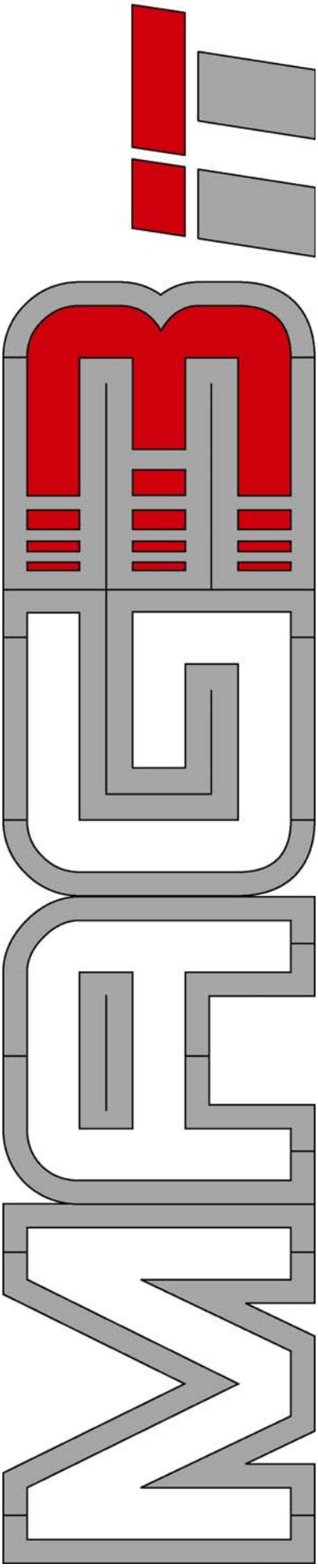


MAG3-IT

Owner's Manual

September 2004

SERVICE

Qubica Worldwide
www.qubica.com

Welcome to the wonderful world of the Qubica MAG3-IT Pinsetter, the first brand new pinsetter to be manufactured since the introduction of the original automatic pinsetter in the 1950's. Utilizing permanent magnets, developed for the NASA space program and state of the art controllers, the Qubica MAG3-IT brings the world of bowling into the 21st century.

Reliability, easy maintenance and speed were primary design goals and the Qubica MAG3-IT exceeds even our expectations. All relays, switches and cam drive/control systems have been replaced with optical scanners and computer control.

Simple self diagnostic routines assure that problems are easily spotted and quickly fixed. The MAG3-IT Controller identifies any malfunctioning section of the pinsetter and instructs how to fix the problem. Most of the time it is a simple matter of plug compatible exchange of a part.

All components have been selected because they have proven themselves in harsh environments. Servomotors, optical sensors, 32-bit micro controllers, stock timing belts and magnetic clutches assure reliability and at the same time, precise control.

The Qubica MAG3-IT Pinsetter has been designed to economize on the use of electricity. Only three electric motors are used to run a pinsetter, none is over ¾ hp.

The simplicity of the MAG3-IT Pinsetter being its main characteristic, it is very easy to understand its concept but at the same time it must be understood that pinsetters of any kind require a minimum of maintenance and should operate according to standards.

This manual contains a complete description of the operation, maintenance and repair of the Qubica MAG3-IT Pinsetter. It includes information for users who have little experience in addition to advanced topics for those who are more familiar with Qubica equipment. It is not necessary to read this manual straight through. Consult the Table of Contents or Index to learn how to use the options you work with most.

The Quality Control Department at Qubica has taken very good care to ship you a machine that was completely adjusted, field tested and checked before shipment. Since the basic functions and different components of the pinsetter are quite simple to understand, you too are now ready for the future. Enjoy.

Table of Contents

1. Fundamentals

Chapter Overview

After reading this chapter you should be able to:

- Understand the rules of bowling necessary to comprehend the different pinsetter cycles.
- Identify the major components of the pinsetter.
- Understand the basic principles of the pinsetter's operation.

Bowling Rules

Before being able to understand the various functions of the pinsetter, you must have certain knowledge of the rules of bowling. A very brief description of the game of bowling is included in the following paragraphs in order to emphasize the fact that the pinsetter must be able to respond to any condition set up by delivery of the first ball.

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

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

At the point where the bowler releases the ball to roll down the lane, there is a black line. If the bowler's foot crosses this line while delivering the ball, it is considered a foul. If a foul occurs on the first ball, all of the pins are set up again and the bowler throws a second ball, losing any possible score he made with the first ball. If the foul occurs on the second ball, the bowler loses the points scored with the second ball only and all ten pins are set up for the next frame.

Pinsetter Operation

Each pair of pinsetters has an ***electronic power box*** and a ***MAG3-IT Controller*** which are used in conjunction with the ***manager's control*** located at the front desk.

When the pinsetter is turned on, ten pins are set on the lane and the pinsetter is placed in a ball one situation. The bowler rolls the ball which passes through the ***ball detector***'s infrared beam of light thus sending a signal to the electronic power box. The ball knocks down some pins which fall into the ***pit***. The floor of the pit is a continuous belt that is angled so that the pins roll to the back and the ball moves toward the ***ball accelerator***. There is a ***baffle stop*** that guides the ball to the ***accelerator port***, while the pins roll under and stage themselves for a ride up the ***pin elevator***.

The ***ball accelerator door*** that covers the port is a unique knife design that allows the ball to exit the pit area while at the same time making it impossible for a pin to enter the ball accelerator. A ***magnetic clutch*** is activated by an ***electronic sensor*** which recognizes that a ball is in position to exit.

The pins stage themselves at the back of the pit and roll into the ***elevator lifts***. These lifts are made of Delron, a virtually indestructible plastic which is easy on the pin finish. The elevator takes the pins up to the top of the pinsetter and are moved into the ***carrousel staging*** position. They move either left or right depending upon the way they settled into the lifts.

Each bowling pin has a magnet placed in the top of the head. The continuous moving carrousel uses a permanent magnet to pick off the pins from the staging position. They pick up either from the left or the right side depending on where the pin's head is located when exiting the elevator. The carrousel carries the pins around the top of the pinsetter and places them into the ***drawer magazine***. Once the pins are in the magazine, they are released into the ***drawer*** when necessary.

The telescoping drawer receives the pins from the magazine in two straight lines; one of three, and one of seven. The drawer then expands into the familiar triangle ready to be picked up by the ***miracle deck***. When necessary, the deck picks up the ten pins from the drawer and lowers and sets the pins on the lane.

If a bowler does not knock down all the pins with the first ball, the deadwood is removed before the second ball is delivered. This operation is accomplished by the deck and the ***sweep***. The deck utilizes magnets and fluid dynamics to lift the standing pins up out of the way while the sweep pushes the deadwood into the pit, and then the deck re-spots the standing pins in their original positions.

Each pinsetter uses two sets of pins, but only ten pins are ever in play at any given time. The extra set of pins is used to speed up operations so that the bowler doesn't have to wait for the pins to be carried from the pit to the lane.

NOTE: **Whenever any motion or direction is described in the text of this manual such as clockwise, counter clockwise, right, left, forward or rearward, the motion is always as viewed from the front of the pinsetter.**

Pinsetter Cycles

The pinsetter must be able to determine the different pinsetter reactions based on the rules of bowling and set up by delivery of the first ball. After the bowler delivers the first ball, the ball detector sends a signal to the electronic power box which in turn sends a signal to the ***camera***. The camera will determine whether the bowler has thrown a strike or whether there are pins standing and returns the information to the electronic power box. This process is called reading and according to all the information which the electronic power box analyzes, the pinsetter will cycle in one of five possible manners.

Full set

The bowler rolls the first ball down the lane knocking down all the pins (strike). The camera takes its reading and finds no standing pins. The sweep is lowered and pushes the deadwood into the pit and then returns to its forward position. The deck picks up the ten pins from the drawer, lowers and sets the pins on the lane. The deck and the sweep raise and the lane is ready for the next frame

Part set

The bowler rolls the first ball down the lane knocking down some pins. The camera takes its reading and finds some pins still standing. The deck lowers and then lifts the standing pins up out of the way while the sweep pushes the deadwood into the pit and then returns to its forward position while the deck re-spots the standing pins in their original positions. The deck and the sweep raise and the lane is ready for the second ball. The deck picks up the ten pins from the drawer and waits in its upper position

Second ball

The bowler rolls the second ball down the lane. Regardless of the number of pins knocked down, the sweep is lowered and pushes the deadwood into the pit and then returns to its forward position. The deck lowers and sets ten new pins on the lane. The deck and the sweep raise and the lane is ready for the next frame.

Foul

If when rolling the ball, the bowler steps across the foul line, all the pins must be replaced on the lane. Depending on whether or not the lanes are equipped with electronic foul detectors, the pinsetter will or will not do this automatically as described below:

With electronic foul lines, a signal is sent to the electronic power box indicating a foul. The sweep is lowered and pushes the deadwood into the pit and then returns to its forward position. The deck picks up the ten pins from the drawer, lowers and sets the pins on the lane. The deck and the sweep raise and the lane is ready for the next ball. The deck picks up the ten pins from the drawer and waits in its upper position.

Without electronic foul lines, if all the pins were knocked down, the pinsetter will go through its normal cycle and set new pins; the bowler just loses the score of the first ball and throws a second ball. However, if standing pins were left, the pinsetter, not knowing that the bowler has fouled, will re-spot the standing pins. As the bowler is penalized by losing the score made on any foul ball, it is necessary for the pinsetter to sweep and set ten new pins for the bowler's second ball, even though there were pins left standing by the first ball. There is a button located at the bowler's end of the ball return which, when pushed, will cause the pinsetter to cycle. This button is called the ***cycle button*** and will satisfactorily handle any foul situation.

Fouls which occur on second ball are no problem since the pinsetter will automatically sweep and set ten new pins as previously described.

Out of range pin

The one condition which may never be handled completely automatically is when a pin moves but does not fall down. The pin may move far enough to prevent it from being lifted up by the deck while the sweep pushes the deadwood into the pit. To prevent the ***out of range*** pin from being swept into the pit, the deck comes down, detects the out of range pin, and the pinsetter stops while the MAG3-IT Controller displays a message indicating the out of range and requesting someone to inform it whether or not one or more pins have remained in the deck. Before the bowler may bowl again, it is necessary for someone to remove the deadwood manually and choose the appropriate answer on the MAG3-IT Controller. After the first answer, the MAG3-IT Controller will request someone to indicate whether the pinsetter should perform a ***part set*** or a ***full set***, which will restart the pinsetter. There is no problem if an out of range pin occurs on the second ball, since the pinsetter will automatically sweep and set ten new pins.

Important Safety Instructions

WARNING

To reduce the risk of fire or electrical shock, do not expose this equipment to rain or moisture.

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

This appliance is equipped with more than one power source. Disconnect all power sources before servicing.

To reduce the risk of fire or electrical shock, do not expose this EQUIPMENT TO rain or moisture.

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

this appliance must be positioned such that the mains supply cord connector is accessible after installation.

Before discarding this APPLIANCE, the battery must be removed and disposed of safely. Disconnect the power supply cord before removing THE battery.

Mains supply wiring to this appliance is to be dressed away from this appliance.

The ac supply cord to the ball return motor is to be dressed away from the appliance, the ball return motor and any moving parts of the ball return assembly.

if the supply cord is damaged, it must be replaced by a qualified person in order to avoid hazards.

This appliance is not suitable for outdoor use.

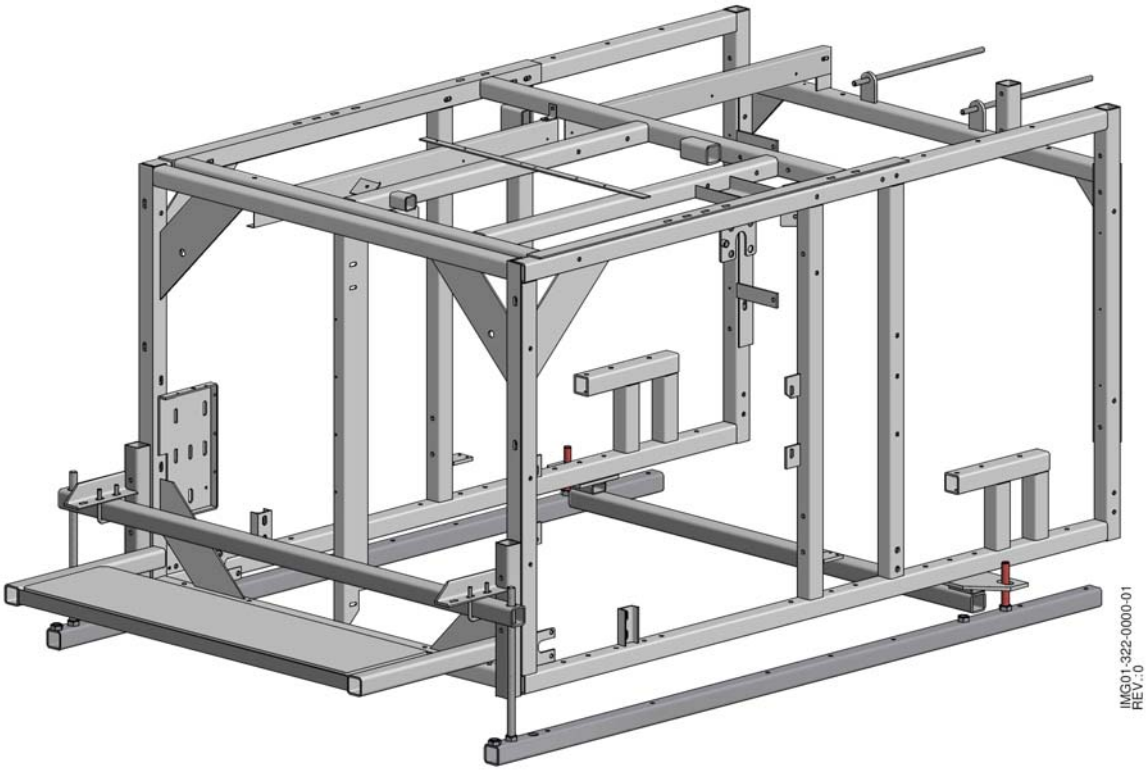
This appliance is not suitable for installation in AN area where A WATER jet could be used.

This appliance must not be cleaned using a water jet.

In order to avoid a shock or fire hazard, if replacement of any existing polymeric screws is required, they must only be replaced by the same type polymeric screw and must not be replaced by metal screws.

Major Pinsetter Components

Frame & Support



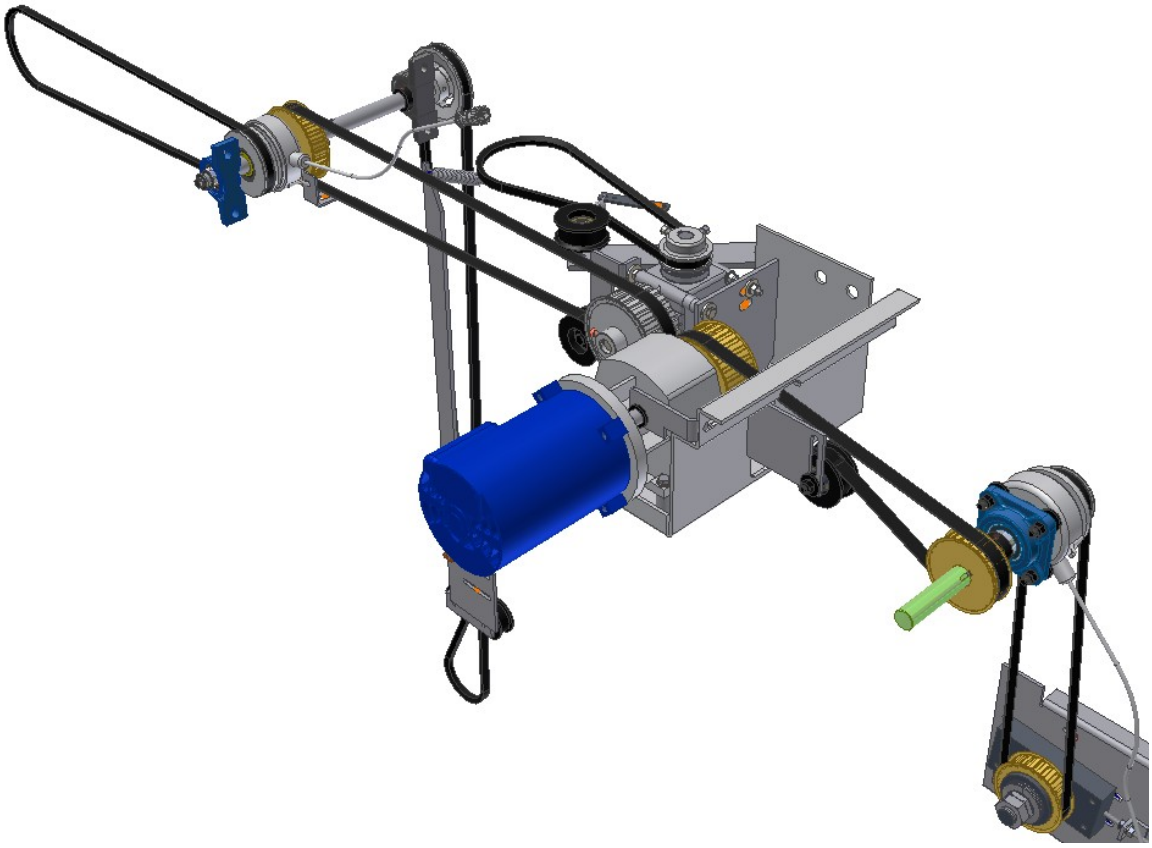
The frame provides the main support in suspending the pinsetter above the lane and pit.

Screwed to the top of each kickback is the kickback tubing. The kickback tubing runs the entire length of the kickback and beyond in order to line up with the front of the pinsetter.

The frame is made up of 6 separate assemblies (each assembly is composed of lengths of tubular steel which are welded together). The 6 assemblies are bolted together to form the frame which is then mounted on the kickback tubing using the front and rear leveling rods. Welded to the kickback tubing are nuts which are used to position the front and rear leveling rods. The leveling rods are used to adjust the pinsetter in relation to the lane surface. Used to raise or lower the frame, the leveling rods set the pinsetter parallel to the lane surface.

Attached to the top of the frame are the front and rear wiring ducts which house the various cabling to and from the different components. Two (2) thread rods are positioned at the rear of the frame in order to secure the pin elevator to the pinsetter.

Drive Train



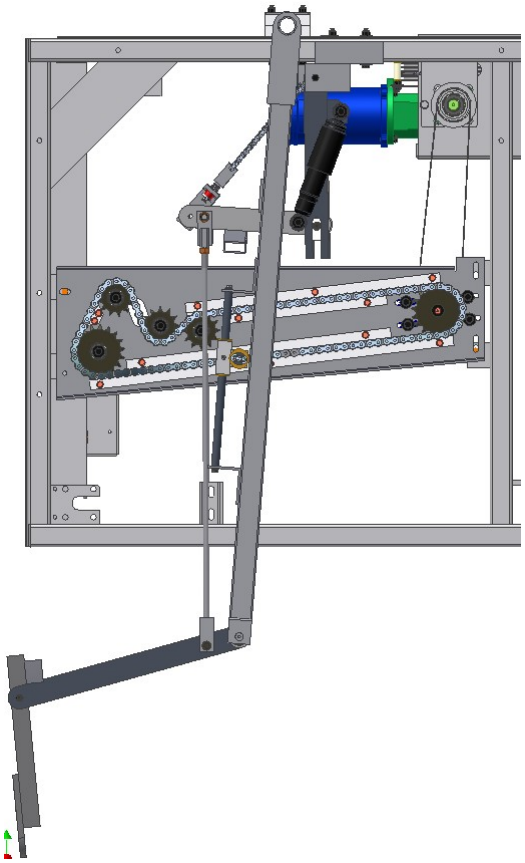
Located on the top of each pinsetter is the ½ hp main motor . Using a series of magnetic clutches, belts and pulleys, the main motor supplies the driving power to the sweep, the carrousel, the pin elevator and the pit.

The parallel shaft gearbox reduces the speed of the main motor. Synthetic lubricants are used in this gearbox due to its wide temperature range. The gearbox is breather less and lubricated for life thus eliminating maintenance. Internal parts for the parallel shaft gearbox are not available through Qubica, only complete gearboxes. In the event that the gearbox needs to be refilled, check the chart in the Drive Train section of "Chapter 3 - Adjustments & Maintenance" for the recommended lubricants.

The main motor is controlled through the electronic power box. When the electric power to one or both pinsetters is turned on, the pinsetter(s) will not start until it receives a power on command from the electronics.

Sweep

The sweep frame assembly pivots on the pinsetter frame through two plastic collars. Hinged at the bottom of the sweep frame assembly are two follower arms upon which are mounted the sweep arms and finally the sweep board. When the sweep board is drawn rearward by the sweep frame assembly, it removes deadwood from the pin area and pushes it into the pit.



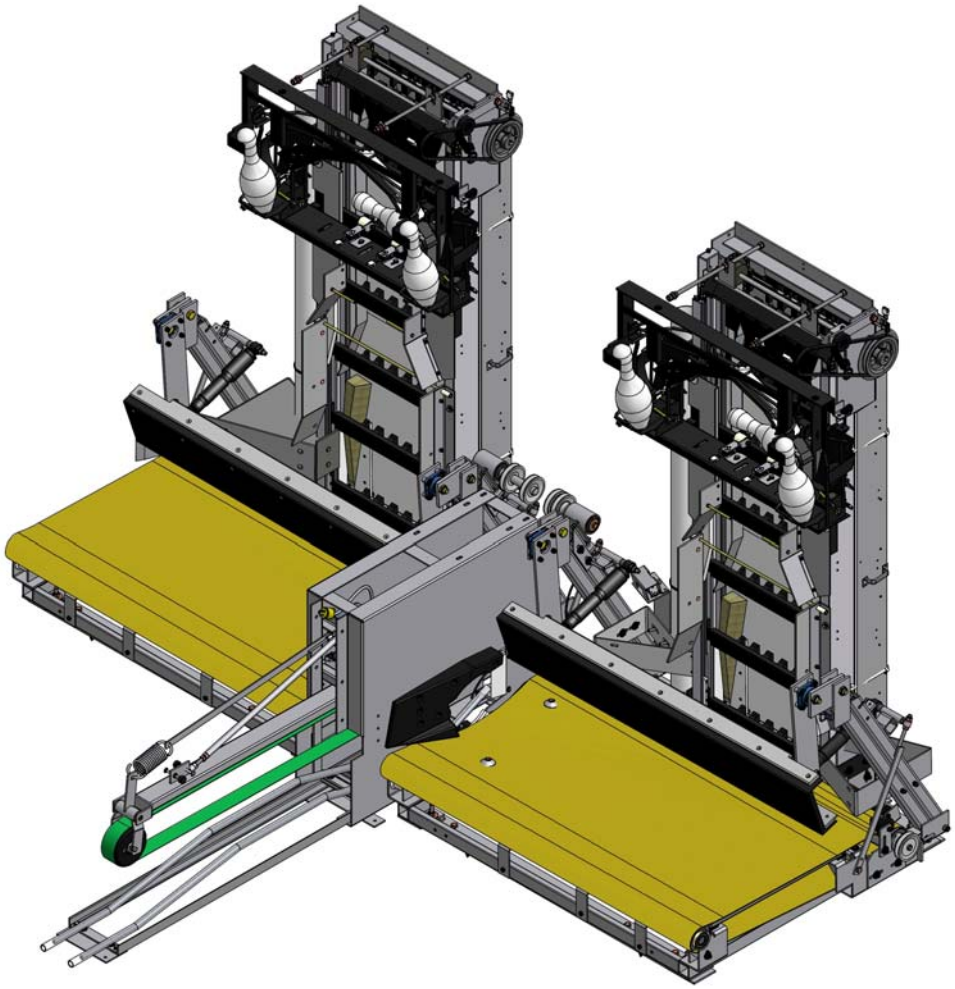
A series of sprockets located in the sweep drive channel carry the sweep chain between them. The sweep is powered by the main motor. The power generated by the motor is relayed to the sweep chain through the two sweep timing belts, with the second one being activated by a magnetic clutch when necessary.

When the sweep's clutch is activated, it results in the sweep chain traveling over its sprockets and carrying with it the sweep chain attachment which pulls the sweep frame assembly through its cycle.

Attached to the top of the sweep frame assembly are two actuators which rotate with the movement of the sweep and activate the sensors attached to the front wiring duct. The left actuator has a single arm and is used to trip the sweep's up position optical sensor ***(SWUP)***. When the sweep is lowered prior to sweeping, the first arm of the V-shaped actuator trips the sweep's forward position optical sensor ***(SWFW)***. After the sweeping movement, the second arm of the V-shaped actuator trips the same sensor, this time signaling its back limit.

The up and down motion is controlled by the sweep lift chains which collapse and extend with the movement of the center sweep bar assembly thus letting go or pulling up the sweep rods. Two (2) shock absorbers, mounted between each sweep bar assembly and the center sweep bar assembly, cushion the sudden, downward motion of the sweep board. As the sweep board moves rearward and forward in its sweeping motion, the left and right adjustment brackets control its height to obtain a horizontal sweep motion.

Pit



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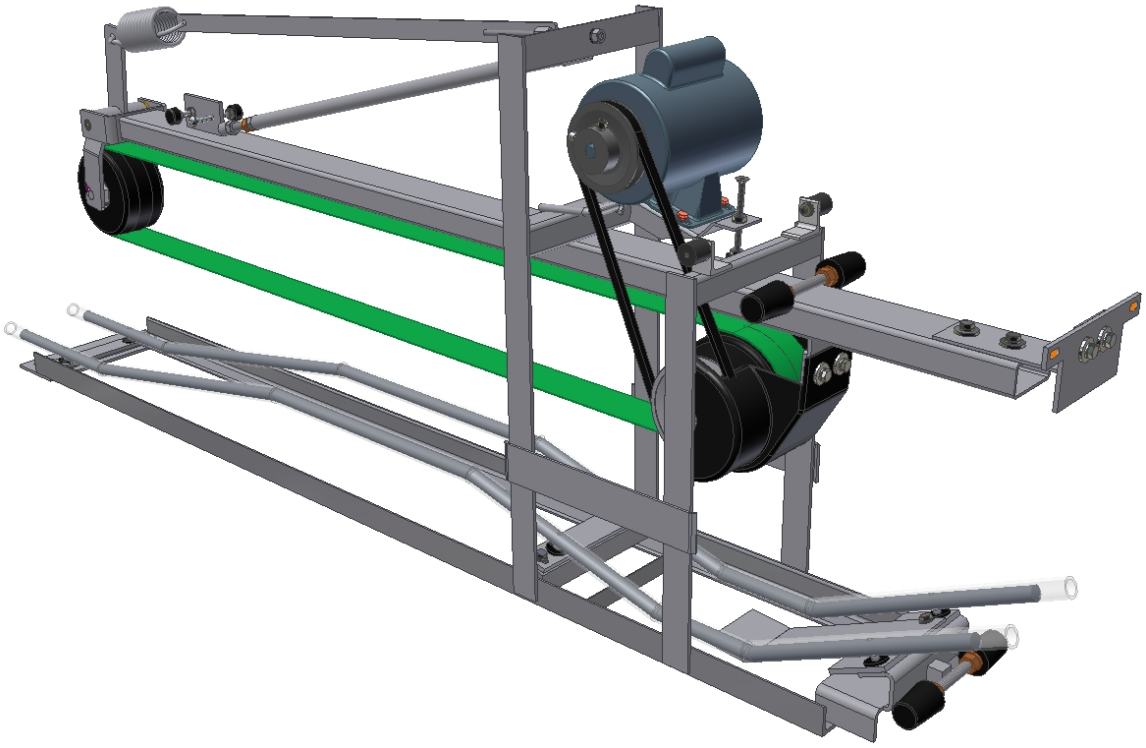
Located at the rear of each lane's pin deck is the pit which uses a conveyor belt to transport the deadwood to the pin elevator and the ball to the ball accelerator door. The conveyor belt travels on the front roller and the rear roller. The power generated by the main motor is continuously relayed to the rear rollers through the stock timing belt and the pit belt.

Located at the rear of each pit is the ball ready transmitter which emits an infra-red light beam returned to it by the round reflector located in the deflector block. When a ball rolls into position behind the deflector block, it cuts the infra-red light beam which in turn activates the ball door's magnetic clutch. When the ball door's clutch is activated, it results in the ball door opening, thus allowing the ball to exit into the ball accelerator.

Ball Accelerator

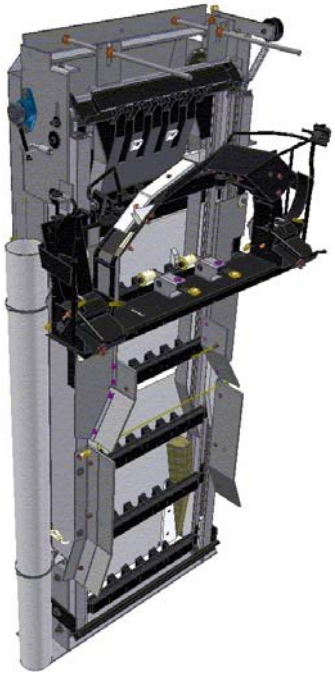


Fastened to the floor between each pair of pinsetters is the ball accelerator assembly which propels the ball to the ball return rack located at the bowler's end of the lane. Mounted on the accelerator's frame are two carriage bolts which exert pressure on both kickbacks in order to keep the accelerator belt and accelerator track parallel to each other.

The drive wheel and the tension wheel carry a long, flat accelerator belt between them. The accelerator is powered by a 1/3 horsepower, capacitor start electric motor that is mounted on the motor support bracket at the rear end of the accelerator frame. The power generated by the motor is relayed to the accelerator belt through the pulley on the motor shaft, the drive belt, the drive pulley, and the drive wheel. The motor support bracket is adjustable to obtain constant pressure on the drive belt, while the tension rod is used to provide proper tension of the tension wheel on the accelerator belt.

Fastened to the bottom of the frame is the ball accelerator track which from rear to front is sloped down, then up, and finally back down again. As a returning ball enters the accelerator, it rolls down the first slope of the track, contacts the constantly rotating accelerator belt and is moved up the inclined surface of the track, thereby increasing the tension on the accelerator belt. When the ball reaches the highest point on the track, the accelerator belt is under maximum tension, thereby propelling the ball down the curved portion of the track and back to the bowler.

Pin Elevator & Carrousel Staging



The pin elevator receives the pins from the pit conveyor belt and carries them up to the carrousel staging position using the elevator lifts. A series of sprockets located inside the left and right plates carry the elevator chains between them. The elevator is powered by the main motor. The power generated by the motor is relayed to the elevator chain through the stock timing belt and the elevator belt which is activated by a magnetic clutch when necessary.

When the elevator's clutch is activated, it results in the elevator chains traveling over their sprockets and thus revolving the elevator lifts through their endless cycle. The tension on the chains is adjustable through the two adjustment rods located at the top of the elevator.

As the pins ride up the elevator, they are individually counted by the two pin elevator optical sensors located on the carrousel staging channel support. The pin elevator's left side optical sensor ***(PL)*** is used to signal the presence of a pin on the elevator's left side (head to the right) while the pin elevator's right side optical sensor ***(PR)*** is used to signal the presence of a pin on the elevator's right side (head to the left).

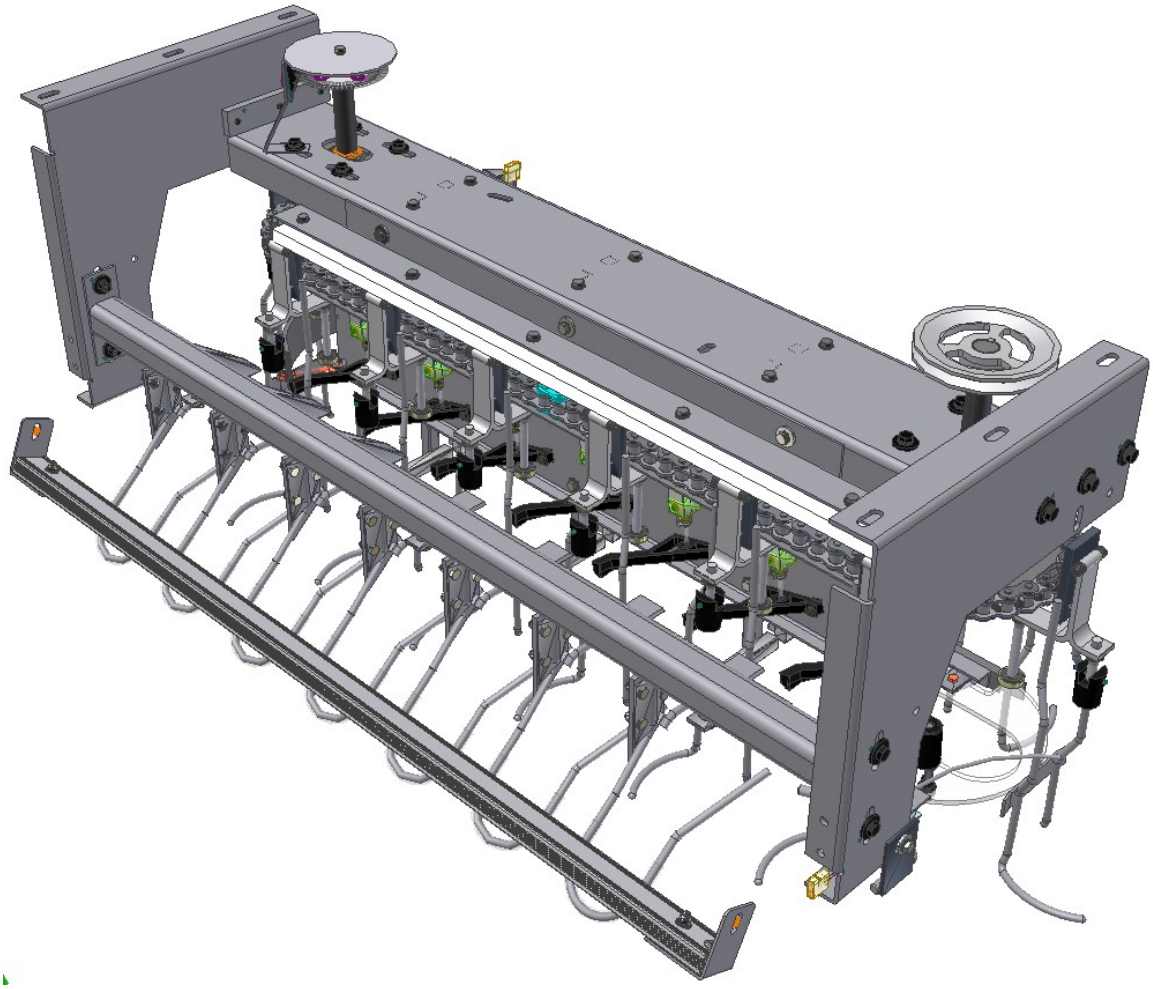
When the pins reach the carrousel staging position located at the top of the elevator, they move either left or right depending on the way they settled into the elevator lifts. As the pins fall into place to be picked up by the carrousel's pin loaders, they are once again individually counted by the two pin loader optical sensors located inside each staging unit. The pin loader's left side optical sensor ***(LL)*** is used to signal the presence of a pin in the carrousel staging left side while the pin loader's right side optical sensor ***(LR)*** is used to signal the presence of a pin in the carrousel staging right side.

All this pin counting is needed in order to control the pin traffic in the elevator. With the pins being accounted for on their way up the elevator and on their way out the carrousel staging, the electronic power box activates and de-activates the pin elevator's magnetic clutch as needed. Without this control, the pin elevator would continuously drop pins into the carrousel staging eventually causing a jam.

The pin elevator's optical sensor ***(ER)***, located on the top right side of the elevator is used to detect the elevator's movement. If the electronic power box sends an ON signal to the elevator's clutch and no elevator movement is detected, the MAG3-IT Controller will display a troubleshooting message to indicate the fact that there is a physical malfunction with one of the elevator's components.

A manual, low-voltage on-off switch is mounted at the rear of each pin elevator. This switch may be used to open the power circuit to the pin elevator without disrupting the pinsetter's operation in order to clear a pin jam or to perform other quick maintenance to the elevator.

Carrousel



The continuous moving carrousel uses fourteen (14) pin loaders with permanent magnets to pick off the pins from the staging position. Each pin loader may pick up from the left or the right staging position and an empty pin loader will always pick off a pin if one is present in the carrousel staging.

Two (2) sprockets located inside the frame assembly carry the carrousel chain between them. The carrousel is powered by the main motor. The power generated by the motor is relayed to the carrousel chain through the pulley on the motor shaft, the angle drive and pulley, the carrousel belt, the pulley, and the shaft sprocket assembly.

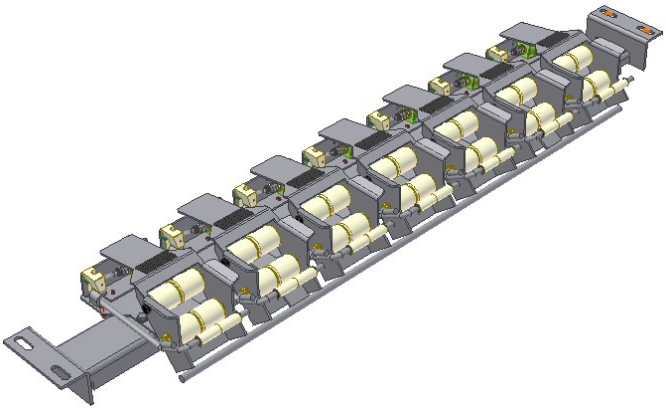
Located on the top of the carrousel frame assembly on its left hand side is the encoder assembly which rotates at the same speed as the carrousel. As it turns, it passes through the carrousel synchronization optical sensor ***(CS)*** which keeps the carrousel in sync with the pinsetter's electronics. The carrousel station synchronization optical sensor ***(SS)*** is located just below the CS on the underside of the frame assembly. One of the fourteen pin loaders has an actuator welded to it which activates the SS as it passes through it. The SS serves as a starting point for the electronics when the pinsetter is

started. Once the SS has been detected after startup, the carrousel may begin its job of loading the magazine.

Located inside the detection bar assembly are seven (7) reed switches ***(CS1-CS7)*** which detect the presence of pins in their respective magazine station. After a pin loader has picked off a pin from the carrousel staging position, it travels around the carrousel to the front. On the right side of the carrousel is the pin detector optical sensor ***(PD)***. The PD lets the electronics know that a pin is on its way to the front. If there is at least one magazine station empty, the electronics will activate its solenoid cam in order to push the pin loader to the front, releasing the pin into the magazine station. If all seven magazine stations are full, the pin loaders will simply continue rotating on the carrousel until the pins they are carrying are needed.

Due to the manner in which the magazine will later feed the drawer, the electronics will always give priority to magazine stations number three, four and five. These stations will always be filled prior to filling the remaining stations.

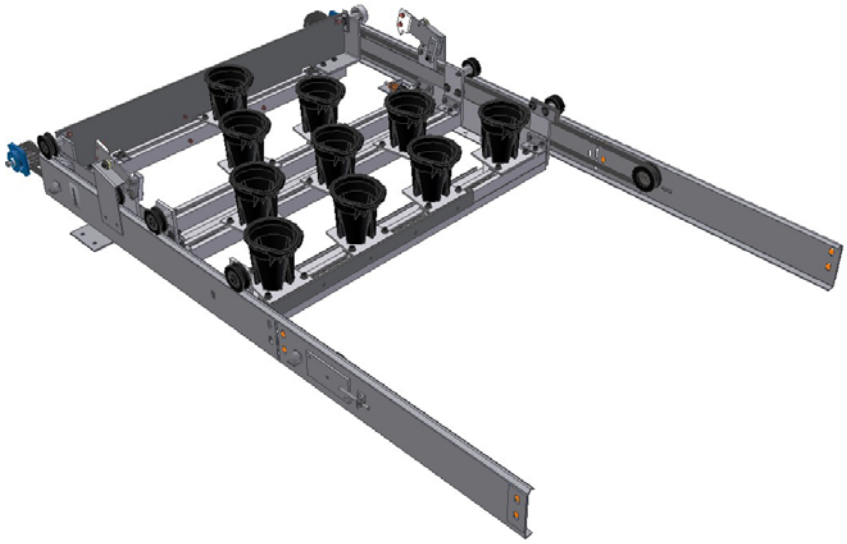
Magazine



The magazine contains seven (7) stations used to load the drawer with its pins. Once the pins have been loaded into the magazine by the carrousel, the electronics loads the drawer in two steps. The first step places pins number one, two and three into the drawer from magazine stations number three, four and five. The second step places pin numbers four to ten into the drawer from all seven magazine stations.

The dumping procedure is quite simple. The electronics activate the necessary stations' solenoids which allow the stations' arms to move freely. The pins fall into the drawer due to their sheer weight and angle.

Drawer

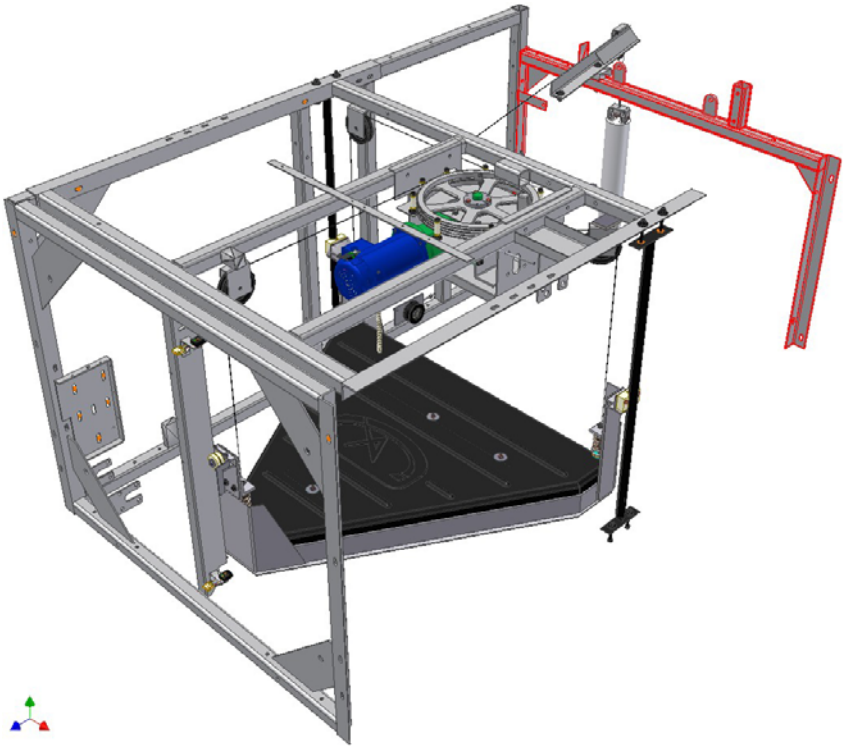


The telescoping drawer receives the pins from the magazine in two straight lines; one of three and one of seven. The drawer then expands in order to position the ten pins in their standard triangular shape ready to be picked up by the deck.

The drawer is powered by a ½ hp, 180VDC motor located at the front of the pinsetter.

The drawer movement control optical sensor and encoder are used to control the drawer's displacement by sixteenths of an inch. The drawer back limit optical sensor (***DWBL***) and the drawer front limit optical sensor (***FRNT***) keep the electronic power box informed on the drawer's position. When the drawer is in its rear position, it may be loaded with pins from the magazine and when it is in its forward position, the magnetic deck may pick up the pins from the drawer. A third detection unit, the drawer obstruction (***DWOB***), using a transmitter and a receiver is used to detect the presence of pins in the drawer as the drawer returns to its rear position. At this point, the drawer should be empty since all ten pins should now be in the magnetic deck. If a pin has remained in the drawer, a problem will occur when the magazine dumps new pins into the drawer. To avoid this problem, the ***DWOB*** signals the fact on the MAG3-IT Controller and stops the pinsetter.

Deck

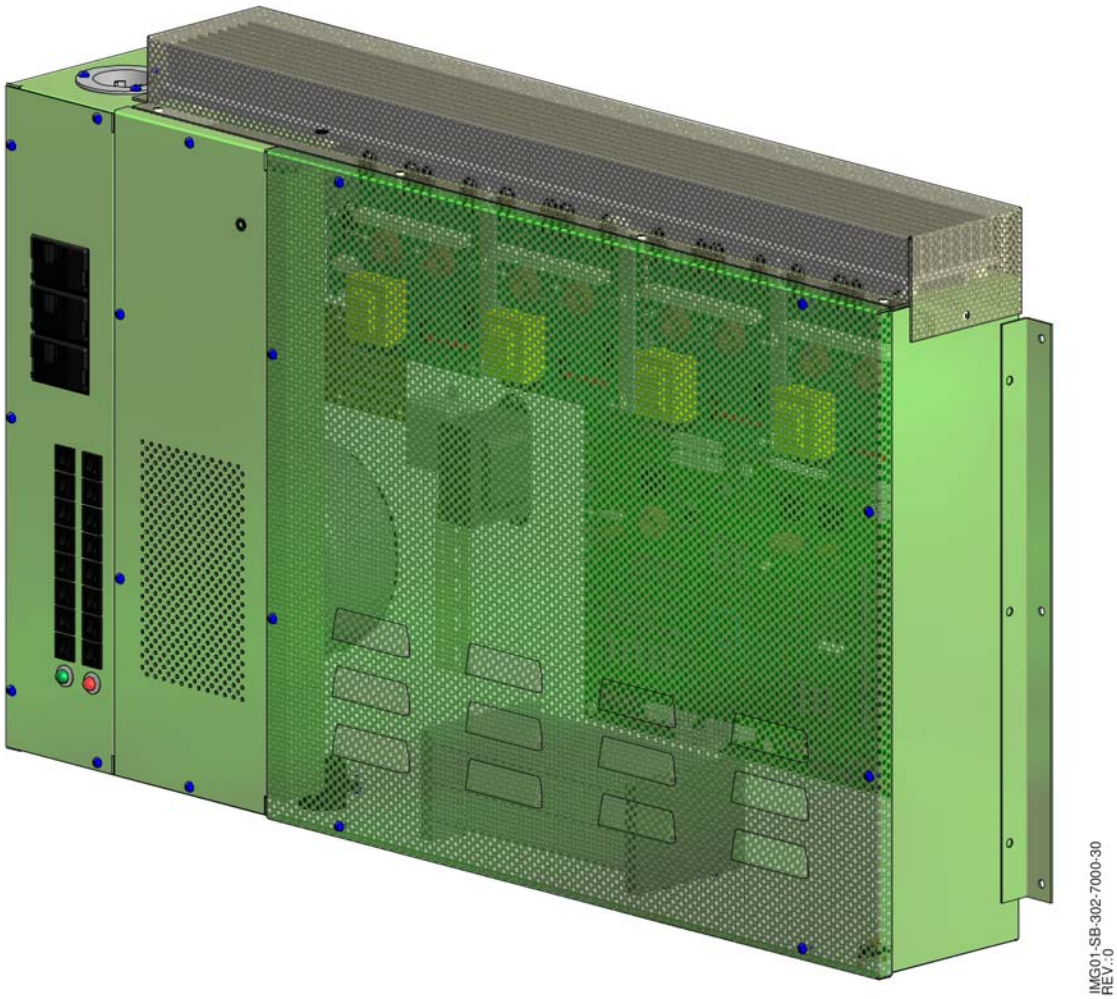


The magnetic deck is a multi-functional component which carries out precision movement commands. When the drawer is expanded, the deck uses fluid dynamics to lift the pins out of the drawer and, after the drawer has receded to its rear position, set the pins on the pin deck. The deck is the principle component used to perform the different pinsetter cycles, full set, part set, second ball, foul, and out of range pin. The out of range pin is actually detected by the deck's out of range plate located on the underside of the deck.

The deck is powered by a ¾ hp, 180VDC motor located at the top of the pinsetter, just above the deck. This motor power a 14-inch pulley which controls the movement of 4 different wire cables used to move the deck up and down. Deck wire 1, deck wire 2 and deck wire 3 travel over the deck pulleys which are placed at the top of the pinsetter relative to each corner of the deck. As these wires rotate on the 14-inch pulley in one direction, the fourth wire cable, the load wire, rotates in the opposite direction. The load wire also travels through a deck pulley, this one located at the rear of the pinsetter. At the end of the load wire is a load of approximately 70lbs (31.8kg) which is used to control the deck's movement. As the load is pulled up and down, the deck rides up and down along the columns using the column guides to keep it straight.

The deck movement control optical sensor and encoder are used to control the deck's displacement by sixteenths of an inch. The deck upper limit optical sensor ***(DKUP)*** and the deck lower limit optical sensor ***(DOWN)*** keep the electronic power box informed on the deck's position. When the deck is in its upper position, it will lift the pins out of the drawer after the drawer has been loaded and expanded. From its lower limit, the deck will lift pins from the pin deck in order for the sweep to remove the deadwood. A third detection unit, the out of range ***(OORG)*** detection plate, uses a metal plate to close a read switch circuit when it comes into contact with an out of range pin. At this point, the pinsetter will stop and signal the presence of the out of range to the MAG3-IT Controller.

Electronic Power Box



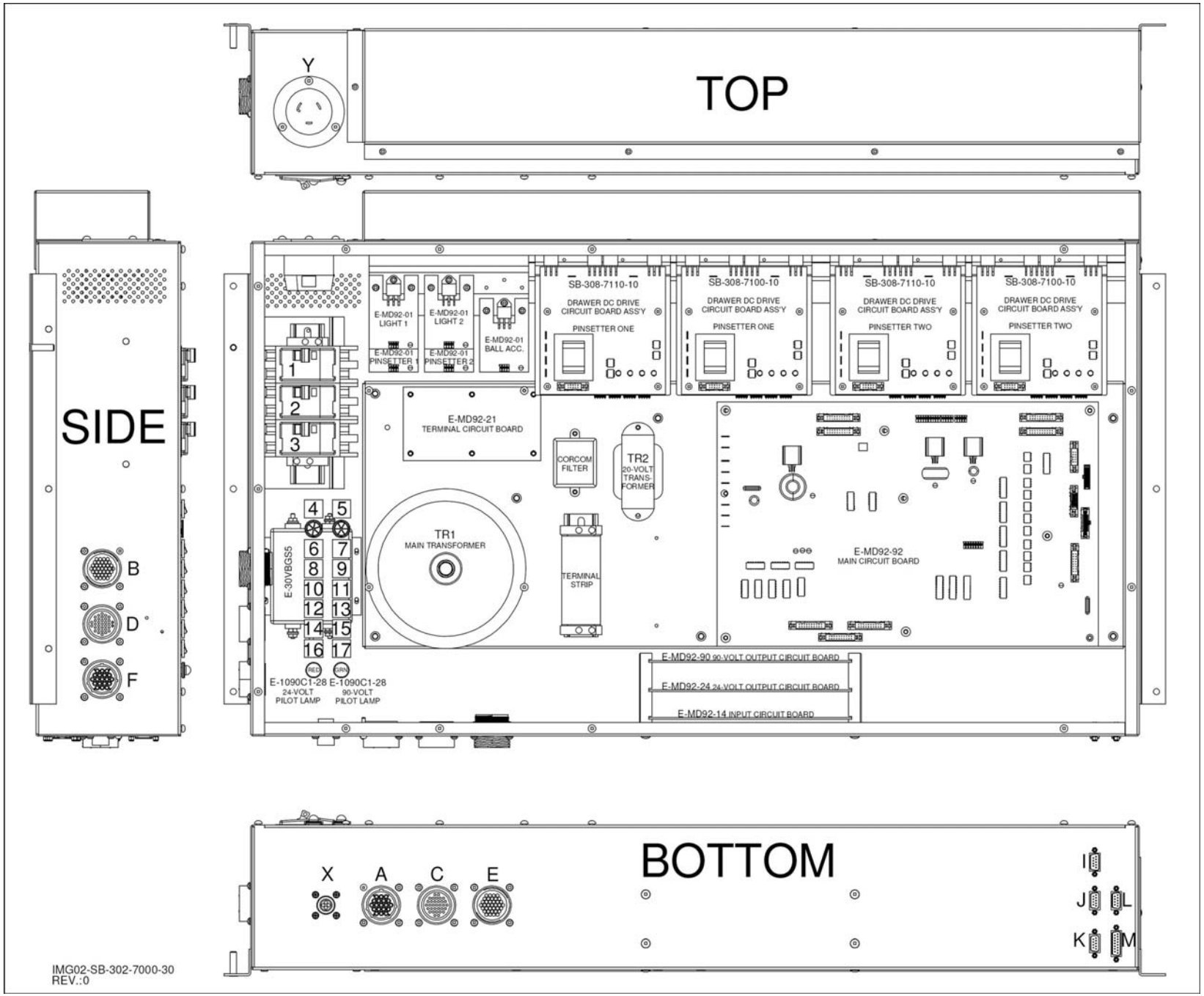
Attached to the front frame of each even numbered pinsetter is the electronic power box used to control both pinsetters. Unlike conventional electrical circuits, which are controlled through a multitude of microswitches, all opening and closing of electrical circuits on the MAG3-IT is done through the electronic power box using software and optical reading devices (sensors and transmitters/receivers). The electronic power box receives software commands from the MAG3-IT Controller and/or the Qubica Manager's Control Computer System / Qubica Automatic Scoring System. Input signals originate from the different optical devices located on the pinsetter. The electronic power box, through its different circuit boards, analyzes the input signals and sends the appropriate output signal (s) to the pinsetter's components. The electronic power box keeps both pinsetters under constant surveillance, turning on and off components as necessary.

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

All wiring to and from the different components is grouped together in six circular plastic connectors, five sub miniature D connectors and two electrical receptacles. Due to the different cable lengths and different connectors used, it is practically impossible to make a mistake in connecting components which have been replaced by the pinsetter maintenance crew.

Three on-off switches are located on the electronic power box and are used to manually open and close the thermal overload circuit breakers. The first switch (top) is used for pinsetter one's electric motors. The second switch (middle) is used for pinsetter two's electric motors. The third switch (bottom) is used for the pair's electronics and the ball accelerator.

In series with the on-off switches located on the electronic power box, are sixteen overload switches. When any of these switches are open, the power to its corresponding component will be shut off. The button on the electronic power box must be manually depressed to restore power to the component. Ample cooling time must be allowed for the overload elements to cool before pressing the button.


TOP
Y
SIDE
B
D
F
SB-308-7110-10
DRAWER DC DRIVE CIRCUIT BOARD ASS'Y
PINSETTER ONE
SB-308-7100-10
DRAWER DC DRIVE CIRCUIT BOARD ASS'Y
PINSETTER ONE
SB-308-7110-10
DRAWER DC DRIVE CIRCUIT BOARD ASS'Y
PINSETTER TWO
SB-308-7100-10
DRAWER DC DRIVE CIRCUIT BOARD ASS'Y
PINSETTER TWO
E-MD92-01 LIGHT 1
E-MD92-01 LIGHT 2
E-MD92-01 BALL ACC.
E-MD92-01 PINSETTER 1
E-MD92-01 PINSETTER 2
1
2
3
E-MD92-21 TERMINAL CIRCUIT BOARD
CORCOM FILTER
TR2 20-VOLT TRANS-FORMER
TR1 MAIN TRANSFORMER
TERMINAL STRIP
E-MD92-92 MAIN CIRCUIT BOARD
4 5
6 7
8 9
10 11
12 13
14 15
16 17
E-30VBGS5
E-1090C1-28 24-VOLT PILOT LAMP
E-1090C1-28 90-VOLT PILOT LAMP
E-MD92-90 90-VOLT OUTPUT CIRCUIT BOARD
E-MD92-24 24-VOLT OUTPUT CIRCUIT BOARD
E-MD92-14 INPUT CIRCUIT BOARD
BOTTOM
X
A
C
E
I
J
L
K
M
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Electronic Power Box Legend

Index	Part Number	Overload or Breaker which protects
1	E-QUO215	PINSETTER 1
2	E-QUO215	PINSETTER 2
3	E-QUO210	BALL ACCELERATOR & ELECTRONICS
4	E-W28XQ1A-3	CAROUSEL CONTROLLERS, MAG3 CONTROLLER & INPUT CIRCUIT BOARD
5	E-W28XQ1A-1	20 VOLT TRANSFORMER TR2
6	E-W28XQ1A-5	MAIN TRANSFORMER TR1
7	E-W28XQ1A-4	90-VOLT OUTPUT CIRCUIT BOARD
8	E-W28XQ1A-5	24-VOLT OUTPUT CIRCUIT BOARD
9	E-W28XQ1A-7	BALL ACCELERATOR AC MOTOR
10	E-W28XQ1A-7	PINSETTER 1 AC MOTOR
11	E-W28XQ1A-7	PINSETTER 2 AC MOTOR
12	E-W28XQ1A-7	DRAWER 1 DC MOTOR
13	E-W28XQ1A-7	DECK 1 DC MOTOR
14	E-W28XQ1A-7	DRAWER 2 DC MOTOR
15	E-W28XQ1A-7	DECK 2 DC MOTOR
16	E-W28XQ1A-10	CAROUSEL 1 SOLENOIDS
17	E-W28XQ1A-10	CAROUSEL 2 SOLENOIDS

Index	Part Number	Used to Connect
A	E-211773-1	PINSETTER 1 DC MOTOR DRIVES & CLUTCHES + PINSETTER AC MOTOR
B	E-211773-1	PINSETTER 2 DC MOTOR DRIVES & CLUTCHES + PINSETTER AC MOTOR
C	E-206306-1	PINSETTER 1 DRIVE INPUT SIGNALS & 24-VOLT OUTPUT SIGNALS
D	E-206306-1	PINSETTER 2 DRIVE INPUT SIGNALS & 24-VOLT OUTPUT SIGNALS
E	E-206151-1	PINSETTER 1 OPTICAL SENSOR INPUTS
F	E-206151-1	PINSETTER 2 OPTICAL SENSOR INPUTS
I	CPB-71	MAG3 2001 CONTROLLER
J	CPB-70	PINSETTER 2 CAROUSEL CONTROLLER
K	CPB-70	PINSETTER 1 CAROUSEL CONTROLLER
L	CPB-73	AUTOMATIC SCORING PLAYER'S CONSOLE
M	CPB-72	CAMERA & BALL DETECTORS
X	E-206430-1	PINSETTER FLUORESCENT LIGHT
Y	E-2625	MAIN POWER CONNECTOR

For more information on the electronic power box and its various components along with descriptions of their functions, refer to "Chapter 5 - Wiring Diagrams & Schematics".

Optical Reading Devices

Each pinsetter uses a total of twenty-eight (28) different optical reading devices in order to send signals directly or indirectly to the electronic power box. These devices come in the form of optical sensors, read switches and transmitters with each one equipped with a partner device such as an actuator, encoder, receiver or reflector. Some of the components used are interchangeable as shown in the table below.

Device	Signal	Partner
Optical Sensor	Carrousel Synchronization.	Carrousel Encoder
	Deck Motor Synchronization	Motor Encoder
	Drawer Motor Synchronization	Motor Encoder
Optical Sensor	Ball Door Open	Actuator
	Carrousel Pin Detector	Actuator
	Carrousel Station Sync.	Actuator
	Deck Lower Limit	Actuator
	Deck Upper Limit	Actuator
	Drawer Back Limit	Actuator
	Drawer Front Limit	Actuator
	Pin Elevator Running	Actuator
	Pin Elevator Left Side	Actuator
	Pin Elevator Right Side	Actuator
	Pin Loader Left Side	Actuator
	Pin Loader Right Side	Actuator
	Sweep Forward	Actuator
	Sweep Up	Actuator
Reed Switch	Carrousel Sensor 1	Magnet
	Carrousel Sensor 2	Magnet
	Carrousel Sensor 3	Magnet
	Carrousel Sensor 4	Magnet
	Carrousel Sensor 5	Magnet
	Carrousel Sensor 6	Magnet
	Carrousel Sensor 7	Magnet
Reed Switch	Out of Range	Detection Plate
Transmitter	Ball Ready	Reflector located in deflector blocks
Transmitter	Drawer Obstruction	Receiver
Transmitter	Ball Detector	Reflector

MAG3-IT Controller

There is one MAG3-IT Controller assembly for each pair of MAG3-IT pinsetters. The controller is located on a pivotal arm which is attached to the even numbered pinsetter's frame. The pivotal arm allows the user to place the display unit in the most comfortable position desired.

Connected to the electronic power box through connector DB-S09I, the MAG3-IT Controller uses the metaphor of a dashboard which is constantly displaying information on the status of your pinsetters and their activities. It will display messages if there is a physical malfunction with a pinsetter and more importantly what to do in order to correct the malfunction.

The MAG3-IT Controller is a very important component of your MAG3-IT pinsetters. Use it wisely and treat it respectfully in order for the controller to give you years of trouble free service.

Learn to read the digital display before attempting any type of intervention. The digital display gives you precise information in order to help you. By reading the digital display, you will save time and effort during your daily duties.

With the MAG3-IT Controller you can:

- Verify each pinsetter's components individually by sending on/off signals to check output signals or simple commands in order to verify input signals;
- Troubleshoot your pinsetters if a problem arises;
- Turn pinsetters on and off or perform different types of pinsetter cycles after mechanical maintenance has been performed.

For information on how to use the MAG3-IT Controller, refer to "Chapter 2 - Using the MAG3-IT Controller".

Pinsetter Component Notes

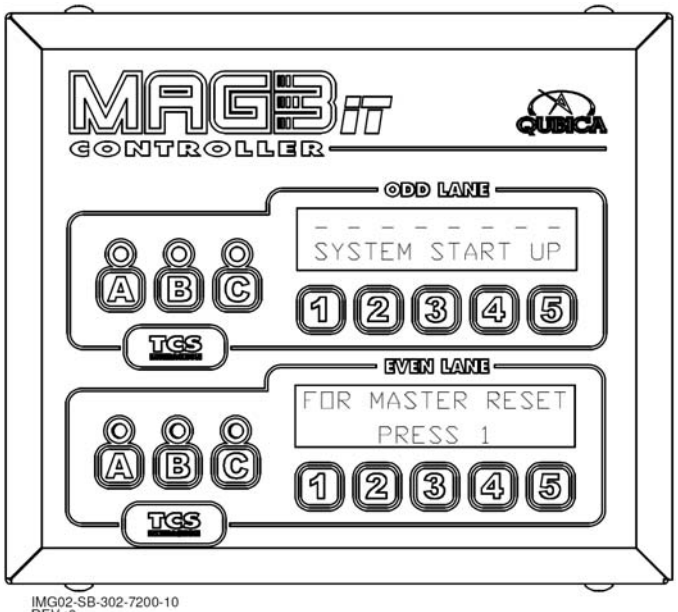
2. Using the MAG3-IT Controller

Chapter Overview

After reading this chapter you should be able to:

- Use the MAG3-IT Controller to start and stop pinsetters.
- Perform verifications of the different pinsetter components.
- Display relevant information on each pinsetter.

Power On



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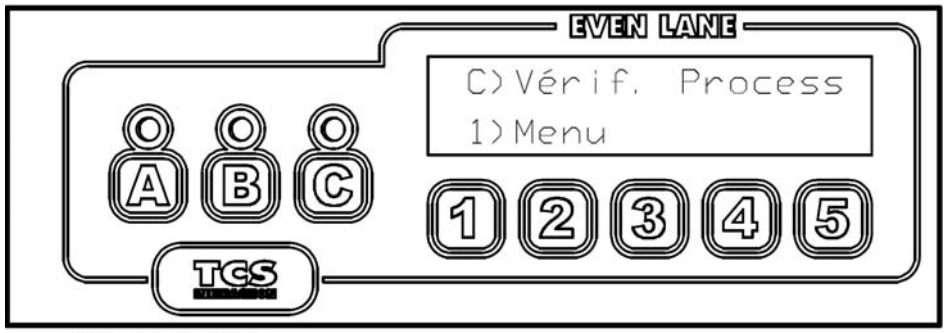
When the electrical power is turned on to the pair of lanes, the MAG3-IT Controller will display a message indicating its start up. Allow the pinsetters to start up normally unless you have experienced a problem which would necessitate a RESET.

Once the MAG3-IT Controller is started, its buttons (or keys) have different functions depending on what is displayed except for the letter buttons. The letter buttons react as indicated below ***whenever*** pressed. Each display unit shows two lanes and the commands are independent of each other except for the **A** button.



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Button	Function
A	Commonly called the PANIC BUTTON, pressing the **A** button will reset ***both*** pinsetters causing them to go through their synchronization cycles.
B	USER PROBLEM BUTTON, pressing the **B** button will stop the corresponding pinsetter immediately (if the E-MD92-92 version is 1.14 or older, the pinsetter will stop only if it was in movement at the time the button was pressed). Pressing the **B** button for one pinsetter has no effect on the other pinsetter. To return the pinsetter to its normal operation, the **B** button must be pressed again.
C	VERIFICATION PROCEDURES BUTTON, pressing the **C** button will activate or deactivate the Component Verification Procedures (tests) for the MAG3-IT pinsetter.
Numbers	The number keys are used to gain access to the menu system and carry out pre-programmed items. Refer to "Chapter 4 - Troubleshooting" for additional information.
TCS	Used to interact with the optional Trouble Call System.

Component Verification Procedures

The installation procedures used by Qubica technicians include the verification procedures. These procedures may be carried out at any time by pressing **C** on the MAG3-IT Controller. In doing so, you gain access to the verification procedures used to test each electronic component in a logical and systematic order.

The verification procedure is composed of three different steps:

1. Verification of all input signals from the major components;
2. Verification of all output signals to the major components;
3. Calibration of both the deck and the drawer.

The operator may exit the verification procedures at all times by pressing **C** on the MAG3-IT Controller. It is also possible to skip over the different tests, performing only the ones desired.

When performing the verification procedures, make sure that you follow the instructions indicated in the display window.

Testing Input Signals

All input signals may be verified by performing an optical transition test (*pass an object through the optical sensor or in front of the optical transmitter in order to cut its signal*). If the transition is successful, the MAG3-IT Controller automatically passes to the next test. If the transition is not successful, the MAG3-IT Controller will continue to display the same message until a transition is successful or until the test is skipped. The following pages list the INPUT SIGNAL TESTS displayed and a brief description for each one. The tests are listed in the order in which they appear during the installation procedure.

```
DWBL      5)Skip
Make Transition
```

The first test is to verify that the drawer's back limit optical sensor (***DWBL***) is functioning correctly.

```
DWBL again 5)Skp
Make Transition
```

The drawer's back limit optical sensor (***DWBL***) must be verified a second time in order to test the drawer's DC drive communication bypass with the input circuit board.

```
FRNT      5)Skip
Make Transition
```

The drawer's front limit optical sensor (***FRNT***).

```
DWOB      5)Skip
Make Transition
```

The drawer obstruction optical transmitter & drawer obstruction optical receiver (***DWOB***). At this time you should also verify that the two components used are well aligned by insuring that the green LED is clearly visible on the transmitter.

```
DWOB again 5)Skp
Make Transition
```

The drawer obstruction optical transmitter & drawer obstruction optical receiver (***DWOB***) must be verified a second time in order to test the drawer's DC drive communication bypass with the input circuit board.

```
DKUP      5)Skip
Make Transition
```

The deck's upper limit optical sensor (***DKUP***). This only appears if the deck IS NOT in its uppermost position. **If the deck IS in its uppermost position then the "Skip Test/Move Deck" will be displayed:**

If you don't wish to skip the test, you must use the manual deck crank supplied in your spare parts kit to physically lower the deck so as to have the

```
1)Skip Test
2)Move Deck
```

optical sensor actuator completely removed from the sensor. Once the deck is lowered, press **2** on the MAG3-IT Controller. If the transition was successful, the MAG3-IT Controller automatically passes to the next test. If the transition was not successful, the MAG3-IT Controller will once again display "DKUP 5)Skip" which in effect keeps the same test active but this time with the deck not being in its uppermost position.:

```
DKUP again 5)Skp
Make Transition
```

The deck's upper limit optical sensor (***DKUP***) must be verified a second time in order to test the deck's DC drive communication bypass with the input circuit board. This only appears if the deck **IS NOT** in its uppermost position. **If the deck IS in its uppermost position then the "Skip Test/Move Deck" will be displayed:**

```
1)Skip Test
2)Move Deck
```

If you don't wish to skip the test, you must use the manual deck crank (Z-ME4100) supplied in your spare parts kit to physically lower the deck so as to have the optical sensor actuator completely removed from the sensor. Once the deck is lowered, press **2** on the MAG3-IT Controller. If the transition is successful, the MAG3-IT Controller automatically passes to the next test. If the transition is not successful, the MAG3-IT Controller will once again display "DKUP again 5)Skip" which in effect keeps the same test active but this time with the deck not being in its uppermost position.

```
Make Transition
DOWN      5)Skip
```

The deck's lower limit optical sensor (***DOWN***). This only appears if the deck IS NOT in its lowermost position. **If the deck IS in its lowermost position then the "Skip Test/Move Deck" will be displayed**:

If you don't wish to skip the test, you must use the manual deck crank supplied in your spare parts kit to physically raise the deck so as to have the

```
1)Skip Test
2)Move Deck
```

optical sensor actuator completely removed from the sensor. Once the deck is raised, press **2** on the MAG3-IT Controller. If the transition was successful, the MAG3-IT Controller automatically passes to the next test. If the transition was not successful, the MAG3-IT Controller will once again display "DOWN 5)Skip" which in effect keeps the same test active but this time with the deck not being in its lowermost position.

```
OORG      5)Skip
Make Transition
```

The out of range detector (***OORG***) must be verified by pushing up on the metal plate located on the underside of the deck. This plate will make contact with the switch located inside the deck, thus closing the circuit and producing a pulse signal to the electronics.

```
OORG again 5)Skp
Make Transition
```

The out of range detector (***OORG***) must be verified a second time in order to test the deck's DC drive communication bypass with the input circuit board.

```
SWUP      5)Skip
Make Transition
```

The sweep's up position optical sensor (***SWUP***).

```
SWFW      5)Skip
Make Transition
```

The sweep's forward position optical sensor (***SWFW***).

```
BLRD      5)Skip
Make Transition
```

The ball ready optical transmitter (***BLRD***) used to signal a ball's presence at the accelerator's door.

```
BDOP      5)Skip
Make Transition
```

The ball door optical sensor (***BDOP***) used to signal the status of the ball accelerator's door (open or closed).

```
CSENSOR-1 5)Skip
Make Transition
```

The first of seven read switch detectors (***CS1***) located in the detection bar assembly used to signal the presence of pins in the magazine. Number 1 detector is located to the left. To perform a transition, place a pin in its corresponding magazine station.

```
CSENSOR-2 5)Skip
Make Transition
```

The second of seven read switch detectors (***CS2***) located in the detection bar assembly used to signal the presence of pins in the magazine. To perform a transition, place a pin in its corresponding magazine station.

`CSENSOR-3 5)Skip Make Transition`	The third of seven read switch detectors (***CS3***) located in the detection bar assembly used to signal the presence of pins in the magazine. To perform a transition, place a pin in its corresponding magazine station.
`CSENSOR-4 5)Skip Make Transition`	The fourth of seven read switch detectors (***CS4***) located in the detection bar assembly used to signal the presence of pins in the magazine. To perform a transition, place a pin in its corresponding magazine station.
`CSENSOR-5 5)Skip Make Transition`	The fifth of seven read switch detectors (***CS5***) located in the detection bar assembly used to signal the presence of pins in the magazine. To perform a transition, place a pin in its corresponding magazine station.
`CSENSOR-6 5)Skip Make Transition`	The sixth of seven read switch detectors (***CS6***) located in the detection bar assembly used to signal the presence of pins in the magazine. To perform a transition, place a pin in its corresponding magazine station.
`CSENSOR-7 5)Skip Make Transition`	The last of seven read switch detectors (***CS7***) located in the detection bar assembly used to signal the presence of pins in the magazine. To perform a transition, place a pin in its corresponding magazine station.
`Carrou PL 5)Skip Make Transition`	The pin elevator's left side optical sensor (***PL***) used to signal the presence of a pin on the elevator's left side.
`Carrou LL 5)Skip Make Transition`	The pin loader's left side optical sensor (***LL***) used to signal the presence of a pin on the loader's left side.
`Carrou PR 5)Skip Make Transition`	The pin elevator's right side optical sensor (***PR***) used to signal the presence of a pin on the elevator's right side.
`Carrou LR 5)Skip Make Transition`	The pin loader's right side optical sensor (***LR***) used to signal the presence of a pin on the loader's right side.
`Carrou ER 5)Skip Make Transition`	The pin elevator's optical sensor (***ER***) used to signal the elevator's movement.
`Carrou SS 5)Skip Make Transition`	The carrousel's station synchronization optical sensor (***SS***). One of the 14 bucket assemblies has an optical actuator welded to it which allows for the synchronization.
`Carrou PD 5)Skip Make Transition`	The carrousel's pin detector optical sensor (***PD***) used to signal the presence of pins in the revolving carrousel.
`Carrou CS 5)Skip Make Transition`	The carrousel's synchronization optical sensor (***CS***). This sensor is located on top of the carrousel and is activated by the encoder. To perform the transition, gently rotate the carrousel since the encoder is marked at every ¼ inch.

Testing Output Signals

All output signals may be verified by pressing **1** on the MAG3-IT Controller or skipped by pressing **5** in order to go to the next test.. Pressing **1** will send a power ON signal to the output device being tested followed automatically by a power OFF signal. After each output test is completed, the following will be displayed:

```
1)Again
2)Next Test
```

Each output signal may be tested as often as desired before going on to the next test. It must be noted that the electronics do not verify the fact that the component was actually activated. You must verify the fact of functionality on your own. The only electronic reaction to each command is to turn on the corresponding LED on its corresponding circuit board (refer to the Wiring Diagrams beginning on page 94 of the MAG3-IT Pinsetter Manual for more details on the location of each LED). The following pages list the OUTPUT SIGNAL TESTS displayed and a brief description for each one. The tests are listed in the order in which they appear during the installation procedure.

```
Fluorescent
1)Start   5)Skip
```
The pinsetter's fluorescent light.

```
Sweep Clutch
1)Start   5)Skip
```
The sweep's magnetic clutch.

```
Elevator Clutch
1)Start   5)Skip
```
The pin elevator's magnetic clutch.

```
Ball Clutch
1)Start   5)Skip
```
The ball door's magnetic clutch.

```
Ball 1 Light
1)Start   5)Skip
```
The pinsetter's ball 1 light.

```
Ball 2 Light
1)Start   5)Skip
```
The pinsetter's ball 2 light.

```
Trouble Light
1)Start   5)Skip
```
The pinsetter's trouble light.

```
Ball Lift
1)Start   5)Skip
```
The ball lift's motor (actually the 24-volt relay which activates the ball lift's motor).

```
Main Motor
1)Start   5)Skip
```
The pinsetter's main motor.

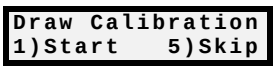
```
Ball Acc. Motor
1)Start   5)Skip
```
The ball accelerator's motor.

```
Carrou Solenoids
1)Start   5)Skip
```
Each of the 14 carrousel solenoids.

Calibration Tests

Calibration tests are vital to the pinsetter's good operation. During these tests, the pinsetter will physically measure the distance it has to travel during its various cycles and store the information for future reference. Since distances traveled by the different components of the pinsetter are measured in sixteenths of an inch, the slightest movement of an optical sensor necessitates a calibration adjustment. Listed below are the CALIBRATION TESTS displayed and a brief description for each one. The tests are listed in the order in which they appear during the installation procedure.

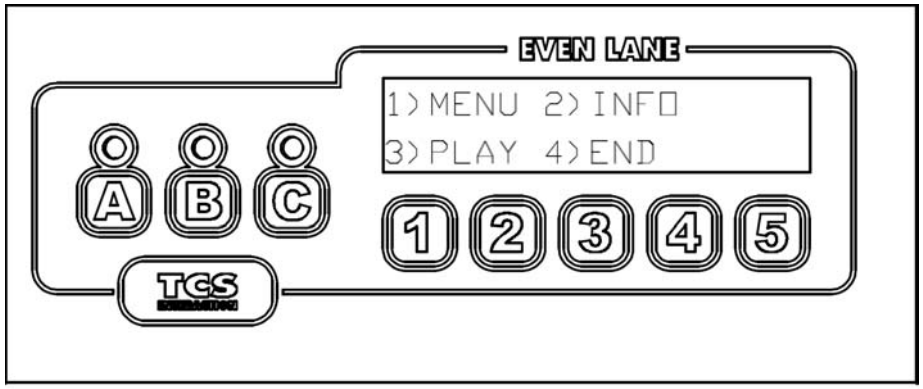
Performs the *deck calibration command*. The deck will physically calibrate itself in conjunction with the deck's lower limit optical sensor.



Performs the *drawer calibration command*. The drawer will physically calibrate itself in conjunction with the drawer's front limit optical sensor.

Menu System

The MAG3-IT Controller has a user friendly menu system which is built in a pyramidal fashion in order to facilitate its use. Most of the components listed on the preceding pages under verifications are also accessible through the menu system along with many other options which are combined together in categories. Each category is branched out into groups and sub-groups, thus making the controller easy to use and understand.



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Press	to gain access to
1) Menu	the Main Menu System.
2) Info	the Pinsetter Information display..
3) Play	the Play Information & Commands display.
4) End	the previous menu.

Pinsetter Information

```
1)Seri   2)Cycle
3)Phas   4)More
```

Depending on the version of the EPROM located on the E-MD92-92 circuit board, different information is available to you. Listed below is the information displayed with version 1.16, you may have less information if your version number is lower.

```
Serial Number:
MD92-92-
```

Pressing **1** will display your pinsetter's serial number.

```
Total Full Set:
          5896
```

Pressing **2** will display the number of Full Sets completed by the pinsetter.

```
System Phase:
50 Hertz
```

Pressing **3** will display the electrical phase used (50 or 60 Hz.).

```
1)Ver    2)ReSt
3)Dsw    4)Pins
```

Pressing **4** will present another display with more options as indicated below.

```
     VERSION
      1.16
```

Pressing **1** will display the version number of the EPROM located on the E-MD92-92 circuit board.

```
External Reset
```

Pressing **2** will display the type of RESET last seen by the controller. The display which follows is only an example, various displays are possible.

```
SW302-> 00000000
SW301-> 00000000
```

Pressing **3** will display the setting which is in effect for dip switches SW301 and SW302 (0 = OFF, 1 = ON). The example below displays the Qubica factory settings.

```
Pin  12345678910
pos: 0010010001
```

Pressing **4** will display the status of each pin as seen by the pin detection camera (0 = NO PIN, 1 = PIN PRESENT). The example below indicates that the camera is reading pins 3, 6, and 10.

Play Information & Commands

```
1)Info  2)Enab
3)MoId  4)Sdsw
```

Depending on the version of the EPROM located on the E-MD92-92 circuit board, different information is available to you. Listed below is the information displayed with version 1.16, you may have less information if your version number is lower.

```
AO)1 BI)0 EB)1
VB)1 TpuB)0 MI)0
```

Pressing **1** will display the global ball detector status. The example below indicates the default settings.

- **AO** is the lane status (1 = open, 0 = closed);
- **BI** is the ball input status (1 = ball detected (TPU), 0 = pinsetter reaction to detected ball);
- **EB** is the ball enable status (1 = active, 0 = inactive);
- **VB** is the ball valid status (1 = ready, 0 = waiting for pinsetter to complete its cycle);
- **TpuB** is the ball toggle status (1 = infra-red light beam interrupted, 0 = infra-red light beam present).
- **MI** is the autoscoring idle mode (1 = idle, 0 = normal). See below for more information

Pressing **2** will reset the ball detector global settings to their default settings.

```
1)Set OFF
2)Set ON      <5
```

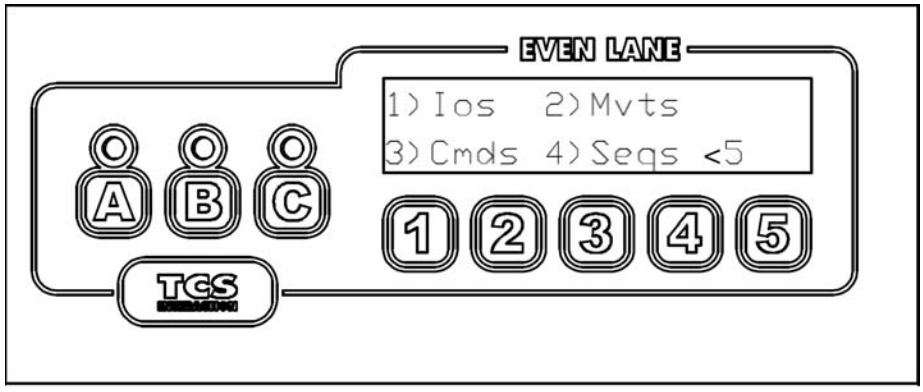
Pressing **3** will access the AUTOSCORING IDLE MODE. This mode was introduced with version 1.16 and is used to disactivate the autoscoring functions (especially the ball detector) in order that the lanes be dressed with an automatic lane machine without the pinsetter cycling. Press 2 to set the idle mode and press 1 to return to normal once lane dressing is completed. Pressing 5 will return to the previous menu.

```
Set dip switches
AND hit any key!
```

Pressing **4** allows the user to change dip switch settings on the E-MD92-92 circuit board without having to RESET the board afterwards. This option is practical when a lane is already in play and the user wishes to change a dip switch setting. After having pressed 4, change the desired dip switch settings and then press any key on the MAG3-IT Controller in order to confirm the changes.

Main Menu

After having pressed **1** while in the Menu System, the four (4) major categories of the menu system will be presented. Each category is divided into different groups and sub-groups accessible through the major categories.



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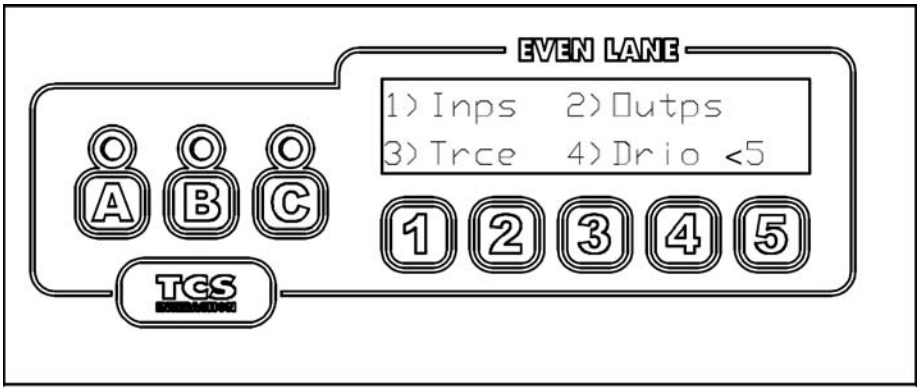
Once in the main menu, you make choices through the number buttons on the controller. Pressing **5** will always return you to the previous menu viewed or skip to the next operation depending on the circumstances and what was displayed on the MAG3-IT Controller.

Category	Gains access to
1) IOs	the input/output signals used to verify the status of different pinsetter sensors and circuits (inputs) and also to activate and/or de-activate various pinsetter components (outputs) in order to verify their functionality. The input/output signals are divided into 4 major groups under Menu 1.
2) Mvts	the movement commands used to send minor commands to the different moving parts in order to verify their movement and functionality. The movement commands are divided into 4 major groups under Menu 2. During movement commands, the MAG3-IT Controller will display the action being taken and then return the display to its previous condition allowing the user to select another movement command or return to the previous menu display.
3) Cmds	the basic pinsetter commands used to send major commands to the pinsetter as a whole. These commands will start every moving part necessary in order to perform what is asked of the pinsetter. The basic pinsetter commands are divided into 4 major groups under Menu 3. During movement commands, the MAG3-IT Controller will display the action being taken and then return the display to its previous condition allowing the user to select another movement command or return to the previous menu display.
4) Seqs	the sequential pinsetter commands used to send major commands to the pinsetter on a repetitive basis. These commands will start every moving part necessary in order to perform what is asked of the pinsetter. The sequential pinsetter commands are divided into 3 major groups under Menu 4. During sequential commands, the MAG3-IT Controller will display the action being taken and once completed will return the display to its previous condition allowing the user to select another movement command or return to the previous menu display.

NOTE: **A detailed layout of the menu structure may be found at the end of this chapter.**

Menu 1 Input/Output Signals



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Group	Gains access to
1) Inps	the input signals as received by the input circuit board and which originate from different optical reading devices. When using the input signals option, a code number is displayed next to each item in order to inform you of its status. The possible values returned by the different pinsetter components when verifying inputs are 0 and 1. A displayed 0 indicates that the signal is OFF (sensor is not obstructed) while 1 indicates that the signal is ON (sensor is obstructed).
2) Outps	the output signals used to turn on and off the different electrical components through the 24-volt output circuit board, the 90-volt output circuit board and the three AC drive circuit boards. Contrary to the verification procedures, the menu options under Menu 1.2 will send an ON command to the component if it is off and will send an OFF command to the same component if it is on. The component will remain in the ON or OFF state until another command is sent. For example; if pinsetter 1's fluorescent light is OFF and you press 1 while in Menu 1.2.1, the fluorescent light will be turned ON and remain ON until you press 1 again.
3) Trce	the tracing system which is a programming utility used to de-bug the system. Do not attempt to use the tracing commands unless asked to do so by an accredited Qubica technician. The tracing commands are not explained here, since only an accredited Qubica technician should use the functions in this group which are used for software de-bugging purposes.
4) Drio	the input signals as received by the two drawer DC drives and by the two deck DC drives and which originate from different optical reading devices and bypasses from the input circuit board. The possible values returned by the different pinsetter components when verifying inputs are 0 and 1. A displayed 0 indicates that the signal is OFF (sensor is not obstructed) while 1 indicates that the signal is ON (sensor is obstructed).

Menu 1.1 Input Signals

```
Groups  1)1
2)2 3)3 4)4   <5
```

The input signals are grouped into 4 distinct sub-groups. Group 1 gains access to the input signals relative to the drawer and deck drive functions. Group 2 gains access to the input signals relative to the sweep and ball accelerator functions. Group 3 gains access to the remote input signals which originate from the player's score table and manager's control when no automatic scoring is installed with the MAG3-IT. Finally, group 4 gains access to the carrousel related input signals.

Menu 1.1.1 DC Drives

```
DWBL)0    DKUP)0
DWOB)0    OORG)0
```

The optical reading devices used to determine the functioning of the drawer and deck drives. The drawer back limit optical sensor (***DWBL***), the deck up optical sensor (***DKUP***), the drawer obstruction transmitter - receiver (***DWOB***) and the out of range detector plate (***OORG***) are all included in group 1 of the input signals. Each one of these detectors may be verified at this point by performing a transition.

Presently, as displayed in the example, each one of the detectors is de-activated (indicated by **0**). By performing a transition on any given detector, its corresponding value displayed should change to **1**. If the value remains at **0**, there is definitely a problem with the detector, its cabling, or one of its components (circuit boards included).

Menu 1.1.2 Sweep & Ball Accelerator

```
SWUP)0    SWFW)0
BLRD)0    BDOP)0
```

The optical reading devices used to determine the functioning of the sweep and ball accelerator. The sweep up optical sensor (***SWUP***), the sweep forward optical sensor (***SWFW***), the ball ready transmitter - reflector (***BLRD***) and the ball door open optical sensor (***BDOP***) are all included in group 2 of the input signals. Each one of these detectors may be verified at this point by performing a transition. Presently, as displayed in the example, each one of the detectors is de-activated (indicated by **0**). By performing a transition on any given detector, its corresponding value displayed should change to **1**. If the value remains at **0**, there is definitely a problem with the detector, its cabling, or one of its components (circuit boards included).

Menu 1.1.3 Remote

```
PSPL)0    FSPL)0
RJSW)0    POSW)0
```

There are no reading devices used for remote input signals and they are only valid if the MAG3-IT pinsetters are not equipped with automatic scoring. The remote input signals are read through the carrousel controllers and originate from the player's score table and manager's control. When a remote signal is sent to the pinsetter, its corresponding display value will change from **0** to **1**. If the MAG3-IT pinsetters are equipped with automatic scoring, the values displayed for these input signals will always be **1**.

Menu 1.1.4 Carrousel

```
1)Stat  2)Sensor
3)Others      <5
```

Due to the quantity of input signals related to the carrousel, they are broken down into three sub-groups. The "Stat" sub-group reports on the flag switches which are used to control the carrousel status. The "Sensor" sub-group displays the status of each read switch located inside the carrousel's detection bar assembly. The "Others" sub-group displays the status of all eight optical sensors used to control the carrousel and pin elevator. By noting

all of the circuits necessary for the well functioning of the carrousel, one may quickly determine the importance of the carrousel in conjunction with the performance of the MAG3-IT pinsetter.

Menu 1.1.4.1 Flag Switches

```
ELFL)0    CARR)0
```

The carrousel's optical sensors read information which is then analyzed by the carrousel controller. When the carrousel is full, the elevator full flag switch (***ELFL***) is lifted (display will read **1** instead of **0**) in order to advise the main circuit board of this fact so that it may in turn de-activate the magnetic clutch which powers the pin elevator. The carrousel reset flag switch (***CARR***) is used to continually inform the main circuit board of the fact that the carrousel has or hasn't been reset (during a reset, the value displayed will be **1** until the drawer has been calibrated, after which, it will return to **0**).

Menu 1.1.4.2 Magazine

```
1 2 3 4 5 6 7 ID
0 0 0 0 0 0 0  1
```

The seven optical read switches used to determine the presence of pins in their respective magazine stations are all included in this sub-group of the input signals. Each one of these read switches may be verified at this point by placing or removing the pin from its magazine station. Presently, as displayed in the example, and being the exception to the rule, each one of the detectors is activated (indicated by **0**). By removing a pin from any given station, its corresponding value displayed should change to **1**. If the value remains at **0**, there is definitely a problem with the read switch, its cabling, or one of its components (circuit boards included).

The "ID" information located at the right of the display (introduced in version 1.14) is used to identify the carrousel controller. Although all carrousel controllers are physically the same, they must be correctly identified in order for the electronic power box to distribute its commands correctly. All commands for the carrousel controllers are transmitted to both carrousel controllers (pinsetter 1 & 2). The correct circuit board must capture its own commands and react accordingly. On each even numbered carrousel controller, an MTA connector with a jumper wire joining pins 1 and 2 is connected to CO108 in order to identify it. The odd numbered carrousel controllers have no such jumper. The "ID" displays **0** for an even numbered carrousel controller and displays **1** for an odd numbered carrousel controller. When, if ever, you replace a carrousel controller, make sure it is correctly identified (jumper or no jumper).

Menu 1.1.4.3 Optical Sensors

```
Pl:0Ll:0Pr:0Lr:0
Er:0Ss:0Pd:0Cs:0
```

The eight optical sensors used to determine the functioning of the carrousel and pin elevator. The pin elevator left side optical sensor (***Pl***), the pin loader left side optical sensor (***Ll***), the pin elevator right side optical sensor (***Pr***), the pin loader right side optical sensor (***Lr***), the pin elevator movement optical sensor (***Er***), the station synchronization optical sensor (***Ss***), the pin detector optical sensor (***Pd***) and the carrousel synchronization optical sensor (***Cs***) are all included in this sub-group of input signals.

Each one of these sensors may be verified at this point by performing a transition. Presently, as displayed in the example, each one of the detectors is de-activated (indicated by **0**). By performing a transition on any given

detector, its corresponding value displayed should change to **1**. If the value remains at **0**, there is definitely a problem with the detector, its cabling, or one of its components (circuit boards included).

NOTE: **The *Pl*, *Ll*, *Pr*, *Lr* and *Pd* optical sensors use negative reactions, which is to say that the actuator is present in the sensor when nothing is happening and is removed from the sensor when activated by a pin. The *Er* optical sensor uses a similar principle with the pulley having a small hole in it allowing it to activate the sensor with each revolution.**

Menu 1.2 Output Signals

```
1)90Vt  2)24Vt
3)220Vt       <5
```

The output signals are grouped into 3 distinct sub-groups according to the circuit board(s) which control the electrical components. Group 1 gains access to the output signals sent through the 90-volt output circuit board. Group 2 gains access to the output signals sent through the 24-volt output circuit board. Group 3 gains access to the output signals sent through the AC drive circuit boards.

Menu 1.2.1 90 Volts

```
1)Fluo 2)Swcl
3)Evcl 4)Bacl <5
```

Through this option you may send a power ON signal to each of the 4 components which function on 90 volts. The components are the fluorescent light (***Fluo***), the sweep's magnetic clutch (***Swcl***), the pin elevator's magnetic clutch (***Evcl***) and the ball door's magnetic clutch (***Bacl***). When a power ON signal is sent through the selection of a number on the keyboard, the component's LED will light up on the 90-volt output circuit board and the component itself will be activated. If the LED does not light up, there is a problem with the cabling between the MAG3-IT Controller and the electronic power box or the 90-volt output circuit board itself is defective. If the LED lights up but the component is not activated, there is a problem with the cabling between the component and the electronic power box or the component itself is defective. Refer to the 90-Volt Output Circuit Board schematics for the component to LED correspondence.

Menu 1.2.2a 24 Volts (Pinsetter 1)

```
1)Bal1 2)Bal2
3)Tble 4)Blif <5
```

Through this option you may send a power ON signal to each of the 4 components controlled by pinsetter 1 and which function on 24 volts. The components are the ball 1 light (***Bal1***), the ball 2 light (***Bal2***), the trouble light (***Tble***) and the ball lift's 24-volt relay (***Blif***) which activates the main power to the ball lift. When a power ON signal is sent through the selection of a number on the keyboard, the component's LED will light up on the 24-volt output circuit board (E-MD92-24) and the component itself will be activated. If the LED does not light up, there is a problem with the cabling between the MAG3-IT Controller and the electronic power box or the 24-volt output circuit board itself is defective. If the LED light up but the component is not activated, there is a problem with the cabling between the component and the electronic power box or the component itself is defective. Refer to the 24-Volt Output Circuit Board schematics for the component to LED correspondence

Menu 1.2.2b 24 Volts (Pinsetter 2)

```
1)Bal1 2)Bal2
3)Tble 4)CamP <5
```

Through this option you may send a power ON signal to each of the 4 components controlled by pinsetter 2 and which function on 24 volts. The components are the ball 1 light (***Bal1***), the ball 2 light (***Bal2***), the trouble light (***Tble***) and the camera's power supply (***CamP***). When a power ON signal is sent through the selection of a number on the keyboard, the component's LED will light up on the 24-volt output circuit board and the component itself will be activated. If the LED does not light up, there is a problem with the cabling between the MAG3-IT Controller and the electronic power box or the 24-volt output circuit board itself is defective.

If the LED light up but the component is not activated, there is a problem with the cabling between the component and the electronic power box or the component itself is defective. Refer to the 24-Volt Output Circuit Board schematics for the component to LED correspondence.

Menu 1.2.3 220 Volts

```
1)Main Mo
2)BAcc.Mo     <5
```

Through this option you may send a power ON signal to each of the 2 components which function on 220 volts. The components are the pinsetter's main motor (***Main Mo***) and the ball accelerator's motor (***Bacc. Mo***). When a power ON signal is sent through the selection of a number on the keyboard, the component's LED will light up on its AC drive circuit board and the component itself will be activated. If the LED does not light up, there is a problem with the cabling between the MAG3-IT Controller and the electronic power box or the AC drive circuit board itself is defective. If the LED light up but the component is not activated, there is a problem with the cabling between the component and the electronic power box or the component itself is defective.

Menu 1.4 DC Drive Bypass Signals

```
1)Deck
2)Drawer      <5
```

The input signals which communicate directly with the DC drives or are bypassed to the DC drives through the input circuit board are grouped under their respective drive (deck & drawer).

Menu 1.4.1 Deck

```
DOWN)0    UP)0
OORG)0
```

The optical reading devices used to determine the functioning of the deck drive. The deck lower limit optical sensor (***DOWN***), the deck up optical sensor (***UP***) and the out of range detector plate (***OORG***) are all included in this group of input signals. Each one of these detectors may be verified at this point by performing a transition. Presently, as displayed in the example, each one of the detectors is de-activated (indicated by **0**). By performing a transition on any given detector, its corresponding value displayed should change to **1**. If the value remains at **0**, there is definitely a problem with the detector, its cabling, or one of its components (circuit boards included).

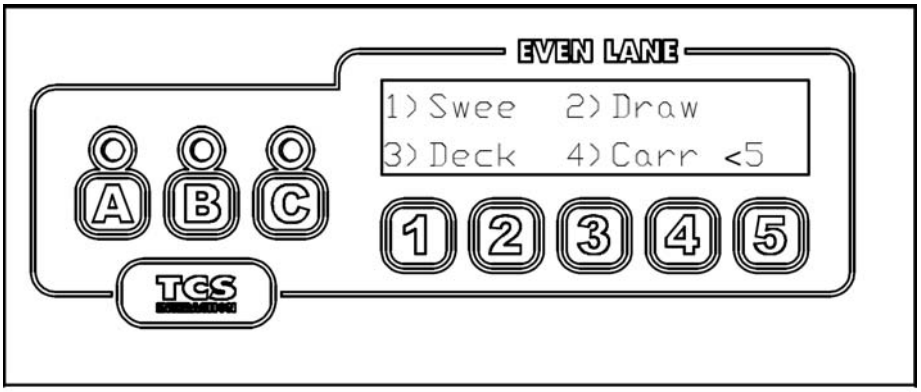
Menu 1.4.2 Drawer

```
FRNT)0    BACK)0
OBST)0
```

The optical reading devices used to determine the functioning of the drawer drive. The drawer front limit optical sensor (***FRNT***), the drawer back limit optical sensor (***BACK***) and the drawer obstruction transmitter & receiver (***OBST***) are all included in this group of input signals. Each one of these detectors may be verified at this point by performing a transition. Presently,

as displayed in the example, each one of the detectors is de-activated (indicated by **0**). By performing a transition on any given detector, its corresponding value displayed should change to **1**. If the value remains at **0**, there is definitely a problem with the detector, its cabling, or one of its components (circuit boards included).

Menu 2 Movement Commands



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Group	Gains access to
1) Swee	the different movement commands available for the sweep components.
2) Draw	the different movement commands available for the drawer components.
3) Deck	the different movement commands available for the deck components.
4) Carr	the different movement commands available for the carrousel components.

Menu 2.1 Sweep

```
1)Sweeping
2)Up  3)Down  <5
```

Three movement commands are available in order to verify the sweep functions.

1. Sweeping: performs a complete back to front sweep movement.
2. Up: lifts the sweep arm to its uppermost position.
3. Down: lowers the sweep arm to the pin deck.

Menu 2.2 Drawer

```
1)Init 2)Front
3)Pos0 4)Pos1 <5
```

The drawer may be initialized or calibrated through this menu along with three movement commands used to verify the drawer functions.

1. ***Init***: gains access to Menu 2.2.1.
2. ***Front***: moves the drawer from its middle position to its front position.
3. ***Pos0***: moves the drawer from its front position to its rear position.
4. ***Pos1***: moves the drawer from its rear position to its middle position.

Menu 2.2.1 Initialization

```
1)Init
2)Cali          <5
```

The drawer may be initialized or calibrated through this menu.

1. ***Init***: physically locates the drawer's back limit optical sensor (***DWBL***) and initializes the DC motor's encoder.
2. ***Cali***: physically locates the drawer's front limit optical sensor (***FRNT***) and then positions the drawer accordingly.

Menu 2.3 Deck

```
1)Init
2)Others        <5
```

The deck may be initialized or calibrated through this menu along with four movement commands used to verify the deck functions.

1. ***Init***: gains access to Menu 2.3.1.
2. ***Others***: gains access to Menu 2.3.2.

Menu 2.3.1 Initialization

```
1)Init
2)Cali          <5
```

The deck may be initialized or calibrated through this menu.

1. ***Init***: physically locates the deck's upper limit optical sensor (***DKUP***) and initializes the DC motor's encoder.
2. ***Cali***: physically locates the deck's lower limit optical sensor (***DOWN***) and then positions the deck accordingly.

Menu 2.3.2 Others

```
1)Fset 2)Pset
3)Pkup 4)Load <5
```

Four movement commands used to verify the deck functions.

1. ***Fset***: spots pins from the deck's uppermost position.
2. ***Pset***: spots pins from the deck's pick-up position.
3. ***Pkup***: Lifts the pins from the pin deck and remains in the pick-up position.
4. ***Load***: loads the deck with the pins from the drawer and remains in the uppermost position.

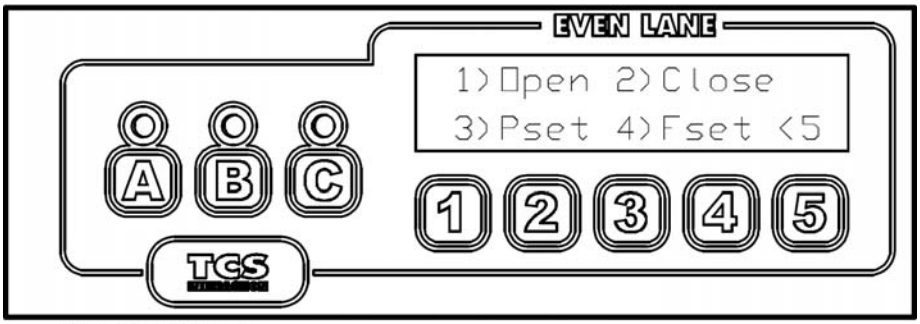
Menu 2.4 Carrousel

```
1)Sole 2)Init
3)Dmp0 4)Dmp1 <5
```

The carrousel may be initialized along with three movement commands used to verify the carrousel functions.

1. ***Sole***: all fourteen (14) solenoids used in conjunction with the carrousel are turned ON and then automatically turned OFF.
2. ***Init***: physically locates the carrousel synchronization optical sensor (***CS***) which, once completed, allows the carrousel to fill the magazine accordingly (the carrousel is automatically initialized any time it is reset).
3. ***Dmp0***: deposits the row of three (3) pins from the magazine into the drawer.
4. ***Dmp1***: deposits the row of seven (7) pins from the magazine into the drawer.

Menu 3 Pinsetter Commands



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REV.:0

Group	Gains access to
1) Open	the different commands used to open or power on the pinsetter.
2) Close	the different commands used to close or power off the pinsetter.
3) Pset	and performs the part set command.
4) Fset	and performs the full set command.

Menu 3.1 Open

```
1)Cold 2)CdPs
3)Warm 4)WmPs <5
```

There are four (4) methods available in order to turn a pinsetter on. Depending on the method chosen, the pinsetter will open under different conditions and be ready to bowl in different time delays.

WARNING: **Whenever a pinsetter is powered ON, the optical sensor actuator must be in the drawer back limit optical sensor (DWBL) and there must be NO PINS in the drawer's row of seven (7). If these physical conditions are not present, you must manually remove the pins from the drawer and then push the drawer to the rear so as to have the back limit optical sensor obstructed by its actuator before performing an OPEN command. If the deck is in**

its lower position, you must use the manual deck crank in order to lift the deck so as to be able to push the drawer back.

1. ***Cold***: before placing the pinsetter in a ball 1 situation (ready to bowl), all of the pinsetter components will be initialized, calibrated and tested.
2. ***CdPs***: the same as a ***Cold*** open with the exception that the pinsetter will spot the same pins on the pin deck as prior to the command.
3. ***Warm***: contrary to a ***Cold*** open, no complicated operations are completed during a ***Warm*** open.
4. ***WmPs***: the same as a ***Warm*** open with the exception that the pinsetter will spot the same pins on the pin deck as prior to the command.

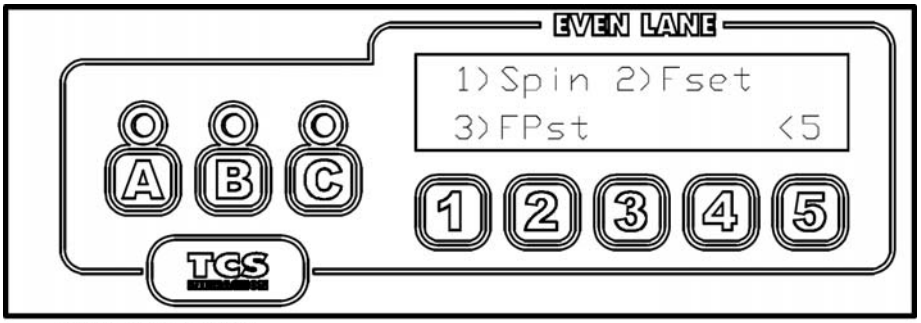
Menu 3.2 Close

```
1)Full
2)Empty        <5
```

There are two (2) methods available in order to turn a pinsetter off. Depending on the method chosen, the pinsetter will close under different conditions.

1. ***Full***: shuts down the pinsetter leaving ten pins on the pin deck and the sweep in its up position.
2. ***Empty***: shuts down the pinsetter leaving no pins on the pin deck and the sweep in its down position.

Menu 4 Sequential Commands



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REV.:0

Group	Gains access to
1) Spin	the spot pin sequential commands.
2) Fset	the full set sequential commands.
3) FPst	the combination pinsetter (full set followed by a part set) sequential commands.

Menu 4.1 Spot Pins

```
1)Fever 2)Resume
3)1     4)10   <5
```

This option is used to spot pins using different combinations of pre-programmed pin selections.

1. ***FEver***: performs 999 series of 3 pre-programmed spot pin commands.
2. ***Resume***: resumes the ***Fever*** cycle after experiencing a stoppage of any kind.
3. ***1:*** performs 1 series of 3 pre-programmed spot pin commands.
4. ***10:*** performs 10 series of 3 pre-programmed spot pin commands.

Menu 4.2 Full Sets

```
1)FEver 2)Resume
3)10    4)15  <5
```

This option is used to perform a specific quantity of full sets only.

1. ***ForEver***: performs 999 pre-programmed full set command.
2. ***Resume***: resumes the ***Fever*** cycle after experiencing a stoppage of any kind.
3. ***10:*** performs 10 pre-programmed full set commands.
4. ***15:*** performs 15 pre-programmed full set commands.

Menu 4.3 Combinations

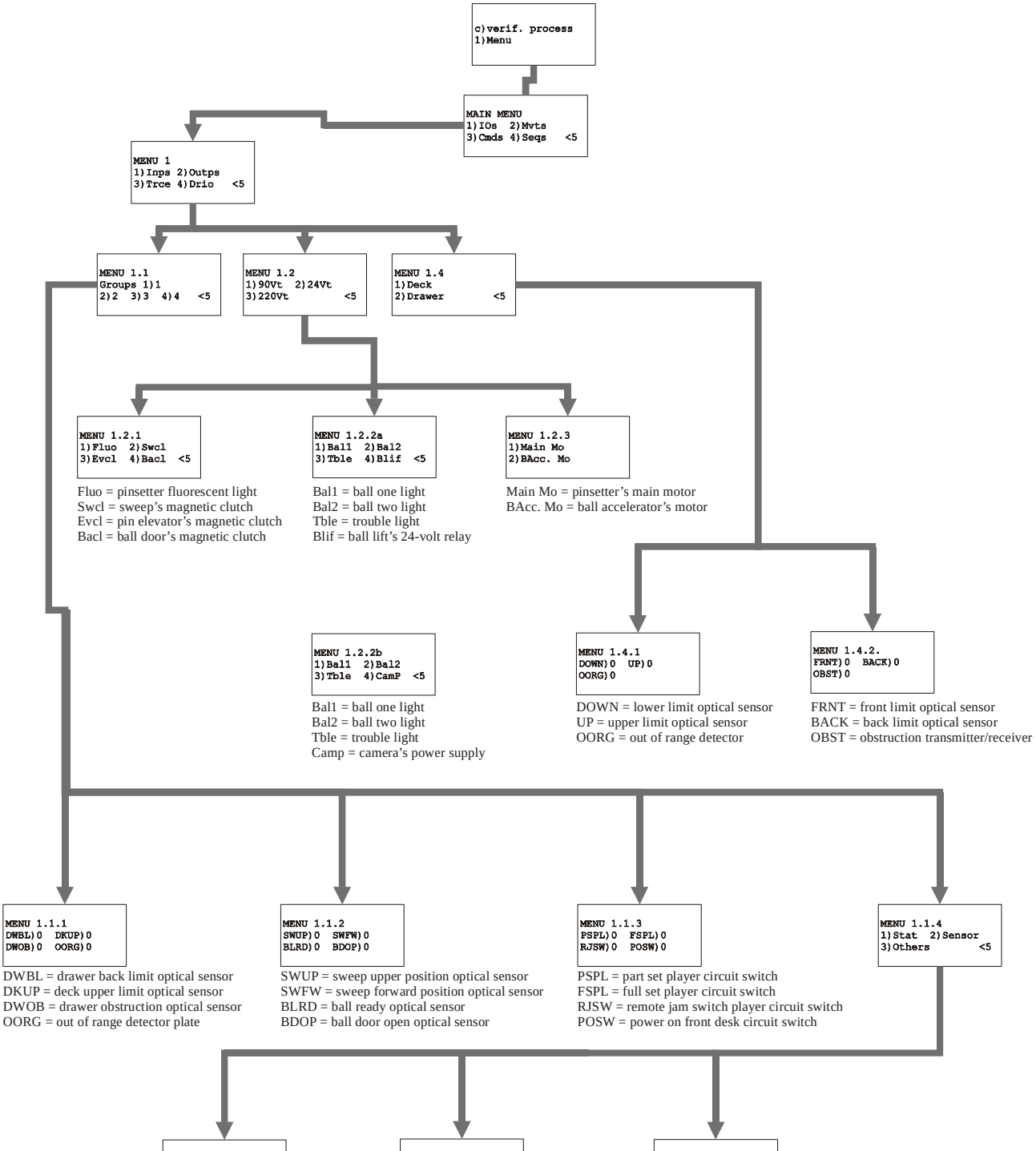
```
1)FEver 2)Resume
3)1     4)10  <5
```

This option is used to perform a specific quantity of full sets, with each being followed by a part set.

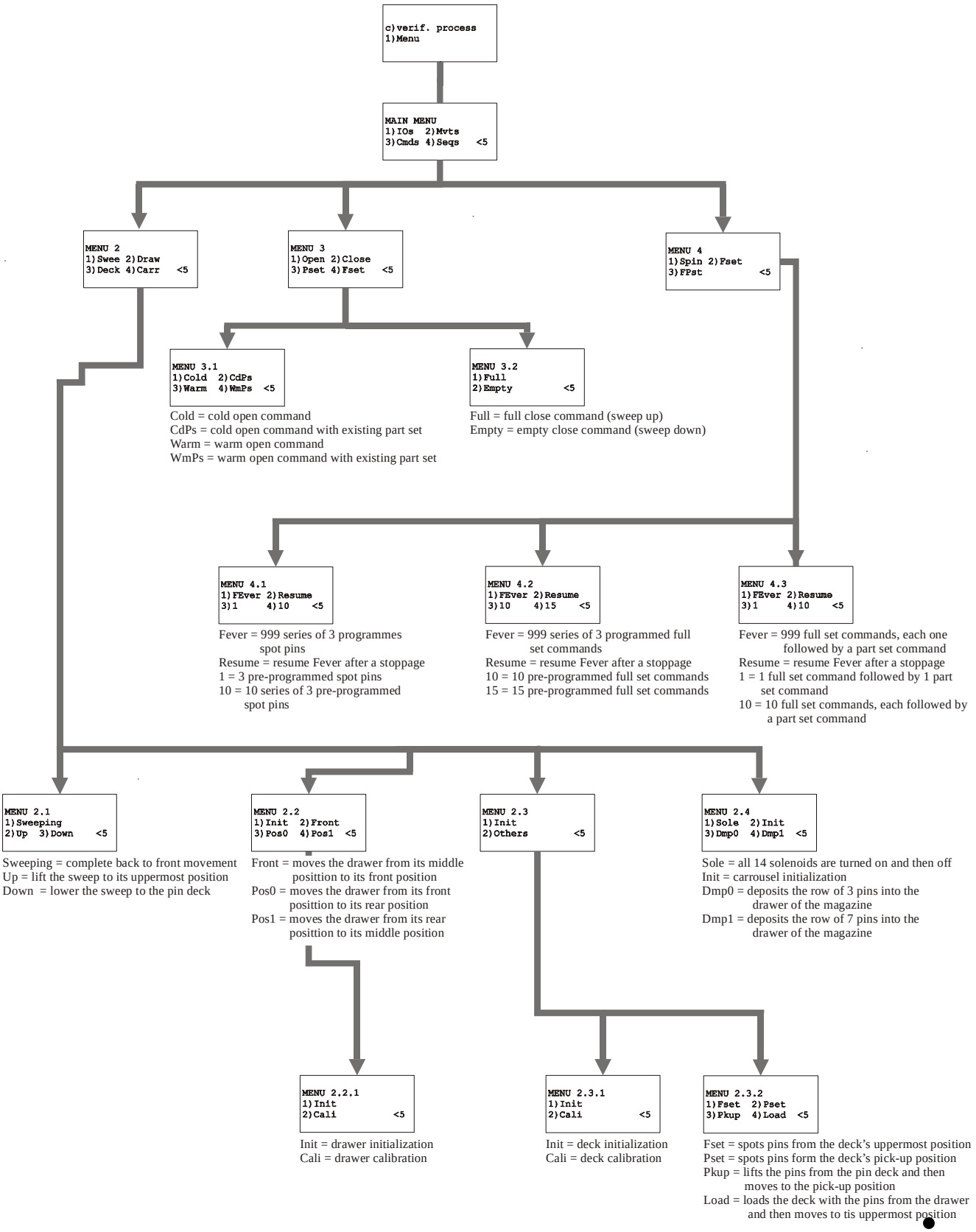
1. ***ForEver***: performs 999 pre-programmed full set commands with each one being followed by a pre-programmed part set command.
1. ***Resume***: resumes the ***Fever*** cycle after experiencing a stoppage of any kind.
2. ***1:*** performs 1 pre-programmed full set command followed by 1 pre-programmed part set command.
3. ***10:*** performs 10 pre-programmed full set commands with each one being followed by a pre-programmed part set command.

Menu System Notes

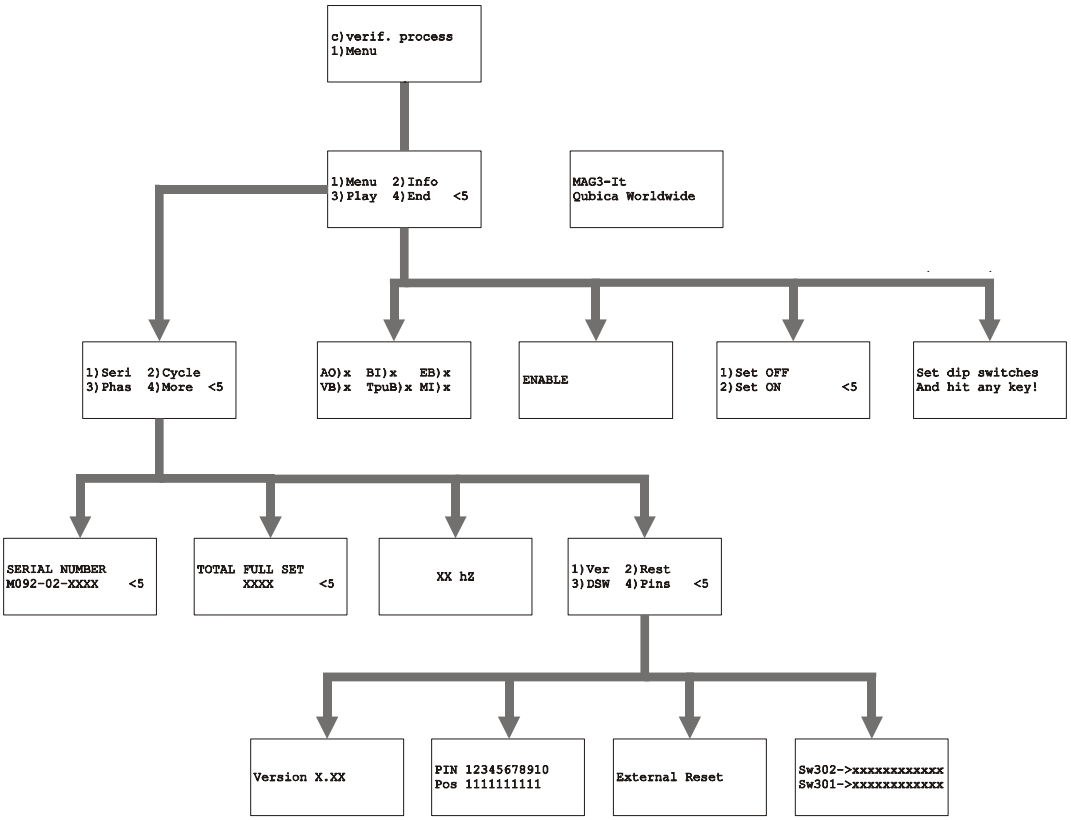
MAG3-IT Controller



Main Menu System (Version 1.50)



Main Menu System (Version 1.50)



3. Adjustments & Maintenance

Chapter Overview

After reading this chapter you should be able to:

- Perform the various adjustments necessary to keep your pinsetters in top condition.
- Analyze the importance of and set up a good maintenance program.
- Use the complementary information found in "Chapter 4 - Troubleshooting" to great advantage.
- The simplicity of the MAG3-IT pinsetter being its main characteristic, it is very easy to understand its concept. At the same time, it must be understood that pinsetters of any kind require a minimum of maintenance and should operate to standards.

Mechanical Maintenance Schedule

Adjustment Number	Component	Description	Weekly	Monthly	Semi-Ann.	As Required
ID	Drive train	Ball detector		X		
2A	Sweep	Chain tension		X		
2B	Sweep	Height		X		
2C	Sweep	Parallelism		X		
2D	Sweep	Arc, right side		X		
2D	Sweep	Arc, left side		X		
2F	Sweep	Drive chain tension		X		
2H	Sweep	Up actuator		X		
2I	Sweep	Double actuator		X		
2K	Sweep	Torque		X		
3A	Pit	Ball ready opto		X		
3B	Pit	Deflector blocks replacement				X
4D	Accelerator	Ball door torque				X
4E	Accelerator	Ball door cam				X
4F	Accelerator	Ball door actuator			X	
5A	Elevator	Drive chain tension	X			
5B	Elevator	Pin alignment		X		
5C	Elevator	Right pin alignment		X		
5D	Elevator	Right pin actuator		X		
5E	Elevator	Left pin actuator		X		
5F	Elevator	Right pin loader actuator		X		
5H	Elevator	Left pin loader actuator		X		
6A	Carrousel	Synchronization opto		X		
6B	Carrousel	Station synchronization opto		X		
6C	Carrousel	Pin detect opto		X		
6D	Carrousel	Chain alignment			X	
6E	Carrousel	Cam alignment			X	
6F	Carrousel	Pin alignment			X	
6G	Carrousel	Magnet disengagement plate		X		
6H	Carrousel	Magnet guide rod		X		
6I	Carrousel	Pin drop height		X		
7A	Magazine	Solenoid block		X		
7B	Magazine	Solenoid bracket		X		
7C	Magazine	Landing pad replacement				X
7D	Magazine	Detection bar assembly		X		
8A	Drawer	Triangle			X	
8C	Drawer	Out of spot pin		X		
8D	Drawer	Hook		X		
8F	Drawer	Front limit actuator		X		
8G	Drawer	Back limit actuator		X		
8H	Drawer	Obstruction opto		X		
9A	Deck	Wire length		X		
9B	Deck	Pin height			X	
9C	Deck	Bumper height			X	
9D	Deck	Lower limit opto		X		
N/A	Belts	Refer to Belt Tension		X		
N/A	Bolts	Refer to Bolt Torque		X		

Lubrication Schedule

Proper lubrication is essential to a smooth running, trouble-free machine and also prolongs the life of all moving parts. It is very important to perform the lubrication according to the following schedule.

Adjustment Number	Component	Description	Weekly	Monthly	Semi-Ann.	As Required
1A	Drive train	Parallel shaft gearbox oil change				**X**
2G	Sweep	Attachment lubrication			**X**	
2J	Sweep	Clutch cleaning & lubrication	**X**			
3E	Pit	Ball door clutch cleaning & lubrication	**X**			
5G	Elevator	Clutch cleaning & lubrication	**X**			
7E	Magazine	Flange bearings lubrication	**X**			
9E	Deck	Pin centering dish fluid		**X**		
9F	Deck	Motor reducer oil level		**X**		
9G	Deck	Motor reducer oil change				**X**
N/A	Chains	Refer to Pulley and Chain Oils		**X**		
N/A	Pulleys	Refer to Pulley and Chain Oils	**X**			

Cleaning Schedule

Machines must be kept free of dirt, dust and excess of oil. A well cared for machine is a ***clean machine***. A clean machine performs much better and reduces the chance of electronic problems. This table contains the items that should be ***cleaned on a weekly basis***.

PART NUMBER	DESCRIPTION	PROCEDURE
303-5210-00	SOLENOID CAM	Clean with a damp cloth
303-5560-00	SOLENOID BLOCK	Clean with a damp cloth
303-6610-00	BALL READY REFLECTOR	Clean with a damp cloth
304-6000-00	PIT CONVEYOR BELT	Clean with a damp cloth
322-6500-00	METAL KICKBACK ASSEMBLY	Clean the area with a vacuum cleaner
322-9000-00	BALL ACCELERATOR ASSEMBLY	Clean the area with a vacuum cleaner
333-6170-00	PIT TABLE ASSEMBLY, RIGHT LANE	Clean the area with a vacuum cleaner
333-6175-00	PIT TABLE ASSEMBLY, LEFT LANE	Clean the area with a vacuum cleaner
E-GPIA05	ENCODER OPTICAL SENSOR	Clean with compressed air
E-VC69105T	CAMERA LENS	Clean with a soft tissue approved for use on optical lenses
P-1500-16	BALL DETECTOR REFLECTOR	Clean with a damp cloth
SB-1500-31-B	BALL DETECTOR TRANSMITTER ASSEMBLY	Clean with a damp cloth
SB-1500-40	BALL READY TRANSMITTER ASSEMBLY	Clean with a damp cloth
SB-1500-41	DRAWER OBSTRUCTION RECEIVER ASSEMBLY	Clean with a damp cloth
SB-1500-42	DRAWER OBSTRUCTION TRANSMITTER ASSEMBLY	Clean with a damp cloth
SB-ECIL-325-FS	OPTICAL SENSOR ASSEMBLY	Clean with compressed air

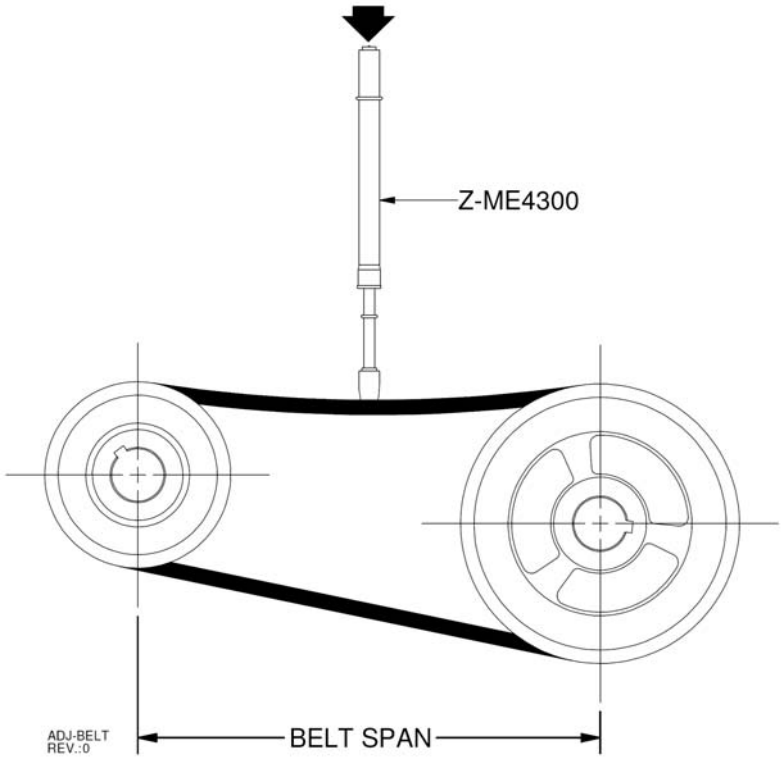
Belt Tension

PART NUMBER	DESCRIPTION	ADJUSTMENT NUMBER	REQUIRED RECESSION DEPTH +/- 1/16” (2mm)
304-2000-00	DRIVE TRAIN BELT, 480H075	1B	1/2" (13 mm(
304-2000-00	DRIVE TRAIN BELT, 480H075	2E	1/2" (13 mm(
304-2020-00	DRIVE TRAIN BELT, 800H075	1C	1/2" (13 mm(
304-3000-00	DRAWER BELT, H075	8B	7/8" (22 mm(
304-3010-00	DRAWER MOTOR BELT, 255L075	8E	1/4" (6 mm(
304-50000-00	CARROUSEL BELT, 4L 500	N/A	Automatic
304-6000-00	PINT CONVEYOR BELT	3D	Special
304-6050-00	PIT BELT, B107	N/A	Automatic
304-6100-00	PIT BELT, B65	3C	1/2" (13 mm(
304-6500-00	BALL DOOR BELT, 4L 340	4B	Special
304-8000-00	ELEVATOR BELT, 4L 460	N/A	Automatic
304-9000-00	ACCELERATOR BELT	4A	5/8" (16 mm(
304-9010-00	ACCELERATOR BELT, 4L 390	4C	5/8" (16 mm(

All belts on the MAG3-IT pinsetter must be kept at specific tensions in order for the pinsetter to function normally. Most of the belts used are stock timing belts which do not slip, but some V-belts are also used. The general rules of tensioning belt are as follows:

1. Ideal tension is the lowest tension at which the belt will not slip under peak lead conditions.
2. Check tension frequently during the first 24-48 hours of operation and at least once every month afterwards.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material, which may cause slip.
5. Make drive inspections on a periodic basis, tension belts when slipping. Never apply belt dressing, as this will damage the belt and cause early failure.

Tension Measurement Procedure



1. Place the Qubica Tension Gauge squarely on one belt at the center of the belt span. Apply a force of 5 lbs (2.25 kg) on the plunger and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures.
2. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.
3. Repeat steps 1 and 2 until the tension is correct.

Bolt Torque

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

Machines are subject to constant vibration and must be checked frequently for loose nuts and bolts. All bolts on the MAG3-IT pinsetters and accessories must be tightened with a torque wrench as indicated in the table above. 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 loos screws on the pinsetters (especially set screws) as well as any loose bolts on the pit cushions and ball accelerators at regular intervals.

Pulley and Chain Oils

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

Oil all chains with very small quantities of SW10 motor oil only if judged necessary

Drive Train

1A. Parallel Shaft Gearbox Oil Change

Synthetic lubricants are used in the parallel shaft gearbox due to its wide temperature range. The gearbox is breatherless and lubricated for life thus eliminating maintenance. In the event that the gearbox needs to be refilled, refer to the chart below for the recommended lubricants.

Manufacturer	Standard Synthetic Gear Oil
Cofran	Sintogear 125
Mobile Oil Corp.	SHC 629

1B. Drive Belt Tension (304-2000-00)

Using the belt tension tool apply a force of 5 lbs (2.25 kg) on the plunger and and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.

To adjust tension on the belt, loosen the bolt which holds the tensioner pulley in the desired direction. Retighten the bolt and measure the recession depth once again. Repeat until tension is correct.

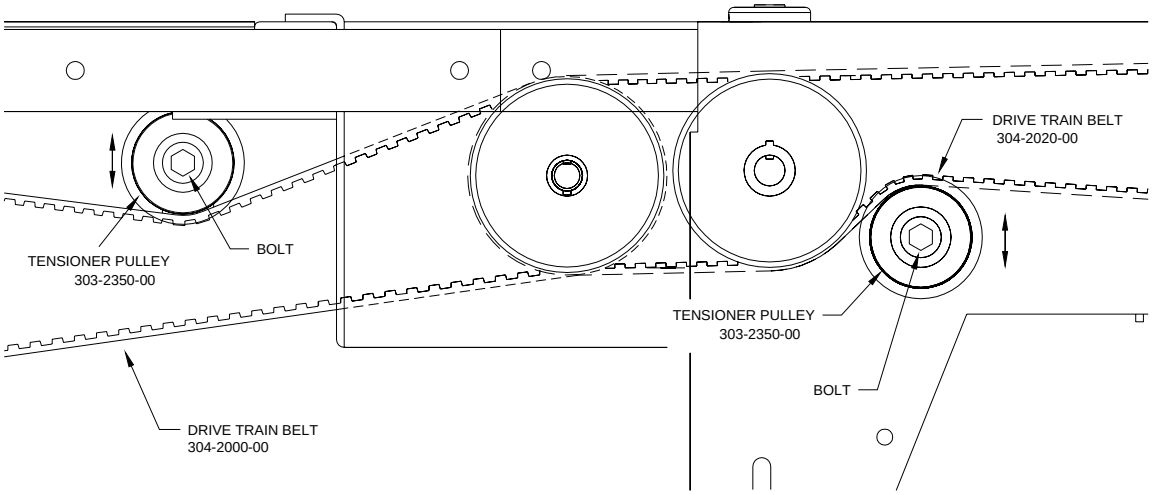


Figure 1 - Belt Tension

1C Drive Belt Tension (304-2020-00)

Using the belt tension tool apply a force of 5 lbs (2.25 kg) on the plunger and and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.

To adjust tension on the belt, loosen the bolt which holds the tensioner pulley in the desired direction. Retighten the bolt and measure the recession depth once again. Repeat until tension is correct.

1D. Ball Detector

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

The ball detector is a simple, very reliable stand alone device but may become misaligned once in a while due to the constant vibration caused by the balls rolling down the lane.

Each ball detector has two LEDs that simplify the adjustment of the unit. The green LED signifies that the unit is perfectly aligned with the reflector while the red LED indicates that the alignment is borderline (usually requiring you to adjust it until the green LED turns ON). If neither of the two LEDs are visible on a ball detector, one of four things is possible. The ball detector is completely misaligned, it is defective, the reflector on the opposite side of the lane is soiled or has fallen, or the cable that supplies the necessary voltage to the unit has been cut or disconnected.

To adjust the ball detector:

1. Loosen the screws which hold the ball detector transmitter assembly in place.
2. Move the detector assembly up, down, right or left until the green LED appears on the ball detector.
3. Re-tighten the screws.

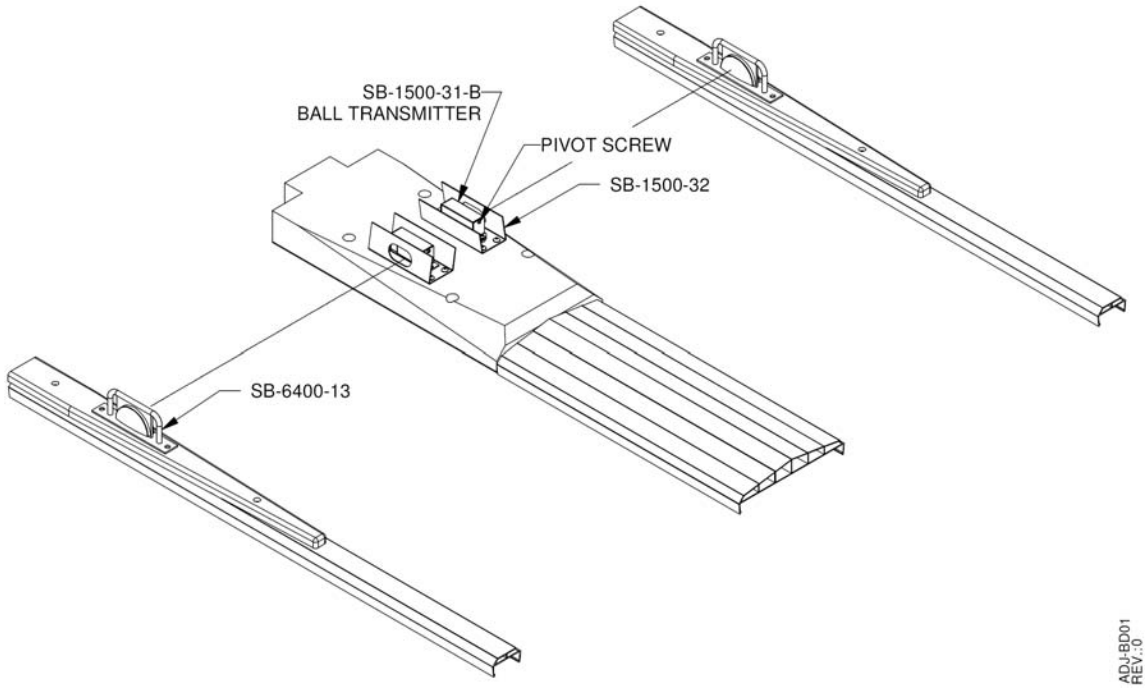


Figure 2 - Ball detector

NOTE **Slide a 1/2 inch (13 mm) square block of wood about 12 inches (305 mm) long across the lane where the ball detector is located (*the block of wood should be painted black or covered with black tape*). The green LED should stay on. If the green LED goes out, this means that your signal is bounding off the lane. If you leave your ball detector like this you will have detection problems due to reflections and shadows.**

Drive Train Maintenance Notes

Sweep

There are five identified positions pertaining to the sweep as indicated in the diagram below. Note the position of the ***SWEEP CHAIN ATTACHMENT*** when the sweep is in its different positions. The proper positioning of the sweep chain attachment will ensure that the sweep is in its correct position for the necessary adjustment. ***The first four adjustments (2A through 2D) made to the sweep must be carried out as a whole (all adjustments in the order listed) and with the sweep in the appropriate position for each adjustment***. Failing to place the sweep in its appropriate position before performing an adjustment will result in disastrous consequences with the performance of the MAG3-IT.

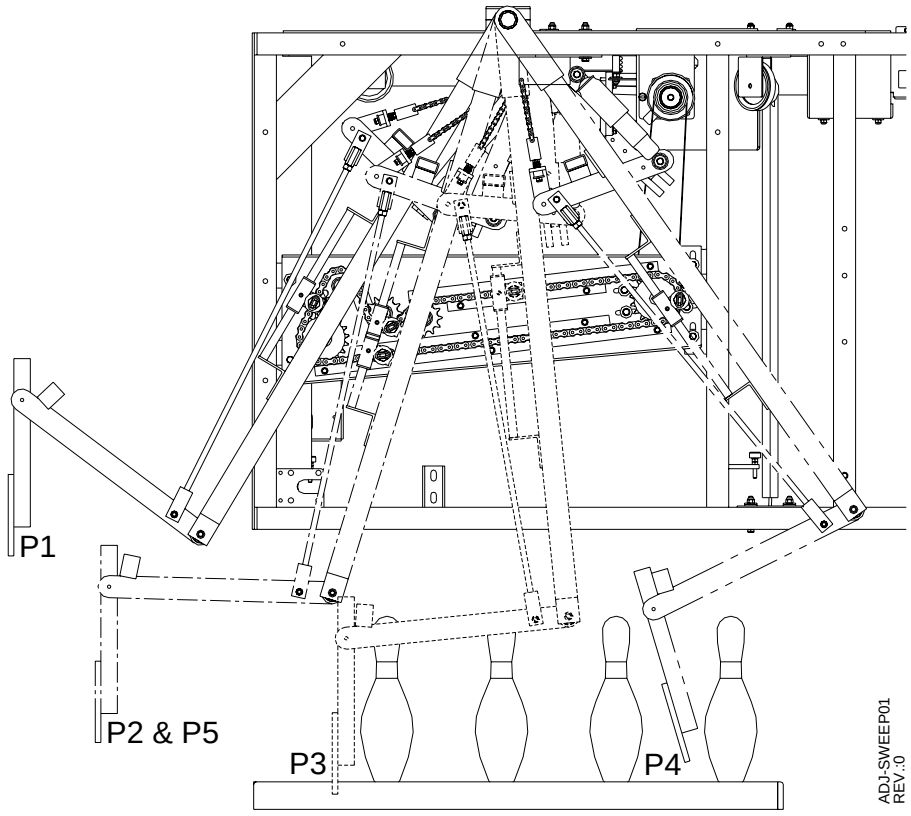


Figure 3 - Sweep Positions

P1 Ready To Bowl

P2 Lower Limit Prior To Sweeping

P3 Sweeping Motion

P4 Back Limit

P5 Lower Limit After Sweeping

The first four sweep adjustments (2A through 2D) are made by measuring the distance between the sweep and the lane. Make sure that the distance obtained is equal at both extremities (left and right) of the sweep.

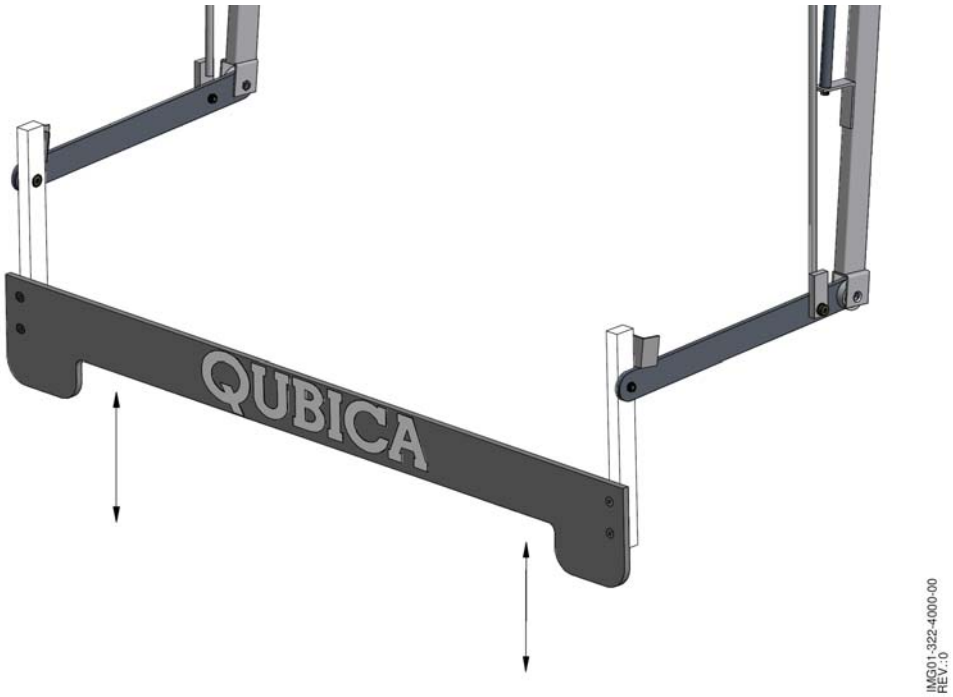


Figure 4 - Sweep adjustments measure

2A. Chain Tension

With the sweep in its P1 position, adjust the tension on both chains equally by removing the sweep chain coupling half (302-4225-00) and rotating the bottom chain block (302-4240-00) until the sweep is 20,5 inches (520 mm) from the lane.

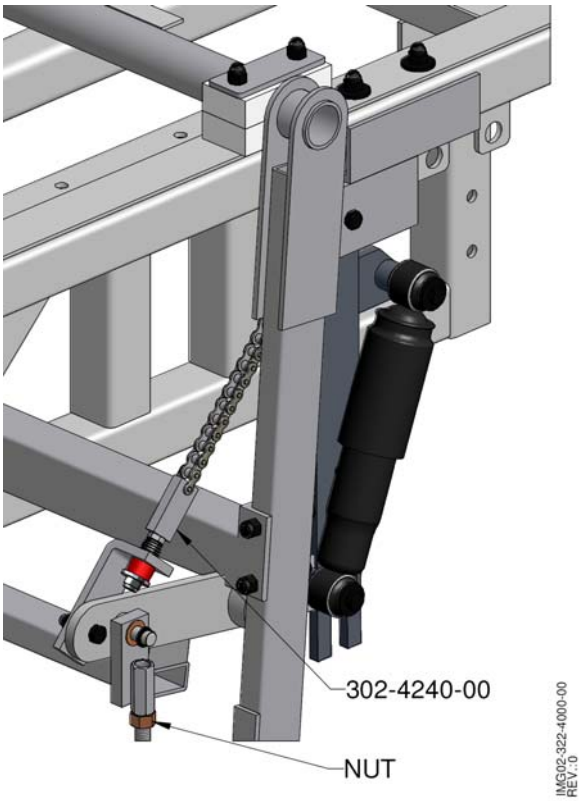


Figure 5

2B. Height

Lower the sweep to its P2 position and move both adjustment plates (302-4030-01) equally by loosening the 4 bolts (2 on each plate) and sliding the adjustment plate in the direction of the arrows until the sweep is 1¾ inches (45mm) from the lane. Re-tighten the 2 bolts on each side once the desired height is attained.

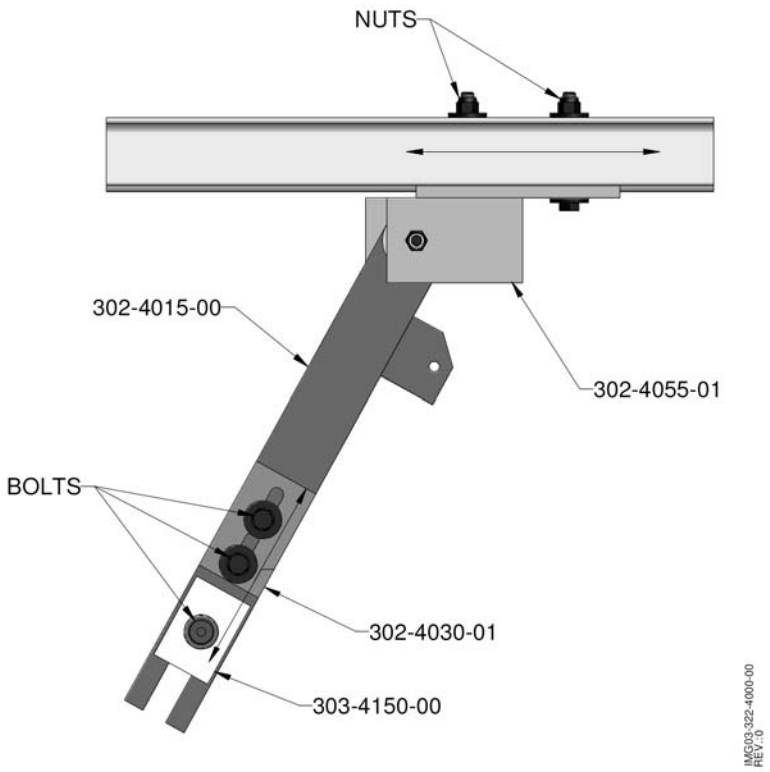


Figure 6 - Sweep Adjustment Points

2C. Parallelism

The sweep must always be parallel to the lane and is adjusted during the installation procedure. If the sweep should ever lose its parallelism, it may be adjusted by rotating the adjustment nut until the sweep is parallel to the lane.

2D. Arc

Due to the sweep's arc movement, the right (302-4010-00) and left (302-4015-00) sweep bars must be adjusted in order to keep the sweep parallel to the lane during its sweeping (P3) motion. With the sweep in its P4 position, move the brackets (302-4050-00 & 302-4055-00)equally by loosening the 4 bolts (2 on each bracket) and sliding the brackets from front to back until the sweep is ¾ inch (20mm) from the lane.

NOTE: **Adjustment 2D has a direct effect on adjustment 2B and should be verified once again after adjustment 2D is completed.**

2E. Drive Belt Tension

Using the tension tool, apply a force of 5 lbs (2.25 kg) on the plunger and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.

The sweep timing belt must be kept taut. To adjust the tension on the belt, loosen the three bolts **(E)** and move the sweep drive channel (302-4400-00) in the direction of the arrows. Re-tighten the three bolts once the correct tension is obtained.

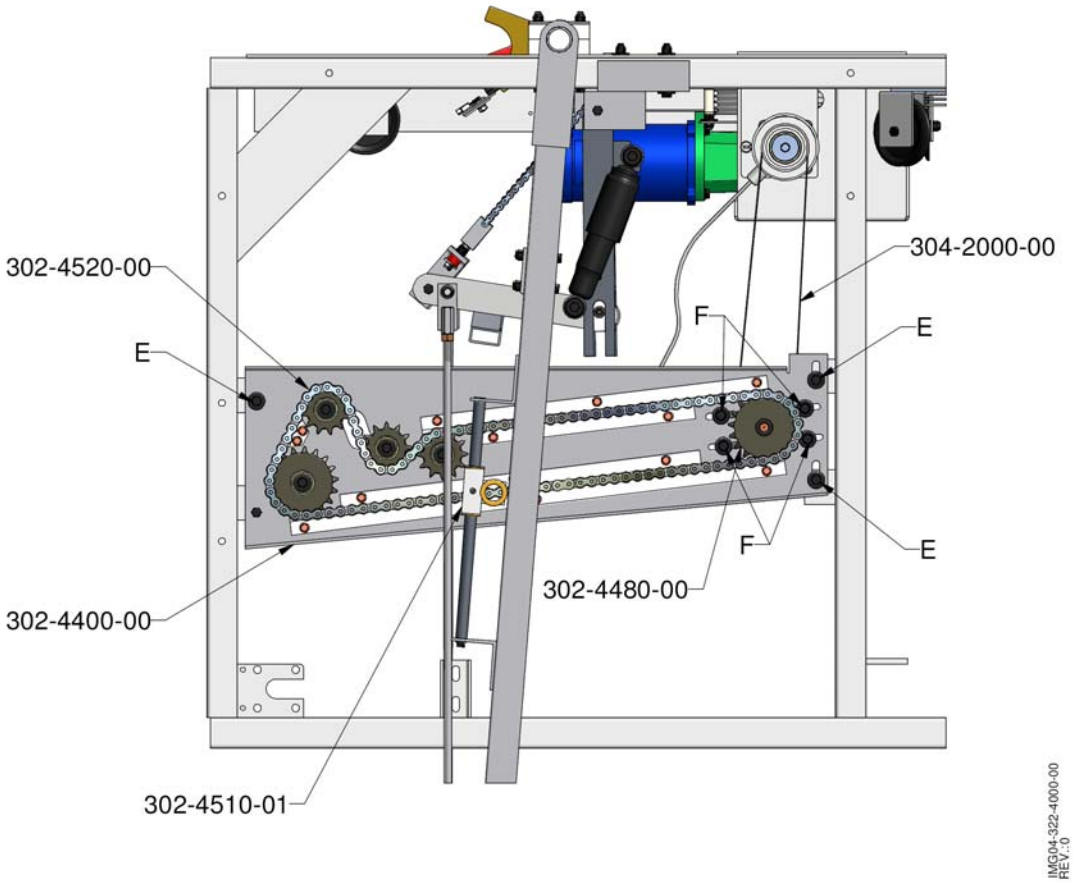


Figure 7 - Sweep Drive Adjustment Points

2F. Drive Chain Tension

The sweep chain (302-4520-00) must be kept taut. To adjust the tension on the chain, loosen the four bolts **(F)** and move the shaft sprocket assembly (302-4480-00) in the direction of the arrows by loosening or tightening the adjustment bolt (not shown in diagram) located on the left side of the sweep channel behind the shaft sprocket assembly. Re-tighten the four bolts once the correct tension is obtained.

2G. Sweep Attachment

The sweep attachment (302-4510-00) must be greased once a year with a 30/90 grease such as Valvoline 606 or its equivalent.

2H. Sweep Up Actuator

The sweep up optical sensor is used to detect the presence of the sweep in its up position. With the sweep in its P1 position, adjust the position of the optical sensor (SB-ECIL=325-FS) or the position of the up actuator (303-4610-00) in order to have both of them perfectly aligned with each one's bottom. Loosen the hexagon nut to adjust the optical sensor. Loosen the two-inch sweep collar to adjust the up actuator.

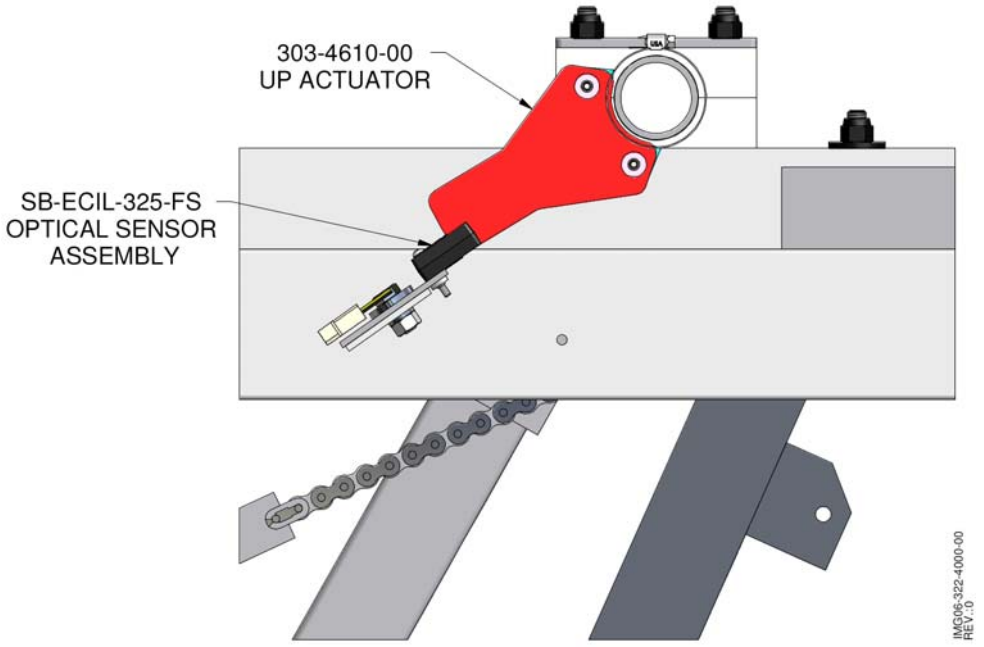


Figure 8

2I. Sweep Double Actuator

The sweep forward and rear optical sensor serves a dual porpose and is equipped with a double actuator. With the sweep in its P1 position, adjust the position of the optical sensor (SB-ECIL-325FS) or the position of the double actuator (303-4630-00) in order to have both of them aligned as shown in the figure below. Loosen the hexagon nut to adjust the optical sensor. Loosen the two-inch sweep collar to adjust the double actuator.

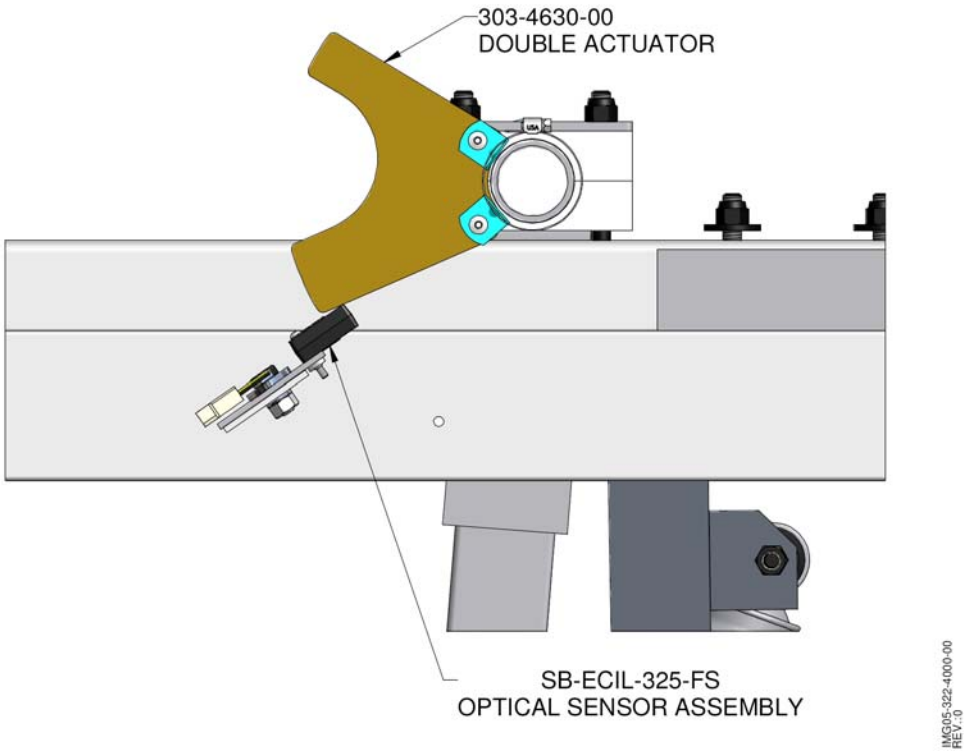


Figure 9

With the sweep in the P4 position, and if the preceding adjustment was carried out correctly, the same optical sensor should be somewhat aligned with the center if the second prong on the double actuator. The double actuator will not necessarily be perfectly aligned but it should obstruct the optical sensor enough to be able to cut its signal.

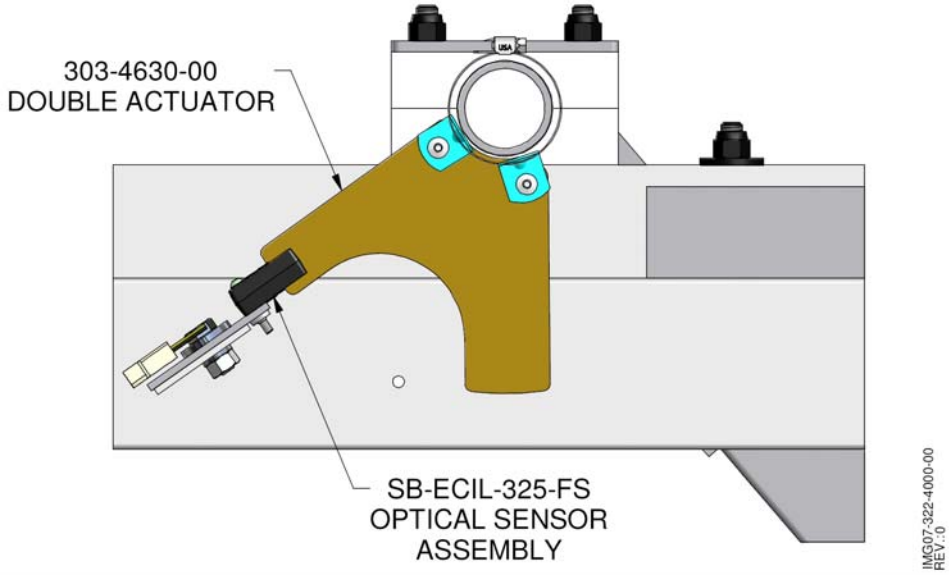


Figure 10

2J. Clutch Cleaning & Lubrication

Cleaning and lubrication of the magnetic clutch (301-1400-00) and the timing gear (302-2050-00) must be performed on a bimonthly basis (every two months). To do this, the assembly should be removed from the pinsetter and cleaned. The components should be cleaned with a solvent such as paint thinner. The components should then be dried using a towel. The shaft (302-2060-00) of the machine where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

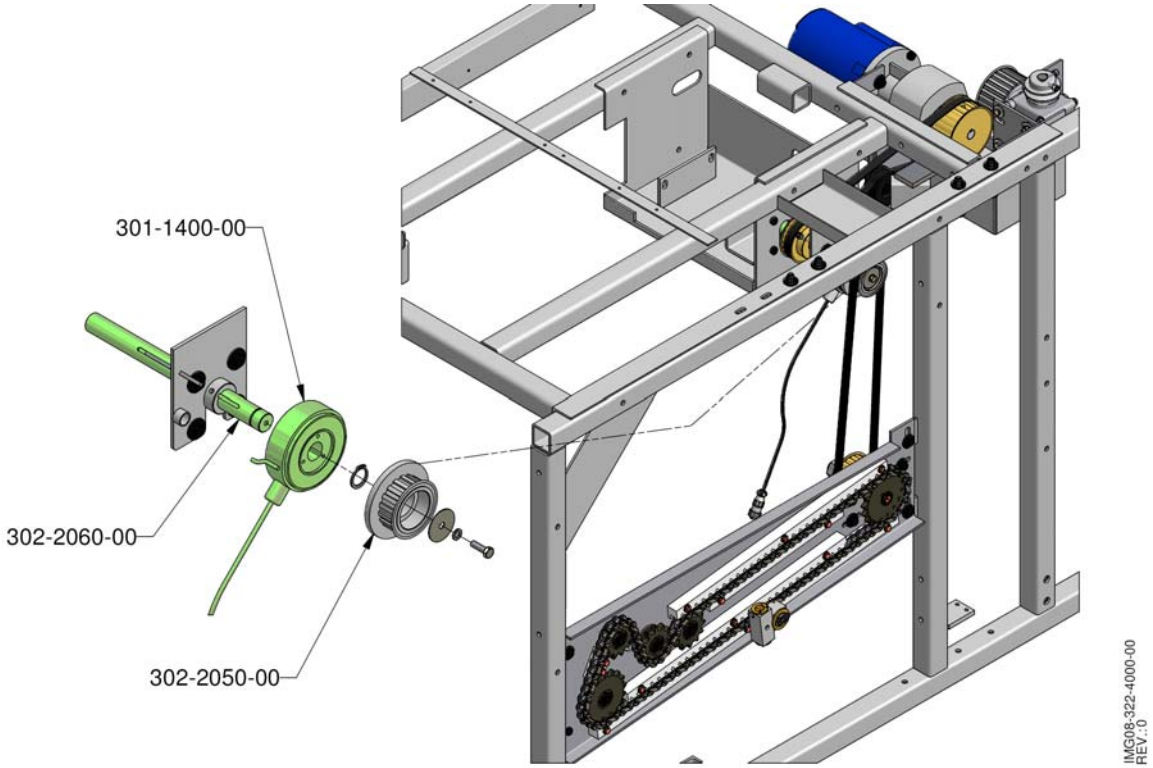


Figure 11

NOTE **The shaft is shown removed in the diagram only for demonstration purposes. It is not necessary to remove the shaft form the pinsetter.**

To remove the clutch assembly, you must first remove the timing belt. The tension on the belt must first be removed by loosening the three bolts which hold the sweep drive channel in place as explained in adjustment 2E. The belt will now come off easily.

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

Following re-assembly of the sweep drive clutch assembly, make sure to re-adjust the tension on the timing belt as explained in adjustment 2E.

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

2K. Sweep Double Actuator

The sweep's torque may be verified by marking the timing gear and friction disk with a pencil as indicated below. Once your mark has been made, perform a few complete sweep cycles through the MAG3-IT controller and then verify your marks. If the two marks have remained aligned, the torque is correct. If the two marks have become misaligned, complete the following in order:

1. Erase the pencil marks
2. Loosen the outer half-inch lock nut.
3. tighten the inner half-inch nut ***one-quarter of a turn***.
4. Re-tighten the outer lock nut.
5. Mark the timing gear and friction disc anew.
6. Perform a few sweep cycles through the MAG3-IT controller.
7. Check the marks again.
8. Repeat step one through seven as necessary until both pencil marks remain aligned.

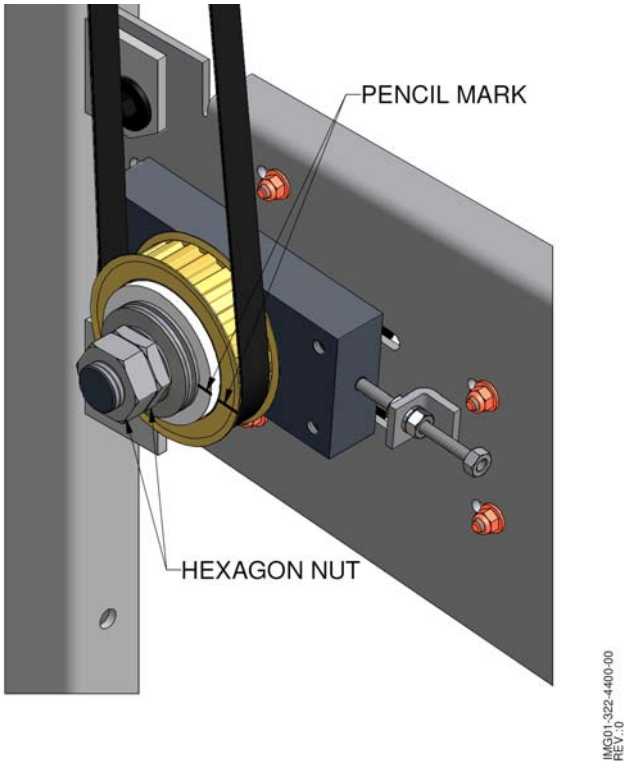


Figure 12

Sweep Maintenance Notes

Pit

3A. Ball Ready Opto

The ball ready transmitter assembly (SB-1500-40) is used to detect the presence of a ball at the ball door (303-6560-00 or 303-6565-00). The ball cuts the infrared signal between the transmitter and the reflector. The infrared signal passes through the slot located in the pit cushion frame (302-6150-00). If the ball ready opto is not properly adjusted, unnecessary "ball jams" will occur. When adjusting this sensor, you must take into consideration the fact that the cushion may move back approximately 2 inches (50mm) each time it is hit by a ball.

To adjust the ball ready transmitter assembly, loosen the screws that hold it in place and then move the transmitter up or down and left or right as indicated by the arrows until the green light appears.

IMPORTANT **Once the green light is obtained, re-tighten the screws and then push the cushion to its rear position and verify the fact that the green light is still ON. If the green light turns OFF and the red light turns ON, raise the angle of the transmitter until the light remains green with the cushion in its rear position.**

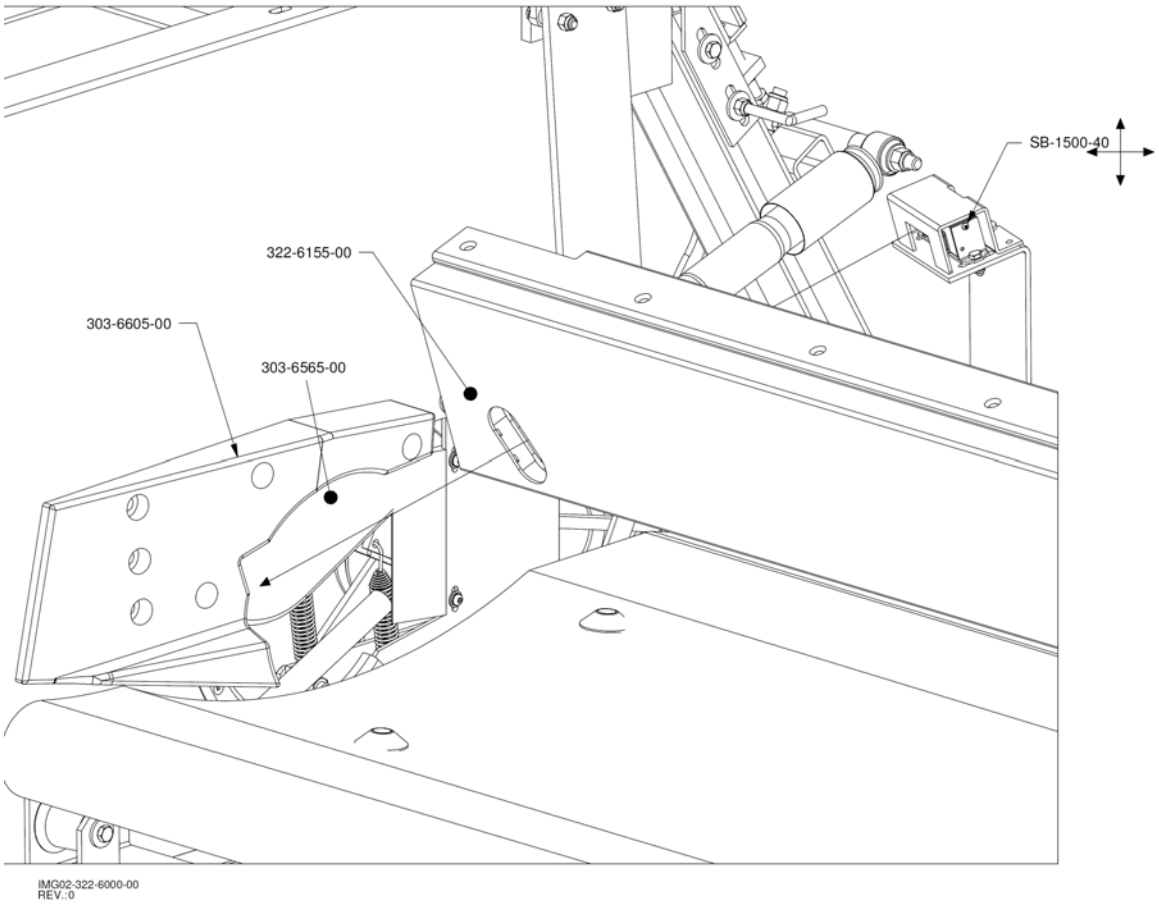


Figure 13

3B. Deflector Blocks

Although no adjustments exist for the right (303-6600-00) and left (303-6605-00) deflector blocks, it must be noted that if for whatever reason the deflector blocks are removed from the kickbacks, the bolts **(B)** used to hold them in place must be treated with a removable thread locker, such as Loctite 242, prior to their reinstallation. A removable thread locker is available through Qubica and its affiliated distributors under part number Z-24221.

3C. Drive Belt Tension

Using the Qubica Tension Gauge squarely on one belt at the center of the belt span. Apply a force of 5 lbs (2.25 kg) on the plunger and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.

To adjust the tension on the belt, simply loosen both bolts and rotate the tensioner rod (302-2290-00) in the desired direction and then re-tightening the bolts once the desired adjustment is attained.

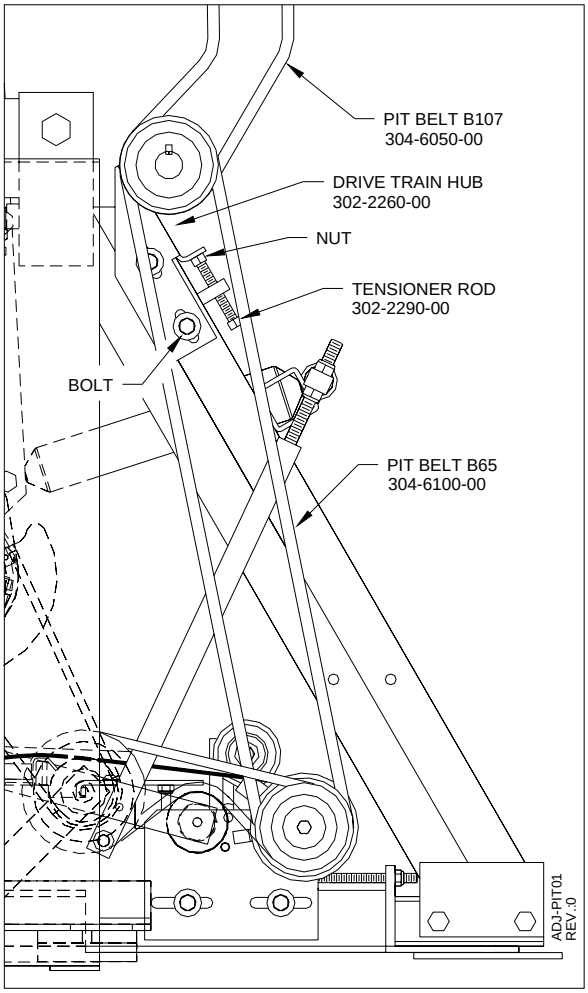


Figure 14

NOTE: **Once adjustment 3C has been carried out correctly, any stoppage with the pit conveyor belt should cause the B65 pit belt (3.04-6100-00) to slip and not the B107 pit belt (304-6050-00).**

3D. Conveyor Belt 304-6000-00 Tension

The pit's conveyor belt must be adjusted using the lightest ball bowled with in the bowling center (usually 6 lbs.). Loosen the bolts which hold the right tension plate (302-6030-00) in place and then with the bowling ball on the conveyor belt, adjust the nut until the ball is level with the ball door's port hole.

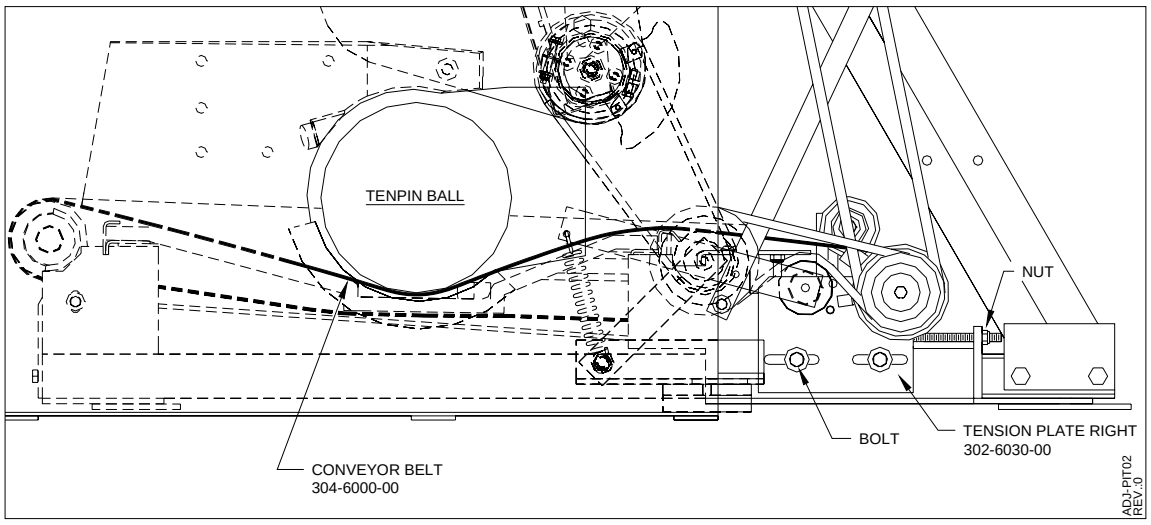


Figure 15

Once the inside of the pit's conveyor belt is adjusted, the outside must be adjusted in order to take up the slack, if any. Loosen the bolts which hold the left tension plate (302-6045-00) in place and then use the nut to adjust the tension on the conveyor belt. And ideal tension will not cause any ripples in the carpet as it rotates.

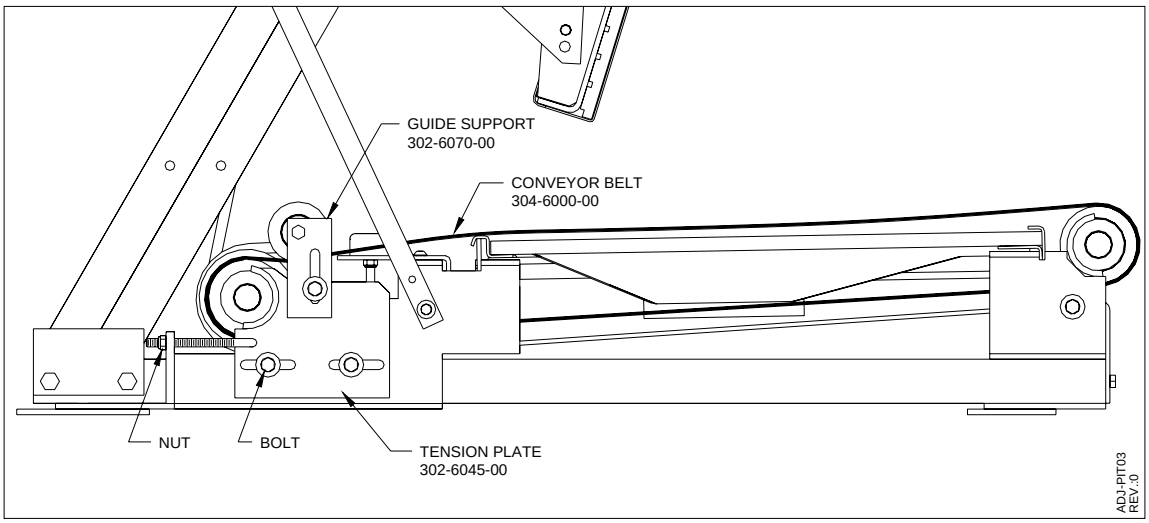


Figure 16

3E. Ball Door Clutch Cleaning & Lubrication

Cleaning and lubrication of the magnetic clutch (301-1400-00) and the pulley (302-2090-00) must be performed on a bimonthly basis (every two months). To do this, the assembly should be **removed** form the pinsetter and cleaned. The components should be cleaned with a solvent such as paint thinner. The components should then be dried using a towel. The shaft of the conveyor roller (302-6050-00 or 302-6075-00) where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

To remove the clutch assembly, you must first remove the belt. The tension on the belt must first be removed by removing the spring (S-080) as shown in figure 17. The belt will now come off easily.

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

Following re-assembly of the clutch assembly, make sure to replace the spring in order to re-establish tension on the belt. Cleaning and lubrication of the magnetic clutch assembly is critical for proper performance. Failure to have a clean, well lubricated clutch will result in jams.

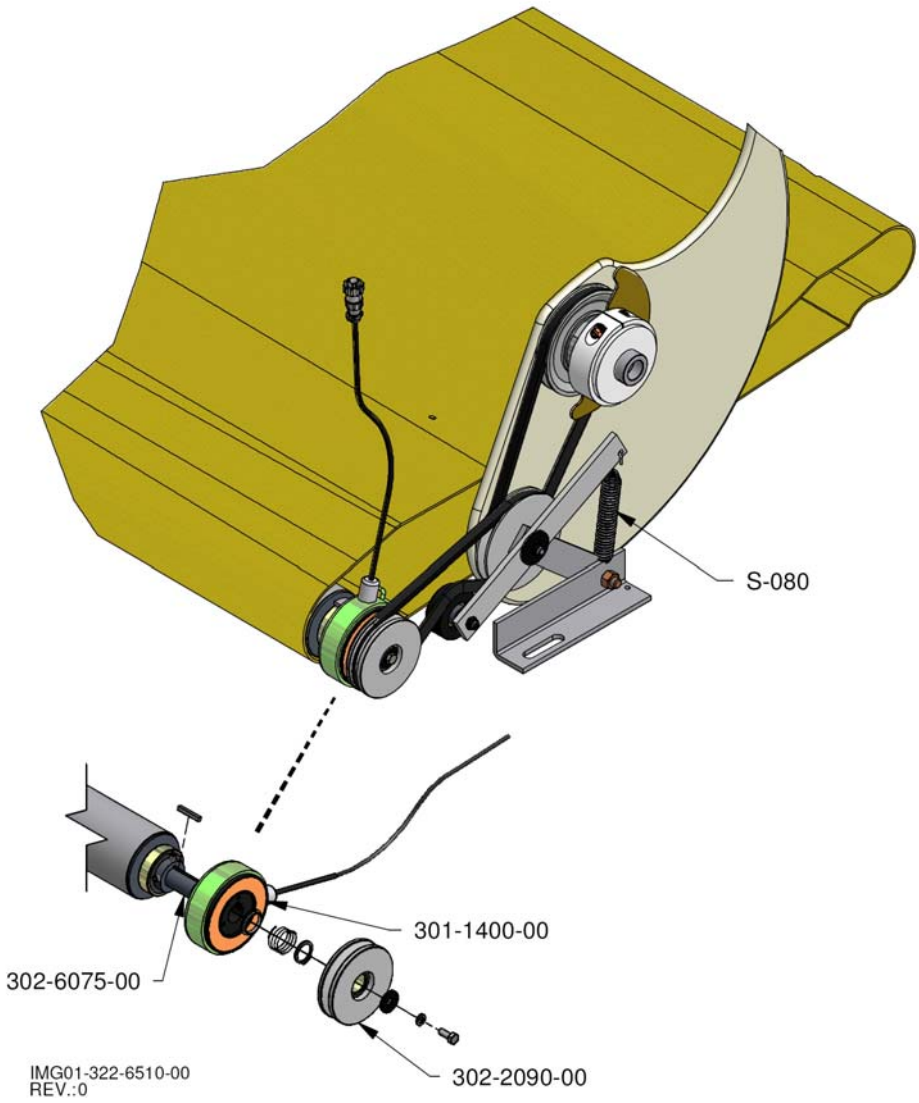


Figure 17

Pit Maintenance Notes

Ball Accelerator

4A. Belt 304-9000-00Tension

Place the Qubica Tension Gauge squarely on one belt at the center of the belt span. Apply a force of 5 lbs (2.25 kg) on the plunger and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.

To adjust the tension on the belt, simply rotate the tension rod (302-9075-00) in the desired direction (tighten the bolt to increase the tension and loosen the bolt to decrease tension).

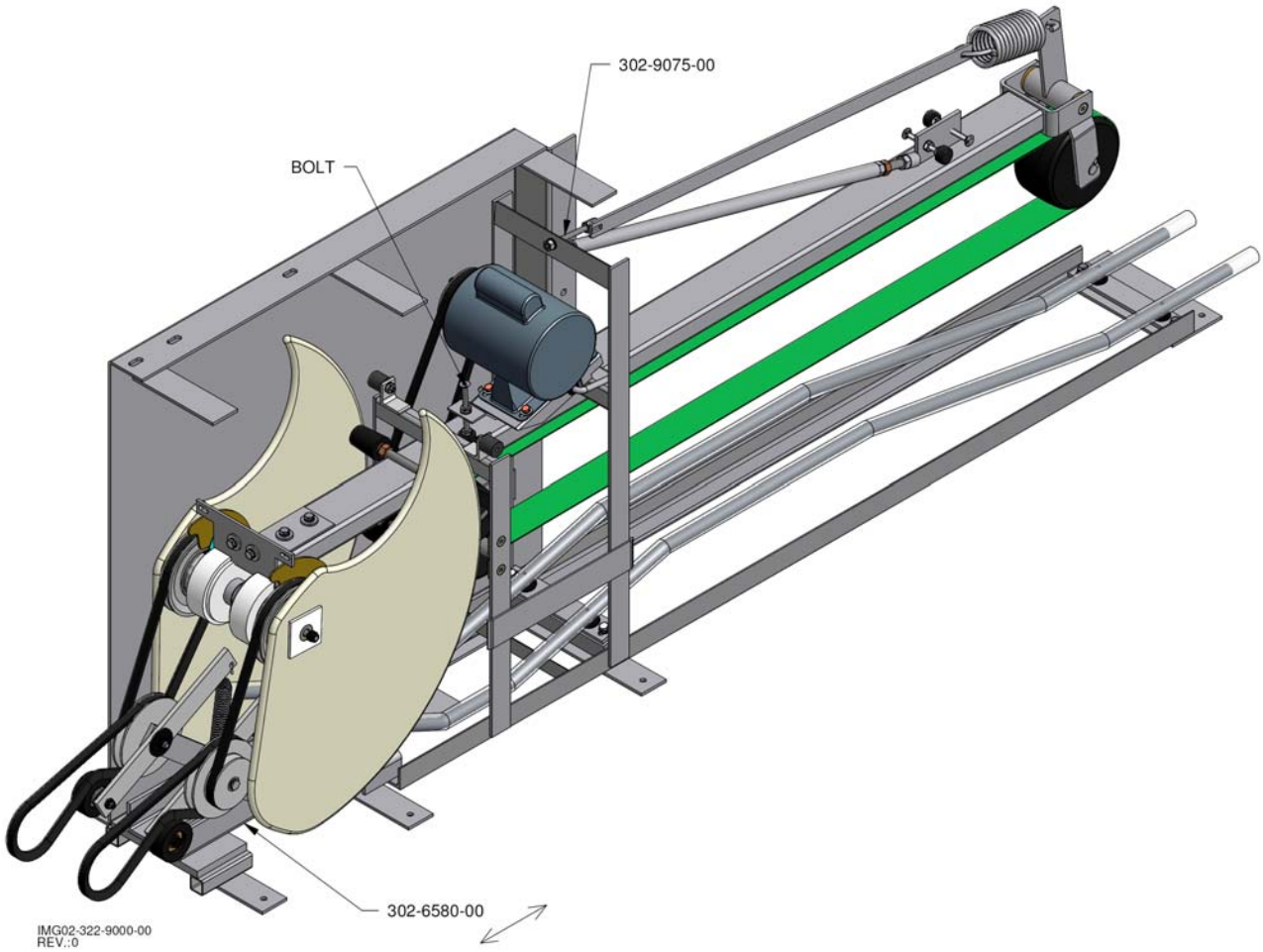


Figure 18

4B. Door Belt Tension

The drive belts used to operate the ball doors are automatically tensioned with their X-form and the spring with which they are mounted. The only thing to check is that the belts do not come in contact with the magnetic clutch situated just below the pulley. If the belts get too close for comfort, adjust the tension as described below.

To adjust the tension on the belt, simply loosen the bolts which hold the tension plates (302-6580-00 and 302-6585-00) in place and then move the tension plates in the direction of the arrows.

4C. Drive Belt Tension

Using the belt tension tool, apply a force of 5 lbs (2,25 kg) on the plunger and perpendicular to the belt span. Measure the recession depth and compare it to Table 4. If the recession depth is greater, you must tighten the belt and if the recession depth is less, you must loosen the belt.

To adjust the tension on the belt, simply rotate the adjustment bolt located on the motor support bracket in the desired direction (tighten the bolt to increase the tension and loosen the bolt to decrease tension).

4D. Door Torque

The torque exerted on the ball door must be sufficient enough to allow for its normal movement but at the same time it keep the door open when necessary. To adjust the torque, simply rotate the adjustment bolt on the ball door brake (303-6510-00) in the desired direction (tighten the bolt to increase the tension and loosen the bolt to decrease tension).

4E. Door Cam

The positioning of the door cam determines the ball door's stopping position. To change the position, loosen the HS044 pit collar (302-6550-00) which holds the cam in place, move the cam and then re-tighten the bolt.

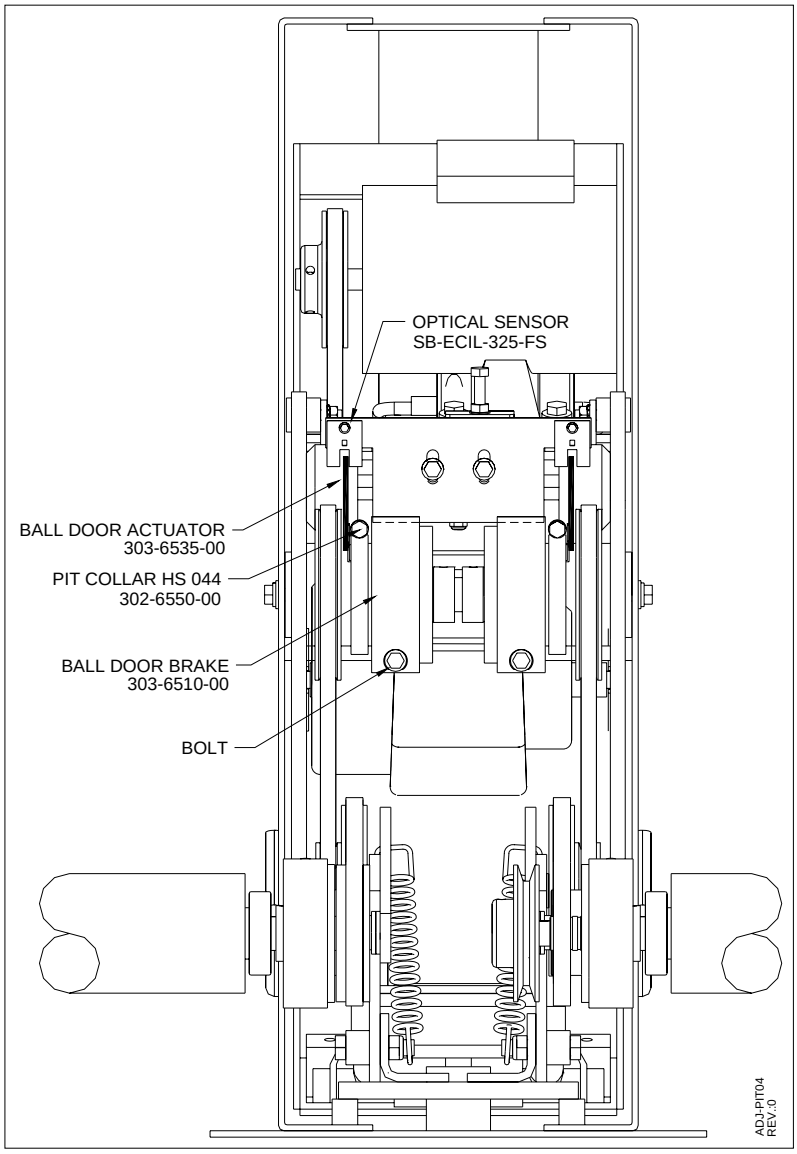


Figure 19 - Rear view

4F. Ball Door Open Opto

The ball door open optical sensor (SB-ECIL-325-FS) must be aligned so as to have the actuator (303-6535-00) pass through it when it opens.

Ball Accelerator Maintenance Notes

Pin Elevator & Carrousel Staging

5A. Drive Chain Tension

The pin elevator's chains must be adjusted so as to have the chains rotate freely on their sprockets. In order to adjust the tension on the chain, loosen the sprocket's bolt and then rotate the nylock nut in the desired direction. Once the desired tension has been obtained, re-tighten the sprocket's bolt.

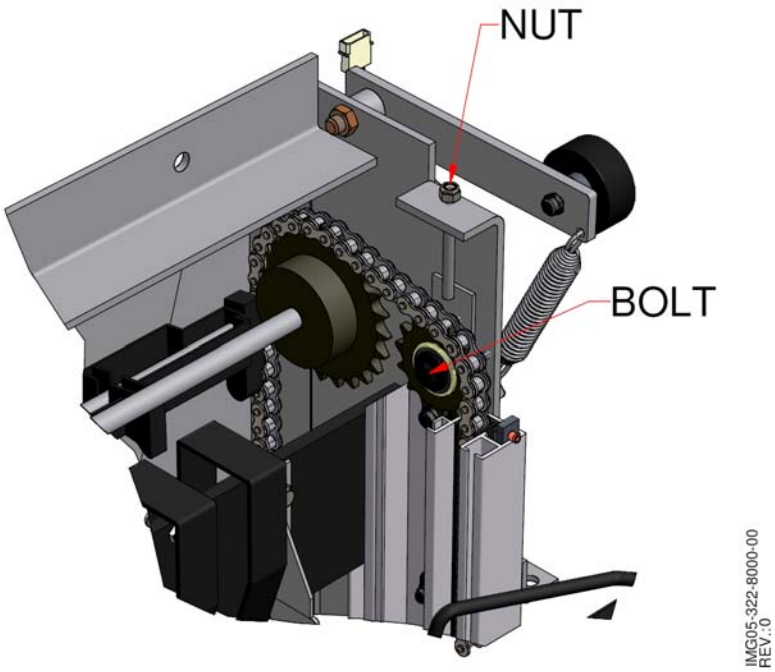


Figure 20

5B. Pin Alignment

The pin alignment bar (304-8200-00) must always be as taut as possible in order for the pin elevator to function correctly. In order to tighten the pressure exerted on the pins, remove both metal screws (one on each side) which hold the guide rollers (303-5520-00) and pin alignment bar in place and then remove a section of the pin alignment bar by cutting it. Re-assemble the components.

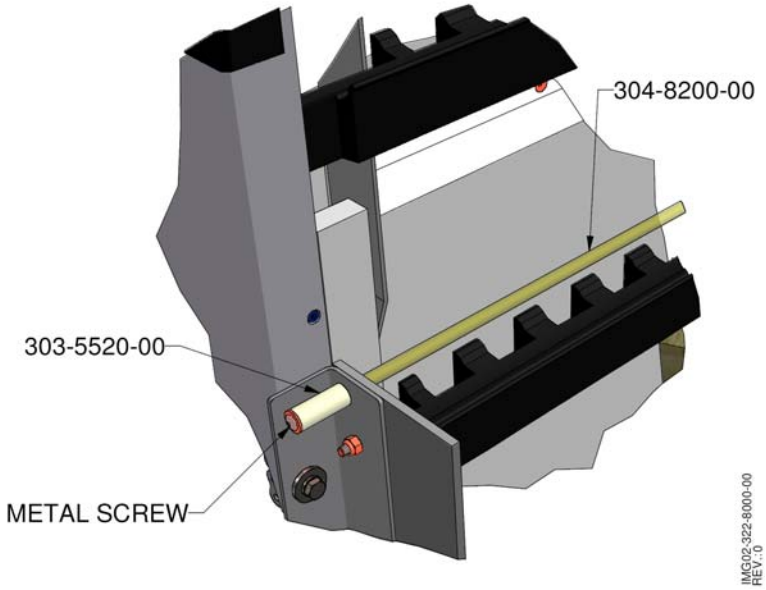


Figure 21

Located on the carrousel staging assembly are four (4) optical sensors which determine the pin elevator's movement. All of these sensors function in a negative manner, which is to say that their actuators are always present in the sensor and are only removed by the presence of a pin.

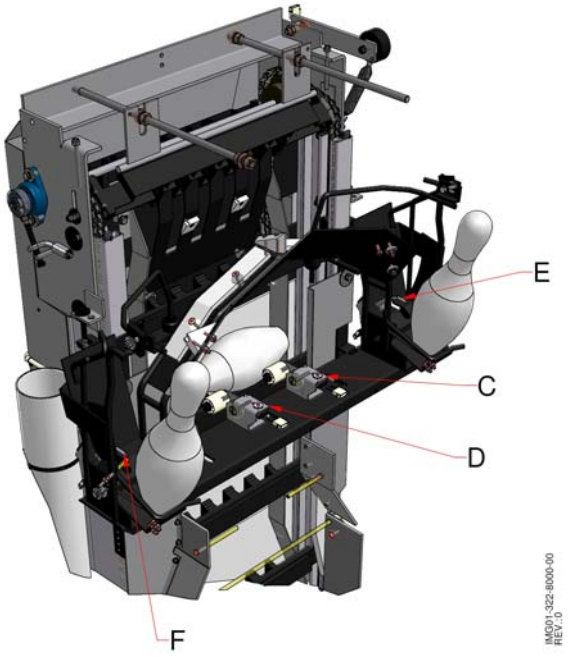


Figure 22

5C. Right Pin Actuator

The pin elevator right side optical sensor **(C)** must be adjusted so as to detect a pin riding up the elevator with its head to the left. The pin must activate the right pin actuator from all positions (far left, far right and everything in between) without activating the pin elevator left side optical sensor **(D)**.

5D. Left Pin Actuator

The pin elevator left side optical sensor **(D)** must be aligned so as to detect a pin riding up the elevator with its head to the right (not shown). The pin must activate the left pin actuator from all positions (far left, far right and everything in between) without activating the pin elevator right optical sensor **(C)**.

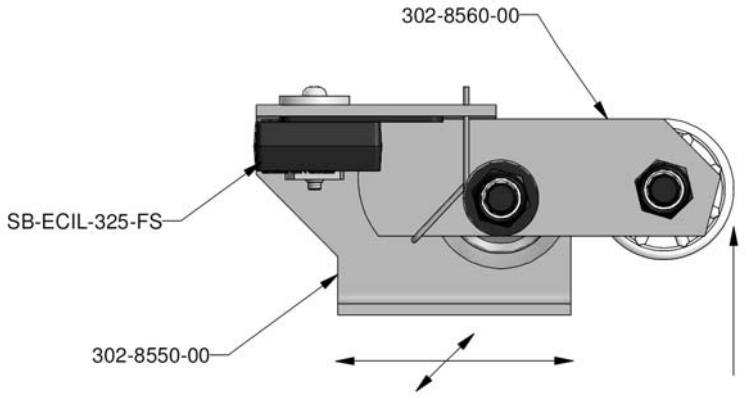


Figure 23

The pin elevator optical sensors **(C and D)** are both adjusted in the same manner. Loosen the bolts which attach the actuator base (302-8550-00) to the carrousel staging frame and the move the base in the direction of the black arrows until all pins are detected as previously specified. The gray arrow in the figure above indicates the pressure from the pin. Once the adjustment is completed, right-tighten the bolts.

5E. Right Pin Loader Actuator

The pin loader right side optical sensor **(E)** must be adjusted so as to have the actuator (302-8550-00) completely removed from the sensor by a pin falling into the carrousel staging assembly as seen in the pin and optos diagram.

5F. Left Pin Loader Actuator

The pin loader left side optical sensor **(F)** must be adjusted so as to have the actuator (302-8550-00) completely removed from the sensor by a pin falling into the carrousel staging assembly as seen in the pin and optos diagram.

The pin elevator optical sensors **(C)** and **(D)** are adjusted in the same manner. Loosen the bolts which attach the sensors to the actuator base (322-8550) and then move them in the direction of the arrows until all pins are detected as previously specified. Once the adjustment is completed, re-tighten the bolts.

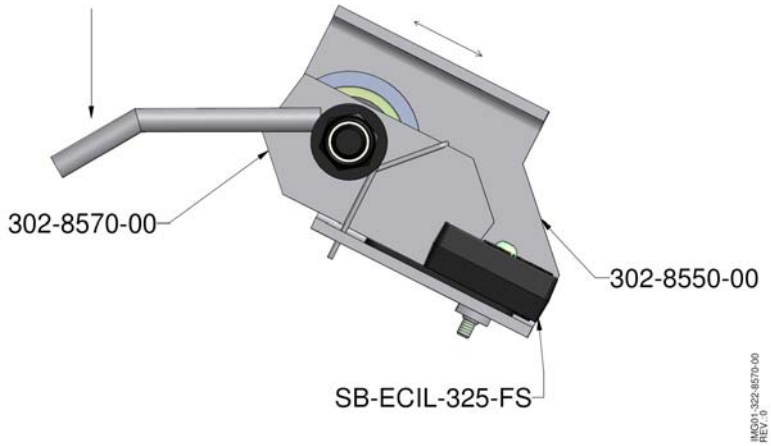


Figure 24

To adjust the pin loader sensors **(E)** and **(F)**, loosen the bolts which attach the actuator base (302-8550-00) to the carrousel staging frame and then move the base in the direction of the black arrows until all pins are detected as previously specified. The gray arrow in the figure above indicates the pressure from the pin. Once the adjustment is completed, re-tighten the bolts.

5G. Clutch Cleaning and Lubrication

Cleaning and lubrication of the magnetic clutch (301-1400-00) and the pulley (302-2090-00) must be performed on a bimonthly basis (every two months). To do this, the assembly should be **removed** form the pinsetter and cleaned. The components should be cleaned with a solvent such as paint thinner. The components should then be dried using a towel. The shaft (302-2080-00) of the machine where the clutch assembly is normally inserted should also be cleaned with a clean rag while the clutch assembly is out being cleaned as per the above.

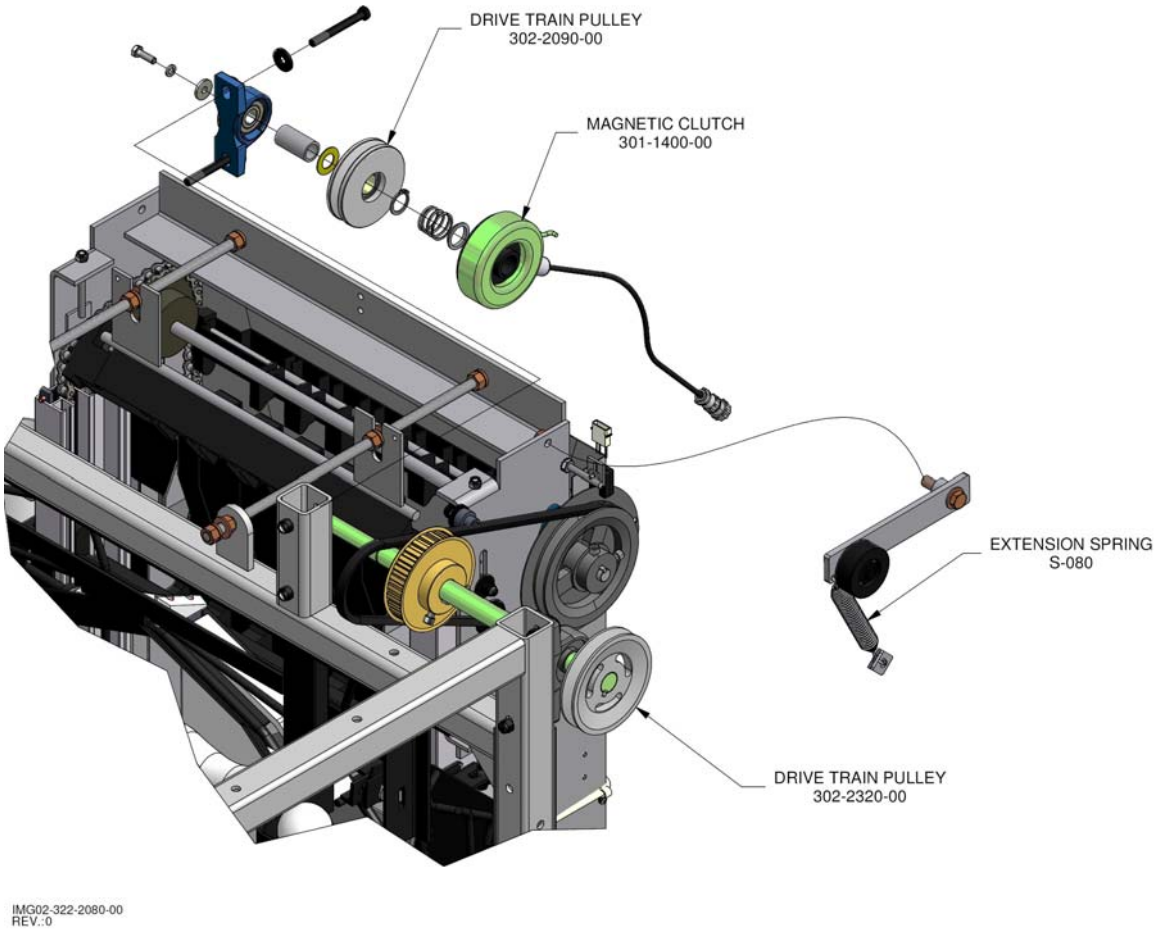


Figure 25

To remove the clutch assembly, you must first remove the belt. The tension on the belt must first be removed by removing the spring (S-080) as shown in figure 17. The belt will now come off easily.

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

Following re-assembly of the clutch assembly, make sure to replace the spring in order to re-establish tension on the belt. Cleaning and lubrication of the magnetic clutch assembly is critical for proper performance. Failure to have a clean, well lubricated clutch will result in jams.

5H. Elevator Movement Opto

The elevator movement opto (SB-ECIL-325-FS) keeps the pinsetter's electronics informed of the movement of the elevator so as to be able to shut off the motor in the case of a pin jam. The optical sensor must be kept

aligned with the elevator's pulley (302-8230-00) in order to function. To adjust the opto, simply loosen the screws which attach it to the frame and then move it in the necessary direction until it is perfectly aligned with the pulley. Make sure that the pulley does not come in contact with sensor. It must pass freely through the sensor's slot.

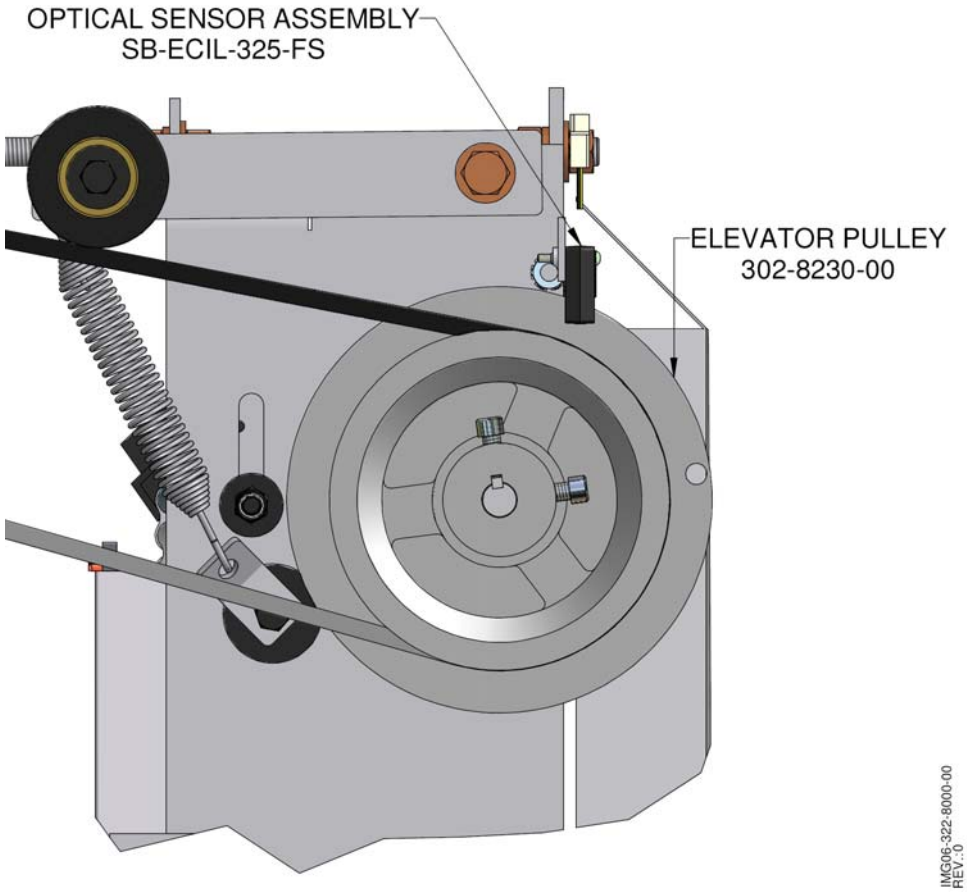


Figure 26

Pin Elevator & Carrousel Staging Maintenance Notes

Carrousel

The carrousel adjustments should always be carried out as a whole since one adjustment usually influences another one directly or indirectly. The order in which the adjustments appear are the order in which they should normally be performed.

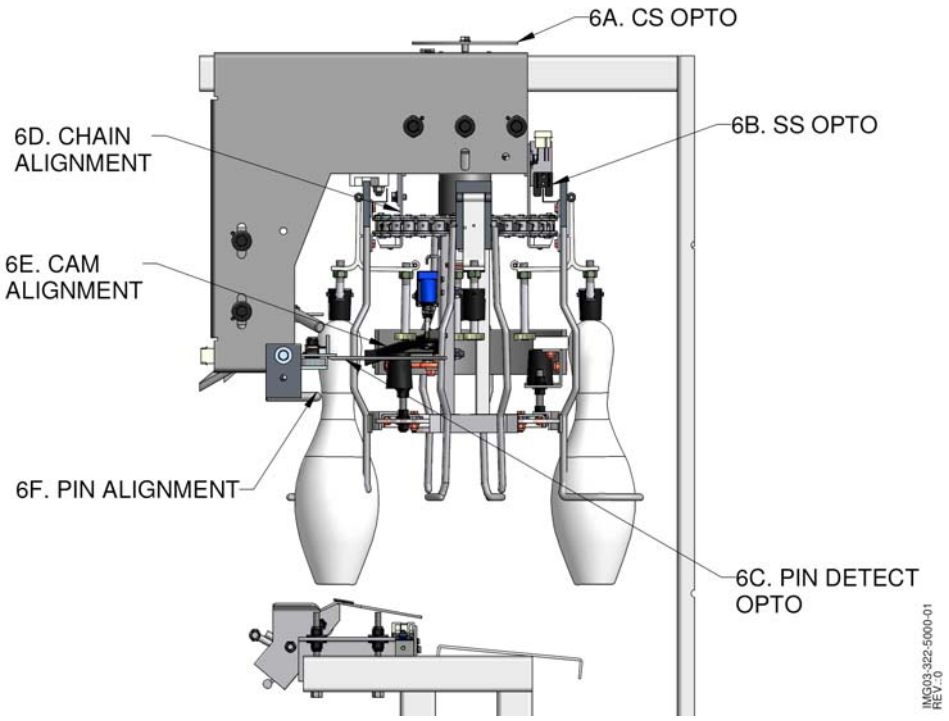


Figure 27

6A. Synchronization Opto

The encorder's optical sensor (E-GP1A05) located on top of the carrousel must be positioned so as to have the encoder (303-5810-00) pass through its center. To adjust the sensor, simply loosen the bolt which holds it in place and move the sensor's mounting plate (302-5800-00) it in the direction of the arrows. Once aligned, re-tighten the bolt.

At this point verify that the encoder does not tuch the optical sensor as it rotates. The sensor may be moved up or down as indicated by the white arrows.

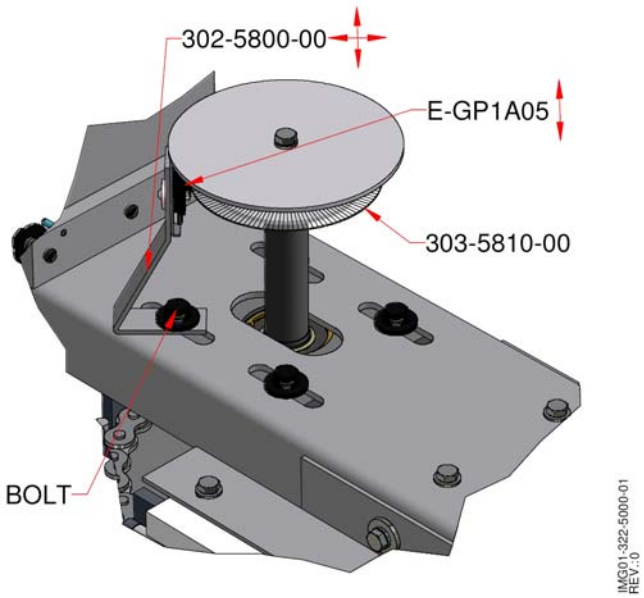


Figure 28

6B. Station Syncronization Opto

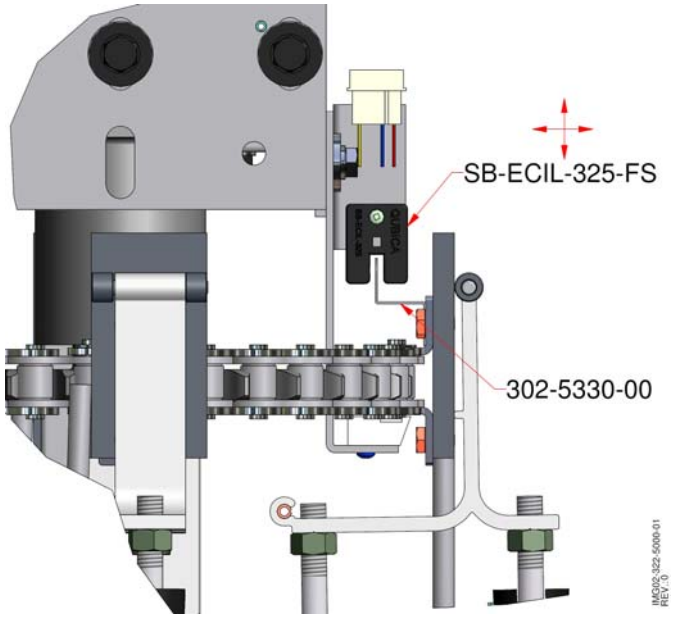


Figure 29

The SS optical sensor (SB-ECIL-325-FS) keeps the carrousel's station in sync. Its actuator (302-5330-00) must cut the opto's signal at each passage. The sensor is aligned by loosening its screws and moving it in the direction of the arrows. Re-tighten the screws once aligned.

6C.Pin Detect Opto

The pin detector actuator assembly (322-5300-00), used to detect the pins and they round the front of the crrousel in their buckets (302-5120-00), must be adjusted so as to have the actuator completely removed from the optical sensor by a passing pin.

This adjustment must be performed in conjunction with the MAG3-OT controller. Proceed to Menu 1.1.4.3 which displays the statusd of each one of the eight optical sensors used to determine the functioning of the carrousel. The information of interest is the **Pd** status which should initially be at **1** since the actuator is obstructing the opto.

Position one of the carrousel buckets with a bowling pin as shown in the figure below, ***Position 1***. The pin should be as close as possible to the pin detector's arm without touching it. Measure the distance between the carrousel bucket's arm and the frame as indicated. If the measurement is not 10" (254 mm), loosen the bolt which holds the detector assembly in place and move the assembly until the requires distance is obtained. Re-tighten the bold.

Proceed to turn the carrousel until it is in the arm is 9" (228 mm) from the frame (***Position 2***). The display on the MAG3-IT controller should change from **1** to **0**. Again proceed to turn the carrousel until the arm is 53/4" (146 mm) from the frame (***Position 3***). The display on the MAG3-IT controller should now change from **0** back to **1**.

If the measurements do not coincide with the MAG3-IT controller display, the pin detector actuator may have been bent out of shape. Correct the situation if able, otherwise replace the pin detector actuator (302-5310-00).

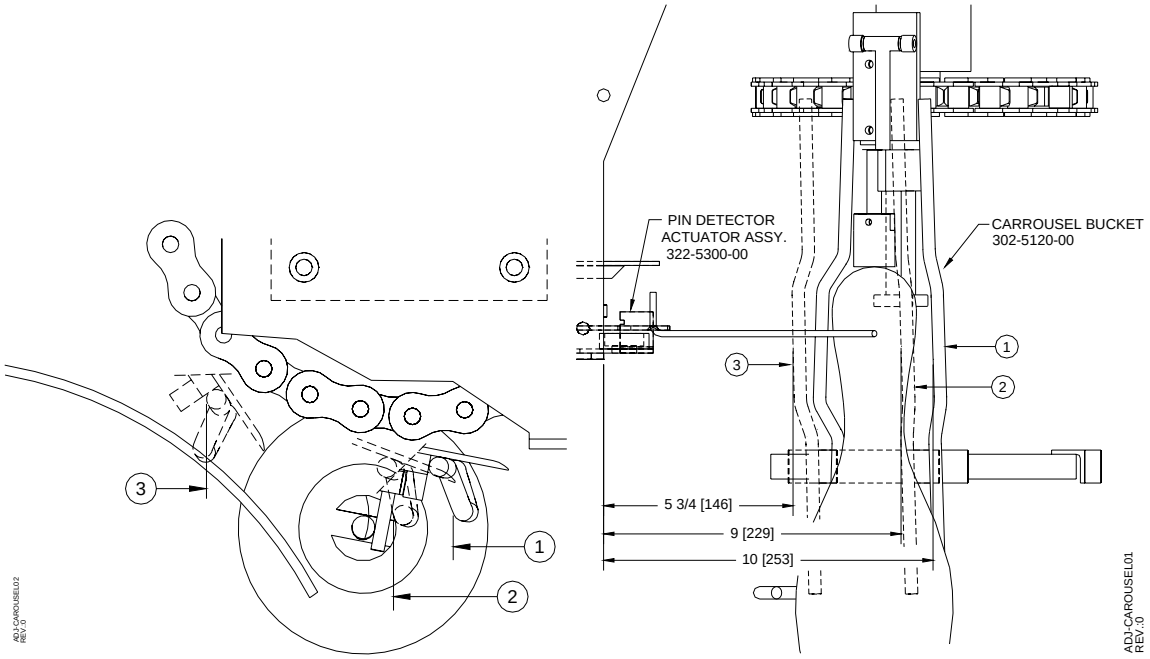


Figure 30

6D. Chain Alignment

The carrousel's chain guide supports (303-5010-00) must be adjusted in order to do exactly as their name implies, support the carrousel chain (302-5050-00) in order that it remains centered on the two sprockets on which is rotates. To align the chain with its sprockets, loosen the bolts which hold the mounting plates (302-5010-00) in place and then move the mounting plates in the direction of the arrows until aligned. Re-tighten the bolts once completed. Check the chain's tension at this point.

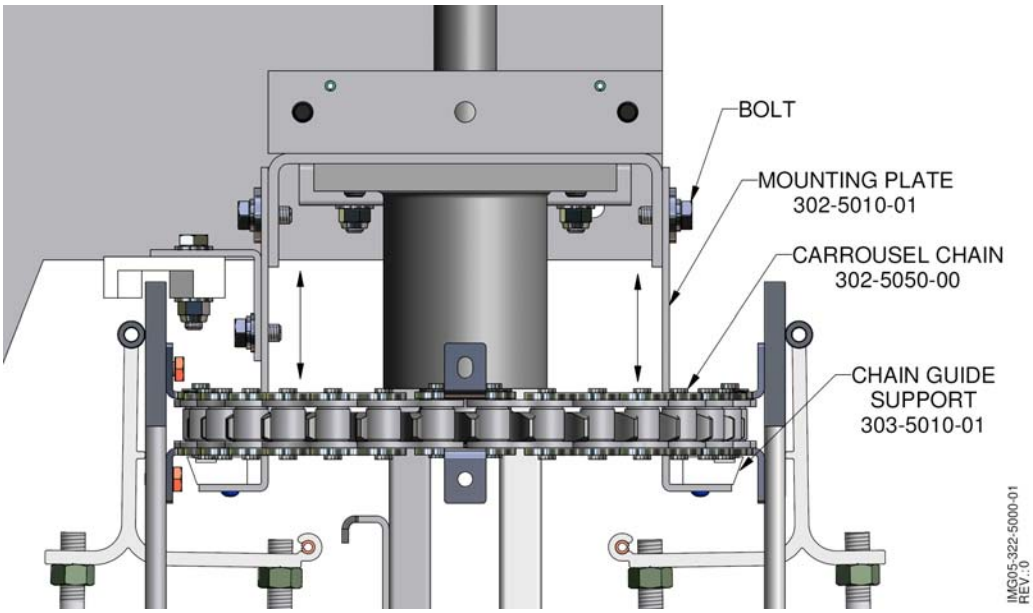
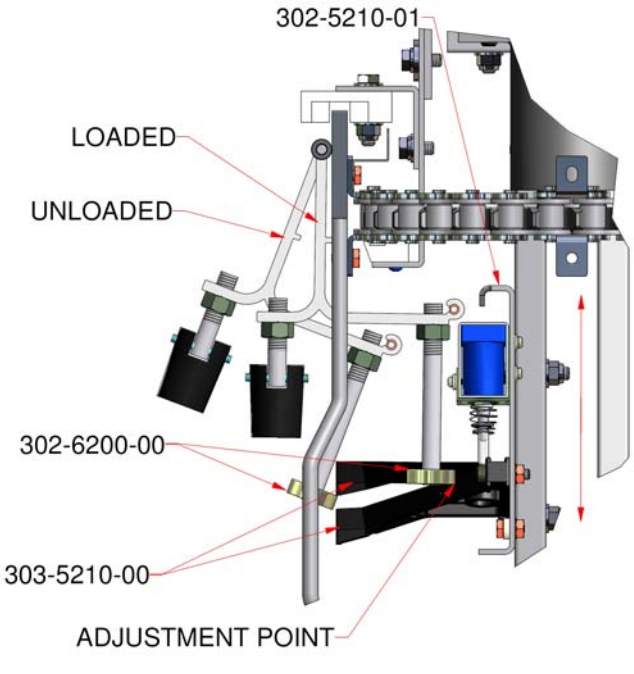


Figure 31

6E. Cam Alignment



The carrousel's fourteen ball bearings (302-6200-00) located on the magnet assemblies must have the least possible amount of space between themselves and the seven solenoid cams (302-5210-00). When the magnet assemblies are in their loaded positions, verify the spacing at the location marked by the circle for all 14 magnet assemblies. Make the necessary adjustment in conjunction with the closest ball bearing and cam which are the closest together. To adjust the space between the ball bearings and the cams, loosen the bolts which hold the mounting plate (302-5210-00) in place and move it in the direction of the arrows. Once the desired space is obtained, re-tighten the bolts.

Figure 32

6F. Pin Alignment

The space between a passing pin and the pin guide (302-5730-00) must be 3/32" (2,4 mm). To adjust the space, loosen the bolt, which holds the pin guide in place, and then move it in the direction of the arrows until the required spacing is obtained, Re-tighten the bold when done.

6G. Magnet Guide Rod

In order to correctly adjust the magnet guide rod (302-5710-00), the #20 template (Z-ME5020) must be used. The template must fit at both ends (left and right) of the magnet guide rod as shown in the figure below. If it doesn't, loosen the bolts which hold the magnet guide rod in place and then move the magnet guide rod in the direction of the arrows until the template fist perfectly. *You may find it easier to perform this adjustment with two #20 templates*.

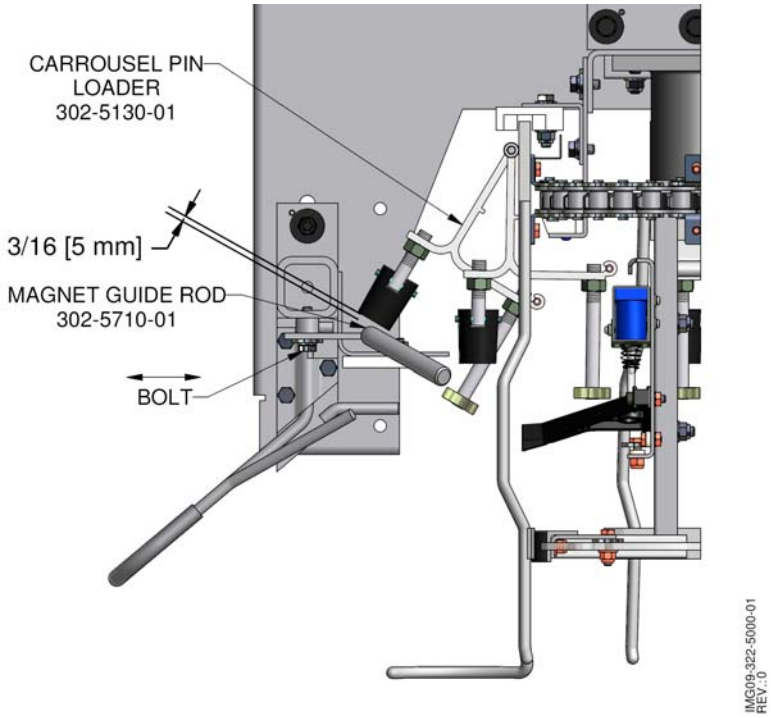

CARROUSEL PIN
LOADER
302-5130-01
3/16 [5 mm]
MAGNET GUIDE ROD
302-5710-01
BOLT
IMG09-322-5000-01
REV.: 0

Figure 33

6H. Pin Drop Height

In order to correctly adjust the pin drop height, the #30 template (Z-ME5030) must be used. Position the template on the magazine station assembly (322-5510-00) as shown in the figure below. The should be a 1/8” (3 mm) gap between the template and the bowling pin. If there isn’t raise or lower the magazine assembly by removing the bolts which hold it in place and shimming the height using flat washers (7050-040122-012).

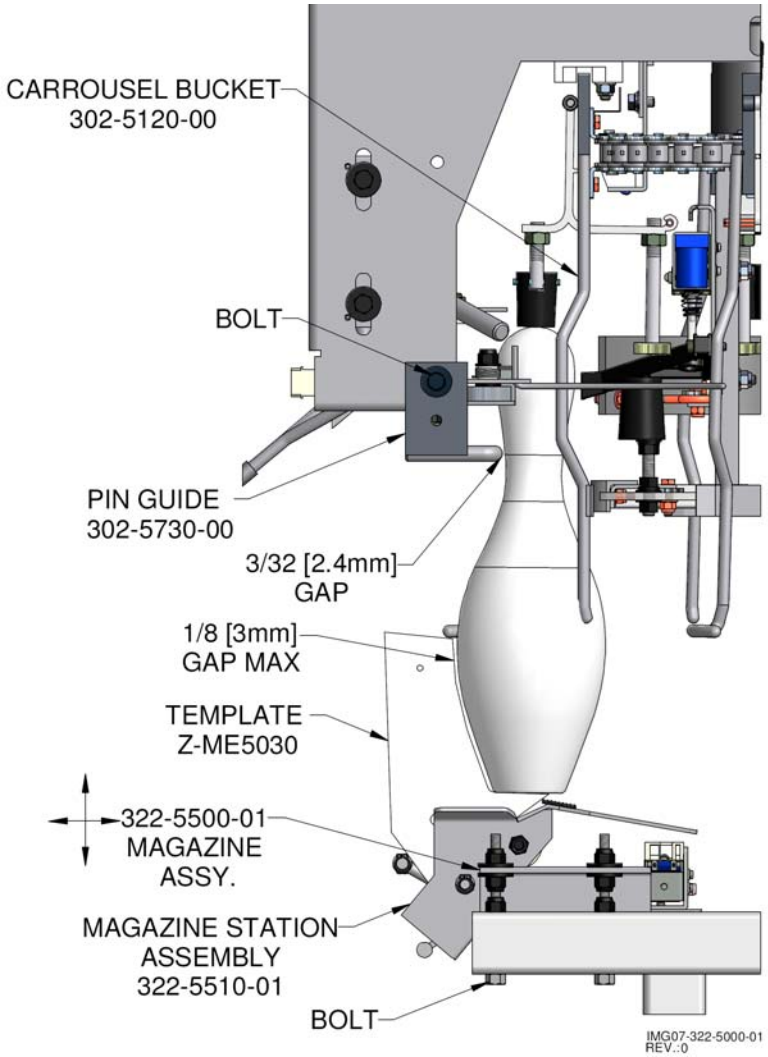


Figure 34

6l Pin Holder Arm Adjustment

Position the pin holder arm at 1/18” (28 mm) of the transversal bar of the carrousel bucket. With a pin, position the bucket in a manner to have 1/16” to 1/32” (1,6 to 0,8 mm) between the red arm and the stopper.

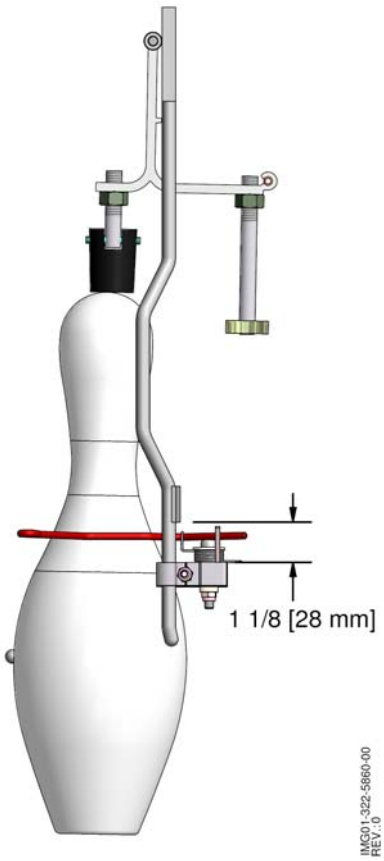


Figure 35

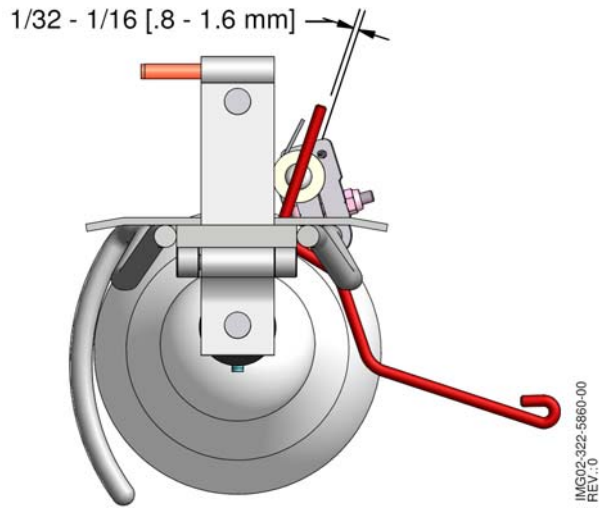


Figure 36

Carrousel Maintenance Notes

Magazine

7A. Solenoid Block

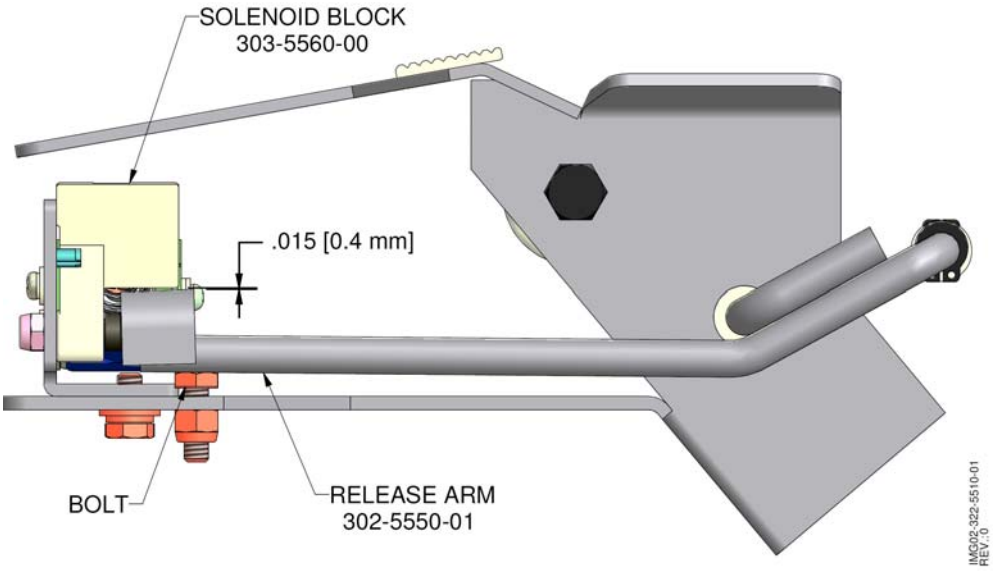


Figure 37

Without the magazine station's solenoid being activated, the distance between the bottom of the block (303-5560-00) and the top of the arm's (302-5550-00) toe must be kept at 0.015" (0.4 mm). Rotate the bolt located beneath the release arm until the correct distance is obtained.

7B. Solenoid Bracket

With the magazine station's solenoid activated, the distance between the side of the block (303-5560-00) and the side of the release arm (302-5550-00) must be kept at 1/16" (2 mm). Move the solenoid bracket (302-5560-00) in the direction of the arrows to obtain the required distance.

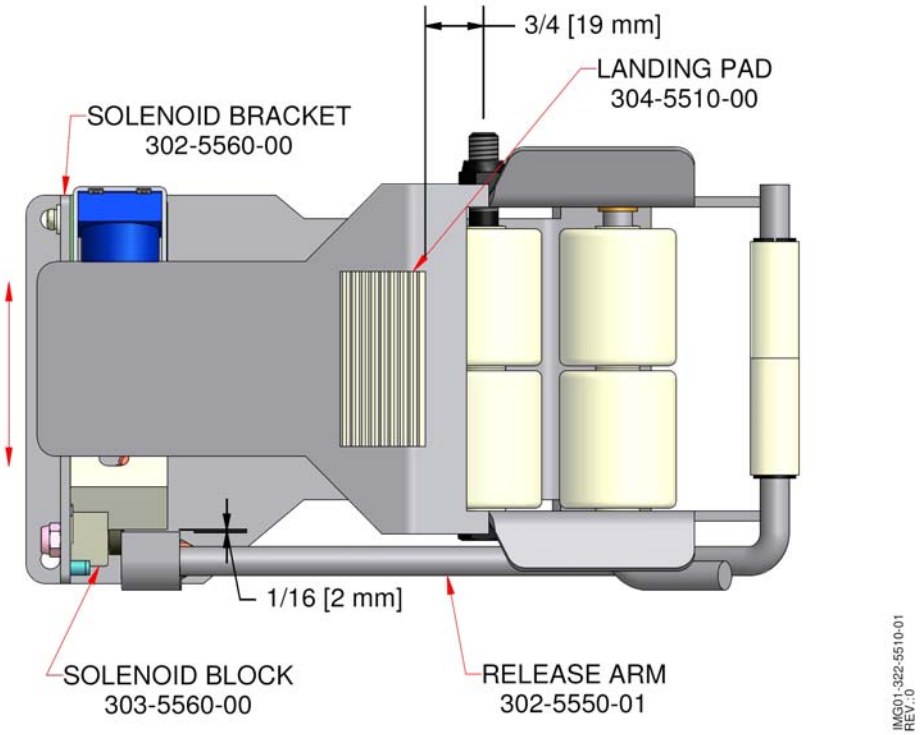


Figure 38

7C. Landing Pad Replacement

The landing pad (304-5510-00) is glued to the station. When replacing the landing pads, clean the metal surface with an acetone solvent before gluing the new pad in place. Place the new landing pad 3/4" (19mm) from the center of the first row of guide rollers as indicated.

7D. Detection Bar Assembly

When pins are in the magazine, their heads must be centered on the detection bar assembly (SB-308-5700) at a distance of 3/16" (5mm). To adjust this distance, loosen the bolts which hold the detection bar assembly in place and move it in the direction of the arrows until the desired position is obtained. Retighten the bolts.

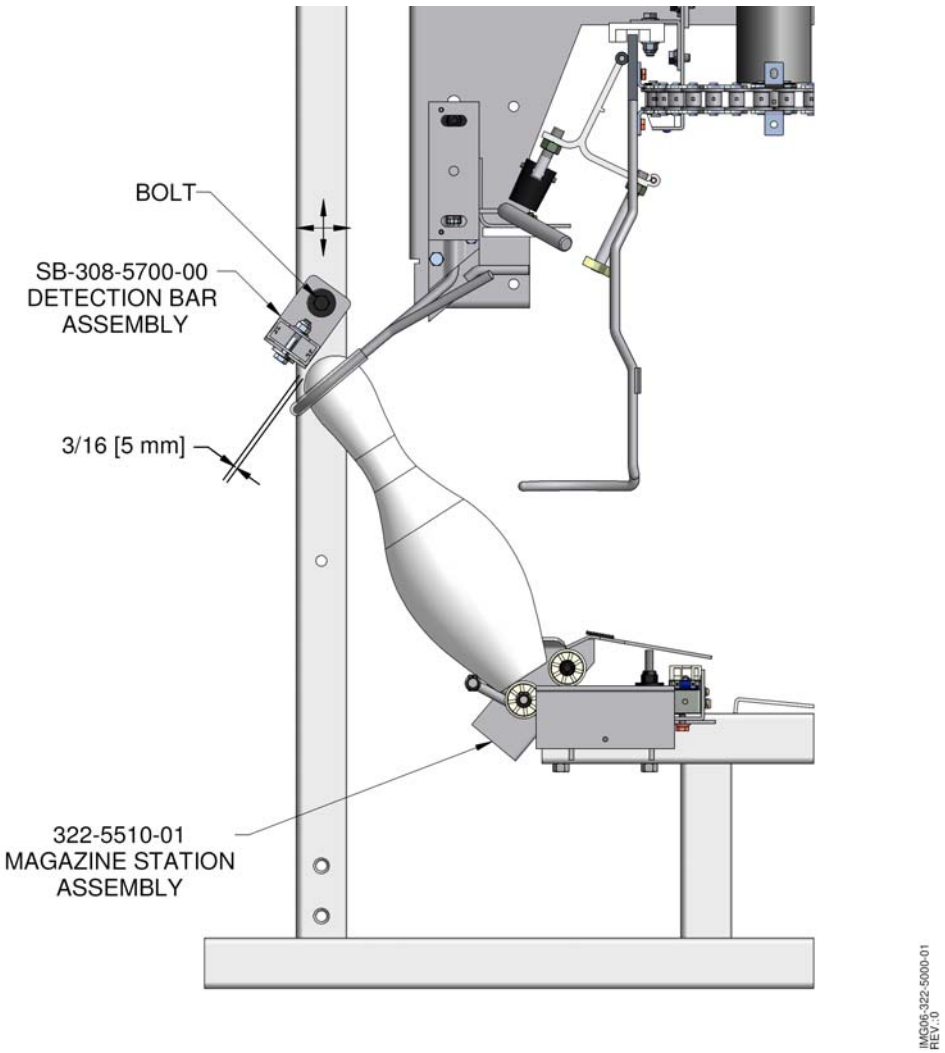


Figure 39

7E. Flange Bearings Lubrication

The magazine station's flange bearings (302-5520-00) must allow the release arm (302-5550-00) to open and close without the slightest restriction. To allow this, the flange bearings must be oiled with very small quantities of SW10 motor oil on a bimonthly basis (every two months) only if judged necessary. Don't forget that any excess oil will only drip inot undesired places causing headaches for cleaning.

Refer to the parts section of this manual for the flange bearings' location. Don't forget to check each one of the seven stations.

Magazine Maintenance Notes

Drawer

8A. Triangle

The drawer's triangle is formed with rows of tubular metal with pin cups bolted to them. The tubular must always be kept parallel to each other in order to maintain a perfect triangle.

The drawer needs to be completely adjusted if your pinsetter experiences a lot of "Drawer Troubles" or if pins are set out of spot in a de-formed triangle. Steps 1 through 7 must be carried out in order when performing a complete triangle adjustment.

If the drawer suddenly becomes de-calibrated after a drawer obstruction, stops 2, 3 and 6 need only be performed.

1. Join the drawer's two main components by using two large C clamps as shown in the figure below.

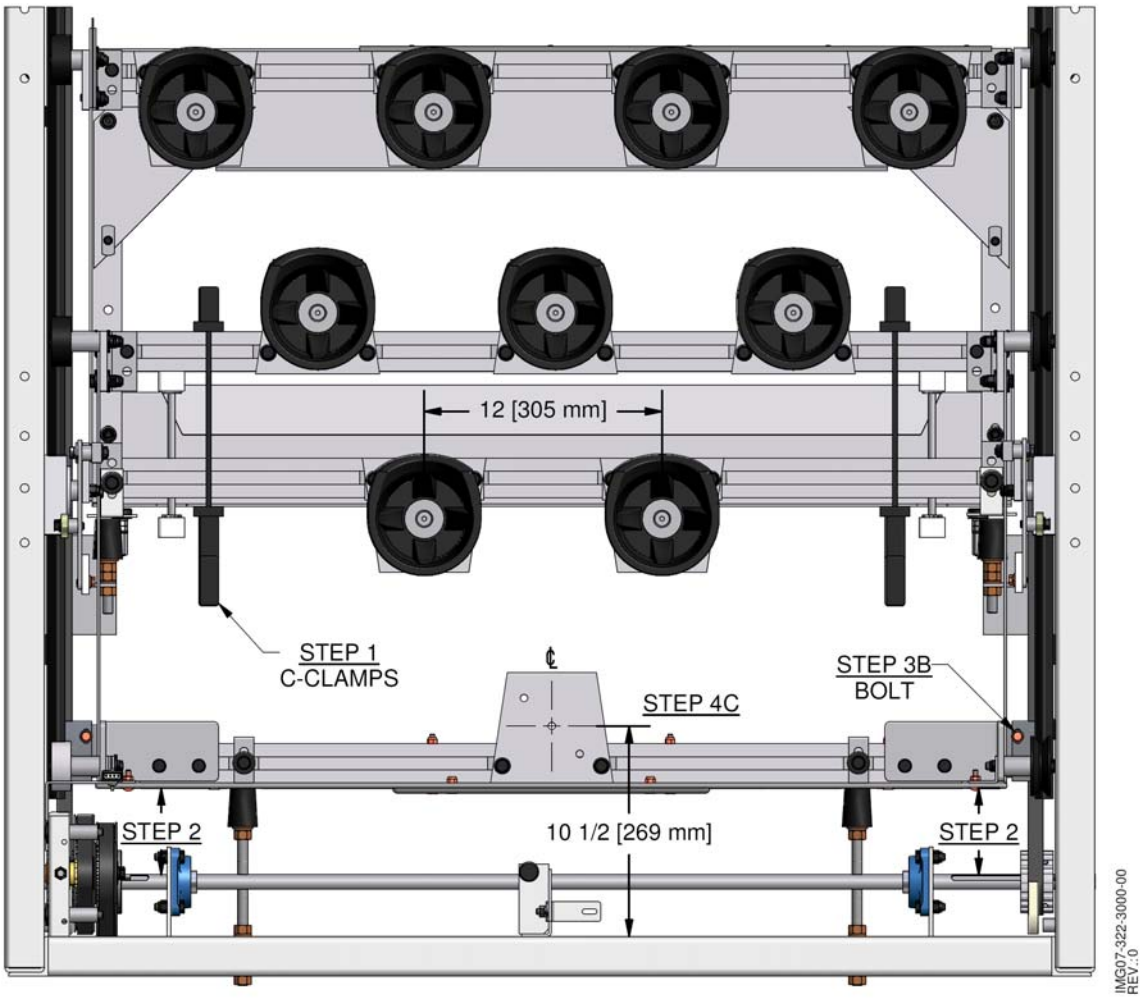


Figure 40

2. Measure the distance from the front of the drawer to the drive shaft at both extremities as indicated in the figure above to ensure that they are parallel to each other. If they are parallel go to step 4, otherwise complete step 3.
3. Remove the tension on the drawer's belt. To do loosen the four bolts which hold the left (302-3035-00) and right (302-3030-00) tension plates in place and also by loosening the two nuts as indicated in the figure below. Remove the two bolts which hold the mointing plate since doing so will cause the drawer belt to be separated.

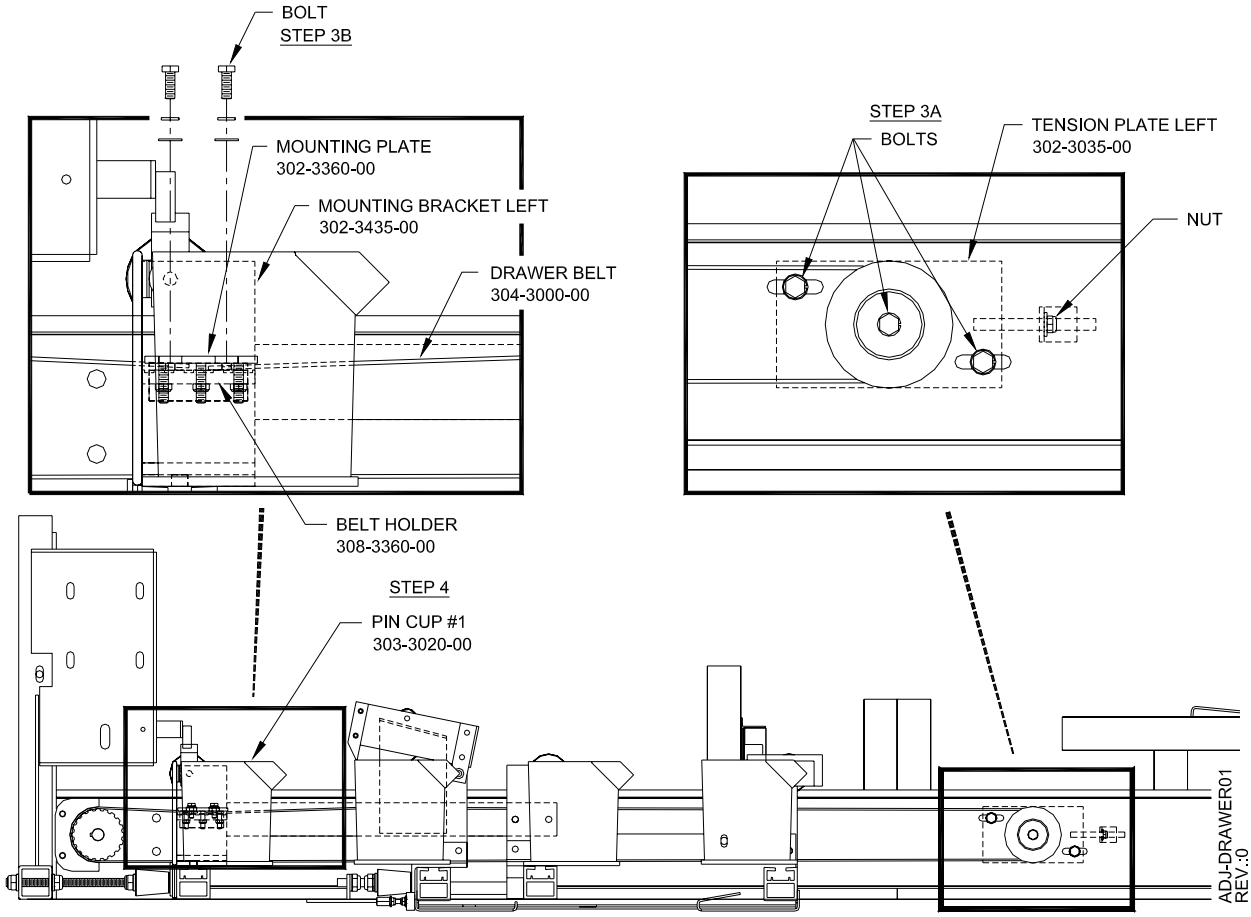


Figure 41

4. Remove pin cup #1 (303-3020-00) and use the bumper pads (304-1560-00) located on both sides of the drawer to position the drawer's frame assembly 10.5" (266 mm) from the frame as indicated in the previous figure.

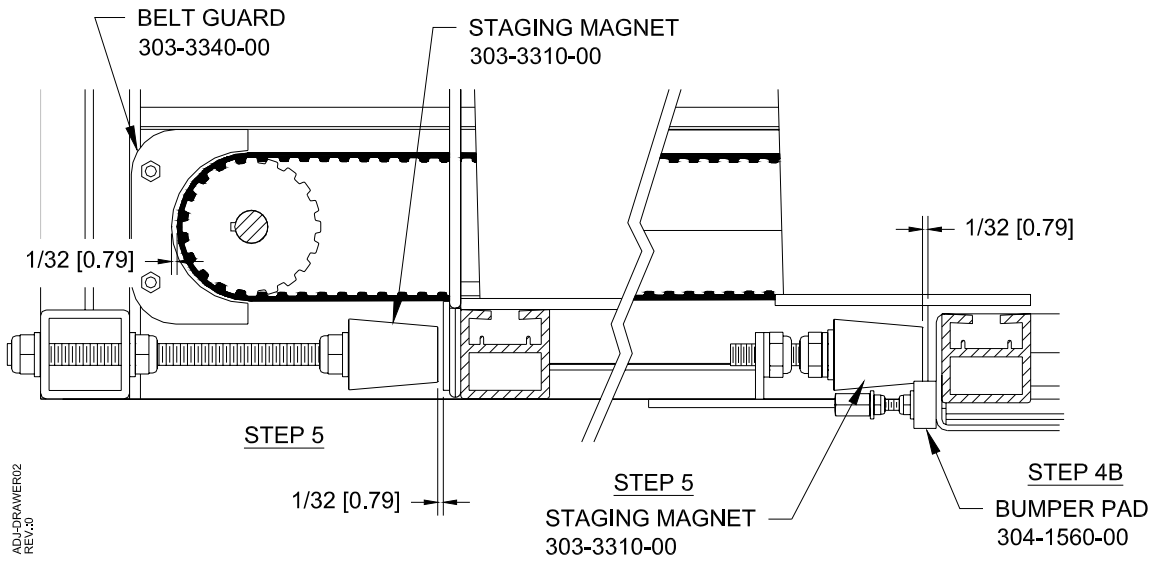


Figure 42

5. Adjust the four staging magnets (303-3310-00) to obtain a space of 1/32” (0,75 mm) as indicated in the figure above.
6. If step 3 was completed, re-assemble the drawer belt and its mounting plate jumping the number of notches in the required direction in order to maintain the drawer’s parallelism and then re-tension the drawer’s belt. Check the drive belt tension as described in adjustment 8B.
7. Replace pin cup #1 and remove the two C clamps.

8B. Drive Belt 304-3000-00 Tension

Place the Qubica Tension Gauge squarely on one belt at the center of the belt span. Apply a force of 5 lbs (2.25 kg) on the plunger and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt. Loosen the left (302-3035-00) and/or right (302-3030-00) tension plate and then use the nut to increase or decrease tension.

8C. Out of Spot Pin

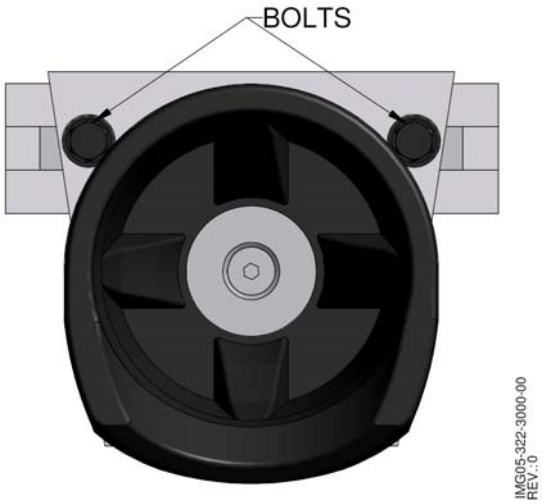


Figure 43

If only one pin is constantly set out-of-spot and no drawer troubles are signaled through the MAG3-IT controller, it is probably just a case of relocating the pin cup in its tubular bar. This adjustment only affects the left and right positioning of the pin.

To relocate a pin cup, simply loosen the bolts which hold it in place as indicated in the figure above and then move it in the desired direction. Once completed, re-tighten the bolts.

WARNING **When tightening the bolts, be sure to respect the 25 ft.lb. (112 N/M) torque. Failure to do so may result in breaking a bolt which will mean dismantling the complete drawer in order to replace it.**

8D. Drawer Hook

Completely close the drawer (push to the rear) and check the pace between the plastic hook (303-3320-00) and the pulley shoulder (302-3350-00). The necessary spacing is 1/16” (2 mm). To adjust the space, loosen the bolts which hold the hook plate (302-3320-00) in place and then re-tighten them when the spacing is correct.

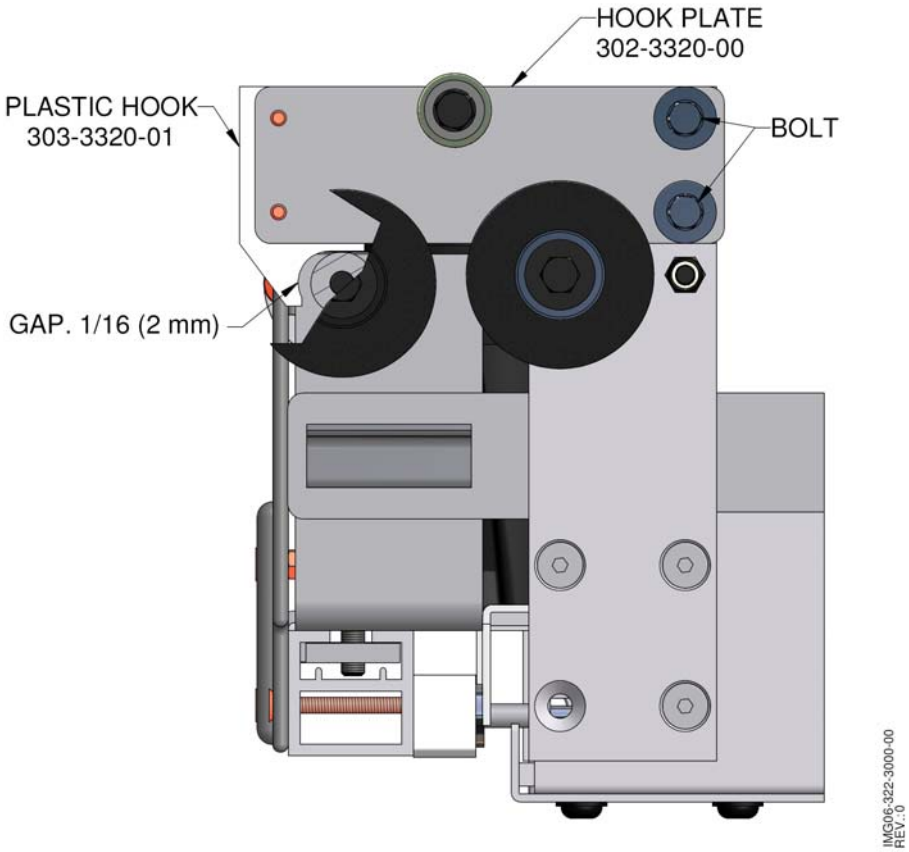

HOOK PLATE
302-3320-00
PLASTIC HOOK
303-3320-01
BOLT
GAP. 1/16 (2 mm)
IMG06-322-3000-00
REV.:0

Figure 44

8E. Drive Belt 304-3010-00 Tension

Place the Qubica Tension Gauge squarely on one belt at the center of the belt span. Apply a force of 5 lbs (2.25 kg) on the plunger and perpendicular to the belt span. Measure the recessing depth and compare it to Belt Tension figures. If the recessing is greater, you must tighten the belt and if the recession is less, you must loosen the belt.

To adjust the tension on the belts, loosen the bolts which hold the motor in place and then use the nut at the top to increase or decrease tension.

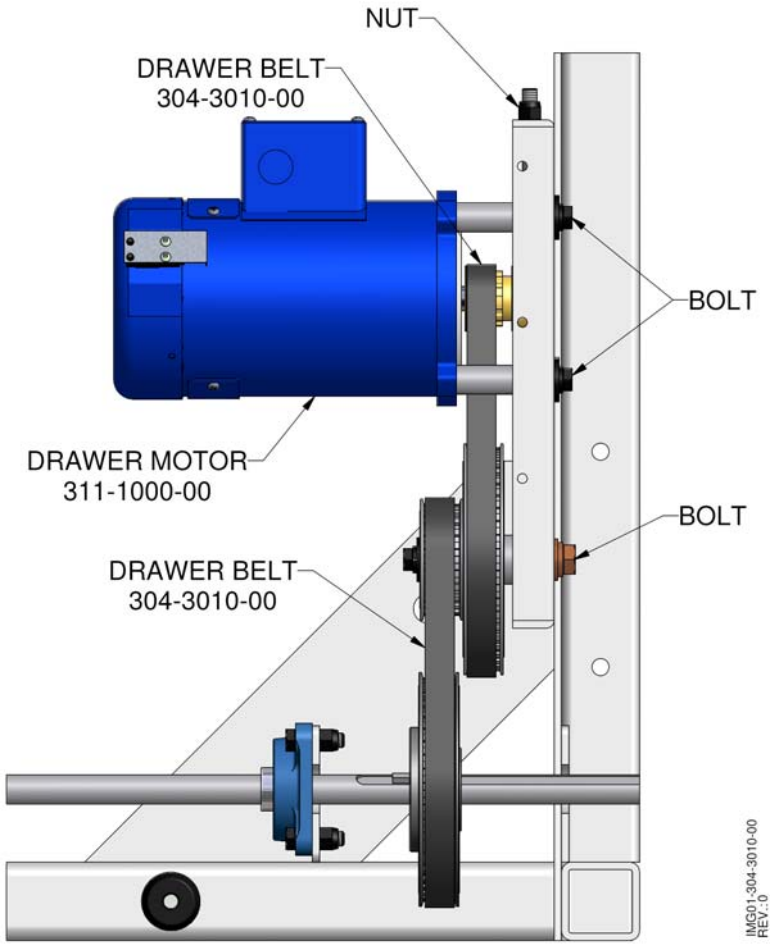


Figure 45

8F. Front Limit Actuator

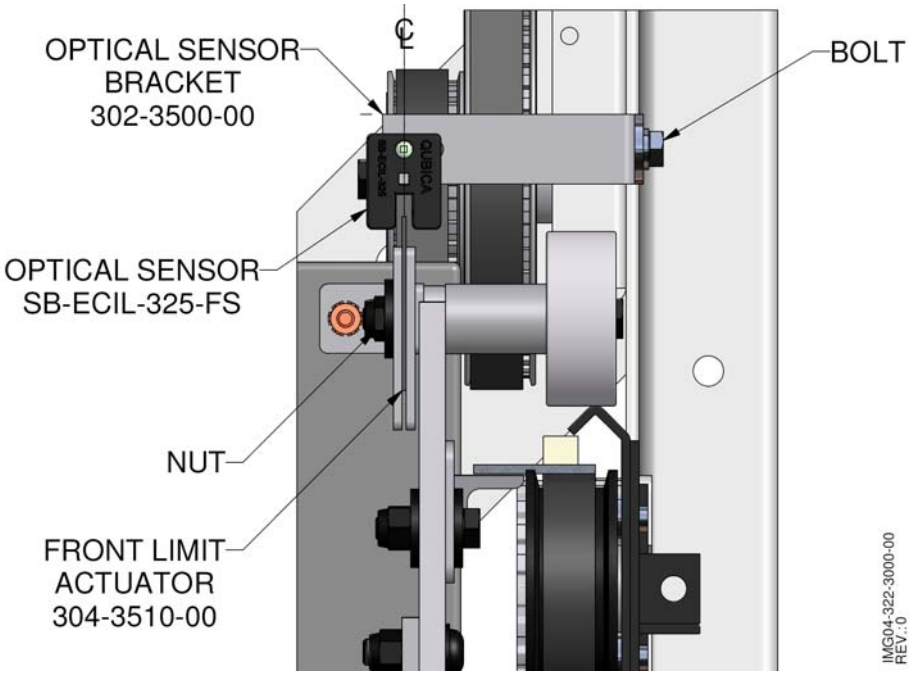


Figure 46

The drawer's front limit optical sensor must be kept centered with its actuator (304-3510-00). The front of the actuator must also be kept flush with the front of the optical sensor when the drawer is its front position. Place the drawer in its front position, loosen either the nut which holds the actuated or the bolt which holds the bracket (302-3500-00) and adjust the two until perfectly aligned.

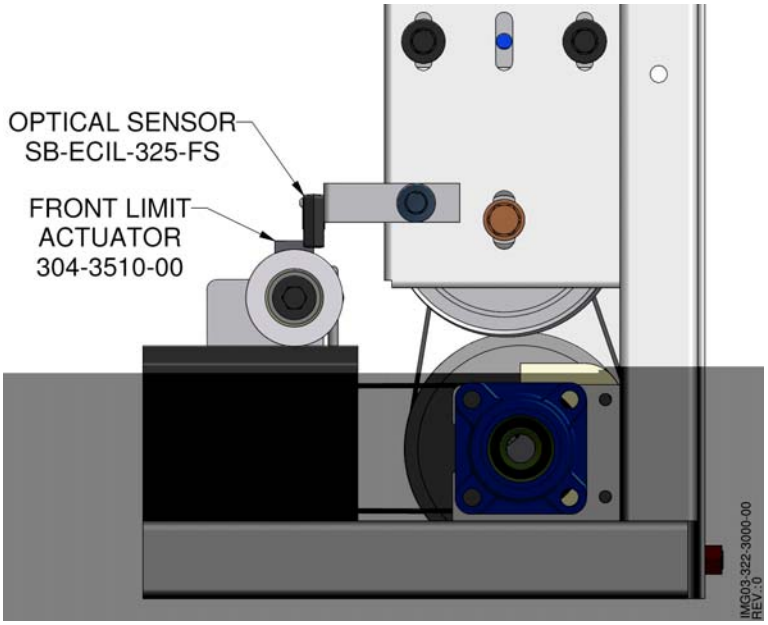


Figure 47

8G. Back Limit Actuator

The drawer's back limit optical sensor must be kept centered with its actuator (304-3530-00). Place the drawer in its rear position, loosen either the nut which holds the actuator or the bolt (7016-410632-100) which holds the sensor and adjust the two until perfectly aligned.

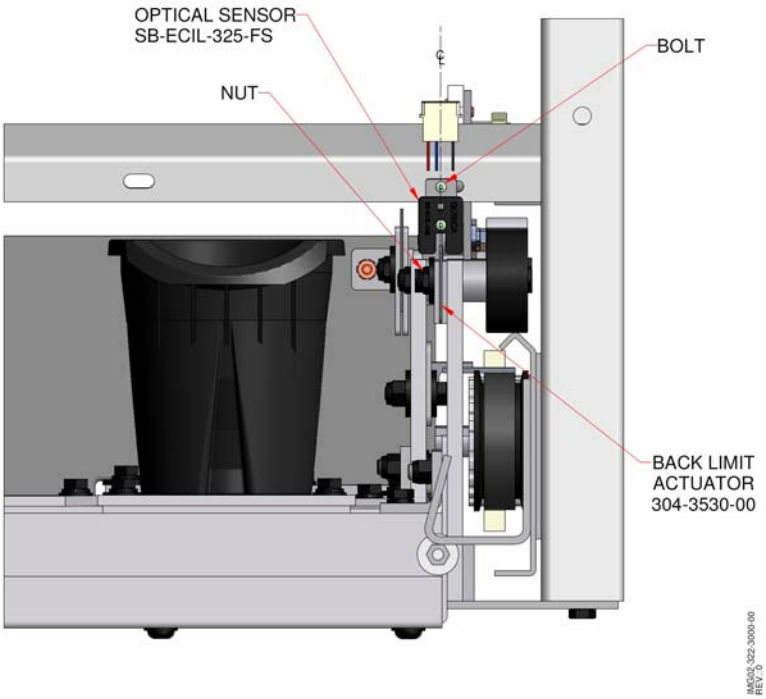


Figure 48

8H. Drawer Obstruction Opto

The drawer obstruction transmitter (SB-1500-42) and receiver (SB-1500-41) must be perfectly aligned in order to avoid unnecessary stoppages. The infrared light beam should be aligned in a manner to have the LEDs on both assemblies green. If both LEDs aren't green, loosen the screw which hold one of the assemblies in place and move it until perfectly aligned.

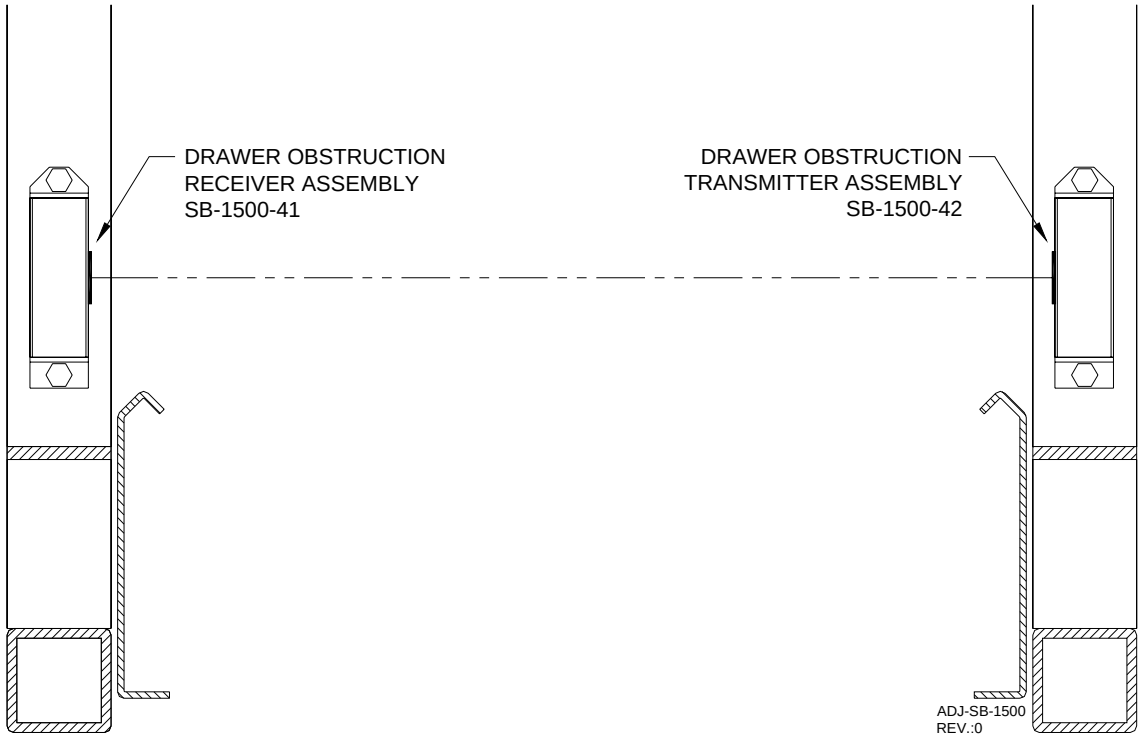


Figure 49

Drawer Maintenance Notes

Deck

9A. Wire Length

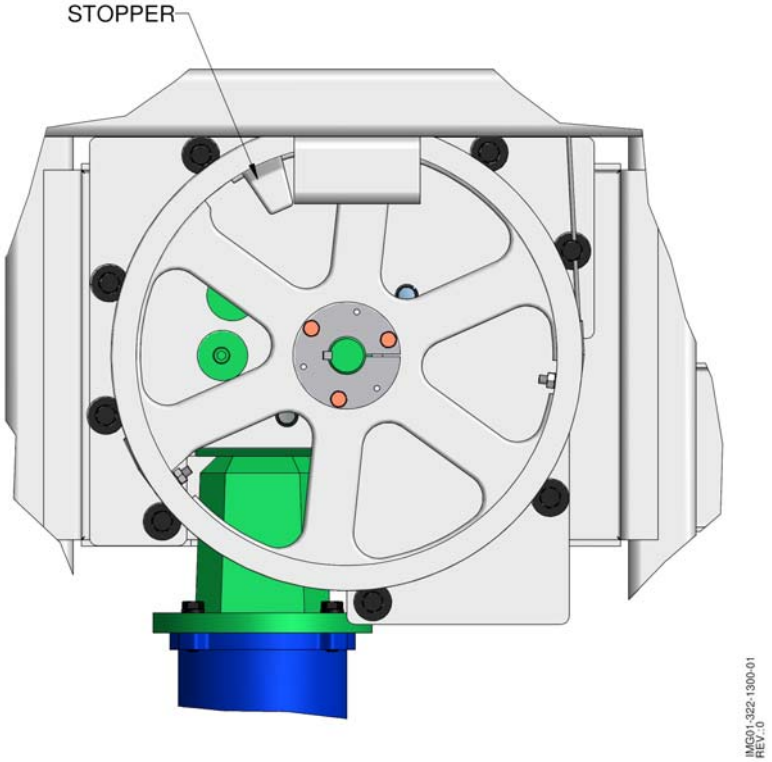


Figure 50

Using the manual deck crank (Z-ME4100), raise the deck to its maximum height and then check that the 14” (355 mm) pulley has stopped rotating due to its stopper and not due to the deck wires being too tights. This may be seen by looking at the 14” pulley from the top of the pinsetter.

If the pulley has **not** stopped due to its stopper, loosen the nylock nut(s) (7036-002520-000) which hold the deck wires in place until you can manually crank the deck all the way to the stopper. There are three such nylock nuts (one for each deck wire).

Once the pulley is held in place with the stopper, adjust the two side deck wires in the same manner as explained in the previous step until ½” (13 mm) gap is obtained between the deck column guide (303-1540-00) and the deck column’s top.

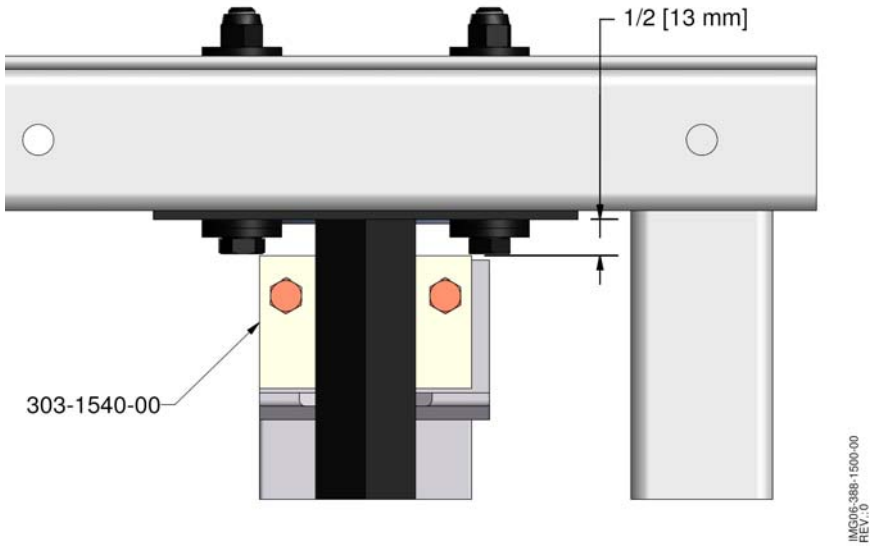


Figure 51

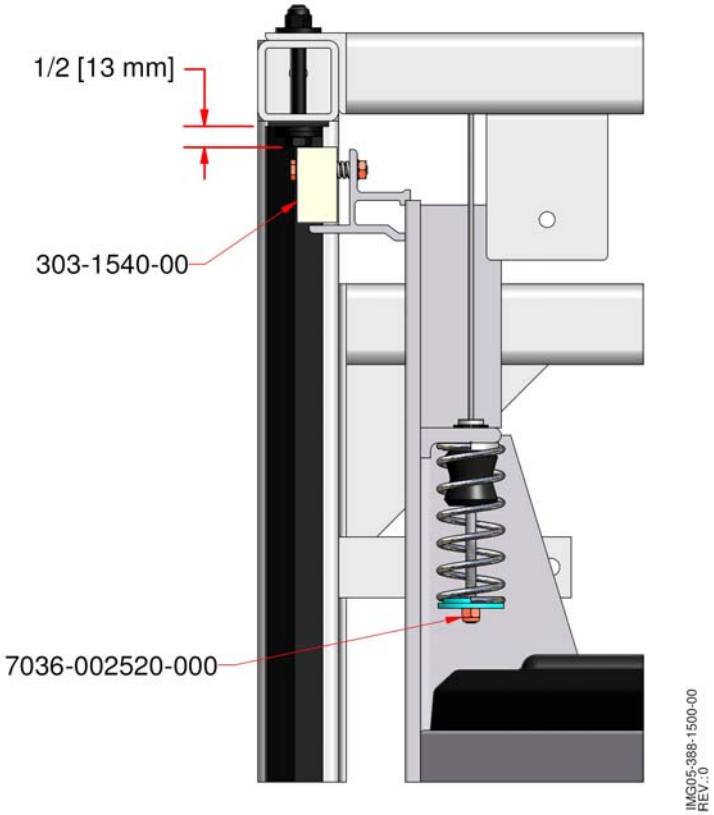


Figure 52

With the deck in its upper position, check the deck's upper limit optical sensor to ensure that it is flush with the actuator. If necessary, lower or raise the optical sensor by loosening the hexagon nut (7034-003118-000) in order to align it with the actuator (302-1610-00). Also make sure that the actuator

is at a 90° handle with the deck's column. Failure to do so will cause the optical sensor to deteriorate due to friction caused by the actuator.

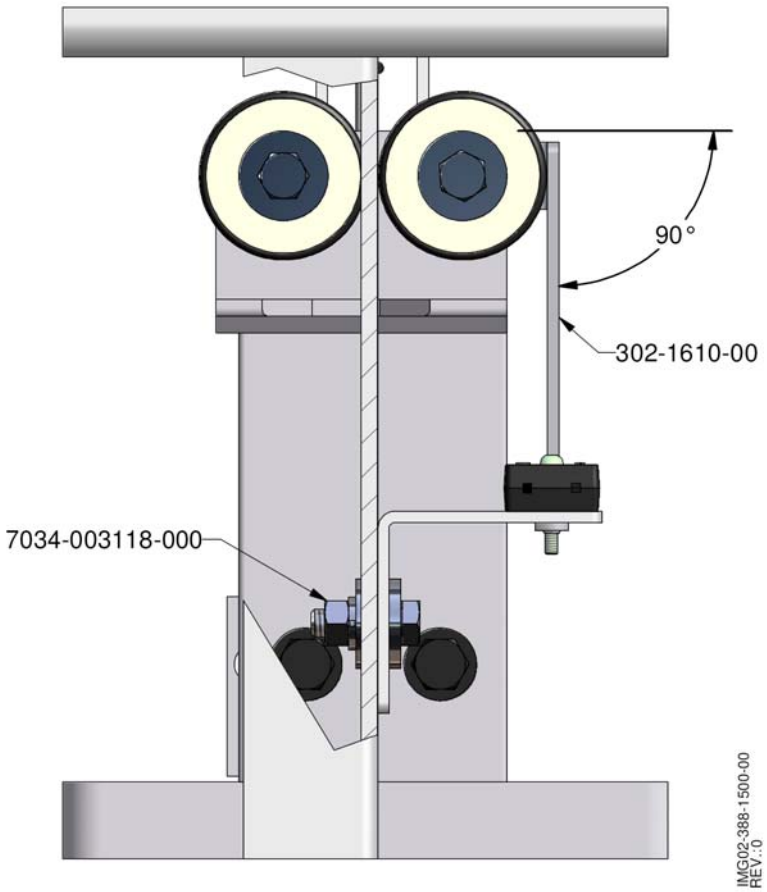


Figure 53

9B. Pin Height

Perform adjustment 9A before attemping this adjustment.

Suspend pin numbers 1, 7 and 10 from their respective positions in the deck. Using the manual deck crank (Z-ME4100), lower the deck until the base od the lowest pin is 0.020” (0.5 mm) form the lane’s pin deck.

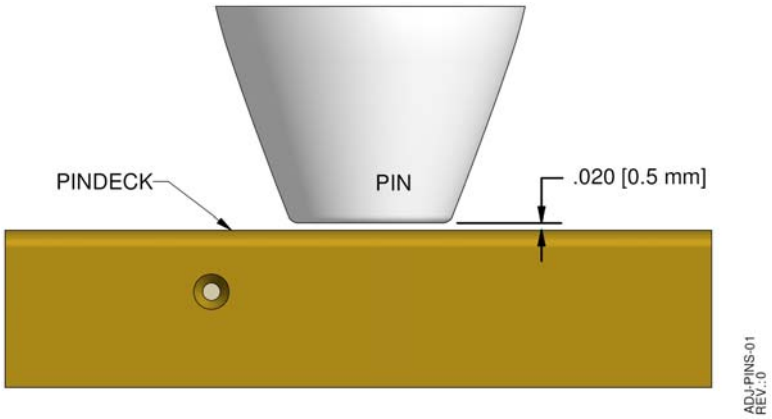


Figure 54

Place the deck parallel to the pin deck by adjusting the deck wires, as explained in 9, of the two remaining pins which are not yet at 0.020” from the lane’s pin deck.

Example: pin #7 is the lowest pin. Once pin #7 is 0.020” from the pin deck, adjust the deck’s right side wire (pin #10) until pin #10 is also 0.020” from the pin deck. Once pin #10 is 0.020” from the pin deck, adjust the deck’s front wire (pin #1) until pin #1 is also 0.020” from the deck.

9C. Bumper Height

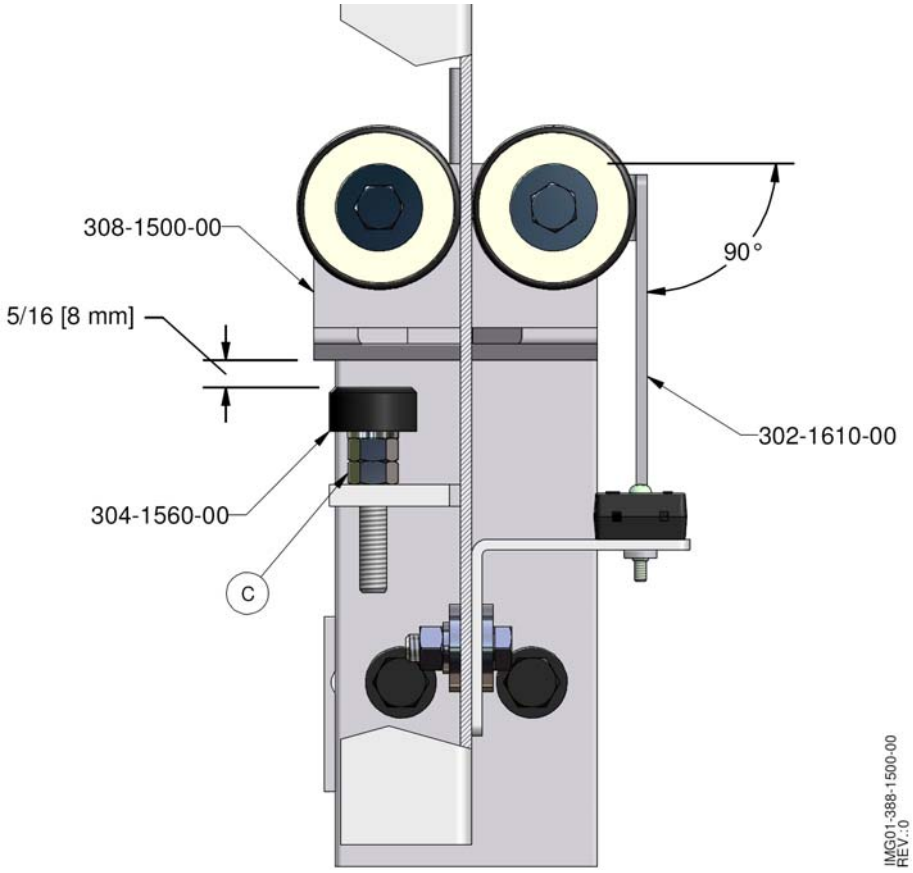


Figure 55

With all three pins 0.20” from the pin deck, the distance between each bumper (304-1560-00) and the deck frame (308-1500-00) will have to be adjusted again to 5/16" (8 mm). Loosen the lock nut which holds the bumper in place, then screw or unscrew the bumper itself until the necessary distance is obtained. Re-tighten the lock nut.

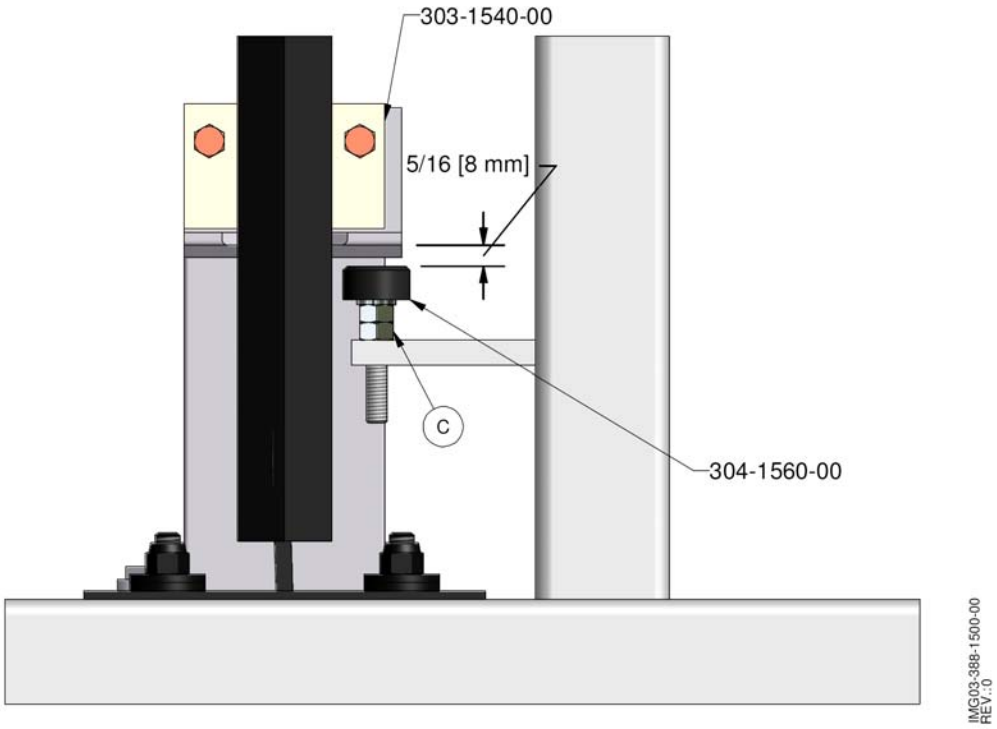


Figure 56

9D. Lower Limit Opto

Perform adjustment 9C before attempting this adjustment.

Using the manual deck crank (Z-ME4100) lower the deck until it rests on the bumpers which were adjusted in 9C. Check the deck's lower limit optical sensor to ensure that it is flush with the actuator's bottom. If necessary, lower or raise the optical sensor by loosening the hexagon nut (D) in order to align it with the actuator (302-1610-00_. Perform a deck calibration through the MAG3-IT controller once the opto has been adjusted.

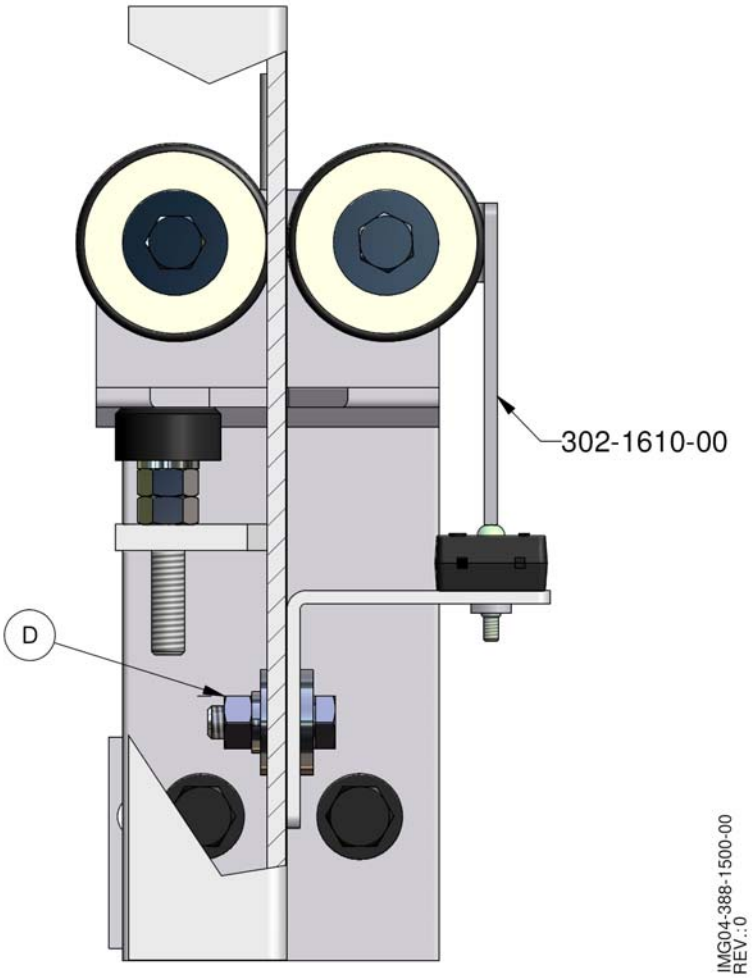


Figure 57

9E. Pin Centering Dish

The pin centering dish contains a mixture of water (60%) and radiator coolant (40%). The correct amount of liquid is crucial to the pinsetter's well functioning. Each dish contains **28.7** ounces (850 ml) of the mixture)

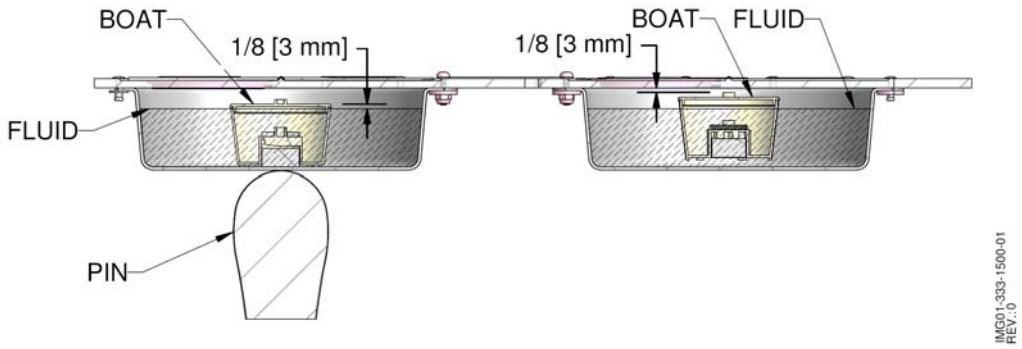


Figure 58

You may visually check the quantity of deck fluid by looking at the boat. When the boat is at the bottom of the pin centering dish (pin is present), the boat must clear the liquid by approximately 1/8" (3mm). When the boat is at the top of the pin centering dish (no pin), the boat must clear the dish cover by approximately 1/8" (3mm). Use the filler pump (Z-V538) supplied with your spare parts kit to add or remove fluid.

Manufacturer	Anti-Freeze
Exxon Co. USA	
Guld Oil Co.	
Mobile Oil Corp.	
Shell Oil Co.	
Texaco	

9F. Motor Reducer Oil Level

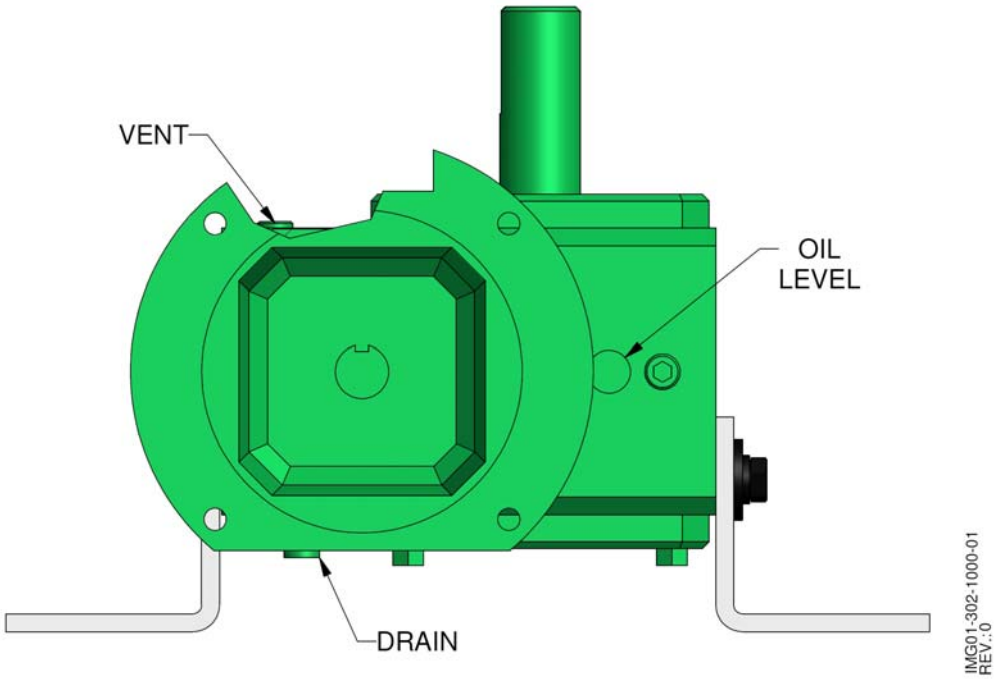


Figure 59

Check the oil level of the deck motor reducer (302-1000-00) on a semi-annual basis. If the oil level is low, add lubrication through the filler plug until it comes out the oil level plug.

At this time, also inspect the vent plug located on the deck motor reducer to ensure it is clean and operating well.

The precision-made gears and bearings in the deck motor reducer require high-grade lubricants to maintain trouble-free performance. For best results use lubricants listed in the following chart.

Deck Motor Reducer Recommended Lubricants

Manufacturer	Lubricant
Amoco Oil Co.	Cylinder Oil #680
Chevron USA, Inc.	Cylinder Oil #680X
Exxon Co. USA	Cylesstic TK-680
Gulf Oil Co.	Senate 680D
Mobile Oil Corp.	Extra Hecia Super
Shell Oil Co.	Valvata Oil J680
Sun Oil Co.	Gear Oil 8C
Texaco	650T Cylinder Oil
Union Oil Co. of California	Worm Gear Lube 140

NOTE: **Do not overfill the deck motor reducer with oil, or failure could result in damage to pinsetter or personal injury.**

9G. Oil Change

Change the oil in the deck motor reducer every 2 years. Reducer's full capacity is 26 ounces.

Deck Maintenance Notes

4. Troubleshooting

Chapter Overview

After reading this chapter you should be able to:

- Diagnose problems which arise during the use of the pinsetter.
- Effectively use the MAG3-IT Controller to locate electronic related problems.
- Use the charts at the end of this chapter to compile problems which arise in order to effectively follow-up on your maintenance program.

Troubleshooting the Qubica MAG3-IT Pinsetter is a task which has been rendered almost effortless. The MAG3-IT Controller keeps your MAG3-IT pinsetter under constant surveillance. When a problem is diagnosed by the controller, it will turn the appropriate pinsetter's fluorescent light OFF, simultaneously flash its TROUBLE light (ball 1 and ball 2 lights also if version 1.14 or later), and display a short message on the controller's corresponding pinsetter display window.

If you have a problem, always verify the following points before replacing system components as indicated on the following pages.

- Check that you have electrical power to the system; a glance at the fuse box could save you a lot of precious time.
- Make sure that the LED on the ball detector is green.
- Check that LEDs LD301, LD302, LD303 and LD304 are flashing inside your electronic power box. If not, reset it using the RESET button located on the main circuit board.
- Reset the player's console if you have automatic scoring.
- Simulate a power failure.
- Verify the relative humidity in your center. When humidity levels get too low, static electricity transported by people can build up to enormous levels. These levels can be so large that even good grounds will not stop the destruction of these static discharges. Be advised that the recommended relative humidity level for a bowling center is between 40 and 50 percent.
- Retrace the ground wire installed with your equipment all the way to the building's main ground. Never depend upon the ground installed with your outlets, since many electricians do not reliably install these grounds. ***If your equipment is not properly grounded the CPU's can literally blow their electronic chips when they receive a static electricity discharge, be it from the players or a defective part.***
- Check that all four of the pinsetter's grounding mechanisms are securely in place. The grounding mechanisms are part umbers 302-1630-00, EC-2001-G and both S-080 (on part on the pit table and one in the kickback assembly).

NOTE: **There are only two possible solutions to cabling problems. First, any one of the connectors used with the cable assembly may have become loose due to the constant vibration present in bowling facilities. Secondly, a cable may be cut or have been pinched by a foreign object. The solutions are simple, ensure that all connectors are well positioned and push down on each one to ensure its proper contact. If this fails to resolve your problem, use a multimeter to verify the cable assembly's continuity. In both cases, the schematic diagrams will be of great assistance to you in locating all the connectors concerned with the different cable assemblies and also the beginning and ending of all electric and electronic circuits.**

Regarding all problems pertaining to the carrousel's solenoids and the drawer obstruction detector, it is possible to continue with the pinsetter's normal cycle or abort the cycle. Dip switches SW301-3 and SW301-4 on the main circuit board determine how the controller will react under each situation.

Displayed Problems

Listed on the following pages, in alphabetical order, are the various “TROUBLE!” messages along with the reason for the displayed message. Following the “TROUBLE!” messages are pointers which should be verified in order to rectify the situation and return the pinsetter to its normal working condition. This section does not specify how to make adjustments or change components, but indicates what components you should verify, adjust or replace if defective. Refer to the Adjustments section in this manual if you are not familiar with its necessary adjustment(s).

NOTE: **Any trouble causing a pinsetter or pinsetters to shutdown is indicated with an asterisk (*) followed by “SHUTDOWN”. Due to the fact that the pinsetter is controlled electronically, it must always be kept in synchronization with the electronics. After having resolved the problem which caused the shutdown, the pinsetter(s) must be turned back ON and its synchronization re-established. Make sure the drawer is completely empty and perform a cold open command from the MAG3-IT Controller.**

WARNING: **The problems indicated with "SHUTDOWN" will cause the software to de-activate the necessary pinsetter components in order to rectify the situation. When this happens, the pinsetter's corresponding circuit breaker on the electronic power box must be manually opened before locating and clearing the cause of the jam. If the jam is corrected without opening the circuit breaker, the pinsetter could possibly start to cycle and might result in personal injury.**

The problems listed in this section which are not indicated by "SHUTDOWN" do not cause the software to de-activate the necessary pinsetter components. The user must press B on the MAG3-IT Controller and wait for the main motor to stop before opening the pinsetter's circuit breaker.

Ball JAM! Repair And Hit Key '1'

The door to the ball accelerator is malfunctioning. Remedy the situation and then press 1 on the MAG3-IT Controller to resume play.

- Pin(s) may be obstructing the door.
- Ball ready optical transmitter or reflector may be misaligned, disconnected, soiled or defective (adjustment 3A).
- Ball door optical sensor may be misaligned, disconnected, soiled or defective (adjustment 4F).
- Ball door clutch may be defective or need maintenance (adjustment 3E).
- Check the ball door adjustments (adjustments 4D or 4E).
- Belt used to power the ball door may need adjusting or replacing (adjustments 4B).
- 90-volt circuit board may be defective.

Ball Reflector Repair & Hit '1'

The ball ready optical transmitter used to detect a ball at the ball accelerator door has been ON for over two minutes. Remedy the situation and then press 1 on the MAG3-IT Controller to resume play.

- Ball ready optical transmitter or reflector may be misaligned, disconnected, soiled or defective (adjustment 3A).
- Object may be impeding the ball's passage.
- Input circuit board may be defective.

BREAKER SET OFF Run OPEN after!

*Shutdown! The pinsetter's breaker located on the electronic power box has been manually opened. *Introduced with version 1.18.*

- Turn the breaker back on and then perform an open command accordingly.

Carrou Answer TROUBLE!

*SHUTDOWN! A carrousel coded response to the main circuit board was lost due to a communication problem between the main circuit board and the carrousel's circuit board.

- Verify all cabling and connections between the carrousel controller and the electronic power box followed by a reset on the main circuit board.

CARR.CS/SS/PD... Repair & Hit '1'

During a start-up procedure, the optical sensors used to control the carrousel's movements were checked and found to be not correctly functioning.

- Check all of the carrousel's optical sensors (CS, SS, & PD). Make sure that each opto is correctly activated by its actuator (adjustments 6A, 6B and 6C).

Carrou NACK TROUBLE!

*SHUTDOWN! The carrousel's circuit board is no longer able to send return coded messages to the main circuit board.

- Carrousel circuit board is defective or its identification connector is misplaced.
- Main circuit board may be defective or need to be reset.

```
Carrou Reset
TROUBLE!
```

*SHUTDOWN! A RESET has been detected through the carousel's reset circuit, probably caused by a loss of electrical power to the carrousel's circuit board.

- Verify all cabling and connections between the carrousel controller and the electronic power box followed by a reset on the main circuit board.

```
Carr SCI TROUBLE
Check cabling
```

*SHUTDOWN! The main circuit board has not received a coded message in over 30 seconds from the carrousel's serial communication interface.

- Check the carrousel controller's heartbeat LED, if non-functional, RESET the carrousel controller.
- Carrousel cable assembly may be cut or unplugged from the main circuit board (E-MD92-92).

```
Deck-Drawer PH
TROUBLE-PSUPPLY
```

*SHUTDOWN! The AC drive circuit boards or one of their components has an electrical power supply problem.

- Verify the pinsetter's circuit breaker and the motor's overload.
- One or both of the drive circuit board assemblies may be defective.

```
DECK     ID:BAD
DRAWER   ID:BAD
```

An identification error was detected on the deck's DC drive or the drawer's DC drive during power up of the main circuit board.

- Verify that the cabling and the drive circuit board assemblies are intact and in their correct positions (sometimes when changing drive circuit board assemblies, they are inverted - drawer in deck's place, etc.).

```
Deck Jam
TROUBLE!
```

*SHUTDOWN! The deck is not moving according to the commands sent to it by the software.

- An object is physically impeding the deck's movement.
- If the deck is moving correctly, the deck's motor encoder is defective.

```
Deck Phase
TROUBLE!
```

*SHUTDOWN! The deck's DC drive experienced an electrical power shortage for at least two consecutive seconds.

- Deck's circuit overload.
- Deck's drive circuit board assembly or cabling.

Deck TROUBLE!

*SHUTDOWN! The deck's DC drive or one of its components is not functioning normally.

- Deck's circuit overload.
- Deck upper limit optical sensor (check its adjustment and cabling).
- Deck lower limit optical sensor (check its adjustment and cabling).
- Check the motor encoder and its cabling. The encoder could be loose on the motor's shaft and is not rotating at the same speed as the motor itself or the cabling could be loose or disconnected.
- Check the detection plate foams. If they have absorbed deck fluid which has leaked, they will constantly signal the deck to stop on its way down. The electronics will not have the time to read an out of range, and it will display "Deck Trouble."

Deck TROUBLE (Spi. Comm.)

*SHUTDOWN! The deck's DC drive experienced a communication problem or glitch with the electronic power box.

- There is nothing physically wrong with the pinsetter or its components, but you should advise Qubica or one of its accredited distributors of the situation.

Drawer No Front TROUBLE!

*SHUTDOWN! The drawer was unable to detect its front limit optical sensor.

- Check the optical sensor's adjustment and cabling (adjustment 8F).
- Check the optical sensor's actuator to ensure that it is not bent out of shape.

Drawer Obstruct TROUBLE!

*SHUTDOWN! A pin remained in the drawer after having loaded the deck and was detected by the drawer obstruction optical transmitter & drawer obstruction optical receiver. Once the deck is loaded and the drawer returns to its REAR position it should always be empty. ***This message will only appear if dip switch 301-4 is ON.***

- If there are no pins located in the drawer, verify the drawer obstruction transmitter and receiver along with its cabling (adjustment 8H).
- If there are pins in the drawer, check that the pins in question have no defaults which would cause them to stay stuck in the pin cups.
- Check the deck height (adjustment 9A) and make sure that none of the wires have frayed or broken.

Drawer Phase TROUBLE!

*SHUTDOWN! The drawer's DC drive experienced an electrical power shortage for at least two consecutive seconds.

- Drawer's circuit overload.
- Reset the main circuit board.
- Drawer's drive circuit board assembly or cabling.

```
Drawer Pin Jam
TROUBLE!
```

*SHUTDOWN! The drawer is not moving according to the commands sent to it by the software.

- An object is physically impeding the drawer's movement.
- Check the motor encoder and its cabling. The encoder could be loose on the motor's shaft and is not rotating at the same speed as the motor itself or the cabling could be loose or disconnected.

```
Drawer TROUBLE!
```

*SHUTDOWN! The drawer's DC drive or one of its components is not functioning normally.

- Drawer's circuit overload.
- Drawer back limit optical sensor (check its adjustment and cabling).
- Drawer front limit optical sensor (check its adjustment and cabling).
- Check the motor encoder and its cabling. The encoder could be loose on the motor's shaft and is not rotating at the same speed as the motor itself or the cabling could be loose or disconnected.
- Reset the main circuit board.
- Drawer's drive circuit board assembly or cabling.

```
Drawer TROUBLE!
(Spi. Comm.)
```

*SHUTDOWN! The deck's DC drive experienced a communication problem or glitch with the electronic power box.

- There is nothing physically wrong with the pinsetter or its components, but you should advise Qubica or one of its accredited distributors of the situation.

```
DW OBST   2)Stop
Move PIN &->1)Go
```

*SHUTDOWN! A pin remained in the drawer after having loaded the deck and was detected by the drawer obstruction optical transmitter & drawer obstruction optical receiver. Once the deck is loaded and the drawer returns to its REAR position it should always be empty. ***This message will only appear if dip switch 301-4 is OFF*.**

- Remove the pins from the drawer and press **1** on the MAG3-IT Controller.
  OR
- Press **2** on the MAG3-IT Controller and refer to "Drawer Obstruct TROUBLE!".
- If there are no pins located in the drawer, verify the drawer obstruction transmitter and receiver (adjustment 8H) along with its cabling.
- If there are pins in the drawer, check that the pins in question have no defaults which would cause them to stay stuck in the pin cups.

```
Elevator JAM!
1)Go     2)Stop
```

The pin elevator is no longer able to move. Remedy the situation and then press **1** on the MAG3-IT Controller to resume play. If more than thirty seconds pass before **1** is pressed, the main motor will be powered off. ***Introduced with version 1.16 in order to reduce the number of pins being chewed up by the conveyor belt's constant movement, this message will only appear if dip switch 301-5 is OFF.***

- Pin(s) may be obstructing its movement.
- Pin elevator's optical sensor may be misaligned or defective (adjustment 5H).
- Pin elevator's clutch may be defective or need maintenance (adjustment 5G).
- Check all of the pin elevator's adjustments.
- Output circuit board may be defective.

```
Elev.JAM! Repair
And Hit Key '1'
```

The pin elevator is no longer able to move. Remedy the situation and then press 1 on the MAG3-IT Controller to resume play. *Beginning with version 1.16, this message will only appear if dip switch 301-5 is ON.*

- Pin(s) may be obstructing its movement.
- Pin elevator's optical sensor may be misaligned or defective (adjustment 5H).
- Pin elevator's clutch may be defective or need maintenance (adjustment 5G).
- Check all of the pin elevator's adjustments.
- Output circuit board may be defective.

```
Main Motor Flag
Call Down...
```

*SHUTDOWN! The pinsetter's motor was shut off and the sweep moved without the pinsetter's motor being on. This error should never occur unless there is a conflict between simultaneous commands sent through the Qubica Automatic Scoring Player Console and the MAG3-IT Controller.

- Do not send commands to the pinsetter through the MAG3-IT Controller if the pinsetter is operating normally under regular bowling conditions.

```
OOR:PIN IN DECK?
Yes)1(dump) No)2
```

The out of range detector has determined that one or more pins are out of range. The operator must signal to the MAG3-IT Controller whether or not one or more pins have been picked up by the deck. After having done this,

```
OUT OF RANGE
1)PSET   2)FSET
```

the following will be displayed:

One or more pins are out of range, the operator is presented two choices:

Remove all deadwood from the pin deck and then press 1 on the MAG3-IT Controller (the "Move Sweep Up" display will appear asking you to lift the sweep and then press "1" to resume play) .

```
Move Sweep UP
And Hit Key '1'
```

OR

- Press **2** on the MAG3-IT Controller in order to have the pinsetter perform a FULL SET.
- If no pins are out of range, check that the detector is functioning normally and that its cabling circuit is complete.
- Check the insulation foams to make sure that they are in place and have not been altered or deteriorated.
- Verify the brass screws which make contact with the detection plate to ensure that they have not come loose.
- Check the fluid level in the pin centering dish (adjustment 9E).

```
OPEN TROUBLE
(Pins in Drawer)
```

*SHUTDOWN! During an OPEN cycle, one or more pins were detected in the drawer's row of 7. ***This message will only appear if the version on the E-MD92-92 circuit board is older than 1.16.***

- Check the drawer to ensure that it is closed (in its rear position).

```
Pin Elev.JAM!
1)Go     2)Stop
```

For some reason, the carrousel is unable to pick up pins from the elevator. Remedy the situation and then press **1** on the MAG3-IT Controller to resume play. If more than thirty seconds pass before **1** is pressed, the main motor will be powered off. ***Introduced with version 1.16 in order to reduce the number of pins being chewed up by the conveyor belt's constant movement, this message will only appear if dip switch 301-5 is OFF.***

- Make sure that all of the pins have a magnet in their head.
- Verify all of the carrousel's adjustments (6A to 6I).

```
Pin Elev.Repair
And Hit Key '1'
```

For some reason, the carrousel is unable to pick up pins from the elevator. Remedy the situation and then press **1** on the MAG3-IT Controller to resume play. ***Beginning with version 1.16, this message will only appear if dip switch 301-5 is ON***

- Make sure that all of the pins have a magnet on their head.
- Verify all of the carrousel's adjustments (6A to 6I).

```
Power Failure
DETECTION
```

*SHUTDOWN! During the pinsetter's normal operation, a power failure occurred.

- There is no problem, this message is used for your information only so as not to waste time looking for a problem when there is none.

```
Remove DRAW.Pin
Move Draw.BACK!
```

*SHUTDOWN! During an OPEN cycle, one or more pins were detected in the drawer's row of 7. ***This message will only appear if the version on the E-MD92-92 circuit board is 1.16 or later. This new version obliges the user to place the drawer in its back limit optical sensor in order to clear the trouble message.***

- Check the drawer to ensure that it is closed (in its rear position).
- Reset the main circuit board.

NOTE: **The following four (4) troubleshooting messages pertaining to the solenoids may be caused by physically removing pins from the magazine while the pinsetter is running. NEVER REMOVE PINS FROM THE MAGAZINE WHILE THE PINSETTER IS RUNNING. Version 1.17 introduced the possibility of removing pins from the magazine when the pinsetter is turned OFF, but when the pinsetter is running the same rule of not removing pins from the magazine remains.**

```
Sole.(_)  Carrou
1)Go      2)Stop
```

*SHUTDOWN! One of the solenoids used to deposit the pins from the carrousel into the magazine is not functioning correctly. (the number of the defective solenoid will appear between the parentheses). ***This message will only appear if dip switch 301-3 is OFF.***

- Press **1** on the MAG3-IT Controller in order to continue the cycle. ***OR***
- Press **2** on the MAG3-IT Controller in order to stop the cycle. Doing so will display the "Solenoids Carrou TROUBLE!" message.

```
Sole.(_)   Rack
1)Go      2)Stop
```

*SHUTDOWN! One of the solenoids used to deposit the pins from the magazine into the drawer is not functioning correctly. (the number of the defective solenoid will appear between the parentheses). ***This message will only appear if dip switch 301-3 is OFF.***

- Press **1** on the MAG3-IT Controller in order to continue the cycle. ***OR***
- Press **2** on the MAG3-IT Controller in order to stop the cycle. Doing so will display the "Solenoids Rack TROUBLE!" message.

```
Solenoids Carrou
TROUBLE!     (_)
```

*SHUTDOWN! One of the solenoids used to deposit the pins from the carrousel into the magazine is not functioning correctly. (the number of the defective solenoid will appear between the parentheses).

- Defective solenoid.
- Solenoid cam adjustment (6E).
- Check the cable connectors on the carrousel controller.
- Detection bar assembly may have a defective reed switch or may need adjusting (adjustment 7D).
- Check all carrousel mechanical adjustments (adjustments 6A to 6I).

- Check all of the pin loaders to make sure that non of them are defective.
- Check the corresponding magazine station assembly to ensure that it is functioning correctly (adjustments 7A and 7B).
- Defective carrousel controller circuit board.

Solenoids Rack TROUBLE! (_)

*SHUTDOWN! One of the solenoids used to deposit the pins from the magazine into the drawer is not functioning correctly. (the number of the defective solenoid will appear between the parentheses).

- If the pin is still present in the magazine, the solenoid or the mechanics used to deposit the pin is (are) defective (adjustems 7A and 7B).
- If there is no pin in the magazine, the reed switch is defective or the mechanical procedure of dumping is taking too long for the electronics (this is usually caused by a weak solenoid). Refer to adjustment 7D.
- Check all carrousel mechanical adjustments.

Sweep Jam TROUBLE!

*SHUTDOWN! The sweep is taking more than 5 seconds to perform a front to back movement or a back to front movement.

- Object(s) may be obstructing its movement (check also the other components such as the carrousel and pin elevator since they are all powered by the same motor and pulley system - one blockage could cause another).
- Sweep's magnetic clutch is slipping or defective (adjustment 2J).
- Sweep's forward position optical sensor is misaligned or defective (adjustment 2K).
- Sweep's up position optical sensor is misaligned or defective (adjustment 2I)
- Check all remaining sweep mechanical adjustments.

USER TROUBLE Source!

*SHUTDOWN! Message which appears when the **B** button is pressed on the MAG3-IT Controller by the operator signaling a forced stoppage.

- Restart the pinsetter when desired using a COLD OPEN.

Non-Displayed Problems

There are a few problems, which due to their nature, are impossible for the MAG3-IT Controller to diagnose. These problems are listed on the following pages and should be read thoroughly in order to fully understand the importance of a regular maintenance program. The order in which solutions are listed is the order in which they should be performed.

NOTE: **Although the MAG3-IT Controller does not detect the problems listed below, it may still be used to help locate the problem. By sending a command to the component, the electronics may be verified through the various LEDs located on the electronic circuit boards. If the electronics is functioning, the component or its wiring is defective. If the electronics is not functioning, replace the necessary circuit board.**

There is no display on the MAG3-IT Controller.

- Check the main service circuit breaker and the electronic power box circuit breaker to ensure that they are ON.
- Check the cabling which connects the MAG3-IT Controller to the electronic power box.
- Reset the main circuit board.
- Replace the MAG3-IT Controller.

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

- Check the ball detector's adjustment.
- Check the camera assembly cabling which includes the ball detectors.
- Reset the main circuit board.
- Replace the 24-volt output circuit board.

A non-signaled elevator jam occurs immediately following a power on.

- Check the pin elevator running optical sensor. It may be improperly aligned with the wheel actuator, disconnected or defective.

The carrousel does not drop its pins into the drawer's magazine.

- Check all of the carrousel's optical sensors (CS, SS, & PD). Make sure that each opto is correctly activated by its actuator (adjustments 6A, 6B and 6C).

The sweep performs the wrong motions at the wrong time such as sweeping pins when it should simply move to its upper position.

- The sweep's optical sensor's actuators need adjusting (adjustments 2H and 2I).

The pinsetter cycles when it shouldn't.

- Check the ball detector's adjustment.
- Check the camera assembly cabling which includes the ball detectors.
- Reset the main circuit board, if this does not rectify the problem, replace the main circuit board.

The pinsetter re-spots ten new pins when it should spot the remaining pins for a second ball situation.

- Perform the camera adjustment if you are equipped with the SB-6400 model Cameras.
- Reset the main circuit board, if this does not rectify the problem, replace the main circuit board.

The camera misreads or misses the 7-pin on lane #1 or the 10-pin on lane #2. This problem will only arise with the SB-6400 model Camera.

- Perform the camera adjustment.
- Replace the camera circuit board.

Ball Accelerator Motor is not functioning

- Check the circuit's overload on the front of the electronic power box.
- Check that the LED on the AC Drive Circuit board is ON. If it is OFF, replace the board, if it is ON, plug the motor directly into a 220VAC electrical outlet to verify it. If the motor functions, verify all wiring from the electronic power box, if the motor does not function, replace it.

Fluorescent light does not turn on.

- Check the circuit's overload on the front of the electronic power box.
- Replace the fluorescent tube.
- Replace the ballast.
- Check the fluorescent light cable assembly.
- Replace the 90-volt output circuit board if your fluorescent lights are controlled through this board (North American market).

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

- Check the circuit's overload on the front of the electronic power box.
- Replace the ball 1/2 light bulb(s).
- Check the ball 1/2 cable assembly.
- Replace the 24-volt output circuit board.

Trouble light does not turn on.

- Check the circuit's overload on the front of the electronic power box.
- Replace the trouble light bulb.
- Check the trouble light cable assembly.
- Replace the 24-volt output circuit board.

Ball return's power lift isn't functioning.

- Check the main service circuit breaker to ensure that it is ON. Don't forget that the ball lift motor does not receive its electrical power from the same source as the pinsetter but is on another circuit breaker.
- Check the circuit's overload on the front of the electronic power box.
- Check the 24-volt relay located inside the ball return's power box.
- Check the ball return cable assembly.
- Replace the 24-volt output circuit board.

The following problems regarding the foul lights should be considered only if you are **not** equipped with automatic scoring. If you are equipped with automatic scoring, refer to your automatic scoring manual.

The foul light does not signal a foul when it should.

- Check the foul light's adjustment.
- Check the foul light assembly's cabling.
- Replace the foul light circuit board.
- Replace the main circuit board.

The foul light constantly signals a foul.

- Check the foul light's adjustment.
- Foul light castings are misplaced or need cleaning.
- Check the foul light assembly's cabling.
- Replace the foul light circuit board.
- Replace the main circuit board.

Troubleshooting Notes

Mechanic's Troubleshooting Report

Bowling Center Name & Location _____ Lane Number _____

DATE	DISPLAYED PROBLEMS	OTHER PROBLEMS	SOLUTIONS

Manager's Monthly Troubleshooting Report

Bowling Center Name & Location _____ Month Ending _____

DISPLAYED PROBLEMS	TOTAL	COMMENTS
BALL JAM! REPAIR AND HIT KEY '1'		
BALL REFLECTOR REPAIR & HIT '1'		
BREAKER SET OFF RUN OPEN AFTER!		
CARROU ANSWER TROUBLE!		
CARR.CS/SS/PD... REPAIR & HIT '1'		
CARROU NACK TROUBLE!		
CARROU RESET TROUBLE!		
CARR SCI TROUBLE		
DECK-DRAWER PH TROUBLE-PSUPPLY		
DECK ID:BAD DRAWER ID:BAD		
DECK JAM TROUBLE!		
DECK PHASE TROUBLE!		
DECK TROUBLE!		
DECK TROUBLE! (SPI COMM.)		
DRAWER NO FRONT TROUBLE!		
DRAWER OBSTRUCT TROUBLE!		
DRAWER PHASE TROUBLE!		
DRAWER PIN JAM TROUBLE!		
DRAWER TROUBLE!		
DRAWER TROUBLE! (SPI COMM.)		
DW OBST 2)STOP MOVE PIN &->1)GO		
ELEV.JAM! REPAIR AND HIT KEY '1'		

MAG3 pinsetter - manager's monthly troubleshooting report

Bowling Center Name & Location | Month Ending

DISPLAYED PROBLEMS	TOTAL	COMMENTS
Main Motor Flag Call Down...		
OOR:PIN IN DECK? Yes)1(dump) No)2		
OPEN TROUBLE (Pins in Drawer)		
Pin Elev! Repair And Hit Key '1'		
Power Failure DETECTION		
Remove DRAW.Pin Move Draw.BACK!		
Solenoids Carrou TROUBLE! (1)		
Solenoids Carrou TROUBLE! (2)		
Solenoids Carrou TROUBLE! (3)		
Solenoids Carrou TROUBLE! (4)		
Solenoids Carrou TROUBLE! (5)		
Solenoids Carrou TROUBLE! (6)		
Solenoids Carrou TROUBLE! (7)		
Solenoids Rack TROUBLE! (1)		
Solenoids Rack TROUBLE! (2)		
Solenoids Rack TROUBLE! (3)		
Solenoids Rack TROUBLE! (4)		
Solenoids Rack TROUBLE! (5)		
Solenoids Rack TROUBLE! (6)		
Solenoids Rack TROUBLE! (7)		
Sweep Jam TROUBLE!		

5. Wiring Diagrams & Schematics

The Qubica MAG3-IT Pinsetter is supplied to operate on 240 volts, 50/60 cycles, single phase. The Qubica Ball Return may be supplied to operate on 240 volts, 50/60 cycles, single phase or 120 volts, 60 cycles, single phase. The electrical supply lines must conform to all electrical codes and it is the responsibility of the proprietor to supply power to all the electrical components necessary for the normal function of the pinsetters.

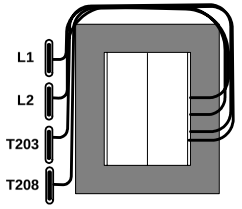
A power supply line is run from the main service circuit breaker distribution panel to a junction box mounted on the rear curtain wall, above each even numbered pinsetter. From each junction box, a three conductor drop cord (2-wires plus an ***insulated ground***), terminating in a twist lock connector, is plugged into the electronic power box of each pair of pinsetters to supply the electrical power necessary. All of the pinsetter's components are controlled through the electronic power box which is connected to the manager's control panel located at the front desk.

A separate power supply line is run from the main service circuit breaker distribution panel to each ball return's power box located under the approach, below each ball return rack. From each ball return's motor, a three conductor power cord (2-wires plus an ***insulated ground***), terminating in a twist lock connector, is plugged into the power box.

WARNING: If the electrical supply lines in your bowling center are 208 volts, your electronic power boxes have been modified by the accredited Qubica technicians who installed the pinsetters. The wiring modifications concern the transformers and all 4 DC Drive Circuit Board Assemblies. Although all wiring diagrams in this manual assume that the electrical supply lines are 240 volts, variations may occur due to this modification. Refer to the wiring diagrams under the Transformers section of this chapter for the wiring modifications and note them on each wiring plan concerned for future reference on your part.

230VAC
WIRING

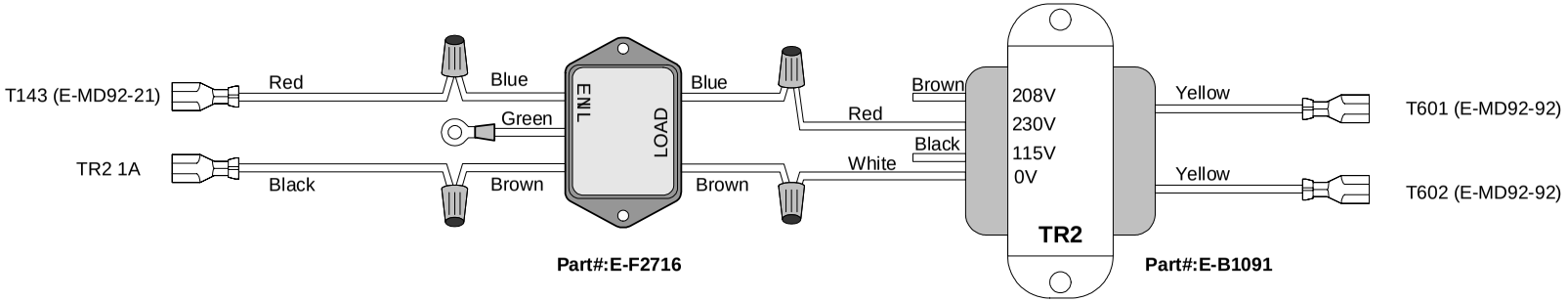
L1 - White
L2 - Red
T203 - Black
T208 - Yellow



Part#:E-HDC40F

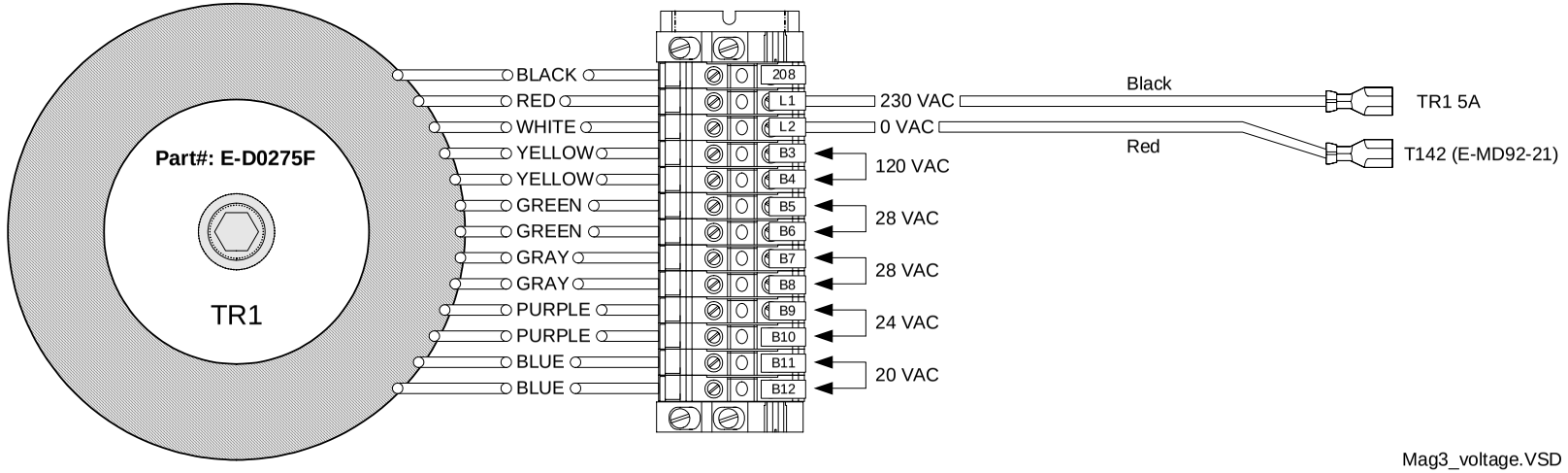
DC DRIVE OPERATING VOLTAGE SELECTOR

SB-308-7110-10
SB-308-7100-10



Part#:E-F2716

Part#:E-B1091



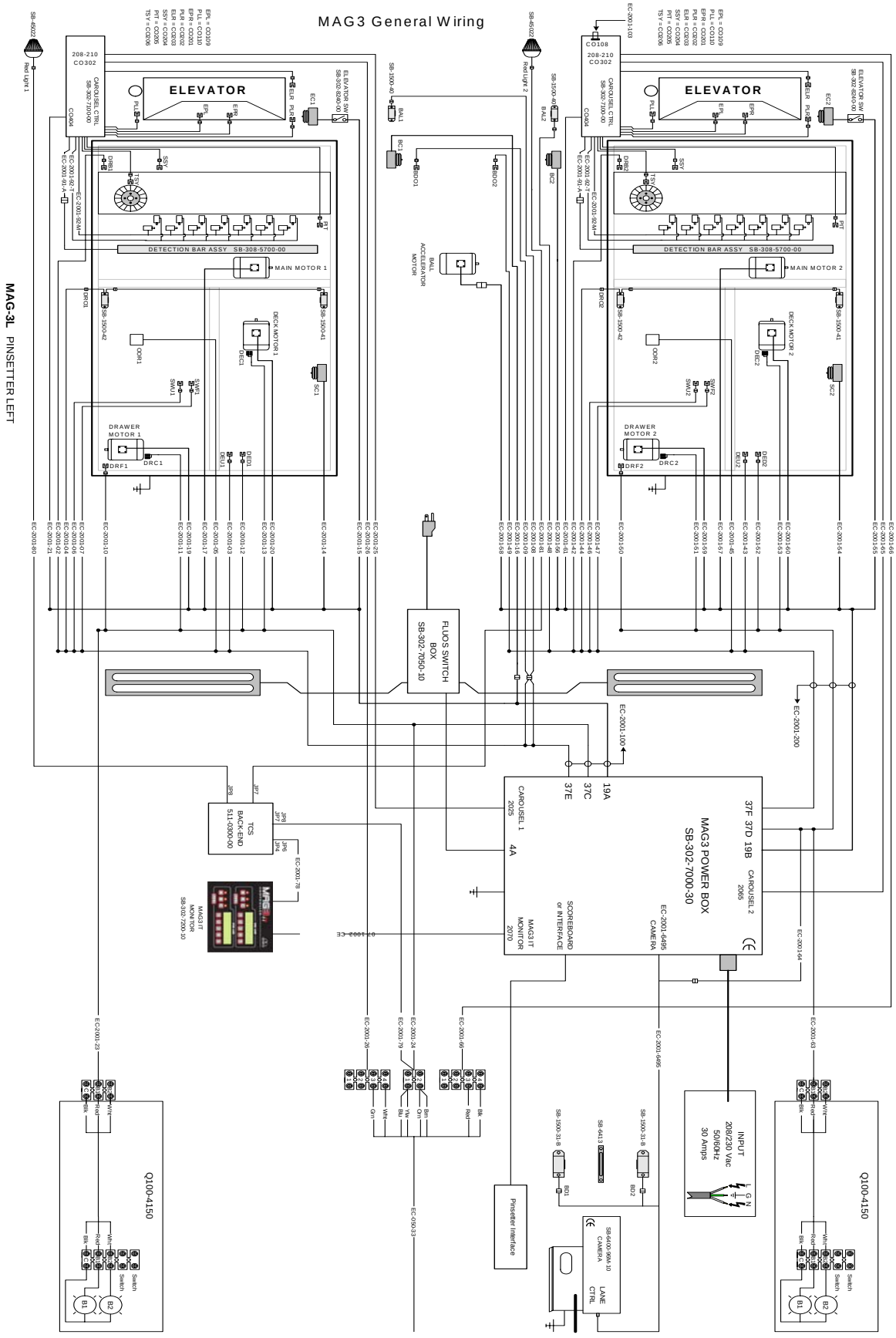
Mag3_voltage.VSD

Cable Assemblies

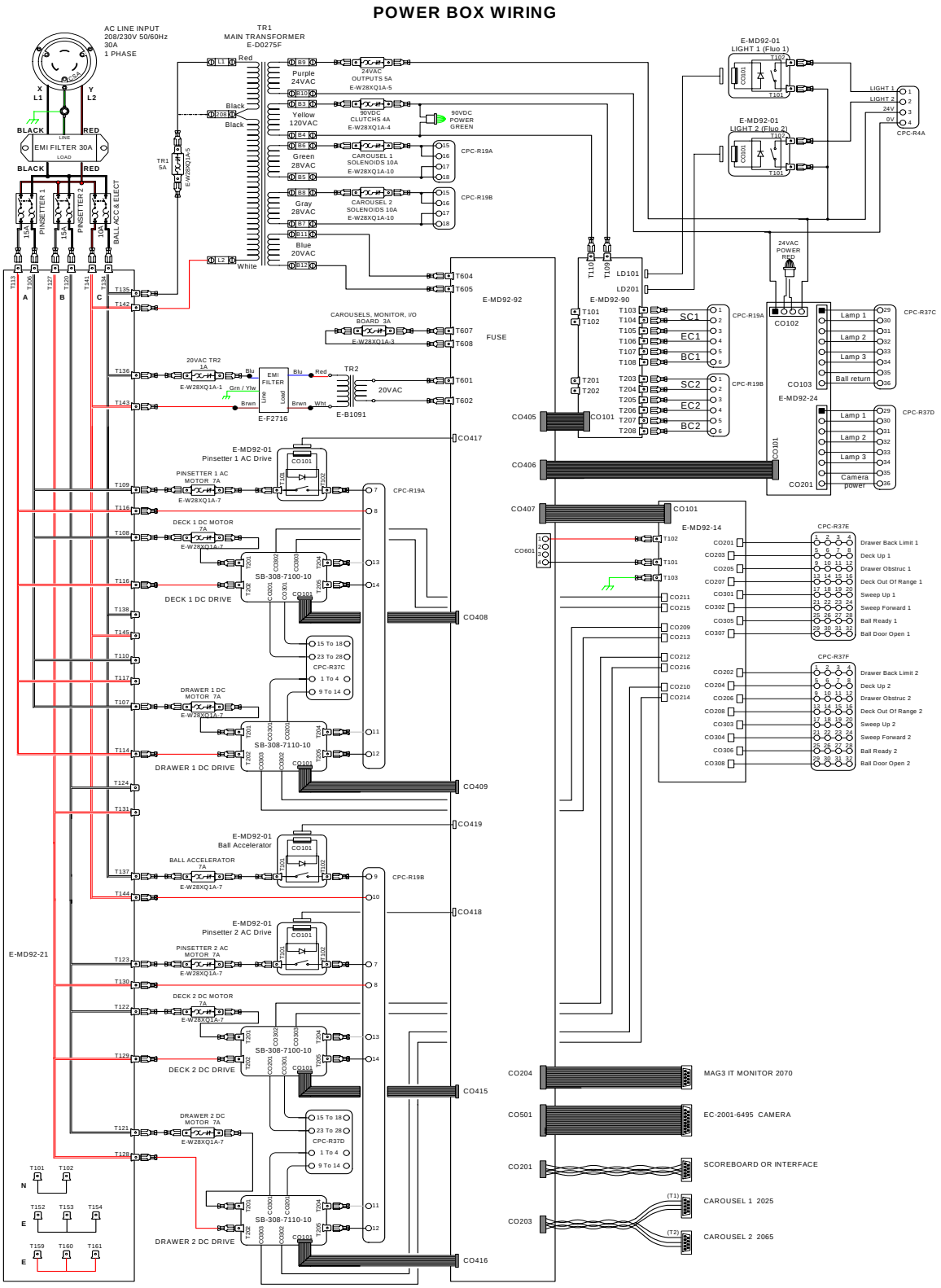
The cable assemblies used with the MAG3-IT pinsetter, as with all other Qubica products, are all hand-made and individually tested in order to ensure their continuity. In addition to their precision quality, the cable assemblies may be easily removed and replaced due to their plug compatible characteristics.

As a matter of fact, each cable assembly may only be plugged into one receptacle, which matches the pin-out of the cable assembly. In cases where the pin-out and receptacle are identical, the length of the cable assembly will help determine its location. The electronic power box, being positioned on the even-numbered pinsetter, uses longer cable assemblies in order to reach the odd-numbered pinsetter.

The figure below illustrates a complete pair of pinsetters and their accessories with all the cable assemblies used to communicate between the different components.

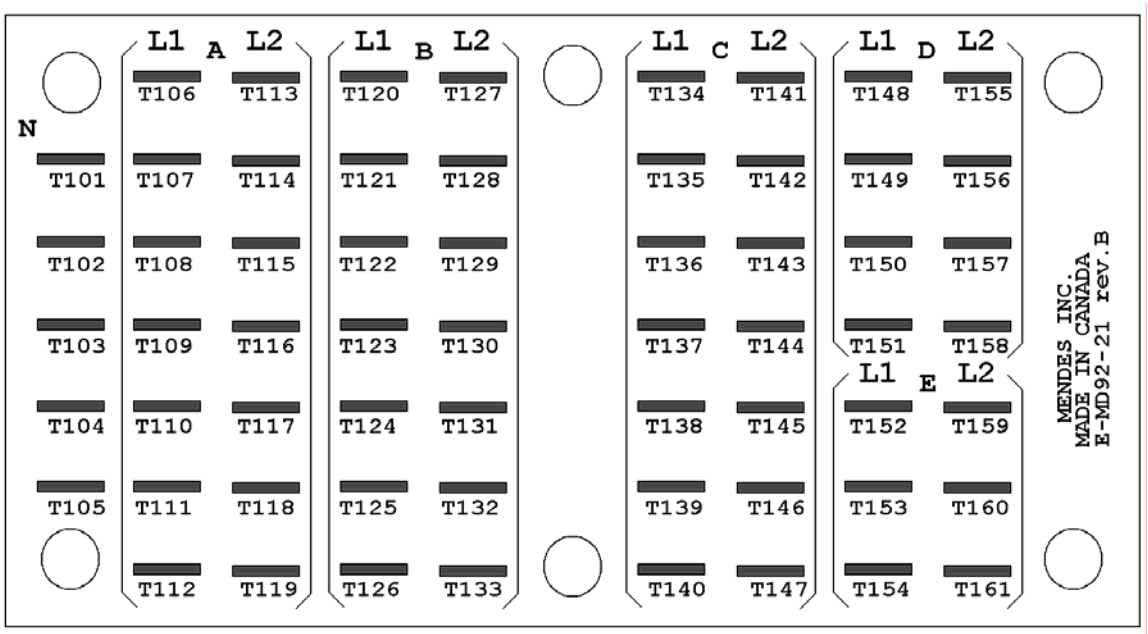


Power Box Wiring Diagrams



Terminal Circuit Board

The terminal circuit board is used to distribute the high voltage electrical power from the twist lock plug to the pinsetter's different components through a multitude of terminal connectors.



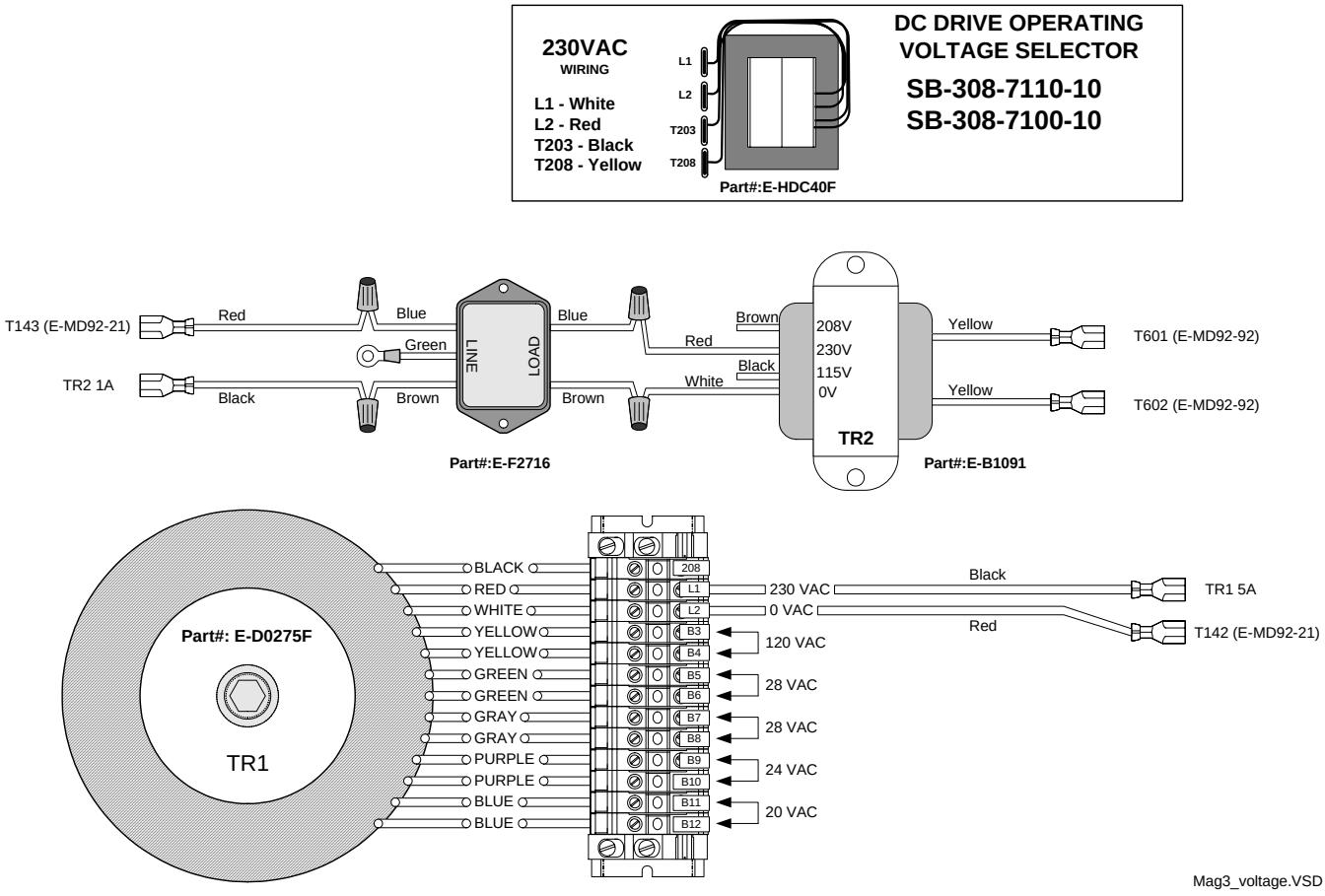
No wiring diagram of the Terminal Circuit Board is presented due to the fact that it appears in almost every other wiring diagram with its corresponding terminal connections.

Transformers

Various transformers are used to convert variations of electrical current in a primary circuit into variations of voltage and current in a secondary circuit.

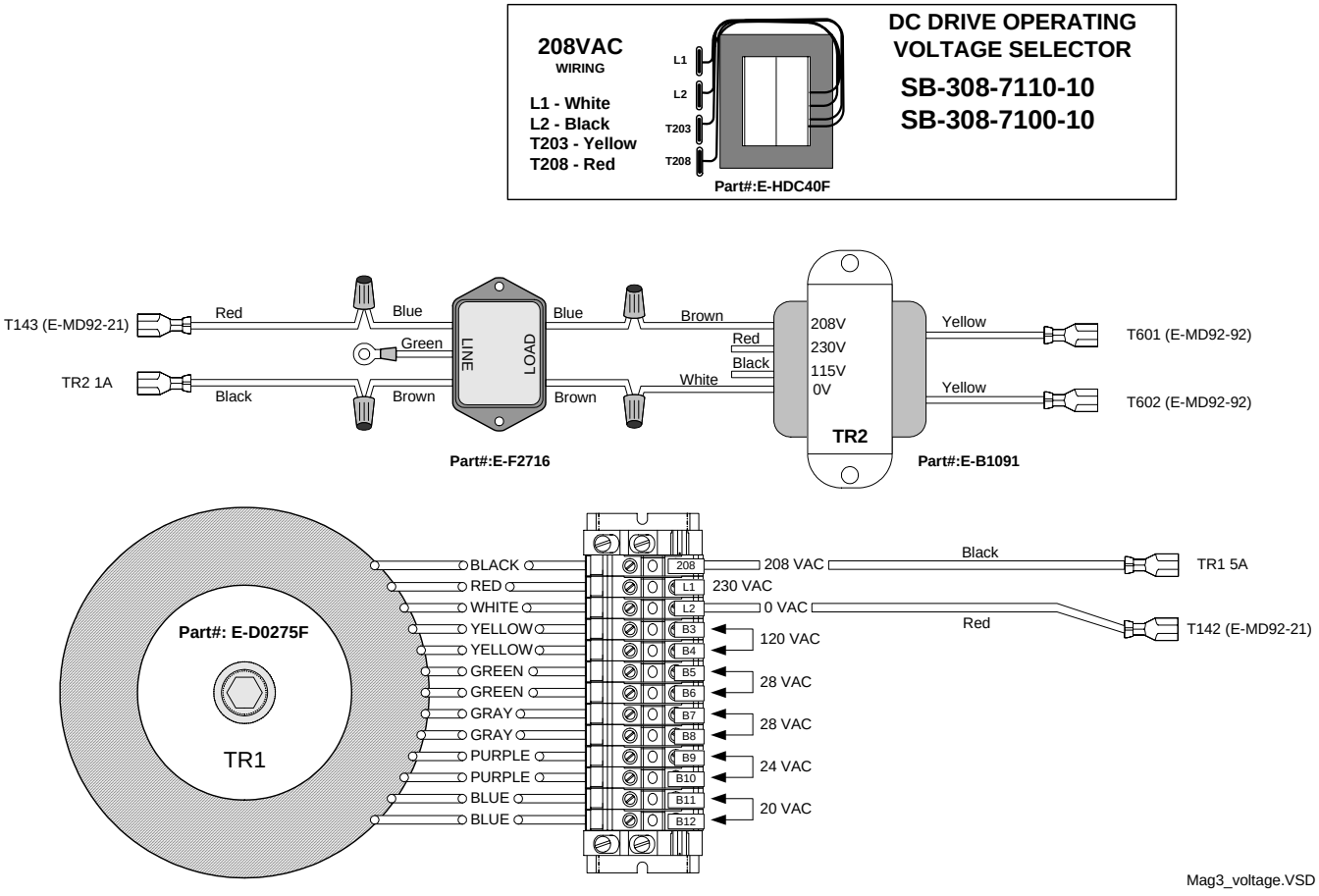
The main transformer (T1), the smaller transformer (T2), and the four transformers located on each DC Drive Circuit Board Assembly all distribute the necessary voltage to the different components.

MAG3 POWER TRANSFORMER WIRING DIAGRAM



The standard 240VAC wiring of the transformers is indicated below:

NOTE: **If the electrical supply lines in your bowling center are 208 volts, your electronic power boxes have been modified by the accredited Qubica technicians who installed the pinsetters. The wiring modifications are as appears below. Although all wiring diagrams in this manual assume that the electrical supply lines are 240 volts, variations may occur due to this modification. Note the modifications on each wiring plan concerned for future reference.**



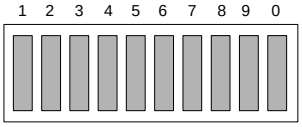
Main Circuit Board

The main circuit board controls both MAG3-IT pinsetters and their functions. Located on this board are the EPROMs and dip switch banks used to control the main board's functions. Each and every electronic component communicates in one way or another with the main circuit board, it is the brains behind the brawn of the MAG3-IT Pinsetter.

Flat cables with latch connectors, MTA's, terminal connectors and one MNL connector are all used to inter-connect the different components necessary in the running of the pair of pinsetters. Refer to the circuit board layout and the wiring diagram to locate and identify the various connectors.

The main circuit board runs on 20VAC which is supplied through the 20-volt transformer located inside the electronic power box and connected to two terminal connectors (T601 and T602) on the main circuit board. The main circuit board also supplies other components with 20VAC (T604 and T605), the main circuit board. The main circuit board is protected by an overload (OL1) located on the front of the electronic power box.

There are three LED displays (DSP201, DSP301 & DSP302) and seven LEDs (LD301, LD302, LD303, LD304, LD501, LD601 & LD603) located on the main circuit board. LD601 is used to signal the presence of the necessary 5-volt electrical power, while LD603 is used to signal the presence of the necessary 12 volt electrical power. LD501 signals the presence of the necessary 24-volt electrical power to the camera assembly. DSP301 and DSP302 are used for debugging purposes by Qubica technicians and are not explained here in order to avoid unnecessary complicated jargon. The most important LEDs for the user are LD301-LD304, which are grouped together and are constantly flashing. If these LEDs ever cease to flash, you must reset the main circuit board by pressing the RESET button located just under the LEDs.



DSP201 is used to signal communication between electronic components and is described in the table below.

Led Number	Signals
1	MAG3-IT Controller (CO204) transmission communication
2	MAG3-IT Controller (CO204) reception communication
3	Carrousel (CO203) transmission communication
4	Carrousel (CO203) reception communication
5	(CO202) transmission communication
6	(CO202) reception communication
7	Automatic Scoring Console (CO201) transmission communication
8	Automatic Scoring Console (CO201) reception communication
9	not used
0	CPU heartbeat: this LED constantly flashes, if it ceases to flash, you must reset the main circuit board.

Software contained in the two user changeable EPROMs (U102 & U103) will react differently under specific conditions established through dip switches and the dip switches will affect the software differently depending on the version of the software contained on the EPROMs.

The tables on the following pages indicate the value for each dip switch depending on whether it is ON or OFF and specifies the version of the EPROMs in which the setting was introduced. The latest software version contains all of the previous selections, therefore you must have the version number indicated or a later one in order for the setting to be valid.

A dip switch which has no identified settings should always be set to OFF.

Dip Switch Bank SW101

Switch	Version	Position	Result
101-1		ON OFF	
101-2		ON OFF	
101-3		ON OFF	
101-4		ON OFF	
101-5		ON OFF	
101-6		ON OFF	
101-7		ON OFF	
101-8		ON OFF	

Dip Switch Bank SW301

Switch	Version	Position	Result
301-1	1.12	ON OFF	Automatic Test Mode Normal Mode
301-2	1.12	ON OFF	Without Qubica 2001 Automatic Scoring With Qubica 2001 Automatic Scoring System
301-3	1.12	ON OFF	A problem caused by the carrousel solenoids will automatically stop the pinsetter. A problem caused by the carrousel solenoids will give the operator the choice of continuing the pinsetter's cycle or aborting the cycle.
301-4	1.13	ON OFF	A problem caused by the drawer obstruction detector will automatically stop the pinsetter. A problem caused by the drawer obstruction detector will give the operator the choice of continuing the pinsetter's cycle or aborting the cycle.
301-5	1.16	ON OFF	Elevator jams will not stop the main motor. Elevator jams will stop the main motor after 30 seconds.
301-6 301-7 301-8	1.14		Used to determine the delay between the detection of a ball and the lowering of the sweep. Refer to the "Sweep Pause Time" table for details. Factory setting is ¼ second.

Sweep Pause Time

301-6	301-7	301-8	Sweep Delay Obtained
OFF	OFF	OFF	¼ second
OFF	OFF	ON	½ second
OFF	ON	OFF	¾ second
OFF	ON	ON	1 second
ON	OFF	OFF	1¼ seconds
ON	OFF	ON	1½ seconds
ON	ON	OFF	1¾ seconds (version 1.14) 2 seconds (version 1.15)
ON	ON	ON	2 seconds (version 1.14) Sweep is not lowered on first delivery gutter balls nor on first delivery corner pins (version 1.15)

Dip Switch Bank SW302

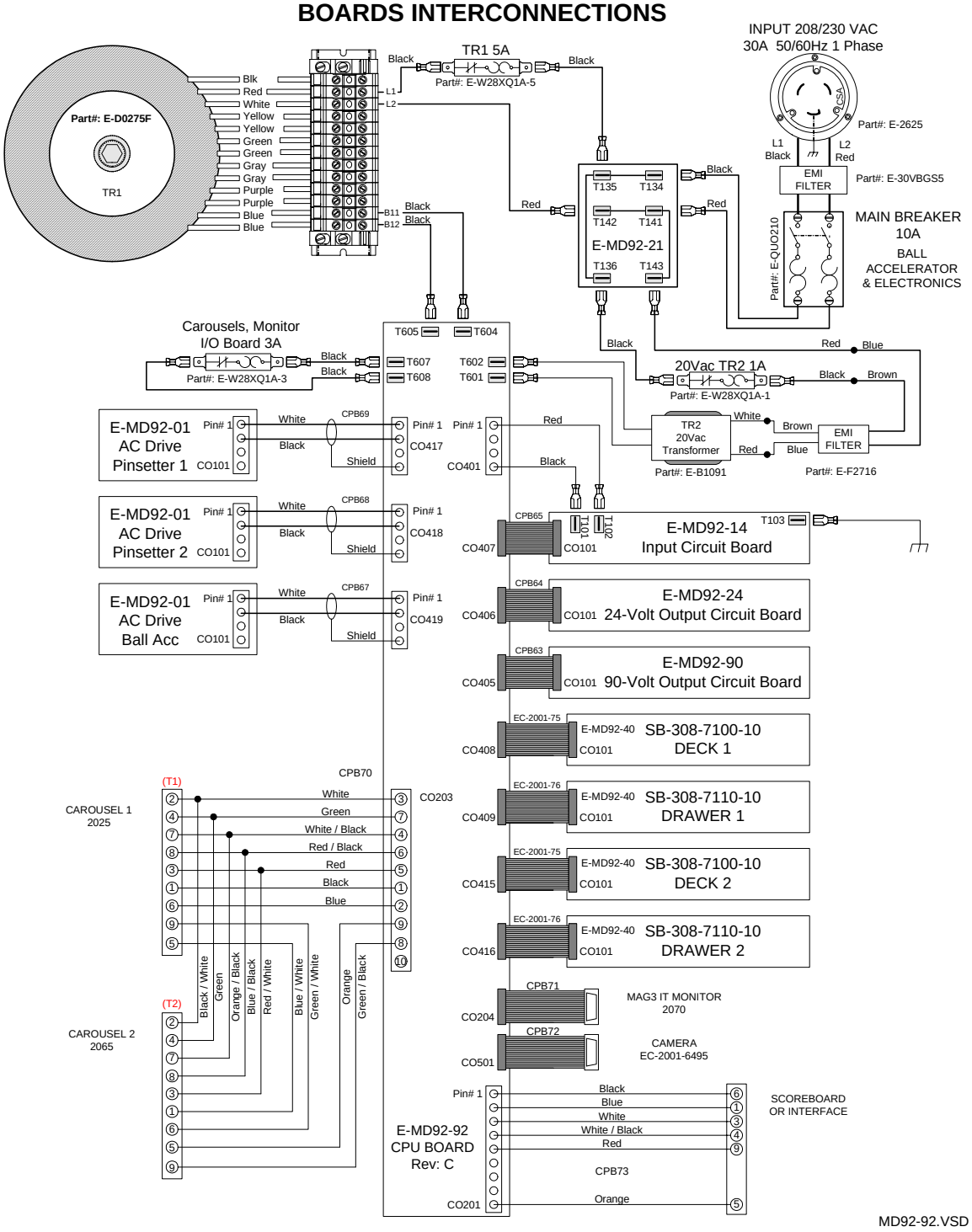
Switch	Version	Position	Result
302-1 302-2 302-3	1.12		Used to determine the delay used by the pin detection camera to correctly take its reading. Refer to the "Camera Pause Time" table for details. Factory setting is 1½ seconds (version 1.12) and 2 seconds (version 1.14).
302-4	1.12	ON OFF	Main circuit board battery deactivated. Main circuit board battery activated.
302-5	1.18	ON OFF	Camera deactivated. Use this setting if you have a problem with your camera which you are unable to solve. This mode will cycle the pinsetter according to ball detection only. (DS301-2 must be ON in order for this setting to function. Normal mode. Camera activated.
302-6		ON OFF	
302-7		ON OFF	
302-8		ON OFF	

Camera Pause Time

302-1	302-2	302-3	Camera Reading Delay Obtained
OFF	OFF	OFF	1.5 seconds (version 1.12) 2 seconds (version 1.14)
OFF	OFF	ON	2.5 seconds (version 1.12) 2.3 seconds (version 1.14)
OFF	ON	OFF	3.5 seconds (version 1.12) 2.6 seconds (version 1.14)
OFF	ON	ON	4.5 seconds (version 1.12) 3 seconds (version 1.14)
ON	OFF	OFF	5.5 seconds (version 1.12) 3.3 seconds (version 1.14)
ON	OFF	ON	6 seconds (version 1.12) 3.6 seconds (version 1.14)
ON	ON	OFF	6.5 seconds (version 1.12) 4 seconds (version 1.14)
ON	ON	ON	7 seconds (version 1.12) 4.3 seconds (version 1.14)

Main Circuit Board Layout & Wiring Diagram

BOARDS INTERCONNECTIONS



NOTE: **Refer to the Carrousel Circuit Board Wiring Diagrams and the Camera Circuit Board Wiring Diagram for the remaining wiring which connects with DB-R09K, DB-R09J, DB-R09L and DB-R15M.**

AC Drive Circuit Boards

There are five inter-changeable AC drive circuits inside the power box. Three are used to turn on and off an AC motor, one for main motor 1, one for main motor 2 and one for ball accelerator motor.

Each AC drive circuit board communicates with the main circuit board through an MTA connected to CO101. It is through the main circuit board that each motor is turned ON and OFF.

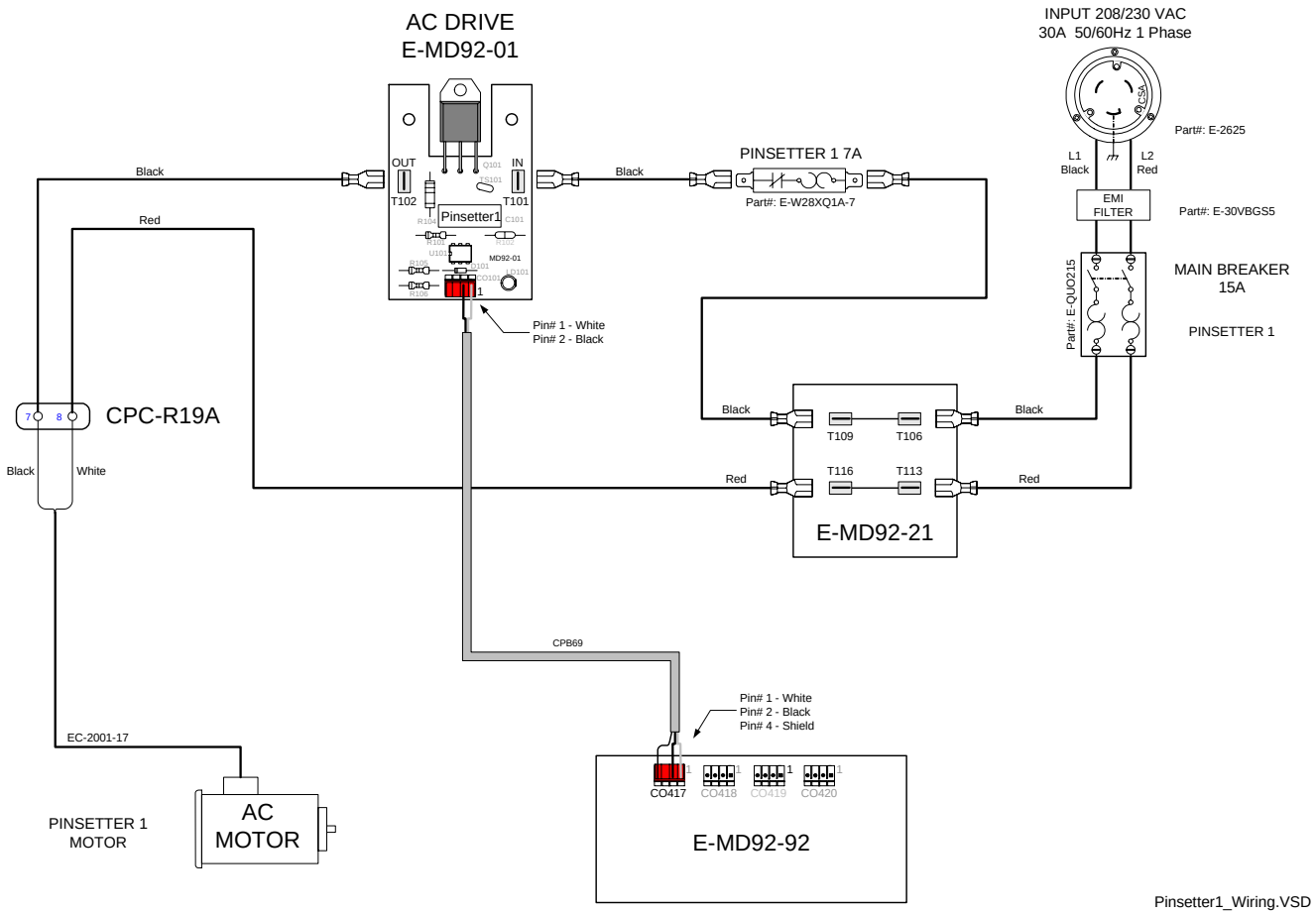
When the LED (LD101) located on the AC drive circuit board is ON, it signifies that the main circuit board has powered ON its corresponding motor.

The electrical power to each AC motor is supplied through the two terminal connectors (T101 and T102) located on each AC drive circuit board. Each motor is protected by an overload located on the front of the electronic power box with the electric circuit being completed through the terminal circuit board.

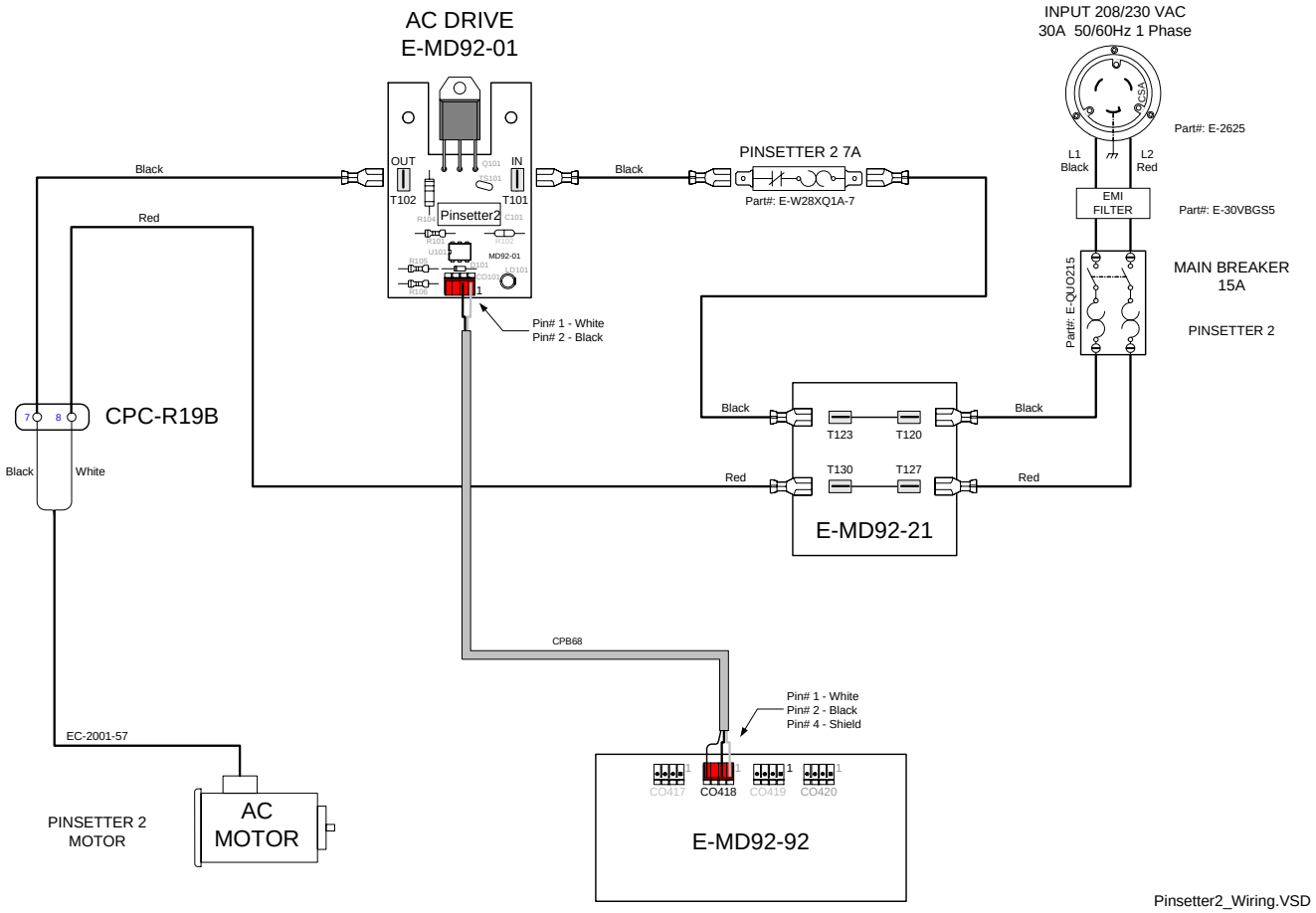
The two other AC drive circuits are used to send signals to the fluorescent control box. They receive signals from the E-MD92-90 board and send a 24 VAC signal to the fluorescent control box.

The following pages illustrate the different wiring diagrams for the five AC Drive Circuit Boards.

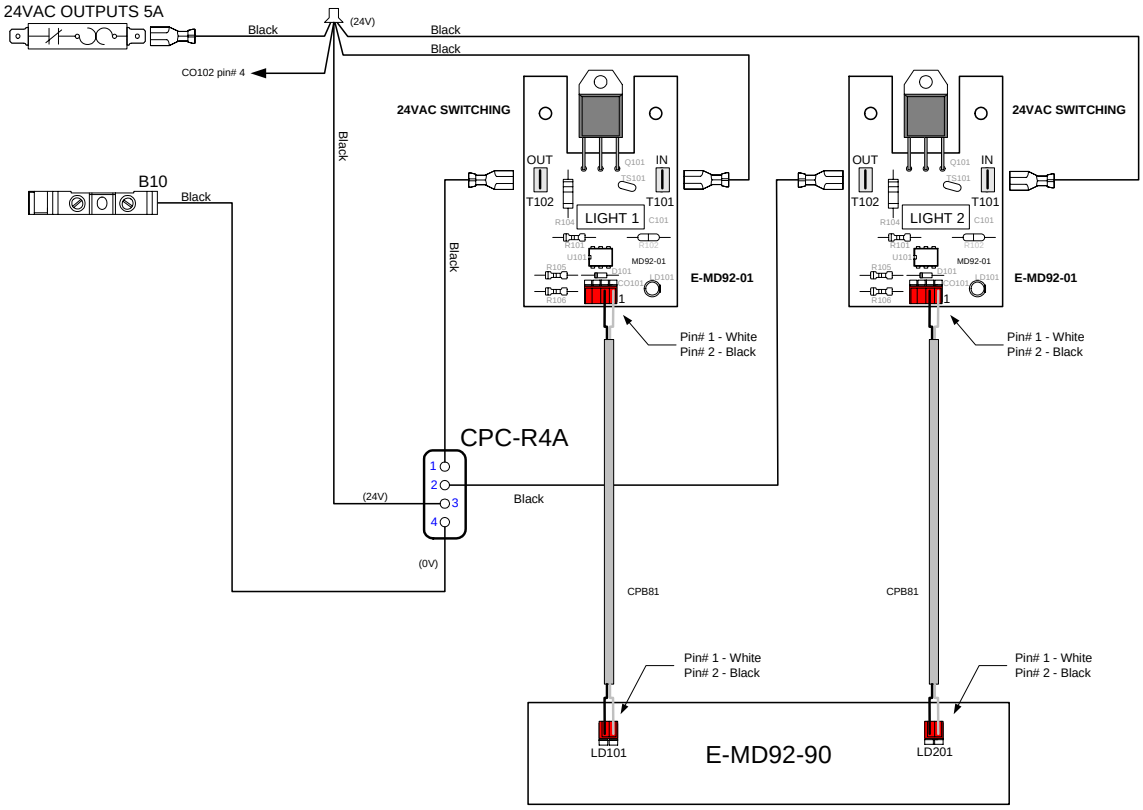
Pinsetter 1 AC Drive Wiring Diagrams



Pinsetter 2 AC Drive Wiring Diagrams

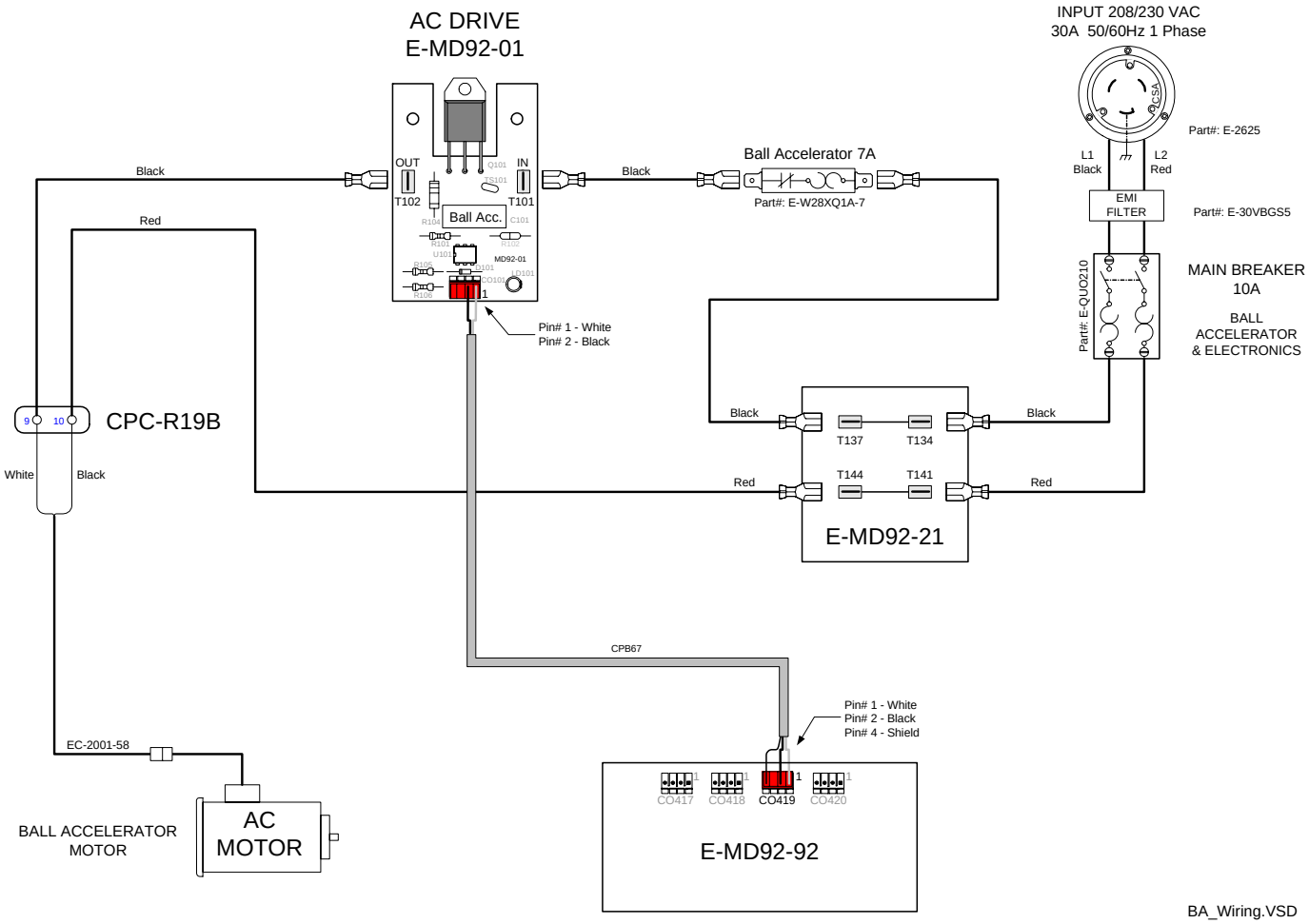


AC Drive for 24 VAC Switching



Light_switching.VSD

Ball Accelerator AC Drive Wiring Diagram



AC Drive Notes

DC Drive Circuit Boards

There are two inter-changeable ***drawer*** DC drives located inside each electronic power box. The only difference between each assembly is the length of the flat cable which is used to communicate with the main circuit board. Pinsetter 1's drawer DC drive uses a 20-inch flat cable while pinsetter 2's DC drive uses a 14-inch flat cable.

There are also two inter-changeable ***deck*** DC drives located inside each electronic power box. The only difference between each of these assemblies is once again in the length of the flat cable used to communicate with the main circuit board. Pinsetter 1's deck DC drive uses a 16-inch flat cable while pinsetter 2's DC drive uses a 10-inch flat cable.

Each assembly is made up of two electronic circuit boards along with a mounting plate and the necessary hardware to join both circuit boards together. If a problem arises with one of these assemblies, do not attempt to swap boards with another assembly. This could result in having two non-functioning assemblies. Always replace a complete assembly and return the faulty assembly for repairs since each board is dependent of the other in order to perform correctly. For the same reasons, you may not order one board but must order a complete DC drive.

NOTE: **The spare parts kits and any replacement orders are always supplied as follows: The SB-308-7110 with a 20-inch flat cable and SB-308-7100 with a 16-inch flat cable.**

The top circuit board on each DC drive is the E-MD92-43.

The electrical power to each DC motor is supplied through the E-MD92-43 using four terminal connectors (T201, T202, T203 and T204). Each DC motor is protected by an overload located on the front of the electronic power box with the electric circuit being completed through the terminal circuit board.

When the LEDs (LD201, LD202, LD203 and LD204)located on E-MD92-43 are ON, it signifies that the main circuit board has powered on its corresponding DC motor.

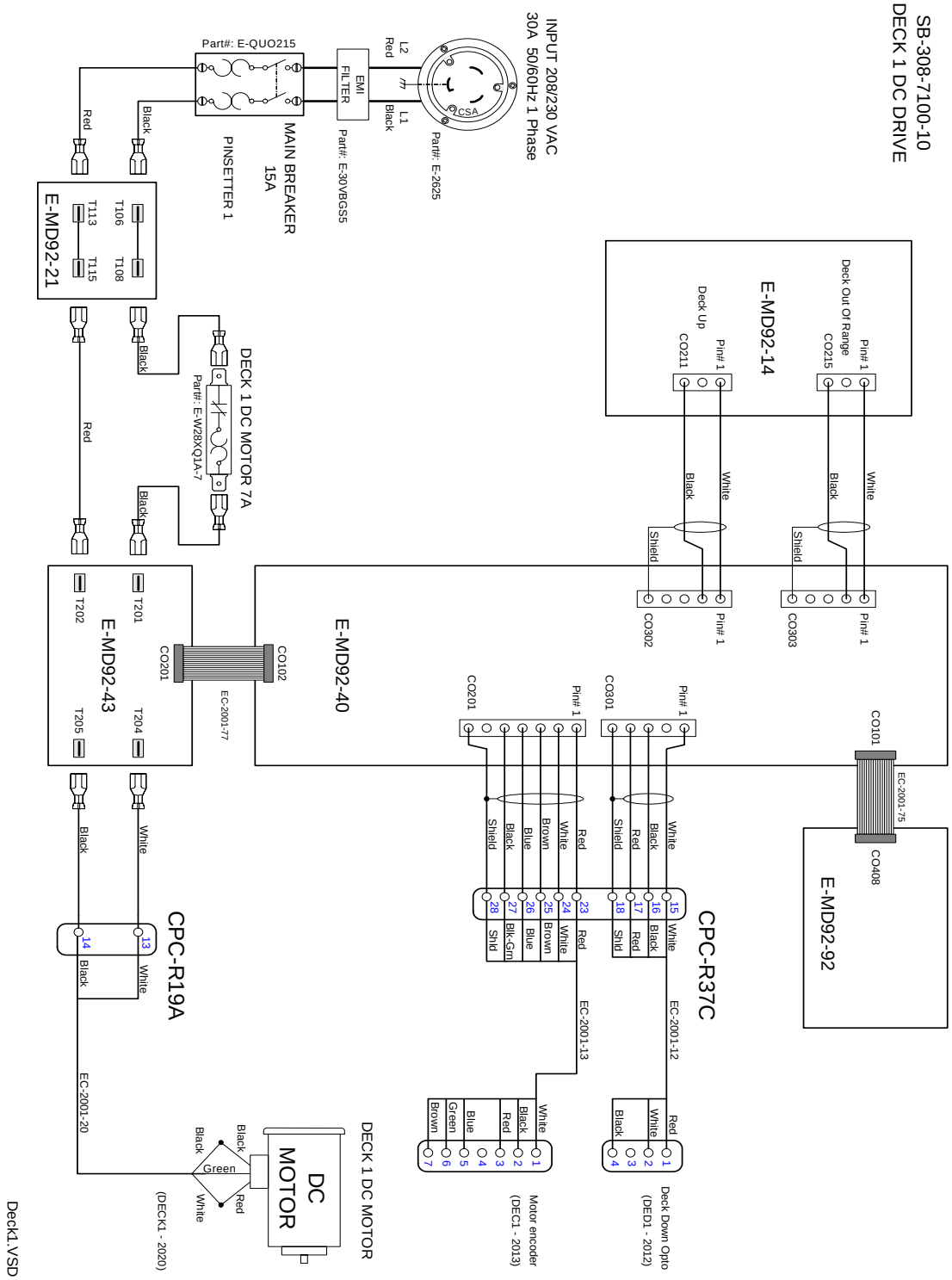
The E-MD92-43 communicates with the E-MD92-40 through a flat cable connected to CO201 and CO102 respectively.

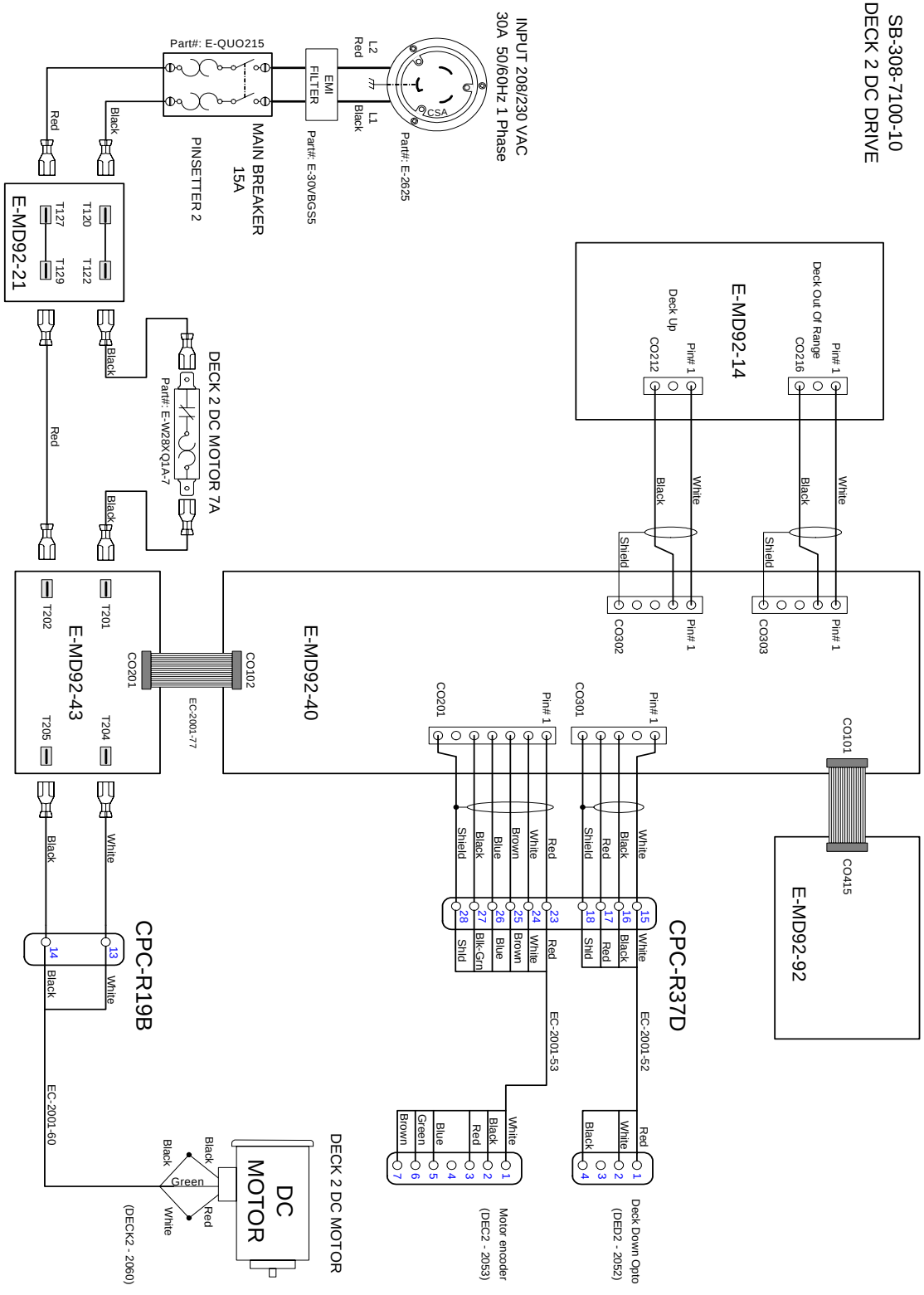
The E-MD92-40 communicates with the main circuit board through an MTA connected to CO101. It is through the main circuit board that each motor is turned ON and OFF.

Each DC motor has an encoder used to control the revolution of the motor according to the software. This encoder communicates with E-MD92-40 through an MTA located on CO201. The four remaining MTA's are used for input signals with CO301 and CO304 being connected directly to optical sensors while CO302 and CO303 are used as bypasses communicating with the input circuit board.

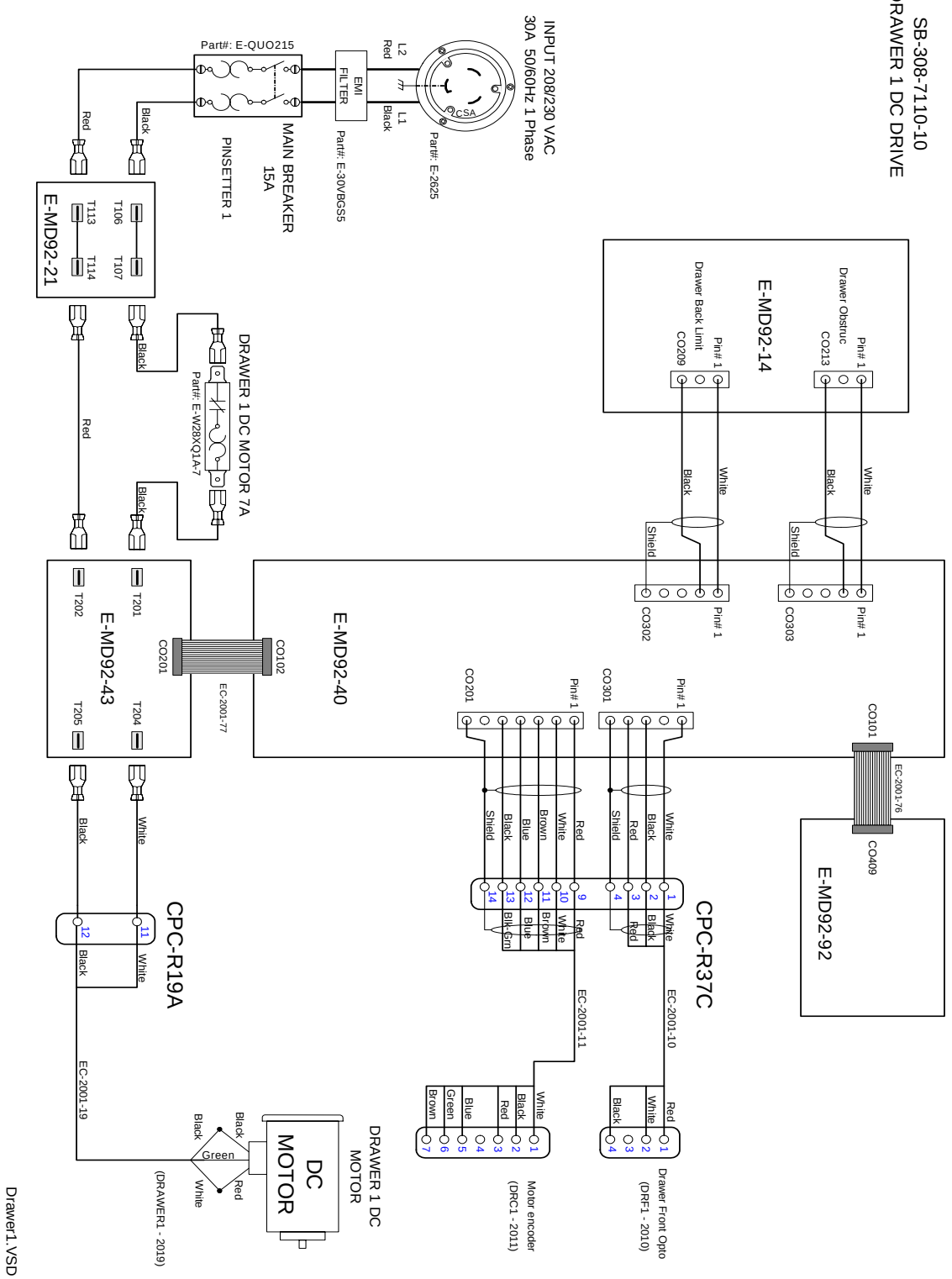
The two LEDs (LD101 & LD201) along with the two test points (TP1 & TP2) located on MD92-40 are for analysis purposes only and are of no significance in the normal functioning of this circuit board's components.

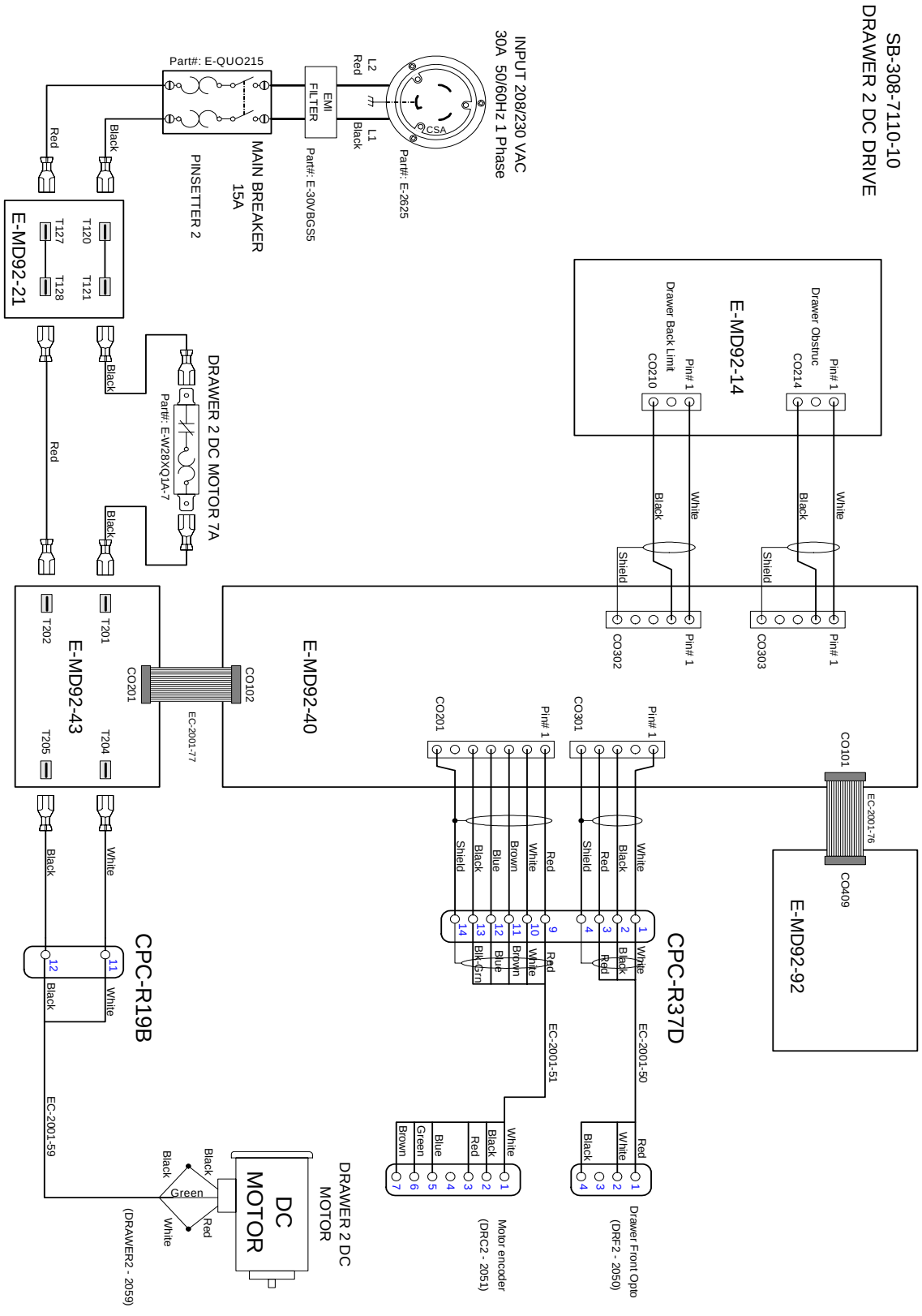
Deck DC Drive Wiring Diagrams




SB-308-7100-10
DECK 2 DC DRIVE
INPUT 208/230 VAC
30A 50/60Hz 1 Phase
Part#: E-QUO215
MAIN BREAKER
15A
PINSETTER 2
EMI
FILTER
Part# E-30VBGS5
L2
Red
L1
Black
CSA
Part#: E-2625
E-MD92-21
T120
T122
T127
T129
DECK 2 DC MOTOR 7A
Part#: E-W28XQ1A-7
E-MD92-14
Deck Out Of Range
CO216
Pin# 1
Deck Up
CO212
Pin# 1
White
Black
Shield
CO303
CO302
E-MD92-40
CO101
CO415
E-MD92-92
CO201
CO301
CPC-R37D
EC-2001-52
EC-2001-53
Deck Down Opto
(DED2 - 2052)
Motor encoder
(DEC2 - 2053)
E-MD92-43
T201
T202
T204
T205
CO201
CO102
EC-2001-77
CPC-R19B
EC-2001-60
DECK 2 DC MOTOR
DC
MOTOR
Green
Red
(DECK2 - 2060)
Deck2.VSD

Drawer DC Drive Wiring Diagrams




SB-308-7110-10
DRAWER 2 DC DRIVE
INPUT 208/230 VAC
30A 50/60Hz 1 Phase
Part#: E-QUO215
MAIN BREAKER
15A
PINSETTER 2
EMI
FILTER
Part#: E-30VBGS5
L2
Red
L1
Black
CSA
Part#: E-2625
E-MD92-21
T127
T128
T120
T121
Red
Black
DRAWER 2 DC MOTOR 7A
Part#: E-W28XQ1A-7
E-MD92-14
Drawer Obstruc
CO214
Pin# 1
Drawer Back Limit
CO210
Pin# 1
Black
White
Shield
CO302
Pin# 1
CO303
Pin# 1
E-MD92-40
CO101
EC-2001-76
CO409
E-MD92-92
CO201
Pin# 1
CO301
Pin# 1
CPC-R37D
E-MD92-43
T201
T202
T204
T205
CO201
CO102
EC-2001-77
EC-2001-50
EC-2001-51
CPC-R19B
EC-2001-59
DRAWER 2 DC
MOTOR
DC
MOTOR
Black
Green
Red
White
(DRAWER2 - 2059)
Motor encoder
(DRC2 - 2051)
Drawer Front Opto
(DRF2 - 2050)
Drawer2.VSD

Input Circuit Board

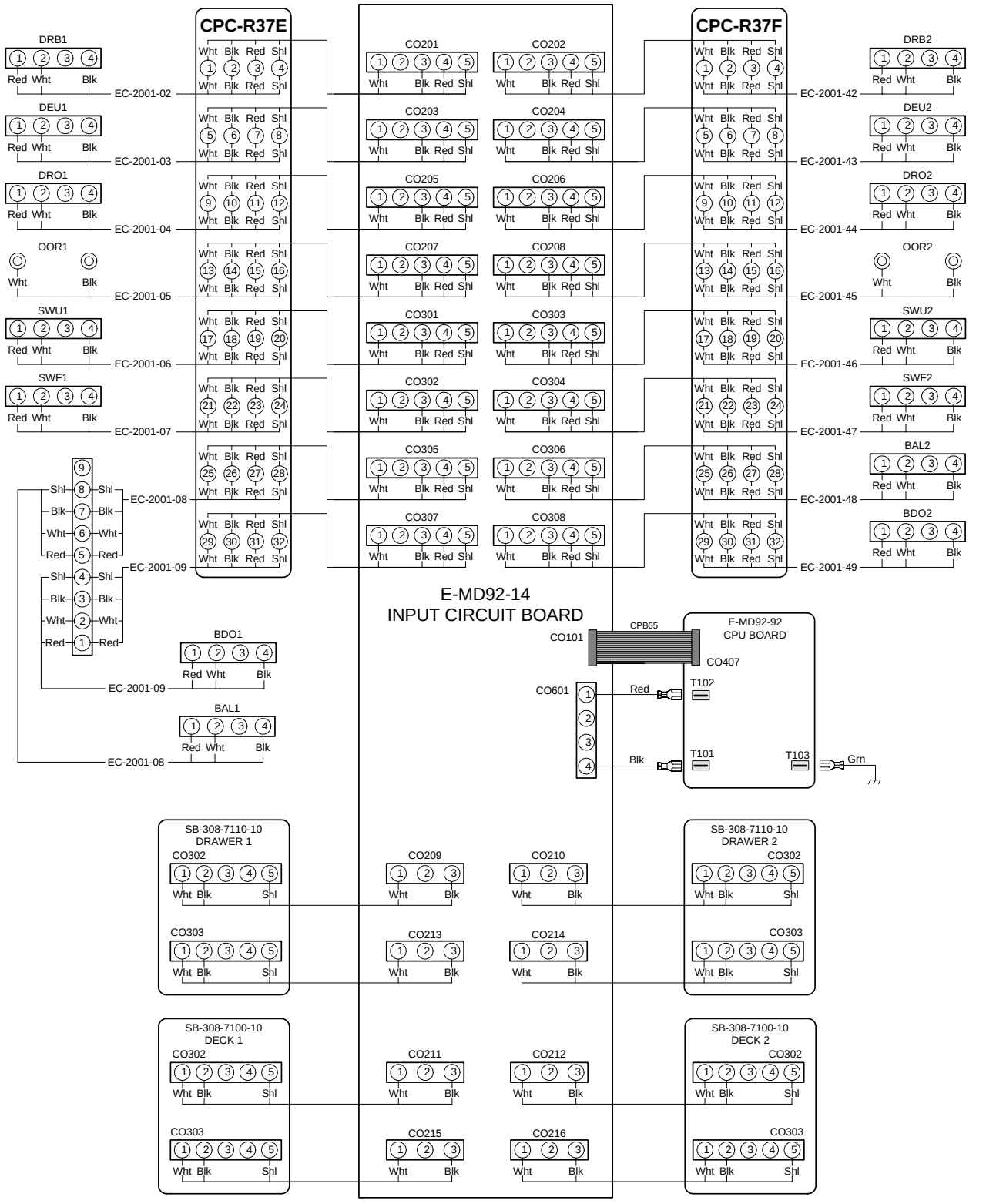
The input circuit board located inside the electronic power box receives pulse signals from the different optical sensors located on both pinsetters. The optical sensors use 4-position MNL connectors to communicate with the input circuit board through CPC-S37E for pinsetter 1 and CPC-S37F for pinsetter 2. Completing the circuits are sixteen MTA assemblies located on CO201, CO202, CO203, CO204, CO205, CO206, CO207, CO208, CO301, CO302, CO303, CO304, CO305, CO306, CO307 and CO308.

The two LEDs (LD101 and LD102) located on the circuit board are used to signal the presence of the necessary voltage. LD101 is ON when the 5-volt power supply is present and LD102 is ON when the 12-volt power supply is present.

The input circuit board communicates with the main circuit board through a flat cable and latch connector located on CO101. This flat cable also supplies 5 volts of electrical power to different components on the circuit board. The 12-volt electrical power to the input circuit board is supplied through the two terminal connectors (T101 and T102) which are powered from the main circuit board.

The input circuit board also communicates with each DC drive (drawer 1 & 2 and deck 1 & 2) through eight MTA assemblies located on CO209, CO210, CO211, CO212, CO213, CO214, CO215 and CO216. These bypasses are used to capture the signals from the various optical sensors which communicate directly with the DC drive assemblies.

E-MD92-14 INPUT CIRCUIT BOARD



MD92-14.VSD

24-Volt Output Circuit Board

The ball 1 / ball 2 lights, the trouble lights, the ball lift's 24-volt relay, and the camera's power supply are all controlled through the 24-volt output circuit board located inside the electronic power box.

The 24-volt output circuit board communicates with the main circuit board through a flat cable and latch connector located on CO101.

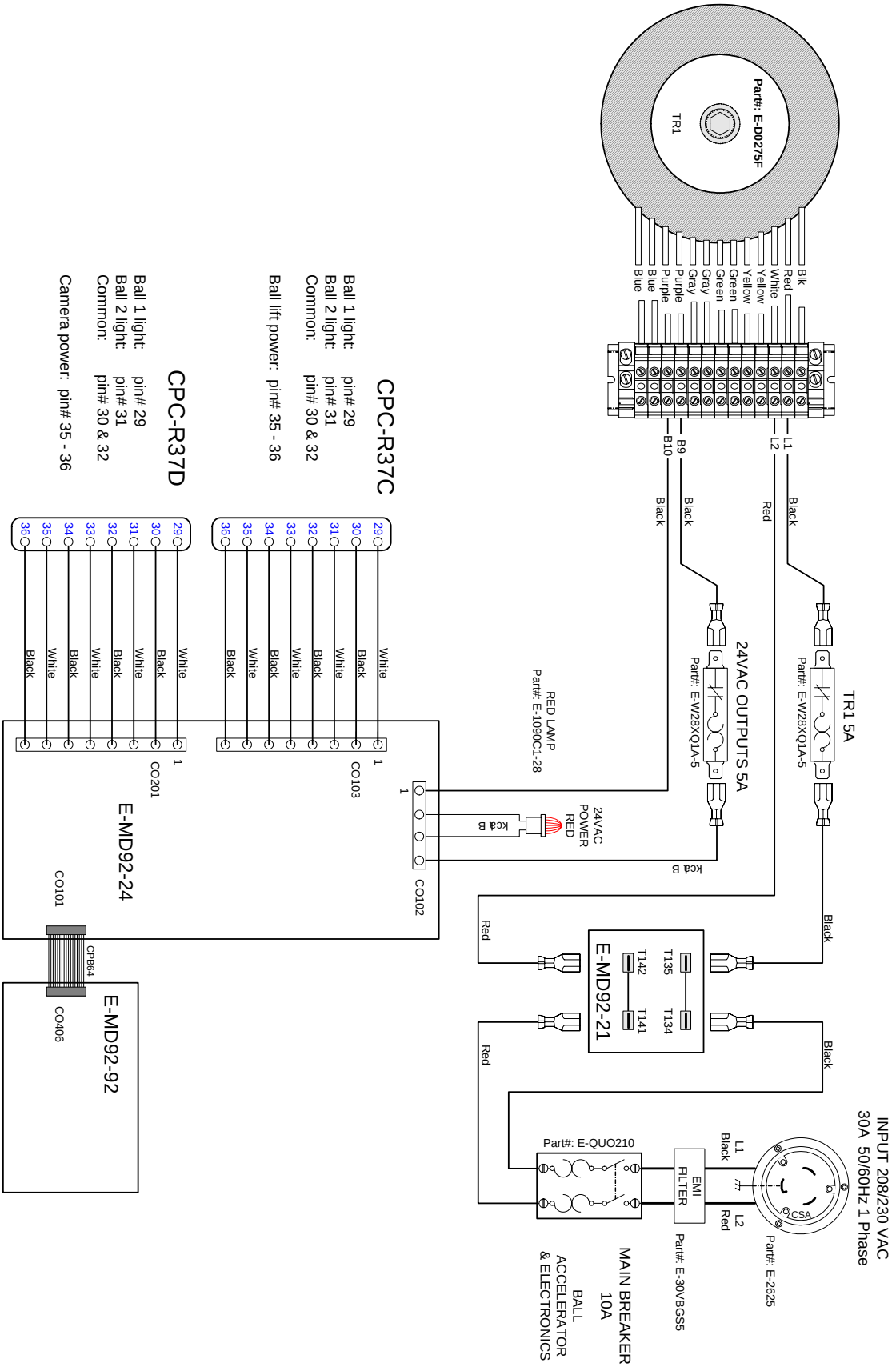
The eight LEDs, LD101 (*pinsetter 1 - ball 1*), LD102 (*pinsetter 1 - ball 2*), LD103 (*pinsetter 1 - trouble light*), LD104 (*ball lift*), LD201 (*pinsetter 2 - ball 1*), LD202 (*pinsetter 2 - ball 2*), LD203 (*pinsetter 2 - trouble light*), and LD204 (*camera*) located on the circuit board are used to signal the presence of electrical power to its component. In other words, when the LED is ON, the main circuit board has sent a power on command to the component.

The low voltage accessories are wired to the 24-volt output circuit board through CPC-R37C for pinsetter 1 and the ball lift, while CPC-R37D is used for pinsetter 2 and the camera. Completing the circuits are two MTA assemblies located on CO103 and CO201.

The low voltage electrical power to each component is supplied through the main transformer using an MNL connector located on CO102. The circuit board is protected by an overload (OL7) located on the front of the electronic power box with the electric circuit being completed through the terminal circuit board (E-MD92-21).

The opposite page illustrates the 24-Volt Circuit Board's wiring diagram.

NOTE: **Refer to the Carrousel Circuit Board Wiring Diagrams and the Camera Circuit Board Wiring Diagrams for the remaining wiring of the Ball Lift Terminal Strip and the Camera Terminal Strip.**


Part#: E-D0275F
TR1
Blk
Red
White
Yellow
Yellow
Green
Green
Gray
Gray
Purple
Purple
Blue
Blue
L1
L2
B9
B10
Black
Red
Black
Black
TR1 5A
Part#: E-W28XQ1A-5
24VAC OUTPUTS 5A
Part#: E-W28XQ1A-5
RED LAMP
Part#: E-1090C1-28
24VAC POWER RED
Kcâ B
Kcâ B
CO102
CO103
CO201
CPC-R37C
Ball 1 light: pin# 29
Ball 2 light: pin# 31
Common: pin# 30 & 32
Ball lift power: pin# 35 - 36
CPC-R37D
Ball 1 light: pin# 29
Ball 2 light: pin# 31
Common: pin# 30 & 32
Camera power: pin# 35 - 36
E-MD92-24
CO101
CPB64
E-MD92-92
CO406
E-MD92-21
T135
T134
T142
T141
Red
Red
Black
Black
Part#: E-QUO210
EMI FILTER
L1
Black
L2
Red
CSA
Part#: E-2625
Part#: E-30VBGS5
INPUT 208/230 VAC
30A 50/60Hz 1 Phase
MAIN BREAKER
10A
BALL
ACCELERATOR
& ELECTRONICS
24V_output.VSD

90-Volt Output Circuit Board

The sweep clutches, the pin elevator clutches, the ball door clutches, and the fluorescent lights are all controlled through the 90-volt output circuit board located inside the electronic power box.

The 90-volt output circuit board communicates with the main circuit board through a flat cable and latch connector located on CO101.

The eight LEDs, LD101 (*fluorescent 1*), LD102 (*sweep clutch 1*), LD103 (elevator *clutch 1*), LD104 (*ball door clutch 1*), LD201 (*fluorescent 2*), LD202 (*sweep clutch 2*), LD203 (*elevator clutch 2*), and LD204 (*ball door clutch 2*) located on the circuit board are used to signal the presence of electrical power to its component. In other words, when the LED is ON, the main circuit board has sent a power on command to the component.

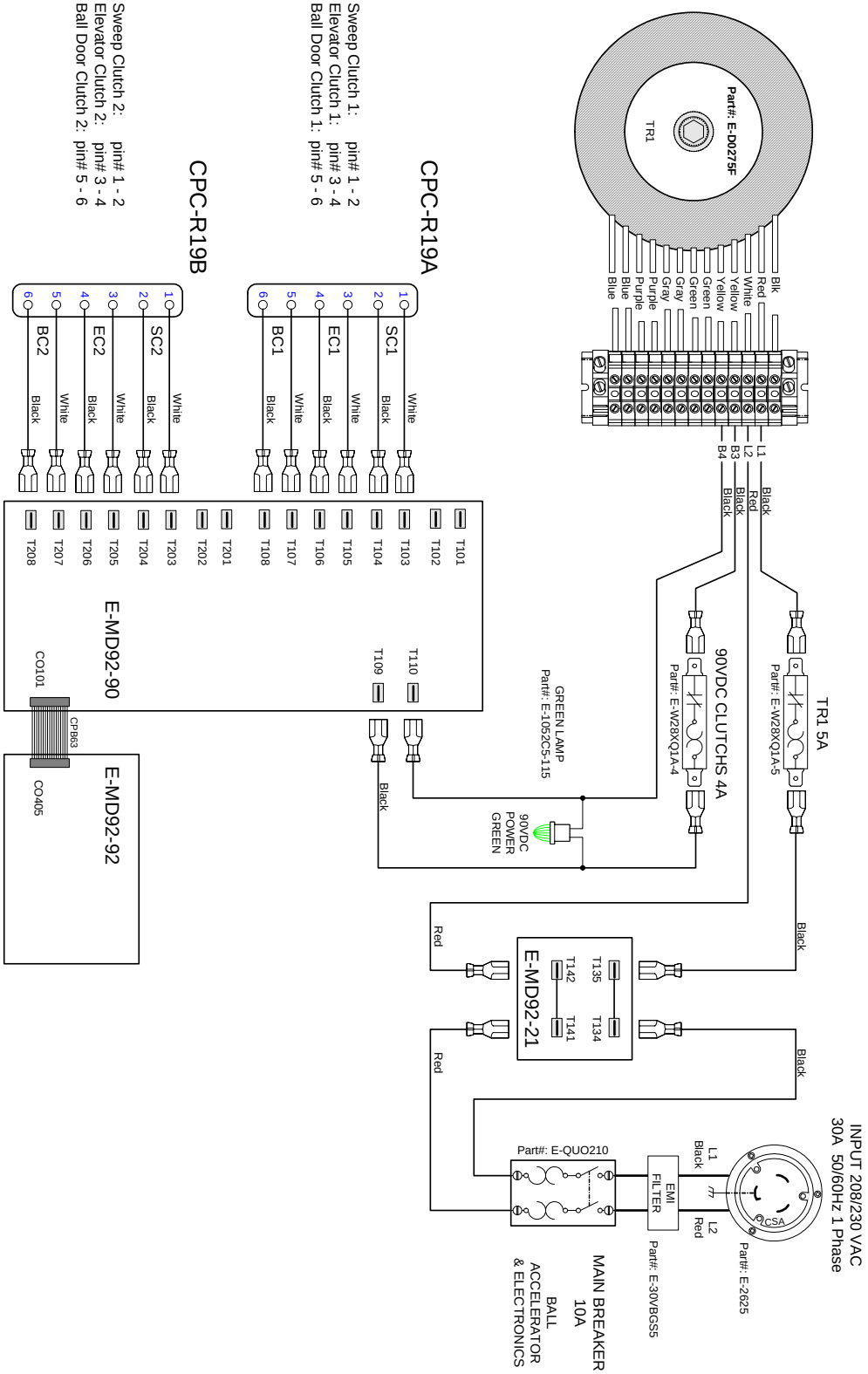
The above mentioned components are wired to the 90-volt circuit board through CPC-R19A for pinsetter 1 and CPC-R19B for pinsetter 2. Terminal connectors are used to complete the circuits.

The electrical power to each component is supplied through the main transformer using terminal connectors T109 & T110. The circuit board is protected by an overload (OL6) located on the front of the electronic power box with the electric circuit being completed through the terminal circuit board (E-MD92-21).

Each fluorescent light is also protected by an overload (OL3 & OL4) located on the front of the electronic power box.

NOTE: **Installations which are supplied with 50Hz electrical cycles have been modified. The fluorescent lights are not activated by the 90-Volt Circuit Board, but through the pinsetter's AC Drive. The opposite page illustartes both 60Hz and 50Hz installations. Refer to the 240VAC 50Hz Electronic Power Box wiring diagram for the fluorescent lighting wiring.**

90-Volt Output Circuit Board Wiring Diagrams



Carrousel Controllers

Each pinsetter has its own carrousel controller located on the pinsetter's frame below the trouble light at the rear of the pinsetter.

Each controller contains a carrousel circuit board which is mounted on a metal frame with insulators in order to protect it from metal to metal contact. Your spare parts kit contains a carrousel controller, if a problem arises with one of your controllers, do not attempt to swap boards with your spare. Doing so could result in having two non-functioning controllers. Always replace a complete carrousel controller and return the faulty controller for repairs. For this same reason, you may not order a single carrousel circuit board but must order a complete carrousel controller.

The carrousel receives pulse signals from the different carrousel related optical sensors and then reacts according to the software contained in EPROM U301. The optical sensors use 4-position MNL connectors to communicate with the carrousel circuit board through connectors CO109, CO110, CO201, CO202, CO203, CO204, CO205 and CO206.

The carrousel controller runs on 32VAC which is supplied through the main transformer located inside the electronic power box and connected to CO404 through CPC-R19A on pinsetter 1 and CPC-R19B on pinsetter 2. Each carrousel controller is protected through an overload (OL15 on carrousel 1 and OL16 on carrousel 2) located on the front of the electronic power box.

The three LEDs (LD301, LD302 & LD303) located on the carrousel circuit board are used to signal the carrousel's heartbeat, in-coming communication signals (reception) and out-going communication signals (transmission) respectively. The heartbeat (LD301) constantly flashes, if it ceases to flash, you must reset the carrousel controller.

The carrousel controllers are used to activate the carrousel solenoids used to load the magazine and the magazine solenoids used to load the drawer. The 14 solenoids are connected to the carrousel controller through connectors CO401, CO402 and CO403. The 7 read switches (E-MD92-35) located inside the detection bar assembly are also connected to the carrousel controller. A miniature D connector is used to distribute each read switch to connectors CO101, CO102, CO103, CO104, CO105, CO106 and CO107 respectively.

The Manager's Control Panel uses the carrousel controller to turn pinsetters on and off and also to count the number of full sets performed by each pinsetter. The 24-volt signal which activates the Manager's Control counter is sent through pins 9 and 10 of CO403 while CO210 is used to close the electric circuit connected to the on/off switches.

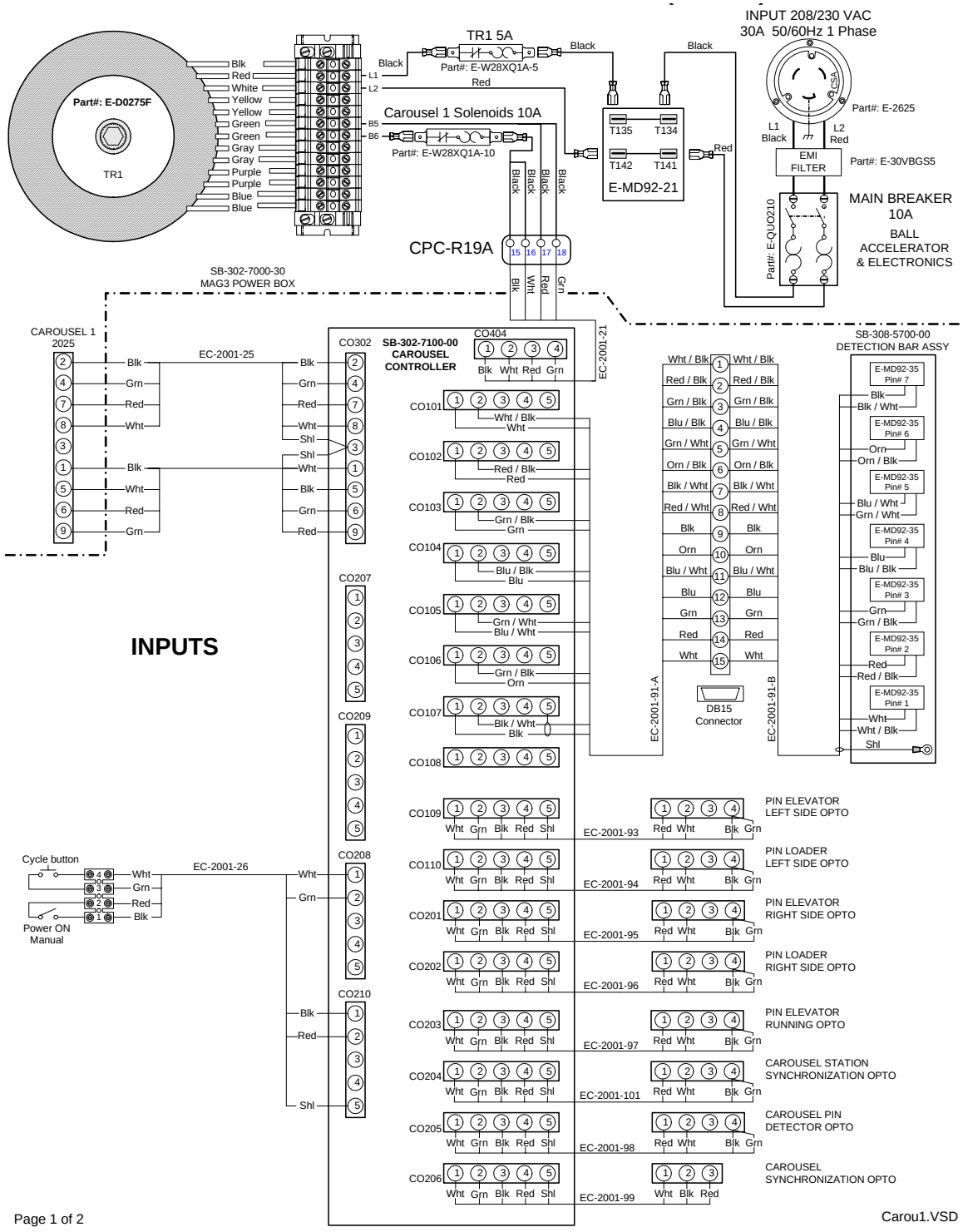
The cycle buttons located on the sides of the ball return trays are wired to their respective carrousel controllers through CO208.

Both carrousel controllers are inter-connected through two miniature D connectors located on the electronic power box and also communicate with the main circuit board hrough CO302. Although all carrousel controllers are physically the same, they must be correctly identified in order for the electronic power box to distribute its commands correctly. All commands for the carrousel controllers are transmitted to both carrousel controllers (pinsetter 1 & 2) through the afore mentioned connectors. The correct controller must capture its own commands and react accordingly. On each even numbered carrousel controller, an MTA connector with a jumper wire joining pins 1 and 2 is connected to CO108 in order to identify it. The odd numbered carrousel controllers have no such jumper. When, if ever, you replace a carrousel controller, make sure it is correctly identified (jumper or no jumper).

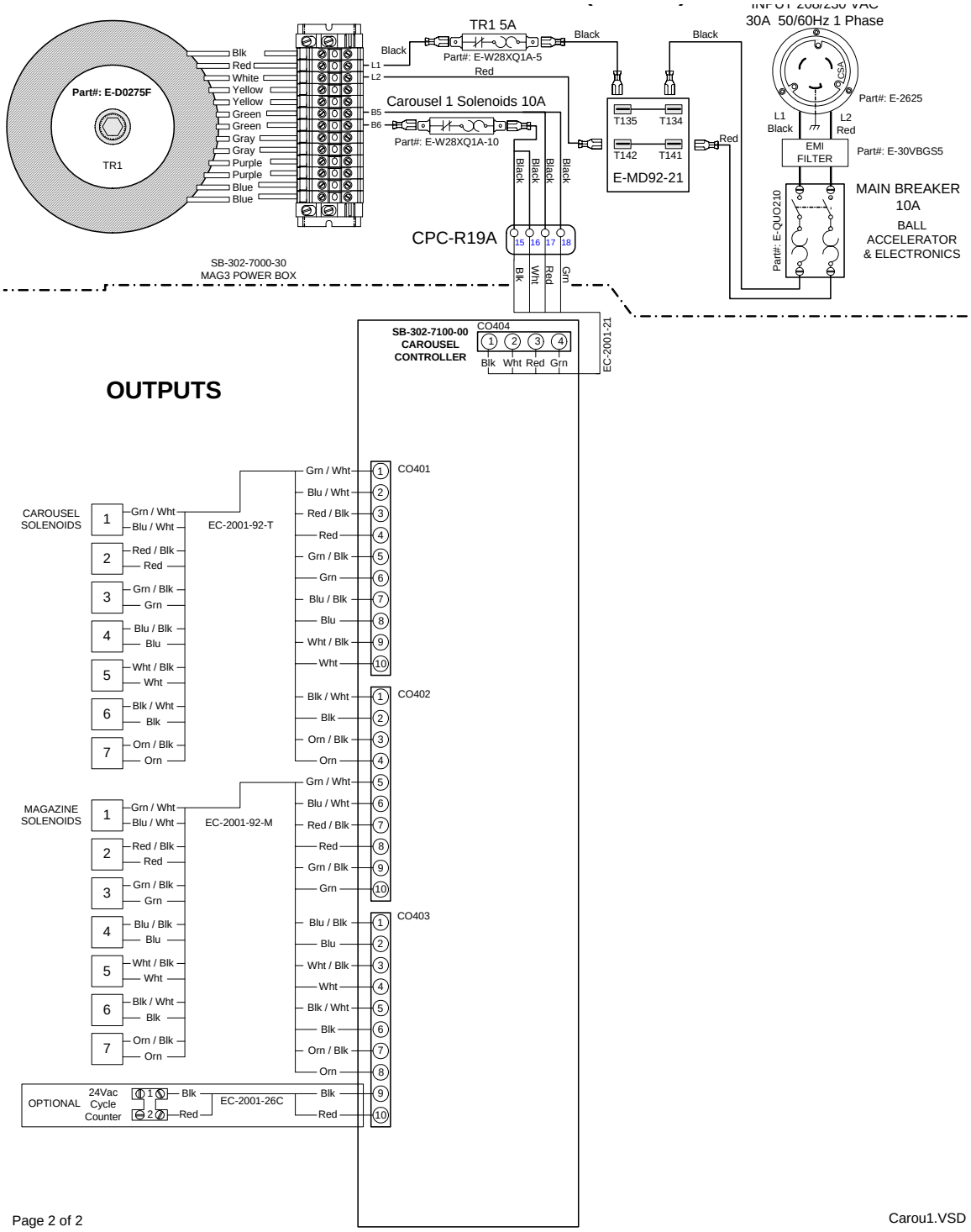
NOTE: **Prior to Carrousel version 1.20, each carrousel circuit board had to have its own specific EPROM, identified LANE 1 and LANE 2 in order for them to recognize their respective commands.**

The wiring diagrams on the following pages represent Carrousel 1 and Carrousel 2 respectively. Refer to the 24-Volt Output Circuit Board wiring diagram for the remaining wiring of the Ball Lift Terminal Strip.

Pinsetter 1 Carrousel Controller

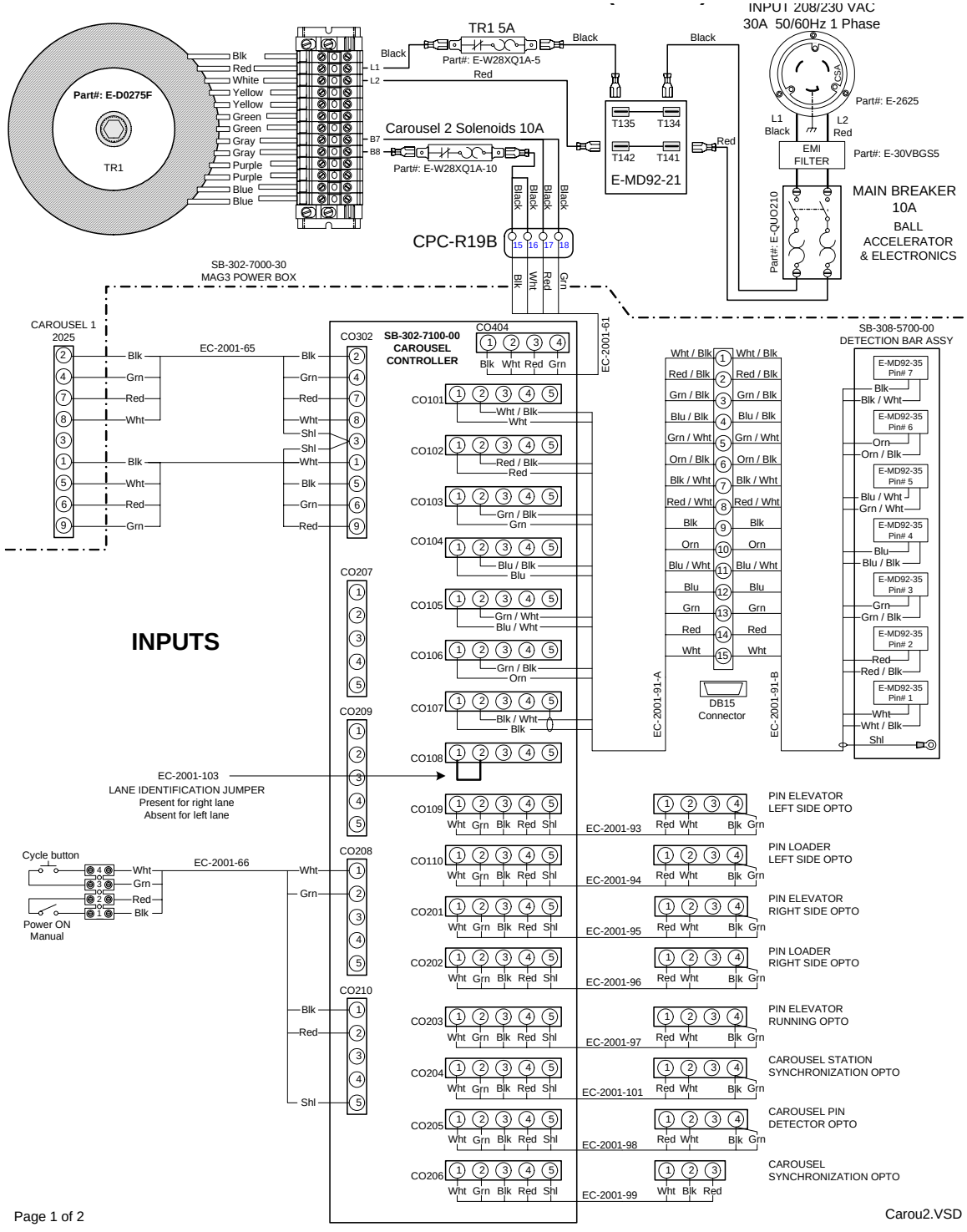


Carou1.VSD

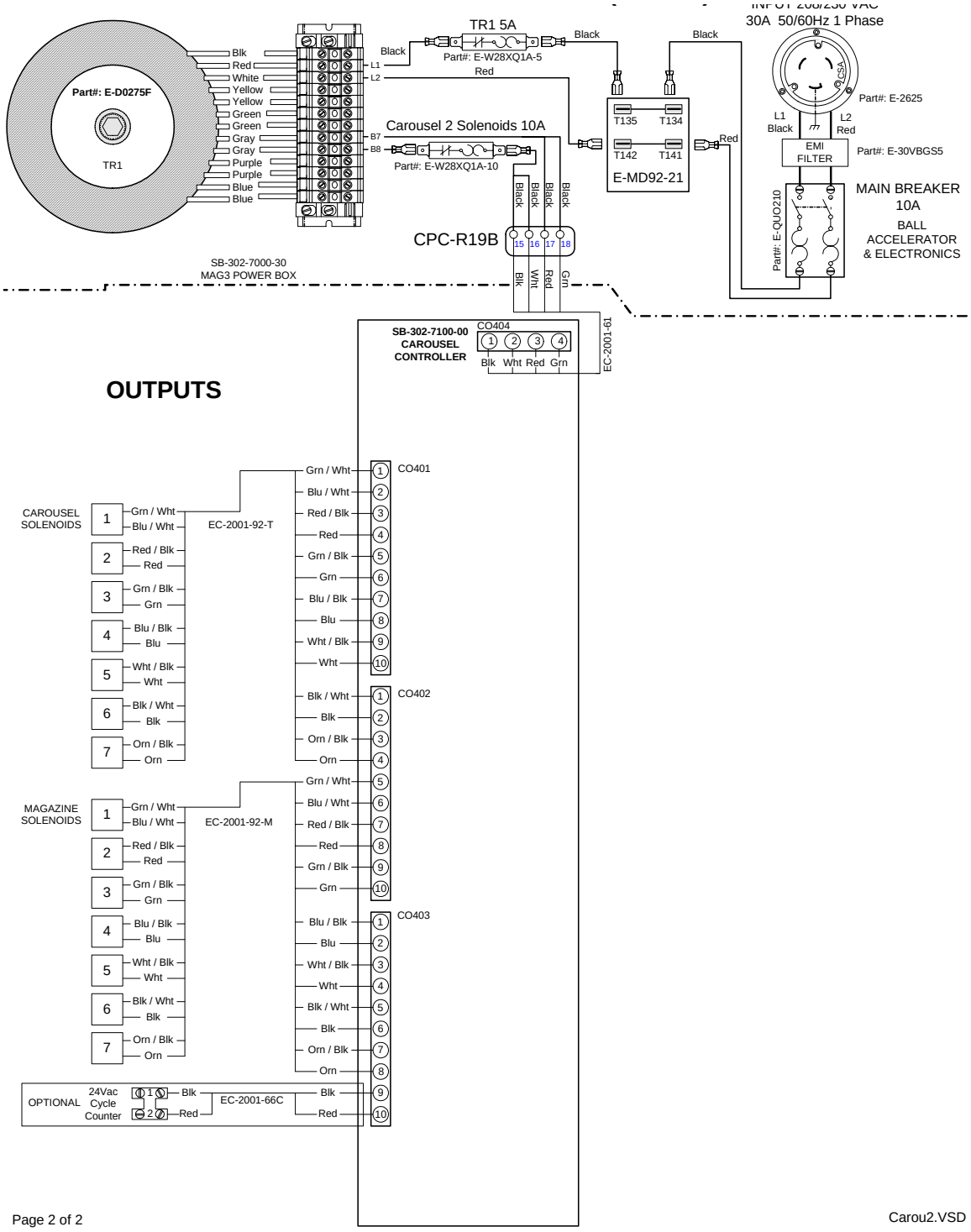

Part#: E-D0275F
TR1
Blk
Red
White
Yellow
Yellow
Green
Green
Gray
Gray
Purple
Purple
Blue
Blue
L1
L2
B5
B6
TR1 5A
Part#: E-W28XQ1A-5
Carousel 1 Solenoids 10A
Part#: E-W28XQ1A-10
Black
Red
T135
T134
T142
T141
E-MD92-21
INPUT 208/230 VAC
30A 50/60Hz 1 Phase
CSA
Part#: E-2625
L1
Black
L2
Red
EMI
FILTER
Part#: E-30VBGS5
Part#: E-QUO210
MAIN BREAKER
10A
BALL
ACCELERATOR
& ELECTRONICS
CPC-R19A
15 16 17 18
Blk
Wht
Red
Grn
SB-302-7000-30
MAG3 POWER BOX
SB-302-7100-00
CAROUSEL
CONTROLLER
CO404
1 2 3 4
Blk Wht Red Grn
EC-2001-21
OUTPUTS
CAROUSEL
SOLENOIDS
MAGAZINE
SOLENOIDS
EC-2001-92-T
EC-2001-92-M
CO401
CO402
CO403
Grn / Wht
Blu / Wht
Red / Blk
Grn / Blk
Blu / Blk
Wht / Blk
Blk / Wht
Orn / Blk
Orn
OPTIONAL
24Vac
Cycle
Counter
EC-2001-26C

Carou1.VSD

Pinsetter 2 Carrousel Controller



Carou2.VSD



Page 2 of 2

Carou2.VSD

MAG3-IT Controller

Inside the MAG3-IT Controller are two circuit boards which are used to communicate with the Main Circuit Board and to display the necessary information. The wiring is simple, one DB-9 cable runs from connector DB-S09I on the Electronic Power Box to the MAG3-IT Controller. No wiring diagrams are supplied for the MAG3-IT Controller. If a problem arises, replace the complete module. Do not attempt to interchange circuit boards.

Manager's Control Panel

Refer to the Carrousel Controllers' Wiring Diagrams for wiring on a pair of lanes. Each box supports eight lanes, so the wiring indicated is multiplied by four in order to obtain a complete Manager's Control Panel Wiring Diagram.

Power Lifts

Due to the wide variety of power lifts on the market, no wiring diagrams for the ball return's power lift are supplied. Every power lift is activated by a 24-volt relay. The Carrousel Controllers' Wiring Diagrams indicate the wiring up to the 24-volt relay necessary to activate the power lifts, regardless of their make and model.

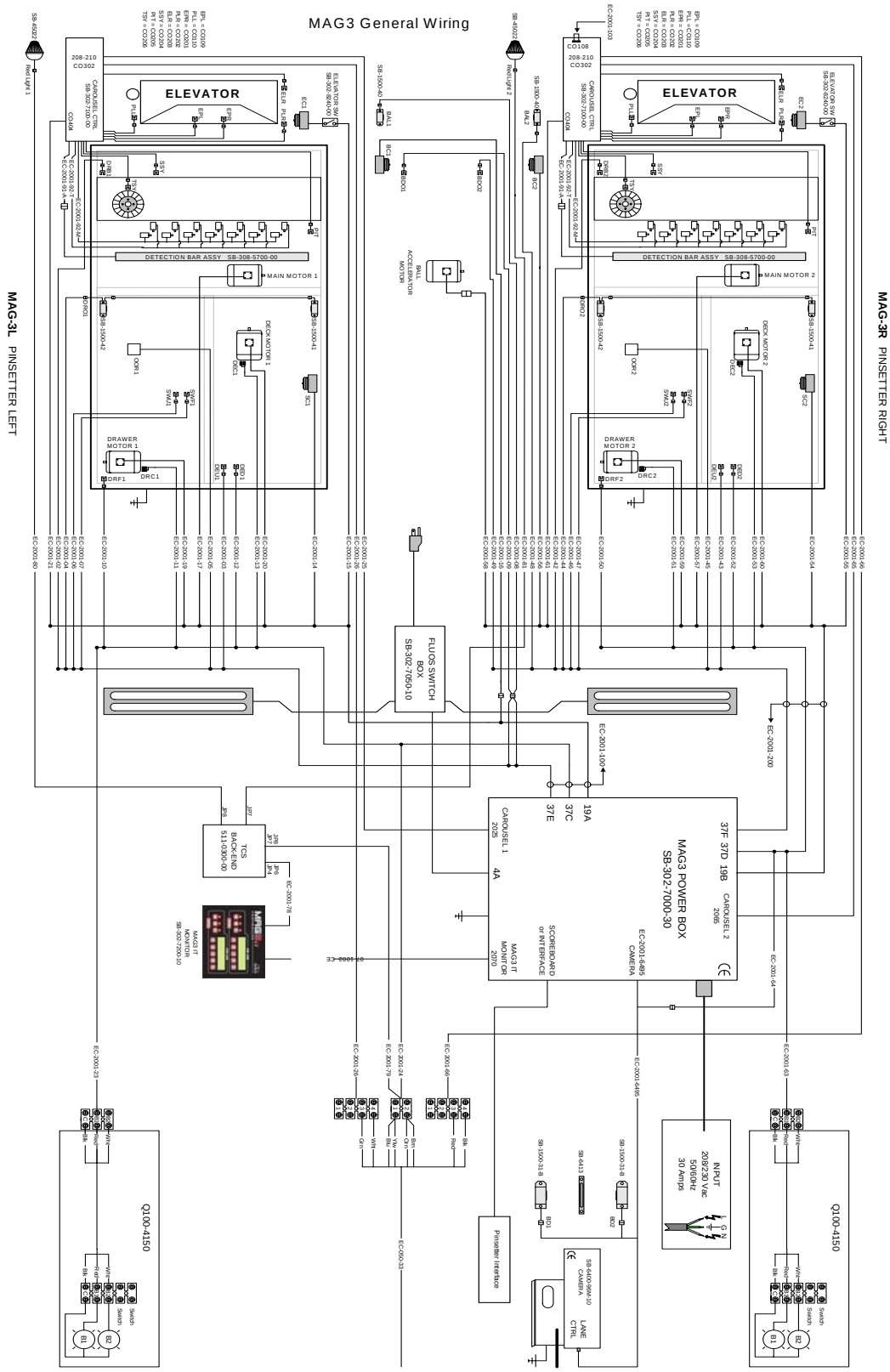
Camera

See the accessories section for more information about the camera.

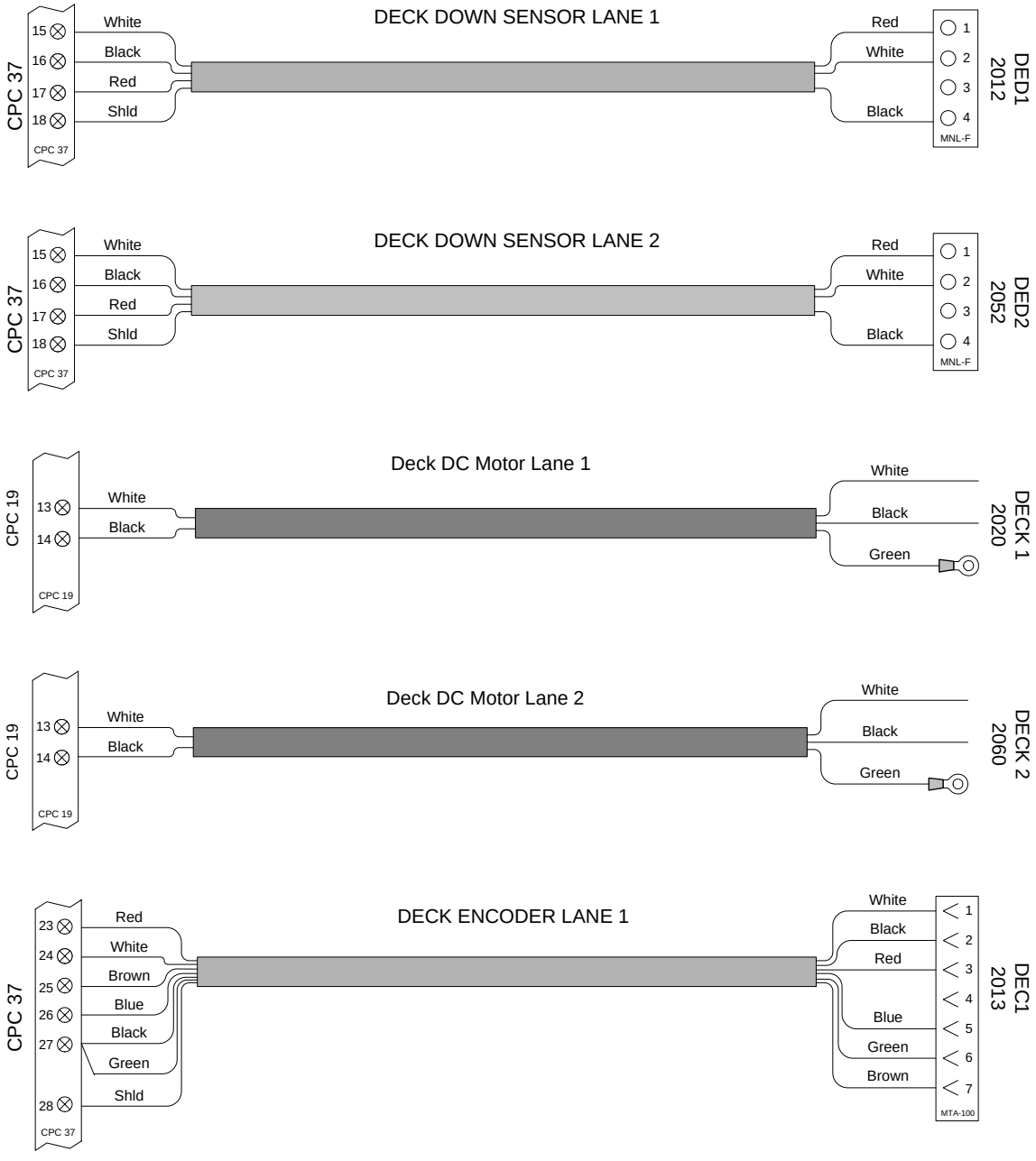
Important Notes on Fluorescent Lights

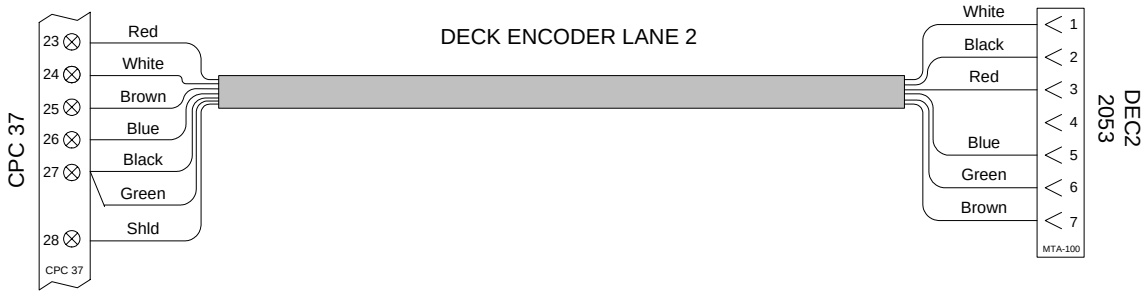
See the accessories section for more information about the fluorescent control box.

Detailed Wiring Diagrams

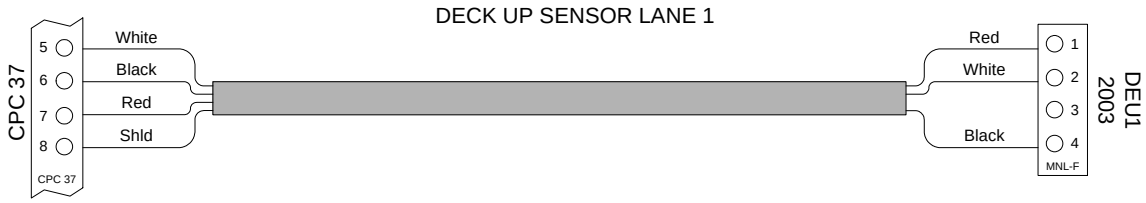


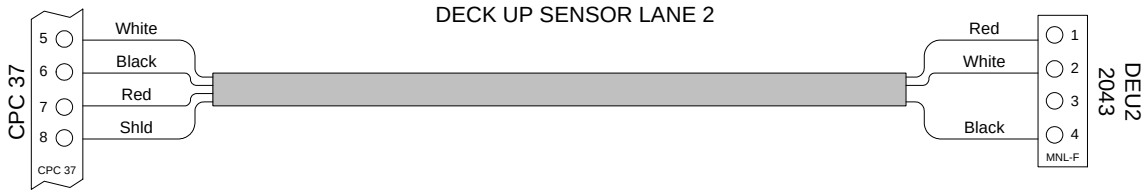
Deck cabling

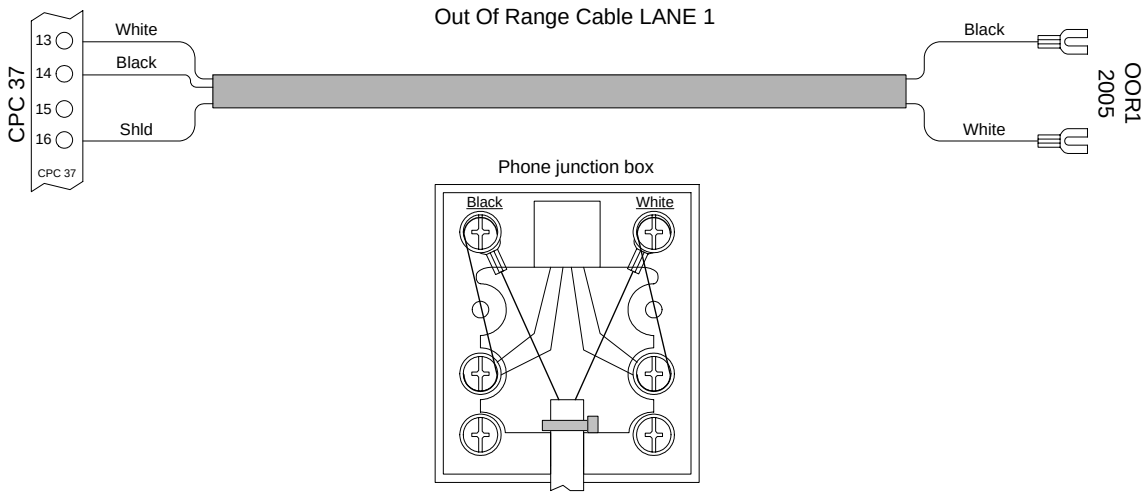


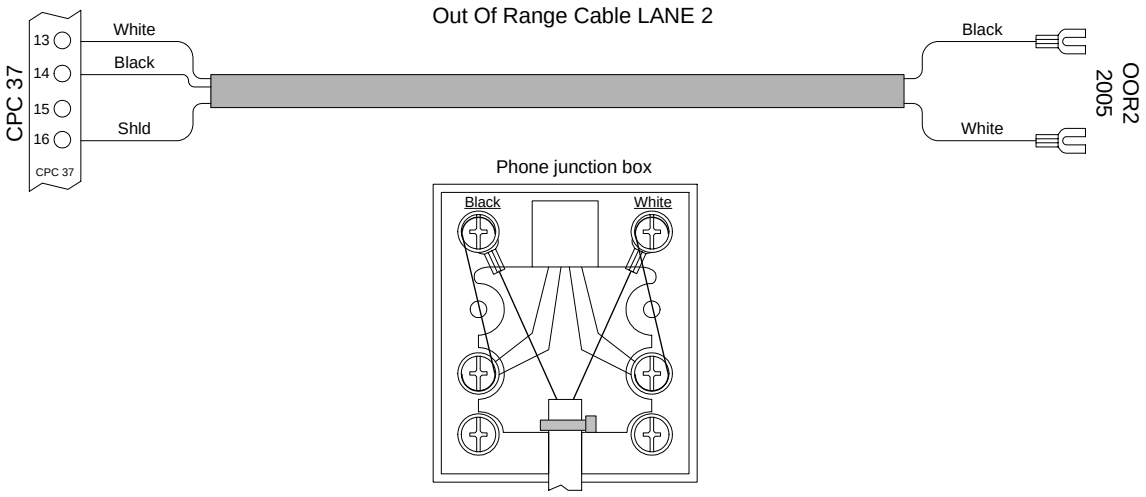


Deck cabling

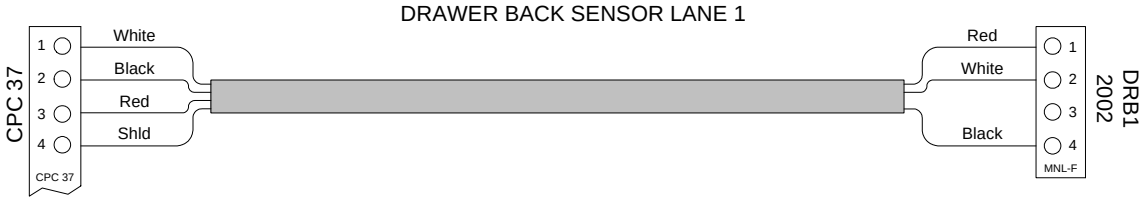


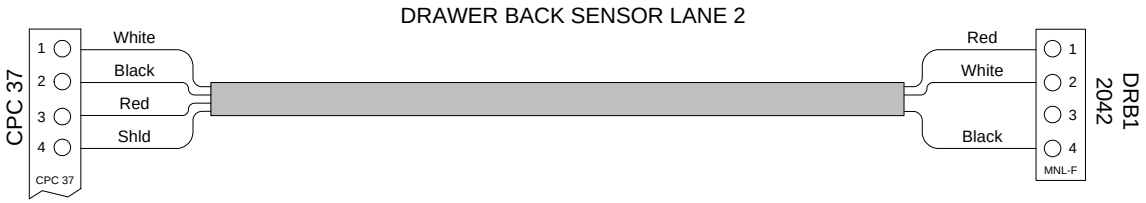


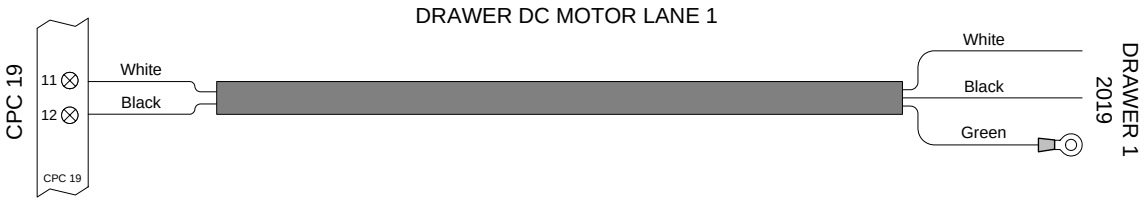


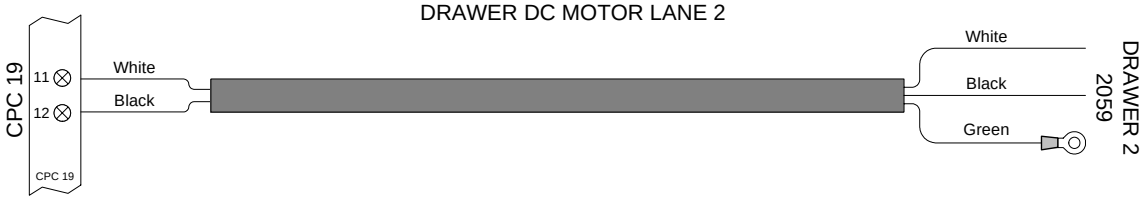


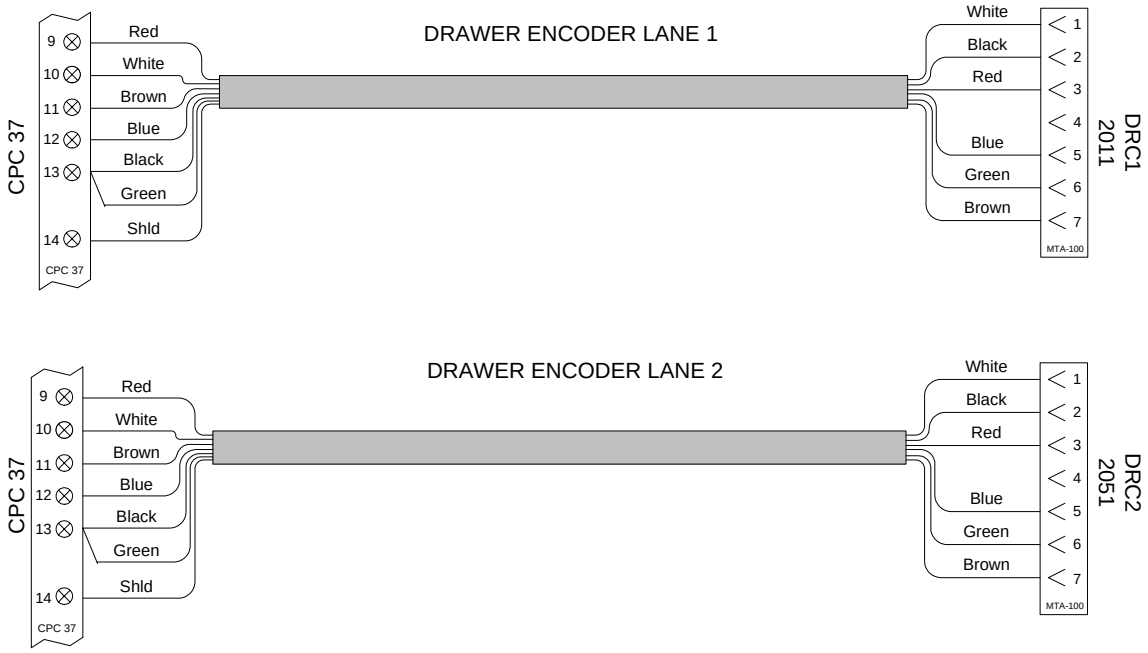
Drawer cabling



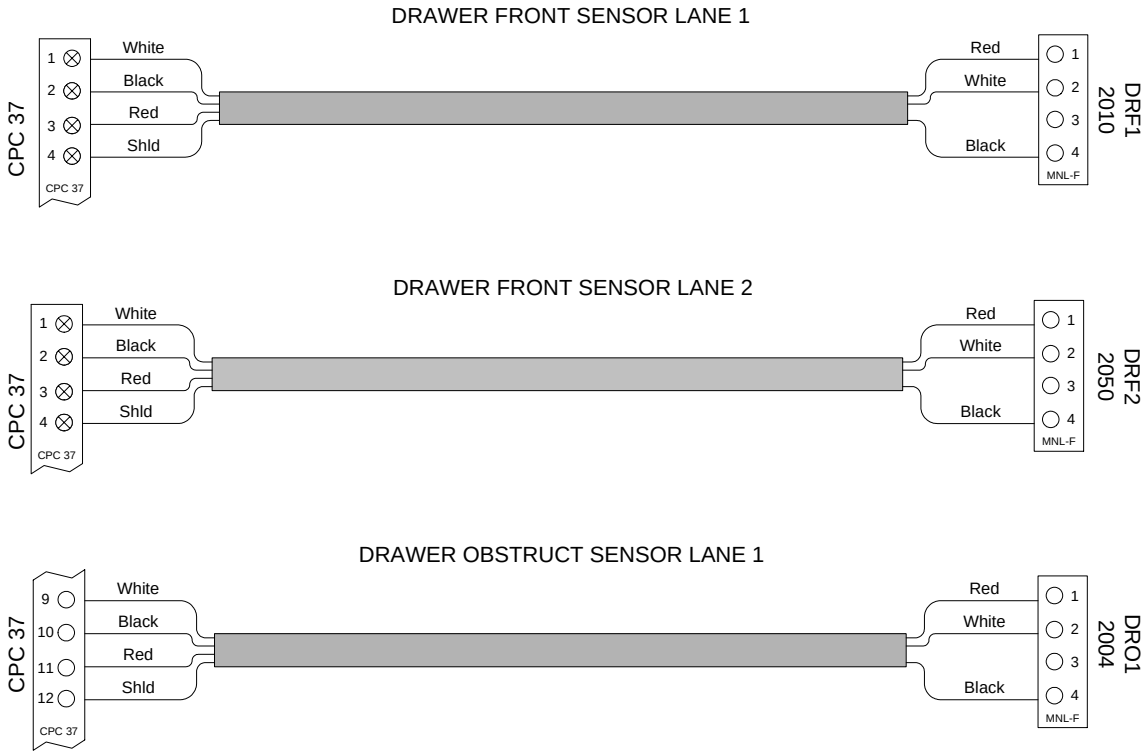


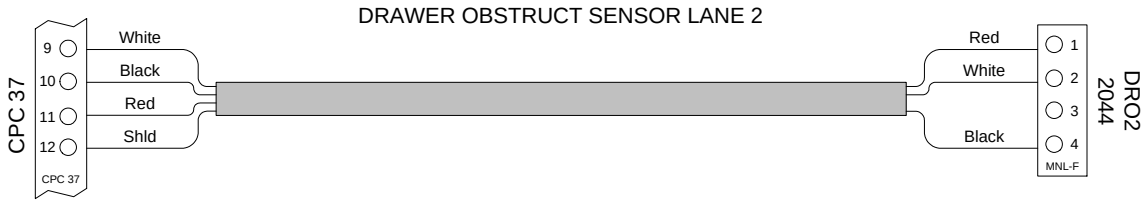




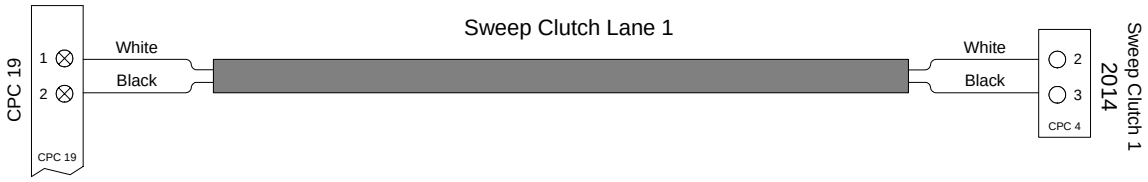


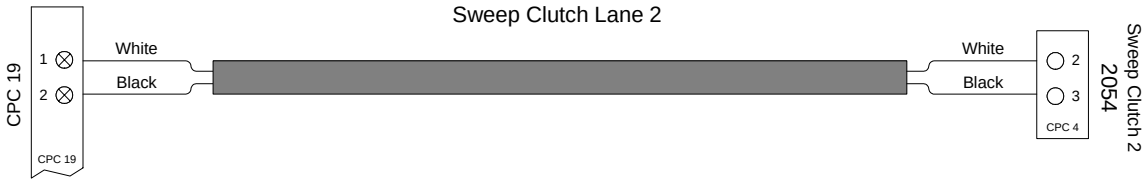
Drawer cabling

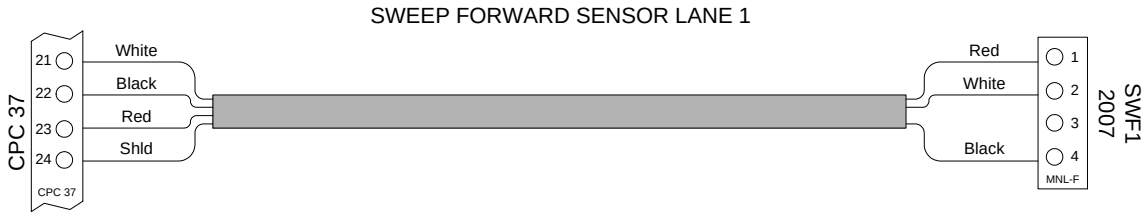


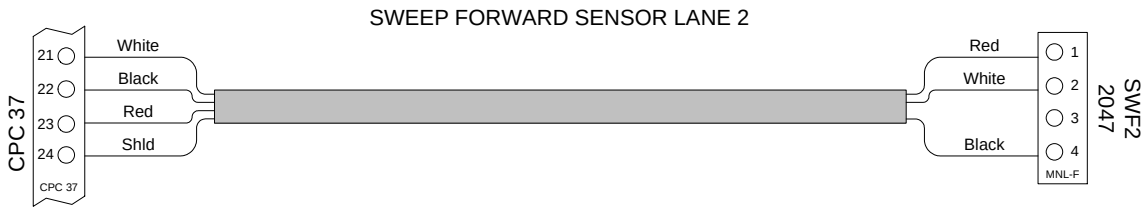


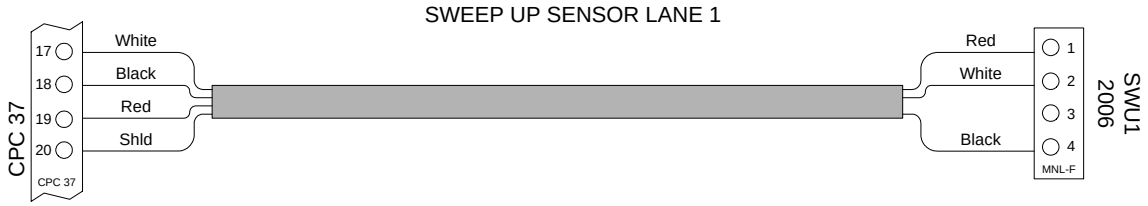
Sweep cabling



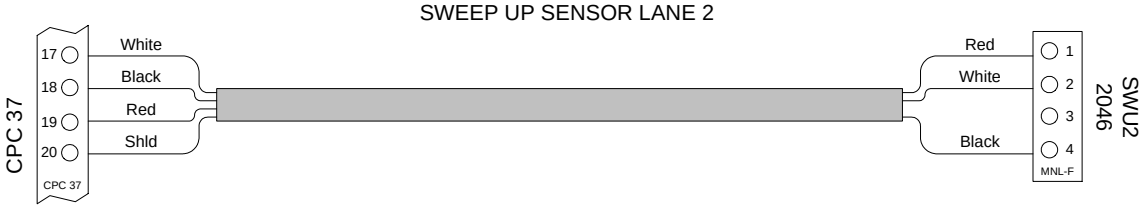






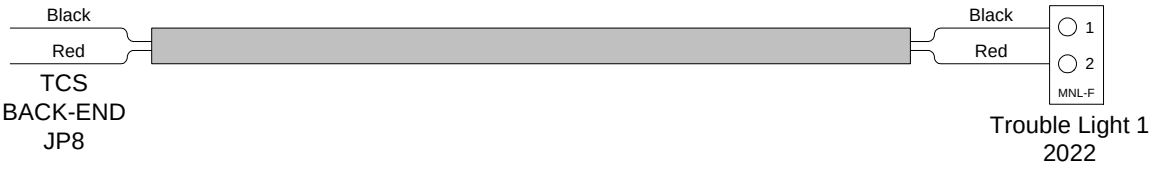


SWEEP UP SENSOR LANE 2

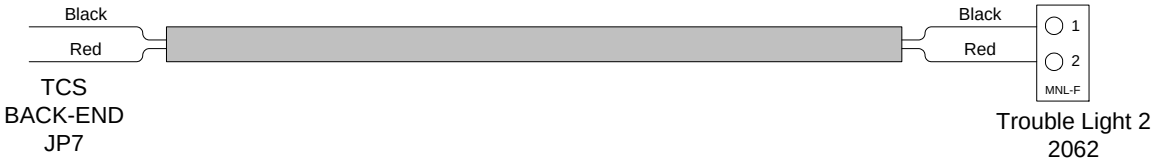


Trouble Light and TCS cabling

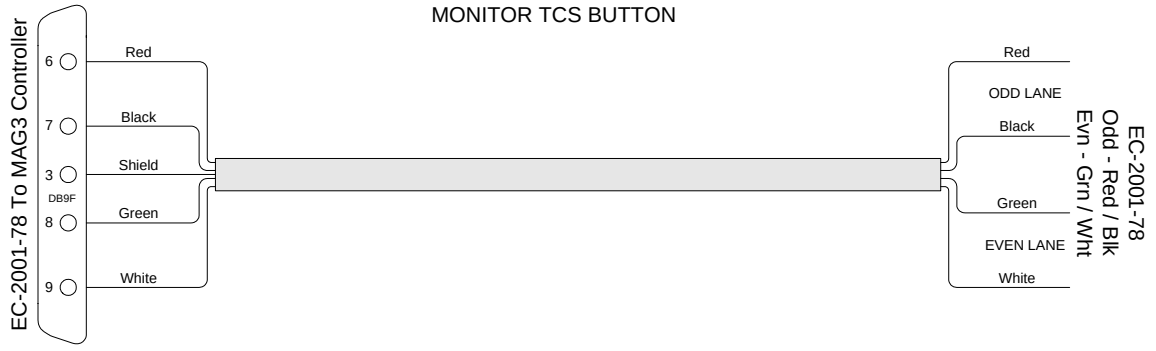
TROUBLE LIGHT LANE 1



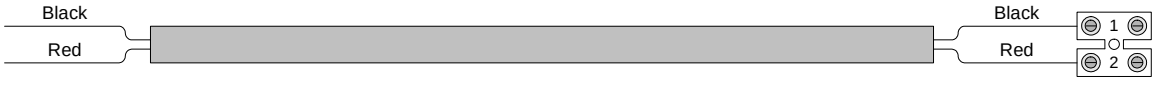
TROUBLE LIGHT LANE 2



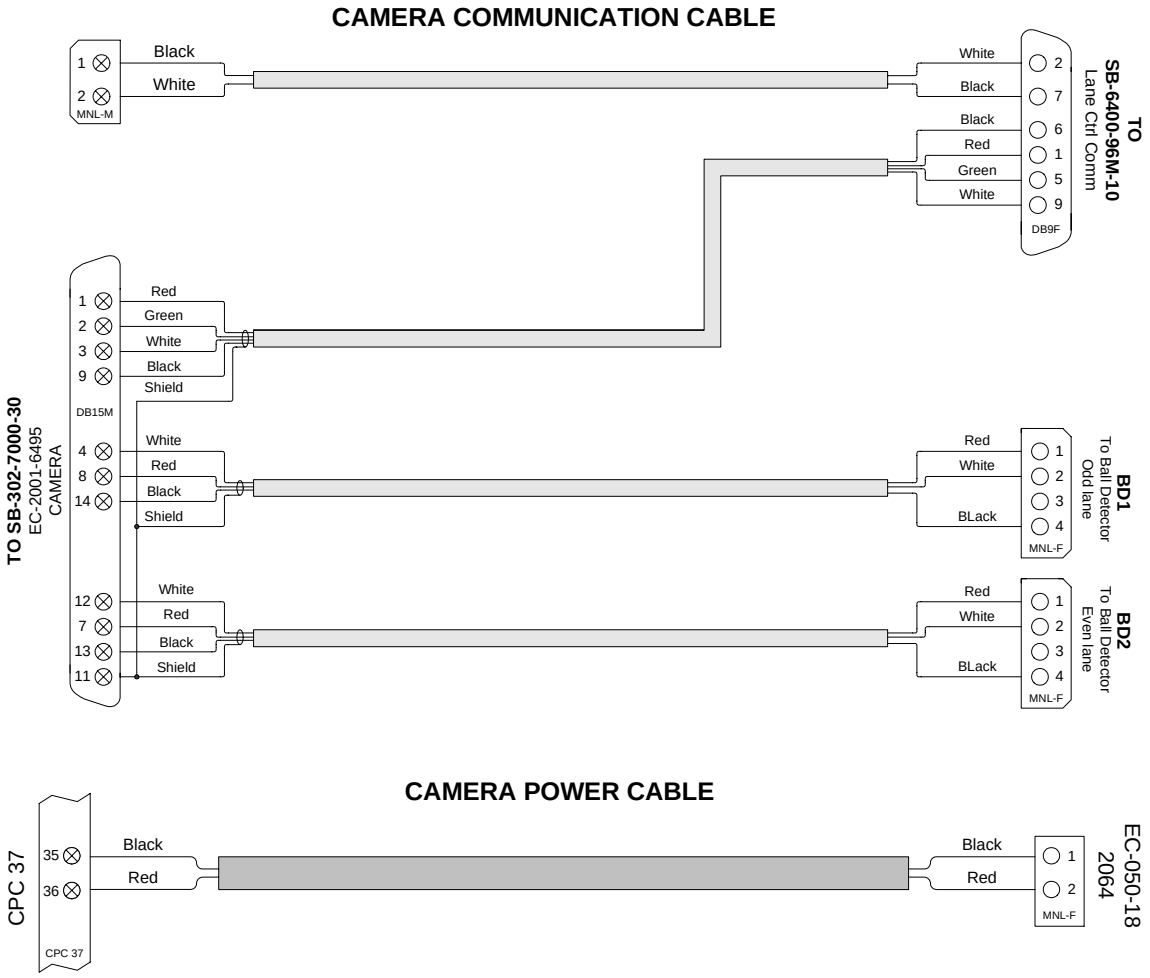
MONITOR TCS BUTTON



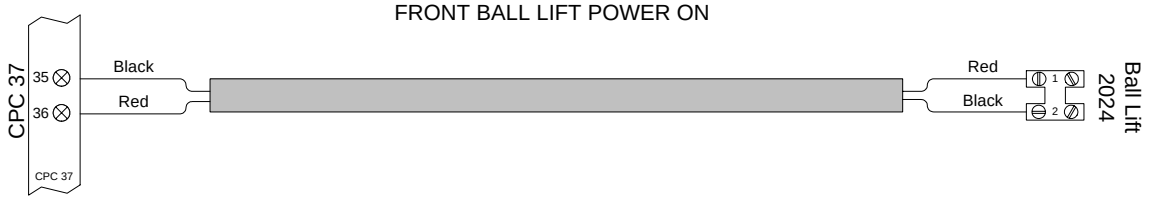
POWER CABLE TCS BACK END



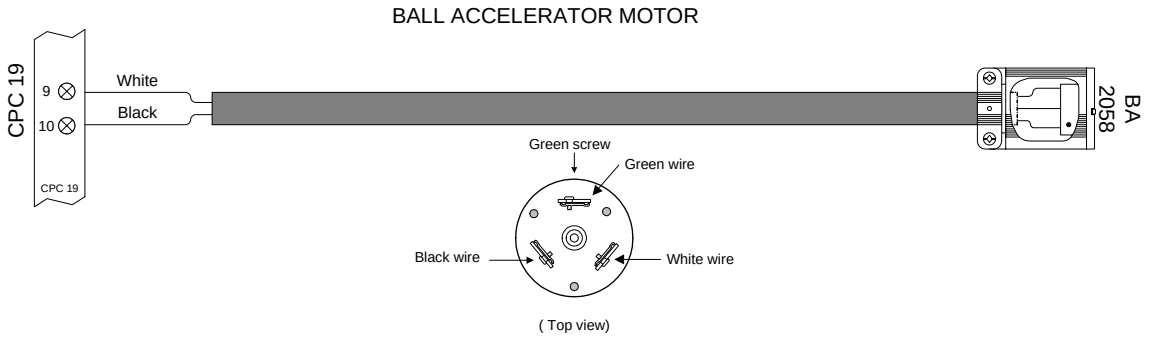
Camera and Ball Detector cabling

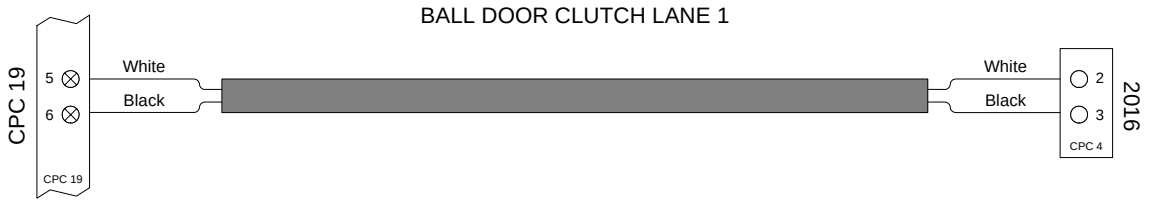


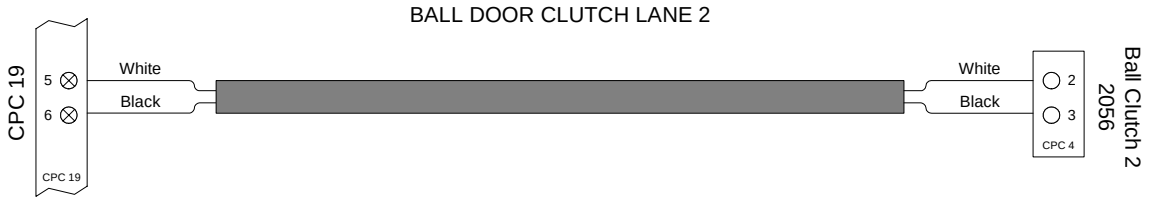
Front Ball lift cabling

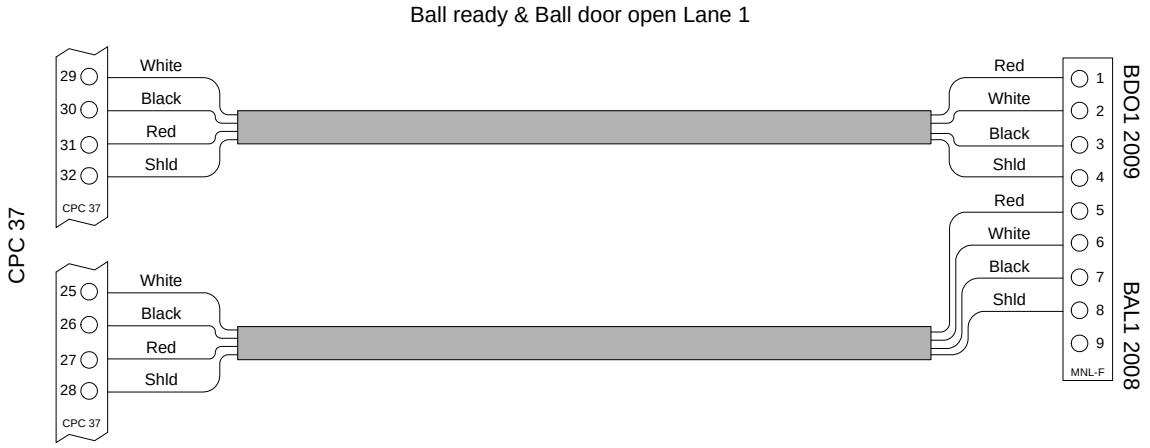


Ball Accelerator cabling

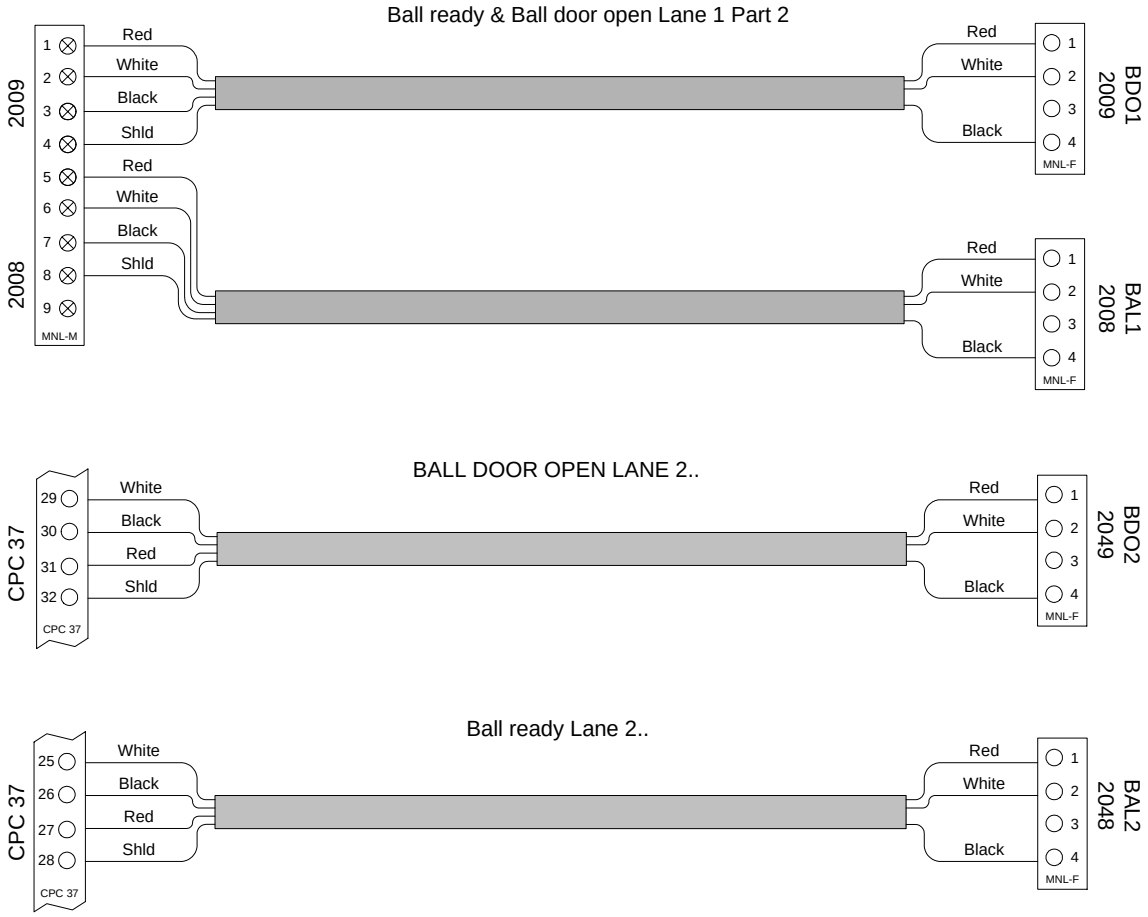




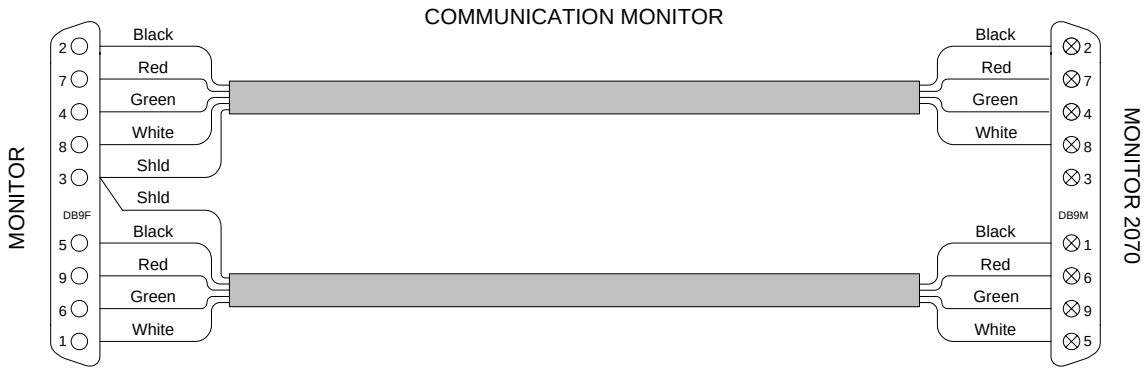




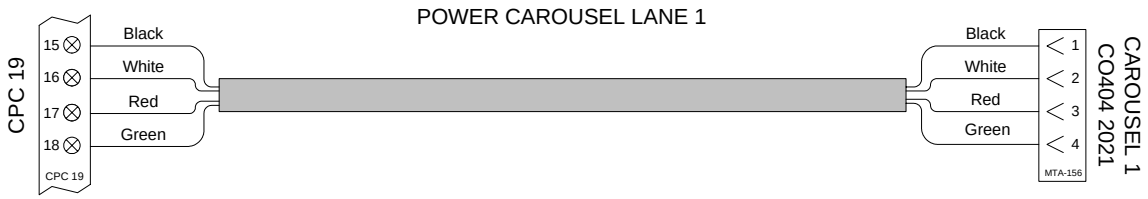
Ball Accelerator cabling

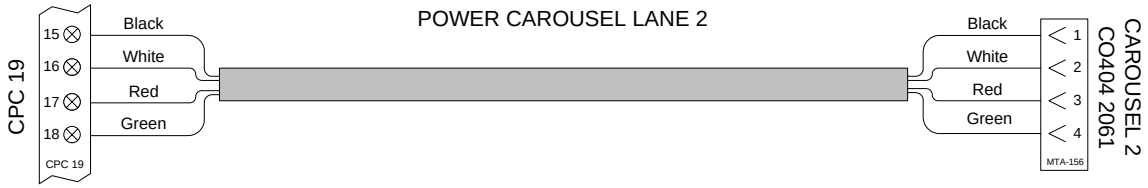


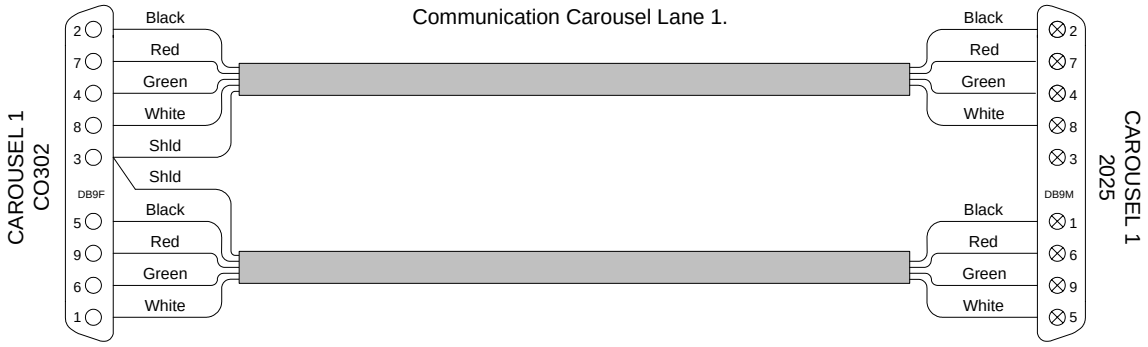
Monitor cabling

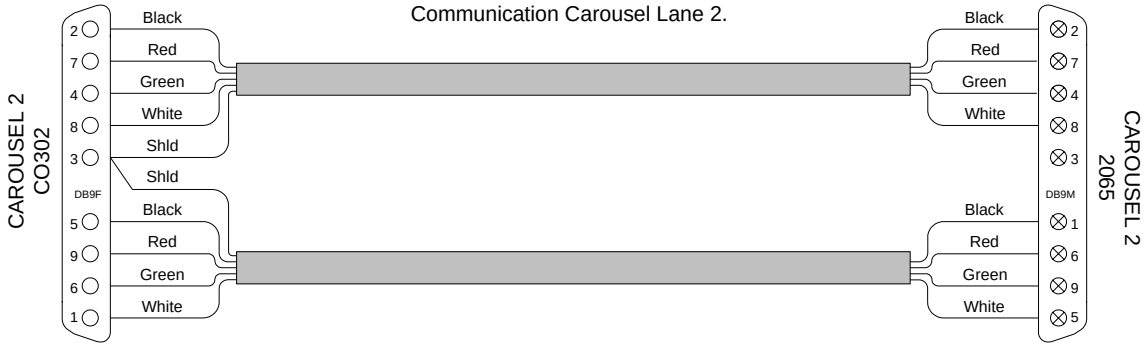


Carrousel cabling

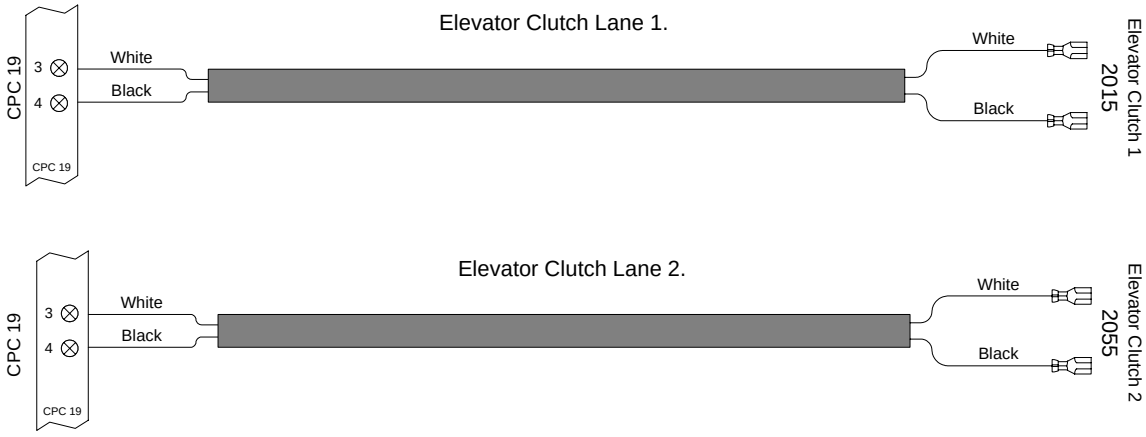




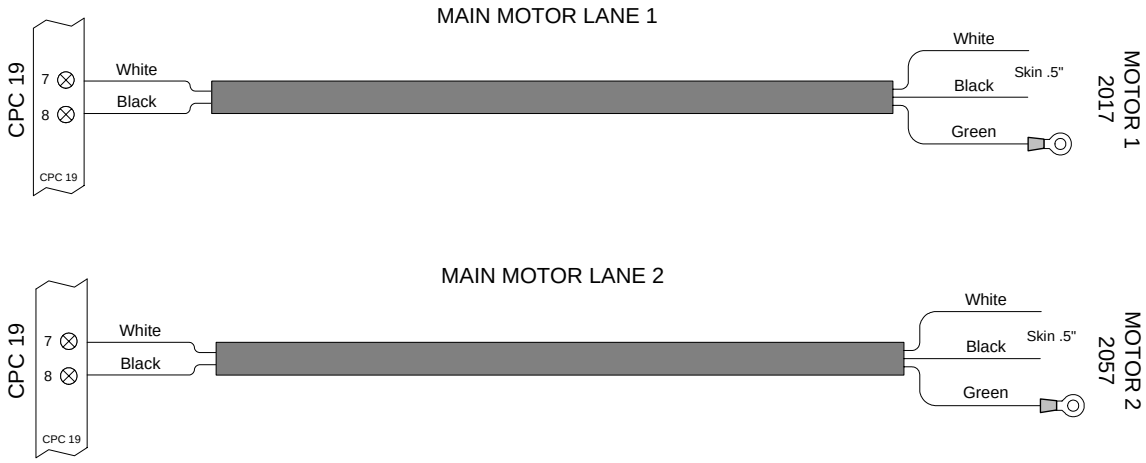




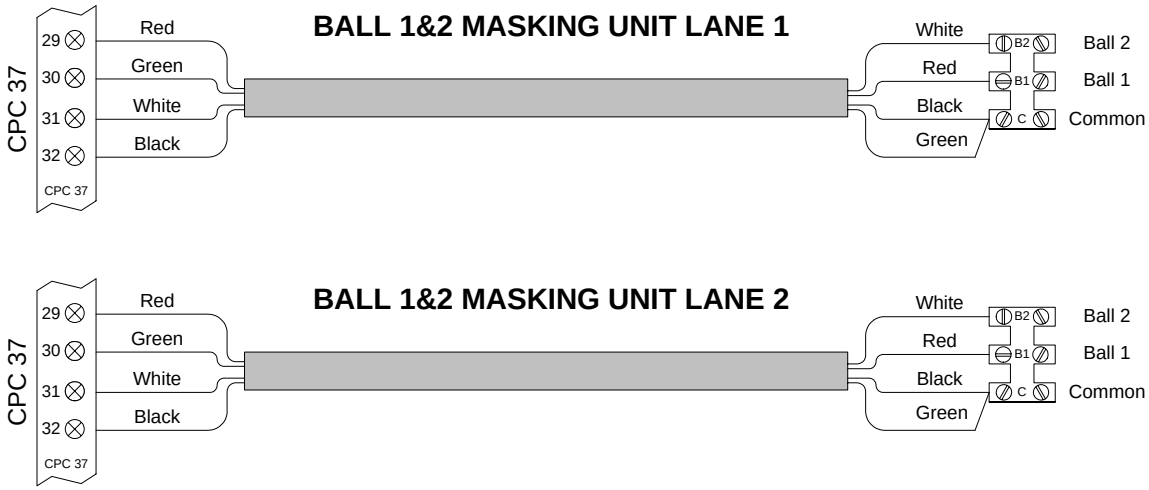
Elevator cabling



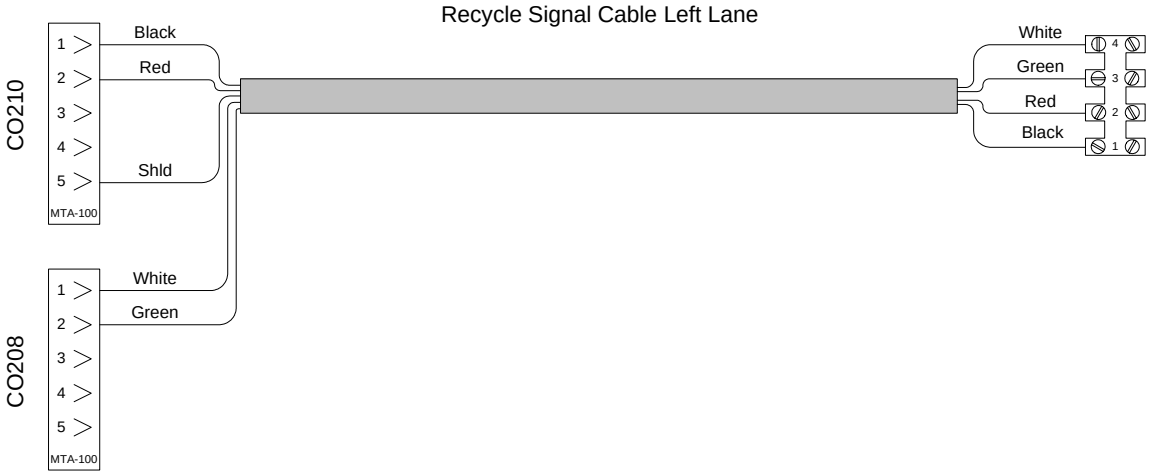
Main Motor cabling

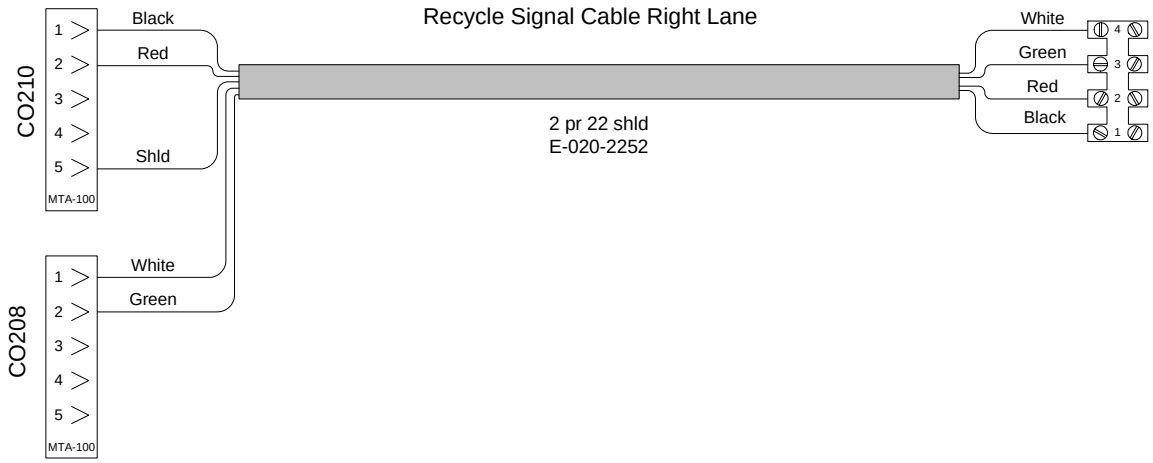


Masking Unit cabling



Recycle Button cabling





Wiring Notes

6. Options and Accessories

Chapter Overview

You will find in this chapter information about the accessories and option available with the MAG3 pinsetter.

Options & Accessories

TCS Backend Unit

The TCS backend unit works in conjunction with Qubica Scoring System.

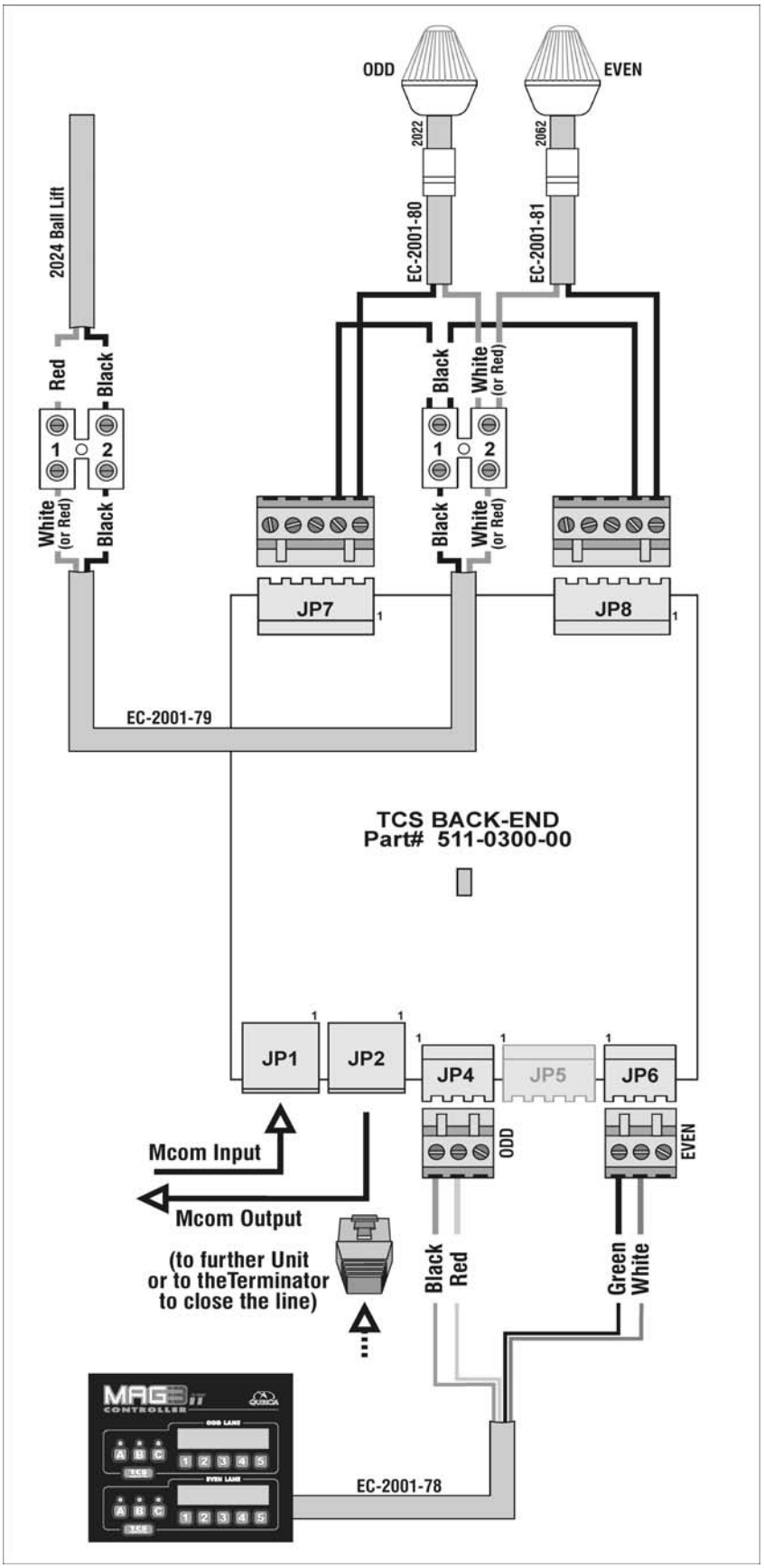
The main purpose of the unit is to provide an interface between the machine and the scoring system in order to be able to keep record of the trouble that happens on the machine and serve as an interface between the mechanic and the front desk.

How it Works

Part of the TCS system is the TCS interaction button on the MAG3it controller. These buttons are use by the mechanics to interact with the Trouble Call System. For complete details of operations and functions of the TCS system, please read the TCS user manuals.

Trouble Lights and TCS

The trouble lights are controlled by the back end unit, so when the machine detect a problem she will send a message to the TCS and then the trouble light will start flashing. When the mechanic acknowledge the call the light will remain steady on as long the trouble is clear and the mechanic clear the call with the TCS button. Please note that a trouble call can be initiate from the desk, in this case the trouble light will work as long that one of the two machines is on.



Important Safety Instructions

Warning

- THIS APPLIANCE IS EQUIPPED WITH MORE THAN ONE POWER SOURCE. DISCONNECT ALL POWER SOURCES BEFORE SERVICING.
- AN APPROVED POWER SUPPLY CORD, APPROPRIATELY RATED FOR THE AC VOLTAGE INPUT, IS TO BE USED FOR MAINS SUPPLY TO THE FLUORESCENT CONTROL BOX.
- VERIFY THAT THE FLUORESCENT LIGHT FIXTURE HAS A VOLTAGE RATING SUITABLE FOR CONNECTION TO THE AC MAINS INPUT OF THE FLUORESCENT CONTROL BOX.
- THE POWER SUPPLY CORD FOR THE FLUORESCENT CONTROL BOX IS TO BE INSTALLED BY THE MANUFACTURER OR TRAINED SERVICE REPRESENTATIVE TO ENSURE PROPER GROUNDING AND BONDING CONNECTIONS ARE MADE.
- APPROPRIATE, APPROVED WIRING, ACCEPTABLE IN THE COUNTRY OF END USE, IS TO BE USED FROM THE MAINS OUTPUT CONNECTIONS OF THE FLUORESCENT CONTROL BOX TO THE FLUORESCENT LIGHTING FIXTURES . ALSO, APPROPRIATE, APPROVED POLYMERIC TYPE STRAIN RELIEF DEVICES MUST BE USED FOR THIS WIRING AT THE EXIT POINTS FROM THE FLUORESCENT CONTROL BOX.
- THE MAINS SUPPLY CORD OF THE FLUORESCENT CONTROL BOX MUST BE ROUTED SUCH THAT IT WILL NOT BE SUBJECTED TO MECHANICAL ABUSE.
- TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.
- THE MAINS SUPPLY CORD PLUG MUST BE ACCESSIBLE AFTER INSTALLATION OF THIS APPLIANCE.
- THIS APPLIANCE IS NOT SUITABLE FOR OUTDOOR USE.
- THIS APPLIANCE IS NOT SUITABLE FOR INSTALLATION IN AN AREA WHERE A WATER JET COULD BE USED.
- THIS APPLIANCE MUST NOT BE CLEANED USING A WATER JET.
- MAINS SUPPLY WIRING TO THIS APPLIANCE IS TO BE DRESSED AWAY FROM THIS APPLIANCE.
- IF THE SUPPLY CORD IS DAMAGED , IT MUST BE REPLACED BY A QUALIFIED PERSON IN ORDER TO AVOID HAZARDS.

Introduction

The fluorescent switch box is an accessories design to work with the TMS and MAG3 pinsetters, the main function of that switch box is to turn on and off the fluorescent light for the pin at the same time the pinsetter turn on and off.

The box can control two fluorescent lights for each pinsetter, there is a manual switch to select between fluorescent 1 (white light) and fluorescent 2 (black light).

Installation

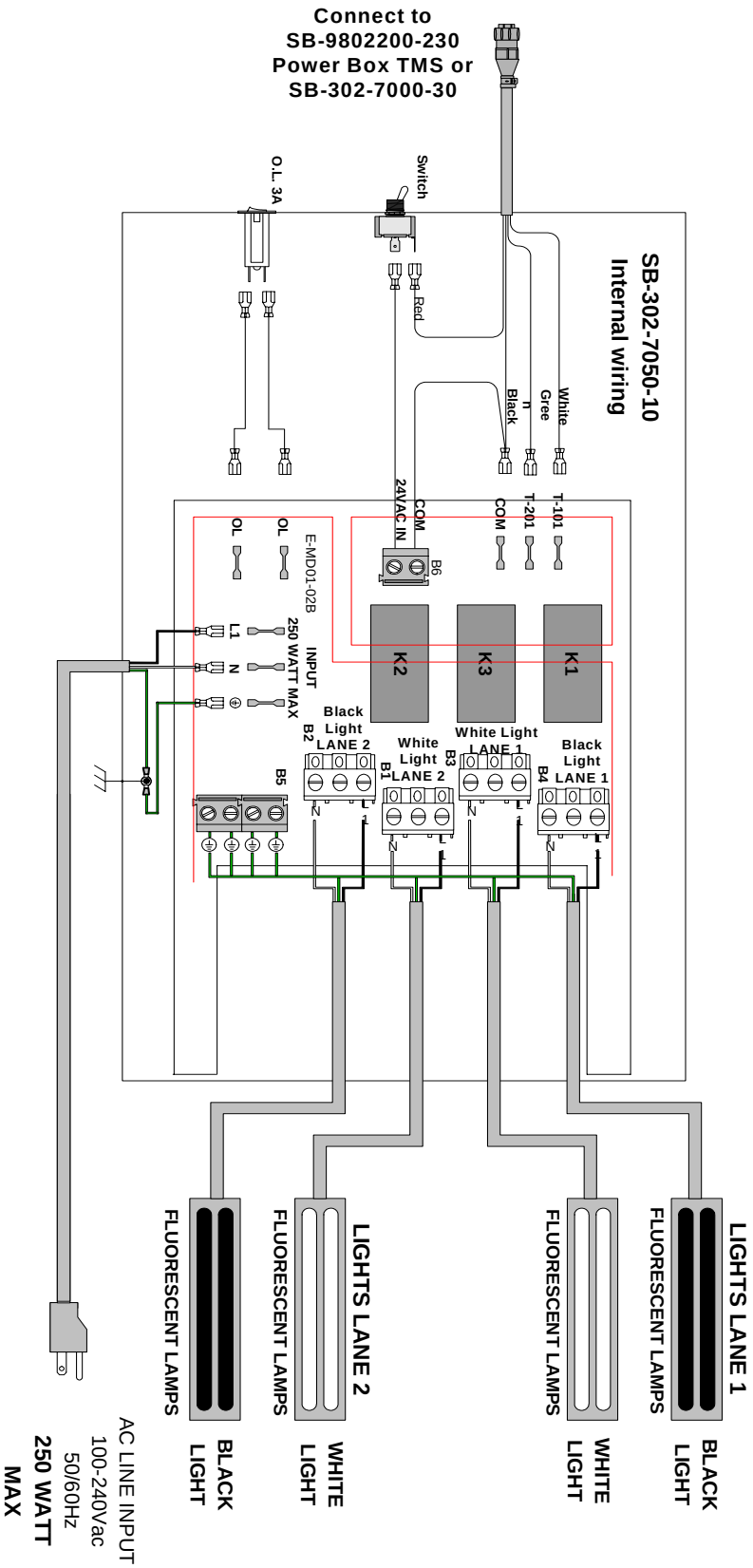
BEFORE PROCEEDING WITH INSTALLATION PLEASE CAREFULLY READ ALL THE WARNINGS!

Installation should be performed by qualified persons according to the authorities having jurisdiction in the end user location.

The fluorescent switch box should be installed:

- For TMS machines: on the wood panel between the two pinsetters
- For MAG3-IT pinsetters: in front of the odd pinsetter in case of MAG3.

Wire the fluorescent as shown in diagram 2.



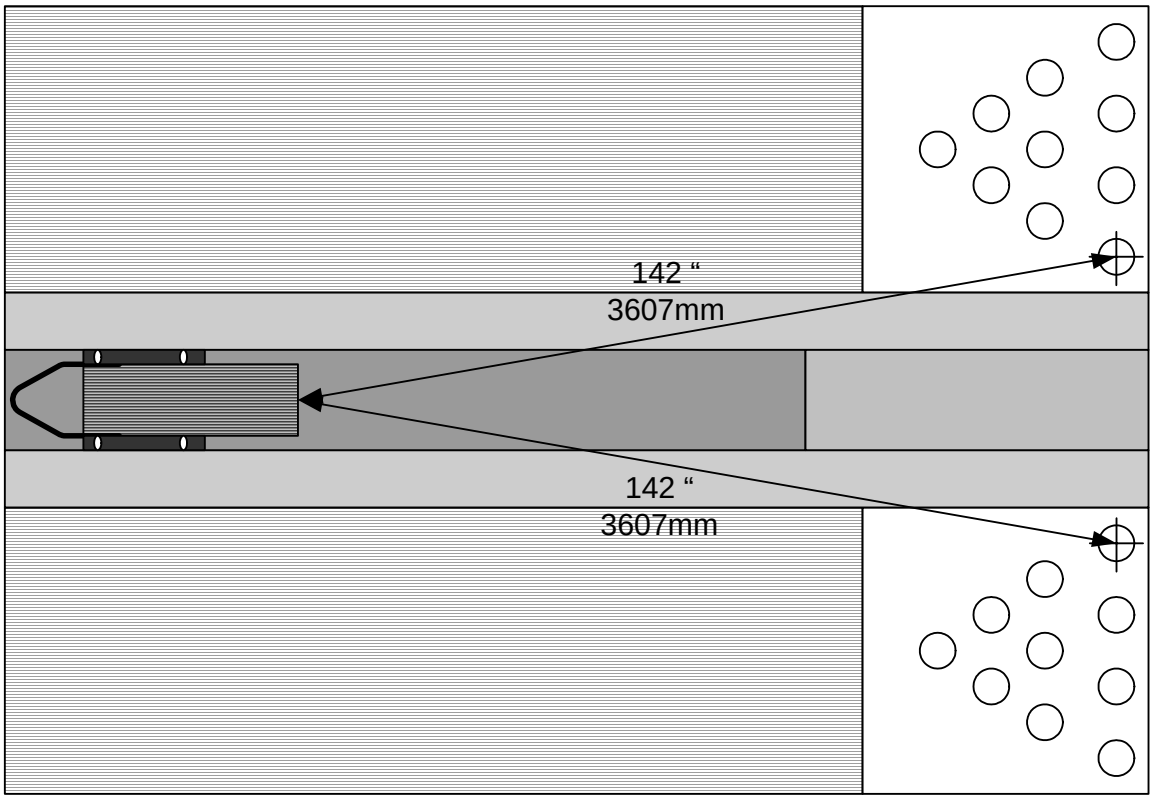
Camera

The camera is a device used to read the pins. With a normal installation, only one camera is used for a pair of lanes. In some special cases we may need to use two cameras: in this case the two cameras are interconnected together.

The camera has no moving parts. However, with all the vibration caused by the machinery and the ball, you might have to recalibrate the camera. Please read the procedure carefully.

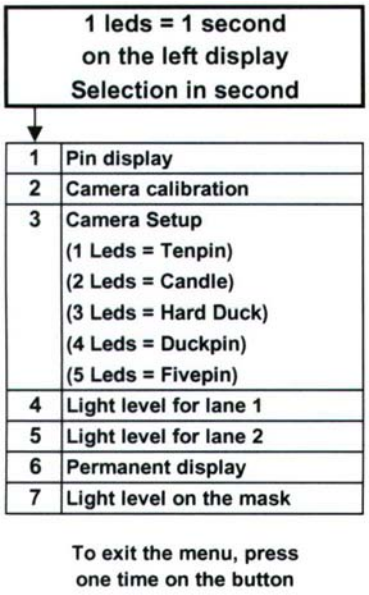
On the back of the camera you will find two LED displays, 2 computer cables and one push button. The push button is used to interact with the camera.

The camera must be installed on the division between a pair of lanes. Refer to the following diagram for the exact distance where it should be mounted.



General

1. 1 second = 1 light (LED) on left display.
2. The left display offers all the available options, and the one from the right indicates the chosen option.



Turning On Displays: "One Second Click"

The One Second Click is used to exit the various menus and turn on the display lights.

1. Push on the calibration button once and the two displays will turn on.
   a) The left display shows the pins from lane 1.
   b) The right display shows the pins from lane 2.
   c) On the two displays, the pins are numbered from left to right (1 to 10)
2. The two displays will shut down by themselves after 60 seconds.

Calibration: "Two-Second Click"

The Two-Second Click is used to position the pins reading frame (calibration).

1. Make sure that the two machines (pinsetters) are turned on.
2. Make sure that the lights on the machines are turned on.
3. Make sure that there are 10 pins on each lane.
4. Make sure the masking is standing (on normal position).
5. Hold the calibration button for 2 seconds and then let go.
6. A light will scan the left display during the calibration of lane 1, and then it will scan the right one during calibration of lane 2.

Configuration: "Three-Second Click"

The Three-Second Click is used to select in which mode the camera will read the pins.

1. Hold the calibration button during 3 seconds and then release.
2. The left display offers all the configuration options available for your pin type:
   a) Tenpin : 1 light (led)
   b) Candlepin : 2 lights (led)

c) Harduck : 3 lights (led)

d) Duckpin : 4 lights (led)

e) Fivepin : 5 lights (led)

3. Press once on the calibration button to confirm your choice and then the right display will show you the new configuration.
4. After changing the pin type, you need to perform a calibration.

Light intensity on the pins: "Four-Second Click" (lane 1) or "Five-Second Click" (lane 2)

The Four- or Five-Second Click is used to adjust the light intensity level on the pins.

1. Check the light intensity on the mask with the Seven-Second Click.
2. In order to check the light intensity on pins 3 and 9 of lane 1:
   a) Hold the calibration button on the left display during 4 seconds.
   b) Compare the two displays. On the one with the fewer lights turned on, write down how many LEDs are on (usually there are only 2 lights that are not).
   c) Press the calibration button once to exit this menu.
3. In order to check the light intensity on pins 2 and 8 of lane 2.
   a) Hold the calibration button on the left display for 5 seconds.
   b) Compare the two displays. On the one with the fewer lights turned on, write down how many LEDs are on.
   c) Press the calibration button once to exit this menu.
4. Find the lane with the lowest light intensity and adjust the other lanes with this one.

Intensity Adjustment

1. Find the lane with the lowest intensity and select the Four-Second Click if it's lane 1 or the Five-Second Click for lane 2.
2. To increase the light intensity, turn very gently the intensity of the potentiometer anticlockwise on the front of the camera, in other words towards lane 2, in order to obtain a maximum of 8 lights turned on.
3. If there are more than 8 lights turned on, turn the intensity of the potentiometer clockwise, in other words towards lane 1, to obtain only 8 lights turned on.
4. Always recalibrate after an intensity adjustment.

Keeping the Display Turned on: "Six-Second Click"

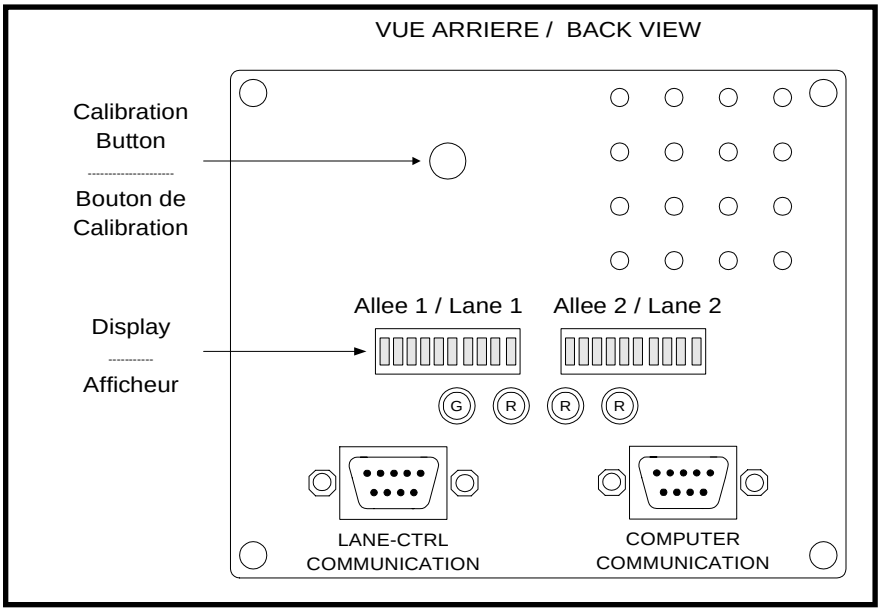
The Six-Second Click is used to maintain the two displays turned on permanently to allow the verification of the pins dropped one by one.

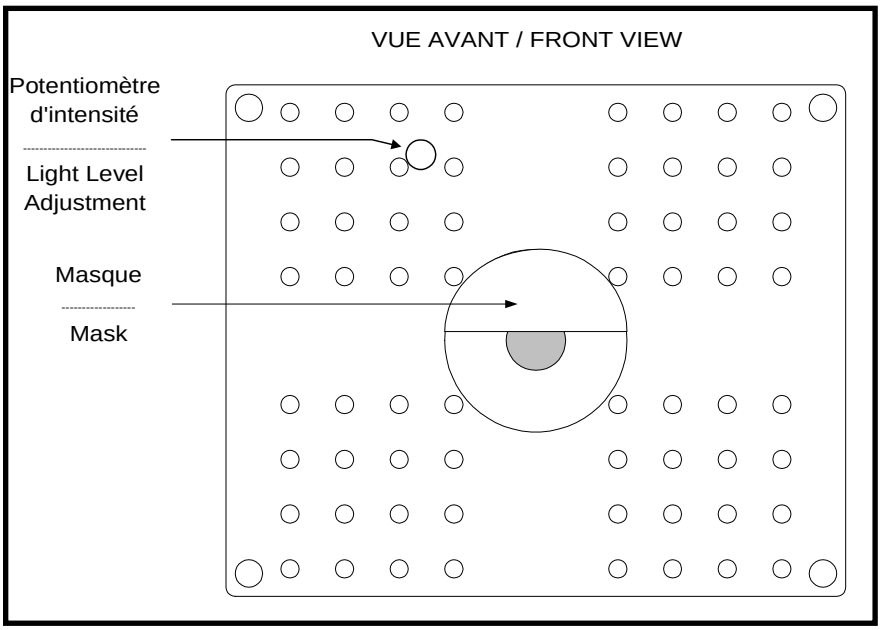
1. Hold the calibration button for 6 seconds on the left display, the two displays will always be turned on.
2. In order to exit this menu, you need to unplug the power cord of the camera (unplug the silver connector on the back of the camera – “Lane-ctrl communication”) and than plug it back.

Intensity on the Mask: " Seven Seconds Click"

The Seven Seconds Click is used as an initial reference before doing the light intensity adjustment on the pins because there's a delay between the potentiometer and the electronic circuit reaction. This intensity is measured on the white obstructer in front of the lens.

1. Check this reference before adjusting the light intensity on the pins and write it down. If you move too the potentiometer intensity quickly, your adjustment could be completely wrong. It will then be possible for you to readjust the initial value in this mode.
2. Hold the calibration button for 7 seconds on the left display and then write down how many lights are turned on as an initial reference.
3. Press the calibration button once to exit this menu.


VUE ARRIERE / BACK VIEW
Calibration Button
Bouton de Calibration
Display
Afficheur
Allee 1 / Lane 1
Allee 2 / Lane 2
G
R
R
R
LANE-CTRL COMMUNICATION
COMPUTER COMMUNICATION


VUE AVANT / FRONT VIEW
Potentiomètre d'intensité
Light Level Adjustment
Masque
Mask

The following procedure is to be used when you have two cameras for one pair of machine.

General

1. 1 second = 1 light (led) on left display.
2. The left display offers all the available options, and the one from the right indicates the chosen option.

Turning On Displays: "One LED"

The One LED Click is used to exit the various menus and turn on the display lights.

1. Push on the function button once and the two displays will turn on.
2. The left display shows the pins from lane 1.
3. The right display shows the pins from lane 2.
4. On the two displays, the pins are numbered from left to right (1 to 10)
5. The two displays will shut down by themselves after 60 seconds.

Calibration of the Primary Camera: "Two LED's"

(Lane is to the left of the camera)

The Two LED Click is used to position the pins reading frame (calibration).

1. Make sure the that only cable connected to the camera is the Lane Controller / Pinsetter cable (Never connect the Inter-communication between the two camera at this point).
2. Make sure that the machine (pinsetter) is turned on.
3. Make sure that the light on the machine is turned on.
4. Make sure that there are 10 pins on the lane.
5. Make sure the masking is standing (on normal position).
6. Make sure the camera does not have all ten LED's on, on the right display.
7. Hold the function button for 7 LED's on the left display and then write down how many lights are turned on as an initial reference.
8. Hold the function button for 2 LED's and then let go.
9. A light will scan the left display during the calibration of lane 1, and then it will scan the right one for approximately 60 seconds.
10. Once the calibration is finished, the left display should be completely lithe. If it is not the case, restart from step 7 above.
11. Check the **Light intensity on the pins**: "Four LED Click" (lane 1).
12. If the light intensity is not within the specifications, make the proper adjustment (as shown on in section 4) and restart from step 7 above.

Calibration of the Secondary Camera: “Two LED’s"

(The Lane is to the Right of the camera)

The Two-LED Click is used to position the pins reading frame (calibration).

1. Disconnect the “Lane Controller / Pinsetter cable” from the Primary Camera an connect it to the “Lane Controller / Pinsetter” connector on the Secondary camera (Never connect the Inter-communication between the two camera at this point)
2. Make sure that the machine (pinsetter) is turned on.
3. Make sure that the light on the machine is turned on.
4. Make sure that there are 10 pins on the lane.
5. Make sure the masking is standing (on normal position).
6. Make sure the camera does not have all ten light (LED’s) on, on the left display.
7. Hold the function button for 7 LED’s on the left display and then write down how many lights are turned on as an initial reference.
8. Hold the function button for 2 LED’s and then let go.
9. A light will scan the left display for approximately 60 seconds, and then it will scan the right display for the calibration of lane 2.
10. Once the calibration is finished, the right display should be completely lithe. If it is not the case, restart from step 7.
11. Check the **Light intensity on the pins**: "Five LED’s Click" (lane 2).
12. If the light intensity is not with-in the specification, make the proper adjustment (as shown on in section 4) and restart from step 7 above

Final Connection and Testing for Both Cameras.

1. Disconnect the “Lane Controller / Pinsetter cable” from the Secondary Camera and connect it to the “Lane Controller / Pinsetter” connector on the Primary camera.
2. Connect the Inter-communication between the two cameras.
3. **At this point, both displays on both cameras will work synchronously.**

Configuration: "Three LED's"

The Three LED's Click is used to select in which mode the camera will read the pins.

1. Hold the function button for 3 seconds.
2. The left display offers all the configuration options available for your pin type:
   a) Tenpin : 1 light (led)
   b) Candlepin : 2 lights (led)
   c) Harduck : 3 lights (led)
   d) Duckpin : 4 lights (led)
   e) Fivepin : 5 lights (led)
3. Press once on the function button to confirm your choice and then the right display will show you the new configuration.
4. After changing the configuration, you need to do the calibration again.

Light Intensity on the Pins: "Four-LED" (lane 1) or "Five-LED" (lane 2)

The Four- or Five-LED Click is used to adjust the light intensity level on the pins.

1. Check the light intensity on the mask with the Seven LED's Click.
2. Hold the function button during 4 LED's, on the left display (light intensity on lane 2).
3. On the one with the less lights turned on, write down how many led are on.
4. Press once on the function button to exit this menu.
5. Hold the function button for 5 LED's, on the left display (light intensity on lane 2).
6. On the one with the less lights turned on, write down how many led are on.
7. Press the function button once to exit this menu.

Intensity Adjustment

1. Once you have selected the lanes with the lowest intensity, select the Four LED's Click (lane 1) or the Five LED's Click (lane 2).
2. To increase the light intensity, turn the potentiometer (very slowly) anti-clockwise in order to obtain a maximum of 8 LED's on the right display.
3. If there is more than 8 LED's On, turn the potentiometer (very slowly) clockwise in order to obtain only 8 LED's turned on the right display.

Note: Always calibrate after adjustment of the intensity.

Keeping the Display Turned on: "Six LED's"

The Six LED's Click is used to maintain the two displays turned on permanently to allow the verification of the pins dropped one by one.

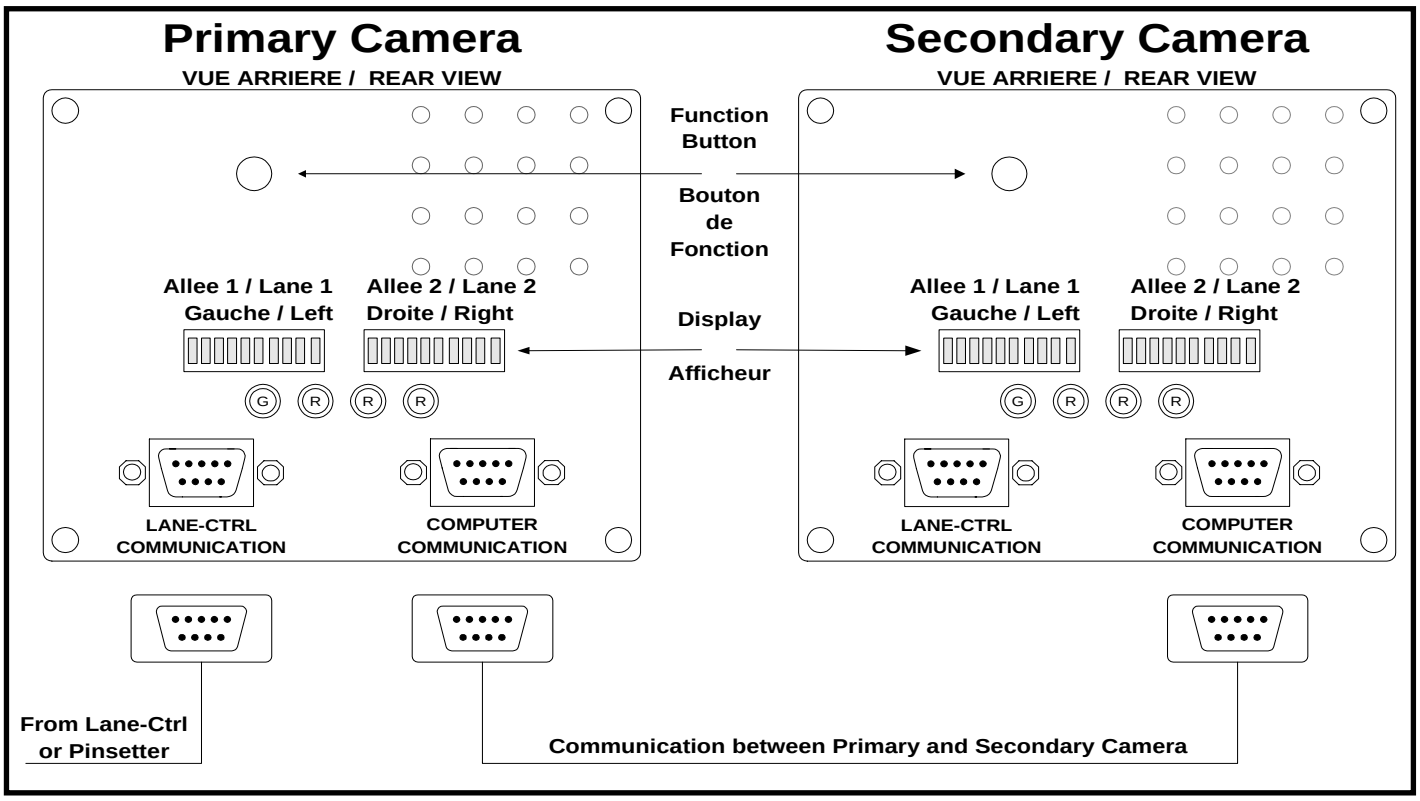
1. Hold the function button for 6 LED's on the left display.
2. In order to exit this function, you need to hold the function button for 6 LED's.

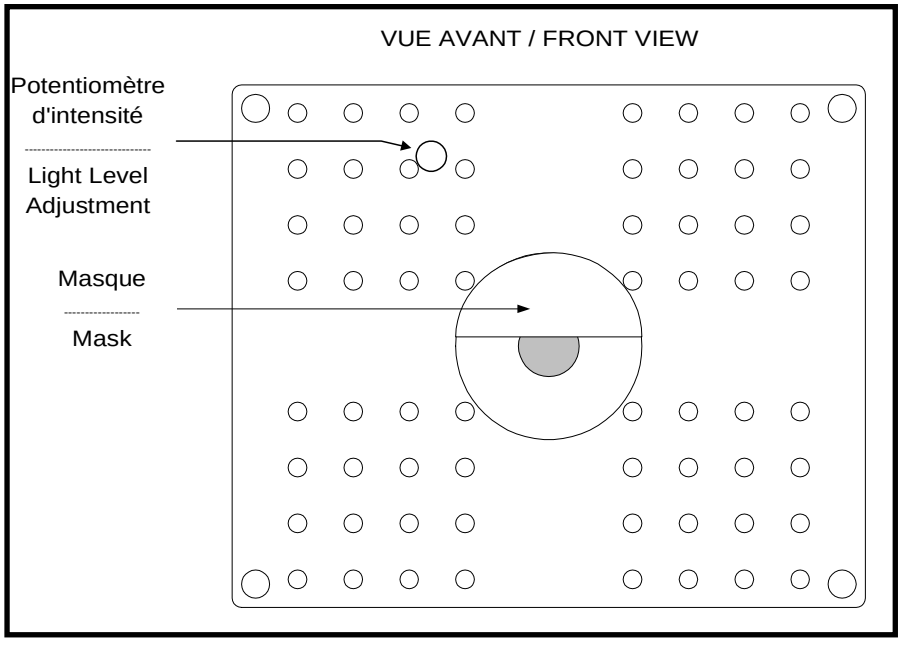
Intensity on the Mask: "Seven LED's"

The Seven LED's Click is used as an initial reference before doing the light intensity adjustment on the pins. This intensity is measured on the white mask in front of the camera.

Check this reference before adjusting the light intensity on the pins and write it down. It will then be possible to use this value as a reference for further adjustment.

1. Hold the function button for 7 LED's on the left display and then write down how many lights are turned on.
2. Press once on the function button to exit this menu.





7. Parts

Chapter Overview

You will find in this chapter all the parts listing of your MAG3 pinsetter.