

## CHAPTER 7 MAINTENANCE

### INTRODUCTION TO MAINTENANCE PROCEDURES

The Series Three programmable controller is designed to provide trouble-free operating during its lifetime. However, occasionally problems do occur and it is important to be able to quickly identify the source of the problem and correct it. Many times these problems originate outside of the Series Three.

### TROUBLESHOOTING AIDS

The advantage the Series Three design provides is indicators and built-in aids to troubleshoot not only the PC but also the overall control system. The main diagnostic tool is the programming device, which can be the CPU/Programmer, the Portable Programmer or the Workmaster industrial computer with Logicmaster 3 software. The programmers provide great insight to the status of the overall control system.

All major faults can be corrected by replacing modules. No special tools are required other than a screwdriver and voltmeter. The recommended screwdriver is a U.S. #2 Phillips. There is normally no requirement for an oscilloscope, highly accurate voltage measurements (digital to voltmeters), or specialized test programs.

### BASIC TROUBLESHOOTING PROCEDURE

Table 7.1 is a renewal parts list for the Series Three programmable controller. A spare parts kit is recommended so that a system can be returned to service with a minimum amount of down time in the event a problem should occur. If a failure should occur, some basic questions should be asked and appropriate corrective action taken to negative answers.

1. Is the **POWER** light on (located on power supply)? If not, measure the applicable source voltage at the terminals on the power supply, either 115/230 V ac,  $\pm 15\%$  or 24 V dc, +20 to +30 V dc. If AC or DC power is not present, locate the source of the problem external to the Series Three. If the AC or DC power is adequate, but the POWER light is off, the power supply should be replaced.
2. Is the **RUN** light on? If not, ensure that the CPU cable is connected securely at the power supply. If it is, be sure that the mode switch is not in the *PROG*, *LOAD*, or *PROM* position. If those checks are all good, replace the CPU/Programmer.
3. Is the back-up battery O.K.? If error code *E22* is displayed on the programmer display, it is a warning that the battery voltage has dropped below 2.7 V dc and will not retain memory if power is removed. The battery should be replaced. After replacing the battery, verify the program or test the Series Three programmable controller's operation. If a fault is discovered, reload the program from a tape recorded after initial system programming.

Table 7.1 SERIES THREE RENEWAL PARTS LIST

Catalog Number	Description
<b>CPU - POWER SUPPLIES - BASE UNITS</b>	
IC630CPU301	CPU/Programmer Unit
IC630PWR310	Power Supply, 115/230 V ac
IC630PWR320	Power Supply, 115/230 V ac (For Remote I/O)
IC630PWR314	Power Supply, 24 V dc
IC630PWR324	Power Supply, 24 V dc (For Remote I/O)
IC630CHS304	Base Unit, 4 Modules
IC630CHS306	Base Unit, 6 Modules
IC630CHS308	Base Unit, 8 Modules
<b>INPUT MODULES</b>	
IC630MDL301	24 V dc Sink Input Module (16 Inputs)
IC630MDL303	5-12 V dc (TTL) Input Module (32 Inputs)
IC630MDL306	24 V dc Sink Input Module (32 Inputs)
IC630MDL311	24 V ac/dc Source Input Module (16 Inputs)
IC630MDL325	115 V ac Input Module (16 Inputs)
IC630MDL326	115 V ac Isolated Input Module (8 Inputs)
IC630MDL327	230 V ac Input Module (16 Inputs)
<b>OUTPUT MODULES</b>	
IC630MDL351	24 V dc Sink Output Module, 2 Amp (8 Outputs)
IC630MDL352	24 V dc Sink Output Module, 1 Amp (16 Outputs)
IC630MDL354	5-12 V dc Output Module (32 Outputs)
IC630MDL356	24 V dc Sink Output Module (32 Outputs)
IC630MDL357	24 V dc Source Output Module (16 Outputs)
IC630MDL375	115/230 V ac Output Module (16 Outputs)
IC630MDL376	115/230 V ac Isolated Output Module (8 Outputs)
IC630MDL380	Relay Output Module (16 Outputs)
<b>ANALOG MODULES</b>	
IC630MDL316	Analog Input Module
IC630MDL366	Analog Output Module (1 to 5 V dc, 4 to 20 mA)
IC630MDL367	Analog Output Module (-10 to +10 V dc)
IC630MDL368	Analog Output Module (0 to 10 V dc, 4 to 20 mA)
<b>SPECIAL MODULES</b>	
IC630MDL304	24 V dc In/Out (16 Inputs/16 Outputs)
IC630MDL310	High Speed Counter Module
IC630MDL324	I/O Simulator Module
<b>COMMUNICATIONS</b>	
IC630CCM300	Data Communications Module
IC630CCM310	I/O Link Local, Twisted Pair
IC630CCM311	I/O Link Remote Twisted Pair
IC630CCM320	I/O Link Local, Fiber Optics, Point-to-Point
IC630CCM321	I/O Link Remote, Fiber Optics, Point-To-Point
IC630CCM330	I/O Link Local, Fiber Optics, Multiple Point
IC630CCM331	I/O Link Remote, Fiber Optics, Multiple Point
IC630CCM390	RS-232/422 Adaptor Unit
IC630CCM394	Link/Test Connector

Table 7.1 SERIES THREE PARTS LIST (Continued)

Catalog Number	Description
<b>ACCESSORIES</b>	
IC630ACC150	Lithium Battery
IC630ACC320	Accessory Kit
<b>CABLES</b>	
IC610CBL105	I/O Interface Cable, 24 Pin, 10' (3m)
IC610CBL106	I/O Interface Cable, 16 Pin, 10' (3m)
IC610CBL108	I/O Interface Cable, 40 Pin, 10' (3m)
IC630CBL304	I/O Expander Cable, 19" (0.5m)
IC630CBL305	I/O Expander Cable, 3' (1.0m)
IC630CBL392	Communications - CPU Cable
IC630CBL395	Spare Communications - CPU Cable
<b>FIBER OPTICS</b>	
IC630FBNXXX *	Fiber Optic Cable, Indoor Type
IC630FBTXXX *	Fiber Optic Cable, Outdoor Type
IC630FBR310	Fiber Optic Repair Parts Kit
IC630FBR311	Fiber Optic Repair Tool Kit
IC630FBR312	Fiber Optic Duplex Cable Adapter

\* Fiber optic cables are available in lengths from 3 to 2952 feet (1 to 300 meters). Refer to chapter 2 for a list of available lengths and catalog numbers.

### GENERAL TROUBLESHOOTING PROCEDURE

Additional troubleshooting procedures depend upon knowledge of the logic installed by the user. The following steps are general in nature and should be modified or adjusted to your specific application. The best troubleshooting tools are common sense and experience. With the mode switch in the RUN position, follow these steps:

1. If the Series Three PC has stopped with some outputs energized or basically in mid-steam, locate the signal (input, timer, coil, etc.) that should cause the next operation to occur. The programmer will display the ON/OFF condition of that signal (monitor display area, position 0).
2. If the signal is an input, compare the programmer state with the LED on the input module. If they are different, replace the input module. If multiple modules in expander base are faulty, verify that the I/O cable connection is secure before replacing the module.

3. If an input state and the applicable LED on the Input module agree, compare the LED status with the input device (pushbutton, limit switch, etc.). If they are different, measure the voltage at the Input module terminals (refer to Chapter 6 for typical I/O wiring). If the measured voltage indicates a faulty I/O device replace it, or the field wiring, or its power source; otherwise, replace the input module.
4. If the signal is a coil wired to a field device, compare its status to the LED on the output module. If they are different, verify the source of field power to ensure that an excitation voltage is available. If field power is not present, examine the power source and its wiring. Otherwise, with field power available and the wrong status at the output module, replace the output module.
5. If the signal is a coil and either there is no output module or the output is the same as the coil state, examine the logic driving the output using the programmer and a hard copy of your program. Proceeding from right towards left, locate the first contact that is not passing power that is otherwise available to it from the immediate left.

Troubleshoot that signal using the procedures in steps 2 and 3 above if it is an input, or steps 4 and 5 if it is a coil. Ensure that Master Control Relays are not impacting operation of the logic.

6. If the signal is a timer that has stopped at a non zero value below 999.9 replace the CPU module.
7. If the signal is the control over a counter, examine the logic controlling the reset first and then the count signal. Follow steps 2-5 above.

## **REPLACEMENT OF COMPONENTS**

The following procedures provide details on steps to be followed when replacing various modules.

### **REPLACING A POWER SUPPLY**

1. Turn off AC or DC power, as applicable, and remove the CPU/Programmer (Refer to Figure 3.2).
2. Disconnect wiring from the power supply terminal board.
3. Remove the power supply by loosening the two captive screw fasteners.
4. Install the new power supply.
5. Reconnect wiring to the terminal board.
6. Verify correct power wiring and reconnect the AC or DC power. Carefully check operation of the entire system.

### REPLACING THE CPU/PROGRAMMER

1. Remove AC or DC power, as applicable, then remove the CPU/Programmer by loosening the captive screw fastener at the bottom of the unit.
2. Disconnect the cable from its mating connector on the power supply.
3. Connect the cable on the new CPU/Programmer.
4. Install the CPU/Programmer and tighten the captive screw fastener.
5. Reconnect the AC or DC power and verify operation of system.

### REPLACING I/O MODULES

1. Turn OFF power from both the base unit and the I/O system.
2. Remove the protective plastic cover from over the terminals on the I/O module. Only the connector on the faulty module needs to be removed. Loosen the two screws holding the socket-type terminal assembly in place and remove the terminal board.
3. If the module is connected to field devices through one or two I/O Interface cables, disconnect the cable(s) from the mating connectors on the faceplate.
4. Loosen the two screws holding the I/O module in place.
5. Pull the module straight out.
6. Insert the new I/O module. Place the terminal assembly over the edge connector and firmly push down. Tighten screws on the connector. Reconnect the I/O Interface cable connector(s) as required.
7. Replace the plastic cover.
8. Reapply power to the CPU, then the I/O system and verify proper system operation.

### REPLACING A BATTERY

1. Remove the CPU from the base unit.
2. Remove the plastic cover to the compartment containing the battery in the rear of the CPU (refer to Figure 7.1).
3. Unplug the Lithium battery. There is sufficient capacitance in the system to retain the CMOS memory, even without the battery, for 20 minutes.
4. Connect the new battery.
5. Replace the cover.
6. Reinstall the CPU module.
7. Verify that Error code E22 has been cleared.

**WARNING**

**DO NOT DISCARD THE LITHIUM BATTERY IN FIRE. DO NOT ATTEMPT TO RECHARGE THE BATTERY. DO NOT SHORT THE BATTERY. THE BATTERY MAY BURST OR BURN OR RELEASE HAZARDOUS MATERIALS.**

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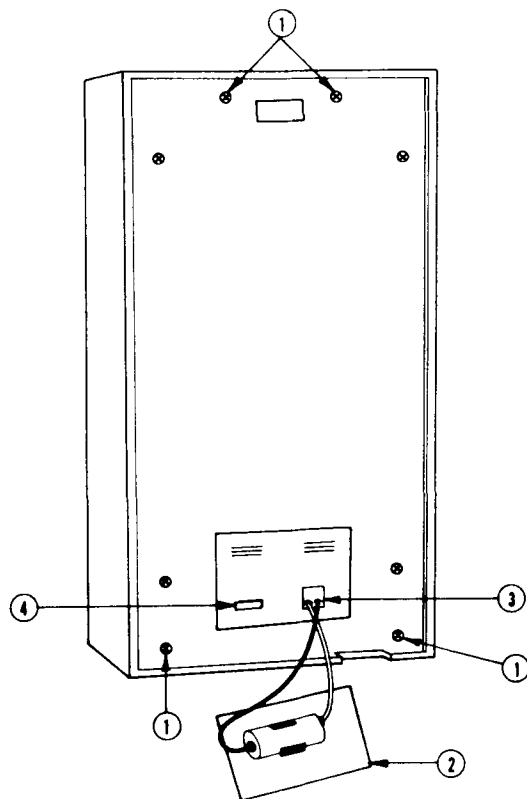


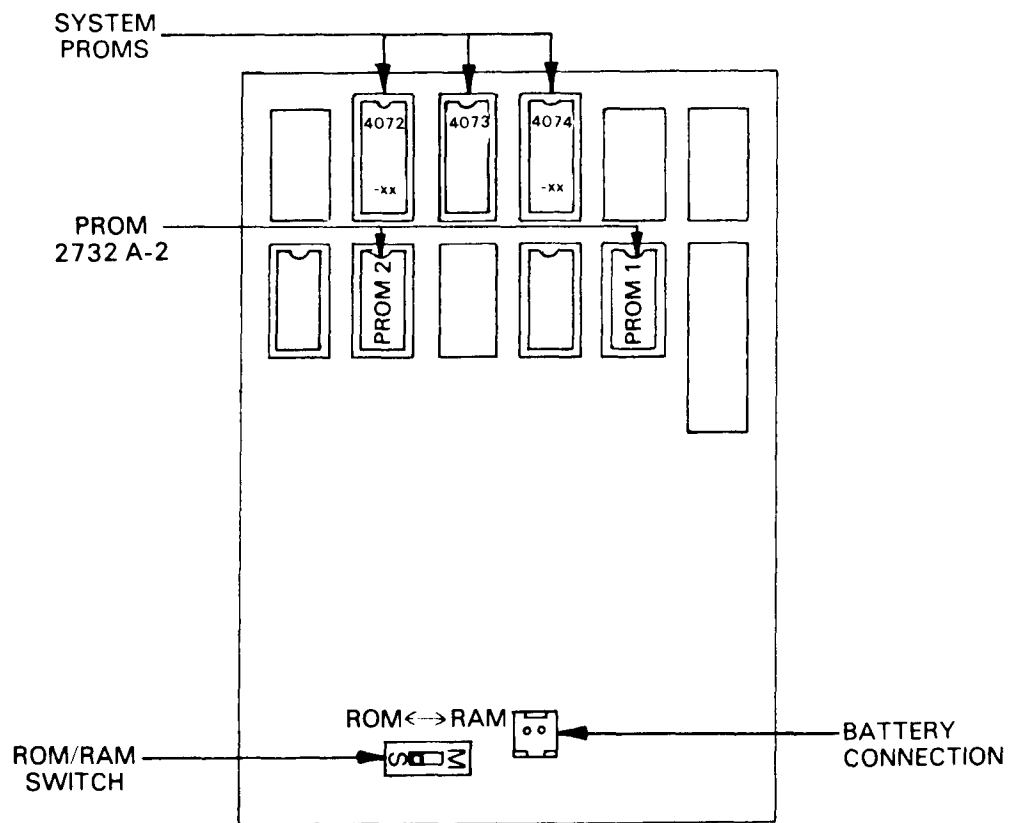
Figure 7.1 LOCATION OF LITHIUM BATTERY

- 1 Rear compartment screws.
- 2 Battery compartment cover.
- 3 Battery connector.
- 4 ROM/RAM Switch.  
 M = RAM (Factory setting)  
 S = ROM (EPROM)

**INSTALLING PROM MEMORY**

1. Turn off AC or Dc power, as applicable, and remove the CPU/Programmer from the base unit. Remove 4 screws from rear cover plate as shown in Figure 7.1.
2. Locate the spare memory sockets on the printed circuit board. They will be marked PROM 1 and PROM 2. Refer to Figure 7.2.

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**NOTE**

The ROM/RAM switch is shown in the ROM position.

Figure 7.2 LOCATION OF PROM MEMORY SOCKETS

3. Obtain the ICs required for PROM memory (2732A-2 PROM). Refer to Chapter 4 for instructions on loading programs in PROM memory. A Series Three programmable controller requires two PROMs, one for the lower 8 bits of memory and one for the upper 8 bits of memory.
4. Orient each PROM so that the notch at one end matches the notch in the memory socket.
5. Insert the PROMs into each socket carefully and evenly so as not to bend any leads. Visually inspect each PROM to ensure that all leads are in place and then push down to firmly seat each PROM.
6. Replace the cover plate.
7. Reinstall CPU module. Verify proper system operation.
8. When PROMs are installed and are to be the memory source, the ROM/RAM switch next to the battery connector must be positioned to the left (ROM position).

**FUSE LIST**

Table 7.2 is a list of fuses used in Series Three I/O modules.

Table 7.2 SERIES THREE FUSE LIST

MODULE NAME	CATALOG NUMBER	FUSE TYPE	SLOW/FAST BLOW	CURRENT RATING	REMOVABILITY	QUANTITY
Power Supply	IC630PWR310	Midget	Slow	3A	•	1
	IC630PWR320	Midget	Slow	3A	•	1
Power Supply	IC630PWR314	Midget	Slow	6A	•	1
	IC630PWR324	Midget	Slow	6A	•	1
Output of All Supplies (5 V dc)		Midget	Slow	5A	•	1
	(12 V dc)	Micro	Slow	3A	•	1
24 V dc In/Out	IC630MDL304	Micro	Fast	5A	o	2
24 V dc Out	IC630MDL351	Micro	Fast	5A	o	4
24 V dc Out	IC630MDL352	Micro	Fast	5A	o	4
24 V dc Out	IC630MDL356	Micro	Fast	5A	o	4
24 V dc Src Out	IC630MDL357	Micro	Fast	5A	o	4
115 Vac Out	IC630MDL375	Midget	Fast	8A	•	2
Isolated 115 V ac Out	IC630MDL376	Midget	Fast	8A	•	8
Relay Output	IC630MDL380	Midget	Slow	10A	•	2

• = Mounted in fuse clips  
o = Soldered connection



**ACCESSORY KIT**

To support the Series Three programmable controller, an accessory kit is available (IC630ACC320) as shown in Figure 7.3. This kit includes commonly needed components that may get damaged or lost in the normal course of operation. Rather than attempting to order small parts such as fuses, audio cables, screws, etc., this kit is available and provides sufficient parts to support 3 to 5 CPUs, depending upon their I/O count. Included in the kit are the items listed below.

<u>ITEM</u>	<u>QUANTITY</u>
Cable, CPU/Programmer to Cassette	1
Cable, CPU/Programmer to Peripheral	1
Cover, Connector, 16 I/O	2
Dust Cover, Base	1
Dust Cover, CPU Connector	1
Dust Cover, Fiber Optic Connector	2
Dust Cover, Power Supply	1
Fuses, Slow Blow, 1A, 3A, 5A, 6A, 10A	5 each
Fuses, Fast Blow, 3A, 8A	5 each
I/O Connector, 20 Pin	1
Key, CPU/Programmer	1
Screws, Binding Head, M3x6	10
Screws, Counter Sunk Head, M3x6	10
Screws, Pan Head, M3.5x7, M3x6, M4x50	10 each
Screws, Terminal, Pan Head, M4x8	20
Washer, M3	10

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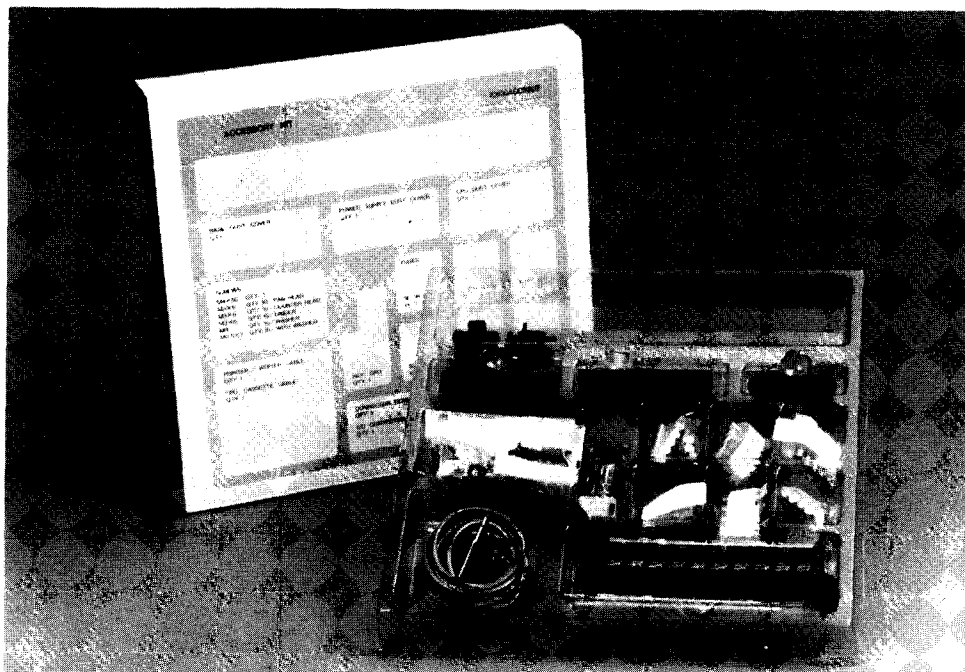


Figure 7.3 SERIES THREE ACCESSORY KIT