# The AN 401 Series

## HP 1000/HP-IB Programming Application Notes

HEWLETT hp PACKARD

HP 3495A Scanner ⟷ HP-IB ⟷ HP 1000 Computer

Programming Guide

Application Note 401-11

HP 6002A Power Supply ⟷ HP-IB ⟷ HP 1000 Computer

Programming Guide

Application Note 401-9

HP 3438A Digital Multimeter ⟷ HP-IB ⟷ HP 1000 Computer

Programming Guide

Application Note 401-6

HP 59307A VHF Switch ⟷ HP-IB ⟷ HP 1000 Computer

Programming Guide

Application Note 401-2

HP 436A Microwave Power Meter ⟷ HP-IB ⟷ HP 1000 Computer

Programming Guide

Application Note 401-16

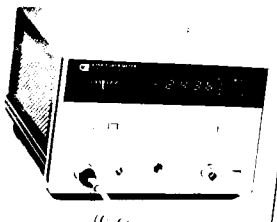
**Device Introduction**

The HP 436A power meter is a general purpose digital power meter intended for RF and microwave power measurements. Power meters are usually indispensible for microwave measurement. At microwave frequencies, power is the best measure of signal amplitude because, unlike voltage and current, power remains constant along a lossless transmission line.

The 436A power meter is designed to be connected to a compatible power sensor to form a complete power measurement system. The frequency and power range of the system are determined by the particular power sensor selected for use. With the power sensors available from Hewlett-Packard, the overall frequency range of the system is from 100 kHz to 18 GHz, and the overall power range is -70 to +45 dBm.

The power meter has five ranges, and can automatically switch these ranges (autoranging), or be set and locked to a particular range. The power meter automatically decodes the sensitivity of the power sensor to which it is connected. This information is then used to control the decimal point location and set the appropriate power unit multiplier.

The 436A power meter can read in either absolute power or relative power. Absolute power can be read out in either watts or dBm. Relative power is read out in dB. Although relative power measurements are useful in manual testing, the relative mode is seldom required when the power meter is connected to an HP 1000 computer system. The HP 1000 can compute the relationship between two values much faster than the power meter. Therefore, power measurements tend to be absolute when taken in an HP-IB system.



**Addressing**

In the 436A, the HP-IB TALK and LISTEN address can be set by either jumpers or switches located on the A6 printed circuit board assembly. The factory usually presets the power meter address to 15 octal. *If more than one power meter is used in a system, make sure that each power meter has a seperate HP-IB address.*

To set the HP-IB address, perform the following steps.

a. Disconnect the power line.

b. Disconnect any HP-IB cables from the HP-IB connector on the power meter.

c. Remove the top cover of the power meter.

d. Locate the A6 printed circuit board assembly (refer to figure 16-1). It is parallel to the front panel, and furthest back (closest to the power supply).

e. If the A6 board has switches, set the switches. Refer to figure 16-2 for switch positions. Replace the top cover, power cord, and HP-IB cables.

f. If the A6 card has jumpers, the A7 board should be removed. The A7 board is perpendicular to the A6 board and has the HP-IB connector attached to it. Remove the two screws holding the A7 board assembly to the rear panel.

g. Unplug the flat cable connected to the A7 board. Pay attention to the direction which this plug goes. If replaced upside down, the data returning from the power meter will be garbled.

h. Set the jumpers on the A6 board, as shown in figure 16-2.

i. Reinstall the A6 and A7 boards, and reconnect the flat cable. Replace the screws holding A7 board.

j. Replace the top cover power cord and HP-IB cables.

# HP-IB brings you more

## AN 401 brings it together

At last! The HP-IB support that you have been asking for: comprehensive instructions how to integrate and program some of our most popular HP-IB instruments with an HP 1000 computer. This series of application notes is aimed at users who have some knowledge of the computer but are not too familiar with automating instruments.

Following a logical procedure, these instructions take the user step-by-step from setting addresses, through setup and on-line programming, to sophisticated performance comparisons. *All program listings are included* — programs that have been developed and tested by Data Systems' Applications Group. They can save you hours of software development . . . and us hours of telephone assistance!

The 401 Series will be distributed, in late July, to all HP 1000 sales representatives, the Instrument sales force, the HP-IB specialists, and all sales offices. The scope of this program is instructive, extensive . . . and impressive!

## AN 401-1, HP 1000/HP-IB Programming Procedures

AN 401-1 (5953-2800) is the main overview note and should be read first. It supplies the general prerequisite information and software utilities which are implemented in the rest of the series.

AN 401-1 presents an easy-to-follow outline that simplifies HP-IB instrument operation with the HP 1000. It explains what hardware to use, how to set the device address, how to configure your system (software requirements), and even gives performance graphs showing how many readings per second an instrument can take.

The actual programming examples range from the most fundamental and interactive, to high performance routines that will take your breath away. If the instrument is somewhat older and does not always behave as expected, these peculiarities are documented and listings for workaround solutions are given.

AN 401-1 answers commonly asked questions such as:

"How do I determine LU assignment?"

"What about buffering and should I use it?"

"How do I set limits on time-out and how do I use it?"

"What does the Device Configuration Word look like, and how do I set it?"

"Does the device have service request capability and how can I optimize its use?"

"Should I use the interrupt technique or DMA?"

For those of you who have been asking us to make the computer more friendly, check the following new sections:

- **How to send commands to the instrument and take readings** just as with a desktop computer. We show how to use **File Manager** commands and the return key. Programming, compilation, and relocation are not required for checking out your instrument.

- **A new HP-IB Status/Configuration Utility** is given (get it from the contributed library). It describes EQT's and LU's and tells the user how everything is set up on the bus. This greatly simplifies the operation of multiple devices on the bus.

- A program is given (from the contributed library) that **verifies device addresses and LU assignments.** Even if you don't know what address is set on your device, just plug it on the bus and the computer will tell you its address and automatically assign it an LU number. What could be more friendly?

# than just IEEE-488 compatibility

## Not just one ap note, but 21 of them

AN 401-1 is supplemented by detailed instrument-specific programming guides. These are separate modules so that you can select those pertinent to your individual needs.

| Application Note | Content | Document Number |
|---|---|---|
| 401-1 | HP 1000/HP-IB Programming Procedures | 5953-2800 |
| 401-2 | 59307 VHF Switch/HP 1000 Computer | 5953-2801 |
| 401-3 | 5345A Counter/HP 1000 Computer | 5953-2802 |
| 401-4 | 5342A Microwave Counter/HP 1000 Computer | 5953-2803 |
| 401-5 | 5328A Counter/HP 1000 Computer | 5953-2804 |
| 401-6 | 3438A Digital Multimeter/HP 1000 Computer | 5953-2805 |
| 401-7 | 3455A Digital Multimeter/HP 1000 Computer | 5953-2806 |
| 401-8 | 59309A Digital Clock/HP 1000 Computer | 5953-2807 |
| 401-9 | 6002A Power Supply/HP 1000 Computer | 5953-2808 |
| 401-10 | 3437A Digital Voltmeter/HP 1000 Computer | 5953-2809 |
| 401-11 | 3495A Scanner/HP 1000 Computer | 5953-2810 |
| 401-12 | 3582A Spectrum Analyzer/HP 1000 Computer | 5953-2811 |
| 401-13 | 3325A Function Generator/HP 1000 Computer | 5953-2812 |
| 401-14 | 4262A Digital LCR Meter/HP 1000 Computer | 5953-2813 |
| 401-15 | 8672A Synthesized Signal Generator/HP 1000 Computer | 5953-2814 |
| 401-16 | 436A Microwave Power Meter/HP 1000 Computer | 5953-2815 |
| 401-17 | 8620C Sweep Oscillator/HP 1000 Computer | 5953-2816 |
| 401-18 | 59306A Relay Actuator/HP 1000 Computer | 5953-2817 |
| 401-19 | 8660C Synthesized Signal Generator | 5953-2818 |
| 401-20 | 9871A Character Impact Printer | 5953-2819 |
| 401-21 | 6942A Multiprogrammer II | 5953-2820 |

## What about instruments not on this list?

This is just the beginning of an on-going program aimed at simplifying HP-IB systems and solving many of the support problems between the Instrument and Computer Groups. We encourage your comments and feedback so that we can improve future application programming notes. Also, if there is a commonly-used HP-IB instrument that you think should be documented, fill out and mail us the attached tear-off page.

We hope this concept helps you show your customer what he is getting over and above IEEE-488 compatability when he buys HP-IB. How could Fluke, Systron Donner, DEC, or Data General provide **anything** like this?


**HP-IB INSTRUMENTATION — HP 1000**

Please check one:

☐ The AN 401 Series is the greatest thing I have seen since _____.

☐ Please give me more notes on _____ _____ _____
the following instruments. _____ _____ _____

☐ The AN 401 Series is OK, but that's enough.

☐ The AN 401 Series isn't worth the paper it's printed on.

My name is _____,

I am a _____, My Office is _____.

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