Evaluation Report No. E2777G
Printed: August, 1979
Tested at: Humboldt
ISSN 0383-3445

Evaluation Report 110

Parmak FM Fence Controller

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

PARMAK FM FENCE CONTROLLER

MANUFACTURER:

Parker-McCrory Manufacturing Company
3175 Terrace Street
Kansas City, Missouri 64111
U.S.A.

RETAIL OUTLETS:

United Farmers of Alberta Co-op Ltd.
4635 - 1st Street S.E.
Calgary, Alberta
T2G 2L2

RETAIL PRICE:

$36.15 (August, 1979, f.o.b. Humboldt)

SUMMARY AND CONCLUSIONS

The Parmak FM fence controller was suitable for use over a limited range of fence conditions.

Peak voltage output on a 5.4 km (3.3 mi) single wire fence varied from 1900 V for a well-insulated, grass-free, dry fence to 240 V for an uninsulated, grass-grown, wet fence. For most normal fence conditions, 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. For most fence conditions, the Parmak FM could be used to control short-haired animals on this fence length.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 1300 V for a well-insulated, grass-free, dry fence to 130 V for an uninsulated, grass-grown, wet fence. Plant growth touching an insulated fence during wet weather reduced the voltage output below the required 700 V minimum guard voltage.

Peak current flow through a cow touching well-insulated 5.4 and 16 km (3.3 and 10 mi) single wire fences varied from 0.48 to 0.26 A for a cow standing in water and from 0.24 to 0.17 A for a normally-grounded cow. The peak current output indicated that the Parmak FM was suitable for fences shorter than 16 km (10 mi) in length.

Total charge delivered by the Parmak FM varied from 0.98 to 3.2 mC.

The Parmak FM was suitable for cold weather use on short feeding fences. Peak voltage output at -37°C on a 5.4 km (3.3. mi) single wire fence was about 1445 V, 24% lower than its output at room temperature.

No durability problems occurred during testing.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Revising the instruction sheet to include information on the types of fence arrangements suitable for cattle.
2. Modifications to permit field replacement of the indicator light bulb.

Chief Engineer -- E. O. Nyborg
Senior Engineer -- L. G. Smith
Technical Officer -- J. M. Williams

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. A new instruction sheet, which includes the above information is now being supplied.
2. Regarding the test light bulb being replaced in the field; unlike the power line models, the test light on the FM is used only periodically and then only for a few flashes. One of CSA and U/L requirements is that there be no opening in the housing to give access to the operating mechanism. This requirement makes it difficult to install a replaceable bulb in a weatherproof outdoor model. Because of the bulbs limited use we have never had any difficulty with the bulbs burning out in the field.

GENERAL DESCRIPTION

The Parmak FM fence controller is designed for 12 V battery operation and for outdoor use, without a weather shelter.

The Parmak FM uses both electrical and mechanical components to produce the charge pulses. A light is provided to indicate shock intensity.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The performance characteristics of the Parmak FM 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 Parmak FM is equipped with wire leads for connection to any type of 12 V battery or two 6 V dry batteries. The controller is designed for outdoor use without a weather shelter. The controller is connected to the fence 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 2 to 3 m ground rod length may be needed.

Fence Condition: The manufacturer recommends that the Parmak FM be used only on insulated fences. If the fence is properly insulated, 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 fence erected about two-thirds of animal height above ground 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 Parmak FM is equipped with a switch, which includes a test position to check the fence condition by means of an indicator light. When the light flashes normally, it indicates that the fence is properly charged. Conversely, if this light is very dim, 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 assembly was sealed from the factory and the indicator light could not be replaced without factory servicing. It is recommended that the manufacturer consider modifications to permit indicator light bulb replacement without chassis disassembly.

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. For safety reasons, the total electrical charge in each pulse of power line-operated controllers should not exceed 1 mC if it has an on-time less than 14.2 ms. For an on-time of 200 ms, 4 mC is the allowable total electrical charge. Electrical regulations do not apply to battery-operated controllers.

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

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

a 1.6 km single wire fence typically varies from about 1 kΩ for an uninsulated, grass-grown, wet fence to well above 500 kΩ for a well-insulated, grass-free, dry fence. The higher the fence insulation resistance, the greater is the length of fence on which a certain 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 kΩ for a cow standing in water and licking a charged wire to about 4 kΩ 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 Parmak FM for 5.4 and 16 km lengths of single wire fence over a range of insulation resistances. On a 5.4 km fence (FIGURE 1), peak voltage output varied from 1900 V for a well-insulated, grass-free, dry fence to 240 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 fence insulation values greater than 2.2 kΩ**W**, while it was below the 2000 V minimum guard voltage needed for long-haired animals for all fence conditions. From FIGURE 1, it can be seen that the Parmak FM can be satisfactorily used to control short-haired animals for most fence conditions on this length of fence.

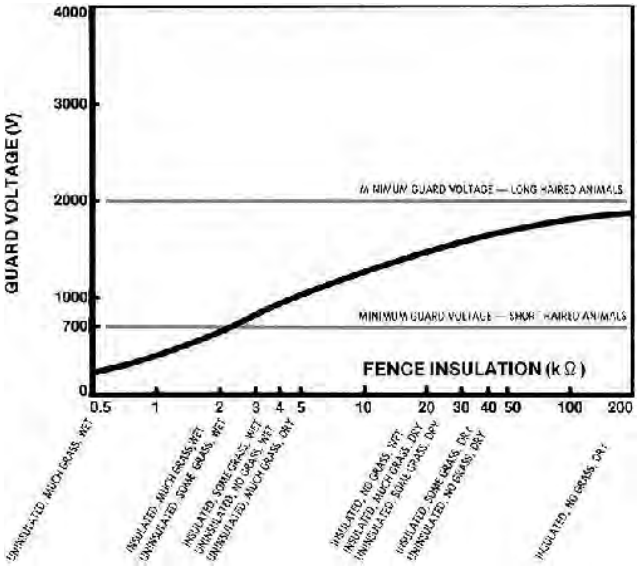

FIGURE 1. Guard Voltage Produced on a 5.4 km Single Wire Fence.

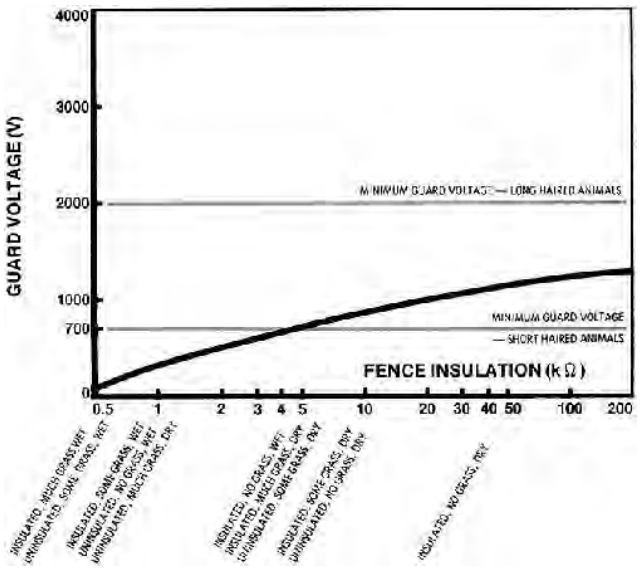

FIGURE 2. Guard Voltage Produced on a 16 km Single Wire Fence.

On a 16 km fence (FIGURE 2), peak voltage output ranged from 1300 V for a well-insulated, grass-free, dry fence to 130 V for an uninsulated, grass-grown, wet fence. Voltage output was below the 2000 V minimum required for long-haired animals, but was above the 700 V minimum required for short-haired animals for fence insulation values greater than 5 kΩ. From FIGURE 2, it can be seen that the Parmak FM can be satisfactorily used to control short-haired animals if the fence is kept clean of plant growth during wet weather.

Electrical Charge: FIGURES 3 to 6 show the current output of the Parmak FM when a cow touches 5.4 and 16 km lengths of well-insulated, single wire, fence. FIGURES 3 and 4 are for an animal resistance of 0.5 kΩ, 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 kΩ, 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.

The peak current delivered by the Parmak FM varied from 0.48 A for a well-grounded cow touching the 5.4 km fence to 0.17 A for a normally-grounded cow touching the 16 km fence. The total charge delivered to the cow varied from 0.98 to 3.2 mC. The controller gave an adequate shock and was suitable for well-insulated fences shorter than 16 km in length.

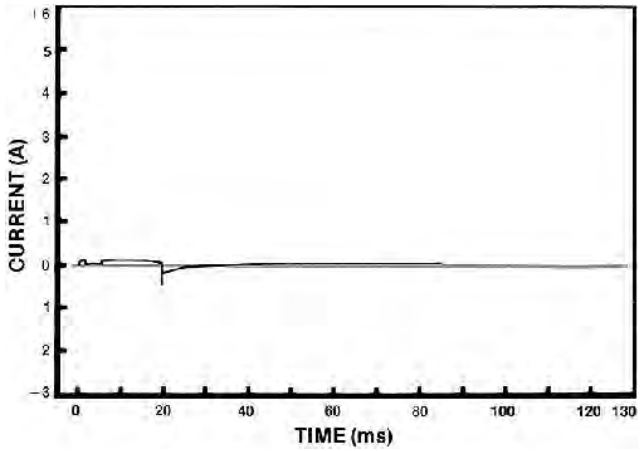

FIGURE 3. Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

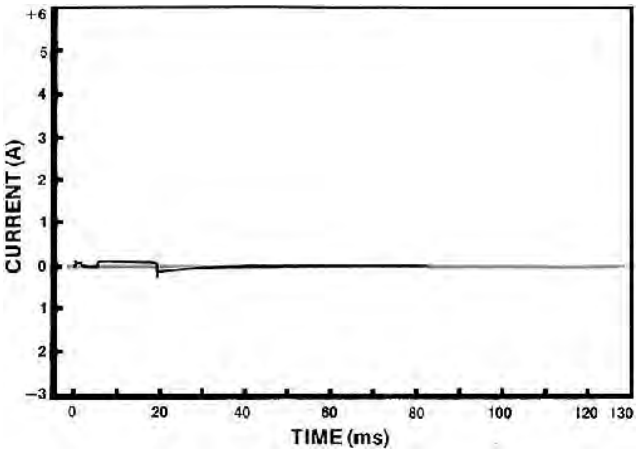

FIGURE 4. Current Delivered to a Well-Grounded Cow Touching a 16 km Well-Insulated Fence.

The number of charge pulses delivered per minute varied from 50 to 56. The on-time was also affected by fencer load and varied from about 45 to 85 ms.

Low Temperature Operation: The Parmak FM could be used to energize cattle feeding wires during low winter temperatures. The peak voltage output of the controller at -37°C on a 5.4 km single wire fence was about 1445 V, 24% lower than its output at room temperature. A higher peak voltage output could be expected on a short feeding fence. The peak voltage output was well above the 700 V minimum required to overcome the insulation resistance of short-haired animals, but was below the 2000 V minimum required for long-haired animals. The low temperature caused the controller to deliver about 90 charge pulses per minute. The peak battery

input current was reduced by about 50%, while the total current consumption remained about the same as at room temperature.

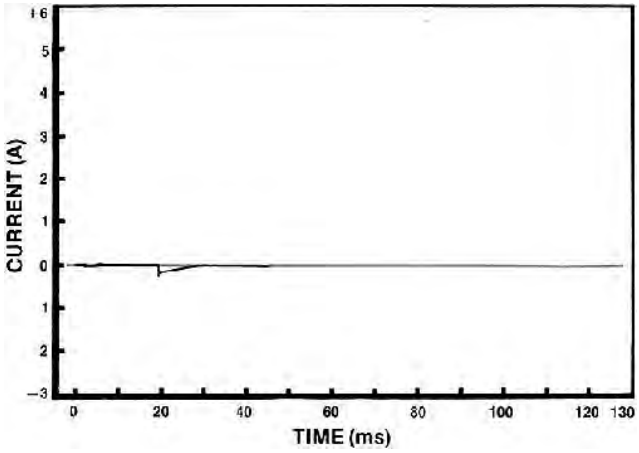

FIGURE 5. Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

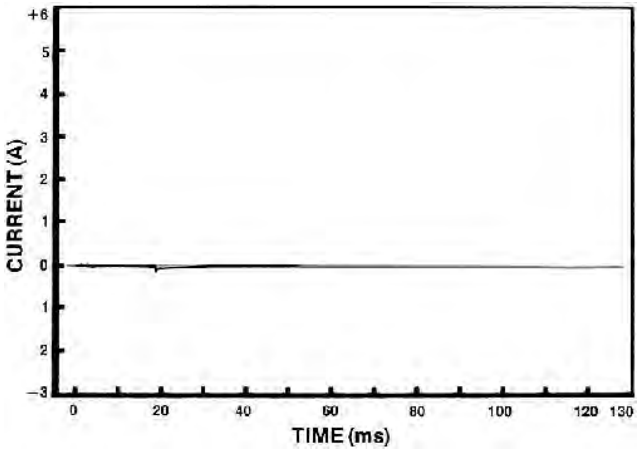

FIGURE 6. Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

Since battery voltage is severely reduced at low temperatures, it is 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 Parmak FM about 3 months before recharging is required. The consumption rate increased slightly as the load on the controller increased. The battery should be regularly checked to ensure effective controller performance.

SAFETY

No safety problems were evident if the manufacturer's instructions were followed.

INSTRUCTION MANUAL

The instruction sheet was clear and concise. It outlined installation, safety considerations and operation. It is recommended that additional instructions be provided to advise on the types of fence arrangements suitable for livestock.

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:	Parmak Fence Controller
MODEL:	FM
SERIAL NUMBER:	2329088
TYPE:	Electro-Mechanical
POWER REQUIREMENTS:	12 V DC
WEIGHT:	4.5 kg
OVERALL DIMENSIONS:	
-- length	220 mm
-- width	190 mm
-- height	302 mm
NUMBER OF INDICATOR LIGHTS:	1 (for shock intensity)
TYPE OF ENCLOSURE:	for outdoor use

APPENDIX II
SI UNITS AND SYMBOLS

(a) In keeping with the Canadian metric conversion program, this report has been prepared in SI units. For comparative purposes, the following conversions may be used:

1 millimetre (mm)	= 0.039 inches (in)
1 metre (m)	= 3.28 feet (ft)
1 kilometre (km)	= 0.62 mile (mi)
1 kilogram (kg)	= 2.2 pounds (lb)

(b) The following symbols are used in this report:

electric current	= ampere (A)
electric potential	= volt (V)
electric charge	= coulomb (C)
electric resistance	= ohm (Ω)
pulse time	= second (s)

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:
P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080