

Basic Electricity

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AT&T Proprietary (Internal Use Only) Not for use or disclosure outside the AT&T companies except under written agreement What is Voltage?A difference of potential.Also explained as pressure.

What is it's measurement? VOLTS

Symbol? V

What are normal voltages?

48VDC POTS 120VDC ONU 120VAC Ringing current 190VDC T1/HDSL 0VDC ADSL/VDSL





The flow of electrons.

What is it's measurement? AMPS





Or 6.24 Quintillion electrons per second



What is Resistance? The opposition of electron flow.

What is it's measurement? OHMS Symbol? Ω

What is static Resistance?

A resistance that does not change when voltage is applied

What is variable Resistance?

One that changes when voltage is applied





Resistance continued

Variable resistance explained

Applied voltage	meter	POTS	ONU	T1 HDSL
Voltage On the same pair	14VDC	48VDC	100VDC	190VDC
Change in resistance	50 Mohms	30 Mohms	5 Mohms	25 kohms

Resistance drops as we apply more voltage.

Our meter does not simulate circuit voltage

This is why we need higher resistance values when we test. So that when we place our circuit back on the pair, it will still Be in the millions of ohms.



Resistance continued

What is a minimum good resistance reading?

POTS 3.5 Mohms ADSL 3.5 Mohms **VDSL** 100 Mohms **T1** 100 Mohms 100 Mohms HDSL



Resistance continued

Terminology

ohms	1-999 ohms
Kohms	1000-999,999 ohms
Mohms	1,000,000-999,999,999 ohms

1 ohm = 1 Volt * 1 Amp

1 kohm = 1000 ohms

1 Mohms = 1,000,000 ohms



What is Capacitance?

The ability of a conductor to store an electric charge.

What is it's measurement? FARAD

Symbol? F

Where do we see capacitance in the phone company?

A twisted pair



Capacitance continued

Your meter measures open using Capacitance

Prefix	Symbol	1000 ^m	10 ⁿ	Decimal	Short scale	Long scale	Since ^[n 1]
yotta	Y	1000 ⁸	10 ²⁴	1 000 000 000 000 000 000 000 000	Septillion Quadrillion		1991
zetta	Z	1000 ⁷	10 ²¹	1 000 000 000 000 000 000 000	Sextillion	Trilliard	1991
exa	Е	1000 ⁶	10 ¹⁸	1 000 000 000 000 000 000	Quintillion	Trillion	1975
peta	Р	1000 ⁵	10 ¹⁵	1 000 000 000 000 000	Quadrillion	Billiard	1975
tera	т	1000 ⁴	10 ¹²	1 000 000 000 000	Trillion	Billion	1960
giga	G	1000 ³	10 ⁹	1 000 000 000	Billion	Milliard	1960
mega	М	1000 ²	10 ⁶	1 000 000	Million		1960
kilo	k	1000 ¹	10 ³	1 000	Thousand		1795
hecto	h	1000 ^{2/3}	10 ²	100	Hundred		1795
deca	da	1000 ^{1/3}	10 ¹	10	Ten		1795
		1000 ⁰	10 ⁰	1	0	ne	-
deci	d	1000 ^{-1/3}	10 ⁻¹	0.1	Tenth		1795
centi	с	1000 ^{-2/3}	10 ⁻²	0.01	Hundredth		1795
milli	m	1000 ⁻¹	10 ⁻³	0.001	Thousandth		1795
micro	μ	1000 ⁻²	10 ⁻⁶	0.000 001	Millionth		1960
nano	n	1000 ⁻³	10 ⁻⁹	0.000 000 001	Billionth Milliardth		1960
pico	р	1000 ⁻⁴	10 ⁻¹²	0.000 000 000 001	Trillionth Billionth		1960
femto	f	1000 ⁻⁵	10 ⁻¹⁵	0.000 000 000 000 001	Quadrillionth Billiardth		1964
atto	а	1000 ⁻⁶	10 ⁻¹⁸	0.000 000 000 000 000 001	Quintillionth	Trillionth	1964
zepto	z	1000 ⁻⁷	10 ⁻²¹	0.000 000 000 000 000 000 001	Sextillionth Trilliardth		1991
yocto	У	1000 ⁻⁸	10 ⁻²⁴	0.000 000 000 000 000 000 000 001	Septillionth	Quadrillionth	1991
1. A The metric system was introduced in 1795 with six prefixes. The other dates relate to recognition by a resolution of the CGPM in the state channel.							

1 foot = 15 pF Or .0000000001 F





What is Inductance?

What is it's measurement?

The ability of one conductor to transfer electrons from one conductor to another using EMF (electromotive force).

What is it's measurement? Henries

Symbol? L



Inductance continued

What are two inductors in the phone company?

The cable

The cable induce frequncies between pairs

Load Coils

Load coils add inductance into the cable to counter act the affects of capacitance



Understanding the relationship of inductance and capacitance...

capacitance

Our cable is both a capacitor and an inductor. But they are imbalanced Cables have large amounts of **capacitance** and small amounts of **inductance**

inductance



Understanding the relationship of inductance and capacitance...

They are opposites

capacitors	Inductors (load coils)
Allow high frequencies to pass (6001-30MHz)	Allow low frequencies to pass (voice band 0-6000 hz)
Block low frequencies (voice band 0-6000 hz)	Blocks high frequencies (6001-30MHz)

Cables lengths over 18,000 feet must be loaded for Pots service (low frequencies) to work.

Load coils must be removed to allow data sevice (high frequencies) work a peak performance.



Load Coil placement



Each load coil adds 88 mL (milli Henries) at each loading point



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88 mL = .088 L

What is Impedance?

Impedance is the combined resistance of resistors, inductors and capacitors.

It is measured in ohms.

() What is attenuation?

It is the flattening of frequencies over a impedance.





Laws of a series circuit



 \checkmark E = VOLTS = ADD \checkmark R = OHMS = ADD \checkmark I = AMPS = CONSTANT \checkmark P = WATTS = ADD



Laws of a series circuit



$E P P E^{2}$ $\overline{I R R I^{2}} \overline{I E R P}$





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a	ws of a	a serie	s circui	t		$\checkmark E = ADD$ $\checkmark R = ADD$ $\checkmark I = CONSTA$	ANT
12	20VDC	R: 	1 //	-~	R2	✓P = ADD	
TOTAL		13	13		45		
E	120 V						
R	58				R2		
I	2.07 A	E	26.91 V		E	93.15 V	
P	513.9	R	13		R	45	
• 	3	I	2.07 A		Ι	2.07 A	
		Р	55.7 W		Р	192.82 W	



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Laws of a Parallel circuit



- \checkmark E = VOLTS = CONSTANT
- $\checkmark R = OHMS = INVERSIVE$
- $\checkmark I = AMPS = ADD$
- $\checkmark P = WATTS = ADD$



Laws of a Parallel circuit











