



TECHNICALLY SPEAKING

The CW2200 Conductive Pens: Tips and Tricks for Best Performance

ITW Chemtronics
8125 Cobb Center Drive
Kennesaw, GA 30152

Tel: 800-645-5244 x166

Fax: 770-423-0748

Technical Support:

800-TECH-401

or

mwatkins@chemtronics.com

Website:
www.chemtronics.com

The CircuitWorks Conductive Pens, part numbers CW2200STP and CW2200MTP, are among Chemtronics most popular products. These pens have a wide range of uses, from drawing traces between components on proto-type circuit boards, coating components and assemblies to shield them from electrical and radio frequency interference, to repairing broken solder traces on PCBs and broken grid lines on automobile rear-windshield defoggers. The silver-filled acrylic polymer in the CW2200 pens provides a quick, easy alternative to building solder traces between components and can effect repairs where conventional soldering techniques are not practical or possible. The nature of the conductive “ink” does lead to issues with regard to shelf-life, flexibility, clogging, conductivity, curing and thinning which I would like to address in this article.

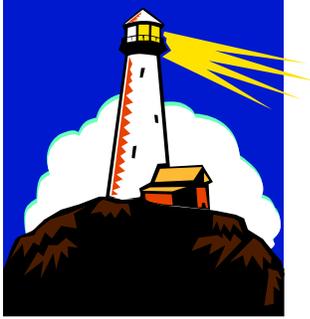
Tip Assembly and Trace Dimensions

The tip of the CW2200 Conductive Pens is really a spring-loaded retractable stopper. As you press the tip of the pen against a hard surface, the tip retracts into the tip assembly, opening a channel through which the conductive ink flows out of the pen. Ejection of the ink is aided by gently squeezing the flexible pen barrel.

The CW2200STP (standard tip pen) has an orifice size of 1 mm and will draw traces that will average 2.0 mm in width. The CW2200MTP (micro-tip pen) has an orifice size of 0.7 mm and will draw traces that average 1.5 mm in width. A skilled technician, with experience in using the CW2200 pen applicators should be able to produce consistent traces that will be narrower than the dimensions cited. If even narrower trace widths are required, the ink can be applied using a fine artist's brush or pen. A stencil can also be prepared to facilitate the drawing of fine pitch traces. The CW2200 Conductive Ink is also available in bulk form in a 100 gram bottle for large-volume brush or pen applications.

Shelf-Life and Clogging

The **unopened** CW2200 Conductive Ink Pens have a shelf-life of 18 months from its date of manufacture. The four-digit manufacturing date code appears on a sticker affixed to the back of the product display/instruction card. This code is read as follows: the first digit indicates the year of manufacture (4 = 2004, 5 = 2005, etc.); the next three digits indicate the consecutive day, from 001 to 365, on which the product was made. After this time ITW Chemtronics can no longer guarantee the performance of the product.



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After opening and initial use the shelf-life immediately decreases to six months. If you experience difficulty in producing a smooth flow of conductive ink when the pen is being reused within this six month time frame, this could indicate clogging of the product outflow channel within the tip assembly. As the pen sits in storage, especially if stored tip downward, the suspended silver particles will slowly settle and can clog the channel through which the product flows.

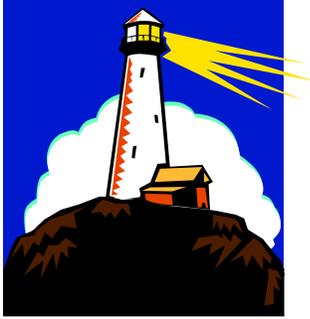
To restore the pen to proper operation, it must be shaken vigorously, usually for two to three minutes. Shake the pen until you can hear the internal mixing bearing “clicking” or moving within the pen barrel. Once you have established movement of the mixing bearing, continue to shake the pen for another minute or so to completely re-suspend the silver particles within the polymer matrix, to produce a smooth, homogenous product.

If shaking the pen does not free the mixing bearing (you cannot hear it moving within the pen barrel) or the ink still refuses to flow when the pen tip is retracted, then the clogging within the tip assembly is more serious and will require a more rigorous cleaning to re-establish proper operation. The tip can be removed and soaked in solvent to dissolve the material that is clogging the outflow channel. Remove the cap and with the pen tip pointing up, grip the white base of the tip assembly gently but firmly and turn it to the right (clockwise-because the tip assembly is “reverse-threaded”). Remove the tip assembly and drop in into a small container of Flux-Off® Plus or another suitable solvent.

Let the tip soak for 30 minutes to one hour, with occasional shaking or swirling, to clear the internal spaces within the tip assembly. As dried polymer dissolves you may see a fine dust of silver collect on the bottom of the soaking container. While the tip is soaking you may want to cover the opening in the pen barrel with a piece of tape to minimize exposure of the conductive ink to air and moisture. Once the tip has been cleared of ink, remove it from the solvent and let it drain on a paper towel and stand in the air for 10 minutes to allow the cleaning solvent to evaporate. Check that the “tip” stopper moves freely and retracts into the assembly easily, then screw the tip assembly back onto the pen barrel. The pen should now perform properly. If not, repeat the soaking procedure until the tip has been cleared. If soaking the tip assembly does not get the pen flowing, then the pen is probably past its usable shelf-life and should be replaced.

Flexibility

The CW2200 Conductive Ink has a limited degree of flexibility. If a conductive trace is bent beyond an angle of fifteen degrees the trace will loose adhesion to the flexible surface. Further bending can produce fine cracks within the trace and eventually result



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in breaking of the trace and loss of electrical continuity.

Adhesion and Temperature

The CW2200 Conductive Ink has very good adhesion to most surfaces. The surfaces should be cleaned prior to ink application, to insure that the surface is free of oil, greases and handling soils. The maximum operating temperature of the CW2200 Conductive Ink is 200 °C (405 °F). The CW2200 Conductive Ink is a good alternative to other conductive adhesives when a higher operating temperature is desired and high bond strength is not required.

Soldering

A trace drawn with the CW2200 polymer ink will combine with solder, provided the soldering temperature does not exceed 350 °F and the solder joint is formed within 5 seconds. If a CW2200 trace must be soldered to, it is recommended that tin/lead solder containing 2 % silver be used and that the trace is heat-cured at 150 °F for five minutes to produce the most durable trace possible.

Curing and Thinning

The one-component conductive ink will dry tack-free within 5 minutes and a trace drawn with the CW2200 will dry completely within 30 minutes, but maximum conductivity will not be achieved until the trace has fully cured for 24 hours at room temperature. For increased conductivity, durability and chemical resistance the trace should be heat-cured by heating at 250 to 300 °F (120 to 150 °C) for no more than five minutes. If a thinner coating is required, the CW2200 Conductive Ink can be thinned using butyl acetate solvent. Using other solvents to thin the conductive ink is not recommended, as they may change the properties of the acrylic polymer or force the polymer out of solution.

Michael Watkins
ITW Chemtronics
Technical Support