LWD 1

The Pulser and How to Test it

Pulser Testing Objectives

At the completion of this presentation you should be able to:

1. **Describe the important differences between the MK VI, VII, & VIII pulsers.**
2. **You will be able to test the pulser and determine whether it should be used.**

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The Pulser

- The central component of all four systems
- The same pulser can be used on all four systems
- There are three current versions of the pulser

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The Pulser

– Generates electrical and hydraulic power

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Pulser's Hydraulic Power

- Operates a poppet/orifice valve that intermittently restricts the fluid flow, producing a pressure increase, or pulse. These pulses are detected on the surface.

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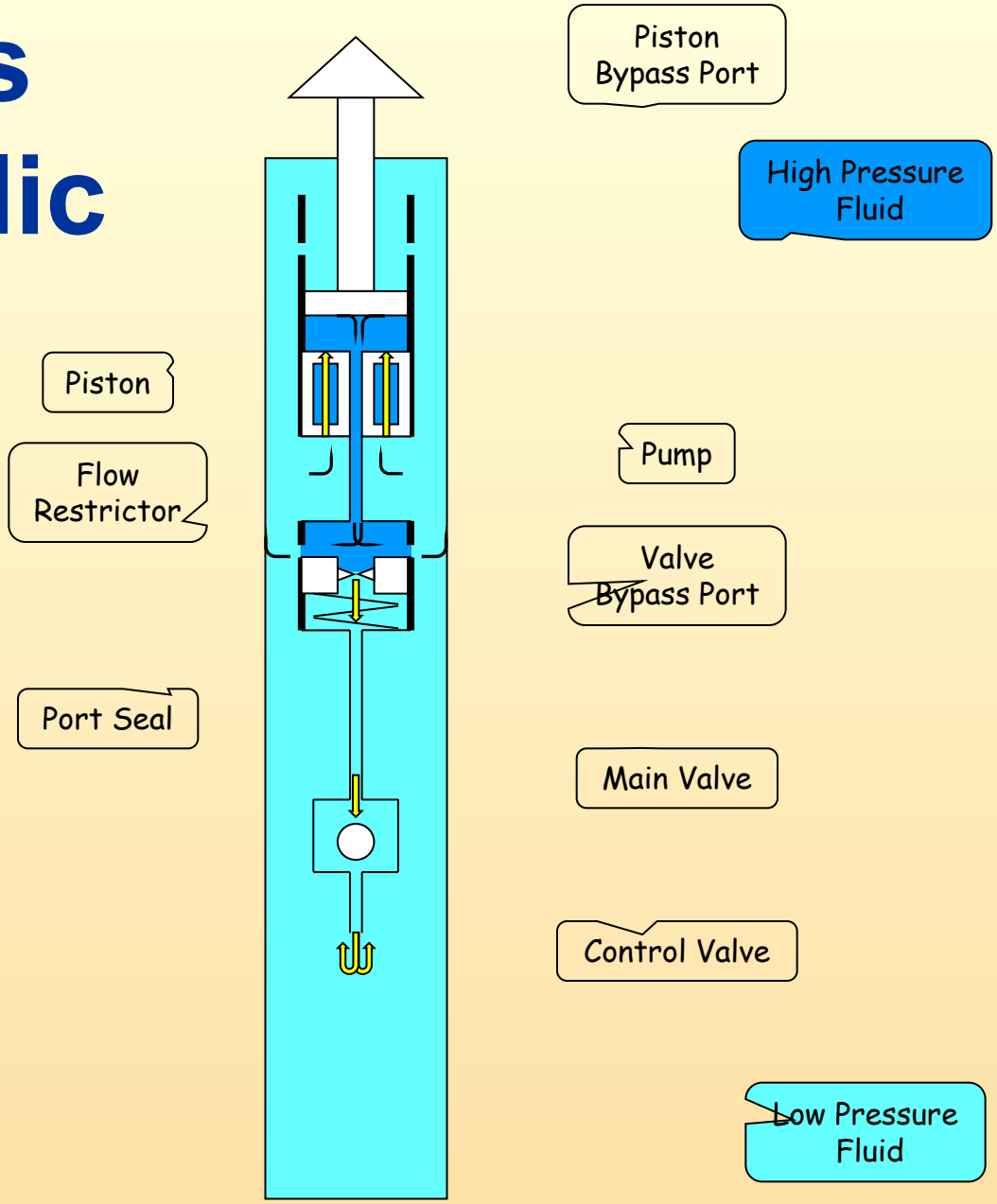
Pulser's Hydraulic System



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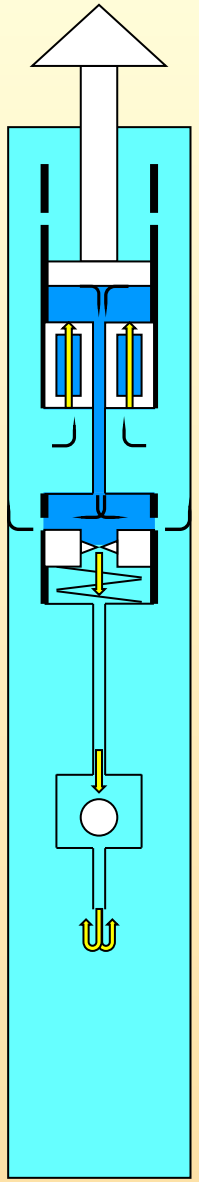
Pulser's Hydraulic System

- Control valve open
  - Flow through control valve
    - Allows flow through main valve
  - Flow through main
    - Pressure drop across flow restrictor moves port seal down against spring
    - Valve bypass port opens
  - Poppet fully retracted



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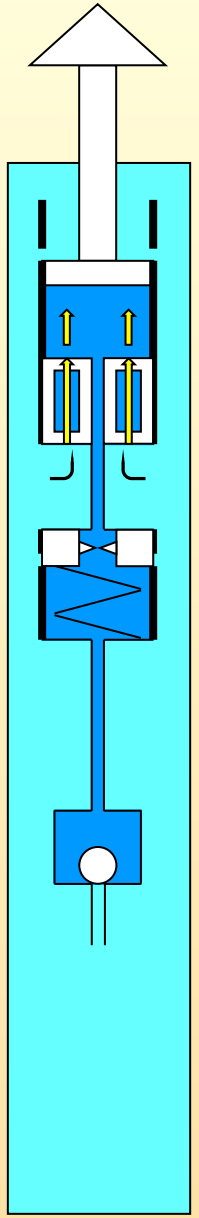
Pulser's Hydraulic System

- Control valve closed
  - No flow through control valve
    - Stops flow through main valve
  - No flow through main valve
    - Spring moves port seal up
    - Valve bypass port closes
    - Piston moves up
  - Poppet partially extended



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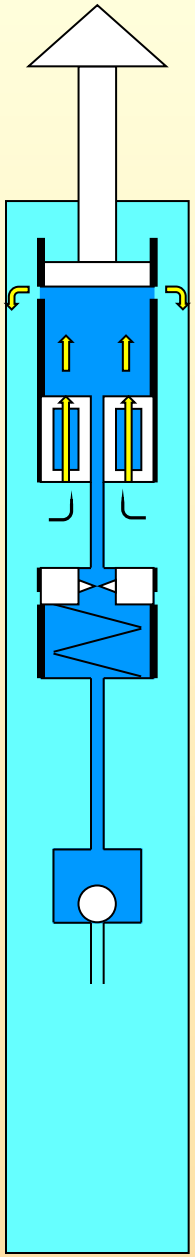
Pulser's Hydraulic System

- Control valve closed
  - No flow through control valve
    - Stops flow through main valve
  - No flow through main valve
    - Spring moves port seal up
    - Valve bypass port closes
    - Piston moves up
    - Piston bypass port opens
  - Poppet fully extended



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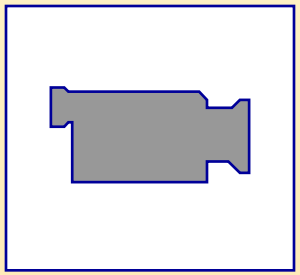
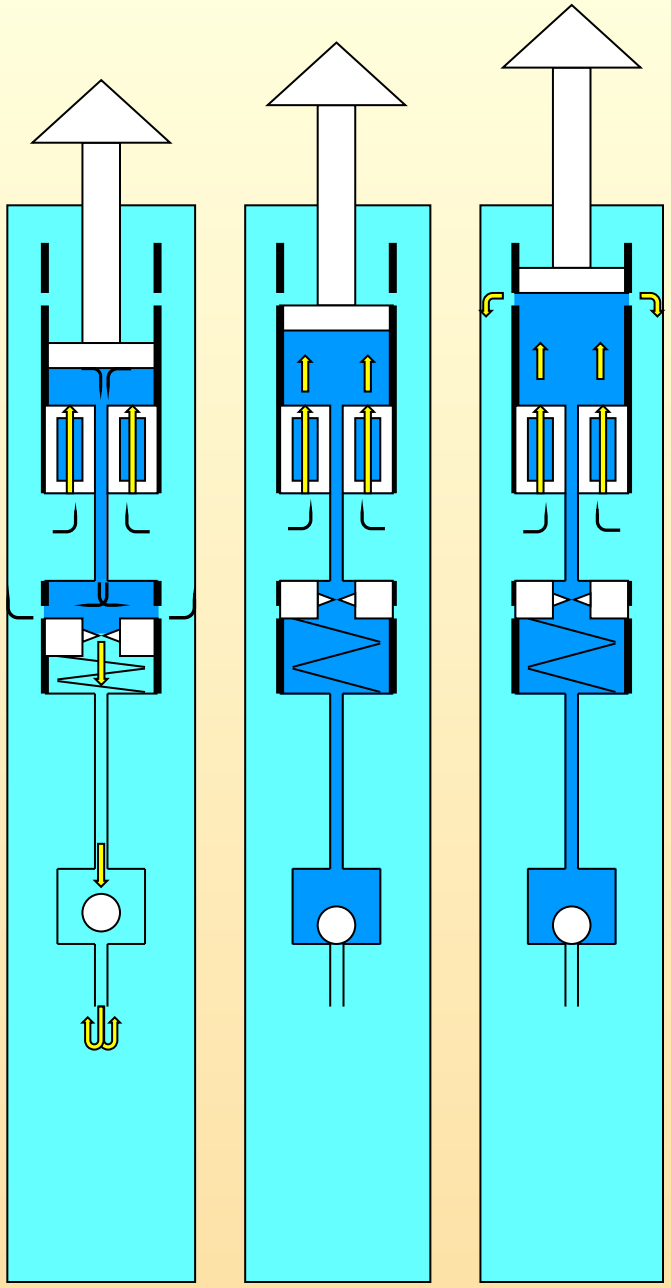
Pulser's Hydraulic System





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Pulser's Hydraulic System

- The control valve is operated by a signal from the telemetry controller. Closing the control valve causes the poppet to extend into the orifice.

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Pulser's Electrical Power

- Generator consists of six fixed coils and eight rotating magnets.
- Electrical power is supplied to the sondes attached to the pulser.

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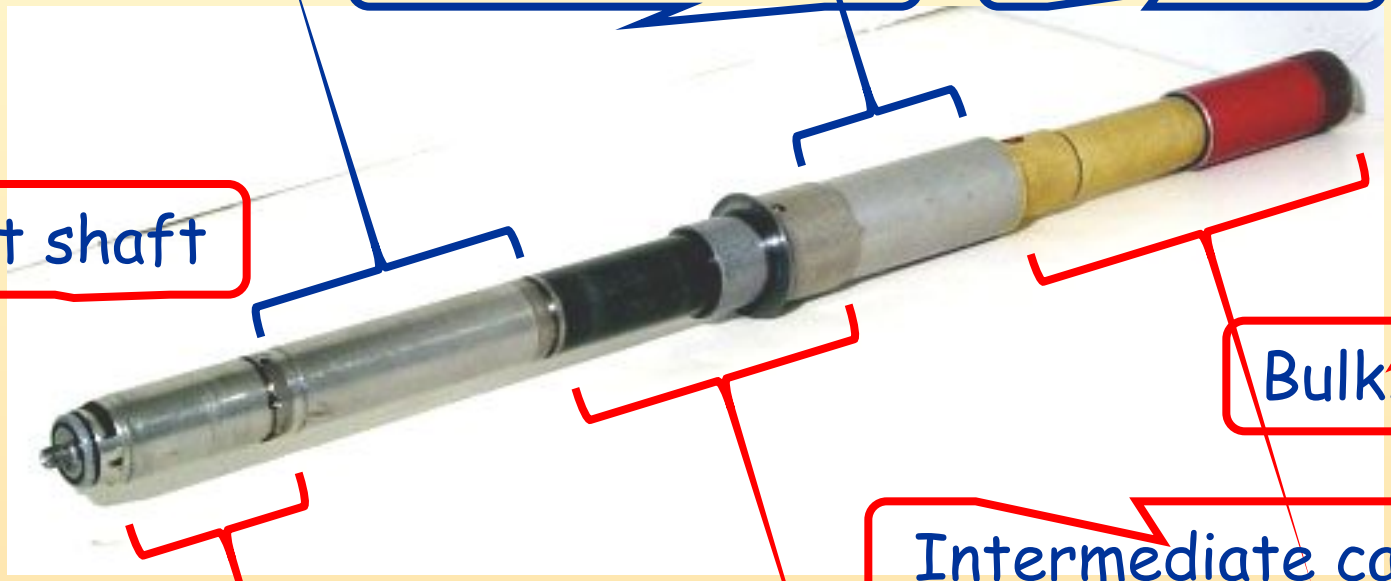
The Parts of a Pulser



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Booted Vs. Bootless Pulser

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Booted Vs. Bootless Pulser

- Boot
  - Gas permeable
  - Susceptible to damage
  - No moving parts
  - Transmits external pressure to pulser's internal fluid

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Booted Vs. Bootless Pulser

- **Bootless**
  - **Increased reliability**
  - **Requires seal pack assembly change every 100 or 200 hours depending on temperature**
  - **Moving parts**
  - **Transmits external pressure to pulser's internal fluid**

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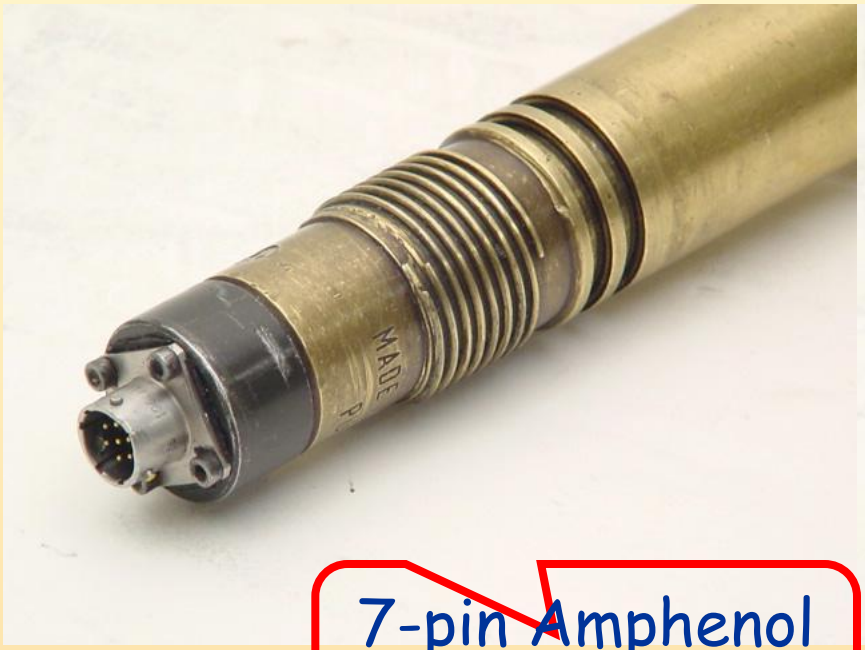
Pulser Connections



7-pin Amphenol Connector

4 Cond. Rotational Connector

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Pulser Connection

- 7-pin Amphenol
  - Used for DWD
  - Careful assembly required to avoid damage
  - Uses coil cord

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Pulser Connection

- 4-Conductor Rotational Connector
  - Used for Solar
  - Easy to make-up connection
  - Increased reliability

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The Four Current Pulsers

- Mark 6 DWD
- Mark 7 Solar
- Mark 8 Solar
- Mark 8 DWD

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Mark 6 DWD

- 7-Pin Amphenol Connector
- Maximum Temperature 175°C
- Full Stroke (0.374 in.)

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Mark 7 Solar

- 4-Conductor Rotational Connector
- Maximum Temperature 200°C
- Full Stroke (0.374 in.)

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Mark 8 Solar

- 4-Conductor Rotational Connector
- Maximum Temperature 200°C
- Half Stroke (0.187 in.)

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Mark 8 DWD

- 7-Pin Amphenol Connector
- Maximum Temperature 175°C
- Half Stroke (0.187 in.)

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How to Identify Pulsers

- **Mark 6 DWD**
  - 7-pin amphenol connector
  - Lower filling screw NOT marked 8
  - Poppet extends 9.5 mm (0.374 in.)
- **Mark 7 Solar**
  - Rotational connector
  - Lower filling screw NOT marked 8
  - Poppet extends 9.5 mm (0.374 in.)

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How to Identify Pulsers

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How to Identify Pulsers

- **Mark 8 Solar**
  - Rotational connector
  - Lower filling screw MAY BE marked 8
  - Poppet extends 4.8 mm (0.187 in.)
- **Mark 8 DWD**
  - 7-pin amphenol connector
  - Lower filling screw MAY BE marked 8
  - Poppet extends 4.8 mm (0.187 in.)

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Testing the Pulser

- Two tests
  - Resistance
    - Tests electrical resistance of the generator coils and control valve solenoid
  - Extension/retraction
    - Tests hydraulic system

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Pulser Test Equipment

- **DWD Electronic Test Kit**
  - **MWD Pulser Test Set and Leads**
  - **Digital Multi-meter**
  - **Coil Cord Pulser to MEP**
  - **Pulser Ground Lead**
  - **BNC Female/Banana Connector (2)**
  - **BNC Cable (36 inch)**
  - **Poppet Retraction Tool**

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Additional Test Equipment for Solar Pulsers

- Solar 175 Test Cable Amphenol/9-pin
- 4-pin Male Rotational Test Connector

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MWD Pulser Test Set

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Digital Multi-meter

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Coil Cord

7-Pin Female
Amphenol Connector

7-Pin Female
Amphenol Connector

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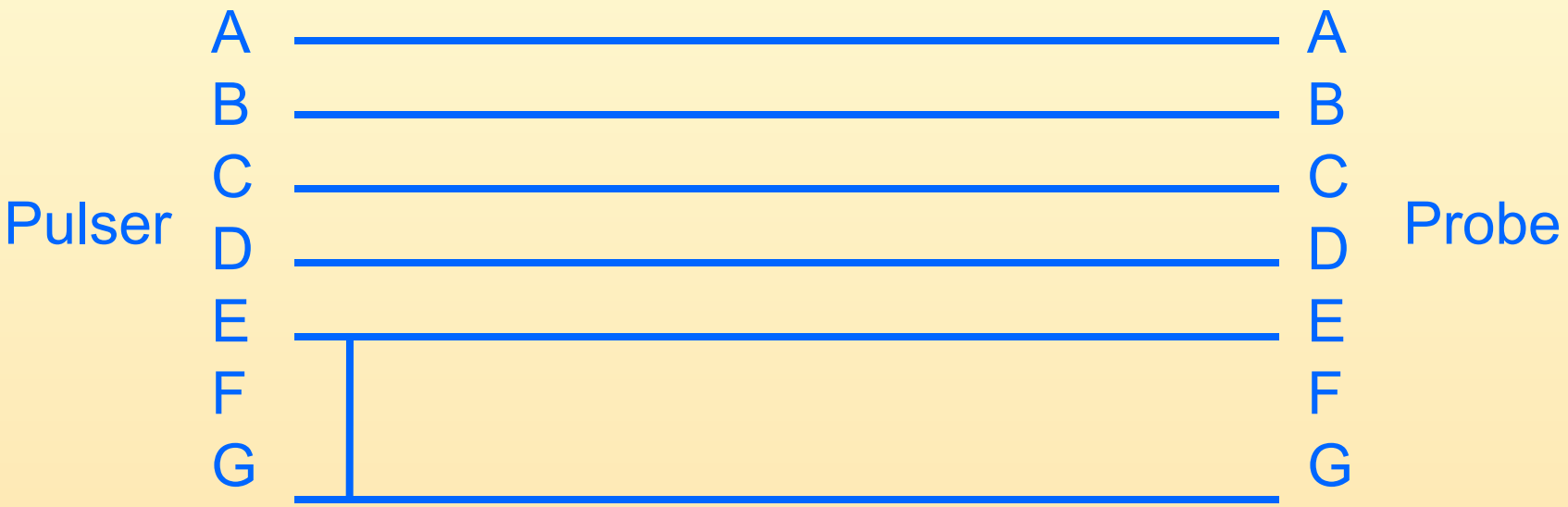
Coil Cord



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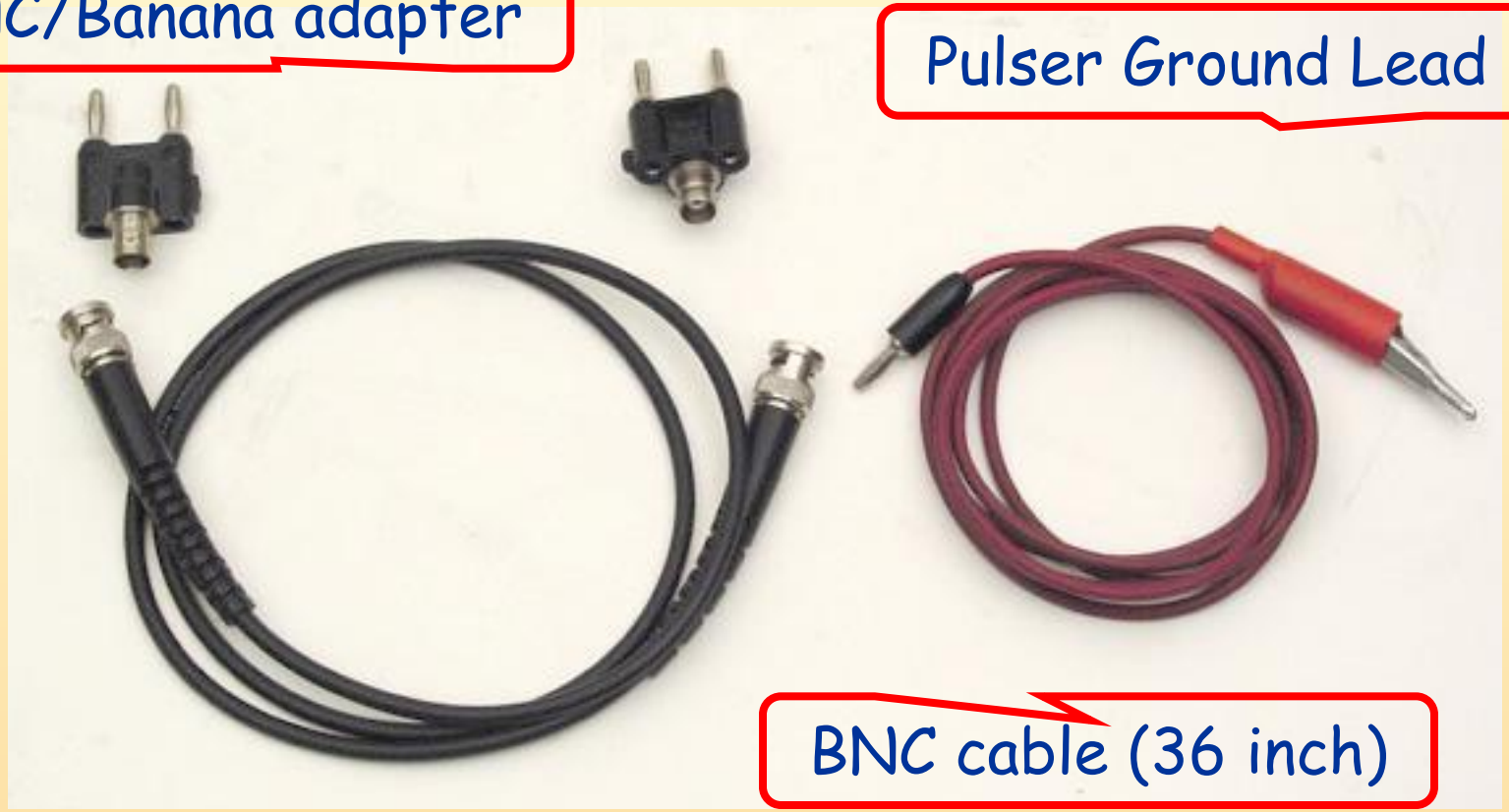
Pulser Resistance Test Equipment



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Pulser Extension Test Equipment

Poppet retraction Tool

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Pulser Resistance Test Equipment

Solar 175 Test Cable
Amphenol/7-pin

4-pin Male Rotational
Test Connector

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Pulser Resistance Test Purpose

- Tests the pulser generator coils for shorts and open circuits
- Tests the pulser control valve solenoid for shorts and open circuits

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Pulser Resistance Test Procedure

- Set the 9v switch on the MWD Pulser Test Set to off
- Set the meter to measure resistance and ensure that the scale selected is appropriate for the resistance expected.

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Pulser Case Lead Continuity

- Measure the pulser case lead resistance
- A reading of 0-1 ohms indicates continuity.

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Pulser Resistance Test Procedure

Connect the meter to the ohms out ports on the test set using the BNC cable and adapters.

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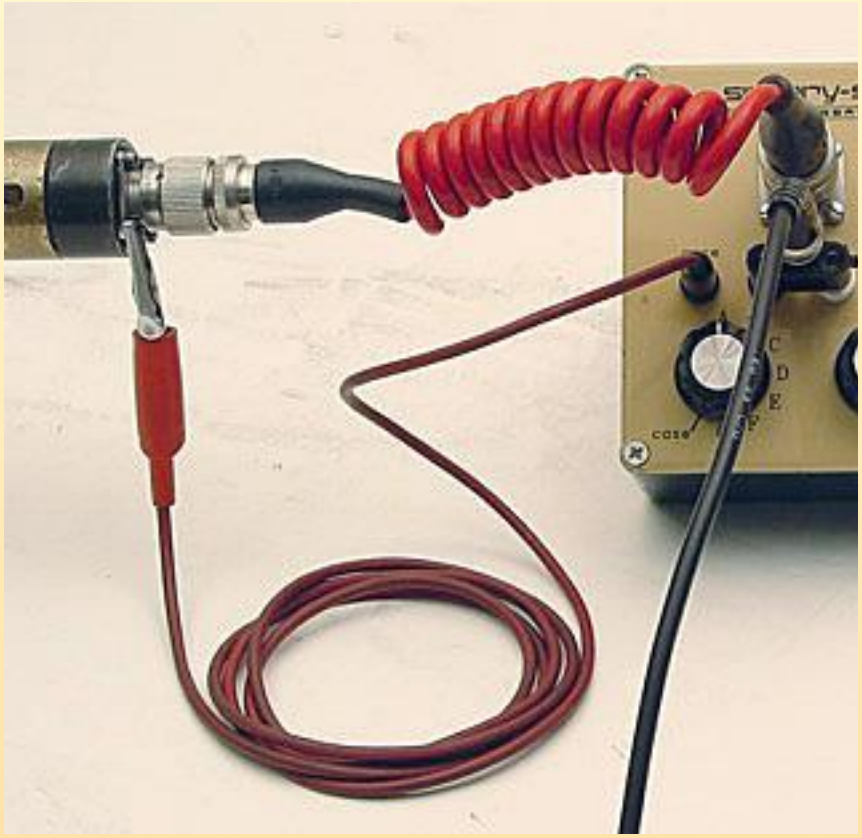
Pulser Resistance Test Procedure

Connect the pulser case lead to the case port on the test set and to the pulser with the alligator clip.



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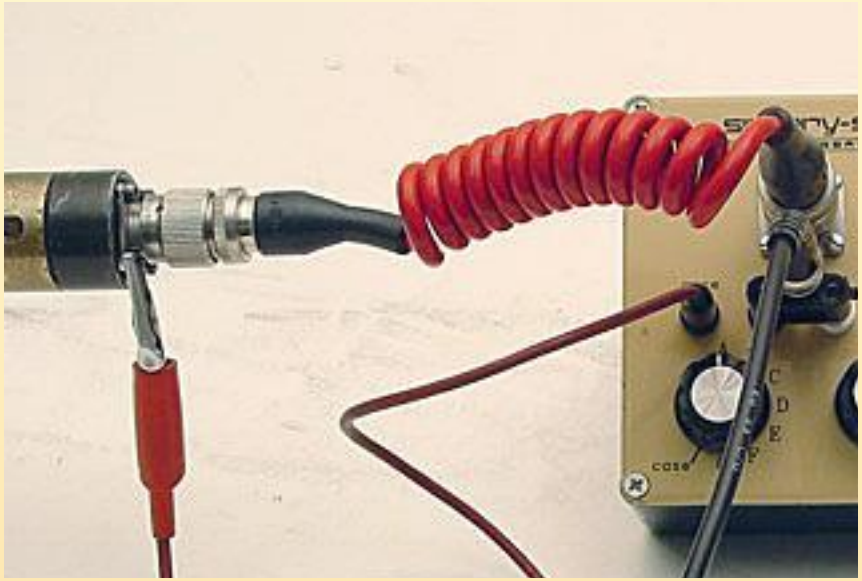
Pulser Resistance Test Procedure

Connect the coil cord from the pulser to the pulser port on the test set.



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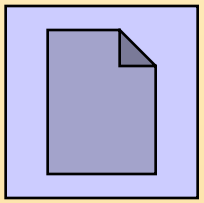
Pulser Resistance Test Procedure

- Check resistance readings by rotating switches S1 and S2 through all positions shown on the Pulser Test Form.



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DWD Pulser Resistances

		Switch S2						
		A	B	C	D	E	F	G
Switch S 1	A	0-1	340-608	>100k	>100k	>100k	Inf	>100k
	B		0-1	>100k	>100k	>100k	Inf	>100k
	C			0-1	9-11k	9-11k	Inf	9-11k
	D				0-1	0-1	Inf	0-1
	E					0-1	Inf	0-1
	F						0-1	Inf
	G							0-1
	Case			>100k	>100k	>100k	Inf	>100k

A = Solenoid, B = Ground, C = Generator A, D = Generator B,
E = Generator C, F = Not used, G = Jumped to E in coil cord

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Solar Pulser Resistances

		Switch S2				
		A	B	C	D	E
Switch S1	A	0-1	340-608	Inf	Inf	Inf
	B		0-1	Inf	Inf	Inf
	C			0-1	15-26	15-26
	D				0-1	15-26
	E					0-1

A = Solenoid, B = Ground, C = Generator A,
D = Generator B, E = Generator C

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Pulser Resistance Test Procedure

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Pulser Resistance Test Procedure

- If any readings are out of specification, check the coil cord and the pulser test set and isolate the defective part.
- Then complete a Failure Report.

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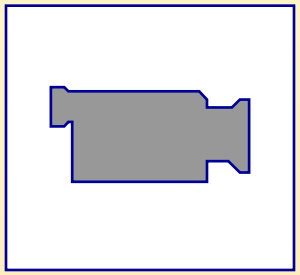
Pulser Resistance Test Procedure

What was all that about?



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Pulser Extension/Retraction Test Purpose

- Basic test of the hydraulic system
- Tests the seals on the main valve, control valve, the pump rams' seals, and the piston seal
- Tests function of both the main and control valves

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Pulser Extension/Retraction Test Procedure

- Clean the pulser; pay particular attention to the three threaded location holes on the pump housing.

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Pulser Extension/Retraction Test Procedure

Install an impeller assembly over the intermediate case.

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Pulser Extension/Retraction Test Procedure

Prepare the poppet retraction tool by screwing the adjuster nut fully onto the shaft

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Pulser Extension/Retraction Test Procedure

Slide the retraction tool over the poppet end of the pulser.

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Pulser Extension/Retraction Test Procedure

Insert the locating screws into the threaded holes on the pulser and hand tighten.

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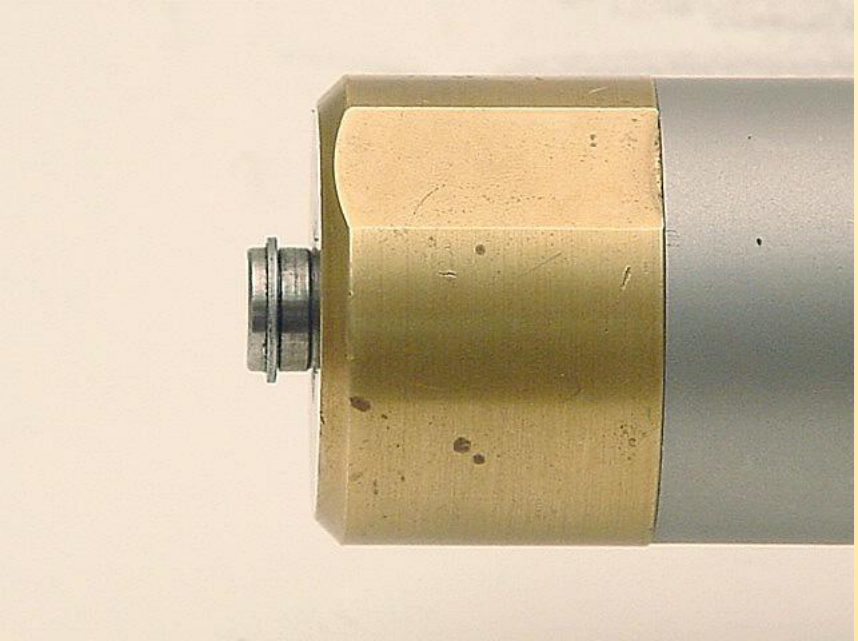
Pulser Extension/Retraction Test Procedure

Screw the adjuster nut against the poppet shaft until the first groove on the retraction tool's shaft is aligned with the face of the locking ring.



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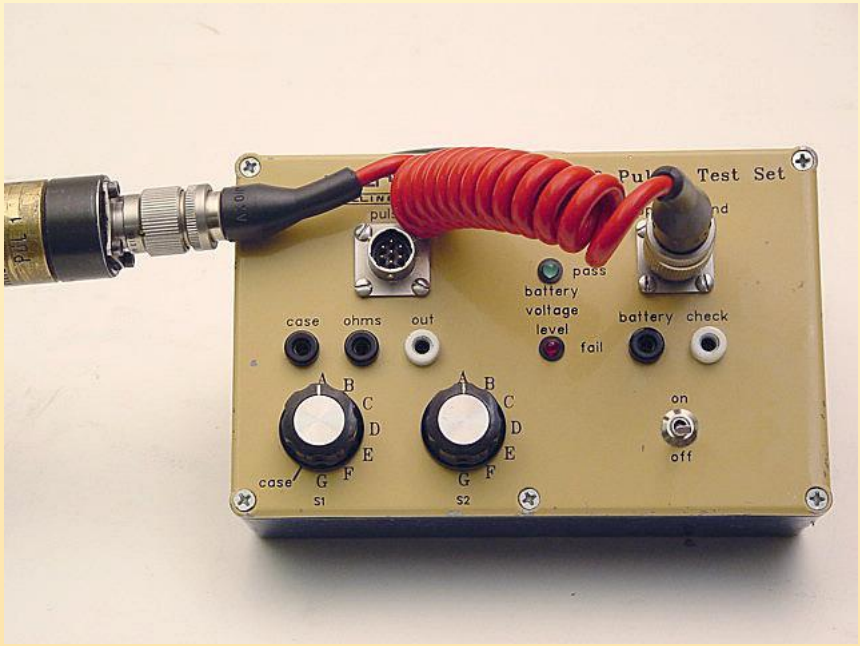
Pulser Extension/Retraction Test Procedure

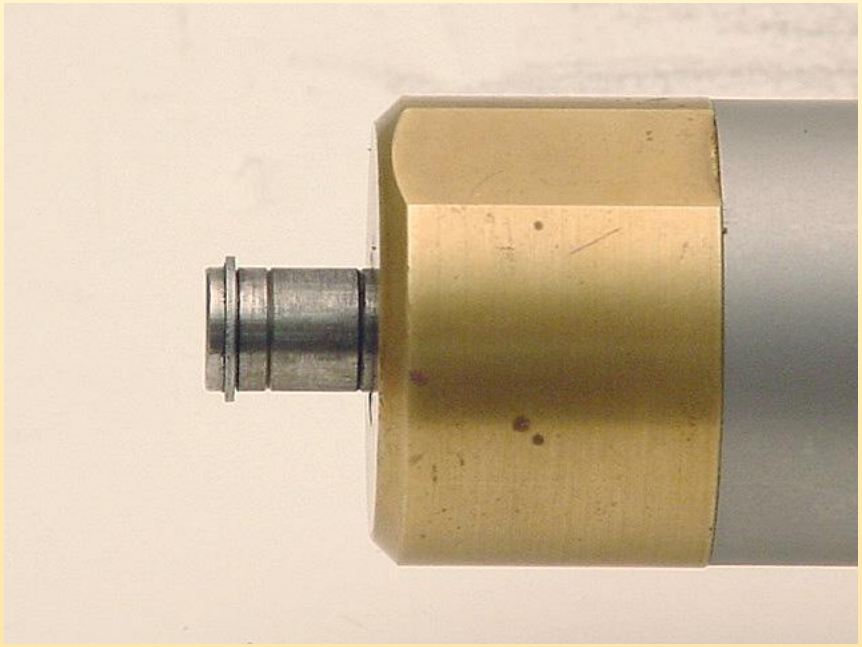
Connect the pulser to the poppet extend socket on the MWD Pulser Test Set using the coil cord

Turn on the 9v switch.



Pulser Extension/Retraction Test Procedure

Rotate the impeller assembly. The retraction tool's shaft should extend to reveal the second groove on the shaft.



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Pulser Extension/Retraction Test Procedure

- Monitor the extension; the retraction tool's shaft must remain extended for 2 minutes without bleeding off and retracting all the way to the first groove.

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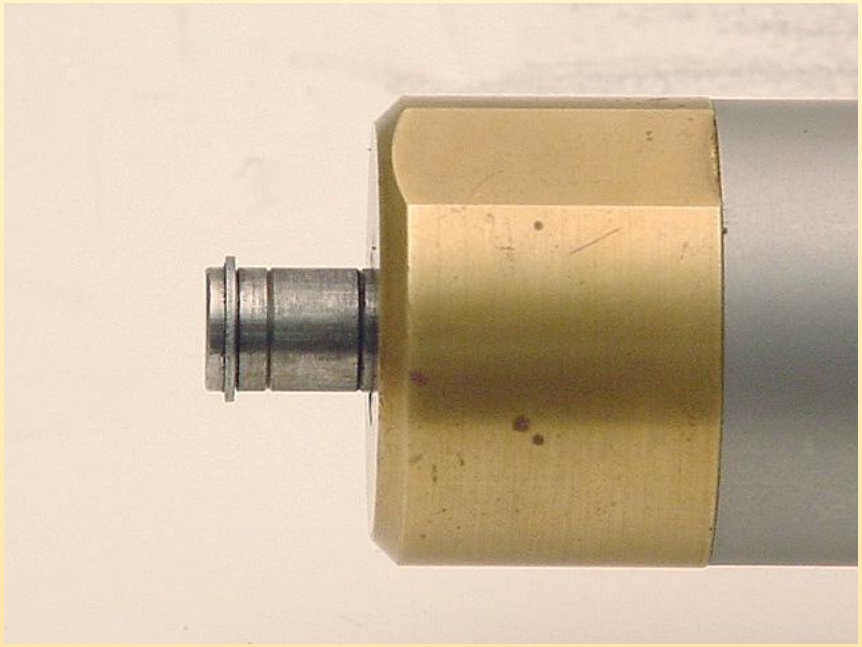
Pulser Extension/Retraction Test Procedure

Rotate the impeller assembly until the retraction tool's shaft again extends to reveal the second groove on the shaft.



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Pulser Extension/Retraction Test Procedure

- Turn off the 9v switch.

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Pulser Extension/Retraction Test Procedure

- Monitor retraction
  - For a Booted Pulser
    - The retraction tool's shaft should retract to the first groove in less than 2 seconds.
  - For a Bootless Pulser
    - The retraction tool's shaft should retract to the first groove in about 8 seconds.

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Pulser Extension/Retraction Test Procedure

- Record the results on the Pulser Test Sheet.

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Pulser Extension/Retraction Test Procedure

- Should the pulser fail to meet the above procedure, return pulser for R&M, stating “Retraction Fault”.

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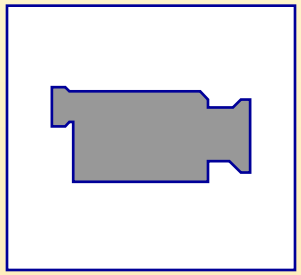
Pulser Extension/Retraction Test Procedure

What was all that about?



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Testing an MWD Pulser Test Set

- Test S1 and S2 Switches
- Test Ohms Out and Case Ports
- Test Pulser Connector
- Test Poppet Extend Connector
- Test Internal Batteries

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Test S1 and S2 Switches

Set the volt/ohm meter to ohms

Connect the test leads to the black and white ohms out ports.

A to A

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Test S1 and S2 Switches

- Check resistance readings by rotating switches S1 and S2 through all positions on Table 1

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Test S1 and S2 Switches Table 1

		Switch S2						
		A	B	C	D	E	F	G
Switch S1	A	0-1	Inf	Inf	Inf	Inf	Inf	Inf
	B		0-1	Inf	Inf	Inf	Inf	Inf
	C			0-1	Inf	Inf	Inf	Inf
	D				0-1	Inf	Inf	Inf
	E					0-1	Inf	Inf
	F						0-1	Inf
	G							0-1

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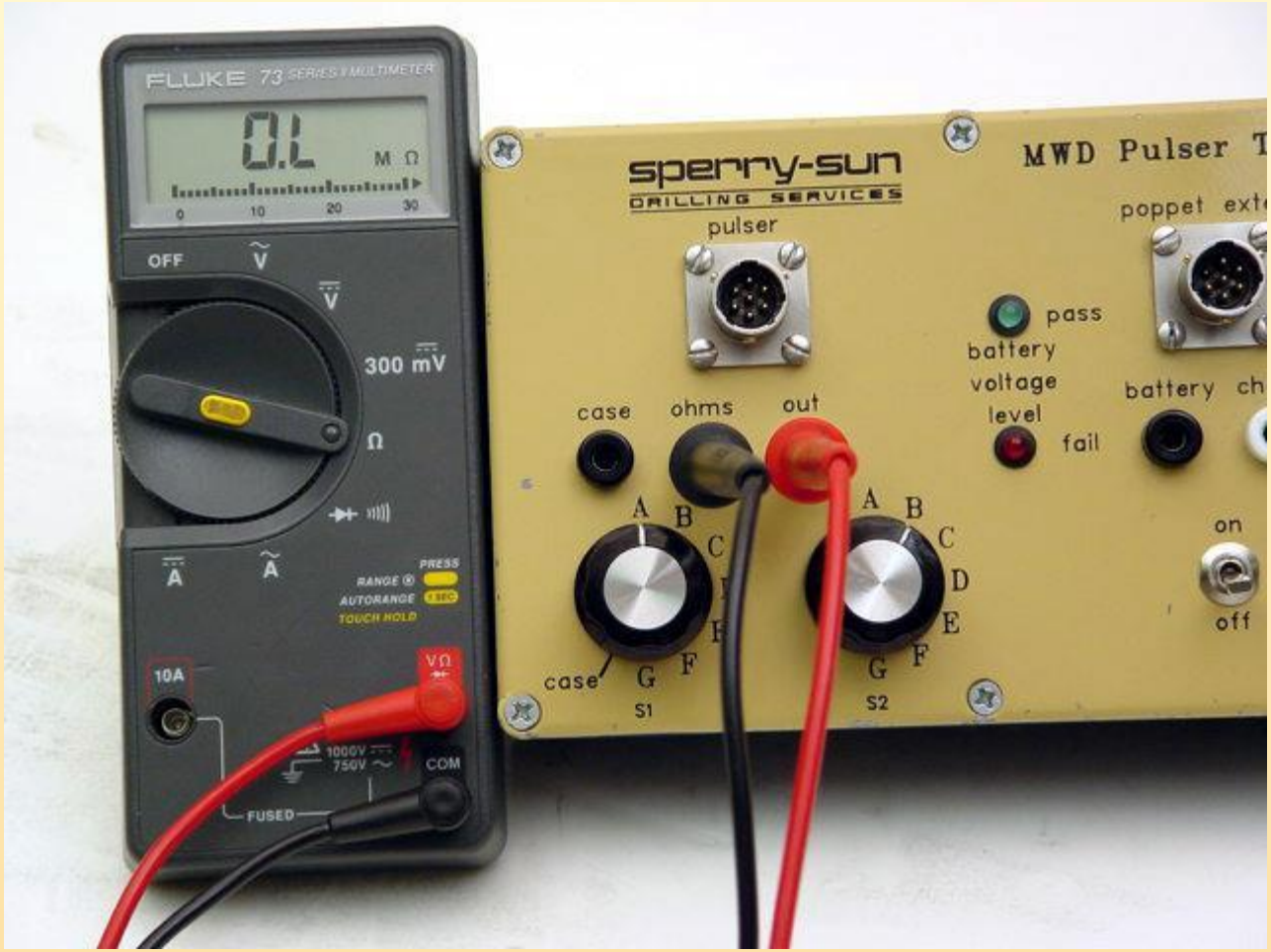
Test S1 and S2 Switches



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Test S1 and S2 Switches

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Test Ohms Out & Case Ports

Connect the test leads to the white ohms out port and the black case port.

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Test Ohms Out & Case Ports

Rotate switch S2 through positions A to G.

All positions should read infinity.

S2 G

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Test Ohms Out & Case Ports

Connect the test leads to the black ohms out port and the black case port.

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Test Ohms Out & Case Ports

Rotate switch S1 through positions A to G.

All positions should read infinity.

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Test Ohms Out & Case Ports

- Move switch S1 to the case position.
- The meter should read 0-1 ohms.

S1 Case

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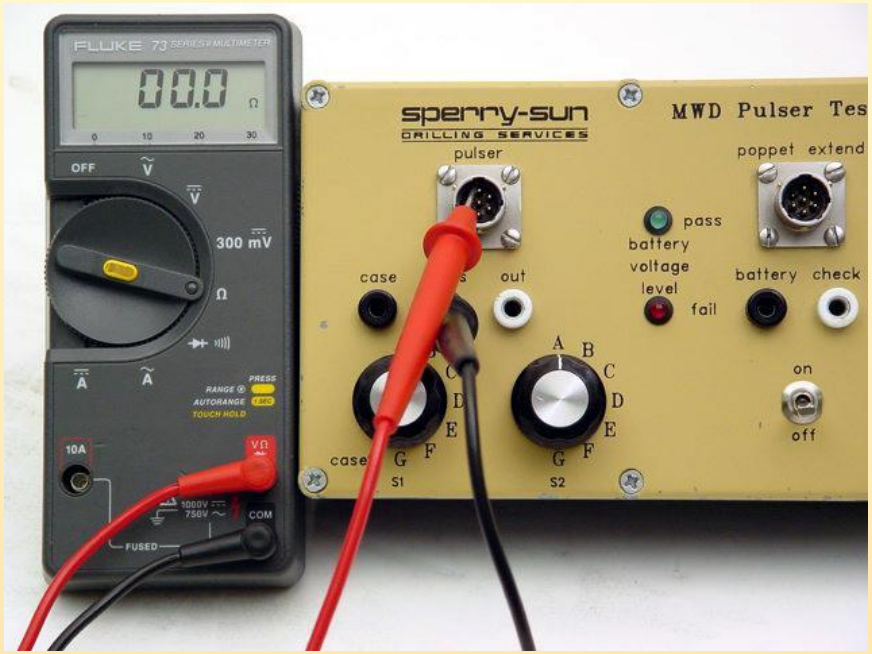
Test Pulser Connector

- Connect the test leads to the black ohms out port and pin A inside the pulser connector on the test set.



Pin A
S1 A

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Test Pulser Connector

Rotate switch S1 through positions A to case. The meter should read infinity in all positions except A, which should read 0-1 ohms.

Pin A
S1 Case

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Test Pulser Connector

- Repeat this for pins B through G on the pulser connector for all positions shown on Table 2

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Test Pulser Connector Table 2

		Switch S1 or S2							
		A	B	C	D	E	F	G	Case
Test Set Pulser Connector	A	0-1	Inf	Inf	Inf	Inf	Inf	Inf	Inf
	B		0-1	Inf	Inf	Inf	Inf	Inf	Inf
	C			0-1	Inf	Inf	Inf	Inf	Inf
	D				0-1	Inf	Inf	Inf	Inf
	E					0-1	Inf	Inf	Inf
	F						0-1	Inf	Inf
	G							0-1	Inf

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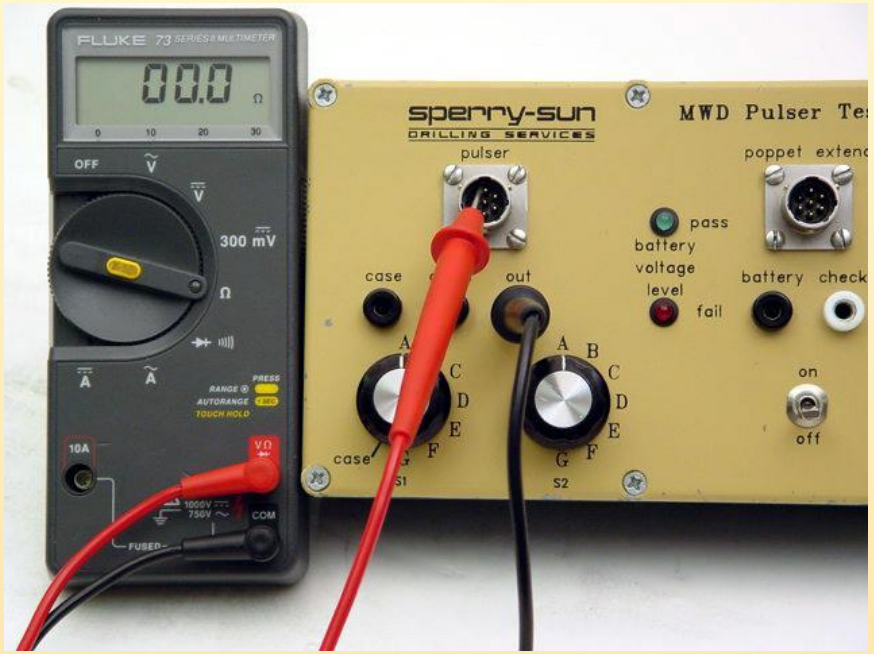
Test Pulser Connector

- Connect the test leads to the white ohms out port and pin A inside the pulser connector.



Pin A
S2 A

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Test Pulser Connector

- Rotate switch S2 through positions A to G. The meter should read infinity in all positions except A, which should read 0-1 ohms.

Pin A
S2 G

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Test Pulser Connector

- Repeat this for pins B through G on the pulser connector for all positions shown on on Table 2

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Test Poppet Extend Connector

- Ensure that the 9v switch is off.

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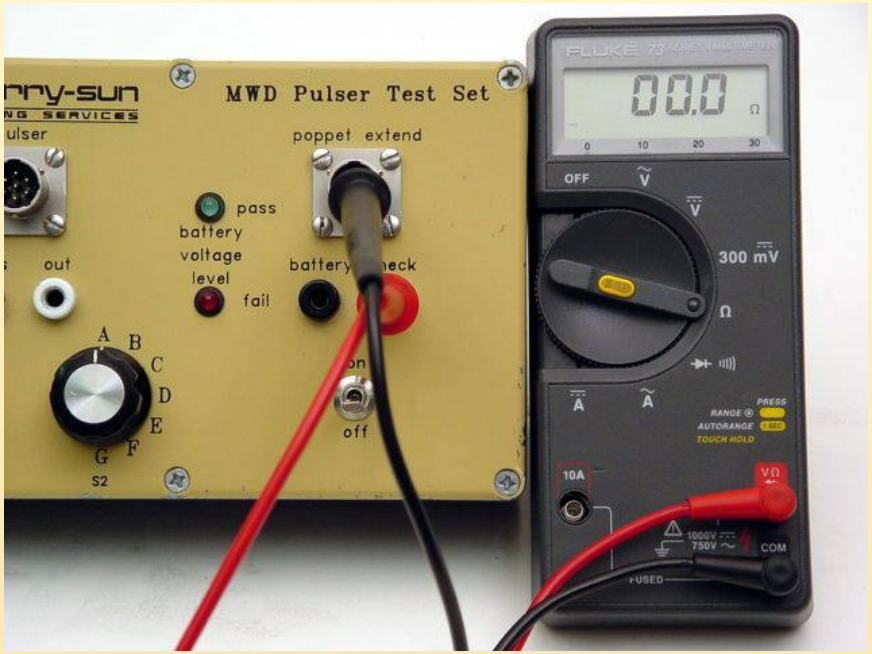
Test Poppet Extend Connector

- Place one test lead in the white battery check port and touch the other lead to each pin inside the poppet extend connector.



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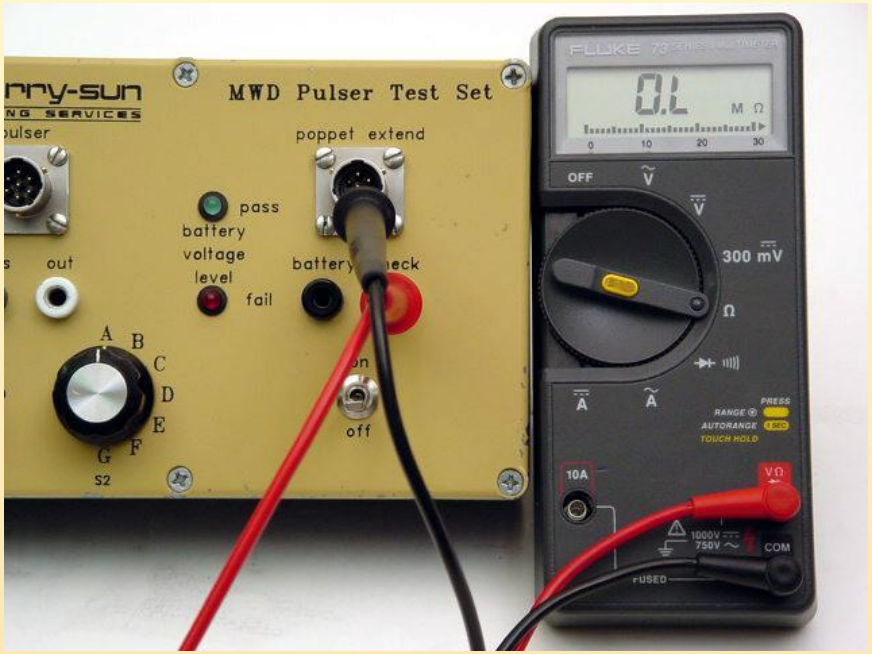
Test Poppet Extend Connector

- Each pin should read infinity except pin A which should read 0-1 ohms.



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Test Poppet Extend Connector

- Remove the test lead from the white battery check port and place it in the black battery check port.
- Touch the other lead to each pin inside the poppet extend connector.

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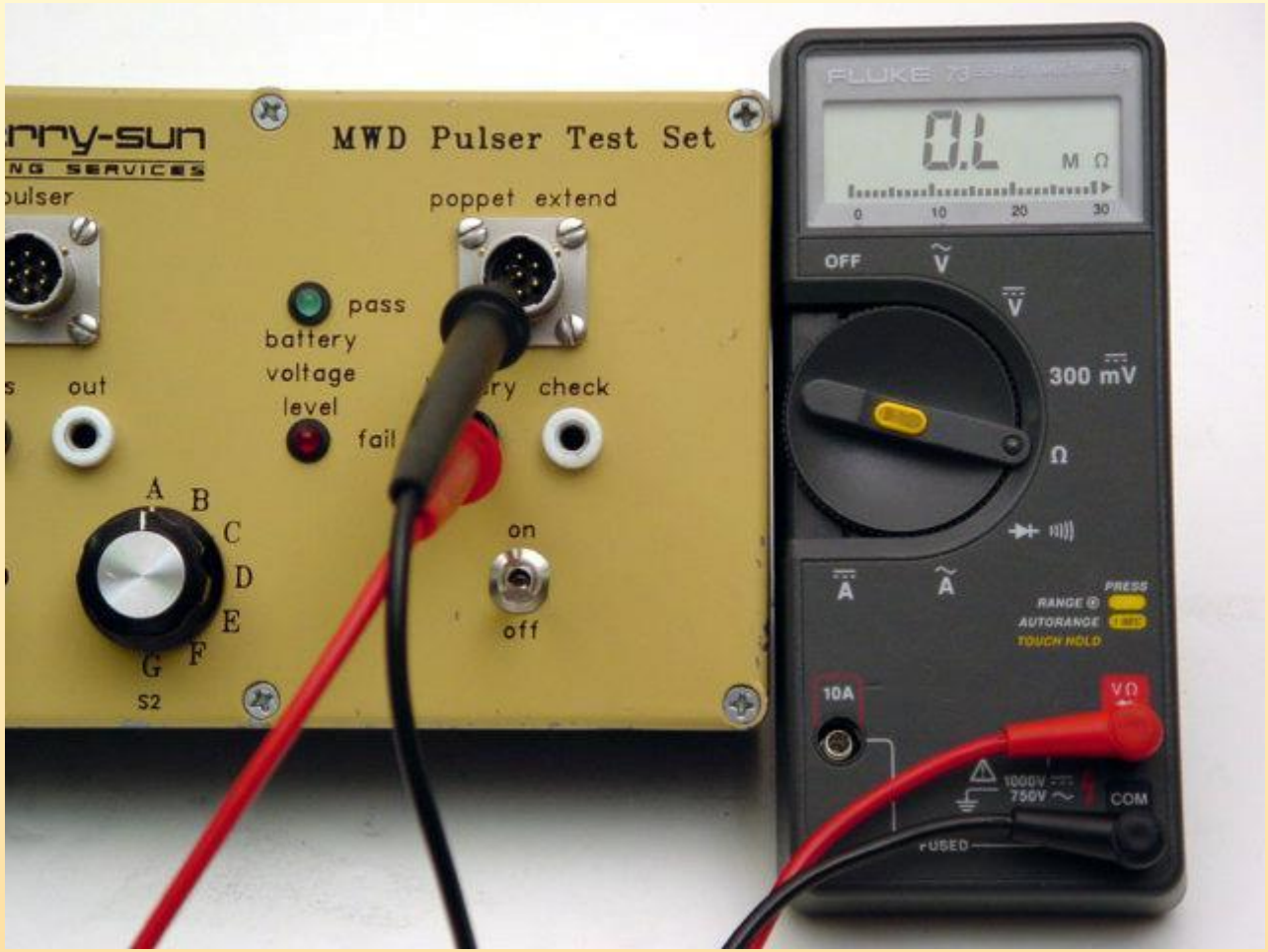
Test Poppet Extend Connector



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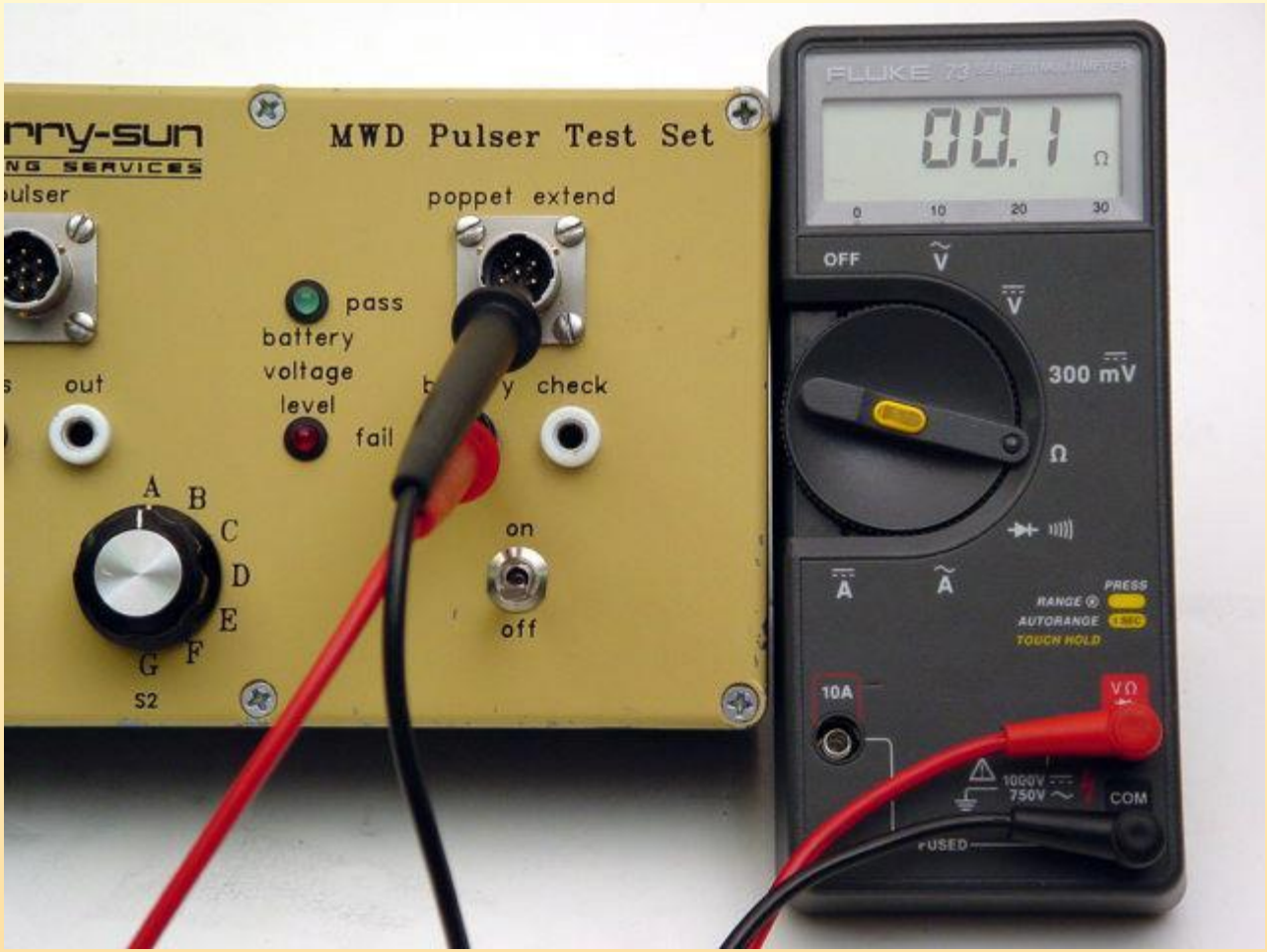
Test Poppet Extend Connector



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Test Poppet Extend Connector

- Each pin should read infinity except pin B which should read 0-1 ohms.

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Test Internal Batteries

- Set the meter to the DC voltage range to test the eight 1.5 volt AA battery cells (12 volts).

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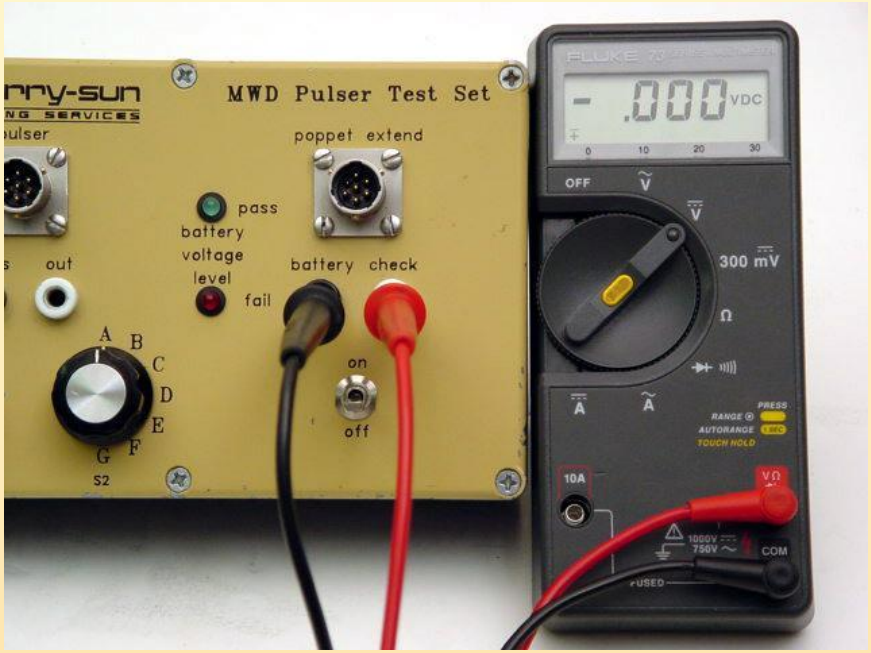
Test Internal Batteries

- Connect the test leads to the battery check ports. Black is negative, white is positive.



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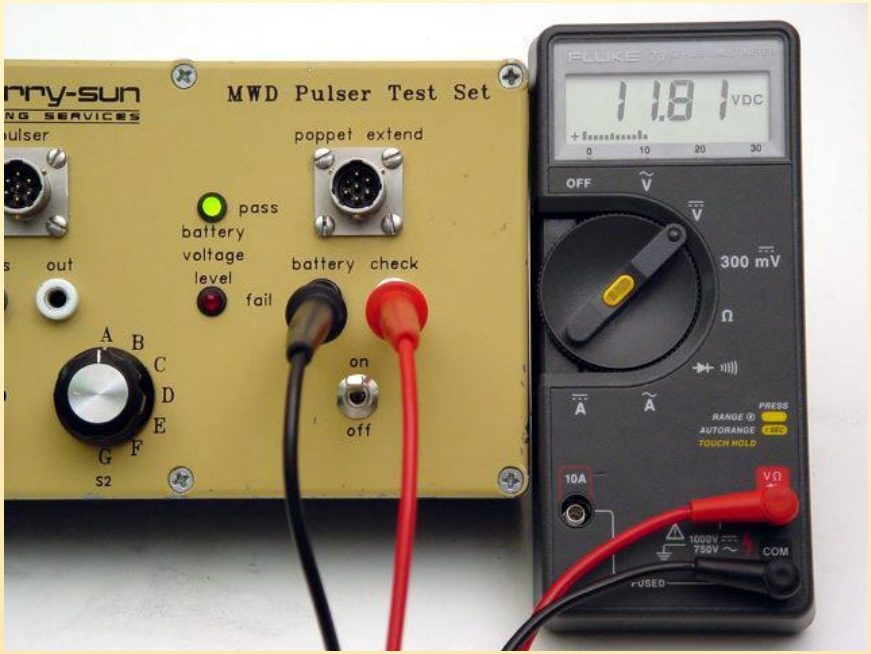
Test Internal Batteries

- Check the internal battery voltage by switching the 9v switch on.
- The meter should read greater than 10 volts.



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Test Internal Batteries

- Turn the 9v switch off and remove the meter leads from the battery check ports.

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Replace Internal Batteries

- If the voltage is lower than 10 volts, open the test set and replace the eight 1.5 volt battery cells.

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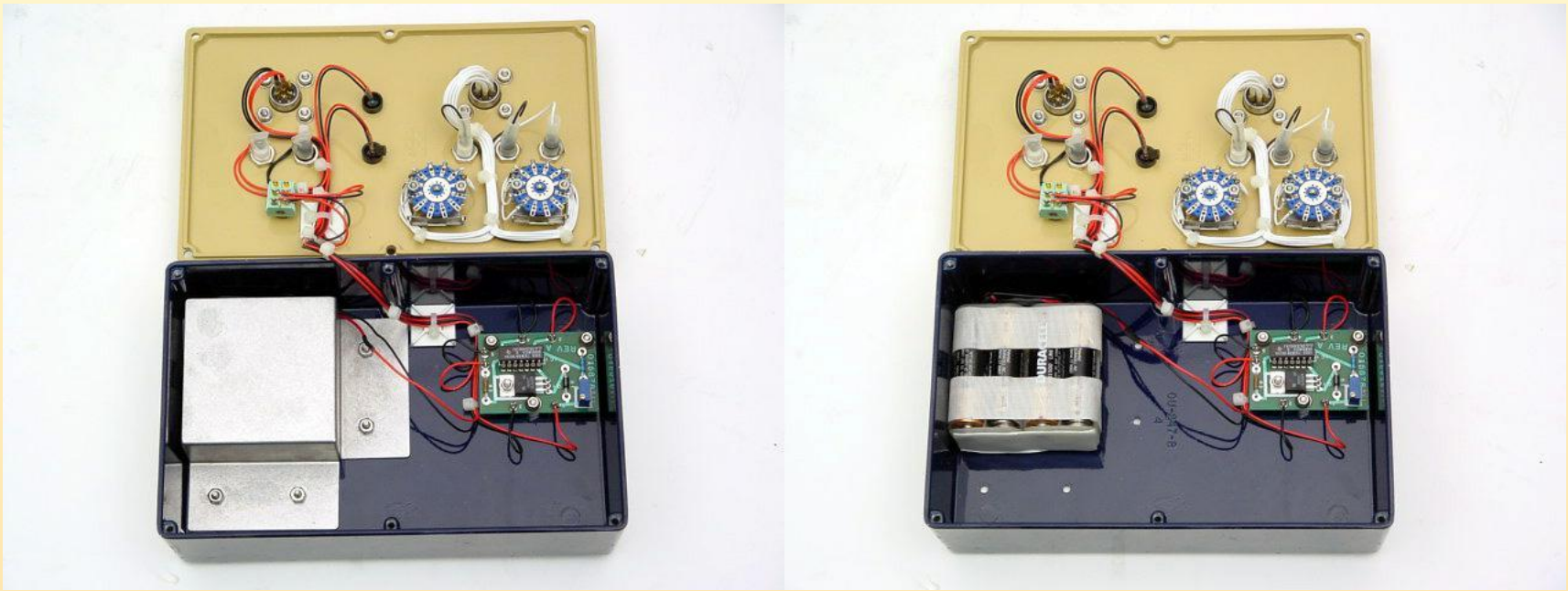
Replace Internal Batteries



8 AA 1.5V Cells

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