

Radio Play Days

WB6DHW

PC-Based RLC Meter Kit



- Proposed Buildathon Project:
 - April 2011 Radio Play Days (16 Apr 2011)
 - Build simple \$20 kit in one play day session
 - Learn some electronics while we're at it
 - Minimal hand-holding
 - Have fun, too
- Kit:
 - Furnished by Dave Brainerd WB6DHW
 - **No toroids, no SMT**
 - Measures R, L, and C
 - Easy build (25 components)

Components

Component Type	Category	Component	Qty
Capacitor	Ceramic	100 nF(0,1 uF) (104)	2
Capacitor	tantalum	10 uF (106)	3
connector	Cable	wire and alligator clips	2
connector	Jack-RA	3.5mm stereo jack - PCB mount (rt-angle)	2
connector	Jack-RA	USB-B pcb jack (rt-angle)	1
Diode	LED	red LED	1
IC	DIP-8	LM358N dual OpAmp 0-70 deg C (LM358N dual OpAmp 0-70 deg C)	1
IC	DIP-8	TC7660 charge Pump DC-DC Conv	1
IC	TO-92	LE33CZ 3.3V voltage regulator	1
Resistor	1/4W	1 k 1/4W 1% (br-blk-blk-br-br)	1
Resistor	1/4W	10 k 1/4W 1% (brn-blk-blk-red-brn)	2
Resistor	1/4W	10 ohm 1/4W 1% (br-blk-blk-gld-br)	1
Resistor	1/4W	100 k 1/4W 1% (brn-blk-blk-orng-brn)	1
Resistor	1/4W	100 ohm 1/4W 1% (br-blk-blk-blk-br)	1
Resistor	1/4W	330 1/4W 5% (ora-ora-brn-gld)	1
Switch	2P6T	2 pole six pos rotary switch	1

User-furnished parts

Two stereo M-M 1/8" cables

Hookup wire

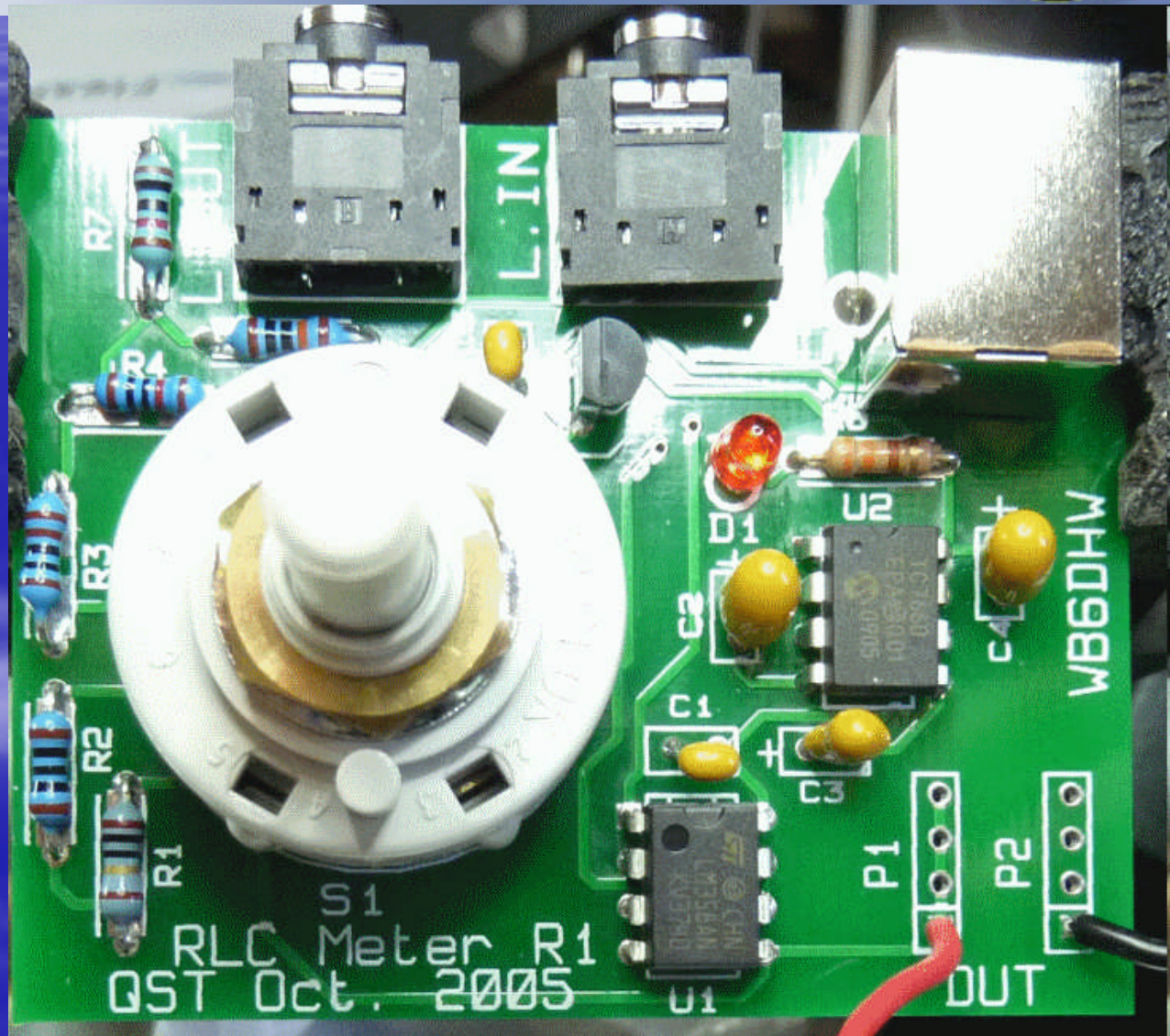
2 alligator clips

One USB-A to USB-B cable

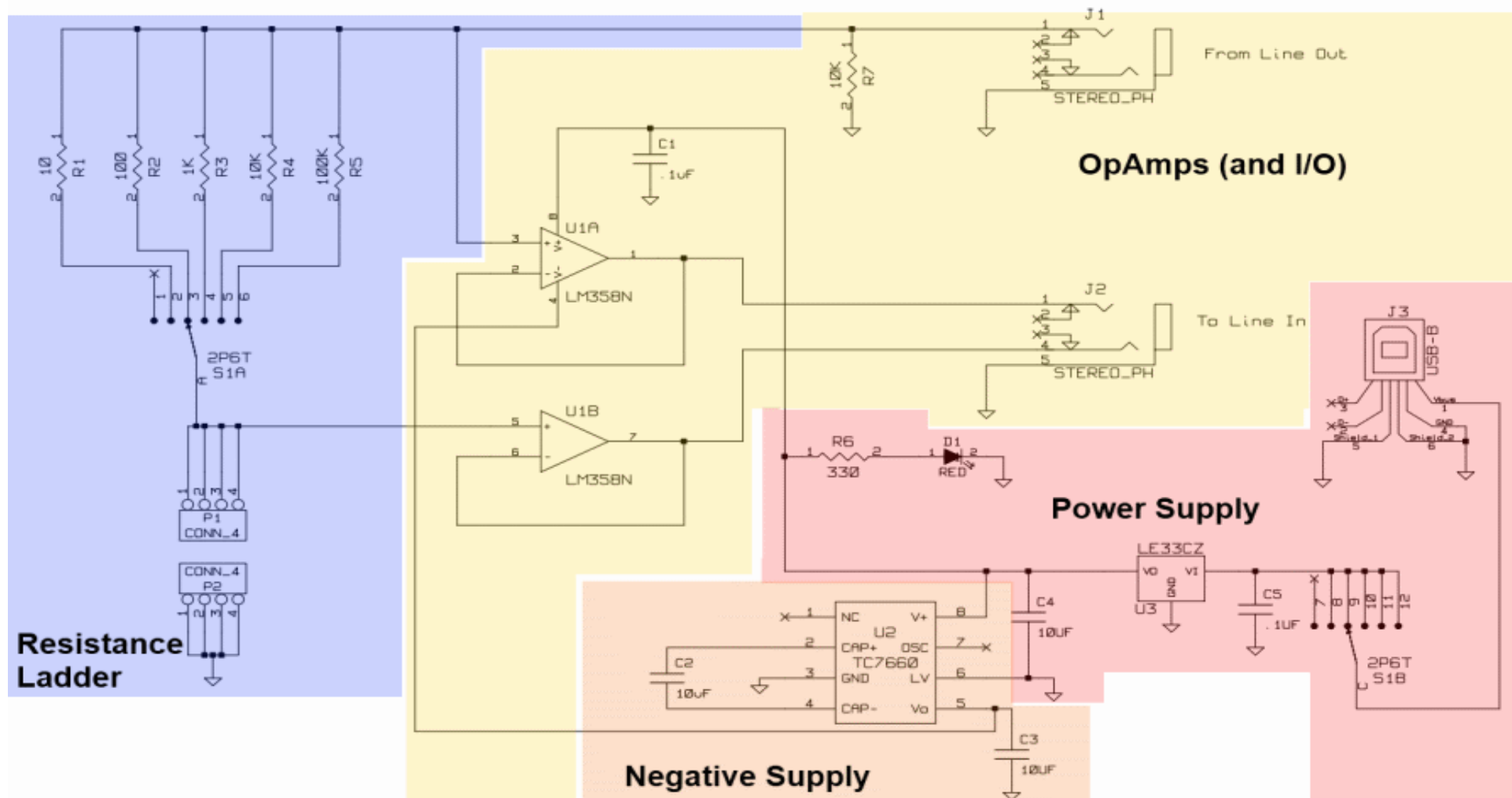
■ Requirements

- PC with soundcard and free USB port
 - Soundcard MUST have **stereo** input
 - USB just for 5V power
- Fairly accurate DMM
- (downloadable) Software
- Soldering iron and solder
- Diagonal cutters and needle-nosed pliers
- A (Pana)vise would be nice
- User-furnished parts
 - Two stereo M-M 1/8" cables
 - Hookup wire
 - 2 alligator clips
 - One USB-A to USB-B cable

- Completed Kit:

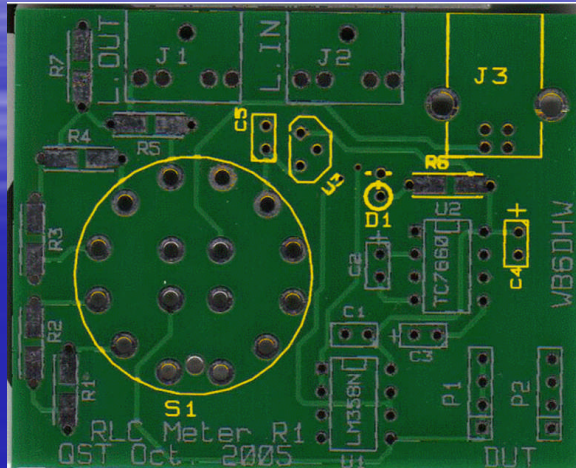


■ Schematic

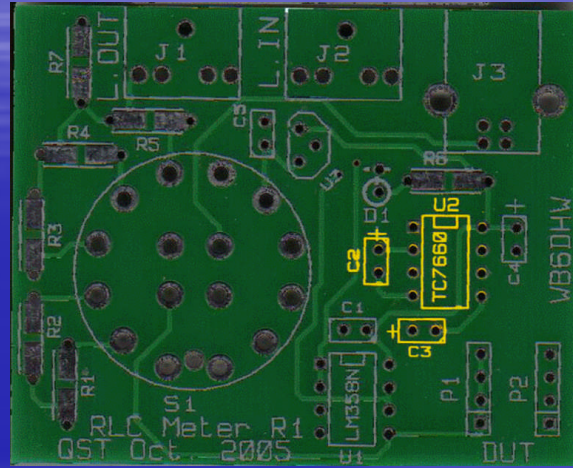


Build Stages

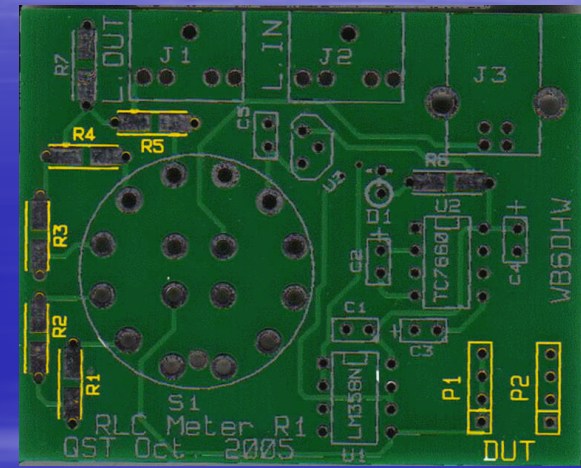
Power Supply



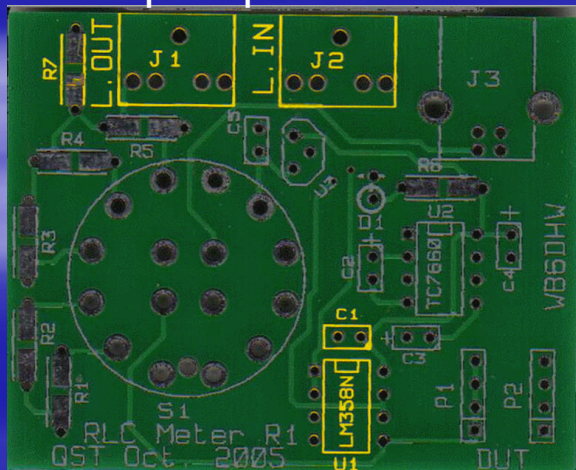
Negative Power Supply



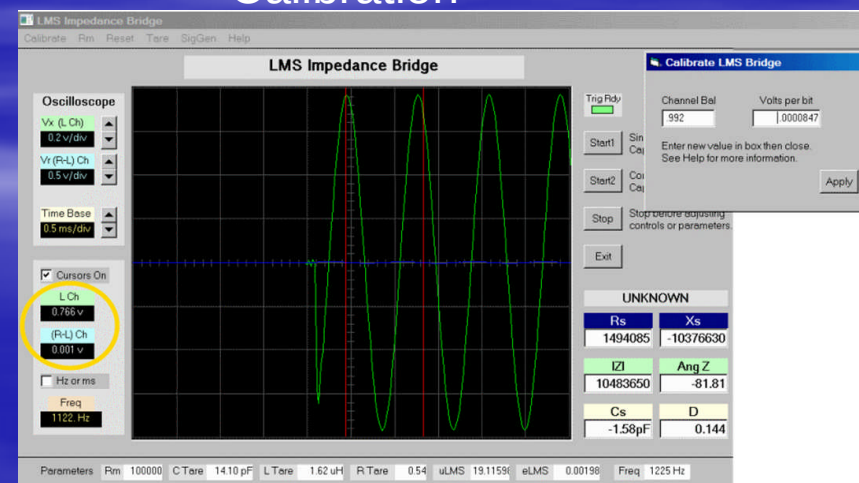
Resistance Ladder



OpAmps & I/O

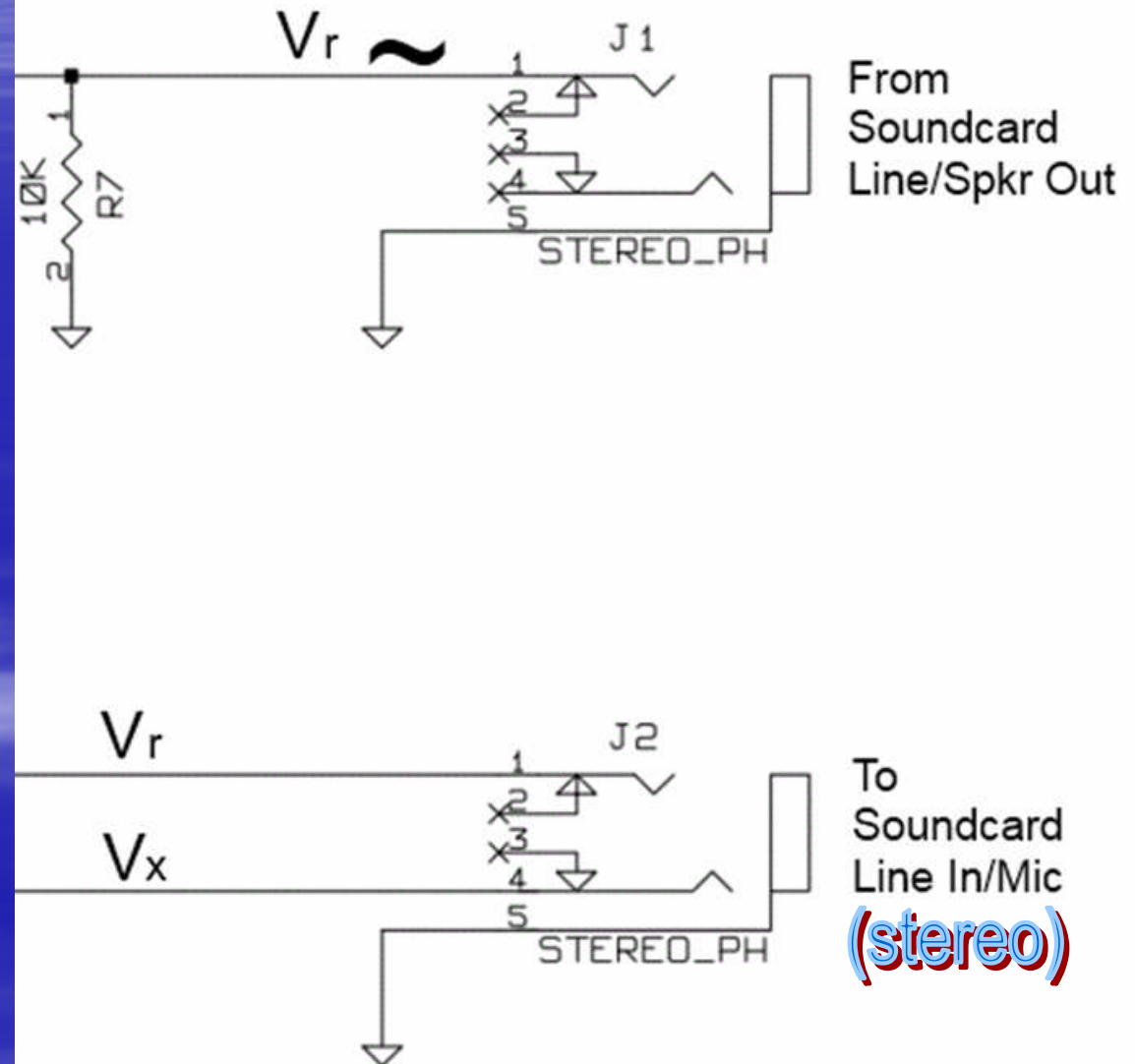


Calibration



■ Theory

- **Apply** reference signal to voltage divider
- **Measure** reference and output signals
- **Calc** Unknown impedance (ohms: R & X)

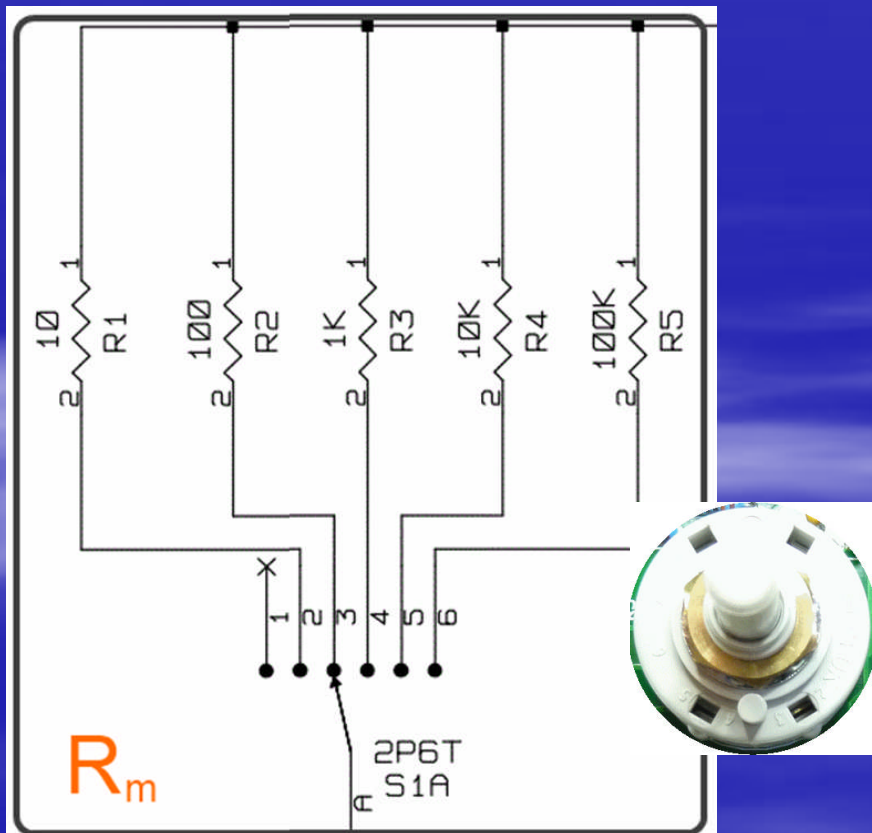


Resistor Ladder Selection

the measurement of inductances and resistances calls for values of R_m that are proportional to the expected value of the component being measured; the value of R_m for capacitors is inversely proportional to the expected value

$$X_C = \frac{1}{2 * \pi * F * C}$$

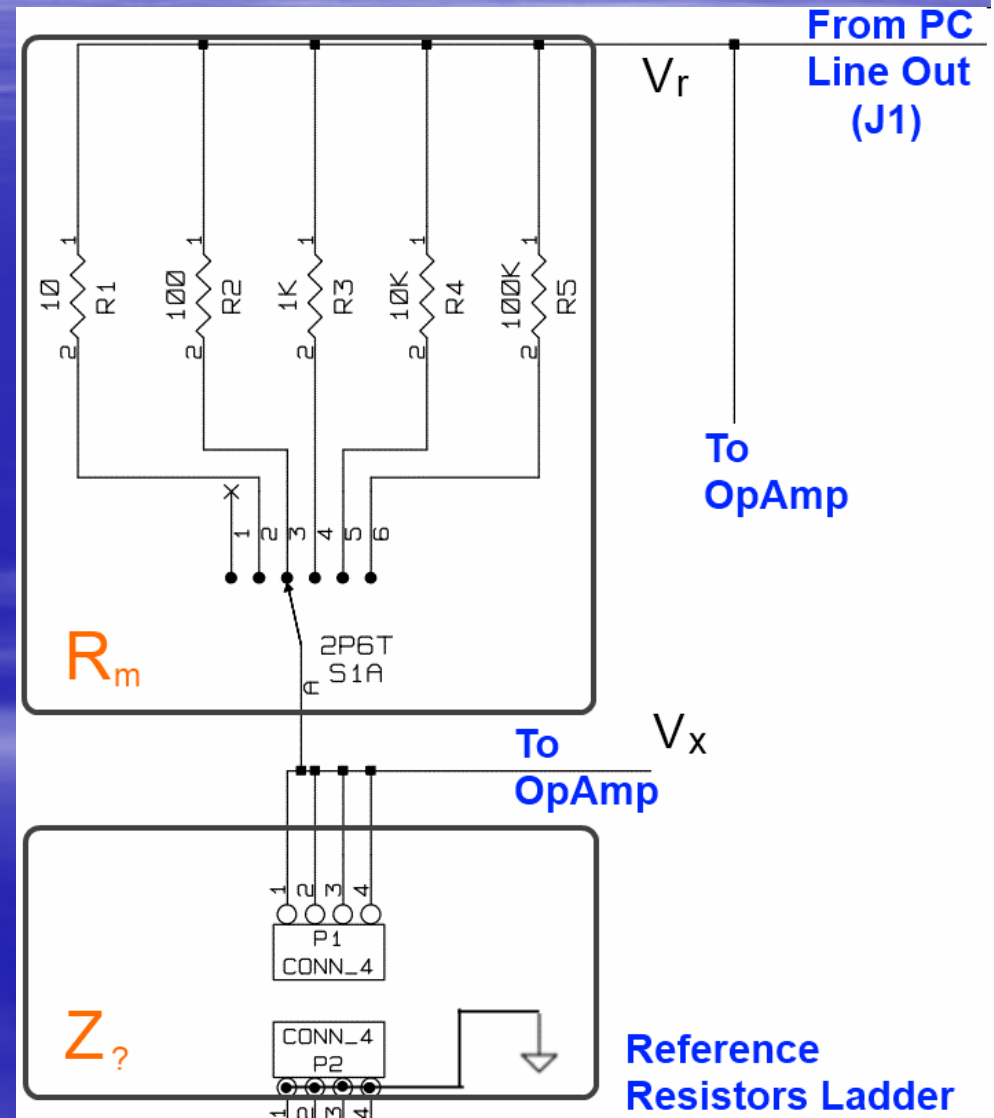
$$X_L = 2 * \pi * F * L$$



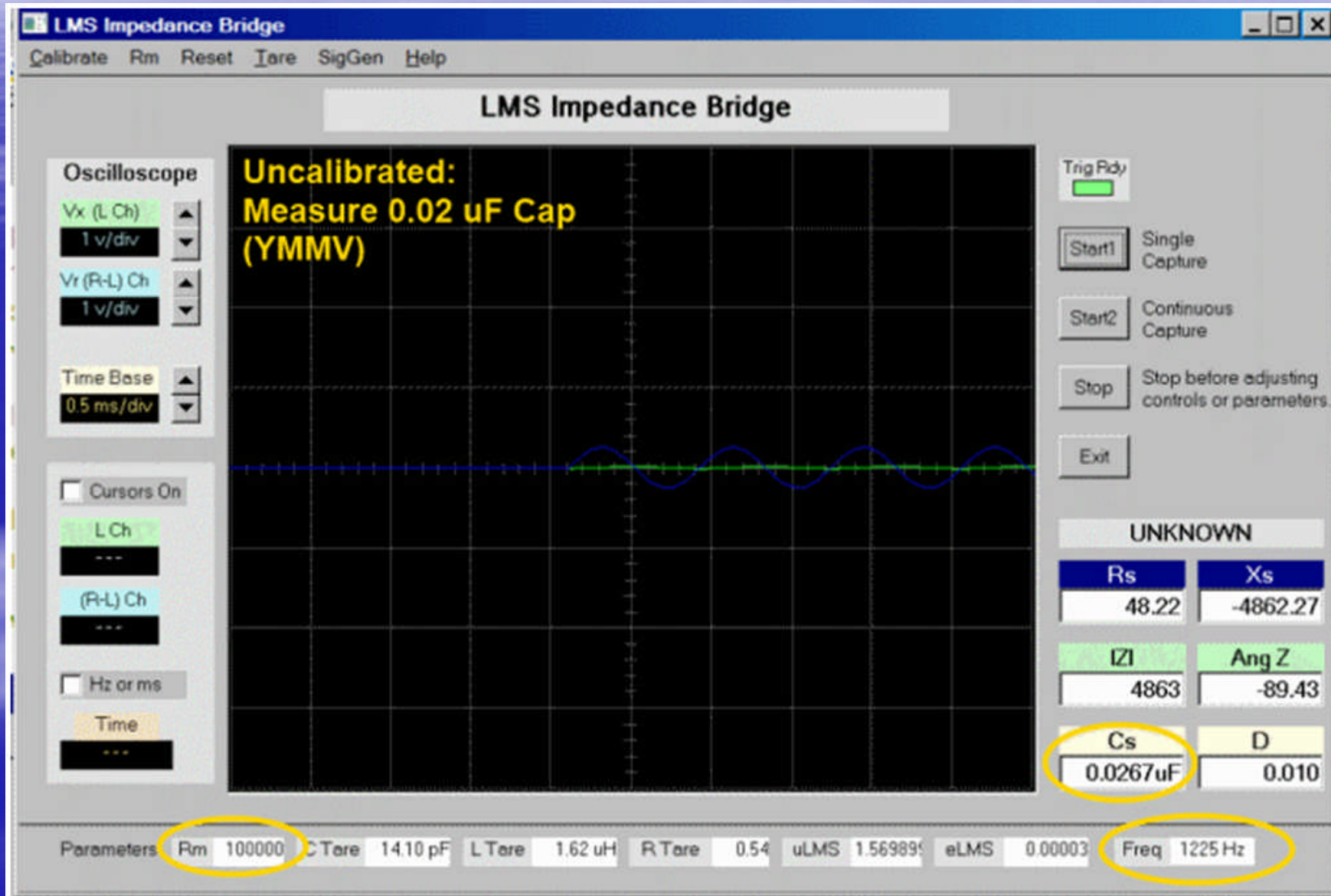
Rm	L-From	L-To	C-From	C-To
10	12.99 uH	12.99 mH	0.1299 uF	1299 uF
100	129.9 uH	129.9 mH	0.01299 uF	129.9 uF
1k	1.299 mH	1299 mH	1.29 nF	12.9 uF
10k	12.99 mH	12.99 H	1299 pF	1.29 uF
100k	129.9 mH	129.9 H	12.99 pF	0.129 uF
Rm	XL_From	XL_To	Xc_From	Xc_To
10	0.1	100	1k	0.1
100	1	1k	10k	1
1k	10	10k	100k	10
10k	100	100k	100k	100
100k	100k	1M	10M	1k

■ Theory

- $Z_{?} = \sqrt{R^2 + X^2}$
- X is capacitive or inductive reactance
- Voltage Divider consists of **R_m** and **$Z_{?}$**
- V_r = reference (AC) voltage, V_x = measured (AC) voltage
- Calc: **Z_x** , Given:
- V_r
 - V_x
 - **R_m**



Measurements



■ References

WB5RVZ Documentation Projects Home

(WB5RVZ.COM)

[Current SDR Projects' Documentation](#) [Ensemble RXTX](#) [Ensemble RX II](#) [Ensemble RX II \(VHF\) \(BETA\)](#) [\(retired\) Ensemble RX \(retired\)Genesis G40 \(no SMT!\) Transceiver](#) [\(retired\)Genesis G3020 \(no SMT!\) Transceiver](#) [Mobo 4.3 Motherboard \(for RXTX V6.3\)](#) [MARS SDR Buildathon](#) [Notes on PowerSDR-IQ V1.19.3.15](#) [RLC Meter Kit](#) [MARS RLC Meter Buildathon](#) [Comments](#)

– Kit Resources: http://wb6dhw.com/RLC_Meter.html

■ Articles

- QST
- QEX

■ Software

■ Purchase:

http://wb6dhw.com/For_Sale.html#RLC_Meter

■ Any Questions????????????