CAMERA

SB-6400-95 SB-6400-95M SB-6400-96 SB-6400-96M

Installation

The installation of the sB-6400-95 Complete Camera Assemblies may commence only if the cabling has been run and the capping and the ball detectors have been installed. The instructions detailed here are for subway ball returns. Surface ball returns use the same procedures and hardware but are fixed to the outer edge of the ball tracks. Refer to the MAG-3 Automatic Scoring System Service Manual or the MAG-3 Pinsetter Service Manual for information on installing the cable assemblies.

NOTE: If you have a slave camera assembly to be installed in conjunction with a master camera assembly, refer to "Master / Slave Installation" beginning on page 14 of this manual.

1. Place the first camera assembly on the 10½ -inch capping between lanes one and two at approximately twelve feet (3.66 meters) from the rear of the pin decks. Measure 142 inches (3607mm) from the center of spot #10 on lane number one to the center of the 10½-inch capping. Repeat the same measurement for lane number two using the center of spot #7. Position the camera unit with the center of the optical lens facing the pit area at the axis of both afore mentioned measurements. (Figure 3)

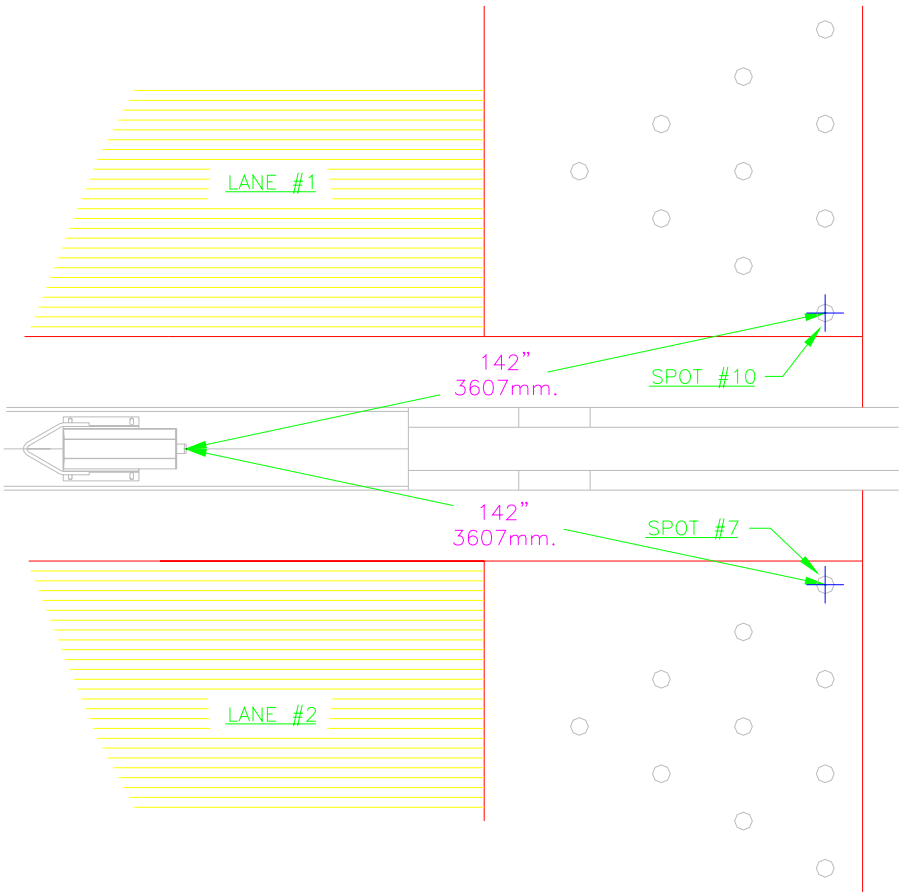


Figure 3

2. Mark the mounting hole locations, set the camera unit aside and drill 5/32" (4mm) holes for the mounting screws. Replace the camera unit and secure it in place using the center guide holes with the two truss head tapping screws supplied. Level the camera unit by shimming as necessary with flat washers. (Figure 4)

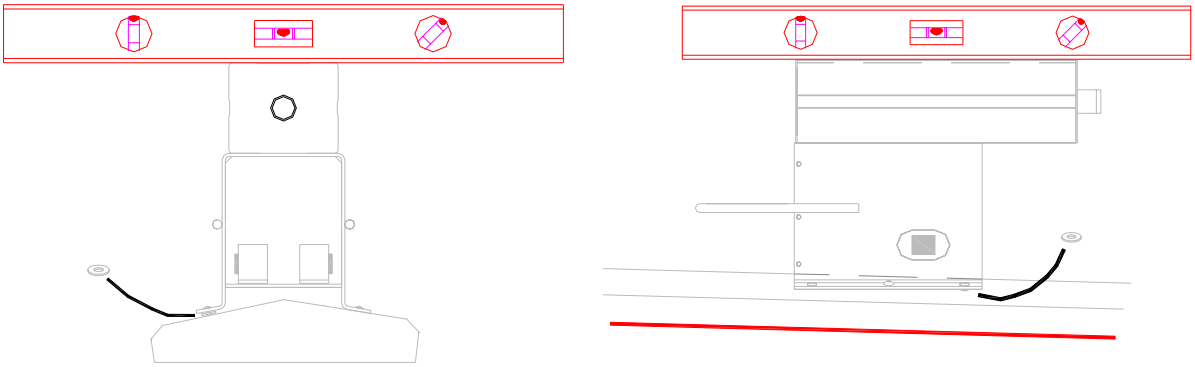


Figure 4

3. Use the four 5/16" X 2-1/2" lag screws with the four flat washers and four lock washers supplied to mount the camera unit in place. (Figure 5)

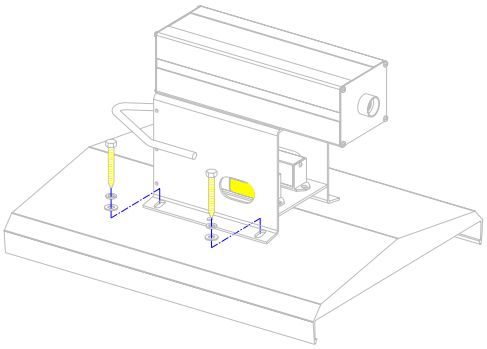


Figure 5

4. Once the camera has been installed and leveled, the DB9 connector is plugged into the camera assembly. (The connector is on the end of the cable assembly which was previously placed in position while installing the MAG-3 Automatic Scoring System and/or the MAG-3 Magnet Pinsetters.)
5. Repeat steps one through four on the last pair of lanes which are in line with the first pair.
6. Stretch a string from the first camera to the last camera at the rear of the camera chassis. (Figure 6)

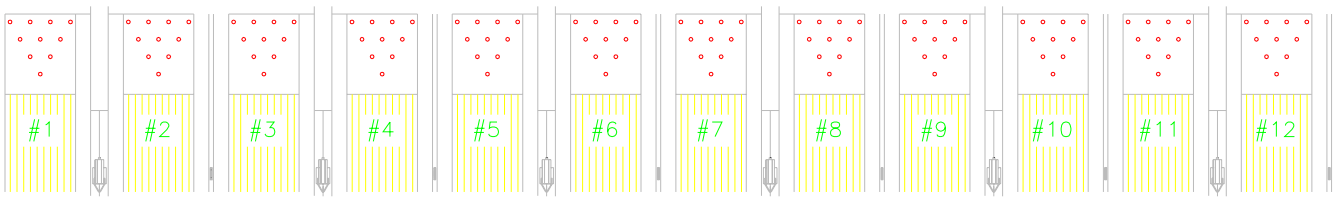
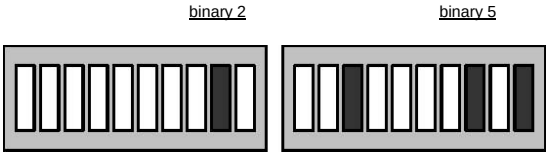


Figure 6

7. Position the remaining camera units in line with the string.
8. Repeat steps two through four for each remaining camera unit.
9. Install the ball detectors and reflectors. Refer to the cable assembly documentation for more information.

Power Up

When powering up the camera (turning on electrical power to pinsetters), both LED groups will be used to display the version number of the firmware installed. Each group of 10 LEDs show, in binary, the version number. The number before the dot is displayed on the left LED group and the number after the dot is shown on the right LED group. For example, version 2.85 would be displayed as shown in Figure 7.



Initialization

After displaying the version number, the initialization process will resume. The camera will try to perform a calibration if no previous calibration was successfully completed. If the camera had previously and successfully gone through a calibration process, then the camera will read the pins immediately.

Special note for version 1.00 and later. If the video signal from the embedded video camera is not valid, the backplane LED will flash rapidly in a special sequence. (Figure 8)

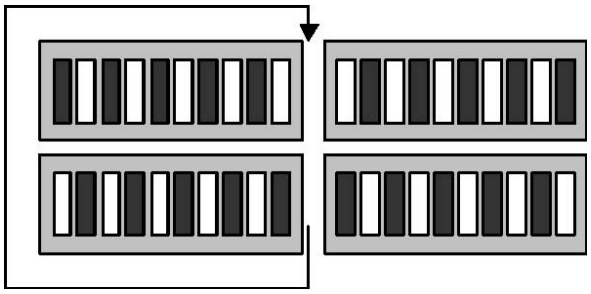


Figure 8

The calibration process is displayed on the backplane by having the LEDs perform an outside-in movement. If the calibration is successful for the first (left) lane, then the green light will be turned ON and the 10 LEDs of the left group will all be turned ON. The same process applies to the second (right) lane with the only difference being the use of the right group of LEDs. If the camera is unable to calibrate properly on any of the 2 lanes, it will simply keep trying until at least one side (lane) is calibrated. This process will go on forever if the camera cannot calibrate itself.
Special note for version 1.00 and later. After a successful calibration, the software will try to define the best "threshold" for the digitized white and black. This threshold level will flash 5 times if the threshold definition routine came to a successful result . The less light you have, the lower the threshold, the less LEDs will flash. A good threshold level is somewhere between 25 and 35, which is between 2 and 6 LEDs flashing (refer to the table below).

Threshold Level	Number of LEDs Flashing	Comment
less than 20	0	bad lighting conditions - contrast between pins and background is not well defined
20-24	2	low lighting conditions - good contrast
25-29	4	good lighting conditions - very good contrast
30-34	6	good lighting conditions - ideal contrast
35-40	8	good lighting conditions - very good contrast
more than 40	10	bright lighting conditions - may cause a blurred image due to very high contrast

You do NOT have to try to get the best lighting conditions. The camera should be able to operate in any "good" lighting conditions. Accuracy on tough to read pins (pins that have moved after the first throw) will be better if you have a threshold level of more than 25 and less than 40. Old pins will lose most of their lighting reflection, which is another cause of having a low threshold. The first cause is usually bad fluorescent lighting.

The camera is now ready for operation. If the camera does not function normally, refer to the "Troubleshooting" section of this manual.

HINT: *Once the cameras are functioning correctly, trace the four corners of each camera's chassis on the 10½-inch capping using a black felt-tip pen. This trick will let you visually check the camera's position if scoring errors occur in the future. If the camera has moved, simply replacing it in its original location usually solves the problem.*

Calibration Button

The **calibration button** located above the LEDs on the front of the camera (Figure 13) is multi-functional, which is to say that it may trigger many different procedures, all of which are described below.

Starting with version 1.1, when the calibration button is depressed and held, the left LED Display will light up one LED each second you hold the button down. If you wish to perform the Three-Second Click, wait until 3 LEDs are lit up before releasing the button as described below. Prior to version 1.1, the user must use his judgment on the elapsed time before releasing the calibration button.

Click. Press and release the calibration button quickly, the LEDs on the camera will light up for a period of thirty (30) seconds.

Double Click. Rapidly press and release the calibration button twice, the calibration function is activated. A successful calibration is signaled by both groups of 10 LEDs being lit up. After the calibration, the Heartbeat LED should flash for a period of sixty (60) seconds. This flashing indicates that the camera is functioning normally. After the sixty-second period, all the LEDs will be turned off except the Power ON LED. The threshold level may be automatically adjusted after a successful calibration.

IMPORTANT: In order for the camera to successfully calibrate itself, a full rack of pins must be present on each lane, the sweeps must be in their upper positions, and the

fluorescent lights must be on.

Two-Second Click (version 1.0 and later). In some rare cases, the camera will not be able to safely determine the ideal threshold level. If this is the case, you won't see the LEDs flashing after the calibration process, indicating that a new threshold level has been calculated.

If the camera seems to have difficulty reading the pins, it is probably due to the default threshold level being too high. The two-second click is used to manually adjust the threshold setting. Press the calibration button and keep it pressed for a period of two seconds and then release the button. The manual threshold adjustment function will be activated. Each LED display will show the threshold level for each lane. After a few seconds, the LED display will show a new threshold level every 1.5 seconds. To choose a new threshold level, click the calibration button when the threshold level you want is displayed. The new level will affect both lanes.

Threshold Level	Number of LEDs Flashing	Comment
less than 20	0	bad lighting conditions - contrast between pins and background is not well defined
20-24	2	low lighting conditions - good contrast
25-29	4	good lighting conditions - very good contrast
30-34	6	good lighting conditions - ideal contrast
35-40	8	good lighting conditions - very good contrast
more than 40	10	bright lighting conditions - may cause a blurred image due to very high contrast

Three-Second Click. Press the calibration button and keep it pressed for a period of three seconds and then release the button. The physical adjustment function will be activated.

The two groups of LEDs represent two separate levels (carpenter's level principle) which allow for the physical adjustment of the camera. The left group of LEDs indicate the horizontal position of the pins in the camera's image, while the right group of LEDs indicate the vertical position of the pins in the camera's image. Once the camera has been physically adjusted, press and release the calibration button quickly in order to return to its normal operation.

The physical adjustment of a camera may only be performed after the camera has been calibrated. A camera which has previously been calibrated is indicated by the Green LED being lit up when the camera is powered on.

Four-Second Click. Press the calibration button and keep it pressed for a period of four seconds and then release the button. The pin selection function will be activated. The right group of LEDs indicate the game and pin type actually selected. The left group of LEDs will display each game type in succession for a short period of time. To change the camera's game type, press and release the calibration button quickly when the left LED dis play contains the correct game type. The LEDs will flash, confirming your selection and the camera will perform an automatic calibration corresponding to the new game type. The game types and the manner in which they are displayed are shown in the table below.

Game and Pin Type	Number of LEDs Lit Up
Tenpin	1
Candlepin	2
Hard Duck (American Duckpin)	3
Soft Duck (Canadian Duckpin)	4
Fivepin	5

Five -Second Click (version 1.1 and later). Since one lens is used to read two lanes, some cases may arise where two cameras will be necessary to read the pair of lanes. Examples of such conditions are posts placed in the middle of the pair, a large walkway placed between the pair, etc. When two cameras are placed on a pair of lanes, they must be configured as a master (connected to the pinsetters), and a slave (connected to the master camera). The cameras may also be placed to the left or the right of the lane depending on available space and wiring capabilities.

To configure a camera, press the calibration button and keep it pressed for a period of five seconds and then release the button. The camera configuration function will be activated. The right group of LEDs indicate the configuration actually selected. The left group of LEDs will display each possible configuration in succession for a short period of time. To change the camera's configuration, press and release the calibration button quickly when the left LED display contains the correct configuration. The configurations and the manner in which they are displayed are shown in the table below.

Configuration	Number of LEDs Lit Up
Stand Alone	**1**
Slave Reading to the Right	**2**
Slave Reading to the Left	**3**
Master Reading an Odd Numbered Lane to the Right	**4**
Master Reading an Even Numbered Lane to the Right	**5**
Master Reading an Odd Numbered Lane to the Left	**6**
Master Reading an Even Numbered Lane to the Left	**7**

IMPORTANT: **When installing two cameras on one pair of lanes, the following procedures must be carried out in order:**

1. 1. Connect the master camera to the pinsetters.
2. 2. Configure the master camera.
3. 3. Connect the slave camera to the master camera.
4. 4. Configure the slave camera.
5. 5. Calibrate both cameras.

Refer to the "Master / Slave Installation" beginning on page 14 for more details.

Troubleshooting

Any time you have a problem with a camera, disconnect the DB-9 connector on the front of the camera assembly and then re-connect it and perform a calibration using the *double-click* procedure prior to attempting anything else.

Complaint No. 1 - there is no power to the camera assembly and/or the ball detectors.

Cause: Cabling is disconnected or not properly seated.
Remedy: Check cabling connection for proper seating.

Cause: Cabling has been cut or pinched by a foreign object.
Remedy: check the camera's cabling with a multimeter to verify the cable assembly's continuity. Replace any faulty cable assembly.

Cause: The electronic component which supplies the electrical power is faulty.
Remedy: Refer to the "Automatic Scoring System Service Manual"
Magnet Pinsetter Service Manual".

Complaint No. 2 - after performing a calibration, the LEDs don't light up as supposed to and the camera misreads the pins.

Cause: Dirty camera lens.
Remedy: Clean the camera lens using a soft tissue approved for use on optical lenses.

Cause: During the camera's calibration there were pins missing or the sweep(s) were not in the correct position.
Remedy: Perform a camera calibration making sure that there is a full rack of pins on both lanes and that the sweeps are in their upper positions.

Cause: Camera is no longer level or has moved.
Remedy: Check the camera's level using the *3-second click* function of the calibration button. Visually check the camera's position if you marked the capping with a black felt-tip or measure the location of the camera according to the installation specifications.

Cause: Bad lighting conditions.
Remedy Replace the fluorescent lighting tubes with new ones.

Cause: Old or dirty bowling pins.
Remedy: Clean or replace the bowling pins. The pins must be relatively clean with no apparent marks or burns on them. If the pins have yellowed (old pins), replace them.

Complaint No. 3 - the camera calibrates itself but some LEDs indicating pins are flashing.

Cause: The threshold level may be too high.
Remedy: Re-calibrate the camera making sure that the automatic threshold adjustment terminates successfully. If not, you may have to perform a manual threshold level adjustment (*two-second click*).

Cause: The threshold level may be too low caused by very bad lighting.
Remedy: Replace the fluorescent lighting tubes with new ones.

Complaint No. 4 - the camera never seems to stay adjusted very long.

Cause: The camera has physically moved out of position.
Remedy: Check the camera's level using the *3-second Click* function of the calibration button. Check the camera's lens position (it must be 142 inches (3607mm) from the inner pin spots as explained in step 1 of "Installation" on page 10 of this manual. Make sure that the camera is sturdily anchored to the capping.

Complaint No. 5 - the camera takes a reading and transmits it to the Automatic Scoring System when no ball has been rolled down the lane.

Cause: Dirty ball detector transmitter or reflector.
Remedy: Clean the ball detector transmitter and reflector.

Cause: Misadjusted ball detector. Remedy: Adjust the ball detector following instructions in the Automatic Scoring System service manual.