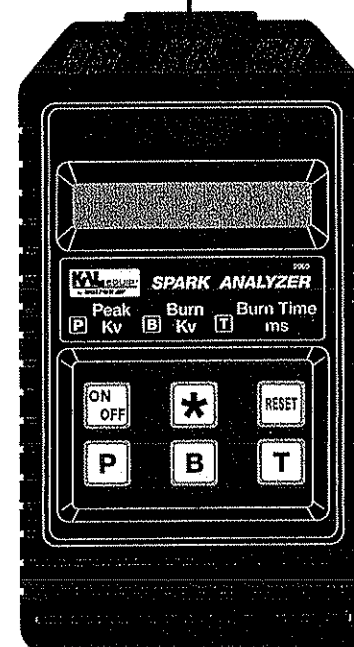


actron///®

**KAL
EQUIP**

FULL THREE (3) YEAR WARRANTY

Actron Manufacturing Company, 9999 Walford Avenue, Cleveland, Ohio 44102-4621, USA warrants to the user that this unit will be free of defects in materials and workmanship for a period of three (3) years from the date of original purchase. Any unit that fails within this period will be repaired without charge when returned to an authorized factory repair center. Actron requests that a copy of the original, dated sales receipt be returned with the unit to determine if the warranty period is still in effect. This warranty does not apply to damages caused by accident, alterations or improper or unreasonable use. ACTRON MANUFACTURING COMPANY DISCLAIMS ANY LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY WRITTEN WARRANTY ON THE UNIT. Some countries do not allow the disclaimer of liability for incidental or consequential damages, so the above disclaimer may not apply to you. This warranty gives you specific legal rights and you may also have rights which vary from state to state.



2969

Spark Analyzer

actron///®
ACTRON MANUFACTURING CO.

9999 Walford Avenue
Cleveland, Ohio 44102
USA

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Printed in USA
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Vehicle Service Information

The following is a list of publishers who have manuals containing vehicle diagnostic information. Some manuals may be available at auto parts stores or your local public library. For others, you need to write for availability and pricing, specifying the make, model and year of your vehicle.

Vehicle Service Manuals:

Chilton Book Company

Chilton Way
Radnor, PA 19089

Haynes Publications

861 Lawrence Drive
Newbury Park, CA 91320

Mitchell Manuals, Inc.

Post Office Box 26260
San Diego, CA 92126

Motor's Auto Repair Manual

Hearst Company
250 W. 55th Street
New York, NY 10019

Buick, Cadillac, Chevrolet, GEO, GMC, Oldsmobile, Pontiac, Honda, Isuzu, Suzuki, Kia, Hyundai, & Subaru

Helm Incorporated
Post Office Box 07130
Detroit, MI 48207

Saturn

Adistra Corporation
c/o Saturn Publications
101 Union St.
Post Office Box 1000
Plymouth, MI 48170

Ford, Lincoln, & Mercury

Ford Publication Department
Helm Incorporated
P.O. Box 07150
Detroit, MI 48207

Chrysler, Plymouth, Dodge, Jeep, Eagle

Dymont Distribution Service
Service Publications
12200 Alameda Drive
Strongsville, OH 44136

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General Safety Guidelines to Follow When Working on Vehicles

To prevent accidents that could result in serious injury and/or damage to your vehicle or test equipment, carefully follow these safety rules and test procedures at all times when working on vehicles:

- Always wear approved eye protection.
- Always operate the vehicle in a well-ventilated area. Do not inhale exhaust gases — they are very poisonous!
- Always keep yourself, tools and test equipment away from all moving or hot engine parts.
- Always make sure the vehicle is in **Park** (Automatic transmission) or **neutral** (manual transmission) and that the **parking brake is firmly set**. Block the drive wheels.
- Never lay tools on vehicle battery. You may short the terminals together causing harm to yourself, the tools or the battery.
- Never use tool if its internal circuitry has been exposed to any liquids.
- Never smoke or have open flames near vehicle. Vapors from gasoline and charging battery are highly flammable and explosive.
- Never leave vehicle unattended while running tests.
- Always keep a fire extinguisher suitable for gasoline/electrical/chemical fires handy.
- Always use caution when working around the ignition coil, distributor cap, ignition wires, and spark plugs. These components have **high voltage** when the engine is running.
- When performing a road test, **never** operate the tool alone while driving the vehicle. **Always** have one person drive the vehicle while an assistant operates the tool.
- Always turn ignition key OFF when connecting or disconnecting electrical components, unless otherwise instructed.
- Always follow vehicle manufacturer's warnings, cautions and service procedures.

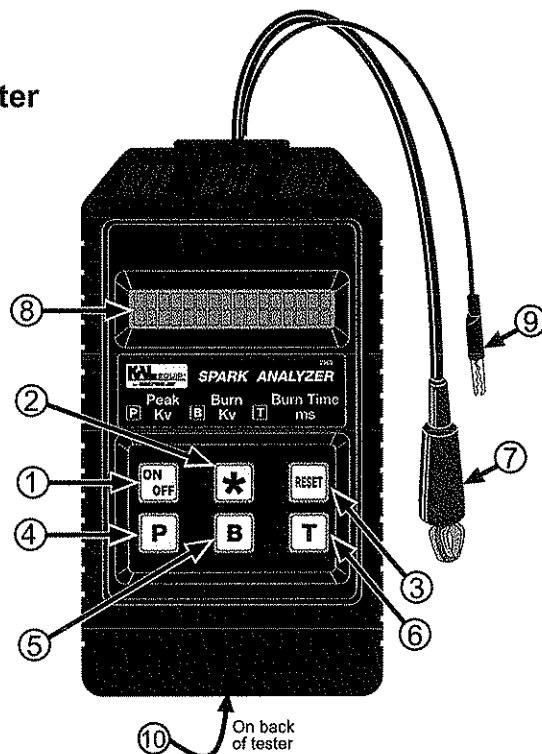
Section 1: The Spark Analyzer

1-1 Introduction

The Spark Analyzer is used to measure secondary ignition firing events. Because firing voltages are typically in the thousands, voltage readings are referred to as Kv (Kilovolts) readings. Peak firing and burn voltages are both measured by this unit. The tester will also measure the length of burn time. This is referred to as ms (milliseconds). All of the measurements are possible on ignition system using distributors and on DIS (Distributorless or Direct Ignition System) type system. Measurements are not possible on coil on plug systems.

Much like more costly ignition oscilloscopes, the Spark Analyzer allows the user to compare ignition firing events to one another. These readings may be taken at idle or at higher engine speeds with the engine under load. The Kal Equip Spark Analyzer will often test an ignition system in less time than required to hookup an ignition oscilloscope.

1-2 The Tester



1. **ON/OFF Button:**

This button is used to turn the tester on and off. If no spark signal or button presses occur in three minutes the tester will automatically turn off. Turn the tester off when not in use to conserve battery life.

2. *** Button:**

This button is used to view the triple screen. The triple screen gives all three real time readings at one time.

3. **RESET Button:**

The Reset button clears the minimum and maximum values. All min. and max. values will be cleared whether they are currently being displayed or not.

NOTE: The RESET button does not function while the unit is in Triple Screen mode.

4. **P - Peak Kv:**

Pressing the P button will display Peak Kv readings. The "real time", minimum, and maximum readings will all be displayed. Peak Kv is the secondary ignition voltage it took to initiate the spark event.

5. **B - Burn Kv:**

Pressing the B button will display Burn Kv readings. The "real time", minimum, and maximum readings will all be displayed. Burn Kv is the secondary ignition voltage it took to maintain spark during the combustion process.

6. **T - Burn Time ms:**

Pressing the T button will display Burn Time readings. The "real time", minimum, and maximum readings will all be displayed. Burn time is the length of time from Peak Kv until Burn Kv ends (length of spark event). The Burn time is measured in milliseconds (one thousandths of a second).

7. **Pickup Clamp (blue):**

The Pickup Clamp connects the tester to the vehicle's spark plug wires for firing event measurements.

8. **Display:**

The display is 16 characters by 2 lines and will be used to show readings and display information.

9. **Ground Clamp (black):**

The ground clamp is used to supply ground for the Pickup Clamp's harness shield. If this is not properly grounded misleading data may be received.

10. **Battery Compartment:**

The battery compartment located on the back of the tester, is used to hold the units 9V battery.

1-3 Using the Spark Analyzer

Selecting Distributor or Distributorless (DIS)

A screen asking you to choose what type of ignition system is to be tested will appear after the welcome screen. The two selections are P for Distributored systems and T for DIS (Distributorless) systems.

- The P=DISTRIB. selection will not try to filter-out wasted spark data.
- The T = DIS selection will allow the tester to ignore the wasted spark events. This means the real-time and min./max. data will only be displayed for combustion firing events.

NOTE: If P=DISTRIB. is chosen for a DIS system the wasted spark firing event data will be displayed. Since the wasted spark event has lower readings, this will cause the min. values to reflect the lower wasted spark readings. Also do to wasted spark readings the real-time data will jump around a lot.

Viewing Spark event measurements

To view spark event measurements press P, B, or T buttons:

- P for Peak Kv measurements
- B for Burn Kv measurements
- T for Burn Time measurements

Clearing min. and max. values


If you wish to clear the values stored in min. and max. press the RESET button. The reset function clears the min. and max. for all spark events measurements.

NOTE: The RESET button does not function while the unit is in Triple Screen mode

Triple Screen mode (View all three spark event readings at once)

If you wish to view Peak Kv, Burn Kv, and Burn Time on the display at one time press the * button. This function is helpful in comparing the relationship of all three measurements at once.

Low Battery Indicator

The low battery symbol "  " will flash in the lower left corner of the LCD when the battery needs replacing.

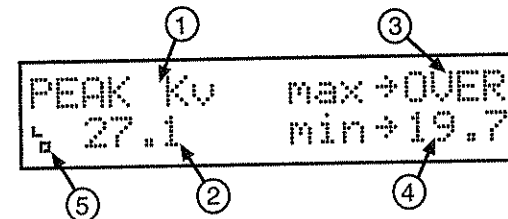
Auto shut-off feature

The tester will automatically turn off if no button/s are pressed and no spark data is received for about three minutes.

Tester will not turn on

Check that a fresh battery is installed in the tester.
If the battery is good and the tester still does not power up call KAL Equip at 1-800-253-9880.

1-4 Display Descriptions



1. Measurement Type

This area of the display will indicate what type of measurement is being displayed. There are three different measurements this tester will perform, Peak Kv, Burn Kv and Burn ms.

2. Real Time Measurement Reading

The real time measurement is displayed in this screen location. When readings greater than the measurement range are received OVER will appear instead of a number.

- For Peak Kv - OVER indicates that the reading was 50Kv or higher.
- For Burn Kv - OVER indicates that the reading was 10Kv or higher.

NOTE: If distributor ignition type was selected this reading will reflect every ignition event. When DIS ignition type is selected this reading will reflect only combustion ignition events, no wasted spark data.

3. Maximum Measurement

This number is the maximum measurement for the current measurement type since last reset. OVER may also appear in the max location, indicating that a reading higher than the range was received.

NOTE: If DIS ignition type was selected only the combustion event data will be used to determine the maximum.

4. Minimum Measurement

This number is the minimum measurement for the current measurement type since last reset.

NOTE: If DIS ignition type was selected only the combustion event data will be used to determine the minimum.

5. Low battery Indicator

When the testers battery is nearly discharged, the Low Battery indicator will flash in the lower left corner of the display.

Section 2: Testing

WARNING:

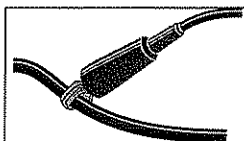
- Use caution working around the ignition coil, distributor cap, ignition wires, and spark plugs. These components have **high voltage** when the engine is running.
- Electrical shock may occur if you disconnect or connect secondary wires while the engine is running.

2-1 Spark Event Test Procedure

You may want to draw a picture of the engine and spark plug wires showing the order in which you will be testing.

1. Attach Pickup clamp

Connect the Pickup Clamp (blue) to the first plug wire near the spark plug. To ensure accurate readings keep clamp at least 1-2 inches from other ignition cables and metallic engine parts. See the illustration for an example.



2. Ground the tester

Connect Ground Clamp (black) to a good vehicle ground or the battery's negative terminal. A good ground is required for Pickup Clamp's harness shield. If this is not properly grounded noise may cause misleading data to be received.

3. Turn tester ON

Press the ON/OFF button. If the tester does turn on make sure it has a good 9V battery.

4. Select Distributor or DIS

Select P=DISTRIB. for testing on vehicles with distributors or press T=DIS for distributorless vehicles.

5. Start Engine

Start engine and let idle. Allow engine to warm-up and the idle to stabilize before monitoring and recording readings.

6. Take readings

Record the Peak Kv, Burn Kv and Burn Time real time readings.

7. Next Cylinder

Connect the Pickup Clamp (blue) to the next cylinder's wire to be tested. Refer to the drawing you made indicating test order. Remember to keep clamp at least 1-2 inches from other ignition cables and metallic engine parts, to ensure accurate readings.

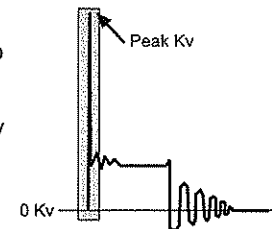
8. Repeat steps 5 and 6 until all cylinders have been tested

9. Compare readings

Refer to the different measurement sections for test results explanations.

Peak Kv Measurements

Peak Kv is the secondary ignition voltage it took to initiate the spark event. Because this voltage is in the thousands it is referred to as Kv (Kilovolts). Differences in Peak Kv readings can be caused by problems with the following areas: plug wires & plugs, cap, rotor, coil/s, ignition timing, air/fuel mixture, cylinder compression.



When testing a DIS vehicle, consideration must be given to cylinder firing polarity. Most DIS ignition systems use coils that connect two secondary wires and plugs. This type of ignition coil setup will fire one plug conventionally (negative). The other plug connected to the same coil will fire inverted (positive). There may be a noticeable difference, as much as 6 Kv, in Peak Kv readings from conventional to inverted. This is normal. To avoid being misled, only compare similar firing types readings to each other when testing on DIS systems.

NOTE: Some engine applications use two spark plugs per engine cylinder. The secondary plugs may not be used at all times.

If voltage measurements, on the same type of firing plugs, varies by more than about 5Kv, a problem may exist in ignition circuit or it's components.

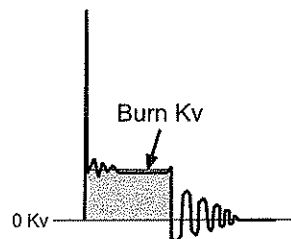
See the **Table 1** below for test result meanings.

Test Result	Possible Causes
All like readings within approx. 5Kv	• None - Functioning properly
No firing voltage all cylinders	• No power to ignition coil/s • Bad Ignition coil/s • Ignition Module/Powertrain controller failure • Crank / Cam sensor failure
Lower secondary Kv on one or more cylinders	• Shorted plug wire/s • Shorted coil secondary • Cylinder compression low • Plug gap to small • Fuel mixture too rich • Ignition timing overly retard • Fouled spark plug • Shorted spark plug
Higher secondary Kv on one or more cylinders	• Open plug wire/s • Degraded spark plug/s • Plug gap to big • Ignition timing overly advanced • Fuel mixture to lean (may also cause misfires)
Uneven secondary Kv on all cylinders	• Fuel distribution problems • Vacuum leak • Bent or worn out shaft bushings in the distributor • Loose rotor or distributor cap • Moisture inside distributor cap • Multiple ignition related problems (such as those listed for Low and High Kv)

Table 1

Burn Kv Measurements

The amount of voltage required to maintain spark during the combustion event is referred to as Burn Kv. Differences in burn voltage can be the result of bad plug wires, bad plugs, bad cap or rotor, or fouling. If the readings vary significantly from each other check **Table 2** below for possible causes.

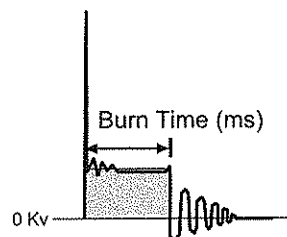


Test Result	Possible Causes
High burn Kv on one or more cylinders	<ul style="list-style-type: none"> • Open plug wire/s • Corrosion on the distributor cap • Worn spark plug/s • Spark plug/s gap set to big • Plug wire/s not properly seated to plug or coil / cap
Low burn Kv on one or more cylinders	<ul style="list-style-type: none"> • Shorted plug wire/s • Shorted coil secondary • Fouled spark plug/s • Shorted spark plug/s • Spark plug/s gap set to small

Table 2

Burn Time Measurements

Burn time is the amount of time spark is maintained across the electrodes. Differences in burn time can be the result of secondary wires, plugs, plug gap, cap or rotor, fuel mixture, ignition timing, cylinder compression. If the readings vary significantly from each other check **Table 3** below for possible causes.



Test Result	Possible Causes
Long burn time on one or more cylinders	<ul style="list-style-type: none"> • Rich fuel mixture • incorrect plug gap • Incorrect Cylinder compression • Coil or plug wires • Ignition timing
Short burn time on one or more cylinders	<ul style="list-style-type: none"> • Lean fuel mixture • incorrect plug gap • Incorrect Cylinder compression • Coil or plug wires • Ignition timing

Table 3

2-2 Additional Tests

• Secondary Cable Check

This check procedure can be used to find open, shorted or high resistance secondary cables.

1. Attach Pickup clamp

Connect the Pickup Clamp (blue) to the first plug wire near the spark plug. To ensure accurate readings keep clamp at least 1-2 inches from other ignition cables and metallic engine parts.

2. Ground Tester

Connect Ground Clamp (black) to a good vehicle ground or the battery's negative terminal.

3. Turn tester ON

Press the ON/OFF button. If the tester does turn on make sure it has a good 9V battery.

4. Select Distributor or DIS

Select P=DISTRIB. for testing on vehicles with distributors and press T=DIS for distributorless vehicles.

5. Start engine

Start engine and let idle. Allow engine to warm-up and the idle to stabilize before monitoring and recording readings.

6. Set tester to Peak Kv measurements

Press the P button. The tester will display peak secondary ignition voltage measurement on the LCD.

7. Take Firing Voltage reading

Take Kv reading from the LCD (real time reading).

8. Move Pickup Clamp

Move the Pickup clamp (blue) up the secondary cable towards the ignition coil / distributor. Take a Kv reading and note the difference.

- If the Kv reading increase from little or no Kv to a significantly higher reading - a short may be present in-between the two points.
- A significant increase or decrease in Kv reading indicates the secondary cable is open between the two points.
- If you reach the coil or distributor end of the cable and the Kv reading has increased more than expected check the secondary cables resistance.

NOTE: Most modern vehicles use resistive secondary cables for noise reduction. These cables will cause a slight increase in the Kv reading from the plug to the coil or distributor. This is normal.

• Acceleration Test (for distributor ignition systems)

A quick acceleration with no load on the engine can help you find several problems in the secondary of the ignition system. This test checks for the following ignition related problems; worn plugs, spark gap problems, incorrect fuel mixture, and ignition wire problems. A properly functioning ignition system's firing voltage will increase about 30 to 50 percent, when a no load quick acceleration is performed.

1. Attach Pickup clamp

Connect the Pickup Clamp (blue) to the first plug wire near the spark plug. To ensure accurate readings keep clamp at least 1-2 inches from other ignition cables and metallic engine parts.

2. Ground Tester

Connect Ground Clamp (black) to a good vehicle ground or the battery's negative terminal.

3. Turn tester ON

Press the ON/OFF button. If the tester does turn on make sure it has a good 9V battery.

4. Select Distributor or DIS

Select P=DISTRIB. for testing on vehicles with distributors and press T=DIS for distributorless vehicles.

5. Start engine

Start engine and let idle. Allow engine to warm-up and the idle to stabilize before monitoring and recording readings.

6. Set tester to Peak Kv measurements

Press the P button. The tester will display peak secondary ignition voltage measurement on the LCD.

7. Take Firing Voltage reading

Take Kv reading from the LCD (real time reading).

8. Take Acceleration Firing Voltage reading

While observing the Kv reading (real time), quickly increase the engine's speed (snap the throttle) and allow engine to return to idle. The Kv reading should increase from about 30 to 50 percent during increased engine speed. If the Kv did not increase the proper amount see the **Table 4**.

Example: An idle reading of 15Kv. $15Kv \times 1.3$ (30%) = 19.5Kv $15Kv \times 1.5$ (50%) = 22.5Kv. The Kv reading should have increased to about 19.5 to 22.5 Kv.

Test Result	Possible Causes
Kv reading change HIGH	<ul style="list-style-type: none"> • Worn spark plug • Wide plug gap • Misaligned or worn distributor cap • Spark plug wire conductor has a break in it • Resistor spark plug bad • Fuel mixture lean
Kv reading change LOW	<ul style="list-style-type: none"> • Spark plug gap to small • Spark plug fouled • Plug wire or plug voltage leakage • Ceramic Insulator damaged • Fuel mixture rich

Table 4

• Load Test

Observing firing voltages while the engine is under load can also help you find several problems in the secondary of the ignition system. A properly functioning ignition system's firing voltage will increase about 30 to 50 percent, when sufficiently loaded.

WARNING:

Observe all vehicle manufacturer's safety practices and precautions for catalytic converter protection when testing a ignition system under load.

1. Attach Pickup clamp

Connect the Pickup Clamp (blue) to the first plug wire near the spark plug. To ensure accurate readings keep clamp at least 1-2 inches from other ignition cables and metallic engine parts.

2. Ground Tester

Connect Ground Clamp (black) to a good vehicle ground or the battery's negative terminal.

3. Turn tester ON

Press the ON/OFF button. If the tester does turn on make sure it has a good 9V battery.

4. Select Distributor or DIS

Select P=DISTRIB. for testing on vehicles with distributors and press T=DIS for distributorless vehicles.

5. Start engine

Start engine and let idle. Allow engine to warm-up and the idle to stabilize before monitoring and recording readings.

6. Set tester to Peak Kv measurements

Press the P button. The tester will display peak secondary ignition voltage measurement on the LCD.

7. Take Firing Voltage reading

Take Kv reading from the LCD (real time reading).

8. Take Firing Voltage Reading Under Load

Place the engine under load condition while observing the Kv reading. The Kv reading should increase 30 to 50 percent during increased engine load. If the Kv did not increase the proper amount see **Table 4 (on page 12)**.

Example: An idle reading of 15 Kv. $15 Kv \times 1.3$ (30%) = 19.5Kv $15 Kv \times 1.5$ (50%) = 22.5Kv. The Kv reading should have increased to about 19.5 to 22.5 Kv.

• Misfire Check

Intermittent misfires under load can be found using the Spark Analyzer. To find such problems follow the directions below;

1. Attach Pickup clamp

Connect the Pickup Clamp (blue) to the first plug wire near the spark plug. To ensure accurate readings keep clamp at least 1-2 inches from other ignition cables and metallic engine parts.

2. Ground Tester

Connect Ground Clamp (black) to a good vehicle ground or the battery's negative terminal.

3. Turn tester ON

Press the ON/OFF button. If the tester does turn on make sure it has a good 9V battery.

4. Select Distributor or DIS

Select P=DISTRIB. for testing on vehicles with distributors and press T=DIS for distributorless vehicles.

4. Start engine

Start engine and let idle. Allow engine to warm-up and the idle to stabilize before monitoring and recording readings.

5. Set tester to Peak Kv measurements

Press the P button. The tester will display peak secondary ignition voltage measurement on the LCD.

6. Reset min. and max. values

Press the RESET button. The tester will display peak secondary ignition voltage measurement on the LCD.

6. Observe Reading Under Load

Operate the test vehicle at the speed and load conditions where you believe the misfire is occurring. Check the min. and max. readings. If either is more than 30 to 50 percent higher or lower than the average real time reading, the cylinder may be misfiring.

NOTE: A quick check off all cylinders can be accomplished by hooking the KV Clamp (blue) to the ignition coil's secondary wire on distributor type vehicles.

Section 3: Battery Installation

Note: If the tester will not be used for an extended amount of time, remove the battery. This is done to prevent battery leakage while in the tester.

Installation of the battery

- 1) Disconnect the tester from vehicle.
- 2) Turn tester OFF.
- 3) Hold the tester face down with both hands.
- 4) Using both thumbs, firmly press downwards and outwards on the battery compartment door at the bottom of the tester.
- 5) Slide the battery compartment door away from the tester to remove.
- 6) Remove old battery if necessary.
- 7) Attach new battery to connector and install inside compartment
- 5) Replace battery cover door. Slide door inwards until it snap closed.

Section 4: Call KAL Equip

In addition to your local dealer, product catalogs, pricing information, and replacement components can be ordered by contacting KAL Equip directly.

By US mail:

Actron Manufacturing Company
9999 Walford Avenue
Cleveland, OH 44102-4621, USA

Phone For Technical Support call:

1-800-253-9880

E- Mail

Actron is also available electronically for comments and ordering information.

Actron's E-Mail address is:

sunpro@actron.com

And while you're on-line, be sure to check out Actron's Website, where you'll find equipment information, new products, and technical tips.

On the World Wide Web: <http://www.actron.com>