

# OPEN FAULT LOCATOR

## DELCON 4910F

### DESCRIPTION AND MAINTENANCE

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#### 1. GENERAL

- 1.01** This section covers the description and maintenance of the Hewlett-Packard/Delcon Model 4910-Type Open Fault Locator.
- 1.02** This section is reissued to add the Delcon 4910F Open Fault Locator (Fig. 1).
- 1.03** The 4910B Open Fault Locator has been superseded by the 4910F but will be retained in this section due to the large number in use.

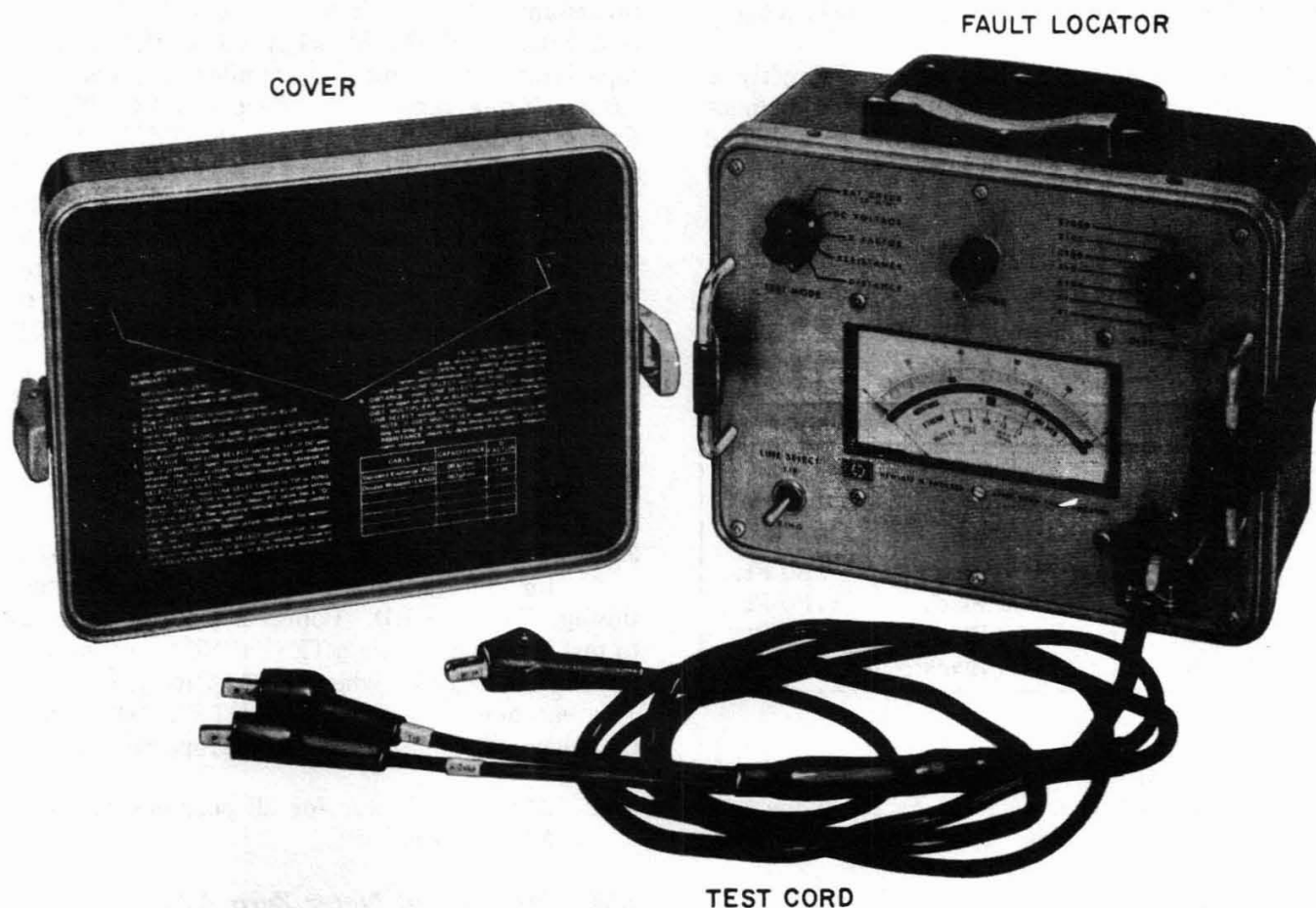


Fig. 1—Delcon 4910F

\*\*Reprinted to comply with modified final judgment.

**1.04** The Model 4910F is a direct reading test set designed to locate open faults in paired communications cable. The test set employs a dc capacitance measuring technique, which relates the charge placed on a length of wire to its capacitance and hence to the length. The meter is calibrated to provide distance readings in feet.

**1.05** Use of this test set is covered in Section 634-305-510.

## 2. DESCRIPTION

**2.01** The Delcon 4910F Open Fault Locator is a lightweight portable solid-state test set powered by eight 9-volt zinc carbon batteries. It measures 9 1/2 by 8 1/2 by 7 inches and weighs 7 1/2 pounds with batteries, cover, and test cord.

**2.02** The test set is housed in a rugged fiberglass case. The shielded cord and case are furnished with the set. A separate battery compartment permits battery replacement without disassembly.

**2.03** Distance to the fault is indicated directly in feet on a mirror-type meter and the distance multiplier. The meter movement is of the taut-band type which is sensitive and accurate and capable of withstanding rough handling.

**2.04** The DIST MULTIPLIER switch permits selection of any one of seven ranges from 100 to 100,000 feet full scale as follows:

METER SCALE	DIST. MULT.	ACCURACY
0-100	X1 Black	±1 Ft.
0-300	X1 Blue	±3 Ft.
0-100	X10 Black	±10 Ft.
0-300	X10 Blue	±30 Ft.
0-100	X100 Black	±100 Ft.
0-300	X100 Blue	±300 Ft.
0-100	X1000 Black	±1000 Ft.

**2.05** The test set is essentially a capacitance meter, and is unaffected by the inductance or resistance of the line. The test set is affected by:

- Foreign EMF
- Power line influence

- Shunt faults across the pair

- Side to ground

- Water in the cable which can change the capacitance of the cable.

**Note:** Any extremes of the above will make it difficult if not impossible to locate faults with this test set.

**2.06** The technique employed is **automatic charge sampling**, which relates the charge placed on a pair to the length of the pair. The test set measures the total capacitance of a circuit, including bridged taps and buildout devices, which must be taken into account when attempting to locate opens.

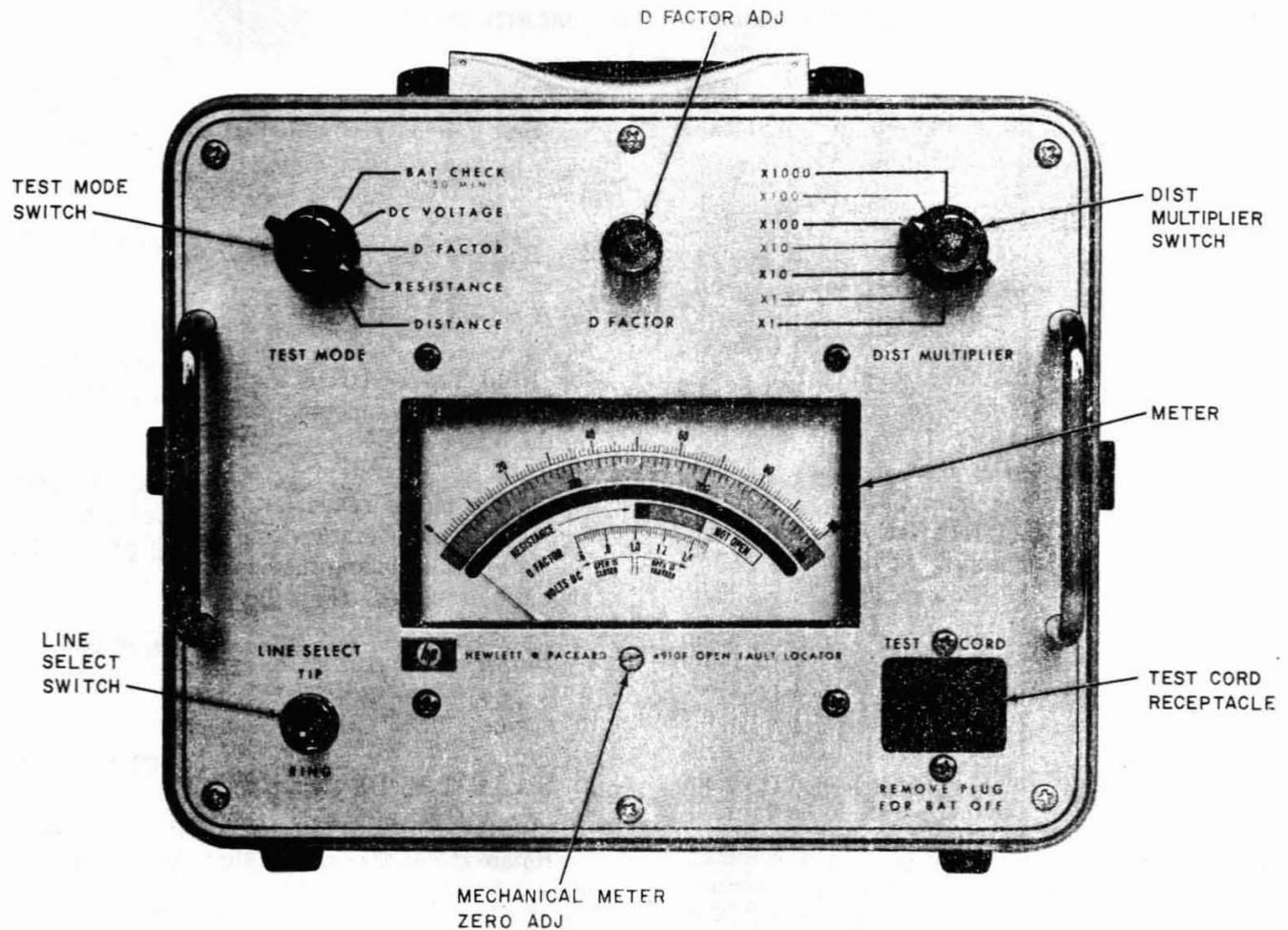
**2.07** The test set is designed for use with all types of paired telephone cable or wire. This is accomplished through the use of the D FACTOR adjustment, which compensates for mutual capacitance of the pair being checked. D Factor is a ratio of  $0.083/X$ ; where X is the mutual capacitance of the pair in  $\mu\text{f}/\text{mile}$ . For standard  $0.083 \mu\text{f}/\text{mile}$  cable the D Factor is 1.0. The D Factor is adjusted by setting the TEST MODE switch to D FACTOR and then rotating the D FACTOR knob until the correct reading is obtained on the D FACTOR scale. Where the cable capacitance is unknown, the D Factor can be obtained by adjusting the test set to read the known length of a piece of cable and then switching to D FACTOR and reading it directly from the meter. This technique can be utilized for B Service Wire as well as other types of wire and cable.

## 3. CONTROLS AND INDICATORS (Fig. 2).

**3.01 TEST CORD Receptacle**—Provides means for connecting test set to cable under test through TEST CORD. Connects internal batteries to test set circuitry when TEST CORD is connected; disconnects batteries when TEST CORD is removed. This receptacle is keyed to TEST CORD plug so that they will connect only when properly mated.

**3.02 Meter**—Indicator for all positions of TEST MODE switch.

**3.03 Mechanical Meter Zero Adjust**—Used to mechanically zero meter pointer with TEST CORD removed. This adjustment should be made only when necessary per procedure in 4.04.



**Fig. 2—Controls And Indicators**

**3.04 TEST MODE SWITCH**—Provides step-by-step operating sequence.

- (a) **BAT CHECK**—Provides means for checking operating battery supplies. If the meter reads at least 150 on the blue scale, the batteries are suitable for operating the meter. **THIS DOES NOT CHECK THE LINE CHARGING BATTERIES.** (See 4.03 for test procedure.)

- (b) **DC VOLTAGE**—Indicates if there is any error-causing foreign battery on the cable that is under test. If there is sufficient foreign battery to cause error, the meter will indicate "OPEN IS CLOSER" or "OPEN IS FARTHER" on the VOLTS DC scale. If the reading is in either of the areas, **DISTANCE** reading will be invalid. Operates in conjunction with the **LINE SELECT** switch.

(c) **D FACTOR**—Enables D FACTOR control to be adjusted for the appropriate cable capacitance calibration. Also checks condition of the line charging batteries.

(d) **RESISTANCE**—Provides means for checking leakage resistance across circuit under test. When the meter reads in the black area on RESISTANCE scale, distance reading can have up to -1 percent ADDITIONAL error. If reading is in the gray area, distance reading can have up to -5 percent ADDITIONAL error. If reading is in white NOT OPEN area, distance reading is invalid. LINE SELECT switch selects side of pair to be tested when depressed to TIP or RING position. DIST MULTIPLIER switch must be set to proper position for these tests to be valid.

(e) **DISTANCE**—Reads distance to fault on meter when the LINE SELECT switch is depressed to the TIP or RING position and when DIST MULTIPLIER switch is set the correct range position.

**3.05 D FACTOR Control**—Used to calibrate instrument to capacitance of cable under test when TEST MODE switch is set to D FACTOR and LINE SELECT switch is depressed to TIP or RING. Calibration is set on meter D FACTOR scale as specified in Section 634-305-510.

**3.06 DIST MULTIPLIER Switch**—Multiplies meter scale points by factor selected. Multiplying factors are color-coded to meter scales for easy identification.

**3.07 LINE SELECT Switch**—Connects measuring circuit to line and actuates measurements for VOLTAGE, D FACTOR, RESISTANCE and DISTANCE modes of TEST MODE switch. Selects side of pair to be measured when depressed to TIP or RING.

#### 4. MAINTENANCE

**4.01** This section includes maintenance functions that can be accomplished with simple test equipment and without major disassembly of the test set.

##### **4.02 Battery Test (Instrument Supplies):**

- (a) Connect TEST CORD.
- (b) Hold TEST MODE switch in BAT TEST position. The meter must read *at least* 150 on the blue scale.
- (c) If the meter reads less than 150, the test set will not operate within specified accuracy. *All* batteries (including the line charging batteries) should be replaced. (Fig. 3)

##### **4.03 Battery Test (Line Charging Supply):**

- (a) Connect TEST CORD.
- (b) Set TEST MODE switch to D FACTOR.
- (c) Hold LINE SELECT switch in RING position. Rotate D FACTOR control through its complete range.
- (d) The D FACTOR control must have sufficient range to adjust the meter over the complete D FACTOR scale.
- (e) If the D FACTOR cannot be adjusted over its complete range, *all* batteries (including the instrument supply batteries) should be replaced.

**4.04 Mechanical Zero Adjustment**—The mechanical meter zero is used to position the meter pointer on zero under *no power* conditions. When properly adjusted, the mechanical adjustment sets the meter so that it will respond accurately to electrical signals. The meter was mechanically zeroed at the factory. This adjustment is very stable and should not be touched unless absolutely necessary. It can occasionally go out of adjustment, especially when subjected to extreme temperature changes or mechanical shock. To readjust:

- (a) Disconnect TEST CORD.

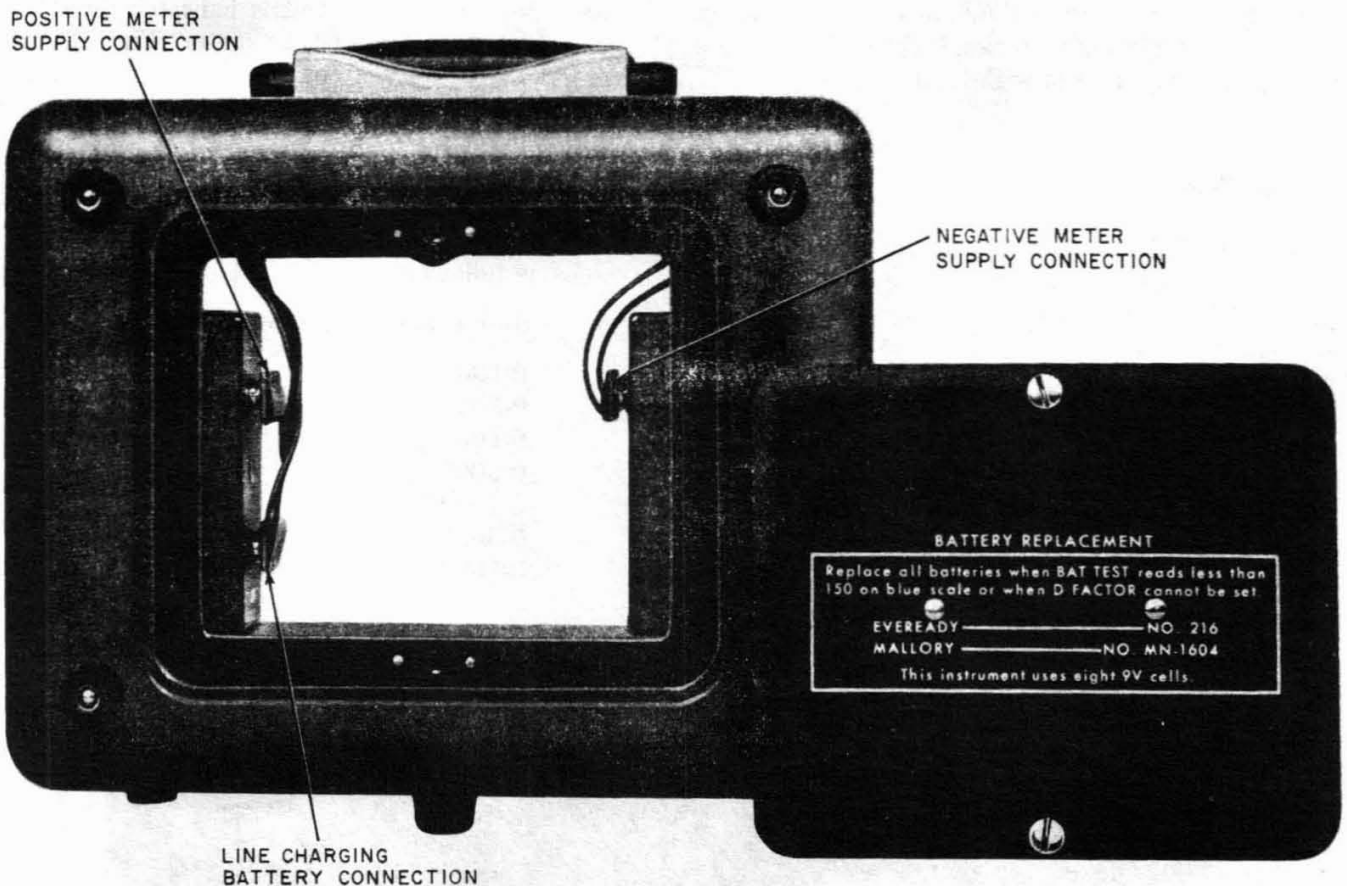


Fig. 3—Battery Compartment

- (b) Place test set on level surface with panel facing up.
- (c) With a small screwdriver, adjust the mechanical zero adjustment until the pointer is aligned exactly over the "0" calibration mark.

**4.05 Electrical Zero Check**—The electrical circuits in the test set are very stable and do not require routine readjustment. However, it is good practice to periodically check electrical zero, especially if there is any doubt about measurement results. Electrical zero should also be checked after repairing or replacing the test cord. To check electrical zero:

- (a) Check mechanical zero and readjust if necessary per 4.04.
- (b) Test batteries per 4.02 and 4.03 and replace if necessary. **Batteries must be good to perform these tests.**
- (c) Connect TEST CORD to test set and leave clips free.
- (d) Set TEST MODE switch to RESISTANCE. Hold LINE SELECT switch to RING. Meter should read at the left edge of the black area on the RESISTANCE scale. If it does not, it should be returned for repair in accordance with local instructions.
- (e) Set TEST MODE switch to DISTANCE. Set DIST MULTIPLIER switch to X100 black. Hold LINE SELECT switch to RING. Meter should read exactly "0". If it does not, it should be returned for repair in accordance with local instructions.
- (f) Repeat step (e) with DIST MULTIPLIER switch set to X1 black.

**4.06** Should the test set fail to operate properly after replacing batteries, it should be returned for repair in accordance with local instructions.

## 5. SUPERSEDED 4910B

**5.01** The Delcon 4910B Open Fault Locator is a lightweight portable solid-state test set powered by four 9-volt transistor-radio batteries. It measures 7 by 5-1/2 by 5 inches and weighs 5 pounds with batteries.

**5.02** The test set is contained in an aluminum housing. A leather carrying case and strap and a 3-wire test cord are provided with the test set. A separate battery compartment permits battery replacement without disassembly.

**5.03** Distance to the fault is indicated directly in feet on a mirror-type meter (Fig. 4). The meter movement is of the taut-band type which is sensitive and accurate, and capable of withstanding rough handling.

**5.04** A DISTANCE/FEET switch permits selection of any one of seven ranges having accuracy values as follows:

RANGE (FEET)	ACCURACY (FEET)
0-100	±1
0-300	±3
0-1000	±10
0-3000	±30
0-10,000	±100
0-30,000	±300
0-100,000	±5000



Fig. 4—Meter And Controls On Delcon 4910B

**5.05** The test set is designed for use with all types of cable or wire. This is accomplished through the use of the D Factor adjustment, which compensates for mutual capacitance of the pair being checked. D Factor is a ratio of  $0.083/X$  where X is the mutual capacitance of the pair in  $\mu\text{f}/\text{mile}$ . For standard  $0.083 \mu\text{f}/\text{mile}$  cable the D factor is 1.0. The D FACTOR is adjusted by setting the TEST MODE switch to D FACTOR and then rotating the D FACTOR knob until the correct reading is obtained on the D FACTOR scale. The D Factor may be obtained where it is unknown by adjusting the test set to read the known length of a piece of cable and then switching to D FACTOR and reading it directly from the dial. This technique can be utilized for B Service Wire, as well as other types of wire and cable.

**5.06** The VOLTAGE position is provided on the TEST MODE switch to permit checking for foreign ac or dc voltages up to 200 volts. Special techniques must be employed when ac induction causes the voltmeter to indicate on the NOT OPEN portion of the LINE TEST scale.

**5.07** The RESISTANCE position of the TEST MODE switch allows checking the pair for leakage resistance. If the resistance test indicates NOT OPEN, the line must be cleared before the open can be located.

**5.08** The LINE SELECT switch on the side of the test set is a two position spring-loaded toggle switch which connects the charge sampling circuit to either the TIP or RING of the line while taking readings.

**5.09** A meter zero adjustment is provided on the face of the meter. Amplifier and test cord zero adjustments are located in the battery compartment.

**5.10** If there is a residual reading on the meter when the unterminated test cord is plugged

into the test cord jack, perform the following zero adjustments in order:

- (a) **Meter Zero:** Set the meter pointer to exactly zero by moving the black disc on the meter face. A depression is provided in the disc so that it may be moved with a pencil or pointed tool (Fig. 4).
- (b) **Amplifier Zero:** Set TEST MODE switch to VOLTAGE position, actuate LINE SELECT switch, and, using a screwdriver adjust AMPLIFIER ZERO SET control in battery compartment (Fig. 5) to produce a meter reading of exactly zero.
- (c) **Test Cord Zero:** Set TEST MODE switch to DISTANCE position, set DISTANCE/FEET switch to 100, actuate LINE SELECT switch, and adjust TEST CORD ZERO SET control in battery compartment to produce a meter reading of exactly zero.

## MAINTENANCE

**5.11** Under normal use, the test set should not require any maintenance except battery replacement at approximately 1-year intervals.

**5.12** An automatic feature of the test set is a built-in D Factor and distance lock-out when battery voltage falls below an acceptable level for proper operation. If the D Factor cannot be set to the desired value on the 4910B Open Fault Locator, replace all batteries as follows:

- (1) Open the door on the back of the test set (Fig. 6).
- (2) Remove and discard old batteries (Fig. 5) and replace with four fresh batteries of one of the types listed on the back of the test set (Fig. 6).

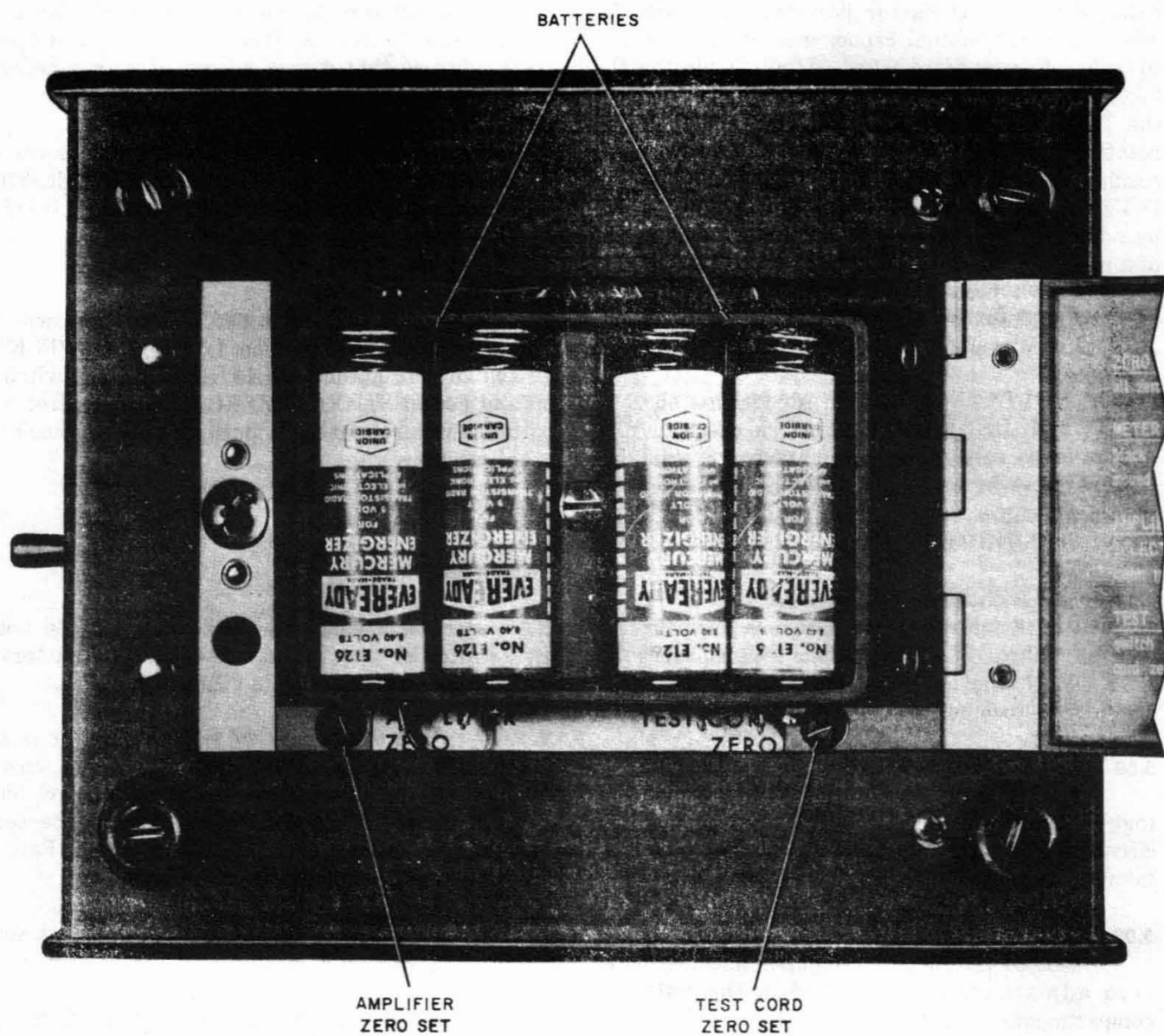


Fig. 5—Access To Zero Adjustments And Batteries

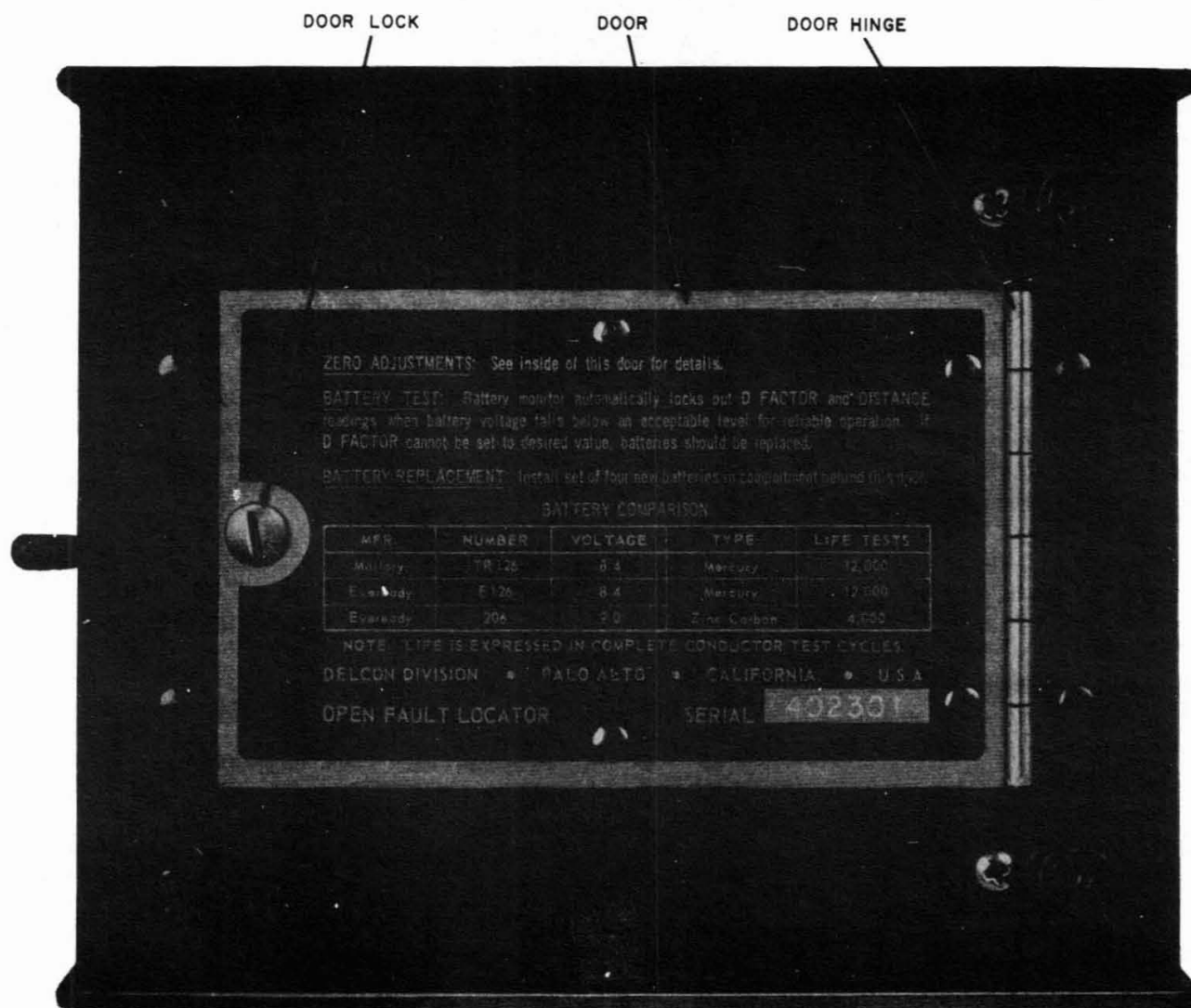


Fig. 6—Battery Compartment Door On Delcon 4910B