OPERATION AND
SERVICE GUIDE
O-1250E
AUGUST 1994

# SERIES 1000
# INTEGRATING AMPERE-TIME CONTROLLER

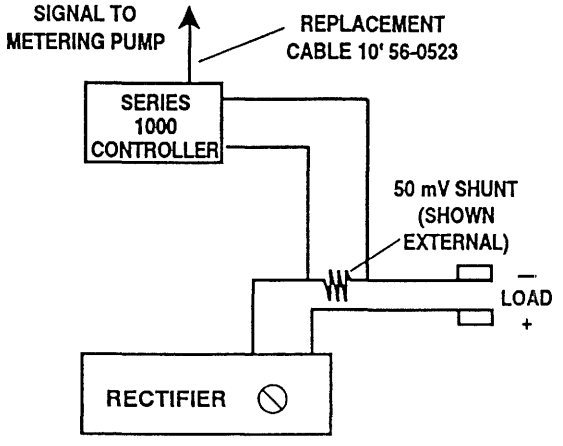
**AMP-HOUR 56-0024**
**AMP-MINUTE 56-0027**

## DESCRIPTION

The Ampere-Time Pump controller unit is designed to facilitate the addition of liquid chemicals to electroplating processes in proportion to associated DC plating current. Specifically the controller obtains a 0 to 50 millivolt direct current input from a DC current shunt and continuously produces impulses to proportionally operate a companion chemical addition pump. In addition, the controller includes an eight digit liquid crystal display showing the accumulated amperes of plating current over a period of time, ampere-hours or ampere-minutes, provided with a display reset push-button. Low power level solid-state components are used throughout to provide reliable operation with minimum maintenance. A rugged polyester waterproof enclosure protects the unit for use in corrosive and hostile environments.

The Ampere-Time Controller is specifically designed for use with **SERFILCO** metering pumps with a 4-prong external pulse control connection and receives its operating power from Pump No. 1 (Refer to label on controller). The controller in turn is designed to pulse one or two pumps. Note: when used as a monitor (without metering pump) an auxiliary DC power supply is required. Refer to Product Bulletin A-104, or catalog.

An internal programming switch in the Ampere-Time Controller allows connecting the unit to a standard 50 millivolt DC current shunt to obtain calibrated digital display readout for various size rectifiers. The unit provides a 0 to 100 pulses/minute signal to the associated chemical pump proportional to DC current through the connected 50 millivolt current shunt.




## DISPLAY

Eight digit, Liquid Crystal, 0.5 inch high. Overflow condition after 99999999 AMPERE-HOURS indicated by display decimal. AMPERE-MINUTE model displays to first decimal; 123.4 for example.

## OUTPUT TO PUMP

Provides 0 to 100 pulses per minute to operate associated chemical addition pump proportional to current through 50 millivolt shunt. Two pumps may be connected for additional chemical pumping capacity or for pumping two solutions. The second pump is isolated to eliminate potential problems due to erroneous AC line connections or grounding deficiencies.

## RESET

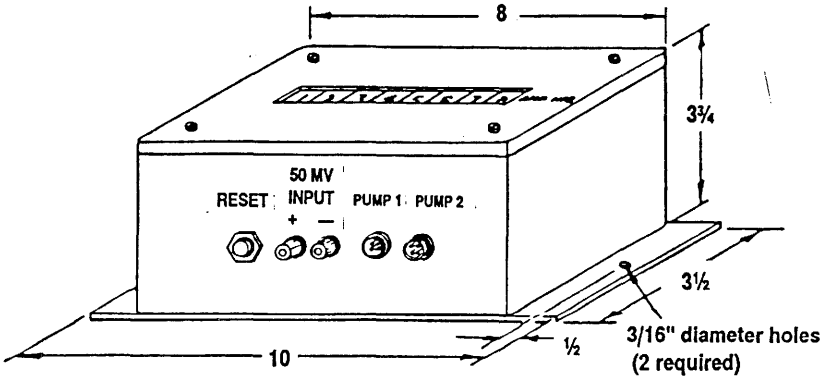
Rubber boot covered push-button allows manually resetting accumulated display to zero reading. Zero reading results in blank display (no zero displayed).

## CABLE

Each controller is supplied with one (1) connecting cable, ten (10) feet long with connectors for mating controller and above referenced pump. Additional cable extensions (Part No. 56-0523) or longer cables are available.

## CONTROLLER INSTALLATION

Internal program switch is factory calibrated to rectifier's maximum shunt amperage for which the controller was specified. This value is included on the nameplate label. Should the controller be installed on a rectifier of different maximum amp value or different millivolt value, recalibration of controller is required. Refer to controller recalibration.




## SPECIFICATIONS

INPUT:

0 to 50 millivolts DC from shunt (NOT supplied). Special leads or limited length not required for input signal. Low pass filter prevents interference from 60 Hz or other AC signals or reverse polarity to prevent damage or errors.

## CONTROLLER CALIBRATION (Refer to page 4 also)

To cabibrate or recalibrate, loosen the front panel slotted screws and carefully extend the assembly to expose the printed circuit board. The eight digit programming switch will be visible and must be set for associated rectifier size. Note reference to Amp-Hour and Amp-Minute controller. See table A. If rectifier size is not on Table A, set switches for next larger size and refer to Page 4, example 4 to determine multiplier for digital display.

TABLE A

| RECTIFIER SIZE AMPS | | SWITCH SEGMENT NUMBER | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AMP-HR | AMP-MIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 25 | - | 0 | 0 | 0 | 0 | X | 0 | 0 | X |
| 50 | - | 0 | 0 | 0 | X | 0 | 0 | 0 | X |
| 100 | 5 | 0 | 0 | X | 0 | 0 | 0 | 0 | X |
| 200 | 10 | 0 | X | 0 | 0 | 0 | 0 | 0 | X |
| 250 | - | 0 | 0 | 0 | 0 | X | 0 | X | 0 |
| 500 | 25 | 0 | 0 | 0 | X | 0 | 0 | X | 0 |
| 1000 | 50 | 0 | 0 | X | 0 | 0 | 0 | X | 0 |
| 2000 | 100 | 0 | X | 0 | 0 | 0 | 0 | X | 0 |
| 2500 | - | 0 | 0 | 0 | 0 | X | X | 0 | 0 |
| 5000 | 250 | 0 | 0 | 0 | X | 0 | X | 0 | 0 |
| 10,000 | 500 | 0 | 0 | X | 0 | 0 | X | 0 | 0 |
| 20,000 | 1000 | 0 | X | 0 | 0 | 0 | X | 0 | 0 |
| TEST* | TEST* | X | 0 | 0 | 0 | 0 | X | 0 | 0 |

0 - designates OFF or OPEN circuit
X - designates ON or CLOSED circuit

NOTE: Only two circuits are to be in the closed position.

*Factory Maintenance

Carefully replace front cover and tighten the cover screws to provide moderate sealing pressure. Excessive tightening will deform the cover gasket causing potential sealing problems.

## INSTALLATION Refer to wiring diagram Page 3

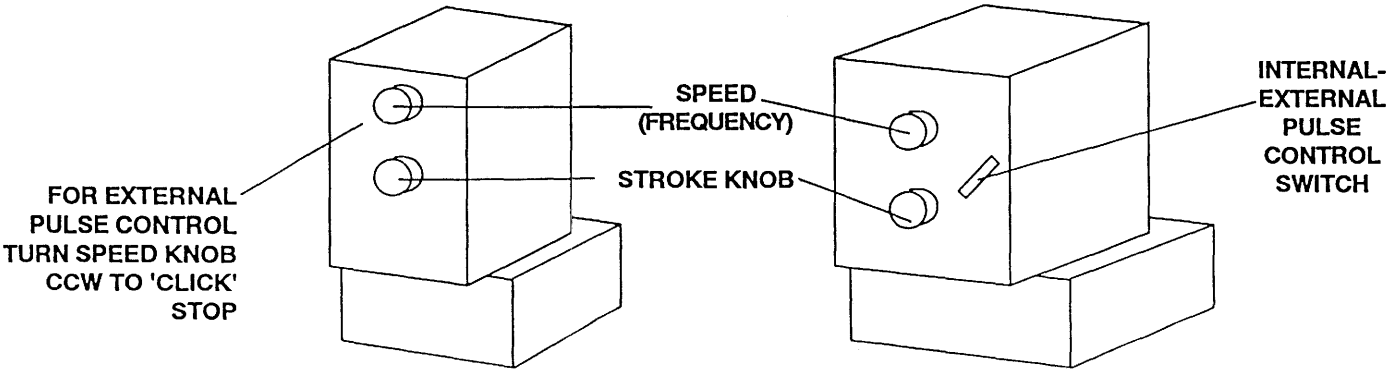
Mount the unit to a wall or other vertical support in a location for conveniently reading the display with the connectors facing down. Connect the associated current shunt (not provided) using twisted 18G color coded wire to the proper polarity input connectors on the controller. Red='+' Positive; Black='-' Negative. Attach the extension cable to 'Pump No. 1" connection on controller and other end to the metering pump. When two pumps are used, a second cable is connected between Pump No. 2 and "Pump No. 2" connection on the controller. Metering pump has INTERNAL/EXTERNAL control switch which should be placed at the INTERNAL position when calibrating the pump. Be sure pump is switched to EXTERNAL pulse control after it is calibrated.

## METERING PUMP

INSTALLATION - Refer to operating instructions. Install pump inlet and outlet hose. Place suction hose in brightener solution, place discharge into collection container. Connect power supply.

## PUMP CALIBRATION AND VERIFICATION

1. Set pump pulse control to INTERNAL and speed knob (frequency) to maximum. Series 'A' pumps will be on INTERNAL when frequency knob is at maximum clockwise. Series 'B' & 'D' pumps have a notch which should be set at INTERNAL.
2. This adjustment duplicates rectifier demand when rectifieris operating on full amperage (when pump is on EXTERNAL control).
3. Turn STROKE knob to percent of scale that will deliver the volume of brightener required for maximum ampere output of rectifier for a one hour duration.
4. EXAMPLE: 2000 amp rectifier (2000 amp hours) and 2000 cc of brightener required for 2000 amp-hrs.
   a. Metering pump maximum flow rate 3.8 LPH (3780 mlh)
   b. Set STROKE knob to 53% of scale (2000 ml)
   c. Allow pump to operate for 6 minutes.
   d. Compare test volume of brightener to the 200 ml required (For a 6 minute test)
   e. If exactly correct, 2000 ml. of brightener will be pumped in one hour.
   f. If 200 ml. was not pumped in 6 minutes then adjust stroke knob & retest until calibrated.
5. Pump is now calibrated and will not require any adjustment unless ratio of brightener requirements to amperetime is to be changed. Set pump control to EXTERNAL. Series 'A' , turn frequency knob full counterclockwise to 'click' stop. Series 'B' & 'D' position switch to EXTERNAL.




SERIES 'A' PUMP

SERIES 'B' & 'D' PUMP

## OPERATION

1. Pump control to be on EXTERNAL. Do not make any subsequent adjustments to stroke knob or speed knob.
2. Place pump discharge hose into plating tank.
3. Adjustment of rectifier output amperage will now be continuously monitored by the controller to automatically readjust the metering pump to add the correct amount of brightener in exact proportion to the plating tank work load, i.e. ampere-time.
4. At zero DC current through the shunt, the pump delivery will be zero and at full shunt current, the pump delivery will be 100% with linear pump delivery between the two limits. Turning the pump power OFF also turns OFF the controller with loss of the display count.
5. If calibration difficulties or equipment operation problems occur, contact the factory.

When power is connected and metering pump is at 'External Pulse Control' the LCD will display eight digits of zero.When current passes through the current shunt, the pump controller display will read in Ampere-Time and the pump will be pulsed up to 100 pulses per minute maximum. Proportional to the associated 0 to 50 millivolt current level.

An overflow condition on the display is indicated by a decimal point between the seventh and eighth digit as soon as a 99999999 count is exceeded on the Ampere-Hour model. Depressing the reset button at any time will reset the reading to zero (a blank display).

If calibration difficulties or equipment operation problems occur, contact the factory.

## BATTERY BACK-UP

Maintains digital display during interruption or failure of power supply. When power resumes the display will continue from the point of interruption. Rechargeable batteries are included in controller case and will automatically charge when instrument is connected to the pump.

## AUXILIARY POWER SUPPLY

Low voltage transformer reduces 115 VAC to 15 VDC for instrument operation. Auxiliary power supply is required when the Integrating controller is used only as an Ampere-Time indicator and will not be controlling a metering pump (from which it receives its operating power). Under these circumstance brightener additions are made manually at predesignated Ampere-Time values displayed.

## MAINTENANCE

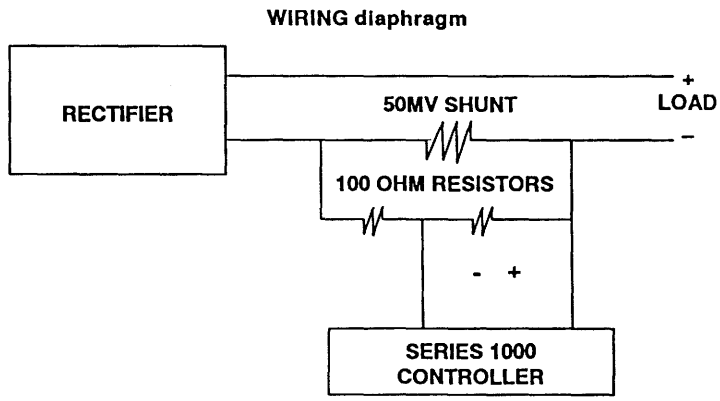
The Ampere-time controller requires very little maintenance other than keeping the unit clean to allow proper reading of the display. Do not use hydrocarbon solvent based cleaners, but rather water base cleanser to prevent attacking the enclosure surface. Operating the unit with the front cover removed must be avoided.

## MINIMUM PUMP FLOW RATE

To maintain accuracy of pumping dosage, the pump stroke length should not be set below the minimum recommended in pump operating instruction.

If lower rates are required then a voltage dividing device or a larger value shunt is necessary.
EXAMPLE: To obtain one half of the minimum flow rate for a 1000A rectifier with a 50MV shunt.

A. Install a 2000A, 50MV shunt or
B. Install two .5 Watt 100 Ohm resisters in series as follows.




## METERING PUMP AND PERIODIC REVERSE PLATING

Requires shunt external of rectifier per schematic above. If shunt is internal, consult factory. Chemical addition feed rate can be varied from 10 to 100% of maximum by adjusting stroke length of pump. Refer to pump operating instructions.

## AMPERE-HOUR CONTROLLER RECALIBRATION

The controller can be recalibrated for several application conditions, taking into account shunt size and ampere output of the rectifier. Application and recalibration examples are given below.

A = Rectifier output: amps
B = Controller Switch setting; amps
C = Rectifier shunt rating: MV
D = Standard shunt : 50MV
E = Percentage to increase pump liquid via stroke adjustment
F = 100 pump pulses/min
G = Factor to multiply digital display for correct amp-time
H = Rectifier shunt rating: amps

### NO. 1

**CONDITION**

Controller installed on rectifier having different maximum ampere rating of shunt than specified, shunt is 50MV, andrectifier rating is on Table 'A'.

**RECALIBRATION EXAMPLE:**

Set controller internal program switches to proper setting for maximum amp rating of shunt.

### NO. 2

**CONDITION**

When amp size of shunt is larger than the maximum ampere output of the rectifier, but the MV signal is standard 50MV then the pump output needs to be adjusted.

**RECALIBRATION EXAMPLE:**

Rectifier is 10,000 maximum ampere output with a 15,000 amp shunt @ 50MV and controller switch internal setting matches the rectifier.

Pump stroke adjustment

E = (H/A -1) x 100

E = (15,000/10,000) - 1 x 100 =50% increase

### NO. 3

**CONDITION**

When rectifier amp rating, with 50MV shunt, is not shown on Table A. The display on the controller needs a multiplier.

**RECALIBRATION EXAMPLE:**

15,000 amp rectifier. Set controller switch setting for next higher ampere value.

Digital display multiplier

G = A/B

G = 15,000/20,000 = .75 multiplier

### NO. 4

**CONDITION:**

When rectifier shunt value is other than 50MV, but all other factors match, then the digital display and pump stroke require adjustment.

**RECALIBRATION EXAMPLE:** 20,000 amp rectifier, 20,000 amp controller switch setting, 20,000 amp, 35MV shunt

$$\text{Pump stroke ADJ.E} = \left(\left[\frac{F}{C/D \times (100)}\right] - 1\right) \times 100$$

$$E = \left(\left[\frac{100}{35/50 \times 100}\right] - 1\right) \times 100 = 43\% \text{ increase}$$

Digital display multiplier G=D/C = 50/35 = 1.43

### NO.5

**CONDITION**

Controller does not have an internal switch setting to match the rectifier output and the shunt is other than 50MV, then the digital display and pump require adjustment.

**RECALIBRATION EXAMPLE:** 15,000 rectifier output,15,000 amp 35MV shunt. Controller internal switches set for 20,000 amp

Stroke adjustment E = (D/C - 1) x 100

E = (50/35)x100 + 43% increase

Digital display multiplier G = AD/BC = G= (15000x50)/ (2000x35) = 1.07 multiplier



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