
Section 2: Theory of Operation

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Overview

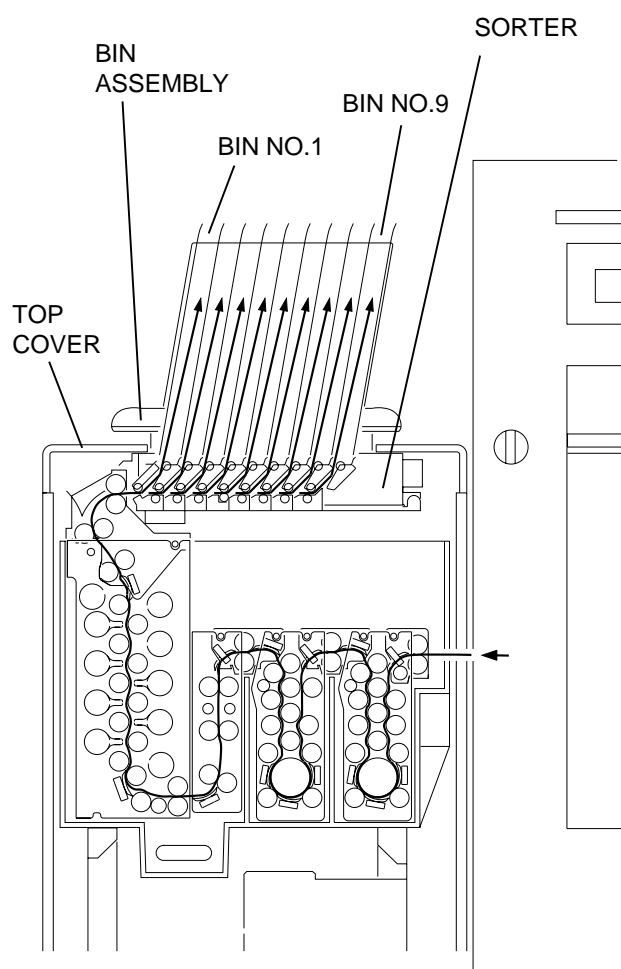
Description

The *Kodak X-Omat 180 LPS PROCESSOR* is a *Kodak X-Omat 180 LP PROCESSOR* with a SORTER KIT installed at the factory.

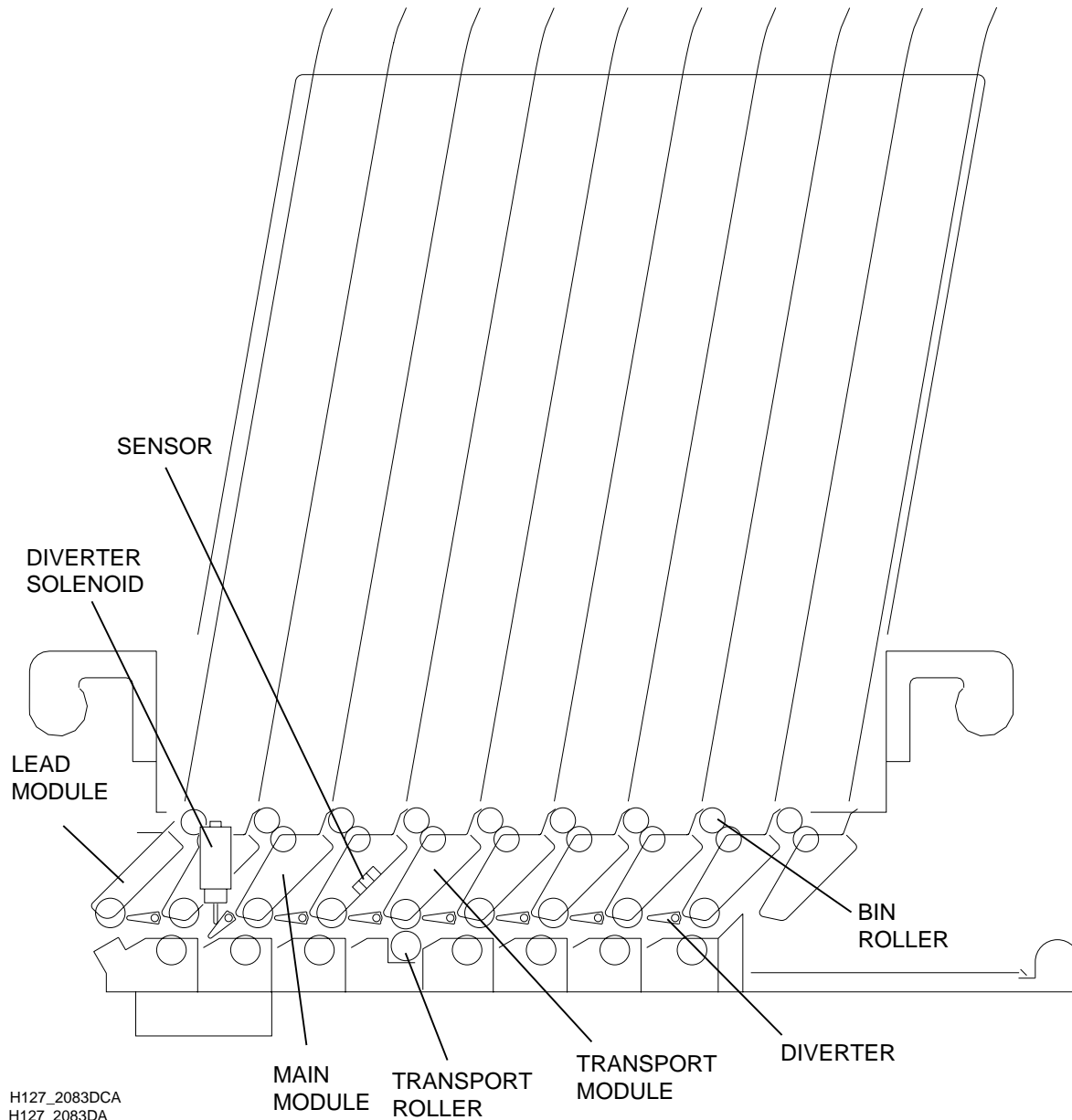
The SORTER is designed for optimizing system footprint, operator convenience, processor maintenance, and access to film jams.

The SORTER has 9 BINS, with a capacity of 50 sheets of film each. The BINS accept all film sizes, including mixed film sizes, at the rate of 180 sheets per hour. The sorting mechanism is built into the TOP COVER of the PROCESSOR. A lightweight removable BIN ASSEMBLY is mounted above it.

Figure 2-1 **Film Path Through the SORTER**



H127_2066CCA
H127_2066CA

Figure 2-2 **MODULES, SENSORS, and DIVERTERS**

Each BIN is identified with a number and a customer-written label naming the modality assigned to it. Assignment of BINS is done through the DISPLAY SCREEN on the *Kodak Ektascan 2180 LASER PRINTER*. Any modality can be assigned to one or more BINS to provide an overflow capability. In this case, the destination BIN is switched every 50 sheets regardless of the number of sheets remaining in the BIN. Bins can also be assigned more than one modality in order to accommodate more than 9 sources.

Sheets of film enter the horizontal film path of the SORTER as they exit the PROCESSOR. A drive transport ROLLER is located in the middle of this film path to handle the smaller film sizes that would not reach the last BIN while the processor ROLLERS was still advancing them. A DIVERTER is below each BIN to direct the sheets into the BIN. At rest, the DIVERTER acts as part of the UPPER FILM GUIDE. When a SOLENOID pivots the DIVERTER down, the DIVERTER blocks the film path and guides the leading edge of a film up toward the BIN.

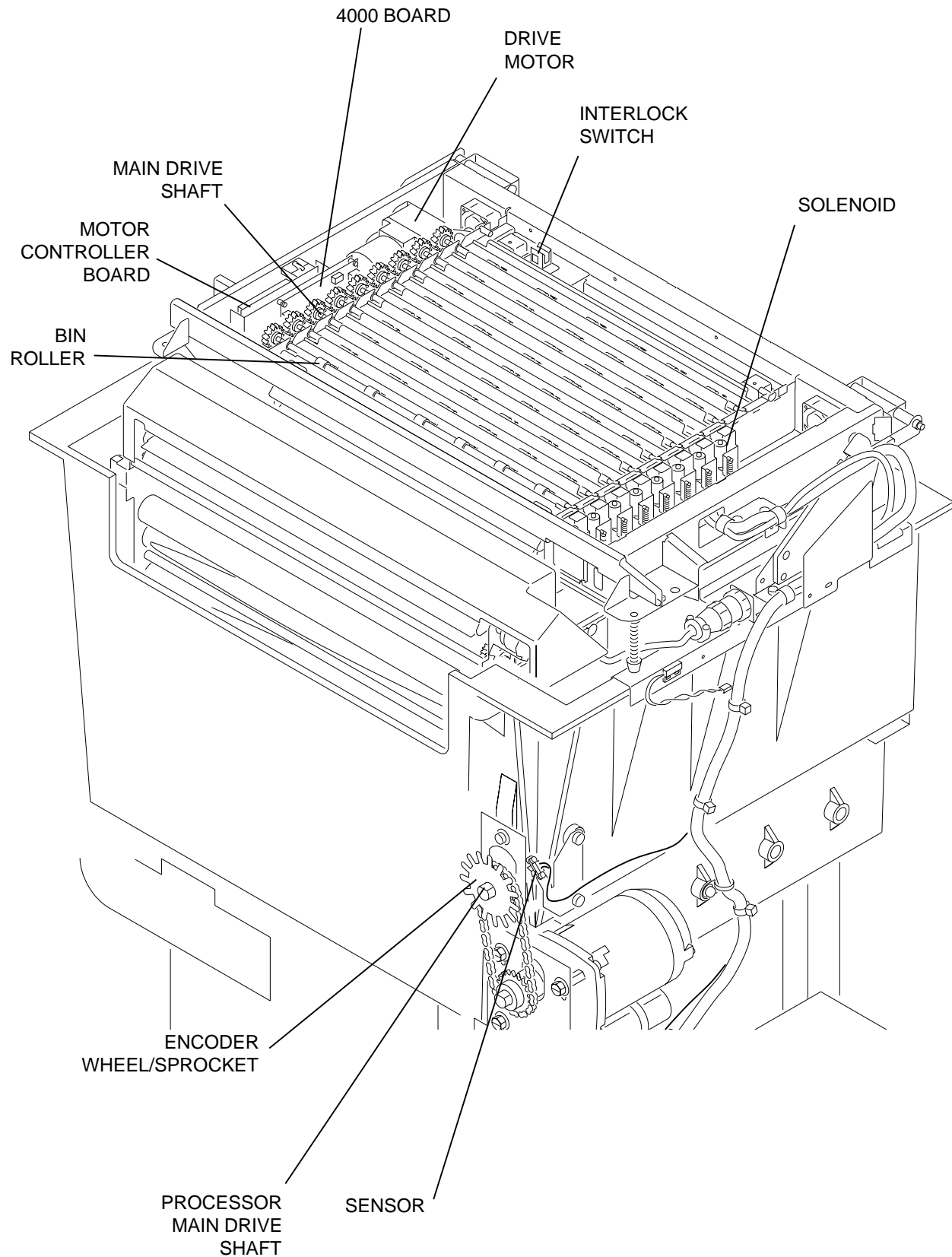
The film is then guided between MODULES where an optical infrared SENSOR in the upstream MODULE senses it. A drive BIN ROLLER engages the IDLER ROLLERS in the MODULE and feeds the film up at an angle into the BIN.

The SORTER has 10 MODULES. MODULES No. 2 - 4 and 6 - 10 are identical and are called MAIN MODULES. MODULE No. 5 is called the TRANSPORT MODULE. The ROLLERS in the bottom of MODULE No. 5 are spring loaded and ride against the transport ROLLER to transport the smaller size films. MODULE No. 1 is unique and is called the LEAD MODULE.

A speed-controlled DRIVE MOTOR drives the MAIN DRIVE SHAFT of the SORTER via a DRIVE BELT. WORM GEARS on the MAIN DRIVE SHAFT drive the BIN ROLLERS. An ENCODER WHEEL/ SPROCKET and SENSOR on the MAIN DRIVE SHAFT of the PROCESSOR monitors the transport speed of the PROCESSOR. The software on the 500 CIRCUIT BOARD in the PROCESSOR controls the speed of the DRIVE MOTOR on the SORTER so that it is in synch with the transport of the PROCESSOR.

For access to the PROCESSOR, the BIN ASSEMBLY is removed. A GAS SPRING allows the TOP COVER of the PROCESSOR along with the SORTER to be easily raised. A FILM TRAY located under the SORTER allows operation of the PROCESSOR if the SORTER requires service. The SORTER is raised and the processed films exit the PROCESSOR into the FILM TRAY. SENSORS for each of these parts indicate if the parts are in position.

Figure 2-3 Driving the ROLLERS of the SORTER



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H127_2088EA

Operation of the BOARDS

Control of the DIVERTER SOLENOIDS

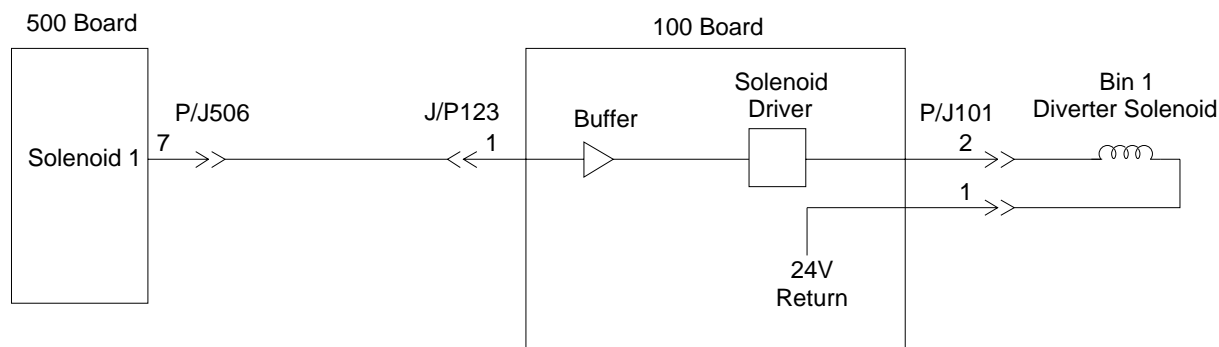
Note

The following explanation is for DIVERTER No. 1. The other DEVERTERS are controlled in the same manner.

The 500 BOARD provides the control signal on PIN 7 of CONNECTOR P/J506 (0 volts to turn the SOLENOID off or 5 volts to turn the SOLENOID on). This signal enters the 100 BOARD on PIN 1 of CONNECTOR P/J123. The signal goes through a buffer. The output from the buffer (5 volts to turn the SOLENOID off or 0 volts to turn the SOLENOID on) goes to a SOLENOID DRIVER. The SOLENOID DRIVER initially provides 20 - 24 volts to turn on the SOLENOID. Over the next $\frac{1}{4}$ second, the voltage drops to a holding voltage of approximately 4 - 6 volts.

The SOLENOID DRIVER has an internal thermal FUSE. The thermal FUSE will turn off the current to the SOLENOID if the current is excessive. The thermal FUSE will automatically reset when the current is reduced.

Figure 2-4 100 BOARD



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Operation of the BIN SENSORS

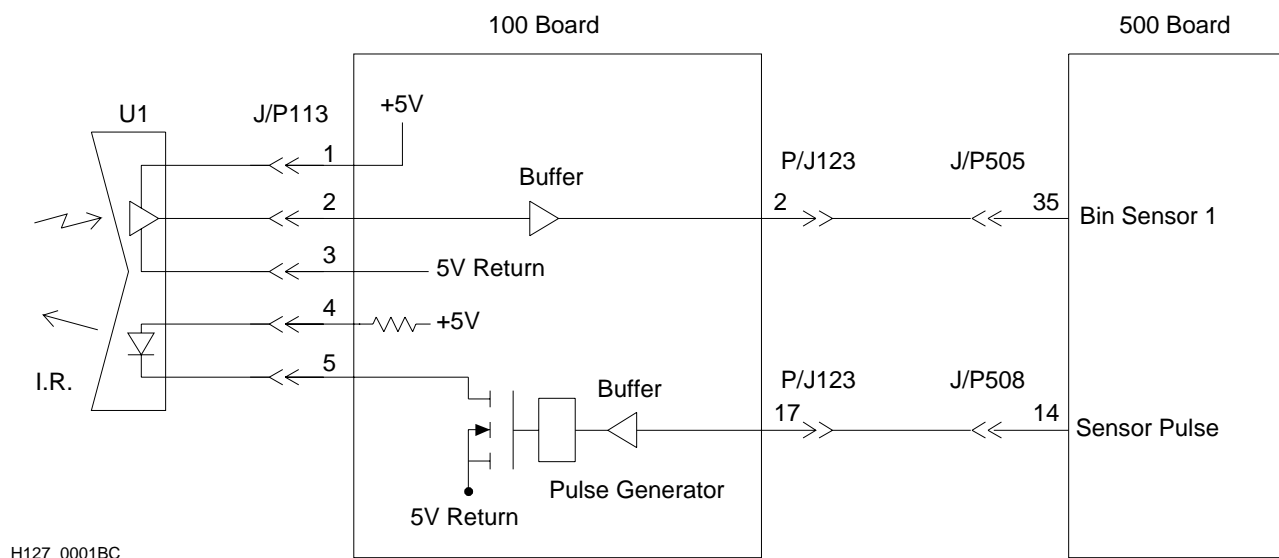
Note

This explanation follows the signal for BIN SENSOR No. 1. The others operate the same way.

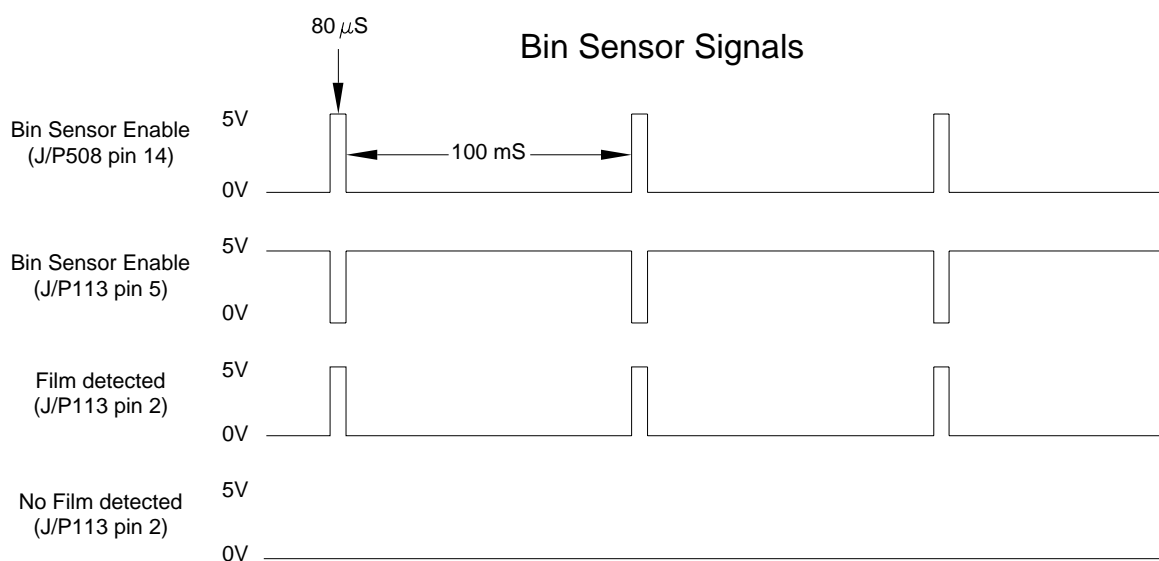
The 100 BOARD supplies a constant 5 volts to an infrared LED in the BIN SENSOR. The return for the LED is provided through a transistor that is enabled by a signal from the 500 BOARD. This signal is pulsed on for approximately 80 mseconds and off for approximately 100 milliseconds by the 500 BOARD when the software looks for films. Under certain conditions, this signal may stay on for extended periods. A pulse generator on the 100 BOARD limits the ON time of the TRANSISTOR to a maximum of 10 milliseconds under these conditions. This ensures correct operation of the BIN SENSOR.

The infrared energy reflects off the film and is sensed. When film is present, the output from the BIN SENSOR (P/J113 pin 2) is a pulsed digital signal with the timing corresponding to the enable signal from the BIN SENSOR (5 volts on for 80 mseconds, OFF for 100 mseconds). This signal goes through a buffer, leaves the 100 BOARD, and is sent to the 500 BOARD.

Figure 2-5 Operation of the BIN SENSORS



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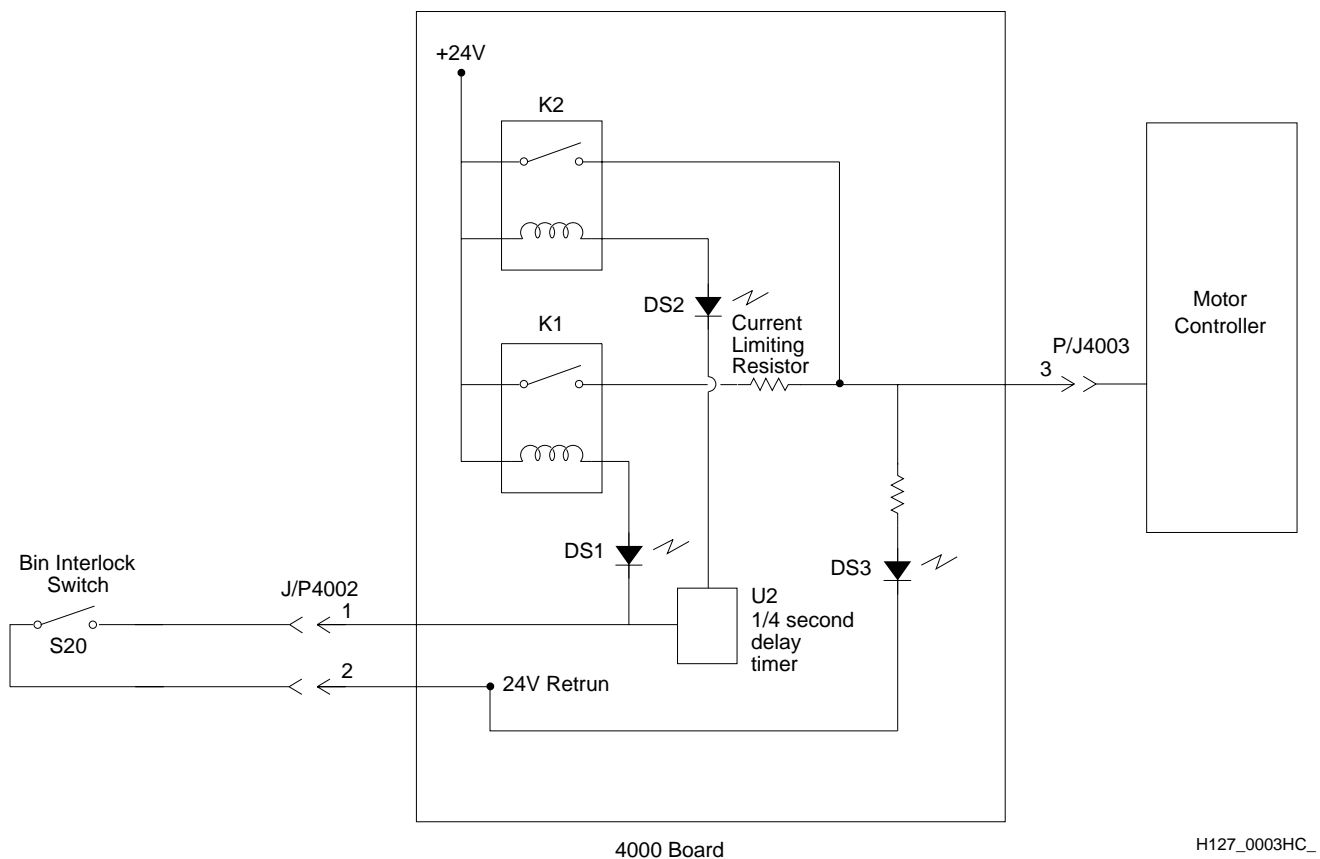
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Operation of the INTERLOCK BOARD for the TOP COVER

The INTERLOCK BOARD (the 4000 BOARD) disables the SORTER transport if the BIN is removed from the SORTER. The 4000 BOARD is a safety device.

S20 is the INTERLOCK SWITCH for the BIN. When the BIN is in position, S20 is on. When S20 is on, the 24 volt return on PIN 4002 of CONNECTOR P4002 on the INTERLOCK BOARD is applied to PIN 1 of P4002 on the INTERLOCK BOARD through the S20 SWITCH. This turns on RELAY K1. LED DS20 illuminates to indicate that RELAY K1 is on. RELAY K1 applies 24 volts through a current-limiting resistor to PIN 3 of P3 on the INTERLOCK BOARD, which provides power to the MOTOR CONTROLLER. The current-limiting resistor limits the initial surge of current that the MOTOR CONTROLLER would normally draw. This limitation is done to keep from loading down the 24-volt POWER SUPPLY. The 24-volt return signal supplied by the S20 INTERLOCK SWITCH for the BIN is also applied to a TIMER U2. The TIMER delays the turn on of RELAY K2 approximately $\frac{1}{4}$ second. RELAY K2 then supplies 24 volts to the MOTOR CONTROLLER by passing the current-limiting resistor. LED DS2 illuminates to indicate that RELAY K2 is on. LED DS3 indicates that 24 volts is being applied to the MOTOR CONTROLLER. If the BIN is removed, the 24-volt return is removed, and both the K1 and K2 relays open turning the MOTOR off.

Figure 2-6 Operation of the INTERLOCK BOARD

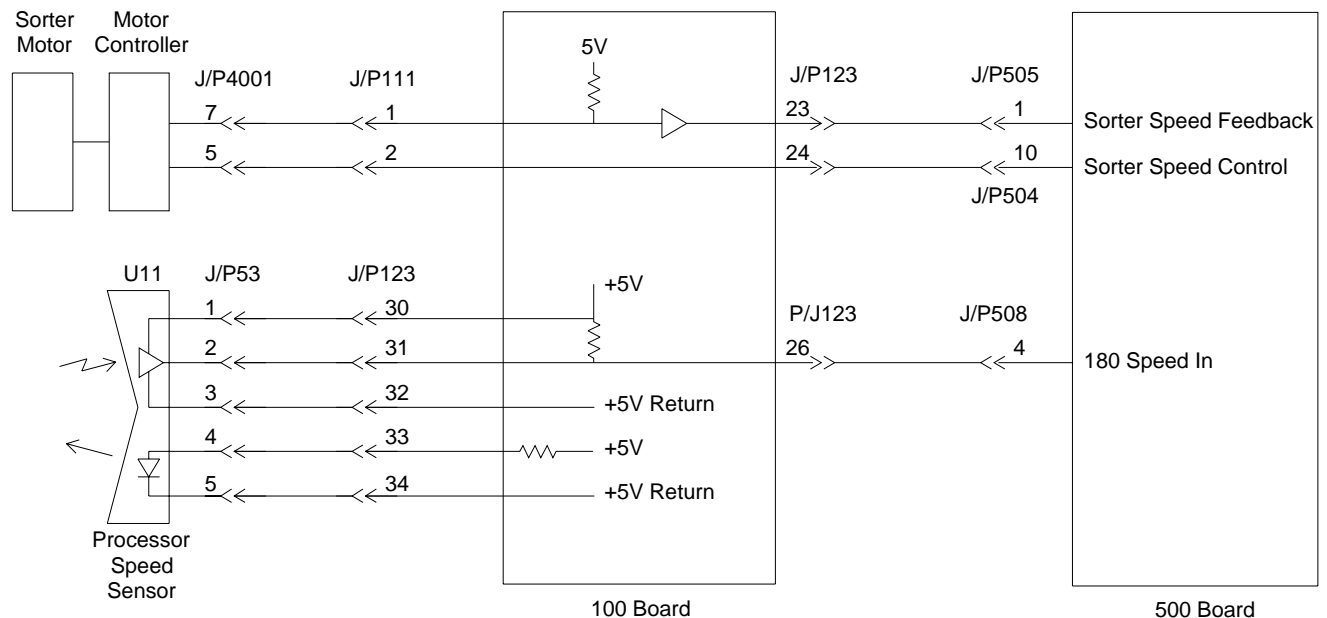


Operation of the SORTER Transport

The 100 BOARD powers an infrared LED on SENSOR U11 mounted next to an ENCODER WHEEL/ SPROCKET on the MAIN DRIVE SHAFT of the PROCESSOR. The ENCODER WHEEL/SPROCKET has alternating holes and reflective material, which the infrared energy passes either through or reflects back to SENSOR U11. This generates a 5 volts pulsed output from U11 at approximately 26 - 30 Hz (for 63 in./min). This pulsed signal passes through the 100 BOARD to the 500 BOARD. The frequency is monitored by the software on the 500 BOARD.

The software sends a control-voltage signal (0 - 5 volts) from the 500 BOARD through the 100 BOARD to the MOTOR CONTROLLER. A speed SENSOR in the DRIVE MOTOR of the SORTER sends a pulsed 5 volts signal (nominal frequency of approximately 350 Hz 10Hz for 63 in./minute) through the 100 BOARD to the 500 BOARD. This signal is monitored by the software which raises (increases the speed of the SORTER) or lowers (decreases the speed of the SORTER) the 0 - 5 volts control voltage until the SORTER transport matches the transport speed of the PROCESSOR. The nominal control voltage is approximately 4 volts (for 63 in./minute).

Figure 2-7 Operation of the SORTER Transport



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Explanation of Error Codes

- **Error 080 BIN Assembly not in position**

This warning will only occur if the BIN ASSEMBLY is removed from the SORTER. The MAIN DRIVE MOTOR on the SORTER will shut down, regardless whether film is present, until the BIN ASSEMBLY is put back in place. The transport system of the PROCESSOR will not shut down. This error will clear either when the BIN ASSEMBLY is installed or when the TOP COVER of the PROCESSOR is opened.

- **Error 081 FILM TRAY not in position**

This warning will only occur if the TOP COVER of the PROCESSOR is open and the FILM TRAY is not in position. The MAIN DRIVE MOTOR on the PROCESSOR will shut down, regardless whether film is present, until either the TOP COVER of the PROCESSOR is closed or the FILM TRAY is put back in place. This error will clear either when the FILM TRAY is installed or when the TOP COVER of the PROCESSOR is closed.

- **Error 082 Speed of the 180 LP PROCESSOR is out of range**

This error will be reported if the number of feedback pulses from the transport speed encoder on the PROCESSOR is out of the normal range of transport speed. The transport of the SORTER will continue to operate to try to transport film out of the system. This error will clear when the PROCESSOR goes into standby. Error 082 will not be reported if the PROCESSOR is operating with the TOP COVER open and the FILM TRAY is in position.

- **Error 083 Inoperative transport in the SORTER**

This error will be reported if there are no feedback pulses from the MOTOR CONTROLLER, indicating a speed of 0, even though the transport should be operating. Error 083 will also be reported if the output to the DAC has reached its maximum or minimum value and the speed is still not the expected value. The transport system of the PROCESSOR will not shut down. This error will clear when the PROCESSOR goes into standby. Error 083 will not be reported if the PROCESSOR is operating with the TOP COVER open and the FILM TRAY in position.

- **Error 09X Film did not arrive at BIN X**

This error will be reported for BIN X, where X = 1 through 9, if a SENSOR does not detect film at the appropriate BIN SENSOR when expected. This error indicates that the film has not reached the BIN SENSOR and may be stuck in the SORTER transport, or that a DIVERter failure has caused the film to go to a different BIN than expected. The PROCESSOR will stop reporting this error after 5 seconds, but the error will remain on the DISPLAY PANEL of the 2180 LASER PRINTER until the operator clears it.

- **Error 10X Film jam at BIN X**

This error will be reported for BIN X, where X = 1 through 9, if a SENSOR detects film at a BIN for longer than the time it would take for the film to pass the SENSOR and enter the BIN. This error indicates that the film is jammed in the MODULE.

- **Error 11X Unexpected film sensed at BIN X**

This error will be reported for BIN X, where X = 1 through 9, if a SENSOR detects film when no film should be present at that SENSOR. This error will clear when the SENSOR is no longer blocked.

- **Error 182 Printer's Sorting Queue Is Full**

This error will be reported if the LASER PRINTER receives Film Exited commands faster than it expects films to be exiting the PROCESSOR and entering the SORTER.

- **Error 183 Printer's Sorting Time Expired**

This error will be reported if the LASER PRINTER did not receive either a Film In Bin command or an error from the PROCESSOR for a film that the PRINTER is tracking through the SORTER.

- **Warning 184 Printer's Sorting Queue Error**

This message will appear if the LASER PRINTER receives a Film In Bin command that specifies a BIN No. that does not match the BIN No. saved for the oldest in its SORTER queue.

