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bowlingo™

User's Guide

1st Release
January 1997

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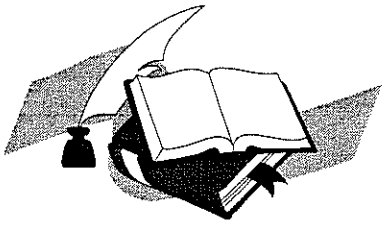
This manual assumes that the Mendes equipment and/or software has been installed by an accredited Mendes technician and is functional in every aspect. Should you encounter problems in operating the equipment, follow the instructions in Appendix A of this manual before contacting MENDES for service under warranty.

In our continuing effort to provide the best products possible, we welcome your suggestions and comments on how we can improve the Mendes equipment or its documentation. If you have any information which you think would benefit other users of Mendes equipment or software and would like to share it with them, please write your ideas down and send them to our Documentation Department. We will use your comments in future publications.



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Introduction to Bowlingo

Bowlingo is a coin-operated tenpin bowling system. Smaller than conventional tenpin bowling, Bowlingo has been developed to appeal to families, novices and experienced players alike. Special footwear is not required and the coin operation ensures a steady flow of players. In order to play:

1) Insert the required number of coins in the coin mechanism.

2) Roll the ball down the lane in order to attempt knocking down as many pins as possible.

Understanding how the Game is Played

A game of bowling is made up of ten frames. At the beginning of each frame, ten pins are set in a triangular form at the far end of the bowling lane, and the bowler rolls a maximum of two balls per frame at the pins trying to knock down as many as possible. If all the pins are knocked down with the first ball it is called a strike. The ball is returned to the bowler and ten pins are then set up for the next frame.

If all the pins are not knocked down by the first ball, the ball is returned to the bowler and the standing pins are left for the bowler's second roll of the frame. The deadwood is removed from the playing area so as not to interfere with the game. The bowler then rolls the ball a second time in order to attempt to knock down the remaining pins. Regardless of the number of pins left standing after the delivery of the second ball, the ball is returned to the bowler and ten pins are set up for the next frame.

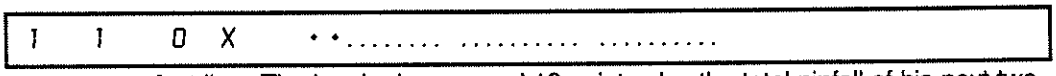
How Bowlingo Keeps Score

- Bowlingo uses the same scoring method as regular bowling. A game of bowling consists of 10 frames. A maximum of 2 deliveries is made in each frame except the 10th. In the 10th frame, if a strike is rolled, two bonus balls are awarded. So it is possible to roll 3 strikes in the 10th frame. If a spare is rolled in the 10th frame, one bonus ball is awarded.

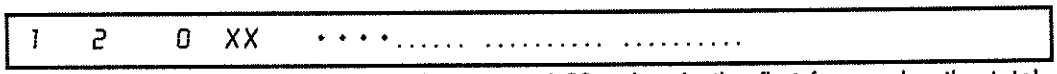
- **Strike.** If a bowler knocks down all 10 pins with his first ball, it is a strike and is marked with an X. The next ball delivered begins a new frame. When a bowler rolls a strike, he is credited with a count of 10 in that frame **plus the total pinfall on his next two deliveries.**

- **Spare.** If a bowler knocks down all the pins with 2 deliveries in a frame, he has a spare. A spare is marked with a /. When a bowler makes a spare he is credited with a count of 10 in that frame **plus the total pinfall on his next delivery.**

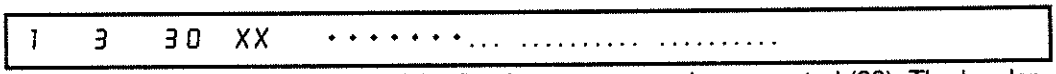
An example of a complete game follows accompanied with illustrations of the Bowlingo Scoring Display Unit.



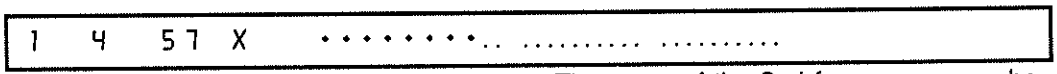
Frame 1 - A strike - The bowler has earned 10 points plus the total pinfall of his next two deliveries. The actual score cannot be computed, but 2 LED's are turned on.



Frame 2 - A strike - The bowler has earned 20 points in the first frame plus the total pinfall of his next delivery. The bowler has also earned 10 more points in the second frame plus the total pinfall of his next two deliveries. The total cannot be computed, but 4 LED's are turned on.



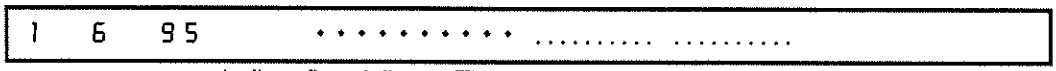
Frame 3 - A strike - The score of the first frame may now be computed (30). The bowler has earned 20 points in the second frame plus the total pinfall of his next delivery. The bowler has also earned 10 more points in the third frame plus the total pinfall of his next two deliveries. The total cannot be computed, but 7 LED's are turned on.



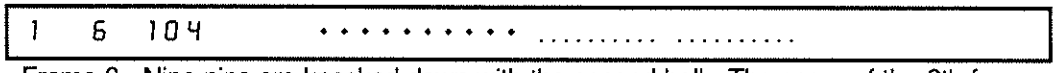
Frame 4 - Seven pins on the first delivery - The score of the 2nd frame may now be computed. The bowler had already earned 20 points in the second frame plus the total pinfall of his next delivery (7) for a total of 27 which is added to the score obtained in the first frame (30+27=57). The actual score of 57 is displayed before the bowler delivers his second ball and the 7 LED's remain on.

Frame 4 - Two pins are knocked down with the second ball - The score of the 3rd frame may now be computed. The bowler had already earned 10 points in the third frame plus the total pinfall of his next two deliveries (10+7+2) for a total of 19 which is added to the score obtained in the second frame (57+19=76). The score of the 4th frame is computed at the same time since it is an "open frame" (no strike or spare). The score of 9 obtained with the two deliveries is added to the score obtained in the third frame (76+9=85). The actual score of 85 is now displayed and 9 LED's are on.

Frame 5 - 8 pins on the first ball - The player then spares. The bowler has earned 10 points plus the total pinfall of his next delivery. The actual score cannot be computed, but another LED is turned on.



Frame 6 - gutter ball on first delivery. The score of the 5th frame may now be computed. The bowler had already earned 10 points in the fifth frame plus the total pinfall of his next delivery (0) for a total of 10 which is added to the score obtained in the fourth frame (85+10=95). The actual score of 95 is displayed before the bowler delivers his second ball and the 10 LED's remain on.



Frame 6 - Nine pins are knocked down with the second ball - The score of the 6th frame is computed since it is an "open frame". The score of 9 obtained with the two deliveries is added to the score obtained in the fifth frame (95+9=104). The actual score of 104 is now displayed and 10 LED's are on.

Frame 7 - A strike - Two more deliveries are needed to compute the score for this frame. The actual score cannot be computed, but 2 more LED's are turned on.

Frame 8 - 7 pins on the first delivery - The player then spares. The score of the 7th frame may now be computed. The bowler had already earned 10 points in the seventh frame plus the total pinfall of his next two deliveries (10) for a total of 20 which is added to the score obtained in the sixth frame (104+20=124). In the eighth frame the bowler has earned 10 points plus the total pinfall of his next delivery. The actual score cannot be computed, but another LED is turned on.

Frame 9 - nine pins are knocked down on the first delivery. The score of the 8th frame may now be computed. The bowler had already earned 10 points in the eighth frame plus the total pinfall of his next delivery (9) for a total of 19 which is added to the score obtained in the seventh frame (124+19=143). The actual score of 143 is displayed before the bowler delivers his second ball and another LED is lit up.

Frame 9 - Player misses the remaining pin on second delivery - The total of 9 obtained with both deliveries is added to the 143 for a total of 152 after the ninth frame. 15 LED's are now on.

Frame 10 - A strike - The bowler has earned 10 points plus the total pinfall of his next two deliveries. The actual score cannot be computed, but 2 more LED's are turned on.

Frame 10 - Another strike on second delivery - The bowler has now earned 20 points plus the total pinfall of his next delivery. The actual score cannot be computed, but 2 more LED's are turned on.

Frame 10 - 8 pins knocked down on the last delivery - This gives a total of 28 pins for the 10th frame which is added to the 152 from the ninth frame for a total score of 180 for the game.

What makes up the Bowlingo System

The structure of the Bowlingo system is based on a wooden truss foundation with prefabricated lanes. The **lane surface** is of a hard-wearing synthetic material, designed to withstand the most extreme operating conditions and providing the operator with the minimum amount of maintenance.

The **Bowlingo Electronic Controller** (BEC), located inside the **ball return rack**, contains the necessary electronics to control the pair of lanes. Made up principally of two printed circuit boards (E-MD3-93 and E-MD3-94), the BEC may be called the brains of the Bowlingo system.

Initializing the BEC

The main component in the BEC is the E-MD3-93 PCB. It contains the **central processing unit** (CPU) and DIP switches which actually run the pair of lanes. Also found on this board are 6 push buttons which are used for various functions.

- **PB101** has only one function, that of **resetting the electronic controller**, although there exist two different reset levels. Pressing PB101 by itself resets the CPU but restores the scores and game results just prior to the reset. This is called a partial reset. The second type of reset is done by pressing the same button, PB101, and pressing PB601 while the L601 LED is flashing. This results in the erasing of all game results and turning the pinsetters off. This is called a complete reset.

The remaining buttons react as follows:

- **PB601** - When in play this button can be used to refresh the overhead display.

- **PB602** - Runs the board through an auto-test sequence. This function is only available when the system is not in play. The auto-test is usually used only under the guidance of a qualified Bowlingo technician.

- **PB603** - After having pressed PB101 and while the L601 LED is flashing, pressing PB603 will place the odd numbered pinsetter in its auto mode. The auto mode has the pinsetter spot pins in 100 various combinations. This function is useful during installation and after having changed the pinsetter's strings.

- **PB604** - Same function as PB603 for the even numbered pinsetter.

- **PB605** - When in play, pressing this button will send a full set (cycle the machine command) to the pinsetters. If both machines are in play it will send the command to the presently active pinsetter (active for the CPU), therefore you may have to press it a few times before it cycles the pinsetter you actually want to cycle.

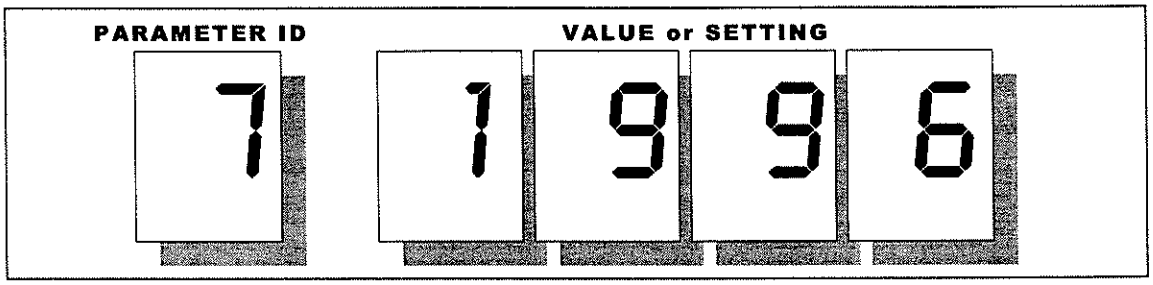
The second board located in the BEC is the **power supply circuit board** (E-MD3-94). This board is used to distribute the necessary electrical power to the various electronic components including the E-MD3-93 PCB.

Suspended above the Bowlingo lanes are the **scoring display modules** which control the display on each lane. Located inside each one of these modules is a box which contains the printed circuit boards used to control the display of each pair of lanes. There are no user configured options in these boxes. The only thing the end user must always keep in mind is that the right lane scoring display module contains one extra printed circuit board which is E-MD3-04. This board is the CPU for the pair of lanes.

Also suspended above the Bowlingo lanes, between the scoring display modules, is the optional **High Score Module**. This module is designed to display the highest scores achieved on a Bowlingo lane. There are 2 high scores displayed for each lane. The first one (top) is the best score EVER. The second one (bottom) is the best score of the day. You may also configure the system so the second best score displayed will be the best score of the week or even the best score of the month. The module is also used to display the pins knocked down after each throw during a normal game.

The High Score Module is made up of two printed circuit boards. The one with the actual LED's which make up the display as shown above is the best score display circuit board (E-MD92-61). When the back cover is removed from the module, the second PCB is accessible. This central processing unit circuit board (E-MD92-60) is used to configure or reset the module through the five push buttons located to the left of the five liquid crystal displays.

The **liquid crystal display** (LCD) located on the E-MD92-60 is used to display the High Score Module's parameters and their corresponding values or settings. When not being used to change the parameters, the LCD displays the time of day as configured by the parameters.



The **push buttons** located to the left of the LCD on the E-MD92-60 PCB are used to change parameter settings. The buttons function as follows.

- **SELECT button**: Press this button to cycle through the parameters. There are sixteen different parameters. For example, press the SELECT button four times to move from Hours (2) to Day of Week (6). Once you get to 6, you can then change the Day of Week Parameter setting.

- ▲ **button:** Press this button to increment through the settings of each parameter. For example there are seven available settings in the Day of Week Parameter: To go from 4 to 5, press the ▲ button.

- ▼ **button**: Press this button to decrement through the settings of each parameter. For example, to go from 4 to 3 in the Day of Week Parameter, press the ▼ button.

- **ENTER button**: Use this button to change the setting of a parameter. For example, once you have changed the Day of Week Parameter to the one desired using the arrow buttons, press ENTER to save the new setting.

Example: To change the *Type of Best Score TWO* from best score of the day to best score of the week, follow these simple steps:

1) Press the **SELECT** button once, the **PARAMETER ID** displays 1 and its VALUE or SETTING displays 0012 or 0024.

2) Continue to press the **SELECT** button in order to cycle through the different parameters until the **PARAMETER ID** displays A and its VALUE or SETTING displays 0000.

3) Press the ▲ button to change the VALUE or SETTING to 0001.

4) Press the **ENTER** button to confirm the new setting.

Initializing the High Score Module

The High Score Module may be initialized at any time in order to have the system return to its set of default values. To do so follow these steps:

1) Press the **RESET** button located on E-MD92-60. (a small "r" will appear in each of the five displays for a period of 5 seconds)

2) During the 5-second period, press the **PB203** button also located on the E-MD92-60.

Each pair of **pinsetters** has an electric power box and a lane controller which are used in conjunction with the **coin mechanism** activated by the introduction of the correct amount of money.

The ME-90 pinsetter is supplied to operate on 240 volts, 50/60 cycles, single phase. The electrical supply lines must conform to all electrical codes and it is the responsibility of the proprietor to supply power to all the electrical components necessary for the normal function of the pinsetters.

A power supply line is run from the main service circuit breaker distribution panel to a junction box mounted above each pair of pinsetters. From each junction box, a three conductor drop cord (2-wires plus an insulated ground), terminating in a twist lock connector, is plugged into the power box of each pair of pinsetters to supply the necessary electrical power.

Attached to a panel which is mounted between each pair of pinsetters is the **electric power box** used to supply the necessary electrical power to all components on a pair of pinsetters. Unlike conventional electrical circuits, which are controlled through a multitude of microswitches, all opening and closing of electrical circuits on the ME-90 pinsetter and its accessories is done through the lane controller using software and optical reading devices (sensors and transmitters/receivers).

An on-off switch is located on the power box and is used to manually open and close the thermal overload circuit breaker.

Any time the electrical power is cut (power failure, opening of circuit breaker, etc.) to the power box, a relay is opened which ensures that all pinsetters do not start when the electrical power is restored. The START button located below the circuit breaker on the power box must be depressed in order to close the relay and restore all electrical components on the pair of lanes.

Warning

High voltage is present in the power box. The main circuit breakers must always be shut off or the twist lock plug disconnected prior to removing the power box cover.

Mounted to the right of the power box is the **lane controller** which receives software commands from the pin detection assembly and/or the master device which controls the pair of lanes. Input signals originate from the different optical devices located on the pinsetter. The lane controller, through its different circuit boards, analyzes the input signals and sends the appropriate output signals to the pinsetter's components. The lane controller keeps both pinsetters under constant surveillance, turning on and off components as necessary.

The lane controller (SB-6500-90) controls both ME-90 pinsetters and their functions. Inside the lane controller are two printed circuit boards, the central processing unit (E-MD3-85) and the input / output circuit board (E-MD3-80).

Located on the central processing circuit board (E-MD3-85) are the EPROM's and DIP switch banks used to control the board's functions. Each and every electronic component communicates in one way or another with the central processing unit, it is the brains behind the brawn of the ME-90 Pinsetter.

Mounted below the pinsetter is the **stabilizer assembly** which absorbs most of the vibration and then stabilizes each pin before its descent to the lane. The stabilizer assembly is a very important part of the pinsetter. Without it, the pins would have to be picked up much gentler than they are and the untangling mode would lose its powerful effect. Another important factor is the speed and accuracy which is obtained through the stabilizer. Each pin is spotted according to its position in the stabilizer, thus allowing for consistent pin spotting cycle after cycle.

Located at the rear of each lane's pin deck is the **pit** which is slanted to the inside of the pair of lanes in order to direct the ball to the ball return assembly. Above the pit, the **cushion** absorbs the impact of the bowling ball.

The **rear ball lift** assembly is fastened to the floor between each pair of pinsetters. Using a simple conveyor system, the ball is raised to a level above the pinsetters and then propelled by shear gravity to the front ball return rack located at the bowler's end of the lane.

The ball lift's conveyor is powered by a ½hp, capacitor start electric motor that is mounted on the motor support bracket at the top of the ball lift's frame. The power generated by the motor is relayed to the conveyor's chains through the pulley on the motor shaft, the drive belt, the drive pulley, and the drive wheel. The motor support bracket is adjustable to obtain constant pressure on the drive belt.

Located at the rear of each pinsetter is a ½hp **main motor**. A 10/1 double shaft reducer reduces the speed of the main motor which uses two magnetic clutches to perform the raising and lowering actions. Once the pinsetter is turned on, the main motor runs continuously.

The two **magnetic clutches**, one for raising and one for lowering, actually couple the motor reducer to the main shaft which carries the drawbar to its desired position.

The lane controller takes care of the time of raising and lowering, stabilizing pause, braking action, untangle routine, and all other pinsetter movements by activating and disengaging the magnetic clutches as needed. All of the different delays are controlled by the user through DIP switches located inside the lane controller.

Attached to both chains on the sides of the pinsetter is the **drawbar**. The drawbar is made up of sheaf assemblies (one for each pin) mounted on a shaft. Each sheaf pulls its corresponding pin's string when the drawbar is pulled to the rear of the machine by the chains.

The **shield** is powered by the drawbar's forward and backward movements. When the drawbar is pulled to the rear of the pinsetter, the shield is lowered. When the drawbar returns to the front of the pinsetter, the shield is raised.

The strings themselves are the concept of the machine. Each pin has a fourteen-foot length of string attached to its head. A four-foot length of this same string is wound on each reel and storage assembly to be used as spare string. In other words, the pinsetter needs ten feet of string to operate normally.

With a well adjusted pinsetter, the only point of wear on the string is immediately above the top of the pin. When it wears, it may be merely pulled through the pin, the worn out part cut (six inches), and the string refastened. Keeping in mind the four-foot length of spare string and the fact that six inches of string is cut. Each string may be repaired eight times before having to replace the complete length of string (fourteen feet).

The ME-90 Pinsetter's good operation is directly related to the proper length of the strings. Any variation in the length of the strings caused by humidity or stretching is sufficient to disturb the system.

Mounted at the front of each pinsetter is the **pin detection assembly** (SB-2131) and the **pin detection wheels** (one for each pin). These wheels are activated (rotated) by their corresponding strings when a pin is knocked down. Each wheel has holes in it and the wheel itself rotates through an optical sensor (SB-ECIL-325-PD). As the wheel turns, its optical sensor counts the number of holes which pass through it. This information is transmitted to the lane controller. The lane controller then determines which pins, if any, have been knocked down.

The sensitivity of the pin detection optical sensors is determined through a dip switch setting inside the lane controller itself.

The pin detection assembly is connected to the lane controller along with the individual pin detectors and brake solenoids. The pin detection circuit board (E-MD3-88) located on SB-2131 has five buttons, each one with a corresponding LED. Each button will send different commands to the lane controller when pressed. When the LED above the button is lit up, this indicates that the button is ON. From left to right, the buttons and their functions are:

- **Manual/Auto Button**; when ON, this means that the pinsetter is in slave mode (controlled by the lane controller). This is the only LED which should be lit up when the pinsetter is in normal operation.

- **ON/OFF Button**: Used to manually turn the pinsetter ON and OFF in order to perform adjustments and maintenance on the pinsetter.

- **FS1Button**: Used to perform a full set cycle, the LED will only light up when you press the button. Once the button is released, its LED will turn OFF.

- **PS1Button**: Used to perform a part set cycle, the LED will only light up when you press the button. Once the button is released, its LED will turn OFF.

- **AUX Button**: Used to place the pinsetter in an idle mode in order to untangle strings when the pinsetter is unable to do so itself. THE BUTTON MUST BE PRESSED A SECOND TIME IN ORDER TO RETURN TO NORMAL OPERATION. As with the full set and part set buttons, the LED will only light up when you press the button. Once the button is released, its LED will turn OFF.

When combining buttons, the following adjustment functions are available:

- **FS1 & PS1 Buttons**: When pushing these 2 buttons simultaneously, the string extension function is activated. The pinsetter pulls the strings for 20 seconds allowing you to adjust the strings correctly.

- **PS1 & AUX Buttons**: When pushing these two buttons simultaneously, the brakes test function is activated. The pinsetter performs a cycle and holds all pins up with the brakes. To re-establish normal functions, simply press the FS button.

When depressing buttons, hold them down for a few seconds to ensure a good signal to the lane controller. When in Idle Mode, the LED's on the lane controller flash 5 at a time in an alternating pattern. When in String Extension Mode, the same LED's perform an inside-out movement. Finally, when in Brakes Test Mode, the LED's all flash at the same time.

Mounted behind the pin detectors and below the reel and storage assemblies are the **pin brakes**. There is one brake assembly for each pin. The brake assembly has three main parts, a cam, a solenoid and a brake-shoe. When a pin is determined as fell by the lane controller, its solenoid activates the cam which in turn secures the string holding the pin up while the drawbar descends the remaining pins to the lane.

Each ME-90 pinsetter uses a total of fourteen (14) different **optical reading devices** in order to send signals directly to the lane controller. These devices come in the form of optical sensors and transmitters with each one equipped with a partner device such as an actuator or reflector.

- **Ball detector**: With the pinsetter in a ready to bowl position, the ball detector allows for the detection of the ball on its way down the lane. Once a ball is detected, the reading pause commences.

The ball detector must be operational in order for the pinsetter to function. All commands to and from the pinsetter start with the detection of a ball.

- **Pin detector**: There is one **PD optical sensor** (SB-ECIL-325-PD) for each bowling pin. When a pin is knocked down, its string rotates the wheel (9103058) through the PD, indicating to the lane controller that the pin has been knocked down. Once the reading pause expires, the PD optical sensors are placed in an idle mode until the next ball detection and the magnetic clutch used to raise the drawbar is activated.

- **Landing signal**: When pins are in the stabilizers and the drawbar has completed its cycle, the drawbar's left adjustment plate (9102012) passes through the **LS optical sensor** (SB-ECIL-325-FS) sending a positive signal to the lane controller. The magnetic clutch used to raise the drawbar is disengaged and the stabilizing pause commences.

- **Pin brakes**: Once the stabilizing pause has expired, the magnetic clutch used to lower the drawbar is activated. The drawbar's left adjustment plate passes through the **PB optical sensor** (SB-ECIL-325-FS) sending a positive signal to the lane controller. The necessary pin brakes are activated.

- **Position 0**: Once the pins have been deposited on the lane, the drawbar's left adjustment plate passes through the **PO optical sensor** (SB-ECIL-325-FS) sending a positive signal to the lane controller. The magnetic clutch used to lower the drawbar is disengaged and the pinsetter is now ready to bowl.

Understanding how the System Works

When the pinsetter is turned on, the pins are set on the lane and the pinsetter is placed in a ball one situation. The bowler rolls the ball which passes through the ball detector's infrared beam of light thus sending a signal to the lane controller. The ball knocks down some pins which fall into the pit. The floor of the pit is angled so that the ball moves toward the rear ball lift.

Each pin has a string attached to its head which activates its pin detection wheel when the pin is knocked down. The pin detection wheel in turn, advises the lane controller that the pin has been knocked down.

After a pre-determined delay, the lane controller activates a magnetic clutch which couples the motor reducer to the main shaft which pulls the drawbar to the rear of the pinsetter. The shield is lowered as the drawbar picks up the pins from the pit and secures them in the stabilizer. The drawbar then activates the optical sensor at the rear of the machine, which indicates to the lane controller that the drawbar is at the end of its cycle and that no strings are tangled. At this point, the lane controller will disengage the magnetic clutch.

If the strings are tangled, the optical sensor at the rear of the machine will not be activated. This will cause the lane controller to activate the pinsetter's untangling routine, which will cause the pinsetter to lower and raise the pins in different manners until the strings are untangled. The number of attempts made by the pinsetter is controlled through a DIP switch setting inside the lane controller itself.

Pinsetter cycles

After a slight pause, the drawbar will commence its downward cycle aided by a second magnetic clutch which is activated once again through the lane controller. The ME-90 Pinsetter will then perform one of two different types of cycles:

1) **Part set**: the pinsetter sets on the lane only the pins which weren't knocked down, the shield raises and the lane is ready for the next ball. If a part set is necessary, the lane controller activates each individual brake for each pin which was detected as knocked down.

2) **Full set**: the pinsetter spots a full set of pins on the lane, the shield raises and the lane is ready for the next frame. If a full set is necessary, none of the brakes are activated.

The pinsetter must be able to determine the different pinsetter reactions based on the rules of bowling and set up by delivery of the ball. After the bowler delivers the ball, the ball detector sends a signal to the lane controller. The lane controller will determine whether there are pins standing and what type of cycle to perform. This process is called reading and according to all the information which the lane controller analyzes, the pinsetter will cycle in one of the two possible manners.

- If the bowler rolls the first ball down the lane and knocks down all the pins (strike), the pin detection wheels all rotate through their corresponding optical sensors and when the lane controller takes its reading it will find no pins standing. At this point, the lane controller has the pinsetter perform a full set.

- If the bowler rolls the first ball down the lane and knocks down some pins but not all, the pin detection wheels again rotate through their corresponding optical sensors and the lane controller takes its reading to find some pins still standing. At this point, the lane controller has the pinsetter perform a part set.

- Whenever the bowler delivers a second ball, regardless of the number of pins knocked down, the lane controller has the pinsetter perform a full set.

Safety procedures

Use of common sense and industry experience are key factors which one should utilize whenever operating a pinsetter. As with all machinery, there is an element of risk working on the pinsetter if the rules of safety are disregarded. Training in the operation of this machine is available. Schools in the pinsetter's use and operation are held periodically. It is the responsibility of the attendant to provide his or her own travel, lodging and school expenses. Anyone interested in attending a factory training school should contact their local Mendes sales or service representative or Mendes directly to make arrangements.

1) Always open the pinsetter circuit breaker or disconnect the pinsetter power plug from the electrical box before looking for, and clearing, the cause of the jam.

2) Always reach over and around the machine assemblies, never through or between the components.

3) Avoid the use of cleaners which are toxic.

4) Immediately wipe up any oil or liquids that have spilled to prevent slipping.

5) Store oily rags and any other combustibles in a fireproof container.

6) The mechanic must teach all personnel who will work on the pinsetters enough about the machine to prevent accidents through ignorance.

7) Under no circumstances allow an unqualified person to work on the pinsetter.

8) Use the right tool for each job to prevent injury to yourself and to the machine. Remove all tools from the machine before turning it on.

9) Wear the proper clothing when working on the pinsetter. Do not wear neckties or loose clothing that may be caught by the machine. Wear trousers without cuffs to prevent tripping. Wear shoes with safety, non-slip soles.

10) When more than one person is working on the machines, never turn on a machine without checking to see if everyone is clear of the machine.

11) When the safety guards are removed from the pinsetter, be extra cautious when the machine is turned on. Replace the guards immediately when the work is completed.

Chapter 2

bowlingo™ User's Guide

1st Release - January 1997

Setting Up a Preventive Maintenance Program

The simplicity of the Mendes ME-90 Pinsetter being its main characteristic, it is very easy to understand its concept. At the same time, it must be understood that pinsetters of any kind require a minimum of maintenance and should operate according to standards. Regular, scheduled maintenance is very important in order to keep your equipment in excellent condition.

Basic rules of preventive maintenance

1) Machines must be kept free of dirt, dust and excess of oil. A well cared for machine is a clean machine. A clean machine performs much better and reduces the chance of electronic problems.

2) Proper lubrication is essential to a smooth running, trouble-free machine and also prolongs the life of all moving parts. It is very important to perform the lubrication according to schedule. Oil all chains and pulleys with very small quantities of SW10 motor oil only if judged necessary. Don't forget that any excess oil will only drip into undesired places causing headaches for cleaning.

3) Machines are subject to constant vibration and must be checked frequently for loose nuts and bolts. All bolts on the machines and accessories must be tightened with a torque wrench. Over tightening bolts will simply cause them to break and depending on the function of the bolt, may cause operating headaches. Also, check and tighten any loose screws on the pinsetters (especially the set screws) as well as any loose bolts on the pit cushions and ball accelerators at regular intervals.

The adjustment numbers used in this chapter are in reference to the adjustment procedures which are detailed in Appendix C.

Getting organized

The Preventive Maintenance Work Schedule is an organized schedule of routine preventive maintenance that must be performed on all pinsetters over a four week period.

First, the pinsetters must be divided into four groups as evenly as possible. For example, if your center has sixteen pinsetters that are divided into four groups, each group would have four pinsetters. Maintenance is performed on each group during different days of the week.

Let's briefly look at how the Preventive Maintenance Work Schedule is organized.

At the top of the work schedule are the four different colored boxes. This color-coding prevents confusion between the groups of pinsetters. For example, if pinsetters 1-4 are color-coded in green, once the scheduled preventive maintenance has been performed on pinsetters 1-4, it is recorded in green on the work schedule.

Looking down the rest of the work schedule we see that the maintenance is divided into five areas. These are indicated by the headers on the right side of the page.

They show that the preventive maintenance is divided into five areas, according to time. There are services that must be performed:

- Daily
- Weekly
- Monthly
- Quarterly
- Annually

Mendes Inc.

MACHINES #_____THRU #_____ | MACHINES #_____THRU #_____ | MACHINES #_____THRU #_____ | MACHINES #_____THRU #_____

PREVENTIVE MAINTENANCE WORK SCHEDULE
BOWLINGO MACHINES

FOUR WEEK PERIOD ENDING _____

	ASSIGN TO	DAILY SERVICE (ALL MACHINES DAILY)
ADJUSTMENTS		S M T W T F S S M T W T F S S M T W T F S S M T W T F S
CHECK STOP SHEETS		
CHECK STRINGS AND BUSHINGS ME-04a		
ADJUST PIN STRINGS ME-04b		
CLEANING		
CLEAN ALL LANE SURFACES		
CONDITION ALL LANE SURFACES		
		WEEKLY SERVICE (1/4 OF MACHINES PER 2 DAYS)
CLEANING		S M T W T F S S M T W T F S S M T W T F S S M T W T F S
ALL OPTICAL SENSORS (COMPRESSED AIR)		
ALL PIN DETECTOR WHEELS (COMPRESSED AIR)		
REMOVE EXCESS OIL & GREASE FROM CHAINS		
REMOVE DUST FROM STABILIZERS		
PIT AREA (VACUUM)		
REAR BALL LIFT AREA (VACUUM)		
BALL DETECTORS & REFLECTORS (WIPE)		
FRONT BALL RACK & BOWLING BALLS (WIPE)		
WORK AREA (BENCH, ROOM AISLE)		
ADJUSTMENTS		
ASCENDING TORQUE ADJUSTMENT ME-01b		
PIN BRAKES ADJUSTMENT ME-05a		
		MONTHLY SERVICE (1/4 OF MACHINES PER WEEK)
ADJUSTMENTS		S M T W T F S S M T W T F S S M T W T F S S M T W T F S
BALL DETECTOR ADJUSTMENT MA-11b		
ASCENDING CHAIN ADJUSTMENT ME-01d		
DESCENDING CHAIN ADJUSTMENT ME-01e		
DRAWBAR ALIGNMENT ADJUSTMENT ME-03a		
DRAWBAR CHAIN ADJUSTMENT ME-03b		
REAR BALL LIFT ADJUSTMENT ME-02a		
LUBRICATION		
CHECK OIL LEVEL IN MOTOR REDUCERS		
		QUARTERLY SERVICE (1/3 OF MACHINES PER MONTH)
MACHINE NUMBER		
TIGHTEN ALL BOLTS & SCREWS		
TIGHTEN VIBRO INSULATORS		
TIGHTEN BASE PLATE SPACER BOLTS		
ADJUSTMENTS		
PIN PAUSE ADJUSTMENT ME-03c		
LUBRICATION		
CLEAN & LUBRICATE MAGNETIC CLUTCHES ME-01a		
OIL ALL CHAINS IF NECESSARY		
OIL ALL PULLEYS IF NECESSARY		
		ANNUAL SERVICE (1/12 OF MACHINES PER MONTH)
PINSETTER NUMBER		
LUBRICATION		
GREASE THE PILLOW BLOCKS		
INSPECT & CORRECT		
WELDED ASSEMBLIES		
PIVOT AND WEAR POINTS		

REMARKS:

bowlingo™

HEAD MECHANIC'S SIGNATURE PROPRIETOR'S SIGNATURE

Daily maintenance schedule

	ASSIGN TO	DAILY SERVICE (ALL MACHINES DAILY)																												
ADJUSTMENTS		S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
CHECK STOP SHEETS																														
CHECK STRINGS AND BUSHINGS ME-04a																														
ADJUST PIN STRINGS ME-04b																														
CLEANING																														
CLEAN ALL LANE SURFACES																														
CONDITION ALL LANE SURFACES																														

The maintenance that must be performed daily is shown above. Let's look at the daily maintenance required of all pinsetters each and every day.

- Everyday, all the pinsetters must be checked for stop sheets. These are pieces of paper that are put on the back of the pinsetter to indicate if something went wrong with it the night before. The malfunction should be immediately corrected by a qualified mechanic.

- Check strings and pin bushings, change if worn or broken and then adjust all strings (ME-04a and ME-04b);

- Clean all lane surfaces and surrounding areas with "Squeaky lane cleaner" (part number Q82-0824-05-99) or similar. DO NOT use in concentrated form, for general use dilute 1 part of "Squeaky" to 3 parts water in accordance with the manufacturers instructions. Always use a hand spray applicator.

- Condition all lane surfaces using bowling lane conditioner, but sparingly; excess conditioner will make lanes appear to be dirty, it will also cause balls to be slippery - making them difficult to handle and also impeding their return. Too much conditioner will also cover the bowling balls causing them to spin at the base of the ball lift and block the ball pit. **Do not** apply conditioner to the gray approach sections, any conditioner in this area will cause players to slip.

Once the daily maintenance is finished for all the pinsetters, it is color-coded in the appropriate places on the work schedule.

Weekly maintenance schedule

		WEEKLY SERVICE (1/4 OF MACHINES PER 2 DAYS)																												
CLEANING		S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
ALL OPTICAL SENSORS (COMPRESSED AIR)																														
ALL PIN DETECTOR WHEELS (COMPRESSED AIR)																														
REMOVE EXCESS OIL & GREASE FROM CHAINS																														
REMOVE DUST FROM STABILIZERS																														
PIT AREA (VACUUM)																														
REAR BALL LIFT AREA (VACUUM)																														
BALL DETECTORS & REFLECTORS (WIPE)																														
FRONT BALL RACK & BOWLING BALLS (WIPE)																														
WORK AREA (BENCH, ROOM AISLE)																														
ADJUSTMENTS																														
ASCENDING TORQUE ADJUSTMENT ME-01b																														
PIN BRAKES ADJUSTMENT ME-05a																														

Following the daily maintenance of the pinsetters there is also scheduled maintenance that needs to be performed weekly, as shown above. Most of the weekly maintenance is simply cleaning which requires wiping off the major assemblies. All assemblies should be wiped clean with a dry cloth. Sometimes oil or grease may accumulate on these surfaces and a dry cloth will not remove them. When this happens, it makes sense to moisten the cloth with pinsetter cleaner.

The weekly work schedule does not require that all the pinsetters be serviced together. Rather, only one quarter of the pinsetters must be serviced every two days. For a sixteen lane center, pinsetter numbers one to four would be serviced on Monday, pinsetter numbers five to eight would be serviced on Wednesday, pinsetter numbers nine to twelve would be serviced on Friday, and pinsetters thirteen to sixteen would be serviced on Sunday. This process repeats itself so that by the end of the month each pinsetter will have been serviced four times.

Weekly cleaning

The cleaning simply involves wiping the various components indicated with a dry cloth. The pit and ball lift areas are best cleaned by vacuuming the dust that accumulates. Dust also accumulates inside the various optical reading devices located on the pinsetter. This dust is best removed by using compressed air prior to vacuuming.

Just as the pinsetters must be kept clean, the work area must also be kept clean, especially the bench, room and aisle.

- Clean all optical sensors and pin detector wheels with compressed air;
- Remove all excess oil and grease from the chains and surrounding area. Care must be taken to remove all excess oil from the gear and near the friction disk (**this disk must never be oiled**);
- Remove all dust deposits which have accumulated on the pin tables and pin stabilizer boards;
- Vacuum the pit area;
- Vacuum the ball lift area;
- Wipe the ball detectors and reflectors with a damp cloth;
- Wipe the ball return track;
- Wipe the front ball rack and the bowling balls;
- Wipe work area (bench, room, aisle).

Weekly adjustments

The torque power used to pull the drawbar to its up position, must be strong enough to perform the operation but at the same time, not too high so as to have the pinsetter components force themselves and cause premature wearing.

If a bowling pin is lowered to the lane when it should stay up or if a bowling pin stays up when it should be lowered to the lane, the pin brakes need adjusting.

- Check and adjust the pinsetter's torque (ME-01b);
- Adjust the pin brakes if necessary (ME-05a).

Once the weekly items are finished for one quarter of all the pinsetters, it is color-coded in the appropriate places on the work schedule.

Monthly maintenance schedule

		MONTHLY SERVICE (1/4 OF MACHINES PER WEEK)																												
ADJUSTMENTS		S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
BALL DETECTOR ADJUSTMENT MA-11b																														
ASCENDING CHAIN ADJUSTMENT ME-01d																														
DESCENDING CHAIN ADJUSTMENT ME-01e																														
DRAWBAR ALIGNMENT ADJUSTMENT ME-03a																														
DRAWBAR CHAIN ADJUSTMENT ME-03b																														
REAR BALL LIFT ADJUSTMENT ME-02a																														
LUBRICATION																														
CHECK OIL LEVEL IN MOTOR REDUCERS																														

Moving on to items performed monthly, we see that the first area is to inspect and correct is the ball detector alignment (MA-11b). The ball detector is a critical component to the pinsetter's mechanics since all commands to and from the pinsetter start with the detection of a ball.

Although the ball detector is not a mechanical part of the drive train, it is a critical component to the pinsetter's mechanics since all commands to and from the pinsetter start with the detection of a ball.

The ball detector is a simple, very reliable stand alone device but may become misaligned once in a while due to the constant vibration caused by the balls rolling down the lane. Each ball detector has two LED's that simplify the adjustment of the unit. The green LED signifies that the unit is perfectly aligned with the reflector while the red LED indicates that the alignment is borderline (usually requiring you to adjust it until the green LED turns on). If neither of the two LED's are visible on a ball detector, one of four things is possible. The ball detector is completely misaligned, it is defective, the reflector on the opposite side of the lane is soiled or has fallen, or the cable which supplies the necessary voltage to the unit has been cut or disconnected.

The remaining monthly procedures are just as important as the rest of the preventive maintenance program. Although most of the adjustments listed below will not need adjusting, you must verify each one of them correctly in order to ensure yourself of their perfection thus allowing yourself to rest easy for another month

- Check the ball detectors (MA-11b);
- Check the ascending chain (ME-01d);
- Check the descending chain (ME-01e);
- Check the drawbar chain and alignment (ME-03a and ME-03b);
- Check the ball lifts (ball elevators) (ME-02a);
- Check the oil in all motor reducers and add if required (use 80W-80 oil).

Once the monthly items are finished for one quarter of all the pinsetters, it is color-coded in the appropriate places on the work schedule.

Quarterly and annual maintenance schedule

		QUARTERLY SERVICE (1/3 OF MACHINES PER MONTH)
MACHINE NUMBER		
TIGHTEN ALL BOLTS & SCREWS		
TIGHTEN VIBRO INSULATORS		
TIGHTEN BASE PLATE SPACER BOLTS		
ADJUSTMENTS		
PIN PAUSE ADJUSTMENT ME-03c		
LUBRICATION		
CLEAN & LUBRICATE MAGNETIC CLUTCHES ME-01a		
OIL ALL CHAINS IF NECESSARY		
OIL ALL PULLEYS IF NECESSARY		

		ANNUAL SERVICE (1/12 OF MACHINES PER MONTH)
PINSETTER NUMBER		
LUBRICATION		
GREASE THE PILLOW BLOCKS		
INSPECT & CORRECT		
WELDED ASSEMBLIES		
PIVOT AND WEAR POINTS		

Although the quarterly and annual servicing of pinsetters is not done as frequently as the other services, they are just as important. Much of the quarterly service involves tightening the bolts and screws of the various assemblies. Loose bolts and screws may result in premature failure of the pinsetter and may even result in serious damage to the pinsetter or an operator.

Nuts and bolts

Pinsetters are subject to constant vibration and must be checked for loose nuts and bolts. All bolts on the ME-90 pinsetters and accessories must be tightened with a torque wrench as indicated in the table below. Over tightening bolts will simply cause them to break and depending on the function of the bolt, may cause operating headaches.

The vibro-insulators and base plate spacer bolts located on the stabilizers are subject to continual violent shock and extreme vibration. They should be checked frequently for tightness

BOLT SIZE	AMERICAN	NEWTON
1/4"	15 FT. LB.	67 N/M
5/16"	19 FT. LB.	85 N/M
3/8"	25 FT. LB.	112 N/M
1/2"	29 FT. LB.	130 N/M

Tightening loose bolts and screws should not be limited to quarterly service however. Any time you come across a loose bolt or screw, it should be corrected immediately. Also, check and tighten any loose screws on the pinsetters (especially the set screws) as well as any loose bolts on the pit cushions and ball accelerators at regular intervals.

Quarterly adjustments

- Tighten all bolts and screws;
- Check the pin pause (ME-03c).

Quarterly lubrication

- Clean and lubricate the magnetic clutches (ME-01a);
- Oil all chains if necessary;
- Oil all pulleys if necessary.

Oil all pulleys and chains with very small quantities of SW10 motor oil only if judged necessary. Don't forget that any excess oil will only drip into undesired places causing headaches for cleaning.

Annual lubrication

- Grease the pillow blocks.

Annual inspection

An annual inspection of the pinsetter is best done by a qualified mechanic. He has the experience to determine the wear of parts and their need for replacement.

Appendix A: Troubleshooting

If you have a problem, always verify the following points before replacing system components as indicated in this appendix.

1) Check that you have electrical power to the system; a glance at the fuse box could save you a lot of precious time.

2) Make sure that the LED on the ball detector is green.

3) Simulate a power failure.

4) Check that all cabling assemblies are well connected.

Hint on cabling problems: There are only two possible solutions to cabling problems. First, any one of the connectors used with the cable assembly may have become loose due to the constant vibration present in bowling facilities. Secondly, a cable may be cut or have been pinched by a foreign object. The solutions are simple, ensure that all connectors are well positioned and push down on each one to ensure its proper contact. If this fails to resolve your problem, use a multi-meter to verify the cable assembly's continuity.

5) Verify the relative humidity in your center. When humidity levels get too low, static electricity transported by people can build up to enormous levels. These levels can be so large that even good grounds will not stop the destruction of these static discharges. Be advised that the recommended relative humidity level for a bowling center is between 40 and 50 percent.

6) Retrace the ground wire installed with your equipment all the way to the building's main ground. Never depend upon the ground installed with your outlets, since many electricians do not reliably install these grounds. If your equipment is not properly grounded the CPU's can literally blow their electronic chips when they receive a static electricity discharge, be it from the players or a defective part.

7) Check that the START button on the power box is activated.

8) Check the fuse or the transformer's reset in the power box.

9) Check that the LED's are flashing inside your lane controller. If not, reset the lane controller using the RESET button located on the main circuit board (E-MD3-85).

10) Reset the Bowlingo Electronic Controller.

Bowlingo display problems

The system does not start-up when coins are inserted and the coin mechanism has been confirmed to work properly and is powered.

- ☑ Reset the E-MD3-93 PCB located inside the Bowlingo Electronic Controller.
- ☑ Check the coin mechanism cabling to the E-MD3-93 PCB.
- ☑ Replace the ULN2804A chip on the E-MD3-93 PCB.
- ☑ Replace the E-MD3-93 PCB.

The display units are not ON when they should be.

- ☑ If both displays are off chances are the internal breaker that controls the power to the display units has been set off, reset and ensure there is no short circuit within the system. If it continues to happen regularly replace the breaker and/or the power unit.

Segments of the display unit do not function.

- ☑ Replace the E-MD3-03 PCB located in the display unit. Also possibly change the flat cables connected to the E-MD3-03 PCB.

Display panel "freezes" periodically, or continuously.

- ☑ Disconnect the power source from the display unit, wait a few seconds and reconnect.
- ☑ Press the "RESET" button on the E-MD3-04 PCB found in the right display unit.
- ☑ Replace the communication chips (75157 and 75158) on E-MD3-04.
- ☑ Verify the wire connections between the display unit and the Bowlingo Electronic Controller.
- ☑ Replace the E-MD3-04 PCB
- ☑ Reset the E-MD3-93 PCB located inside the Bowlingo Electronic Controller.
- ☑ Replace the communication chips on the Bowlingo Electronic Controller (the two 75175).
- ☑ Replace the E-MD3-93 PCB located inside the Bowlingo Electronic Controller.

No sound (audio) is emitted through the ball return speaker(s).

☑ Reset the E-MD3-93 P.C.B located inside the Bowlingo Electronic Controller.

☑ Check the speaker cabling.

☑ Check the speaker's volume controls located on the E-MD3-93 PCB inside the Bowlingo Electronic Controller. P901 controls the volume for the speaker on lane #1 while P902 controls the volume for the speaker on lane #2.

☑ Replace the E-MD3-93 PCB.

☑ Replace the speaker(s).

Pinsetter problems

The pinsetter doesn't react to a ball rolled down the lane.

☑ Check the ball detector's adjustment and cabling. (MA-11b)

☑ Reset the main circuit board (E-MD3-80), if this does not rectify the problem, replace the lane controller.

The pinsetter cycles when it shouldn't.

☑ Check the ball detector's adjustment. (MA-11b)

☑ Reset the main circuit board (E-MD3-80), if this does not rectify the problem, replace the lane controller.

The pinsetter does not shut off when it is supposed to.

☑ Check the ON/OFF button located on the Pin Detection Assembly. Its LED should be OFF, if not, press the button to turn the pinsetter OFF.

The drawbar continuously moves back and forth.

☑ Strings may be too tight, check their adjustment. (ME-04b)

☑ The LS optical sensor may be misaligned, disconnected or defective. Make sure that the actuator moves completely through the optical sensor. If it doesn't, adjust the bracket until it does. Follow the cable from the optical sensor all the way back to the lane controller, verifying all connections and making sure that the cable has not been cut or crimped.

The drawbar does not attain the rear of the pinsetter.

☑ Check the strings adjustment, they are probably too tight. (ME-04b)

☑ Check the torque adjustment, it may be too low. (ME-01b)

☑ There may be foreign matter in the magnetic clutch drive, or the UP clutch sprocket (part #9102114) may be slipping. Dismantle the UP clutch sprocket, clean and reassemble. After re-assembly, cycle the pinsetter 3-4 times so as to ensure that the clutch makes good contact with the disk. (ME-01a) Adjust the torque if necessary. (ME-01b)

Once the pins are set on the lane, the drawbar carriage remains in the middle of the pinsetter.

☑ Check that the magnetic clutch used to lower the pins is functioning properly and that it has the correct clutch/disk spacing as shown in Appendix C of this manual. (ME-01a)

The drawbar does not move after a ball has been detected and after 7-8 seconds, the drawbar pushes the stoppers in position D1 (DOWN).

☑ The 90-volt bridge (part #E-214115) located in the power box may be defective. The green light on the power box must be ON, if it isn't, replace the 90-volt bridge.

If the 90-volt bridge is defective, there is a good chance that its Varistor is also defective.

☑ Check that the magnetic clutch used to raise the pins is functioning properly and that it has the correct clutch/disk spacing as shown in Appendix C of this manual. (ME-01a)

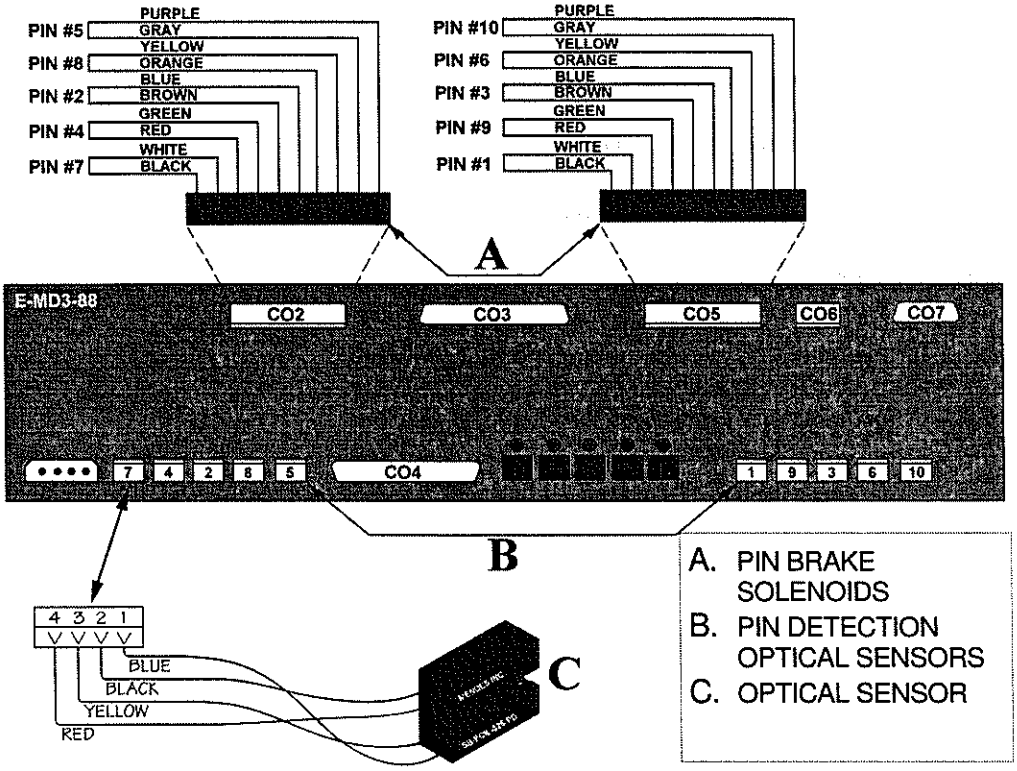
☑ If only one of the magnetic clutches does not engage, chances are that the problem may be its corresponding relay located inside the power box.

The chains emit a loud noise.

☑ Chains need to be adjusted. (ME-01d and ME-01e)

All fallen pins are re-spotted.

☑ The brake solenoids may be disconnected from the pin detector board (E-MD3-88). Push the connectors on the pin detector board to ensure a good contact.



A fallen pin is re-spotted.

☑ Check the pin's brake adjustment and make sure that the pin's string follows its proper route.

☑ The brake solenoid (part #9101070) or the brake cam spring (part #9105070) may be defective.

☑ The pin detector optical sensor may be disconnected from the pin detector board. Push the connector on the pin detector board to ensure a good contact.

☑ Check the pin detection assembly. The pin detection wheel must spin freely when its corresponding pin is hit. Lift the optical assembly with a finger and make sure that the pin detection wheel is free to turn.

☑ The optical sensor may be defective or obstructed with dust. Clean the optical sensor with pressurized air or replace it.

A pin kept up, slowly descends or suddenly falls to the lane.

☑ Check the pin's brake adjustment and make sure that the pin's string follows its proper route. (ME-05a and ME-04a)

One or more pins do not descend to their proper location (out of spot).

☑ Strings are too loose and should be adjusted correctly. (ME-04b)

The pins fall over when set on the lane.

☑ Check the pin pause adjustment. (ME-03c)

The pins hit the lane with a loud noise.

☑ Check the pin pause adjustment. (ME-03c)

Ball 1 and/or ball 2 signal lights do not turn on.

☑ Replace the ball 1/2 light bulb(s).

☑ Check the ball 1/2 cable assembly.

Appendix B: DIP Switch Functions & Parameters

The tables which follow describe the DIP switch functions.

The version in which the setting was introduced or changed is indicated in brackets following the description.

The shaded areas indicate the preset factory settings.

Switch functions for DS-101 on E-MD3-85

SW	Description	ON	OFF
1 2	These switches are not used and must be set to OFF. (*version 1.00*)		
3	Used to determine whether or not the jumping ball routine is activated. When the jumping ball routine is activated, the pinsetter's electronics verify if any pins have been knocked down at regular intervals instead of waiting for a signal from the ball detector. This option is used to counter a ball which bounces over the ball detector. (*version 2.40*)	Active	Not active
4	Used to determine the electrical phase which the pinsetters are running on. This switch is set at the factory and verified during the installation and should never be changed. (*version 2.30*)	60Hz	50Hz

Switch functions for DS-301 on E-MD3-85

SW	Description	ON	OFF
1 2 3 4	These dip switches are used to set the pin detector wheels' sensitivity. In order for the pinsetter to detect a pin as fell a specific quantity of holes located on the pin detector wheels must pass through its corresponding optical sensor. Fifteen (15) different settings are possible. The more sensitive the setting, the less number of holes are necessary to count a pin as fell. You usually won't have to change these dip switches, but if you do, refer to the settings below. The first setting indicates the most sensitive reading possible while the last setting indicates the least sensitive reading possible. *(version 1.00)*	see table below	

Pin detection sensitivity

SW1	SW2	SW3	SW4
OFF	ON	ON	ON
ON	OFF	ON	ON
OFF	OFF	ON	ON
ON	ON	OFF	ON
OFF	ON	OFF	ON
ON	OFF	OFF	ON
OFF	OFF	OFF	ON
ON	ON	ON	OFF
OFF	ON	ON	OFF
ON	OFF	ON	OFF
OFF	OFF	ON	OFF
ON	ON	OFF	OFF
OFF	ON	OFF	OFF
ON	OFF	OFF	OFF
OFF	OFF	OFF	OFF

Switch functions for DS-501 on E-MD3-85

SW	Description	ON	OFF
1 2	Used to determine the pause time which the pins will be held in the UP position during a normal pinsetter cycle. If this stabilizing pause time is too short, pins may not be stable when beginning their trip down. *(version 1.00)*	see table below	
3 4 5	Used to determine the reading pause time between the ball detection and pinsetter action. The shorter the pause, the quicker the pinsetter will be to re-spot pins (less time will be allotted for pins to fall which may cause erroneous pin fall detection). *(version 1.00)*	see table below	
6 7	Used to determine the drawbar pull time before activating the tangle routine. Once the Reading Pause Time has expired, the Pull Time enters into effect. If the pins are unable to attain the UP position after the Pull Time has expired, the untangle routine is activated. Once the pins are in the UP position, the Pull Time ends and the UP Pause Time begins. *(version 1.00)*	see table below	
8	Used to determine the maximum number of times the pinsetter will attempt to untangle strings once the pull time has expired. After the maximum number of attempts has expired, the pinsetter will place itself in idle mode and wait for manual assistance. *(version 3.00)*	5	10

Stabilizing pause time

Setting	SW1	SW2
1.75 seconds	OFF	OFF
1.50 seconds	ON	OFF
1.25 seconds	OFF	ON
1.00 second	ON	ON

Drawbar pull time

Setting	SW6	SW7
7.00 seconds	OFF	OFF
6.00 seconds	ON	OFF
5.00 seconds	OFF	ON
4.00 seconds	ON	ON

Reading pause time

Setting	SW3	SW4	SW5
3.75 seconds	OFF	OFF	OFF
3.50 seconds	ON	OFF	OFF
3.25 seconds	OFF	ON	OFF
3.00 seconds	ON	ON	OFF
2.75 seconds	OFF	OFF	ON
2.50 seconds	ON	OFF	ON
2.25 seconds	OFF	ON	ON
2.00 seconds	ON	ON	ON

Switch functions for DS-502 on E-MD3-85

SW	Description	ON	OFF
1 2	Used to determine the duration of the pulling time for each attempt at untangling the strings when the pinsetter is in its tangle routine. *(version 1.00)*	see table below	
3 4	Used to determine the duration of each pause between each attempt to untangle strings when the pinsetter is in its tangle mode. *(version 1.00)*	see table below	
5	Used to determine whether the untangle routine will use constant patterns and force at each attempt to untangle strings or will use different patterns and pull different strings with different strength at each attempt to untangle strings. *(version 1.00)*	Different	Constant
6	Used to determine the pinsetter's reaction when a gutter ball is thrown. *(version 1.09)*	Cycles	Does not cycle
7	Used to determine the number of pins which are installed on the pinsetter. *(version 1.09)*	5	10
8	Used to determine the master device which controls the pinsetters. *(version 2.20)*	Pin Selector	Scoring or Bowlingo

Untangle routine pulling time

Setting	SW1	SW2
5 seconds	OFF	OFF
4 seconds	ON	OFF
3 seconds	OFF	ON
2 seconds	ON	ON

Untangle routine pause delay

Setting	SW3	SW4
1.25 seconds	OFF	OFF
1.00 second	ON	OFF
0.75 seconds	OFF	ON
0.50 seconds	ON	ON

Switch functions for DS-401 on E-MD3-93

SW	Description	ON	OFF
1 2	Used to determine the minimum number of pins which must be knocked down with the player's first ball in order for the electronics to attribute a strike. *(version 1.00)*	see table below	
3 4	Used to determine the time delay between games, meaning that the next game will not start until the selected time period has expired. *(version 1.00)*	see table below	
5 6	Used to determine penalties, if any, to be attributed on either balls thrown before the STOP display has disappeared or too many balls thrown (more than one) on the same throw. The penalty results in the loss of the score obtained with the throw. *(version 1.03)*	see table below	
7 8	Used to determine different pre-configured player interface options. *(version 1.00)*	see table below	

Strike (no-tap)

Setting	SW1	SW2
10 pins	OFF	OFF
9 pins	ON	OFF
8 pins	OFF	ON
7 pins	ON	ON

Time delay between games

SW3	SW4	Setting
OFF	OFF	5 seconds
ON	OFF	10 seconds
OFF	ON	15 seconds
ON	ON	20 seconds

Penalties

Setting	SW5	SW6
None	OFF	OFF
Early ball	ON	OFF
Too many balls	OFF	ON
Both	ON	ON

Interfaces

SW7	SW8	Setting
OFF	OFF	None
ON	OFF	Keyboard
OFF	ON	Start button
ON	ON	CAPCOM

Switch functions for DS-402 on E-MD3-93

SW	Description	ON	OFF
1	Used to determine how DS-403-7 and 8 will dispense coupons. *(version 1.09)*	Strikes	Spares
2 3	Used to determine the number of frames bowled by each player when it is his or her turn to bowl. These switches are also used to determine whether players take turns beginning with an even or odd numbered frame. *(version 1.00)*	see table below	
4 5 6 7 8	Depending on the Game Control that is in effect (Game or Time determined with DS-404-7) these switches have different uses. In Game mode, the settings determine the time that is used to close the lane after a period of inactivity (no ball thrown or detected). In Time mode the settings determine the actual time that is allotted for each credit. (refer to DS-405-1, 2, 3 and 4 for credit values) All values are specified in seconds. *(version 1.00)*	see table below	

Number of frames

Setting	SW2	SW3
1	OFF	OFF
2 (even)	ON	OFF
2 (odd)	OFF	ON
Reserved	ON	ON

Number of seconds

GAME	TIME	SW4	SW5	SW6	SW7	SW8	GAME	TIME	SW4	SW5	SW6	SW7	SW8
120	180	OFF	OFF	OFF	OFF	OFF	600	660	OFF	OFF	OFF	OFF	ON
150	210	ON	OFF	OFF	OFF	OFF	630	690	ON	OFF	OFF	OFF	ON
180	240	OFF	ON	OFF	OFF	OFF	660	720	OFF	ON	OFF	OFF	ON
210	270	ON	ON	OFF	OFF	OFF	690	750	ON	ON	OFF	OFF	ON
240	300	OFF	OFF	ON	OFF	OFF	720	780	OFF	OFF	ON	OFF	ON
270	330	ON	OFF	ON	OFF	OFF	750	810	ON	OFF	ON	OFF	ON
300	360	OFF	ON	ON	OFF	OFF	780	840	OFF	ON	ON	OFF	ON
330	390	ON	ON	ON	OFF	OFF	810	870	ON	ON	ON	OFF	ON
360	420	OFF	OFF	OFF	ON	OFF	840	900	OFF	OFF	OFF	ON	ON
390	450	ON	OFF	OFF	ON	OFF	870	930	ON	OFF	OFF	ON	ON
420	480	OFF	ON	OFF	ON	OFF	900	960	OFF	ON	OFF	ON	ON
450	510	ON	ON	OFF	ON	OFF	930	990	ON	ON	OFF	ON	ON
480	540	OFF	OFF	ON	ON	OFF	960	1020	OFF	OFF	ON	ON	ON
510	570	ON	OFF	ON	ON	OFF	990	1050	ON	OFF	ON	ON	ON
540	600	OFF	ON	ON	ON	OFF	1020	1080	OFF	ON	ON	ON	ON
570	630	ON	ON	ON	ON	OFF	1050	2010	ON	ON	ON	ON	ON

Switch functions for DS-403 on E-MD3-93

SW	Description	ON	OFF
1 2 3	Used to determine the score(s) at which a coupon is dispensed for each individual game (if you have the coupon dispenser installed). If no coupon dispenser is installed set all of these switches to OFF. If a coupon dispenser is installed, first set DS-404-5 accordingly. *(version 1.10)*	see table below	
4 5 6	Used to determine the number of coupons that are dispensed for strikes during each individual game. Again this feature is only available if you have a coupon dispenser installed. If no coupon dispenser is installed set all of these switches to OFF. *(version 1.00)*	see table below	
7 8	Used to determine the number of coupons that are dispensed for spares or consecutive strikes during each individual game (depending on how DS-402-1 is set). Again this feature is only available if you have a coupon dispenser installed. If no coupon dispenser is installed set both of these switches to OFF. *(version 1.09)*	see table below	

Coupon scores

Settings with DS-404-5 set to OFF
(1 coupon is dispensed only once and only if the player attains the score indicated)

Setting	SW1	SW2	SW3
Never	OFF	OFF	OFF
50	ON	OFF	OFF
75	OFF	ON	OFF
100	ON	ON	OFF
125	OFF	OFF	ON
150	ON	OFF	ON
175	OFF	ON	ON
200	ON	ON	ON

Settings with DS-404-5 set to ON
(1 coupon is dispensed each time the player's score increments by the value indicated)

SW1	SW2	SW3	Setting
OFF	OFF	OFF	Never
ON	OFF	OFF	10
OFF	ON	OFF	15
ON	ON	OFF	20
OFF	OFF	ON	25
ON	OFF	ON	30
OFF	ON	ON	40
ON	ON	ON	50

Strike coupons

Setting	SW4	SW5	SW6
Never	OFF	OFF	OFF
1 coupon for every 3 strikes.	ON	OFF	OFF
1 coupon for every 2 strikes.	OFF	ON	OFF
1 coupon for each strike.	ON	ON	OFF
2 coupons for each strike.	OFF	OFF	ON
3 coupons for each strike.	ON	OFF	ON
4 coupons for each strike.	OFF	ON	ON
1 coupon for the first strike, 2 coupons for the second strike, 3 coupons for the third strike, ... 12 coupons for the twelfth strike.	ON	ON	ON

Spare and consecutive strikes coupons

Settings with DS-402-1 set to OFF (spares)

Setting	SW7	SW8
Never.	OFF	OFF
1 coupon for every 3 spares.	ON	OFF
1 coupon for every 2 spares.	OFF	ON
1 coupon for each spare.	ON	ON

Settings with DS-402-1 set to ON (consecutive strikes)

SW7	SW8	Setting
OFF	OFF	Never.
ON	OFF	1 coupon for 8 and 9 consecutive strikes.
OFF	ON	1 coupon for 10, 11 and 12 consecutive strikes.
ON	ON	1 coupon for 8, 9, 10, 11 and 12 consecutive strikes.

Switch functions for DS-404 on E-MD3-93

SW	Description	ON	OFF
1	This switch is no longer used and must be set to OFF. (*North American Market version 1.09*) **or** Used to determine whether a coupon dispenser or a rate selector is connected to CN703 (lane 1) and CN704 (lane 2). (*World Market version 1.13*)	Rate selector	Coupon dispenser
2	This switch is no longer used and must be set to OFF. (*version 1.09*)		
3	Used to determine whether or not coin mechanism B will count coins. This switch is commonly called the service switch since it is possible to verify the machine's functions without having the counter increment. (*version 1.09*)	Does not count coins	Counts coins
4	Used to determine whether or not the pair of lanes is equipped with the High Score Module display option. (*version 1.09*)	Best Score	None
5	Used to determine the method used by DS-403-1, 2 and 3 to dispense coupons for high scores. (*version 1.09*)	Increment	Fixed score
6	Used to determine which of the 2 types of play to be used. The Bowling type follows exactly the same rules as conventional bowling, that is 2 balls per frame. The second type of play, Arcade type, allows only one ball per frame, its main advantage is that it makes the games much shorter. (*version 1.00*)	Arcade	Bowling
7	Used to determine the value of credits. This switch is used in conjunction with DS-405-1, 2, 3, 4, 5, 6, 7 and 8 if set to OFF and in conjunction with DS-402-4, 5, 6, 7 and 8 if set to ON. (*version 1.00*)	Time	Game
8	Used to determine how credits are used in conjunction with play and players. Regardless of how this switch is set, once the maximum number of player's is attained (4), credits will simply accumulate until the end of the current game. **System 1:** If 2 frames or less have been played, a new credit will add a new bowler. If more than 2 frames have been played, credits will accumulate until the end of the game. **System 2:** A new credit will always add a new player. (*version 1.09*)	System 1	System 2

Switch functions for DS-405 on E-MD3-93 (North American Market)

SW	Description	ON	OFF
1 2 3 4	Used to determine the relationship of coins and credits through coin mechanism A. Refer to DS-404-7 to establish the value of a credit (Game or Time). *(version 1.13)*	see table below	
5 6 7 8	Used to determine the relationship of coins and credits through coin mechanism B. Refer to DS-404-7 to establish the value of a credit (Game or Time). *(version 1.13)*	see table below	

Coin mechanism A

Setting	SW1	SW2	SW3	SW4
1 coin = 4 credits	OFF	OFF	OFF	OFF
1 coin = 3 credits	ON	OFF	OFF	OFF
1 coin = 2 credits	OFF	ON	OFF	OFF
1 coin = 1 credit	ON	ON	OFF	OFF
2 coins = 1 credit	OFF	OFF	ON	OFF
3 coins = 1 credit	ON	OFF	ON	OFF
4 coins = 1 credit	OFF	ON	ON	OFF
5 coins = 1 credit	ON	ON	ON	OFF
6 coins = 1 credit	OFF	OFF	OFF	ON
8 coins = 1 credit	ON	OFF	OFF	ON
10 coins = 1 credit	OFF	ON	OFF	ON
12 coins = 1 credit	ON	ON	OFF	ON
14 coins = 1 credit	OFF	OFF	ON	ON
16 coins = 1 credit	ON	OFF	ON	ON
20 coins = 1 credit	OFF	ON	ON	ON
24 coins = 1 credit	ON	ON	ON	ON

Coin mechanism B

Setting	SW5	SW6	SW7	SW8
1 coin = 4 credits	OFF	OFF	OFF	OFF
1 coin = 3 credits	ON	OFF	OFF	OFF
1 coin = 2 credits	OFF	ON	OFF	OFF
1 coin = 1 credit	ON	ON	OFF	OFF
2 coins = 1 credit	OFF	OFF	ON	OFF
3 coins = 1 credit	ON	OFF	ON	OFF
4 coins = 1 credit	OFF	ON	ON	OFF
5 coins = 1 credit	ON	ON	ON	OFF
6 coins = 1 credit	OFF	OFF	OFF	ON
8 coins = 1 credit	ON	OFF	OFF	ON
10 coins = 1 credit	OFF	ON	OFF	ON
12 coins = 1 credit	ON	ON	OFF	ON
14 coins = 1 credit	OFF	OFF	ON	ON
16 coins = 1 credit	ON	OFF	ON	ON
20 coins = 1 credit	OFF	ON	ON	ON
24 coins = 1 credit	ON	ON	ON	ON

Switch functions for DS-405 on E-MD3-93 (World Market)

SW	Description	ON	OFF
1 2 3 4	Used to determine the relationship of coins, units and credits through coin mechanisms A and B. Refer to DS-404-7 to establish the value of a credit (Game or Time). Refer to DS405-8 to establish coin and unit values. *(version 1.13)*	see table below	
5 6 7	These switches are no longer used and must be set to OFF. *(version 1.13)*		
8	Used to determine the value of units attributed by the coin mechanisms. *(version 1.13)*	A = 100 B = 25	A = 100 B = 50

Coins and credits

Setting	SW1	SW2	SW3	SW4
1 coin = 1 credit	OFF	OFF	OFF	OFF
2 coins = 1 credit	ON	OFF	OFF	OFF
50 units = 1 credit	OFF	ON	OFF	OFF
75 units = 1 credit	ON	ON	OFF	OFF
100 units = 1 credit	OFF	OFF	ON	OFF
125 units = 1 credit	ON	OFF	ON	OFF
150 units = 1 credit	OFF	ON	ON	OFF
175 units = 1 credit	ON	ON	ON	OFF
200 units = 1 credit	OFF	OFF	OFF	ON
225 units = 1 credit	ON	OFF	OFF	ON
250 units = 1 credit	OFF	ON	OFF	ON
275 units = 1 credit	ON	ON	OFF	ON
300 units = 1 credit	OFF	OFF	ON	ON
325 units = 1 credit	ON	OFF	ON	ON
350 units = 1 credit	OFF	ON	ON	ON
375 units = 1 credit	ON	ON	ON	ON

High Score Module Parameters

ID	Description	Setting range or values	Default
1	*Time mode*	0012 (12-hour clock) 0024 (24 hour clock)	0024
2	*Set Time (Hour)* Depending on how Parameter **1** is set, this parameter has two different ranges.	0001 - 0012 (12 hour mode) 0000 - 0023 (24-hour mode)	0000
3	*AM / PM mode* (only if Parameter **1** is set to 12-hour mode)	000A (AM mode) 000P (PM mode)	
4	*Set Time (Minutes)*	0000 - 0059	0000
5	*Set Time (Seconds)*	0000 - 0059	0000
6	*Set Day of Week*	0001 - 0007 (Sunday = 1)	0001
7	*Set Year*	0000 - 9999	1994
8	*Set Month*	0001 - 0012 (January = 1)	0001
9	*Set Calendar Date*	0001 - 0031	0001
A	*Type of Best Score TWO* (bottom score on display unit)	0000 (best score of the day) 0001 (best score of the week) 0002 (best score of the month)	0000
b	*Reset Scores* Used to determine at what moment in time the Best Score TWO will be reset to its default value. Depending on how Parameters **1** and **A** are set, this parameter has four different ranges.	0001 - 0012 (12 hour mode, best score of the day) 0000 - 0023 (24-hour mode, best score of the day) 0001 - 0007 (best score of the week) 0001 - 0031 (best score of the month)	0000
C	*Reset Scores (AM / PM mode)* Only if Parameter 1 is set to 12-hour mode.	000A (AM mode) 000P (PM mode)	
d	*Best Score Type ONE* (top score on display unit) for even numbered lane	0000 - 0300	0075
E	*Best Score Type TWO* (bottom score on display unit) for even numbered lane	0000 - 0300	0075
F	*Best Score Type ONE* (top score on display unit) for odd numbered lane	0000 - 0300	0075
h	*Best Score Type TWO* (bottom score on display unit) for odd numbered lane	0000 - 0300	0075

Parameters **d**, **E**, **F**, and **h** are used to manually input high scores which will be displayed. These settings are useful when replacing High Score Modules after repairs.

Appendix C: Adjustment Procedures

ME-90 pinsetter positions

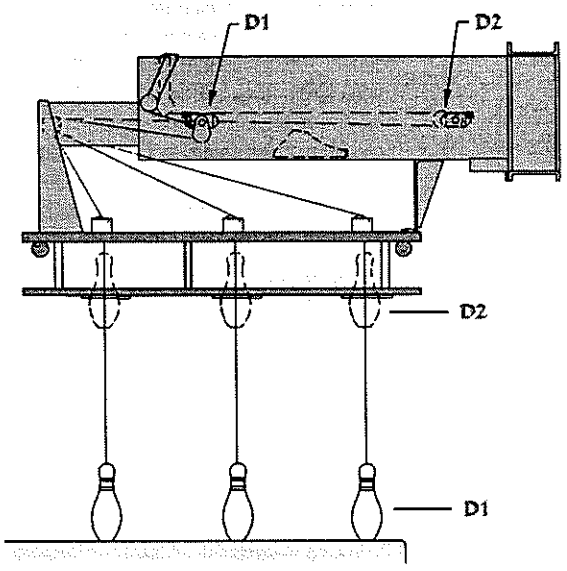
Illustrated in the diagram below are the two (2) pinsetter positions which are referred to in this appendix as D1 and D2.

Before making any mechanical adjustments, the following steps must be carried out.

1) Press the FS1 button on the pin detection assembly so as to have the pinsetter perform a complete cycle;

2) Make sure the strings are all properly aligned in their sheaves;

3) If the drawbar cannot reach the D2 position, proceed with the strings adjustment before attempting any other adjustments;



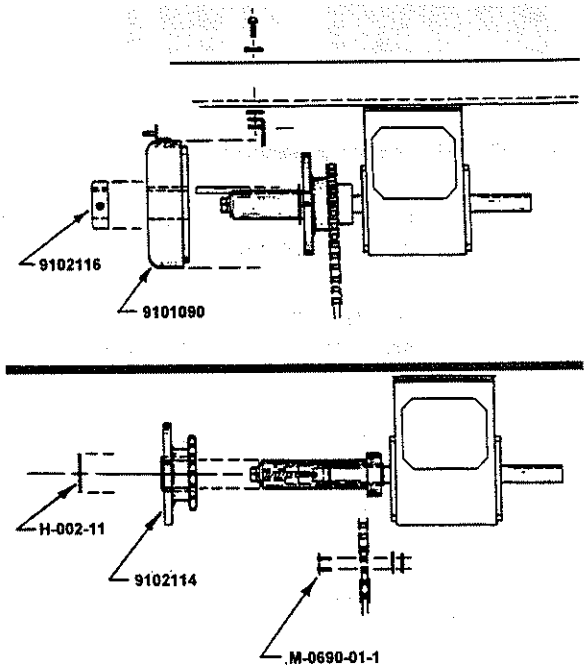
4) Ensure that the optical sensors (LS, PB, PO and PD) are free of dust and well aligned with their partners. The actuators must pass freely inside the optical sensors in order for them to function normally.

Ball detector adjustment

Adjustment number MA-11b (monthly): 1) Loosen the screws which hold the ball detector transmitter assembly (SB-1500-31-BW) in place; 2) Move the detector assembly up, down, right or left until the green LED appears on the ball detector; 3) Re-tighten the screws.

Drive train adjustments

Magnetic clutches



Adjustment number ME-01a (quarterly): Cleaning and lubrication of the magnetic clutches must be performed on a quarterly basis (every three months). To do this, the assembly should be removed from the pinsetter and cleaned. (Open the main circuit breaker located on the gray power box situated between the two pinsetters prior to working on the pinsetter.) The components should be cleaned with a solvent such as a paint thinner. The components should then be dried using a towel. The shaft of the machine where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

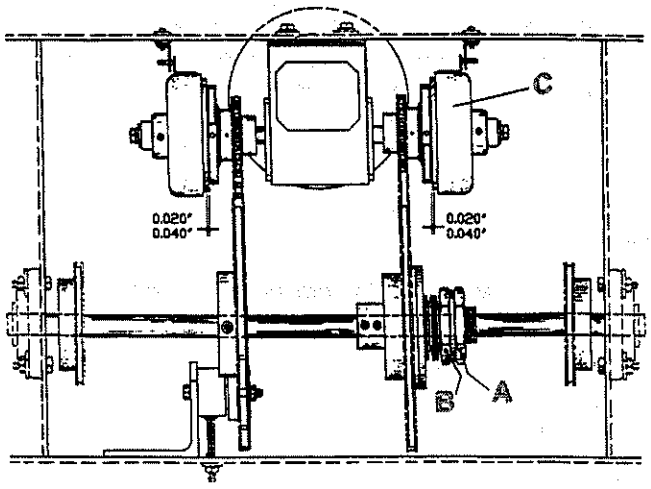
Prior to re-assembly, lightly lubricate the shaft with an anti-seize lubricant such as Loctite Anti-Seize Brush Type No. 76764, and make sure that the clutch components travel freely on the shaft. Do not apply too much lubricant so as to have it overflow from the shaft to the components' outer surfaces. The clutch's facing must never be lubricated. A lubricant is available from Mendes and its affiliated distributors under part number Z-76764.

Following re-assembly of the clutch assembly, close the main circuit breaker located on the gray power box situated between the two pinsetters and then cycle the pinsetter 3-4 times so as to ensure that the clutch makes good contact with the disk. Verify and adjust the torque if necessary.

Cleaning and lubrication of the magnetic clutch assembly is critical for proper performance. Failure to have a clean, well lubricated clutch will result in unnecessary problems.

When re-assembling the clutch, make sure to line up the clutch with its locking mechanism.

Ascending torque adjustment



Adjustment number ME-01b (weekly)

1) Open the main circuit breaker located on the gray power box situated between the two pinsetters.

2) Place and hold the torque gauge (Z-ME90) on the inner left wall at the rear of the pinsetter.

3) Close the main circuit breaker and press the start button on the power box.

4) Raise the front gray plastic cover of the pinsetter and press the Power On button. Once the pinsetter is activated and exerts pressure on the torque gauge, take your reading. The torque reading should be between 200 and 300. If it is, proceed to step 11. If the torque needs adjusting, continue.

5) Open the main circuit breaker located on the gray power box situated between the two pinsetters in order to completely disengage the magnetic clutch (C).

6) Raise the pinsetter's back cover. Check the clutch's empty space as indicated. The clutch must be completely disengaged in order to work efficiently.

7) Place a block of wood under the drive cog in order to prevent slipping and then loosen the 2-inch outer lock nut (A).

8) Using the 2" open face key (Z-ME90-10), turn the 2-inch inner adjustment nut (B) clockwise (forward) to increase the torque, or counter-clockwise (backward) to decrease the torque.

9) After each adjustment, re-check the torque as previously described before re-tightening the 2-inch outer lock nut.

10) After tightening the 2-inch outer lock nut, check the torque again.

11) Power OFF the pinsetter.

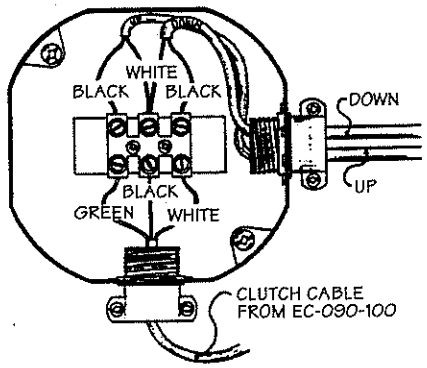
Descending torque adjustment

Adjustment number ME-01c (as required): As you may well imagine, the descending torque cannot be adjusted in the same manner as the ascending torque. On the descending torque, the friction between the clutch and the clutch sprocket is calibrated so the drawbar has sufficient torque to return to the D-1 position. To increase the lowering torque, the friction between the clutch and the contact plate must be increased. To increase the friction, follow these steps:

1) Open the main circuit breaker located on the gray power box situated between the two pinsetters.

2) Remove the clutch. Clean it using the procedure explained in adjustment ME-01a.

3) Open the clutch electrical junction box which is located above the reducer and invert the white and green cable connections of the right clutch and the left clutch.



4) Close the main circuit breaker and press the start button on the power box.

5) Press the FS1 and PS1 buttons together in order to activate the string extension function. Since the two clutches have been inverted, the drawbar will stay in its D1 position and the lowering clutch will slide on its contact plate.

6) Repeat the string extension function 8 to 10 times.

7) Open the main circuit breaker located on the gray power box situated between the two pinsetters.

8) Replace the white and green wires to their original position.

9) Clean the descending clutch once again.

10) Place and hold the torque gauge (Z-ME90) on the inner left wall at the front of the pinsetter.

11) Close the main circuit breaker and press the start button on the power box.

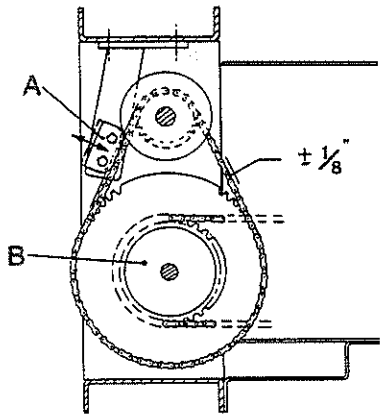
12) Raise the front gray plastic cover of the pinsetter and press the Power On button. Once the pinsetter is activated and exerts pressure on the torque gauge, take your reading. The torque reading should be between 115 and 135.

13) Open the main circuit breaker located on the gray power box situated between the two pinsetters in order to completely disengage the magnetic clutch.

14) If the torque's reading coincides with step 12, all is well. If the torque's reading doesn't coincide with step 12, repeat this complete procedure until it does.

If you replace a clutch or a contact plate, you must follow this procedure prior to using the pinsetter for normal play.

Ascending chain adjustment



Adjustment number ME-01d (monthly): The ascending chain, must not be tightened to extreme. The mechanism must have some slack to it in order to extend the life of the pinsetter. Oil the chain with a very small quantity of SW10 motor oil only when absolutely needed. Remove all excess oil and grease from the chain and surrounding area on a weekly basis. Care must be taken to remove all excess oil from the gear and near the friction disk (this disk must never be oiled). The chain's tension should be verified and adjusted on a monthly basis as indicated below.

1) Open the main circuit breaker located on the gray power box situated between the two pinsetters.

2) Raise the back cover of the pinsetter.

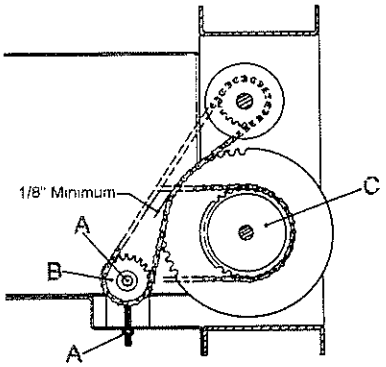
3) Check the chain tension by manually rotating the main sprocket (B). There should be a 1/8-inch (3mm) play at the tightest spot of a 360° rotation.

4) If adjustment is necessary, loosen the nuts on the tension plate (A) and slide back or forward until correct tension is obtained.

5) Re-tighten the nuts on the tension plate prior to closing the back cover.

Descending chain adjustment

Adjustment number ME-01e (monthly): The descending chain, as the ascending chain, must not be tightened to extreme. The mechanism must have some slack to it in order to extend the life of the pinsetter. Oil the chain with a very small quantity of SW10 motor oil only when absolutely needed. Remove all excess oil and grease from the chain and surrounding area on a weekly basis. Care must be taken to remove all excess oil from the gear and near the friction disk (this disk must never be oiled). The chain's tension should be verified and adjusted on a monthly basis as indicated below.



1) Open the main circuit breaker located on the gray power box situated between the two pinsetters.

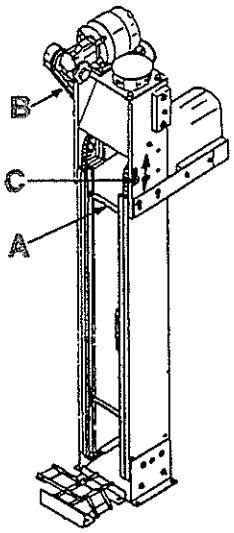
2) Raise the back cover of the pinsetter.

3) Check the chain tension by manually rotating the main sprocket (C). There should be a 1/8-inch (3mm) play at the tightest spot of a 360° rotation.

4) If adjustment is necessary, move the chain binder sprocket (B) using the adjustment nuts (A).

5) Re-tighten the binder nuts prior to closing the back cover.

Rear ball lift adjustment

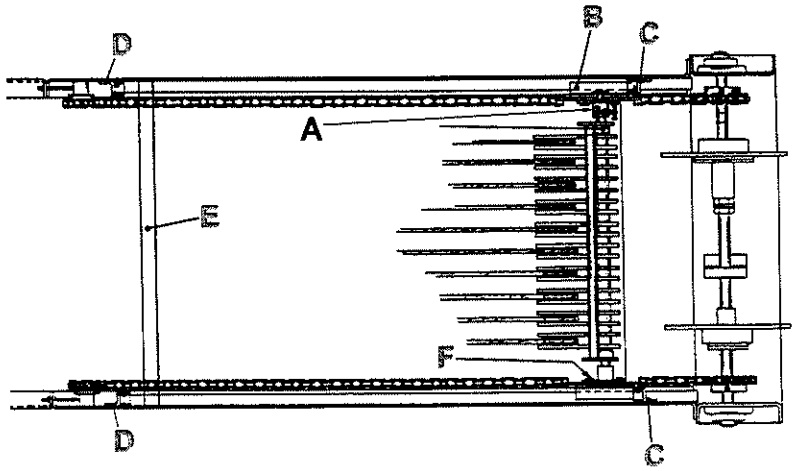


Adjustment number ME-02a (monthly): The rear ball lift's belt tension must be adjusted so that the bars (A) which lift the balls reach 10lbs (4.6kg) of pulling pressure. You must be able to stop the mechanism easily by applying simple hand pressure on any one of the bars. The belt's tension should be verified and adjusted on a monthly basis as indicated below.

1) Loosen the sprocket (C).
2) Set the tension with the adjustment bolt (B).
3) Re-tighten the sprocket.

Drawbar adjustments

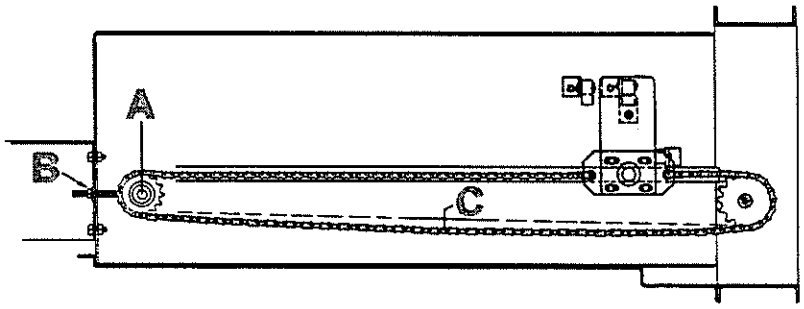
Drawbar alignment



Adjustment number ME-03a (monthly): The drawbar must be kept perpendicular to the frame and parallel to the crossing bar and drive train in order to pull and set the pins evenly. The drawbar's alignment should be verified and adjusted on a monthly basis as indicated below.

1) Make sure that the drawbar is in its D2 (UP) position.
2) Open the main circuit breaker located on the gray power box situated between the two pinsetters.
3) Center the drawbar on its carriage (B) using the set screws located on the drawbar (A).
4) Position the drawbar parallel to the crossing bar (E) using the bolts which attach the drawbar to the carriage (F).
5) Adjust the front (D) and rear (C) stoppers on both sides of the pinsetter so they come into contact at the same time with the carriage. Manually pull the drawbar back and forth to perform this adjustment.

Drawbar chain adjustment



Adjustment number ME-03b (monthly): The drawbar chain, must not be tightened to extreme. The mechanism must have some slack to it in order to extend the life of the pinsetter. Oil the chain with a very small quantity of SW10 motor oil only when absolutely needed. Remove all excess oil and grease from the chain and surrounding area on a weekly basis. The chain's tension should be verified and adjusted on a monthly basis as indicated below.

1) Make sure that the drawbar is in the D2 (UP) position.

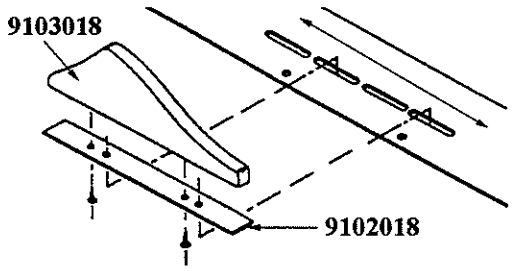
2) Open the main circuit breaker located on the gray power box situated between the two pinsetters.

3) Visually check for a 1/4-inch (6mm) dip in the middle of the chain (C).

4) If adjustment is necessary, loosen the sprocket's nut (A) and adjust as necessary using the front end adjustment nut (B).

5) Re-tighten the sprocket's nut (A).

Pin pause adjustment



Adjustment number ME-03c (quarterly): The pin pause is controlled through the cam (9103018) which is located on the main frame bottom plate. This cam slows the drawbar down on its way to the front of the pinsetter, allowing a pause which ensures that the pins are spotted gently onto the lane. If the pause occurs too early or too late, the pins will not be spotted correctly. To adjust the pause action, simply loosen the screws which hold the cam adjustment plate (9102018) in place and then proceed with the required movement of the cam as indicated below.

- Slide the cam to the rear if there is little or no pause;
- Slide the cam to the front if the pause occurs too early.

Strings and bushings adjustments

Checking strings and bushings

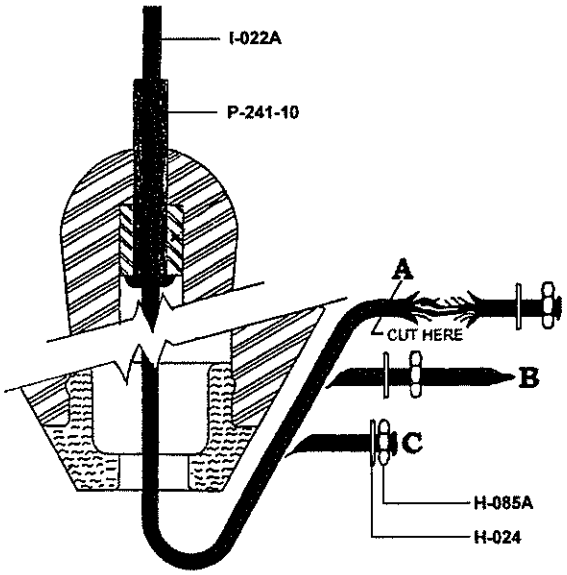
Pin strings should be inspected daily and if showing evidence of wear, they should be shortened and refastened and the string tension readjusted to compensate for the shortened string. If a proper program of string maintenance and inspection is set up, you will never experience a broken string during normal play. Put very simply, there is no excuse for strings breaking in play other than careless string maintenance.

1) Raise the front gray plastic cover of the pinsetter and press the Power On button. The pinsetter will start up and set the pins on the lane.

2) Open the circuit breaker located on the power box between the two pinsetters.

3) Look for visual signs of wear on strings and pin head bushings.

4) Any strings which are frayed or worn should be repaired or replaced.



Adjustment number ME-04a
(daily):

A) Slide the string down through the pin and cut the worn out section.

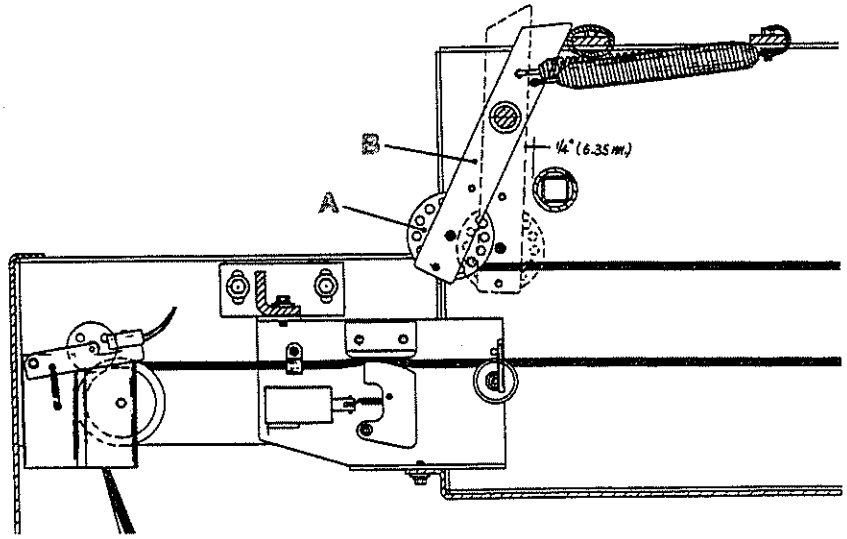
B) Burn the string tip using a match or cigarette lighter. Use a rotating motion with a rag to create a point on the string. Replace the pin head bushing if necessary. Place a new washer and crimp a new nylock nut on the string. Use the swaging tool (Z-001) supplied with your spare parts kit to crimp the nut on the string.

C) Cut the end of the string ¼-inch (6mm) from the crimped nut. Burn the string tip to shape a lump under the nut. Slide the pin along the string and check that it turns freely.

5) Once the repairs have been finished, close the circuit breaker on the power box and press the start button.

6) Proceed with the strings adjustment procedure.

Strings adjustment



Adjustment number ME-04b (daily):

1) Raise the front gray plastic cover of the pinsetter and press the Power On button. The pinsetter will start up and set the pins on the lane.

2) Press the FS1 and PS1 buttons together. The drawbar will move to the rear of the pinsetter (position D2). The drawbar should go back to the stop pad and past the LS optical sensor. If it doesn't, the strings are too taut.

3) Adjust the strings by loosening and/or tightening the reel and storage assemblies (A) so as to have them all aligned 1/4" from the bar as indicated by the dotted line. To release the spool in order to loosen or tighten the strings, pull the spool away from its corresponding mounting arm (B).

Untangling pin strings

Adjustment number ME-04c (as required): If pin strings tangle, the pinsetter will attempt to untangle them according to the settings established through the lane controller's DIP switch banks. If strings are knotted, they will have to be untangled manually. Use the following steps to perform such an operation.

1) Raise the masking unit and enter beneath it to the front of the pinsetter.

2) Lift the gray plastic cover at the front of the pinsetter and press the AUX button until the pins fall to the lane. The pinsetter is now in its idle mode.

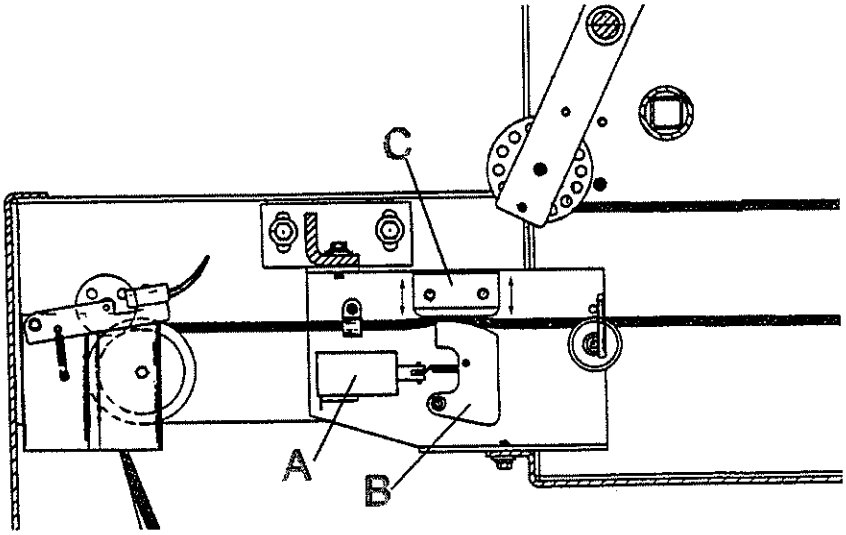
3) Untangle the strings by hand.

4) Press the AUX button again until the pinsetter begins its raising operation.

5) Close the gray plastic cover on front of the pinsetter. The pins which were still in play will be re-spotted.

6) Leave the pinsetter area and lower the masking unit to its normal position.

Pin brakes adjustment



Adjustment number ME-05a (weekly): Pin brakes should be inspected weekly and if necessary, adjusted. The solenoid (A) pulls the cam (B) which jams the string on the brake plate (C). If a pin is lowered to the lane when it should stay up or if a pin stays up when it should be lowered to the lane, the pin brakes need adjusting. Follow the procedures below to adjust your pin brakes.

1) Raise the front gray plastic cover of the pinsetter and press the Power On button. The pinsetter will start up and set the pins on the lane.

2) Press the PS1 and AUX buttons together. The drawbar will move to the rear of the pinsetter (position D2) and each pin brake will be activated.

3) The brake plate may be moved in the direction shown by the arrows in order to adjust it. Slightly loosen the bolts which hold the brake plate in place and then raise the brake plate to loosen the pin's string or lower the brake plate to tighten the pin's string.

4) Press the FS1 button to reestablish normal functions.

Mendes Inc.

MACHINES #_____THRU #_____ | MACHINES #_____THRU #_____ | MACHINES #_____THRU #_____ | MACHINES #_____THRU #_____

PREVENTIVE MAINTENANCE WORK SCHEDULE
BOWLINGO MACHINES

FOUR WEEK PERIOD ENDING _____

	ASSIGN TO	DAILY SERVICE (ALL MACHINES DAILY)
ADJUSTMENTS		S M T W T F S S M T W T F S S M T W T F S S M T W T F S
CHECK STOP SHEETS		
CHECK STRINGS AND BUSHINGS ME-04a		
ADJUST PIN STRINGS ME-04b		
CLEANING		
CLEAN ALL LANE SURFACES		
CONDITION ALL LANE SURFACES		
		WEEKLY SERVICE (1/4 OF MACHINES PER 2 DAYS)
CLEANING		S M T W T F S S M T W T F S S M T W T F S S M T W T F S
ALL OPTICAL SENSORS (COMPRESSED AIR)		
ALL PIN DETECTOR WHEELS (COMPRESSED AIR)		
REMOVE EXCESS OIL & GREASE FROM CHAINS		
REMOVE DUST FROM STABILIZERS		
PIT AREA (VACUUM)		
REAR BALL LIFT AREA (VACUUM)		
BALL DETECTORS & REFLECTORS (WIPE)		
FRONT BALL RACK & BOWLING BALLS (WIPE)		
WORK AREA (BENCH, ROOM AISLE)		
ADJUSTMENTS		
ASCENDING TORQUE ADJUSTMENT ME-01b		
PIN BRAKES ADJUSTMENT ME-05a		
		MONTHLY SERVICE (1/4 OF MACHINES PER WEEK)
ADJUSTMENTS		S M T W T F S S M T W T F S S M T W T F S S M T W T F S
BALL DETECTOR ADJUSTMENT MA-11b		
ASCENDING CHAIN ADJUSTMENT ME-01d		
DESCENDING CHAIN ADJUSTMENT ME-01e		
DRAWBAR ALIGNMENT ADJUSTMENT ME-03a		
DRAWBAR CHAIN ADJUSTMENT ME-03b		
REAR BALL LIFT ADJUSTMENT ME-02a		
LUBRICATION		
CHECK OIL LEVEL IN MOTOR REDUCERS		
		QUARTERLY SERVICE (1/3 OF MACHINES PER MONTH)
MACHINE NUMBER		
TIGHTEN ALL BOLTS & SCREWS		
TIGHTEN VIBRO INSULATORS		
TIGHTEN BASE PLATE SPACER BOLTS		
ADJUSTMENTS		
PIN PAUSE ADJUSTMENT ME-03c		
LUBRICATION		
CLEAN & LUBRICATE MAGNETIC CLUTCHES ME-01a		
OIL ALL CHAINS IF NECESSARY		
OIL ALL PULLEYS IF NECESSARY		
		ANNUAL SERVICE (1/12 OF MACHINES PER MONTH)
PINSETTER NUMBER		
LUBRICATION		
GREASE THE PILLOW BLOCKS		
INSPECT & CORRECT		
WELDED ASSEMBLIES		
PIVOT AND WEAR POINTS		

REMARKS:

bowlingo™

HEAD MECHANIC'S SIGNATURE

PROPRIETOR'S SIGNATURE

bowlingo™

Appendix D: Parts Listings

Manufacturer's recommendations:

Always use original bowlingo™ parts with your equipment.

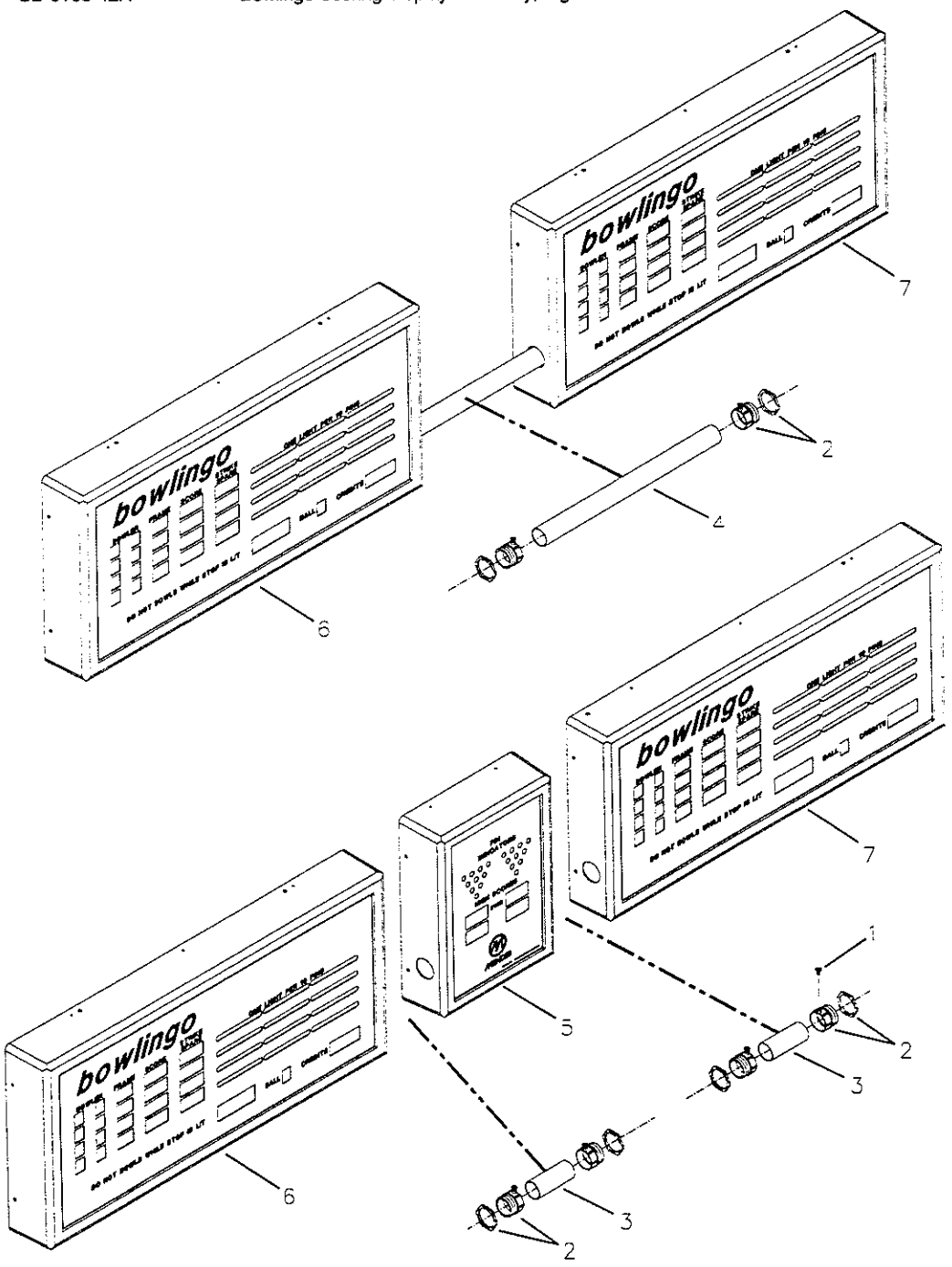
The detailed parts listings in this appendix make it easy to locate parts for re-ordering. Always order spare parts by part number and description, not by index and page numbers because this information is subject to change.

Always supply your equipment serial number when placing an order.

Contents

Scoring display unit components

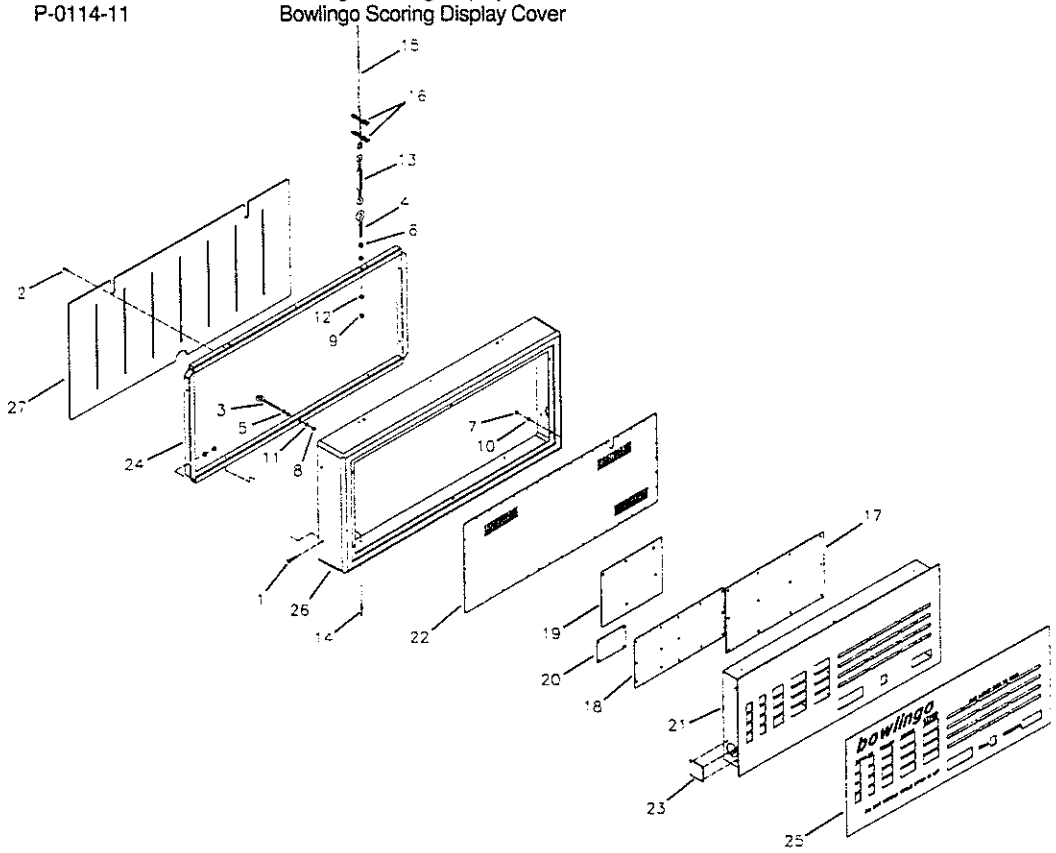
INDEX	PART NUMBER	DESCRIPTION	
1	7016-412520-050	Round Socket Head Machine Screw	1/4"-20 x 1/2"
2	M-0108-008	Collar	
3	M-0108-009	Pipe	
4	M-0108-12	Pipe	
5	SB-0108-005	Bowlingo High Score Module Assembly	
6	SB-0108-42L	Bowlingo Scoring Display Assembly, Left	
7	SB-0108-42R	Bowlingo Scoring Display Assembly, Right	



Left scoring display unit

Sub assembly number SB-0108-42L

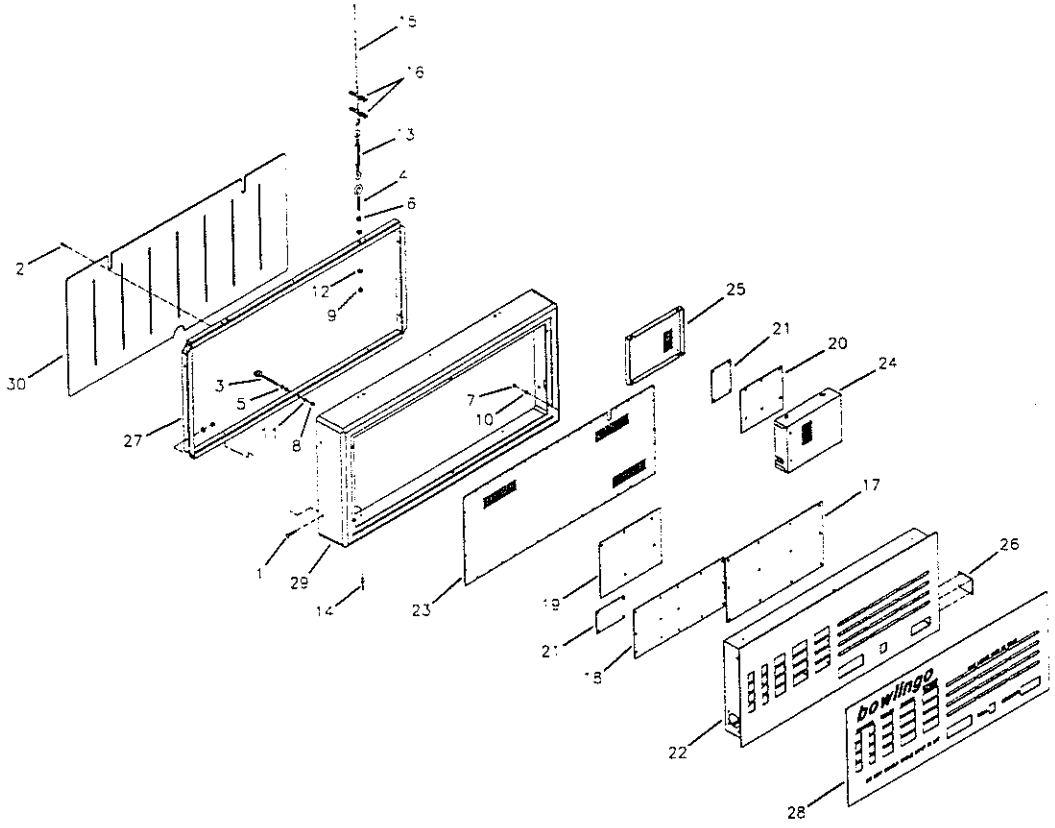
INDEX	PART NUMBER	DESCRIPTION	
1	7012-002520-150	Carriage Bolt	1/4"-20 x 1-1/2"
2	7027-201016-075	Hex Washer Head Teck Screw	#10-16 x 3/4"
3	7032-002520-400	Eye Bolt	1/4"-20 x 4"
4	7032-003118-400	Eye Bolt	5/16"-18 x 4"
5	7034-002520-000	Hexagon Nut	1/4"-20
6	7034-003118-000	Hexagon Nut	5/16"-18
7	7036-001032-000	Nylon Lock Nut	#10-32
8	7036-002520-000	Nylon Lock Nut	1/4"-20
9	7036-003118-000	Nylon Lock Nut	5/16"-18
10	7050-021050-006	Flat Washer	7/32" x 1/2" x 1/16"
11	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
12	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
13	7080-800000-030	Turnbuckle	5/16"-18
14	7108-401800-050	Dome Head Aluminum Pop Rivet	3/16" x 1/2"
15	C-060	Support Cable	
16	C-084	Cable Clip	
17	E-MD3-01	Bowlingo Scoring Display LED PCB	
18	E-MD3-02	Bowlingo Scoring Display SEG7 PCB	
19	E-MD3-03	Bowlingo Scoring Display Driver PCB	
20	E-MD3-98	Bowlingo Scoring Display Power Supply PCB	
21	M-0108-004	Bowlingo Scoring Display PCB Box	
22	M-0108-004-5	Bowlingo Scoring Display PCB Box Cover	
23	M-0108-004-9	Protector Plate	
24	M-0114-10	Bowlingo Scoring Display Frame	
25	P-0108-004-1	Bowlingo Scoring Display Facia	
26	P-0114-10	Bowlingo Scoring Display Cabinet	
27	P-0114-11	Bowlingo Scoring Display Cover	



Right scoring display unit

Sub assembly number SB-0108-42R

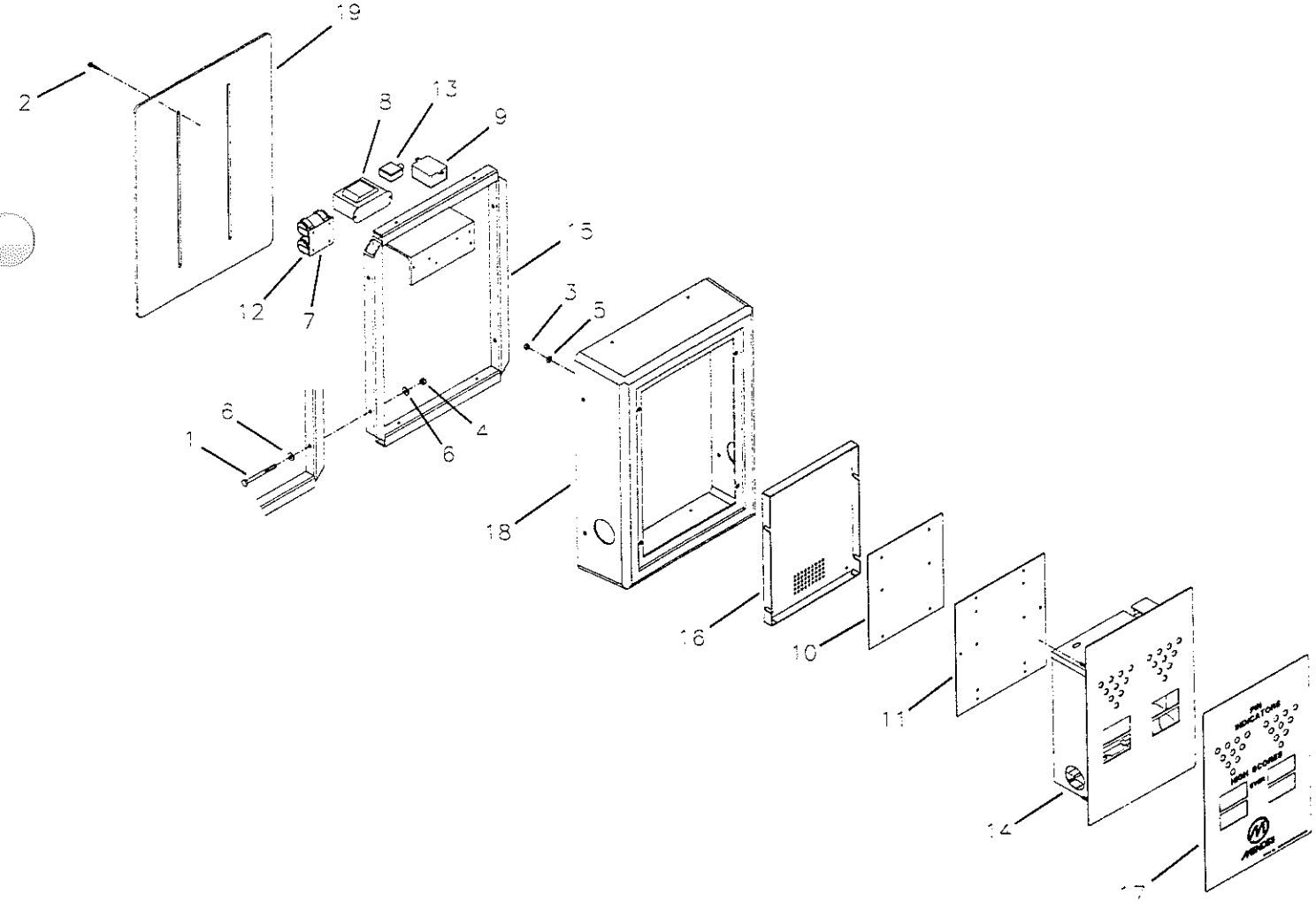
INDEX	PART NUMBER	DESCRIPTION	
1	7012-002520-150	Carriage Bolt	1/4"-20 x 1-1/2"
2	7027-201016-075	Hex Washer Head Teck Screw	#10-16 x 3/4"
3	7032-002520-400	Eye Bolt	1/4"-20 x 4"
4	7032-003118-400	Eye Bolt	5/16"-18 x 4"
5	7034-002520-000	Hexagon Nut	1/4"-20
6	7034-003118-000	Hexagon Nut	5/16"-18
7	7036-001032-000	Nylon Lock Nut	#10-32
8	7036-002520-000	Nylon Lock Nut	1/4"-20
9	7036-003118-000	Nylon Lock Nut	5/16"-18
10	7050-021050-006	Flat Washer	7/32" x 1/2" x 1/16"
11	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
12	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
13	7080-800000-030	Turnbuckle	5/16"-18
14	7108-401800-050	Dome Head Aluminum Pop Rivet	3/16" x 1/2"
15	C-060	Support Cable	
16	C-084	Cable Clip	
17	E-MD3-01	Bowlingo Scoring Display LED PCB	
18	E-MD3-02	Bowlingo Scoring Display SEG7 PCB	
19	E-MD3-03	Bowlingo Scoring Display Driver PCB	
20	E-MD3-04A	Bowlingo Scoring Display CPU PCB	
21	E-MD3-98	Bowlingo Scoring Display Power Supply PCB	
22	M-0108-004	Bowlingo Scoring Display PCB Box	
23	M-0108-004-5	Bowlingo Scoring Display PCB Box Cover	
24	M-0108-004-6	Bowlingo Scoring Display CPU Box	
25	M-0108-004-7	Bowlingo Scoring Display CPU Box Cover	
26	M-0108-004-9	Protector Plate	
27	M-0114-10	Bowlingo Scoring Display Frame	
28	P-0108-004-1	Bowlingo Scoring Display Facia	
29	P-0114-10	Bowlingo Scoring Display Cabinet	
30	P-0114-11	Bowlingo Scoring Display Cover	



High score unit components

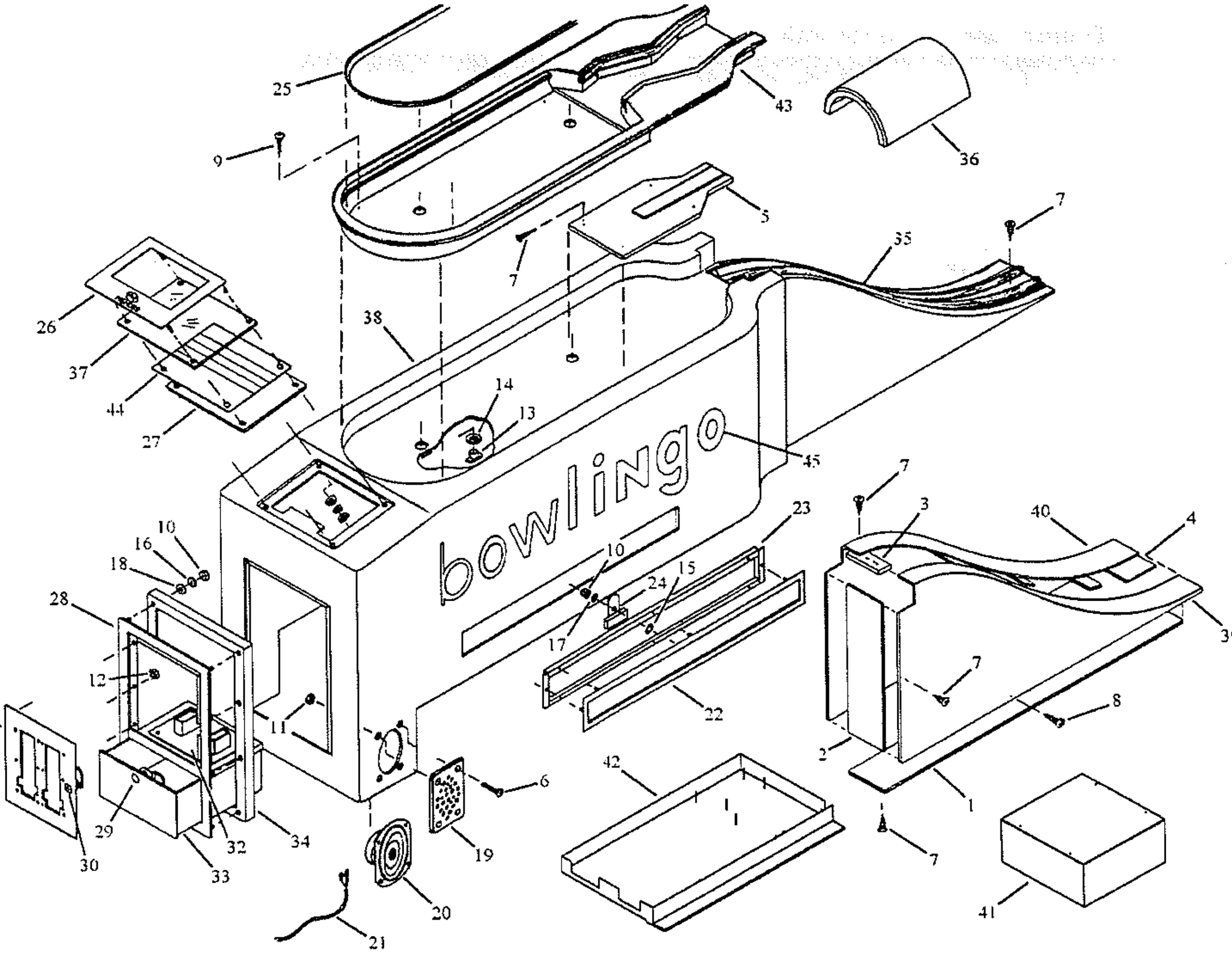
Sub assembly number SB-0108-005

INDEX	PART NUMBER	DESCRIPTION	
1	7010-002520-300	Hexagon Cap Screw	1/4"-20 x 3"
2	7027-201016-075	Hex Washer Head Teck Screw	#10-16 x 3/4"
3	7036-001032-000	Nylon Lock Nut	#10-32
4	7036-002520-000	Nylon Lock Nut	1/4"-20
5	7050-021050-006	Flat Washer	7/32" x 1/2" x 1/16"
6	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
7	E-2176	Battery Support	
8	E-B1091	Voltage Transformer	
9	E-F2716	Corcom Filter	
10	E-MD92-60	Bowlingo High Score Module CPU PCB	
11	E-MD92-61	Bowlingo High Score Module Display PCB	
12	E-PC1300	Battery	
13	E-W28XQ1A-2	Circuit Overload	02 AMP
14	M-0108-005	Bowlingo High Score Module PCB Box	
15	M-0108-006	Bowlingo High Score Module Frame	
16	M-0108-10	Bowlingo High Score Module PCB Box Cover	
17	P-0108-005	Bowlingo High Score Module Facia	
18	P-0108-006	Bowlingo High Score Module Cabinet	
19	P-0108-007	Bowlingo High Score Module Cover	



Front ball rack components

INDEX	PART NUMBER	DESCRIPTION	
1	30W-0020-1	Plywood	.75" x 7.344" x 44.31"
2	30W-0020-3	Plywood	.75" x 16" x 7.344"
3	30W-0020-5	Plywood	.75" x 6.5" x 3"
4	30W-0020-7	Plywood	.50" x 6.5" x 7"
5	30W-0540-20	Shim Insert	
6	7016-310832-075	Flat Socket Head Machine Screw	#8-32 x 3/4"
7	7022-311000-150	Flat Socket Head Wood Screw	#10 x 1-1/2"
8	7022-410800-075	Round Head Wood Screw	#8 x 3/4"
9	7024-711000-100	Truss Socket Head Metal Screw	#10 x 1"
10	7034-001032-000	Hexagon Nut	#10-32
11	7036-000832-000	Nylon Lock Nut	#8-32
12	7038-000632-000	Hexagon K-Lock Nut	#6-32
13	7045-002520-031	Tee Nut	1/4"-20 x 5/16"
14	7050-034175-012	Flat Washer	11/32" x 1-3/4" x 1/8"
15	7052-034056-003	Spacer Washer	11/32" x 9/16" x 1/32"
16	7060-018003-006	Lock Washer	3/16" x 1/32"
17	7150-018050-004	Aluminum Flat Washer	3/16" x 1/2"
18	7150-019075-009	Aluminum Flat Washer	0.193" x 3/4" x 3/32"
19	E-40-1291	Speaker Guard	
20	E-8LS3506-23	Speaker	3" x 5"
21	EC-043-36	Bowlingo Speaker Cable Assembly	
22	M-0114-15	Cluster Rack Door	
23	M-0114-16	Cluster Rack Door Ring	
24	M-0114-17	Cluster Rack Door Lock	
25	M-0540-210	Bowlingo Ball Tray	
26	M-114-0002	Console Ring Top	
27	M-114-0003-1	Blank Memb. Base Plate	
28	M-114-05	Coin Mechanism Frame Assy	
29	M-114-05-10	Camlock Drawer Ace Key	8601
30	M-114-05-12	Camlock Door Ace Key	8603
31	M-114-05-2E	Coin Mechanism Door (England)	
31	M-114-05-2J	Coin Mechanism Door (Japan)	
31	M-114-05-2U	Coin Mechanism Door (USA)	
32	M-114-05-4E	Coin Mechanism Plate (England)	
32	M-114-05-4J	Coin Mechanism Plate (Japan)	
32	M-114-05-4U	Coin Mechanism Plate (USA)	
33	M-114-05-5	Coin Mechanism Drawer	
34	M-114-05-6	Coin Ring	
35	M-114-1	Aluminum Rail Curve	50"
36	P-0540-13	Bowlingo Insert Guard	
37	P-114-0003-1	Plexiglas Memb. Base Plate	
38	P-114-1	Bowlingo Cluster Rack	
39	P-114-2	Front Side Cluster Left	
40	P-114-3	Front Side Cluster Right	
41	SB-0114-08	Bowlingo Power Box	
42	SB-0114-09	Bowlingo Electronic Controller	
43	SB-0540-10	Bowlingo Ball Rack Insert Assembly	
44	SB-114-0003	Bowlingo Keyboard	
45	Z-540	Bowlingo 5-Color Sticker	



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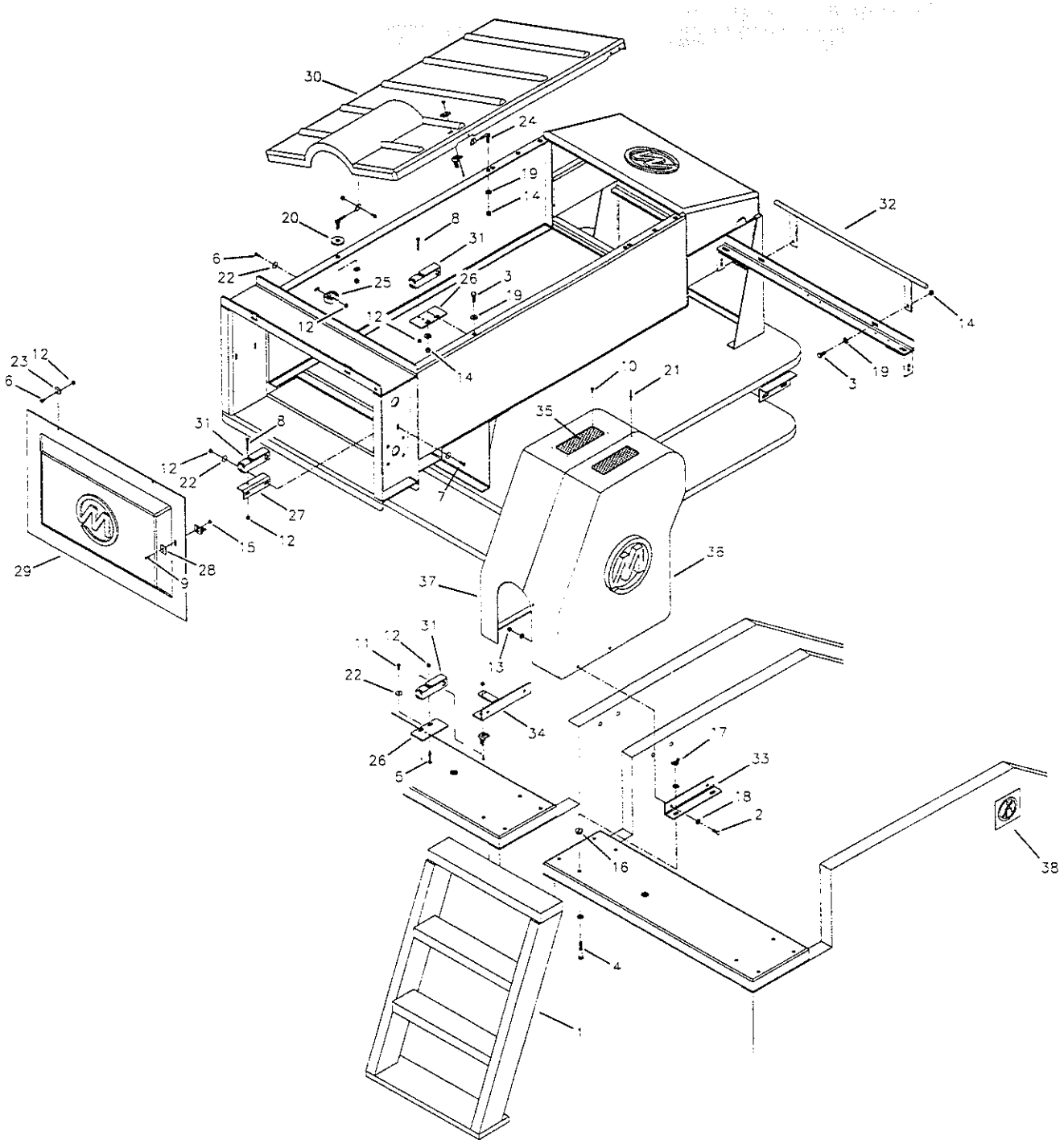
Guards and CE Accessories

INDEX	PART NUMBER	DESCRIPTION	
1	50W-0540-30	Steps Assembly	
2	7010-002520-075	Hexagon Cap Screw	1/4"-20 x 3/4"
3	7010-003118-075	Hexagon Cap Screw	5/16"-18 x 3/4"
4	7010-003118-200	Hexagon Cap Screw	5/16"-18 x 2"
5	7016-311032-150	Flat Socket Head Machine Screw	#10-32 x 1-1/2"
6	7016-411032-050	Round Socket Head Machine Screw	#10-32 x 1/2"
7	7016-411032-075	Round Socket Head Machine Screw	#10-32 x 3/4"
8	7016-411032-150	Round Socket Head Machine Screw	#10-32 x 1-1/2"
9	7016-430632-050	Round Combined Machine Screw	#6-32 x 1/2"
10	7024-710800-050	Truss Socket Head Metal Screw	#8 x 1/2"
11	7024-710800-075	Truss Socket Head Metal Screw	#8 x 3/4"
12	7036-001032-000	Nylon Lock Nut	#10-32
13	7036-002520-000	Nylon Lock Nut	1/4"-20
14	7036-003118-000	Nylon Lock Nut	5/16"-18
15	7038-000632-000	Hexagon K-Lock Nut	#6-32
16	7045-003118-037	Tee Nut	5/16"-18 x 3/8"
17	7047-003118-000	Wing Nut	5/16"-18
18	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
19	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
20	7050-043100-009	Flat Washer	7/16" x 1" x 3/32"
21	7108-401200-050	Dome Head Aluminum Pop Rivet	1/8" x 1/2"
22	7150-019075-009	Aluminum Flat Washer	0.193" x 3/4" x 3/32"
23	9102047	"D" Ring Clip	3/4"
24	9102048	Top Cover Pivot	
25	9102049	Pressure Guage Clip	
26	9102060	Mounting Plate	
27	9102061	Mounting Bracket	
28	9102062	Washer Plate	
29	9103002	Rear Cover	
30	9103003	Top Cover	
31	E-519-169	Security Switch	
32	M-0391-02	Front Guard	
33	M-0700-81	Head Guard Bracket	
34	M-0700-81-1	Head Guard Bracket	
35	M-0700-82	Ventilation Plate	
36	P-0700-61-4	Ball Lift Guard Right	
37	P-0700-61-7	Ball Lift Guard Left	
38	Z-611	Don't Walk Decal	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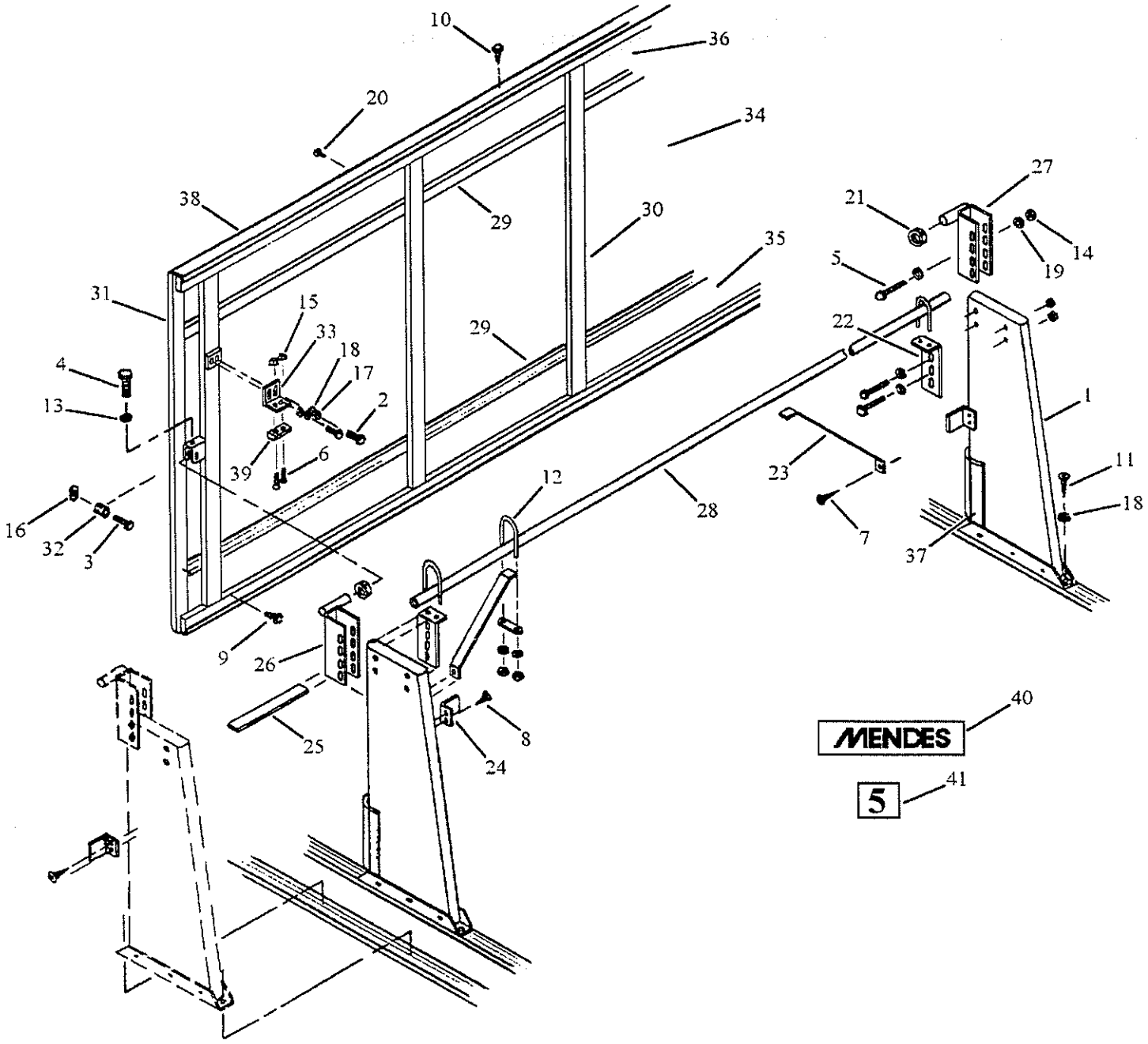
Masking unit components

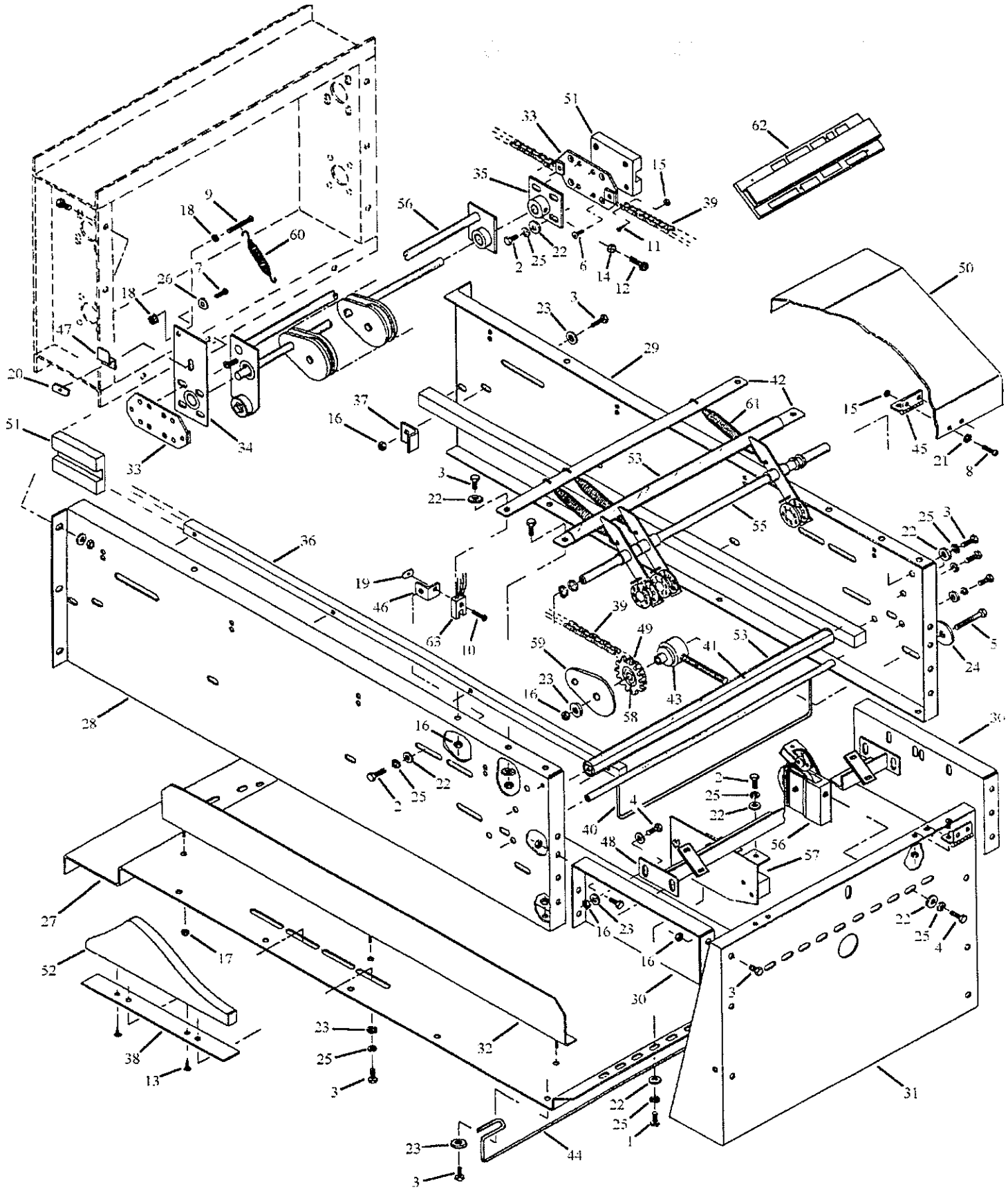
INDEX	PART NUMBER	DESCRIPTION	
1	10W-2000-03	Support Arch Assembly	
2	7010-002520-100	Hexagon Cap Screw	1/4"-20 x 1"
3	7010-002520-150	Hexagon Cap Screw	1/4"-20 x 1-1/2"
4	7010-003118-125	Hexagon Cap Screw	5/16"-18 x 1-1/4"
5	7010-003118-175	Hexagon Cap Screw	5/16"-18 x 1-3/4"
6	7016-310632-100	Flat Socket Head Machine Screw	6/32" x 1"
7	7022-311000-100	Flat Socket Head Wood Screw	#10 x 1"
8	7024-711000-100	Truss Socket Head Metal Screw	#10 x 1"
9	7027-201016-050	Hex Washer Head Teck Screw	#10-16 x 1/2"
10	7027-201016-075	Hex Washer Head Teck Screw	#10-16 x 3/4"
11	7028-003100-250	Lag Screw	5/16" x 2-1/2"
12	7030-003118-137	U Bolt	5/16" x 1-3/8"
13	7034-003118-000	Hexagon Nut	5/16"-18
14	7036-003118-000	Nylon Lock Nut	5/16"-18
15	7038-000632-000	Hexagon K-Lock Nut	#6-32
16	7046-002520-006	Weld Nut	1/4"-20
17	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
18	7050-034100-012	Flat Washer	11/32" x 1" x 1/8"
19	7050-034100-062	Flat Washer	11/32" x 1" x 0.062"
20	7108-401200-037	Dome Head Aluminum Pop Rivet	1/8" x 3/8"
21	M-0193	Steel Collar	1.062"ID
22	M-2000-13	Pipe Support Bracket	
23	M-2000-15	Brace	
24	M-2000-35	Stopper Bracket	
25	M-2001-31	Support Arch Union	
26	M-2001-32	Pivot Pin Right	
27	M-2001-33	Pivot Pin Left	
28	M-2001-34	Pipe Support	101-1/4"
29	M-2001-35	Aluminum Moulding	106.5"
30	M-2001-38	Masking Unit Frame	103.5"
31	M-2100-06	Side Guide	
32	M-2100-29	Pivot Bracket Spacer	
33	M-2100-37	Lock Bracket	
34	P-2000-40	Graphic Panel Bowling City Left	
34	P-2000-41	Graphic Panel Bowling City Right	
35	P-2001-01	Bottom Coroplast	6" x 106.5"
36	P-2001-02	Top Coroplast	5" x 106.5"
37	P-2001-031	Support Arch Bumper	12"
38	P-2001-38	Plastic Moulding White	
39	P-2100-37	Plastic Lock	
40	Z-462	Black Mendes Sticker	
41	Z-470-00	Number 0 Sticker	
41	Z-470-01	Number 1 Sticker	
41	Z-470-02	Number 2 Sticker	
41	Z-470-03	Number 3 Sticker	
41	Z-470-04	Number 4 Sticker	
41	Z-470-05	Number 5 Sticker	
41	Z-470-06	Number 6 or 9 Sticker	
41	Z-470-07	Number 7 Sticker	
41	Z-470-08	Number 8 Sticker	



STOP & GO PLATE P-200L-26

MEB-90 pinsetter main components

INDEX	PART NUMBER	DESCRIPTION	
1	7010-003118-050	Hexagon Cap Screw	5/16"-18 x 1/2"
2	7010-003118-062	Hexagon Cap Screw	5/16"-18 x 5/8"
3	7010-003118-075	Hexagon Cap Screw	5/16"-18 x 3/4"
4	7010-003118-100	Hexagon Cap Screw	5/16"-18 x 1"
5	7010-003118-275	Hexagon Cap Screw	5/16"-18 x 2-3/4"
6	7016-312520-100	Flat Socket Head Machine Screw	1/4"-20 x 1"
7	7016-411032-050	Round Socket Head Machine Screw	#10-32 x 1/2"
8	7016-411032-062	Round Socket Head Machine Screw	#10-32 x 5/8"
9	7016-412520-150	Round Socket Head Machine Screw	1/4"-20 x 1-1/2"
10	7016-430632-075	Round Combined Machine Screw	#6-32 x 3/4"
11	7018-001032-087	Hexagon Socket Cap Screw	#10-32 x 7/8"
12	7018-003118-062	Hexagon Socket Cap Screw	5/16"-18 x 5/8"
13	7022-311200-150	Flat Socket Head Wood Screw	#12 x 1-1/2"
14	7034-003118-000	Hexagon Nut	5/16"-18
15	7036-001032-000	Nylon Lock Nut	#10-32
16	7036-003118-000	Nylon Lock Nut	5/16"-18
17	7038-000632-000	Hexagon K-Lock Nut	#6-32
18	7038-002520-000	Hexagon K-Lock Nut	1/4"-20
19	7046-000632-006	Weld Nut	#6-32 x 1/16"
20	7046-001032-006	Weld Nut	#10-32
21	7050-021050-006	Flat Washer	7/32" x 1/2" x 1/16"
22	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
23	7050-034100-012	Flat Washer	11/32" x 1" x 1/8"
24	7050-034175-012	Flat Washer	11/32" x 1-3/4" x 1/8"
25	7060-031057-009	Lock Washer	5/16" x 37/64" x 3/32"
26	7150-019075-009	Aluminum Flat Washer	0.193" x 3/4" x 3/32"
27	9102001	Bottom Frame Plate	
28	9102002	Frame Plate, Left	
29	9102003	Frame Plate, Right	
30	9102004	Sensor Plate, Side	
31	9102005	Sensor Plate, Front	
32	9102007	Side Guard	
33	9102011	Drawbar Chain Plate	
34	9102012	Left Adjustment Plate	
35	9102013	Right Adjustment Plate	
36	9102016	Drawbar Guide	
37	9102017	Drawbar Stopper	
38	9102018	Cam Adjustment Plate	
39	9102019	Drawbar Chain	
40	9102025	Shaft	
41	9102026	Lower Reel Arm Stopper	
42	9102030	Upper Reel Arm Stopper	
43	9102036	Tensioner	
44	9102037	String Support	
45	9102044	Hinge	
46	9102054	Optical Sensor Support	
47	9102055	Actuator	
48	9102072	Brake Support	
49	9102094	Sprocket 40B15	
50	9103001	Pin Detection Cover	
51	9103011	Drawbar Guide	
52	9103018	Pause Cam	
53	9103026	Hose	
54	9122014	Drawbar Assembly	
55	9122027	Reel Arm Complete Assembly	
56	9122057	Pin Detection Assembly	
57	9122070	Pin Brake Assembly	
58	M-0680-29	Bearing 6203	
59	P-001A	Drawbar Sheaf Plate	
60	S-071	Tension Spring	
61	S-080	Tension Spring	
62	SB-2131	Electronic Pin Detection Assembly	
63	SB-ECIL-325-FS	Optical Sensor Assembly	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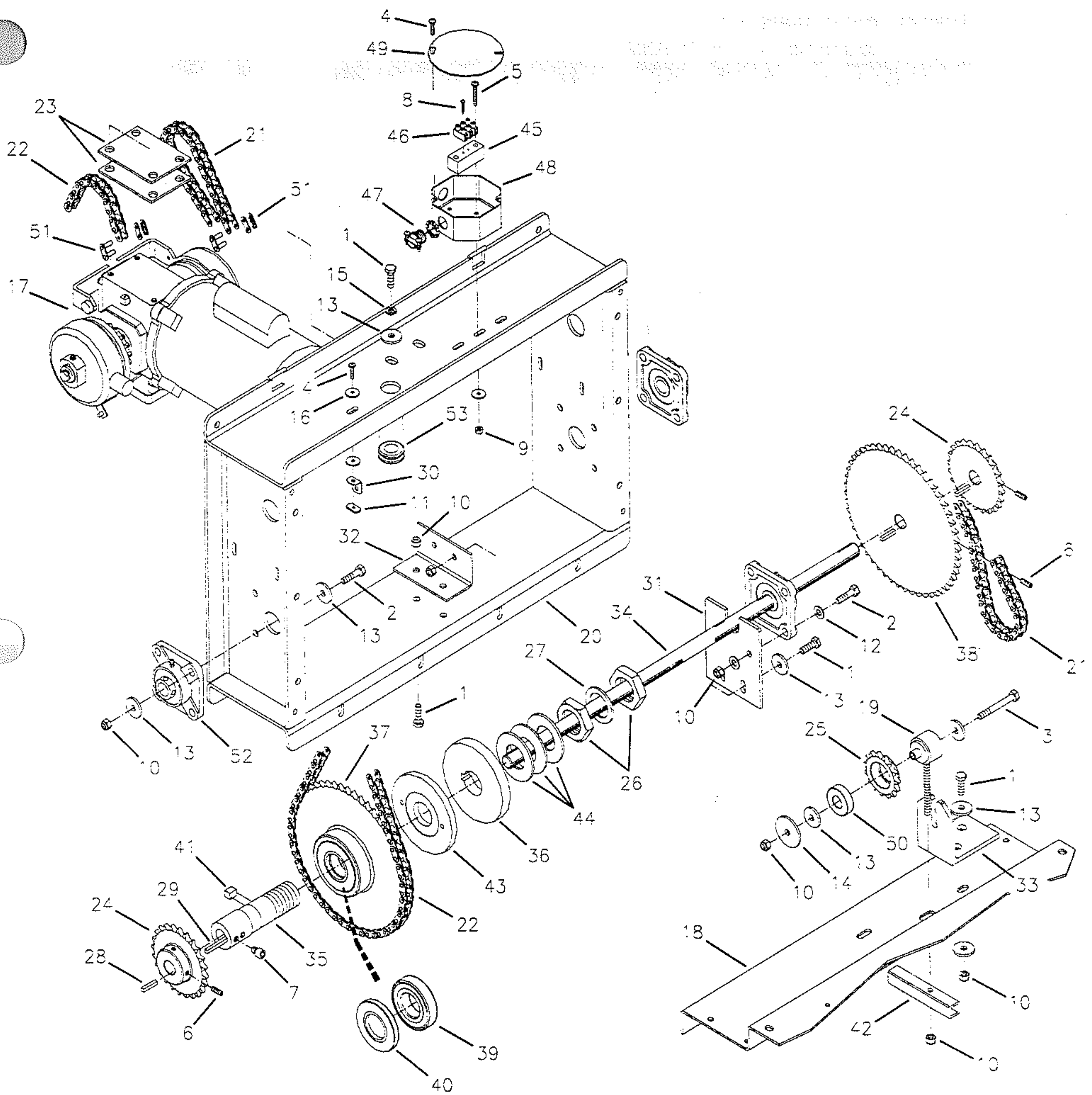
Drive train components

INDEX	PART NUMBER	DESCRIPTION	
1	7010-003118-100	Hexagon Cap Screw	5/16"-18 x 1"
2	7010-003118-125	Hexagon Cap Screw	5/16"-18 x 1-1/4"
3	7010-003118-250	Hexagon Cap Screw	5/16"-18 x 2-1/2"
4	7016-411032-075	Round Socket Head Machine Screw	#10-32 x 3/4"
5	7016-411032-125	Round Socket Head Machine Screw	#10-32 x 1-1/4"
6	7018-002520-075	Hexagon Socket Cap Screw	1/4"-20 x 3/4"
7	7018-003118-037	Hexagon Socket Cap Screw	5/16"-18 x 3/8"
8	7024-610400-075	Pan Socket Head Metal Screw	#4 x 3/4"
9	7036-001032-000	Nylon Lock Nut	#10-32
10	7036-003118-000	Nylon Lock Nut	5/16"-18
11	7046-001032-006	Weld Nut	#10-32
12	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
13	7050-034100-012	Flat Washer	11/32" x 1" x 1/8"
14	7050-034175-012	Flat Washer	11/32" x 1-3/4" x 1/8"
15	7060-031057-009	Lock Washer	5/16" x 37/64" x 3/32"
16	7150-019075-009	Aluminum Flat Washer	0.193" x 3/4" x 3/32"
17	9100002-4	Electric Motor Assembly	
18	9102001	Bottom Frame Plate	
19	9102036	Tensioner	
20	9102080	Drive Train Frame	
21	9102081	Up Sprocket Chain	
22	9102082	Down Sprocket Chain	
23	9102084	Reducer Spacer Plate	
24	9102092	Sprocket 40B24	
25	9102094	Sprocket 40B15	
26	9102099	Nut	1-3/8"
27	9102107	Special Spacer Washer	1-3/8"
28	9102108-1	Machine Key	3/16" x 1"
29	9102108-4	Machine Key	3/16" x 3"
30	9102109	Attachment Bracket	
31	9102110	Support Plate	
32	9102110-1	Drive Shaft Center Support Base	
33	9102113	Bracket	
34	9102120	Drive Shaft	
35	9102121	Drive Hub	
36	9102122	Disk Slipping Plate	
37	9102123	Raising Drive Shaft Sprocket	
38	9102124	Lowering Drive Shaft Sprocket	
39	9102125	Bearing	
40	9102126	Seal	
41	9102127	Machine Key	3/8" x 1/2"
42	9102145	Chain Binder Down Reinforcement	
43	9103122	Friction Disk	
44	9105095	Disk Spring	
45	9106045	Spacer Block	
46	E-323HDS12	Terminal Strip	
47	E-3302M	Power Cord	
48	E-550	Junction Box	
49	E-551	Junction Box Cover	
50	M-0680-29	Bearing 6203	
51	M-0690-01-1	Chain Coupling	
52	M-0690-21	Pillow Block	
53	RB-249	Rubber Grommet	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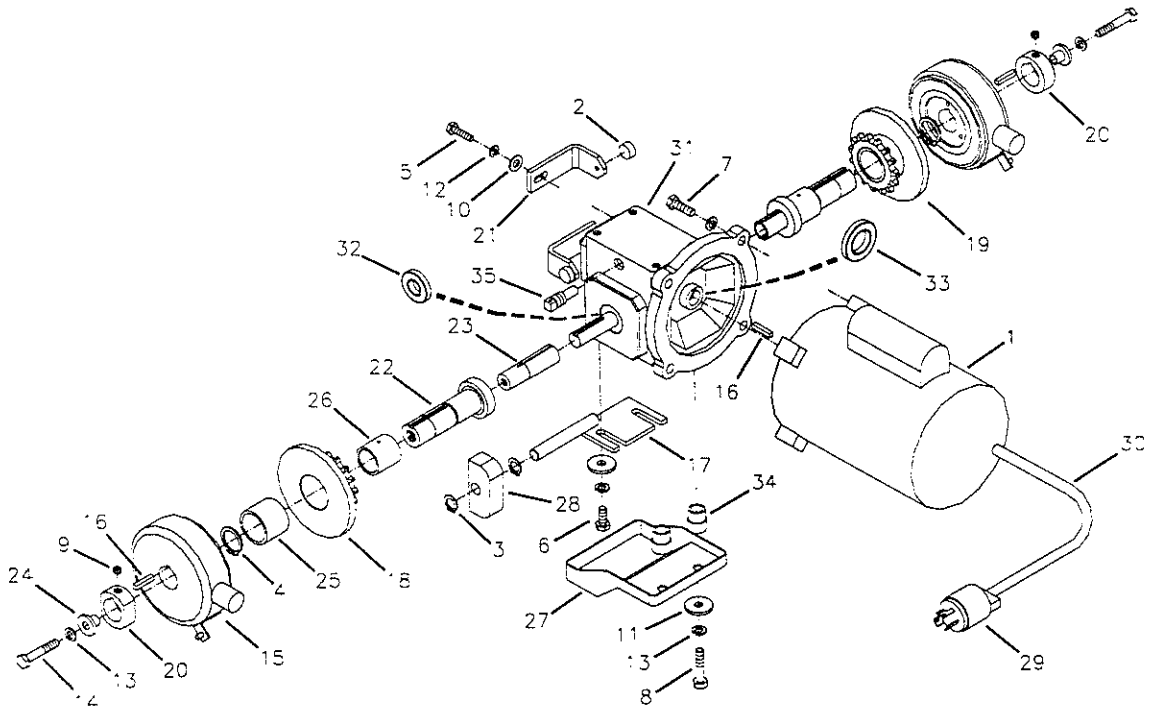
Electric motor components

Sub assembly number 9100002-4

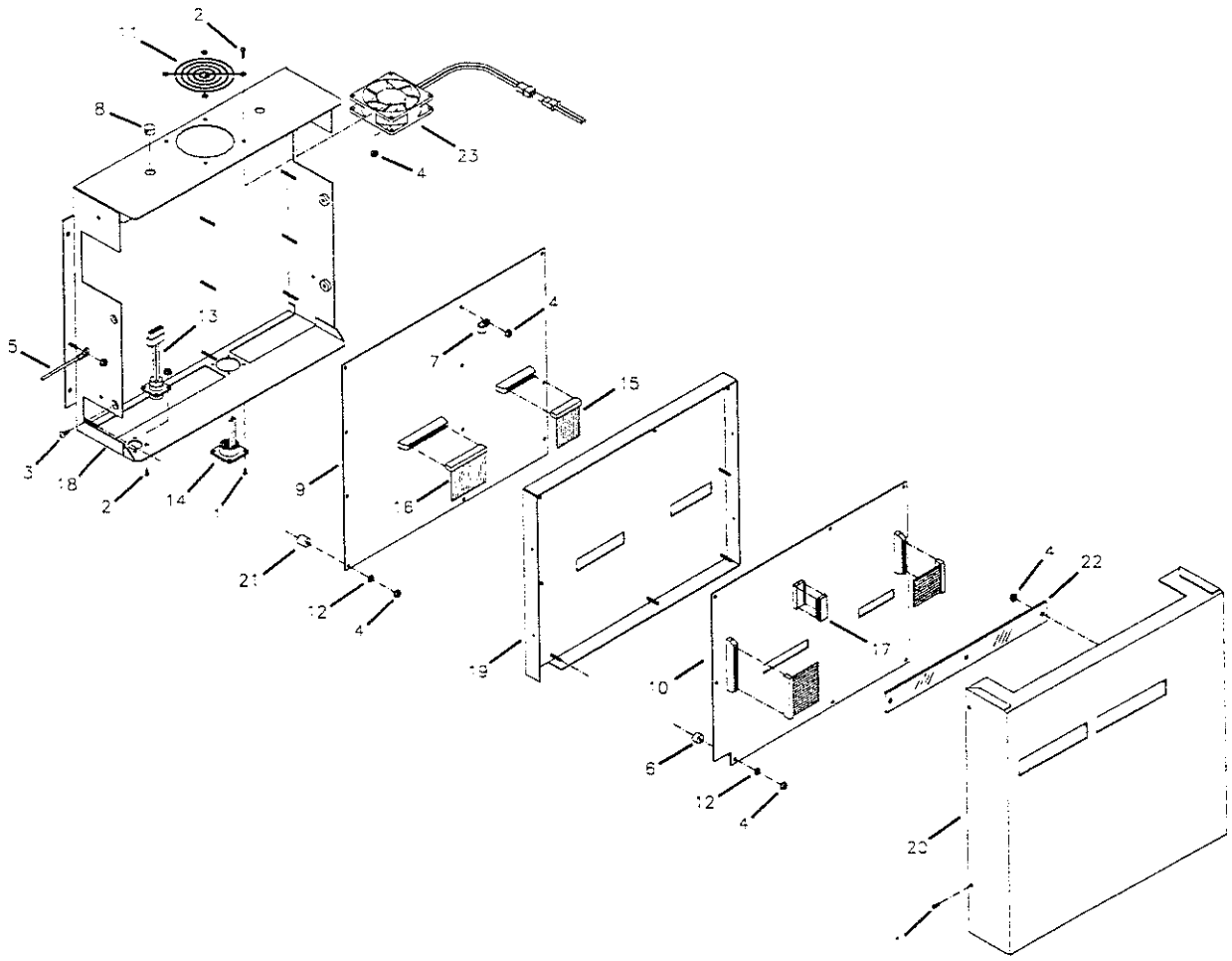
INDEX	PART NUMBER	DESCRIPTION	
1	301-1200-00	Electric Motor 208/230 VAC 1/2 HP	
2	307-0000-00	Magnet	
3	7002-710000-050	External Retaining Ring	1/2"
4	7002-720000-098	External Retaining Ring	63/64"
5	7010-002520-100	Hexagon Cap Screw	1/4"-20 x 1"
6	7010-003118-075	Hexagon Cap Screw	5/16"-18 x 3/4"
7	7010-003118-100	Hexagon Cap Screw	5/16"-18 x 1"
8	7010-003118-150	Hexagon Cap Screw	5/16"-18 x 1 1/2"
9	7014-003118-025	Hexagon Socket Set Screw	5/16"-18 x 1/4"
10	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
11	7050-034100-012	Flat Washer	11/32" x 1" x 1/8"
12	7060-025046-006	Lock Washer	1/4" x 15/32" x 1/16"
13	7060-031057-009	Lock Washer	5/16" x 37/64" x 3/32"
14	7810-003124-175	Grade 8 Hexagon Cap Screw	5/16"-24 x 1-3/4"
15	9101080	Magnetic Clutch	
16	9102108-2	Machine Key	3/16" x 1-3/4"
17	9102112-1	Binder Plate	
18	9102114	Up Clutch Sprocket	
19	9102115	Down Clutch Sprocket	
20	9102116	Special Collar	
21	9102118-1	Bracket	
22	9102129	Reducer Coupling	
23	9102129-1	Inside Coupling	
24	9102130	Special Coupling Washer	
25	9102140	Bushing	
26	9102141	Inner Ring	
27	9103036	Oil Pan	
28	9103112	Chain Binder	
29	E-605-91	Twist Lock Plug	
30	EC-090-220	ME-90 Power Cord	
31	M-BMQ1133-1	Double Shaft Reducer	
32	M-BMQ1133-17	Output Oil Seal	
33	M-BMQ1133-18	Input Oil Seal	
34	P-029	Spacer	
35	P-1133-3	Reducer Vent for M-BMQ1133-3	



ME-90 lane controller components

Sub assembly number SB-6500-90

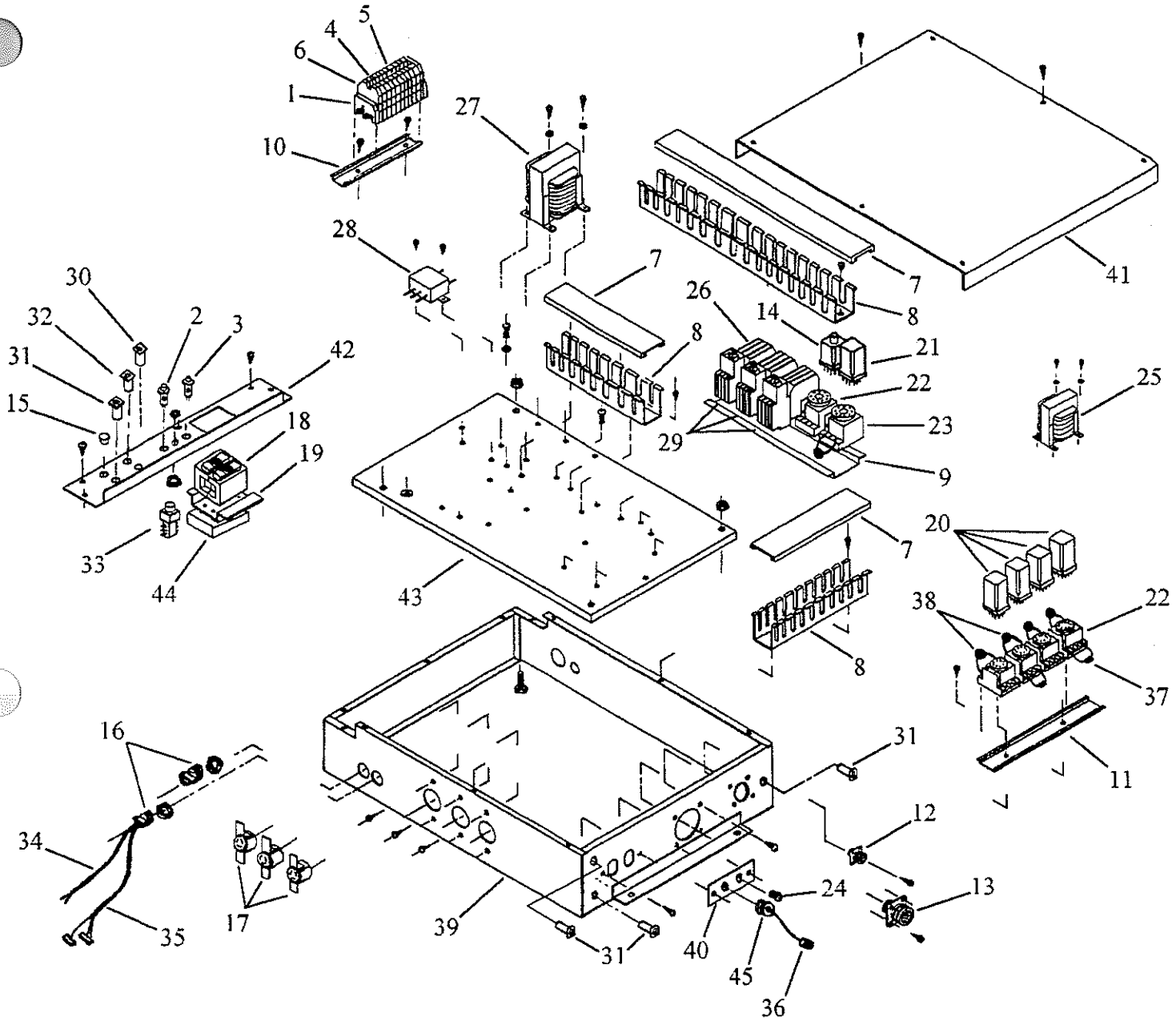
INDEX	PART NUMBER	DESCRIPTION	
1	7016-430632-031	Round Combined Machine Screw	#6-32 x 5/16"
2	7016-430632-050	Round Combined Machine Screw	#6-32 x 1/2"
3	7024-710800-050	Truss Socket Head Metal Screw	#8 x 1/2"
4	7038-000632-000	Hexagon K-Lock Nut	#6-32
5	E-020-10TEW	Grounding Cable 10AWG	
6	E-219	Round Nylon Spacer	
7	E-660-09	Cable Clamp	
8	E-805	Plastic Snap Plug	
9	E-MD3-80	ME-90 Lane Controller Power Supply PCB	
10	E-MD3-85	ME-90 Lane Controller CPU PCB	
11	E-SC80-W2	Fan Grill	
12	E-W3751	Nylon Washer	
13	EC-090-280	ME-90 Lane Controller Power Supply Cable	20VAC
14	EC-090-290	ME-90 Lane Controller Power Supply Cable	24VAC
15	EC-090-98	Flat Cable Assembly	34P
16	EC-090-99	Flat Cable Assembly	50P
17	IF-PGM1	User-Changeable EPROM	
18	M-6590-11	ME-90 Lane Controller Cabinet	
19	M-6590-12	ME-90 Lane Controller Cover	
20	M-6590-13	ME-90 Lane Controller Pan	
21	P-057	Nylon Spacer	
22	P-6590-01	ME-90 Lane Controller Window	
23	SB-900-1	Fan Assembly	



ME-90 electric power box components

Sub assembly number SB-6400-99

INDEX	PART NUMBER	DESCRIPTION	
1	E-103002-26	Stopper	
2	E-1052C5-115	Pilot Lamp, 115VAC Green	
3	E-1090C1-28	Pilot Lamp, 28VAC Red	
4	E-115116	Electric Terminal, Small	
5	E-115118	Electric Terminal, Large	
6	E-118368	Electric Terminal Separator	
7	E-1631	Wiring Duct Cover	
8	E-1635	Wiring Duct	
9	E-164800-11	Rail, 11	
10	E-164800-5	Rail, 05	
11	E-164800-8	Rail, 08	
12	E-206043-1	Female Connector	CPC-14
13	E-206838-1	Female Connector	CPC-24
14	E-214215	Power Supply	90VDC
15	E-315-751	Snap-In Bushing	
16	E-3302M	Power Cord	
17	E-4560	Twist-Lock Receptacle	
18	E-600-20	Circuit Breaker	20AMP
19	E-600-25-1	Attachment Plate	
20	E-6012	Relay	24VAC-08P
21	E-6013	Relay	24VAC-11P
22	E-620-12	Relay Base for E-6012	
23	E-620-13	Relay Base for E-6013	
24	E-805	Plastic Snap Plug	
25	E-B1091	Voltage Transformer	
26	E-B12-10-3	Contact 3-P	
27	E-C0187	Voltage Transformer	208/240VAC
28	E-F2716	Corcom Filter	
29	E-RSA-22K	Circuit Overload	
30	E-W28XQ1A-15	Circuit Overload	15 AMP
31	E-W28XQ1A-3	Circuit Overload	03 AMP
32	E-W28XQ1A-5	Circuit Overload	05 AMP
33	E-ZF122UEE	Shadow Switch	
34	EC-090-056	Ball Lift Cable Assembly	
35	EC-090-057	One/Two Ball Light Cable Assembly	
36	EC-090-210	ME-90 Lane Controller Power Supply Cable	
37	EE-IN4007	Diode	
38	EE-V47ZA7	Varistor	38VDC
39	M-0640-58-1	ME-90 Power Box Cabinet	
40	M-0640-58-2	ME-90 Power Box Wiring Plate	
41	M-0640-58-4	ME-90 Power Box Cover	
42	M-0640-58-6	ME-90 Power Box Small Cover	
43	M-0640-58-15	ME-90 Power Box Pan	
44	P-0640-58-1	Plastic Spacer	
45	RB-39	Rubber Grommet	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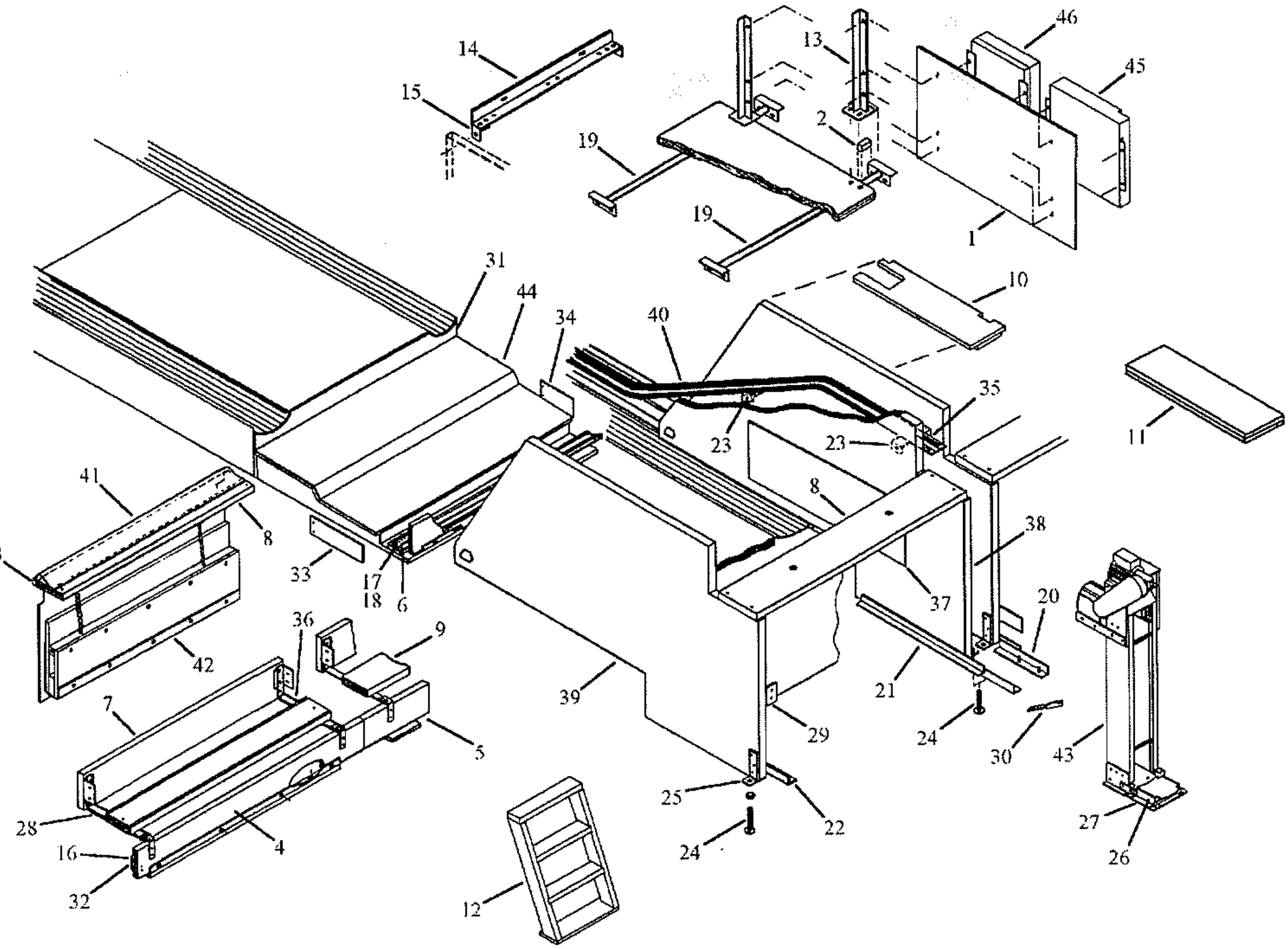
Pit components

INDEX	PART NUMBER	DESCRIPTION
1	15W-0374	Mounting Panel
2	15W-0374-1	Spacer Block
3	50W-0540-01	Apron Fixation
4	50W-0540-02-4	Ball Trough Wall, Right
5	50W-0540-02-7	Ball Trough Wall, Left
6	50W-0540-04	Angle Block
7	50W-0540-05	Pit Cushion Stop Plank
8	50W-0540-11	Pit Cushion Plank
9	50W-0540-12	Ball Trough Cover
10	50W-0540-13-1	Kickback Spacer, Top
11	50W-0540-13-2	Catwalk
12	50W-0540-30	Steps Assembly
13	M-0374	ME-90 Power Box Mounting Foot
14	M-0391-01	Bowlingo Cross Bar
15	M-0392	Angle
16	M-0540-04	Steel Strap
17	M-0540-06-4	Ball Trough, Right
18	M-0540-06-7	Ball Trough, Left
19	M-0540-08	Main Cross Support
20	M-0540-20	Ball Lift Support Bracket, Left
21	M-0540-21	Ball Lift Support Bracket, Right
22	M-0540-22	Support Angle
23	M-0540-23	Kickback Spacer
24	M-0540-29	Kickback Leveling Rod
25	M-0540-30	Bracket
26	M-0700-19-1	Inside Railing
27	M-0700-20-1	Inside Railing Base
28	M-0700-26	Pump Support Bracket
29	M-0700-41	Bracket
30	M-0700-47	Cross Brace
31	P-0540-01	Pin Deck Rear Guard
32	P-0540-02	Rubber Ball Stop
33	P-0700-20	Ball Guide
34	P-0700-21	Ball Guide
35	P-0700-27	Plastic Ball Guide
36	P-0700-62	Hose
37	Q88-0171	Bowlingo Kickback Plate
38	Q88-0171-175L	Bowlingo Kickback, Left
39	Q88-0171-175R	Bowlingo Kickback, Right
40	Q89-0303	Drop Sweep Track
41	R-0540-01	Pit Apron
42	SB-0540-70	Bowlingo Pit Cushion Assembly
43	SB-0701-25	Bowlingo Rear Ball Lift Assembly
44	SB-50W-0540-07	Bowlingo Pit Floor Assembly
45	SB-6400-99	ME-90 Power Box Assembly
46	SB-6500-90	ME-90 Lane Controller Assembly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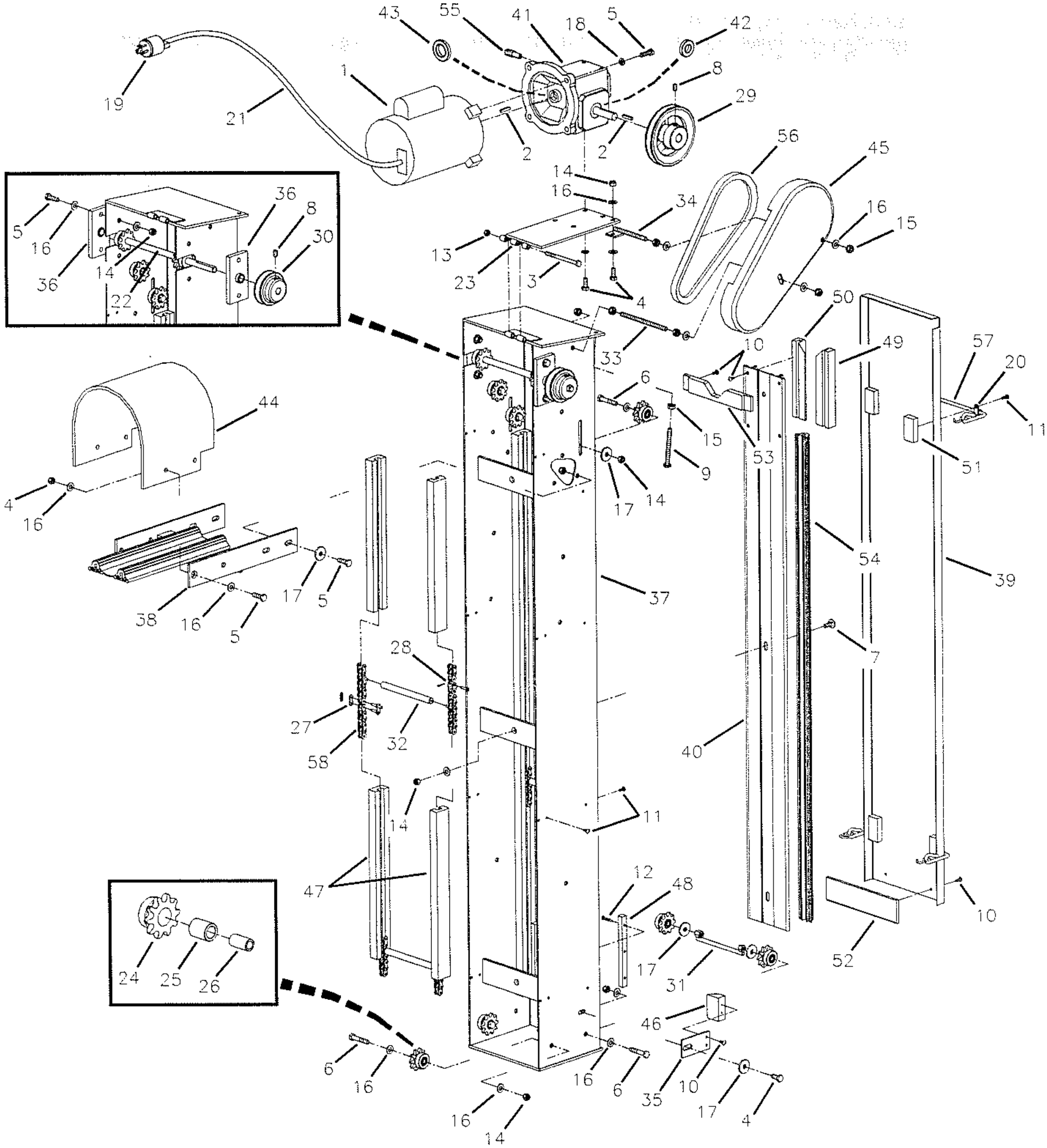
Rear ball lift components

Sub assembly number SB-0701-25

INDEX	PART NUMBER	DESCRIPTION	
1	301-1200-00	Electric Motor 208/230 VAC 1/2 HP	
2	302-2410-00	Machine Key	3/16" x 1"
3	7010-002520-350	Hexagon Cap Screw	1/4"-20 x 3-1/2"
4	7010-003118-075	Hexagon Cap Screw	5/16"-18 x 3/4"
5	7010-003118-100	Hexagon Cap Screw	5/16"-18 x 1"
6	7010-003118-175	Hexagon Cap Screw	5/16"-18 x 1-3/4"
7	7012-003118-075	Carriage Bolt	5/16"-18 x 3/4"
8	7014-003118-050	Hexagon Socket Set Screw	5/16"-18 x 1/2"
9	7016-413118-300	Round Socket Head Machine Screw	5/16"-18 x 3"
10	7024-710800-050	Truss Socket Head Metal Screw	#8 x 1/2"
11	7024-710800-075	Truss Socket Head Metal Screw	#8 x 3/4"
12	7026-310800-100	Flat Socket Head Self-Drilling Screw	#8 x 1"
13	7036-002520-000	Nylon Lock Nut	1/4"-20
14	7036-003118-000	Nylon Lock Nut	5/16"-18
15	7038-003118-000	Hexagon K-Lock Nut	5/16"-18
16	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
17	7050-034100-012	Flat Washer	11/32" x 1" x 1/8"
18	7060-031057-009	Lock Washer	5/16" x 37/64" x 3/32"
19	E-605-91	Twist Lock Plug	
20	E-660-09	Cable Clamp	
21	EC-090-250	Motor Power Cord	
22	M-0700-07	Drive Shaft Assembly	
23	M-0700-09	Motor Drive Plate	
24	M-0700-10	Idler Sprocket 40B10	
25	M-0700-10-01	Oilite	
26	M-0700-10-02	Steel Bearing	
27	M-0700-14	Chain Coupling	
28	M-0700-15	Chain Coupling Half-Link	
29	M-0700-21-2	Pulley	
30	M-700-22	Pulley	
not available with E-Z luster			
31	M-0700-23	Ball Leveling Rod	
32	M-0700-27	Cross Chain Travel Shaft	
33	M-0700-29	Guard Rod	
34	M-0700-29-1	Pulley Retaining Guard	
not available with E-Z luster			
35	M-0700-55	Bottom Ball Lift Guard	
36	M-0700-67	Steel Bearing Block	
37	M-0700-90	Ball Lift Frame Assembly	
38	M-0700-94	Ball Lift Bridge	
39	M-0700-96	Ball Lift Cover	
40	M-0700-97	Aluminum Track	
41	M-BMQ1133-3	Motor Reducer	
42	M-BMQ1133-17	Output Oil Seal	
43	M-BMQ1133-18	Input Oil Seal	
44	P-0700-13	Ball Guard, Outside	
45	P-0700-14	Pulley Guard	
not available with E-Z luster			
46	P-0700-55	Bottom Ball Lift Guard	
47	P-0700-69	Chain Guide	
48	P-0700-71	Bottom Ball Guide	
49	P-0700-72-4	Ball Guide, Right	
50	P-0700-72-7	Ball Guide, Left	
51	P-0700-73	Spacer Block	
52	P-0700-74	Guard Block	
53	P-0700-75	Ball Track Guide	
54	P-0700-97	Ball Track Guard	
55	P-1133-3	Reducer Vent for M-BMQ1133-3	
56	R-0700-01	V-Belt 4L-280	
57	R-0700-90	Ball Lift Cover Attachment	
58	SB-0700-13	Chain	#40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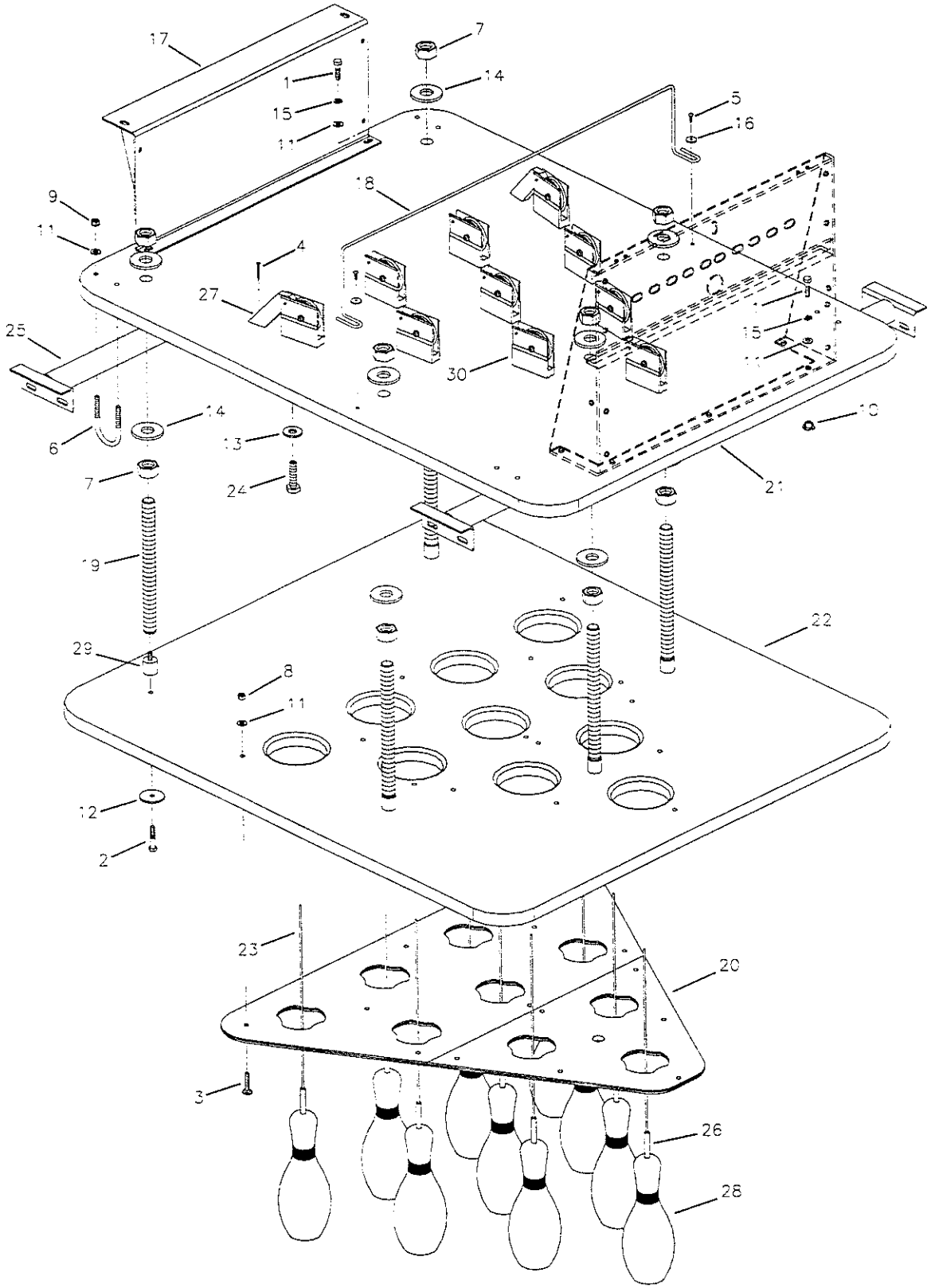
Pin stabilizer components

INDEX	PART NUMBER	DESCRIPTION	
1	7010-003118-125	Hexagon Cap Screw	5/16"-18 x 1-1/4"
2	7010-003118-175	Hexagon Cap Screw	5/16"-18 x 1-3/4"
3	7012-003118-150	Carriage Bolt	5/16"-18 x 1-1/2"
4	7022-410600-125	Round Head Wood Screw	#6 x 1-1/4"
5	7024-710800-075	Truss Socket Head Metal Screw	#8 x 3/4"
6	7030-003118-325	U Bolt	5/16"-18 x 3-1/4"
7	7034-008709-000	Hexagon Nut	7/8"-9
8	7036-003118-000	Nylon Lock Nut	5/16"-18
9	7038-003118-000	Hexagon K-Lock Nut	5/16"-18
10	7045-003118-037	Tee Nut	5/16"-18 x 3/8"
11	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
12	7050-034175-012	Flat Washer	11/32" x 1-3/4" x 1/8"
13	7050-056137-012	Flat Washer	9/16" x 1-3/8" x 1/8"
14	7052-093225-018	Spacer Washer	15/16" x 2-1/4" x 3/16"
15	7060-031057-009	Lock Washer	5/16" x 37/64" x 3/32"
16	7150-019075-009	Aluminum Flat Washer	0.193" x 3/4" x 3/32"
17	9102006	Pinsetter Support Plate	
18	9102038	String Support	
19	9102039	Spacer Rod	
20	9103005	Bowlingo Pin Centering Plate	
21	9106004	Bowlingo Pinsetter Support Table	
22	9106005	Bowlingo Stabilizer Base Plate	
23	I-022A	Pin String, Complete	
24	M-041	Pin Bumper Bolt	1/2"-20
25	M-0540-01	Main Cross Support	
26	P-0241-10	Plastic Bushing	
27	P-043	Pulley Sheaf Guard	
28	Q72-0241	Bowlingo Pin	
29	R-014	Bumper Pad	
30	SB-043-1	Pulley Sheaf	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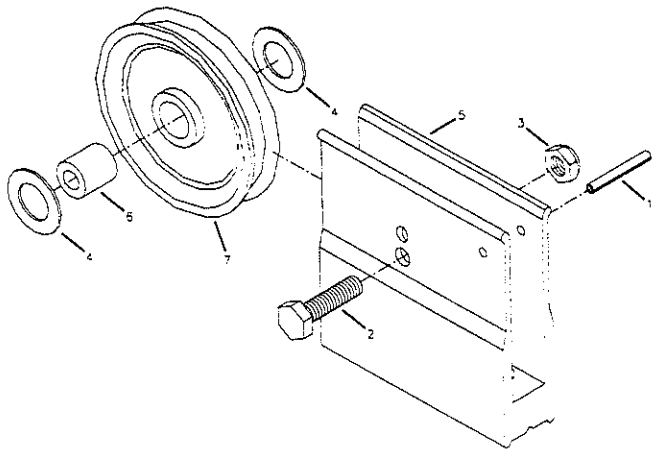
Pulley sheaf components

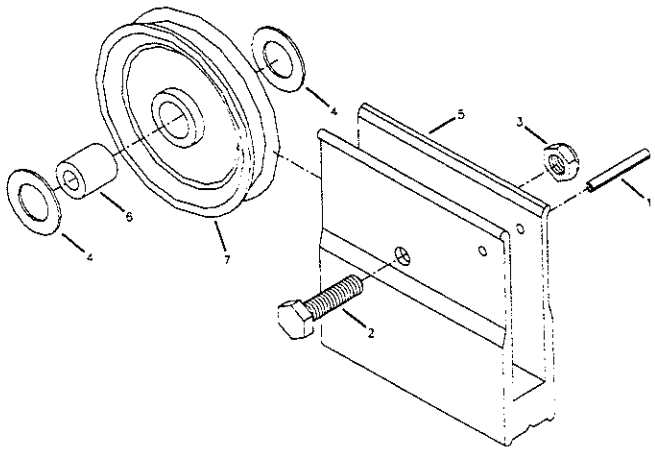
Sub assembly number SB-043-1

INDEX	PART NUMBER	DESCRIPTION	
1	7006-001200-100	Spring Tension Pin	1/8" x 1"
2	7010-002520-100	Hexagon Cap Screw	1/4"-20 x 1"
3	7044-002520-000	Thin Nylon Lock Nut	1/4"-20
4	7052-050087-003	Spacer Washer	1/2" x 7/8" x 1/32"
5	M-043-1	Sheaf Binder	
6	M-100B	Bushing	
7	P-16A	Pulley	



Sub assembly number SB-043-2

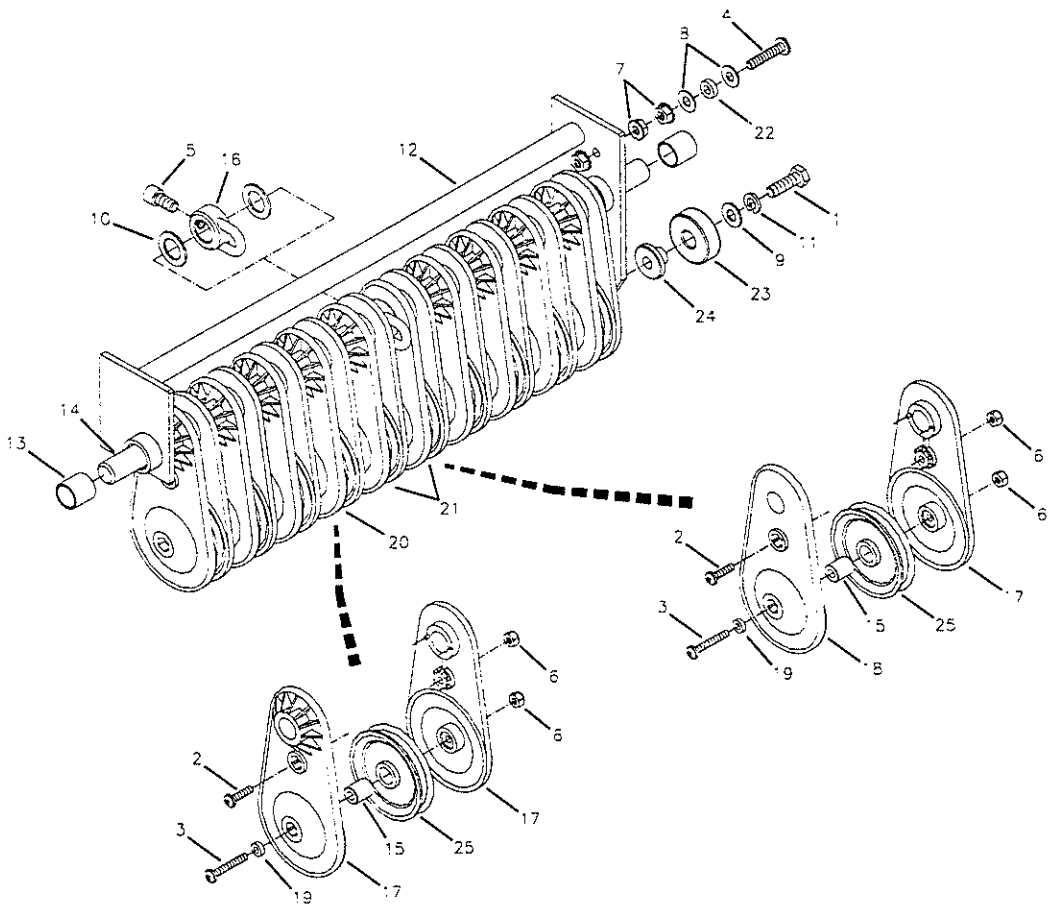
INDEX	PART NUMBER	DESCRIPTION	
1	7006-001200-100	Spring Tension Pin	1/8" x 1"
2	7010-002520-100	Hexagon Cap Screw	1/4"-20 x 1"
3	7044-002520-000	Thin Nylon Lock Nut	1/4"-20
4	7052-050087-003	Spacer Washer	1/2" x 7/8" x 1/32"
5	M-043-2	Sheaf Binder	
6	M-100B	Bushing	
7	P-16A	Pulley	



Drawbar components

Sub assembly number 9122014

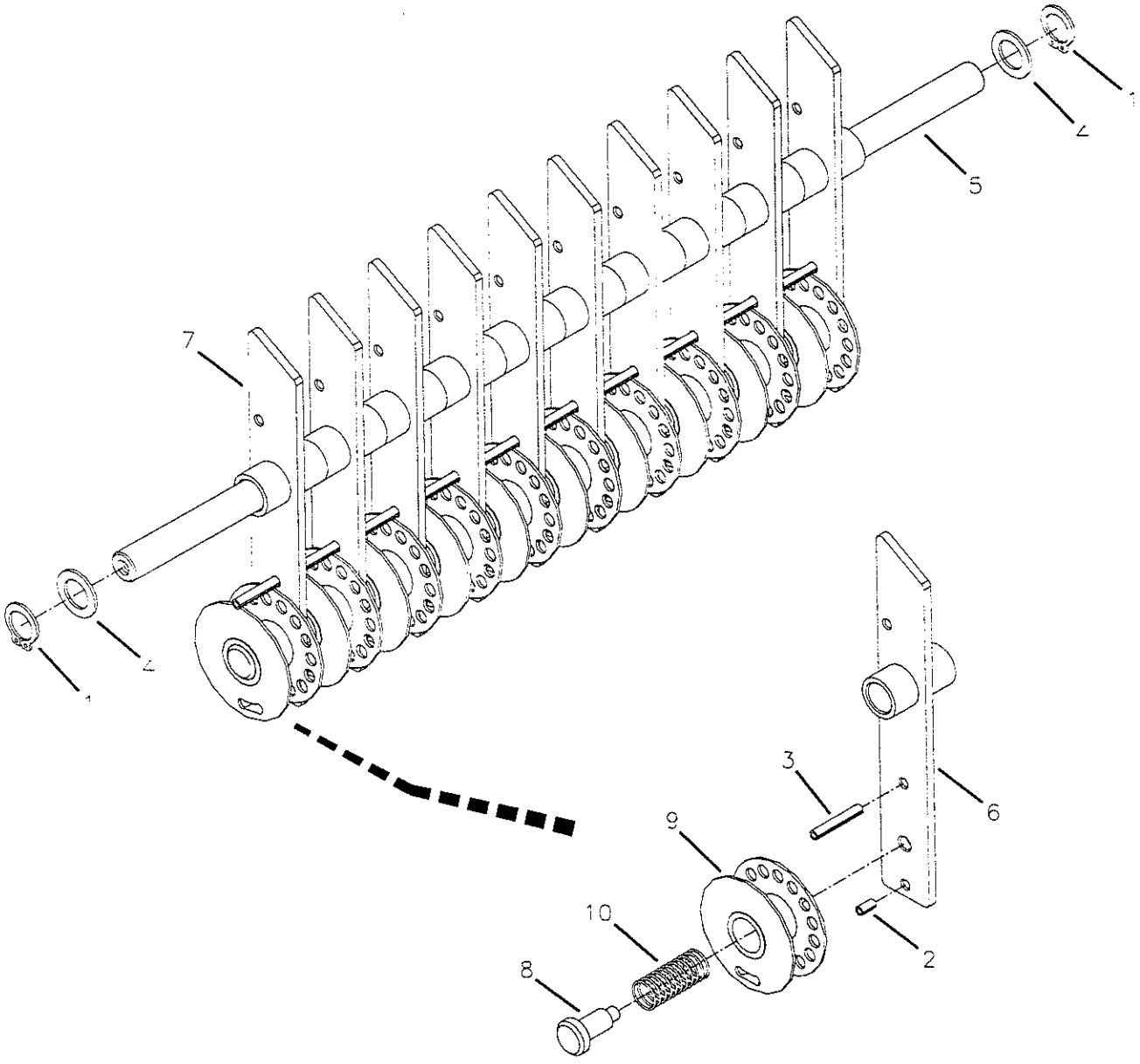
INDEX	PART NUMBER	DESCRIPTION	
1	7010-003118-100	Hexagon Cap Screw	5/16"-18 x 1"
2	7016-411032-075	Round Socket Head Machine Screw	#10-32 x 3/4"
3	7016-411032-125	Round Socket Head Machine Screw	#10-32 x 1-1/4"
4	7016-412520-125	Round Socket Head Machine Screw	1/4"-20 x 1-1/4"
5	7018-003118-062	Hexagon Socket Cap Screw	5/16"-18 x 5/8"
6	7036-001032-000	Nylon Lock Nut	#10-32
7	7038-002520-000	Hexagon K-Lock Nut	1/4"-20
8	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
9	7050-034068-006	Flat Washer	11/32" x 11/16" x 1/16"
10	7052-062100-006	Spacer Washer	5/8" x 1"
11	7060-031057-009	Lock Washer	5/16" x 37/64" x 3/32"
12	9102014	Drawbar Handle	
13	9102014-5	Oilite Bearing	
14	9102015	Drawbar Shaft	
15	9102020	Bushing	
16	9102181	Shield Collar Attachment	
17	9103014	Sheaf Plate	
18	9103014-1	Sheaf Plate, Flat	
19	9103071	Plastic Spacer	3/16" x 3/8" x 1/8"
20	9133014	Sheaf Plate Assembly	
21	9133014-1	Sheaf Plate Assembly, Flat	
22	E-W5007	Nylon Spacer	
23	M-0680-29	Bearing 6203	
24	M-0680-31	Steel Bushing	
25	P-16A	Pulley	



Reel arm and storage components

Sub assembly number 9122027

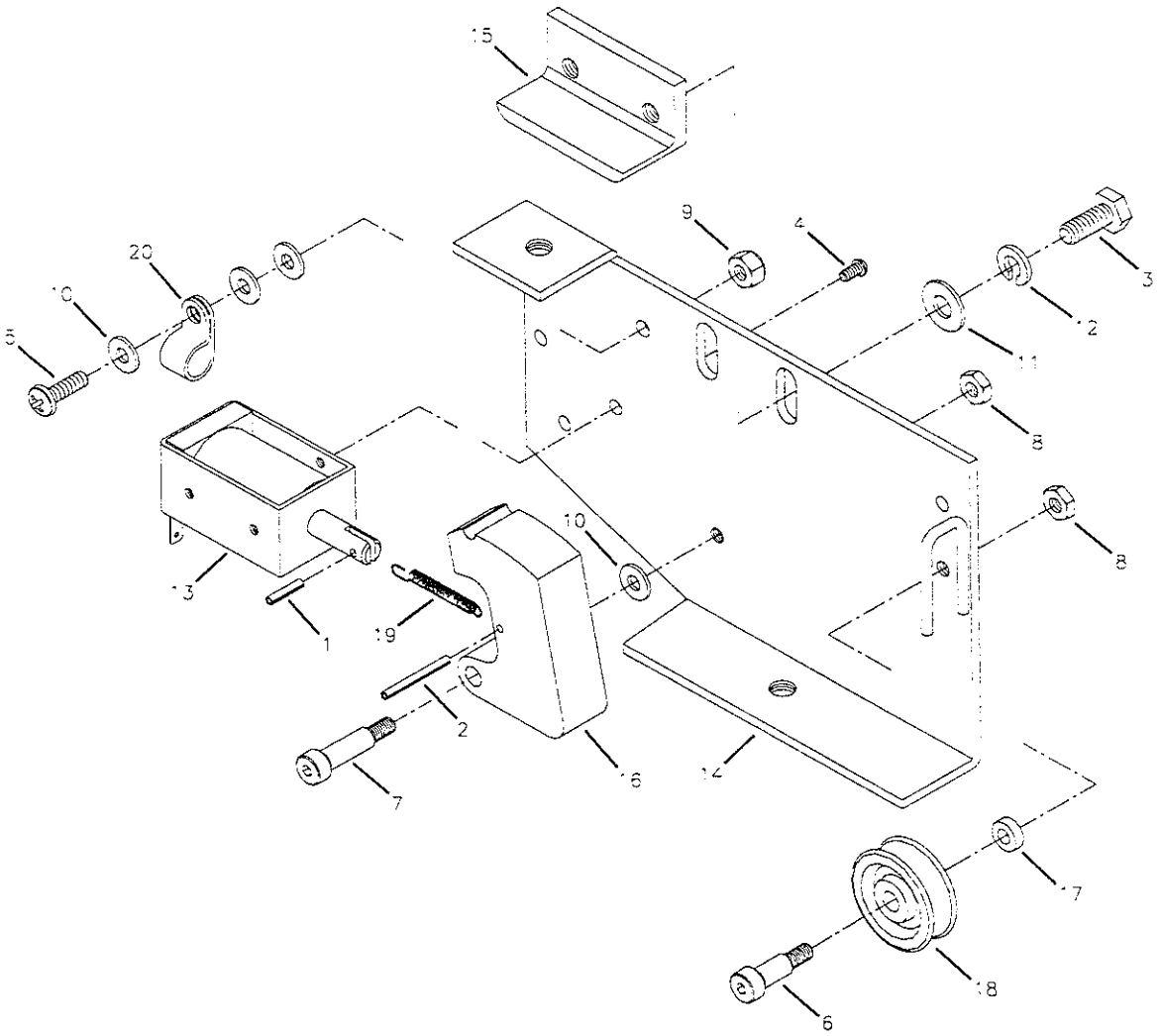
INDEX	PART NUMBER	DESCRIPTION	
1	7002-710000-062	External Retaining Ring	5/8"
2	7006-001800-037	Spring Tension Pin	3/16" x 3/8"
3	7006-001800-125	Spring Tension Pin	3/16" x 1-1/4"
4	7052-062100-006	Spacer Washer	5/8" x 1"
5	9102027	Reel Arm Shaft	
6	9102028	Reel Arm	
7	9122028	Reel Arm Assembly	
8	M-0011	Axle Pin	
9	M-0042	Storage Reel	
10	S-074	Storage Reel Spring	



Pin brake components

Sub assembly number 9122070

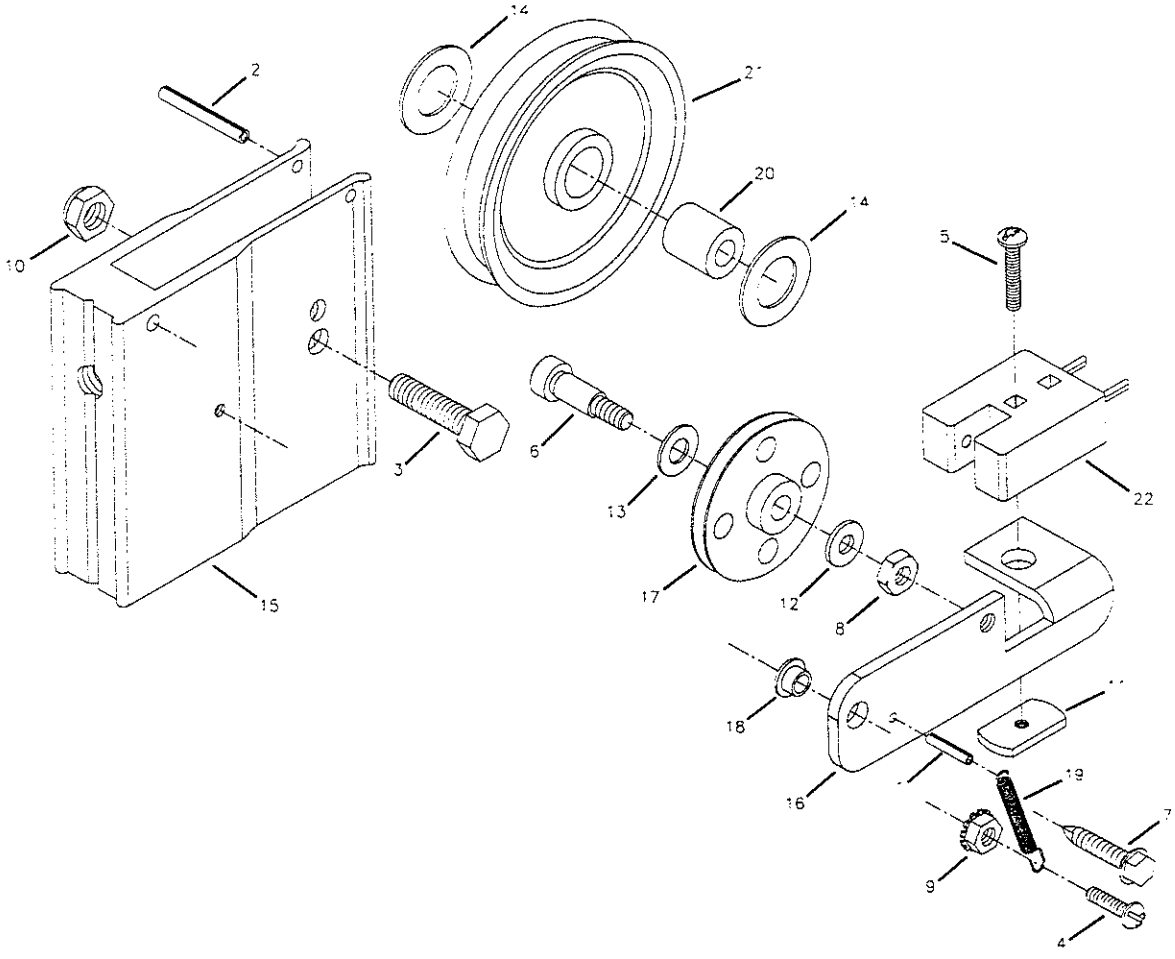
INDEX	PART NUMBER	DESCRIPTION	
1	7006-000900-050	Spring Tension Pin	3/32" x 1/2"
2	7006-000900-100	Spring Tension Pin	3/32' x 1"
3	7010-002528-062	Hexagon Cap Screw	1/4"-28 x 5/8"
4	7016-410632-025	Round Socket Head Machine Screw	#6-32 x 1/4"
5	7016-411032-062	Round Socket Head Machine Screw	#10-32 x 5/8"
6	7020-002500-050	Shoulder Screw	1/4" x 1/2"
7	7020-002500-075	Shoulder Screw	1/4" x 3/4"
8	7034-001024-000	Hexagon Nut	#10-24
9	7036-001032-000	Nylon Lock Nut	#10-32
10	7050-018043-004	Flat Washer	3/16" x 7/16" x 3/64"
11	7050-028062-006	Flat Washer	9/32" x 5/8" x 1/16"
12	7060-025046-006	Lock Washer	1/4" x 15/32" x 1/16"
13	9101070	Solenoid	24 Volts
14	9102070	Brake Plate	
15	9102071	Brake Angle Plate	
16	9103070	Brake Cam	
17	9103071	Plastic Spacer	3/16" x 3/8" x 1/8"
18	9103072	Guide Wheel	
19	9105070	Spring	
20	E-660-09	Cable Clamp	



Pin detection mechanical components

Sub assembly number 9122057

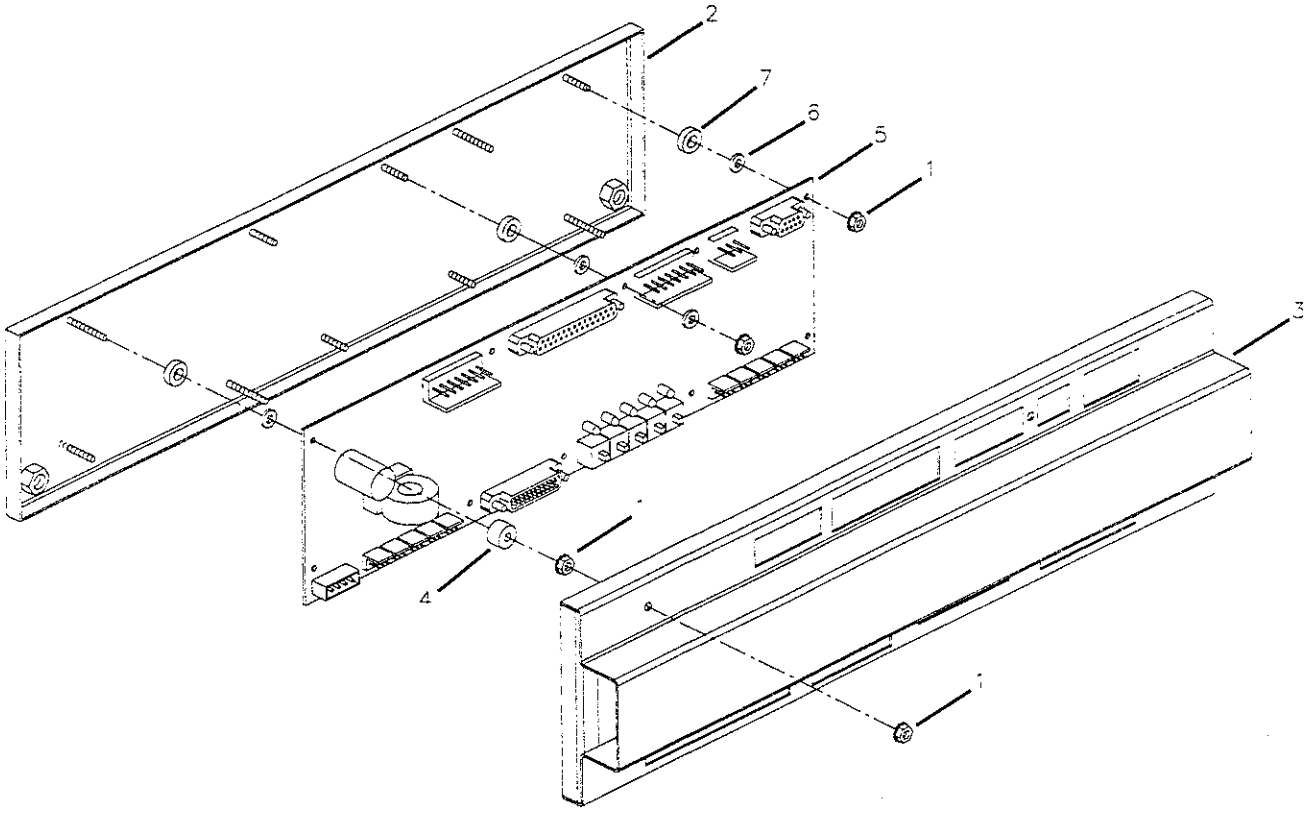
INDEX	PART NUMBER	DESCRIPTION	
1	7006-000900-050	Spring Tension Pin	3/32" x 1/2"
2	7006-001200-100	Spring Tension Pin	1/8" x 1"
3	7010-002520-100	Hexagon Cap Screw	1/4"-20 x 1"
4	7016-430632-050	Round Combined Machine Screw	#6-32 x 1/2"
5	7016-430632-075	Round Combined Machine Screw	#6-32 x 3/4"
6	7020-002500-050	Shoulder Screw	1/4" x 1/2"
7	7027-201016-075	Hex Washer Head Teck Screw	#10-16 x 3/4"
8	7034-001024-000	Hexagon Nut	#10-24
9	7038-000632-000	Hexagon K-Lock Nut	#6-32
10	7044-002520-000	Thin Nylon Lock Nut	1/4"-20
11	7046-000632-006	Weld Nut	#6-32 x 1/16"
12	7050-018043-004	Flat Washer	3/16" x 7/16" x 3/64"
13	7052-025050-003	Spacer Washer	1/4" x 1/2" x 1/32"
14	7052-050087-003	Spacer Washer	1/2" x 7/8" x 1/32"
15	9102057	Sensor Sheaf	
16	9102058	Support Bracket	
17	9103058	Detection Wheel	
18	9103059	Nylon Shoulder Washer	
19	9105070	Spring	
20	M-100B	Bushing	
21	P-16A	Pulley	
22	SB-ECIL-325-PD	Optical Sensor Assembly	



Pin detection electronic components

Sub assembly number SB-2131

INDEX	PART NUMBER	DESCRIPTION	
1	7038-000632-000	Hexagon K-Lock Nut	#6-32
2	9102131	PCB Base	
3	9102132	PCB Cover	
4	E-219	Round Nylon Spacer	
5	E-MD3-88	Pin Detector PCB	
6	E-W3751	Nylon Washer	
7	E-W5007	Nylon Spacer	



bowlingo™

Appendix E: Wiring Diagrams and Electric Parts Listings

Manufacturer's recommendations:

Always use original bowlingo™ parts with your equipment.

The detailed parts listings in this appendix make it easy to locate parts for re-ordering. Always order spare parts by part number and description, not by index and page numbers because this information is subject to change.

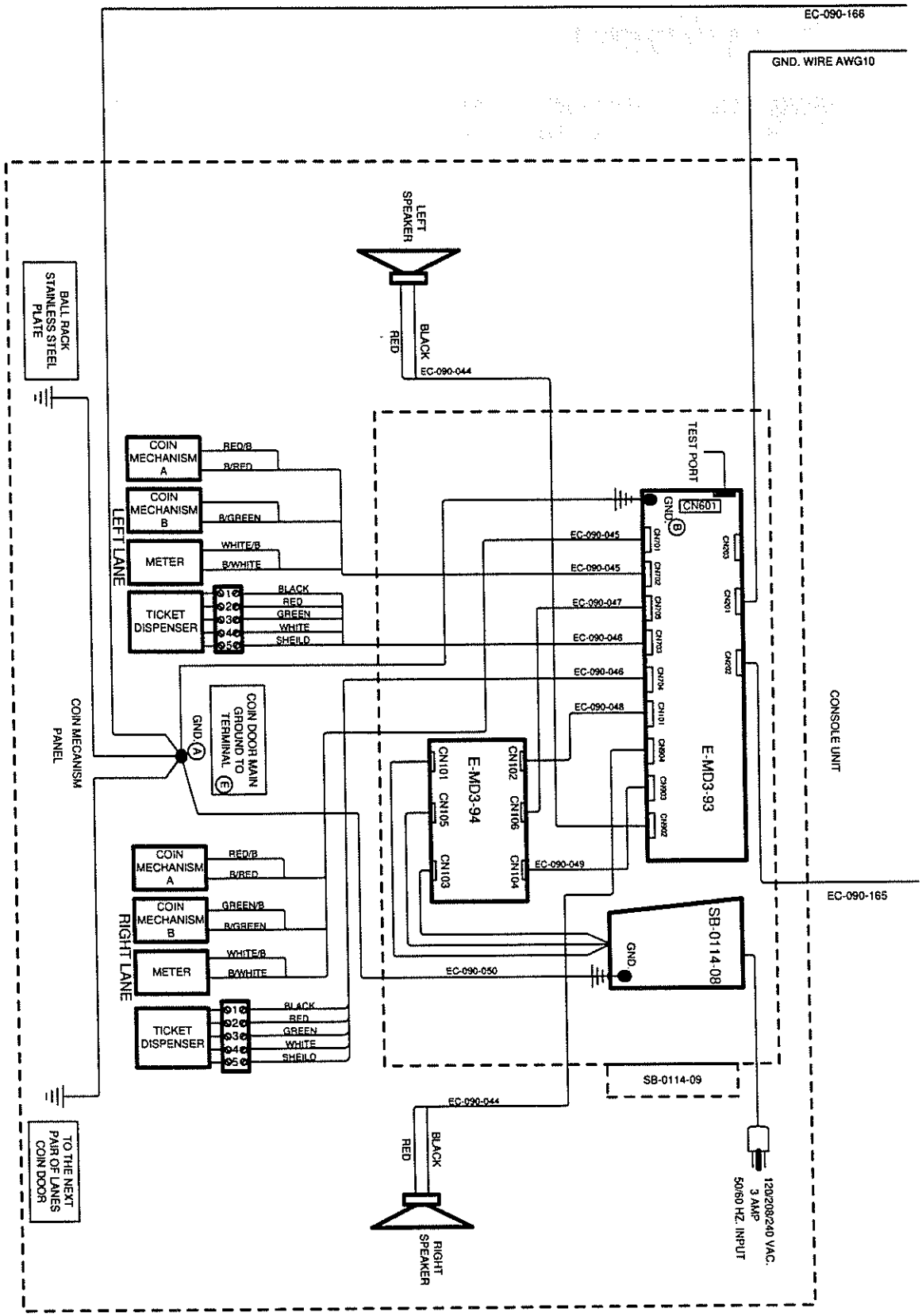
Always supply your equipment serial number when placing an order.

Contents

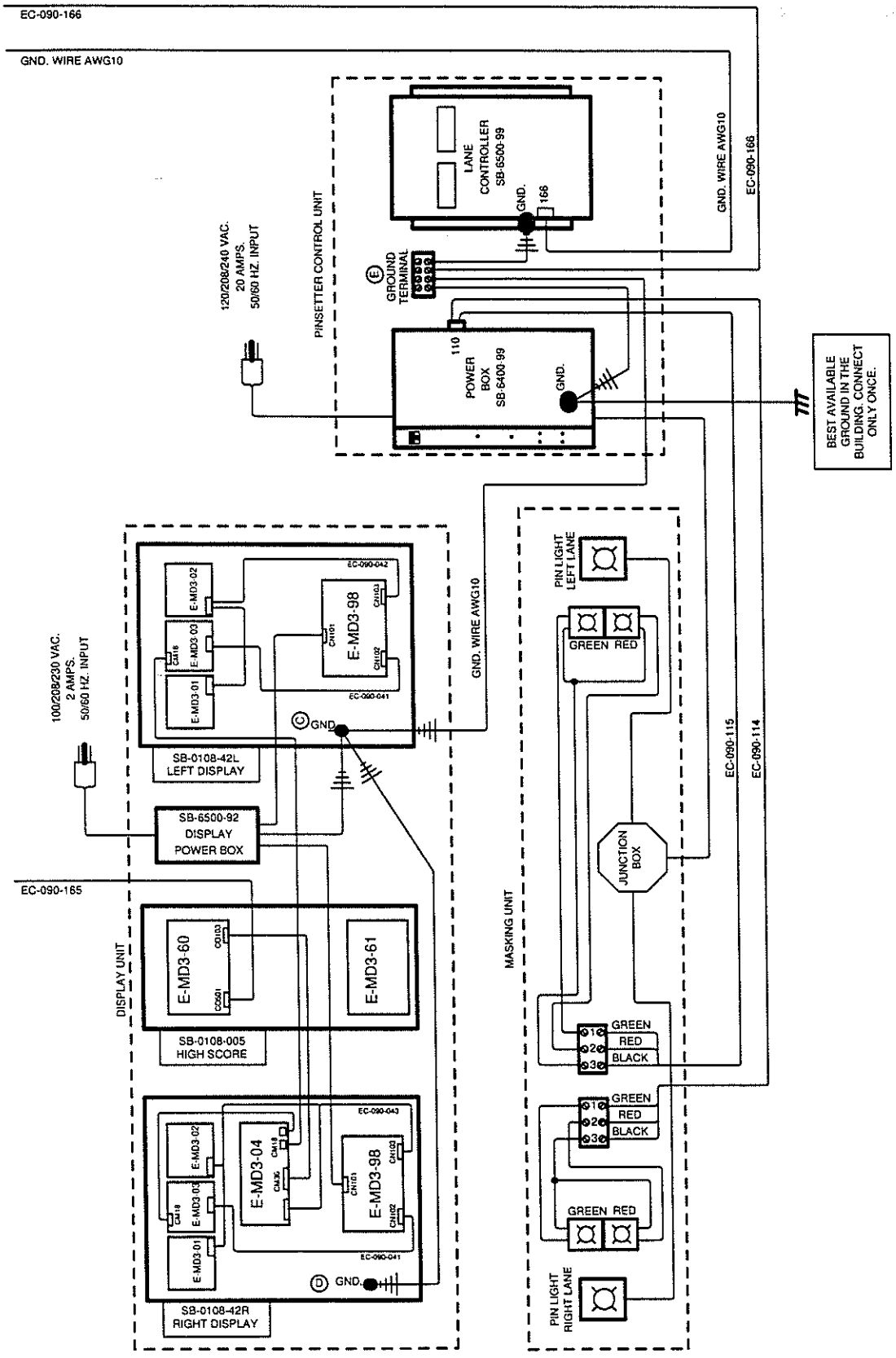
Important Note for European Installations:

All Mendes ground wires are colored green instead of the standard European green and yellow.

General wiring diagram

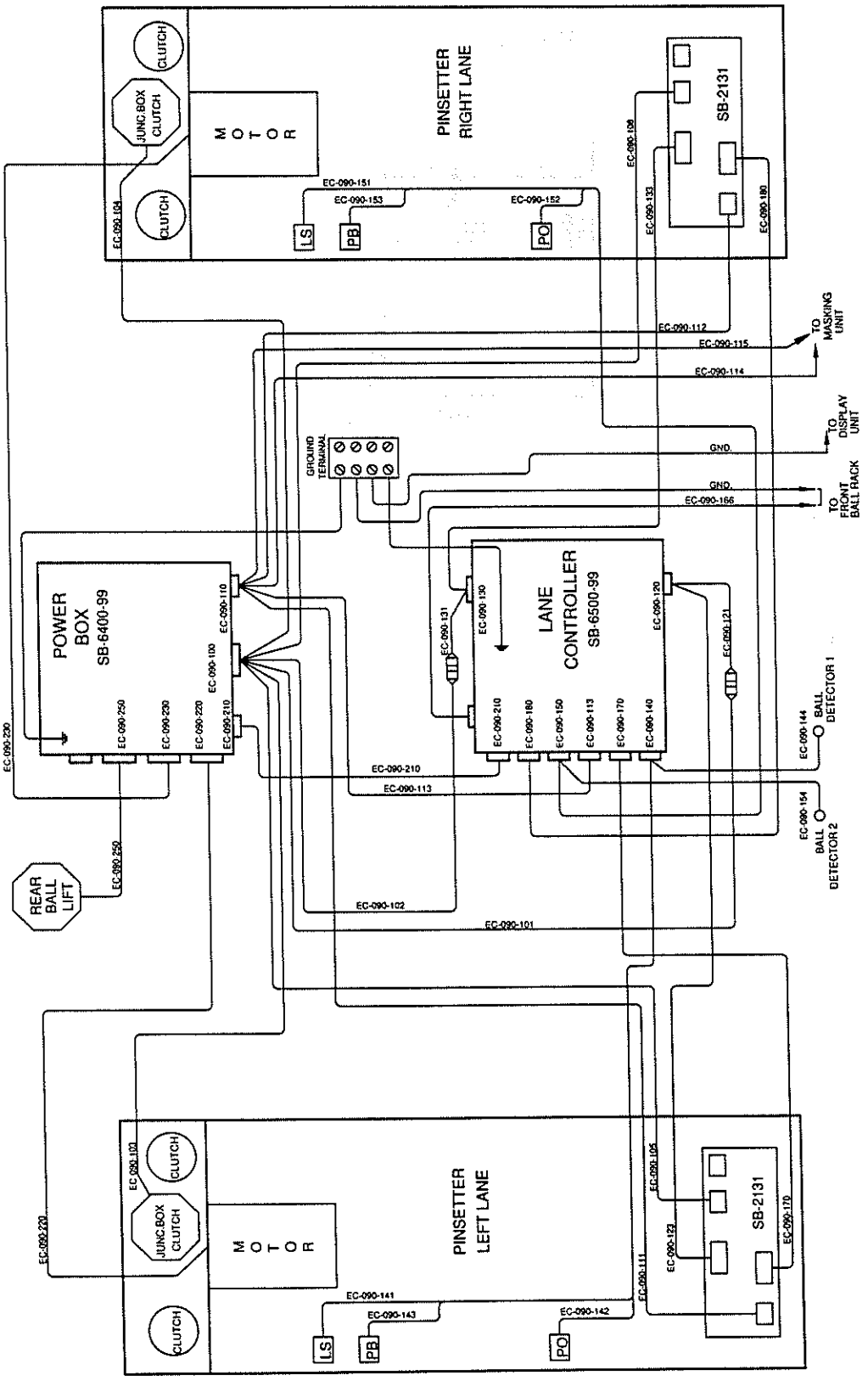


General wiring diagram



Pinsetter wiring diagram

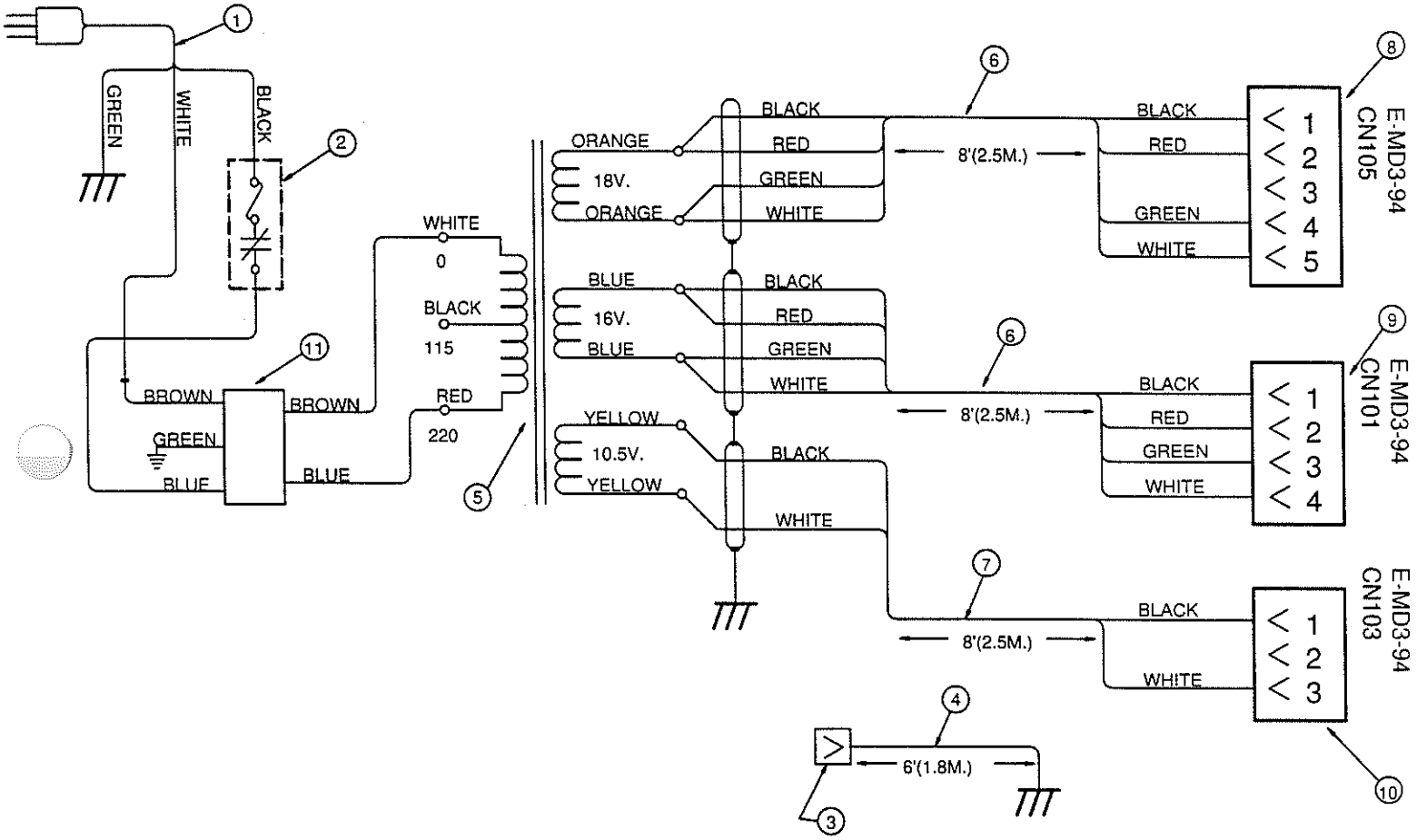
Plan number EL-92-02



Front ball rack power box

Plan number EL-0114-08 (240)

INDEX	PART NUMBER	DESCRIPTION
1	E-020-183-6	Power Supply Cable
2	E-600-46-2	2AMP Overload
3	E-640905-1	#16-14 Terminal Faston
4	E-020-16TEW	16AWG 1-Conductor Cable
5	E-B1090	Voltage Transformer
6	E-020-2248	18AWG 4-Conductor Shielded Cable
7	E-020-2234	18AWG 2-Conductor Shielded Cable
8	E-640425-5	5-Position Terminal
9	E-640426-4	4-Position Terminal
10	E-640426-3	3-Position Terminal

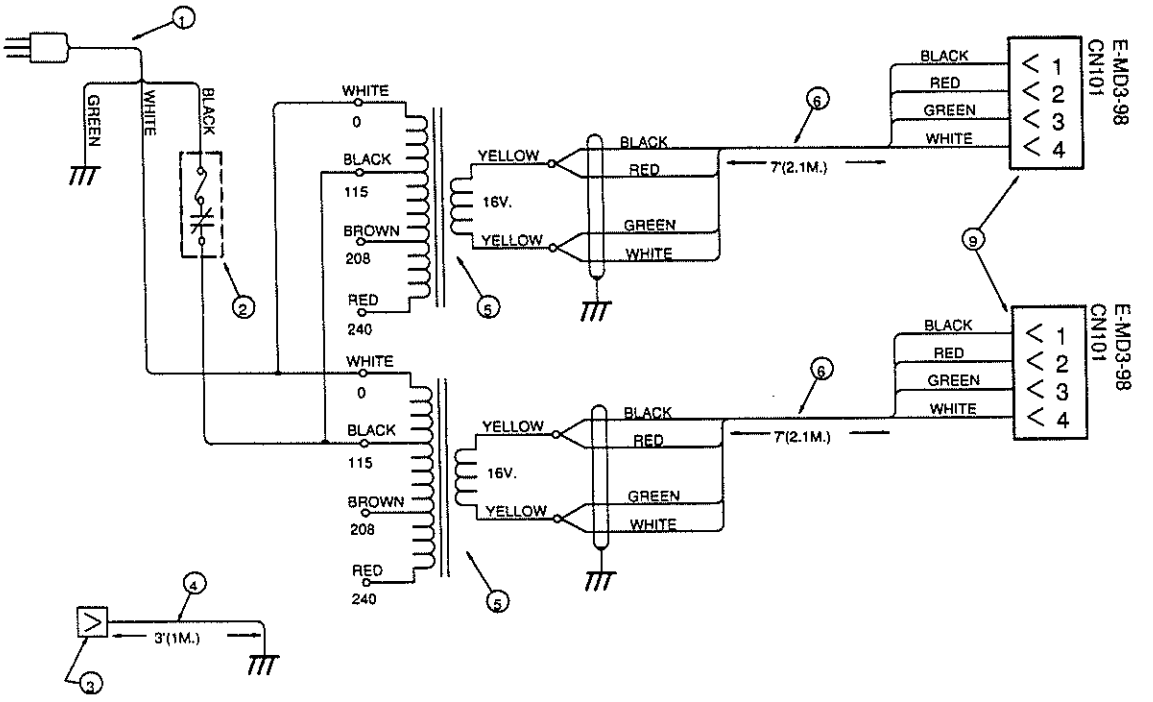


Scoring display unit power box

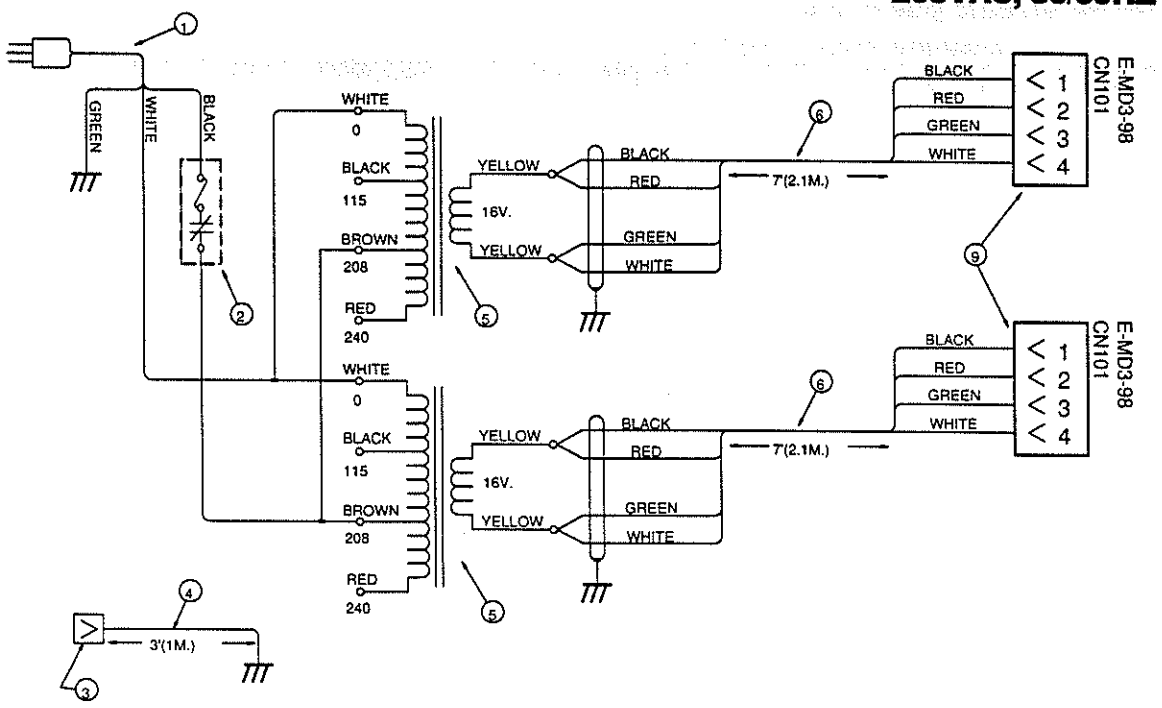
Plan number EL-6500-92 (240)

INDEX	PART NUMBER	DESCRIPTION
1	E-020-183-6	Power Supply Cable
2	E-W28XQ1A-2	2AMP Circuit Overload
3	E-640905-1	#16-14 Terminal Faston
4	E-020-16TEW	16AWG 1-Conductor Cable
5	E-B1091	Voltage Transformer
6	E-020-2248	18AWG 4-Conductor Shielded Cable
9	E-640426-4	4-Position Terminal

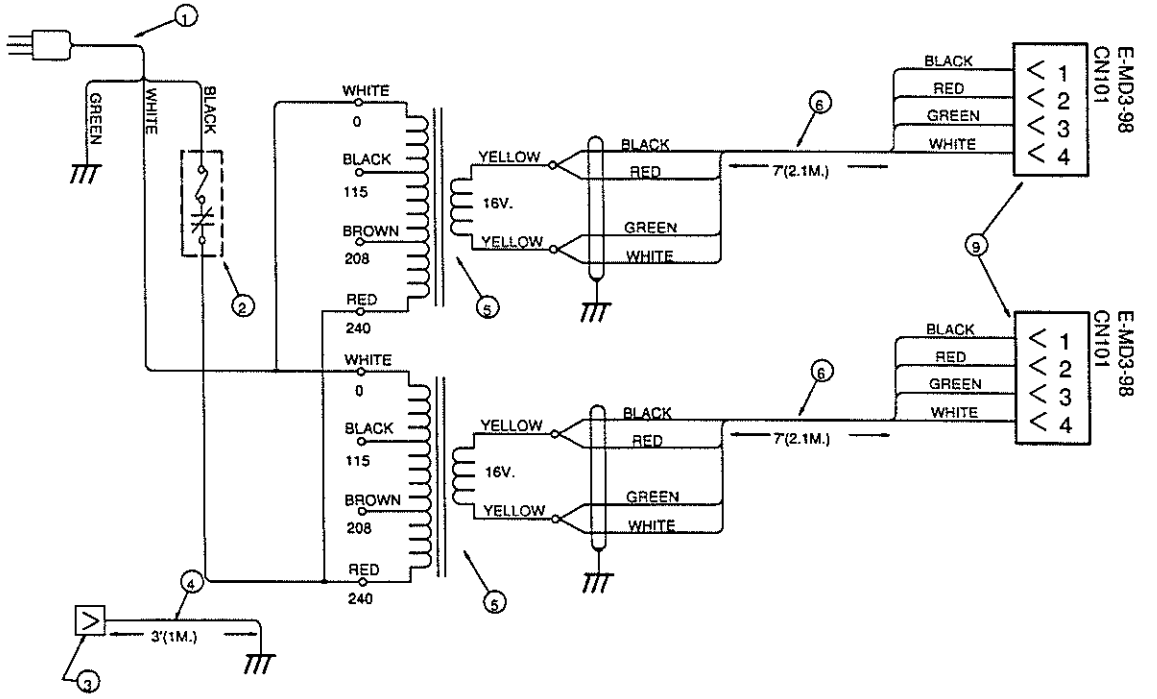
120VAC, 50/60HZ



208VAC, 50/60HZ



240VAC, 50/60HZ

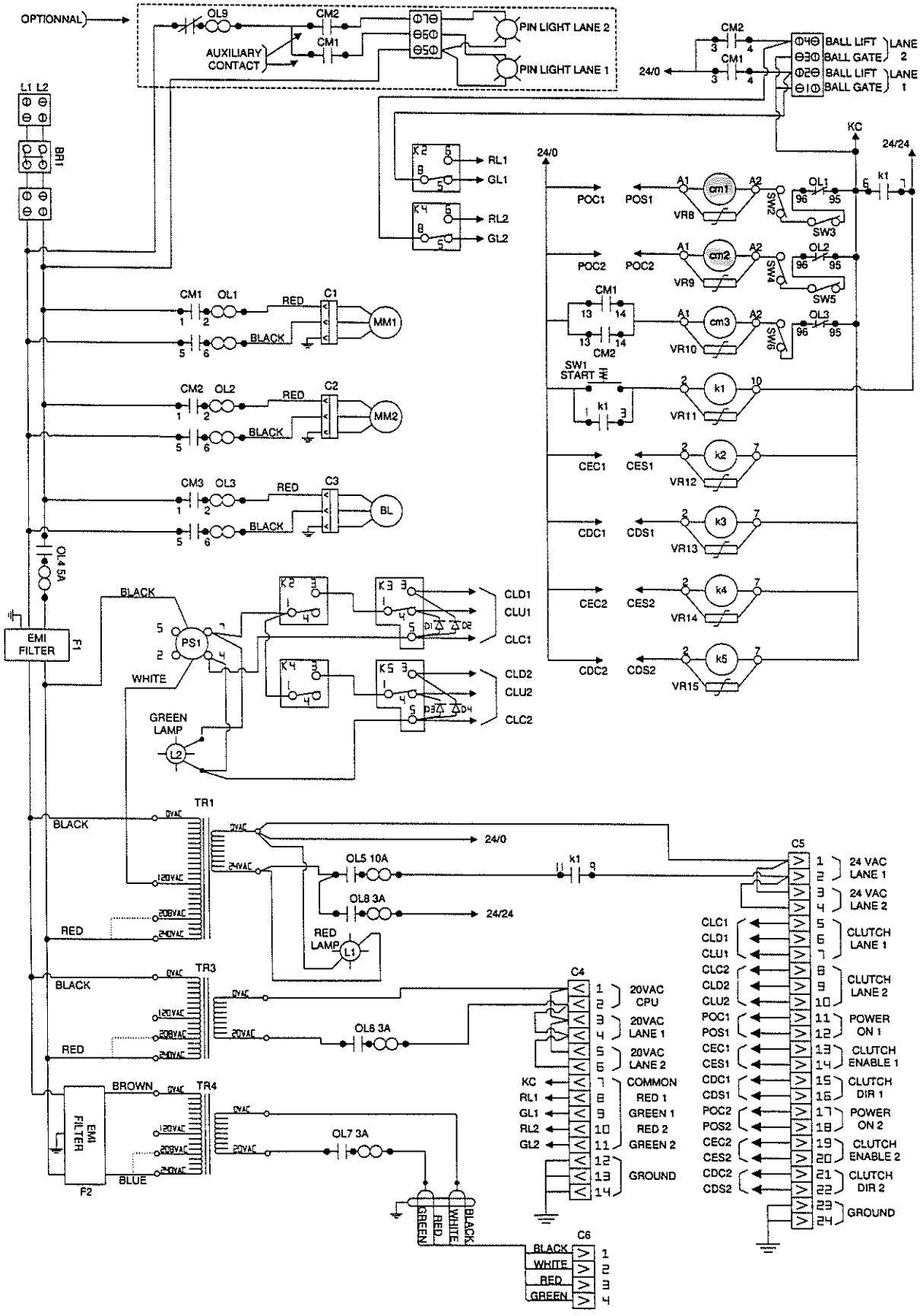


ME-90 electric power box

Sub assembly number SB-6400-99

INDEX	PART NUMBER	DESCRIPTION	
BL	301-1200-00	Electric Motor 208/230 VAC 1/2 HP	Rear Ball Lift
BR1	E-600-20	20AMP Circuit Breaker	
C1	E-4560	220VAC Twist-Lock Receptacle	ME-90 Pinsetter 1
C2	E-4560	220VAC Twist-Lock Receptacle	ME-90 Pinsetter 2
C3	E-4560	220VAC Twist-Lock Receptacle	Rear Ball Lift
C4	E-206043-1	14-Position Female Connector	
C5	E-206838-1	24-Position Male Connector	
C6	E-206429-1	4-Position Male Connector	
CM1	E-B12-10-3	3-P Motor Contactor	ME-90 Pinsetter 1
CM2	E-B12-10-3	3-P Motor Contactor	ME-90 Pinsetter 2
CM3	E-B12-10-3	3-P Motor Contactor	Rear Ball Lift
F1	********	5AMP EMI Filter	
F2	E-F2716	3AMP EMI Corcom Filter	
K1	E-6013	11-Position 24VAC 3FC Relay	
K2	E-6012	8-Position 24VAC 2FC Relay	
K3	E-6012	8-Position 24VAC 2FC Relay	
K4	E-6012	8-Position 24VAC 2FC Relay	
K5	E-6012	8-Position 24VAC 2FC Relay	
L1	E-1090C1-28	28VAC Red Pilot Lamp	
L2	E-1052C5-115	115VAC Green Pilot Lamp	
MM1	301-1200-00	Electric Motor 208/230 VAC 1/2 HP	ME-90 Pinsetter 1
MM2	301-1200-00	Electric Motor 208/230 VAC 1/2 HP	ME-90 Pinsetter 2
OL1	E-RSA-22K	Motor Overload	ME-90 Pinsetter 1
OL2	E-RSA-22K	Motor Overload	ME-90 Pinsetter 2
OL3	E-RSA-22K	Motor Overload	Rear Ball Lift
OL4	E-600-46-5	5AMP Overload	
OL5	E-600-46-10	10AMP Overload	
OL6	E-600-46-3	3AMP Overload	
OL7	E-600-46-3	3AMP Overload	
OL8	E-600-46-3	3AMP Overload	
OL9	E-600-46-3	3AMP Overload	
PS1	E-214215	90VDC Power Supply	
SW1	E-ZF12	Push Button Switch	
SW2	E-519-169	Security Switch	ME-90 Pinsetter 1
SW3	E-519-169	Security Switch	ME-90 Pinsetter 1
SW4	E-519-169	Security Switch	ME-90 Pinsetter 2
SW5	E-519-169	Security Switch	ME-90 Pinsetter 2
SW6	E-519-169	Security Switch	Rear Ball Lift
TR1	E-70137	24VAC Transformer	
TR3	E-90341	20VAC Transformer	
TR4	E-90341	20VAC Transformer	
VR 8	EE-V47ZA7	38VDC Varistor	
VR 9	EE-V47ZA7	38VDC Varistor	
VR10	EE-V47ZA7	38VDC Varistor	
VR11	EE-V47ZA7	38VDC Varistor	
VR12	EE-V47ZA7	38VDC Varistor	
VR13	EE-V47ZA7	38VDC Varistor	
VR14	EE-V47ZA7	38VDC Varistor	
VR15	EE-V47ZA7	38VDC Varistor	

Take note that the safety switches (SW2-SW6) are located on the equipment itself and not inside the electric power box.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OL9
CM2
CM1
AUXILIARY CONTACT
PIN LIGHT LANE 2
PIN LIGHT LANE 1
BALL LIFT
BALL GATE
LANE 2
LANE 1
24/0
24/24
KC
L1 L2
BR1
RL1
GL1
RL2
GL2
POC1
POS1
POC2
CEC1
CES1
CDC1
CDS1
CEC2
CES2
CDC2
CDS2
VR8
VR9
VR10
VR11
VR12
VR13
VR14
VR15
SW1 START
SW2
SW3
SW5
SW6
OL1
OL2
OL3
RED
BLACK
MM1
MM2
BL
OL4 5A
EMI FILTER
F1
PS1
WHITE
GREEN LAMP
CLD1
CLU1
CLC1
CLD2
CLU2
CLC2
TR1
TR3
TR4
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OL8 3A
OL6 3A
OL7 3A
RED LAMP
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BLUE
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C3
C4
C5
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COMMON
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GREEN 1
RED 2
GREEN 2
GROUND
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24 VAC LANE 2
CLUTCH LANE 1
CLUTCH LANE 2
POWER ON 1
CLUTCH ENABLE 1
CLUTCH DIR 1
POWER ON 2
CLUTCH ENABLE 2
CLUTCH DIR 2
GROUND

Appendix F: Self Testing the System

It is possible to perform a series of self tests to check the central processing unit PCB (E-MD3-93). These tests are integrated in ROM memory on the PCB. The following devices of the subsystems are tested:

- KEYBOARDS
- COIN-OP MECHANISMS
- TICKET DISPENSERS
- TIMERS
- SOUNDS (MUSIC)
- LED's
- RAM RETENTION
- DIP SWITCHES
- MECHANICAL TIMERS
- DISPLAYS
- COMMANDS TO LANE CONTROLLER

Equipment required to run self tests:

- a terminal (A VT100 for example) or
- a PC compatible with a terminal emulator (Procomm™, Crosstalk™, etc).

In both cases, you must plug your terminal (or emulator) to SERIAL3 (CN204) of the PCB (E-MD3-93).

Performing the self tests

1. Press the RESET BUTTON (PB101)
2. Press the SELF TEST BUTTON (PB602) during the fast flashing of the CPU LED (you have approximately two seconds to execute this operation). Use the RESET BUTTON by itself to QUIT self tests.

After this operation, the main menu will appear. To perform a test, choose the appropriate number from the main menu. Pressing <ESC> returns to the previous menu.

Main menu items by number

1. KEYBOARD TEST

Checks keyboard keys and buttons (PB601, PB602, PB603, PB604, PB605).

Displays the pressed key.

2. COIN-OP MECHANISMS TEST

Checks detection of coin-op input. Four entries of coin-op are present:

COIN-OP A -> lane 0,
COIN-OP B -> lane 0,
COIN-OP A -> lane 1,
COIN-OP B -> lane 1;

displays the message identifying the appropriate COIN-OP detection;

3. TICKET DISPENSERS TEST

Checks the TICKET DISPENSERS. The number of tickets is user selectable.

4. TIMERS TEST

Checks frequency of three CLOCK types:

-QUICK CLOCK (q), (1/16 second);
-FAST CLOCK (f), (1/4 second)
-CLOCK (c) (1/2 second);

5. SOUNDS (MUSIC) TEST

Checks different SOUNDS (MUSIC) available on each lane. Thirty-one different sounds are present; you simply have to specify the lane and sound identifiers.

SOUNDS are:

1 -> BOWLINGO ACTION,
2 -> LOOP ACTION,
3 -> END ACTION,
4 -> INTRODUCTION,
5 -> MONEY IN,
6 -> 100 POINTS,
7 -> 150 POINTS,
8 -> SPARE,
9 -> GUTTER,
10-> LONG APPLAUSE,
11-> BUTTON,
12-> SHORT APPLAUSE,
13-> STRIKE 1,
14-> STRIKE 2,
15-> STRIKE 3,
16-> END OF GAME,
17-> YAI BGO,
18-> YAI 1,
19-> YAI 2,
20-> OH YAI 1,
21-> OH YAI 2,
22-> NICE SHOT,
23-> GROUP LAUGHTER,
24-> GROUP HA,
25-> GOOD SHOT,
26-> NICE SHOT + LAUGHTER,
27-> YAI 1 + NICE SHOT,
28-> YAI 1 + APPLAUSE,
29-> YAI 2 + APPLAUSE,
30-> OH YAI 1 + APPLAUSE,
31-> OH YAI 2 + APPLAUSE;

6. LED'S TEST

Checks LED'S: L601, L602, L603, L604, L605. After selection of LED number, press <ENTER> key to activate or deactivate LED (TOGGLE for ON/OFF status);

7. OTHER TESTS

To perform a test, choose 7 from the main menu and then choose the appropriate number from the sub menu. Pressing <ESC> returns to the previous menu.

7.1 RAM TEST

Checks the RAM RETENTION:

1. Press <ENTER> key
2. Perform a POWER OFF
3. Wait ten seconds
4. Power up the system again (see section RUNNING THE SELF TESTS OF BOWLINGO SYSTEM to know how to renter test software)
5. Press the <ENTER> key again

7.2 DIP SWITCHES TEST

Checks the DIP SWITCHES: DS401, DS402, DS403, DS404, DS405. This test shows the setting of dip switches. You can change the device value, press the <ENTER> key and check the new value displayed on the terminal screen;

7.3 MECHANICAL TIMERS TEST

Checks MECHANICAL TIMERS devices: usually one per lane. You select the MECHANICAL TIMER (its number(1 or 2)) and press <ENTER> key;

7.4 DISPLAYS TEST

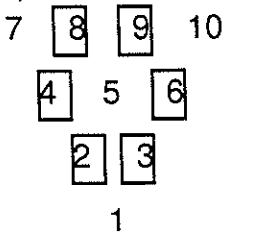
Checks the display of both lanes. This test will light up every LED in the display.

7.5 LANE CONTROLLER TEST

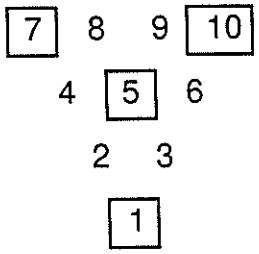
Checks the LANE CONTROLLER OPERATION as follows:

1. OPEN COMMAND
2. SPOT PINS COMMAND
3. FULL SET COMMAND (reset all pins)
4. CLOSE COMMAND

After selection of the lane number, press the <ENTER> key and verify if the following pins are spotted:



-> OPEN lane
-> SPOT PINS:
-> SPOT PINS:



-> FULL SET
-> CLOSE lane

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