AUTOMOTIVE TECHNICIAN TRAINING SERVICES

Presents

Mastering The Labscope Part 1

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Your Instructor For This Seminar

"G" Jerry Truglia

- **National Trainer, ASE World Class, Master: Auto, Truck, School Bus, L1, L3, CNG and…**
- **ATTP Master Instructor, New York State, CT and New Jersey**
- **STS (Service Technician Society) 2003 President**
- **TST (Technicians Service Training) Founder and President**
- **Author / Co Author/ Technical adviser on 25 plus books including OBD II and Mode 6, and Understanding and Diagnosing Hybrid Vehicles**
- **Published articles for multiple newsletters, and magazines**
- **Picked as one of the Top Instructors in the country by EPA & SAE**
- **Numerous Radio, TV, Internet, and SAE Video appearances**
- **PTEN, MotorAge and TST Webcast Instructor**
- **Motor Magazine Top 20 award winner**
- **Provider of OBD II Training for 14 states, Ontario Canada and the US EPA**
- **Guest speaker at SAE Congress, IM Solutions and Clean Air Conference**

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What Will Be Covered In Part 1:

Labscope Information

Labscope Setup (Manual – No Auto) Why?

DC – AC Coupling

AC Setup

DC Square Wave Setup

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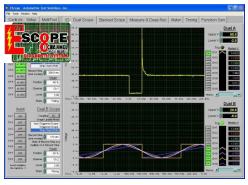
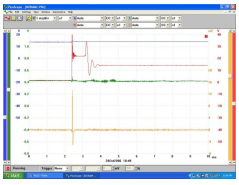
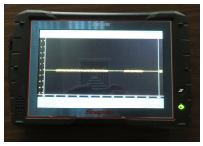
Labscopes







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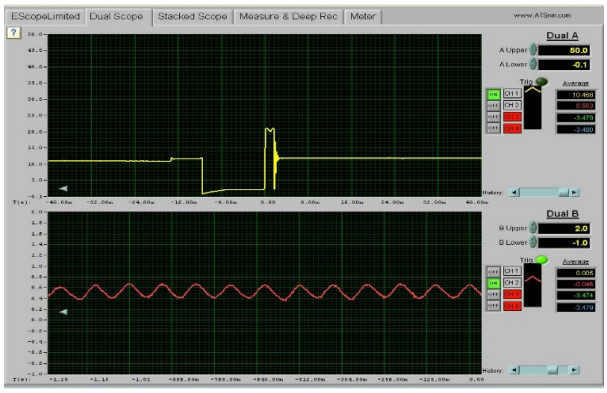
Scope Essentials - Meters VS. Scopes



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Scopes Compared To Other Testers

If you can use a test light, logic probe, meter, or graphing meter, you can use a scope.
Scopes take accurate measurements that other testers miss. It's the MRI (magnetic resonance imaging) of the automotive industry.

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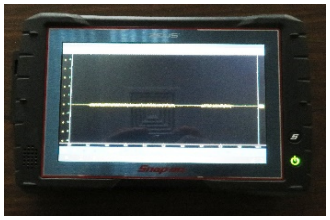
Scopes And Meters



The DMM and scope can both be used to measure voltage, but the way each displays voltage potential is very different. Take a look above

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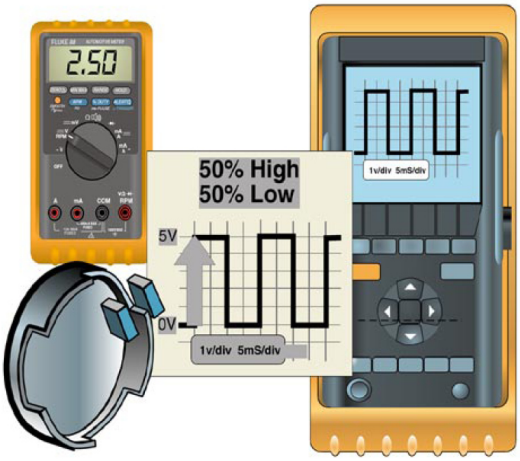
High Speed Signals

The scope also tells us how long voltage stays at different levels. We receive much more information from the scope than we do from a meter when we measure fast-changing voltage signals.



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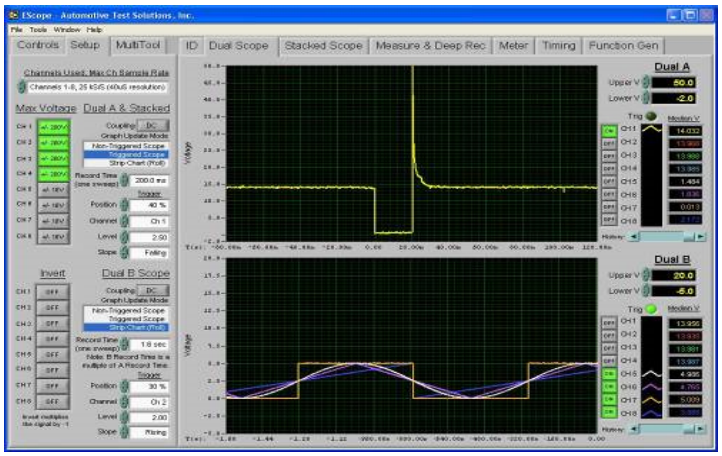
Big Boxes Scopes And Handhelds



Whether it's a Big Box or a small handheld model, a "scope" is nothing more than a voltmeter that draws pictures of voltage on a screen.

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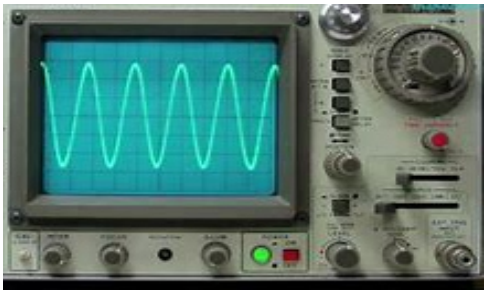
Analog Scopes



There are two basic types of scopes, based on how they interpret and display signal voltages: analog and digital. Analog scopes came before digital scopes. They are not better or worse than digital scopes, but they are different.

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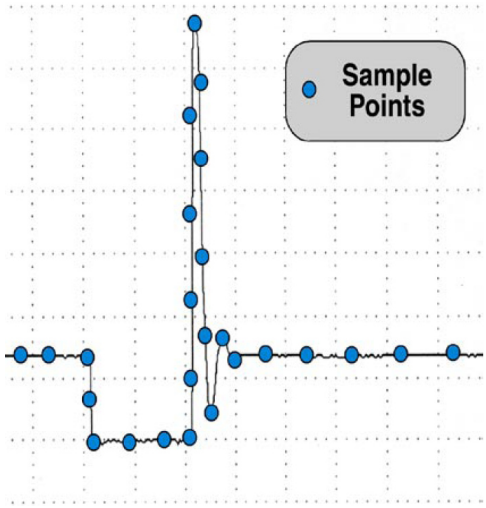
Digital Storage Oscilloscope (DSO)

The digital storage oscilloscope (DSO) samples circuit voltage by taking a series of rapid fire snapshots known as samples.



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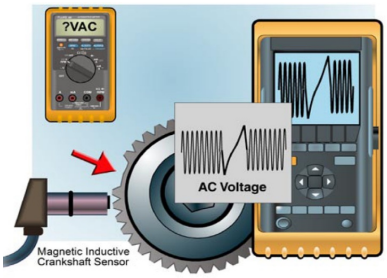
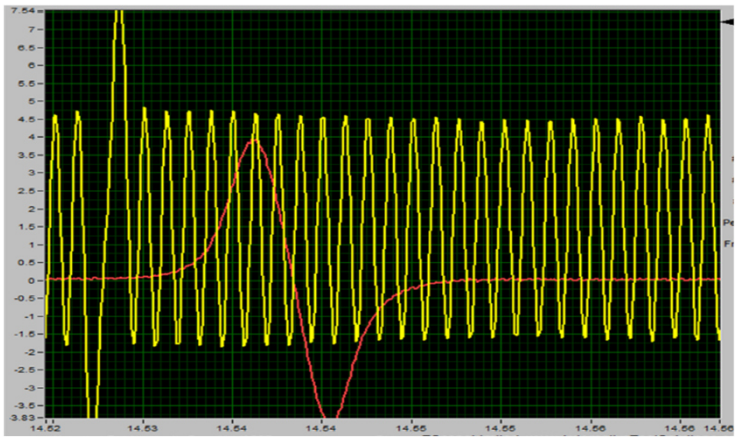
Viewing AC Speed Sensor Signals





The scope is better for testing fast AC signals than the DMM. It draws each voltage pulse individually to help us distinguish between signal problems and normally occurring gaps in the signal that identify component location to the computer.

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Using The Labscope

Task To Perform:

1. Couple Scope to AC Voltage

2. Acuquire a AC wave signal

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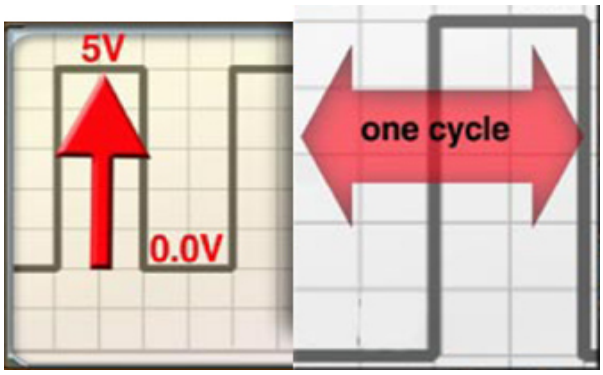
Waveform Appearance - Signature



The UP and DOWN movement of the trace tells us that voltage in the circuit being tested is switching rapidly between zero and 5 volts.

Our sample waveform has an amplitude of 5 volts.

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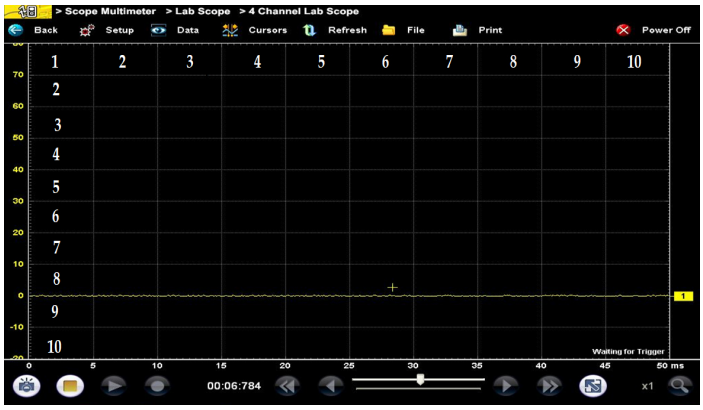
The Scope Screen



The grid is usually 10 rows high and 10 columns wide, dividing the screen into 100 blocks, called major divisions. Older labscopes were 8 rows high and 10 columns wide, dividing the screen into 80 blocks, called major divisions

In digital scopes where the grid is made of light segments or dots instead of paint on the glass screen, you may have the option of turning the graticule off or changing the spacing or number of lines or dots that make up the grid.

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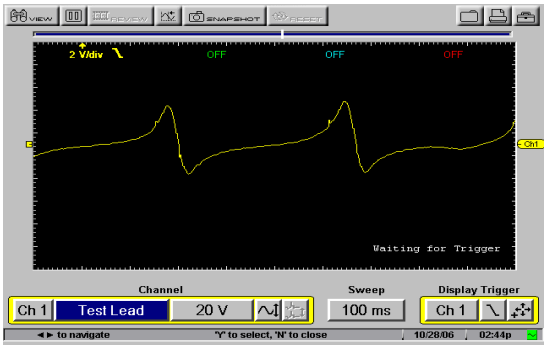
Time And Voltage On The Scope Screen



- **When the scope is connected to a circuit, voltage in the circuit is displayed vertically, (up and down).**

- **Vertical movement indicates a change in voltage. To measure voltage, count the number of divisions the trace rises and multiply times the voltage scale selected.**

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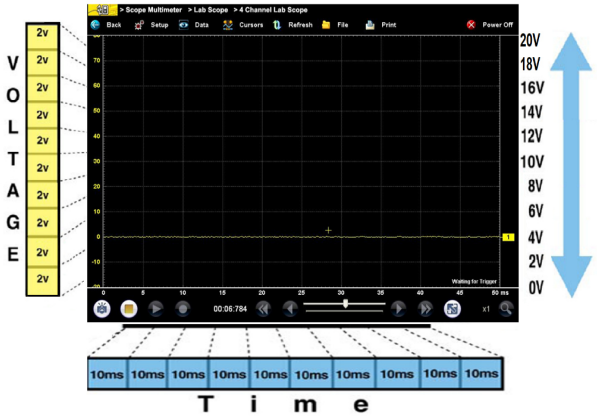
Voltage And Time Per Division



Here, we've adjusted the scope so each vertical division equals 2 volts. Since there are 10 rows on the screen, we can measure a total voltage of 20 volts at one time (10 rows x 2 volts = 20 volts).

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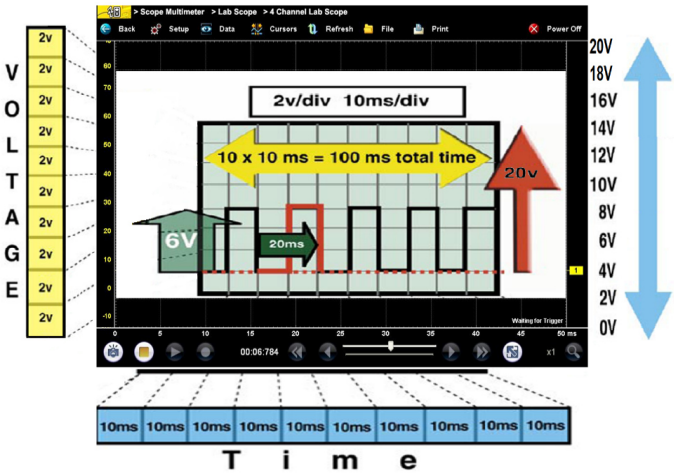
Divisions

The scope is set to 2V/Div and 10 ms/Div. We have set the ground level (zero volts) at the horizontal grid line above the graticule bottom row (shown by the dotted line).



The waveform rises three divisions from the ground line. That's 3 x 2 volts = 6 volts. Our waveform has an amplitude of 6 volts.

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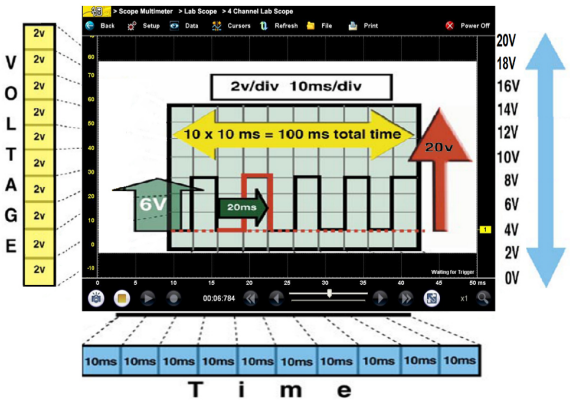
Divisions

- **CYCLE - One complete instance of a wave**
- **FREQUENCY - The number of cycles per second**
- **PERIOD - The time it takes for one cycle to occur**
- **AMPLITUDE -The voltage potential or difference between the ground level and the highest voltage measured above it.**



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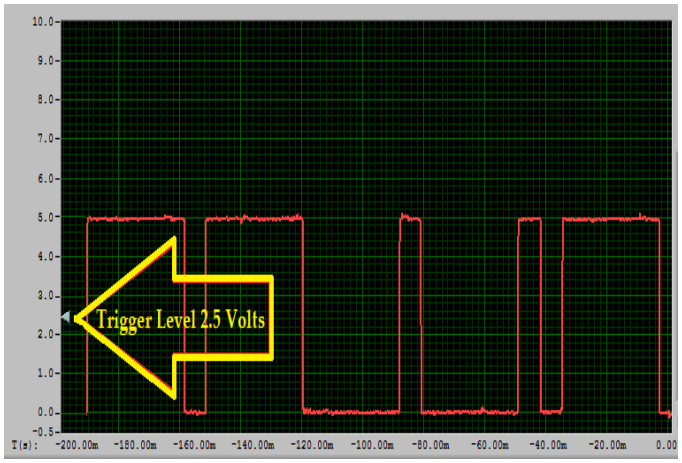
Trigger

There are three essential settings needed to display a waveform:

- **volts/div**
- **time/div**
- **trigger**



Trigger is pretty simple:
It's a voltage level that the sampled signal must cross to start the horizontal sweep that draws the waveform across the screen.

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Using The Labscope

Task To Perform:

1.Set Ground line on your scope 1 division up

2. Acuquire a Square wave signal

3. Adjust Trigger Level

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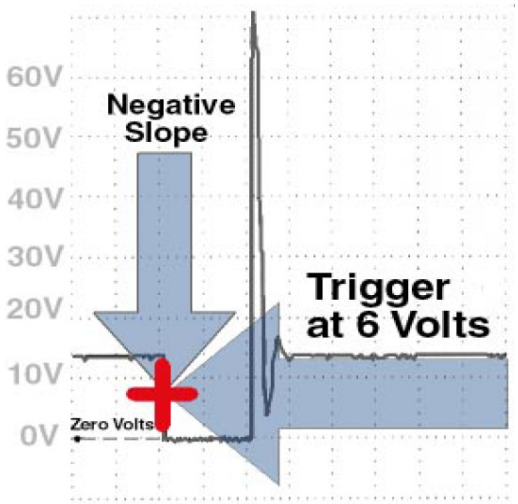
Trigger And Slope

Trigger sets the voltage level that the sampled signal must cross to start a sweep.

Slope determines if the scope triggers on a rising or a falling voltage.



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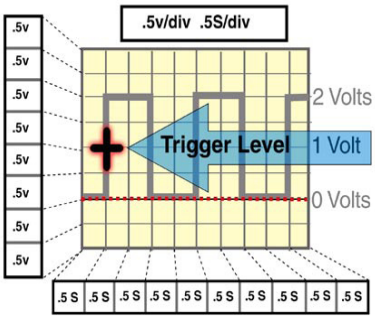
Trigger And Slope

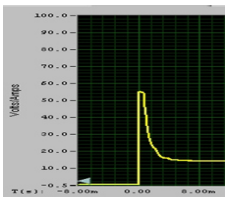
The trigger function does what its name suggests: it "triggers" the scope sweep when the signal crosses a specified voltage. But we can also set the scope to trigger on either a rising voltage or a falling voltage, and that's where slope comes in.



Signal Amplitude = 2 Volts

Trigger Level Set at 1 Volt

Positive slope triggers the sweep on a signal whose voltage is rising.



Negative slope triggers the sweep on a signal whose voltage is falling.

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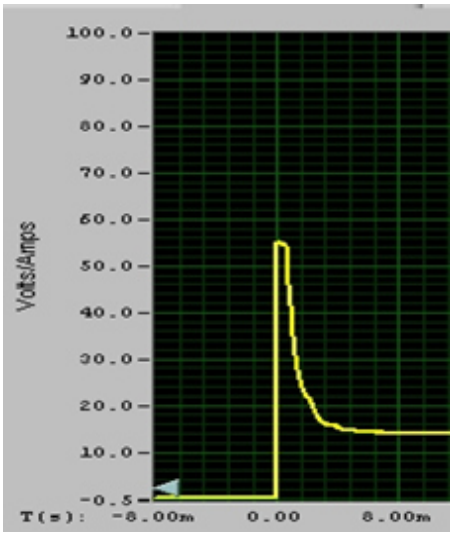
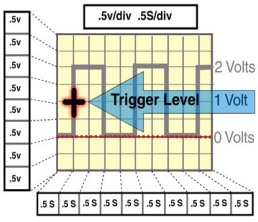
Positive And Negative Slope

Instead of triggering at 6 volts on a falling voltage (negative slope), we are now triggering above 0 volts on a rising voltage (positive slope).





Signal Amplitude = 2 Volts

Trigger Level Set at 1 Volt

Compare

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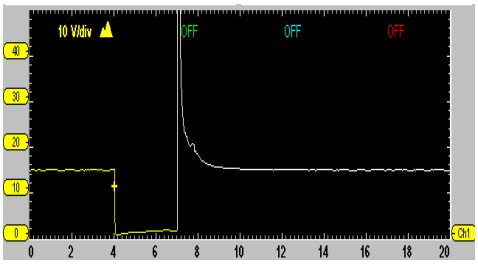
Trigger Sources

Internal - The scope is triggered by the sampled voltage at one of the scope's input channels. In other words, the scope is triggered



External - This is a separate scope input (commonly marked ext) that triggers the scope from an external source, regardless of the channel settings or channel voltage.

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What Will Be Covered In Part 1:

Labscope Information

Labscope Setup (Manual – No Auto) Why?

DC – AC Coupling

Isolated Channel

Testing Sensors and Actuators

Amp clamp and more

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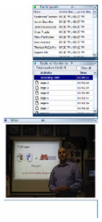

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Thank You !

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