MegaSquirt Discussions of technical related subjects pertaining to the MegaSquirt FI system.

March 28th, 2007, 08:52 PM

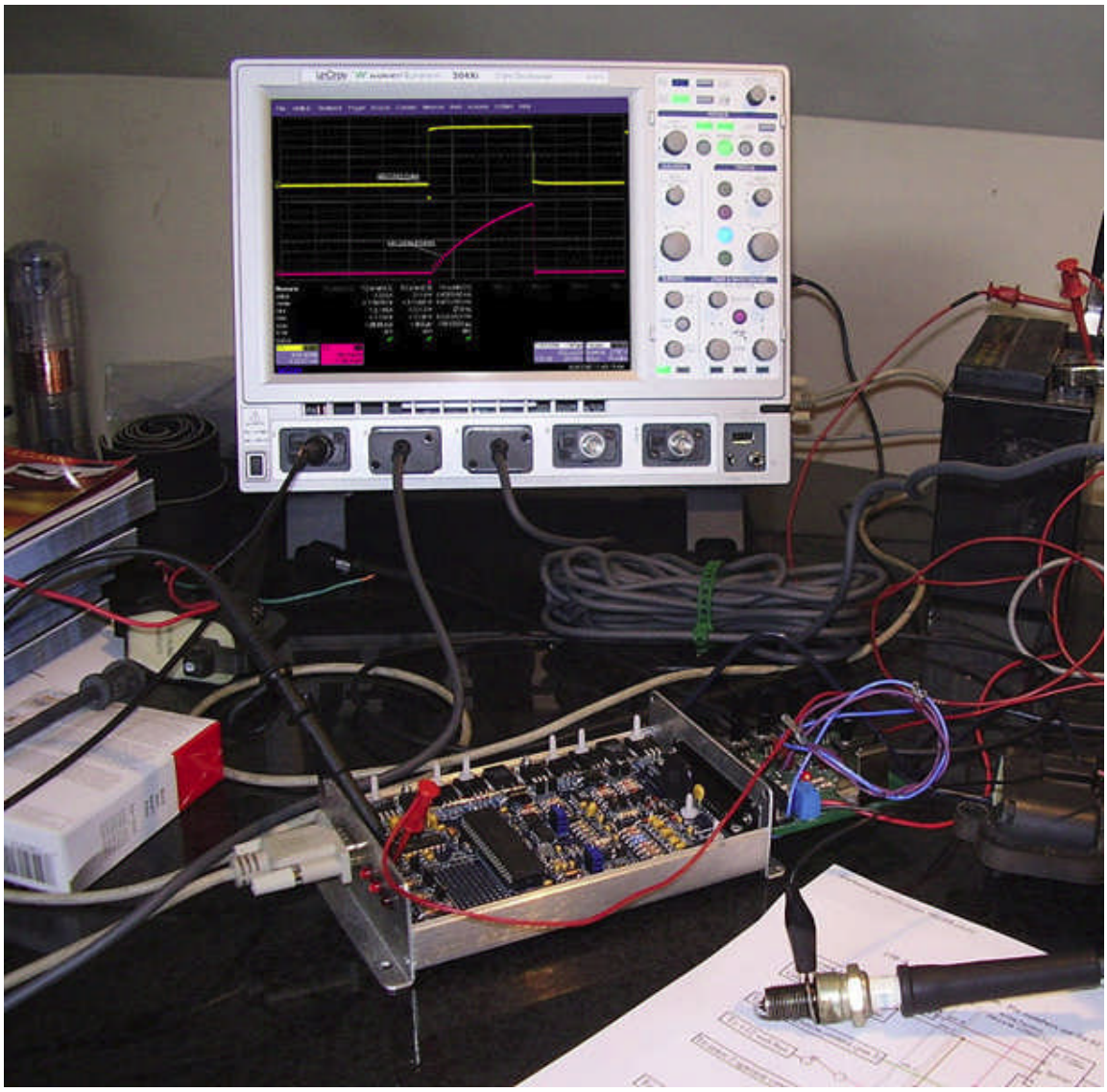
z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

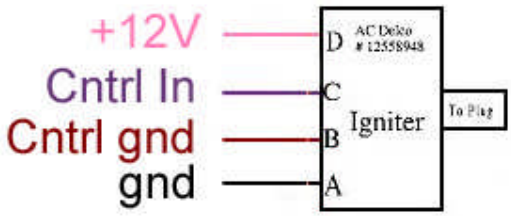
LSx Coil Testing

Hear is the test data from my detailed LS1 coil measurements using Megasquirt (MS) to trigger the coils. These are the coils that Ron Tyler has used on L6s with a Wolf ECU as the trigger source. These coils have the igniters built in, which makes for a much easier install. They are used on late model Camaros, Firebirds, and GM trucks.

Hear is what my test setup looks like:



Hear is the coil pinout:



AC Delco PN # 12558948

Let's start with the input to the coils. The coils require a positive input pulse, the width bei
One important thing to note is that the MS output pulse width for the ignition outputs doe
the dwell time you set in Megatune (MT). Not sure if this is a firmware bug or not.

When I set the dwell to 1ms, the actual output pulsewidth is around 690us (0.69ms). The the output pulse from the MS (C1, yellow), and the input current to the LS1 coilpack (C2, as soon as the MS output pulse goes high (C1), the coil current starts to charge (C2). It re MS output pulse goes low. There are three measurements which include statistics: amplitu and amplitude of C2. The most important statistic is the mean, or average value for these

1ms dwell:

2ms dwell:


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
LED17(D14) Output
C1
LS1 Coil Input Current
C2
Measure P1:area(C3) P2:ampl(C2) P3:ampl(C1) P4:width(C1) P5:- - - P6:-
value 2.238 A 3.114 V 1.4995480 ms
mean > 2.24296 A > 3.11401 V 1.4735118 ms
min > 2.144 A > 3.113 V 27.0 ns
max > 2.328 A > 3.120 V 1.5063477 ms
sdev > 20.48 mA > 305 µV 194.10631 µs
num 461 461 469
status
C1 DC1M 540 mV/div -1.620 V ofst
C2 DC 350 mA/div -1.190 A ofst
LeCroy

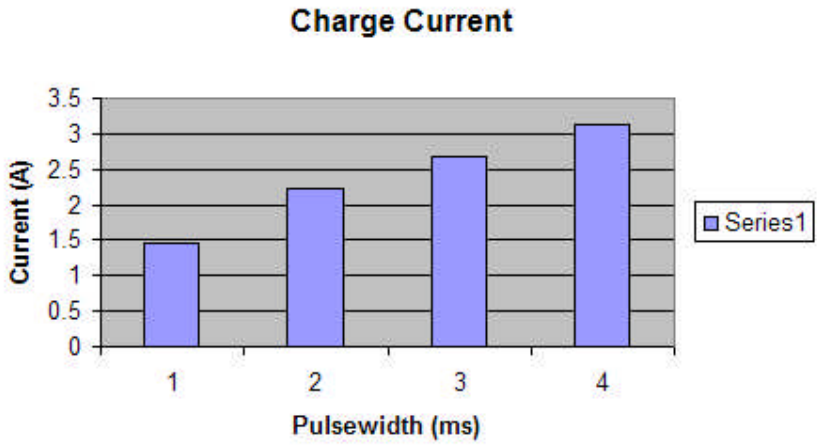
3ms dwell:


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
LED17(D14) Output
C1
LS1 Coil Input Current
C2
Measure P1:area(C3) P2:ampl(C2) P3:ampl(C1) P4:width(C1) P5:- - - P6:-
value 2.744 A 3.113 V 2.1987661 ms
mean 2.69693 A > 3.11338 V 2.1017204 ms
min 2.655 A > 3.113 V 31.3 ns
max 2.790 A > 3.114 V 2.2053364 ms
sdev 37.54 mA > 164 µV 451.94722 µs
num 346 346 362
status
C1 DC1M 540 mV/div -1.620 V ofst
C2 DC 455 mA/div -1.480 A ofst
LeCroy

4ms dwell:

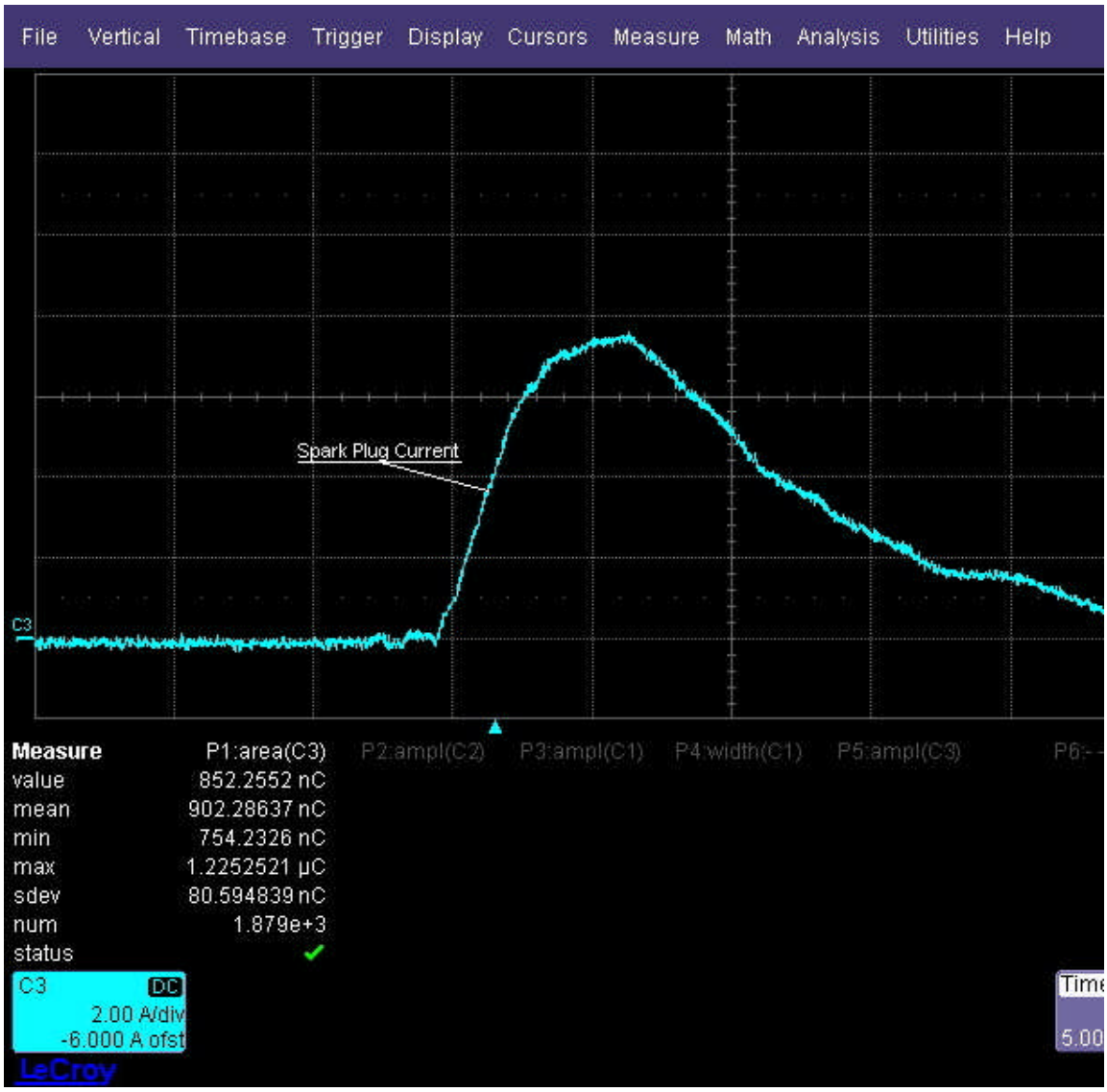
So from all this data, if you look at the mean amplitude for C1, you see that it is consisten means that the LS1 coils can fire at that voltage. The mean pulsewidth of C1 is always abc program into MS. This must be a firmware bug, I will post this on msefi.com.

If you plot the charge current you get this:

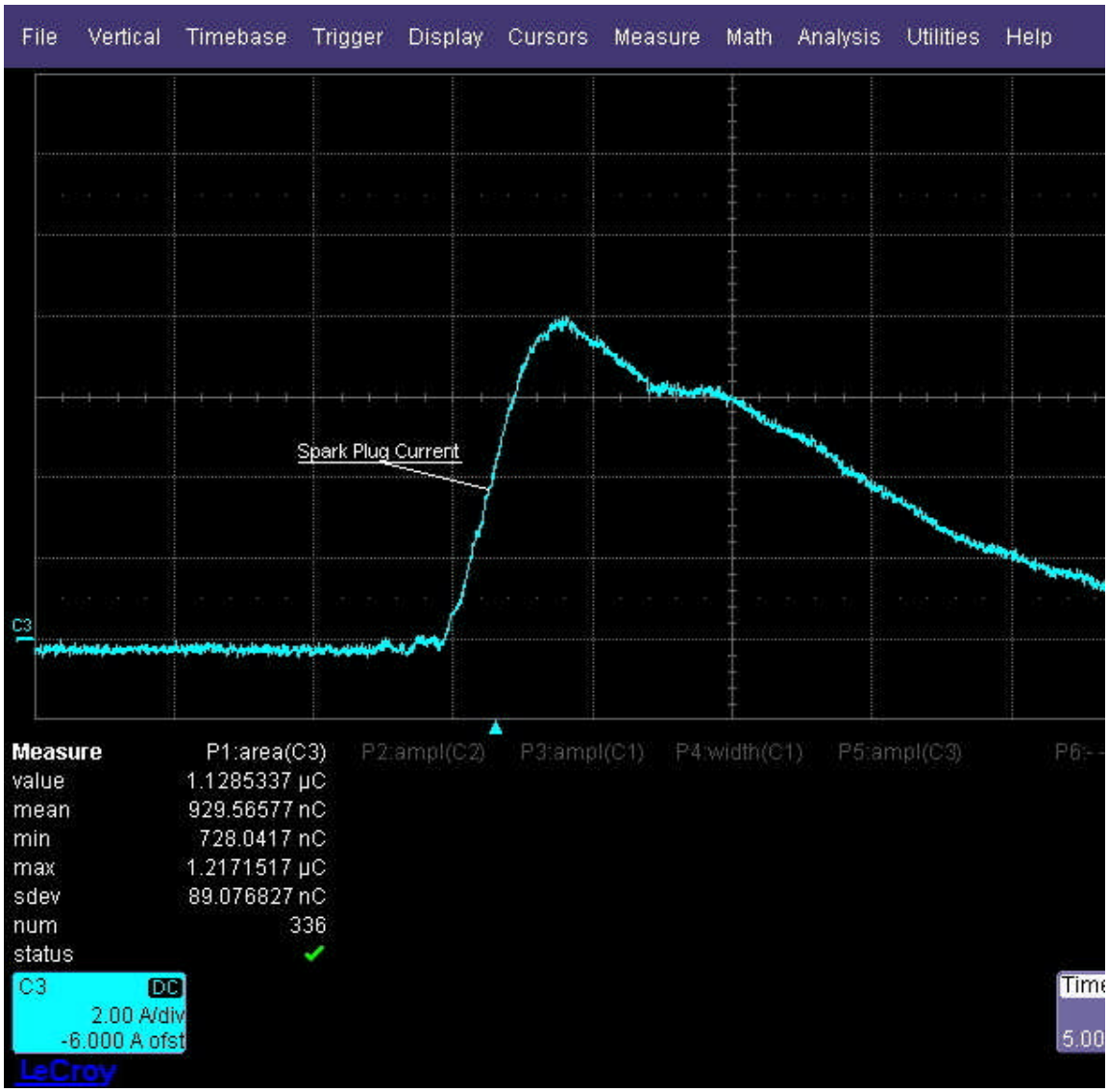


We know what went into the coil pack, now lets look at what comes out. The next measure
output current from the LS1 coil pack. Instead of measuring peak current, I set up a meas
area under the current pulse. Current per unit time is measure in Coulombs. In this case r

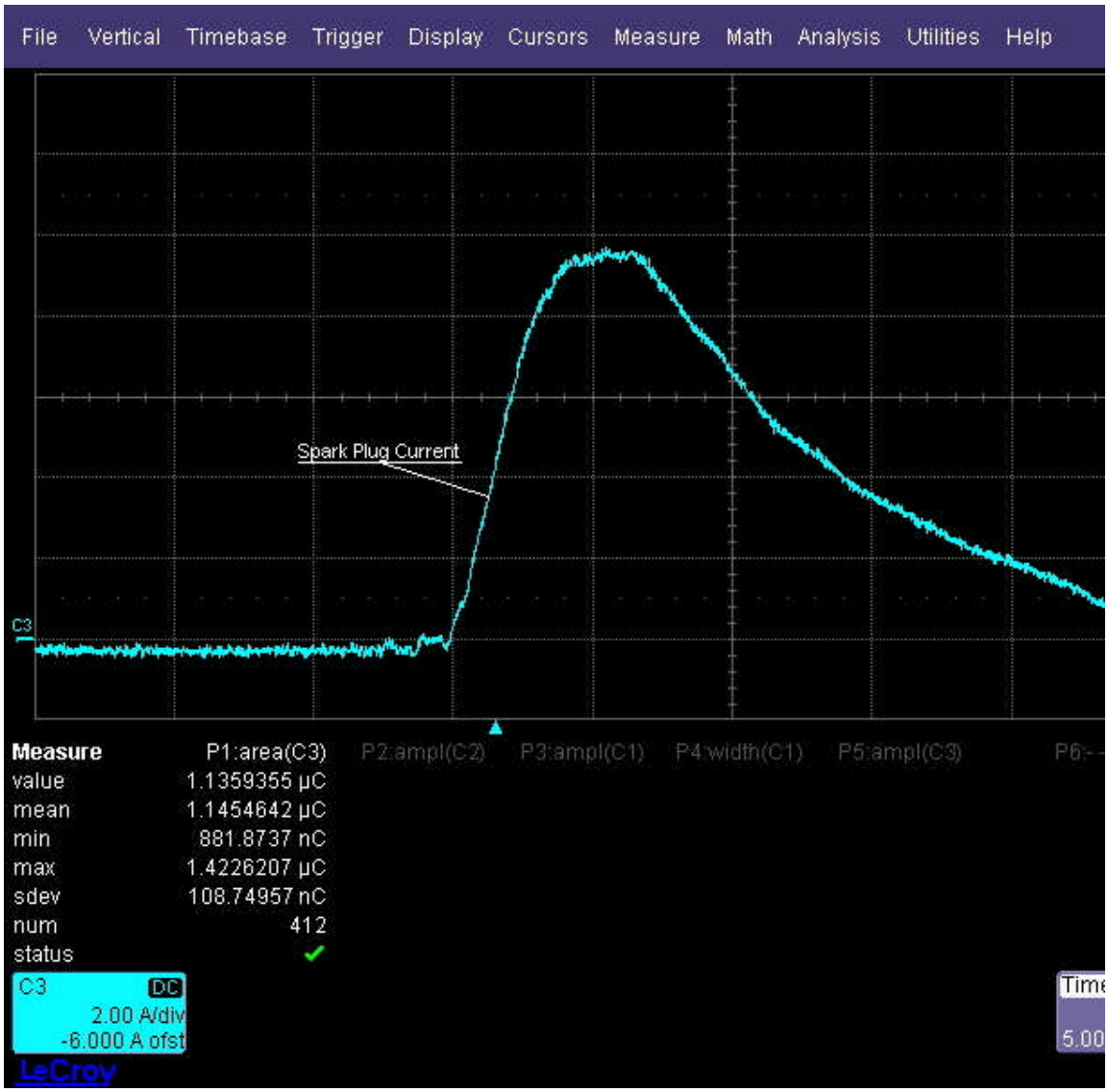
1ms dwell:



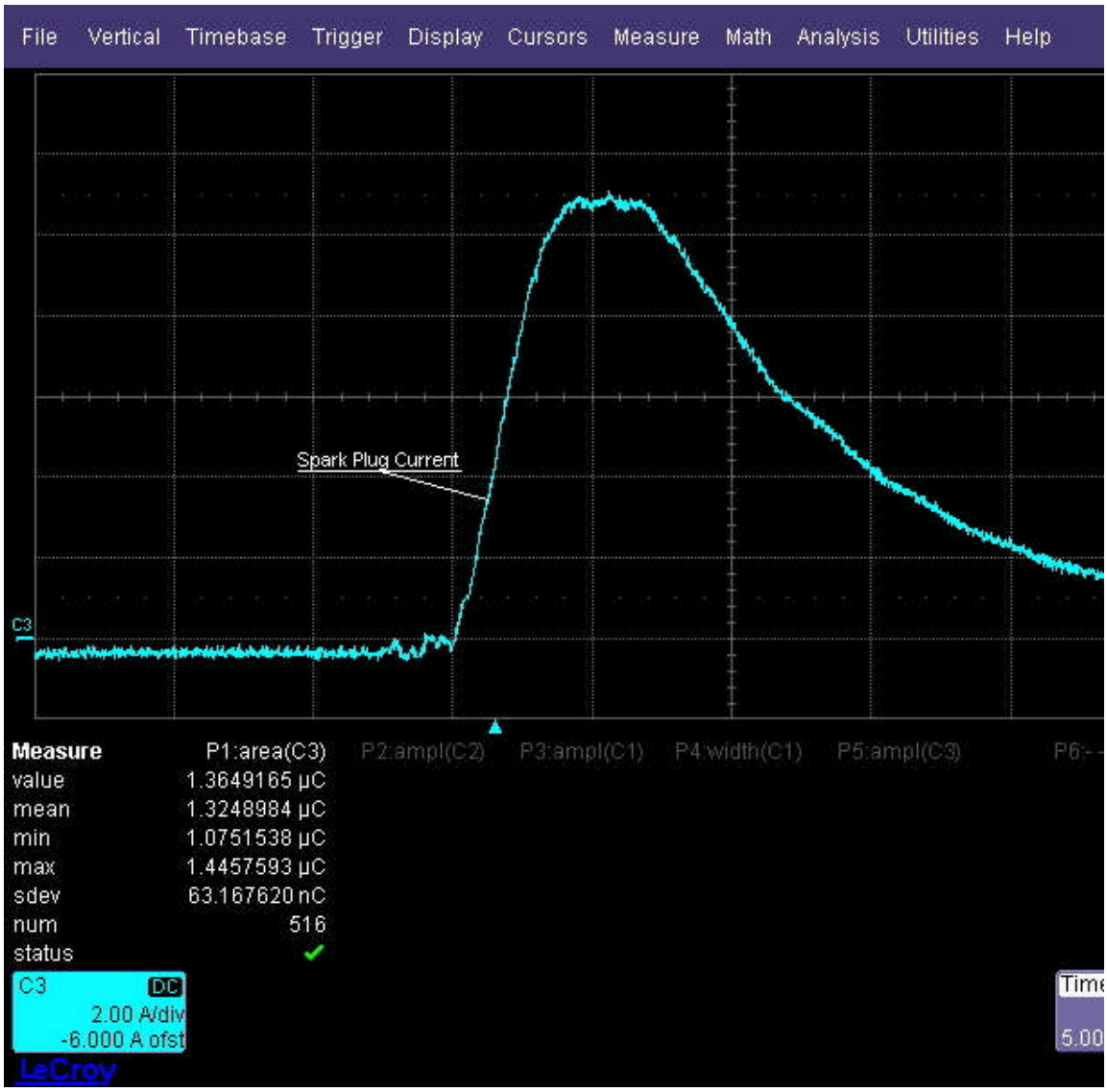
2ms dwell:


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
Spark Plug Current
C3
Measure P1:area(C3) P2:ampl(C2) P3:ampl(C1) P4:width(C1) P5:ampl(C3)
value 1.1285337 µC
mean 929.56577 nC
min 728.0417 nC
max 1.2171517 µC
sdev 89.076827 nC
num 336
status
C3 DC
2.00 A/div
-6.000 A ofst
LeCroy

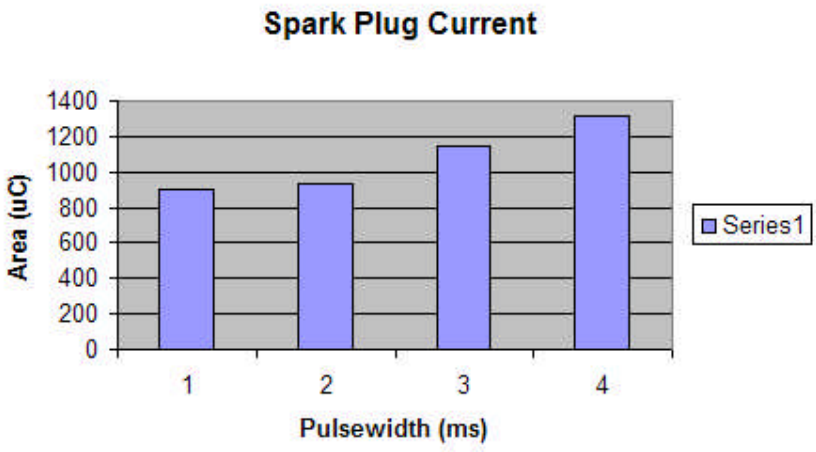
3ms dwell:


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
Spark Plug Current
C3
Measure P1:area(C3) P2:ampl(C2) P3:ampl(C1) P4:width(C1) P5:ampl(C3)
value 1.1359355 µC
mean 1.1454642 µC
min 881.8737 nC
max 1.4226207 µC
sdev 108.74957 nC
num 412
status
C3 DC
2.00 A/div
-6.000 A ofst
LeCroy

4ms dwell:



Again, if we plot the area vs dwell time (pulsewidth), we get this:



Hear is a shot of all three signals on the same grid. The trigger pulse (yellow), charge curr current (blue).

Conclusions from all of this:

As you would expect, as the dwell time increases, the peak coil charge current increases li current is not as linear, and at 4ms charge time, it has not hit coil saturation point. This is current is created when the peak input charge current continues to increase. This is when I will take more measurements at 5, 6 and 7ms to see what the effects are.

The other important fact is that the LS1 built in coil igniters (the amplifier that drives the width. So setting some nominal dwell time will not get you the optimal spark. This is wher

Lastly, the MS LED output can easily drive two of these LS1 coils. Driving two coils, no red observed. It stayed in the 3V range, and fired both coils reliably. So you can fire three pai three LED outputs on the MS. Yes, this is a wasted spark configuration, but unlike coil pacl LS1 coils will provide equal spark energy to each cylinder.

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasc

- ZZ Top

March 29th, 2007,
05:57 PM

RTz
Administrator

Join Date: Oct 2005
Location: Oregon
Posts: 1,915

Nice work!

What voltage are you supplying the ignitors with?

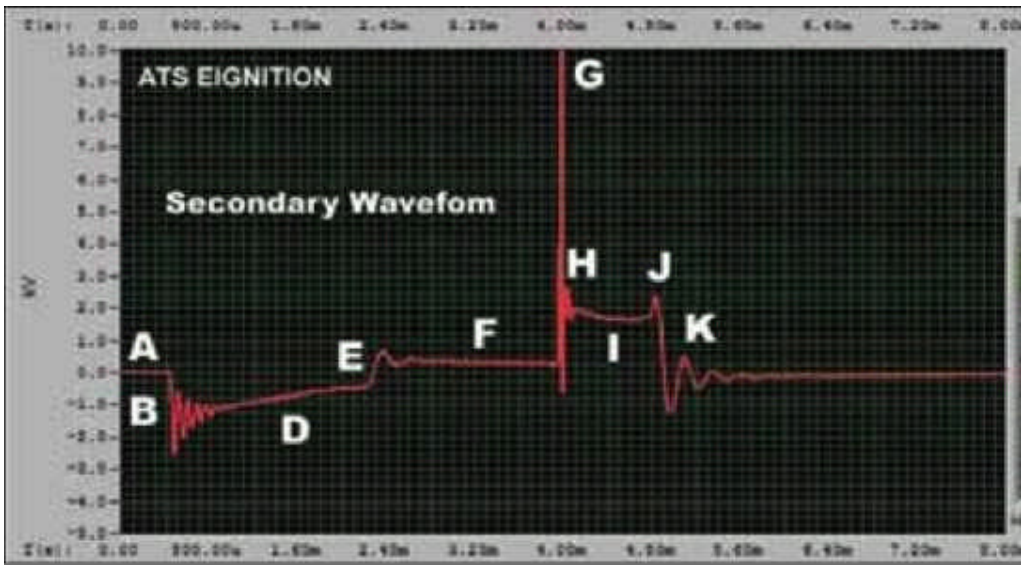
It would be nice to see similar testing with low voltages, say around 10v, to simulate start

> Quote:
> Originally Posted by **z-ya**
> *4ms charge time, it has not hit coil saturation point.*

I undertstand saturation with those coils hits around 5.6 to 5.8ms. I'd like to see that conf

> Quote:
> Originally Posted by **z-ya**
> *This is where no additional output current is created when the peak input charge curre increase.*

Another way to say it... where the ringing stops and the curve flattens, per this diagram, a



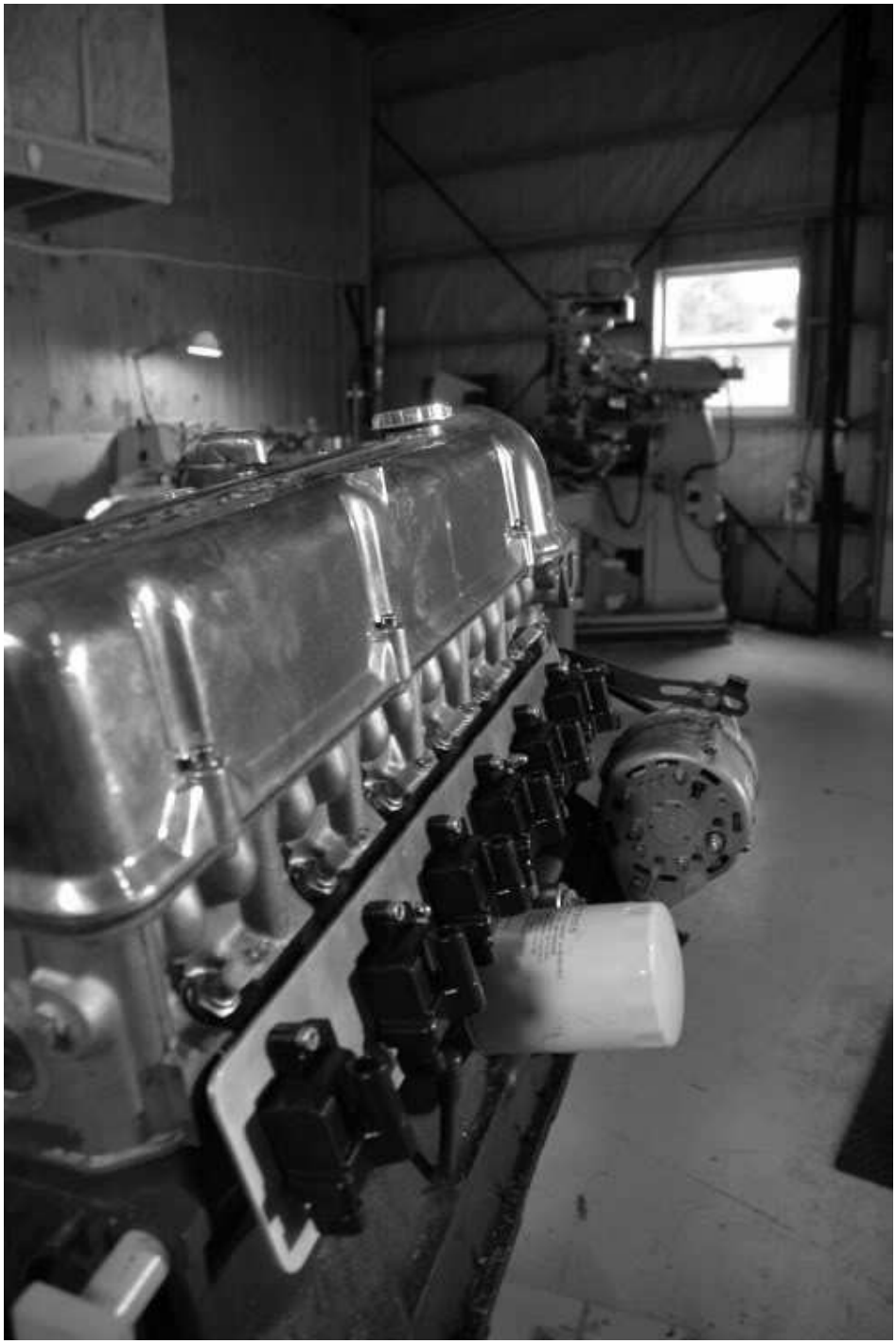
> Quote:
> Originally Posted by **z-ya**
> *This is when things will start to get hot! I will take more measurements at 5, 6 and 7m are.*

I believe you'll find these coils to protect themselves somewhere around 8ms... they dump the requested timing.

Quote:

> Originally Posted by **z-ya**
> *These are the coils that Ron Tyler has used on L6s with a Wolf ECU as the trigger sourc*

Pete's referring to these...



.
.

_____
Regards, Ron

rt260
rt510

March 29th, 2007, 06:28 PM #3

ktm
The Real McCoy

Join Date: Apr 2006
Location: Irvine
Posts: 964

Ron, how did you hang that plate off that supports the coils?

_____
-Bo

Quote

March 29th, 2007, 07:05 PM

RTz
Administrator

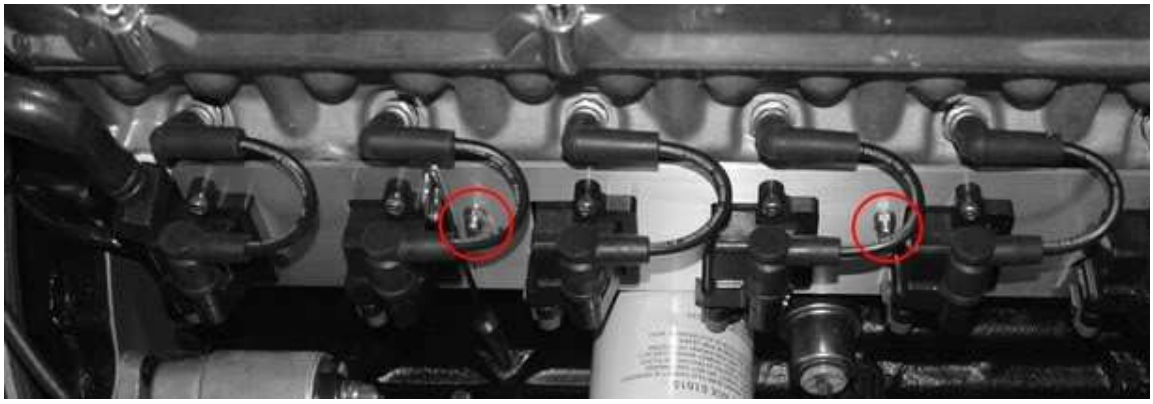
Join Date: Oct 2005
Location: Oregon
Posts: 1,915

Quote:

> Originally Posted by **ktm**
> *Ron, how did you hang that plate off that supports the coils?*

Bo,

There are two bosses in the block that originally hung (or is that hanged?) your heater ho hose along the frame rail and used those bosses to support the bracket, per this picture...



As a side note, my preference is to use the truck coils in this aplication due to the low volt from the 'bottom'.

Pete, I have unconfirmed data that suggests the truck coils are electrically identical... if I s care to test it?

P.S. I like where Pete is going with this thread and would hate to jack it, so any f questions/comments about this specific arrangement would best be posted here. /showthread.php?t=119783

_____
Regards, Ron

rt260
rt510

Last edited by RTz; March 29th, 2007 at 07:10 PM.

March 29th, 2007, 08:52 PM #5

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

Quote:

> Originally Posted by **rontyler**
> *Nice work!*
>
> *What voltage are you supplying the ignitors with?*

I'm running the coils off a motorcycle battery with a charger on it. The ZRX1100 isn't out of the shed yet. The MS was running off a bench top 15V supply.

Quote:

> Originally Posted by **rontyler**
> *It would be nice to see similar testing with low voltages, say around 10v, to simulate starting conditions.*

I can try this if my bench supply can provide enough current. You can set a larger crank dwell with the MS. I'm sure the Wolf can dot he same thing.

Quote:

> Originally Posted by **rontyler**
> *I understand saturation with those coils hits around 5.6 to 5.8ms. I'd like to see that confirmed/denied.*

I plan on confirming the optimal dwell. I'll also measure all the coils I see the see how much the vary.

Quote:

> Originally Posted by **rontyler**
> *Another way to say it... where the ringing stops and the curve flattens, per this diagram, area D, yes?*

Yes, C2 (red) in my screen shot is area D on your plot. I just stopped at 4ms charge time. It should flatten out when I approach 6ms.

Quote:

> Originally Posted by **rontyler**
> *I believe you'll find these coils to protect themselves somewhere around 8ms... they dump their charge irrespective of the requested timing.*

That is what I expect when I exceed 7ms or so.

The coils I tested are Camaro SS coils. If you send me a truck coil, I can test it. BTW, I plan on mounting them on the valve cover. So far I think it will work out real nice.

_____

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 30th, 2007, 01:38 PM #6

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns' Newfoundland
Posts: 7

Just came upon this, I find it hard to get info for the LS-1 coils, so I registered to dig into things.
Looking forward to finding out the best dwell for the truck coil packs,
If you post up a quick "how to" I can scope them in several weeks. As I have a scope+inductive pickup, and will hopefully have them installed by then.

First I need to know the circuit you used to drive the coils if possible. I know what i should use, just want to double check before i end up frying a set of coils.
Much thanks.
...Mitch

Quote

March 30th, 2007, 01:50 PM #7

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

You need a 3-5V square wave with a positive pulse width equal to the dwell time (yellow trace (C1)).

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 30th, 2007, 02:08 PM #8

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns'

The application I'm installing is a 4 cyl, COP (type) setup.

The circuit I had posted previously was obviously incorrect, removed due to possible issues.

Newfoundland
Posts: 7

I`d be interested to see how you trigger the coils, the specific circuit if possible
Thanks.
...Mitch

Quote

March 30th, 2007, 04:19 PM #9

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

I'm using a Megasquirt ECU:

http://www.msefi.com

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 30th, 2007, 04:32 PM #10

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns' Newfoundland
Posts: 7

Yes, I am as well.
Just that I`m not quite sure how to interface the coils with the megasquirt.
Most of the issue is that I`m unsure how to grab the +5V signals from the transistors on the LED's.
It seems that other than just grabing the output voltage directly from the pin (which can only source 20mA or so I believe) I will need a transistor, but looking at the LED transistors, it seems that they provide a ground, and cannot be configured to source voltage.
...Mitch

Quote

March 30th, 2007, 05:27 PM #11

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

Yes, you can use the LED transistor directly. You need to setup MS for the proper mode to get the correct waveform from the LED output. "Code base and output functions" need to be set so "Spark Output A" come out of LED17. What are you going to use for a trigger wheel? You need to configure that too. I am just using it in distributor mode for this test.

_____

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 30th, 2007, 05:37 PM #12

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns' Newfoundland
Posts: 7

Right now I'm just bench testing the circuit, physically supplying +5V at the processor pin to light a LED, on the output using the following circuit :

This gives +5V out when the led is off, and 0V when the led is on,
I could simply say "spark output inverted" but I'd like to have it trigger when the led is on.
I've just ran into this problem today, so maybe I'm confused and not seeing this correctly..
...Mitch

Quote

March 30th, 2007, 06:47 PM #13

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

Do you have a stimulator? The "output inverted" box should be set to "no". Unless you have a crank trigger wheel setup on a drill or something, you need a stimulator with MS setup for a distributor. Only spark output A will be functional in this mode.

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 31st, 2007, 12:51 PM #14

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns'

As of right now I'm simply supplying power to the processor pins, as I dont have a sim yet, and want to test all 4 coil outputs.
my problem is that the circuit I posted above gives 5V out when the LED is off, which it will do, when you measure from the pin out, to ground, I

Newfoundland
Posts: 7

just dont know if thats what should trigger the coil, or if I should redesign the circuit to output a 5V out when the led is on.

Basically, what I'm trying to understand, is that where exactly are you getting the signal to send to the coil? do you have signal(+) tied to 5v, and are you grounding the transistor through the gnd pin?

Quote

March 31st, 2007, 04:19 PM #15

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

LED17

The MS needs an input tach signal to do anything. Get a stimulator, it will allow you to control RPM, IAT, CLT, TPS, and O2.

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 31st, 2007, 05:34 PM #16

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns' Newfoundland
Posts: 7

the ls-1 coil has 4 leads,

12V
sense (+)
sense (gnd)
Ground

so you're saying you have the sense (+) across LED17, and sense (gnd) to the ground of LED17..?

Or are you taking the signal directly from the top of the 1K resistor, basically the processor pin? and tieing the sense (gnd) to the megasquirt ground..?

As of right now, I have a 1k resistor acting as a 5V pullup to the 3 led's, and another led circuit made, which is identical to the other circuits, I know the circuit i have is wrong, because it's inverted to what I want, as Idealy, I would like the LED to be on, as the coil is fired, which means 5V out when the led is on, which is reverse to what I have.
I dont understand why noone will respond to me on msextra.com, creating the circuit is no problem, nor is requiring a sim (i'm basically triggering the circuit myself as-is), it's the principle I dont quite understand, because as of now, it seems to me that I have the same condition as a VB921, requiring the spark to be inverted.

Sorry if this is gunking up your post, if you want to continue, I have a post over at msextra.com, I seen your post about the coil dwell as well. Thanks for helping.
...Mitch

Quote

March 31st, 2007, 06:15 PM #17

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

Do you have RPM in Megatune? If not, nothing will work.

I have the sense+ connected to either LED terminal. LED have about a .7V drop across them, so either terminal will work. Connect the sense- to the same ground for MS and the coil.

The LED will be on all the time, the pulse frequency is too fast for the human eye to see. You must set the output to me not inverted.

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

March 31st, 2007, 06:33 PM #18

Mitchy
Junior Member

Join Date: Mar 2007
Location: St.Johns' Newfoundland
Posts: 7

If you have the MS powered up, but with no RPM, is the LED on? and what is the output from the coil out? when the led is off?

I dont have rpm, because as of right now, I'm simply triggering the circuit to deterimine I have the correct logic signals; ie,

processor pin low = led off = coil output high
processor pin high = led on = coil output low.

I understood that the LED would be on when the coil is charging.
but it seems that you're suggesting that the LED is always on, unless the coil is charging.
which would prove that the circuit I have is correct.

EDIT:
Just hooked stuff up, you were right about the LED's.. I couldn't grasp the concept of the LED's being always on, since all the other installs I had used VB921's, which are obviously inverted.

I thank you very much for the info.

Quote

April 8th, 2007, 03:35 PM #19

z-ya
HybridZ Supporter

Join Date: Mar 2002
Location: New Hampshire
Posts: 2,127

OK, I took some more measurements and found the following:

The LS1 coils do not saturate until around 8ms, but the spark energy does not increase significantly beyond 6ms. So stick with a dwell setting of 5-6ms. This will keep the coils cooler, and extend their life.

I also measured the dwell for 2nd gen RX7 coil packs (I run these on my turbo car). The max dwell should be in the 1.6ms range. Any more than that and you are just heating up the coils and modules.

The LS1 coils have a much hotter spark that the RX7 units. I may switch over to them on my turbo car, we'll see.

_____

"I finally found my old blue jeans. I could tell that they was mine from the oil and the gasoline."

- ZZ Top

Quote

April 13th, 2007, 07:22 AM #20

Evan Purple240zt
Member

Join Date: Jun 2000
Location: Madison, WI
Posts: 1,491

Pete, great information on the coils. I will probably upgrade to the LS1 units on my RB. The stock RB coils are weak sauce, and tend to fail under high boost levels unless you are using a rediculously small gap.

Evan

_____
1995 240sx....
1972 240z RIP

Quote

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