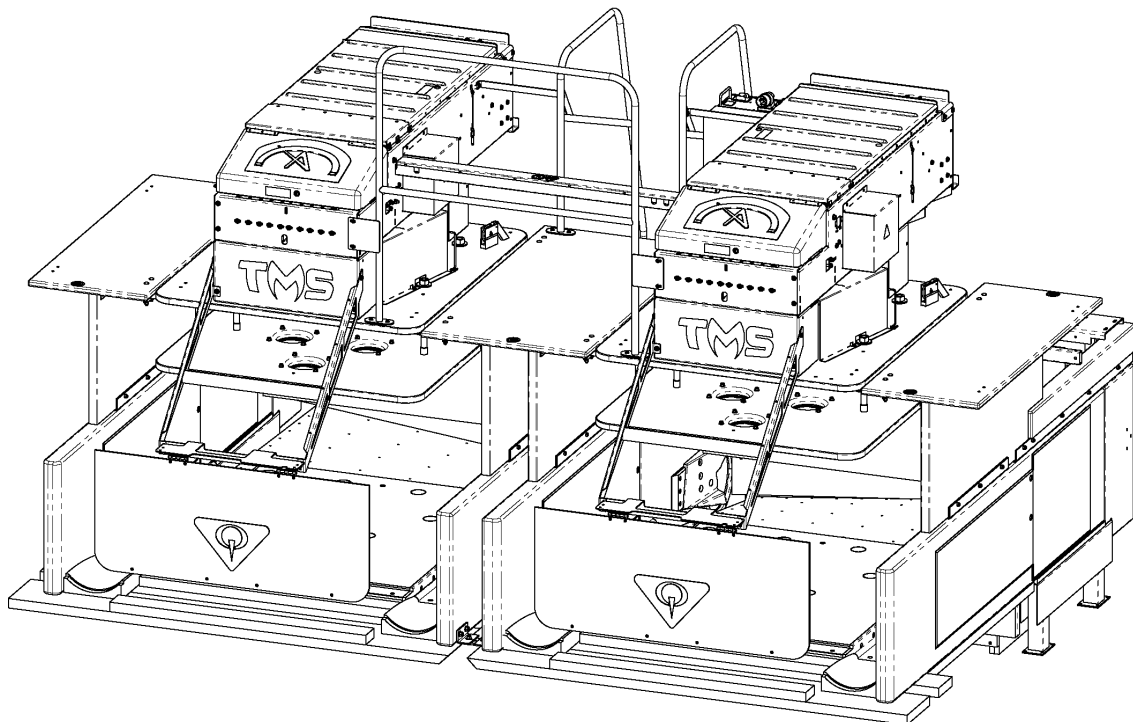




QUBICAAMF
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TMS

TMS Tenpin String Pinspotter Owner's Manual



Original Instructions Written in English

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DOCUMENT UPDATES

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EU DECLARATION OF CONFORMITY IN ACCORDANCE WITH COUNCIL DIRECTIVES

We hereby declare that the machinery described below complies with the essential machine health and safety requirements of Council Directives 2006/42/EC and the electromagnetic compatibility requirements of Council Directives 2004/108/EC on the approximation of the laws of the Member States.

<i>Conforming Machinery:</i>	TMS String Pinspotter
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SECTION 1

**TMS PINSPOTTING
SYSTEM FUNDAMENTALS**



1.0 TMS Tenpin System Fundamentals

Section Overview

This Section provides an overview of your TMS 10-Pin Pinspotting Machine. This section provides a description of the pinspotter's major components and describes how the machine operates. Details on how to make machine adjustments, periodic maintenance, and troubleshooting are provided in other sections of this manual. This manual will be made available in local languages of the European Community upon request.

The electronic unit controlling the pinspotting machine and accessed by the user may be interchangeably called the "chassis," "controller," or "chassis controller." An electronic unit inside the pinspotter may be interchangeably called the "pin detector," "pin detector board," or "pin detector box."



Safety

The TMS Tenpin String Pinspotter has been designed to be a reliable and safe machine. As with any piece of equipment that utilizes motors, gears, chains, and other moving parts, there are a few general safety precautions that must be followed to ensure that those who use, operate, or maintain this machine are provided with the safest environment possible. Failure to follow these safety precautions can result in severe personal injury. The “Declaration of Incorporation” and “Declaration of Conformity” provided by QubicaAMF (required by the European Union) is fulfilled only if the following safety requirements are met and incorporated along with the machinery supplied.



- Read, understand, and follow all of the precautions and procedures outlined in this manual.



- **This machine contains high voltage.** The controller circuit board and pin detector circuit board contain no user serviceable parts. Do not open any electrical panel or attempt to work on any electrical equipment or cable while electrical power is supplied to the machine. Opening panels that have tamper indicators will void the warranty.



- Never operate the pinspotter with any guard or panel removed unless specifically required for the maintenance or adjustment being performed. Never place the machine into service with any guard or panel removed or disabled.



- This machine contains pinching hazards such as gears, chains, pulleys, springs, strings, and other moving parts. Keep hands and fingers away from these areas.



- This machine can start suddenly and automatically. De-energize the machine before servicing unless power is specifically required for the adjustment or service being performed. See LOTO procedure instructions.



- Bowling balls and scattering pins can cause severe injury. Do not stand in front of the machine or in the pit area behind the machine, or place hands, arms, or head in the area behind the machine above the pit without first assuring that no one is positioned to bowl. See Lock Out/Tag Out (LOTO_) and pin-hook instructions.



- The end user or operator of the machine must employ a barricade to bowlers or physically prevent the possibility of bowling during any maintenance operation.
- Allow only authorized personnel to access any of the machine's components.
- Never install or operate this equipment in the vicinity of a water jet. This machine is designed for indoor use only.
- Do not wear long hair, neckties, necklaces, or loose clothing or jewelry around rotating machinery, pulleys, or gears.



- The wires of the power supply cord must be at least 14 AWG (2.5 mm²) in cross section.
- Lockout/tagout procedure is to be implemented in the facility. Shutoff and lockout/tagout (LOTO) machine before entering the machine or doing anything on the ball return. A lock-out device should be placed over the power connector to prevent power from being applied to the machine during maintenance or repair.
- For an individual machine, noise amplitude in the area behind or in front of the machine will exceed 80dBA and reach 110dBA for short periods during the impact of bowling. With multiple adjacent machines in operation, significant noise amplitude will superimpose and become more persistent. Hearing protection must be used while working near the pinspotter area in the back.
- When conducting repair or maintenance in the pit area, use of extra lighting is essential.
- The end user of the machine must provide sufficient ambient lighting for the general area of the machine.
- The end user or operator must ensure that there is no access to the machines from the front or sides after the guards provided are installed. Do not allow bowling to occur on a lane with a machine that is being serviced. Place a physical barrier at the approach or otherwise ensure that no ball is thrown if an operator must access the pit area. Do not allow movement at the front of the pinspotter between a machine under service and a machine with active play.
- All guards provided are installed by certified QubicaAMF personnel, tested and checked for function.
- Safety goggles and steel-toed shoes are recommended whenever any work is being performed on a pinspotter.



- Use caution moving between levels to service the machine. Always use approved steps and railings. Do not enter unprotected areas. This symbol indicates a fall hazard.



- Indicates a tripping hazard. Use caution around known, marked obstructions.



- Do not stand on areas where this decal is shown.



- Use pin-hook for all activity inside the pit. Use pin-hook to retrieve pins, perform detangle, or move ball from position outside the pit.



The TMS pinspotter by QubicaAMF has many built-in features that provide safe and secure operation. Warning labels are designed to warn against risks that remain beyond the normal operating machine limits. Heed all warnings and do not defeat the safety features that come with your pinspotters.

Lockout/Tagout (LOTO) Procedure:

Lockout/Tagout (LOTO) procedure is to be implemented in the facility. Refer to the separate LOTO procedure document (400-051-026) inside the LOTO kit (610-088-160) for detailed instruction. Shutoff and lockout/tagout (LOTO) the machine before entering for service. LOTO should be initiated anytime an operator or technician moves to place his/her body inside the operating limits of the machine.



Major Components and Assemblies

Pinspotter

The equipment used to control the setting of the pins is a **string pinspotter**. The usual configuration is in pairs and multiples thereof, although single pinspotter configurations are possible. The pinspotter consists of a number of subassemblies that operate in coordination with each other to guide the operation of the machine. A large metal box houses the majority of the moving components. This box rests on a set of two **tables** below which are ten **pins** that are connected to the pinspotter by strings. The machine and tables are supported by two crossbars that are attached to the **kickbacks** which also act to contain and deflect the pins and balls during a game. Directly below the tables is the area of the lane called the **pin deck** upon which the pins rest during play. Behind the pin deck is the **pit** which is sloped to direct the balls to the exit opening in the kickback so that the ball can be propelled back to the bowler by the **horizontal ball accelerator** located in the space between the pair of pinspotter kickbacks. Behind the pit is a heavy curtain called a **cushion** that absorbs the impact of the bowling ball and pins, and at the front is a shield which raises and lowers during play.

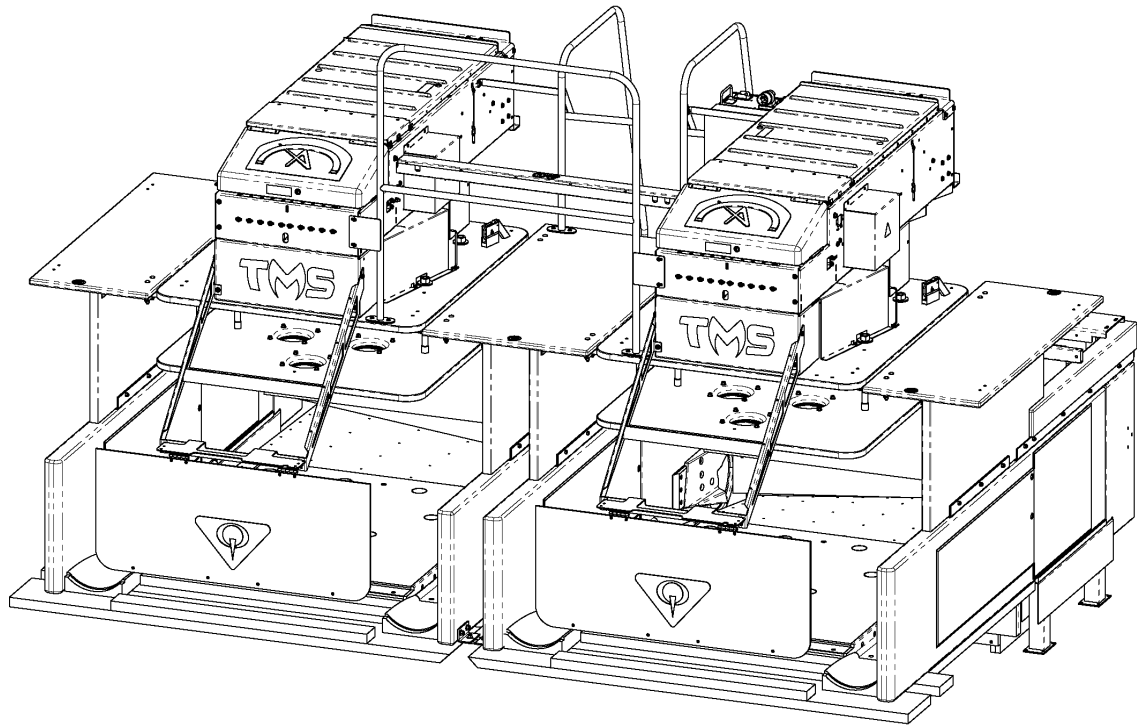


Figure 1, TMS Tenpin Pinspotter Pair

Located just to the right of the left hand pinspotter is the **controller** also referred to as the **control chassis**. This black box contains a computer, liquid crystal display, keypad, and numerous connectors, switches, breakers, and other electrical components necessary to control a pair of pinspotters. The controller contains the software used to guide the

machine through a game of Tenpins in accordance with the established rules of the game. The pinspotter can be used as a standalone unit or in conjunction with a separately available scoring system. Alongside each pinspotter housing under a metal enclosure is the **drawbar drive motor controller** and **radio frequency EMI filter**. The function of the controller is covered in more detail later in this manual.

Inside the pinspotter housing are a number of assemblies vital to the operation of the machine. Below the front plastic cover panel is the **pin detector circuit board assembly**. This control board is the hub through which the signals to and from the pin brakes and pin detectors travel. Pin information is relayed to the control chassis and on to the scoring system (if equipped).

Below the pin detector circuit board assembly are two rows of modules that house the **pin detectors** as well as the **pin brakes** and **solenoids**. Each string runs from its pin, up through the tables and through its associated pin detector where it passes between a pulley and a perforated wheel. When a pin is knocked over, the movement of the string causes the perforated wheel to rotate. This wheel movement is sensed by optical sensors, and if a sufficient amount of movement is detected, the controller registers that the pin has been knocked down. The pin detector's sensitivity setting is adjustable and is discussed in more detail in the adjustments section. The string then passes through the brake assembly. The purpose of this module is to hold its pin up near the lower table after it has been knocked down by the play of the first ball of the frame. This allows the bowler to attempt to knock down only those pins that remained standing after the first ball was rolled. The string then passes over a pivoting pulley and terminates on a take-up reel.

The ten pivoting pulleys are ganged together along a **drawbar**. Each end of the drawbar is attached to a chain that is driven by the **drawbar motor and gearbox** at the rear of the machine. Movement of the drawbar back and forth inside the machine causes the pins to raise and lower as needed to play a game, perform maintenance, or make adjustments.

Inside each pinspotter is a ramp that causes the drawbar's pivoting sheave assemblies for pins 4, 7, & 8 (even machine) or pins 6, 9, & 10 (odd machine) to pivot rearward as the drawbar approaches the front of the machine. This effectively reduces the amount of available slack in the strings for these pins reducing the likelihood that any of these pins will enter the ball exit opening and cause a pin jam.

Power Requirements

Voltage: 208 – 240 VAC, Single Phase

Current: 10A – 8.7A

Frequency: 50/60 Hertz



How It Works

Like driving an automobile, it isn't necessary to know all of the details of how the pinspotters work in order to operate them, but the more you know about the equipment, the more you will be able to recognize when maintenance or adjustment is needed in order to keep the machine in optimal operating condition. It can also help you to return a machine to operation quickly following a malfunction.

Each pair of pinspotters is controlled by a common chassis, through which all the settings for each pinspotter can be independently set. To guard against unauthorized access, the settings are password protected. The passwords are entered by pressing specific combinations of the arrow keys on the keypad. Once entered, each password remains in effect for a specific amount of time. Pressing certain pushbuttons before the time has elapsed restarts the clock. This allows time for the maintenance or adjustment to be completed without the need to constantly reenter the password.

Machine Modes

The control chassis can be placed in several **Modes**. They are:

Standby

Practice without Pins

Bowl Mode

Mechanics Mode

Practice with Pins

All of them except the Mechanics Mode can be accessed through the **Settings** Menu. (More on chassis menus in the *Control Chassis* subsection.) The **Mode** button on the keypad is used to cycle between the current Mode and the Mechanics Mode.

In Bowl Mode, each time a bowler rolls a ball, the pinspotter goes through a specific sequence of operations called a **Cycle**. At the beginning of a game, all ten pins are deposited on the pin deck and one **Red**, (1st ball) light is illuminated on the **Mask Panel**. When the bowler rolls the first ball of a frame, the passage of the ball is detected by the **Ball Detector** located near lane level just in front of the kickbacks. This tells the controller to begin "looking" for falling pins. The ball continues on and strikes the pins knocking some, and sometimes all, of them over. This causes the strings to move, which is detected by the pin detectors. After a time delay (to allow for ball speed and pin action) the chassis registers the fallen pins and sends a signal to the drawbar motor to raise all of the pins to the UP position. At the same time, the chassis sends pin data information to the scoring system (if one is part of your system). Once in a while the strings can become tangled from pin action. If this occurs, the control chassis can detect this and initiates a string untangle routine that lowers and raises different combinations of pins and that has been shown to be very effective in untangling pins. Once the pins reach the UP position (the drawbar is now near the rear of the machine at the HOME position), the chassis starts the drawbar motor in the opposite direction to lower the pins and sends a signal through the pin detector circuit board to momentarily energize the pin brake solenoids for those pins that had been knocked over. The



brake cams attached to the solenoids clamp the strings preventing those pins from lowering. The solenoids remain energized for only a second, and the weight of the pins keeps the brakes engaged. The brakes will release automatically when upward pressure is placed on the strings as the drawbar returns to the HOME position during the next cycle.

Meanwhile, the ball is guided to the ball exit by the slope of the pit where it enters the ball accelerator and is returned to the bowler. The pins that had not been knocked over continue to be lowered to the pin deck and are set for the second ball of the frame. When the pins are deposited on the pin deck, the drawbar has only traveled part way towards the limit of its forward movement. It continues on for several more inches. This does two things: 1) It raises the shield in front of the pin deck which lowered when the pins were cycled up, and 2) It provides the necessary slack in the strings to ensure the proper operation of the pin detectors. There needs to be sufficient slack available for this as well as to ensure that string tension does not influence the action of the pins. After the second ball is rolled, the fallen pins are registered, the total is sent to the scoring system (if applicable), and the machine sets a complete set of pins for the next frame.

More Details

TMS Control Chassis

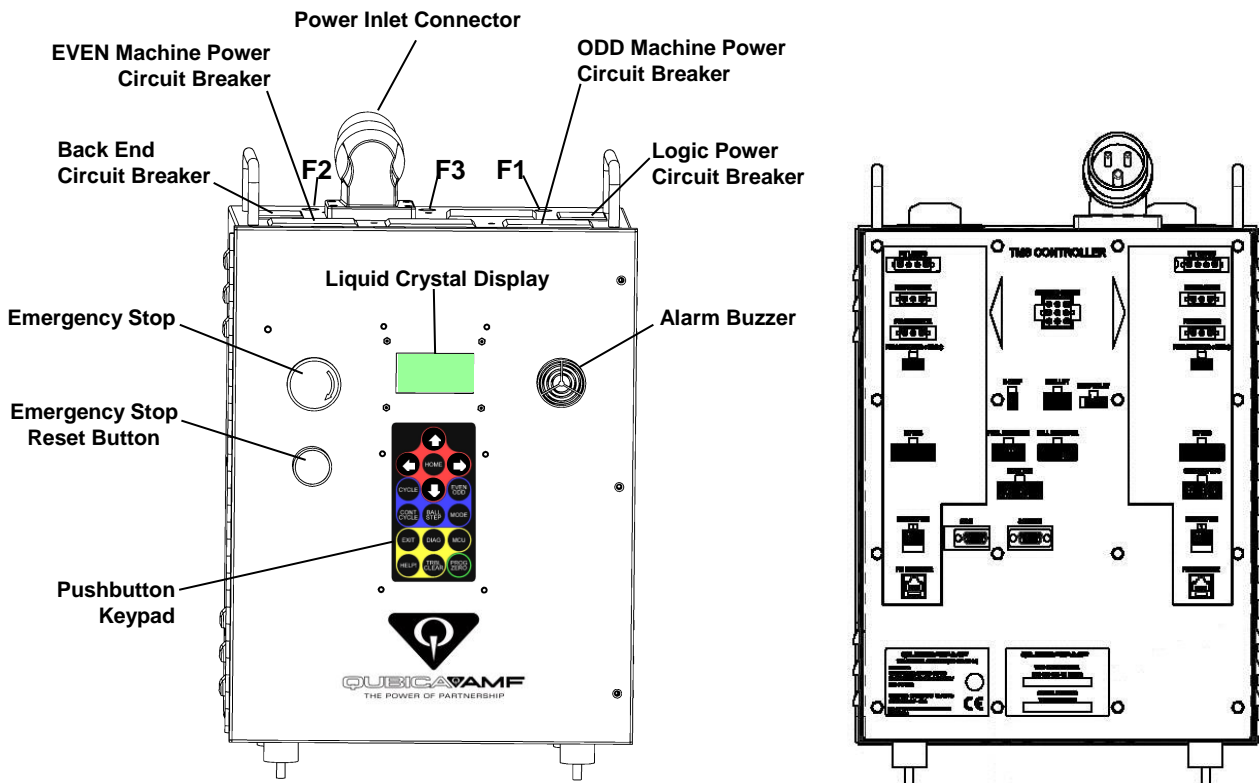


Figure 2, TMS Control Chassis



A power supply line is run from the main service distribution panel circuit breaker to each pair of pinspotters. A three conductor drop cord terminating with the provided **power connector**, is plugged into the control chassis to supply the necessary electrical power. Each pair of pinspotters share a control chassis which can be used with or without an automatic scoring system.

The control chassis is mounted to a bracket on the upper table between the two pinspotters and is used to supply the necessary electrical power to all components on a pair of pinspotters. A combination ON-OFF switch/circuit breaker for each lane is located on the top of the control chassis, as is a logic control power switch and a power switch that controls power to the ball accelerator (sometimes referred to as the back end).

Warning



High voltage is present in the pinspotter control chassis and on the pin detector circuit board. The main circuit breakers must always be OPEN or the power plug DISCONNECTED before working on any electrical component or cable.

The Control Chassis contains a keypad and display through which you can check and set all of the machine's operating parameters. A diagnostics button is provided to allow you to check the status of the various machine components and circuit breakers and a number to error messages can be displayed as well to help in the troubleshooting of any problems that should arise.

The Display

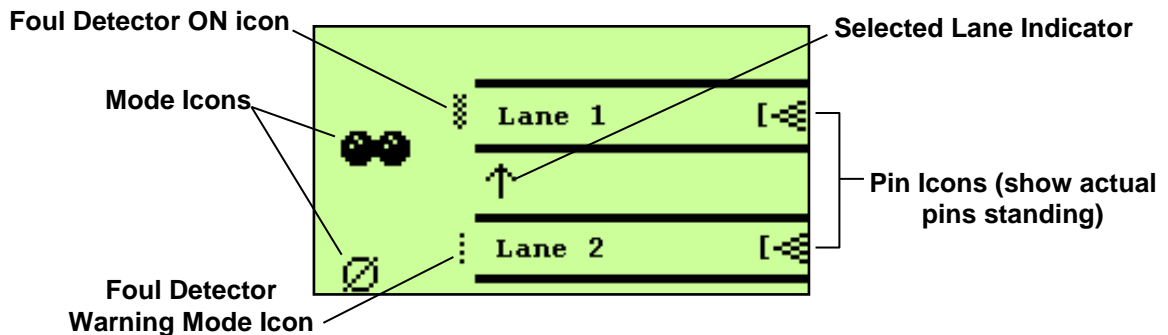


Figure 3, The Main Screen







Figure 3 shows a representation of the control chassis' liquid crystal display. Each pair of horizontal lines represents a lane with the pins at the right. (Horizontal lines that look like train tracks indicate the controller is calling for the bumpers, if installed, to be up.) The lanes shown here are numbered 1 & 2, but they will show the lane numbers entered into your chassis during the initial setup. For two-lane installations, they will be lanes 1 & 2. For larger installations, they will be numbered sequentially. This is especially




important if a common scoring system or management system is attached, as each lane needs to have a unique identifier. This parameter should only need to be set once.

An arrow between the lanes pointing either up or down indicates the lane that will respond to keypad commands and whose settings and diagnostics will be displayed. You can alternate between the odd and even lane by pressing the ODD/EVEN pushbutton on the keypad. **You must ensure the intended lane is selected when changing or viewing parameters and settings.**

To the left of each lane on the display is a symbol or symbols that convey information about the state of the equipment. For example, lane one shows that it is in the **BOWL Mode**, and that it is ready for the second ball of the frame. This would be a normal indication during a game. Lane 2 shows the symbol that indicates it is in **Standby** in a first ball condition. This is the normal state the machine would be in when a game is not in progress. The machine will not respond if a ball is rolled while it is in standby. This ensures that the owner has control of play. Other symbols and a brief description of their meaning are shown below.

-  **BOWL MODE** – Signifies that a game has started.
-  **STANDBY MODE** – Signifies that the machine is idle and is ready for a game to be started. Will not respond to a ball, but will respond to certain keypad commands.
-  **PRACTICE with PINS** – The machine will respond as if a game was in progress, but will not send pin fall data to a scoring system.
-  **PRACTICE without PINS** – The machine raises the pins to the UP position and returns balls to the bowler. Sometimes referred to as shadow bowling.
-  **MECHANICS MODE** – Signifies that the pinspotter is ready for adjustment and/or testing. The machine will not respond to the ball detector or pins being knocked over.
-  **CONTINUOUS CYCLE** – The pinspotter cycles on a preset schedule (approximately every 30 to 35 seconds). Used mainly for testing.

NOTE: A single symbol to the left of a lane icon indicates the machine is in the first ball cycle, while two identical side-by-side symbols indicate that it is in the second ball cycle.

-  **(flashing) UNLOCKED** – Indicates that the control chassis keypad is unlocked and that it has not timed out. It is done by entering a valid password or by pressing one of the center three pushbuttons on the pin detector circuit board assembly. Required for changing settings, resetting error messages, etc.



E-STOP

An emergency stop (**E-Stop**) pushbutton is provided to shut down the machine rapidly should the need arise. This pushbutton shuts down both pinspotters and is located on the face of the control chassis. Some configurations where 10Pin-Swap is enabled as the Game also include an E-Stop pushbutton at the front of the machines. To restart the machines from an emergency stop condition:

1. Rotate the E-Stop pushbutton clockwise (chassis) or pull it (front) until it pops out.
2. Press the blue E-Stop Reset Button located just below the Emergency Stop Button on the front of the control chassis.
3. Press the **TRBL CLEAR** pushbutton on the keypad. The word **PASSWORD** will flash at the bottom of the display.
4. Enter the *Trouble Clear* password. The unlocked symbols flash on the display and the flashing E-STOP message for the selected lane turns off.
5. Press the EVEN/ODD pushbutton on the keypad to select the other lane.
6. Press the TRBL CLEAR pushbutton again. The flashing E-STOP message for the other lane turns off. The machines return to their previous operating Mode.

For more on passwords, see the subsection on passwords later in this section.



The Keypad

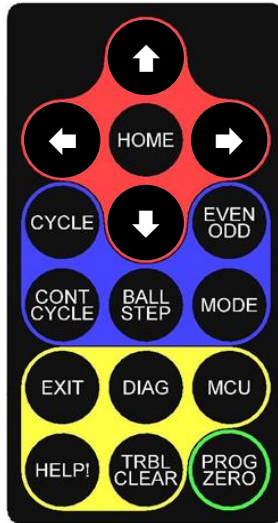


Figure 4, TMS Control Chassis Keypad

The keypad is used to enter and view settings, check equipment status, change modes, clear error messages, enter passwords, and initiate machine operations. A brief description of each button's function follows. Some actions can only be performed if the correct password is first entered using the arrow keys. For a complete list of the functions and settings available using the keypad, see the *TMS Chassis Logic Tree* in Section 4 of this manual.

HOME – The position of the drawbar at its rearmost limit of travel. The **LOS (Limit Optical Sensor)** senses when the drawbar has reached the HOME position and sends this information to the control chassis. At HOME, the pins are in the UP position and the drive motor encoder counts are reset to zero.

↑ UP ARROW – Used to scroll upwards through a list.

↓ DOWN ARROW – Used to scroll downward through a list.

➔ RIGHT ARROW – Used to scroll through and select an item in a sublist.

➔ LEFT ARROW – Used to scroll backwards through a list or sublist.

CYCLE – Causes the pinspotter to cycle the pins up and down (or down and up depending on their initial position).

EVEN/ODD – Switches the keypad and display functions back and forth between pinspotters. The Arrow and Lane ID on the display indicate which pinspotter is the active machine (the one whose parameters are being displayed and whose settings will be changed when the keypad is used).

CONTINUOUS CYCLE (CONT CYCLE) – Causes the machine to start and stop a repetitive pin cycling routine. (See Section 2.)



BALL STEP –	Causes the controller to switch the selected machine from a first ball to a second ball condition or from a second ball to a first ball condition without cycling the pins.
MODE –	Cycles the selected pinspotter between the current mode and the Mechanics Mode.
EXIT –	Returns the controller to the previous menu level. Pressing it a second time returns the controller to the main screen.
DIAGNOSTICS – (DIAG)	Allows the user to view the state of the various system components.
MCU –	Allows access to the <i>Settings, Functions, and Counters</i> submenus.
HELP! –	Press and hold to display a brief message about the current screen or menu selection.
TROUBLE CLEAR – (TRBL CLEAR)	Press to clear error messages. Requires a password. Must fix the machine fault first. For example, a tripped breaker must be closed before the error message can be cleared.
PROGRAM ZERO – (PROG ZERO)	Stops the string untangle routine.

Passwords

To prevent unauthorized changes to your machine's software settings, most keypad and control chassis functions are password protected. There are three passwords which are entered by pressing specific combinations of keypad arrow pushbuttons. The first password is the *Trouble Clear* Password. This is used to activate the TRBL CLEAR pushbutton on the keypad. A password is necessary because pushing this button to clear an error message can cause the machine to cycle (depending on the fault being cleared). The second password, the *General* password, is required any time the MCU, CYCLE, *HOME, or MODE pushbuttons are pressed. These buttons allow the user to change machine functions, and is necessary to prevent unauthorized changes. The third password is the *Output Control* password. This enables control of individual outputs for diagnostic purposes. It is accessed from the diagnostic menu.

*No password is required for the HOME button if 10_PINS_SWAPPED mode is selected.

There is a fourth password (that is not provided) that is required to change the game type. The game type is set during machine installation and should never need to be changed. The password is necessary because setting the chassis to the wrong game type for your installation will cause the machine to malfunction. The *Game Type* is for installers and Technical Support personnel and is not disclosed in this manual.

Trouble Clear Password: ↑↓↑↓→ (UP-DOWN-UP-DOWN-RIGHT)

General Password: ↓←↑→↑←↓ (DOWN-LEFT-UP-RIGHT-UP-LEFT-DOWN)

Output Control Password: ↑→→↓←←↑ (UP-RIGHT-RIGHT-DOWN-LEFT-LEFT-UP)



Menu Items

The *Settings*, *Functions*, and *Counters* menus are accessed by pressing the **MCU** pushbutton and entering the *general* password. When you have finished accessing the menus, press the **EXIT** pushbutton on the keypad while in the top menu (main screen) to immediately lock chassis access. As a backup, a timer will automatically lock access after 15 minutes (*general* password) or 5 minutes (*Trouble Clear* password) of keypad inactivity unless the chassis is in the Mechanics Mode, which bypasses the auto-timeout feature. Password protection helps to prevent unauthorized access to machine software settings. A listing of each submenu is described below. Factory defaults are shown in **BOLD**. Use the right arrow pushbutton to scroll through the list associated with each menu item or to select an item in the list.

SETTINGS MENU

Parameter	Possible Settings	Additional Information
Odd Lane ID	1, 3, 5, 7, 9 . . . 127	The even lane ID is automatically programmed as the next higher even number.
Chassis Mode	<i>Standby, Bowl, Practice Pins, Practice no Pins</i>	Mechanics Mode is accessed using the MODE pushbutton.
Auto Backend Shutoff	<i>On, Off</i>	Turns off the ball accelerator after a period of 40 seconds without a ball being detected if neither pinspotter is in the Mechanics Mode.
Auto Ball Lift Shutoff	<i>On, Off</i>	Turns off the ball lift at the approach when the ball accelerator is not running.
Ball Detector	<i>Round, Square</i>	Set for type of detector installed
Bumpers	<i>Up, Down, Auto</i>	Default is DOWN for the Tenpin game.
Foul Detector	<i>Off, Warning, On</i>	Default is ON for the 10-Pin/10PinSwap game. Warning sounds buzzer, does not penalize score.
Game	<i>Highway66, 10 Pins, Duck Pins, KnockOut, 10PinSwap</i>	A password is required to change this item. Selecting <i>10-Pins</i> or <i>10PinSwap</i> automatically changes the settings to the 10-Pin game defaults.
Mask Lights	<i>AS: Bowl/No Bowl, AS: Ball Number</i>	The 10-Pin game default is: AS: Ball Number (1 st ball, 2 nd ball)
Pin Data Delay	2.0, 2.3, 2.6, 3.0, 3.3, 3.6, 4.0, 4.3, 4.6, 5.5	The 10-Pin or 10PinSwap game default is: 3.0 . (number of seconds after a ball is detected before pin fall data is collected)
Pin Detector Count	4, 5, 6 . . . 20	10-Pin or 10PinSwap game default is 15 . Indicates the relative amount of string movement needed to register as a fallen pin.
Pin Park State	<i>Up, Down</i>	Determines pin position upon completion of game.
Pit Light	<i>White, Black</i>	“Black” light is used for colors.
Scoring System	<i>Scoring, Standalone</i>	Standalone is used when no automatic scoring system is attached.
Smart Cycle	<i>Off, On</i>	Default is ON for 10-Pin/10PinSwap game. Makes the machine ready for the second ball of the frame without cycling pins if no pins were knocked down by the first ball (gutter ball). Speeds up the game.
Stabilizing Time	1.5, 1.75	10-Pin or 10PinSwap default is 1.75 . Time delay in seconds at UP position motion before resetting.
Tenth Frame Switch	<i>Full, Partial, Off</i>	Determines whether the response to pushing the tenth frame button is a full set, a partial set, or no response.



FUNCTIONS MENU

Selecting the Functions Menu brings up a list of items that can be used for testing the machine, setting the machine up in the correct condition for adjustment, or for viewing and resetting the counts for the number of balls that have been played.

Function	Explanation
Pins Full Set	Sets all pins on the pin deck.
Pins Partial Set	Sets pins as they were after the first ball of the frame – restores a second ball setup, if needed.
Pins Up	Raises all pins to up.
Pins Down	Sets all pins on the pin deck.
Brake Adjust	Runs the drawbar forward and momentarily energizes the brakes to check for brakes that need adjustment.
String Adjust	Runs the drawbar to the back and holds it there so that the strings can be properly adjusted.
Calibrate Drive	Used to initiate a motor controller calibration following replacement of the drive motor controller, drive motor, or EPM (electronic programming module).
Reset Bowling Counters	Resets the count of the number of balls played in BOWL Mode since the last reset.
Reset Mechanic Counters	Resets the count of the number of balls played in Mechanics Mode since the last reset.
Reset to Factory Settings	Changes many of the settings under the Settings Menu back to the factory defaults. NOTE: This does NOT change the Game type or the Game's default settings.

COUNTERS

Selecting *Counters* from the menu list brings up the following screen for the lane indicated.

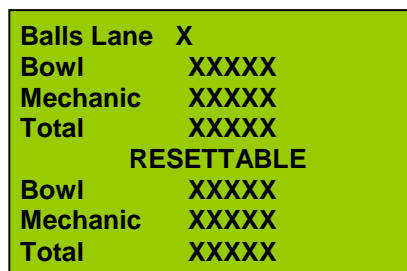


Figure 5, Counters Screen

Where XXXXX represents the number of balls rolled in the modes listed. The top three numbers represent the totals since manufacture and cannot be reset. The bottom three numbers are the totals since they were last reset using the *Functions* menu. (The Counts can be useful for scheduling maintenance and for tracking the amount of play over a given period of time.)



Diagnostics

Pushing the DIAG pushbutton will display the Text Menu, Graphics, and Output Control submenus.

Text Menu

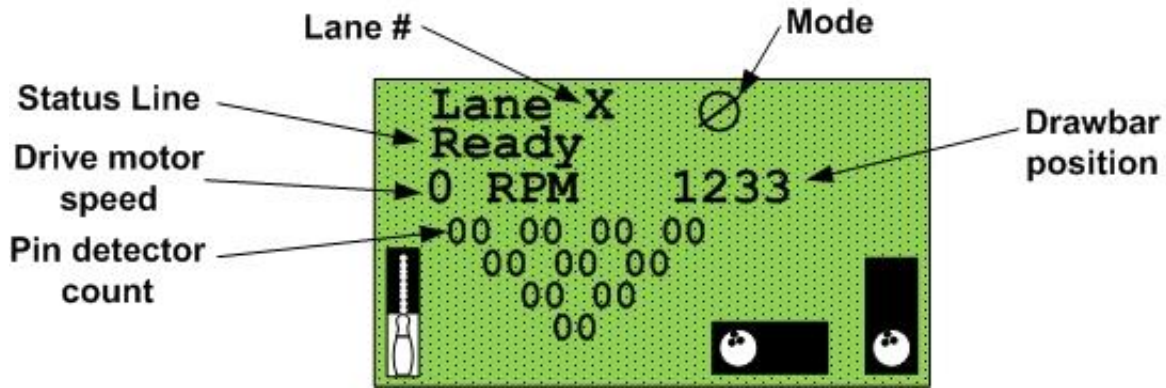
Selecting text menu will display a list of components that are monitored by the control chassis. This can be very useful when trying to figure out why the pinspotter isn't operating normally. A list of monitored components and their possible states is shown below.

Monitored Component	Possible States	Additional Information
Backend Breaker	OK, Tripped	Ok when on, Tripped when off.
Backend Motor	On, Off, Asleep	Asleep is a state which the motor turns off after a period of inactivity during a game.
Ball Detector	Ball, No Ball	
Ball Lift	On, Off, Asleep	Asleep is a state which the motor turns off after a period of inactivity during a game.
Ball Sensor	0, 1	
Drive Encoder	0 to 1250 / Valid / Invalid	This the count for the encoder wheel of the motor. Invalid indicates either an out of normal value or the home position has not been set.
Encoder Sensors	A:ON/OFF B:ON/OFF	Monitor both optical sensors of the encoder.
Drive RPM	-900 to 1800	This is the speed the motor controller is asking the motor to turn.
E-Stop Loop	Closed, Open	
Foul detector	Foul, No Foul	
Home	Home, Not Home	
Lane Breaker	Ok, Tripped	Ok when on, Tripped when off.
Mask Lights On	Go(green), No Go (Red)	Indicates which light of the masking is on.
Mechanic Call	On, Off	
Pin Encoder	xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx	Indicates the counts of the pin detectors wheels.
Software	VX.XX	Software version of the chassis.
Stack Lights	Off, Red, Green, Red and Green	
Tenth frame	On, Off	



Graphics

The graphics menu displays a graphic indication of the pinspotter status as shown below:



The *Status Line* indicates the state of the pinspotter, such as: **Ready**, **Spotting Pins**, **Parking**, **Adjusting Pins**, and **Detangling**. It can also indicate any of the following error messages:

- LANE BRKR
- BE BRKR
- E-STOP
- DRIVE ERROR
- LOCKOUT

Error messages are shown in reverse text.

Pin Detector Data is usually 00 or 01, unless the pins are moving. After the pins are set on the pin deck and are no longer moving, the control chassis resets the pin data to 00 so that it can sense additional pin movement. This graphic indication can be used to verify pin detector operation during troubleshooting.

Drawbar position gives an indication of the position of the drawbar as determined by the motor encoder count. A count over 1,200 indicates the drawbar is near the front limit of its travel. A zero count signifies that the drawbar is at the home position towards the rear of the pinspotter.

Output Control

Within the output control menu you can control every output by using right and left arrow buttons once the desired output is highlighted. Below is a list of the outputs that can be controlled:

- Ball Lift, Mask Ball 1, Mask Ball 2, Bumper, Buzzer, Spare Relay, Foul Light, Foul Buzzer, Backend Pad, Backend Motor, Red Stack Light, Green Stack Light, Pit Light 1, Pit Light 2, Brake, Red Lamp, Counter, and Drawbar Motor.



Drawbar Motor Controller

The drawbar motor controller takes the single phase, 50 or 60 hertz power that is supplied to the control chassis and converts it to three phase, 0 to 200 hertz power for the operation of the three phase drawbar drive motor. The speed of this motor is proportional to the frequency of the power supplied to it. By using a variable frequency controller, the speed of the drawbar motor can be varied to optimize the operation of the pinspotter. A variable low voltage direct current signal supplied by the control chassis to the motor controller determines the output frequency of the controller. A pamphlet detailing the operation of this component is included with your machine and contains important information concerning safety, operation, troubleshooting, and diagnostic messages.



Figure 6, Drawbar Motor Controller

Drawbar Motor

Located at the rear of each pinspotter is the **drawbar motor and gearbox assembly**. This three phase AC motor is coupled to a **reducer** that drives a chain and sprocket arrangement to drive the drawbar over its length of travel and is controlled by a **variable frequency motor controller**. The motor contains an encoder and disk assembly. The disk has a series of light and dark areas that are sensed by the optical encoder. When the drawbar is driven to the HOME position, as detected by the **Home Sensor (LOS)**, the drawbar motor encoder reading is zeroed. As the motor rotates during operation, the encoder detects the bars on the disk and sends this information to the control chassis which counts the number of bars to determine the position of the drawbar. This information allows the Chassis to control the drawbar motor's speed to optimize machine operation. For example, the pins can be lowered fast and then slowed down just before they reach the pin deck to minimize the chances of any pins falling over when being set, and then the motor can speed up again to finish the cycle thereby speeding up play.

Drawbar

Spanning the width of the pinspotter and attached to chains on both sides of the pinspotter is the **drawbar**. The drawbar is made up of **sheave (pulley) assemblies** (one for each pin) mounted on a shaft. Each sheave guides and takes up the slack of its corresponding pin's string when the drawbar is driven towards the rear of the machine.

In addition to moving the pins, the drawbar operates the **shield**, which is designed to deter the bowler from rolling a ball while the machine is cycling. The shield moves in opposition to the pins. When the drawbar is pulled toward the rear of the pinspotter, the shield is lowered. When the drawbar returns to the front of the pinspotter to lower the pins, the shield is raised.

Strings

The strings are the concept of the machine. Each pin has fourteen feet of string attached to it. A four-foot length of this string is wound on each **take-up reel arm assembly** to be used as spare string. In other words, each pin needs ten feet of string to operate normally.

Properly adjusted, a string should only wear immediately above the pin. When it wears, it can be pulled through the pin, the worn-out section (approximately six inches) cut off, the string refastened, and an equal amount of string unspooled from the take-up reel. With an extra four feet of string on the take-up reel, each string may be repaired up to eight times before having to be replaced with a new fourteen-foot length.

Each take-up reel is mounted to a spring-loaded bar that helps limit the tension that can be applied to the strings when the pins are raised to the up position and make contact with the underside of the table. This keeps the strings from being overstretched or pulled out of the pins from excessive force.

Note The TMS pinspotter's operation is directly related to the proper length of the strings, which are adjustable. Any variation in the length of the strings caused by humidity, stretching, or incorrect adjustment is sufficient to adversely affect system operation.

Pin Stabilizers

Below the pinspotter housing are two tables. The upper table supports the pinspotter and contains the pulleys that guide the strings into the machine. The lower table acts as a pin stabilizer. When the pins are raised after being knocked over and scattered, they can be swinging and spinning. The plastic stabilizer rings mounted to the underside of the lower table quiet pin movement and stabilize the pins rapidly so that they can be reset as quickly as possible. The stabilizers also center the pins over their designated positions on the pin deck to ensure consistent pin setting. The plastic rings also prevent wear to the table.

Pin Detectors and Pin Detector Circuit Board Assembly

Mounted at the front of the pinspotter are the **pin detectors** (one for each pin) and the **pin detector circuit board assembly**. The pin detectors sense movement of the strings that are attached to the pins. A detector consists of an optical sensor, a pulley, and a wheel which rotates when its corresponding string moves. Each wheel has four holes in it, and rotates through an **optical sensor**. As the wheel turns, the optical sensor detects whenever one of the holes passes through it and sends this signal to the pin detector circuit board. This information is relayed to the pinspotter control chassis which compares the number of holes seen by the sensor against the sensitivity setting (*pin detector count*) to determine if the pin has been knocked over.



The pin detector signals are routed to the control chassis along with the **brake solenoid** circuits via the **pin detector circuit board assembly**.

The pin detector should not be accessed with the cover open and the machine power on. Use the chassis controller to direct machine action. If lit LEDs are visible during a maintenance operation, close the top cover. Re-start the operation and apply LOTO before opening the top cover. The pin detector may have to be moved in order to perform some maintenance. The pin detector buttons are used for factory testing but should not be used in normal operation.

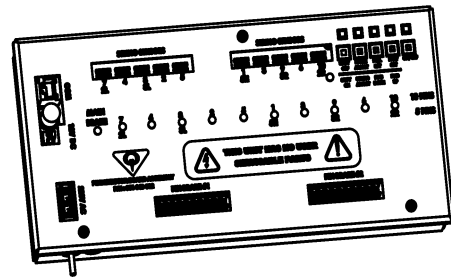


Figure 7, Pin Detector Circuit Board Assembly

Pin Brakes

Mounted just to the rear of the pin detectors and below the take-up reel assemblies are the **pin brakes**. There is one brake assembly for each pin. The brake assembly has three main parts: a **cam**, a **solenoid**, and a **brake plate**. When a pin is determined to have fallen and the pins have been raised to the up position, its solenoid activates the cam which in turn pinches the string against the brake plate to secure the string, holding the pin up while the drawbar lowers the remaining pins to the pin deck. It is only necessary to energize a brake solenoid momentarily for the brake to function. The weight of the pin keeps the brake engaged until the pin is raised slightly by the drawbar during the next cycle.

Shield

The pinspotters are equipped with a shield consisting of a plastic panel that is lowered in front of the machine whenever the pins are raised. This panel indicates to the bowler that the machine is NOT ready to receive a ball adding an element of safety whenever someone needs to enter the machine area for maintenance, **although it should be noted that the shield will not prevent the passage of a ball**. The shield is connected to the back of the drawbar by a string. When it is properly adjusted, it raises only after the pins have been set, allowing the chassis to determine if any pins fall over during setting before indicating to the bowler that the machine is ready. **The shield string is connected to the drawbar by a clip that can be disconnected to keep the shield in the down position while making and testing machine adjustments.**



Pit Lights

Each pinspotter has a pit light assembly mounted to it. The pit lights are off in Standby and come on in Bowl and Mechanics Modes. Each pit light can either shine white or “black”. When set to black, you can select any one of the preset colors available. The decision to shine white or a color is selectable from the control chassis *SETTINGS* menu. To select a color, the black setting must be select, then press the red button on the pit light’s DMX dimmer box until the desired color is shown. To turn on a white light for any reason (even if the pinspotter is powered down), press the red button and hold it for approximately two seconds.

Ball Detector

The ball detector consists of twin combination **transmitter/sensor** units located on the flat surface above the under-lane ball return track between the two lanes of a pinspotter pair just in front of the kickbacks, and **reflectors** located on the capping on the opposite sides of the lanes across from the transmitters. The transmitter emits an infrared beam which the reflector returns to the **sensor**. As the ball rolls down the lane, it obstructs the **ball detector's** infrared light beam preventing it from being reflected back. The ball detector then triggers, or starts, the pin detection cycle. **The ball detector must be operational for the pinspotter to function. All commands to and from the pinspotter start with the detection of a ball.**

The Pit

Located behind each lane's pin deck is the **pit**, which is slanted to the inside of the pair of lanes in order to direct the ball to the **ball accelerator**. Above the back of the pit, hangs the **cushion**, which absorbs the impact of the bowling ball.

Ball Accelerator

When the ball exits the pit area, it drops onto a pair of rails located just behind a horizontal belt driven by a single phase AC (back end) motor that receives power from the control chassis. The rails are pitched downward causing the ball to roll forward and under the belt. When the ball contacts the belt, the ball is accelerated along the rails, onto a track, and returned to the ball rack.



Powering Up the Machine

When the pinspotter is turned on by placing the **Logic Power Switch**, located on top of the control chassis, in the ON position, the control chassis “boots up”. At the end of its boot cycle, the chassis goes into the Standby Mode and awaits operator interaction. By pressing the *Cycle* pushbutton on the keypad and entering the general password, or by placing the pinspotter in the Bowl Mode, the pinspotter enters a pin deck calibration cycle where it runs the drawbar to the *Home* position, sets the drawbar drive motor encoder counts to zero, and then slowly lowers the pins to the pin deck. It does this because at this point it does not “know” where (at what counts) the pin deck is and must locate it. It does this by monitoring the pin detectors. As long as there is string movement from lowering the pins, it knows the pins have not reached the pin deck. When the pins touch the pin deck, the drawbar continues forward, but pin detector activity (string movement) stops. The chassis registers and remembers this drive motor encoder count total as the pin deck location. From this point on (as long as the machine remains powered up) it remembers this count total and during each cycle it slows down the lowering of the pins at a preset number of counts short of this total to minimize the chances of pins falling over while being set, and then speeds up again to complete the cycle.

Note If during the pin deck calibration process the drawbar is unable to reach the HOME position, the control chassis will stop the pin deck calibration process and wait for an intervention from the user. (See the Troubleshooting section for more details.)

Pinspotter Cycles

The pinspotter must be able to take several different actions based on the rules of bowling, and set up the machine for delivery of the correct ball (first ball or second ball of the frame). After the bowler delivers the first ball of a frame, the ball detector sends a signal to the pinspotter control chassis. The chassis determines whether there are pins standing and what type of cycle to perform. This process is called reading, and according to all the information that the pinspotter control chassis analyzes, the pinspotter will cycle in one several possible manners.

Partial Set

If a partial set is necessary, the pinspotter control chassis activates the individual brakes for each pin that was detected as being knocked down. The pinspotter then lowers and sets only the pins that were not knocked down, raises the shield, and indicates that the system is ready for the next ball.



Full Set

If all of the pins were detected as being knocked down or at the completion of a frame, a full set is necessary, so none of the brakes are activated. The pinspotter spots a full set of pins on the lane, raises the shield, and the lane is ready for the next frame.

First Ball

A full set of pins is placed on the pin deck, and one red LED is illuminated on the Mask Panel. This is the condition at the start of every frame.

Second Ball

A full or partial set of pins (depending on the number of pins knocked down by the first ball) is placed on the pin deck, and two red LEDs are illuminated on the Mask Panel.

Smart Cycle ON

If no pins were knocked over by the first ball of the frame (gutter ball) and Smart Cycle is ON, the pins do not cycle up and down, and the second red LED is illuminated on the Mask Panel indicating that the machine is ready to receive the second ball of the frame. This eliminates an unnecessary cycling of the machine and speeds up play. The machine will always cycle after the second ball of the frame.

Strike

If all ten pins are knocked down by the first ball of the frame, the pinspotter sets a complete set and stays in the first ball mode (begins a new frame).

Tenth Frame

In the tenth frame, a third ball will be given if a strike or spare is scored with the first two balls. The machine will set up in a first ball condition after a strike. The scoring system (if attached) will score the results as a third ball in the tenth frame only.

String Untangle Routine

If the strings become tangled, the drawbar will not be able to reach the Home position. This will cause the TMS control chassis to activate the pinspotter's pin untangling routine, which directs the pinspotter to make up to eight attempts at untangling the strings by lowering and raising the pins in different combinations until the strings are untangled or the maximum number of attempts is reached.



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SECTION 2

Setting Up & Adjusting the TMS Pinspotter



2.0 Setting Up & Adjusting the TMS Pinspotter

Section Overview

This section provides step-by-step instructions for setting up and configuring your equipment to meet your needs along with instructions for periodic adjustment and servicing to help ensure a smooth running machine.

This manual does not cover installation of the TMS Pinspotter, operation of a scoring system, bowler interface, or cash management system. Refer to the documentation that came with your add-on systems for information relating to those systems.

The electronic unit controlling the pinspotting machine and accessed by the user may be interchangeably called the “chassis,” “controller,” or “chassis controller.” An electronic unit inside the pinspotter may be interchangeably called the “pin detector,” “pin detector board,” or “pin detector box.”



Initial Setup

Your pinspotter was installed by QubicaAMF-authorized technicians and configured in a manner to give optimal performance under most situations. This section explains some of these initial setups and adjustments. Understanding this and how it affects the operation of the machine will make it easier to keep the machine functioning smoothly and with fewer problems.

Some initial setups are performed at the factory and some during installation. For example, the drawbar drive motor controller must be calibrated to the specific drive motor in your machine, and this was done at the factory during initial machine testing. String adjustment is done in the field because they are matched to your specific installation.

The drawbar motor controller contains programming that is specific to the TMS pinspotter's operation. This programming is contained in a memory chip called an **electronic programming module (EPM)**. This module is replaceable should that ever become necessary. It is important to note that if it is replaced, or if the EPM from one machine be swapped with the EPM of another machine, the drive controller(s) must be recalibrated. This is also true whenever the drive controller or drive motor is swapped or replaced. The procedure for calibrating the controller is discussed later in this section.

The remaining initial setups are mostly related to the control chassis. The factory defaults are geared towards providing trouble-free performance, but since conditions can vary from bowling center to bowling center, many of these settings have been made user programmable. The recommended factory settings associated with a 10-Pin setup are automatically set when the Game type is set, and while the Game type cannot be changed, the associated settings are programmable. If you ever use the *Functions* menu to reset the control chassis to its factory settings, any setting changes you have made to customize your setup will need to be manually reentered as well.

Adjustments

All of the adjustments needed for the operation of your TMS pinspotter were made prior to placing your machine into service. Periodically, some of these adjustments may need to be repeated. This section contains the procedures for making these adjustments. Be sure to observe all of the safety precautions and read the instructions carefully before beginning any machine maintenance. LOTO procedure is to be implemented in the facility. Shutoff and LOTO machine before entering.

The adjustments can be broken down into two general categories: electronic adjustments, and mechanical adjustments. Electronic adjustments are generally easy to make and are done by changing the control chassis software settings. A few of the adjustments contain elements of both categories.



Warning:



High voltage is present in the pinspotter control chassis, drive motor controller, and pin detector circuit board. The main circuit breaker must always be **OPEN** or the electrical power cord **DISCONNECTED** prior to opening any cover that exposes electrical connections or circuits and before performing any mechanical adjustment.

See Lockout/Tagout Procedure.

TMS Control Chassis Settings

The TMS control chassis provides the user with the means of changing a number of parameters that can be used to set up or modify certain machine functions for optimal performance. These settings can be accessed using the keypad and liquid crystal display on the front of the chassis.

Section 1 provided a list of all the settings that can be made from the chassis as well as an indication of the default settings. Sometimes it is beneficial for the pinspotter to be configured differently in order accommodate your specific conditions and needs. The following is a list of the electronic adjustments that can be made to customize the machine's operation along with some information to help you understand the consequences and interactions associated with changing these settings. Not all setting changes are discussed here because many of them are self-explanatory or are simple on/off settings.

This section provides information concerning:

- | | |
|---------------------------|-------------------------|
| Pin Data Delay | Continuous Cycle |
| Pin Detector Count | Calibrate Drive |

Pin Data Delay

This feature allows pin action to occur before the machine tallies the pin fall data. Once the delay has elapsed, pin data is gathered very quickly, and any pins that fall over after the delay will not be counted and will be reset for the second ball of the frame, if applicable. The delay period starts when the ball detector detects the passage of a ball. The default setting is three seconds, and sometimes this does not provide enough of a delay to capture all of the pin fall. This is especially true for a very slow ball. By their nature, the larger 10-pins (as compared to the smaller Highway66 pins, which also utilize this pinspotter) are slower to react, and so this setting is adjustable so you can find a happy medium between capturing all of the pin fall data without unnecessarily slowing down play.



To change this setting:

- Press the MCU pushbutton on the keypad
- Enter the general password (DOWN-LEFT-UP-RIGHT-UP-LEFT-DOWN)
- Select *Settings* (right arrow)
- Scroll up or down (up or down arrow) through the list of settings until *Pin Data Delay* is on the top line of the screen.
- Scroll to the right or left (right or left arrow) until the desired time delay is displayed.
- Press the EXIT pushbutton twice to return to the main screen.
- Press the EXIT pushbutton to lock the keypad.

Pin Detector Count

This feature determines the sensitivity of the pin detectors. The optical sensors of the pin detectors “see” the holes in the wheels that rotate because of string movement. The control chassis counts the number of holes for each pin and compares it to the setting. If it is equal to or more than the default setting, it is virtually assured that it is due to the pin being knocked over. Simply being slid to the side by contact with the ball or another pin does not produce sufficient string movement. The default setting is 15 with a maximum of 20 and a minimum of 4, but setting it too high or low will cause pin count errors. If you find that a pin falling over does not register as fallen, you can decrease the setting which increases the sensitivity (it takes fewer holes to register as a fallen pin). This is a single setting that applies to all of the pins of a pinspotter (but each pinspotter of the pair can have a different setting). Note: before lowering this setting, make sure that the reason a pin wasn't counted isn't due to the delay time having expired. Pins must fall over during the delay period in order to be counted.

To change this setting:

- Press the MCU pushbutton on the keypad
- Enter the general password (DOWN-LEFT-UP-RIGHT-UP-LEFT-DOWN)
- Select *Settings* (right arrow)
- Scroll up or down (up or down arrow) through the list of settings until *Pin Detector Count* is on the top line of the screen.
- Scroll to the right or left (right or left arrow) until the desired setting is displayed.
- Press the EXIT pushbutton twice to return to the main screen.
- Press the EXIT pushbutton to lock the keypad.




Continuous Cycle

While not actually a setting, the Continuous Cycle feature can lead to some confusion if not clearly understood. This feature causes the machine to cycle every 30 to 35 seconds, and is generally used for tests and demonstrations. The timing of the cycle is not user adjustable. The Continuous Cycle feature contains two types of cycles: a continuous cycle of all the pins, and a continuous cycle of a random selection of pins where a different group of pins is set during each cycle. A prerequisite for placing a machine in a continuous cycle is that the machine must first be in the Mechanics Mode.

To place the machine in a continuous cycle:

- Press the Mode pushbutton on the keypad
- Enter the general password (DOWN-LEFT-UP-RIGHT-UP-LEFT-DOWN). The chassis will enter the Mechanics Mode.
- Press the Continuous Cycle pushbutton.

Several of the icons on the screen will begin flashing and the continuous cycle icon  will appear in place of the Mechanics Mode icon, but it will not be flashing.

To place the machine in the Random Pins cycle:

- While the machine is in a Continuous Cycle, press the Continuous Cycle pushbutton.

The Continuous Cycle icon will begin flashing and the machine will begin setting random groups of pins.

To exit from a Continuous Cycle condition:

- Press the Continuous Cycle pushbutton TWICE.

To exit from a Random Pins cycle:

- Press the Continuous Cycle pushbutton ONCE.

To return the machine to service:

- Press the Mode pushbutton to go from the Mechanics Mode to the previous Mode. You cannot lock the keypad while in the Mechanics Mode, and the timeout feature will not function.
- Press the EXIT pushbutton to lock the keypad.



Calibrate Drive

As mentioned previously, any time the drawbar drive motor, drive motor controller, or electronic programming module is changed, you must perform a drive calibration. The calibration electronically matches the drive to the motor.


To run a drive calibration:

- Press the Mode pushbutton on the control chassis keypad.
- When prompted, enter the general password (DOWN-LEFT-UP-RIGHT-UP-LEFT-DOWN)
- Press the MCU pushbutton on the chassis keypad.
- Scroll down and select *Functions* using the ↓ & → Arrow pushbuttons.
- Scroll up or down until the cursor points to *Calibrate Drive*. **DO NOT** select this function with the Right Arrow pushbutton at this time.



Warning: High voltage is present inside the plastic housing of the drive motor controller. Exercise caution when removing any cover that exposes electrical connections or circuits.

On the drive motor controller:

- If necessary, remove the metal enclosure that covers the drive motor controller from the side of the pinspotter.
- Press the blue Mode button  .
- Use the drive's up or down buttons to select parameter **P399**.
- Press the blue Mode button again. The current parameter value is displayed.
- If necessary, use the up or down button to set the parameter to 01.
- Press the blue Mode button again. The drive's display will alternate between *STOP* and *CAL*.

On the TMS chassis keypad:

- Press the Right Arrow pushbutton to select the *Calibrate Drive* function and start the calibration process. The motor drive display will flash *CAL* for approximately 20 seconds and then will display *STOP*.
- Push the Cycle pushbutton on the chassis keypad to complete the process and to test the machine.
- Press the Exit Pushbutton twice to return to the Main Screen.
- Press the Mode pushbutton to exit the Mechanics Mode.
- Press the Exit pushbutton to lock the keypad.
- Reinstall the drawbar drive motor controller's metal enclosure.



Adjustment Procedures

Procedure 2-1, Ball Detector Alignment:

The ball detector is a simple, very reliable stand-alone device, but it may become misaligned once-in-a-while due to the constant vibration caused by bowling balls rolling down the lane and pin action against the kickbacks. Located in front of the kickback, it communicates with the pinspotter control chassis via a cable.

Ball detectors use a very simple principle. An invisible beam of light is constantly emitted from the ball detector. A reflector placed on the opposite side of the lane returns the light beam to the unit, which also contains a sensor. When the signal is interrupted by a ball passing through the beam, the ball detector communicates this information to the pinspotter control chassis. This action starts the pin-fall reading period followed by the appropriate pinspotter cycle, which depends on what ball (first or second) of the frame it is and whether or not pins remain standing.

Each ball detector has a combination emitter/detector mounted in a housing that simplifies the adjustment of the unit. The unit contains an LED on the tail end that is ON when no return signal is being detected and is OFF when a return signal is detected. If the LED is ON, a few things are possible: The ball detector is completely misaligned, the beam is blocked, the emitter/sensor is very dirty, or the unit is defective. The unit is held rigidly by its support housing and can be adjusted as follows:



CAUTION: Ensure that no one is preparing to bowl before stepping onto the lane. Employ a barricade to bowlers or physically prevent the possibility of bowling during any maintenance operation.

1. Loosen the screws that secure the cover to the assembly at the front of the unit, and remove the cover.
2. Loosen the four (4) small flathead screws that secure the top half of the sensor housing just enough to allow the sensor to be adjusted.
3. Adjust the detector as necessary so that the beam is reflected back and detected as indicated by the LED on the tail end of the sensor going out.
4. Once the light is out, tighten the four screws.
5. Lay a sheet of black construction paper on the lane where the ball detector is located and slide it from gutter to gutter. The light should stay off. If the light comes on, this means that the signal is bouncing off the lane instead of being just above the lane. Repeat steps 2, 3, & 4 angling the ball detector up, and then repeat step 5.
6. Reinstall the detector assembly cover.



Procedure 2-2, String Adjustment

Good string adjustment is the key to the proper operation of the TMS pinspotter. Perform the string adjustment before attempting any other pinspotter adjustment.

For software version 2.14 and newer, do the following:

1. If not already ON, turn on power to the pinspotter. With the machine game set in 10PinSwap (the setting for the controller at the rear of the machine) start the stop pins into their holes, but do not press all the way in.
2. Start the string adjustment process by pressing HOME on the keypad. If already in MECH mode, the machine will not ask for a password. Otherwise, the control box will ask for a password. Enter the MECH password (down>left>up>right>up>left>down). The pinspotter drawbar will drive to the rear of the machine and stop at the HOME position and hold there for 10 seconds.
3. During the 10-second wait period, push the stop pins fully into their holes. After the 10-second wait period, the drawbar will move forward and rest on the stop pins. Once that happens, the control box will detect that the drawbar has stopped moving and will shut the machine off. Turn OFF the AC power. Apply LOTO procedure to ensure that AC power cannot be reapplied during the string adjustment.
4. Unlock and open the plastic cover at the front of the machine and the main top cover. This provides access to the string take-up reel assemblies.



- Adjust the strings with the take-up reels (pull the reel out from the reel arm and rotate) so that the pins just touch the stabilizing rings on the underside of the lower table, are all at the same height, and so that the top of the reel arms are still touching the rear reel arm stopper (see image below). Pull the string towards the drawbar to identify the proper reel to adjust. Use one hand to pull on the string, lifting the pin up to the table while adjusting the reel with the other hand. This will take the tension off the string to make adjusting the reel easier.

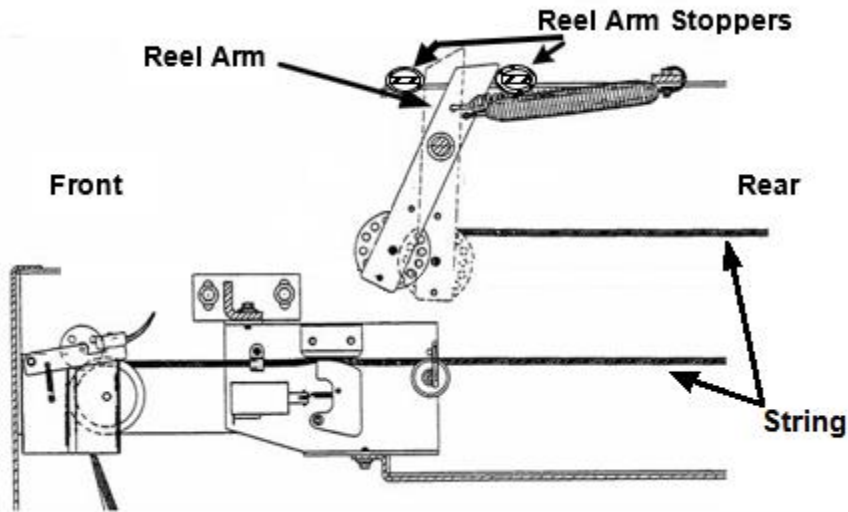


Figure 2-1, Reel Arm Position

- When the string adjustment is complete, close and lock the top and front covers of the machine. Remove LOTO constraints from the power connector. Turn the AC power ON and press the HOME pushbutton on the control box keypad. Enter password (down>left>up>right>up>left>down) if a password is requested. Then press TRBL CLR. The drawbar will retract from the stop pins and return to the HOME position again and stay there for 10 seconds.
- During the 10-second wait period, pull the stop pins out of their holes and let the machine finish the cycle. The machine will perform a pin deck calibration to relocate the pin deck following a string adjustment.
- Press the MODE pushbutton on the control box keypad to exit the Mechanics Mode. Push EXIT to lock the keypad.

This alternate string adjustment method is required for software version 2.13 and older (**not CE compliant**):

1. If it is not already ON, turn on power to the pinspotter.



Warning: High voltage is present in the pin detector circuit board assembly.

2. Unlock and open the plastic cover at the front of the machine. This provides access to the pin detector circuit board assembly and the string take-up reel assemblies.

3. Select the **String Adjust** function using either the pin detector circuit board pushbuttons (preferred) or the control chassis keypad. If using the keypad, return to the main screen by pressing the EXIT pushbutton twice so the counts can be observed.

The pinspotter drawbar will drive to the rear of the machine and stop at the *String Adjust* position. The chassis display for that machine will indicate *ADJUST* and show the counts. **Wait until the counts stop changing and indicate 0 ± 5 counts.** If the counts are outside of the range of 0 ± 5 , repeat step 3.

4. Adjust the strings with the take-up reels (pull the reel out from the reel arm and rotate) so that the pins just touch the stabilizing rings on the underside of the lower table, and so that the top of the reel arms are still touching the rear reel arm stopper (see Figure 2-2).

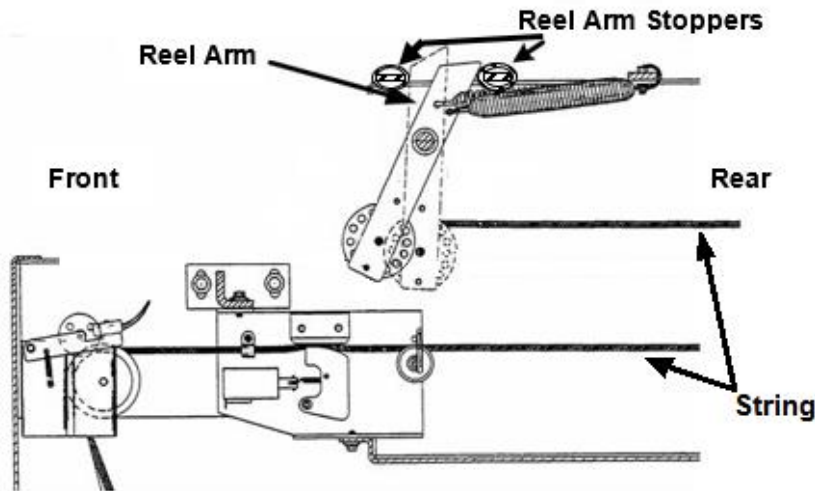


Figure 2-2, Reel Arm Position

5. When the string adjustment is complete, press the CYCLE pushbutton on the control chassis keypad. The machine will perform a pin deck calibration to relocate the pin deck following a string adjustment.
6. Press the MODE pushbutton on the control chassis keypad to exit the Mechanics Mode and to lock the keypad. (If the chassis *Functions* menu was used instead of the pin detector circuit board pushbuttons, press the EXIT pushbutton to relock the keypad.)
7. When adjustments have been completed, close and lock the front cover.



Procedure 2-3, Pin Brake Adjustment

This feature is used to adjust the clamping force of the brake cams against the strings. Indications that a brake needs adjustment are: if a pin that should be held up is lowered, a **PIN BRAKE** error message on the control chassis display, or a pin that stays up when it should be lowered. This adjustment needs to be made only if a brake is not functioning properly and other causes, such as a failed solenoid, bad wire or electrical connection, encoder wheel holes that have become filled with dust or string debris, broken cam spring, or damaged or misrouted string have been eliminated as the cause.

1. If it is not already ON, turn on power to the pinspotter. Apply LOTO before opening covers with supplied tool (key).



Warning: High voltage is present in the pin detector circuit board assembly.

2. From the chassis, select the **Brake Adjust** function using either the pin detector circuit board pushbuttons (preferred) or the control chassis keypad.

The drawbar will drive to the rear of the machine and then drive forward. The pin brakes momentarily energize as the drawbar continues to the front of the machine.

3. Remove AC power and apply LOTO constraints. Unlock and open the front and top covers to access the pin brake assemblies that are underneath the pin detector.

The pin brake assemblies at the ends of the pin brake array (located under the pin detector circuit board assembly) are easily accessible. If you need to adjust a pin brake that is located below the pin detector circuit board assembly, perform step 5; otherwise, skip to step 6.

4. Remove the two screws that secure the pin detector circuit board assembly mounting brackets to the machine (see Figure 2-3) and move the assembly out of the way.

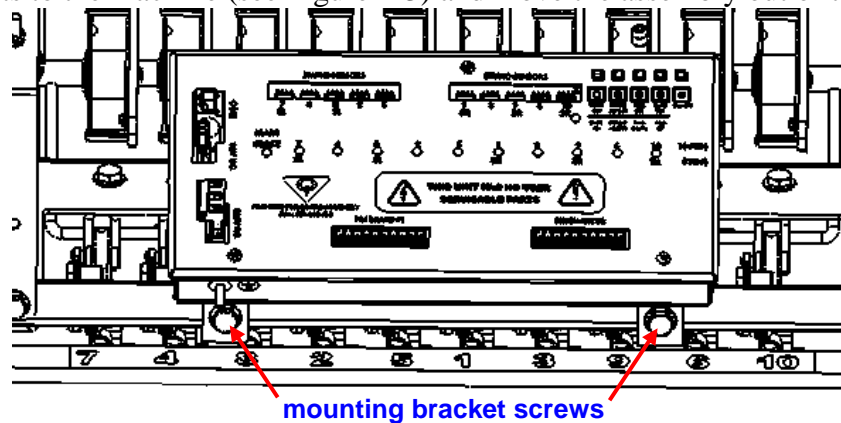


Figure 2-3, Pin Detector Circuit Board Assembly



- Adjust the clamping pressure by loosening the two screws that secure the brake angle plate to the assembly and moving the plate up to decrease or down to increase the clamping pressure (see Figure 2-4). Try to maintain the original angle of the plate and only move it a small amount. Tighten the screws.

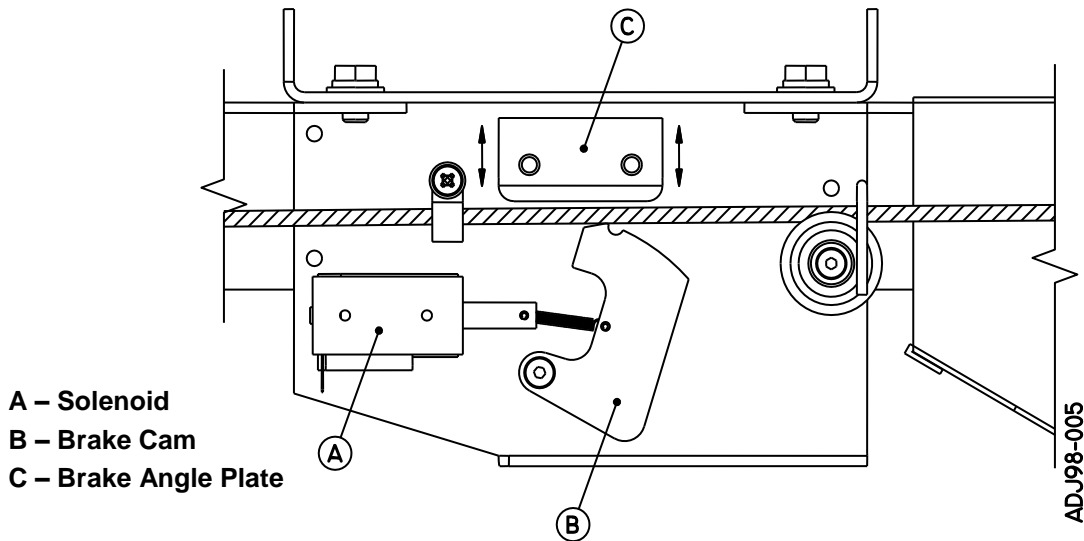


Figure 2-4, Pin Brake Assembly

- Reinstall the pin detector circuit board assembly. Close and secure the top cover.
- Remove LOTO and energize the machine.
- Test the adjustment by pressing the **Brake Adjustment** pushbutton on the pin detector circuit board. Repeat the adjustment as necessary. Apply LOTO before the top or front cover is opened.
- Close covers and remove LOTO.
- When the adjustment has been completed, press the EXIT pushbutton on the control chassis keypad to exit the Mechanics Mode and to lock the keypad.

Procedure 2-4, Adjusting Drawbar Chain Tension

The drawbar chain must not be overtightened. The mechanism must have some slack to it in order to extend the life of the pinspotter. Oil the chain with a very small quantity of 10-weight motor oil only when absolutely needed. Remove all excess oil from the chain and surrounding area on a weekly basis. The chain's tension should be verified and adjusted monthly.

1. Open the **Machine Power** circuit breaker located on the top of the control chassis. Apply LOTO constraints.
2. Unlock and open the top cover and visually check for a 1/4-inch (6mm) dip in the middle of the chain (upper or lower portion) using a straight-edged tool. Too much of a dip means the chain needs to be tightened, while too little dip means it is too tight.

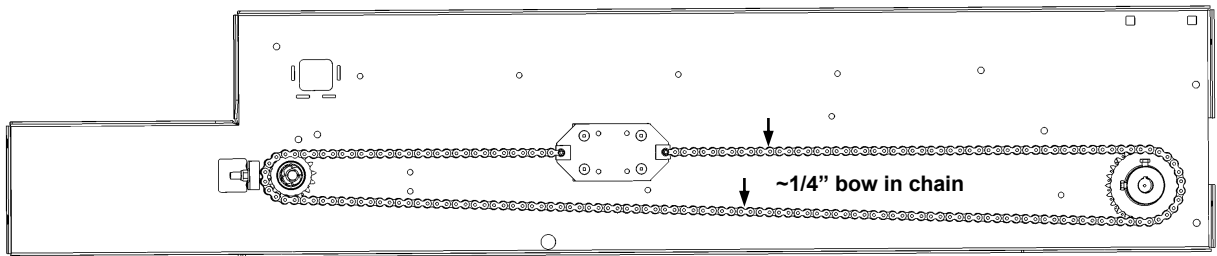
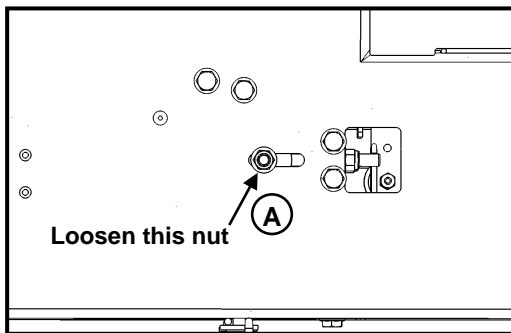


Figure 2-5, Drawbar Chain

3. If adjustment is necessary, loosen the sprocket's nut (A) at the front of the chain and adjust as necessary using the front end adjustment nut (B) (see Figure 2-6).

Outside View



Inside View

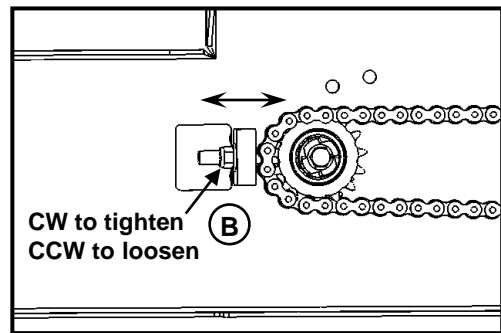


Figure 2-6, Drawbar Chain Adjustment

4. Retighten the sprocket's nut (A).
5. Repeat this procedure for the chain on the other side of the machine. Both chains must have approximately equal tension to prevent binding.
6. Remove LOTO. Close and secure the top cover, shut the Main Power circuit breaker, and clear the **Lane Breaker** error message.

Procedure 2-5, Repairing Strings and Bushings

1. Regular inspection and maintenance will reduce tangles and related trouble calls and extend the life of pins. Apply LOTO before opening covers with supplied tool (key).



Warning: High voltage is present in the pin detector circuit board assembly.

2. Use FUNCTION > Pins Down on the chassis controller to place a full set of pins on the pin deck.
3. See LOTO procedure. Open the **Main Power** circuit breaker for that pinspotter located on top of the control chassis. Remove power supply from chassis per LOTO.
4. Look for visual signs of wear on the strings and pin head bushings.
5. Any worn or frayed string should be repaired or replaced as illustrated in Figure 2-7.

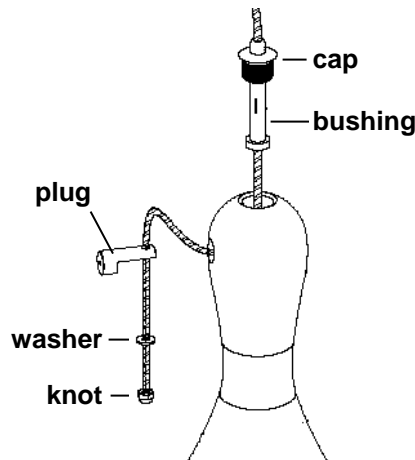


Figure 2-7, Ten Pin String Repair

5. Insert a screw part way into the hole in the plug near the top of the pin and remove the plug to access the string.
6. If replacing the pin head cap or bushing, cut the string above the damaged portion. If not replacing the pin head cap or bushing, pull the damaged portion of the string through the head of the pin and then cut the string.
7. Carefully melt the string tip using a match or cigarette lighter. Use a rotating motion with a rag to create a point on the string.
8. Place the pin head cap and bushing, if necessary, onto the string and thread the string through the head of the pin.
9. Place the plug (note its orientation in Figure 2-7) and a new washer onto the string.



10. Tie a single overhand knot into the string. Leave 1-1.5" (25-38mm) of slack past the knot. Tighten the knot as small as possible (using the knot tensioner tool if you have one).
11. Cut the end of the string ¼-inch (6mm) below the knot. Melt the string tip and press it into the knot.
12. Slide the string back through the pin. Seat the plug securely in the head of the pin and remove the screw that was used to remove the plug. Keep the string tight while sliding it through the pin to avoid the string being pinched/tangled inside the pin.
13. Once the plug is inserted into the pin, hold the pin up by the string and check to make sure the pin spins freely in both directions.
14. Unspool approximately the same amount of string that was cut off for the repair from that pin's string take-up reel.
15. Once the repairs have been finished, remove LOTO restraints, close the **Main Power** circuit breaker on the control chassis, and **perform the string adjustment procedure (Procedure 2-2)**.

Procedure 2-6, Adjusting the Ball Accelerator V-Belt Tension



Caution: This part of the machine can start automatically and without warning.

Correct V-belt tension results in a deflection of 3/8 to 1/2" with 5 pounds of pressure on the middle of the belt.

1. Disconnect power to the **Ball Accelerator** motor by unplugging the Main Power connector from the top of the Chassis.
2. Loosen the lock nut on the adjusting screw and adjust the screw to raise or lower the motor assembly which will tighten or loosen the belt. Retighten the lock nut.
3. When adjustment is complete, plug in the Main Power connector.

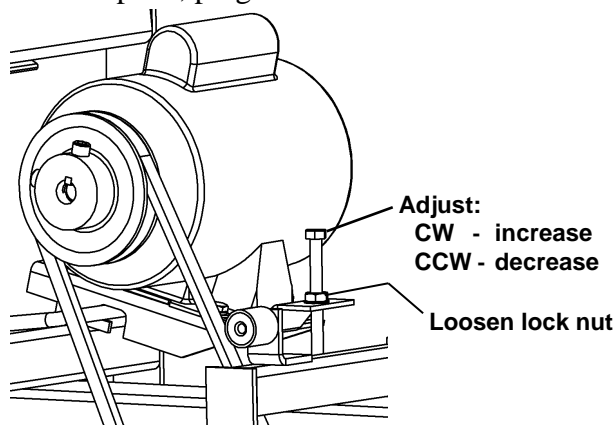


Figure 2-8, Ball Accelerator V-Belt Adjustment



Procedure 2-7, Adjusting the Ball Accelerator Flat Belt Tension



Caution: This part of the machine can start automatically and without warning.

If the flat main ball accelerator belt becomes loose and begins to flap noticeably, adjust as follows:

1. Apply LOTO procedure. Disconnect power to the **Ball Accelerator** motor by opening the Logic Power circuit breaker and unplugging the Main Power connector from the top of the control chassis.
2. Adjust the flat belt tension by turning the long adjusting screw attached to the tension rod as shown in Figure 2-9.
3. When adjustment is complete, plug in the Main Power connector, shut the Logic Power circuit breaker and test the unit. Repeat as needed.

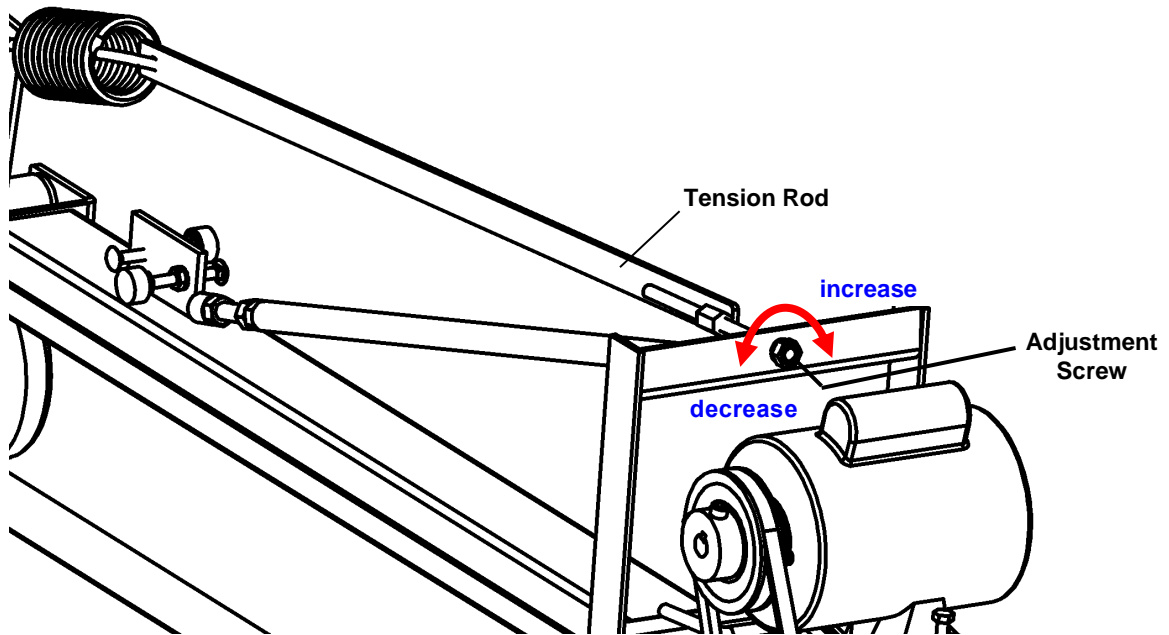


Figure 2-9, Flat Belt Adjustment



Taking Care of Your TMS Machine

Preventive Maintenance Basics

Here are some basic points about keeping your equipment functioning properly:

- Pinspotters must be kept free of dirt, dust, and excess oil. A clean pinspotter performs much better and reduces the chance of electronic and mechanical problems.
- Do not place items on top of electronic components or cover any of their vents. These vents provide airflow to keep your electronics from overheating.
- Keep food and drinks away from electronic components. Food particles and spills might make the electronics sticky and unusable.
- Do not get the power switches or other components wet. Moisture can damage these parts and cause an electrical hazard.
- Always disconnect a power cord by grasping the plug, not the cord.
- Pinspotters are subject to constant vibration and must be checked frequently for loose nuts and bolts. All bolts on the pinspotters and accessories must be tightened with a torque wrench. Over tightening bolts will simply cause them to break and, depending on the function of the bolt, may cause operating headaches. Also, check and tighten any loose screws on the pinspotters, especially the setscrews, as well as any loose bolts on the pit cushions and ball elevators, at regular intervals.
- Setup and maintain a preventive maintenance program as outlined in this chapter.

Manufacturer's Recommendations

Always use original QubicaAMF parts with your equipment.

The detailed part listings in this publication make it easy to locate parts for reordering purposes. Always order parts by the part number and description, not by index and/or page numbers because this information is subject to change.

Always supply your equipment's serial number when placing an order.

Setting Up a Preventive Maintenance Program

It must be understood that equipment of any kind requires a minimum maintenance and should operate according to standards. Regular, scheduled maintenance is very important in order to keep your equipment in excellent condition.

Daily Maintenance Schedule

Let's look at the daily maintenance required for all pinspotters:

- o Every day, all the pinspotters must be checked for stop sheets. These are pieces of paper that are put on the back of the pinspotter to indicate if something went wrong with it the night before. A qualified maintenance technician should immediately correct the malfunction.
- o Pin strings should be inspected daily. If they show evidence of wear, they should be shortened and refastened and the string tension readjusted to compensate for the shortened string. If a proper program of string maintenance and inspection is set up, you will never experience a broken string during normal play. Put very simply, there is no excuse for strings breaking in play other than careless string maintenance.
- o Clean all lane surfaces and surrounding areas.



Weekly Maintenance Schedule

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

Weekly Cleaning

- The cleaning simply involves wiping the various components indicated with a dry cloth. The pit area is best cleaned by vacuuming the dust that accumulates. Dust also accumulates inside the various optical reading devices located on the pinspotter. This dust is best removed by using compressed air prior to vacuuming.
- Clean all optical sensors and pin detector wheels.
- Remove all excess oil and grease from the chains and surrounding area.
- Remove all dust deposits which have accumulated on the pin tables and pin stabilizer boards.
- Vacuum the pit area.
- Vacuum the ball elevator area.
- Wipe the ball detectors and reflectors with a damp cloth.
- Wipe the ball return track.
- Wipe the front ball rack and the bowling balls.
- Wipe the work area (bench, room, and aisle).

Weekly Adjustments

- Verify the pin brakes are adjusted correctly.

Quarterly (25,000 Frames) Maintenance Schedule

The first area to inspect and correct is the ball detector alignment. Although the ball detector is not a mechanical part of the drive train, it is a critical component to the pinspotter's mechanics, since all commands to and from the pinspotter start with the detection of a ball. Although most of the adjustments listed below will not need adjusting, they should still be verified monthly:

- Check the drawbar chain and alignment.
- Check the ball accelerators.

Much of the quarterly service involves tightening the bolts and screws of the various assemblies. Loose bolts and screws may result in premature failure of the pinspotter and may even result in serious damage to the pinspotter or an operator.

Nuts and Bolts

Pinspotters are subject to constant vibration and must be checked for loose nuts and bolts. All bolts and accessories on the pinspotters must be tightened with a torque wrench as indicated in the table below. Over tightening bolts will simply cause them to break and depending on the function of the bolt, may cause operating headaches. The vibro-insulators and base plate spacer bolts located on the stabilizers are subject to continual violent shock and extreme vibration. They should be checked frequently for tightness.



*Bolt Size & Required Torque**

Bolt Size	American	Metric
1/4"	15 FT. LB.	20.5 N/M
5/16"	19 FT. LB.	26 N/M
3/8"	25 FT. LB.	34 N/M
1/2"	29 FT. LB.	39 N/M

*unless specified otherwise

Tightening loose bolts and screws should not be limited to quarterly service, however. Any time you come across a loose bolt or screw, it should be corrected immediately. The following item must also be performed quarterly:

- Oil all chains, if necessary.

Note

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

Annual (100,000 Frames) Maintenance Schedule

An annual inspection of the pinspotter is best done by a qualified mechanic who has the experience to determine the wear of parts and their need for replacement. The oil in all gearboxes must also be checked and added if required (use Kluber Oil 715-022-505). Apply LOTO procedure where required.

5 Year (500,000 Frames) Maintenance Schedule

Apply LOTO procedure where required. Replace the oil in the gearbox(es). Remove the motor/gearbox assembly from the pinspotter. Separate the motor from the gearbox and remove the mounting bracket from the gearbox side opposite the shaft. Loosen and remove the (oil) plug. Rotate the gearbox to allow the oil to drain from the gearbox. Refill gearbox with 2.5oz (75ml) of Kluber Oil (715-022-505). Apply thread sealant to the oil plug and reinstall into the gearbox, tighten securely. Install mounting bracket and motor to gearbox, then install assembly to pinspotter.

For ball accelerator, remove assembly from the mounting bracket and then separate gearbox from motor. Follow instructions above to change oil and then reinstall.



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SECTION 3
Troubleshooting



3.0 Troubleshooting

Section Overview

This section contains information that will help you identify and correct problems that might arise as you use your equipment. The TMS String Pinspotter's control chassis contains significant diagnostic tools that can help you get back up and running quickly in the event of a malfunction.

The control chassis contains a diagnostic text menu that gives status information for many of the pinspotters subsystems, as well as a graphics screen that lets you observe many of the machine's parameters while it is in operation.

The electronic unit controlling the pinspotting machine and accessed by the user may be interchangeably called the "chassis," "controller," or "chassis controller." An electronic unit inside the pinspotter may be interchangeably called the "pin detector," "pin detector board," or "pin detector box."



Warning: High voltage is present in the control chassis, drawbar drive motor controller enclosure, and pin detector circuit board assembly. Apply LOTO before servicing. The main circuit breaker must always be OPEN or the power plug DISCONNECTED prior to performing any service/repair to electrical components.



The control chassis and pin detector circuit board assembly contain tamper indicators. Opening these enclosures voids your warranty.

Read This First

If you have a problem with your TMS Pinspotter System, always verify the following points before replacing system components or calling technical support.

- Check that you have electrical power to the system. Verify that breakers have not been tripped.
- Ensure that the LED on the ball detector comes on when the beam is obstructed.
- Check that all cables are securely connected.
- Simulate a power failure. Turning off and restarting the control chassis can sometimes cure a problem.
- Try Resetting to Factory Settings using the Functions Menu, especially if you have recently used a password to enter commands.
- Review the troubleshooting items in this section.

Hint on Cabling Problems

There are generally two possible solutions to cabling problems. First, any one of the connectors used with the cables may have become loose due to the constant vibration generated from play. Second, a cable may be damaged by a machine component. Ensure that all connectors are fully inserted to ensure its proper contact. If this fails to resolve your problem, use a multimeter to verify the cable's continuity. NEVER unplug a cable by grasping the wire and pulling. Many of the connectors are designed to be held firmly in place and have tabs that must be squeezed for the plug to be released.

When the humidity levels get too low, static electricity transported by people and equipment can build up to enormous levels. These levels can be so large that even good grounds will not stop the destruction of these static discharges. The recommended relative humidity level for a bowling center is between 40 and 60 percent.

Retrace the ground wire installed with your equipment all the way to the building's main ground. Never depend on the ground installed with your outlets, since many electricians do not reliably install these grounds. If your equipment is not properly grounded, the electronics can suffer significant damage when they receive a static electrical discharge.



Untangling Pin Strings

If pin strings tangle, the pinspotter will attempt to untangle them using a routine that causes different groups of pins to raise and lower. If the strings are knotted, they will have to be untangled using the pin hook.

1. Do not allow bowling to occur on machine that is being serviced. Place a physical barrier at the approach or otherwise ensure that no ball is thrown.
2. If the untangle routine has finished running without untangling the strings, the pins will have been deposited on the pin deck and the LCD screen will have a **TANGLED** error message. (Pressing the **PROG ZERO** [Program Zero] pushbutton on the control box keypad will stop an untangle routine that is in progress.)
3. Raise the pit area cover and hang the cover on the hooks on the back of the machine using the cover's handles.
4. Untangle the strings using the pin hook.
5. Press **TRBL CLEAR** (Trouble Clear) on the control box keypad. Enter the Trouble Clear password (up>down>up>down>right) if required. The pinspotter will cycle.
6. Lower the pit area cover to its closed position and leave the pinspotter area.

The Pinspotter Doesn't React to a Ball Rolled Down the Lane.

1. Control chassis is not in *BOWL* Mode.
2. Check the ball detector's alignment. The LED on the detector should be off and turn on when the beam is obstructed. Verify the cable is securely plugged in (both ends) and that the reflector is not damaged or missing.
3. Check the *SETTINGS* menu and verify that the ball detector type is set to *ROUND*.
4. Using the Diagnostics Text or Graphics menus, verify the Ball Detector status alternates between No Ball and Ball as you pass an object through the beam.
5. If the Ball Detector is not working properly, replace the detector.
6. If the detector is functioning properly, restart the control chassis.

The Pinspotter Cycles when it shouldn't.

1. Check the ball detector's alignment.
2. Check to see if the ball shield is interrupting the ball detector's beam. Adjust shield height.
3. Restart the control chassis.

The Machine Stopped in the Middle of a Pin Deck Calibration.

1. The drawbar failed to make it all the way to the HOME position. Press the **CYCLE** pushbutton to restart the calibration.



The Drawbar Continuously Moves Back and Forth.

1. Strings may be too tight and drawbar cannot reach HOME. Check string adjustment.
2. If this problem occurs when you start the pinspotter, check the LOS (HOME position) optical sensor.

The Drawbar Does Not Go All the Way Back to the Home Position.

1. Check the string adjustment, they are probably too tight.

One or More Fallen Pins Are Respotted When They Shouldn't Be.

1. Check the *Pin Detector Count* (sensitivity) setting. Change the setting to be more sensitive (lower number).
2. Check the *Pin Data Delay* setting. Increasing the delay time will allow pin action to be completed before fallen pins are recorded. This remedy is indicated if late falling pins are being respotted.

One or More Pins Remain UP When They Should Be Spotted.

1. Check the brake adjustment for those pins.
2. Check for frayed or tangled string(s) inside the machine.

Machine Cycles Up and Down

1. Check the chassis display for an error message.
2. Strings tangled. Untangle routine in progress.
3. Check pin detector operation. Red LEDs on pin detector circuit board assembly should go on and off when pins are being raised or lowered. Check for clogged holes (from dust and string shavings) in the pin detector wheel(s) and optical sensor(s).
4. Faulty pin brake adjustment. Machine sensing pin movement for a pin that should be held up and is attempting to correct. Will stop after several tries. Adjust brake.
5. Failed solenoid or bad connection. Check connection at solenoid and pin detector board.
6. Pin(s) fall over while being spotted. Check for damaged pin(s) or debris on pin deck.

Pressing the Pushbuttons on the Control Chassis Keypad Has no Effect

1. Enter the General Password (↓←↑→↑←↓). This is required for most keypad functions. Screen will prompt for password by displaying **PASSWORD** when a keypad button is pressed. You have a limited time to enter the password.
2. Restart the control chassis.



Control Chassis Error Messages

Error messages are displayed in **reverse type** and may be either flashing or constant. Below are error messages you could encounter and some potential causes. Error messages that recur should be investigated further since they may be an indication of an incorrect setting or of equipment that is starting to fail. There are separate error messages for each lane when viewing the main screen. When viewing a screen that shows data for one lane only, only the error messages associated with that lane will be displayed. Multiple error messages on one lane will display one at a time. Clearing one will reveal the next.

ERROR MESSAGE	CAUSE
LOCKOUT	This message tells the operator that the keypad is temporarily deactivated while the control chassis performs a critical evolution (such as an initial start-up) that could be adversely affected by keypad operation. Message clears automatically.
LANE BRKR	Indicates that the circuit breaker that supplies power to the lane is open or has tripped. Does not distinguish between a breaker that has been manually opened or that has tripped because of an electrical fault. Must shut the breaker, press the TRBL CLEAR pushbutton, and enter the Trouble Clear password to reset.
BE BRKR	Indicates that the circuit breaker that supplies power to the Ball Accelerator is open or has tripped. Does not distinguish between one that has been manually opened or that has tripped because of an electrical fault. To reset: shut the breaker, press the TRBL CLEAR pushbutton, and enter the Trouble Clear password.
E-STOP	Indicates that the pinspotter has been shutdown by the Emergency Stop circuitry. Either an E-STOP pushbutton has been pressed, or the E-STOP cable connector on the back of the control chassis has been unplugged. Follow the procedure specified in Section 1 of this manual to reset.
DRIVE ERR	DO NOT ATTEMPT TO MAKE CHANGES TO THE DRAWBAR DRIVE MOTOR CONTROLLER SETTINGS. Indicates that the drawbar drive motor controller has detected an out of tolerance condition and has shut down the drive. The drawbar drive controller display will indicate an error code that can be used to determine the cause. This can also help Technical Support determine the status of the controller if the error cannot be reset. Refer to the controller's operating instructions for lists of warning and error codes and their descriptions. Attempt to reset by opening the Machine Power circuit breaker for that lane located on the top of the control chassis, wait 7 to 8 seconds, and then shut the breaker. Press TRBL CLEAR on the chassis keypad, and when prompted, enter the Trouble Clear password.
DISABLED	One or more subsystems failed to respond during machine start-up. Check breakers and connections and restart the control chassis.
BALL FAULT	The ball detector does not sense a return signal for an extended period of time. Check for obstruction. Check detector alignment. Check reflector.
BALL LIFT	An off-normal condition exists at the ball lift on the approach. Reset off-normal condition. Check cable connections. Faulty cable between ball lift and chassis.



MECH CALL	The mechanics call button has been pressed. Bowler needs assistance.
PINS FELL	Pins fall over while being set. Machine made several tries, but failed to set pins successfully. Check for damaged pin bottom or debris on pin deck.
PIN BRAKE	String movement after brake solenoid has been actuated. Machine made several attempts, but failed to set brake. Check solenoid operation. Check connections on solenoid and pin detector circuit board. Adjust brake. Replace solenoid.
PIN ENCODER	Pins being raised or lowered, but not sensed by encoder. Encoder wheel stuck or holes in wheels or optical sensors filled with debris. Faulty encoder. String entangled inside machine.
STALLED	Drawbar cannot reach the forward position. Check for anything that prevents full travel of the drawbar (jammed linkage, internal string tangle, etc.)
ENCODER	This error message is received when the expected drawbar motor counts are not reached within a preprogrammed period of time. Drive system jammed. Check for faulty chain adjustment. Object jammed in sprocket. Internal string entanglement. Faulty drive motor or gearbox.
ENCODER?	Received invalid motor encoder counts. Encoder counts outside of expected range. Restart control chassis. Faulty drive motor encoder.
LOS	Home position attained as determined by drive motor encoder counts, but Home sensor not actuated. Incorrect Home sensor alignment or adjustment. Faulty Home sensor. Check sensor cable connection.
PIN COMM	Communication error between chassis and pin detector circuit board. Check connections. Faulty pin detector circuit board. Faulty chassis.
TANGLED	Machine failed to untangle strings after multiple attempts. Manually untangle strings. Check string adjustment.
DETANGLE	Displayed while the machine is performing the string untangling routine.
Main Clock Math Err EEPROM Serial	Control Pin Det Sensor Scoring Event
Subsystem errors. All of these error messages signify that either the operating software has not functioned correctly or a chassis control circuit has malfunctioned. Attempt to restart the control chassis. Contact Technical Support if the error does not clear. May be necessary to reload software. Faulty chassis.	



Using *Diagnostics* and the *Pin Detector Circuit Board* as Troubleshooting Aids

(Refer to the *TMS Chassis Logic Tree* for a road map of chassis menu items.)

The control chassis diagnostics menu can be used to check the operating status of many of the pinspotter's components. For instance, the operation of the ball detector can be checked from either the *Text* or *Graphics* diagnostics windows. Using the *Text* menu, the possible indications are *Ball* or *No Ball*. This is an active indication, so by passing an object through the ball detector's beam, the indication should go from *No Ball* to *Ball* and back to *No Ball*.

The diagnostics *Graphics* screen (see Figure 3-1) displays a combination of icons and numerals in a layout that allows you to see many of the machine's parameters at one time. These diagnostic tools provide more information than can be seen by observing just the component. For example, there is an LED on the ball detector that lights when the beam is broken telling you that the detector has sensed the object, but the diagnostics menus tell you that this information has been received by the chassis, and that the cable and connections, as well as the applicable part of the chassis circuitry, are also functioning correctly. Data can be delayed slightly when viewing the graphics screen.

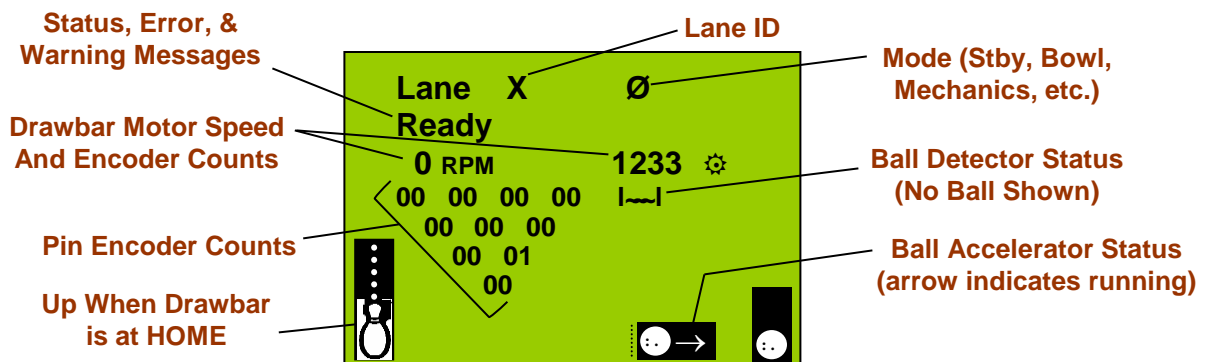


Figure 3-1, Diagnostics Graphics Screen

The Pin Detector Circuit Board Assembly (Figure 3-2) provides indications for the pin encoders, the brake solenoids, and circuit board communications in the form of LEDs. Ten numbered LEDs form a line across the enclosure cover. These LEDs blink on and off in response to string movement to indicate that the pin encoders are functioning. These LEDs also light to show which pin brake solenoids are being energized. Since the brake solenoids are energized only briefly, the LEDs are lit only briefly and then return to their pin sensing function. Another LED labelled *Main Brake*, located just to the left of the numbered LEDs, serves to act in a permissive function for the brake solenoids and will also light when the solenoids are energized. Three additional LEDs can be seen by looking downward through the gap in the cutout for the left hand group of string sensor (pin encoder) connectors. One of these is the “heartbeat” of the board and flashes to indicate the board internal circuits are functioning. The remaining two LEDs flash to indicate that transmit and receive communications to and from the control chassis are functioning.

NOTE: Removing the Pin Detector Circuit Board Cover will void its warranty.



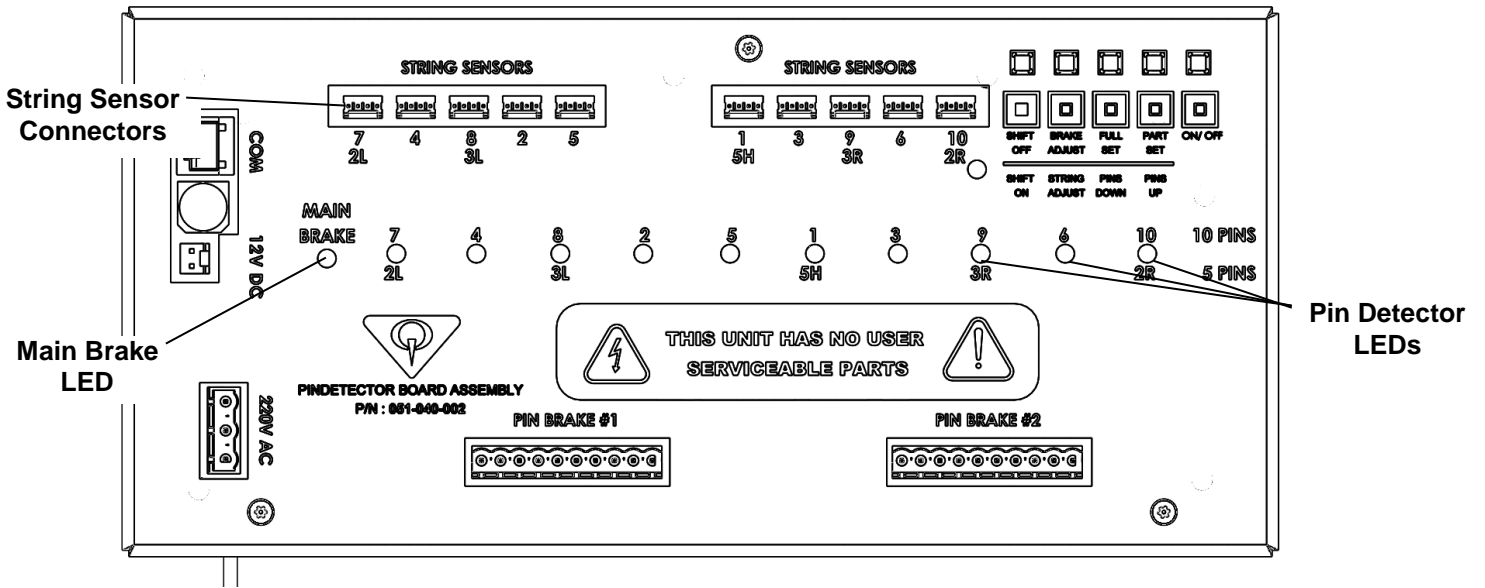


Figure 3-2, Pin Detector Circuit Board Assembly



SECTION 4

**Chassis Software Logic Tree
&
System Wiring Diagram**



4.0 Chassis Software Logic Tree & System Wiring Diagram

Section Overview

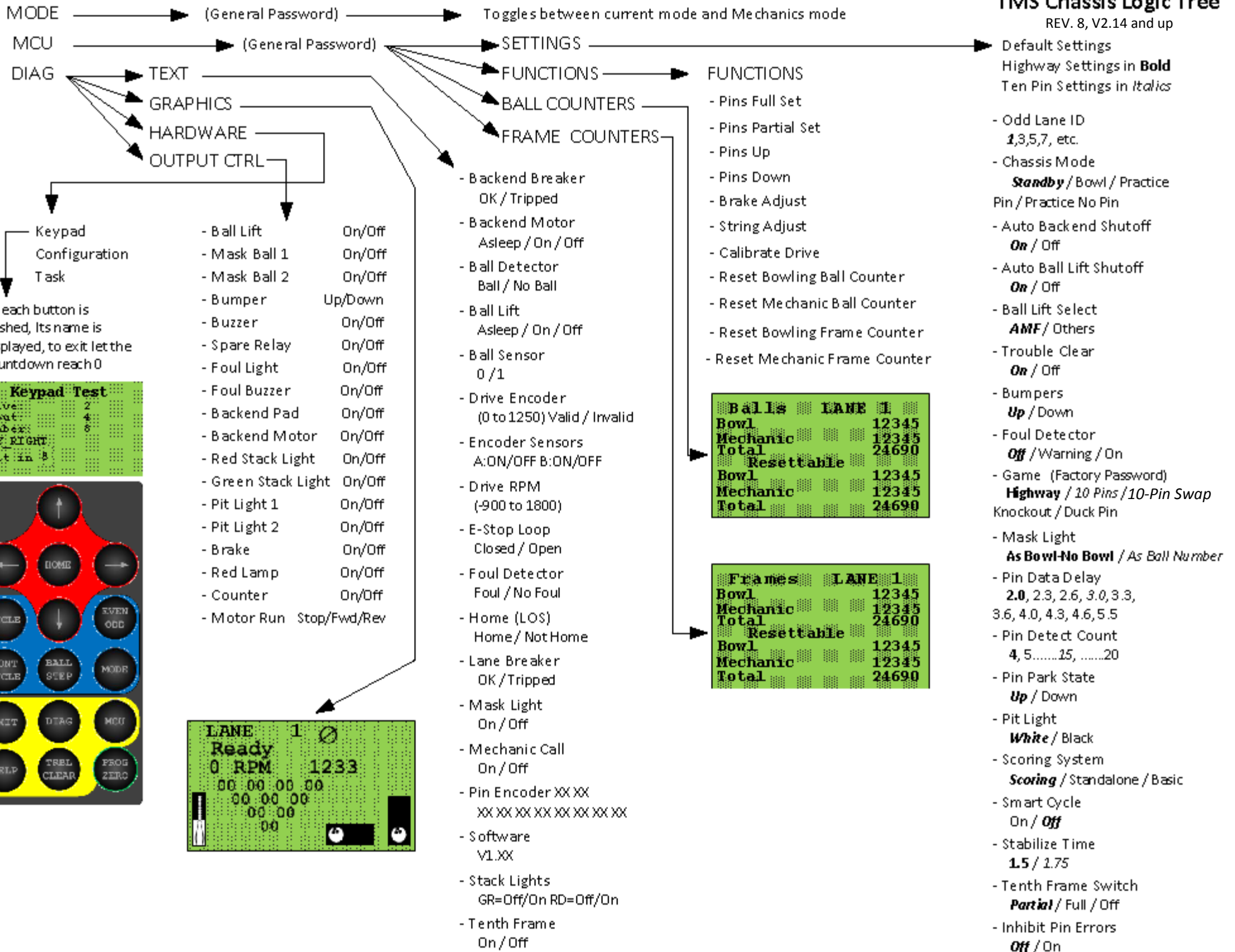
This Section provides wiring and electronic information in an easy to comprehend full-size diagram that can be very useful when making repairs. It also provides a diagram mapping Chassis software elements that can be used as a navigation aid for performing various adjustments and settings changes.

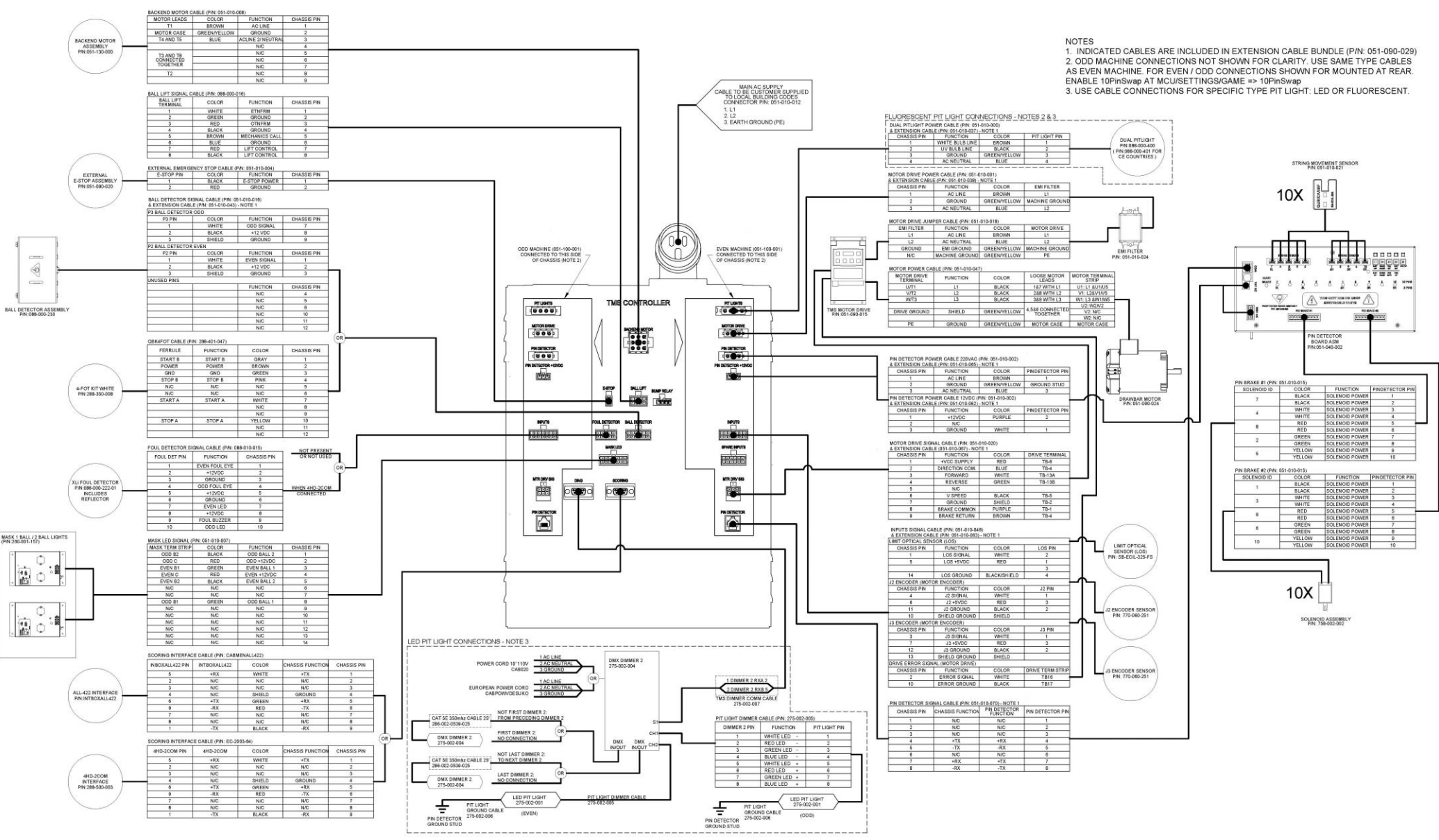
The electronic unit controlling the pinspotting machine and accessed by the user may be interchangeably called the “chassis,” “controller,” or “chassis controller.” An electronic unit inside the pinspotter may be interchangeably called the “pin detector,” “pin detector board,” or “pin detector box.”



TMS Chassis Logic Tree

REV. 8, V2.14 and up





- NOTES
- INDICATED CABLES ARE INCLUDED IN EXTENSION CABLE BUNDLE (P/N: 051-090-029)
 - ODD MACHINE CONNECTIONS NOT SHOWN FOR CLARITY. USE SAME TYPE CABLES AS EVEN MACHINE. FOR EVEN / ODD CONNECTIONS SHOWN FOR MOUNTED AT REAR. ENABLE 10PinSwap AT MCU/SETTINGS/GAME => 10PinSwap
 - USE CABLE CONNECTIONS FOR SPECIFIC TYPE PIT LIGHT: LED OR FLUORESCENT.

TMS TenPin Wiring Diagram 051-010-025-01

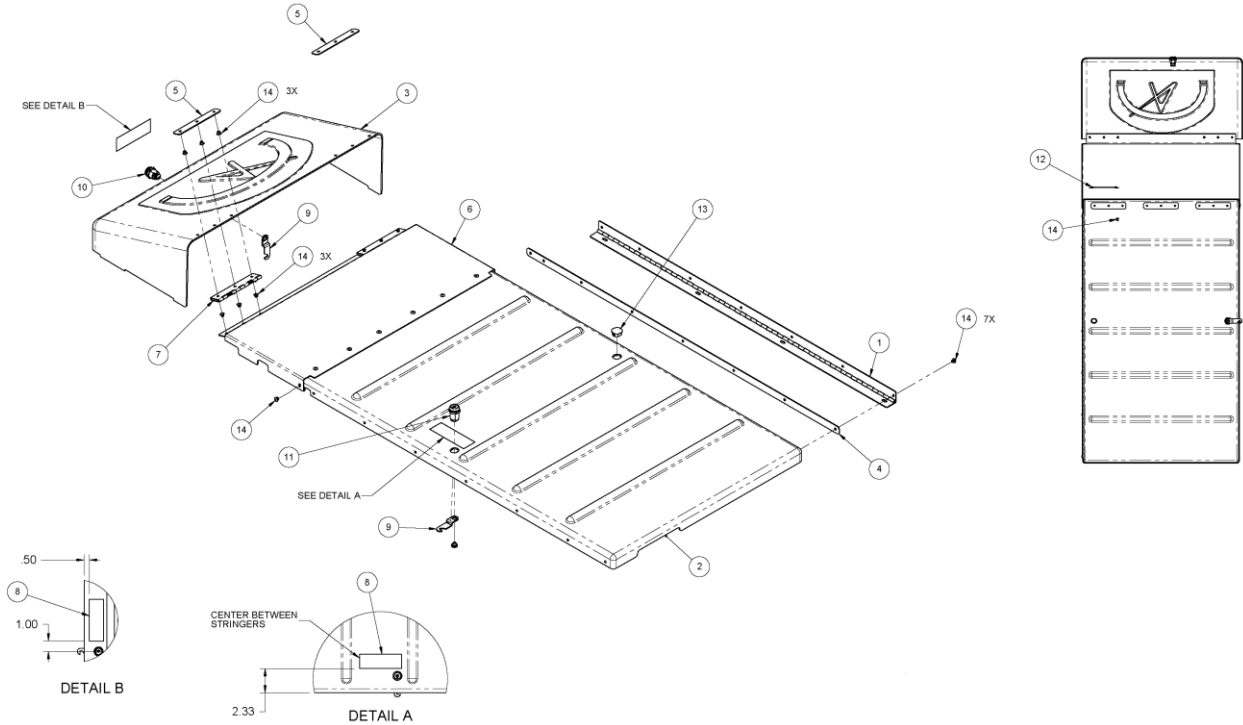
A full size hard copy is included at the back of this manual.

SECTION 5
Drawings
&
Parts Lists

An item shown in bold type in a parts list indicates that there is an exploded view drawing for that assembly on the pages that follow.



Safety Covers

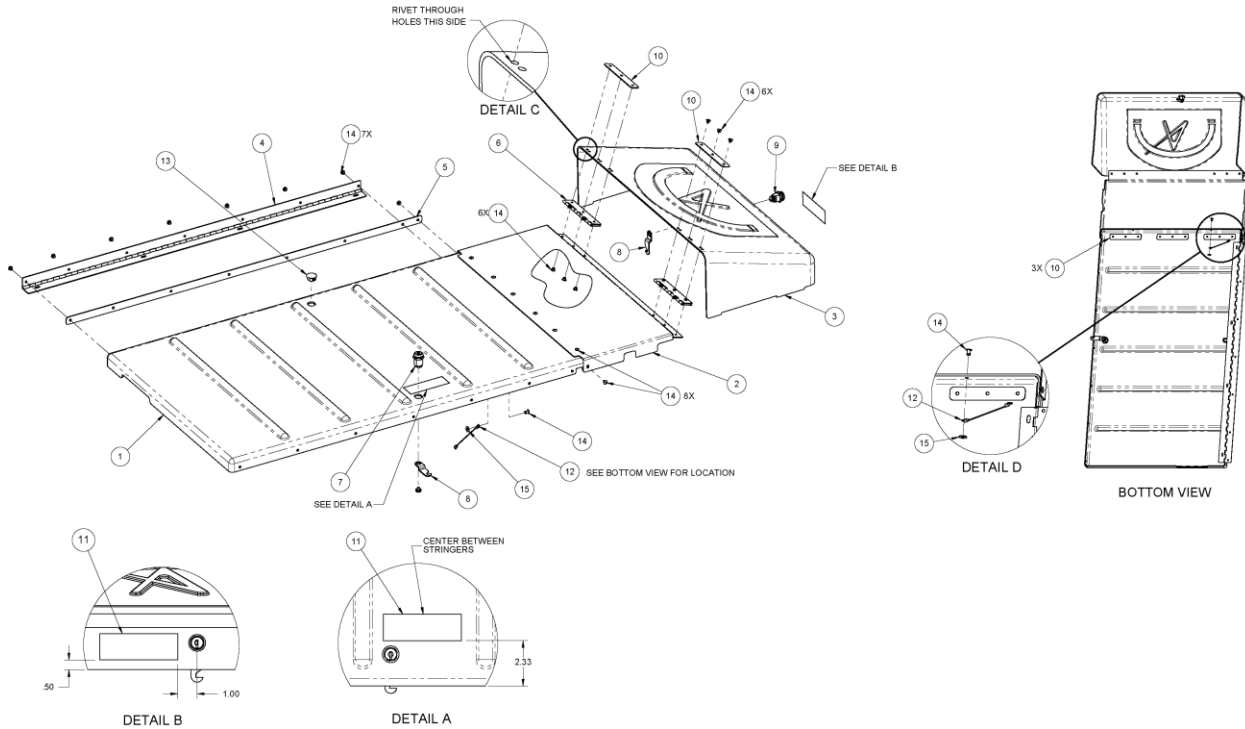


051-090-021 – Odd TMS Top Cover Assembly

Item	Part Number	Description
1	051-070-011	TOP COVER HINGE
3	051-070-013	TMS LOCKING TOP COVER
2	051-070-014	TMS LOCKING FRONT COVER
4	051-070-008	TOP COVER HINGE BRACE
5	051-070-009	FRONT COVER HINGE BRACE
6	051-070-003	SPRING COVER PANEL
7	051-070-002	SELF OPENING SPRING HINGE
8	051-070-007	MECHANICAL HAZARD LABEL
9	051-070-006	CAM LOCK
10	051-070-004	FRONT COVER LOCK
11	051-070-012	TOP COVER LOCK
12	051-070-015	COVER RETAINER LANYARD
13	719-024-010	BLACK PLUG
14	7108-401800-050	0.19 X 0.43 ALUMINUM RIVET
15	051-070-005	KEY LOCK



Safety Covers

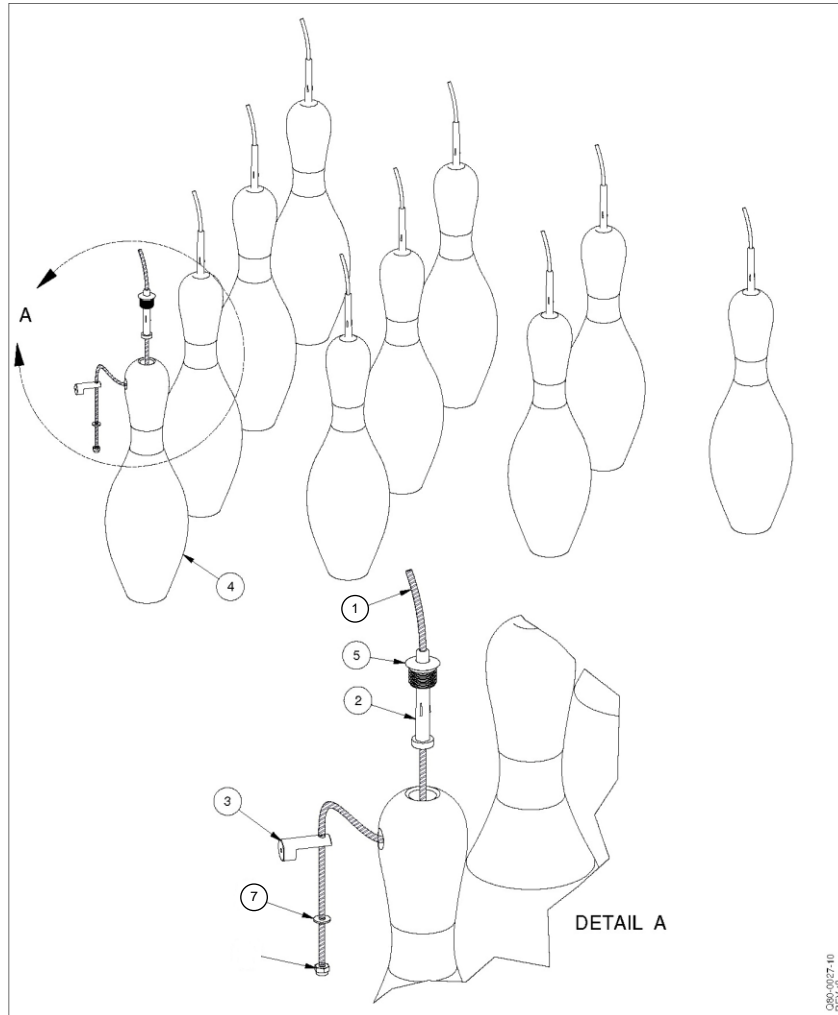


051-090-028 – Even TMS Top Cover Assembly

Item	Part Number	Description
1	051-070-013	TMS LOCKING TOP COVER
2	051-070-003	SPRING COVER PANEL
3	051-070-014	TMS LOCKING FRONT COVER
4	051-070-011	TOP COVER HINGE
5	051-070-026	EVEN TOP COVER HINGE BRACE
6	051-070-002	SELF OPENING SPRING HINGE
7	051-070-012	TOP COVER LOCK
8	051-070-006	CAM LOCK
9	051-070-004	FRONT COVER LOCK
10	051-070-009	FRONT COVER HINGE BRACE
11	051-070-007	MECHANICAL HAZARD LABEL
12	051-070-015	COVER RETAINER LANYARD
13	719-024-010	BLACK PLUG
14	7108-401800-050	0.19 X 0.43 ALUMINUM RIVET
15	7150-019050-004	0.19 X 0.50 X 0.05 ALUMINUM FLAT WASHER
16	051-070-005	KEY LOCK



Tenpin Bowling Pin

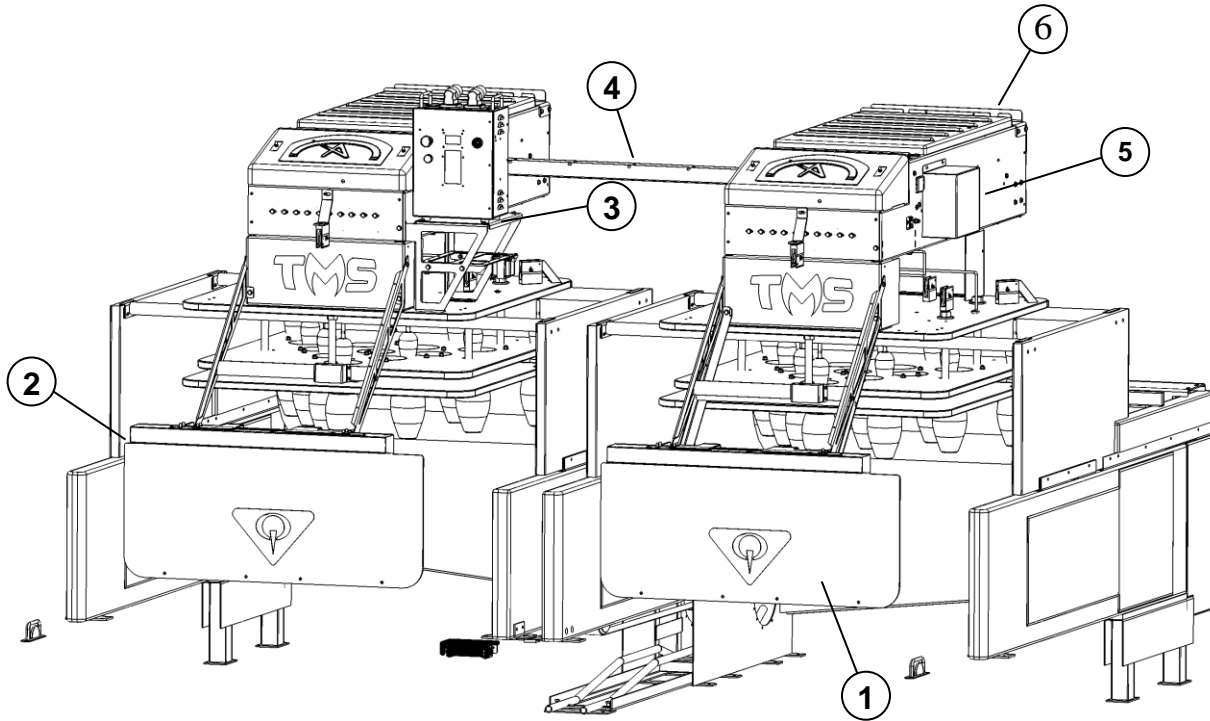


Tenpin Parts List

Item	Part Number	Description
1	051-150-000	TMS STRING
2	051-160-008-01	CLEAR TMS STRING PINHEAD BUSHING
3	PT-002	PIN PIVOT
4	Q80-0027-10	COMPLETE SET of 10 PINS (incl. items 2, 3, & 5)
5	Q80-2001-0020	STRING PIN CAP
7	7050-021050-006	3/16 X 31/64 X 3/64 FLAT WASHER



Miscellaneous Components



Miscellaneous Components

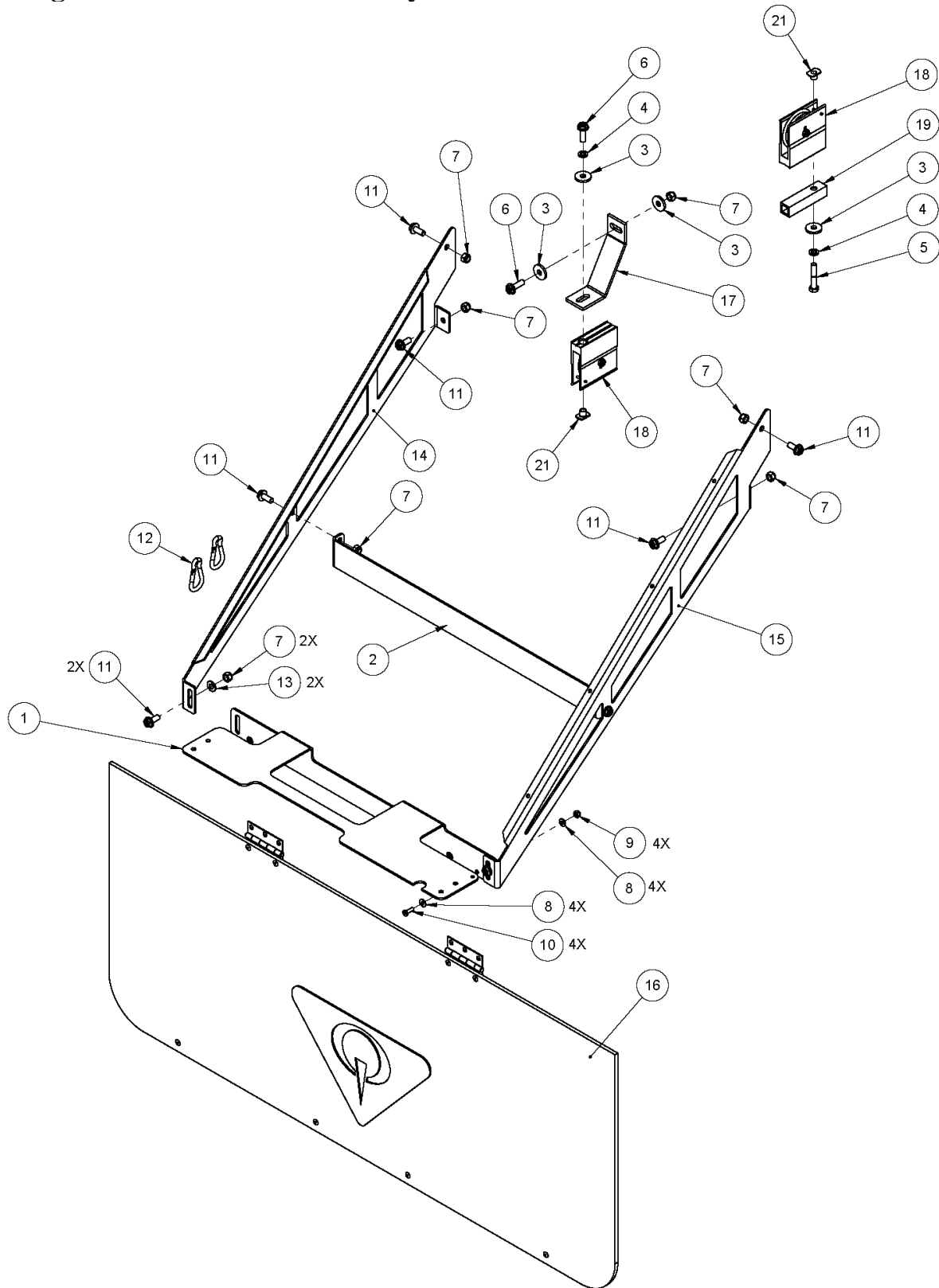
Item	Part Number	Description
1	051-090-016-01	PIT LIGHT MOUNT BRACKET ASSEMBLY
2	610-051-012	TMS LED PIT LIGHT KIT
3	051-090-005	CHASSIS MOUNT ASSEMBLY
4	051-090-013	TENPIN CONDUIT KIT
5	051-020-009	MOTOR DRIVE COVER
6	9103202	REAR COVER



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Pit Light Mount Bracket Assembly

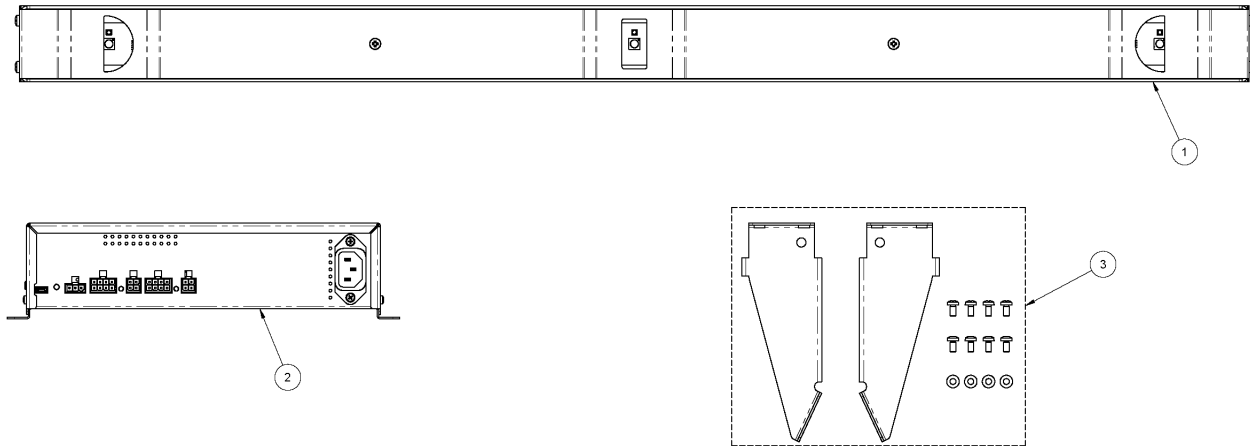


Pit Light Mount Bracket Parts List

Item	Part Number	Description
1	051-080-020	PIT LIGHT HANGER BRACKET
2	051-080-022-01	SHIELD BRACE
3	7050-034100-012	FW 0.34 X 1.00 X 0.13 ZN
4	7060-031057-009	SWM 5/16 ANSI ZN
5	7010-003118-175	HHCS 5/16-18 X 1.75 GR5 ZN
6	801-757-161	FBCS 5/16-18 X 1.00 GR5 BP PA
7	7036-003118-000	HLN 5/16-18 ZN NE
8	7050-021050-006	FW 10 SAE ZN
9	7036-001032-000	HLN 10-32 ZN NM
10	7016-411032-062	PHPMS 10-32 X 0.63 ZN
11	801-757-121	FBCS 5/16-18 X 0.75 GR5 BP PA
12	051-070-025	CARABINER SHIELD TMS
13	948-722-111	FW 5/16 SAE BO
14	051-080-017	07P PIT LIGHT AND SHIELD TRUSS
15	051-080-018	10P PIT LIGHT AND SHIELD TRUSS
16	SB-0700-50-3	SHIELD ASSEMBLY
17	9102163	SHIELD BRACKET
18	SB-043-1	TMS TABLE PULLEY ASSEMBLY
19	9102164	SPACER PULLEY
21	7046-003118-037	EN 5/16-18 NS OBL
22	051-150-002	TMS SHIELD STRING (NOT SHOWN)



610-051-012 – TMS LED Pit Light Kit



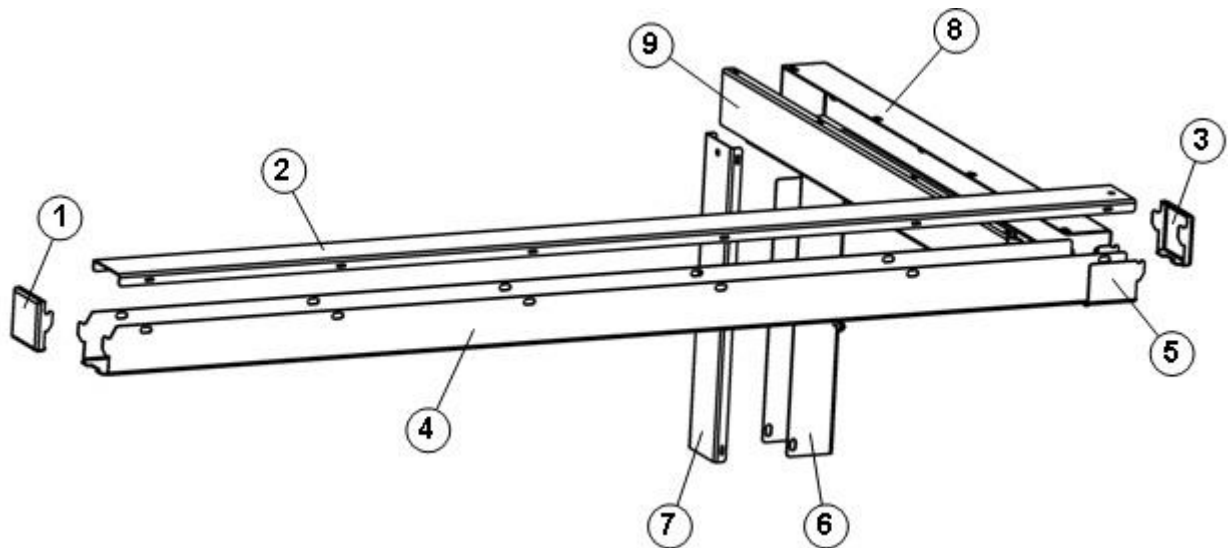
TMS LED Pit Kit Parts List

Item	Part Number	Description
1	275-002-001	PIT LIGHT FIXTURE
2	275-002-004	PIT LIGHT DMX DIMMER
3	275-002-012	PIT LIGHT BRACKET KIT
4*	275-002-005	PIT LIGHT DIMMER CABLE
5*	275-002-006	PIT LIGHT GROUND CABLE
6*	275-002-007	TMS DIMMER COMM CABLE
7*	286-002-539-025	25' CAT 5E 350 MHZ CABLE
8*	CAB020	10' 110V POWER CORD
9*	CABPOWVDESUKO	EUROPEAN POWER CORD

* Items 4-9 are not shown.



051-090-013 – Tenpin Conduit Kit

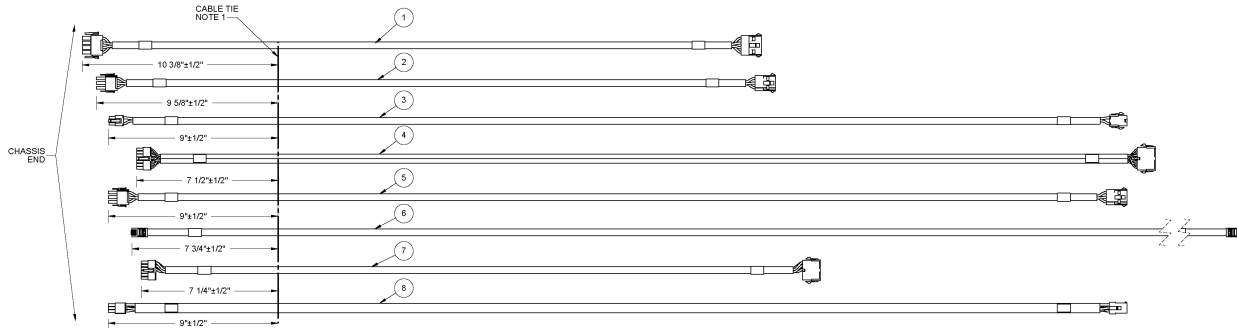


Tenpin Conduit Kit Parts List

Item	Part Number	Description
1	051-080-013	CONDUIT END CAP, ODD
2	051-080-016	CONDUIT COVER
3	051-080-014	CONDUIT END CAP, EVEN
4	051-080-015	CONDUIT
5	051-080-000	CONDUIT CONNECTOR
6	051-080-011	CONDUIT LEG
7	051-080-012	CONDUIT COVER, LEG
8	051-080-009	CONDUIT, REAR
9	051-080-010	CONDUIT COVER, REAR



051-090-029 – Cable Extension Bundle

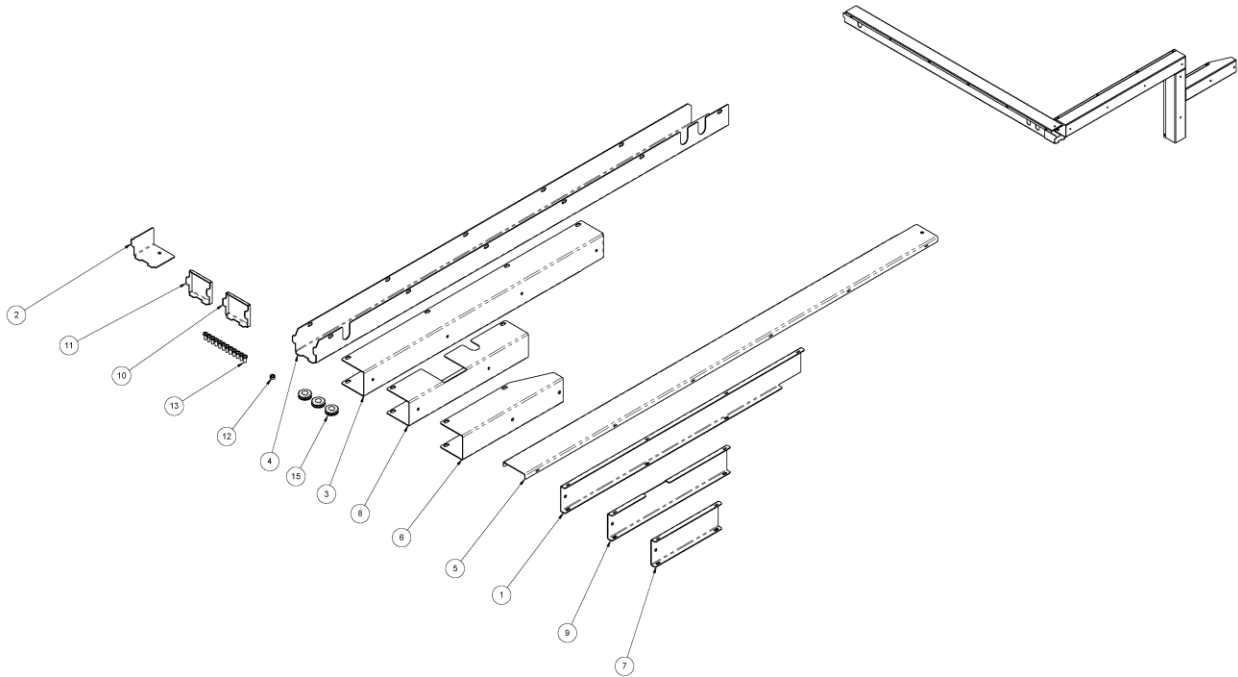


Cable Extension Bundle

Item	Part Number	Description
1	051-010-037	DUAL PITLIGHT CABLE EXTENSION
2	051-010-038	DRIVE MOTOR POWER CABLE EXTENSION
3	051-010-062	PIN DETECTOR 12V POWER CABLE EXTENSION
4	051-010-063	INPUTS SIGNAL CABLE EXTENSION
5	051-010-065	PIN DETECTOR 220 POWER CABLE EXTENSION
6	051-010-070	15' PIN DETECTOR SIGNAL CABLE
7	051-010-043	BALL DETECTOR SIGNAL CABLE EXTENSION
8	051-010-067	DRIVE MOTOR SIGNAL CABLE EXTENSION



051-090-030 – Rear Chassis Conduit

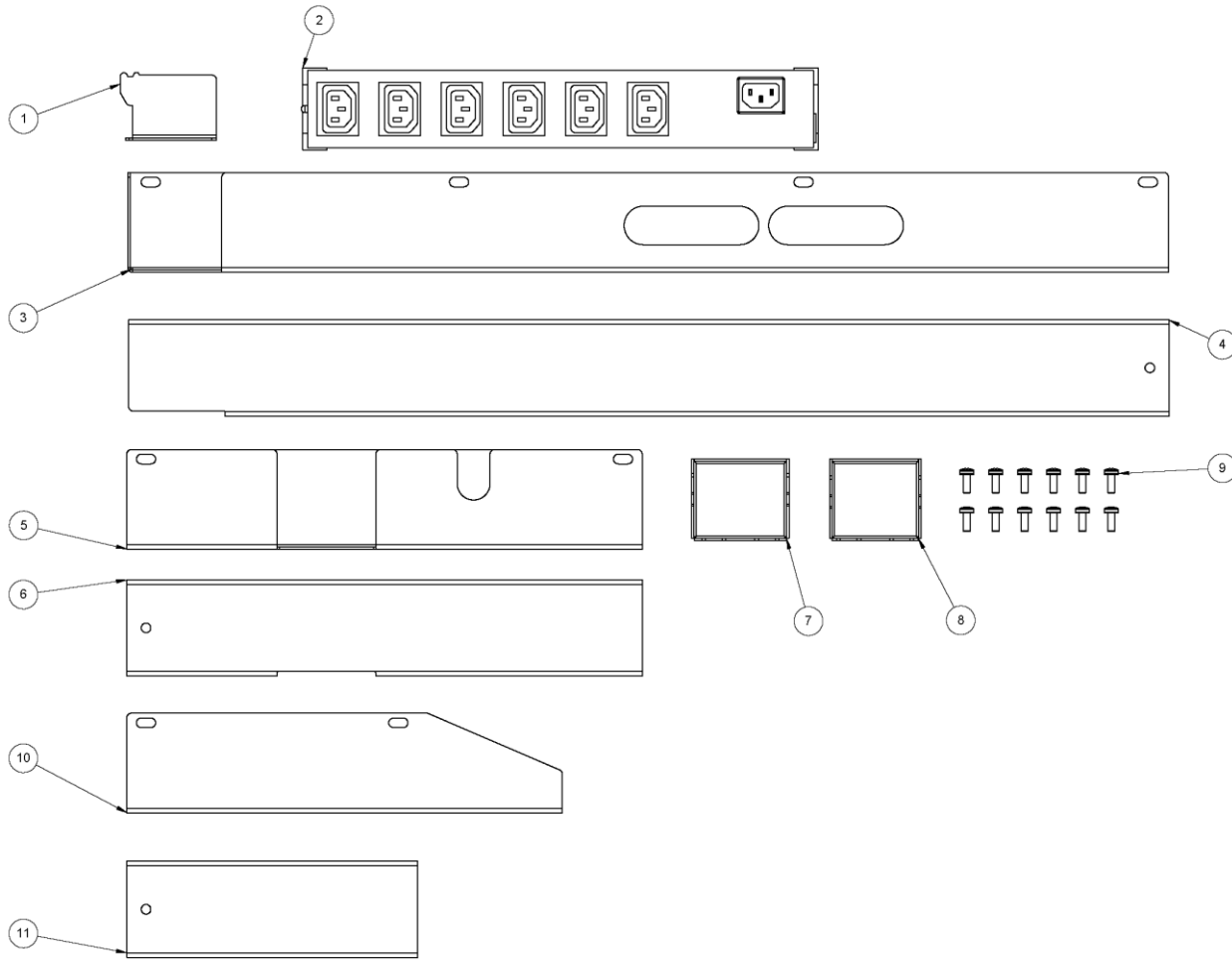


051-090-030 – Rear Chassis Conduit

Item	Part Number	Description
1	051-080-010	REAR CONDUIT COVER
2	051-080-024	CONDUIT CONNECTOR
3	051-080-025	REAR CONDUIT
4	051-080-026	PAIR CONDUIT
5	051-080-027	PAIR CONDUIT COVER
6	051-080-028	REAR CHASSIS CONDUIT
7	051-080-029	REAR CHASSIS CONDUIT COVER
8	051-080-030	LEG CONDUIT
9	051-080-031	LEG CONDUIT COVER
10	051-080-013	ODD END CAP CONDUIT
11	051-080-014	EVEN END CAP CONDUIT
12	838-740-002	HLN 10-32 ZN NM
13	818-240-082	PHPMS 10-32 X 0.50 ZN SEMS
15	711-516-020	GPI 0.50 X 0.81 X 0.13 RB 1



051-090-022 – Single Conduit Kit

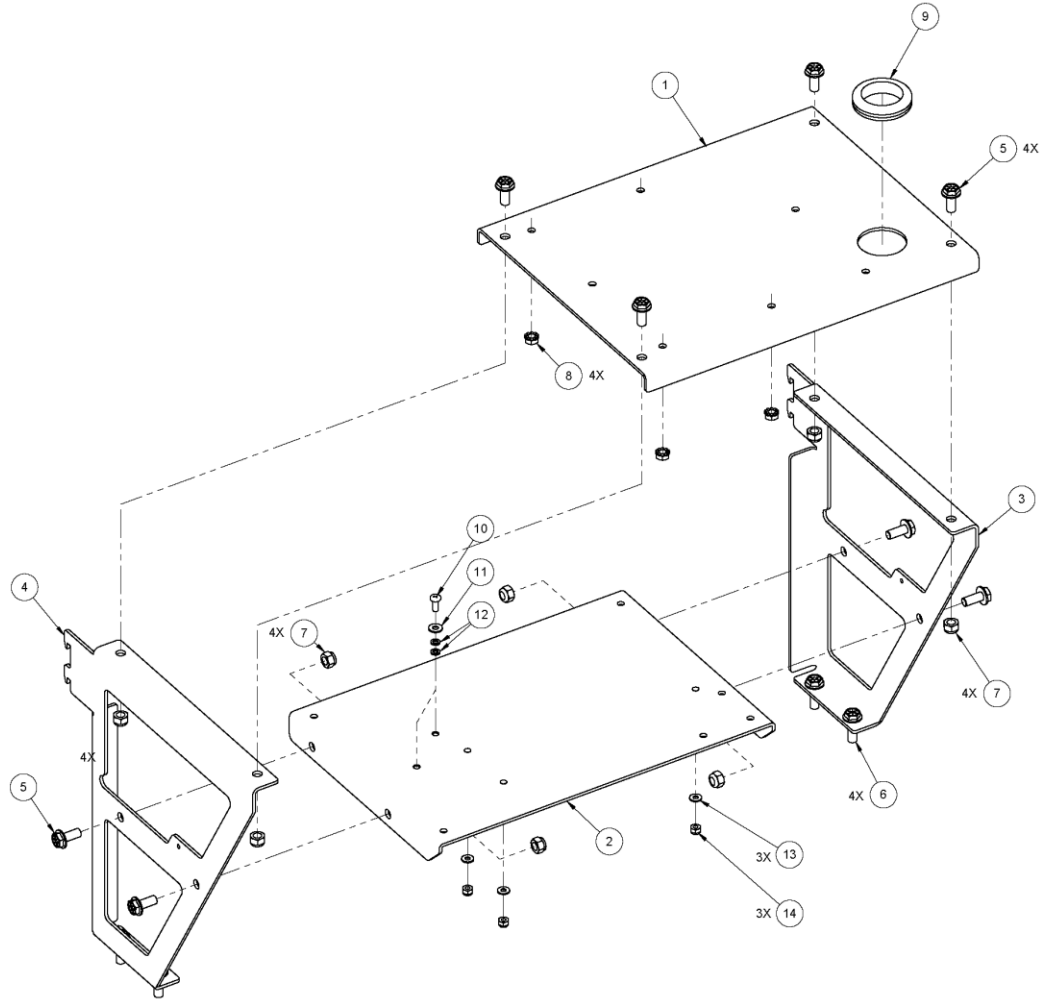


051-090-022 – Single Conduit Kit

Item	Part Number	Description
1	051-080-024	CONDUIT CONNECTOR
2	051-010-023	AUXILIARY POWER STRIP
3	051-080-025	REAR CONDUIT
4	051-080-010	REAR CONDUIT COVER
5	051-080-030	LEG CONDUIT
6	051-080-031	LEG CONDUIT COVER
7	051-080-013	ODD END CAP CONDUIT
8	051-080-014	EVEN END CAP CONDUIT
9	818-240-082	PHPMS 10-32 X 0.50 ZN SEMS
10	051-080-028	REAR CHASSIS CONDUIT
11	051-080-029	REAR CHASSIS CONDUIT COVER



051-090-005 – Chassis Mount Assembly

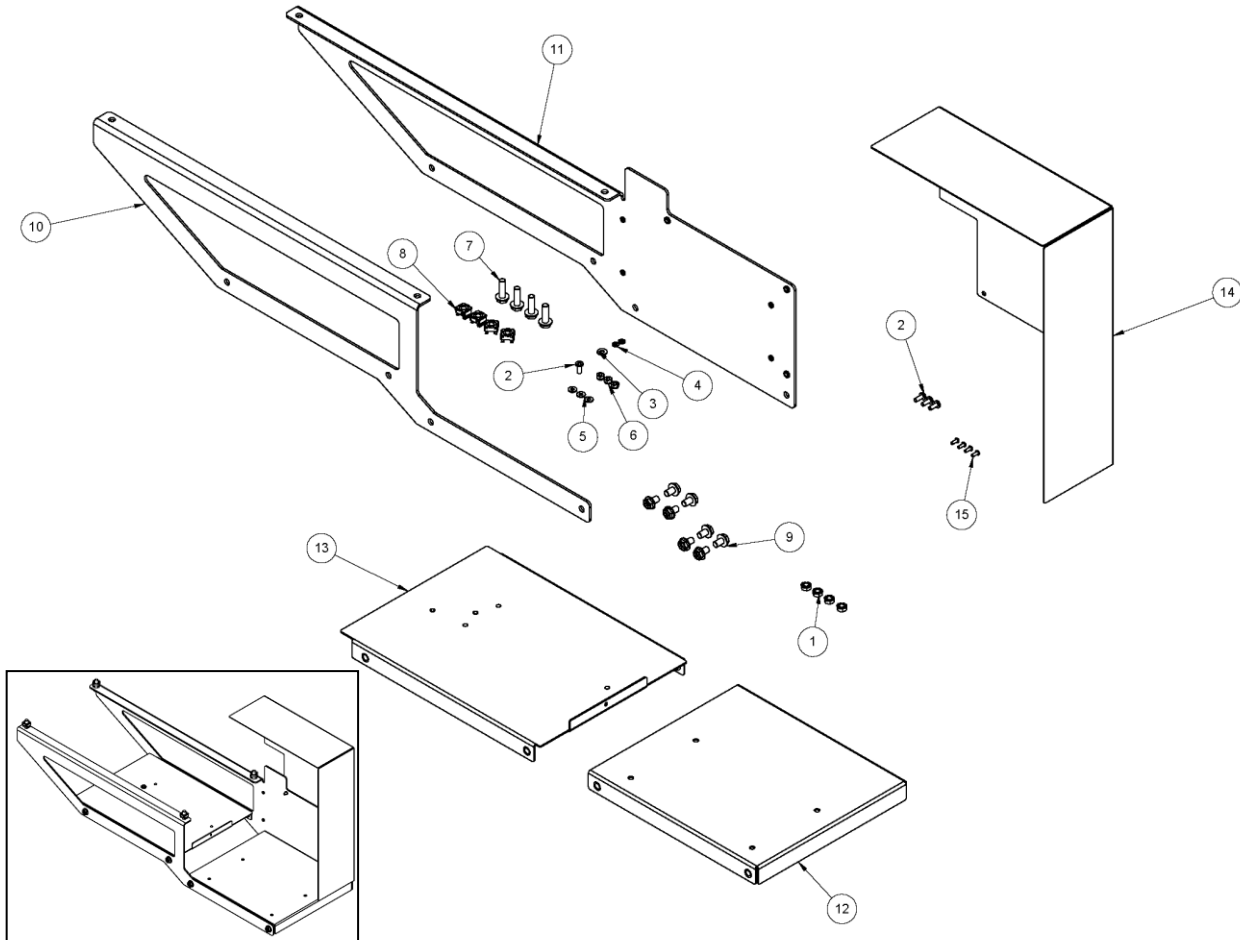


Chassis Mount Assembly Parts List

Item	Part Number	Description
1	051-020-020	CHASSIS SUPPORT SHELF
2	051-020-025	CHASSIS SHELF ASSEMBLY
3	051-020-018	RIGHT-HAND CHASSIS SUPPORT BRACKET
4	051-020-017	LEFT-HAND CHASSIS SUPPORT BRACKET
5	801-757-121	FBCS 5/16-18 X 0.75 GR5 BP PA
6	801-757-161	FBCS 5/16-18 X 1.00 GR5 BP PA
7	7036-003118-000	HLN 5/16-18 ZN NE
8	843-149-002	KN 1/4-20 ZN
9	711-512-051	GPI 1.50 X 2.13 X 0.13 RB 1
10	813-240-082	PHPMS 10-32 X 0.50 ZN
11	7050-021050-006	FW 10 SAE ZN
12	951-138-000	SWM 10 ANSI NS
13	01-109	FW 8 SAE ZN
14	01-014	HLN 8-32 ZN NM



051-070-060 – Rear Chassis Mount Assembly



Rear Chassis Mount Assembly Parts List

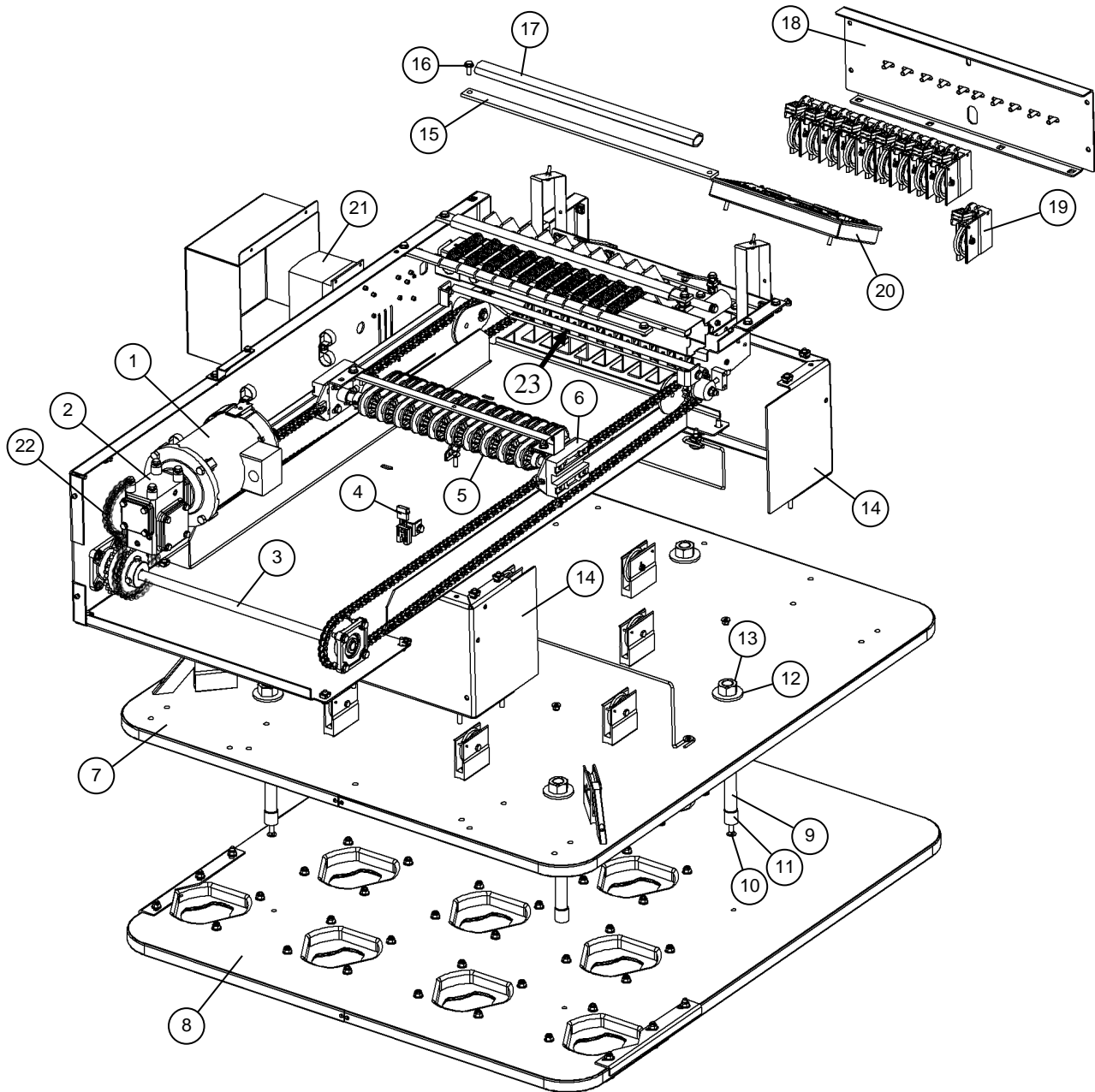
Item	Part Number	Description
1	843-149-002	KN 1/4-20 ZN
2	813-240-082	PHPMS 10-32 X 0.50 ZN
3	7050-021050-006	FW 10 SAE ZN
4	951-138-000	SWM 10 ANSI NS
5	01-109	FW 8 SAE ZN
6	01-014	HLN 8-32 ZN NM
7	801-757-161	FBCS 5/16-18 X 1.00 GR5 BP PA
8	833-200-012	CON Q 5/16-18 BP
9	801-757-081	FBCS 5/16-18 X 0.50 GR5 BP PA
10	051-070-052	REAR CHASSIS MOUNT SIDE 1
11	051-070-054	SUPPORT SIDE 2 ASSEMBLY
12	051-070-056	CHASSIS SUPPORT SHELF ASSEMBLY
13	051-070-058	SCORING SUPPORT SHELF ASSEMBLY
14	051-070-059	CHASSIS WIRING COVER
15	808-527-061	BHSCS 6-32 X 0.38 BO



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Main Components

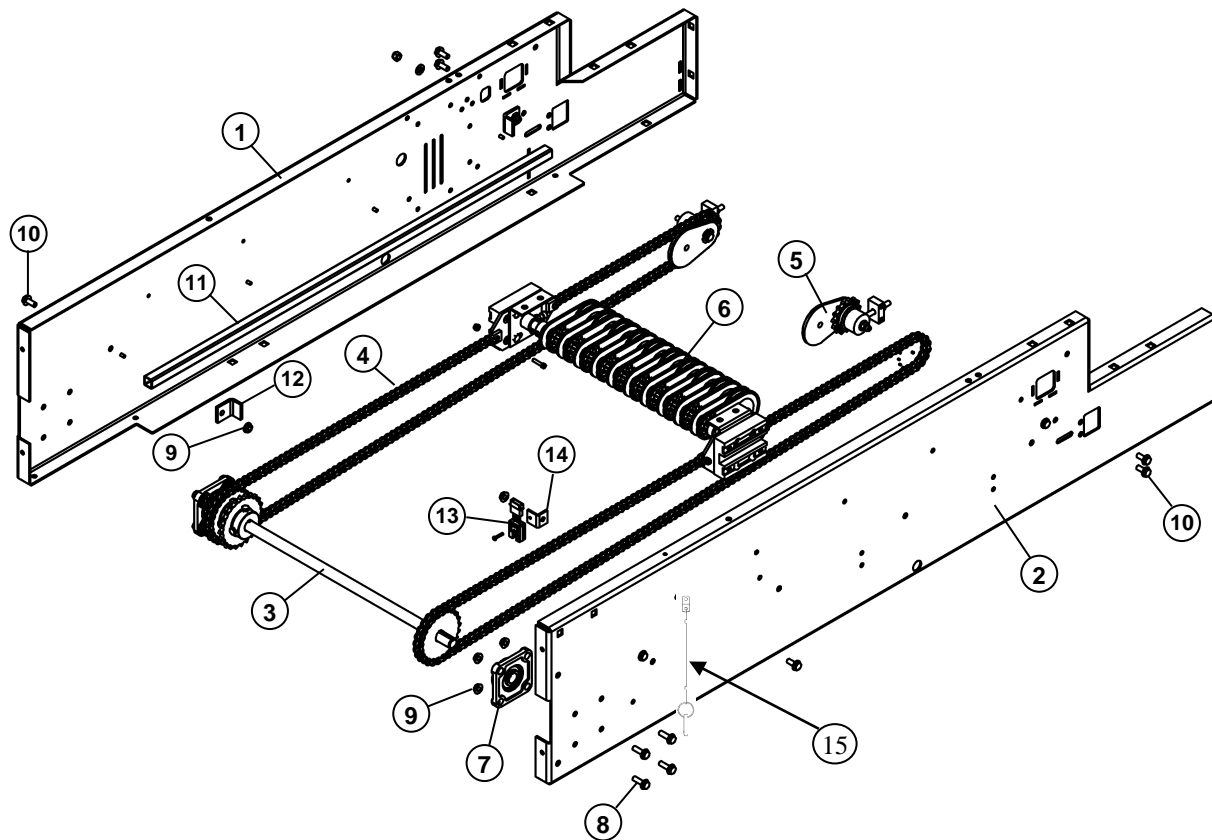


Main Components Parts List

Item	Part Number	Description
1	051-090-024	DRAWBAR MOTOR ASSEMBLY
2	051-030-019	TMS GEARBOX
3	051-090-008	REAR SHAFT ASSEMBLY
4	SB-ECIL-325-FS	OPTICAL SENSOR ASSEMBLY
5	051-090-011	DRAWBAR ASSEMBLY
6	051-090-009	DRAWBAR GUIDE ASSEMBLY
7	051-050-003	TENPIN UPPER TABLE
8	051-050-009	TENPIN LOWER TABLE
9	9102039	SPACER ROD
10	R-014	BUMPER PAD
11	7012-003118-150	CARRIAGE BOLT, 5/16-18 X 1-1/2
12	7052-093225-018	2-1/4" SPACER
13	7034-008709-000	HEX NUT, 7/8-9
14	051-020-000	FOOT BRACKET
15	9102030	REEL ARM STOPPER
16	801-757-161	SCREW, HEX, 5/16-18 X 3/4
17	8664-137112-012	PVC TUBING
18	051-020-008	FRONT PANEL
19	051-090-002	PIN DETECTOR ASSEMBLY
20	051-040-002	PIN DETECTOR BOARD ASSEMBLY
21	051-090-015	DRAWBAR MOTOR CONTROLLER (PROGRAMMED)
22	051-030-009	CHAIN, MOTOR DRIVE
23	9102025	SHAFT



Frame Assembly

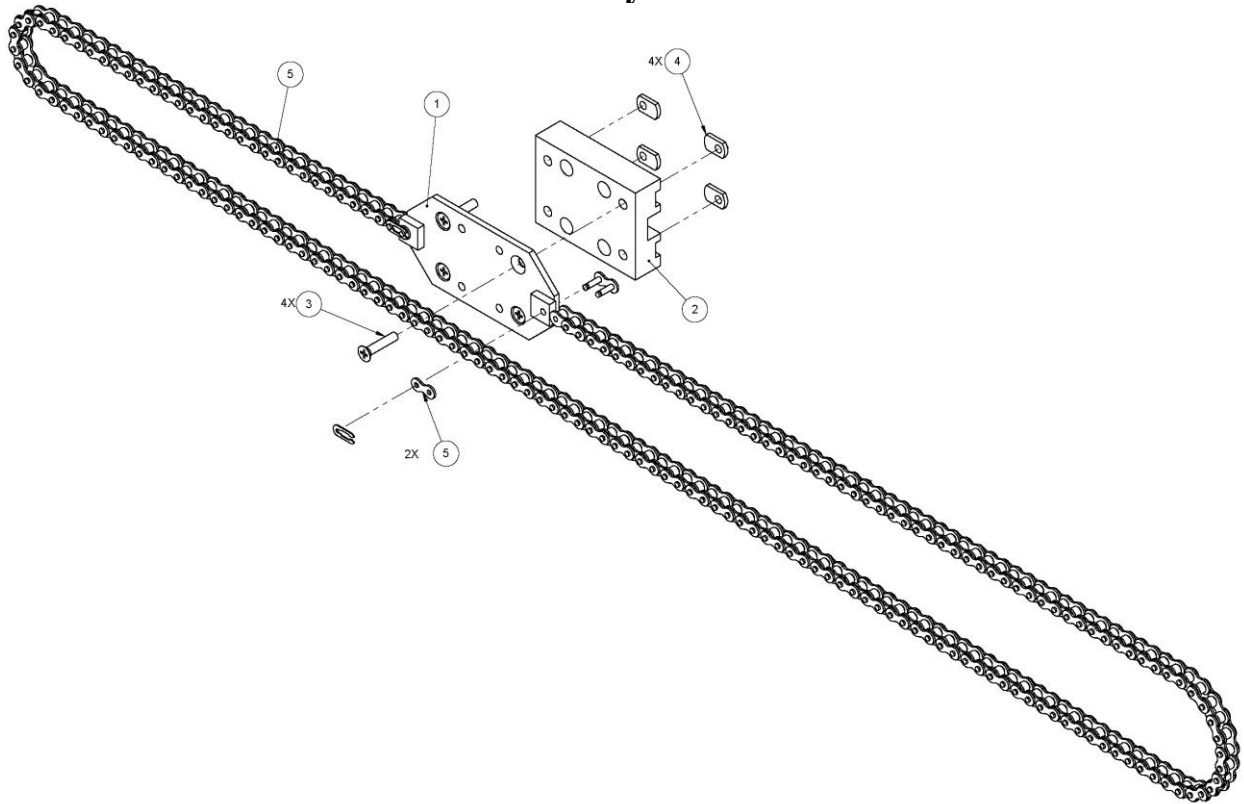


Frame Assembly Parts List

Item	Part Number	Description
1	051-020-002	OUTER PANEL, 10-PIN SIDE
2	051-020-004	OUTER PANEL, 7-PIN SIDE
3	051-090-008	REAR SHAFT ASSEMBLY
4	051-090-009	DRAWBAR GUIDE ASSEMBLY
5	051-090-010	CHAIN TENSIONER ASSEMBLY
6	051-090-011	DRAWBAR ASSEMBLY
7	M-0690-21	FLANGE BEARING
8	801-757-161	SCREW, HEX WASHER HEAD, 5/16-18 X 1, BLACK
9	856-057-001	NUT, HEX FLANGE HEAD, 5/16-18, BLACK
10	801-757-121	SCREW, HEX WASHER HEAD, 5/16-18 X ¾, BLACK
11	051-020-010	DRAWBAR GUIDE BAR
12	9102017	DRAWBAR STOPPER
13	SB-ECIL-325-FS	OPTICAL SENSOR ASSEMBLY, WHITE
14	9102054	OPTICAL SENSOR SUPPORT
15	914-148-158	STOP PINS



051-090-009 - Drawbar Guide Assembly

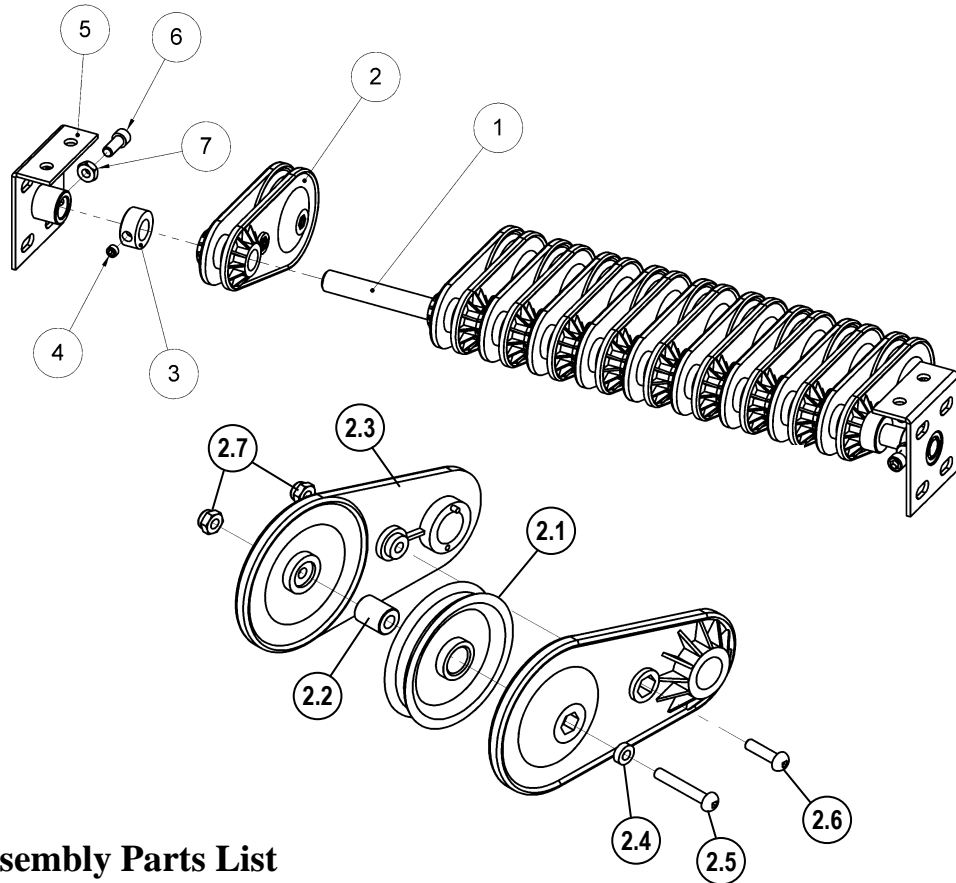


Drawbar Guide Assembly Parts List

Item	Part Number	Description
1	9102011	DRAWBAR CHAIN PLATE
2	9103011	DRAWBAR GUIDE
3	7016-312520-125	SCREW, FLAT HEAD, 1/4-20 X 1.25
4	7046-002520-000	WELD NUT, 1/4-20
5	910-2019-1	DRAWBAR CHAIN SET



051-090-011 - Drawbar Assembly

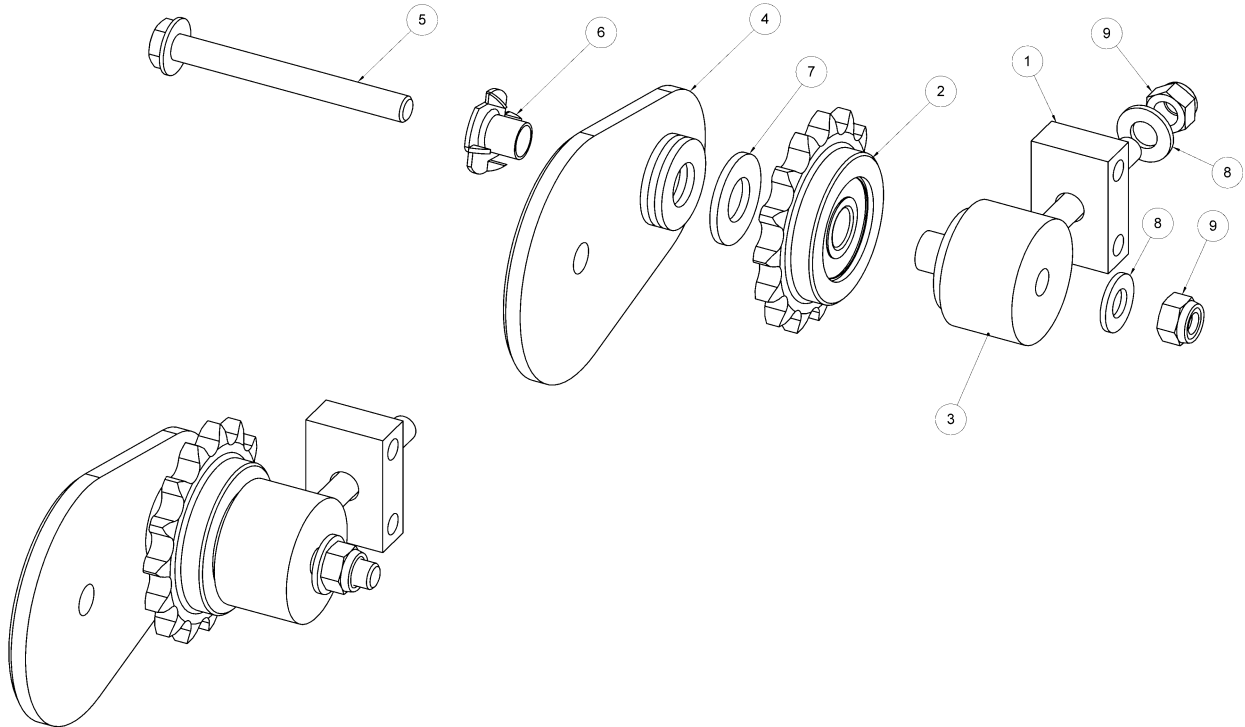


Drawbar Assembly Parts List

Item	Part Number	Description
1	9102015	DRAWBAR SHAFT
2	9133014	SHEAVE PLATE ASSEMBLY
2.1	P-016A	PULLEY
2.2	9102020	BUSHING
2.3	9103014	SHEAVE PLATE
2.4	9103071	PLASTIC SPACER
2.5	7016-411032-125	SCREW, ROUND HEAD, 10-32 X 1-1/4
2.6	7016-411032-075	SCREW, ROUND HEAD, 10-32 X 3/4
2.7	7036-001032-000	NUT, HEX, 10-32, NYLON LOCKING
3	M-0190	STEEL COLLAR
4	7014-003118-025	SET SCREW, 5/16-18 X 1/4
5	9102213	DRAWBAR ADJUSTMENT PLATE
6	7018-003118-075	SCREW HEX SOCKET CAP, 5/16-18 X 3/4
7	834-557-002	NUT, HEX JAM, 5/16-18
8	9102250	DRAWBAR BRACE (NOT SHOWN)



051-090-010 - Chain Tensioner Assembly

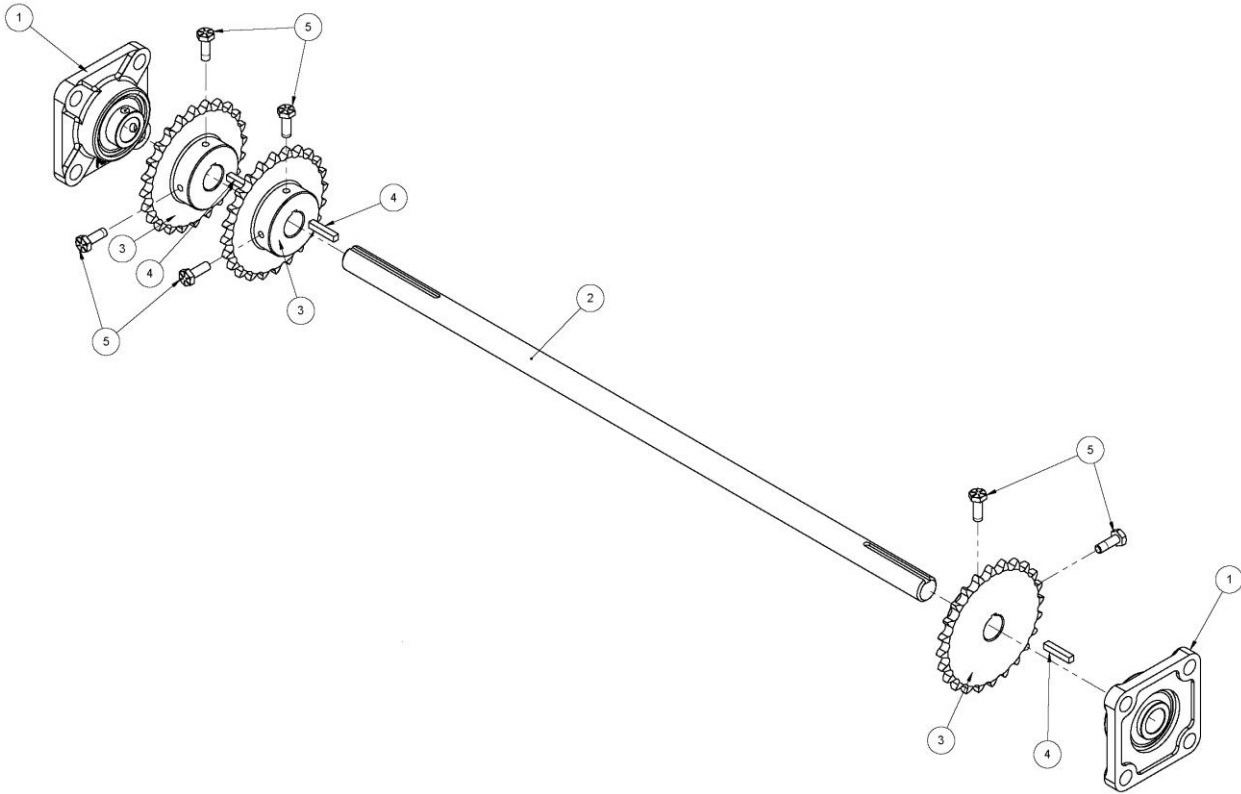


Chain Tensioner Assembly Parts List

Item	Part Number	Description
1	051-020-012	CHAIN BLOCK
2	9102094	DRIVE CHAIN SPROCKET, FRONT
3	9102036	TENSIONER
4	P-001A	DRAWBAR SHEAVE PLATE
5	801-757-481	SCREW, HEX WASHER HEAD, 5/16-18 X 3, BLACK
6	7045-003716-043	TEE NUT, 3/8-16
7	7050-050106-009	WASHER, FLAT, 1/2 X 1-1/16
8	948-722-111	WASHER, FLAT, 5/16, BLACK
9	7036-003118-000	NUT, HEX, 5/16-18, NYLON LOCK



051-090-008 - Rear Shaft Assembly

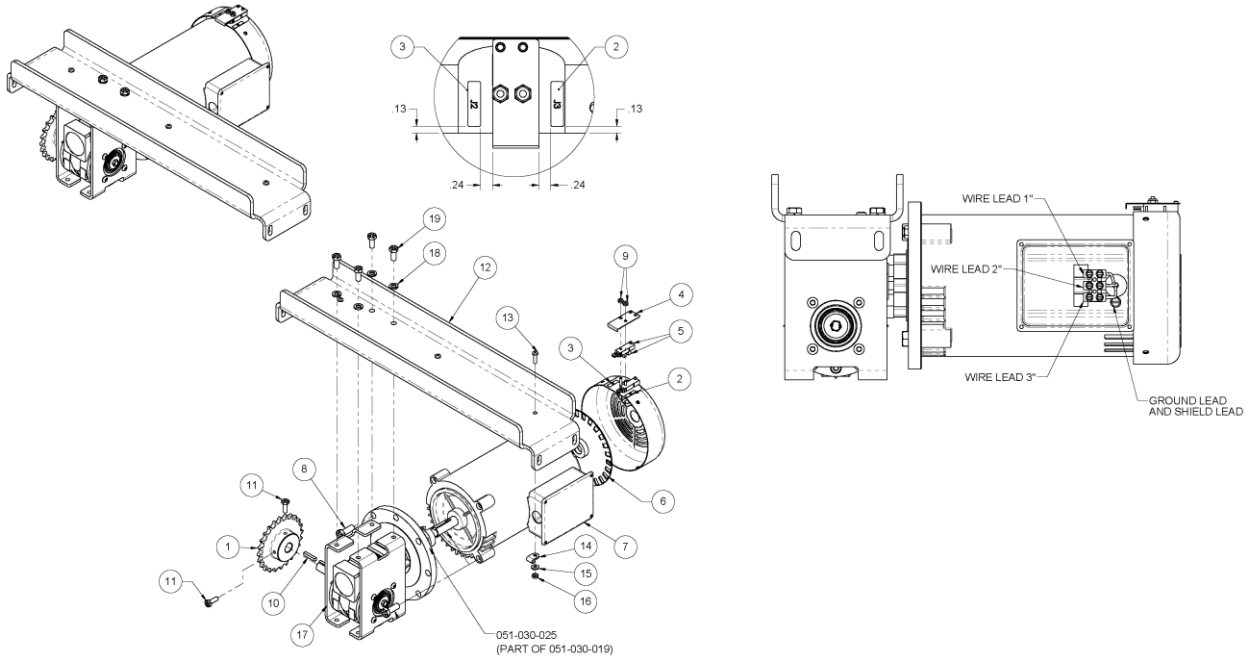


Rear Shaft Assembly Parts List

Item	Part Number	Description
1	M-0690-21	FLANGE BEARING
2	051-030-008	REAR DRAWBAR SHAFT
3	9102092	3/4 BORE SPROCKET
4	302-2410-00	KEY SQ 0.19 X 1.00 Q
5	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
6	700-107-910	REMOVABLE THREAD LOCKER (BLUE 242)



Motor, Reduction Gear, & Encoder Assembly

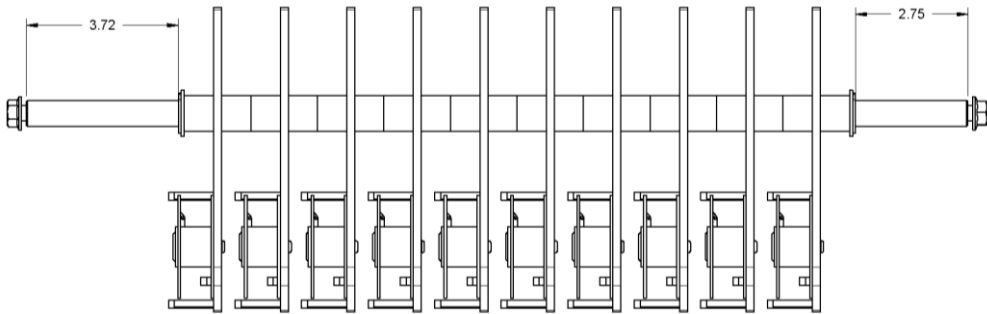
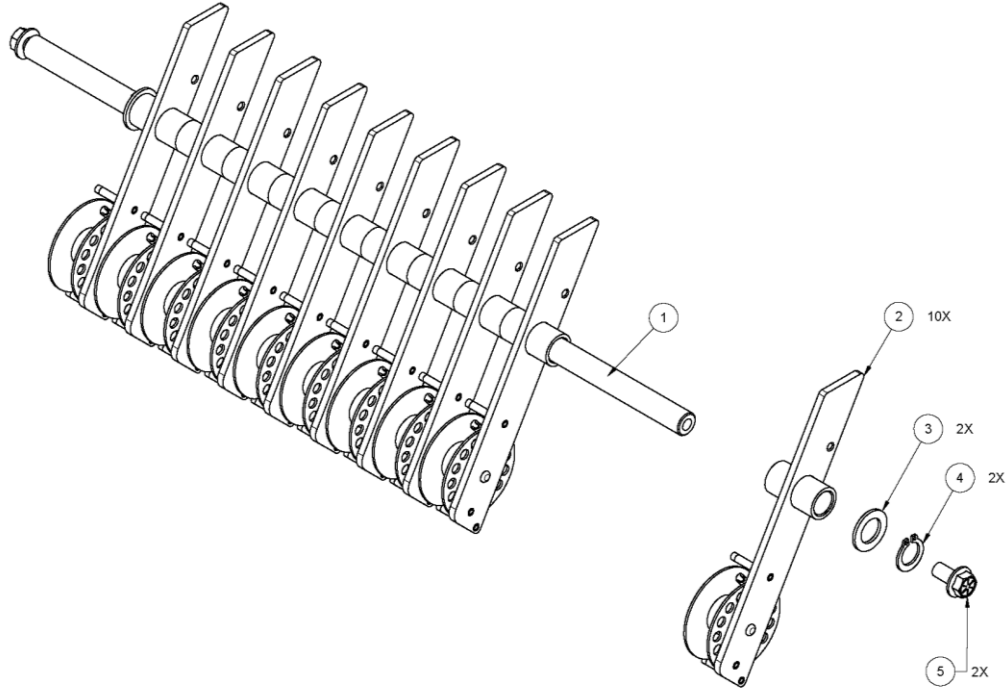


Motor, Reduction Gear, & Encoder Assembly Parts List

Item	Part Number	Description
1	9102292	SPROCKET
2	051-010-030	J3 ENCODER LABEL
3	051-010-029	J2 ENCODER LABEL
4	302-2200-00	CONNECTION RETAINER
5	770-060-251	ENCODER OPTICAL SENSOR
6	051-030-002-01	MOTOR ENCODER ASSEMBLY
7	051-030-015	TMS DRAWBAR MOTOR
8	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
9	7036-000632-000	HLN 6-32 ZN NM
10	302-2410-00	KEY SQ 0.19 X 1.00 Q
11	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
12	051-020-026	DRAWBAR MOTOR BRACKET
13	7016-411032-075	PHPMS 10-32 X 0.75 ZN
14	744-107-016	CMP CBL 0.19 X 0.50 NY
15	7050-021050-006	FW 10 SAE ZN
16	7034-001032-000	HMSN 10-32 ZN
17	051-030-019	TMS GEARBOX
18	951-156-002	SWM 5/16 ANSI BO
19	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
20	7014-002520-050	SSS 1/4-20 X 0.50 CUP BO



Reel Arm Assembly

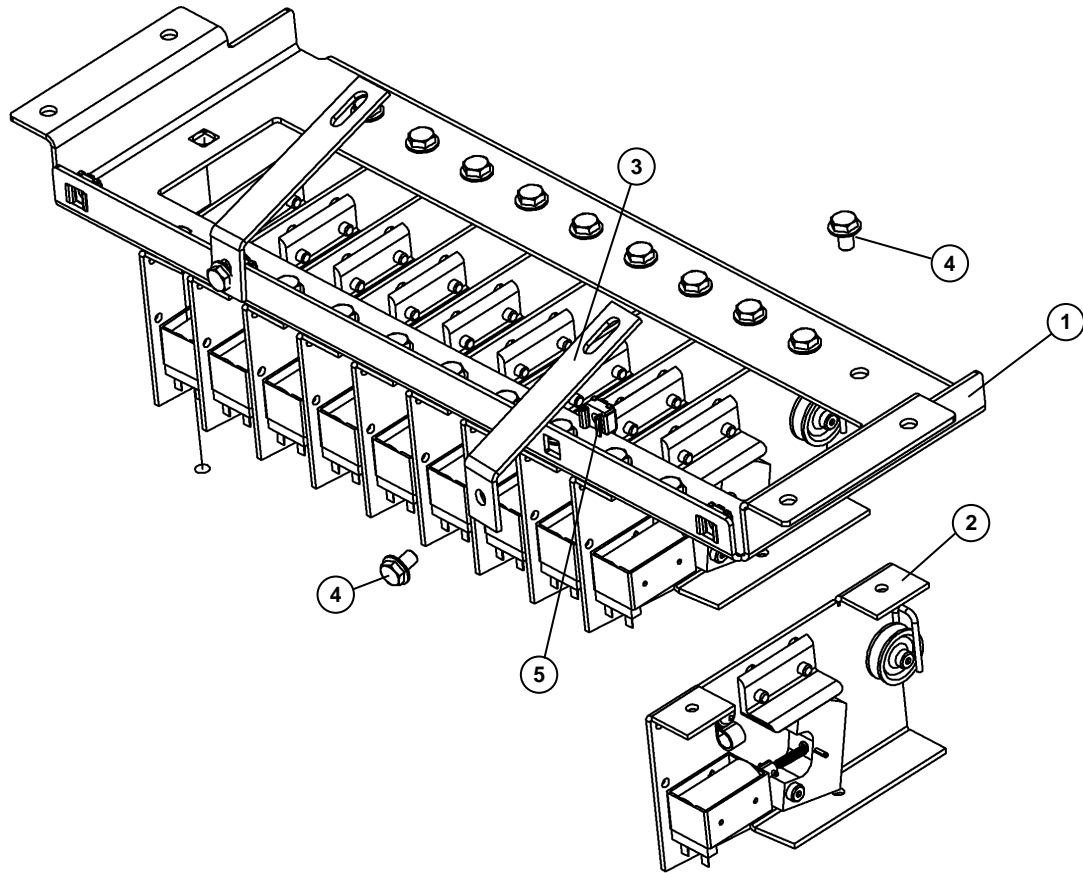


Reel Arm Assembly Parts List

Item	Part Number	Description
1	051-090-025	REEL ARM SHAFT II
2	051-090-007	REEL ARM ASSEMBLY
3	948-884-187	FLAT WASHER, 11/16
4	7002-710000-062	5/8" EXTERNAL RETAINING RING
5	801-765-121	FBCS 3/8-16 X 0.75 GR8 BO



Pin Brake Array

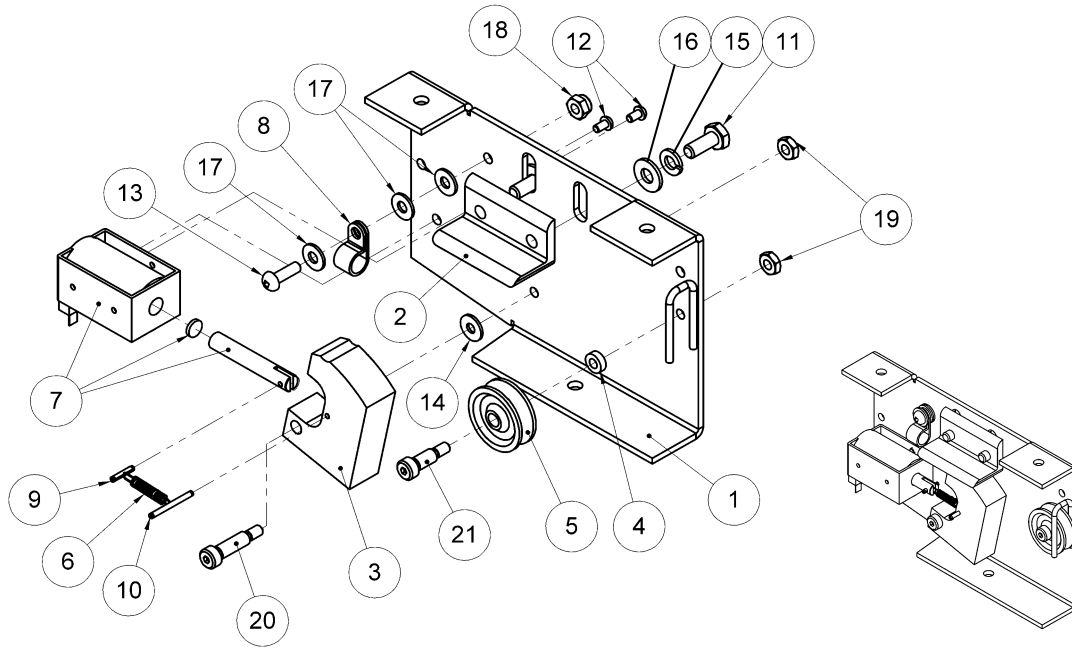


Pin Brake Array Parts List

Item	Part Number	Description
1	051-020-013	PIN BRAKE PANEL
2	051-090-000	PIN BRAKE ASSEMBLY
3	9102221	CONTROLLER BRACKET
4	801-757-081	SCREW, HEX, WASHER HEAD, 5/16-18 x 1/2, BLACK
5	833-200-012	CAGE NUT, 5/16-18



Pin Brake Assembly

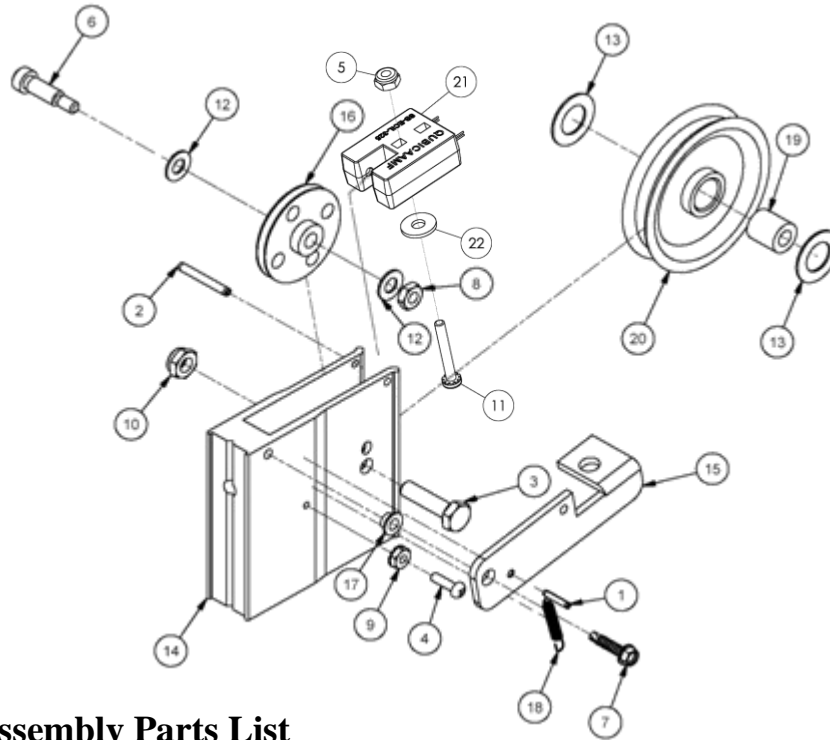


Pin Brake Assembly Parts List

Item	Part Number	Description
1	9102070	BRAKE PLATE
2	9102071	BRAKE ANGLE PLATE
3	9103070	BRAKE CAM
4	9103071	PLASTIC SPACER
5	9103072	GUIDE WHEEL
6	9105070	EXTENSION SPRING
7	758-002-002	SOLENOID ASSEMBLY, 220 vac
8	E-660-09	CABLE CLAMP
9	7006-000900-050	SPRING PIN, 3/32 X 1/2
10	7006-000900-100	SPRING PIN, 3/32 X 1
11	7010-002528-062	SCREW, HEX, 1/4-28 X 5/8
12	7016-410632-025	SCREW, ROUND HEAD, 6-32 X 1/4
13	7016-411032-062	SCREW, ROUND HEAD, 10-32 X 5/8
14	7150-019050-004	WASHER, FLAT, .193 X 1/2 X 3/64
15	7060-025046-006	LOCK WASHER, 1/4
16	7050-028062-006	WASHER, FLAT, 9/32 X 5/8 X 1/16
17	7050-021050-006	WASHER, FLAT, 7/32 X 1/2 X 3/64
18	7036-001032-000	NUT, HEX, 10-32 NYLON INSERT
19	7034-001024-000	NUT, HEX, 10-24
20	7020-002500-075	SHOULDER SCREW, 1/4 X 3/4
21	7020-002500-050	SHOULDER SCREW, 1/4 X 1/2



051-090-002 - Pin Detector Assembly

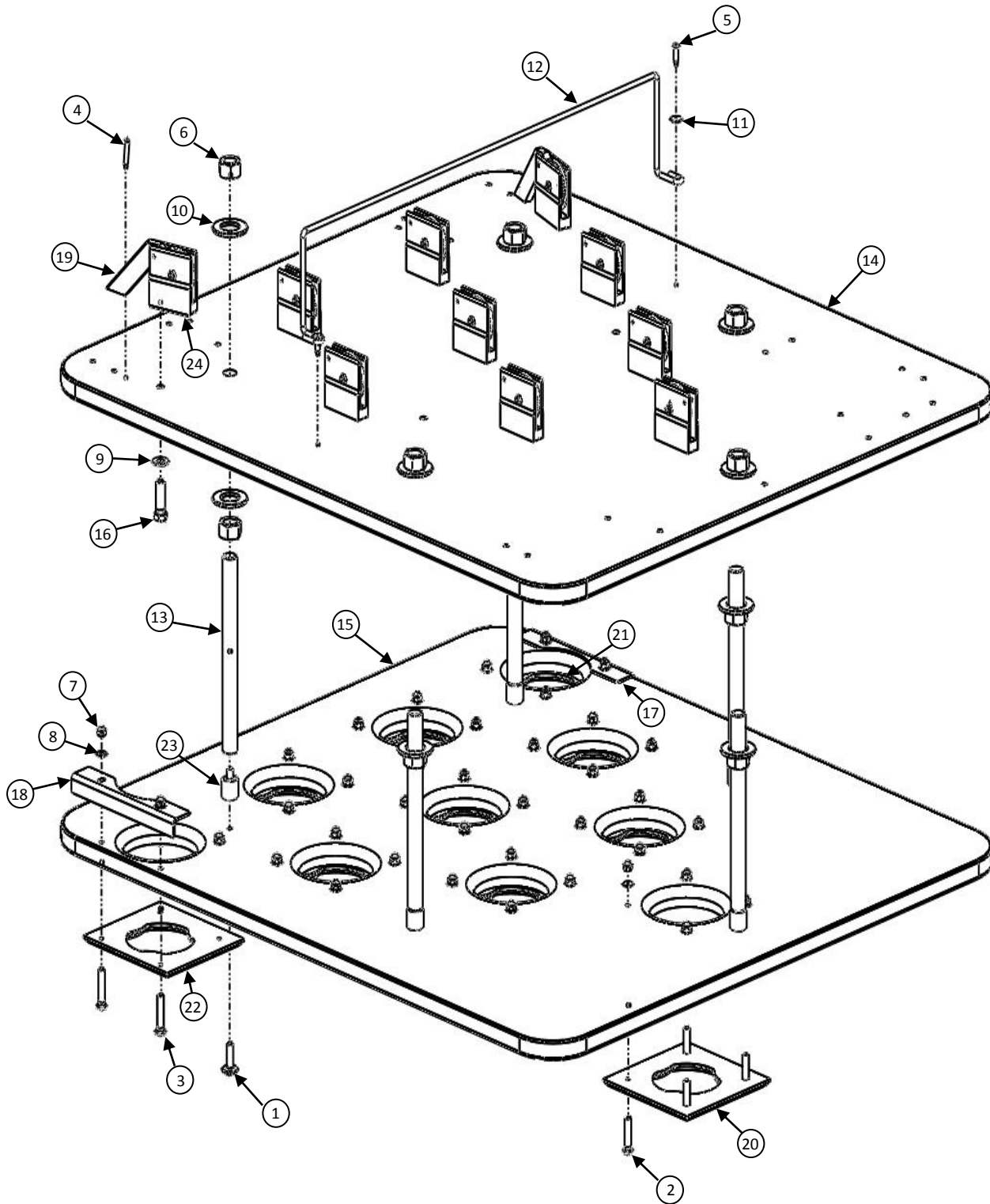


Pin Detector Assembly Parts List

Item	Part Number	Description
1	7006-000900-050	SPRING PIN, 3/32 X 1/2
2	7006-001200-100	SPRING PIN, 1/8 X 1
3	7010-002520-100	SCREW, HEX, 1/4-20 X 1
4	7016-410632-050	SCREW, ROUND HEAD, 6-32 X 1/2
5	7036-000632-000	NUT, HEX LOCK, 6-32
6	880-148-108	SHOULDER SCREW, SOCKET HEAD, HEX, 1/4 X 0.63
7	7027-200818-075	SCREW, HEX WASHER HEAD, 8-18 X 3/4 TEC
8	7034-001024-000	NUT, HEX, 10-24
9	7038-000632-000	NUT, HEX, 6-32 KEP
10	7044-002520-000	NUT, HEX, 1/4-20, NYLON INSERT, THIN
11	818-227-162	SCREW, ROUND HEAD, 6-32 X 1
12	7052-025050-003	FLAT WASHER, 1/4 X 1/2 X 1/32
13	7052-050087-003	FLAT WASHER, 1/2 X 7/8 X 1/32
14	9102057	SENSOR SHEAVE
15	9102058	SUPPORT BRACKET
16	9103058	WHEEL MOVEMENT DETECTOR
17	9103059	NYLON SHOULDER WASHER
18	9105070	EXTENSION SPRING
19	M-0100B	BUSHING
20	P-016A	PULLEY
21	051-010-021	STRING ENCODER SENSOR
22	7150-019050-004	FLAT WASHER, 0.19 X 0.50 X 0.05, ALUMINUM



Upper and Lower Tables with Stabilizers

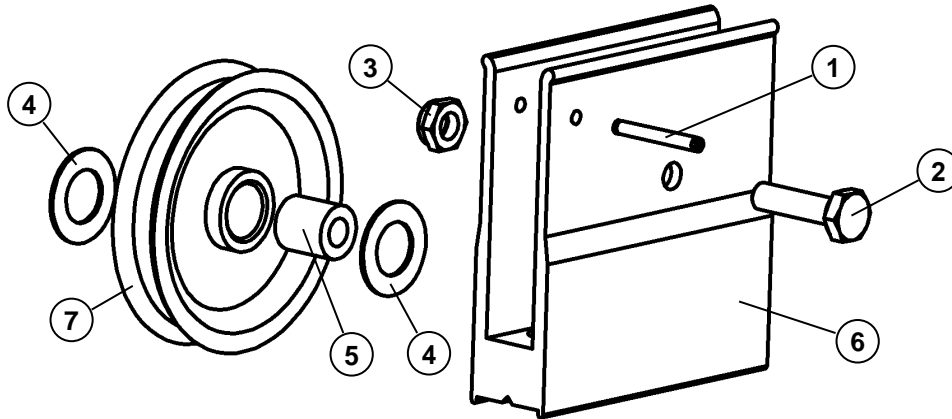


Upper and Lower Tables with Stabilizers Parts List

Item	Part Number	Description
1	7012-003118-150	CARRIAGE BOLT, 5/16-18 x 1-1/2
2	7012-003118-175	CARRIAGE BOLT, 5/16-18 x 1-3/4
3	7012-003118-200	CARRIAGE BOLT, 5/16-18 x 2
4	7023-410800-150	SCREW, ROUND HEAD, #8 x 1-1/2
5	7024-711000-100	SCREW, #10 X 1, SELF-TAPPING
6	7034-008709-000	NUT, HEX, 7/8-9
7	7036-003118-000	NUT, HEX, 5/16-18, NYLON INSERT
8	7050-034068-006	WASHER, FLAT, 5/16 SAE
9	7050-050106-009	WASHER, FLAT, 1/2 SAE
10	7052-093225-018	WASHER, FLAT, 7/8 USS
11	7150-019075-009	WASHER, FLAT, 3/16 X 3/4 X 3/32
12	9102038	STRING SUPPORT
13	9102039	SPACER ROD
14	051-050-004	UPPER TABLE
15	051-050-010	LOWER TABLE
16	M-0041	SPECIAL SCREW
17	051-050-018	TABLE BRACE
18	051-050-018	TABLE BRACE
19	P-043	PULLEY SHEAVE GUARD
20	P-013	PIN CENTERING RING (1-6, 8, 9 PINS)
21	P-013-4	PIN CENTERING RING, RIGHT (10-PIN)
22	P-013-7	PIN CENTERING RING, LEFT (7-PIN)
23	R-014	BUMPER PAD
24	SB-043-1	PULLEY ASSEMBLY



SB-043-1 - Pulley Assembly

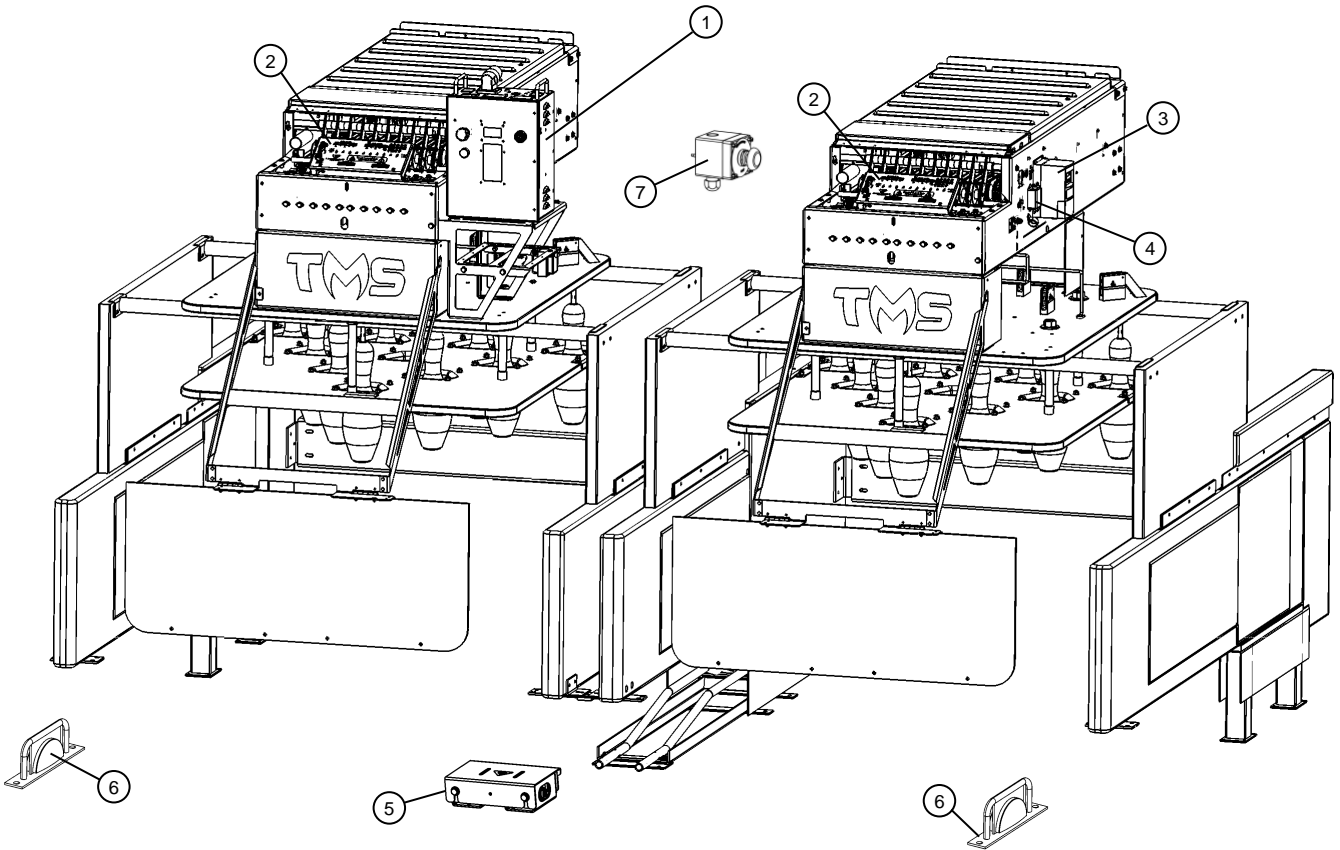


Pulley Assembly Parts List

Item	Part Number	Description
1	7006-001200-100	SPRING PIN, 1/8 X 1
2	7010-002520-100	1/4-20 X 1 HEX CAP SCREW
3	7044-002520-000	1/4-20 NYLON INSERT HEX NUT, THIN
4	7052-050087-003	1/2 X 7/8 X 1/32 FLAT WASHER
5	M-0100B	BUSHING
6	M-043-1	SHEAVE
7	P-016A	PULLEY



Electronic Components

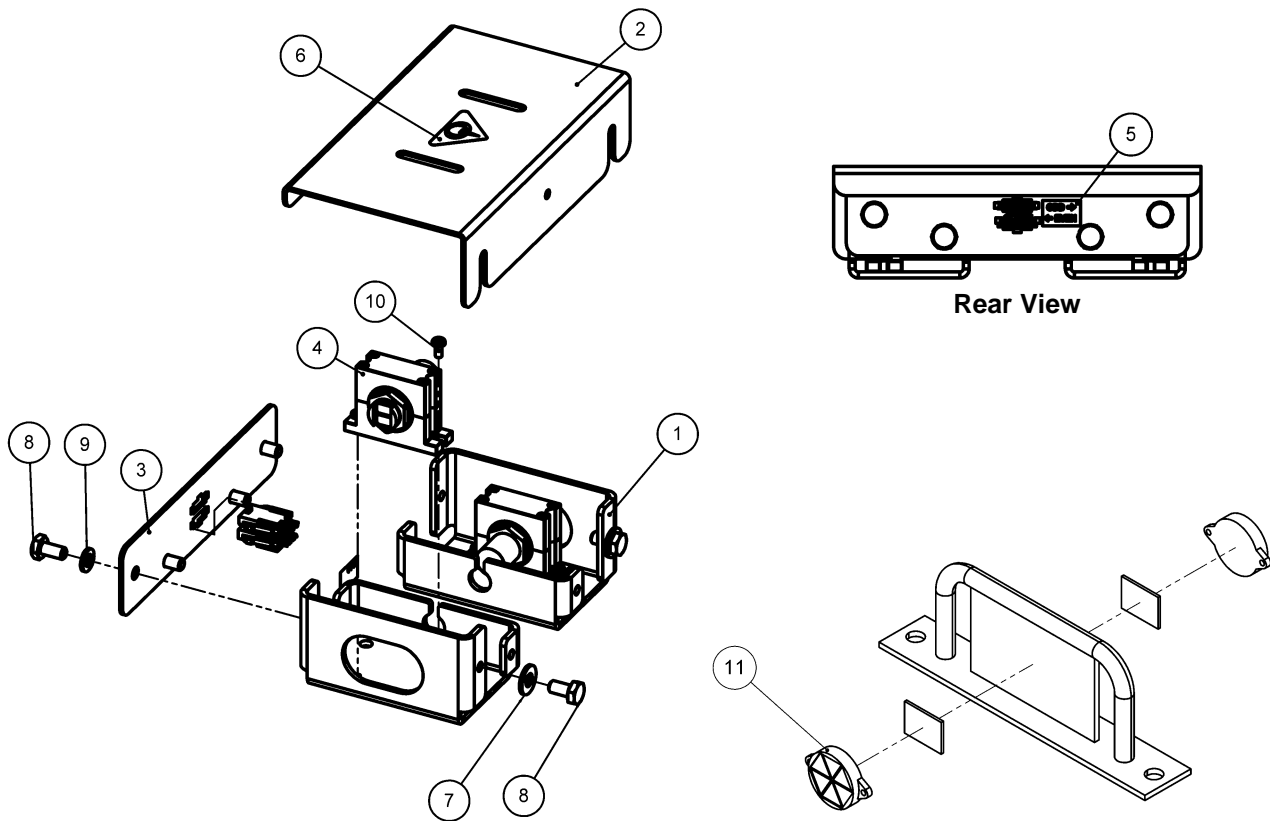


Electronic Components Parts List

Item	Part Number	Description
1	051-000-001T	TMS CONTROLLER
2	051-040-002	PIN DETECTOR BOARD ASSEMBLY
3	051-090-015	DRIVE MOTOR CONTROLLER (PROGRAMMED)
4	051-010-024	EMI LINE FILTER
5	088-000-230	BALL DETECTOR ASSEMBLY
6	051-090-018	REFLECTOR ASSEMBLY
7	051-090-020	EXTERNAL E-STOP ASSEMBLY



088-000-230 - Ball Detector Assembly

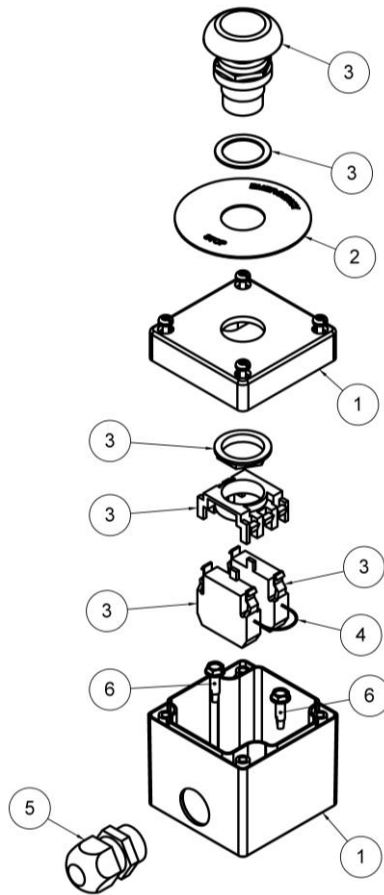


Ball Detector Parts List

Item	Part Number	Description
1	088-000-231	BALL DETECTOR SENSOR BOX
2	088-000-232	BALL DETECTOR SENSOR COVER
3	088-000-233	BALL DETECTOR BACK PLATE
4	060-060-005	BALL DETECTOR SENSOR
5	088-000-235	STICKER, ODD & EVEN
6	088-000-236	STICKER, QAMF LOGO
7	7050-028062-006	FLAT WASHER, 9/32 X 5/8
8	7010-002520-050	SCREW, HEX, 1/4-20 X 1/2
9	7060-025046-006	SPLIT LOCK WASHER, 1/4 X 15/32
10	7016-430632-031	SCREW, ROUND HEAD, 6-32 X 5/16
11	PLAREF30AS	ROUND REFLECTOR



051-090-020 – External E-Stop Assembly

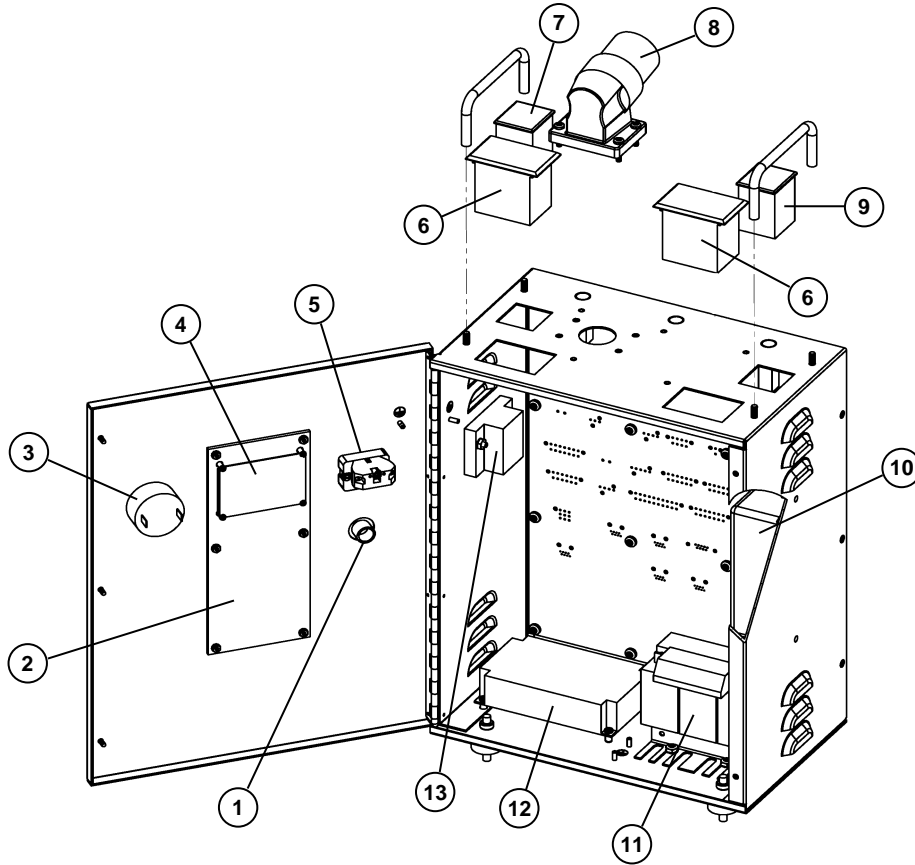


External E-Stop Assembly Parts List

Item	Part Number	Description
1	088-200-251	SINGLE HOLE PUSHBUTTON ENCLOSURE
2	770-067-257	E-STOP LEGEND PLATE
3	759-506-131	E-STOP PUSHBUTTON ASSEMBLY, PUSH/PULL TYPE
4	088-200-211	INTERLOCK & E-STOP JUMPER
5	088-200-230	STRAIN RELIEF
6	7027-200818-075	SCREW, HEX WASHER HEAD, SELF-DRILLING, #10 X .75



TMS CONTROLLER COMPONENTS



TMS CONTROLLER COMPONENTS

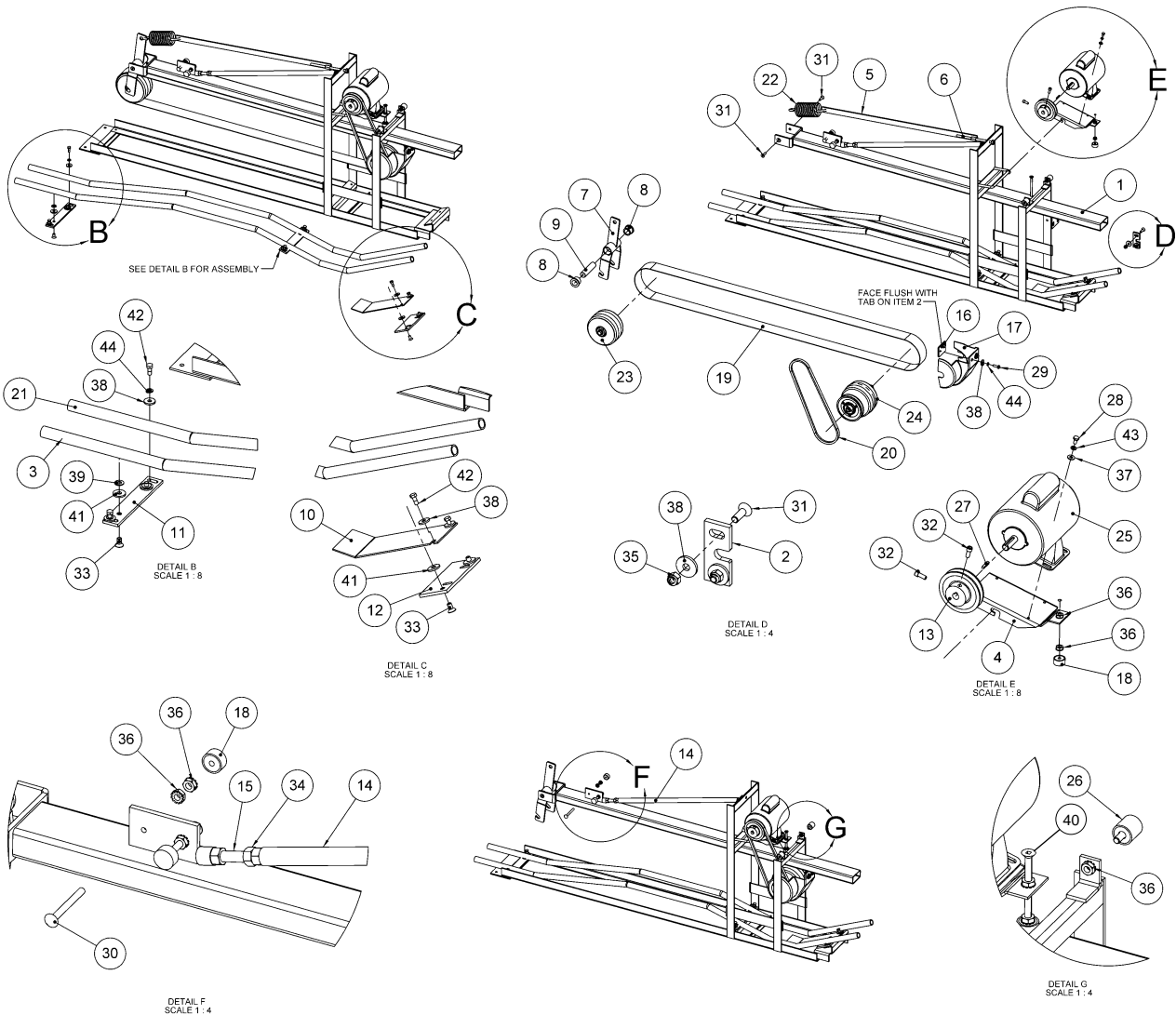
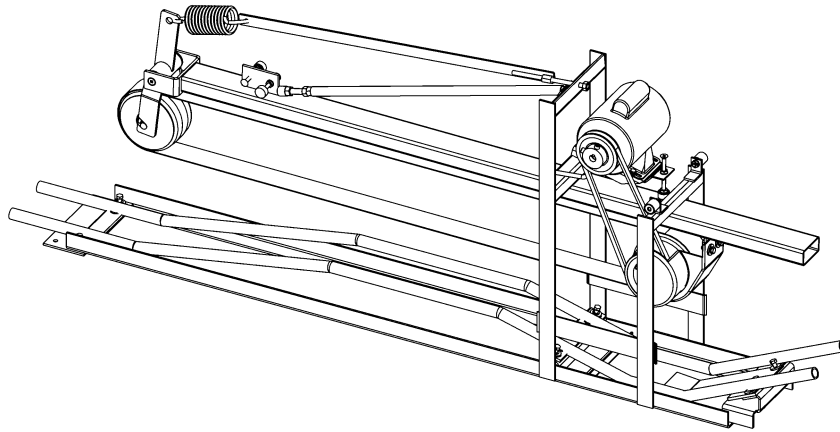
Item	Part Number	Description
1	051-000-022	E-STOP RESET BUTTON
2	051-000-015	KEYPAD
3	051-000-023	BUZZER
4	051-000-019	LCD DISPLAY
5	051-000-021	E-STOP BUTTON ASSEMBLY
6	051-000-037	CIRCUIT BREAKER, 5A
7	051-000-039	CIRCUIT BREAKER SWITCH, 5A
8	051-000-025	POWER INLET, 3 POLE, 220V
9	051-000-038	CIRCUIT BREAKER SWITCH, 3A
10	051-000-030	EMI FILTER, 250VAC, 12A
11	051-000-032	LINE REACTOR, 250VAC, 11.6A
12	051-000-040	POWER SUPPLY
13	051-000-031	POWER DISTRIBUTION BLOCK, 600V, 70A



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051-090-019 -Ball Accelerator

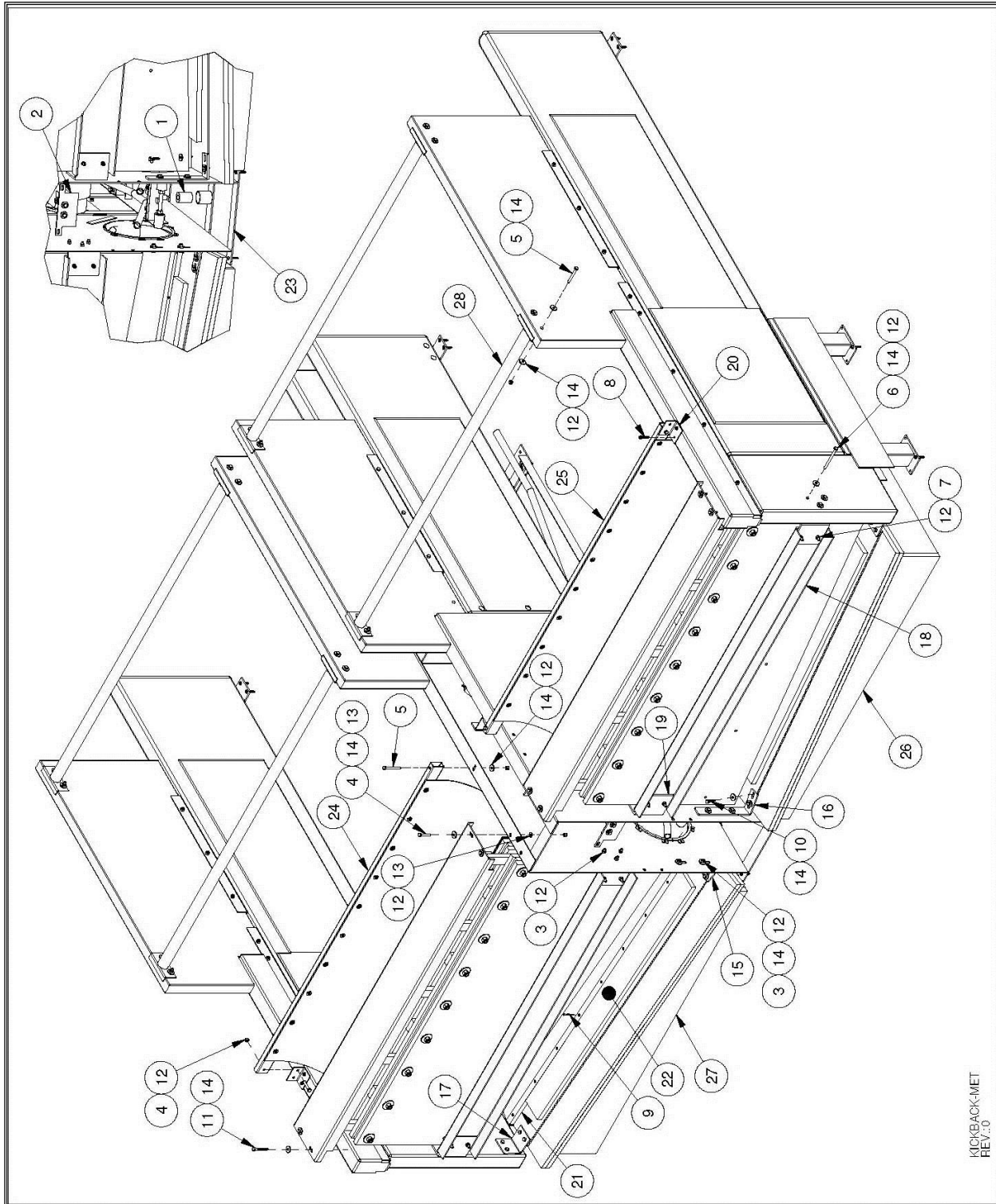


051-090-019 - Ball Accelerator Parts List

Item	Part Number	Description
1	302-9000-00	ACCELERATOR FRAME
2	302-9010-00	ADJUSTMENT PLATE
3	302-9020-00	TRACK
4	302-9060-00	MOTOR SUPPORT
5	302-9070-00	TENSION BAR
6	302-9075-00	SPECIAL BOLT
7	302-9090-00	TENSION BRACKET
8	302-9095-00	FLANGE BEARING
9	302-9100-00	ACCELERATOR SHAFT
10	302-9120-00	PIN HEAD GUARD
11	302-9180-00	ATTACHMENT PLATE
12	302-9190-00	ATTACHMENT PLATE
13	302-9200-00	ACCELERATOR PULLEY
14	302-9220-00	STABILIZER ARM
15	302-9230-00	ADJUSTMENT ROD
16	302-9030-01	BALL GUARD BRACKET
17	303-9030-00	BELT GUARD
18	304-1560-00	BUMPER PAD
19	304-9000-00	ACCELERATOR BELT
20	304-9010-00	ACCELERATOR MOTOR BELT
21	304-9020-00	TRACK TUBING
22	305-9080-00	ACCELERATOR SPRING
23	333-9110-01	TENSION WHEEL ASSEMBLY
24	333-9140-01	DRIVE WHEEL ASSEMBLY
25	051-130-000	TENPIN ACCELERATOR MOTOR ASSEMBLY
26	R-014	BUMPER PAD
27	302-2410-00	KEY, 3/16
28	7010-002520-050	SCREW, HEX, ¼-20 X ½
29	7010-003118-100	SCREW, HEX, 5/16-18 X 1
30	7012-003118-300	CARRIAGE BOLT, 5/16-18 X 3
31	7016-313118-100	SCREW, FLAT HEAD, 5/16-18 X 1
32	7018-003118-075	SCREW, HEX, 5/16-18 X 3/4
33	7018-303716-075	SCREW, FLAT HEAD, 3/8-16 X 3/4
34	7034-005013-000	NUT, HEX, 1/2-13
35	7036-003118-000	NUT, HEX, 5/16-18, NYLON INSERT
36	7038-003118-000	NUT, HEX, 5/16-18 KEPS
37	7050-028062-006	WASHER, FLAT, 9/32 X 5/8
38	7050-034100-012	WASHER, FLAT, 11/32 X 1 X 1/8
39	7050-040081-006	WASHER, FLAT, 13/32 X 13/16 X 1/16
40	7016-313118-400	SCREW, FLAT HEAD, 5/16-18 X 4
41	7050-040112-012	WASHER, FLAT, 13/32 X 1-1/8 X 1/8
42	7010-003118-075	SCREW, HEX, 5/16-18 X 3/4
43	7060-025046-006	WASHER, ¼, LOCK
44	7060-031057-009	WASHER, 5/16, LOCK



Pit Assembly



Pit Assembly Parts List

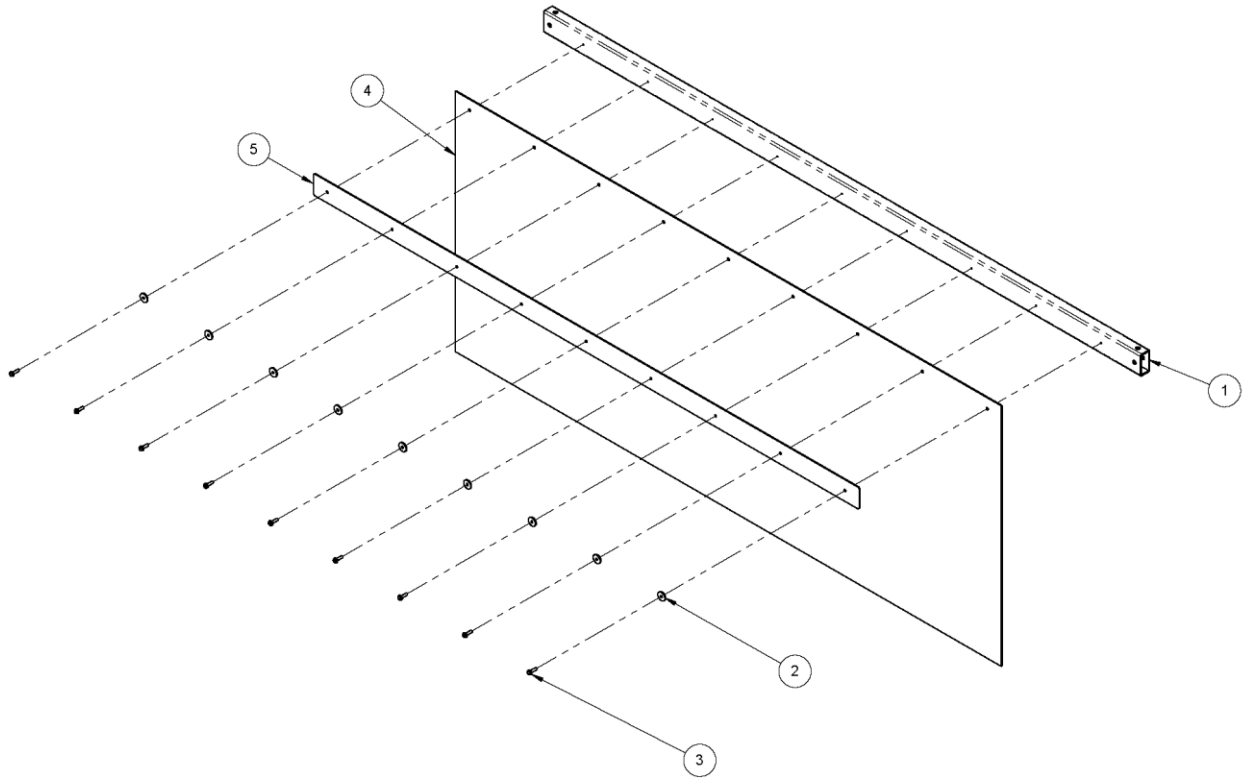
Item	Part Number	Description
1	304-9030-00	POSITIONING TUBE
2	322-9000-00	BALL ACCELERATOR ASS'Y
3	7010-003118-100	5/16-18 X 1 HEX CAP SCREW
4	7010-003118-175	5/16-18 X 1-3/4 HEX CAP SCREW
5	7010-003118-275	5/16-18 X 2-3/4 HEX CAP SCREW
6	7010-003118-400	5/16-18 X 4 HEX CAP SCREW
7	7012-003118-100	5/16-18 X 1 CARRIAGE BOLT
8	7024-201400-150	14-10 X 1-1/2 HEX/WASHER HEAD SELF-TAPPING SCREW
9	7026-310800-200	#8 X 2 SELF-DRILLING FLAT HEAD SCREW
10	7028-003100-150	5/16 X 1-1/2 LAG SCREW
11	7028-003100-250	5/16 X 2-1/2 LAG SCREW
12	7036-003118-000	5/16-18 NYLON INSERT HEX NUT
13	7050-034068-006	11/32 X 11/16 X 1/16 FLAT WASHER
14	7050-034100-012	11/32 X 1 X 1/8 FLAT WASHER
15	9202043	PIT HOLDING BRACKET, LEFT
16	9202044	PIT HOLDING BRACKET, RIGHT
17	9202045	PIT HOLDING BRACKET
18	9202047	CUSHION STOP PLANK
19	9202049	CUSHION STOP BRACKET
20	9202054	TUBING BRACKET
21	9203052	BALL GUIDE
22	9206055	BALL GUIDE STOPPER
23	9222001	BALL RETURN KICKBACK ASS'Y
24	9222048-4	CUSHION ASSEMBLY, RIGHT
25	9222048-7	CUSHION ASSEMBLY, LEFT
26	9266051	PIT FLOOR, LANE 1
27	9266052	PIT FLOOR, LANE 2
28	M-0376	MAIN CROSS SUPPORT



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051-060-017 – TSM TenPin Drop Curtain Assembly

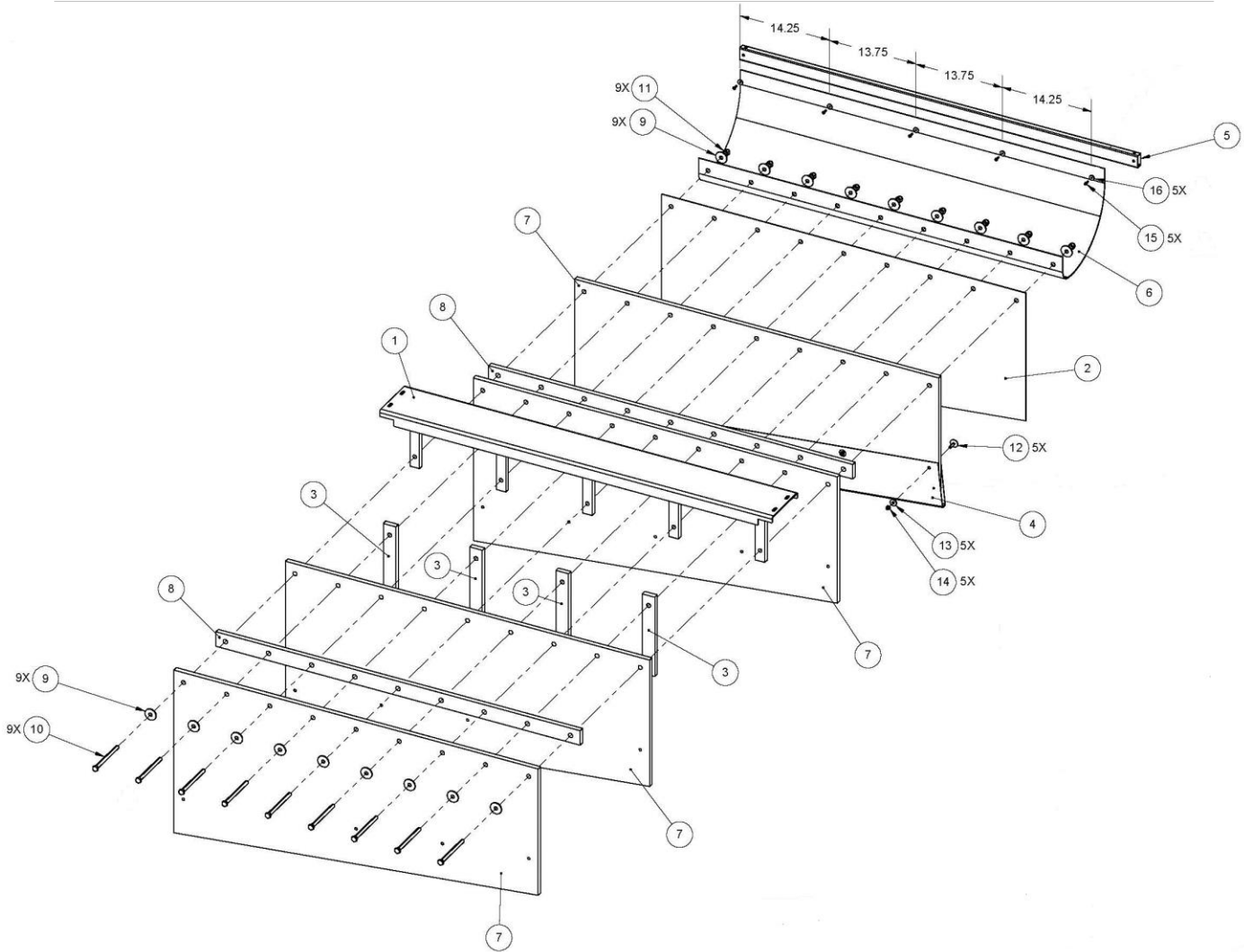


Drop Curtain Assembly Parts List

Item	Part Number	Description
1	9202053	APRON TUBING
2	7150-019075-009	FW 0.19 X 0.75 X 0.09 AL
3	7027-201016-075	HWTS 10 X 0.75 ZN TEK2
4	051-060-016	DROP CURTAIN
5	051-060-018	DROP CURTAIN BRACE



Cushion Assembly - 9222048-7 (Odd Lane) & 9222048-4 (Even Lane)

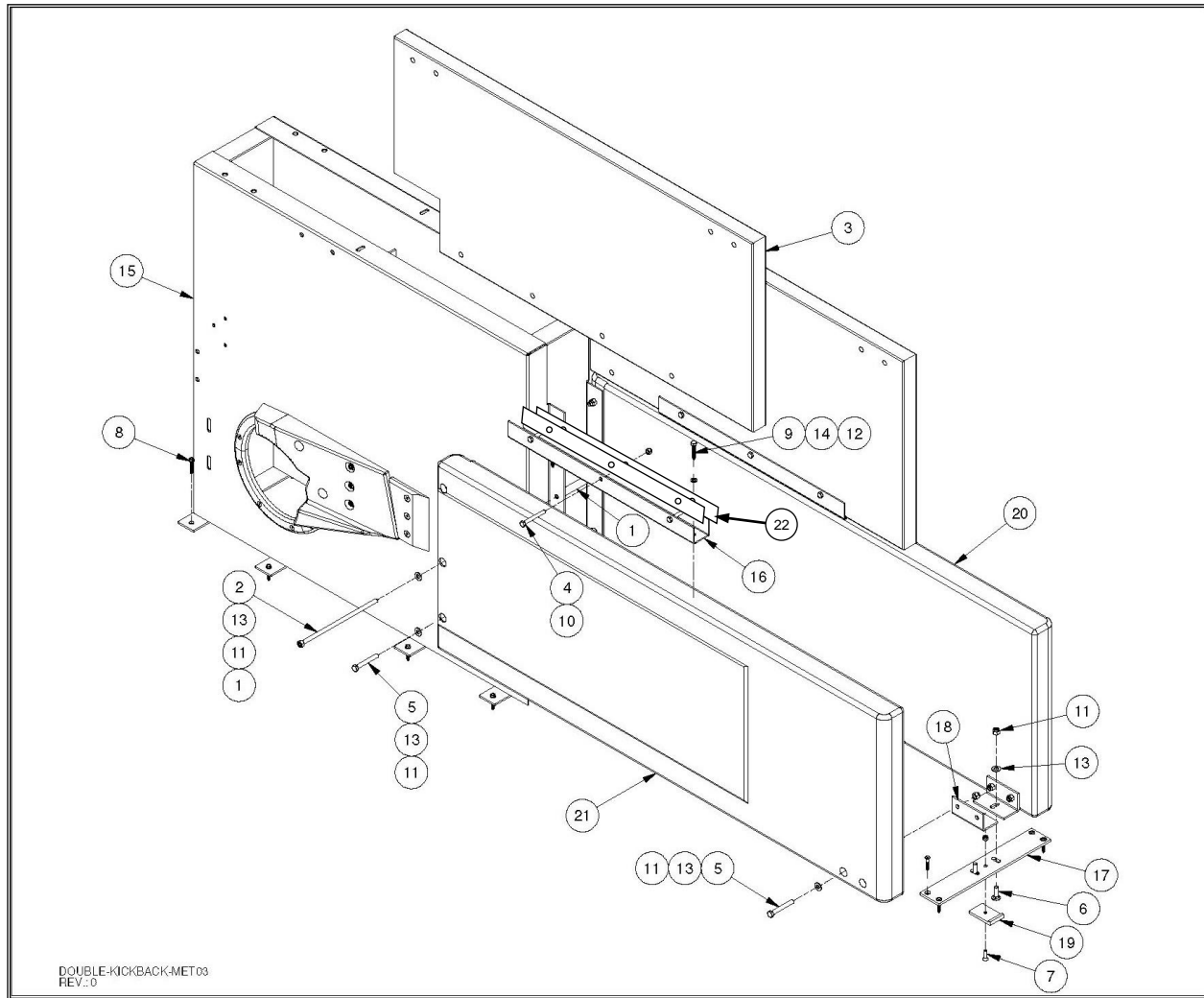


Cushion Assembly Parts List 9222048-7 & 9222048-4

Item	Part Number	Description
1	9202048	CUSHION SUPPORT CHANNEL
2	051-060-002	CUSHION COVER – LN1
3	9204040	CUSHION SPACER
4	9204041	PIT APRON PROTECTOR
5	9202053	APRON TUBING
6	9204037	APRON PROTECTOR
7	9204039	PIT CUSHION
8	9206039	CUSHION WOOD SPACER
9	7050-051175-012	WASHER, 17/32 X 1 3/4 X 1/8, FLAT
10	7010-005013-650	BOLT, 1/2-13 X 6 1/2, HEX
11	7036-005013-000	NUT, 1/2-13, HEX, NYLON LOCK
12	7013-003118-125	BOLT, ELEVATOR, 5/16-18 X 1 1/4, ZINC
13	7050-034100-012	WASHER, 11/32 X 1 X 1/8, FLAT, ZINC
14	7036-003118-000	NUT, 5/16-18, HEX, NYLON NUT
15	7027-201016-075	#10-16 X 3/4 TECK SCREW HEX WASHER
16	7150-019075-009	WASHER, FLAT, .193 X .75 X .093



Double Kickback Assembly

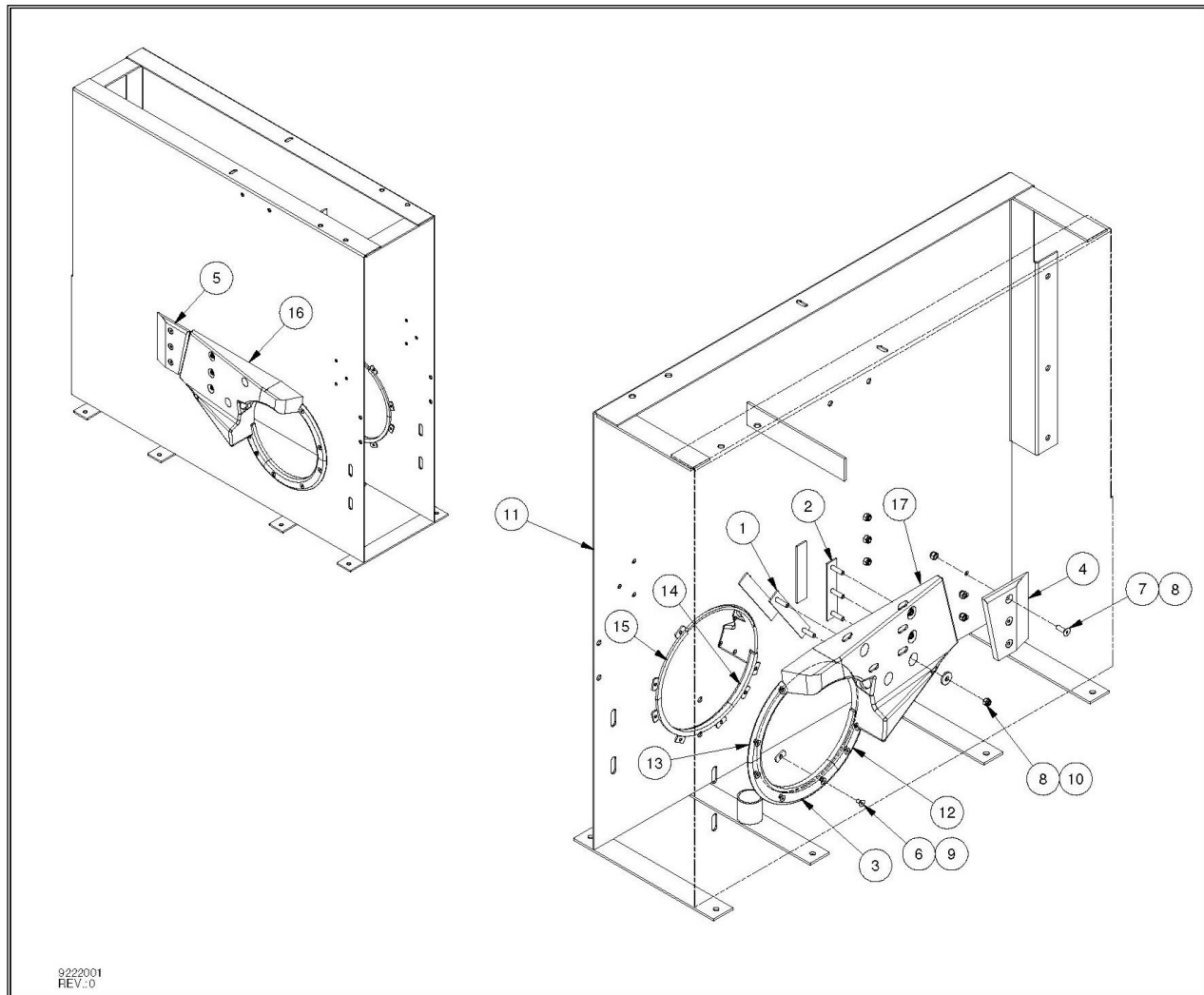


Double Kickback Parts list

Item	Part Number	Description
1	302-6650-00	SPACER FOR KICKBACK
2	302-6660-00	SPECIAL BOLT FOR KICKBACK
3	30W-0180-45	PINSPOTTER SUPPORT, TENPIN
4	7010-003118-275	5/16-18 X 2-3/4 HEX CAP SCREW
5	7010-003716-275	3/8-16 X 2-3/4 HEX CAP SCREW
6	7012-003716-100	3/8-16 X 1 CARRIAGE BOLT
7	7016-312520-100	1/4-20 X 1 FLAT HEAD MACH SCREW
8	7024-201400-150	14-10 X 1-1/2 HEX/WASHER HEAD SELF-TAPPING SCREW
9	7028-003100-175	5/16 X 1-3/4 LAG SCREW
10	7036-003118-000	5/16-18 NYLON INSERT HEX NUT
11	7036-003716-000	3/8-16 NYLON INSERT HEX NUT
12	7050-034068-006	11/32 X 11/16 X 1/16 FLAT WASHER
13	7050-040081-006	13/32 X 13/16 X 1/16 FLAT WASHER
14	7060-031057-009	5/16 LOCK WASHER
15	9222001	BALL RETURN KICKBACK ASSEMBLY
16	M-0180-37-8	KICKBACK U-BAR, 24
17	M88-0181-03	KICKBACK MOUNTING PLATE
18	M88-0181-04	KICKBACK BRACKET
19	P88-0181-03	PLASTIC PROTECTOR
20	Q88-0181-30L	BALL RETURN MAG3 KICKBACK, LEFT
21	Q88-0181-30R	BALL RETURN MAG3 KICKBACK, RIGHT
22	051-060-000	U-BAR SHIM



Ball Return Kickback Pit Section

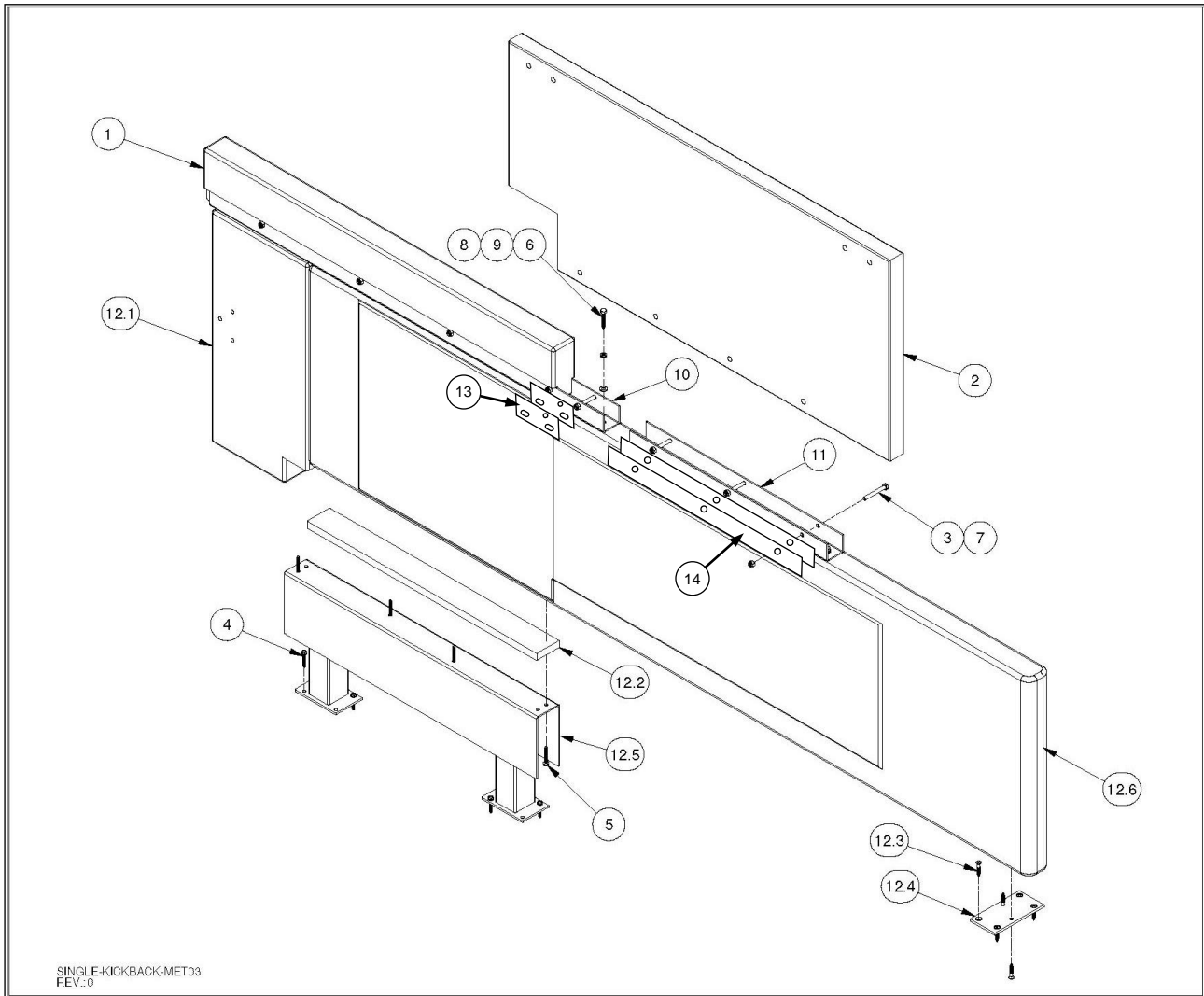


Ball Return Kickback Part List

Item	Part Number	Description
1	302-6680-00	DEFLECTOR BLOCK MOUNTING PLATE
2	302-6690-00	DEFLECTOR BLOCK MOUNTING PLATE
3	303-6550-00	PLASTIC RING
4	303-6620-00	BALL DEVIATOR, RIGHT
5	303-6625-00	BALL DEVIATOR, LEFT
6	7016-312520-050	1/4-20 X 1/2 FLAT HEAD MACH SCREW
7	7016-313118-100	5/16-18 X 1 FLAT HEAD MACH SCREW
8	7036-003118-000	5/16-18 NYLON INSERT HEX NUT
9	7046-002520-000	1/4-20 WELD NUT
10	7050-034100-012	11/32 X 1 X 1/8 FLAT WASHER
11	9202001	BALL RETURN CASING
12	9203001-1	PLASTIC RING
13	9203001-2	PLASTIC RING
14	9203001-3	PLASTIC RING
15	9203001-4	PLASTIC RING
16	9266003	DEFLECTOR BLOCK, LEFT
17	9266004	DEFLECTOR BLOCK, RIGHT



Single Kickback



Single Kickback Parts List

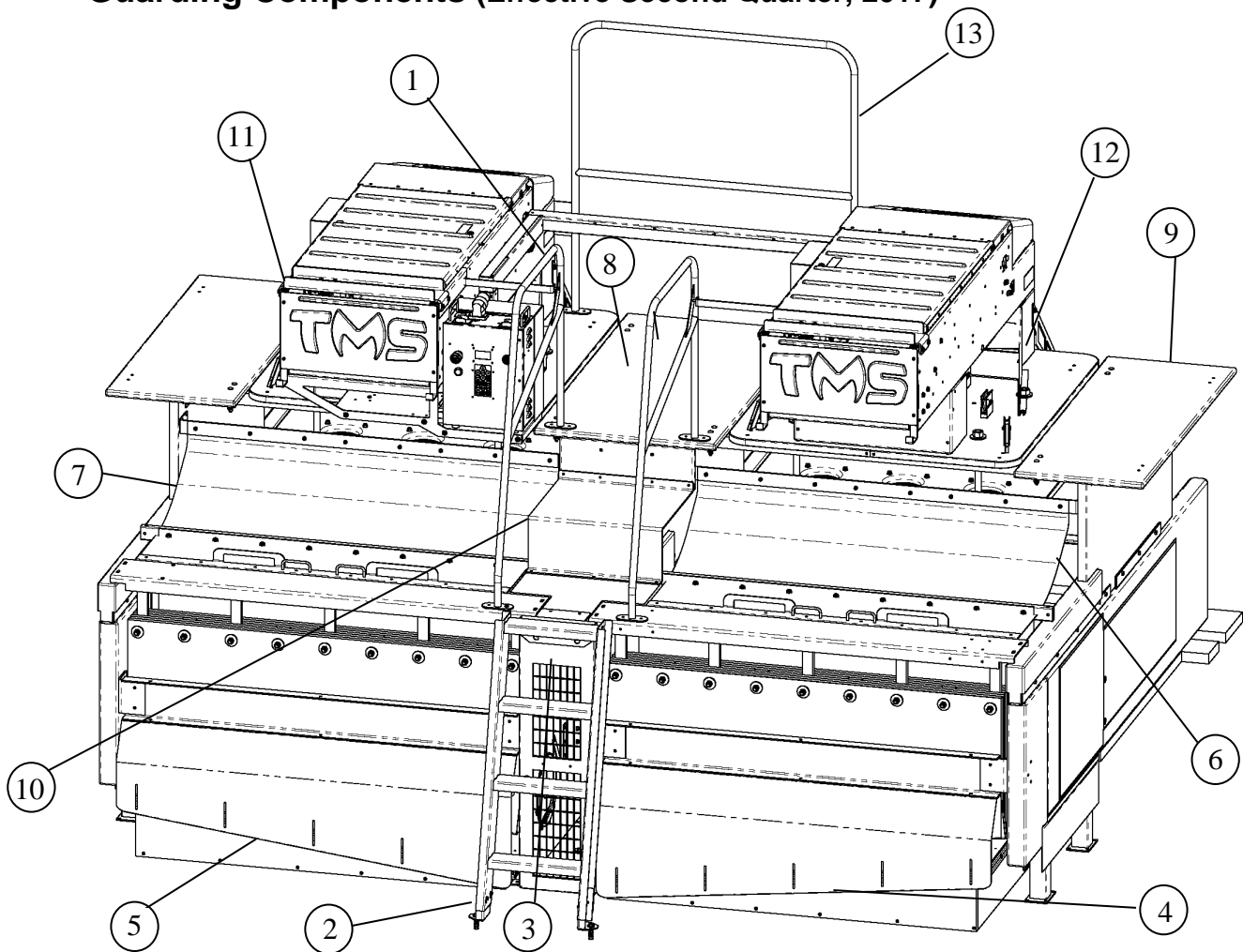
Item	Part Number	Description
1	30W-0180-44	SPACER BLOCK KICKBACK
2	30W-0180-45	PINSPOTTER SUPPORT, TENPIN
3	858-649-087	JCN 1/4-20 BO HDT
4	7024-201400-150	14-10 X 1-1/2 HEX/WASHER HEAD SELF-TAPPING SCREW
5	7024-201400-175	14-10 X 1-3/4 HEX/WASHER HEAD SELF-TAPPING SCREW
6	7028-003100-175	5/16 X 1-3/4 LAG SCREW
7	801-549-807	SJB 1/4-20 X 45MM BO TYBB
8	7050-034068-006	11/32 X 11/16 X 1/16 FLAT WASHER
9	7060-031057-009	5/16 LOCK WASHER
10	M-0180-37-12	KICKBACK U-BAR, 48
11	M-0180-37-8	KICKBACK U-BAR, 24
12	Q88-0180-42	SINGLE KICKBACK
12.1	30W-0180-12	REAR KICKBACK BLOCK
12.2	30W-0180-29	KICKBACK SPACER
12.3	7022-311400-150	#14 X 1-1/2 FLAT HEAD WOOD SCREW
12.4	M88-0181-02	ATTACHMENT PLATE, 2-3/4
12.5	M88-0181-30	WOOD KICKBACK SUPPORT
12.6	W88-0180-30	SINGLE DIVISION KICKBACK
13	051-060-001	U-BAR SHIM
14	051-060-000	U-BAR SHIM



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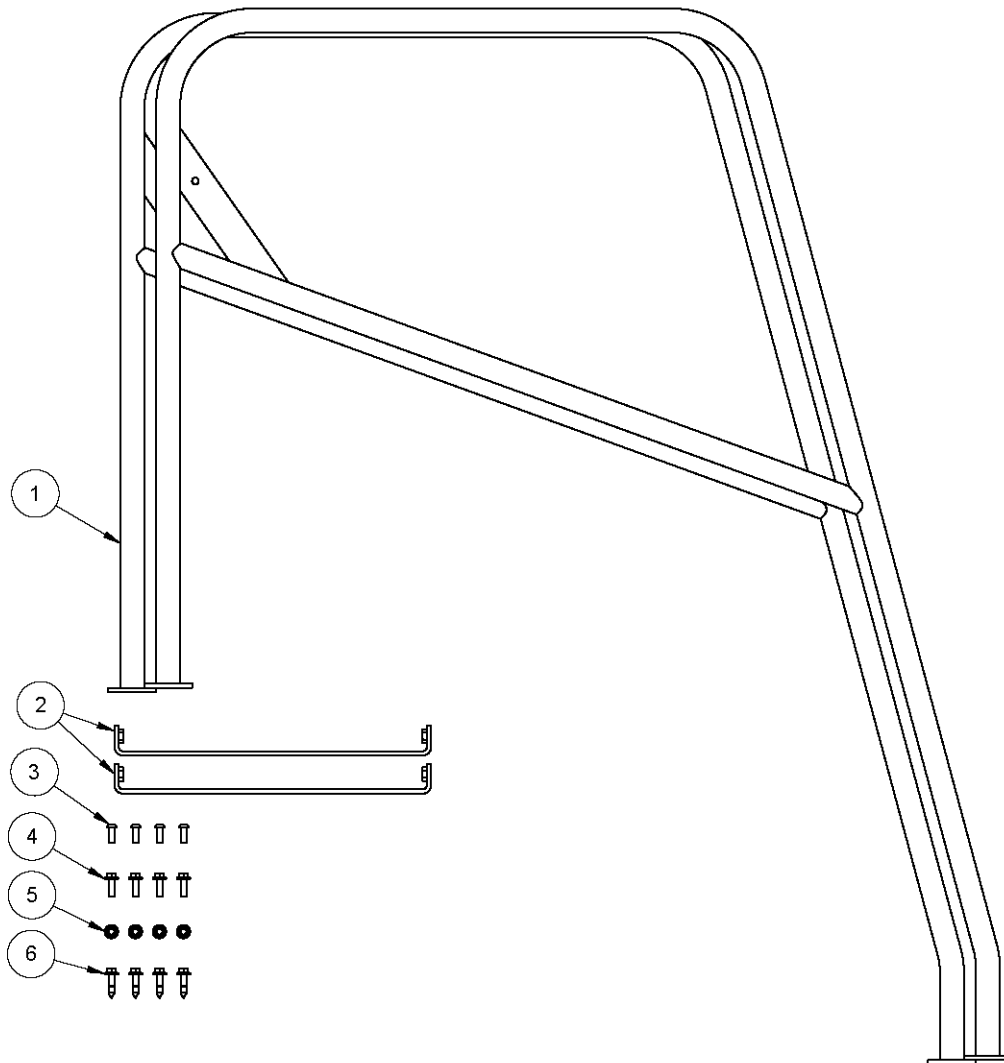
Guarding Components (Effective Second Quarter, 2017)



Item	Part Number	Description
1	610-051-015	REAR HANDRAIL KIT
2	610-051-016	LADDER KIT
3	610-051-003	ACCELERATOR GUARD KIT
4	610-051-023	ODD TOE GUARD KIT
5	610-051-024	EVEN TOE GUARD KIT
6	051-070-065	ODD PIT GUARD ASSEMBLY
7	051-070-066	EVEN PIT GUARD ASSEMBLY
8	051-070-024	DOUBLE DIVISION PLATFORM ASSEMBLY
9	051-070-023	SINGLE DIVISION PLATFORM ASSEMBLY
10	051-070-035	CENTER STEP
11	051-070-036	10-PIN BRAKE GUARD
12	051-070-037	7-PIN BRAKE GUARD
13	051-070-100	FRONT HANDRAIL



610-051-015 – TMS Rear Handrail Kit

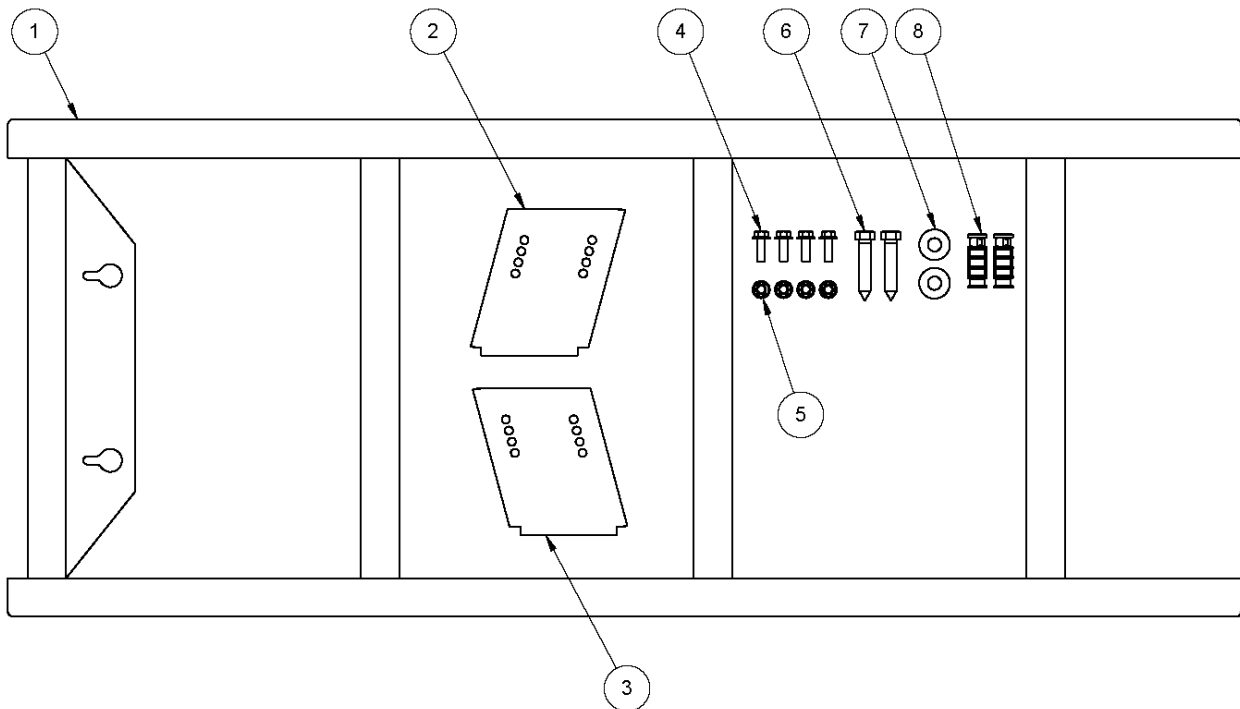


610-051-015 – TMS Rear Handrail Kit

Item	Part Number	Description
1	051-070-089	REAR HANDRAIL
2	051-070-094	HANDRAIL STRAP WELDMENT
3	808-549-102	BHSCS 1/4-20 X 0.63 BO
4	801-749-121	FBCS 1/4-20 X 0.75 GR8 BO
5	856-149-001	HFLN 1/4-20 BO STV
6	859-048-167	FBLs 1/4 X 1.00 ZN



610-051-016 – TMS Ladder Kit

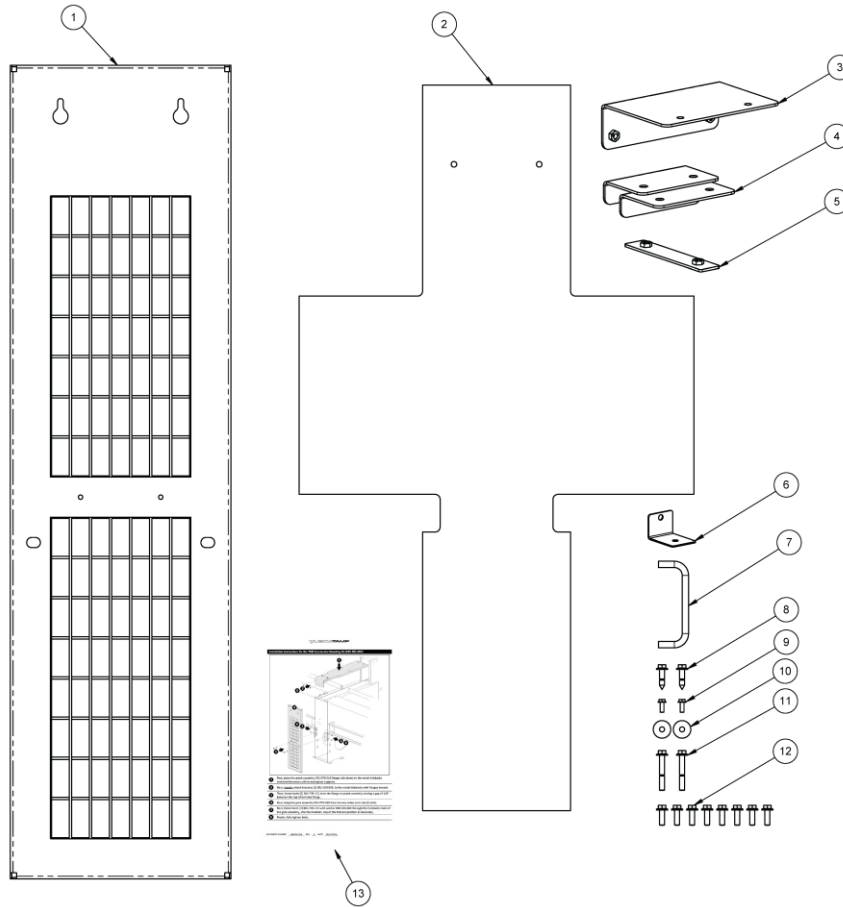


610-051-016 – TMS Ladder Kit

Item	Part Number	Description
1	051-070-028	LADDER WELDMENT
2	088-200-884	LEFT-HAND LADDER WELDMENT FOOT
3	088-200-885	RIGHT-HAND LADDER WELDMENT FOOT
4	801-749-121	FBCS 1/4-20 X 0.75 GR8 BO
5	856-149-001	HFLN 1/4-20 BO STV
6	810-564-420	HHLB 3/8 X 2.00 ZN
7	947-367-141	FW 3/8 USS BO
8	730-069-640	ANCR SL 3/8 X 1.75 NS



610-051-003 – TMS Accelerator Guard Kit

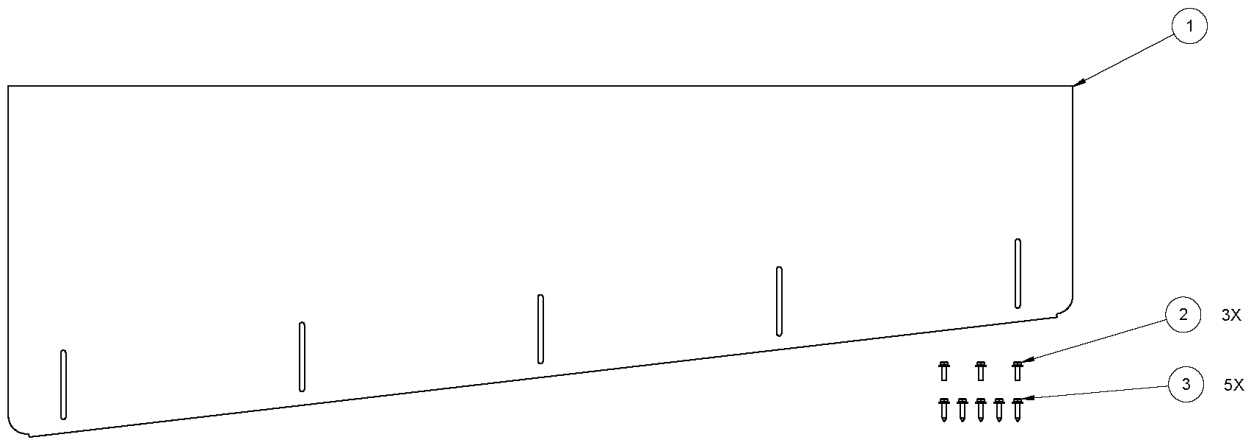


610-051-003 – TMS Accelerator Guard Kit

Item	Part Number	Description
1	051-020-032	ACCELERATOR GUARD GATE WELDMENT
2	051-070-086	ACCELERATOR WALKBOARD
3	051-020-030	ACCELERATOR GUARD GATE SUPPORT WELDMENT
4	051-020-035	ACCELERATOR GUARD GATE BRACKET WELDMENT
5	051-070-097	WALKBOARD NUT PLATE ASSEMBLY
6	088-200-313	MASK GUARD ANGLE BRACKET
7	088-501-144	HANDLE
8	859-048-167	FBLs 1/4 X 1.00 ZN
9	818-740-082	HWMS 10-32 X 0.50 ZN
10	000-026-865	FW 0.25 X 0.88 X 0.06 ZN
11	801-749-281	FBCS 1/4-20 X 1.75 GR8 BO
12	801-749-121	FBCS 1/4-20 X 0.75 GR8 BO
13	400-051-014	ACCELERATOR GUARD INSTALLATION SHEET



610-051-023 – TMS Odd Toe Guard Kit

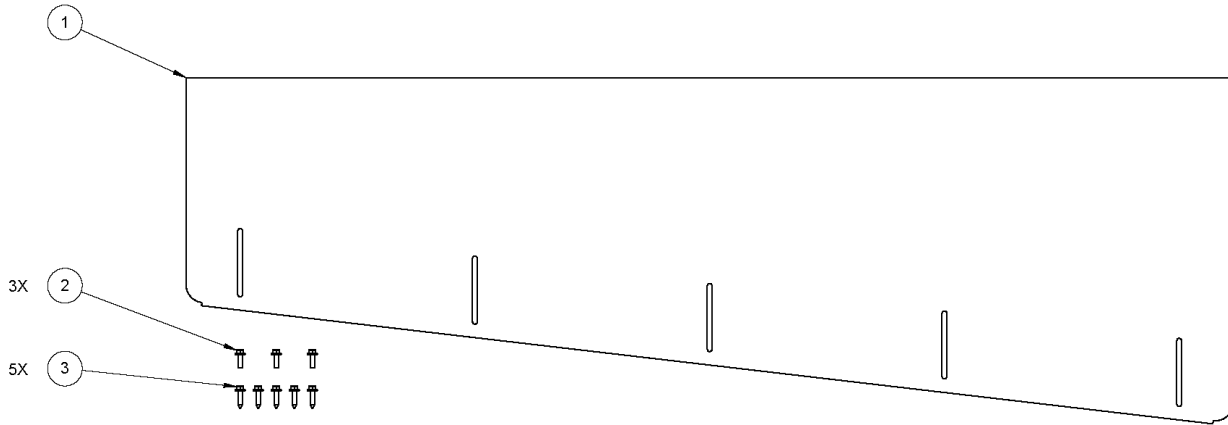


610-051-023 – TMS Odd Toe Guard Kit

Item	Part Number	Description
1	051-070-061	ODD TOE GUARD ASSEMBLY
2	801-749-121	FBCS 1/4-20 X 0.75 GR8 BO
3	859-048-167	FBLs 1/4 X 1.00 ZN



610-051-024 – TMS Even Toe Guard Kit

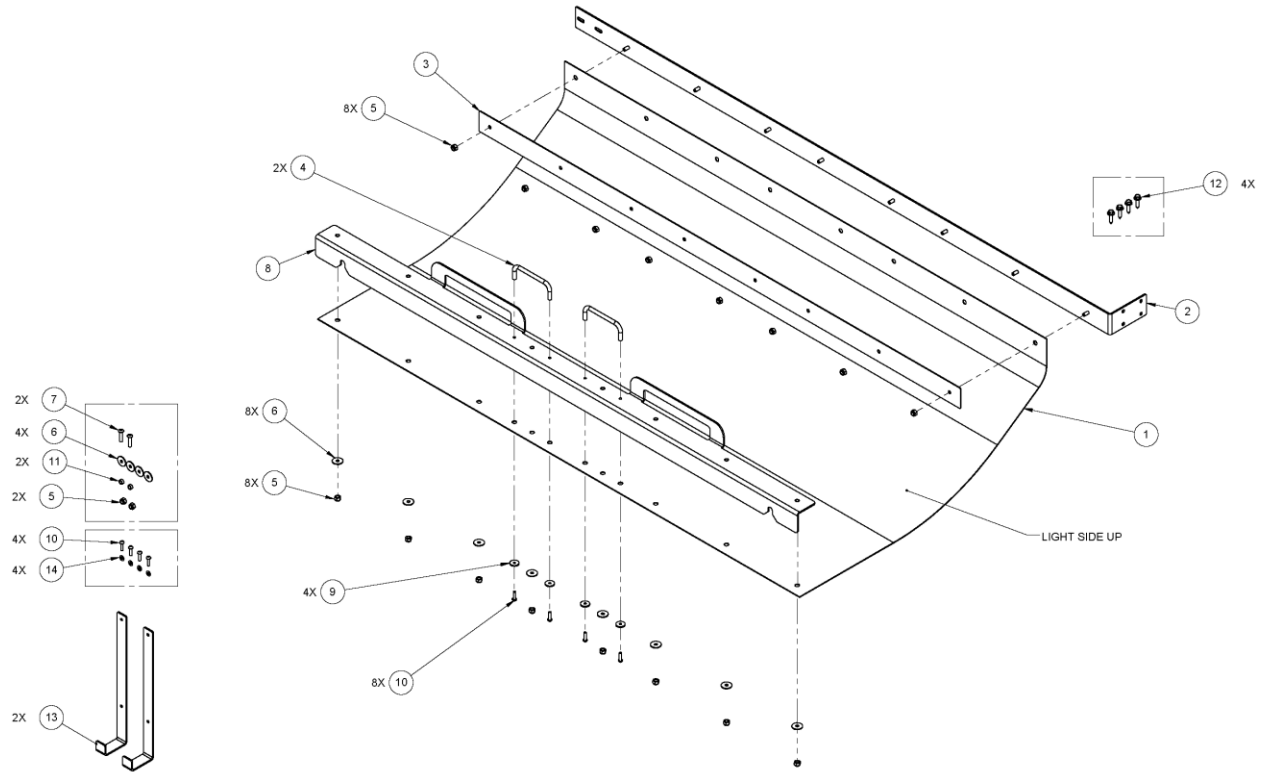


610-051-024 – TMS Even Toe Guard Kit

Item	Part Number	Description
1	051-070-062	EVEN TOE GUARD ASSEMBLY
2	801-749-121	FBCS 1/4-20 X 0.75 GR8 BO
3	859-048-167	FBLs 1/4 X 1.00 ZN



051-070-065 – TMS Odd Pit Guard Assembly

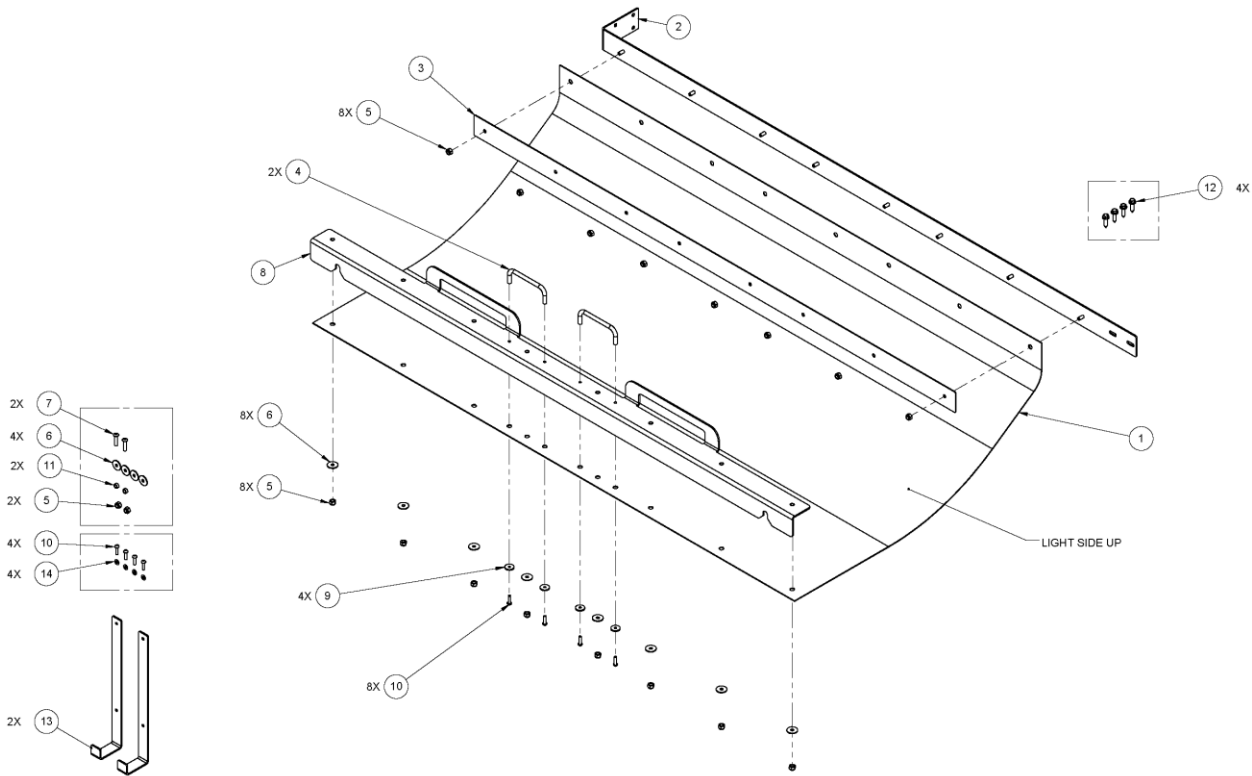


051-070-065 – TMS Odd Pit Guard Assembly

Item	Part Number	Description
1	051-070-067	PIT GUARD CURTAIN
2	051-070-068	PIT GUARD SUPPORT ASSEMBLY
3	051-070-070	PIT GUARD MOUNT PLATE
4	088-501-144	HANDLE
5	7036-002520-000	HLN 1/4-20 ZN NE
6	000-026-865	FW 0.25 X 0.88 X 0.06 ZN
7	808-549-160	BHSCS 1/4-20 X 1.00 BO
8	051-070-071	PIT GUARD HANGER ASSEMBLY
9	7150-019075-009	FW 0.19 X 0.75 X 0.09 AL
10	818-240-122	RHPMS 10-32 X 0.75 ZN SEMS
11	722-501-030	SFR .257 X .375 X .188 AL
12	859-048-167	FBL 1/4 X 1.00 ZN
13	051-070-102	PIT GUARD HOOK BRACKET
14	948-545-072	FW 10 MACH ZN



051-070-066 – TMS Even Pit Guard Assembly

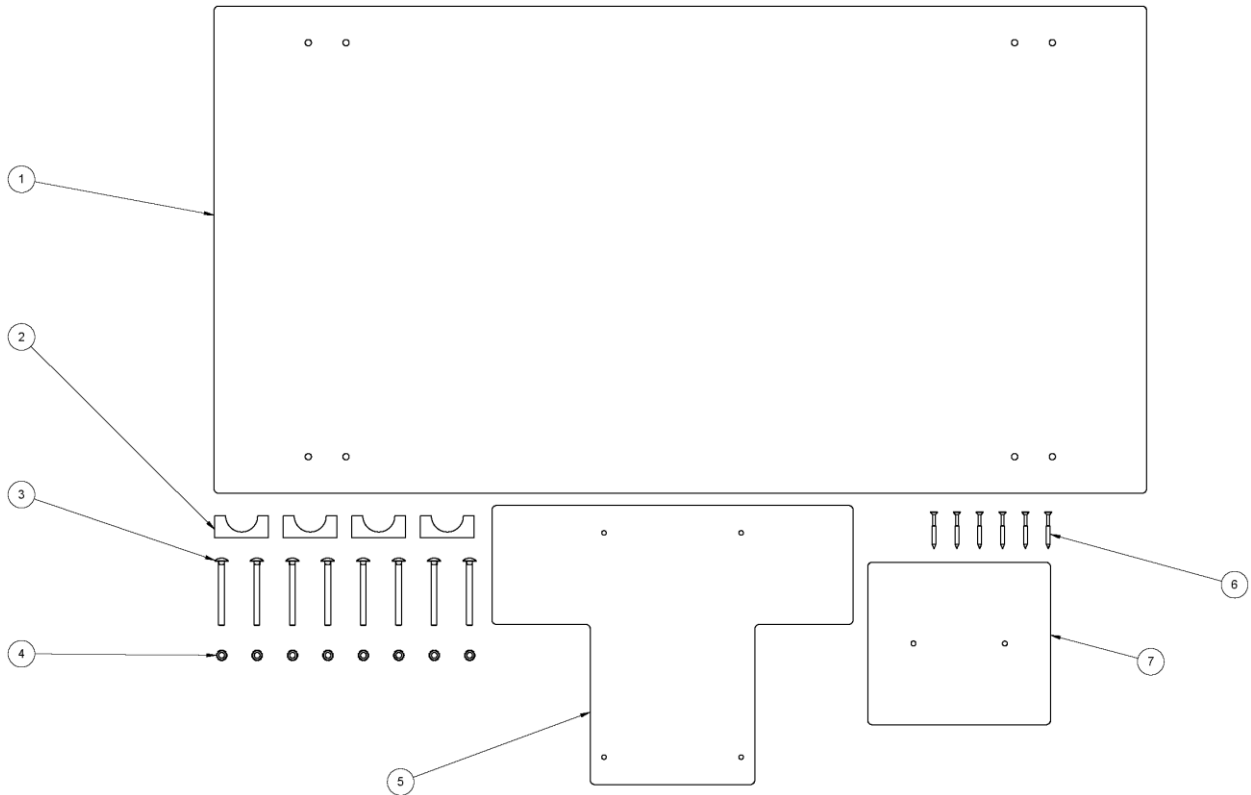


051-070-066 – TMS Even Pit Guard Assembly

Item	Part Number	Description
1	051-070-067	PIT GUARD CURTAIN
2	051-070-068	PIT GUARD SUPPORT ASSEMBLY
3	051-070-070	PIT GUARD MOUNT PLATE
4	088-501-144	HANDLE
5	7036-002520-000	HLN 1/4-20 ZN NE
6	000-026-865	FW 0.25 X 0.88 X 0.06 ZN
7	808-549-160	BHSCS 1/4-20 X 1.00 BO
8	051-070-071	PIT GUARD HANGER ASSEMBLY
9	7150-019075-009	FW 0.19 X 0.75 X 0.09 AL
10	818-240-122	RHPMS 10-32 X 0.75 ZN SEMS
11	722-501-030	SFR .257 X .375 X .188 AL
12	859-048-167	FBL 1/4 X 1.00 ZN
13	051-070-102	PIT GUARD HOOK BRACKET
14	948-545-072	FW 10 MACH ZN



051-070-024 – Double Division Platform Assembly

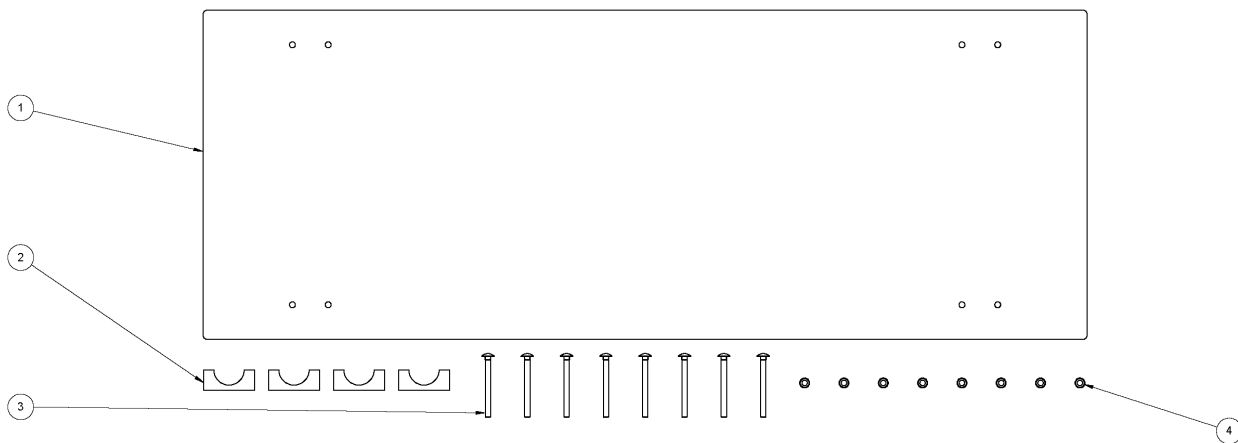


051-070-024 – Double Division Platform Assembly

Item	Part Number	Description
1	051-070-051	DOUBLE DIVISION PLATFORM
2	051-070-021	TUBE CLAMP
3	7012-003118-350	CB 5/16-18 X 3.50 GR5 ZN
4	7038-003118-000	KN 5/16-18 ZN
5	051-070-088	DOUBLE DIVISION COVER
6	049-006-531	FHPWS 10 X 2.00 ZN
7	051-070-087	STEP SUPPORT



051-070-023 – Single Division Platform Assembly

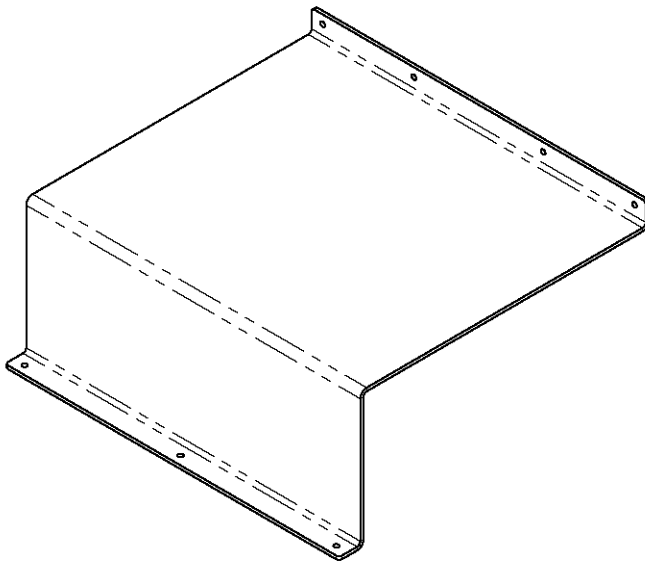


051-070-023 – Single Division Platform Assembly

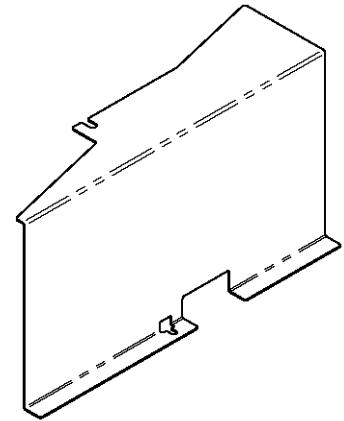
Item	Part Number	Description
1	051-070-050	SINGLE DIVISION PLATFORM
2	051-070-021	TUBE CLAMP
3	7012-003118-350	CB 5/16-18 X 3.50 GR5 ZN
4	7038-003118-000	KN 5/16-18 ZN



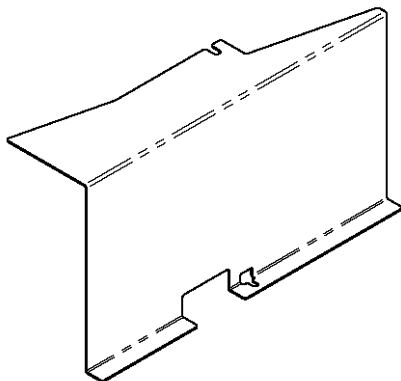
TMS Step, Brake Guards, and Front Handrail



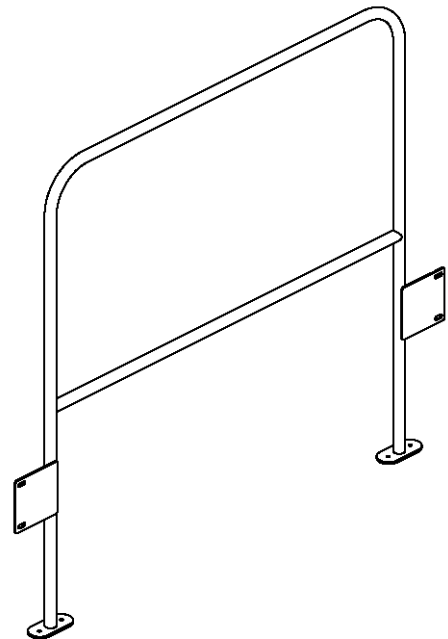
051-070-035 – CENTER STEP



051-070-036 – 10-PIN BRAKE GUARD



051-070-037 – 7-PIN BRAKE GUARD



051-070-100 – FRONT HANDRAIL



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948-884-187	26
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M88-0181-03.....	47
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TMS Chassis Logic Tree

REV. 8, V2.14 and up

MODE → (General Password) → Toggles between current mode and Mechanics mode

MCU → (General Password)

DIAG → TEXT
 DIAG → GRAPHICS
 DIAG → HARDWARE
 DIAG → OUTPUT CTRL

Keypad Configuration Task

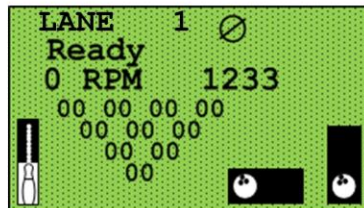
As each button is pushed, its name is displayed, to exit let the countdown reach 0

```

Keypad Test
Drive:      2
Input:      4
Number:     8
KEY_RIGHT
Exit in 8
    
```



- Ball Lift On/Off
- Mask Ball 1 On/Off
- Mask Ball 2 On/Off
- Bumper Up/Down
- Buzzer On/Off
- Spare Relay On/Off
- Foul Light On/Off
- Foul Buzzer On/Off
- Backend Pad On/Off
- Backend Motor On/Off
- Red Stack Light On/Off
- Green Stack Light On/Off
- Pit Light 1 On/Off
- Pit Light 2 On/Off
- Brake On/Off
- Red Lamp On/Off
- Counter On/Off
- Motor Run Stop/Fwd/Rev



SETTINGS → Default Settings

FUNCTIONS → Functions

BALL COUNTERS → Ball Counters

FRAME COUNTERS → Frame Counters

- Backend Breaker OK / Tripped
- Backend Motor Asleep / On / Off
- Ball Detector Ball / No Ball
- Ball Lift Asleep / On / Off
- Ball Sensor 0 / 1
- Drive Encoder (0 to 1250) Valid / Invalid
- Encoder Sensors A:ON/OFF B:ON/OFF
- Drive RPM (-900 to 1800)
- E-Stop Loop Closed / Open
- Foul Detector Foul / No Foul
- Home (LOS) Home / Not Home
- Lane Breaker OK / Tripped
- Mask Light On / Off
- Mechanic Call On / Off
- Pin Encoder XX XX XX XX XX XX XX XX
- Software V1.XX
- Stack Lights GR=Off/On RD=Off/On
- Tenth Frame On / Off

- Pins Full Set
- Pins Partial Set
- Pins Up
- Pins Down
- Brake Adjust
- String Adjust
- Calibrate Drive
- Reset Bowling Ball Counter
- Reset Mechanic Ball Counter
- Reset Bowling Frame Counter
- Reset Mechanic Frame Counter

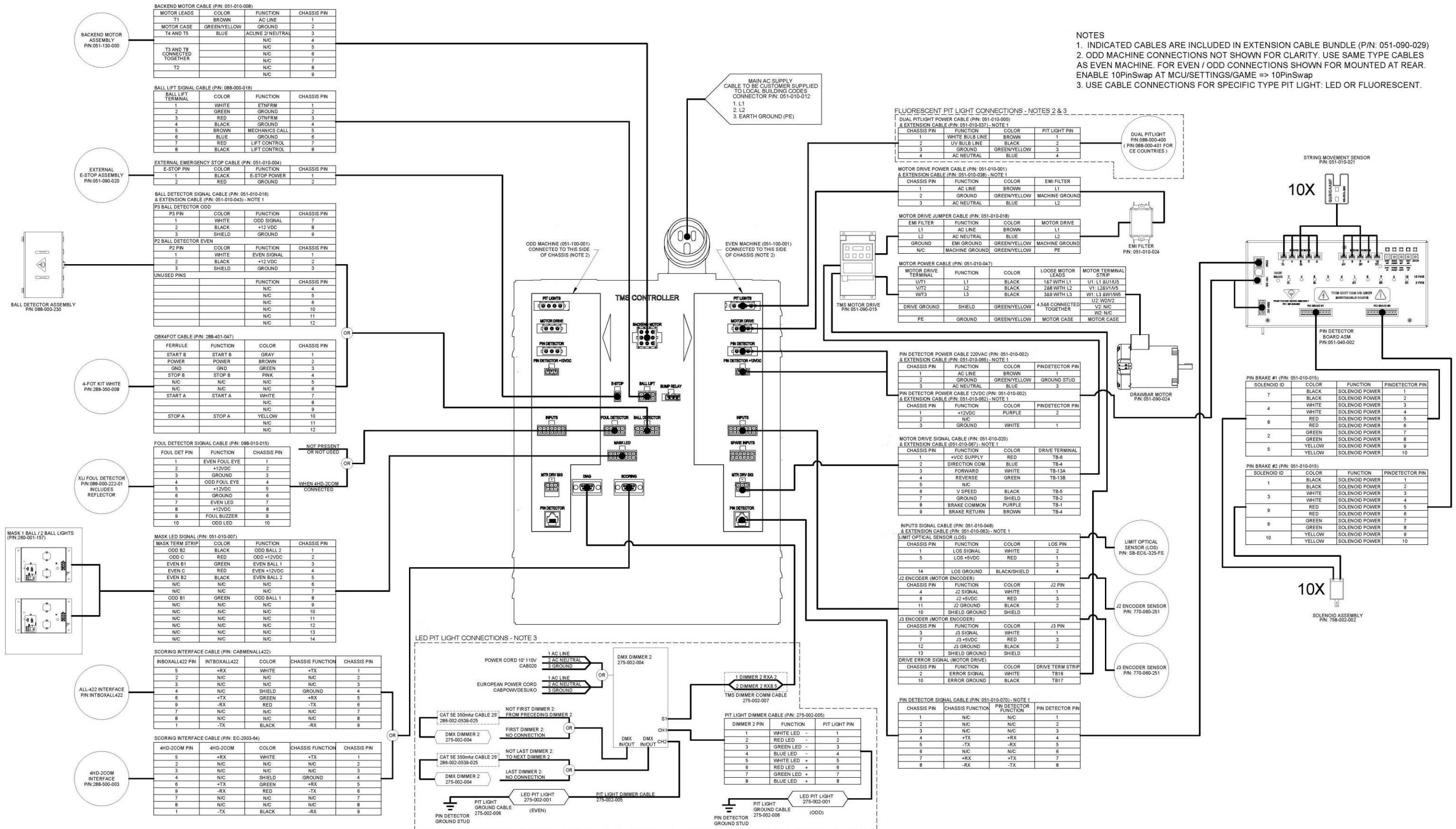
```

Balls LANE 1
Bowl      12345
Mechanic   12345
Total     24690
Resetable
Bowl      12345
Mechanic   12345
Total     24690
    
```

```

Frames LANE 1
Bowl      12345
Mechanic   12345
Total     24690
Resetable
Bowl      12345
Mechanic   12345
Total     24690
    
```

- Highway Settings in **Bold**
- Ten Pin Settings in *Italics*
- Odd Lane ID **1,3,5,7**, etc.
- Chassis Mode **Standby** / Bowl / Practice Pin / Practice No Pin
- Auto Backend Shutoff **On** / Off
- Auto Ball Lift Shutoff **On** / Off
- Ball Lift Select **AMF** / Others
- Trouble Clear **On** / Off
- Bumpers **Up** / Down
- Foul Detector **Off** / Warning / On
- Game (Factory Password) **Highway** / 10 Pins / Knockout / Duck Pin / 10Pin Swap
- Mask Light **As Bowl-No Bowl** / As Ball Number
- Pin Data Delay **2.0**, 2.3, 2.6, 3.0, 3.3, 3.6, 4.0, 4.3, 4.6, 5.5
- Pin Detect Count **4**, 5,.....15,20
- Pin Park State **Up** / Down
- Pit Light **White** / Black
- Scoring System **Scoring** / Standalone / Basic
- Smart Cycle **On** / **Off**
- Stabilize Time **1.5** / 1.75
- Tenth Frame Switch **Partial** / Full / Off
- Inhibit Pin Errors **Off** / On



NOTES

- INDICATED CABLES ARE INCLUDED IN EXTENSION CABLE BUNDLE (P/N: 051-090-029)
- ODD MACHINE CONNECTIONS NOT SHOWN FOR CLARITY. USE SAME TYPE CABLES AS EVEN MACHINE. FOR EVEN / ODD CONNECTIONS SHOWN FOR MOUNTED AT REAR. ENABLE 10PinSwap AT MCU/SETTINGS/GAME => 10PinSwap
- USE CABLE CONNECTIONS FOR SPECIFIC TYPE PIT LIGHT: LED OR FLUORESCENT.

TMS TenPin Wiring Diagram
051-010-025-01