COMPUTER SCORE
AUTOMATIC PIN SENSOR
OPERATING INSTRUCTIONS
(Version 4.0 or Later)

Figure 1.01 COMPUTER SCAN Automatic Pin Sensor
Section 7.07 Introduction

COMPUTER SCAN is the automatic pin detection camera (called a Pin Sensor) used in the COMPUTER SCORE Tenpin Bowling Scoring System. COMPUTER SCORE can be installed and operated as a manual score input system but requires the COMPUTER SCAN Pin Sensor to operate in ‘Fully Automatic’ Mode.

These instructions have been written to enable the correct adjustment and service of the COMPUTER SCAN Pin Sensor Unit, Section 1 provides a reference for understanding the principles and features of COMPUTER SCAN. Section 2 outlines the various mechanical, electrical and software adjustments of the unit. Section 3 describes the procedure required to align and configure the unit. Section 4 is a trouble shooting guide.

Section 7.02 Principle of Operation

One COMPUTER SCAN scores for two lanes and is located on the centre capping 4.01 m from the end of the lane.

The COMPUTER SCAN Pin Sensor operates like a camera. The Pin Sensor ‘views’ the pins standing on the deck to determine the score. The Pin Sensor has a camera lens which focuses an image of the pair of lanes onto an Image Sensing Integrated Circuit (IC). The image Sensing IC is a special component designed to distinguish between light and dark. This Image Sensing IC is made up of 256 light sensitive elements which are arranged in a line. The Image Sensing IC only ‘sees’ one line of the image of the pins.

The COMPUTER SCAN Pin Sensor has two mechanical adjustments which are used to move the Image Sensing IC to the correct position to clearly detect 10 pins on each lane. The correct position of the Image Sensing IC’s light sensitive elements is horizontal across the pair of lanes at the height of the neck of the pins, (The neck of the pin is the thinnest part of the pin, between the two horizontal stripes on most brands of pins). Refer Figure 1.02.

The back of the bowling pin spotter machine is dark. The Image Sensing IC detects the difference between the light areas of the pins and the dark areas of the bowling pin spotter machine. The number of pins standing on each lane is determined by counting the number of areas of light (each representing a pin). It is very important, therefore, that the light of the bowling pin spotter machine is bright, operating correctly and that the pins are kept in reasonable condition to allow the Pin Sensor to reliably determine the number of pins.
Figure 1.02
Positioning of COMPUTER SCAN ‘line of sight’
Section 7.03 System Features

1. Connections

The COMPUTER SCAN Pin Sensor has two cables attached to it. One cable connects the Pin Sensor to the scoring display units located back at the approach area. The Pin Sensor also receives its power from this cable. The other cable connects the Pin Sensor with the foul units, ball detectors and the bowling pin spotter machine triggering switches (if fitted). The methods for determining the correct time to determine the score vary with different brands of bowling pin spotter machines. For AMF brand machines the score time depends on the detection of light reflected from sweep. A sweep reflection tile is placed on the inside sweep arm of each lane (right side sweep arm for the odd lane, left side for the even lane) to allow the unit to detect when the sweep has fallen. For Brunswick brand machines the Pin Sensor is triggered by a switch located on the machine which is open when the rake is up and closed when the rake is down.
2. L.C.D. Display Screen

To allow the Pin Sensor to be adjusted, each sensor has a display port into which can be connected a removable L.C.D. display screen. This display gives a representation of the light and dark ‘seen’ by the Pin Sensor. It must be understood that the display does not show a picture in the same way a camera does. The display shows a spectrum of the reflected light from the pins that the Image Sensing IC’s line of light sensitive elements detect. The Image Sensing IC only ‘views’ a line not an area. The top half of the display shows a representation of how much light is received along the first half of the line of light sensitive elements (the left or odd side machine). The bottom half of the display shows how much light is received along the second half of the line (the right or even side machine).

If a particular light sensitive element of the Image Sensing IC receives a large amount of light the display shows a high peak on the L.C.D. screen at the position of that element. Large peaks in the spectrum represent the pins. Refer figure 1.04.

3. Toggle Switch and Push Button

The Pin Sensor has a series of programmable features which are stored in its memory. These include the ability to be able to set the time delay between the when the machine is triggered to when the Pin Sensor determines the score (this is called the Take Data Delay).

The Pin Sensor has two modes of operation, Scoring Mode and Programming Mode. The Pin Sensor has a Toggle Switch which is used to select either mode and a Push Button to make changes when appropriate. When the Toggle Switch is in the Up position the Pin Sensor is in Scoring Mode. The COMPUTER SCAN Pin Sensor is set to Scoring Mode for normal operation. When the Toggle switch is in the Down position the Pin Sensor is in Programming Mode. Programming Mode is used with the L.C.D. display to program the Pin Sensor features. Once the Pin Sensor has been set to Programming Mode a series of menus will appear on the L.C.D. display screen. These menus allows the setting of the Take Data Time Delay and the configuring of the Pin Sensors features.

4. Mechanical Adjustments

The COMPUTER SCAN Pin Sensor has a two major mechanical adjustments (tilt and height adjustment). These adjustments use the two screws located on the side of the Pin Sensor. These screws allow the Image Sensing IC to be moved so its line of light sensitive elements is placed along a horizontal line across the neck of the pins within the lens’ field of view. This allows the best definition of all pins on both lanes. The height adjustment is located above the tilt adjustment.
4. Light Sensitivity
The Pin Sensor also has an adjustment screw, located inside the Pin Sensor to change the Pin Sensor’s sensitivity to light. The use of these screw adjustments in co-junction with the display screen will be explained in later sections.

5. Ball Detectors
COMPUTER SCAN is attached to two (one per lane) ball detectors (photo-electric switches). These ball detectors ARE NOT to be used to cycle the Pin spotter machinery. The ball detectors provide the scoring system with a reference as to whether a score transmitted from the Pin Sensor is to be displayed or ignored. When a ball is bowled the ball detector senses the passage of the ball. The next time the Pin Sensor is triggered (either by the switch contacts for Brunswick Brand or from the sweep reflection tile for AMF Brand) the score information transmitted to the scoring display unit will be displayed as a valid score. If the pin sensor is triggered again without the detection of a ball having been bowled no scores will be displayed.

Figure 1.04 Typical Operating L.C.D. Display Spectrum
Section 1.04  L.C.D. Display Indicators

1. Noise Level Threshold

The pit of the bowling pin spotter machine may contain other forms of light reflection e.g. Oil streaks. These forms of light reflection may be sensed by the Image Sensing IC of the Pin Sensor. The Noise Level Threshold of the system is visible on the L.C.D. display in Scoring Mode as a horizontal line, refer figure 1.05.

Reflections from sources in the bowling pin spotter that do not extend above this line will not be considered as being from a pin. It is therefore possible to mask any “Phantom Pins” caused by light from the bowling pin spotter machine pit provided that its level is less than the darkest pin in the pit. All reflections from the pins should be adjusted using the Light Sensitivity Adjustment (refer section 2.02) so that all pins extend above this line or they will not be counted as pins.

Figure 1.05 Effect of Noise Level Threshold

The possibility of ‘Phantom Pins’ can be reduced by regular cleaning of the pit curtain.
2. **Blanking Window Indicators**

There is a region between the two machines, i.e. the ball chute, where the COMPUTER SCAN Pin Sensor does not attempt to find pins. The Left and Right edges of this region known as the 'Blanking Window' is displayed on the L.C.D. Display as two vertical lines, Refer figure 1.06. Any peaks in the spectrum of the Image Sensing IC that are within this region will not be counted as pins. If COMPUTER SCAN is configured for AMF brand (or equivalent) Pin spotter Machines the reflection from the tiles placed on the Sweep Arms for each lane will not register as pins because they fall within this region. The position of the Left and Right Edges of the Blanking Window region is automatically determined and saved during Programming Mode, refer Section 3.

*Figure 1.06 Blanking Window*
3. **Triggering Options**

The COMPUTER SCAN Pin Sensor can be configured to be Triggered by one of two methods. Triggering refers to the determination of when to transmit the correct score. For both methods the score is transmitted an adjustable time delay (the Take Data Delay) after the Pin Sensor determines that the Sweep (AMF brand machines) or Rake (Brunswick brand machines) has been lowered. For AMF (or equivalent) brand bowling pin spotter machines the Pin Sensor uses light reflected from a tile placed on the Sweep Arm to determine that the Sweep has lowered. For Brunswick (or equivalent) brand pin spotter machines the Pin Sensor uses a mechanical switch on the rake instead.

The Pin Sensor is configured to either method during the alignment and configuration process, refer section 3. During this process the Pin Sensor attempts to find the peaks in the spectrum of the Image Sensing IC (inside the Blanking Window Region) that correspond to the reflection from tiles placed on each sweep arm of the AMF Pin spotter machines. If it is unable to detect either peak it assumes that the Pin spotters are of Brunswick (or equivalent) type. If AMF (or equivalent) pin spotter machines are used it is important that the Pin Sensor is configured (section 3) with the reflection tile attached to the sweep arm of both machines and the sweeps of both machines in the ‘guard position. If the Pin Sensor is configured for AMF (or equivalent) Pin spotter machines two vertical lines can be seen on the L.C.D. Display. These Left and Right Trigger Indicator Lines are positioned where the Pin Sensor expects the find the Sweep tile reflection, refer figure 1.06.

4. **Pin Position Indicators**

After the COMPUTER SCAN has been properly aligned and ten pins are visible on both lanes the Pin Sensor stores the position of the pins in memory during Programming Mode (refer Section 3). These pin positions are used as a reference when in Scoring Mode to determine which pins are standing (e.g. 7 pin and 10 pin). The pin positions stored in memory are displayed on the L.C.D. Display as dots on the top of the spectrum for either side lane, refer figure 1.04. These dots should line up with the maximums representing the pins on each lane.

5. **Score Replay**

While the unit is in operating mode (toggle switch in the Up position), a replay of the last score can be viewed by pressing the push button. The image displayed on the L.C.D. display screen is the image that COMPUTER SCAN used to determine the last score. This image can be used to determine why a score was incorrect and which adjustment may be incorrect.
Section 2.01
COMPUTER SCAN Mechanical Adjustments

Once the COMPUTER SCAN Pin Sensor is correctly installed, only two mechanical alignments should be necessary. If it is possible to count ten distinct peaks on the display for each lane inside the active viewing area (refer Figure 1.04) then there is a good chance that the system will interpret the correct score.

Figure 2.01 Effect of Screw Adjustments
Of the two screw adjustments located on the left hand side of COMPUTER SCAN, the top adjustment controls the raising and lowering of the Image Sensing IC vertically (Height Adjustment), while the bottom adjustment affects the tilting of the Image Sensing IC (Tilt Adjustment). The Height Adjustment allows the line of light sensitive elements of the Image Sensing IC to be positioned to view across the neck of the pins, this being the line of best distinction between the pins and the bowling pin spotter machine, refer figure 1.02. The Tilt Adjustment is used to ensure that the Image Sensing IC is horizontal.

The degree of movement required to position the Image Sensing IC is small, due to the wide angle characteristics of the lens, but it is possible to observe the Image Sensing IC moving when the lens is removed. It must be remembered that the lens will invert the image seen by the Image Sensing IC so moving the Image Sensing IC physically upwards in fact lowers the IC’s ‘line of sight’ into the pins, refer figure 2.01. Note avoid prolonged periods with COMPUTER SCAN on and the lens removed. COMPUTER SCAN will not work without the lens and prolonged exposure to saturating light will effect the Image Sensing IC’s long term reliability.

COMPUTER SCAN has two locking nuts that lock the mechanical adjustments in place to prevent movement. These nuts are located inside the back cover above and below the cradle that hold the Image Sensing IC. Before re-adjusting the unit, it is necessary to loosen these two nuts.

**Section 2.02 COMPUTER SCAN Light Sensitivity Adjustment**

COMPUTER SCAN has a light sensitivity adjustment. The light sensitivity adjustment is a blue colored adjustable resistor located inside the back cover of the unit on the top Printed Circuit Board (P.C.B.) that contains the Image Sensing IC. This adjustment changes the degree of sensitivity to light of the Image Sensing IC. Turning the adjustment clockwise decreases light sensitivity, anti-clockwise increases light sensitivity. This has the effect of allowing the Pin Sensor to detect darker objects. If the Pin Sensor is not sufficiently sensitive to light the darker pins in the pit, namely the 7 and 10 pins may not be detected. If the Pin Sensor is too sensitive to light, reflections from the bowling pin spotter machine, for example from oil streaks, may register as phantom pins. Also the lighter pins will saturate the Image Sensing IC and reduce the definition between the pins. If the Adjustment set too sensitive the L.C.D. display may show a totally black display (Image Sensing IC saturated).
The light reflected by each pin will vary depending on its distance from the light of the bowling pin spotter machine. Some points to note about COMPUTER SCAN's ability to detect pins are,

1. Clean Pins will be easier to detect, they will show up a larger light spectrum reflection.
2. Coloured pins should be painted with a white stripe around the neck of the pin. So they can be detected by the Pin Sensor.
3. Should very dirty pins be changed for a clean or new set of pins it may be necessary to inspect and readjust the light sensitivity down to compensate for the better reflection.
4. Try and maintain a uniform pin condition in the lane pair.
5. Variations in the strength of lights on each bowling pin spotter machine in the pair can make adjustment difficult. If one light is of different brightness to the other it is difficult to determine when the Image Sensing IC is adjusted horizontal. All bowling pin spotter machine lights in the centre should be in good condition with an identical type of fluorescent tube. COMPUTER SCORE highly recommends a Cool White or Tri-phosphorous type, The brighter the pit lights the easier the adjustment.
6. Minimise the amount of natural light reflecting into the pit of the bowling pin spotter machine. Sunlight will saturate the fluorescent light possibly causing problems in scoring between night and day.

7. Damaged pins should be repaired with standard pin patch as large dark patches around the neck of the pit may cause problems.

![Figure 2.03 Damaged Pins cause scoring problems](image)

8. COMPUTER SCAN may have problems with bowling pin spotter machines that are incorrectly adjusted and are placing the pins on the deck outside the limits prescribed by the ABC specifications. All machines should be adjusted to spot within the distance prescribed by the rules of bowling.

![Figure 2.04 Effect of Poor Pin spotter Adjustment](image)
Section 2.03  Take Data Time Delay

As with the bowling pin spotter machine, COMPUTER SCAN provides a time delay to allow for pins to fall late. This ‘Take Data Delay’ can be varied to suit the cycle characteristics of the particular bowling pin spotter machine pair.

As previously mentioned COMPUTER SCAN can be triggered in two ways either by the opening of a set of isolated switch contacts on the machine (Brunswick or equivalent brands) or by the detection of light reflected by the sweep arm when the sweep is in the guard position, (AMF or equivalent brands).

The Take Data Delay is defined as the time in seconds after the trigger has occurred that the score is to be determined and transmitted (sometimes known as the Wobble Time). It should be noted that the setting of this time delay depends on the correct operation of the machine’s time delay. It is important that the machine is operating with the correct time delay between the ball cycling the machine and the pins being picked up on 1st Ball cycle. For example if the Take Data Delay is too fast there is the possibility of an excessive need to correct scores due to late pinfall i.e. pins have fallen after the Pin Sensor has transmitted the Score to the Scoring Consoles. Also with Brunswick brand pin spotter machines there is a danger of incorrect scoring due to the rake blocking the Image Sensing IC’s sight of the pins when the score is determined and transmitted, particularly if the rake is slow to fall. If the Take Data Delay is set too long there is the possibility of incorrect score due to the pin spotter machine, as it pick the pins up on first ball cycle, blocking the Pin Sensors sight of the pins. If the Pin spotter Machine, particularly Brunswick brand, is not operating with a correct first ball machine time delay there may indeed be no time when both the rake and the deck of the machine are clear of the Pin Sensor’s ‘line of sight’. It is important therefore for the reliable operation the Pin Sensor that the Pin spotter machines are operating reliably using a time delay period compatible to the rules of bowling. Refer section 3.01 for adjustment of Take Data Delay.

For Brunswick brand pin spotters, the Take Data Delay varies depending on the period since a ball detect signal has been determined. After a ball has been detected COMPUTER SCAN will await the triggering input. If the triggering input has not occurred within the normal operating period, it is assumed that the machine has not been cycled by the ball (a common problem with light balls and Brunswick machinery). The next trigger will cause the score to be transmitted after a zero take data delay to allow for the fact that the Brunswick A2 brand pin spotters do not have a first ball time delay when cycled by the reset button at the ball return unit.
Section 3.07 Aligning and Configuring COMPUTER_SCAN

The following is a step by step description of the method of re-adjusting the COMPUTER_SCAN Pin Sensor.

1. The COMPUTER_SCAN Pin Sensor is installed at position 4.01m from the back of the deck of the machine. Should a Pin Sensor receive a major blow from an object e.g. a ball jumping the lane gutter, the Pin Sensor’s housing may be moved so that it is no longer vertical. i.e it may be tilted either left or right or forward or back. If this happens then it will be necessary to loosen the coach screws (lags) that fasten the mounting brackets into the support timbers, Using a spirit level to test vertical, move the Pin Sensor until to is level again and re-tighten the coach screws (lags). Be careful not to strip the thread of the coach screw (lag). Remember to only do this if the Pin Sensor is noticeably not vertical.

2. Turn on both lanes and place them both onto 1st ball 10 pins standing on both lanes, Check that both pit lights of the Pin spotter machines are in good condition and of similar brightness. If using AMF brand (or equivalent) pin spotter machines place the sweep in the guard position (down) and turn off the machine motors, NOTE! never enter a pin spotter machine while it is on.

3. Check that the pins are all in good condition with no damage around the area of the neck

4. Insert the L.C.D. Display Plug into the Pin Sensor and check each lane for ten visible distinct Peaks within the correct area (outside the Blanking Window refer section 1.03 and figure 1.04). If the display shows an spectrum from the Image Sensing IC that appears to be correct proceed to step 13 (section 3.02).

5. Remove the Pin Sensor unit’s back cover and loosen the two locking nuts (located inside the back cover). These two nuts are used to lock the Pin Sensor adjustments to prevent adjustment. NOTE! under no circumstances should the tilt and height adjustments be altered without first loosening the locking nuts. For best results during adjustment re-tighten the nuts until they only just touch the adjustment plate. This allows the adjustments to move with the minimum of slack.

Figure 3.01 Loosenina locking nuts
6. Turn the Height Adjustment Clockwise until no pins are visible (viewing over the top of the pins).

7. Turn the Height Adjustment Anti-Clockwise until the first peak appears on each lane, this will be the Head Pin.

**Figure 3.02**
Step 6 Raising the ‘line of sight’ over the Dins

**Figure 3.03**
Step 7 Lowering the ‘line of sight’ into the head pins
8. Use the Tilt Adjustment to balance the size of the two peaks from either lane. This ensures that the 'line of sight' is horizontal. During the use of the Tilt adjustment it may be necessary from time to time to alter the height adjustment to ensure that the display maintains a view of both head pins. It is during this operation of trying to ensure that the 'line of sight' of the Image Sensing IC is horizontal that the need for even light condition across both lane can be seen.

9. Turn the Height Adjustment Slowly Anti-Clockwise. As this is done more pins will slowly appear of the display. The 'line of sight' of the Image Sensing IC will be first placed over the head of the pins so the display will show that the peaks in the spectrum for each lane are not very distinct. As the 'line of sight' of the Image Sensing IC slowly approaches the neck of the pins the peaks in the spectrum on the L.C.D. display will become thinner and more distinct until all pins on both lanes are visible and distinct on both lane, refer Figure 3.05. If the peaks of the pins start to grow in width until they run into each other then the 'line of sight' is too low and is viewing the belly of the pins. If this is the case turn the height adjustment Clockwise until the best definition is determined.

**Figure 3.04**

*Step 8 Using the Tilt adjustment to ensure the 'line of sight' is horizontal.*
Figure 3.05 Adjustment of 'Line of Siaht
10. If it is not possible to see all ten pins over the full height adjustment or the 7 and 10 Pin for each lane appear to be too low on the display. Try increasing the light sensitivity adjustment, refer section 2.02. Remember that excessive light sensitivity tends to make the peaks for each pin less distinct on the display.

11. Once satisfied with the quality of the spectrum of the Image Sensing IC shown on the L.C.D. (refer figure 3.05) carefully re-tighten the locking nuts and replace the Pin Sensor back cover.

12. The Golden Rules are, If it is working correctly leave it alone and if you can observe ten distinctive pins on each lane on the L.C.D. display so will COMPUTER SCAN. The ability to quickly adjust COMPUTER SCAN comes with a little experience.

Section 3.02
Configuring COMPUTER SCAN’s Operation

13. After all mechanical adjustments are completed and the L.C.D. Display shows ten distinct pins on each lane the Pin Sensor is ready to be configured. This configuration process allows for the adjustment of the Take Data Delay, refer section 2.03 and the Automatic determining and saving of a number of system indicators, refer section 1.04. Enter Programming Mode by placing the Toggle Switch in the Down position. The Programming Mode Menu will appear on the L.C.D. Display, refer figure 3.06. Press the Enter Push Button to continue to the next menu.

Figure 3.06 Programming Mode Menu
14. The next menu to appear on the L.C.D. Display is the Take Data Delay Menu, refer figure 3.07. This Menu allows the Take Data Delay to be modified, refer section 2.03. Pressing the Push Button will allow the Take Data Delay to be set in seconds.

![Take Data Delay Menu](image)

Figure 3.07 Take Data Delay Menu

15. If the Take Data Delay is correct or the Take Data Delay has been set place the Toggle Switch in the UP position. The Pin Sensor will then attempt to configure itself to either AMF brand (or equivalent) or Brunswick brand triggering method. It will also determine the position of the Blanking Window and the Pin Position Indicators.

16. The Pin Sensor will indicate whether it is satisfied that it has been correctly aligned.

17. If alignment was successful, refer figure 3.08a press the Push Button to save the setup. The system should now be ready for use.

18. If alignment was unsuccessful, refer figure 3.08b press the Push Button and repeat steps 2-15 until successful.
Figure 3.08a & 3.08b Configuration Result Menus
Section 4.07 Troubleshooting

With most problems it is best to configure the Score Display unit to manual scoring to allow the current bowlers on the lane to finish their games before attempting to adjust COMPUTER SCAN.

1. No Score is being displayed on either lane
   - Insert the L.C.D. display unit into the display port.
   - If the display is completely blank COMPUTER SCAN is not receiving power from the Score display units via the communications port. Check that the Score Display units are on and the communications cable is inserted.
   - If the L.C.D. display unit displays only the message “COMPUTER SCORE PINSENSOR DISPLAY”, COMPUTER SCAN is receiving power but is not operating correctly. Reset the unit by turning the lane pair off then on at the scoring display unit. COMPUTER SCAN’s main PCB may need replacement.
   - If the L.C.D. display unit is displaying the Programming mode menu, the toggle switch has been accidentally placed in the programming mode (down) position thus preventing normal scoring operation.
   - If the L.C.D. display unit is displaying either of the Configuration result menus (figures 3.08a&b) then COMPUTER SCAN is waiting for the push button to be pressed.
   - If the L.C.D. display unit shows a correct spectrum, check that the ball detectors are powered on and operating correctly. Use a multi-meter to check that the contacts of the ball detectors are activating when its beam has been broken. Check that all connections are inserted to the Trigger port. For AMF brand pin spotters, check that the left and right trigger indicators are present and correctly positioned in line with the sweep reflection tile (refer section 1.04 & figure 1.04). For Brunswick brand pin spotters, check that the trigger switches and connections are all correct. Check that the Scoring Display units are not configured to manual scoring mode. The quickest test of this is to press a score key at the lower keyboard console. If the score is displayed without the need to go to the score correction menu then the lane is configured for manual scoring and will not display scores from COMPUTER SCAN. Place the Pin spotters in the correct position and re-configure COMPUTER SCAN (section 3.02).
2. No Score is being displayed on one lane

- Check that the ball detector for that lane is powered on and operating correctly. Use a multi-meter to check that the contacts of the ball detector are activating when its beam has been broken.
- For AMF brand pin spotters, check that the trigger indicator for that lane is present and correctly positioned in line with the sweep reflection tile (refer section 1.04 & figure 1.04).
- For Brunswick brand pin spotters, check that the trigger switches and connections are all correct.
- Check that the Scoring Display unit is not configured to manual scoring mode. The quickest test of this is to press a score key at the lower keyboard console. If the score is displayed without the need to go to the score correction menu then the lane is configured for manual scoring and will not display scores from COMPUTER SCAN.
- Place the Pin spotters in the correct position and reconfigure COMPUTER SCAN (section 3.02).

3. Strike or scores significantly different from the correct score are being displayed

- Use the L.C.D. display unit check the display spectrum. Re-adjust (refer section 3.01 & 3.02) if necessary, however on most occasions this problem is due to some part of the pin spotter machine blocking the pins at the time COMPUTER SCAN is determining the score. In such a case the display spectrum will be acceptable (figure 1.04) when the machines are at rest but will be unusual when the score replay (section 1.04) is observed after an incorrect score. This is because either the pin spotter sweep (rake) or table (deck) has interfered with the pins.
- Check for slow sweep (rake) fall. Check the pin spotter machine time delay is functioning correctly, there must be enough time to allow the for the sweep (rake) to pass and COMPUTER SCAN to determine the score before the table (deck) picks up the pins.
- Place both pin spotter machines in the appropriate position and re-configure COMPUTER SCAN’s operation (section 3.02). It may be necessary to experiment with either lengthening the take data delay to avoid the sweep (rake) or reducing the take data delay to avoid the table (deck).
- Check for sources of sunlight which may affect the display spectrum.
4. COMPUTER SCAN is scoring one or two pins missing e.g. 1 for a gutter ball or 8 instead of 7.
   - There are two most likely causes,
     1. The peak in the display spectrum representing a pin was not sufficiently high (figure 1.05) or,
     2. Two or more peaks in the display spectrum were jointed together to appear a one (figure 2.04).
   - Use the score replay (1.04) after an incorrect score to determine which of the two situations is occurring. Adjust COMPUTER SCAN (sections 3.01 & 3.02). It may merely require the adjustment of the light sensitivity up (1) or down (2).
   - Cause 1. will most likely occur during 1st ball cycle as the pin spotter table (deck) may obscure the light source marginally depending on the take data delay.
   - Cause 2. will most likely occur during 2nd ball cycle due to the greater possibility of pins moved from their ideal positions. An off-spot pin that has occurred in isolation may not require any action.

5. COMPUTER SCAN is scoring one or two pins extra e.g. 7 instead of 8, 9 instead of strike.
   - COMPUTER SCAN has located extra peaks in the display spectrum.
   - If the problem is due to a pin falling late and this occurs more than very occasionally, it may be necessary to increase the take data delay to allow more time for pins to fall. Be careful not to induce problem #3 by increasing the take data delay too much.
   - If the problem was not due to late pinfall, clear the pit of pins and check the L.C.D. display for any peaks in the spectrum outside the blank window area (section 1.04). It may be that an oil streak or the reflection from a sweep (rake) arm is being interpreted as a pin. The score replay (section 1.04) may show the location of the unwanted peak.

6. Foul is being scored even when the foul units are off.
   - This problem can occur if the ball detectors are not correctly adjusted and the ball detector contact stays closed for greater than 2 seconds.

7. A Score is being display when the reset has been pressed and a ball has not been bowled.
   - Check that the ball detectors are operating correctly.
   - Check that the ball detect facility has not been disabled at the main system computer.
8. COMPUTER SCAN has received a major blow (e.g. from a ball) and it is not possible to find a position on the height adjustment where the peaks of the display spectrum are distinct.

- The focus adjustment (the distance from the lens to the image sensing IC) has been moved. COMPUTER SCAN has a factory set focus adjustment consisting of four Allen key head screws that when loosened allow the PCB containing the image sensing IC to move away or towards the lens. This adjustment is very fine and should only be attempted after the focus has been affected by a major incident.

- If the focus adjustment is attempted it is best to loosen just the two top Allen key head screws (located inside the unit) that join the top 'L' shaped section to the 'C' shaped section that carries the image sensing IC. Move the 'C' shaped section in and out until the clearest display spectrum is located. Holding the 'L' and 'C' sections in place careful re-tighten the screws. Re-adjust and configure the unit (sections 3.01 & 3.02).
**Appendix A. COMPUTER SCAN Pin Out Definitions**

**COMMUNICATIONS PORT**  
DB9 Female (Centre)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>Transmit</td>
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<td>2</td>
<td>/Transmit</td>
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<td>3</td>
<td>-12v</td>
</tr>
<tr>
<td>4</td>
<td>Receive (NC)</td>
</tr>
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<td>/Receive (NC)</td>
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<td>8</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>+12V</td>
</tr>
</tbody>
</table>

**IMPORTANT OPERATING NOTE !**

COMPUTER SCAN receives its power from the COMMUNICATIONS PORT, to avoid damage to the system processor DO NOT remove the Communications Port connection without Turning Off the display monitors for that lane pair.

**TRIGGER PORT**  
DB9 Male (Right)

The Trigger port may be connected to the Pinsensor Enhancement Unit on some installations.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Left Trigger Contact</td>
</tr>
<tr>
<td>4</td>
<td>Right Trigger Contact</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>Left Foul/Ball detect Contact</td>
</tr>
<tr>
<td>1</td>
<td>Right Foul/Ball detect Contact</td>
</tr>
<tr>
<td>9</td>
<td>LEN trigger Contact</td>
</tr>
<tr>
<td>8</td>
<td>Right Trigger Contact</td>
</tr>
<tr>
<td>7</td>
<td>Left Foul/Ball detect Contact</td>
</tr>
<tr>
<td>6</td>
<td>Right Foul/Ball detect Contact</td>
</tr>
</tbody>
</table>

Pins 1,2,3,4 and 5 are internally connected to ground.