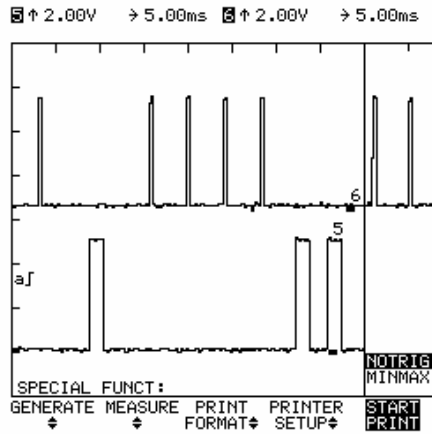
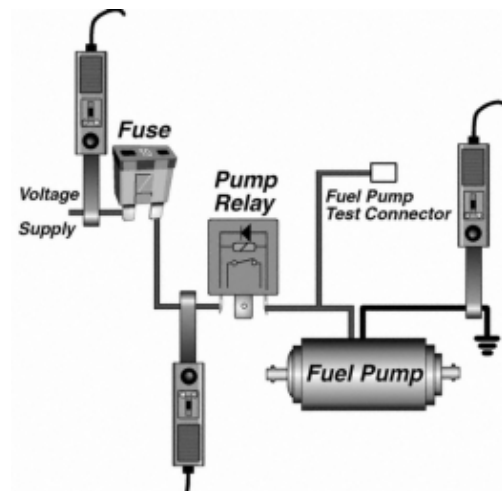


# Mastering Your Lab Scope



**Remember:**  
*The only limit to your knowledge,  
are the limits that you put on  
yourself...*



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## ***Introduction:***

One of the biggest problems I have noticed when talking to technicians lately is their lack of understanding in the use of a Lab Scope and how to properly set it up to view the signals correctly.

I have compiled this manual solely for this reason. The information found here has been accumulated over many years of my real world experience using a Lab Scope. All the examples found in this manual have been captured from vehicles with, and without problems. There are no simulated waveforms. One thing I can not stress enough (and you will repeatedly see it mentioned throughout this manual) is that you need to look at good waveforms and compare their relationship with each other considerably more than you need to look at all bad examples. What good does it do to look at a bad waveform when you do not know how it normally should look?

When I was creating this manual many techs wanted it to be on a particular scope. This is a good idea - but, would be almost impossible for me to do. You see, there are so many different scopes on the market that I can not possibly collect waveforms on all of them. Also, I do not have all the scopes available to me. Although you may not see your particular scope in this manual, these set-ups and waveforms will be the same on any scope available now & in the future. All waveforms display the same, and since the laws of electricity will not change, neither can a waveform. They will always be displayed as voltage over time.

On the next few pages we will cover the some of the common items found on all scopes. Although I used the Vetronix MTS 5100, Fluke 97, Fluke 98 & the LS-2000 scopes for these screen shots, all scopes still operate the same way. The only difference is how you will get to the different menu selections on your particular scope. So keep in mind that even if you have a digital, analog or an electronic bench scope, this manual will apply to you.

You can e-mail me if you have any suggestions on future manuals, changes you would like to see or something you do not understand in the manual. Contact me at [mherbert1@woh.rr.com](mailto:mherbert1@woh.rr.com). If you would like a hands on training class on Lab Scopes contact me at 937-498-4384 or 937-492-5397 8 am – 5 pm Mon. – Fri. EST.

### ***Cam Position Sensor – Ford:***

Scope Hook-up: Red lead is on the signal return wire at the sensor & the black lead is on the battery ground terminal.

Set the voltage level to 500 mV - 1 V per/div. This will vary as the RPM increases.

Set the time base to 50 ms. Again this will vary depending on the RPM.

Set scope to ac coupling.

Move the ground indicator to the center of the screen.

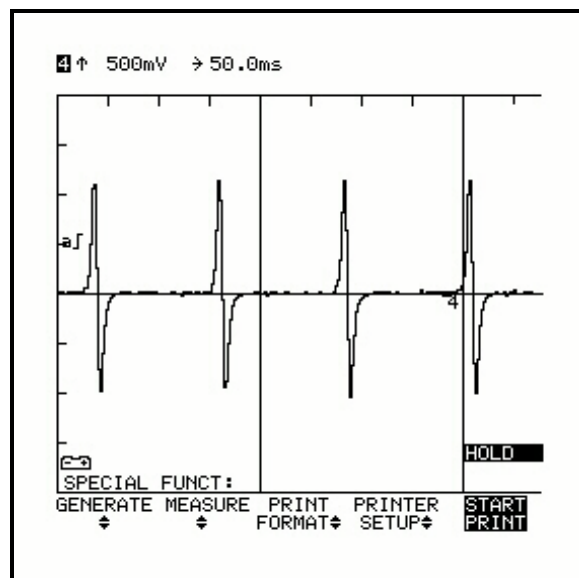
Turn min/max or peak-detect off - if your scope has this option.

Set the scope to free run or auto trigger and set the trigger to internal.

Set the trigger level to 500 mV and trigger on positive slope.

Set the sweep to recurrent.

After you have the pattern stabilized on the screen, you can turn free run or auto trigger off. This will help you find a glitch in the circuit. If the signal does not cross the trigger level the pattern will freeze on the screen.



***Crank Position Sensor – 24x – GM 3100:***

Scope Hook-up: Red lead is on the signal return wire at the sensor by the crankshaft balancer & the black lead in on the battery ground terminal.

Set the voltage to 2 - 5 V per/div.

Set the time base to 1 - 2 ms per/div. This will vary as the RPM changes.

Set the scope to dc coupling.

Set the ground indicator one division up from the bottom.

Make sure the min/max or the peak-detect function is turned off.

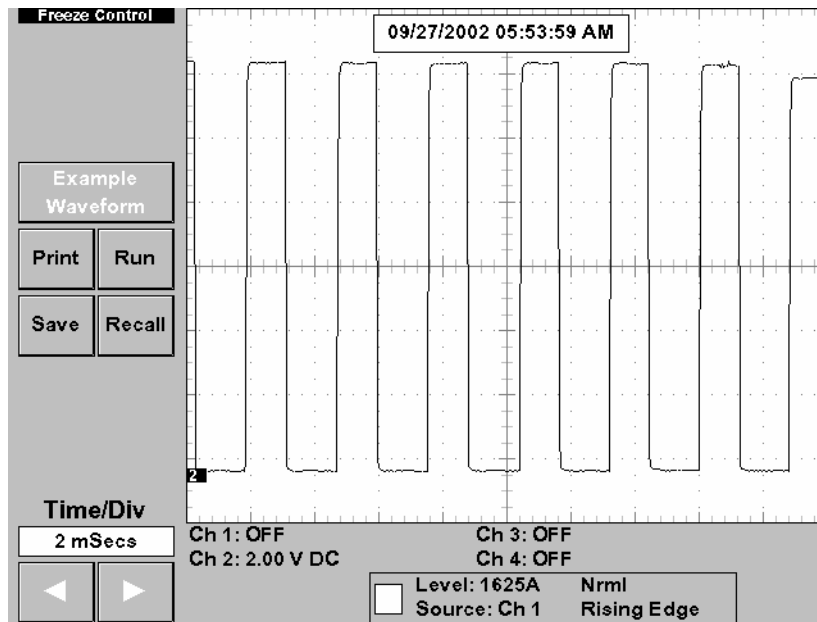
Move the ground tick one division up from the bottom.

Turn the free run or auto trigger off and set to internal trigger.

Set the trigger to positive slope.

Set the trigger level to 5 V.

Set the sweep to recurrent.



### ***EGR Solenoid - Using an Amp Probe:***

Scope Hook-up: Clamp the Amp Probe around the power wire to the solenoid. If the pattern is upside down reverse the probe & re-clamp.

Set the voltage level to 100 mV per/div.

Set the time base to 5 ms per/div.

Set scope to dc coupling.

Move the ground indicator 1 division up from the bottom.

Turn the invert function off - if your scope has this option available.

Turn min/max or peak-detect off - if this option is available.

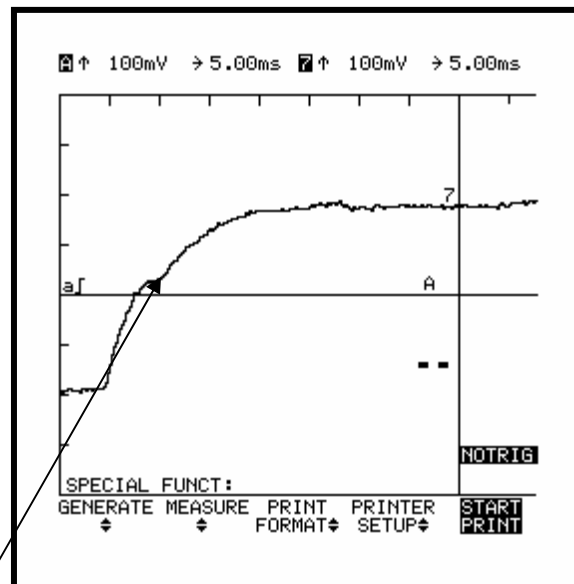
Turn free run or auto trigger off and set trigger to internal.

Set trigger to positive slope and set trigger level to positive 100mv.

Set trigger delay to -1 division or 20% delay.

Set sweep to single.

With this setup the pattern will freeze on the screen when the solenoid cycles once. This will allow you to examine the waveform more closely.



Notice the dimple in the upward slope of the waveform. This is caused from the pintle movement within the solenoid. This is a great test not only for verifying command, but also seeing that command, and the reaction that occurred.

### ***Amp Probe Notes:***

There are many things to consider when using an amp probe. One of the most important things is probe placement. Amp probes are very sensitive and act like antennas. If you connect one in the wrong location under a hood you will pick up a lot of electrical noise. This may lead you to an incorrect diagnosis if you are not aware of this. If you do see too much noise, more than likely you need to move your probe to a different location. If at all possible try to find the power feed on the circuit away from the engine, and hook your probe there. One of the best places is at the fuse block.



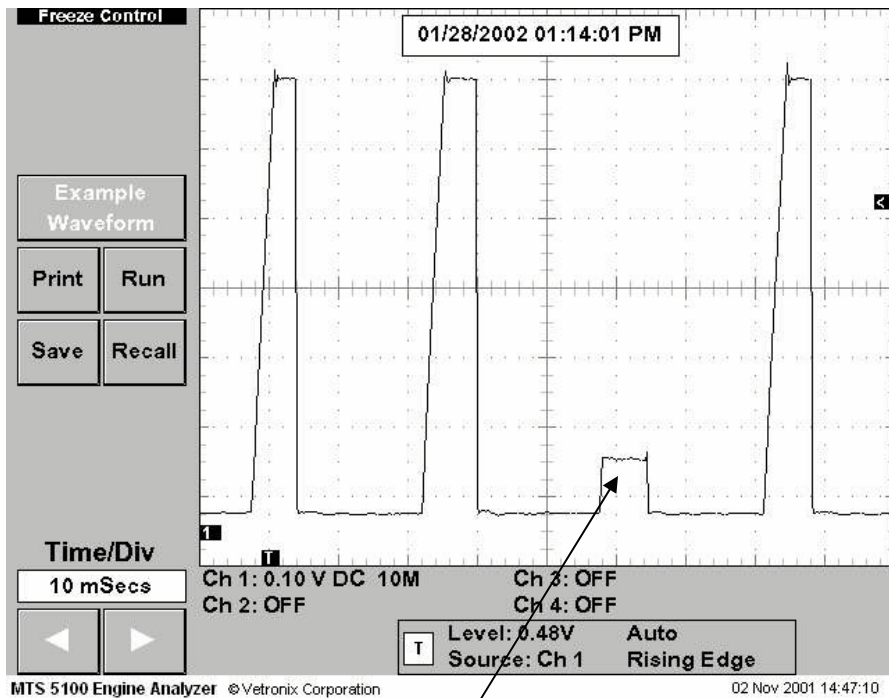
Most probes are directionally sensitive. What this means is, if you do not connect the probe over the wire in the proper direction, the waveform will display upside down. This will not damage the probe, but may lead you to believe that there is a problem when actually – there is not.



On most low amp probes there are two different settings to choose from, a 10 amp setting or a 100 amp setting. More often than not you will want to use the 100 amp setting. If you switch to the 10 amp scale many times the probe will be too sensitive. This will cause too much noise on your lab scope screen if you are trying to diagnose a very low amperage circuit.

## ***Failing Ignition Module – GM:***

In this example we are looking at a bad module. As the amperage would build up – the module would break down. This would not allow enough time to properly saturate the ignition coil.



The module would build amperage up to approximately 1 amp before it would break down.