HEWLETT PACKARD

BENCH BRIEFS

SERVICE INFORMATION FROM HEWLETT-PACKARD

JANUARY-FEBRUARY 1983

Improving Bandwidth and Risetime in 174x Oscilloscopes

Doug Moloney, Hewlett-Packard

Low bandwidth and slow risetime problems in your 174X series of oscilloscopes may be caused by corrosion of the delay line's braided shield. What HP has discovered is that under extreme operating conditions (wide ambient temperature variations) the braid becomes corroded from gasses emitted by the outer PVC (polyvinyl chloride) jacket of the delay line.

This PVC outgassing is very similar to the vinyl dashboard and seats in a car emitting gasses to create the film on the inside of the car windows.

Regular BNC cables with PVC jackets are susceptible to the same problem. However, due to the constant flexing in normal handling, the individual strands of the braided shield rub against each other to keep the contact between them clean.

Since the delay line is rarely moved once it is installed in the scope, the PVC contamination may continue to build until the braid's conductivity decreases to the point where high-frequency attenuation becomes significant. This process can occur in a relatively short time if the scope is subjected to repeated and radical changes in ambient temperature (extreme heating and cooling of the delay line). On the other hand, if the scope is operated in a constantly controlled environment, it may take years for the contamination to become objectionable.

Identifying a faulty delay line is easy.

1. Remove the scope's bottom cover.

2. Input a fast risetime pulse or 100 MHz sine wave and note the risetime or amplitude.

3. Locate the delay line (accessible from the rear of the A1 preamp assembly) and squeeze it several times while watching the CRT for high-frequency response improvement.

4. If response improves, keep squeezing the cable. You can expect to see improvements of 1 to 3 nanoseconds or 10 to 60 MHz. If no improvement is observed, perform the pulse response adjustments and repeat step 3.

5. Perform the pulse response adjustments and high-frequency performance tests in the manual.

If your oscilloscope meets its specifications, no further action is required and the delay line reliability will be as good as a new one. However, if your oscilloscope does not meet its specifications, additional troubleshooting should be performed to verify the true problem before replacing the delay line.

Or, if desired, a new delay line can be installed that is no longer susceptible to the PVC contaminants. The new delay line part numbers are:

- 01740-61633 (for all 174X except 1743)
- 01743-61613 (1743 only)

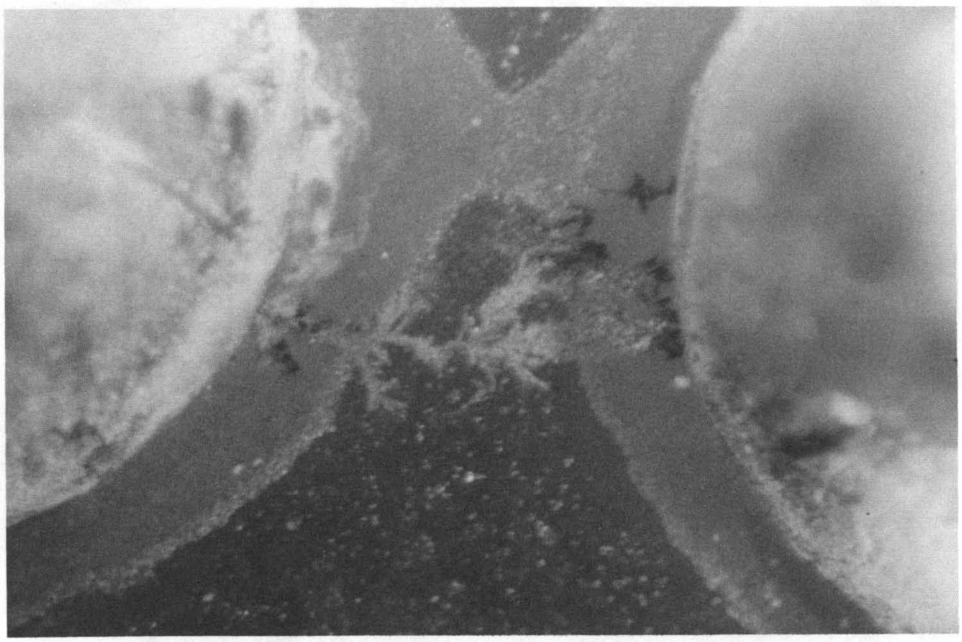
For more information on individual oscilloscopes, order the following service notes from the address on the service note order form. The service notes are:

- 1740A-20A
- 1741A-13A
- 1742A-5A
- 1743A-6A
- 1744A-7A
- 1745A-1
- 1746A-1

More On Printed Circuit Board Rework, Repair, and Cleaning

Dendrite

A dendrite, as shown in the photo, is a resistive short between these two solder nodes.



The previous issue of *Bench Briefs* showed a picture of a dendrite formed between two circuit traces and indicated that the cause was excessive use of circuit cooler. It's true that using the circuit cooler helped cause the dendrite, but it was mainly the moisture condensed out of the atmosphere that gave the dendrite its start. The water causes a bridge across the circuit traces, and the difference in voltage potential forms an electrolyte corrosion cell. Since corrosion is electroplating in reverse and gold is a noble metal, it becomes a cathode and the copper trace under the gold becomes the anode. The copper anode is depleted and the metal follows the water path to the gold.

You can create your own dendrite phenomena by placing DI water between two traces on an old circuit board and applying a voltage potential of 30 volts. Watch the dendrite grow under a microscope. In some tests here at HP it grew across the gap in less than 60 seconds.

Videotapes on PC Board Reliability

The last issue of *Bench Briefs* discussed three new videotapes available from Hewlett-Packard concerning printed circuit board reliability. Unfortunately, the ordering information was incomplete.

The complete tape part numbers are:

Printed Circuit Board Reliability–36 min.
HP part 90660R*

Printed Circuit Board Contact Reliability–25 min.
HP part 90661R*

Analysis of Multilayer Ceramic Capacitors–27 min.
HP part 90662R*

* = Tape Formats:

A = VHS-SP
B = Beta 1
D = ¾″ Umatic

Example:

90660RB orders the 36-minute tape in Beta 1 format.

Ordering:

Contact your nearest HP sales or service office and specify the tapes you want, or contact Hewlett-Packard Video Products directly at:

Hewlett-Packard
Video Products
1819 Page Mill Road
Palo Alto, California 94304
(415) 857-2381

For more information on many other HP videotapes and videotape products, ask for the videotape catalog HP part number 5952-0157.

Conformal Coatings

What They Are

A conformal coating can be a thick or thin layer of protective material that is applied to one or both sides of an assembly. The thin coating closely follows the contours of the board and components; it "conforms" to the shape of the assembly, and ideally produces a film of consistent thickness over the entire surface. It can be so thin as to be unnoticed, or so thick that you can't even see the unit (i.e., a "potted" assembly).

Assemblies are frequently given a conformal coating to assist them in functioning under harsh environmental conditions. When correctly chosen and carefully applied, conformal coatings will help to protect an assembly from the following hazards:

- Humidity
- Dust and dirt
- Airborne contaminants—e.g., smoke, chemical vapors
- Conducting particles—e.g., metal chips, filings
- Accidental short circuit by dropped tools, fasteners, etc.
- Abrasion damage
- Vibration and shock (to a certain extent)
- Tampering or modification

Generally speaking, the primary function of the conformal coating on printed circuit boards is to protect the electrical characteristics of the board. And high-impedance boards are the ones most susceptible to leakage in almost any environment. Therefore, conformal coatings on printed circuit boards are used especially to:

- Prevent contamination of the dielectric surface by field soil (oil vapor or fingerprints), which can cause electrical leakage in humid environments.
- Inhibit the growth of fungus, thereby improving the electrical characteristics. Even nonnutrient surfaces (the fiberglass board) can support fungus growth when contaminated with field soils such as oil vapor.
- Suppress electrical flashover between conductors at high altitudes.

A secondary function of the conformal coating is to help support the components so that the entire mass of the component is not carried by the solder joints.

A lot more information on conformal coatings is contained in the following publication:

IPC-CM-770B
Guidelines for Printed Board Component Mounting

—obtained from—

The Institute for Interconnecting and Packaging Electronic Circuits
~~1717 Howard St.~~
~~Evanston, IL 60202~~
7380 Lincoln Ave
Lincolnwood IL 60646

Removing the Conformal Coating

Occasionally, you are going to be faced with repairing a board that has a conformal coating. You may have to either replace a component or actually modify or repair part of the circuit board. To do this means you are going to have to determine which removal method (there are several) should be used for a specific coating.

It is beyond the scope of this article to try to describe all the different coatings and the methods of removal. The above IPC reference does a good job of describing all the various coatings, and reference IPC-R-700B does an equally good job of describing how to remove them.

I can, however, describe the recommended handling procedure for some of Hewlett-Packard's PPC (Protective Polymer Coating) coated boards used in several of our DVM products (e.g., 3468A/3478A DMMs). The PPC provides a high-impedance barrier to leakage between nodes and circuit traces. The PPC is applied before the board is loaded and wavesoldered and all solder points are left open. The PPC is the solder mask.

If you are confronted with another manufacturer's board where the entire solder-side is covered by a thin conformal coating, the repair procedure would be similar.

1. Remove the PPC film by scraping with an x-acto knife. Be careful to remove only the film.
2. Make the repair or alteration following the accepted procedures at your company. The volume 22, number 4 issue of *Bench Briefs* contained some information on this subject.

Cleaning the Repaired Area

Clean the repaired area according to the following steps. The flux removers we use contain bipolar solvents. That means they contain two kinds of solvent, one to dissolve the rosin and one to dissolve the activators in the rosin. Once you dissolve the rosin and activators and spread them all over the board, you then have to remove the rosin, the activators, and the flux remover. The key to proper flux removal is to use large quantities of solvent for thorough cleaning and rinsing.

1. When applying the flux remover, hold the board with the edge connector up. This prevents the dissolved rosin from running onto the contacts and possibly causing intermittents and corrosion. Use Reliasolve No. 564 or MS 190HD to dissolve the rosin. Use a short-bristled brush and scrub the area vigorously to remove all traces of flux

2. Next, generously rinse the repaired area with a solution of 80% isopropyl alcohol and deionized water, keeping the board's edge connector up. This rinse should flood the entire PC board and should always be done with a clean and fresh alcohol/water solution. You should rinse the board several times, holding it over a large container to catch the excess runoff. Allow at least two minutes for final air dry.

From this point on the board should only be handled by its edges. Never touch the circuit area with your fingers—they leave oily fingerprints, which cause corrosion. We do not recommend the use of gloves unless they are clean and fresh. In some cases the gloves (through constant use) are actually dirtier and more contaminated than your bare fingers.

NOTE

A *Bench Briefs* reader suggested using a water-bicarbonate of soda solution at this point to neutralize the chlorides in the solder flux.

3. Generously rinse the PC board with clean and fresh DI (deionized) or distilled water. (Both must be stored in poly plastic bottles.)

Again, hold the board (by its edges) over a large container to catch the excess runoff. Allow five minutes for complete drying, or in some cases, it may be necessary to oven dry the board to remove all traces of moisture. Allow one hour at 70°C (158°F).

4. Apply RTV 3140 directly from the tube. If you have to use an applicator, use the wooden end of a clean Q-tip.

5. Allow to set for three minutes. The RTV will be completely cured after 60 minutes.

6. Use a piece of lint-free cloth or a foam-tipped swab to lightly apply a thin coating of Cramolin, No-noise, or other electronics-grade contact oil to the contact surfaces. This helps to seal the pores in the gold surface and lower contact resistance. Polish off all excess residue, leaving only a vapor-thin coating.

Remember that the ultimate goal is a perfectly clean board, free of moisture, and sealed from the environment.

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supplement to

BENCH BRIEFS SERVICE NOTE INDEX

Need Any Service Notes?

They're free!

Here's the latest listing of Service Notes. They recommend modifications to Hewlett-Packard instruments to increase reliability, improve performance, or extend their usefulness.

Use the order form at the rear of Bench Briefs to select the notes that relate to your instruments.

1333A DISPLAY

1333A-3A. All serials. Preferred replacement for A2R90 astigmatism potentiometer.

1335A DISPLAY

1335A-6A. All serials. Preferred replacement for A2R90 astigmatism potentiometer.
1335A-7A. All serials. CRT uniformity/writing speed optimization adjustments.
1335A-16. Serials 1949A and above. Line switch mounting screws changed to metric.

1611A LOGIC STATE ANALYZER

10260A-1. Option Z80 microprocessor. Serials 1838A 00864 and below. Modification to correct PEXCK timing problem.

1980B OSCILLOSCOPE MEASUREMENT SYSTEM

1980A/B-5B. Serials 2131A and below. Preferred replacement for the HP-IB Talk/Listen device and the masked ROM.
1980A/B-10. 1980A serials 2240A and below; 1980B serials 2216A and below. Modification to improve compatibility with fast controllers.
1980A/B-11. All serials. Modifications to improve trigger flag performance.

3060A CIRCUIT TEST SYSTEM

3060A-52. All serials. Suggested 9825 I/O slot for 98034A/B HP-IB interface.

3325A SYNTHESIZER/FUNCTION GENERATOR

3325A-11B-S. Serials 1748A00101 through 1748A07339 and 1818G00101 through 1818G01930 (Mfg. in Germany). Notification of potential electrical shock hazard.

3336A/B/C SYNTHESIZER/LEVEL GENERATOR

3336A/B/C-5B-S. Serials 3336A 1930A00409 through 1930A00530; 3336B 1931A00396 through 1931A00570; 3336C 1932A00276 through 1932A00340. Notification of potential shock hazard.

3421A DATA AQUISITION AND CONTROL UNIT

3421A-1. All serials. 3421A performance verification and calibration program tape.

3435A DIGITAL MULTIMETER

3435A-1B. All serials. Recommended LED display replacements.

3438A DIGITAL MULTIMETER

3438A-7. All serials. Recommended LED Display replacements.

3453A DIGITAL STIMULUS RESPONSE UNIT

3453A-4. All serials. Proper alignment of the HP-IB interface connector.

3455A DIGITAL MULTIMETER

3455A-19A. All serials. Recommended LED display replacements.

3465A/B DIGITAL MULTIMETER

3465A-4B. All serials. Recommended LED display replacements.
3465B-1B. All serials. Recommended LED display replacements.

3466A DIGITAL MULTIMETER

3466A-11. All serials. Recommended LED display replacements.

3467A LOGGING DMM

3467A-5. All serials. Recommended LED display replacements.

3490A MULTIMETER

3490A-9B. All serials. Recommended LED display replacements.

3495A SCANNER

3495A-7A. All serials. Spare parts and troubleshooting information.

3496A SCANNER

3496A-7. Serials 2137A00990 and below. Eliminating fixture enable arc at paddle pins.

3497A DATA ACQUISITION/CONTROL UNIT

3497A-11. All serials. Recommended LED display replacements.

3712A IF/BB RECEIVER

3712A-7. Serials 2243U00422 and below. Repair and troubleshooting information when replacing A24MC3.

3712A-8. Serials 2243U00422 and below. Preferred replacement for A16MC1.

3716A BB TRANSMITTER

3716A-12. Serials 1942U2961 and below. Preferred replacement for A8MC1.

3745A/B SELECTIVE LEVEL MEASURING SET

3745A/B-20E. Serials 1812U and below. Retrofit kits for special options H15 and H16.

3745A/B-30D. 3745A serials 2032U and below; 3745B serials 2030U and below. Preferred replacement of A109 memory assembly.

3745A/B-53. All serials. Preferred replacement for A200E1 10 MHz master oscillator.

3746A SELECTIVE LEVEL MEASURING SET

3746A-5. All serials. Retrofit procedure for OPT 011—group filter.

3747A/B SELECTIVE LEVEL MEASURING SET

3747A/B-26. All serials. Preferred Replacement for A200E1 10 MHz master oscillator.

3779A PRIMARY MULTIPLEX ANALYZER

3779A-11-A. Serials 1919U-00170 and below. Modification to provide better protection to transmitter output.

3779A-25. All serials. Preferred replacement of shift register A15U27.

3779B PRIMARY MULTIPLEX ANALYZER

3779B-11-A. Serials 1919U-00190 and below. Modification to provide better protection to the transmitter output.

3779B-23-A. Serials 2005U and below. Recommended update of verification software.

3779B-27. All serials. Preferred replacement of shift register A15U27.

3779C PRIMARY MULTIPLEX ANALYZER

3779C-3-A. Serials 2215U and below. Modification to protect relays at switch-on.

3779C-6. Serials 2234U and below. Recommended update of verification software.

3779D PRIMARY MULTIPLEX ANALYZER

3779D-3-A. Serials 2213U and below. Modification to protect relays at switch-on.

3779D-6. Serials 2234U and below. Recommended update of verification software.

3785A/B JITTER GENERATOR & RECEIVER

3785A-3. Serials 2208U 00131 and below. Modification to prevent power supply oscillation when A30C29, C30 are replaced.

3785A-4. Serials 2226U00229 and below. Modification to prevent possible latch-up of the Clock Transitions detector.

3785A-5. Serials 2226U 00229 and below. Modification to prevent 34 MHz receiver VCO instability.

3785B-3. Serials 2212U 00121 and below. Modification to prevent power supply oscillation when A30C29, C30 are replaced.

3785B-4. Serials 2228U 00145 and below. Modification to prevent DS3 receiver VCO instability.

3791B BB TRANSMITTER

3791B-2. All serials. Retrofit procedure for options 210, 211, 212 and 221.

3791B-3. Serials 1910U00341 and below. Preferred replacement for amplifier A8MC1.

3793B DIFFERENTIAL PHASE DETECTOR

3793B-3. All serials. Retrofit procedure for options 210, 222, 212 and 221.

3968A INSTRUMENTATION TAPE RECORDER

3968A-20A. All serials. Insulating vs. noninsulating head mounting screws.

4145A SEMICONDUCTOR PARAMETER ANALYZER

4145A-1A. Serials 2149J00146 and below, and 2149J00147 through 2149J00168. Power supply modification for protection against surge current damage.

4192A LF IMPEDANCE ANALYZER

4192A-12. All serials. BASIC language (HP85) HP-IB interface test programs.

4193A VECTOR IMPEDANCE METER

4193A-1. All serials. BASIC language (HP85) HP-IB interface test programs.

4274A MULTIFREQUENCY LCR METER

4274A-19. All serials. BASIC language (HP85) HP-IB interface test programs.

4275A MULTIFREQUENCY LCR METER

4275A-17. All serials. BASIC language (HP85) HP-IB interface test programs.

4944A TRANSMISSION IMPAIRMENT MEASURING SET

4944A-9A. Serials 2027A01021 and below. Enhancement of the A8 modem assembly to ensure valid modem self-check. Also, instructions to secure bumper feet hardware.

5005B SIGNATURE MULTIMETER

5005B-2. Serials 2228A and below. ROM change corrects probe switch/local key depressions being ignored.

5045A DIGITAL I.C. TESTER

5045A-17A. All serials. Handler signal checkout procedure (including foot switch signals).

5061A CESIUM BEAM FREQUENCY STANDARD

5061A-11B. All serials. Replacement kit for A10 oscillator assembly part number 05061-6170.

5180A WAVEFORM RECORDER

5180A-8. Serials 2224A00350 and below. Addition of wires to the −5.2 V motherboard supply lines.

5180A-10. Serials 2222A00303 and below. Firmware (ROM) revision 1.3 procedures.

5180A-11. Serials 2210A00220 and below. Modification to correct possible shorting of −5.2 V supply to chassis.

5312A HP-IB INTERFACE

5312A-4B. All serials. Operational verification using the HP 85A controller.

5316A UNIVERSAL COUNTER

5316A-3B. All serials. HP-IB verification program using the HP 85A controller.

5328A UNIVERSAL COUNTER

5328A-33C. All serials. HP-IB verification program using the HP 85A controller.

5328A-34C. HP models 5328A/H99, 5328AF/096, 5328AF/098, 5328A/H42, C96-5328A. All serials. HP-IB verification program using the HP 85A controller.

5354A AUTOMATIC FREQUENCY CONVERTER

5354A-7A. All serials. Improved adjustment procedures.

6024A POWER SUPPLY

6024A-1. Serials 2129A01390 and below. Modified drive circuit for new power FETS A1Q1, Q2.

6034A POWER SUPPLY

6034A-7. Serials 2222A00830 and below. Modified drive circuit for new power FETS A1Q1, Q2.

6130C DIGITAL VOLTAGE SOURCE

6130C-5. Serials 2229A01916 and below. Modification to prevent oscillation under varying A.C. input conditions.

7155B STRIP CHART RECORDER

7155B-1. All serials. Corrections to manual.

8443A TRACKING GENERATOR/COUNTER

8443A-9. Serials 2204A03885 and below. Improved low-amplitude, low-frequency response of the frequency counter.

8443A-10. All serials. Improved tracking adjust range.

8445A AUTOMATIC PRESELECTOR

8445A-1A. All serials. Replacement YIG filter assembly.

8555A SPECTRUM ANALYZER RF SECTION

8555A-8A. All serials. Repair or replacement of interconnect connectors J6 and A1P6.

8557A SPECTRUM ANALYZER

8557A-6. Serials 2106A and below. Front latch assembly parts list.

8558B SPECTRUM ANALYZER

8558B-25. Serials 2145A and below. Front latch assembly parts list.

8559A SPECTRUM ANALYZER

8559A-15. Serials 2208A and below. Front latch assembly parts list.

8656A SIGNAL GENERATOR

8656A-8A. Serials 2107A and below. Frame boss replacement.

8684A SIGNAL GENERATOR

8684A-2. Serials 2210A and below. Improvement of pulse overshoot.

10260A PERSONALITY MODULE (1611A OPTION Z80 LOGIC STATE ANALYZER)

10260A-1. Serials 1838A 00864 and below. Modification to correct PEXCK timing problem.

10556A RETROREFLECTOR

10556A-1. Serials 1208A03460 and below. Misfitting of retroreflectors into angular mounts.

10811B 10 MHz CRYSTAL OSCILLATOR

10811B-1. Serials 2216A01725 and below. Replacement kit for flex circuit assembly part number 10811-60014.

59300-10002 HP 85A HP-IB TEST TAPE (REV. E)

59300A-2C. All serials. List of HP-IB test tapes and instructions for counter-type products from HP Santa Clara Division.

63005E/63315E MODULAR POWER SUPPLIES

63005E-1/63315E-1. All serials. Operating and Service Manual typographic error correction, all serial numbers.

CUSTOMER SERVICE TRAINING CALENDAR FOR 1983

CONTENT	DATES	LOCATION	TUITION per student	COORDINATOR
Logic Systems				
64000S Logic Development System	January 31-February 11	Logic Systems Division 1900 Garden of the Gods Road Colorado Springs, CO 80907	$1600	Michel Fredeen
64000 State and Timing	February 14-18	Logic Systems Division	$1000	Michel Fredeen
1600 Series Logic Analyzers	March 28-April 1	Logic Systems Division	$ 900	Michel Fredeen
Scopes and Displays				
1350A, 1351A Displays	February 14-16 March 24-25	Orsay, France Colorado Springs Division 1900 Garden of the Gods Road Colorado Springs, CO 80907	$ 400	Jerry Murphy
1345A, 1346A, 1347A Digital Displays	February 14-16 March 17-18	Orsay, France Colorado Springs Division	$ 400	Jerry Murphy
1332A, 1333A, 1335A, 1336A, 1340A Analog Displays	February 14-16 March 14-16	Orsay, France Colorado Springs Division	$ 400	Jerry Murphy
1310B, 1311B, 1317B, 1321B Graphic Displays	February 17-18 March 21-23	Orsay, France Colorado Springs Division	$ 400	Jerry Murphy
1980A/B Oscilloscope Measurement Systems	February 28-March 4	Colorado Springs Division	$1000	Jerry Murphy
171x and 172x HF Oscilloscopes	March 7-9	Colorado Springs Division	$ 600	Jerry Murphy
174x Oscilloscopes	March 10-11	Colorado Springs Division	$ 400	Jerry Murphy
Automatic Test				
Circuit Test Systems Model 3060A	January 24-February 4 March 14-25 May 2-13 July 25-August 5 September 26-October 7 November 7-18	Loveland Instrument Division 815 Fourteenth Street Loveland, CO 80537	$2100	Sandy Selleck
DTS 70	January 7-11 May 16-20 July 18-22 October 10-14	Loveland Instrument Division	$1050	Sandy Selleck
Network Measurements				
8350 Sweep Oscillator and 83500 Series RF Plug-ins	May 23-27	Neely Sales Region 3200 Hillview Palo Alto, CA 94304	$1000	Jim Arnold (Network Measurement Division)
	September 26-30	Neely Sales Region 5400 W. Rosecrans Lawndale, CA 90260		
Signal Analysis				
8566A/8568A Spectrum Analyzers	July 25-August 5	Eastern Sales Region 120 W. Century Rd. Paramus, NJ 07652	$1750	Carol Smith (Signal Analysis Division)
	October 10-21	Signal Analysis Division 1400 Fountain Grove Road Santa Rosa, CA 95404		
RF and Microwave				
8672A	August 29-30	Stanford Park Division 1501 Page Mill Palo Alto, CA 94304	$ 400	Len Leeb
8970A	August 31-September 1	Stanford Park Division	$ 400	Len Leeb
436A	September 2	Stanford Park Division	$ 200	Len Leeb
8660/8662/8663	October 3-6	Spokane Division 1620 Signal Drive TAF C-34 Spokane, WA 99220	$ 700	Roger Tracy
8656A	October 6-7	Spokane Division	$ 300	Roger Tracy
8640A/B option 004	October 10-11	Spokane Division	$ 400	Roger Tracy
8901A/8903A	October 12-13	Spokane Division	$ 400	Roger Tracy
Multiprogrammer				
6942A Multiprogrammer	April 25-29 October 24-28	New Jersey Division 150 Green Pond Rd. Rockaway, NJ 07866	$1000	Bob Sanocki
Precision Frequency Sources				
5061A Cesium Beam Frequency Standard	November 7-11	Santa Clara Division 5301 Stevens Creek Santa Clara, CA 95050	$1000	Fran Groat
Technology Training				
Digital Troubleshooting Techniques	To be determined	To be determined	$ 700	Tom O'Connor (Instrument Support Division)
Microprocessor Troubleshooting Techniques	To be determined	To be determined	$ 700	Tom O'Connor

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READERS CORNER

Editor's Note

Your response to the July-October issue of Bench Briefs *on Printed Circuit Board Rework, Repair, and Cleaning has been overwhelming. Thank you one and all.*

It would not be possible to reprint all the letters received. However, one letter was by far the most comprehensive. It encompasses all the questions asked concerning the article.

Questions on PCB (PWB) Cleaning

Editor, Bench Briefs

I have just completed reading your July-October 1982 *Bench Briefs*. Overall, I find the material well written and informative.

For the past 21 years I have been in electronics repair, the last seven years as a supervisor of an electronics training program consisting of theory and in-depth repair of mini- and microelectronic devices. Just recently I became an electronics equipment specialist, specializing in unique micro/hybrid repair techniques and electrostatic discharge (ESD).

Some points you brought up in *Bench Briefs* have me somewhat puzzled, for they are contrary to my information, teachings and experience. If you will, please allow me to point out these areas of concern and also render an opinion.

Page 8. PC Board Cleaning. One other reason for cleaning PCBs (we refer to them as PWB—Printed Wiring Boards—for PCB is a dangerous chemical), and a most important one, is for the application of conformal coatings. Specific cleaning specifications *must* be met.

Page 9. Your recommendations to (1) use RMA flux core solder, and (2) not remove the flux residue bothers me very much. As you must know, the MA means mildly activated, and this includes the use of chlorides, an acid. As you pointed out later on, these chlorides would become activated if chemical cleaning is not done properly. I agree, but if left alone on the solder connection and then subjected to high humidity or changes in altitude, would not that one glob become active and begin to corrode the connection?

We have found that if you clean the soldered connection with isopropyl alcohol first, then neutralize the chlorides with a water-bicarbonate of soda solution, and then use a final rinse with deionized water, you have a perfectly clean board.

Another reason for completely cleaning a board of all flux residue is to prevent the collection and buildup of dust. As you may know, flux is sticky and dust contains minute conductive particles. If these conductive particles are allowed to build up, resistance is induced between connections and a short occurs, disabling the function of the board and, in many cases I have seen, resulting in fiberglass damage and pad/conductor delamination.

Page 10. General Cleaning Procedure. You may wish to point out in future editions that when using air pressure to clean and/or dry a PWB, the use of in-line air ionizers or handle ionizers will eliminate a static buildup and prevent damage to sensitive devices by ESD.

I am not familiar with the solvent MS-180. We have found that many aerosol flux-removing solvents contain chlorides. Due to extensive corrosion caused by chlorides, we have removed all such cleaning agents from our inventory and repair areas. Do MS-180, Reliasolve No. 564 and MS-190HD contain chlorides?

You also recommend the use of electronic-grade oil, thin film, on electrical points. I have found over the years that fine (micro) oil does indeed extend the life of contact points—if they are in sealed containers. If they are not sealed, again we have the problem of dust collection.

Page 11. Alcohol/Water and Contact Oil. In the last sentence of the first paragraph: How does *more* than 20% water cause static electricity? And in the second paragraph: Again, I believe the use of oil, after it serves its purpose of removing oxidation and tarnish, could cause many electrical problems.

Page 12, item #3. Would not the foam of a foam-tipped swab cause enough ESD to damage highly sensitive devices?

Please accept my above comments as (1) constructive criticism and (2) an effort to have some questions answered. If you have at your disposal recent research confirming the points you bring out in this issue, I would be pleased to have this information.

Thank you for your time. I do enjoy *Bench Briefs*.

Mike Harris
McClellan AFB
Sacramento, CA

Let me reemphasize the basic premise the article stated concerning board cleaning.

Cleaning a PCB (or PWB) should be an all-or-nothing proposition. Solvents that dissolve the flux and chlorides will spread them all over the board. If this resulting contamination is not completely removed by the most stringent cleaning process available, long-term reliability is almost certain to suffer.

While it is true that cleaning the board is necessary in order to apply a conformal coating, not everyone is interested in applying conformal coatings to their boards. However, if your goal is ultimate reliability, then clean and clean and clean–and then apply your conformal coating. But, if the board ever needs rework, be prepared to remove that conformal coating from the solder nodes, make the repair, reclean the area, and then reapply the conformal coating.

If you do not remove the glob of solder, what happens to the trapped chlorides? They remain trapped. In order for the corrosion process to get started you must have electrolytic action, and electrolytic action requires moisture. But the solder flux is not readily water soluble, so it serves as a barrier to keep the moisture out. If any corrosion does form, it will take a very long time, be minimal, and not cause near the reliability problems improper cleaning could cause.

As for cleaning the area with a water-bicarbonate of soda solution, that sounds very promising and we are going to investigate further.

Dust buildup on the boards. Since most electronic equipment requires some sort of regular preventative maintenance, that would be the time to remove any dust. Also, any dust collected by the vapor-thin film of oil on the contacts would not be nearly as destructive as the corrosion the oil prevents.

Your point on using in-line air ionizers to prevent ESD damage is well taken. Look for an ESD article in the near future.

We do not have any data on foam-tipped swabs creating enough ESD to cause damage. We do feel, though, that since the swab is soaked with alcohol and water, it will probably not be a problem.

But why not do away with the foam-tipped swab altogether? One of HP's service centers is now using a number of lint-free cloth products from the Texwipe Company, including TX300, a small sleeve that fits over a plastic wand. The technicians use it to clean both the PC board edge connector contacts and the inside of the female edge connector socket. They also use TX801 texpads that are presoaked in 91% alcohol and 9% water. And there is also TX809 gold wipes, which are treated pads especially for cleaning, lubricating, and protecting PC board gold contact edge connectors.

The solution of 80% alcohol/20% water was not based on careful experiments to determine exact levels of ESD. There was some evidence that a 50/50 solution squirted with force through a plastic nozzle had a high potential for generating ESD. At any rate, it's the cleaning action that's important and the 80/20 solution seems to be the optimum mix.

And finally, none of the flux-removing solvents contain chlorides. Their product literature states, "Not a combustible liquid, compressed gas, corrosive material, nor explosive. Exempt from all federal regulations. May be shipped air transport."

Editor

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