



# Trouble-shooting Manual

## SOLID STATE

### MOTOR OPERATED POTENTIOMETER

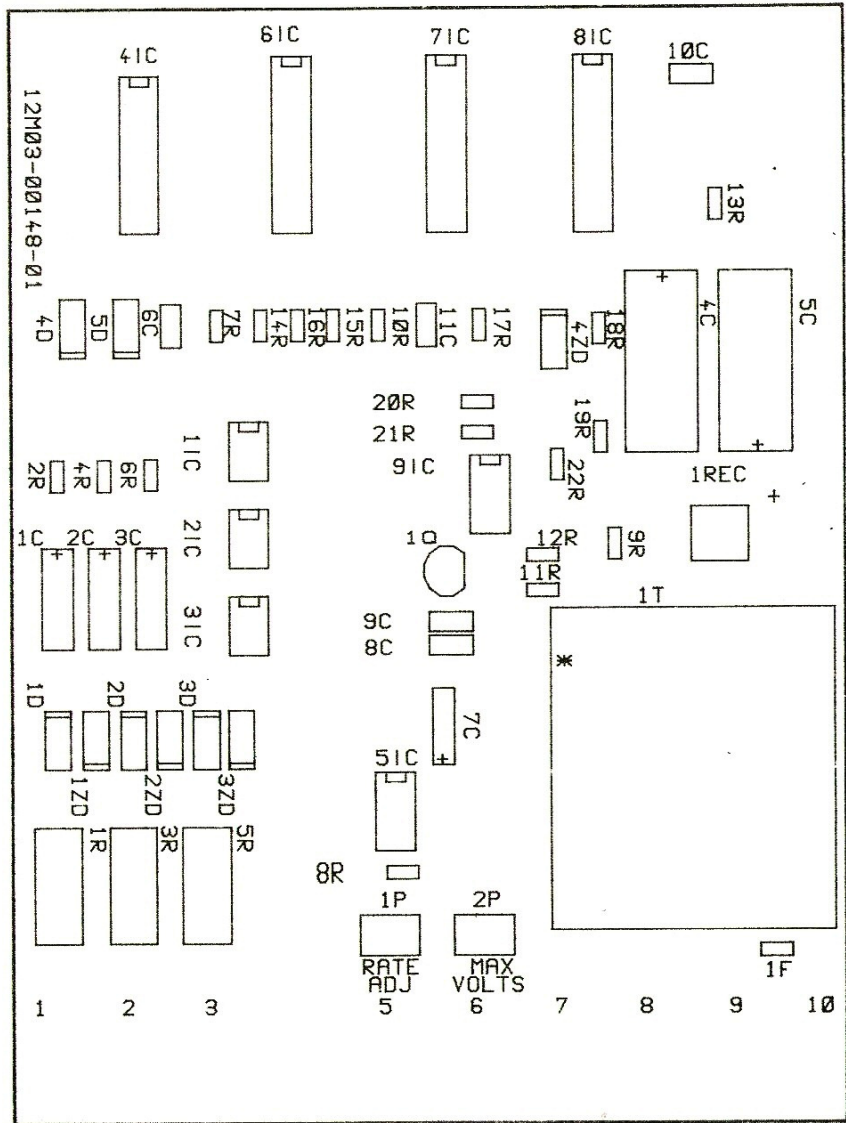
PART NUMBER 12M03-00148-01

#### BENCH TEST

##### Test Material

- 1 - 120 VAC Source
- 1 - Multimeter - Simpson 260 or equal
- 1 - Jumper

1. Set "MAX VOLTAGE" Full CW, "RATE" Full CW.
2. Connect meter to terminal 6 (positive) and terminal 8 (negative).
3. Connect 120 VAC to terminals 9 and 10.
4. The Meter should indicate zero volts on power up.
5. Connect one end of jumper to terminal 10 and the other end to terminal 1. Output should ramp to full scale (approximately +10V) in approximately 20 seconds.
6. Turn "MAX VOLTAGE" CCW. Output should adjust to 0 volts. Return "MAX VOLTAGE" CW.
7. Move jumper from terminal 1 to terminal 2. Output should ramp down to zero in approximately 20 seconds.
8. Turn "RATE" Full CCW. Connect jumper to terminal 1. Output should ramp from 0 volts to full scale in approximately 2 seconds. Connect jumper to terminal 2. Output should ramp to 0 volts in approximately 2 seconds.
9. Move jumper to terminal 1. When output is at maximum move jumper to terminal 3. Output should immediately reset to 0 volts.
10. Repeat 1 through 9 above except with meter between terminal 5 (negative) and 8 (positive).



#### VOLTAGE CHECKS

1. The primary voltage of 1T; leads 1 to 2 and 3 to 4 (terminals 9 and 10) should be 120V AC.
2. The secondary voltage of 1T; leads 5 to 6 and 7 to 8 should be 10V AC - 20V AC between terminals 5 and 8.
3. Measure +15V DC from terminal 8 to the positive end of capacitor 5C.
4. Measure - 15V DC from terminal 8 to the negative end of 4C.

# SOLID STATE MOTOR-OPERATED POTENTIOMETER

PART NUMBER 12M03-00148

## TECHNICAL DESCRIPTION

The REFLEX® SOLID STATE MOP is a digital-based equivalent of a mechanical motor-operated potentiometer. It provides an adjustable DC output voltage, increasing or decreasing at an adjustable rate in response to external signal devices such as pushbuttons, relay contacts, a programmable controller, or similar devices from several locations.

In operation, optically-isolated 120V AC signals actuate a Solid State Oscillator which provides pulses to an Up/Down Counter. The digital output of the counter is converted to an analog output voltage adjustable from zero to ten volts DC. The frequency of the Oscillator is adjustable for different rates of change on the output.

The counter is an 8-bit device providing a resolution of one part in 256. Accuracy is 1% of maximum output.

Non-adjustable limits for zero and maximum are built in electronically. Option relay boards are available if electrical contacts for "Limit Switches" are required.

Field-proven circuit design insures a high-level of accuracy, noise immunity and reliability. The mounting arrangement provides a reliable connection, but allows easy removal without disturbing permanent wiring.

**GEMINI ELECTRONIC CONTROL COMPONENTS** can be combined in cost-effective way for a variety of popular systems:

- Universal Eddy Current Drive
- M-G Set Replacement
- Firing Circuits and Regulators to replace electronic boards in obsolete single and three phase DC motor drives
- DC Shunt Motor Field Crossover Control
- Wound Rotor Motor Secondary Control
- Power Supplies for Plating, Heating and Annealing
- Winders
- Custom Multi-Motor Drive Systems
- Special and Hard-to-Find Controls

***WE SELL SOLUTIONS TO PROBLEMS!***

***Call or Write for Information on these and other custom controls***



GEMINI CONTROLS LLC  
W61 N14280 TAUNTON AVE.  
PO BOX 380  
CEDARBURG, WI 53012  
[www.geminicontrols.com](http://www.geminicontrols.com)

PHONE: (262)-377-8585  
FAX: (262)-377-4920  
email: [sales@geminicontrols.com](mailto:sales@geminicontrols.com)



# SOLID STATE MOTOR OPERATED POTENTIOMETER

PART NUMBER 12M03-00148-01

## I. SPECIFICATIONS

### SUPPLY:

- 120 Volts AC  $\pm 10\%$
- 50/60 Hz, Single Phase

### AMBIENT TEMPERATURE:

- 0° to 40°C (32° to 104°F)
- 50°C in Cabinet

### INPUTS:

- 120V AC from pushbuttons, relay contacts, programmable controllers\* or similar devices for functions of "UP," "DOWN," and "RESET."

\*NOTE: Triac outputs from a PC must have less than 0.1mA leakage unless a burden resistor is added.

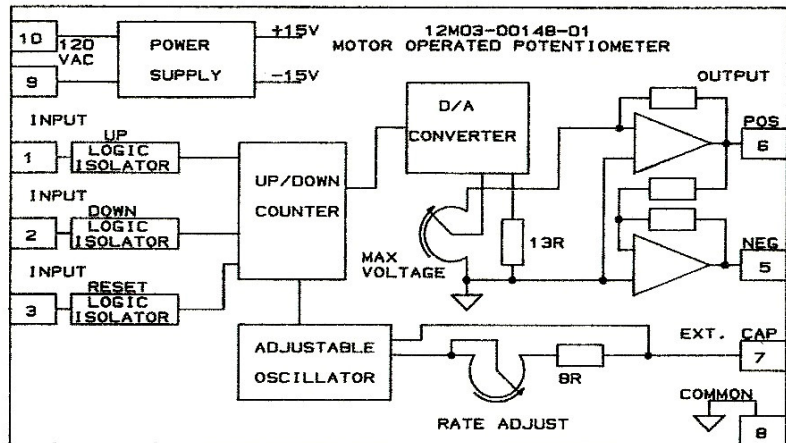
- Built-in, non-adjustable electronic limit switches for "ZERO" and "MAX."
- Automatic reset to zero on power up.

### OUTPUT:

Adjustable, zero to 10VDC @ 5mA, both positive and negative.

### ACCURACY:

1% of maximum output.



### RESOLUTION:

One part in 256.

### TIMING ADJUSTMENT RANGE:

Nominally 2 to 20 seconds.  
Range extendable with external capacitance approximately 20 seconds per 0.22MF.

### DIMENSIONS:

3 1/4"H x 5 1/4"W x 6"D in optional mounting bracket.

## II. THEORY OF OPERATION

The Reflex Part No. 12M03-00148 Solid-State MOP is a digital-based equivalent of a mechanical motor-operated potentiometer. It allows adjustment of an analog output voltage up or down in response to external signal devices such as pushbuttons, relay contacts, a programmable controller, or similar devices at an adjustable rate. It consists of the following elements as shown in the simplified schematic diagram (Figure 1).

1. Power Supply
2. Input
3. Voltage Controlled Oscillator
4. Up/Down Counter
5. Digital to Analog Converter

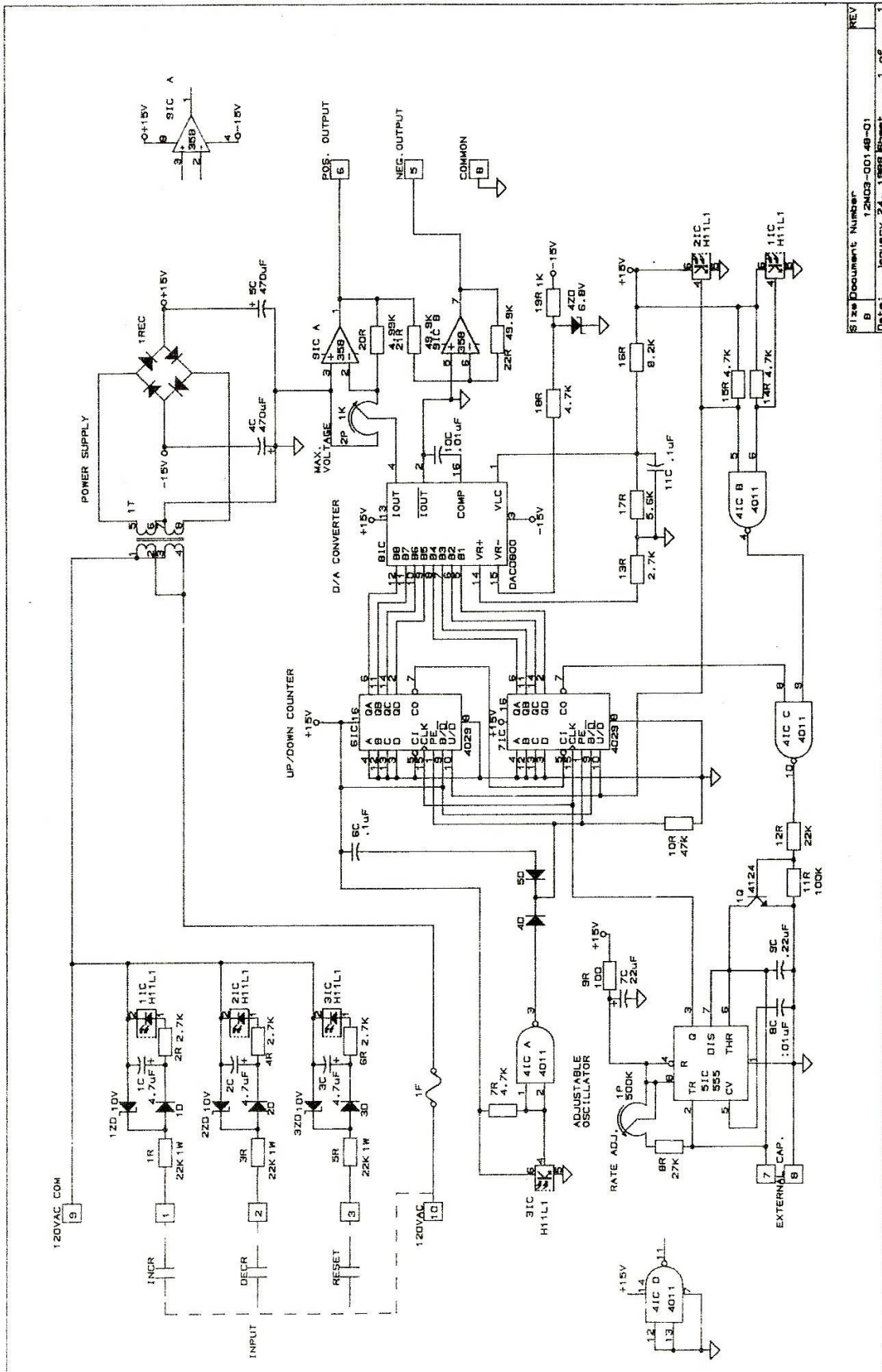
1. **Power Supply.** The Power Supply used a centertapped transformer with 10 volts on each side of the center together with a bridge rectifier and two 470MF capacitors to provide a nominal positive and negative unregulated 15 volts DC with respect to the transformer centertap, which is connected to circuit common.
2. **Input.** The three inputs each consist of a rectifier, a filter capacitor, and a voltage divider to provide a current to the input diode of an opto-isolator. The input converts the 120V AC into a digital logic for UP, DOWN, and RESET of the counter.

3. **R-C Voltage Controlled Oscillator.** A Voltage Controlled Oscillator consisting of 5IC and associated components provides an output frequency inversely proportional to the amount of resistance set by the "RATE" adjustment pot and 8R in conjunction with the amount of capacitance between terminals 7 and 8 — a nominal frequency from 12 to 240Hz to furnish timing pulses to the Up/Down counter.
4. **Up/Down Counter.** An 8-bit Binary Up/Down Counter consisting of 6 and 7 IC will count "UP," "DOWN," or remain at a fixed count depending on the "UP" or "DOWN" inputs at terminals 4 and 5. If the "UP" terminal is activated, the counter will accumulate pulses until full unless the input is interrupted. If the "RESET" terminal (6) is activated, both ICs are reset to zero count regardless of inputs of terminals 4 and 5. To prevent recycling of the counter past 100%, 7IC is used to disable the voltage controlled oscillator.
5. **Digital To Analog Converter.** An 8-bit Digital to Analog Converter takes the digital outputs from the counter ICs and provides an output current which has a ratio to the input reference current of zero to 100% depending on the "fullness" of the Up/Down Counter. 9IC is used with the D/A Converter to produce both a positive and a negative output at terminals 1 and 2 respectively, whose magnitude is determined by the counter and the setting of the "MAX VOLTAGE" potentiometer.

**COMPONENT LIST — ASSEMBLY #12M03-00148-01**

Symbol	Part #	Description (Acceptable Substitute) *	Symbol	Part #	Description (Acceptable Substitute) *
1-3C	03P01-05001-01	CA. 4.7MF, 16V, ELECTROLYTIC	2,4,6,13R	01P01-27200-02	RESISTOR, 2.7K, 1/4W, 5%
4.5C	03P01-47102-01	CAP, 470MF, 25V, ELECTROLYTIC	7,14,15,18R	01P01-47200-02	RESISTOR, 4.7K, 1/4W, 5%
6,11C	03P07-10410-00	CAP, 0.1MF, 100V, FILM	8R	01P01-27300-02	RESISTOR, 27K, 1/4W, 5%
7C	03P01-25001-01	CAP, 25MF, 16V, ELECTROLYTIC	9R	01P01-10100-02	RESISTOR, 100 OHM, 1/4W, 5%
8,10C	03P07-10310-00	CAP, 0.01MF, 100V, FILM	10R	01P01-47300-02	RESISTOR, 47K, 1/4W, 5%
9C	03P07-22410-00	CAP, 0.22MF, 50V, FILM	11R	01P01-10400-02	RESISTOR, 100K, 1/4W, 5%
1-5D	05P02-00001	DIODE, SIGNAL (1N4148)	12R	01P01-22300-02	RESISTOR, 22K, 1/4W, 5%
1F	08P01-00040	FUSE, 1/4 AMP, 125 VAC (BUSSMAN A 1/4)	16R	01P01-82200-02	RESISTOR, 8.2K, 1/4W, 5%
1-3IC	05P10-00004	OPTO ISOLATOR (GE, H11L1)	17R	01P01-56200-02	RESISTOR, 5.6K, 1/4W, 5%
4IC	05P09-00011	NAND GATE (4011)	19R	01P01-10200-02	RESISTOR, 1K, 1/4W, 5%
5IC	05P08-00003	TIMER (LM555)	20R	01P02-49911-01	RESISTOR, 4.99K, 1/2W, 1%
6,7IC	05P09-00009	COUNTER (4029)	21,22R	01P02-49921-01	RESISTOR, 49.9K, 1/2W, 1%
8IC	05P09-00013	DAC, 8 BIT (0800)	1REC	05P01-00003	RECTIFIER BRIDGE, 200V, 1A (PACE B20S-TCL)
9IC	05P08-00012	DUAL OP-AMP (LM358)	1T	04P01-00015	TRANSFORMER, 115/240V-28VCT (STANCOR DSW528)
1P	02P04-50401-00	POTENTIOMETER, 500K, 1/2W (BECKMAN 72XR500K)	1-3ZD	05P03-00006	ZENER DIODE, 10V, 500MW
2P	02P04-10201-00	POTENTIOMETER, 1K, 1/2W (BECKMAN 72XR1K)	4ZD	05P03-00005	ZENER DIODE, 6.8V, 500MW
1Q	05P04-00002	TRANSISTOR (MPS4124)			
1,3,5R	01P01-22302-02	RESISTOR, 22K, 1W, 5%			

\* OR EQUAL



Size Document Number  
 12403-00148-01  
 B  
 Date: JANUARY 24, 1988 B:smc 1 of 2