

# **MULTIMETERS AND OTHER WIRING BASICS**

**DIAGNOSTIC TOOL FOR TROUBLE SHOOTING PRECISION AG EQUIPMENT**



# MULTIMETERS COME IN MANY SHAPES, SIZES, AND CAPABILITIES



# TUTORIAL

Measuring resistance



# WHAT ARE WE USING A MULTIMETER FOR IN THE FIELD?

## 1. CHECK VOLTAGE

- VOLTAGE IS THE FORCE OF THE CURRENT

## 2. CONTINUITY OF THE CIRCUIT

- FINDING A FAULTY WIRE OR "CIRCUIT"

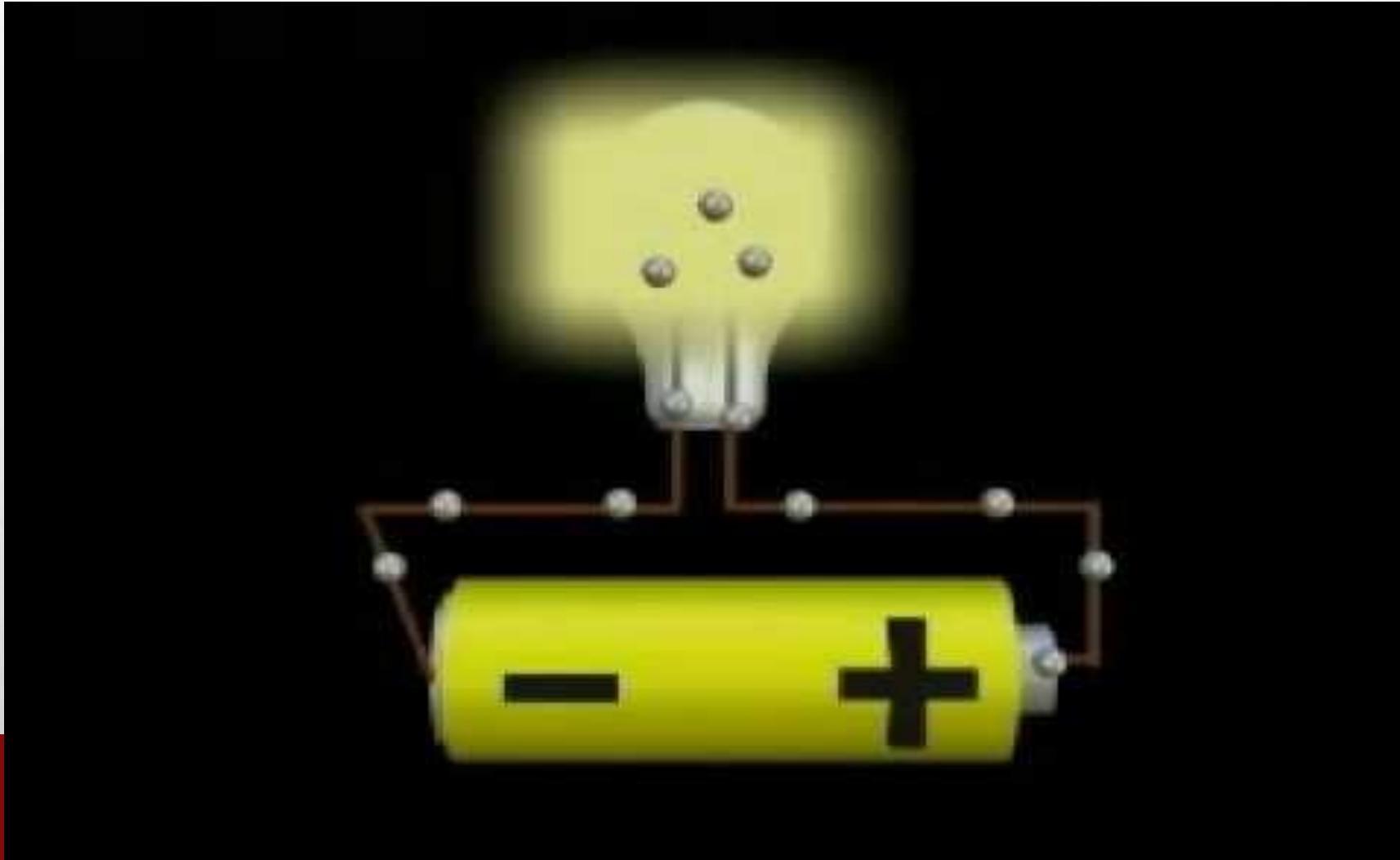
## 3. AMPERAGE

- AMOUNT OR VOLUME OF ELECTRICITY

## 4. RESISTANCE

- A CIRCUIT CAN HAVE CONTINUITY AND STILL BE FAULTY
- HIGH RESISTANCE=LOWER AMPS

# TUTORIAL (DON'T FALL ASLEEP)



# FUSES

- **WHAT IS THE PURPOSE OF A FUSE?**
  - **TO PROTECT THE CIRCUIT (WIRE)**
- **HOW DO YOU CHECK TO SEE IF A FUSE IS GOOD?**
  - **CONTINUITY ACROSS THE FUSE**
  - **CHECK FOR VOLTAGE ON THE BACK SIDE OF THE FUSE**

# FUSE TYPES USED THE MOST IN AG

- **MINI BLADE**
- **STANDARD BLADE**
- **MAXI BLADE**
- **BUS FUSES**



# WHAT WOULD CAUSE A FUSE TO BLOW?

- **BROKEN WIRES**
  - **CHECK FOR PINCH POINTS, CORRODED WIRES, AND VARMINT DAMAGE**
- **ELECTRIC MOTOR STARTING TO GO BAD**
  - **BRUSH MOTORS WILL SPIKE AMPERAGE WHEN BAD (ELECTRIC PUMPS FOR LIQUID)**
- **OTHER DEFECTIVE ELECTRONICS**
  - **PLANTER CLUTCHES**
  - **PWM VALVES**
  - **DEFECTIVE SENSORS**
  - **SERVO MOTORS (WHERE ARE THESE AT?)**
  - **BAD DISPLAY**
- **ALTERNATOR OR BATTERY ON VEHICLE COULD BE GOING BAD**



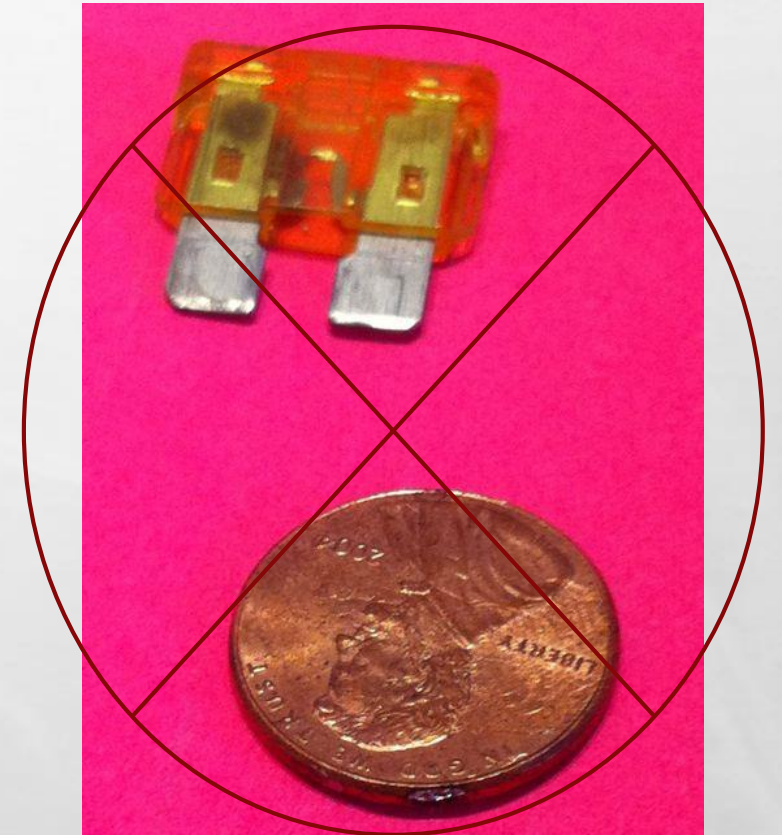
# WHY WOULD PRECISION AG SYSTEMS HAVE MULTIPLE FUSES/POWER SYSTEMS?

- **TROUBLE SHOOTING**
  - **YOU CAN FIND THE PROBLEM MUCH QUICKER IF THERE ARE MULTIPLE CIRCUITS**
- **DIFFERENT SYSTEMS REQUIRE DIFFERENT AMPERAGE**

<b>MONITOR</b>	<b>5</b>
<b>GPS/AUTOSTEER</b>	<b>15</b>
<b>IMPLEMENT</b>	<b>30</b>
- **A SENSITIVE SYSTEM CAN BE DAMAGED IF THE WRONG FUSE IS USED**

# PROPER TECHNIQUES

- **A PENNY IS NOT A SUITABLE REPLACEMENT FOR A FUSE**
- **“TRY” TO REPLACE THE FUSE WITH THE SAME RATED FUSE**
- **CHECK AND REPLACE ANY DAMAGED OR ERODED FUSE HOLDERS**
- **MIGHT BE GOOD TO REPLACE BUS FUSES WITH BLADE FUSES IF POSSIBLE**



# WIRE SIZE

Length (feet)	Current (amps)									
	5	10	15	20	25	30	40	50	60	70
15	16	12	10	10	8	8	6	6	4	4
20	14	12	10	8	8	6	6	4	4	4
25	14	10	8	8	6	6	4	4	2	2
30	12	10	8	6	6	4	4	2	2	2
40	12	8	6	6	4	4	2	2	1	1/0
50	10	8	6	4	4	2	2	1	1/0	1/0
60	10	6	6	4	2	2	1	1/0	2/0	2/0
70	10	6	4	2	2	2	1/0	2/0	2/0	3/0
80	8	6	4	2	2	1	1/0	2/0	3/0	3/0
90	8	4	4	2	1	1/0	2/0	3/0	3/0	4/0

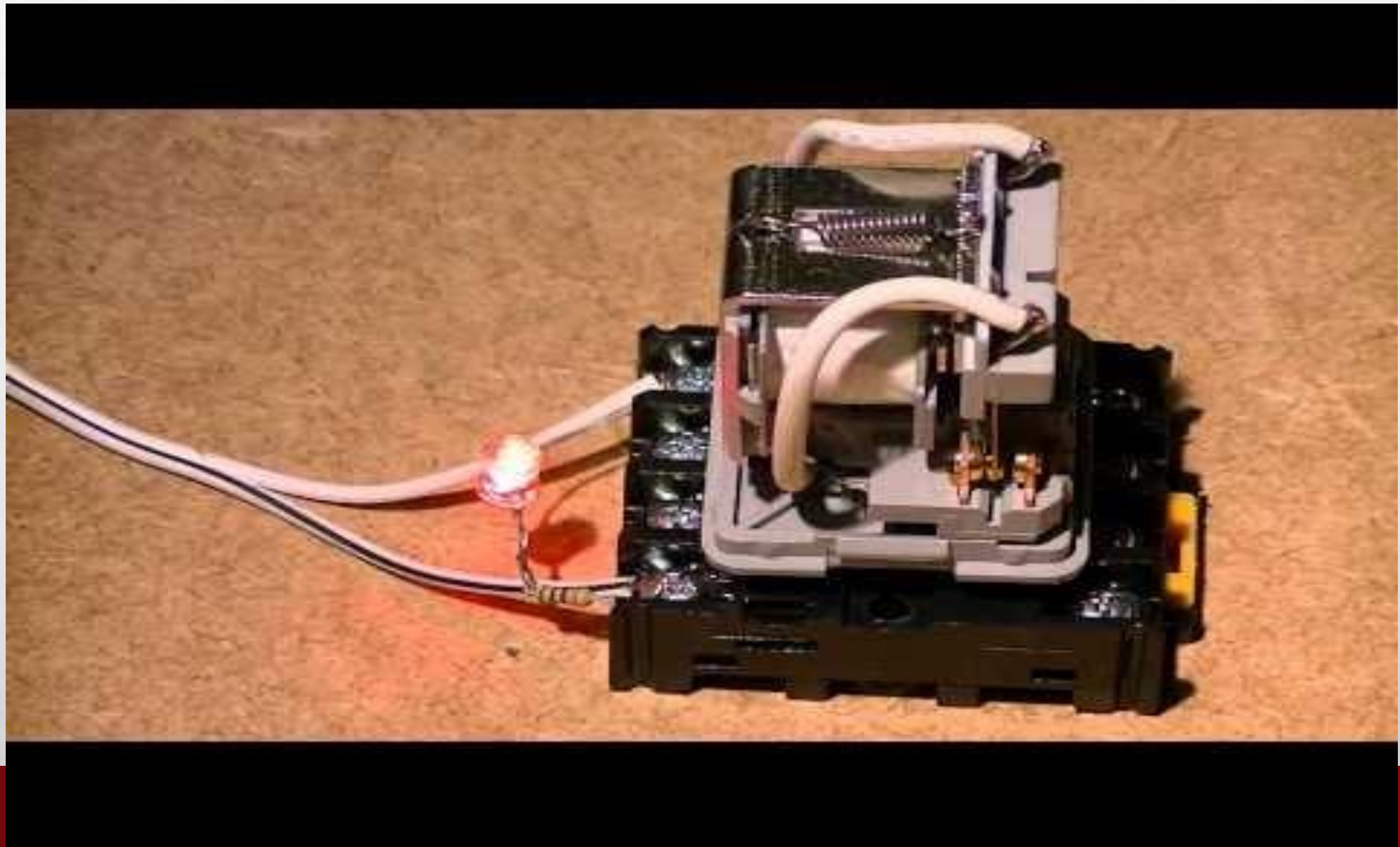
# Ohm's Law

$$I = \frac{V}{R}$$

**Electric current = Voltage / Resistance**

# RELAYS

- **ANYBODY HEARD OF A RELAY?**
  - **A RELAY IS SIMPLY A SWITCH. IT TAKES A POWER SIGNAL TO ACTIVATE. ONCE THAT SIGNAL IS RECEIVED, IT WILL SEND POWER OUT ON ANOTHER SET OF WIRES.**
- **USED MANY TIMES TO SIMPLIFY A WIRING HARNESS AND CAN USE LOWER VOLTAGE TO SWITCH HIGHER VOLTAGE.**
- **COMPONENTS OF A RELAY**
  - **POLES**
  - **CONTACTS**
  - **COIL**



# WHAT DO THEY LOOK LIKE?



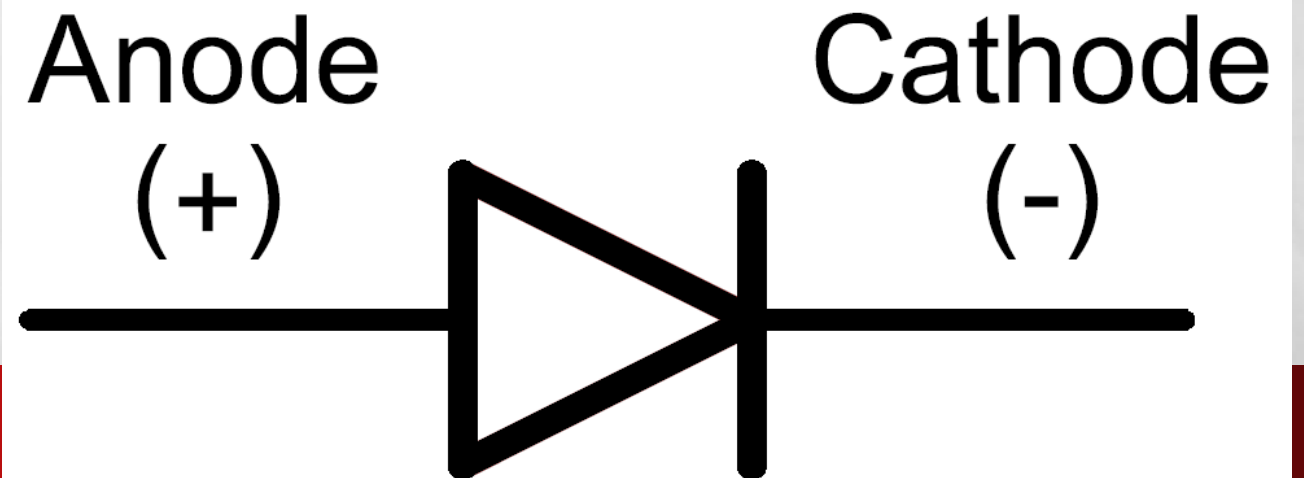
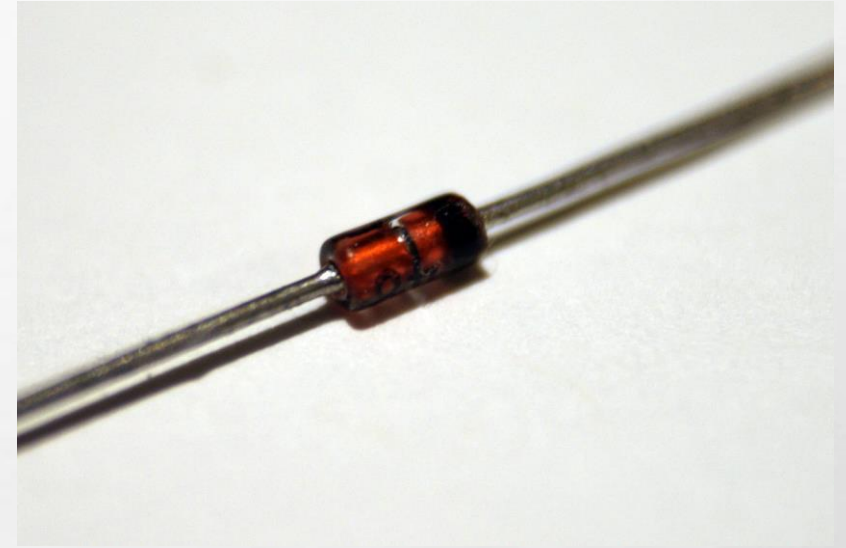
# HOW DOES A RELAY WORK?



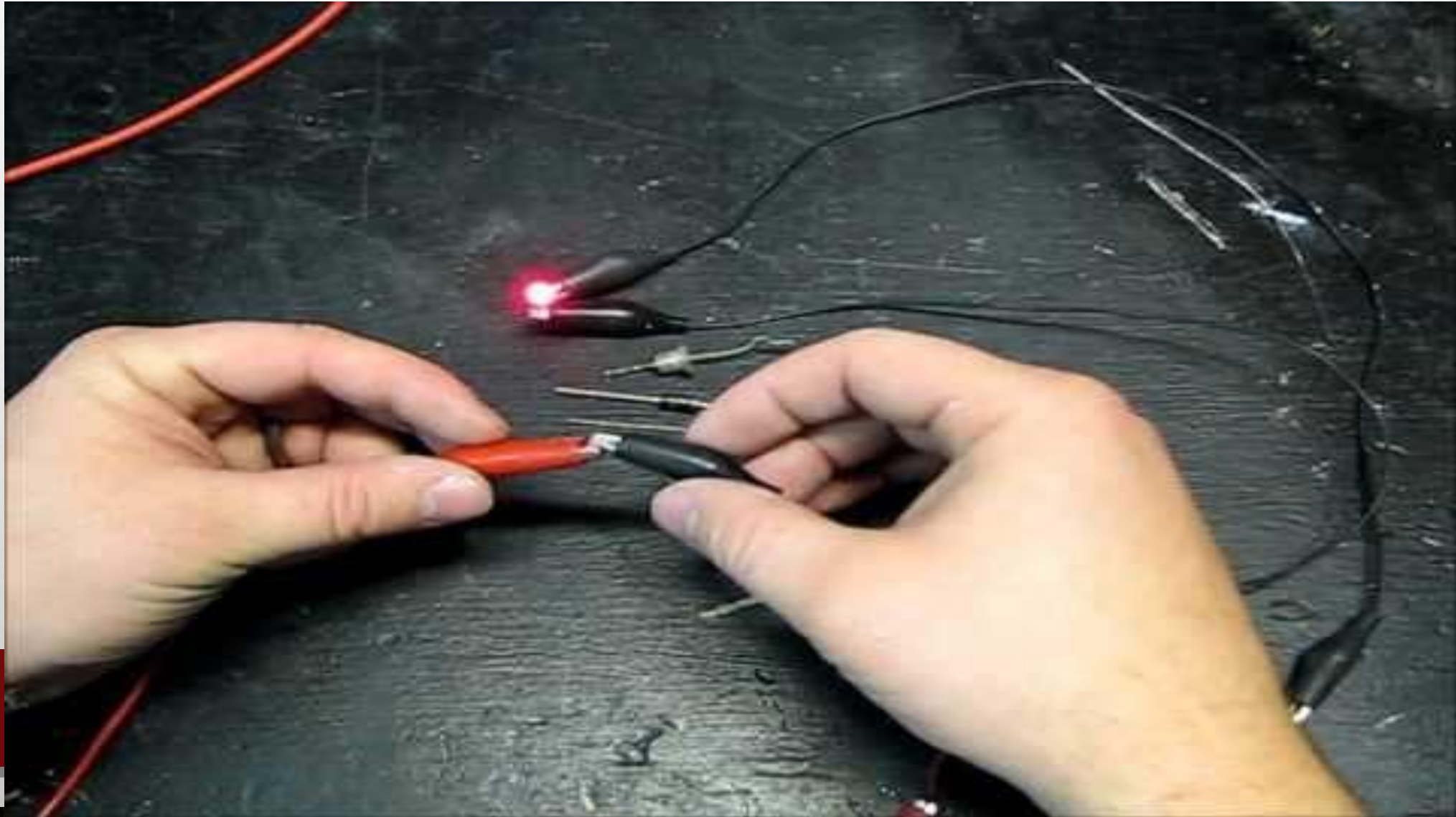


# DIODES

- **ANYONE GOT A GUESS WHAT A DIODE IS?**
  - **ONE WAY FLOW OF ELECTRONS OR “CHECK VALVE” FOR ELECTRICITY**
- **WHAT DO WE USE IT FOR?**
  - **PROTECT CIRCUITS**
  - **LIGHT EMITTING DIODES (LED)**
  - **CREATE “DC” CURRENT**



# HOW DOES A DIODE WORK?



# PRECISION AG KNOWLEDGE OVERVIEW

**IN PRECISION AG WE NEED TO KNOW A LITTLE ABOUT EVERYTHING**

- **ELECTRICITY AND ELECTRONICS**
- **GPS TECHNOLOGY**
- **HYDRAULICS**
- **DISPLAY INTERFACE**
- **DATA COLLECTING, PROCESSING, AND APPLICATIONS (PRECISION AG TECH)**
- **WIRELESS COMMUNICATION (WHY)**