

Figure 4-1. CBA-2 Components

Section 4: CBA-2 Maintenance

SYSTEM DESCRIPTION

The Rowe Compact Bill Acceptor-2 (CBA-2) extends the capability of your equipment to include the acceptance of one and five dollar bills. Valid bills of genuine United States currency are accepted by the CBA-2, which then outputs credit pulses. Rejected bills are returned to the customer.

Equipment Description

The CBA-2 consists of a bill acceptor transport/stacker mechanism, an electronic logic board, and a power supply integrated into a single unit.

TRANSPORT

The bill acceptor transport mechanism contains optical and magnetic sensors for bill validation. These sensors transmit their signals to the control circuitry.

The transport/stacker unit uses long life optical cells and a timing belt drive for trouble-free performance.

LOGIC BOARD

The logic board contains electronics for operation of the CBA-2. Microcomputer based electronic circuitry provides protection against bogus bills and bills of different denominations. The control of the transport motor, the stacker motor, and the credit function are also contained in the logic board.

BILL ACCEPTOR TRANSPORT/STACKER

The CBA-2 Transport is a mechanical device that carries the bill through five test stations. The transport contains a V_1 , V_2 , V_3 , and V_4 sensor and a magnetic head.

The V_1 sensor consists of an infrared emitter and receiver which senses that a bill has been inserted into the transport.

The V_2 backside sensor consists of a green emitter and receiver to make checks on the backside of the bill.

The V_3 sensor consists of a detector, which senses that the bill has reached the magnetic head.

V_4 verifies that the bill has left the transport.

MAGNETIC HEAD AND BILL PRESSURE ROLLER

The magnetic head checks the magnetic properties of the bill. A spring-loaded pressure roller, located under the lower track, presses the bill firmly against the magnetic head.

ANTI-CHEAT LEVER AND V₄ SENSOR

The anti-cheat lever prevents the bill from being pulled back through the transport once it has exited and credit has been given. The anti-cheat lever also works in conjunction with the V₄ sensor, sensing bill position and providing a signal to give credit when the bill has exited the transport. The V₄ sensor is an infrared emitter/receiver.

TRANSPORT/STACKER DRIVE

The transport uses a direct gear drive from the motor to the drive shaft. The drive shaft drives the front belts, which are also timing belts. Adjustable idler pulleys are used to maintain the correct timing belt tension. The rear belts are the semi-stretch type and do not require length adjustment. The bill is trapped between the front and rear belts for positive, non-slip movement through the transport.

The stacker uses a gear-head motor. A cam on the motor shaft causes the bill pusher plate to move forward and backward inside the transport. This action removes the bill from between the belts and places it into the bill box. A micro-switch riding on the motor cam allows the logic board to monitor the pusher plate position.

Bill Acceptor Logic Board

The logic board directs all of the operations of the bill acceptor. It contains a microcomputer which is the "brain" of the system, as well as self-diagnostic circuitry and the interface and drive circuitry necessary to monitor and control the transport/stacker.

Power is provided by the power supply. The CBA-2 requires a voltage of +12 VDC. A regulator on the logic board reduces the +12 VDC to +5 VDC.

The logic board contains all the electrical controls and visual indicators for the CBA-2. These are:

POWER AND STATUS LED'S

The logic board contains a self diagnostic feature, which is capable of detecting various malfunctions as well as certain normal conditions within the bill acceptor. The POWER LED indicates that the CBA-2 is receiving power. The STATUS LED indicates the status of the CBA-2.

RESET PUSHBUTTON

When the CBA-2 is in a FAULT condition, this pushbutton will cause the CBA-2 to reset.

DIP SWITCH SETTING

Switches 1,3, and 4 are set to ON, the rest are set to OFF.

FUNCTIONAL DESCRIPTION

The following functional description will give you a basic understanding of how the bill acceptor normally operates. This information and the schematic in *Figures 4-2 and 4-3* can also be used as an aid in troubleshooting.

Power-Up Sequence

The CBA-2 goes through a well defined power-up sequence as follows:

1. The transport motor runs forward for about 75 milliseconds.
2. The stacker is cycled to purge any bills from the drive belts.
3. The transport motor runs in reverse and the computer adjusts the motor to the correct speed. If any of the sensors detect a bill during power-up, the reject sequence described later in this section is initiated. If this sequence successfully removes the bill (or object), the power-up sequence just described is followed.

If the stacker does not cycle properly during the power-up sequence, the bill acceptor enters the shutdown sequence (which is described later).

If the transport motor speed cannot be correctly adjusted within 5 seconds, a modified shutdown sequence is followed:

1. The bill acceptor ignores any inserted bills and the STATUS LED flashes in a 7-flash sequence.
2. During each 2-minute interval (up to 8½ hours maximum) the computer will attempt to adjust the motor speed correctly. If the correct speed is attained, the unit will enter the standby mode. If, after 8½ hours, the speed still cannot be set correctly, the bill acceptor will remain in shutdown mode with the STATUS LED in a 7-flash sequence.

Acceptor in Standby Mode (Ready to Accept Bills)

Although the CBA-2 appears to be idle, it is continually checking the sensors in the bill transport and bill stacker mechanisms. If the CBA-2 senses an incorrect signal, it takes the appropriate action.

Problems That May Arise in the Standby Mode:

THE V₃ OR V₄ SENSOR IS ACTIVE

The bill acceptor assumes that something is trapped in the bill transport path if either of these sensors are active while in the STANDBY mode. The bill acceptor then begins the REJECT sequence to remove the trapped object from the path. For further information, see the following paragraphs on the REJECT sequence.

STACKER HOME SWITCH NOT ACTIVATED

The bill acceptor turns on the stacker motor and attempts to return the stacker platen to its HOME position. If it is successful, the bill acceptor returns to the STANDBY mode. If the bill acceptor is unsuccessful, it shuts itself down. For further information, see the following section on the SHUTDOWN sequence:

Actions Taken by the Bill Acceptor to Correct Problems

REJECT SEQUENCE

In order to clear the bill transport mechanism and purge any objects from the transport path, the bill acceptor turns on its motor in the reverse direction. If the bill acceptor is following a normal bill rejection sequence, it will reject the bill and the transport mechanism will return the bill to the bill acceptor opening. The bill acceptor will place the bill so that the bill can be easily grasped by the customer. If the customer retrieves the bill within five seconds, and all other sensors indicate that the transport path is clear, the bill acceptor returns to the STANDBY mode. If the track is not clear, the bill acceptor begins the SELF-CLEARING sequence described in the following paragraph:

SELF-CLEARING SEQUENCE

If the transport cannot clear the transport path as previously described, the bill acceptor begins a SELF-CLEARING sequence. This process consists of a series of reverse cycles to dislodge any object trapped in the transport. If this procedure is successful, the bill acceptor returns to the STANDBY mode. If the track is not clear after 10 cycles, the unit shuts down. The SHUTDOWN sequence is as follows:

SHUTDOWN SEQUENCE

Several things may cause a bill acceptor shutdown. During the SELF-CLEARING sequence, if the bill acceptor is unable to clear an object lodged in the transport path, it will initiate a SHUTDOWN sequence. In the event of a shutdown, the bill acceptor turns everything OFF except the STATUS LED, which it flashes ON and OFF to indicate a FAULT condition. After a fault has occurred, the system must be reset by pushing the RESET button on the logic board.

Bill Acceptance Mode

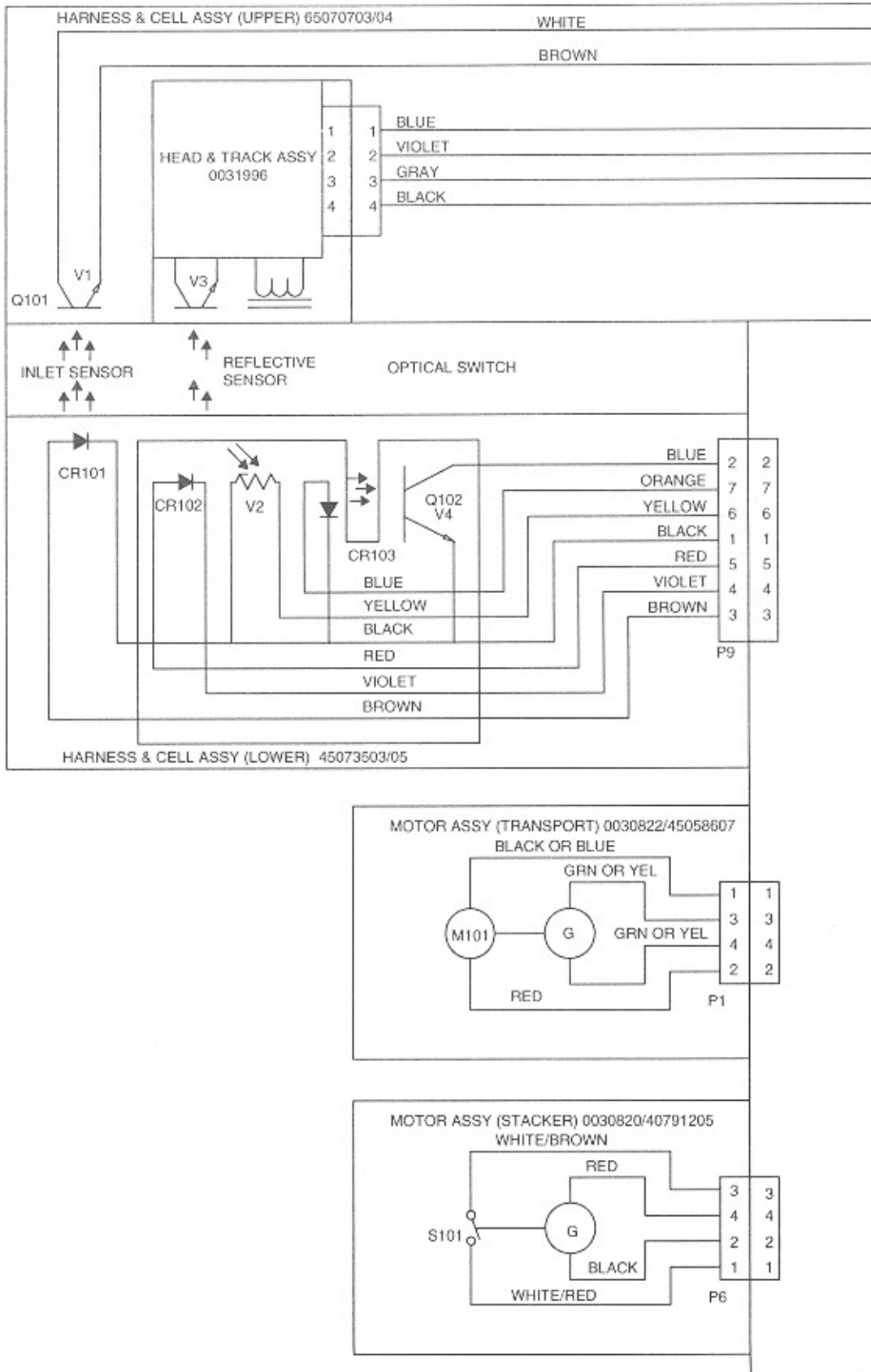
1. The customer inserts a bill and bill validation begins

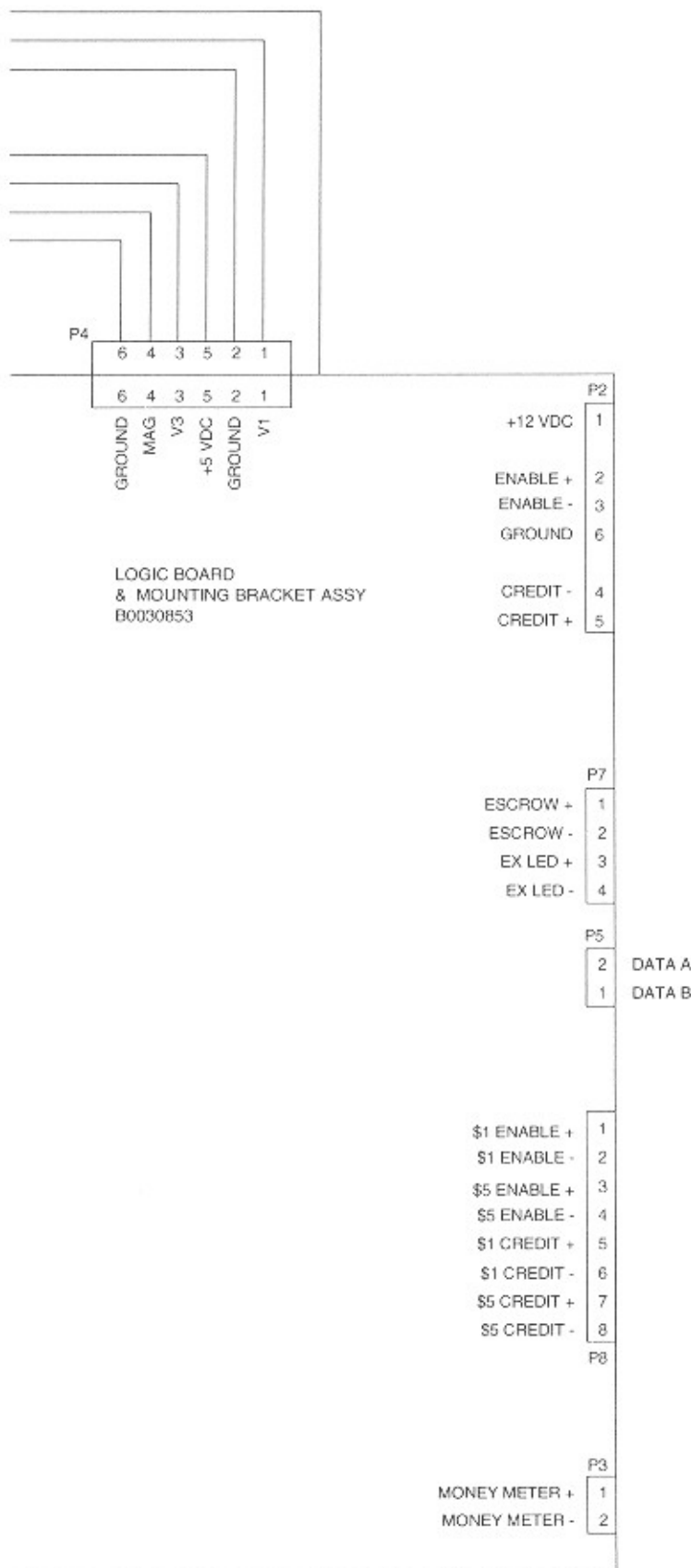
- a. The V_1 sensor is covered by the leading edge of the bill.
- b. The computer starts the Motor Forward and Motor On circuits, which start the transport motor in the forward direction.
- c. As the bill is moved through the transport mechanism, the computer closely monitors all sensors for the proper signals and timings representative of a valid bill.
- d. If the bill meets all of the necessary requirements, the transport motor continues to run until the bill exits the rear of the transport and allows the anti-cheat lever to move back to its rest position, which uncovers the V_4 sensor.

2. Bill validation sequence complete-The credit and stacking cycles are activated

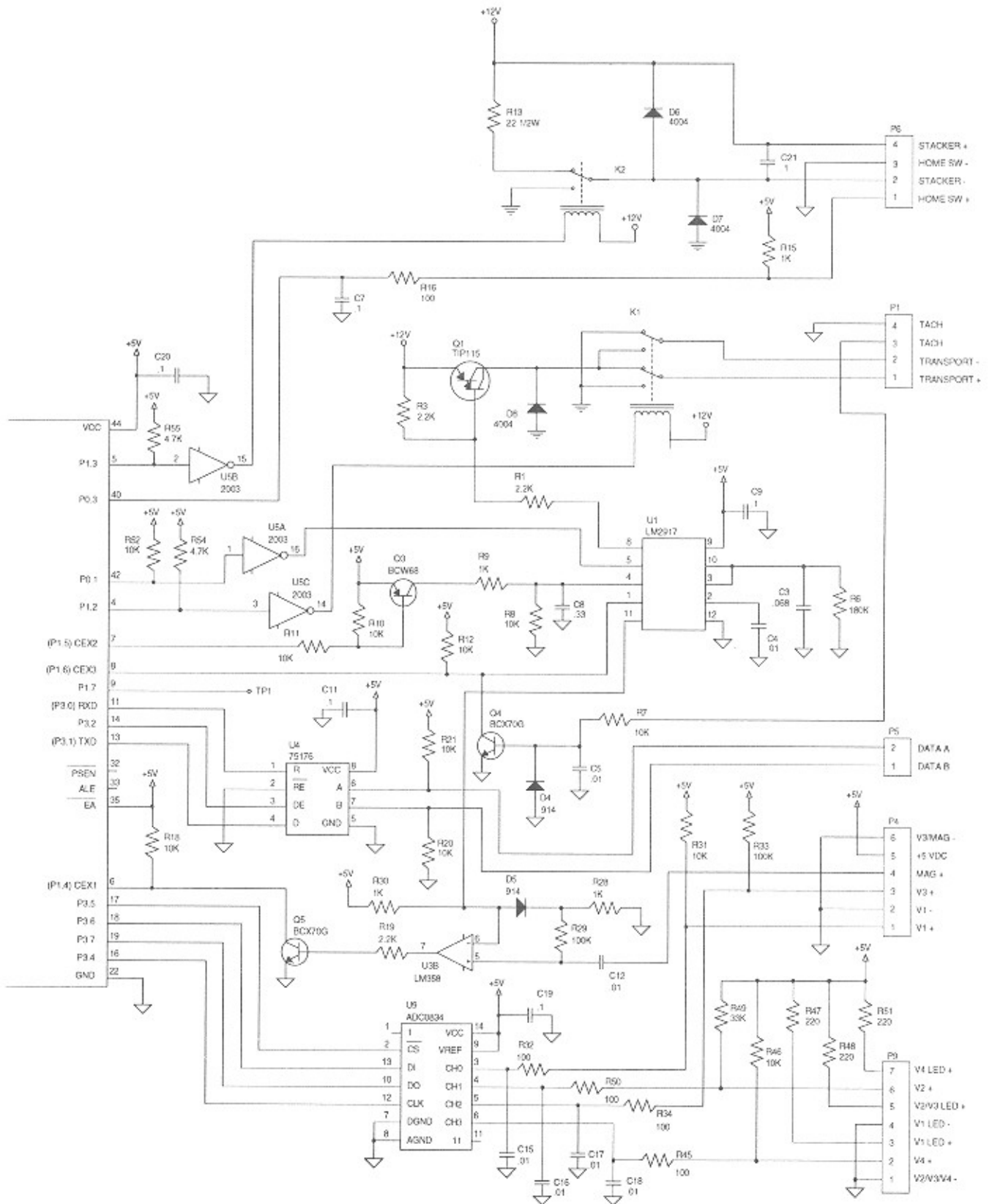
- a. The Transport motor continues to run until the bill is in position to be stacked.
- b. The computer sends a credit signal to the output circuitry.
- c. The computer also turns on the bill stacker motor for one cycle of the bill pusher plate, which will move the bill from the transport belts to the bill box.

- 3. If any of the validation conditions are not met, the bill is returned to the customer as follows:**
- a. The transport motor changes direction from forward to reverse and returns the bill to the transport opening.
 - b. The computer checks for the V_4 and V_3 sensors to be uncovered by the returning bill.
 - c. The computer stops the transport motor with the leading edge of the bill still in the transport inlet covering the V_1 cell.
 - d. If the V_1 cell is still covered after 5 seconds, the computer enters the self-clearing sequence as described in *Self-Clearing Sequence* in this section.





For Equivalent Engineering Drawing See 65093004-Q7 - B
Figure 4-2. System Block Diagram



For Equivalent Engineering Drawing See 0030832/53 - B
Figure 4-3. CBA-2 Schematic Diagram

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ROUTINE MAINTENANCE

Jammed bills are the cause of most maintenance calls. If you have recurring bill jams or other CBA-2 problems, follow the troubleshooting procedures (see *Troubleshooting* at the end of this section).

Tools Required

The CBA-2 does not require special tools. The following tools are recommended, however:

- 1/8" Nut Driver
- 1/4" Nut Driver
- 5/16" Nut Driver
- Small Phillips Screwdriver
- 3/32" Flat Blade Insulated Screwdriver
- Long-Nose Pliers
- 3/8" Open End Wrench
- 5/16" Open End Wrench
- 0.030" Feeler Gauge
- External Retaining Ring Tool
- Precision Oiler with Lightweight Machine Oil (Such as 3-in-1 Electric Motor Oil)



CAUTION:

Always disconnect the power to the CBA-2 before turning the gear by hand. Be careful not to pinch your fingers between the gears.

Open the bill box and determine if the bill can be reached. If necessary, the transport can be turned by hand, either forward or reverse to remove the bill. To turn the transport by hand, turn the gear on the side of the transport. If the bill is jammed near the inlet, try to remove it by turning the transport by hand. If this does not free the bill; remove the transport from the unit and remove the inlet (see *Removing the Inlet* later in this section).

Bill Jamming Checklist and Corrective Procedures

If frequent bill jamming occurs, perform the following checks and corrective procedures:

1. Check that the timing belts are not too loose or too tight (see *Timing Belt Tension Adjustment* in this section). Make sure the belts are positioned on the pulleys correctly.
2. Make sure the upper belts run freely and stay centered on the crowned rollers while the transport is running.
3. The inlet and bill track surfaces must be free of dirt, moisture, burrs, projections, and rough spots, which might catch edge of a bill or slow the bill down.
4. Check that the anti-cheat lever moves freely.
5. Check that the belts are clean and not glazed or slippery. If the belts are dirty or oily, clean them by wiping them with denatured alcohol.
6. Check that the drive pulleys are not loose on the shaft.
7. Check that the upper input roller is not loose on the shaft.
8. Check that the lower input roller has the correct amount of spring pressure and moves up and down without binding. The force to move the roller should be 150 to 200 grams.

CLEANING

The bill acceptor does not require routine cleaning, however, the inlet and track surface should be wiped with a clean soft lint free cloth each time the mechanism is removed for service. Due to the abrasive nature of currency, the magnetic head does not normally require cleaning. If the head does become dirty, use a clean cotton swab saturated with denatured alcohol or other suitable cleaning solution. Never soak the belts in cleaning solvents.

LUBRICATION

The bill acceptor does not require lubrication under normal use. If the transport turns hard or squeaks, apply one drop of light machine oil (such as 3-in-1 Electric Motor Oil or equivalent) to the following 19 areas:

- Gear shaft
- The nylon bearings
- Each roller for the upper and lower belts
- Two blue bearings on the upper inlet shaft (These bearings can be reached by removing the inlet; see *Removing the Bill Inlet* in this section)

See *Figure 4-4* for oiling locations.

Do not over lubricate.

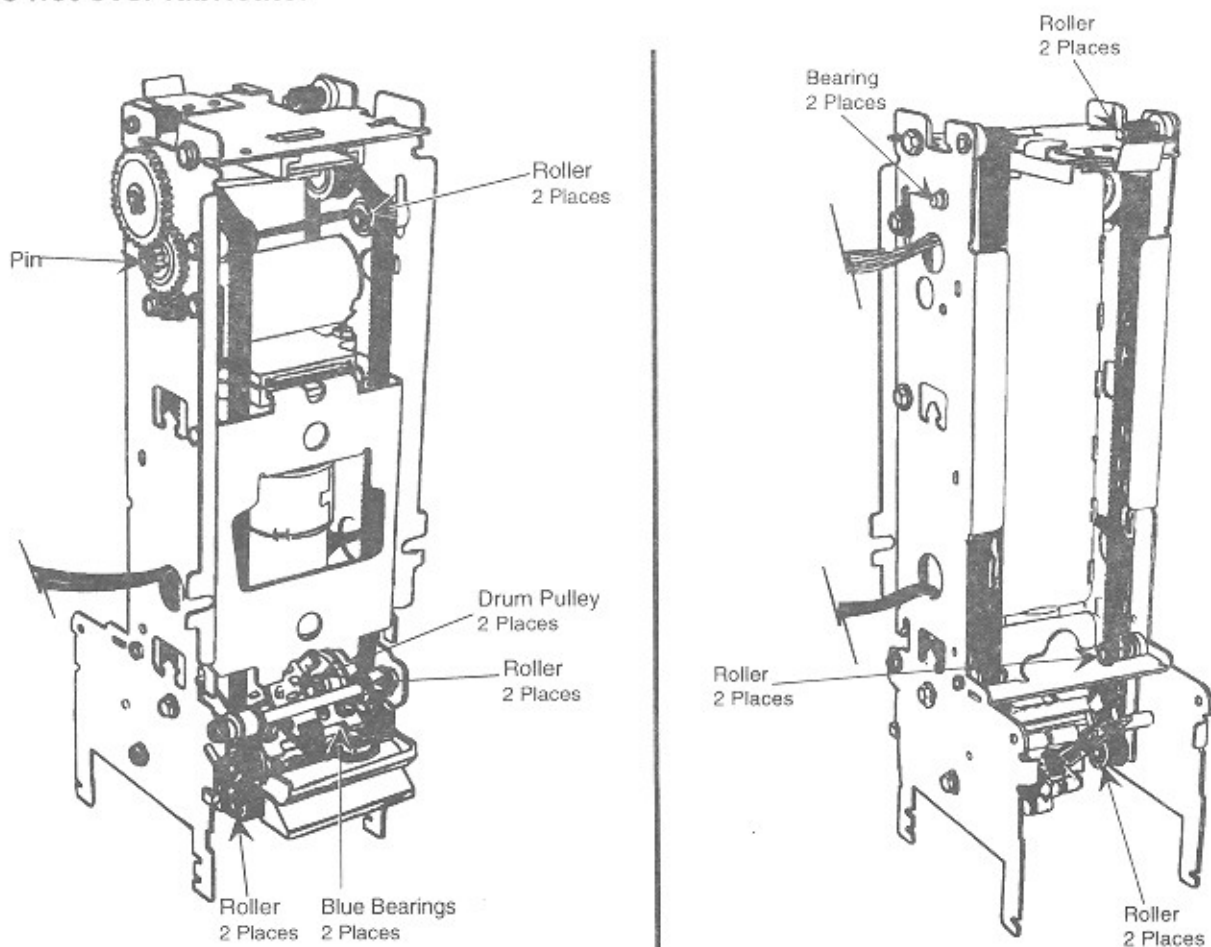


Figure 4-4. Oiling Locations

MECHANICAL ADJUSTMENTS

The bill acceptor transport mechanism does not require setup or routine adjustment; however, if the mechanism binds or slips, the following adjustments can be made. These adjustments should also be made if the transport is disassembled.

Belt Adjustment

Refer to *Figure 4-5* for adjustment locations and the precision adjustment illustration.

COARSE ADJUSTMENT CHECK

Timing belts should be adjusted tight enough that they do not come off the pulleys, but not so tight that they put a load on the transport. This tension is achieved by adjusting the belt to the point that the slack in the belt is taken up.

PRECISION ADJUSTMENT CHECK

If this general adjustment procedure is not satisfactory, you may use the following precision adjustment procedure (*Refer to Figure 4-5*):

1. Apply a force of 118 grams to each belt. Each belt must deflect a distance of 3/16 inch.
2. Apply the force mentioned in step 1 with the end of a 1/4 inch diameter pin. The centerline of the pin must be centered on a line that is 1/4 inch from the stacker motor bracket and the pin must be centered on the belt. Apply the force in a direction perpendicular to the belt.
3. If the tension is not correctly set, loosen the screw(s) (A) in *Figure 4-5* so that the pulleys move freely in their slots. Adjust the pulley(s), tighten the screw(s), and recheck the belt deflection.

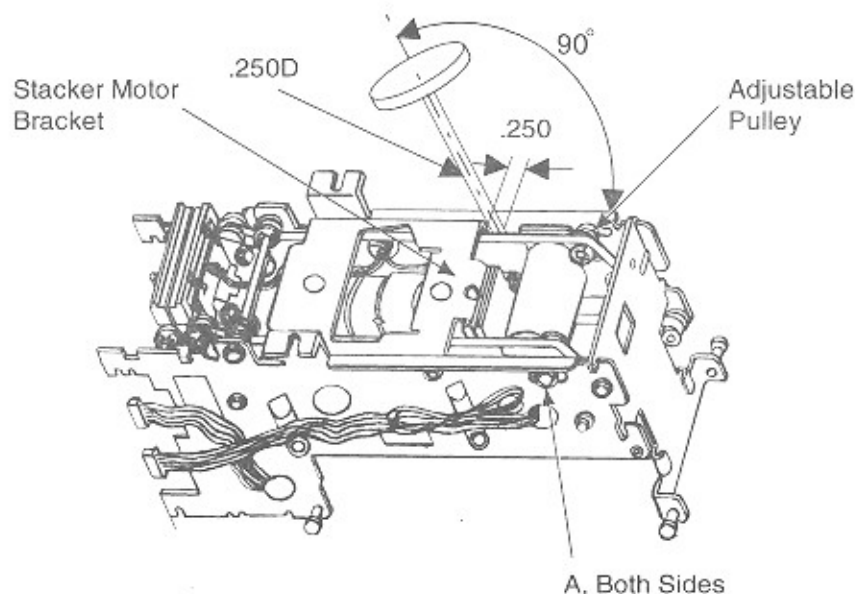


Figure 4-5. Timing Belt Tension Adjustment

Gear Backlash Adjustment

Check that the gears in *Figure 4-6* have a slight backlash of .008 to .012 inch. To adjust the gear backlash:

1. Loosen the two Hex-head adjusting screws (A) holding the motor.
2. Move the motor to obtain the correct backlash.
3. Tighten the two screws and recheck the gear backlash.

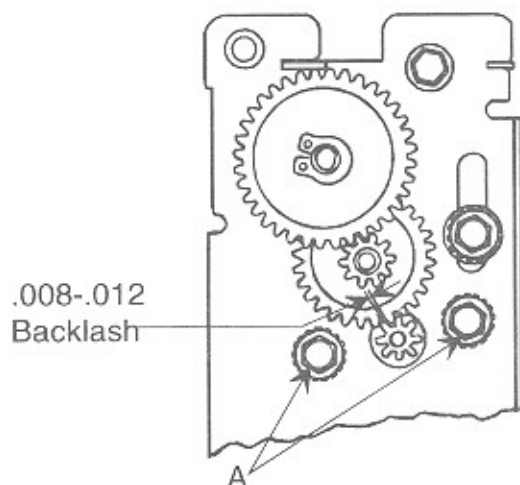


Figure 4-6. Gear Backlash Adjustment

Stacker Home Switch Adjustment

Check for a gap of $1/32$ (.030 inch feeler gauge) between the stacker switch arm and the stacker switch body as shown in *Figure 4-7*.

If this clearance is not correct, adjust the stacker switch as follows:

1. Loosen the two adjusting screws as shown in *Figure 4-7*.
2. Position the cam so that the switch arm rests on the raised lobe of the cam.
3. Insert a $1/32$ inch gauge (0.030 inch feeler gauge) between the switch arm and the switch body.
4. Hold the switch against the arm and tighten the two adjusting screws.

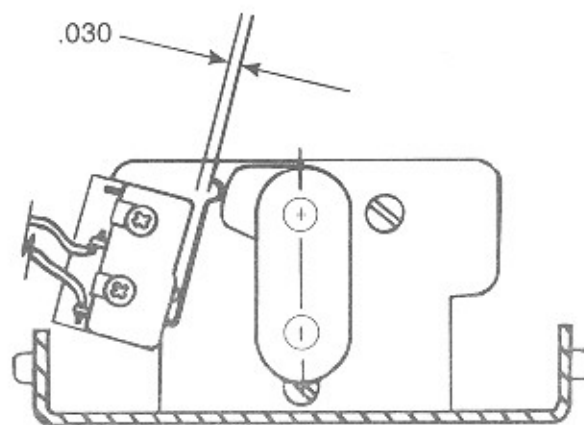


Figure 4-7. Stacker Home Switch Adjustment

Magnetic Head Alignment

The magnetic head is aligned to the upper track at the factory. If the head must be aligned or replaced, order the *Upper Track Harness and Cell Assembly* listed in *Figure 8-8*.

ELECTRICAL ADJUSTMENTS

The CBA-2 has no electrical adjustments.

REMOVAL AND REPLACEMENT PROCEDURES

Removing the Bill Inlet

1. Remove the countersunk screw that holds the inlet on the front of the transport (See *Figure 4-8*).
2. Lift off the inlet.

Removing the Water Shield

The water shield must be removed to gain access to the outer belts, rollers, and the lower harness and cell assembly. Remove the water shield as follows:

Remove the inlet (see *Removing the Inlet* above), disconnect the logic board wiring harnesses, and slide the logic board back; then, remove all three pieces (watershield, logic board, mounting bracket) at the same time.

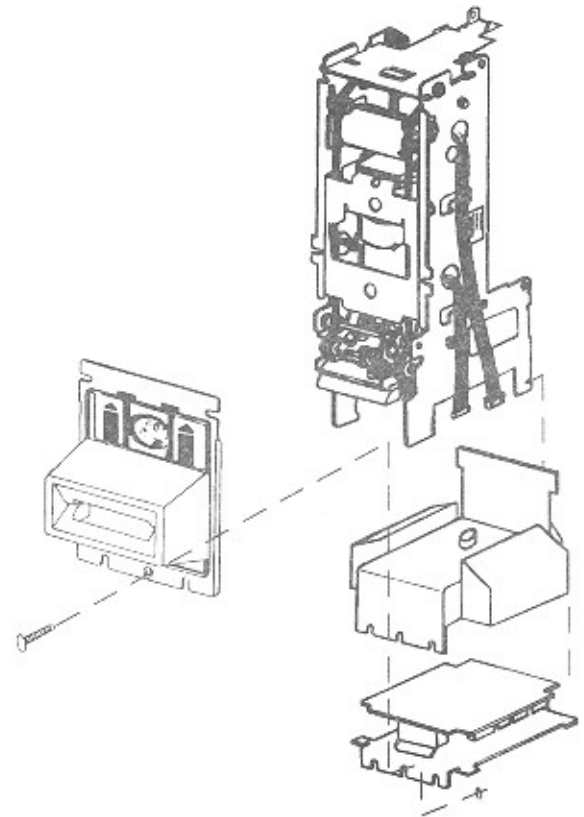


Figure 4-8. Removing the Bill Inlet

Re-Installing the Water Shield

1. Slide the water shield into its former position.
2. Re-install the logic board, reconnect the wiring harnesses, and re-install the inlet (See *Figure 4-8*).

Removing the Lower Harness and Cell Assembly

1. Remove the water shield (see *Removing the Water Shield* in the preceding paragraph for this procedure).
2. Unhook the circuit board by pushing back on the catch (see *Figure 4-9*), then remove the board.

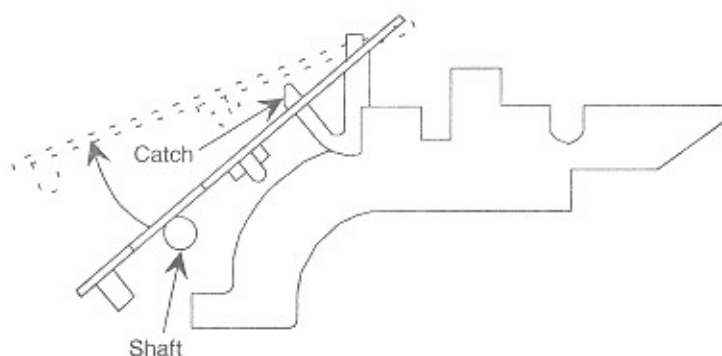



Figure 4-9. Removing the Cell Assembly

Re-Installing the Lower Harness and Cell Assembly



CAUTION:
The plastic circuit board catch, shown in *Figure 4-9*, can be damaged very easily if it is allowed to push its way through the circuit board. Always pull the catch tip to the right so that the catch will pass through the circuit board without damaging the catch tip.

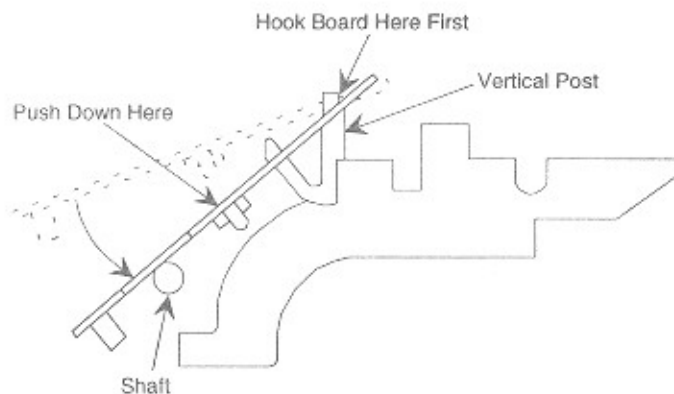


Figure 4-10A. Mounting the Cell Assembly

1. To replace the assembly on the lower track, set the transport upside down. Hook the board over the vertical post, pull the catch back, then push down on the board to snap it under the catch (See Figure 4-10A).
2. Re-Install the water shield (See *Re-installing the Water Shield* in this section).
3. Check to see that the catch is hooked over the board (A) and the board is setting in the recessed area on the shaft (B). See Figure 4-10B.

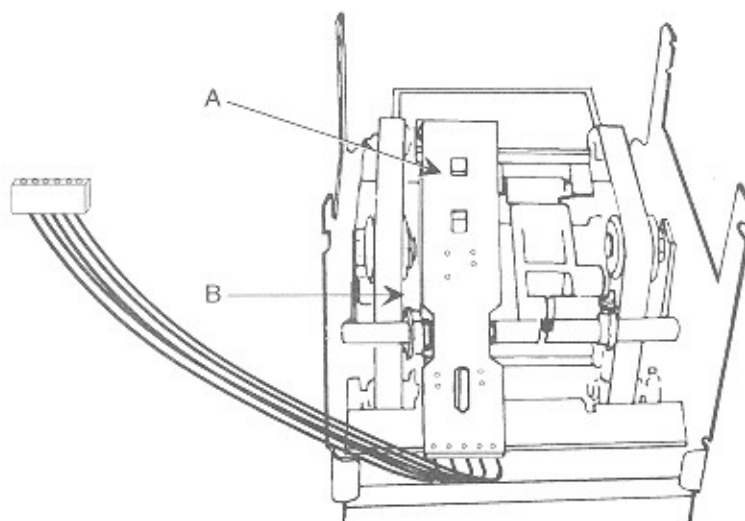


Figure 4-10B. Mounting the Cell Assembly

TROUBLESHOOTING

Logical troubleshooting minimizes effort caused by removing and replacing the wrong part. Many failures are caused by minor defects such as loose connections or dirty contacts. Check the following before replacing any parts:

1. Check that all plugs are firmly seated.
2. Check that connector pins are not bent, broken, or pushed through the back of the connector when mated.
3. Check that the coin acceptor operates properly. If the machine has disabled the coin acceptor, the CBA-2 will also be disabled.

TROUBLESHOOTING GUIDE

This guide will help you isolate problems and return the bill acceptor to service as quickly as possible. *Table 4-2* lists common “Trouble” situations, their symptoms, and the most likely defective modules.

Rowe recommends that you replace defective modules with new modules, rather than try to replace individual components within the modules.

Table 4-2. Troubleshooting Chart

Trouble	Symptom	Probable Cause
Transport motor does not start when a bill is inserted.	POWER LED on the logic board is not lit.	1. The problem is in the power supply or the harness to the CBA-2. 2. Defective logic board.
	The STATUS LED is ON or is blinking.	The CBA-2 is not operational due to a fault condition (see the next section of this chart).
	The transport does not start, but a clicking sound is heard in the logic board.	1. An object is jammed in the transport mechanism. 2. Defective transport. 3. Defective logic board.
	No sound or other indication that the transport is trying to run.	1. Defective V1 cell. 2. Defective logic board.
CBA-2 in SHUTDOWN	CBA-2 STATUS LED is ON steady.	The CBA-2 has not been enabled by the controlling machine.
In this state, the CBA-2 STATUS LED will be flashing ON and OFF. The number of flashes indicates the cause of the SHUTDOWN.	The CBA-2 STATUS LED flashes once.	1. An object is covering the V1 cell in the transport. 2. Defective transport. 3. Defective logic board.
	The CBA-2 STATUS LED flashes three times.	1. An object is covering the V3 cell. 2. Defective lower harness and cell assembly. 3. Defective transport. 4. Defective logic board.

Table 4-2. Troubleshooting Chart

Trouble	Symptom	Probable Cause
In this state, the CBA-2 STATUS LED will be flashing ON and OFF. The number of flashes indicates the cause of the SHUTDOWN.	The CBA-2 STATUS LED flashes four times.	<ol style="list-style-type: none"> 1. An object is activating the anti-pull-back lever in the transport. 2. Defective lower harness and cell assembly. 3. Defective logic board.
	The CBA-2 STATUS LED flashes five times.	<ol style="list-style-type: none"> 1. The bill stacker is full. 2. The bill stacker is jammed in the OFF-HOME position. 3. The bill stacker HOME switch is out of adjustment. 4. Defective bill stacker home switch. 5. Defective logic board.
	The CBA-2 STATUS LED flashes seven times.	<ol style="list-style-type: none"> 1. Motor speed could not be adjusted. 2. Incorrect belt tension. 3. Defective motor. 4. Defective logic board.
The bill acceptor rejects a large number of valid bills. The CBA-2 STATUS LED will flash one or more times to indicate the cause of the rejection.	The CBA-2 STATUS LED flashes once after rejecting the bill.	<ol style="list-style-type: none"> 1. Defective V1 cell in the transport. 2. Defective logic board.
	The CBA-2 STATUS LED flashes twice after rejecting the bill.	<ol style="list-style-type: none"> 1. Defective lower harness and cell assembly. 2. Defective logic board.

Table 4-2. Troubleshooting Chart

Trouble	Symptom	Probable Cause
The bill acceptor rejects a large number of valid bills. The CBA-2 STATUS LED will flash one or more times to indicate the cause of the rejection.	The CBA-2 STATUS LED flashes three times after rejecting the bill.	<ol style="list-style-type: none"> 1. Defective V3 cell in the transport. 2. Defective logic board.
	The CBA-2 STATUS LED flashes four times after rejecting the bill.	<ol style="list-style-type: none"> 1. An object is lodged in the transport. 2. Binding anti-pull-back lever. 3. Defective lower harness and cell assembly. 4. Defective logic board.
	The CBA-2 STATUS LED flashes five times after rejecting the bill.	<ol style="list-style-type: none"> 1. Defective magnetic head or transport. 2. Defective logic board.
	The CBA-2 STATUS LED flashes six times after rejecting the bill.	The bill denomination inserted has not been enabled.
Bills jam frequently.		<ol style="list-style-type: none"> 1. The anti-pull-back lever is not moving freely. 2. The bill pressure roller is binding. 3. The transport inlet or track surfaces have projections, or rough spots, on them. 4. The transport belts are out of adjustment or dirty. 5. The transport belts are not centered on their rollers. 6. The transport upper input roller does not move up and down freely. 7. Defective power supply.