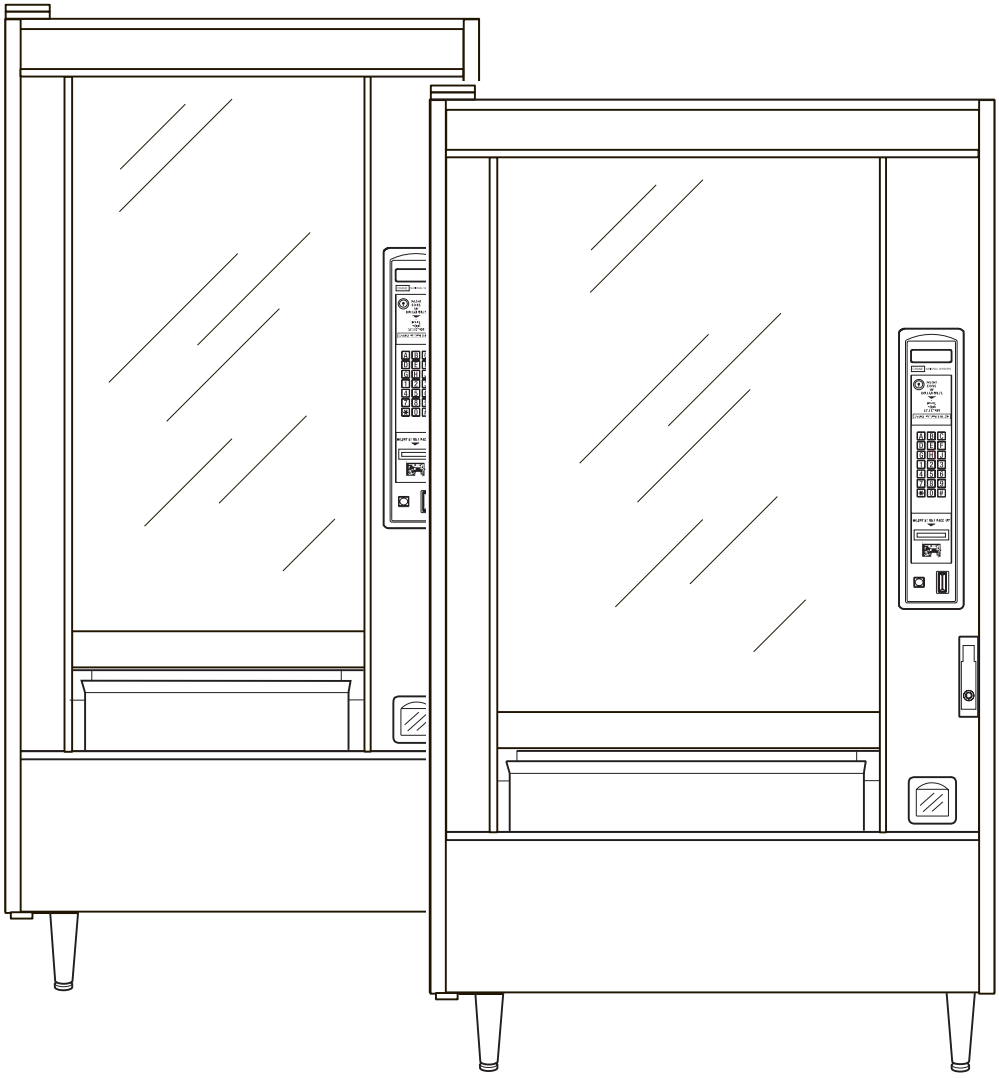
1670065

Model 167 / 168

$22.95

Snack Center I & II



Troubleshooting & Repair Guide

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Section I. General Information

1. Preventing Circuit Board Damage From Electrostatic Discharge

Electronic printed circuit board assemblies are susceptible to physical damage, for example, broken components due to rough handling. In addition, printed circuit board assemblies (and their components, such as EPROMs) are subject to damage by various types of static electricity. Damage of this type is called **ELECTROSTATIC DISCHARGE (ESD)**. ESD can cause immediate damage to components on a circuit board assembly, or it can weaken them to the point where the damage will show up days, weeks, or months later.

PRECAUTIONS TO TAKE WHEN HANDLING PCB ASSEMBLIES

1. The PCB assembly is usually shipped in a cardboard shipping carton to prevent physical damage. Inside the carton, the PCB was placed in 1 of 3 types of closed protective bags: black translucent, smoked gray transparent, or pink transparent.
2. For storage, the best protection for the assembly is to leave it in its shipping carton. If it is removed from the carton, leave the assembly in its ***CLOSED storage bag while transporting, or until it is ready to be installed in a machine.***
3. **Before handling the PCB assembly, be sure you are wearing a conductive wrist strap or other suitable ESD protective device. The conductive wrist strap should be connected to ground in the machine. This can be any exposed metal part.**
   DO NOT CONNECT YOUR WRIST STRAP TO A PAINTED PART.
4. Remove the new PCB assembly from its bag. Set the PCB assembly on top of the bag on a flat surface while you remove the old PCB assembly from the machine.
5. Static can migrate on outside of bag, so it is recommended that when you pick up the new PCB assembly, to set the old one down on the protective bag. Install the new PCB assembly in the machine.
6. Insert the old PCB assembly into the protective bag. Seal the bag.
7. If the old PCB assembly is to be shipped, it is best to ship it in the same shipping carton you received with the new PCB assembly.

2. EPROM Replacement

CAUTION:

Do not remove the new EPROM from its shipping carton until you are ready to use it.

CAUTION:

Observe Electrostatic Discharge precautions to protect the electronics from damage while they are being handled. Wear a grounded wrist strap connected to any unpainted metal part of the machine. If a wrist strap is not available, remove any electrostatic charge (static electricity) from yourself by touching any unpainted metal part of the machine before handling any electronic component. Do this often during the removal and installation process.

1. See the shaded area representing EPROM U4(figure 1). These devices have various means of showing how they are to be oriented on the circuit board. Some EPROMs will have a small notch which matches the notch printed on the controller board. Other EPROMs may have a small dimple as shown, others may have a painted stripe. Take note of where the locating mark is on the EPROM currently mounted on the controller board. Your new EPROM will be placed in that same orientation. Some EPROMs have 28 pins, (opposed to 32 pins on newer snack-based models), so they will not use the entire socket (Newer snack-based machine's EPROMS will cover entire socket). The shaded area on the figure is where the new EPROM will go, leaving the four holes at the bottom of the socket empty if you are using older EPROM.

2. Carefully remove the old EPROM from the controller board. Use an EPROM removal tool or a thin tool such as a small screwdriver or knife blade to gently rock the EPROM from its socket.

3. Carefully insert the new EPROM in the controller board. MAKE SURE THE LOCATING MARK (NOTCH, DIMPLE, STRIPE) ON THE EPROM IS FACING THE SAME WAY AS ON THE OLD EPROM! Make sure each of the pins is in its respective hole in the socket before pushing the EPROM into place.

4. Carefully seat the EPROM into place using uniform pressure all around.

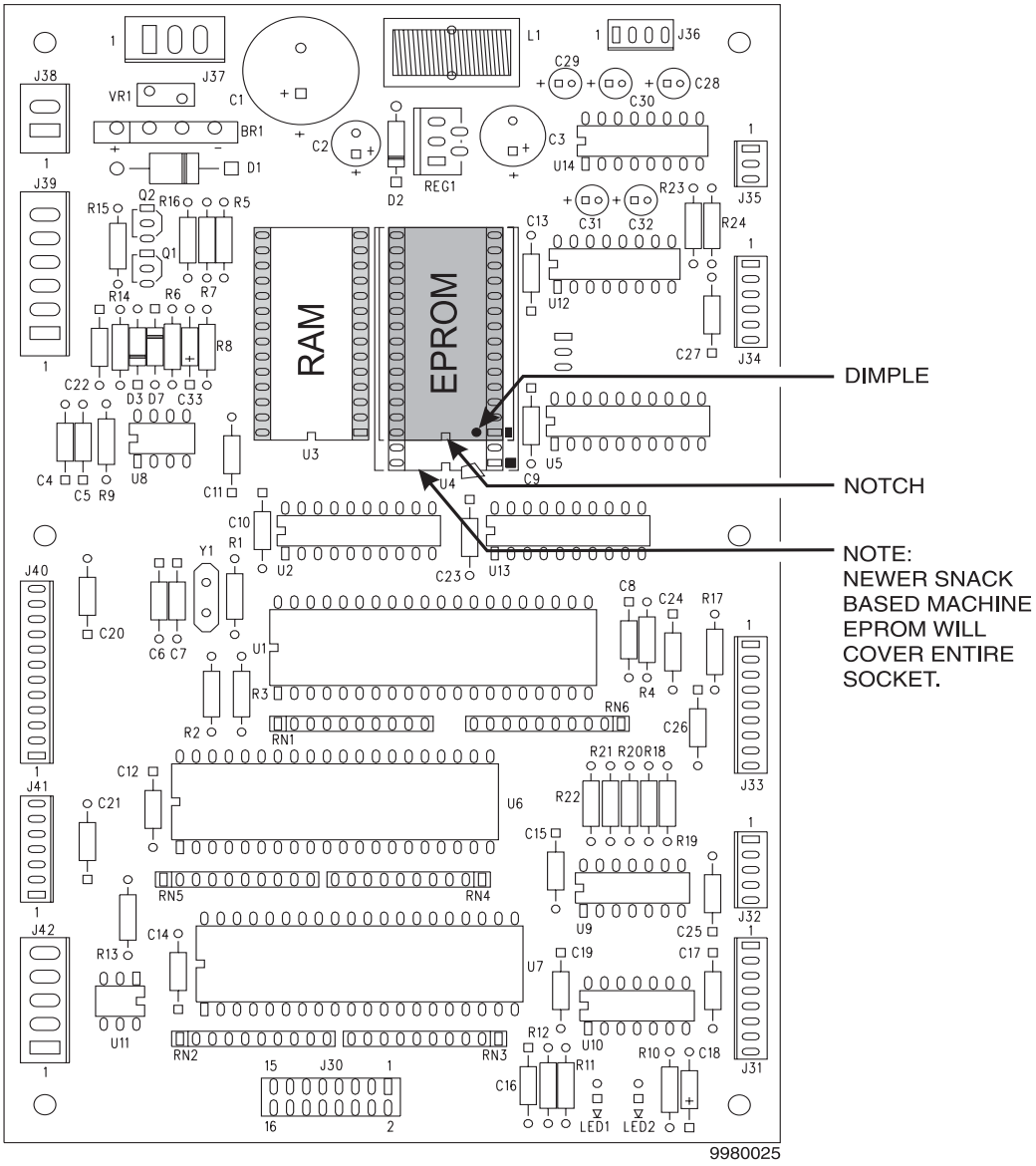

RAM
EPROM
DIMPLE
NOTCH
NOTE:
NEWER SNACK
BASED MACHINE
EPROM WILL
COVER ENTIRE
SOCKET.
9980025

Figure 1

Section II. Theory of Operation

1. Overall Merchandiser

A. Power Circuit

1. The power circuit for the basic snack merchandiser consists of the following components:
   Power Cord
   Electronic Breaker
   Main Switch
   Coin Power Board (Optional)
   EMI Filter
   Main Circuit Breaker
   Transformer
2. Power Parameters
   a. The merchandiser is supplied with a service cord for the country of use and is terminated in a grounding type plug. The wall receptacle used for this merchandiser must be properly polarized, grounded, and of the correct voltage. Operating the merchandiser from a source of low voltage will **VOID THE WARRANTY**.
   b. Each merchandiser should have its own electrical circuit and that circuit should be protected with a circuit breaker or fuse conforming to local regulations.
3. Power Checks
   a. Voltage, polarity, and noise potential checks should be made to determine that each is of correct level.
   b. Voltage (checked between hot and neutral lines), polarity (checked between hot and ground lines), should indicate 110 - 130 volts ac for 120 volt, 60 Hz locations, or 220 240 volts ac for 230 volt, 50 Hz locations. A noise potential check may be accomplished by measuring between neutral and ground. The meter should indicate 0 volts ac. A measurement greater than 1 - 1.5 volts ac could result in problems for the merchandiser's electronic circuitry caused by the electrical noise.
4. Main Switch
   a. The first component encountered in the power circuit is the main switch. The main switch is a **double pole, single throw** switch, rated at 20 amps, ¼ hp, and 125 - 250 volt ac. When the switch is closed or in the "on" position, voltage is transferred to the EMI filter and throughout the rest of the merchandiser.

5. Main Circuit Breaker
   a. The main circuit breaker is placed in line just after the main switch. The main circuit breaker is designed to protect the merchandiser from over-current conditions that may be produced at the wall outlet in the electrical circuitry of the location. These conditions could cause erratic operation of the merchandiser, damage internal components and even electrical shock and personal injury.

WARNING:

The over-current protection provided by the main circuit breaker must never be compromised. Shorting or jumping across this breaker WILL compromise this protection and cause, potentially, severe problems. (SEE ABOVE PARAGRAPH)

6. EMI Filter
   a. The EMI, or line load filter is rated at 5 amp, 115/250-volt ac, 50/60Hz. The internal components consist of two 850 uH (micro Henry) inductors, a.01 uF (MicroFarad) capacitor and two 2800 pF (Pico Farad) capacitors. The purpose of the filter is to filter "noise" that may be riding the ac signal. This unstable, tag along voltage riding the ac signal could adversely effect the operation of the electronic components within the merchandiser and cause erratic operation of those electronics i.e. main controller, Interface Board etc. Failure of any of the internal components within the filter could prevent proper power distribution within the merchandiser. Light failure, improper board operation, or tripping of main breaker could be attributed to internal component damage in the EMI Filter.
7. Transformer
   a. The transformer is a double primary winding, 120-volt ac step-down that provides 24-volt ac to the main controller board for distribution to other low voltage components within the merchandiser. The voltage is filtered, rectified and dropped to accommodate the various circuits respectively. (See Main Controller and Interface Board).
8. Electronic Circuit Breaker
   a. A 3 amp rated electronic circuit breaker completes the power circuit. It is designed to provide protection from over current conditions that may potentially damage low voltage electronics. Circuit boards and other low voltage component are vulnerable to high current and a three amp rating is the limit with which to prevent board damage, fire and/or electrical shock.

WARNING:

The over-current protection provided by the electronic circuit breaker must never be compromised. Shorting or jumping across this breaker WILL compromise this protection and cause, potentially, severe problems.

B. Coin Power Board(Optional)

1. The coin power board, though considered part of the power circuit, is also part of the monetary circuit. The coin power board uses a full wave rectifier which takes 120 volts ac and converts it to 120 volts dc for coin mechanism use.

a. 120 vac is tapped from the output of the EMI Filter and is input at pins 1 and 2 of connector J25. On the board, this ac voltage goes through the series of diodes D1-D4 (full wave rectifier), and is output as 120 volts dc at pins 3 and 4 of J25.

CAUTION:

Low input voltage at pins 1 and 2 will invariably equate to low output voltage at pins 3 and 4. This may cause erratic operation of coin mechanism. Jackpotting may result as well as potential damage to main controller board.

b. The 0.1 microfarad capacitor functions as a noise filter for the incoming ac voltage before it is rectified.
c. In line with the incoming ac voltage is a resistor and 1 AGC fuse combination for rectifier protection. The 5-watt ceramic wire wound resistor acts to limit current and allow the fuse to blow before damage is done to the bridge rectifier.
d. Variable resistor VR1 filters noise from the newly rectified dc voltage. DC filtering is necessary to provide the cleanest possible voltage for coin mechanism operation.

C. Main Controller

1. The main controller processes all information, data, and decision-making functions for the entire merchandiser. The main controller is connected directly or indirectly to every major component within the merchandiser, receiving and processing a variety of inputs and initiating several outputs and functions.
   a. These functions are accomplished primarily by way of microprocessor U1 working in conjunction with the other onboard processor chips. Conditions are constantly monitored with the help of several peripheral devices working in conjunction with one another. Diagnostic messages are generated and displayed when conditions within the merchandiser warrant.
   b. All machine setup data that must be stored on power down (timers, data processing - sales, vends etc.) reside in the RAM (random access memory) or Dallas chip. The Dallas chip is located on chip base U3 on the board and is located next to, and slightly higher than the Eraseable programmable read only memory (EPROM) chip.
   c. EPROM U4 is usually marked with a version number denoting the features and upgrades available on the chip. The EPROM is known as the "personality" chip. This gives the machine its own unique identity, causing a snack machine to operate as a snack machine, a coffee as a coffee etc. Generally the functions located in the product configure mode are resident on the EPROM.

NOTE:

Updated versions of software may be obtained from the Parts Department at 1-800-621-7278.

   d. Two light emitting diodes (LED) are used. When lit, LED 1 indicates electrical power is applied to the controller. When flashing, LED 2 indicates that the controller is active and the software (EPROM) is operating.

2. The connector configuration for the main controller board is as follows:
   a. **J30 Data Transfer Port**. Transfer of data between the main controller and the Interface Boards is performed at this connector. This is accomplished by way of a 16-con-

ductor ribbon cable connected at J55 of the Interface Board (see Interface Board). Tray status and other conditions including the status of rail boards as well as all other peripherals connected to the Interface Board are monitored here. Operational commands for peripherals are sent and received via this port using a serial data stream.

NOTE:

Disruption of this data stream will result in a (TEMPORARY OUT OF SERVICE), (ABCDEF) OR (NONE READY) error message in the display. This condition will continue until such time that the problem is corrected.

Pins 2-14 provide communication through IC U7 via microprocessor U1. 5 volts dc logic circuit voltage can be measured between pins 1 and 15.

b. **J33 Display PCB Connection**. Pins 1 and 9 provide 5 volts dc for operation of display console logic circuit functions. All display data, including load beeper, are controlled through the following IC chips: U13A (octal 3-state driver), U6 (general I/O buffer), and gate controlled U9C (OR gate). This port provides visual information concerning the state of merchandiser, command control and diagnostics.
c. **J34** Used for Sure-Vend.
d. **J35 Communication Port**. Reserved for future use.
e. **J36 DEX Device Port**. This is a serial data communication port for retrieving data from the merchandiser by way of hand held printer or (DEX) data retrieval device. Pin 1 provides a ground reference for data transmission (pin 2), data receive (pin 3), and return transmission signal (RTS) (pin 4). Pin 3 also acts as a communication transmission signal (CTS) and reports directly to microprocessor U1. Data transfer is controlled through U14 inverter chip. 5 volts dc can be measured at pins 1 and 4 for logic circuit operation.

NOTE:

See DEX Overview and Capabilities on page 14 for more information.

f. **J37**. 24 vac is supplied to pins 1 and 2 of this connector. This voltage is received from the Transformer (see "Power Circuit" on page 6) located on power panel. The 24 vac is rectified at bridge BR1 (bridge rectifier) and sent as 24 volt unregulated dc to various locations on the board, and to regulator circuit REG 1. At the regulator circuit the dc voltage is filtered and reduced to 5 vdc for use as high and low signals (on/off) for all logic circuit functions and other on-board uses.
g. **J38**. Pins 1 and 2 of this connector supply output power to the Interface Board. This 24 volt unregulated dc is sent to the Interface Board at connector J-62 where it is regulated (See Interface Board).
h. **J39 MDB (Multi-Drop Bus) Port**. Unregulated 24 volts dc at pin 6 and unregulated dc return at pin 5 is used to power all MDB protocol capable monetary units. These include coin mechanisms, dollar bill validators, card readers etc. (See Multi-Drop Bus). Master data transmissions, and receiving communication is accomplished at pins 3 (transmit data) and 4 (receive data). Pins 1 and 2 supply a regulated and filtered 5 volts for monetary unit logic circuits.

CAUTION::
See Multi-Drop Bus (MDB) on page 14 for more information.

a. **J40 Dumb Coin Mechanism Port.** 24 volt unregulated dc is supplied at pins 11 and 12 for power to 24 volt coin mechanisms. Pin 6 (reset) is used to identify the presence of a dumb coin mechanism to the merchandiser. This reset pulse is only used once on power up for this function and is not used again unless a mechanism is changed from dumb to Multi-Drop Bus and back to dumb again. A low at pins 1, 2, or 3 will initiate a payout signal to the coin mechanism's 5, 10, and 25 cent payout solenoids. All pay-out signals are controlled at these points through the general I/O buffered IC U6. A low at pin 4 enables the coin acceptance circuit identifying the coin inserted into the mechanism. This data is sent by way of the switching IC U12, through buffer U13B, to microprocessor U1 for evaluation. Data transmission takes place at pin 5 (interrupt, low for data present), pin 7 (data received), and pin 8 (send data). Pins 9 and 10 supply a regulated and filtered 5 volts dc for coin mechanism logic circuit operation.

b. **J41 Serial Validator Port**. The communication protocol accomplished at this connector is much the same as that which is done at J40. A low at pin 2 enables the bill acceptance circuit which identifies the received bill. This data is sent by way of switching IC U12, through buffer U13B, to microprocessor U1 for evaluation. Data transmission takes place at pin 5 (interrupt, low for data), pin 6 (data receive), and pin 5 (send data). Pins 1 and 7 supply a regulated and filtered 5 volts dc for validator logic circuit operation.

c. **J42 Pulse Validator Port**. Serial data communication represents a constant stream of information traveling in both directions (send and receive). Pulse operation is based on a single signal being sent and processed at the microprocessor for response. No transfer of "data" occurs and consequently no smart responses are possible. Each bill accepted would generate this "pulse" which is acknowledged at the microprocessor and processed. Since no data is transferred, only a one-dollar bill can be accepted, since each one dollar bill will generate one pulse. Acknowledgment of data about any other bill is not possible. Pins 1 and 2 provide 115-volt ac which enables voltage connected through opto coupler U11 for voltage isolation purposes. This prevents high voltage interacting with low voltage board components. While maintaining a 5-volt dc logic level, the pulse signal is sent at pin 4 (ground) and pin 5 connected through logic gate U9B to microprocessor U1 send leg.

NOTE:
If machine has pulse validator only, during troubleshooting, pins 4 and 5 may be momentarily shorted together to simulate a pulse signal and establish a $1.00 credit. If credit is established then dollar bill validator is defective, if no credit is established the main controller board is defective.

A. Interface Board

1. The snack interface (or driver) board provides the means to perform matrix operations (see Matrix) for all tray motors, whether located on standard snack trays or trays located within modules (Frozen, Food, or Can). It also provides voltage for the opto coupler on the refrigeration triac board and monitors vend door and module door switches on Frozen and Food modules.

2. The connector configuration for the Interface Board is as follows:
   a. **J55 Data Transfer Port**. Data is transferred to and from the Interface Board and main controller boards at this connector. The data transfer is accomplished by way of a 16-conductor ribbon cable connected at J30 of the main controller board. The selection matrix data, once activated (see selection matrix), is sent here, as well as cycle and motor sense data which is monitored through this connector. Operational commands are sent and received through this port by a serial data stream.

CAUTION:

Disruption of this data stream will result in a (TEMPORARY OUT OF SERVICE), (ABCDEF+) OR (NONE READY) diagnostic error message until such time as the cause is corrected.

Pins 3 through 12, 14, and 16 provide the medium for the data stream, through the data bus to and from all on-board IC chips. Pin 13 is used to reset IC's requiring it at the appropriate time. Pins 1 and 5 have 5 volts d.c. present for board logic circuit operation.

   b. **J56 Triac Board Connector**. Not used in this machine.
   c. **J57 Frozen/Fresh Food Connector**. Not used in this machine.
   d. **J58 Gum and Mint/Can Module Connector**. Column lines, gum and mint sense, even gum and mint row line and motor sense lines are provided at this connector. Pins 5 and 9 provide positive column lines (see the Matrix) in conjunction with transistors Q1 through Q5, and Darlington array drivers U5 through U9. Positive column line voltage for all motors within the merchandiser are provided by transistors Q1 through Q5. The transistors are turned ON by Darlington drivers U5 through U9 when a selection has been made and the comparator motor sense line has been satisfied. The Darlington will turn ON transistors Q1 through Q5 and provide the low to run the selected motor(s). Pin 1 provides gum and mint sense by way of comparator circuit U10B.

      All sense lines within the merchandiser operate by two comparators, U10A and U10B. These components compare voltage changes in accordance with the presence of home switch and railboard, and in conjunction with tray motor PCB circuits. A high or low output is sent from the comparator to buffer chip U4A. The buffer chip reports to the main controller as to the status of the tray motor(s). to provide diagnostic messages when a railboard or motor is not sensed.

      Pin 2 provides row line (Low) for Gum and Mint in conjunction with Darlington driver, U9. Pins 3 and 4 provide odd and even sense lines respectively. Sense lines are operated by two comparators, U10A and U10B.
   e. **J59 Row Line Connector**. This connector provides odd and even row lines (ground) for snack trays D, E, and F.
   f. **J60 Snack Tray Connector**. All column lines, row lines and sense lines for trays A through C are provided at this connector. Pins 1 and 2 provide odd and even row lines for the C tray, 3 and 4 for the B tray, and 6 and 7 for the A tray. Pins 9 through 13 provide column lines for each tray (A through C). Pins 5 and 8 provide odd and even sense lines.
   g. **J61 Input Power Connector**. The main controller provides 24 vdc at this connector. Pins 1 (ground) and 2 (24 volts) receive 24 volts **unregulated** voltage. This voltage is

passed through regulator circuit REG1, where it is regulated for use by the driver circuits.

h. **J62 Coffee Controller Power Connector**. Not used in this machine.

i. **J63 Can Module Connector**. Not used in this machine.

B. Interlock Switch

1. The interlock switch is a single pole single throw switch designed to provide information to the controller regarding the position of the main door. The interlock also will effect the operation of the service keypad. In the door opened position, programming functions are operational but are suspended with the switch in the door closed position.

C. Keypads

1. The selection keypad is a universal keypad used on all present production snack merchandisers and is designed to allow control of the selection functions as well as certain data retrieval operations.
2. The service keypad, on **NV** models, is designed to allow control of all programming functions.
3. Both keypads operate on a matrix concept (see Selection Matrix on page 11).

NOTE:
Early NV models are equipped with a 4 arrow keypad as opposed to a two arrow keypad.

D. Display System

1. The universal display board is powered by an on-board DC-DC\DC-AC converter that supplies low voltage AC (approximately 5V P-P) to heat the florescent tube filament. It also provides the high (approximately 29vdc) grid voltage to attract electrons to the appropriate segments. A matrix system is used by the display to determine what will light up and when. The fluorescent display contains 10 digits, each with 15 segments.
2. All 15-segment anodes in each digit are wired in parallel across the entire display. For example, the upper left segment in the first digit is also connected to the upper left segment in digits 2 through 10, and so on for all 15 segments. Segments are selected by applying a high to the appropriate segment anodes. Each digit has a mesh grid placed between the segment anodes and the cathode. The digits are turned on and off by the grid drivers which put either a high or low voltage on each grid. When the grid is low, the digit is off; when the grid is high, the digit lights.

3. As with the selection system, the displays are strobed. Each digit is turned on and off 60 times each second. This fast strobing allows the display to be turned on one digit at a time, but at a rate so fast that the display is seen as showing complete words and numbers. The strobed signals to the digit grids are the same signals sent to the column lines of the selection system, further reducing the number of control lines needed by the microcomputer system.
4. The connector configuration for the display board is as follows:
   a. **J46; J49 Customer and Service Keypad Ports**. J46 pins 1-8, and J49 pins 1-4 tap the strobe signal provided to each digit of the florescent tube when a button is pressed on one of the keypads. A low is provided by the shift register chip U3, which then sends the data from the selection button to connector J45 and on to the main controller board for processing.
   b. **J47** Is used for FreeVend key switch.
   c. **J48 Door Switch Port**. Door status data is provided at this port. Data is provided to the shift register chip U3 and sent to the main controller board for processing.

E. Selection Matrix

Most microcomputer systems use a concept known as the Matrix to control (or be controlled by) various peripheral devises. Keypads, displays, and even the tray system in the snack merchandisers as well as applications for other merchandisers, are all examples of matrixed devises.

Basically, a matrix can be pictured as a grid with vertical and horizontal lines that intersect in a symmetrical pattern. The points where the lines cross represent an input (switches) or an output (motor, digit in a display, etc.) to the microcomputer.

The advantage of a matrix system is the ability for the microcomputer to use a large number of devices with a relatively small number of control lines. For instance the snack merchandisers can operate as many as 80 different motors with only 21 control lines.

Think of a matrix as a chart or table. A number of rows and columns are used. To find what we want, we select one row and one column. Where these two lines meet we-find the desired result.

	Column 1	**Column 2**	**Column 3**	**Column 4**
Row 1	Gray	Violet	Tan	Aqua
Row 2	Yellow	Red	Brown	Black
Row 3	Blue	Green	Orange	Purple
Row 4	White	Pink	Gold	Silver

In this example, a 4 x 4 matrix is used (four rows by four columns). If we select Column 3 and Row 2 and follow them until they intersect, the result is “BROWN”. Notice that we have 16 colors, but only 8 lines (4 rows arid 4 columns). By using the same principle, the microcomputer can use two signals (one Row and one Column) to turn on a display, operate a motor, or read a switch.

All merchandisers use a switch matrix to determine selections. The standard selection panel is made up of 21 buttons controlled by 10 lines (7 columns and 3 rows).

Each Column line receives a signal from the control board. These lines are strobed 60 times per second so that when column 1 is on, all other column lines are off. When column 1 turns off column 2 line turns on, and so on through each of the Column lines. When the last column line turns off column 1 turns on again and the process is repeated.

The three Row lines are used to detect when a button has been pressed by sending the line low (ground). The microcomputer sees the strobed signal from column line being fed back through the low row line and determines which button has been pressed. For example, if the control board observed the column line 3 strobe on the row 2 line it would be determined that the number 2 button had been pressed.

F. Motor Matrix

1. Since a matrix cannot directly control AC motors, the snack merchandiser uses 24 vdc motors. For the matrix to work, both Row and Column signals are needed. In this case, the Row controls the DC ground to the motor while the Column controls +24 vdc power.
2. The 5 wide snack is capable of handling up to 7 trays with 5 or 10 selections per tray or 4 to 8 selections per tray (depending on tray configuration). In addition, a 5 selection gum and mint unit, and 5 additional selections (not presently used) are available for a total of 80 possible motors. The matrix consists of 5 Column lines and 16 Row lines.
   a. In order for any motor to run, both Column and Row signals are needed. Candy trays use 2 row lines for control. The motors are organized in terms of “odds” and “evens”. The even numbered row is connected to all “even” numbered selections. For example, Row A0 is connected to A0, A2, A4, A6, and A8. “Odd” numbered rows are connected to “odd” selections. So Al is connected to A3, A5, A7, and A9. This system is very effective with snack trays. A factory-built snack tray only uses 5 motors, but rather than numbering the selections as 1 through 5 each snack selection uses an even number (0, 2, 4, 6, and 8). This means that only a single (even) row line is necessary.
   b. In standby, the Row lines will read approximately +12 vdc. When a motor runs, the Row line goes to a ground (0 volts) level. For example, to run the motor for the A0 selection, Column 1 is energized, putting +24 vdc at all “0” and “1” selections. Row A0 Even goes low, putting DC ground at even motors A0 through A4. Since motor A0 is the only one having both +24 vdc and ground applied, motor A0 runs. ***Note that A0 is the only motor in the entire matrix where Row A0 even and Column 1 meet, so it is the only motor that can run.*** The entire motor matrix is set up so that only one motor can possibly run when any pair of Row and Column lines are active.

c. Because a vend cycle is determined by one complete revolution of a snack motor, the machine must have a method of determining whether or not the motor has made that revolution (ending back in the “home” position). This is done through a series of two Cycle Sense lines. As with the Row lines, the Cycle Sense lines are organized in “odd’ and “even”.

The following example is the sequence of events which occur after an even numbered selection (0) is made. Figure 2 is the motor circuit showing the cycle switch in the closed position. Figure 3 shows the identical circuit with the cycle switch in the open position.

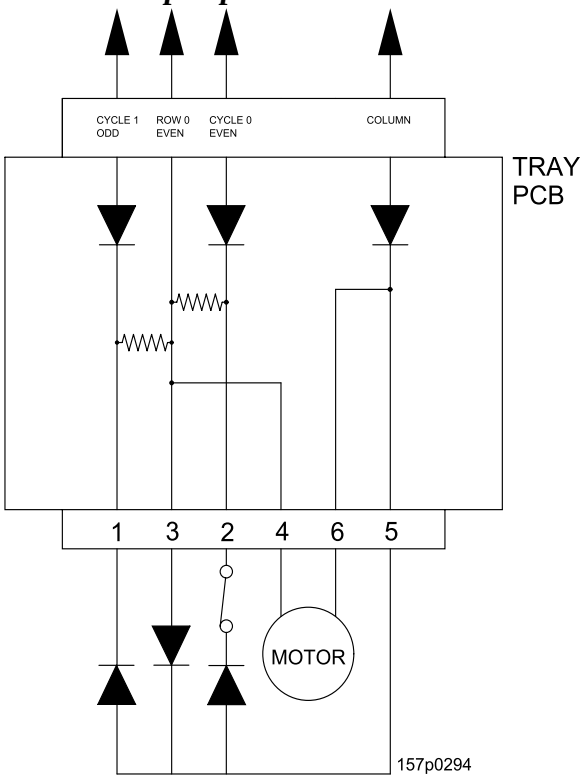


Figure 1

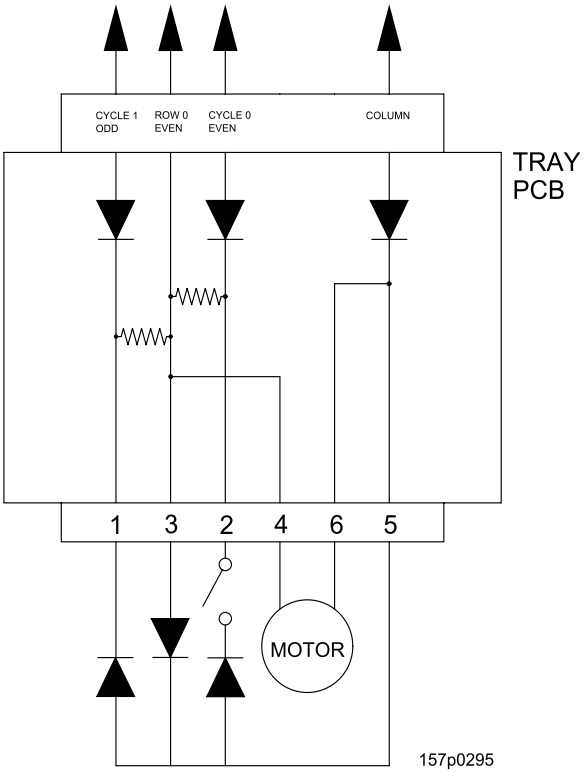


Figure 2

The controller applies a ground (0 vdc) to the Row 0 Even line. This ground passes through two resistors and two diodes and is sent back to the controller. Both Cycle Sense lines (Cycle 1 Odd and Cycle 0 Even) are considered to be **ON**, telling the controller that the motor (and therefore the tray) is present. The ground is also applied to the motor, but since +24 vdc power is not yet present, the motor does not turn.

Once the controller has verified the motor is present, +24 vdc is applied to the proper Column line, powering the motor, which begins turning. At the same time, +24 vdc also passes through two diodes at the motor assembly, through the cycle switch (closed, because the motor is still in home position) and to the diodes on the tray connector. The +24 vdc reverse biases the two diodes, removing the grounds from the controller (turning the Cycle Sense lines **OFF**). Turning Cycle 1 Odd **OFF** tells the controller that the motor is still present. Turning Cycle 0 Even **OFF** tells the controller that the motor is still in the home position.

Within one second of receiving the +24 vdc, the motor should have turned enough for its cam to actuate the cycle switch, opening it and removing +24 vdc from the Cycle 0 Even diode on the tray connector. This removes the reverse bias from the diode, allowing the ground to again be passed through the diode to the controller (turning the Cycle 0 Even line back **ON**). ***If this does not occur within one second, the controller will shut down power to the motor, turning OFF both the Row and Column drivers.*** The controller then records the selection as a jammed motor, preventing any future vends until it is repaired. If a vend is attempted for this selection, the display will tell the customer to MAKE ANOTHER SELECTION.

Note that the Cycle 1 Odd line remains ON (grounded). This line is not normally used during a normal (even selection) vend after the controller determined that the motor was present. In the case where initial testing located a motor that was not "home", Cycle 0 Even would have been **OFF**, as it is now. Cycle 1 Odd in the **ON** state indicates a motor is present but not "home".

If the cycle switch opens in the allotted time as previously described, power remains applied to the motor until it returns to the home position. (This should take no more than four additional seconds.) The motor's cam allows the cycle switch to close, placing +24 vdc back on the Cycle 0 Even diode. The diode is again reverse biased, removing the ground from the Cycle 0 Even line, turning it **OFF**. The controller then shuts down the Column and Row drivers, then the vend is complete. A five second total time limit is set for a vend, and if the motor does not return home within that time power is removed from that motor and the selection is recorded as a jammed motor.

G. Multi-Drop Bus (MDB)

1. Multi-Drop Bus (MDB) is a controller/node serial communication bus for a vending machine which allows up to 32 devices to be connected on a single bus. A coin mechanism, a bill validator, a card reader, and a vending machine controller (VMC) can all be connected on one bus. The VMC is the bus master; all other devices are nodes and provide responses or actions as instructed by the VMC.
2. The MDB capability uses a new monetary operating system which has new rules for handling bills and coins. Improvements in several monetary configuration functions now utilize a variable value which provides greater flexibility in machine setup. These three functions are listed below:
   a. The amount of change which is paid without a purchase.
   b. The denominations to accept when the change is less than that denomination.
   c. The change level when the "USE EXACT CHANGE" message will appear.
3. The MDB interface was added to the new PIE controller boards and will not be available on any pre-PIE machines. MDB capability can be added to an existing PIE machine by adding the MDB cable (cable P/N 1679054) and the appropriate MDB software (EPROM).
4. DEX Overview and Capabilities

NOTE:
Availability on all Crane Snack-Based equipment.

5. DEX (pronounced “decks”) is an electrical interface which connects a vending machine to an external computer (or hand held device). The interface has a standardized set of data and transmission protocol. This standardized interface allows any portable data collection device using this protocol, to communicate with a DEX equipped machine.
6. The data sent consists of the overall status of the monetary, sales totals and the vend counts. Additionally, product counts, sales totals, and vend counts are sent for each individual selection. An automatic data clearing capability (if enabled by the operator) will clear the DEX data in the machine memory after the data download.
7. The amount of data transmitted will be larger for those machines which have more product selections, because each selection has data to send. Several seconds are typically required to download data from a machine.
8. The external computer or P.D.C.D connects to the DEX connector, a round female stereo jack which hangs down from the controller card approximately behind the bill validator.
9. The device that collects the data from the vending machine is typically hand held, but any computer with DEX client software loaded can be used. The data collection devices can decode the data and display it for the operator.
10. Typically, the hand held device collects the data from several machines and then transfers that data to a main office computer for further data processing. The main office computer provides data analysis and planning capabilities for the individual machines of the entire route.
11. The DEX hardware interface is built directly into the main controller on P.I.E controllers, so no additional electronics are needed. The DEX function is built into the standard software. A DEX data cable is the only additional component that needs to be added to a standard machine to make the DEX capability operational.
12. A portable data collection device is used by opening the machine door and connecting it to the DEX cable. The data download may be automatically initiated by the data collection device on **NV** models, or the operator may initiate the download as described in the ***Programming Guide***.

H. SureVend™

The SureVend™ product detection system consists of ten(1-9 and “H”, H represents 10) infrared light emitters and ten infrared light detectors that scan the product delivery area with a pattern of crisscrossed light beams. An additional emitter/detector pair is dedicated (in most instances) to detecting product from the gum & mint dispensers. The light beams are specially modulated to ignore changes in ambient light. While the machine is idle, the SureVend™ system is constantly calibrating itself for optimum performance in all temperature, humidity, dust, and alignment conditions. The SureVend™ detection system is used by the controller to assure that the selected product is delivered.

1. When a selection for a product is made, the controller checks that the SureVend™ detection system is ready and tells the system to begin scanning for the particular type of product to be delivered.
   a. Different scanning patterns are used if the product is a snack or candy selection, or a gum & mint selection.

2. The vending machine controller then starts the delivery motor and constantly checks the SureVend™ system for detection of the delivered product.
3. If no product delivery is detected, the controller continues to run the delivery motor for up to three revolutions, pausing momentarily at the home position of each revolution of the motor.
   a. If no product is detected after the third revolution, the selection is marked as empty and the customer's credit is optionally restored to make another selection or is automatically returned.
4. If product delivery is detected before the delivery motor has come to the home position for the first time, the delivery motor continues running to its home position.
   a. If the delivery motor has already passed the first home position, the motor will stop immediately upon product detection to avoid the possibility of vending a second product.

NOTE:

A fatal malfunction in the SureVend™ detection system during the vend is treated the same as product delivery. It is assumed that the malfunction is due to tampering or vandalism.

5. The SureVend™ system has several operating options.
   a. **ON or OFF.** Choose OFF only if the SureVend™ system is not installed or if you do not wish it to be used.
   b. **OPTIONAL or "MUST".** If OPTIONAL is selected, operation will revert to (normal) home switch operation if the SureVend™ system cannot operate normally because of an obstruction or loss of communication. If "MUST" is selected the machine will be operational only if the SureVend™ system is operational for the main delivery area (not including gum & mint). The machine will go temporarily out-of-service until the blockage or other error is corrected.
   c. **ANTI-JACKPOT.** This is protection against unforeseeable cheating of the Posi-Vend™ system. The user can set the number of SureVend™ empty conditions that will disable the SureVend™ system for a selectable the time period. A SureVend™ empty condition occurs when product delivery is not detected and the customer's money is restored or returned.
   The assumption of this option is that very few SureVend™ failures to vend will occur other than as a result of tampering. The SureVend™ system will be turned off for a certain number of minutes so that money can no longer be refunded because of vend failure and thus discourage a thief from remaining. The machine will either revert to home switch operation or go out of service, depending on other selected options. Once the time has elapsed SureVend™ is re-enabled. The total number SureVend™ empty selections, the number of anti-jackpot occurrences, and the date and time of the last occurrence are recorded.

Section I. Test Equipment

1. Using A Multimeter

A. General Information

Warning!

Some test points you will be measuring carry high voltages. Take care to avoid contact with those points to avoid personal injury or death. Make sure your multimeter is set to the correct function for the measurement you are taking, otherwise damage to the multimeter could result.

Read and familiarize yourself with the multimeter's instructions prior to using it for the first time.

- Turn on the meter if it is not already on.
- Turn the selector to change between the meter's functions and familiarize yourself with the displays.

NOTE:

Some voltage ranges might show a phantom reading in the display when the test leads are not connected to a circuit. This is normal. When you connect the test leads to a circuit, a proper measurement appears.

Measuring High-Voltages

When you use the meter to check a high-voltage circuit, do not try to position both test leads at once. Instead, use an insulated slip-on alligator clip to attach one of the test leads to the neutral or ground lead of the circuit (a bare, green, or white lead), or a piece of bare metal that is attached to the chassis of the machine. Then check for high voltage using the remaining probe. This helps prevent you from accidentally touching a hot wire, because you only need to concentrate on one test lead at a time.

Using Display Hold (not on all meters)

Your meter's display hold feature lets you hold the current reading on the meter's display. The meter holds the measured value on the display even if you remove the test leads from the circuit.

Using Range Hold

Your meter is preset to automatically set a constant measurement range for voltage or resistance you measure. The range hold feature lets you hold the current measurement range.

B. Making Measurements

Measuring DC/AC Voltage

Consult your multimeter's instructions to determine the maximum safe DC voltage you are allowed to measure.

1. Turn on the meter if it is not already on.
2. Turn the selector to the proper setting to measure DC or AC voltage.
3. Touch the test leads to the circuit you want to test

Measuring Resistance

The resistance measuring circuit in your meter compares the voltage gained through a known resistance (internal) with the voltage developed across an unknown resistance.

4. Remove all power from the circuit under test and discharge all capacitors.
5. Turn the selector to Ohms (Ω).

Familiarize yourself with the display by touching the test leads together (short circuit). The display should show "0". Separate the leads to simulate an open circuit. The display may show ∞ (infinite), flash a high reading, or other. The instructions for your meter should tell you what to look for.

CAUTION:

Never connect the test leads to a source of voltage while the selector is set to Ohms (Ω). Otherwise, damage to your multimeter could result.

6. Touch the test leads across the circuit you want to measure, or remove one of the leads of the component you want to measure from its circuit and touch the test leads across the component. The resistance value appears.

   If you are measuring resistance of about 1 Ω or more, the display might take a few seconds to stabilize. This is normal.

NOTE:

As with the voltage range, use the measuring units that appear on the display to determine the current resistance range. If only Ω appears, the values of the measurements are in Ohms. If K and Ω appear, the meter is measuring kil Ω (1 k Ω = 1000 Ohms). If M and Ω appear, the meter is measuring MegOhms (1 MegOhm = 1,000,000 Ohms).

Checking Continuity

You can use the multimeter to check for shorted or open electrical circuits.

1. Remove all power from the circuit under test and discharge all capacitors.
2. Set the selector to Ohms (Ω).
3. Touch the test leads across the circuit you want to measure. Depending on your multimeter, a buzzer sounds if the circuit resistance is less than about 50 Ohms (meaning the circuit is continuous or shorted). Otherwise look for a low resistance reading on the display.
4. Touch the test leads across the circuit you want to measure. Depending on your multimeter, a buzzer sounds if the circuit resistance is less than about 50 Ohms (meaning the circuit is continuous or shorted). Otherwise look for a low resistance reading on the display.

C.) Testing For Proper Input Voltage and Noise

1. **Voltage Check** - Place the leads of a voltmeter across the LINE (LIVE) and NEUTRAL terminals of the wall receptacle. The voltmeter should indicate 110-130 volts ac for 120 volt, 60 Hz locations, or 220-240 volts ac for 230 volt, 50 Hz locations.
2. **Polarity Check** - Place the leads of a voltmeter across the LINE (LIVE) and GROUND terminals of the wall receptacle. The voltmeter should indicate 110-130 volts ac for 120 volt, 60 Hz locations, or 220-240 volts ac for 230 volt, 50 Hz locations.
3. **Noise Potential Check** - Place the leads of a voltmeter across the NEUTRAL and GROUND terminals of the wall receptacle. The voltmeter should indicate 0 volts ac. A measurement greater than 1.5-2.0 volts ac could result in problems for the merchandiser's electronic circuitry caused by electrical noise.

Section I. Identifying Failures

This section contains two tables of possible failures. When your merchandiser does not work properly, you will either know which part is failing, or you will see a diagnostic message in the display, or both. In the tables, first find the appropriate failure or diagnostic message. To the right, there is a list of one or more possible causes of the problem; with each possible cause having one or more remedies. Perform the maintenance tasks in the order suggested, referring to the repair procedure, wiring diagrams, or other resource as directed.

Table 1. Possible Failures (Symptoms)

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Will not accept coins; coins fall into the cup	Machine configuration.	1. Verify that the machine is configured for the coin mechanism installed.	***Programming Guide***
		2. Verify the machine is not set for free vend.	
	Equipment failure.	1. See if the coin mechanism pays, it it pays you have power. 2. Check for proper power to the coin mechanism.	
		a. If power is present, replace the coin mechanism.	*Coin Mechanism on page 49*
		b. Check the harness for continuity; replace if necessary.	
		c. Replace the power panel.	*Power Panel Assembly page 37*
		d. Replace the main controller PCB.	

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Coin mechanism does not pay out at all.	Equipment failure.	1. Check for proper power to the coin mechanism.	
		a. If power is present, replace the coin mechanism.	*Coin Mechanism on page 49*
		b. Check the harness for continuity; replace if necessary.	
		c. Replace the power panel. (For 110v Change coin PCB)	*Power Panel Assembly page 37*
		2. Check connections between the coin mechanism and the main controller PCB.	
		a. Replace the harness.	
		b. Replace the main controller PCB.	*Controller Board on page 39*
Blown fuse in 110 VDC coin validator board. (If installed optional)	"Hot plugged" changer (the coin mech was plugged in while power was applied).	1. Verify 110 VDC is present on coin board. a. If not present, replace coin board. **NOTE: *Have coin mechanism tested before applying power to new coin board***	*Coin Mechanism on page 49*
	A 24 VDC changer is used in a 110 VDC application.	2. Replace coin mechanism with one of the proper type.	
Coin mechanism will not take one denomination of coin.	Flight deck is dirty	1. Clean the flight deck	***Coin mechanism on page 49***
	Changer is out of tune.	2. Tune the changer.	
Coin mechanism is jackpotting.	Improper line voltage, or noise on the line.	1. Test your line for proper operating parameters. a. Clear RAM b. If bad, contact the appropriate representative of the facility or location. c. Use a surge suppressor. d. Use a line conditioner.	*Testing for proper input voltage and noise, on Page 19.*
"Garbage" on display.	Scrambled RAM		

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Multiple errors following an electrical storm.	Bad EPROM or main controller or Scrambled RAM	1. Clear RAM 2. Replace main controller.	*Controller Board on page 39*
Bill validator won't accept bills; validator inoperative.	Improper configuration.	1. Verify that the validator cycles upon machine power-up.	
		2. Verify the machine is configured for the validator which is installed. a. If necessary, configure the machine properly.	***Programming Guide***
		3. Check for proper switch settings on the validator.	***Validator's User Manual***
	Equipment failure.	4. Check for proper connections and for proper power. Replace appropriate items one by one until problem is solved.	
		a. Replace the validator.	*Bill Validator on page 51*
		b. Replace the harness from the validator to the main controller PCB.	
		c. Replace the main controller PCB.	*Controller Board on page 39*

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Validator takes bills then rejects them.	Improper configuration.	1. Verify the machine is configured for the validator which is installed.	***Programming Guide***
		a. If necessary, configure the machine properly.	
	Equipment failure.	2. Clean the validator.	***Validator User Manual***
		3. Check for proper connections and for proper power. Replace appropriate items one by one until problem is solved.	
		a. Replace the validator.	*Bill Validator on page 51*
		b. Replace the harness from the validator to the main controller PCB.	
		c. Replace the main controller PCB.	*Controller Board on page 39*
Status LED on controller board does not blink; power LED is illuminated.	Bad EPROM	1. Replace EPROM with a known good one.	*EPROM replacement on page 2*
	Bad RAM or controller board.	2. Replace controller board.	*Controller Board on page 39*
Power LED is not illuminated.	Controller board is not receiving 24 VDC.	1. Using the wiring diagram, check for proper voltages. a. Tripped low voltage breaker b. Replace bad harness(es). c. Replace power panel.	*Power Panel Assembly page 37*

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
No display.	Bad display PCB.	1. Disconnect everything but the display and its power input. If the display works again, re-connect items one by one until the problem is found.	
		a. If display still does not work, replace display PCB	Display PCB on page 41.
	Bad ribbon cable.	b. If ribbon cable is bad, replace the ribbon cable.	
	Bad controller board.	c. If everything is connected and the display still does not work, replace controller board.	*Controller Board on page 39*
	No “heartbeat LED on main controller	1. No 24VAC to main controller 2. Bad RAM or EPROM	Test for 24VAC CJ37 replace
One or several selection(s) will not vend.		1. Swap the affected tray with a known good one.	***Programming Guide***
	Failure on the affected tray.	2. If the problem moves with the tray, check all connections on the tray board and motors. Check the tray harness for proper continuity.	
		a. Replace the tray harness.	*Tray Rails on page 45*
		b. Replace tray PCB.	*Tray Rails on page 45*
		c. Replace affected tray motor.	*Tray Rails on page 45*
	Failure in the machine cabinet.	3. If the problem does not move with the tray, check connections of the harness between the tray and the rail, and check the harness for proper continuity.	
		a. Replace the harness.	
		b. Replace the interface PCB.	*Interface Card on page 40*

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Two or more selections run at the same time. (Selections are not coupled.)	Bad tray harness.	1. Inspect tray harness. Replace if needed.	
	Bad interface card.	1. Replace the interface card.	*Interface Card on page 40*
All odd or all even motors do not run.	Loose connections	2. Check all connectors and harnesses between the tray and the interface PCB for proper continuity.	
		a. Replace bad harness(es).	
		b. Replace the Interface Board if harnesses check good.	*Interface Card on page 40*
		3. Check the tray harness for proper continuity.	
		a. Replace the tray harness if necessary.	*Tray Rails on page 45*

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Selection keypad does not respond or beep.	If the display functions properly... If the display does not function properly....	1. Unplug one keypad to see if the other keypad is functioning properly. Then vice-versa to find if one keypad is not functioning. 2. Check the connections on the display PCB. a. If display PCB connections are good, replace the selection pad.	*Selection Keypad on page 43.* and *Maintenance Keypad on page 52*
		3. Verify proper operation of the LEDs on the controller PCB.	***Setup and Operator's Guide***
		4. Check connectors and harnesses between the power panel and controller PCB. Replace suspect components:	
		a. Power panel.	*Power Panel Assembly page 37*
		b. Controller PCB.	*Controller Board on page 39*
		c. Harnesses.	
		d. Display PCB.	***Display PCB*** on page 41
Keypad is working erratically.	Unplug one keypad	1. Unplug first keypad, if good then disconnect and check the second keypad.	
	Keypad is affected by a bad display.	2. Replace the display.	Display PCB on page 41.
	Bad selection keypad.	3. Replace the selection keypad.	*Selection Keypad on page 43.*
	Bad service keypad.	1. Replace the maintenance keypad.	*Maintenance Keypad on page 52*

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Only certain rows of buttons work on selection keypad.		1. Check the monetary door switch for proper operation. Replace as needed.	
		2. Replace the display PCB and ribbon cable.	Display PCB on page 41
Maintenance keypad does not respond; no beeps.		1. Check the monetary door switch for proper operation. Replace as needed.	*Maintenance Keypad on page 52*
		2. Replace the maintenance keypad	
		3. Replace the controller PCB.	
Pad beeps but nothing happens.		1. Check all connections on the interface PCB. Replace as needed.	*Interface Card on page 40*
No selections vend.		1. Check all connections between the interface PCB and the trays. Replace harnesses as needed.	
Spirals turn halfway then stop.	Possible loose connections.	1. Check connections on tray rail PCBs and interface PCB. Swap the trays to see if problem still exists.	
		2. Check the harness between the tray rail PCBs and the interface PCB for proper continuity. As needed:	*Tray Rails on page 45*
		a. Replace affected harness(es).	
		b. Replace the interface PCB.	*Interface Card on page 40*
Multiple selections vend at the same time.	Possible tray diode problem.	1. Disconnect as many trays as possible. Then plug them in one at a time after vending from each tray.	*Tray Rails on page 45*
		2. When the problem happens again, check the diodes of the last tray rail PCB to be connected.	
		3. If all diodes check good, check the diodes on the tray rail PCB you connected just before.	
		a. Replace the affected tray rail PCB.	*Tray Rails on page 45*

Table 1. Possible Failures (Symptoms) - Continued

SYMPTOM	POSSIBLE FAILURE(S)	DO THIS:	REFER TO:
Multiple selections run and do not cycle correctly.		1. Disconnect tray motors one at a time and try to isolate the faulty motor.	
		2. Check for pinched or shorted wires.	
		a. Replace the affected motor(s).	
		b. Replace any affected harness.	
All odd or even motors will not run	Possible bad connection.	1. Check all connectors on tray and at the tray rail PCB.	*Tray Rails on page 45*
		2. Check harnesses for pinched wires.	
		a. If all connections and harnesses check good, replace the interface PCB.	*Interface Card on page 40*
Rotary delivery pan door is jamming.	Gear(s) are stripped or not properly timed.	1. Replace affected gear(s).	
		2. Set timing (must be done after gear replacement).	*Set Timing of the Rotary Vend Door on page 53*

Table 2. Possible Failures (Diagnostic Messages)

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
AJP XXX MN/DY HR.MN	The SureVend™ anti-jackpot feature has been implemented.		***Program Guide***
CARD.COMM	Incomplete card reader communications. Check cables or replace unit.	Check cables Check programming of card reader or replace reader	***Card reader documentation***
CARD.ERR	Card reader is indicating it has a problem.	Swap card reader	
CARD.ERRXX	Card reader error (code XX). The unit is still operational.		***Card reader's documentation.***

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
CARD.F.COMM	Incomplete card reader communications. (The card reader is not operational.)	1. Check cables.	
CARD.F.ERR	Card reader has failed.	1. Replace card reader (same procedure as replacing bill validator).	*Bill Validator on page 51*
CARD.F.JAM	Card is jammed in the card reader.	1. Remove jammed card	
CARD.SERV	Card reader requires service. The unit is still operational.		***Card reader User Manual***
CHK CONFIG	Invalid configuration code	1. Enter valid code from those listed.	***Programming Guide***
CHK PRICE	Price error detected.	1. Check prices; re-enter if necessary.	***Programming Guide***
COMMLINK *(SEE **NOTE:** ON PAGE 10 UNDER **KEYPADS SECTION**)*	Communications interrupted between main controller and interface PCB. J Comm main PCB not talking to coffee PCB or communicating, (RC 3 only)		
		1. Check continuity of the cable between the above connectors.	
		a. If cable checks bad, replace cable.	
		b. Replace main controller PCB.	*Controller Board on page 39*
		c. Replace interface PCB.	*Interface Card on page 40*
CPL ERROR	Tray message, or the procedure to couple two motors together was not completed correctly.	1. Check tray lists to be sure the trays are all listed.	***Programming Guide***
		2. Check coupling lists to ensure that the coupling procedure was correct and complete.	
DBV.ACCEPT	The merchandiser is telling the bill validator not to accept any bills.	1. Check the enabled channels of the bill validator.	

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
DBV.COMM	Incomplete bill validator communications.	1. Check harness(es).	
	Bad bill validator.	2. Replace bill validator.	*Bill Validator on page 51*
DBV.JAM	A bill is jammed in the acceptance path.	1. Remove bill stuck in the acceptance path. 2. Cycle machine power OFF and then ON.	
DBV.MOTOR	One of the validator motors has failed.	1. Check for bill stuck in the acceptance path. a. Remove bill, then cycle machine power OFF then ON.	
		2. If no bill is present, replace the validator. a. Cycle machine power OFF and then ON.	*Bill Validator on page 51*
DBV.ROM	ROM checksum failure.	1. Replace the validator.	*Bill Validator on page 51*
DBV.SENSOR	One of the sensors in the bill validator has failed.	1. Check for bill stuck in the acceptance path. a. Remove bill, then cycle machine power OFF then ON.	
		1. If no bill is present, replace the validator. a. Cycle machine power OFF and then ON.	*Bill Validator on page 51*
DBV.STACKR	The stacker is open or removed.	1. Install the stacker correctly.	
	The stacker is full of bills.	1. Remove bills from the stacker.	
ERR A B C (etc.)	Error exists on tray A, B, C, etc. Motor may be jammed, not home, or a couple error exists.	1. Swap tray with a known working tray.	*Tray Rails on page 45*
		a. If problem is cleared, check tray motors, harnesses, etc.	
		b. If problem persists, check tray block, machine harness or interface PCB.	*Tray Rails on page 45*

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
KEYPAD XY	Keypad problem.	1. Disconnect each keypad in turn. a. Replace affected keypad.	*Selection Keypad on page 43*, ***or Maintenance Keypad on page 52.***
MECH.ACCEPT	Coin mechanism acceptor section is unplugged from the main body of the coin mech.	1. Connect the cable and cycle machine power OFF and then ON.	
MECH.COMM	Incomplete coin mech communications.	1. Check harness.	
MECH.JAM	One or more coin tubes are jammed.	1. Pay a coin from each tube until the jam is cleared.	***Programming Guide***
	Coin is jammed in the acceptor section.	2. Check the coin mechanism for a jam in this position. 3. Insert coins and cycle machine power OFF and then ON.	
MECH.ROM	Coin mech ROM has failed.	1. Replace the coin mechanism.	*Coin Mechanism on page 49*
MECH. SENSOR	Coin mech reporting a bad tube sensor.	1. Replace the coin mechanism.	*Coin Mechanism on page 49*
NO ERRORS	No errors are detected; machine is ok.		
NO MECH	Machine is configured for coin mechanism; none is installed.	1. Configure machine.	***Programming Guide***
	Coin mechanism has failed.	2. If dumb mechanism, check power and attempt paying out coins.	***Programming Guide***
		3. If payout was unsuccessful and the coin mechanism has power, replace the coin mechanism.	*Coin Mechanism on page 49*

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
NONE READY	No selection is ready to vend. Check that no time-of-day inhibits are active.	1. Check time-of-day or tray list.	***Programming Guide***
		1. Disconnect all trays. 2. Check main J30 to J55 interface or J38 to J61 3. Plug one tray in at a time and test.	(See **NOTE** on page 7).
RAM ERROR	RAM is not initialized or is not compatible with the currently loaded software. Connection between main controller and interface lost.	1. Clear RAM.	***on page 54***
		2. If problem persists, replace controller board.	*Controller Board on page 39*
ROM ERROR	Error in the programming EPROM.	1. Clear RAM.	***on page 54.***
		2. If problem persists, replace EPROM.	***EPROM Replacement on page 2.***
		3. If problem persists, replace controller board.	*Controller Board on page 39*
SV.EMPTY NN	Selection NN was marked as empty by the SureVend™ system because a product delivery was not detected.	1. Check that product is loaded properly. 2. Open, then close the main service door.	***Operator's Guide***
SV.TST XX	This diagnostic automatically enters the appropriate screen.	1. Perform appropriate SureVend™ tests.	***Programming Guide***

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
SERIAL VAL *(SEE **NOTE:** ON PAGE 10 UNDER **KEYPADS SECTION**)*	An error message from the validator is sensed.	1. Check programming.	***Programming Guide***
		2. Check switches on coin mechanism.	
		3. Check connectors on validator, main control board, and coin Interface Board.	
		a. Replace validator	*Bill Validator on page 51*
		b. Replace main controller.	*Controller Board on page 39*

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
TC ERROR *(SEE **NOTE:** ON PAGE 10 UNDER **KEYPADS SECTION**)*	An error is detected in a motor circuit.	If the message "Fault Test" is displayed: 1. Record the selections listed.	
		2. Remove the product from those spirals.	
		3. Press  until the display shows HOME MOTORS.	
		4. Verify the listed selections return to home.	
		5. If they return to home check to be sure that the product is fitting "comfortably" in the spirals. If the product fits too snug the tray will more than likely continue to jam.	
		6. Check tray lists. a. "T" stands for the tray level, "C" stands for the column number.	***Programming Guide***
		7. Check for tray error by swapping the tray with a known good tray. a. Check wiring harness on the tray. b. Check the board on the back of the tray.	
		8. Check the harness between the connector and the interface PCB for continuity.	
		9. Check the connectors on the interface PCB and the main controller PCB.	
		10. Check the harness between the main controller PCB and the interface PCB for continuity.	
		a. If the harnesses check good, replace the main controller PCB.	*Controller Board on page 39*
		b. Replace any bad harnesses.	

Table 2. Possible Failures (Diagnostic Messages) - Continued

DIAGNOSTIC MESSAGE	FAILURE	DO THIS:	REFER TO:
TRAY UN-LATCHED *(SEE **NOTE:** ON PAGE 10 UNDER **KEYPADS SECTION**)*	The cabinet door is closed and a programmed tray is not sensed.	1. Check programming.	***Programming Guide***
		2. Check that the terminal block is in the correct position and is in good contact with the tray.	
		3. Check the tray interface PCB to see if it is installed upside down.	
		4. Check the harness to the Interface Board for continuity.	
		a. If the harness checks bad, replace the harness.	
		b. If the harness checks good, replace the interface PCB.	*Interface Card* *on page 40*

Section V. Removal and Replacement Procedures

1. General Information

These procedures are intended to aid in removing and replacing some major assemblies in your merchandiser. Some things to remember:

- Unless you are testing for voltages, **ALWAYS UNPLUG YOUR MERCHANDISER PRIOR TO STARTING WORK.**
- Always follow proper shop practices.
- Get help when lifting heavy objects.

A. Power Panel Assembly

Removal

CAUTION:
Prior to working on the machine, be sure it is unplugged from its power source.

1. Remove one screw (figure 4). Save the screw for later use.
2. Tilt the power panel out from the machine and lift straight up (figure 5).

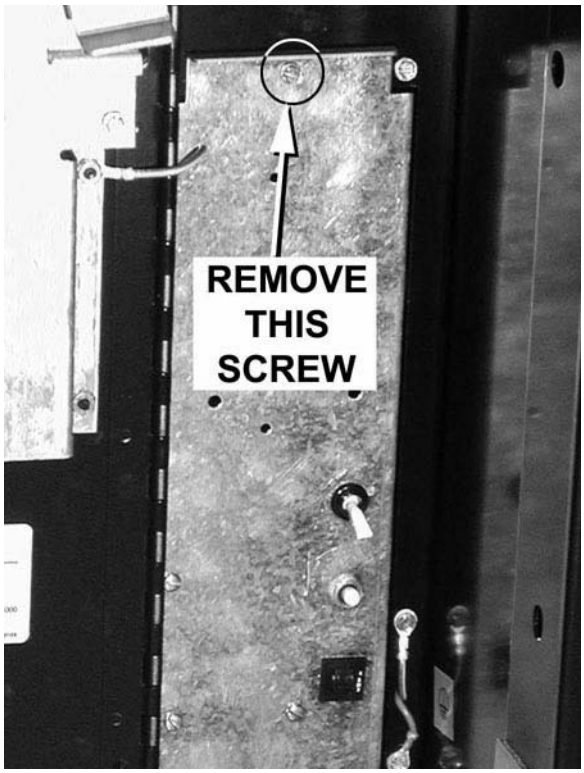


Figure 4

Figure 5

3. Make a note of where all the harnesses attach, then disconnect them (figure 6).

Replacement

1. Connect all harness to their proper connectors (figure 6).
2. Hook the lower edge of the power panel onto the bottom of the cutout in the monetary panel.
3. Tilt the power panel up until the top lip is against the monetary panel.
4. Secure with the screw you removed earlier.

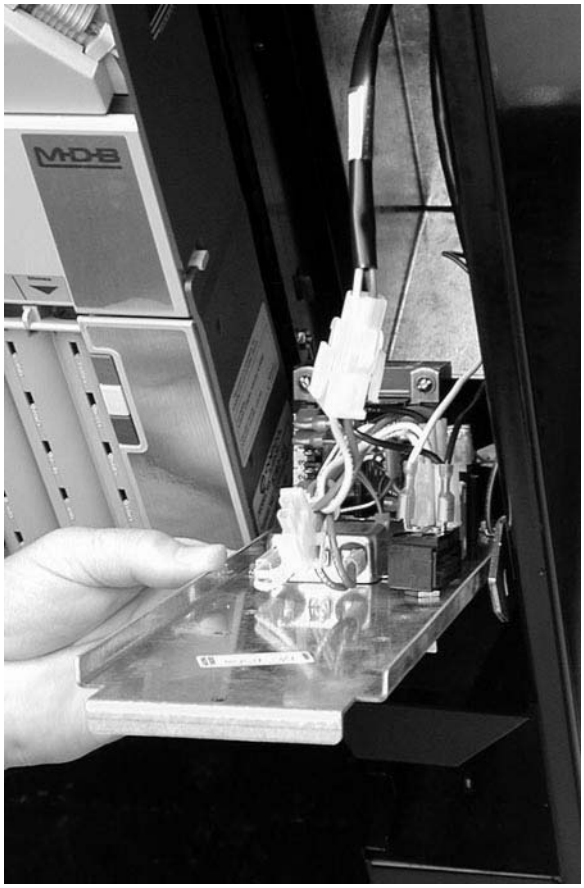


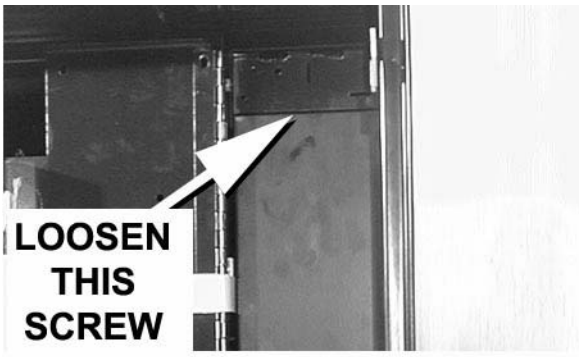
Figure 6

A. Controller Board

Removal

NOTE:
Observe proper ESD procedures. ***See "Preventing Circuit Board Damage from Electrostatic Discharge" on page 1***

1. Loosen one screw at the top and one at the bottom of the circuit board cover (figure 7).
2. Lift up on the cover and pull it straight back.
3. Turn it sideways to remove it from the machine.
4. Remove one screw as shown from the controller board (figure 8). Save the screw for later use.
5. Lift straight up on the controller board until the standoffs are free from the keyed holes in the monetary panel.
6. Make note of the locations of all harnesses, then remove the harnesses from the board.



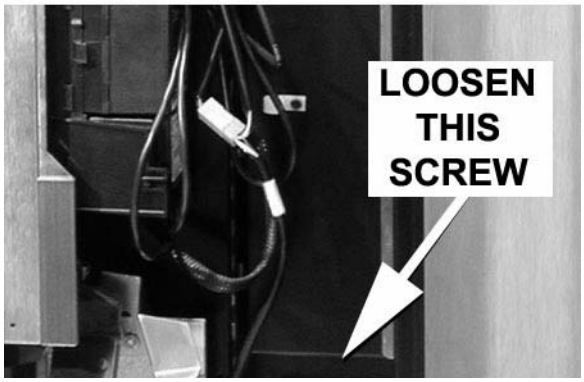


Figure 7

Replacement

NOTE:
Observe proper ESD procedures. ***See "Preventing Circuit Board Damage from Electrostatic Discharge" on page 1***

1. Connect all harnesses to the circuit board.
2. Place the board's standoffs in their respective holes and allow the board to drop so the standoffs are captured by the keyways (figure 9).
3. Secure the board with the screw you removed earlier.

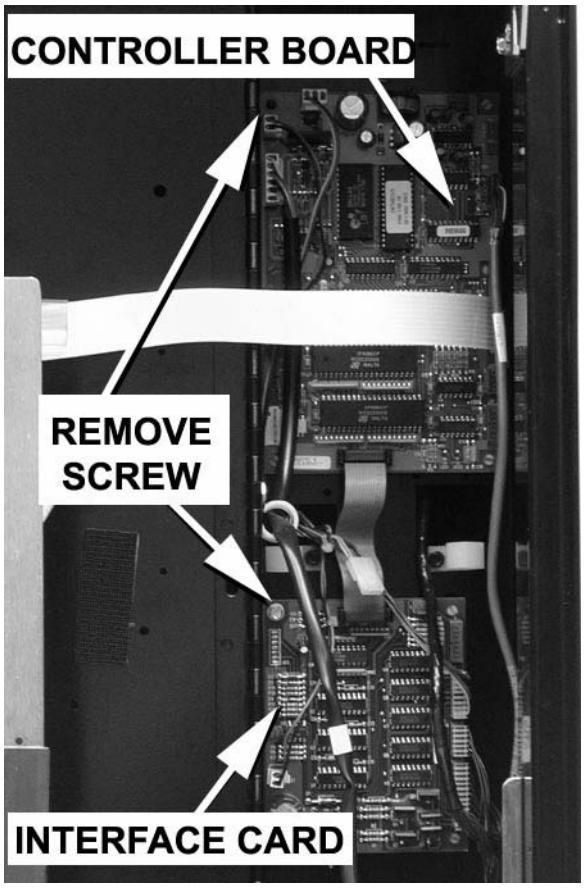


Figure 8

1. Hold the circuit board cover vertically and turned at a 90 degree angle to the monetary panel.
2. As you move the circuit board cover into place, turn it so that it faces outward.
3. Hook the holes in the circuit board cover over the screws. Tighten the screws.

A. Interface Card

Removal

1. Loosen one screw at the top and one at the bottom of the circuit board cover (figure 7).
2. Lift up on the cover and pull it straight back.
3. Turn it 90 degrees to remove from the machine.
4. Remove one screw as shown from the interface board (figure 8). Save the screw for later use.
5. Lift straight up on the interface board until the standoffs are free from the keyed holes in the monetary panel.
6. Make note of the locations of all harnesses, then remove the harnesses from the board.

Replacement

1. Connect all harnesses to the circuit board.
2. Place the board's standoffs in their respective holes and allow the board to drop so the standoffs are captured by the keyways (figure 10).
3. Secure the board with the screw you removed earlier.
4. Hold the circuit board cover vertically and turned at a 90 degree angle to the monetary panel.

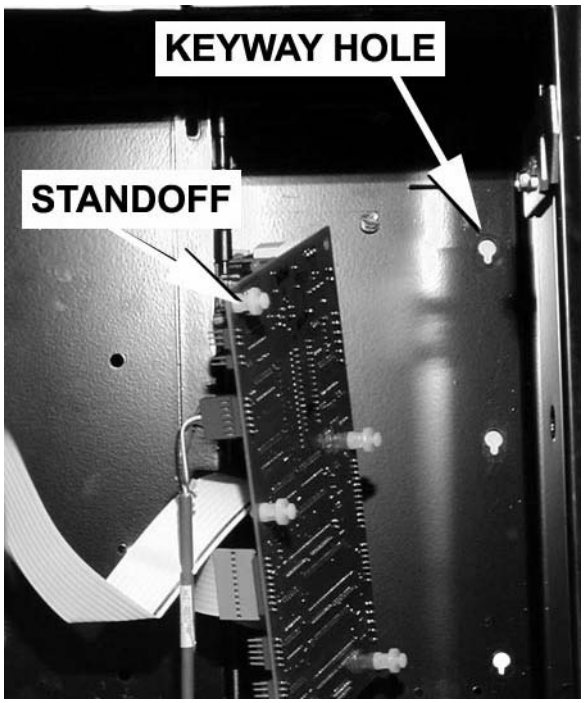


Figure 9

1. As you move the circuit board cover into place, turn it so that it faces outward.
2. Hook the holes in the circuit board cover over the screws. Tighten the screws.

A. Display PCB

Removal

1. Remove one screw from the side of the monetary door (figure 11). Save this screw for later use.
2. Remove the display PCB cover.

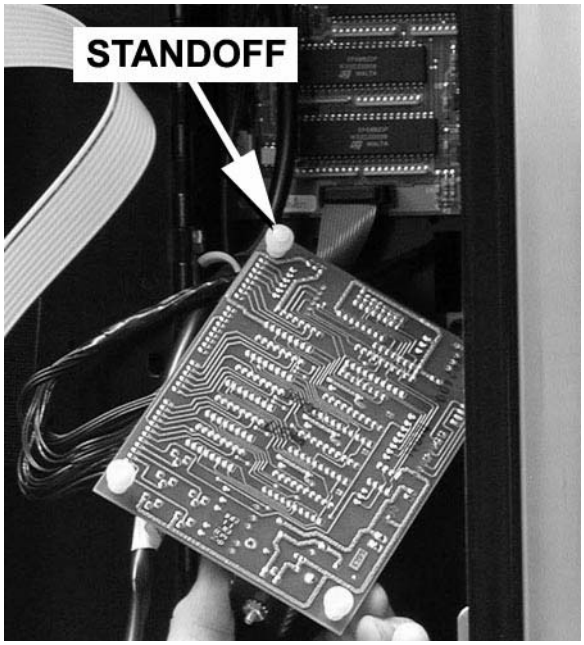


Figure 10

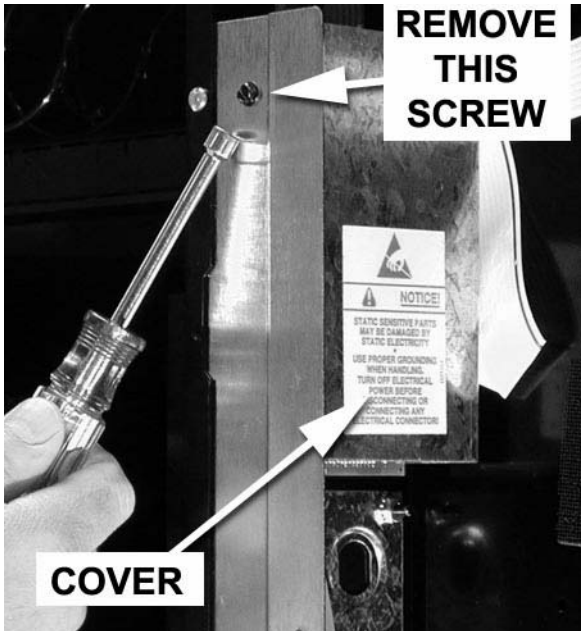


Figure 11

1. Make a note of the locations of all harnesses going to the display PCB. Remove the harnesses (figure 12).
2. Remove two thread forming screws as shown (figure 13). Save them for later use.
3. Remove the display PCB.

Replacement

1. Position the new display PCB, and lightly tighten the two screws removed earlier.
2. Looking through the tinted display cover, make sure the display is straight, centered, and fully visible.

CAUTION:
The screws you are about to tighten are in plastic, so don't overtighten them or you will strip the threads in the plastic.

3. When you are satisfied the display is correct, fully tighten the two screws.
4. Connect all harnesses to the display PCB.
5. Install the display PCB cover and secure with the screw you removed earlier.

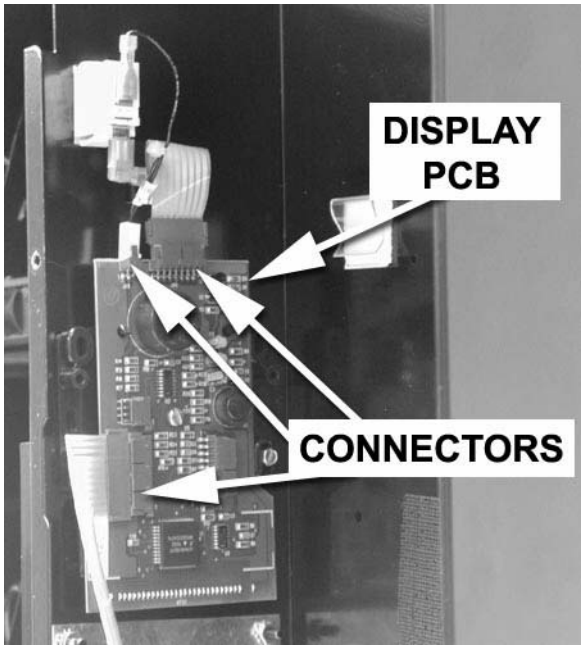


Figure 12

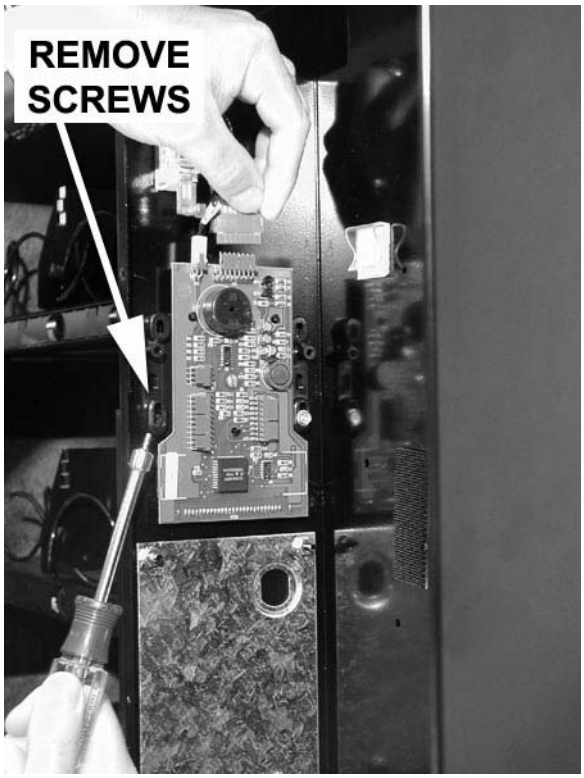


Figure 13

A. Selection Keypad

Removal

1. Remove the display PCB.
   (see ***"Display PCB"*** on page 41)
2. Remove the bill validator.
   (see ***"Bill Validator"*** on page 51)
3. Remove 4 screws and cup spacers See (figure 14). Save them for later use.

NOTE:
The top two screws securing the faceplate were removed with the display PCB.

4. Before you remove the faceplate from the front of the monetary door, put one or two pieces of masking tape across the display window and the instruction insert to keep them from falling out (figure 15).
5. Slowly remove the faceplate from the top as shown (figure 15).
6. Work the keypad ribbon cable through its slot to completely remove the assembly (figure 15).
7. Lay the assembly face down on a flat surface to avoid losing parts.

Figure 14

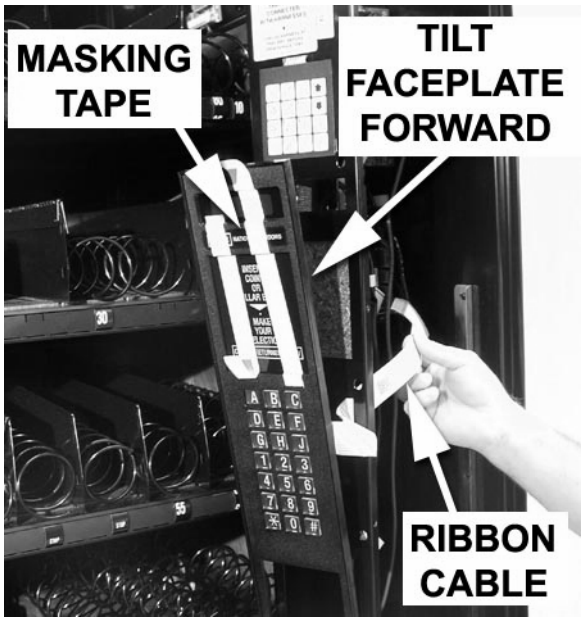


Figure 15

1. Remove 4 nuts from the rear of the assembly ((figure 16)). Save them for later use You might need to gently pry up on the metal backing plate as you turn the nuts in case the plastic studs are stripped.

NOTE:
You may need to gently pry up on the metal backing plate as you turn the nuts in case the plastic studs are stripped.

2. Lift the metal backing plate off the assembly and set aside.
3. Remove the keypad membrane (figure 17).

Replacement

1. Install the new keypad membrane. Observe that it is marked “TOP” and “BOTTOM” (figure 17). Be sure you have oriented it properly.
2. Install the metal backing plate, ensuring that the notch in one side corresponds to the keypad ribbon cable (figure 18).
3. Secure the backing plate with the 4 nuts removed earlier, taking care not to strip the plastic studs.
4. Feed the keypad ribbon cable through the slot in the monetary door (figure 15).
5. Tilt the bezel into place from the bottom as shown (figure 15).
6. Secure the bezel with the 4 screws and cup spacers you removed earlier. Take care not to overtighten the screws, or you will strip the plastic fittings.
7. Install the display PCB.
(see ***“Display PCB”*** on page 41)

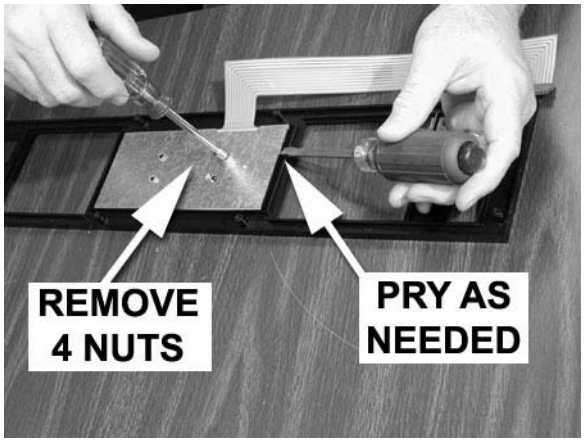


Figure 16

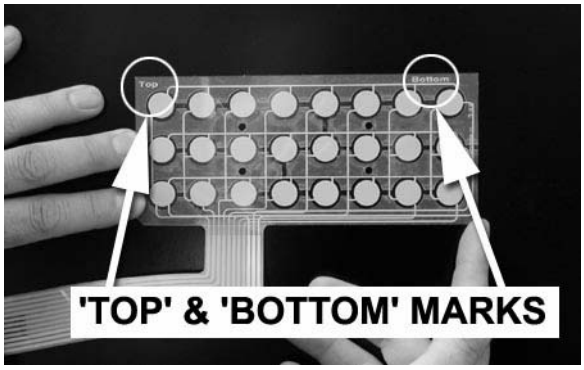


Figure 17

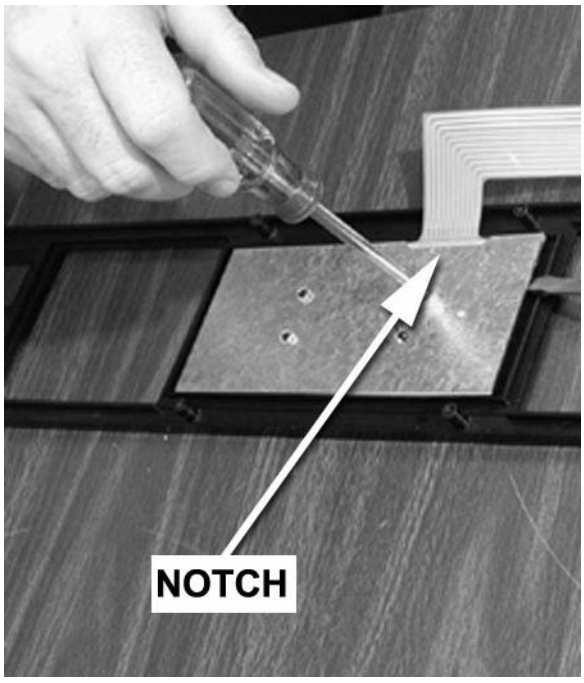


Figure 18

A. Tray Rails

Removal

1. Remove the tray. See the procedure in the Setup Guide.
2. If you are removing the right hand tray rail, disconnect the tray harness from the rail PCB connector (figure 19).
3. Each tray rail is held in place by one thread-forming screw near the front of the machine.
4. Remove the screw from the rail you are removing (figure 20). Save the screw for later use.
5. Lift up on the front of the tray rail and twist it to release the rear portion.

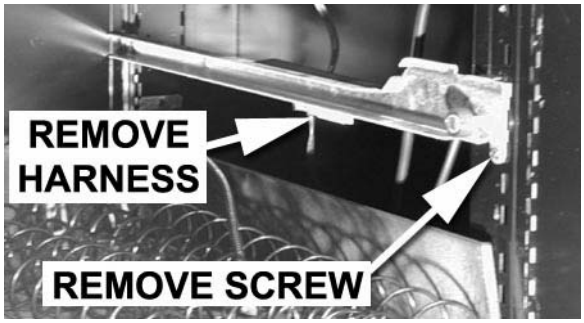


Figure 19

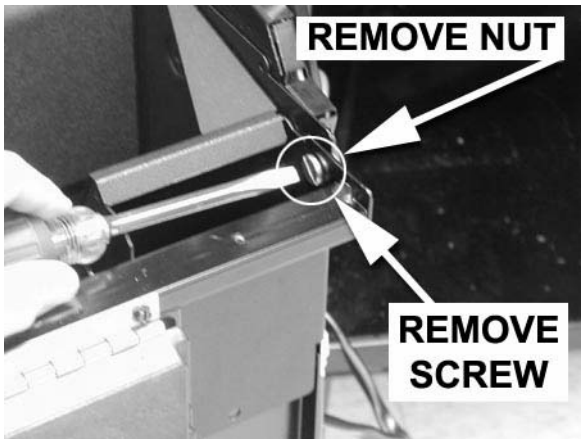


Figure 20

Replacement

1. Hook the rear portion of the rail into the rear bracket.
2. Hook the front of the rail into the corresponding slot on the front bracket.
3. Secure with the screw you removed earlier.
4. If you are replacing the right hand rail, re-connect the tray harness to the rail PCB.
5. Replace the tray. See the procedure in the Setup Guide.

B. Gum and Mint Unit

Removal

1. While supporting the gum and mint unit, remove one nut and one shoulder screw from each side of the delivery pan (figure 21). Save these for future use.
2. Remove the gum and mint unit.

Replacement

1. Lift the gum and mint unit into place.
2. Secure with one shoulder screw and one nut on each end, removed earlier.

A. Gum and Mint Motors

Removal

1. Disconnect the wiring harness from the gum and mint motor assembly.
2. Remove 2 hex head screws securing each side of the gum and mint motor assembly to the delivery pan (figure 21). Save the screws for later use.
3. Remove the gum and mint motor assembly.

Figure 21

Replacement

1. Lift the gum and mint motor assembly into place.
2. Secure with 4 screws previously removed.
3. Connect the wiring harness to the motor assembly.

B. SureVend™ System

Removal

NOTE:
To aid in reassembly, keep track of where all parts, particularly harness clips and harnesses are positioned prior to disassembly.

1. Disconnect all SureVend™ wiring harnesses from the circuit boards mounted on the delivery pan (figure 22).
2. Remove 1 locknut, and remove the receiver cover (figure 23). Save for later use.

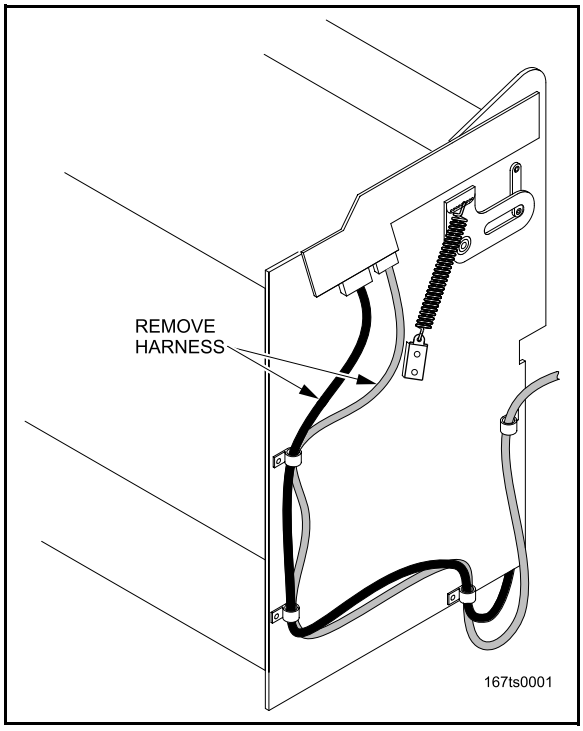


Figure 22

CAUTION:
Observe proper ESD procedures. ***See "Preventing Circuit Board Damage from Electrostatic Discharge" on page 1***

1. Remove 5 Phillips head screws, and remove the receiver circuit board and paper insulator (figure 20). Save for later use.
2. Remove 2 screws securing the bracket to the delivery pan and the door (figure 20).
3. Remove 1 screw securing the emitter cover to the emitter bracket (figure 21). Remove the cover and save for later use.

CAUTION:
Observe proper ESD procedures. ***See "Preventing Circuit Board Damage from Electrostatic Discharge" on page 1***

4. Remove 5 Phillips head screws, and remove the emitter circuit board and paper insulator (figure 21). Save for later use.
5. Remove 2 hex head screws securing the emitter bracket to the door and the delivery pan. (figure 21). Save for later use.
6. Remove the screw and locknut securing the emitter bracket to the delivery pan (figure 21). Remove the bracket and save for later use.

Replacement

1. Install the emitter bracket and secure with 2 hex head screws, and one slotted screw/locknut combination.

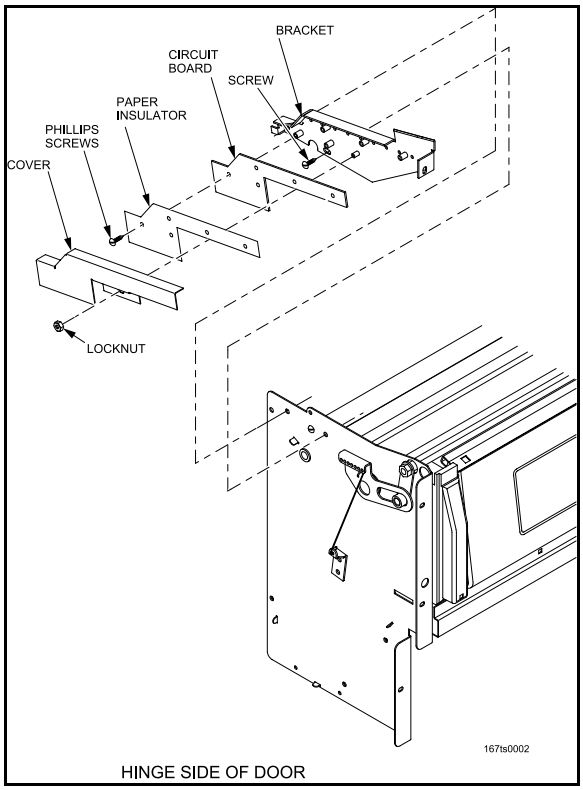


Figure 23

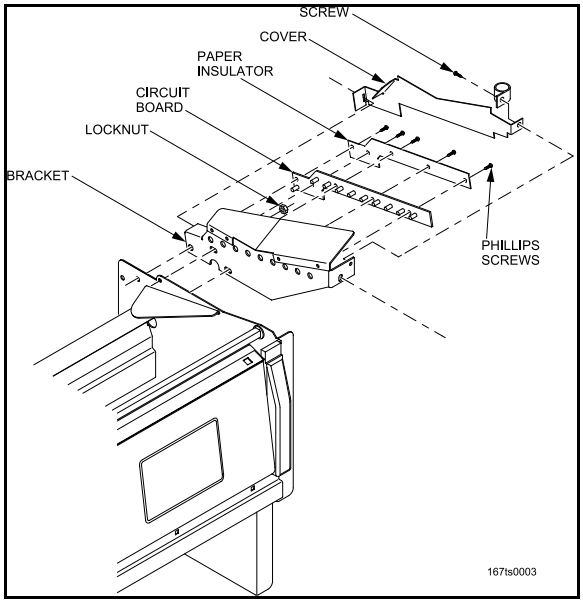


Figure 24

CAUTION:

Observe proper ESD procedures. ***See "Preventing Circuit Board Damage from Electrostatic Discharge" on page 1***

1. Install the emitter circuit board and paper insulator using 5 Phillips head screws.
2. Hook the slot in the emitter cover over the tab on the emitter bracket. Secure the emitter cover to the door with 1 hex head screw.
3. Install the receiver bracket and secure with 2 hex head screws (one into the delivery pan; one into the door).

CAUTION:

Observe proper ESD procedures. ***See "Preventing Circuit Board Damage from Electrostatic Discharge" on page 1***

4. Install the receiver circuit board and paper insulator using 5 Phillips head screws.
5. Hook the slot in the receiver cover over the tab on the emitter bracket. Secure the emitter cover to the delivery pan with 1 lock nut.
6. Route the SureVend™ harnesses and connect to the circuit boards. Secure harnesses with the harness clips.

A. Delivery Pan Assembly

Removal

1. If so equipped, remove the SureVend™ system. (see ***"SureVend™ System"*** on page 46) Remove the upper deflector.
2. If no SureVend™ system is installed, remove 2 hex head screws securing the upper deflector to the door (figure 25). Save for later use. Remove the deflector and save for later use.
3. Remove 3 hex head screws from each side of the delivery pan (figure 25). Save the screws for later use.
4. Lift the delivery pan up and toward you to remove.

Replacement

1. Hook the top of the delivery pan under the lower panel assembly and rest it on the welded hat section inside the door.
2. Secure the delivery pan to the door with 3 hex head screws on each side.
3. If no SureVend™ system is to be installed, attach the upper deflector with the 2 hex head screws removed earlier.
4. If so equipped, replace the SureVend™ system. (see ***"SureVend™ System"*** on page 46)

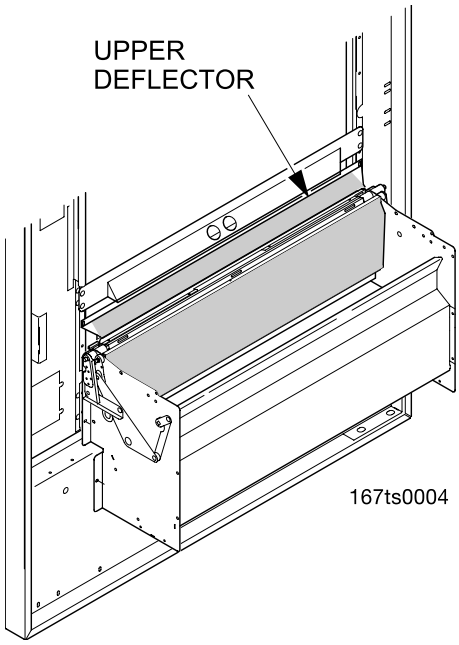


Figure 25

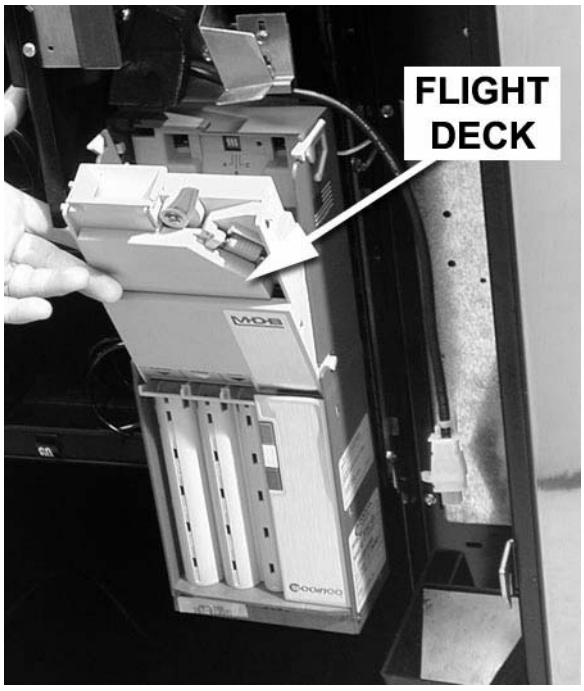


Figure 26

B. Coin Mechanism

Removal

NOTE:
A representative coin mechanism is shown. Yours may differ.

1. Turn power off.
2. Disconnect the harness from the machine.
3. Remove or drop the flight deck down as shown (figure 26)

4. Loosen 2 hex-head slotted screws on mechanism. You will need to manipulate the coin return lever to gain access to the upper screw (figure 27).
5. Loosen 3 hex-head slotted screws as shown (figure 28).
6. Lift up slightly on the coin mechanism and remove it from the machine.

Replacement

1. Hook the keyway holes in the rear of the coin mechanism on the 3 hex-head slotted screws loosened earlier (figure 29). Lower the coin mechanism into place.
2. Tighten the 3 screws.

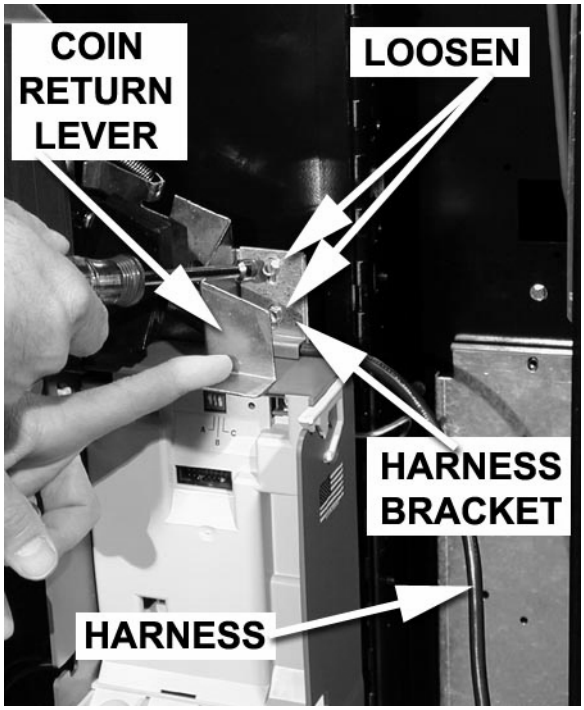


Figure 27

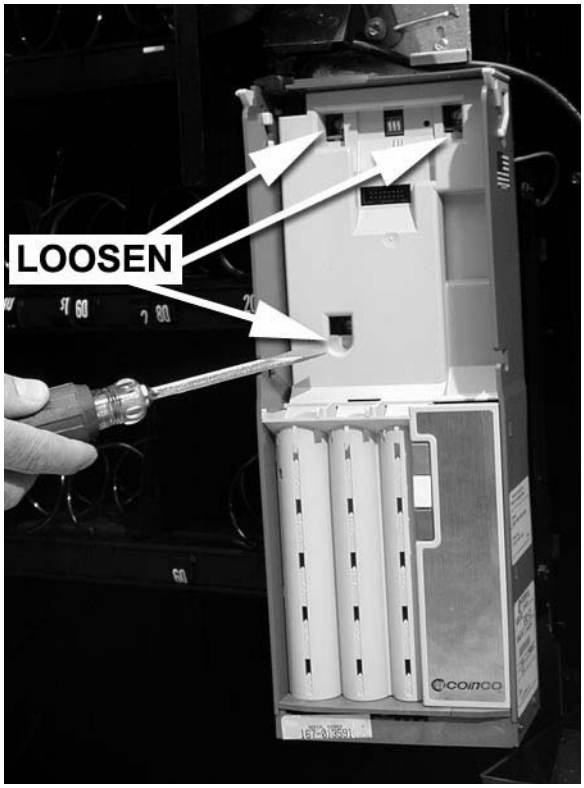


Figure 28

3. Feed the harness through the harness bracket (figure 29). Push down on the harness bracket to capture the harness against the top of the coin mechanism.
4. Tighten the 2 hex-head slotted screws.
5. Connect the coin mechanism wiring harness.
6. Replace the flight deck.

A. Bill Validator

Removal

1. Disconnect the bill validator wiring harnesses from the machine.
2. Remove the 3 nuts (*Optional 4th nut See **Note***) as shown (See figure 30). Save the nuts for later use.

NOTE:
It may be easier to access the nuts if you remove the stacker section.

3. Remove the bill validator.

Replacement

1. Position the bill validator in place.
2. Secure with the 3 nuts **(***Removal of 4th nut is Optional See **Note*)** you removed previously.
3. Connect the bill validator wiring harnesses to the machine.

NOTE:
For ease of installation and or removal, the 4th nut is optional (See figure 30)

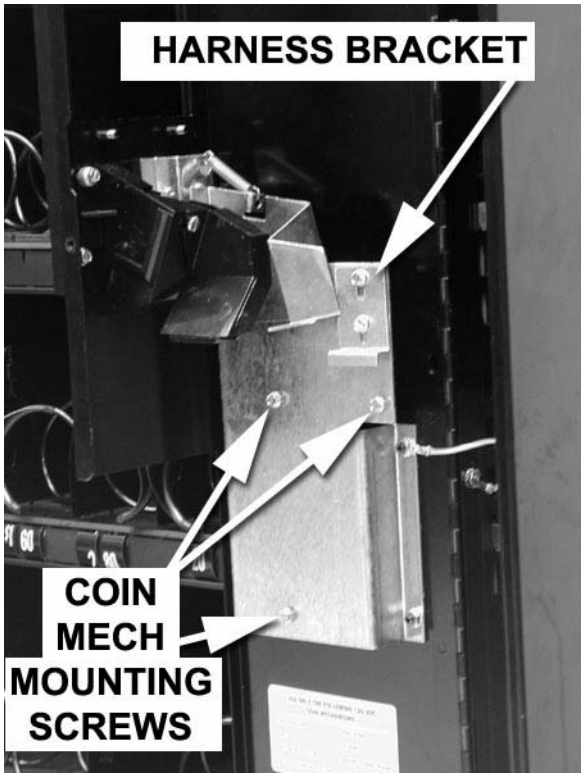


Figure 29

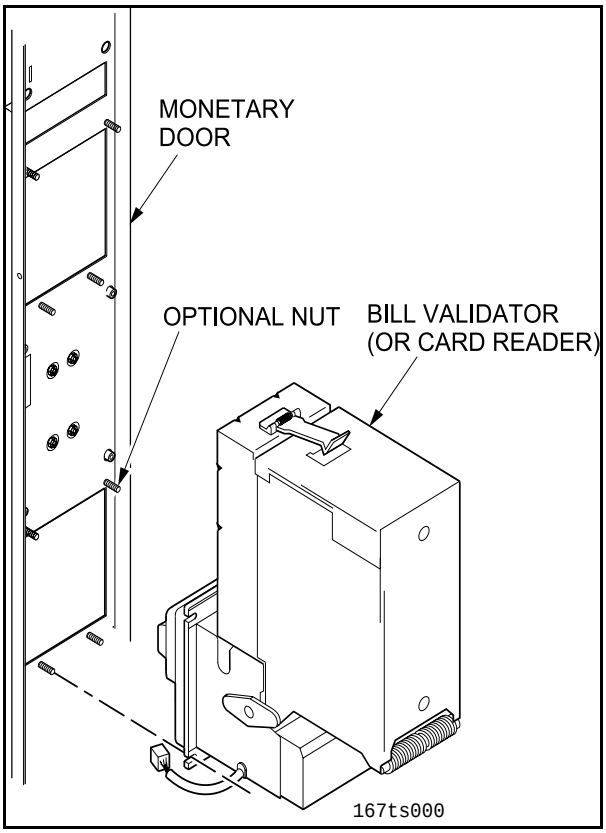


Figure 30

A. Maintenance Keypad

Removal

1. Remove the cover from the display PCB. (see ***"Display PCB"*** on page 41)
2. Disconnect the ribbon cable from the maintenance keypad to the display PCB (figure 31).
3. Using a small putty knife or other flat-bladed tool, carefully pry the maintenance keypad off the monetary door (figure 32).
4. Feed the ribbon cable out through the slot in the monetary door (figure 32).

Replacement

1. Feed the new maintenance keypad's ribbon cable through the slot in the monetary door (figure 32).
2. Apply the new maintenance keypad to the monetary door with the included self-stick tape.
3. Connect the ribbon cable to the display PCB (figure 31).
4. Install the cover over the display PCB. (see ***"Display PCB"*** on page 41)

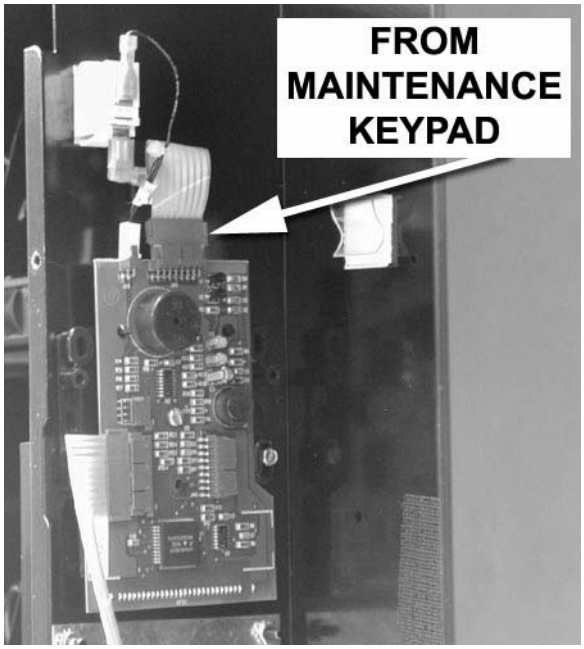


Figure 31

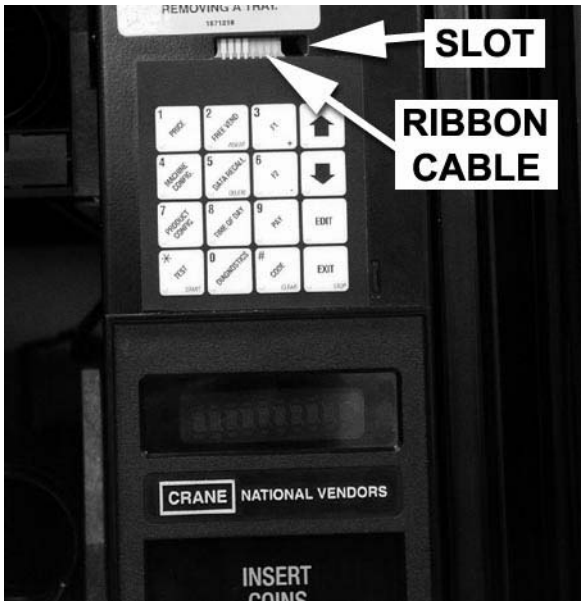


Figure 32

A. Set timing of the Rotary Vend Door

1. Remove the right end plate (See figure 33).
2. Rotate the delivery door until timing marks "A" and "D" are in line with the rotary door center.
3. Remove the pinion gear bushing and nut.
4. Rotate the pinion gear until timing marks "B" and "C" are in line with timing marks "A" and "D".
5. Reinstall the pinon gear bushing and nut.
6. Reinstall the right end plate.
7. Repeat steps 1 through 6 for the left end.
8. Verify that the timing is still correct.

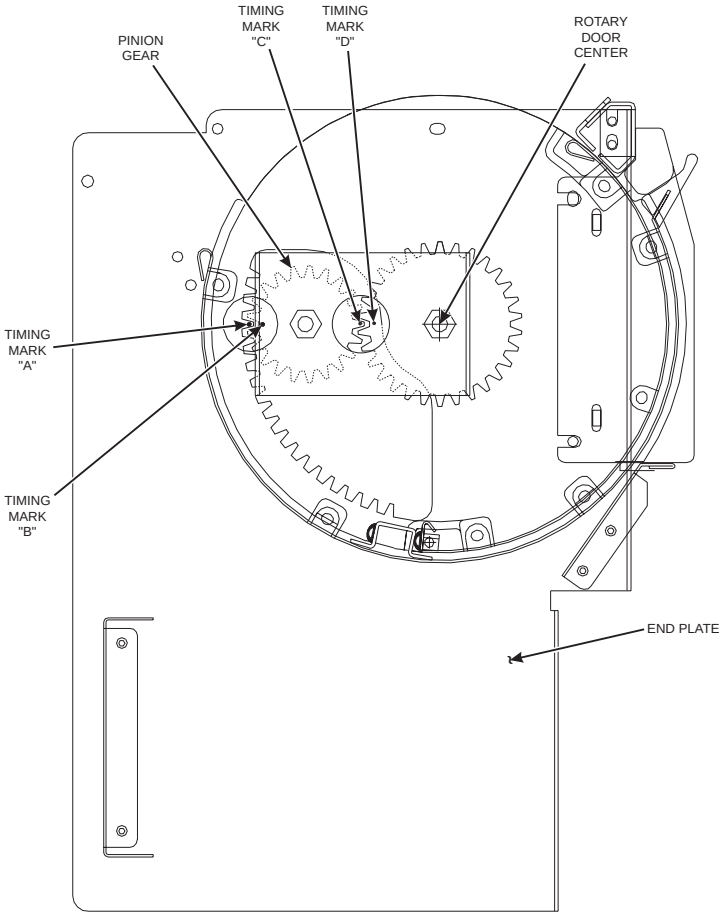


Figure 33

Snack Center (Models 157, 158, 465, 484, 485, 486, 487, 488, 489) Shoppertron (Model 431)

NOTE:

When you installed the new controller board, chances are good that its memory (the RAM) is scrambled. If that is the case, you may be locked out of the functions you need to access in order to program the machine. To get around this, you will need to clear the entire RAM. This not only erases any stray supervisor codes, but eliminates accumulated sales totals, and any custom programming. YOU DO NOT WANT TO DO THIS TO A MACHINE WHICH HAS NOT HAD ITS CONTROLLER BOARD CHANGED!! (Unless you enjoy doing a lot of unnecessary programming, that is.)

Clearing RAM Procedure:

1. The machine must be on and in "ready" mode. This is when a message - any message (or part of one) is scrolling across the display. Press 

two times.

2. While holding 

, press  on the service keypad.
   The display shows the current software version.

3. Press  . 3 to 4 times, or until the display shows CLEAR ALL.

4. Press and hold 

. The display shows CLEARING, then the beeper sounds and the display shows FINISHED. You have now cleared RAM.

5. Press 

to continue the setup procedure.

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WARRANTY STATEMENT

LIMITED WARRANTY. Subject to the limitations specified herein, this merchandiser is warranted for one (1) year against defective parts and workmanship. Any part or parts which are proven to be defective within one (1) year of the date of shipment will be repaired or replaced free of charge when the defective part is returned, with transportation charges prepaid, to the destination designated by CRANE MECHANDISING SYSTEMS Warranty Department.

Refrigeration system's are warranted for (2) years against defective parts and workmanship. Any part or parts of the refrigeration system which are proven to be defective within (2) years of the date of shipment of the merchandiser will be repaired or replaced free of charge when the defective part(s) is returned, with transportation charges prepaid, to the destination designated by the Crane Merchandising Systems Warranty Department. Any part or parts that are proven to be free from defect will be assessed a diagnostic charge. This diagnostic charge will be added to the price of any replacement unit which might have been sent as an advanced replacement, as well as any shipping and handling fees that may have accrued as a result of shipping the original refrigeration unit. The charges will be the sole responsibility of the original purchaser.

This warranty does not include any cost of service rendered or repairs made by customer or it's agents on Merchandiser, or parts, unless authorization to incur such expense has been given in writing by CRANE MERCHANDISING SYSTEMS prior to incurring such expense. This warranty does not cover labor and service charges performed by CRANE MERCHANDISING SYSTEMS service technicians. Customer shall pay all labor costs with respect to warranty repairs.

This warranty does not apply to A) electrical components, wiring, or circuits and/or for all mechanical parts or assemblies damaged as a result of operating the Merchandiser at other than the design voltage and frequency specified on the Electrical Rating Tag, or B) in event of vandalism, fire or negligence, or C) incandescent lamps, neon lamps, fluorescent lamps, ballasts, starters or other expendable items or D) when other manufactured components are installed in Crane Merchandising Systems Merchandisers.

Replacement parts sold by CRANE MERCHANDISING SYSTEMS as After Market shall be covered for three months from the date shown on the parts invoice. Purchaser must obtain prior RETURN AUTHORIZATION for return of all parts, following guidelines given by
Crane Merchandising Systems

New, unused parts purchased as AFTER MARKET can be returned within 30 days from date of parts invoice, with prior authorization from CRANE MERCHANDISING SYSTEMS.

CRANE'S LIABILITY FOR ANY AND ALL LOSSES AND DAMAGES TO CUSTOMERS RESULTING FROM ANY CAUSE WHATSOEVER INCLUDING CRANE'S NEGLIGENCE, ALLEGED DAMAGE OR DEFECTIVE GOODS, IRRESPECTIVE OF WHETHER SUCH DEFECTS ARE DISCOVERABLE OR LATENT, SHALL IN NO EVENT EXCEED THE REPAIR OR REPLACEMENT OF DEFECTIVE OR DAMAGED GOODS OR, AT THE ELECTION OF CRANE, THE PURCHASE PRICE OF THE PARTICULAR GOODS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. CRANE RESERVES THE RIGHT TO REPLACE OR REPAIR DEFECTIVE OR DAMAGED GOODS WITH REMANUFACTURED PARTS OR MACHINES.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PUPOSE. CRANE MERCHANDISING SYSTEMS SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL OR PUNITIVE DAMAGES. CRANE MERCHANDISING SYSTEMS NEITHER ASSUMES NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT ANY OBLIGATION OR LIABILITY IN CONNECTION WITH THE SALE OF SAID EQUIPMENT OR ANY PART THEREOF.

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