

MODEL 902 FISH COUNTER

INTRODUCTION:

The Model 902 is an automatic electronic fish counter. The fish counter is used to detect the passage of fish around a dam or barrier and to keep a tally of these passages. Smith-Root electronic fish counters have been used successfully in various installations since 1965.

The easy to use Model 902 has features not found on earlier models. The auto-balance circuit keeps the fish counter accurately balanced, without having to readjust the balance for wide changes in water conditions, and is easier to use.

The major parts of the fish counter are the sensors, the detector and the connecting cables. The sensors are mounted inside stainless steel or fiberglass tubes. They consist of insulated silver epoxy ring electrodes bonded to the inner surface. The electrodes form electrical resistors using the water as the conductor. Shielded coaxial cables are used with the 903-D and can be up to 200 feet long.

THEORY OF OPERATION:

Operation of the 902 Counter is based on the "Balanced Conductivity Bridge Principle" using water in a fish tunnel as two elements of a four element balanced bridge. Passage of a fish through the tunnel causes corresponding changes in tunnel conductance. These conductance changes are used by the 902 to sense the presence and directional movements of fish in the tunnel.

DESCRIPTION OF PRINCIPLE PARTS

The following text describes the principle operating parts of the 902 fish counter and their functions.

Counting Tunnels:

Standard Smith-Root counter tunnels are round and vary from 1 to 24 inch diameters. Other sizes and shapes are available on request. Inside each tunnel are three silver epoxy ring electrodes. These electrodes make contact with the water forming resistor elements for the Wheatstone bridge. The elements are connected to the fish counter through coaxial cables.

The 902 counting system requires 2 resistor elements in the water. One arrangement is to have 2 counting tunnels with a single resistive element in each; the tunnels are then positioned side by side. Fish passing through each tunnel are counted on separate front panel registers. Another arrangement is to have a single counting tunnel that has two resistor elements inside. Logic circuits inside the detector can determine the direction of fish passage when using this type of tunnel.

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Model 902 Fish Counter (Detector)

The Model 902 fish counter is the center of the fish counting system. There are a variety of controls and adjustments that need to be understood and correctly applied. The type of application and results desired will affect all of them.

Back Panel Controls & Connections:

On the back panel there are the tunnel input connectors, the capacitance balance control, the power input fuse, the tunnel size switch and the count test switches.

Fuse - The 1 amp fuse protects the internal circuits from catastrophic internal shorts. If the fuse blows, determine why before replacing it. Always use a 1 amp 3AG fast blow fuse.

C Balance - Compensates for the capacitance of extremely large tunnels.

Tunnel Inputs - The coaxial connector from the tunnels are connected here. If the tunnel is used for directional counting, the upstream cable should be connected to the upstream input (A) and the downstream cable to the downstream input (B).

Auxillary Connector - Contains connections for A and B count output, power supply common, and a 1000 ohm pullup resistor to the +12V supply.

Test Push Buttons - These buttons are used to check for proper counter operation. To use, connect a tunnel (with water passing through) to the counter. Balance the counter (see operating instructions). For dual operation, use two separate tunnels; for directional operation, use two tunnels in series or a double counter tunnel. With counter balanced, press the push buttons to simulate fish passages. For dual switch setting, pressing each button will register a count on its corresponding count register. For directional setting, first one button and then the second button is pressed to simulate a complete fish passage through both tunnel elements placed in series to the water flow.

Directional Switch - Selects mode of fish counter operation, ie., dual for side-by-side tunnel operation, and directional for counting tubes placed in series to count directional fish passages.

Tunnel Size Switch - The tunnel size switch sets the range of tunnels that can be used. The switch selects internal resistor elements for the Wheatstone bridge that best match the tunnel's resistive elements. The Small position is for tunnels less than 3 inches in diameter, the Medium position is for tunnels 3 to 6 inches in diameter and the Large position is for tunnels over 6 inches.

NOTE: The switch positions are based on water with medium conductivity (aprx. 175 micromho/cm³). Better results may be obtained using a different range than the one indicated if the water's conductivity is very high or very low.

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Front Panel Controls & Indicators:

On the front panel there are the count registers, the balance adjust, the gain control, the over gain indicator, the auto-balance on/off switch, the count reset and the power on/off switch.

Power on/off - This switch turns the counter's input power on or off.

Count registers - The count registers tally the counts for the tunnels.

Count reset - The count reset button will reset the count registers back to zero.

Auto-balance on/off - This switch will turn off the auto-balance circuit. The auto-balance feature should be turned off when setting the initial balance and then turned on for normal operation.

Balance control and high/low indicators - The balance control is used to set the initial balance for the Wheatstone bridge circuit. The high/low indicators tell which way to turn the balance control. If the high indicator is on, the balance control should be turned counter-clockwise. If the low indicator is turned on, the balance control should be turned clockwise. When both of the indicator lamps are turned off the Wheatstone bridge is balanced.

Gain control and over-gain indicator - The gain control adjusts the sensitivity of the detector circuit. The sensitivity of the detector determines how much change in resistance inside the tunnel is needed to get a count. Smaller fish will need more gain than larger fish. Do not use more gain than is needed. If the gain is set too high the over-gain indicator will be turned on and the counter will not work correctly. It is normal however for the over-gain indicator to blink when a fish passes through the tunnel.

NOTE: Normally the over-gain indicator should not turn on if tunnel size switch is in the correct setting for the tunnel used. If the over-gain indicator stays on when the gain is reduced, switch the tunnel size switch to a smaller tunnel size position. If the over-gain lamp still will not turn off check the tunnels and the coaxial cables for damage. Sometimes ground loops require isolating the detector's box from electrical ground.

OPERATING INSTRUCTIONS

Mounting locations of the tunnels and the hydrodynamics of the water will effect the results more than any other factor. The following requirements outline the most critical.

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The tunnels should be solidly mounted so they will not vibrate or fall off.

No large bubbles or debris should pass through the tunnels.

The fish should be prevented from lingering inside the tunnels. This is more critical for directional counting. The fish must pass both of the tunnel elements within 5 seconds or it will not be counted. The time delay can be adjusted internally to meet special requirements.

The tunnels should be situated so the fish will not pass back through the tunnel causing a double count.

The following procedure covers the basic steps to be followed when using the 902 fish counter.

BACK PANEL:

Connect the cables from the tunnels to the appropriate input connectors.

Set the tunnel size switch to the appropriate size (0-3" - small, 3-6" - medium, greater than 6" - large).

Set the C Balance control to the center of its range.

Set the dual directional switch to the appropriate position (refer to "Back Panel Controls & Connections").

Connect the power cord to a 120VAC, 60Hz outlet.

If a data logger is used, plug the cable into auxiliary plug.

FRONT PANEL:

Preset the front panel controls as follows: Power switch OFF, Auto-balance OFF, Gain Control ZERO.

When ready to adjust, turn the power switch ON. Both LED count displays will be on.

Advance the gain control clockwise until one of the High-Low LEDs comes on (the over-gain light may perhaps be on also).

Adjust the balance control until both the High & Low indicators are off.

Continue to increase the gain control clockwise until the over-gain comes on. Readjust the balance control as necessary to keep the High-Low indicators off.

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Adjust the C Balance on the rear panel for the lowest light level on the over-gain control. Alternately adjust the balance and the C Balance control until all 3 LED lights are out.

Turn the auto-balance switch to on. This will keep the bridge circuit balanced.

Push the count reset button and check to see that both registers are reset to zero.

Start passing fish through the counting tunnels. The final setting for the gain control will have to be determined experimentally, by counting the fish passed through the tunnels and comparing it with the count on the front panel.

NOTE: To count only larger fish, turn the gain control down. Do not increase the gain past the point where the overgain light stays on.

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SPECIFICATIONS - MODEL 902 FISH COUNTER

POWER SUPPLY VOLTAGE.....120 VAC, 60 Hz
BALANCE CONDUCTIVITY RANGE.....10 - 500 MICROMHO/CM³
NUMBER OF INPUT CHANNELS.....2 FOR DUAL AND
1 FOR DIRECTIONAL
COUNT CAPACITY.....999999
COUNT RATE.....25/SECOND PER CHANNEL
MINIMUM SENSITIVITY.....0.5% TUNNEL UNBALANCE
AUTO-BALANCE CORRECTION RANGE.....+/- 2% TUNNEL UNBALANCE
AUTO-BALANCE CORRECTION TIME.....3 MINUTES MAX.

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