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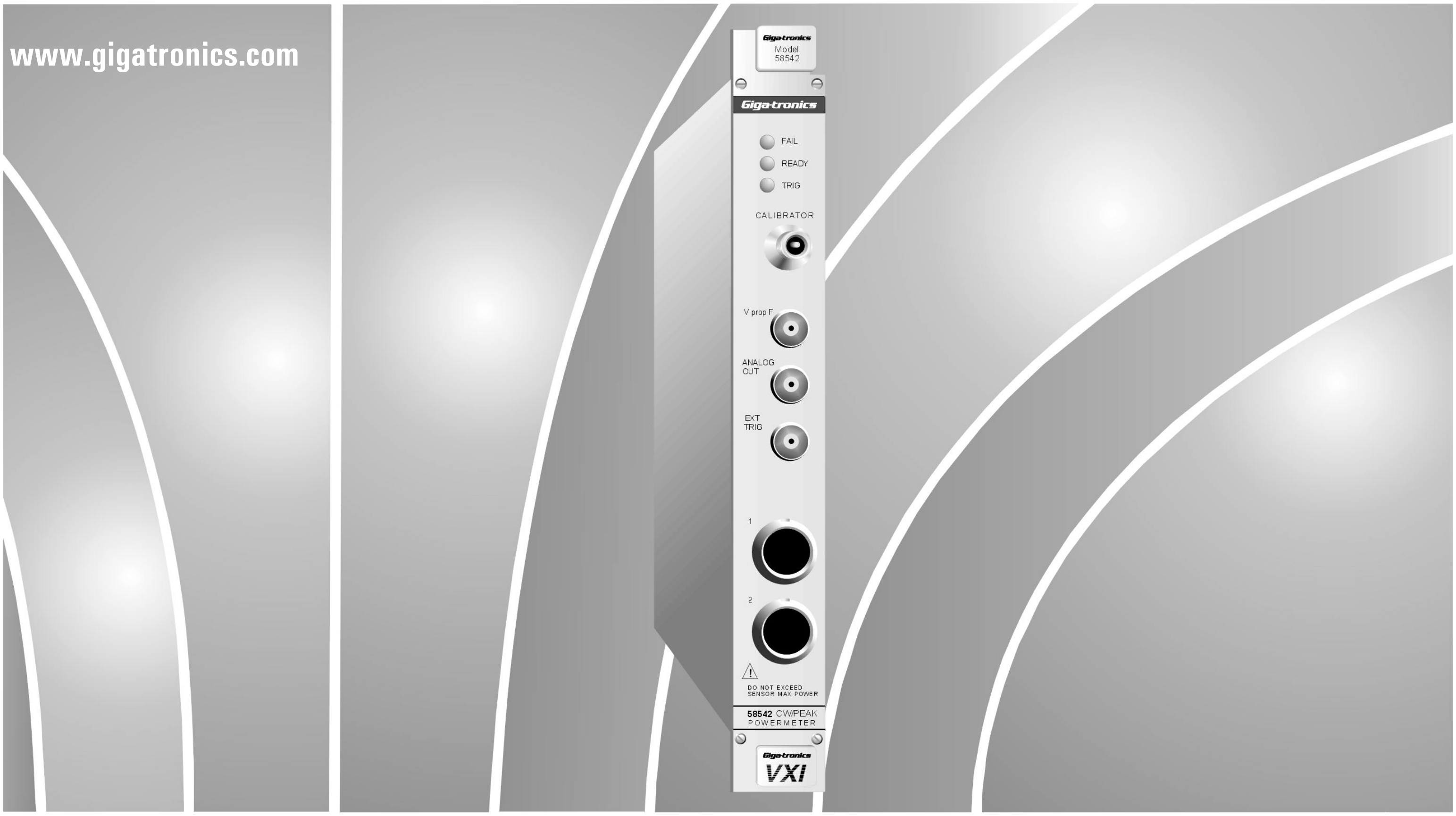

58542 VXIbus Universal Power Meter

Operation & Maintenance Manual

Publication 21555, Rev. E, September 2002

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DECLARATION OF CONFORMITY

Application of Council Directive(s)

Standard(s) to which Conformity is Declared:

89/336/EEC and 73/23/EEC	EMC Directive and Low Voltage Directive
EN61010-1 (1993)	Electrical Safety
EN61326-1 (1997)	EMC – Emissions & Immunity

Manufacturer's Name:
Giga-tronics Incorporated

Manufacturer's Address:
4650 Norris Canyon Road
San Ramon, California 94583
U.S.A.

Type of Equipment:
Universal Power Meter

Model Series Number:
58540

Model Number in Series:
58542

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Steve Gredell (Full Name) — (Signature) — Acting Director of Quality Assurance (Position)

San Ramon, California (Place) — August 2, 2002 (Date)

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About this Publication

This publication contains the following chapters to describe the operation and maintenance of the 58542 VXIbus Universal Power Meter.

Preface

In addition to a comprehensive Contents and general information about the publication, the Preface also contains a record of changes made to the publication since its production, and a description of Special Configurations. If a user-specific produce has been ordered, please refer to page xv for a description of the special configuration.

Chapters

1- Introduction

Contains a brief introduction to the instrument and its performance parameters.

2 - Operation

Contains a guide to the instrument and its configuration menus.

3 - Theory of Operation

Contains a block diagram level description of the instrument and its circuits for maintenance and applications.

4 - Calibration & Testing

Contains procedures for inspection, calibration and performance testing.

5 - Maintenance

Contains procedures for maintenance and troubleshooting.

6 - Parts Lists

Contains list of components, parts and their sources.

7 - Diagrams

Contains schematics and component diagrams for circuits.

Appendices

A - Program Examples

Contains examples of programs for controlling the 58542 remotely over the GPIB.

B - Power Sensors

Contains specifications and technical data for the selection and application of power sensors.

C - Options

Contains a description of options available for the 58542.

Index - 58542 VXIbus Universal Power Meter

A subject listing of contents for the 58542.

Changes that occur after production of this publication, and Special Configuration data will be inserted as loose pages in the publication 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 publication. Additional conventions not included here will be defined at the time of usage.

Warning

WARNING

The WARNING statement is encased in gray 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

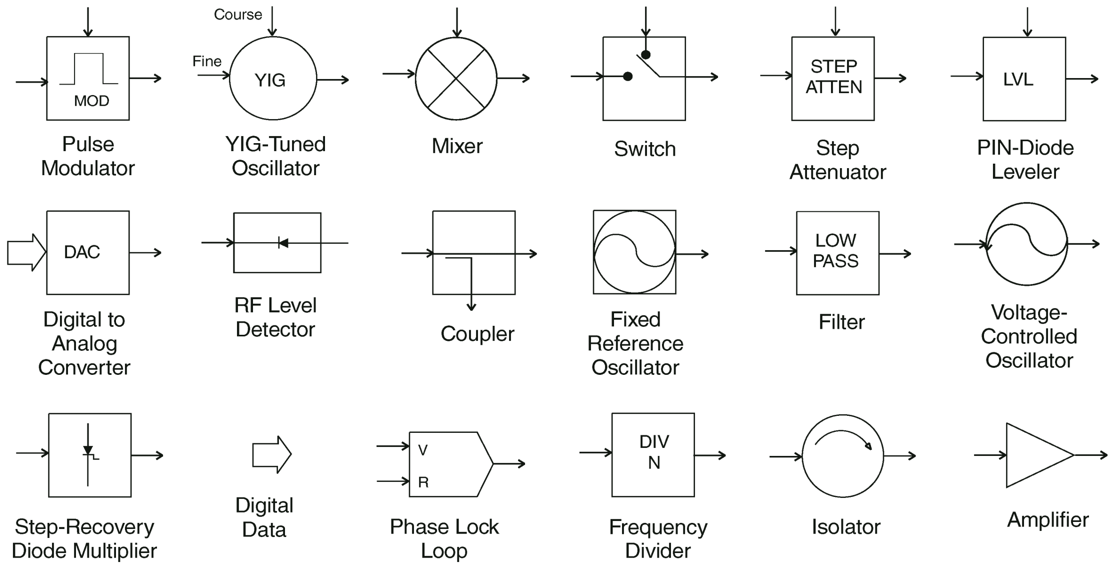
The CAUTION statement is enclosed with single lines and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in temporary or permanent damage to the equipment, or loss of effectiveness.

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 publication are illustrated below.



Record of Publication Changes

This table is provided for convenience to maintain a permanent record of publication change data. Corrected replacement pages will be issued as TPCI (Technical Publication Change Instructions), and will be inserted at the front of the binder. Remove the corresponding old pages, insert the new pages and record the changes here.

TPCI Number	TPCI Issue Date	Date Entered	Comments

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When the accompanying product has been configured for user-specific application(s), supplemental pages will be inserted at the front of the publication binder. Remove the indicated page(s) and replace it (them) with the furnished Special Configuration supplemental page(s).

1

Introduction

1.1 Description

The Giga-tronics 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 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 ±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 only entering a frequency of operation to the power meter is needed to obtain frequency corrected power readings.

The 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 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 ± 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 publication 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 (P/N 21555)
- 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 58542 to fit the dual-channel female output connectors.

1.1.3 Tools & Test Equipment

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

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 Reshipment Preparation

If it is necessary to return the instrument to the factory, protect the instrument during reshipment by using the best packaging materials available. If possible, use the original shipping container. If the original container is not available, use a strong carton (350 lbs./sq.in. 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. Take extra precaution 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 reshipment, please provide the model and serial number. If the instrument is being returned for repair, be sure to enclose all relevant information regarding the problem that has been found.

☛ ***NOTE:*** *If returning an instrument to Giga-tronics for service, first contact Customer Service so that a return authorization number (RMA) can be assigned. Contact Giga-tronics via e-mail* ***(repairs@gigatronics.com)*** *or by phone* ***800.444.2878*** *(The 800 number is only valid within the US). Giga-tronics may also be contacted via our domestic line at 925.328.4650 or Fax at 925.328.4702.*

1.2 Specifications

Performance specifications describe the 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 – 40 GHz[1]

Power Range
-70 dBm – +47 dBm (100 pW - 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 ±0.7% traceable to the National Institute of Standards and Technology (NIST). Measure within 15 seconds of setting calibrator to 0.0 dBm

Accuracy
±1.2% worst case for one year, over temperature range of 5 °C – 35 °C

Connector
Type N(f) connector, 50 Ω

VSWR
< 1.05 dB (Return Loss > 33 dB)

System Linearity (@ 50 MHz for Standard CW Sensors)

±0.02 dB over any 20 dB range from -70 — +16 dBm
±0.02 dB + (0 dB, -0.05 dB/dB) from +16 — +20 dBm
±0.04 dB from -70 — +16 dBm

Linearity Temperature Coefficient

<0.1%/ °C temperature change following Power Sweep Calibration, 24-hour warm-up required
<0.3%/ °C temperature change following Power Sweep Calibration, 24-hour warm-up required (8035XA Series Sensors)

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]

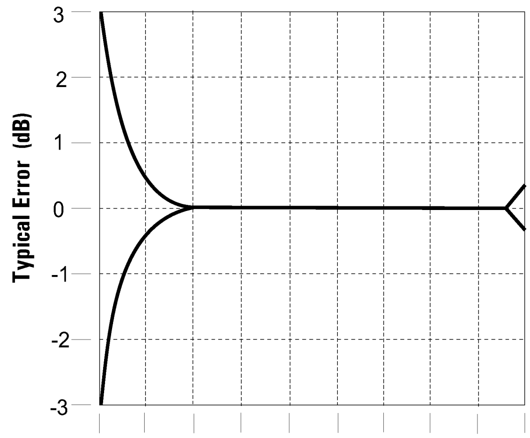
Averaging

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)



SENSORS										
80301A	-70	-60	-50	-40	-30	-20	-10	0	10	20
80310A	-64	-54	-44	-34	-24	-14	-4	6	16	26
80320A	-60	-50	-40	-30	-20	-10	0	10	20	30
80321A	-50	-40	-30	-20	-10	0	10	20	30	40
80322A	-40	-30	-20	-10	0	0	20	20	40	44
80325A	-40	-30	-20	-10	0	10	20	30	40	50
80330A	-30	-20	-10	0	10	20				
80401A (CW)	-67	-57	-47	-37	-27	-17	-7	3	13	
80401A (MAP, PAP)	-60	-50	-40	-30	-20	-10	0	10	20	
80401A (BAP)	(See 80401A Modulated-related uncertainty in Appendix B)									
80601A (CW)	-60	-50	-40	-30	-20	0	10	20		
80601A (MAP, PAP)	-55	-45	-35	-25	-15	-5	5	15		
80601A (BAP)	(See 80601A Modulated-related uncertainty in Appendix B)									

Figure 1-1: Instrument Linearity

1.2.4 Meter Functions

dB Offset & Relative
Allows both relative readings and offset readings. Power readings can be offset by -99.999 – +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 – +10 V from either Channel 1 or Channel 2 in either Lin or Log units[1]

Accuracy
1.0% ±32 mV, -10 – +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 V_{PROP}F IN BNC[1]

Input Range
0 – 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

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

1.2.8 General Specifications

Temperature Range

Operating	0 °C – 50 °C (32 °F – 122 °F) Operating the 58542 Power Meter in a high level RF field (Approximately 3 V/m) may degrade performance, this degradation occurs at measured levels below -36 dBm and when the field frequency is nominally between 50 and 1000 MHz
Non-Operating	-40 °C – 70 °C (-40 °F – 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

2

Operation

2.1 Preparation for Use

This chapter describes how to operate the 58542 VXIbus 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:

- Installation (Section 2.2)
- Initial Setup (Section 2.3)
- Sensor Precautions (Section 2.4)
- Operation (Section 2.5; Error Messages, Section 2.5.34)

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.

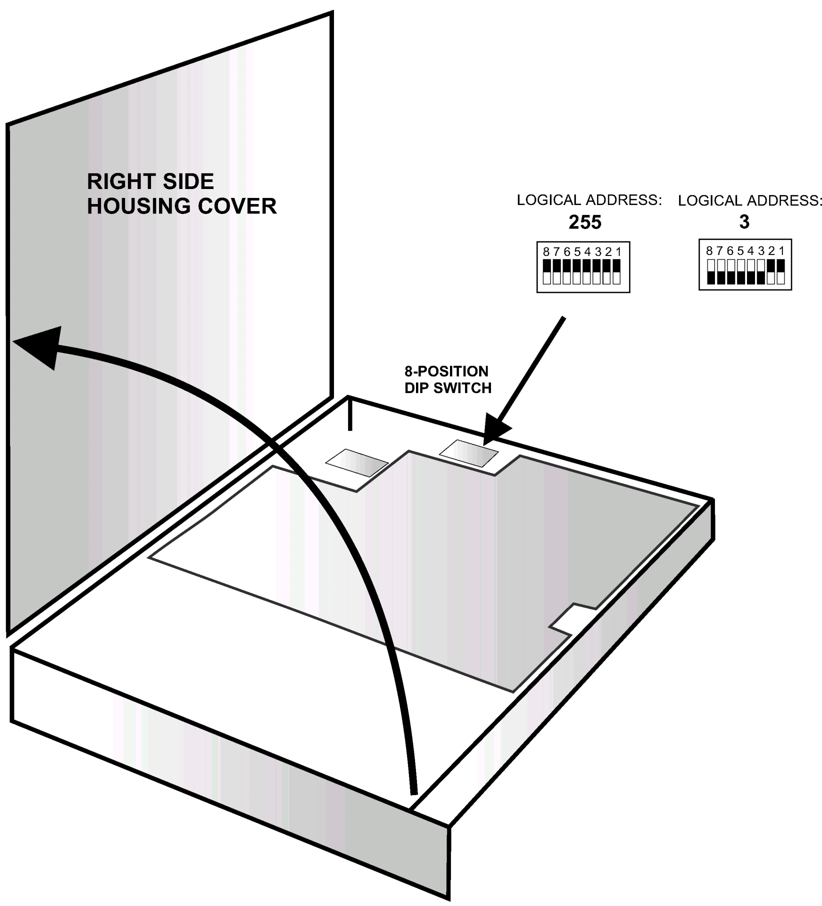


Figure 2-1: Setting the Logical Address

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.

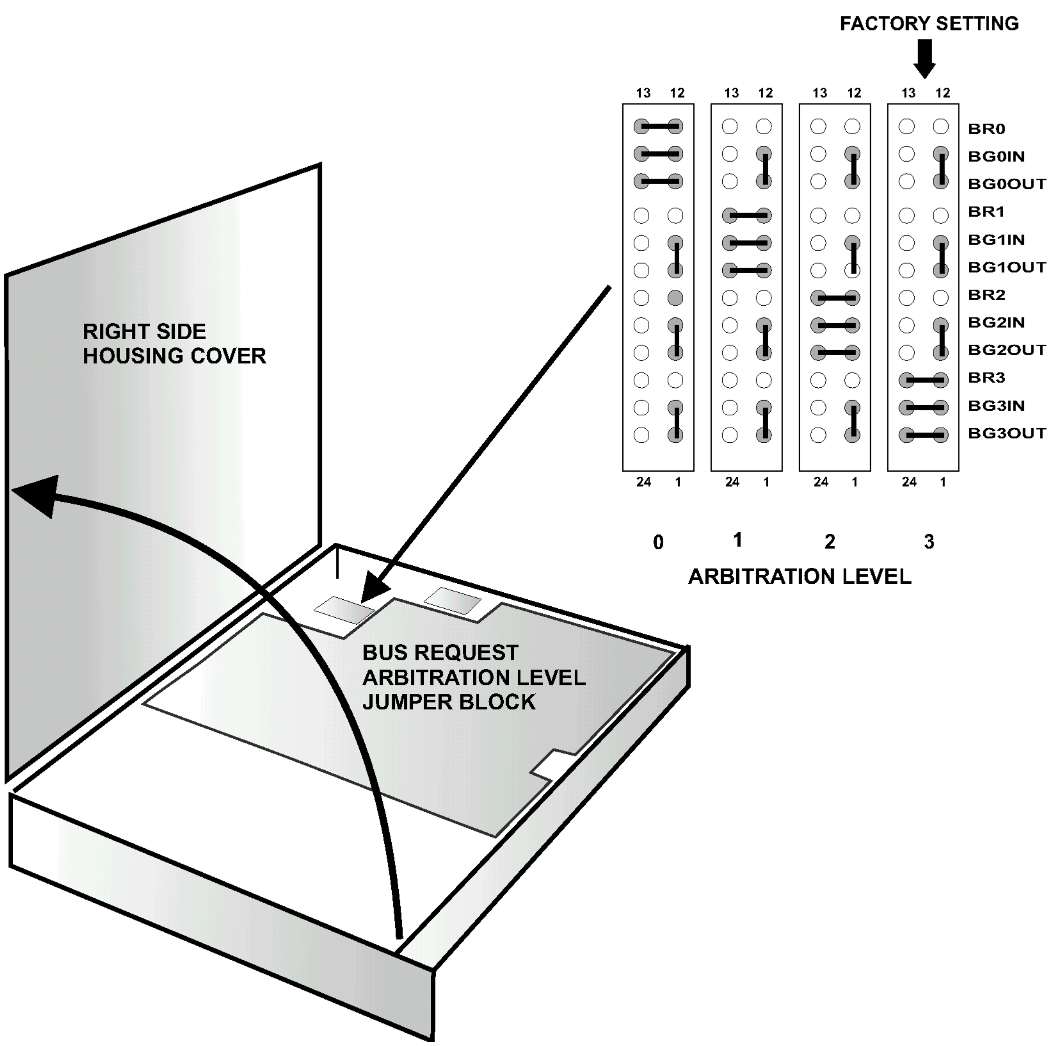


Figure 2-2: Default Bus Arbitration Settings

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, $True_{RMS}$ and Low VSWR sensors.

2.5 Operation

2.5.1 SCPI Command Interface

This section details operation of the 58542 VXIbus Universal Power Meter using the SCPI (Standard Communications for Programmable Instruments) interface commands. A SCPI command reference is presented in Table 2-2 and the sections that follow.

SCPI commands promote consistency in 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 publication, some commands will be in both upper- and lower-case, such as CALCulate and MEMory. The uppercase is the required input. The whole word can be used if desired. If the whole word is used, it must be used in its entirety. For example, CALCulat will not be recognized as a valid command.*

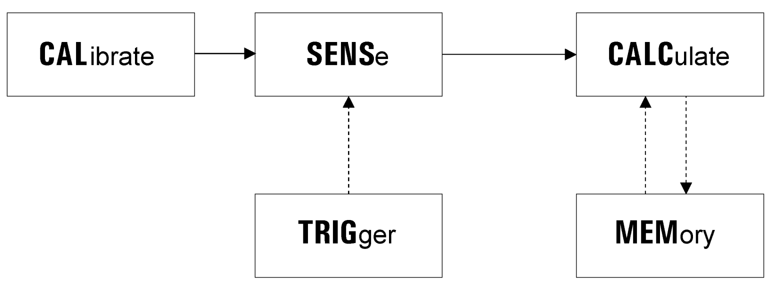


Figure 2-3: SCPI Subsystem Model

2.5.2 Sensor Calibration & Zeroing

The Calibration subsystem performs sensor calibration and zeroing. CALibrate:STATe*n* selects if the calibration data is applied or not. If STATe is ON, then the instrument uses the calibration data for correction. If STATe:OFF is selected, then no calibration using the calibration data will be made. The CALibrate:ZERO subsystem controls the autozero calibration of the sensor.

2.5.3 Sensor & 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. 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.

2.5.4 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.

2.5.5 Memory Functions

The MEMory commands control the configuration of the automated Voltage-Proportional-to-Frequency ($V_{PROP}F$ or VF), sensor Cal Factor correction, and the analog outputs on the rear panel. Each of these connectors is used with external devices. The $V_{PROP}F$ can be configured to match the $V_{PROP}F$ output of the microwave source. The analog outputs are used with a variety of devices including chart recorders, oscilloscopes, voltmeters and microwave source leveling inputs.

2.5.6 IEEE 488.2 Required Commands

Consistent with SCPI compliance criteria, the power meter implements all the common commands declared mandatory by IEEE 488.2 (See Table 2-1).

Table 2-1: IEEE Required Command Codes

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
*RCL	Recall Command
*RST	Reset Command
*SAV	Save Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TRG	Trigger Command
*TST?	Self-Test Query
*WAI	Wait-to-Continue Command

2.5.7 DIAGnostic Commands

DIAGnostic commands are used for a variety of instrument specific maintenance and calibration functions. Unless performing instrument calibration functions, it is unlikely the DIAGnostic command sets will need to be used. For calibration laboratory metrology professionals, the DIAG commands will allow completely automated 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.

2.5.8 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 publication as "channels". See Section 2.5.9 for sensor-specific configuration and measurement function control.

The query form of CALC#?, with # replaced by the channel modifier (1 or 2), returns the current configuration status for that channel. This verifies configuration commands or return current status information following data acquisition or power measurements.

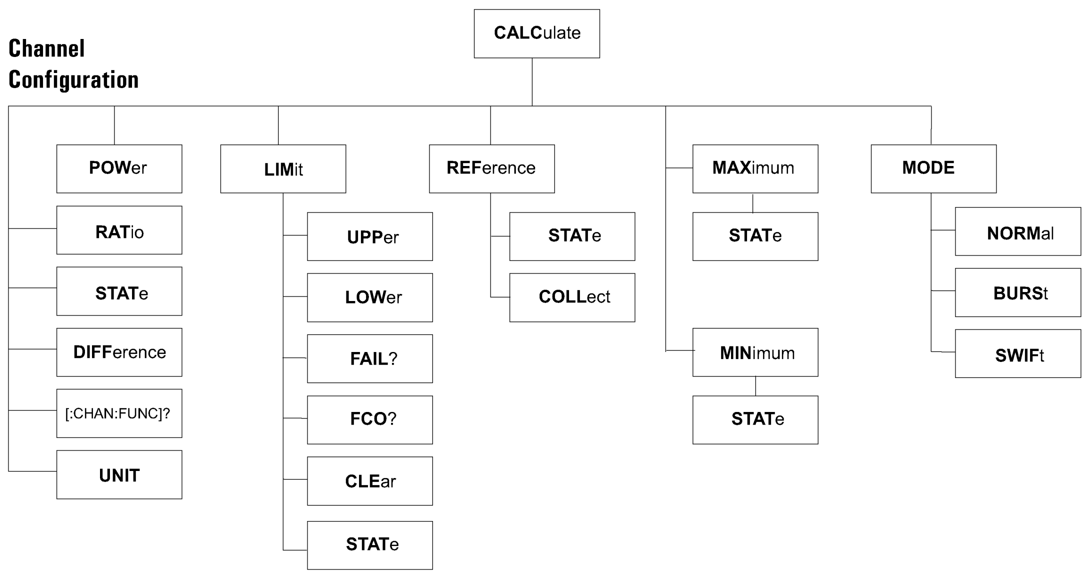


Figure 2-4: CALCulate Subsystem Commands

Limit Lines are set on a channel basis. These 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. The final measurement data is calculated from Sense subsystem sensor data as well as the Calculate 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.

2.5.9 Sense Subsystem Commands

The Sense subsystem configuration commands, illustrated in Figure 2-5, apply 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 the Sense subsystem commands for:

- Averaging power measurements in the 58542
- Offsetting power measurements for attenuation or amplification
- Entering the operating frequency of the measured signal 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.

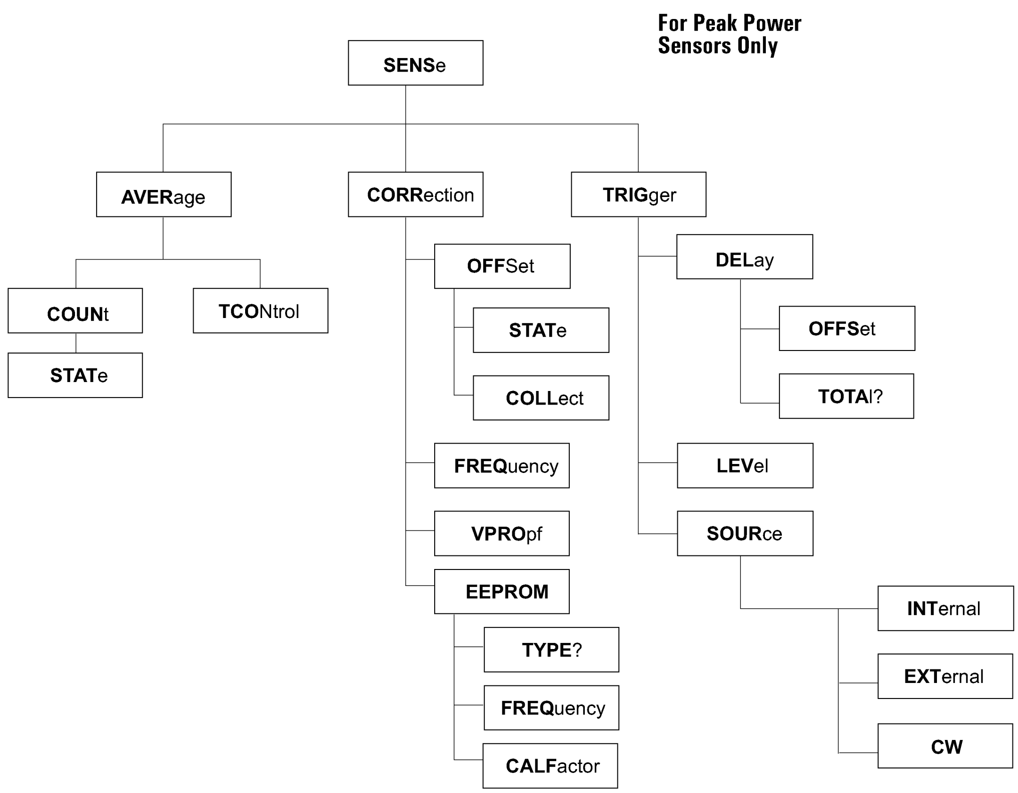


Figure 2-5: SENSe Subsystem Command Tree

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 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. The AVERage and CORRection commands apply to all Series 803XXA CW & Peak Power Sensors.

STATe ON OFF controls for COUNt and DELay, previous page, are not shown.

2.5.10 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 and Swift modes). The Trigger command tree is illustrated in Figure 2-6.

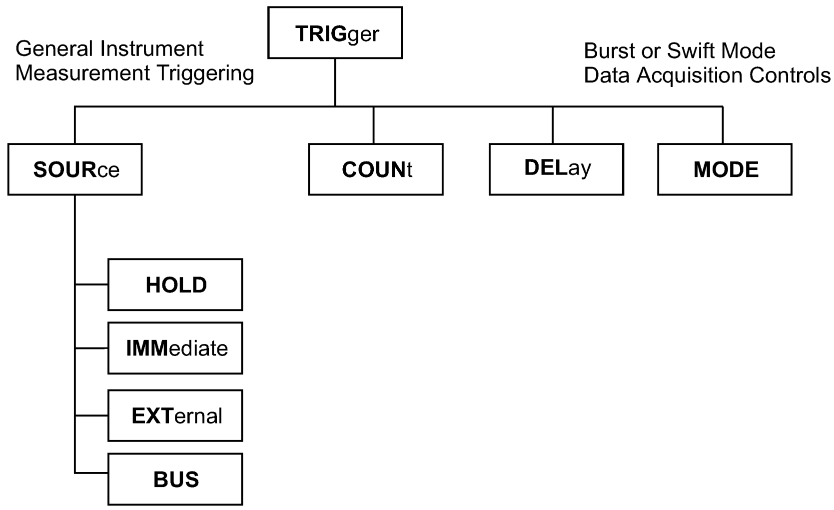


Figure 2-6: TRIGger Subsystem Command Tree

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 input. 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.

2.5.11 GPIB Command Syntax

The following conventions are used with the GPIB commands in this publication. Some commands will be in both upper- and lower-case, 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 GPIB commands supported by the power meter. The basic function performed by that command is given and the page number in this chapter where a description of each command can be located. Most query command syntaxes have been provided on the description page, not in Table 2-2.

2.5.11.1 Commands in Brackets

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

2.5.11.2 Programmer Selective Parameters

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

2.5.11.3 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.

2.5.11.4 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 using the query format. Some commands have only a query format. With the exception of the Calibration queries, query commands will not change the status of the power meter. The CALibration1? and CALibration1:ZERO? commands query respectively to automatically begin the calibration and zeroing process.

2.5.11.5 Linking Command Strings

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

2.5.11.6 Measurement Data Output Format

The examples 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.

™HTBasic is a trademark of TransEra Corporation.

Table 2-2: VXI GPIB Command Syntax

Command Syntax	Function	Page
Required Codes		
*CLS	Clear SRQ and status byte registers	2-39
*ESE	Enable bit 4 of event status register mask	2-39
*ESE?	Query return the of the event status register mask	
*ESR?	Returns event status register value	2-39
*IDN?	Query instrument mfgr and model number	2-52
*OPC	Allows a one-time SRQ enable	2-20 2-39
*OPC?	Returns a value of 1 after an operation is completed	
*RCL	Recall 58542 register *n*	2-49
*RST	Reset 58542 configuration	2-50
*SAV	Save at 58542 register *n*	2-49
*SRE	Service Request Enable	2-40
*SRE?	Query return the status register mask value	
*STB?	Query status byte register	2-40
*TRG	BUS Trigger Event	2-22
*TST?	Query self-test result	2-55
*WAI	Wait, following command completion	2-23
Function Codes		
ABORt	Halts measurement & triggering	2-49
CALCulate<channel 1 to 2>:DATA?	Query channel 1 & 2 burst mode data	2-30
CALCulate<channel 1 to 2>[:CHANnel]:DIFFerence*space*<sensor 1 or 2*comma*sensor 2 or 1>	Configures channel 1 to measure Sensor 2 minus Sensor 1 power	2-25
CALCulate<channel 1 to 2>[:FUNCtion]?	Query channel 2 sensor mode	2-25
CALCulate<channel 1 to 2>:LIMit:CLEar[:IMMediate]	Reset channel 1 limit violation indicator to 0	2-44
CALCulate<channel 1 to 2>:LIMit:FCOunt?	Query number of channel 1 limit failures	2-44
CALCulate<channel 1 to 2>:LIMit:FAIL?	Check for channel 1 limit line violation (Output 0 = OK; 1 = fail)	2-44

Table 2-2: VXI GPIB Command Syntax (Continued)

Command Syntax	Function	Page
CALCulate<channel 1 to 2>:LIMit:LOWer*space*<numeric value in dB from -299.99 to 299.99>	Set channel 1 lower limit line to -50 dBm	2-45
CALCulate<channel 1 to 2>:LIMit:STATe*space*<ON | OFF>	Enable channel 1 upper and lower limit checking. (0 = off; 1 = on)	2-46
CALCulate<channel 1 to 2>:LIMit:UPPer*space*<numeric value in dB from -299.99 to 299.99>	Set channel 1 upper limit line to 17 dBm	
CALCulate<channel 1 to 2>[:CHANnel]:POWer*space*<sensor 1 or 2>	Configures channel 2 to measure Sensor 1 power	2-25
CALCulate<channel 1 to 2>[:CHANnel]:RATio*space*<sensor 1 or 2*comma*sensor 2 or 1>	Configures channel 1 to measure Sensor 2 over Sensor 1 power	
CALCulate<channel 1 to 2>:MODE*space*<NORMal, BURst, SWIFt Selection>	Set up time gating mode on the specified input	2-30
CALCulate<channel 1 to 2>:MAXimum:STATe*space*<ON | OFF>	Enable channel 2 maximum value monitoring	2-43
CALCulate<channel 1 to 2>:MAXimum[:MAGnitude]?	Query channel 2 maximum value in dBm	
CALCulate<channel 1 to 2>:MINimum:STATe*space*<ON | OFF>	Enable channel 1 min. value monitoring	
CALCulate<channel 1 to 2>:MINimum[:MAGnitude]?	Query channel minimum value in dBm	
CALCulate<channel 1 to 2>:REFerence:STATe*space*<ON | OFF>	Activate level reference for relative measurements	2-37
CALCulate<channel 1 to 2>:REFerence[:MAGnitude]<dB Offset value from -299.999 to 299.999>	Set channel 2 reference offset value in dB Reset channel 2 Relative meas. operation	
CALCulate<channel 1 to 2>:REFerence:COLLect	Take channel 2 reading as reference value. Reset with CALC:REF 0.0	
CALCulate<channel 1 to 2>:STATe*space*<ON | OFF>	Disable channel 1 measurement	2-26
CALCulate<channel 1 to 2>:UNIT[:POWer]*space*<data units selection, dBm or Watt>	Selects channel 1 linear units in Watts Selects channel 1 Log Units in dBm	2-26
CALibrate<sensor 1 or 2>[:SENSor]	Calibrate Sensor 1	2-17
CALibrate<sensor 1 or 2>:ZERO	Zero Sensor 1	2-18
CALibrate<sensor 1 or 2>:STATe?	Query sensor for calibration status	2-17
FETCh<channel 1 to 2>?	Read previously triggered channel 1 power, Normal, Swift, Burst mode data	2-19
INITiate[:IMMediate]	Initiate instrument triggering cycle	2-24
INITiate:CONTinuous*space*<ON | OFF>	58542 self-triggers continuously	
MEASure<channel 1 to 2>[:SCALar:POWer]?	Configure triggering and measure channel 2 power in NORMal mode	2-19
MEMory[:TABLe]:CHANnel*space*<channel 1 to 2>	Set analog out to channel 2	2-46
MEMory[:TABLe]:FREQuency< Start frequency>	Set V_{PROP}F start frequency to 1 GHz	2-28
MEMory[:TABLe]:POWer*space*<start value from -80 to +20 dBm>*comma*<stop value from -80 to +20 dBm>	Set analog out power range (in dBm) from -80 to 20 dBm	2-47

Table 2-2: VXI GPIB Command Syntax (Continued)

Command Syntax	Function	Page
MEMory[:TABLe]:POWer*space*<start value from 0 to 0.01W>*comma*<stop value from 0 to 0.01W>	Set analog out power range (in Watts) from 0 to 0.01 Watts	2-47
MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1, VPROPF2>	Select memory table V_{PROP}F1 for editing in following lines	2-27 2-47
MEMory[:TABLe]:SLOPe*space*<Volts per Hz>	Set V_{PROP}F slope in 1V/GHz	2-27
MEMory[:TABLe]:UNIT*space*<Units for analog output configuration, dBm or Watt>	Set analog out power unit	2-47
MEMory[:TABLe]:VOLTage*space*<start value from -10 to +10 V>*comma*<stop value from -10 to +10 V>	Set analog out voltage range from -8 to 2 volts corresponding to power	2-47
OUTPut[:BNC]:ANAlog[:STATe]*space*<ON | OFF>	Enable analog out function	
OUTPut:ROSCillator[:STATe]*space*<ON | OFF>	Turn ON 0.0 dBm Calibrator Oscillator	2-53
READ<channel 1 to 2>[:POWer]?	Trigger measurement and read channel 2	2-19
SENSe<sensor 1 or 2>:AVERage:COUNt*space*<averaging value 1,2,4,8,16,32,64,128,256,or512>	Set sensor 1 average number to 16	
SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO*space*<ON | OFF>	Select sensor 2 Auto-average mode	2-36
SENSe<sensor 1 or 2>:AVERage:TCONtrol*space*<data acquisition averaging method, MOVing or REPeat>	Set sensor 1 to acquire fresh measurement data before averaging	
SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	Query sensor 1 eeprom type	
SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?	Query sensor 1 eeprom frequency table	2-53
SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?	Query sensor 1 eeprom cal factor table	
SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7	Set sensor 2 frequency to 50 MHz	2-27
SENSe<sensor 1 or 2>:CORRection:OFFSet:COLLect	Take sensor 1 current reading as offset value	
SENSe<sensor 1 or 2>:CORRection:OFFSet [:MAGnitude]*space*<offset value in dB -99.99 to 99.99>	Compensate sensor 2 for 10.2 dB attenuation	2-38
SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe*space*<ON | OFF>	Enable sensor 2 offset correction	
SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]*space*<ON | OFF>	Enable sensor 1 v_prop_f function	2-27
SENSe<sensor 1 or 2>:TEMPerature?	Query sensor 1 temperature (in centigrade)	2-18
SENSe<sensor 1 or 2>:TRIGger:SOURce*space*<peak sensor triggering INTernal, EXTernal or CW>	Set sensor 1 peak trigger mode to CW mode	
SENSe<sensor 1 or2>:TRIGger:DELay[:MAGnitude]:*space*<Peak Sensor sample delay in seconds from -20e-9 to 104e-3>	Set sensor 2 peak delay value to 1e6 seconds	2-34
SENSe<sensor 1 or 2>:TRIGger:DELay:STATe*space*<ON | OFF>	Enable peak sensor 1 delay function	

Table 2-2: VXI GPIB Command Syntax (Continued)

Command Syntax	Function	Page
SENSe<sensor 1or2>:TRIGger:LEVel[:MAGnitude]*space*<trigger level of peak power sensor>	Set peak sensor 1 trigger level to 1.7 volts	2-35
SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]	Set peak sensor 1 trigger offset time to 0 second	
SENSe<sensor 1 or 2>:TRIGger:TOTAl[:MAGnitude]?	Query peak sensor 1 total trigger delay time	
STATus:OPERation[:EVENt]?	Query operation event register result	2-40
STATus:OPERation[:ENABle]	Set Status Enable Mask	
STATus:PRESet	Clears all the status register value	2-40 2-50
SYSTem:ERRor?	Query system error message	2-59
SYSTem:PRESet	Reset 58542 configuration	2-50
SYSTem:VERSion?	Query SCPI version	2-52
TRIGger[:IMMediate]	Trigger measurement cycle	2-22
TRIGger:SOURce*space*<instrument triggering source IMMediateBUS, HOLD, or EXTernal>	Set instrument measurement trigger source to IMMediate	
TRIGger:MODE*space*<burst mode data gathering POST trigger receipt or PRE trigger receipt>	Set Burst or Swift mode data collection relative to Timing of event trigger post	2-21
TRIGger:DELay*space*<delay time between buffered readings in sec 0.000 to 5.000>	Set Burst mode measurement time to 5 ms between measurements (resolution, one msec)	2-23
TRIGger:COUNt*space*<number of data values to buffer in memory from 1 to 5000 for standard 58542 from1 to 128,000 on one channel with option 02; from 1 to 64000 for two channels with option 02>	Set Burst or Swift mode buffer reading number to 100	

2.5.12 Sensor Calibration & Zeroing

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

2.5.12.1 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#

Syntax:	CALibration<sensor 1 or 2>[:SENSor]	
Example:	OUTPUT @PWR_MTR;CAL1	! CALIBRATE SENSOR 1
Description:	This command begins the sensor power sweep calibration process. Power sweep calibration can be performed only 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.	

CALibrate:STATE?

Syntax:	CALibrate<sensor 1 or 2>:STATe?	
Example:	OUTPUT @PWR_MTR;CAL1:STAT?	! QUERIES SENSOR FOR CALIBRATION STATUS
Response:	1 if sensor is calibrated, or 0 if sensor is not calibrated.	
Description:	This command queries whether or not a sensor has been calibrated.	

2.5.12.2 Sensor Zero

Zeroing automatically accounts for ground noise and other noise in the 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

Syntax:	CALibration<sensor 1 or 2>:ZERO	
Example:	OUTPUT @PWR_MTR;CAL1:ZERO	! ZERO SENSOR 1
Description:	This command begins the zeroing process. To offset for measurement circuit noise during zeroing, The sensor needs to remain attached to the measurement circuit during zeroing. Disable the signal source into the sensor. If disabling the signal source cannot occur, 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?

Syntax:	CALibration<sensor 1 or 2>:ZERO?	
Example:	OUTPUT @PWR_MTR;CAL1:ZERO?	! ZERO SENSOR 1 & RETURN PASS/FAIL STATUS
Response:	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 turing off the source power meter before beginning the zeroing process.	

SENS#:TEMP?

Syntax:	SENSe<sensor 1 or 2>:TEMPerature?	
Example:	OUTPUT @PWR_MTR;SENS1:TEMP?	! QUERIES SENSOR 1 TEMPERATURE (IN CENTIGRADE)
Response:	Current sensor temperature in degrees centigrade	
Description:	This command reports sensor temperature. If the temperature varies in the operating environment, monitor the relative temperature variations. If the variation since the previous power sweep calibration exceeds ±5 °C (±9 °F), perform the power sweep calibration for that sensor.	

Example programs for Sensor Calibration and Zeroing are contained in Appendix A.

2.5.13 Reading Power Measurements

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

Syntax:	FETCh <channel 1 to 2> ?	
Example:	OUTPUT @PWR_MTR;FETC1?	! READS PREVIOUSLY TRIGGERED CHANNEL 1 POWER ! NORMAL, SWIFT, BURST MODE DATA
Response:	Whatever is in the output buffer whether it is a new measurement or an old one.	
Description:	The FETCh? query command returns post-processed measurement data from the active channels of the 58542. After receiving FETCh? the 58542 will output the contents of its active data output buffer. The data size and output format of the buffer are 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, BURSt Mode measurement data from the meter's data buffer.	

MEAS?

Syntax:	MEASure <channel 1 to 2> [:SCALar:POWer]?	
Example:	OUTPUT @PWR_MTR;MEAS2?	! ARMS, TRIGGERS AND MEASURES CHANNEL 2 ! POWER IN NORMAL MODE
Response:	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?

Syntax:	READ <channel 1 to 2> <channel 1 to 2> <channel 1 to 2> [:POWer]?	
Example:	OUTPUT @PWR_MTR;READ2?	! TRIGGER MEASUREMENT AND READ CHANNEL 2
Response:	A power measurement.	
Description:	The READ[:POWer]? query command triggers measurement and sends the data to the controller. The READ? command enables 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

Example:	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.	

*OPC?

Example:	OUTPUT@PWR_MTR;*OPC?	! RETURNS A VALUE OF 1 AFTER AN OPERATION IS COMPLETED
Description:	The *OPC? operation complete query allows synchronization between the controller and the test set using either the message available (MAV) bit in the status byte, or a read of the output OPC?.	

2.5.13.1 Special Errors

An unusual or non-sense numeric response, such as 9e+40, indicates an error response. For instance, not performing 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 using the READ#? measurement query and INIT:CONT is ON, a bad value is returned, 9e+40. Sending 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.

Example programs for Reading Power Measurements are contained in Appendix A.

2.5.14 Instrument Triggering

- *TRG
- TRIGger[:IMMediate]
- TRIGger:SOURce
- TRIGger:MODE
- TRIGger:DELay
- TRIGger:COUNt
- INITiate:CONTinuous
- INITiate[:IMMediate]
- *WAI

These SCPI commands trigger the measurement cycle. They do not configure or provide triggering for Peak Power Sensors. Those commands are defined in Section 2.5.19. 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.

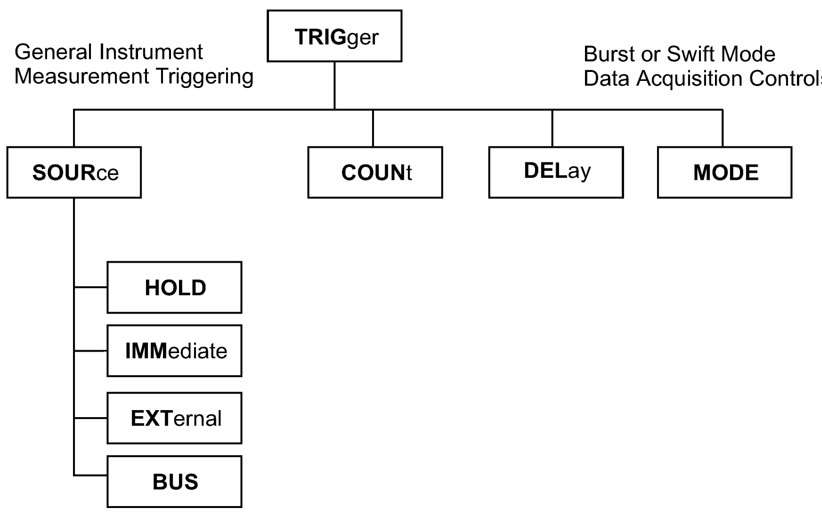


Figure 2-7: TRIGger Subsystem Command Tree

EXT triggering is performed with the rear 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 perform continuous measurements. This is the default setting. 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. To 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. To 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 specifying a TRIG:COUN# higher than 1.

*TRG

Syntax:	*TRG	
Example:	OUTPUT @PWR_MTR;*TRG	! 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

Syntax:	TRIGger[:IMMediate]	
Example:	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

Syntax:	TRIGger:SOURce*space*<instrument triggering sourc IMMediate, BUS, HOLD, or EXTernal>	
Example:	OUTPUT @PWR_MTR;TRIG:SOUR IMM	! SETS 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, send the triggering configuration.

TRIG:MODE

Syntax:	TRIGger:MODE*space*<burst mode data gathering POST trigger receipt or PRE trigger receipt>	
Example:	OUTPUT @PWR_MTR;TRIG:MODE POST	! SETS 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 in the 58542 is constantly performing data acquisition. To send any configuration commands while it is collecting the PRE trigger data, the timing of the data point collection can be interrupted.	

TRIG:DEL

Syntax:	TRIGger:DELay*space* < delay time between buffered readings in sec, 0.000 to 5.000 >	
Example:	OUTPUT @PWR_MTR;TRIG:DEL 5E-3	! SETS BURST MODE MEASUREMENT TIME TO ! 5 MS BETWEEN MEASUREMENTS.
Example 2:	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 controlling is required of individual data point triggering, the SWIFt mode will provide the highest measurement rates, with or without SRQ or hardware handshaking.	

TRIG:COUN

Syntax:	TRIGger:COUNt*space* < number of data values to buffer in memory from 1 to 5000 for the standard 58542; from 1 to 128,000 on one channel with option 02; and 1 to 64000 for two channels with option 02 >	
Example:	OUTPUT @PWR_MTR;TRIG:COUN 100	! SETS 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, to control the triggering of individual data points. 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.	

*WAI

Example:	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.	

Example programs for Instrument Triggering are contained in Appendix A.

2.5.15 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.

Perform triggering configuration 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

<table>
<tr><td>Syntax:</td><td colspan="2">INITiate:CONTinuousspace<ON | OFF></td></tr>
<tr><td>Example:</td><td>OUTPUT @PWR_MTR;INIT:CONT ON</td><td>! CONTINUOUS TRIGGERING</td></tr>
<tr><td>Description:</td><td colspan="2">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. 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.</td></tr>
</table>

INIT:IMM

<table>
<tr><td>Syntax:</td><td colspan="2">INITiate[:IMMediate]</td></tr>
<tr><td>Example:</td><td>OUTPUT @PWR_MTR;INIT</td><td>! INITIATE INSTRUMENT TRIGGERING CYCLE</td></tr>
<tr><td>Description:</td><td colspan="2">This command enables the triggering cycle. Instrument triggering will not occur unless INIT has been enabled, even when 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 using READ#? or FETCh#? to read data, this command arms the 58542 for triggering upon the occurrence of the next valid trigger.

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.</td></tr>
</table>

2.5.16 Channel Configuration

- **CALCulate:POWer**
- **CALCulate:RATio**
- **CALCulate:DIFFerence**
- **CALCulate?**
- **CALCulate:UNIT**
- **CALCulate:STATe**
- **CALCulate:STATe?**

CALC#:POW

Syntax:	CALCulate<channel 1 to 2>[:CHANnel]:POWer*space*<sensor 1 or 2>	
Example:	OUTPUT @PWR_MTR;CALC2:POW 1	! CONFIGURES CHANNEL 2 TO ! MEASURES 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

Syntax:	CALCulate<channel 1 to 2>[:CHANnel]:RATio*space*<sensor 1 or 2*comma*sensor 2 or 1>	
Example:	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 Watts, 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

Syntax:	CALCulate<channel 1 to 2>[:CHANnel]:DIFFerence*space*<sensor 1 or 2*comma*sensor 2 or 1>	
Example:	OUTPUT @PWR_MTR;INIT:CONT ON	! 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#?

Syntax:	CALCulate<channel 1 to 2>[:FUNCtion]?	
Example:	OUTPUT @PWR_MTR;CALC2?	! QUERIES CHANNEL 2 SENSOR CONFIGURATION
Response:	POW #, RAT #,#, OR DIFF #,#	
Description:	This command returns the current channel configuration. This command is a query format only.	

CALC#:UNIT

Syntax:	CALCulate <channel 1 to 2>:UNIT[:POWer]*space*<data units selection, dBm or Watt>	
Example:	OUTPUT @PWR_MTR;CALC1:UNIT W	! SELECTS CHANNEL 1 LINEAR UNITS, WATTS
Example 2:	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 UNIT is dBm, the RATio configuration produces measurements in dB, and POWer and DIFF measurements in dBm. When UNIT is Watts, the RATio configuration measurements are percentages, and POWer and DIFF measurements are in Watts.	

CALC#:STAT

Syntax:	CALCulate <channel 1 to 2>:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC1:STAT OFF	! DISABLES 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.	

CALC#:STAT?

Syntax:	CALCulate <channel 1 to 2>:STATe?	
Example:	OUTPUT @PWR_MTR;CALC1:STAT?	! QUERIES CHANNEL 1 MEASUREMENT STATUS
Response:	0 = off, 1 = on	
Description:	This command is the query format of the command above.	

Example programs for Channel Configuration are contained in Appendix A.

2.5.17 Cal Factor Correction

- **SENS#:CORR:FREQ**
- **MEMory:FREQuency**
- **MEMory:SELect**
- **MEMory:SLOPe**

Power Sensors have a measurable frequency response. During manufacture, this response is calibrated at 1 GHz intervals. Instead of printing the data on the sensor label, each Giga-tronics power sensor includes a built-in EEPROM which has been programmed with the frequency calibration factor data for that particular power sensor.

The following SCPI commands tell the 58542 the operating frequency of the measured microwave or RF signal. Thus, the meter automatically interpolates the correct Cal Factor and applies that value to the measurement data. By performing this automatically, there is no need to read Cal Factor data from the side of sensor housings and program the data into tables within the ATE programming. Except for advanced measurement techniques using Burst Mode, there is no need to write cal factor interpolation routines; this is all done by the power meter. As shown below, sensor Cal Factor data can be read into the computer. Also see the Sensor EEPROM Commands in Section 2.5.32 for Cal Factor programming.

SENS#:CORRection:FREQ

Syntax:	SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:FREQ 5E7	! SETS SENSOR 2 FREQUENCY TO 50 MHZ
Response:	0 = off, 1 = on	
Description:	This command allows correcting for sensor frequency response characteristics. The power meter uses this frequency to automatically interpolate and apply the Cal Factor for that sensor (computed from Cal Factor data points stored within each sensor's EEPROM). Unless the EEPROM has been modified subsequent to shipment, the Cal Factor is always 0.0 dB at 50 MHz, 5e7. Be sure to correct for sensor cal factor by using this command, using automated V_{PROP}F correction, sending cal factor REFerence value, or correcting for Cal Factor in the ATE system by downloading Cal Factor points for the 58542.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:FREQ?	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:FREQ?	! QUERIES SENSOR 2 FREQUENCY VALUE FOR 50 MHZ
Response:	+5.0000E+07	
Description:	This command reports the current operating frequency setting for a particular sensor.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]*space*<ON-OFF>	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:VPRO ON	! ENABLES SENSOR 1 V_{PROP}F FUNCTION
Description:	Setting this control to ON activates V_{PROP}F and deactivates SENS#:CORR:FREQ.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:VPRO?	! QUERIES V_{PROP}F FUNCTION STATUS
Description:	This command reports the ON or OFF status of the V_{PROP}F 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 sent 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, measurement variation due to this discrepancy will typically be less than 0.02 dB, well below typical RSS measurement accuracy levels.

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

MEM:FREQ

Syntax:	MEMory[:TABLe]:FREQuency*space* <Start frequency>	
Example:	OUTPUT @PWR_MTR;MEM:FREQ 1E9	! SETS $V_{PROP}F$ FREQUENCY TO 1 GHZ
Description:	This command sets the automated $V_{PROP}F$ correction start frequency. The frequency at which the voltage input into the 58542 is 0.0 V.	

Syntax:	MEMory[:TABLe]:FREQuency?	
Example:	OUTPUT @PWR_MTR;MEM:FREQ?	! QUERIES $V_{PROP}F$ START FREQUENCY
Description:	This $V_{PROP}F$ command reports the start frequency setting.	

MEM:SEL

Syntax:	MEMory[:TABLe]:SELect*space* <ANALOGout,VPROpf1,VPROpf2>	
Example:	OUTPUT @PWR_MTR;MEM:SEL VPROPF1	! SELECTS MEMORY TABLE $V_{PROP}F1$! FOR EDITING IN FOLLOWING LINES
Description:	This command selects between one of three editable tables. Using the meter's automated $V_{PROP}F$ capability to correct for Cal Factor requires configuring the $V_{PROP}F$ IN connector to match the signal that source will output. This is performed by setting the frequency so that source's $V_{PROP}F$ output is 0.0 V. Then the slope relationship is entered in the form of a value representing the V/Hz relationship. If source is a Giga-tronics GT 9000 Series Signal Generator, this relationship is 0.5 V/GHz or 5e-8 V/Hz.	

Syntax:	MEMory[:TABLe]:SELect?	
Example:	OUTPUT @PWR_MTR;MEM:SEL?	! QUERIES THE SELECTED MEMORY TABLE
Response:	Tables currently editable; ANALOG, VPROPF1 or VPROPF2	
Description:	This command reports the currently active, editable table.	

2.5.17.1 V_{PROP}F Configuration

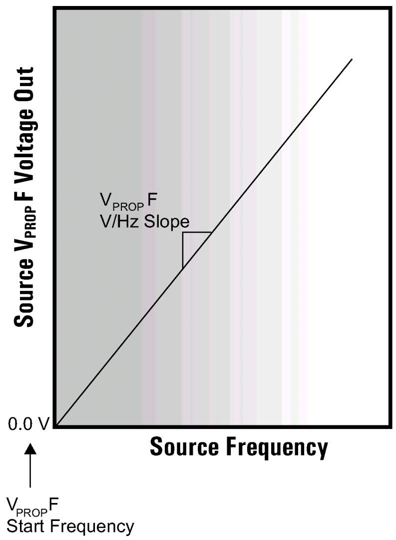


Figure 2-8: V_{PROP}F Configuration

MEM:SLOP

Syntax:	MEMory[:TABLe]:SLOPe*space* <Volts per Hz>	
Example:	OUTPUT @PWR_MTR;MEM:SLOP 1E-9	! SETS V_{PROP}F SLOPE TO 1 V/GHZ
Description:	This command sets the V/Hz relationship for automated Cal Factor correction.	

Syntax:	MEMory[:TABLe]:SLOPe?	
Example:	OUTPUT @PWR_MTR;MEM:SLOP?	! QUERIES V_{PROP}F SLOPE VALUE
Response:	The voltage to frequency value set that corresponds to source's V_{PROP}F output.	
Description:	This command sets the V/Hz slope relationship for V_{PROP}F frequency correction.	

2.5.17.2 Cal Factor Error Control

- See Error Messages in Section 2.5.34
- 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

2.5.18 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?

Syntax:	CALCulate<channel 1 to 2>:DATA?	
Example:	OUTPUT @PWR_MTR;CALC1:DATA?	! QUERIES 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.	

2.5.18.1 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. The fast mode permits more frequent return of measurement data to the host during operation in the modulated measurement modes (MAP, PAP or BAP).

CALC:MODE

Syntax:	CALCulate<channel 1 to 2>:MODE *space*<NORMal, BURSt or SWIFt selection>	
Example:	OUTPUT @PWR_MTR;CALC2:MODE NORMAL	! SETS THE MEASUREMENT TO NORMAL
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 unique applications. NORMal Mode is full functioned. SWIFt Mode allows individual data point triggering. BURSt Mode allows the fastest measurement rates.	

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

Syntax:	TRIGger:MODE*space* < burst mode data gathering POST trigger receipt or PRE trigger receipt >	
Example:	OUTPUT @PWR_MTR;TRIG:MODE POST	! SETS 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. Sending any configuration commands while the 58542 is collecting the PRE trigger data, interrupting the timing of the data point collection can be done.	

TRIG:DEL

Syntax:	TRIGger:DELay*space* < delay time between buffered readings in sec, 0.000 to 5.000 >	
Example:	OUTPUT @PWR_MTR;TRIG:DEL 5E-3	! SETS BURST MODE MEASUREMENT TIME TO ! 5 MS BETWEEN MEASUREMENTS
Example 2:	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 requiring 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.	

TRIG:COUN

Syntax:	TRIGger:COUNt*space* < number of data values to buffer in memory from 1 to 5000 >	
Example:	OUTPUT @PWR_MTR;TRIG:COUN 100	! SETS BURST OR SWIFT MODE BUFFER READING ! NUMBER TO 100
Description:	The 58542 has an internal 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. During BURSt mode, the COUNt # of readings will be taken with just one instrument trigger. During SWIFt Mode however, control the triggering of individual data points. Setting 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.	

Syntax:	TRIGger:COUNt?	
Example:	OUTPUT @PWR_MTR;TRIG:COUN?	! QUERY BURST OR SWIFT MODE BUFFER NUMBER
Response:	Response is a single number - the number of data points stored in memory during Burst of 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.	

2.5.18.2 Approximate Measuring 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.

Normal 1:	SENS1:AVER:TCON MOV INIT:COUN ON FETC1
Normal 2:	SENS1:AVER:TCON MOV INIT:COUN ON MEAS1?
Normal 3:	SENS1:AVER:TCON REP MEAS1?
Swift Imm	
Swift 1:	(SRQ Handshake) Swift 2:(without SRQ Handshake) Swift 3:(without TTL Handshake)
Burst	

2.5.18.3 Triggering Notes

Refer to Instrument Triggering in Section 2.5.14 for more information.

EXT triggering is performed with the front panel BNC connector and will work only 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 sending 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 using 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 specifying a TRIG:COUN # higher than 1. Using the FETCh#? measurement query, taking accurate measurements can be done anyway; do not set TRIG:COUN.

Using FETCh#? when having time-dependent measurement processes can be a little tricky unless using 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, manage the measurement/triggering timing problem closely.

2.5.18.4 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.

Example programs for High Speed Measurements are contained in Appendix A.

2.5.19 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:TRIGger

Syntax:	SENSe<sensor 1 or 2>:TRIGger:SOURce*space*<INTernal, EXTernal, or CW>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:SOUR CW	! SETS SENSOR 1 PEAK TRIGGER MODE TO CW MODE
Description:	This command controls the trigger source for the sensors. Both the Series 80350A 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.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]:*space*<delay in seconds from -20e-9 to 105e-3>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:DEL 1E-/6	! SETS SENSOR 2 PEAK DELAY VALUE TO 1E-6 ! SECONDS
Description:	The SENS:TRIG:DEL # is the time in seconds between the Series 80350A 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, measuring 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.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:DELay:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:DEL:STAT ON	! ENABLES PEAK SENSOR 1 DELAY FUNCTION
Description:	This command activates the sample delay in the Series 80350A Peak Power Sensors.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]*space*<R In EXT triggering use -0.1 to 5.000 V. In INT triggering use -30 to +20 dBm>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:LEV 1.7	! SETS PEAK SENSOR 1 TRIGGER LEVEL TO1.7 VOLTS
Description:	This command sets the trigger level for the Series 80350A 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. Using 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. Be sure to set the trigger level after the INTernal or EXTernal triggering is selected.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:OFFS 0	! SETS PEAK SENSOR 1 TRIGGER OFFSET TIME TO 0 ! SECOND
Description:	This command sets the peak power sensor trigger offset time.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:TOTAl[:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:TOTA?	! QUERIES PEAK SENSOR 1 TOTAL TRIGGER DELAY ! TIME
Response:	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.	

2.5.20 Averaging

■ SENSe:AVERage

Averaging is applied during normal operating mode. In the normal mode, Avg $_n$ results in $_n$ x 192 samples taken. In the Swift or Burst modes, Avg $_n$ results in 2_n 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:Average

Syntax:	SENSe <sensor 1 or 2> :AVERage:COUNt*space* <1,2,4,8,16,32,64,128,256,or 512>	
Example:	OUTPUT @PWR_MTR;SENS1:AVER:COUN 16	! SETS 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.	

Syntax:	SENSe <sensor 1 or 2> :AVERage:COUNt:AUTO*space* <ON | OFF>	
Example:	OUTPUT @PWR_MTR;SENS2:AVER:COUN:AUTO ON	! SELECTS 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.	

Syntax:	SENSe <sensor 1 or 2> :AVERage:TCONtrol*space* <data acquisition averaging method, MOVing or REPeat>	
Example:	OUTPUT @PWR_MTR;SENS1:AVER:TCON REP	! SETS 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, a measurement data point every time a sample is taken will occur, 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.	

2.5.21 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 setting personal calibration factors. Thus the channel and sensor offset functions can remain dedicated to other setup dependent controls in programming.

CALCulate:REFerence

Syntax:	CALCulate<channel 1 to 2>:REFerence:STATE*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC2:REF:STAT ON	! ACTIVATES LEVEL REFERENCE FOR RELATIVE ! MEASUREMENTS
Description:	This command activates the meter’s level reference to give it the ability to perform relative measurements.	

Syntax:	CALCulate<channel 1 to 2>:REFerence [:MAGnitude]<dB Offset value from -299.999 to 299.999>	
Example:	OUTPUT @PWR_MTR;CAL2:REF -30.11	! SETS 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).	

Syntax:	CALCulate<channel 1 to 2>:REFerence:COLLect	
Example:	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 sending this command, the channel measurement will be zero, assuming the power levels at the sensor(s) did not change and REF:STAT is ON.	

2.5.21.1 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.

2.5.22 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 measuring high power signals (>100 mW), but are not using Giga-tronics high power sensors, 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:CORRection

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet:COLLect	
Example:	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.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]*space*<offset value in dB, -99.99 to 99.99>	
Example:	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.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:OFFS?	! QUERIES SENSOR 2 OFFSET VALUE
Response:	0.0000E+00 for 0 dB.	
Description:	This query reports the current dB sensor offset value which is being subtracted from measurements.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:STAT ON	! ENABLES SENSOR 2 OFFSET CORRECTION
Description:	This command activates and deactivates the sensor offset function.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe?	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:STAT?	! QUERIES SENSOR 2 OFFSET FUNCTION STATUS
Response:	1 for ON or 0 for OFF.	
Description:	This query reports the ON or OFf status of the sensor offset function.	

2.5.23 SRQ & Status Monitoring

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

*CLS

Example:	OUTPUT @PWR_MTR;*CLS	! CLEARS 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, having 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

Syntax:	ESE*space*<event status register value, 0 to 255>	
Example:	OUTPUT @PWR_MTR;*ESE 16	! ENABLES BIT 4 OF EVENT STATUS REGISTER MASK
Description:	This command sets/clears the event status register enable mask.	

*ESR?

Example:	OUTPUT @PWR_MTR;*ESR?	! RETURNS EVENT STATUS REGISTER VALUE
Description:	This query returns the current status register value.	

*OPC

Example:	OUTPUT @PWR_MTR;*OPC	! *OPC ALLOWS ONE TIME SRQ ENABLE
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.	

*OPC?

Example:	OUTPUT @PWR_MTR;*OPC?	! RETURNS A VALUE OF 1 AFTER AN OPERATION IS COMPLETED
Description:	The *OPC? operation complete query allows synchronization between the controller and the test set using either the message available (MAV) bit in the status byte, or a read of the output OPC?.	

*SRE

Syntax:	*SRE*space* < event status register value, 128, 64, 32, 16, 8, 4, 2, 1 >	
Example:	OUTPUT @PWR_MTR;*SRE 32	! ENABLES BIT 5 OF STATUS BYTE REGISTER
Description:	This command sets the mask of the Status Byte register.	

Syntax:	*SRE?	
Example:	OUTPUT @PWR_MTR;*SRE?	! QUERIES BITS ENABLE OF STATUS BYTE REGISTER
Response:	Status register mask value.	
Description:	This query returns the mask of the Status Byte register.	

STAT:OPER

Syntax:	STATus:OPERation[:EVENt]?	
Example:	OUTPUT @PWR_MTR;STAT:OPER?	! QUERIES OPERATION EVENT REGISTER RESULT
Description:	This query returns the operation event register result.	

Syntax:	STATus:OPERation:ENABle*space* < event register value 0 through 65535 >	
Example:	OUTPUT @PWR_MTR;STAT:OPER:ENAB 1	! SETS THE EVENT REGISTER ENABLE MASK
Description:	This command sets the enable mask, which allows true conditions in the event register to be reported in the summary bit.	

STAT:PRES

Syntax:	STATus:PRESet	
Example:	OUTPUT @PWR_MTR;STAT:PRES	! CLEARS ALL THE STATUS REGISTER VALUE
Description:	This command clears all status registers.	

*STB?

Example:	OUTPUT @PWR_MTR;*STB?	! QUERIES 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.	

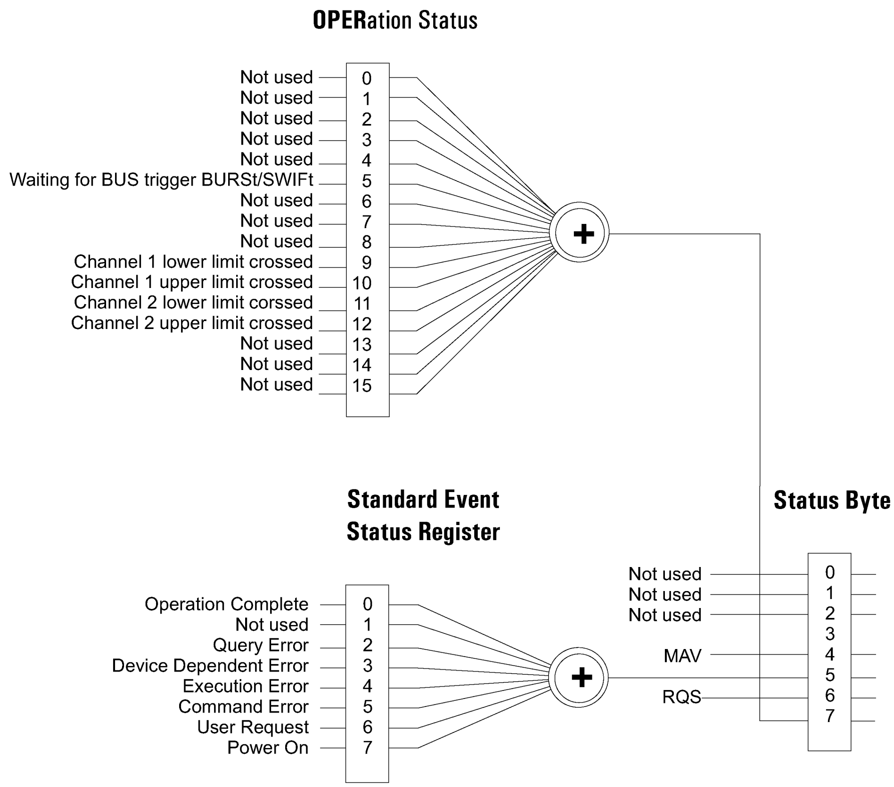


Figure 2-9: SCPI Status Structure Registers

2.5.23.1 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 that can used 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 = 128	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 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.

The *ESR? query returns the current value of the event status register.

☛ ***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).*

2.5.23.2 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 command 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.

2.5.24 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, 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

Syntax:	CALCulate<channel 1 to 2>:MAXimum:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC2:MAX:STAT ON	! ENABLES 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.	

Syntax:	CALCulate<channel 1 to 2>:MAXimum:STATe?	
Example:	OUTPUT @PWR_MTR;CALC2:MAX:STAT?	! QUERIES CHANNEL 2 MAXIMUM MODE
Response:	1 is for ON or 0 for OFF.	
Description:	Reports ON or OFF status of MAX monitoring.	

Syntax:	CALCulate<channel 1 to 2>:MAXimum[:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;CALC2:MAX?	! QUERIES CHANNEL 2 MAXIMUM VALUE IN DBM
Response:	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

Syntax:	CALCulate<channel 1 to 2>:MINimum:STATe*space*ON | OFF	
Example:	OUTPUT @PWR_MTR;CALC1:MIN:STAT ON	! ENABLES CHANNEL 1 MINIMUM TRACKING
Description:	This command activates the minimum channel value monitor.	

Syntax:	CALCulate<channel 1 to 2>:MINimum [:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;CALC1:MIN?	! QUERIES CHANNEL MINIMUM VALUE IN DBM
Response:	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.	

2.5.25 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:LIMit

Syntax:	CALCulate<channel 1 to 2>:LIMit:CLEar[:IMMediate]	
Example:	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.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:FCOunt?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:FCO?	! QUERIES NUMBER OF CHANNEL 1 LIMIT FAILURES
Response:	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.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:FAIL?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:FAIL?	! CHECK FOR CHANNEL 1 LIMIT LINE VIOLATION
Response:	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.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:LOWer*space*<numeric value in dB from -299.99 to 299.99>	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:LOW -50.0	! SETS 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.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:LOWer?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:LOW?	! QUERIES CHANNEL 1 LOWER LIMIT LINE SETTING
Response:	Response is a single number; the lower limit setting.	
Description:	This command queries the value of the lower limit line.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:STAT ON	! ENABLES CHANNEL 1 UPPER AND LOWER LIMIT ! CHECKING
Response:	0 = off; 1 = on	
Description:	This command activates and deactivates the limit line checking. The default condition is OFF.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:STATe?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:STAT?	! QUERIES CHANNEL 1 ON OR OFF STATUS
Response:	0 = off; 1 = on	
Description:	This command reports the activated or deactivated status of limit line checking.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:UPPer*space*<numeric value in dBm or dB from -299.99 to 299.99>	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:UPP 17.0	! SETS 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.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:UPPer?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:UPP?	! QUERIES CHANNEL 1 UPPER LIMIT LINE SETTING
Response:	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.	

2.5.26 Analog Output

- **MEMory:CHANnel**
- **MEMory:SELect**
- **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:CHANnel

Syntax:	MEMory[:TABLe]:CHANnel*space*<channel 1 to 2>	
Example:	OUTPUT @PWR_MTR;MEM:CHAN 2	! SETS ANALOG OUT TO CHANNEL 2
Description:	This command selects which channel will be present on the analog output connector.	

Syntax:	MEMory[:TABLe]:CHANnel?	
Example:	OUTPUT @PWR_MTR;MEM:CHAN?	! QUERIES ANALOG CHANNEL NUMBER
Response:	Response is channel 1 to channel 2.	
Description:	This query reports which channel will be present on the analog output connector.	

MEM:SELect

Syntax:	MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1,VPROPF2>	
Example:	OUTPUT @PWR_MTR;MEM:SEL VPROPF1	! SELECTS 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 configuring the numerically linear power measurement to voltage output relationship by defining the corresponding end points of power and voltage.	

Syntax:	MEMory[:TABLe]:SELect?	
Example:	OUTPUT @PWR_MTR;MEM:SEL?	! QUERIES MEMORY TABLE VPROPF1 ! FOR EDITING IN FOLLOWING LINES
Response:	Response is the table currently editable: ANALOG, V_{PROP}F1, or V_{PROP}F2.	
Description:	This query reports the currently editable table in the 58542.	

MEM:UNIT

Syntax:	MEMory[:TABLe]:UNIT*space*<choice of units dBm or Watt>	
Example:	OUTPUT @PWR_MTR;MEM:UNIT DBM	! SETS 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.	

Syntax:	MEMory[:TABLe]:UNIT?	
Example:	OUTPUT @PWR_MTR;MEM:UNIT?	! QUERIES ANALOG OUT POWER UNIT
Description:	This query reports the units used for analog output configuration.	

MEM:POWer

Syntax:	MEMory[:TABLe]:POWer*space*<start value from -80 to +20 dBm>*comma*<stop value from -80 to +20 dBm>	
Example:	OUTPUT @PWR_MTR;MEM:POW -70,20	! SETS 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.	

Syntax:	MEMory[:TABLe]:POWer*space*<start value from 0 to 0.01 W>*comma*<stop value from 0 to 0.01 W>	
Example:	OUTPUT @PWR_MTR;MEM:POW 0,1E2	! SETS 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 below.	

Syntax:	MEMory[:TABLe]:POWer?	
Example:	OUTPUT @PWR_MTR;MEM:POW?	! QUERIES ANALOG OUT POWER RANGE (IN DBM)
Response:	Response is two dBm 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:VOLTage

Syntax:	MEMory[:TABLe:VOLTage*space*<start value from -10 to +10 V>*comma*<stop value from -10 to +10 V>	
Example:	OUTPUT @PWR_MTR;MEM:VOLT -7,2	! SETS 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 desired 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.	

Syntax:	MEMory[:TABLe:VOLTage?	
Example:	OUTPUT @PWR_MTR;MEM:VOLT?	! QUERIES ANALOG OUT VOLTAGE RANGE
Response:	Two voltage values separated by commas indicating analog output range.	
Description:	This query reports the end points of the voltages configured for analog output operation.	

OUTP:ANAlog

Syntax:	OUTPut[:BNC]:ANAlog[:STATe]*space*< ON | OFF >	
Example:	OUTPUT @PWR_MTR;OUTP:ANA ON	! ENABLES 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.	

Syntax:	OUTPut[:BNC]:ANAlog[:STATe]?	
Example:	OUTPUT @PWR_MTR;OUTP:ANA?	! QUERIES ANALOG OUT FUNCTION STATUS
Response:	1 for ON or 0 for OFF.	
Description:	This query reports the ON or OFF status of the analog output.	

2.5.27 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 the 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.

*RCL

Syntax:	*RCL*space*<memory location number 0 to 20>	
Example:	OUTPUT @PWR_MTR;*RCL 19	! RECALL 58542 REGISTER 19
Description:	Recalls instrument configuration. 0 is the PRESet configuration.	

*SAV

Syntax:	*SAV*space*<memory location number 1 to 20>	
Example:	OUTPUT @PWR_MTR;*SAV 20	! SAVES AT 58542 REGISTER 20
Description:	Saves current configuration to memory. Saving a configuration to memory position 0 cannot be done.	

2.5.28 Halting Operation

- ABORt

ABORt

Example:	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.	

☛ ***NOTE:*** *When using the 8035XA Peak Sensor, if a Time-Out occurs due to the sensor not triggering (i.e., Level too low) then send "Abort" to clear the meter.*

2.5.29 Preset Configuration

- *RST
- STATus:PRESet
- SYSTem:PRESet

*RST

Example:	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

Example:	OUTPUT @PWR_MTR;STAT:PRES	! CLEARS ALL THE STATUS REGISTER VALUE
Description:	This command resets the 58542 Status information buffers. See Table 2-4. Note that these are not the power ON conditions.	

SYSTem:PRESet

Example:	OUTPUT @PWR_MTR;SYST:PRES	! RESET 58542 CONFIGURATION
Description:	This command resets the 58542 configuration to a known condition. SYST:PRES is identical in function to *RST (Command Default, Minimum, Maximum).	

Table 2-4: Reset & Power on Default Commands

Command	Default	Minimum	Maximum
CALCulate1[:CHANnel]: CALCulate2[:CHANnel]:	POWer 1 POWer 2	,	
CALCulate1-2:			
LIMit			
STATe	OFF		
UPPer	299.999	-299.999	299.999
LOWer	-299.999	-299.999	299.999
FAIL?	0		
FCOunt?	0		
MAXimum:			
STATe	OFF		
[MAGnitude]	299.999	-299.999	299.999
MINimum:			
STATe	OFF		
[MAGnitude]	-299.99	-29.999	29.99
MODE	NORmal		
REFerence:			
STATe	OFF		
[MAGnitude]	0	-299.99	299.99
STATe	ON		
UNIT	dBm		
INITiate:CONTinuous	OFF	,	

Table 2-4: Reset & Power on Default Commands (Continued)

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] VPROpf[: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

2.5.30 Identification Commands

- ***IDN**
- **SENSe:CORRection:EEPROM:TYPE?**
- **SYSTem:VERSion**

Identification commands ensure that the power meter and sensor are appropriate for the test program. The sensor identification commands allow monitoring 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 publication.*

*IDN?

Example:	OUTPUT @PWR_MTR;*IDN?	QUERY INST. MFGR & MODEL #
Response:	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?

Syntax:	SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:EEPROM:TYPE?	! QUERIES SENSOR 1 EEPROM TYPE
Response:	80301,1818436 which is model number and serial number respectively	
Description:	This command returns sensor model and serial number information.	

SYST:VERSion

Syntax:	SYSTem:VERSion?	
Example:	OUTPUT @PWR_MTR;SYST:VERS?	! QUERIES SCPI VERSION
Response:	1995.0	
Description:	This query returns the compiled SCPI version.	

2.5.31 Calibrator Controls

■ OUTPut:Reference:OSCillator

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

■ OUTP:ROSC

OUTP:ROSC

Syntax:	OUTPut:ROSCillator[:STATe]*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;OUTP:ROSC ON	! TURN ON CALIBRATOR OSCILLATOR
Description:	The reference oscillator (Calibrator port) connection is 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.	

Syntax:	OUTPut:ROSCillator[:STATe]?	
Example:	OUTPUT @PWR_MTR;OUTP:ROSC?	! QUERIES INST. MFGR & MODEL #
Description:	This query command returns the ON or OFF status of the meter's built-in reference oscillator.	

2.5.32 Sensor EEPROM Commands

■ SENSe:CORRection:EEPROM:TYPE?
■ DIAGnostic:SENSe:CORRection:EEPROM:CALFRange?
■ SENSe:CORRection:EEPROM:CALFactor?
■ SENSe:CORRection:EEPROM:FREQuency?

SENSe:CORRection:EEPROM:TYPE?

Syntax:	SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:EEPROM:TYPE?	! QUERIES SENSOR 1 EEPROM TYPE
Response:	Typically, 80301,1818436 which is model number and serial number respectively	
Description:	This command allows programming to verify correct sensor usage and monitor whether power sweep calibration has been performed or not.	

DIAGnostic:SENSe:CORRection:EEPROM:CALFRange?

Syntax:	SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	
Example:	OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFR?	! QUERIES SENSOR 1 EEPROM CAL FACTOR RANGE TABLE
Response:	Typically 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:CORRection:EEPROM:CALFactor?

Syntax:	SENSe <sensor 1 or 2> :CORRection:EEPROM:CALFactor?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:EEPROM:CALF?	! QUERIES SENSOR 1 EEPROM CAL FACTOR TABLE
Response:	Typically, 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?	

SENSe:CORRection:EEPROM:FREQuency?

Syntax:	SENSe <sensor 1 or 2> :CORRection:EEPROM:FREQuency?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:EEPROM:FREQ?	! QUERIES SENSOR 1 EEPROM FREQUENCY TABLE
Response:	Typically, 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.	

2.5.33 Self-Test

■ *TST?

*TST?

Syntax:	*TST?	
Example:	OUTPUT @PWR_MTR;*TST?	! QUERIES SELF-TEST RESULT
Response:	0 if all is OK, otherwise, it returns a value of 1.	

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 Indication & 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	

Table 2-5: Self-Test Error Indication & Limitations (Continued)

Error Number	Result	Minimum	Maximum	Test Description
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	
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	

Table 2-5: Self-Test Error Indication & Limitations (Continued)

Error Number	Result	Minimum	Maximum	Test Description
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.
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.

Table 2-5: Self-Test Error Indication & Limitations (Continued)

Error Number	Result	Minimum	Maximum	Test Description
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 3fffff 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.

2.5.34 Error Messages

■ SYSTem:ERRor?

SYSTem:ERRor?

Syntax:	SYSTem:ERRor?	
Example:	OUTPUT @PWR_MTR;SYST:ERR?	! QUERIES 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: SCPI Standard 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:STATe	Channel is not valid	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:REFerence:COLLect	Normal mode is off Channel is not valid	Burst mode setup No sensor or sensor not calibrated
CALibrate1	No sensor Sensor not connected to calibrator Sensor calibration error	No sensor Calibration error
CALibrate1:ZERO	No sensor Sensor zeroing error	 Zeroing error
DIAGnostic:SENSe1:EEPROM:CORRection	No valid sensor sensor eeprom data:correction factor number does not match	No sensor
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:SENSe:EEPROM:FREQSTandard?	No valid sensor Sensor eeprom data is over space	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFRange 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

Table 2-7: Device Specific Error Messages (Continued)

Command	Error Message	Example of Problem
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:POWer	Analog out Table is not selected Analog out Table data input error	Other table Lower power is greater than upper power
MEMory:TABLe:SLOPe	No valid sensor V_{PROP}F Table is not selected	Select others No sensor
MEMory:TABLe:UNIT	Analog out Table is not selected	Other table
MEMory:TABLe:VOLTage	Analog out Table is not selected Analog out Table data input error	Other table Lower voltage is greater than upper voltage
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	No valid sensor	No sensor
SENSe1:TRIGger:DELay SENSe1:TRIGger:LEVel	No valid sensor Sensor is in CW source mode	No pulse sensor
SENSe1:TRIGger:DELay:STATe ON	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: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

3

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 P/N	DWG
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 Meter's 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 DWG 21406 in Chapter 7 for specific interconnect information.

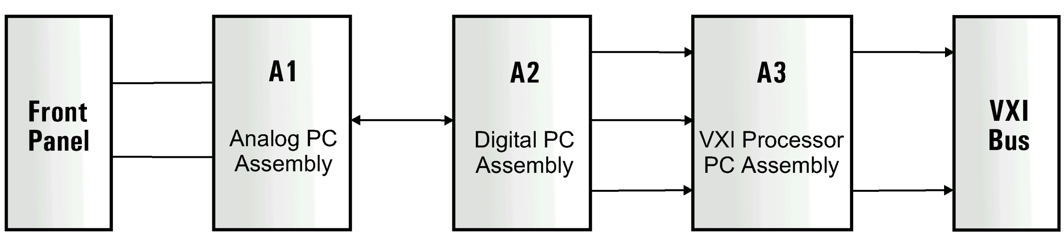


Figure 3-1: VXI Power Meter System Block Diagram

3.3 Analog PC Board (A1)

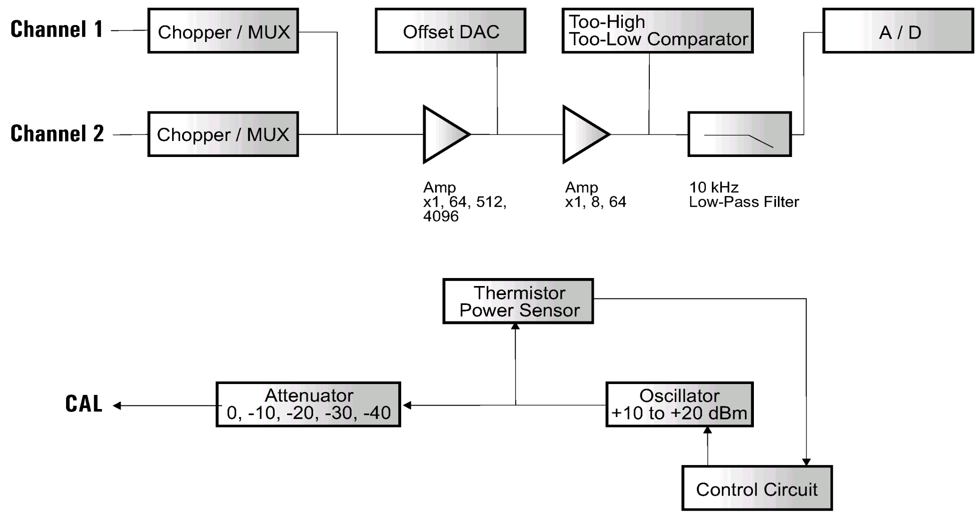


Figure 3-2: Analog PC Assembly Block Diagram

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 12 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 µs 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_{PROP}F input that enters through J3 on the front panel. CR15 provides input protection, and U21A is a x1 amplifier/buffer. The V_{PROP}F signal can be read at pin 26 of the multiplexer. U25 is a 14-bit A/D converter which operates at an 11 µs 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 DWG 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.

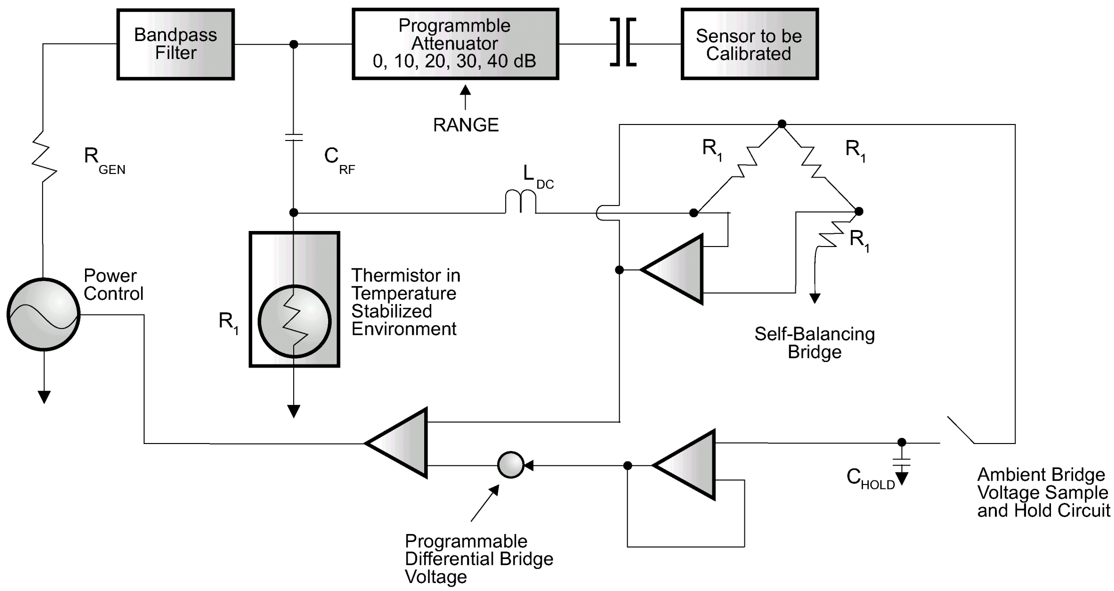


Figure 3-3: Calibrator Internal Power Standard Configuration

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:

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

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)

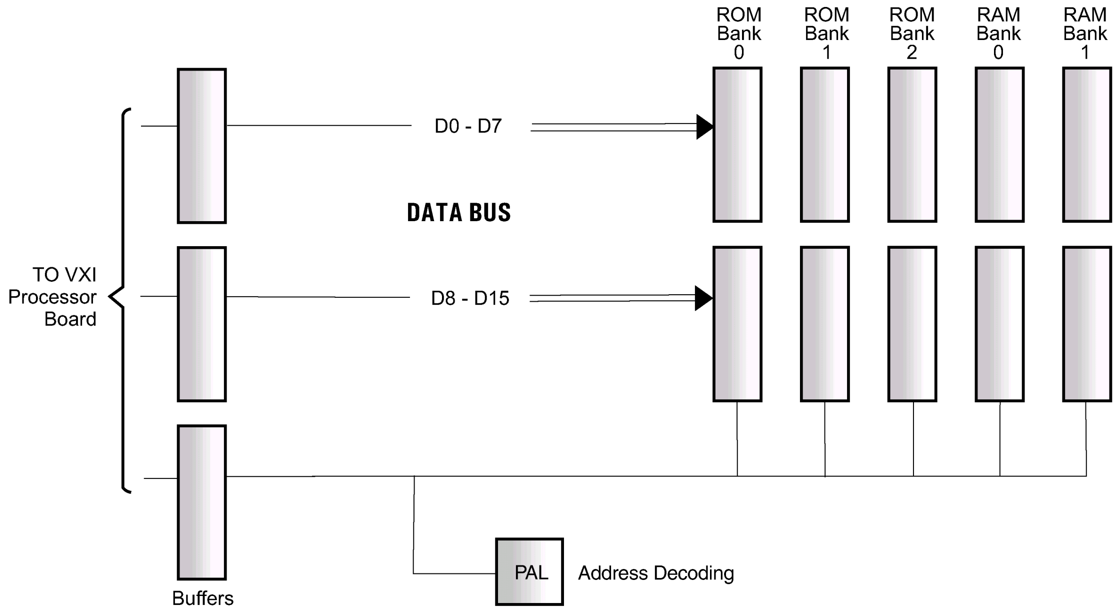


Figure 3-4: Digital PC Assembly (A2) Block Diagram

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 µA, 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)

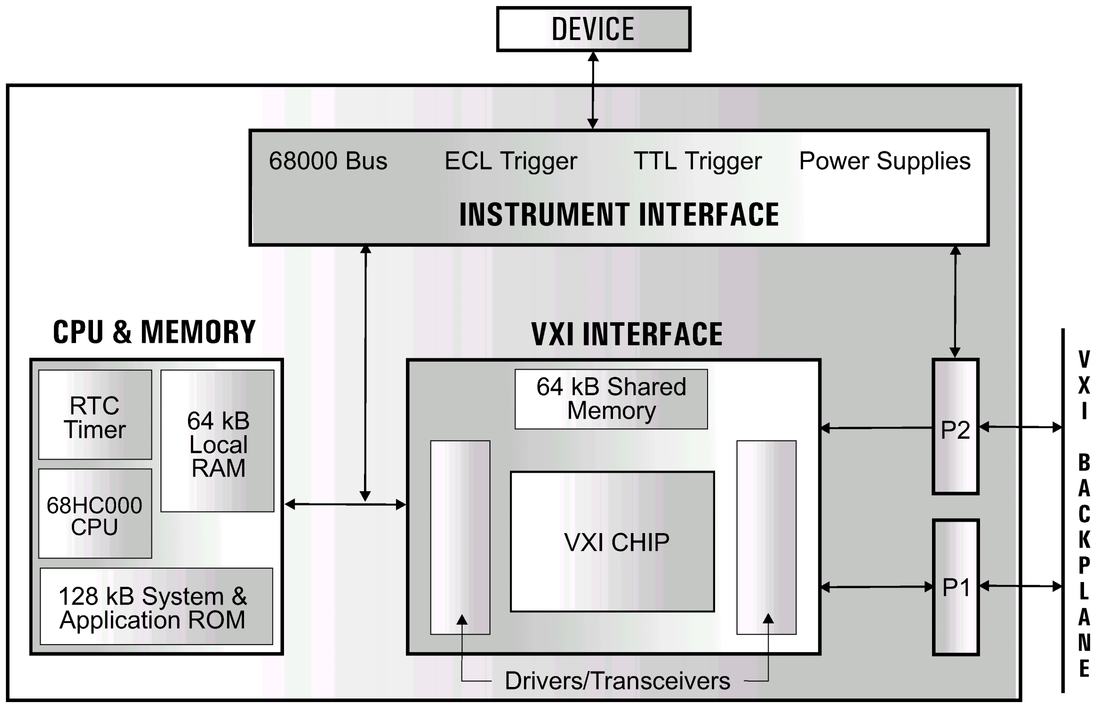


Figure 3-5: VXI Processor (A3) Block Diagram

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 2.5.30). 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.

3.6.1.1 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.

3.6.1.2 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.

3.6.1.3 Shared Memory Decoders

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

3.6.1.4 Drivers & 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.

3.6.1.5 Logical Address Switch

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

3.6.1.6 TTL Triggers & 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 & Memory

3.6.2.1 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.

3.6.2.2 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.

3.6.2.3 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.

3.6.2.4 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.

3.6.2.5 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.

3.6.2.6 Drivers & 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.

3.6.2.7 Local Memory

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

3.6.2.8 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.

4

Calibration & Testing

4.1 Introduction

Information in this chapter is useful for periodic calibration and testing of the 58542 VXIbus 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, please review Section 2.3.

4.2 Equipment Required

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

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	±0.05% accuracy and 1 μV 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 ±0.1dB 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
GPIB 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 ±0.7%. To achieve this accuracy, Giga-tronics uses a precision measurement system with accuracy to ±0.5% (traceable to the NIST) and allows for a transfer error of ±0.2% for a total of ±0.7%. If an equivalent measurement system is used for verification, the power reference oscillator output can be verified to 1mW ±1.9% (±1.2% accuracy + ±0.5% verification system error + ±0.2% transfer error = ±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.

4.3.1.1 Equipment Required

HP 432A Power Meter • DVM • Thermistor Power Meter • Thermistor Mount

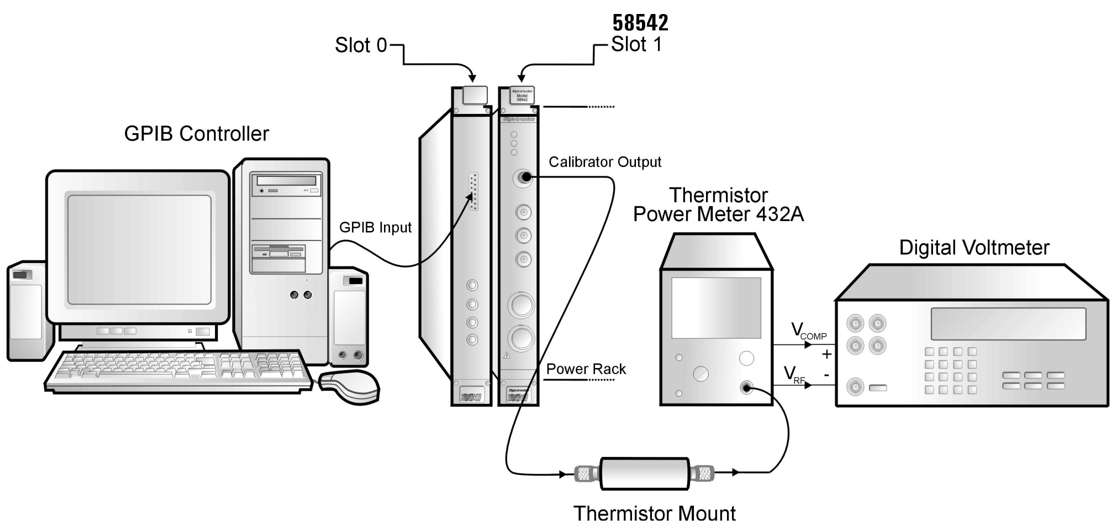


Figure 4-1: Calibrator Reference Level Test Setup

4.3.1.2 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 HP 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 (±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 µV. Connect the positive lead to the V_{COMP} connector, and the negative lead to V_{RF} connector, both on the rear panel of the HP 432A.

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 V_0.

7. Turn on the power meter Calibrator RF power by sending

   OUTP:ROSC ON

8. Record the reading shown on the DVM as V_1.

☛ ***NOTE:*** *The V_1 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 HP 432A 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:

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

where:

P_{RF} = calibrator output power reference level
V_{COMP} = previously recorded value in Step 9
V_1 = previously recorded value in Step 8
V_0 = previously recorded value in Step 6
R = 200W (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 ±0.019 mW (0.981 to 1.019 mW)

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

4.3.2 Calibrator Output Power

To correct the setting of the power output of the calibrator, the password must be known if it has been set, or 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, 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.

The Performance Verification Test Data Sheet is 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.

4.4.1.1 Equipment Required

GPIB Controller

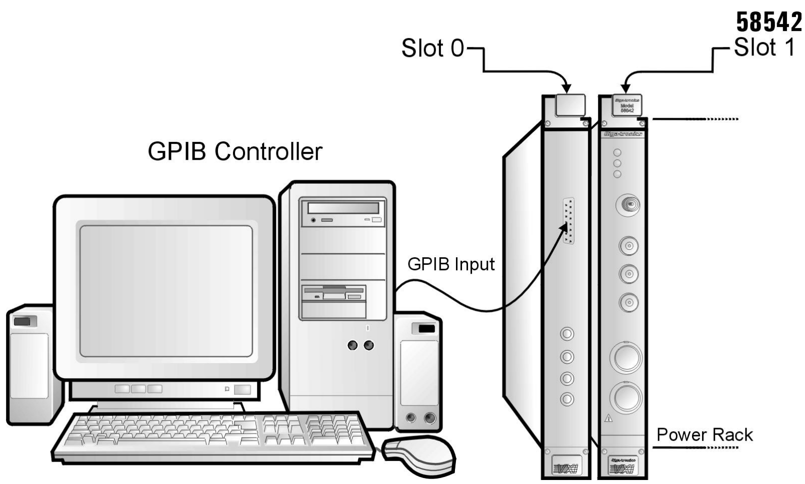


Figure 4-2: GPIB Port Test Setup

4.4.1.2 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 VXIbus Universal 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 2.5.28.*

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 (Series 8031XA) or a High Power (Series 8032XA) 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 (Series 8030XA) and True RMS (Series 8033XA) 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 Test Data Sheet 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.

4.4.2.1 Setup Parameters

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

4.4.2.2 Equipment Required

GPIB Controller • Digital Voltmeter • RF Signal Generator • Thermistor Power Meter • Directional Coupler • Step Attenuator • Power Sensor

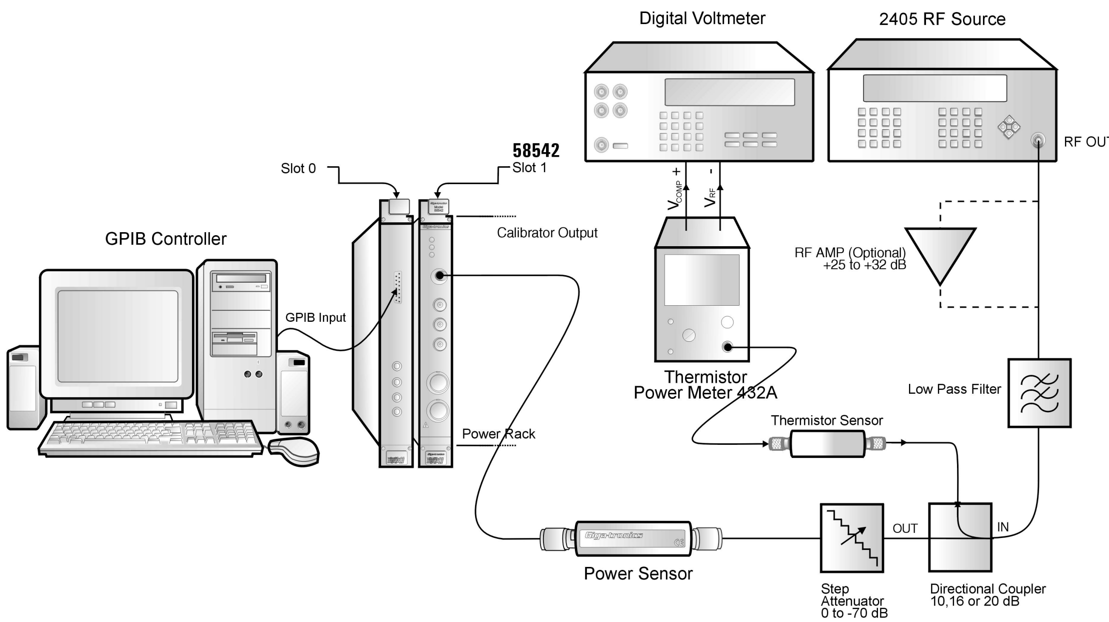


Figure 4-3: Power Sensor Linearity Test Setup

1. The power meter and sensor should be calibrated by following the instructions in Section 4.3 of this publication.

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 HP 432A 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 Sheet.

4.4.2.3 Test Procedure

1. 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**)

2. Set the step attenuator to 0 dB after the power meter has zeroed.

3. Set the power output of the RF source so that the thermistor power meter indicates 1.00 mW ±0.025 mW.

4. 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.

5. Set the power output of the RF source so that the thermistor power meter indicates 3.98 mW ±0.10 mW.

6. Record the new calculated power meter reading and the new power meter reading in the correct columns of the Linearity Data section of the data sheet.

7. Set the power output of the RF Source so that the thermistor power meter indicates 3.98 mW ±0.10 mW.

8. Record the calculated power meter reading and the power meter reading in the correct columns of the Linearity Data section of the data sheet.

9. Set the power output of the RF Source so that the thermistor power meter indicates 5.01 mW ±0.13 mW.

10. Record the new calculated power meter reading and the new power meter reading in the correct columns of the Linearity Data section of the data sheet.

11. Repeat using the power meter indications in the Test Data 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 section of the data sheet.

12. Make the calculations indicated on the Linearity Data section of the test 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.

58542 VXIBUS UNIVERSAL POWER METER

Performance Verification Test Data Sheet (1 of 2)

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	Linearity Error (%)[1]	
						Linearity Specification	Accumulated Linearity Error[2]
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] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

58542 VXIBUS UNIVERSAL POWER METER

Performance Verification Test Data Sheet (2 of 2)

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	Linearity Error (%)[1]	
						Linearity Specification	Accumulated Linearity Error[2]
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] x 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 on page 4-13.

5

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 unit's front panel and housing 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 Section 4.4 of this publication. 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 7-6. 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 P/N 21212.

5.3.1 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. The 58542 can be turned off while changing the battery, but install the new battery within ten seconds to avoid losing RAM data.
5. Disconnect the battery wires. The connector is polarized so it can be inserted only one way, with the red wire toward the rear of the instrument.
6. Install the new battery and connect the wires.
7. Turn the 58542 off and measure the battery voltage between TP13 (common) and TP17 (bat). It must be at least 3.6 V.
8. Connect a voltmeter between A2TP1 & TP2. The voltage must settle to <3 mV. If above this level, the battery life will be shortened. The only load on the battery is the static RAM. It might be necessary to find out which chip is drawing too much current, and replace it if the current is excessive.
9. Replace the cover and secure.

10. If desired, attach a label indicating when the next battery replacement is due.

11. Test for satisfactory operation of the new battery. Turn on the 58542 and calibrate a sensor. Turn the 58542 off, wait ten seconds, and turn on the 58542. The sensor calibration should still be valid as indicated by proper measurement of a power level.

5.4 GPIB Test Functions

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

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

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

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

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

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

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

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

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

5.4.1 58542 Channel 2 Troubleshooting

If only one channel will calibrate, troubleshoot the circuits associated with the channel that fails. The separate channels are shown on Sheet 1 (Ch 2) and Sheet 2 (Ch 1) of Schematic DWG 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 58542 VXIbus Universal 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	Function
DIAGnostic:ADC? OUTPUT @PWR_MTR;DIAG:ADC?	Query analog to digital converter reading (Return: 0 – 32767)
DIAGnostic:AVADC?*space***16** OUTPUT @PWR_MTR;DIAG:AVADC? 16	Query analog to digital reading with 16 average (Average from 1 to 512) (Return: 0 – 32767)
DIAGnostic:AVOLT?*space***16** OUTPUT @PWR_MTR;DIAG:AVOLT? 16	Query analog to digital reading in volts with 16 average (Average from 1 to 512) (Return: 0 – 10)
DIAGnostic:BNC:ANAlog*space*5.5 OUTPUT @PWR_MTR;DIAG:BNC:ANA 5.5	Set analog BNC port output to 5.5 V (-10 – 10)
DIAGnostic:BNC:TRIGger? OUTPUT @PWR_MTR;DIAG:BNC:TRIG?	Query EXT trigger input high, 5 V or low, 0.00 V, status (1: Triggered, 0: No trigger)
DIAGnostic:BNC:VPROpf? OUTPUT @PWR_MTR;DIAG:BNC:VPRO?	Query V_{PROP}F port reading (0 – 32767)
DIAGnostic:CALibrator:ATTenuator*space***10** OUTPUT @PWR_MTR;DIAG:CAL:ATT 10	Set calibrator attenuator to 10 dB (0 – 40)
DIAGnostic:CALibrator:ATTenuator? OUTPUT @PWR_MTR;DIAG:CAL:ATT?	Query calibrator attenuator value
DIAGnostic:CALibrator:EEPROM*space***100** OUTPUT @PWR_MTR;DIAG:CAL:EEPROM 1800123,30,9,23,6,92,0,123456	Set calibrator EEPROM data: cal fac, s/n, min, hr, day, month, yr, password flag (0:Disable, 1:Enable), password
DIAGnostic:CALibrator:EEPROM? OUTPUT @PWR_MTR;DIAG:CAL:EEPROM?	Query calibrator eeprom data
DIAGnostic:CALibrator:POWer*space***-23.5** OUTPUT @PWR_MTR;DIAG:CAL:POW-23.5	Set calibrator power to -23.5 dBm
DIAGnostic:CALibrator:PTEMperature? OUTPUT @PWR_MTR;DIAG:CAL:PTEM?	Query calibrator temperature (in Celsius)
DIAGnostic:CALibrator:SOURce*space***9.5** OUTPUT @PWR_MTR;DIAG:CAL:SOUR 9.5	Set calibrator internal power to 9.5 dBm (Power output in dBm assuming perfect 10 dB pad)
DIAGnostic:CALibrator:VAMB? OUTPUT @PWR_MTR;DIAG:CAL:VAMB?	Query calibrator bridge volts (0 – 10)
DIAGnostic:CTABle?*space***<Sensor 1 or 2>** OUTPUT @PWR_MTR;DIAG:CTAB? 1	Query sensor 1 calibration data

Table 5-1: Diagnostic Commands (Continued)

Command Syntax	Function
DIAGnostic:GAIN*space*A-B,0-1,-2-3-4-5-6,N-I-G-O OUTPUT @PWR_MTR;DIAG:GAIN	Set gain circuit; Channel, Gain, Mode, A,B Channel, Gain 0 to 6; N: Non_invert, I: Invert, G:Ground, O:Option
DIAGnostic:LED*space*ON-OFF OUTPUT @PWR_MTR;DIAG:LED ON	Turn trigger led on
DIAGnostic:MULtiplexer*space*MA-MB-MC .... MO-MP OUTPUT @PWR_MTR;DIAG:MUL MA	Set multiplexer
DIAGnostic:MEASurement*space*STARt-STOP OUTPUT @PWR_MTR;DIAGMEAS STAR	Resume measurement process
DIAGnostic:OFFSet*space*3.5 OUTPUT @PWR_MTR;DIAG:OFFS 3.5	Set ADC offset to 3.5 V (-5 to +5)
DIAGnostic:RAM? OUTPUT @PWR_MTR;DIAG:RAM?	Query ram destructive test result (0 = Pass; 1 = Fail)
DIAGnostic:ROM? OUTPUT @PWR_MTR;DIAG:ROM?	Query rom test result (0 = Pass; 1 = Fail)
DIAGnostic:RAWdata*space*<ON or OFF> OUTPUT @PWR_MTR;DIAG:RAW ON	Enable measurement raw data output
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:READ OUTPUT @PWR_MTR;DIAG:SENS1:READ	Read eeprom table data from sensor 1 into editor memory
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:WRITe 123456 OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:WRIT 123456	Write eeprom sensor 1 editor data into sensor (Using password)
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:TYPE 80301,0,59,9,22,12,92,0 OUTPUT @PWR_MTR;DIAG:SENS2:TYPE 80301,0,59,9,22,12,92,0	Edit sensor 2 eeprom type table data: model, s/n, cal location, min, hour, day, month, year, password flag (0:Disable, 1:Enable)
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:SPEC 1e7,18e9,4100,3900 OUTPUT @PWR_MTR;DIAG:SENS2:SPEC 1E7,18E9,4100,3900	Lower frequency, upper frequency video R+, R-
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:TYPE? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:TYPE?	Query sensor 1 eeprom type table data
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CORRection OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CORR "1.1,2.1,3.1,4.1,5.1,6.1,7"	Edit sensor 1 eeprom correction table: A,B,C,D,E,H
DIAGnostic:SENS<sensor 1 or 2>:EEPROM CORRection? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CORR?	Query sensor 1 eeprom correction table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange 2e9,1e9,17,1 OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFR 2E9,1E9,17,1	Edit sensor 1 eeprom cal factor range table:standard:start:cf freq, step cf freq, cf number, special cf number
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFR?	Query sensor 1 eeprom cal factor range table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSTandard? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:FREQST?	Query sensor 1 eeprom cal factor standard freq table
DIAGnostic:SENS<sensor 1 or 2>:FREQSPecial? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:FREQSP?	Query sensor 1 eeprom cal factor special freq table

Table 5-1: Diagnostic Commands (Continued)

Command Syntax	Function
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSPecial*space double quote***one or more frequencies 1e7 to 40e9***double quote* OUTPUT @PWR_MTR;DIAG:SENS1 :EEPROM:FREQSP "1E9,2.2E9"	Add special cal factors at 1 GHz and 2.2 GHz
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSTandard? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFST?	Query sensor eeprom cal factor standard table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSTandard*space quote* **0.20,0.30,0.40,0.50,0.60,0.70,0.80,0.90,0,0.10,0.11,0.12,0.13,0.14, 0.15,0.16,0.17,0.18***quote* OUTPUT @PWR_MTR;DIAG:SENS1:CALFST "0.20,0.30,0.40,0.50,0.60,0.70,0.80,0.90,0,0.10,0.11,0.12,0.13,0.14,0.15.0.16,0.17,0.18"	Edit sensor 1 eeprom cal factor standard table: 2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18. Standard Cal Factor frequencies Match Start,Step and #
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSPecial*space double quote* **one or more calfactor values-99.9***double quote* OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFSP "0.03,-0.04"	Added sensor 1 cal factors, # of items matches # of Frequencies
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSPecial? OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFSP?	Query sensor 1 special frequency cal factor
DIAGnostic:SENVolt*space* **<ON or OFF>** OUTPUT @PWR_MTR;DIAG:SENV ON	Turn on sensor 5 volt line
DIAGnostic:VOLT? OUTPUT @PWR_MTR;DIAG:VOLT?	Query ADC reading in volts
DIAGnostic:ZTABle?*space* **<sensor 1 or 2>** OUTPUT @PWR_MTR;DIAG:ZTAB? 1	Query sensor 1 zeroing data

6

Parts Lists

6.1 Introduction

This chapter contains the parts lists for all assemblies in the 58542 VXIbus Universal Power Meter. Each parts list includes the CAGE identifier. A list of manufacturers is in Section 6.3.

6.2 58542 VXIbus Universal Power Meter Parts Lists

58542	VXI POWER METER, REV: E				
Item	**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
	32273	REF	58900	32273	MODEL 58542 LAB WINDOWS
1	21383-A00	1	58900	21383-A00	58542,VXI CHASSIS ASSY
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
8	32442	REF	58900	32442	OUTLINE DRAWING FOR 58542 VXI

21383-A00	58542, VXI CHASSIS ASSY, REV: H				
Item	**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**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
11	20192	1	58900	20192	SHELL,OBLONG
12	20259	1	58900	20259	COVER,CALIBRATOR HOUSING

21383-A00		58542, VXI CHASSIS ASSY, REV: H (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
	13	20800	1	58900	20800	LABEL,US PATENT 4,794,325
	14	20112	1	58900	20112	CALIB THERM OVEN PCB ASSY
	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
	112	32023	REF	58900	32023	CODE LABEL
A	1	21359	1	58900	21359	PCB ASSY,ANALOG VXI
A	2	21356	1	58900	21356	PCB ASSY,DIGITAL
A	3	21418	1	58900	21418	PCB ASSY,VXI PROCESSOR
BT	1	VB00-00360	1	68630	TL-5242/W	3.6 VOLT LITHIUM BATTERY
U	13	21371	1	58900	21371	PROM SET, VXI DIGITAL
U	14	21371	REF	58900	21371	PROM SET, VXI DIGITAL
U	15	21371	REF	58900	21371	PROM SET, VXI DIGITAL
U	16	21371	REF	58900	21371	PROM SET, VXI DIGITAL
W	1	21442	1	58900	21442	CABLE ASSY,CAL
W	2	21405	1	58900	21405	CABLE ASSY,SENSOR INPUT
W	3	21405	1	58900	21405	CABLE ASSY,SENSOR INPUT

21359		PCB ASSY, ANALOG VXI, REV: R				
Item		P/N	Qty	Cage	Mfr's P/N	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
	7	HQH0-00000	2	05820	274-2AB	HEATSINK
	9	GFU0-01204	0	53387	4504-3/4"	3/4 X 1/4 FOAM TAPE
	10	21385	1	58900	21385	COVER,BTM,SENSOR INPUT
	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

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
	107	HSCS-40204	3	-----	BR6921B-0.156-34	4-40 x 5/32 SWAGE SPACER
	112	20260	1	-----	20260	HOUSING,CALIBRATOR
	114	21384	1	58900	21384	COVER,TOP,SENSOR INPUT
C	10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	18	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	19	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	20	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	21	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	22	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	23	CD99-01820	1	-----	DM15821F	820 PF 300V DIP MICA
C	24	CD99-01820	1	-----	DM15821F	820 PF 300V DIP MICA
C	25	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	31	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	33	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	34	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	35	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	36	CC98-00330	1	-----	CCD-330	33 PF 1KV CERAMIC NPO
C	37	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	38	CC50-04220	1	31433	C330C224MSU5CA	.22 UF CERAMIC Z5U
C	39	CF00-04470	1	58900	CF00-04470	.47UF 100V POLYPROPYLENE
C	40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	42	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	44	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	46	CE50-R5470	1	74840	475PGM050M	4.7UF 50V RADIAL
C	47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	48	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	49	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	52	CD99-01150	1	-----	DM15-151F	150 PF DIP MICA
C	53	CD99-01240	1	-----	DM15-241F	240 PF DIP MICA
C	54	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	55	CD99-00620	1	-----	CMO5FD620F03	62 PF DIP MICA
C	56	CD99-01120	1	-----	CMO6FD121J03	120 PF DIP MICA
C	57	CD99-00620	1	-----	CMO5FD620F03	62 PF DIP MICA
C	58	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	59	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	60	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	61	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	62	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	63	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	64	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	65	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	66	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	67	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	68	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	69	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	70	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	71	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	72	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	73	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	74	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	75	CC50-04220	1	31433	C330C224MSU5CA	.22 UF CERAMIC Z5U
C	76	CC50-?????	1	58900	CC50-?????	COMPONENT SELECTED IN TEST
C	77	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	78	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C	79	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	80	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	81	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	82	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	83	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	84	CC50-03470	1	04222	SR205C473KAA	.047 UF CERAMIC X7R
C	85	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	86	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	87	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C	88	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	90	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C	91	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	92	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	93	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	94	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	100	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	101	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	102	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	103	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	104	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	105	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	106	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	107	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	108	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	109	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	110	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	112	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	114	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	115	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	124	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	126	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	127	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	128	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	129	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	130	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	131	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	132	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	133	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	134	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	135	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	136	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	137	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	138	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	139	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	140	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	141	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	142	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	143	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	144	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	145	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
C	14	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	147	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	148	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	149	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	150	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	151	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	152	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	153	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	154	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	155	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	156	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	157	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	158	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	161	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	162	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	163	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	167	CD99-02250	1	-----	DM19F252J500V	2500 PF 500 V DIP MICA
C	171	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	173	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	174	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	175	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C	176	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C	177	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	178	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	179	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	180	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	185	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C	186	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C	187	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	188	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	189	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	190	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	191	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	192	CC50-04220	1	31433	C330C224MSU5CA	.22 UF CERAMIC Z5U
CR	1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
CR	7	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	8	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	9	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	10	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	11	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	12	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	13	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	14	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	15	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	16	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	17	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	20	DZAB-00751	1	04713	1N751A	1N751A 5.1V ZENER
CR	21	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	22	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	23	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	24	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
DS	1	ILYR-00200	1	83330	550-0306	RIGHT ANGLE YELLOW LED
DS	2	ILGR-10200	1	08MU3	5300H5	RIGHT ANGLE GREEN LED
DS	3	ILRR-20200	1	83330	550-0406	RIGHT ANGLE RED LED
J	3	JRDF-00008	1	09769	413524-1	BNC F RT ANG PC MOUNT
J	4	JRDF-00008	1	09769	413524-1	BNC F RT ANG PC MOUNT
J	5	JRBM-00100	1	58900	JRBM-00100	SMB M PC MOUNT
J	6	JRDF-00008	1	09769	413524-1	BNC F RT ANG PC MOUNT
J	7	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
J	8	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
J	9	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
J	10	JIA1-07118	1	58900	JIA1-07118	7 PIN STRIPLINE PLUG
L	11	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L	12	19203	1	OB3G8	19203	.1 UH RF COIL
L	13	15293	1	58900	15293	.17 UH INDUCTOR
L	14	15293	1	58900	15293	.17 UH INDUCTOR
L	15	15293	1	58900	15293	.17 UH INDUCTOR
L	16	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L	17	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L	18	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
P	1	JIA2-50318	1	09769	2-87227-5	50 PIN STRIPLINE PLUG
Q	1	QBPP-00170	1	04713	MJE 170	MJE 170 3A 40V 12.5W PNP
Q	2	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
Q	3	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
Q	4	QBNP-00231	1	58900	QBNP-00231	BFQ231 1W 1GHZ NPN

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)			
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**

Item		P/N	Qty	Cage	Mfr's P/N	Description
Q	5	QBPS-03644	1	55464	2N3645	2N3644 .3 A 45 V PNP
Q	6	QBNS-03569	1	4U751	2N3569	PN3569 .5A 40V NPN
Q	7	QBNS-03569	1	4U751	2N3569	PN3569 .5A 40V NPN
Q	8	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
R	1	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	2	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	4	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R	5	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R	6	RN55-21960	1	91637	RN55C1962F	19.6 K OHMS 1% MET FILM
R	7	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	8	RN55-00340	1	58900	RN55-00340	34.0 OHMS 1% MET FILM
R	9	RN55-00097	1	91637	RN55D 9.76 OHM 1%	9.76 OHM 1% MET FILM
R	10	RN55-00340	1	58900	RN55-00340	34.0 OHMS 1% MET FILM
R	11	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	12	RN55-21960	1	91637	RN55C1962F	19.6 K OHMS 1% MET FILM
R	15	RN55-22870	1	91637	RN55C2872F	28.7 K OHMS 1% MET FILM
R	16	RN57-27000	1	91637	MFF 1/8 T2	70.0 K OHM .1 % MET FILM
R	17	RN57-18750	1	91637	MFF 1/8 T2	8.75 K OHM .1 % MET FILM
R	18	RN57-11250	1	58900	RN57-11250	1.25 K OHM .1% MET FILM
R	19	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	20	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	21	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	22	RN55-04020	1	91637	RN55C4020F	402 OHMS 1% MET FILM
R	23	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	24	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	25	RN55-13650	1	91637	RN55C3651F	3.65 K OHMS 1% MET FILM
R	26	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	27	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	28	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	29	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	30	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	31	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R	32	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R	33	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R	34	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	35	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	36	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	37	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	38	RN55-31740	1	91637	RN55C1743F	174 K OHMS 1% MET FILM
R	39	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	40	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R	41	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	42	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	43	RN55-33920	1	91637	RN55C3923F	392 K OHMS 1% MET FILM
R	44	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	45	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
R	46	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	77	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	78	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	79	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R	80	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	81	RN55-24750	1	91637	RN55C4752F	47.5 K OHMS 1% MET FILM
R	82	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	83	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	84	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	96	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	97	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R	98	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	99	RN55-00274	1	91637	RN55C27R4F	27.4 OHMS 1% MET FILM
R	100	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	101	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	102	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	103	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	104	RN55-02000	1	91637	RN55C2000F	200 OHMS 1% MET FILM
R	105	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R	107	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	108	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
R	113	RN55-24750	1	91637	RN55C4752F	47.5 K OHMS 1% MET FILM
R	114	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	115	RN55-11130	1	1E4C5	RN 1/4 T2 1.13K 1%	1.13 K OHMS 1% MET FILM
R	116	RN55-?????	1	58900	RN55-?????	COMPONENT SELECTED IN TEST
R	117	RN57-21500	1	58900	RN57-21500	15.0 K OHM .1 % MET FILM
R	118	RN57-11290	1	58900	RN57-11290	1.29K OHM .1% MET FILM
R	119	RN57-21250	1	60393	GP 1/4-TC50-12.5-.1%	12.5 K OHM .1% MET FILM
R	120	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	121	RN55-41000	1	91637	RN55C1004F	1 M OHMS 1% MET FILM
R	122	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	123	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	124	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	125	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	126	RN57-21333	1	58900	RN57-21333	13.33 K OHM .1 % MET FILM
R	127	12449-129	1	58900	12449-129	40.0 K OHM .1 % MET FILM
R	128	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R	131	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R	132	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R	133	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	134	RN55-13010	1	91637	RN55C3011F	3.01 K OHMS 1% MET FILM
R	135	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R	136	RN55-23160	1	91637	RN55C3162F	31.6 K OHMS 1% MET FILM
R	137	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R	138	RN55-13320	1	91637	RN55C3321F	3.32 K OHMS 1% MET FILM
R	139	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	140	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R	141	RN57-18000	1	58900	RN57-18000	8.00 K OHM .1 % MET FILM
R	142	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	143	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	144	RN55-00274	1	91637	RN55C27R4F	27.4 OHMS 1% MET FILM
R	146	RN55-12490	1	91637	RN55C2491F	2.49 K OHMS 1% MET FILM
R	147	RN55-12490	1	91637	RN55C2491F	2.49 K OHMS 1% MET FILM
R	148	RN55-21210	1	91637	RN55C1212F	12.1 K OHMS 1% MET FILM
R	149	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	150	RN55-03740	1	91637	RN55C3740F	374 OHMS 1% MET FILM
R	151	RN55-03740	1	91637	RN55C3740F	374 OHMS 1% MET FILM
R	152	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	153	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	154	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	155	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	156	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	157	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R	158	RN55-00953	1	91637	RNC55H95R3FP	95.3 OHM 1% MET FILM
R	159	RN55-00953	1	91637	RNC55H95R3FP	95.3 OHM 1% MET FILM
R	160	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R	161	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	162	RN55-00287	1	91637	CCF55-2-28.7^1%T2T/R	28.7 OHMS 1% MET FILM
R	163	RN55-00110	1	91637	RN55C11R0F	11.0 OHMS 1% MET FILM
R	164	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	165	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	166	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R	167	RN55-02430	1	91637	RN55C2430F	243 OHMS 1% MET FILM
R	168	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	169	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	170	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R	171	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	172	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
R	173	RN55-12740	1	91637	RN55C2741F	2.74K OHMS 1% MET FILM
R	174	RG03-00150	1	91637	FP215R0 5%	15 OHM 10% METAL GLAZE
R	175	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R	176	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	177	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	178	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	179	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R	180	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	181	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	182	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	183	RN55-02490	1	91637	RN55C2490F	249 OHMS 1% MET FILM
R	184	RN55-34750	1	91637	RN55C4753F	475 K OHMS 1% MET FILM
R	185	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	186	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R	187	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R	190	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	191	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	194	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	195	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	196	RN55-21540	1	91637	RN55C1542F	15.4 K OHMS 1% MET FILM
R	199	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	204	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	205	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	206	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	207	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	228	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	229	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	232	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	233	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	234	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	235	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	240	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	241	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	242	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	243	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	246	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	247	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	248	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	249	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	250	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	251	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	252	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R	253	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	256	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	257	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	258	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	259	RN57-21000	1	58900	RN57-21000	10K OHM .1% MET FILM
R	260	RN57-21000	1	58900	RN57-21000	10K OHM .1% MET FILM
R	261	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	262	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	263	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
RP	1	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RP	2	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RP	3	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RT	2	RTC2-21000	1	56866	QTMC-14	10 K OHM THERMISTOR
RT	3	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
RT	4	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
RT	5	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
TP	1	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	2	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	3	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	4	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	5	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	6	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	7	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	8	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	9	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	10	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	11	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	12	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	13	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	14	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	15	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
U	1	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	2	ULN0-00411	1	2M881	DG411DJ	DG411DJ QUAD SPST SWITCH
U	3	UFN0-03240	1	34371	CA3240E	CA3240E DUAL OP AMP

21359		PCB ASSY, ANALOG VXI, REV: R (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
U	4	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	5	ULN0-00393	1	01295	LM393P	LM393N VOLT COMPARATOR
U	6	UVG0-00070	1	64155	LM199H	LM399H 7V PRECISION ZENER
U	7	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	8	ULN0-00411	1	2M881	DG411DJ	DG411DJ QUAD SPST SWITCH
U	9	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U	10	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	11	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	12	UIN0-07534	1	24355	AD7534JN	AD7534JN 14 BIT DAC
U	13	UTN0-00042	1	01295	SN74HC04N	74HC04 HEX INVERTER
U	14	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U	15	UIN0-07245	1	24355	AD7245JN	AD7245JN 12 BIT D/A
U	16	UTN0-00082	1	01295	SN74HC08N	74HC08N QUAD AND
U	17	UIN0-07245	1	24355	AD7245JN	AD7245JN 12 BIT D/A
U	18	UMN0-02444	1	60395	X2444P	X2444P 256 BIT NV RAM
U	19	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U	20	UTN0-00143	1	34371	CD74HCT14E	74HCT14N HEX SCHMITT TRIGGER
U	21	UFN1-00358	1	01295	LM358AP	LM358AN DUAL OP AMP
U	22	UTN0-00742	1	34371	SN74HC74D	74HC74 DUAL D FLIP FLOP
U	23	ULN0-00506	1	2M881	DG406DJ	DG506ACJ 16 CHANNEL SW
U	24	UTN0-00143	1	34371	CD74HCT14E	74HCT14N HEX SCHMITT TRIGGER
U	25	UIN0-00779	1	24355	AD779JD	AD779JN 14 BIT A/D
U	26	UGN1-08255	1	4T165	8255AC-2	8255A-5 PROG PIA
U	27	UGN1-08255	1	4T165	8255AC-2	8255A-5 PROG PIA
U	28	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U	29	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U	30	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U	31	UFN0-00625	1	24355	AD625JN	AD625JN PROG INST AMP
U	32	UFN0-01014	1	64155	LT1014DN	LT1014DN QUAD OP AMP
U	33	ULN0-00409	1	17856	DG409DJ	DG409DJ 2X 4IN SWITCH
U	34	ULN0-00339	1	04713	LM339N	LM339N COMPARATOR
U	35	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U	36	ULN0-00339	1	04713	LM339N	LM339N COMPARATOR
U	37	URC0-07815	1	01295	L7815C	MC7815CT 1A 15V REG
U	38	URC0-07915	1	04713	MC7915CT	MC7915CT 1A -15V REG
U	39	URP0-78120	1	04713	MC78L12ACP	MC78L12CP .1A 12V REG
U	43	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
W	1	JIA0-01443	1	58900	JIA0-01443	CONTACT POST
W	2	JIA0-01443	1	58900	JIA0-01443	CONTACT POST
XU	2	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET

21359 PCB ASSY, ANALOG VXI, REV: R (Continued)

Item		P/N	Qty	Cage	Mfr's P/N	Description
XU	3	JSP0-10008	1	09769	390261-2	8 PIN DIP SOCKET
XU	8	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	15	JSP2-10024	1	09769	390261-8	24 PIN DIP SOCKET
XU	17	JSP2-10024	1	09769	390261-8	24 PIN DIP SOCKET
XU	23	JSP0-10028	1	09769	2-641615-1	28 PIN DIP SOCKET
XU	28	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	29	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	30	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	31	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	32	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XU	33	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	34	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XU	36	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XW	1	17240-001	1	27264	15-38-1024	JUMPER,INSULATED,2 POS

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, REV: N

Item		P/N	Qty	Cage	Mfr's P/N	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
C	10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	18	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	19	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	20	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	21	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	22	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	23	CD99-01820	1	-----	DM15821F	820 PF 300V DIP MICA
C	24	CD99-01820	1	-----	DM15821F	820 PF 300V DIP MICA
C	25	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
C	28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	31	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	33	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	34	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	35	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	36	CC98-00330	1	-----	CCD-330	33 PF 1KV CERAMIC NPO
C	37	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	38	CC50-04220	1	31433	C330C224MSU5CA	.22 UF CERAMIC Z5U
C	39	CF00-04470	1	58900	CF00-04470	.47UF 100V POLYPROPYLENE
C	40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	42	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	44	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	46	CE50-R5470	1	74840	475PGM050M	4.7UF 50V RADIAL
C	47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	48	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	49	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	52	CD99-01150	1	-----	DM15-151F	150 PF DIP MICA
C	53	CD99-01240	1	-----	DM15-241F	240 PF DIP MICA
C	54	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	55	CD99-00620	1	-----	CMO5FD620F03	62 PF DIP MICA
C	56	CD99-01120	1	-----	CMO6FD121J03	120 PF DIP MICA
C	57	CD99-00620	1	-----	CMO5FD620F03	62 PF DIP MICA
C	58	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	59	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	60	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	61	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	62	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	63	CD00-02100	1	-----	CM05E102	1000 PF DIP MICA
C	64	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	65	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	66	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	67	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	68	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	69	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	70	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	71	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	72	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	73	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	74	CC00-02220	1	04222	SR201A222KAA	2200 PF CERAMIC COG
C	75	CC50-04220	1	31433	C330C224MSU5CA	.22 UF CERAMIC Z5U
C	77	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	78	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C	79	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	80	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	81	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	82	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	83	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	84	CC50-03470	1	04222	SR205C473KAA	.047 UF CERAMIC X7R
C	85	CC50-02220	1	04222	SR151C222KAA	2200PF CERAMIC X7R
C	86	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	87	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C	88	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	90	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C	91	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	92	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	93	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	94	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	100	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	101	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	102	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	103	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	104	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	105	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	106	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	107	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	108	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	109	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	110	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	112	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	114	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	115	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	124	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	126	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	127	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	128	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	129	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	130	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	131	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	132	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	133	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	134	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	135	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	136	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	137	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	138	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	139	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	140	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	141	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	142	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	143	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	144	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	145	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	146	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	147	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	148	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	149	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	150	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	151	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	152	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	153	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	154	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	155	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	156	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	157	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	158	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	161	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	162	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	163	CC51-04100	1	04222	SR205C-104KAA	.1 UF CERAMIC X7R
C	167	CD99-02250	1	-----	DM19F252J500V	2500 PF 500 V DIP MICA
C	171	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	173	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	174	CE50-06100	1	55680	TVX1H100MAA	10UF 50V AXIAL
C	175	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	176	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C	177	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	178	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	179	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	180	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	185	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C	186	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C	187	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	188	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	189	CC50-B4470	1	04222	SR305C474KAA	.47 UF CERAMIC X7R
C	190	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	191	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR	1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	7	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	8	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	9	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	10	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	11	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	12	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	13	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	14	13618	1	58900	13618	DIODE,uWAVE PIN SW,.3PF,100ns
CR	15	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	16	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	17	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	20	DZAB-00751	1	04713	1N751A	1N751A 5.1V ZENER
CR	21	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	22	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	23	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR	24	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
J	5	JRBM-00100	1	58900	JRBM-00100	SMB M PC MOUNT
L	11	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L	12	19203	1	OB3G8	19203	.1 UH RF COIL
L	13	15293	1	58900	15293	.17 UH INDUCTOR
L	14	15293	1	58900	15293	.17 UH INDUCTOR
L	15	15293	1	58900	15293	.17 UH INDUCTOR

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
L	16	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L	17	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
L	18	LAB0-05680	1	58900	LAB0-05680	6.8 UH INDUCTOR
P	1	JIA2-50318	1	09769	2-87227-5	50 PIN STRIPLINE PLUG
Q	1	QBPP-00170	1	04713	MJE 170	MJE 170 3A 40V 12.5W PNP
Q	2	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
Q	3	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
Q	4	QBNP-00231	1	58900	QBNP-00231	BFQ231 1W 1GHZ NPN
Q	5	QBPS-03644	1	55464	2N3645	2N3644 .3 A 45 V PNP
Q	6	QBNS-03569	1	4U751	2N3569	PN3569 .5A 40V NPN
Q	7	QBNS-03569	1	4U751	2N3569	PN3569 .5A 40V NPN
Q	8	QBNS-03904	1	04713	2N3904	2N3904 .2A 40V NPN
R	1	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	2	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	4	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R	5	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R	6	RN55-21960	1	91637	RN55C1962F	19.6 K OHMS 1% MET FILM
R	7	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	8	RN55-00340	1	58900	RN55-00340	34.0 OHMS 1% MET FILM
R	9	RN55-00097	1	91637	RN55D 9.76 OHM 1%	9.76 OHM 1% MET FILM
R	10	RN55-00340	1	58900	RN55-00340	34.0 OHMS 1% MET FILM
R	11	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	12	RN55-21960	1	91637	RN55C1962F	19.6 K OHMS 1% MET FILM
R	15	RN55-22870	1	91637	RN55C2872F	28.7 K OHMS 1% MET FILM
R	16	RN57-27000	1	91637	MFF 1/8 T2	70.0 K OHM .1 % MET FILM
R	17	RN57-18750	1	91637	MFF 1/8 T2	8.75 K OHM .1 % MET FILM
R	18	RN57-11250	1	58900	RN57-11250	1.25 K OHM .1% MET FILM
R	19	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	20	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	21	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	22	RN55-04020	1	91637	RN55C4020F	402 OHMS 1% MET FILM
R	23	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	24	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	25	RN55-13650	1	91637	RN55C3651F	3.65 K OHMS 1% MET FILM
R	26	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	27	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	28	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	29	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	30	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	31	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	32	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R	33	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R	34	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	35	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	36	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	37	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	38	RN55-31740	1	91637	RN55C1743F	174 K OHMS 1% MET FILM
R	39	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	40	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R	41	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	42	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	43	RN55-33920	1	91637	RN55C3923F	392 K OHMS 1% MET FILM
R	44	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	45	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
R	46	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	77	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	78	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	79	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R	80	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	81	RN55-24750	1	91637	RN55C4752F	47.5 K OHMS 1% MET FILM
R	82	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	83	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	84	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	96	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R	97	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R	98	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	99	RN55-00274	1	91637	RN55C27R4F	27.4 OHMS 1% MET FILM
R	100	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	101	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	102	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	103	RN57-25000	1	58900	RN57-25000	50.0 K OHM .1 % MET FILM
R	104	RN55-02000	1	91637	RN55C2000F	200 OHMS 1% MET FILM
R	105	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R	107	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	108	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
R	113	RN55-24750	1	91637	RN55C4752F	47.5 K OHMS 1% MET FILM
R	114	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	115	RN55-11130	1	1E4C5	RN 1/4 T2 1.13K 1%	1.13 K OHMS 1% MET FILM
R	116	RN55-?????	1	58900	RN55-?????	COMPONENT SELECTED IN TEST
R	117	RN57-21500	1	58900	RN57-21500	15.0 K OHM .1 % MET FILM

21359-A00 PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)

Item		P/N	Qty	Cage	Mfr's P/N	Description
R	118	RN57-11290	1	58900	RN57-11290	1.29K OHM .1% MET FILM
R	119	RN57-21250	1	60393	GP 1/4-TC50-12.5-.1%	12.5 K OHM .1% MET FILM
R	120	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	121	RN55-41000	1	91637	RN55C1004F	1 M OHMS 1% MET FILM
R	122	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	123	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	124	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	125	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	126	RN57-21333	1	58900	RN57-21333	13.33 K OHM .1 % MET FILM
R	127	12449-129	1	58900	12449-129	40.0 K OHM .1 % MET FILM
R	128	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R	131	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R	132	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R	133	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	134	RN55-13010	1	91637	RN55C3011F	3.01 K OHMS 1% MET FILM
R	135	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R	136	RN55-23160	1	91637	RN55C3162F	31.6 K OHMS 1% MET FILM
R	137	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R	138	RN55-13320	1	91637	RN55C3321F	3.32 K OHMS 1% MET FILM
R	139	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	140	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R	141	RN57-18000	1	58900	RN57-18000	8.00 K OHM .1 % MET FILM
R	142	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	143	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	144	RN55-00274	1	91637	RN55C27R4F	27.4 OHMS 1% MET FILM
R	146	RN55-12490	1	91637	RN55C2491F	2.49 K OHMS 1% MET FILM
R	147	RN55-12490	1	91637	RN55C2491F	2.49 K OHMS 1% MET FILM
R	148	RN55-21210	1	91637	RN55C1212F	12.1 K OHMS 1% MET FILM
R	149	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	150	RN55-03740	1	91637	RN55C3740F	374 OHMS 1% MET FILM
R	151	RN55-03740	1	91637	RN55C3740F	374 OHMS 1% MET FILM
R	152	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	153	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	154	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	155	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	156	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	157	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R	158	RN55-00953	1	91637	RNC55H95R3FP	95.3 OHM 1% MET FILM
R	159	RN55-00953	1	91637	RNC55H95R3FP	95.3 OHM 1% MET FILM
R	160	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	161	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	162	RN55-00287	1	91637	CCF55-2-28.7^1%T2T/R	28.7 OHMS 1% MET FILM
R	163	RN55-00110	1	91637	RN55C11R0F	11.0 OHMS 1% MET FILM
R	164	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	165	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	166	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R	167	RN55-02430	1	91637	RN55C2430F	243 OHMS 1% MET FILM
R	168	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	169	RN55-04990	1	91637	RN55C4990F	499 OHMS 1% MET FILM
R	170	RN55-00619	1	91637	CCF55-2-61.9^1%T2T/R	61.9 OHMS 1% MET FILM
R	171	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	172	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
R	173	RN55-12740	1	91637	RN55C2741F	2.74K OHMS 1% MET FILM
R	174	RG03-00150	1	91637	FP215R0 5%	15 OHM 10% METAL GLAZE
R	175	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R	176	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	177	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	178	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	179	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R	180	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	181	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	182	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	183	RN55-02490	1	91637	RN55C2490F	249 OHMS 1% MET FILM
R	184	RN55-34750	1	91637	RN55C4753F	475 K OHMS 1% MET FILM
R	185	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	186	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R	187	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R	190	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	191	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	194	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	195	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	196	RN55-21540	1	91637	RN55C1542F	15.4 K OHMS 1% MET FILM
R	199	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	204	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	205	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	206	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	207	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	228	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	229	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	232	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
R	233	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	234	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	235	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	240	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	241	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	242	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	243	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	246	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	247	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	248	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	249	RN55-00475	1	91637	RN55C47R5F	47.5 OHMS 1% MET FILM
R	250	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	251	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	252	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R	253	RN55-21000	1	1E4C5	RN 1/4 T2 10K 1%	10 K OHMS 1% MET FILM
R	256	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	257	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	258	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	259	RN57-21000	1	58900	RN57-21000	10K OHM .1% MET FILM
R	260	RN57-21000	1	58900	RN57-21000	10K OHM .1% MET FILM
R	261	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	262	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
RP	1	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RP	2	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RP	3	RM9S-21001	1	58900	RM9S-21001	10K OHM X 9 SIP NETWORK
RT	2	RTC2-21000	1	56866	QTMC-14	10 K OHM THERMISTOR
RT	3	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
RT	4	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
RT	5	FSS0-00050	1	06090	RXE050	.5A RES CIRCUIT BREAKER
TP	1	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	2	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	3	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	4	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	5	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	6	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	7	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	8	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	9	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	10	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	11	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
TP	12	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	13	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	14	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	15	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
U	1	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	4	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	5	ULN0-00393	1	01295	LM393P	LM393N VOLT COMPARATOR
U	6	UVG0-00070	1	64155	LM199H	LM399H 7V PRECISION ZENER
U	7	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	9	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U	10	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	11	UFN0-05135	1	01295	OP-07/CP	HA5135-5 PRECISION OP AMP
U	12	UIN0-07534	1	24355	AD7534JN	AD7534JN 14 BIT DAC
U	13	UTN0-00042	1	01295	SN74HC04N	74HC04 HEX INVERTER
U	14	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U	16	UTN0-00082	1	01295	SN74HC08N	74HC08N QUAD AND
U	18	UMN0-02444	1	60395	X2444P	X2444P 256 BIT NV RAM
U	19	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U	20	UTN0-00143	1	34371	CD74HCT14E	74HCT14N HEX SCHMITT TRIGGER
U	21	UFN1-00358	1	01295	LM358AP	LM358AN DUAL OP AMP
U	22	UTN0-00742	1	34371	SN74HC74D	74HC74 DUAL D FLIP FLOP
U	24	UTN0-00143	1	34371	CD74HCT14E	74HCT14N HEX SCHMITT TRIGGER
U	25	UIN0-00779	1	24355	AD779JD	AD779JN 14 BIT A/D
U	26	UGN1-08255	1	4T165	8255AC-2	8255A-5 PROG PIA
U	27	UGN1-08255	1	4T165	8255AC-2	8255A-5 PROG PIA
U	35	UFN1-00324	1	01295	LM324N	LM324AN QUAD OP AMP
U	39	URP0-78120	1	04713	MC78L12ACP	MC78L12CP .1A 12V REG
U	43	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
W	1	JIA0-01443	1	58900	JIA0-01443	CONTACT POST
W	2	JIA0-01443	1	58900	JIA0-01443	CONTACT POST
XU	2	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	3	JSP0-10008	1	09769	390261-2	8 PIN DIP SOCKET
XU	8	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	15	JSP2-10024	1	09769	390261-8	24 PIN DIP SOCKET
XU	17	JSP2-10024	1	09769	390261-8	24 PIN DIP SOCKET
XU	23	JSP0-10028	1	09769	2-641615-1	28 PIN DIP SOCKET
XU	28	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	29	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	30	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	31	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET

21359-A00		PCB ASSY PRE-WAVE, ANALOG VXI, REV: N (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
XU	32	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XU	33	JSP0-10016	1	09769	2-614610-2	16 PIN DIP SOCKET
XU	34	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
XU	36	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET

21356		PCB ASSY, DIGITAL, REV: K1				
Item		P/N	Qty	Cage	Mfr's P/N	Description
	1	21355	1	58900	21355	PCB,DIGITAL
	2	21357	REF	58900	21357	SCHEMATIC,DIGITAL PCB
	3	WTT0-24001	1	29005	#24AWG-TFE/TW	#24 TEFLON SLEEVE
	4	XAR0-03140	REF	05AJ8	3140	RTV SEALANT
	5	WSB0-22000	REF	16428	8021-C1000-22AWG	22 GAUGE BUS WIRE
C	1	CE25-R7100	1	00656	AMR101M025	100 UF 25V RADIAL LEAD
C	2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	24	CE25-07100	1	55680	TVX1E101MAA	100UF 25V ELECTROLYTIC
C	25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	26	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	27	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	28	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	29	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	30	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	31	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	32	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	33	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO

21356		PCB ASSY, DIGITAL, REV: K1 (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	34	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	35	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	36	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	37	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	38	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	39	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	40	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	41	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	42	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	43	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	44	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	45	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	46	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	47	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	48	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	49	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	51	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	52	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	53	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	54	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	55	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	56	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	57	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	58	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	59	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	61	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	66	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	67	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	68	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	69	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	70	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	71	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	72	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	73	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	74	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	75	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	77	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	81	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	82	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
J	1	JSE0-20050	1	55322	ESW-125-37-S-D	50 PIN ELEVATED SOCKET
J	2	JIB2-40100	1	91506	A015-040-YE-0013	40 PIN STRIPLINE SOCKET
J	3	JIB2-40100	1	91506	A015-040-YE-0013	40 PIN STRIPLINE SOCKET
J	4	JIB2-36100	1	91506	A015-036-YE-001	36 PIN STRIPLINE SOCKET
J	6	JIR1-04295	1	09769	640453-4	4 PIN RT ANG STRPLN PLUG
L	1	LCC0-00000	1	19701	WBC 2.5/A- 3S4	WIDE-BAND CHOKE
L	2	LCC0-00000	1	19701	WBC 2.5/A- 3S4	WIDE-BAND CHOKE
L	3	LCC0-00000	1	19701	WBC 2.5/A- 3S4	WIDE-BAND CHOKE

21356 PCB ASSY, DIGITAL, REV: K1 (Continued)

Item		P/N	Qty	Cage	Mfr's P/N	Description
R	1	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	2	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
RP	1	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	2	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	3	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	4	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	5	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	6	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
TP	1	ETI0-10018	1	58900	ETI0-10018	BLACK TEST POINT
TP	2	ETI0-10018	1	58900	ETI0-10018	BLACK TEST POINT
U	1	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U	2	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U	3	UTN0-02443	1	01295	SN74HCT244N	SN74HCT244N BUFFER
U	4	UTN0-02453	1	01295	SN74HCT245N	74HCT245 OCTAL BUSXCVR
U	5	UTN0-02453	1	01295	SN74HCT245N	74HCT245 OCTAL BUSXCVR
U	6	UIN0-01210	1	0B0A9	DS1210	DS1210 NONVOL CONTROLLER
U	7	UTN0-03932	1	01295	SN74HC393N	74HC393 BINARY DIVIDE
U	8	UTN0-05402	1	01295	SN74HC540N	SN7HC540N OCTAL BUFFER
U	9	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U	10	21379	1	58900	21379	PAL,PROG,VXI DIGITAL
U	11	UTN0-00042	1	01295	SN74HC04N	74HC04 HEX INVERTER
U	12	UTN0-00052	1	01295	SN74HC05N	74HC05, HEX INVERTER
U	21	UMN0-51001	1	4T165	UPD431000ACZ-70L	TC551001BPL-10 1M RAM
U	22	UMN0-51001	1	4T165	UPD431000ACZ-70L	TC551001BPL-10 1M RAM
XU	10	JSP0-10020	1	09769	2-641612-1	20 PIN DIP SOCKET
XU	13	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	14	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	15	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	16	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	17	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	18	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET

21356-A00 PCB ASSY, PRE-WAVE, DIGITAL VXI, REV: D

Item		P/N	Qty	Cage	Mfr's P/N	Description
	1	21355	1	58900	21355	PCB,DIGITAL
	2	21357	REF	58900	21357	SCHEMATIC,DIGITAL PCB
C	1	CE25-R7100	1	00656	AMR101M025	100 UF 25V RADIAL LEAD
C	2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	26	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	27	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	28	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	29	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	30	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	31	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO

21356-A00		PCB ASSY, PRE-WAVE, DIGITAL VXI, REV: D (Continued)				
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
C	32	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	33	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	34	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	35	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	36	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	37	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	38	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	39	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	40	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	41	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	42	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	43	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	44	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	45	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	46	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	47	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	48	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	49	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	51	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	52	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	53	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	54	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	55	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	56	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	57	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	58	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	59	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	61	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	66	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	67	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	68	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	69	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	70	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	71	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	72	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	73	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	74	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	75	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	77	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	81	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	82	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C	9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

21356-A00		PCB ASSY, PRE-WAVE, DIGITAL VXI, REV: D (Continued)				
Item		P/N	Qty	Cage	Mfr's P/N	Description
C	10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C	24	CE25-07100	1	55680	TVX1E101MAA	100UF 25V ELECTROLYTIC
C	25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
J	1	JSE0-20050	1	55322	ESW-125-37-S-D	50 PIN ELEVATED SOCKET
J	2	JIB2-40100	1	91506	A015-040-YE-0013	40 PIN STRIPLINE SOCKET
J	3	JIB2-40100	1	91506	A015-040-YE-0013	40 PIN STRIPLINE SOCKET
J	4	JIB2-36100	1	91506	A015-036-YE-001	36 PIN STRIPLINE SOCKET
J	6	JIR1-04295	1	09769	640453-4	4 PIN RT ANG STRPLN PLUG
L	1	LCC0-00000	1	19701	WBC 2.5/A- 3S4	WIDE-BAND CHOKE
L	2	LCC0-00000	1	19701	WBC 2.5/A- 3S4	WIDE-BAND CHOKE
L	3	LCC0-00000	1	19701	WBC 2.5/A- 3S4	WIDE-BAND CHOKE
R	1	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R	2	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
RP	1	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	2	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	3	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	4	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	5	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
RP	6	RM9S-11000	1	58900	RM9S-11000	1 KOHM X 9 SIP NETWORK
TP	1	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
TP	2	ETT0-00001	1	63345	330.100W/ TIN PLATE	TEST JACK PIN
U	1	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U	2	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U	3	UTN0-02443	1	01295	SN74HCT244N	SN74HCT244N BUFFER
U	4	UTN0-02453	1	01295	SN74HCT245N	74HCT245 OCTAL BUSXCVR
U	5	UTN0-02453	1	01295	SN74HCT245N	74HCT245 OCTAL BUSXCVR
U	6	UIN0-01210	1	0B0A9	DS1210	DS1210 NONVOL CONTROLLER
U	7	UTN0-03932	1	01295	SN74HC393N	74HC393 BINARY DIVIDE
U	8	UTN0-05402	1	01295	SN74HC540N	SN7HC540N OCTAL BUFFER
U	9	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U	11	UTN0-00042	1	01295	SN74HC04N	74HC04 HEX INVERTER
U	12	UTN0-00052	1	01295	SN74HC05N	74HC05, HEX INVERTER
U	21	UMN0-51001	1	4T165	UPD431000ACZ-70L	TC551001BPL-10 1M RAM
U	22	UMN0-51001	1	4T165	UPD431000ACZ-70L	TC551001BPL-10 1M RAM

21356-A00		PCB ASSY, PRE-WAVE, DIGITAL VXI, REV: D (Continued)				
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
XU	10	JSP0-10020	1	09769	2-641612-1	20 PIN DIP SOCKET
XU	13	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	14	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	15	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	16	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	17	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET
XU	18	JSP0-10032	1	09769	390263-2	32 PIN DIP SOCKET

21418		PCB ASSY, VXI PROCESSOR, REV: B				
Item		P/N	Qty	Cage	Mfr's P/N	Description
	1	21404	1	58900	21404	VXI PROCESSOR/INTERFACE
	2	21419	1	58900	21419	PROM SET, VXI PROCESSOR
C	1	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM

6.3 List of Manufacturers

The names and addresses of manufacturers cited in the preceding parts lists are shown in Table 6-1. Each manufacturer is listed under its CAGE number (COMMERCIAL AND GOVERNMENT ENTITY), as noted in the parts lists. In a few cases, no CAGE number has been assigned; these manufacturers are referenced by Giga-tronics codes which are shown at the end of the list.

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
53387	3M	3M Electronics Products Division	6801 River Place Blvd.	Austin	TX
53387	ITWPAN	3M Electronics Products Division	309 E. Crossroads Parkway	Bolingbrook	IL
-----	A&J	A&J Manufacturing Company Inc.	11121 Hindry Ave.	Los Angeles	CA
53387	APWELE	APW Electronic Solutions	14100 Danielson Street	Poway	CA
53387	ARC	ARC Technology, Inc.	11 Chestnut Street	Amesbury	MA
-----	ATP	ATP Technologies, Inc.			
04222	AVX	AVX Ceramics	19th Ave. South	Myrtle Beach	SC
30161	AAVID	Aavid	1 Kool Path	Lacona	NH
-----	ADVPWR	Advance Power, Inc.	11035 Switzer Ave.	Dallas	TX
61638	ADVANC	Advanced Interconnections	5 Energy Way	West Warwick	RI
34335	AMD	Advanced Micro Devices	910 Thompson Place	Sunnyvale	CA
4U751	ADV/SE	Advanced Semiconductor, Inc.	7525 Ethel Ave. Unit G	North Hollywood	CA
00656	AEROVO	Aerovox	740 Belleville Ave.	New Bedford	MA
0H379	AEROWA	Aerowave Inc.	344 Salem Street	Medford	MA
9Y422	AIR	Air Filtration Products Inc.	707 North Main Ave.	Tucson	AZ
52750	ALAN	Alan Industries	745 Greenway Drive	Columbus	IN
56563	ALATEC	Alatec Products	21123 Nordhoff Street	Chatsworth	CA
-----	ALCO	Alco Electronics Products Inc.	1551 Osgood Street	North Andover	MA
0EUK7	ALLAME	All American Transistor Corp.	369 VanNess Way	Torrance	CA
01121	ALLEN	Allen Bradley Company	1201 South Second Street	Milwaukee	WI
-----	ALLIED	Allied Electronics, Inc.	2105 Lundy Lane	San Jose	CA
-----	ALLSWI	Allied Swiss Screw Products, Inc.	2636 Vista Pacific Drive	Oceanside	CA
-----	ALLSTR	Allstar Magnetics			
-----	ALMAGU	Almaguer Precision Manufacturing	1240 Yard Court, Bldg. J	San Jose	CA
17540	ALPIND	Alpha Industries	20 Sylvan Road	Woburn	MA
92194	ALPSEM	Alpha Semiconductor Inc.	1031 Serpentine Lane	Pleasanton	CA
92194	ALPHA	Alpha Wire Corp.	711 Lidgerwood Ave.	Elizabeth	NJ
67183	ALTERA	Altera Corp.	2610 Orchard Parkway	San Jose	CA
06540	AMATOM	Amatom Division of New Haven Mfg Co	446 Blake Street	New Haven	CT
99800	DELEVA	American Precision Ind. Delevan Div.	270 Quaker Road	East Aurora	NY

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
1HY41	AMER R	American Relays Inc.	10306 Norwalk Blvd.	Sante Fe Springs	CA
84411	AM SHI	American Shizuki Corp.	301 West O Street	Ogallaia	NE
-----	SKYNET	American Skynet Electronic	1474 Gladding Court	Milpitas	CA
29990	ATC	American Technical Ceramics	1 Norden Lane	Huntington Station	NY
09769	AMP	Amp Inc.	2800 Fulling Road	Harrisburg	PA
34553	AMPERE	Amperex Electronics Corp.		Hauppauge	NY
74868	AMPHEN	Amphenol Corp.	One Kennedy Ave.	Danbury	CT
24355	ANALOG	Analog Devices, Inc.	1 Technology Way	Norwood	MA
04ZM0	APPLIE	Applied Thin-Film Products	3439 Edison Way	Fremont	CA
-----	ARCO	Arco Electronics	400 Moreland Road	Commack	NY
1HYW5	ARDIN	Ardin Frequency Control, Inc.	150 Paularino Ave # 166	Costa Mesa	CA
51167	ARIES	Aries Electronics Inc.	62 Trenton Ave.	Frenchtown	NJ
61529	AROMAT	Aromat Corp.	629 Central Ave.	New Providence	NJ
46467	AROW	Arow Fasteners Inc.	31012 Huntwood Ave.	Hayward	CA
-----	ASSOCC	Associated Components Technology	11576 Trask Ave.	Garden Grove	CA
4J995	ASSOCS	Associated Spring	401 East Stadium Blvd.	Ann Arbor	MI
62277	ATLAS	Atlas Wire and Cable Corp.	133 S. Van Norman Road	Montebello	CA
1FN41	ATMEL	Atmel	2325 Orchard Parkway	San Jose	CA
91506	AUGAT	Augat Inc.	452 John Dietsch Blvd.	Attleboro Falls	MA
24539	AVANTE	Avantek, Inc. (HP Components)	3175 Bowers Ave.	Santa Clara	CA
65517	AYER	Ayer Engineering	1250 West Roger Road	Tucson	AZ
21604	BRDE00	Brothers Electronics	438 SO. Military Trail	Deerfield Beach	FL
53387	BROTHE	Brothers Electronics		Deerfield Beach	FL
1E584	BAY	Bay Associates	150 Jefferson Drive	Menlo Park	CA
52683	BAYTRO	Baytron Company Inc.	344 Salem Street	Medford	MA
13150	BEAU	Beau Interconnect	4 Aviation Drive	Gilford	NH
5Y491	BECKMA	Beckman Industrial	4141 Palm Street	Fullerton	CA
16428	BELDEN	Belden Corp.	350 NW 'N' Street	Richmond	IN
55285	BERQUI	Berquist Company Inc.	5300 Edina Industrial Blvd.	Minneapolis	MN
0Y1C7	BIPOLA	Bipolarics Inc.	108 Albright Way	Los Gatos	CA
32559	BIVAR	Bivar Inc.	4 Thomas Street	Irvine	CA
71034	BLILEY	Bliley Electric Company	2545 West Grandview Blvd.	Erie	PA
32997	BOURNS	Bourns Inc.	1200 Columbia Ave.	Riverside	CA
57834	BRIM	Brim Electronics Inc.	120 Home Place	Lodi	NJ
21604	BUCKEY	Buckeye Stamping	555 Marion Road	Columbus	OH
71218	BUD	Bud Industries	4605 East 355th Street	Willoughby	OH

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
09922	BURNDY	Burndy Corp.	1 Richards Ave.	Norwalk	CT
13919	BURR B	Burr Brown Research Corp.	6730 South Tucson Blvd.	Tucson	AZ
-----	BUSSMA	Bussmann Manufacturing	114 Old Street Road	Street Louis	MO
0RF16	C&D	C&D Electronics	28 Appleton Street	Holyoke	MA
09353	C&K	C&K Components	57 Stanley Ave.	Watertown	MA
46381	CALRAD	California Radomes	364 Reed Street	Santa Clara	CA
53387	CAPLUG	Caplugs	2150 Elmwood Ave.	Buffalo	NY
53387	CENSEM	Central Semi			
----	CLIPPR	Clipper			
53387	COMPAS	Compass Components	48502 Kato Road	Fremont	CA
53387	CPCLAI	CP Claire			
71450	CTS	CTS Corp.	1201 Cumberland Ave.	West Lafayette	IN
16733	CABLEW	Cablewave Systems Inc.	60 Dodge Ave.	North Haven	CT
09CW5	CALCHP	Cal Chip Electronics	59 Steamwhistle Drive	Ivyland	PA
56427	CALMIC	California Micro Devices	215 Topaz Street	Milpitas	CA
0N0K0	CALOGI	Calogic Corp.	237 Whitney Place	Fremont	CA
53387	CAPAX	Capax Technologies, Inc.	24842 Ave. Tibbitts	Valencia, CA	CA
65664	CATAMO	Catamount Manufacturing Inc.	158 Governor Drive	Orange	MA
2J873	CELERI	Celeritek Inc.	3236 Scot Blvd.	Santa Clara	CA
51642	CENTRE	Centre Capacitor Inc.	2820 East College Ave.	State College	PA
56988	CENTRY	Century Spring Corp.	P.O Box 15287 222 E 16th St.	Los Angeles	CA
01963	CHERRY	Cherry Electrical Products	3600 Sunset Ave.	Waukegan	IL
8W262	CHOMER	Chomerics Inc.	16 Flagstone Drive	Hudson	NY
52072	CIR AS	Circuit Assembly Corp.	18 Thomas Street	Irvine	CA
-----	CIREXX	Cirexx Corp.	3391 Keller StreetS	Santa Clara	CA
12697	CLAROS	Clarostat Sensors and Controls	12055 Rojas Drive Ste. K	El Paso	TX
-----	CODI/S	Codi Semiconductor	144 Market Street	Kenilworth	NJ
02113	COILCR	Coilcraft Inc.	1102 Silver Lake Road	Cary	IL
0NFL0	COILTR	Coiltronics Inc.	6000 Park of Commerce Blvd.	Boca Raton	FL
62839	COMLIN	Comlinear	4800 Wheaton Drive	Fort Collins	CO
-----	COMPAR	Compar Corp.	85 Spy Court	Markham, Ontario	
55801	COMP D	Compensated Devices	166 Tremont Street	Melrose	MA
0ABX4	COMPTE	Comptec International LTD	7837 Custer School Road	Custer	WA
18310	CONCOR	Concord Electronics Corp.	30 Great Jones Street	New York	NY
08MU3	CONDUC	Conductive Rubber Technology, Inc.	22125 17th Ave.	Bothell	WA
26923	CONTRO	Control Master Products	1062 Shary Circle	Concord	CA

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
05245	CORCOM	Corcom Inc.	1600 Winchester Road	Libertyville	IL
14655	CORNEL	Cornell Dublier Electronics	1605 East Rodney French Blvd.	New Bedford	MA
14674	CORNIN	Corning Glass Works	Houghton Park	Corning	NY
34808	CUSTCO	Custom Coils Inc.	109 South Iowa Street	Alcester	SD
65786	CYPRES	Cypress Semiconductor Corp.	3901 North First Street	San Jose	CA
-----	DCELEC	DC Electronics	1870 Little Orchard Street	San Jose	CA
53387	DCSU00	DC Machine	220 Humboldt Crt.	Sunnyvale	CA
53387	DIALAC	DialAct Corp.	45979 Warm Springs Blvd. Ste. 1	Fremont	CA
57032	DADEN	Daden Associates Inc.	1001 Calle Amanacer	San Clemente	CA
91637	DALE	Dale Electronics Inc.	1122 Twenty Third Street	Columbus	NE
0B0A9	DALLAS	Dallas Semiconductor Corp.	6350 Beltwood Pkwy. South	Dallas	TX
-----	DATCIR	Data Circuits Systems, Inc.			
50721	DATEL	Datel Inc.	11 Cabot Blvd.	Mansfield	MA
34785	DEK	Dek Inc.	3480 Swenson Ave.	Street Charles	IL
0JBU8	DELNET	Delnetics	521 Wilbur Ave.	Antioch	CA
1JB33	DEXTER	Dexter Corp.	1 Dexter Drive	Seabrook	NH
83330	DIALIG	Dialight Corp.	1913 Atlantic Ave.	Manasquan	NJ
55153	DIEL L	Dielectric Laboratories	69 Albany Street	Cazenovia	NY
18041	DIODEI	Diode Inc.	21243 Ventura Blvd.	Woodland Hills	CA
0AX52	DITOM	Ditom Microwave Inc.	1180 Coleman Ave. #103	San Jose	CA
05AJ8	DOW	Dow Corning Corp.	Wolverine Building	Midland	MI
0JNR4	DUPONT	Dupont Electronics	825 Old Trail Road	Wilmington	DE
2J899	DYNAWA	Dynawave Inc.	94 Searle Street	Georgetown	MA
74970	EFJOHN	E. F. Johnson Company	299 Johnson Ave.	Waseca	MN
72825	EBY	EBY Company	4300 H Street	Philadelphia	PA
53387	ECMETL	EC Metal Plating	3005 Copper Road	Santa Clara	CA
-----	EDT	EDT	2680 Walnut Ave., Unit C	Tustin	CA
05820	WAKEFI	EG&G Wakefield Engineering	60 Audubon Road	Wakefield	MA
-----	EL CAP	EL Cap	116 Depot Ave.	Elgin	TX
2J899	EXCELF	Excelfab	1020 Morse Ave.	Sunnyvale	CA
78553	EATON	Eaton Corp.	1060 West 130th Street	Brunswick	OH
0GUG6	ECLIPT	Ecliptek	18430 Bandilier Circle	Fountain Valley	CA
31781	EDAC	Edac Inc.	40 Tiffield Road	Scarborough, Ontario	
91662	ELCO	Elco Corp.	801 Seventeenth Ave. South	Myrtle Beach	SC
-----	ELEFIL	Electro-Films Inc.	111 Gilbane Street	Warwick	RI
-----	EE&I	Electronic Eyelet & Interconnect	911 Bern Court	San Jose	CA

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
14604	ELMWOO	Elmwood Sensors Inc.	500 Narragansett Park Drive	Pawtucket	RI
64013	ELNA	Elna America, Inc.	5770 Warland Drive	Cypress	CA
0JMR7	EMERSO	Emerson & Cuming	61 Holton Street	Worburn	MA
-----	ENVIRO	Enviro Tech International	P.O. Box 5052	Alameda	CA
33246	EPOTEK	Epoxy Technology Inc.	14 Fortune Drive	Billerica	MA
0HAF7	EPSON	Epson America, Inc.	20770 Madrona Ave.	Torrance	CA
72982	ERIE	Erie Technological	645 West Eleventh Street	Erie	PA
8B808	EVAPOR	Evaporated Coatings, Inc.	2365 Maryland Road	Willow Grove	PA
65964	EVOX	Evox-Rifa Inc.	100 Tri-State International	Lincolnshire	IL
52063	EXAR	Exar Integrated Systems	2222 Qume Drive	San Jose	CA
53387	FOSCOO	Force Electronics	477 Gianni Street	Santa Clara	CA
73734	FED SC	Federal Screw Products Inc.	3917 North Kedzie Ave.	Chicago	IL
1BH13	FENWAL	Fenwal Electronics Inc.	64 Fountain Street	Framingham	MA
02114	FERROX	Ferroxcube/Division of Amperex	5083 Kings Highway	Saugerties	NY
60204	FLECK	Fleck Company	3410 A Street S.E.	Auburn	WA
61429	FOX	Fox Electronics Inc.	5570 Enterprise Parkway	Ft. Myers	FL
26629	FREQ S	Frequency Sources, Inc.	15 Maple Road	Chelmsford	MA
-----	FUJI P	Fujipoly	365 Carnegie Ave.		
9Z397	FUJITS	Fujitsu Component of America	3320 Scott Blvd.	Santa Clara	CA
0HFH6	FUTABA	Futaba Corp. of America	555 West Victoria Street	Compton	CA
14936	GENERA	General Instrument Corp.	10 Melville Park Road	Melville	NY
0J9P9	GEROME	Gerome Manufacturing Co, Inc.	403 N. Main Street	Newburg	OR
58900	GIGA	Giga-tronics Inc.	4650 Norris Canyon Road	San Ramon	CA
3T059	GILWAY	Gilway Technical Lamps Inc.	800 West Cummings Park	Woburn	MA
1BX85	GLOBAL	Global Computer Supplies	2318 E. Del Amo Blvd., Dept 75	Compton	CA
-----	GOLDEN	Golden Pacific Quality Products	23585 Connecticut Street #18	Hayward	CA
95348	GORDOS	Gordos Corp.	1000 North 2nd Street	Rogers	AZ
17217	GORE	Gore & Associates Inc., W.L.	1901 Barksdale Road	Newark	DE
81073	GRAYHI	Grayhill Inc.	561 Hillgrove Ave.	La Grange	IL
2R182	SMITH	H.H. Smith Company	325 North Illinois Street	Indianapolis	IN
63542	HAMILT	Hamilton Hallmark			
9Z740	HNL	HNL Inc.	3250 Victor Street, Bldg C	Santa Clara	CA
4F708	HAMMON	Hammond Manufacturing Company	1690 Walden Drive	Buffalo	NY
2M881	HARRIS	Harris Semiconductor	883 Sterling Road, Ste. 8120	Mountain View	CA
67297	HEROTE	Herotek Inc.	222 North Wolfe Road	Sunnyvale	CA
28480	HP	Hewlett Packard Company	3000 Hanover Street	Palo Alto	CA

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
28520	HEYCO	Heyco Molded Products	750 Blvd.	Kenilworth	NJ
0AG18	HIROSE	Hirose Electric	2688 West Hills Court	Simi Valley	CA
61485	HITACH	Hitachi Denshi America Ltd.	175 Crossways Parkway West	Woodbury	NY
-----	HITECH	Hitech Die Casting, Inc.	2245 S. Vasco Road	Livermore	CA
-----	SUHNER	Hubner Suhner Ltd.	Tumbleinstrass 20	Pfaffikon, Switz	
55536	HUNTER	Hunter Technology Corp.	3305 Kifer Road	Santa Clara	CA
58558	ICS	ICS Electronics	473 Los Coches Street	Milpitas	CA
32293	INTER	Interconnect System	2501 Mission Street	Santa Cruz	CA
4J532	IOTECH	IOtech, Inc.	25971 Cannon Road	Cleveland	OH
71468	ITT CA	ITT Cannon Electric	666 East Dyer Road	Santa Anna	CA
98291	ITT SE	ITT Cannon RF Products	585 East Main Street	New Britain	CT
05276	ITT PO	ITT Pomona Electronics	1500 East Ninth Street	Pomona	CA
31918	ITT SH	ITT Schadow Inc.	8081 Wallace Road	Eden Prarie	MN
04426	ITW SW	ITW Switches	6615 West Irving Park Road	Chicago	IL
51705	ICO RL	Ico-Rally Corp.	2575 East Bayshore Road	Palo Alto	CA
0FY98	IDAHO	Idaho Circuit Technologies	401 East 1st Street	Glenns Ferry	ID
74840	ILLCAP	Illinois Ccpacitor Inc.	3757 West Touhy Ave.	Lincolnwood	IL
-----	INDUIM	Induim Corp. of America	1676 Lincoln Ave.	Utica	NY
64671	INMET	Inmet Corp.	300 Dino Drive	Ann Arbor	MI
58202	INNOWA	Innowave Inc.	955/975 Benecia Ave.	Sunnyvale	CA
9Z890	INTCIR	Integrated Circuit Systems	525 Race Street	San Jose	CA
61772	IDT	Integrated Device Technology, Inc.	2975 Stender Way	Santa Clara	CA
34649	INTEL	Intel Corp.	2200 Mission College Blvd.	Santa Clara	CA
0RMV0	INTELL	Intelligent Instrumentation	6550 S. Bay Colony Dr., MS 130	Tucson	AZ
5J927	INT.TE	Interface Technology Inc.	300 South Lemon Creek Drive	Walnut	CA
4S177	IMS	International Mfg Services	50 Schoolhouse Lane	Portsmouth	RII
59993	INT RE	International Rectifier	233 Kansas Street	El Segundo	CA
32293	INTERS	Intersil Inc.	2450 Walsh Ave.	Santa Clara	CA
-----	ITEM	Item	1249 Quarry Lane Ste. 150	Pleasanton	CA
-----	J&J	J&J Electronics Inc.	6 Faraday	Irvine	CA
0K971	JAE	JAE Electronics	142 Technology Dr., Ste. 100	Irvine	CA
91293	JOHANS	Johanson Mfg. Company	400 Rockway Valley Road	Boonton	NJ
30035	JOLO I	Jolo Industries Inc.	13921 Nautilus Drive	Garden Grove	CA
05236	JONATH	Jonathan Manufacturing Company	1101 South Acacia Ave.	Fullerton	CA
23499	JUDD	Judd Wire and Cable	870 Los Vallecitos Road	San Marcos	CA
66126	KDI	KDI Precision Products	3975 McMann Road	Cincinnati	OH

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
-----	KINKOS	KINKOS			
08EW3	KMW	KMW Inc.	9970 Bell Ranch Drive	Santa Fe Springs	CA
-----	KOA	KOA SPEER	6801 River Place Blvd.	Austin	TX
59124	KOASPE	KOA Speer Electronics Inc.	Bolivar Drive	Bradford	PA
3M918	KANEMA	Kanematsu-Gosho USA, Inc.	3335 Hope Street, Ste. 2800	Los Angeles	CA
31433	KEMET	Kemet Electronics Corp.	2835 Kemet Way	Simpsonville	SC
75263	KEYSTO	Keystone Carbon Company	1935 State Street	Street Marys	PA
91836	KING E	Kings Electronics	40 Marbledale Road	Tuckahoe	NY
62331	KRYTAR	Krytar Inc.	1292 Anvilwood Court	Sunnyvale	CA
2P953	LEMO	Lemo USA Inc.			
8Z313	LMS	LMS Electronics	34101 Monroe Road	Charlotte	NC
55261	LSI SY	LSI Computer Systems	1235 Walt Whitman Road	Melville	NY
4J674	LEADER	Leader Tech	14100 McCormick Drive	Tampa	FL
24759	LENOX	Lenox-Fugal Electronics Inc.	1071 North Grandview Ave.	Nogales	AZ
24759	LENXFU	Lenox-Fugle International, Inc.	P.O. Box 1448	Nogales	AZ
34333	LINFIN	LinFinity Microelectronics, Inc.	11861 Western Ave.	Garden Grove	CA
64155	LIN TE	Linear Technology Corp.	1630 McCarthy Blvd.	Milpitas	CA
75915	LITTLE	Littelfuse Tracor Inc.	800 East Northwest Hwy.	Des Plaines	IL
93459	LUCAS	Lucas Weinschel Inc.	5305 Spectrum Drive	Frederick	MD
0C7W7	MPULSE	M-Pulse Microwave	576 Charcot Ave.	San Jose	CA
96341	M/A CO	M/A Com	1011 Pawtucket Blvd.	Lowell	MA
53387	MICROO	Micro-Ohm Corpporation	1088 Hamilton Road	Duarte	CA
53387	MILL-M	Mill-Max	190 Pine Hollow Road		NY
2T737	MOUSER	Mouser Electronics			
53387	MULTIF	Multiflex Inc.	282 Browkaw Road	Santa Clara	CA
94696	MAGCRA	Magnecraft	1910 Techny Road	Northbrook	IL
90201	MALLOR	Mallory Capacitor Company	4760 Kentucky Ave.	Indianapolis	IN
0H1N5	MARCON	Marcon America Corp.	998 Forest Edge Drive	Vernon Hills	IL
0UC32	MARKI	Marki Microwave	2320 B Walsh Ave.	Santa Clara	CA
1ES66	MAXIM	Maxim Integrated Products	510 North Pastoria Ave.	Sunnyvale	CA
00136	MCCOY	McCoy/Oak Frequency Control Group	100 Watts Street	Mount Holly Springs	PA
63058	MCKENZ	McKenzie Technology	44370 Old Warm Springs Blvd.	Fremont	CA
3A054	MCMAST	McMaster-Carr Supply Company	9630 Norwalk Blvd.	Santa Fe Springs	CA
65249	MEMORY	Memory Protection Devices Inc.	320 Broad Hollow Road	Farmingdale	NY
0D3V2	MENLO	Menlo Industries Inc.	44060 Old Warm Springs Blvd.	Fremont	CA
12457	MERRIM	Merrimac Industries Inc.	41 Fairfield Place	West Caldwell	NJ

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
59365	METELI	Metelics Corp.	975 Stewart Drive	Sunnyvale	CA
0RN63	MICRLA	Micro Lambda, Inc.	4037 Clipper Court	Fremont	CA
-----	MICROC	Micro-Chem Inc.			
00929	MICROL	Microlab/FXR	10 Microlab Road	Livingston	NJ
54487	MICRNE	Micronetics	26 Hampshire Drive	Hudson	NH
0HFJ2	MICPLA	Microplastic Inc.	9180 Gazette Ave.	Chatsworth	CA
54186	MICROP	Micropower Systems Inc.	48720 Kato Road	Fremont	CA
14552	MICRSE	Microsemi Corp.	2830 South Fairview Street	Santa Ana	CA
66449	MICROS	Microsource Inc.	1269 Corporate Center Parkway	Santa Rosa	CA
6Y341	MTI	Microwave Technology Inc.	4268 Solar Way	Fremont	CA
34078	MIDWES	Midwest Microwave Inc.	6564 South State Road	Saline	MI
0S5P0	MILLWA	Milliwave Technology Corp.	6425-C Capital Ave.	Diamond Springs	CA
15542	MINI C	Mini Circuits Laboratory	13 Neptune Ave.	Brooklyn	NY
33592	MITEQ	Miteq Inc.	100 Davids Drive	Huappauge	NY
0D2A6	MITSUB	Mitsubishi Electronics Inc.	5665 Plaza Drive	Cypress	CA
27264	MOLEX	Molex, Inc.	2222 Wellington Court	Lisle	IL
54331	MONITO	Monitor Products Company Inc.	502 Via Del Monte	Oceanside	CA
-----	MOTION	Motion Industries, Inc.	2705 Lafayette Street	Santa Clara	CA
04713	MOT	Motorola Semiconductor Products	5005 East McDowell Road	Phoenix	AZ
04713	MOTO	Motorola Semiconductor Products	5005 East McDowell Road	Phoenix	AZ
0YP31	MULTIC	Multicore Solders	1751 Jay Ell Drive	Richardson	TX
72982	MURATA	Murata Erie North America	645 West 11th Street	Erie	PA
4T165	NEC	NEC Electronics USA Inc.	401 Ellis STreet	Mountain View	CA
-----	NIC	NIC			
0D1M6	NMB	NMB Technologies Inc.	9730 Independence Ave.	Chatsworth	CA
7T184	NTE	NTE ELectronics	44 Farrand Street	Bloomfield	NJ
60583	NARDA	Narda Microwave Corp.	11040 White Rock Road Ste 200	Rancho Cordova	CA
54516	NATCAB	National Cable Molding Company	136 San Fernando Road	Los Angeles	CA
58377	NATELE	National Electronics	11731 Markon Drive	Garden Grove	CA
64667	NATINS	National Instruments Corp.	6504 Bridge Point Parkway	Austin	TX
27014	NATION	National Semiconductor Corp.	2900 Semiconductor Drive	Santa Clara	CA
04569	NATWIR	National Wire & Cable	136 San Fernando Road	Los Angeles	CA
55680	NICHIC	Nichicon America Corp.	927 East State Parkway	Schaumburg	IL
-----	NIDEC	Nidec	152 Will Drive	Canton	MA
0LU72	NORITA	Noritake, Electronics Division	23820 Hawthorne Blvd. #100	Torrance	CA
3K718	NOVATR	Nova-Tronix Inc.	4781 Patrick Henry Drive	Santa Clara	CA

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
65238	NOVACA	Novacap	25111 Anza Drive	Valencia	CA
26233	NYLOK	Nylok Fastener Corp.	1161 Sandhill Ave., Bldg. D	Carson	CA
72259	NYTRON	Nytronics Inc.	475 Park Ave. South	New York	NY
5W060	OLANDE	Olander Company, Inc.	144 Commercial Street	Sunnyvale	CA
61964	OMRON	Omron Electronics Inc.	1E Commerce	Schaumburg	IL
12020	OVENAI	Ovenaire Division	100 Watts Street	Mount Holly Springs	PA
63345	OVERLA	Overland Products Company	1867 Airport Road	Fremont	NE
61964	PHASE	PHASE II			
0DJ29	PSELEC	PSElect	520 Mercury Drive	Sunnyvale	CA
0HS44	PAC MI	Pacific Millimeter	169 Linbrook Drive	San Diego	CA
55387	PAMTEC	Pamtech	4053 Calle Tesoro	Camarillo	CA
61058	PANSON	Panasonic Industrial Division	2 Panasonic Way	Secaucus	NJ
06383	PANDUI	Panduit Corp.	17301 Ridgeland	Tinley Park	IL
-----	PAPST	Papst Mechatronic Corp.	Aquidneck Industrial Park	Newport	RI
53919	PASTER	Pasternack Enterprises	P.O. BOX 16759	Irvine	CA
-----	PEGASU	Pegasus Electronics, Inc.	2240 Lundy Ave.	San Jose	CA
46384	PENN	Penn Engineering and Mfg Company	5190 Old Easton Road	Danboro	PA
-----	PERFOR	Performance Semiconductor Corp.	610 E. Weddell Drive	Sunnyvale	CA
3W023	PHILLI	Phillips Components	5083 Kings Highway	Saugerties	NY
5Z179	PLANAR	Planar Systems Inc.	1400 N.W. Compton Drive	Beaverton	OR
82199	POLARA	Polarad Electronics Inc.	5 Delaware Drive	Lake Success	NY
60046	POWDY	Power Dynamics, Inc.	59 Lakeside Ave.	West Orange	NJ
60393	PRECIS	Precision Resistive Products	202 Mack Lane	Mediapolis	IA
57177	PROMPT	Promptus Electronic Hardware	520 Homestead Ave.	Mount Vernon	NY
53387	QRM	Quick Reponse Mfg. Inc.	793 Ames Ave.	Milpitas	CA
1DN14	QUALCO	Qualcomm Inc.	6455 Lusk Blvd.	San Diego	CA
56866	QTI	Quality Thermistor Inc.	2147 Centurion Place	Boise	ID
-----	RFMICR	R.F. Micro Devices, Inc.	7625 Thorndike Road	Greensboro	NC
55566	RAF EL	RAF Electronic Hardware	95 Silvermine Road	Seymour	CT
53387	RICHO	Richo Inc.	5825 N Tripp Ave.	Chicago	IL
53387	RLCUOO	RLC Elect. C/O Dura	21710 Stevens Creek, Bldg. 240	Cupertino	CA
0GP12	RADIAL	Radiall Inc.	150 Long Beach Blvd.	Stratford	CT
0VUE0	RALTRO	Raltron Electronics Corportion	10651 NW 19th Street	Miami	FL
06090	RAYCHE	Raychem Corp.	300 Constitution Drive	Menlo Park	CA
06915	RICHCO	Richco Plastic Company	5825 North Tripp Ave.	Chicago	IL
06776	ROBINS	Robinson Nugent Inc.	800 East Eighth Street	New Albany	IN

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
34576	ROCKWE	Rockwell International Corp.	4311 Jamboree Road	Newport Beach	CA
4U402	ROEDER	Roederstein Electronics	2100 West Front Street	Statesville	NC
86797	ROGAN	Rogan Corp.	3455 Woodhead Drive	Northbrook	IL
65032	ROGERS	Rogers Corp.	100 North Dobson Road	Chandler	AZ
65940	ROHM	Rohm Corp.	111 Pacifica	Irvine	CA
82877	ROTRON	Rotron Inc.	7 Hasbrouck Lane	Woodstock	NY
98159	RUB-CR	Rubber Craft	15627 South Broadway	Gardena	CA
98159	RUB-TE	Rubber Teck	15627 South Broadway	Gardena	CA
0FB81	SMOS	S-MOS Systems Inc.	2460 North First Street	San Jose	CA
31586	SAFT	SAFT America Inc.	107 Beaver Court	Cockeysville	MD
53387	SEI	SEI Electronics	P.O. Box 58789	Raleigh	NC
66958	SGS	SGS Thompson Microelectronics	1000 East Bell Road	Phoenix	AZ
53387	STMICR	ST Microelectronics			
53387	SYNSEM	Synergy Semiconductor	3250 Scott Blvd.	Santa Clara	CA
07180	SAGE	Sage Laboratories Inc.	East Natick Industrial Park	Natick	MA
55322	SAMTEC	Samtec Inc.	810 Progress Blvd.	New Albany	IN
96733	SAN FE	San Fernando Electric Mfg	1501 First Street	San Fernando	CA
62559	SCHROF	Schroff Inc.	170 Commerce Drive	Warwick	RI
70561	SCITEQ	Sciteq Communications, Inc.	9990 Mesa Rim Road	San Diego	CA
7U905	SEASTR	Seastrom Inc.	2351 Kentucky Ave.	Indianapolis	IN
61394	SEEQ	Seeq Technology Inc.	47131 Bayside Parkway	Fremont	CA
59270	SELCO	Selco Products	7580 Stage Road	Buena Park	CA
55989	SEMICO	Semicon Inc.	8810 Frost Ave.	Street Louis	MO
4W070	SHARP	Sharp Electronics Corp.	Sharp Plaza Blvd.	Memphis	TN
0B549	SIEMEN	Siemens Components	10950 North Tantau Ave.	Cupertino	CA
1CY63	SMT	Sierra Microwave Technology Inc.	One Sierra Way	Georgetown	TX
17856	SILICO	Siliconix Inc.	2201 Laurelwood Road	Santa Clara	CA
5L401	SSI	Solid State, Inc.	46 Farrand Street	Bloomfield	NJ
95077	SOLITR	Solitron/Vector Microwave	3301 Electronics Way	West Palm Beach	FL
66049	SWMICR	Southwest Microwave	2922 South Roosevelt	Tempe	AZ
1W232	SPACEK	Spacek Labs	528 Santa Barbara Street	Santa Barbara	CA
24931	SPECIA	Speciality Connector Company, Inc.	2100 Earlywood Drive	Franklin	IN
56289	SPRAGU	Sprague Electric Company	68 Main Street	Sanford	ME
51791	STATEK	Statek Corp	512 North Main Street	Orange	CA
0GAA9	STATIC	Static Control Compnonents	330 Wicker Street	Sanford	NC
0KA21	STETCO	Stetco Inc.	3344 Schierhorn Court	Franklin Park	IL

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
57771	STIMPS	Stimpson Company	900 Sylvan Ave.	Bayport	NY
29005	STORM	Storm Products Company	112 South Glasglow Ave.	Inglewood	CA
1U930	SUPER	Supertex	2231 Colby Ave.	Los Angeles	CA
63155	SYNERG	Synergy Microwave Corp.	483 McLean Blvd.	Patterson	NJ
54583	TDK	TDK of America	12 Harbor Park Drive	Port Washington	NY
-----	TEMIC	TEMIC			
2W053	TARGET	Target Electronics	715A Pastoria Ave.	Sunnyvale	CA
3Z990	TECH P	Tech Pro Inc.	6243 East US Highway 98	Panama City	FL
52814	TECH-E	Tech-Etch	45 Adlrin Road	Plymouth	MA
00RB0	TECHNI	Techni-tool	1575 University Drive	Tempe	AZ
15818	TELCOM	TelCom Semiconductor	1300 Terra Bella Ave.	Mountain View	CA
11532	TELEDY	Teledyne Relays	12525 Daphne Ave.	Hawthorne	CA
15915	EPRO	Tepro of Florida Inc.	2608 Enterprise Road	Clearwater	FL
01295	TI	Texas Instruments	8505 Forrest Lane	Dallas	TX
13103	THRMLL	Thermalloy Co, Inc.	2021 W. Valley View Lane	Dallas	TX
58090	THERMO	Thermometrics	808 US Highway #1	Edison	NJ
56501	T&B	Thomas & Betts Corp.	1555 Lynnfield Road	Memphis	TN
0HHH5	THUNDE	Thunderline Z, Inc.	11 Hazel Drive	Hampstead	NH
0B3G8	TOKIN	Tokin America Inc.	2261 Fortune Drive	San Jose	CA
06049	TOPAZ	Topaz Inc.	1660 Scenic Ave.	Costa Mesa	CA
61802	TOSHIB	Toshiba International	13131 West Little York Road	Houston	TX
82152	TRANSC	Transco Products Inc.	200 West Los Angeles Ave.	Simi Valley	CA
59660	TUSONI	Tusonix Inc.	7741 N. Business Park Drive	Tucson	AZ
53421	TYTON	Tyton Corp.	7930 North Faulkner Road	Milwaukee	WI
53387	UNITED	United Mfg. Assy.	42680 Christy St.	Fremont	CA
0TAZ2	UNION	Union Carbide	39 Old Ridgebury Road	Danbury	CT
62643	UNCHEM	United Chemicon Inc.	9806 Higgins Street	Rosemont	IL
52847	USCRYS	United States Crystal Corp.	3605 McCart Street	Fort Worth	TX
3S125	UNITRO	Unitrode Corp.	5 Forbes Road	Lexington	MA
95275	VISION	Vision Electronics	1175 Spring Ctr. S BLVB	Altamont Springs	FL
53387	VPR	VPR			
27802	VECTRO	Vectron Laboratories, Inc.	166 Gover Ave.	Norwalk	CT
95275	VITRAM	Vitramon Inc.	10 Route 25	Monroe	CT
18736	VOLTRO	Voltronics Corp.	100-10 Ford Street	Denville	NJ
53387	WARDBA	Ward Bagby	1360 Piper Drive	Milpitas	CA
66579	WAFER	WaferScale Integration	47280 Kato Road	Fremont	CA

Table 6-1: List of Manufacturers

Cage	Supplier	Name	Address	City	State
00443	WAVELI	Waveline Inc.	160 Passaic Ave.	Fairfield	NJ
0AN50	WESTEC	Westec Plastics Corp.	2044 Concourse Drive	San Jose	CA
52840	WEST.D	Western Digital Corp.	3128 Red Hill Ave.	Costa Mesa	CA
16453	WEST/M	Western Microwave Inc.	495 Mercury Drive	Sunnyvale	CA
20944	WILTRO	Wiltron Company	685 Jarvis Drive, Ste. F	Morgan Hill	CA
68919	WIMA	Wima (Intertechnical Group)	2269 Saw Mill River Road	Elmsford	NY
60395	XICOR	Xicor Inc.	1151 Buckeye Drive	Milpitas	CA
68994	XILINX	Xilinx Inc.	2100 Logic Drive	San Jose	CA
58758	ZAMBRE	Zambre Company	2134M Old Middlefield Way	Mountain View	CA
79963	ZIERIC	Zierick Manufacturing Company	Radio Circle	Mt. Kisco	NY
-----	ZOLTAR	Zoltar Engineering, LLC	32 Galli Drive, Ste. A	Novato	CA

7

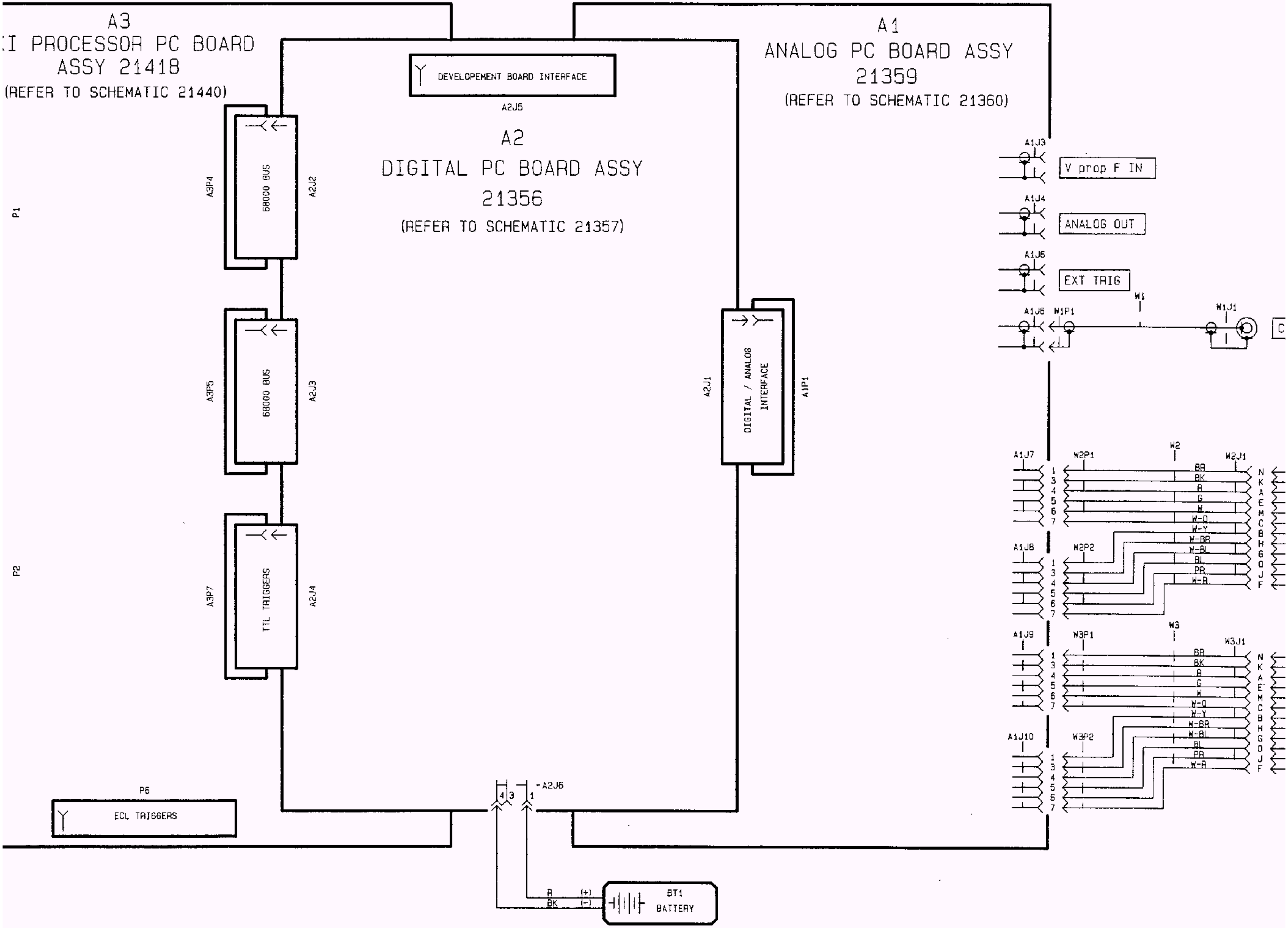
Diagrams

7.1 Introduction

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

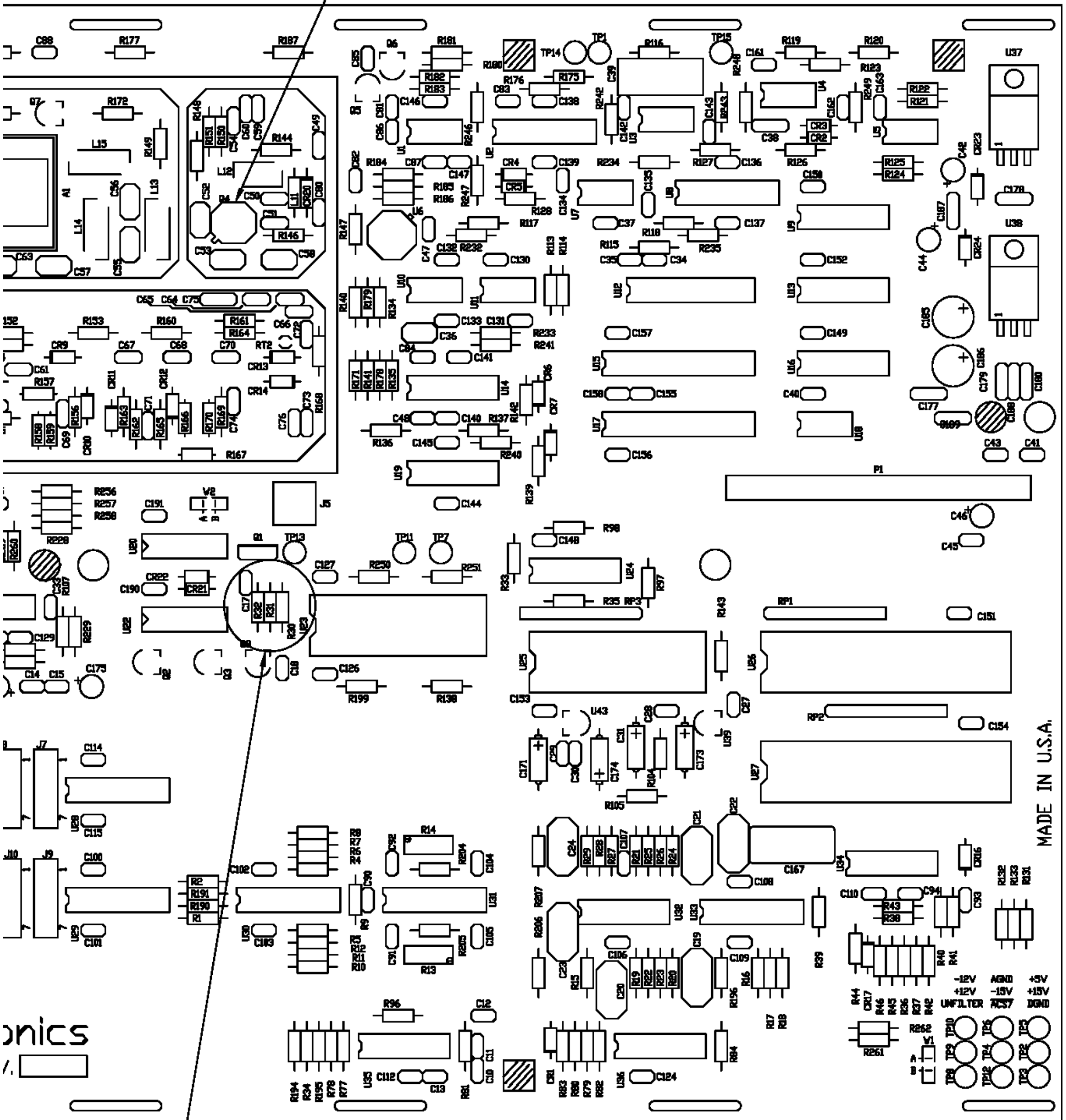
Parts lists for all assemblies are contained in Chapter 6.

11" x 17" (Landscape) pages follow continuing Chapter 7 of the 58542 Publication



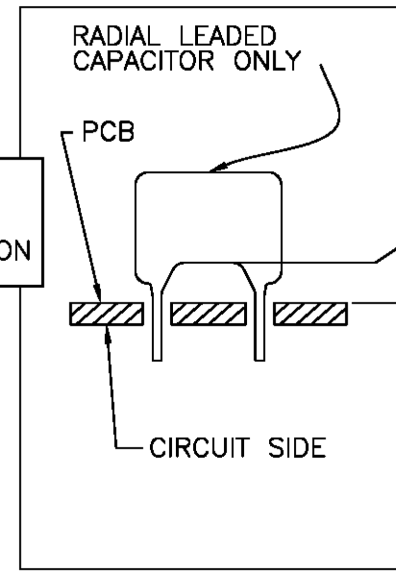
A3
I PROCESSOR PC BOARD
ASSY 21418
(REFER TO SCHEMATIC 21440)
DEVELOPEMENT BOARD INTERFACE
A2J5
A2
DIGITAL PC BOARD ASSY
21356
(REFER TO SCHEMATIC 21357)
A1
ANALOG PC BOARD ASSY
21359
(REFER TO SCHEMATIC 21360)
A3P4
68000 BUS
A2J2
A3P5
68000 BUS
A2J3
A3P7
TTL TRIGGERS
A2J4
P1
P2
A2J1
DIGITAL / ANALOG INTERFACE
A1P1
A1J3
V prop F IN
A1J4
ANALOG OUT
A1J5
EXT TRIG
A1J6
W1P1
W1
W1J1
A1J7
W2P1
W2
W2J1
A1J8
W2P2
A1J9
W3P1
W3
W3J1
A1J10
W3P2
BR
BK
R
G
W
W-O
W-Y
W-BR
W-BL
BL
PR
W-R
N K A E M C B H G O J F
P6
ECL TRIGGERS
A2J6
R
BK
(+)
(-)
BT1
BATTERY

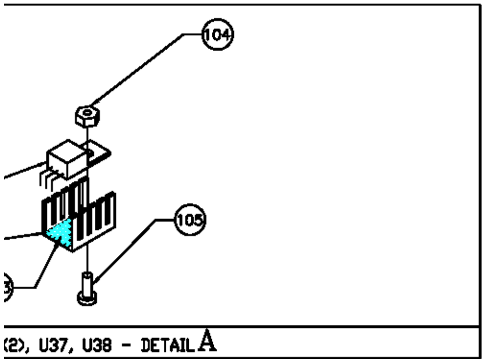
SEE DETAIL H
SHEET 2 (Q4)



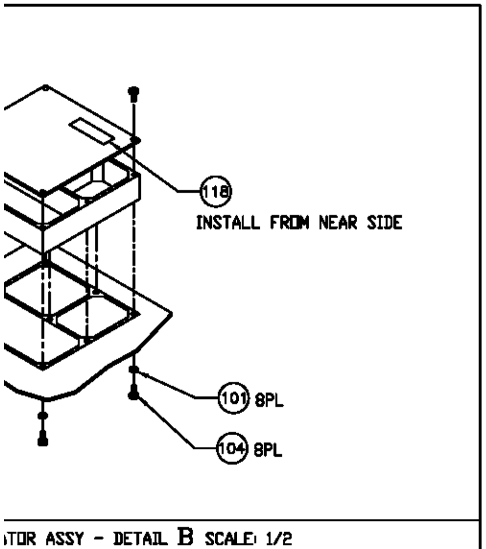
DETAIL G

DETAIL K
NO SCALE
CAP INSTALLATION

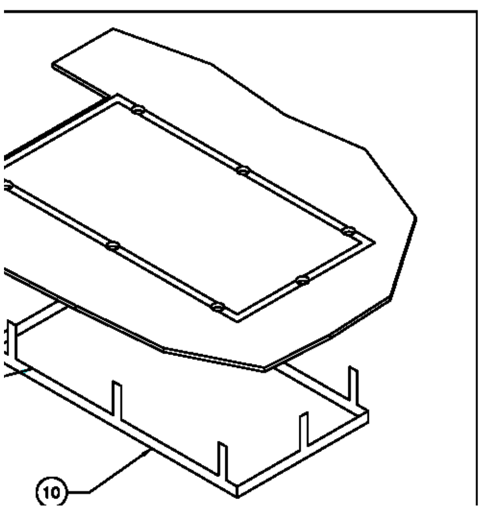




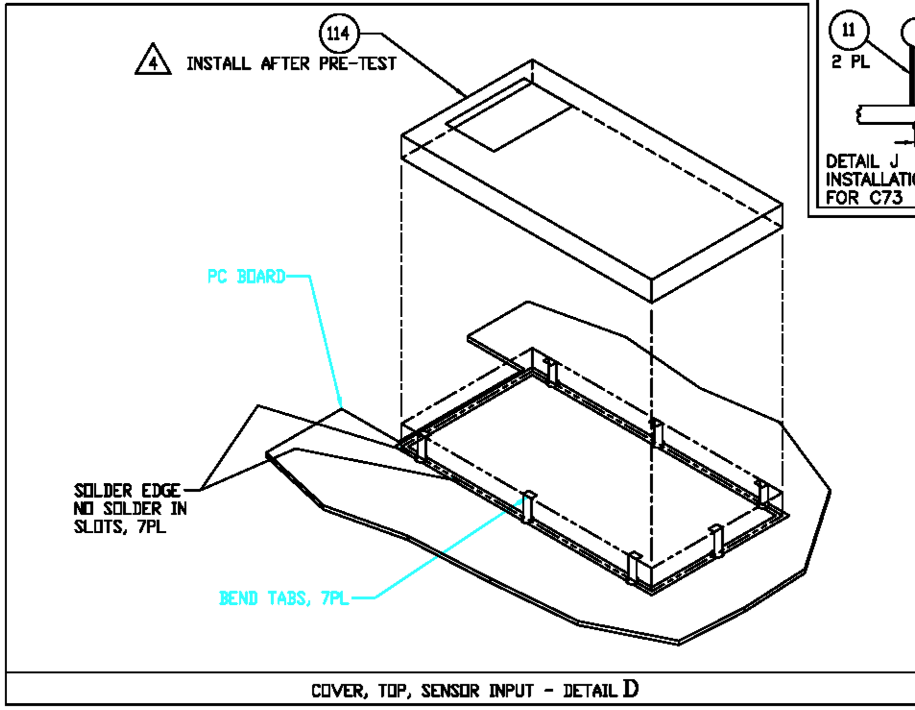
104
105
(2), U37, U38 - DETAIL A



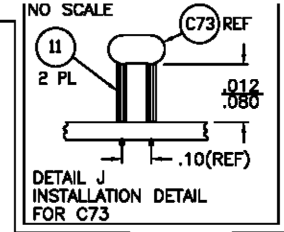
118
INSTALL FROM NEAR SIDE
101 8PL
104 8PL
TOR ASSY - DETAIL B SCALE: 1/2



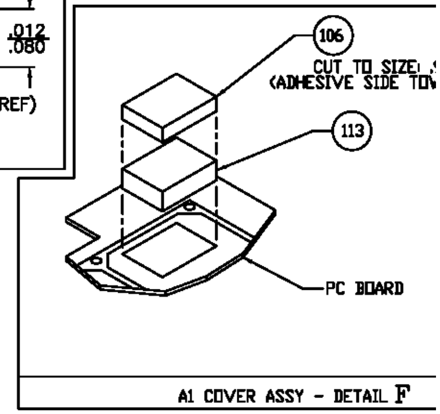
10



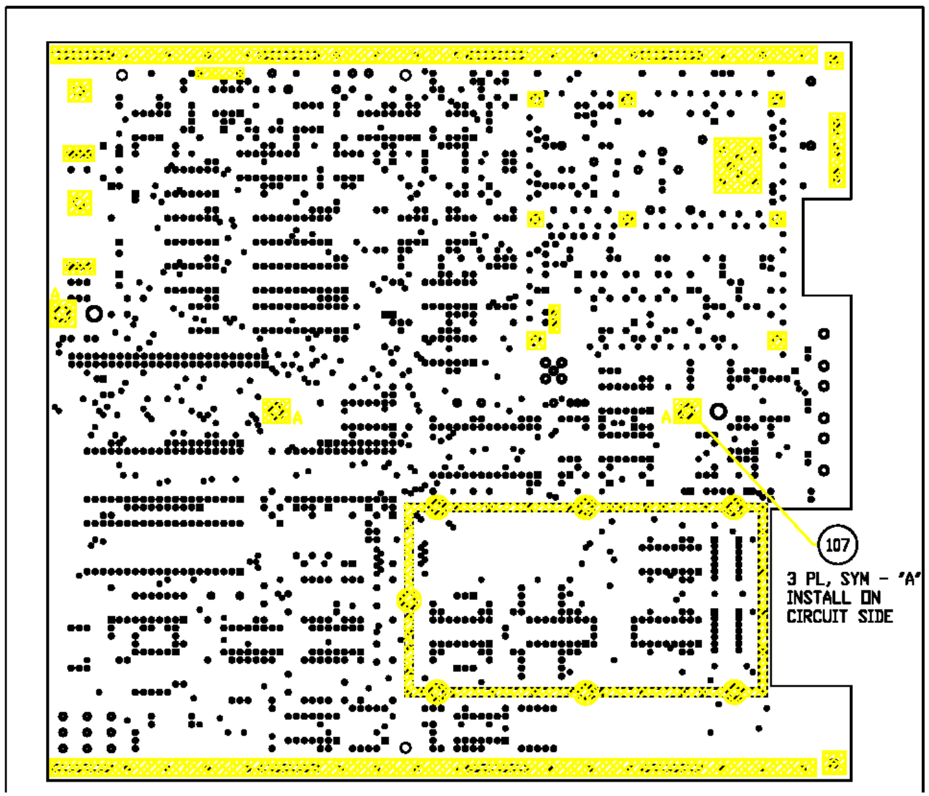
114
4 INSTALL AFTER PRE-TEST
PC BOARD
SOLDER EDGE
NO SOLDER IN
SLOTS, 7PL
BEND TABS, 7PL
COVER, TOP, SENSOR INPUT - DETAIL D



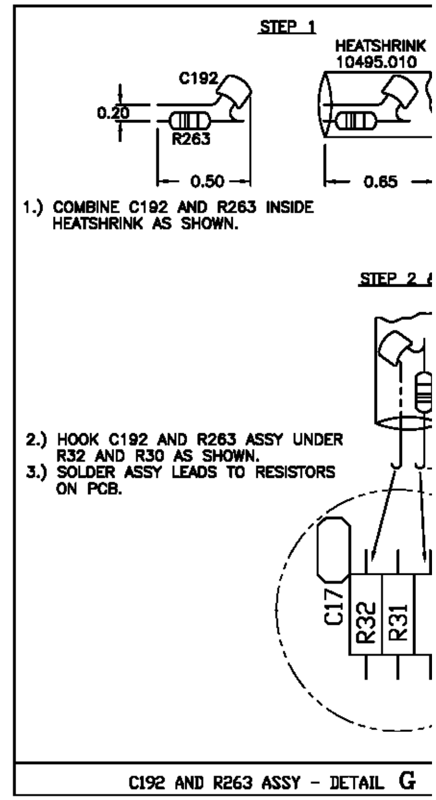
NO SCALE
C73 REF
11
2 PL
.012
.080
.10(REF)
DETAIL J
INSTALLATION DETAIL
FOR C73



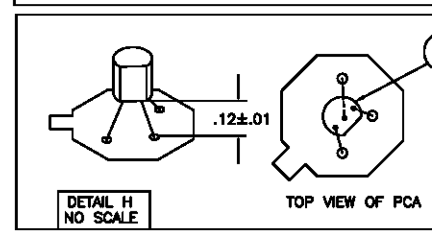
106
CUT TO SIZE;
(ADHESIVE SIDE TO
113
PC BOARD
A1 COVER ASSY - DETAIL F



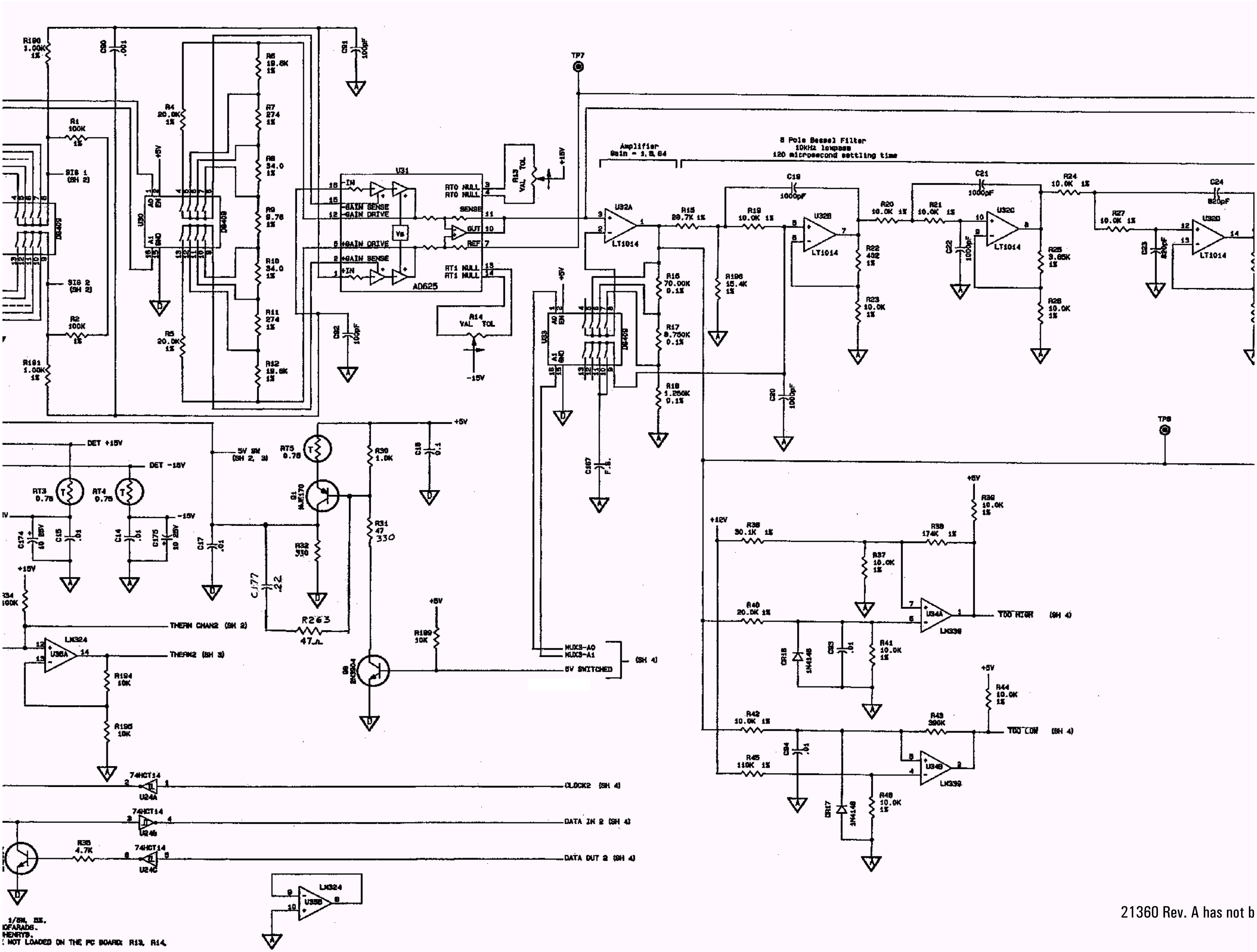
107
3 PL, SYM - "A"
INSTALL ON
CIRCUIT SIDE



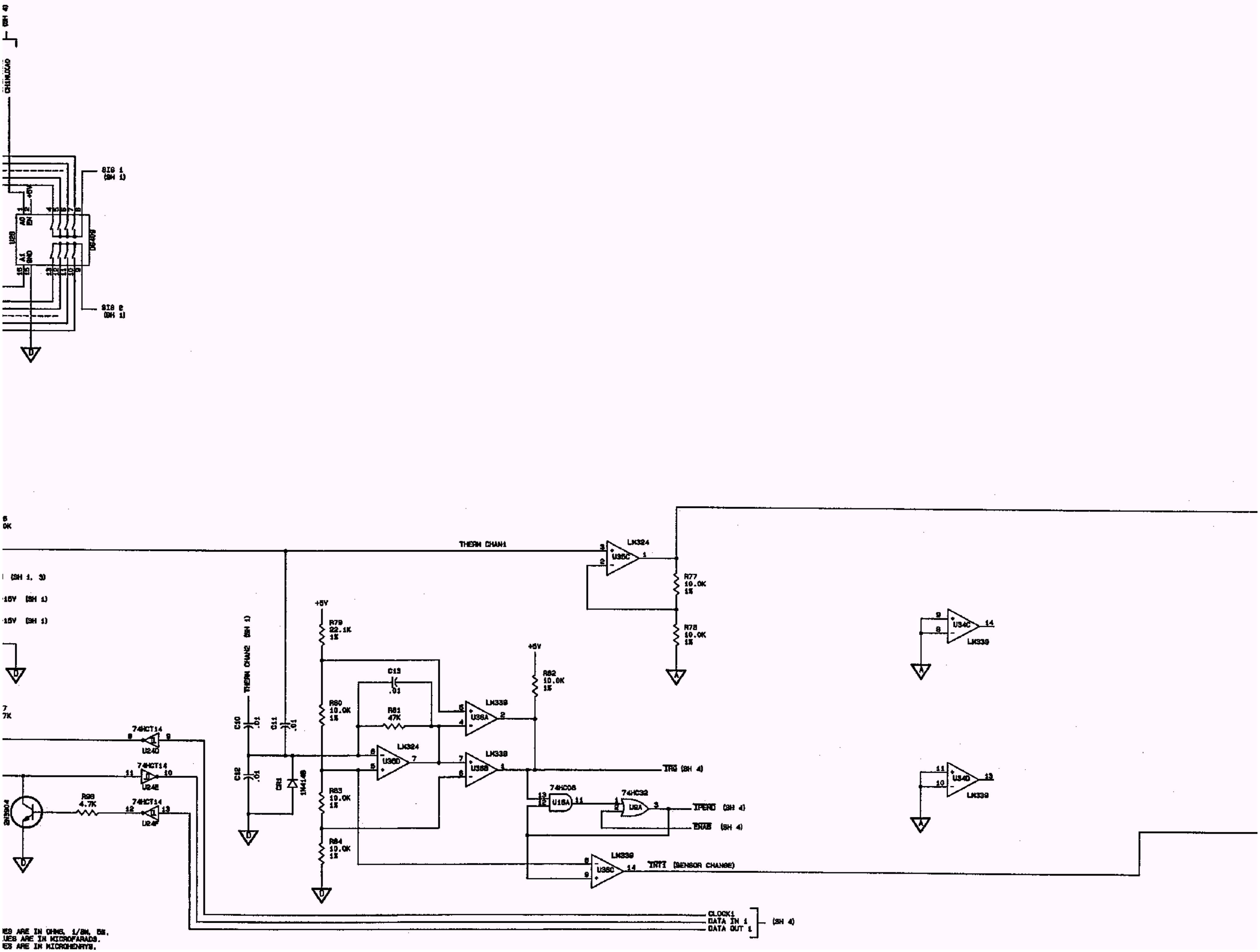
STEP 1
HEATSHRINK
10495.010
C192
0.20
R263
0.50
0.65
1.) COMBINE C192 AND R263 INSIDE
HEATSHRINK AS SHOWN.
STEP 2
2.) HOOK C192 AND R263 ASSY UNDER
R32 AND R30 AS SHOWN.
3.) SOLDER ASSY LEADS TO RESISTORS
ON PCB.
C17
R32
R31
C192 AND R263 ASSY - DETAIL G



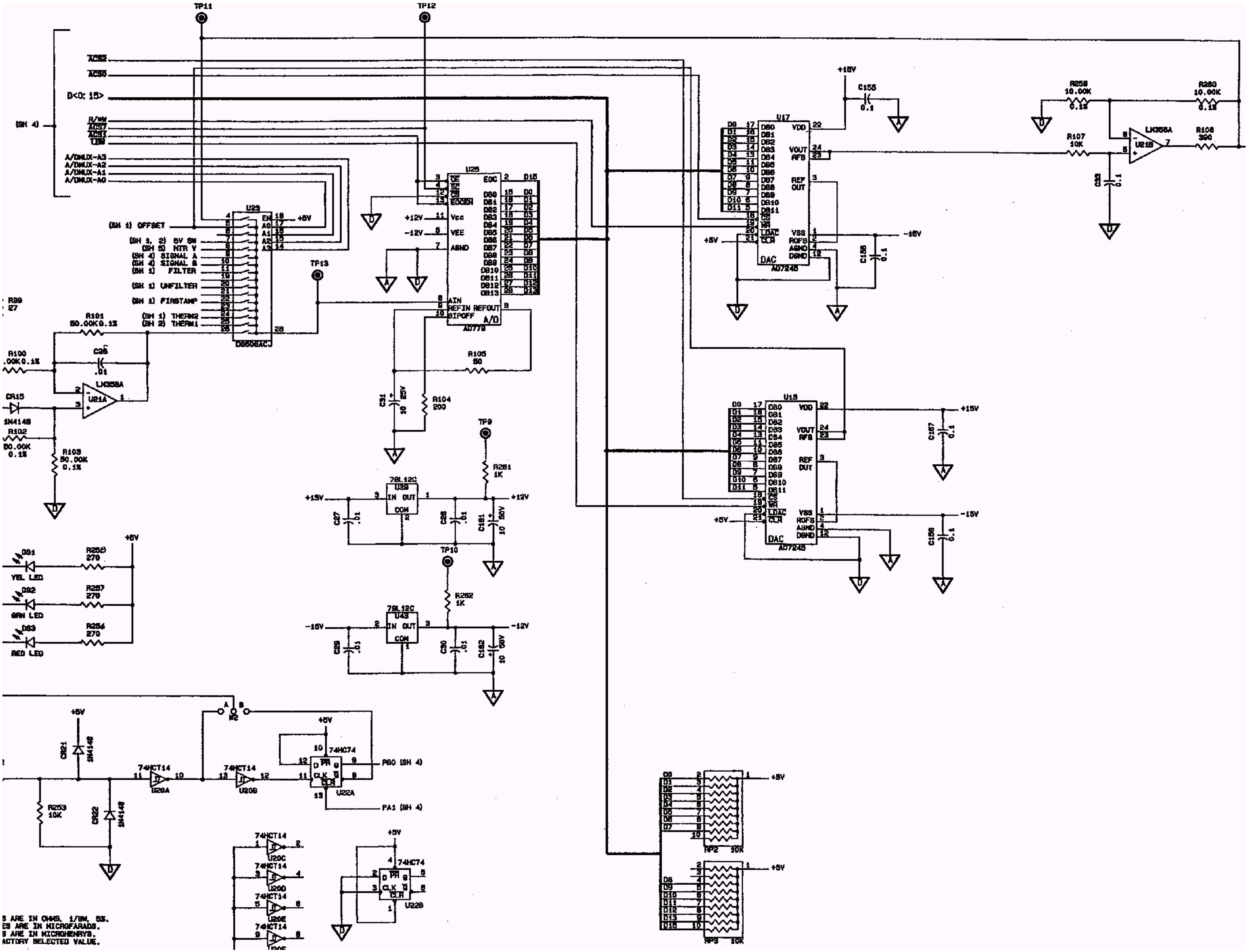
.12±.01
DETAIL H
NO SCALE
TOP VIEW OF PCA



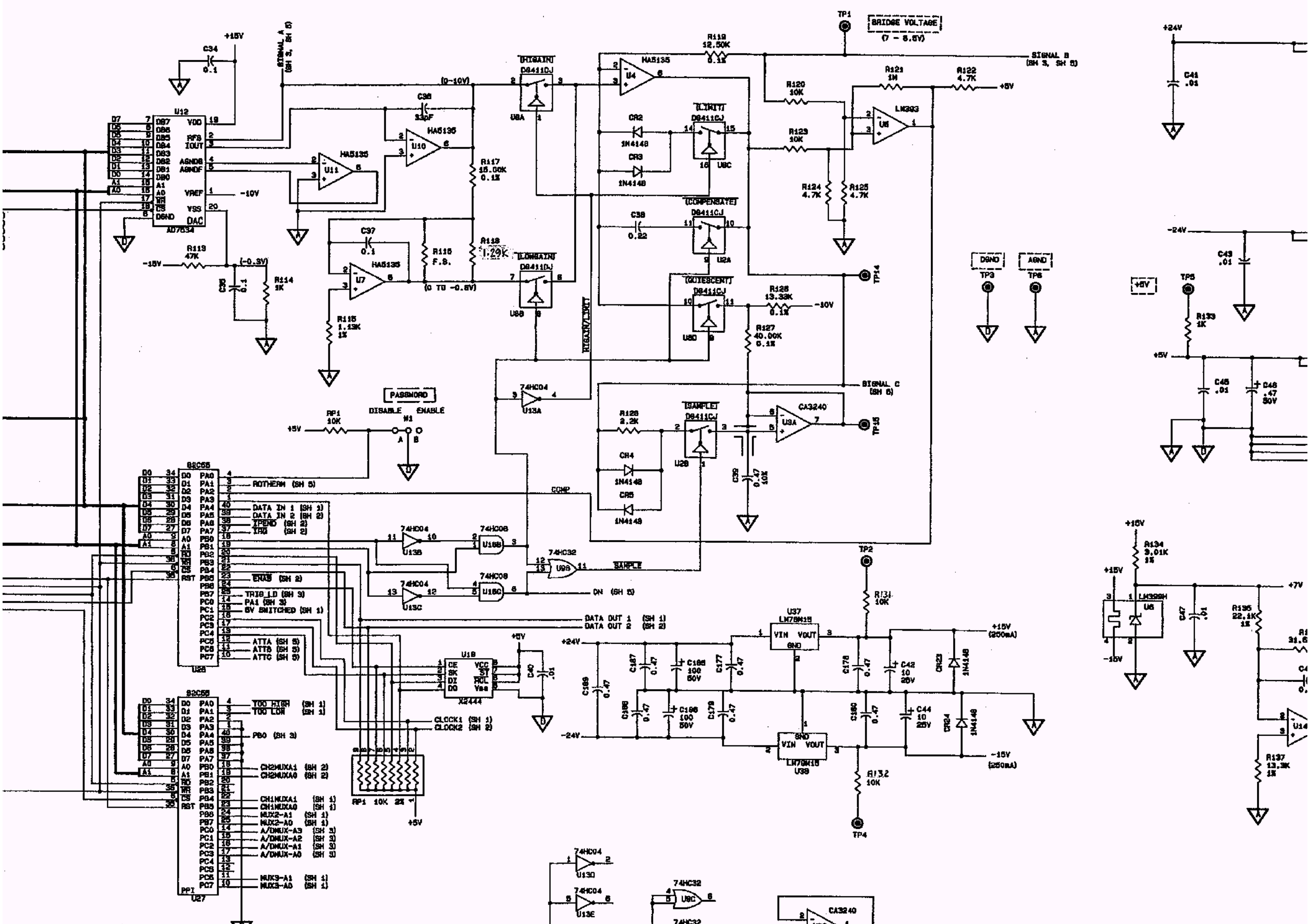
21360 Rev. A has not b



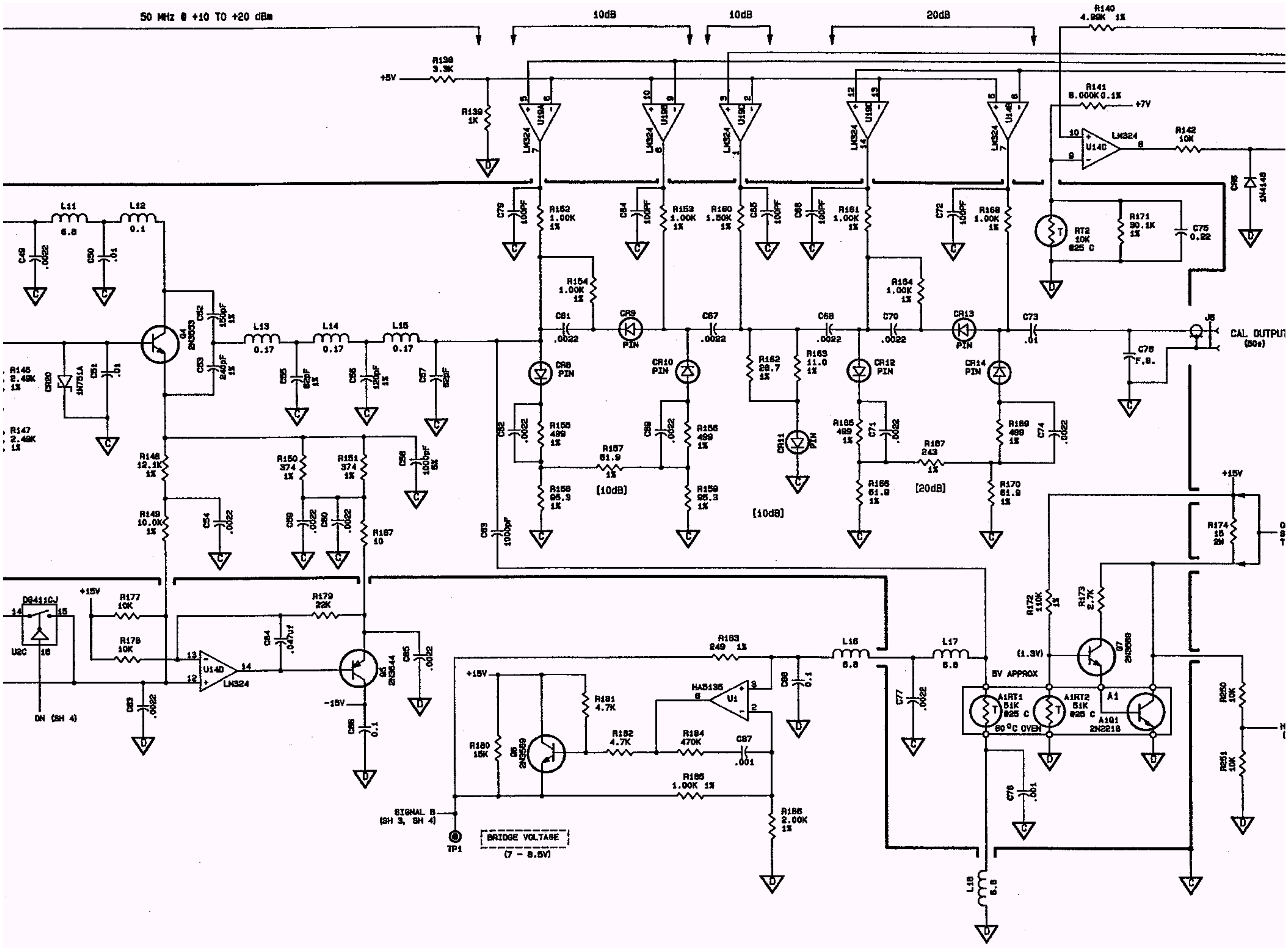
SIG 1 (SH 1)
SIG 2 (SH 1)
THERM CHAN1
LM324
U35C
R77 10.0K 1%
R78 10.0K 1%
(SH 1, 3)
+15V (SH 1)
-15V (SH 1)
THERM CHAN2 (SH 1)
+5V
R79 22.1K 1%
C13 .01
R80 10.0K 1%
R81 47K
LM339
U36A
R82 10.0K 1%
LM324
U35D
U36B
TRG (SH 4)
74HC08
U16A
74HC32
U2A
IPEND (SH 4)
ENAB (SH 4)
R83 10.0K 1%
R84 10.0K 1%
INT1 (SENSOR CHANGE)
U36C
CR1 1N4148
74HCT14
U24D
U24E
U24F
R98 4.7K
2N3904
U34C
U34D
CLOCK1
DATA IN 1
DATA OUT 1
(SH 4)
DG409



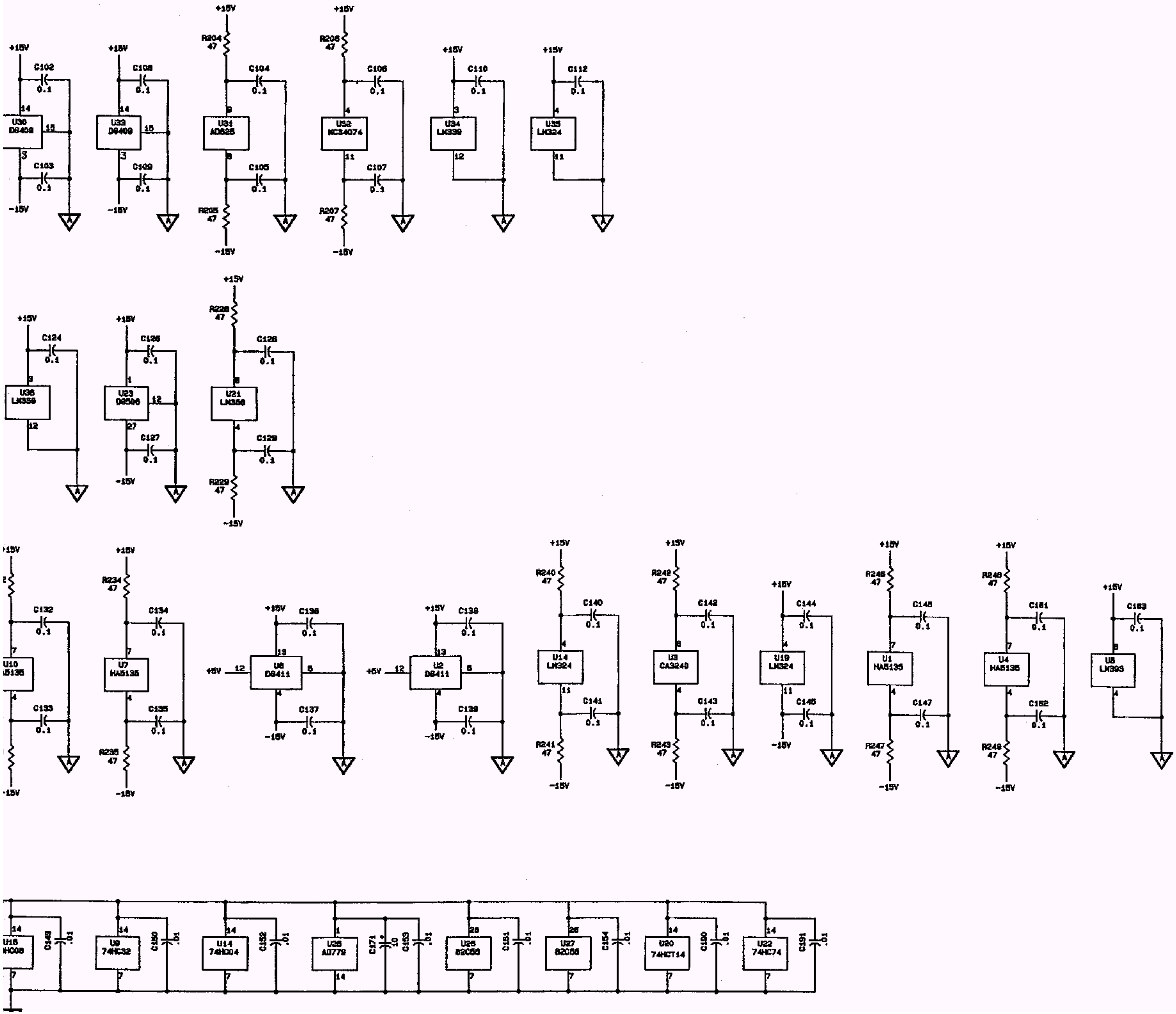
TP11
TP12
TP13
TP9
TP10
ACS2
ACS0
D<0:15>
(SH 4)
R/WW
ACS7
ACS1
LDW
A/DMUX-A3
A/DMUX-A2
A/DMUX-A1
A/DMUX-A0
U25
AD779
A/D
EOC
OE
CS
EOCEN
Vcc
VEE
AGND
AIN
REFIN
REFOUT
BIPOFF
U29
DG506ACJ
EN
A0
A1
A2
A3
(SH 1) OFFSET
(SH 1, 2) 5V SW
(SH 5) HTR V
(SH 4) SIGNAL A
(SH 4) SIGNAL B
(SH 1) FILTER
(SH 1) UNFILTER
(SH 1) FIRSTAMP
(SH 1) THERM2
(SH 2) THERM1
+5V
+12V
-12V
+15V
-15V
U17
U18
AD7245
DAC
VDD
VOUT
RFB
REF OUT
VSS
ROFS
AGND
DGND
LDAC
CLR
WR
C155
0.1
C156
C157
C158
R258
10.00K
R260
10.00K
0.1%
R107
10K
R108
390
C33
0.1
LM358A
U21B
U21A
R101
50.00K 0.1%
R100
C25
.01
CR15
1N4148
R102
50.00K
0.1%
R103
50.00K
0.1%
R39
27
R105
50
R104
200
C31
10
25V
R261
1K
R262
1K
78L12C
U39
79L12C
U43
IN
OUT
COM
C27
.01
C28
.01
C161
10
50V
C29
.01
C30
.01
C162
10
50V
DS1
YEL LED
DS2
GRN LED
DS3
RED LED
R259
270
R257
270
R256
270
CR21
1N4148
CR22
1N4148
R253
10K
74HCT14
U20A
U20B
U20C
U20D
U20E
U20F
74HC74
U22A
U22B
PR
CLK
CLR
PB0 (SH 4)
PA1 (SH 4)
W2
RP2
RP3
10K
S ARE IN OHMS, 1/8W, 5%.
ES ARE IN MICROFARADS.
S ARE IN MICROHENRYS.
ACTORY SELECTED VALUE.



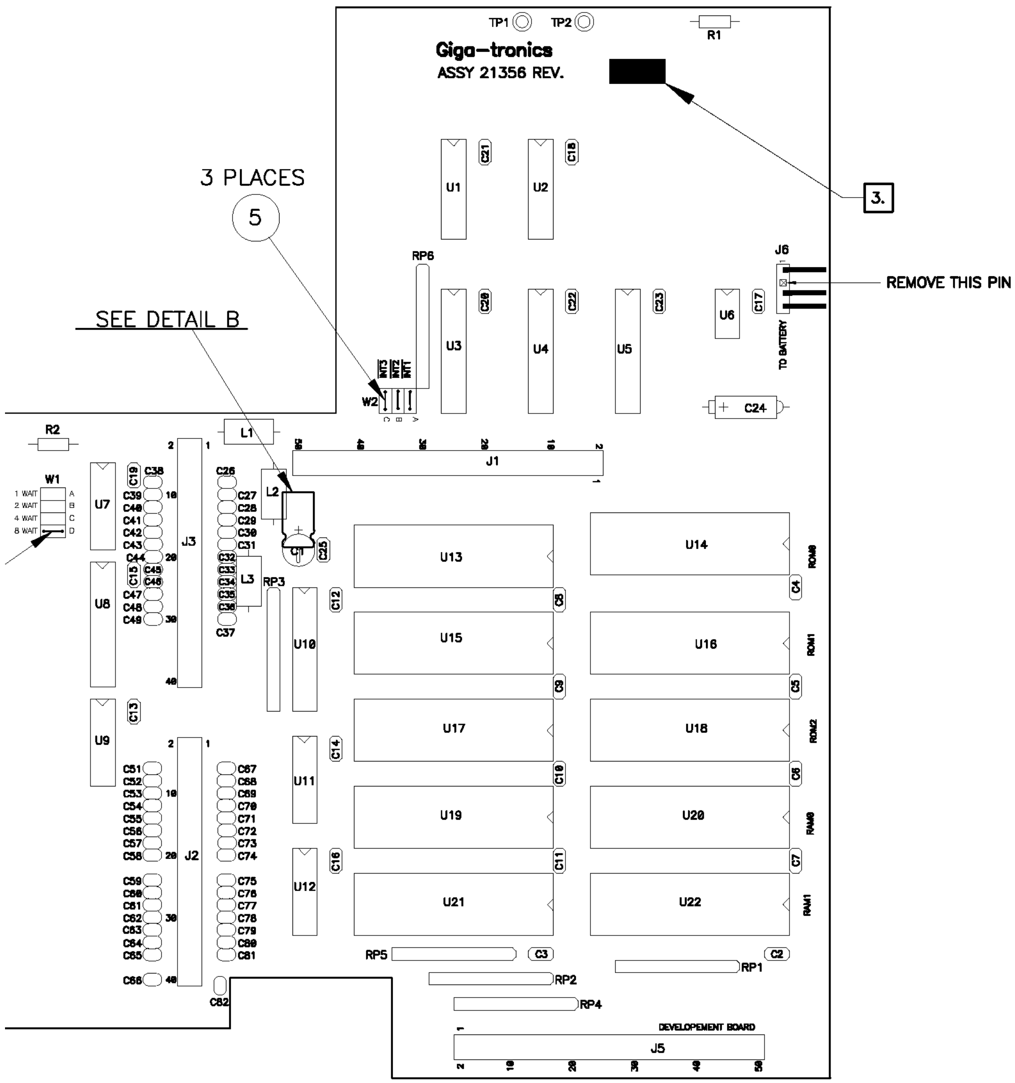
RE IN OHMS, 1/8W, 5%.
ARE IN MICROFARADS.
RE IN MICROHENRYS.



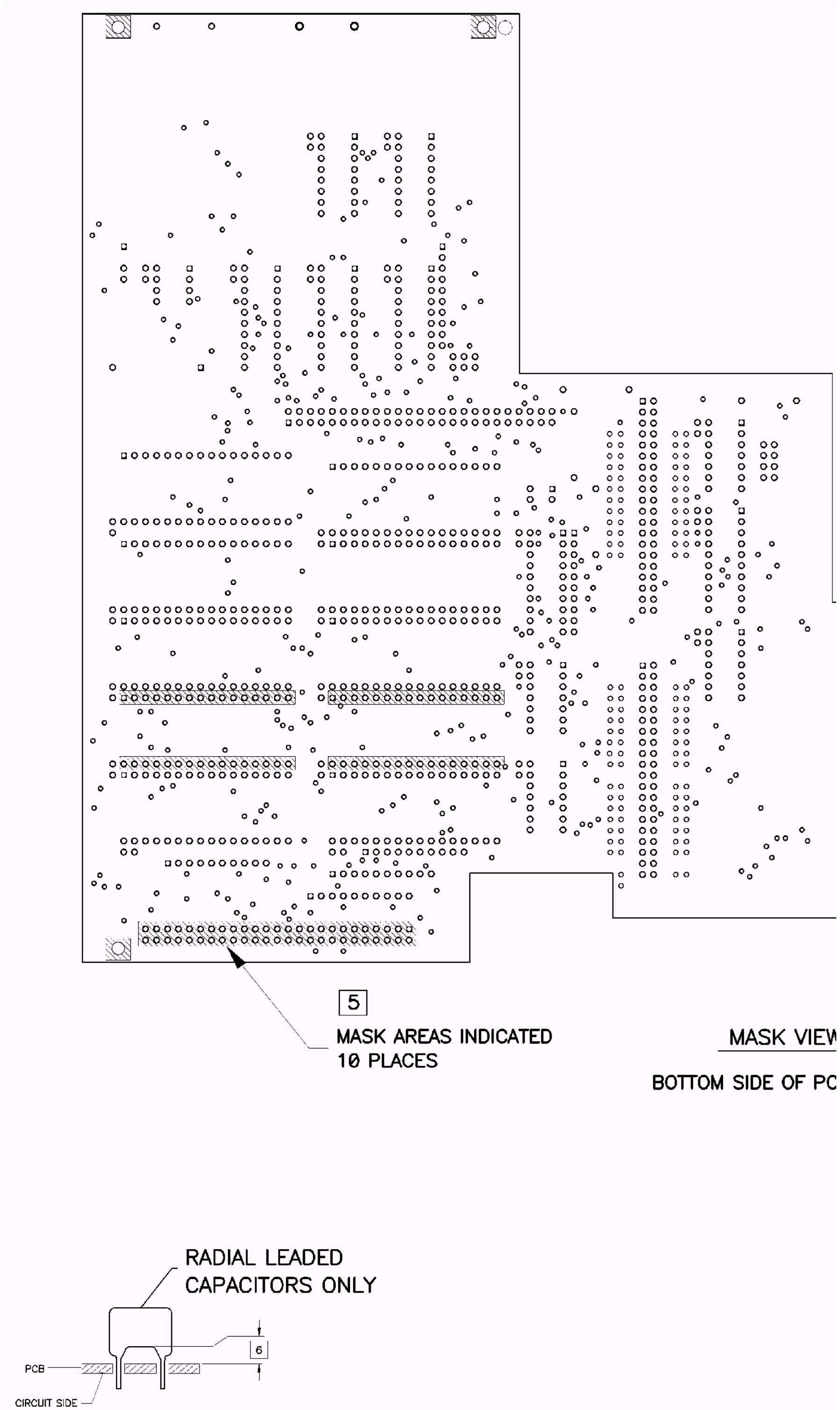
50 MHz @ +10 TO +20 dBm
10dB
10dB
20dB
CAL OUTPUT (50Ω)
BRIDGE VOLTAGE (7 - 8.5V)
SIGNAL B (SH 3, SH 4)
TP1
ON (SH 4)
5V APPROX
80°C OVEN



NOTES:
1. RESISTOR VALUES
2. CAPACITOR VALUE
3. INDUCTOR VALUES
4. F.S. DENOTES FA

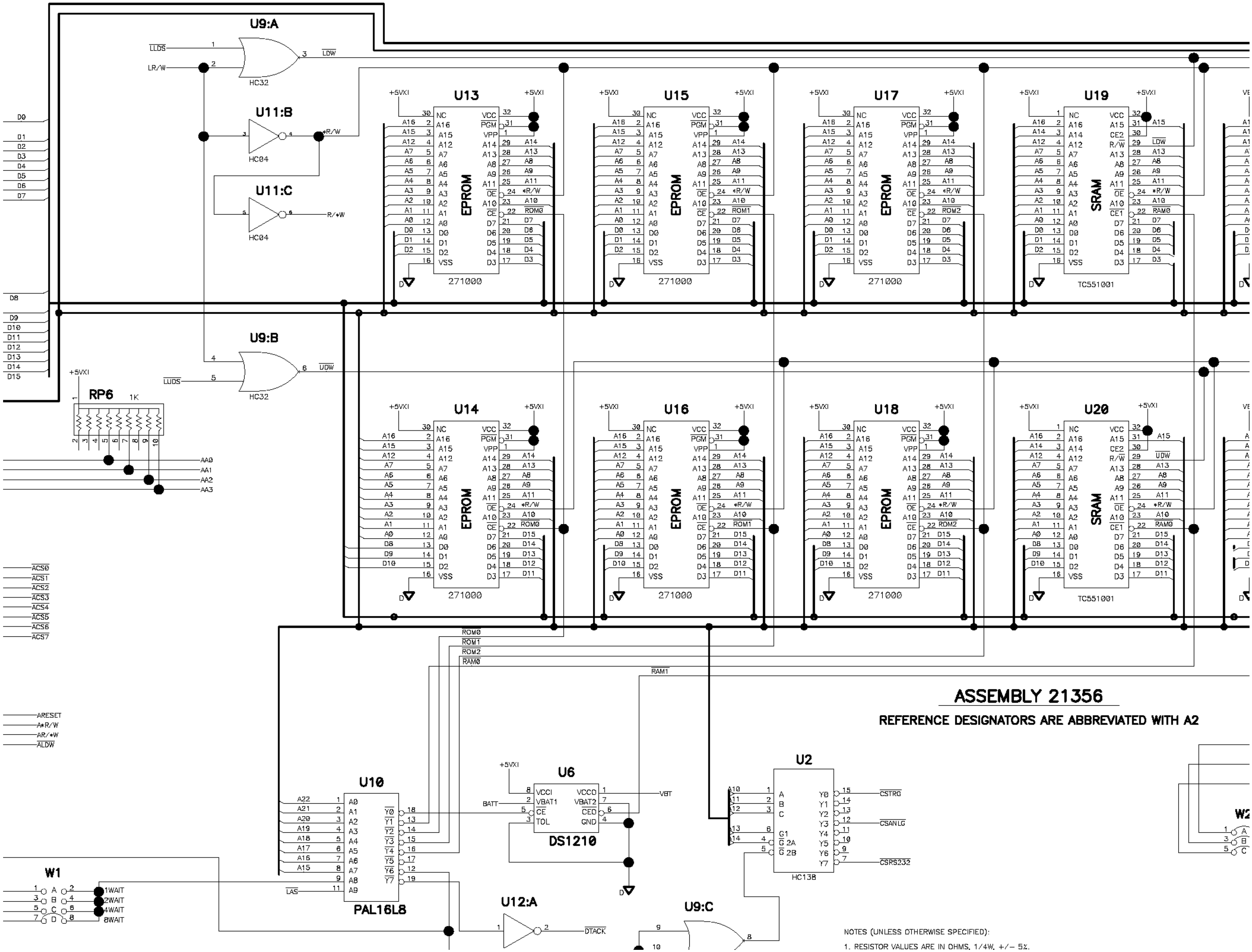


COMPONENT SIDE



MASK VIEW

BOTTOM SIDE OF PC

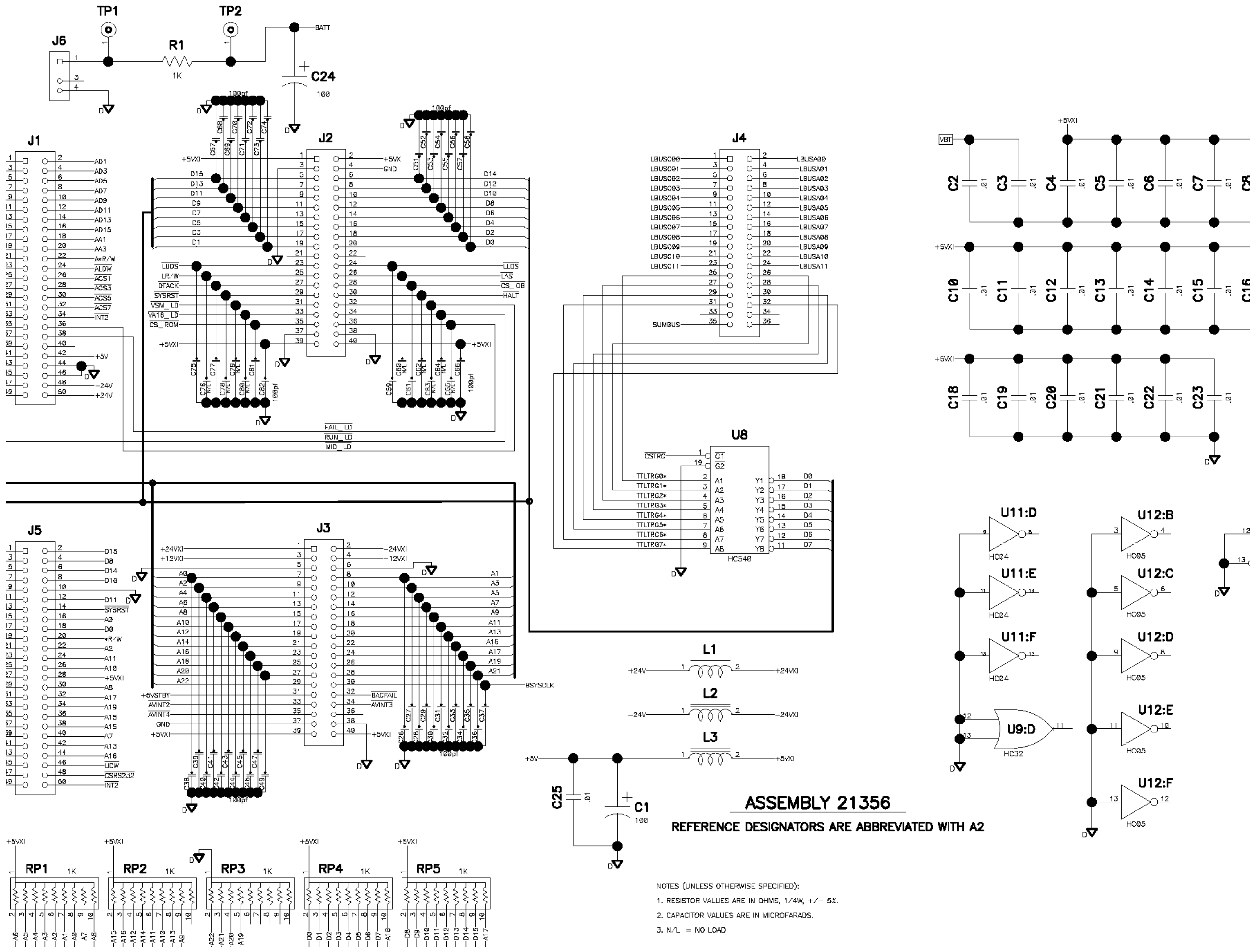


ASSEMBLY 21356

REFERENCE DESIGNATORS ARE ABBREVIATED WITH A2

NOTES (UNLESS OTHERWISE SPECIFIED):

1. RESISTOR VALUES ARE IN OHMS, 1/4W, +/- 5%.



ASSEMBLY 21356

REFERENCE DESIGNATORS ARE ABBREVIATED WITH A2

NOTES (UNLESS OTHERWISE SPECIFIED):

1. RESISTOR VALUES ARE IN OHMS, 1/4W, +/- 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. N/L = NO LOAD

A

Program Examples

A.1 Introduction

This appendix contains examples of the various operating programs in the 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, assuring that the 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 the user 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 the user 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 the DUT measurement port. DO NOT attach the sensor to the power meter's calibrator port. The zeroing offset process will 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 performing critical final power measurements in the bottom 15 to 20 dB of a power sensors dynamic range. Zeroing removes zero drift error from the 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 the user asks 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 the user asks 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 as 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 the user's 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 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 switching the default averaging control, SENS#:AVER:TCON MOV, to SENS#:AVER:TCON REP.

When using the MEAS#? command, Auto-Averaging is automatically set to ON. If another part of programming was using manual averaging, be sure to turn Auto-Averaging back off (SENS#:AVER:COUN:AUTO OFF) before exiting the section of the program code using MEAS? When operating in NORMal Mode the user 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 sending the MEAS#? command, two configuration changes occur. These are listed as shown below. 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 sending 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 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 the user needs 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 Series 80350A 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 the 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;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.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 the 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 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 it's 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
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 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 using BURSt Mode. For example, the user must use INIT:CONT ON; the user does not have manual control of trigger arming sequence using INIT, as the user 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. The user must control the triggering through control of the trigger source. The user must use INIT:CONT ON in BURSt Mode; using INIT control arming of the trigger sequence is not allowed.

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 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, consider turning 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 $V_{PROP}F$ connector on the front panel. In the first part of the program the power meter's $V_{PROP}F$ 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 how to input 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 2.5.32 for more information). This technique applies a specific known value during measurements. It is useful when having performed a sensor calibration with other devices attached to the sensor input, such as a power splitter or coupler, but 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 measuring a single frequency, this technique will not be need for 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 entering 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 if changing 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 the 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.,Swep_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 Swep_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; The user 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 the 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 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
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.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
420                                        ! Applies Cal Factor in burst mode
440                                        ! Can be sent before or after CALC#:MODE BURS
450  !
460  OUTPUT @Pwr_mtr;TRIG:SOUR EXT         ! EXT TTL Level input begins BURSt Mode measure-
ment.
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, -30 dBm.
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 user or 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 reading 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, if preferred use a simple WHILE/UNTIL loop in the program to detect when the operator connects the correct power sensor.

Tracking the model number allows the user to be sure that a sensor is being used which is appropriate for measurement application. For example, some user 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. The user's program can automatically check for the appropriate sensor and prompt to Please connect Giga-tronics 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_mdl=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_mdl=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_mdl=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_mdl;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, the user 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
```

B

Power Sensors

B.1 Introduction

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

- Power Sensor Selection
- Power Sensor Calibration

B.2 Power Sensor Selection

Standard Series 803XXA Sensors measure CW signals from -70 to +20 dBm; and the Series 804XXA Sensors measure modulated or CW signals from -67 to +20 dBm; the 58542 VXIbus Universal Power Meter also use Peak Power Sensors for measuring radar and digital modulation signals.

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

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

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

B.2.1 Modulation Power Sensors

Table B-1: Power Sensor Selection Guide

Model	Freq. Range/ Power Range	Max. Power	Power Linearity[4] (Freq > 8 GHz)	RF Conn.	Length	Dia.	Wgt.	VSWR
Standard CW Sensors								
80301A	10 MHz to 18 GHz -70 to +20 dBm	+23 dBm (200 mW)	-70 to -20 dBm ±0.00 dB -20 to +20 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.29:12.4 - 18 GHz
80302A				APC-7 50Ω				
80303A	10 MHz to 26.5 GHz -70 to +20 dBm		-70 to +20 dBm ±0.00 dB -20 to +20 dBm ±0.1 dB/10 dB	Type K(m)1 50Ω				1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.38:12.4 - 18 GHz 1.43:18 - 26.5 GHz 1.92:26.5 - 40 GHz
80304A	10 MHz to 40 GHz -70 to 0 dBm		-70 to -20 dBm ±0.00 dB -20 to 0 dBm ±0.2 dB/10 dB					
Low VSWR CW Sensors								
80310A	10 MHz to 18 GHz -64 to +26 dBm	+29 dBm (800 mW)	-64 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.05 dB/10 dB	Type K(m)[1] 50W	127mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5lb)	1.13:0.01 - 2 GHz 1.15:2 - 12 GHz 1.23:12 - 18 GHz 1.29:18 - 26.5 GHz 1.50:26.5 - 40 GHz
80313A	10 MHz to 26.5 GHz -64 to +26 dBm		-64 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.1 dB/10 dB					
80314A	10 MHz to 40 GHz -64 to +6 dBm		-64 to -14 dBm ±0.00 dB -14 to + 6 dBm ±0.2 dB/10 dB					
1W CW Sensors								
80320A	10 MHz to 18 GHz -60 to +30 dBm	+30 dBm (1 W)	-60 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.05 dB/10 dB	Type K(m)[1] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.11:0.01 - 2 GHz 1.12:2 - 12 GHz 1.18:12 - 18 GHz 1.22:18 - 26.5 GHz 1.36:26.5 - 40 GHz
80323A	10 MHz to 26.5 GHz -60 to +30 dBm		-60 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.1 dB/10 dB					
80324A	10 MHz to 40 GHz -60 to +10 dBm		-60 to -10 dBm ±0.00 dB -10 to +10 dBm ±0.2 dB/10 dB					

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

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

Notes:

1. The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors.
2. Power coefficient equals <0.01 dB/Watt.
3. Power coefficient equals <0.015 dB/Watt.
4. For frequencies above 8 GHz, add power linearity to system linearity.
5. Peak operating range above CW maximum range is limited to <10% duty cycle.
6. Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NIST.
7. Square root of sum of the individual uncertainties squared (RSS).
8. Cal Factor numbers allow for 3% repeatability when connecting attenuator to sensor, and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination. 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 80402 80303 80304 80343 80344	80310A 80313A 80314A	80320A 80323A 80324A	80321A[8] 80322A[8] 80325A[8]	80330A 80333A 80334A	80301 80302 80340 80401A 80402 80303 80304 80343 80344	80310A 80313A 80314A	80320A 80323A 80324A	80321A[8] 80322A[8] 80325A[8]	80330A 80333A 80334A	80321A[8] 80322A[8] 80325A[8]	80330A[8] 80333A[8] 80334A[8]
0.1	1	1.61	3.06	2.98	2.96	7.61	2.95	1.04	1.64	1.58	1.58	4.54	1.58
1	2	1.95	3.51	3.58	3.57	7.95	3.55	1.20	1.73	1.73	1.73	4.67	1.73
2	4	2.44	4.42	4.33	4.29	8.44	4.27	1.33	1.93	1.91	1.91	4.89	1.90
4	6	2.67	4.74	4.67	4.63	8.67	4.60	1.41	2.03	2.02	2.01	5.01	2.01
6	8	2.86	4.94	4.87	4.82	8.86	4.80	1.52	2.08	2.07	2.06	5.12	2.06
8	12.4	3.59	6.04	5.95	5.90	9.59	5.87	1.92	2.55	2.54	2.53	5.56	2.53
12.4	18	4.09	6.86	6.76	6.69	10.09	6.64	2.11	2.83	2.80	2.79	5.89	2.78
18	26.5	––	9.27	9.43	9.28	––	9.21	––	3.63	3.68	3.62	––	3.59
26.5	40	––	15.19	14.20	13.86	––	13.66	––	6.05	5.54	5.39	––	5.30

Notes:

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

Modulation-Induced Measurement Uncertainty for the 80401A Sensor

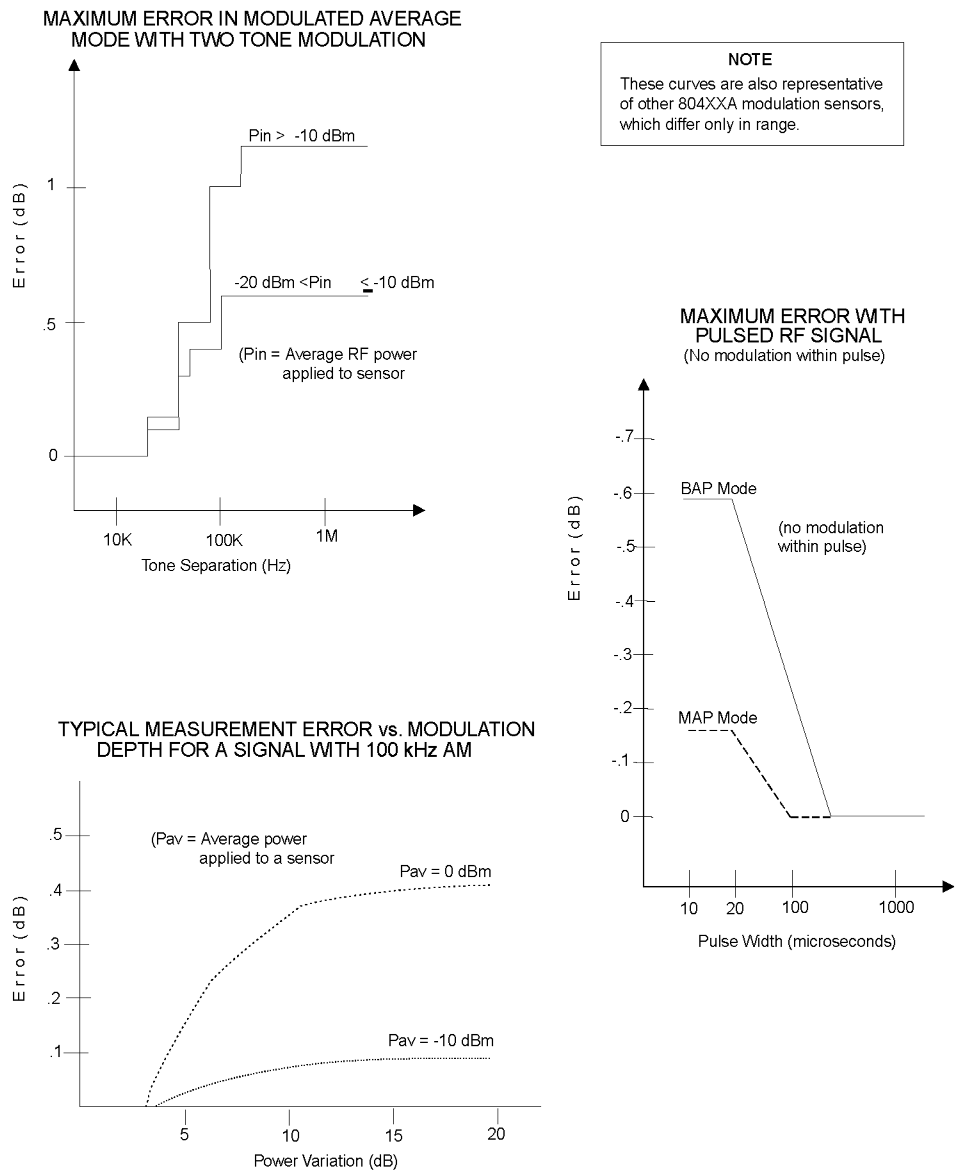


Figure B-1: 80401A Modulation-Related Uncertainty

B.2.2 BAP Mode Limitations

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

B.2.3 Peak Power Sensors

Table B-3: 8035XA Peak Power Sensor Selection Guide

Peak Power Sensors								
Model	**Freq. Range/ Power Range**	**Max. Power**	**Power Linearity[4]**	**RF Conn.**	**Dimensions**		**Wgt.**	**VSWR**
					Length	**Dia.**		
Standard Peak Power Sensors								
80350A	45 MHz to 18 GHz -20 to +20 dBm, Peak -30 to +20 dBm, CW		-30 to -20 dBm ±0.00 dB -20 to +20 dBm ±0.05 dB/10 dB	Type N(m) 50Ω				1.12:0.045 - 2 GHz 1.22:2 - 12.4 GHz 1.37:12.4 -18 GHz
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	Type K(m)[1] 50Ω	165 mm (6.5 in)	37 mm 1.25 in)	0.3 kg (0.7 lb)	1.12:0.045 - 2 GHz 1.22:2 - 12.4 GHz 1.37:12.4 -18 GHz 1.50:18 - 26.5 GHz
80354A	45 MHz to 40 GHz -20 to +0.0 dBm, Peak -30 to +0.0 dBm, CW		-30 to -20 dBm ±0.00 dB -20 to 0.0 dBm ±0.2 dB/10dB					1.12:0.045 - 2 GHz 1.22:2 - 12.4 GHz 1.37:12.4 -18 GHz 1.50:18 - 26.5 GHz 1.92:26.5 - 40 GHz
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	Type N(m) 50Ω	200 mm (7.9 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)	1.15:0.045 - 4 GHz 1.25:4 - 12.4 GHz 1.35:12.4 -18 GHz
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 ±0.00 dB +10 to +50 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	280 mm (11.0 in)	104 mm (4.1 in)	0.3 kg (0.7 lb)	1.20:0.045 - 6 GHz 1.30:6 - 12.4 GHz 1.40:12.4 -18 GHz
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	Type N(m) 50Ω	280 mm (11.0 in)	104 mm (4.1 in)	0.3 kg (0.7 lb)	1.25:0.045 - 6 GHz 1.35:6 - 12.4 GHz 1.45:12.4 -18 GHz

Notes:

1. The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors.
2. Power coefficient equals <0.01 dB/Watt (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-4: 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 (P/N 21568) publication and data sheet.

B.2.4 Directional Bridges

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

Table B-5: Directional Bridge Selection Guide

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

The Selection Guide in Table B-5 shows primary specifications. Additional specifications are:

Bridge Frequency Response

Return loss measurements using the 8541/8542 power meter can be frequency compensated using the standard *Open/Short* supplied with the bridge.

Insertion Loss

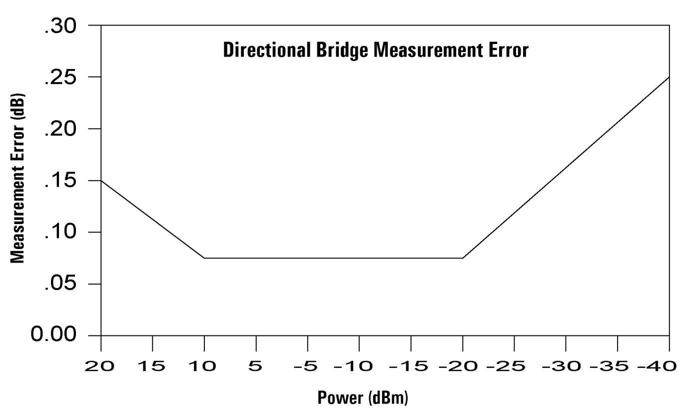
6.5 dB, nominal, from input port to test port

Maximum Input Power

+27 dBm (0.5 W)

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

See Table below



Dimensions

80501	76 x 50 x 28 mm (3 x 2 x $1\text{-}^{1}/_{8}$ in.)
80502	76 x 50 x 28 mm (3 x 2 x $1\text{-}^{1}/_{8}$ in.)
80503	19 x 38 x 29 mm ($^{3}/_{4}$ x $1\text{-}^{1}/_{2}$ x $2\text{-}^{1}/_{8}$ in.)
80504	19 x 38 x 29 mm ($^{3}/_{4}$ x $1\text{-}^{1}/_{2}$ x $2\text{-}^{1}/_{8}$ in.)

Weight

80501	340 g (12 oz.)
80502	340 g (12 oz.)
80503	198 (7 oz.)
80504	198 (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 58542 VXIbus 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. The user 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.

B.3.1 Equipment Required

58542 VXIbus Universal Power Meter • GPIB Controller • Power Sensor

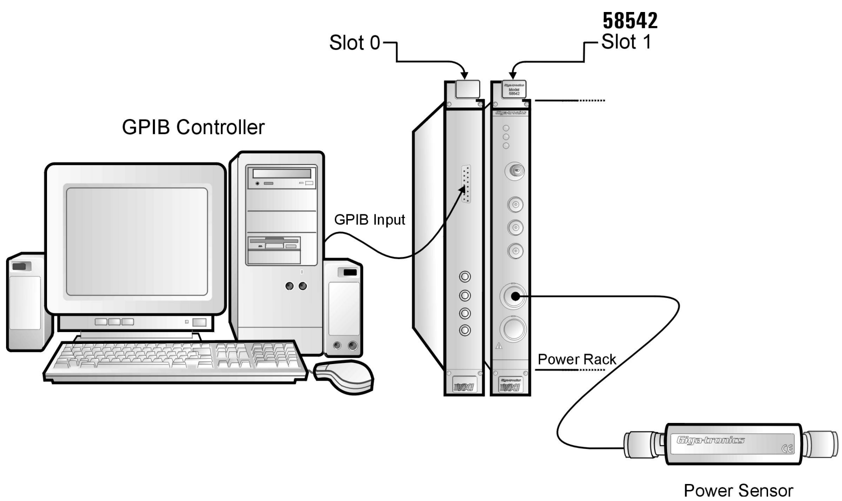


Figure B-1: Power Sensor Calibration Setup

B.3.2 Procedure

Connect the power sensor to Channel 1 or 2 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. **DIAG:SENS1 (or 2):EEPROM:READ**

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

   Example: OUTPUT@ PWR_MTR; DIAG:SENS1:EEPROM:READ

2. (Optional) **DIAG:SENS < 1 OR 2 > :EEPROM:CALFR?**

    a.) Query sensor 1 (or 2) standard cal factor start frequency, number of standard frequencies and number of special frequencies.

    b.) Read the standard cal from the input buffer and extract the start frequency and number of standard frequencies.

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

3. **DIAG:SENS < 1 or 2 > :EEPROM:CALFST?**

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

    b.) Read the standard cal from the input buffer and extract the standard cal factor; e.g., INPUT (GPIB address).

    c.) DIAG:SENS<1 OR 2>:EEPROM:CALFST*space*"0.02, 0.03,0.04,0.05,0.06,0.07,0.08,0.09,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18" form to write to editor buffer.

    d.) Set the sensor standard cal factor table.

    e.) Make changes from the table and put them back into the table.

    f.) After all changes are made, put the table back into the input buffer.

4. **DIAG:SENS < 1 or 2 > :EEPROM:WRITE 0**

    a.) Write sensor 1 (or 2) EEPROM data into the 58542 buffer. If no password has been set up, use 0 for a password.

    b.) Restore the input buffer from step 3.d above to the EEPROM buffer (e.g., OUTPUT [GPIB] address, input buffer).

    c.) Write sensor 1 (or 2) editor buffer data into the EEPROM with the password number, e.g., OUTPUT (GPIB address, DIAG:SENS1 (OR 2):EEPROM:WRITE 0).

    d.) Editing the EEPROM routine is complete.

Sensor EEPROM Code Sequence Writing:

(The following program example is written in Microsoft® Visual Basic using National Instruments® VISA Instrument calls)

```
Private Sub cmdWriteNewData_Click()
   'Write new calibration data to sensor for form

   cmdWriteNewData.Caption = "Writing"

   wrt = "DIAG:SENS" + SensNum + ":EEPROM:TYPE " + space$(1) _
      + Chr$(34) + txtModelNum.Text + "," + txtSerNum.Text + "," + _
      txtCalLoc.Text + "," + MinVal + "," + HourVal + "," + DayVal + _
      "," + MonthVal + "," + YearVal + "," + PWDVal + Chr$(34)

   stat = viWrite(MVISAaddress, wrt, Len(wrt), retCnt)

   SensorWrite 'Call Write new type data

   wrt = "DIAG:SENS" + SensNum + ":EEPROM:CALFR" + space$(1) + _
      Chr$(34) + "2.000e9,1.000e9,17,1" + Chr$(34) 'txtCalFreq.Text

   stat = viWrite(MVISAaddress, wrt, Len(wrt), retCnt)

   SensorWrite 'Call Write new range data

   wrt = "DIAG:SENS" + SensNum + ":EEPROM:CALFST" + space$(1) _
      + Chr$(34) + Str(txtCF1) + "," + Str(txtCF2) + "," _
      + Str(txtCF3) + "," + Str(txtCF4) + "," + Str(txtCF5) + _
      "," + Str(txtCF6) + "," + Str(txtCF7) + "," + Str(txtCF8) _
      + "," + Str(txtCF9) + "," + Str(txtCF10) + "," + _
      Str(txtCF11) + "," + Str(txtCF12) + "," + Str(txtCF13) + _
      "," + Str(txtCF14) + "," + Str(txtCF15) + "," + Str(txtCF16) _
      + "," + Str(txtCF17) + Chr$(34)

   stat = viWrite(MVISAaddress, wrt, Len(wrt), retCnt)

   SensorWrite 'Call Write new cal factor data

   stat = viClear(MVISAaddress)
   rd = ""
   Beep

   cmdWriteNewData.Caption = "Write New Information"
End Sub

Public Sub SensorWrite()
   wrt = "DIAG:SENS" + SensNum + ":EEPROM:WRIT 0"

   stat = viWrite(MVISAaddress, wrt, Len(wrt), retCnt)

   Sleep (5000) 'Wait five seconds

End Sub
```

C

Options

C.1 Introduction

This appendix describes all options that are currently available for use with the 58542 VXIbus Universal Power Meter.

C.2 Option 02: 256K Buffer

Option 02 (P/N 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.

21335		**EXTRA MEMORY, 128K, 8540/02, REV. A**				
Item		**P/N**	**Qty**	**Cage**	**Mfr's P/N**	**Description**
U	29	21165	1	61802	TC551001BPL-85	TC551001BPL-10 1M RAM
U	30	21165	1	61802	TC551001BPL-85	TC551001BPL-10 1M RAM

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