REMINDER:
This Webinar is being Recorded
Please Turn Off Cell Phones
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 fleet’s 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

[Images of a multimeter showing a reading of 0.04 in the left image and 0.00 in the right image, indicating defective and correct states respectively.]
Pre-Check Multimeters

Testing Meter Only

[Images showing a multimeter with DEFECTIVE and CORRECT indicators with the use of paperclips highlighted]
Pre-Check Multimeters

Testing Red Leads

[Image: A multimeter showing a reading of 0.00 labeled as correct, and another showing a defective red lead with the label 'DEFECTIVE'.]
Pre-Check Multimeters

Testing Black Leads

[Image of a multimeter showing a reading of 0.8 labeled 'DEFECTIVE']

[Image of a multimeter showing a reading of 0.00 labeled '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

0.00V
Current Flowing

Red Lead: 8.5
Black Lead: -0.00

Red Lead: 7.0
Black Lead: -0.30
Current Flowing

Red Lead: 8.5
Black Lead: -7.0

1.5 V
Current Flowing

Red Lead: 0.3
Black Lead: -0.0

0.3V
Must Have Current Flow to Have Voltage Drops

A Voltmeter Only Reads Voltage
Using the Ammeter

Ammeter
Pre-Check Multimeters

Test Fuses (10 amp)
Pre-Check Multimeters

Test Fuses (400 milliamp)

OL

15.8

× 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 place your 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 battery 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 = 0.001 Amps
- 400 mA = 0.4 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 it will blow the 400mA fuse.
Magnetic Flux
Clip - On
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 Only Measures Current Flow
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 KΩ
Ohmmeter

Position #2

- 99.0 kΩ

- \( k = 10^3 \)
- 99,000 Ohms
Ohmmeter

Position #3

- 9.58 MΩ
Ohmmeter

Position #3

- 9.58 MΩ
- M = 10^6
- 9,580,000 Ohms
Ohmmeter

Position #4

- .990 MΩ
Ohmmeter

Position #4

• .990 M Ω

• M = 10^{+6}
• 990,000 Ohms
Ohmmeter

Position #5

- 9.76 kΩ
Ohmmeter

Position #5

- 9.76 kΩ

- k = 10^3
- 9,760 Ohms
Ohmmeter

Position #6

- 21.71 kΩ
Ohmmeter

Position #6

- 21.71 kΩ
- $k = 10^3$
- 21,710 Ohms
Ohmmeter

Position #7

• 0.546 kΩ
Ohmmeter

Position #7

- 0.546 kΩ
- $k = 10^3$
- 546 Ohms
Ohmmeter

Position #8

- 14.85 kΩ
Ohmmeter

Position #8

• 14.85 kΩ

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

Position #9

• 0.983 kΩ
Ohmmeter

Position #9

• .983 kΩ

• \( k = 10^3 \)
• 983 Ohms
Ohmmeter

Position #10

- 3.239 kΩ
Ohmmeter

Position #10

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

Good

30 Amp Relay, Checking Coil Resistance

\[
\frac{V}{R} = I
\]

\[
\frac{12.5}{102} = 0.12
\]
Ohmmeter

Open Coil

30 Amp Relay
Ohmmeter

Shorted Coil
30 Amp Relay
**Ohmmeter**

**Good**

30 Amp Relay

\[
\frac{V}{R} = I
\]

\[
\frac{12.5}{102} = 0.12 \quad \frac{12.5}{54.2} = 0.23
\]

GOOD - SHORTED

Over 1.9 Times The Normal Current

*WATT Keeps You Trucking*
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 Reference 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**

\[ m = \text{Thousandth Part} \times 10^{-3} (0.000) \]

**Voltage and Amperage Calculations**

- **k**: Thousand Fold \( \times 10^3 (1,000) \)
- **M**: Million Fold \( \times 10^6 (1,000,000) \)

**Examples**

- \( 3.15 \, M \Omega = 3.15 \, \Omega \times 10^6 = 3,150,000 \, \Omega \)
- \( 0.85 \, M \Omega = 0.85 \, \Omega \times 10^6 = 850,000 \, \Omega \)
- \( 21.02 \, M \Omega = 21.02 \, \Omega \times 10^6 = 21,020,000 \, \Omega \)
- \( 26.32 \, k \Omega = 26.32 \, \Omega \times 10^3 = 26,320 \, \Omega \)
- \( 2.156 \, k \Omega = 2.156 \, \Omega \times 10^3 = 2,156 \, \Omega \)
- \( 0.952 \, k \Omega = 0.952 \, \Omega \times 10^3 = 952 \, \Omega \)
- \( 3.4 \, \Omega = 3.4 \, \Omega \times 1 \times 1 = 3.4 \, \Omega \)
- \( 28.6 \, \Omega = 28.6 \, \Omega \times 1 \times 1 = 28.6 \, \Omega \)
Questions & Answers
Thank you!