SECTION VI
TROUBLESHOOTING

INTRODUCTION

The MODICON 184/384 Controllers are rugged, heavily protected, modular systems designed specifically for industrial environments. As such, it requires no regular maintenance and, in the event of failure, any module can be quickly replaced. Indicator lights are provided to indicate proper operation of all major subassemblies.

If a suspected failure is encountered, there are several procedures which can be followed by the customer to ascertain that there is indeed a failure in the MODICON system, and to isolate that failure to a particular module. These proecedures are outlined in this section. They require no special test equipment, only a basic understanding of the functions of the modules and their indicator lights.

The major troubleshooting method available to the user is checkout of the processor, using the Programming Panel. This Panel allows any logic line, input, or output to be examined and changed in any manner desired.

Through the combination of line examination and visual examination or electrical test of I/O module 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 will greatly decrease down-time.

SYSTEM ASSEMBLY AND CABLING

As with any system in control of a large number of machines or line stations, there are many electrical connections that must be made, involving spring fasteners, screw terminals, or cable connectors. All of these connections are potential causes of system failure and should be the first area of inspection in the event of system malfunction.

All connections should be checked to make certain they are secure and that no damage or misalignment has occurred to the connectors.

I/O modules must be firmly seated in their sockets. The modules are ruggedly constructed and will withstand considerable force either during insertion or removal. On the other hand, force must not be used when connecting the cammed cable connectors to the I/O housings (see Installation). Any resistance encountered in making these connections is a warning sign. The connector should be examined and any fault, mechanical distortion or misalignment, corrected so that connection can be made freely.

INDICATOR LIGHTS

The 184/384 Controllers are modularized systems containing subassemblies, each of which has its own indicators. All of these indicators (when operating properly) show that the system is fully functional.

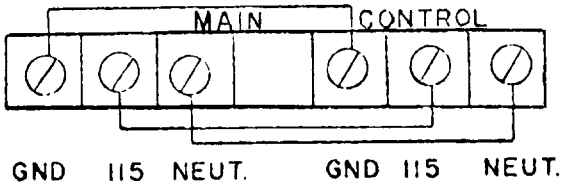
NOTE

The Controller interlock switch must be turned "ON" before the Processor and I/O power lights can function. (The interlock is the large black knob on the left front of the Processor. It also serves as the cam to hold in place, over the service port, either the peripheral device which is connected or, when none is in place, the protective cover. Either the cover or a device must be in place before power can be turned "ON".)

POWER SUPPLY

The Power Supply has four indicator lights. The Main Power light (upper left) shows that the module is receiving AC power. This indicator light only shows that power is being supplied; it does not mean that the Processor is in the running state. If this indicator does not light, check your source of AC power.

The Control Power light (upper right) indicates that power is being supplied to put the Processor in the Run (or cycling) condition. This requires that AC power be connected to the Control Power Terminals. This three-wire AC power connection will normally be made through the user's machine stop controls. For checkout of the Power Supply, jumpers can be applied on the Power Supply terminal strip:



When power has been properly supplied, the Control light of the Power Supply should light.

The Input/Output indicator lamp (lower left) shows, when lit, that dc voltage is available to the I/O housings. The Power OK or Main Frame lamp (lower right) indicates that full running power is operative in the Processor. Both of these lights will be lit only when the Processor is turned on.

For purposes of troubleshooting, the Processor may be put into an idle state by removing the voltage from the Control Power Input. The lower lamps of the Power Supply (and Run lamp of the Processor) will go off. DC voltage is still being supplied to the Processor, but no monitoring or processing of user signals will occur.

To test the power supply, it should be connected to another mainframe that is known to be operational.

PROCESSOR

The main function of the Processor is to monitor the status of all inputs continuously and direct the status of all outputs. The Processor has five indicator lights at the lower left, beneath the interlock knob.

RUN
CHANNEL I
CHANNEL II
CHANNEL III
CHANNEL IV

The Run light, when lit, shows that the Processor is cycling or running (i.e, scanning inputs and controlling outputs). It is controlled by monitoring logic within the system and will be on steady when the Processor is running. The Channel Lamps will be on when a channel is connected at the Main Frame and is being serviced by the system; they will normally be blinking at a rapid (watchdog timer) rate.

Check that the cable from the Power Supply is properly connected to its receptacle on top of the Processor. To ascertain the status of the Processor, switch the interlock knob on front of the Processor to ON. This should cause the Input/Output and Power OK lights on the Power Supply to light, and the Run light on the Processor to light.

NOTE

DO NOT remove power supply cable from mainframe while system is operating. Turn AC power OFF prior to removing this cable.

Operation of the Processor is made possible by a control module installed at the factory. The Run light shows that this is operating properly. If the Run light (and System operation) fails, call the MODICON Service Center. Using your telephone interface, they will interrogate the Processor and advise what action is necessary.

IMPORTANT

During normal operation, the Processor's key-operated Memory Protect switch should always be "ON." Only when troubleshooting by one of the means available (Programming Panel, Telephone Interface, Computer Interface, or Program Loader) should the Memory Protect be switched OFF to permit necessary interrogation or replacement of user's Executive.

MODICON maintains a complete record of the user's Executive and of his ladder-diagram logic when this has been requested by the user. They are therefore available either as paper tapes, magnetic tapes, printouts, or data transmitted via telephone for rapid replacement or modification in event of their loss from the Processor's memory. Use of the magnetic-tape Program Loader, Telephone Interface, and Computer Interface options is discussed under Auxiliary Units.

INPUT/OUTPUT HOUSINGS & MODULES

The I/O system operates on DC signals from the MODICON Power Supply. The user supplies power for all inputs from the controlled machine as well as power for the output circuits to be switched to the machine devices.

The Active light, when ON, indicates that an I/O module is being serviced properly from the Processor; individual status (Input or Output) lights indicate whether ON voltage level exists at the terminal of the output or input points. When the channel active lamps on the Processor have shown that a channel is connected and is being properly serviced, the individual modules may be checked out.

In addition to the Active light, 16 indicators (one for each point) show the status of the inputs/outputs. When lit, the status light shows the associated terminal has voltage present.

IMPORTANT

Specifications on input impedances, sinking current, must be met for correct operation of the I/O circuits and their status lamps.

AC output modules contain a fuse and neon blown fuse indicator light for each circuit in addition to the status lights. Fuses used on modules where field replacement is possible are listed in Table 23. To replace a fuse, remove the module from its housing. There is an opening (approximately 1 in. x 8 in.) on the terminal side of the module through which access to the fuses can be obtained. All fuses are oriented in accordance with the output

terminals such that the top fuse is for the No. 1 output on the module and the bottom fuse is for the No. 16 output; except for the B238, whose top fuse is for the common indicator supply, and the B244 and B246 whose orientation is per Figure 147.

Table 23.

Module	Standard Size Pico Fuse	Littlefuse Pt. No. or Equiv.	MODICON Part No.
B230	5 Amps	275-005	57-0003
B232	7 Amps	275-007	57-0005
B234	5 Amps	275-005	57-0003
B236	2 Amps	275-002	57-0002
B238	3 Amps	275-003	57-0007
B239	1-1/2 Amps	276-015	57-0022
B243	1/4 Amps	275-250	57-0032
B244	7 Amps	275-007	57-0005
B246	7 Amps	275-007	57-0005
B248	3 Amps	275-003	57-0007
B256/B258	1/2 Amp	276-500	57-0024
B260	1/8 Amps	276-125	57-0023
B262	1/8 Amps	276-125	57-0023
B266	3 Amps	212-003	57-0038
B270	5 Amps	275-005	57-0003
B680	1/4 Amps	313-015	57-0036

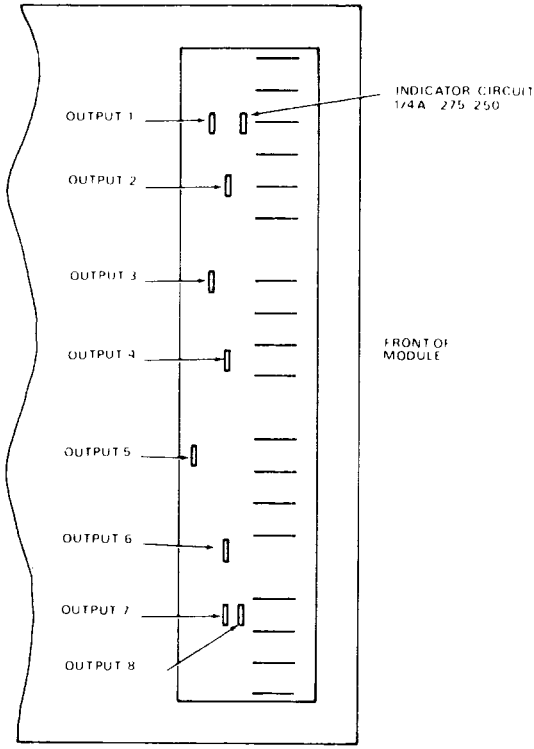


Figure 147. Location of Fuses on B244 & B246 Isolated Output Modules

User troubleshooting of his own ladder-line logic is readily accomplished using the Programming Panel described previously. The methods of simulating inputs and examining outputs have been described; the Programming Panel can also be used to diagnose user hardware problems.

CAUTION

When simulating inputs or forcing outputs, insure that these operations will NOT damage or be unsafe to the machine or process under control.

When an input from the limit switch on a transfer line is wired to the Controller's first input circuit (1001), its status is seen at the input card *and* its reception into the Controller's memory can be verified.

Circuit 1001 is selected on the Line Number thumbwheels of the Programming Panel. If the Processor is receiving the input signal, the OUTPUT button will light. In the event the Limit switch is closed and the I/O input card status lamp is OFF, check for the proper voltage at the input terminal. If the voltage is present and the input can be monitored at the Programming Panel yet the circuit lamp is not on, the lamp circuit is defective. If the status lamp is ON and the input is not seen by the Programming Panel, the input signal-conditioning card should be replaced.

When testing input circuits prior to connection to the machine, each circuit can be tested by applying the reference lead or your power source to the appropriate common terminal (2, 7, 12, 17) and the hot lead to the input terminal corresponding to the circuit under test. Input from the limit switch may be overridden or simulated through use of the Programming Panel's Disable button. Depress the Disable button to remove control of this input from the external device; the input can be switched ON or OFF by the output button.

Similarly, individual outputs may be examined via the Programming Panel while verifying the presence of the signal at the terminal with a buzzer or indicator lamp.

CAUTION

DC input/output modules are polarity-sensitive, and the proper equipment must be used when detecting signals.

COMMON FAULTS

1. *No Run Light*—This indicates that the Processor is not running through its normal cycle. All power supply indicator lights and cable connections should be checked. If a Programming Panel or other interfaces are connected, they should be disconnected, and the door securely closed. The Controller interlock knob should be turned OFF and then ON. If there is still no Run light, the MODICON Service Center should be notified. The operator on duty will advise you of subsequent action to be taken.

   Before calling Service Center, be sure to have symptoms thoroughly documented (i.e. AC power supply status, circumstances governing failure, and mainframe serial number).

2. *No Input or Output*—In the event that an individual input or output does not appear to be functioning correctly, the customer should check his program using the Programming Panel to be sure that all associated lines are correctly programmed. If the lines are correctly programmed, the suspect output should be disabled ON and OFF manually. If, in the case of an output problem, the field device cannot be turned ON and OFF by the Programming Panel, the output voltage should be measured. If the output module appears to be switching correctly, the field device or its wiring should be suspected. If the Controller does not appear to be turning the output ON and OFF, replace the suspected output module.

In testing an input, the suspected input should be manually disabled ON and OFF. If this correctly activates the associated lines of the ladder program, the on and off voltages from the field device should be checked. If these voltages appear to be correct, replace the suspected input module.

3. *No Channel Light*—Beginning with the last (right-most) I/O housing, uncam each housing including the first housing from the I/O cable or Auxiliary Power Supply, until the Channel light comes ON. Remove all I/O modules from the last housing uncammed prior to restoring the Channel light, and then recam it into the I/O channel. If the Channel light goes out, the housing is defective and its backplane should be replaced. If the Channel light remains ON after the housing is recammed, replace each I/O module until the Channel light goes Out; the last I/O module inserted is defective and should be replaced. If uncamming all I/O housings does not restore the Channel light, the Processor is defective and should be replaced. If an entire housing or group of housings have all their I/O module active lights turned OFF, the left-most housing should be suspected and tested as discussed above, by uncamming and removing all I/O modules and then replacing them one at a time.

4. *No I/O or MF Power Lights on Main Power Supply*—The main power and control power lights must be ON and all auxiliary interfaces should be disconnected. The Controller interlock knobs should be turned ON with the service port door completely closed against the side of the Processor. If there are still no I/O of MF lights, the I/O cables should be disconnected from the CPU, one at a time, cycling the main frame interlock OFF and ON each time. If the I/O power lights and MF power lights come on, the last I/O cable disconnected should be checked for possible shorts or grounds. If, however, the lights still do not come on, the power supply cable should be disconnected at the Processor, connected to either another mainframe known to function properly, or a MODICON Load Box. If the lights still do not come ON, the power supply should be replaced.

   If the Power Supply lights come ON with a different mainframe or the load box, yet does not function with the main frame (all I/O and peripherals disconnected), replace the main frame and reload the ladder program using your Program Loader or Telephone Interface and the MODICON Service Center.

AUXILIARY UNITS

All auxiliary units have indicator lamps associated with major functions to indicate proper operation. Specific troubleshooting aids are available for the Programming Panel, the Printer, and the Remote Driver.

Entering the code 9999 into the line number location on the Programming Panel will allow testing of all indicator lamps and displays without effecting the processor; disconnecting the Programming Panel from the processor is NOT required. With 9999 entered as the line number, all pushbuttons can be depressed to verify the operation of their lamps. The reference display will display whatever number is dialed on the reference thumbwheels. When depressing the selected elements (A through D) pushbuttons, note that the decimal points on the reference display will also light, one at a time left to right, as elements A through D are selected. Failure of any indicator lamp will not prevent the programming panel from entering data into the processor; it only prevents the operator from visually observing his data. The programming panel will enter correct data even if it is not supplied with AC power; however, detailed record keeping is suggested if a panel is used without AC power, since monitoring of the program (other than the reference numbers) will not be possible.

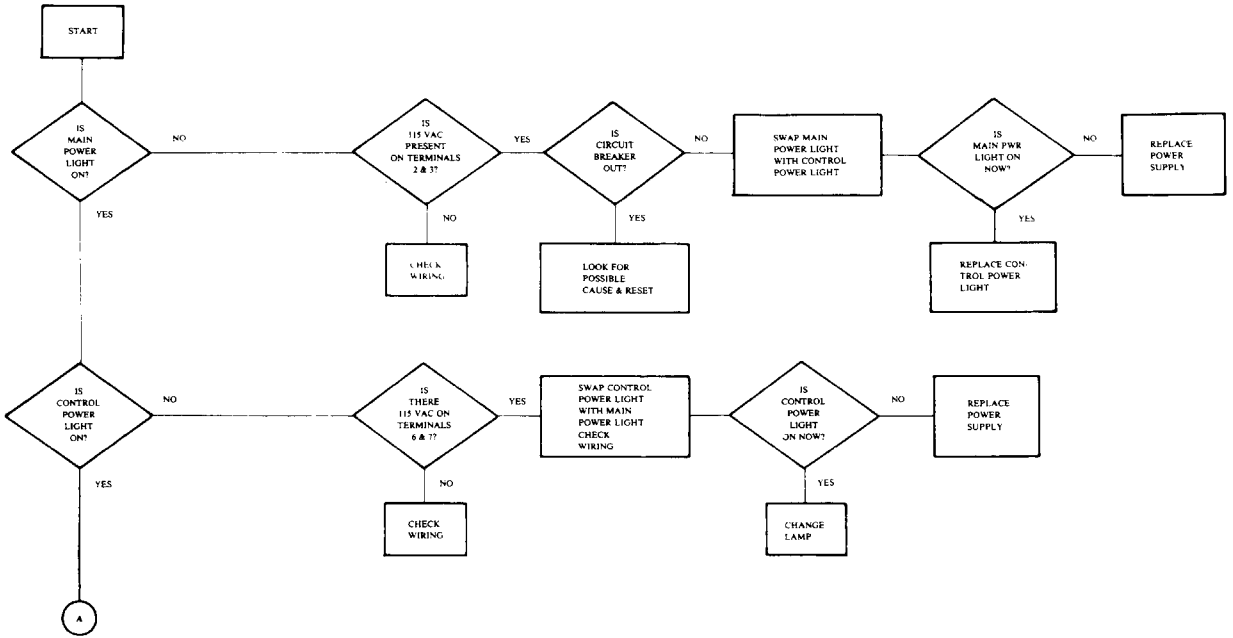
The P500 Printer operates based upon data it receives from the controller via the output register. This output register can be forced to any value by the programming panel and thus instructions can be simulated under a more

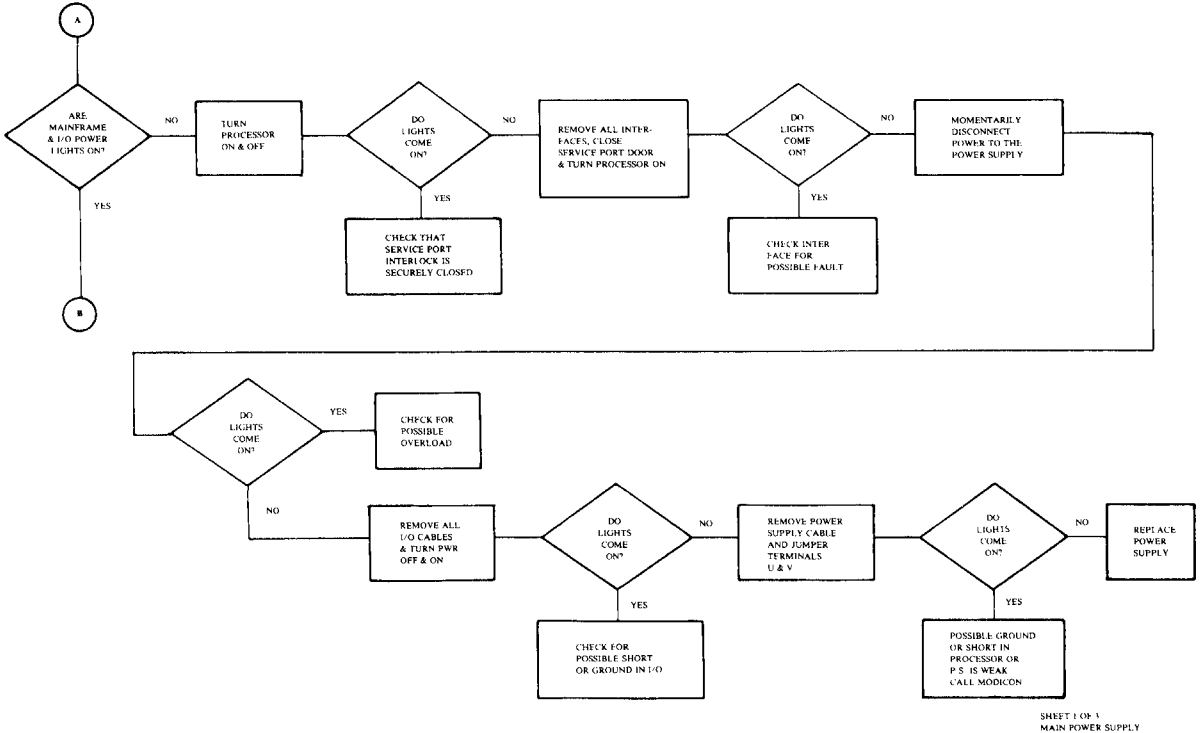
controlled environment. Before any attempt is made to force the output register, insure that there is sufficient paper in the printer (no paper out light on the printer) and that the two input signals (busy and form busy) are properly connected. A busy signal can be generated by depressing the paper feed pushbutton on the top of the printer and then observe it at the input module and the WDT-4 line. Both the I/O power and Motor ON indicators should be lit; the I/O power is controlled by a fuse on the top near the indicators and the Motor ON is controlled by a fuse on the back near the AC power cord. If both the busy and form busy lamps are lit for an extended period of time without change, cycle power on the printer to generate a rest signal. An automatic form feed is normal upon restoring power. If both signals cannot be cleared, abort the print operation by activating WDT-2 coil and recycle power on the printer. To assist in defining the problem, first attempt to print just numerical data (DX code 40PL) and then stored messages. If a 40PL print operation is performed and a 41XX or 4200 command results in both the busy and form busy lines ON but no printing, the problem is with the PROM card in the printer; either it is not properly seated or all PROM's are not fully installed in their sockets. After all the above checks have been made, the printer can be exercised by the commands provided in table 24. The printer reacts to changes of status not just presentation of data; thus data must be re-applied for the printer to react properly if repetitive operations are desired.

Remote installations (I425 and I430) have a number of indications associated with them to insure data transmissions over paths up to 2000 feet (4000 feet round-trip). Data is obtained by the I425 driver from the processor in serial format, and then it is modulated into a single carrier for transmission at 312,000 Hertz. The DATA OUT indicator on the top of the I425 (see figure A-12) indicates data is available at all four pairs of out terminals. The LINE TO indicator on the I430 indicates data is being received by the I430 and the active lights on the individual modules verify that they are receiving their individual status from the processor. The LINE FROM indicator on the I430 indicates data is being supplied for transmission to the driver. The individual DATA IN indicators indicate data is being received by the driver on the respective sub-channels. Finally, the controller indicator light (see figure 128) corresponding to the channel being remoted, will light if responses are being received by the processor. However, this indicator will be dimmer than when the channel is connected directly to its I/O housings; it may be necessary to remove other I/O cables to insure this indicator is lit. If remote data transmissions fail between any two points as previously discussed, the indicator at the receiving end will be then extinguished; the channel communications light on the processor is the last indicator to be serviced. For example, if a LINE FROM indicator on an I430 is lit, but its respective DATA IN indicator on the I425 is not lit, the problem is between these two units and the connections and continuity of cable 1 should be examined (see figure A-13). If a DATA IN indicator on an I425 is lit and the channel communication light is not lit, the driver should be examined, especially the position of the Test Mode switch.

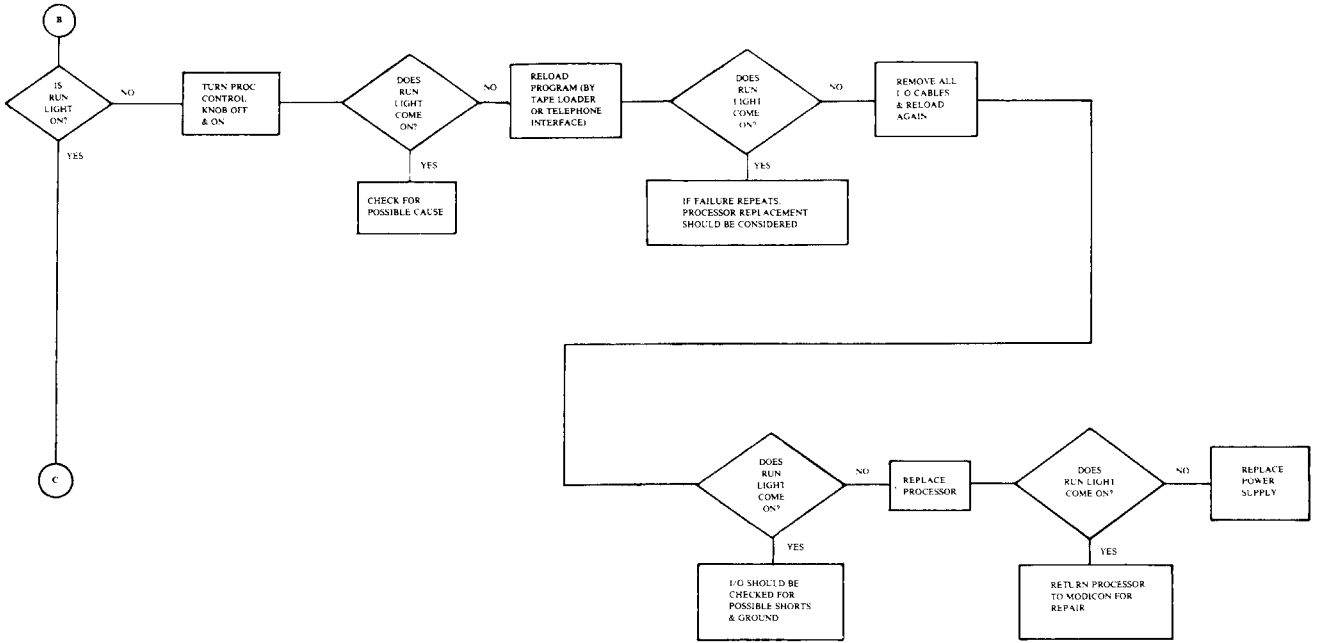
Table 24.

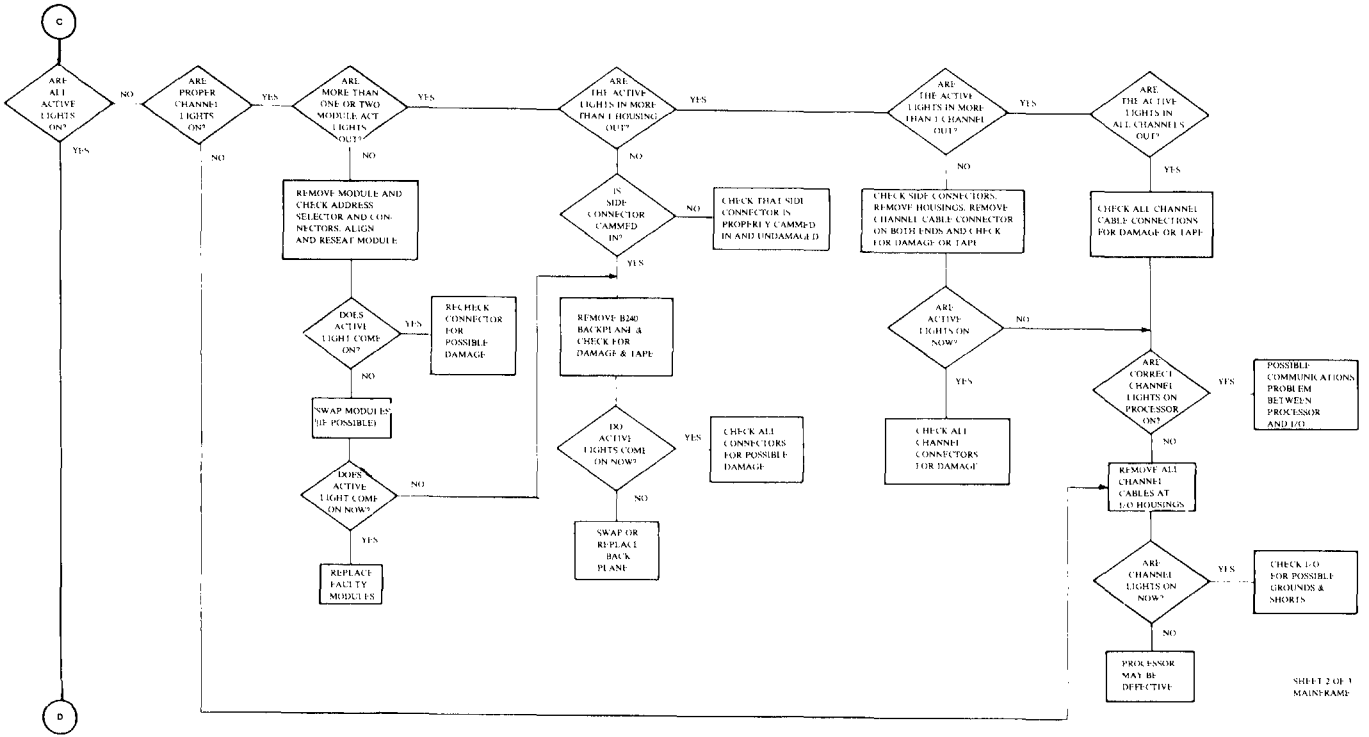
Output Register Contents	Function
XXX1	PRINT—causes the contents of the printer's variable data buffer to be printed.
XXX2	SPACE—loads buffer with a space.
XXX4	FORM FEED—forces printer to execute a form feed.
AAX8	START FORM—starts printing at address (message number) AA
DX1X	LOAD BUFFER—loads one buffer position with BCD value D.
XX2X	MOTOR ON—turns motor ON.
XX8X	CLEAR—clears buffer to zero.

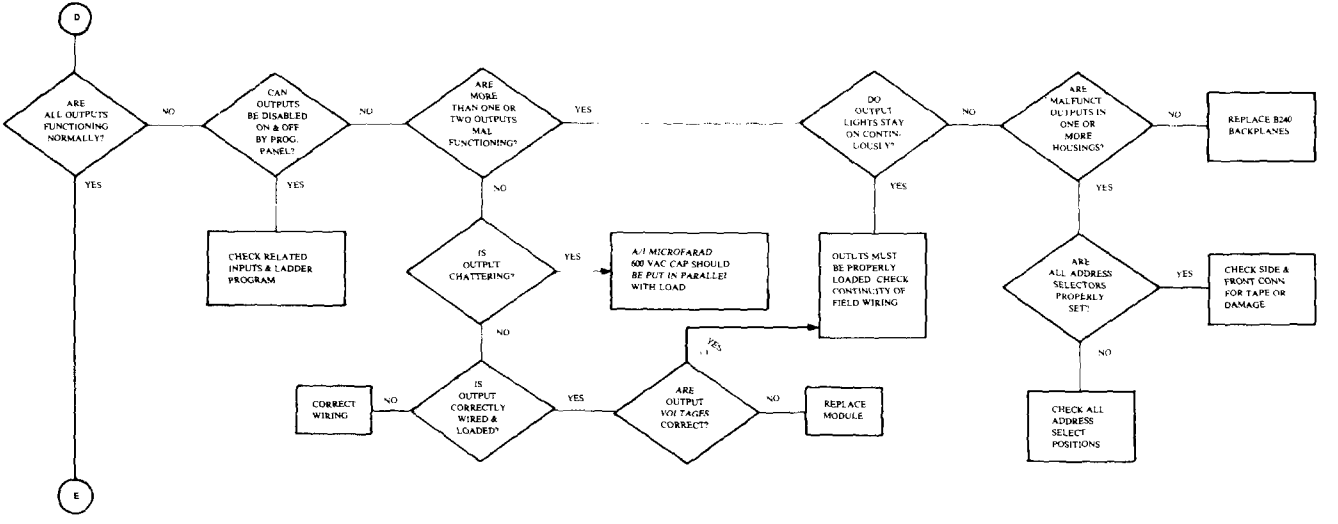

START
IS MAIN POWER LIGHT ON?
NO
IS 115 VAC PRESENT ON TERMINALS 2 & 3?
YES
IS CIRCUIT BREAKER OUT?
NO
SWAP MAIN POWER LIGHT WITH CONTROL POWER LIGHT
IS MAIN PWR LIGHT ON NOW?
NO
REPLACE POWER SUPPLY
YES
NO
CHECK WIRING
YES
LOOK FOR POSSIBLE CAUSE & RESET
YES
REPLACE CONTROL POWER LIGHT
YES
IS CONTROL POWER LIGHT ON?
NO
IS THERE 115 VAC ON TERMINALS 6 & 7?
YES
SWAP CONTROL POWER LIGHT WITH MAIN POWER LIGHT CHECK WIRING
IS CONTROL POWER LIGHT ON NOW?
NO
REPLACE POWER SUPPLY
YES
NO
CHECK WIRING
YES
CHANGE LAMP
A

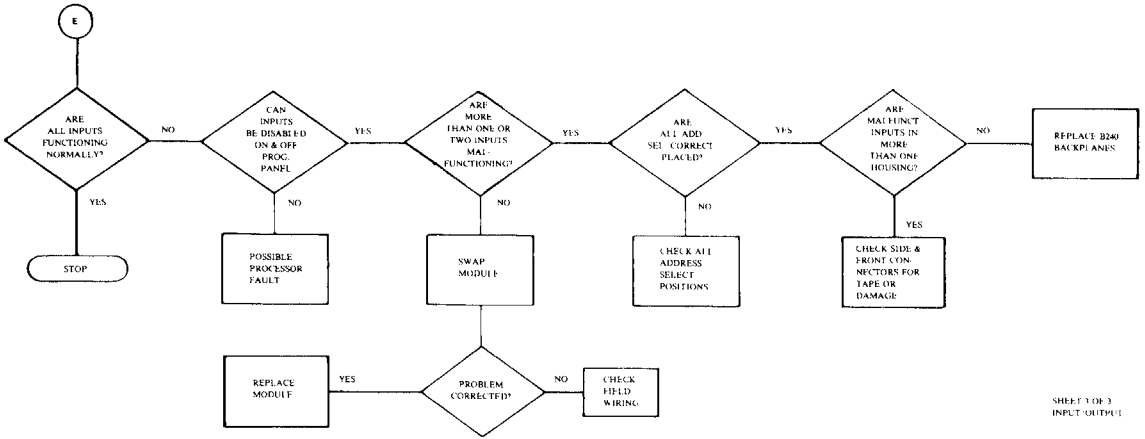


SHEET 1 OF 3
MAIN POWER SUPPLY


B
IS RUN LIGHT ON?
NO
YES
TURN PROC CONTROL KNOB OFF & ON
DOES RUN LIGHT COME ON?
NO
YES
CHECK FOR POSSIBLE CAUSE
RELOAD PROGRAM (BY TAPE LOADER OR TELEPHONE INTERFACE)
DOES RUN LIGHT COME ON?
NO
YES
IF FAILURE REPEATS, PROCESSOR REPLACEMENT SHOULD BE CONSIDERED
REMOVE ALL I/O CABLES & RELOAD AGAIN
C
DOES RUN LIGHT COME ON?
NO
YES
I/O SHOULD BE CHECKED FOR POSSIBLE SHORTS & GROUND
REPLACE PROCESSOR
DOES RUN LIGHT COME ON?
NO
YES
RETURN PROCESSOR TO MODICON FOR REPAIR
REPLACE POWER SUPPLY


C
ARE ALL ACTIVE LIGHTS ON?
NO
YES
ARE PROPER CHANNEL LIGHTS ON?
YES
NO
ARE MORE THAN ONE OR TWO MODULE ACT LIGHTS OUT?
YES
NO
REMOVE MODULE AND CHECK ADDRESS SELECTOR AND CONNECTORS. ALIGN AND RESEAT MODULE
DOES ACTIVE LIGHT COME ON?
YES
RECHECK CONNECTOR FOR POSSIBLE DAMAGE
NO
SWAP MODULES (IF POSSIBLE)
DOES ACTIVE LIGHT COME ON NOW?
NO
YES
REPLACE FACTTY MODULES
ARE THE ACTIVE LIGHTS IN MORE THAN 1 HOUSING OUT?
YES
NO
IS SIDE CONNECTOR CAMMED IN?
NO
CHECK THAT SIDE CONNECTOR IS PROPERLY CAMMED IN AND UNDAMAGED
YES
REMOVE B240 BACKPLANE & CHECK FOR DAMAGE & TAPE
DO ACTIVE LIGHTS COME ON NOW?
YES
CHECK ALL CONNECTORS FOR POSSIBLE DAMAGE
NO
SWAP OR REPLACE BACK PLANE
ARE THE ACTIVE LIGHTS IN MORE THAN 1 CHANNEL OUT?
YES
NO
CHECK SIDE CONNECTORS. REMOVE HOUSINGS. REMOVE CHANNEL CABLE CONNECTOR ON BOTH ENDS AND CHECK FOR DAMAGE OR TAPE
ARE ACTIVE LIGHTS ON NOW?
NO
YES
CHECK ALL CHANNEL CONNECTORS FOR DAMAGE
ARE THE ACTIVE LIGHTS IN ALL CHANNELS OUT?
YES
CHECK ALL CHANNEL CABLE CONNECTIONS FOR DAMAGE OR TAPE
ARE CORRECT CHANNEL LIGHTS ON PROCESSOR ON?
YES
POSSIBLE COMMUNICATIONS PROBLEM BETWEEN PROCESSOR AND I/O
NO
REMOVE ALL CHANNEL CABLES AT I/O HOUSINGS
ARE CHANNEL LIGHTS ON NOW?
YES
CHECK I/O FOR POSSIBLE GROUNDS & SHORTS
NO
PROCESSOR MAY BE DEFECTIVE
SHEET 2 OF 3
MAINFRAME
D


D
ARE ALL OUTPUTS FUNCTIONING NORMALLY?
NO
YES
CAN OUTPUTS BE DISABLED ON & OFF BY PROG. PANEL?
NO
YES
CHECK RELATED INPUTS & LADDER PROGRAM
ARE MORE THAN ONE OR TWO OUTPUTS MAL FUNCTIONING?
YES
NO
IS OUTPUT CHATTERING?
YES
ADD MICROFARAD 600 VAC CAP SHOULD BE PUT IN PARALLEL WITH LOAD
NO
IS OUTPUT CORRECTLY WIRED & LOADED?
NO
CORRECT WIRING
YES
ARE OUTPUT VOLTAGES CORRECT?
NO
REPLACE MODULE
YES
DO OUTPUT LIGHTS STAY ON CONTINUOUSLY?
NO
YES
OUTPUTS MUST BE PROPERLY LOADED. CHECK CONTINUITY OF FIELD WIRING
ARE MALFUNCTIONING OUTPUTS IN ONE OR MORE HOUSINGS?
NO
REPLACE B240 BACKPLANES
YES
ARE ALL ADDRESS SELECTORS PROPERLY SET?
YES
CHECK SIDE & FRONT CONN FOR TAPE OR DAMAGE
NO
CHECK ALL ADDRESS SELECT POSITIONS
E



SHEET 3 OF 3
INPUT/OUTPUT