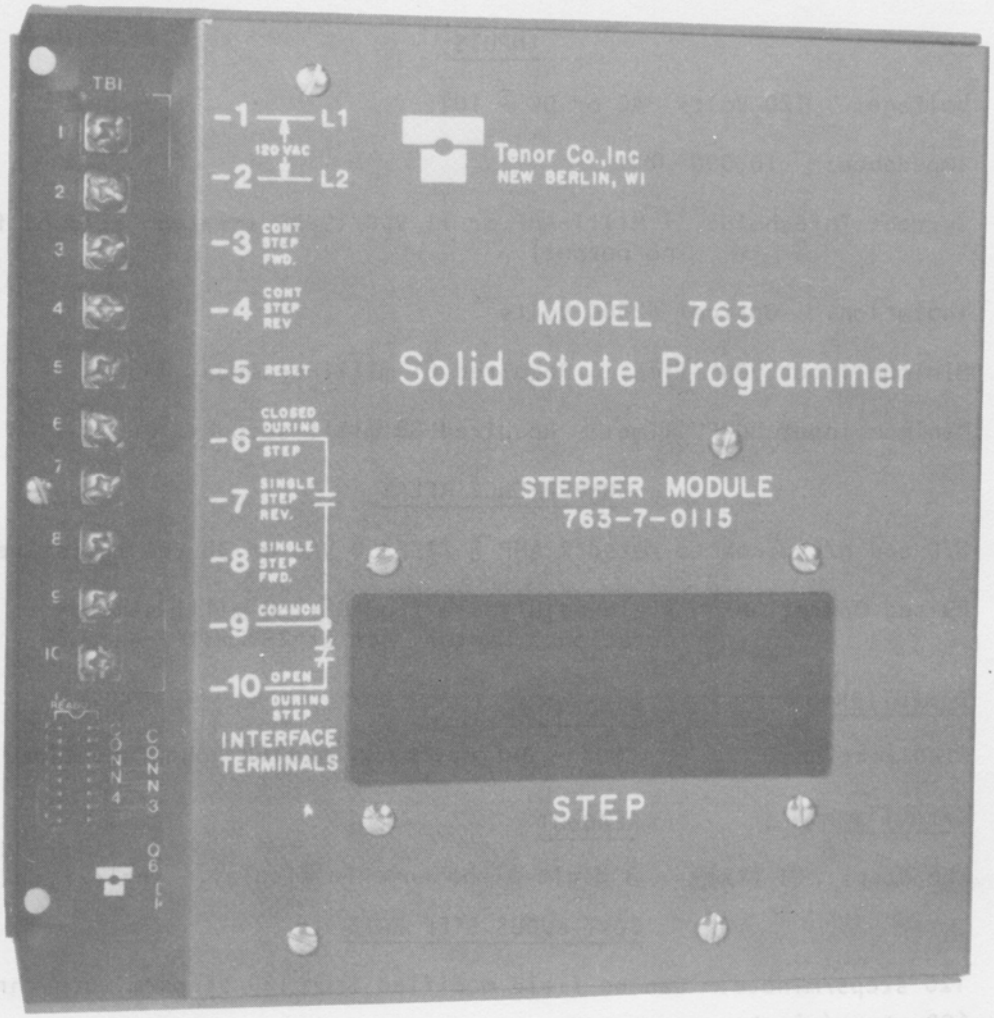
SECTION 4
SOLID STATE STEPPER MODULE
763-7-0115-01



4.0 SOLID STATE STEPPER ELECTRICAL SPECIFICATIONS MODEL 763-7-0115-01

GENERAL

Main Power: 120 VAC $\pm$ 10% 60 H_z

Operating Temperature Range: 0^o - 60^o

Maximum Combination of Input/Output Modules: 5 (4 with remote readout).

Fusing: Must be fused externally with 3/4 AMP slow blow fuse.

INPUTS

Voltage: 120 Volts AC or DC $\pm$ 10%

Impedance: 10,000 OHM

Current Threshold: 1 Milli-AMP or 11 VDC/19VAC (Maximum allowed for no output)

Isolation: Optical @2500 Volts

Minimum Input "ON" Time: Required 61 milli-seconds

Minimum Input "OFF" Time: Required 58 milli-seconds.

CONVENIENCE RELAY

N/O and N/C contacts rated 2 AMP @ 125/250 VAC or 30 VDC resistive.

Pulsed Operation: Field-adjustable from 25-250 milli-seconds duration. Factory set at 250 milli-seconds.

DIRECTION

Bi-Directional

MEMORY

CMOS - Battery back up (168 hour retention)

CAPACITY

128 Steps (H-127)

READOUT

3 digit alpha numeric display. (H-127)

CONTINUOUS STEP RATE

120 steps/minute. Can be field modified from 120 steps/minute thru 600 steps/minute.

4.1 SOLID STATE STEPPER MODULE I/O FUNCTIONS

TERMINAL NUMBER	DESCRIPTION
1 - L1	Power required for the system is 120 Volts AC ± 10%, 60 H_z
2 - L2	120 Volts neutral
3	Continuous Step Forward (See Note 1)
4	Continuous Step Reverse (See Note 1 & 2)
	Applying 120 VAC (L1) to terminals 3 or 4 will cause the module to step continuously at a rate of 120 step/minute. Higher stepping speeds are optionally available.
5	Reset
	Applying 120 VAC (L1) to terminal 5 will cause the unit to reset to the Home - (H) position with output circuits held off.
6	Convenience Contact - Normally Open N.O.
9	Convenience Contact - Common COM
10	Convenience Contact - Normally Closed N.C.
	The convenience contacts operate during the step action. The length of operation is potentiometer adjustable between 25 - 250 milli-seconds. The convenience contacts are frequently used for pulsing external counters or resetting external timers. Contacts are rate 1 ampere - 120 VAC.
7	Single Step Input - Reverse
8	Single Step Input - Forward
	Applying 120 VAC (L1) to terminal 7 or 8 will cause the module to take one step only. The voltage to the terminal 7 or 8 must be removed and reapplied to take another step.

NOTE 1: CONTINUOUS STEP overrides SINGLE STEP, even if the SINGLE STEP input remains energized.

NOTE 2: CONTINUOUS STEP REVERSE overrides CONTINUOUS STEP FORWARD in the event that both inputs are energized at the same time

All terminals will accept 2 #12 AWG wires.

4.2 PSC 763 SOLID STATE STEPPER OPERATING INSTRUCTIONS

GENERAL INFORMATION

The PSC 763 is functionally an electronic equivalent to the Tenor Stepping Drum Programmer Models 200, 250, 2410 and 2420, therefore it is referred to as a Solid State Programmer. The basic concept of the Solid State Programmer is that, on any given step, predetermined functions of output Modules are initiated, then either a verification or timing signal is sent back to the PSC 763 causing it to advance to the next step. It can be determined from the above statements that the PSC 763 acts as the Central Processing Unit (CPU) for the Tenor PSC System. Therefore, the only connections required in the field are the appropriate terminals wires determined by the application and the Ribbon Bus Cable which carries the Program Instructions to the output Modules and synchronizes all the associated Digital Readouts.

SELECTING PROGRAM STEP LENGTH

The maximum number of steps is selected by using the 8 switch DIP package shown in Figure 1.22. The switches are coded in Binary Sequence as follows:

SW 1 = 1
SW 2 = 2
SW 3 = 4
SW 4 = 8
SW 5 = 16
SW 6 = 32
SW 7 = 64

To select the program length, turn off the appropriate switches equaling the number of the last program step.

EXAMPLE: Program Length = 41 steps
= SW 1 off + SW 4 off + SW 6 off
= 1 + 8 + 32
= 41

In the run mode when the last program step is finished, the Solid State Programmer will return to Home and recycle the program.

CONVENIENCE RELAY

The convenience relay operation time is controlled by the potentiometer shown in Figure 1.22. The relay operation time is factory set at 250 milli-seconds. This time is field adjustable by turning the potentiometer in the clockwise direction to increase time and counterclockwise to decrease it.

OPTIONAL STEP RATE

The eighth switch on the DIP is used for selecting the programmer step rate. With the switch in the "off" position the standard 120 step/minute rate is selected. If the switch is put in the "on" position the optional step rate is selected which requires the addition of a standard 1/4 watt carbon resistor. The resistor should be inserted as shown in

OPTIONAL STEP RATE - CONTINUED

Figure 1.23. Resistor leads should be left short so as not to come in contact with the stepper enclosure. There is approximately 3/8" clearance between the bottom of the PC board and the enclosure. Solder the resistor in place and verify that there is no short to the module enclosure.

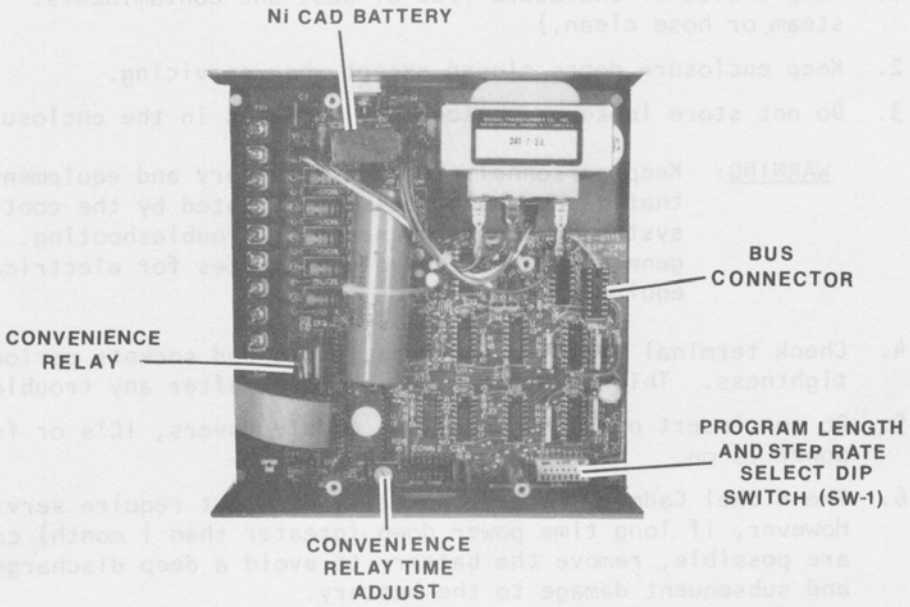


Figure 1.22

APPROXIMATE STEPS/MINUTE	PARALLEL RESISTOR* OHMS
200	56K
300	27K
450	15K
600	10K

*Resistor 1/4W 5%

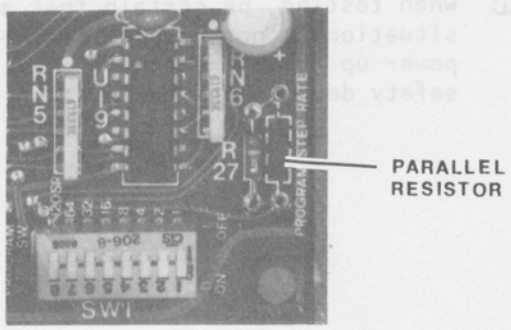


Figure 1.23

4.3 MAINTENANCE

Solid state control devices require a minimum of maintenance. A good preventive maintenance program should include the following:

1. Keep inside of enclosure free of dust and contaminents. (Do NOT steam or hose clean.)
2. Keep enclosure doors closed except when servicing.
3. Do not store loose or unnecessary articles in the enclosure.

   WARNING: Keep personnel clear of machinery and equipment that can be hazardous if activated by the control system during maintenance or troubleshooting. Use generally accepted safe practices for electrical equipment maintenance.

4. Check terminal block connections, plugs and sockets periodically for tightness. This is especially important after any troubleshooting.
5. Do not insert or remove modules, module covers, IC's or fuses while power is on.
6. The Nickel Cadmium battery normally does not require servicing. However, if long time power down (greater than 1 month) conditions are possible, remove the battery to avoid a deep discharge condition, and subsequent damage to the battery.
7. The step retention capability of the unit should be verified every six (6) months. Follow this procedure:

   a) Unplug all BUS CONN ribbon cables to the Stepper Module.

   b) Apply power to the stepper module and step it to a step other than Home. Note this number.

      Signals should not be present at any of the STEP inputs that would cause the unit to step.

   c) Remove power for five (5) minutes.

   d) Reapply power and verify that the unit powered up in the same step.

   e) With power off, reconnect all cables.

   WARNING: When testing, be certain that a dangerous situation is not created if the unit should power up in an unintended step. Backup safety devices are essential.

BATTERY REPLACEMENT

1. With power OFF, remove the four #4-40 x 1/4" module cover screws. Be careful not to loosen the screws securing the Step Digit Readout.

2. Carefully lift the module cover approximately 1" noting that the Step readout is connected to the main P.C. Board by a flat ribbon cable/DIP connector combination. Unplug the ribbon cable at this time.

3. Unsnap the battery from its connector.

4. Install new battery.

   WARNING: DO NOT substitute a non-rechargeable battery -- Serious damage could occur.

5. Position cover over module, guiding readout connector into DIP socket, labeled "LOCAL" with pin 1 in the proper position.

6. Replace screws in cover.

   WARNING: The programmer will now power up in the Home step since the battery was removed. Take appropriate precautions to insure that this does not cause hazardous conditions in the controlled equipment.

7. The battery must charge for 24 hours before being fully charged.

4.4 RECOMMENDED SPARE PARTS

Description	Tenor Part Number
Readout PCB Assembly	724-6-0118
Readout Cable Assembly	700-3-5062
Battery - 7.2 Volt Ni-Cad (Everyready P/N CH22)	670-3-8075

NOTE: Review WARRANTY before attempting field repairs.

SPARE PARTS ORDERING INFORMATION

Each module contains two identification plates:

1. Catalog Name/Number Plate
2. Serial Number Plate

Name/number plates generally are located on module covers. Serial number plates generally are located on side (outside) of bases.

To aid in furnishing the proper spare parts, please show both numbers.

EXAMPLE: Parts for a Stepper Module 763-7-0115

Serial Number -- 763-1234-S-0580
1 Each Battery -- Part Number 670-3-8075

All Prices: F.O.B. New Berlin, Wisconsin

Terms: As Arranged

Minimum Billing: $50.00

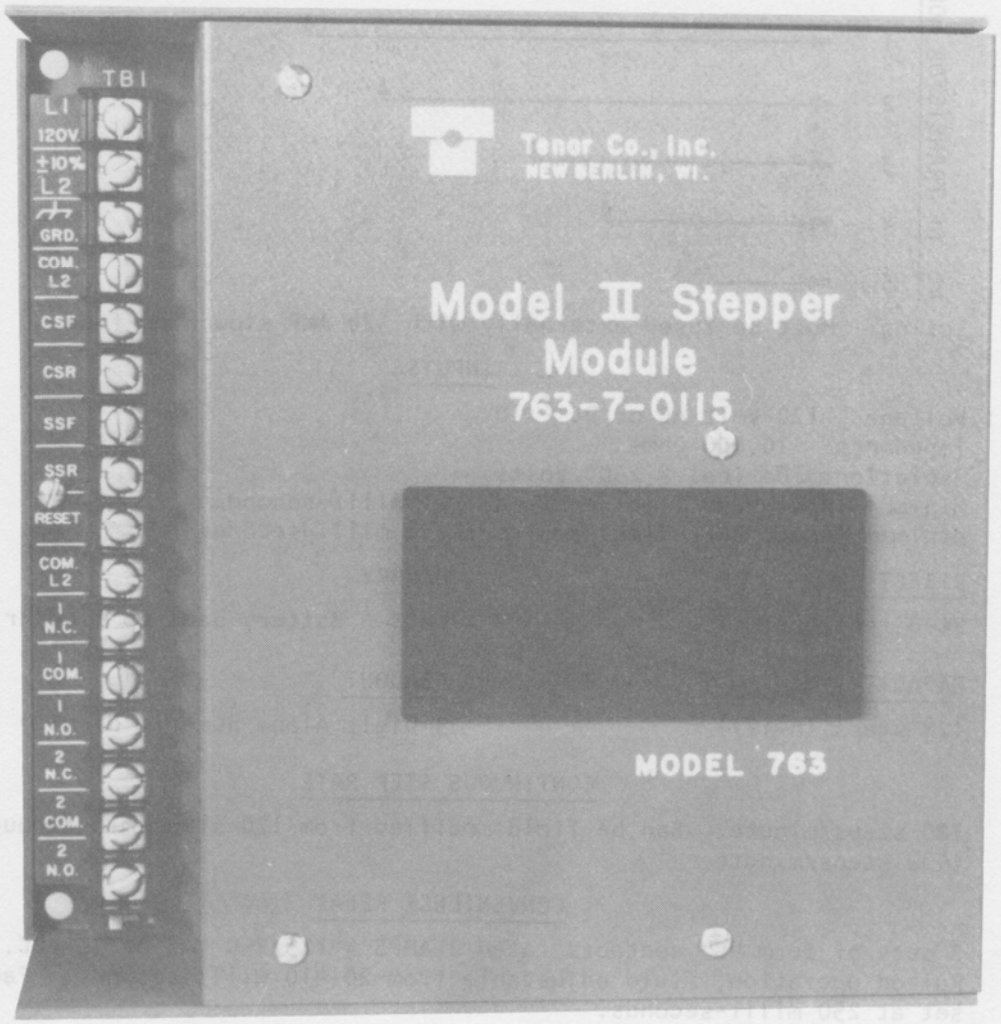
Factory: Tenor Company, Inc.
17020 W. Rogers Drive
New Berlin, Wisconsin 53151

(414) 782-3800

Prices and all terms and conditions of sale are subject to change without notice. Prices are net and do not include any applicable State, Federal, or Excise Taxes which are payable by purchaser.

All orders are subject to acceptance by Tenor Company at its home office.

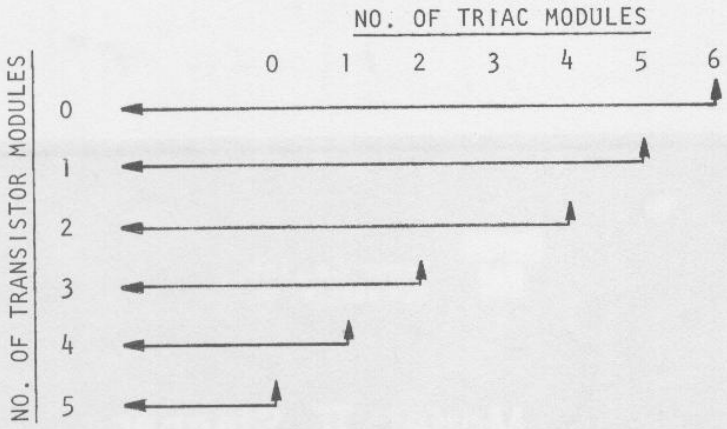
SECTION 5
SOLID STATE STEPPER MODULE
763-7-0115-02



5.0 SOLID STATE STEPPER ELECTRICAL SPECIFICATIONS MODEL 763-7-0115-02

GENERAL

Main Power: 120 VAC ± 10% @ 50/60 Hz
Operating Temperature Range: 0^{o} - 60^{o} C
Maximum Combination of Input/Output Modules: 6 @ 60 Hz. See following table for 50 Hz combinations.



Fusing: Must be fused externally with 3/4 AMP slow blow fuse.

INPUTS

Voltage: 120 Volt AC or DC ± 10%
Impedance: 10,000 Ohms
Isolation: Optical @ 2500 Volts
Minimum Input "ON" Time Required: 61 milli-seconds
Minimum Input "OFF" Time Required: 58 milli-seconds

DIRECTION

Bi-Directional

MEMORY

CMOS - Battery back up (168 hr. retention)

CAPACITY

128 steps (h-127)

READOUT

3 Digit Alpha numeric display (H-127)

CONTINUOUS STEP RATE

120 steps/minute. Can be field modified from 120 steps/min through 1400 steps/minute.

CONVENIENCE RELAY

2 sets of form "C" contacts rated 2 AMPS @ 125/250 VAC or 30 VDC. Pulsed operation, field adjustable from 20-410 milli-seconds. Factory set at 250 milli-seconds.

5.1 SOLID STATE STEPPER MODEL II MODULE I/O FUNCTIONS

Terminal Number	Description
1 - L1	Power required for the system is 120 Volts AC $\pm$ 10%, 50/60 H_z.
2 - L2	120 Volt System neutral
3 - GRd	Earth ground for 120 Volt AC power.
4 - Com L2	Customer connected to 120 Volt AC power source neutral.
5 - CSF	Continuous step forward (See Note 1)
6 - CSR	Continuous step reverse (See Note 1 & 2)
	Applying 120 VAC (L1) to terminals 5 or 6 will cause the module to step continuously at a rate of 120 steps per minute.
Higher stepping speeds are optionally available.	
7 - SSF	Single step forward
8 - SSR	Single step reverse
	Applying 120 VAC (L1) to terminal 7 or 8 will cause the module to take one step only. The voltage at terminal 7 or 8 must be removed and reapplied to take another step.
9 - Reset	Applying 120 VAC (L1) to terminal 9 will cause the module to reset to the Home (H) position with output circuits held off.
10 - COM L2	Customer connected to 120 Volt AC power source neutral.
11 - 1 N.C.	Convenience Contact 1 - Normally closed.
12 - 1 COM	Convenience Contact 1 - Common
13 - 1 N.O.	Convenience Contact 1 - Normally open
14 - 2 N.C.	Convenience Contact 2 - Normally closed.
15 - 2 COM	Convenience Contact 2 - Common
16 - 2 N.O.	Convenience Contact 2 - Normally open
	The convenience contacts operate during the step action. The length of operation is potentiometer adjustable between 20-410 milli-seconds. The convenience contacts are frequently used for pulsing external counters or resetting external timers. Contacts are rated 2 amperes 125/250 Volts AC.

5.1 SOLID STATE STEPPER MODEL II MODULE I/O FUNCTIONS (continued)

NOTE 1: CONTINUOUS STEP overrides single step, even if the SINGLE STEP INPUT remains energized.

NOTE 2: CONTINUOUS STEP REVERSE overrides CONTINUOUS STEP FORWARD in the event that both inputs are energized at the same time.

All terminals will accept 2 #12 AWG wires.

5.2 SOLID STATE PROGRAMMER OPERATING INSTRUCTIONS

GENERAL INFORMATION

The PSC763 is functionally an electronic equivalent to the Tenor Stepping Drum Programmer Models 200, 250, 2410 and 2420, therefore it is referred to as a Solid State Programmer. The basic concept of the Solid State Programmer is that, on any given step, predetermined functions of output Modules are initiated, then either a verification or timing signal is sent back to the PSC 763 causing it to advance to the next step. It can be determined from the above statments that the PSC 763 acts as the Central Processing Unit (CPU) for the Tenor PSC System. The only connections required in the field are the appropriate terminal wires determined by the application and the Ribbon Bus Cable which carries instructions to the output Modules and synchronizes all the associated Digital Readouts.

SELECTING PROGRAM STEP LENGTH

The maximum number of steps is selected by using the 8 switch DIP package shown in Figure 1.24. The switches are coded in Binary Sequence as follows:

SW 1 = 1
SW 2 = 2
SW 3 = 4
SW 4 = 8
SW 5 = 16
SW 6 = 32
SW 7 = 64

To select the program length, turn off the appropriate switches equalling the number of the last program step.

EXAMPLE: Program Length = 41 steps
= SW 1 off + SW 4 off + SW 6 off
= 1 + 8 + 32
= 41

In the run mode when the last program step is finished, the Solid State Programmer will return to the Home step.

CONVENIENCE RELAY

The convenience relay operation time is controlled by the potentiometer shown in Figure 1.24. The relay operation time is factory set at 250 milli-seconds. This time is field adjustable by turning the potentiometer in the clockwise direction to increase time and counterclockwise to decrease it.

OPTIONAL STEP RATE

The eighth switch on the DIP is usedfor selecting the programmer step rate. With the switch in the "off" position the standard 120 step/ minute rate is selected. If the switch is put in the "on" position the optional step rate is selected which requires the addition of a standard 1/4 watt carbon resistor. The resistor should be inserted as shown in Figure 1.25. Resistor leads should be left short so as not to come in contact with the stepper enclosure. There is approximately 3/8" clearance between the bottom of the PC board and the enclosure. Solder the resistor in place and verify that there is no short to the module enclosure.

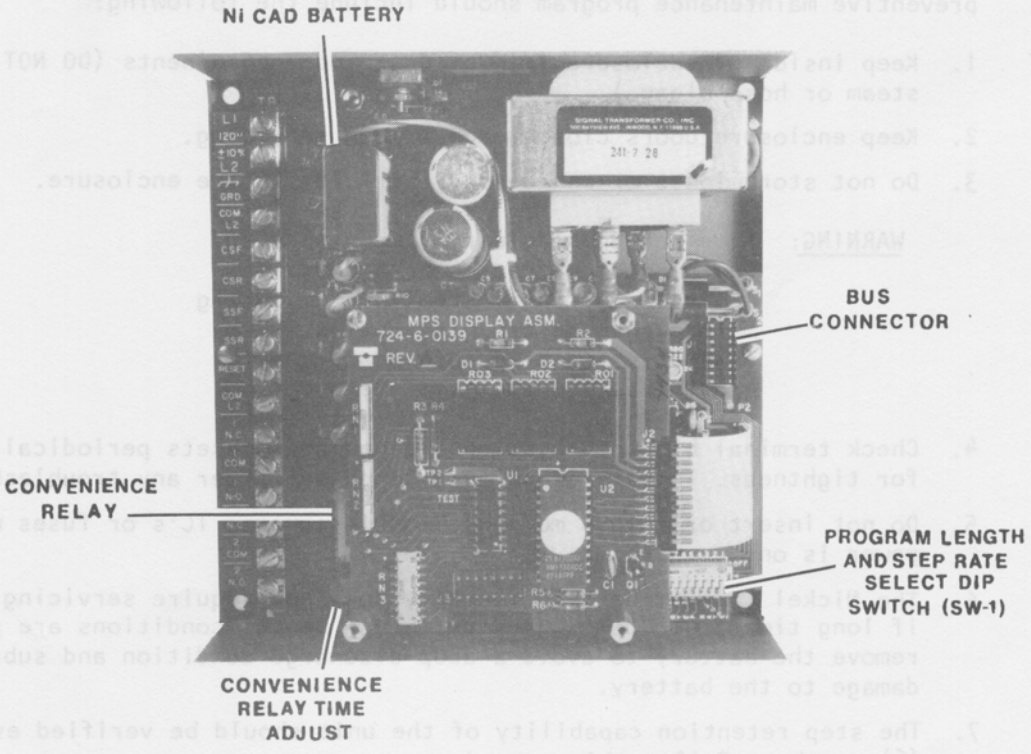
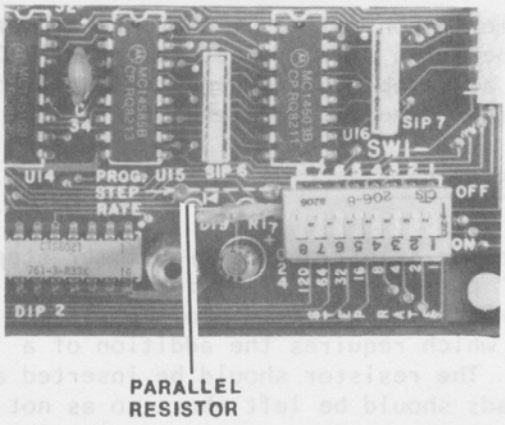


Figure 1.24



APPROXIMATE STEPS/MINUTE	PARALLEL RESISTOR OHMS
200	330K
300	150K
500	82K
750	47K
1000	33K
1400	22K

Figure 1.25

5.3 MAINTENANCE

Solid state control devices require a minimum of maintenance. A good preventive maintenance program should include the following:

1. Keep inside of enclosure free of dust and contaminents (DO NOT steam or hose clean.)
2. Keep enclosure doors closed except when servicing.
3. Do not store loose or unnecessary articles in the enclosure.

   WARNING: Keep personnel clear of machinery and equipment that can be hazardous if activated by the control system during maintenance or troubleshooting. Use generally accepted safe practices for electrical equipment maintenance.

4. Check terminal block connections, plugs and sockets periodically for tightness. This is especially important after any troubleshooting.
5. Do not insert or remove modules, module covers, IC's or fuses while power is on.
6. The Nickel Cadmium battery normally does not require servicing. However, if long time power down (greater than 1 month) conditions are possible, remove the battery to avoid a deep discharge condition and subsequent damage to the battery.
7. The step retention capability of the unit should be verified every six (6) months. Follow this procedure:
   a) Unplug all BUS CONN ribbon cables at the Stepper Module.
   b) Apply power to the stepper module and step it to a step other than Home. Note this number.

Signals should not be present at any of the STEP inputs that would cause the unit to step.

c) Remove power for five (5) minutes.

d) Reapply power and verify that the unit powered up in the same step.

e) With power off, reconnect all cables.

WARNING: When testing, be certain that a dangerous situation is not created if the unit should power up in an unintended step. Back-up safety devices are essential.

BATTERY REPLACEMENT

1. With power OFF, remove the four #4-40 x 1/4" module cover screws.

2. Carefully lift the module cover and unsnap the battery from its connector.

3. Install new battery.

   WARNING: DO NOT substitute a non-rechargeable battery - Serious damage could occur

4. Position cover over module and replace screws in cover.

   WARNING: The programmer will now power up in the Home step since the battery was removed. Take appropriate precautions to insure that this does not cause hazardous conditions in the controlled equipment.

5. The battery must charge for 24 hours before being fully charged.

5.4 BATTERY BACK-UP

In the event of a power failure or the removal of main power from the Stepper Module, the internal battery will retain the step number that was in process at the time of the power failure. Upon reapplication of main power, the Stepper Module will automatically start at the step that was in progress prior to the power failure or removal of main power. Take all necessary precautions to prevent accidental injury due to automatic starting of the Stepper Module.

5.5 RECOMMENDED SPARE PARTS

Description	Tenor Part Number
Battery - 7.2 Volt Ni-Cad (Everyready P/N CH22)	670-3-8075
Relay	700-3-1804

NOTE: Review WARRANTY before attempting field repairs.

5.6 SPARE PARTS ORDERING INFORMATION

Each module contains two identification plates:

1. Catalog Name/Number Plate

2. Serial Number Plate

Name/number plates generally are located on module covers. Serial number plates generally are located on side (outside) of bases.

To aid in furnishing the proper spare parts, please show both numbers.

EXAMPLE: Parts for a Stepper Module 763-7-0115-02

Serial Number -- 763-1234-S-0580
1 Each Battery -- Part Number 670-3-8075

All Prices: F.O.B. New Berlin, Wisconsin

Terms: As Arranged

Minimum Billing: $50.00

Factory: Tenor Company Inc.
17020 W. Rogers Drive
New BErlin, Wisconsin 53151

(414) 782-3800

Prices and all terms and conditions of sale are subject to change without notice. Prices are net and do not include any applicable State, Federal, or Excise Taxes which are payable by purchaser.

All orders are subject to acceptance by Tenor Company at its home office.