SECTION 9. TROUBLESHOOTING

PC 700/900 Programmable Controllers

9-1. INTRODUCTION

Troubleshooting is the process of logically analyzing system performance to detect areas where system operation does not meet requirements. The actual repair or corrective actions to the equipment are generally the last steps of the troubleshooting process. A logical, systematic approach to system troubleshooting should consist of the following steps:

- **Symptom Recognition**

  The user's operator and/or maintenance personnel must be aware of proper system operation, so that an undesired operation can be easily recognized.

- **Symptom Evaluation**

  Once a problem is recognized, the system is further tested to establish the extensiveness of the failure.

- **Fault Definition**

  After symptoms have been evaluated and defined, the probable faulty functions are logically determined.

- **Fault Isolation**

  Each suspect function is tested to isolate the faulty function(s).

- **Corrective Action**

  Upon fault isolation, a single component or subassembly chain is analyzed and the malfunctioning unit is replaced.

CAUTION

During these troubleshooting procedures, when a programmable controller module subassembly is determined to be at fault, it is recommended that the entire programmable controller be replaced and sent back to Westinghouse for repair. Many Numa-Logic modules are produced with separate versions, which are not directly interchangeable. Installing a failed module with an improper replacement version can cause system failures. Any user trouble-shooting repair of programmable controller modules should only be done through prior agreement with Westinghouse.

This section is restricted to recommended troubleshooting procedures for the PC-700 or PC-900 Programmable Controllers. These processors are usually a small part of a larger system application. Also, external factors can affect processor performance. Due to these factors, this section should be used in conjunction with other system component documentation and overall system-level documentation when performing fault analysis for specific applications. **The procedures of this section should be used when the processor is determined to be the probable cause of a failure.**

Additionally, the procedures of this section assume that the user is familiar with the system, system components, program loader, and related peripherals. If this is not the case, the user should study all related documentation before proceeding with these procedures.

9

No specialized training in electronics and/or complex test equipment is required to perform the troubleshooting procedures of this section. These procedures emphasize the exchange or replacement of components (i.e., processor power supply racks, etc.). In this way, troubleshooting and down time are held to a minimum.

CAUTION

Any attempt by the user to repair the circuitry on a module voids the warranty.

Indicating lights are provided on the processors and I/O modules for quick and easy verification of the operation of system subassemblies. Additionally, a system's program loader functions as a diagnostic tool by allowing coils to be forced, displaying programming, and displaying processor/program error codes.

WARNING

WHILE TROUBLESHOOTING A SYSTEM AND ITS COMPONENT EQUIPMENT, TAKE ALL STEPS NECESSARY TO PREVENT ACCIDENTAL INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT. EXTREME CAUTION SHOULD BE USED WHEN ENERGIZING INPUTS OR OUTPUTS OF THE PROGRAMMABLE CONTROLLER. ALWAYS REMOVE THE POWER FROM THE PROCESSOR AND POWER SUPPLIES BEFORE CHANGING MODULES OR DISCONNECTING CABLES. DISCONNECT THE POWER FROM I/O RACKS PRIOR TO I/O MODULE REPLACEMENT.

9-2. TROUBLESHOOTING PROCEDURES

9-3. GENERAL

The following troubleshooting procedures are provided to assist the user in isolating a failure at the module or system subassembly levels. **The warranty is voided if the user attempts circuitry repair on a module.**

Two basic types of failures occur in PC-700 or PC-900 systems: complete or partial. By using the following recommended procedures, and by visual inspection of processor and I/O module indicators, the user can easily determine the type of failure, isolate its source, and restore the system to its proper operation.

9-4. Complete Failure

The complete failure of the PC-700 or PC-900 system occurs when either of the following two sets of conditions exists:

- The programmable controller is in fault, the **DC OK** or **Power OK** is OFF, the **Fault LED** is OFF, and all outputs are OFF.

- The programmable controller is in fault, the **Fault LED** is ON, and all outputs are either OFF or in the Last Valid States (depending on the state of the Last Valid State/All OFF jumper). With the Version 2 power supply and Last Valid State selected, a fault turns ON both the **Run** and **Fault** lights. Outputs are held on in their Last Valid States. Turning the keyswitch to **Program** causes the outputs to go OFF.

Generally, the processor and/or power supply causes complete failure. In either case, first check for the proper line voltage and power supply connections before proceeding with troubleshooting procedures.

9-5. Partial Failure

The partial failure of the PC-700 or PC-900 system occurs when some outputs fail to operate or when inputs are not recognized. A partial failure of a programmable controller and the process or machine it controls is generally detected when an expected event fails to occur at the proper time. A partial failure can originate in either the external wiring or in the programmable controller system. If the partial failure does not originate externally, it must be isolated to either the processor, expander power supply, or the I/O modules/cables/racks.

Example: An example of a partial failure is the case where a motor fails to rotate when its corresponding START pushbutton is pressed. By examination of the associated input module's LED indicator, it can be determined whether or not the pushbutton is operating properly. The LED on the output module is located on the user-powered side of the board. A lit LED indicates that voltage is applied to the load; if the LED is OFF, the load is not powered. Checking the associated output module's LED indicator determines whether or not the output is conducting, thus, energizing the motor starter. Depending upon the information detected by examining these I/O indicators, the user can determine whether the source of a failure is external (process or machine being controlled) or internal (programmable controller system).

All probable external causes of failure should be eliminated before proceeding with the troubleshooting procedures.

9-6. Common Failures

The most common cause of failure is generally external to the programmable controller system. External failures are usually caused by malfunctioning sensing devices, actuators, or indicators. Also, blown fuses, shorts, or open circuits may be encountered during installation, start-up, or during normal operations. Miswired connections generally occur during start-up. Close examination of the I/O modules and external devices is often sufficient to isolate the cause of a failure.

9-7. PROCESSOR CONTROLS AND INDICATORS

The PC-700 and PC-900 processor front panel controls and indicators are shown in Figures 9-1 through 9-3. Also, all versions of the front panel keyswitch are illustrated in Figures 9-4 through 9-8. Use these figures for the following descriptions of the front panel controls and indicators.

Power OK or **DC OK** (LED)

When this indicator lights, it indicates that the processor's internal power supply voltages are within tolerances. When this indicator is not lit, all outputs are OFF. In this case, check the power connections and the associated internal and external fuses.

WARNING

WHEN CHECKING POWER CONNECTIONS AND FUSES, PERSONNEL MAY BE EXPOSED TO APPLIED POWER, RESULTING IN INJURY OR DEATH. ENSURE THAT THE POWER IS REMOVED FROM THE CIRCUITS BEING CHECKED, OR EXERCISE EXTREME CAUTION WHEN CHECKING "LIVE" CIRCUITS.

Run (LED)

The processor is scanning memory and controlling outputs when this indicator is lit. When this indicator is not lit, all outputs are OFF. In this case, check to see that the keyswitch is placed in the **Run** or **Run/Modify** position. When the keyswitch is in the **Program** or **Stop/Program** position, this indicator and all outputs are OFF. If this indicator remains OFF when the keyswitch is in the proper position, check the state of the **Power OK/DC OK** and **Fault** LEDs.

Note

With the Version 2 power supply set up for the Last Valid State, **Run** and **Fault** LEDs are ON together to indicate that the processor is not scanning, but outputs are still ON in their Last Valid States.

Battery OK (LED)

The operation of this indicator is dependent on the type of processor used and the type of power supply version present for PC-700 applications. A description of each operation follows:

- PC-700 Application with Version 1 Power Supply.

  When the processor is not powered up and the **Battery Test** pushbutton is pressed, this indicator lights, indicating that the battery is charged and operating. If this indicator does not light, the backup battery has discharged or failed. In this case, refer to the battery checkout procedures of paragraph 7-7 to service this battery.

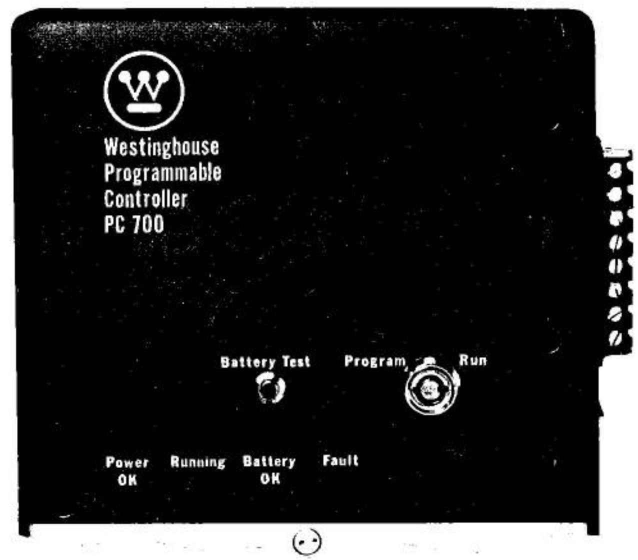

Figure 9-1. Controls and Indicators on PC-700 with Version 1 Power Supply

- PC-700 Application with Version 2 Power Supply

  In this version of the PC-700, pressing the **Battery Test** pushbutton at any time produces one of the following indications:

  Steady — Battery fully charged.

  Flickering — Battery discharged.

  Out — Battery failed.

  In the second two cases, refer to the battery checkout procedures of paragraph 7-7 to service this battery.

- PC-900 Application

  In PC-900 applications, this indicator lights while the processor is powered up and if the battery is charged and operational. During normal PC-900 operation, this battery maintains memory for one week after the indicator first goes out. The battery should be replaced when the indicator does not light.

Fault (LED)

This indicator, when lit, indicates that a processor failure has occurred. However, in PC-700 applications with Version 1 power

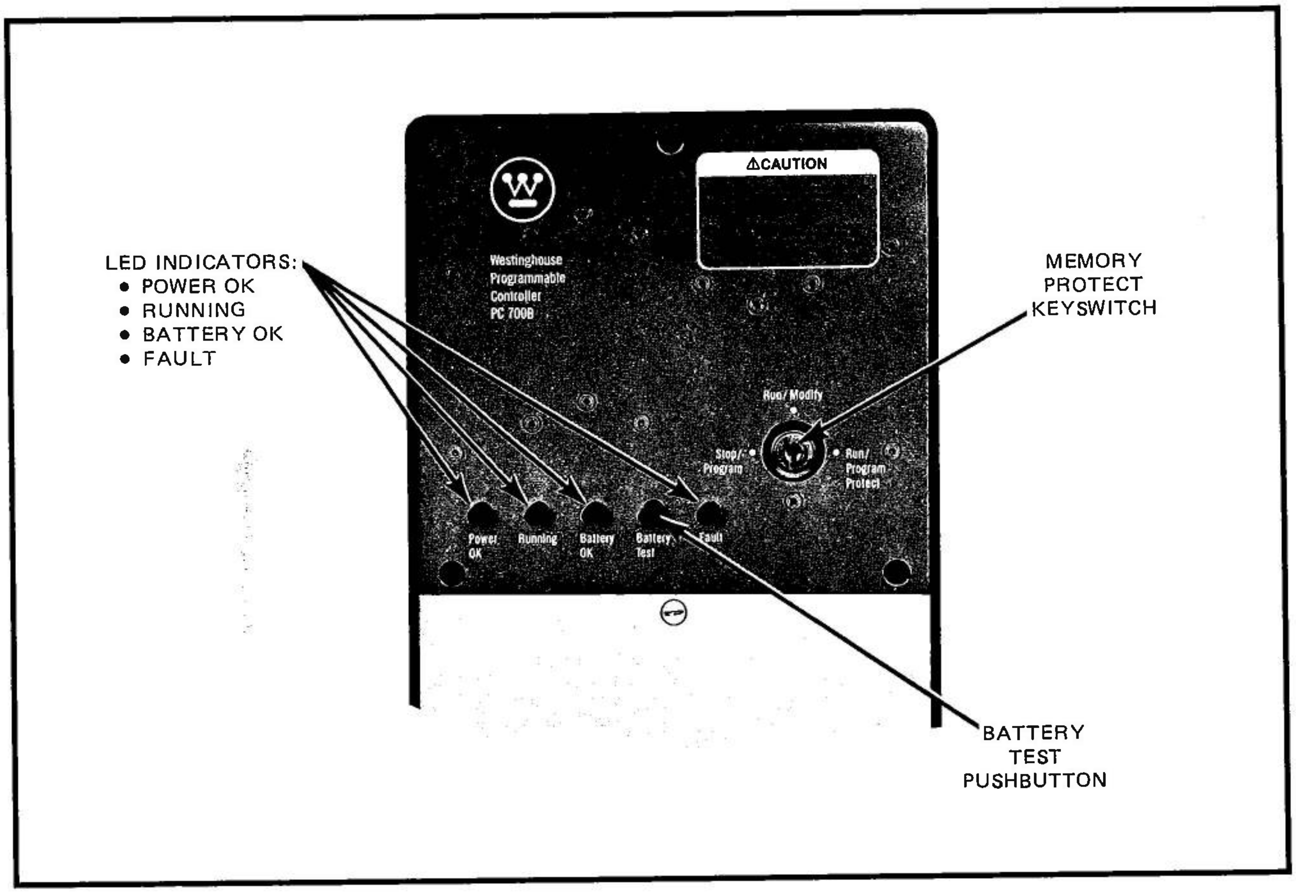

Figure 9-2. Controls and Indicators on PC-700 with Version 2 Power Supply

supplies, this indicator also lights when the keyswitch is placed in the **Program** position. In this case, a processor failure has not occurred. For this PC-700 application, processor failure is detected only when this indicator lights in the **Run** position of the keyswitch. In PC-700 processors with Version 2 power supplies, a lit **Run** and **Fault** (LED) indicates a fault; however, some outputs may be ON due to Last Valid State selection, with the **Run** light on in PC-700 processors with Version 2 power supplies, depending on jumper selection. Also, during a fault, the fault relay is de-energized. If a fault condition is detected, refer to the troubleshooting procedures to locate and correct the problem.

Keyswitch: **Program** or **Stop/Program**

Placing the keyswitch in this position stops processor scanning and disables all outputs. This keyswitch position enables lines of a reference ladder diagram to be entered, deleted and altered. Also, register data is modified in this keyswitch position.

Keyswitch: **Run/Modify**

Placing the keyswitch in this optionally available position enables the processor to continue to scan while the existing program is modified or edited. In this keyswitch position, newly programmed logic is not acted upon until a complete and logical line has been entered.

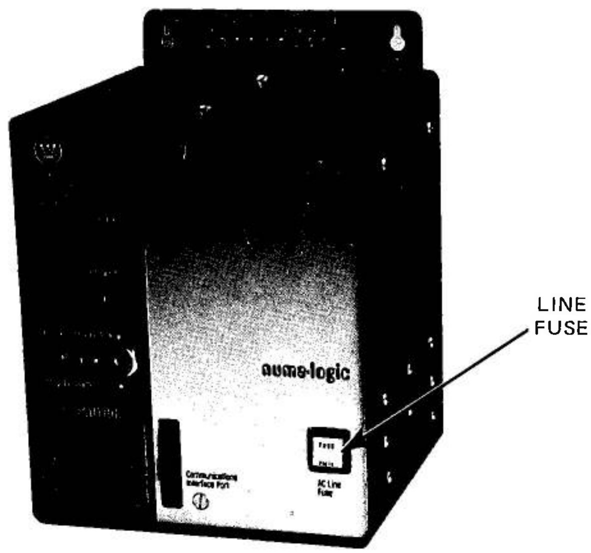

Figure 9-3. Controls and Indicators on PC-900 A/B

WARNING

WHEN MAKING CHANGES WITH THE SYSTEM RUNNING, IT IS THE OPERATOR'S RESPONSIBILITY TO ENSURE THAT CHANGES BEING MADE DO NOT CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT.

Keyswitch: **Run** or **Run/Program Protect**

Placing the keyswitch in this position enables the processor to scan memory and control outputs. This position prevents normal reference ladder diagram programming. The program loader is used in this keyswitch position to monitor I/O and register data, to force I/O, and to make register data changes.

9-8. FUSES

The location and number of fuses are dependent on the type of processor used and on which power supply version is present for PC-700 applications. The troubleshooting parameter for each fuse configuration follows.

9-9. PC-700 Version 1 Power Supply

This PC-700 processor and power supply combination is protected by three replaceable fuses. Two of these fuses are located in the Version 1 power supply unit; the third is mounted on the user memory module. Figure 9-9 shows the location of the two power supply line fuses. The Version 1 power supply provides 120 V operation only and uses two 4 A, 250 V, 3 AG fuses.

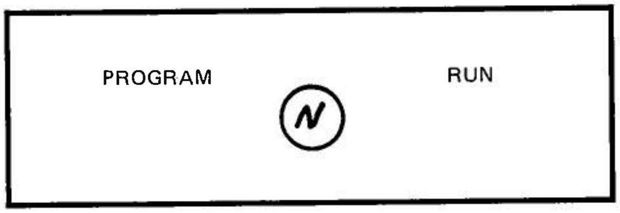

Figure 9-4. Keyswitch Positions for PC-700, Version 1

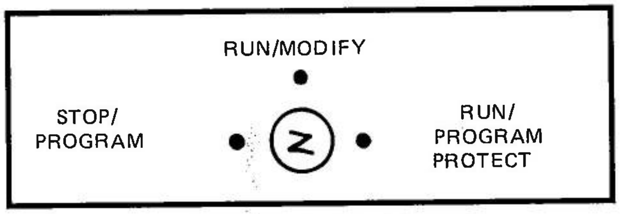

Figure 9-5. Keyswitch Positions for PC-700, Version 2 with Online Programming Option

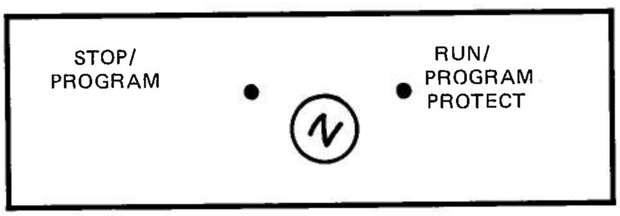

Figure 9-6. Keyswitch Positions for PC-700, Version 2 without Online Programming Option

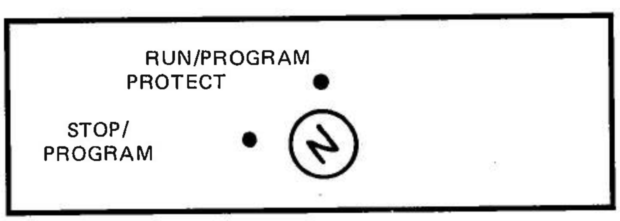

Figure 9-7. Keyswitch Positions for PC-900 A/B without Online Programming Option

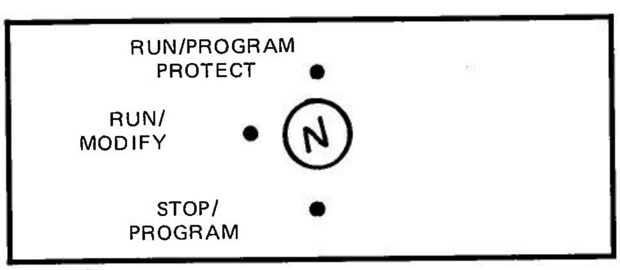

Figure 9-8. Keyswitch Positions for PC-900 A/B with Online Programming Option

The user memory module used with this Version 1 power supply is different from that used in Version 2 power supply applications. The user memory module for Version 2 does not contain a battery recharge circuit. The memory module for the Version 2 power supply has a 0.5 A, 8 AG fuse in addition to a non-replaceable pico fuse to prevent insertion into a programmable controller with a Version 1 power supply. If the pico fuse blows, return the programmable controller to **Numa-Logic** for replacement and testing.

The power supplies pico fuse (F3) is located behind the transformer (see Fig. 9-9). This is a 2.5 A pico fuse which protects the power supply from damage due to overloading caused by I/O malfunctions. This fuse is soldered in and should not be replaced in the field. The processor should be returned to the factory for repair.

The loss of either or both line fuses is easily detectable in that the processor completely shuts down.

Figure 9-10 shows the location of the user memory module fuse. This fuse is accessible from the front of the unit and protects the memory backup battery circuit. Whenever a battery test fails, this fuse should be checked. Also, if the PC-700 processor has been stored for an extended period of time, this fuse may have been previously removed. This fuse is a 0.5 A, 8 AG fuse installed in Fuse Holder FU-1.

CAUTION

All three fuses should be replaced with fuses of similar type and value.

9-10. PC-700 Version 2 Power Supply

This PC-700 processor and power supply combination is protected by three internal/replaceable fuses. Two of these fuses are located in the Version 2 power supply unit; the third fuse is mounted on the user memory module. Figure 9-11 shows the locations of the two power supply line fuses. Unlike the Version 1 power supply, this supply provides user-selectable 120 V or 240 V operation. For 120 V operation, this supply uses two 4 A, 250 V, 3 AG fuses. For 240 V operation, two 2 A, 250 V, 3AG fuses are used.

CAUTION

Ensure that the proper fuse sizes for the selected operation are installed.

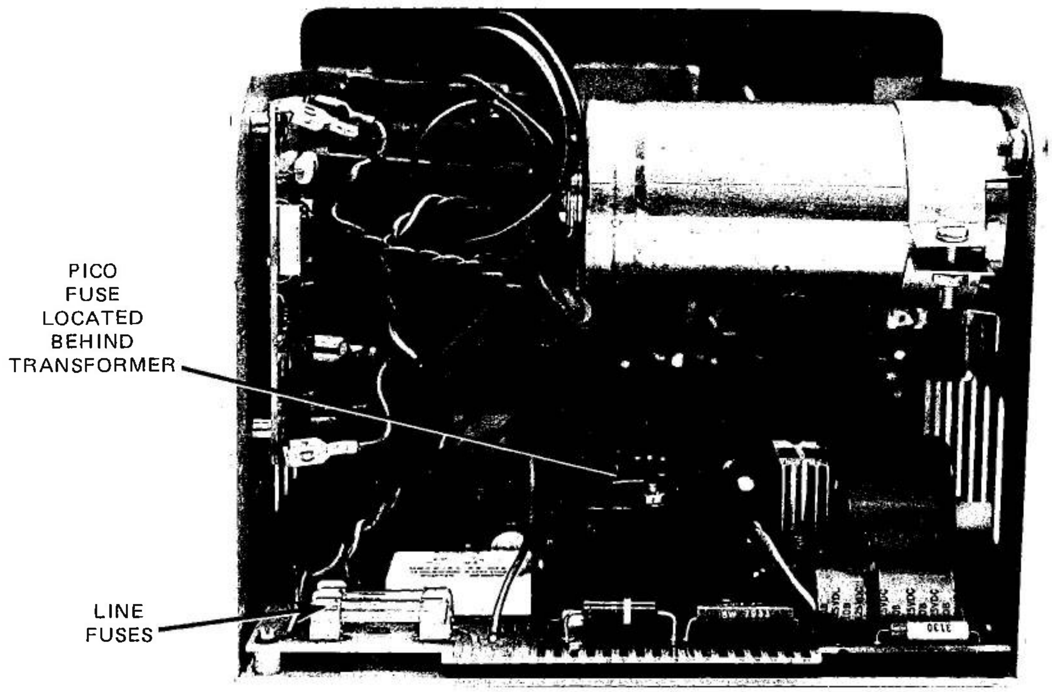

Figure 9-9. PC-700 Version 1 Power Supply Line Fuse Locations

This Version 2 power supply contains crowbar circuitry which shuts down this supply if overloading occurs due to I/O malfunctions. When the Version 2 power supply is shut down in this manner, power must be removed and re-applied after a minimum of one minute to reset the circuitry.

9-11. PC-900 Power Supply

The PC-900 processor and power supply module are protected by one replaceable fuse located on the front panel, under an easily accessible cover. Figure 9-3 shows this front panel-mounted line fuse. The PC-900 offers three input power options, each with its own fuse requirements, as follows:

- 240 Vac operation — 2 A, 250 V, 3 AG
- 120 Vac operation — 4 A, 250 V, 3 AG
- 24 Vdc operation — 7 A, 250 V, 3 AB

CAUTION

Ensure that the proper fuse size for the selected operation is installed.

The other fuse is mounted on the PC-900 motherboard in the power supply area. This is a 2.5 A pico fuse that protects the power supply from damage due to overloading caused by I/O malfunctions.

As in the case of the PC-700 Version 1 power supply, the loss of the PC-900 line fuse is easily detectable. When the line fuse blows, the processor completely shuts down.

9-12. FAULT REGISTER DATA

Both the PC-700 and PC-900 Programmable Controllers provide program loader display of fault register messages. This register contains fault messages, which result from the

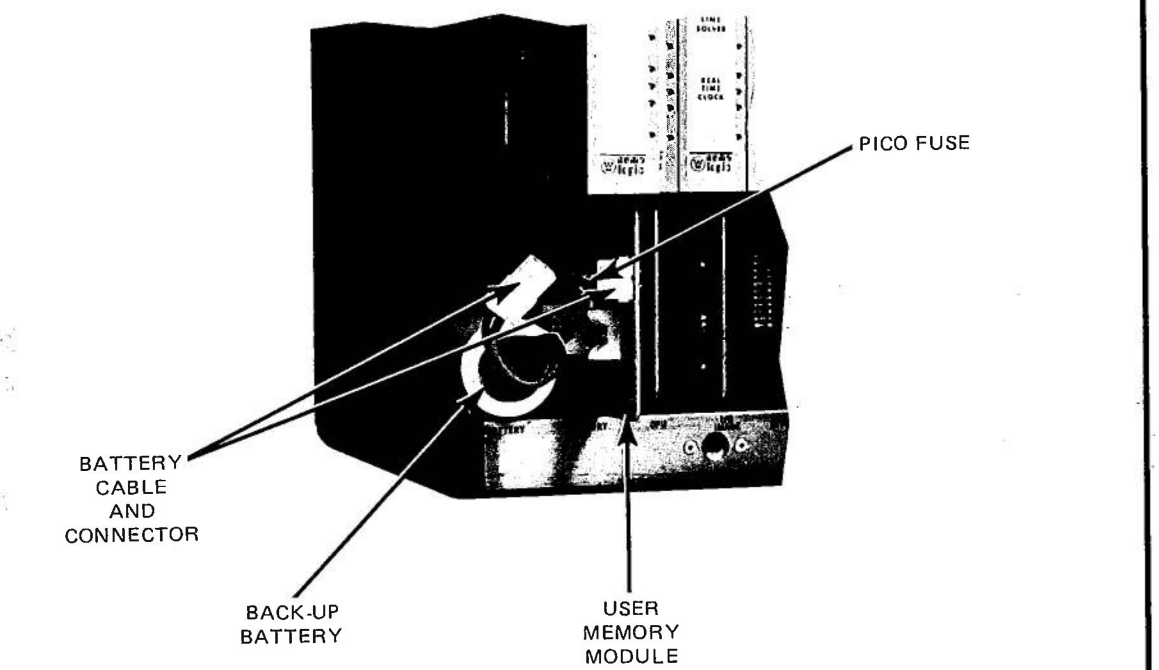

Figure 9-10. PC-700 Version 1 User Memory Module Pico Fuse

processor's internal, self-diagnostic tests. This fault register display feature enables the user to rapidly diagnose and correct system problems. The procedures for interpreting fault register messages are provided in the following paragraphs.

9-13. Pre-check Procedure

Prior to interpreting the fault register displays, complete the following checks:

1. Check to see that the processor is correctly connected to control power. Check the wiring and grounding circuits associated with both the processor and I/O system. Improper grounding can cause sporadic "nuisance faults" within a system.
2. Check for blown fuses or tripped circuit breakers in the associated wiring.
3. Check to see that all rack, rocker and module I/O switches are set correctly.
4. Check to see that all modules, including those in the processor, are properly seated and in the appropriate socket.
5. Check to see that all interconnecting cables are properly connected.
6. Check to see that all other front panel indicators, other than **Fault**, are correct.

9-14. PC-700 Fault Register Interpretation

The display field for the PC-700's 16-bit fault register is shown in Figure 9-12. As shown, Bits 1 through 3 act as an I/O monitor field, indicating

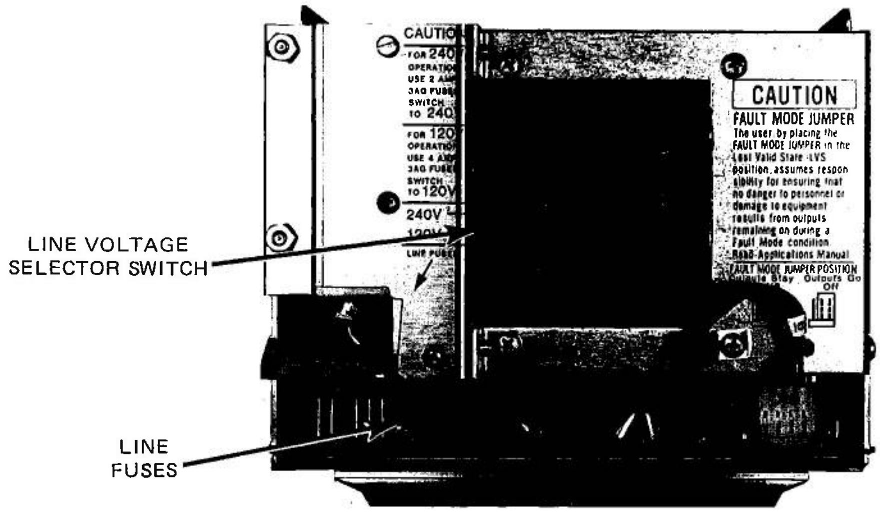

Figure 9-11. PC-700 Version 2 Power Supply Line Fuse Locations

errors within the I/O structure of a PC-700 system. Bits 6 through 8, and 10 through 16 display other error conditions within the PC-700 system. Bits 4, 5, and 9 of the fault register are not used for PC-700 applications.

Table 9-1 lists the I/O monitor field fault indications. Figure 9-13 provides a troubleshooting flowchart to aid in resolving any errors detected. Use this table and figure to evaluate and correct I/O failures. Table 9-2 lists the fault and suggested action for each remaining bit displayed in the fault register.

9-15. PC-900 Fault Register Interpretation

The display field for the PC-900's 16-bit fault register is shown in Figure 9-14. As shown, Bit 6 is unused and all other bits display error conditions within the PC-900 system.

Table 9-3 lists each fault and its suggested action for each bit displayed in the fault register. Use this table and Figure 9-13 to troubleshoot PC-900 system faults.

9-16. COMMUNICATIONS ERROR

In either the PC700 or PC-900 applications, an error in communications can occur between the program loader and processor. A communications error occurs when the program loader cannot acquire and present requested data including fault register data for evaluation. Use the following procedure to evaluate and correct this type of error.

1. **PC-700/900** — Ensure that the power is present for both the processor and program loader.

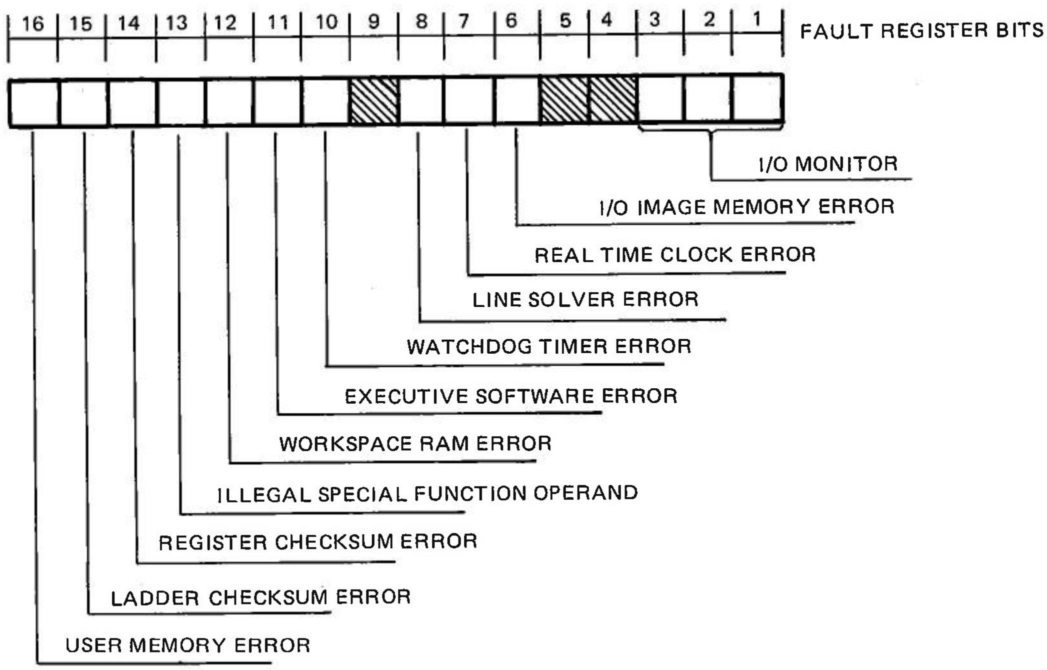

Figure 9-12. PC-700 Fault Register Display

TABLE 9-1. PC-700 I/O MONITOR FIELD FAULTS

I/O Monitor			Indicated Fault	Suggested Action In Figure 9-13
Bit 3	Bit 2	Bit 1		
0	0	0	None	None
0	0	1	Input Data Error	Enter 2
0	1	0	Control Line Error	Enter 2
0	1	1	Output Data Error	Enter 2
1	0	0	Output Strobe Error	Enter 2
1	0	1	I/O Bus Error	Enter 1

2. **PC-700/900 —** If a communications error occurs during a power up, turn the program loader OFF, and then back ON to clear the error. Communications errors normally occur on power up, due to the reframe sequence (approximately two to four seconds).

3. **PC-700/900 —** If a communications error occurs during initialization, repeat the initialization before taking other corrective actions. Momentary communications errors normally occur at the end of intialization sequences, or during tests that can cause the loader to reframe. If the error exists more than 10 to 15 seconds, communications have failed; therefore, check the baud rates.

4. **PC-700/900 —** Check to see that the communications cable runs from the proper processor port to the appropriate portion of the program loader. Check to see that communications cable connectors are seated properly. Ensure that processor port is set up and implemented for use with the program loader.

5. **PC-700/900 —** If the **Power OK** or **DC OK** indicator does not light, the power supply is defective; replace the processor. If a processor is not available, contact the Westinghouse Service Representative for a replacement.

CAUTION

The PC-900 processor's power supply is part of the PC-900 case. In this instance, the PC-900 processor should be returned to the factory for replacement.

6. **PC-700/900 —** Check to see that all internal processor modules are located in proper slots and sealed properly. Figure 9-15 shows the PC-700 module locations and Figure 9-16 shows the PC-900 module locations.

7. **PC-700 only —** Check to see that the jumper is installed on the CPU module's connector, between Pins 8 and 9 from the right or top of the inner row. The jumper connects the PROMs with the microprocessor; therefore, the processor will not operate if the jumper is missing. See Figure 9-17.

8. **PC-700 only —** Check to see that the UART IC is securely seated and positioned properly into its socket on the I/O interface module. See Figure 9-18.

9. **PC-700 only —** Check to see that the microprocessor IC and EPROMs are securely seated and positioned properly into their sockets on the CPU module. See Figure 9-17.

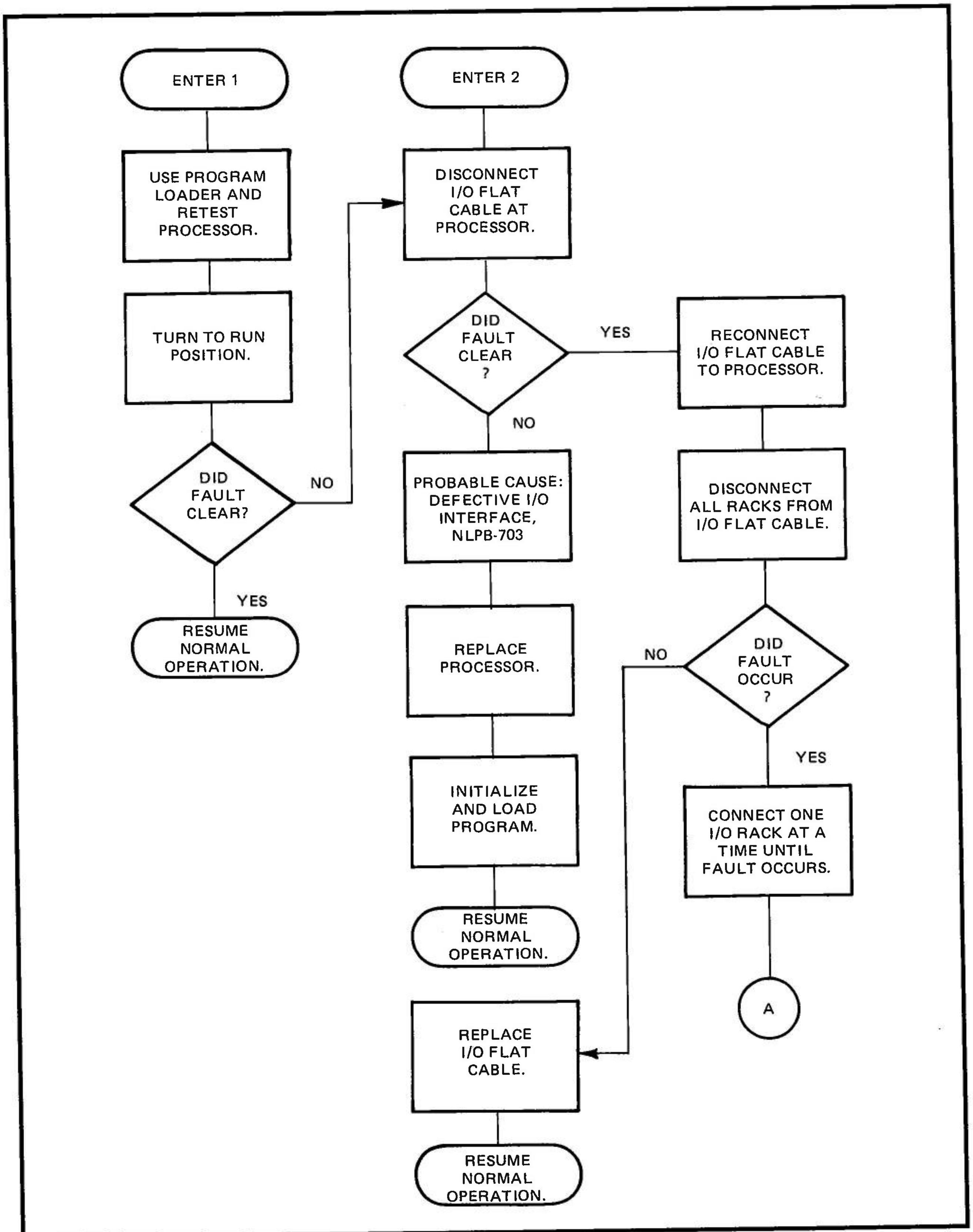

Figure 9-13a. PC-700/900 I/O Troubleshooting Flowchart

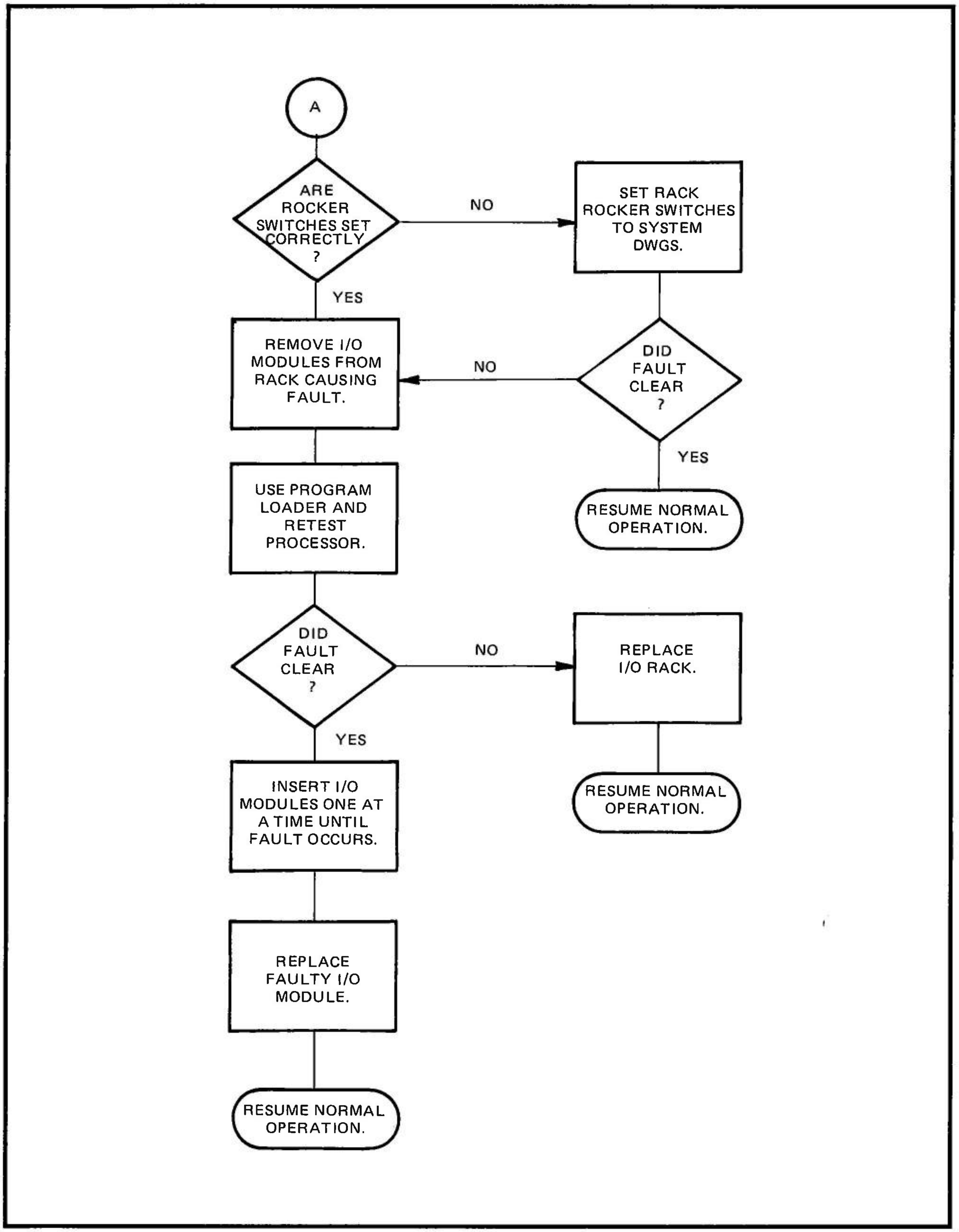

Figure 9-13b. PC-700/900 I/O Troubleshooting Flowchart (Cont'd)

TABLE 9-2. PC-700 FAULT REGISTER INTERPRETATION

Bit	Indicated Fault	Suggested Action
1 to 3	See Table 9-1	See Table 9-1.
6	1 = I/O Image Memory Error	See Figure 9-19.
7 8	1 = Real-Time Clock Error 1 = Line Solver Error	See Figure 9-20.
10	1 = Watchdog Timer Error	This fault normally results from: 1. A program that takes longer to execute than the 100 msec the processor allows. 2. Possible cause: a program with too many complex functions being performed on the same scan. If this fault occurs during programming installation and checkout, re-examine the program and re-program, as necessary. If this fault occurs after a program has run successfully for an extended period of time, the program may not be at fault. In this case, perform the troubleshooting procedure shown in Figure 9-21.
11	1 = Executive Software Error	This fault results from: 1. The loading of a special function, or 2. The attempt to load a function not supported by the processor. If, when loading, the "SF Not Supported" message is overridden, the tape loader could have loaded an unsupported special function and can cause this error. If this fault occurs, change the processor to a version that supports the special function. Possible causes are incorrect software and the wrong version of the CPU module.
12	1 = Workspace RAM Error	See Figure 9-22.

TABLE 9-2. PC-700 FAULT REGISTER INTERPRETATION (Cont'd)

Bit	Indicated Fault	Suggested Action
14	1 = Register Checksum Error	Manually verify register contents (in particular, contents containing preset values). If the register contents are valid, perform the troubleshooting procedures shown in Figure 9-23. This error only occurs on power up. Check the battery status and for overloaded I/O (i.e., too many modules for processor power).
15	1 = Ladder Checksum Error	See Figure 9-24.
16	1 = User Memory Error	Ensure that the user memory module is properly seated in its motherboard socket and reload the program. Also check the battery and ensure that all modules are seated. If the error still occurs, replace the processor. Possible cause: CPU memory module.

10. **PC-900 only** — The baud rate for the program loader to processor communications is determined by dip switches on the interface module. Check to see that the appropriate baud rate has been selected. See the "Programmable Controller Communications Manual" (NLAM-B58) for the proper setting.

11. **PC-700/900** — Check to see that both the program loader and the processor use the same line power. When different power sources are used, improper line phasing can occur, which can damage the processor's and program loader's communications port logic.

CAUTION

Whenever the processor's interface module has failed, line phasing between the program loader and the processor must be checked as a possible cause. If the interface module is replaced without resolving line phasing problems, the new card can also be damaged. Check the jumpers for the baud rate and data format in the PC-700 and the program loader. (See the "Programmable Controller Communications Manual" (NLAM-B58) for the proper settings.) Check the program loader to see if it communicates with another processor to ensure that the problem is not with the loader.

12. **PC-700 only** — If the preceding steps have not cleared the communications error, the probable cause is the PC-700's interface module. In this case, replace the programmable controller and return it to Westinghouse for repair. Also, recheck the communications.

CAUTION

Switching PC-700 modules may cause an improper version of the module to be used, which can cause system failures.

13. **PC-700 only** — If Step 12 does not clear the communications error, the probable cause is the PC-700's CPU module. In this case, replace the programmable controller and return it to Westinghouse for repair. Also, recheck the communications.

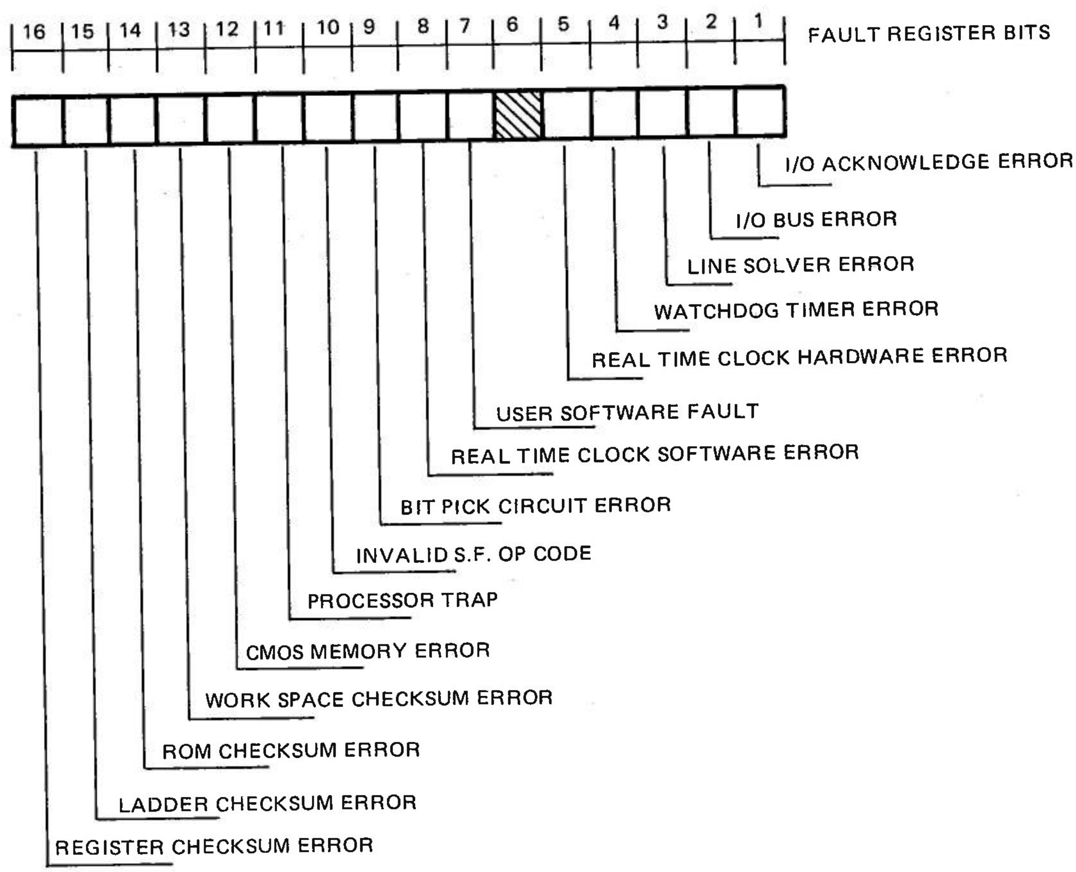

Figure 9-14. PC-900 Fault Register Display

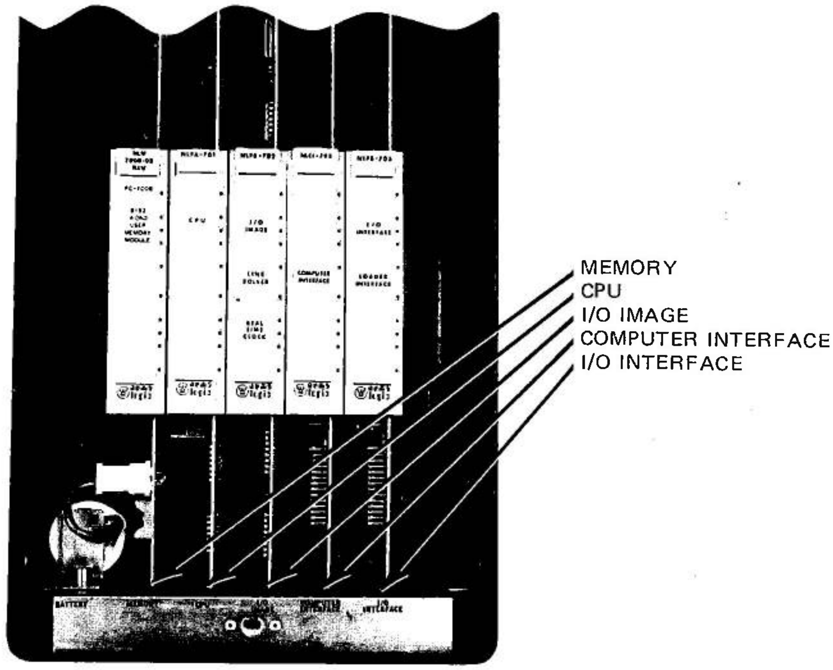

Figure 9-15. PC-700 Module Locations

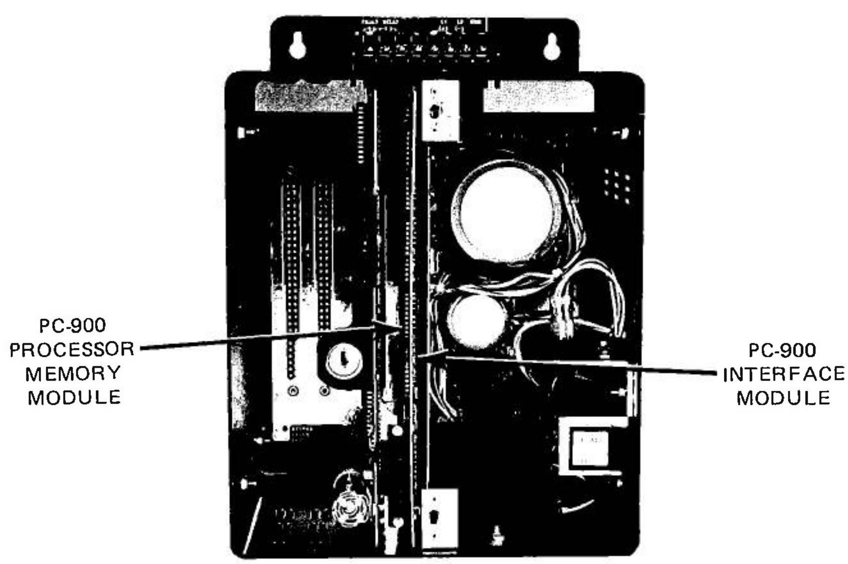

Figure 9-16. PC-900 Module Locations

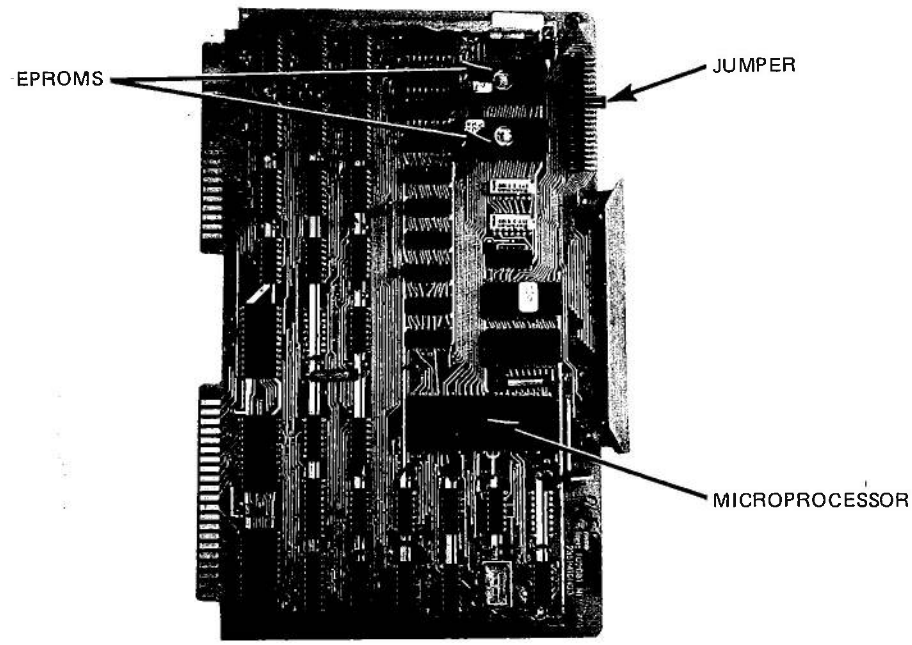

Figure 9-17. PC-700 CPU Module Jumper Location

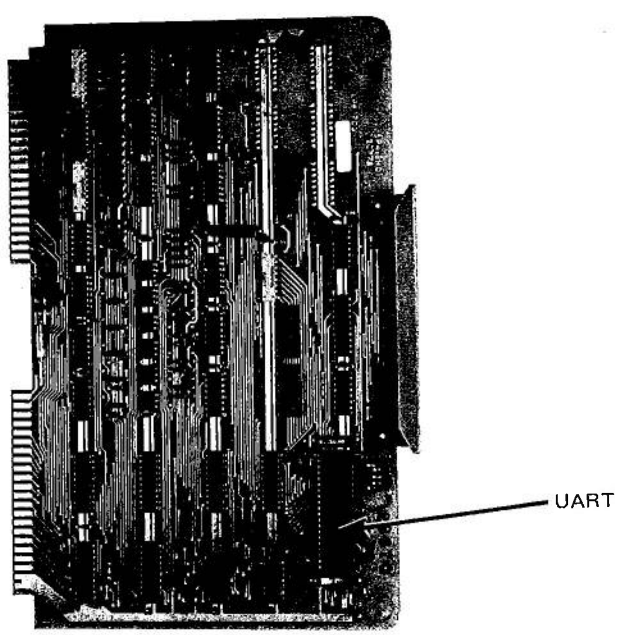

Figure 9-18. PC-700 I/O Interface Module UART Location

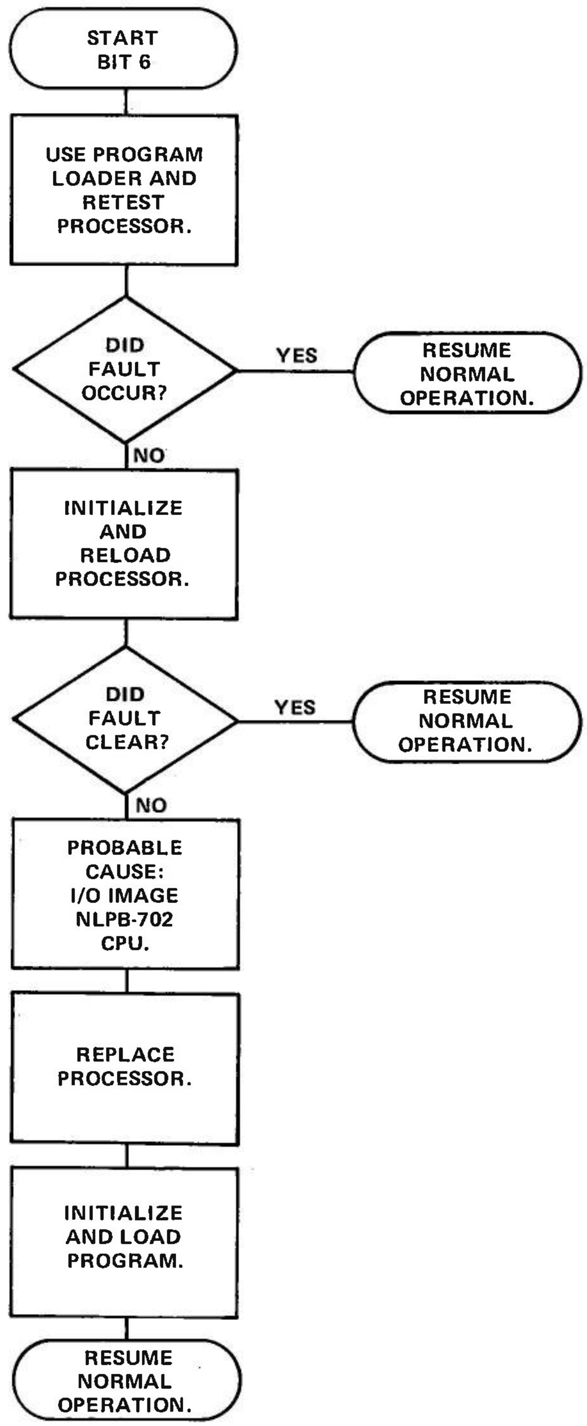

Figure 9-19. PC-700 I/O Image Memory Error Correction Procedure

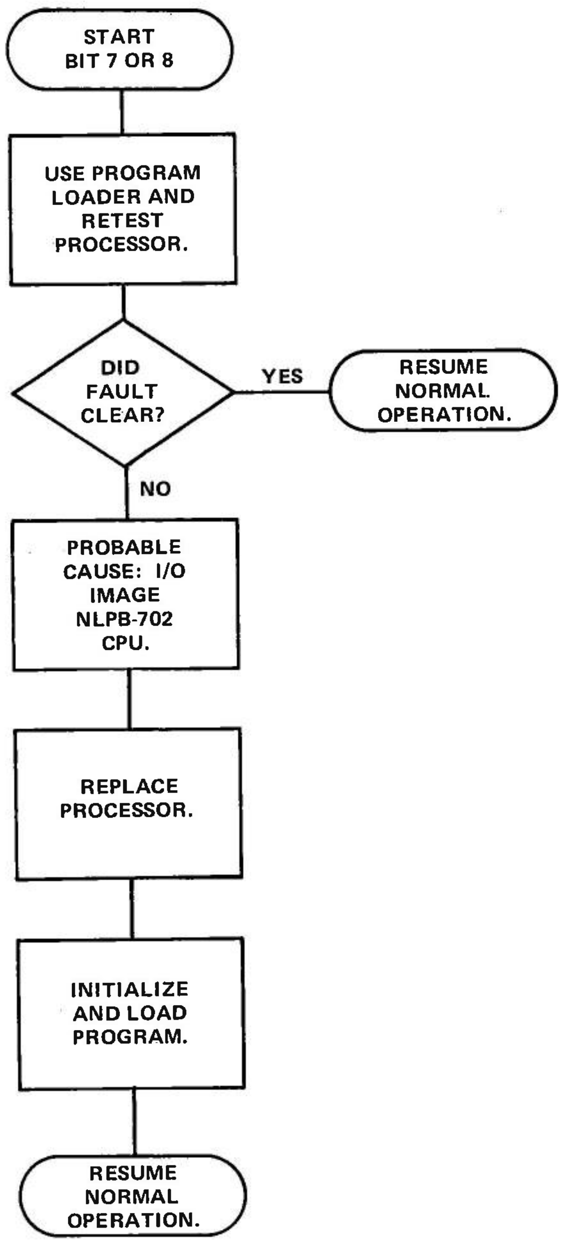

Figure 9-20. PC-700 Real-Time Clock Error/Line Solver Error Correction Procedure

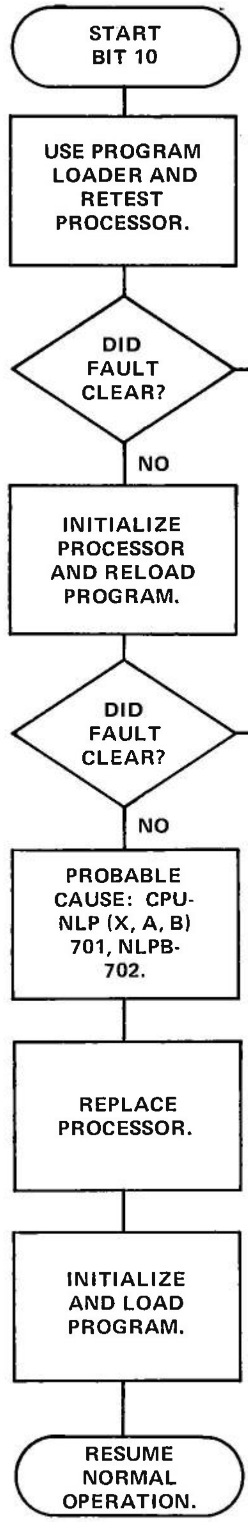

Figure 9-21. PC-700 Watchdog Timer Error Correction Procedure

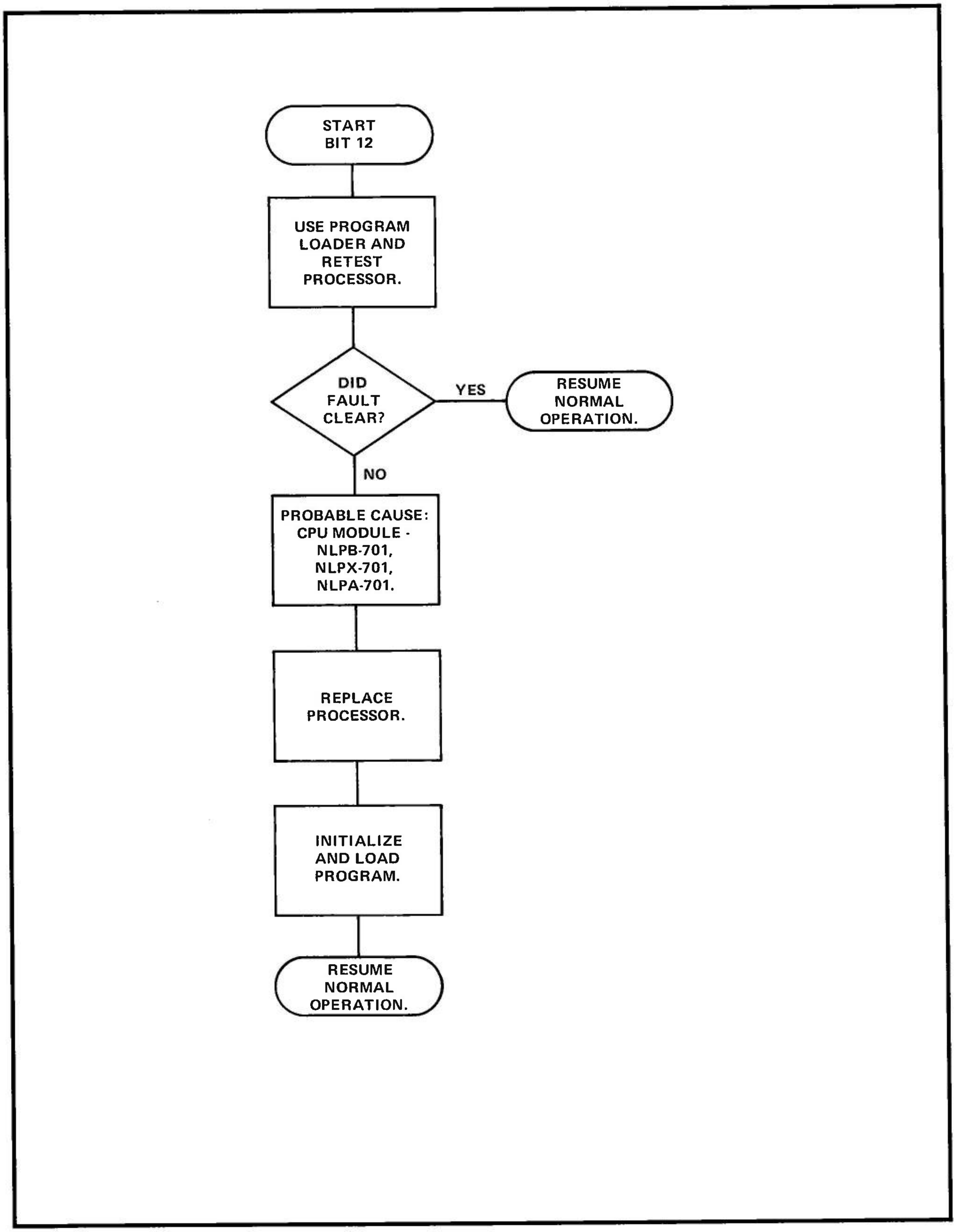

Figure 9-22. PC-700 Workspace RAM Error Correction Procedure

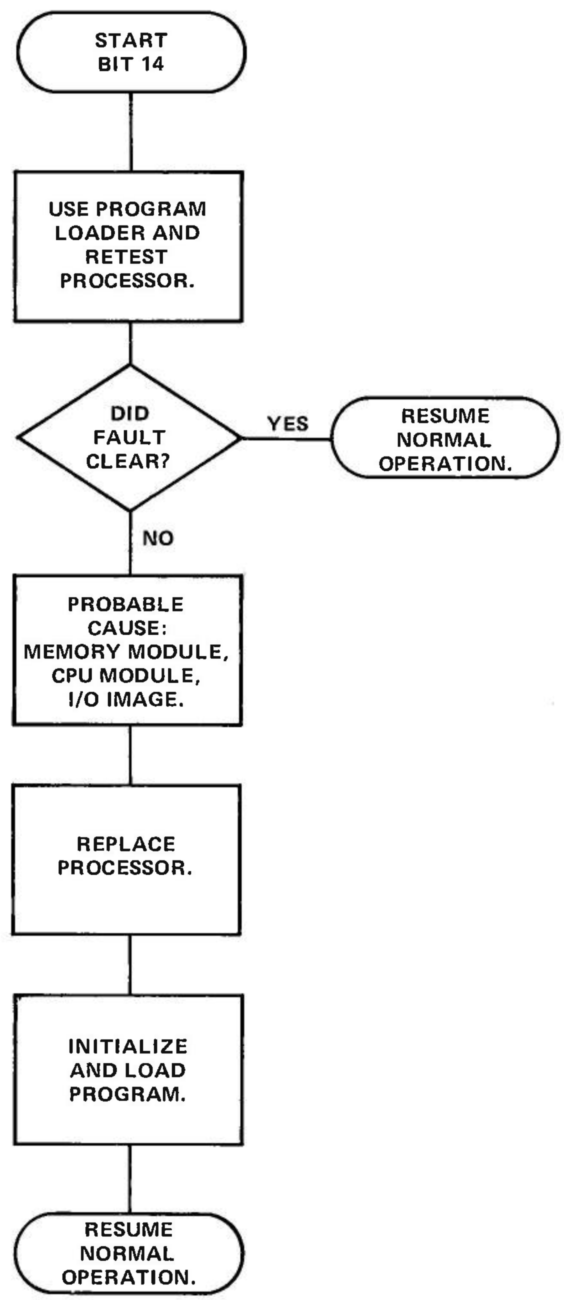

Figure 9-23. PC-700 Register Checksum Error Correction Procedure

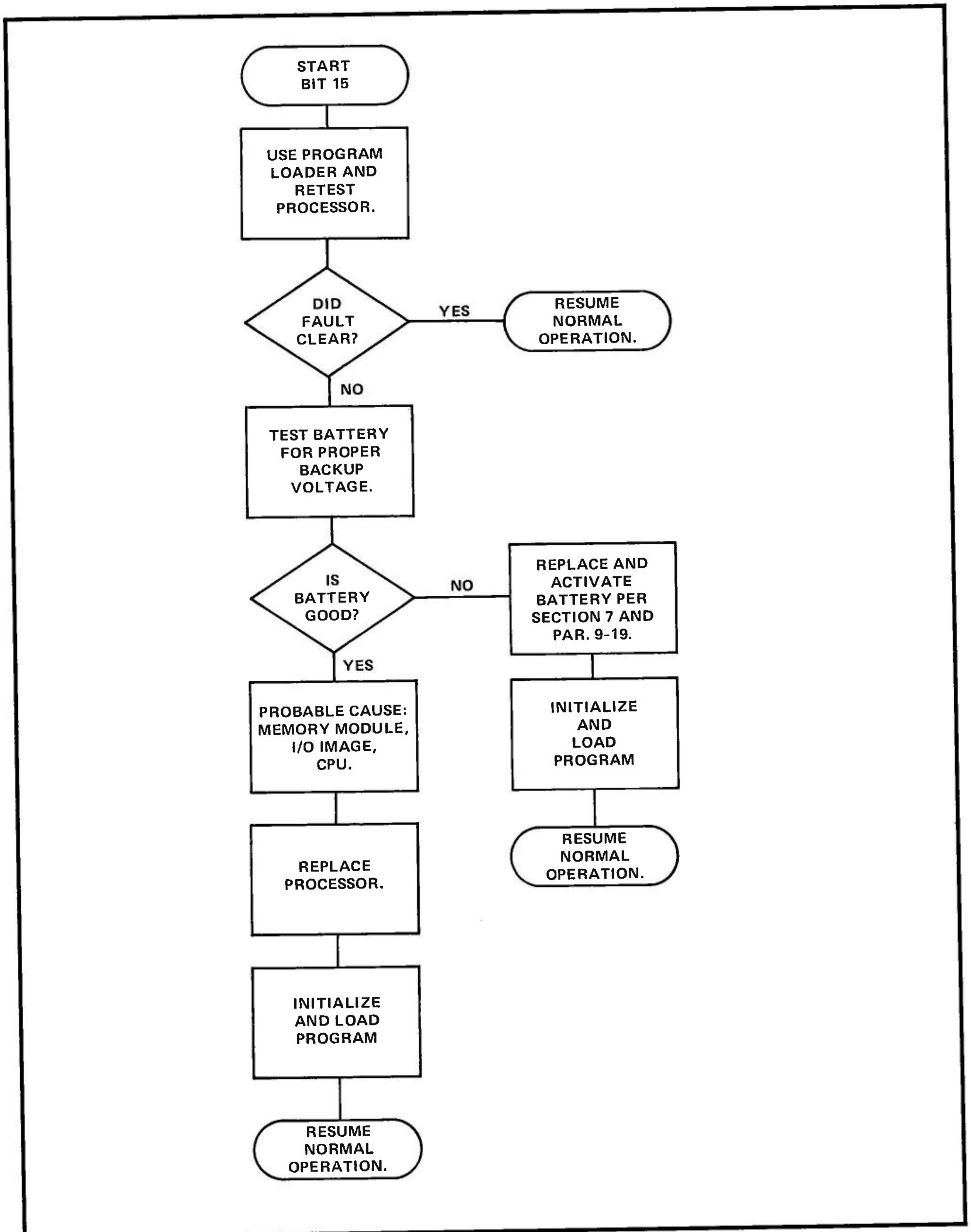

Figure 9-24. PC-700 Ladder Checksum Error Correction Procedure

TABLE 9-3. PC-900 FAULT REGISTER INTERPRETATION

Bit	Indicated Fault	Suggested Action
1 2	1 = I/O Acknowledge Error 1 = I/O Bus Error	Go to Figure 9-13, ENTER 2.
3	1 = Line Solver Error	See Figure 9-25.
4	1 = Watchdog Timer Error	**CAUTION** **If this fault occurs in combination with any other fault, check the other fault cause first.** See Figure 9-26.
5	1 = Real-Time Clock Hardware Error	See Figure 9-27.
7	1 = User Software Fault	This fault occurs when the user improperly programs a Literal function with the wrong data or operand. When this fault occurs: 1. Use the program loader and retest the processor to clear the fault. 2. Re-program the function correctly. **CAUTION** **If the fault only is cleared and the function is not reprogrammed correctly, the fault recurs.**
8	1 = Real-Time Clock Software Error	See Figure 9-28.
9	1 = Bit Pick Circuit Error	See Figure 9-29.
10	1 = Invalid SF OP Code	This fault indicates that a special function is resident in memory, which is not supported by the processor. The fault can also occur when loading a tape and an unsupported special function is overridden. To clear this invalid special function: 1. Use the program loader and retest the processor. 2. With the keyswitch still in the **Stop/Program** position, find the rung containing the invalid special function. 3. Delete the invalid special function. **Note** Use the processor with the software version that supports the special function.

TABLE 9-3. PC-900 FAULT REGISTER INTERPRETATION (Cont'd)

Bit	Indicated Fault	Suggested Action
11	1 = Processor Trap	See Figure 9-30.
12	1 = CMOS Memory Error	See Figure 9-31.
13	1 = Workspace Checksum Error	See Figure 9-32.
14	1 = ROM Checksum Error	See Figure 9-33.
15	1 = Ladder Checksum Error	See Figure 9-34.
16	1 = Register Checksum Error	See Figure 9-35.

14. **PC-700 only** — If Step 13 does not clear the communications error, the probable cause is the PC-700's power supply. In this case, replace the programmable controller and return it to Westinghouse for repair. Also, recheck the communications. Communications are not possible if the +12 Vdc or −12 Vdc supplies fail. These are the I/O interface module's operating voltages and do not affect the **Power OK** indicator. Therefore, this failure is not detected by Step 5.

15. **PC-900 only** — If the preceding steps have not cleared the communications error, the probable cause is the PC-900's interface module. In this case, replace the programmable controller and return it to Westinghouse for repair. Also, recheck the communications.

16. **PC-900 only** — If Step 15 does not clear the communications error, the probable cause is the PC-900's processor memory module. In this case, replace the programmable controller and return it to Westinghouse for repair. Also, recheck the communications.

17. **PC-900 only** — If Step 16 does not clear the communications error, return the PC-900 processor to the factory as a last step. The PC-900's case-mounted power supply assembly may have failed, and is not detectable in Step 5.

The program loader can communicate with the processor and not give a fault register display. Under these circumstances, it is difficult to locate faults. If this occurs, ensure that there is no "Improper Keyswitch" error message present. If an "Improper Keyswitch" error has occurred, either a wire to the keyswitch has become disconnected or the keyswitch has failed. If there is no keyswitch error, check the program loader as the probable source of this problem.

9-17. RANDOM FAULTS

If random faults occur frequently, and are cleared by using the program loader to retest the processor, the circuit module contacts may be contaminated. When random faults occur because of contact contamination, use the following procedure to clean each processor module's contact.

CAUTION

When handling a processor's modules, the user's personnel must be properly grounded to prevent damage to the module by electrostatic discharge. See paragraph 7-6 for details.

1. Turn OFF the power to the processor.

2. Remove the processor's front panel.

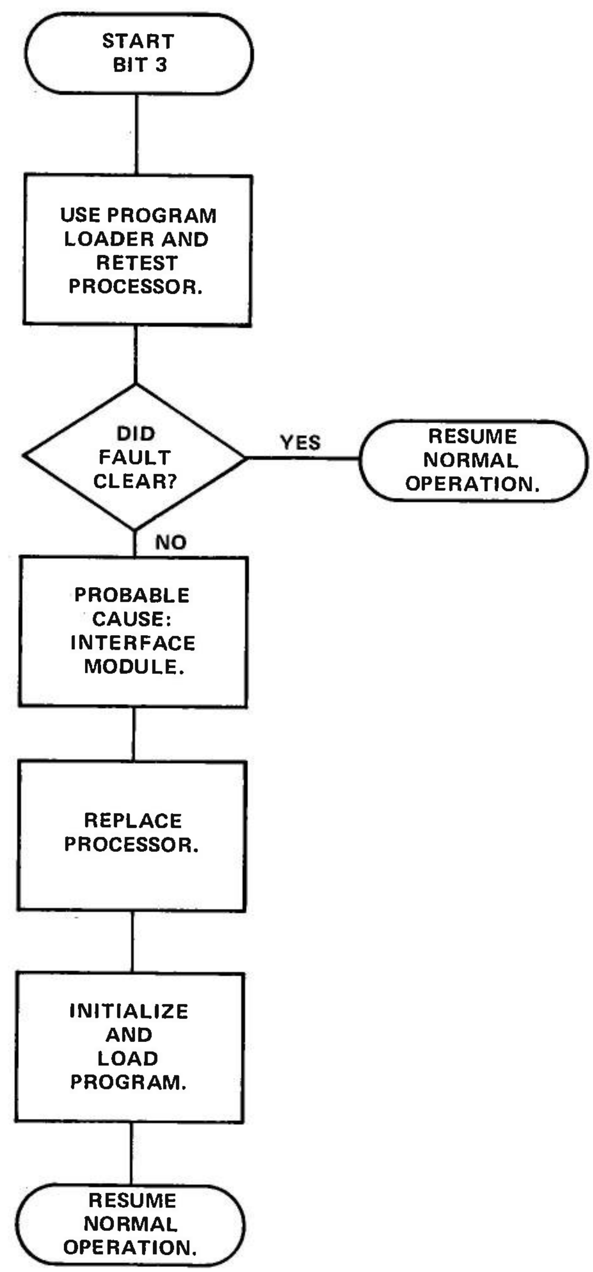

Figure 9-25. PC-900 Line Solver Error Correction Procedure

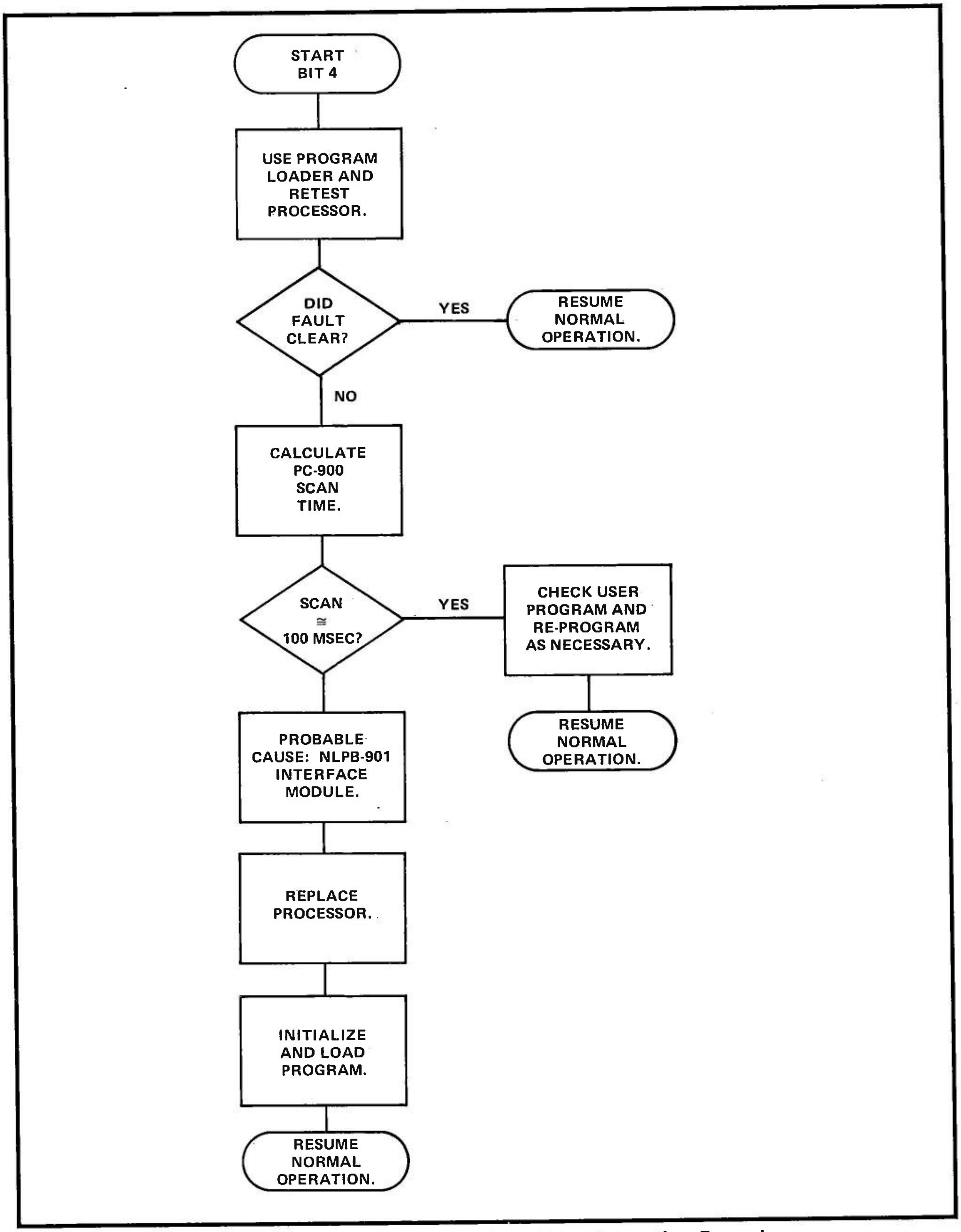

Figure 9-26. PC-900 Watchdog Timer Error Correction Procedure

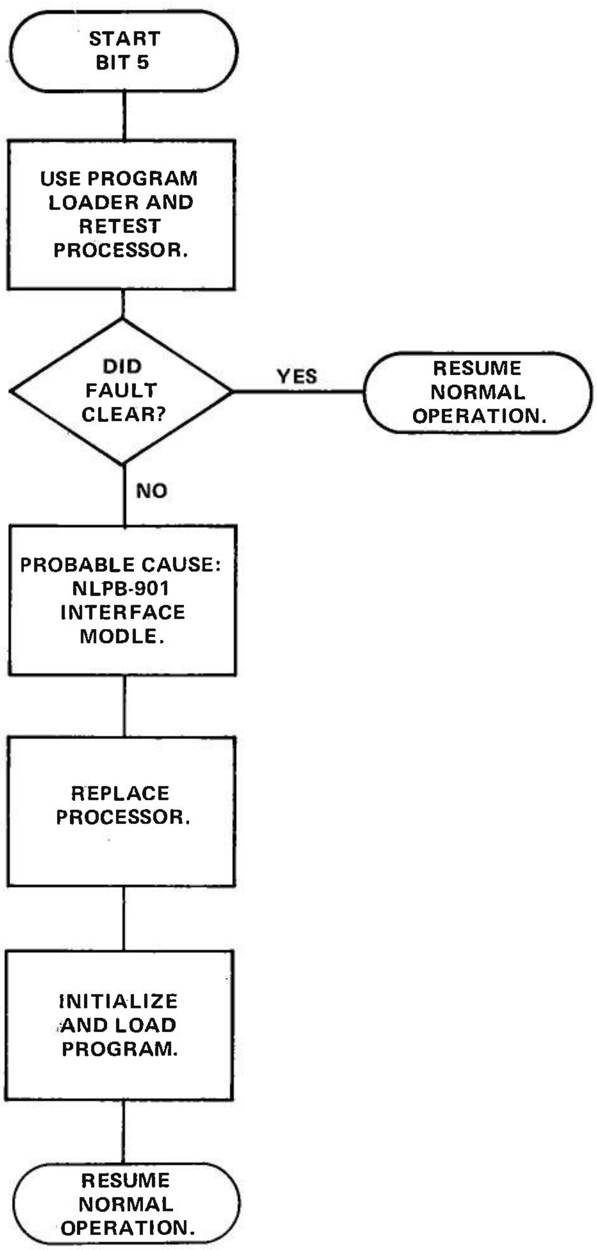

Figure 9-27. PC-900 Real-Time Clock Hardware Error Correction Procedure

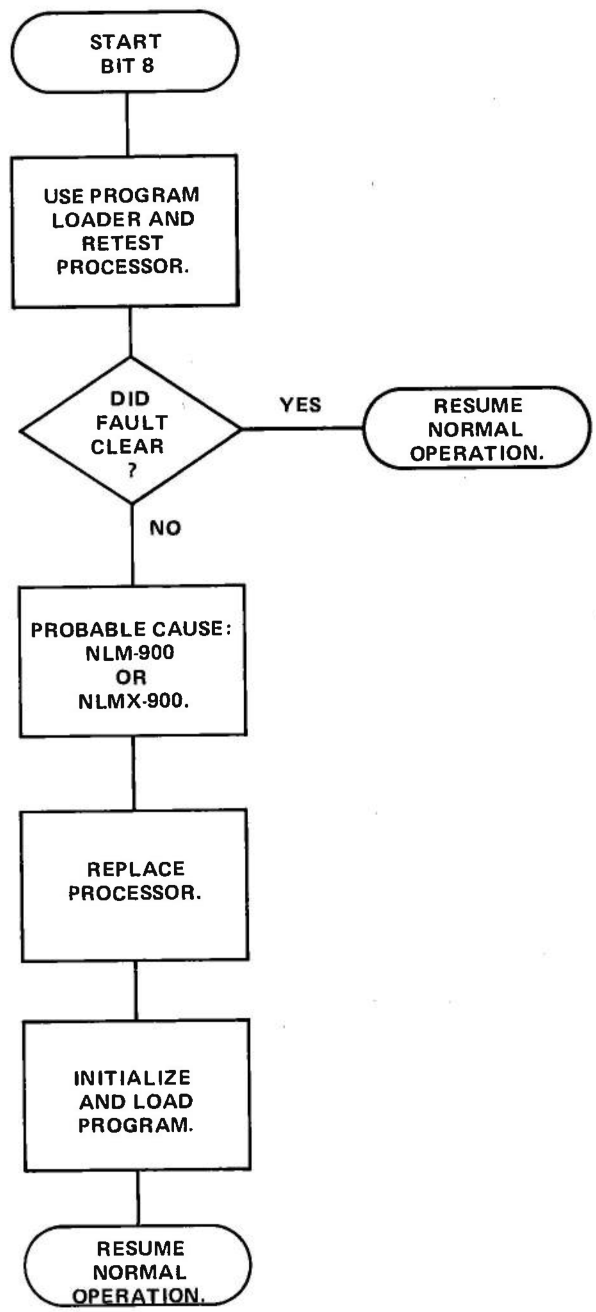

Figure 9-28. PC-900 Real-Time Clock Software Error Correction Procedure

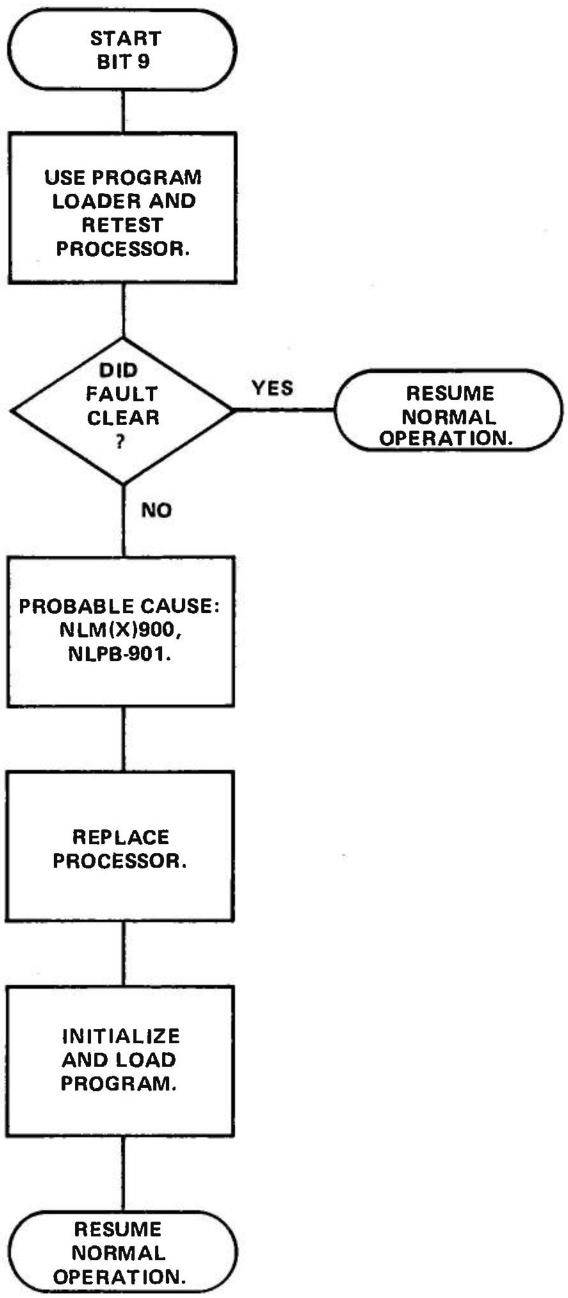

Figure 9-29. PC-900 Bit Pick Circuit Error Correction Procedure

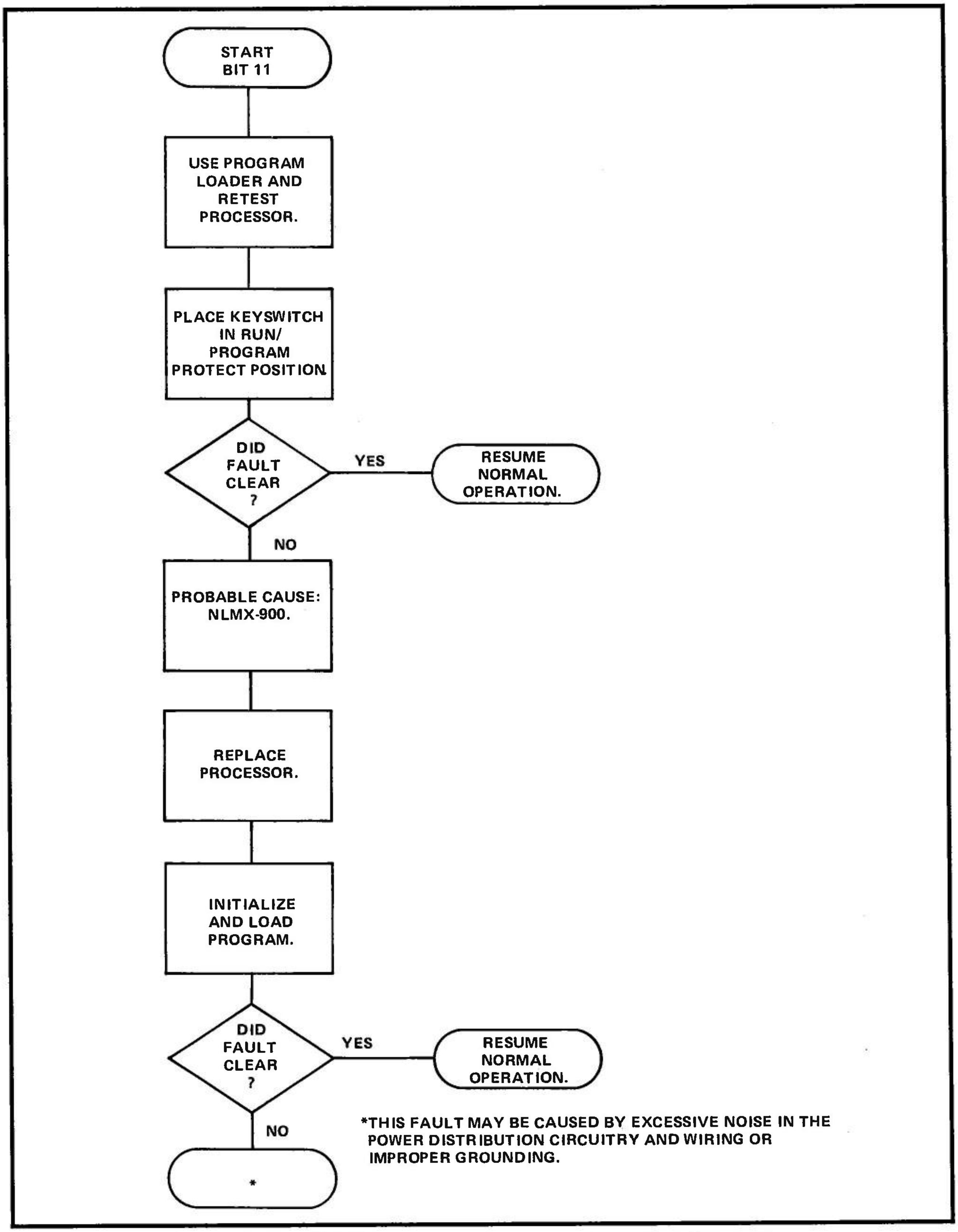

Figure 9-30. PC-900 Processor Trap Error Correction Procedure

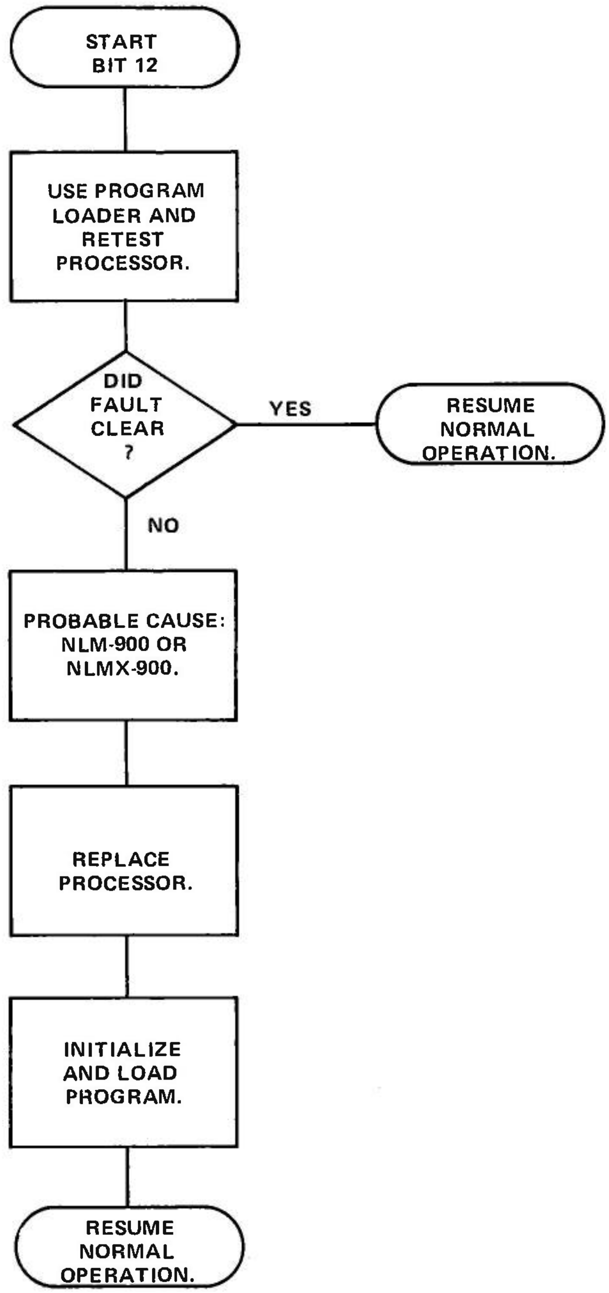

Figure 9-31. PC-900 CMOS Memory Error Correction Procedure

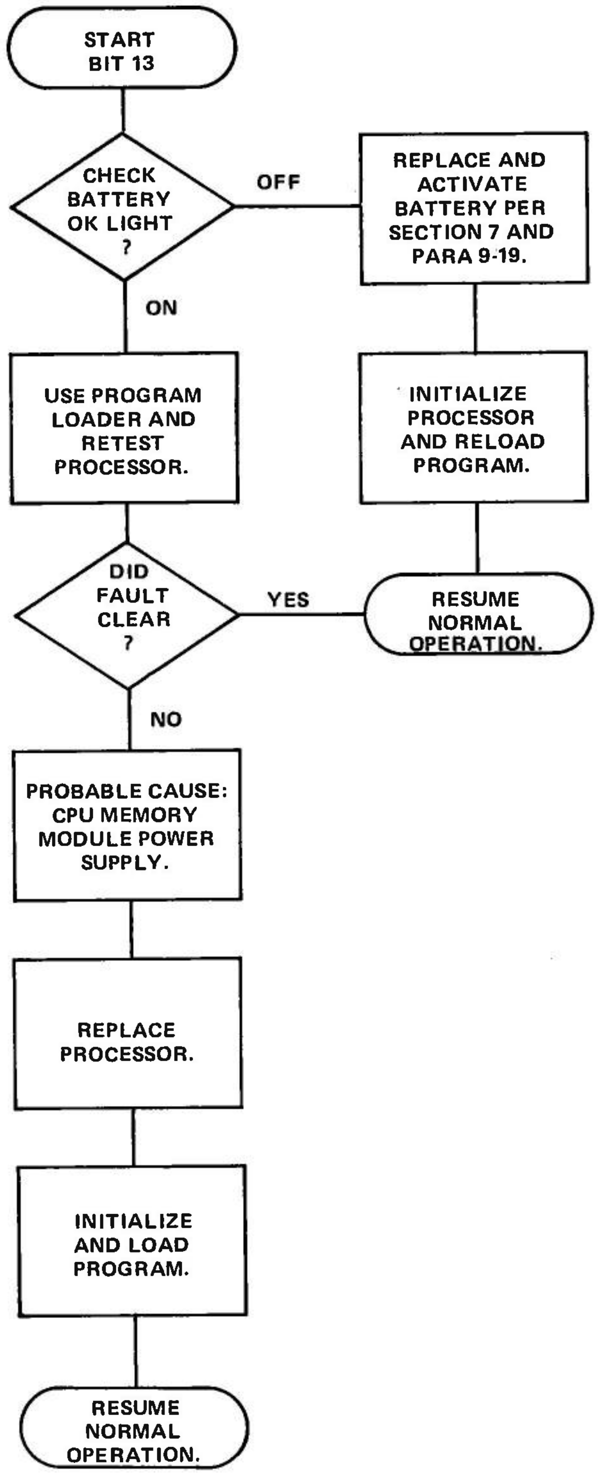

Figure 9-32. PC-900 Workspace Checksum Error Correction Procedure

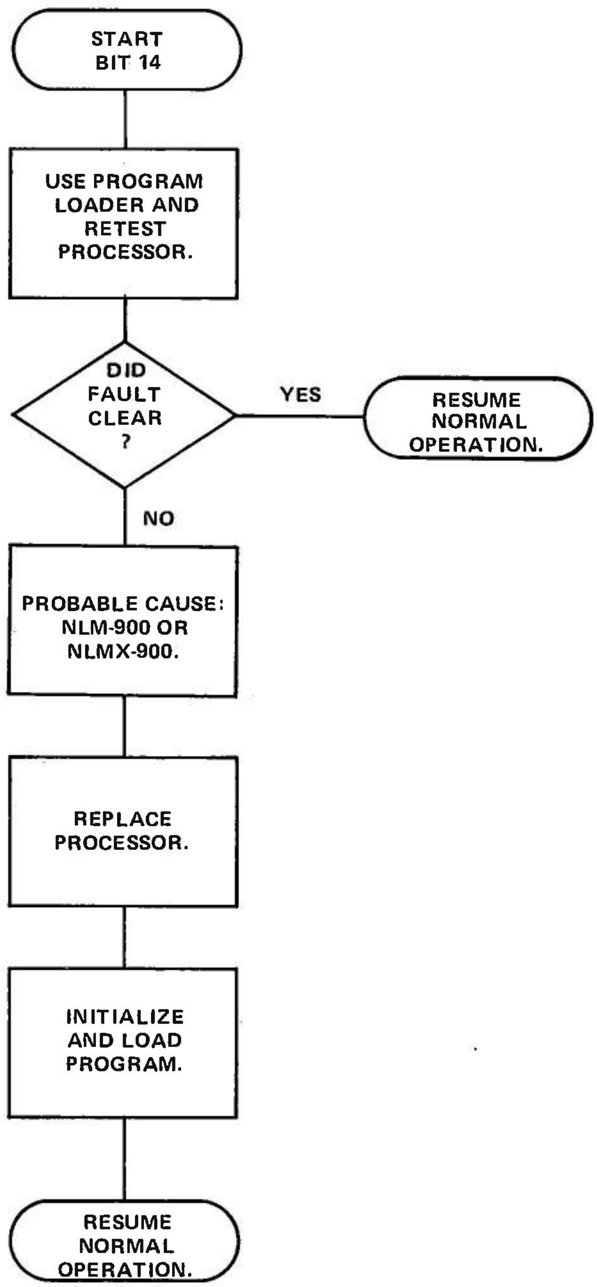

Figure 9-33. PC-900 ROM Checksum Error Correction Procedure

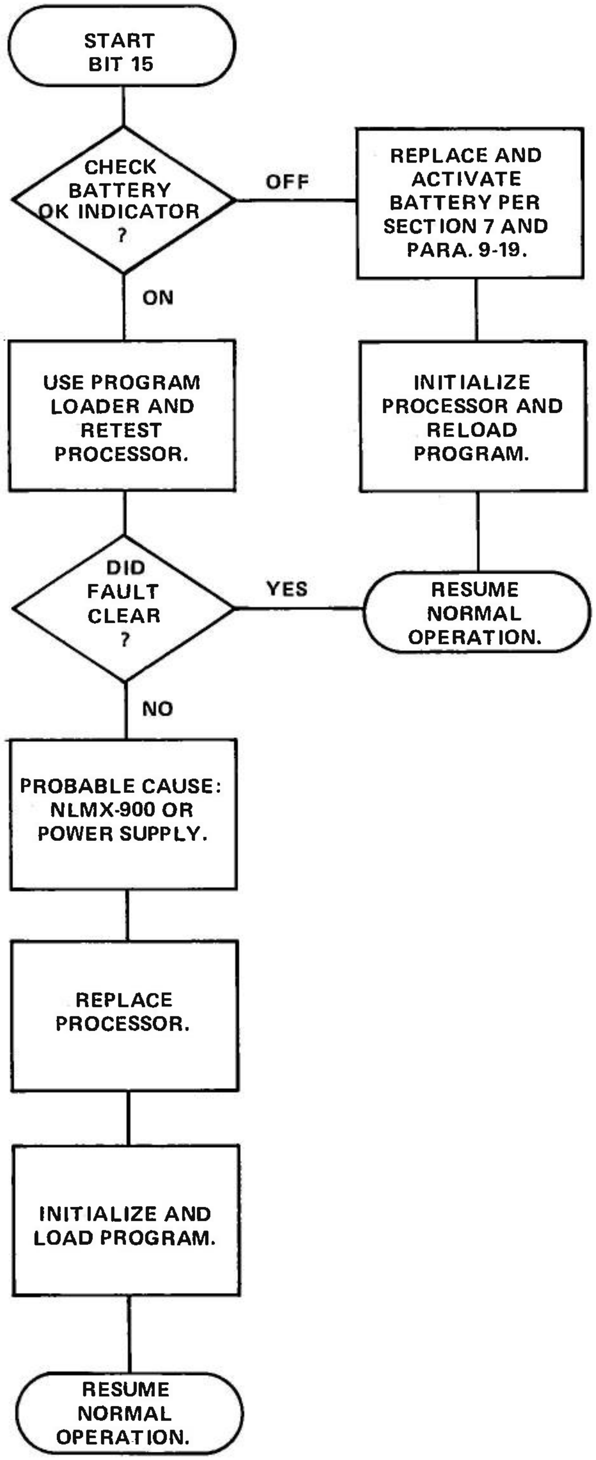

Figure 9-34. PC-900 Ladder Checksum Error Correction Procedure

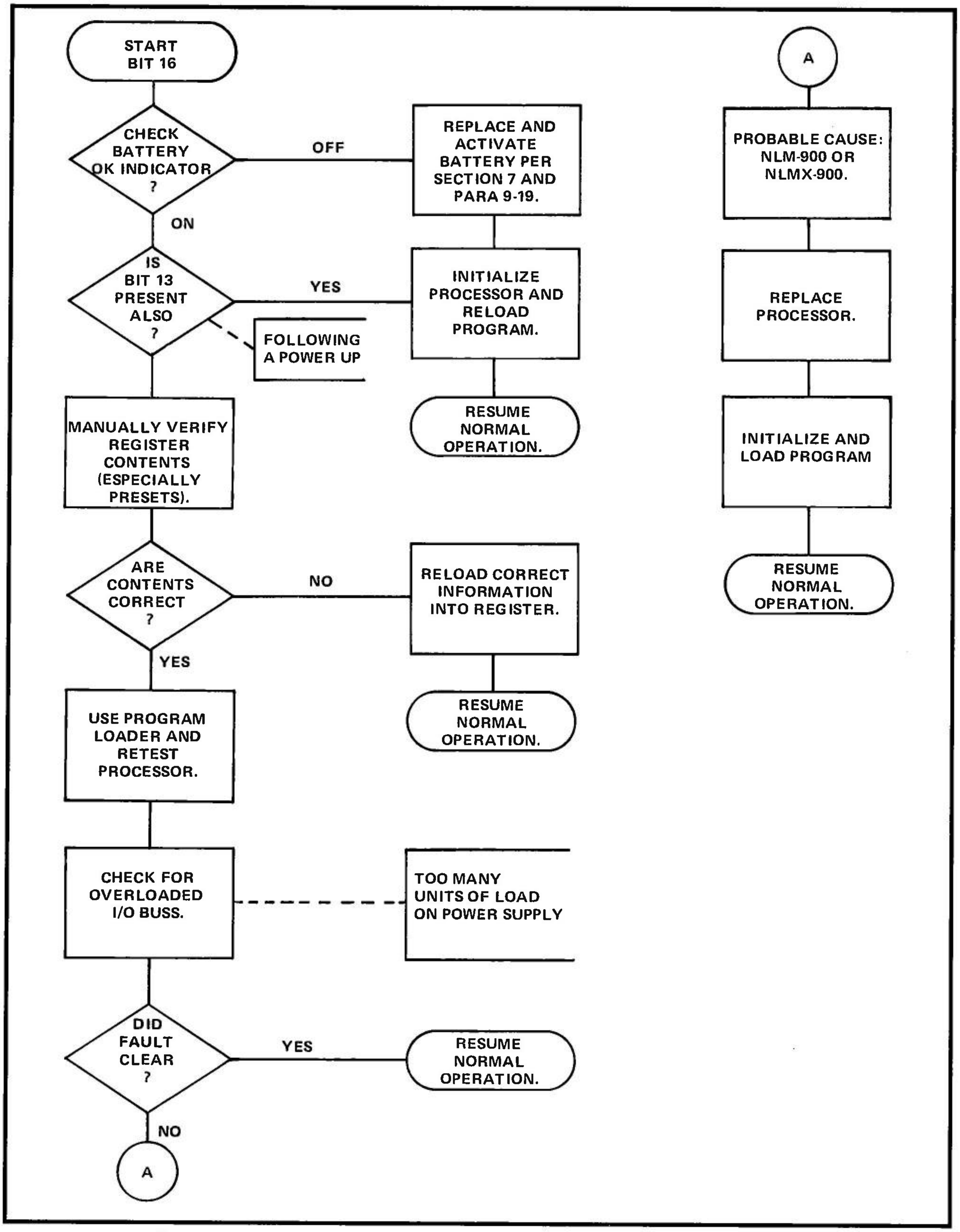

Figure 9-35. PC-900 Register Checksum Error Correction Procedure

3. Remove the first processor module to be cleaned.

Note

Removing the PC-700 memory and/or I/O image module will result in the loss of the user's program; therefore, the processor will require reloading. (Checksums are stored on the I/O image module; removing either the memory with the power OFF, or the I/O image module, causes the checksum to be lost.)

CAUTION

Do not lay processor modules on a metal surface.

4. Use a soft eraser (i.e., pencil) to erase all visible traces of contamination from the module's edge connector pins.
5. Use a soft brush or lint-free cloth to gently brush all traces of the eraser from the edge connector pins.
6. Place the processor in a vertical position. Starting at the top, wash the module's mating connector on the processor's backplane with a freon-based, non-residue contact cleaner without a lubricant. The recommended cleaner is the Miller Stephenson Contact RE-NU or equivalent.
7. Use the same contact cleaner and wash the module's edge connector pins.

CAUTION

Do not touch edge connector pins after washing them. This practice can re-contaminate pins.

8. Insert the module back into the processor.
9. Repeat Steps 3 through 8 for each subsequent processor module.
10. After all modules have been cleaned in this manner, replace the processor's front panel and restore its power.

9-18. USER MEMORY MODULE REPLACEMENT

PC-700

The user memory of the PC-700 user memory module is lost when the module is removed from the processor. Whenever the PC-700 user memory module is removed and replaced, the processor must be re-initialized and the program reloaded. The program may appear to be in memory, but removing the memory module with the power OFF causes the loss of the checksum stored on the I/O image module.

PC-900

The backup battery for the PC-900 processor memory module is an integral part of the module. For this reason, user programs are transferred from one PC-900 processor to another by exchanging modules.

9-19. BATTERY REPLACEMENT

9-20. PC-700 APPLICATIONS

To replace the backup battery in the PC-700 Programmable Controller, use the following procedure.

CAUTION

Damage to the user memory module can occur if the module is removed without observing proper static handling procedures.

Do not remove any processor modules while power is applied. This practice can damage the modules.

Do not lay the user memory module on a metal surface.

1. Remove the PC-700 processor's front plate and locate the backup battery.
2. In Version 1 applications, the battery is located on the user memory module. For this application, turn the power OFF and remove the user memory module, observing anti-static precautions. The battery is either hardwire-connected or plug-connected into the user memory circuit board. Unplug or de-solder the battery leads, as required. Replace the battery. Observe that the negative (−) lead is black and the positive (+) lead is red. Reinstall the memory module.

3. In Version 2 applications, the battery is mounted on the PC-700 processor case. For this application (with the power ON), unplug the battery, and remove the battery retaining bracket. Replace the battery and reconnect it to the plug.

Note

It is not necessary to remove the user memory module or to turn the power OFF for battery replacement in Version 2 applications.

CAUTION

In all PC-700 applications, the user memory is lost when the module is removed. The processor must be initialized and the program reloaded to resume normal operations.

4. Replace the PC-700 front plate.

9-21. PC-900 APPLICATIONS

To replace the backup battery in the PC-900 Programmable Controller, use the following procedure.

CAUTION

Power must remain applied to the PC-900 processor during backup battery replacement. If power is removed, the user memory is lost, and the processor must be initialized and the program reloaded.

1. Remove the PC-900 processor's front plate. The backup battery is located under the keyswitch on the NLM-900 or NLMX-900 series processor memory modules.

2. To replace the battery, **do not remove the processor memory module from the processor** with the power ON. With the module still installed in the processor, push in and remove the end cap of the battery bracket assembly.

3. Remove the old battery. Ensure that the terminal connectors to the module are clean and free from contamination.

4. Insert a new battery (Mallory PX-21, Ray-O-Vac RPX-21 or equivalent) into the battery bracket. Ensure that the positive (+) terminal installs towards the inside of the processor.

5. Replace the end cap on the battery bracket assembly.

6. Observe that the **Battery OK** indicator lights. If this indicator does not light, check the polarity and condition of the new battery. A new battery should measure 4.2 Vdc minimum.

7. Replace the PC-900 processor front plate.

9-22. ADDITIONAL TROUBLESHOOTING

If a problem remains after performing the procedures of this section, contact the Westinghouse Service Representative for further technical assistance from **Numa-Logic** field service personnel.