HEWLETT PACKARD

Important Measurement Information on Cleaning and Handling HP Lightwave Equipment

David B. Grant / Hewlett-Packard

Proper cleaning and handling of lightwave connectors is imperative for achieving accurate and repeatable measurements with your Hewlett-Packard lightwave equipment. Lightwave interfaces should be cleaned before each measurement using the techniques described here. Information on protecting and storing your connectors/cables, and tips on how to properly mate connectors are also included.

Handling

Always handle lightwave connectors and cable ends with great care. Fiber ends should never be allowed to touch anything except other mating surfaces or cleaning solutions and tools.

Caution

Hewlett-Packard strongly recommends that index matching compounds *not* be applied to HP instruments and accessories. Some compounds, such as gels, may be difficult to remove and can contain damaging particulates. If you think the use of such compounds is necessary, refer to the compound manufacturer for information on application and cleaning procedures.

Storage

All of Hewlett-Packard's lightwave instruments are shipped with either laser shutter caps or dust caps on the lightwave adapters that come with the instrument. Also, all of the cables that are shipped have covers to protect the cable ends from damage or contamination. These dust caps and protective covers should be kept on the equipment at all times except when in use.

The adapters that were shipped on the instrument can be removed from the connectors on the instrument. If you remove these adapters you should keep the exposed connector of your instrument covered until the next use. Protective covers for these exposed connectors are not provided with the instruments, so it is best to keep the adapters on the instrument with the dust covers on.

Making Connections

When you insert the ferrule into a connector or adapter, make sure that the fiber end does not touch the outside of the mating connector or adapter. In this way, you will not rub the fiber end against any undesirable surface. Many connectors have a keyed slot provided for optimum measurement repeatability that also helps to align and seat the two connectors. After the ferrule is properly seated inside the other connector, use one hand to keep it straight, rotate it to align the key, and tighten it with the other hand.

Most connectors using springs to push fiber ends together exert one to two pounds of force. Over-tightening or under-tightening these connectors can result in misalignment and non-repeatable measurements. Always finger tighten the connector in a consistent manner. Refer to the manufacturer's data sheet for any torque recommendations.

Cleaning

Two cleaning processes are provided. The first process describes how to clean non-lensed lightwave connectors. The second process describes how to clean lightwave adapters.

Caution

These cleaning processes apply only when dry connections are used (no index matching compounds). Hewlett-Packard strongly recommends against the use of index matching compounds, particularly gels, as they may be difficult to remove and can contain damaging particulates. If an index matching compound is used, contact the compound manufacturer for specific information about recommended solvents and cleaning procedures.

Cleaning Non-Lensed Lightwave Connectors

Equipment

The following is a list of the items that should be used to clean non-lensed lightwave connectors.

Description	HP Part No.
Isopropyl alcohol	8500-5344
Cotton swabs	8520-0023
Compressed air	8500-5262

Caution

Hewlett-Packard recommends that you do not use any type of foam swab to clean optical fiber ends. Foam swabs can leave filmy deposits on fiber ends that can degrade performance.
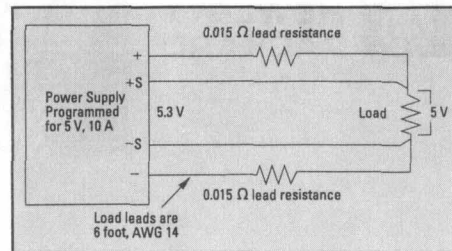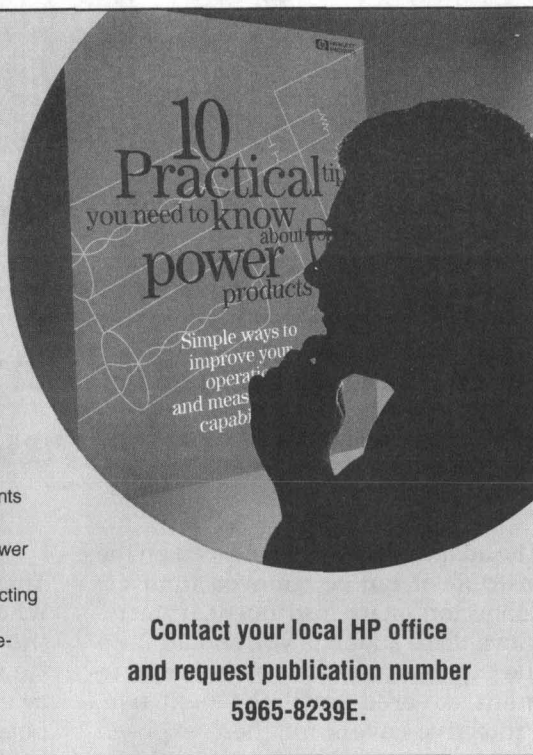
Process

Before cleaning the fiber end, clean the ferrules and other parts of the connector. Use isopropyl alcohol, clean cotton swabs, and clean compressed air. Then use alcohol to clean the fiber end. Some amount of wiping or mild scrubbing of the fiber end can help remove particles

Practical Tips on Using Power Supplies in the T&M Environment

Bench, system and rack-mount power supplies are frequently used in test and measurement (T&M) environments, including automatic test equipment (ATE) systems. This article adapted from material contributed by Hewlett-Packard (Canada) Ltd., Mississauga, ON, provides practical tips on how to best use power supplies in a number of common scenarios.

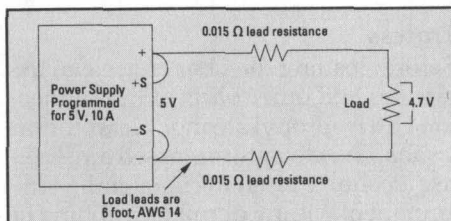## Tip #1. Remote Sensing Compensates for Load-lead Effects

When your power supply leaves the factory, its regulation sense terminals are usually connected to the output terminals. This limits the supply's voltage regulation abilities, even with very short leads. The longer the leads and the higher the wire gauge, the worse the regulation gets. Compare output impedance of a well-regulated 10A supply, which might have an output impedance of 0.2 milliohms, with the resistance of copper wire:

AWC wire size	Resistance in mohm/ft at 20°C
22	16.1
20	10.2
18	6.39
16	4.02
14	2.53
12	1.59
10	0.999

Regulation gets even worse if you use a relay to connect power to the load.

Remote sensing, in which you connect the sense terminals of the power supply's internal feedback amplifier directly to the load, lets the power supply regulate its output at the load terminals, rather than at its own output terminals. The supply voltage shifts as necessary to compensate for the resistance of the load leads, relays, or connectors, thereby keeping the voltage at the load constant.


Effects of six feet of AWG14-gauge leads without remote sensing.

Remote sensing can correct the load-lead problem.

To implement remote sensing, disconnect the local sense leads from the output terminals. Use twisted two-wire shielded cable to connect the power supply sensing terminals to the sense points on the load. Don't use the shield as one of the sensing conductors. Connect one end of the shield to ground and leave the other end unconnected.

Sensing currents are typically less than 10mA, and as a general rule, you should keep the voltage drop in the sense leads to less than 20 times the power supply temperature coefficient (usually stated in mV/°C). This is easy to achieve with readily available shielded two-wire cable.

Tip #2. Eliminate Noise from Low-level Measurements

Noise in low-level measurements can come from a number of different sources and it's easier to eliminate noise than to filter it. Check these noise sources.

- Power supply: starting with a low-noise supply is naturally a great way to keep noise out of your measurements. Linear power supplies have lower common-mode noise currents, and operate at low frequency. However, you can use switch-mode supplies successfully if their specifications include a low common-mode current. As a rule of thumb, common-mode current over 20 to 30mA is likely to cause trouble.

- DUT-to-power-supply connections: minimize conducted noise by eliminating ground loops. Ideally, there should be only one connection to ground. In rack systems, where multiple ground points are inevitable, separate the dc distribution path from other conductive paths that carry ground currents. If necessary, float the power supply: don't connect either terminal directly to ground.
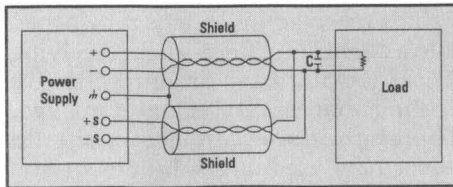
Use twisted shield leads for both output and remote sense leads to minimize radiated pick-up.

Minimize electrical and magnetic radiated pick-up by using twisted shielded conductors for the output and remote sense leads. To make sure the shield doesn't carry current, connect the shield to ground at one end only, preferably the single-point ground on the supply.

Minimize the power supply's common-mode noise current by equalizing the impedance to ground from the plus and minus output terminals. Also equalize the DUT's impedance to ground from the plus and minus input terminals. Magnetic coupling or capacitive leakage provide a re-

turn path for noisy ground loop current at higher frequencies. To balance the DUT's impedance to ground for your test frequencies, use a common-mode choke in series with the output leads and a shunt capacitor from each lead to ground.

■ Current variation to the DUT: rapid changes in the DUT's current demand cause voltage spikes. To prevent this, add a bypass capacitor close to the load. The capacitor should have a low impedance at the highest testing frequencies. Avoid imbalances in load lead inductance; direct connections to the DUT, such as twisted shielded pair, are your best bet.

Tip #3. Use Your Power Supply to Measure Pulsed Current

To adequately specify the power source for products that exhibit pulsed and dynamic current loading, such as digital cellular phones and hard drives, you
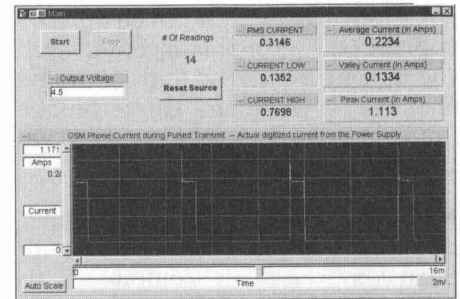
This HP VEE program makes parametric measurements and captures the pulse current loading of a digital cellular phone.

need to evaluate both the peak and dc averages current draws. You could use an oscilloscope to monitor a shunt or a current probe, but this approach raises issues with voltage drops, ground loops, common mode noise, space, and calibration.

As a simpler and cheaper alternative, use a power supply with built-in measurement capabilities. HP 66312A and 66332A dynamic measurement dc sources store up to 4.096 data points at sample intervals from 15.6ms to 31,200s. Like an oscilloscope, they acquire pre and post-trigger buffer data by crossing a user-set threshold.

You can use SCPI commands in the Set Up Source, Measure, and Enter Array blocks. You can use these commands in other programming environments as well. Note that MEAS can be used in place of FETC to cause an immediate trigger. Obtain subsequent measurement parameters from the same data by using FETC. □

DC Supplies Give Instant Peak Measurements

HP 66312A (40W) and 66332A (100W) power supplies provide instantaneous peak measurement capability; users no longer need scopes or high-speed digital voltmeters to test devices that draw pulsed current.

Specifications include:

■ Precision current measurement as low as 0.6µA.

■ Dynamic voltage measurements accurate to 0.03% + 5mV.
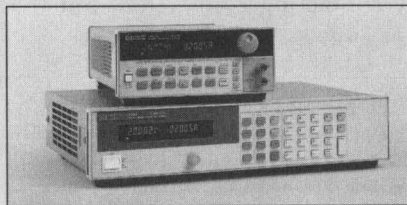
■ Dynamic current measurements accurate to 0.6% + 1mA (66312A).

■ Voltage output: 0 to 20Vdc.

■ Current output: 0 to 2Adc (66312A), 0 to 5A (66332A).

Instrument Service Notes For HP Trade Customers

Jim Bechtold / Hewlett-Packard

Introduction

Test and Measurement (T&M) Service Notes contain product-specific service information about Hewlett-Packard products. Subject include product improvements, modifications, and procedures for troubleshooting, maintenance, and repair. Service notes are published as appropriate throughout

the life of a product and are imperative for customers that service their own HP products.

New FAX Service

A new fax service has been implemented with a new phone number. If you are familiar with the process of obtaining service notes from the fax system, you will like our new system. It is much easier to use.

HP T&M Service Note Fax System-(650) 688-4313
Enter the Password-76683

The scripting (instructions) have changed and are more user friendly.

You no longer have to order the entire service note index (in excess of 30 pages), but can select a custom index of model numbers of your choice.

New WEB Service

T&M service notes are now available on the world-wide web. The url is

http://www.hp.com/go/tm_servicenotes

T&M Service Notes can be viewed and ordered from this site for delivery to the fax machine number or email address of your choosing. Other benefits include shopping basket-type selection of service notes, and looking at select model number indexes. □

not remove them. This can be done by applying the alcohol to a cotton swab and moving it back and forth across the fiber end several times. This technique can help remove or displace particles smaller than one micron.

Allow the connector to dry (about 1 minute) or dry it immediately with clean compressed air. Compressed air lessens the chance of deposits remaining on the fiber end after the alcohol evaporates. It should be blown horizontally across the fiber end. Visually inspect the fiber end for stray cotton fibers. As soon as the connector is dry, the connection should be made.

Caution
Inverting the compressed air canister while spraying will produce residue on the sprayed surface. Refer to instructions provided on the compressed air canister.

Cleaning Lightwave Adapters
Equipment
All of the items listed above for cleaning connectors may be used to clean lightwave adapters. In addition, small foam swabs (HP Part No. 9300-1270) may be used along with isopropyl alcohol and compressed air to clean the inside of lightwave connector adapters.

Note: As noted in a previous caution statement, the foam swabs can leave filmy deposits. These deposits are very thin however, and the risk of other contamination buildup on the inside of adapters greatly outweighs the risk of contamination of foam swab deposits left from cleaning the inside of adapters.

Process
Clean the adapter by applying isopropyl alcohol to the inside of the connector with a foam swab. Allow the adapter to air dry, or dry it immediately with clean compressed air.

Cleaning Lensed Connections
Some instruments may have a connector that is "lensed." In other words the connection does not provide a physically contacting connection, but the light is received into a lens rather than into a connecting fiber. These receiving lenses usually have an anti-reflective coating that is very easily damaged. Therefore, these connectors should never have cleaning solutions or any other substance applied to them unless it is specifically recommended by the manufacturer. You may wish to use clean compressed air to rid them of dust from time to time.

Summary
When making measurements with lightwave instruments or accessories, the following precautions will help to insure good, reliable, repeatable measurements:

- Use extreme care in handling all lightwave cables and connectors.
- Be sure the connector interfaces are clean before making any connections.
- Use only the cleaning methods described.
- Keep connectors and cable ends covered when not in use. □

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