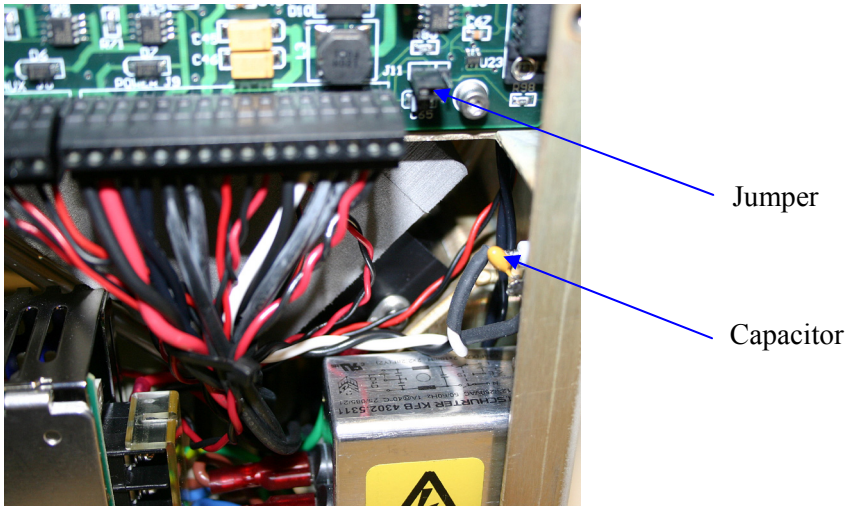
Application Note WCPC-002

Model 378x-PC Water-based Condensation Particle Counter

Is it possible to get particle concentrations from analog output?

No. The WCPCs are not designed to output a voltage that is proportional to aerosol concentration because of the dynamic range issues associated with this kind of output. For the WCPCs, it is possible to get digital particle count information that can be used to calculate particle concentrations. The pulses that are generated when particles pass through the optics can be obtained through the BNC port at the back panel of the WCPC with a couple modifications to the instrument. The first modification is to move a jumper. There is a 3-pin jumper at the lower right corner of the main electric board of the WCPC. Move the 2-pin black or blue cap from the left and middle pins (A – Analog) to the middle and right pins (D – Digital). The second modification is to cut a capacitor. Cut the connection between the yellow capacitor and the inside of the BNC port. See the figure below for the locations of the jumper and the capacitor. In this configuration, the digital pulses will be output from the BNC port and the WCPC can't be used in SMPS setup.



An electronic counter can be connected to the BNC output to get the particle counts. Particle concentration can be calculated using particle counts and aerosol flow rate using the following equation

$$C = \frac{N}{Q \bullet t},$$

where C is the particle concentration in particles/cm^3, N is the number of pulses counted through the BNC port within a time period of t in seconds, and Q is the flow rate in cm^3/s. In the WCPCs, a single particle passing through the optics gives a digital pulse of roughly 1 microsecond duration. Coincident particles will extend the pulse width and at very high concentrations the particle count rate obtained from the BNC port will begin to decrease as concentration increases. The digital output is only good at concentrations lower than about 30,000 particles/cm^3.

The particle concentrations obtained through the BNC port **don't have live-time coincidence correction**. A simple correction can be done by using the following equation

$$C_a = C_c \exp(C_a Q \tau),$$

where C_a is the actual concentration in particles/cm^3, C_c is the calculated concentration in particles/cm^3 based on the particle count information from the BNC, Q is the aerosol flow rate in cm^3/s, and τ is the pulse width in second. The C_a in the exponent can be approximated by C_c in the calculation. Please note that this corrected concentration will be different from the concentration displayed on the front panel of the WCPC because of the different methods for coincidence correction.

To use the WCPC again in the SMPS setup, the jumper needs to be moved back to the analog position (the left two pins). The capacitor can be left unconnected but the analog signal will have a little electric noise during data collection. The capacitor can be soldered back to the inside of the BNC port to improve the signal.

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