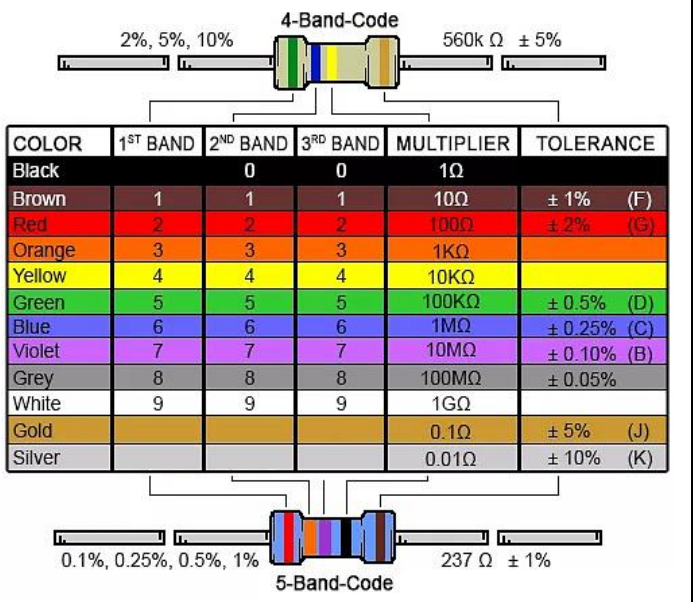
ELECTRONICS REFERENCE NOTES FOR MODEL RAILROADERS

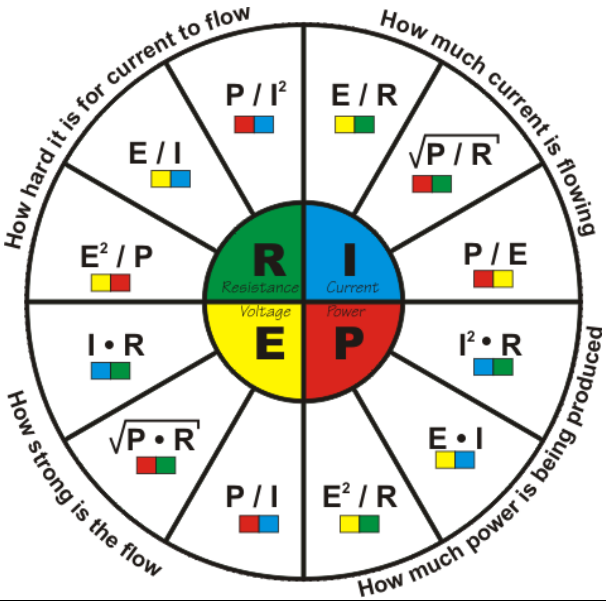
(ELECTRONIC SURVIVAL GUIDE)

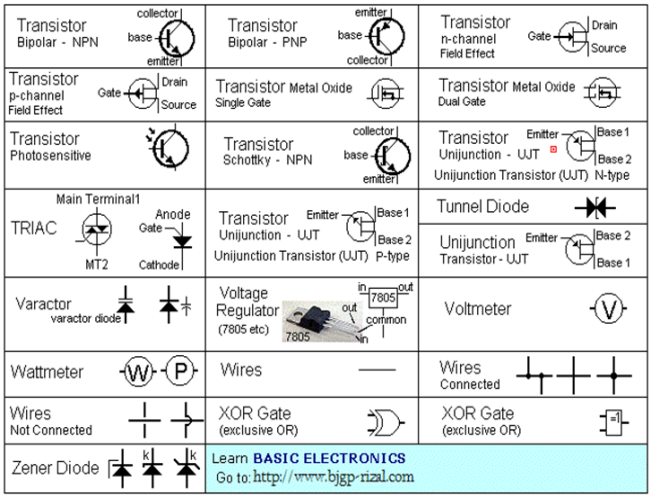
RESISTOR COLOR CODE



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black		0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8	100MΩ	± 0.05%
White	9	9	9	1GΩ	
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

OHMS LAW





Courtesy of Pembelajaran Online Guru Elektronik

Term	Abbreviation	Value (Scientific)	Value (Normal)
Tera	T	1×10^{12}	1,000,000,000,000
Giga	G	1×10^{9}	1,000,000,000
Mega	M	1×10^{6}	1,000,000
kilo	k (lower case)	1×10^{3}	1,000
Units	-	1	1
Milli	m	1×10^{-3}	1 / 1,000
Micro	µ or u	1×10^{-6}	1 / 1,000,000
Nano	n	1×10^{-9}	1 / 1,000,000,000
Pico	p	1×10^{-12}	1 / 1,000,000,000,000

Metric Multiplication Units

Term	Abbreviation	Unit	Unit Symbol	Component
Resistance	R	ohm	Ω	Resistor
Capacitance	C	farad	F	Capacitor
Inductance	L	henry	H	Inductor
Voltage	E or V	volt	V	–
Current	I	amp	A	–

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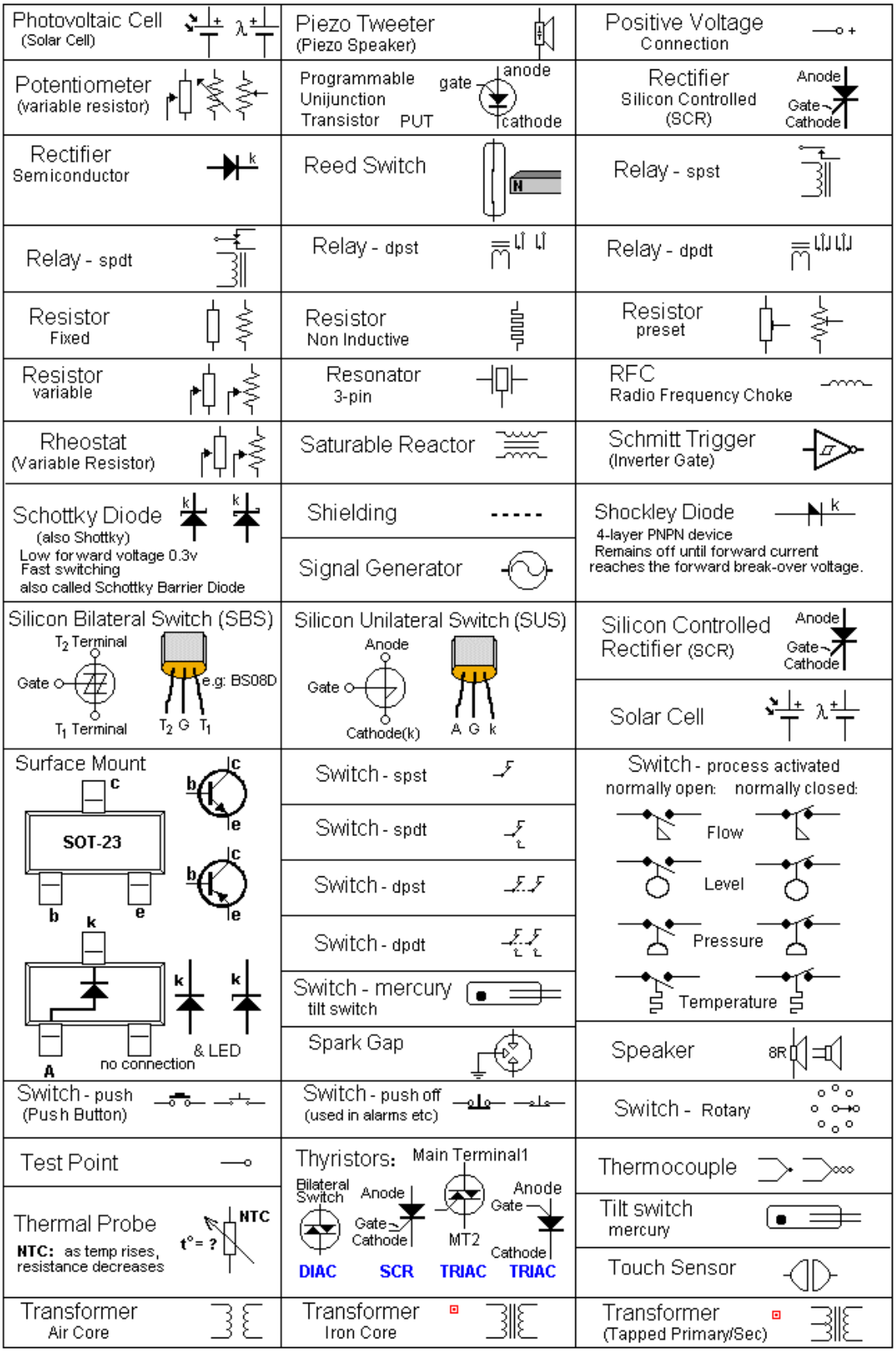

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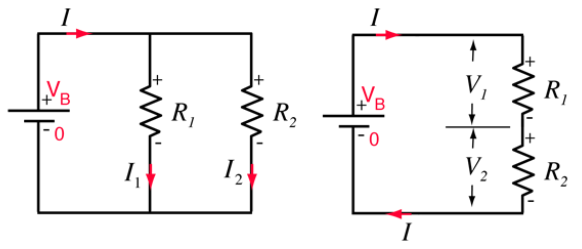
RESISTANCE IN SERIES AND PARALLEL CIRCUITS



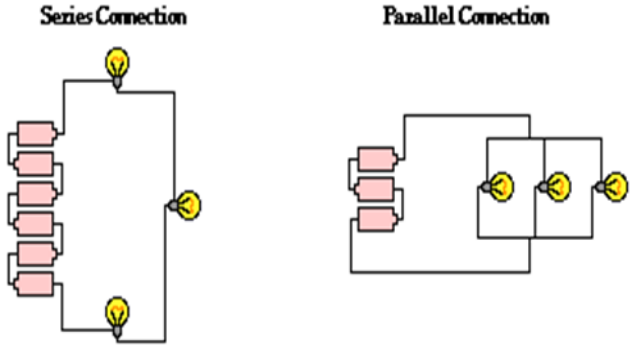
Parallel resistors

$$\frac{1}{R_{equivalent}} = \frac{1}{R_1} + \frac{1}{R_2}$$

Series resistors

$$R_{equivalent} = R_1 + R_2$$

SERIES VS. PARALLEL CONNECTIONS



Standard Resistor Values (±5%)						
1.0	10	100	1.0K	10K	100K	1.0M
1.1	11	110	1.1K	11K	110K	1.1M
1.2	12	120	1.2K	12K	120K	1.2M
1.3	13	130	1.3K	13K	130K	1.3M
1.5	15	150	1.5K	15K	150K	1.5M
1.6	16	160	1.6K	16K	160K	1.6M
1.8	18	180	1.8K	18K	180K	1.8M
2.0	20	200	2.0K	20K	200K	2.0M
2.2	22	220	2.2K	22K	220K	2.2M
2.4	24	240	2.4K	24K	240K	2.4M
2.7	27	270	2.7K	27K	270K	2.7M
3.0	30	300	3.0K	30K	300K	3.0M
3.3	33	330	3.3K	33K	330K	3.3M
3.6	36	360	3.6K	36K	360K	3.6M
3.9	39	390	3.9K	39K	390K	3.9M
4.3	43	430	4.3K	43K	430K	4.3M
4.7	47	470	4.7K	47K	470K	4.7M
5.1	51	510	5.1K	51K	510K	5.1M
5.6	56	560	5.6K	56K	560K	5.6M
6.2	62	620	6.2K	62K	620K	6.2M
6.8	68	680	6.8K	68K	680K	6.8M
7.5	75	750	7.5K	75K	750K	7.5M
8.2	82	820	8.2K	82K	820K	8.2M
9.1	91	910	9.1K	91K	910K	9.1M

These fixed capacitor values are the most commonly found										
pF	pF	pF	pF	µF	µF	µF	µF	µF	µF	µF
1.0	10	100	1000	0.01	0.1	1.0	10	100	1000	10,000
1.1	11	110	1100							
1.2	12	120	1200							
1.3	13	130	1300							
1.5	15	150	1500	0.015	0.15	1.5	15	150	1500	
1.6	16	160	1600							
1.8	18	180	1800							
2.0	20	200	2000							
2.2	22	220	2200	0.022	0.22	2.2	22	220	2200	
2.4	24	240	2400							
2.7	27	270	2700							
3.0	30	300	3000							
3.3	33	330	3300	0.033	0.33	3.3	33	330	3300	
3.6	36	360	3600							
3.9	39	390	3900							
4.3	43	430	4300							
4.7	47	470	4700	0.047	0.47	4.7	47	470	4700	
5.1	51	510	5100							
5.6	56	560	5600							
6.2	62	620	6200							
6.8	68	680	6800	0.068	0.68	6.8	68	680	6800	
7.5	75	750	7500							
8.2	82	820	8200							
9.1	91	910	9100							

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LIST OF ELECTRONIC TOOL AND PARTS SUPPLIERS

Company	Web Address
Digi-Key	https://www.digikey.com/
Mouser	https://www.mouser.com/
All Electronics	https://www.allelectronics.com/
Micro-Mark	https://www.micromark.com
Grainger	https://www.grainger.com/
Newark	http://www.newark.com/

REFERENCE WEBSITES

Name	Web Address
Wiring For DCC (useful for DC and DCC applications)	http://wiringfordcc.com/
Model Railroad & Misc. Electronics	http://www.circuitous.ca/
MERG - Model Electronic Railway Group	https://www.merg.org.uk/
Discover Circuits	http://www.discovercircuits.com/M/model-trains1.htm
MY WEBSITE	**http://www.dccgeek.com**

REFERENCE BOOKS

Electronics for Dummies by Cathleen Shamieh and Gordon McComb
Getting Started in Electronics by Forrest.M.Mims
Make Electronics – Learning by Discovery by Charles Platt (2nd Edition)
All New Electronics – Self Teaching Guide by Harry Kybett & Earl Boysen
Practical Electronics for Inventors by Paul Scherz