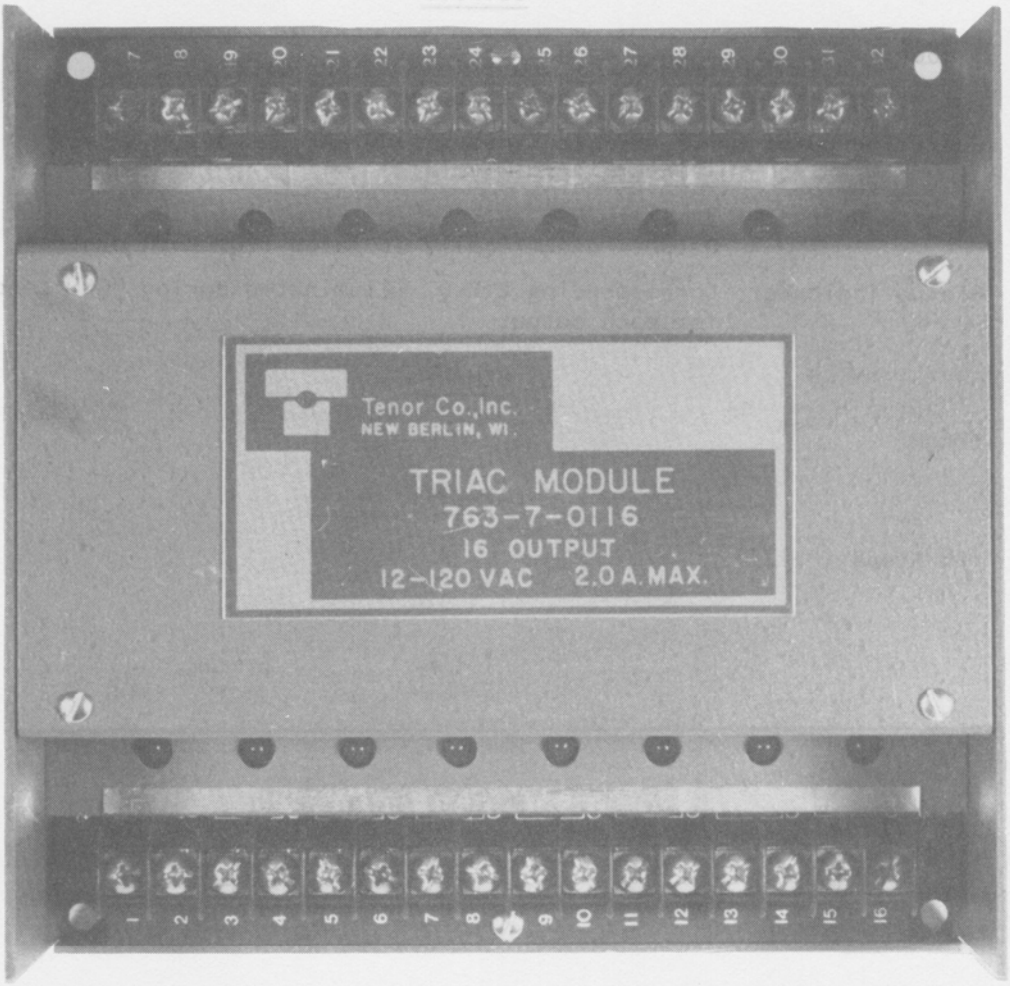
SECTION 8

AC TRIAC OUTPUT MODULE

763-7-0116-01

763-7-0116-02



8.0 AC TRIAC OUTPUT MODULE ELECTRIC SPECIFICATIONS MODELS 763-7-0116-01 and 763-7-0116-02

GENERAL

Operating Temperature Range: 0^{o} - 60^{o} C

Main Power: Connected to power supply of Solid State Stepper or Multi-Program Stepper via ribbon cable.

OUTPUTS

Number: 16 - Switchable each program step.

Operating Voltage: 12-120 VAC Customer supplied.

Operating Current: 2 AMPS Continuous, 100 AMP Inrush for 1 cycle

Leakage Current: 3 milli-AMPS
Outputs electrically isolated from each other.

Status Indicator: Corresponding L.E.D. illuminated during "ON" condition for each output.

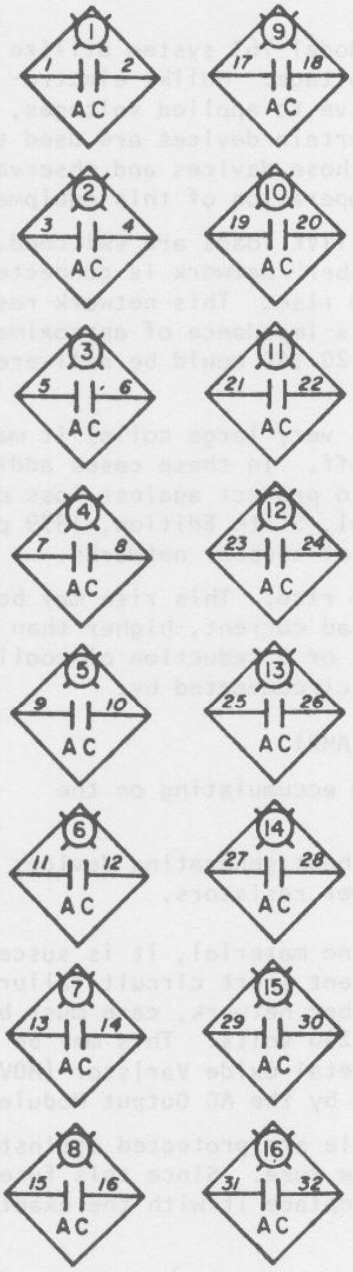
MEMORY

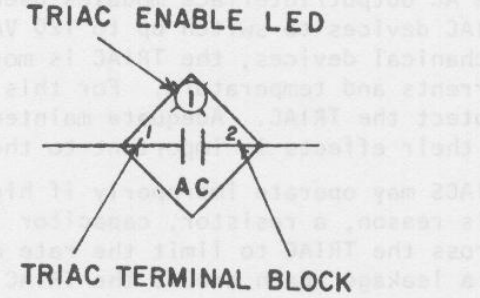
EPROM

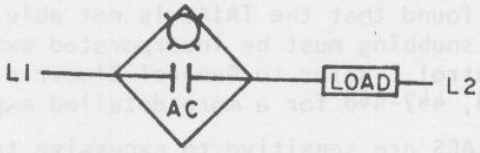
CAPACITY

128 Steps (H-127)

8.1 AC TRIAC OUTPUT MODULE OUTPUT FUNCTIONS







TYPICAL A.C. CONNECTION
(OUTPUT)

All terminals will accept 2 #12 AWG wires.

8.2 AC TRIAC OUTPUT MODULE - OPERATING INSTRUCTIONS

GENERAL DESCRIPTION

The AC Output/Interface modules used in the Model 763 system utilize TRIAC devices to switch up to 120 VAC line voltage. Unlike electro-mechanical devices, the TRIAC is more sensitive to applied voltages, currents and temperature. For this reason certain devices are used to protect the TRIAC. Adequate maintenance of those devices and observance of their effects is important to the proper operation of this equipment.

TRIACS may operate improperly if highly INDUCTIVE loads are switched. For this reason, a resistor, capacitor (RC) "snubber" network is connected across the TRIAC to limit the rate of voltage rise. This network results in a leakage path around the TRIAC due to its impedance of approximately 40K OHM. Thus a leakage current of 3 ma at 120 VAC could be delivered even if the TRIAC is off.

Under certain loading conditions (for example very large coils) it may be found that the TRIAC is not able to turn off. In these cases additional RC snubbing must be incorporated externally to protect against loss of control. Refer to General Electric SCR Manual, Sixth Edition, 1979 pages 158, 447-448 for a more detailed explanation of snubber networks.

TRIACS are sensitive to excessive temperature rise. This rise may be due to a number of reasons including excessive load current, higher than specified ambient temperature (60° C, 140° F) or a reduction of cooling capability. Generally these problems can be circumvented by:

1. Not exceeding rated load current (2 AMP).
2. Preventing dust or contaminents from accumulating on the case or heat sink.
3. Proper mounting away from, or below heat generating devices such as transformers, heaters or power resistors.

Since the TRIAC is a solid block of crystalline material, it is susceptible to OVER VOLTAGE breakdown resulting in permanent short circuit failure. While some protection is provided by the snubber network, care must be taken to prevent voltage surges in excess of 200 Volts. This may be accomplished by connecting a properly sized Metal Oxide Varistor (MOV) across the AC line feeding the loads switched by the AC Output Module.

TRIACS in the Model 763 Output/Interface Module are protected against failure due to fault currents by a replaceable fuse. Since this fuse is matched to the TRIAC, it is important to replace it with the exact type of fuse originally supplied.

MEMORY CHIP HANDLING

The EPROM memory device used in the output modules is a metal oxide semi-conductor (MOS) device which may be damaged by static electricity. Before removing the memory, disconnect 120 VAC power to the Stepper Module. When handling the MOS memory, do not touch the leads of the integrated circuit. It is advisable to use an integrated circuit DIP removal tool. Store the MOS devices with leads inserted in conductive foam or aluminum foil.

PROGRAMMING

It is best to prepare a program chart in advance to aid in loading the EPROM.

An example of a typical program chart and program are shown in Figure 1.31.

The charts are a grid on which up to 16 controlled items (work performing devices and feedback sensors) can be listed along the horizontal axis, and up to 64 program steps can be listed along the two (2) vertical axis. Notice that 2 separate sheets are required for operations having over 64 steps. One program chart set is required for each EPROM in the PSC 763 output modules. It should be noted that each EPROM controls 16 outputs.

An (X) on the program chart indicates a closed switch in that step.

EPROM REMOVAL AND INSTALLATION - MODEL 763-7-0116-01

Included with the PSC 763 Stepper Module is an EPROM Removal Tool (Augat - Part No. T114-1)*. Power should be removed from the PSC 763 before any EPROM is removed or installed in its socket. To remove an EPROM, gently spread the fingers of the removal tool and place under EPROM as shown in Figure 1.30. While applying a slight clamping pressure on the fingers of the removal tool, gently rock the EPROM up and out of its socket.

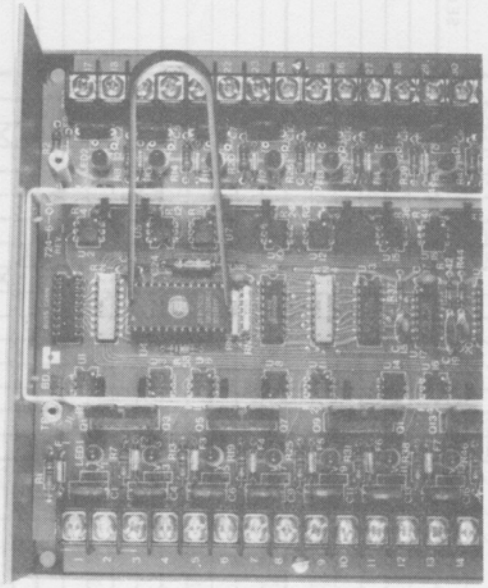


Figure 1.30

CAUTION: Do not pull the EPROM out at an angle. This will almost always result in bending or breaking of the EPROM leads. Do NOT touch EPROM leads. Static electricity will damage this chip.

*AUGAT, INC., P. O. BOX 779, ATTLEBORA, MA 20703

MODULE TYPE: TRIAC NO.: 1 PROGRAM: DATE

Tenor Co. Inc.
BULLETIN 800301

SET SW1 IN STEP MODULE
TO 19 = 16 + 2 + 1

EPROM #1

SWITCH NO.		RETURN P.B.	STATION 1 LS1	" 2 LS2	" 3 LS3	" 4 LS4	" 5 LS5	" 6 LS6	" 7 LS7	HOIST UP LS8	HOIST DOWN LS9	1TR 10 MINUTES	2TR 15 MINUTES	3TR 3 MINUTES	CONVEYOR FWD. - 1ME	CONVEYOR REV. - 1NR		
STEP NO.	TIME INTERVAL																	
SEQUENCE OF EVENTS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
START AT STATION 1		H	X															32
FORWARD TO STATION 2		1		X											X			33
LOWER HOIST		2									X							34
RAISE HOIST		3								X								35
FORWARD TO STATION 3		4			X										X			36
DWELL		5										X						37
FORWARD TO STATION 4		6				X									X			38
LOWER HOIST		7									X							39
RAISE HOIST		8								X								40
FORWARD TO STATION 5		9					X								X			41
LOWER HOIST		10									X							42
DWELL		11											X					43
RAISE HOIST		12								X								44
FORWARD TO STATION 6		13						X							X			45
LOWER HOIST		14									X							46
DWELL		15												X				47
RAISE HOIST		16								X								48
FORWARD TO STATION 7		17							X						X			49
WAIT FOR RETURN P.B.		18	X															50
REVERSE TO STATION 1		19		X														51
		20																52
		21																53
		22																54
		23																55
		24																56
		25																57
		26																58
		27																59
		28																60
		29																61
		30																62
		31																63

SWITCH NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
STEP NO.	TIME INTERVAL																
SEQUENCE OF EVENTS																	

Typical Program Chart

Figure 1.31

EPROM REMOVAL AND INSTALLATION - Continued

To reinstall the EPROM, align the EPROM over its socket with the notched end of the EPROM at the same end as the notched end of the socket. Be sure that the EPROM leads are aligned with the corresponding socket holes. Gently push the EPROM straight down into its socket, being careful not to bend the pins on the EPROM during insertion.

EPROM REMOVAL AND INSTALLATION - MODEL 763-7-0116-02

Gently depress the 2 clamp release slides of the zero insertion force IC socket until all downward movement has stopped as shown in Figure 1.32. Grasp the EPROM on both ends with the EPROM Removal Tool and lift the EPROM out of the socket. Do NOT touch EPROM leads as static electricity will damage this chip.

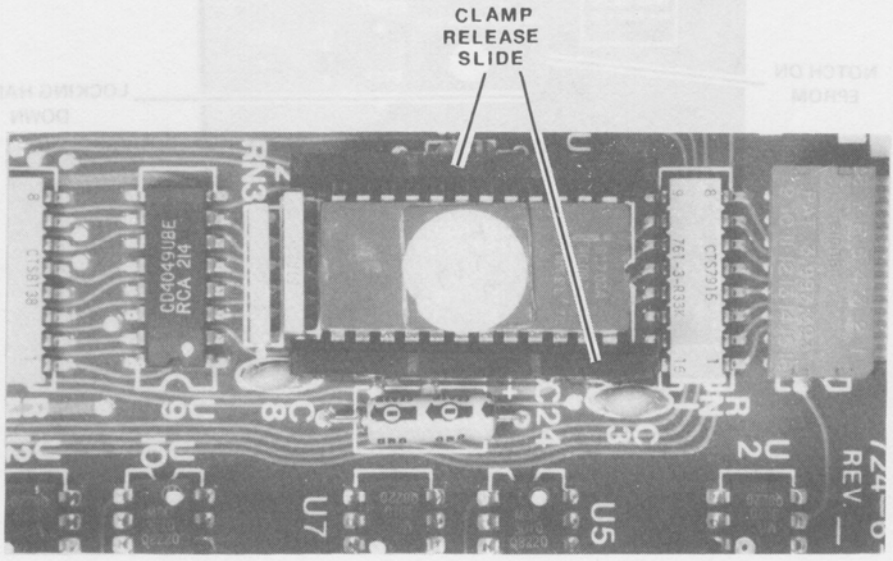


Figure 1.32

To reinstall the EPROM, carefully align the EPROM leads with the socket with the notched end of the EPROM at the same end as the notched end of the socket. After inserting the EPROM into the socket, grasp one of the clamp release slides and pull upward until the slide has fully seated. Repeat this process with the remaining clamp release slide. Verify that the EPROM is securely clamped in the socket.

LOADING THE PROGRAM

To program the EPROM on the Tenor EPROM Loader (Catalog No. 763-7-0120) first plug the programmer into a 120 VAC 60 Hz grounded receptacle. After the loader is plugged in, install the EPROM into its socket.

WARNING: Do not connect or disconnect AC power from the loader with an EPROM in the socket.

The locking handle on the socket must be "up" to allow the EPROM to be inserted. The notched end of the EPROM must be at the locking handle end of the socket, see Figure 1.33.

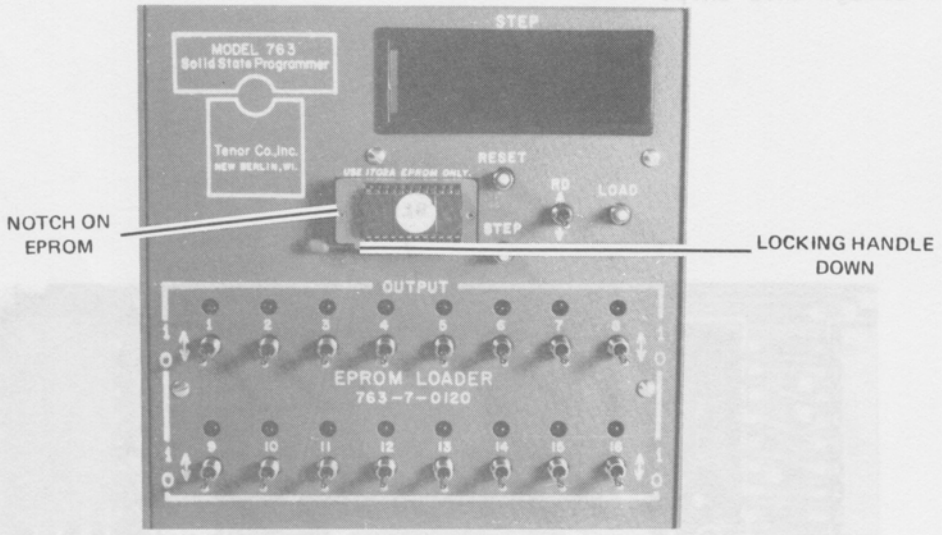


Figure 1.33

With the EPROM secured in its socket, move the read - write (RD-WR) toggle switch on the loader face to the (RD) position and depress the (RESET) pushbutton. The step readout should now indicate the Home (H) step and all (16) of the lights on the face of the loader panel should be off.

With the loader in the Read (RD) mode of operation it is now advisable to check the EPROM address locations to ensure that they are empty. By pressing and releasing the (STEP) pushbutton the loader will now step to step number (1). All (16) lights on the face of the loader panel should be off. A quick check of the remaining memory locations should be made by cycling the (STEP) pushbutton, verifying that all lights are off for the balance of the program steps. When you arrive at the final step in your program you can push the (RESET) pushbutton and return to the Home (H) step.

Before programming, a piece of opaque tape must be placed across the window of the EPROM to prevent possible erasure of the light sensitive device. A marking should be made on the tape to aid in identifying the program about to be stored and its proper system location.

Move the (RD - WR) toggle switch to the Write (WR) position. The loader is now in the programming mode. Refer to the program chart and look at the horizontal row adjacent the (H) (STEP NO.). Wherever an (X) occurs in the (H) row, the corresponding toggle switch on the programmer should be put in the "1" position.

After the switches are all set, the (LOAD) pushbutton should be depressed and released. The information is now stored on the EPROM. Notice that after depressing and releasing the pushbutton, the loader (STEP) readout moved to the number (1) step.

The loader is now ready to be set-up for step number (1). Move along the horizontal row adjacent to step number (1) on the program chart and set-up the switches as indicated by the program. After the switches are set-up, depress the (LOAD) pushbutton and proceed with programming the balance of the program.

PROGRAM VERIFICATION

After the last step has been set-up and loaded, move the (RD -WR) toggle switch to the (RD) position and depress the (RESET) pushbutton.

Verify the EPROM program by checking the indicator lights in each step of the program. To step forward, press and release the (STEP) pushbutton.

If a memory location was accidentally left unprogrammed ("0") it may be programmed ("1") by following the regular programming procedure outlined in this section. However, a memory location that was accidentally programmed and should have been left empty cannot be erased in this manner. Instead, the entire EPROM must be erased.

When the program has been verified, move the locking handle up, and remove the EPROM from its socket. Handling of the EPROM should be kept to an absolute minimum. Replace EPROM in its respective module socket as soon as possible.

INITIAL CHECKOUT

Static program check of the system is recommended at this time.

Figure 1.34 shows the correct wiring diagram for the 763 Solid State Stepper and the 763 Multi-Program Stepper.

CAUTION: AC power must be disconnected from the output loads during this procedure to prevent accidental injury or damage.

1. Connect AC power (L1 and L2) to the appropriate terminals on the 763 Solid State Programmer or 763 Multi-Program Stepper.

2. Install a normally open pushbutton switch between L1 and the single step forward input.

3. Apply power to the circuit. If this is the first time the system has been energized since unpacking, it should start at the Home (H) step. If it does not, cycle the pushbutton switch until the readout is at the Home step.

4. Using the program chart, single step through the program verifying the status of all outputs in each step. The Red Lamp corresponding to each output will light signifying the "ON" state and ability to turn on the respective circuit.

   The Red indicating lamps should follow the sequence of the program chart.

5. Upon completion of verifying the program, cycle the pushbutton switch to the Home step and remove all AC power.

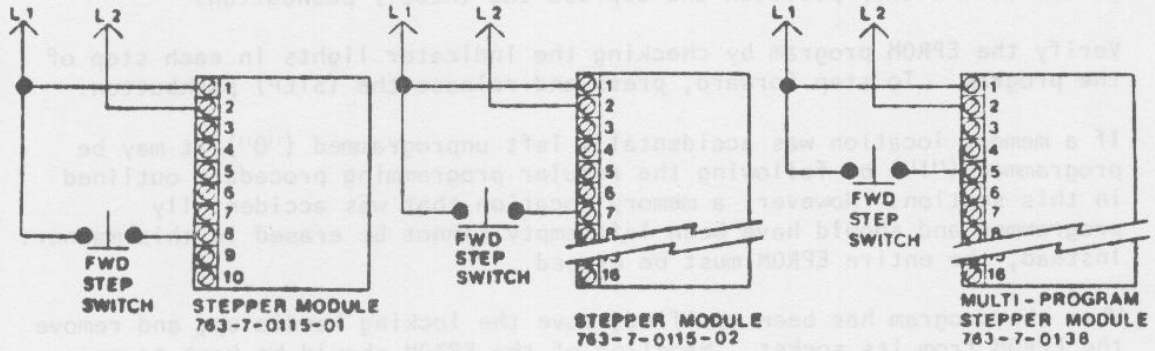


Figure 1.34

ERASING THE EPROM

To erase or empty the data stored in the EPROM, a U-V (ultra-violet) Memory Chip Eraser is available (Catalog No. 763-3-0121). This device will erase up to 4 EPROMS at the same time. A picture of this device is shown in Figure 1.35.

Instructions for the use of this device are included in its packaging. It is recommended that the 1702A EPROM used in the PSC 763 be exposed to the shortwave U-V lamp for a minimum of 45 minutes to ensure complete erasure.

WARNING: Never look directly into the lit U-V lamp because this may cause permanent eye damage.

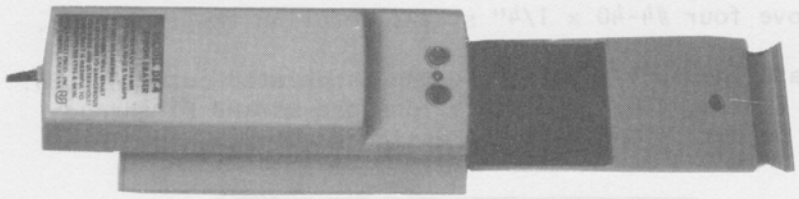


Figure 1.35

8.4 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..

USER SERVICEABLE ITEMS

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.

IT IS RECOMMENDED THAT THESE ITEMS BE REPLACED WITH ALL POWER OFF.

A. FUSES - LITTLEFUSE Part No. 275005 or 276005

5 Ampere Sub-Miniature Picofuse - Tenor Part No. 700-3-3073

The fuses are in series with the individual triacs in the TRIAC OUTPUT MODULE.

WITH ALL POWER OFF

1. Remove four #4-40 x 1/4" screws securing the top cover.

2. Locate the fuse adjacent to the associated output's LED. See Figure 1.36. Fuse locations are marked F1 through F16 to correspond with the assigned output.

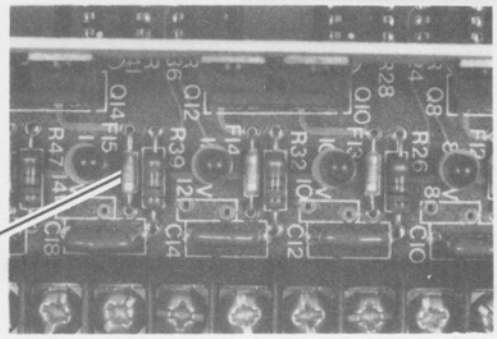


Figure 1.36

3. Fuses plug into individual spring sockets mounted in the PC board.

4. Using a needlenose pliers, grasp the body of the fuse and pull to remove the fuse.

5. The fuse may be checked with a continuity tester or ohmmeter.

6. Shape the leads of the replacement fuse and trim the leads to the dimensions shown in Figure 1.37.

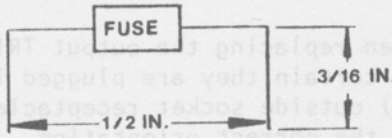


Figure 1.37

7. Replace the fuse using needlenose pliers.

8. Replace the cover.

B. TRIACS -- TECCOR ELECTRONICS, Part No. Q4010L4

400 Volt, 10 AMP - Tenor Part No. 700-3-0654

The TRIACS plug into a socket and are easily replaceable.

1. With all power off, remove the four #4-40 x 1/4" screws securing the top cover.

2. Locate the suspect TRIAC. See Figure 1.38.

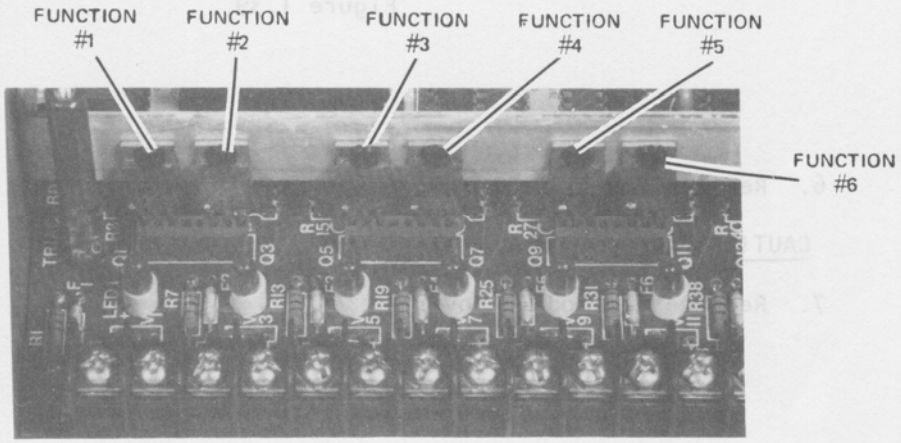


Figure 1.38

3. Remove the #4-40 x 3/8" nylon machine screw and use a needlenose pliers to pull the TRIAC from the socket.

4. Before inserting the new TRIAC make sure the heatsink/triac mating surface is free of dirt or grease.

5. Insert the new TRIAC in the socket.

   CAUTION: When replacing the output TRIAC devices be certain they are plugged in the same (3) outside socket receptacles and are in the correct orientation. See Figure 1.39.

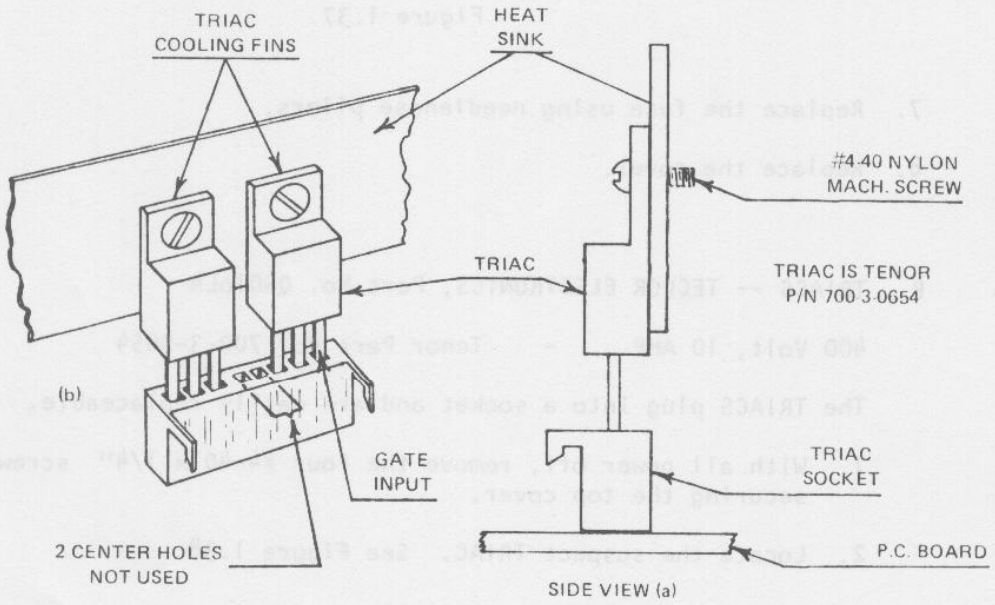


Figure 1.39

6. Replace the nylon screw.

   CAUTION: Do not overtighten.

7. Replace the Module Cover.

8.5 RECOMMENDED SPARE PARTS

Description	Tenor Part Number
EPROM (National or AMD 1702A)	700-3-0769
TRIAC (Teccor Electronics P/N Q4010L4)	700-3-0654
Fuse (Littlefuse P/N 275005 or 276005)	700-3-3073
Flat Interconnection Cable Assembly	700-3-5059

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 sides (outside) of bases.

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

EXAMPLE: Parts for a TRIAC Module 763-7-0116

Serial Number - 763-1234-S-0580
1 Each Fuse - Part Number 700-3-3073

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 Sales, Federal or Excise Taxes which are payable by purchaser.

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