WCU Series
Electroless Copper Controller
Instruction Manual

Proprietary Material

Statement of Limited Warranty

WALCHEM Corporation warrants equipment of its manufacture, and bearing its identification to be free from defects in workmanship and material for a period of 24 months for electronics and 12 months for mechanical parts from date of delivery from the factory or authorized distributor under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by WALCHEM Corporation and for the purposes disclosed in writing at the time of purchase, if any. WALCHEM Corporation's liability under this warranty shall be limited to replacement or repair, F.O.B. Holliston, MA U.S.A. of any defective equipment or part which, having been returned to WALCHEM Corporation, transportation charges prepaid, has been inspected and determined by WALCHEM Corporation to be defective. Replaceable elastomeric parts and glass components are expendable and are not covered by any warranty.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, AS TO DESCRIPTION, QUALITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR ANY OTHER MATTER.

P/N 180099.J1
Feb 2006

TABLE OF CONTENTS

1.0 Introduction 1

2.0 Specifications 1
2.2 Electrical: Input/Output 1
2.3 Mechanical 2

3.0 Unpacking and Installation 2
3.1 Unpacking the unit 2
3.2 Mounting the electronic enclosure 3
3.3 Immersible Copper Sensor Installation 3
3.4 Flow Through Copper Sensor/Sample Loop Installation 4
3.5 Control Module Installation 8
3.6 Icon Definitions 9
3.7 Electrical Installation 9

4.0 Function Overview 14
4.1 Front Panel 15
4.2 Display 15
4.3 Keypad 16
4.4 Access Code 16
4.5 Startup 16
4.6 Shutdown 17

5.0 Operation 17
5.1 Main Menu 17
5.2 Sensor Menu 18
5.3 Output 1 Menu 22
5.4 Output 2, 3, and 4 Menus 26
5.5 Clock Menu 27
5.6 Alarm Menu 28
5.7 4-20 mA Menu (Optional) 28
5.8 Access Code Menu 29

6.0 Maintenance 31
6.1 Sensor Maintenance 31
6.2 Replacing the Fuses 31

7.0 Troubleshooting 32
7.1 Error Messages 32

8.0 Service Policy 35

1.0 Introduction

The WCU310 series copper controllers are optoelectronic on-line analyzers that may be used in variety of applications including electroless copper baths, microetch baths and a number of other chemistries that contain more than 0.10 grams/liter (g/L) of copper ions.

There are four relays that may be used as control outputs that are activated simultaneously. The direction of control is selected via software. The outputs each have timers associated with them, that may be used to track the volume of chemistry added, or the time that the output has been on.

An optional 4-20 mA output that is proportional to the copper concentration is available.

Either an immersible in-tank sensor or flow-through out-of-tank sensor may be specified.

2.0 Specifications

2.1 Measurement Performance

Electroless Copper Concentration Range:	.01 - 5.5 g/L	(.001 - 0.73 oz/gal)
Microetch Copper Concentration Range:	.01 - 99 g/L	(.001 – 13.2 oz/gal)
Concentration Resolution:	.001 g/L	(.0001 oz/gal)
Concentration Accuracy:	.01 g/L	(.001 oz/gal)

2.2 Electrical: Input/Output

Input Power

110-120 VAC 50/60 Hz, 10A	or	220-240 VAC 50/60 Hz, 5A

Input Signals

Sensor	Power: + 5VDC, 150 mA Signals: 0 to 2VDC
Interlock (optional)	Isolated dry contact closure required (i.e., flow, level, etc.)

Output

Mechanical Relays (5)	@ 120 VAC, 10A resistive, 1/8 HP @ 240 VAC, 5A resistive, 1/8 HP internally powered, switching line voltage
4 - 20 mA (optional)	Fully isolated, internally powered 600 Ω max. resistive load. Resolution .001% of span, accuracy ± 1% of reading.

Agency Approvals

UL	UL 61010-1, 2nd Edition
CSA	C22,2 No.61010-1 2nd Edition
CE Safety	EN 61010-1 2nd Edition
CE EMC	EN 61326 :1998 Annex A*

Note: For EN61000-4-6,3 the controller met performance criteria B.
*Class A equipment: Equipment suitable for use in establishments other than domestic, and those directly connected to a low voltage (100-240 VAC) power supply network which supplies buildings used for domestic purposes.

2.3 Mechanical

Controller

Enclosure:	Fiberglass
NEMA Rating:	NEMA 4X
Dimensions:	8.5" x 6.5" x 5.5"
Display:	2 x 16 character backlit liquid crystal
Operating Ambient Temp:	32 - 122°F (0 - 50°C)
Storage Temperature:	-20 to 180°F (-29 to 80°C)
Shipping Weight:	7 lbs (3kg) (approximately)

Sensor

	Immersible	Flow Through
Enclosure:	Polycarbonate/Polypro	ABS
NEMA Rating:	NEMA 4X	NEMA 4X
Dimensions:	5.25" x 4.0" x 20.25"	6.75" x 4.75" x 2.25"
Operating Ambient Temp:	32 - 122°F (0 - 50°C)	32 - 122°F (0 - 50°C)
Storage Temperature:	-40 to 185°F (-40 to 85°C)	-40 to 185°F (-40 to 85°C)
Solution Temperature:	200°F (93°C) max.	200°F (93°C) max.
Maximum cable length:	80 ft .	80 ft.

3.0 Unpacking and Installation

3.1 Unpacking the unit

Inspect the contents of the carton. Please notify the carrier immediately if there are any signs of damage to the controller or its parts. Contact your distributor if any of the parts are missing. The carton should contain a WCU310 controller and instruction manual. Any options or accessories will be incorporated as ordered.

3.2 Mounting the electronic enclosure

The WCU series controller is supplied with mounting holes on the enclosure. It should be wall mounted with the display at eye level, on a vibration-free surface, utilizing all 4 mounting holes for maximum stability. Use M6 (1/4" diameter) fasteners that are appropriate for the substrate material of the wall. The enclosure is NEMA 4X rated. The maximum operating ambient temperature is 122° F (50° C). The enclosure requires the following clearances:

Top:	2"
Left:	8"
Right:	4"
Bottom:	7"

3.3 Immersible Copper Sensor Installation

The immersible copper sensor is designed for direct in-tank monitoring of electroless copper and microetch solutions. By monitoring the copper content directly in the solution, control lag and hydraulic problems are eliminated.

The sensor is constructed such that a constant path length exists between the fiber optic light guides. The solution between the light guides absorbs light at specific wavelengths in proportion to the copper concentration. The lamp and electronics are located under the cover of the sensor. In order to avoid a shift in calibration due to condensation, the sensor's cover should NEVER be opened.

The immersible sensor is provided with a mounting plate and 20 feet of cable. Extension cable is available if the sensor can not be mounted within 20 feet of the controller. The maximum cable length is 80 feet.

While the positioning of the sensor is not particularly sensitive to the tank layout, the following suggestions are given to aid installation:

- Do not place the sensor beside heaters; if solution flow stops, the polypropylene guard may melt.
- Do not immerse the entire sensor, or the cable.
- Place the sensor where the loads of parts will not strike it.
- Place the sensor in an area of good solution movement, but not directly in the path of any air agitation.
- Mount the sensor securely to the rim of the tank using the holes provided. If the tank is rimless, use a block to provide the support for the mounting plate.

Attach the cable's connector to the WCU controller. The connector is keyed, do not force! The sensor you receive with the controller has already been calibrated.

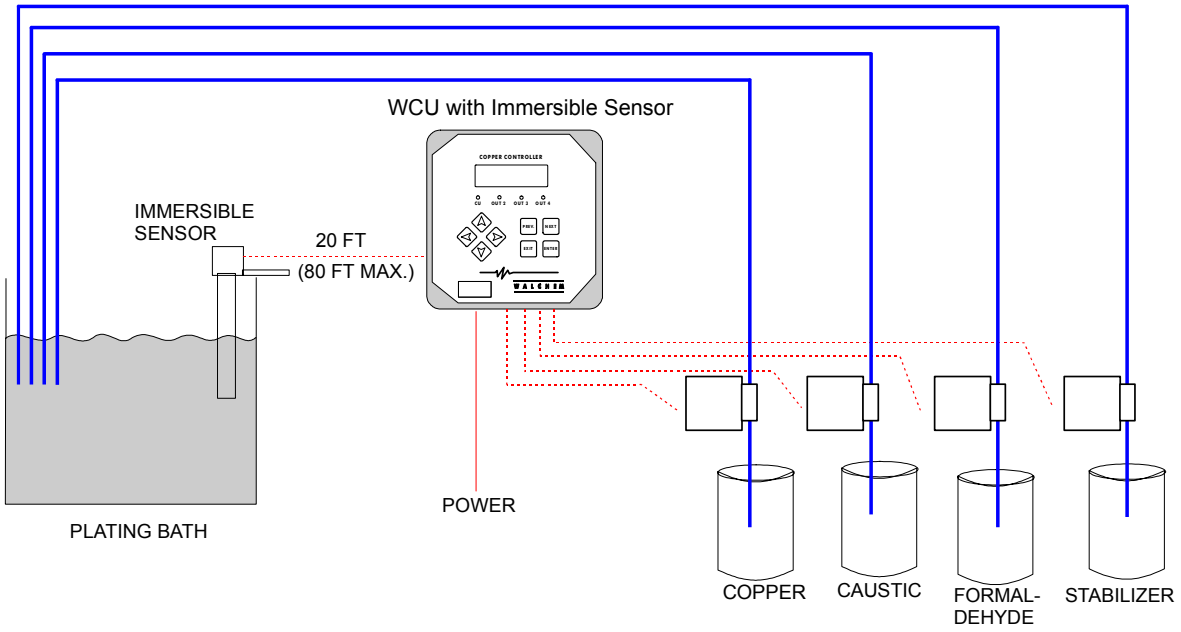
3.4 Flow Through Copper Sensor/Sample Loop Installation

The copper flow through sensor is designed for out-of-tank monitoring of electroless copper and microetch solutions.

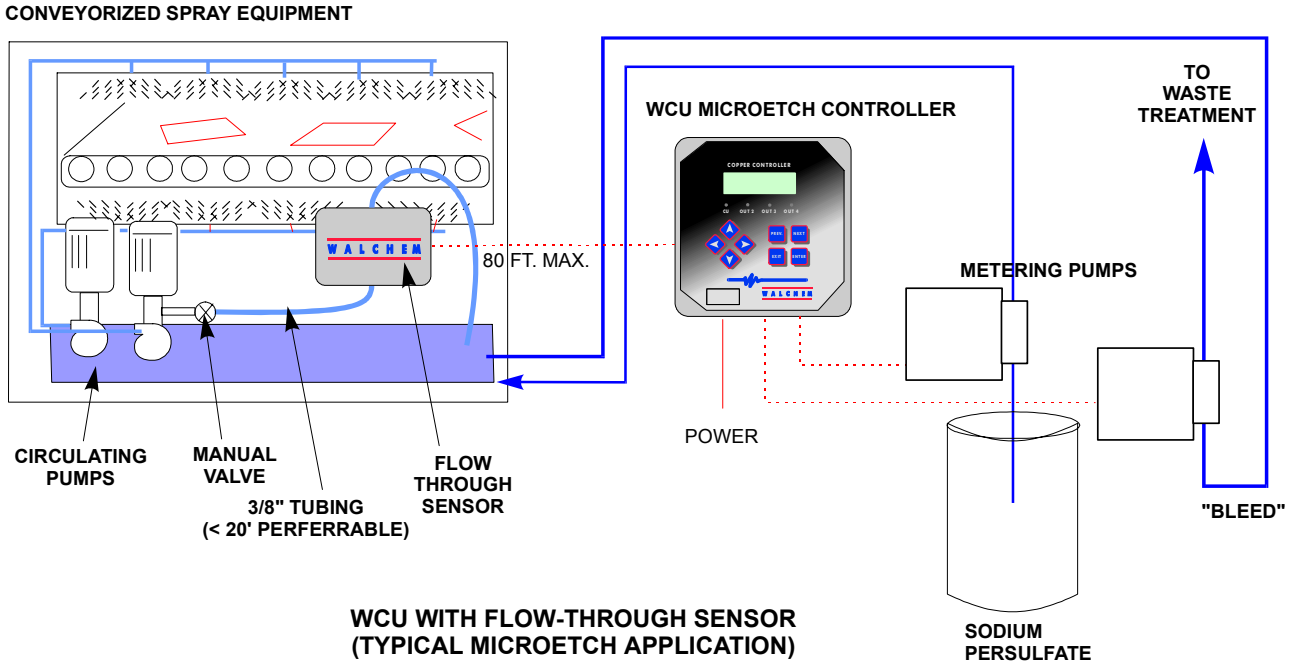
The sensor is designed with a glass tube that contains the copper solution that forms a fixed path length between the lamp and receptor module. The solution absorbs light at specific wavelengths in proportion to the copper concentration. In order to avoid a shift in calibration caused by condensation, the sensor cover should NEVER be removed!

The flow through sensor is provided with a mounting plate and 20 feet of cable. Extension cable is available if the sensor can not be placed within 20 feet of the controller. The maximum cable length is 80 feet.

The sample loop consists of a shut off valve, a cooling coil or plate, a sensor and a pump or any combination thereof. The shut off valve is to quickly isolate the system if necessary. A cooling coil or plate is necessary to cool the copper solution down to a temperature acceptable to a sample pump. Cooling the solution is also recommended to help reduce the amount of plate out which may form in the sample loop. The pump may be either a stand alone sample pump (which typically have temperature restriction) or a high temperature pump (which is usually just a branch off the recirculation pump).



WCU WITH IMMERSIBLE SENSOR
(TYPICAL ELECTROLESS COPPER APPLICATION)



WCU WITH FLOW-THROUGH SENSOR
(TYPICAL MICROETCH APPLICATION)

Figure 1 Typical Installation

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 shut off 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 which 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 below.

- 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!

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),

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

$$= 0.60 \text{ minutes}$$

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

To calculate pump flow rate:

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

where Volume of system = $\pi \left(\frac{\text{Tubing I.D.}}{2}\right)^2 \times$ 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. x 1/4" I.D.
Length is 30 feet (360 inches)

$$\text{then the volume of the system} = \pi \left(\frac{0.25 \text{ in}}{2}\right)^2 \times (360 \text{ in}) = 17.7 \text{ in}^3$$

Note: 1 U.S. Gallon = 231 U.S cubic inches	1 Liter = 61.03 U.S. cubic inches
Volume of Cooling Coil: 0.018 Gallons 0.068 Liters	Volume of Cooling Plate: 0.023 Gallons 0.088 Liters
Volume of 3/8" O.D. x 1/4" I.D. (0.59 in3/ft): 0.00255 Gallons/linear ft 0.00965 Liters/linear ft	

Volume of the system = $\frac{17.7 \text{ in3}}{231 \text{ in3 / gallon}}$ = 0.0765 gallons

Maximum lagtime = 0.60 minutes (previously calculated)

So, the minimum pump flow rate

= $\frac{0.0765 \text{ gallons}}{0.60 \text{ minutes}}$

= 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.

3.5 Control Module Installation

Once the enclosure is mounted, the output pumps may be located at any distance from the controller. The sensor may be placed up to 80 feet from the controller. Shielded cable is preferable. Always route AC voltage wiring in conduit that is separated a minimum of 6 inches away from low voltage DC signal lines (such as the sensor signal).

3.6 Icon Definitions

Symbol	Publication	Description
	IEC 417, No.5019	Protective Conductor Terminal
	IEC 417, No. 5007	On (Supply)
	IEC 417, No. 5008	Off (Supply)
	ISO 3864, No. B.3.6	Caution, risk of electric shock
	ISO 3864, No. B.3.1	Caution

3.7 Electrical Installation

Based on the model number, the following voltages are required:

WCU310-1xx	120 VAC, 50/60 Hz
WCU310-4xx	120 VAC, 50/60 Hz
WCU310-5xx	240 VAC, 50/60 Hz

The various standard wiring options are shown below. Your WCU series controller will arrive from the factory prewired or ready for hardwiring. Depending on your configuration of controller options, you may be required to hardwire some or all of the input/output devices. Refer to figures 3 and 4 for circuit board layout and wiring.

Note: When wiring the optional 4-20 mA output or a remote flow switch, it is advisable to use stranded, shielded, twisted pair wire between 22-26 AWG. Shield should be terminated at the controller ground stud (see figure 4).

CAUTION! There are live circuits inside the controller even when the power switch on the front panel is in the OFF position! The front panel must never be opened before power to the controller is REMOVED!
If your controller is prewired, it is supplied with a 8 foot, 18 AWG power cord with USA style plug. A tool (#1 phillips driver) is required to open the front panel.

CAUTION! When mounting the controller, make sure there is clear access to the disconnecting device!

CAUTION! The electrical installation of the controller must be done by trained personnel only and conform to all applicable National, State and Local codes!

CAUTION! Proper grounding of this product is required. Any attempt to bypass the grounding will compromise the safety of persons and property.

CAUTION! Operating this product in a manner not specified by Walchem may impair the protection provided by the equipment.

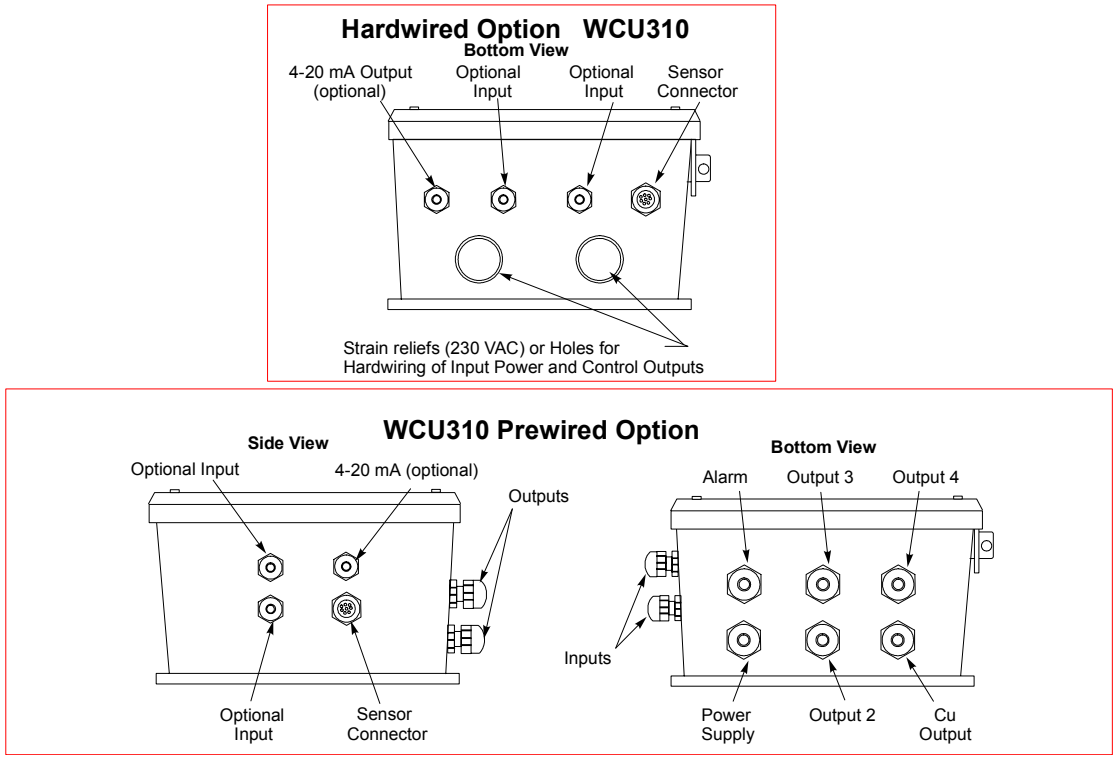


Figure 2 Conduit/Wiring Configuration

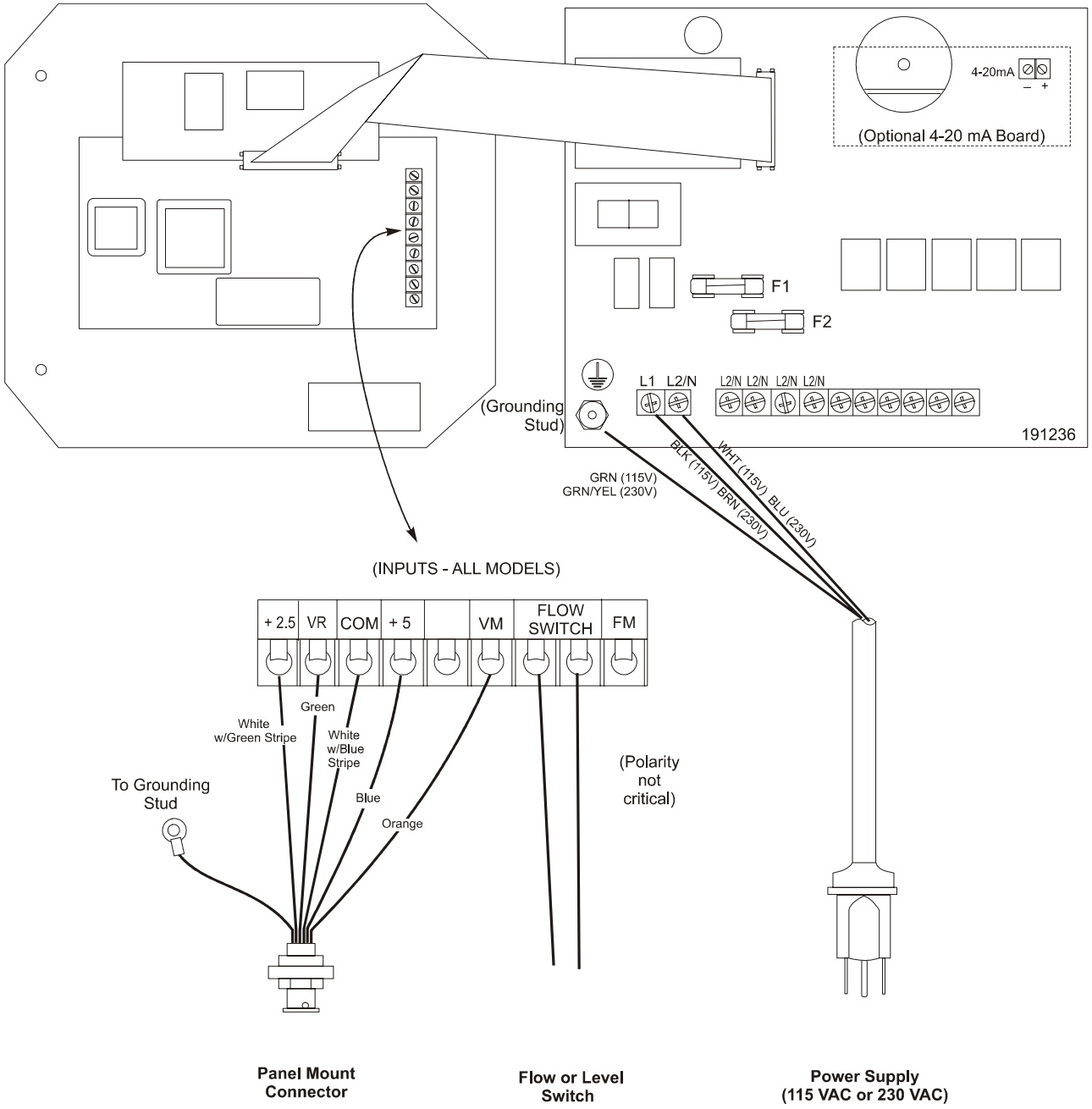


Figure 3 Inputs (for power relay board #191236)

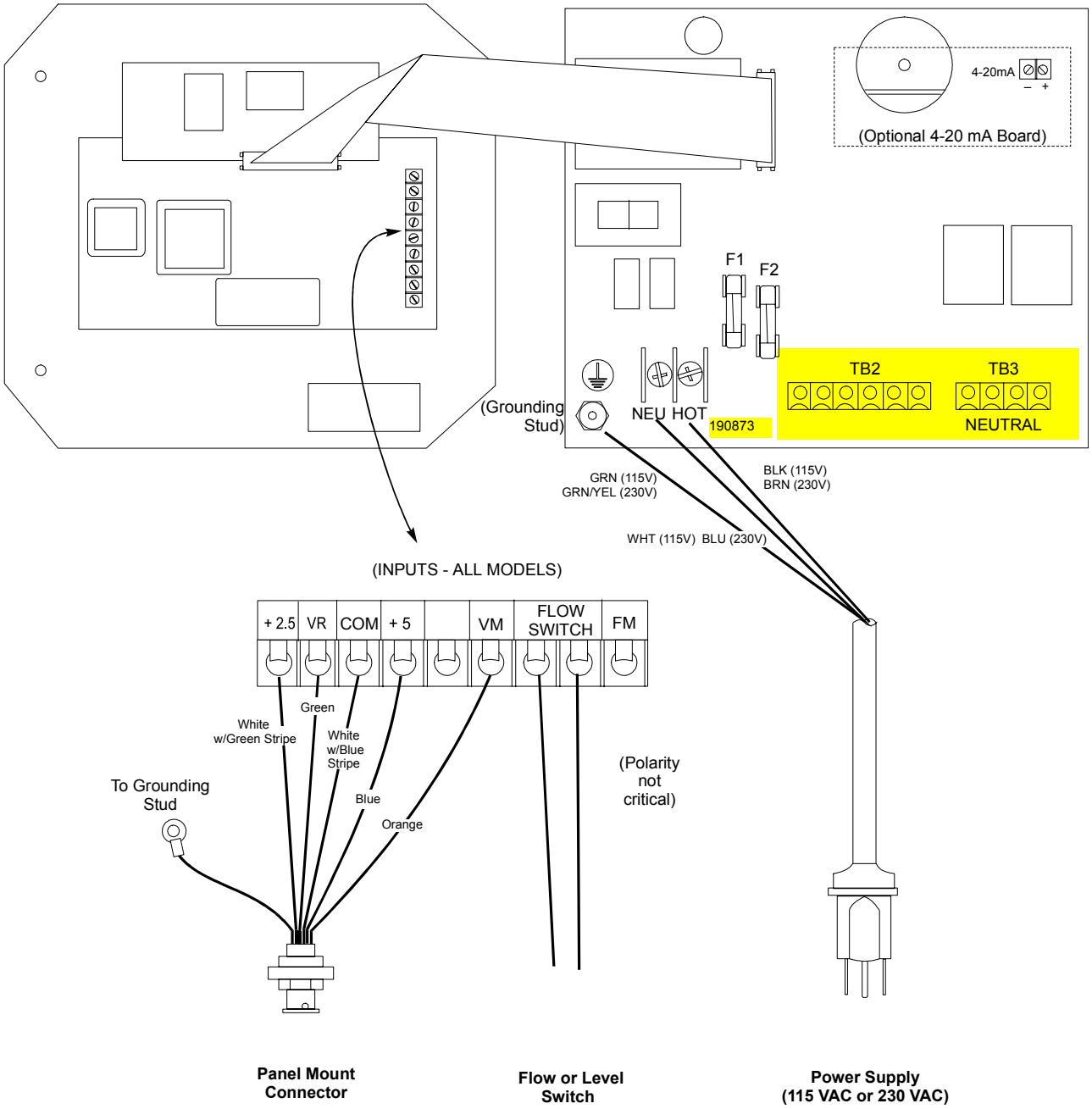


Figure 3a Inputs (for power relay board #190873)

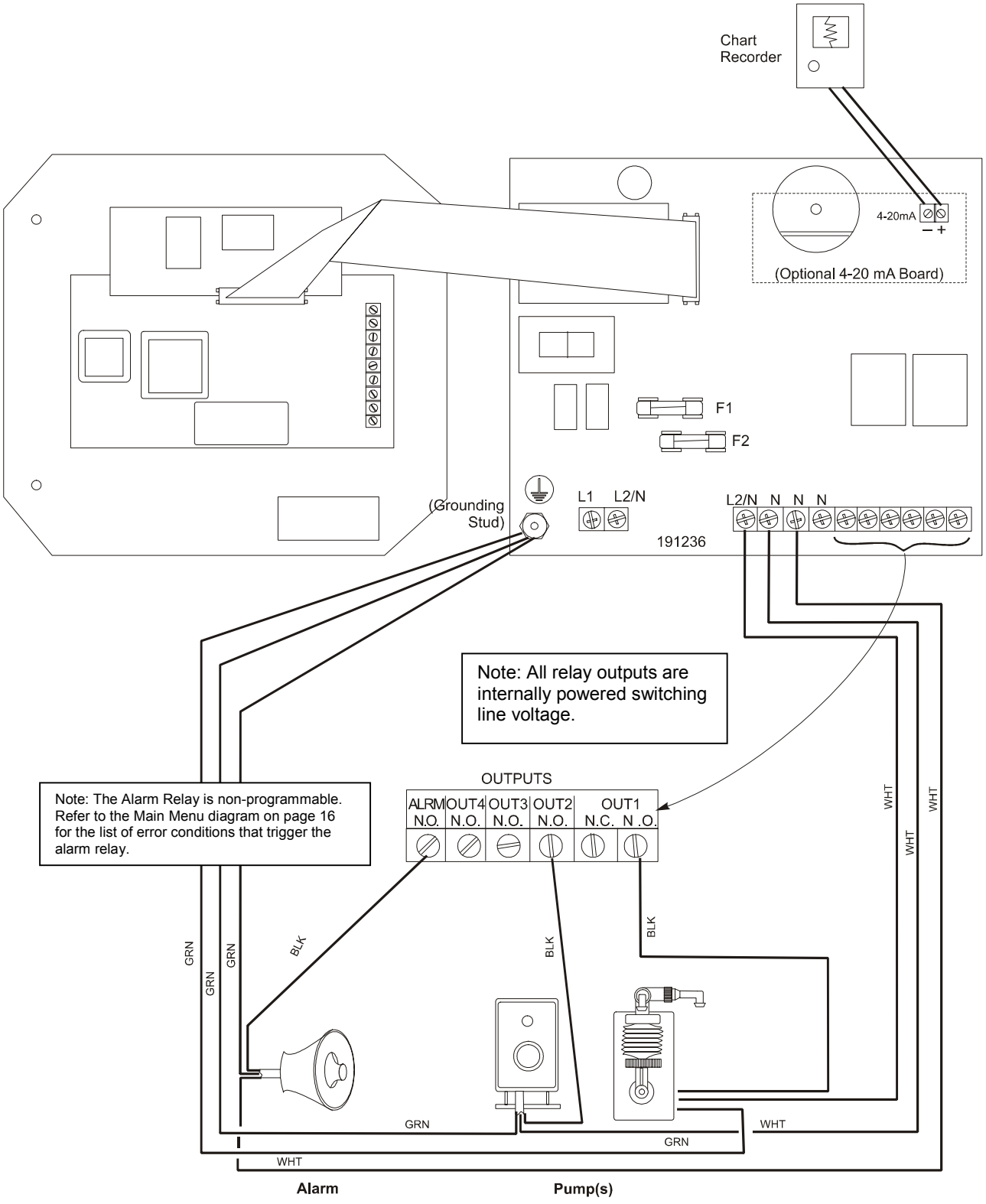


Figure 4 Outputs (for power relay board #191236)

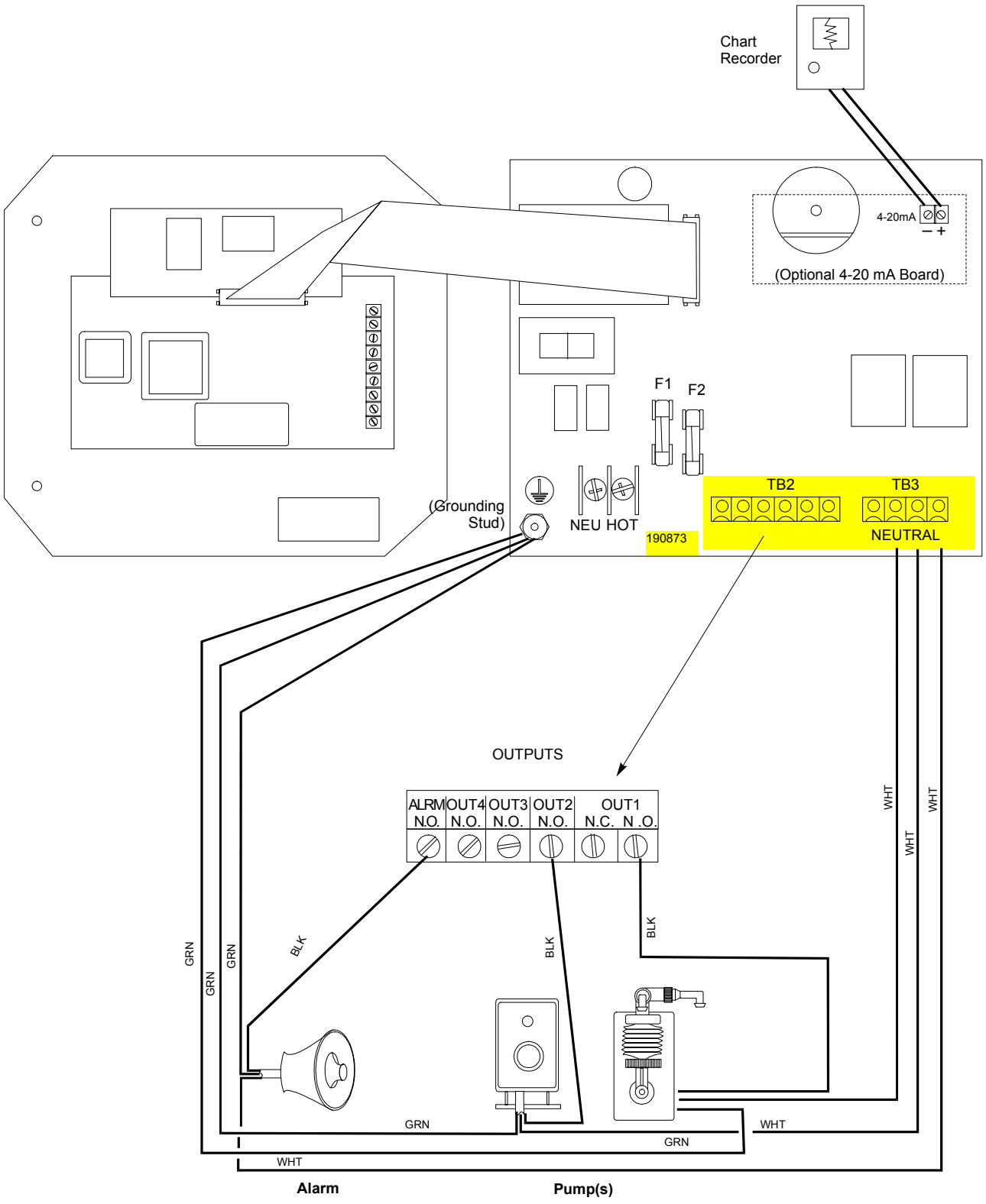
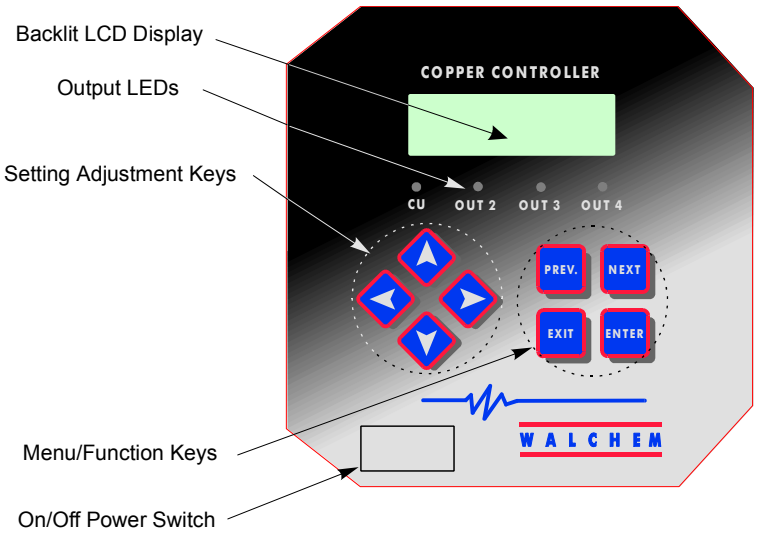


Figure 4a Outputs (for power relay board #190873)

4.0 Function Overview

4.1 Front Panel



Front Panel

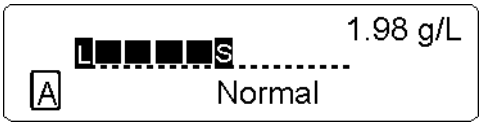
4.2 Display

A summary screen is displayed while the WCU controller is on. This display shows a bar graph of the copper concentration relative to the set point, a digital display of the copper concentration, and the current operating conditions.

Towards the center of the bar graph is an (S), which represents the set point. For each 1% rise above the set point a vertical line appears to the right of the (S). For each 1% drop below the set point a vertical bar appears to the left of the (S). There are small breaks in the bars at each 5%. If high or low alarm limits are reached, then either an (H) or (L) will appear.

The operating conditions which may be displayed on the bottom line of the display are: Control Delay 30* (number counts down), Sensor Error, Light Bulb Out, No Sample, Plate Out, Manual Output* Interlock, Output Disabled*, Pump Overrun, High/Low Alarm, Turnover Limit, Calibration Time, Outputs On* and Normal*

*These messages do not activate the diagnostic alarm relay.

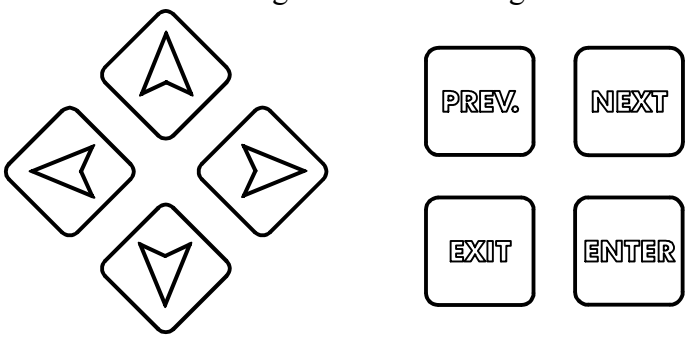


Summary Display

4.3 Keypad

The keypad consists of 4 directional arrows and 4 function keys. The arrow keys are used to move the adjustment cursor and change settings, while the function keys are used to enter values, and navigate the various menu screens. The function keys are **ENTER, EXIT, NEXT** and **PREV** (previous). **NEXT** and **PREV** scroll through the various menu choices. **ENTER** is used to enter a menu and to enter a value. **EXIT** is used to back up one menu level. If you are at the main menu level, **EXIT** will return you to the summary screen.

To change a value or option in a submenu, the left/right arrow keys move the cursor left and right to each digit or option that can be changed. The up/down arrows will change numeric values up or down, or scroll through option choices. Press **ENTER** only when you have finished making ALL of the changes for that menu screen.



4.4 Access Code

The WCU series controller is shipped with the access code disabled. If you wish to enable it, see Section 5.8 for operation. With the access code enabled, any user can view parameter settings, but not change them. Note that this provides protection only against casual tampering. Use a lock on the cover latch if you need more protection.

4.5 Startup

Initial Startup

After having mounted the enclosure and wired the unit, the controller is ready to use.

CONTROL DELAY: The display will show the WCU series model number then revert to the top level summary screen with "Control Delay" for a status message. This message will be displayed for approximately 30 seconds. In some situations, the user may not want the unit to be controlling and possibly turning on pumps when it is first powered on. This allows you enough time to enter the Output menus and disable the outputs. The only difference in the controller operation during these 30 seconds is that it will not activate any outputs. All measurements are live and all menus are accessible. Scroll through the menus, calibrate the sensor, and set the control parameters as detailed in Section 5, Operation.

To return to the summary screen, press the **EXIT** key until you return to this screen. The controller will automatically return to this screen after 10 minutes.

Normal Startup

Startup is a simple process once your set points are in memory. Simply check your supply of chemicals, turn on the controller, calibrate the sensor if necessary and it will start controlling.

4.6 Shutdown

To shut the WCU controller down, simply turn off the power switch. Programming remains in memory.

5.0 Operation

These units control continuously while power is applied. Programming is accomplished via the local keypad and display.

To view the top level menu, press any key. The menu structure is grouped by inputs and outputs. Each input has its own setup menu for calibration and unit of measure selection as needed. Each output has its own setup menu including set points, timer values, direction of control, etc as needed. After 10 minutes of inactivity in the menu, the display will return to the summary screen. Keep in mind that even while browsing through the menus, the unit is still controlling.

5.1 Main Menu

The exact configuration of your WCU controller determines which menus are available as you scroll through the settings. Certain menus are only available if you select certain options. All settings are grouped under the following main menu items:

Sensor
Out 1
Out 2
Out 3
Out 4
Alarm
Time
4-20 mA (Only if 4-20 mA option circuit board is installed)
Access Code

The **NEXT** key travels forward through this list while the **PREV** key travels backwards through the list. Pressing **ENTER** will enter the lower level menu that is currently displayed.

5.2 Sensor Menu

The sensor menu provides the following settings: Calibration history (informational only), 1 point calibration, Days between Calibration, Units of measure, Control mode, and New sensor set-up. Each is discussed in detail below. Refer to the Sensor Menu Chart.

*Note: If you are programming the unit for the first time, scroll to the Cu Mode menu and set the "Cu Mode" option first, choosing either Electroless Copper or Microetch mode. Then press **PREV** to choose units of measure. Then press **NEXT** to set the rest of the menus.*

Cal'd

Displays the date of the last sensor calibration.

1 Pt Calibration

Press **ENTER** to perform a 1 point calibration of the copper sensor. This calibration is best performed at normal operating temperature.

Keep the immersible sensor in place or have solution flowing through the flow-through sensor. Take a sample of the solution and note the concentration displayed by the WCU controller. Carefully perform the normal laboratory analysis of the copper concentration. Calculate the offset by subtracting the displayed value from the lab results. If the lab analysis is significantly different, adjust the offset in the 1 point calibration menu, using the arrow keys to change the value and the +/- sign. If the controller's display is higher than the lab analysis, the offset should be negative.

The maximum offset for a one point calibration is 7 g/l(0.7 oz/gal) from the last new sensor setup value. If you have an offset larger than this, then perform a new sensor setup (see next page).

Days Btwn Cal

Use the arrow keys to set the number of days that you would like to go by before recalibrating the sensor. The controller will prompt you to recalibrate when that time has expired. Setting this to zero days will disable the calibration reminder.

Conc. Units

Press **ENTER** to change the units of measure. Use the Up and Down arrows to toggle between grams per liter and ounces per gallon, then press **ENTER** to make your selection. The controller will warn you to check your set points, since all set point values will stay the same even though the units of measure may have changed.

Cu Mode

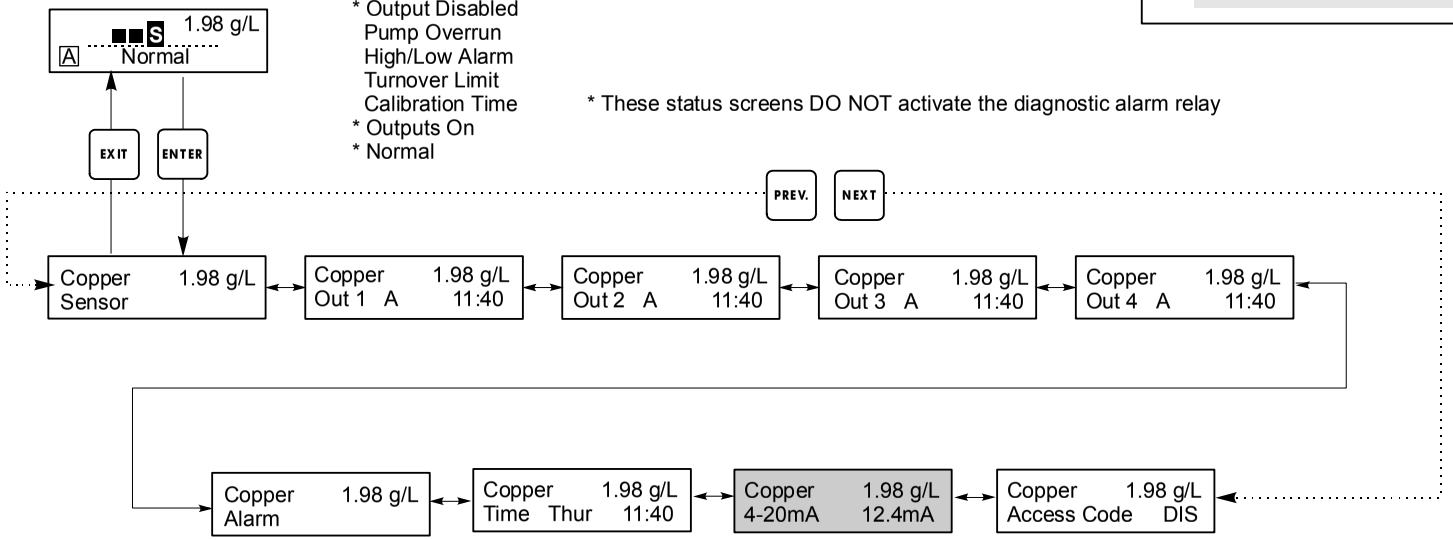
Press **ENTER** to change the controller from Electroless copper mode to Microetch mode by toggling between the two choices using the Up and Down arrow keys. The controller will warn you to check your set points, since these do not change when the Cu Mode is changed.

Possible Status Screens

* Control Delay 30
  Sensor Error
  Light Bulb Out
  No Sample
  Plate Out
* Manual Input
  Interlock
* Output Disabled
  Pump Overrun
  High/Low Alarm
  Turnover Limit
  Calibration Time
* Outputs On
* Normal

* These status screens DO NOT activate the diagnostic alarm relay

Main Menu



Legend

4-20mA menu is only present if 4-20mA option is installed.

Operation

Press Enter key to enter menu or submenu.
Press Exit key to exit menu.
After 10 minutes of inactivity the controller will automatically return to the summary screen.

Self Test

This feature is a diagnostic tool which can help isolate a problem between the sensor and controller. Before initiating the self test, the sensor **MUST** be disconnected from the controller in order to function properly. When **ENTER** is pressed the controller disables the sensor inputs and injects 2 test signals, simulating a properly functioning sensor. The controller will display "PASS" or "FAIL" along with a live mV reading. If "PASS" is displayed then it indicates the controller is functioning properly and the problem is likely to be with the sensor. See the troubleshooting section for further details. If "FAIL" is indicated, the controller is defective. Consult your factory representative for service options.

New Sensor Setup

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
Place the immersible sensor in clean tap or DI water, or circulate 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.**

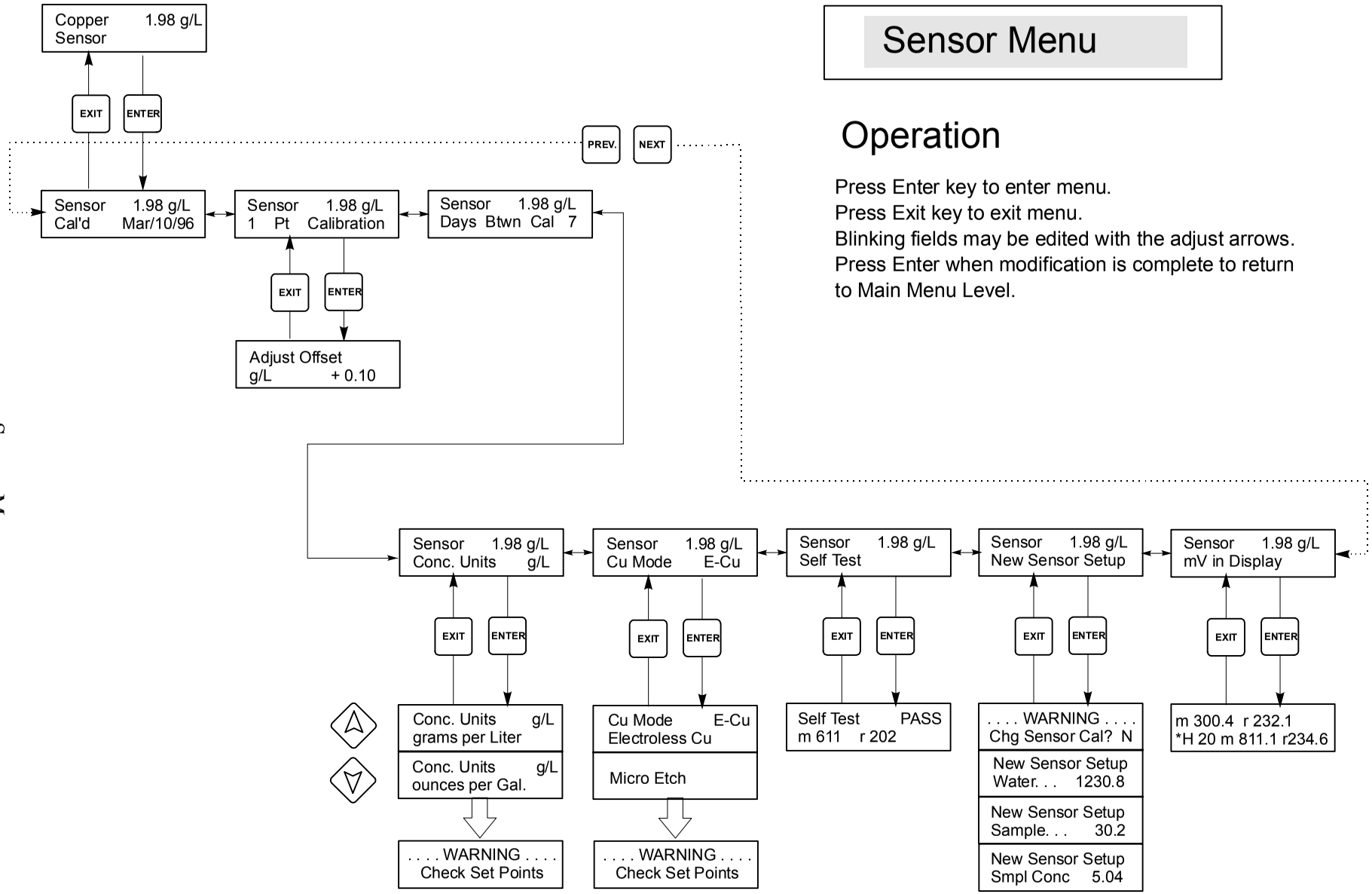
mV in Display

This display is only for diagnostic purposes. The top line shows 2 live voltage readings from the sensor in millivolts. The bottom line shows the stored values for each sensor signal from the most recent new sensor set up calibration - specifically the signal values measured with water.

Sensor Menu

Operation

Press Enter key to enter menu.
Press Exit key to exit menu.
Blinking fields may be edited with the adjust arrows.
Press Enter when modification is complete to return to Main Menu Level.



5.3 Output 1 Menu

The Out 1 menu is used to set the control set point, and to configure the timer/totalizer to keep track of replenishment in the desired way. This menu provides the following settings: Total 1, Set Point, Dead Band, Time Limit, Interlock, and H O A.

The top level menu status line may display the following messages: Off, Intrlck, Timeout, or a time. "Off" indicates that the output is off. "Intrlck" indicates that the output would be on but is not because of a signal from a flow switch or level switch is stopping control. "Overrun" indicates that the output has been on for longer than the maximum time programmed by the user. The time shows how long the output has been on.

Total 1

Press **ENTER** to program the timer/totalizer functions.

Reset Total Y/N
Use the arrow keys to toggle between Y(Yes) and N(No) to reset the totalizer.

Total As
Press **ENTER**, then use the Up and Down arrows to choose whether to totalize in units of time, volume or copper metal turnovers.

Turnover Lim.
Only appears if you choose to totalize by metal turnovers. Use the arrow keys to enter the maximum number of turnovers. The controller will prompt you when this number has been exceeded.

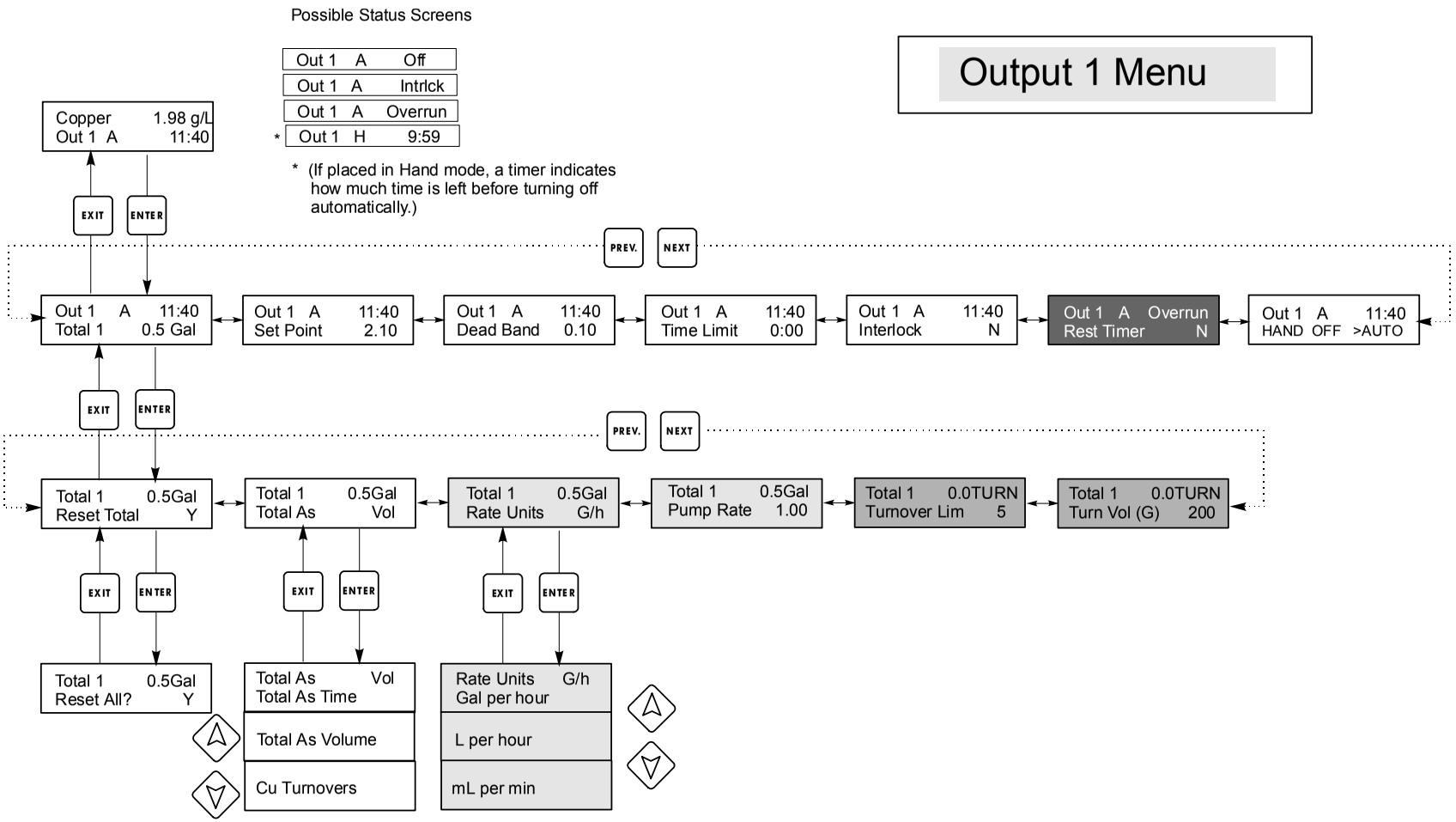
Turn Vol(G or L)
Only appears if you choose to totalize by metal turnovers. Enter the number of gallons (G) or liters (L) that equals one metal turnover. The unit of measure displayed correlates with that of the rate units selected in the next menu.

Rate Units
Only appears if you choose to totalize by volume or metal turnovers. Press **ENTER,** then use the arrow keys to toggle between Gallons per Hour, mL per minute or Liters per hour. These units of measure will be used to enter the rate at which the replenishment pump adds chemicals.

Pump Rate
Only appears if you choose to totalize by volume or metal turnovers. Use the arrow keys to set the flow rate of the replenishment pump.

Set Point
Use the arrow keys to adjust the display to read the desired set point value of the bath. Press **ENTER** to accept the change.

Output 1 Menu



Legend

Menu appears when a pump overrun condition occurs

Menu appears when Total As Volume or As Cu Turnovers is selected

Menu appears when Total As Copper Turnovers is selected

Operation

Press Enter key to enter menu.
Press Exit key to exit menu.
Blinking fields may be edited with the adjust arrows.
Press Enter when modification is complete to return to Main Menu Level.

Dead Band

Use the arrow keys to set the desired dead band, then press **ENTER.** If the set point is 2.50 g/L, and the dead band is 0.05 g/L, then the relay will close at 2.50 g/L and open 0.05 g/L away from 2.50 g/L (2.55 g/L if set for EC, 2.45 g/L if set for microetch).

Time Limit

Use the arrow keys to set the time limit for the output to be active, then press **ENTER.** Since all outputs are turned on at the same time for control purposes, the time limit set applies to outputs 2, 3 and 4 also. If it is set for "0:00", no limit will be imposed and the output could stay on forever.

Interlock

Use the Up and Down arrows to toggle between Y(Yes) and N(No). Choosing Y means that the output will deactivate depending on the state of the device attached to the controller. If the device is open, the interlock condition exists and control is stopped. For example, if the sensor is installed in a recirculating pipe line, a flow switch that is closed if flow is sufficient and open if flow is insufficient may be installed in the line, so that if flow past the sensor stops, the controller will not pump in chemicals based on a stagnant sample.

An interlock condition disables all outputs.

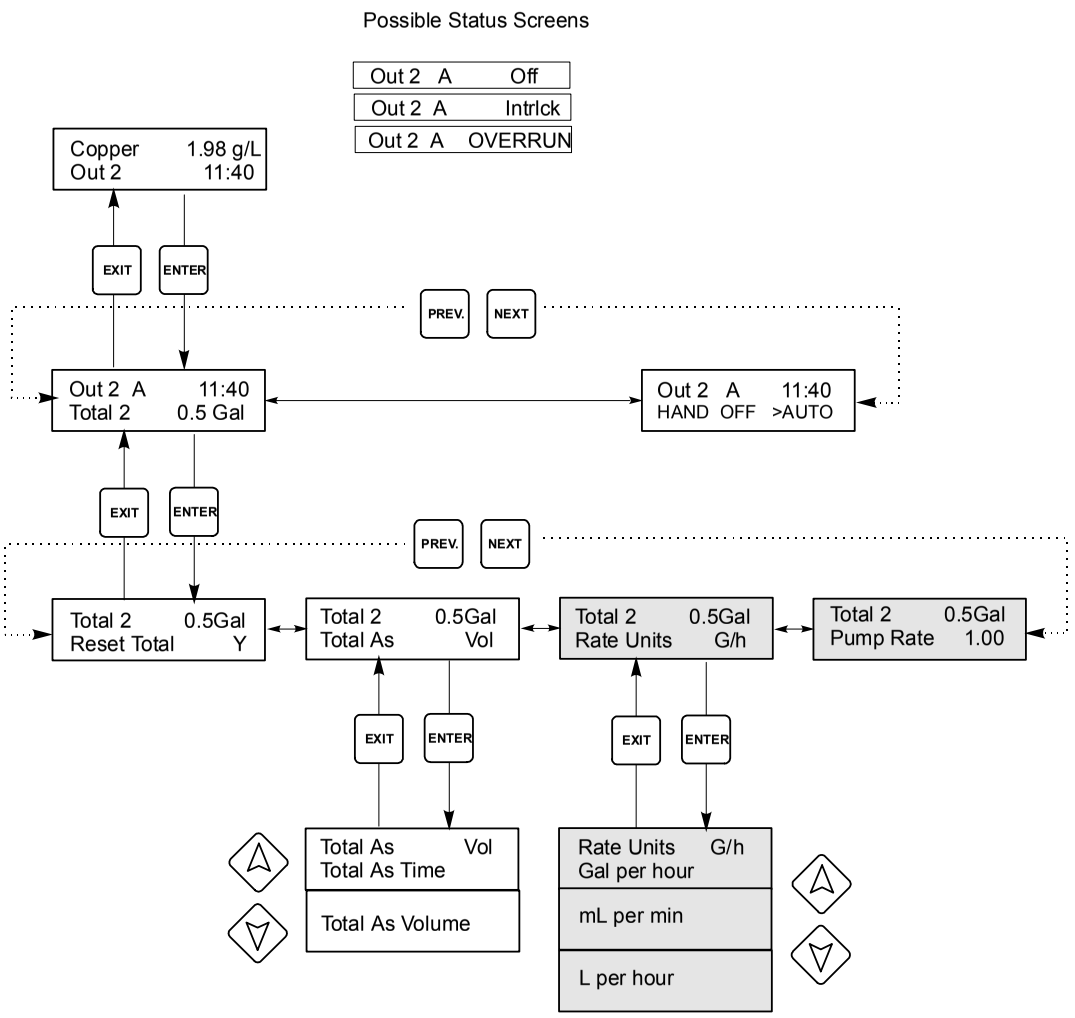
Reset Timer

This menu appears when the programmed time limit has elapsed, creating a pump overrun condition. Use this menu to reset the timer. This applies to all outputs.

H O A

Use the Left and Right arrows to move between Hand, Off and Auto (H O A). In Hand (Manual) mode, the output will be turned on immediately for a maximum of 10 minutes. In the Off mode, the output will be turned off indefinitely. In the Auto mode, the output turns on and off in response to changes in the process value relative to the set point. The letter inside the block on the status screen indicates which mode the output is in.

Output 2, 3 & 4 Menus



Legend

Menu appears when Total As Volume is selected

Operation

Press Enter key to enter menu.
Press Exit key to exit menu.
Blinking fields may be edited with the adjust arrows.
Press Enter when modification is complete to return to Main Menu Level.

5.4 Output 2, 3, and 4 Menus

The Out 2, 3 and 4 menus are separate from each other but operate in exactly the same way. Each menu provides the Total and H O A settings. These additional outputs are activated simultaneously with output 1 and are provided to be able to add other bath components in proportion to the copper, and display independent replenishment totals.

The top level menu status line may display the following messages: Off, Intrlck, Timeout, or a time. "Off" indicates that the output is off. "Intrlck" indicates that the output would be on but is not because of a signal from a flow switch or level switch is stopping control. "Overrun" indicates that the output has been on for longer than the maximum time programmed by the user. The time shows that the output is on, and has been for that amount of time.

Total 2,3 or 4

This menu works the same as Total 1 described for Out 1 in Section 5.3.

H O A

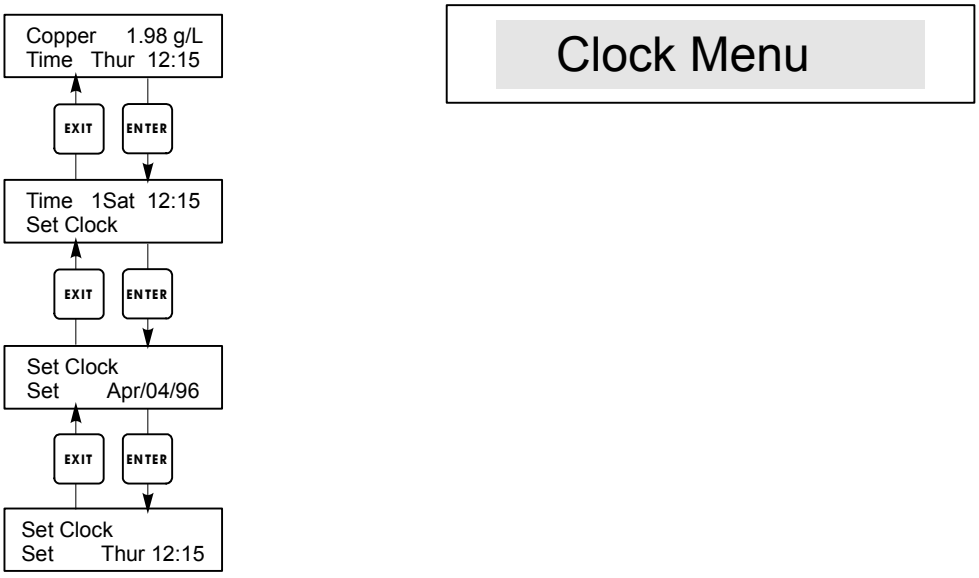
Use the Left and Right arrows to move between Hand, Off and Auto (H O A). In Hand (Manual) mode, the output will be turned on immediately for a maximum of 10 minutes. In the Off mode, the output will be turned off indefinitely. In the Auto mode, the output turns on and off in response to changes in the process value relative to the set point. The letter inside the block on the status screen indicates which mode the output is in.

5.5 Clock Menu

The clock menu is used to set the date and time that the controller uses to schedule calibration prompts. There is only one menu selection: Set Clock.

Set Clock

Press **ENTER** to set the clock. Use the arrow keys to change the year, date, and month, then press **ENTER**. Use the arrow keys again to set the day of the week and the time. Use military time (for example, 1:00 PM is 13:00). Press **ENTER** to return to the top level clock menu.



Clock Menu

5.6 Alarm Menu

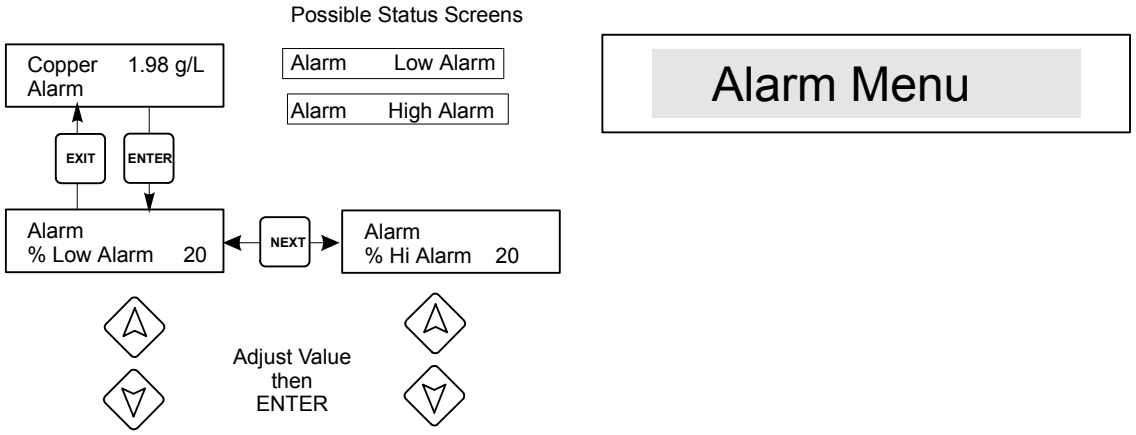
This menu is used to set the high and low copper concentration alarm points. Press ENTER to adjust the alarm set points.

% Low Alarm

Use the arrow keys to change the % below the set point copper concentration that will trigger a low alarm. Percentage range is 0-50%. Alarm can be disabled if zero is entered.

% High Alarm

As above for the high alarm set point.



Alarm Menu

5.7 4-20 mA Menu (Optional)

This menu will only appear if the optional 4-20 mA output board is installed. It is used to scale the 4-20 mA output to a corresponding copper range. It contains the following menu selections: 4 mA Point, 20 mA Point, and Calibrate.

4 mA Pt

Use the arrow keys to enter the copper concentration that you want to correspond to a 4 mA output from the controller.

20 mA Pt

Use the arrow keys to enter the copper concentration that you want to correspond to a 20 mA output from the controller.

Calibrate

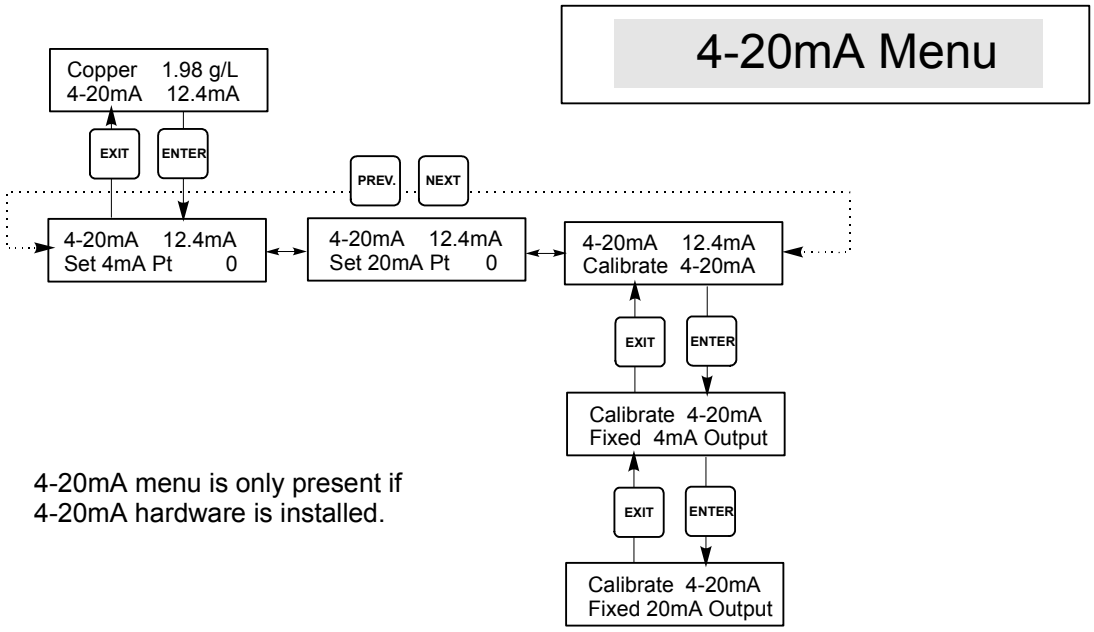
This menu, in conjunction with an ammeter, is used to calibrate the mA output. Press **ENTER** to start the calibration.

Fixed 4 mA Out

The controller will output 4.00 mA. Adjust the chart recorder or data logger per its instruction so that the process value displayed is what is expected for a 4.00 mA input.

Fixed 20 mA Out

As above, except that the controller will output 20.00 mA.
The design of the 4-20 mA output is such that it should never need calibration. If the mA signal is not what it should be, call the factory for service.



4-20 mA Menu

5.8 Access Code Menu

This menu determines whether the access code feature of the controller is enabled or disabled and allows you to customize the access code. The access code controls whether or not you are allowed to change the parameters in the controller. With the access code disabled, any user may change any parameter. With the access code enabled, any user can view any parameter, but cannot change them.

Once an attempt is made to change a parameter, the display will prompt the user to enter the access code. If the correct code is entered, the parameter can be changed. (If the cursor is blinking, a change will be allowed; if the number or words are not blinking, they can't be changed). Once the correct access code has been entered, it will remain valid until there is a period of 5 minutes without a key being pressed.

Possible status screens are: Access Code REQ, Access Code OK, and Access Code DIS.

The first indicates that the access code is required to alter settings. The second indicates that the access code is required and has been entered correctly, and the last indicates that the access code has been disabled.

Enable Y/N

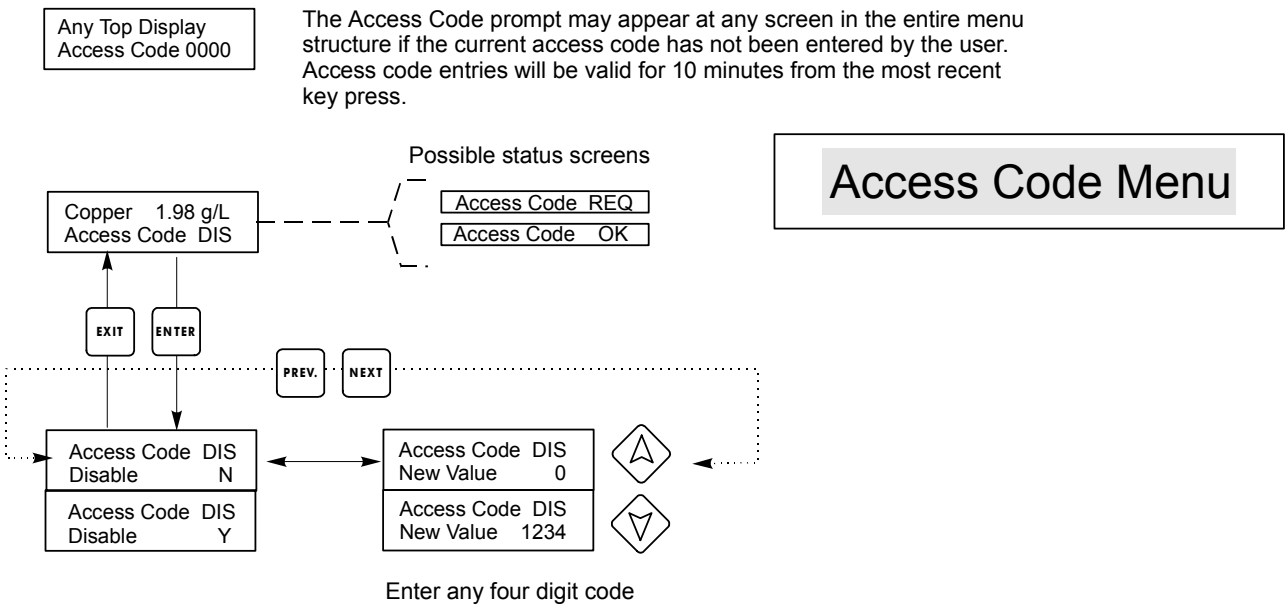
Use the arrow keys to select Y(Yes) or N(No) and press ENTER to enable or disable the access code. If the code was enabled, you must enter the access code in order to disable it.

New Value

Press **ENTER** to display the current access code value and use the arrow keys to change it to any value between 0 and 9999. If the access code has been enabled, you will be prompted to enter the current access code before being allowed to change it.

The factory default access code is 1995.

If you change the access code and can't remember it, follow this procedure:
1. Turn off the power to the controller.
2. Wait 10 seconds.
3. Press and hold the Up and Down arrow keys while turning on the power.
4. Read the access code on the display.
5. Release the arrow keys and the code will disappear.



Access Code Menu

6.0 Maintenance

The WCU control module itself needs very little maintenance. Clean the outside of the controller enclosure with a damp cloth. Do not spray down the controller unless the enclosure door is closed and latched. "Pigtails" should be protected from spray or washdown. Check the cords and cables for damage.

6.1 Sensor Maintenance

The most important maintenance item for the sensor is to keep the optical paths clean of plate-out or other coatings. In electroless copper applications, the sensor should be etched when the tank is etched, or whenever plate-out is evident. If plate-out does occur in the sample line or sensor, etch the system as you would the tank.

Avoid any mechanical cleaning of the optical surfaces to avoid scratching them. 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 should not be attempted. Call your factory representative in order to arrange for factory service.

NOTE: TO PREVENT CALIBRATION SHIFTS DUE TO CONDENSATION FORMING ON THE FIBER OPTIC LIGHT GUIDES INSIDE THE CAP OF THE SENSOR, DO NOT REMOVE THE SENSOR CAP FOR ANY REASON!

6.2 Replacing the Fuses

CAUTION: Disconnect power to the controller before opening front panel!

Locate the fuses on the circuit board at the back of the controller enclosure. Gently remove the old fuse from its retaining clip and discard. Press the new fuse into the clip, secure the front panel of the controller and return power to the unit.

Warning: Use of non-approved fuses can affect product safety approvals. Fuse ratings depend on controller power rating. Specifications are shown below. To insure product safety certifications are maintained, it is recommended that a Walchem fuse is used.

Controller Rating	F1	Walchem PN	F2	Walchem PN
120 VAC	5 x 20 mm, 0.125A,250V	102369	5 x 20mm,10A,125V	102432
240 VAC	5 x 20 mm, 0.063A,250V	103363	5 x 20mm, 5A, 250V	102370

7.0 Troubleshooting

CAUTION: Disconnect power to the controller before opening front panel!

Troubleshooting and repair of a malfunctioning controller should only be attempted by qualified personnel using caution to ensure safety and limit unnecessary further damage. Contact the factory.

7.1 Error Messages

HIGH ALARM

The summary screen will display an H at the right side of the bar graph if the copper concentration rises above the high alarm set point.

Possible Cause	**Corrective Action**
1. Overshooting set point	Reduce replenishment pump rate. Increase solution flow through sensor. Immerse sensor in area of better solution movement. Place replenishment line closer to sensor.
2. Pump siphoning	Check all valves. Re-route tubing.
3. Output 1 in HAND mode	Go to H O A menu and put in AUTO mode.

LOW ALARM

The summary screen will display an L at the left side of the bar graph if the copper concentration drops below the low alarm set point.

Possible Cause	**Corrective Action**
1. Pump not working	Inspect and repair pump if necessary.
2. No replenishment	Refill chemical supply. Check pump valves.
3. Output 1 in OFF mode	Go to H O A menu and put in AUTO mode.

NO SAMPLE

No sample will be displayed if the measurement signals indicate excess air in the sample. Perform a self test to verify that the control module passes, which indicates that the problem is with the sensor (see section 5.2). If the control module fails the self test, return it for repair.

Possible Cause	Corrective Action
1. Liquid level too low for immersible sensor.	Increase liquid level
2. Sample pump failure.	Repair sample pump
3. Leak in or blockage of sample line.	Repair sample line
4. Partial plate out of sensor.	Etch sensor.
5. Excess air in line.	Check vertical mounting of sensor

LIGHT BULB OUT

This message indicates that the measurement signals have disappeared. Perform a self test to verify that the control module passes, which indicates that the problem is with the sensor (see section 5.2). If the control module fails the self test, return it for repair.

Possible Cause	Corrective Action
1. Light bulb failure	Return sensor for repair
2. Severe plate out	Etch sensor
3. Sensor disconnected	Reconnect sensor

PLATE OUT

This message is displayed when signals levels have been reduced considerably due to plate out. Perform a self test to verify that the control module passes, which indicates that the problem is with the sensor (see section 5.2). If the control module fails the self test, return it for repair.

Possible Cause	Corrective Action
1. Plate-out of sensor	Etch sensor

SENSOR ERROR

Caused by the measurement signals being outside the normal range, such as a negative concentration reading. perform a self test to verify that the control module passes, which indicates that the problem is with the sensor (see section 5.2). If the control module fails the self test, return it for repair.

Possible Cause	Corrective Action
1. Condensation inside sensor	Allow to dry out thoroughly
2. Faulty new sensor set-up	Repeat new sensor set-up with clean water
3. Sensor disconnected	Reconnect sensor

CALIBRATION TIME

The controller will display this prompt based upon the setting of the "Days between cal" menu in the Sensor menu group and the time of the last calibration. It may be cleared by performing a 1 point calibration of the sensor. If this feature is not desired, setting "Days between cal" to 0 will disable it.

TURNOVER LIMIT

This prompt is displayed if the output 1 totalizer has calculated a replenishment volume that exceeds the number of turnovers set in the "turnover limit" menu.

PUMP OVERRUN

This display appears if the pump output has been on longer than the time limit set in the "Time Limit" menu. It could be caused by a pump failure, lack of replenishment chemical, the time limit being set too low, or a failure of the pump to respond.

INTERLOCK

This error message is displayed if the signal from a flow or level switch is open, and the "Interlock Y/N" menu is set for "Y". Restore flow or level. The switch may be tested by measuring ohms when the switch should be closed (it should be very low, not infinite). The input may be tested by shorting the two terminals (interlock message should disappear).

CHECK SET POINTS

This is a normal display if you have changed the units of measure of the copper concentration. This serves as a reminder that the controller does not convert the numerical value of the set points; for example, if the set point was 7.5 g/L, it will become 7.5 oz/gal, not 1 oz/gal.

PASS

This message is displayed after initiating the SELF TEST feature. This indicates the controller is functioning properly and the problem is likely to be with the sensor. However, the wiring between the controller front panel circuit board and the external sensor connector should be checked for breakage or wear. See diagram in figure 3.

FAIL

This message is displayed after initiating the SELF TEST feature. The controller is probably defective. Make sure to disconnect the sensor prior to attempting the self test. Consult your factory representative for service options.

8.0 Service Policy

The WCU Series Copper Controller has a 2-year warranty on electronic components and a 1-year warranty on mechanical parts (keypad, terminal strip and relays).

We stock circuit boards for immediate exchange after we have isolated the cause of the problem.

Factory authorized repairs that are received by next-day-air will be returned within 24 hours. Normal priority for returns is two weeks.

Out of warranty repairs or circuit board exchanges are done on a flat fee basis after the warranty is expired.