # of data points to the buffer.

TRIGger:COUNt?

OUTPUT @Pwr_mtr;TRIG:COUN?

! Query Burst or Swift mode buffer

! number

Response is a single number - the number of data points stored in memory during Burst or Swift modes.

Description

This query returns the current setting of the number of data points to collect in the meter's internal data buffer during BURSt or SWIFt Mode.

Approximate Measurement Speeds

Table 2-3 lists the 58542 approximate measurement speeds in readings per second.

Table 2-3. Approximate Measurement Speeds

Range (dBm)	22 to 4	6 to -10	-7 to -21	-18 to -30	-27 to -37	-35 to -48	-46 to -66	-64 to -99
Normal 1	53	53	53	53	53	53	53	53
Normal 2	23	23	23	23	24	6.9	6.6	5.8
Normal 3	22	22	22	16	17	0.5	0.06 ²	0.06 ²
Swift IMM	71	71	71	71	71	71	71	71
Swift Bus 1	39	39	39	39	40	25	25	25
Swift Bus 2	53	53	53	53	56	24	24	24
Swift Ext	150 ¹	150 ¹	150 ¹	150 ¹	150 ¹	150 ¹	150 ¹	150 ¹
Burst ³	5100	5100	5100	5100	5100	5100	5100	5100

Notes:

1. HP 9000-300 Computer, HP BASIC Language, HP-E1505B Controller
2. Speed will be 0.24 for average number of 32, and 0.12 for average number of 64
3. Speed only includes measurement time

Normal 1: SENS1:AVER:TCON MOV
 INIT:COUN ON
 FETC1

Normal 2: SENS1:AVER:TCON MOV
 MEAS1?

Normal 3: SENS1:AVER:TCON REP
 MEAS1?

Swift Imm

Swift Bus 1: (SRQ Handshake)

Swift Bus 2: (without SRQ Handshake)

Swift Ext: (without TTL Handshake)

Burst

Triggering Notes

Also refer to Instrument Triggering in Section 2.5.13 for more information.

EXT triggering is performed with the front panel BNC connector and will only work in BURSt and SWIFt Modes. EXT triggering is not available in NORMal Mode. Provision has been made for a hardware ready type handshaking capability using the analog output. This feature can be used as a loop back test when performing troubleshooting procedures.

BUS triggering is available for all operating modes, BURSt, SWIFt and NORMal.

IMMediate triggering is not compatible with BURSt and SWIFt Modes. If you send the CALC#:MODE BURS command to enter the BURSt Mode, IMM instrument triggering for NORMal Mode will automatically be switched to TRIG:SOUR BUS. If you use the CALC#:MODE SWIF command to enter the SWIFt Mode, IMM instrument triggering will remain IMM, but a device-specific error will be

generated whenever you specify a TRIG:COUN # higher than 1. Using the FETCh#? measurement query, you can take accurate measurements anyway; do not set TRIG:COUN.

Using FETCh#? when you have time-dependent measurement processes can be a little tricky unless you use SRQs. If the 58542 has not had enough time to process the measurement or has not received a trigger, it will return an abnormally large number — 9.e40 is common, but other obviously invalid readings can occur. Not using SRQs is fastest for measurement speed, but you will have to manage the measurement/triggering timing problem closely.

Measurement Level Notes

The SWIFt Mode should not be used for measuring power in the bottom 10 dB of the CW dynamic range. At low power levels, the NORMal mode reduces the measurement speed to account for the effects of noise.



NOTE: Example programs for High Speed Measurements are contained in Appendix A of this manual.

2.5.18 Peak Power Sensor Triggering

SENSe:TRIGger

The Peak Power Sensors sample power levels almost instantaneously. Since there is a sampler built into the Peak Power sensor housing, there are several controls to configure the source of the sensor trigger signal. These include the delay time from triggering to when the sample is to be taken (Sample Delay), and the trigger level.

All Peak Power Sensors will operate in the SWIFt and BURSt modes when in the CW measurement mode (SOURce) configuration (not when using INT or EXT trigger).

```
SENSe<sensor 1 or 2>:TRIGger:SOURcespace
<INTERNAL, EXTERNAL, or CW>
OUTPUT @Pwr_mtr;SENS1:TRIG:SOUR CW      ! Set sensor 1 peak trigger mode to CW mode
```

Description

This command controls the trigger source for the sensors. Both the 80350A Series and 80340 Series of Peak Power Sensors respond to this command. INTERNAL triggering is performed automatically by the 80350A Sensor; however, the trigger level must be set to a value of power that is lower than the power level of the pulsed signal incident upon the sensor. EXTERNAL triggering is performed by inputting a baseband pulse into the rear connector on the sensor housing. BNC to SMB cables have been provided for this purpose. For high speed trigger pulses, SMB to SMA adapters are available from Giga-tronics. CW triggering sets the power sensors to measure CW power and triggering is essentially disabled. CW is automatically set by the 58542 during power sweep calibration; do not apply any triggering to the peak power sensor during power sweep calibration.

Be sure to set the trigger level, SENS:TRIG:LEV ### after the INTERNAL or EXTERNAL triggering is selected.

```
SENSe<sensor 1 or 2>:TRIGger:SOURce?
OUTPUT @Pwr_mtr;SENS1:TRIG:SOUR?      ! Query sensor 1 peak trigger mode
```

Response is INT, EXT, or CW.

Description

This command reports the current trigger source setting.

```
SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]:space
<delay in seconds from -20e-9 to 105e-3>
OUTPUT @Pwr_mtr;SENS1:TRIG:DEL 1e-6    ! Set sensor 2 peak delay value to 1e-6
seconds
```

Description

The SENS:TRIG:DEL # is the time in seconds between the 80350A Series Peak Power Sensor's receipt of a sensor trigger (INT is auto, EXT is a trigger input) and the time that the sampler is fired. This delay is typically accurate to about 0.5%; repeatability is an order of magnitude better. There is a delay line built into the peak power sensor. Therefore, you can measure the power on the leading edge of the pulsed signal even if it is the same edge on which the sensor was triggered. This also allows limited look ahead capability as identified by the allowed negative time values for this command. The other reason negative time values are allowed is due to the sample delay offset capability. (The 80340 Series of Peak Power Sensors do not support this command.)

SENSe<sensor 1 or 2>:TRIGger:DELAy[:MAGnitude]?
OUTPUT @Pwr_mtr;SENS1:TRIG:DEL? ! Query sensor 1 peak delay value

Response is Peak Sensor sample delay in seconds from -20e-9 to 105e-3.

Description

This query reports the current value of the peak power sensor sample delay.

SENSe<sensor 1 or 2>:TRIGger:DELAy:
STATe:space<ON or OFF>
OUTPUT @Pwr_mtr;SENS1:TRIG:DEL:STAT ON ! Enable peak sensor 1 delay function

Description

This command activates the sample delay in the 80350A Series Peak Power Sensors. The 80340 Peak Power Sensors also respond to this command, but with only a fixed time delay.

SENSe<sensor 1 or 2>:TRIGger:DELAy:STATe?
OUTPUT @Pwr_mtr;SENS1:TRIG:DEL:STAT? ! Query peak sensor 1 delay function

Response is 1 for ON or 0 for OFF.

Description

This query identifies if the DELay:STATe is ON or OFF.

SENSe<sensor 1 or 2>:TRIGger:LEVEl[:MAGnitude]space<
In EXT triggering use -0.1 to 5.000 V.
In INT triggering use -30 to +20 dBm>
OUTPUT @Pwr_mtr;SENS1:TRIG:LEV 1.7 ! Set peak sensor 1 trigger level to 1.7 volts

Description

This command sets the trigger level for the 80350A Series Peak Power Sensors. Under INTERNAL triggering the value is in dBm (-30 to +20 dBm, with default of -20 dBm). When EXTERNAL triggering is used the value is in Volts (-0.100 to 5.000 V, with a default of 1.700 V). The trigger level must be lower than the signal that is triggering the peak power sensor. Under Internal triggering, this means that a -16 dBm signal must be triggered with a setting that is less than -16 dBm. EXT responds similarly. The input impedance to the EXT trigger port on the back of the sensor housing is not 50 ohms: it is a high impedance to prevent damage from triggering inputs such as 5.0 V TTL signals. If you use a high speed 50 Ω trigger source, this may cause unwanted signal reflections and noise on the trigger line. An SMB to SMB attenuator is available from Giga-tronics to alleviate this condition. The attenuation reduces the reflected noise, and reduces/eliminates the noisy trigger characteristics. (80340 Series Peak Power Sensors do not support this command.)

Be sure to set the trigger level after the INTERNAL or EXTERNAL triggering is selected.

SENSe<sensor 1 or 2>:TRIGger:LEVEl[:MAGnitude]?
OUTPUT @Pwr_mtr;SENS1:TRIG:LEV? ! Query peak sensor 1 trigger level

Response is the current peak power sensor trigger level setting; a single value in Volts or dBm.

Description

This query reports the current trigger level setting. Under INTERNAL triggering the value is in dBm. When EXTERNAL triggering is used the value is in volts.

SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]
OUTPUT @Pwr_mtr;SENS1:TRIG:OFFS 0 ! Set peak sensor 1 trigger offset time to 0 second

Description

This command sets the peak power sensor trigger offset time.

(The 80340 Series Power Sensors do not support this command.)

SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]?

OUTPUT @Pwr_mtr;SENS1:TRIG:OFFS? ! Query peak sensor 1 trigger offset time

Response is the current peak power sensor trigger offset setting; a single value in seconds

Description

This query reports the peak power sensor trigger offset time.

SENSe<sensor 1 or 2>:TRIGger:TOTAL[:MAGnitude]?

OUTPUT @Pwr_mtr;SENS1:TRIG:TOTA? ! Query peak sensor 1 total trigger delay time

Response is the current peak power sensor total trigger delay setting; a single value in seconds

Description

This query reports the peak power sensor total trigger delay time

2.5.19 Averaging

SENSe:AVERage

Averaging is applied during normal operating mode. In the normal mode, Avg_n results in $n \times 192$ samples taken. In the Swift or Burst modes, Avg_n results in $2n$ samples taken. Auto averaging takes 4 samples all the time. For auto averaging in the normal mode, the averaging number is level dependent with very low averaging at +20 dBm, and many samples taken at very low levels.

```
SENSe<sensor 1 or 2>:AVERage:COUNTspace
<1,2,4,8,16,32,64,128,256,or 512>
OUTPUT @Pwr_mtr;SENS1:AVER:COUN 16      ! Set sensor 1 average number to 16
```

Description

This command averages successive sensor readings in a digital averaging filter. As the measured signal level approaches the noise floor of the power sensor, measurement data values begin to fluctuate. To measure very low signal levels (within a few dB of the sensor noise floor), set a large value for averaging such as 128, 256, or 512. Be sure to zero the sensor, CALibration:ZERO, prior to critical measurements.

```
SENSe<sensor 1 or 2>:AVERage:COUNT?
OUTPUT @Pwr_mtr;SENS1:AVER:COUN?      ! Query sensor 1 current averaging value
```

Description

This query returns the current averaging value of the meter's internal digital averaging filter.

```
SENSe<sensor 1 or 2>:AVERage:COUNT:AUTOspace<ON or OFF>
OUTPUT @Pwr_mtr;SENS2:AVER:COUN:AUTO ON
                                           ! Select sensor 2 Auto-Averaging mode
```

Description

Auto-Averaging optimizes the measurement averaging value for reading stability and update rate when the measurement data is being repeatedly updated. At high power levels (measured), minimum averaging is applied to optimize measurement speed. As the power level drops, additional averaging is applied to steady the measured data reading.

```
SENSe<sensor 1 or 2>:AVERage:COUNT:AUTO?
OUTPUT @Pwr_mtr;SENS2:AVER:COUN:AUTO? ! Query sensor 2 Auto-Averaging mode
                                           ! ON or OFF status
```

Response is 1 or 0

Description

This query returns the ON or OFF status of the meter's Auto-Averaging.

```
SENSe<sensor 1 or 2>:AVERage:TCONtrolspace<data
acquisition averaging method, MOVing or REPeat>
OUTPUT @Pwr_mtr;SENS1:AVER:TCON REP      ! Set sensor 1 to acquire fresh
                                           ! measurement data before averaging
```

Description

The SENSe:AVERage:TCONtrol commands are instrument level commands that control the internal measurement data averaging of the power meter. Two modes are selectable, MOVing and REPeat.

The MOVing control applies the current measurement to the previously measured data. That is, even if the averaging number is 16, you will get a measurement data point every time a sample is taken, not just after every 16 samples. There is some limited built in level sensing capability. For example,

when Auto-Averaging is used and the power is suddenly changed from a low value to a high, MOVing averaging throws out the very low level previous data as the gain range changes and begins averaging fresh data. Thus, wide abrupt changes in power level are not masked by the MOVing averaging. The 58542 can fully range in about 4 ms. MOVing averaging is similar to TR1 mode in typical benchtop power meters.

REPeat averaging performs full averaging every time the 58542 is triggering. Unless the averaging number is set to 1, REPeat is slower than MOVing averaging. REPeat control is similar to TR2 mode in typical benchtop power meters. Fresh data is measured and averaged with each complete measurement cycle.

SENSe<sensor 1 or 2>:AVERage:TCONtrol?

OUTPUT @Pwr_mtr;SENS1:AVER:TCON?

! Query sensor 1 average method

Response is REP or MOV or NOR.

Description

This query returns the average method chosen by the command form or the default.

2.5.20 Relative or Referenced Measurements

CALCulate:REfERENCE

Relative and referenced measurements are used when one measured value needs to be compared to another measured value on the same channel. For example, this function is used when it is desired to monitor the power level variation around an initial turn on or reference set value.

Referenced measurements are performed when finding the 1 dB compression power of an amplifier or using a return loss bridge. When a stable source is used, a relative measurement is useful for measuring the loss through an attenuator with a single sensor or channel.

Due to the ability to set a specific value of reference using the CALC:REF[:MAG] # command, this reference measurement function can also be used to set your own calibration factors. Thus the channel and sensor offset functions can remain dedicated to other setup dependent controls in your programming.

CALCulate<channel 1 or 2>:REfERENCE:STATe*space***<ON or OFF>**
OUTPUT @Pwr_mtr;CALC2:REF:STAT ON ! Activate level reference for relative
! measurements

Description

This command activates the meter's level reference to give it the ability to perform relative measurements.

CALCulate<channel 1 or 2>:REfERENCE:STATe?
OUTPUT @Pwr_mtr;CALC2:REF:STAT? ! Query ON or OFF status

Response is 0 = off; 1 = on

Description

This query returns the ON or OFF status of the reference function.

CALCulate<channel 1 or 2>:REfERENCE [:MAGnitude]
<dB Offset value from -299.999 to 299.999>
OUTPUT @Pwr_mtr;CALC2:REF -30.11 ! Set channel 2 reference offset value in dB

Description

This command sets the value to subtract from the channel measurement value. This command applies to the channel (1, or 2, or 1/2, ...), not the sensor (1 or 2, only).

CALCulate<channel 1 or 2>:REfERENCE[:MAGnitude]?
OUTPUT @Pwr_mtr;CALC1:REF? ! Query channel reference value

Response is a single number reporting the reference value.

Description

This query reports the current value being subtracted from channel measurements.

CALCulate<channel 1 or 2>:REfERENCE:COLlect
OUTPUT @Pwr_mtr;CALC2:REF:COLL ! Current Rdg. ==> Ref level.
! Take channel 2 reading as reference value

Description

The CALCulate:REfERENCE:COLlect command will cause the level of the current power measurement to become the reference level. There is no query form of this command. After you send this command, the channel measurement will be zero, assuming the power levels at the sensor(s) did not change and REF:STAT is ON.



NOTE: Example programs for Relative or Referenced Measurements are located in Appendix A of this manual.

Error Control

Selected basic SCPI syntax and execution error apply to these commands.

Device-specific errors include the following and other -300 level errors.

Use CALC:REF commands only in the NORMal Mode. Attempts to use these commands in the SWIFt and BURSt modes will be ignored and the error, -300, Device-specific error;Normal mode is off. will be generated.

2.5.21 Offsets

SENSe:CORRection

Sensor power offsets apply to the individual sensor. Use sensor offsets to account for the loss of attenuators, which are commonly used during measurement to reduce standing waves to improve measurement accuracy. If you are measuring high power signals (>100 mW), but are not using Giga-tronics high power sensors, you will need to use a power attenuator between the high power output and the sensor input to prevent damage. Enter the value of attenuation as a sensor offset, and the 58542 will automatically respond with the actual power level output in its measurement data.

SENSe<sensor 1 or 2>:CORRection:OFFSet:COLlect
OUTPUT @Pwr_mtr;SENS1:CORR:OFFS:COLL ! Take sensor 1 current reading as offset value

Description

This command enters the current power level reading as the offset value.

SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]space
<offset value in dB, -99.99 to 99.99>
OUTPUT @Pwr_mtr;SENS2:CORR:OFFS 10.2 ! Compensate sensor 2 for 10.2 dB
! attenuation

Description

This command enters a specific sensor offset value.

SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]?
OUTPUT @Pwr_mtr;SENS2:CORR:OFFS? ! Query sensor 2 offset value

Response is 0.0000E+00 for 0 dB

Description

This query reports the current dB value of the sensor offset which is being subtracted from measurements.

SENSe<sensor 1 or 2>:CORRection:OFFSet:
STATespace<ON or OFF>
OUTPUT @Pwr_mtr;SENS2:CORR:STAT ON ! Enable sensor 2 offset correction

Description

This command activates and deactivates the sensor offset function.

SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe?
OUTPUT @Pwr_mtr;SENS2:CORR:STAT? ! Query sensor 2 offset function status

Response is 1 for ON or 0 for OFF.

Description

This query reports the ON or OFF status of the sensor offset function.

2.5.22 SRQ & Status Monitoring

*CLS
*ESE
*ESR?
*OPC and *OPC?
*SRE
STATus:OPERation
STATus:PREset
*STB?

*CLS

OUTPUT @Pwr_mtr;*CLS

! Clear SRQ and status byte registers

Description

*CLS is the clear status command defined by IEEE 488.2. This command clears all of the status bytes to the value 0. After a service request interrupt is transmitted from the 58542 to the controller, use the *STB command to read the status byte from the 58542. Then reset the SRQ and use *CLS clear status command to reset the numeric status indication of the status byte/registers to 0 (all bits will be 0).

*CLS does not affect the enabled or disabled status of the status byte/register masks. For example, if you have bit 8 of the operation register enabled before sending *CLS, it will remain enabled afterward. *CLS also clears the output queue (takes 0.3 sec to complete this function).

*ESE

ESEspace<event status register value, 0 to 255>

OUTPUT @Pwr_mtr;*ESE 16

! Enable bit 4 of event status register mask

Description

This command sets/clears the event status register enable mask.

*ESE?

OUTPUT @Pwr_mtr;*ESE?

! Query currently enabled bits of
! event status register mask

Response is Sum of the bits set in the event status enable register.

Description

This query returns the mask of the event status register.

*ESR?

OUTPUT @Pwr_mtr;*ESR?

! Return event status register value

Description

This query returns the current status register value.

*OPC and *OPC?

OUTPUT @Pwr_mtr;*OPC ! *OPC allows one time SRQ enable

OUTPUT @Pwr_mtr;*OPC? ! send a 1 upon operation complete

Description

*OPC determines when an operation is completed. This command is generally used to monitor the completion of long measurement sequences. It sets the operation complete bit in the event status register upon completion of operation. The query form, *OPC?, automatically returns a 1 or 0 flag.

*SRE

*SREspace<event status register value, 128, 64, 32, 16, 8, 4, 2, 1>

OUTPUT @Pwr_mtr;*SRE 32 ! Enable bit 5 of Status Byte register

Description

This command sets the mask of the Status Byte register.

*SRE?

OUTPUT @Pwr_mtr;*SRE? ! Query Bits Enabled of Status Byte register

Response is the status register mask value

Description

This query returns the mask of the Status Byte register.

STAT:OPER

STATus:OPERation[:EVENT]?

OUTPUT @Pwr_mtr;STAT:OPER? ! Query operation event register result

Description

This query returns the operation event register result.

STAT:PRES

STATus:PRESet

OUTPUT @Pwr_mtr;STAT:PRES ! Clears all the status register value

Description

This command clears all status registers.

*STB?

OUTPUT @Pwr_mtr;*STB?

! Query status byte register

Description

This query returns status byte register result.

The SCPI status reporting structure includes the IEEE-488.2 Status Registers. Please note that bit 5 of the OPERATION Status Register is only used during BURSt and SWIFt modes. NORMAl mode does not use this function.

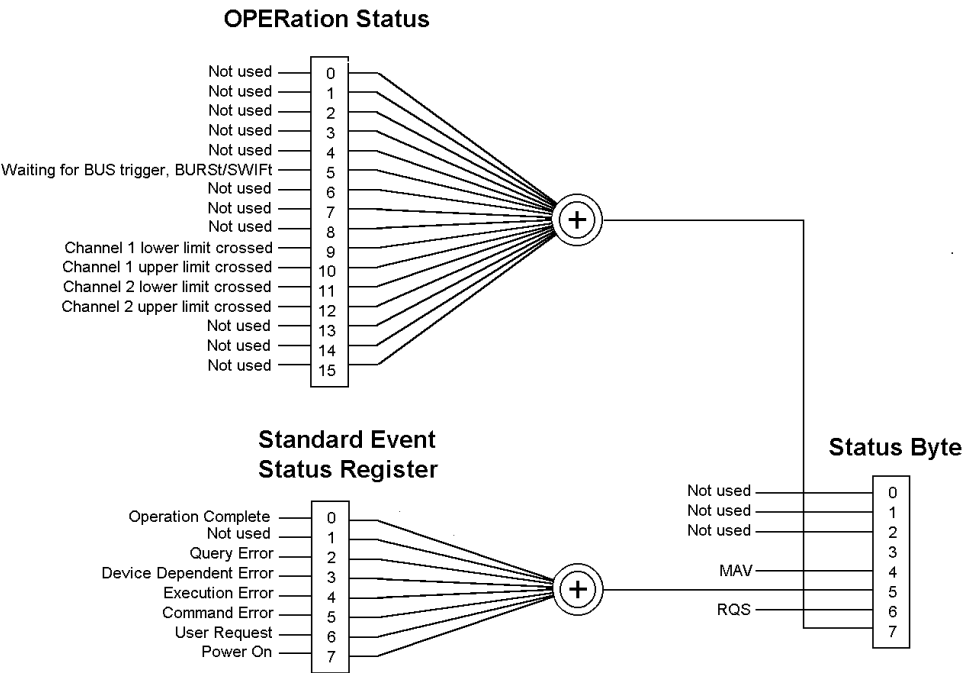


Figure 2-10. SCPI Status Structure Registers

Event Status Register

The *ESE command is used in combination with group commands that form the meter’s service request system. These commands and their responses are almost identical to the IEEE-488 (GPIB) SRQ service request command structures. The *ESE command is used to enable bits of the event status register mask.

The *ESE command is one of the commands you can use to monitor the status of the power meter. Together with the status byte (also see commands *STB? or *SRE?) and the operation status register (STATus:OPERation), the event status register provides information on several critical 58542 functions and error conditions.

7	6	5	4	3	2	1	0
Power On	0	Command Error	Execution Error	Device-Dependent Error	0	0	Operation Complete
Value = 124	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1



NOTE: The logical value in the register is used both to enable a bit's event function and to enable that bit of the event status register mask to report the event status (following the *ESR? command).

The event status register is 8 bits long and is structured as follows:

Bits 1, 2, and 6 are not used. When bit 3 is a 1, a device-dependent error has occurred. When bit 4 is a 1, an execution error has occurred. When bit 5 is a 1, a command error has occurred. Bit 7 is a 1 when the 58542 is turned ON. The 58542 does not have a standby mode; therefore, it is probably not useful to enable bit 7 of the event status register mask (by sending the command *ESE 128).

In the default state, the meter's event status register is masked, or set to off. None of the bits are enabled. If an execution error occurs, a service request will not be sent to the controller and the event status register will remain set to 0. The *ESE command is used to enable individual bits. These bits must be enabled individually. They can be cleared or turned off as a group by sending the *CLS command.

To use the event status register, bit 5 of the status byte must also be enabled by sending the command *SRE 32.

*ESE? reports the enabled settings of the event status register mask. The *ESR? query returns the current value of the event status register.



NOTE: A Functional Description of the service request system can be found under *SRE in the IEEE Standard Codes, Formats, Protocols, and Common Commands (ANSI/IEEE Std 488.2-1987) publication.

Status Byte Register

7	6	5	4	3	2	1	0
Operational Status	Require Service (RQS)	Event Status	Message Available	0	0	0	0

Notes:

1. The condition indicated in bits 1 through 5 must be enabled by the Service Request Mask to cause a Service Request Condition. The mask is set with the *SRE program code followed by ASCII characters. The value of the byte is determined by summing the weight of each bit to be checked.
2. The RQS (bit 6) is true when any of the conditions of bits 4, 5, and 7 are enabled and occur.
3. Bits remain set until the Status Byte is cleared.

2.5.23 Min/Max Configuration & Monitoring

CALCulate:MAXimum

CALCulate:MINimum

MIN and MAX channel monitoring records the minimum and maximum variation of channel amplitude over time. Time zero is set by setting the MIN or MAX STATE to ON. The default Preset and turn on configuration is ON. After setting to ON, the minimum and maximum value of the measured value on that channel will be recorded. To reset the MIN and MAX value back to the current value, you only need to set the STATE to ON again. The STAT OFF does not need to be sent during reset of MIN and MAX values. Individual sensor minimum and maximum power level variations can be monitored only if that sensor is defined directly to a channel with POW 1 or POW 2.

MIN and MAX channel monitoring is only available in Normal Mode. BURSt and SWIFt modes do not perform MIN and MAX monitoring.

CALC:MAX

CALCulate<channel 1 or 2>:MAXimum:STATespace<ON or OFF>

OUTPUT @Pwr_mtr;CALC2:MAX:STAT ON ! Enable channel 2 maximum tracking

Description

ON activates the MAX monitoring function. The maximum value of the channel (not sensor) is monitored until the value is reset by CALC#:MAX:STAT ON or CALC#:MAX:STAT OFF is sent.

CALCulate<channel 1 or 2>:MAXimum:STATe?

OUTPUT @Pwr_mtr;CALC2:MAX:STAT? ! Query channel 2 maximum mode

Response is 1 for ON or 0 for OFF.

Description

Reports ON or OFF status of MAX monitoring.

CALCulate<channel 1 or 2>:MAXimum[:MAGNitude]?

OUTPUT @Pwr_mtr;CALC2:MAX? ! Query channel 2 maximum value in dBm

Response is highest power reading since CALC2:MAX:STAT ON was sent.

Description

This command reports the value maintained as the maximum in the 58542 max monitor.

CALC:MIN

CALCulate<channel 1 or 2>:MINimum:STATespaceON OFF

OUTPUT @Pwr_mtr;CALC1:MIN:STAT ON ! Enable channel 1 minimum tracking

Description

This command activates the minimum channel value monitor.

CALCulate<channel 1 or 2>:MINimum:STATe?

OUTPUT @Pwr_mtr;CALC1:MIN:STAT? ! Query channel 1 minimum mode

Response is 1 for ON or 0 for OFF.

Description

This command queries the activation or deactivation of the minimum channel value monitor.

CALCulate<channel 1 or 2>:MINimum [:MAGnitude]?

OUTPUT @Pwr_mtr;CALC1:MIN? ! Query channel minimum value in dBm

Response is lowest power reading since CALC2:MIN:STAT ON was sent.

Description

This command reports the value maintained as the minimum in the 58542 min monitor.

2.5.24 Limit Line Configuration & Monitoring

CALCulate:LIMit

The CALCulate:LIMit commands specify and query the status of power measurement limit values and limit line pass/fail checking. This allows the 58542 to monitor measured values and determine if the values are outside certain limits or above/below a single limit. The upper limit cannot be specified any lower than the lower limit; meaning that an exclusion zone of values cannot be specified.

Limit values can be specified separately for either of the two software calculation channels - 1 and 2. These channels can be specified to correspond to power sensors 1 and 2 (default) or as a combination of the power sensors. For example, set limit lines to monitor overload or under range conditions on an amplifier's output power and gain by specifying channel 1 as sensor 1 limits checking and channel 2 as Sensor 2/Sensor 1. Power sensor assignments to channel measurement definition is also part of the CALCulate Subsystem. Limit monitoring can not be performed for individual sensors unless a channel is configured for single sensor, POW 1 or POW 2 operation.

Upper and Lower limits can be active simultaneously.

Unless serial requests are enabled, the CALCulate:LIMit commands can not be configured to automatically alert the controller directly during a limit violation; the 58542 must be queried to receive information regarding pass/fail status of limit line violations.

Automatic notification of limit line violations is accomplished using the status byte and the operation register. A controller can be notified of a limit line violation via the request service, *SRE command. After the controller receives the request service, query the event status register. Check the status register for a limit line violation or send CALCulate:LIMit:FAIL? to check if a limit line is being or has been violated. 1 indicates a limit line violation. 0 indicates the channel measurement is within the limit lines.

CALCulate<channel 1 or 2>:LIMit:CLEar[:IMMediate]

OUTPUT @Pwr_mtr;CALC1:LIM:CLE

! Reset channel 1 limit violation indicator to 0

Description

This command resets the limit line pass/fail indicator to 0.

CALCulate<channel 1 or 2>:LIMit:FCOunt?

OUTPUT @Pwr_mtr;CALC1:LIM:FCO?

! Query number of channel 1 limit failures

Response is a single number; the number of times the limit lines were exceeded.

Description

This command reports the number of times a limit line has been exceeded since the limit checking function was set to ON, or the limit line monitor was cleared with CALC#:LIM:CLE.

CALCulate<channel 1 or 2>:LIMit:FAIL?

OUTPUT @Pwr_mtr;CALC1:LIM:FAIL?

! Check for channel 1 limit line violation

Response is 0 = OK; 1 = fail.

Description

This command reports whether or not a limit line has been exceeded since the limit checking function was set to ON, or the limit line monitor was cleared with CALC#:LIM:CLE.

CALCulate<channel 1 or 2>:LIMit:LOWerspace<numeric value in dB from -299.99 to 299.99>
OUTPUT @Pwr_mtr;CALC1:LIM:LOW -50.0 ! Set channel 1 lower limit line to -50 dBm

Description

This command specifies the lower limit line power level. The value should allow for any offset values currently in use. The default value is -299.99 dB or dBm.

CALCulate<channel 1 or 2>:LIMit:LOWer?
OUTPUT @Pwr_mtr;CALC1:LIM:LOW? ! Query channel 1 lower limit line setting

Response is a single number; the lower limit setting.

Description

This command queries the value of the lower limit line.

CALCulate<channel 1 or 2>:LIMit:STATespace<ON or OFF>
OUTPUT @Pwr_mtr;CALC1:LIM:STAT ON ! Enable channel 1 upper and lower limit
! checking

Response is 0 = off; 1 = on

Description

This command activates and deactivates the limit line checking. The default condition is OFF.

CALCulate<channel 1 or 2>:LIMit:STATe?
OUTPUT @Pwr_mtr;CALC1:LIM:STAT? ! Query channel 1 ON or OFF status

Response is 1 for ON or 0 for OFF.

Description

This command reports the activated or deactivated status of limit line checking.

CALCulate<channel 1 or 2>:LIMit:UPPerespace<numeric value in dBm or dB from -299.99 to 299.99>
OUTPUT @Pwr_mtr;CALC1:LIM:UPP 17.0 ! Set channel 1 upper limit line to 17 dBm

Description

This command specifies the upper limit line power level. The value should allow for any offset values currently in use. The default value is 299.99 dB or dBm.

CALCulate<channel 1 or 2>:LIMit:UPPer?
OUTPUT @Pwr_mtr;CALC1:LIM:UPP? ! Query channel 1 upper limit line setting

Response is a single value in dBm or dB, the upper limit line value

Description

This query returns the value of the upper limit line.

2.5.25 Analog Output

MEMory:CHANnel
MEMory:UNIT
MEMory:POWer
MEMory:VOLTagE
OUTPut:ANALog

The ANALOG OUT BNC connector on the front panel can be configured to output a voltage that corresponds to the power levels on one of the channels. This is useful for applications such as source leveling or printing to a chart recorder.

The Analog Output operates only in NORMal Mode. It is automatically deactivated during SWIFt or BURSt modes, and comes back when operation is returned to the NORMal Mode.

MEM:CHAN

MEMory[:TABLE]:CHANnel space <channel 1 or 2>
OUTPUT @Pwr_mtr;MEM:CHAN 2 ! Set analog out to channel 2

Description

This command selects which channel will be present on the analog output connector.

MEMory[:TABLE]:CHANnel?
OUTPUT @Pwr_mtr;MEM:CHAN? ! Query analog out channel number

Response is channel 1 or channel 2.

Description

This query reports which channel will be present on the analog output connector.

MEMory[:TABLE]:SELEct space <ANALOGout,VPROPF1,VPROPF2>
OUTPUT @Pwr_mtr;MEM:SEL VpROPF1 ! Select memory table VpROPF1
! for editing in following lines

Description

This command selects between one of three editable tables. Using the meter's Analog Output capability requires you to configure the numerically linear power measurement to voltage output relationship by defining the corresponding end points of power and voltage.

MEMory[:TABLE]:SELEct?
OUTPUT @Pwr_mtr;MEM:SEL? ! Query selected memory table

Response is the table currently editable: ANALOG, VpROPF1, or VpROPF2.

Description

This query reports the currently editable table in the 58542.

MEM:UNIT

MEMory[:TABLE]:UNIT*space*<
choice of units DBM or Watt>

OUTPUT @Pwr_mtr;MEM:UNIT DBM

! Set analog out power unit

Description

This command selects between one of two configurations, log units or linear units. In either case the voltage output will be numerically linear. Be sure to set the units control properly (dBm or W) before trying to set the numeric values.

MEMory[:TABLE]:UNIT?

OUTPUT @Pwr_mtr;MEM:TABL:UNIT?

! Query analog out power unit

Response is the units used for analog output configuration, DBM or W.

Description

This query reports the units for a channel analog output configuration.

MEM:POW

MEMory[:TABLE]:POW*er**space*<start value from -80 to
+20 dBm>*comma*<stop value from -80 to +20 dBm>

OUTPUT @Pwr_mtr;MEM:POW -70,20

! Set analog out power range (in dBm)
! from -70 to 20 dBm

Description

If log units are selected for analog output control, this command selects the beginning and end points of the power levels which will be assigned corresponding voltages at the analog output.

OUTPUT @Pwr_mtr;MEM:POW?

! Query analog out power range

Response is two dBm values separated by a comma indicating analog output range.

Description

This query reports the beginning and end points of the power levels selected to specify the analog output voltage.

MEMory[:TABLE]:POW*er**space*<start value from
0 to 0.01 W>*comma*<stop value from 0 to 0.01 W>

OUTPUT @Pwr_mtr;MEM:POW 0,1e2

! Set analog out power range (in Watts)
! from 0 to 0.01 Watts

Description

If linear units are selected for analog output control, this command selects the beginning and end points of the power levels which will be assigned corresponding voltages at the analog output. Also see MEM:VOLT on the next page.

MEMory[:TABLE]:POW*er*?

OUTPUT @Pwr_mtr;MEM:POW?

! Query analog out power range

Response is two Watt values separated by a comma indicating analog output range.

Description

This query reports the end points of power levels of the analog output configuration. When log units are selected, the units are dB or dBm. When linear units are selected the units are Watts.

MEM:VOLT

MEMory[:TABLE:VOLTage]space<start value from -10 to +10 V>comma<stop value from -10 to +10 V>

OUTPUT @Pwr_mtr;MEM:VOLT -7,2

! Set analog out voltage range from
! -8 to 2 volts corresponding to power

Description

This command is not units dependent. It selects the beginning and end points of the voltage levels which you desire to be present at the analog output. These voltages correspond to the power end points that are defined with either MEM:VOLT or MEM:POW.

MEMory[:TABLE:VOLTage]?

OUTPUT @Pwr_mtr;MEM:VOLT?

! Query analog out voltage range

Response is two voltage values separated by a comma indicating analog output range.

Description

This query reports the end points of the voltages configured for analog output operation.

OUTP:ANA

OUTPut[:BNC]:ANALog[:STATe]space<ON or OFF>

OUTPUT @Pwr_mtr;OUTP:ANA ON

! Enable analog out function

Description

This command activates and deactivates the analog output. The analog output will not operate unless this control is set to ON.

OUTPut[:BNC]:ANALog[:STATe]?

OUTPUT @Pwr_mtr;OUTP:ANA?

! Query analog out function status

Response is 1 for ON or 0 for OFF.

Description

This query reports the ON or OFF status of the analog output.

2.5.26 Saving & Recalling Configurations

***RCL**
***SAV**

The 58542 has 21 instrument state memory registers. Registers 1 through 20 are available for store and recall. Register 0 contains the previous state of the instrument and can be used to toggle between two different instrument configuration states.

Instrument configuration can be saved to registers 1 through 20. CAUTION: Any configuration items which are not listed under the *RST or PRESet conditions are not savable. Make sure all aspects of your configuration are savable. For example, sensor power sweep calibration curves can not be saved in the configuration memory registers. Sensors must be calibrated to the 58542 power meter each time a new sensor is attached.

***RCLspace<memory location number, 0 to 20>**

OUTPUT @Pwr_mtr;*RCL 19

! Recall 58542 register 19

Description

Recalls instrument configuration. 0 is the PRESet configuration.

***SAVspace<memory location number, 1 to 20>**

OUTPUT @Pwr_mtr;*SAV 20

! Save at 58542 register 20

Description

Saves current configuration to memory. You cannot save a configuration to memory position 0.

2.5.27 Halting Operation

ABORT

OUTPUT @Pwr_mtr;ABOR

! Halts measurement & triggering

Description

This command stops operation, but it does not interrupt the completion of the current action. For example, sensor calibration is not interrupted. Burst mode data collection is not interrupted.

2.5.28 Preset Configuration

***RST**

STATus:PRESet

SYSTem:PRESet

***RST**

OUTPUT @Pwr_mtr;*RST

! Reset 58542 configuration

Description

This command resets the 58542 configuration to a known condition (see Table 2-4). These are not the power ON conditions. The 58542 has an internal battery which powers a non-volatile memory chip to retain configuration information. The only configuration that will change between power OFF and power ON is noted at the end of the table.

STATus:PRESet

OUTPUT @Pwr_mtr;STAT:PRES

! Clears all the status register value

Description

This command resets the 58542 configuration to a known condition. See Table 2-4. Note that these are not the power ON conditions.

SYSTem:PRESet

OUTPUT @Pwr_mtr;SYST:PRES

! Reset 58542 configuration

Description

This command resets the 58542 Status information buffers. SYST:PRES is identical in function to *RST.

Table 2-4. Reset and Power On Default Commands

Command	Default	Minimum	Maximum
CALCulate1[:CHANnel]: CALCulate2[:CHANnel]:	POWER 1 POWER 2		
CALCulate1-2: LIMit STATe UPPer LOWer FAIL? FCOut? MAXimum: STATe [MAGnitude] MINimum: STATe [MAGnitude] MODE REFerence: STATe [MAGnitude] STATe UNIT	OFF 299.999 -299.999 0 0 OFF 299.999 OFF -299.99 NORmal OFF 0 ON DBM	-299.999 -299.999 -299.999 -29.999	299.999 299.999 299.999
INITiate:CONTinuous	OFF		

Command	Default	Minimum	Maximum
MEASure1-2[:SCALar:POWer]	With Auto average on		
MEMory[:TABLE]: CHANnel FREQuency POWer SELEct ANALOGout SLOPe VOLTage UNIT	1 0 -80,20 0 -10,10 DBM	1 0 -80,-80 0 -10,-10	2 40e9 20,20 10e9 10,10
OUTput: ROScillator[:STATe] [BNC:]ANALog[:STATe]	OFF OFF		
SENSe1-2: AVERage: COUNT: AUTO TCONtrol CORRection: FREQ OFFset: STATe [MAGnitude] VPROp[:STATe] TRIGger: DELay: STATe [MAGnitude] LEVel (if INT trig) LEVel (if EXT trig) SOURce	1 ON MOVing 5e7 OFF 0 OFF OFF 1e-6 -20.0 1.7 IMMediate	1 0 -99.999 -5e-8 -30.0 0.1	512 4e10 99.999 104e-3 20.0 5.000
TRIGger: COUNT DELay MODE SOURce	1 0.000 POST IMMediate	0 0.000	128000 5.000
UNIT1-2[:POWer]	DBM		
POWER ON will override the internal battery back up memory and reset only the following configuration items as shown below. All other configuration items will remain the same as was true before power OFF.			
CALCulate1-2:MODE	NORMal		
INITiate:CONTinuous	OFF		
MEMory[:TABLE]:SELEct	ANALOGout		
OUTput:ROScillator[:STATe]	OFF		
TRIGger: COUNT DELay MODE SOURce	1 0.000 POST IMMediate	0 0.000	128000 5.000

2.5.29 Identification Commands

*IDN

SENSe:CORRection:EEPROM:TYPE

SYSTem:VERSion

Identification commands ensure that the power meter and sensor are appropriate for your test program. The sensor identification commands allow you to monitor what model of sensor is attached and ensure that the sensor has been properly calibrated to the power meter.



NOTE: Example programs for Identification Commands are contained in Appendix A of this manual.

*IDN?

OUTPUT @Pwr_mtr;*IDN?

! Query inst. mfg & model #

Response is Giga-tronics, 58542,0,1.09 where 1.09 is software version

Description

The *IDN? is the identify query command defined by IEEE 488.2. Upon receipt of this command, the power meter will output a string that identifies itself as the Giga-tronics 58542 and indicates the firmware version number.

SENS:CORR:EEPROM:TYPE

SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?

OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:TYPE?

! Query sensor 1 EEPROM type

Response is 80301,1818436 which is model number and serial number respectively

Description

This command returns sensor model and serial number information.

SYST:VERS

SYSTem:VERSion?

OUTPUT @Pwr_mtr;SYST:VERS?

! Query SCPI version

Response is 1990.0

Description

This query returns the compiled SCPI version.

2.5.30 Calibrator Controls

OUTPut:Reference:OSCillator

The reference oscillator is the RF calibration source for the sensors.

OUTP:ROSC

OUTPut:ROSCillator[:STATe]space<ON or OFF>

OUTPUT @Pwr_mtr;OUTP:ROSC ON

! Turn ON Calibrator Oscillator

Description

The reference oscillator (Calibrator port) connection is located on the front panel of the power meter. The OUTPut:ROSCillator ON command turns on this 0 dBm, 50 MHz output. The reference oscillator power level should be calibrated annually. Please refer to the Calibration Procedures in Chapter 4 for additional details.

OUTPut:ROSCillator[:STATe]?

OUTPUT @Pwr_mtr;OUTP:ROSC?

! Query ON or OFF status

Response is 1 or 0 (1 = ON)

Description

This query command returns the ON or OFF status of the meter's built-in reference oscillator.

2.5.31 Sensor EEPROM Commands

SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?
DIAGnostic:SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFRange?
SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?
SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?

SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?
OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:TYPE?! Query sensor 1 EEPROM type

Typical response is 80301,1818436 which is model number and serial number respectively

Description

This command allows your program to verify correct sensor usage and monitor whether power sweep calibration has been performed or not.

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange?
OUTPUT @Pwr_mtr;DIAG:SENS1:EEPROM:CALFR?! Query sensor 1 EEPROM cal factor
range
! table

Typical response is 2e9,1e9,17,1 which is the start frequency, step between standard frequencies, frequency, number of standard frequencies, and number of special frequencies.

Description

Provides a count of standard and special cal factors for use in retrieving the data in the next two commands.

SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?
OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:FREQ?! Query sensor 1 EEPROM frequency table

Typical response is 5.000e7,2.000e9,.....

Description

Provides a listing of calibration frequencies in the sensor, sorted by frequency, so that both standard and special frequencies are listed. The number of items matches the sum of the number at standard frequencies, and the number of special frequencies reported by DIAG:SENS1:EEPROM:CALFR?

SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?
OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:CALF?! Query sensor 1 EEPROM cal factor table

Typical response is 5.000e7,2.000e9,.....

Description

Provides a listing of calibration factors in the sensor, sorted in frequency order, to match previous command. The number of items matches the sum of the number at standard frequencies, and the number of special frequencies reported by DIAG:SENS1:EEPROM:CALFR?

2.5.32 Self-Test

***TST?**

***TST?**

OUTPUT @Pwr_mtr;*TST?

! Query self-test result

Response is 0 if all OK. Otherwise, it returns one of the code numbers below

Description

If an error occurred during Self Test, the amber TRIG LED will remain on until cleared by sending the SYST:ERR? command which will return -300 Device-Specific Error; Self Test Failed.

Table 2-5 lists the indications and limitations that will occur when the Self-Test command is applied to the 58542 instrument. The Result, Minimum, and Maximum indications are all given in millivolts.

Table 2-5. Self-Test Error Indications & Limitations

Error Number	Result	Minimum	Maximum	Test Description
100	0	0	50	OUTPUT DAC This test steps the analog output DAC from 0 volts to 10 volts in 1 volt steps, and measures the resultant output voltage with the system ADC. It then compares the results with the limits shown to the left and, if it is outside any limit, it will set the error number corresponding to that voltage level.
101	1000	950	1050	
102	2000	1900	2100	
103	3000	2850	3150	
104	4000	3800	4200	
105	5000	4750	5250	
106	6000	5700	6300	
107	7000	6650	7350	
108	8000	7600	8400	
109	9000	8550	9450	
110	10000	9500	10500	
200	0	0	50	OFFSET DAC This test steps the sensor input amplifier offset DAC from 0 volts to 5 volts in 1 volt steps, and measures the resultant output voltage with the system ADC. It then compares the results with the limits stated to the left and, if outside any limit, it will set the error number corresponding to that voltage level.
201	1000	950	1050	
202	2000	1900	2100	
203	3000	2850	3150	
204	4000	3800	4200	
205	5000	4750	5250	
400	0	0	50	CALIBRATOR DAC This test steps the calibrator control DAC from 0 to 10 volts in 1 volt steps and measures the resultant output voltage with the system ADC. It then compares the results with the limits shown to the left and if outside any limit it will set the error number corresponding to that voltage level.
401	1000	950	1050	
402	2000	1900	2100	
403	3000	2850	3150	
404	4000	3800	4200	
405	5000	4750	5250	
406	6000	5700	6300	
407	7000	6650	7350	
408	8000	7600	8400	
409	9000	8550	9450	
410	10000	9500	10500	

Error Number	Result	Minimum	Maximum	Test Description
600	0	50	50	OFFSET AMP 1 This test steps the sensor input amplifier offset DAC from 0 to 5 volts in 1 volt steps and measures the resultant output voltage from the first amplifier stage with the system ADC. It then compares the results with the limits shown to the left and if outside any limit it will set the error number corresponding to that voltage level.
601	1000	950	1050	
602	2000	1900	2100	
603	3000	2850	3150	
604	4000	3800	4200	
605	5000	4750	5250	
800	0	0	50	GAIN AMP 2 This test steps the sensor input amplifier offset DAC from 0 volts to 5 volts in 1 volt steps, sets the second stage gain to 1 and measures the second stage output voltage with the system ADC. It then compares the results with the limits shown to the left and if outside any limit it will set the error number corresponding to that voltage level.
801	1000	950	1050	
802	2000	1900	2100	
803	3000	2850	3150	
804	4000	3800	4200	
805	5000	4750	5250	
1000	0	0	50	THRU FILTER This test steps the sensor input amplifier offset DAC from 0 to 5 volts in 1 volt steps, and measures the filter amplifier output voltage with the system ADC. It then compares the results with the limits shown to the left and if outside any limit it will set the error number corresponding to the voltage level.
1001	1000	950	1050	
1002	2000	1900	2100	
1003	3000	2850	3150	
1004	4000	3800	4200	
1005	5000	4750	5250	
Gain = 1, Amp 2: 1200	1000	950	1050	GAIN = 1, AMP 2 This test sets the sensor input amplifier offset DAC to 1 volt and measures the output of the second stage amplifier with its gain set to 1. It then compares the results with the limits shown to the left and if outside any limit it will set the error number corresponding to that voltage level. Then it sets the gain of the second stage to 8 and measures the output of that stage. Any out of tolerance voltage will be indicated by a corresponding error number. This checks the gain of this stage at a gain of 8.
Gain = 8, Amp 2: 1201	8000	7200	8800	
Gain = 1, Amp 2: 1400	100	90	110	GAIN = 1, AMP 2 This test sets the sensor input amplifier offset DAC to 0.1 volt and measures the output of the second stage amplifier with its gain set to 1. It then compares the results with the limits shown to the left and if outside any limit it will set the error number corresponding to that voltage level. Then it sets the gain of the second stage to 64 and measures the output of that stage. Any out of tolerance voltage will be indicated by a corresponding error number. This checks the gain of the second stage at a gain of 64.
Gain = 64, Amp 2: 1401	6400	5760	7040	
1600	9000	8000	10000	TOO HIGH This test checks the upper limit for the auto-range system by applying a voltage from the offset DAC. The output of the second stage is monitored while also monitoring the ! too-high comparator output. If the comparator output comes true outside of the voltage limits specified to the left the corresponding error number is set.
1800	1000	700	1100	TOO LOW This test checks the lower limit for the auto-range system by applying a voltage from the offset DAC. The output of the second stage is monitored while also monitoring the ! too-low comparator output. If the comparator output comes true outside of the voltage limits specified to the left the corresponding error number is set.

Error Number	Result	Minimum	Maximum	Test Description
2000	7000	6300	7700	CAL HEATER This measures the calibrator thermistor heater voltage. This is half of the actual voltage on the heater transistor collector which will be about 0.5 volts below the level of the 15 volt supply after the heater is stable. Since this takes about a minute after power on the POST does not check this. However the command *TST? does.
2100	0	0	500	SW +5 OFF This test measures the switched 5 volt logic supply applied to the sensor when it is switched off. Whenever a peak power sensor (8034X or 8035XA) is connected, this test will be bypassed.
2101	5000	4500	5500	SW +5 ON This test measures the switched 5 volt logic supply applied to the sensor when it is switched on. Whenever a peak power sensor (8034X or 8035XA) is connected, this test will be bypassed.
3000		0x3c0000	0x3fffff	RAM BANK 1 This does a byte by byte check of the optional extra 128K RAM at addresses 3c0000 to 3ffff hex. An error at any address will result in an error number of 3000. If the optional RAM is not present (which is tested by checking the first byte for write/read cycle ability), then this test is aborted without an error flag.
3001		0x400000	0x43ffff	RAM BANK 2 This does a byte by byte check of the standard RAM at addresses 400000 to 43ffff hex. This is done in a non-destructive manner by saving the data that is present and then writing a pattern, reading it back, checking it for validity, and then restoring the original. An error at any address will result in an error number of 3001.
3100		0x300000	0x37ffff	ROM This does a complete checksum of the program ROM at addresses 300000 to 37ffff hex and compares it with the correct value stored in the ROM. Any error will result in an error number of 3100.

2.5.33 Error Messages

SYSTem:ERRor

SYSTem:ERRor?

OUTPUT @Pwr_mtr;SYST:ERR?

! Query system error message

Description

This command reads error messages from the error buffer. Use *CLS and CLEAR @PM_address to clear the SYST:ERR buffer just prior to entering measurement configurations and measurement routines. A listing of compatible standard SCPI error and device-specific errors follows.

Table 2-6. Standard SCPI Error Messages

Error Number	Description
0	No Error
-7	Invalid Error Number
-108	Parameter Not Allowed
-111	Header Separator Error
-113	Undefined Header;- - -
-120	Numeric Data Error
-200	Execution Error
-211	Trigger Ignored
-213	Init Ignored
-214	Trigger Deadlock
-230	Data Corrupt or Stale
-300	Device-specific errors (see Table 2-7)

Table 2-7. Device Specific Error Messages

Command	Error Message	Example of Problem
ABORt		
CALCulate1:DATA?	Burst mode is off	Not burst mode; Command requires BURSt mode
CALCulate1:DIFFerence 1,1 CALCulate1:RATio 1,1	Conflict in channel configuration	Same sensor
CALCulate1:LIMit:LOWer :UPPer	Conflict between upper and lower limits	Upper is smaller than lower or lower is greater than upper
CALCulate1:MAXimum?	MAX:STATe is off Channel is not valid	Mode is off No sensor or sensor not calibrated
CALCulate1:MAXimum:STATe	Channel is not valid	No sensor or sensor not calibrated
CALCulate:MINimum?	MIN:STATe is off Channel is not valid	Mode is off No sensor or sensor not calibrated
CALCulate1:MINimum:STATe	Channel is not valid	No sensor or sensor not calibrated
CALCulate1:MODE	No valid sensor Channel is not valid	No sensor No sensor or sensor not calibrated
CALCulate1:POWer	No valid sensor	No sensor
CALCulate1:REFerence:COLlect	Normal mode is off Channel is not valid	Burst mode setup No sensor or sensor not calibrated
CALibrate1 CALibrate1?	No sensor Sensor not connected to calibrator Sensor calibration error	No sensor Calibration error
CALibrate1:ZERO CALibrate1:ZERO?	No sensor Sensor zeroing error	Zeroing error
DIAGnostic:CTABLE? 1	Sensor is not calibrated No Sensor	No sensor table is available No sensor
DIAGnostic:SENSe1:EEPROM:CORRection	No valid sensor sensor eeprom data:correction factor number does not match	No sensor
DIAGnostic:SENSe1:EEPROM:CORRection? DIAGnostic:SENSe1:EEPROM:READ	No valid sensor	No sensor
DIAGnostic:SENSe1:EEPROM:CALFSPecial DIAGnostic:SENSe1:EEPROM:CALFSTandard	No valid sensor Sensor eeprom data is over space Sensor eeprom data:cal factor number does not match	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFSPecial?	No valid sensor Sensor eeprom data is over space	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFSTandard? DIAGnostic:SENSe1:EEPROM:FREQSPecial? DIAGnostic:SENSe:EEPROM:FREQSTandard?	No valid sensor Sensor eeprom data is over space	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFRange DIAGnostic:SENSe1:EEPROM:CALFRange? DIAGnostic:SENSe1:EEPROM:TYPE DIAGnostic:SENSe1:EEPROM:TYPE?	No valid sensor	No sensor
DIAGnostic:SENSe1:EEPROM:FREQSPecial	No valid sensor Sensor eeprom data is over space Sensor eeprom data:freq is above upper freq limit Sensor eeprom data:freq is below lower freq limit Sensor eeprom data:freq number do not match	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:TYPE	No valid sensor Sensor eeprom data:upper freq should be larger than lower freq	No sensor
DIAGnosticSENSe1:EEPROM:WRITe	No valid sensor Sensor eeprom data:write error Password is incorrect	No sensor Sensor eeprom error Password is activated

Command	Error Message	Example of Problem
DIAGnostic:ZTABLE? 1	No sensor	No sensor
FETCH1?	Data corrupt or stale TTL trigger mode not applicable	No valid sensor Normal mode
INITiate:IMMediate	Init ignored	Continuous is on
MEASure1?	Data corrupt or stale Normal mode is off	No valid sensor Burst or swift mode
MEMory:TABLE:FREQuency	No valid sensor V_prop_f Table is not selected V_prop_f Table freq data error	No sensor Select others Start freq is greater than sensor maximum
MEMory:TABLE:FREQuency?	V_prop_f Table is not selected	Select others
MEMory:TABLE:POWer	Analog out Table is not selected Analog out Table data input error	Other table Lower power is greater than upper power
MEMory:TABLE:POWer?	Analog out Table is not selected	Other table
MEMory:TABLE:SLOPe	No valid sensor V_prop_f Table is not selected	Select others No sensor
MEMory:TABLE:SLOPe?	V_prop_f Table is not selected	Select others
MEMory:TABLE:UNIT MEMory:TABLE:UNIT?	Analog out Table is not selected	Other table
MEMory:TABLE:VOLTag	Analog out Table is not selected Analog out Table data input error	Other table Lower voltage is greater than upper voltage
MEMory:TABLE:VOLTag?	Analog out Table is not selected	Other table
READ1?	Data corrupt or stale Normal mode is off Trigger deadlock	No valid sensor Burst or swift mode is on TRIG:SOUR is not in IMM mode
SENSe1:EEPROM:CALFactor? SENSe1:EEPROM:FREQuency?	No valid sensor Sensor eeprom data is over space	No sensor Too much data
SENSe1:CORRection:VPROpf:STATe SENSe1:CORRection:VPROpf:STATe?	No valid sensor	No sensor
SENSe1:FREQuency	Frequency data is above sensor specification	
SENSe1:OFFSet:COLlect	Normal mode is off Channel is not valid	In burst or swift mode No sensor
SENSe1:TRIGger:DELAy SENSe1:TRIGger:LEVel	No valid sensor Sensor is in CW source mode	No pulse sensor
SENSe1:TRIGger:DELAy? SENSe1:TRIGger:DELAy:SOURce SENSe1:TRIGger:DELAy:SOURce? SENSe1:TRIGger:DELAy:STATe ON SENSe1:TRIGger:DELAy:STATe? SENSe1:TRIGger:DELAy:LEVel?	No valid sensor	No pulse sensor
TRIGger:COUNter	Normal mode is on Counter has to be one in Swift immediate source No valid sensor Channel is not valid	Not in burst or swift mode Swift mode, imm source No sensor Ratio mode setup
TRIGger:COUNter?	Normal mode is on No valid sensor Channel is not valid	Not in burst or swift mode No sensor Ratio mode setup
TRIGger:IMMediate	Init ignored	Source is in immediate mode
TRIGger:MODE PRE	No PRE mode for trigger immediate source	
TRIGger:SOURce:IMMediate	Counter has to be one in Swift immediate source No valid sensor Channel is not valid	Swift mode is on No sensor Ratio mode setup

Theory of Operation

3.1 Introduction

This chapter contains a functional description of the electrical circuits contained on the PC board assemblies of the 58542 VXI Universal Power Meter. Table 3-1 lists the circuit assemblies by their reference designations, and includes the assembly part number and schematic drawing number for each board.

Table 3-1. VXI Power Meter Circuit Assemblies

Ref #	Title	Assembly Part No.	Schematic Dwg No.
A1	Analog PC Assembly	21359	21360
A2	Digital PC Assembly	21356	21357
A3	VXI Processor PC Assembly	This PCA is an OEM item	

3.2 Circuit Description

The 58542 Power Meters electrical circuitry resides mainly on three PC boards; the Analog PC Board (A1), the Digital PC Board (A2), and the VXI Processor PC Board (A3). The Processor contains the microprocessor, some ROM and RAM, and the VXI interface chip. The remainder of the required ROM and RAM is contained on the Digital board.

Two cables interface to the meter through the VXI Bus Interface connections on the rear panel. The Bus Interface goes to the Processor board through connectors P1 and P2. Three front panel BNCs connect to the Analog board. See schematic drawing 21406 in Chapter 7 for specific interconnect information.

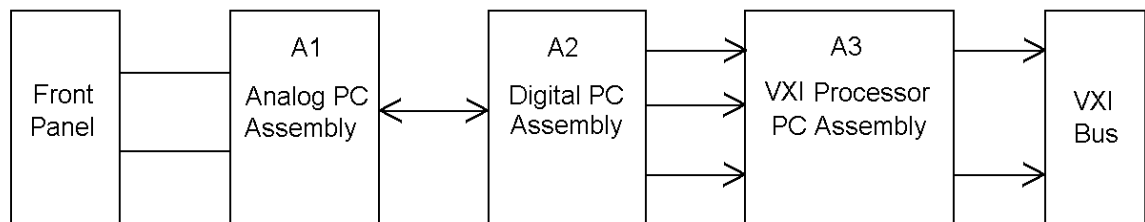


Figure 3-1. VXI Power Meter System Block Diagram

3.3 Analog PC Board (A1)

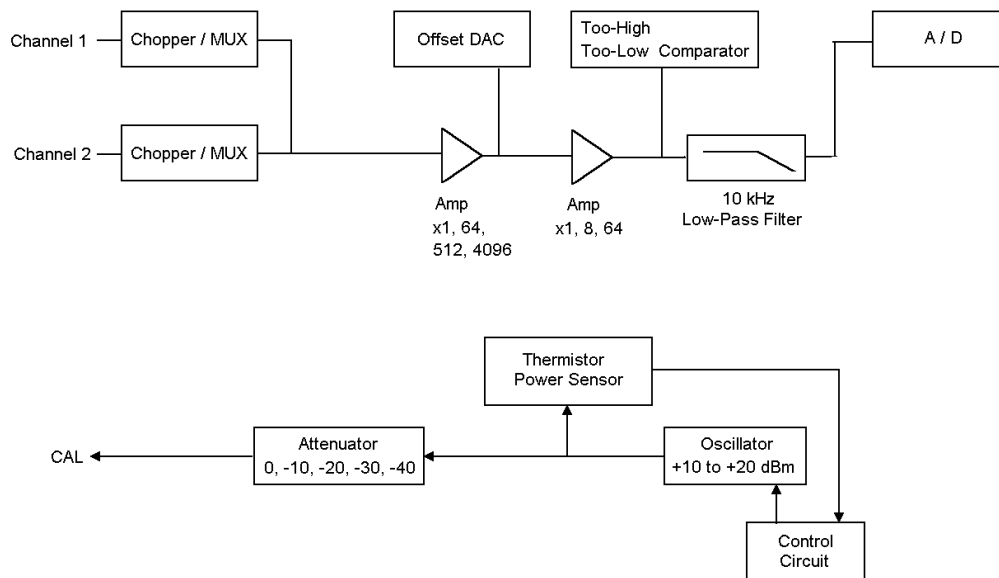


Figure 3-2. Analog PC Assembly Block Diagram

The sensors are connected from the front panel through W3 and W2 which are connected to the Analog Board through W2P1 and W2P2 for sensor 1 and W3P1 and W3P2 for sensor 2. The detected DC voltage from the sensor is a differential voltage applied to pins 3 and 4 of J7 or J9. This differential voltage goes to the U28 or U29 FET chopping circuit. The outputs are pins 8 and 9 of the chopper. An incoming signal can either be fed straight through or inverted. The signal is fed straight through when A1 and A0 are both low. It is fed through in the inverted mode when A1 is low and A0 is high. When A0 is low and A1 is high the signal is shorted together and grounded, and when A0 and A1 are both high, the input is open (floating). This provides chopper stabilized amplification when low power signals are being received by switching the FET switch from the inverting to non-inverting mode and back again at a rate of 300 times per second.

U31 is the 1st stage amplifier, and has programmable gain. The programmable gain is provided by U30 and the resistor ladder composed of R6 through R12 which will program gains of 1, 64, 512, and 4096. U32A is the 2nd stage amplifier that provides programmed gains of 1, 8, and 64 using FET switch U33 and resistor ladder R16, R17, and R18. C167 (though shown on the schematic) is not loaded on the board.

U32B/C/D and associated components provide a 6-pole bessel filter in the low pass configuration -10 kHz with a 120 μ s settling time. In normal operation, the signal will always go through this filter. Other paths such as unfiltered, TP8, and 1st amp signals are provided for testing only and not used in normal operation.

The 1st amplifier, U31, has an offset voltage injected into it via pin 7. This offset voltage comes from the 12-bit DAC, U15. Offset voltages range from +5 V to -5 V which can effectively remove about a ± 1.2 mV offset at the detector. U34A&B are comparators which monitor the input signal for a too high or too low condition. The too low comparator, U34B, will fire if the voltage is below 1 V, and the too high comparator, U32A will fire if the voltage is above 9 V. This provides an A/D conversion range of 1 to 9 V. The too high and too low signals are used by the software to determine whether or not a range change should be made. There are 7 ranges. Four ranges are processed by U31 (1st Amp), and three ranges by U32A. Appropriate gains are set to keep voltages at the A/D conversion point between 1 V and

9 V. R45 and R46, divide the 12 V regulated voltage to 1 V such that the too low comparator will fire below 1 V to assert the too low signal. R36 and R37, divide the 12 V signal to 3 V, and R40 and R41 divide the incoming signal by 3 so that the too high comparator will always fire at 9 V.

Each detector has a thermistor included in its housing so that the power meter can read the temperature of the sensor. The voltage from that thermistor is applied through J7-6 (for channel 1) and amplified by a gain of 2 by U35C (shown on Sheet 2). Channel 2 sensor's thermistor voltage comes in through J9-6 and is amplified by 2 at U35A. The thermistor voltages are also routed to U35D and U36A&B. This circuit is used to detect whether a sensor has been attached or disconnected. The connection or disconnection of a sensor causes a transient voltage which is passed through C10 (for channel 2) or C11 (for channel 1). This is detected by a window comparator consisting of U35D and U36A&B. Whenever the voltage is outside the normal DC bias range, the detector change will cause either a rise or a fall in the voltage that will be detected by the comparator. The comparator will output an interrupt to the processor, IRQ, which will be the output of U36A&B.

U16A and U9A provide a latch for the interrupt so that the processor will have time to respond. Pin 2 of U9A is used to enable or disable interrupts. U36C buffers the interrupt signal. The interrupt 1 signal goes to the CPU board.

The sensors also have EEPROMs that connect to the system through a serial interface. Channel 1 uses J8-6 for the clock and J8-5 for the data. This is a bi-directional device wherein data needs to be written to the sensor and also read from the sensor. U24E buffers incoming data, and U24F buffers outgoing data. Q3 provides the necessary open collector interface. U26 supplies the clock during a read or write action. The clock signal is buffered by U24D. Channel 2 has a duplicate circuit consisting of U24A/B/C and Q2. DC supplies of +5 V and ± 15 V are also routed to the sensors. The 15 V supplies are routed through solid state fuses to provide protection in case of any shorts. These are resettable solid state fuses which do not need to be replaced. The +5 V can be switched on and off. This is controlled by U26, and buffered by Q8 and Q1.

To recap the preliminary actions of the incoming signals; they first go through the chopper, the 1st stage amplifier, the 2nd stage amplifier, and then the filter. The signals are then sent to U23, a 16:1 multiplexer. U23 can select one signal to route to U25, the A/D converter. Most of the other signals are used for testing purposes only. During normal operation, the signal path will be through the Bessel filter.

Thermistor voltages enter on pins 24 and 25 for channels 1 and 2. The only other signal that is used for normal operation is the V_{propF} input that enters through J3 on the front panel. CR15 provides input protection, and U21A is a $\times 1$ amplifier/buffer. The V_{propF} signal can be read at pin 26 of the multiplexer. U25 is a 14-bit A/D converter which operates at an 11 μ s conversion time. The input is via pin 6 on TP13. This device can measure between 0 and 10 V. U25 operating power supplies are limited to ± 12 V (pins 11 and 5). Those voltages are derived from U39 and U43 which regulate the ± 15 V to ± 12 V.

R105, R104, and C31 configure U33 to measure from 0 to 10 V. Pin 4 of U33 provides the start convert signal, and the processor asserts this signal to start an A/D conversion. After the conversion has completed, pin 3 can be asserted to output the data to the bus. These two functions are supplied by chip select ACS7 and ACS1. ACS1 is the output enable and ACS7 is the start convert. EOC is end of convert, which occurs at pin 2 of U33, and is routed to data byte 15 so that the process can interrogate if the data conversion is complete. D15 will be asserted if the A/D has completed its conversion.

U15 is the offset 12-bit D/A converter which provides the 1st stage amplifier with ± 5 V offset voltage. U17 is similar but configured for 0 to 10 V. The output of U17 is buffered by U21B, current limited by R108, and available at J4 for analog output.

U23 has a number of signals available for testing purposes. Offset voltage is available on pin 5. Output DAC voltage is available on pin 4, and switched 5 V signals on pin 7.

Sheet 5 of schematic # 21360 details the interconnections for the Calibrator circuitry and will be discussed in Section 3.4, but U27 also provides three 8-bit ports for control of the multiplexers in the Analog section, and an input port for the Too High and Too Low comparators.

3.4 Calibrator Module

The Calibrator Module is located on the Analog PC Board. It is the heart of the 58542 Power Meter in that it is a patented system that allows the power sensors to be calibrated against an internal thermistor power standard (see Figure 3-3). In contrast to the conventional fixed-level calibrators, the 58542 calibrator produces a range of power levels over a 50 dB dynamic range to an accuracy of a few thousandths of a dB.

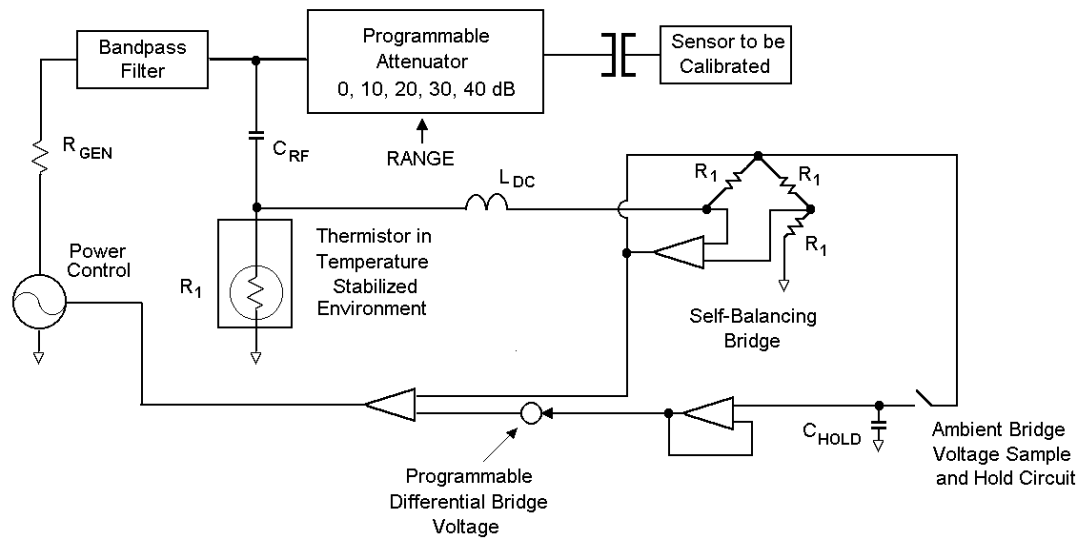


Figure 3-3. Calibrator Internal Power Standard Configuration

The thermistor is mounted in a self-balancing bridge configuration using DC substitution in the bridge. The thermistor is maintained at a fixed operating point and the DC power (P_{DC}) in the thermistor is related to the RF power (P_{RF}) by the simple relationship:

$$P_{DC} + P_{RF} = P_{AMBIENT} = \text{constant}$$

The constant, $P_{AMBIENT}$, is found by turning the RF power off and measuring the ambient voltage, $V_{AMBIENT}$ to which the self-balancing bridge settles. The advantage of this approach is that the linearity of the thermistor-leveled oscillator is limited only by the accuracy with which DC voltages can be measured and the stability of the RF calibrator. To ensure exceptional stability, the thermistor assembly is enclosed in a temperature-stabilized environment and a low drift sampling circuit is used to hold the ambient bridge voltage. The RF power can then be programmed by controlling a difference voltage, δV , at the summing node. The power is related to the voltage by:

$$P_{RF} = \frac{V_{AMBIENT} \delta V - \delta V^2}{R_1} = \frac{\delta V^2}{2R_1}$$

This permits the RF power to be precisely controlled over a dynamic range of about 12 to 15 dB. The dynamic range is extended using a switched attenuator, the properties of which are determined using the thermistor-leveled oscillator itself. The effective attenuation (including all mismatch effects) of each attenuator relative to the next is measured by finding a pair of powers, one for each attenuator, that produces identical signals from the sensor under test. Because the sensor under test is used at a fixed operating point, no knowledge of its detection law is required.

The operation of the various functions of the Calibrator Module can be understood more easily if the circuits are discussed individually. The functional sections of this module include the following:

1. The 50 MHz oscillator (Q4) and its current control circuit consisting of U4D, Q5, and U2C.
2. The RF output circuit consisting of the low pass filter, the stepped attenuator, and the connector and cable to the front panel of the power meter.
3. The oven to maintain the control thermistor at a constant 60 °C. It is located on the small board attached to the bottom of the Q1 heater transistor. The board contains the RT1 and RT2 thermistors and the Q7 control transistor.
4. The thermistor bridge to measure the RF power by DC substitution. It consists of RT1, U1, and Q6.
5. The track and hold circuit that remembers the ambient bridge voltage, using U2B, U8D, and U3A.
6. The 14-bit DAC and reference supply to measure the ambient bridge voltage and control the RF output level, made up of U11, U7, U8C&D, U4, U14A, U2A&B, U3A, U5, U10, U16B&C, U13B&C, and U9B.
7. The correction circuit to measure the temperature of the PIN diode attenuator so that a correction for the temperature dependent loss of the diodes can be corrected, consisting of RT2 and U14C.
8. Calibrator NVRAM control circuit, U26 and U18.

3.4.1 50 MHz Oscillator

The first section of the Calibrator Module consists of a colpits oscillator circuit with a controllable power output. The output power is measured by the thermistor bridge and set by varying the DC current through Q4. This current is supplied by a voltage to current converter consisting of U14D, Q5, and U4. The power generated by Q4 is linearly related to the current through it. Thus, the voltage from U4 that is converted to current by U14D and Q5 is linearly related to the RF power generated. When the calibrator is set for 0 dBm, the voltage at U4-6 is near 0 volts.

3.4.2 RF Output

The 50 MHz oscillator output is capacity coupled to the low pass filter, L13, L14, L15, and associated capacitors. The resultant harmonic-free RF is applied to the switched PIN attenuator, CR8 - 14 and associated resistors and control amplifiers U19 and U14B. The first section is 10 dB, the output section is 20 dB, and a resistor between sections adds another 10 dB. Thus, the output power can be programmed from +20 to -30 dBm.

3.4.3 Oven

The measuring thermistor is maintained at a constant 60 °C by being mounted on the Q1 heater transistor, which is driven from the sensing thermistor RT2 by way of the Q7 current amplifier. RT2 is mounted very close to RT1 so that both are maintained at the same temperature. When RT2 reaches 60 °C, the voltage across it is just enough to maintain drive to the heater. This condition will be maintained regardless of the ambient temperature.

3.4.4 Thermistor Bridge

RT1 is connected in a self-balancing bridge circuit which delivers just enough power to the thermistor to keep it at 500 Ω . Thus, if part of the power delivered to it is from the RF generated by the oscillator and the rest is from the DC current of the bridge, then by reducing the amount of DC power, the circuit will increase the drive to the oscillator as needed to keep the total power in RT1 constant. It is necessary to

measure only the amount of DC power reduction to know the amount of RF power present. In this way, a precisely known RF output level can be established.

3.4.5 Track & Hold and DAC

In order to know how much power is being added by the oscillator, it is necessary to measure the power delivered to the thermistor with no RF present. This is done by turning off the oscillator power (closing switch U2C), and then measuring the voltage out of the control bridge. This is known as the ambient bridge voltage. To make this measurement, the following conditions are established: U8D and U2B are switched open, and U8A & C are switch closed. By using the U13 DAC, a successive approximation measurement of the voltage is made. The output of the DAC is connected to one input of U4 and the bridge is connected to the other. Thus, it becomes a comparator that makes it possible for the computer to tell when the output voltage of the DAC is greater than the bridge voltage, and so complete the successive approximation. Once this is done, the DAC is set for 0 V output, U8A is opened, U8B, U8D and U2B are closed, and the track and hold capacitor, C39 will charge up to the voltage which represents the zero RF power condition of the bridge. When the oscillator is turned on by U9C, then the sampling switch, U2B, will open and allow C39 to supply this “RF Off” condition to the measuring circuit. Any voltage from the DAC will now reduce the amount of DC power being delivered to the thermistor bridge, and the control circuit will add just enough current to the oscillator to cause its output to add back that much RF power into the bridge.

3.4.6 Correction Thermistor Circuit

The compensation thermistor is mounted near CR13 to sense the temperature of the 20 dB attenuator section that produces the 0 dBm output. This is the only absolute power specified. All other power levels are measured by the software relative to 0 dBm.

3.4.7 Calibrator NVRAM Control Circuit

The calibrator serial number and the correction constant for the 0 dBm output level, as well as the date of calibration and password for rewrite access, is contained in a Non-Volatile RAM. The read and write for it is provided by the parallel peripheral interface (PPI) U26. Before allowing access to the NVRAM, the software looks for a logic 1 on port A, bit zero of the PPI and, if that is present, it asks the operator for the password. If the correct password is supplied, the collected data will be written into U18. If the jumper W1 is set to supply a logic 0 to the PPI, the operator will have write-access to U18 without needing a password.

3.4.8 Sensor NVRAM

Each sensor has a NVRAM to store all of the calibration constants, the date of calibration, place of calibration, etc. This NVRAM is also password protected but has no hardware switch to defeat it. The read/write control for it is furnished by U24A/B/C, U24D/E/F, Q2, and Q3. Q1 and Q8 control the 5 V supply to reduce the amount of heat in the sensor, as well as reducing the noise from the supply.

3.4.9 Sensor Interrupt

Each time a sensor is connected or disconnected from the 58542, a CPU interrupt is generated by causing the thermistor voltage change to set a latch, which signals the CPU that it needs to check for a sensor change. The latch is driven from a “window” comparator, U35D and U36A & B. This comparator is driven from capacitors which are connected to each of the thermistor lines from the sensors. The latch is enabled or cleared by a signal from the PPI, U26.

3.4.10 Digital Control Circuit

The digital control circuit is the interface between the CPU and the preceding functions.

3.5 Digital PC Board (A2)

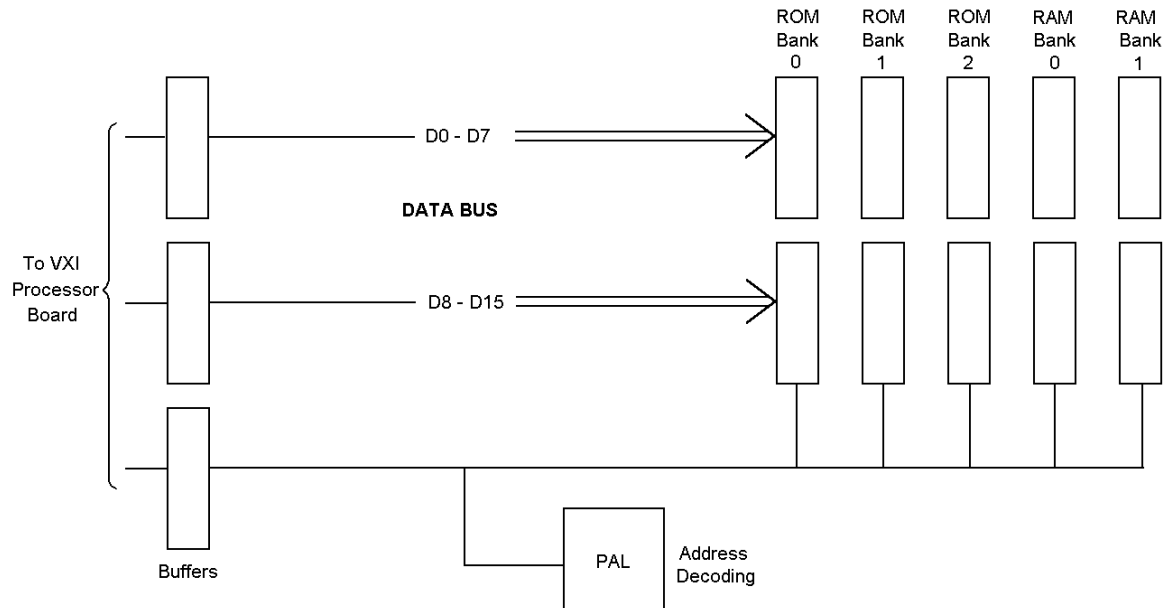


Figure 3-4. Digital PC Assembly (A2) Block Diagram

I/O address decoding is done first in the PAL (U10), and secondarily in U2. During valid I/O addressing, wait states are generated. The PAL monitors a clock cycle count (from U7A) to hold off DTACK on the CPU. W1 is jumpered to four wait states. During ROM and RAM accesses, the PAL asserts DTACK immediately with no wait states.

DTACK is passed back to the VXI Processor board. U12A provides an open collector signal.

RAM bank 1 is connected to the battery. When power is lost, U6 de-selects RAM bank 1 and connects Vcc to the battery. This bank is then non-volatile and can be used for data storage. C24 is in parallel with the battery and allows it to be replaced without losing data. Battery current can be measured at R1, TP1 and TP2. At 2 μ A, the voltage across the test points should measure about 2 mV.

U8 acts as an 8-bit input port addressed at CSTRG to monitor the eight TTL trigger lines on the VXI bus. The 58542 can trigger measurements either from these eight lines or from the TTL trigger BNC input on the front panel.

The Digital board interfaces with the Analog board at J1. All digital lines are buffered (U3, U4, and U5), and additional analog chip select decoding is done with U1.

U9A and U9B generate the upper data byte and lower data byte write signals. U11 buffers the R/*W and Reset signals.

W2 jumpers the three interrupt signals from the Analog board to the VXI Processor board. These jumpers should only be removed for troubleshooting.

3.6 VXI Processor PC Board (A3)

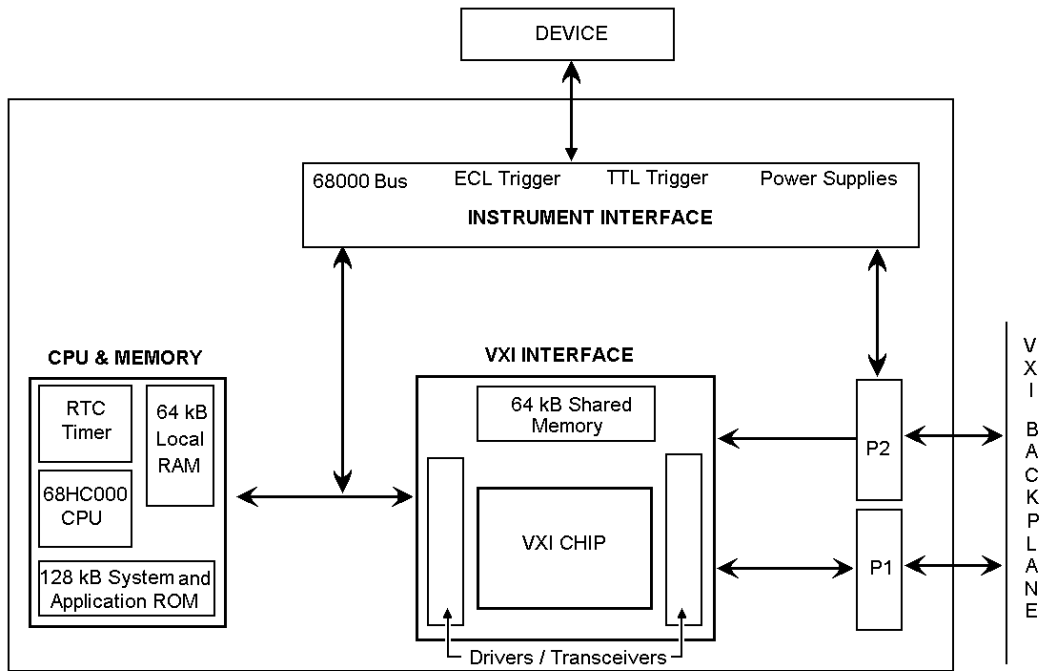


Figure 3-5. VXI Processor (A3) Block Diagram

The following circuit description is given for information only. The VXI Processor and Memory PC boards are OEM assemblies. If these boards are not functioning properly, the problem will usually be indicated by the instrument not responding to an Identification query (*IDN? - see Section 2.5.29). See Section 5.3 for replacement instructions.

The VXI Processor PC Board circuit functions are divided into three main sections:

- VXI Interface
- CPU and Memory
- LEDs and Drivers

3.6.1 VXI Interface

The VXI interface contains 64 kB of Shared Memory, a VXI interface gate array, and the drivers and transceivers to enable the VME and CPU to access the Shared Bus.

VXI Gate Array

U28 is a 120-pin gate array, packaged in a 13x13-pin grid array. The gate array generates the necessary signals that control the flow of data from the processor section through the shared bus, and to the VXI bus, and vice versa.

The gate array also controls the LEDs that indicate whether the VXI is accessing the VXI A16 or the A24/A32 registers, and the FAIL LED, which indicates whether the VXI A16 registers have been initialized.

Shared Memory

U29 and U30 are 32 k x 8 static RAM chips located on the Shared Bus for the development of VXI Shared Memory Protocols.

Shared Memory Decoders

U33 generates the necessary strobes and control signals to the Shared Memory static RAMs.

Drivers and Transceivers

U36 and U37 transceivers enable the data lines from the VXI bus onto the shared bus, and vice versa.

The A1 through A15 address lines are latched by U38 and U39 latching transceivers from the VXI bus onto the shared bus to implement address pipe-lining. The address lines are not latched going the other way.

The U40 transceiver buffers the address modifier lines.

The VXI chip controls the direction, and enables the transceivers.

U23 and U24 latch the processor data lines D00 to D15 to drive the upper 16 address lines of the VXI A32 space to implement A32 bus mastership.

The A24 through A31 address lines are buffered by U45 from the VXI bus P2 connector to the gate array.

U35 is a GAL which controls the direction of the data strobes, data transfer acknowledge, and the bus error from the VXI bus to the gate array and vice versa.

Logical Address Switch

U19 buffers the outputs of the address switch SW1 to enable the processor to read the logical address from the switch.

TTL Triggers and Local Bus

The TTL triggers and local bus are not used by the Processor board, but are made available to be used on the Digital board through the P7 pin connector.

3.6.2 CPU and Memory

Processor

The Interface circuitry of the Processor board uses an 8 MHz 68HC000 CMOS processor (U7). See the latest Motorola data sheet for further information on this chip.

Real Time Clock/Timer

U1 generates the system tick for a pSOS kernel operating system. It also adds time and event capabilities to the application code. For further information, see the latest Hitachi 146818 data sheet.

Interrupt Controller

The processor uses seven levels of auto vectored interrupts. U6 encodes the priority levels for the processor. Three levels of auto vectored interrupts are available to the user. These are signals AVINT4, AVINT3, and AVINT2. The higher numbered interrupt signal has the higher priority. The user accesses these signals from the P5 pin connector on the Processor board.

Bus Error Timer

U2A divides down the VXI 16 MHz clock for the 8 MHz processor. U2B is used to generate a bus error signal if timeout occurs before data transfer acknowledgement. The timer generates this signal if a processor access cycle exceeds 16 microseconds.

Local Address Decoders

U17 and U18 are address decoding GALs. These circuits generate the chip selects and the control lines for access to the RAM, ROM, and other functions.

Drivers and Transceivers

U26 and U27 transceivers drive the local data from the processor bus to the shared bus, and vice versa.

The processor address lines are driven by U21 and U22 to the shared bus.

The VXI gate array, U28, enables these buffers.

Local Memory

U9 and U11 are two 32K X 8 static RAM chips on the processor bus.

LED Drivers

The actual LEDs are located on the Analog PC Board. U32 is a one-shot used to widen the pulse of the VME A16 and A24/A32 signals. U34 is used to drive the RUN, HALT, MODID, A16 and A24/A32 LEDs. The FAIL LED is driven directly from the VXI chip. The TRIGGER LED is driven under software control.

Calibration & Testing

4.1 Introduction

Information in this chapter is useful for periodic calibration and testing of the Model 58542 VXI Universal Power Meter and its power sensors. These tests can also be used for incoming inspection testing when the instrument is first received.

If the 58542 power meter has not been previously used, you should review Section 2.3.

4.2 Equipment Required

The following equipment is required to complete the performance test procedures:

Table 4-1. Calibration and Test Equipment List

Description	Representative Model	Key Characteristics
CW Thermistor Power Meter	HP432A	V_{RF} and V_{COMP} available externally
Thermistor Mount	HP 478A-H75	≤ 1.07 VSWR @ 50 MHz (30 dB return loss)
Digital Voltmeter (DVM)	Fluke 8842A	$\pm 0.05\%$ accuracy and 1 μ V resolution
Directional Coupler, 10 dB	Mini Circuits ZFDC-10-1 10dB	≤ 1.15 SWR @ 50 MHz
Step Attenuator, 0 to 90 dB in 10 dB increments	Weinschel AC 118A-90-33	≤ 1.15 SWR @ 50 MHz ± 0.1 dB attenuation
RF Source (Signal Generator) (High Power)	Wavetek 2405 Option XP	+22 dBm @ 50 MHz
Low Pass Filter	Integrated Microwave 904 881	>30 dB attenuation @ 100 MHz
GPB Controller for IBM PC	National PC2/2A	With driver software

4.3 Calibration Procedures

Perform the Calibrator Output Power Reference Level check. If the unit fails to meet the power output specification within 0.981 mW (minimum) to 1.019 mW (maximum) limits, then proceed with the following steps:

4.3.1 Calibrator Output Power Reference Level

The Calibrator Output power reference is factory adjusted to 1 mW $\pm 0.7\%$. To achieve this accuracy, Giga-tronics uses a precision measurement system with accuracy to $\pm 0.5\%$ (traceable to the NIST), and allows for a transfer error of $\pm 0.2\%$ for a total of $\pm 0.7\%$. If an equivalent measurement system is used for verification, the power reference oscillator output can be verified to 1mW $\pm 1.9\%$ ($\pm 1.2\%$ accuracy + $\pm 0.5\%$ verification system error + $\pm 0.2\%$ transfer error = $\pm 1.9\%$ maximum error).

This test procedure is valid for an ambient temperature range between +15 °C and +35 °C (+59 °F to +95 °F).

To ensure maximum accuracy in verifying the Calibrator Output power reference, the following procedure provides step-by-step instructions for using specified test instruments of known capability. If equivalent test instruments are substituted, refer to the Key Characteristics in Table 4-1.

Equipment Required

HP 432A Power Meter
DVM
Thermistor Power Meter
Thermistor Mount

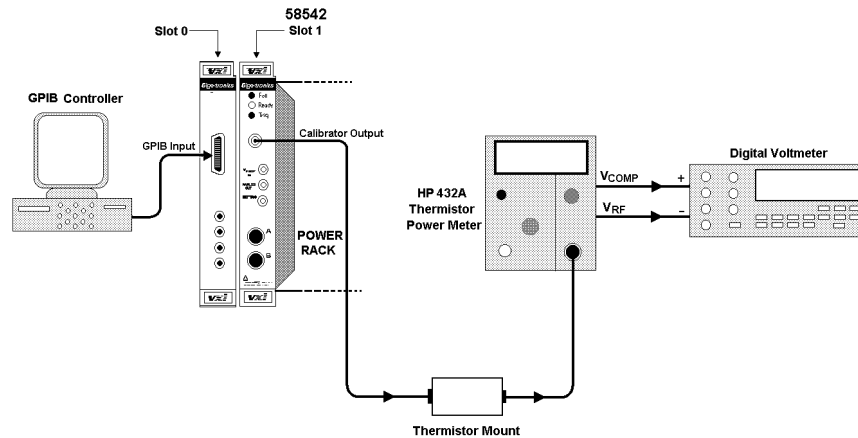


Figure 4-1. Calibrator Reference Level Test Setup

Procedure

In the following steps, precision power measurements will be made using the HP 432A Power Meter. Refer to the HP 432A manual for detailed operating information.

1. Connect the 432A to the Calibrator Output on the power meter as shown in Figure 4-1.
2. Turn on all equipment and wait 30 minutes for the thermistor mount to stabilize before proceeding to the next step.
3. Set the 432A Range switch to COARSE ZERO, and adjust the front panel COARSE ZERO control to obtain a zero ($\pm 2\%$ FS) meter indication.



NOTE: Ensure that the DVM input leads are isolated from chassis ground when performing the next step.

4. Set the DVM to a range that results in a resolution of 1 μ V. Connect the positive lead to the V_{COMP} connector, and the negative lead to V_{RF} connector, both on the rear panel of the HP432A.
5. Fine zero the HP 432A on the most sensitive range, then set the HP 432A range switch to 1 mW.
6. Record the DVM indication as V₀.
7. Turn on the power meter Calibrator RF power by sending

OUTP:ROSC ON

8. Record the reading shown on the DVM as V₁.



NOTE: The V₁ reading must be taken within 15 seconds after entering the command. Otherwise, turn off REF POWER as shown in Step 9 and repeat Steps 6 and 7.

9. Disconnect the DVM negative lead from V_{RF} on the HP432A and connect it to the 432A chassis ground. Record the new DVM indication as V_{COMP}.
10. Send OUTP:ROSC OFF to turn off REF POWER.
11. Calculate the Calibrator Output level (P_{CAL}) using the following formula:

$$P_{CAL} \text{ (Watts) } = \frac{2V_{COMP} (V_1 - V_0) + V_0^2 - V_1^2}{4R(\text{Calibration Factor})}$$

where:

P_{RF} = calibrator output power reference level

V_{COMP} = previously recorded value in Step 9

V₁ = previously recorded value in Step 8

V₀ = previously recorded value in Step 6

R = 200 Ω (assuming HP478A-H75 mount)

Calibration Factor = value for the thermistor mount at 50 MHz (traceable to NIST)

12. Verify that the P_{CAL} is within the following limits:

1 mW $\pm$ 0.019 mW (0.981 to 1.019 mW)

For record purposes, the measured value of P_{CAL} can be entered on the Test Data Recording Sheet at the end of this chapter.

4.3.2 Calibrator Output Power

To correct the setting of the power output of the calibrator, you must know the password if it has been set, or you must defeat it by setting jumper A1W1 to position A. This jumper is located and indicated on the Analog PC Board. If a password has not been set, you can proceed with the jumper in position B. Calculate the percent error in power (as described in the Performance Verification Linearity check in Section 4.4.2), and change the CALFAC by that amount. For example, if the power output is low by 0.5%, increase the CALFAC by that amount.

The following is a sample program (written in Turbo-Basic) that sets the Calibrator correction. After this program has been run, the password enable link, A1W1, can be set to **B** and a password can be assigned.

```
PRINT IT IS NECESSARY TO DEFEAT PASSWORD PROTECTION TO DO THIS TASK.
INPUT IS THE PASSWORD PROTECTION TURNED OFF (W1 ON POSITION A);A$
PRINT:PRINT Connect the Power Meter sensor to the DUT calibrator output.
INPUT Press ENTER when ready to set the calibrator correction;A$
PRINT
```

```
MEAS ROUTINE TURNS ON THE CALIBRATOR, MEASURES THE POWER OUTPUT IN mW AND
CALCULATES CAL FACTOR AND TURNS THE CALIBRATOR OFF AGAIN. SENDIT ROUTINE
SENDS THE STRING C$ TO THE DUT.
```

Fields in the CALFAC from EEPROM? : calfac, sernum, min, hr, day, mo, yr, enab, pswd

Note that the password is not sent. enab is the password enable bit.

```
C$ = DIAG:CAL:EEPROM?
GOSUB SENDIT                                ! Send the command
GOSUB DAT                                    ! GET THE EEPROM DATA
! TO PROCESS IN R$
PRINT R$                                    ! SEE FIELDS ABOVE
LAST = 1
FOR 1=1 TO 8P=INSTR(LAST,R$, )              ! Separate the result into array elements
IF P=0 THEN B$[ ] = MID$(R$,LAST):ELSE B$[ ]=MID$(R$,LAST,P-LAST)
LAST=P+1
NEXT | ! Now the data fields have been put into an array B$
B$[8] = 0                                    ! DISABLE THE PASSWORD
C$ = *CLS                                    ! Clear the status byte
GOSUB SENDIT
B$[1] = 100.00                              ! SET THE CAL FACTOR TO 100%
GOSUB MKCS                                  ! MAKE THE STRING TO SEND TO THE DUT
GOSUB SENDIT
C$ = *ESR?
GOSUB SENDIT
GOSUB DAT:PRINT EVENT STATUS IS::R$         ! MUST BE 0
PRINT
! PRINT Connect the Power Meter sensor to the DUT calibrator output.
! INPUT Press ENTER when ready to set the calibrator correction;A$
GOSUB MEAS MEASURE POWER OUTPUT IN mW AND RETURN CAL FACTOR IN %
B$[1] = STR$(INT(100*CF)/100)              ! CF IS CAL FACTOR
PRINT:PRINT CAL CORRECTION IS::B$[1]
INPUT ENTER THE SERIAL NUMBER;B$[2]
INPUT ENTER THE TIME AS H,M[4],B$[3]
INPUT ENTER THE DATE AS M,D,Y (e.g. 5,9,93);b$[6],b$[5],b$[7]
C$ = *CLS                                    ! CLEAR THE STATUS BYTE
GOSUB SENDIT
GOSUB MKCS                                  ! CONVERT THE NEW DATA
GOSUB SENDIT                                ! SEND TO DUT (did it understand and execute properly?)
```

```

C$ = *ESR?
GOSUB SENDIT
GOSUB DAT:PRINT EVENT STATUS IS:;R$ ! MUST BE 0
GOSUB MEAS                                ! VERIFY THAT THE POWER OUTPUT IS NOW CORRECT
END

MKCS: ! CONVERT THE ARRAY TO A STRING OF COMMA SEPARATED VALUES
C$ = DIAG:CAL:EEPROM
FOR | = 1 TO 8:C$=C$+B$[|];IF | <8 THEN C$=C$+;NEXT |
C$=C$+,000000                                ! APPEND THE DEFAULT PASSWORD
PRINT:PRINT EEPROM DATA:;C$
RETURN
MEAS:
C$ = OUTP:ROSC ON                                ! Turn on the Calibrator
GOSUB SENDIT
INPUT Enter the power output in mW;m                                ! Enter the measured power here either by a call to a
                                                                    ! subroutine or from the keyboard

CF = 100/m:print The power is;m
C$ = OUTP:ROSC OFF
GOSUB SENDIT                                ! Turn off the calibrator
Return

```

The sensor(s) can now be calibrated by connecting to the calibrator output and entering the command CAL1 (or 2). If the calibration does not complete satisfactorily, refer to the calibrator voltage and frequency checks starting in Section 4.3.3.

The Linearity test can now be performed as described in Section 4.4.2. This is a complete procedure and must be performed in the exact order given to produce accurate results. If this test fails, try it again with a different sensor. If it still fails, refer to the calibrator voltage and frequency checks in Section 4.3.3.

The following tests require that the power meter side cover be removed. remove the two flat head screws from the right side cover and slide the cover about 1/4 inch to the rear and lift it off.

The same test equipment that was used for the Performance Verification Tests can be used for these tests.

Refer to the Analog PC Board description in Section 3.3 for further help in defining the problem. If the fault cannot be located to the component level, the PC board can be removed and replaced with a different one with no further calibration required except to set the calibrator output power to 0 dBm.

4.3.3 Calibrator Voltages

To measure the calibrator voltages, first make sure that neither side of the DVM is grounded. The following measurements should find most of the problems that can occur in the calibrator circuitry.

1. Connect the DVM across the large resistor, A1R174. Measure 0.4 to 0.9 volts depending on the room temperature and how long the unit has been operating. This voltage is proportional to the current in the thermistor heater transistor which maintains the calibrator thermistor in a 60 °C (140 °F) environment. The voltage measured in the next step is dependent on this being correct.



NOTE: The exact ambient temperature and power-on time of the instrument in Step 1 are not specific factors, but do have some effect on the reading taken across A1R174. If there is a problem in the circuit, the measured voltage will usually be some amount outside of the 0.4 to 0.9 volts specification (such as 0, +4, or +5 volts).

2. Connect the low side of the DVM to A1TP3 and the high side to A1TP1. Measure +7 to +8.5 volts. This is the voltage applied to the thermistor bridge that is used to measure the calibrator power. This voltage will vary as the calibrator provides different amounts of RF power. This measurement assumes that the calibrator is OFF. To verify that the calibrator is off, send OUTP:ROSC OFF
3. Turn the calibrator ON by sending OUTP:ROSC ON. Now connect the high side of the DVM to A1U3, pin 7. Measure +2 to +11 volts, which should change less than 2 mV per minute. If the voltage is incorrect or drifts excessively, troubleshoot the sample and hold circuit surrounding A1U3A.

4.3.4 Calibrator Frequency Check

To measure the frequency of the calibrator:

1. Connect a 50 MHz counter to the calibrator output connector.
2. Turn ON the calibrator according to the procedure given in Step 3, above.
3. Measure 49 to 51 MHz.
4. Turn OFF the calibrator by sending OUTP:ROSC OFF.

4.4 Performance Tests

It is recommended that the performance tests be done in the order described as some of the steps use the configuration from a previous step.

Performance Test data recording sheets are at the end of this chapter. These sheets can be copied and used for recording results each time testing is performed on the power meter.

4.4.1 GPIB Port Check

This procedure confirms that the GPIB port is functional.

Equipment Required

GPIB Controller

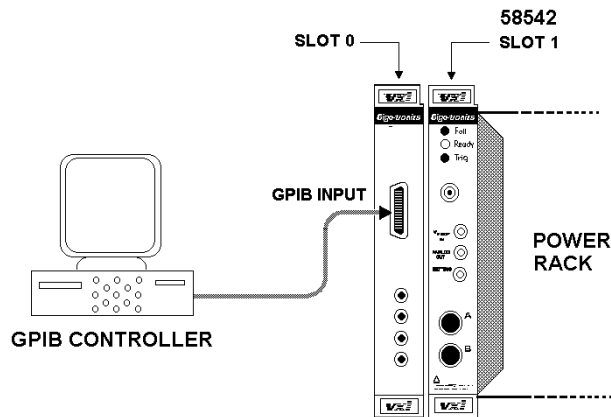


Figure 4-2. GPIB Port Test Setup

Procedure

1. Set the power meter's logical address (see Section 2.3 for instructions on how to set the address).
2. Connect the GPIB controller to the GPIB port of the SLOT 0 plug-in next to the power meter (see Figure 4-2).
3. Send the command:

*IDN?

This is the standard COMMON identify query command defined by IEEE 488.2 1988. When talk addressed after receiving the command, the power meter will output a string that identifies itself as the 58542 VXI Power Meter.

4. Display the response on the controller. It should be similar to:

Giga-tronics 58542, 0, 1.10

(the last number is the current software revision number)



NOTE: If the instrument will not respond to the *IDN? command, see the note in Section 2.5.29

4.4.2 Power Sensor Linearity

This procedure tests the power sensor linearity over the range +20 dBm to -60 dBm. At low power levels, the linearity measurement will include the uncertainty due to the zero set specification. The procedure should be repeated for each sensor used with the power meter.

The instrument plus power sensor linearity test is valid when the sensor has been calibrated using the front panel calibrator at a temperature between 0 °C and +50 °C (+32 °F to +122 °F), and if operating within ± 5 °C (± 9 °F) of that calibration temperature.

When measuring the linearity of a Low VSWR (8031X Series) or a High Power (8032X Series) sensor, the power output of the source must be increased from 10 dB to either 16 or 20 dB respectively (see Figure 4-3). The power coefficient of the step attenuator will also have to be considered. The specification of power coefficient for the Weinschel attenuator cited in the Equipment List is: <0.005 dB/dB/W. The latter will effect the linearity of each 10 dB segment, and make it necessary to expand the overall linearity specification by this quantity.

Connect the test setup shown in Figure 4-3. In assembling the test setup, keep in mind that if testing is to be conducted with Low VSWR or High Power sensors, the optional RF Amplifier must have frequency and bandwidth to match the sensor's characteristics (see the Sensor Selection Guide in Appendix B), and the Directional Coupler must be increased as stated above for the particular series of sensors. All Standard (8030X series) and True RMS (8033X series) sensors are tested without the optional RF Amplifier, and with a 10 dB Directional Coupler.

Refer to the Linearity Data section of the Performance Verification Data recording sheets at the end of this chapter. The tolerance is already entered for the various steps, and includes an allowance for specified zero-set errors at low power levels.

Setup Parameters

The following setup parameters should be accomplished prior to performing the Power Linearity test:

Equipment Required

GPIO Controller
DVM
RF Signal Generator
Thermistor Power Meter
Directional Coupler
Step Attenuator
Power Sensor

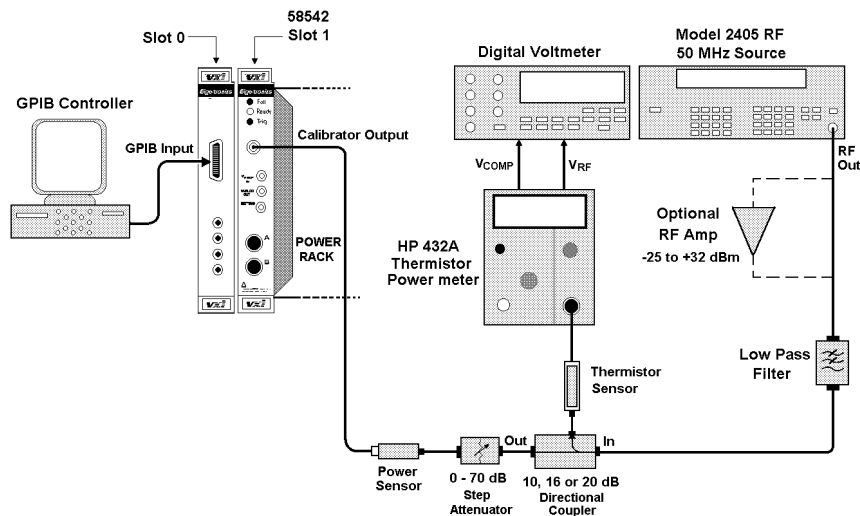


Figure 4-3. Power Sensor Linearity Test Setup

1. The power meter and sensor should be calibrated by following the instructions in Section 4.3 of this manual.
2. The Averaging is set to AUTO by entering:

SENS1: AVER: COUN: AUTO ON

(Enter SENS2 for channel 2)

CAUTION

Extreme care is required in the following procedure since the accuracy requirements are critical to ensure the most accurate test results.

Power readings are determined using the thermistor power meter in the same general way as given in the Power Reference Level test. That is, P1 and P2 in the Power Meter reading column of the Performance Verification Test Data Sheet tables are calculated each time for the respective values of V_{COMP} , V_0 , and V_1 as read on the DVM.

3. To ensure accurate and repeatable measurements, the HP432A power meter should be zeroed just before taking each reading that will be used to calculate P1 in the Power Meter column of the Performance Verification Test Data Sheets.

Test Procedure

4. Set the step attenuator to 70 dB. Turn the source power output off, and then zero the power meter (the power meter is zeroed by sending CAL1:ZERO)
5. Set the step attenuator to 0 dB after the power meter has zeroed.
6. Set the power output of the RF source so that the thermistor power meter indicates $1.00 \text{ mW} \pm 0.025 \text{ mW}$.
7. Record the calculated power meter reading and the power meter reading at the end of this chapter. The power meter data is obtained by sending MEAS1? (or MEAS2?) and then receive the data.
8. Set the power output of the RF source so that the thermistor power meter indicates $3.98 \text{ mW} \pm 0.10 \text{ mW}$.
9. Record the new calculated power meter reading and the new power meter reading in the correct columns of the Linearity Data recording sheet.
10. Set the power output of the RF Source so that the thermistor power meter indicates $3.98 \text{ mW} \pm 0.10 \text{ mW}$.
11. Record the calculated power meter reading and the power meter reading in the correct columns of the Linearity Data recording sheet.
12. Set the power output of the RF Source so that the thermistor power meter indicates $5.01 \text{ mW} \pm 0.13 \text{ mW}$.
13. Record the new calculated power meter reading and the new power meter reading in the correct columns of the Linearity Data recording sheet.
14. Repeat using the power meter indications in the Data Recording sheet. Note that the Step Attenuator generates the remaining 70 dB range of 10 dB steps for a total range of 80 dB. Repeat Step 1 between each 10 dB step shown on the Linearity Data Recording sheet.

15. Make the calculations indicated on the Linearity Data sheet, and enter the values in the appropriate blank spaces.

This completes the Performance Tests for the power meter and its sensors. If the meter has performed as described in this chapter, it is correctly calibrated and within specifications.

Performance Test Data Sheet

Date:	
Operator:	
Test Number:	
Power Meter S/N:	
Power Sensor S/N:	

Calibrator Output Power Reference		
Minimum	Actual Reading	Maximum
0.981 mW		1.019 mW

Linearity Data (+16 dBm to +20 dBm)							
Step Attenuator Value	Power Set Point	Power Meter Reading (P)	58542 (DUT) Reading (R)	Reference Power Ratio	58542 (DUT) Reading Ratio	¹ Linearity Error (%)	
						Linearity Specification	² Accumulated Linearity Error
0 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	3.98 mW ±0.10 mW	P2 =	R2 =			±1%	Same as Lin. error above
0 dB	3.98 mW ±0.10 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	5.01 mW ±0.13 mW	P2 =	R2 =			+1% -1.6%	
0 dB	5.01 mW ±0.13 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	6.31 mW ±0.16 mW	P2 =	R2 =			+1% -2.7%	
0 dB	6.31 mW ±0.16 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	7.94 mW ±0.2 mW	P2 =	R2 =			+1% -3.8%	
0 dB	7.94 mW ±0.2 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10 mW ±0.25 mW	P2 =	R2 =			+1% -4.9%	
-60 dBm to +16 dBm Linearity Data are on the next page.							

Notes:

1 Linearity Error (%) = $[(R1/R2) / (P1/P2) - 1] * 100$

2 Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

Linearity Data (+16 dBm to +60 dBm)							
Step Attenuator Value	Power Set Point	Power Meter Reading (P)	58542 (DUT) Reading (R)	Reference Power Ratio	58542 (DUT) Reading Ratio	¹ Linearity Error (%)	
						Linearity Specification	² Accumulated Linearity Error
0 dB						See Note 3	
						±1%	Same as Lin. error above
10 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
20 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
30 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
40 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
50 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
60 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.5%	
70 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±6%	

Notes:

1 Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] * 100

2 Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

3 Use the first CW Linearity error value entered in the +16 dBm to +20 dBm Linearity Data.

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 $+20 \text{ dBm} \pm 0.8 \text{ dB}$.
 - c. Send DIAG:CAL:ATTEN 10.
This will insert the 10 dB attenuator into the calibrator output. The power should measure a decrease of $10 \text{ dB} \pm 1 \text{ dB}$.
 - 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 $\pm 1 \text{ dB}$. 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?space16 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?space16 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:ANALogspace5.5 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 VpropF port reading (0 to 32767)
DIAGnostic:CALibrator:ATTenuatorspace10 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:EEPROMspace100 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:POWerspace-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:SOURcespace9.5 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:GAINspaceA-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
DIAGnostic:LEDspaceON-OFF OUTPUT @Pwr_Mtr;DIAG:LED ON	Turn trigger led on

Command Syntax Typical Example	Function
DIAGnostic:MULtiplexerspaceMA-MB-MC MO-MP OUTPUT @Pwr_Mtr;DIAG:MUL MA	Set multiplexer
DIAGnostic:MEASurementspaceSTART-STOP OUTPUT @Pwr_Mtr;DIAGMEAS STAR	Resume measurement process
DIAGnostic:OFFSetspace3.5 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:RAWdataspace<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:CALFRRange 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:CALFRRange? 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 quoteone or more frequencies 1e7 to 40e9double 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
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 OUTPUT @Pwr_Mtr;DIAG:SENS1:CALFST0.20,0.30,0.40,0.50,0.60,0.70,0.80,0.90,0,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18	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 #

Command Syntax Typical Example	Function
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSP <i>Special space double quote one or more calfactor values-99.9double quote</i> 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:CALFSP <i>Special?</i> OUTPUT @Pwr_Mtr;DIAG:SENS1:EEPROM:CALFSP?	Query sensor 1 special frequency cal factor
DIAGnostic:SENVolt <i>space<ON or OFF></i> 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? <i>space<sensor 1 or 2></i> OUTPUT @Pwr_Mtr;DIAG:ZTAB? 1	Query sensor 1 zeroing data

Parts Lists

6.1 Introduction

This chapter contains the parts lists for all assemblies in the Model 58542 VXIbus Universal Power Meter. Each parts list includes the CAGE identifier. A list of manufacturers is in Section 6-2.

58542 VXI POWER METER, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
2	21555	1	58900	21555	MANUAL,MODEL 58542
3	21373	1	58900	21373	COVER,RT SIDE
4	21461	1	58900	21461	INSULATOR,RIGHT SIDE
5	20954-001	2	54516	20954-001	DET EXT CABLE ASSY 1.5M (5 FT)
6	21556	2	58900	21556	LABEL, ESD
7	PS00-00005	1	0GAA9	3001418	STATIC SHIELDING BAG

21383-A00 58542,VXI CHASSIS ASSY, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
	30008	REF	58900	30008	58542 PRETEST PROCEDURE
1	21375	1	58900	21375	FRT PNL,MODEL 58542 (VXI)
2	30009	REF	58900	30009	58542 CAL PROCEDURE
3	30010	REF	58900	30010	58542 SYSTEM TEST PROC
4	30018	REF	58900	30018	58542 SERIES JIT FLOW CHART
5	21374	1	58900	21374	COVER,LT SIDE
6	10129	1	58900	10129	LABEL, CODE AND SERIAL NUMBER
7	21462	1	58900	21462	INSULATOR,LEFT SIDE
8	HEH0-00001	1	58900	HEH0-00001	EXTRACTOR HANDLE
9	HEH0-00002	1	58900	HEH0-00002	EXTRACTOR HANDLE
10	21414	2	58900	21414	LABEL,VXI LOGO
101	HNKS-44004	4	58900	HNKS-44004	4-40 KEP NUT
102	HWSS-40300	10	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
103	HBFP-44003	4	26233	NS139CR440R3	4-40 X 3/16 FLAT
104	HCTX-02511	2	62559	21100-464	GRAY COLLAR SCREW SLEEVE
105	HBPP-44004	10	26233	NS137CR440R4	4-40 X 1/4 PAN
106	21587	3	58900	21587	RING NUT,BNC
107	HBPC-02510	2	58900	HBPC-02510	M2.5 X 10 CHEESE HEAD
108	HCTS-02511	2	58900	HCTS-02511	M2.5 x 11 COLLAR SCREW
109	HWFS-02507	2	58900	HWFS-02507	M2.5 FLAT WASHER
110	HBFP-02508	2	58900	HBFP-02508	M2.5 X 8 RAISED C'SINK
111	70564	REF	58900	70564	VXI ASSEMBLY WORK INSTRU
A1	21359	1	58900	21359	PCB ASSY,ANALOG VXI
A2	21356	1	58900	21356	PCB ASSY,DIGITAL
A3	21418	1	58900	21418	PCB ASSY,VXI PROCESSOR
BT1	VB00-00360	1	58900	VB00-00360	3.6 VOLT LITHIUM BATTERY
W1	21442	1	58900	21442	CABLE ASSY,CAL
W2	21405	1	58900	21405	CABLE ASSY,SENSOR INPUT
W3	21405	1	58900	21405	CABLE ASSY,SENSOR INPUT

21359 PCB ASSY,ANALOG VXI, Rev: M

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	21359-A00	1	58900	21359-A00	PCB ASSY PRE-WAVE,ANALOG VXI
2	20260	1	—	20260	HOUSING,CALIBRATOR
3	20192	1	58900	20192	SHELL,OBLONG
4	21384	1	58900	21384	COVER,TOP,SENSOR INPUT
5	21385	1	58900	21385	COVER,BTM,SENSOR INPUT
6	20259	1	58900	20259	COVER,CALIBRATOR HOUSING
7	HQH0-00000	2	58900	HQH0-00000	HEATSINK
8	20800	1	58900	20800	LABEL,US PATENT 4,794,325
9	GFU0-01204	0	53387	4504-3/4"	3/4 X 1/4 FOAM TAPE
10	HSCS-40204	3	58900	HSCS-40204	4-40 x 5/32 SWAGE SPACER
11	WTT0-22001	0	16428	#22AWG-TFE/TW	#22 CLEAR TFE SLVNG
101	HWSS-40300	8	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
102	HBPP-44004	12	26233	NS137CR440R4	4-40 X 1/4 PAN
103	16718	0	05AJ8	COMPOUND 340	THERMAL GREASE
104	HNKS-44004	1	58900	HNKS-44004	4-40 KEP NUT
105	HBPP-44005	1	26233	NS137CR440R5	4-40 X 5/16 PAN
106	GFU0-01204	1	53387	4504-3/4"	3/4 X 1/4 FOAM TAPE
107	HSCS-40204	3	58900	HSCS-40204	4-40 x 5/32 SWAGE SPACER
A1	20112	1	58900	20112	CALIB THERM OVEN PCB ASSY
C76	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
C192	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
DS1	ILYR-00200	1	58900	ILYR-00200	RIGHT ANGLE YELLOW LED
DS2	ILGR-10200	1	08MU3	5300H5	RIGHT ANGLE GREEN LED
DS3	ILRR-20200	1	58900	ILRR-20200	RIGHT ANGLE RED LED
J3	JRDF-00008	1	09769	413524-1	BNC F RT ANG PC MOUNT
J4	JRDF-00008	1	09769	413524-1	BNC F RT ANG PC MOUNT
J6	JRDF-00008	1	09769	413524-1	BNC F RT ANG PC MOUNT
J7	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
J8	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
J9	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
J10	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
R263	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
U2	ULN0-00411	1	17856	DG411DJ	DG411DJ QUAD SPST SWITCH
U3	UFN0-03240	1	58900	UFN0-03240	CA3240E DUAL OP AMP
U8	ULN0-00411	1	17856	DG411DJ	DG411DJ QUAD SPST SWITCH
U15	UIN0-07245	1	24355	AD7245JN	AD7245JN 12 BIT D/A
U17	UIN0-07245	1	24355	AD7245JN	AD7245JN 12 BIT D/A
U23	ULN0-00506	1	17856	DG506ACJ	DG506ACJ 16 CHANNEL SW
U28	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U29	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U30	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U31	UFN0-00625	1	24355	AD625JN	AD625JN PROG INST AMP
U32	UFN0-01014	1	64155	LT1014DN	LT1014DN QUAD OP AMP
U33	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U34	ULN0-00339	1	04713	LM339N	LM339N COMPARATOR
U36	ULN0-00339	1	04713	LM339N	LM339N COMPARATOR
U37	URC0-07815	1	01295	L7815C	MC7815CT 1A 15V REG
U38	URC0-07915	1	04713	MC7915CT	MC7915CT 1A -15V REG
XW1	17240-001	1	27264	15-38-1024	JUMPER,INSULATED,2 POS

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	21358	1	58900	21358	PCB, ANALOG
2	21360	REF	58900	21360	SCHEMATIC, ANALOG
3	JIA0-01443	4	58900	JIA0-01443	CONTACT POST
4	10091-008	3	58900	10091-008	4-40 X 9/16 SWAGE SPACER
5	10091-007	2	58900	10091-007	STANDOFF, SWAGE, 4-40, .750 LG
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C19	18831	1	—	DM15-102J	1000 PF DIP MICA
C20	18831	1	—	DM15-102J	1000 PF DIP MICA
C21	18831	1	—	DM15-102J	1000 PF DIP MICA
C22	18831	1	—	DM15-102J	1000 PF DIP MICA
C23	CD99-01820	1	—	DM15821F	820 PF 300V DIP MICA
C24	CD99-01820	1	—	DM15821F	820 PF 300V DIP MICA
C25	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C33	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C34	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C35	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C36	CC98-00330	1	—	CCD-330	33 PF 1KV CERAMIC NPO
C37	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C38	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C39	CF00-04470	1	58900	CF00-04470	.47UF 100V POLYPROPYLENE
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CE50-R5470	1	74840	475PGM050M	4.7UF 50V RADIAL
C47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C49	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CD99-01150	1	—	DM15-151F	150 PF DIP MICA
C53	CD99-01240	1	—	DM15-241F	240 PF DIP MICA
C54	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C55	CD99-00620	1	—	CM05FD620F03	62 PF DIP MICA
C56	CD99-01120	1	—	CM06FD121J03	120 PF DIP MICA
C57	CD99-00620	1	—	CM05FD620F03	62 PF DIP MICA
C58	CD00-02100	1	—	CM05E102	1000 PF DIP MICA
C59	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C60	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C61	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C62	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C63	CD00-02100	1	—	CM05E102	1000 PF DIP MICA
C64	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C65	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C66	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C67	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C68	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C69	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C70	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C71	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C72	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C73	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C74	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C75	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C77	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C78	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C79	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C80	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C81	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C82	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C83	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C84	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C85	CC50-02220	1	04222	SR155C222KAA	2200PF CERAMIC X7R
C86	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C87	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C88	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C90	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C91	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C92	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C93	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C94	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C100	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C101	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C102	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C103	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C104	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C105	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C106	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C107	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C108	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C109	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C110	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C112	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C114	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C115	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C124	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C126	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C127	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C128	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C129	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C130	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C131	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C132	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C133	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C134	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C135	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C136	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C137	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C138	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C139	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C140	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C141	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C142	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C143	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C144	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C145	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C146	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C147	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C148	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C149	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C150	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C151	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C152	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C153	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C154	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C155	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C156	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R

21359-A00 PCB ASSY PRE-WAVE,ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C157	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C158	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C161	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C162	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C163	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C167	CD99-02250	1	—	DM19F252J500V	2500 PF 500 V DIP MICA
C171	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C173	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C174	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C175	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C176	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C177	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C178	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C179	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C180	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C185	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C186	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C187	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C188	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C189	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C190	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C191	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR7	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR8	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR9	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR10	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR11	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR12	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR13	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR14	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR15	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR16	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR17	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR20	DZAB-00751	1	04713	1N751A	1N751A 5.1V ZENER
CR21	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR22	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR23	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR24	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
J5	JRBM-00100	1	58900	JRBM-00100	SMB M PC MOUNT
L11	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L12	19203	1	OB3G8	19203	.1 UH RF COIL
L13	15293	1	58900	15293	.17 UH INDUCTOR
L14	15293	1	58900	15293	.17 UH INDUCTOR
L15	15293	1	58900	15293	.17 UH INDUCTOR
L16	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L17	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L18	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
P1	JIA2-50318	1	09769	2-87227-5	50 PIN STRIPLINE PLUG
Q4	QBNP-00231	1	58900	QBNP-00231	BFQ231 1W 1GHZ NPN
Q1	QBPP-00170	1	04713	MJE 170	MJE 170 3A 40V 12.5W PNP
Q2	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
Q3	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
Q5	QBPS-03644	1	58900	QBPS-03644	2N3644 .3 A 45 V PNP
Q6	QBNS-03569	1	4U751	2N3569	PN3569 .5A 40V NPN
Q7	QBNS-03569	1	4U751	2N3569	PN3569 .5A 40V NPN
Q8	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
R1	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R2	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R4	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R5	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R6	RN55-21960	1	91637	RN55C1962F	19.6 K OHMS 1% MET FILM
R7	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R8	RN55-00340	1	58900	RN55-00340	34.0 OHMS 1% MET FILM
R9	RN55-00097	1	91637	RN55D 9.76 OHM 1%	9.76 OHM 1% MET FILM
R10	RN55-00340	1	58900	RN55-00340	34.0 OHMS 1% MET FILM
R11	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R12	RN55-21960	1	91637	RN55C1962F	19.6 K OHMS 1% MET FILM
R15	RN55-22870	1	91637	RN55C2872F	28.7 K OHMS 1% MET FILM
R16	RN57-27000	1	91637	MFF 1/8 T2	70.0 K OHM .1 % MET FILM
R17	RN57-18750	1	91637	MFF 1/8 T2	8.75 K OHM .1 % MET FILM
R18	RN57-11250	1	58900	RN57-11250	1.25 K OHM .1% MET FILM
R19	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R20	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R21	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R22	RN55-04020	1	91637	RN55C4020F	402 OHMS 1% MET FILM
R23	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R24	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R25	RN55-13650	1	91637	RN55C3651F	3.65 K OHMS 1% MET FILM
R26	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R27	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R28	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R29	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R30	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R31	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R32	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R33	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R34	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R35	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R36	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R37	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R38	RN55-31740	1	91637	RN55C1743F	174 K OHMS 1% MET FILM
R39	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R40	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R41	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R42	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R43	RN55-33920	1	91637	RN55C3923F	392 K OHMS 1% MET FILM
R44	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R45	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
R46	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R77	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R78	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R79	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R80	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R81	RN55-24750	1	91637	RN55C4752F	47.5 K OHMS 1% MET FILM
R82	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R83	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R84	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R96	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R97	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R98	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R99	RN55-00274	1	91637	RN55C2740F	27.4 OHMS 1% MET FILM
R100	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R101	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R102	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R103	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R104	RN55-02000	1	91637	RN55C2000F	200 OHMS 1% MET FILM
R105	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R107	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R108	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
R113	RN55-24750	1	91637	RN55C4752F	47.5 K OHMS 1% MET FILM
R114	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R115	RN55-11130	1	91637	RN55D 1.13K OHM 1%	1.13 K OHMS 1% MET FILM
R116	RN55-?????	1	58900	RN55-?????	COMPONENT SELECTED IN TEST
R117	RN57-21500	1	58900	RN57-21500	15.0 K OHM .1 % MET FILM
R118	RN57-11290	1	53387	LM3C1291B	1.29K OHM .1% MET FILM
R119	RN57-21250	1	58900	RN57-21250	12.5 K OHM .1% MET FILM

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R120	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R121	RN55-41000	1	91637	RN55C1004F	1 M OHMS 1% MET FILM
R122	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R123	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R124	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R125	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R126	RN57-21333	1	58900	RN57-21333	13.33 K OHM .1 % MET FILM
R127	12449-129	1	58900	12449-129	40.0 K OHM .1 % MET FILM
R128	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R131	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R132	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R133	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R134	RN55-13010	1	91637	RN55C3011F	3.01 K OHMS 1% MET FILM
R135	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R136	RN55-23160	1	91637	RN55C3162F	31.6 K OHMS 1% MET FILM
R137	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R138	RN55-13320	1	91637	RN55C3321F	3.32 K OHMS 1% MET FILM
R139	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R140	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R141	RN57-18000	1	58900	RN57-18000	8.00 K OHM .1 % MET FILM
R142	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R143	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R144	RN55-00274	1	91637	RN55C27R4F	27.4 OHMS 1% MET FILM
R146	RN55-12490	1	91637	RN55C2491F	2.49 K OHMS 1% MET FILM
R147	RN55-12490	1	91637	RN55C2491F	2.49 K OHMS 1% MET FILM
R148	RN55-21210	1	91637	RN55C1212F	12.1 K OHMS 1% MET FILM
R149	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R150	RN55-03740	1	91637	RN55C3740F	374 OHMS 1% MET FILM
R151	RN55-03740	1	91637	RN55C3740F	374 OHMS 1% MET FILM
R152	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R153	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R154	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R155	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R156	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R157	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R158	RN55-00953	1	91637	RNC55H95R3FP	95.3 OHM 1% MET FILM
R159	RN55-00953	1	91637	RNC55H95R3FP	95.3 OHM 1% MET FILM
R160	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R161	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R162	RN55-00287	1	91637	CCF55-2-28.7^1%T2T/R	28.7 OHMS 1% MET FILM
R163	RN55-00110	1	91637	RN55C11R0F	11.0 OHMS 1% MET FILM
R164	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R165	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R166	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R167	RN55-02430	1	91637	RN55C2430F	243 OHMS 1% MET FILM
R168	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R169	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R170	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R171	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R172	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
R173	RN55-12740	1	91637	RN55C2741F	2.74K OHMS 1% MET FILM
R174	RG03-00150	1	91637	FP215R0 5%	15 OHM 10% METAL GLAZE
R175	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R176	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R177	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R178	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R179	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R180	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R181	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R182	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R183	RN55-02490	1	91637	RN55C2490F	249 OHMS 1% MET FILM
R184	RN55-34750	1	91637	RN55C4753F	475 K OHMS 1% MET FILM
R185	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R186	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R187	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R190	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R191	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R194	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R195	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R196	RN55-21540	1	91637	RN55C1542F	15.4 K OHMS 1% MET FILM
R199	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R204	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R205	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R206	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R207	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R228	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R229	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R232	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R233	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R234	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R235	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R240	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R241	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R242	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R243	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R246	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R247	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R248	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R249	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R250	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R251	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R252	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R253	RN55-21000	1	53387	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R256	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R257	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R258	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R259	RN57-21000	1	58900	RN57-21000	10K OHM .1% MET FILM
R260	RN57-21000	1	58900	RN57-21000	10K OHM .1% MET FILM
R261	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R262	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
RP1	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RP2	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RP3	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RT2	RTC2-21000	1	56866	QTM C-14	10 K OHM THERMISTOR
RT3	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
RT4	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
RT5	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
TP1	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP2	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP3	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP4	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP5	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP6	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP7	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP8	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP9	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP10	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP11	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP12	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP13	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP14	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP15	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
U1	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U4	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U5	ULN0-00393	1	01295	LM393P	LM393N VOLT COMPARATOR
U6	UVG0-00070	1	64155	LM199H	LM399H 7V PRECISION ZENER
U7	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U9	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U10	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U11	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U12	UIN0-07534	1	24355	AD7534JN	AD7534JN 14 BIT DAC
U13	UTN0-00042	1	01295	SN74HC04N	74HC04 HEX INVERTER SMT

21359-A00 PCB ASSY PRE-WAVE,ANALOG VXI, Rev: L

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U14	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U16	UTN0-00082	1	01295	SN74HC08N	74HC08N QUAD AND
U18	UMN0-02444	1	60395	X2444P	X2444P 256 BIT NV RAM
U19	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U20	UTN0-00143	1	58900	UTN0-00143	74HCT14N HEX SCHMITT TRIGGER
U21	UFN1-00358	1	01295	LM358AP	LM358AN DUAL OP AMP
U22	UTN0-00742	1	58900	UTN0-00742	74HC74 DUAL D FLIP FLOP
U24	UTN0-00143	1	58900	UTN0-00143	74HCT14N HEX SCHMITT TRIGGER
U25	UIN0-00779	1	24355	AD779JD	AD779JN 14 BIT A/D
U26	UGN0-08255	1	34335	8255A-5	8255A-5 PROG PIA
U27	UGN0-08255	1	34335	8255A-5	8255A-5 PROG PIA
U35	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U39	URP0-78120	1	04713	MC78L12ACP	MC78L12CP .1A 12V REG
U43	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
W1	JIA0-01443	1	58900	JIA0-01443	CONTACT POST
W2	JIA0-01443	1	58900	JIA0-01443	CONTACT POST
XU2	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU3	JSP0-10008	1	09769	2-640463-1	8 PIN DIP SOCKET
XU8	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU15	JSP2-10024	1	09769	2-641932-1	24 PIN DIP SOCKET
XU17	JSP2-10024	1	09769	2-641932-1	24 PIN DIP SOCKET
XU23	JSP0-10028	1	09769	2-641615-1	28 PIN DIP SOCKET
XU28	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU29	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU30	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU31	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU32	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XU33	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU34	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XU36	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET

21356 PCB ASSY,DIGITAL, Rev: F

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	21356-A00	1	58900	21356-A00	PCB ASSY PRE-WAVE,DIGITAL VXI
2	GTS0-00250	0	53387	5419-1/4"	1/4"POLYIMIDE TAPE
3	GTS0-00187	0	53387	1181-3/16"	3/16" COPPER FOIL TAPE
4	WSB0-26000	0	16428	8023	26 GA BUS WIRE
C26	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C27	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C28	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C29	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C30	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C31	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C32	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C33	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C34	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C35	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C36	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C37	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C38	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C39	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C40	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C41	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C42	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C43	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C44	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C45	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C46	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C47	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C48	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C49	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C50	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C51	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C52	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C53	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C54	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C55	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C56	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C57	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C58	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C59	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C61	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C66	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C67	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C68	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C69	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C70	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C71	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C72	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C73	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C74	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C75	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C77	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C81	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
C82	CK50-01100	1	58900	CK50-01100	100 PF CERAMIC NPO
U10	21379	1	58900	21379	PAL,PROG,VXI DIGITAL
U13	21371	1	58900	21371	PROM SET, VXI DIGITAL
U14	21371	REF	58900	21371	PROM SET, VXI DIGITAL
U15	21371	REF	58900	21371	PROM SET, VXI DIGITAL
U16	21371	REF	58900	21371	PROM SET, VXI DIGITAL

21356-A00 PCB ASSY PRE-WAVE,DIGITAL VXI, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	21355	1	58900	21355	PCB,DIGITAL
2	21357	REF	58900	21357	SCHEMATIC,DIGITAL PCB
C1	CE25-R7100	1	00656	AMR101M025	100 UF 25V RADIAL LEAD
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CE25-07100	1	55680	TVX1E101MAA	100UF 25V ELECTROLYTIC
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
J1	JSE0-20050	1	55322	ESW-125-37-S-D	50 PIN ELEVATED SOCKET
J2	JIB2-40100	1	91506	A015-040-YE-0013	40 PIN STRIPLINE SOCKET
J3	JIB2-40100	1	91506	A015-040-YE-0013	40 PIN STRIPLINE SOCKET
J4	JIB2-36100	1	91506	A015-036-YE-001	36 PIN STRIPLINE SOCKET
J6	JIR1-04295	1	09769	640453-4	4 PIN RT ANG STRPLN PLUG
L1	LCC0-00000	1	58900	LCC0-00000	WIDE-BAND CHOKE
L2	LCC0-00000	1	58900	LCC0-00000	WIDE-BAND CHOKE
L3	LCC0-00000	1	58900	LCC0-00000	WIDE-BAND CHOKE
R1	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R2	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
RP1	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP2	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP3	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP4	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP5	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP6	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
TP1	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP2	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
U1	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMUL TIP
U2	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMUL TIP
U3	UTN0-02443	1	01295	SN74HCT244N	SN74HCT244N BUFFER
U4	UTN0-02453	1	01295	SN74HCT245N	74HCT245 OCTAL BUSXCVR
U5	UTN0-02453	1	01295	SN74HCT245N	74HCT245 OCTAL BUSXCVR
U6	UIN0-01210	1	0B0A9	DS1210	DS1210 NONVOL CONTROLLER
U7	UTN0-03932	1	01295	SN74HC393N	74HC393 BINARY DIVIDE
U8	UTN0-05402	1	01295	SN74HC540N	SN74HC540N OCTAL BUFFER
U9	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U11	UTN0-00042	1	01295	SN74HC04N	74HC04 HEX INVERTER SMT
U12	UTN0-00052	1	01295	SN74HC05N	74HC05, HEX INVERTER
U21	UMN0-51001	1	4T165	UPD431000ACZ-70L	TC551001BPL-10 1M RAM
U22	UMN0-51001	1	4T165	UPD431000ACZ-70L	TC551001BPL-10 1M RAM
XU10	JSP0-10020	1	09769	2-641612-1	20 PIN DIP SOCKET
XU13	JSP0-10032	1	09769	2-644018-1	32 PIN DIP SOCKET
XU14	JSP0-10032	1	09769	2-644018-1	32 PIN DIP SOCKET
XU15	JSP0-10032	1	09769	2-644018-1	32 PIN DIP SOCKET
XU16	JSP0-10032	1	09769	2-644018-1	32 PIN DIP SOCKET
XU17	JSP0-10032	1	09769	2-644018-1	32 PIN DIP SOCKET
XU18	JSP0-10032	1	09769	2-644018-1	32 PIN DIP SOCKET

21418 PCB ASSY,VXI PROCESSOR, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	21404	1	58900	21404	VXI PROCESSOR/INTERFACE
2	21419	1	58900	21419	PROM SET, VXI PROCESSOR

6.2 List of Manufacturers

The names and addresses of manufacturers cited in the preceding parts lists are shown on the following pages. Each manufacturer is listed under its CAGE number (Commerical And Government Entity), as noted in the parts lists. In a few cases, no CAGE number has been assigned; these nanufacturers are referenced by Giga-tronics codes which are shown at the end of the list.

Cage	Name	Address
0ABX4	Comptec Inc	7837 Custer School Rd Custer, WA 98240
0AG18	Hirose Electric USA Inc	Chatsworth, CA
0AX52	Ditom Microwave Inc	1180 Coleman Ave #103 San Jose, CA 95110
0BE81	Aerovox-Mallory	20 Aberdeen Dr Glasgow, KY 42141
0B0A9	Dallas Semiconductor Corp	6350 Beltwood Pky S Dallas, TX 75244
0B549	Siemens Components Inc Semiconductor Group	2191 Laurelwood Rd Santa Clara, CA 95054
0D2A6	Mitsubishi Electronics Inc	1050 East Arques Ave Sunnyvale, CA 94086
0D3V2	Menlo Industries Inc	44060 Old Warm Springs Blvd Fremont, CA 94538
0EUK7	All American Transistor of California Inc	369 Van Ness Way Suite 701 Torrance, CA 90501
0GP12	Radiall Inc	150 Long Beach Blvd Stratford, CT 06497
0GYA7	Signal Transformer Co	500 Bayview Ave Inwood, NY 11696
0HS44	Pacific Millimeter	189 Linbrook Dr San Diego, CA 92111
0HFH6	Futaba Corporation of America	555 West Victoria St Compton, CA 90220
0HFJ2	Microplastic	9180 Gazette Ave Chatsworth, CA 91311
0HIN5	Marcon America Corp	998 Forest Edge Dr Vernon Hills, IL 60061
0H379	Aerowave Inc	344 Salem St Medford, MA 02155
0J7V3	Amp Inc	19200 Stevens Creek Blvd Suite 1 Cupertino, CA 95014
0JNR4	Dupont Eelectronics Customer Service Center	825 Old Trail Rd PO Box 80019 Wilmington, DE 19880-0019
0KA21	Stetco Inc	3344 Schierhorn Ct Franklin Park, IL 60131
00443	Waveline Inc	160 Passaic Ave West Caldwell, NJ 07006
00656	Aerovox Inc	740 Belleville Ave New Bedford, MA 02745
00750	Air Track Mfg Corp	College Park, MD
00809	Croven Crystals	500 Beech St Whitby, Ontario, CAN L1N5S5
00815	Midland - Ross	357 Beloit St Burlington, WI 53105
01121	Allen-Bradley Co	1201 South 2nd St Milwaukee, WI 53204
01295	Texas Instruments Inc	13500 N Central Expwy Dallas, TX 75265
01963	Cherry Electrical Products Corp	3600 Sunset Ave Waukegan, IL 60087
02113	Coilcraft Inc	1102 Silver Lake Dr Cary, IL 60013-1658
02490	Electronic Devices Inc	Hampden, MA
02660	Amphenol Corp	358 Hall Ave Wallingford, CT 06492
02735	RCA Corp	Route 202 Somerville, NJ 08876
03614	Bussman Mfg	114 Old St Rd PO Box 144 St Louis, MO 63178
04222	AVX Ceramics Div of AVX Corp	19th Ave South PO Box 867 Myrtle Beach, SC 29577
04426	ITW Switches	6615 West Irving Park Rd Chicago, IL 60634
04552	Grace W R and Co	869 Washington St Canton, MA 02021
04713	Motorola Inc	5005 East McDowell Rd Phoenix, AZ 85008

Model 58542 VXIbus Universal Power Meter

Cage	Name	Address
05236	Jonathan Manufacturing Corp	1101 South Acacia Ave Fullerton, CA 92631
05245	Corcom Inc	1600 Winchester Rd Libertyville, IL 60048
05276	ITT Pomona Electronics Div	1500 E 9th St PO Box 2767 Pomona, CA 91766
05791	Lyn-Tron Inc	3150 Damon Way Burbank, CA 91505
05820	EG and G Wakefield Engineering	60 Audubon Rd Wakefield, MA 01880
05905	Jerobee Industries Inc	Redmond, WA
06049	Topaz Inc	9192 Topaz Way San Diego, CA 92123
06090	Raychem Corp	300 Constitution Dr Menlo Park, CA 94025-1111
06349	Cam-Lok Div Empire Product Inc	10540 Chester Rd Cincinnati, OH 45215
06383	Panduit Corp	17301 Ridgeland Tinley Park, IL 60477
06540	New Haven Mfg Corp Amatom Div	446 Blake St New Haven, CT 06515
06776	Robinson Nugent Inc	800 East 8th St New Albany, IN 47150
06915	Richco Plastics Co	5825 N Tripp Ave Chicago, IL 60646-6013
07115	Corning Glass Works	Houghton Pk Corning, NY 14830
07180	Sage Laboratories Inc	East Natick Industrial Park 3 Huron Dr Natick, MA 01760
07263	Fairchild Semiconductor Corp	Cupertino, CA
07512	Oak Materials Group Inc	McCaffery St Hoosick Falls, NY 12090
07556	Calabro Industries Inc	1372 Enterprise Dr West Chester, PA 19380
09022	Cornell-Dubilier Electronics	1605 East Rodney French Blvd New Bedford, MA 02741
09353	C and K Components Inc	15 Riverdale Ave Newton, MA 02158
09922	Burndy Corp	1 Richards Ave Norwalk, CT 06856
09969	Dale Electronics Inc	East Highway 50 PO Box 180 Yankton, SD 57078
1AU47	Lucas Weinschel Inc	1 Weinschel Ln PO Box 6001 Gaithersburg, MD
1BH13	Fenwall Electronics Inc	64 Fountain St Framingham, MA 01701-6211
1BR23	CW Industries Inc	Atlanta, GA 04000
1CY63	Sierra Microwave Technology	11295-B Sunrise Gold Circle Rancho Cordova, CA 95670
1DS68	Sumner Mfg Inc	Hwy 411 S-Sumner Dr PO Drawer A Rome, GA 30162
1ES66	Maxim Intergrated Products	510 North Pastoria Ave Sunnyvale, CA 94086
1E584	Electrical Wire Products Bay Associates Inc	150 Jefferson Dr Menlo Park, CA 94025-1115
1FN41	Atmel Corp	2125 Onel Dr San Jose, CA 95131
1JJ60	Applied Tooling and Mfg Inc	1115 Industrial Ave Escondido, CA 92025
1W232	Spacek Labs	528 Santa Barbara St Santa Barbara, CA 93101
1Y147	Virtech	805 G University Ave Los Gatos, CA 95030
11532	Teledyne Relays	12525 Daphne Ave Hawthorne, CA 90250
11769	Elco/Dyntech Div of Elco Corp	1225 East Wakeham Ave Santa Ana, CA 92702
12020	Ovenaire Div of Electronic Tech	706 Forrest St Charlottesville, VA 22901
12457	Merrimac Industries Inc	41 Fairfield Pl West Caldwell, NJ 07006
13103	Thermalloy Co Inc	2021 W Valley View Lane PO Box 810839 Dallas, TX 75381
13511	Amphenol Cadre Div Bunker Ramo Corp	Los Gatos, CA
13708	Allied Components	Inglewood, CA
13919	Burr-Brown Corp	6730 S Tucson Blvd Tucson, AZ 85734
14482	Watkins-Johnson Co	3333 Hillview Ave Palo Alto, CA 94304
14552	Microsemi Corp	2830 S Fairview St Santa Ana, CA 92704-5948

Cage	Name	Address
14604	Elmwood Sensors Inc	500 Narragansett Park Dr Pawtucket, RI 02861
14936	General Instrument Corp Power Semiconductor Div	600 West John St Hicksville, NY 11802
15268	RHG Electronics Laboratory Inc	161 East Industry Ct Deer Park, NY 11729
15450	Erie Specialty Products Inc	645 W 11th Street Erie, PA 16512
15542	Mini-Circuits Laboratory	2625 East 14th St Brooklyn, NY 11235
15915	Tepro of Florida Inc	2608 Enterprise Rd Clearwater, FL 33517
16179	M/A-Com Omni Spectra Inc	21 Continental Blvd Merrimack, NH 03054
16352	Codi Semiconductor Inc	144 Market Street Kenilworth, NJ 07033
16428	Cooper Industries Inc	350 NW N St Richmond, IN 47374
16453	Western Microwave Inc	495 Mercury Dr Sunnyvale, CA 94086
16508	Aerovox Corp	19th Ave S PO Box 867 Myrtle Beach, SC 29577
16733	Radio Frequency Systems Inc Cablewave Systems Div	60 Dodge Ave North Haven, CT 06473
17217	Gore W L and Associates Inc	555 Paper Mill Rd Newark, DE 19714
17540	Alpha Industries Inc	20 Sylvan Rd Woburn, MA 01801
17856	Siliconix Inc	2201 Laurelwood Rd Santa Clara, CA 95054
18041	Diodes Inc Power Components Div	21243 Ventura Blvd Woodland Hills, CA 91364-2109
18310	Concord Electronics Corp	30 Great Jones St New York, NY 10012
18324	Signetics Corp	4130 South Market Ct Sacramento, CA 95834
18364	Mag-Tool Co	940 American St San Carlos, CA 94070
18714	RCA Corp Findlay Plant	1700 Fostoria Rd Findlay, OH 45840
18736	Voltronics Corp	West St East Hanover, NJ 07936
19701	Mepco/Electra Inc	PO Box 760 Mineral Wells, TX 76067
2J873	Celeritex Inc	617 River Oaks Pky San Jose, CA 95134
2J899	Dynawave Inc	94 Searle St PO Box 938 Georgetown, MA 01833
2M734	Panasonic Co	PO Box 1502 Secaucus, NJ 07094
2M881	Harris Corp Harris Semiconductor	883 Stierling Rd Suite 8120 Mountain View, CA 94043-1930
2R182	Smith H H Co	325 N Illinois St Indianapolis, IN 46204-1703
2V941	Microsource Inc	1269 Corporate Ctr Pky Santa Rosa, CA 95407
20550	Engineering Mfg Co	Sheboygan, WI
20944	Wiltron Co	805 East Middlefield Rd Mountain View, CA 94042
20999	Minnesota Mining and Mfg Co	3M Center St Paul, MN 55101
21604	Buckeye Stamping Co	555 Marion Rd Columbus, OH 43207
21847	TRW Microwave Inc	825 Stewart Dr Sunnyvale, CA 94086
22519	Data Delay Devices	385 Lakeview Ave Clifton, NJ 07011
23499	Judd Wire Inc	870 Los Vallecitos Blvd San Marcos, CA 92069
23899	Van Petty Mfg Inc	1168 Tourmaline Dr Newbury Park, CA 91320
23936	Pamotor	770 Airport Blvd Burlingame, CA 94010
24355	Analog Devices Inc	Rt 1 Industrial Park Norwood, MA 02062
24539	Avantek Inc	3175 Bowers Ave Santa Clara, CA 95054
24759	Lenox-Fugle Electronics Inc	100 Sylvania Place South Plainfield, NJ 07080-1448
24931	Specialty Connector Co Inc	2100 Earlywood Dr PO Box 547 Franklin, IN 46131

Model 58542 VXIbus Universal Power Meter

Cage	Name	Address
24995	Environmental Container System	3560 Rouge River Hwy Grants Pass, OR 97526
26066	Minnesota Mining and Mfg. Co	3M Center St Paul, MN 55101
26629	Frequency Sources Inc	16 Maple Rd Chelmsford, MA 01824
26692	B and S Tool & Die Company	2300 Sulphur Spring Rd Baltimore, MD 21227
26922	Cetec Corp	9900 Baldwin Place El Monte, CA 91731
26923	Control Master Products Inc	1062 Shary Circle Concord, CA 94518
27014	National Semiconductor Corp	2900 Semiconductor Dr Santa Clara, CA 95051
27264	Molex Inc	2222 Wellington Ct Lisle, IL 60532
27802	Vectron Laboratories Inc	166 Gover Ave Norwalk, CT 06850
27851	Film Microelectronics	17 A St Burlington, MA 01803
28480	Hewlett Packard Co	3000 Hanover St Palo Alto, CA 94304
28520	Heyco Molded Products	750 Boulevard PO Box 160 Kenilworth, NJ 07033
29005	Storm Products Co	112 South Glasglow Ave Inglewood, CA 90301
29111	Trak Microwave Corp	735 Palomar Ave Sunnyvale, CA 94086
29990	American Technical Ceramics	One Nordon Lane Huntington Stn, NY 11746
3A054	McMaster-Carr Supply Co	9630 Norwalk Blvd Santa Fe Springs, CA 90670
3E364	Vemaline	333 Strawberry Field Rd Warwick, RI 02887
3W023	Philips Components Discrete Product Div	5083 Kings Hwy Saugerties, NY 12477
3Z990	Tech Pro Inc	6243 E US Hwy 98 Panama City, FL 32404-7434
30035	Jolo Industries Inc	13921 Nautilus Dr Garden Grove, CA 92643-4026
30817	Instrument Specialties Co Inc	Exit 53 Route 80 PO Box A Delaware Water Gap, PA 18327
31433	Kemet Electronics Corp	2835 Kemet Way Simpsonville, SC 29681
31703	Gudrun Frederickson Co	Oakland, CA
31757	Micropac Industries Inc	905 E Walnut St Garland, TX 75040
31781	Edac Inc	40 Tiffield Rd, Scarborough, Ont CAN M1V 5B6
31918	ITT Schadow Inc	8081 Wallace Rd Eden Prairie, MN 55344
32293	Intersil Inc	2450 Walsh Ave Santa Clara, CA 95051
32559	Bivar Inc	4 Thomas St Irvine, CA 92718
32767	Griffith Plastics Corp	1027 California Dr Burlingame, CA 94010
32997	Bourns Inc Trimpot Division	1200 Columbia Ave Riverside, CA 92507
33592	Miteq Inc	100 Davids Dr Huappauge, NY 11787
34031	Analog Devices	7810 Success Rd Greensboro, NC 27409
34078	Midwest Microwave Inc	3800 Packard Rd Ann Arbor, MI 48104
34335	Advanced Micro Devices Inc	901 Thompson Place Sunnyvale, CA 94086
34553	Amperex Electronic Corp	Hauppauge, NY 32732
34576	Rockwell International Corp	4311 Jamboree Rd Newport Beach, CA 92660
34781	MCW Industries	129 Southside Drive Charlotte, NC 28210
34785	Dek Inc	3480 Swenson Ave St Charles, IL 60174
36437	Star Stainless Products Ltd	Montreal, Que CAN H4T1N8
4F708	Hammond Mfg Co US Inc	1690 Walden Drive Buffalo, NY 14225
4R125	Magnetec Corp	61 W Dudleytown Rd Bloomfield, CT 06002
4S028	Brady W M Co Industrial Products Div	Milwaukee, WI
4T165	NEC Electronics USA Inc Electron Div	401 Ellis St P.O. Box 7241 Mountain View, CA 94039

Cage	Name	Address
4U402	Roederstein Electronics Inc	2100 W Front St Statesville, NC 28677-3651
4U751	Advanced Semiconductors Inc	7525 Etnel Ave Unit 6 North Hollywood, CA 91605-1912
46384	Penn Engineering & Mfg Corp	Old Easton Rd PO Box 1000 Danboro, PA 18916
5H281	Allmetal Screw Products	Arlington, TX
5J927	Interface Technology Div of Dynatech Corp	2100 E Alcosta Ave Glendora, CA 91740
50721	Datel Inc	11 Cabot Blvd Mansfield, MA 02048
51167	Aries Electronics Inc	62 Trenton Ave Frenchtown, NJ 08825
51284	Mos Technology Inc	950 Rittenhouse Rd Norristown, PA 19401
51642	Centre Engineering Inc	2820 East College Ave State College, PA 16801
51705	Ico-Rally Corp	2575 East Bayshore Rd Palo Alto, CA 94303
52063	Exar Integrated Systems	2222 Gume Dr PO Box 49007 San Jose, CA 95161-9007
52072	Circuit Assembly Corp	18 Thomas St Irvine, CA 92718
52648	Plessey Trading Corp	1641 Kaiser Ave Irvine, CA 92714
52683	Baytron Co Inc	344 Salem St Medford, MA 02155
52763	Stettner Electronics Inc	6135 Airways Blvd Chattanooga, TN 37421
52840	Western Digital Corp	3128 Red Hill Ave Costa Mesa, CA 92626
53387	Minnesota Mining & Mfg Co Electronic Products Div 3M	Austin, TX
53421	Tyton Corp	7930 N Faulkner Rd PO Box 23055 Milwaukee, WI 53223
53673	Thomson-CSF Components Corp	6660 Variel Ave Canoga Park, CA 91304
54186	Micro Power Systems Inc	3100 Alfred St Santa Clara, CA 95050
54343	Riedel M W and Co	300 Cypress Ave Alhambra, CA 91801
54487	Micronetics Inc	36 Oak St Norwood, NJ 07648
54516	National Cable Molding Corp	136 San Fernando Rd Los Angeles, CA 90031
54558	SDI Inc	North Billerica, MA
54583	TDK Electronics Corp	12 Harbor Park Dr Port Washington, NY 11550
55153	Dielectric Laboratories Inc	69 Albany St Cazenovia, NY 13035
55261	LSI Computer Systems Inc	1235 Walt Whitman Rd Melville, NY 11747
55285	Bergquist Co Inc	5300 Edina Industrial Blvd Minneapolis, MN 55435
55322	Samtec Inc	810 Progress Blvd PO Box 1147 New Albany, IN 47150
55387	Pamtech	8030 Remmet Ave Canoga Park, CA 91304
55566	RAF Electronic Hardware Inc	95 Silvermine Rd Seymour, CT 06483-3915
55576	Synertek	3001 Stender Way Santa Clara, CA 95051
55680	Nichicon America Corp	927 E State Pky Schaumburg IL 60195
55801	Compensated Devices Inc	166 Tremont St Melrose, MA 02176-2204
55989	Semicon Inc Div of the Lorvic Corp	8810 Frost Ave St. Louis, MO 63134-1002
56248	Consolidated Refining Co	115 Hoyt Ave Mamaroneck, NY 10543
56289	Sprague Electric Co	87 Marshall St North Adams, MA 01247
56501	Thomas & Betts Corp	1001 Frontier Rd Bridgewater, NJ 08807
56563	Alatec Products	12747 Saticoy St North Hollywood, CA 91605
56866	Quality Thermistor Inc	2147 Centurion Pl Boise, ID 83709
57032	Daden Associates Inc	23011 Moulton Pky A-12 Laguna Hills, CA 92653
57793	United Microwave Products Inc	185 West 205th St Torrance, CA 90503

Model 58542 VXIbus Universal Power Meter

Cage	Name	Address
57834	Brim Electronics Inc	120 Home Pl Lodi, NJ 07644-1514
58090	Thermometrics Inc	808 Rt 1 Edison, NJ 08817-4624
58202	Innowave Inc	15555 Concord Circle Morgan Hill, CA 95037
58361	General Instrument Corp Optoelectronics Div	3400 Hillview Ave Palo Alto, CA 94304
58377	National Electronics	11731 Markon Dr Garden Grove, CA 92641
58684	Magnetec Corp	61 W Dudleytown Rd Bloomfield, CT 06002
58756	CTS Corp Electromechanical Div	1142 W Beardsley Ave Elkhart, IN 46514
58758	Zambre Co Inc	2134M Old Middlefield Way Mountain View, CA 94043-2404
58900	Giga-tronics Inc	4650 Norris Canyon Road San Ramon, CA 94583
59124	KOA Speer Electronics Inc	Bolivar Dr PO Box 547 Bradford, PA 16701
59365	Metelics Corp	975 Stewart Dr Sunnyvale CA 94086
59660	Tusonix Inc	2155 N Forbes Blvd #107 Tucson, AZ 85745
59942	AVX Filters Corp	11144 Penrose St Sun Valley, CA 91352
59980	Midwest Polychem Ltd	1502 N 25th Ave Melrose Park, IL 60160
6A566	Tecknit Corp	320 North Nopal St Santa Barbara, CA 93103
6V806	Frammar Mfg Inc (formerly Omni Spectra Corp)	6859 Tujunga Ave North Hollywood CA 91605
6Y341	Microwave Technology Inc	4268 Solar Way Fremont, CA 94538
60393	Precision Resistive Products	655 Main St Mediapolis, IA 52637
60395	Xicor Inc	851 Buckeye Ct Milpitas, CA 95035
60450	Microwave Components Inc	7 Meehan Dr Chelmsford, MA 01824
60583	Narda Microwave Corp	11040 White Rock Rd Suite 200 Rancho Cordova, CA 95670
60644	CSDC	PO Box 2116 Wayne, NJ 07470
61104	Aris Engineering Corp	30 Bond St Haverhill, MA 01830
61429	Fox Electronics Inc	5570 Enterprise Pky Ft. Myers, FL 33905
61485	Hitachi Denshi America Ltd	175 Crossways Park W Woodbury, NY 11797
61529	Aromat Corp	629 Central Ave New Providence, NJ 07974
61638	Advanced Interconnections	5 Energy Way West Warwick, RI 02893
61772	Integrated Device Technology	3236 Scott Blvd PO Box 58015 Santa Clara, CA 95052
61802	Toshiba International	13131 West Little York Rd Houston, TX 77041
61964	Omron Electronics Inc	1E Commerce Schaumburg, IL 60173
62277	Atlas Wire and Cable Corp	133 S Van Norman Rd Montebello, CA 90640
62331	Krytar Inc	1292 Anvilwood Ct Sunnyvale, CA 94086
62559	Schroff Inc	170 Commerce Dr Warwick, RI 02886
62643	United Chemicon Inc	9806 Higgins St Rosemont, IL 60018
63058	McKenzie Socket Technology Inc	44370 Old Warm Springs Blvd Fremont, CA 94538
63132	Time Microwave	398 Martin Ave Santa Clara, CA 95050
63345	Overland Products Co Inc	1687 Airport Rd Fremont, NE 68025
63468	Electro Dynamics	5625 Foxridge Dr Shawnee Mission, KS 66201
63542	Hall-Mark Electronics Corp	11333 Pagemill Rd Dallas, TX 75243
64135	Filter Concepts	2624 S Rousselle St Santa Ana, CA 92707
64155	Linear Technology Corp	1630 McCarthy Blvd Milpitas, CA 95035
64671	Inmet Corp	300 Dino Dr Ann Arbor, MI 48103
64859	AP Products Inc	9325 Progress Parkway Mentor, OH 44061

Cage	Name	Address
65032	Rogers Corp	PO Box 700 Chandler, AZ 85224
65449	Amtex Intl Inc	1878 Star Batt Rochester, MI 48063
65517	Ayer Engineering Co	1250 West Roger Rd Tucson, AZ 85705
65664	Catamount Mfg Inc	158 Governor Dr PO Box 720 Orange, MA 01364
65940	Rohm Corp	8 Whatney Irvine, CA 92714
65964	EVOX-RIFA Inc	100 Tri-State Intl. Suite 290 Lincolnshire, IL 60069
66039	Kaycor International	1732 Central St Evanston, IL 60201
66148	Fairlane Fluid/Air Products	23435 Industrial Park Dr Farmington, MI 48024
66449	Microsource Inc	1269 Corporate Center Pky Santa Rosa, CA 95407
66466	Standard Instrumentation Inc	3322 Pennsylvania Ave Charleston, WV 25302
66544	Continental Microwave & Tool Co	10 Merrill Industrial Dr Hampton, NH 03842-0998
66579	Waferscale Intergraton	47280 Kato Rd Fremont, CA 94538
66958	SGS Semiconductor Corp	7117 E 3rd Ave Scottsdale, AZ 52251
67297	Herotek Inc.	222 N Wolfe Rd Sunnyvale, CA 94086
68459	River Run Enterprises Inc	2001 Jefferson Davis Ave Selma, AL 36701
68630	Tadiran Electronics Industries Inc	3000 Dundee Rd Northbrook IL 60062
7E222	Littlefuse Tracor Inc	800 E Northwest Hwy Des Plaines, IL 60016
7E585	Zero Mfg	777 Front St Burbank, CA 91303
7M800	Analog Devices Inc	2444 Moorpark Ave San Jose, CA 95128
7U905	Seastrom Inc	2351 Kentucky Ave Indianapolis, IN 46241-4827
7W263	Huber and Suhner Ltd	Tumbleinstrass 20 Pfaffikon, Switz CH-8330
70364	American Electric Switch Corp	Route 4 Rocky Hill Hwy Lancaster, SC 29720
70903	Belden Corp	200 South Batavia Ave Geneva, IL 60134
71034	Bliley Electric Co	2545 W Grandview Blvd Erie, PA 16508
71218	Bud Industries	4605 E 355th St Willoughby, OH 44094
71450	CTS Corp	1201 Cumberland Ave West Lafayette, IN 47906
71468	ITT Corp ITT Cannon Div	666 E Dyer Rd Santa Ana, CA 92702
71785	Labinal Components and Systems Inc	1521 Morse Ave Elk Grove Village, IL 60007
72259	Nytronics Inc	475 Park Ave South New York, NY 10016
72982	Murata Erie North America Inc	645 West 11th St Erie, PA 16512
73138	Beckman Industrial	4141 Palm St Fullerton, CA 92635
73734	Federal Screw Products Inc	3917 N Kedzie Ave Chicago, IL 60618-3415
74840	Illinois Capacitor Inc	3757 W Touhy Ave Lincolnwood, IL 60645
74970	Johnson E F Co	299 10th Ave South West Waseca, MN 56093
75263	Keystone Carbon Co Inc	1935 State St St Marys, PA 15857
75332	Kings Electronics Co Inc	Brooklyn, NY (relocated; see CAGE 91836)
75378	CTS Knights Inc	400 Reimann Ave Sandwich, IL 60548
75915	Tracor Littlefuse Inc	800 East Northwest Hwy Des Plains, IL 60016
78553	Eaton Corp Engineered Fasteners Div	14701 Detroit Ave Lakewood, OH 44107-4101
79963	Zierick Mfg Co	Radio Circle Mt Kisko, NY 10549
8B649	Intel Corp	3065 Bowers Ave Santa Clara, CA 95051
8E631	Solitron-MIC	Port Salerno, FL (relocated; see CAGE 95077)
8G639	Wavecom	Sunnyvale, CA 94086

Model 58542 VXIbus Universal Power Meter

Cage	Name	Address
8K805	Omni Spectra Inc	Los Altos, CA
8Z313	LMS Electronics	34101 Monroe Rd Charlotte, NC 28205
81073	Grayhill Inc	561 Hillgrove Ave La Grange, IL 60525
81312	Winchester Electronics	400 Park Rd Watertown, CT 06795
81349	Military specification promulgated by military departments/agencies under authority of Defense Standardization Manual 4120 3-M.	
81703	Mulberry Metal Products Inc	2199 Stanley Terrace Union, NJ 07083
81774	Carol Wire and Cable Corp	249 Roosevelt Ave Pawtucket, RI 02860
82152	Transco Products Inc	4241 Glenco Ave Marina Del Ray, CA 90295
82199	Polarad Electronics Inc	5 Delaware Drv Lake Success, NY 11042
82877	Rotron Inc	7 Hasbrouck Lane Woodstock, NY 12498
83330	Kulka Smith Inc	1913 Atlantic Ave Manasquan, NJ 08736
84084	American Iron and Machine Work	720 Industrial Blvd Oklahoma City, OK
84171	ARCO Electronics	400 Moreland Rd Commack, NY 11725-5707
84411	American Shizuki Corp	301 W O St Ogallala, NE 69153
86797	Rogan Corp	3455 Woodhead Dr Northbrook, IL 60062
88245	Winchester Electronics	13536 Satcoy St Van Nuys, CA 91409
89110	Amp Inc	1595 South Mt Joy St Elizabethtown, PA 17022
9B003	Dynamics Corp of America Electronics Systems Div	Encino, CA
9W826	EZ Form Cable Corp	315 Peck St Bldg 24 New Haven, CT 06513
9Z397	Fujitsu Component of America Inc	3320 Scott Blvd Santa Clara, CA 95054-3101
90201	Mallory Capacitor Co	4760 Kentucky Ave Indianapolis, IN 46206
91303	KOL Inc	St Paul, MN
91506	Augat Inc	452 John Dietsch Blvd Attleboro Falls, MA 02763
91637	Dale Electronics Inc	1122 23rd St Columbus, NE 68601-3632
91662	Elco Corp	Industrial Park Huntington, PA 16652
91833	Keystone Electronics Corp	31-07 20th Rd Astoria, NY 11105
91836	Kings Electronics Co Inc	40 Marbledale Road Tuckahoe, NY 10707-3420
92194	Alpha Wire Corp	711 Lidgerwood Ave Elizabeth, NJ 07207
93459	Weinschel Engineering Co	1 Weinschel Lane Gaithersburg, MD 20877
94696	Magnecraft	1910 Techny Rd Northbrook, IL 60062
95054	Sermex Corp	Milwaukee, WI
95077	Solitron Devices Inc Solitron/Microwave Div	1177 Blue Heron Blvd Bldg 2 Riviera Beach, FL 33404
95146	Alco Electronics Products Inc	1551 Osgood St North Andover, MA 01845
95275	Vitramon Inc	Box 544 Bridgeport CT 06601
95348	Gordos Arkansas Inc	1000 N 2nd St PO Box 824 Rogers, AR 72757
95987	Weskesser Co Inc	727 West Glendale Ave Milwaukee, WI 53209
96341	Microwave Associates Inc	NW Industrial Park S Ave Burlington, MA 01803
96733	San Fernando Electric Mfg Co	1501 First St San Fernando, CA 91341
98291	ITT Sealectro	585 E Main St New Britain, CT 06051
99800	American Precision Industries Inc Delevan Div	270 Quaker Rd East Aurora, NY 14052-2114
99899	Narda Microwave/Loral Corp	435 Moreland Rd Hauppauge, NY 11788

Diagrams

7.1 Introduction

This chapter contains assembly drawings and circuit schematics for the Model 58542 VXIbus Universal Power Meter.

Parts lists for all assemblies are contained in Chapter 6.

Program Examples

A.1 Introduction

This appendix contains examples of the various operating programs in the Model 58542 VXIbus Universal Power Meter.

The examples shown in this chapter are written in HTBasic™ format. Different languages will use different commands, but the string sent or received will always be the same. In HTBasic, the OUTPUT command sends a string to the GPIB bus. The number or variable after the word OUTPUT is the GPIB address of the instrument.

A.2 Sensor Calibration Examples

Sensors must be calibrated to the meter before performing measurements. Only one sensor at a time can be calibrated to a given 58542 VXI Power Meter input. That is, each time a sensor is calibrated to the meter using the power sweep calibration, previous calibrations for that meter input are voided automatically. Thus, you are assured that your measurement system is always performing under a valid sensor calibration.

A.2.1 Sensor Calibration Example 1

The following example performs power sweep calibration of the power sensor connected to input number 2 and sends back a pass/fail flag upon completion using CAL2?

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440  PRINT Connect the sensor to the power sensor cable.
450  INPUT Then connect the sensor to the calibrator and hit ENTER.,Dmy
460  PRINT Calibrating Sensor 2...
470  OUTPUT@Pwr_mtr,CAL2?
480  ENTER@Pwr_mtr,Pass_cal
490  IF Pass_cal=0 THEN PRINT Calibration Passed
500  IF Pass_cal=1 THEN
510    PRINT Calibration FAILED, Sensor 2 on calibrator?
560  ELSE
570    IF Pass_cal<>0 THEN PRINT Strange Response to CAL2?. Clear output Queue?
580  END IF
590  !
```

A.2.2 Sensor Calibration Example 2

The power meter measurement functions are operated to tight tolerances during sensor calibration. If the sensor passes calibration, it is a good health check of the 58542 VXI Power Meter. In general, the power meter and sensors are operating properly if they pass the calibration process. For instance, the calibration process will fail if the sensor detector elements have been damaged. Also see the self test functions, which are initiated using the *TST command or the DIAG: commands (see Table 5-1).

The following program uses the CAL? query format to perform power sweep calibration of a power sensor and sends back a pass/fail flag upon completion. Completion of the calibration function is monitored via service requests using the *OPC, operation complete command.

```
330  !
340  !#####
350  !
350  !  CALIBRATE THE SENSORS
370  !
380  !#####
390  ASSIGN@Pwr_mtr to 70101
400  CLEAR@Pwr_mtr
410  WAIT 1
420  OUTPUT@Pwr_mtr;*CLS                ! Clear status registers and error queue buffer
425  WAIT 0.3
430  OUTPUT@Pwr_mtr;*ESE 1              ! Standard Event Status Enable bit 0, Operation Complete
440  OUTPUT@Pwr_mtr;*SRE 32            ! Service Request Enable Status Byte bit 5, Standard
                                        ! Event Status Register

450  !
460  ON INTR 7 GOSUB Spoll_intr
470  ENABLE INTR 7;2
480  !
490  ! Calibration Routine
500  !
510  INPUT Connect the sensor to the calibrator. Then press ENTER.,Dmy
520  PRINT Calibrating Sensor 1...
525  Srq_flag=0
530  OUTPUT@Pwr_mtr;CAL1?;*OPC          ! For zeroing substitute CAL1:ZERO? for CAL1?
540  !
550  !
560  ! Now wait for srq
570  !
580  !
590  !
600  WHILE Srq_flag=0
610  END WHILE
620  !
630  ! Enter Pass/Fail Flag. This comes with query format, CAL1?, rather than command format, CAL1.
640  !
650  ENTER@Pwr_mtr;Pass_cal
660  IF Pass_cal=0 THEN PRINT Calibration Passed
670  IF Pass_cal=1 THEN
680  OUTPUT@Pwr_mtr;SYST:ERR?
690  ENTER@Pwr_mtr;Err_msg$              ! Reading an error message clears it.
700  PRINT The power meter reports the following error.,ERR_msg$
710  PRINT Calibration FAILED, sensor on calibrator?
720  ELSE
730  IF Pass_cal<>0 THEN PRINT Strange Response to CAL1?. Other Event Status Register Bits Too?
```

```
740    END IF
750    !
760    STOP
770    !
780 Spoll_intr: !
790    !
800    State=SPOLL(@Pwr_mtr)
810    PRINT SPOLL INTR::;State
820    Srq_flag=1
830    ENABLE INTR 7;2
840    !
850    RETURN
860    !
870    !
880    !  END OF SENSOR CAL
890    !#####
900    !
910    END
```

A.2.3 Sensor Calibration Example 3

The following program uses the CAL format to perform power sweep calibration of a power sensor. Completion of the calibration function is monitored via service requests using the *OPC, operation complete command. The Standard Event Status Register is used to report pass/fail by asserting bit 3, value 8, the Device Dependent Error bit.

```
320  !
330  ! #####
340  !
330  ! CALIBRATE THE SENSORS
360  !
370  ! #####
380  !
390  ASSIGN@Pwr_mtr to 70101
400  CLEAR@PWR_mtr
410  WAIT 1
420  OUTPUT@Pwr_mtr;*CLS                ! Clear status registers and error queue buffer
425  WAIT 0.3
430  OUTPUT@Pwr_mtr;*ESE 1              ! Standard Event Status Enable bit 0, Operation complete
440  OUTPUT@Pwr_mtr;*SRE 32             ! Service Request Enable Status Byte bit 5,
                                         ! Standard Event Status Register

450  !
460  ON INTR 7 GOSUB Spoll_intr
470  ENABLE INTR 7;2
480  !
490  ! Calibration Routine
500  !
510  INPUT Connect the sensor to the calibrator. Then press ENTER.,Dmy
520  PRINT Calibrating Sensor 1
525  Srq_flag=0
530  OUTPUT@Pwr_mtr;CAL1;*OPC           ! For zeroing substitute CAL1:ZERO for CAL1
540  OUTPUT@Pwr_mtr;*OPC               ! If not sent with previous line, send *OPC here
550  !
560  ! Now wait for srq
570  !
580  !
590  !
600  WHILE Srq_flag=0
610  END WHILE
620  !
630  ! Enter Error Reporting From Standard Event Status Register
640  !
650  OUTPUT@Pwr_mtr;*ESR?
660  ENTER@Pwr_mtr;Esr
670  IF Esr=0 THEN PRINT Operation was not completed. Also, no errors.
680  IF Esr=1 THEN
690  PRINT Operation Completed. No errors reported during CAL execution.
700  ELSE
710  IF Pass_cal<>0 THEN PRINT Operation completed. An error has occurred or power
    was just turned on.
720  OUTPUT@Pwr_mtr;SYST:ERR?
730  ENTER@Pwr_mtr;Err_msg$            ! Reading an error message clears it
740  PRINT The power meter reports the following error.,Err_msg$
750  PRINT Calibration FAILED, sensor on calibrator?
```

```
760    PRINT Esr
770    !
780    END IF
790    !
800    !
810    STOP
820    !
830 Spoll_intr:~
840    !
850    State=SPOLL(@Pwr_mtr)
860    PRINT SPOLL INTR::State
870    Srq_flag=1
880    ENABLE INTR 7;2
890    !
900    RETURN
910    !
920    !
930    ! END OF SENSOR CAL
940    ! #####
950    !
960    END
```

A.2.4 Sensor Calibration Example 4

The following program prompts you to connect a return loss bridge for calibration and attach an open or short to the bridge test port. It then performs a power sweep calibration and sends back a pass/fail flag upon completion.

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440  PRINT Connect the 80503 Precision Return Loss Bridge to the input #2 power sensor cable.
445  PRINT Connect the open or short calibration connector to the bridge test port.
450  INPUT Then use an adapter to connect the bridge input port to the calibrator and hit ENTER.,Dmy
460  PRINT Calibrating Sensor 2...
470  OUTPUT @Pwr_mtr;CAL2?
480  ENTER @Pwr_mtr;Pass_cal
490  IF Pass_cal=0 THEN PRINT Calibration Passed
500  IF Pass_cal=1 THEN
510    PRINT Calibration FAILED, Bridge connected to calibrator?
560  ELSE
570    IF Pass_cal<>0 THEN PRINT Strange Response to CAL2?. Clear output Queue?
580  END IF
590  !
```

A.2.5 Sensor Calibration Example 5

The following program prompts you to remove the high power attenuator from a high power sensor main housing and connect the main housing to the power sweep calibrator port. It then performs a power sweep calibration and sends back a pass/fail flag upon completion.

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440  PRINT Connect the 80325 50W Power Sensor to the input #2 power sensor cable.
445  PRINT Remove the high power attenuator or leave it attached to the measurement port on the DUT
450  INPUT Then connect the high power sensor main housing to the calibrator and hit ENTER.,Dmy
460  PRINT Calibrating Sensor 2...
470  OUTPUT @Pwr_mtr;CAL2?
480  ENTER @Pwr_mtr;Pass_cal
490  IF Pass_cal=0 THEN PRINT Calibration Passed. Re-attach the high power attenuator immediately!
500  IF Pass_cal=1 THEN
510    PRINT Calibration FAILED, Main sensor housing connected to calibrator?
560  ELSE
570    IF Pass_cal<>0 THEN PRINT Strange Response to CAL2?. Clear output Queue?
580  END IF
590  !
```

A.3 Sensor Zeroing Examples

A.3.1 Sensor Zeroing Example 1

The following example requests that the operator turn off the signal source or disconnect the sensor from the source prior to zeroing. It is preferable to disable the source and leave the sensor attached to the measurement port for proper zeroing. If the source cannot be disabled, use a switch or attach a connector to the grounded metal near your DUT measurement port. DO NOT attach the sensor to the power meter's calibrator port. You want the zeroing offset process to account for the DUT's ground plane noise and thermal emf, not the power meter's.

```

410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440  INPUT Disable the source's RF output or attach it to a grounded connector. Then hit ENTER.,Dmy
450  PRINT Zeroing Sensor 1
460  OUTPUT @Pwr_mtr;CAL1:ZERO?
470  ENTER @Pwr_mtr;Pass_zer
480  IF Pass_zer=0 THEN PRINT Zeroing Passed
490  IF Pass_zer=1 THEN
500    PRINT Zeroing FAILED, Source turned off?
550  ELSE
560    IF Pass_zer<>0 THEN PRINT Strange Response to CAL1:ZERO?. Clear output Queue?
570  END IF
580  !

```

A.3.2 Sensor Zeroing Example 2

The following program turns off the signal source, zeros the power sensor, reports a pass/fail indicator upon completion, and turns the source back on.

```

400  ASSIGN @Pwr_mtr to 70101
410  ASSIGN @Source to 70102
420  CLEAR @Pwr_mtr
430  WAIT 1
440  OUTPUT @Source RF0                                ! Turns source output power off (<-90 dBm).
450  PRINT Zeroing Sensor 1
460  OUTPUT @Pwr_mtr;CAL1:ZERO?
470  ENTER @Pwr_mtr;Pass_zer
480  IF Pass_zer=0 THEN PRINT Zeroing Passed
490  IF Pass_zer=1 THEN
500    Ques$=Zeroing FAILED, Source turned off?
510    OUTPUT @Pwr_mtr;SYST:ERR?
520    ENTER @Pwr_mtr;Err_msg$                          ! Reading an error message clears it.
530    PRINT Err_msg$
540    PRINT Ques$
550  ELSE
560    IF Pass_zer <>0 THEN PRINT Strange Response to CAL1:ZERO?. Clear output Queue?
570  END IF
580  !
590  OUTPUT @Source RF1                                ! Turns source output power back on.

```

Zeroing is recommended whenever you are performing critical final power measurements in the bottom 15 to 20dB of a power sensors dynamic range. Zeroing removes zero drift error from your measurement. At higher power levels, zero drift is typically insignificant when compared to the other sources of error such as source/sensor mismatch uncertainty.

A.3.3 Error Control Examples

Selected basic SCPI syntax and execution errors apply to these commands.

The following command will operate properly.

```
460  OUTPUT @Pwr_mtr;CAL1?           ! Calibrate channel 1
```

The following command is not a legal command. The 58542 only has two channels.

```
460  OUTPUT @Pwr_mtr;CAL3?           ! Calibrate channel 3
```

If you ask for error information, the error reporting is as follows:

```
510  OUTPUT @Pwr_mtr;SYST:ERR?
520  ENTER @Pwr_mtr;Err_msg$         ! Reading an error message clears it.
530  PRINT Err_msg$
Program Output:
      -7,Invalid Error Number
```

The following command is not a legal command. The command is mis-typed.

```
460  OUTPUT @Pwr_mtr;CALS?           ! Calibrate channel 3
```

If you ask for error information, the error reporting is as follows.

```
510  OUTPUT @Pwr_mtr;SYST:ERR?
520  ENTER @Pwr_mtr;Err_msg$         ! Reading an error message clears it.
530  PRINT Err_msg$
Program Output:
      -113,Undefined Header;CALS
      Device-specific errors include the following.
      -300,Device-specific error;No Sensor
```

The following examples demonstrate the conditions for various errors.

```
380  ASSIGN @Pwr_mtr to 70101
390  CLEAR @Pwr_mtr
400  WAIT 1
401  INPUT Disconnect Sensor From Cable for Error Demonstration. Then hit ENTER.,Dmy
410  PRINT Calibrating Sensor 1
420  OUTPUT @Pwr_mtr;CAL1?
430  ENTER @Pwr_mtr;Pass_cal
440  IF Pass_cal=0 THEN PRINT Calibration Passed
450  IF Pass_cal=1 THEN
```

```

460 Ques$=Calibration FAILED, sensor on calibrator?
470 OUTPUT @Pwr_mtr;SYST:ERR?
480 ENTER @Pwr_mtr;Err_msg$           ! Reading an error message clears it.
490 PRINT Err_msg$
500 PRINT Ques$
520 ELSE
521 IF Pass_cal<>0 THEN PRINT Strange Response to CAL1?. Clear output Queue?
530 END IF
531 !
532 !
533 STOP

```

Program Output:

```

Calibrating Sensor 1
-300, Device-specific error;No Sensor
Calibration FAILED, sensor on calibrator?

```

```

410 ASSIGN @Pwr_mtr to 70101
420 CLEAR @Pwr_mtr
440 WAIT 1
450 INPUT Disconnect the sensor from the cable 1 second after hitting ENTER. Hit ENTER.,Dmy
460 PRINT Calibrating Sensor 1
470 OUTPUT @Pwr_mtr;CAL1?
480 ENTER @Pwr_mtr;Pass_cal
490 IF Pass_cal=0 THEN PRINT Calibration Passed
500 IF Pass_cal=1 THEN
510   Ques$=Calibration FAILED, sensor on calibrator?
520   OUTPUT @Pwr_mtr;SYST:ERR?
530   ENTER @Pwr_mtr;Err_msg$           ! Reading an error message clears it.
540   PRINT Err_msg$
550   PRINT Ques$
560 ELSE
570   IF Pass_cal<>0 THEN PRINT Strange Response to CAL1?. Clear output Queue?
580 END IF
590!
600 !
610 STOP

```

Program Output:

```

Calibrating Sensor 1
-300, Device-specific error;Sensor not connected to calibrator
Calibration FAILED, sensor on calibrator?

```

```

410 ASSIGN @Pwr_mtr to 70101
420 CLEAR @Pwr_mtr
440 WAIT 1
450 INPUT Do not connect the sensor to the calibrator. Hit ENTER.,Dmy
460 PRINT Calibrating Sensor 1
470 OUTPUT @Pwr_mtr;CAL1?
480 ENTER @Pwr_mtr;Pass_cal
490 IF Pass_cal=0 THEN PRINT Calibration Passed
500 IF Pass_cal=1 THEN
510   Ques$=Calibration FAILED, sensor on calibrator?
520   OUTPUT @Pwr_mtr;SYST:ERR?

```

```
530 ENTER @Pwr_mtr;Err_msg$           ! Reading an error message clears it.
540 PRINT Err_msg$
550 PRINT Ques$
560 ELSE
570 IF Pass_cal<>0 THEN PRINT Strange Response to CAL1?. Clear output Queue?
580 END IF
590 !
600 !
610 STOP
```

Program Output:

Calibrating Sensor 1
-300, Device-specific error;Sensor not connected to calibrator
Calibration FAILED, sensor on calibrator?

```
410 ASSIGN @Pwr_mtr to 70101
420 CLEAR @Pwr_mtr
440 WAIT 1
449 PRINT Connect the sensor to the calibrator.
450 INPUT Remove the sensor 10 seconds after hitting ENTER. Hit ENTER.,Dmy
460 PRINT Calibrating Sensor 1
470 OUTPUT @Pwr_mtr;CAL1?
480 ENTER @Pwr_mtr;Pass_cal
490 IF Pass_cal=0 THEN PRINT Calibration Passed
500 IF Pass_cal=1 THEN
510   Ques$=Calibration FAILED, sensor on calibrator?
520   OUTPUT @Pwr_mtr;SYST:ERR?
530   ENTER @Pwr_mtr;Err_msg$           ! Reading an error message clears it.
540   PRINT Err_msg$
550   PRINT Ques$
560 ELSE
570   IF Pass_cal<>0 THEN PRINT Strange Response to CAL1?. Clear output Queue?
580 END IF
590 !
600 !
610 STOP
```

Program Output:

Calibrating Sensor 1
-300,Device-specific error;Sensor calibration error
Calibration FAILED, sensor on calibrator?

```
410 ASSIGN @Pwr_mtr to 70101
420 CLEAR @Pwr_mtr
430 WAIT 1
440 INPUT Connect the sensor to a source set to about 0dBm. Hit ENTER.,Dmy
450 PRINT Zeroing Sensor 1
460 OUTPUT @Pwr_mtr;CAL1:ZERO?
470 ENTER @Pwr_mtr;Pass_zer
480 IF Pass_zer=0 THEN PRINT Zeroing Passed
490 IF Pass_zer=1 THEN
500   Ques$=Zeroing FAILED, Source turned off?
510   OUTPUT @Pwr_mtr;SYST:ERR?
520   ENTER @Pwr_mtr;Err_msg$           ! Reading an error message clears it.
```

```
530 PRINT Err_msg$
540 PRINT Ques$
550 ELSE
560 IF Pass_zer<>0 THEN PRINT Strange Response to CAL1:ZERO?. Clear output Queue?
570 END IF
580 !
590 !
600 STOP
```

Program Output:

Zeroing Sensor 1
-300,Device-specific error;Sensor zeroing error
Zeroing FAILED, Source turned off?

```
410 ASSIGN @Pwr_mtr to 70101
420 CLEAR @Pwr_mtr
430 WAIT 1
440 INPUT Disconnect the sensor from the sensor cable. Hit ENTER.,Dmy
450 PRINT Zeroing Sensor 1
460 OUTPUT @Pwr_mtr;CAL1:ZERO?
470 ENTER @Pwr_mtr;Pass_zer
480 IF Pass_zer=0 THEN PRINT Zeroing Passed
490 IF Pass_zer=1 THEN
500 Ques$=Zeroing FAILED, Source turned off?
510 OUTPUT @Pwr_mtr;SYST:ERR?
520 ENTER @Pwr_mtr;Err_msg$ ! Reading an error message clears it.
530 PRINT Err_msg$
540 PRINT Ques$
550 ELSE
560 IF Pass_zer<>0 THEN PRINT Strange Response to CAL1:ZERO?. Clear output Queue?
570 END IF
580 !
590 !
600 STOP
```

Program Output:

Zeroing Sensor 1
-300,Device-specific error;No Sensor
Zeroing FAILED, Source turned off?

A.4 Reading Power Measurement Examples

This section gives you a quick start in performing measurements. Therefore, the easiest measurement commands are in the first example, MEAS#? in NORMal Mode. This may not be the optimum 58542 configuration for your application. There are three example groups, NORMal Mode, SWIFt Mode, and BURSt Mode. The use of the three 58542 measurement data commands, MEAS#?, READ#?, and FETCh#? are explained in detail under the NORMal Mode, which is the meter's power-on default mode.

SWIFt and BURSt Mode measurements use only FETCh#?, not READ#? or MEAS#?. In this getting started section, high speed SWIFt and BURSt Mode examples are few in number and brief in description; detailed information on high speed power measurements can be found in Section A.8 (High Speed Measurements).

A.4.1 Reading Power Measurements Example 1

The following program configures the power meter for single channel operation, and uses the MEAS#? command to perform limited Auto-Configuration and return power measurement data in NORMal Mode. Prior to executing the measurement cycle, the MEAS#? command performs low level configuration functions for averaging and trigger sequence arming automatically. Use MEAS#? to get started performing power measurements quickly. Typically, MEAS#? will satisfy most of your power measurement needs; however, more advanced power meter users of NORMal Mode may prefer lower level controls of the READ#? command and the higher measurement rates of the FETCh#? command. High speed measurements are performed using the SWIFt and BURSt Modes, not NORMal Mode.

Note that the MEAS#? command's measurement response speed is slower at very low power levels and faster at high power levels. This is due to a chopper stabilization system used in the NORMal Mode (also used in SWIFt Mode, but not BURSt mode) and Auto-Averaging when using SENS#:AVER:TCON REP. At the most sensitive gain ranges, chopper stabilization allows the very small voltages from the power sensor to be accurately measured. Also, at lower power meter gain ranges, Auto-Averaging automatically adds additional averaging to counter the effects of noise in the measurement signal. The extra time required to perform these Auto-Averaged measurements will not be apparent unless you switch the default averaging control, SENS#:AVER:TCON MOV, to SENS#:AVER:TCON REP.

When you use the MEAS#? command, Auto-Averaging is automatically set to ON. If another part of your programming was using manual averaging, be sure to turn Auto-Averaging back off (SENS#:AVER:COUN:AUTO OFF) before you exit the section of your program code using MEAS#. When operating in NORMal Mode you can always use the SENS#:AVER:COUN? query to find out the current averaging value for a particular sensor, and the SENS#:AVER:COUN ### command to set a higher or lower averaging value.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
280  WAIT 1
290  OUTPUT @Pwr_mtr;CALC1:MODE NORM    ! Can ONLY send Configuration Commands in Normal Mode!!
300  OUTPUT @Pwr_mtr;CALC1:POW 1        ! Channel 1 configured to measure sensor 1 power
310  !
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                     ! Applies Cal Factor for 1.44 GHz to measurement data.
330  !
340  FOR I=1 TO 10
350    OUTPUT @Pwr_mtr;MEAS1?           ! Measures Power at sensor.
360    ENTER @Pwr_mtr;Rdg
370    PRINT Rdg
380  NEXT I
390  !
510  END
```

A.4.2 Reading Power Measurements Example 2

If you send the MEAS#? command, two configuration changes occur. These are listed as shown below. If you prefer to perform measurements without changing the configuration, use the READ#? command.

Command/Configuration Item	MEAS#? Auto-Setting
SENS#:A VER:COUN:AUTO	ON
INIT:CONT	OFF

No other items than the above will change configuration when you send the MEAS#? command.

The following example illustrates that Auto-Averaging changes the active averaging number. Since Auto-Averaging was activated through use of the MEAS#? command, the averaging value currently in use when Auto-Averaging is set to OFF is taken as the new averaging number. This is likely to differ from the averaging number in effect before the MEAS#? command was sent. If this is an undesirable effect, remember to read the averaging number using SENS#:AVER:COUN? and store the value for post Auto-Averaging output at the conclusion of the MEAS#? power meter reading measurement routine.

```

260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
290  WAIT 1
300  OUTPUT @Pwr_mtr;CALC1:MODE NORM
310  OUTPUT @Pwr_mtr;SENS1:AVER:COUN:AUTO OFF
320  OUTPUT @Pwr_mtr;SENS1:AVER:COUN:AUTO?
330  ENTER @Pwr_mtr;A$
340  PRINT A$,1 is AUTO ON
350  OUTPUT @Pwr_mtr;SENS1:AVER:COUN 16
360  OUTPUT @Pwr_mtr;SENS1:AVER:COUN?
370  ENTER @Pwr_mtr;A$
380  PRINT A$,16 MEANS AVERAGING #=16 ACCEPTED.
390  OUTPUT @Pwr_mtr;INIT:CONT ON
400  OUTPUT @Pwr_mtr;INIT:CONT?
410  ENTER @Pwr_mtr;A$
420  PRINT A$,1 is INIT:CONT ON
430  OUTPUT @Pwr_mtr;CALC1:POW 1           ! Channel 1 configured to measure sensor 1 power
440  !
450  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                           ! Applies Cal Factor for 1.44 GHz.
460  !
470  FOR I=1 TO 10
480    OUTPUT @Pwr_mtr;MEAS1?           ! Measures Power at sensor.
490    ENTER @Pwr_mtr;Rdg
500    PRINT Rdg
510  NEXT I
520  !
530  OUTPUT @Pwr_mtr;SENS1:AVER:COUN:AUTO?
540  ENTER @Pwr_mtr;A$
550  PRINT A$,1 is AUTO ON
560  OUTPUT @Pwr_mtr;INIT:CONT?
570  ENTER @Pwr_mtr;A$
580  PRINT A$,1 is INIT:CONT ON
590  OUTPUT @Pwr_mtr;SENS1:AVER:COUN:AUTO OFF
600  OUTPUT @Pwr_mtr;SENS1:AVER:COUN:AUTO?

```

```
610 ENTER @Pwr_mtr;A$
620 PRINT A$,1 is AUTO ON
630 OUTPUT @Pwr_mtr;SENS1:AVER:COUN?
640 ENTER @Pwr_mtr;A$
650 PRINT A$,Value not equal to 16 means reset by Auto-Averaging during MEAS#?
760 !
770 END
```

A.4.3 Reading Power Measurements Example 3

The following program configures the power meter for dual channel operation and uses the MEAS#? command to return power measurement data in NORMal Mode. Please note that measurement speed per channel decreases slightly in NORMal mode when two channels, versus only a single channel, are connected and calibrated. In NORMal Mode, single channel measurement rates are slightly faster than two channel measurement rates. If you are using CW power sensors, also please note that power measurements are not performed at specifically the exact, simultaneous instant in time. In NORMal Mode there will be a short time delay of about 3 ms between the two channels' sample points, about two and a half orders of magnitude faster than traditional CW power meters. In BURSt and SWIFT mode this time is about 1 ms. If you need to guarantee that power sampling occurs on both channels within a smaller interval of time, this can be accomplished to within about 2% of the Sample Delay time plus 2 ns using the 80350A Series Peak Power Sensors and triggering both sensors at the same time. The example below operates with either Peak or CW power sensors.

```
260 ASSIGN @Pwr_mtr to 70101
270 CLEAR @Pwr_mtr
280 WAIT 1
290 OUTPUT @Pwr_mtr;CALC1:MODE NORM      ! Can ONLY send Configuration Commands in Normal Mode!!
300 OUTPUT @Pwr_mtr;CALC1:POW 1          ! Channel 1 configured to measure sensor 1 power
310 OUTPUT @Pwr_mtr;CALC1:UNIT W         ! Transmitter output power in Watts.
320 OUTPUT @Pwr_mtr;CALC2:RAT 1,2        ! Transmitter gain stays in default, dBm.
330 !
340 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                           ! Applies Cal Factor for 1.44 GHz to sensor 1 data.
350 OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 0.96E9
                                           ! Applies Cal Factor for 960 MHz to sensor 2 data.
360 !
370 FOR I=1 TO 10
380   OUTPUT @Pwr_mtr;MEAS1?;MEAS2?      ! Measures Power at sensors.
390   ENTER @Pwr_mtr;Chn_pow 1
400   ENTER @Pwr_mtr;Chn_1rat2
410   PRINT Chn_pow1,Chn_1rat2
420 NEXT I
430 !
550 END
```

A.4.4 Reading Power Measurements Example 4

The following program configures the power meter for single channel operation and uses the READ#? command to return power measurement data in NORMal Mode. Using the READ#? command will not change power meter configuration items under any circumstances. Note that INIT:CONT ON is illegal when using READ#?. When continuous trigger arming is desired, use INIT:CONT ON with the FETCh#? command if desired. Also, use TRIG:SOUR IMM when using the READ#? command.

```

280  ASSIGN @Pwr_mtr to 70101
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;CALC1:MODE NORM    ! Can ONLY send Configuration Commands in Normal Mode!!
320  OUTPUT @Pwr_mtr;TRIG:SOUR IMM      ! TRIG:SOUR must be IMM when using READ#?
330  OUTPUT @Pwr_mtr;INIT:CONT OFF      ! INIT:CONT arming must be OFF when using READ#?
340  !
350  OUTPUT @Pwr_mtr;SENS2:AVER:COUN 1  ! Sets averaging to manual and one sample per reading.
360  OUTPUT @Pwr_mtr;CALC1:POW 2        ! Channel 1 configured to measure sensor 2 power
370  !
380  OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 17.4E9
                                         ! Applies Cal Factor for 17.4 GHz to measurement data.
390  !
400  FOR I=1 TO 10
410    OUTPUT @Pwr_mtr;READ2?           ! Measures Power at sensor.
420    ENTER @Pwr_mtr;Rdg
430    PRINT Rdg
440  NEXT I
450  !
650  END

```

A.4.5 Reading Power Measurements Example 5

READ#? measurement response speed is slower at very low power levels and faster at high power levels. This is due to a chopper stabilization system used in the NORMal Mode which is also used in the SWIFt Mode, but not the BURSt mode. At the most sensitive gain ranges, chopper stabilization allows the very small voltages from the power sensor to be accurately measured.

The following program configures the power meter for dual channel operation and uses the READ#? command to return power measurement data in NORMal Mode.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
280  WAIT 1
290  OUTPUT @Pwr_mtr;CALC1:MODE NORM      ! Can ONLY send Configuration Commands in Normal Mode!!
300  OUTPUT @Pwr_mtr;CALC1:POW 1          ! Channel 1 configured to measure sensor 1 power
310  OUTPUT @Pwr_mtr;CALC1:UNIT W         ! Transmitter output power in Watts.
320  OUTPUT @Pwr_mtr;CALC2:RAT 1,2        ! Transmitter gain stays in default, dBm.
330  !
340  OUTPUT @Pwr_mtr;TRIG:SOUR IMM         ! TRIG:SOUR must be IMM when using READ#?
350  OUTPUT @Pwr_mtr;INIT:CONT OFF        ! INIT:CONT arming must be OFF when using READ#?
360  !
370  OUTPUT @Pwr_mtr;SENS1:AVER:COUN 1
                                           ! Sets averaging to manual and one sample per reading.
380  OUTPUT @Pwr_mtr;SENS2:AVER:COUN 16
                                           ! Sets averaging to manual and 16 samples per reading.
390  !
400  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                           ! Applies Cal Factor for 1.44 GHz to sensor 1 data.
410  OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 0.96E9
                                           ! Applies Cal Factor for 960 MHz to sensor 2 data.
420  !
430  FOR I= 1 TO 10
440    OUTPUT @Pwr_mtr;READ1?;READ2?      ! Measures Power at sensors.
450    ENTER @Pwr_mtr;Chn_pow1
460    ENTER @Pwr_mtr;Chn_1rat2
470    PRINT Chn_pow1,Chn_1rat2
480  NEXT I
490  !
610  END
```

A.4.6 Reading Power Measurements Example 6

FETCh? allows finer control of the meter's measurement sequences. The low level control function of FETCh#? is to first, process the measurement channel information based upon sensor data and configuration settings and then, place the result in the meter data output buffer to be read by the slot 0 controller/resource manager.

The following program uses the INIT command to control acceptance of measurement values in conjunction with the FETCh#? command. When using FETCh#?, both trigger sequence arming and triggering/data acquisition must be controlled in your program. This is juxtaposed with MEAS#? and READ#? which, being higher level commands, include these functions.

This program will allow the fastest measurement speed performance in NORMal mode.

```

280  ASSIGN @Pwr_mtr to 70101
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;CALC1:MODE NORM    ! Can ONLY send Configuration Commands in Normal Mode!!
320  OUTPUT @Pwr_mtr;TRIG:SOUR IMM      ! Power Meter controls triggering with TRIG or *TRG
330  OUTPUT @Pwr_mtr;INIT:CONT ON       ! Power Meter controls instrument trigger arming
340  !
350  OUTPUT @Pwr_mtr;SENS2:AVER:COUN 1  ! Sets averaging to manual and one sample per reading.
360  OUTPUT @Pwr_mtr;CALC1:POW 2        ! Channel 1 configured to measure sensor 2 power
370  !
380  OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 17.4E9
                                         ! Applies Cal Factor for 17.4 GHz to data.
390  !
400  FOR I=1 TO 10
430    OUTPUT @Pwr_mtr;FETC1?           ! Measures Power at sensor.
440    ENTER @Pwr_mtr;Rdg
450    PRINT Rdg
460  NEXT I
470  !
670  END

```

A.4.7 Reading Power Measurements Example 7

The following example is similar to the example above; however, it now uses TRIG:SOUR BUS instead of IMMEDIATE so that triggering is controlled by the TRIG command. EXT or TTLT triggering can not be used in NORMal Mode. Additionally, INIT:CONT is set to OFF, allowing the INIT (or INIT:IMM) command to control arming of the triggering cycle.

```
280  ASSIGN Pwr_mtr to 70101
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;CALC1:MODE NORM      ! Can ONLY send Configuration Commands in Normal Mode!!
320  OUTPUT @Pwr_mtr;TRIG:SOUR BUS        ! Program controls triggering with TRIG or *TRG
330  OUTPUT @Pwr_mtr;INIT:CONT OFF        ! Program controls instrument trigger arming
340  !
350  OUTPUT @Pwr_mtr;SENS2:AVER:COUN 1    ! Sets averaging to manual and one sample per reading.
360  OUTPUT @Pwr_mtr;CALC1:POW 2          ! Channel 1 configured to measure sensor 2 power
370  !
380  OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 17.4E9
                                           ! Applies Cal Factor for 17.4 GHz to data.
390  !
400  FOR I=1 TO 10
410    OUTPUT @Pwr_mtr;INIT                ! INIT arms the triggering and measurement cycle
420    OUTPUT @Pwr_mtr;TRIG                ! BUS trigger
430    OUTPUT @Pwr_mtr;FETC1?              ! Measures Power at sensor.
440    ENTER @Pwr_mtr;Rdg
450    PRINT Rdg
460  NEXT I
470  !
670  END
```

A.4.8 Reading Power Measurements Example 8

The following program shows fast BUS triggering in the SWIFt Mode. TRIG (or *TRG) is used to acquire data, and FETCh#? processes and outputs the data to the slot 0 controller/resource manager. This program does not use the meter's data buffering capability.

```

170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;*CLS                ! Clears old messages from SYST:ERR buffer
205 WAIT 0.3
210  PRINT Running...
220!
230  OUTPUT @Pwr_mtr;CALC1:MODE NORM    ! NORMal Mode to perform channel configuration
240  OUTPUT @Pwr_mtr;CALC1:POW 1        ! Channels 1 or 2 can be either POW 1 or POW 2
250                                     ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
260  !
270  !#####
280  !
290  ! Entering SWIFt Mode
300  !
310  OUTPUT @Pwr_mtr;CALC1:MODE SWIF    ! Enters SWIFt Mode for fastest individual data point
                                       ! triggered measurements.
320  !
330  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                       ! Applies Cal Factor in SWIFt mode
340                                     ! Can be sent before or after CALC#:MODE SWIF
350  !
360  OUTPUT @Pwr_mtr;TRIG:SOUR BUS      ! BUS or EXT triggering is slower than IMM
370                                     ! Can be sent before or after CALC#:MODE SWIF
380  !
390  FOR I=1 TO 10
400    FOR K=1 TO 20
410      OUTPUT @Pwr_mtr;TRIG           ! TRIG is the SCPI Bus trigger. Can also use *TRG
420      OUTPUT @Pwr_mtr;FETCh#?       ! FETCh#? acquires data
430      ENTER @Pwr_mtr;Chan1sens_1(K)
440      !ENTER @Pwr_mtr;Chan1sens_1(K),Chan2sens_2(K)
                                       ! Use this line when two sensors are attached.
450    NEXT K
460  !
470    PRINT Chan1sens_1(*)
480    !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
490    PRINT ""
500  NEXT I
510  !
520  END

```

A.4.9 Reading Power Measurements Example 9

The following program uses BURSt Mode for the fastest measurement rates possible. The maximum measurement speed is performed when TRIG:DEL is set to 0. TRIG:DEL controls the speed of sampling and data buffering. When TRIG:DEL is set to 0.004, samples will be taken every 4 milliseconds, on both channels if connected, and stored in internal data buffer. This speed does not control or account for the meter's internal data processing time after data acquisition or the speed of data transfer to your controller. This second component of time, the time to get data from the 58542, is proportional to the number of data points measured. Therefore, the example below uses only one channel and keeps the number of points buffered to a minimum.

Both channels' data will be taken at the same time during BURSt Mode. Power meter measurement speed does not change when two sensors are connected versus only one sensor. However, the meter's processing time and the time to transmit the data over the VXI and GPIB interfaces takes longer due to the additional sensor data. If two sensors are connected, calibrated, and their respective channels are set to ON, then you must read both arrays of data. Only read one array of data when one sensor is attached, calibrated, and set to ON.

As shown in the examples, send the CALC#:MODE BURS command prior to sending the BURSt Mode configuration commands TRIG:SOUR, TRIG:MODE, TRIG:COUN, and TRIG:DEL.

```
10  ALPHA ON
20  CLEAR SCREEN
30  !
40  OPTION BASE 1
50  DIM Id$(50),Err_msg$(70)
60  DIM Ques$(200),A$(80),Chan1sens_1(500)
70  DIM Chan2sens_2(500)
80  !
90  !
100 !#####
110 !   Instrument ADDRESS ALLOCATION
120 !
130 ASSIGN @Slot0 TO 70100           ! 70100 is Logical Address of the Slot 0 controller
140 ASSIGN @Pwr_mtr TO 70101        ! 70101 is Power Meter in 1st position right of slot 0
150 !#####
160 !
170 ! Identify Attached Instruments
180 !
190 OUTPUT @Slot0;*Slot0;*IDN?
200 ENTER @Slot0;Id$
210 PRINT SLOT 0 is ;Id$
220 !
230 OUTPUT @Pwr_mtr;*IDN?
240 ENTER @Pwr_mtr;Id$
250 PRINT SLOT 1 is ;Id$
260 WAIT 1
270 !
280 !
290 CLEAR @Pwr_mtr
300 WAIT 1
310 OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
320 WAIT 0.3
330 OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMAl Mode to perform channel configuration
340 OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
350                                ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
```

```

360 OUTPUT @Pwr_mtr;TRIG:SOUR IMM      ! IMM set here to highlight conflict with BURSt operation.
370 !
380 !#####
390 !
400 ! Entering BURSt Mode
410 !
420 OUTPUT @Pwr_mtr;CALC1:MODE BURS    ! Enters BURSt Mode for fastest measurement speeds.
430 !
440 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 2.44E9
                                     ! Applies Cal Factor in BURSt mode
450                                     ! Can be sent before or after CALC#:MODE BURS
460 !
470 OUTPUT @Pwr_mtr;TRIG:SOUR BUS      ! IMM triggering is illegal in BURSt Mode, Use BUS or EXT.
480                                     ! Can be sent before or after CALC#:MODE BURS
490 !
500 OUTPUT @Pwr_mtr;TRIG:MODE POST     ! Data acquired after trigger, not before as with PRE.
510                                     ! Send only after CALC#:MODE BURS
520 !
530 OUTPUT @Pwr_mtr;TRIG:COUN 500      ! 500 readings acquired and stored with each trigger.
540                                     ! Send only after CALC#:MODE BURS, following TRIG:MODE.
550                                     ! Be sure COUN# matches ENTER variable dimension.
560 !REDIM Chan1sens_1(500),Chan2sens_2(500) ! REDIM to smaller array size only if necessary.
570!
580 OUTPUT @Pwr_mtr;TRIG:DEL .000      ! 0 millisecond between rdgs setting is 5100 rdgs/sec.
590                                     ! Send only after CALC#:MODE BURS, following TRIG:COUN.
600 !
610 !
620 FOR I=1 TO 10
630   Time1=TIMEDATE
640!
650   OUTPUT @Pwr_mtr;TRIG              ! TRIG is the SCPI Bus trigger. Can also use *TRG
660   OUTPUT @Pwr_mtr;FETC1?            ! FETC#? acquires data
670   ENTER @Pwr_mtr;Chan1sens_1(*)
680   !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)
                                     ! Use this line when two sensors are attached.
690   !
700   Time2=TIMEDATE
710   Time=Time2-Time1
720   Speed=500/Time
730   PRINT Chan1sens_1(*)
740   !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
750   PRINT Speed; readings per second, round trip.
760   PRINT ""
770 NEXT I
780 !
790 END

```

A.5 Instrument Triggering Examples

A.5.1 TRIGgering Example 1

The following two programs illustrate the operation of TRIG:SOUR HOLD with the MEAS#? and FETCh#? measurement data queries. This first program shows TRIG:SOUR HOLD used with MEAS#?. Since MEAS#? is a high level command containing its own trigger sequence arming, triggering, and measurement data acquisition functions, the program returns valid measurement data. The output from the SYST:ERR query is -0, No error.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
275  WAIT 1
280  OUTPUT @Pwr_mtr;*CLS                ! Clears old messages from SYST:ERR buffer
290  WAIT 0.3
300  OUTPUT @Pwr_mtr;CALC1:MODE NORM    ! NORMAl Mode.
310  OUTPUT @Pwr_mtr;CALC1:POW 1        ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                         ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;TRIG:SOUR HOLD     ! Halts triggering when used with FETCh#?
350  !
360  FOR I=1 TO 10
370    OUTPUT @Pwr_mtr;MEAS1?           ! MEAS#? returns valid data with TRIG:SOUR set to HOLD.
380    ENTER @Pwr_mtr;Rdg
390    PRINT Rdg
400  NEXT I
410  !
420  OUTPUT @Pwr_mtr;SYST:ERR?          ! Query error buffer
430  ENTER @Pwr_mtr;A$
440  PRINT A$
530  END
```

A.5.2 TRIGgering Example 2

When FETCh#? is used while TRIG:SOUR is HOLD, invalid data, 9.e+40, is returned and the SYST:ERR? query returns -230, Data corrupt or stale.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
275 WAIT 1
280  OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
290  WAIT 0.3
300  OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMal Mode.
310  OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;TRIG:SOUR HOLD ! Halts triggering when used with FETCh#?
350  !
360  FOR I=1 TO 10
370    OUTPUT @Pwr_mtr;FETC1?      ! FETC#? will not acquire valid data when TRIG:SOUR
                                   ! is set to HOLD.
380    ENTER @Pwr_mtr;Rdg
390    PRINT Rdg
400  NEXT I
410  !
420  OUTPUT @Pwr_mtr;SYST:ERR?    ! Query error buffer
430  ENTER @Pwr_mtr;A$
440  PRINT A$
530  END
```

A.5.3 TRIGgering Example 3

Please note, the READ#? measurement data query requires TRIG:SOUR IMM for proper operation. While TRIG:SOUR is HOLD, data output is also invalid, 9.e+40, but the SYST:ERR? query response is different, -214, Trigger deadlock.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
275 WAIT 1
280  OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
290  WAIT 0.3
300  OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMal Mode.
310  OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;TRIG:SOUR HOLD ! Halts triggering when used with FETCh#?
350  !
360  FOR I=1 TO 10
370    OUTPUT @Pwr_mtr;READ1?       ! READ#? requires TRIG:SOUR IMM not, HOLD.
380    ENTER @Pwr_mtr;Rdg
390    PRINT Rdg
400  NEXT I
410  !
420  OUTPUT @Pwr_mtr;SYST:ERR?     ! Query error buffer
430  ENTER @Pwr_mtr;A$
440  PRINT A$
530  END
```

A.5.4 TRIGgering Example 4

The following examples show the use of BUS triggering with FETCh#? in NORMal and BURSt Modes.

```
270  ASSIGN @Pwr_mtr to 70101
280  CLEAR @Pwr_mtr
290  WAIT 1
300  OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMal Mode.
310  OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;TRIG:SOUR BUS
350  !
360  FOR I=1 TO 10
362  OUTPUT @Pwr_mtr;TRIG           ! TRIG is the SCPI Bus trigger. Can also use *TRG
370    OUTPUT @Pwr_mtr;FETC1?       ! FETC#? acquires data
380    ENTER @Pwr_mtr;Rdg
390    PRINT Rdg
400  NEXT I
410  !
530  END
```

A.5.5 TRIGgering Example 5

BURSt Mode BUS triggering with FETCh?

```

10  ALPHA ON
20  CLEAR SCREEN
30  !
40  OPTION BASE 1
50  DIM Id$(50),Err_msg$(70)
60  DIM Ques$(200),A$(80),Chan1sens_1(50)
70  DIM Chan2sens_2(50)
80  !
90  !
100 !#####
110 ! Instrument ADDRESS ALLOCATION
120 !
130 ASSIGN @Slot0 TO 70100          ! 70100 is Logical Address of the Slot 0 controller
140 ASSIGN @Pwr_mtr TO 70101       ! 70101 is Power Meter, in 1st position right of slot 0
150 !#####
160 !
170 ! Identify Attached Instruments
180 !
190 OUTPUT @Slot0;*IDN?
200 ENTER @Slot0;Id$
210 PRINT SLOT 0 is ;Id$
220 !
230 OUTPUT @Pwr_mtr;*IDN?
240 ENTER @Pwr_mtr;Id$
250 PRINT SLOT 1 is ;Id$
260 WAIT 1
270 !
280 !
290 CLEAR @Pwr_mtr
300 WAIT 1
310 OUTPUT @Pwr_mtr; *CLS          ! Clears old messages from SYST:ERR buffer
320 !
330 OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMAl Mode to perform channel configuration
340 OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
350                               ! RAT and DIFF are illegal in SWIFt and BURSt Modes
360 OUTPUT @Pwr_mtr;TRIG:SOUR IMM  ! IMM set here to highlight conflict with BURSt operation
370 !
380 !#####
390 !
400 ! Entering BURSt Mode
410 !
420 OUTPUT @Pwr_mtr;CALC1:MODE BURS ! Enters BURSt Mode for fastest measurement speeds
430 !
440 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 2.44E9
                                   ! Applies Cal Factor in burst mode
                                   ! Can be sent before or after CALC#:MODE BURS
450                               !
460 !
470 OUTPUT @Pwr_mtr;TRIG:SOUR BUS  ! IMM triggering is illegal in BURSt Mode, Use BUS or EXT.
480                               ! Can be sent before or after CALC#:MODE BURS
490 !
500 OUTPUT @Pwr_mtr;TRIG:MODE POST ! Data acquired after trigger, not before as with PRE.

```

```
510                                     ! Send only after CALC#:MODE BURS
520 !
530 OUTPUT @Pwr_mtr;TRIG:COUN 50      ! 50 readings acquired and stored with each trigger
540                                     ! Send only after CALC#:MODE BURS
550                                     ! Be sure COUN# matches ENTER variable dimension.
560 !REDIM Chan1sens_1(50),Chan2sens_2(50) ! REDIM to smaller array size only if necessary
570 !
580 OUTPUT @Pwr_mtr;TRIG:DEL .001     ! 1 millisecond between rdgs, 0 ms is 5100 rdgs/sec
590                                     ! Send only after CALC#:MODE BURS
600 !
610 !
620 FOR I=1 TO 10
630 WAIT .01                          ! For handshaking compensation. If necessary, use wait
640
650
660 OUTPUT @Pwr_mtr;TRIG              ! TRIG is the SCPI Bus trigger. Can also use *TRG
670 WAIT .01                          ! For handshaking compensation. If necessary, use wait
680 OUTPUT @Pwr_mtr;FETC1?           ! FETC#? acquires data
690 ENTER @Pwr_mtr;Chan1sens_1(*)
700 !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)
                                     ! Use this line when two sensors are attached.
710 PRINT Chan1sens_1(*)
720 !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
730 PRINT ""
740 NEXT I
750 !
760 END
```

A.5.6 TRIGgering Example 6

Be careful when you use BURSt Mode. For example, you must use INIT:CONT ON; you don't have manual control of trigger sequence arming using INIT, as you do using the FETCh#? command with the NORMal Mode. This is of particular concern using TTL level triggering on either the front panel EXT connector or the VXI backplane TTLT trigger functions. You must control the triggering through control of the trigger source. That is, you must use INIT:CONT ON in BURSt Mode; you can't use INIT control arming of the trigger sequence.

The following example uses EXTeRnal TTL level triggering using the external trigger input on the front panel of the 58542 VXI Universal Power Meter. Twenty readings are stored in the measurement buffer. Then FETCh#? is used during SWIFt Mode. Please note there is a TTL level hardware handshake capability using the ANALOG OUT BNC connector which is also on the front panel. The Analog BNC will output a high (5V) when the instrument is ready for triggering. After a trigger is received, the Analog BNC output goes low (0V).

TRIG:SOUR HOLD halts the SWIFt Mode triggering sequence.

```

10  ALPHA ON
20  CLEAR SCREEN
30  !
40  OPTION BASE 1
50  DIM Id$(50),Err_msg$(70)
60  DIM Ques$(200),A$(80),Chan1sens_1(20)
70  DIM Chan2sens_2(20)
80  !
90  !
100 !#####
110 !   Instrument ADDRESS ALLOCATION
120 !
130 ASSIGN @Slot0 TO 70100           ! 70100 is Logical Address of the Slot 0 controller
140 ASSIGN @Pwr_mtr TO 70101        ! 70101 is Power Meter, in 1st position right of slot 0
150 !#####
160 !
170 !
180 CLEAR @Pwr_mtr
190 WAIT 1
200 OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
210 WAIT 0.3
220 OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMal Mode to perform channel configuration
230 OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
240                               ! RAtio and DIFFerence configurations are illegal in
                               ! SWIFt and BURSt Modes.

250 !
260 !#####
270 !
280 ! Entering SWIFt Mode
290 !
300 OUTPUT @Pwr_mtr;CALC1:MODE SWIF ! Enters SWIFt Mode for fastest individual data point
                               ! triggered measurements.

310 !
320 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 2.22E8
                               ! Applies Cal Factor in SWIFt mode
330                               ! Can be sent before or after CALC#:MODE SWIF
340 !

```

```
350  OUTPUT @Pwr_mtr;TRIG:SOUR EXT      ! TTL level triggering, Each trigger acquires one data
                                           ! point in SWIFt Mode.
360                                     ! Can be sent before or after CALC#:MODE SWIF
370  !
380  OUTPUT @Pwr_mtr;TRIG:COUN 20      ! Stores 20 points for simultaneous output using
                                           ! FETCh#?.
390                                     ! Must be sent after CALC#:MODE SWIF
400  !
410  !
420  FOR I=1 TO 10
430  !WAIT 2                          ! If necessary, use wait
440
450  OUTPUT @Pwr_mtr;FETC1?            ! FETC#? acquires data
460  ENTER @Pwr_mtr;Chan1sens_1(*)
470  !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)
                                           ! Use this line when two sensors are attached.
480  !
490  PRINT Chan1sens_1(*)
500  !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
510  PRINT ""
520  NEXT I
530  !
540  END
```

The fastest SWIFt Mode measurement speeds are achieved with TRIG:SOUR:IMM and TRIG:COUN set to values larger than about 25. See High Speed Measurements in Section A.8 for additional information and examples.

The fastest BURSt Mode measurement speeds are achieved with TRIG:COUN at about 80 and TRIG:DEL 0. See High Speed Measurements in Section A.8 for additional information and examples.

A.6 Channel Configuration Examples

A.6.1 Single Sensor Power Measurement

Default definition of software calculation channels 1 and 2 are for sensors 1 and 2, respectively. This configuration allows measurement of the power level incident upon sensor 1 on software configuration channel 1, and measurement of the power level incident upon sensor 2 on software configuration channel 2. Normal Mode and Swift Mode measurements are faster with only one sensor set to STATE ON. Since this is the default configuration, you might want to turn one channel off occasionally. This will only be necessary when two sensors are attached and both are calibrated. Channel configuration can be changed by sending the CALCulate:RATio or CALCulate:DIFFerence commands.

```
OUTPUT @Pwr_mtr;*RST           ! Configure 58542 to Default Setup
OUTPUT @Pwr_mtr;CALC1?;CALC2?  ! Query channel configuration
ENTER @Pwr_mtr;Chn1_config,Chn2_config
PRINT Chn1_config,Chn2_config
```

Program Output: POW 1 POW 2

The following program reverses the default sensor-to-channel assignments.

```
OUTPUT @Pwr_mtr;CALC2:POW 1    ! Configures channel 2 to measure Sensor 1 power
OUTPUT @Pwr_mtr;CALC1:POW 2    ! Configures channel 1 to measure Sensor 2 power
OUTPUT @Pwr_mtr;CALC1?;CALC2?  ! Query channel configuration
ENTER @Pwr_mtr;Chn1_config,Chn2_config
PRINT Chn1_config,Chn2_config
```

Program Output: POW 2 POW 1

A.6.2 Ratio Measurement

The CALCulate:RATio command is used to automatically measure the ratio of the power levels incident on the two sensors. Permissible settings are Sensor 1/Sensor 2 & Sensor 2/Sensor 1.

```
OUTPUT @Pwr_mtr;CALC1:RAT 2,1  ! Configures channel 1 to measure Sensor 2 over
                                ! Sensor 1 power
OUTPUT @Pwr_mtr;CALC2:RAT 1,2  ! Configures channel 2 to measure Sensor 1 over
                                ! Sensor 2 power
OUTPUT @Pwr_mtr;CALC1?;CALC2?  ! Query channel configuration
ENTER @Pwr_mtr;Chn1_config,Chn2_config
PRINT Chn1_config,Chn2_config
```

Program Output: RAT2,1 RAT1,2

A.6.3 Difference Measurement

The CALCulate:DIFFerence command is used to automatically measure the difference of the power levels incident upon the two sensors.

```
OUTPUT @Pwr_mtr;CALC1:DIFF 2,1 ! Configures channel 1 to measure Sensor 2 minus
                                ! Sensor 1 power
OUTPUT @Pwr_mtr;CALC1?         ! Query Channel 1 configuration
ENTER @Pwr_mtr;Chn1_config
PRINT Chn1_config
```

Program Output: DIFF2,1

A.7 Cal Factor Examples

Entering a frequency causes the power meter to use frequency calibration factors which are stored in the power sensor's internal EEPROM. Generally, frequency calibration factors are stored in one gigahertz steps.

Two methods are available for frequency entry. Use SENSE:CORRection:FREQuency to enter a specific carrier frequency, or use SENSE:CORRection:VPROpf to enable the meter's voltage proportional to frequency input BNC. (See front panel of the meter.)

A.7.1 Cal Factor Example 1

The following program automatically applies the correct cal factor for an 8.23 GHz measurement frequency to the measured data value.

```
310  ASSIGN @Pwr_mtr to 70101
320  CLEAR @Pwr_mtr
330  WAIT 1
350  OUTPUT @Pwr_mtr;CALC1:MODE NORMAL
                                     ! Can ONLY send Cal Factor Correction Commands in
                                     ! Normal Mode!!

360  !
370  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 8.23E9
                                     ! Applies Cal Factor for 8.23 GHz to measurement data.

380  !
400  OUTPUT @Pwr_mtr;MEAS1?          ! Measures Power of 8.23 GHz signal.
410  ENTER @Pwr_mtr;Rdg
420  PRINT Rdg
460  !
470  END
```

A.7.2 Cal Factor Example 2

The following program steps from 1.8 GHz to 2.2 GHz in 10 MHz intervals. The measurement at each step is automatically corrected for cal factor.

```
340  ASSIGN @Pwr_mtr to 70101
350  CLEAR @Pwr_mtr
360  WAIT 1
370  REAL Rdg(41)
380  REAL Frq(41)
390  OUTPUT @Pwr_mtr;CALC1:MODE NORMAL ! Can ONLY send Cal Factor Correction Commands in
                                     ! Normal Mode!!
400  !
410  FOR I=1 TO 41
420  !
430  Freq=1.8E+9+(I-1)*1.E+7
440  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ;Freq
                                     ! Applies Cal Factor to measurement data.
450  !
460  OUTPUT @Pwr_mtr;MEAS1?
470  ENTER @Pwr_mtr;Rdg(I)
480  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ? ! Power meter outputs freq setting to confirm command
                                     ! reception.
490  ENTER @Pwr_mtr;Frq(I)
500  NEXT I
510  !
520  PRINT Rdg(*)
530  PRINT Frq(*)
540  !
550  END
```

A.7.3 Cal Factor Example 3

The following program also steps from 1.8 GHz to 2.2 GHz in 10 MHz intervals. The measurement at each step is automatically corrected for cal factor using the VpropF connector on the front panel. In the first part of the program the power meter's VpropF input is configured for compatibility with the Giga-tronics Source.

```
340  ASSIGN @Pwr_mtr to 70101
350  CLEAR @Pwr_mtr
360  WAIT 1
370  REAL Rdg(41)
380  OUTPUT @Pwr_mtr;CALC1:MODE NORMAL
                                     ! Can ONLY send VpropF Config. Commands in Normal
                                     ! Mode!!

390  !
400  ! Configure VpropF input for Cal Factor correction
410  !
420  OUTPUT @Pwr_mtr;MEM:SEL VPROPF1    ! Selects memory table for sensor on for editing
430  OUTPUT @Pwr_mtr;MEM:FREQ 0.0       ! Sets freq that corresponds to 0.0V out from source.
440  OUTPUT @Pwr_mtr;MEM:SLOP 0.5E-9    ! Sets the voltage to freq (must be linear) relationship of
                                     ! source's output (V/Hz).

450  !
460  OUTPUT @Pwr_mtr;SENS1:CORR:VPRO ON
                                     ! Turns VpropF on and all other sources of Cal Factor
                                     ! correction OFF

470  !
480  FOR I=1 TO 41
490  !
500  Freq=1.8E+9+(I-1)*1.E+7
510  OUTPUT @Source;CW;Freq;HZ
520  !
530  OUTPUT @Pwr_mtr;MEAS1?
540  ENTER @Pwr_mtr;Rdg(I)
550  NEXT I
560  !
570  PRINT Rdg(*)
580  !
590  END
```

A.7.4 Cal Factor Example 4

The following program shows you how to input your own specific User Calibration Factor during measurement. This is not the same as the special Frequency Cal Factors that can be programmed into the EEPROM. (See Sensor EEPROM Commands in Section 2.5.31 for more information). This is a technique for you to apply a specific known value during your measurements. It is useful when you have performed a sensor calibration with other devices attached to the sensor input, such as a power splitter or coupler, but you do not want to change or reprogram the CAL factor information inside the power sensor's EEPROM. First the program sets the 58542 to 50 MHz where the Cal Factors of Giga-tronics power sensors are always 0.0 dBm.

```

310  ASSIGN @Pwr_mtr to 70101
320  CLEAR @Pwr_mtr
330  WAIT 1
340  OUTPUT @Pwr_mtr;CALC1:MODE NORMAL
                                     ! Can ONLY send Sensor Offset Commands in
                                     ! Normal Mode!!

350  !
360  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 5E7
                                     ! Cal Factors always 0.00dB at 50 MHz.

370  OUTPUT @Pwr_mtr;SENS1:CORR:OFFS:STAT ON
                                     ! Enables sensor offset control.

380  OUTPUT @Pwr_mtr;SENS1:CORR:OFFS 6.024
                                     ! Enters 6.024 dB as a Sensor Offset

390  !
400  OUTPUT @Pwr_mtr;MEAS1?          ! Measures Power
410  ENTER @Pwr_mtr;Rdg
420  PRINT Rdg
430  !
440  END

```

A.7.5 Cal Factor Example 5

In Burst and Swift Mode, the meter's functionality is restricted to allow the microprocessor to devote most of its operation to performing measurement operations. If you are measuring a single frequency, you will not need this technique for your Burst or Swift Mode data. In Burst or Swift Mode, measurement correction for Cal Factor is always performed with the SENS:CORR:FREQ ### command. By sending this command before you enter the Burst or Swift Mode from the Normal mode, all subsequent Burst or Swift Mode measurements will be corrected for that frequency.

The above operation creates a problem for you if you change frequency during Burst or Swift Mode measurement. The following program is used to apply correct cal factors to swept or multi frequency measurements that have been performed during Burst or Swift Modes. In these modes, swept measurement correction functions are performed in your computer, thus increasing the measurement speed more than would otherwise be possible. First the Cal Factors are read from the sensor's EEPROM. Then the Cal Factors are put through an interpolation algorithm into a correction data array that matches the start/stop frequencies of the test source and the number of measurement points to be collected during measurement. Then measurement is performed, and the correction factor array is added to the measurement data array before being output to a file or swept onto a screen display.

```
10  ALPHA ON
20  CLEAR SCREEN
30  OPTION BASE 1
40  !
50  DIM Freqs(80),Clfcs(80),Corr_clf(5000),Rdgs(5000),Rdgs_corr(5000)
                                     ! These are in REDIMs later in program
60  DIM Id$(90),Err_msg$(70)
70  DIM Ques$(200),Calf$(200)
80  !
90  Tim_per_pnt = 5 ! milliseconds per sample point. Set 1 to 999.
100 !
110 !#####
120 !  Instrument ADDRESS ALLOCATION
130 !
140 ASSIGN @Slot0 TO 70100           ! 70100 is Logical Address of the Slot 0
                                     ! controller (Resource Manager)
150 ASSIGN @Sweeper TO 720           ! Use normal address for non-VXI instruments
160 ASSIGN @Pwr_mtr TO 70101        ! Power Meter is next to the slot 0 Resource Manager
170 !#####
180 !
190 ! Identify Attached Instruments
200 !
210 OUTPUT @Slot0;*IDN?
220 ENTER @Slot0;Id$
230 PRINT SLOT 0 is ;Id$
240 !
250 OUTPUT @Pwr_mtr;*IDN?
260 ENTER @Pwr_mtr;Id$
270 PRINT SLOT 1 is ;Id$
280 WAIT 1
290 !
300 !#####
310 !
320 ! CALIBRATE THE SENSORS
330 !
340 !#####
350 !
```

```

360 CLEAR @Pwr_mtr
370 WAIT 1
380 OUTPUT @Pwr_mtr;CALC1:MODE NORMAL
                                     ! Can ONLY send Sensor Offset
                                     ! Commands in Normal Mode!!

390 !
400 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 5E7
                                     ! Cal Factors always 0.00dB at 50MHz

410 !
420 ! Find out the number of Cal Factors in EEPROM
430 ! Include Std Cal Factors at 1 GHz intervals and any special Cal Factors.
440 !
450 OUTPUT @Pwr_mtr;DIAG:SENS1:EEPROM:CALFR?
460 !ENTER @Pwr_mtr;Frs_std_freq,Std_freq_step,No_std_freqs,No_spl_freqs
470 ENTER @Pwr_mtr;Frst_std_freq,Std_freq_step,No_std_freqs
480 No_spl_freqs=1                    ! Added to correct bug in DIAG:SENS#:EEPROM:CALFR?
490 PRINT Frst_std_freq,Std_freq_step,No_std_freqs,No_spl_freqs
500 !
510 !
520 ! When you query the 58542 for frequencies and Cal Factors there will be
530 ! No_std_freqs + No_spl_freqs = number of items you need to read
540 !
550 No_cal_pnts=No_std_freqs+No_spl_freqs
560 REDIM Freqs(No_cal_pnts),Clfcs(No_cal_pnt)
                                     ! Dimension according to number of Cal Factors to be read in.

570 PRINT There are ;No_cal_pnts; of Cal Factors in this sensor.
580 !
590 OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:FREQ?
                                     ! Asks the 58542 for the Frequency array from sensor 1

600 ENTER @Pwr_mtr;Freqs(*)
610 PRINT Freqs(*)
620 !
630 OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:CALF?
                                     ! Asks the 58542 for the Frequency array from sensor 1

640 ENTER @Pwr_mtr;Clfcs(*)
650 PRINT Clfcs(*)
660 !
670 !#####
680 ! Now that all the Cal Factors are loaded with their corresponding frequencies,
690 ! we need to create a table of interpolated Cal Factor points based upon the frequencies used
700 ! and number of measurement points in the test program.
710 !
720 ! First get a couple pieces of necessary information
730 !
740 INPUT Input sweep START frequency in GHz.,Strt_freq
750 INPUT Input sweep STOP frequency in GHz.,Stop_freq
760 INPUT Number of points per sweep. 100 to 400 suggested.,Sweep_pnts
770 IF Strt_freq>Stop_freq THEN
780     PRINT Make STOP freq. > START freq.
790     WAIT 1
800     GOTO 740
810 ELSE
820     IF Strt_freq<.051 THEN GOTO 740
830     IF Sweep_pnts<1 THEN GOTO 740          ! You can put additional requirements in this section.
840 END IF

```

```
850 Strt_freq=1.E+9*Strt_freq
860 Stop_freq=1.E+9*Stop_fr           ! Set units to Hz
870 REDIM Corr_clf(Swep_pnts),Rdgs(Swep_pnts),Rdgs_corr(Swep_pnts)
                                     ! Re-sized to match number of measuremen
                                     ! points in sweep

880 !
890 ! Interpolation routine creates Cal Factor Correction Table in Clf_corr(*)
900 ! Values are in dB!!!! NOT W linear units
910 !
920 FOR I=1 TO Swep_pnts              ! For each point in Clf_corr(*)
930   Rdgs(I)=1
940   Corr_freq=Strt_freq+(I-1)*(Stop_freq-Strt_freq)/(Swep_pnts-1)
                                     ! Corr_freq is freq corresponding to Clf_corr(I)
950   FOR K=1 TO No_cal_pnts          ! Find next highest and lowest Cal Factor
                                     ! frequency from Corr_freq

960   IF Freqs(K)>=Corr_freq THEN
970     Next_higher_f=Freqs(K)
980     Next_higher_clf=Clfcs(K)
990     Next_lower_f=Freqs(K-1)
1000    Next_lower_clf=Clfcs(K-1)
1010    K=No_cal_pnts
1020  !
1030  END IF
1040  NEXT K
1050  F_delta_multpl=(Corr_freq-Next_lower_f)/(Next_higher_f-Next_lower_f)
                                     ! Multiplier for next formula
1060  Corr_clf(I)=Next_lower_clf+F_delta_multpl*(Next_higher_clf-Next_lower_clf)
                                     ! Interpolates the Cal Factor Value

1070  PRINT Corr_freq,Corr_clf(I)
1080 NEXT I
1090 !
1100 ! Set the source for swept operation
1110 !
1120 PRINT Configuring Gigatronics 7200 Microwave Sweeper.
1130 OUTPUT @Sweeper,HP              ! Set Giga-tronics 7200 to HP emulation mode
1140 OUTPUT @Sweeper;OPFA;Strt_freq
1150 OUTPUT @Sweeper;OPFB;Stop_freq
1160 OUTPUT @Sweeper;FC;Tim_per_pnt*Swep_pnts;MS
1170 !
1180 ! Perform Measurement in Burst Mode or Swift Mode for Fast measurements.
1190 ! Shared Variables may include Sweep_pnts and Tim_per_pnt
1200 !
1210 GOSUB Burst_mode_swp             ! Goes to the swept frequency, Burst/Swift Mode Data
                                     ! acquisition subroutine

1220 !
1230 ! Data comes back in from Burst Mode-or Swift Mode-as rdgs(*). Always in log units, dBm.
1240 !
1250 MAT Rdgs_corr=Rdgs+Corr_clf      ! Array math function that adds the measurement
                                     ! data to the cal factor array

1260 !
1270 GOSUB Output_data                ! Output to screen graph, printout, file, etc.....
1280 !
1290 END
```

A.8 High Speed Measurement Examples

A.8.1 High Speed Measurement Example 1

The following program shows the fastest SWIFt Mode measurement speed possible. IMMEDIATE triggering is used to allow the 58542 to trigger a measurement automatically. Be sure to only use one channel defined to one sensor for the fastest speeds.

```

170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
210  WAIT 0.3
220  OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMAl Mode to perform channel configuration

230  OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
240                                ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
250  !
260  !#####
270  !
280  ! Entering SWIFt Mode
290  !
300  OUTPUT @Pwr_mtr;CALC1:MODE SWIF ! Enters SWIFt Mode for fastest continuous
                                     ! measurements with IMM.
310  !
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 16.97E9
                                     ! Applies Cal Factor in SWIFt mode
330                                ! Can be sent before or after CALC#:MODE SWIF
340  !
350  OUTPUT @Pwr_mtr;TRIG:SOUR IMM
360
370  !
380  !
390  Loopcount=100
400  Time1=TIMEDATE
410  FOR I=1 TO Loopcount
420  OUTPUT @Pwr_mtr;FETC1?         ! FETC#? acquires data
430  ENTER @Pwr_mtr;Chan1sens_1(I)
440  NEXT I
450  Time2=TIMEDATE
460  Time=Time2-Time1
470  Speed=Loopcount/Time          ! Units are readings per second.
480  !
490  PRINT Chan1sens_1(*)
500  PRINT Speed; readings per second.
510  !
520  END

```

A.8.2 High Speed Measurement Example 2

Using one of the slowest system configurations available, external PC controller with GPIB slot 0 resource manager and programming through a very slow Basic program, the previous program achieved a speed of 24 readings per second. With faster systems using embedded PCs and faster software, measurement speeds have been recorded as high as 71 readings per second.

```
10  ALPHA ON
20  CLEAR SCREEN
30  !
40  OPTION BASE 1
50  DIM Id$(50),Err_msg$(70)
60  DIM Ques$(200),A$(80),Chan1sens_1(200)
70  DIM Chan2sens_2(200)
80  Counter=1
90  !
100 !#####
110 !   Instrument ADDRESS ALLOCATION
120 !
130 ASSIGN @Slot0 TO 70100           ! 70100 is Logical Address of the Slot 0 controller
140 ASSIGN @Pwr_mtr TO 70101        ! 70101 is Power Meter in 1st position right of slot 0
150 !#####
160 !
280 !
290 CLEAR @Pwr_mtr
300 WAIT 1
310 OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
320 WAIT 0.3
330 OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMAl Mode to perform channel configuration
340 OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
350                                ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
370 !
380 !#####
390 !
400 ! Entering SWIFt Mode
410 !
420 OUTPUT @Pwr_mtr;CALC1:MODE SWIF ! Enters SWIFt Mode for fastest continuous
                                     ! measurements with IMM.
430 !
440 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 16.97E9
                                     ! Applies Cal Factor in SWIFt mode
450                                ! Can be sent before or after CALC#:MODE SWIF
460 !
470 OUTPUT @Pwr_mtr;TRIG:SOUR IMM  ! IMM triggering is illegal in SWIFt Mode, Use BUS or EXT.
480                                ! Can be sent before or after CALC#:MODE SWIF
490 !
610 !
611 Loopcount=50
613 Time1=TIMEDATE
620 FOR I=1 TO Loopcount
670  !OUTPUT @Pwr_mtr;FETC1?        ! FETC#? acquires data
671  OUTPUT @Pwr_mtr;FETC1?;FETC2? ! Use this line when two sensors are attached.
680  !ENTER @Pwr_mtr;Chan1sens_1(I)
681  ENTER @Pwr_mtr;Chan1sens_1(I),Chan2sens_2(I)
                                     ! Use this line when two sensors are attached.
```

```
730 NEXT I
731 Time2=TIMEDATE
733 Time=Time2-Time1
743 Speed=Loopcount/Time           ! Units are readings per second.
753 !
763 !PRINT Chan1sens_1(*)
773 PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
783 !PRINT Speed; readings per second.
784 PRINT Speed; readings per second per channel.
793 !
803 END
```

A.8.3 High Speed Measurement Example 3

Using the same system configuration, the previous program achieved a speed of 25 readings per second per channel. With faster systems using embedded PCs and faster software, measurement speeds have been recorded as high as 71 readings per second.

The following program shows fast BUS triggering in the SWIFt Mode. TRIG (or *TRG) is used to acquire data, and FETCh#? processes and outputs the data to the slot 0 controller/resource manager. This program does not use the meter's data buffering capability.

```
170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;*CLS                ! Clears old messages from SYST:ERR buffer
205  WAIT 0.3
210  PRINT Running...
220  !
230  OUTPUT @Pwr_mtr;CALC1:MODE NORM    ! NORMal Mode to perform channel configuration
240  OUTPUT @Pwr_mtr;CALC1:POW 1        ! Channels 1 or 2 can be either POW 1 or POW 2
250                                     ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
260  !
270  !#####
280  !
290  ! Entering SWIFt Mode
300  !
310  OUTPUT @Pwr_mtr;CALC1:MODE SWIF    ! Enters SWIFt Mode for fastest individual data point
                                         ! triggered measurements.
320  !
330  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.44E9
                                         ! Applies Cal Factor in SWIFt mode
340                                     ! Can be sent before or after CALC#:MODE SWIF
350  !
360  OUTPUT @Pwr_mtr;TRIG:SOUR BUS      ! BUS or EXT triggering is slower than IMM
370                                     ! Can be sent before or after CALC#:MODE SWIF
380  !
390  FOR I=1 TO 10
400    FOR K=1 TO 20
410      OUTPUT @Pwr_mtr;TRIG            ! TRIG is the SCPI Bus trigger. Can also use *TRG
420      OUTPUT @Pwr_mtr;FETC1?          ! FETC#? acquires data
430      ENTER @Pwr_mtr;Chan1sens_1(K)
440      !ENTER @Pwr_mtr;Chan1sens_1(K),Chan2sens_2(K)
                                         ! Use this line when two sensors are attached.
450    NEXT K
460  !
470    PRINT Chan1sens_1(*)
480  !PRINT Chan1sens_1(*),Chan2sens_2(*)    ! Use this line when two sensors are attached.
490    PRINT ""
500  NEXT I
510  !
520  END
```

A.8.4 High Speed Measurement Example 4

The following program shows SWIFt Mode measurements using EXT TTL triggering and Buffered data. INIT:CONT must be set to ON; you can not use INIT with INIT:CONT set to OFF. This program buffers 30 measurements in the 58542 before group download to the controller using the TRIG:COUN command in line 390. In the SWIFT mode, this command must be sent after the TRIG:SOUR command.

```

170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
210  WAIT 0.3
220  OUTPUT @Pwr_mtr;CALC1:MODE NORM ! NORMal Mode to perform channel configuration
230  OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
240                                ! RAtio and DIFFerence configurations are illegal in
                                ! SWIFt and BURSt Modes.

250  !
260  !#####
270  !
280  ! Entering SWIFt Mode
290  !
300  OUTPUT @Pwr_mtr;CALC1:MODE SWIF ! Enters SWIFt Mode for fastest individual data point
                                ! triggered measurements.

310  !
320  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 2.22E8
                                ! Applies Cal Factor in SWIFt mode
330                                ! Can be sent before or after CALC#:MODE SWIF
340  !
350  OUTPUT @Pwr_mtr;TRIG:SOUR EXT  ! TTL level triggering, Each trigger acquires one
                                ! data point in SWIFt Mode.
360                                ! Can be sent before or after CALC#:MODE SWIF
370  !
380  Num_pts=30
390  OUTPUT @Pwr_mtr;TRIG:COUN;Num_pts ! Stores 20 points for simultaneous output using FETCh#?.
400                                ! Must be sent after CALC#:MODE SWIF
410  !
420  REDIM Chan1sens_1(Num_pts),Chan2sens_2(Num_pts)
430  !
440  Time1=TIMEDATE
450  WAIT 5                      ! If necessary, use wait statements
460                                ! For example, use it if TRIG:COUN # is high or TTL
                                ! trigger source is slow.
470  OUTPUT @Pwr_mtr;FETC1?      ! FETC#? acquires data
480  !OUTPUT @Pwr_mtr;FETC1?;FETC2?
490  ENTER @Pwr_mtr;Chan1sens_1(Num_pts)
500  !ENTER @Pwr_mtr;Chan1sens_1(Num_pts),Chan2sens_2(Num_pts)
                                ! Use this line when two sensors are attached.

510  Time2=TIMEDATE
520  Time=Time2-Time1
530  Speed=Num_pts/Time
540!
550  PRINT Chan1sens_1(*)
560  !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
570  PRINT Speed; readings per second.
580  PRINT ""

```

```
590  !
600  END
```

A.8.5 High Speed Measurement Example 5

The following program uses BURSt Mode for the fastest measurement rates possible. The maximum measurement speed is performed when TRIG:DEL is set to 0. TRIG:DEL controls the speed of sampling and data buffering. When TRIG:DEL is set to 0.004, samples will be taken every 4 milliseconds, on both channels if connected, and stored in the meter's internal data buffer. This speed does not control or account for the meter's internal data processing time after data acquisition or the speed of data transfer to your controller. This second component of time, the time to get data from the 58542, is proportional to the number of data points measured. Therefore, the example below uses only one channel and keeps the number of points buffered to a minimum.

Both channels' data will be taken at the same time during BURSt Mode. Power meter measurement speed does not change when two sensors are connected versus only one sensor. However, the 58542 processing time and the time to transmit the data over the VXI and GPIB interfaces takes longer due to the additional sensor data. If two sensors are connected, calibrated, and their respective channels are set to ON, then you must read both arrays of data. Only read one array of data when one sensor is attached, calibrated, and set to ON.

As shown in the examples, send the CALC#:MODE BURS command prior to sending the BURSt Mode configuration commands TRIG:SOUR, TRIG:MODE, TRIG:COUN, and TRIG:DEL.

```
10  ALPHA ON
20  CLEAR SCREEN
30  !
40  OPTION BASE 1
50  DIM Id$(50),Err_msg$(70)
60  DIM Ques$(200),A$(80),Chan1sens_1(500)
70  DIM Chan2sens_2(500)
80  !
90  !
100 !#####
110 ! Instrument ADDRESS ALLOCATION
120 !
130 ASSIGN @Slot 0 TO 70100          ! 70100 is Logical Address of the Slot 0 controller
140 ASSIGN @Pwr_mtr TO 70101        ! 70101 is Power Meter in 1st position of slot 0
150 !#####
160 !
170 ! Identify Attached Instruments
180 !
190 OUTPUT @Slot0;*IDN?
200 ENTER @Slot0;Id$
210 PRINT SLOT 0 is ;Id$
220 !
230 OUTPUT @Pwr_mtr;*IDN?
240 ENTER @Pwr_mtr;Id$
250 PRINT SLOT 1 is ;Id$
260 WAIT 1
270 !
280 !
290 CLEAR @Pwr_mtr
300 WAIT 1
310 OUTPUT @Pwr_mtr;*CLS          ! Clears old messages from SYST:ERR buffer
320 WAIT 0.3
```

```

330 OUTPUT @Pwr_mtr;CALC1:MODE NORM      ! NORMAl Mode to perform channel configuration
340 OUTPUT @Pwr_mtr;CALC1:POW 1          ! Channels 1 or 2 can be either POW 1 or POW 2
350                                     ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
360 OUTPUT @Pwr_mtr;TRIG:SOUR IMM        ! IMM set here to highlight conflict with BURSt operation
370 !
380 !#####
390 !
400 ! Entering BURSt Mode
410 !
420 OUTPUT @Pwr_mtr;CALC1:MODE BURS      ! Enters BURSt Mode for fastest measurement speeds.
430 !
440 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 2.44E9
                                     ! Applies Cal Factor in BURSt mode
                                     ! Can be sent before or after CALC#:MODE BURS
450                                     !
460 !
470 OUTPUT @Pwr_mtr;TRIG:SOUR BUS        ! IMM triggering is illegal in BURSt Mode, Use BUS or
                                     ! EXT.
                                     ! Can be sent before or after CALC#:MODE BURS
480                                     !
490 !
500 OUTPUT @Pwr_mtr;TRIG:MODE POST      ! Data acquired after trigger, not before as with PRE.
510                                     ! Send only after CALC#:MODE BURS
520 !
530 OUTPUT @Pwr_mtr;TRIG:COUN 500        ! 500 readings acquired and stored with each trigger.
540                                     ! Send only after CALC#:MODE BURS, following
                                     ! TRIG:MODE.
                                     ! Be sure COUN# matches ENTER variable dimension.
550                                     !
560 !REDIM Chan1sens_1(500),Chan2sens_2(500) ! REDIM to smaller array size only if necessary.
570 !
580 OUTPUT @Pwr_mtr;TRIG:DEL .000        ! 0 millisecond between rdgs setting is 5100rdgs/sec.
590                                     ! Send only after CALC#:MODE BURS, following
                                     ! TRIG:COUN.

600 !
610 !
620 FOR I=1 TO 10
630   Time1=TIMEDATE
640   !
650   OUTPUT @Pwr_mtr;TRIG              ! TRIG is the SCPI Bus trigger. Can also use *TRG
660   OUTPUT @Pwr_mtr;FETC1?           !FETC#? acquires data
670   ENTER @Pwr_mtr;Chan1sens_1(*)
680   !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)
                                     ! Use this line when two sensors are attached.
690   !
700   Time2=TIMEDATE
710   Time=Time2-Time1
720   Speed=500/Time
730   PRINT Chan1sens_1(*)
740   !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
750   PRINT Speed; readings per second, round trip.
760   PRINT ""
770 NEXT I
780 !
790 END

```

A.8.6 High Speed Measurement Example 6

The preceding program performed 500 measurements at a rate of 5100 per second then processed and output the data to the controller. Round trip speed was between 120 and 140 per second. Using 100 measurements per BURSt instead of 500, the round trip speed was 100 to 115 per second.

The following example is similar to the previous program except for the use of EXT triggering to initiate the BURSt measurement.

```
10  ALPHA ON
20  CLEAR SCREEN
30  !
40  OPTION BASE 1
50  DIM Id$(50),Err_msg$(70)
60  DIM Ques$(200),A$(80),Chan1sens_1(500)
70  DIM Chan2sens_2(500)
80  !
90  !
100 !#####
110 !   Instrument ADDRESS ALLOCATION
120 !
130 ASSIGN @Slot0 TO 70100           ! 70100 is Logical Address of the Slot 0 controller
140 ASSIGN @Pwr_mtr TO 70101        ! 70101 is Power Meter in 1st position right of slot 0
150 !#####
160 !
170 ! Identify Attached Instruments
180 !
190 OUTPUT @Slot0;*IDN?
200 ENTER @Slot0;Id$
210 PRINT SLOT 0 is ;Id$
220 !
230 OUTPUT @Pwr_mtr;*IDN?
240 ENTER @Pwr_mtr;Id$
250 PRINT SLOT 1 is ;Id$
260 WAIT 1
270 !
280 !
290 CLEAR @Pwr_mtr
300 WAIT 1
310 OUTPUT @Pwr_mtr;*CLS           ! Clears old messages from SYST:ERR buffer
320 WAIT 0.3
330 OUTPUT @Pwr_mtr;CALC1:MODE NORM ! Normal Mode to perform channel configuration
340 OUTPUT @Pwr_mtr;CALC1:POW 1    ! Channels 1 or 2 can be either POW 1 or POW 2
350                                ! RAT and DIFF are illegal in SWIFt and BURSt Modes.
360 !
370 !#####
380 !
390 ! Entering BURSt Mode
400 !
410 OUTPUT @Pwr_mtr;CALC1:MODE BURS ! Enters BURSt Mode for fastest measurement speeds.
420 !
430 OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 2.44E9
440                                ! Applies Cal Factor in burst mode
450                                ! Can be sent before or after CALC#:MODE BURS
460 !
460 OUTPUT @Pwr_mtr;TRIG:SOUR EXT   ! EXT TTL Level input begins BURSt Mode measurement.
```

```

470                                     ! Can be sent before or after CALC#:MODE BURS
480 !
490 OUTPUT @Pwr_mtr;TRIG:MODE POST      ! Data acquired after trigger, not before as with PRE.
500                                     ! Send only after CALC#:MODE BURS
510 !
520 OUTPUT @Pwr_mtr;TRIG:COUN 500       ! 500 readings acquired and stored with each trigger.
530                                     ! Send only after CALC#:MODE BURS, following TRIG:MODE
540                                     ! Be sure COUN# matches ENTER variable dimension.
550 !REDIM Chan1sens_1(500),Chan2sens_2(500) ! REDIM to smaller array size only if necessary.
560 !
570 OUTPUT @Pwr_mtr;TRIG:DEL .000       ! 0 millisecond between rdgs setting is 5100 rdgs/sec.
580                                     ! Send only after CALC#:MODE BURS, following TRIG:COUN.
590 !
600 !
610 FOR I=1 TO 10
620 !WAIT .01                           ! Wait for trigger compensation. If necessary, use wait statements
630
640
650 Time1=TIMEDATE
660 !
670 OUTPUT @Pwr_mtr;FETC1?              ! FETC#? acquires data
680 WAIT 2                             ! for POST triggering
690 ENTER @Pwr_mtr;Chan1sens_1(*)
700 !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)
                                         ! Use this line when two sensors are attached.
710 !
720 Time2=TIMEDATE
730 Time=Time2-Time1
740 Speed=500/Time
750 PRINT Chan1sens_1(*)
760 !PRINT Chan1sens_1(*),Chan2sens_2(*) ! Use this line when two sensors are attached.
770   PRINT Speed; readings per second, round trip.
780   PRINT ""
790 NEXT I
800 !
810 END

```

The preceding program performs measurement at approximately 5100 measurements per second. Assuming pretriggering during the PRINT statements, a round trip speed of 180 to 195 measurements per second was achieved.

A.9 Relative or Referenced Measurement Examples

A.9.1 Relative or Referenced Measurements Example 1

The following program automatically sets a power level reference when the computer's ENTER key is actuated. From that point forward the power level - relative to the power level at the time the ENTER key was actuated - is monitored and displayed with minimum and maximum values since the reference was set.

```
290  ASSIGN @Pwr_mtr to 70101
300  CLEAR @Pwr_mtr
310  WAIT 1
320  !
330  OUTPUT @Pwr_mtr;CALC1:MODE NORMAL ! Can ONLY use REFERENCE commands in NORMAl Mode!!
340  OUTPUT @Pwr_mtr;CALC2:POW 2          ! Channel 2 configured to measure sensor 2 power
350  !
360  OUTPUT @Pwr_mtr;TRIG:SOUR IMM        ! TRIG:SOUR must be IMM when using READ#?
370  OUTPUT @Pwr_mtr;INIT:CONT OFF       ! INITiate:CONTinuous arming must be OFF when using
                                         ! READ#?
380  !
390  OUTPUT @Pwr_mtr;SENS2:AVER:COUN 1    ! Sets averaging to manual and one sample per
                                         ! measurement reading.
400  !
410  OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 17.4E9
                                         ! Applies Cal Factor for 17.4 GHz to measurement data.
420  !
430  !#####
440  !
450  ! Relative measurement setup using CALC#:REF:COLL.
460  !
470  OUTPUT @Pwr_mtr;CALC2:REF:MAG 0.00  ! Resets REFERENCE level from value set with CALC2:REF:COLL
480  OUTPUT @Pwr_mtr;CALC2:REF:STAT ON   ! Enables REFERENCE operation.
490  !
500  INPUT Press ENTER key to set to 0.0dB reference operation,Dmy
510  OUTPUT @Pwr_mtr;CALC2:REF:COLL      ! Takes current measurement and adds inverse to further
                                         ! measurements
520  !
530  ! Setup power meters' MIN and MAX monitors
540  !
550  OUTPUT @Pwr_mtr;CALC2:MIN:STAT ON
560  OUTPUT @Pwr_mtr;CALC2:MAX:STAT ON
570  !
580  PRINT Power Variation, Largest Min, Largest Max.
590  WHILE Cont_meas=1
600    OUTPUT @Pwr_mtr;MEAS2?            ! Measures Power at sensor.
610    ENTER @Pwr_mtr;Rdg
620    !
630    OUTPUT @Pwr_mtr;CALC2:MIN?        ! Grabs minimum since CALC2:MIN:STAT ON
640    ENTER @Pwr_mtr;Min
650    OUTPUT @Pwr_mtr;CALC2:MAX?        ! Grabs maximum since CALC2:MAX:STAT ON
660    ENTER @Pwr_mtr;Max
670    PRINT Rdg,"",Min,"",Max
680  END WHILE
690  !
890  END
```

A.9.2 Relative or Referenced Measurements Example 2

The following program finds the 1 dB compression of an amplifier/transmitter at a single frequency.

```

300  ASSIGN @Pwr_mtr to 70101
310  CLEAR @Pwr_mtr
320  WAIT 1
330  !
340  OUTPUT @Pwr_mtr;CALC1:MODE NORMAL
                                     ! Can ONLY use REference commands in NORMAl Mode!!
350  OUTPUT @Pwr_mtr;CALC1:POW 1      ! Channel 1 configured to measure sensor 1 power
360  OUTPUT @Pwr_mtr;CALC1:UNIT W     ! Transmitter output power in Watts.
370  OUTPUT @Pwr_mtr;CALC2:RAT 1,2    ! Transmitter gain stays in default, dBm.
380  OUTPUT @Pwr_mtr;CALC2:UNIT DBM   ! Transmitter output power in Watts. Units are channel,
                                     ! not sensor, specific
390  !
400  !
410  OUTPUT @Pwr_mtr;TRIG:SOUR IMM    ! TRIG:SOUR must be IMM when using READ#?
420  OUTPUT @Pwr_mtr;INIT:CONT OFF   ! INITiate:CONTinuous arming must be OFF when using READ#?
430  !
440  OUTPUT @Pwr_mtr;SENS1:AVER:COUN 1 ! Sets averaging to manual and one sample per measurement reading.
450  OUTPUT @Pwr_mtr;SENS2:AVER:COUN 4 ! Sets averaging to manual and 4 samples per measurement reading.
460  !
470  OUTPUT @Pwr_mtr;SENS1:CORR:FREQ 1.94E9
                                     ! Applies Cal Factor for 1.94 GHz, Sensor 1.
480  OUTPUT @Pwr_mtr;SENS2:CORR:FREQ 7.0E7
                                     ! Applies Cal Factor for 70 MHz IF input, Sensor 2.
490  !
500  !#####
510  !
520  ! System Setup
530  ! Power Splitter attached to source.
540  ! DUT input and sensor 2 on the splitter outputs.
550  ! Sensor 1 at DUT output.
560  ! Check max power rating on sensor 1 and use an appropriate attenuator if necessary.
570  ! Use offset to account for any necessary attenuation when not using Giga-tronics high power sensors.
580  !
590  !#####
600  !
610  ! Relative measurement setup using CALC#:REF:COLL.
620  !
630  OUTPUT @Pwr_mtr;CALC2:REF:MAG 0.00 ! Resets REference level from value set with CALC2:REF:COLL
640  OUTPUT @Pwr_mtr;CALC2:REF:STAT ON  ! Enables REference operation.
650  !
660  Smal_sig_pwr=-30
670  OUTPUT @Source;OPPL;Smal_sig_pwr  ! Set power to small signal region of amp, -30dBm.
680  OUTPUT @Pwr_mtr;CALC2:REF:COLL    ! Takes current measurement and adds inverse to further
                                     ! measurements
690  !
700  ! STEP POWER FROM SMALL SIGNAL REGION TO ABOVE 1 dB COMPRESSION LEVEL
710  !
720  FOR I=Smal_sig_pwr TO Smal_sig_pwr+40 STEP .05
730  OUTPUT @Source;OPPL;I             ! Increments power level into amplifier's input. Add wait statement
                                     ! at 735 if source settles too slow.
740  OUTPUT @Pwr_mtr;READ2?            ! Measures Sensor 1 over sensor 2, dB relationship

```

```
750  ENTER @Pwr_mtr;Rdg
760  PRINT Rdg
770  !
780  Comp_lvl=-1
790  IF Rdg<Comp_lvl THEN                ! Finds 1 dB compression level
800  OUTPUT @Pwr_mtr;READ1?             ! Measures Output Power at sensor 1.
810  ENTER @Pwr_mtr;Rdg
820  PRINT 1 dB Compression level is ;Rdg; Watts, Output Power.
830  GOSUB End
840  END IF
850  NEXT I
860  !
1060 End: !
1070 END
```

A.10 SRQ Interrupt Examples

```

10    ASSIGN @Pwr_mtr to 70101                ! Set GPIB address
20    DIM Buf$(100)                          ! Define data buffer
30    ON INTR 7 GOSUB Srq_isp                 ! Assign interrupt service function
40    ENABLE INTR 7;2                          ! enable interrupt
50    !
60    CLEAR @Pwr_mtr                          ! Reset instrument
70    WAIT 1
80    OUTPUT @Pwr_mtr;*CLS                     ! Clear interface and output queue
90    WAIT 0.3
100   !
110  OUTPUT @Pwr_mtr;*ESE 1                   ! Enable OPC bit
120  OUTPUT @Pwr_mtr;STAT:OPER:ENAB 7712      ! Enable channel 1 & 2 limit and trigger wait mask
130  !
140  Srq_flag=0                               ! Reset task done flag
150  OUTPUT @Pwr_mtr;CAL1:ZERO?;*OPC          ! Zero sensor 1
160  WHILE Srq_flag = 0                       ! Wait until it is done
170    END WHILE
180  ENTER @Pwr_mtr;Result                    ! Read zero result
190  IF Result = 0 THEN PRINT Zero is good
200    ELSE
210      PRINT Zero is no good
220    END IF
230  ENTER @Pwr_mtr;Esr_val                   ! Read ESR status
240  !
250  Srq_flag = 0                             ! Reset task done flag
260  Meas_flag = 0                             ! Reset measurement flag
270  OUTPUT @Pwr_mtr;MEAS1?;*OPC              ! Measure channel 1 data
280  WHILE Srq_flag = 0                       ! Wait until it is done
290    END WHILE
300  IF Meas_flag = 0 THEN                    ! If data is not read
310    ENTER @Pwr_mtr;Result                  ! Read measurement data
320  END IF
330  ENTER @Pwr_mtr;Esr_val                   ! Read ESR status
340  !
350  STOP
360  !
370  Srq_isp: !
380  State = SPOLL(@Pwr_mtr)                  ! Serial poll
390  !
400  IF BIT(State,3) THEN                     ! Error bit
410    OUTPUT @Pwr_mtr;SYST:ERR?              ! Query error message
420    ENTER @Pwr_mtr;Buf$                   ! Read in
430    PRINT Error::Buf$                     ! Print out message
440  END IF
450  !
460  IF BIT(State,7) THEN                     ! OSB bit
470    !
480    IF BIT(State,4) THEN                   ! MAV bit
490      ENTER @Pwr_mtr;Result               ! Query measurement data
500      Meas_flag = 1                       ! Set data read flag
510    END IF
520    !
530    OUTPUT @Pwr_mtr;STAT:OPER?            ! Query operation status register

```

```
540  ENTER @Pwr_mtr;Status
550  PRINT OSB;Status
560  IF BIT(Status,5) THEN PRINT Swift/Burst trigger ready
570  IF BIT(Status,8) THEN PRINT Channel 1 lower limit
580  IF BIT(Status,9) THEN PRINT Channel 1 upper limit
590  IF BIT(Status,10) THEN PRINT Channel 2 lower limit
600  IF BIT(Status,11) THEN PRINT Channel 2 upper limit
610  END IF
620  !
630  IF BIT(State,5) THEN                                ! ESR bit
640      OUTPUT @Pwr_mtr;*ESR?                          ! Reset event status register
650  END IF
660  !
670  Srq_flag = 1                                         ! Set task done flag
680  ENABLE INTR 7;2
690  RETURN
860  END
```

A.11 Instrument & Sensor Identification Examples

A.11.1 Instrument Identification

The following example reads manufacturer identification, model number and software version number. Software version number is important for troubleshooting and factory technical support. Make sure you or your system users can identify the software version when requesting technical support.

```

10  ALPHA ON
20  DIM ID$(60),Mfgr$(12)
    ! FOR INSTRUMENT ID VIEWING AT START UP
30  !
40  CLEAR SCREEN
50  !
60  !#####
70  ! Instrument ADDRESS ALLOCATION
80  !
90  ASSIGN @Slot0 TO 70100          ! 70200 is Logical Address of the Slot 0 controller
100 ASSIGN @Pwr_mtr TO 70101       ! Default Power Meter Address of 255 allows VXI dynamic
110                                ! address configuration
120 !
130 !#####
140 !
150 OUTPUT @Slot0;*IDN?
160 ENTER @Slot0;Id$
170 PRINT SLOT 0 is ;Id$
180 !
190 OUTPUT @Pwr_mtr;*IDN?
200 ENTER @Pwr_mtr;Mfgr$,Model,No,Software_ver
    ! DIM Mfgr$ to 12 characters
210 PRINT A;Mfgr$; model;Model;with software version;Software_ver;is installed in slot 1.
211 !
212 ! Main Measurement Loop Start.
```

Instrument identification can be read as a single string as is done in lines 150 to 170 above. Sometimes, however, it is more convenient to read these four items separately for use in comment statements or as identifiers for selecting special command libraries or subroutines.

A.11.2 Sensor Model Identification

A simple method of separating the manufacturer sub-string from the three following numeric items requires you to read the manufacturer alphabetical letters into a string variable of limited size. Use a DIM or a REDIM statement to limit size to 12 characters. Thus Model and Software Version can easily be read into numeric variables. No is always 0; it is placed in the *IDN? command output as called for by the IEEE 488.2 Standard. The 58542 can not report it's serial number - which is printed on a label positioned on the side of the instrument - over the bus. If preferred, there is space on the 58542's front panel for the serial number label. The factory will place it there upon request.

The following example reads the model number and serial number of the power sensor currently in use. What does currently in use mean? It means that this was the last sensor connected to this meter input. It does not mean that the sensor is currently attached or that the sensor is calibrated. For in-program checking for sensor attachment or completed power sweep calibration, see the Error Control Examples in Section A.3.3 or the Reading Power Measurements in Section A.4. By operating in this manner, you can use a simple WHILE/UNTIL loop in your program to detect when the operator connects the correct power sensor.

Tracking the model number allows you to be sure that a sensor is being used which is appropriate for your measurement application. For example, some of your measurement routines may require the use of Peak Power Sensors rather than CW Power Sensor or use of high power sensors rather than standard sensors. Your program can automatically check for the appropriate sensor and prompt to Please connect Gigatronics Sensor model #####, if necessary.

```
240  !
250  GOSUB Pwr_amp_test
260  !
270  GOSUB Store_results
280  !
290  END LOOP                                ! Return to beginning of main program.
300  !
310  Pwr_amp_test:                          ! Output is 30 to 40 Watts, TOO HIGH for Standard Sensors
320  !
330  Reqd_snsr1_md1=80355                    ! Actual 50W Peak Power Sensor model is 80355A.
340                                          ! The A is ignored in Gigatronics software to simplify programs like
                                          ! this one.
350  Reqd_snsr2_md1=80350                    ! Standard 80350A Peak Power Sensor on input
360  !
370  !
380
!#####
390  !
400  ! Read and compare sensors for correct model number
410  !
420  OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:TYPE?
                                          ! responds with model and serial numbers
430  ENTER @Pwr_mtr;New_snsr1_model,New_snsr1_serno
440  OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:TYPE?
                                          ! responds with model and serial numbers
450  ENTER @Pwr_mtr;New_snsr1_model,New_snsr1_serno
460  !
470  IF Reqd_snsr1_md1=New_snsr1_model THEN
480  ELSE
490  PRINT The amplifier's high power output must be attenuated for this test.,
500  PRINT Connect a Gigatronics model;Reqd_snsr1_md1;to the channel 1 power sensor cable.,
510  INPUT Then press ENTER,Dmy
```

```
520 PRINT""
530 GOSUB Pwr_swp_call
540 END IF
550 !
560 IF Reqd_snsr2_mdl=New_snsr2_model THEN
570 ELSE
580 PRINT Connect a Gigatronics model;Reqd_snsr2_mdl;to the channel 2 power sensor cable.,
590 INPUT Then press ENTER,Dmy
600 GOSUB Pwr_swp_cal2
610 END IF
620 !
630 GOSUB Compare_serno           ! Calibrates sensors, if necessary. SEE next example
640 !
650 GOSUB Gain_tst               ! Configures and performs amplifier gain test.
660 GOSUB Onedb_comp_tst        ! Configures and performs amplifier 1 dB compression test.
670 !
680 RETURN
690 !
700 Pwr_swp_call:               ! Power Sweep Calibration calibrates the sensor to the meter.
710 !
```

A.11.3 Sensor Serial Number Identification

Tracking sensor serial numbers is important. Measurements cannot be performed unless the sensor has been calibrated to the meter using the built-in power sweep calibrator: this ensures that measurements will never be performed with an uncalibrated sensor. The Giga-tronics 58542 tracks this requirement by reading the sensor's serial number. Thus, by reading in the sensor's serial number at the beginning of measurement subroutines, you can automatically determine whether or not power sweep calibration is required. This is illustrated in the following example.

```
990   Compare_serno: !
995 !
1000 !#####
1010 !
1020 ! This program identifies sensors by their serial number
1030 ! and jumps to a calibration subroutine if it is a new sensor.
1040 !
1050 !#####
1060 !
1070 ! Sensor Identification routine at beginning of measurement sequence.
1080 ! New sensors will not operate unless they pass calibration first.
1090 !
1100 OUTPUT @Pwr_mtr;SENS1:CORR:EEPROM:TYPE?
1110 ENTER @Pwr_mtr;New_snsr1_model,New_snsr1_serno
1120 OUTPUT @Pwr_mtr;SENS2:CORR:EEPROM:TYPE?
1130 ENTER @Pwr_mtr;New_snsr2_model,New_snsr2_serno
1140 !
1150 IF Old_snsr1_serno=New_snsr1_serno THEN
1160 !
1170 ELSE
1180   GOSUB Pwr_swp_cal1                      ! New Sensor 1, Must Calibrate To the Meter
1190 END IF
1200 !
1210 IF Old_snsr2_serno=New_snsr2_serno THEN
1220 !
1230 ELSE
1240   GOSUB Pwr_swp_cal2                      ! New Sensor 2, Must Calibrate To the Meter
1250 END IF
1260 !
1270 ! Concludes Sensor Serial Number Comparison
1280 ! Use a similar routine when a particular sensor model is required.
1290 ! To do both: Nest an IF-THEN for model # ahead of GOSUB
                                ! Pwr_swp_cal#.
1300 !
1310 !#####
1320 !
1330 ! Main loop
1340 !
1350 OUTPUT @Pwr_mtr;SENS1:AVER:TCON:MOV
                                ! MOV, Average new sample with previous samples
1360 OUTPUT @Pwr_mtr;SENS2:AVER:TCON:MOV
                                ! MOV, Average new sample with previous samples
1370 !
1380 LOOP
1390 OUTPUT @Pwr_mtr;MEAS1?
                                ! TRIGGER AND READ CHANNEL 1
```

```
1400 ENTER @Pwr_mtr;MEAS1
1410 PRINT CHANNEL 1 IS ;Meas1;dBm.
1420 !
1430 OUTPUT @Pwr_mtr;MEAS2?           ! TRIGGER AND READ CHANNEL 2
1440 ENTER @Pwr_mtr;Meas2
1450 PRINT CHANNEL 2 IS ;Meas2;dBm.
1460 END LOOP
1470 !
1480 !#####
1490 !
1500 ! SUBROUTINES
1510 !
1520 !
1530 Pwr_swp_cal1:                     ! Calibrates Sensor 1 Power Sweep Calibration calibrates the
                                       ! sensor to the meter.
1540 !
1541 PRINT Calibrating.....
1550 OUTPUT @Pwr_mtr;CAL1?           ! Starts Calibration and delivers a pass/fail flag
1560 ENTER @Pwr_mtr;Pass_cal
1570 IF Pass_cal=0 THEN
1580 PRINT Calibration Passed
1590 Old_snsr1_model=New_snsr1_model
1600 Old_snsr1_serno=New_snsr1_serno
1610 ELSE
1620 PRINT Calibration FAILED, Sensor 1 Attached To Calibrator?
1630 WAIT 10                          ! Wait for Operator to attach sensor
1640 GOTO Pwr_swp_cal1
1650 END IF
1660 RETURN
1670 !
1680 Pwr_swp_cal2:                     ! Calibrates Sensor 2
1690 !
1691 PRINT Calibrating.....
1700 OUTPUT @Pwr_mtr;CAL2?           ! Starts Calibration and delivers a pass/fail flag
1710 ENTER @Pwr_mtr;Pass_cal
1720 IF Pass_cal=0 THEN
1730 PRINT Calibration Passed
1740 Old_snsr2_model=New_snsr2_model
1750 Old_snsr2_serno=New_snsr2_serno
1760 ELSE
1770 PRINT Calibration FAILED, Sensor 2 Attached To Calibrator?
1780 WAIT 10                          ! Wait for Operator to attach sensor
1790 GOTO Pwr_swp_cal2
1800 END IF
1810 RETURN
1940 END
```


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 80300 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-3. See Figure 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	Maximum Power	Power Linearity ⁴ (Freq >8 GHz)	VSWR	RF Conn	Dimensions		Wgt
						Length	Dia	
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	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz -18 GHz: 1.29	Type N(m) 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80402A	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	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz -18 GHz: 1.29	APC-7 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80410A	10 MHz to 18 GHz -64 to +26 dBm	+29 dBm (800 mW)	-61 to -14 dBm ±0.00 dB -14 to + 26 dBm æ0.05 dB/10 dB	10 MHz - 2 GHz: 1.13 2 GHz - 12 GHz: 1.16 12 GHz - 18 GHz: 1.23	Type K(m) ¹ 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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	10 MHz - 2 GHz: 1.11 2 GHz - 12 GHz: 1.12 12 GHz - 18 GHz: 1.18	Type K(m) ¹ 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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	10 MHz - 6 GHz: 1.20 8 GHz - 12.4 GHz: 1.25 12.4 GHz - 18 GHz: 1.35	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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	10 MHz - 6 GHz: 1.20 6 GHz - 12.4 GHz: 1.30 12.4 GHz - 18 GHz: 1.40	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)
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	10 MHz - 6 GHz: 1.25 6 GHz - 12.4 GHz: 1.35 12.4 GHz - 18 GHz: 1.45	Type N(m) 50Ω	230mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)
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	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz -18 GHz: 1.29	Type N(m) 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80302A	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	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.29	APC-7 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80303A	10 MHz to 26.5 GHz -70 to +20.0 dBm	+23 dBm (200 mW)	-70 to +20 dBm ±0.00 dB -20 to +20 dBm ±0.1 dB/10dB	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz -18 GHz: 1.38 18 GHz -26.5 GHz: 1.43	Type K(m) ¹ 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80304A	10 MHz to 40 GHz -70 to 0 dBm	+23 dBm (200 mW)	-70 to -20 dBm ±0.00 dB -20 to 0 dBm ±0.2 dB/10 dB	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz -18 GHz: 1.38 18 GHz -26.5 GHz: 1.43 26.5 GHz - 40 GHz: 1.92	Type K(m) ¹ 50Ω	114.5mm (4.5 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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	10 MHz - 2 GHz: 1.13 2 GHz - 12 GHz: 1.16 12 GHz - 18 GHz: 1.23 18 GHz - 26.5 GHz: 1.29 26.5 GHz - 40 GHz: 1.50	Type K(m) ¹ 50Ω	127mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5lb)
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					

Model	Freq. Range/ Power Range	Maximum Power	Power Linearity ⁴ (Freq >8 GHz)	VSWR	RF Conn	Dimensions		Wgt
						Length	Dia	
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	10 MHz - 2 GHz: 1.11 2 GHz - 12 GHz: 1.12 12 GHz - 18 GHz: 1.18 18 GHz - 26.5 GHz: 1.22 26.5 GHz - 40 GHz: 1.36	Type K(m) ¹ 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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					
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	10 MHz - 2 GHz: 1.11 2 GHz - 12 GHz: 1.12 12 GHz - 18 GHz: 1.18 18 GHz - 26.5 GHz: 1.22 26.5 GHz - 40 GHz: 1.36	Type K(m) ¹ 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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	10 MHz - 6 GHz: 1.20 8 GHz - 12.4 GHz: 1.25 12.4 GHz - 18 GHz: 1.35	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
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	10 MHz - 6 GHz: 1.20 6 GHz - 12.4 GHz: 1.30 12.4 GHz - 18 GHz: 1.40	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)
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	10 MHz - 6 GHz: 1.25 6 GHz - 12.4 GHz: 1.35 12.4 GHz - 18 GHz: 1.45	Type N(m) 50Ω	230mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)
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	10 MHz - 12 GHz: 1.12 12 GHz - 18 GHz: 1.15 18 GHz -26.5 GHz: 1.18 26.5 GHz -40 GHz: 1.29	Type K(m) ¹ 50Ω	152.5mm (6.0 in)	32 mm 1.25 in)	0.27kg (0.6 lb)
80340 Series Peak Power Sensors (-30 to +20 dBm)								
80340A	50 MHz to 18 GHz	+23 dBm (200 mW)	-30 to 0 dBm ±0.13 dB 0 to +20 dBm	50 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.37	Type N(m) 50Ω	146 mm (5.75 in)	37 mm (1.44 in)	0.3 kg (0.6 lb)
80343A 80344A	50 MHz to 26.5 GHz 50 MHz to 40 GHz		±0.13 dB ±0.01 dB/dB	18 GHz -26.5 GHz: 1.50 26.5 GHz -40 GHz: 1.92	Type K(m) ¹ 50Ω			

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.
- 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. Attenuator frequency response is added to the Sensor Cal Factors which are stored in the 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(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.
- 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. Attenuator frequency response is added to the Sensor Cal Factors which are stored in the sensor's EEPROM.

B.2.2 Modulation Sensor Specifications

Table B-3. Modulation Sensor Specifications

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 μ s MAP or PAP mode, power level -67 to -20 dBm, pulse width < 200 μ s BAP mode, power level -40 to +20 dBm, pulse width > 200 μ s BAP mode, power level -40 to -20 dBm, pulse width < 200 μ s	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 μ s, $f_m < 40$ kHz MAP or PAP mode, power level -67 to +20 dBm, pulse width > 200 μ s, $f_m > 40$ kHz MAP or PAP mode, power level -67 to -20 dBm, pulse width < 200 μ s BAP mode, power level -40 to +20 dBm, pulse width > 200 μ s, $f_m < 40$ kHz BAP mode, power level -40 to +20 dBm, pulse width > 200 μ s, $f_m > 40$ kHz BAP mode, power level -40 to -20 dBm, pulse width < 200 μ s	none see note ² see note ² none see note ^{2,3} 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 in 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.

MODULATION-INDUCED MEASUREMENT UNCERTAINTY FOR THE 80401A SENSOR

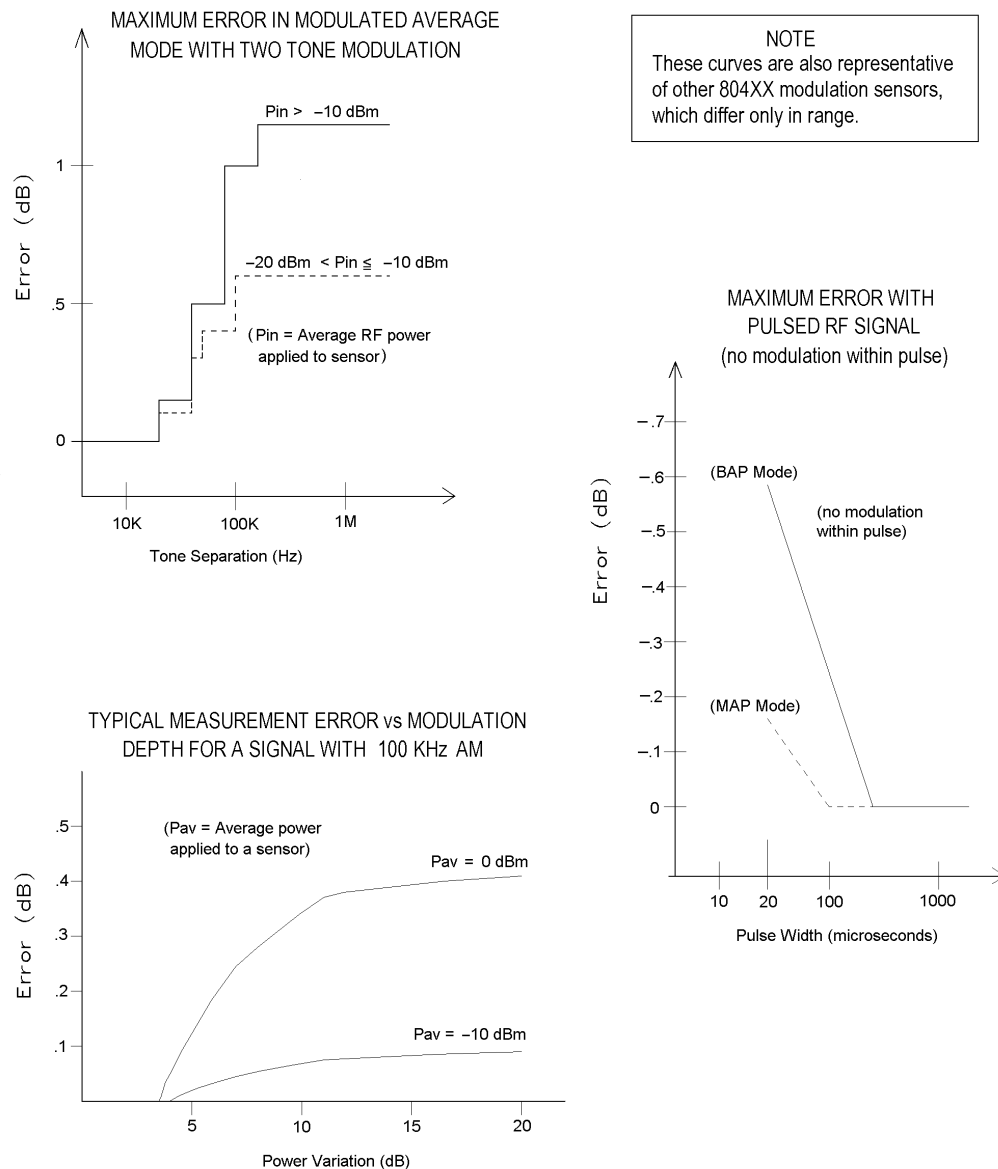


Figure B-1. 80401 modulation-related uncertainty

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, the front panel **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 the LED to flash.

B.2.3 Peak Power Sensors

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

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

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 Series 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

Model	Freq. Range/ Power Range	Max. Power	Power Linearity	Test Port Match (SWR)	Directivity (dB)	Input conn	Test Port conn
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	10 MHz - 8 GHz: <1.17 8 GHz - 18 GHz: <1.27	38	N(f)	N(f)
80502	10 MHz to 18 GHz -35 to +20 dBm	+27 dBm (0.5 W)	-35 to +10 dBm ± 0.1 dB +10 to +20 dBm ± 0.1 dB ± 0.005 dB/dB	10 MHz - 8 GHz: <1.13 8 GHz - 18 GHz: <1.22	40	N(f)	APC-7
80503	10 MHz to 26.5 GHz -35 to +20 dBm	+27 dBm (0.5 W)	-35 to +10 dBm ± 0.1 dB +10 to +20 dBm ± 0.1 dB ± 0.005 dB/dB	10 MHz - 8 GHz: <1.22 8 GHz - 18 GHz: <1.22 18 GHz - 26.5 GHz: <1.27	35	SMA(f)	SMA(f)
80504	10 MHz to 40 GHz -35 to +20 dBm	+27 dBm (0.5 W)	-35 to +10 dBm ± 0.1 dB +10 to +20 dBm ± 0.1 dB ± 0.005 dB/dB	10 MHz - 8 GHz: <1.35 8 GHz - 18 GHz: <1.35 18 GHz - 26.5 GHz: <1.35 26.5 GHz - 40 GHz: <1.44	30	K(f)	K(f)

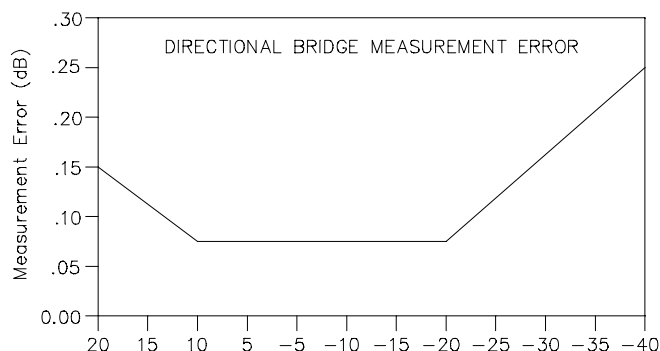
The Selection Guide in Table B-6 shows primary specifications. Additional specifications are:

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

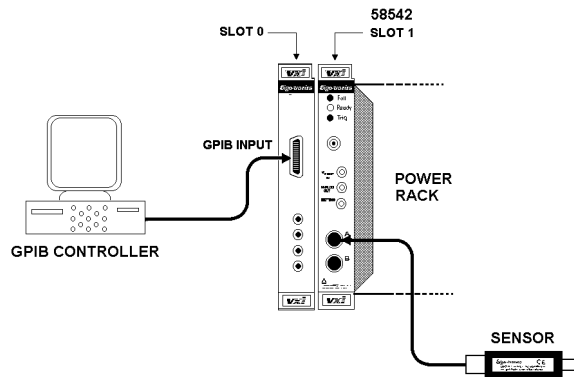


Figure B-2. Power Sensor Calibration Setup

Procedure:

Connect the power sensor to Channel A or B on the 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. TEST EEPROM A (or B) READ

Read sensor A (or B) EEPROM data into the 58542 editor buffer.

2. (Optional) TEST EEPROM A (or B) CALFR?

- Query sensor A (or B) standard cal factor start frequency, number of standard frequencies, and number of special frequencies.
- Read the standard cal from the input buffer and extract the start frequency and number of standard frequencies.
- Calculate and set the frequencies of the cal factor table.

3. TEST EEPROM A (or B) CALFST?

- Query sensor A (or B) standard cal factor table.
- Read the standard cal from the input buffer and extract the standard cal factor; e.g., INPUT (GPIB address).

- c. Set the sensor standard cal factor table.
- d. Make changes from the table and put them back into the table.
- e. After all changes are made, put the table back into the input buffer.

4. TEST EEPROM A (or B) WRITE

- a. Write sensor A (or B) EEPROM data into the 58542 buffer.
- b. Restore the input buffer from step 3.c above to the EEPROM buffer (e.g., OUTPUT [GPIB] address, input buffer).
- c. Write sensor A (or B) editor buffer data into the EEPROM with the password number; e.g., OUTPUT (GPIB address, TEST EEPROM A [or B] WRITE 0)
- d. Editing the EEPROM routine is complete.



Options

C.1 Introduction

This appendix describes all options that are currently available for use with the Model 58542 VXIbus Universal Power Meter.

C.2 Option 02: 256K Buffer

Option 02, part number 21335, adds 256K Buffer for Burst Mode readings. The following parts will be installed at the factory when the 58542 is ordered with this option.

Parts List For: 21335 EXTRA MEMORY, 128K, 8540/02, Rev. A
--

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
U	29	21165	1	61802	TC551001BPL-85	TC551001BPL-10 1M RAM
U	30	21165	1	61802	TC551001BPL-85	TC551001BPL-10 1M RAM

!

- 50MHz Oscillator 3-5
- 58542 System
 - 256K Buffer option C-1
 - Cooling 1-2
 - Description 1-1
 - Diagrams 7-1
 - Environmental specifications 1-6
 - Frequency range 1-4
 - Initial Setup 2-2
 - Installation 2-1
 - Items furnished 1-1
 - Items required 1-2
 - Options C-1
 - Performance specifications 1-4
 - Periodic maintenance 5-1
 - Power requirements 1-6
 - Preparation for reshipment 1-2
 - Preparation for use 2-1
 - Program Examples A-1
 - Receiving inspection 1-2
 - Safety precautions 1-2
 - Special Configurations xiii
 - Storage 1-2
 - Theory of Operation 3-1
 - Tools and test equipment 1-2

A

- Analog output 2-56
- Analog PC board 3-2
- Arming the triggering cycle 2-27
- Averaging 2-43

B

- Battery 5-2
- Bus error timer 3-10

C

- CAGE 6-12
- Cal factor correction 2-31
- Cal Factor Program Examples A-30

- Calculate subsystem commands 2-7
- Calibration & Testing 4-1
 - Calibration Procedure 4-2
 - Equipment required 4-1
 - Performance & Testing 4-7
- Calibration Procedure 4-2
 - Calibrator frequency check 4-6
 - Calibrator output power reference level 4-2
 - Calibrator voltages 4-6
 - frequency check 4-6
 - GPIO test functions 5-3
 - output power 4-4
- Calibrator controls 2-64
- Calibrator frequency check 4-6
- Calibrator module 3-4
 - 50MHz Oscillator 3-5
 - Calibrator NVRAM control circuit 3-6
 - Correction thermistor circuit 3-6
 - Digital control circuit 3-6
 - Oven 3-5
 - RF output 3-5
 - Sensor interrupt 3-6
 - Sensor NVRAM 3-6
 - Thermistor 3-5
 - Thermistor bridge 3-5
 - Track & hold and DAC 3-6
- Calibrator NVRAM control circuit 3-6
- Calibrator output power 4-4
- Calibrator output power reference level 4-2
- Calibrator voltages 4-6
- Channel 2 troubleshooting 5-3
- Circuit description
 - Analog PC board 3-2
 - Calibrator module 3-4
 - Calibrator NVRAM control circuit 3-6
 - Colpits oscillator 3-5
 - Correction thermistor circuit 3-6
 - CPU and memory 3-9
 - Digital control circuit 3-6
 - Digital PC board 3-7
 - RF output 3-5
 - Sensor interrupt 3-6
 - Sensor NVRAM 3-6
 - Thermistor 3-5

- Thermistor bridge 3-5
- Track & hold and DAC 3-6
- VXI Processor 3-8
- Command codes for the 58542
 - IEEE-488.2 common commands 2-6
- Configuration
 - Saving the setup 2-59
 - Specials xiii
- Cooling 1-2
- Correction thermistor circuit 3-6
- CPU and memory 3-9
 - Bus error timer 3-10
 - Drivers and transceivers 3-10
 - Interrupt controller 3-9
 - LED drivers 3-10
 - Local address decoders 3-10
 - Local memory 3-10
 - Processor 3-9
 - Real time clock/timer 3-9

D

- Data transfer bus arbitration 2-3
- Description 1-1
- Diagnostic commands 2-6
- Diagnostic test commands 5-4
- Diagrams 7-1
- Digital control circuit 3-6
- Digital PC board 3-7
- Directional bridges B-9
- Display panel
 - Saving the setup 2-59
- Drivers and transceivers 3-9 - 3-10

E

- Environmental specifications 1-6
- Error Control Examples A-8
- Error messages 2-69

F

- Frequency range 1-4
- Front panel operation
 - Saving the setup 2-59

G

- GPIO command syntax 2-10
- GPIO port check 4-7
- GPIO test functions 5-3

H

- Halting operation 2-59
- High Speed Measurement Examples A-37
- High speed measurements 2-35

I

- Identification commands 2-63
- IEEE-488.2 common commands 2-6
- Initial Setup 2-2
 - Data transfer bus arbitration 2-3
- Inputs/outputs 1-6
- Installation 2-1
 - Cooling 1-2
 - Data transfer bus arbitration 2-3
 - Initial Setup 2-2
 - Preparation for use 2-1
 - Safety precautions 1-2
 - Sensor Precautions 2-4
 - Tools and test equipment 1-2
- Instrument & Sensor Identification Examples A-51
- Instrument triggering 2-23
- Instrument Triggering Examples A-22
- Interrupt controller 3-9
- Introduction
 - Description 1-1
 - Items furnished 1-1
 - Items required 1-2
 - Performance specifications 1-4
 - Preparation for reshipment 1-2
 - Receiving inspection 1-2
 - Safety precautions 1-2
 - Storage 1-2
 - Theory of Operation 3-1
 - Tools and test equipment 1-2
- Items furnished 1-1
- Items required 1-2

L

- LED drivers 3-10
- Limit line configuration & monitoring 2-54
- List of Manufacturers 6-13
- Local address decoders 3-10
- Local memory 3-10
- Logical address switch 3-9

M

Maintenance 5-1

- Channel 2 troubleshooting 5-3
- Diagnostic test commands 5-4
- Diagrams 7-1
- Lithium battery 5-2
- Power Supply Voltage Checks 5-1
- Theory of Operation 3-1

Measurement collection modes

- Measurement triggering 2-6

Measurement triggering 2-6

Memory function 2-6

Min/max configuration & monitoring 2-52

Modulation power sensors B-2

Modulation sensor specifications B-5

O

Offsets 2-47

Operation 2-5

- Analog output 2-56
- Arming the triggering cycle 2-27
- Averaging 2-43
- Cal factor correction 2-31
- Calculate subsystem commands 2-7
- Calibration & Testing 4-1
- Calibrator controls 2-64
- Diagnostic commands 2-6
- Error messages 2-69
- GPIO command syntax 2-10
- Halting operation 2-59
- High speed measurements 2-35
- Identification commands 2-63
- IEEE-488.2 common commands 2-6
- Instrument triggering 2-23
- Limit line configuration & monitoring 2-54
- Measurement triggering 2-6
- Memory function 2-6
- Min/max configuration & monitoring 2-52
- Offsets 2-47
- Peak power sensor triggering 2-40
- Preset configuration 2-60
- Program Examples A-1
- Reading power measurements 2-21
- SCPI command interface 2-5
- Self-test 2-66
- Sense subsystem commands 2-8
- Sensor and channel configuration 2-5, 2-29
- Sensor calibration and zeroing 2-19
- Sensor EEPROM commands 2-65

SRQ & Status Monitoring 2-48

Trigger subsystem commands 2-9

Options C-1

Option 02 C-1

Oven 3-5

P

Parts Lists 6-1

Peak power sensor triggering 2-40

Peak power sensors B-7

Performance & Testing 4-7

- GPIO port check 4-7
- Power sensor linearity 4-8

Performance specifications 1-4

- Accuracy 1-4
- Environmental specifications 1-6
- Frequency range 1-4
- Inputs/outputs 1-6
- Measurement speed 1-5
- Meter functions 1-5
- Power requirements 1-6
- Zeroing accuracy 1-4

Periodic maintenance

- Diagrams 7-1
- Lithium battery 5-2

Power requirements 1-6

Power Sensor Calibration B-10

Power sensor linearity 4-8

Power Sensor Selection B-1

Power Sensor specifications B-1

Power Sensors

- Directional bridges B-9
- Modulation B-2
- Modulation sensor specifications B-5
- Peak B-7
- Selection B-1
- Specifications B-1

Power Supply Voltage Checks 5-1

Preparation for use 2-1

Preset configuration 2-60

Processor 3-9

Program Examples A-1

- Cal Factor A-30
- Error Control A-8
- High Speed Measurements A-37
- Instrument & Sensor Identification A-51
- Instrument Triggering A-22
- Reading Power Measurements A-12
- Relative or Referenced Measurements A-46

Sensor Calibration A-1
Sensor Zeroing A-7
SRQ Interrupts A-49
Special Configurations xiii

R

Reading power measurements 2-21
Reading Power Measurements Examples A-12
Real time clock/timer 3-9
Receiving inspection 1-2
Relative or Referenced Measurement Examples A-46
Reshipment 1-2
RF output 3-5

S

Safety precautions 1-2
Saving the setup 2-59
SCPI command interface 2-5
Self-test 2-66
Sense subsystem commands 2-8
Sensor and channel configuration 2-5, 2-29
Sensor calibration and zeroing 2-19
Sensor Calibration Examples A-1
Sensor EEPROM commands 2-65
Sensor interrupt 3-6
Sensor NVRAM 3-6
Sensor Precautions 2-4
Sensor Zeroing Examples A-7
Shared memory 3-9
Shared memory decoders 3-9

SRQ & Status Monitoring 2-48
SRQ Interrupt Examples A-49
Storage 1-2

T

Theory of Operation 3-1
 Calibrator module 3-4
 Introduction 3-1
Thermistor bridge 3-5
Tools and test equipment 1-2
Track & hold and DAC 3-6
Trigger subsystem commands 2-9
Troubleshooting
 Channel 2 troubleshooting 5-3
 Diagnostic test commands 5-4
TTL triggers and local bus 3-9

V

VXI gate array 3-8
VXI Interface 3-8
 Drivers and transceivers 3-9
 Gate array 3-8
 Logical address switch 3-9
 Shared memory 3-9
 Shared memory decoders 3-9
 TTL triggers and local bus 3-9
VXI Processor 3-8
 CPU and memory 3-9
 Interface 3-8
 Processor 3-9