

## ELECTRIC FENCE CONTROLLERS

An electric fence is a psychological barrier that uses a short duration electric shock to control livestock. This shock is supplied by the fence controller, which transforms a standard electrical energy source and energizes the fence wires.

### Electric Fence Controllers

The electron “pump” for an electric fence is the fence controller, commonly called an energizer or charger. This device is the heart of the system and is available in three forms:

- A controller that uses utility power - 115 or 230 volt (used when close to the utility),
- A controller that uses a rechargeable wet cell battery (typically 12 volt; used when remote from the utility and for portability),
- A controller that uses a replaceable dry cell battery (typically 6, 9, or 12 volt; used for remote sites and for easy portability).

The controller must be able to do two things to be effective:

- Overcome the insulation resistance of the animal hair and hide, and then,
- Deliver a shock of sufficient intensity to be effective.

### Shock Delivery

First of all, a controller must produce enough voltage (electrical pressure) to overcome the resistance of the hair and hide of the animal. This is termed the guard voltage and is given by the type of livestock; minimum values are:

- 700 volts for short-haired animals (such as cows)
- 2000 volts for long-haired animals (such as sheep)
- 2500 volts or greater for other animals (such as deer).

If a controller maintains a guard voltage above the minimum, the animal will receive a shock. If not, no shock will be felt. The guard voltage only means a controller has the voltage to deliver a shock but is not a measure of the shock intensity.

## Shock Intensity or Effectiveness

A controller with sufficient guard voltage will deliver a shock, but what is the intensity or effectiveness of the shock? It depends on the fence, the reaction of the animal and other operating conditions, all of which are difficult to measure. However, indicators of shock intensity are the peak current and electrical energy outputs delivered by the controller under field conditions.

The peak current is the maximum current delivered during the shock measured in amperes (amps). It is not related to the duration of the shock. High currents indicate high shock intensities.

The energy output in a shock is the combination of amps, volts and the shock time and is measured in *joules*. High energy values indicate high shock intensities. Electric fence controllers are often rated by joule output. Shock time is related to the pulse of the controller.

## Controller Pulse Output

Modern controllers are sophisticated electronic devices that are capable of energizing many miles of fence. The electric current flow sent out from the controller to the fence wire(s) is in the form of a pulse that is only “on” for a brief time. The pulse “on” time is typically about 0.3 milliseconds (3/10,000 of a second) and occurs about one pulse a second. This is for safety reasons so animals or humans can free themselves from the electrified wire(s) during the “off” time. This pulsing is automatically controlled and in some cases is adjustable, either faster (for training livestock) or slower (to conserve energy; most useful on battery controllers).

Because of this pulsing action, the dynamics of the electricity flowing in the fence wire(s) is quite complicated. It could be compared to wave action from a rock thrown into a pond. Pulses can reflect back from the end of a fence and often make troubleshooting a challenge, especially on fences over five km or ones with long leadout wires.

Pulse behavior is designed by manufacturers in the fence controller circuitry. This is a feature that may distinguish one controller from another.

## 115/230 Volt Controllers

These controllers are plugged into the utility electrical service and are most often used at the farm or ranch home site. They:

- are CSA tested and approved
- are amongst the most powerful
- are often the least cost per energy (joule) output
- are the least expensive to operate
- are not portable.

## Battery Controllers

These controllers require a battery for energy supply and are used for sites remote from a utility electrical supply. They:

- are not tested or rated by any agency
- are usually in the low to middle power range
- are powered by dry or wet cell batteries of various voltages
- are portable
- may use a solar panel to trickle charge a rechargeable battery.

## Wet Cell Batteries for Controllers

Because the fence controller “load” is always on and will discharge a battery, regular automotive type batteries are not usually selected. These engine starting batteries are only meant to be discharged about 10% (a 10% depth-of-discharge) on a regular basis or they will not recharge properly. A deep discharge battery, however, can be taken to 50 to 80% depth-of-discharge and are best for electric fence controllers.

## Solar Panels for Battery Controllers

Fence controllers that are powered by a rechargeable battery may have a solar or photovoltaic panel added to maintain the battery charge. When the sun shines on a photovoltaic panel current flows to the battery. They are therefore most effective in the high sunshine period of the year but can be sized for any condition. This panel only “trickle charges” the battery and does not directly energize the fence.

Controllers are available with built-in panels. However, the panel should be sized for the local solar conditions and the built-in panel may not be adequate to maintain the battery charge. Note that poorly insulated fences or ones with a lot of vegetation on the wires may have a larger than expected loss and drain the battery even with a solar panel.

One manufacturer uses a built-in microprocessor to control the output of a battery/solar panel controller. On cloudy days or when the battery is low the pulse rate is reduced to conserve energy.

Some solar panels are advertised as "self regulating". These are not actually different from any others except they are sized so their voltage output matches the battery voltage, to avoid battery overcharging.

## Uni-polar and Bi-polar Controllers

Fence controllers can be categorized by the number of energized terminals (or poles) that are connected to fence wires. Most commonly used fence controllers are uni-polar; that is they have one energized terminal (positive) and a negative or ground terminal. Fence wires are either all positive, or alternatively positive and grounded. Only the positive wires are insulated at fence posts. The full controller voltage is available between either the positive and grounded wires or the positive wire and ground.

Bi-polar have two energized terminals (a positive and a negative) that are connected to fence wires, plus a ground terminal. With this arrangement, full voltage is available between a positive and a negative wire with **one-half** the full voltage between either wire and ground. This feature in a controller allows a fence to have all wires energized with only one-half the losses occurring from wires that become short circuited by grass, etc. In poor conditions, this type of controller may be more effective than a uni-polar style.

## Purchasing a Controller

The following are some general things to consider in addition to those already discussed previously:

- Choose a utility powered controller for a permanent fence
- Remember a manufacturers' rating in “¼ miles” is for miles of wire not miles of fence (i.e., a controller rated for 6 miles is sufficient for 1.5 miles of four electrified strands of fence)
- A wet fence environment will require more controller power than a dry one (more potential short circuits).

## Safety Considerations

Electricity must be respected at all times. To ensure the safe installation of an electric fence controller:

- Use only CSA approved plug-in type controllers.
- For plug-in type controllers, ensure the supply electrical service has been inspected by an electrical inspector.
- Use battery controllers from reputable companies (note that there are no provincial regulations regarding these controllers).
- Install the controller according to the manufacturers' recommendations
- No more than one controller may electrify a fence at any one time.

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### FOR FURTHER INFORMATION CONTACT

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