



Service Manual

StringPin Pinsetter

Ten Pin

February 2019 / 55-900001-000

StringPin Pinsetter Service Manual

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Manual Part No. 55-900001-000

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Section 1 - SAFETY!

NOTES & WARNINGS

Throughout this publication, “Warnings”, and “Cautions” (accompanied by one of the International HAZARD Symbols) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. They are defined below. OBSERVE AND READ THEM CAREFULLY!

These “Safety Alerts” alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus training and “Common Sense” operation are major accident prevention measures.

 **NOTE or IMPORTANT!** Will designate significant informational notes.



WARNING! Will designate a mechanical or nonelectrical alert which could potentially cause personal injury or death.



WARNING! Will designate electrical alerts which could potentially cause personal injury or death.



CAUTION! Will designate an alert which could potentially cause product damage.



Will designate grounding alerts.

SAFETY NOTICE TO USERS OF THIS MANUAL

This manual has been written and published by the Service Department of Brunswick Bowling Products to aid the reader when servicing or installing the products described.

It is assumed that these personnel are familiar with, and have been trained in, the servicing or installation procedures of these products, which includes the use of common mechanic's hand tools and any special Brunswick or recommended tools from other suppliers.

We could not possibly know of and advise the reader of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not attempted any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by Brunswick, must first completely satisfy himself that neither his nor the product's safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication.

It should be kept in mind, while working on the product, that the electrical system is capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the power to the product should be disconnected prior to servicing and remain disconnected until servicing is complete.

SAFETY REQUIREMENTS FOR STRINGPIN PINSETTERS

As with all machinery, a certain amount of risk is involved in working on the StringPin Pinsetter. However, if the necessary care, knowledge and responsibility are exercised, damage to the pinsetter and people involved in accidents can be avoided. The following steps should be taken:

Safety Guidelines

1. ONLY PROPERLY TRAINED PEOPLE ARE QUALIFIED TO WORK ON OR OPERATE THE PINSETTER.
2. Never operate the pinsetter without ALL factory supplied guarding in place.
3. Never operate the pinsetter if a guard or safety device is damaged or improperly fitted to the machine.
4. Never bypass, disable, or tamper with the safety switches or pinsetter function switches.
5. Never attempt to climb over or around any mechanical barrier or machine guard.
6. Reinstall all the machine guards and the ladder after any troubleshooting or maintenance work has been done on the pinsetter(s) or ball accelerator.
7. Always face toward the machine when using the ladder to climb onto or off the machine. Only one person should be on the ladder at any time.
8. Suitable clothing must be worn (for example: rubber-soled shoes). Do not wear loose clothing such as neckties or smocks that could get caught in moving parts. Remove rings, watches, earrings, bracelets and other jewelry to avoid injury.
9. Care should be taken while near the front of the machine. Accidentally blocking the photocell beam may cause the pinsetter to cycle.
10. Always turn the pinsetter off before working on the machine. Use the Stop/Run Switches mounted on the rear or front of the pinsetter to turn off the pinsetter.
11. If more than one person is working on a machine or if a stop/run switch will be out of reach while working on the machine, turn off both stop/run switches to prevent a person from turning on the pinsetter before the other person says he/she is clear of the pinsetter.
12. When working on both machines of a lane pair or components that are common to both machines (for example: the ball accelerator) power must be turned off at the StringPin Pinsetter Controller. In addition, the main power switch on the StringPin Controller must be locked into the off position using a suitable locking mechanism.
13. Fire extinguishers must be on hand and maintained properly. Keep oily rags and other combustibles in approved fire proof containers.
14. If more than one person is working on a machine, be sure the other person is CLEAR before restarting the machine.

15. When working in the pinsetter area while machines are in operation, ear protection should be worn. Sound levels greater than 83db can be experienced within 1.6 meters of operating machines.
16. Never work on or around the pinsetter while under the influence of alcohol, drugs, or any other substance that can impair your physical abilities or mental judgment.
17. Always use the correct tools for the job.
18. The StringPin pinsetter is designed for use as a 10 pin bowling machine. Do not use the machine or any of its subassemblies for any other purpose.
19. Poisonous or toxic cleaners must not be used. Always check the material safety data sheets before using new cleaners.
20. Always use factory approved parts when repairing the pinsetter. Using substandard parts may pose a safety risk.
21. Always make sure that a bowler is not positioned to throw a ball before putting yourself between the bowler and the machine. It is good practice to have another employee positioned near any bowler to ensure they cannot throw a ball. Additionally, make sure to properly secure a Brunswick Ball Stop or similar 3rd party product to the lane between you and the bowler for added protection.

Section 2 - Overview

This manual is designed to help you service, repair, and perform preventive maintenance on your pinsetters in a safe and efficient manner. Prior to working on one of these pinsetters, you should read the safety information and be familiar with the Safety Requirements located at the beginning of the manual. This manual also provides troubleshooting guidelines that will help reduce downtime and can be used to provide years of reliable operation of your pinsetters.

OPERATION AND CYCLES

Turning the Pinsetter On/Off

The pinsetter can be turned off using the Stop/Run switches located at the back or front of each individual machine or on the String Pin Controller box. **Always turn the Pinsetter off before working on the machine.** If internal service work is to be performed, turn off the main power switch and use an approved lockout device on the main power switch to prohibit the machine from being turned on. Refer to *Figure 2-1*

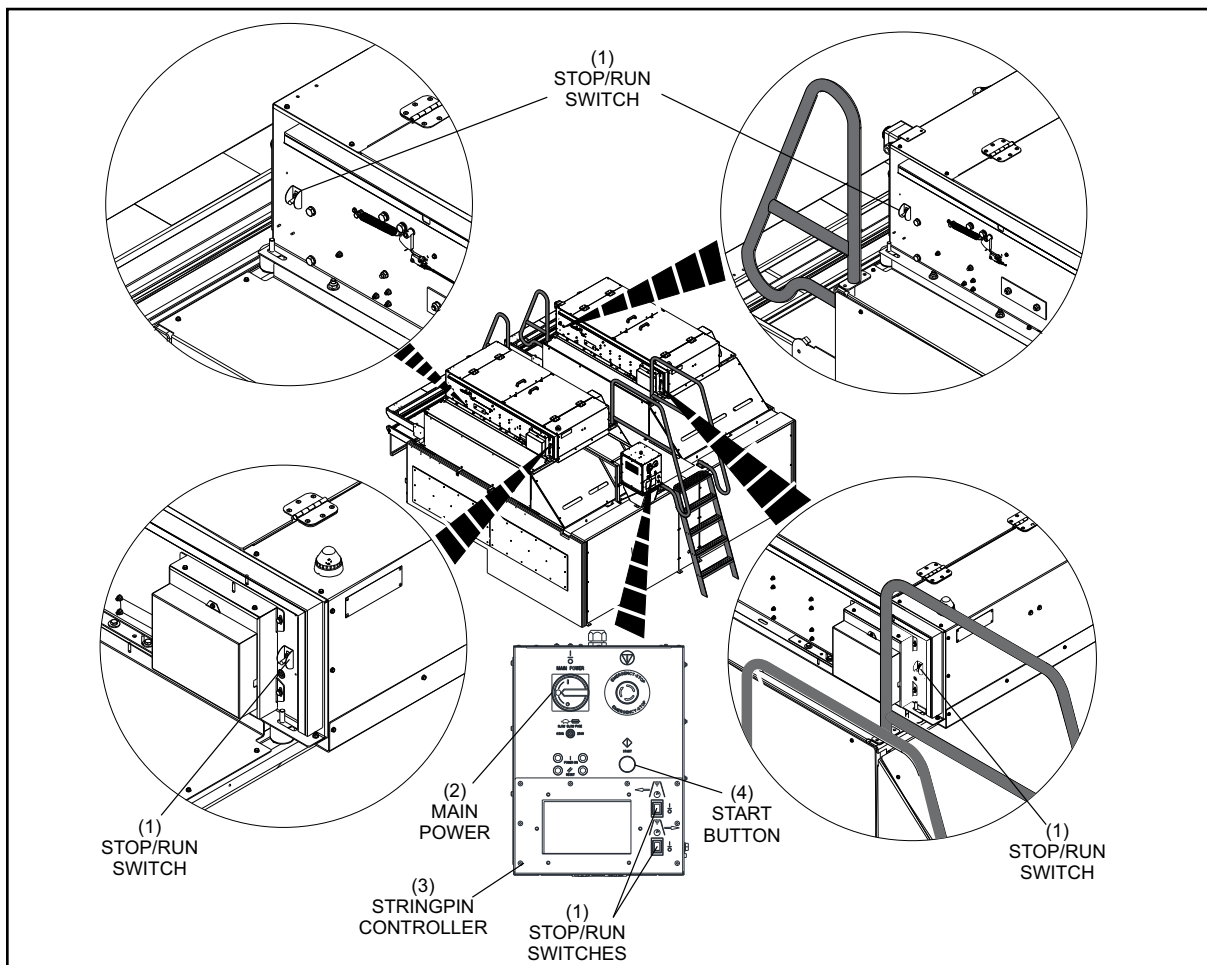


Figure 2-1. Pinsetter On/Off Control

(1) STOP/RUN SWITCH

(2) MAIN POWER

(3) STRINGPIN CONTROLLER

Actions That Start a Machine Cycle

Any of the following occurrences will cycle the pinsetter.

1. Pushing the reset button on the ball rack.
2. The pulling of a string attached to a pin such as when a bowling ball knocks over one or more pins along with a ball detect signal from the pinsetter ball detector.
3. The second ball in a frame breaking the pinsetter ball detector.
4. Switching the main power located on the StringPin Controller to the “On” position.
5. The scoring system sending the pinsetter a “Reset” command through its communication cable.

Description of Pinsetter Cycles During Bowling

First Ball Cycles

Strike

Three seconds after the first pin falls, all ten pins are raised to the full up position and then lowered to the pindeck.

Gutter Ball (Bowling ball rolled in the channel)

The machine will receive and remember the ball detect signal. There is no machine activity and after five seconds the machine is ready for the second ball.

Some Pins Knocked Down (Standing Pin Cycle)

Three seconds after the first pin falls, all ten pins are raised to the full up position and those that were left standing will be lowered to the pindeck.

Second Ball Cycles

Three seconds after receiving a ball detector signal all ten pins are raised to the full up position and then lowered to the pindeck.

PINSETTER STATUS LIGHT/MACHINE POWER ON SEQUENCE

The white light located on top of the StringPin pinsetter provides the operator with valuable information concerning the state of the machine. Refer to *Figure 2-2* and *Figure 2-3* for more information.

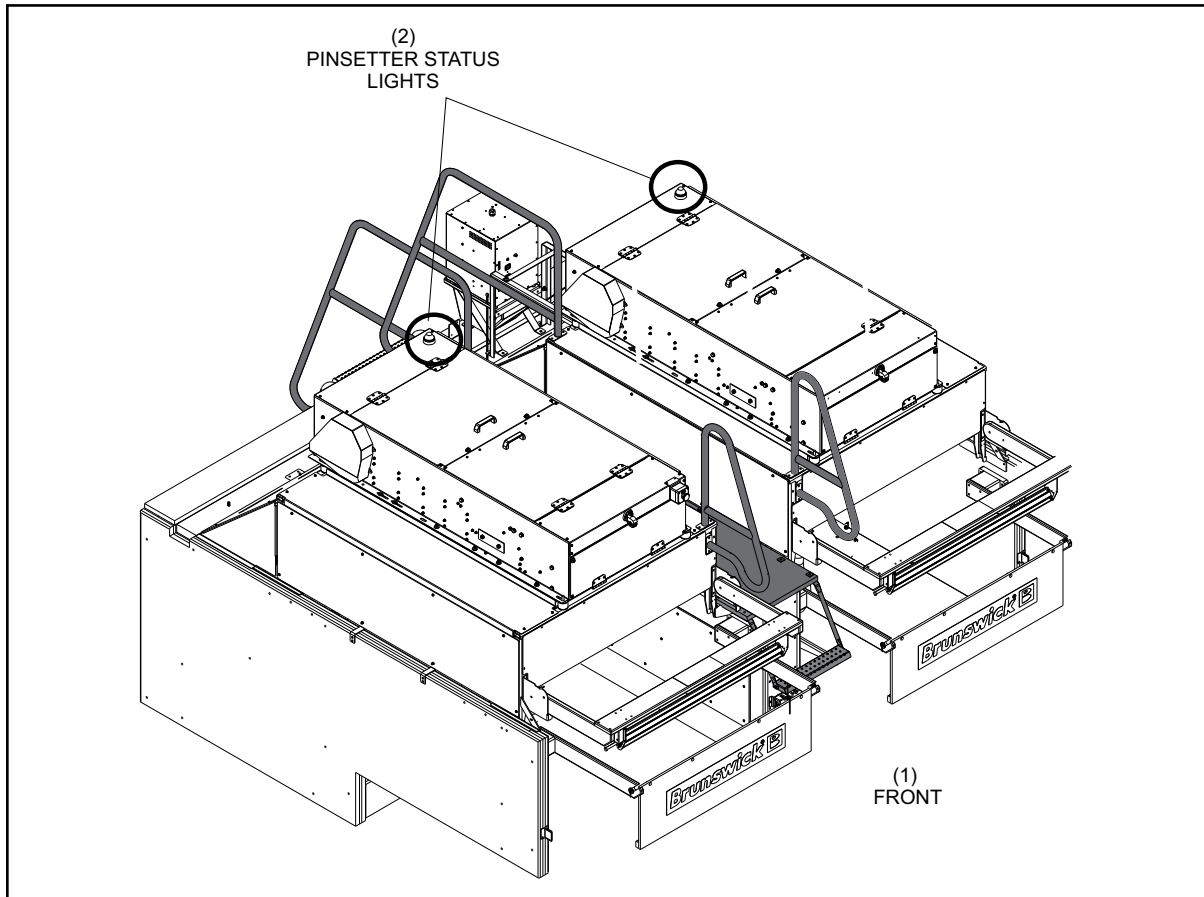


Figure 2-2. StringPin Pinsetter Status Light Location

(1) MACHINE FRONT VIEW

(2) PINSETTER STATUS LIGHTS

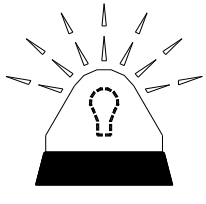
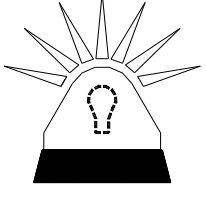
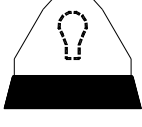
	<p>Slow-flashing white light indicates an error has occurred. The pinsetter needs attention. Turn machine off and lock out power before servicing.</p>
	<p>Solid white light indicates the pinsetter is READY TO RUN. A signal from a remote location will cause the pinsetter to start WITHOUT WARNING. Stay clear of machine. Keep guards in place.</p>
	<p>No light indicates the pinsetter is off. Safe to Service. Lock out power before servicing.</p>

Figure 2- 3. StringPin Pinsetter Status Light

PINSETTER GUARDING

The StringPin Pinsetter is equipped with guards to prevent injury and to limit access to moving parts of the pinsetter. Two guarding options are available; UL certified and CE Certified. UL Certified guarding is the standard guarding for centers outside the European Union while CE Certified guarding is required for centers in European Union countries as well as all residential installations. Refer to *Figure 2-4* and *Figure 2-5* for an explanation of all pinsetter guarding.



Brunswick strongly encourages all centers to consider upgrading to Brunswick's CE Certified guarding.



WARNING! Do not operate the pinsetter without the guarding in place. Severe injury could result if the pinsetter guarding is not used while the machine is operating.

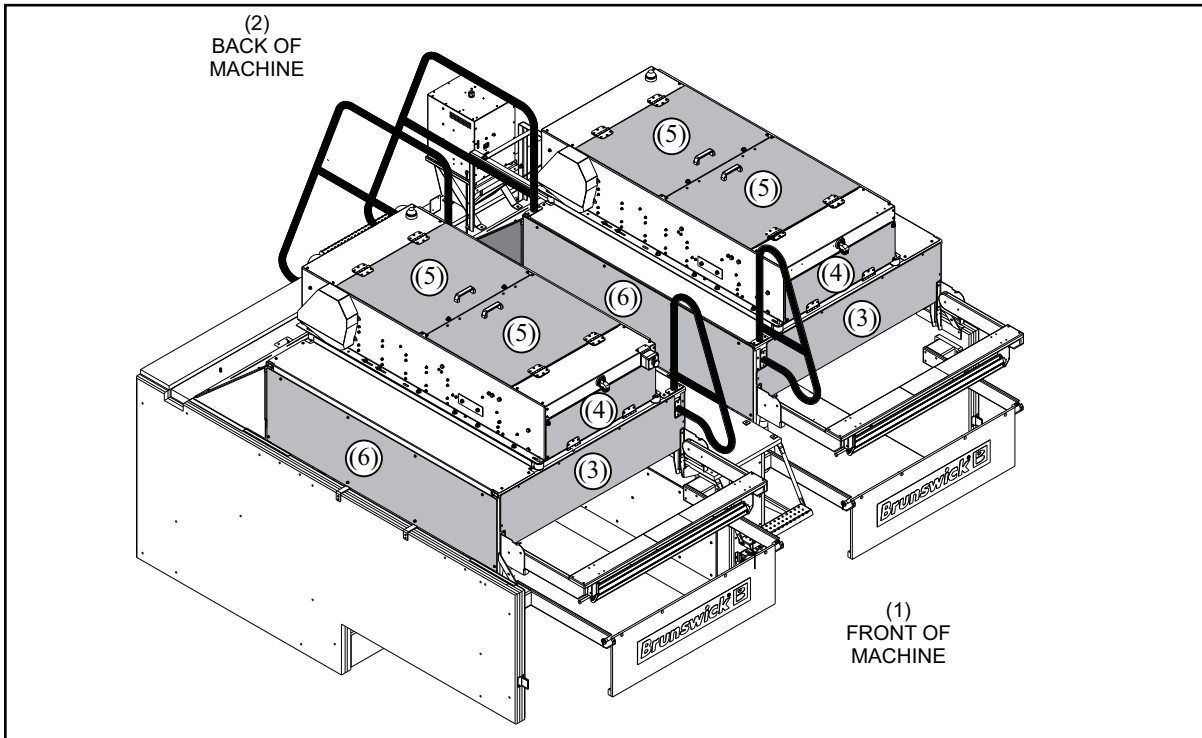


Figure 2-4. Guarding (Front)

(1) FRONT OF MACHINE
(4) PMI GUARDS

(2) BACK OF MACHINE
(5) TOP/MOTOR DRIVE GUARDS

(3) FRONT PINFALL GUARDS (CE ONLY)
(6) SIDE PINFALL GUARDS (CE ONLY)

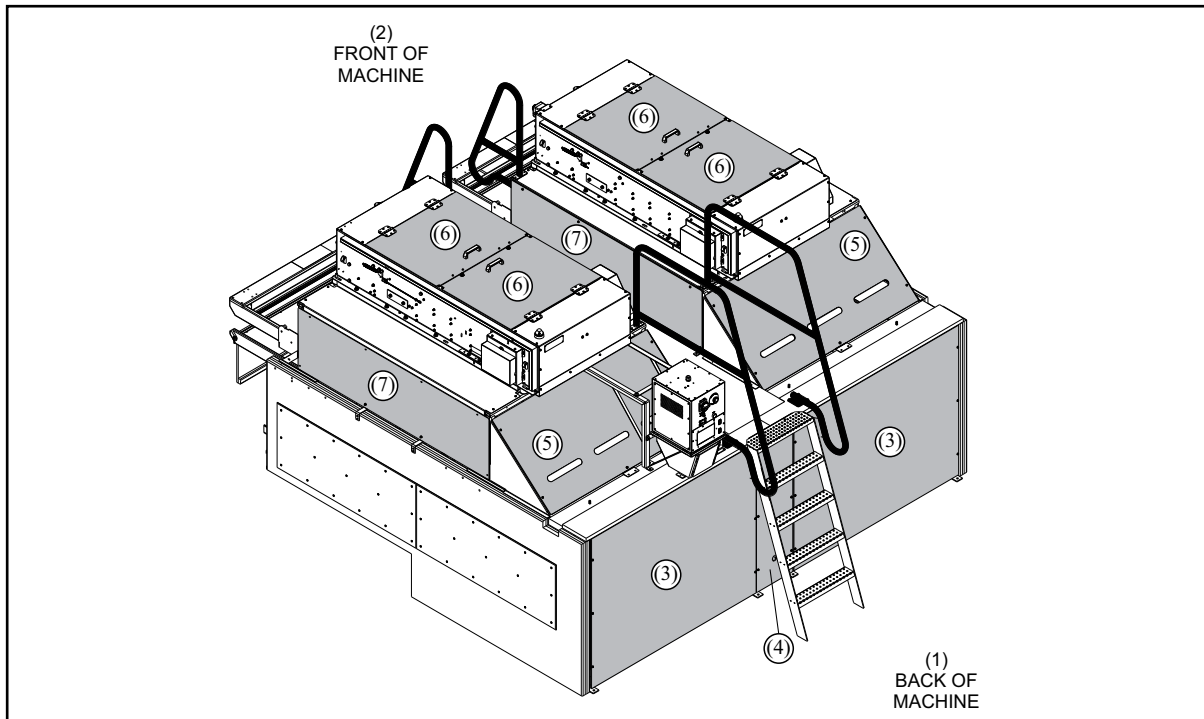


Figure 2-5. Guarding (Rear)

- | | | |
|--------------------------------------|-----------------------------------|--------------------------------------|
| (1) BACK OF MACHINE | (2) FRONT OF MACHINE | (3) REAR MACHINE GUARDS |
| (4) BALL ACCELERATOR GUARD (CE ONLY) | (5) REAR PINFALL GUARDS (CE ONLY) | (6) TOP/MOTOR DRIVE GUARDS (CE ONLY) |
| (7) SIDE PINFALL GUARDS (CE ONLY) | | |

To prevent a ball from impacting the mechanic or operator during maintenance, place a Brunswick Ball Stop or similar 3rd Party Product on the lane. Secure it properly in place between the bowler and the mechanic/operator. Refer to *Figure 2-6*.

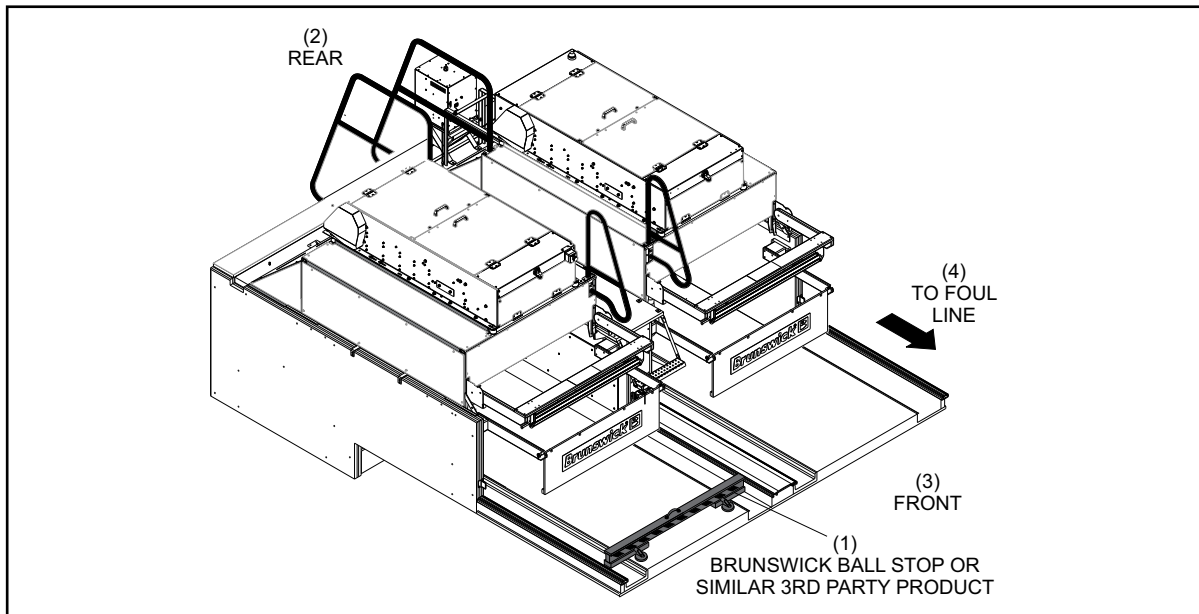


Figure 2-6 Brunswick Ball Stop/3rd Party Product

- | | | |
|--|----------|-----------|
| (1) BRUNSWICK BALL STOP OR 3RD PARTY PRODUCT | (2) REAR | (3) FRONT |
| (4) TO FOUL LINE | | |

PINSETTER GUARD LABELS AND SYMBOLS

The StringPin pinsetter may have guard labels that are installed to alert the operator of various electrical and mechanical warnings throughout the pinsetter. Additionally, various symbols will be found designating many different functions. Refer to *Figure 2-7* and *Figure 2-8* for an explanation of all labels and symbols.

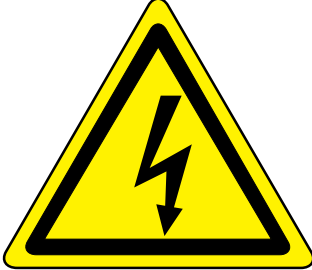


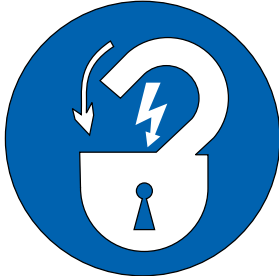
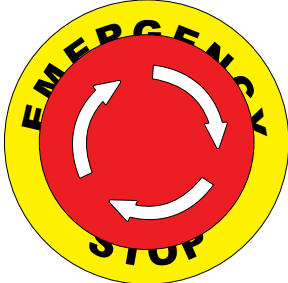
Warning/Symbol	Definition
	<p style="text-align: center;">High Voltage and/or Electrical Warning</p> <hr/> <p>Indicates electrical areas which could potentially cause personal injury or death</p>
	<p style="text-align: center;">Mechanical Warning</p> <hr/> <p>Indicates mechanical areas which could potentially cause personal injury or death</p>
	<p style="text-align: center;">Pinch Point Warning</p> <hr/> <p>Indicates pinch point areas which could potentially cause personal injury or death</p>
	<p style="text-align: center;">Lock Out</p> <hr/> <p>Indicates a reminder to turn off AND lock out the pinsetter power before servicing</p>
	<p style="text-align: center;">Emergency Stop</p> <hr/> <p>Indicates emergency stop(s) and direction to rotate the E-Stop push button to return power to the pinsetters</p>

Figure 2-7 Pinsetter Guard Labels and Symbols - A

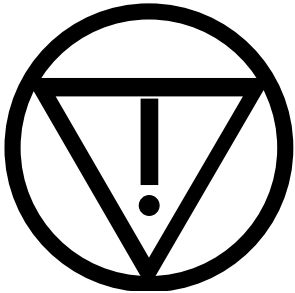
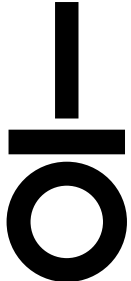

Warning/Symbol	Definition
	<p>General Emergency Stop</p> <hr/> <p>Indicates the location of a general emergency stop switch</p>
	<p>Run or Stop</p> <hr/> <p>Indicates the location of a run or stop switch that can be used to turn one pinsetter on or off</p>
	<p>Do Not Step</p> <hr/> <p>Indicates an area that is not designed to step on or used as a step</p>
	<p>Do Not Stand</p> <hr/> <p>Indicates an area that is not designed to stand on</p>
	<p>Do Not Sit</p> <hr/> <p>Indicates an area that is not designed to be used as a seating area</p>

Figure 2-8 Pinsetter Guard Labels and Symbols - B

MACHINE COMPONENT LOCATION AND DESCRIPTION

The simple design of the StringPin pinsetter makes it easy and inexpensive to operate and maintain. Because the pins are tethered to the machine by the “strings”, only 10 pins are required rather than the 20 - 23 pins typically used in free fall pinsetters. The design also eliminates the need for additional components required to collect pins and move them through the machine. This reduces the noise and pin handling issues associated with free fall pinsetters. Refer to *Figure 2-9*.

The StringPin Pinsetter consists of four subassemblies:

1. Main Frame (Drive Motor, String Spool, Pin Motion Interface)
2. Setting Platform (Centering Cones)
3. Ball Pit (Ball Stop, Carpet Mat, Pit Assembly)
4. Ball Accelerator

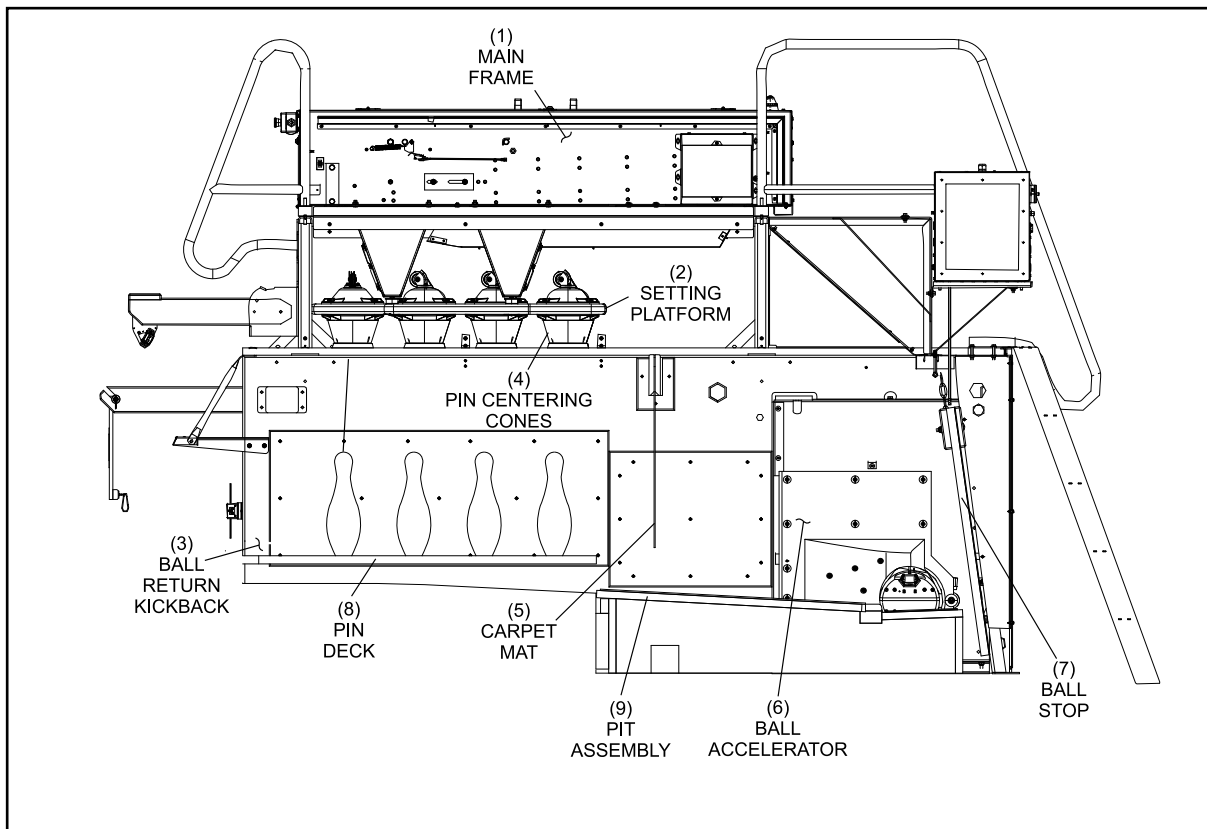


Figure 2-9. String Pinsetter Sub Assemblies and Components - Side View

- | | | |
|-------------------------|----------------------|--------------------------|
| (1) MAIN FRAME | (2) SETTING PLATFORM | (3) BALL RETURN KICKBACK |
| (4) PIN CENTERING CONES | (5) CARPET MAT | (6) BALL ACCELERATOR |
| (7) BALL STOP | (8) PIN DECK | (9) PIT ASSEMBLY |
| (9) PIT CARPET | | |

Main Frame

The Main Frame contains the major components that make the pinsetter function. Refer to *Figure 2-10*.

The main frame is made up of the following components:

1. String Spool and Tension Lever Assembly
2. String Wagon and Drive Assembly
3. Pin Motion Interface (PMI)

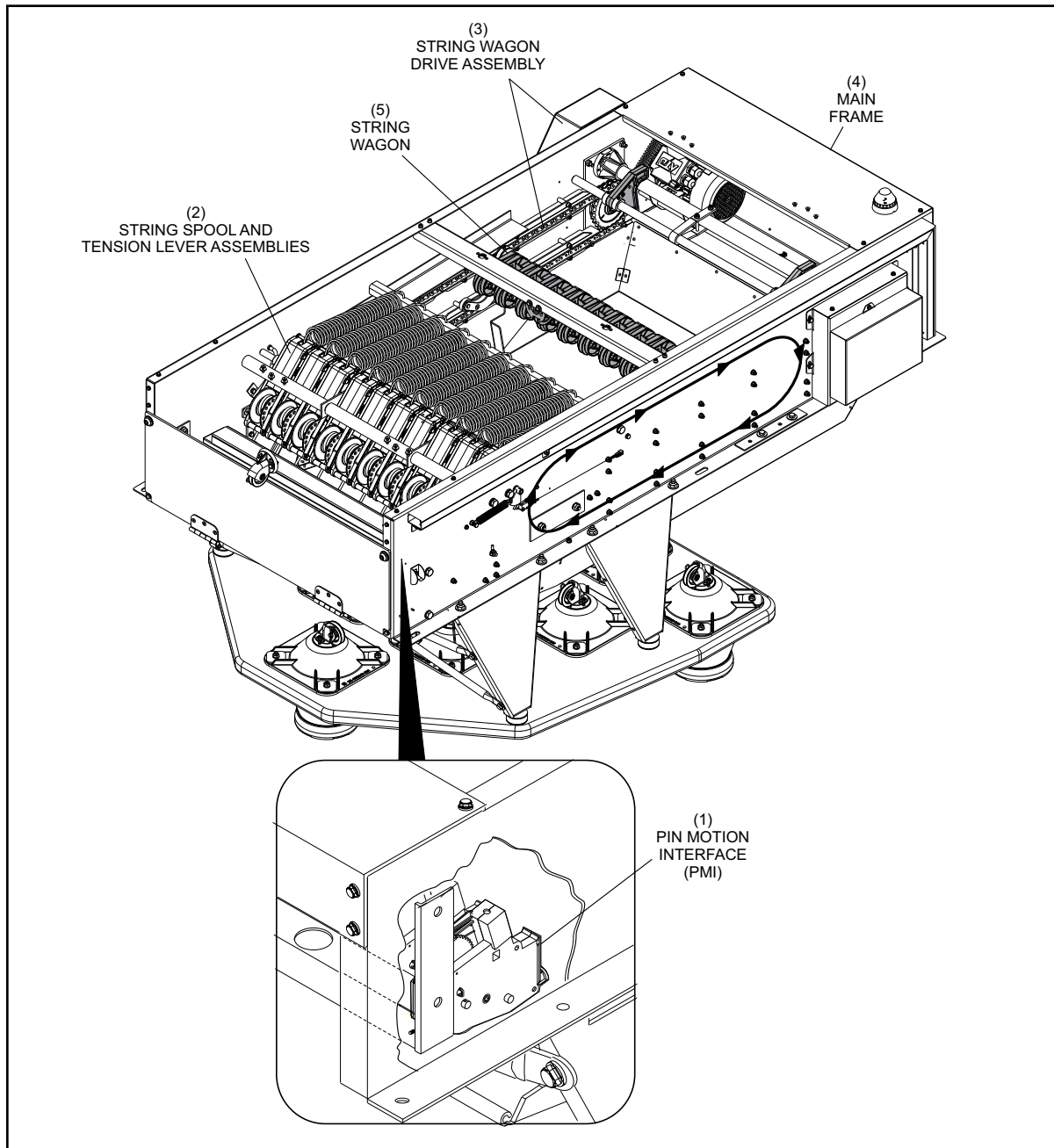


Figure 2-10. Main Frame - Components

- | | | |
|--------------------------------|---|---------------------------------|
| (1) PIN MOTION INTERFACE (PMI) | (2) STRING SPOOL AND TENSION LEVER ASSEMBLIES | (3) STRING WAGON DRIVE ASSEMBLY |
| (4) MAIN FRAME | (5) STRING WAGON | |

The starting point for a string is the String Spool and Tension Lever Assembly. From the spool the string routes through the String Wagon. The wagon moves back and forth in the main frame to lower or raise the pins. From the wagon, the string continues through the Pin Motion Interface (PMI). The PMI contains a switch that detects when a pin has been knocked over and a string brake that controls whether the pin will be lowered to the pindeck when the string wagon moves toward the front of the machine. Finally the string routes through a centering cone before it is tied to the pin. Refer to *Figure 2-11*.

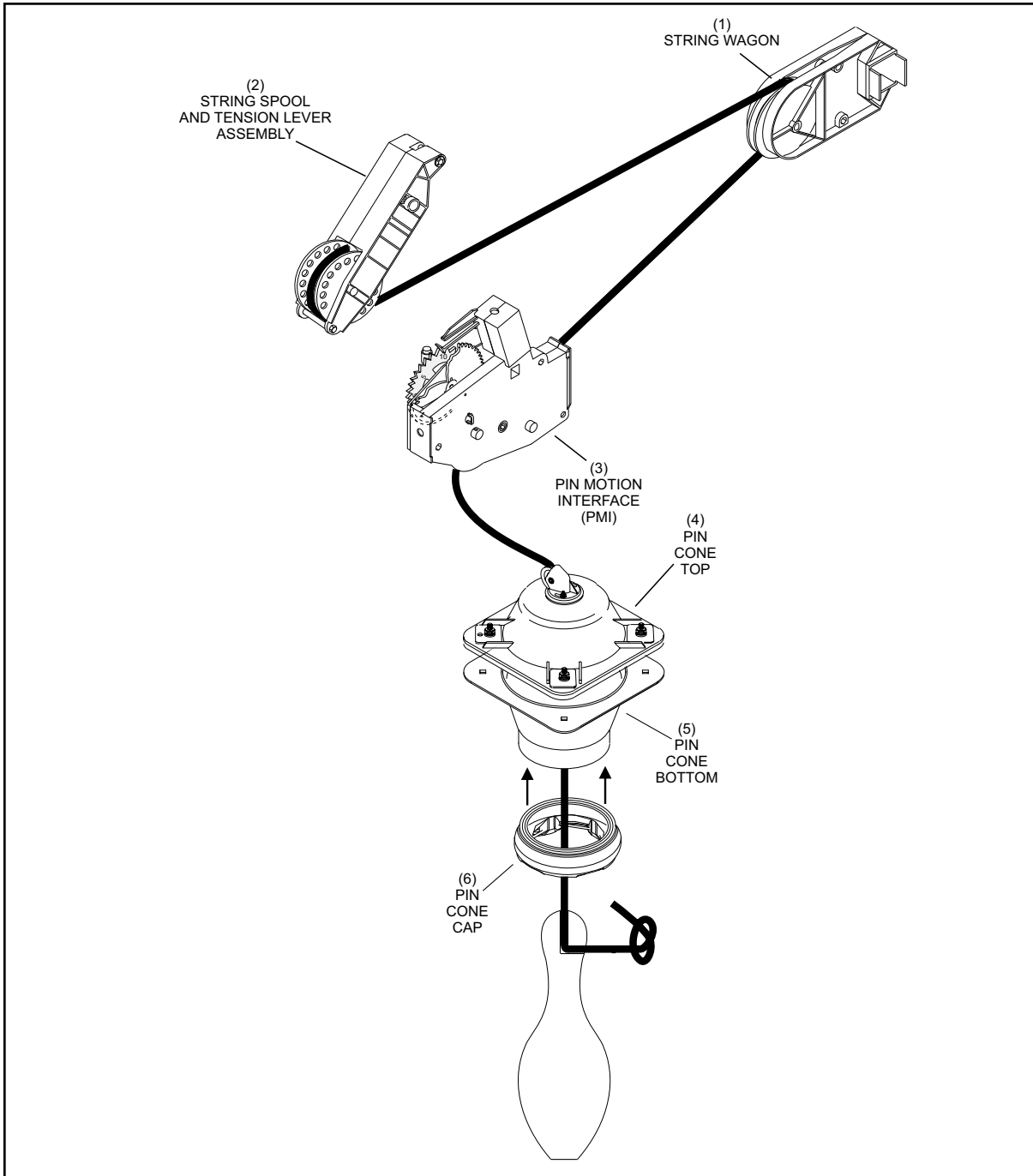


Figure 2-11. Main Frame - String Path

- | | | |
|---------------------|---|--------------------------------|
| (1) STRING WAGON | (2) STRING SPOOL AND TENSION LEVER ASSEMBLY | (3) PIN MOTION INTERFACE (PMI) |
| (4) PIN CONE TOP | | |
| (5) PIN CONE BOTTOM | (6) PIN CONE CAP | |

String Spool and Tension Lever Assembly

The String Spool and Tension Lever assembly is the starting point for the strings. When new, there is 16'5" (5004 mm) length of string attached to each pin. A portion of this string is used during normal machine operation. The rest is wound around the String Spool and is considered spare string that can be used to repair worn-out or damaged sections of the string that is in use.

The String Spool is mounted on a spring loaded Tension Lever. The lever keeps the strings from being stretched due to excessive force as the pins are lifted into the centering cones of the setting platform. Holes in the String Spool reel allows the user to control the length of string in use during normal operation and control the amount of tension applied to the string. Because the strings will stretch over time, it is important to check the string tension regularly to ensure that the machine functions properly. Refer to *Figure 2-12*.

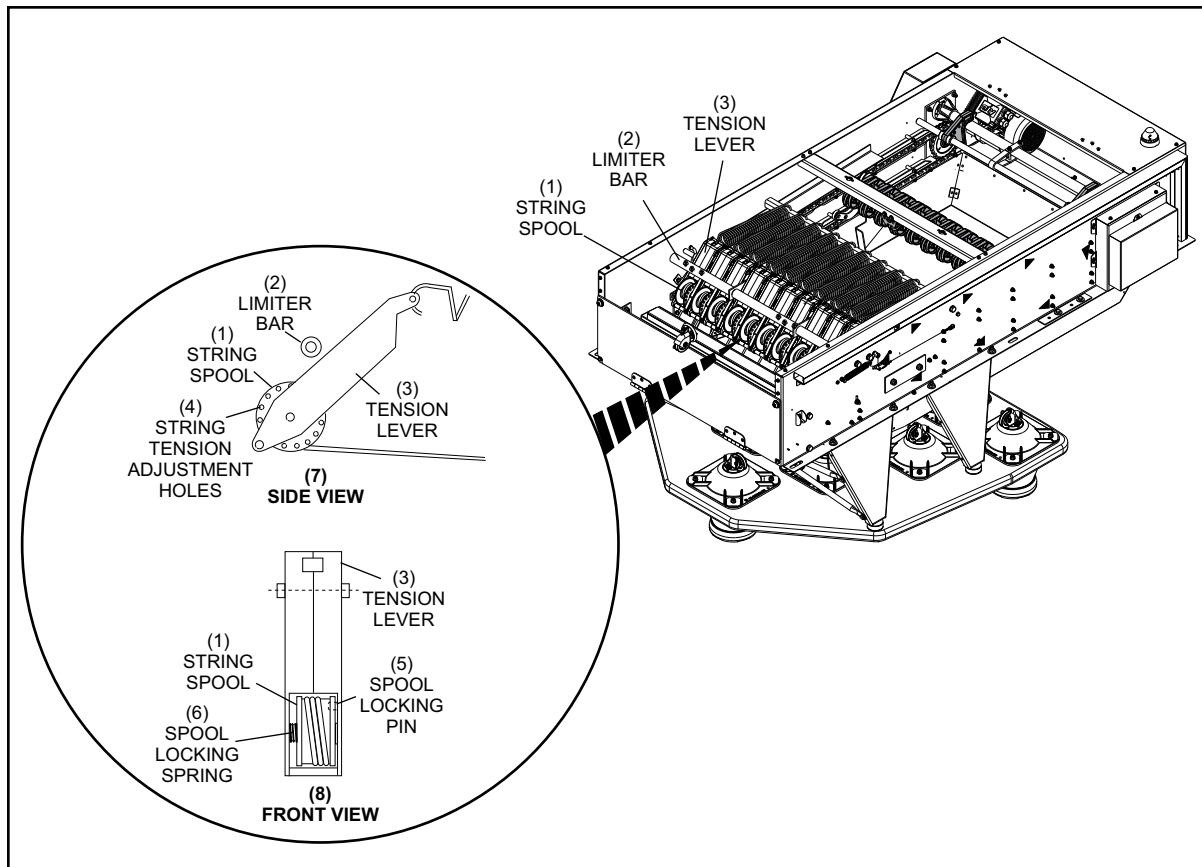


Figure 2-12. String Tension Adjustments

- | | | |
|-------------------------------------|-----------------------|--------------------------|
| (1) STRING SPOOL | (2) LIMITER BAR | (3) TENSION LEVER |
| (4) SPRING TENSION ADJUSTMENT HOLES | (5) SPOOL LOCKING PIN | (6) SPOOL LOCKING SPRING |
| (7) SIDE VIEW | (8) FRONT VIEW | |

String Wagon And Drive Assembly

The String Wagon moves back and forth in the main frame to lower or raise the pins and to lift and lower the gate. The wagon is driven clockwise using a chain attached to the Motor and Gear Assembly. Fins mounted inside the main frame guide the strings front to back keeping them separated so they don't interfere with each other.

When going toward the front of the machine (Home Position), the strings are let out to allow pins to lower to the pindeck. Adjustable brackets called Slow Setting Pin brackets ensure that the pins are set smoothly on the pindeck. Whether the pin is actually lowered is determined by a string brake located in the Pin Motion Interface.

As the wagon returns to the rear of the machine, the strings are pulled back causing the pins to lift into the centering cones located on the setting platform.

If pins are unable to lift into the center cones due to a string tangle, the added tension on the strings trigger a De-tangling Bar and Switch. The machine will attempt to untangle the strings by continually turning the drive motor off, then on, to create a up/down shaking motion of the pins. Switches inside the Cam and Switch Cluster assembly are used to monitor the location of the string wagon.

Stop Dogs hold the sweep wagon at the back of the machine in the "pins up" position. Although they are not used during normal machine operation, the blocks are needed to prevent the weight of the pins from pulling the wagon to the front of the machine after the "Pins Up" switch is pressed. Having the wagon held in this position is useful when performing maintenance functions such as string tensioning. Refer to *Figure 2-13*.

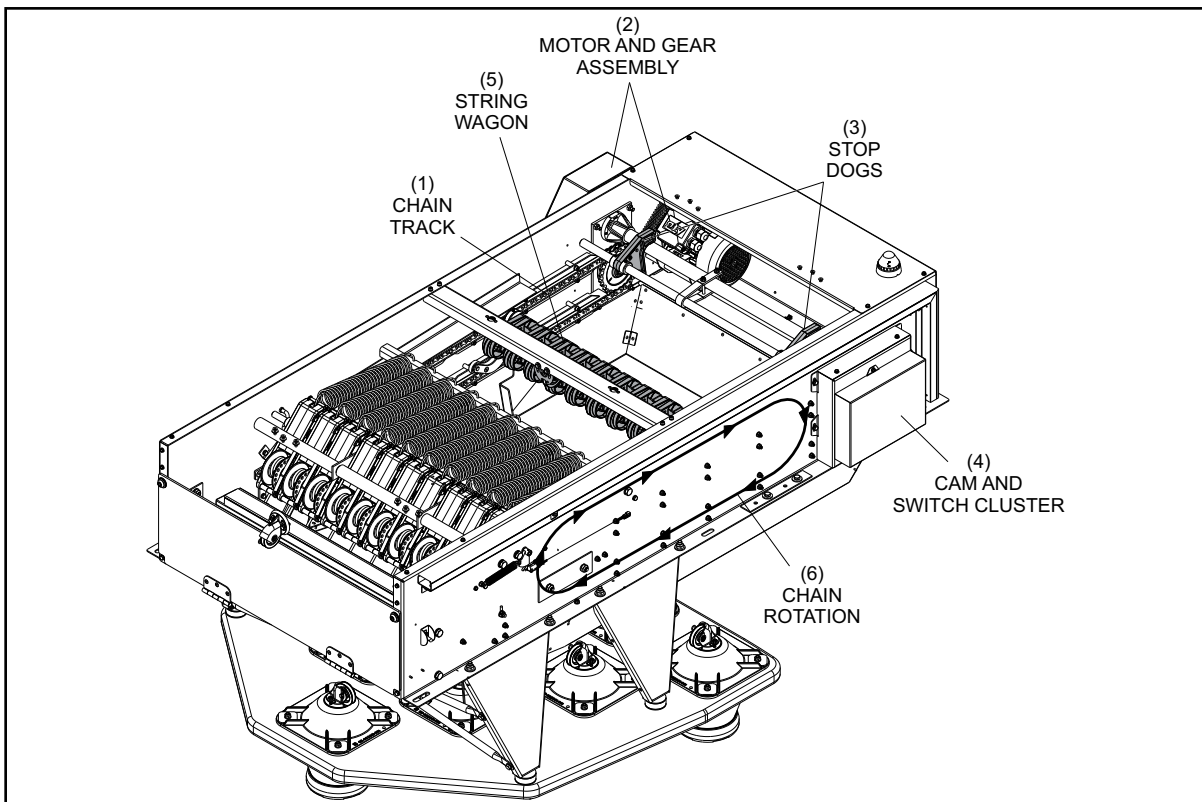


Figure 2-13. String Wagon Drive Components

- | | | |
|----------------------------|-----------------------------|--------------------|
| (1) CHAIN TRACK | (2) MOTOR AND GEAR ASSEMBLY | (3) STOP DOGS |
| (4) CAM AND SWITCH CLUSTER | (5) STRING WAGON | (6) CHAIN ROTATION |

Drive Shaft and Switch Cluster

The pinsetter uses a 3-phase motor and V-belt to run the string wagon drive gear and shaft. A cam and switch cluster located at the opposite end of the drive shaft determines the location of the string wagon by monitoring the rotation of the shaft. String guide fins mounted to the bottom of the frame keep the strings separated to ensure they do not tangle or interfere with each other. Refer to *Figure 2-14* and *Figure 2-15*.

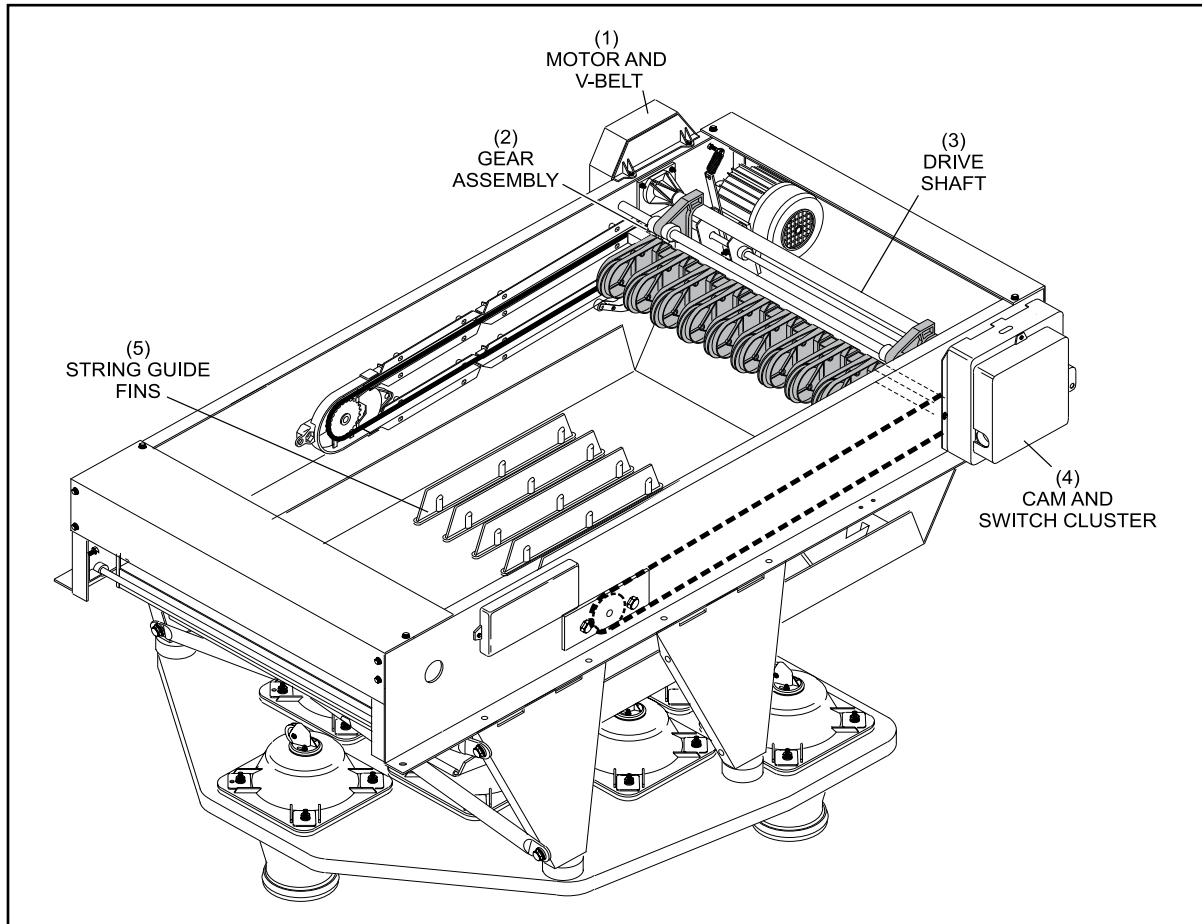


Figure 2-14. String Wagon Drive

- | | | |
|----------------------------|-----------------------|-----------------|
| (1) MOTOR AND V-BELT | (2) GEAR ASSEMBLY | (3) DRIVE SHAFT |
| (4) CAM AND SWITCH CLUSTER | (5) STRING GUIDE FINS | |

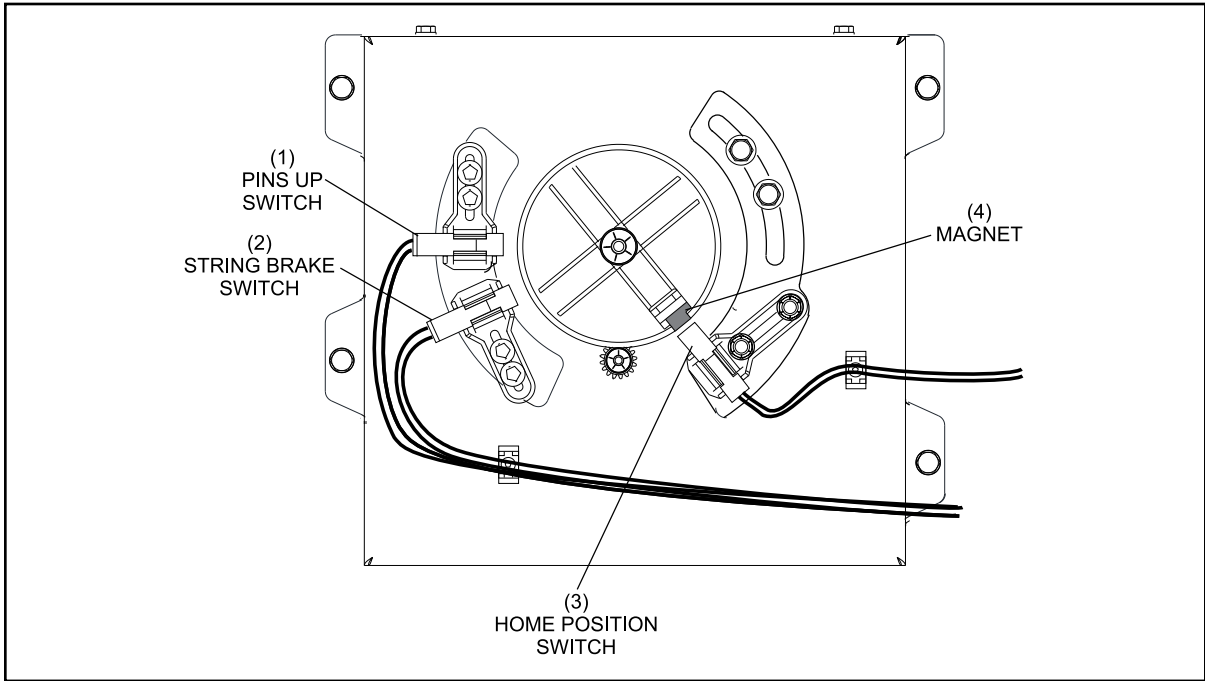


Figure 2-15. Switch Cluster

- (1) PINS UP SWITCH (2) STRING BRAKE SWITCH (3) HOME POSITION SWITCH
 (4) MAGNET

The switches in the cluster include:

- (1) **Pins Up Switch** - This switch indicates when the string wagon is in at the back of the machine and the pins are in the “up” position.
- (2) **String Brake Switch (SOL)** - This switch is used after pins have been knocked over on a first ball delivery. In operation, after the string wagon has passed the pins up position, this switch causes the string brake solenoids inside the PMI (Pin Motion Interface) for those pins that were knocked over to energize. This keeps the pins from lowering onto the pindeck as the wagon travels toward the front of the machine.
- (3) **Home Position Switch** - This switch indicates when the string wagon is positioned toward the front of the machine approximately under the String Limiting Bar and the pins are standing on the pindeck. This switch causes the motor to shut off after the pins are placed on the pindeck.

Slow Setting Pin Bracket

The function of the slow setting pin bracket is to slow down the speed at which the pins are moving as they are being set on the pindeck. There is one of these brackets on each side of the frame. In operation, the brackets interact with pivot rollers attached to each side of the string wagon drive chain causing string wagon to tilt downward. This motion slows the descent rate of pins to allow them to be gently placed on the pindeck. The tipping motion of the wagon also assists in positioning the strings within their guide fins. Refer to *Figure 2-16*.

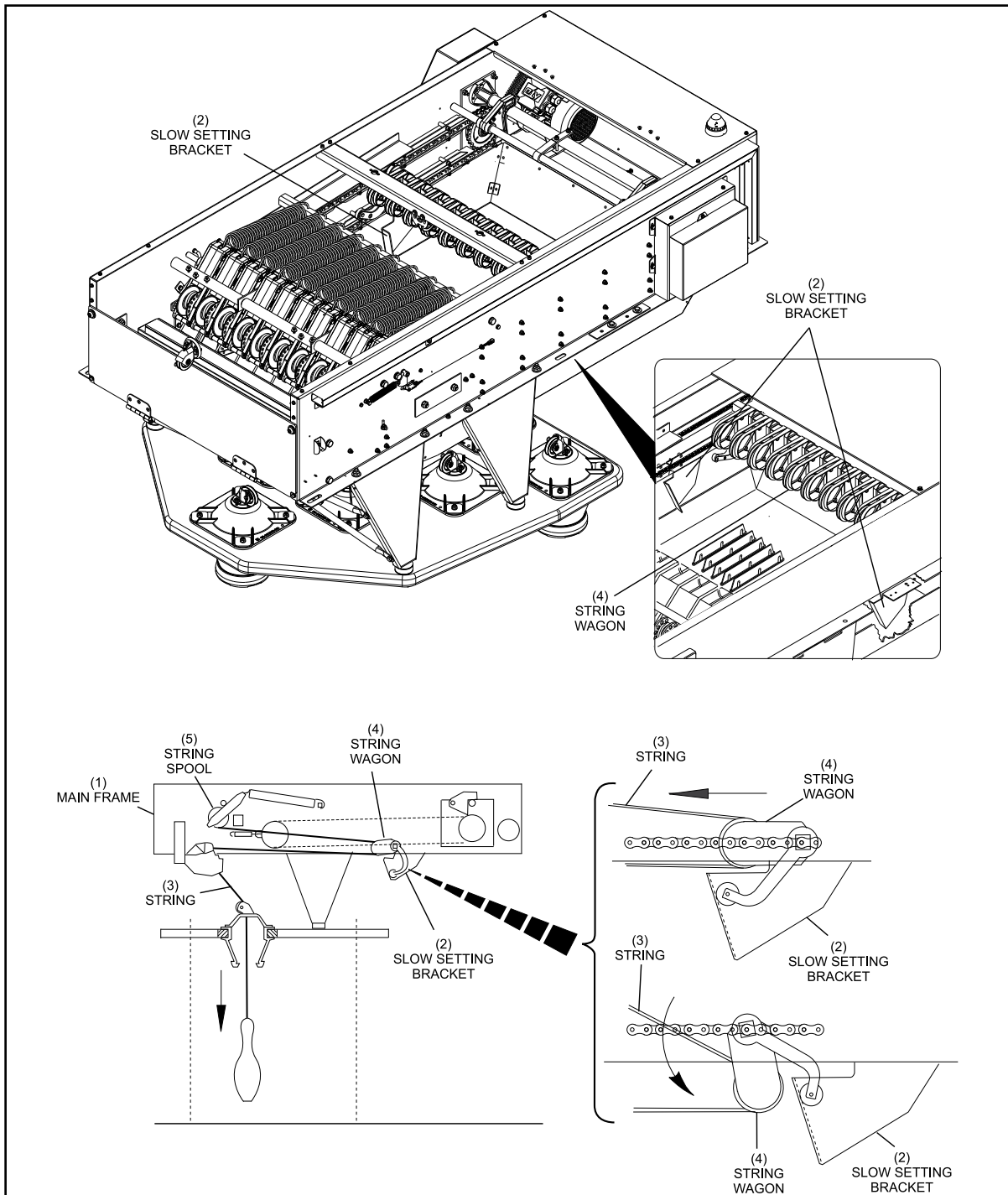


Figure 2-16. Slow Setting Pin Bracket

- (1) MAIN FRAME
- (2) SLOW SETTING BRACKET
- (3) STRING
- (4) STRING WAGON
- (5) STRING SPOOL

De-tangling Bar and Switch

If the string of two or more pins become tangled as the pins are being raised, additional string pressure is put on the tension lever assemblies causing them to lift the de-tangling bar. This action rotates the cam located on the end of the bar to disengage it from the de-tangle switch. The machine enters a de-tangle sequence in an attempt to remedy the problem by using the drive motor to create an up and down motion of the pins. Refer to *Figure 2-17*.

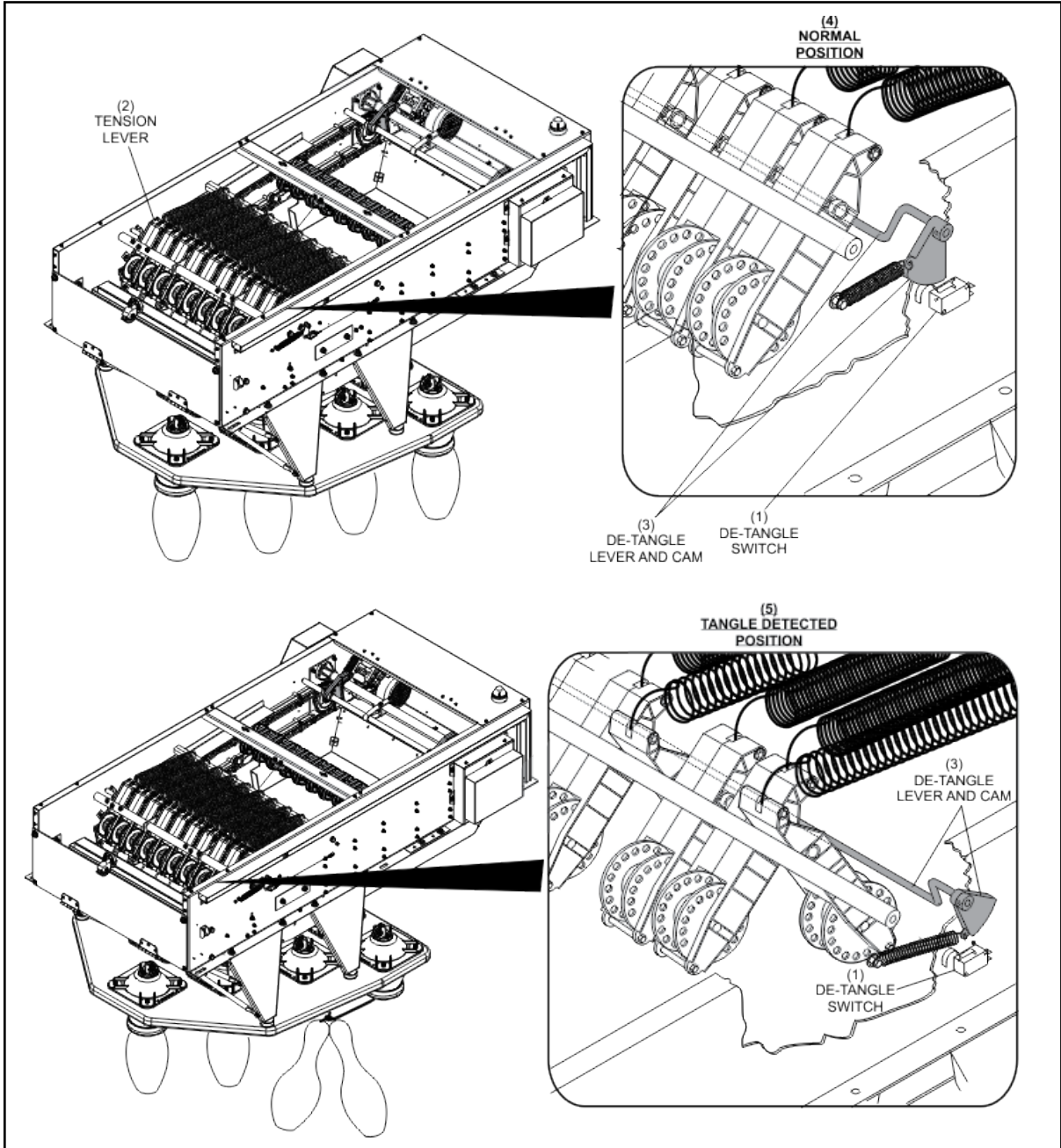


Figure 2-17. De-tangle Switch Activation

- | | | |
|----------------------|------------------------------|-----------------------------|
| (1) DE-TANGLE SWITCH | (2) TENSION LEVER | (3) DE-TANGLE LEVER AND CAM |
| (4) NORMAL POSITION | (5) TANGLE DETECTED POSITION | |

During the default de-tangle sequence, the drive motor will shut off to release the string tension and allow gravity to lower all pins part way towards the pindeck. After one second, the motor turns back on to raise the pins. If a tangle is still present it will again be detected by the de-tangle switch and the motor will shut off for another second to lower the pins. After 5 attempts to de-tangle the strings, the motor shuts off to lower the pins completely to the pindeck. After 2 seconds the motor turns back on to lift the pins to begin another 5 attempt sequence. The pattern will repeat until the tangle is corrected or the pattern has repeated 6 times (30 attempts). After 30 failed attempts to correct the problem, the motor will shut off to allow the pins to lower to the pindeck, the trouble light will flash, and Controller will display a “Tangle-01” error code. At this point a service person must turn off the machine and manually correct the problem.

To further increase the chances that the de-tangle procedure will be successful, alternative shake patterns can be selected on the Options screen of the 360 Controller. Unlike the default sequence where all pins are lowered toward the pindeck, these options use the brakes within the PMI’s to produce a repeating pattern during which only specific pins are allowed to lower. Refer to *Figure 2-18*.

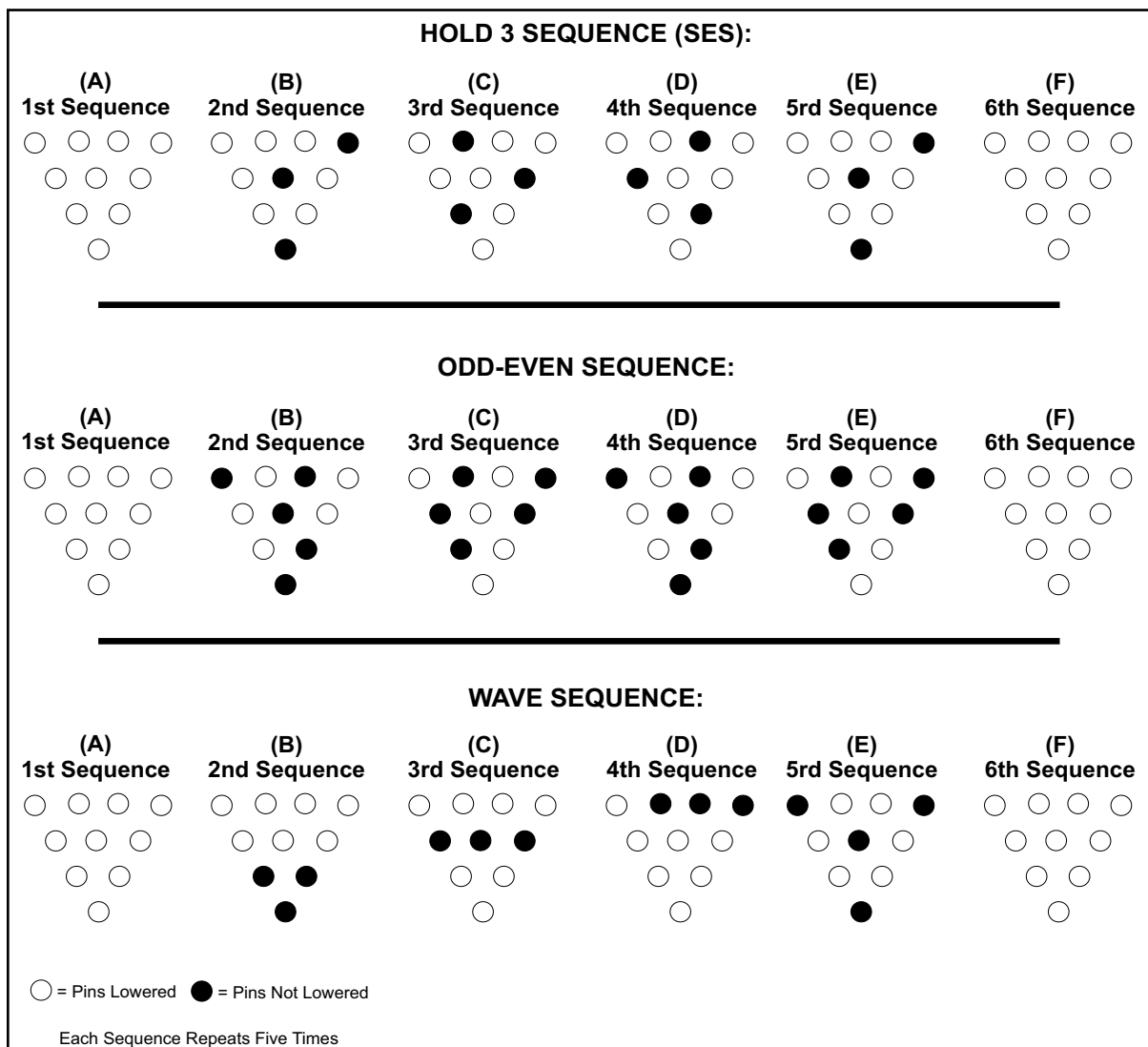


Figure 2-18. Pin Lowering Pattern During the De-Tangle Sequence

- | | | |
|--------------------------------------|------------------|----------------------|
| (1) 1ST SEQUENCE | (2) 2ND SEQUENCE | (3) 3RD SEQUENCE |
| (4) 4TH SEQUENCE | (5) PINS LOWERED | (6) PINS NOT LOWERED |
| (7) EACH SEQUENCE REPEATS FIVE TIMES | | |

Pin Motion Interface (PMI)

The Pin Motion Interface is the final main frame component a string passes through before being routed to the setting platform and pin. The Pin Motion Interface serves two main functions for the pinsetter.

1. Detects when a pin has been knocked over.
2. Controls whether the pin will be lowered to the pindeck when the string wagon moves toward the front of the machine.

When a pin is knocked over, the pulling of the string causes a pulley and gear, referred to as a string roller and string gear, to rotate. If the string pulls with enough force, a magnet, attached to the string gear through a friction clutch, rotates to actuate a reed type switch. A pinfall sensitivity adjustment on the Pin Motion Interface determines the amount of string pull force needed, by controlling the distance the magnet must rotate to actuate the switch.

The second function of the Pin Motion Interface controls whether the pin is allowed to lower to the pindeck. In normal operation the string moves freely through the PMI allowing the pin to lower to the pindeck. Energizing the brake solenoid inside the PMI causes a string brake to pinch the string prohibiting it from passing through the PMI. Refer to *Figure 2-19*.

Each of the ten PMI assemblies consist of the following components:

- Solenoid to operate the string brake
- String Brake
- Pinfall Switch
- Magnet
- Friction Clutch Gear
- String Roller
- Pinfall Sensitivity Adjustment

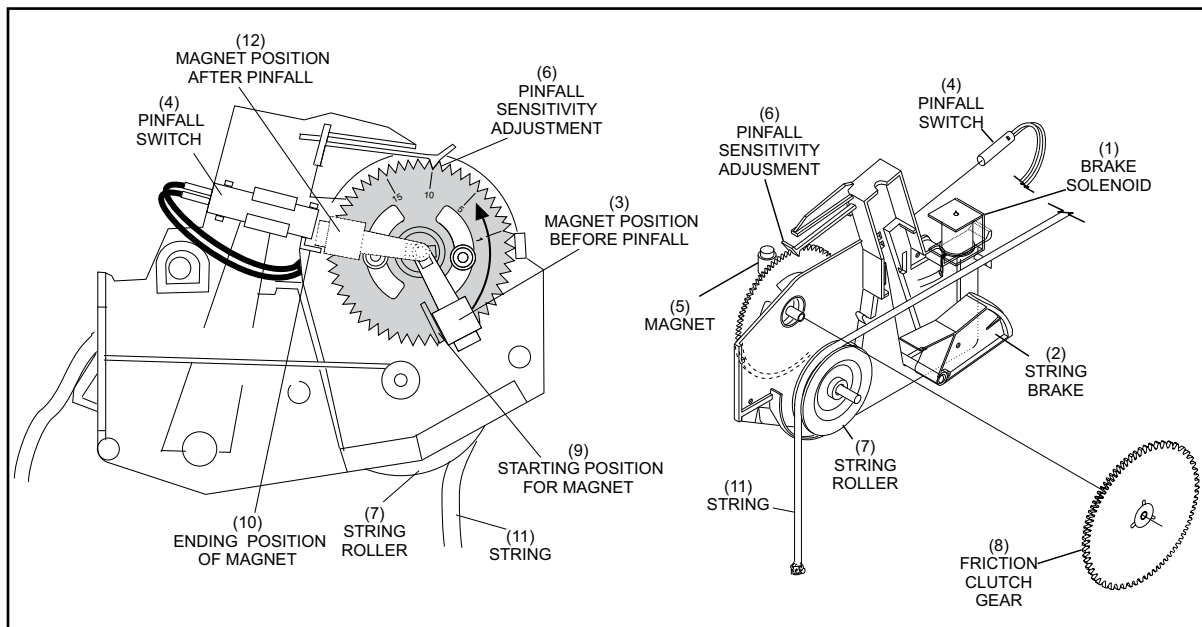


Figure 2-19. Pin Motion Interface Components

- | | | |
|---------------------------------|--------------------------|------------------------------------|
| (1) BRAKE SOLENOID | (2) STRING BRAKE | (3) MAGNET POSITION BEFORE PINFALL |
| (4) PINFALL SWITCH | (5) MAGNET | (6) PINFALL SENSITIVITY ADJUSTMENT |
| (7) STRING ROLLER | (8) FRICTION CLUTCH GEAR | (9) STARTING POSITION FOR MAGNET |
| (10) ENDING POSITION FOR MAGNET | (11) STRING | (12) MAGNET POSITION AFTER PINFALL |

Setting Platform (Pin Table)

The Setting Platform (Pin Table) is a stationary frame mounted under the main frame. The main components on the platform are the Pin Centering Cones. The cones interact with the pins when they are in the up position to stabilize and position them perpendicular to the pindeck so they can be set vertically onto the pindeck. Refer to *Figure 2-20*.

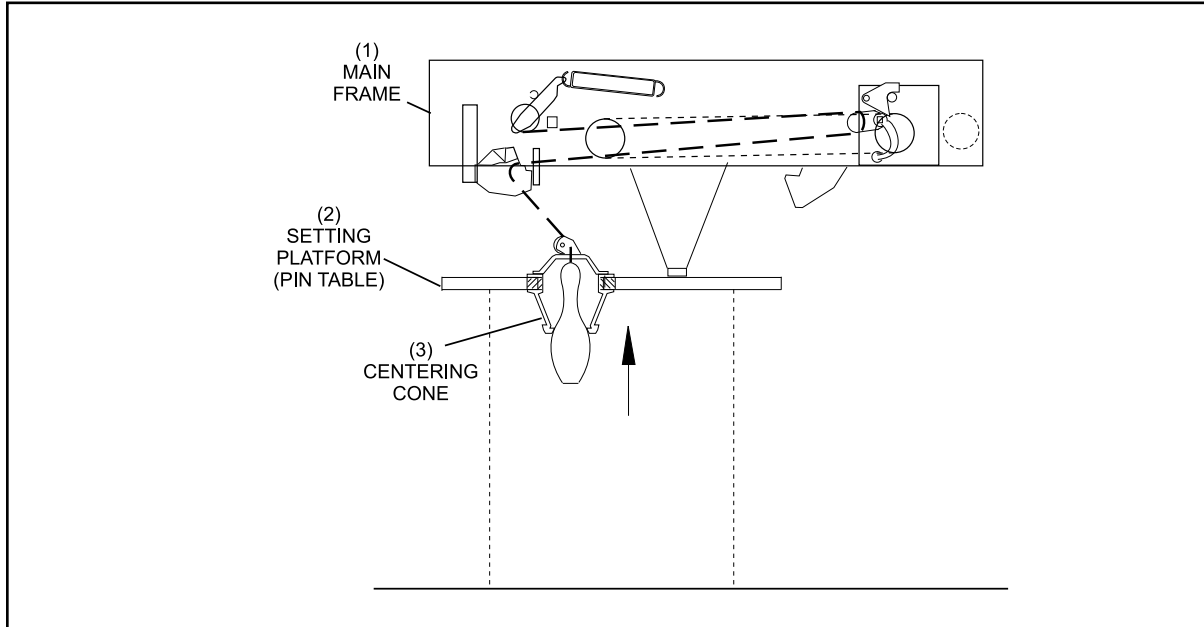


Figure 2-20. String Pinsetter Main Components - Side View

(1) MAIN FRAME

(2) SETTING PLATFORM
(PIN TABLE)

(3) CENTERING CONE

Ball Pit

The primary purpose of this area is to handle the initial impact of the pins and ball and direct the ball into the ball accelerator.

The ball pit is made up of 3 main components:

- Ball Stop
- Carpet Mat (Pin Curtain)
- Pit Assembly

The Carpet Mat is a large piece of carpet like material that stops the rearward movement of the pins and creates a black background behind the pin deck.

The ball stop is a thick piece of non-marking rubber designed to absorb the impact of the ball while at the same time producing as little noise as possible. Refer to *Figure 2-21*.

The pit assembly is used to guide the ball to the ball accelerator's ball door. The pit assembly frame is sloped towards the back of the pinsetter where it is then tapered toward the ball accelerator. This geometry allows gravity to force the ball into the accelerator.

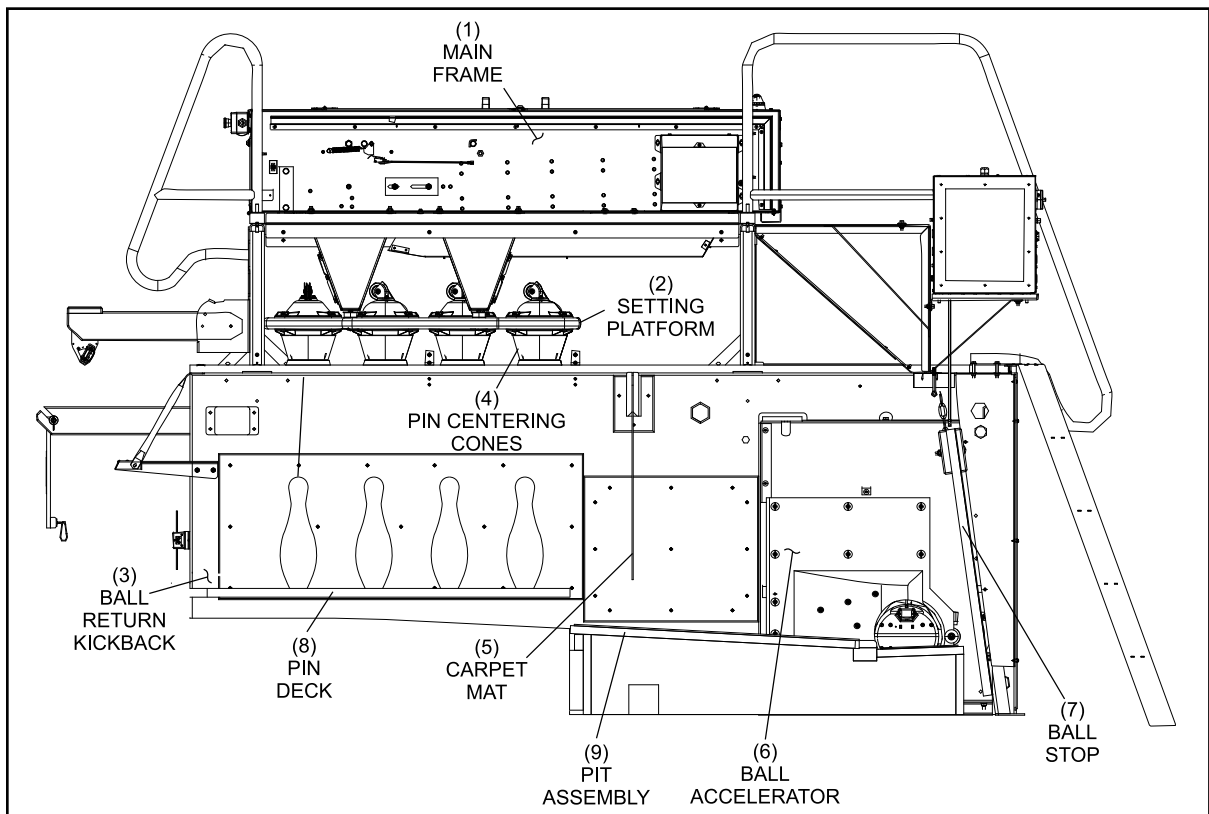


Figure 2-21. String Pinsetter Main Components - Side View

- | | | |
|-------------------------|----------------------|--------------------------|
| (1) MAIN FRAME | (2) SETTING PLATFORM | (3) BALL RETURN KICKBACK |
| (4) PIN CENTERING CONES | (5) PIT CARPET MAT | (6) BALL ACCELERATOR |
| (7) BALL STOP | (8) PIN DECK | (9) PIT ASSEMBLY |

Ball Accelerator

Mounted between the two pinsetters of a lane pair is a ball accelerator that returns balls to the bowler from either lane. The ball enters the accelerator from the pit carpet through a ball door. A large flat belt mounted on two drums grips the ball and propels it forward to the ball lift. Refer to *Figure 2-22*. Power to run the belt is furnished by a three phase motor incorporated into the rear drum.

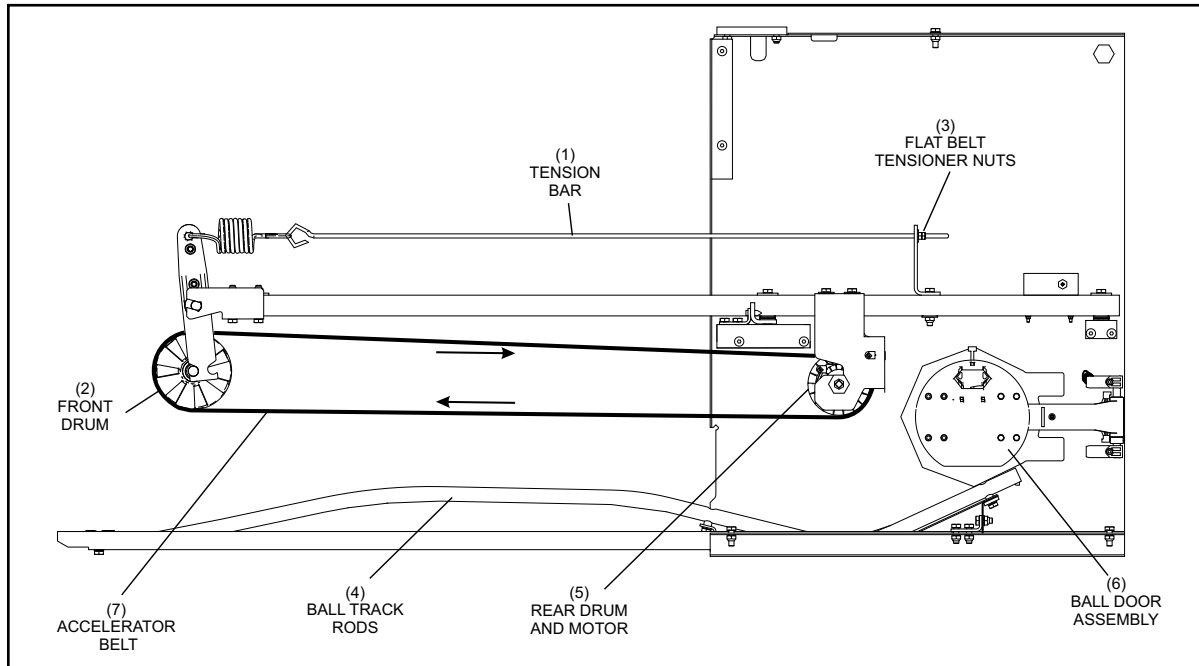


Figure 2-22. Ball Accelerator

- | | | |
|----------------------|-------------------------|------------------------------|
| (1) TENSION BAR | (2) FRONT DRUM | (3) FLAT BELT TENSIONER NUTS |
| (4) BALL TRACK RODS | (5) REAR DRUM AND MOTOR | (6) BALL DOOR ASSEMBLY |
| (7) ACCELERATOR BELT | | |

To prevent balls from opposite lanes from entering the accelerator at the same time, ball door assemblies are incorporated into the ball accelerator. Once a door is open, the door for the other lane is blocked from opening. Refer to *Figure 2-23*.

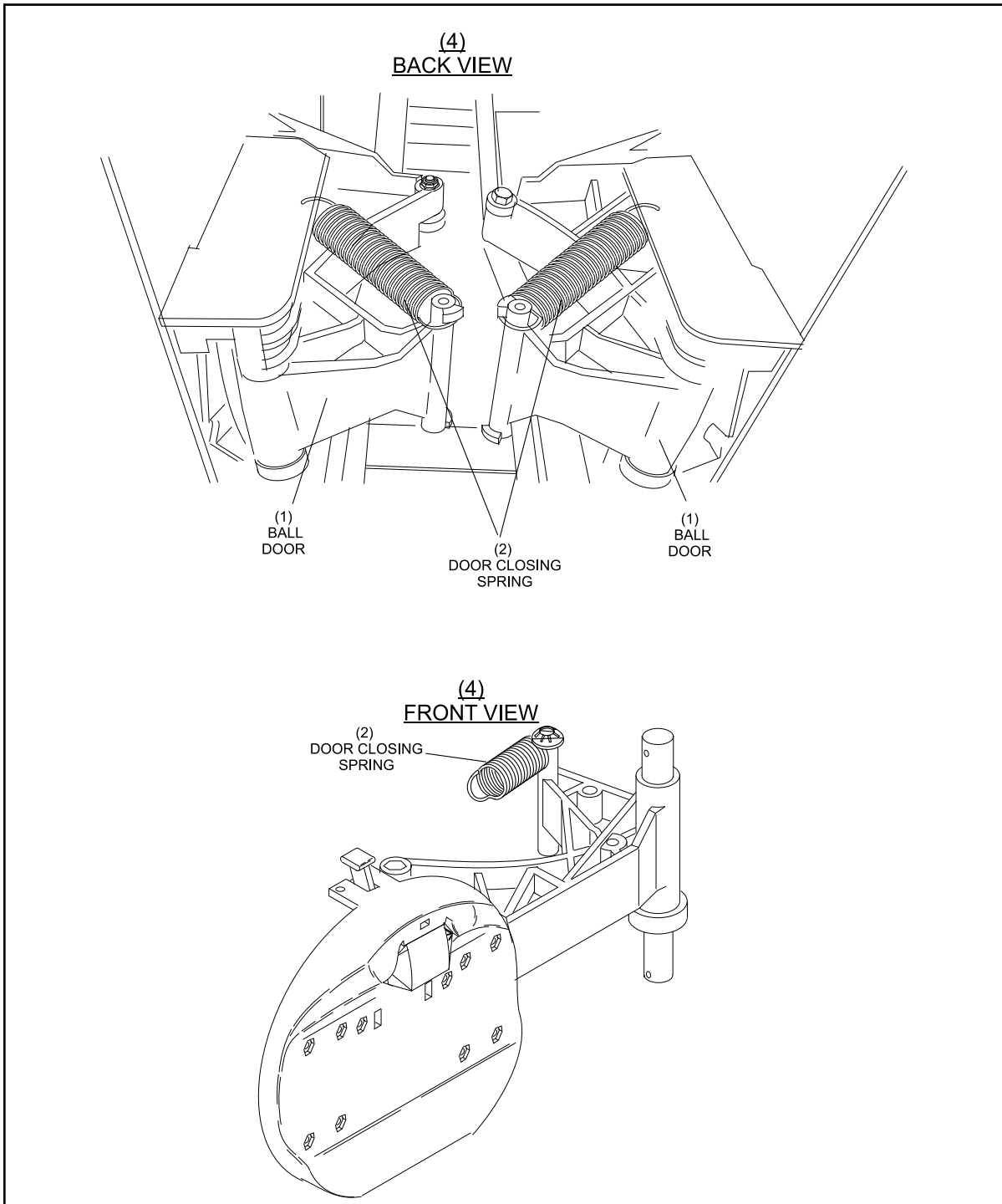


Figure 2-23. Ball Door Assembly

(1) BALL DOOR
(4) FRONT VIEW

(2) DOOR CLOSING SPRING

(3) BACK VIEW

PINSETTER ACCESS POINTS

It may become necessary to enter the pinsetter to perform maintenance tasks or correct a problem with the machine. If entering the pinsetter is needed, only enter using the locations as shown in the Pinsetter Access Points section. The Access Points are highlighted in the following figures. Refer to the *Figure 2-24* and *Figure 2-25*.

i **NOTE:** Always face toward the machine when using a pinsetter ladder to climb onto or off the machine. Only one person should be on the ladder at any time.



CAUTION: Only use the access points as recommended.



WARNING! Always make sure that a bowler is not positioned to throw a ball before putting yourself between the bowler and the machine. It is good practice to have another employee positioned near any bowler to ensure they cannot throw a ball. Additionally, make sure to properly secure a Brunswick Ball Stop or similar 3rd party product to the lane between you and the bowler for added protection.

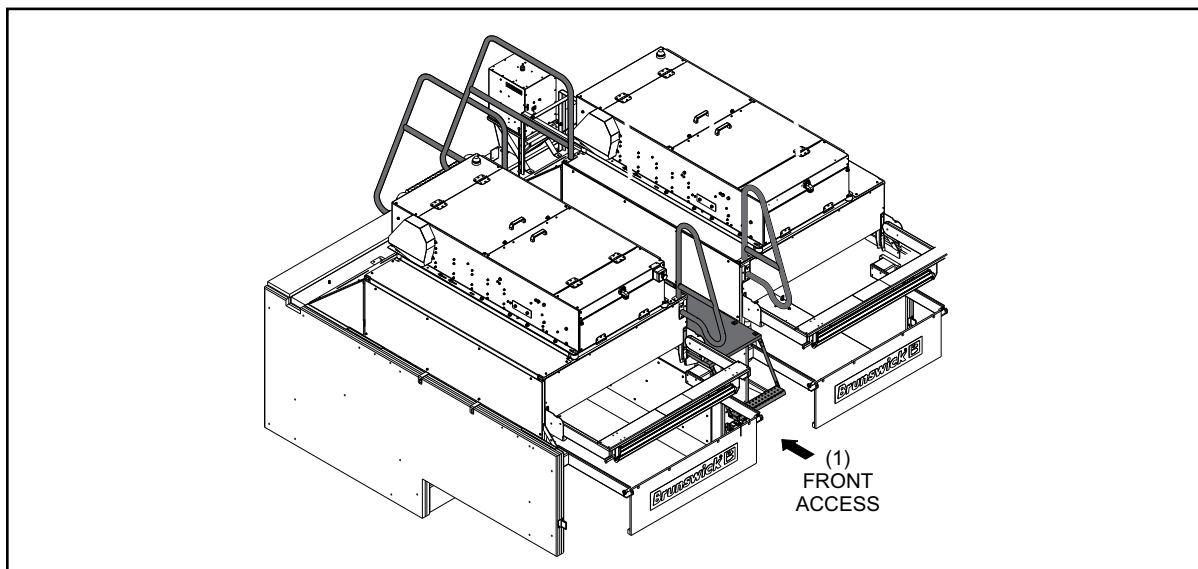


Figure 2-24. Machine Front Access

(1) FRONT ACCESS

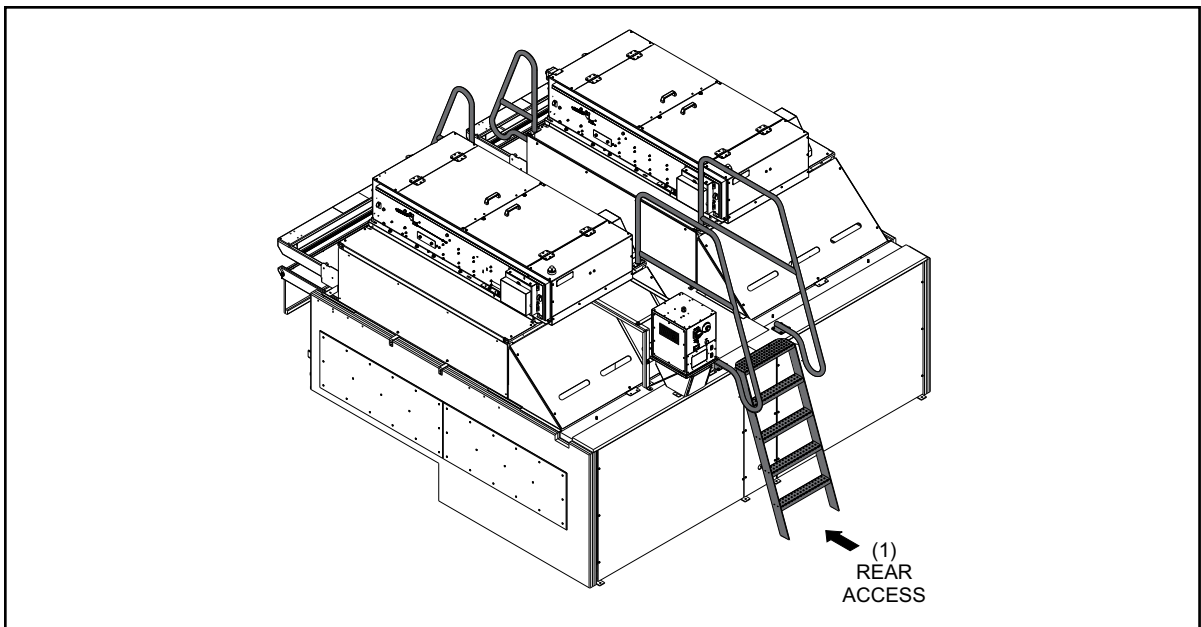


Figure 2-25. Machine Rear Access

(1) REAR ACCESS

WORK AREAS

The operation, maintenance, and repair of the StringPin can be accomplished using three defined work areas or locations, as defined from the most to least frequently used, the areas include:

- Area 1 - Floor
- Area 2 - Ball Accelerator and Standing Platforms
- Area 3 - Pin Deck



CAUTION: When accessing work areas 2 and 3, the main power switch on the StringPin controller must be locked in the off position using a suitable locking mechanism.



CAUTION: When accessing work area 3, make sure to properly secure a Brunswick Ball Stop or similar 3rd party product to the lane between you and the bowler for added protection.

Work Area 1 - Floor

The most frequent area used for operating and maintaining the pinsetter is the floor area behind the pinsetters. During operation, all machine activity can be observed from this location. Additionally, the StringPin Controller can be easily accessed from Work Area 1. Refer to *Figure 2-26* for the work area. This area may be used for such activities as:

1. Correcting Ball Return Stops - Ball Accelerator
2. Respotting Pins

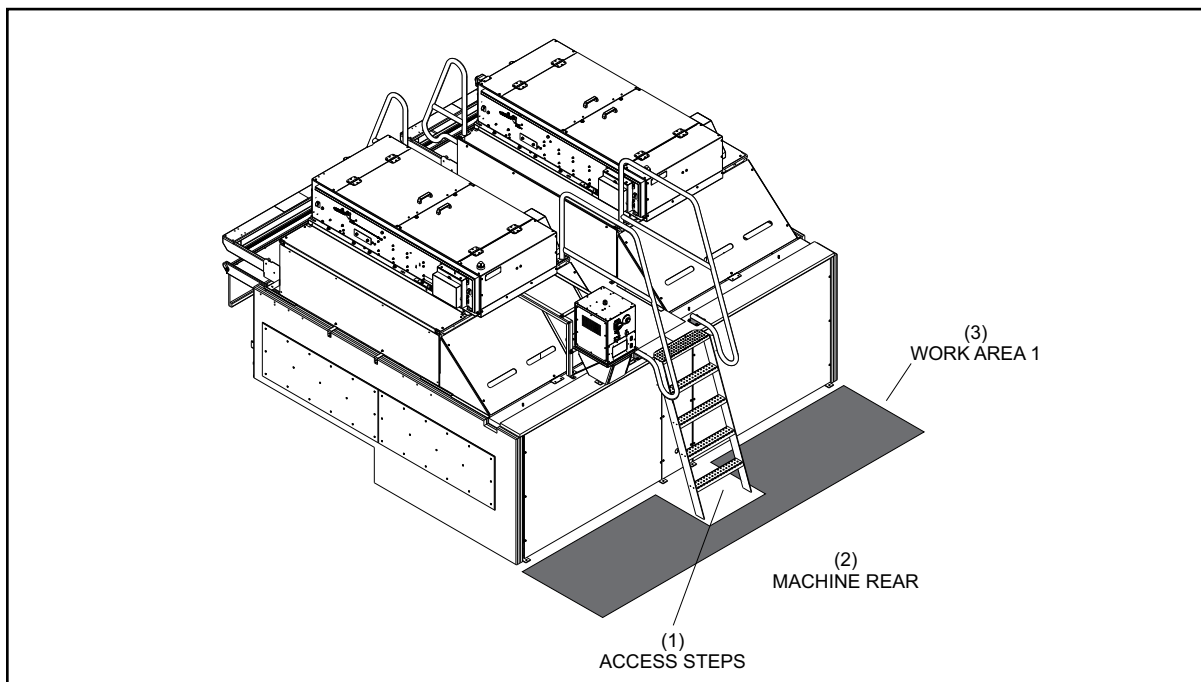


Figure 2-26. Machine Work Area 1 - Floor

(1) ACCESS STEPS

(2) MACHINE REAR

(3) WORK AREA 1

Work Area 2 - Ball Accelerator and Standing Platforms

Infrequently, a pinsetter stop or maintenance requires access further into the machine. For situations that cannot be performed from Work Area 1, Work Area 2 can be used. Refer to *Figures 2-27 and 2-28*. This area may be used for such activities as:

1. Correcting Pinspotting Issues
2. Correcting Ball Return Stop - Pit Area



CAUTION: When accessing work area 2, the main power switch on the StringPin Controller must be locked in the off position using a suitable locking mechanism

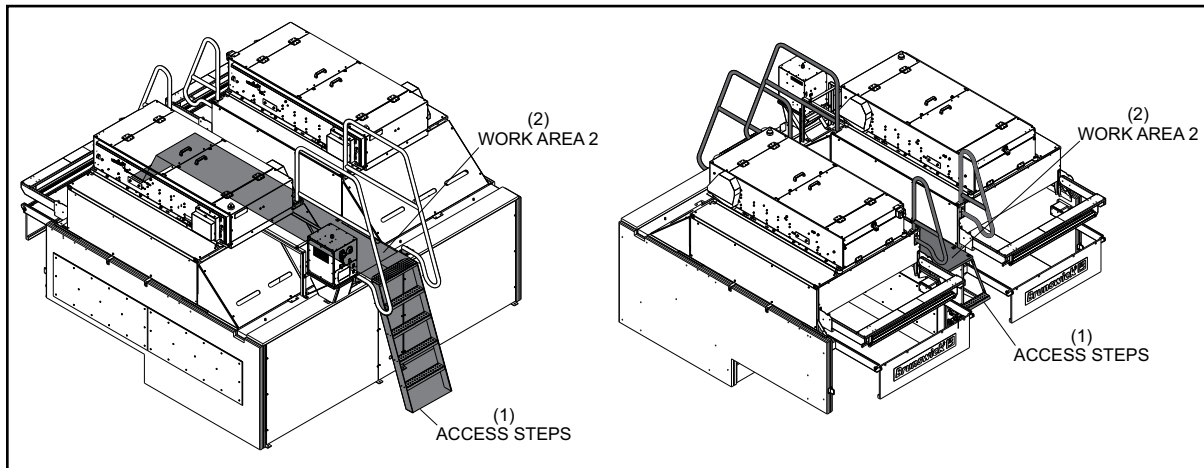


Figure 2-27. Machine Work Area 2 - Ball Accelerator and Standing Platforms

- (1) ACCESS STEPS (2) WORK AREA 2

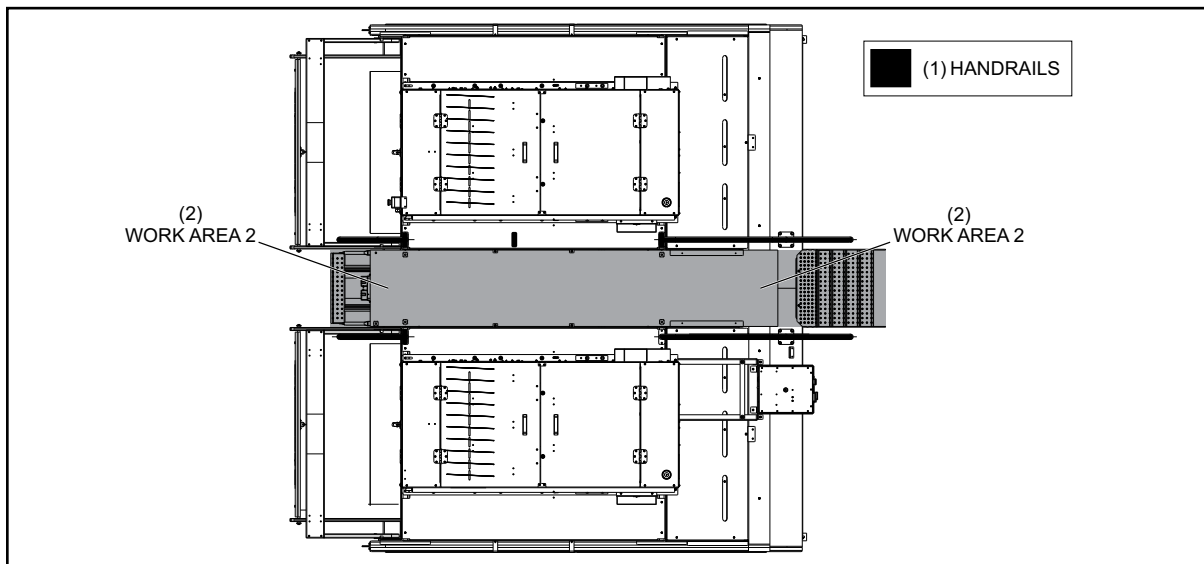


Figure 2-28. Machine Work Area 2 - Ball Accelerator and Standing Platforms

- (1) HANDRAILS (2) WORK AREA 2

Work Area 3 - Pindeck

Rarely, a pinsetter stop or maintenance requires access further into the machine. For situations that cannot be performed from work areas 1 or 2, work Area 3 can be used. Refer to *Figure 2-29* for the work area. This area may be used for such activities as:

1. Detangling Pins
2. Ball Return Stop - Pin Deck



CAUTION: When accessing work area 3, the main power switch on the *StringPin* controller must be locked in the off position using a suitable locking mechanism.



CAUTION: Detangling pins and/or addressing a ball return stop places the mechanic between the bowler and the machine. Place and properly secure a *Brunswick Ball Stop* or similar 3rd Party Product between the bowler and the mechanic. Additionally, make sure that a bowler is not positioned to throw a ball before putting yourself between the bowler and the machine. It is a good practice to have another employee positioned near any bowler to ensure they cannot throw a ball and/or place a sign on the approach to indicate the lane is not available for bowling.

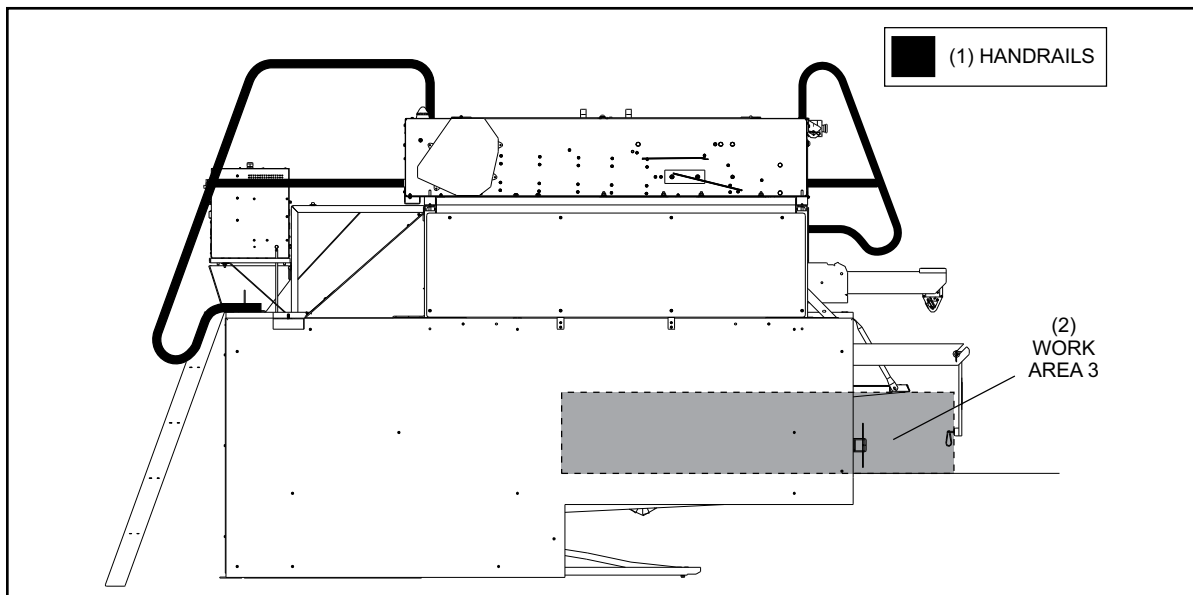


Figure 2-29. Machine Work Area 3 - Pin Deck Side View

(1) HANDRAILS

(2) WORK AREA 3

EMERGENCY STOP (E-STOP)

The Brunswick StringPin Pinsetter has two Emergency stop switches. These switches are to be used to stop the pinsetter immediately if an emergency were to arise. One E-Stop switch is located on the front of the machine and the other is located on the rear. Once an E-Stop as been activated, the high voltage power will be removed from both machines of the lane pair. Refer to *Figure 2-30* and *Figure 2-31* for the E-Stop switch locations.

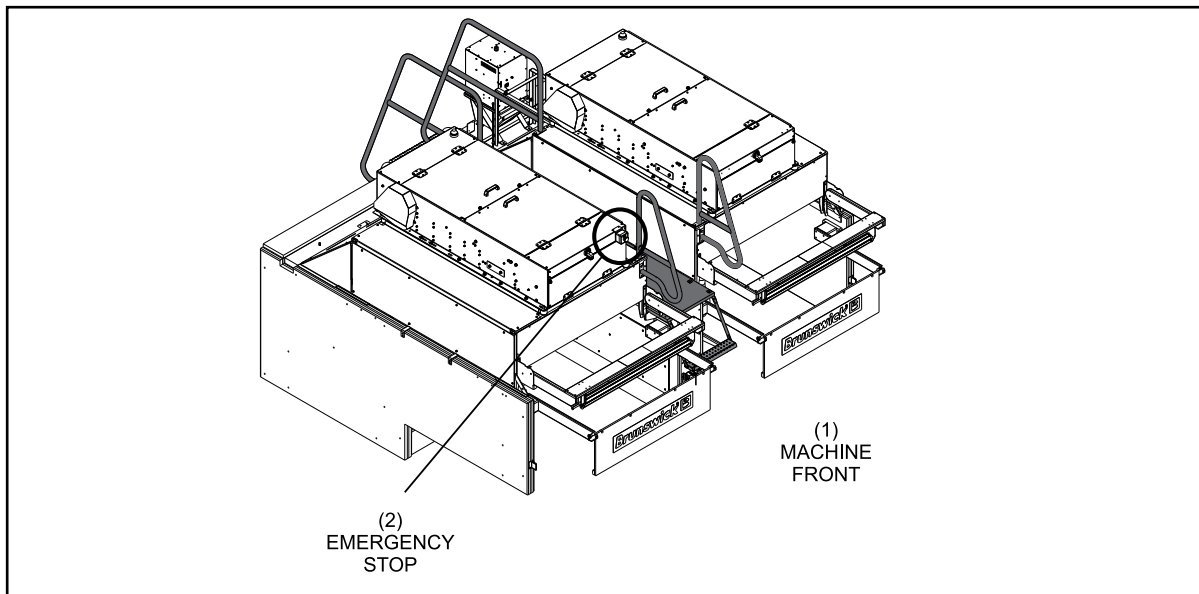


Figure 2-30. E-Stop Switch - Front Location

(1) MACHINE FRONT (2) EMERGENCY STOP

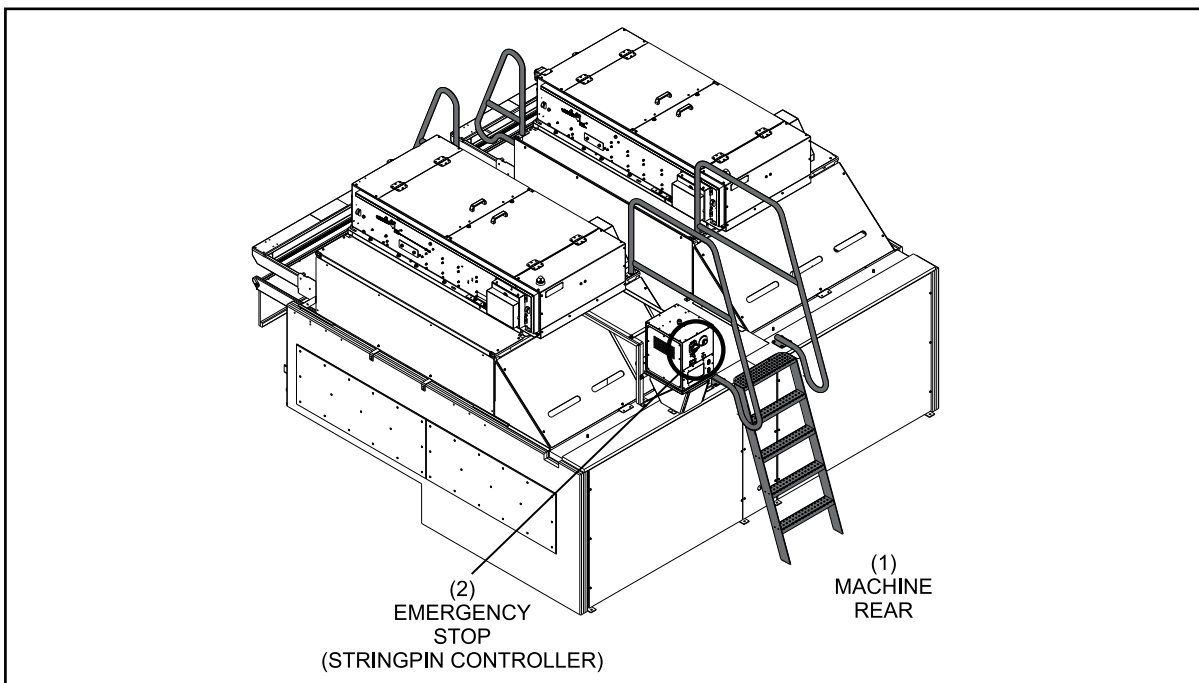


Figure 2-31. E-Stop Switch - Rear (Rear mount Pulse Controller) Location

(1) MACHINE REAR (2) EMERGENCY STOP (PULSE CONTROLLER)

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Section 3 - Pinsetter Electronics

The electronic system for a lane pair of string pinsetters consist of a single StringPin Controller mounted on the rear side of the pinsetter or as an option, to the front of the pinsetters. There is one StringPin Controller box for per lane pair. Refer to *Figure 3-1*.

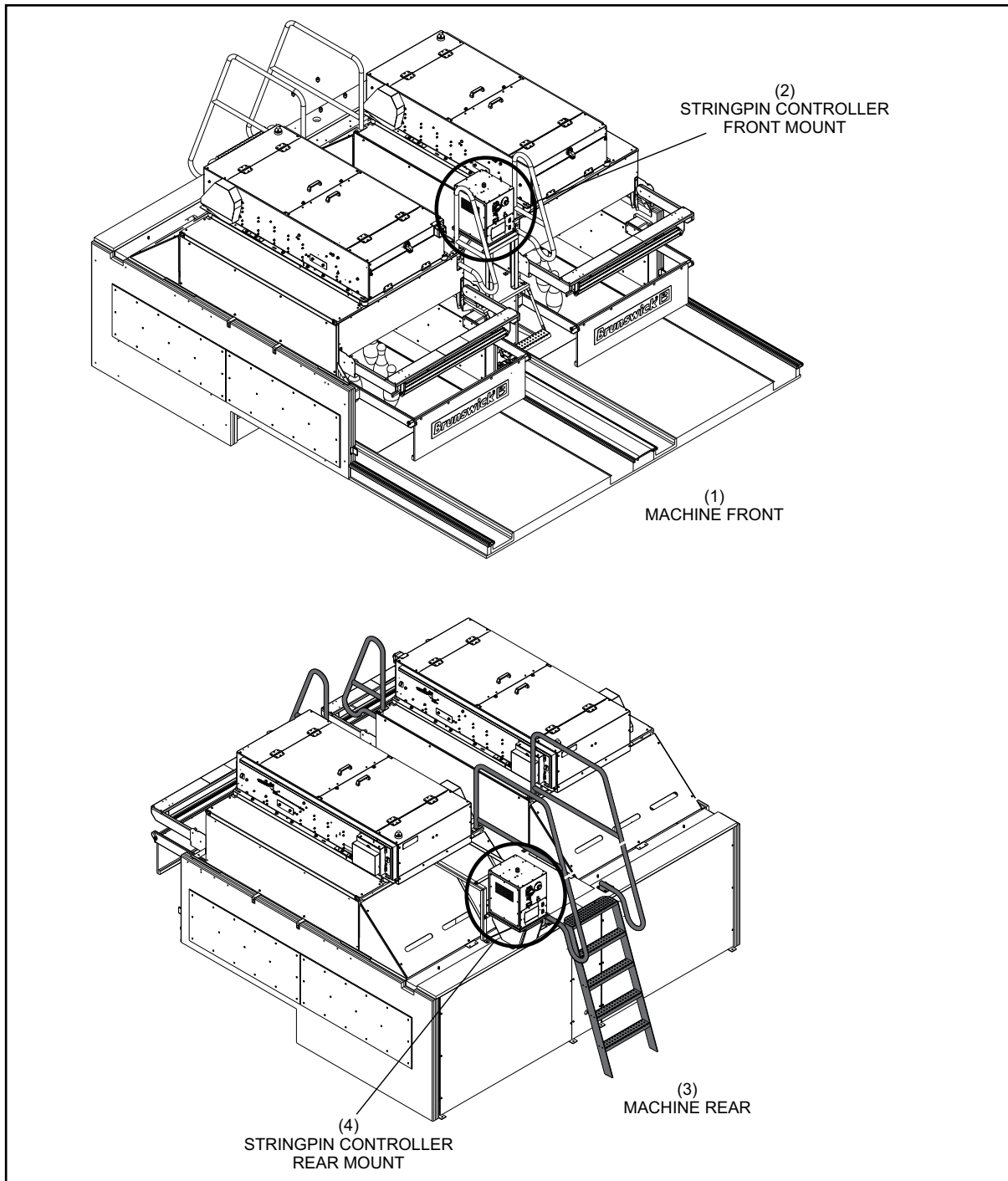


Figure 3-1. String Pinsetter Controller Locations

- (1) MACHINE FRONT
- (2) STRINGPIN CONTROLLER (FRONT MOUNT)
- (3) MACHINE REAR
- (4) STRINGPIN CONTROLLER (REAR MOUNT)

The CPU gathers switch information and sends out solenoid voltage to each pinsetter through the I/O board. The CPU also supplies power for the D/C pinlight and the masking unit 1/2 ball lights through the I/O board. Communication to the scorer is also handled by the CPU.

3-phase power is supplied to the High Voltage board through power contactors that are monitored through an emergency off interlock system. The High Voltage board supplies power for the ball accelerator, pinsetter string wagon motor, and optional A/C pinlights. Refer to *Figure 3-2*.

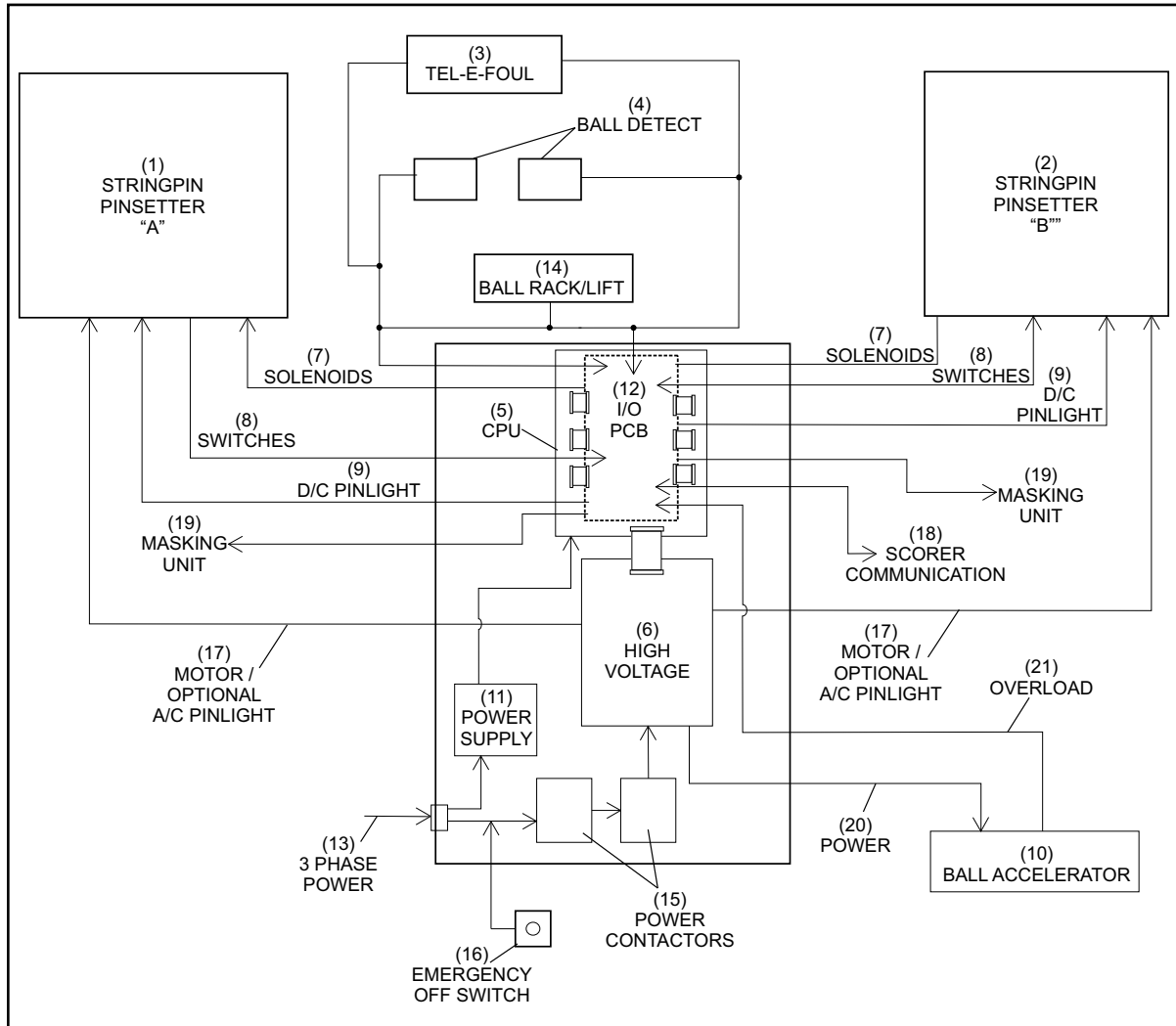


Figure 3-2. Pinsetter Block Diagram

- | | | |
|-----------------------------|------------------------------------|---------------------------|
| (1) STRINGPIN PINSETTER "A" | (2) STRINGPIN PINSETTER "B" | (3) TEL-E-FOUL |
| (4) BALL DETECT | (5) CPU | (6) HIGH VOLTAGE |
| (7) SOLENOIDS | (8) SWITCHES | (9) D/C PINLIGHT |
| (10) BALL ACCELERATOR | (11) POWER SUPPLY | (12) I/O PCB |
| (13) 3-PHASE POWER | (14) BALL RACK / LIFT | (15) POWER CONTACTORS |
| (16) EMERGENCY OFF SWITCH | (17) MOTOR / OPTIONAL A/C PINLIGHT | (18) SCORER COMMUNICATION |
| (19) MASKING UNIT | (20) POWER | (21) MOTOR OVERLOAD |

STRINGPIN PINSETTER CONTROLLER

The StringPin Controller is responsible for all functions and operations for both pinsetters on a lane pair. It receives incoming power and makes it available to the string wagon drive motor and ball accelerator motor and pinlights as needed. It also receives the signals from the switches on each machine and controls the solenoids within the Pin Motion Interfaces (PMI). The following is a description of the Controller's components and connections.

External Connections and Controls

Front View

On the front of the StringPin Controller are the components used to control and monitor the lane pair. Controls include a main power switch, emergency off switch, stop/run switches, a start push-button, status LEDs, and an interactive touchscreen. Refer to *Figure 3-3*.

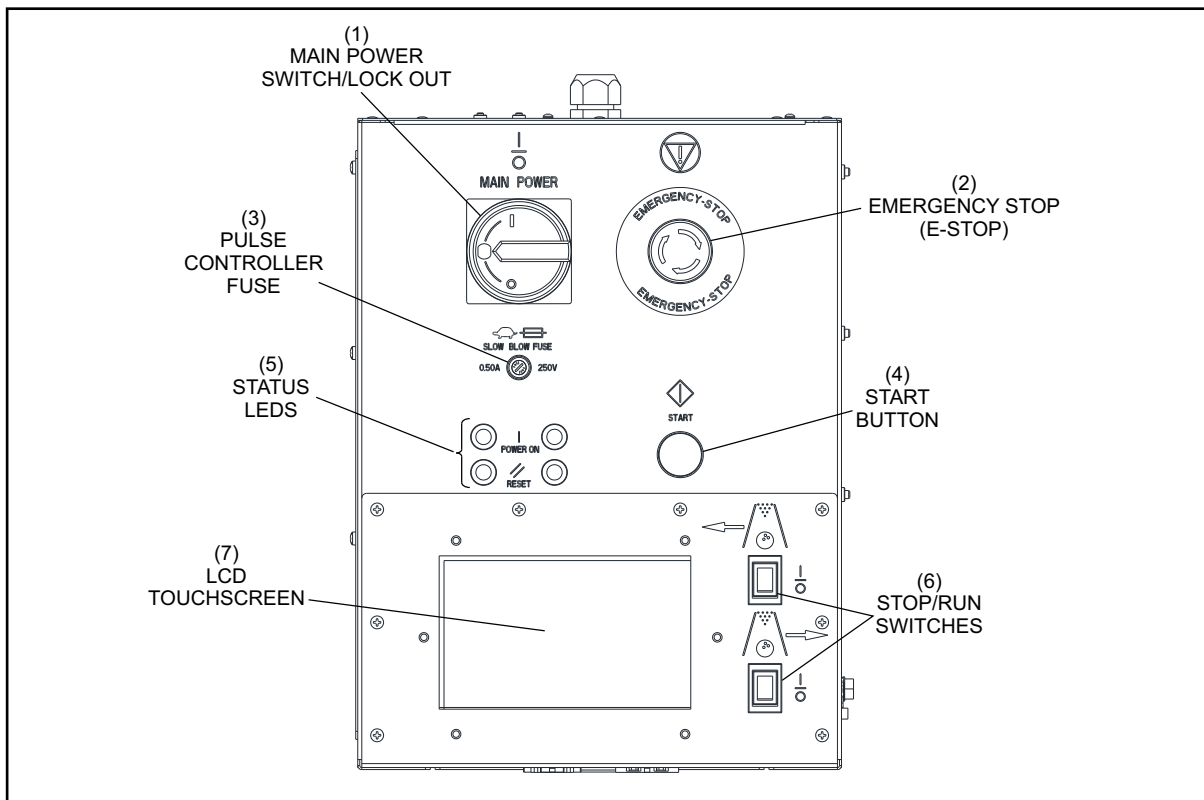


Figure 3-3. StringPin Controller Box - External Front

- (1) **Main Power Switch/Lockout** - Controls the 3-phase power entering the box. In the off position, this switch will remove power from the controller's internal circuits and disable both pinsetters for that lane pair.
- (2) **Emergency Stop** - Allows the operator to quickly shut down power to both pinsetters on a lane pair by removing main power to the StringPin Controller. Once an emergency stop switch has been pressed, the pinsetters cannot be restarted until the switch is returned to its closed position by twisting its actuator button and the **Start** button on the controller is pressed.
- (3) **Controller Fuse** - Fuse used to protect the controller from excessive current. The fuse is rated at 250V 0.5A 5 x 20 mm - Slow Blow.
- (4) **Start Button** - Pushing this button causes the internal power contactors to energize and apply power to Stringpin Controller's internal circuits. Refer to (4) **Status LEDs**.
- (5) **Status LEDs** - These LEDs indicate the status of the 2 internal power contactors. There is a set of LEDs for each contactor. The power LED indicates that the contactor is energized. The reset LED indicates that the contactor is de-energized and must be "reset" using the **Start** push-button. Refer to (5) **Start Button**.
- (6) **Stop/Run Switches** - Switches used to turn an individual pinsetter on/off. The arrows next to the each switch points to the pinsetter that the switch controls.
- (7) **LCD Touchscreen** - Interactive touchscreen display that allows the operator to view pinsetter status, set pinsetter modes, spot pins, view error codes, modify settings, and more.

Bottom View

The connections at the bottom of the StringPin Controller handle most of the low voltage input signals and output voltages for the lane pair as well as the communication to the scoring system. Refer to *Figure 3-4*.

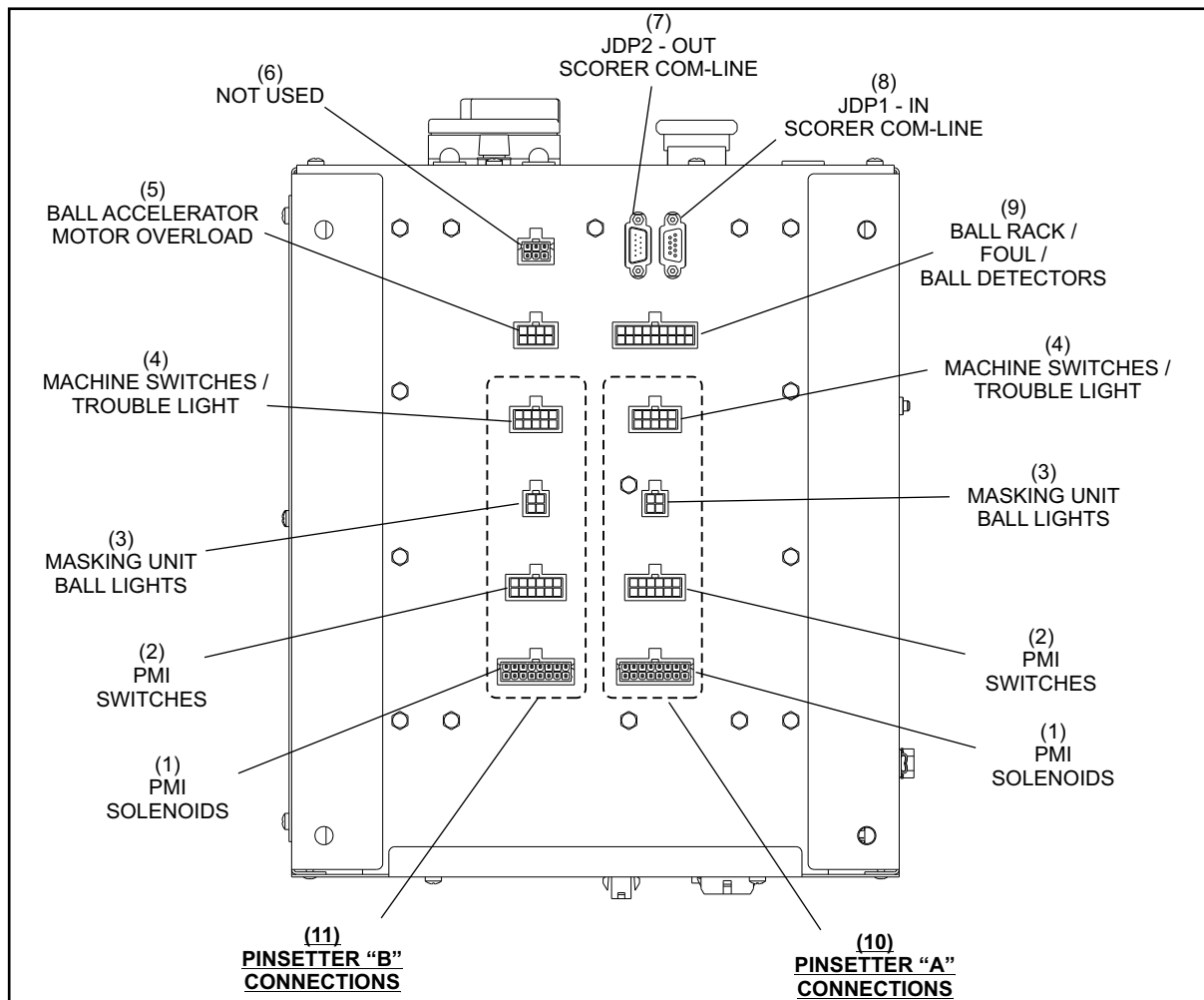


Figure 3-4. Pulse StringPin Controller Box - External Bottom

- (1) **PMI (Pin Motion Interface) Solenoids** - Connection to the solenoids located inside the PMIs. Refer to cables 55-143009-000 and 55-143012-xxx.
- (2) **PMI (Pin Motion Interface) Switches** - Connection to the switches located inside the PMIs. Refer to cables 55-143009-000 and 55-143012-xxx.
- (3) **Masking Unit Ball Lights** - Connection to the 1st/2nd ball lights on the masking unit. Refer to cable 55-143015-xxx
- (4) **Machine Switches/Trouble Light** - Connection to the Switch Cluster, Tangle Switch, Mechanic's Stop Switches, and the Trouble Light. Refer to cables 55-143010-000 and 55-143068-xxx
- (5) **Ball Accelerator Motor Overload** - Connection to the overload circuit located inside the Ball Accelerator Motor. Refer to cable 55-143014-xxx

- (6) **Not Used** - Connection is not used.
- (7) **Scorer COM-Line (JDP 2)** - Not used
- (8) **Scorer COM-Line (JDP 1)** - Connection for communication to the scoring system.
- (9) **Ball Rack /Foul/Ball Detectors** - Connection for inputs from the Foul Unit, Ball Detectors and bowler's reset button on the ball rack. 24VAC power used to energize power relay located at the ball rack which, in turn, powers the ball lift motor and hand blower is also supplied through this connector. Refer to cables 55-143016-000, 55-143016-100, 55-143016-200.
- (10) **Pinsetter "A" Connections** - The cabling from "Pinsetter "A" connectors attach to one of the pinsetters of the lane pair. When the controller is mounted at the rear (back) of the machines, the connectors are used for the odd lane (left) pinsetter. When the controller is mounted at the front of the machines the connectors are used for the even lane (right) pinsetter.
- (11) **Pinsetter "B" Connections** - The cabling from "Pinsetter "B" connectors attach to one of the pinsetters of the lane pair. When the controller is mounted at the rear (back) of the machines, the connectors are used for the even lane (right) pinsetter. When the controller is mounted at the front of the machines the connectors are used for the odd lane (left) pinsetter.

Back View

The connections at the back of the StringPin Controller handle most the higher level output voltages for the lane pair. Refer to *Figure 3-5*.

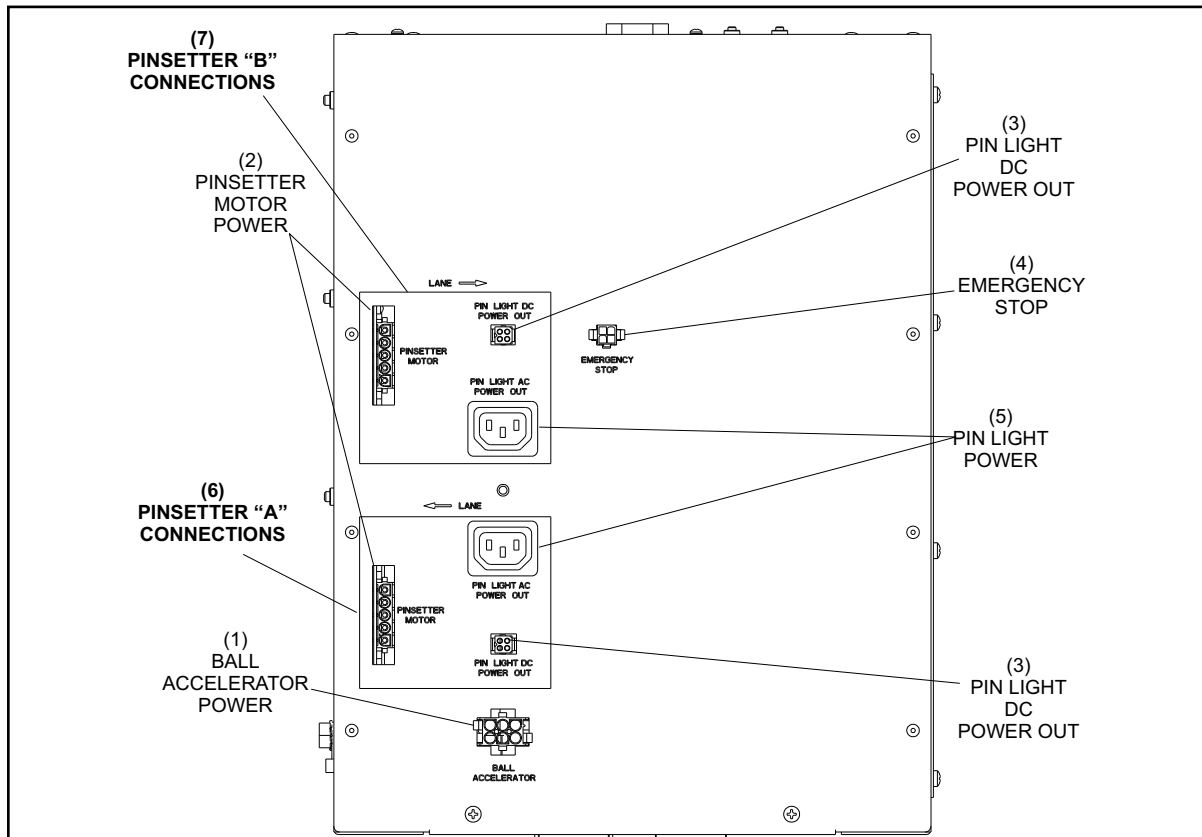


Figure 3-5. StringPin Controller Box - External Rear

- (1) **Ball Accelerator Power** - Connection for the 3-phase power to the ball accelerator motor.
- (2) **Pinsetter Motor Power** - Connection for the 3-phase power to the pinsetter drive motor. Refer to cable 55-143011-000
- (3) **Pin Light Power** - 24VDC power for the white and black light (UV) pinlight that comes standard with the StringPin pinsetters. Refer to cable 55-143069-xxx
- (4) **Emergency Stop** - Connection to the external emergency stop switch. Refer to cable 55-143013-xxx
- (5) **Pin Light AC Power Out**- Power connection for the optional multi-color LED pinlight.
- (6) **Pinsetter "A" Connections** - The cabling from "Pinsetter "A" connectors attach to one of the pinsetters of the lane pair. When the controller is mounted at the rear (back) of the machines, the connectors are used for the odd lane (left) pinsetter. When the controller is mounted at the front of the machines the connectors are used for the even lane (right) pinsetter.
- (7) **Pinsetter "B" Connections** - The cabling from "Pinsetter "B" connectors attach to one of the pinsetters of the lane pair. When the controller is mounted at the rear (back) of the machines, the connectors are used for the even lane (right) pinsetter. When the controller is mounted at the front of the machines the connectors are used for the odd lane (left) pinsetter.

Machine Status LEDs and Start Button

The StringPin Controller is equipped with four led lights, that can be used to indicate machine power and the Controller reset status. Specifically the LEDs monitor status of the 2 internal power contactors which supply power to the controller’s inner circuits. There is a set of LEDs for each contactor. The red “Power On” LED indicates that the related contactor is energized. The green “Reset” LED indicates that the contactor is de-energized and must be re-energized by using the **Start** push-button.

Because the power contactors are wired in series, the each set of LEDs indicate the same information, the status of the controller which in turn is the power status of both pinsetters. Refer to *Figure 3-6*.

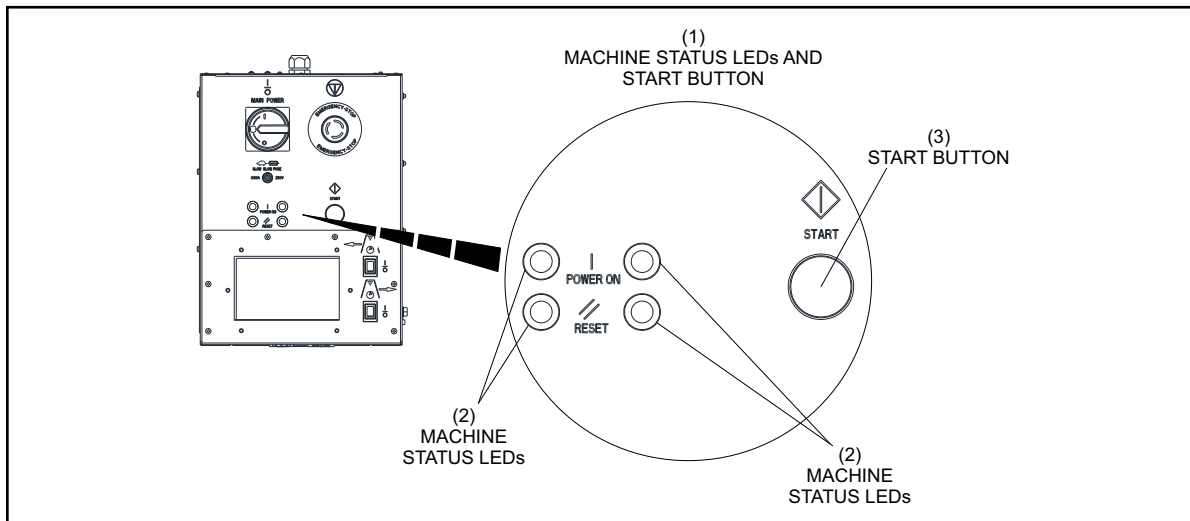


Figure 3-6. Power On Lights - Reset Lights - Start Button

- (1) MACHINE STATUS LEDS AND START BUTTON
- (2) MACHINE STATUS LEDS
- (3) START BUTTON

Stop/Run Switches

The StringPin Controller is equipped with two Stop/Run switches, one for each pinsetter. These switches are used to temporarily turn off the pinsetter so that the touchscreen can be used to change the mode, clear error codes, and perform other functions for a pinsetter. . **The arrow indicates which pinsetter the switch controls.** Refer to *Figure 3-7*.

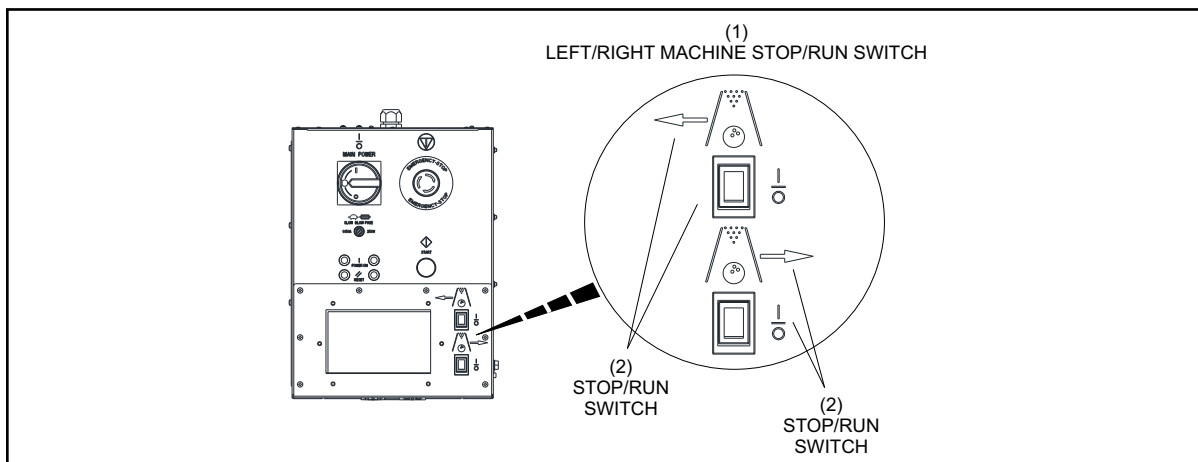


Figure 3-7. Left/Right Machine Stop/Run Switch

- (1) LEFT/RIGHT MACHINE STOP/RUN SWITCH
- (2) STOP/RUN SWITCH

LCD Touchscreen - Operation

Overview

The Stringpin Controller has an interactive touchscreen display that allows the user to review the current status of a pinsetter, set pins, select different modes, view the frame count, switch cluster position, pinsetter ball status (depending on the set mode: ball 1, 2 or 3), and more. Refer to *Figure 3-8* for the main screen - versions 1.1.14 and prior. Refer to *Figure 3-9* for the main screen - versions 1.1.15 and later.

Main Screen - Versions 1.1.11 and Prior

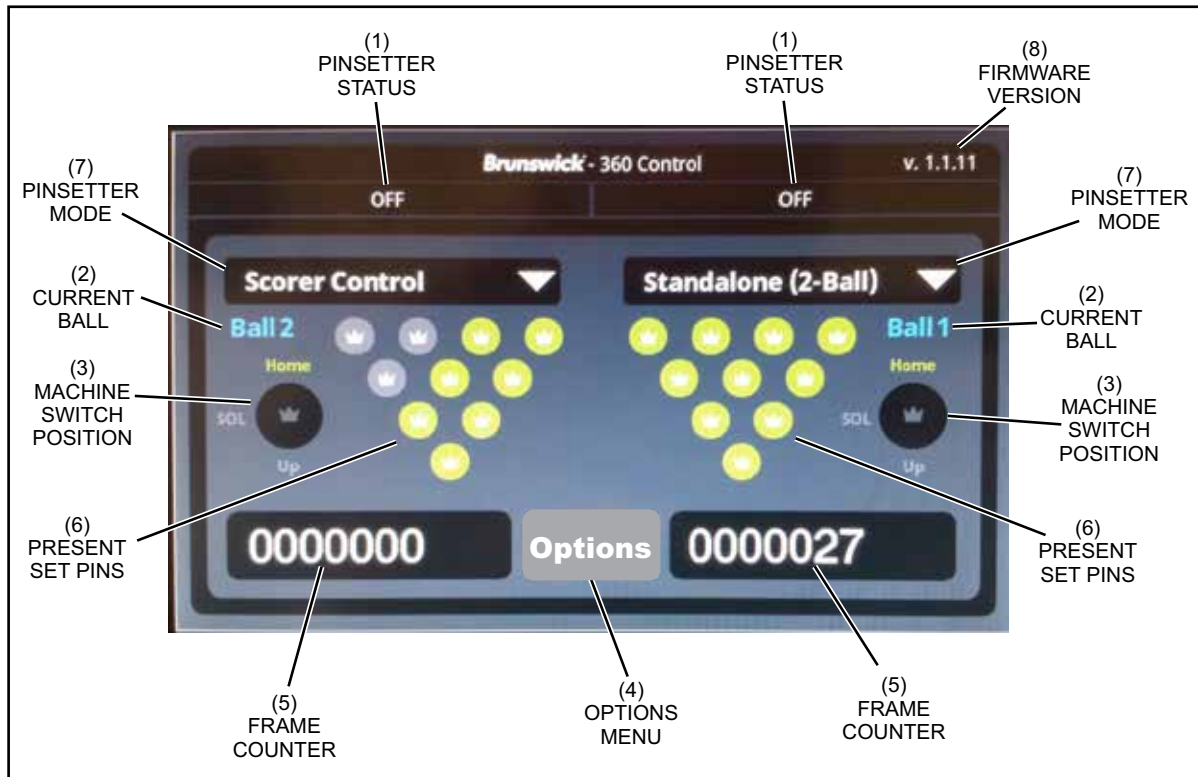


Figure 3-8. LCD Touchscreen - Overview (Main Screen) Versions 1.1.14 and Prior

The functions of the Touchscreen include:

- (1) **Pinsetter Status** - Pinsetter power and error code status (if applicable). This area will display the OFF / RUN status or the error description if the pinsetter is in an error state. Refer to the pinsetter error code chart for more information.
- (2) **Current Ball** - Pinsetter ball count. This will display the current pinsetter ball count. Depending on the mode (2-Ball or 3-Ball), the pinsetter ball count could be one, two, or three. Each ball count refers to the traditional cycle sequence of the pinsetter:

Ball 1 - 10 Pins, first ball

Ball 2 - Spare Ball

Ball 3 - Cleanup (3-ball mode only)

- (3) **Machine Switch Position** - Display of current position of the switch cluster cam as it rotates and passes the three cluster switches.

Home - Indicates the “Home” switch is actuated. In this position, the wagon is at the front of the pinsetter and the pins are spotted on the pin deck

Up - Indicates the “Pins Up” switch is actuated. In this position, The wagon is at the back of the pinsetter and the pins are in the up position.

SOL- Indicates that the wagon is moving from the back to the front of the machine and has actuated the string solenoid switch. This switch determines when the string solenoids are energized.

- (4) **Options Menu** - The options menu allows the user to select language, detangle sequence, pinsetter off state, delay after ball detect, ball return off delay, and ball return energy time out. This menu is only available when both STOP/RUN switches on the Controller are in the STOP position.
- (5) **Frame Counter** - Frame counter display. This displays the total number of frames the pinstter has run in the selected mode.
- (6) **Present Set Pins** - Graphical display of the pins that indicates the pins currently standing on the pindeck.
- (7) **Pinsetter Mode** - Pinsetter mode display and drop down menu mode selector. Use this menu to select the desired pinstter mode. This drop down menu is only available when the STOP/RUN switch on the Controller for the pinsetter is in the STOP position.
- (8) **Firmware Version** - Display of the software version currently installed.

Main Screen - Versions 1.1.12 and Later

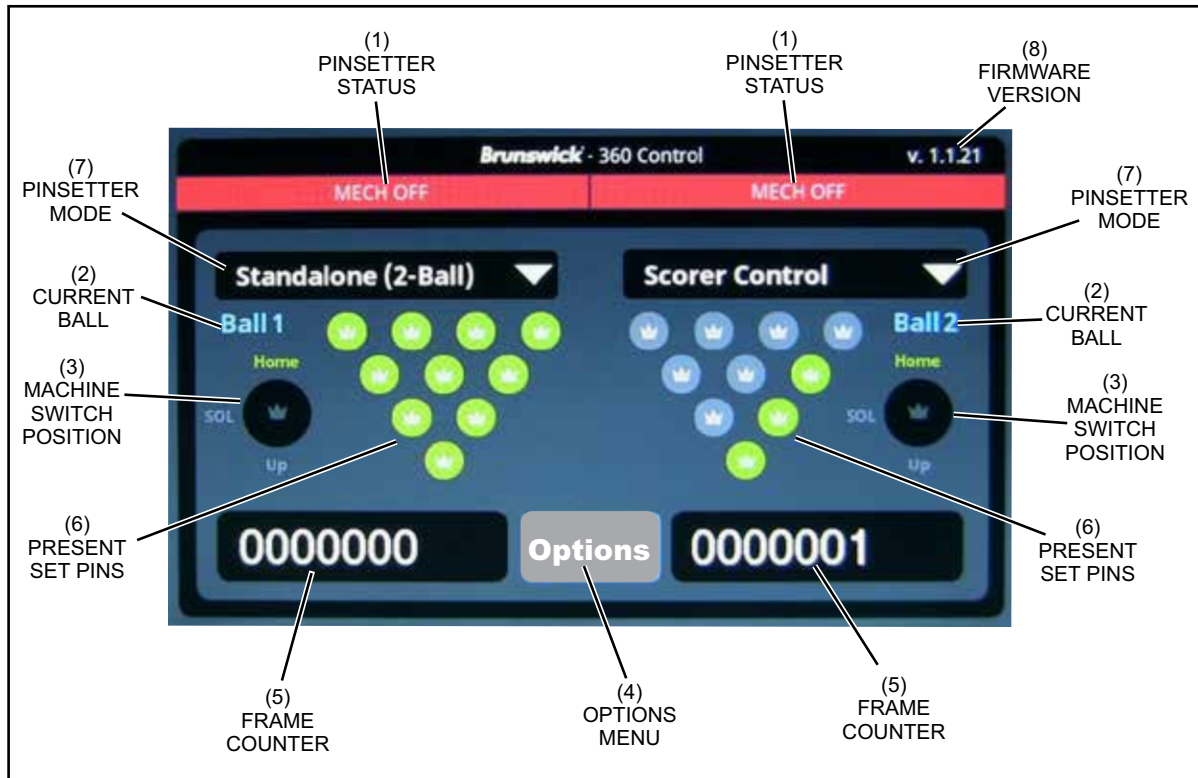


Figure 3-9. LCD Touchscreen - Overview (Main Screen) Versions 1.1.15 and Later

The function of the Touchscreen include:

- (1) **Pinsetter Status** - Pinsetter power and error code status (if applicable). This area will display the OFF / RUN status or the error description if the pinsetter is in an error state. Refer to the pinsetter error code chart for more information.
- (2) **Current Ball** - Pinsetter ball count. This will display the current pinstter ball count. Depending on the mode (2-Ball or 3-Ball), the pinsetter ball count could be one, two, or three. Each ball count refers to the traditional cycle sequence of the pinsetter:

Ball 1 - 10 Pins, first ball

Ball 2 - Spare Ball

Ball 3 - Cleanup (3-ball mode only)

- (3) **Machine Switch Position** - Display of current position of the switch cluster cam as it rotates and passes the three cluster switches. When equipped with firmware version 1.1.23 and newer, touching the switch cluster animation area will open the Switch Diagnostic Menu screen.

Home - Indicates the “Home” switch is actuated. In this position, the wagon is at the front of the pinsetter and the pins are spotted on the pin deck

Up - Indicates the “Pins Up” switch is actuated. In this position, The wagon is at the back of the pinsetter and the pins are in the up position.

SOL- Indicates that the wagon is moving from the back to the front of the machine and has actuated the string solenoid switch. This switch determines when the string solenoids are energized.

- (4) **Options Menu** - The options menu allows the user to select language, detangle sequence, pinsetter off state, delay after ball detect, ball return off delay, and ball return energy time out. This menu is only available when both STOP/RUN switches on the Controller are in the STOP position.
- (5) **Frame Counter** - Frame counter display. This displays the total number of frames the pinsetter has run in selected mode.
- (6) **Present Set Pins** - Graphical display of the pins that indicates the pins currently standing on the pindeck and which pins are up.
- (7) **Pinsetter Mode** - Pinsetter mode display and drop down menu mode selector. Use this menu to select the desired pinsetter mode. This drop down menu is only available when the STOP/RUN switch on the Controller for the pinsetter is in the STOP position.
- (8) **Firmware Version** - Display of the software version currently installed.

Pinsetter Mode - Drop Down Menu

The StringPin Pinsetter is programmed with several operating modes. These modes allow the operator to run the machine in different states depending on the situation and/or the desired operation. The modes are selected by using the drop down menu on the LCD Touchscreen. Refer to *Figure 3-10* for the drop down menu - versions 1.1.14 and prior. Refer to *Figure 3-11* for the drop down menu - versions 1.1.15 and later.

i *NOTE: The Pinsetter Mode Menu is only available when the Stop/Run switch for the pinsetter is in the STOP position.*

Drop Down Menu - Versions 1.1.14 and Prior



Figure 3-10. LCD Touchscreen - Pinsetter Mode Drop Down Menu - Versions 1.1.14 and Prior

The items that appear on the Pinsetter Mode Drop Down Menu include:

- (1) **Mode Drop Down Menu** - Select the down arrow to expand the expand the pinsetter mode menu.
 - (2) **Mode Selections** - The menu has the following selections:
 - **Standalone (2-Ball)** - The 2-Ball Stand alone mode runs independent of the scoring system. In this mode the pinsetter will operate in a 2 balls per frame mode but will not communicate with or provide scoring information to the scoring system (if installed).
 - **Standalone (3-Ball)** - 3-Ball Standalone mode, runs independent of the scoring system. In this mode the pinsetter will operate in a 3 balls per frame mode but will not communicate with or provide scoring information to the scoring system (if installed).
 - **Scorer Control** - Scoring dependent mode. In this mode the pinsetter will operate in a designated frame mode but will communicate with and provide scoring information to the scoring system. While in this mode, the scoring system dictates all pinsetter operation.
 - **Diagnostics** - While in this mode the pinsetter will run a continuous cycle until the user exits the mode or a pinsetter error condition occurs. During operation, the pinsetter spots and retracts each individual pin in sequence.
 - **Ball Return Only** - Turns on the ball return for diagnosis and adjustment of the ball accelerator and the ball lift.
 - **Pins Up** - When this option is selected, the pinsetter lifts all 10 pins to up position so that the string wagon can stop on the stop dogs. Normally this is used when performing the string tension adjustment.
- i** ***NOTE:** The Pins Up mode is only available in firmware versions 1.1.14 and prior. If the firmware is 1.1.15 or later, please see the next section for the explanation of the drop down menu modes.*
- **Pinlight On** - When selected, this option causes the pinlight to turn “ON”. Typically this feature is used to provide additional light for the mechanic when performing maintenance of the pinsetter.

Main Screen - Versions 1.1.15 and Later

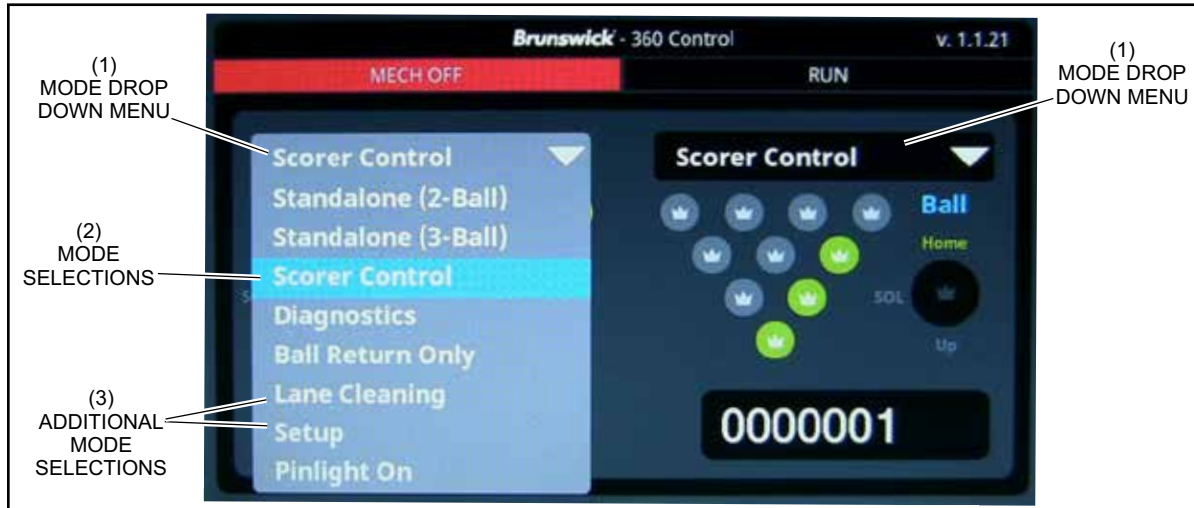


Figure 3-11. LCD Touchscreen - Pinsetter Mode Drop Down Menu V1.1.15 and Later

- (1) MODE DROP DOWN MENU (2) MODE SELECTIONS (3) ADDITIONAL MODE SELECTIONS
(ONLY VERSIONS 1.1.12 AND LATER)

(1) **Mode Drop Down Menu** - Select the down arrow to expand the expand the pinsetter mode menu.

(2) **Mode Selections** - The menu has the following selections:

- **Standalone (2-Ball)** - The 2-Ball Stand alone mode runs independent of the scoring system. In this mode the pinsetter will operate in a 2 balls per frame mode but will not communicate with or provide scoring information to the scoring system (if installed).
- **Standalone (3-Ball)** - 3-Ball Standalone mode, runs independent of the scoring system. In this mode the pinsetter will operate in a 3 balls per frame mode but will not communicate with or provide scoring information to the scoring system (if installed).
- **Scorer Control** - Scoring dependent mode. In this mode the pinsetter will operate in a designated frame mode but will communicate with and provide scoring information to the scoring system. While in this mode, the scoring system dictates all pinsetter operation.

Scorer Control ON: Mode Display - Scorer Control and Pinsetter Status is RUN. In this mode, the lane is assigned from the scoring system, the pinsetter will be running, and ball detectors are fully active. Interrupting the ball detect beam will cause the pinsetter to cycle.

Scorer Control OFF: Mode Display - Scorer Control and Pinsetter Status is OFF. In this mode, the lane is not assigned from the scoring system, the pinsetter will not be running, **but the ball detectors are still active.** Interrupting the ball detect beam will cause the ball accelerator and ball lift to turn on temporarily, but the pinsetter will not cycle. The function of this feature is to return bowling balls that were thrown down an unassigned lane.

- **Diagnostics** - While in this mode the pinsetter will run a continuous cycle until the user exits the mode or a pinsetter error condition occurs. During operation, the pinsetter spots and retracts each individual pin in sequence.
- **Ball Return Only** - Turns on the ball return for diagnosis and adjustment of the ball accelerator and ball lift.
- **Lane Cleaning** - Raises and keeps the pins in the up position by engaging the PMI string brake so that the operator can run the lane machine to clean and condition the lane surface. When this option is selected, the pinsetter lifts all 10 pins to up position and raises the gate.
- **Setup** - Mode used to set up and adjust the StringPin pinsetter. When this option is selected, the pinsetter lifts all 10 pins to the up position so that the string wagon can stop on the stop dogs. Normally this is used when performing the string tension adjustment.
- **Pinlight On** - When selected, this option causes the pinlight to turn “ON”. Typically this feature is used to provide additional light for the mechanic when performing maintenance of the pinsetter.

Pinsetter Options Menu

The Options Menu allows the operator to configure advanced settings for the StringPin Pinsetter. The following is a description of the options available in the menu. Refer to *Figure 3-12*.

i **NOTE:** The menu selections are only available when both Stop/Run switches on the controller are in the STOP position.

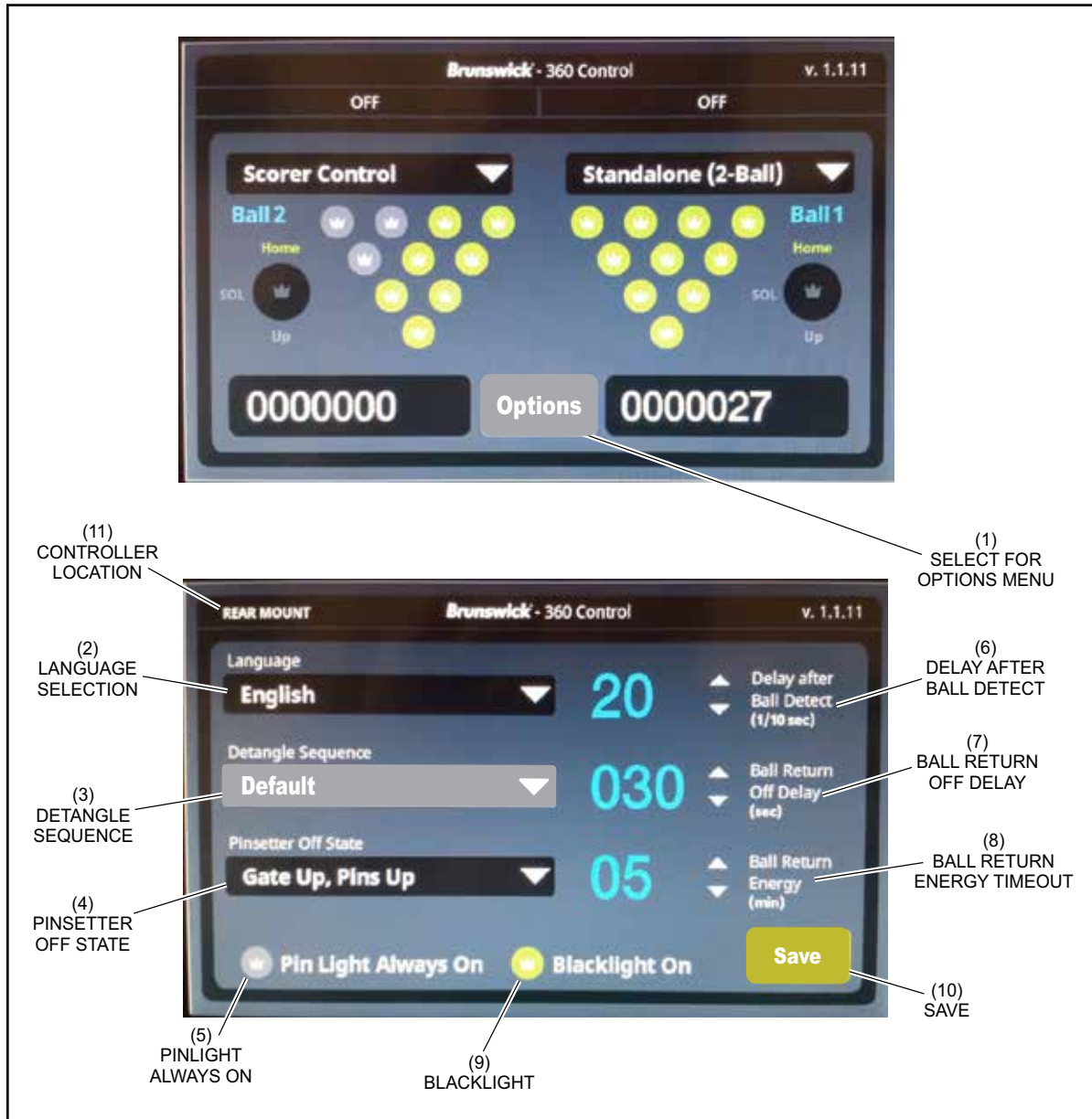


Figure 3-12. LCD Touchscreen - Options Menu

Explanation of items that appear on the Options Menu include:

- (1) **Options** - Select “Options” on the Main screen to display the Options screen.
- (2) **Language** - A drop-down menu that allows the user to select the desired language to be displayed on the LCD.
- (3) **Detangle Sequence** - A drop-down menu that allows the user to select the sequence the pin shake sequence the pinsetter will use when attempting to detangle the strings.
- (4) **Pinsetter Off State** - A drop-down menu that allows the user to select the desired position of the gate and pins when the machine is off. This setting only applies when the pinsetter is in scorer mode. Options include:

Gate Up, Pins On Deck

Gate Up, Pins Up

Gate Down, Pins Up

- (5) **Pinlight Always On** - Select to keep the pinlight “ON” when the lane is turned off.
- (6) **Delay After Ball Detect** - A value Up/Down menu that allows the user to select the time delay (in tenths of a second) that the machine will wait, after ball detect signal, before it begins its cycle. Touch the up or down arrow to increase or decrease the value. A selectable range of 20-40 (2-4 seconds), in increments of 2 (1/5 seconds), is available.
- (7) **Ball Return Off Delay** - A value Up/Down menu that allows the user to select the length of time (in seconds) the ball accelerator and the ball lift will continue running after the pinsetter has been turned off. This is to ensure that the ball can return to the bowler at the end of bowling. Touch the up or down arrow to increase or decrease the value. A selectable range of 30-240 seconds is available.
- (8) **Ball Return Energy Timeout** - A value Up/Down menu that allows the user to set the length of time (in minutes) that the ball accelerator and ball lift will stay on if there is no bowling activity. A selectable range of 01-60 minutes is available.

i *HINT: Selecting and holding your finger on the up or down arrow on a value UP/Down menu will allow fast scrolling through the values.*

- (9) **Black Light On** - Select to switch the D/C pinlight to the black light mode.
- (10) **Save** - Select to save the new settings.
- (11) **Controller Location** - Touch the displayed text to select the location, where the String Pin Controller is mounted. Options include “Front Mount” or “Rear Mount.” Changing this setting will change the lanes for scoring detection.

i *NOTE: This selection impacts scoring operation. If selected improperly, lane control and scoring will be attributed to the wrong lane.*

Pinspot Menu

The Pinspot Menu allows the operator to set any pin combination on the pindeck. Touch anywhere in the pin triangle on the Main screen to display the Pinspot screen. Refer to *Figure 3-13*.

i **NOTE:** The Pinsetter Mode Menu is only available when the Stop/Run switch for the pinsetter is in the RUN position and the pinsetter is turned ON.

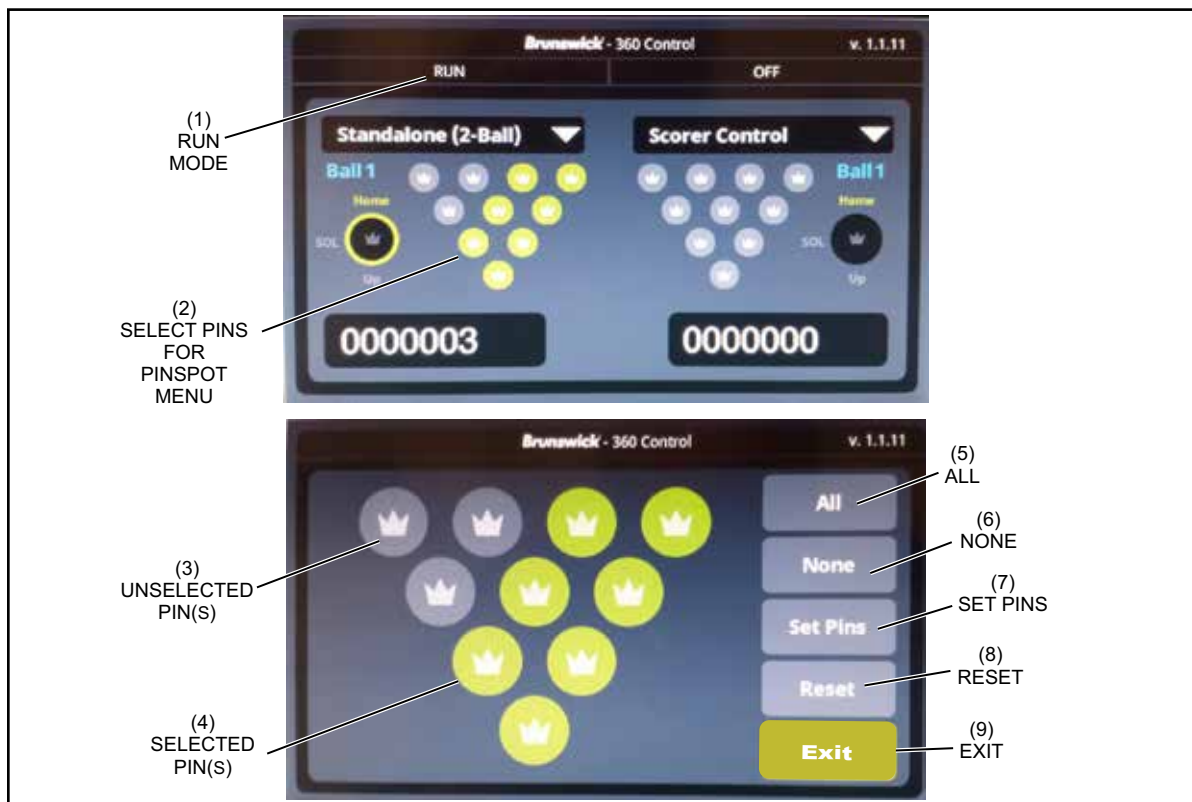


Figure 3-13. LCD Touchscreen - Pinspot Menu

The items that appear on the Pinspot Menu include:

- (1) **Run Mode** - The pinsetter must be in the “Run” mode to access the Pinspot Menu.
- (2) **Select Pins for Pinspot Menu** - Select the outlined pin triangle area to open the Pinspot menu for the desired lane.
- (3) **Selected Pin(s)** - A pin location that is highlighted in color indicates that the pin has been selected to be placed on the pindeck when the “Set Pins” button is pressed.
- (4) **Unselected Pin(s)** - A pin location that is NOT highlighted with color indicates that the pin has been unselected and will not be placed on the pindeck when the “Set Pins” button is pressed.
- (5) **All** - This selection allows the user to quickly select all pins.
- (6) **None** - This selection allows the user to quickly un-select all pins.
- (7) **Set Pins** - This selection causes the pinsetter to place the selected pins on to the pindeck.
- (8) **Reset** - This selection allows the user to cycle (sequence) the pinsetter to the desired ball count.
- (9) **Exit** - Select to exit the Pinspot Menu.

Switch Diagnostics Menu

The Switch Diagnostics Menu allows the operator to view, in real time, the switches on the pinsetter. Touch the switch cluster animation on the Main screen to display the Switch Diagnostics Menu screen. Refer to *Figure 3-14*.

i **NOTE:** The Switch Diagnostics Menu is available anytime the Main Screen is displayed and is only available for firmware versions 1.1.23 and newer.

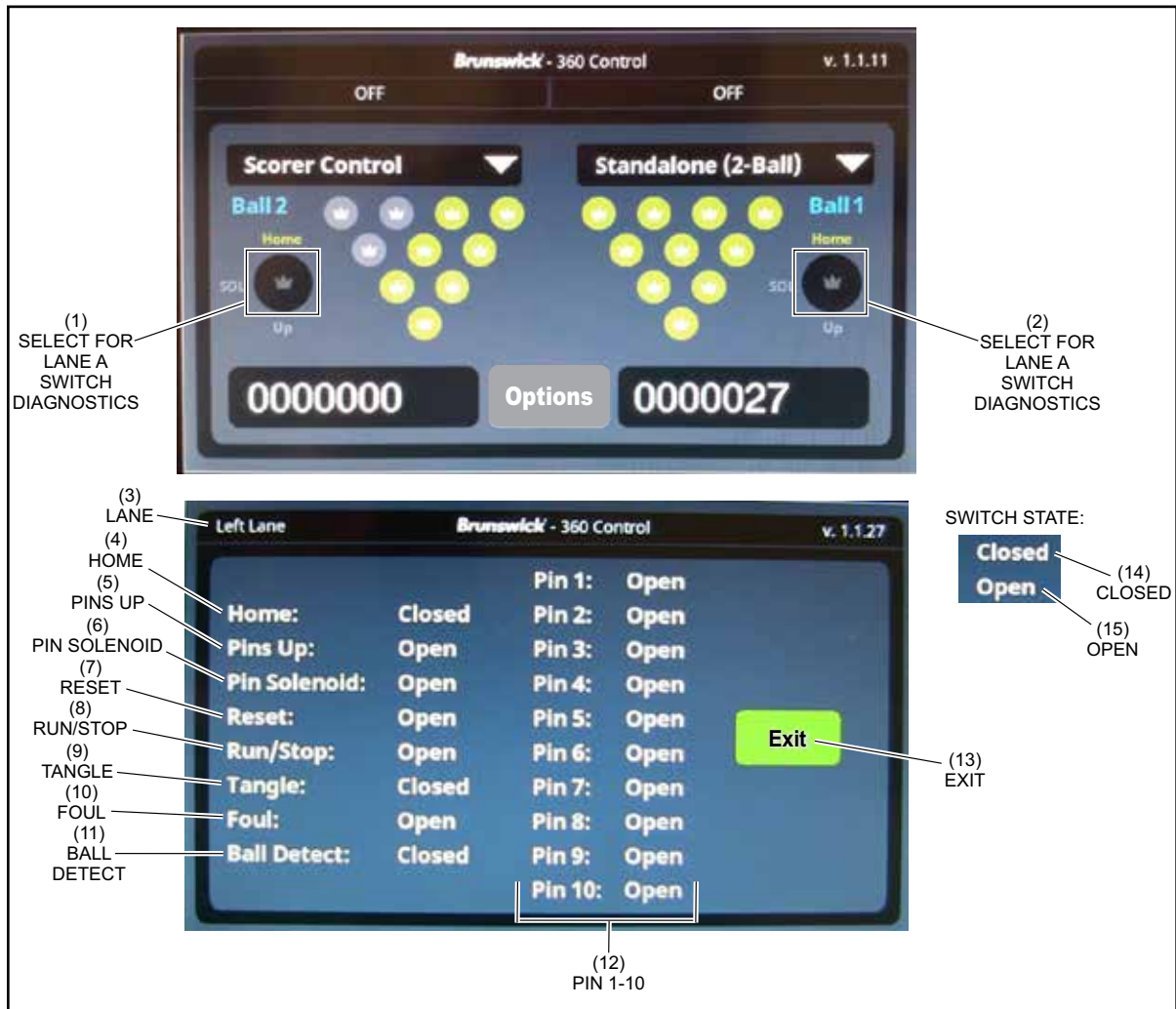


Figure 3-14. LCD Touchscreen - Switch Diagnostics Menu

The items that appear on the Switch Diagnostics Menu include:

- (1) **Select for Lane A Switch Diagnostics** - Select the switch cluster animation to navigate to the Lane A switch diagnostics screen.
- (2) **Select for Lane B Switch Diagnostics** - Select the switch cluster animation to navigate to the Lane B switch diagnostics screen.
- (3) **Lane** - There are two switch diagnostics screens per lane pair: one for the left lane and one for the right lane. The lane display indicates which lane is currently displayed.

- (4) **Home** - Located on the switch cluster, the Home magnetic switch is used to turn off the motor when the string wagon is at home/front position of the mainframe and the pins have been set on the pin deck if applicable. When actuated by a magnet, the display will show the switch as “closed.”
- (5) **Pins Up** - Located on the switch cluster, the Pins Up magnetic switch is used to turn off the motor when the string wagon reaches the proper position at the back of the mainframe so that the string wagon can lock on the stop dogs.
- (6) **Pin Solenoid** - Located on the switch cluster, the Pin Solenoid magnetic switch is used to energize the PMI (Pin Motion Interface) String Brake Solenoids at the proper time to prevent pins from being set on the pin deck. This is normally utilized in a second ball standing pins cycle.
- (7) **Reset** - Located on the Ball Lift/Ball Rack that is installed near the bowler’s settee area, the reset switch allows the pinsetter to cycle or “reset” pins. This switch will cause the pinsetter to cycle from first ball to second ball, then when pressed again, from second ball to first ball setting all 10 pins on the pin deck. When pressed, the display will show the switch as “closed.”
- (8) **Run/Stop** - Located on the 360 Controller or on the side of the pinsetter mainframe are Run/ Stop switches. These switches are used to temporarily stop the pinsetter in the event that minor maintenance needs to be done on the pinsetter.
- (9) **Tangle** - Located on the mainframe of the StringPin pinsetter, the Tangle switch is used to determine if two or more pin strings have become intertwined or tangled. If the machine cannot detangle the pins on its own using a preset detangle sequence, the machine will turn off and report a Tangle-01 error code.
- (10) **Foul** - Located at the beginning of the lane, and at the end of the approach, are Foul units. One for each lane pair. The purpose of the Foul unit is to alert the bowler and the StringPin pinsetter that a foul as occurred, a signal will be sent from the Foul unit to the 360 Controller via a lane cable and the controller will detect the signal and perform a foul cycle when the foul unit is triggered.
- (11) **Ball Detect** - Located in between a lane par, at the end of the lane and in front of the pin deck are two Ball Detects. The purpose of the Ball Detect is to detect if a ball has entered the pin deck area. Once the Ball Detect beam as been broken, the pinsetter will read pin fall, if any, and cycle accordingly.
- (12) **Pin 1-10** - Located on the PMI (Pin Motion Interface), the Pin 1-10 magnetic switches are utilized to detect pin fall.
- (13) **Exit** - Selection to exit the Switch Diagnostics Screen.

Explanation of Switch State:

- (14) **Open** - Indicates the switch is not actuated or a signal from foul or ball detector is not being sent or received.
- (15) **Closed** - Indicates the switch is actuated or a signal from foul or ball detector is being sent and received.

Internal Components and Connections

Internally, the StringPin Controller box contains the following components:

- I/O PCB
- CPU PCB
- High Voltage PCB
- Transformer
- Power Contactors (2)

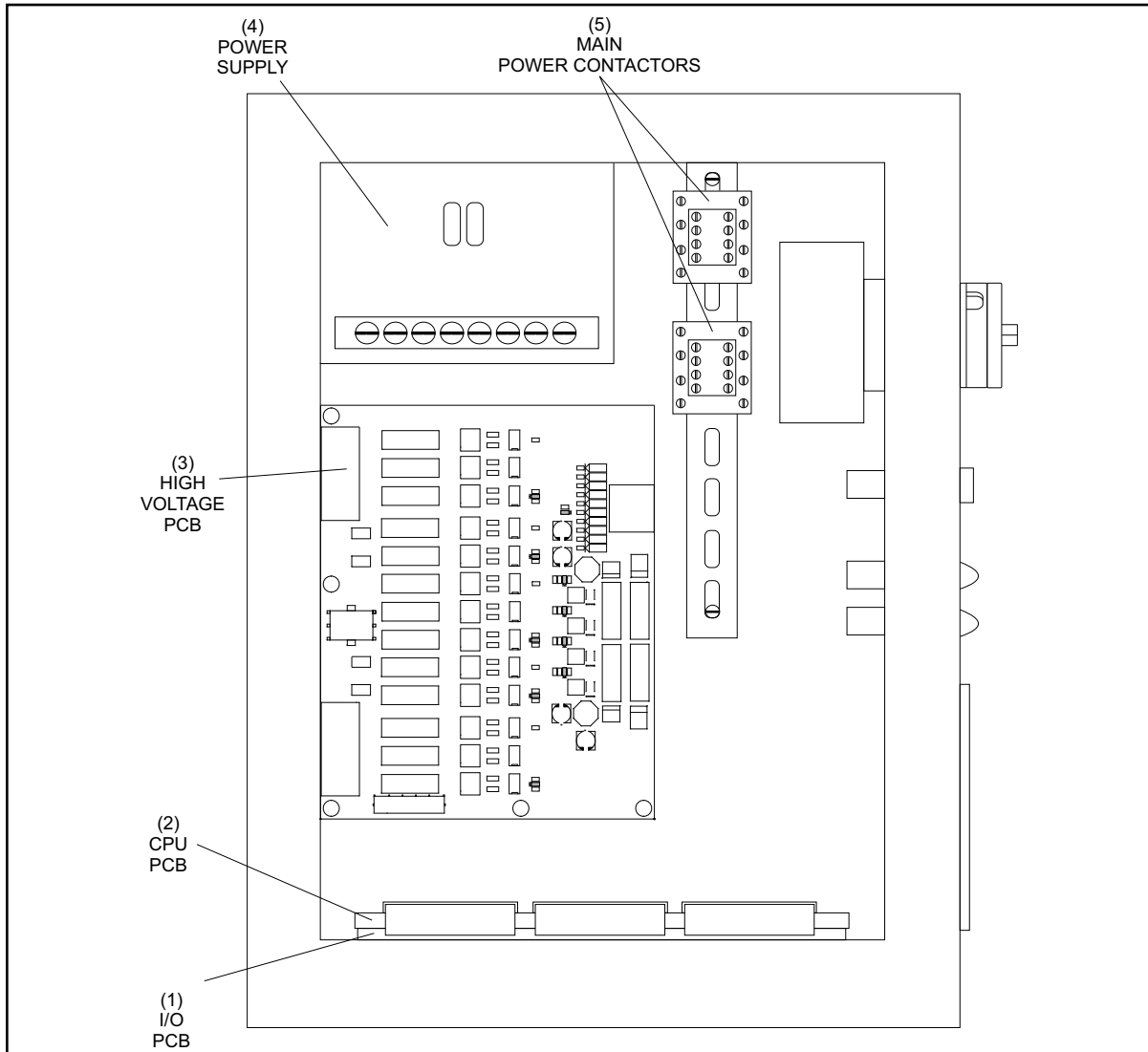


Figure 3-15. StringPin Controller Box - Internal Components

The following is a description of the functions of the StringPin Controller Box internal components:

- (1) **I/O PCB** - Circuit board that provides the connections for the low voltage signals that connect to the bottom of the StringPin Controller. This board also provides protection against electrical surges entering the controller through the low voltage cabling.
- (2) **CPU PCB** - This board gathers switch information and sends out solenoid voltage to each pinsetter through the I/O PCB. Communication to the scoring system is also handled by the CPU.

- (3) **High Voltage PCB** - The High Voltage PCB supplies power for the pinsetter and accelerator motors and standard LED pinlights as well as optional power for multi color LED pinlights.
- (4) **Power Supply** - The Power Supply changes incoming the 208 or 230 voltage to 24VDC. This voltage connects to the CPU where it is then used to power the circuits boards inside the Controller as well as the D/C pinlights, trouble light, and solenoids in the Pin Motion Interfaces.
- (5) **Main Power Contactors** - The Main Power Contactor energize to allow the incoming 3-phase power to reach the High Voltage PCB. The contactors are connected in series to provide 2 stages of protection.

High Voltage PCB

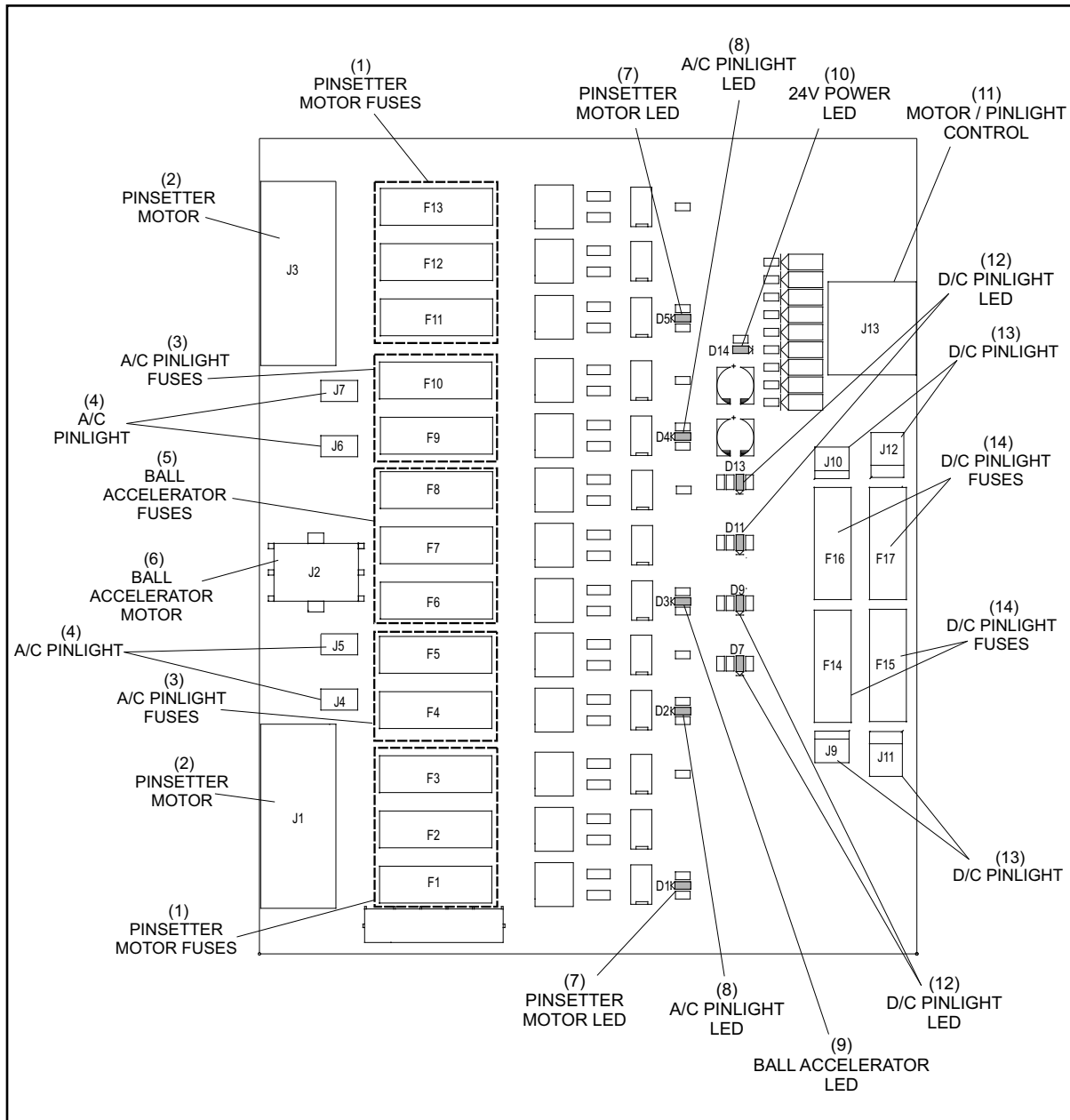


Figure 3-16. High Voltage PCB

The following is a description of the functions of the StringPin High Voltage PCB:

Refer to *Figures 3-16, 3-17, and 3-18* for fuse ratings and additional information.

- (1) **Pinsetter Motor Fuses (F1-F3, F11-F13)** - Fuses used to protect the pinsetter's string wagon motor.
- (2) **Pinsetter Motor (J1,J3)** - Output connections for the 3-phase power used for the pinsetter's string wagon motor.
- (3) **A/C Pinlight Fuses (F4-F5, F9-F10)** - Fuses used to protect power to the optional multi-color pinlight. The fuses are rated at 250V 2A 5 x 20 mm - Slow Blow.
- (4) **A/C Pinlight (J4-J7)** - Output connections for power used for the optional multi-color pinlight.
- (5) **Ball Accelerator Fuses (F6-F8)** - Fuses used to protect the ball accelerator motor.
- (6) **Ball Accelerator Motor (J2)** - Output connection for the 3-phase power used for the accelerator motor.
- (7) **Pinsetter Motor LED (D5, D11)** - These LED light when the voltage is being sent to the corresponding pinsetter's string wagon motor.
- (8) **A/C Pinlight LED (D2, D4)** - These LEDs lights when the voltage is sent to the optional multi-color pinlight.
- (9) **Ball Accelerator LED (D3)** - This LED lights when the voltage is being sent to the ball accelerator motor.
- (10) **24V Power LED (D14)** - This LED lights when the 24VDC circuitry is operating.
- (11) **Motor / Pinlight Control (J13)** - Connection for the cable originating at the CPU. The High Voltage board is "told" when to turn the motors and pinlights ON//OFF through this connection.
- (12) **D/C Pinlight LED (D7,D9,D11,D13)** - These LEDs light to indicate when the voltage is being sent to the D/C pinlight that is standard on the string pinsetter. LEDs D9 and D11 indicate power is being sent to the corresponding pinsetter's "white light" circuit, while LEDs D9 and D13 indicate power is being sent to the corresponding pinsetter's "blacklight" circuit.
- (13) **D/C Pinlight (J9-J12)** - Output connections used to power the white/blacklight pinlights that come standard on the Stringpin pinsetter. Connectors J9 and J10 connect to the "white light" circuit of the pinlight and J11 and J12 connect to the "blacklight" circuit.
- (14) **D/C Pinlight Fuses (F14-F17)** - Fuses used to protect the voltages going to the D/C pinlight. The fuse is rated at 250V 1A 5 x 20 mm - Slow Blow. F14 and F16 protect the voltage going to the "white light" circuits while F15 and F17 protect the voltage to the "blacklight" circuits.

Rear Mounted Pinsetter Controllers			
CONNECTOR	LED	FUSE (5x20mm)	DESCRIPTION
Even (Right) Lane			
J1	D1 (Green)	F1 - F3 208/230V - (3A,250V Slow) 380/400V - (2A,250V Slow)	3-Phase Power Out - Pinsetter Motor
J4	D2 (Green)	F4 (2A,250V Slow)	Power Out - A/C Pinlight
J5		F5 (2A,250V Slow)	
J9	D9 (Green)	F14 (1A,250V Slow)	Power Out - D/C Pinlight (White)
J11	D7 (Green)	F15 (1A,250V Slow)	Power Out - D/C Pinlight (Blacklight)
Odd (Left) Lane			
J3	D5 (Red)	F11 - F13 208/230V - (3A,250V Slow) 380/400V - (2A,250V Slow)	3 Phase Power Out - Pinsetter Motor
J6	D4 (Red)	F9 (2A,250V Slow)	Power Out - A/C Pinlight
J7		F10 (2A,250V Slow)	
J10	D11 (Red)	F16 (1A,250V Slow)	Power Out - D/C Pinlight (White)
J12	D13 (Red)	F17 (1A,250V Slow)	Power Out - D/C Pinlight (Blacklight)
Common			
J2	D3 (Green)	F6 - F8 208/230V - (3A,250V Slow) 380/400V - (2A,250V Slow)	3-Phase Power - Ball Accelerator
J8	N/A	N/A	3-Phase Power In
J13	N/A	N/A	Input - Motor / Pinlight Control
N/A	D14 (Green)	N/A	DC Power LED

Figure 3-17. High Voltage PCB - Connector, LED, and Fuse Chart For REAR Mounted Controllers

Front Mounted Pinsetter Controllers			
CONNECTOR	LED	FUSE (5x20mm)	DESCRIPTION
Odd (Left) Lane			
J1	D1 (Green)	F1 - F3 208/230V - (3A,250V Slow) 380/400V - (2A,250V Slow)	3-Phase Power Out - Pinsetter Motor
J4	D2 (Green)	F4 (2A,250V Slow)	Power Out - A/C Pinlight
J5		F5 (2A,250V Slow)	
J9	D9 (Green)	F14 (1A,250V Slow)	Power Out - D/C Pinlight (White)
J11	D7 (Green)	F15 (1A,250V Slow)	Power Out - D/C Pinlight (Blacklight)
Even (Right) Lane			
J3	D5 (Red)	F11 - F13 208/230V - (3A,250V Slow) 380/400V - (2A,250V Slow)	3 Phase Power Out - Pinsetter Motor
J6	D4 (Red)	F9 (2A,250V Slow)	Power Out - A/C Pinlight
J7		F10 (2A,250V Slow)	
J10	D11 (Red)	F16 (1A,250V Slow)	Power Out - D/C Pinlight (White)
J12	D13 (Red)	F17 (1A,250V Slow)	Power Out - D/C Pinlight (Blacklight)
Common			
J2	D3 (Green)	F6 - F8 208/230V - (3A,250V Slow) 380/400V - (2A,250V Slow)	3-Phase Power - Ball Accelerator
J8	N/A	N/A	3-Phase Power In
J13	N/A	N/A	Input - Motor / Pinlight Control
N/A	D14 (Green)	N/A	DC Power LED

Figure 3-18. High Voltage PCB - Connector, LED, and Fuse Chart For FRONT Mounted Controllers

StringPin 360 Controller CPU PCB - Version A

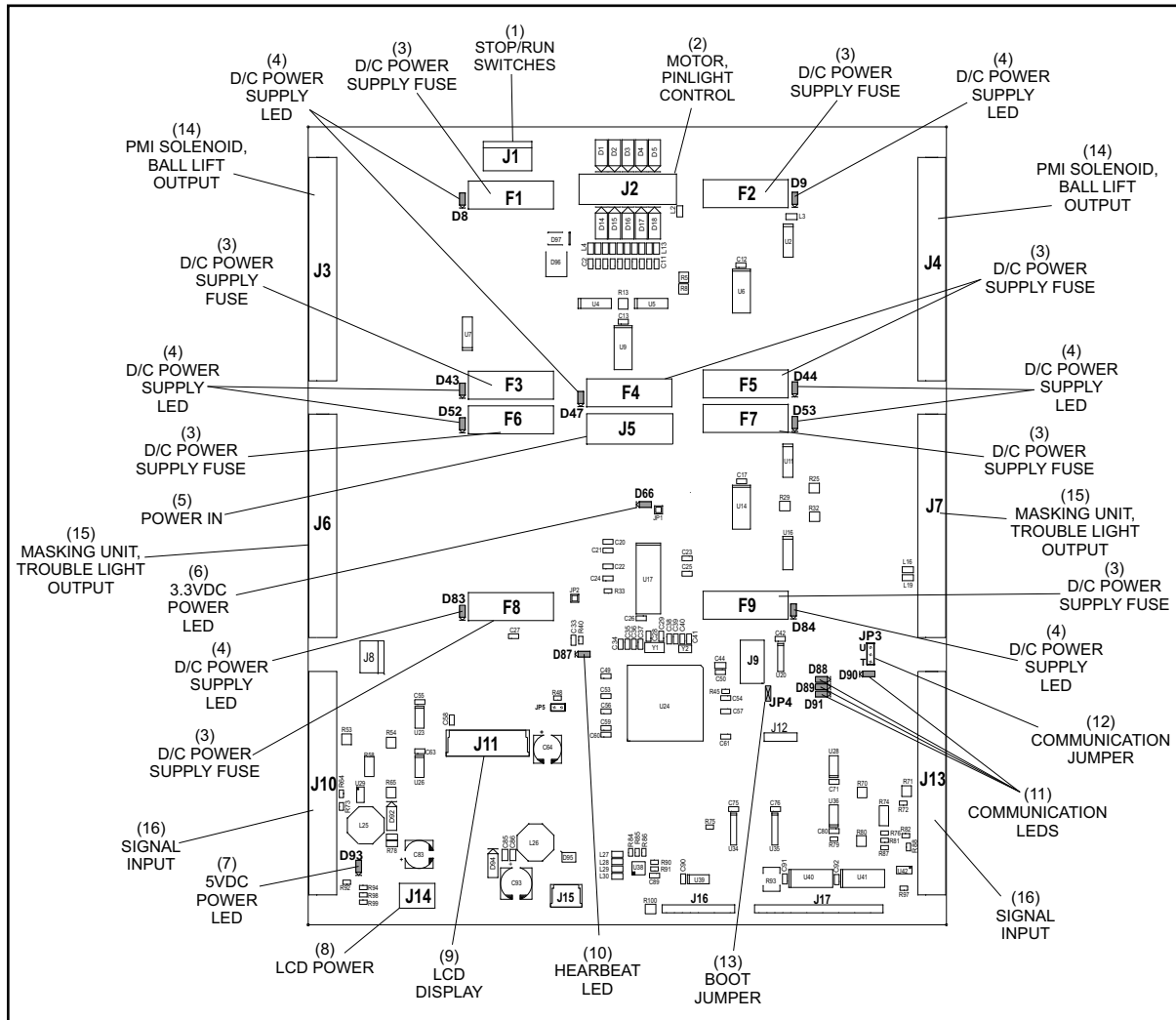


Figure 3-19. Controller CPU PCB - Version A

The following is a description of the String Pin CPU PCB components and connections.

Refer to *Figures 3-19, 3-20, and 3-21* for fuse ratings and additional information.

- (1) **Stop/Run Switches (J1)**- Connection to the stop/run switches on the Controller.
- (2) **Motor, Pinlight Control (J2)** - Connection to the High Voltage PCB used to control the String Wagon Motor and the pinlights.
- (3) **D/C Power Supply Fuse (F1-F9)** - Fuses used to protect the 24VDC used for the PMI solenoids, D/C pinlights, trouble lights, 1/2 ball lights, and ball lift control.

Rear Mounted Pinsetter Controllers		
LED INDICATOR	FUSE (5x20mm) (3.15A, 250V Fast)	DESCRIPTION
Odd (Left) Lane		
D8	F1	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D43	F3	4,5,6 PMI Solenoids
D52	F6	7,8,9 PMI Solenoids
D83	F8	10 PMI Solenoid 1/2 Ball Light (Masking Unit) String Wagon Motor Control
Even (Right) Lane		
D9	F2	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D44	F5	4,5,6 PMI Solenoids
D53	F7	7,8,9 PMI Solenoids
D84	F9	10 PMI Solenoid 1/2 Ball Light (Masking Unit) Trouble Lights (Both Lanes) String Wagon Motor Control Ball Lift Motor Control
Common		
D47	F4	CPU PCB Power High Voltage PCB Power Ball Detect Power Power - Machine Switches Touchscreen LCD Power Ball Accelerator Motor Control D/C Pinlight Power
D66, D93	F4	5VDC Power (Ball Detector) 3.3 VDC Power
D87	F4	CPU Heartbeat
D88	F4	Transmit - Scorer Communication
D89	F4	Receive - Scorer Communication
D90	F4	Power - Scorer Communication
D91	F4	Direction - Scorer Communication (On When Transmitting)

Figure 3-20. CPU PCB Version A - LED and Fuse Chart For REAR Mounted Controllers

Front Mounted Pinsetter Controllers		
LED INDICATOR	FUSE (5x20mm) (3.15A, 250V Fast)	DESCRIPTION
Even (Right) Lane		
D8	F1	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D43	F3	4,5,6 PMI Solenoids
D52	F6	7,8,9 PMI Solenoids
D83	F8	10 PMI Solenoid 1/2 Ball Light (Masking Unit) String Wagon Motor Control
Odd (Left) Lane		
D9	F2	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D44	F5	4,5,6 PMI Solenoids
D53	F7	7,8,9 PMI Solenoids
D84	F9	10 PMI Solenoid 1/2 Ball Light (Masking Unit) Trouble Lights (Both Lanes) String Wagon Motor Control Ball Lift Motor Control
Common		
D47	F4	CPU PCB Power High Voltage PCB Power Ball Detect Power Power - Machine Switches Touchscreen LCD Power Ball Accelerator Motor Control D/C Pinlight Power
D66, D93	F4	5VDC Power (Ball Detector) 3.3 VDC Power
D87	F4	CPU Heartbeat
D88	F4	Transmit - Scorer Communication
D89	F4	Receive - Scorer Communication
D90	F4	Power - Scorer Communication
D91	F4	Direction - Scorer Communication (On When Transmitting)

Figure 3-21. CPU PCB Version A - LED and Fuse Chart For FRONT Mounted Controllers

- (4) **D/C Power Supply LEDs (D8, D9,D43,D44, D47, D52, D53, D83,D84)** - These LEDs light to indicate the 24VDC received from the Power Supply is functioning and the corresponding fuse used to protect the external components has not blown.
- (5) **Power In (J5)** - Connector for the 24VDC voltages originating at the Power Supply.
- (6) **3.3VDC Power LED (D66)** - This LED lights to indicate the 3.3VDC used to power the circuits on the CPU PCB is operating properly.
- (7) **5VDC Power LED (D93)** - This LED lights to indicate the 3.3VDC used to power the circuits on the CPU PCB is operating properly.
- (8) **LCD Power (J14)** - Connection for the 24VDC used to power the LCD touchscreen.
- (9) **LCD Display (J11)** - Connection for the data to the LCD touchscreen.
- (10) **Heartbeat LED (D87)** - This LED blinks when the microprocessor on the CPU PCB is operating properly.
- (11) **Communication LEDs (D88 - D91)** - These LEDs lights to show the status of the scorer communication circuits.

Transmit LED (D88) - This LED flashes when the CPU is transmitting data to the scoring system.

Receive LED (D89) - This LED flashes when the CPU is receiving data to the scoring system.

Power LED (D90) - This LED lights to indicate the communication circuits have power.

Direction LED (D91) - This LED indicates the direction of the communication between the pinsetter and the scoring system. The LED lights when the CPU is transmitting data to the scoring system.

- (12) **Communication Jumper (JP3)** - Jumper used to terminate the communication signal when it does not continue to additional devices. Do not install jumper.
- (13) **Boot Jumper (JP4)** - Factory use Only.
- (14) **PMI Solenoid, Ball Lift Output (J3, J4)** - Connections to the I/O PCB for the signals used to energize the solenoids in the String PMIs and control the relay for the ball lift motor.
- (15) **Masking Unit, Trouble Light Output (J6, J7)** - Connections to the I/O PCB for the signals used to control the 1/2 ball lights on the masking unit and the trouble lights.
- (16) **Signal Input (J10, J3)** - Connections to the I/O PCB for the inputs from the switches on the pinsetter, the ball accelerator overload, and the ball detect and foul signals.

StringPin 360 Controller CPU PCB - Version B

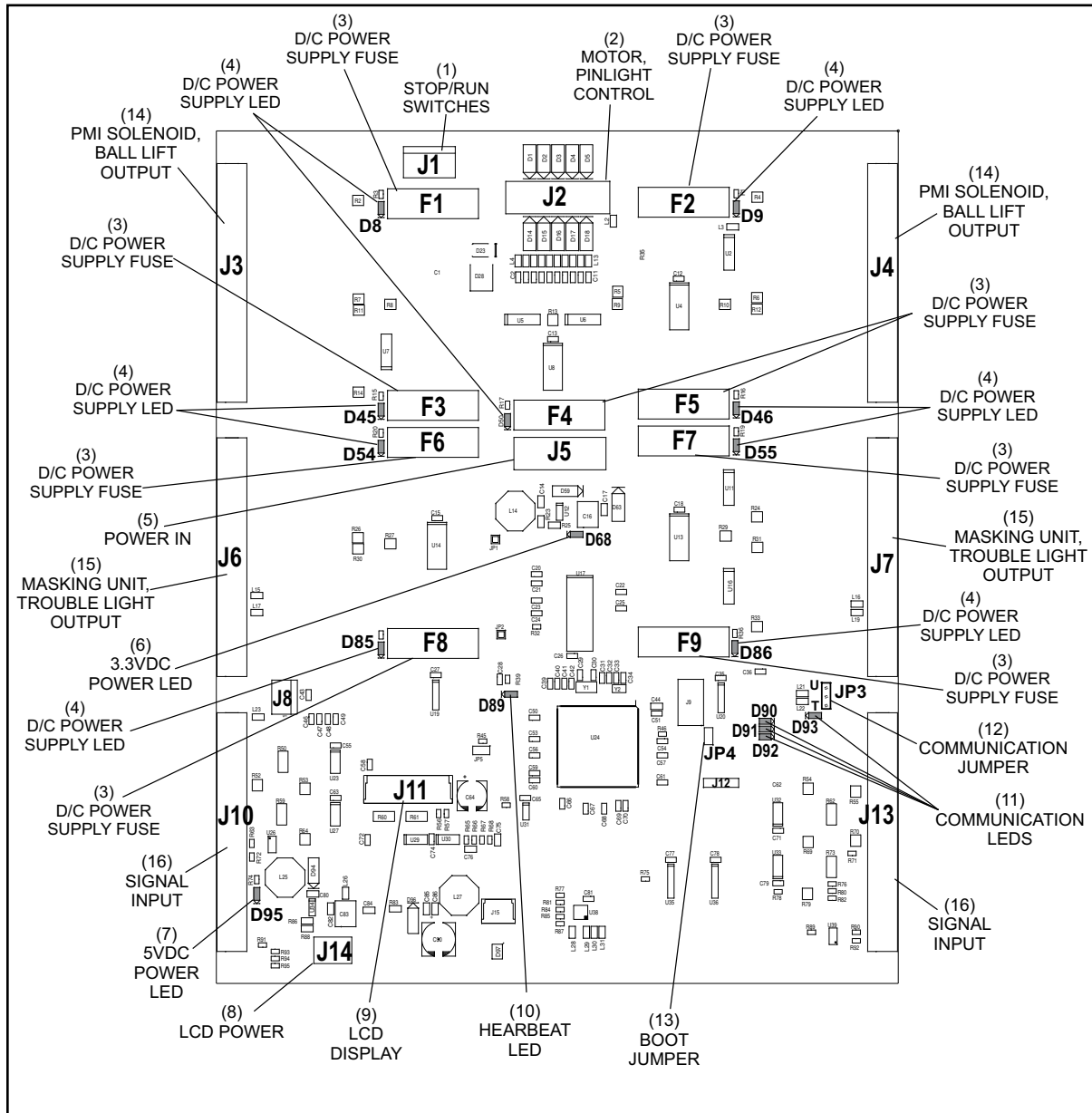


Figure 3-22. Controller CPU PCB - Version B

The following is a description of the String Pin CPU PCB components and connections.

Refer to *Figures 3-22, 3-23, and 3-24* for fuse ratings and additional information.

- (1) **Stop/Run Switches (J1)**- Connection to the stop/run switches on the Controller.
- (2) **Motor, Pinlight Control (J2)** - Connection to the High Voltage PCB used to control the String Wagon Motor and the pinlights.
- (3) **D/C Power Supply Fuse (F1-F9)** - Fuses used to protect the 24VDC used for the PMI solenoids, D/C pinlights, trouble lights, 1/2 ball lights, and ball lift control.

Rear Mounted Pinsetter Controllers		
LED INDICATOR	FUSE (5x20mm) (3.15A, 250V Fast)	DESCRIPTION
Odd (Left) Lane		
D8	F1	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D45	F3	4,5,6 PMI Solenoids
D54	F6	7,8,9 PMI Solenoids
D85	F8	10 PMI Solenoid 1/2 Ball Light (Masking Unit) String Wagon Motor Control
Even (Right) Lane		
D9	F2	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D46	F5	4,5,6 PMI Solenoids
D55	F7	7,8,9 PMI Solenoids
D86	F9	10 PMI Solenoid 1/2 Ball Light (Masking Unit) Trouble Lights (Both Lanes) String Wagon Motor Control Ball Lift Motor Control
Common		
D50	F4	CPU PCB Power High Voltage PCB Power Ball Detect Power Power - Machine Switches Touchscreen LCD Power Ball Accelerator Motor Control D/C Pinlight Power
D68, D95	F4	5VDC Power (Ball Detector) 3.3 VDC Power
D89	F4	CPU Heartbeat
D90	F4	Transmit - Scorer Communication
D91	F4	Receive - Scorer Communication
D93	F4	Power - Scorer Communication
D92	F4	Direction - Scorer Communication (On When Transmitting)

Figure 3-23. CPU PCB Version B - LED and Fuse Chart For REAR Mounted Controllers

Front Mounted Pinsetter Controllers		
LED INDICATOR	FUSE (5x20mm) (3.15A, 250V Fast)	DESCRIPTION
Even (Right) Lane		
D8	F1	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D45	F3	4,5,6 PMI Solenoids
D54	F6	7,8,9 PMI Solenoids
D85	F8	10 PMI Solenoid 1/2 Ball Light (Masking Unit) String Wagon Motor Control
Odd (Left) Lane		
D9	F2	1,2,3 PMI Solenoids Ball Door Solenoid (Optional)
D46	F5	4,5,6 PMI Solenoids
D55	F7	7,8,9 PMI Solenoids
D86	F9	10 PMI Solenoid 1/2 Ball Light (Masking Unit) Trouble Lights (Both Lanes) String Wagon Motor Control Ball Lift Motor Control
Common		
D50	F4	CPU PCB Power High Voltage PCB Power Ball Detect Power Power - Machine Switches Touchscreen LCD Power Ball Accelerator Motor Control D/C Pinlight Power
D68, D95	F4	5VDC Power (Ball Detector) 3.3 VDC Power
D89	F4	CPU Heartbeat
D90	F4	Transmit - Scorer Communication
D91	F4	Receive - Scorer Communication
D93	F4	Power - Scorer Communication
D92	F4	Direction - Scorer Communication (On When Transmitting)

Figure 3-24. CPU PCB Version B - LED and Fuse Chart For FRONT Mounted Controllers

- (4) **D/C Power Supply LEDs (D8, D9,D45,D46,D50, D54, D55, D85,D86)** - These LEDs light to indicate the 24VDC received from the Power Supply is functioning and the corresponding fuse used to protect the external components has not blown.
- (5) **Power In (J5)** - Connector for the 24VDC voltages originating at the Power Supply.
- (6) **3.3VDC Power LED (D68)** - This LED lights to indicate the 3.3VDC used to power the circuits on the CPU PCB is operating properly.
- (7) **5VDC Power LED (D95)** - This LED lights to indicate the 3.3VDC used to power the circuits on the CPU PCB is operating properly.
- (8) **LCD Power (J14)** - Connection for the 24VDC used to power the LCD touchscreen.
- (9) **LCD Display (J11)** - Connection for the data to the LCD touchscreen.
- (10) **Heartbeat LED (D89)** - This LED blinks when the microprocessor on the CPU PCB is operating properly.
- (11) **Communication LEDs (D90 - D93)** - These LEDs lights to show the status of the scorer communication circuits.

Transmit LED (D90) - This LED flashes when the CPU is transmitting data to the scoring system.

Receive LED (D91) - This LED flashes when the CPU is receiving data to the scoring system.

Direction LED (D92) - This LED indicates the direction of the communication between the pinsetter and the scoring system. The LED lights when the CPU is transmitting data to the scoring system.

Power LED (D93) - This LED lights to indicate the communication circuits have power.

- (12) **Communication Jumper (JP3)** - Jumper used to terminate the communication signal when it does not continue to additional devices. Do not install jumper.
- (13) **Boot Jumper (JP4)** - Factory use Only.
- (14) **PMI Solenoid, Ball Lift Output (J3, J4)** - Connections to the I/O PCB for the signals used to energize the solenoids in the String PMIs and control the relay for the ball lift motor.
- (15) **Masking Unit, Trouble Light Output (J6, J7)** - Connections to the I/O PCB for the signals used to control the 1/2 ball lights on the masking unit and the trouble lights.
- (16) **Signal Input (J10, J3)** - Connections to the I/O PCB for the inputs from the switches on the pinsetter, the ball accelerator overload, and the ball detect and foul signals.

StringPin I/O Board

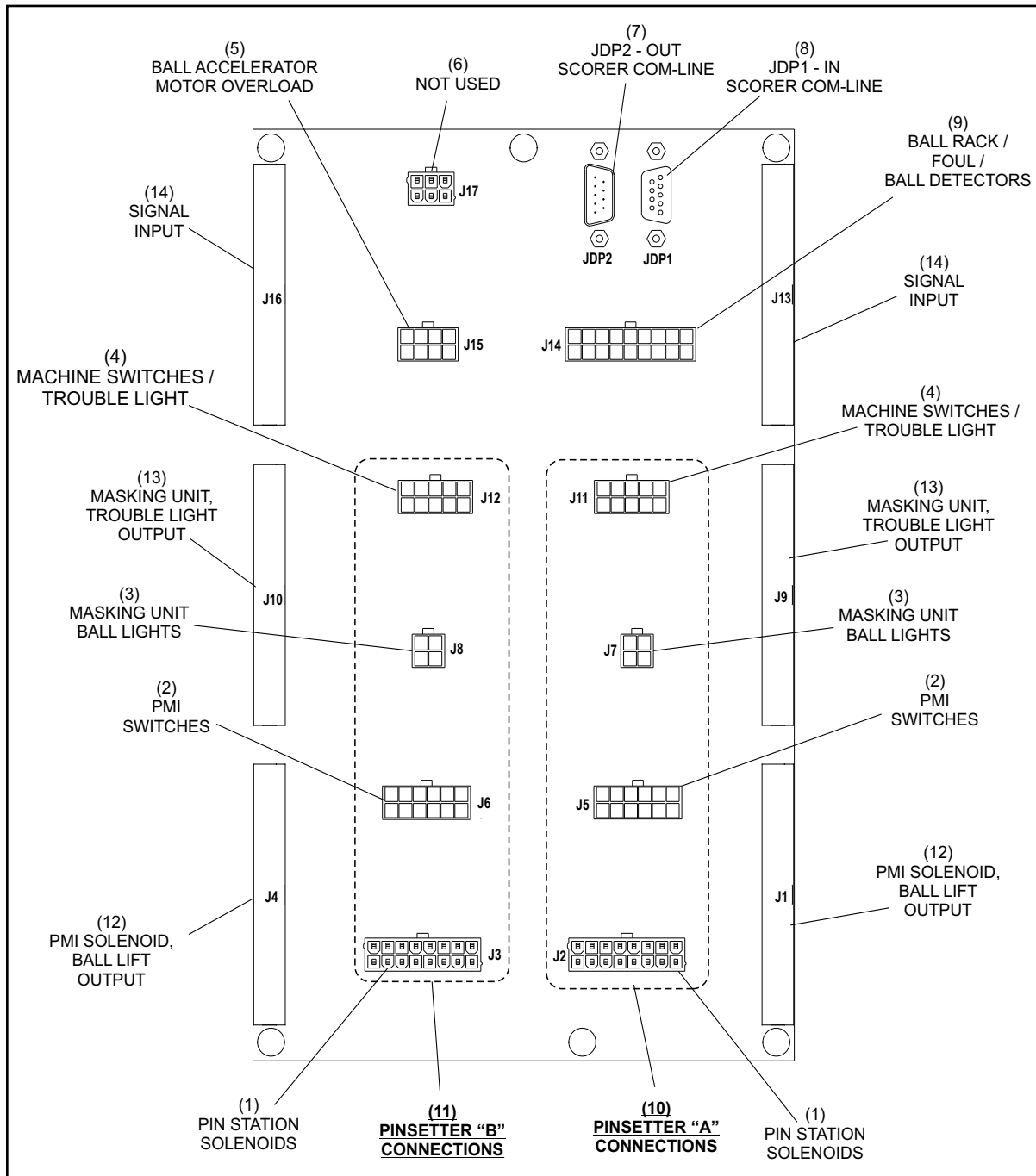


Figure 3-25. StringPin Controller I/O Board

The following is a description of the String Pin I/O PCB connections.

- (1) **PMI (Pin Motion Interface) Solenoids (J2,J3)** - Connection to the solenoids located inside the PMIs. Refer to cables 55-143009-000 and 55-143012-xxx.
- (2) **PMI (Pin Motion Interface) Switches (J5,J6)** - Connection to the switches located inside the PMIs. Refer to cables 55-143009-000 and 55-143012-xxx.
- (3) **Masking Unit Ball Lights (J7,J8)** - Connection to the 1st/2nd ball lights on the masking unit. Refer to cable 55-143015-xxx
- (4) **Machine Switches/Trouble Light (J11,J12)** - Connection to the Switch Cluster, Tangle Switch, Mechanic's Stop Switches, and the Trouble Light. Refer to cables 55-143010-000 and 55-143068-xxx
- (5) **Ball Accelerator Motor Overload (J15)** - Connection to the overload circuit located inside the Ball Accelerator Motor. Refer to cable 55-143014-xxx
- (6) **Not Used (J17)** - Connection is not used.
- (7) **Scorer COM-Line (JDP 2)** - Not used
- (8) **Scorer COM-Line (JDP 1)** - Connection for communication to the scoring system.
- (9) **Ball Rack /Foul/Ball Detectors (J14)** - Connection for inputs from the Foul Unit, Ball Detectors and bowler's reset button on the ball rack. 24VAC power used to energize power relay located at the ball rack which, in turn, powers the ball lift motor and hand blower is also supplied through this connector. Refer to cable 55-143016-xxx
- (10) **Pinsetter "A" Connections** - The cabling from "Pinsetter "A" connectors attach to one of the pinsetters of the lane pair. When the controller is mounted at the rear (back) of the machines, the connectors are used for the odd lane (left) pinsetter. When the controller is mounted at the front of the machines the connectors are used for the even lane (right) pinsetter.
- (11) **Pinsetter "B" Connections** - The cabling from "Pinsetter "B" connectors attach to one of the pinsetters of the lane pair. When the controller is mounted at the rear (back) of the machines, the connectors are used for the even lane (right) pinsetter. When the controller is mounted at the front of the machines the connectors are used for the odd lane (left) pinsetter.
- (12) **PMI Solenoid, Ball Lift Output (J1, J4)** - Connections to the CPU PCB for the signals used to energize the solenoids in the String PMIs and control the relay for the ball lift motor.
- (13) **Masking Unit, Trouble Light Output (J9, J10)** - Connections to the CPU PCB for the signals used to control the 1/2 ball lights on the masking unit and the trouble lights.
- (14) **Signal Input (J13, J16)** - Connections to the CPU PCB for the inputs from the switches on the pinsetter, the ball accelerator overload, and the ball detect and foul signals.

Power Supply

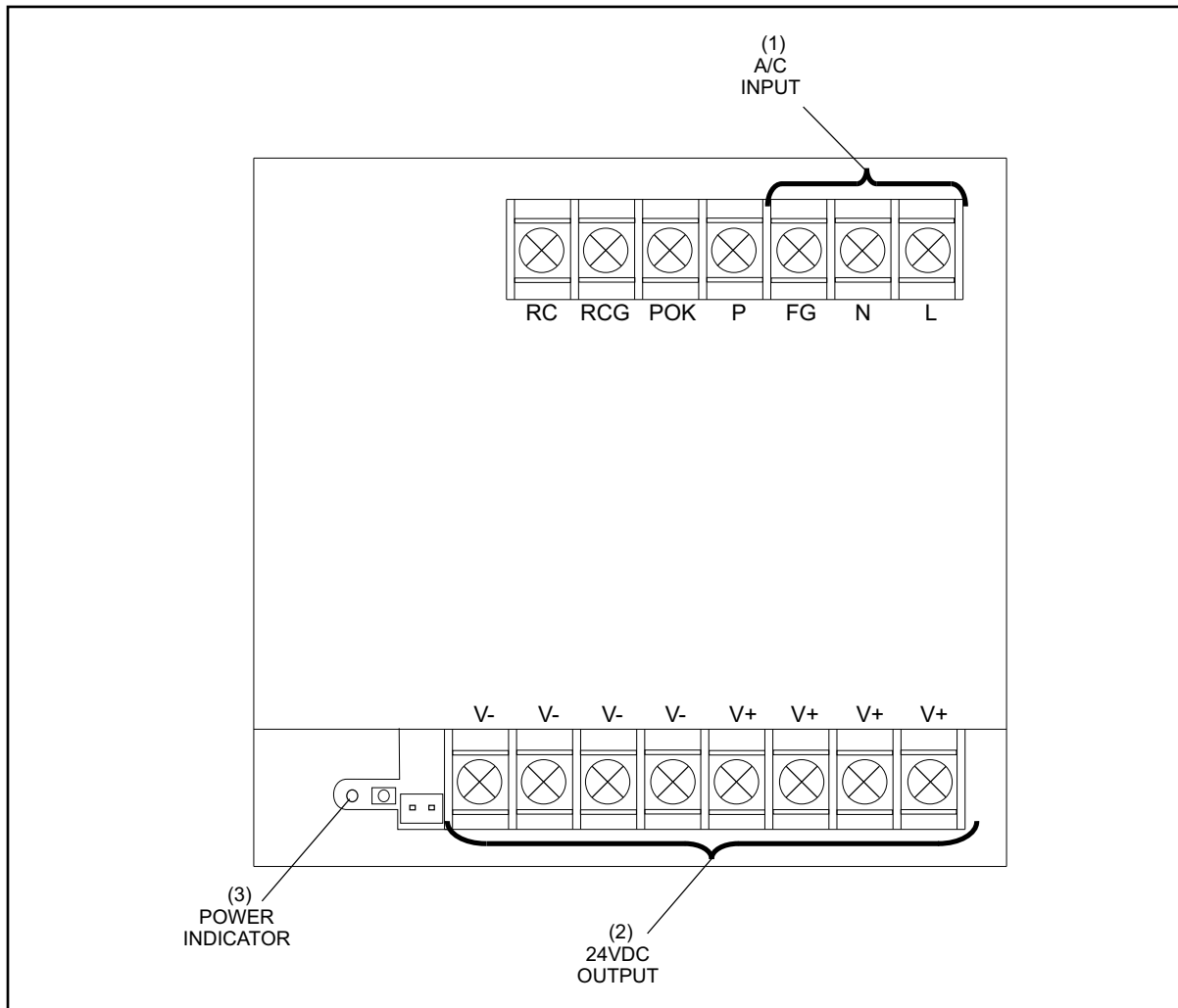


Figure 3-26. Power Supply

- (1) **A/C Input** - Terminals used for the power input to the Power Supply. Terminals used by the Controller include:

FG - Ground
N - Neutral
L - Line

- (2) **24VDC Output** - Output connections 24VDC. Terminals used by the Controller include:

V+ 24 VDC
V- GND

- (3) **Power Indicator** - This LED lights to indicate the power supply is “ON”.

PINSETTER SWITCHES AND SOLENOIDS

De-tangling Bar and Switch

If the string of two or more pins become tangled as the pins are being raised, additional string pressure is put on the tension lever assemblies causing them to rotate into the de-tangling bar. This action rotates the cam located on the end of the bar off of the de-tangle switch. The machine enters a de-tangle sequence in an attempt to remedy the problem by turning the drive motor on/off to create an up and down motion of the pins. Refer to *Figure 3-27*.

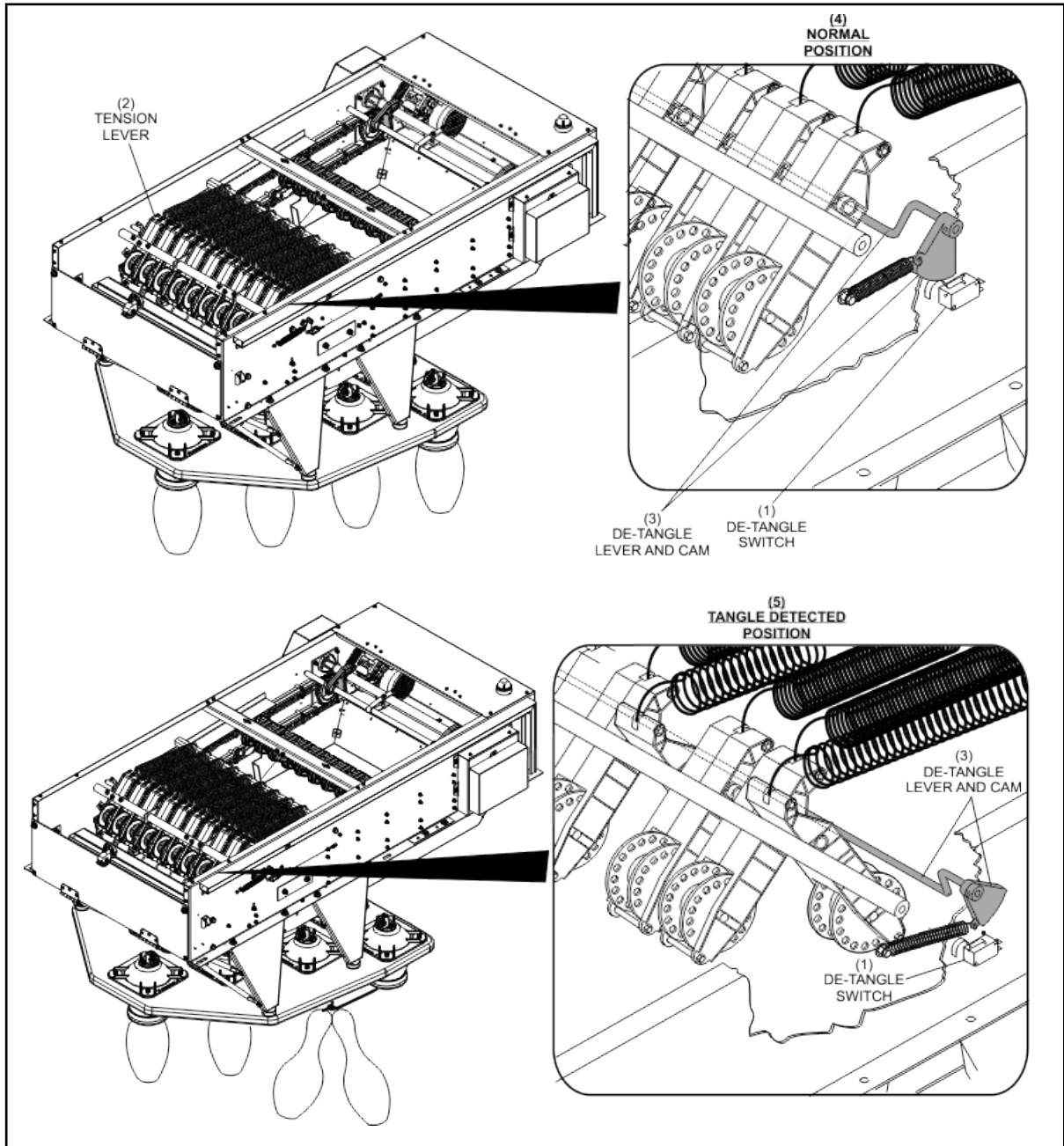


Figure 3-27. De-tangle Switch Activation

- | | | |
|----------------------|------------------------------|-----------------------------|
| (1) DE-TANGLE SWITCH | (2) TENSION LEVER | (3) DE-TANGLE LEVER AND CAM |
| (4) NORMAL POSITION | (5) TANGLE DETECTED POSITION | |

The de-tangle sequence used by the pinsetter is determined by the Detangle Sequence setting selected on the options menu. Choose the sequence that is best for the installation. Refer to *Figure 3-28*.

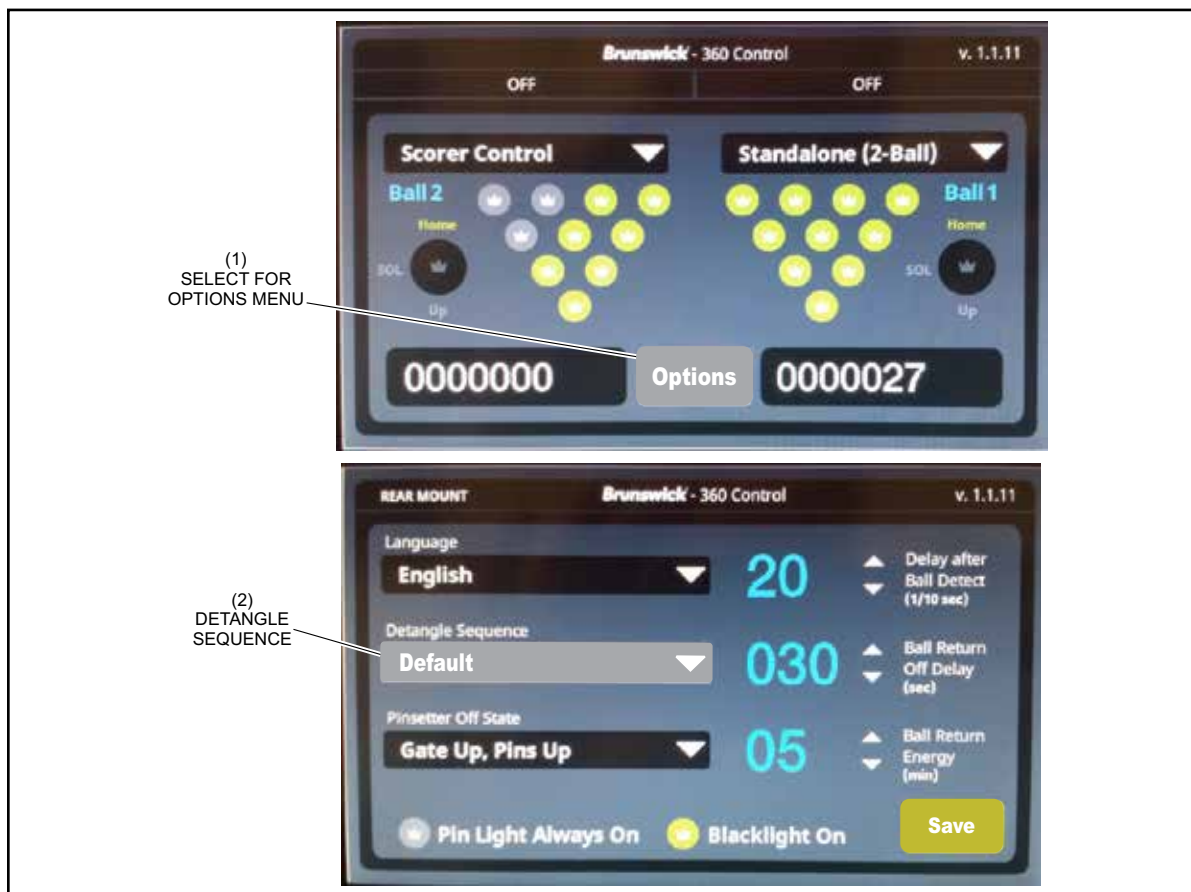


Figure 3-28. LCD Touchscreen - Options Menu - Detangle Sequence

- (1) SELECTION FOR OPTION MENU (2) DETANGLE SEQUENCE

Default Sequence

During the default de-tangle sequence, the drive motor will shut off to release the string tension and allow gravity to lower all pins part way towards the pindeck. After one second, the motor turns back on to raise the pins. If a tangle is still present it will again be detected by the de-tangle switch and the motor will shut off for another second to lower the pins. After 5 attempts to de-tangle the strings, the motor shuts off to lower the pins completely to the pindeck. The motor then turns back on to lift the pins to begin another 5 attempt sequence. The pattern will repeat until the tangle is corrected or the pattern has repeated 6 times (30 attempts). After 30 failed attempts to correct the problem, the motor will shut off to allow the pins to lower to the pindeck, the trouble light will flash, and Controller will show a “Tangle-01” error code. At this point a service person must turn off the machine and manually correct the problem.

Hold 3 - Odd-Even - Wave

To further increase the chances that the de-tangle procedure will be successful, alternative shake patterns are used when the Hold 3, Odd-Even, or the Wave sequence is selected. Unlike the default sequence where all pins are lowered toward the pindeck, these options use the brakes within the PMI’s to produce a repeating pattern during which only specific pins are allowed to lower.

During the alternative de-tangle sequences, the drive motor will shut off to release the string tension and allow the pins to lower towards the pindeck. After two seconds, the motor turns back on to raise the pins. If a tangle is still present it will again be detected by the de-tangle switch and the motor will shut off for another two seconds. After five failed attempts to correct the problem, the motor will shut off for five seconds to allow the pins to lower to the pindeck. The motor then turns back on to lift the pins to begin the next 5 attempt sequence.

This shaking pattern will continue until the strings are no longer tangled, a service person turns off the machine and manually corrects the problem, or the six pin lowering sequences have been attempted. If each sequence is performed without successfully de-tangling the pins, the motor shuts off to lower all pins to the pindeck, the trouble light on the pinsetter will flash to indicate a problem, and the Controller will display a “Tangle-01” error code. Refer to *Figure 3-29*.

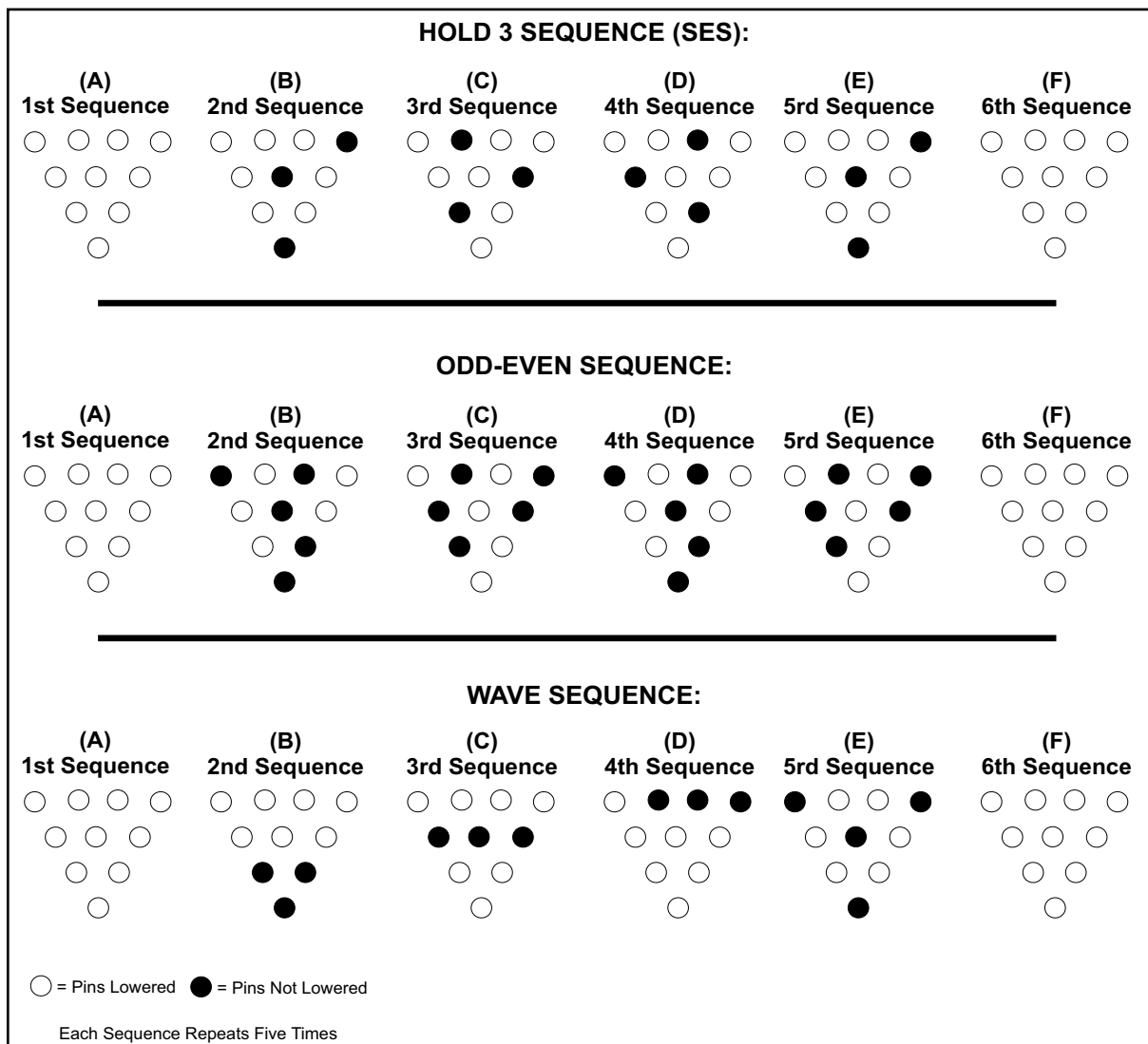


Figure 3-29. Pin Lowering Pattern During the De-Tangle Sequence

- | | | |
|--------------------------------------|------------------|----------------------|
| (1) 1ST SEQUENCE | (2) 2ND SEQUENCE | (3) 3RD SEQUENCE |
| (4) 4TH SEQUENCE | (5) PINS LOWERED | (6) PINS NOT LOWERED |
| (7) EACH SEQUENCE REPEATS FIVE TIMES | | |

Switch Cluster Switches

The pinsetter uses a 3-phase motor and V-belt to run the string wagon drive gear and shaft. A cam and switch cluster located at the opposite end of the drive shaft determines the location of the string wagon by monitoring the rotation of the shaft. Refer to *Figure 3-30*.

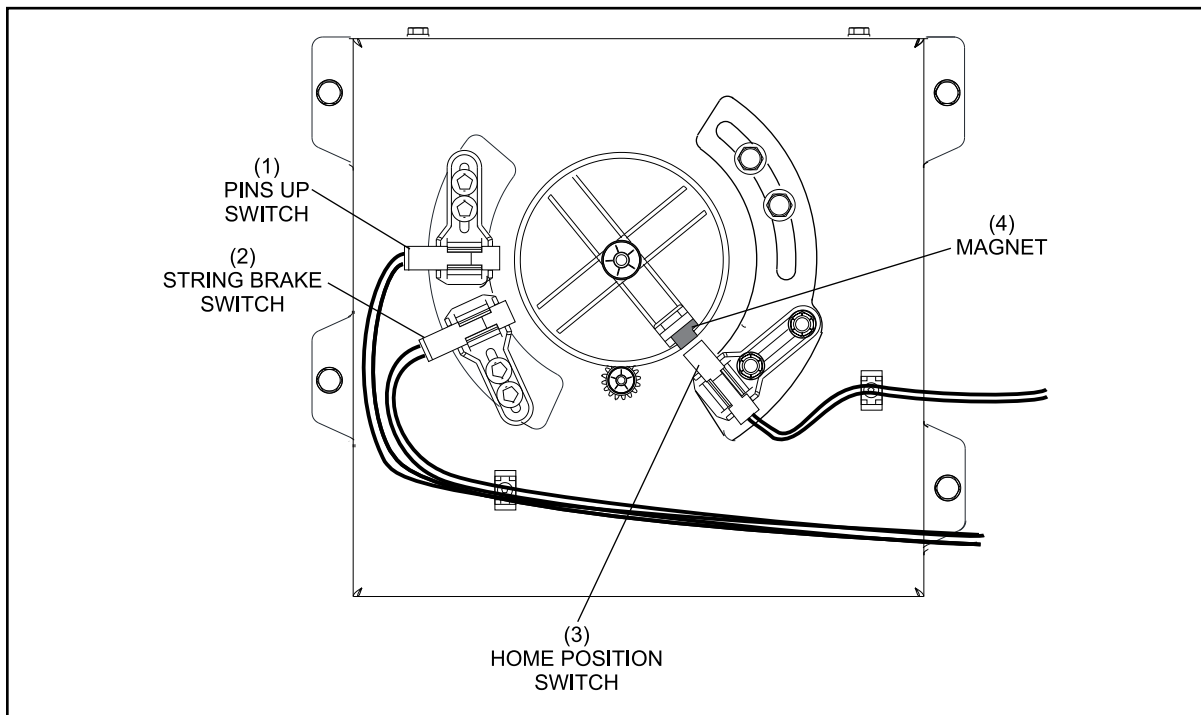


Figure 3-30. Switch Cluster

- (1) PINS UP SWITCH (2) STRING BRAKE SWITCH (3) HOME POSITION SWITCH
(4) MAGNET

The switches in the cluster include:

- (1) **Pins Up Switch** - This switch indicates when the string wagon is at the back of the machine and the pins are in the “up” position. Used only for string tension adjustment.
- (2) **String Brake Switch** - This switch is used after pins have been knocked over on a first ball delivery. In operation, after the string wagon has passed the pins up position, this switch causes the string brake solenoids inside the PMI (Pin Motion Interface) for those pins that were knocked over to energize. This keeps the pins from lowering onto the pindeck as the wagon travels toward the front of the machine.
- (3) **Home Position Switch** - This switch indicates when the string wagon is at the front of the machine and the pins are sitting on the pindeck. This switch causes the motor to shut off after setting the pins onto the pindeck.

String Brake Solenoid

The String Brake Solenoid is located inside the Pin Motion Interface. It controls whether the pin is allowed to lower to the pindeck. In normal operation the string is allowed to move freely through the Pin Motion Interface to allow the pin to lower to the pindeck. The solenoid is energized as needed when the String Brake switch in the switch cluster is actuated forcing the string brake to pinch the string prohibiting it from passing through the Pin Motion Interface. Refer to *Figure 3-31*.

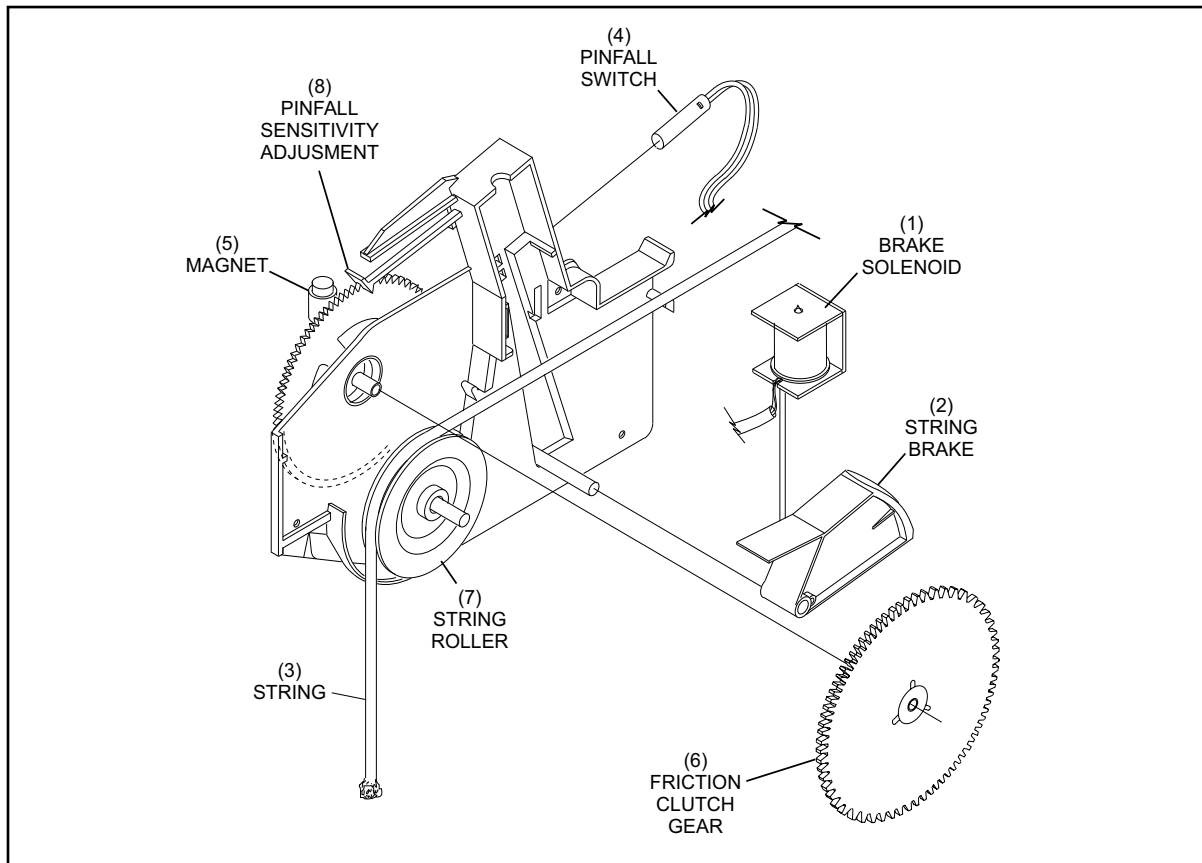


Figure 3-31. String Brake Solenoid

- | | | |
|--------------------|------------------------------------|--------------------------|
| (1) BRAKE SOLENOID | (2) STRING BRAKE | (3) STRING |
| (4) PINFALL SWITCH | (5) MAGNET | (6) FRICTION CLUTCH GEAR |
| (7) STRING ROLLER | (8) PINFALL SENSITIVITY ADJUSTMENT | |

Pinfall Switch

When a pin is knocked over, the pulling of the string causes the string roller and string gear on the Pin Motion Interface to rotate. If the string pulls with enough force, a magnet attached to the string gear through a friction clutch rotates to actuate a reed type switch. A pinfall sensitivity adjustment on the Pin Motion Interface determines the amount of string pull force needed by controlling the distance the magnet must rotate to actuate the switch. **The default factory setting is 10.** Refer to *Figure 3-32*.

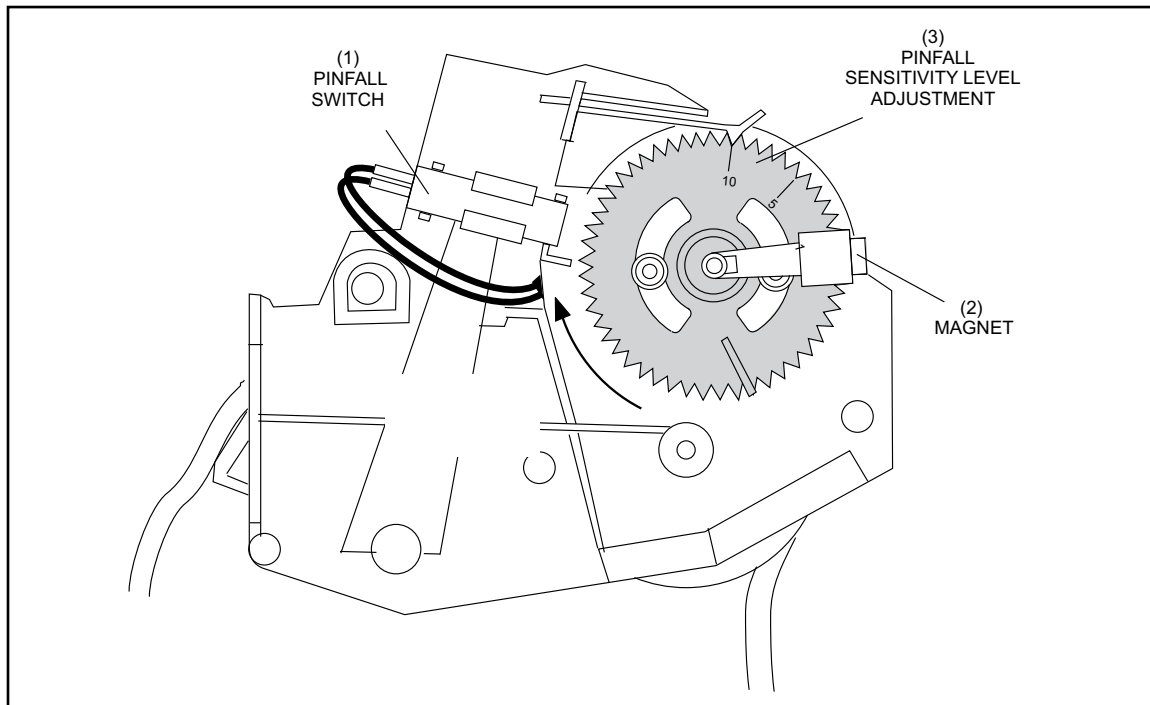


Figure 3-32. Pinfall Switch

(1) PINFALL SWITCH

(2) MAGNET

(3) PINFALL SENSITIVITY
LEVEL ADJUSTMENT

BALL DETECTORS

A ball detector is used to determine when a ball enters the pinsetter. The signal is then used to increment the ball count for the bowling frame and cycle the pinsetter if a pin was knocked over or if it was the last ball in the frame. Refer to *Figure 3-33*.

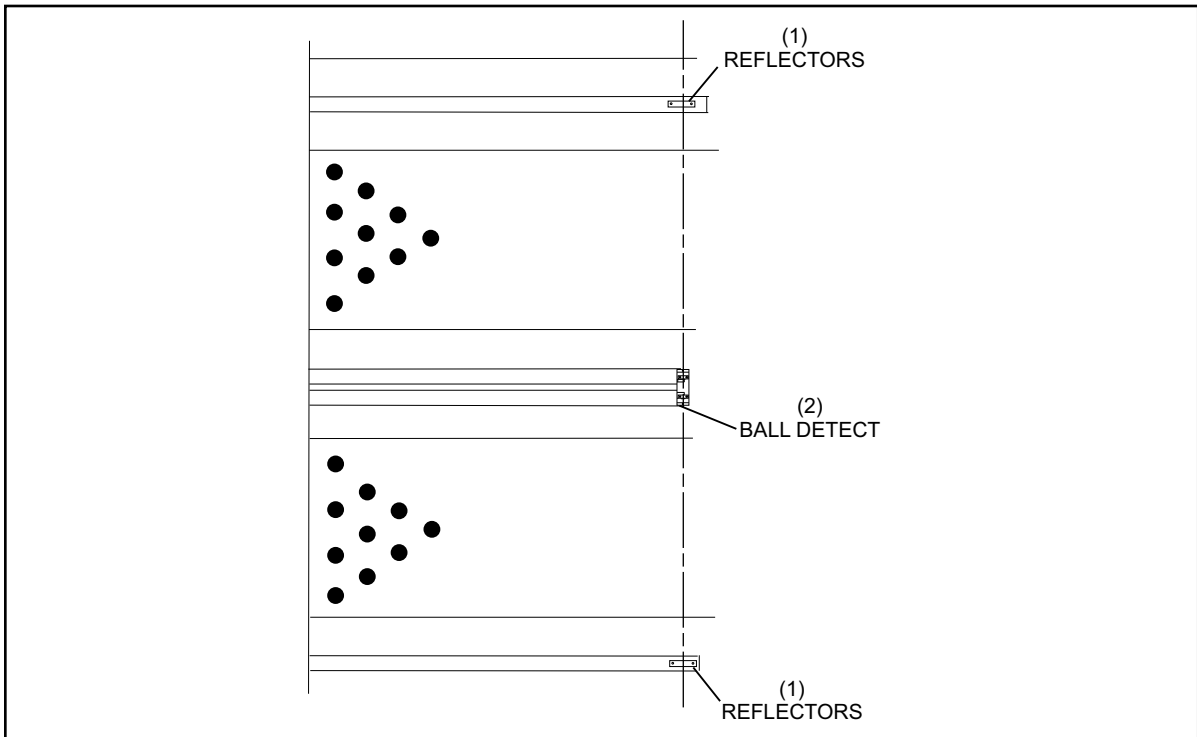


Figure 3-33. StringPin Ball Detectors

- (1) REFLECTORS (2) BALL DETECT

Ball Detector Unit

The pinsetter ball detector unit is made up of an infrared transmitter and receiver. The red LED (Light Emitting Diode) mounted on the ball detect is “on” when the beam is not being received back from the reflector. This indicates a ball or some object is in the beam’s path or there is an alignment problem. An Up/down and side to side alignment adjustments are available on the unit. Refer to *Figure 3-34*.

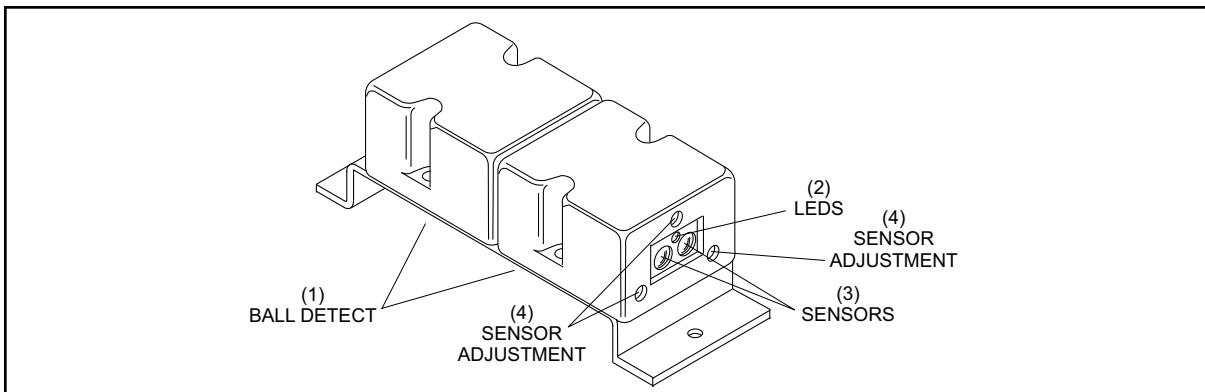


Figure 3-34. Pinsetter Ball Detector

- (1) BALL DETECT (2) LEDS (3) SENSORS
(4) SENSOR ADJUSTMENT

DESCRIPTION OF PINSETTER CYCLES

There are four first ball cycles and one second ball cycle. Additional cycles may be available if a scoring system is connected to the pinsetters.

First Ball Cycles

The first ball cycles include:

1. First Ball - Strike
2. First Ball - Standing Pins
3. First Ball - Short Cycle
4. First Ball - Foul

Prior to the bowler throwing a ball, the pinsetter will be at its home position. Refer to *Figure 3-35*.

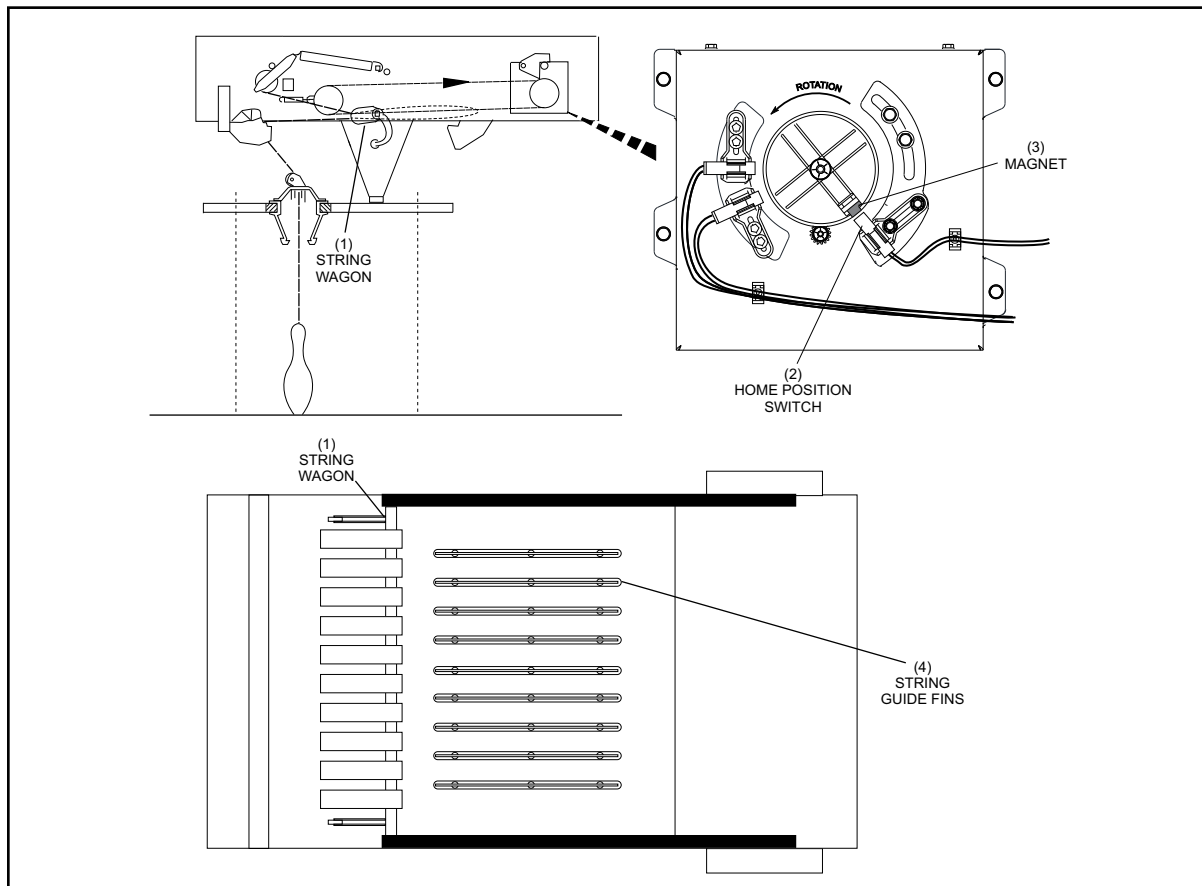


Figure 3-35. Pinsetter is Ready for Bowling

(1) STRING WAGON

(2) HOME SWITCH
(PINS ON PINDECK)

(3) MAGNET

(4) STRING GUIDE FINS

1. The pinsetter must be turned on, waiting for a ball.
2. The string wagon will be positioned at the front of the machine with ten pins sitting on the pin deck.
3. The magnet in the cam control box will be positioned just above the home switch.

To begin a cycle a bowler must throw a ball. The pinsetter reacts as follows: Refer to *Figure 3-36*.

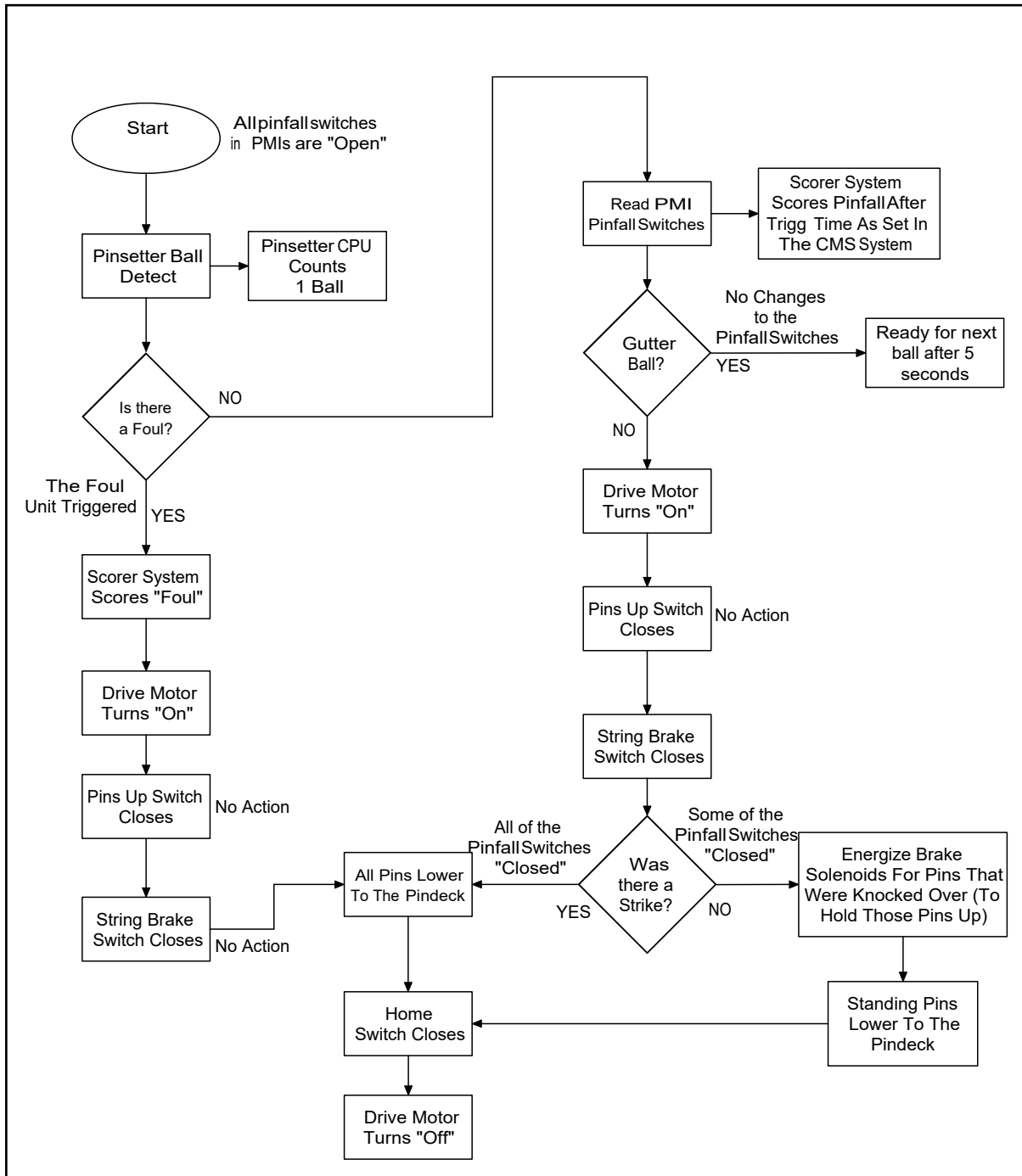


Figure 3-36. Pinsetter First Ball Cycles

Second Ball Cycle

To begin a cycle a bowler must throw a ball. The pinsetter reacts as follows: Refer to *Figure 3-37*.

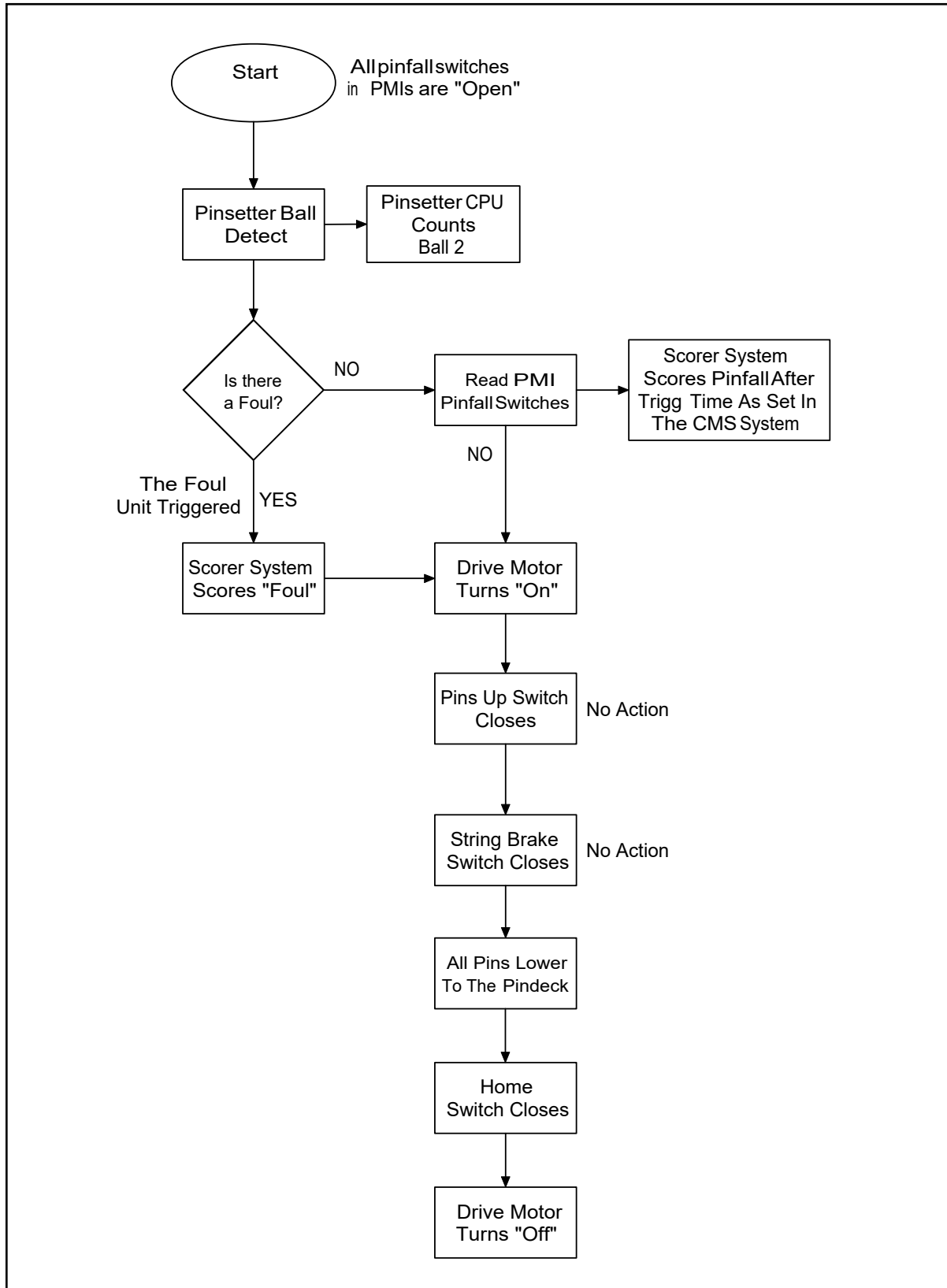


Figure 3-37. Pinsetter Second Ball Cycles

Section 4 - Adjustments

SWITCH CLUSTER ADJUSTMENTS

Pins Up Switch Adjustment

The purpose of the Pins Up switch adjustment is to make sure that the string wagon catches on the stop dogs properly when the Pins Up or Setup selection on the StringPin Controller is selected to raise the pins. This position of the string wagon and pins is used when making other adjustments such as the string tension adjustment.

1. Return All Pins to the Pins Up Position
 - a. Place the Stop/Run switch on the Controller to the “Stop” position.
 - b. On the Pinsetter Mode drop down menu, select Pins Up or Setup. *Figures 4-1a and 4-1b.*
 - c. Place the Stop/Run switch on the Controller to the “Run” position.



Figure 4-1a. Select Pins Up Mode (Versions 1.1.14 and Prior)

(1) MODE DROP DOWN MENU (2) PINS UP



Figure 4-1b. Select Pins Up Mode (Versions 1.1.15 and Later)

(1) MODE DROP DOWN MENU (2) SETUP

2. Observe the string wagon movement.
 - a. Observe the movement of the string wagon to determine if the wagon stops on the dogs correctly. Adjustment is required if either of the following occurs:

The wagon does not travel to the stop dogs:

- The motor will turn off, the pins will fall to the pin deck until the motors starts again. This cycle will continue until the cam is adjusted.

The wagon travels too far beyond the stop dogs:

- The motor will turn off late, and the wagon will slam back onto the stop dogs or the motor will turn off after the wagon passes the drive gear causing the pins to fall to the pindeck.

If neither of above conditions exists, Adjustment Is Not Needed.

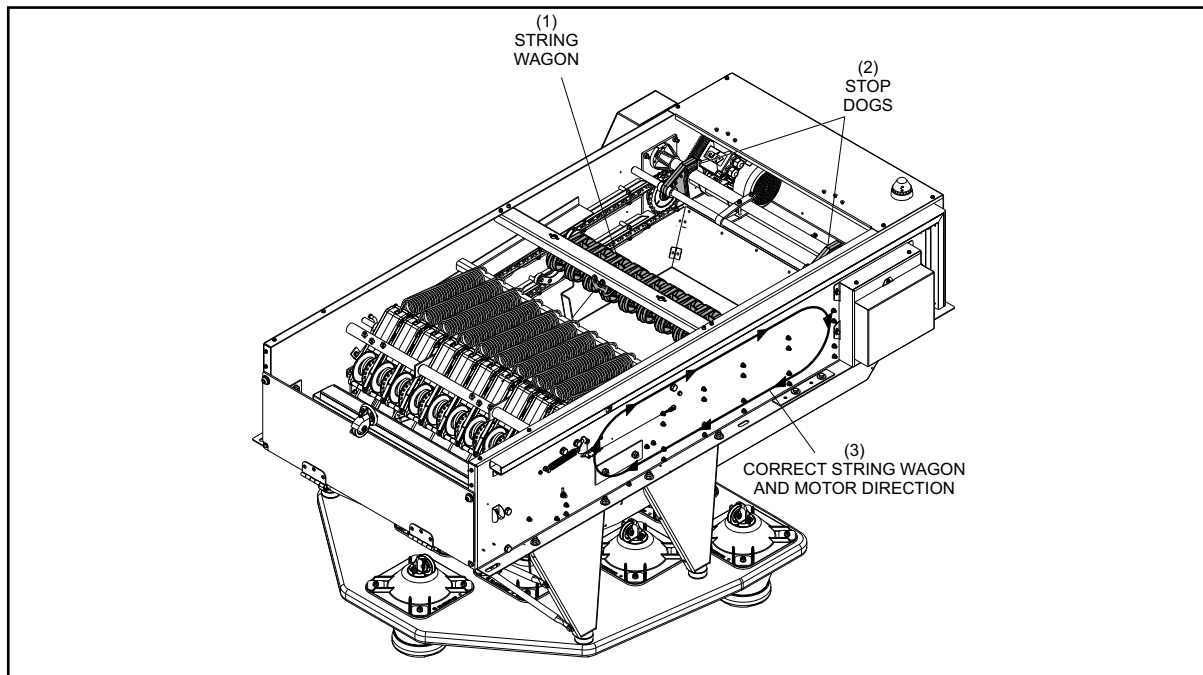


Figure 4-2. Stop Dogs

(1) STRING WAGON

(2) STOP DOGS

(3) CORRECT STRING WAGON AND
MOTOR DIRECTION

3. Adjust (If Needed)

- a. If adjustment is needed, turn the pinsetter off using either of the Run/Stop or the main power switches.
- b. Remove the cover from the switch cluster assembly.
- c. Loosen the (4) bolts for the Cam Control Box. Refer to *Figure 4-3*.

i **NOTE:** DO NOT REMOVE THE SCREWS. The screws only need to be loose to manually adjust the cam.

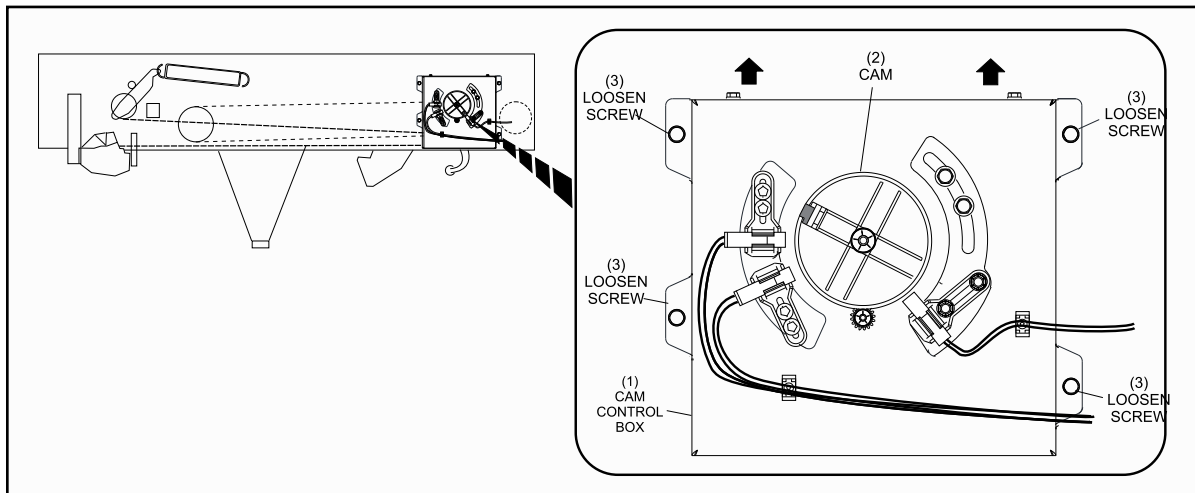


Figure 4-3. Cam Mounting Screws

(1) CAM CONTROL BOX

(2) CAM

(3) LOOSEN SCREW

- d. Push the Cam Control Box UP to rotate the cam as needed based on the operation observed in step 2. Refer to *Figure 4-4*.

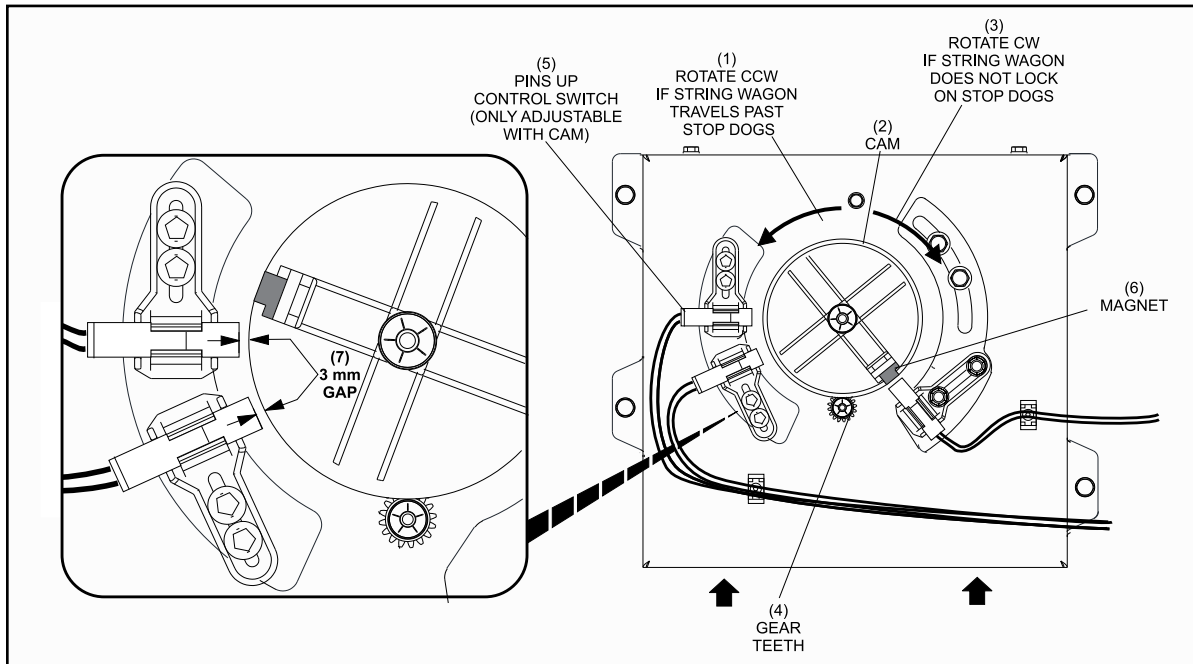


Figure 4-4. Adjust Bracket

- | | | |
|--------------------|---|---|
| (1) PINS UP SWITCH | (2) SLIDE BRACKET UP IF STRING WAGON TRAVELS PAST STOP DOGS | (3) SLIDE BRACKET DOWN IF STRING WAGON DOES NOT LOCK ON STOP DOGS |
|--------------------|---|---|

- e. After the cam is adjusted in the proper direction, lower the cam down to align with gear teeth. Refer to *Figure 4-4*. Tighten the four screws loosened in step 3c.
- f. Toggle the Run/Stop switch from Stop to Run to cycle the pinsetter. Repeat switch adjustment until string wagon locks interacts properly with the stop dogs.
- g. Re-install the switch cluster cover removed in step 3b.

Home Switch Adjustment

The home switch determines when to turn off the drive motor after setting new pins on the pindeck. This switch is factory set and does not normally need adjustment.

Perform the following steps to verify the switch is set properly.

1. Cycle the pins so all 10 pins are on the pindeck.
2. Check the position of the string wagon. It should stop towards the front of the machine just under the String Limiting and Spring Tension bars.
3. If adjustment is needed, loosen the switch mounting screws and position the switch as desired. Refer to *Figure 4-5*.

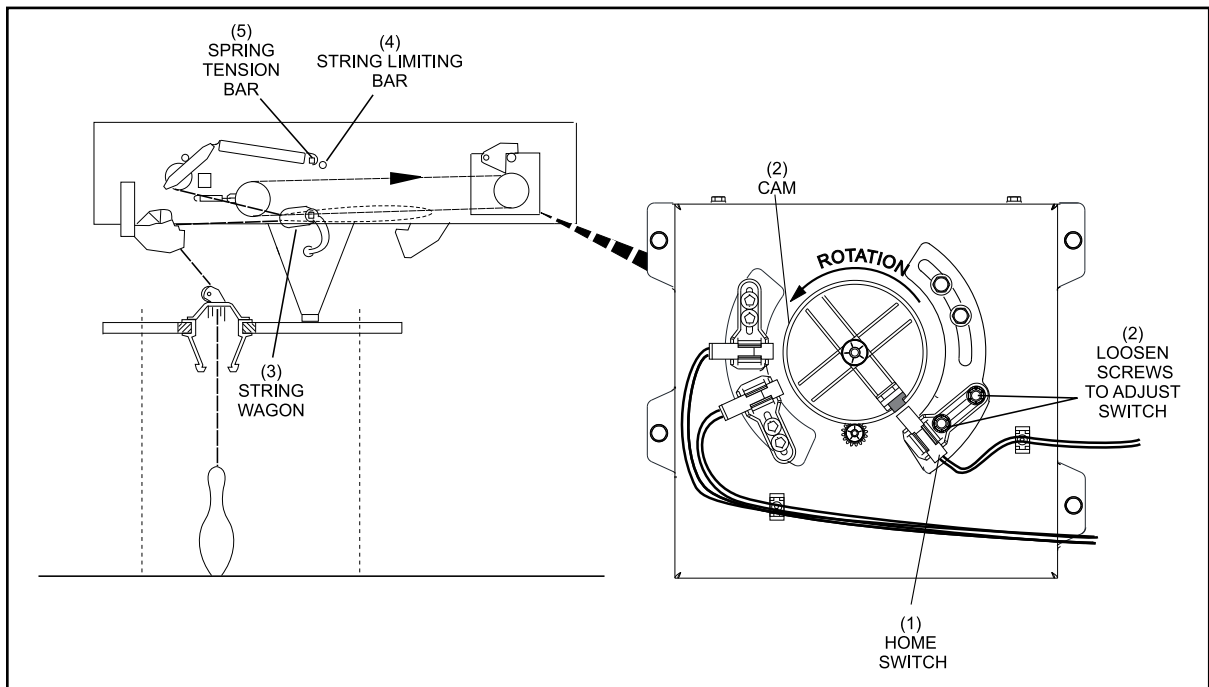


Figure 4-5. String Wagon Position and Home Switch Adjustment

- | | | |
|-------------------------|------------------------------------|------------------|
| (1) HOME SWITCH | (2) LOOSEN SCREWS TO ADJUST SWITCH | (3) STRING WAGON |
| (4) STRING LIMITING BAR | (5) SPRING TENSION BAR | |

String Brake Switch Adjustments

The string brake switch determines when to energize the solenoid in the Pin Motion Interface so that the pins that were knocked over on first ball cycles are not lowered back onto the pindeck.

1. With the pinsetter power on, knock over some pins. The machine will cycle and should keep the knocked over pins in the up position.
2. Turn the pinsetter power off and lockout the power on/off switch.



Warning! Pinsetter power is to remain off while performing any manual function.

3. Check the movement of a raised pin in the pin centering cone by pulling on its string. The travel distance of the pin should be $80\text{ mm} \pm 20\text{ mm}$. Refer to *Figure 4-6*.

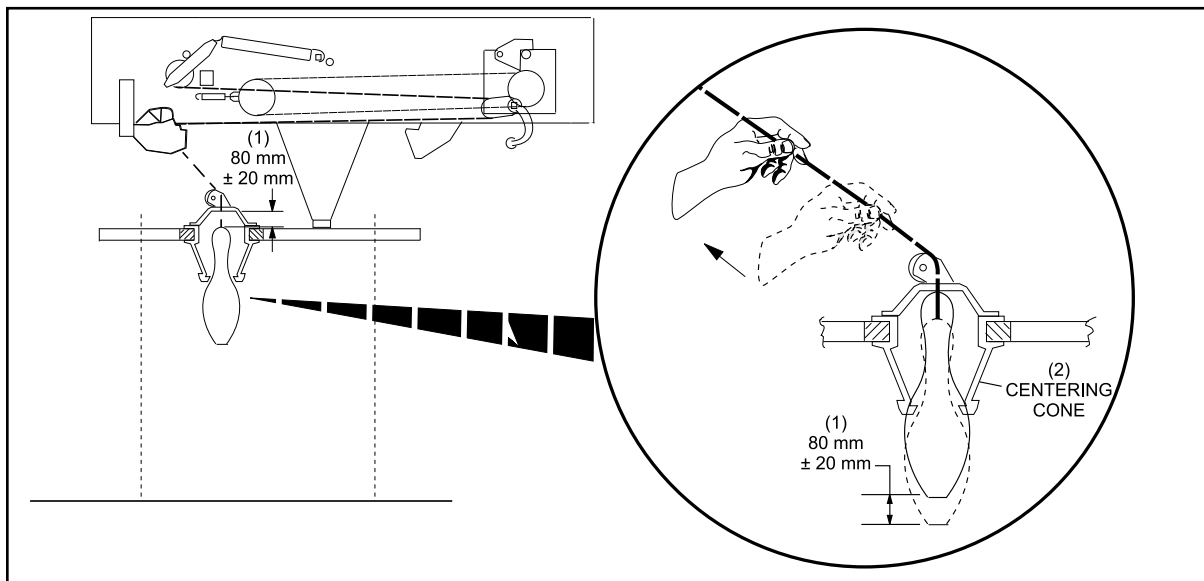


Figure 4-6. String Brake Adjustment

(1) $80\text{ mm} \pm 20\text{ mm}$

(2) CENTERING CONE

4. Adjust the String Brake switch up or down, as needed, to obtain the appropriate pin movement. Refer to *Figure 4-7*.
- i** **TIP:** *If the pin travel is greater than 100 mm, move the string brake switch upward. If the travel is less than 60 mm, move the string brake switch downward.*
5. Repeat steps 1-4 to verify pin movement in pin centering cone.

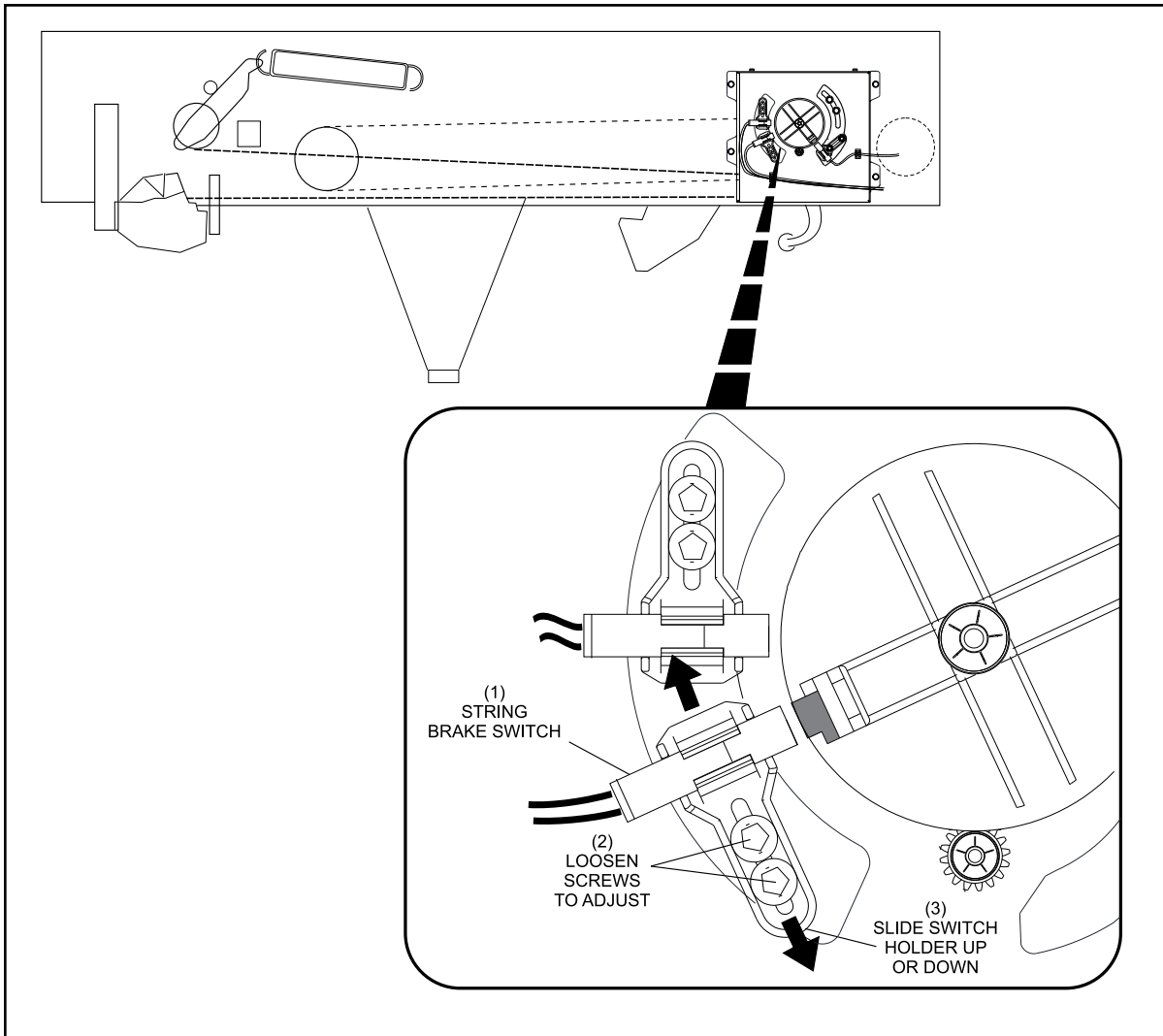


Figure 4-7. Adjust Brake Switch

(1) STRING BRAKE SWITCH

(2) LOOSEN SCREWS TO ADJUST

(3) SLIDE SWITCH HOLDER UP OR DOWN

STRING TENSION ADJUSTMENT

The string tension adjustment determine the amount of string that is in use during normal operation. The adjustment is accomplished by rotating the string spool to let more (or less) string out of the spool.

i **NOTE:** The string for the pins will stretch over time. This adjustment will have to be checked after the string has stretched.

1. Return All Pins to the Pins Up Position
 - a. Place the Stop/Run switch on the Controller to the “Stop” position.
 - b. On the Pinsetter Mode drop down menu, select Pins Up or Setup. *Figures 4-8a and 4-8b.*
 - c. Place the Stop/Run switch on the Controller to the “Run” position.

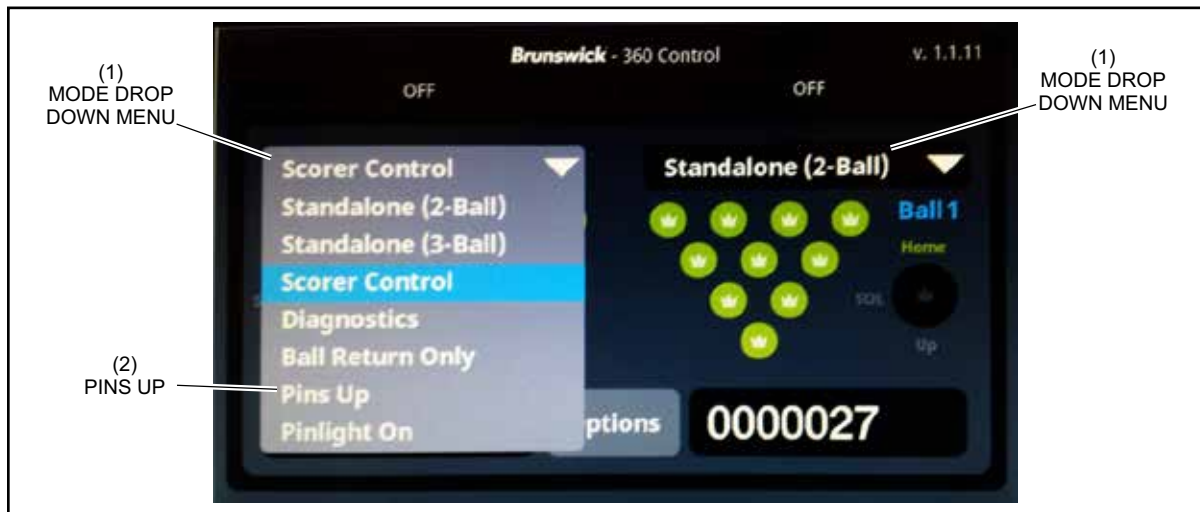


Figure 4-8a. Select Pins Up Mode (Versions 1.1.14 and Prior)

(1) MODE DROP DOWN MENU (2) PINS UP

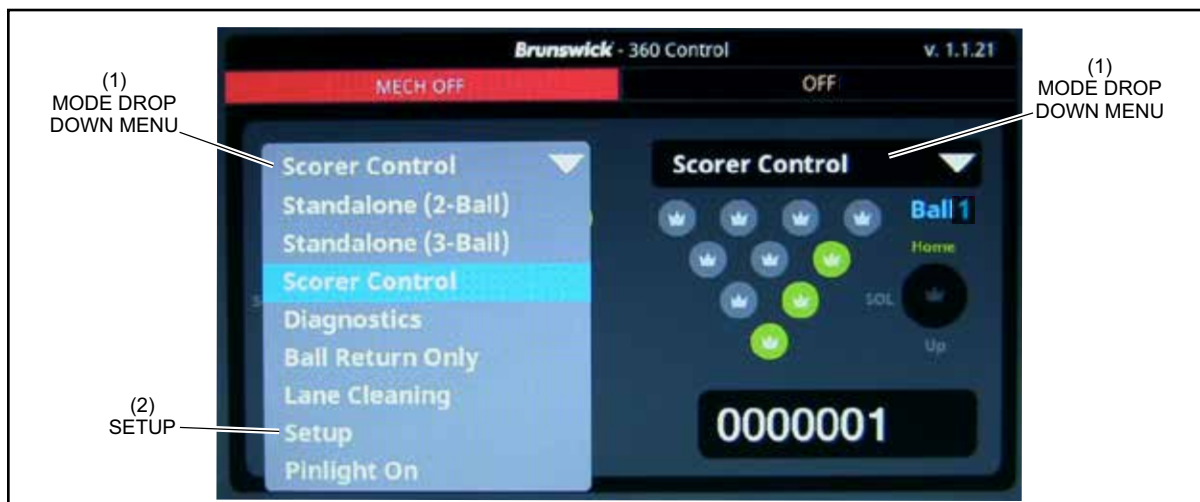


Figure 4-8b. Select Pins Up Mode (Versions 1.1.15 and Later)

(1) MODE DROP DOWN MENU (2) SETUP

i **NOTE:** The string wagon should stop on the stop dogs so that the pins are held in the up position. If the wagon does not catch on the stop dogs, verify the Pins Up adjustment

2. Observe and Adjust

- a. Check the movement of a raised pin in the pin centering cone by pulling on its string. The travel distance of the pin should be 1-3 mm + 2 mm. Refer to *Figure 4-9*.
- b. If the tension adjustment is required for any of the pins. Refer to *Figure 4-9*;

Slide the string spool away from locking pins to release the spool reel.

Rotate the string reel as needed to obtain the 1-3 mm + 2 mm travel distance.

When the proper gap has been obtained, move the string reel to the right rotating it as required to align its holes with locking pins.

i **NOTE:** Rotating the spool towards the back of the machine will reduce the tension and gap. Rotating the spool toward the front of the machine will increase the tension and gap. Refer to Figure 4-9.

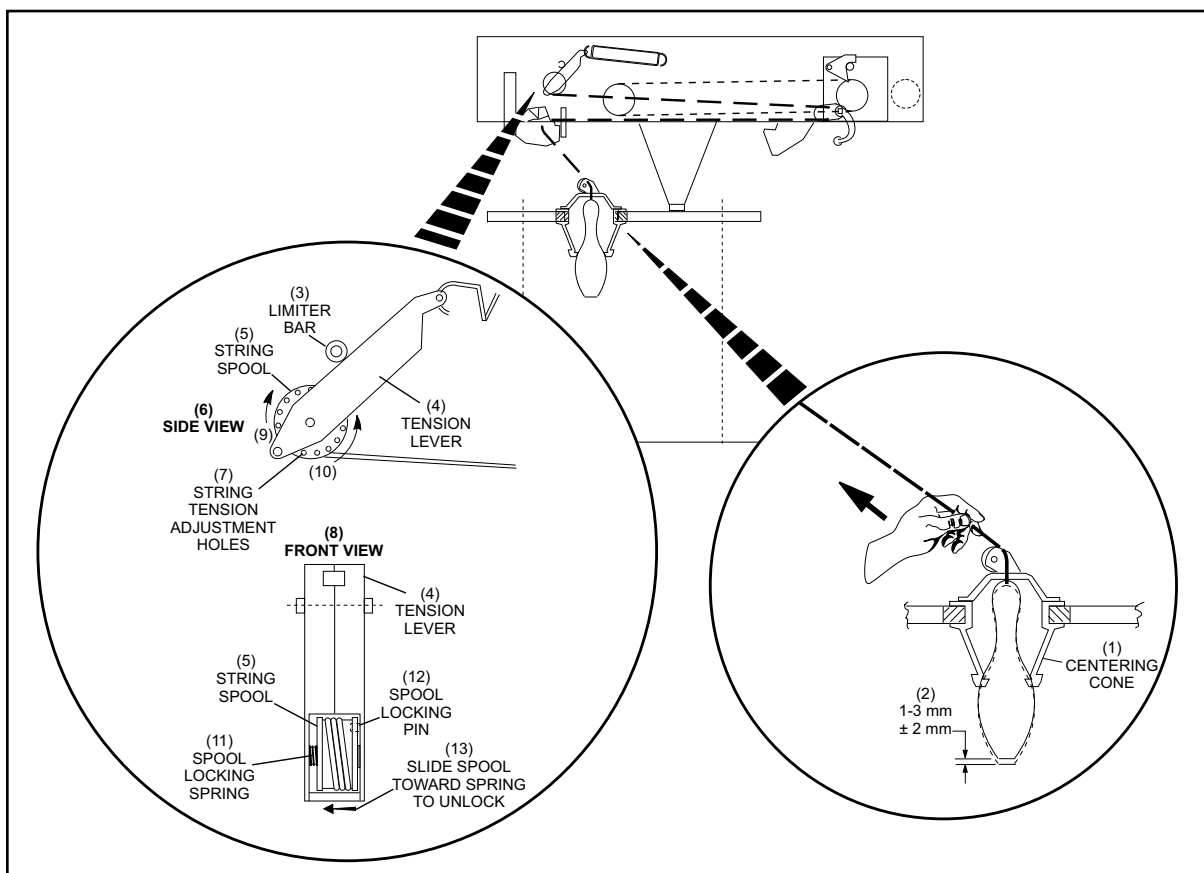


Figure 4-9. String Tension Adjustments

- | | | |
|--|---------------------------|-----------------------------|
| (1) CENTERING CONE | (2) 1-2 MM ± 2 MM | (3) LIMITER BAR |
| (4) TENSION LEVER | (5) STRING SPOOL | (6) SIDE VIEW |
| (7) STRING TENSION ADJUSTMENT HOLES | (8) FRONT VIEW | (9) ROTATE SPOOL TO TIGHTEN |
| (10) ROTATE SPOOL TO LOOSEN | (11) SPOOL LOCKING SPRING | (12) SPOOL LOCKING PIN |
| (13) SLIDE SPOOL TOWARD SPRING TO UNLOCK | | |

PIN DETECTION ADJUSTMENT

The pin detection adjustment ensures the pinsetter identifies only pins that have been knocked over as fallen pins. If this adjustment is incorrect the machine could identify a pin that was moved off spot, but did not fall as a knocked over pin. The pin detection adjustment is accomplished using a Pin Motion Interface sensitivity adjustment which changes the distance the magnet on the Pin Motion Interface must travel to actuate the pinfall switch. Because of the design, re-adjustment from the factory setting is seldom required.

The adjustment gear is marked every fifth tooth with numbers 1, 5, 10, and 15 with 1 being the most sensitive position. A locking clip keeps the gear from rotating. To adjust the sensitivity lift the locking clip and rotate the gear to the desired setting. The recommended sensitivity level setting is 10. Refer to *Figure 4-10*.

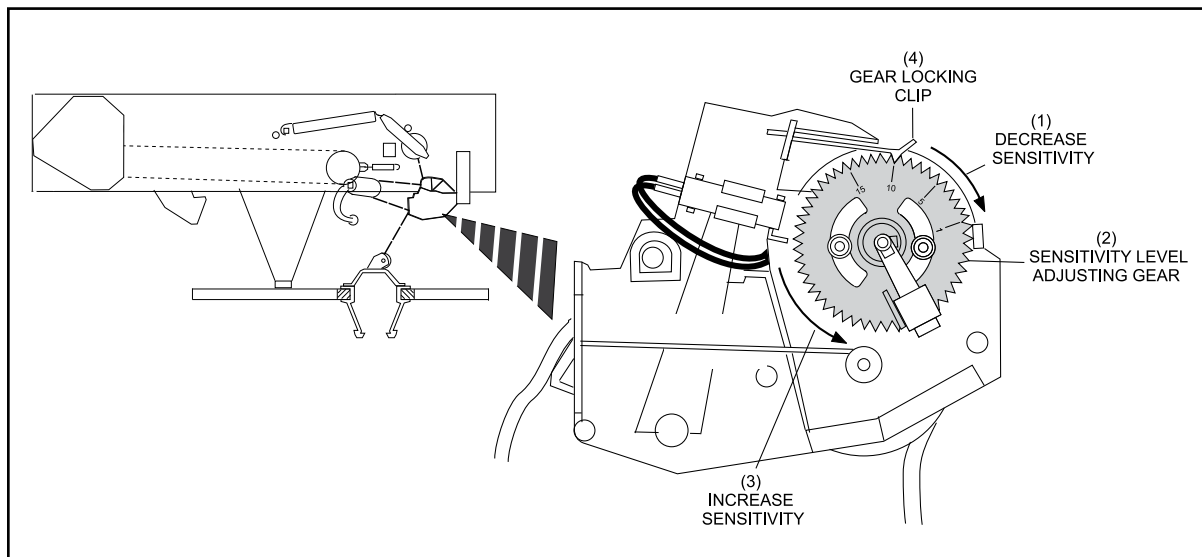


Figure 4-10. Adjust Sensitivity

- (1) DECREASE SENSITIVITY
- (2) SENSITIVITY LEVEL ADJUSTING GEAR
- (3) INCREASE SENSITIVITY
- (4) GEAR LOCKING CLIP

i **TROUBLESHOOTING TIP:** Sometimes the pinfall switch will provide a false signal because the magnet becomes stuck or caught and stays on the switch. To correct this issue, verify the magnet is not broken and rotate magnet away from the reed switch.

PIN SLOW SETTING ADJUSTMENTS

i **NOTE:** *The Slow Pin cam is factory set and should not need adjusting. Before adjusting the Slow Pin cam, verify the string tension for each pin is properly adjusted.*

1. Turn the pinsetter power on. Knock down some pins and block the ball detect beam to simulate a ball detection. When the string wagon travels to the rear of the string pinsetter, turn off the pinsetter power. The pins will travel to the pindeck by gravity.
2. Lock out power to the pinsetter.



Warning! *Pinsetter power is to remain off while performing any manual function.*

3. Manually rotate the large drive pulley in reverse until the string wagon lever roller starts to touch the inside of the pin slow setting bracket. Refer to *Figure 4-11*.
4. Lock the large drive pulley at this position using a tool or clamp.
5. Measure the distance the bottom of pins to the pin deck.

If using pins 1, 2, or 3 for your measurement, the distance should be 60 mm \pm 20 mm. If using pins 4, 5, 6, 7, 8, 9, or 10, the distance should be 80 mm \pm 20 mm.

6. If the distance is greater than 80 mm (pins 1-3) or 100 mm (pins 4-6, 7-10), adjust the pin slow setting brackets forward. If the distance is less than 40 mm (pins 1-3) or 60 mm (pins 4-6, 7-10), adjust the pin slow setting brackets rearward.

i **NOTE:** *The position of the brackets must be the same on both sides of the machine.*

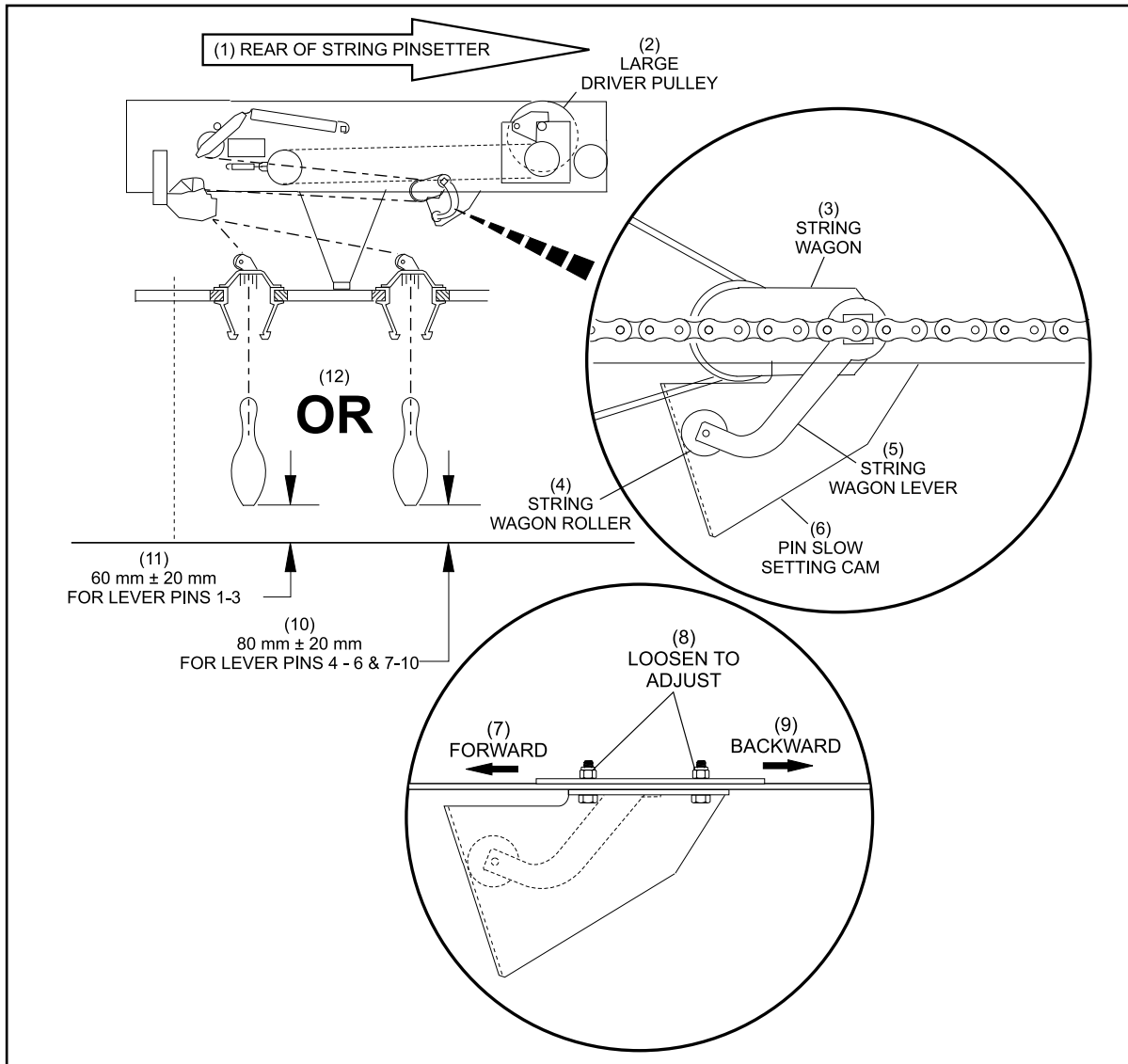


Figure 4-11. Slow Setting Adjustment

- | | | |
|------------------------------|------------------------|--------------------------|
| (1) REAR OF STRING PINSETTER | (2) LARGE DRIVE PULLEY | (3) STRING WAGON |
| (4) STRING WAGON ROLLER | (5) STRING WAGON LEVER | (6) PIN SLOW SETTING CAM |
| (7) FORWARD | (8) LOOSEN TO ADJUST | (9) BACKWARD |
| (10) 80 mm ± 20 mm | (11) 60 mm ± 20 mm FOR | (12) OR |
| FOR LEVER PINS 4-6 AND 7-10 | LEVER PINS 1-3 | |

BALL ACCELERATOR FLAT BELT ADJUSTMENT

Flat Belt Tension

A large tension spring at the front of the accelerator provides the tension for the flat belt. When the belt is under proper tension, this spring will be approximately 185 mm from spring hook to spring hook. Refer to *Figure 4-12*. Adjust by tightening or loosening the two tensioning nuts that secure the long tension bar to the rear of the accelerator frame.

i **HINT:** A good starting point for the adjustment is to measure the amount of tension rod that extends from the locknut. Adjust the nuts so that the tension bar threads extend 50 mm beyond the outside tension nut.

i **NOTE:** Access to the spring is only possible when the accelerator is removed from the ball box.

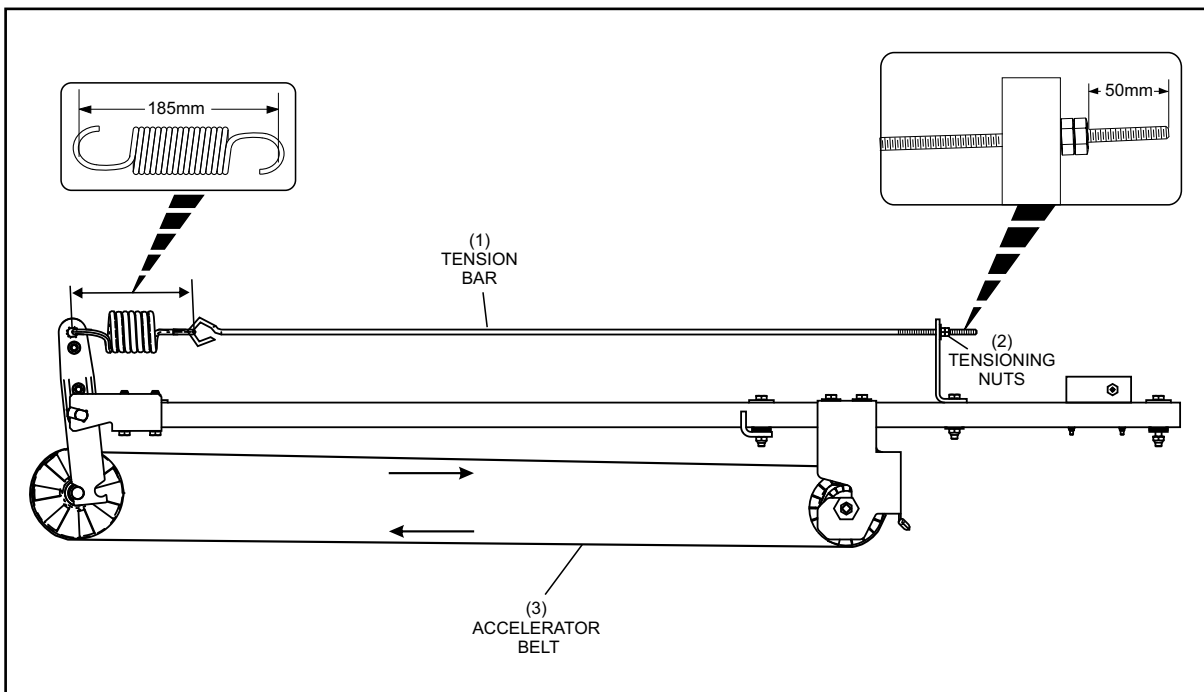


Figure 4-12. Ball Accelerator Flat Belt Tension Adjustment

(1) TENSION BAR

(2) TENSIONING NUTS

(3) ACCELERATOR BELT

Belt Alignment

1. Disconnect the accelerator power cord.
2. Remove the accelerator from the Ball Box.
3. If the belt is not centered on the front pulley drum:
 - a. Using a 17 mm socket, ratchet and wrench, loosen the two screws and nuts securing the pivot levers. ONLY loosen screws enough to allow slight adjustment of pivot levers. Refer to *Figure 4-13*.

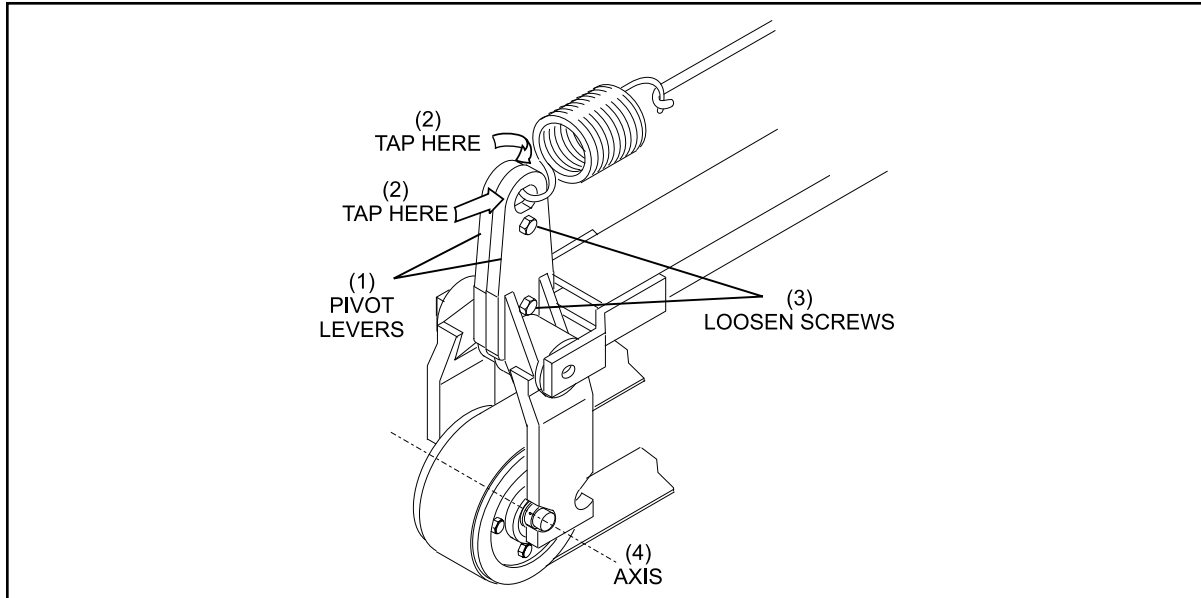


Figure 4-13. Loosen Hardware Securing Pivot Levers

- | | | |
|------------------|--------------|-------------------|
| (1) PIVOT LEVERS | (2) TAP HERE | (3) LOOSEN SCREWS |
| (4) AXIS | | |

- b. Rotate the belt by hand and observe belt tracking. Use light, short taps from a soft rubber mallet to reposition left and right pivot levers until belt is tracking on the center of pulley drum. When the belt is centered, tighten two screws and nuts securing the pivot levers. Refer to *Figure 4-15*.
 - c. Reinstall the Accelerator into the Ball Box.
 - d. Reconnect the accelerator power cord and observe the tracking. Repeat Step #3 if the belt is not centered.

Ball Detect Adjustments



WARNING: Before adjusting the ball detector, turn the stop/run switches on the pinsetter to the stop position. Failure to do this may result in personal injury caused by pinsetter cycling when the ball detect's beam is interrupted or the pinsetter is turned on at the Control Desk.

The ball detect adjustment contains three screws that are used to align the units infrared beam with a reflector opposite side of the lane. Refer to *Figure 4-14*.

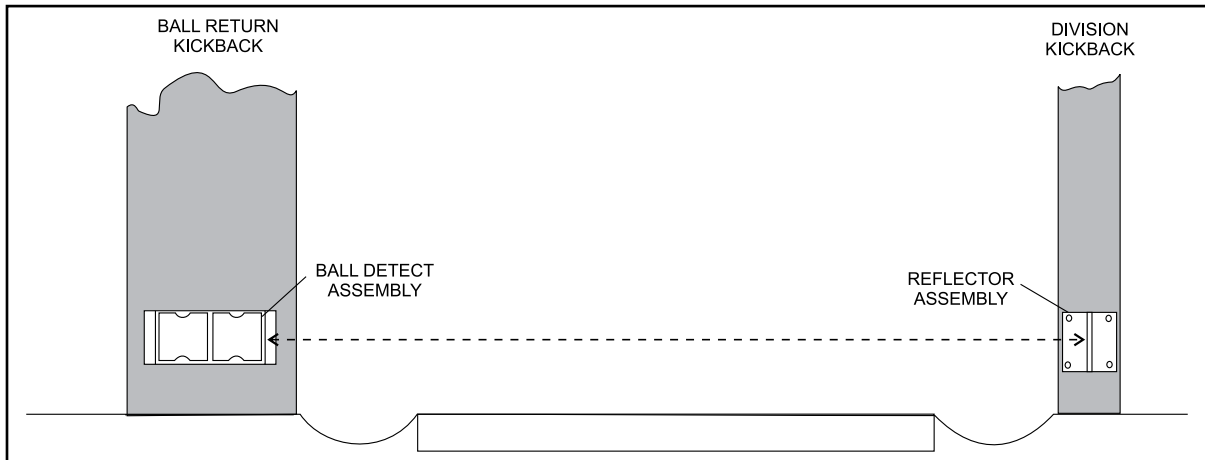


Figure 4-14. Ball Detect and Reflector

The red LED (Light Emitting Diode) mounted on the ball detect is “on” when the beam is not being received back from the reflector. This indicates a ball or some object is in the beam’s path or there is an alignment problem. Refer to *Figure 4-15*.

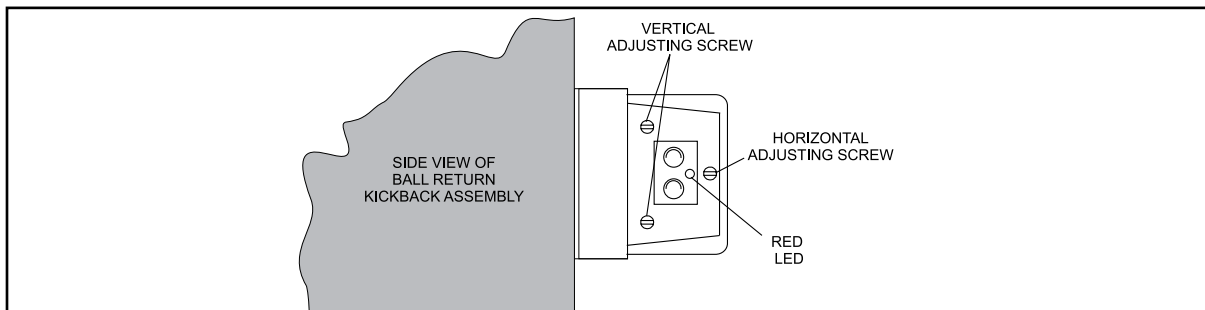


Figure 4-15. Ball Detect Adjusting

1. Check the face of the ball detect and make sure it is parallel with the face of the ball detect’s housing. Check the reflector to see if it is mounted securely and parallel to the ball detect. Clean the transmitter, receiver and reflector before and after adjusting.
2. Cover the reflector with a dark non-reflective object. The red LED should be lit indicating the beam is not being received.
3. Hold an unmounted reflector in your hand and move it above, below and around the mounted reflector until the red LED goes “off.” This will indicate the position of the beam and guide you in your adjustment.
4. Using the vertical and horizontal adjusting screws (refer to *Figure 4-15*) move the beam until it is aimed exactly on the center of the mounted reflector.

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Section 5 - Maintenance & Service



WARNING! When performing any maintenance or machine service, make sure the main power is turned off and the power plug has been disconnected.

SERVICE PROCEDURES

Repairing Worn String

1. Unwind a length of string from the String Spool similar to the length of string that needs to be replaced.
2. From under the setting platform, pull the string through the machine towards the pin. Continue pulling the string through the head of the pin so that the worn portion of the string is all the way through the pin. Refer to *Figure 5-1*.

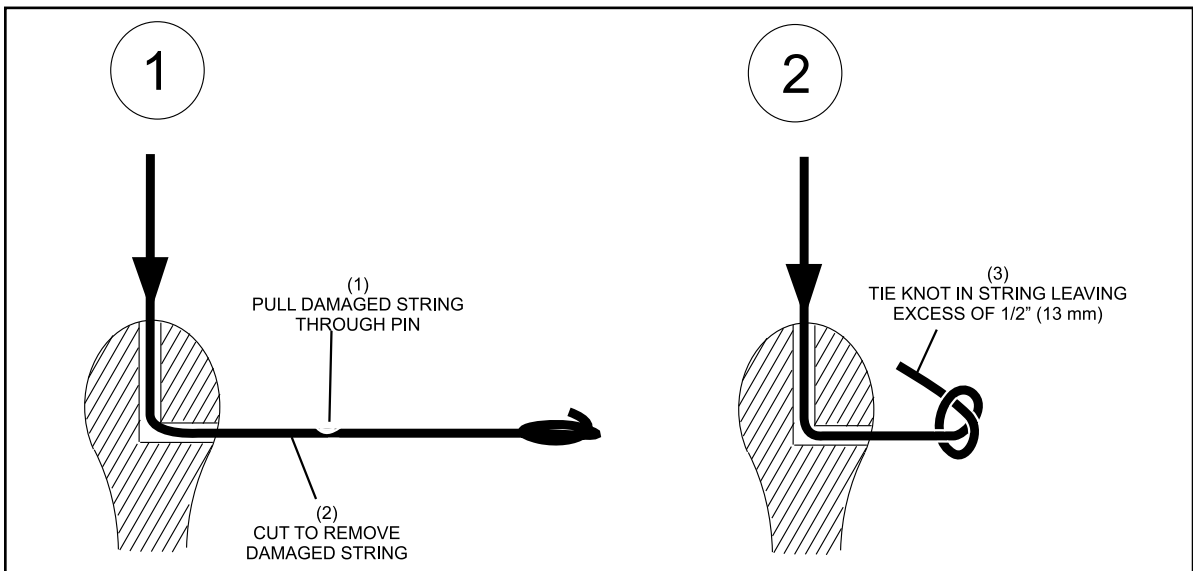


Figure 5-1. Thread String Through Pin

- (1) PULL DAMAGED STRING THROUGH PIN (2) CUT TO REMOVE DAMAGED STRING (3) TIE KNOT IN STRING LEAVING EXCESS OF 1/2" (13 mm)

3. Cut the string at the String Spool side of the damage. Discard the damaged string.
4. Tie a knot in the end of the “good” string. Leave approximately 1/2” (13 mm) of string extending beyond the end of the knot. Refer to *Figure 5-1*.
5. Pull the string back through the pin until the knot bottoms out in the pin. Refer to *Figure 5-1*.
6. Perform the String Tension Adjustment for any pin where the string has been repaired.

Installing New String

When installing new string it is important to make sure the strings are routed through the machine properly. Pay particular attention to how the strings are routed around the String Limiting Bar. The strings for pins 4-6, and 7-10 go over the limiting bar. The strings for pins 1-3 route under the limiting bar. Refer to *Figure 5-2*.



Warning! Pinsetter power is to remain off while performing any manual function.



WARNING! To avoid burning your hands wear gloves and use a rag to taper the melted string end.

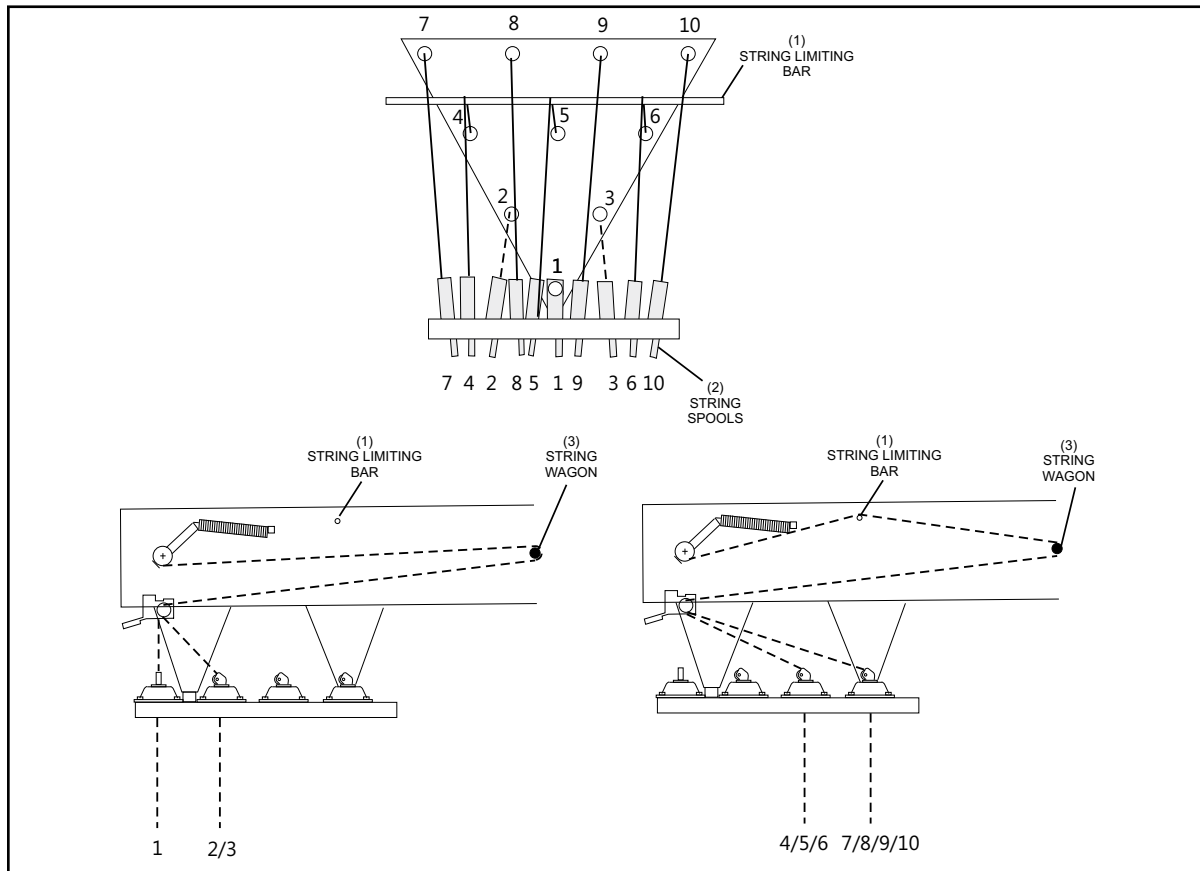


Figure 5-2. String Paths

(1) STRING LIMITING BAR

(2) STRING SPOOLS

(2) STRING WAGON

1. Cycle the pinsetter to first ball with ten pins on the pin deck.
2. Cut the string off any pin being replaced, just above its head. Refer to *Figure 5-3*.

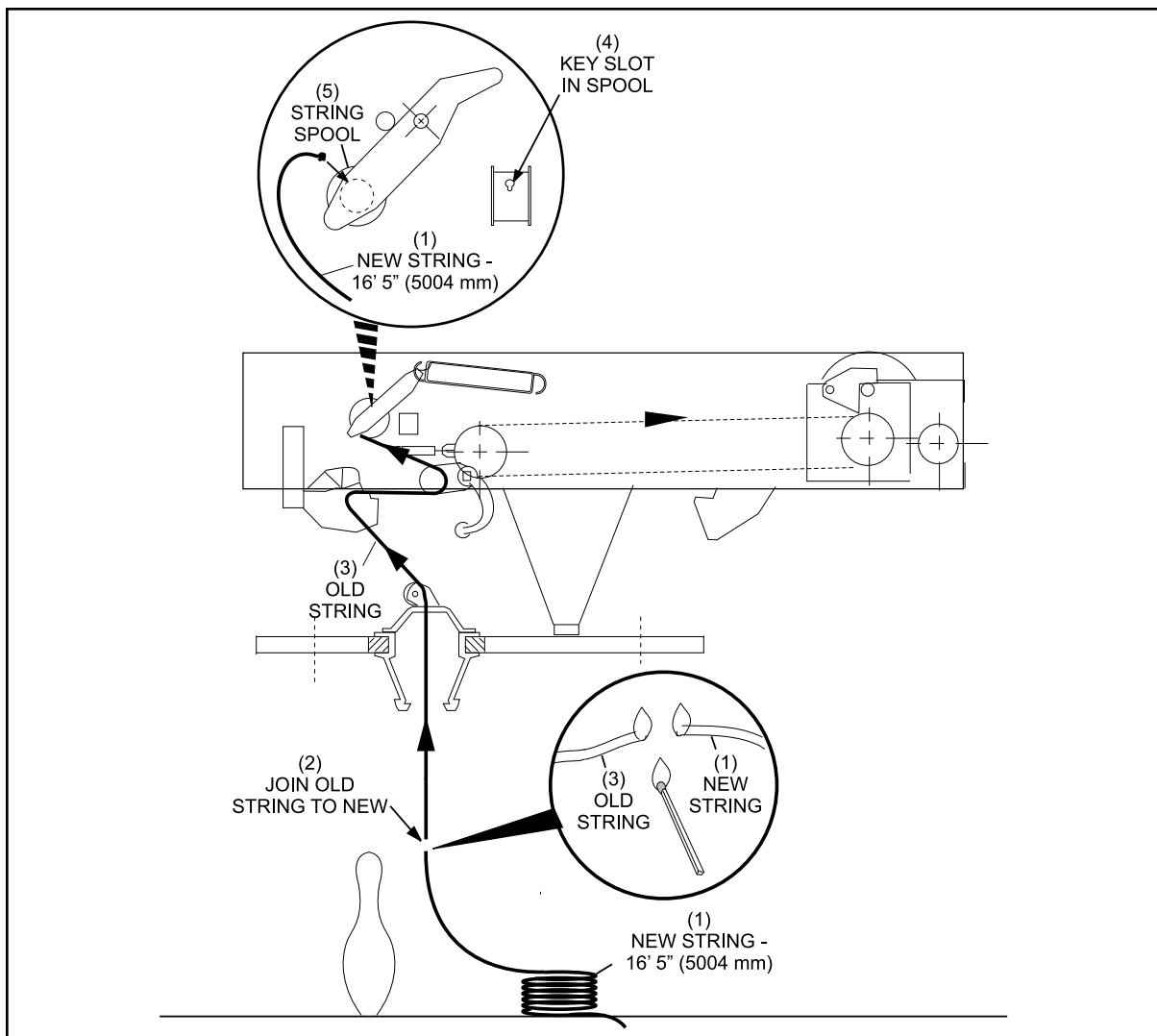


Figure 5-3. Restring Machine

- (1) NEW STRING - 16' 5" (5004 mm) (2) JOIN OLD STRING TO NEW (3) OLD STRING
 (4) KEY SLOT IN SPOOL (5) STRING SPOOL

3. From a spool of replacement string, cut off a piece 16' 5" (5004 mm) long for each pin having its string replaced.
4. At the cut end of the old string and one end of the new string melt the ends of the strings. While the string ends are still hot, press them together and hold until they cool and form a joint. Cover the joint with electrical tape to increase its strength. Refer to *Figure 5-3*.
5. At the String Spool, use the old string to carefully pull the new string through the machine until the new string is at the string spool. Remove the tape at the joint between the old and the new string. Cut off and discard the old string. Refer to *Figure 5-3*.
6. Remove the old string from the spool. Tie a knot in the end of the new string. Slide the knot through the key slot in the spool shaft and secure it. Refer to *Figure 5-3*.

7. At the pin end of the new string, thread the string through the head of the pin and tie a knot in the end of the string. Leave approximately 1/2" (13 mm) of string extending beyond the end of the knot. Refer to *Figure 5-1*.
8. Pull the string back through the pin until the knot bottoms out in the pin. Refer to *Figure 5-1*.
9. Wind the extra string onto the spool by rotating the spool as arrow (3) shows in *Figure 5-3*.
10. Adjust the spring tension for each new string, following the String Tension Adjustment.

MOTOR REPLACEMENT

Pinsetter Drive Motor

Motor Pulley

The single pulley used on drive motor can be used with both 50 and 60 cycle (Hz) power. For 60Hz operation use the smaller pulley, for 50Hz operation use the larger pulley.

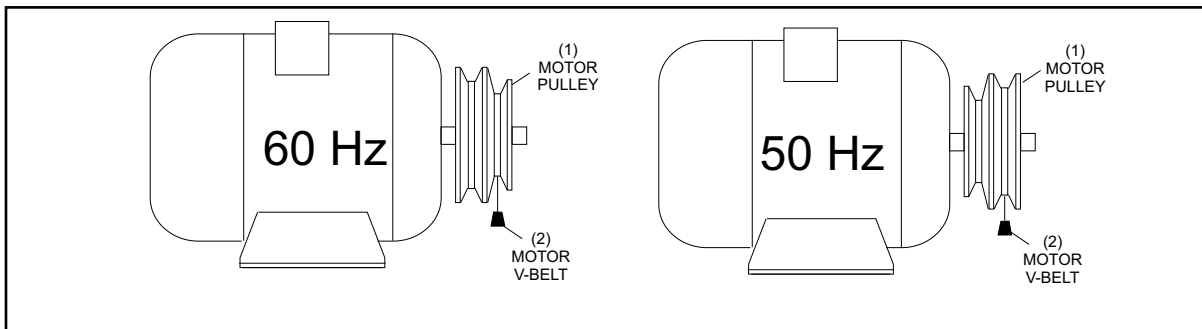


Figure 5-4. Motor Pulley

(1) MOTOR PULLEY

(2) MOTOR V-BELT

Motor Pulley Removal

1. Loosen the pulley's set screw with a 3 mm Allen wrench (hex key).
2. Use a gear puller to slide the pulley off the shaft. Save the key for use during installation.

Motor Pulley Installation

1. Make certain the key is properly seated in the motor shaft.
2. Place the pulley on the shaft with the desired orientation. Tap the pulley onto the shaft with a soft faced hammer.
3. Align the pulley so that the "V" belt will ride in the center of the motor pulley and the large drive pulley.
4. Tighten the set screw to prevent the motor pulley from moving out of position.

Drive Motor Wiring

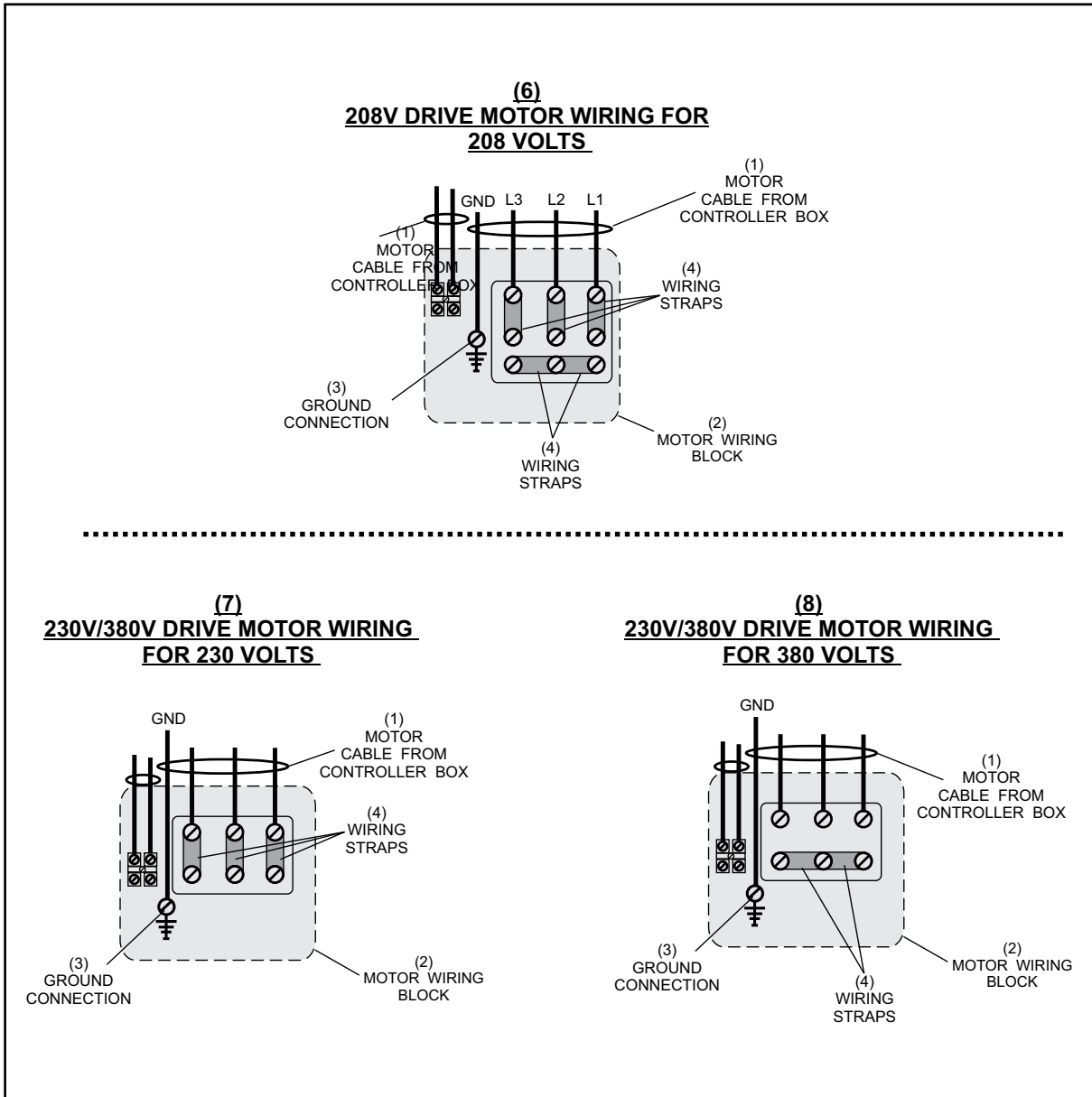


Figure 5-5. Drive Motor Wiring.

- | | | |
|--------------------------------------|--|---|
| (1) MOTOR CABLE FROM CONTROLLER BOX | (2) MOTOR WIRING BLOCK | (3) GROUND |
| (4) WIRING STRAPS | (5) MOTOR OVERLOAD 1 TO CONTROLLER BOX | (6) DRIVE MOTOR WIRING FOR 208 TO 230 VOLTS |
| (7) DRIVE MOTOR WIRING FOR 380 VOLTS | | |

Drive Motor Rotation



Warning! Make sure the wagon is off the stop dogs when testing the motor direction. Until the motor direction is correct do not have the wagon come in contact with the stop dogs or mechanical failure could occur.

1. Make sure wagon is off the stop dogs. Rotate the drive pulley manually until the string wagon is at the front of the pinsetter. Cycle power to make sure motor/wagon is turning in the correct direction.
2. If the motor is running backward, swap any two of the three supply wires at the motor's terminal block. This will reverse the direction of the motor shaft. Refer to *Figure 5-5*.



WARNING: Never swap the ground (earth) wire with one of the supply wires.

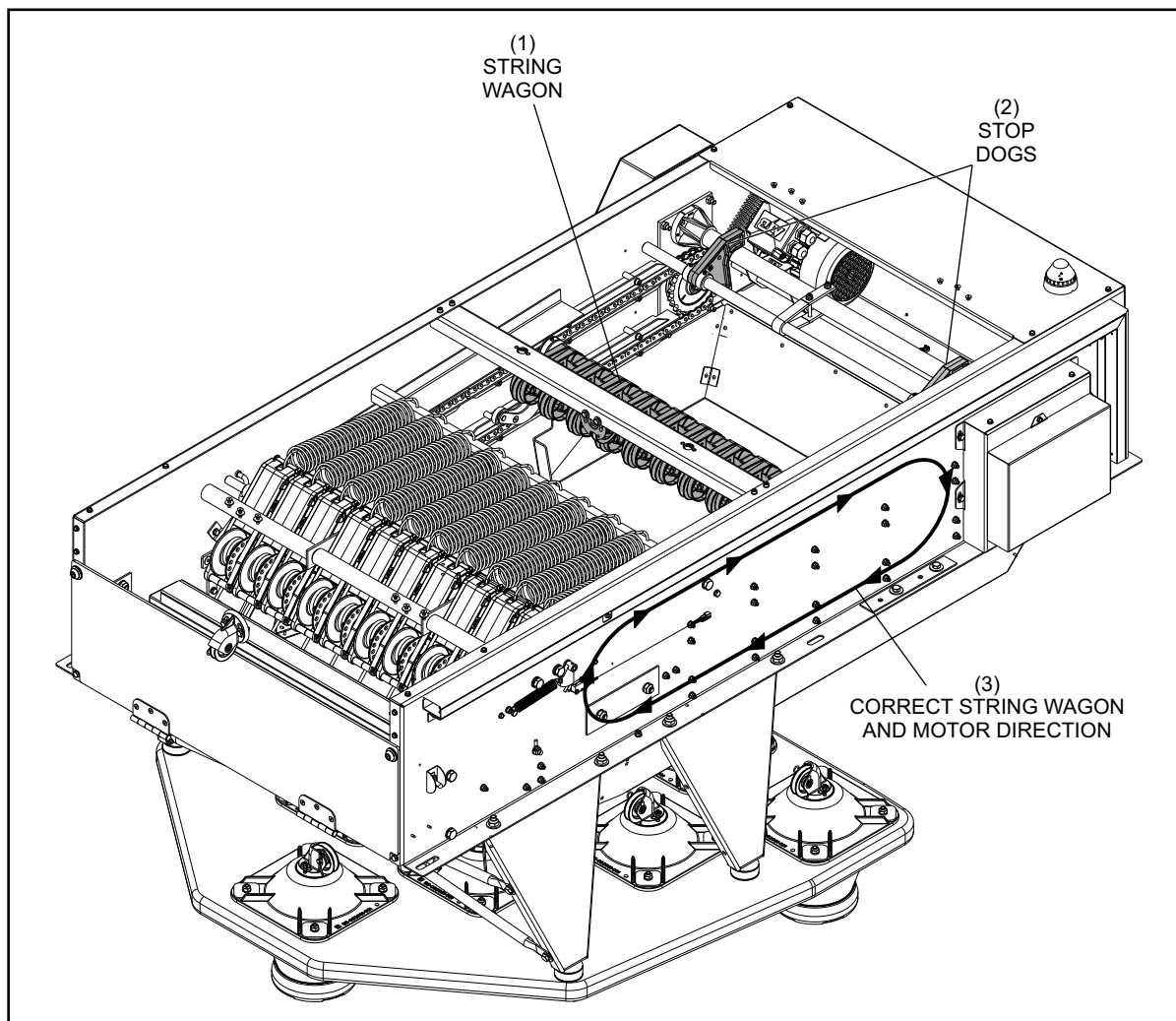


Figure 5-6. Correct Wagon Rotation Direction

(1) STRING WAGON

(2) STOP DOGS

(3) CORRECT STRING WAGON AND
MOTOR DIRECTION

Ball Accelerator Motor Wiring

1. Turn the pinsetter on briefly and watch the rotation of the motor. Verify that the large belt will propel the ball forward.
2. If the motor is running backward, swap any two of the three supply wires at the motor's terminal block. This will reverse the direction of the motor shaft. Refer to *Figure 5-7*.



WARNING: Never swap the ground (earth) wire with one of the supply wires.

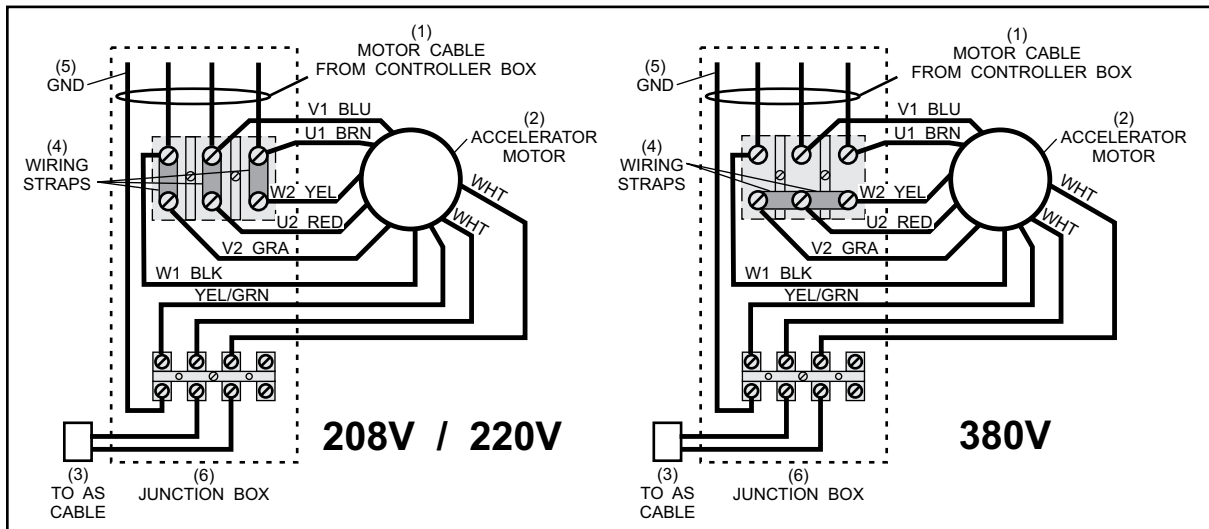


Figure 5-7. Accelerator Motor Wiring.

- | | | |
|--|-----------------------|------------------|
| (1) MOTOR CABLE FROM
CONTROLLER BOX | (2) ACCELERATOR MOTOR | (3) TO AS CABLE |
| (4) WIRING STRAPS | (5) GROUND | (6) JUNCTION BOX |

PREVENTATIVE MAINTENANCE

Preventive maintenance is the most important responsibility of the pinsetter mechanic. Properly performed preventive maintenance will increase reliability, prevent major breakdowns and lengthen the life of the pinsetter.

In general preventative maintenance requires the following:

1. Inspection - The pinsetter should be inspected periodically for the following condition:
 - Loose hardware
 - Damaged or worn parts
 - Proper operation
2. Cleaning - In general the pinsetter should be kept as clean as possible using a vacuum, general purpose cleaner, warm water (with detergent as needed)
3. Lubricating - It is suggested that a chain lubricant such as Brunswick Part No. G34-205116-000 be used to lubricate the pinsetter's drive chains. Penetrating oils do not last long and leave parts exposed to premature failure. For area requiring grease, a medium duty non-lithium such as Brunswick Part No. 11-676361-000 or a light grease such as Nyogel 788 Lubricant (Brunswick Part No. 11-676308-000) is suggested.

Maintenance Schedule

Biweekly (Every Other Week)

Pin Strings

Pin String Inspection and Repairing Worn String

i *NOTE: In a traditional bowling environment, with average pinsetter usage, pin strings should be inspected at least biweekly.*

Check the strings for wear, paying particular attention to the area at the head of the pin. If worn, remove the damaged section of string as described in the Repairing Worn String or the Installing New String procedures located at the beginning of this section.

Monthly

Rotating Pins

i *NOTE: In a traditional bowling environment, with average pinsetter usage, pins should be inspected at least monthly.*

Rotating pins in the 1 through 10 positions is necessary for long life of bowling pins. Untie and rotate all pins in a clockwise rotation and swap the 5 pin (middle) with one of the outside pins (1-4 or 6-10).

Semi Annually (6 Month)

- Lubricate the chain with chain lubricant. Put a light coating of chain lubricant on drive chains - Allow penetration, then remove excess. Refer to item (1), *Figure 5-8*.
- Apply lubricant to the pivot point where the string wagon is attached to the chain. Refer to item (1), *Figure 5-8*.

Annually

- Remove the switch cluster plate located the right side of the rear of the pinsetter. Apply grease to the drive gears. Refer to item (3), *Figure 5-8*.
- Remove cover from the motor and gear assembly located on the left side of the rear of the machine and grease gear. Refer to item (2), *Figure 5-8*.

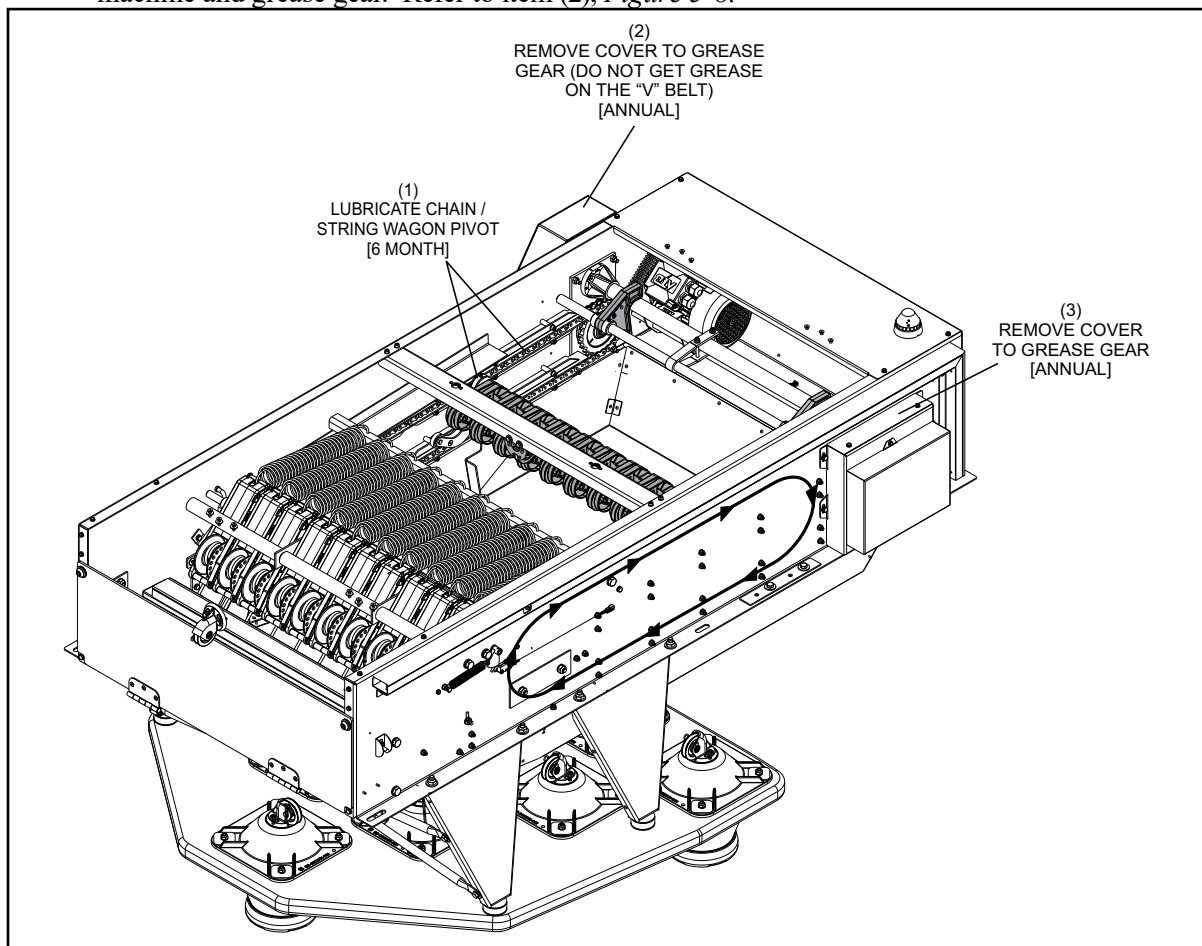


Figure 5-8. Lubrication Locations

- | | | |
|--|---|--|
| (1) LUBRICATE CHAIN / STRING WAGON PIVOT (6 MONTH) | (2) REMOVE COVER TO GREASE GEAR (BE CAREFUL NOT TO GET GREASE ON THE "V" BELT) [ANNUAL] | (3) REMOVE COVER TO GREASE GEAR [ANNUAL] |
|--|---|--|

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Section 6 - Troubleshooting

Solutions to Common Problems

1. Machine and Accelerator Will Not Run

1. Check to see that the main switch is in the ON position.
2. Make sure the power cord is properly installed.
3. Check to ensure that the circuit breaker for the incoming power is not tripped or turned off.

2. One Machine Does Not Run

1. Make sure the motor stop switches on the Pinsetter for the non-running motor are turned ON.
2. Check for reported errors on the stringpin controller LCD display and confirm that all electrical cables are properly installed.
3. Check to confirm that the de-tangle switch (under the cover at the front of the right hand pinsetter side frame) is in the closed position.
4. Make sure the “V” belt for the drive motor is not off the pulley or broken.

3. Accelerator Will Not Run

1. Check the overload for the accelerator motor to make sure it is not tripped.

4. Machine Will Not Stop After Completing a Cycle

1. Check to see that the pinsetter ball detect is clean and properly adjusted.
2. Check the magnet on the Pin Motion Interface to verify it is not stuck in line with the reed switch.
3. Check the Reset switch on the ball rack for proper operation.
4. Check the Home Switch for proper operation. Replace as needed.

5. Machine Starts and Stops When Attempting to Lift Pins

1. Make sure there are not any pins or strings that are caught or not moving freely.
2. One or more pin strings have excessive spring tension.
3. Improper spring tension on the pinsetter motor.
4. A replacement string has been improperly installed.
5. Watch the de-tangle switch to see if its actuator is functioning improperly.
6. Check de-tangle switch wiring.

6. The Pinsetter Respots One or More of the Fallen Pins. Scorer Scores Correctly.

1. Check to see that the solenoid that locks knocked over pins in the up position is functioning.
2. Check to make sure all pins are properly routed and free to move.

7. The Brake in the PMI Does Not Release To Allow the Pin(s) To Lower To the Pindeck.

1. Verify That After First Ball, The Pin Has a Gap of Approximately 80 mm From the Centering Cone. (See String Brake Adjustment.)
2. Open the string break manually and adjust the string tension (increase the length of the string).
3. Make sure the string of the affected pin moves freely.
4. Make sure that the string brake solenoid is not constantly actuated.

8. A Machine is Malfunctioning But You Cannot Isolate the Problem

1. To determine if the problem is in the electrical box or with the machine, exchange the electrical slide out tray with those of a pair that are working properly. Do not swap the entire controller.
2. If the problem follows the electrical boxes, exchange the control unit boxes. This should allow you to determine which of the boxes is causing the problem.

9. Pins Fall When Being Spotted

1. Verify nothing is on the pin deck interfering with pin spotting.
2. Check the bottom of the pin for damage.
3. Check the location of the pin centering rings.

10. Pins Are Not Respotted Accurately

1. Check to see that the strings of the pin or pins being spotted are properly tensioned.
2. Check the location of the pin centering rings.

11. The Pinsetter Shows a Home Switch

1. Check to see that the main switch is in the ON position.
2. Make sure the pinsetter motor power cord is properly installed.
3. Check to ensure that the circuit breaker for the incoming power is not tripped or turned off.

CLEARING ERROR CODES AND CORRECTING PINSETTER STOP

Although pinsetter stops that require a mechanic intervention occur infrequently, circumstances will occur that make them inevitable.

When a pinsetter does experience a stop, the StringPin 360 Controller, will shut down the machine and flash the white Status Light located on top of the pinsetter. A code indicating the problem encountered will be shown on the display of the 360 Controller.

i ***NOTE:** Some errors or problems with the pinsetter may not be detected by the StringPin Pulse Controller. Examples are ball accelerator problems or scoring errors. In these situations, the status light will not flash to indicate a problem.*

The following procedure should be used for correcting pinsetter stops or malfunctions.

1. When approaching the pinsetter from the rear, turn the STOP/RUN switch located on the StringPin Controller to the stop position.
2. Determine the reason for the stop. If the Status Light is flashing, look at the Controller Display located on the rear of the pinsetter for an associated error code.
3. Perform the proper procedure according to the issue/error code.
4. Once the issue has been fixed, make sure that all unused parts, tools, and other mechanics are clear of the machine.
5. Make sure that all guarding is in its proper fixed place. Re-install all guarding if it was removed.
6. Once the machine has been cleared, toggle the STOP/RUN switches for each machine to the RUN position to clear the error code. Press the Start Button to start the pinsetter.
7. If the machine did not restart, recheck the error code diagnostic display and start the procedure over from step #1.

ERROR CODES DESCRIPTION, CAUSES, AND SOLUTIONS

ERROR CODES*		FAILURE DESCRIPTION	POSSIBLE CAUSES AND SOLUTIONS
PINSETTER	DESK		
Tangle	01	Two or more pins became tangled together and the machine failed in an attempt to detangle them.	The pins became tangled or intertwined. The pins require manual detangling. Turn off the machine, use work areas 2/3, and manually detangle the pins.
Motor Backwards	02	The pinsetter motor is running in the wrong direction. The proper direction of the motor is from the Home switch to the Pins UP switch, to the Pins Solenoid Switch, then back to home.	The main power is wired incorrectly. Switch two of the phases. Also, check the wiring and adjustment for the Pins Up switch.
Ball Accelerator Overload	03	The thermal protection activated or accelerator cable is not connected.	1. A Ball or Pin is stick in the accelerator. Turn off the machine, use work areas 2/3, and clear the obstruction. 2. The Ball Accelerator cable is broken or disconnected. Check the accelerator cable.
Motor Overload	04	The pinsetter motor has overheated.	1. Check the wiring to the motor overload. 2. Check the pinsetter mechanical function for reasons for extra load on the motor.
Pins Up Switch Expected	05	The Pins Up Switch was expected but was not detected by the system.	1. Check the wiring to the Pins Up Switch and the switch adjustment. 2. Check the pinsetter motor as it might not be running. 3. Check for mechanical jams or other failures in the pinsetter.
Pins Up Switch NOT Expected	06	The Pins up Switch was not expected but was detected by the system.	1. Check the wiring to the Pins Up Switch and the switch adjustment. 2. Check the motor and cam for improper time. 3. Check for mechanical jams or other failures in the pinsetter.
Pins Solenoid Switch Expected	07	The Pins Solenoid Switch was expected but was not detected by the system.	1. Check the wiring to the Pins Solenoid Switch and the switch adjustment. 2. Check for mechanical jams or other failures in the pinsetter.
Pins Solenoid Switch NOT Expected	08	The Pins Solenoid Switch was not expected but was detected by the system.	1. Check the wiring to the Pins Solenoid Switch and the switch adjustment. 2. Check the motor and cam for improper time. 3. Check for mechanical jams or other failures in the pinsetter.
Home Switch Expected	09	The Home Switch was expected but was not detected by the system.	1. The Controller has not be "Started" after a power interruption. 2. Check the wiring to the Home Switch and the switch adjustment. 3. Check for mechanical jams or other failures in the pinsetter
Home Switch NOT Expected	10	The Home Switch was not expected but was detected by the system.	1. Check the wiring to the Home Switch and the switch adjustment. 2. Check the motor and cam for improper time. 3. Check for mechanical jams or other failures in the pinsetter.

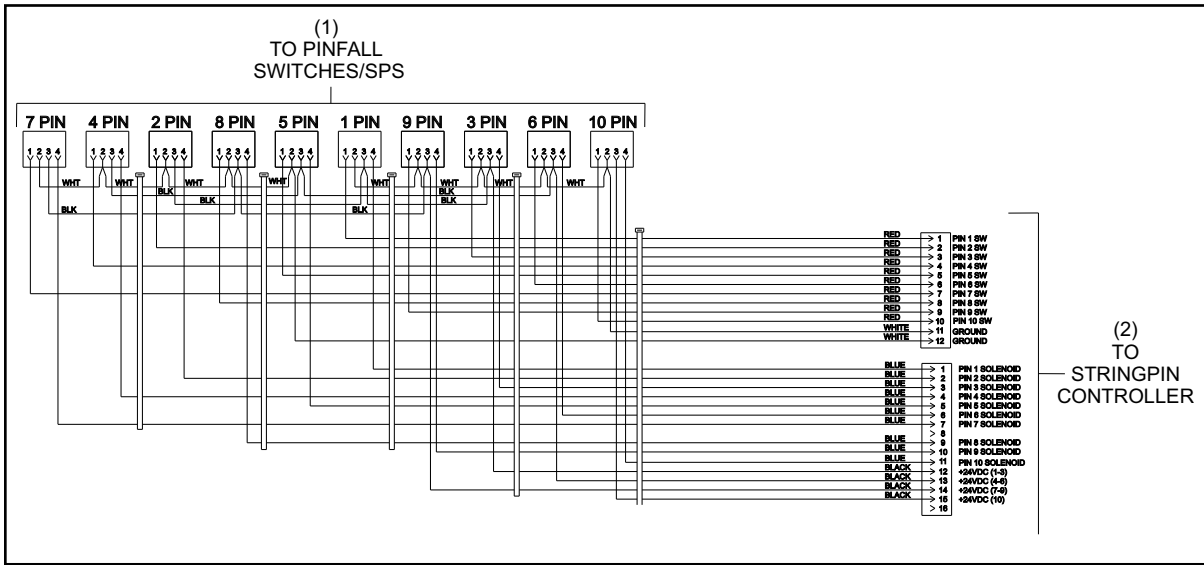
* The "Pinsetter" error codes appear on the display of the Pinsetter Controller. "Desk" error codes display at the control desk for select scoring systems.

PROBLEM/CAUSE/CORRECTIVE ACTION

PROBLEM	CAUSE	CORRECTIVE ACTION
Ball does not return.	<ol style="list-style-type: none"> 1. The ball is stuck on the pindeck, in the pit area, ball door, Ball Accelerator, or other location. 2. Ball doors do not move freely. 3. Accelerator Motor Overload. 4. Ball fell off transition track. 	<ol style="list-style-type: none"> 1. Visually locate the location of the ball. Turn off the machine and use the appropriate work areas to retrieve the ball. 2. Adjust or lubricate ball door. 3. Turn off the machine, use work areas 2/3 and clear the obstruction. 4. Remove capping, retrieve ball and clear any obstruction on or near the track.
Pinsetter does not turn on properly.	<ol style="list-style-type: none"> 1. Photocell not adjusted properly. 2. The stop/run switches on the rear, front, or on the controller is not on. Main power has been turned off and locked out. 3. Pinsetter set to wrong mode. 	<ol style="list-style-type: none"> 1. Adjust ball detector. 2. Turn on all switches. Check all interface plugs and connectors. 3. Set machine to the proper mode.
<p>Pinsetter cycles independently. (One cycle only.)</p> <p>CAUTION: Camera flash may cause the pinsetter to cycle independently.</p>	<ol style="list-style-type: none"> 1. Photocell not adjusted properly. 2. Loose reflector mounting. 3. Faulty power supply connections. 4. StringPin Controller mode setting is wrong. 5. Incoming 3 phase power surge, or is out of balance. 	<ol style="list-style-type: none"> 1. Check for proper hardware and adjust. 2. Remount with proper hardware and adjust. 3. Tighten connections. 4. Place pinsetter in Standalone mode or in Scorer Control mode if attached to the scorer. 5. As a last resort, consult a qualified electrician to help identify the surge and correct the problem.
No Pinsetter motor will operate.	<ol style="list-style-type: none"> 1. Operating switches actuated 2. Faulty StringPin H.V. PCB 	<ol style="list-style-type: none"> 1. Determine the cause of trouble, repair, and restart machine 2. Replace the StringPin H.V. PCB
Individual motor does not operate.	<ol style="list-style-type: none"> 1. Main house breaker box or faulty power supply cables 2. Faulty cables. 3. Damaged motor. 4. All above checked, faulty StringPin CPU or H.V. PCB 	<ol style="list-style-type: none"> 1. Check breaker box and tighten power connections. 2. Check for shorted or loose pins, continuity, faulty connectors. Repair or replace. 3. Replace motor. 4. Power down and exchange faulty box or board.
Incorrect Score	<ol style="list-style-type: none"> 1. Pin Motion Interface Detect Switch 2. Wrong String Length or Broken String 	<ol style="list-style-type: none"> 1. Check the Pin Motion Interface. Adjust, repair or replace appropriately. 2. Adjust string length or replace broken string.
Machine does not set a full rack of pins	<ol style="list-style-type: none"> 1. Broken or wrong string length 2. Faulty Pin Motion Interface 3. Faulty cable 	<ol style="list-style-type: none"> 1. Adjust string length or replace broken string. 2. Check the Pin Motion Interface. Adjust, repair or replace appropriately. 3. Repair or replace cable(s)

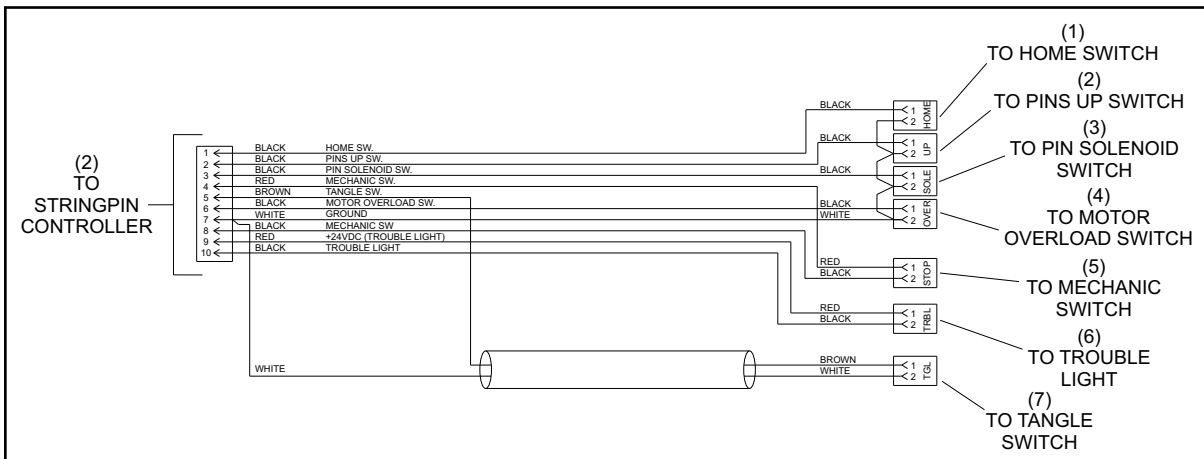
PROBLEM	CAUSE	CORRECTIVE ACTION
Ball Accelerator belt not centering.	1. Front pulley not bolted correctly or front yoke is loose (parts incorrectly installed.)	1. Loosen bolts on yoke and operate accelerator. Align both yoke halves until the belt runs true. Tighten bolts.
Pinsetter operates erratically.	<ol style="list-style-type: none"> 1. Faulty switches. 2. Loose or faulty cables and connections. 3. String length not adjusted properly. 4. Damaged pinsetter parts. 5. Pin Motion Interface not adjusted properly. 6. Switch adjustment faulty or faulty assembly. 7. Photocell adjustment not correct. 8. Faulty motor rotation. 9. Main power supply on too low a voltage. 10. Faulty switch cluster cable. 11. Faulty ball lift cable, foul and optical trigger cable. 12. After above checked, electronics. 	<ol style="list-style-type: none"> 1. Replace Switch. 2. Check all cables and connections. 3. Check pin string length and adjust properly. 4. Repair or replace parts. 5. Adjust Pin Motion Interface. 6. Check switch mountings. Check adjustments. 7. Adjust ball detect. 8. Determine proper rotation and adjust to proper phase status. 9. Use proper line voltage. 10. Substitute spare cable (to check). 11. Check cables and repair or exchange. 12. Change the StringPin controller, CPU or H.V. board(s).

Section 7 - Cables



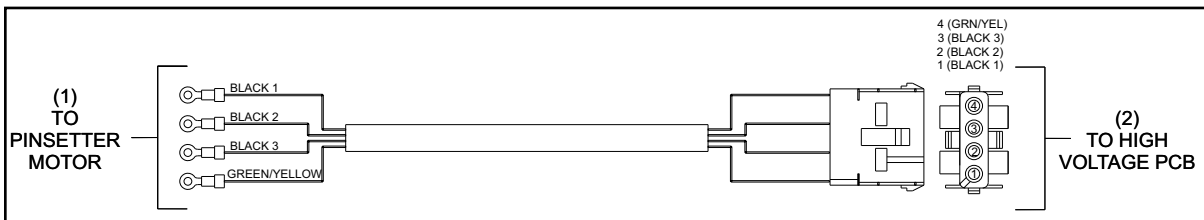
String Pinsetter Pin Motion Interface Harness (P/N 55-143009-000)

(1) TO PINFALL SWITCHES/PMI (2) TO STRINGPIN CONTROLLER



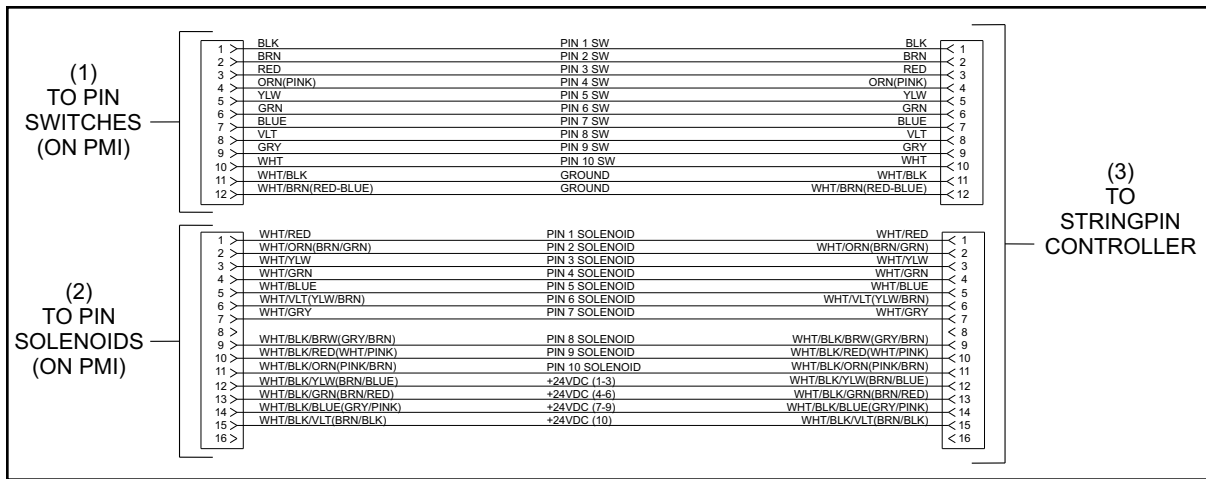
String Pinsetter Switch Cluster Cable (P/N 55-143010-000)

(1) TO HOME SWITCH (2) TO PINS UP SWITCH (3) TO PIN SOLENOID SWITCH
(4) TO MOTOR OVERLOAD SWITCH (5) TO MECHANIC SWITCH (6) TO TROUBLE LIGHT
(7) TO TANGLE SWITCH (8) TO STRINGPIN CONTROLLER



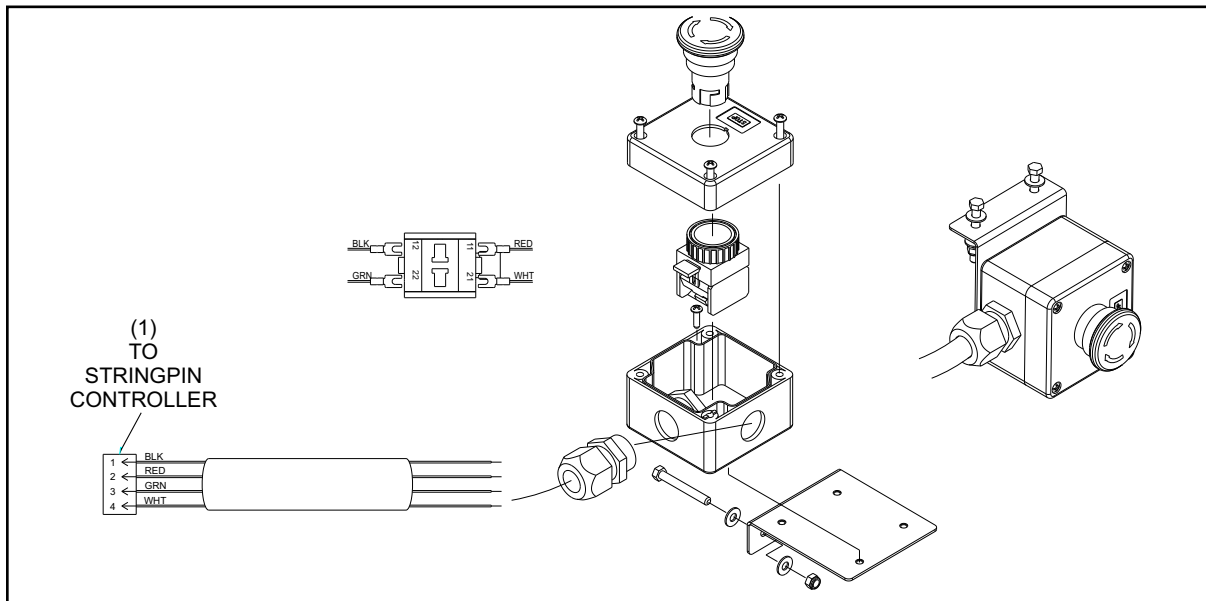
String Pinsetter Motor Cable (P/N 55-143011-000)

(1) TO PINSETTER MOTOR (2) TO HIGH VOLTAGE PCB



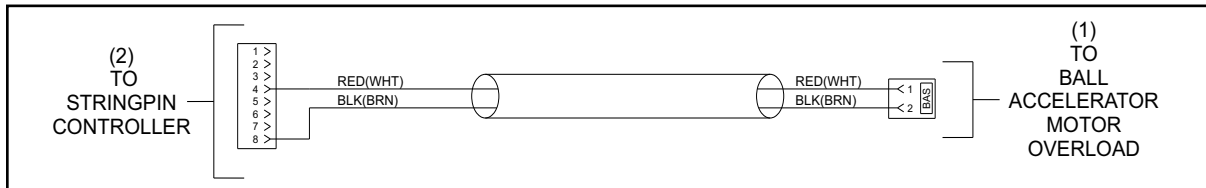
String Pinsetter Controller to Pin Motion Interfaces - Rear Mount Cable (P/N 55-143012-XXX)

(1) TO PIN SWITCHES (ON PMI) (2) TO PIN SOLENOIDS (ON PMI) (3) TO STRINGPIN CONTROLLER



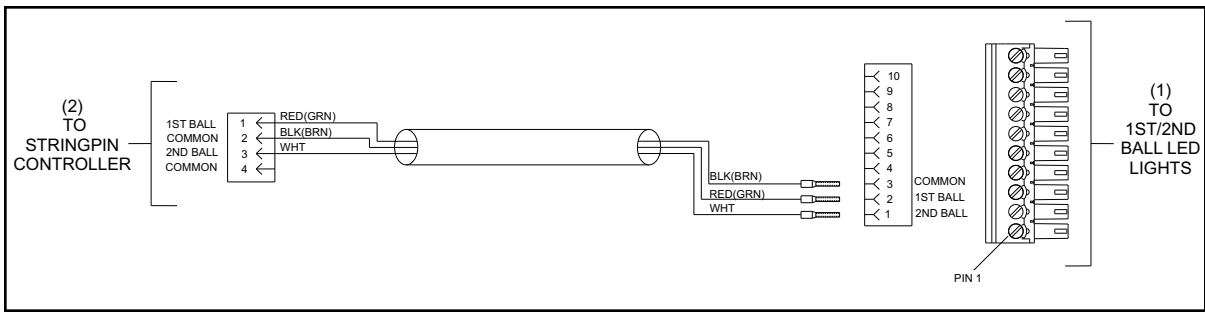
Emergency Stop Box and Cable - Rear Mount (P/N 55-143013-XXX)

(1) TO STRINGPIN CONTROLLER



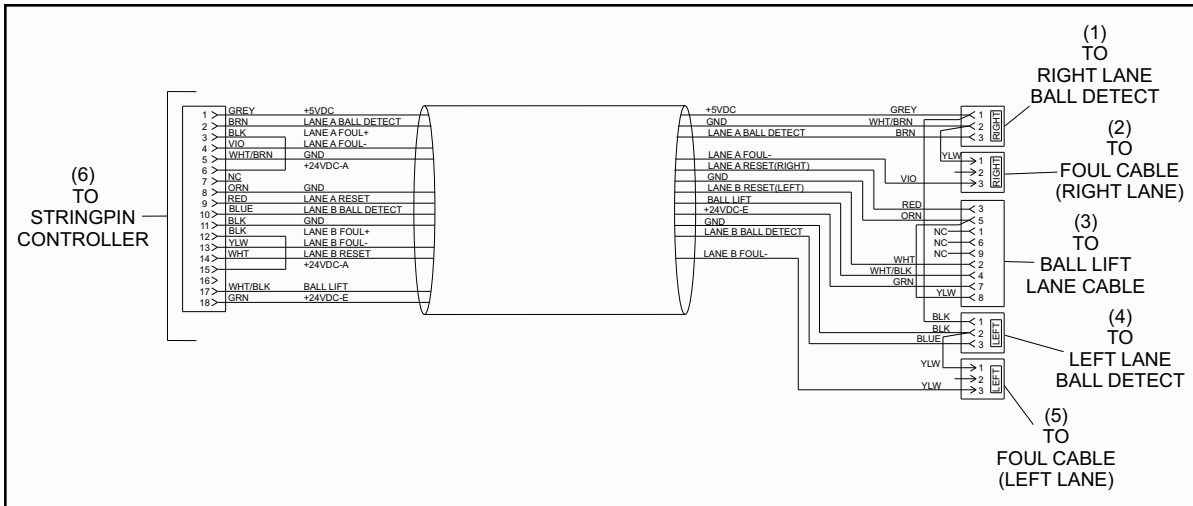
Ball Accelerator Overload Cable - Rear Mount (P/N 55-143014-XXX)

(1) TO BALL ACCELERATOR MOTOR OVERLOAD (2) TO STRINGPIN CONTROLLER



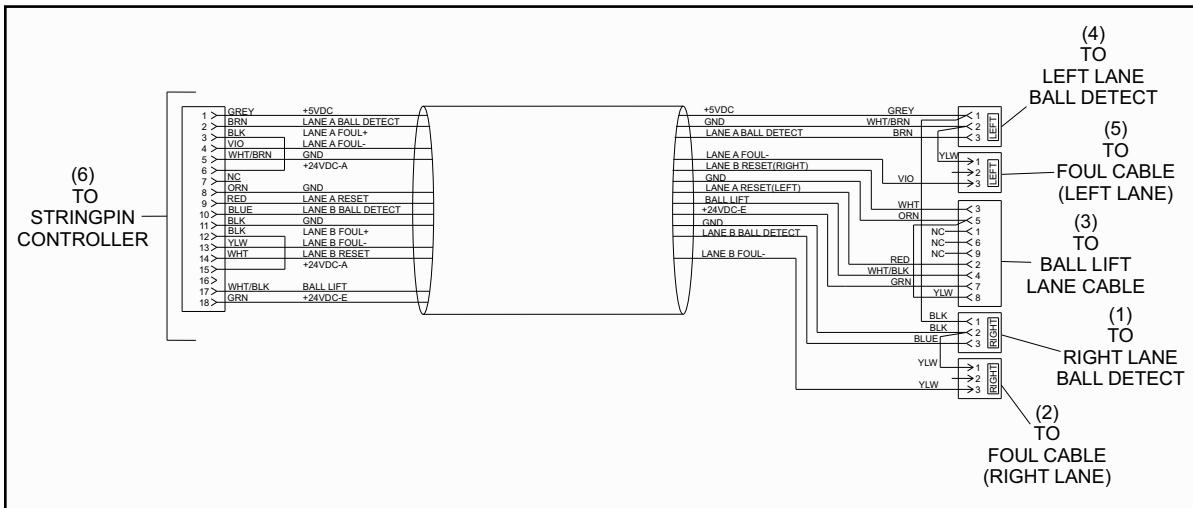
1st/2nd Ball LED Lights Masking Unit Cable - Rear Mount (55-143015-XXX)

(1) TO 1ST/2ND BALL LED LIGHTS (2) TO STRINGPIN CONTROLLER



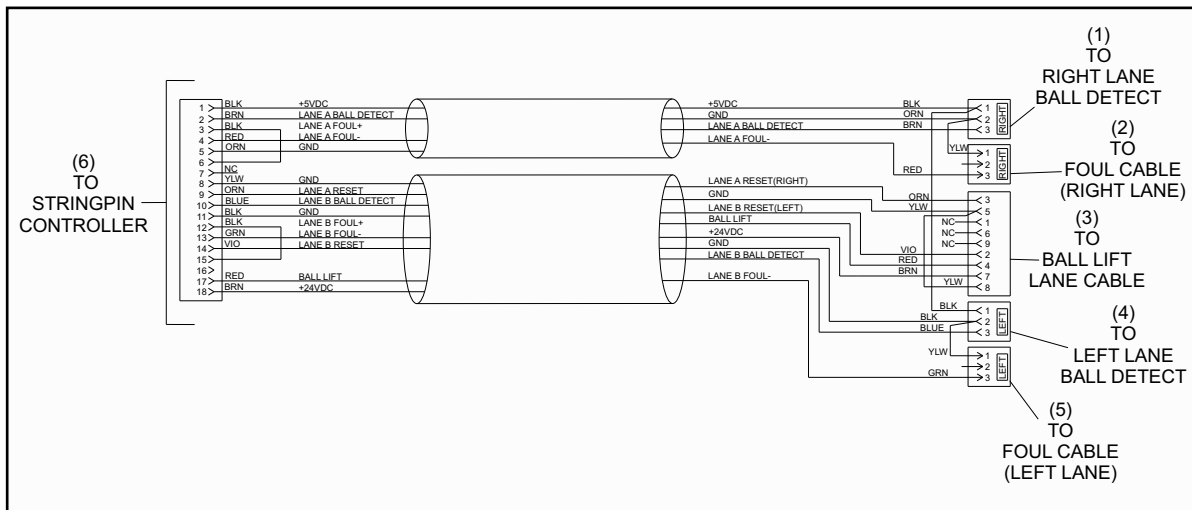
Foul/Ball Lift/Ball Detect Harness - Rear Mount (55-143016-000)

(1) TO RIGHT LANE BALL DETECT (2) TO FOUL CABLE (RIGHT LANE) (3) TO BALL LIFT LANE CABLE
 (4) TO LEFT LANE BALL DETECT (5) TO FOUL CABLE (LEFT LANE) (6) TO STRINGPIN CONTROLLER



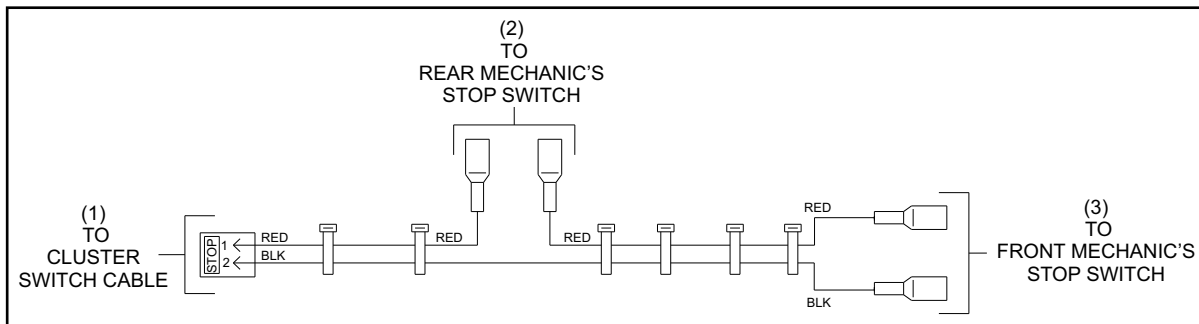
Foul/Ball Lift/Ball Detect Harness - Front Mount (55-143016-100)

(1) TO RIGHT LANE BALL DETECT (2) TO FOUL CABLE (RIGHT LANE) (3) TO BALL LIFT LANE CABLE
 (4) TO LEFT LANE BALL DETECT (5) TO FOUL CABLE (LEFT LANE) (6) TO STRINGPIN CONTROLLER



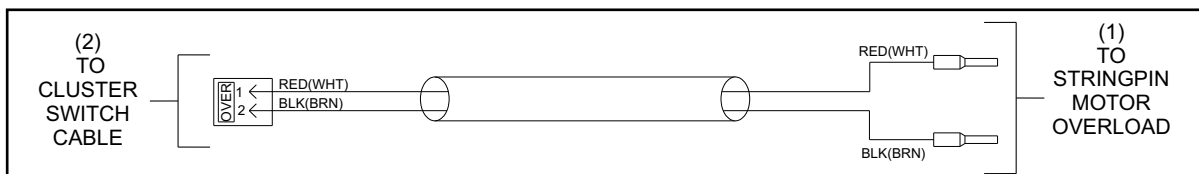
Foul/Ball Lift/Ball Detect Harness - Rear Mount Separated Lane (55-143016-200)

- (1) TO RIGHT LANE BALL DETECT (2) TO FOUL CABLE (RIGHT LANE) (3) TO BALL LIFT LANE CABLE
 (4) TO LEFT LANE BALL DETECT (5) TO FOUL CABLE (LEFT LANE) (6) TO STRINGPIN CONTROLLER



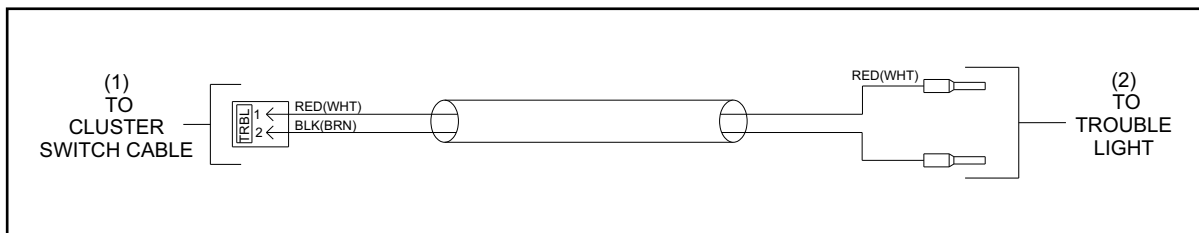
String Pinsetter Mechanic's Stop Switch Cable (55-143017-000)

- (1) TO CLUSTER SWITCH CABLE (2) TO REAR MECHANIC'S STOP SWITCH (3) TO FRONT MECHANIC'S STOP SWITCH



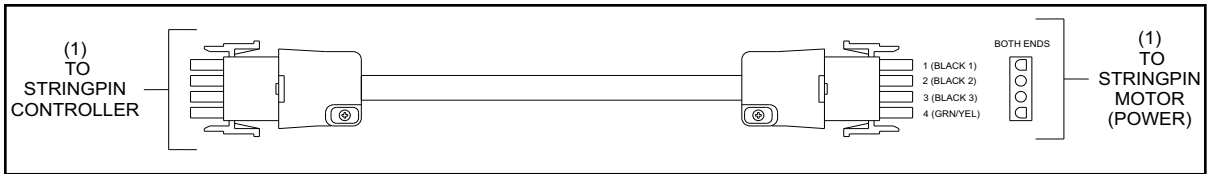
String Pinsetter Motor Overload Cable (55-143018-000)

- (1) TO STRINGPIN MOTOR OVERLOAD (2) TO CLUSTER SWITCH CABLE



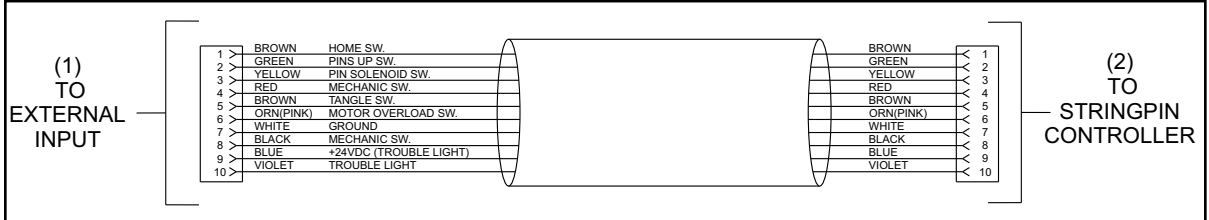
String Pinsetter Trouble Light Cable (55-143019-000)

- (1) TO CLUSTER SWITCH CABLE (2) TO TROUBLE LIGHT



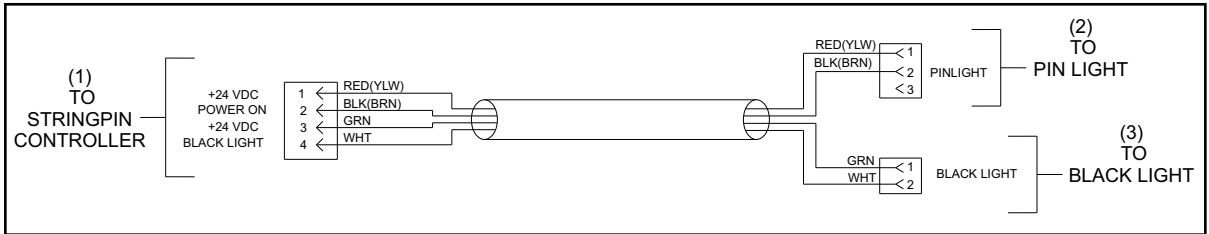
String Pinsetter Motor Power Cable - Rear Mount (55-143067-XXX)

(1) TO STRINGPIN CONTROLLER (2) TO STRINGPIN MOTOR (POWER)



String Pinsetter Switch Cluster EXT Cable - Rear Mount (55-143068-XXX)

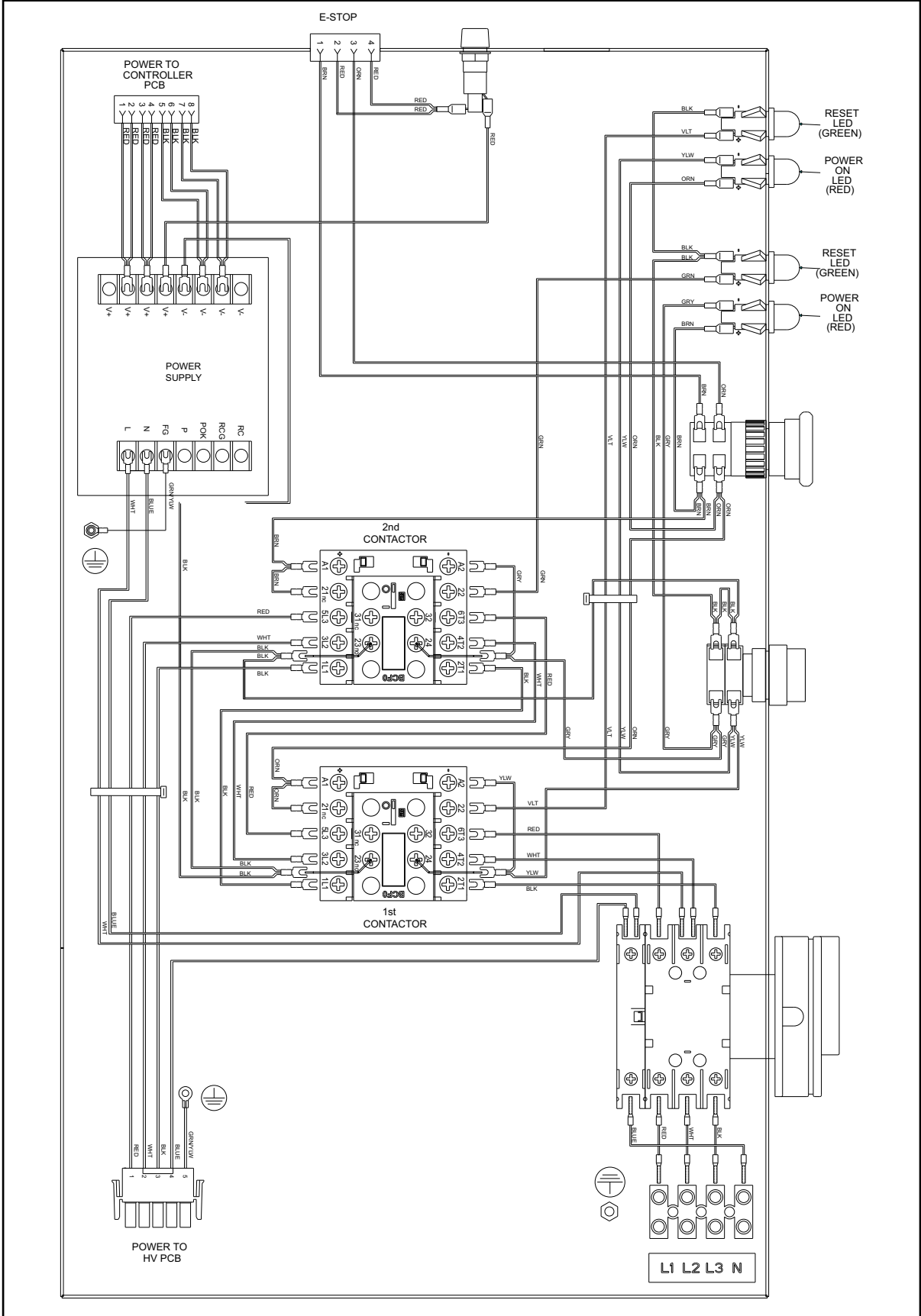
(1) TO EXTERNAL INPUT (2) TO STRINGPIN CONTROLLER



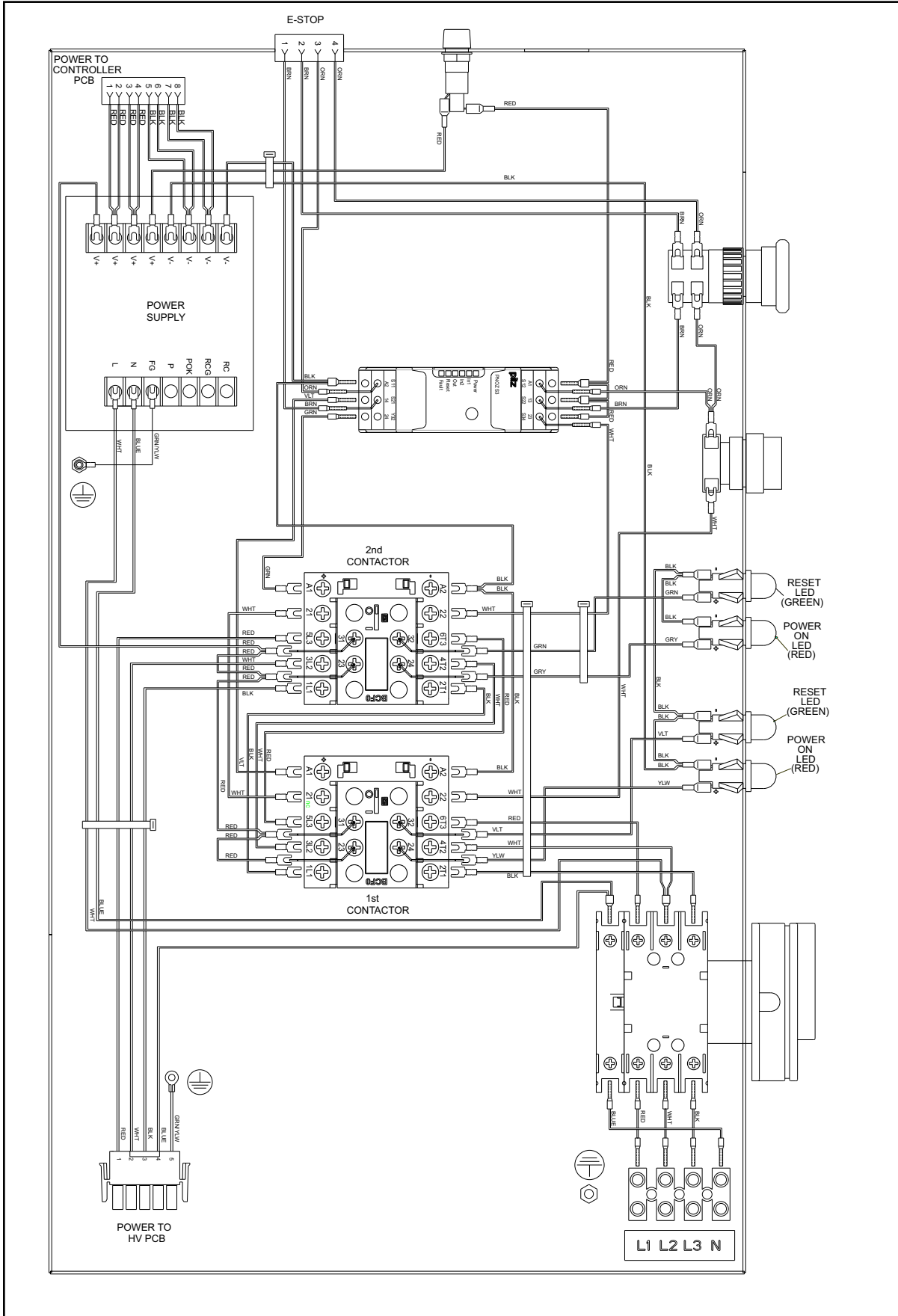
String Pinsetter DC Pinlight Cable (55-143069-000)

(1) TO STRINGPIN CONTROLLER (2) TO REAR MECHANIC'S STOP SWITCH (3) TO FRONT MECHANIC'S STOP SWITCH

StringPin Controller - UL Version



StringPin Controller - CE Version



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