PURKEYS

Fundamentals of Multimeter Training

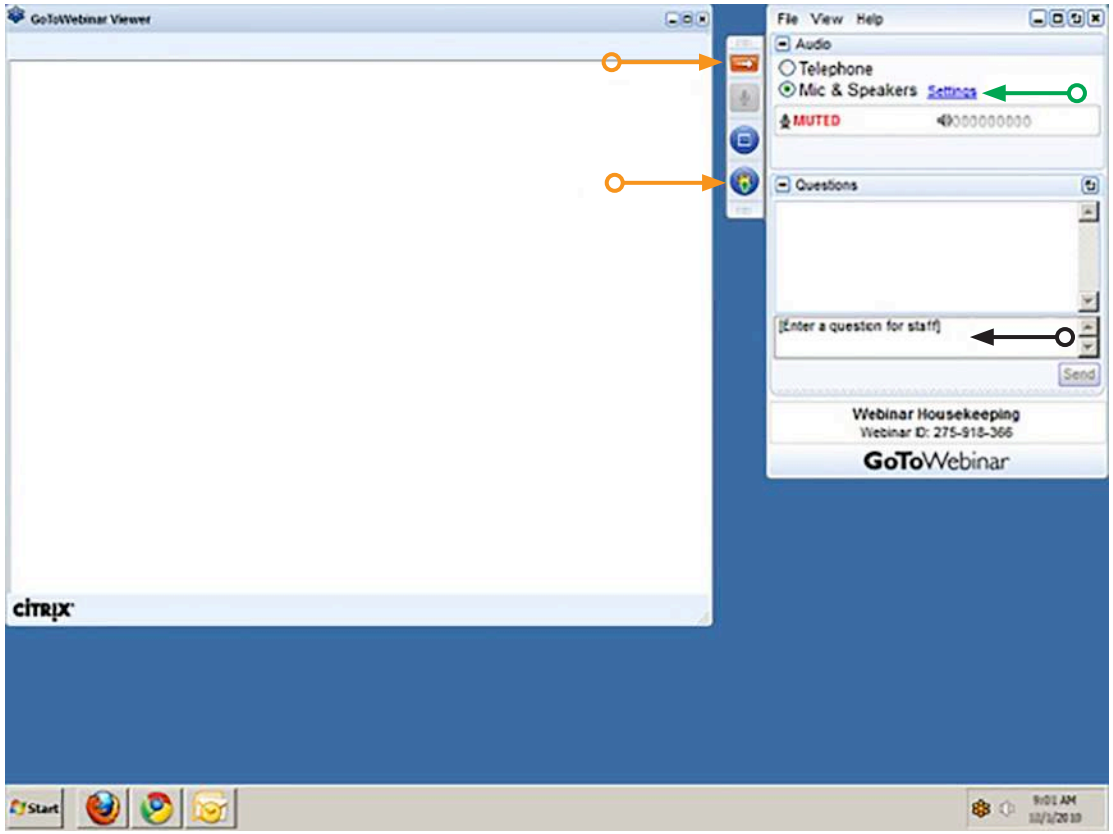
WATT Keeps You Trucking

House Cleaning

REMINDER:

This Webinar is being Recorded

Please Turn Off Cell Phones



About the Presenter

Larry Rambeaux | Senior Account Representative

Larry has over 20 years' experience working with heavy duty fleets. He is an outstanding trainer and uses his extensive experience to help his customers make the best choices for their electrical needs.

He has been awarded the prestigious Recognized Associate Award from the Technology & Maintenance Council. Larry's knowledge of electrical systems enables him to help his customers identify and remedy a fleets' electrical issues.

1-800-219-1269
lrambeaux@purkeys.net

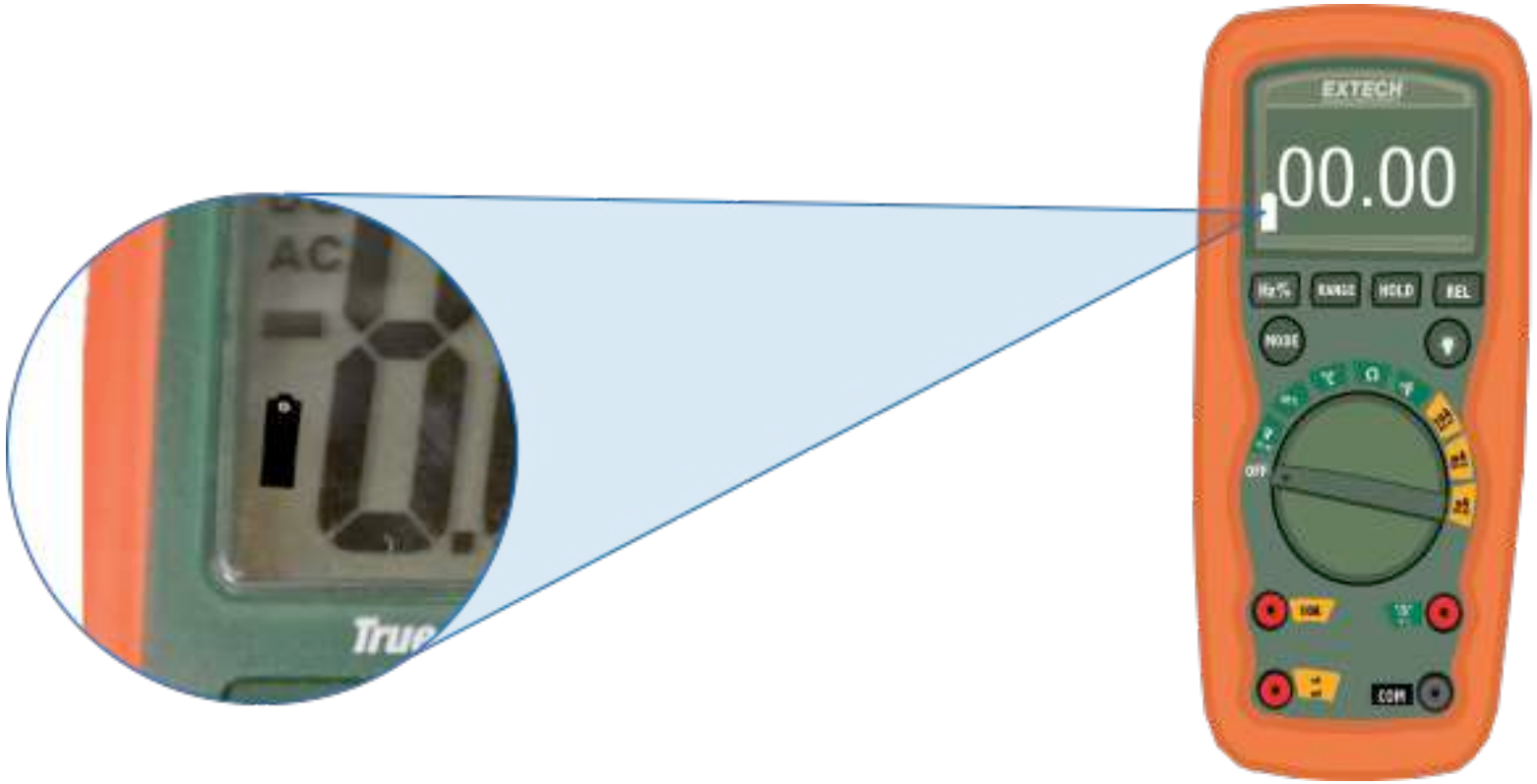
Overview

Multimeter

Voltmeter
Ammeter
Ohmeter
Diode Check
Continuity

Pre-Check Multimeters

Battery Check

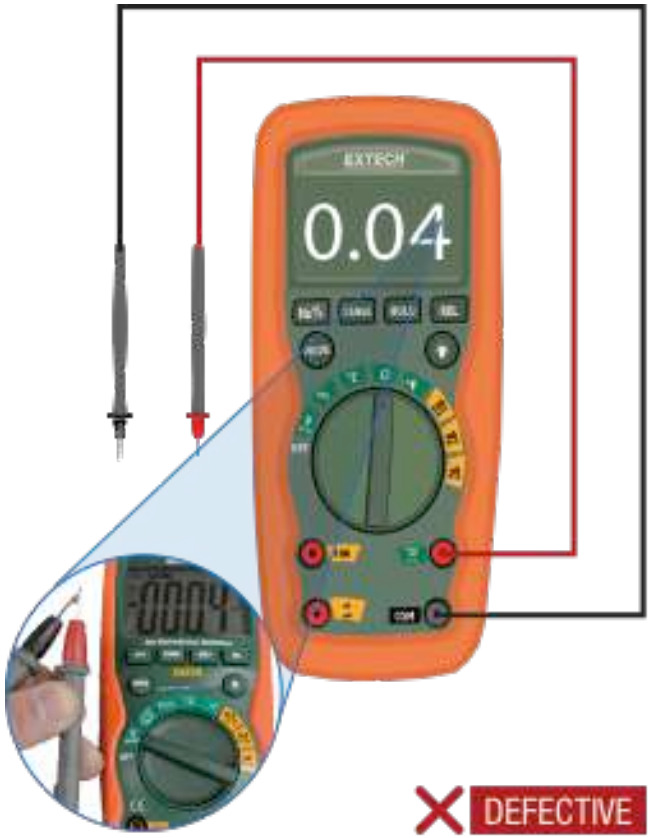


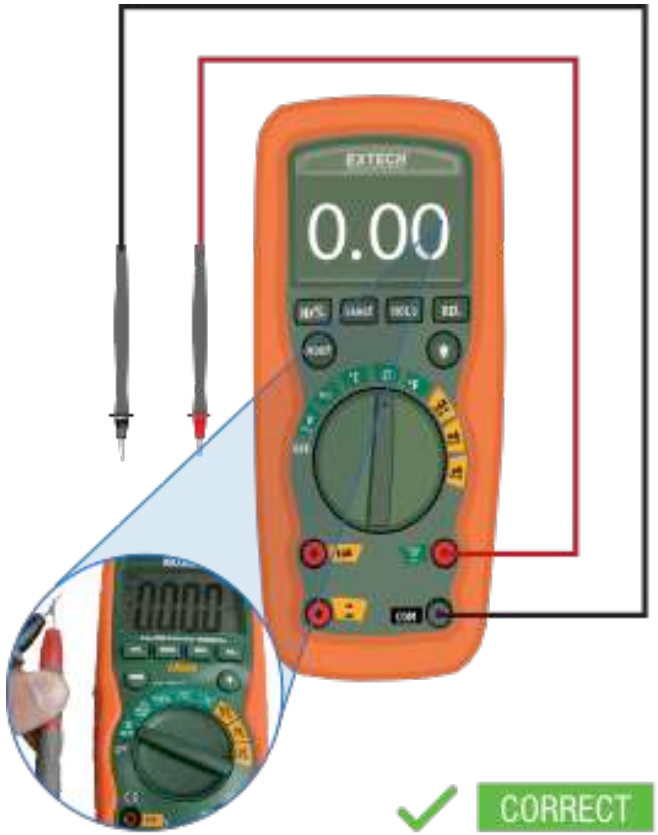
Pre-Check Multimeters

Check and Replace

Pre-Check Multimeters

Testing Leads and Meter

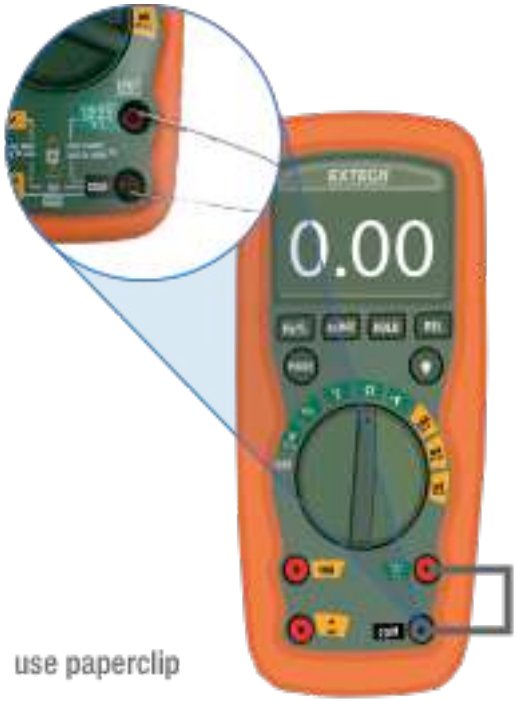




Pre-Check Multimeters

Testing Meter Only

DEFECTIVE



CORRECT

Pre-Check Multimeters

Testing Red Leads

DEFECTIVE

CORRECT

Pre-Check Multimeters

Testing Black Leads

DEFECTIVE

CORRECT

Pre-Check Multimeters

Auto Voltage Operation

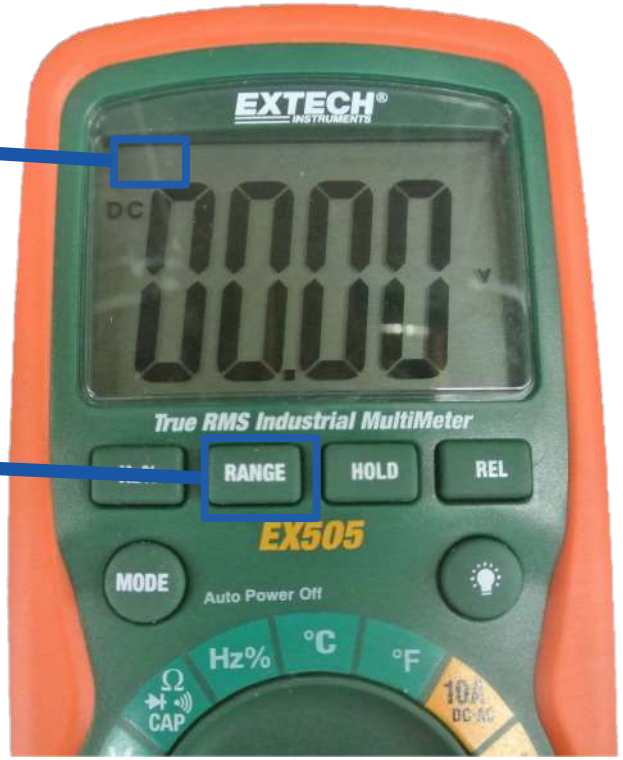
Will Automatically Move to the Proper Range

Pre-Check Multimeters

Manual Voltage Operation

No Icon

Push Range



Pre-Check Multimeters

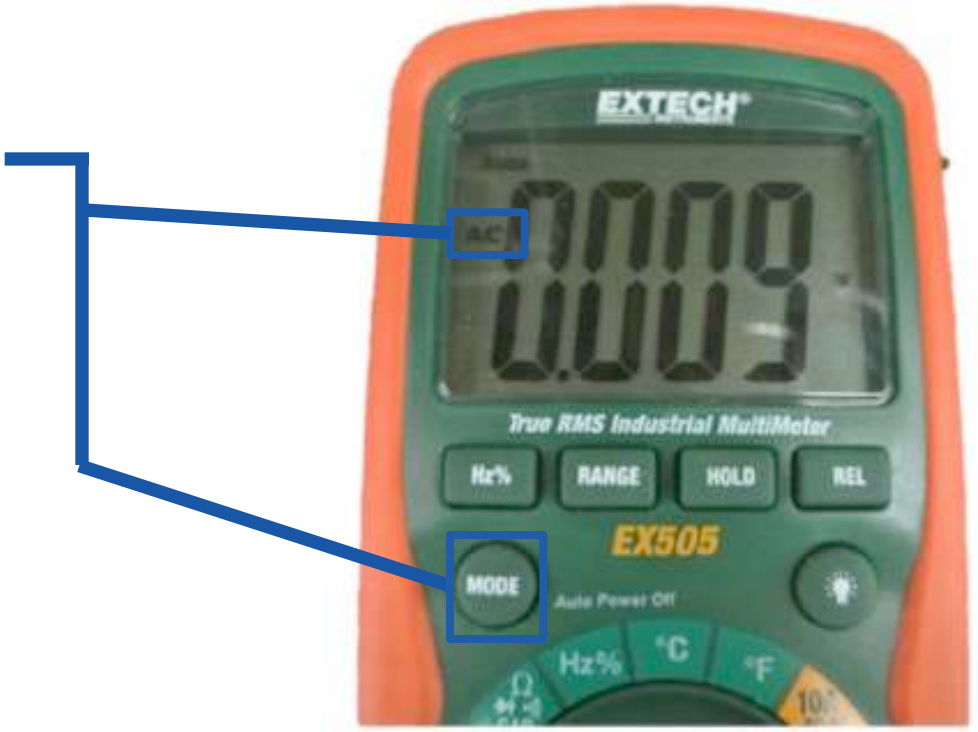
Hold Functions

Push Hold Button

AC Voltage Operation

Range 0 to 1000

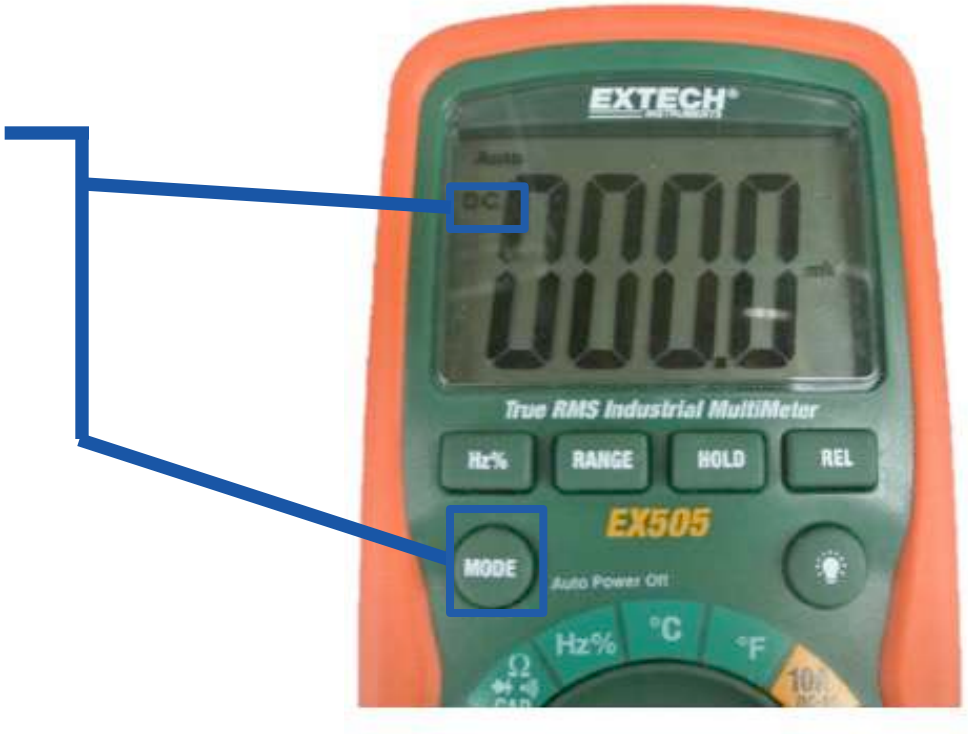
Press Mode Until You See the AC Symbol



DC Voltage Operation

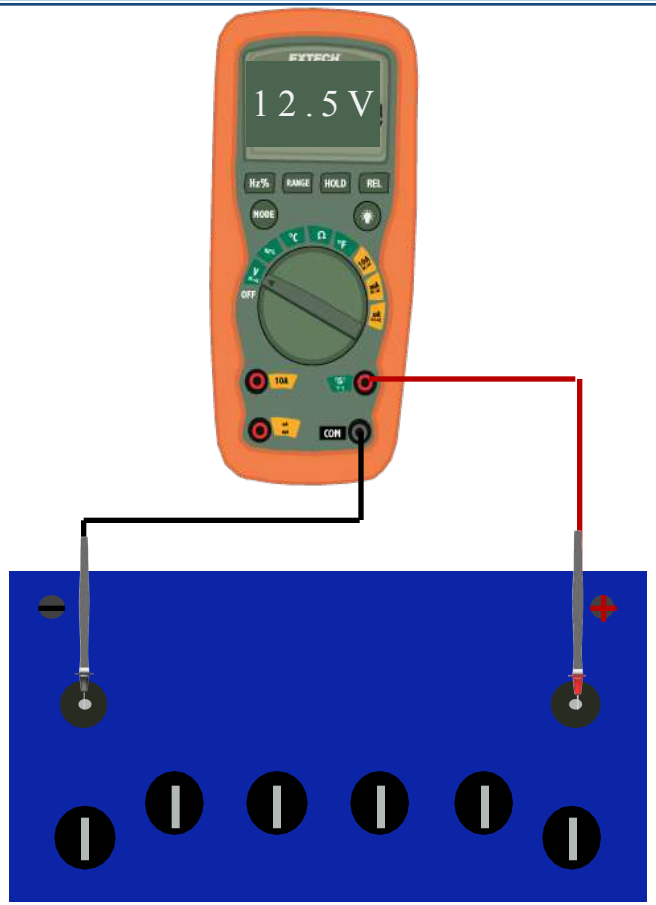
Range 0 to 750

Press Mode Until You See the DC Symbol



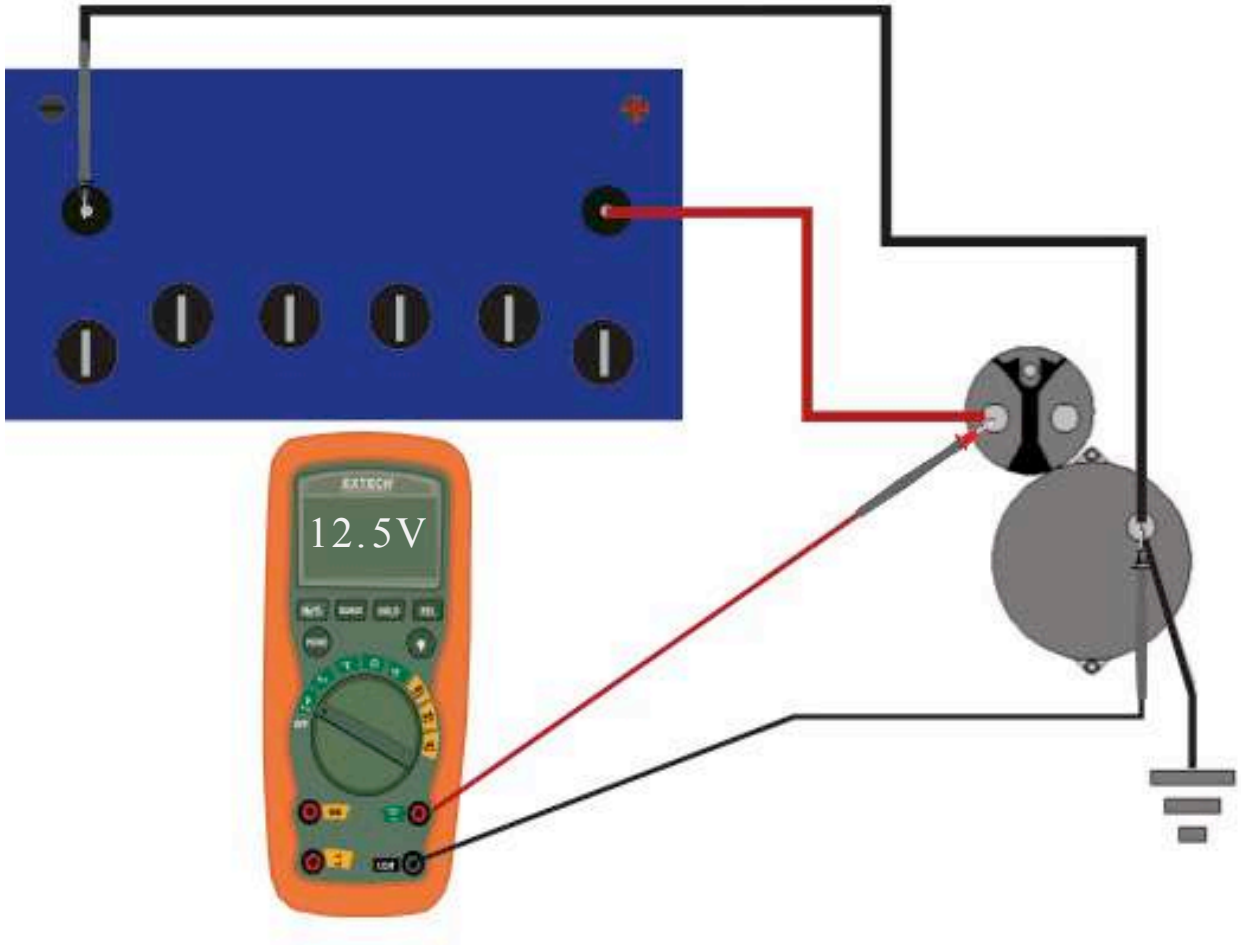
No Current Flowing

Red Lead:	12.5
Black Lead:	-0.00
	12.5



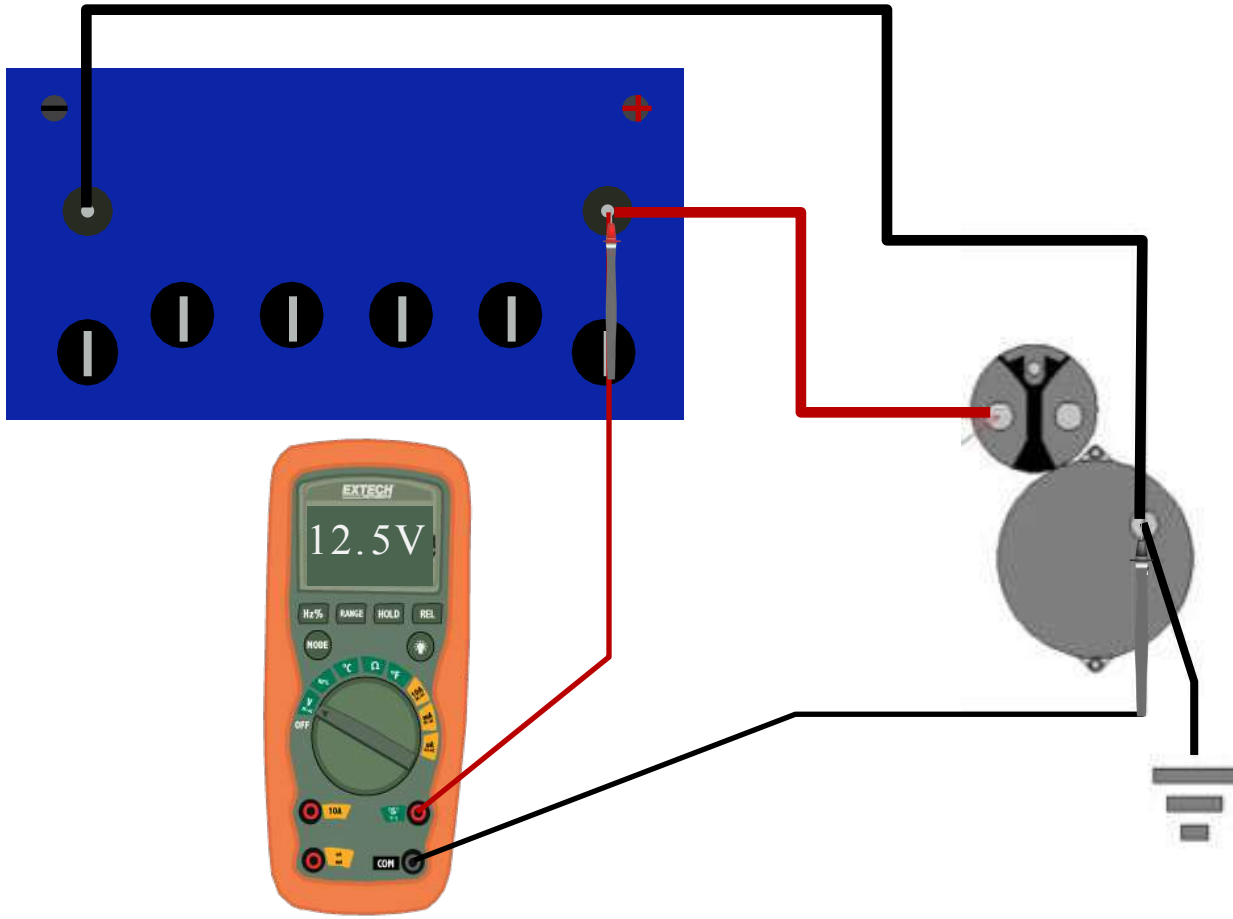
No Current Flowing

Red Lead:	12.5
Black Lead:	-0.00
	12.5



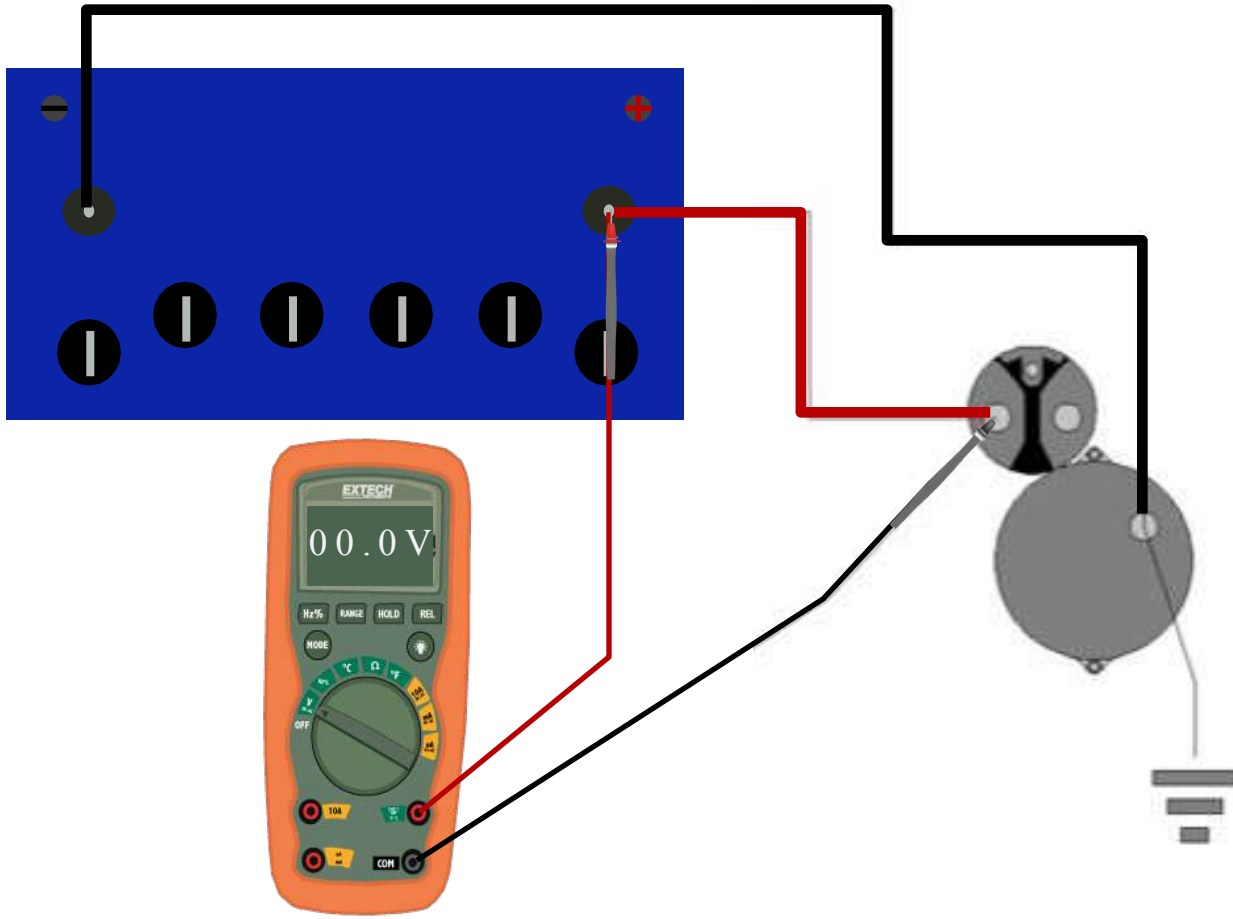
No Current Flowing

Red Lead:	12.5
Black Lead:	-0.00
	12.5



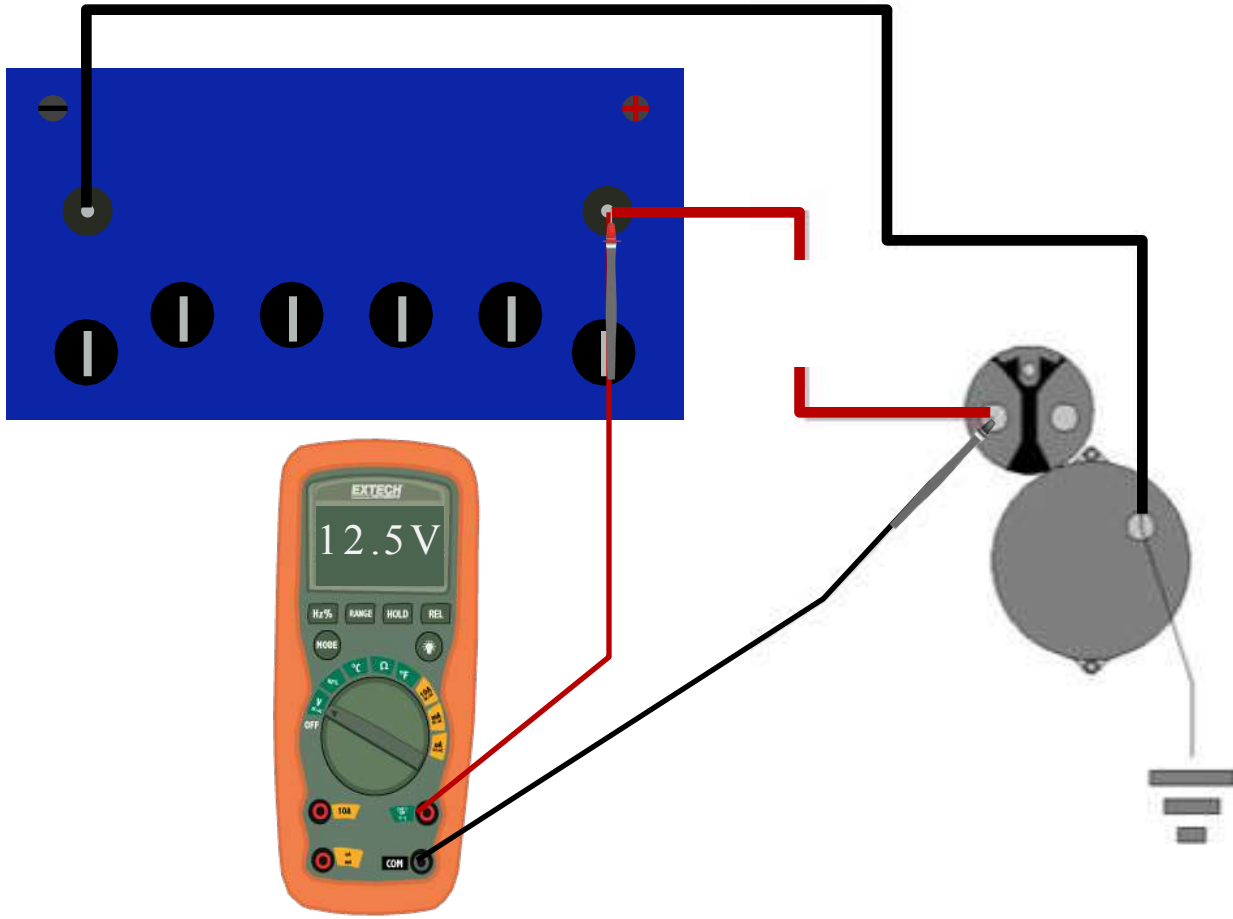
No Current Flowing

Red Lead:	12.5
Black Lead:	-12.5
	0.00



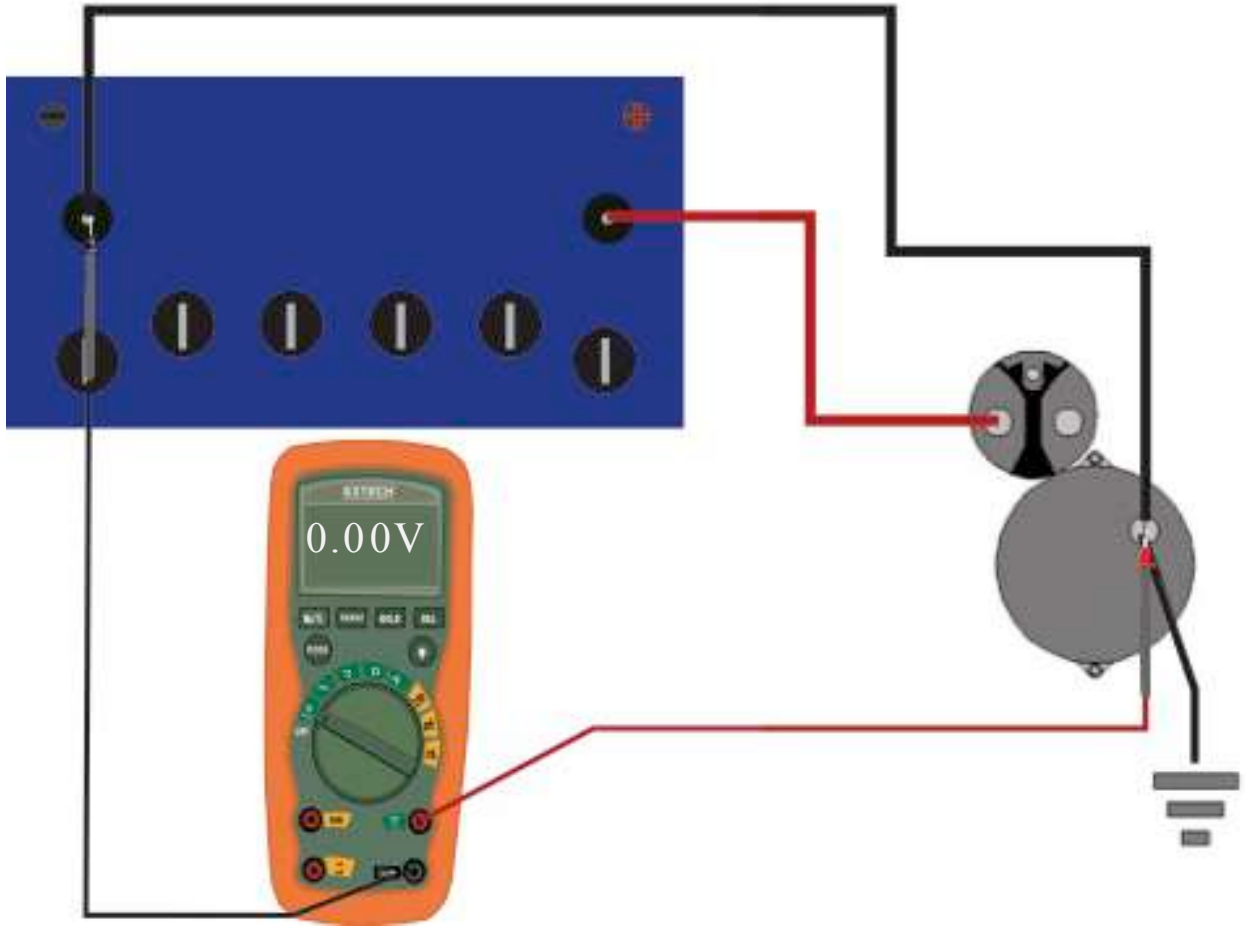
No Current Flowing

Red Lead:	12.5
Black Lead:	-0.00
	12.5



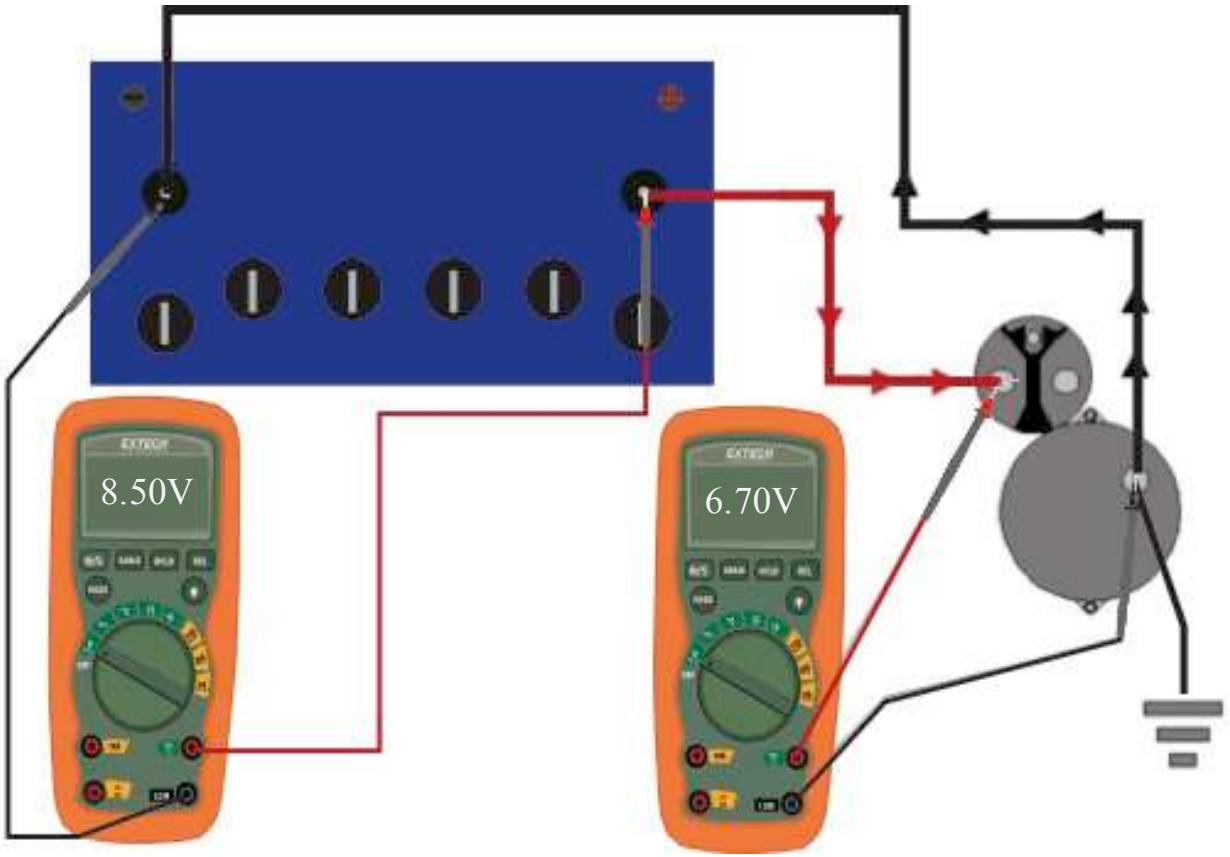
No Current Flowing

Red Lead:	0.00
Black Lead:	- 0.00
	0.00



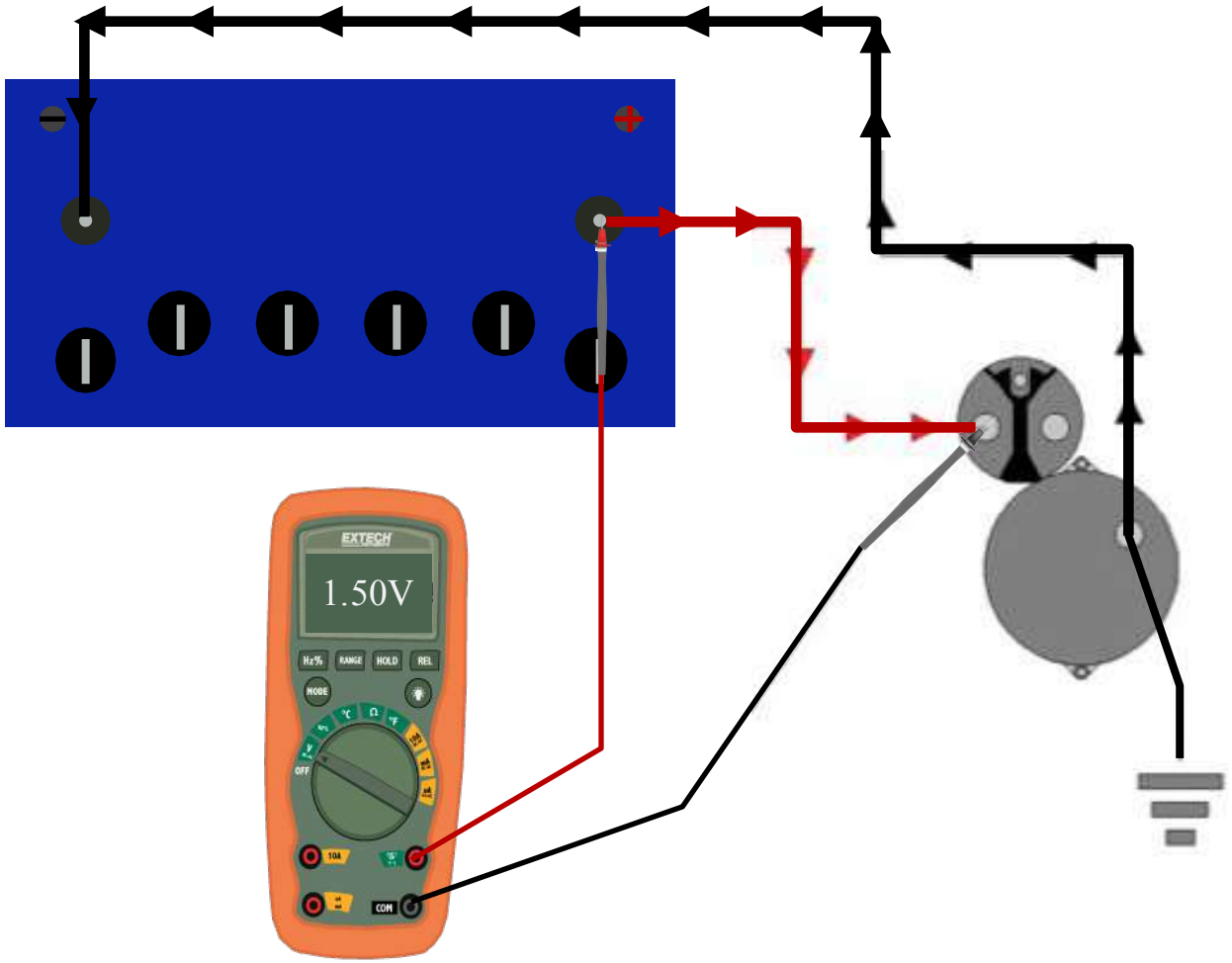
Current Flowing

Red Lead:	8.5
Black Lead:	- 0.00
	8.5
Red Lead:	7.0
Black Lead:	- 0.30
	6.70



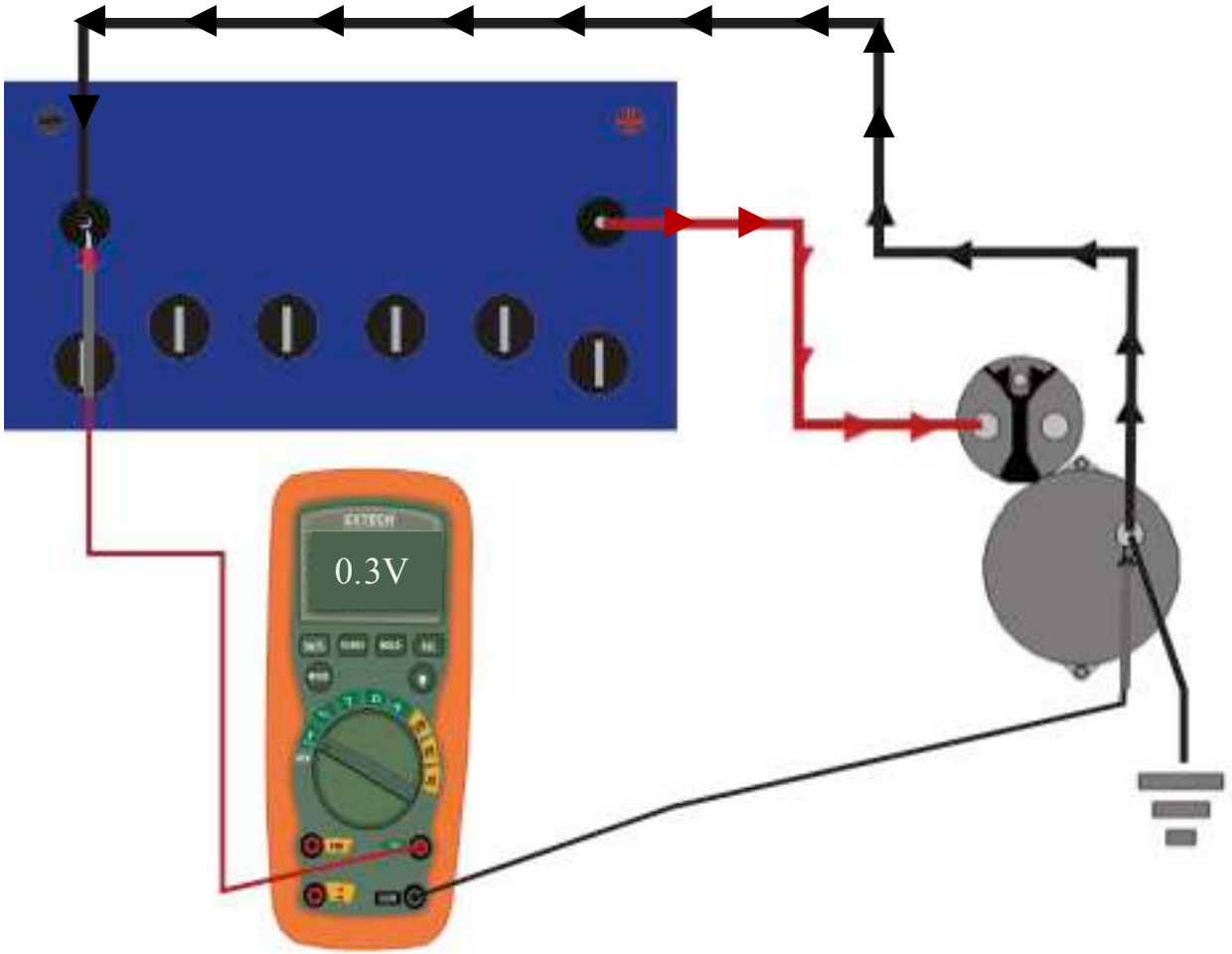
Current Flowing

Red Lead:	8.5
Black Lead:	- 7.0
	1.5



Current Flowing

Red Lead:	0.3
Black Lead:	- 0.0
	0.3



Must Have Current Flow to Have Voltage Drops

A Voltmeter Only Reads Voltage

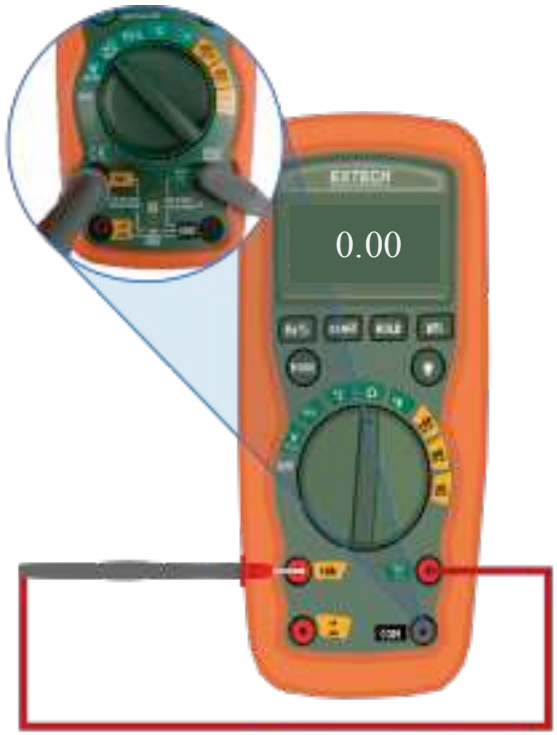
Using the Ammeter

Ammeter

Pre-Check Multimeters

Test Fuses (10 amp)

DEFECTIVE



CORRECT

Pre-Check Multimeters

Test Fuses (400 milliamp)

DEFECTIVE

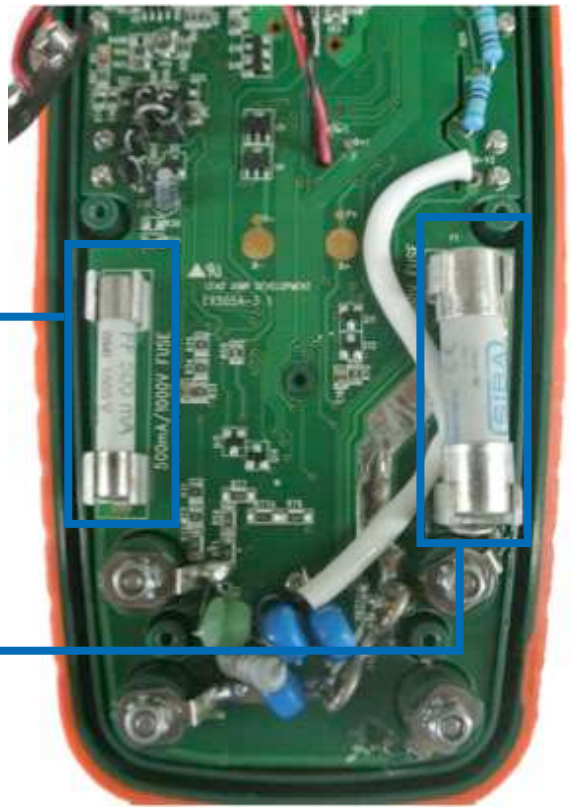
CORRECT

Pre-Check Multimeters

Replacing Fuses

.400 mA Fuse

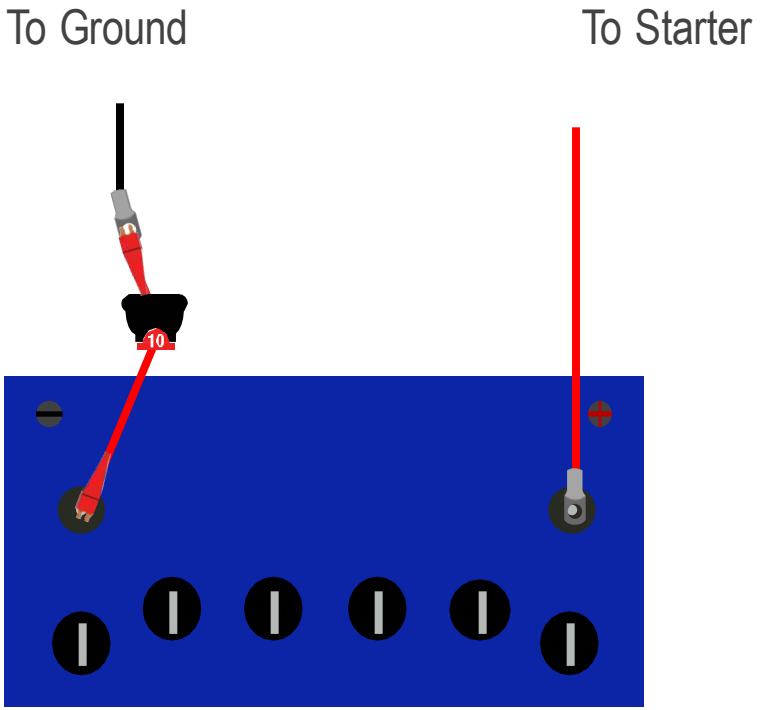
10A Fuse



Using In-Line Ammeter

Pretesting with a 10 amp fuse

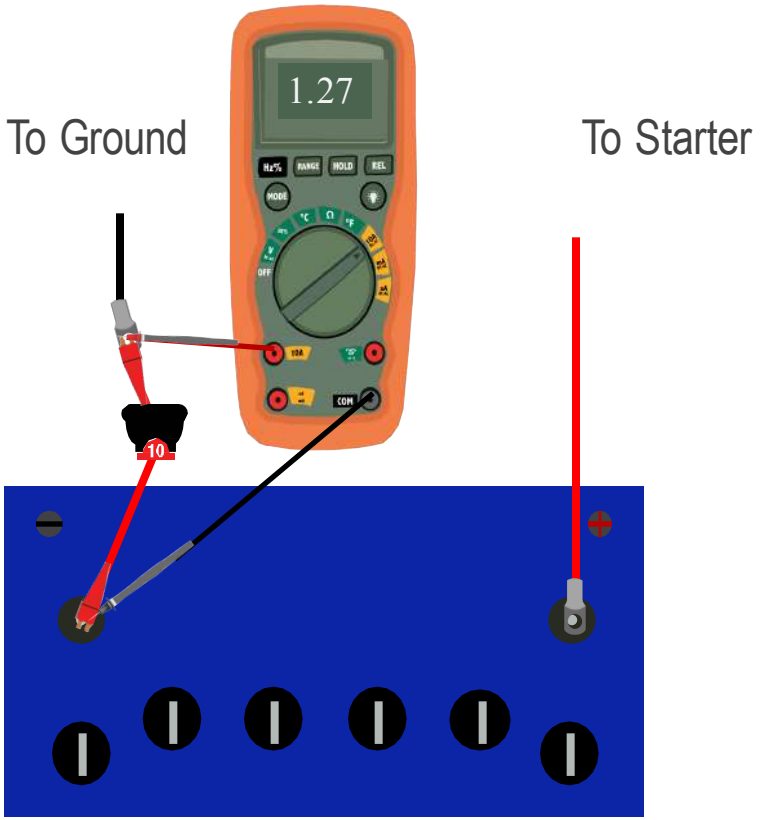
Remove the ground at the battery and place a 10 amp fuse assembly in series. If the fuse blows the current level is over 10 amps. DO NOT placeyour meter in this circuit, it will blow the internal meter fuse.



Using In-Line Ammeter

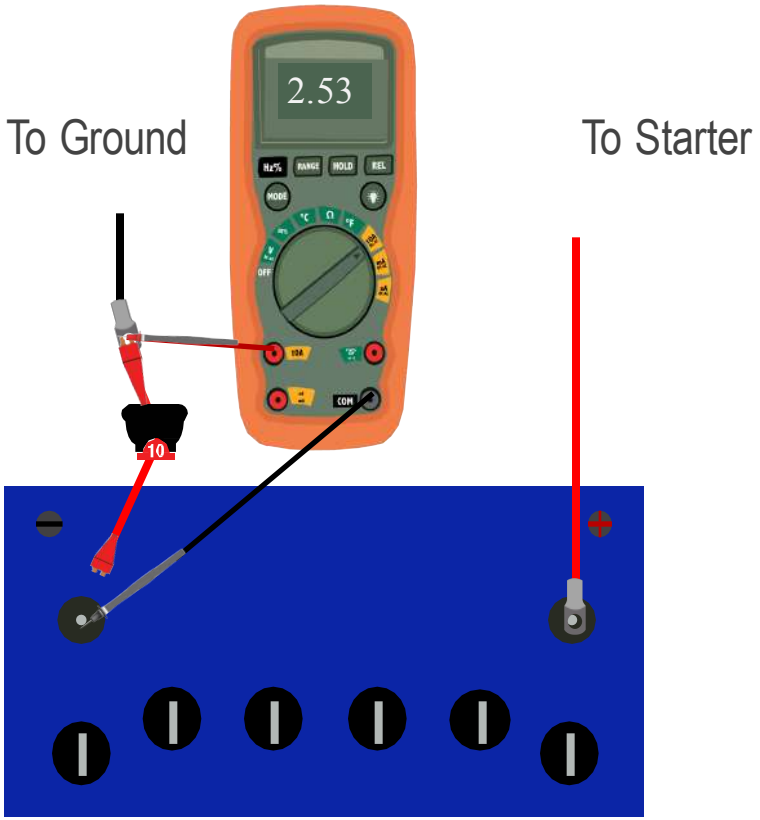
Pretesting with a 10 amp fuse

Move the red lead to the 10 amp connector hole and turn the rotary switch to amp “DC”. Place the red lead on the terminal of the cable and place the black lead on the battery post.



Using In-Line Ammeter

In this example, 2.53 amps flow from the battery to the light, then through the light to the read lead. The current then flows through the meter, then back to the battery through the black lead.



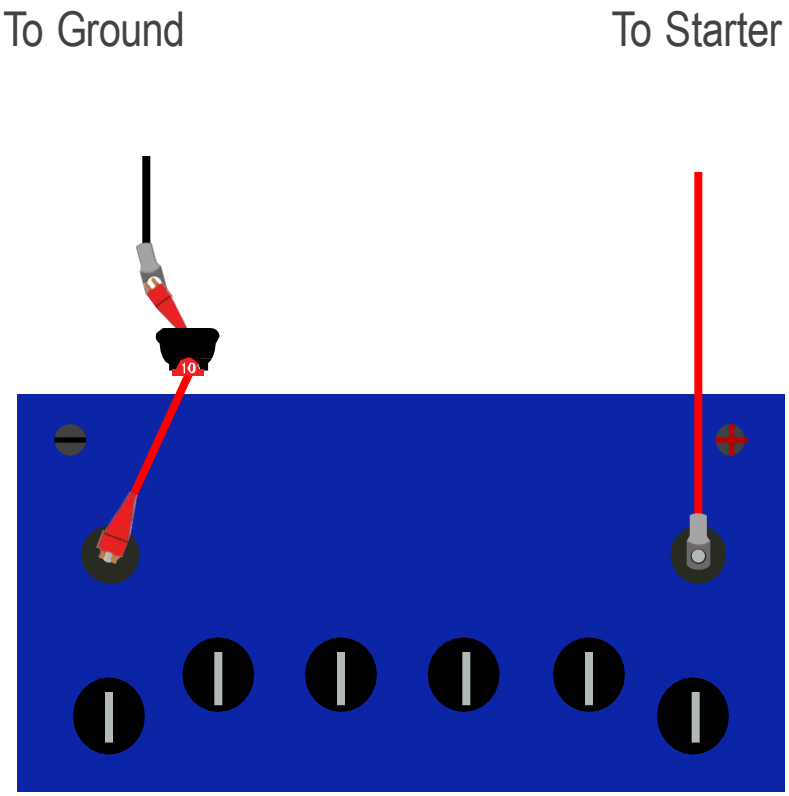
Using In-Line Ammeter

Pretesting with a 10 amp fuse

If the ammeter reads 0 to .40, you may have the range set too high. To protect the meter from surges insert the fuse assembly between the cable connection and the batter ground.

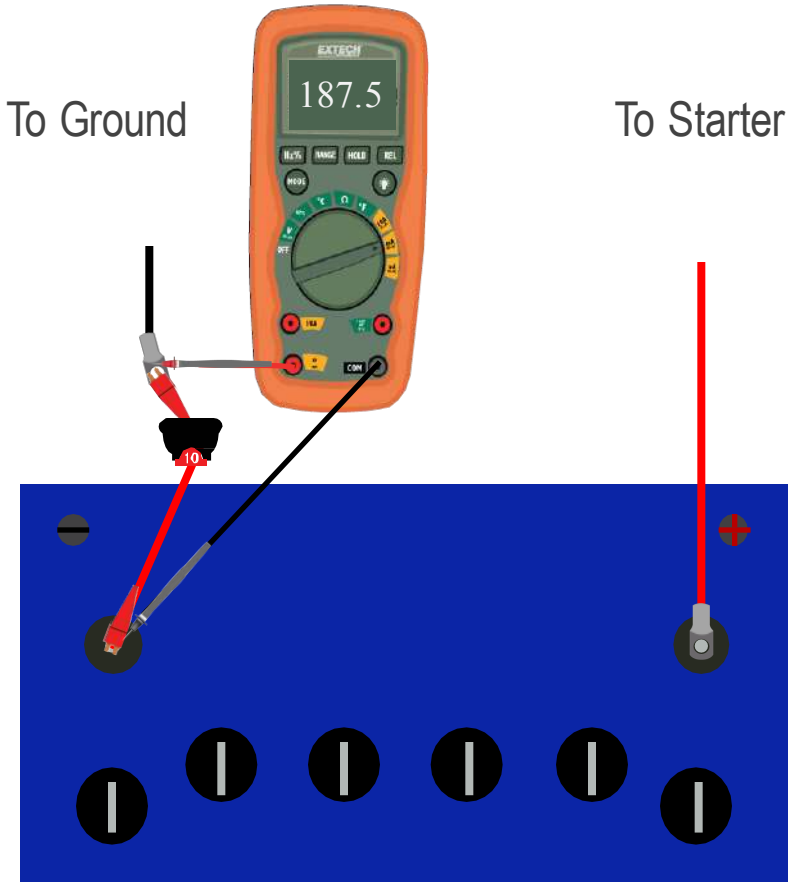
Move the red lead to the 400 mA connector hole and turn the rotary dial to “mA”. Remove the test fuse and read the display.

Remember the meter is reading milliamps. A 25 on this scale means 25mA, which equals .025 amps.



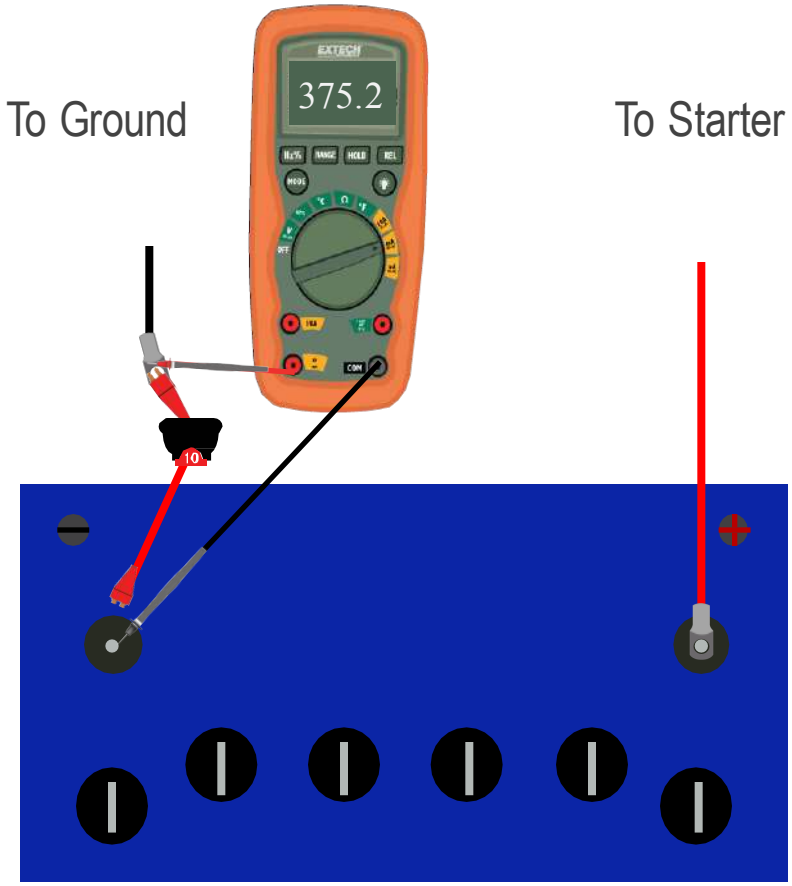
Using In-Line Ammeter

- 1 mA= .001 Amps
- 400 mA= .4 Amps

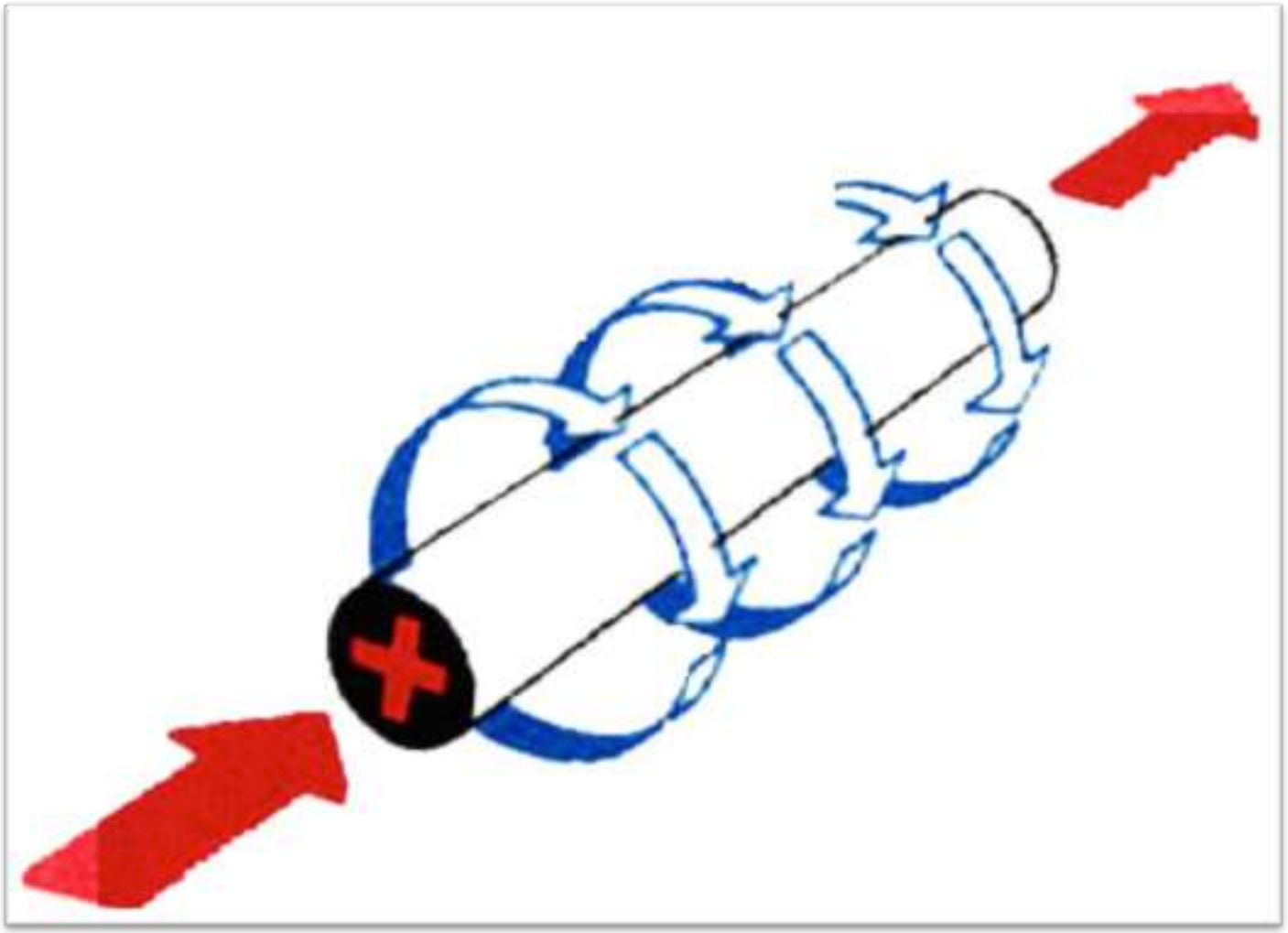


Using In-Line Ammeter

This is a very small amount of current. Be sure to use care when the meter is in this range. DO NOT open the tractor's door or turn on any loads that exceeds .4 amps because is will blow the 400mA fuse.



Magnetic Flux



Clip - On

OFF
400A
40A
ZERO
HOLD
AUTO
POWER
OFF
CE
00.00
EXTECH
DC CURRENT CLAMP METER DC400

Clip - On

Clip Around Wire/Cable Being Measured

- Jaws Must Close Completely
- Must Zero Out Each Time
- Observe Arrow to Direction of Current Flow

Ammeter

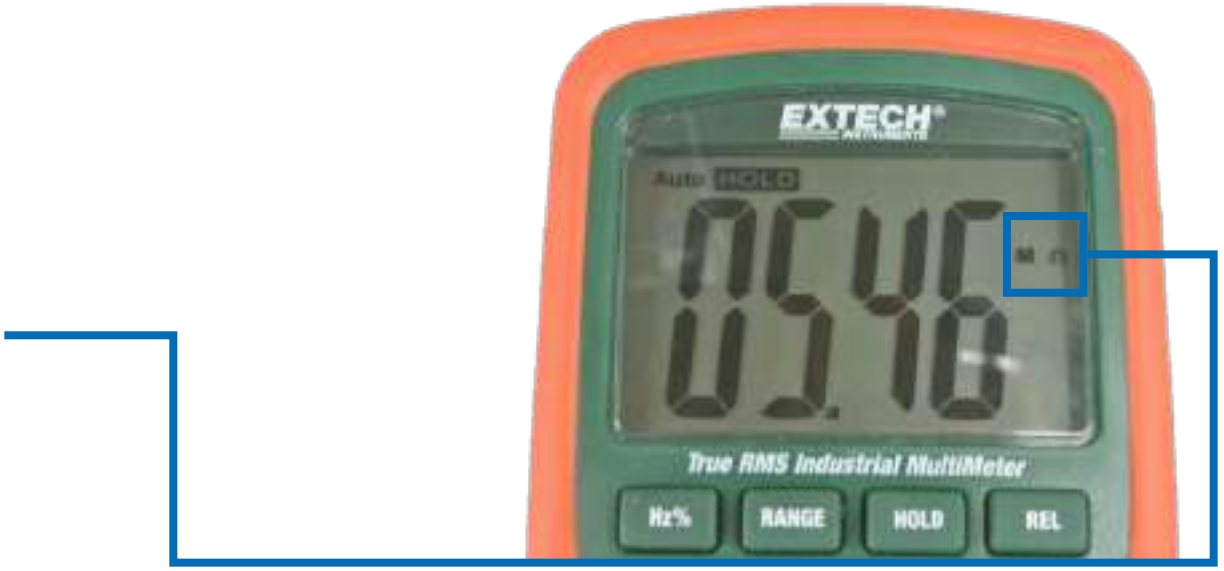
Ammeter Only Measures Current Flow

Ohmmeter

Ohmmeter

Position #1

- 5.46 M Ω



Ohmmeter

Position #1

- 5.46 M Ω

- M= 10^{+6}
- 5,460,000 Ohms

Ohmmeter

Position #2

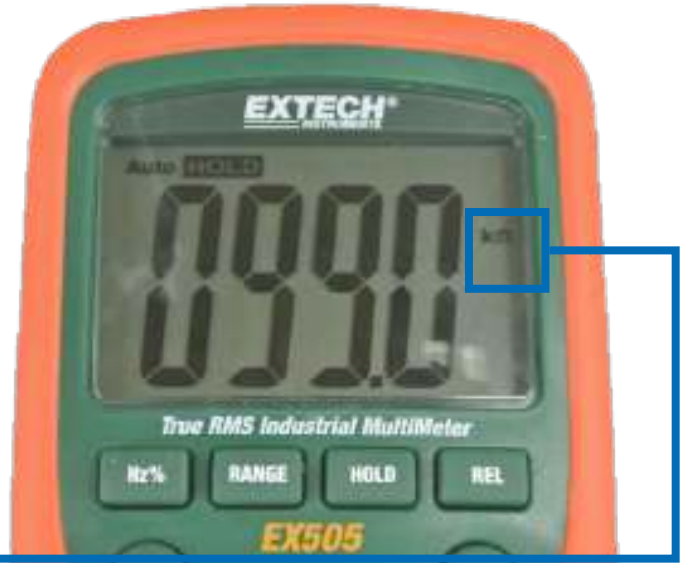
- 99.0 K Ω

Ohmmeter

Position #2

- 99.0 k Ω

- k = 10^{+3}
- 99,000 Ohms



Ohmmeter

Position #3

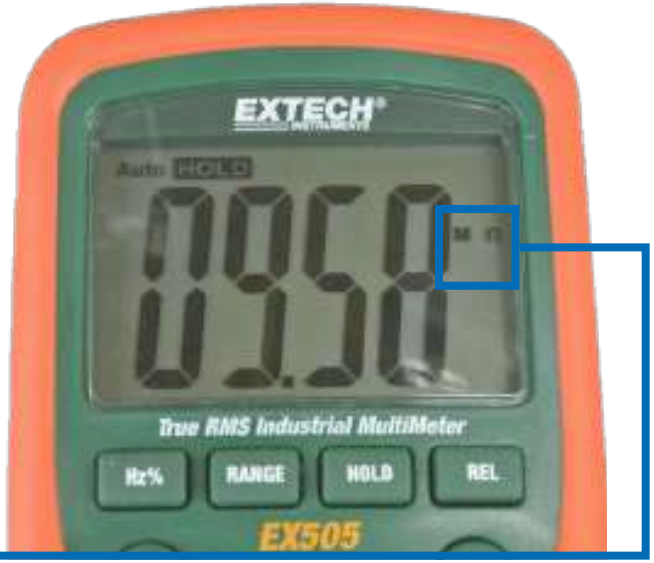
- 9.58 M Ω

Ohmmeter

Position #3

- 9.58 M Ω

- M= 10^{+6}
- 9,580,000 Ohms



Ohmmeter

Position #4

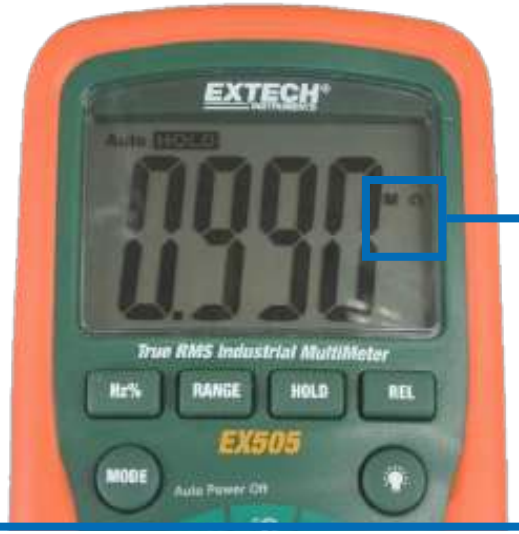
- .990 M Ω

Ohmmeter

Position #4

- .990 M Ω

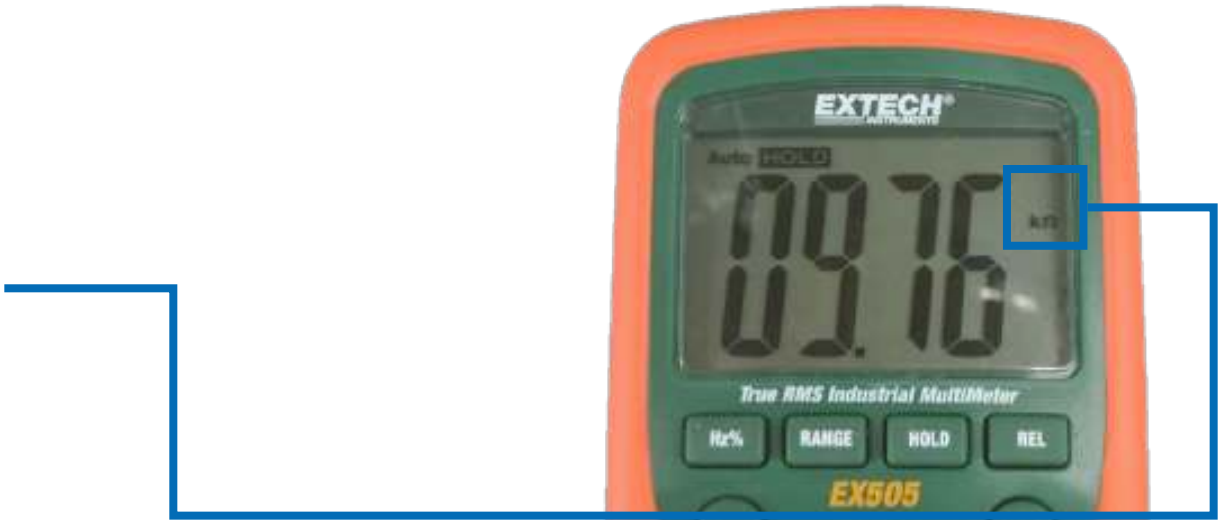
- M= 10^{+6}
- 990,000 Ohms



Ohmmeter

Position #5

- 9.76 k Ω



Ohmmeter

Position #5

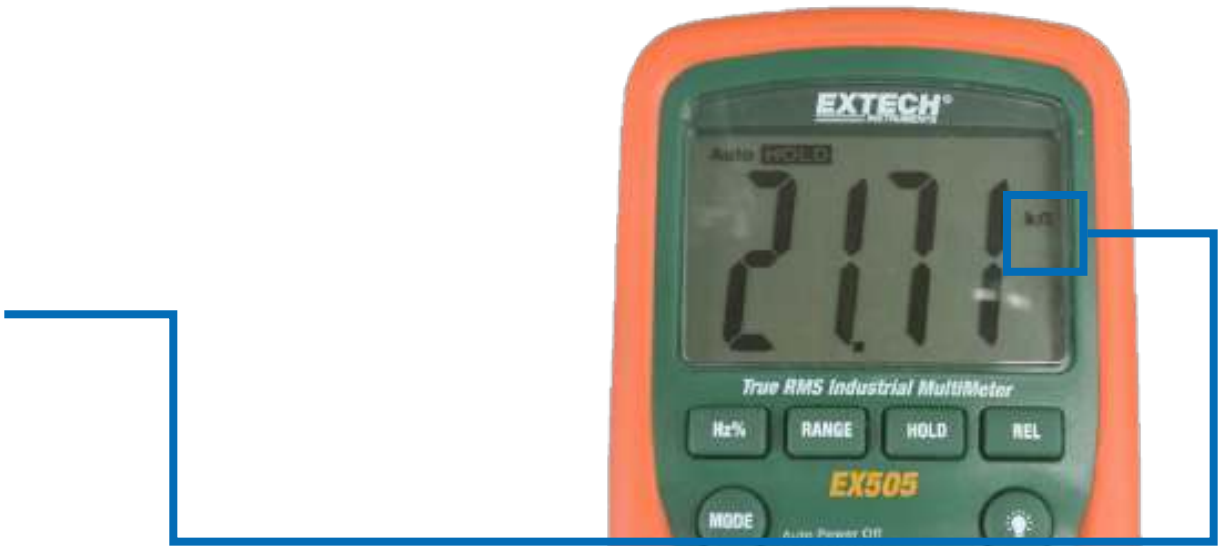
- 9.76 k Ω

- k= 10 $^{+3}$
- 9,760 Ohms

Ohmmeter

Position #6

- 21.71 k Ω



Ohmmeter

Position #6

- 21.71 k Ω

- k= 10 $^{+3}$
- 21,710 Ohms

Ohmmeter

Position #7

- .546 k Ω

Ohmmeter

Position #7

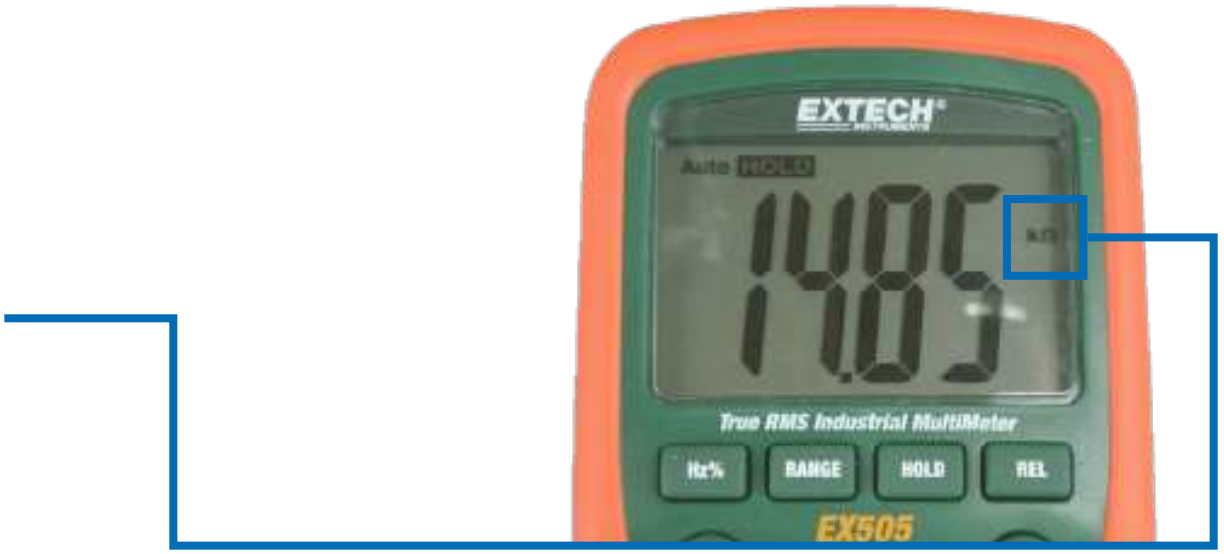
- .546 k Ω

- k= 10 $^{+3}$
- 546 Ohms

Ohmmeter

Position #8

- 14.85 k Ω

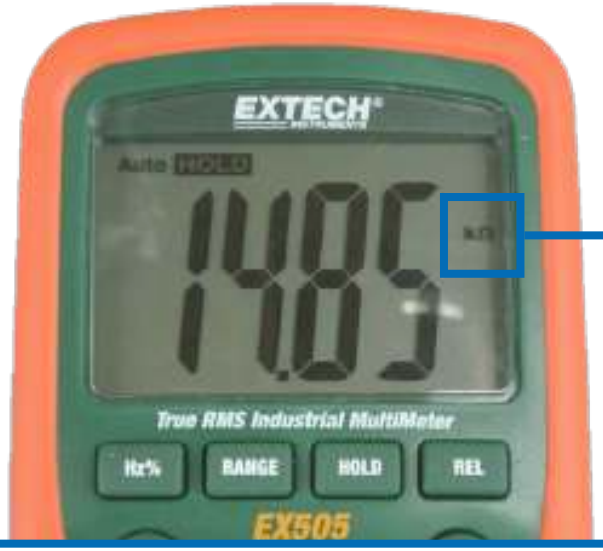


Ohmmeter

Position #8

- 14.85 k Ω

- k= 10 $^{+3}$
- 14,850 Ohms



Ohmmeter

Position #9

- .983 k Ω

Ohmmeter

Position #9

- .983 k Ω

- k= 10 $^{+3}$
- 983 Ohms

Ohmmeter

Position #10

- 3.239 k Ω

Ohmmeter

Position #10

- 3.239 k Ω

- k= 10 $^{+3}$
- 3,293 Ohms

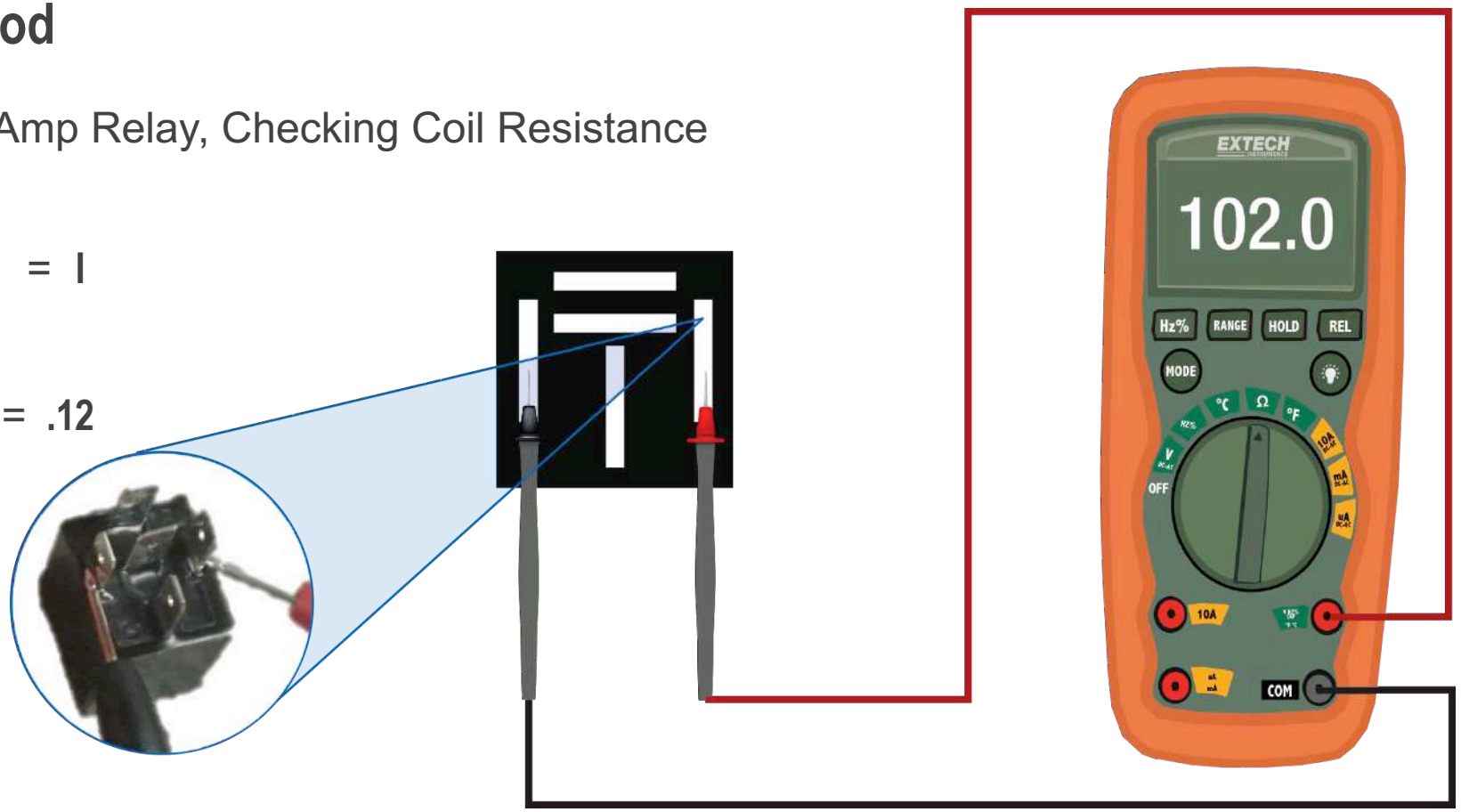
Ohmmeter

Good

30 Amp Relay, Checking Coil Resistance

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

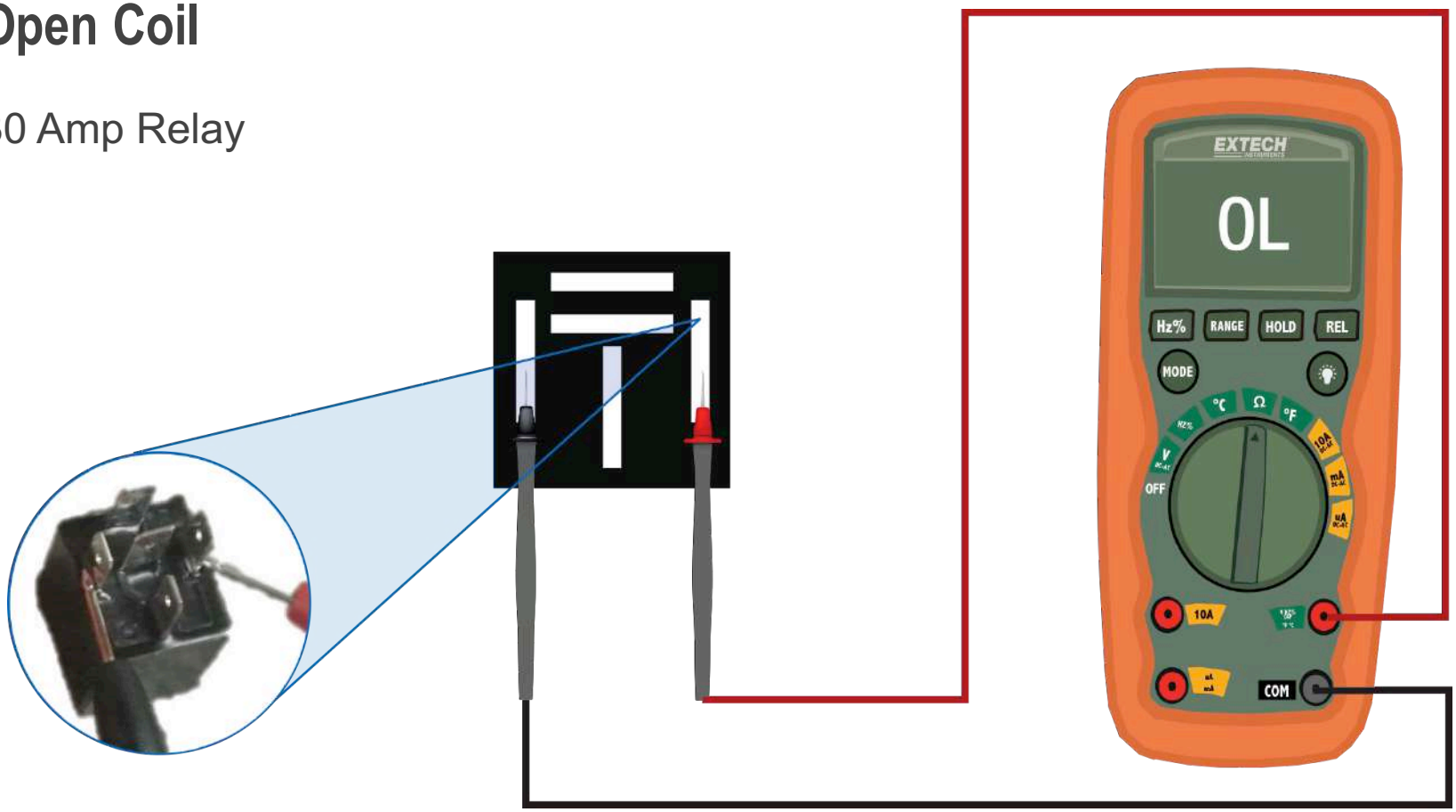
$$\frac{12.5}{102} = .12$$



Ohmmeter

Open Coil

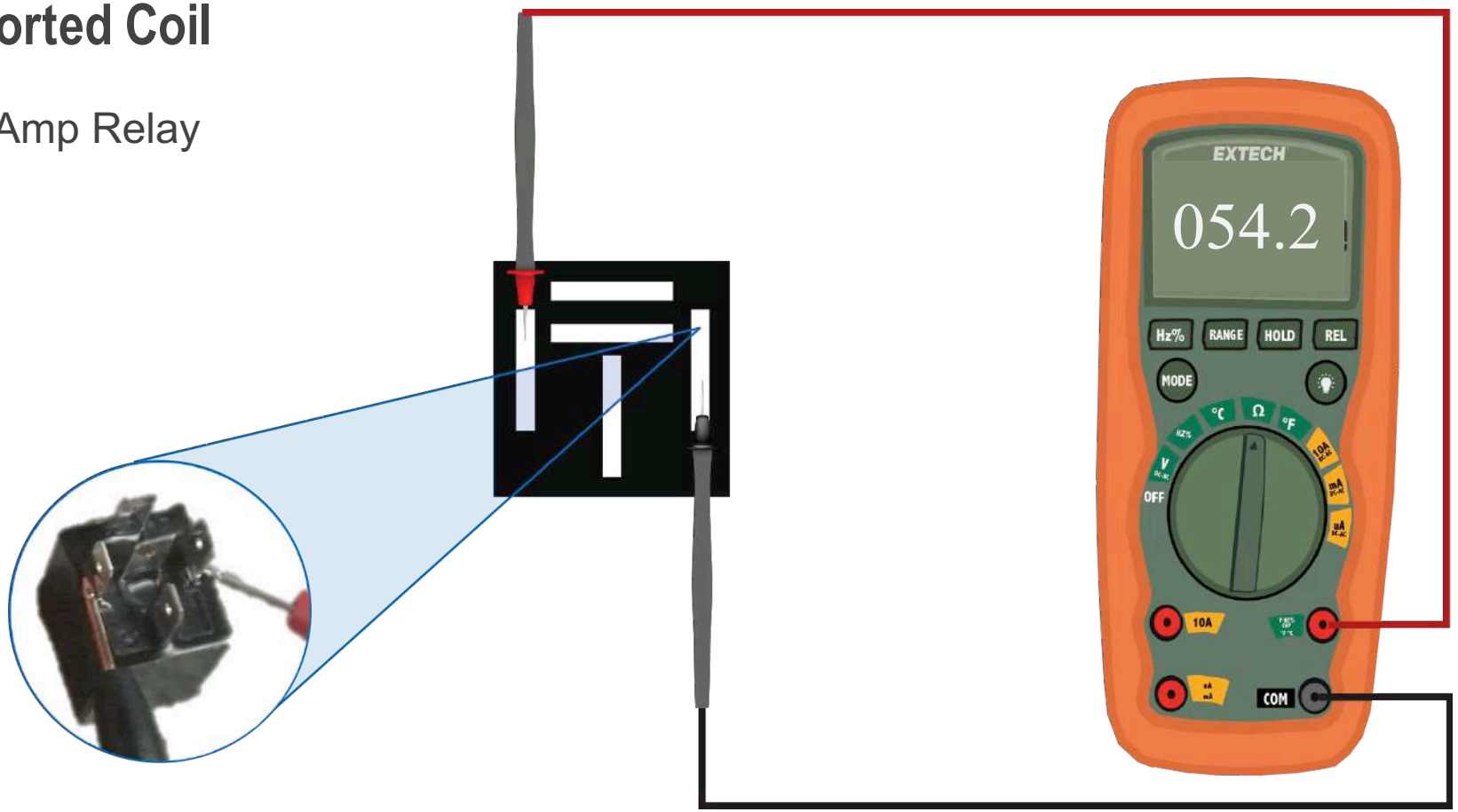
30 Amp Relay



Ohmmeter

Shorted Coil

30 Amp Relay



Ohmmeter

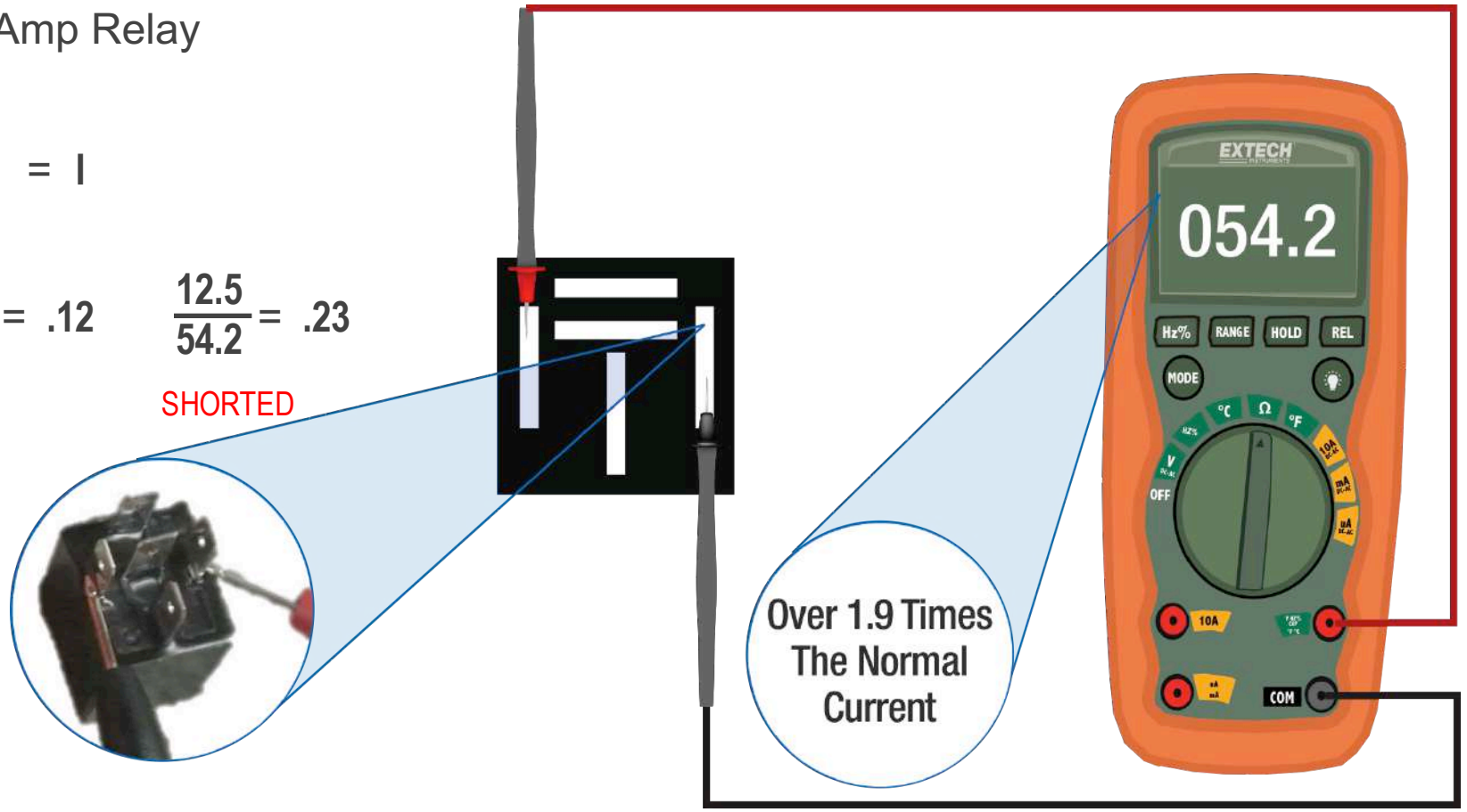
Good

30 Amp Relay

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

$$\frac{12.5}{102} = .12 \qquad \frac{12.5}{54.2} = .23$$

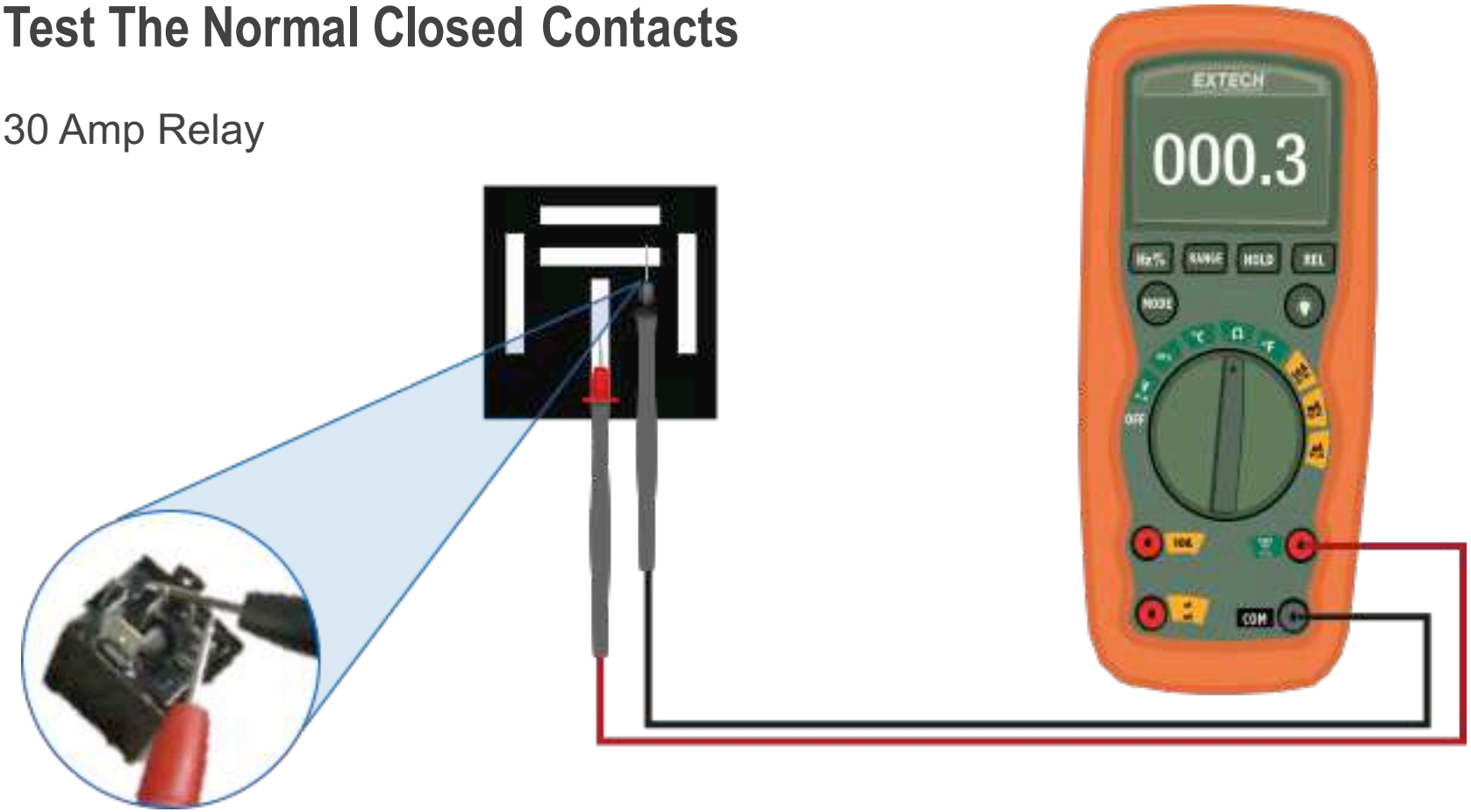
GOOD SHORTED



Ohmmeter

Test The Normal Closed Contacts

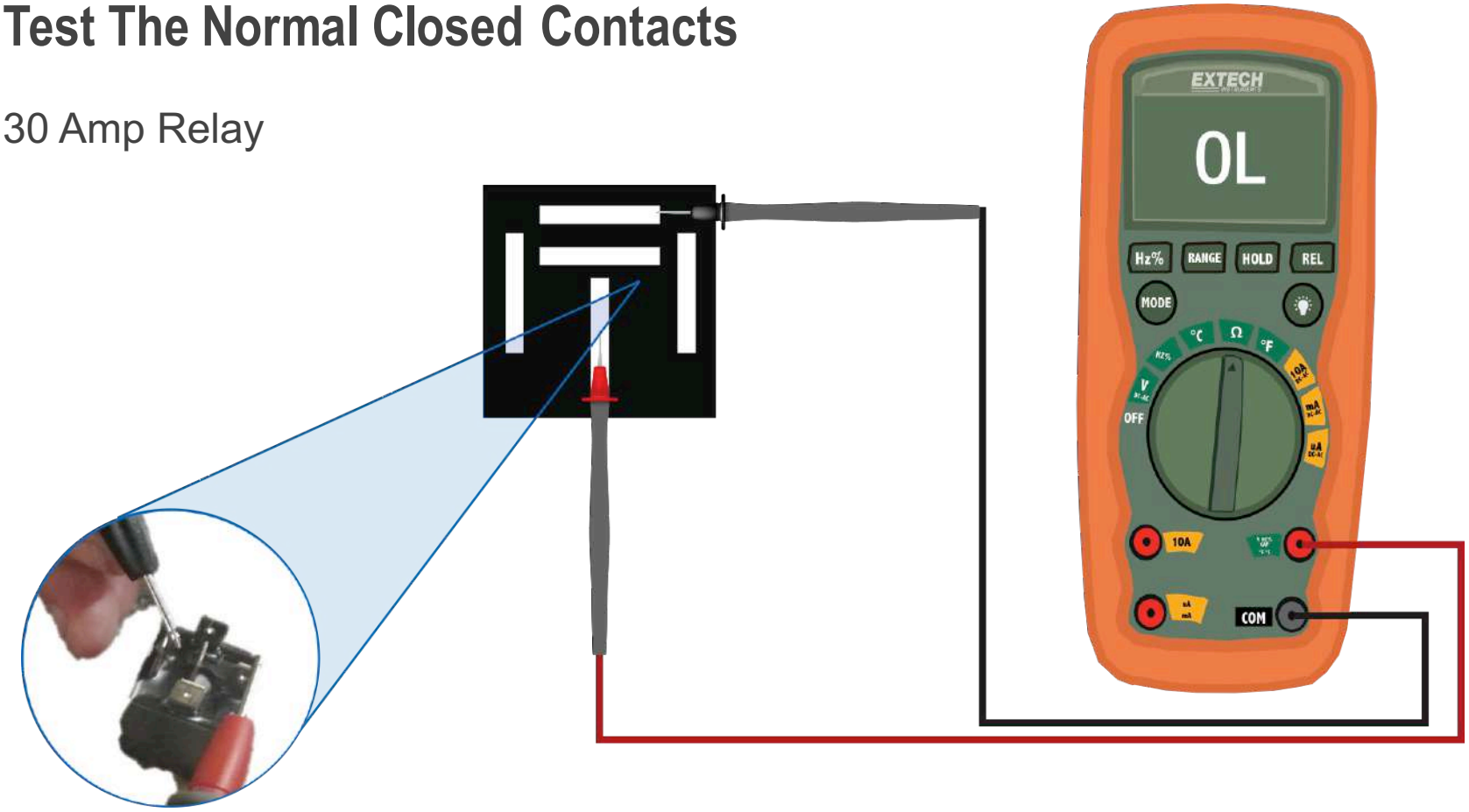
30 Amp Relay



Ohmmeter

Test The Normal Closed Contacts

30 Amp Relay

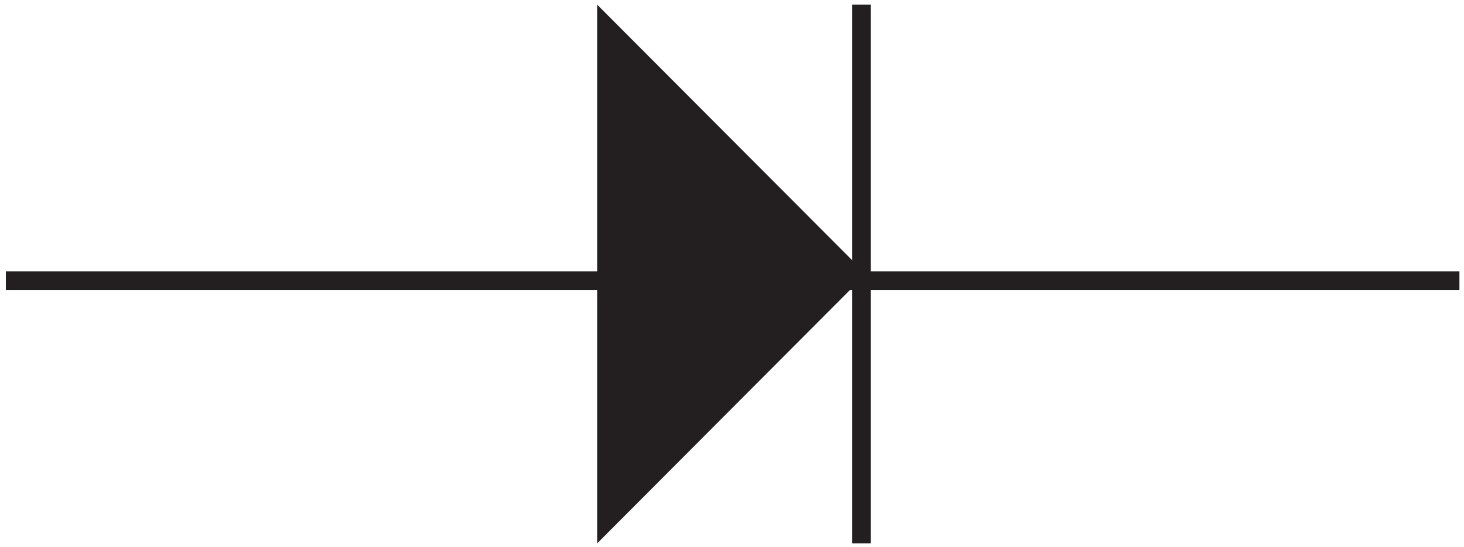


Ohmmeter

Only Measures Resistance

Diode Check

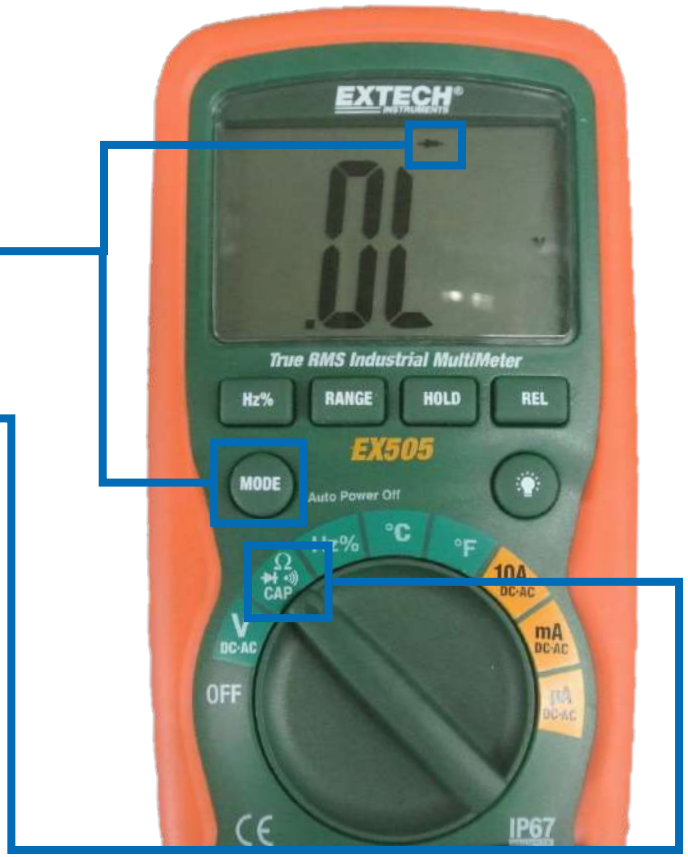
Electrical One-Way Check Value



Diode Testing

Digital Multimeter MUST Be Set to Test Diode

- Press Mode Until You See Diode Symbol
- Must Provide Enough Voltage to Forward Bias Diode

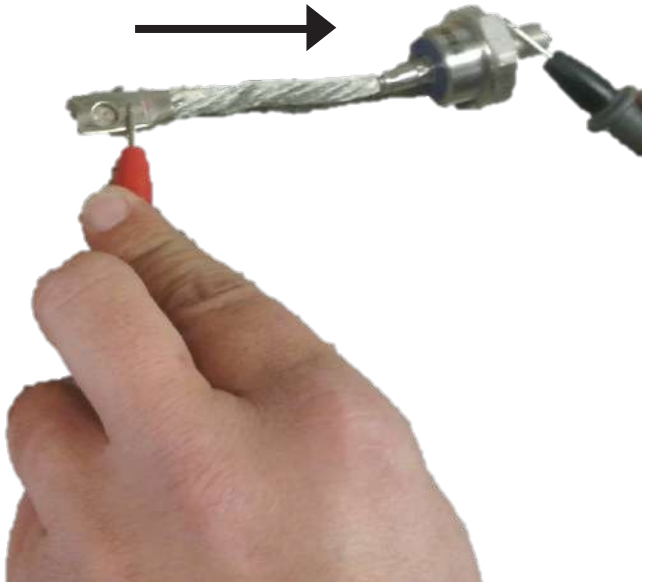


Diode Testing

Current Can't Flow This Direction

Diode Testing

Current Flows This Direction .3 to .6 Voltage Drop



Diode Testing

Open

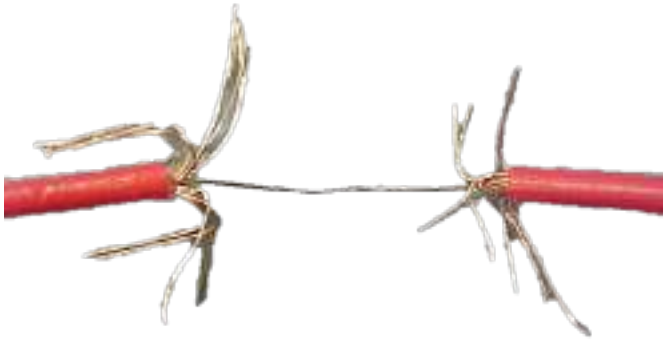
Diode Testing

Shorted

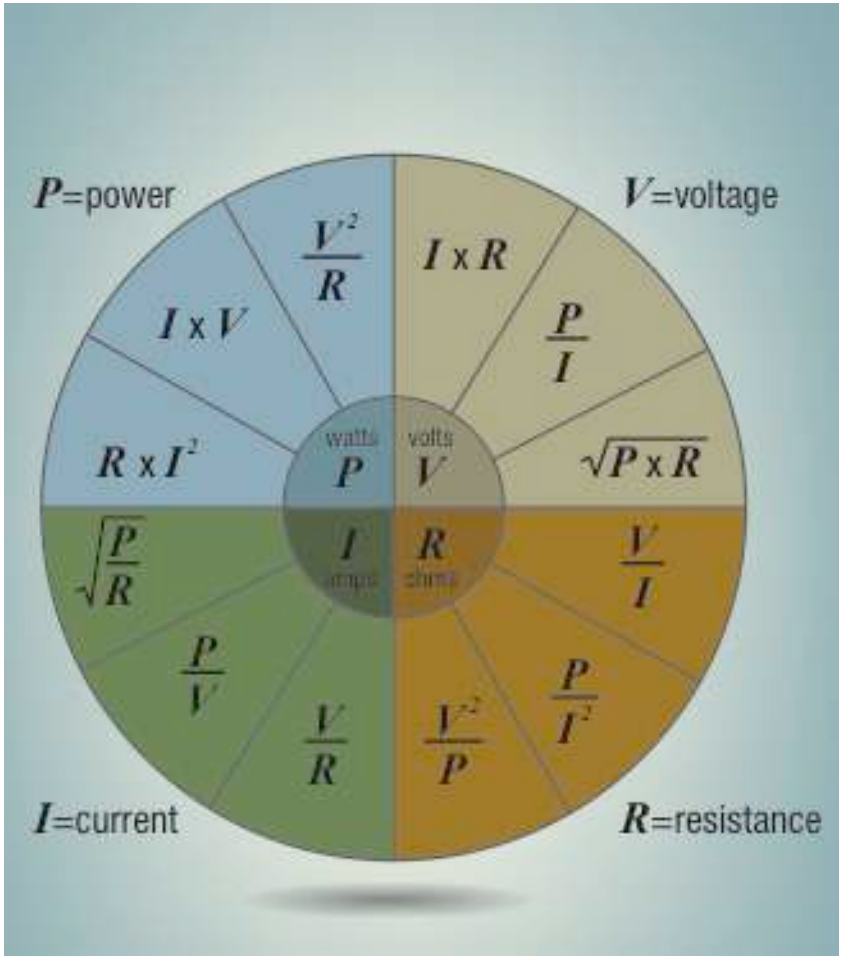
Diode Testing

Continuity Test – (beeps)

- If all but one of the strands are broken it will still show continuity.
- It will not handle the current load.



Meter Cheat Sheet



METER RERERENCE SHEET

X > 10 value of x is greater than 10
X < 10 value of x is less than 10
X ≥ 10 value of x is equal to or greater than 10
X ≤ 10 value of x is equal to or less than 10

Voltage Drop Calculations

m = Thousandth Part....10^{-3} (.000)

Voltage and Amperage Calculations

k = Thousand Fold.....10^{3} (1,000)
M = Million Fold.....10^{6} (1,000,000)

EXAMPLES

3.15 MΩ	=	3.15 Ω	x	10^{6}	=	3,150,000 Ω
0.85 MΩ	=	0.85 Ω	x	10^{6}	=	850,000 Ω
21.02 MΩ	=	21.02 Ω	x	10^{6}	=	21,020,000 Ω
26.32 kΩ	=	26.32 Ω	x	10^{3}	=	26,320 Ω
2.156 kΩ	=	2.156 Ω	x	10^{3}	=	2,156 Ω
0.952 kΩ	=	0.952 Ω	x	10^{3}	=	952 Ω
3.4 Ω	=	3.4 Ω	x	1	=	3.4 Ω
28.6 Ω	=	28.6 Ω	x	1	=	28.6 Ω

Questions & Answers

Thank you!