190785 Flow Thru Copper Sensor Instructions

1.0 OPERATION

The copper flow through sensor is designed for out-of-tank monitoring of electroless copper and microetch solutions. The sensor is compatible with WCU series controllers; it is NOT compatible with Walchem W-10 series controllers. The sensor is designed with a glass tube that contains the copper solution that forms a fixed path length between the lamp and receptor module. The solution absorbs light at specific wavelengths in proportion to the copper concentration.
IN ORDER TO AVOID A SHIFT IN CALIBRATION CAUSED BY CONDENSATION, THE SENSOR COVER SHOULD NEVER BE REMOVED!

2.0 INSTALLATION

The flow through sensor is provided with a mounting plate and 20 feet of cable. Extension cable is available if the sensor cannot be placed within 20 feet of the controller. The flow through sensor/sample loop must be installed according to the following guidelines:

- Mount the sensor on a vibration-free, vertical surface so that the sensor tubing inlet connection is at the bottom and the outlet is at the top. The vertical orientation will prevent air bubbles from being trapped in the sensor.
- Install a shut-off valve at the beginning of the sample loop so that the system may be shutoff quickly if necessary.
- If a sample pump is to be used, it must be installed last, after the flow through sensor and the cooling coil or plate, if applicable.

Other installation guidelines that may be helpful in the overall system:

- Mount the sensor as close to solution as possible. Keep tubing distances to the sensor inlet as short as possible to avoid hydraulic lag time. Maximum recommended length of tubing from solution to sensor is 25 feet. If this is not possible, see Application Notes Section.
- The solution inlet should draw sample from an area of good solution movement in order to respond quickly to chemical additions. However, the solution inlet should not draw too near to where the chemistry is added to avoid artificial 'spikes' in concentration.
- The solution discharge should be open to atmospheric pressure in order to ensure proper flow.
- The cable connector to the controller is keyed, do not force!

New Sensor Setup

A "NEW SENSOR SETUP" must be performed through the controller if the sensor is a replacement to the original or the original sensor was sent back to the factory for repair. A "1-POINT CALIBRATION" should be sufficient for a sensor that was received with, and has the same serial number as a controller. Refer to the WCU Instruction Manual for additional information.

Press ENTER to set up a new sensor. First you see a warning message: "WARNING Chg sensor cal?N" This acts as a safety precaution for those who may only be "browsing" through the menus. If you enter the New Sensor Setup menu, you may easily, inadvertently, change the calibration of the sensor. If you continue with the following procedures, you must recalibrate the new sensor.

Water....xxxx.x
Circulate clean tap or DI water through the flow through sensor. When the number on the display is constant, press ENTER.

Sample....xxxx.x
Place the sensor in the bath at a known concentration or restart pumping the bath sample through the flow through sensor. No work should be going through the bath so that the concentration remains constant. Ideally the bath should be at the typical operating copper concentration. When the number on the display is constant, press ENTER.

Smpl Conc
Use the arrow keys to change the displayed number to the actual concentration of the bath in grams/liter or ounces/gallon, depending on the unit of measure you have selected, then press ENTER.

Application Notes

If the distance from the solution to the sensor is further than the recommended length of 25 feet, the maximum lagtime must be calculated from the desired control band to determine a pump flow rate based on a given distance of standard, uniform tubing. The maximum lagtime is the maximum allowable time for the solution to continuously get to the sensor in order to achieve the desired control band.

To calculate maximum lagtime:

$$\text{Max. Lagtime} = \frac{\text{Desired Control Band*}}{4 \times \text{Depletion Rate}}$$

where Control band = Maximum deviation of concentration
Depletion rate = Rate at which the bath will deplete per unit of time

*The deadband should be adjusted so that it is 1/4 the desired control band.

- For Example: The set point is 4.00 g/L.
- If the desired control band is 0.20 g/L (± 0.10 g/L or 2.5%) and the bath is depleting at a rate of 1.25 g/L every 15 minutes (0.08333 g/L every minute),

then Max. Lagtime = $\frac{0.20\ g/L}{4 \times (0.08333\ g/L/min)}$ = 0.60 minutes

So, 0.60 minutes is the maximum time it should take for the solution to reach the sensor.

To calculate pump flow rate:

Minimum Pump Flow Rate = $\frac{\text{Volume of System*}}{\text{Maximum Lagtime}}$

Where Volume of system = π (Tubing ID/2)^2 x Length of tubing

Maximum lagtime = Previously calculated time to get solution to sensor.*
Volume is based on length from solution to sensor, *not* the return.

For Example: If the system parameters are: Tubing is 3/8" O.D. 1/4" I.D.
Length is 30 feet (360 inches)

then the volume of the system = π (0.25in/2)^2 x (360 in) = 17.7 in^3

Note:	1 U.S. Gallon	=	231 U.S cubic inches
	1 Liter	=	61.03 U.S. cubic inches

Volume of the system= 17.7 in^3 / (231 in^3 /gallon) = 0.0765 gallons

Maximum lagtime = 0.60 minutes (previously calculated)

So, the minimum pump flow rate
= 0.0765 gallons / 0.60 minutes = 0.127 gal/min (483 mL/min)

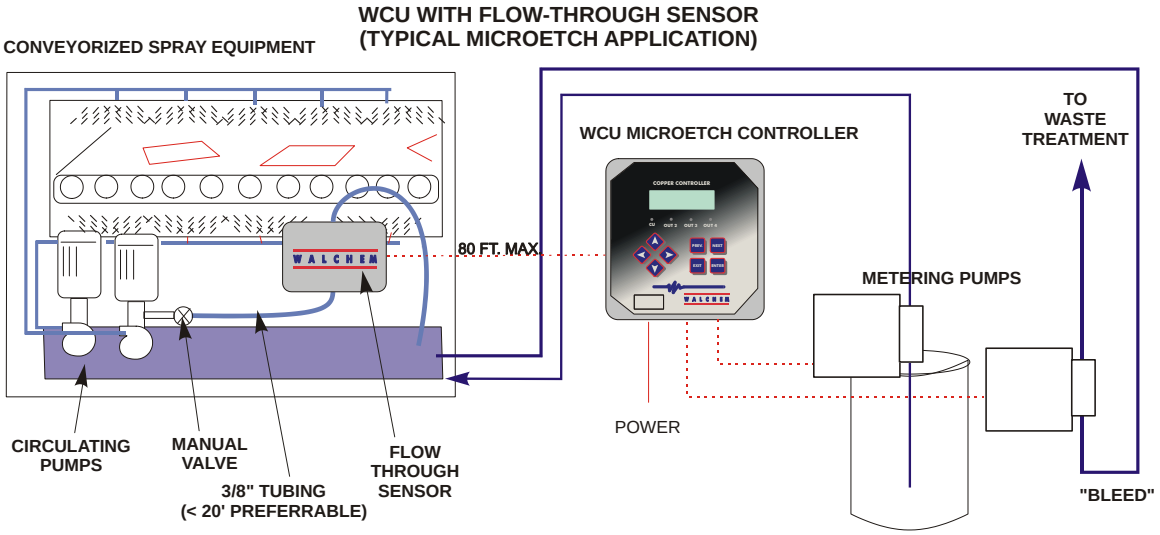
Caution: The calculated pump flow rate is the minimum required to obtain the desired control band, however, if the flow rate increases over the recommended rate of 500 mL/min (approx. 0.13 gal/min) the rate of cooling will decrease. This may be compensated for by re-evaluating the system criteria: length / desired control band or to double up on the cooling plate/coil.

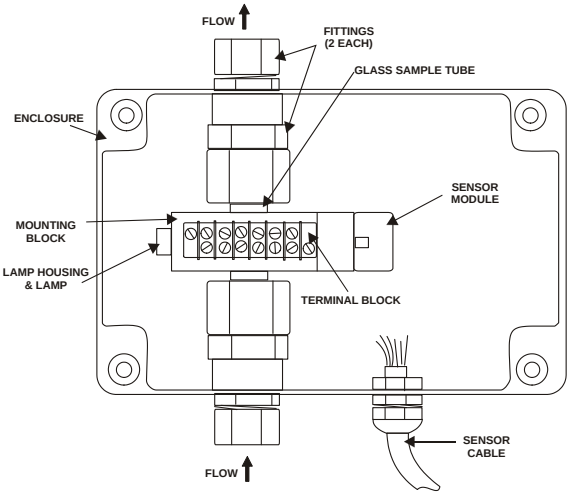
Consult factory with any further installation questions.

3.0 MAINTENANCE

The sensor should be examined periodically for signs of plate-out or other coatings in the glass tube. To avoid scratching the sensitive surface, chemical cleaning is preferred over mechanical cleaning methods. Plate-out should be removed using nitric acid, or a persulfate or peroxide/sulfuric etch.

Field repairs of the sensor should not be attempted. Call your distributor in order to arrange for factory service. Expedited service is available at no extra cost.





P/N 190785 WCU310 Series Flow Through Copper Sensor

NOTE: TO PREVENT CALIBRATION SHIFTS DUE TO CONDENSATION FORMING ON THE SAMPLE TUBE INSIDE THE COVER OF THE SENSOR, DO NOT REMOVE THE SENSOR'S COVER FOR ANY REASON!