

# Bowl-Tronics Enterprises Incorporated

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## ◆ M-2 Infrared Foul Unit Manual ◆

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### Foul Unit Theory

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All foul units manufactured by BOWL-TRONICS work on the same principle. An infrared beam is projected across the foul line which is then reflected back to the unit. When a bowler crosses the foul line the foul unit detects this and turns on the indicator light for that lane and also activates the buzzer. There is approximately a 150 millisecond delay on the detection circuit to allow for the ball to break the infrared beam. As the foul unit turns on the indicator light it also signals the scoring system letting it know that a bowler has fouled.

The foul unit consists of one main component that makes it very easy to install and maintain. The M2PC-1 does all of the processing of signals and also has the infrared optics hard soldered to the circuit board which essentially makes troubleshooting a very easy matter. Also as an added feature there are alignment LED's to make optic alignment a snap.

All of the switching functions that the board performs are done by way of solid state switching. With this method many years of functionality are added to the foul unit. It is not uncommon for a BOWL-TRONICS Foul Unit to operate for many years without being serviced.

### Power for the Foul Unit

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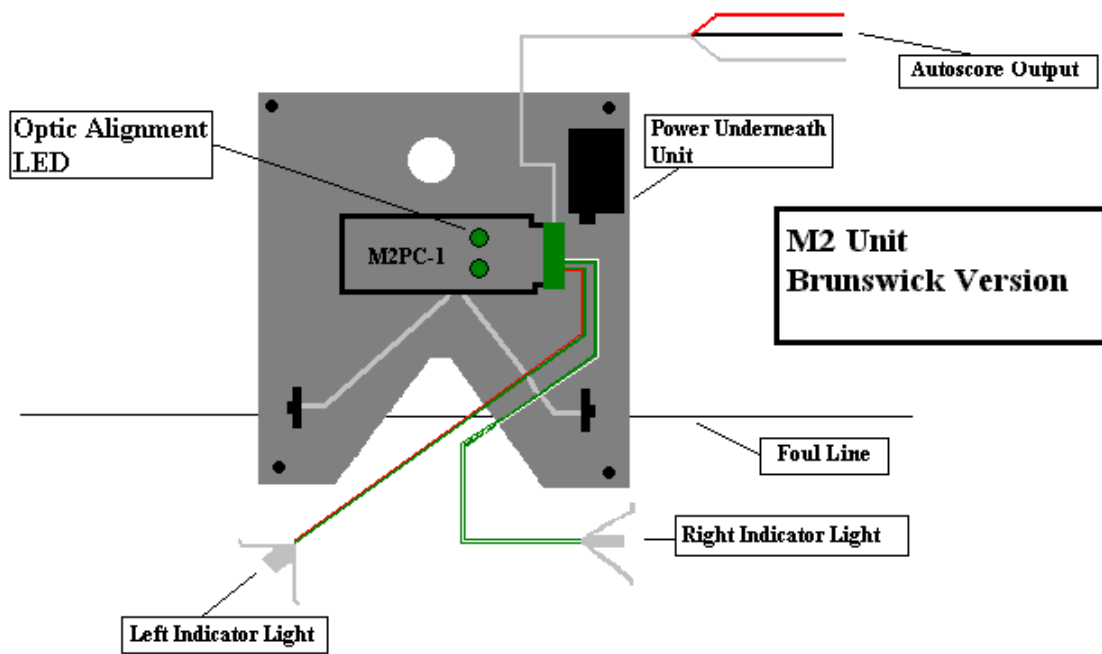
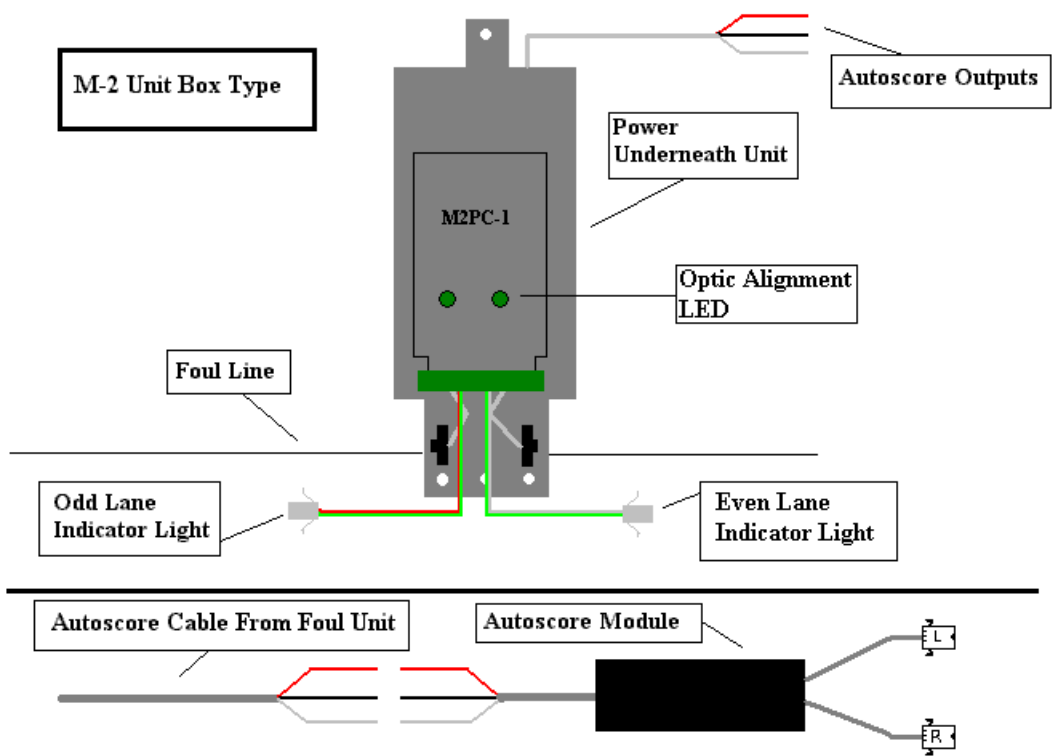
The foul unit is powered by 120 VAC or *(240 VAC on special order)*. This line voltage is normally available at the foul line. Most Brunswick replacements will have cannon plug that screws on. If your center does not have this type, a black cable will be supplied with your unit. Please consult the power section on page #7 if this is the case. If your center is not equipped with line voltage at the foul line a power pack will be supplied with your unit. This will save on the added cost it would have taken to run a 120 volt line to the front, and also allow you the same flexibility to turn the foul units on or off from behind the counter. The power pack mounts in the back where the old foul unit was and a low voltage cable is then run to the foul line to power the unit. The connections for this type of system can also be found in the power section on page #7.

### Caution:

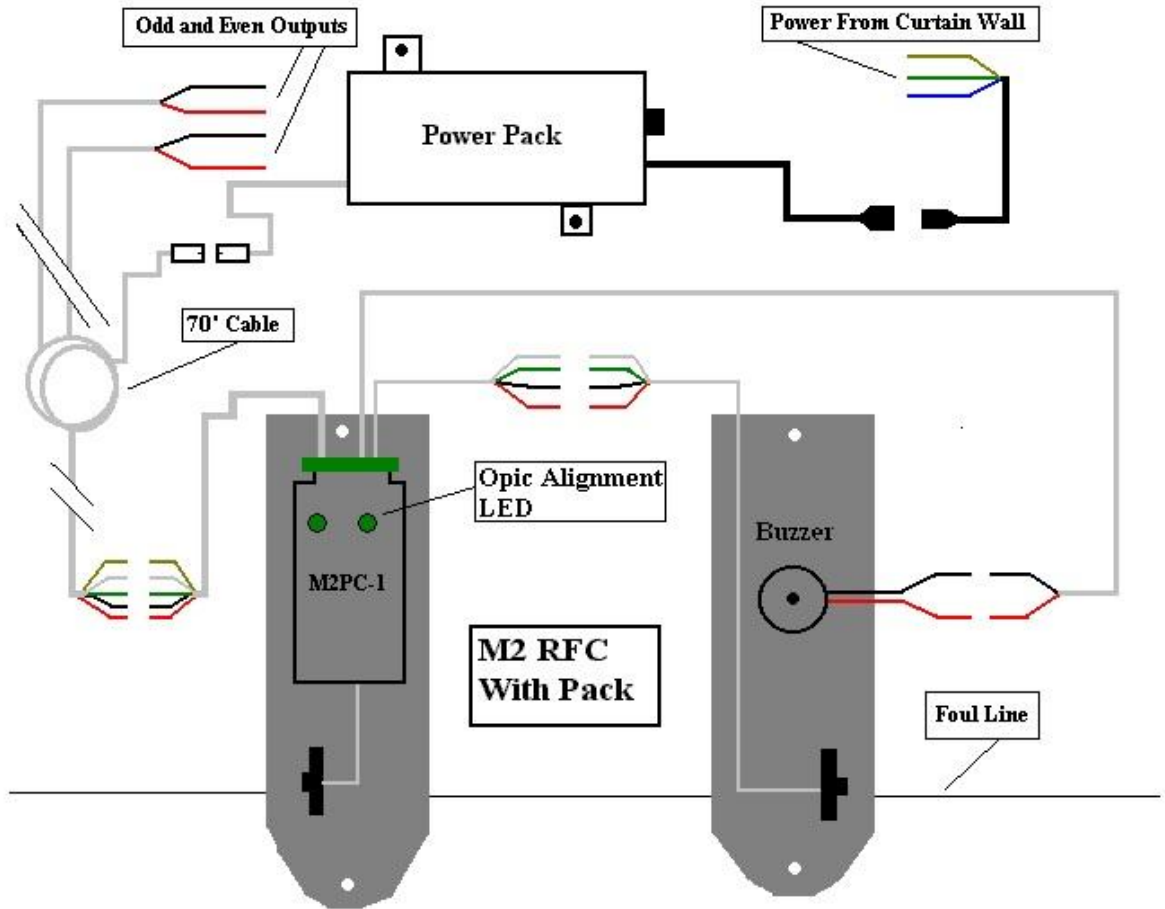
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- *Always remove power before installing foul units!!*
- *Always remove power when removing or installing circuit boards!!*
- *Never short out any of the output or autoscore cables!!*
- *Only use light bulbs that the unit was designed for!! (GE 1891) or equivalent*
- *Mount the foul unit as level and straight as possible!!*

# ◆ Infrared Foul Unit Diagram ◆



## ◆ Infrared Foul Unit Diagram ◆



## ◆ Installation Instructions ◆

*Remember to remove power before performing any installation!!*

### Replacing BRC Astroline Foul Units (M-2)

After removing the power going to the foul unit, remove the division cover. Remove the old Astro Unit and replace it with the new M-2 Foul Unit. For most centers there will be a screw type cannon plug for the power. If your center has this type you just screw it onto the corresponding cannon plug on the M-2 Unit. If your center does not have this type, a black cable will be supplied with the unit for the power connections (*See page #7*). Position the Foul Unit with the optic tubes centered on the front edge of the foul line and use the optic alignment LED's to align the optics. The LED's will be lit when the optics are aligned. Fasten the unit down with the screws provided. Mount the indicator light just in front of the foul unit. Replace the old reflectors with the new ones provided. These are special high output reflectors and should be used with the M-2 Foul Unit. Consult the autoscore section of this manual for all autoscore connections. After connecting you're scoring to the foul unit, restore the power and test for proper operation.

## Replacing BRC Gold Crown Subway Return Units (M-2)

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After removing the power going to the foul unit, remove the large cover over the Gold Crown unit and remove the unit. Under the large cover mount the M-2 Foul Unit as shown in the illustrations on top of page # 2. For most centers there will be a screw type cannon plug for the power. If your center has this type you just screw it onto the corresponding cannon plug on the M-2 Unit. If your center does not have this type, a black cable will be supplied with the unit for the power connections. (See page #7). Position the Foul Unit with the optic tubes centered on the front edge of the foul line and use the optic alignment LED's to align the optics. The LED's will be lit when the optics are aligned. Mount the indicator lights just in front of the foul unit. Fasten down the frame with the mounting screws provided while making sure that the hole in the frame is centered so that the post on the cover fits inside the frame hole. Consult the autoscore section of this manual for all autoscore connections.

You can now remove the small cover over the light source assembly and remove the components. Mount the reflectors with them centered over the leading edge of the foul line and replace the small cover. Before replacing the large cover over the unit, test the unit for proper operation. On the inside of the cover where the infrared beam is transmitted through.

## Replacing AMF Radaray 82-68, 94, & 120 Units (M-2)

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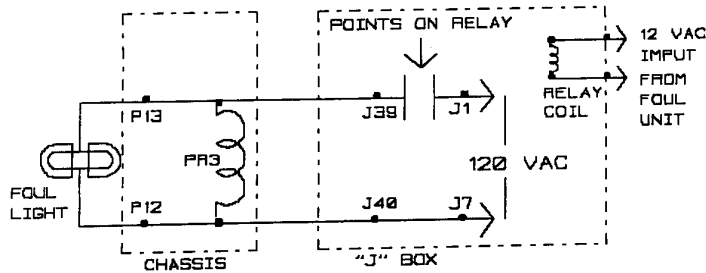
After removing power from the existing foul unit remove the Radaray cover and bottom frame. Mark and save the wires that run to the back. These are your autoscore and machine connections. Follow the power connections on page #7 for the 120 VAC supply voltage for the foul unit. Mount the foul unit where the old frame was *(see diagram on bottom of page # 2)*. Position the Foul Unit with the optic tubes centered on the front edge of the foul line and use the optic alignment LED's to align the optics. The LED's will be lit when the optics are aligned. Fasten the unit down with the screws provided. There will be a three wire gray cable coming from the back of the foul unit. This cable connects to the existing cables that run to the back of the machine. There should be only three wires that run to the back, however, in some older centers there are four wires. Two of the wires are actually the same point (common to both lanes). If these wires are not marked, the easiest way to tell is to use an ohmmeter and measure across each wire until you find the two that read zero or near zero ohms. The output from the foul unit is 12 VAC @ 0.8 amps. The connections are as follows:

<u>Foul Unit</u>		<u>Wires running to back</u>
Red	↔	Left Lane Output
White	↔	Right Lane Output
Black	↔	Common to both

The connection for the 82-70 Machine is in the "TB Box" or "AMC Box", these connections are most likely already made but if they are not the hookup is as follows:

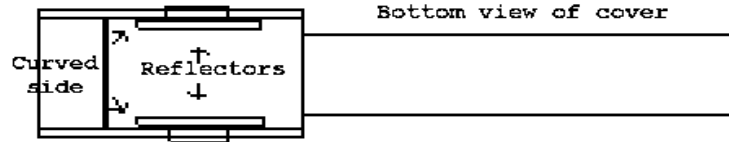
<u>Foul Unit</u>		<u>Wires running to back</u>
Red	↔	Left terminal # 8
White	↔	Right Terminal # 8
Black	↔	Terminal #7 <i>(important that this connection is made!!)</i>

The connections for the 82-30 machine are in the "J Box". The outputs from the foul unit hook to a 12 volt relay inside. The points of the relay connect to J39 and J1. Closing these points will energize the PR3 Relay and turn on the foul light bulb. Connect the outputs from the foul unit to the coil of the relay. A schematic diagram of this connection is shown below.



Remove the old lens and housing from the small division cap across from the unit and mount the reflector as shown in the illustration below.

Pop fit the new reflector on the inside of the cover with the curved side facing forward.



## Replacing the Radaray 82-8 (M-2 RFC W/PK)

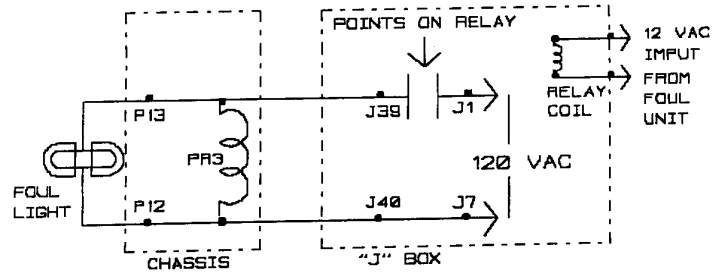
After removing power from the old AMF foul system in the back, mount the new powerpack between the pair of machines on the curtain wall. Position the powerpack where it is most convenient, near to where the power was supplied to the old foul unit. This will give you the same control of turning the units on or off. Consult the power cable hook up on page # 7 for connecting the black cable to the 120 VAC. The 82-8 unit and the connections can be seen on top of page #3 of this manual.

Mount the left and right foul unit on each side of the ball return rail (*see diagram on bottom of page # 3*). Position the unit so that the optic tubes are on the leading edge of the foul line and use the optic alignment LED's to align the optics. The LED's will be lit when the optics are aligned. The LED's on the PC board will be opposite of the optics due to PC board orientation. Included with the unit will be a 70' cable mass that supplies power and the outputs from the foul unit. In most centers this cable can be run from the back to the front by attaching it to one of the existing wires and pulling it through. Position the cable underneath the ball return rails where it will not get damaged. After running the cable mass to the front consult the picture on top of page #3 for connecting the cable mass to the unit. The five wires connect to the corresponding five wires coming from the foul unit. Just match the colors as shown in the picture. The white Molex type connector from the cable mass connects to the corresponding Molex type connector from the power pack. There will also be a two wire cable from the left lane unit that connects to the buzzer on the right lane unit. Also, there will be a four wire cable from the right lane unit that connects to the four wire cable from the left lane unit. Consulting the picture on top of page #3 will help in making these connections.

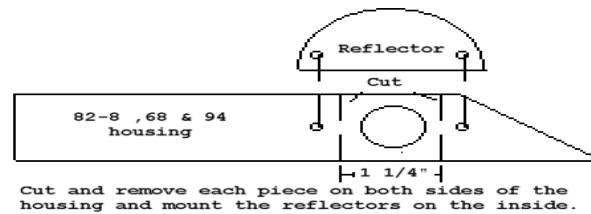
**On the 82-70 machine the 2 two wire cables run to the “TB Box” or “AMC Box”**

<u>Foul Unit</u>		<u>Wires running to back</u>
Red	↔	Left terminal # 8
Black	↔	Left terminal # 7 ( <i>important that this connection is made!!</i> )
Red	↔	Right terminal # 8
Black	↔	Right terminal # 7 ( <i>important that this connection is made!!</i> )

**The connections for the 82-30 machine are in the “J Box”.** The outputs from the foul unit hook to a 12-volt relay inside. The points of the relay connect to J39 and J1. Closing these points will energize the PR3 Relay and turn on the foul light. Connect the outputs from the foul unit to the coil of the relay. A schematic diagram of this connection is shown below.



**Mount the reflectors by cutting 1 ¼” slot into the cover and mount the reflectors in the existing holes of the cover with the hardware provided. (See illustration below).**



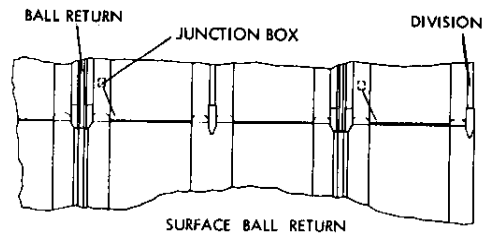
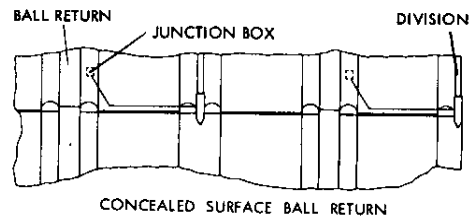
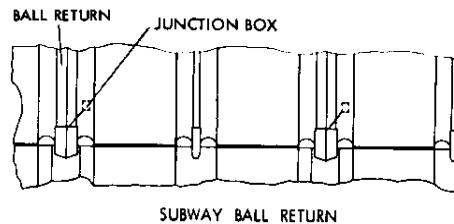
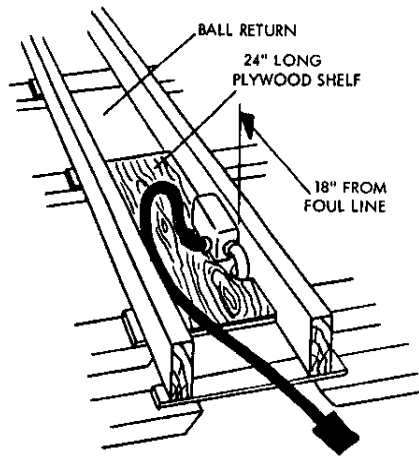
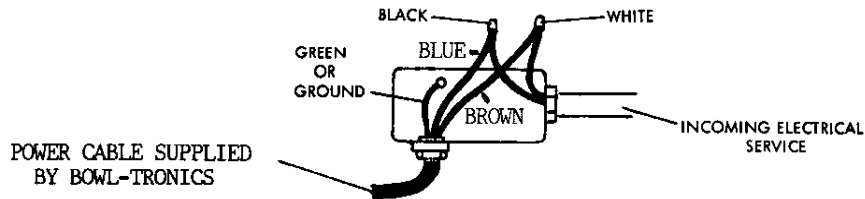
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# ◆ Power Connections for Foul Units ◆

*Remove the power before making electrical connections!  
Take care in making these connections as damage to the unit can result if done improperly!*

Electrical power requirements for foul units are 120 VAC @ 50/60 Hz (220 VAC on special order) There will be a black three wire cable plug coming from the foul unit or the power pack. It is recommended that the power cord be fastened to the woodwork to prevent damage. All centers that are not equipped with power up front will have a power pack included with the foul unit. The power pack should always be installed where the old foul unit was. The connections of the power cable from either the power pack or the foul unit to the electrical box are as follows.

<u>From Unit</u>		<u>from Electrical Box</u>
Brown or white	⇔	White
Blue or black	⇔	Black
Green	⇔	Green or chassis ground



## ◆ Installing New Covers ◆

The approach should be flush with the pit side of the foul line. Notch anchor strips as shown and install the mounting board. The top of the mounting board should be flush with the top of the approach. (See Figure # 1 below)

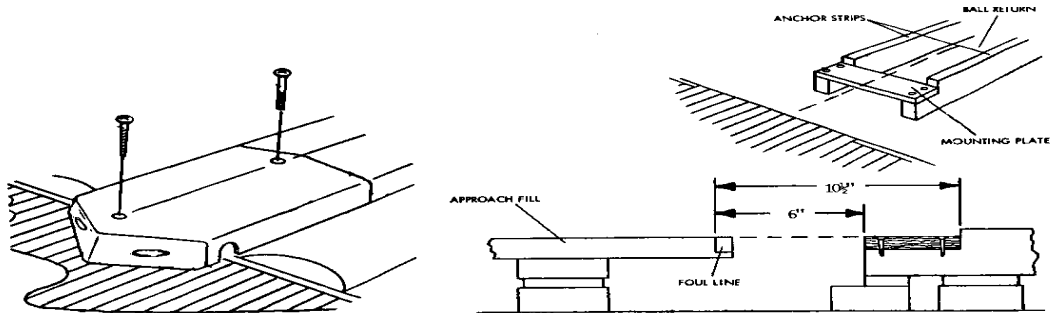


FIGURE 1

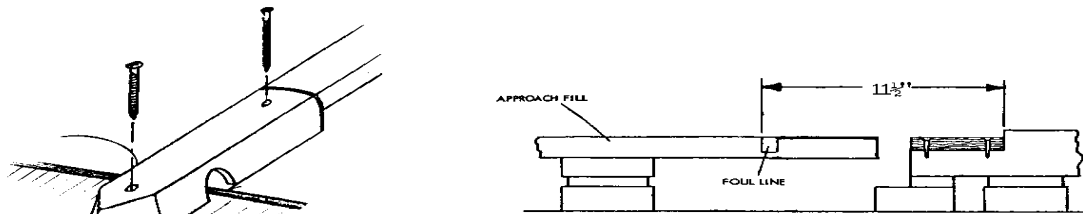


FIGURE 2

## ◆ Autoscore Section ◆

All Bowl-Tronics M-2 Foul Units will come with a three wire output for autoscore (See diagrams pages #2 and #3). If the center has Brunswick or Computerscore a special autoscore module will be supplied with the unit. (See middle of page #3) This autoscore module (ASM) changes the 12 VAC output to point closure, which is what these two autoscore systems require. All other autoscore systems to date require a 12 VAC output. The three wire gray cable coming from the foul unit connects to the autoscore cables from the scorer. The color code is as follows:

<u>From Foul Unit</u>	↔	<u>To Scoring</u>
White	↔	Right Lane Output
Red	↔	Left Lane Output
Black	↔	common or ground

If the unit functions properly and the bulbs light, then a signal is being sent to the scorer. If the scorer is not showing a foul, then the scoring is connected improperly as the scorer output is taken directly from the foul light outputs.



