SECTION IV
TROUBLESHOOTING

4.0 INTRODUCTION

The MODICON 484 Controllers are rugged, heavily protected, modular systems designed specifically for industrial environments. They require no regular maintenance. In the event of failure, components may be quickly replaced. Indicator lights are provided to indicate proper operation of the mainframe's subassemblies.

If a suspected failure is encountered, there are several procedures to be followed by the customer to determine that there is a failure in the MODICON system and to isolate that failure to a particular assembly. These procedures are outlined in this section. They require no special test equipment. As basic understanding of the functions of the components is necessary.

The major troubleshooting methods available to the user are checkouts of the processor using the programming panel. This panel allows any network, input, output, or register to be examined and changed in any proper manner desired.

Through the combination of logic examination and visual inspection or electrical test of field wiring terminals, failures may be isolated to the processor, I/O module, power supply, or customer's hardware. The MODICON maintenance philosophy is based on the assumption that when a major subsystem is proved faulty, it should be immediately removed and replaced in its entirety. This procedure greatly increases system availability.

4.1 INDICATOR LIGHTS

The mainframe has a series of three LED indicators (Figure IV-1). Each LED is energized when a major portion of the mainframe is operating.

NOTE

AC power must be applied to mainframe before any LED will function.

In addition to the mainframe, each I/O module has four indicators to show the field voltage status of each of its circuits. The controller need not be functioning for the input indicators to operate. The only requirement is for the proper field voltage to exist. Output indicators are on only when the controller is in operation.

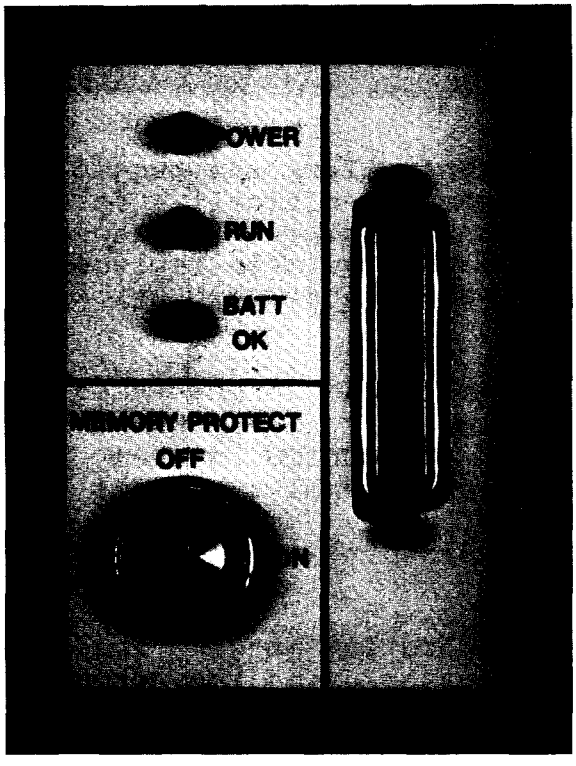

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Figure IV-1. Indicators on Mainframe

4.1.1 POWER SUPPLY

The Power Supply is located in the front cover of the mainframe. Its proper operation (output of both 5DCMF and 12 VDC) is indicated by the DC POWER light on the mainframe. As long as this LED is lit, the Power Supply is supplying the proper voltages. If this indicator is off, verify proper supply voltage at AC power terminals. With proper AC power voltage, the internal fuses should be checked. Open the mainframe and verify continuity of internal fuses (Figure IV-2).

If all internal fuses are operational, the indicator is still off, and the LED itself is operational, the Power Supply should be replaced as follows:

(1) Remove AC power from mainframe terminals.

(2) Unlatch and swing mainframe open.

(3) Disconnect wiring harness and ground strap from power supply side of mainframe (Figure IV-2). Also, disconnect ribbon cable at power supply.

(4) Support power supply (approximately 20 pounds) and lift up to separate hinges that connect power supply section to fixed portion of mainframe.

(5) Remove power supply to work area for further testing or packaging for shipment to MODICON for repair.

(6) Reverse steps 1 through 4 to re-install new power supply.

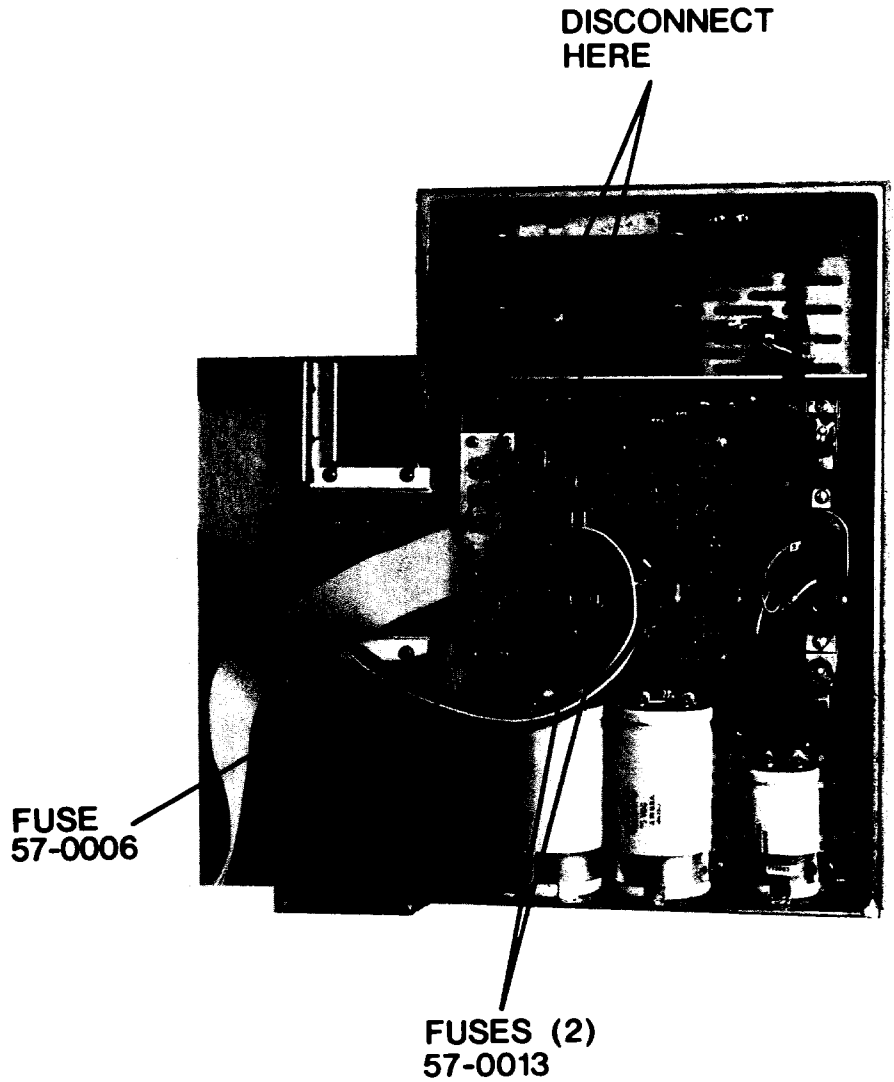

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Figure IV-2. Power Supply - Location of Fuses

4.1.2 PROCESSOR

The main function of the processor is to monitor the staus of all inputs continuously and direct the status of all outputs. There are two LED indicators that, when energized, reflect proper operation of the processor (Figure IV-1). The first indicates proper operation of the processor (RUN), the second proper battery voltage (BATT OK).

If the RUN light goes out, and the DC POWER light is lit, the processor has ceased operation. If the processor fails, its memory should be restored by one of the peripheral devices, such as the model L206 Tape Loader or model T158 Telephone Interface. These are discussed in Section II of this manual. If neither a magnetic tape nor a Service Center "dump" have been made, operation of the controller may be restored by initializing memory with the P180 Programming Panel. Initializing memory will restore all logic to the null state which contains no customer program. If the RUN light cannot be restored by the appropriate peripheral device, the processor should be replaced as follows:

(1) Disconnect AC power connections from power terminals at lower right of mainframe.

(2) Open mainframe and locate I/O connectors (Figure II-13). Disconnect I/O connector(s) on the end of the I/O bus cable(s). Remove from mainframe into I/O duct. If an I/O bus cable is used to connect the I/O housings at the bottom of the mainframe, the entire cable needs to be removed from the mainframe and saved.

(3) Loosen the support of the mainframe at the bottom. Do not remove bolts completely. Support the mainframe (33 pounds) and remove the upper bolts.

NOTE

To reduct the weight of the mainframe to 12 pounds, the power supply section may be removed before the base section of the mainframe.

Lift the mainframe clear of bottom supports.

(4) Take the mainframe to work area for futher testing. If necessary, package and ship to MODICON for repair.

(5) Reverse steps 1 through 3 to install new mainframe.

The second indicator for the mainframe operation is BATT OK. When this LED is energized, there is sufficient battery capacity to retain memory upon loss of AC power.

AC power is required to operate BATT OK indicator or controller system. Batteries are designed only to retain memory. They will not run the controller.

When the BATT OK LED is not illuminated, check the POWER LED. If illuminated, replace batteries. If not illuminated, verify voltage at AC power terminals at bottom right of mainframe.

The BATT OK LED is a warning about battery voltage. When this indicator goes off there is sufficient capacity to maintain memory for at least seven days.

The following procedure should be used when the batteries are to be replaced. It is recommended that AC power to controller be left on while replacing batteries. Memory will be lost if the AC power is removed while either of the alkaline batteries is not installed. Memory will not be lost when AC power is removed if either lithium battery is installed. One lithium battery is sufficient to retain memory.

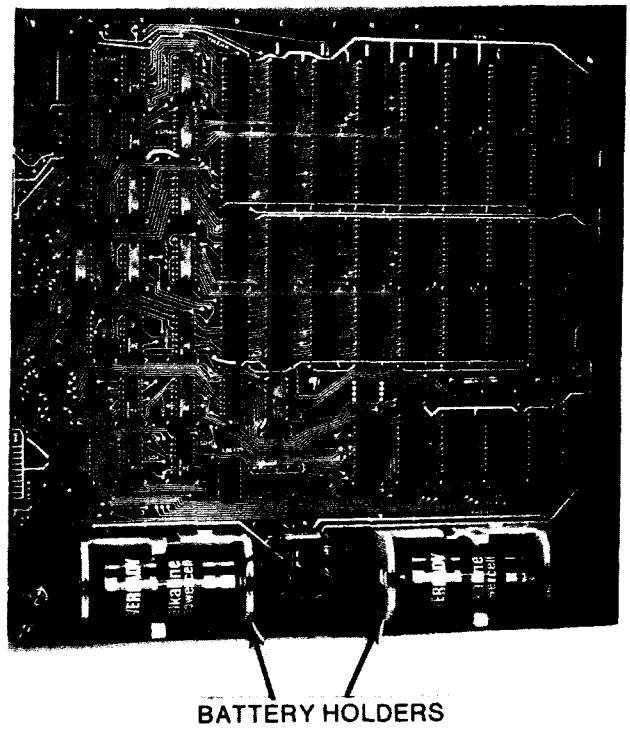

Figure IV-3. Memory Module with Batteries

Procedures for replacement of alkaline or lithium batteries are basically the same and are as follows:

(1) Open mainframe, swing out power supply, and locate memory board (Figure IV-3).

(2) If both battery holders contain batteries, remove ONE to create a vacant holder. Remember that one alkaline battery is insufficient to maintain memory without AC power.

(3) Insert new battery into vacant holder as follows:

- o Lithium batteries are inserted with positive (+) red wire towards center.
- o Alkaline batteries are inserted with positive (+) red wire towards left side.

CAUTION

REVERSE POLARITY WILL CANCEL VOLTAGE OF EXISTING BATTERY AND ELIMINATE BATTERY SUPPORT.

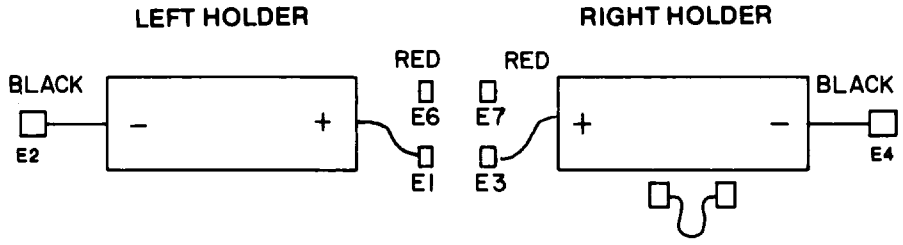

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Figure IV-4. Wiring of Batteries

(4) Connect wires to slide terminals on Rev. C memory board (Figure IV-4).

- o Lithium batteries are supplied with wires for connection. Place batteries in holders and connect red wires to center terminals and black wires to terminals towards side of memory board. Connect jumper between terminals below right holder.
- o Alkaline batteries are placed in spring clip holders. No wires are supplied with these batteries. To connect these batteries in series, jumper is placed between terminals E1 and E3. Connect only one jumper either below right holder or between holders depending upon battery type.

(5) Remove the second old battery from its holder if two batteries are in the controller. Replace with second new battery following steps 3 and 4 above.

(6) Record battery change on memory board in space provided.

(7) Verify operation of BATT OK indicator on front of mainframe and then close mainframe.

(8) If BATT OK indicator is not illuminated, replace LED lamp, or power supply, or memory board (Figure IV-6).

Memory boards can be removed, stored, transported, and exchanged without loss of memory as long as the batteries are inserted. There is no indication of battery level except when installed in controller with AC power applied. Memory sizes of any controller can be changed by replacing the board.

4.1.3 INPUT/OUTPUT SECTION

Communications from the mainframe to the real world is accomplished via the I/O Section. This section isolates all input and output devices to prevent external noise from affecting the internal logic of the 484 Controller system. The circuitry in the I/O Section is specially designed to filter inputs and drive outputs at voltage levels compatible with the user's equipment. There are no limitations on the placement of the modules in the I/O Section relative to their voltage handling capacity. AC circuits do not have to be isolated from DC circuits nor do high voltage (i.e., 220 VAC) have to be separated from low voltages (i.e., 5 DCMF).

Whenever a failure is suspected in the I/O Section, the following steps should be taken to systematically locate the failure:

(1) SINGLE I/O CIRCUIT - Connect Programming Device. Call up input (1XXX reference) or output (0XXX reference) that is suspected. When it is an input, compare its status with that of the indicator of the input module. If they agree, the input is operational and field wiring external device should be examined. If not, the input module should be replaced.

NOTE

When possible, cycle input device such as limit switch, pushbutton etc., ON/OFF/ON to confirm operation.

When it is an output, compare its status with that indicated on output module. If they agree, the output is operational and the field wiring/external device should be examined. If not, the output module should be replaced. Verify that a blown fuse is not being indicated at output module before replacing module.

NOTE

When possible, use DISABLE function (Paragraph 3.1.5) to force output ON/OFF/ON etc. MEMORY PROTECT must of OFF.

CAUTION

BE VERY CAREFUL THAT OUTPUT WILL NOT CAUSE UNSAFE USER EQUIPMENT OPERATION.

(2) MULTIPLE I/O CIRCUITS - Connect Programming Device to verify I/O operation and select appropriate procedure from the following:

- o ON ONE MODULE - Verify proper power supplied to module. If voltage exists, replace module. If not, troubleshoot field wiring and power source.
- o WITHIN ONE I/O HOUSING -

CAUTION

MAIN AC POWER TO 484 SYSTEM SHOULD BE REMOVED FIRST. DO NOT REMOVE CABLES WITH POWER ON 484 MAINFRAME.

- oo Open I/O duct and reseat I/O bus connector. If this does not correct fault, use spare I/O bus connector, rotating connectors within duct as necessary to move spare connector to desired housing.

Remove I/O modules one at a time from suspected housing if fault continues. If faulty module begins to operate when an I/O module is removed, replace that module and inspect its connector on housing backplane.

oo Replace I/O housing or its backplane when removing all I/O modules does not correct fault.

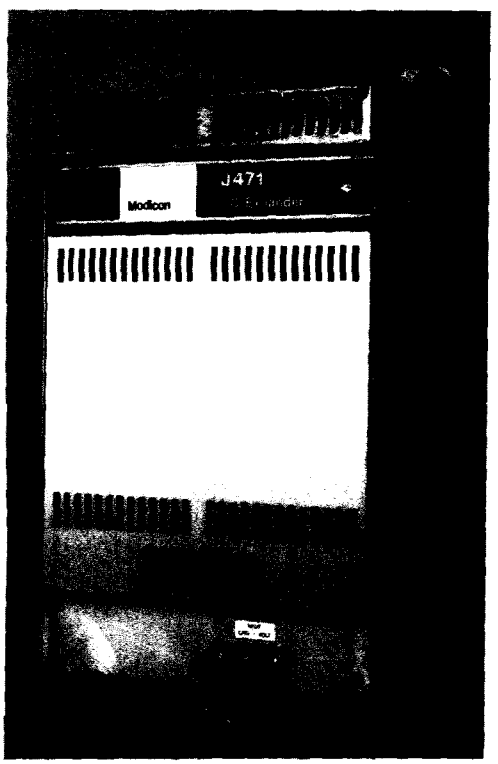

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Figure IV-5. J471 Expander Installation

o MULTIPLE I/O HOUSINGS-

oo Remove top I/O module from faulty housings and verify selection of address. Only one switch should b positioned on any housing (Figure II-14). Reset all switches if no obvious errors are detected.

oo Open I/O duct and remove I/O bus connectors from suspected housings one at a time if the fault still exists. Reconnect in the same order while examining I/O operation with programming device. If one housing creates the fault only when connected to the bus, it or its backplane should be replaced.

oo Remove the entire bus cable, one connector at a time. Replace in same order, searching for a faulty I/O housing. Finally, replace entire I/O bus cable.

(3) OTHER I/O DEVICES - The model J471 Expander (Figure IV-5) is maintained similarly to the power supply discussed above. Its I/O structure can be troubleshot following the procedure listed above.

All I/O modules are parallel to the I/O bus communications, therefore, all I/O data is seen by each module via the I/O bus cable. Only appropriate modules respond to the data. This includes local or expanded I/O's as well as register modules.

B547/B458 are register I/O housings. Register addressing selection is accomplished on the register I/O module.

4.2 FAULT ISOLATION FLOW CHARTS

This part of Section IV contains five fault isolation flowcharts. These are designed for use by MODICON customers. Service personnel recommend users attempt to isolate faults before calling MODICON service center.

The fault isolation flowcharts are as follows:

Figure IV-6. DC POWER Lamp Fault Isolation Flowchart

Figure IV-7. BATT OK Lamp Fault Isolation FLowchart

Figure IV-8. RUN Lamp Fault Isolation FLowchart

Figure IV-9. RUN Lamp Fault Isolation FLowchart (Continuation of A from Figure IV-8)

Figure IV-10. I/O Section Fault Isolation Flowchart.

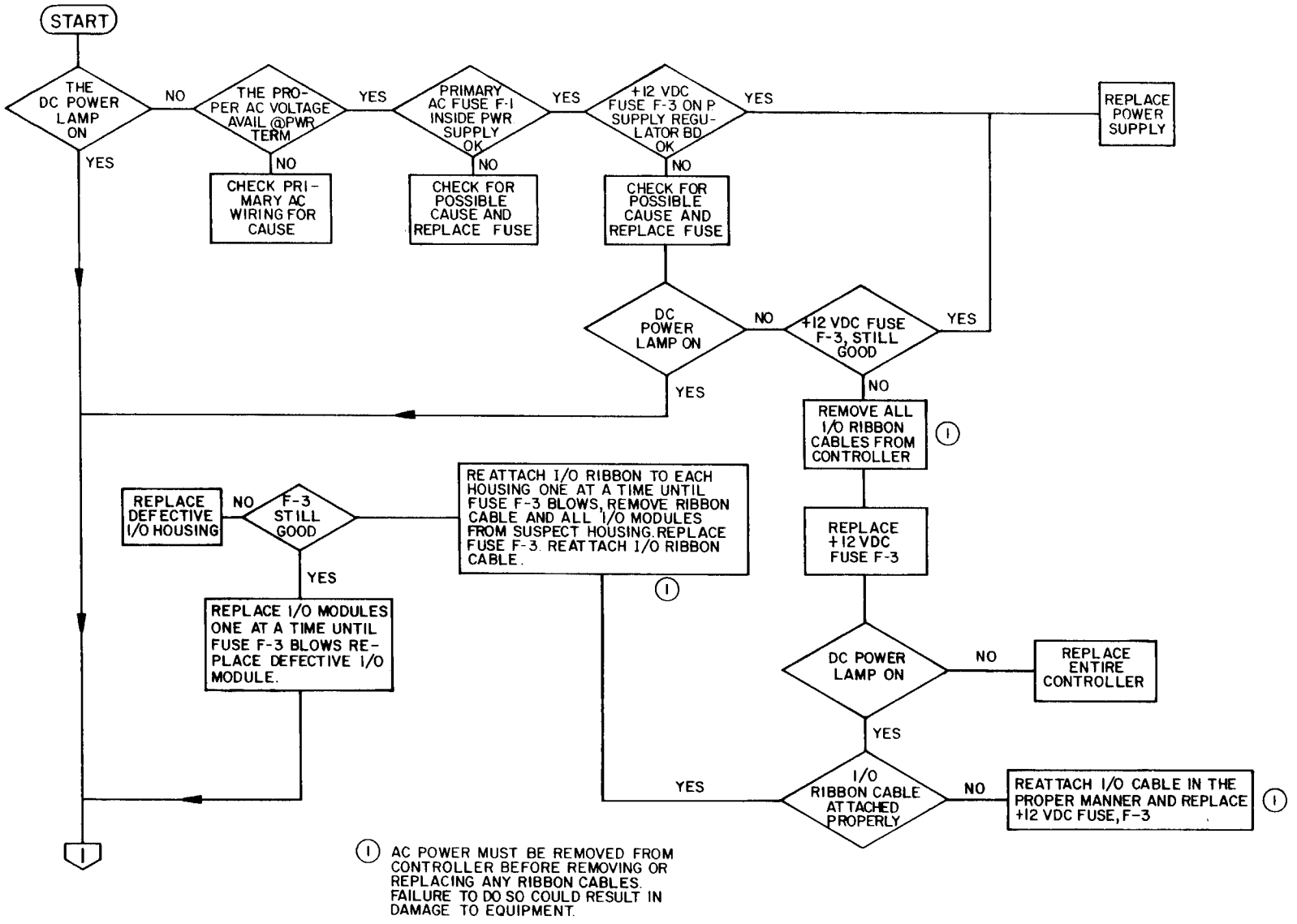

Figure IV-6. DC POWER Lamp Fault Isolation Flowchart

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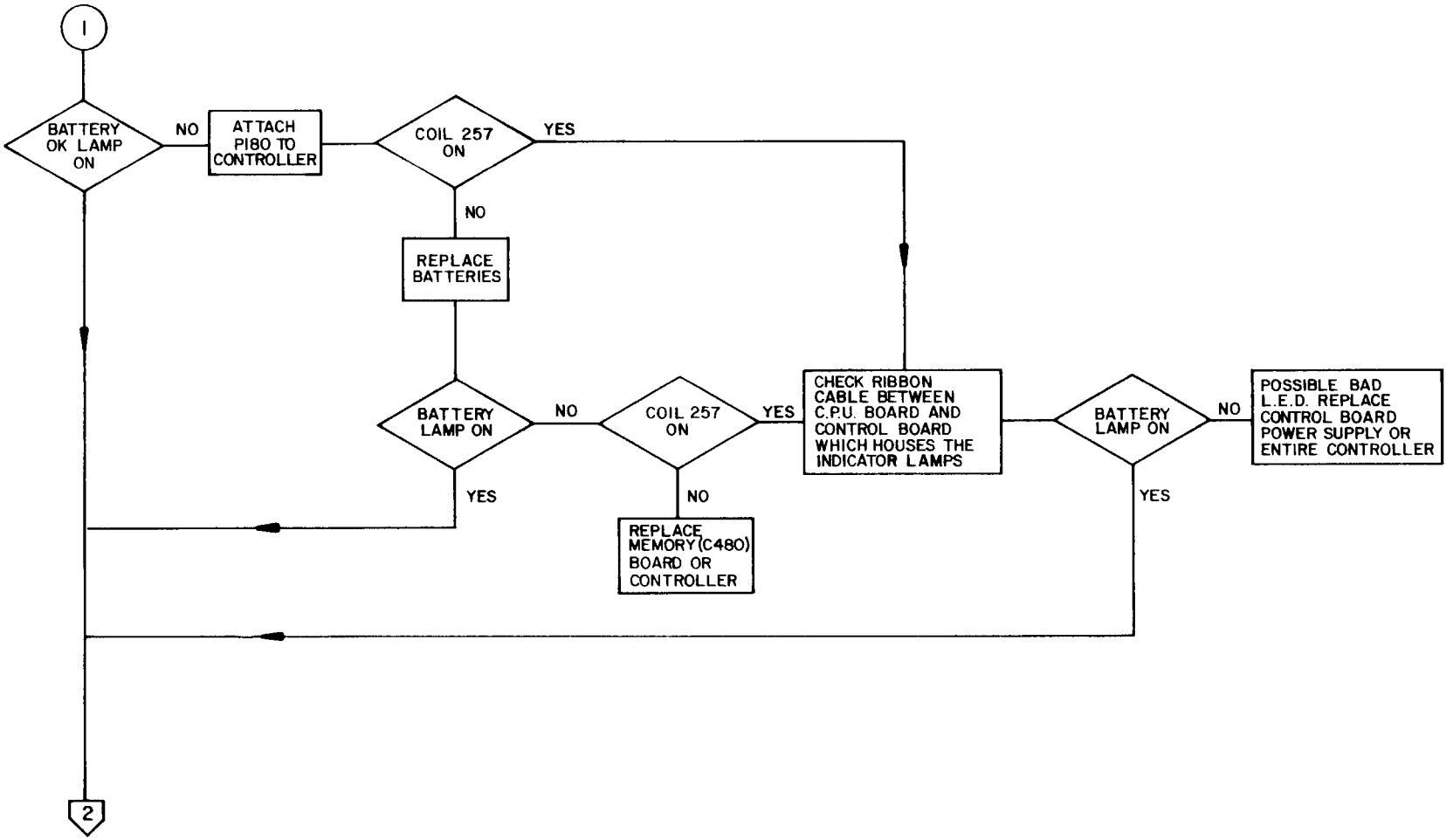

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Figure IV-7. BATT OK Lamp Fault Isolation Flowchart

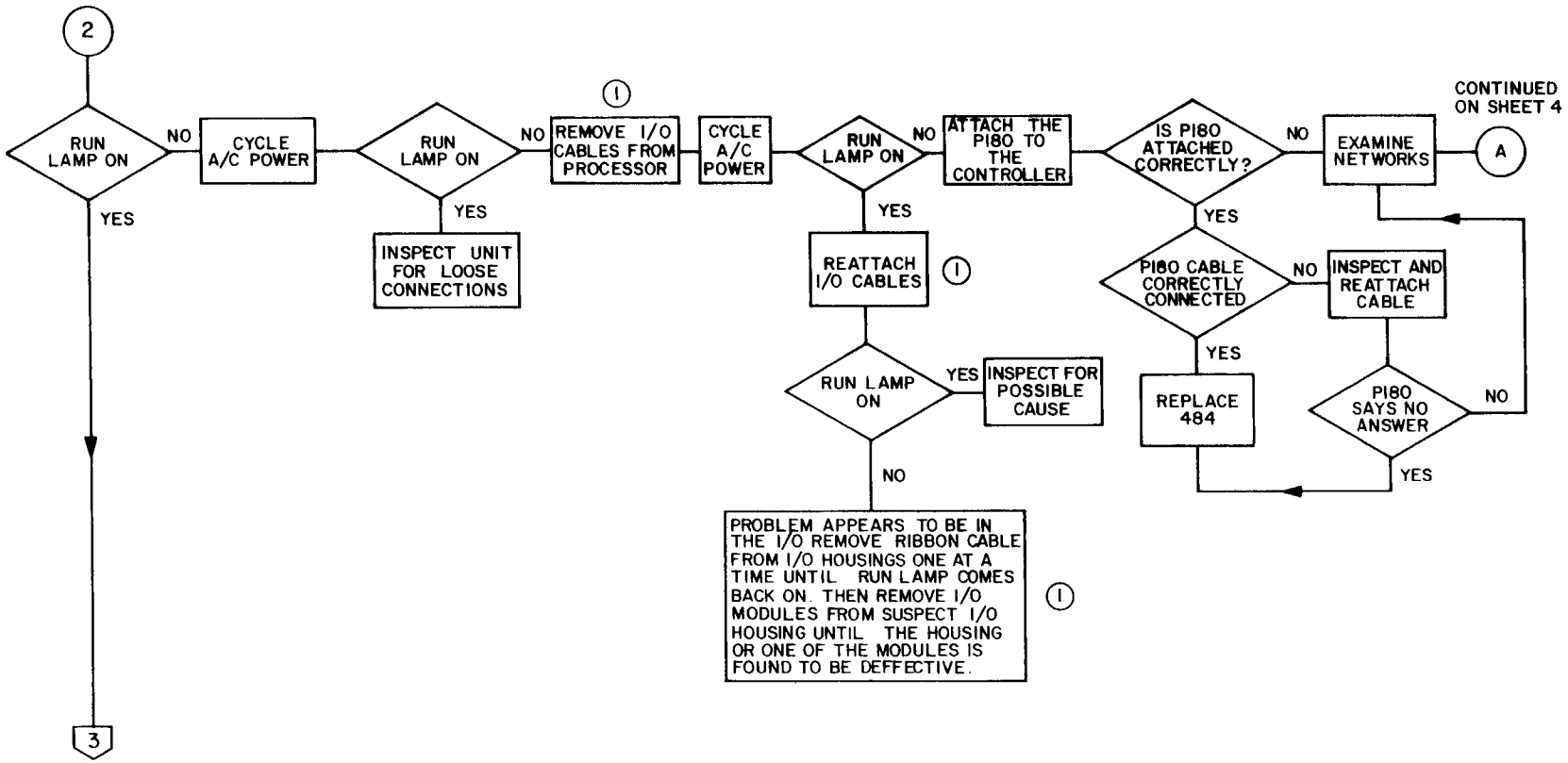

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Figure IV-8. RUN Lamp Fault Isolation Flowchart

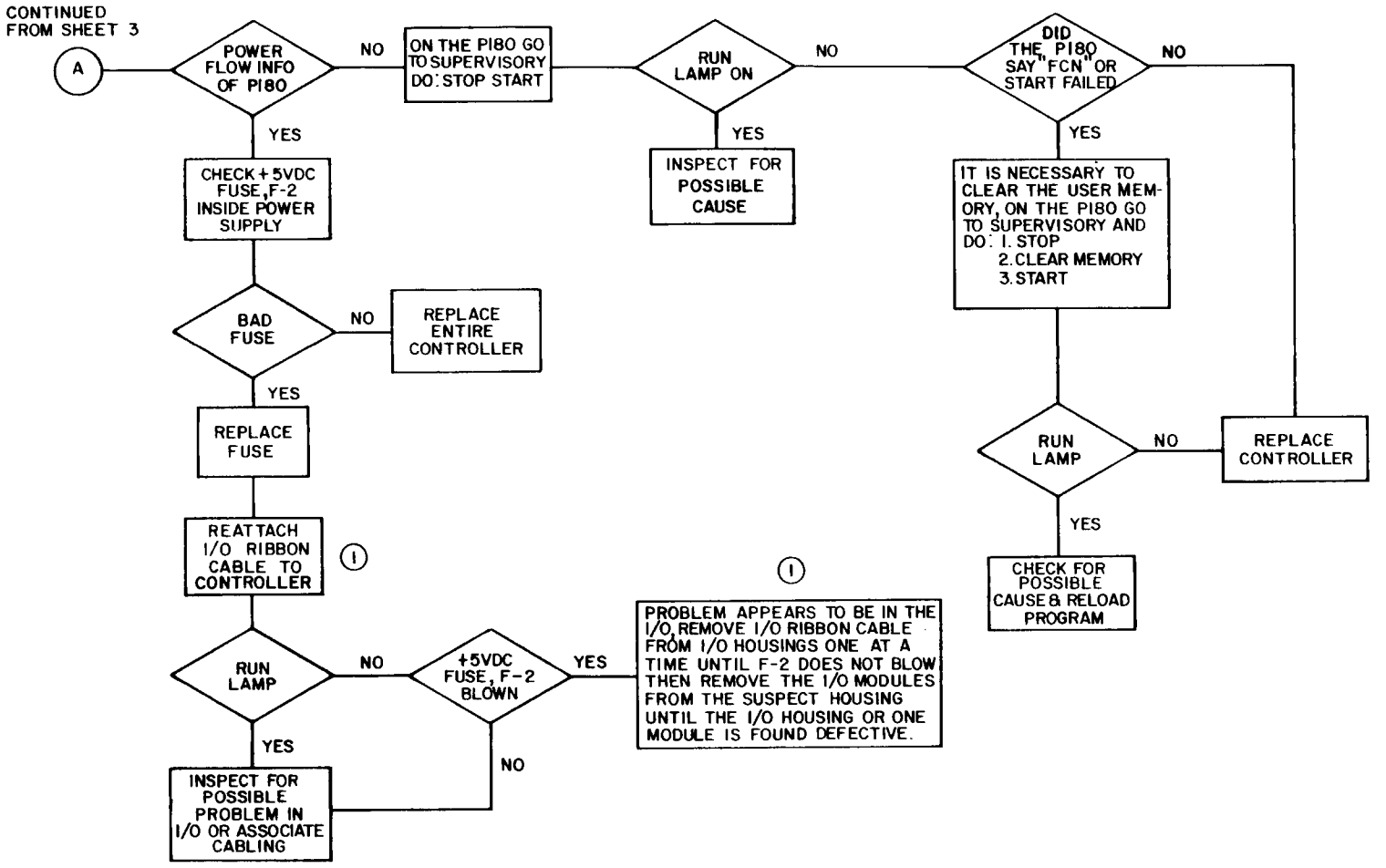

Figure IV-9. RUN Lamp Fault Isolation Flowchart

(Continuation of A from Figure IV-8)

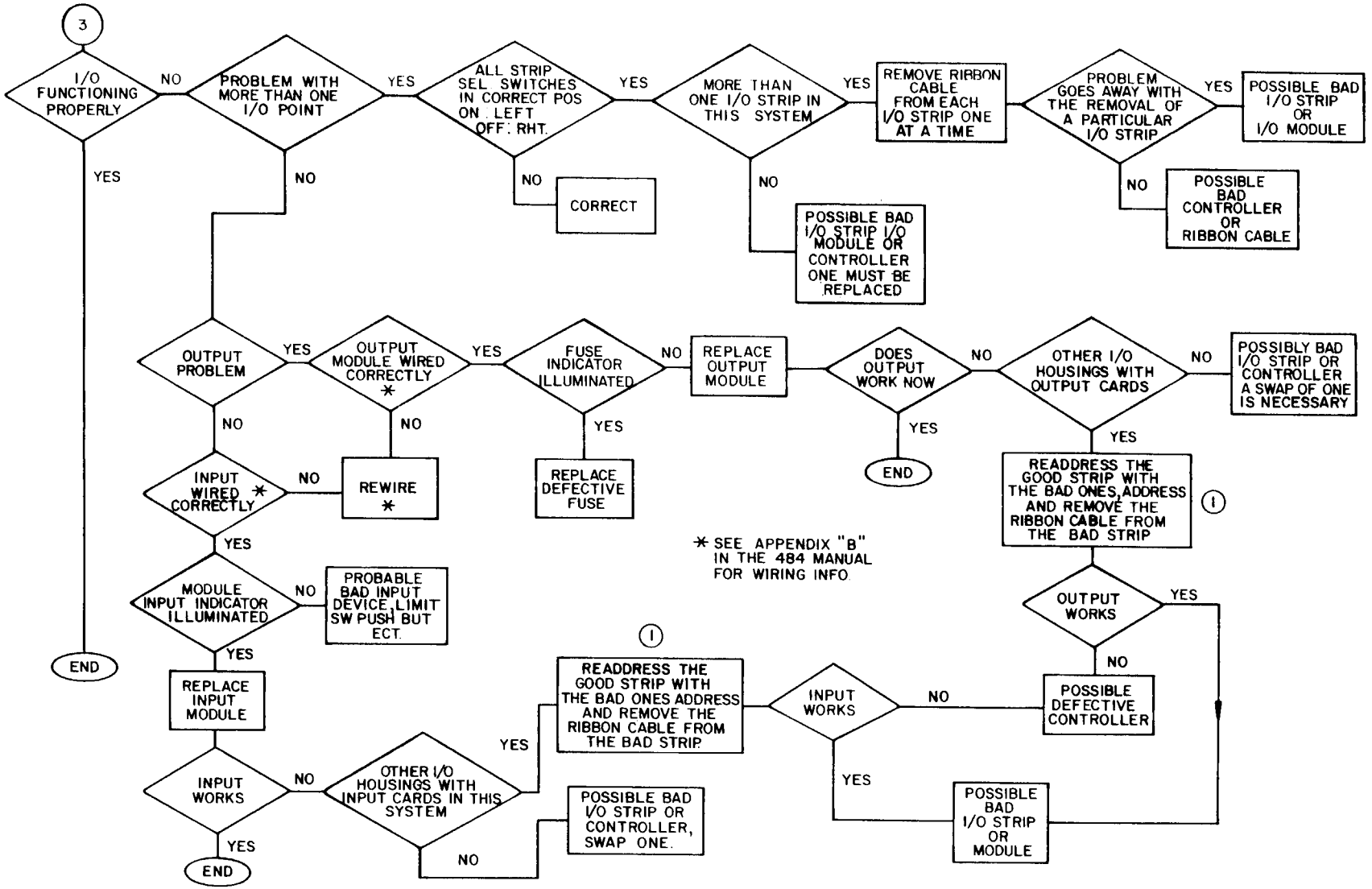

Figure IV-10. I/O Section Fault Isolation Flowchart

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4.3 P180 ERROR MESSAGES

All P180 error messages are detailed here and are organized alphabetically after the 484 Error Code is described.

Many errors are caused by illegal user actions. There are also a number of SYSTEM ERRORS which seldom appear in a functioning system. However, if SYSTEM ERRORS do occur, the system may be in serious difficulty and needs to be serviced.

The following list of SYSTEM ERRORS are messages from the 484 which indicate it has received erroneous information:

1	'PARITY ERROR'
2	'OVERRUN ERR'
3	'CHKSUM ERROR'
4	'BAD ADR RNGE'
5	'ILLEGAL ADDR'
6	'ILLEGAL NODE'
17	'BAD LED REQ'
12	'BAD COMMAND'
15	'BAD LENGTH'

The following list of SYSTEM ERRORS are messages from the P180 which indicate that it has received erroneous information:

'BAD RESPONSE'
'P180 OVERRUN'
'P180 PARITY'
'P180 CKSUM'
'P3 PARITY'
'P3 OVERRUN'
'P3 CKSUM ERR'

4.3.1 484 ERROR CODE

This message appears when P180 is in supervisory status and an error has been detected in the 484. The message will be followed by a two-digit number code indicating error type. The following list contains the error codes and their meanings:

Code	Definition
01	Communications Overrun
02	Memory Checksum Failed
03	Invalid Node Type Found
04	I/O Port Error
05	Scratchpad Diagnostic Failed -Fatal-No Run Light
06	Coil RAM Checksum Failed
07	CPU Diagnostic Failed

10	Illegal Memory Configuration -Fatal-No Run Light
11	Real-Time Clock Not Functioning
12	Watchdog Timer Expired
13	Illegal Column Detected
14	No End-Of-Logic Node

4.3.2 ERROR MESSAGES

BAD ADR RANGE - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request has a serious problem and cannot be processed. Specifically, this message means that the P180 sent a request which would modify memory across an invalid address boundary.

BAD COMMAND - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request has a serious problem and cannot be processed. Specifically, this message means that the request code which the P180 sent is not valid.

BAD LED REQ - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request has a serious problem and cannot be processed. Specifically, this message means that the P180 sent a bad "Element Status" power request.

BAD LENGTH - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request has a serious problem and cannot be processed. Specifically, this message means that the I/O request which the P180 sent had too few or too many characters.

BAD RECORD - This message appears during LOAD, DUMP, VERIFY when the tape being processed has the wrong information.

BAD RESPONSE - This message appears when the P180 has received a response from the 484 but is is so erroneous it is unrecognizable. The P180 and/or 484 are in serious trouble and should be diagnosed.

BAD SHIFT - The 'SHIFT' key was set for a key for which it is meaningless.

BAD TAPE - This message appears during loading or verifying when the tape does not contain the information expected to be on a good tape.

BLANK NODE - This message appears when the user is trying to 'DELETE' a node which is not there or the cursor is on a blank node. The cursor must be on a real node in order to delete it.

BLANK OR - This message appears when the user is entering a new node, but the node above (up-arrow) or to the left (left-arrow) is blank. This is illegal.

BY-PASS I/O - When the user enters registers 4059 or 4060, this message will warn the user that these registers are reversed. This is a warning message only. The P180 will not stop the user from using them.

CHECKING - Although this appears in the error line, it merely tells the user that the P180 must spend time checking to see if a coil is used. This may take several seconds. It is displayed to let the user know that the P180 is still alive.

CHKSUM ERROR - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request cannot be processed the way it was sent. Specifically, this message means that the message from the P180 was received incorrectly. THe 484 is not in agreement with the P180 message.

COIL IN WAY - This error message will occur when any multi-node item is entered and a coil extension is below it. Although the coil may be below and to the left of the multi-node to be entered, the display position of the coil extends across the screen. This prevents any multi-node from extending below the coil.

COIL IS USED - This message means that the coil the user is programming is already used as a coil or in a convert. No coil may be programmed as an output more than once. Converts take 12 coils even though only one number appears on the display. If the user has a convert to coil 15, this uses coil 15 through 26. Later programming to coil 17, for example, will show USED, even though search and display finds NO MATCH.

COIL NO-MATCH - This message appears during VERIFY when the coil bits on tape do not match those of the 484. This error may be disregarded if verifying while running.

COMM BUSY - This message does not appear on the error line and is not strictly an error. It is displayed when the P180 wants to communicate with a 484 but some other device is already communicating. The P180 waits.

END OF LOGIC - This message means that the user tried to call up a network beyond the last network. The user is at the end of the logic.

484 RUNNING - This message appears when the user is trying to perform a function which requires that the 484 be stopped first. (Example: Clear Memory)

ILLEGAL ADDR - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request cannot be processed. Specifically, this message means that the P180 sent an address which is completely wrong.

ILLEGAL NODE - In general this error message comes from the 484 mainframe and means that the most recent P180 I/O request cannot be processed. Specifically, this message means that the P180 sent a node type which is not known by the 484.

ILLEGAL RPLC - This message appears when the user, via ENTER, is trying to change one node type for another and the change is not allowed. These changes are listed:

1 node for 2 or 3 nodes
2 nodes for 1 or 3 nodes
3 nodes for 1 or 2 nodes

INCOMPLETE - This message means that the assemply area is not completely explicitly set for 'ENTER'. When programming a new node, all three fields (contact, reference, vertical) must be stated. The left-pointing arrow directs the eye to the assembly area.

INIT MEM - This message appears when the P180 fails to find the end-of-logic mark in the 484. It means that there is some serious problem in the 484 and the database is not valid. Go to SUPERVISOR and "clear memory".

INV - These three letters do not appear in the error line. They show as register contents in the discrete area when the data in the register is INValid, i.e., exceeds 999.

INVALID KEY - This appears in SUPERVISOR mode for keys which are invalid in that mode only. If the message appears in network display mode, it means that the P180 keyboard hardware has failed.

INVALID # - This message appears when the reference number in the assembly area is invalid for the requested function. Check the memory size and reference rules.

LGC NO-MATCH - This message appears during VERIFY when the network logic (LGC) on the tape does not match the logic in the 484.

MEMORY FULL - This message appears when the user enters information and the 484's logic memory is full.

MEM PROTECT - This message appears when the user is modifying the 484 memory and the MEMORY PROTECT key is ON. MEMORY PROTECT key ON prevents modifications.

MUST BE COIL - This message appears when the user is programming a non-coil node in the coil (right-hand) column. Only "coils" and "horizontal open" are allowed in the right-hand column.

NO ANSWER - This message appears when the P180 makes a request to the 484 and gets no response. Check cables and proper 484 functioning.

NO COIL HERE - This message appears when the user is programming a coil which would be in the middle of the logic.

NODE IN WAY - This message appears when the user is entering a coil and the row already contains another node to the right. Remember that the coil may be entered when the cursor is not in the coil (right-hand) column. It then takes the rest of the row for display purposes only.

NODE TOO LNG - This message appears when entering a two-node item (e.g., counter) on the last row of a three-node item on the next-to-last or last row. The function is too long to fit in the seven row network.

NO MATCH - This message appears during 'SEARCH' when the 484 cannot find a match to the pattern being searched for. Searching for a coil or register implicit in function, e.g., CONVERT, MULT, DIV, shows no match even though it is used.

NO NETWORK - This message appears when the user is performing a function on a network and there is no network displayed or in 484 memory.

NOT 1XXX - This message appears when the user is forcing an item displayed in the descrete area which is not a 1000 series (input) coil. Only 1XXX references can be forced in this area.

NOT ALLOWED - This message appears when the user is getting a reference in the discrete area and the cursor is not in that area. The cursor must be in the discrete area to GET.

NOT DISABLED - This message appears when the user tries to 'FORCE' a coil which is enabled. This is illegal. Disable any coil first before forcing.

NOT ENHANCED - This message appears when the user is trying to program a function which is not allowed in the basic 484.

NOT ENHAN II - This message appears when the user is programming a function which is not allowed in the enhanced or basic 484.

NOT LAST - This message appears when the user is deleting a node which is in the middle of a network. Delete may only be done to:

(1) The last (bottom) node in a column, or
(2) The last node if it is in the top row, the right-most node only.

NOT VERTICAL - This message appears when it is illegal to have a vertical short on a node type; a coil, for example.

ONLY 4XXX - This message appears when the user is entering data into an item displayed in the discrete area and it is not a holding register (4XXX).

OVERRUN ERR - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request cannot be processed. Specifically, this message means that the 484 receiver filled up with characters which were not processed out quickly enough so they got lost.

NOTE

This condition will cause the 484 to lose its RUN light.

P180 CKSUM - This message means that the response from the 484 was received incorrectly and the P180 does not agree with what the 484 sent. This could be a problem in the link between the 484 and P180 or a serious failure in either.

P180 OVERRUN - This message means that the P180 receiver hardware filled and overflowed. This is a failure of the P180. The P180 should be checked.

P180 PARITY - This message means that the P180 receiver detected a bad bit stream. The P180/484 should be checked.

P3 CKSUM ERR - This message means that the message from the device on port 3 was received incorrectly. The P180 does not agree with what the device sent. This could be a problem in the link, the P180, or the device.

P3 OVERRUN - This message means that the P180 port 3 receiver hardware filled and overflowed. This is a failure of the P180. The P180 should be checked.

P3 PARITY - This message means that the P180 port 3 receiver detected a bad bit stream. The P180 and/or device should be checked.

PARITY ERROR - In general, this error message comes from the 484 mainframe and means that the most recent P180 I/O request cannot be processed. Specifically, this message indicates that the 484 message receiver hardware detected a bad bit stream.

PORT 3 EMPTY - This message appears when the user is performing a LOAD, DUMP, or VERIFY and has not plugged in a legal device.

POWER/LED INVALID-NETWORK SKIPPED - This message does not appear on the error line. It is not strictly an error. It displays whenever the current network on the display is being skipped due to the skip command.

REG NO-MATCH - This message appears during VERIFY when the tape does not match the 484. This error may be disregarded if verifying while running.

SPARE KEY - The key which the user has struck has no function.

START FAILED - This message appears when the user tried a START function but the 484 status shows that it would not start. There is a serious problem in the 484 mainframe.

NOTE

In earlier releases of P180, revisions A & B, this message was FCN FAILED.

START LOGIC - This message means that the user tried to call up a network before the first network. Therefore, his is at the start of his logic.

STOP FAILED - This message appears when the user has tried a STOP function and the 484 status shows that it did not stop. There is a problem in the 484. See START FAILED.

TAPE> 484! - This message appears when the user is loading a smaller 484 with a dump from a larger 484. The amount of user logic in the larger is more than the size of the smaller. The P180 tries to load larger to smaller and will succeed if the amount of memory actually programmed in the larger 484 will fit in the smaller 484.

257=BATT OK - This message appears when the user is trying to program a coil with reference #257. Since this is the "BATTERY OK' coil, is is already used and may not be programmed.

UNK CONTACT - This error message appears when the P180 is reading a network and finds a node type which is invalid. It means a serious problem in the 484.

VERT IN WAY - This message appears when the user is trying to program a coil when the cursor is not in the coil column and there is a vertical short coming down immediately to the right of the cursor. There may not be vertical shorts down to the right of the coil.