PRELIMINARY

STANDARD

Horizon SPF-20

Theory of Operation

PRELIMINARY

SPF-20
THEORY OF OPERATION

1. **POWER**: The 3-phase power cord entering into the SPF-20 goes through the Power Switch to a terminal strip, where 1 of the 3 wires stops. Even though the Sales Literature specifies 220 VAC, Single or 3 Phase, the SPF-20 actually runs on 220 VAC single-phase power. From the terminal strip, single-phase power goes through Circuit Breakers Q4 and Q5 to the multitap Power Transformer (ETG-265). The operating voltage can be 220, 230, or 240 VAC. It is possible to run on 208 VAC by bypassing the ETG-265 transformer.

   The 200 Volts from the secondary of the ETG-265 transformer goes through Circuit Breakers Q6 and Q7 to the Inverter and the Stitch Motor Driver. It also goes out to the FC-20 Power Supply, Knife Motor Driver, Blower Motor and Base Motor, through Connector X145. The Inverter produces 3 phase power for the SPF-20 motors, and goes out to the FC-20 Conveyor Motor through Connector X144.

   A second transformer (ETG-265B) provides 100V for the electronics, and a pair of 24V windings to power solenoids and clutch/brakes. **NOTE:** When changing the taps for different line voltages, the taps on this transformer should not be changed, even though other taps are present, since the Main Input Transformer already provides 200 VAC to power this transformer.

   Interlocks: There are 3 separate interlock strings in the SPF-20**.** The first interlock string consists of cover and ancillary switches in series with the 24V to the coils of Relays K01 and K02. Relay K01 controls the Belt Motor Driver **Fwd** signal and the Stitch Motor **Start** signal. Relay K2 is part of the Circuit Breaker Auxiliary Switch String explained below. The switches in the First Interlock String are:
   - S03 Emergency Stop Switch
   - S14 Fold Section Cover Switch
   - S12 Stitch Section Cover Switch (R)
   - S13 Stitch Section Cover Switch (L)
   - S15 Infeed Cover switch, through Connector X141

   Also included in this string is the FC-20 Emergency Stop Switch, through connector X146 Pins 15 and 16. When running the SPF-20 alone, a jumper is required across these pins to complete the string.

   The second interlock string consists of 3 switches mounted to the sides of each cover open switch. SW12B, SW13B, and SW14B, (the secondary Cover Open Switches) are open while their "A" counterparts are closed. All 3 of these secondary switches are placed in parallel across Connector 4, Pins 1 and 2 (E Stop Signal to the Data Bus). Therefore, if any 1 of these secondary switches closes, or if any 1 of the primary switches opens, operation is halted. (See note on page 3)

The third interlock string consists of **Circuit Breaker Auxiliary Switch Contacts, Q01, Q02, and Q03.** There is a microswitch inside each Circuit Breaker. If the breaker trips, or the internal switch is defective, the ground required at connector 7, Pin 7 will be absent. This results in the "PE4" signal to the Data Bus being hi instead of low, preventing operation.

NOTE: In order to start the motors, all 3 strings of switches must be made. S03, S12, S13, S14, S15 and the FC-20 E Stop Switch must all be closed to power K01 and K02. The auxiliary switches in Circuit Breakers Q01, Q02, and Q03 must be closed to prevent an Inhibit condition on the PE4 line, and the second halves of SW12, SW13, and SW14 Cover Open Switches must all be open to prevent an Inhibit on the B5 line.

3. **Pick Belt**: At Home Position, the Pick Belt Position Sensors (B06 and B07) will both be positioned near a hole in the associated encoder disks. When a low Clutch/Brake signal is received from the CPU Board at Connector 4, Pin 10 of the QPW-456 Driver Board, D-Flop IC7 Pin 6 sets, resulting in the Pick Belt Brake being released and the Pick Belt Clutch being energized. IC7 is reset when both of the Pick Belt Position Sensors are once again at a hole in their respective disks. The Pick Belt/Fold Knife Emergency Stop Signal will also reset IC7. (This signal occurs when RL1 and RL2 on the CPU Board are de-energized by a hi PA1 from the Z80.)
4. **Fold Knife**: When a Clutch/Brake signal from the CPU Board is received at Connector 4, Pin 9 of the QPW-456 Driver Board, D-Flop IC7 Pin 8 sets, resulting in the Fold Knife Brake being released and the Fold Knife Clutch being energized. IC7 is reset when the Fold Knife Stop Position Detector sees the hole in the cam on the Fold Knife Shaft. The Pick Belt/Fold Knife Emergency Stop Signal will also reset IC7. (This signal occurs when RL1 and RL2 on the CPU Board are de-energized by a hi from PA1 from the Z80.)
5. **Motor On Signal PA1** The Motor On Signal is provided by the Data Bus through a low PA1. This energizes Relays RY1 and RY2. Relay RY1 provides the FWD signal to the Inverter, which runs the Transport Belt Motor. Relay 2 enables the Stitch Motor. PA1 also runs the Infeed Section Jog Motor, through Solid State Relay SSR1, and enables the Motor Start Signal to the collator, allowing it to be started.

   When RY1 is de-energized by the CPU, the Belt Motor Driver is disabled and the E Stop signal is sent to the collator. De-energizing RY2 removes the Hi Speed signal from the Stitch Motor so the Stitcher Heads can be operated at slow speed only, when the motors are stopped. A high PA1 also sends an E Stop to the QPW456.

6. **System Move Circuit:** The System Move Motor (M10) moves the SPF-20 forward and backwards on its base, to position the SPF-20 in respect to the collator. When the System Forward or System Backward switch is pressed, IC 28 passes the appropriate direction signal to Solid State Relay SSR-2 or SSR-3. If the Emergency Stop Circuit is active, IC28 does not pass these signals. SSR-2 and SSR-3 power the motor in the appropriate direction until one of the System Move Proximity Switches is activated, disabling IC-28.

   The System Move Switch signals are also exported to the FC-20 so both units can be positioned simultaneously.

7. **Motor Speed**: The speed of the Transport Belt is controlled by VR3 on the Operator Panel. This pot connects directly to the Motor Controller.

8. **CPU**: Basic operation of the CPU board involves the Micro-processor continually looking at the inputs coming in from the various sensors and switches, then checking the program stored in the Programmable Read Only Memory (PROM) to determine which outputs are to be enabled at what time. The SPF-20 CPU board, (QPW-455B) uses a Z80 Micro-processor Chip and a Z84 Companion Processor with an 8 Megacycle clock, along with a 16 Bit addressable RAM and ROM, and a vendor proprietary PAL chip set (Hori 14).

   The QPW-455B has a 16 bit **Address Bus**, (A0 – A15) which is used to select an address in the Read Only Memory (**ROM**), Random Access Memory (**RAM**), or the **PAL** Chip. When addressed, each of these devices outputs the information stored at the specified address onto the **Data Bus** (8 Bi-directional lines (D0 – D7) delivering information between the microprocessor and the other components. The Z84 Companion Processor multiplexes the 8 data lines into 32 Input or Output lines (PA0 through PD7) which go directly to the individual input and output components. The Data Bus also interfaces directly with the Communication line to the collator.

   The CPU Board has an 8 bit, switch selectable jumper field (30 - 38 Hex) which translates directly to the Data Bus to provide helpful troubleshooting conditions. The normal operating condition of these switches is "OFF". Turning the switches on produces the following:

Sw1-5	Not Used
Sw6	Top and bottom guides cannot be activated when the Emergency Stop Switch is depressed.
Sw7	Top and bottom guides can be activated when Jog Mode is selected.
Sw8	Main SPF-20 Motor turns off 0.6 to 0.8 Seconds after a jam is detected in the Folding Section.

9. **Input/Output Signals**: Most of the signals going into and out of the QPW-455B CPU board go through Opto-Isolators. Most I/O signals have an accompanying LED to indicate signal condition. A large portion of troubleshooting is accomplished by triggering the sensors and switches, and watching for the correct LEDs to illuminate.

   Information on inputs, outputs, and their associated LEDs can be found in the following tables:

TABLE 1
SENSORS and SWITCHES
QPW-455B CPU Board

Signal	I/O	Bus	LED	Con	Pin	Function
Stitcher Stop Position Sensor (B03)	I	PE5		13	2, 3	Home position for Stitch Head Shaft. Also resets latch for Stitch Motor Start
Set Present Sensor (B04)	I	PD0		13	5, 6	Detects presence of set in stitcher
End Stop Sensor (B09)	I	PD4		14	2, 3	Fiber Optic Sensor for Head Stop
Base Motor Proximity Sw. (B01)	I			14	5, 6	Reset latch for SSR2 Base Motor (Fwd)
Base Motor Proximity Sw. (B02)	I			14	8, 9	Reset latch for SSR3 Base Motor (Rev)
Cover Switches (S14, S13, S12)	I	B5		4	1, 2	Series cover open switches. Each switch has 2 halves. The other half of each switch is in the Cover Open String
Emergency Stop Switch	I	B5		4	3, 6	Stop all motors and prevent operation.
System Fwd Switch	I	N/A	L6	4	4, 6	To Base Motor Latch IC28
System Backward Switch	I	N/A	L5	4	5, 6	To Base Motor Latch IC28
Stitch Delay Time Switch	I	B6		4	7, 8	Allows delay time for Jog to finish. Delay controlled by Stitch Delay Pot.
Stitch Delay Time Pot	I	B7	L1	4	9, 10	IC20 Stitch Delay 1 Shot
Conveyor On Time Pot	I	PD5	L3	4	13, 14	Determines conveyor run time per cycle
Infeed Jam Sensor B08	I	PD6	L4	5	2, 3	Pulse Counter Disk
Fold Delay Time Proximity Switch (B11)	I	PE2		7	2, 3	On Fold Length Knob. Delay for short sets.
Fold Tail Jog Sensor (B10)	I	PE7		8	2, 3	Detects presence of book in Folder
Stitch On/Off Switch (S16)	I	PD2		11	4, 10	Enable or Disable Stitch Motor Driver
FC-20 Emergency Stop	I			X14 6	15, 16	Open Switch drops K1 and K2

TABLE 2
QPW-455B CPU Board Inputs / Outputs to Drivers

Signal	I/O	Bus	LED	Con	Pin	Function
Stitch Motor Start	O	N/A	L11	12	3	Run signal to Stitch Motor Driver. Gated by STOP from Data Bus, IC17 Power On Prime circuit, and Stitch Head Stop Position Sensor.
Stitch Motor Direction (CW)	O	PA3	L12	12	4	Determines direction of Stitch Motor
Stitch Motor Alarm	I	PD3		12	6	Stitch Motor Driver jam or other failure stops SPF-20

TABLE 3
QPW-455B OUTPUTS to QPW-456 Driver Board

Signal	I/O	Bus	LED	Con	Pin	Function
Clutch and Brake for Carry Belt	O	PB0	L18	15	1	Low turns Brake off and Clutch on
Clutch and Brake for Fold Knife	O	PB1	L19	15	2	Low turns Brake off and Clutch on
Tail Jogger Solenoid Signal	O	PB2	L20	15	3	Low energizes Stitch Tail Jog Solenoi
Side Jogger Solenoid	O	PB3	L21	15	4	Low energizes Stitch Side Jog
Center Stitch Solenoid	O	PB4	L22	15	5	Low activates Corner Stitch Gate
Bypass Gate Solenoid	O	PB5	L23	15	6	Low activates Folder Bypass Gate
Fold Jogger Finger Solenoid	O	PB6	L24	15	7	Low activates Fold Jog Fingers

TABLE 4
OUTPUTS TO FC-20

Signal	I/O	Bus	LED	Con	Pin	Function
Base to Rear Signal	O		L5	X146	1	Move FC-20 to Rear
Base to Front Signal	O		L6	X146	2	Move FC-20 Forward

TABLE 5
LEDs ON QPW-455B CIRCUIT BOARD

LED	PURPOSE
L1	Stitch Head is activated
L3	Conveyor running
L4	Jam
L5	FC-20 Move to rear
L6	FC-20 Move to front
L7	Side Stitch Mode output to FC-20
L8	Emergency Stop or Cover Open Switches activated.
L9	Main Motor on
L11	Stitch Motor Start
L12	Stitch Motor Slow Speed Reverse
L13	SPF20 move to front
L14	SPF-20 move to rear
L15	Side Jog Torque Motor activated
L16	Side Jog Torque Motor de-activated
L17	Conveyor Motor activated
L18	Carry Belt Clutch and Brake
L19	Fold Knife Clutch and Brake activated
L20	Stitch Tail Jogger activated
L21	Stitch Side Jogger activated
L22	Side/Corner Stitch Solenoid actuated
L23	Gate Solenoid on Bypass Section
L24	Fold Tail Jog Solenoid
L25	Not Used

TABLE 6
LED ARRAYS ON QPW-455 CIRCUIT BOARD

1	Collating Start/Stop Switch
2	Belt Start/Stop Switch
3	Side Stitch Mode Switch
4	Fold Mode Switch
5	Single Stitch Switch
6	Stitch Head Inching Switch
7	Jog On/Off Switch
8	Single Fold Switch
9	Emergency Stop Signal from Collator
10	Collator Main Motor On Signal
11	Miss Signal from Collator
12	Offset Signal from Collator
13	Emergency Stop Switch
14	Stitch Delay Time On/Off Switch
15	System Backward Switch
16	System Forward Switch
17	Proximity Switch for Stitcher Stop Position
18	Proximity Switch for Sheet Detection on Conveyor Section
19	Emergency Stop Switch on FC-20
20	Fold On/Off Switch (Stitch On/Off from S/N 00201)
21	Stitcher Motor Driver Warning (Alarm LED on motor driver is on)
22	End Stopper Photo Sensor
23	System Back Limit Proximity Switch
24	System Forward Limit Proximity Switch
27	Fold Delay Time Proximity Switch
29	Emergency Stop Relay
32	Photo Sensor for Unaligned Sheet

QPW-456 CIRCUIT BOARD

1. The QPW-456 is the Driver Board for the solenoids and clutch/brakes. Each Solenoid Driving Circuit has 2 drivers; one providing 48 VDC to energize the solenoid quickly, and the other provides 24 VDC to keep the solenoid energized without overheating it.

   Solenoid Driver Operation: When a solenoid signal is received from the CPU board, both drivers for the solenoid in question are triggered at the same time, but a capacitor in the 48V circuit drops the 48V driver after 100MS or so, leaving the 24V to hold in the Solenoid. The Belt Drive Clutch/Brake and the Fold Knife Clutch/brake coils only use 24VDC.

   Clutch/Brake Operation: The Clutch/Brake signals for the Pick Belt and Fold Knife come into the QPW-456 board from the CPU board on connector 4. Each one of these signals sets a latch on IC7 (IC7, pin 2 sets for the Pick Belt and pin 12 sets for the Fold Knife.) An inverter chip insures that when the clutch is energized, the Brake will be de-energized and vise-versa.

   Isolation: All DC signal inputs are isolated with Opto-Isolators PC1, through PC14. This is necessary to prevent the effects of any voltage between chassis ground and DC ground.

Table 7
QPW-456 DRIVER BOARD
Inputs/Outputs

SIGNAL	I/O	LED	Con	Pin	
Pick Belt Brake (Y21)	O		2	7, 8	Direct to solenoid
Pick Belt Clutch (Y22)	O		2	5, 6	Direct to solenoid
Fold Knife Brake	O		2	3, 4	Direct to solenoid
Fold Knife Clutch (Y23)	O		2	1, 2	Direct to solenoid
Sheet End Jog Solenoid (Y24)	O		3	12, 11	Direct to solenoid
Side Stitch Stopper Solenoid (Y25)	O		3	9, 10	Direct to solenoid
Head Stopper Solenoid (Y26)	O		3	7, 8	Direct to solenoid
Fold/Non-Fold Solenoid (Y27)	O		3	5, 6	Direct to solenoid
Folder Jog Solenoid (Y28)	O		3	3, 4	Direct to solenoid
Pick Belt Position Detector 1 (B06)	I	L1	5	8, 9	Direct from sensor
Pick Belt Position Detector 2 (B07)	I	L2	5	5, 6	Direct from sensor
Fold Knife Stop Position Sensor (B05)	I		5	1, 2	Direct from sensor
Transformer TI	I		1	1, 4	Main 24VAC into the board
Transformer TI	I		1	5, 6	Second 24V for 48V Supply

TABLE 8
LED ARRAYS ON QPW-456 CIRCUIT BOARD

1	Fold Knife Stop Position Proximity Switch
2	Emergency Stop for Carry Belt and Fold Knife Input
3	Not Used
4	Not Used
5	Carry belt Start Signal Input
6	Fold Knife Start Signal Input
7	Jog Solenoid ON Signal Input
8	Side Stitch Head Stop ON Signal Input
9	End Stopper Solenoid ON Signal Input
10	Gate Solenoid ON Signal Input
11	Fold Section Jog Solenoid ON Signal Input
12	Not Used

PRELIMINARY

OPERATIONAL SEQUENCE

The following start-up procedure is based on a working SPF-20, connected to an FC-20 Trimmer and a collator. The controls will be set for saddle stitching. All Emergency Stop Switches will be in the Run position.

1. **Power On**

-Turning on the Power Switch provides all AC voltages to the Motor Controllers and all DC voltages to both
Circuit boards.
-Power LED on Control Panel lights.
-At this point it is possible to move the system with the System Move Buttons.
Press the Motor On Button
-The Transport Belts and Fold Rollers start running, and the Stitcher Back Jogger starts jogging.
-The Stitcher End Stop Solenoid (Y26) raises the Head Stop.
-The Pick Belt turns until both of the Pick Belt Position Sensors (B06, B07) are at holes in the disks.
-The Fold/Non Fold Solenoid (Y27) brings the Fold Diverter Gate up. (In Saddle Stitch Mode)

2. Stitch Fold Operation

A book is placed on the Infeed Section Belts by the operator, or by a collator. While moving along the transport into the stitcher section, the book contacts the B04 Set Present Sensor actuator. When the trailing edge of the book passes the sensor actuator, the following things happen:
-The Tail Jog Solenoid energizes in the jogged position.
-The Side Jog Torque Motor moves the Side Guides into the jogged position.
-The Stitch Motor Driver/Motor moves the Stitch heads, until the Stitch Cam Sensor (B03) sees the flag on the cam when the heads are back at home position. This completes one stitch cycle.
-When the Stitch Heads are back in home position, the Side Guide Torque Motor releases the Side Guides.
-The Tail Jog Solenoid releases the Tail Jogger.
-The Head Stopper Solenoid releases the Head Stopper.
-The Pick Belt starts and pushes the book out of the stitch area. The Pick Belt Stops when both sensors are at the holes in Pick Belt Position Disks 1 and 2.
-The Fiber Optic Sensor in the Stitch Area End Stopper watches for the trailing edge of the set to raise the End Stopper for the next set entering the stitch area.

-Since the Fold Diverter Gate is in the "up" position for Saddle Stitch Mode, the set travels onto the Fold Transport Belts that carry it down toward the Fold Head Stop.
-As the trailing edge of the set goes past the Sensor in the Fold Tail Jogger, the following things happen:
- Solenoid (Y28) pushes the Fold Tail Jogger Fingers into the jogged position.
-The Fold Knife Brake releases and the Fold Knife Clutch engages. The Fold Knife pushes the set between the spinning Fold Rollers. The Fold Knife Clutch and Brake reset when the Fold Knife Stop Position Detector sees the hole in the Fold Knife Cam at home position.
-The Tail Jog Fingers release.

-The set passes through the Fold Rollers onto the Conveyor Belt, which moves several inches and stops.

Other modes and settings

1. For short sets, there is a sensor (B11) located just behind the Fold Length Knob. When the Fold Length is set below a certain figure, (4.5") the knob actuates the sensor which adds a delay time for the set to settle in the fold area before the Fold Cycle begins.
2. In the End Stitch /Corner Stitch Mode, the Stop Gate located near the Clinchers raises to stop the set with the leading edge just under the Stitch Head. Also the Fold Diverter Gate stays closed, forcing the sets to travel straight across the folding area instead of going down into it.
3. If the Stitch Heads jam in the middle of a cycle, the Stitch Head Motor can be made to run backwards to return the Stitch Heads to their home position as follows:
   A. Press and hold the Single Fold and Single Stitch buttons on the SPF-20 Control Panel.
   B. While holding these 2 buttons in, press the Stitcher Inching Button to operate the Stitch Motor in the reverse direction
4. Variable Controls

-Conveyor Work Time pot on Operator Control Panel:	This controls how far the conveyor moves each time a book is delivered.
-Stitch Delay Time pot on Operator Control Panel:	Used to increase the time available to jog the sheets before stitching.
-Stitch Delay Time Switch on Operator Control Panel:	Used to turn off the Stitch Delay.
-VR1 Potentiometer on CPU Board:	Changes Stitch Motor Speed.

Power Supplies

The SPF-20 has 2 Power Supplies:

+5 Volts for the Logic

+24 Volts for sensors and, Opto-Isolator inputs

NOTE: 24V and 48V are also generated on the QPW-456 for Solenoids and Clutches.

PRELIMINARY

SPF-20
TROUBLESHOOTING

1. **SPF-20 does not operate:** (Operator Panel Lights are on, but no motors run)
   Do the System Move Buttons work?
   - NO Check the green LEDs inside relays K01 and K02. Are they on?
     - No The Serial Cover Interlock String is not complete. See Interlock String Diagram on page 14. Check Emergency Stop Switches on the SPF-20 and FC-20. If an FC-20 is not present, the Jumper Connector must be installed on Connector X146. Check the Cover Open Switches. Check the 24V Power Supply. (See Page 2, Section 2). Place a jumper from X141, Pin 2 to +24V to test the Serial Cover Interlock String. The FC-20 Interlock Circuit can be eliminated with a jumper across pins 15 and 16 of Connector X146.
     - Yes Check the circuit breakers. Check the contacts of Relays K01 and K02.
   - YES Check Circuit Breakers Q1, Q2, Q3, Q6, and Q7. Check the Inverter. Check the FC-20 Jam Light. Place a jumper across Connector 10, Pins 3 and 4 on the QPW-455 Board to see if the inverter starts. If it does, suspect one of the interlock strings.
     Is LED 29 lit on the QPW-455 circuit Board?
     - No The Serial Circuit Breaker Interlock String may be open. To test this, place a jumper across Connector 7, Pins 7 and 10 of the QPW-455 Board. This string consists of the Q01, Q02, and Q03 Circuit Breaker Auxiliary Contacts and 1 set of contacts in the K02 Interlock Relay. (See the SPF-20 Cover and Emergency Stop Interlock diagram on page 14)
     - Yes The Parallel Cover Interlock String may be shorted. To test this, measure from ground to Connector 4, Pins 3, 4, and 5 on the QPW-455 Board. Each measurement should be 12V. Any 0V measurement means that one of the Cover Switches or the Emergency Stop Switch is defective. (An alternate plan is to momentarily remove connector 4 and see if the motors start.)

2. **End Stop fails to energize or re-energizes before the set has cleared:**
   Is a red light visible from the end of the Fiber Optic Bundle on the End Stopper?
   - NO Check the Fiber Optic Bundles going to the B09 End Stopper Photo Sensor. Check for 24V on Pins 1 and 3 of Connector 14 on the QPW-455B Board. If the 24V is OK, the sensor or cable may be bad or the Optic Bundle may be defective.
   - YES Check for a voltage change between Pins 2 and 3 of Connector 14 on the QPW-455B Board, while blocking and unblocking the sensor. If the voltage does change, suspect the CPU Board. If it does not change, the sensor or the optic bundle may be defective. Before replacing the sensor, adjust the Sensitivity Control fully clockwise to see if this helps.

NOTE: When checking the Fiber Bundle, remove the Philips screw from the sensor retainer. The ends of the Fiber Bundle should protrude from the retainer by 1 MM. When cutting the ends of the Fiber Bundle, a special cutter must be used. Each hole in the cutter may be used only once.

NOTE: If this conditions happens only with certain stock, contact Technical Support for an alternate sensor.

3. Pick Belt Never Turns:

Is the Transport Belt Motor running?

NO Check circuit Breaker Q3, the Inverter, and the Transport Belt Motor.

YES Check for 0V across the Brake at Pins 7 and 8 of Connector 2 on the QPW-456. Check for 24V across the Clutch at Pins 5 and 6 of Connector 2 on the QPW-456. If both are correct, suspect the Brake or Clutch. If only 1 is wrong, the QPW-456 PCB is bad. If both voltages are wrong, check Sensors B06 and B07 for function.

If no problem is found, momentarily ground Connector 4, pin 10 of the QPW-456 board (Clutch/Brake Signal) to see if the belt moves. If it moves 1 normal cycle, suspect the CPU Board.)

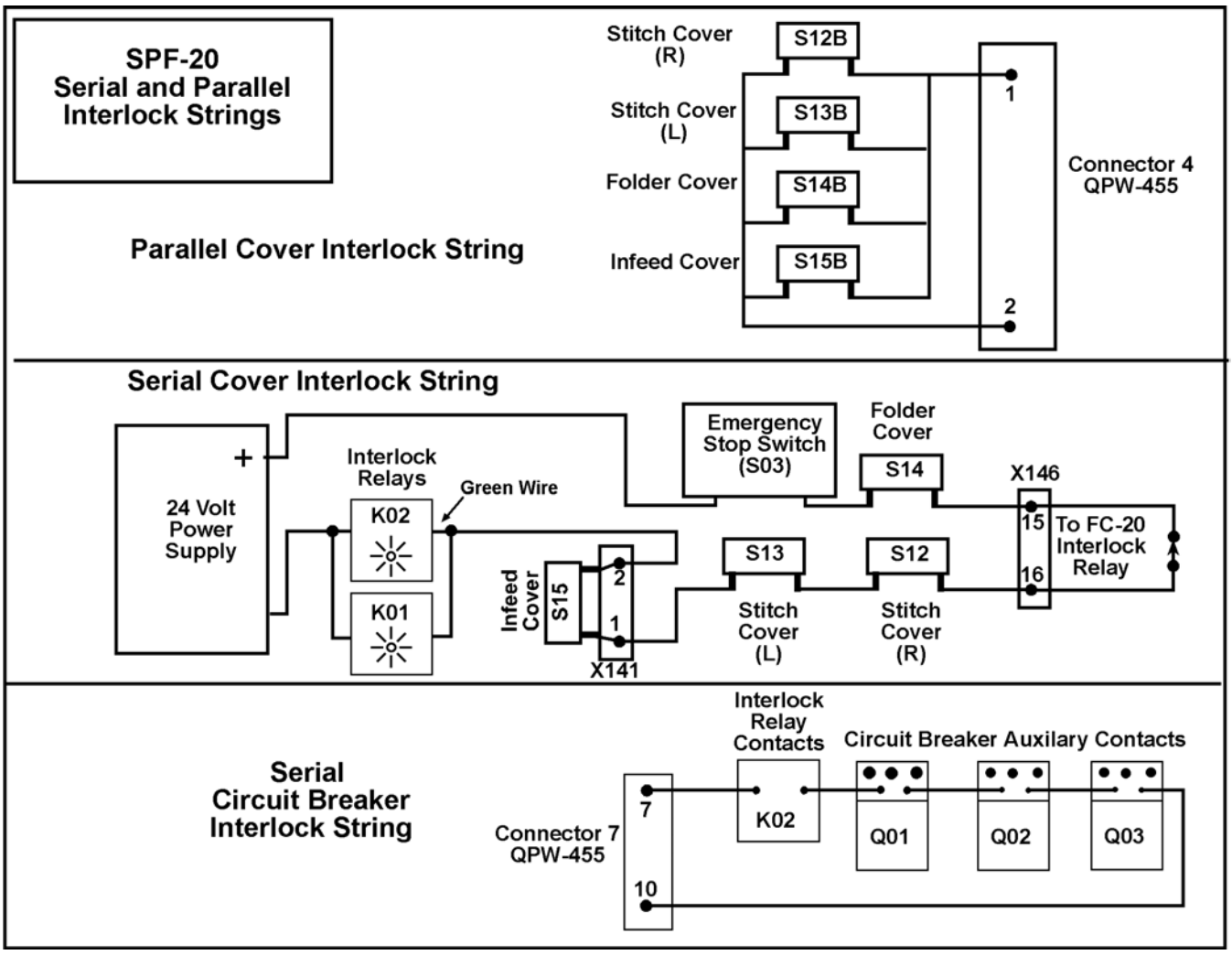
4. **Pick Belt Never Stops Turning:**

Are the voltages measured in #3 above correct?

NO Check the B06 and B07 for proper operation.
Check Pin 10 of Connector 4 on the QPW-456. If this voltage is permanently low (0), the QPW-455B CPU Board is suspect.

YES Check clearances and mechanical operation of Clutch and Brake.

SPF-20 COVER and EMERGENCY STOP SWITCH INTERLOCK STRINGS



Interlock Circumvention:

1. To circumvent the Serial Circuit Breaker Interlock String, jumper Pins 7 and 10 of Connector 7 on the QPW-455 Board.
2. To circumvent the Serial Cover Interlock String, jumper the green wire of the K01 Relay to the + terminal of the 24V Power Supply.
3. To circumvent the Parallel Cover Interlock String, momentarily remove Connector 4 from the QPW-455 Board.