Compumotor

Model 430
Troubleshooting Guide

Compumotor Division
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p/n 88-006107-01 A

Parker

430 TROUBLESHOOTING GUIDE

1.0 INTRODUCTION

This guide is intended to be helpful when experiencing problems with a model 430 indexer. The assumption has been made that the problem is related to the hardware of the 430 indexer, motor/drive, or any external devices interfaced to the 430. If the problem you have is related to programming the 430, refer to Section 2.3.2 for assistance. Programming command list is provided in Figure 2-0 for an easy reference.

1.1 Test Equipment

Before you begin troubleshooting the 430, you should have the following equipment available:

1. Small screwdriver
2. Model 431 programmer
3. Wire for jumpers
4. Voltmeter

The following equipment is optional, but desirable:

5. Terminal with RS-232 transmission
6. Spare Model 430
7. Spare motor/drive
8. Oscilloscope

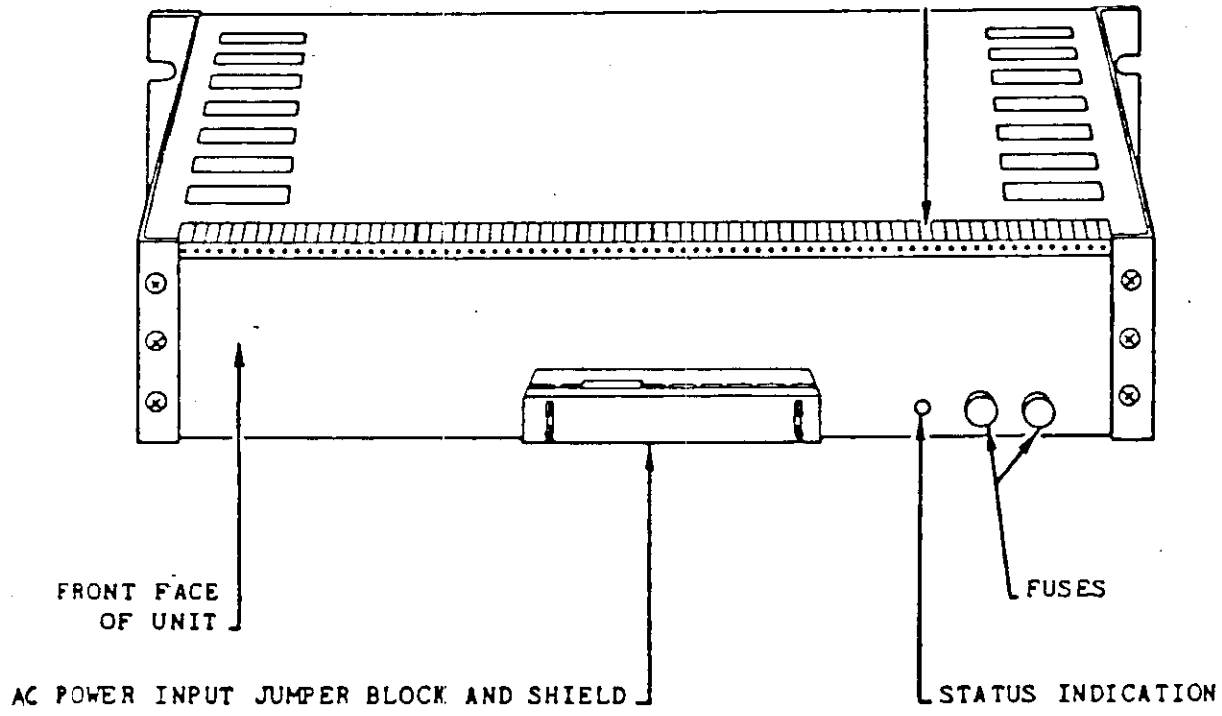


Figure 1-1

2.0 LED DIAGNOSTIC INDICATORS

The 430 has a two-color LED on the front panel (see Figure 1-1) which gives you a quick visual indication of the indexer's condition. The LED can be in one of three possible states: LED OFF, LED RED, or LED GREEN. Refer to Figure 1-2 for a pictorial representation of these conditions.

LED OFF - Indicates that there is no power to the 430's power supply. See Section 2.1 for a further description.

LED RED - Indicates that power is on and that the board monitor alarm has been activated. This means that the microprocessor is not executing its programs properly. See Section 2.2 for further description.

LED GREEN - Indicates that the power is on and that the microprocessor is functioning properly. See Section 2.3 for a further description.

The following sections outline in further detail the possible causes and solutions for each of the above conditons.

2.1 LED Off

2.1.1 AC Power Missing

Check 430 power terminals for correct AC voltage as illustrated in Figure 1-3, then check the wiring from AC power source and reapply power. CAUTION: Be sure to disconnect AC voltage before checking wiring. If AC connections are correct, proceed to next section.

The 430 Operation Manuals up to and including Rev. C have indicated AC power wiring configurations for 100 V and 220 V. These configurations will damage the power supply and should not be used.

2.1.2 Line Fuse Blown

Remove power from the 430 and check AC line fuses for continuity. Refer to Figure 1-1 for fuse location. If a fuse is blown, replace and reapply power. It is likely that a short exists in the 430 power supply if the replacement fuse immediately fails. If this occurs, return faulty unit for repair. See Section 3.0 for return materials assistance. If fuses are intact, continue to next paragraph.

2.1.3 Faulty Power Supply

There is also the possibility of a faulty power supply or some open circuitry. Remove cover and verify that the two ramp-style connectors which carry power from the two 5 volt power supplies to the circuit board are attached. Refer to Figure 1-4 for location of these connectors. If the connectors are in place and the LED is still off, return unit for repair. See Section 3.0 for return materials assistance.

2.2 LED Red

2.2.1 Contact Bounce

Early versions of the 430 could experience intermittent faults if contact bounce of a certain frequency was present on any strobe input, or on trigger one. This can be eliminated by upgrading the 430 software to the latest revision. As of May 1, 1986 the latest software revision for the 430 is number 92-5012-11C/-01C. Refer to Figure 1-4 and for location of PROM's on circuit board part numbers illustrated. When you are examining the PROM's, check to ensure that the chips are installed properly. The chips have a small notch on one end. This notch should be facing away from the screw terminal connections. Also check the chips for proper insertion. If all of the legs of the chips are not completely inserted, the PROM's will not perform as required. Contact Compumotor's application engineering department at 1-800-358-9068 for the most recent set of PROM's if new revision software is required. If the PROM's are 92-5012A or later, proceed to next dipswitch and jumper check.

2.2.2 Dipswitch and Jumper Settings

On 430's with internal CPU circuit cards labeled "PCA 71-003270-01/-02", dipswitch SW9 positions 5 and 6 must be ON for boards to operate properly, while positions 7 and 8 must be OFF. Refer to Figure 1-4 for the location of switches and jumpers on the 430's circuit board. Refer to Figure 1-5 and for proper dipswitch and jumper settings. On CPU circuit cards labeled "PCA 71-003270-03", switch SW9 is a four position switch with two jumpers, JU9 and JU10, added. Make sure these jumpers are on the left side of the circuit board when viewing the screw terminal end of 430. When checking dipswitches and jumpers, make sure each setting is either completely ON or OFF. Be careful not to set a dipswitch to a halfway ON/OFF setting. If jumpers and dipswitches are in the correct positions, cycle power and proceed to the following paragraph if red light still exists. If a green light is now present, proceed to Section 2.3.

2.2.3 Cold Start

If the Red LED came on immediately after power-up, it may be due to a malfunctioning clock chip on the 430. Some 430's were built with Fujitsu 8284 clock chips. Some of these chips fail to operate properly with the 430 design until they are on for approximately 30 minutes. Malfunctioning 430's with Fujitsu 8284 chips should be returned to the factory for repair. A Fujitsu chip has a big "F" stamped on it for identification. This chip is found near the microprocessor. If the Fujitsu chip is present on circuit board, we suggest that the unit be sent back for update.

2.2.4 Electrical Noise

When the red LED comes on intermittently, it usually indicates the presence of extreme electrical noise. Check the connections from the 430 to the motor/drive (terminals 53-66) to ensure that all cabling is shielded and that one end of the shield is connected to earth ground. If intermittant failures persist, it may be necessary to identify and suppress possible sources of noise (i.e. inductive loads such as relays, solenoids or motor starters). You should always avoid routing 430 cabling in close proximity to high voltage

wiring. Also, if you are using a 430 output to drive a relay type load, be sure to shunt back-EMF from the relay with a diode. This will prevent excessive voltage from being fed back into the output and consequently blowing the output. Continue to next paragraph if red LED condition still exists. NOTE: All indexer grounds should be terminated at the same point.

2.2.5 Microprocessor Fault

The red LED indicates that the microprocessor is not able to execute any commands. This is most likely due to some sort of component failure. Cycle the power or reset the 430 by pulling the reset terminal 24 to ground. If the LED immediately turns red again, return faulty unit for repair. See Section 3.0 for return materials assistance.

2.3 LED Green

If the LED is green and the system is not functioning properly, the problem is not likely related to the 430's hardware. When this occurs, we need to isolate the problem; the motor/drive or the user's interface. At this time a spare indexer and motor/drive would be useful in isolating the source of trouble. The sections below provide a description for each of the two LED green conditions and give possible solutions to the troubles being experienced. If the LED is green and there is no motion, see Section 2.3.1. If the LED is green and there is motion, see Section 2.3.2.

2.3.1 No Motion LED Green

2.3.1.1 Holding Torque

Attempt to turn motor shaft with power applied to determine if full torque is present. If no holding torque is present, check the AC power connections to the drive. Also, check to assure that remote power shutdown (terminal 32) is not grounded. Refer to the troubleshooting chart found in the motor/drive operations manual for help. If a spare motor/drive is available, connect the cable from the 430 to the spare drive and verify proper operation. If there still is no holding torque, go to faulty drive section. Otherwise, proceed to the next section.

2.3.1.2 Overtravel Limit Switches (EOT switches)

The CW and CCW limits on the 430 must be pulled to ground for motion to occur. Verify that these inputs are low with respect to ground with a voltmeter. If you read 5 volts on either of terminals 42 or 43, check the wiring from your limit switches. For proper operation, normally closed limit switches must be used for the motor to move. If limit switches are not installed, make sure that terminals 42 and 43 are jumpered to ground (terminal 22).

2.3.1.3 Jog Inputs

If overtravel limits are in place, use a jumper wire from ground to terminal 25 or terminal 26 inputs to see if the 430 causes the motor to jog in each direction. If the motor jogs in each direction, proceed to section 2.3.2. If the motor still does not move, reset the 430 by pulling terminal 24 to ground.

Now try the jog process again. If motors still do not jog, proceed to the following section.

2.3.1.4 Test Move

Connect a Model 431 programmer to the 430. Remove the screw terminal block from pins 1 through 22 and place the screw terminal block connected to the 431 in its place. If you do not have a Model 431, contact your local distributor or Compumotor's application engineering department at 1-800-358-9068. See Figure 1-6 for location of switches on 431. This device should be connected to the low true end for proper interface with the 430 unless the 430 has been changed to operate on high true signals. Now place a 0255 on the thumbwheels and activate the command strobe (switch labeled CMD STB). This will cause the 430 to command the motor/drive to perform a one revolution move in the CW direction, and then a one revolution move in the CCW direction. The CW and CCW motor rotation is the movement direction when viewing the front end of the motor's mounting flange. After the CCW move is completed, the LED will turn red. When this occurs, simply reset the 430 by grounding terminal 24. If the above motion does not occur, connect 431 interface to 430 to the high true end and repeat the above proceedure. If the overtravel limits are not in place no motion will occur and the LED will turn red immediately. If the LED does not turn red immediately, but the motor does not move, the indexer/drive cable may be faulty. Repeat this test with a spare cable (refer to Section 2.3.1.2). If the 0255 move does not occur with 431 connected on low or high true, go to 431 functional test. Otherwise, see Section 2.3.2.3.

2.3.1.5 431 Functional Test

To check this, set the 431 on the low true end and put a 9999 on the thumbwheels. Now check the 430 bits 0-15 with a voltmeter for proper values. See Figure 1-7 for proper voltage readings on each bit. Repeat this proceedure with a 6666 setting on the thumbwheels. If voltages shown in the figure correspond to measured values, the 431 is fuctioning properly. If your 430 is configured to operate on high true signals, the voltages will be opposite from what is shown (i.e., 0 volts will be 5 volts and so on). If the voltages correspond now, proceed to the jog inputs section. However, if the voltages do not check, examine the wiring from the 431 to the 430 for proper connections and continuity. Now attempt the test move process again and proceed to next paragraph if no motion occurs.

2.3.1.6 Faulty Drive

If the motor has no holding torque, this is a good indication that the drive is faulty. The easiest way to determine this is to connect a spare drive to the 430, or monitor the pulse output with an oscilloscope. To check with a spare drive, disconnect the cable from the existing drive and connect it to the spare motor/drive. Check to see if this drive now has holding torque present. If the new motor/drive works, return faulty unit for repair. See Section 3.0 for return materials assistance. Make sure when you are connecting the new motor/drive that the cable is shielded and one end is connected to earth ground. If new drive functions properly, proceed to the next paragraph. If spare drive also does not function, go to pulse output failure.

2.3.1.7 Pulse Output Failure

A spare indexer can be used to check the existing drive, or the step output on the 430 may be checked with an oscilloscope. If you have a spare 430 indexer available, connect it to the existing motor/drive to see if it operates properly. To check with a scope, first disconnect the motor/drive wiring from the STEP+ and STEP- terminals 59 and 60. Isolate your scope from AC ground. With your scope probes connected to terminals 59 and 60, you should see 5 volt positive going pulses. These pulses should be approximately one microsecond wide when the 430 is operating. If the system is operating properly, go to next section for programming assistance if desired. If the 430 is not sending pulses, return the unit for repair. See Section 3.0 for return materials assistance.

2.3.2 Improper Motion LED Green

This section is designed as a guide in troubleshooting the system when there is motion at the motor, but for some reason the system is not functioning properly. It makes the assumption that the problem is now related to programming the 430 indexer.

2.3.2.1 One Limit Switch Floating

If one limit switch is grounded and the other is not, the 430 will move the motor in one direction but not the other. The motors will be capable of moving in the direction of the limit that is grounded, but will not move in the direction of the ungrounded limit. If this seems to be the case, go to the limit switch section for assistance on checking the limit switches (Section 2.3.1). After the limits are checked, reset the 430 by pulling terminal 24 to ground. If this does not help the situation, proceed to the following paragraph.

2.3.2.2 Test Program

At this point, a terminal with RS-232 interface will be very helpful. If you have a terminal available, connect the interface as shown in Figure 1-8. A model 431 can also be used to strobe the test program into the 430. Refer to Figure 2-0 for the listing of all 430 programming commands as needed. If detailed information is needed, refer to the 430 Operator's Manual page number referenced next to each command. Before you begin the test program, reset the indexer by grounding terminal 24. Refer to Figure 1-6 for location of data registers if you are using the Model 431 to program the test move. When using Model 431 to strobe the information found below into each register, the 430 retains the most recently strobed data for each register. If the data for a given register does not change from one command to the next, the data does not need to be re-strobed for that register.

REG1	REG2	REG3	REG4	CMDSTB	DESCRIPTION
0000	0000	0005	0000	0261	Set acceleration to 50,000 steps/sec/sec.
0000	0000	0005	0000	0262	Set velocity to 50,000 steps/sec.
0011	0000	0002	5000	0200	Define move #11.
0013	0000	0000	0000	0217	Define sequence #13 beginning point.
0011	0000	0000	0000	0064	Execute move #11.
0000	0000	0000	1000	0041	Delay for 1 second.
0011	0000	0000	0000	0064	Execute move #11.
0006	0000	0000	0000	0013	Turn on both outputs.
0000	0000	0000	0000	0216	Define sequence end.
0000	0001	0000	0000	0293	Enable autorecall.
0000	0000	0000	0000	0291	Save all parameters.

After you have entered this information, cycle power to the 430. Set the thumbwheel switches to read 13 and pull terminal 27, labeled SPECIAL, to ground terminal 22. This will cause the sequence you have entered to begin execution. The move performed should be a one revolution move in CW direction followed by a delay of one second, then one revolution move in CW direction with both outputs enabled after this move is completed. Check, with a voltmeter, terminals 30 & 31 for a 5 volt reading. If the entire program checks out, you have programmed one move and one sequence successfully. This also indicates that the 430's storage into memory and autorecall on power-up is functioning properly. If you need to erase all contents in the EEPROM, this is acomplished by inputting the information below to the 430.

REG1	REG2	REG3	REG4	CMD STB	DESCRIPTION
0000	0000	0000	0000	0293	Disable autorecall
0000	0000	0000	0000	0291	Save

The save program changes the entire contents of permanent memory to match the contents of the working memory. If the working memory is blank, the save program will blank the permanent memory. If the move was not executed as described above, refer to next paragraph.

2.3.2.3 Error Terminal Status

Jumper the pullups, terminal 46, to 5 volts, terminal 45, then check the error terminal, 23, with a voltmeter. When this pin reads +5 volts, it indicates that the indexer is functioning properly. A low voltage reading (.6 V) indicates a component failure in the 430. This output will go low if there is a failure in the EEPROM of in the static RAM.

3.0 RETURN MATERIALS PROCEDURE

If your 430 indexer or motor/driver requires repair, follow the proceedure listed below for the most rapid turnaround.

1) Obtain the serial number of unit to be returned.
2) Obtain a purchase order number for returned units.
3) Contact the factory at 1-800-358-9068 for a return materials authorization number (RMA number).
4) Package unit in original package or equivalent protection for shipment. Include a note in the box stating the reason for return.
5) Write RMA number on the box before shipment.
6) Send boxed unit to:

COMPUMOTOR CORPORATION
1179 N. McDowell Blvd.
Petaluma, CA 94952

LED TROUBLESHOOTING FLOW CHART WITH SECTION TOPICS

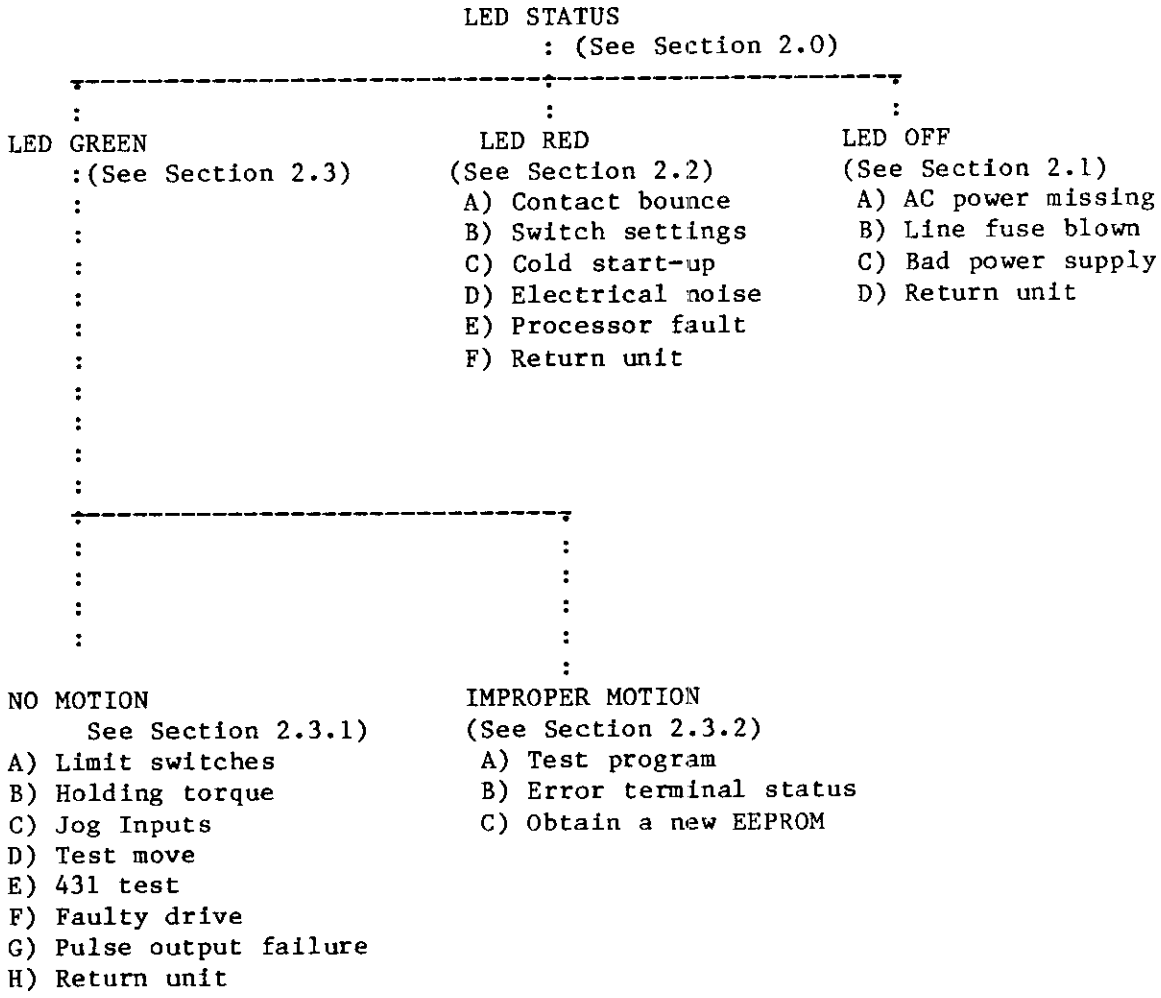
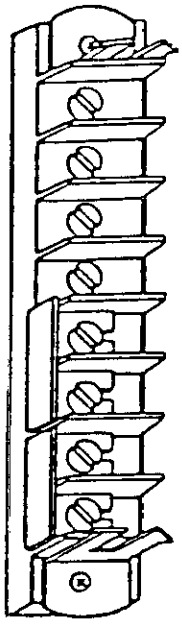


Figure 1-2

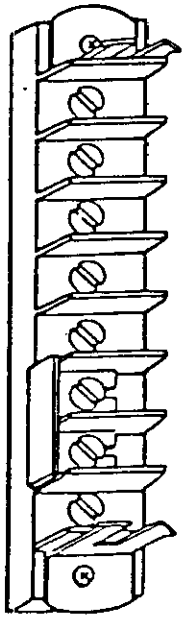


AC LINE -120 VAC (BLACK)

AC NEUT (WHITE)

AC GND (GREEN)

120 VAC



AC LINE -240 VAC (BLACK)

AC NEUT (WHITE)

AC GND (GREEN)

240 VAC

Figure 1-3

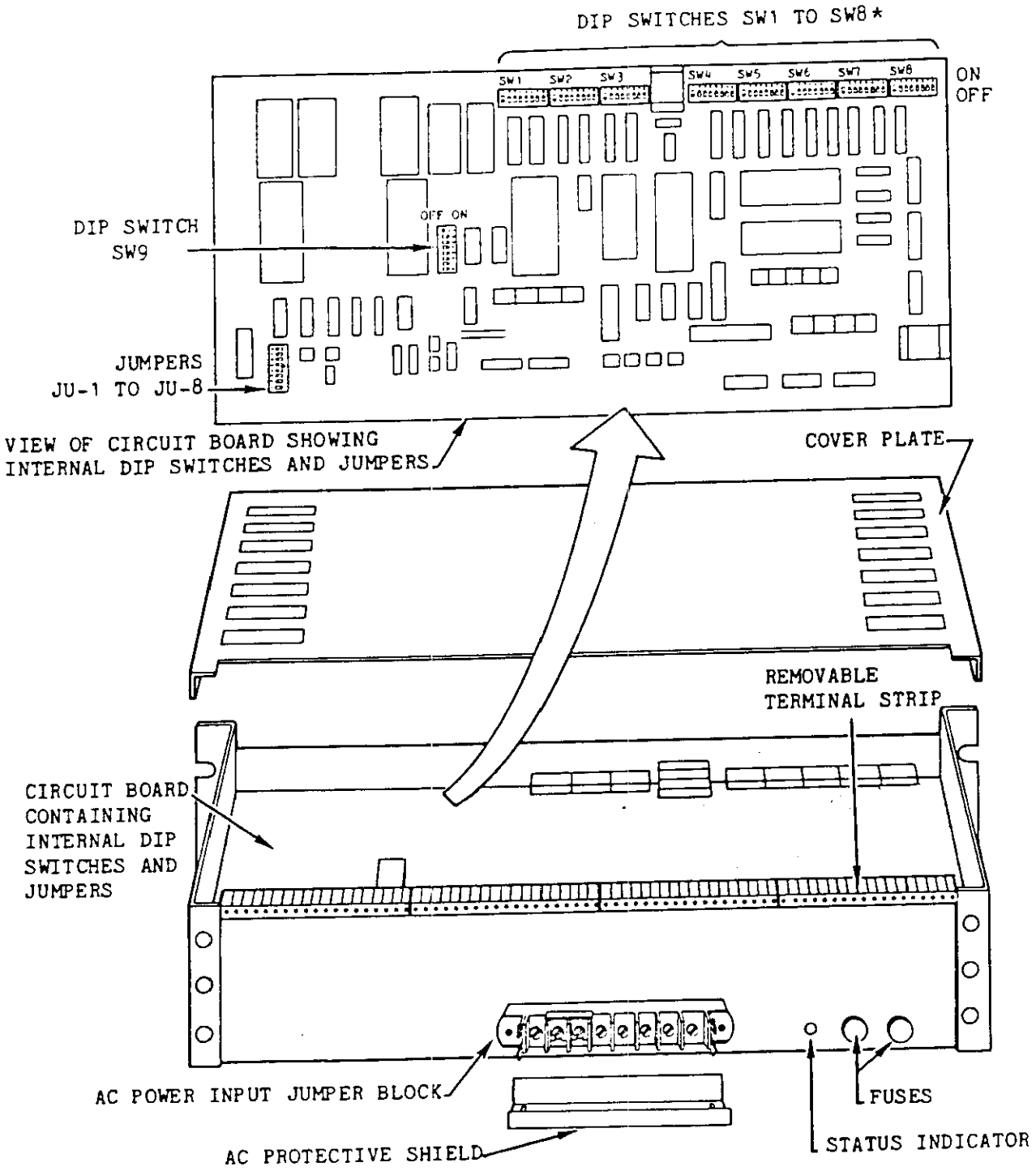

DIP SWITCHES SW1 TO SW8*
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
ON
OFF
DIP SWITCH
SW9
OFF ON
JUMPERS
JU-1 TO JU-8
VIEW OF CIRCUIT BOARD SHOWING
INTERNAL DIP SWITCHES AND JUMPERS
COVER PLATE
REMOVABLE
TERMINAL STRIP
CIRCUIT BOARD
CONTAINING
INTERNAL DIP
SWITCHES AND
JUMPERS
AC POWER INPUT JUMPER BLOCK
AC PROTECTIVE SHIELD
FUSES
STATUS INDICATOR

Figure 1-4

Table 3-1. Model 430 Factory DIP Switch and Jumper Settings

DIP Switch	Setting	DIP Switch	Setting	DIP Switch	Setting
SW1-1	ON	SW5-1	OFF	SW9-1	OFF
SW1-2	OFF	SW5-2	OFF	SW9-2	OFF
SW1-3	OFF	SW5-3	OFF	SW9-3	OFF
SW1-4	OFF	SW5-4	OFF	SW9-4	OFF
SW1-5	OFF	SW5-5	OFF	SW9-5	ON
SW1-6	OFF	SW5-6	OFF	SW9-6	ON
SW1-7	OFF	SW5-7	OFF	SW9-7	OFF
SW1-8	OFF	SW5-8	OFF	SW9-8	OFF
SW2-1	OFF	SW6-1	OFF	JU-1	OFF
SW2-2	OFF	SW6-2	OFF	JU-2	OFF
SW2-3	OFF	SW6-3	OFF	JU-3	OFF
SW2-4	OFF	SW6-4	OFF	JU-4	OFF
SW2-5	OFF	SW6-5	OFF	JU-5	OFF
SW2-6	OFF	SW6-6	OFF	JU-6	OFF
SW2-7	OFF	SW6-7	OFF	JU-7	OFF
SW2-8	ON	SW6-8	OFF	JU-8	OFF
SW3-1	OFF	SW7-1	ON		
SW3-2	OFF	SW7-2	OFF		
SW3-3	OFF	SW7-3	ON		
SW3-4	OFF	SW7-4	OFF		
SW3-5	ON	SW7-5	OFF		
SW3-6	OFF	SW7-6	ON		
SW3-7	ON	SW7-7	OFF		
SW3-8	OFF	SW7-8	OFF		
SW4-1	ON	SW8-1	OFF		
SW4-2	OFF	SW8-2	OFF		
SW4-3	ON	SW8-3	OFF		
SW4-4	OFF	SW8-4	OFF		
SW4-5	OFF	SW8-5	OFF		
SW4-6	ON	SW8-6	OFF		
SW4-7	OFF	SW8-7	OFF		
SW4-8	OFF	SW8-8	OFF		

Figure 1-5

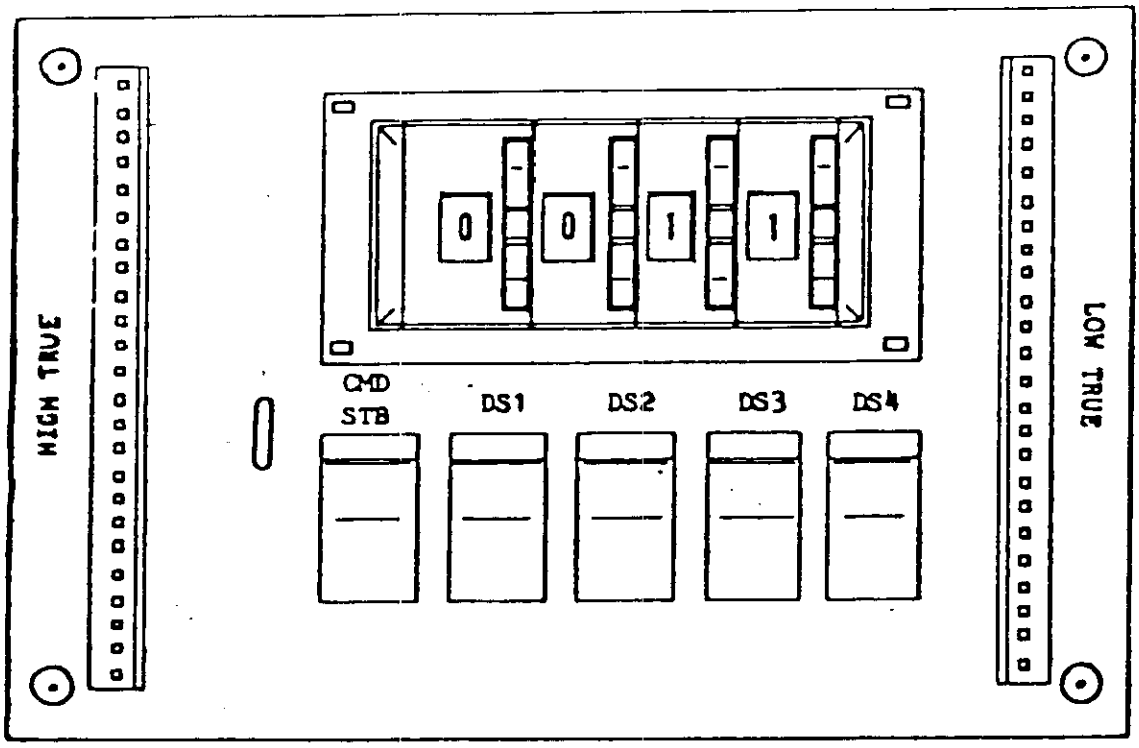


Figure 1-6

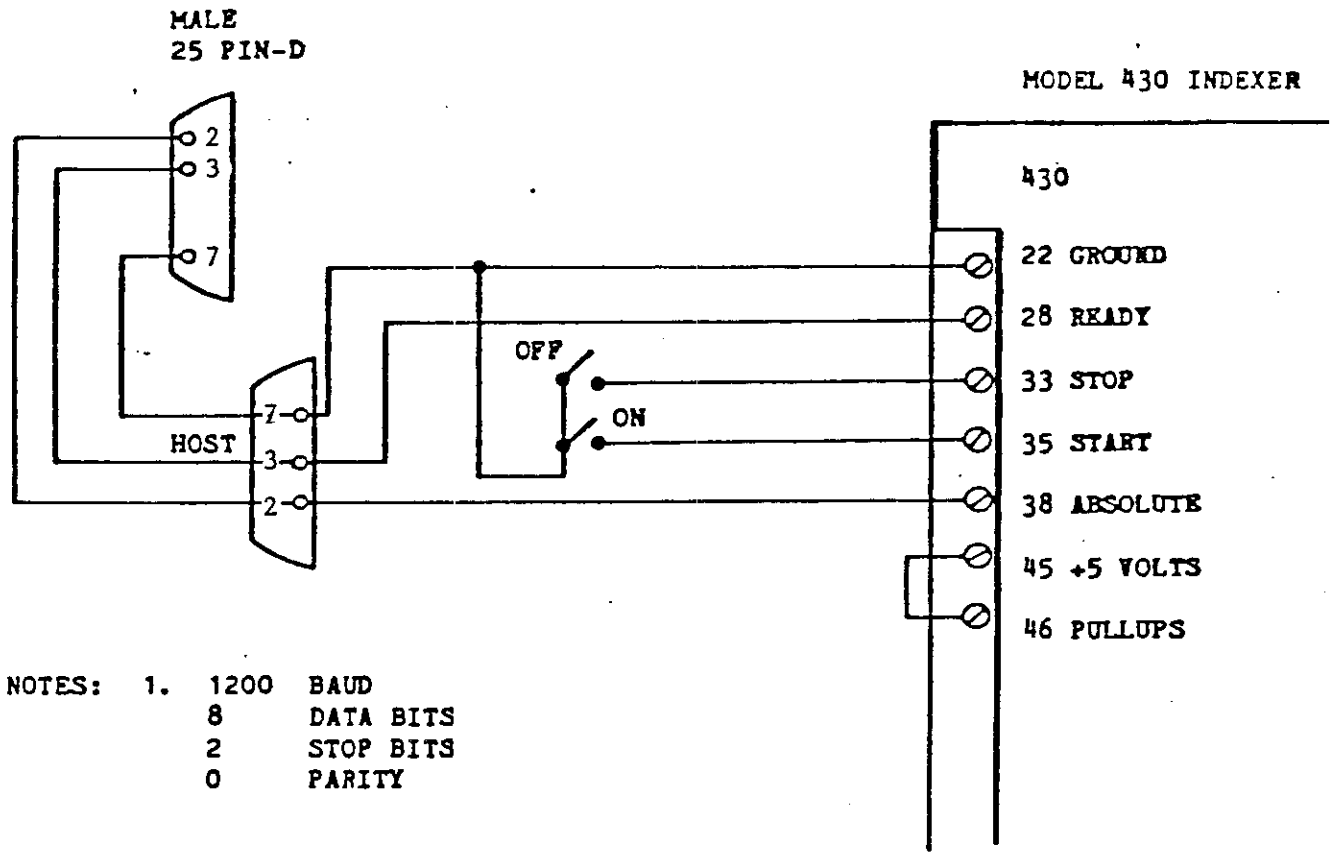
431 PROGRAMMER FUNCTIONAL TEST
431 Setting:9999

BITS:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VOLTAGES:	5	0	0	5	5	0	0	5	5	0	0	5	5	0	0	5

431 Setting:6666

BITS:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VOLTAGES:	0	5	5	0	0	5	5	0	0	5	5	0	0	5	5	0

Figure 1-7



NOTES: 1. 1200 BAUD
8 DATA BITS
2 STOP BITS
0 PARITY

2. ABSOLUTE AND READY MAY NEED TO BE SWITCHED

Figure 1-8

430 COMMAND ALPHABETICAL LISTING

Command	Table	Section	Page
[0000] NULL COMMAND	6-7	6.10.1	6-62
[0011] TURN ON AN OUTPUT	6-7	6.10.2.1	6-63
[0012] TURN OFF AN OUTPUT	6-7	6.10.2.2	6-63
[0013] TURN ON/OFF BOTH OUTPUTS	6-7	6.10.2.3	6-63
[0015] TURN ON/OFF OUTPUT ON CONDITION	6-7	6.1.2.4	6-64
[0018] TURN ON REMOTE POWER SHUTDOWN	6-6	6.10.3.1	6-66
[0019] SELECT REMOTE SHUTDOWN INPUT	6-7	6.10.3.2	6-66
[0020] SET MOVE DIRECTION	6-1	6.4.1	6-43
[0024] ENABLE POSITION MAINTENANCE	6-7	6.8.1	6-43
[0025] ENABLE MOVE TERMINATION OF STALL DETECT	6-5	6.8.2	6-46
[0032] EXECUTE LOOP	6-3	6.6.1.1	6-28
[0033] EXECUTE LOOP UNTIL CONTINUE	6-3	6.6.1.2	6-30
[0040] WAIT FOR CONTINUE	6-4	6.7.1.1	6-36
[0041] WAIT N MILLISECONDS	6-4	6.7.1.2	6-36
[0042] WAIT N SECONDS	6-4	6.7.1.3	6-36
[0043] WAIT N MINUTES	6-4	6.7.1.4	6-37
[0044] WAIT FOR A TRIGGER	6-4	6.7.1.5	6-37
[0046] SET OFFSET FROM ZERO	6-2	6.5.1	6-23
[0047] SET CLOSED LOOP OFFSET FROM ZERO	6-5	6.8.3	6-44
[0048] SET THE PRESENT POSITION AS ABSOLUTE ZERO	6-2	6.5.2	6-24
[0050] EXECUTE CONTINUOUS MOVE	6-3	6.6.2.1	6-30
[0051] EXECUTE PERFORM AN INCREMENTAL MOVE	6-3	6.6.2.2	6-31
[0052] EXECUTE PERFORM AN ABSOLUTE MOVE	6-3	6.6.2.3	6-31
[0053] EXECUTE CLOSED-LOOP INCREMENTAL MOVE (in encoder units)	6-5	6.8.4	6-45
[0054] EXECUTE CLOSED-LOOP ABSOLUTE MOVE (in encoder units)	6-5	6.8.5	6-46
[0056] DEFINE HOME	6-2	6.5.3	6-24
[0057] EXECUTE GO HOME	6-3	6.6.3.1	6-32
[0058] EXECUTE GO HOME CLOSED LOOP	6-5	6.8.6	6-46
[0064] EXECUTE A PREDEFINED MOVE	6-3	6.6.3.2	6-33
[0065] EXECUTE A PREDEFINED SEQUENCE	6-3	6.6.3.3	6-33
[0072] CONTINUE	6-3	6.6.4.1	6-34
[0112] STOP MOTION	6-4	6.7.2.1	6-40
[0114] SUSPEND THE SEQUENCE; WAIT FOR CONTINUE	6-4	6.7.1.6	6-38
[0116] STOP MOTION ON TRIGGER 1	6-4	6.7.2.2	6-41
[0118] SUSPEND THE SEQUENCE ON TRIGGER 1; WAIT FOR CONTINUE	6-4	6.7.1.7	6-38
[0120] KILL MOTION	6-4	6.7.2.3	6-43
[0124] KILL MOTION ON TRIGGER 1	6-4	6.7.2.4	6-42
[0176] DEFINE THE RATIO OF MOTOR STEPS TO ENCODER STEPS	6-5	6.8.8	6-48
[0177] DEFINE MOTOR RESOLUTION	6-5	6.8.9	6-49
[0178] DEFINE BACKLASH DEADBAND	6-5	6.8.10	6-50
[0179] DEFINE POSITION MAINTENANCE	6-5	6.8.11	6-50
[0180] DEFINE ROTOR TEETH	6-5	6.8.12	6-52
[0181] DEFINE SIGNAL DEADBAND	6-5	6.8.13	6-52
[0200] DEFINE AN INCREMENTAL MOVE	6-6	6.9.1.1	6-56
[0203] DEFINE AN ABSOLUTE MOVE	6-6	6.9.1.2	6-56
[0206] DEFINE A CONTINUOUS MOVE	6-6	6.9.1.3	6-57
[0212] DEFINE A CLOSED-LOOP INCREMENTAL MOVE	6-5	6.8.14	6-53
[0213] DEFINE A CLOSED-LOOP ABSOLUTE MOVE	6-5	6.8.15	6-54
[0214] SET START/STOP VELOCITY	6-1	6.4.2	6-17
[0215] DELETE A MOVE	6-6	6.9.1.4	6-58
[0216] END THE SEQUENCE DEFINITION	6-6	6.9.2.1	6-59
[0217] BEGIN THE SEQUENCE DEFINITION	6-5	6.9.2.2	6-59
[0218] DELETE A SEQUENCE	6-6	6.9.2.3	6-59
[0255] EXECUTE TEST MOVE	6-3	6.6.3.4	6-33
[0261] SET VELOCITY	6-1	6.4.3	6-18
[0262] SET ACCELERATION	6-1	6.4.4	6-20
[0271] STOP	6-4	6.7.2.5	6-42
[0272] KILL	6-4	6.7.2.6	6-42
[0280] SET THE DEFAULT POSITION PARAMETER	6-7	6.10.4	6-67
[0281] SET JOG VELOCITY	6-1	6.4.5	6-20
[0282] SET JOG ACCELERATION	6-1	6.4.6	6-21
[0283] EXECUTE CONTINUOUS MOVE USING THE JOG PARAMETERS	6-3	6.6.3.5	6-34
[0284] SET GO HOME VELOCITY	6-1	6.4.7	6-22
[0285] SET GO HOME ACCELERATION	6-1	6.4.8	6-22
[0291] SAVE PROGRAM	6-6	6.9.3	6-60
[0292] RECALL PROGRAM FROM MEMORY	6-6	6.9.4	6-61
[0293] ENABLE AUTORECALL ON POWER-UP	6-6	6.9.5	6-61
[0301] DEFINE THE SPECIAL INPUT	6-7	6.10.5	6-67
[0311] LIST PROGRAM	6-7	6.10.6	6-68
[0027] TURN ON/OFF BOOST	6-7	6.10.7	6-69
[0029] TURN ON/OFF AUTOMATIC BOOST	6-7	6.10.8	6-69
[0026] TURN ON/OFF DRIVE RESET	6-7	6.10.9	6-69
[0028] TURN ON/OFF GEARSHIFT	6-7	6.10.10	6-69

Figure 2-0