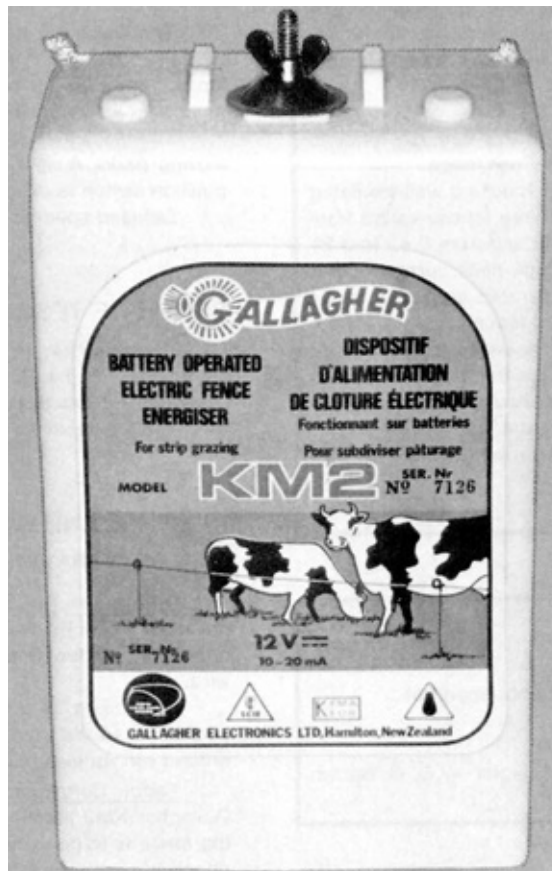


# Evaluation Report

# 255



## Gallagher KM2 Electric Fence Controller

A Co-operative Program Between



ALBERTA  
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MACHINERY  
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CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

# GALLAGHER KM2 ELECTRIC FENCE CONTROLLER

## MANUFACTURER:

Gallagher Electronics Ltd.  
Hamilton, New Zealand

## RETAIL PRICE:

\$130.00 (December, 1981, f.o.b. Humboldt)

## RETAIL OUTLET:

Lamb Acres Farm Supply  
P.O. Box 104  
Bulyea, Saskatchewan  
S0G 0L0

## SUMMARY AND CONCLUSIONS

The Gallagher KM2 electric fence controller was suitable for use over a limited range of fence conditions. Plant growth did not appreciably affect controller performance in most conditions.

Peak voltage output on a 5.4 km (3.3 mi) single wire fence varied from 1630 V for a well-insulated, grass-free, dry fence to 1100 V for an uninsulated, grass-grown, wet fence. Output was above the 700 V minimum guard voltage recommended for short-haired animals, while for all conditions, it was below the 2000 V minimum needed for long-haired animals.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 750 V for a well-insulated, grass-free, dry fence to 610 V for an uninsulated, grass-grown, wet fence.

Peak current flow through a cow touching well-insulated 5.4 and 16 km (3.3 and 10 mi) single wire fences varied from 2.1 to 1.2 A for a cow standing in water and from 0.42 to 0.21 A for a normally-grounded cow. The high peak current output indicated that the Gallagher KM2 generated quite an intense shock on fairly long or poorly insulated fences.

The Gallagher KM2 was very suitable for cold weather use on short feeding fences. Peak voltage output at -35°C on a 5.4 km (3.3 mi) single wire fence was about 1610 V, only 2% higher than its output at room temperature.

No durability problems occurred during testing.

## GENERAL DESCRIPTION

The Gallagher KM2 electric fence controller is designed for 12 V DC operation. It may be powered by two, 6 V lantern batteries located internally, or by an external automotive battery. It may be mounted outdoors without a weather-proof shelter.

The Gallagher KM2 contains solid-state electronics, with no moving parts. A light is provided to indicate operation. A three position switch is used to control the pulse frequency.

Detailed specifications are given in APPENDIX I.

## SCOPE OF TEST

The performance characteristics of the Gallagher KM2 were determined in the laboratory for a range of simulated fence conditions.\* It was evaluated for ease of operation, quality of work, safety and suitability of the instruction manual.

## RESULTS AND DISCUSSION

### EASE OF OPERATION

**Installation:** The controller may be mounted either indoors or outdoors without a weather-proof shelter. The controller may be connected to the fence directly or with a length of insulated wire.

In addition, a suitable ground rod has to be installed and connected to the controller. Depending on ground conditions, a ground rod up to 3 m (10 ft) long may be needed.

**Fence Condition:** The manufacturer recommends that the Gallagher KM2 should be used on fences with wire insulators. If the fence is in good repair, the controller is designed to operate effectively with a certain amount of plant growth touching the charged wire.

The manufacturer recommends that for cattle fences, in areas with normal ground conditions, a single charged wire provides a suitable fence. For very dry or frozen soil, which provide poor ground conditions, a two-wire fence, with one charged wire and one ground wire, may be necessary.

**Operation:** The Gallagher KM2 is equipped with a flashing light to indicate that the fence is properly charged. If this light does not flash, it indicates that insufficient charge is being placed on the fence, which may be the result of too long a fence or poor insulation. The indicator light could be dealer serviced.

The pulse frequency switch is used in setting #3 to train livestock and in setting #2 or #1 to conserve the battery after the livestock have been trained.

## RECOMMENDATIONS

A need for recommendations was not apparent.

*Chief Engineer -- E. O. Nyborg*

*Senior Engineer -- G. E. Frehlich*

*Project Technologist -- G. G. Burton*

## THE MANUFACTURER STATES THAT

The Gallagher KM2 is primarily designed for charging shod fences for feedlots and strip grazing. It is not recommended for charging more than 2.0 km (1.25 mi) of fence.

**NOTE:** This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX II.

\*PAMI T7850, Detailed Test Procedures for Electric Fence Controllers.

## QUALITY OF WORK

**General:** Operation of an electric fence controller is quite complex. To be effective, an electric fence has to deliver a minimum guard voltage to overcome the insulation resistance of the hide and hair of an animal. In addition, once the insulation resistance of the animal is overcome, the controller must deliver a pulse of electrical energy to the animal to create a shock. The amount of energy (charge) delivered is related to the current flow and its duration. If too much energy is delivered, the fence will be hazardous to both animals and humans while if not enough energy is delivered, animal control will be ineffective.

Little is known about the physiological effect of shock pulses on animals. In general, the following guidelines are used in assessing fencer performance: the minimum guard voltage needed to overcome animal insulation resistance should be at least 2000 V for sheep and for long-haired cattle, such as Herefords or Charolais. For shorter haired animals, such as most dairy cows, a minimum guard voltage of 700 V is sufficient. The shape of the current pulse affects what the animal feels when it touches an electrical fence, but little reliable information is available. It has been found that shock intensity is more related to the peak current value in a pulse than to the total value of the electrical charge.

Fence conditions determine the guard voltage produced by a fence controller and limit the amount of charge which a controller is capable of delivering to an animal. The insulation resistance of a 1.6 km (1 mi) single wire fence typically varied from about 1 k $\Omega$  for an uninsulated, grass-grown, wet fence to well above 500 k $\Omega$  for a well-insulated, grass-free, dry fence. The higher the fence insulation resistance, the greater is the length of fence on which a controller can be effectively used. To receive a shock from a single wire electrified fence, an animal must be sufficiently grounded to permit current to flow from the fence, through the animal. Typical electrical resistances of cattle vary from about 0.5 k $\Omega$  for a cow standing in water and licking a charged wire to about 4 k $\Omega$  for typical ground conditions. If ground conditions are too poor, animal resistance to ground is so great that no shock occurs.

**Peak Voltage Output:** FIGURES 1 and 2 show peak voltage outputs of the Gallagher KM2 for a 5.4 and 16 km (3.3 and 10 mi) lengths of single wire fence over a range of insulation resistances. On a 5.4 km (3.3 mi) fence (FIGURE 1) peak voltage output varied from 1630 V for a well-insulated, grass-free, dry fence to 1100 V for an uninsulated, wet fence with considerable grass touching the charged wire. The voltage output was above the 700 V minimum guard voltage needed for short-haired animals for all fence conditions, while it was below the 2000 V minimum guard voltage needed for long-haired animals for all fence conditions.

On a 16 km (10 mi) fence (FIGURE 2), peak voltage output ranged from 750 V for a well-insulated, grass-free, dry fence to 610 V for an uninsulated, grass-grown, wet fence. Voltage output was above the 700 V minimum required for short-haired animals for fence insulation values greater than 1.8 k $\Omega$ , while it was below the 2000 V minimum guard voltage needed for long-haired animals for all fence conditions.

As can be seen from both FIGURES 1 and 2, plant growth touching a fence did not appreciably affect controller performance, since the voltage output was above 700 V for nearly all fence conditions, while it was below 2000 V for all fence conditions. The Gallagher KM2 can be expected to operate well over a limited range of fence conditions.

**Electrical Charge:** FIGURES 3 to 6 show the current output of the Gallagher KM2 when a cow touches 5.4 and 16 km (3.3 and 10 mi) lengths of well-insulated, single wire, fence. FIGURES 3 and 4 are for an animal resistance of 0.5 k $\Omega$ , which represent the most extreme condition of a cow standing in water and licking the charged wire, while FIGURES 5 and 6 are for an animal resistance of 4 k $\Omega$ , representing more normal ground conditions. The shock intensity is related to the peak current in the pulse. The higher the peak current, the more intense will be the shock.

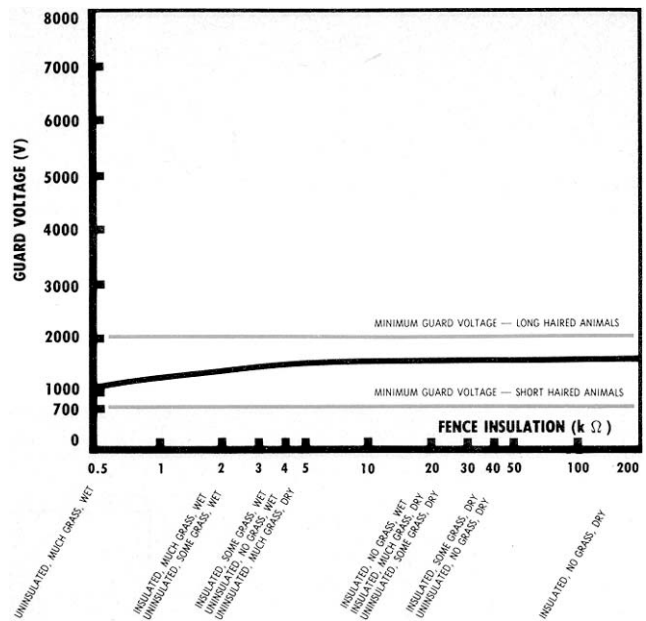


FIGURE 1. Guard Voltage Produced on a 5.4 km Single Wire Fence.

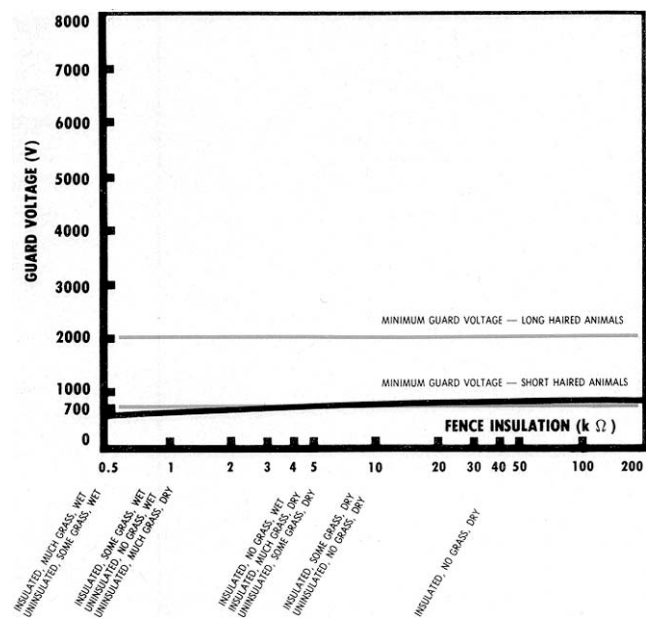


FIGURE 2. Guard Voltage Produced on a 16 km Single Wire Fence.

The peak current delivered by the Gallagher KM2 varied from 2.1 A for a well-grounded cow touching the 5.4 km (3.3 mi) fence to 0.21 A for a normally-grounded cow touching the 16 km (10 mi) fence. The Gallagher KM2 gave quite an intense shock on fairly long or poorly insulated fences.

A switch was provided to vary the number of pulses that were delivered. About 21 charge pulses per minute were delivered for setting #1, 35 for setting #2 and 56 for setting #3. The number of pulses did not vary with fencer load, however, the on-time was affected by load. On-time varied from about 0.12 to 4.83 ms.

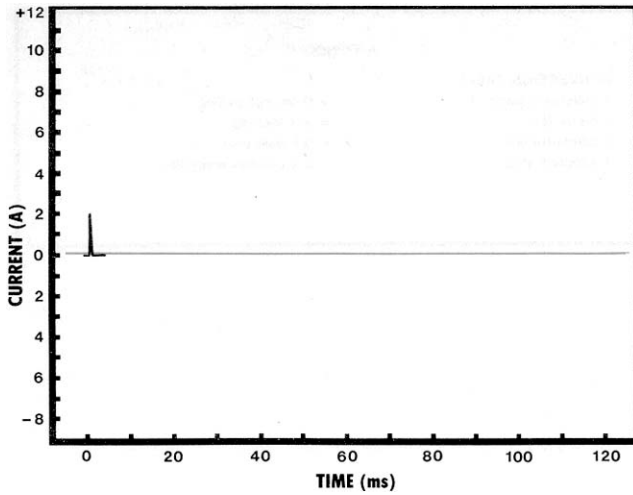


FIGURE 3. Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

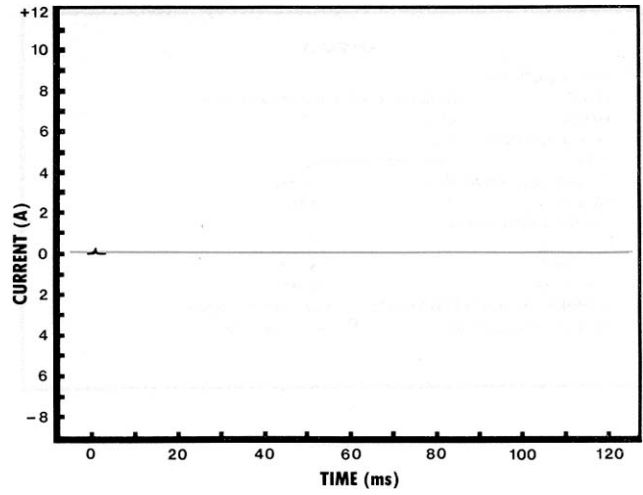


FIGURE 6. Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

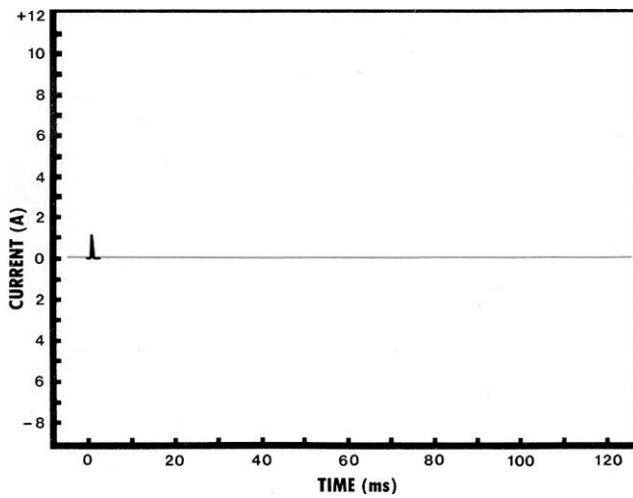


FIGURE 4. Current Delivered to a Well-Grounded Cow Touching a 16 km Well-Insulated Fence.

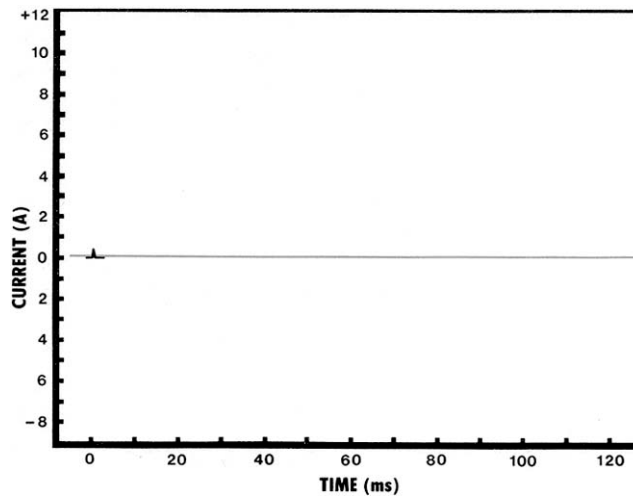


FIGURE 5. Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

**Low Temperature Operation:** The Gallagher KM2 could effectively be used to energize cattle feeding wires during low winter temperatures. The peak voltage output of the controller at  $-35^{\circ}\text{C}$  on a 5.4 km (3.3 mi) single wire fence was about 1610 V, only 1% lower than its output at room temperature. Since the peak voltage output was below the 2000 V minimum required to overcome the insulation resistance of long-haired animals, the Gallagher KM2 was only suitable for shod feeding enclosures.

Since battery voltage is severely reduced at low temperatures, it may be necessary to provide a heated battery enclosure to ensure effective winter operation. As frozen ground is often a very poor electrical conductor, two-wire systems utilizing a separate ground wire are usually most suitable for winter cattle feeding.

**Battery Consumption:** A 12 V, 70 amp-hour battery will operate the Gallagher KM2 from four to 21 months, depending upon the naturally occurring discharge rate. The consumption rate did not increase as the load on the controller increased, but did increase as the shock frequency was increased. The battery should be regularly checked to ensure effective controller performance.

#### SAFETY

The instruction manual clearly outlined safety considerations. No safety problems were evident if the manufacturer's instructions were followed.

#### INSTRUCTION MANUAL

The instruction manual was clear, concise and well illustrated. It outlined installation, safety considerations and operation, as well as suitable fence configurations.

#### DURABILITY RESULTS

The intent of the test was functional evaluation. An extended durability evaluation was not conducted. No problems occurred during functional testing.

APPENDIX I

**SPECIFICATIONS**

MAKE: Gallagher Electric Fence Controller  
MODEL: KM2  
SERIAL NUMBER: 7126  
TYPE: Solid State Electronic  
POWER REQUIREMENTS: 12 V DC  
WEIGHT: 1.2 kg  
OVERALL DIMENSIONS:  
-- length 92 mm  
-- width 158 mm  
-- height 255 mm  
NUMBER OF INDICATOR LIGHTS: 1 (operation indicator)  
TYPE OF ENCLOSURE: for outdoor use

APPENDIX II

**CONVERSION TABLE**

1 millimetre (mm)	= 0.04 inches (in)
1 metre (m)	= 3.3 feet (ft)
1 kilometre (km)	= 0.6 mile (mi)
1 kilogram (kg)	= 2.2 pounds mass (lb)



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