Basic electronics

Anders Ernevi

Voltage and current

- Two different kinds: AC and DC – do not confuse...
- Polarity
- Fixed voltage, varying current consumption

Ohm's law

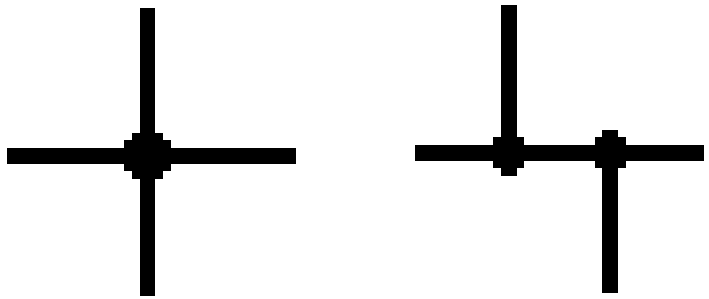
- V=RI
- I=V/R ← This is the most common case, finding what current a certain load consumes at a fixed voltage
- R=V/I ← Very useful for calculating what load we need to draw a certain current at a fixed voltage

Schematic diagrams

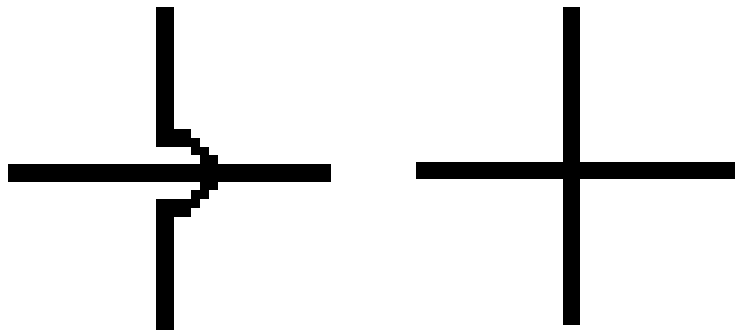
- Symbolic
- Not always representing component layout
- Lines crossing, with and without connection

Connections

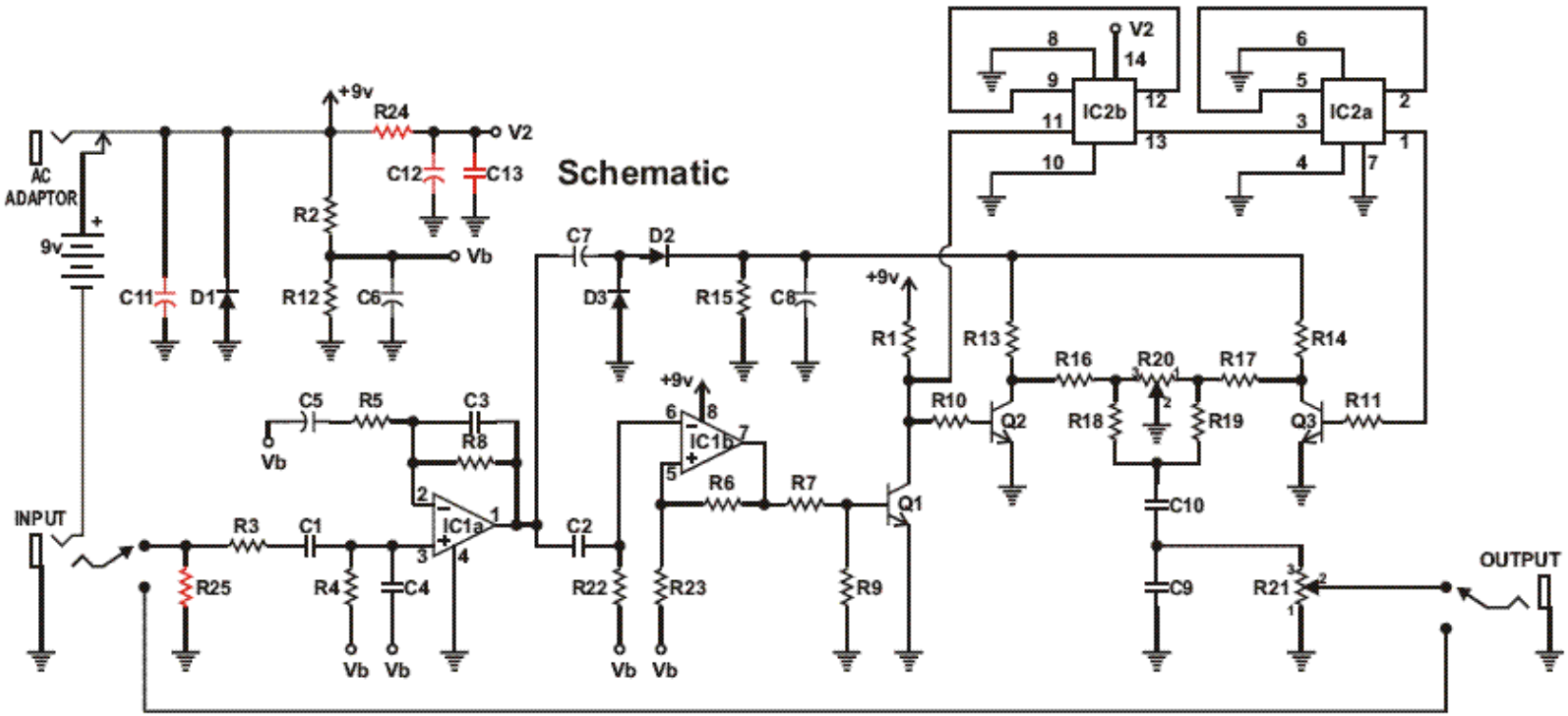
- Wires, Connected, Crossing



- Wires, Not Connected, Crossing

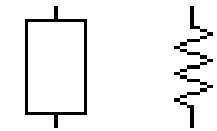


Schematic diagram

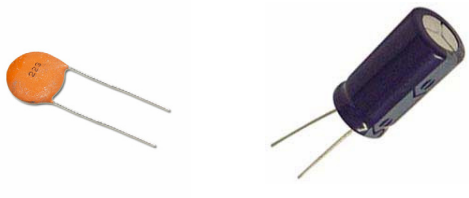


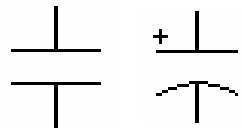
Components

- Resistor

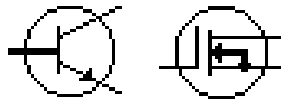


- Capacitor

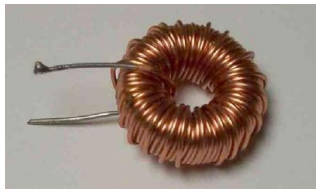




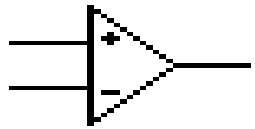
- Transistor



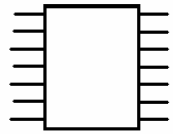
- Inductor



- Op Amp



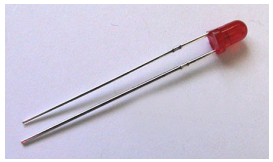
- IC

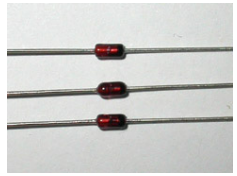


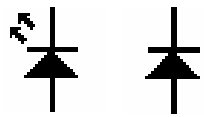
- Battery

- Ground

- LED/Diode

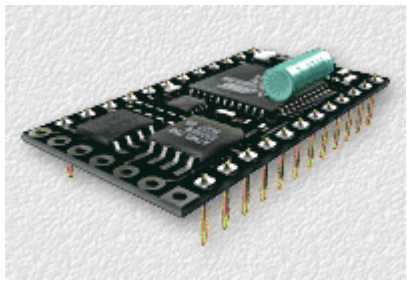






BasicX-24

- 18 mm x 32 mm
- ~ 50 mA
- Basic
- Price ~ $50



Basic Speed	65,000 instructions per second
EEPROM	32K bytes (User program and data storage)
Max program length	8000+ lines of Basic code
RAM	400 bytes
Available I/O pins	21 (16 standard + 2 serial only + 3 accessed outside standard dip pin area)
Analog Inputs (ADCs)	8 (8 of the 16 standard I/O pins can individually function as 10bit ADCs or standard digital I/Os or a mixture of both)
Serial I/O speed	1200 - 460.8K Baud
Programming interface	High speed Serial
Physical Package	24 pin DIP module

Some Sensors

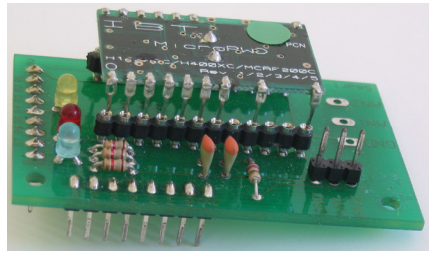
- Temperature
- Pressure
- Humidity
- Soil humidity
- Acceleration
- Noise
- Material stress
- Biometric
- Motion
- Distance
- Touch
- Location
- Orientation
- Light

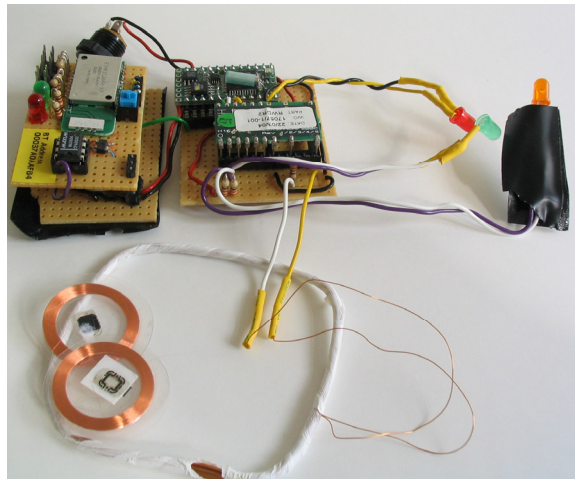
Classification

- Simple vs. complex
- Analog vs. digital
- Continuous vs. discrete
- Active vs. passive
- Cost
- Energy consumption
- Size

RFID

- Radio transmits energy to a tag that sends back its unique id
- Antenna and tag size determine reading distance
- Reading distance 3 cm up to 10-20 m





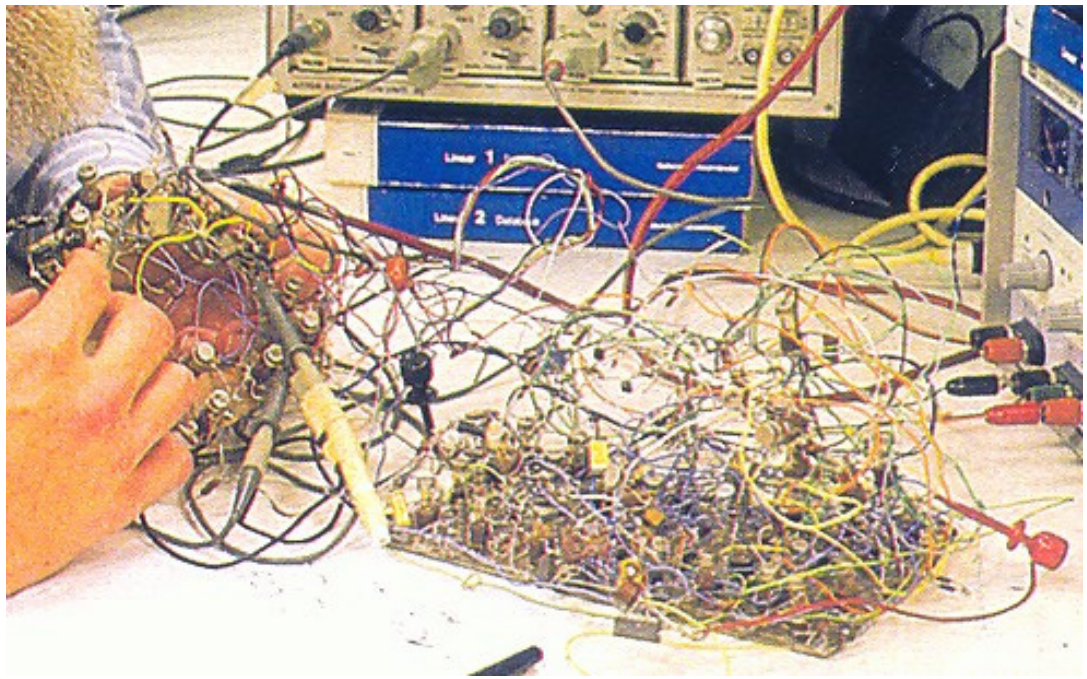
Cables and conventions

- Black = Ground, negative,-
- Red = Positive,+
- Use different colors for different signals – except for above
- Stiff wire on circuit board, soft wire for connections

- Universial standard

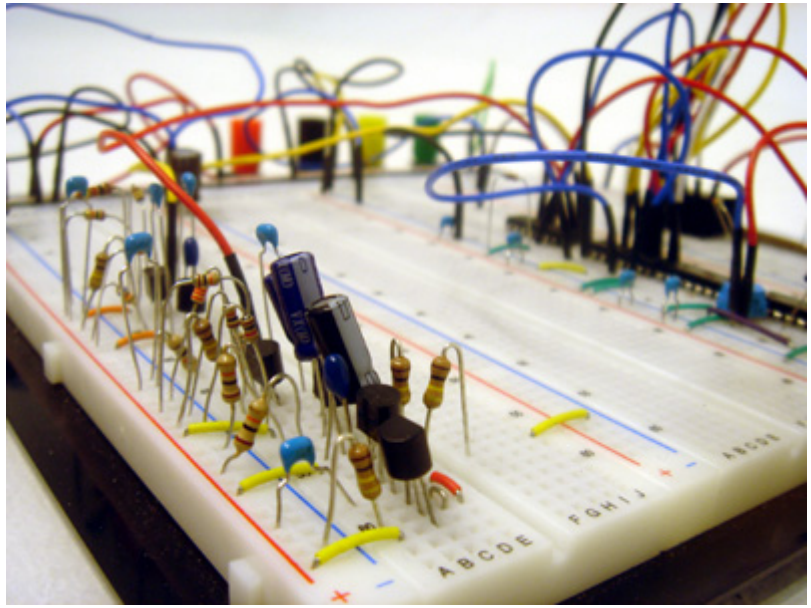
Prototyping

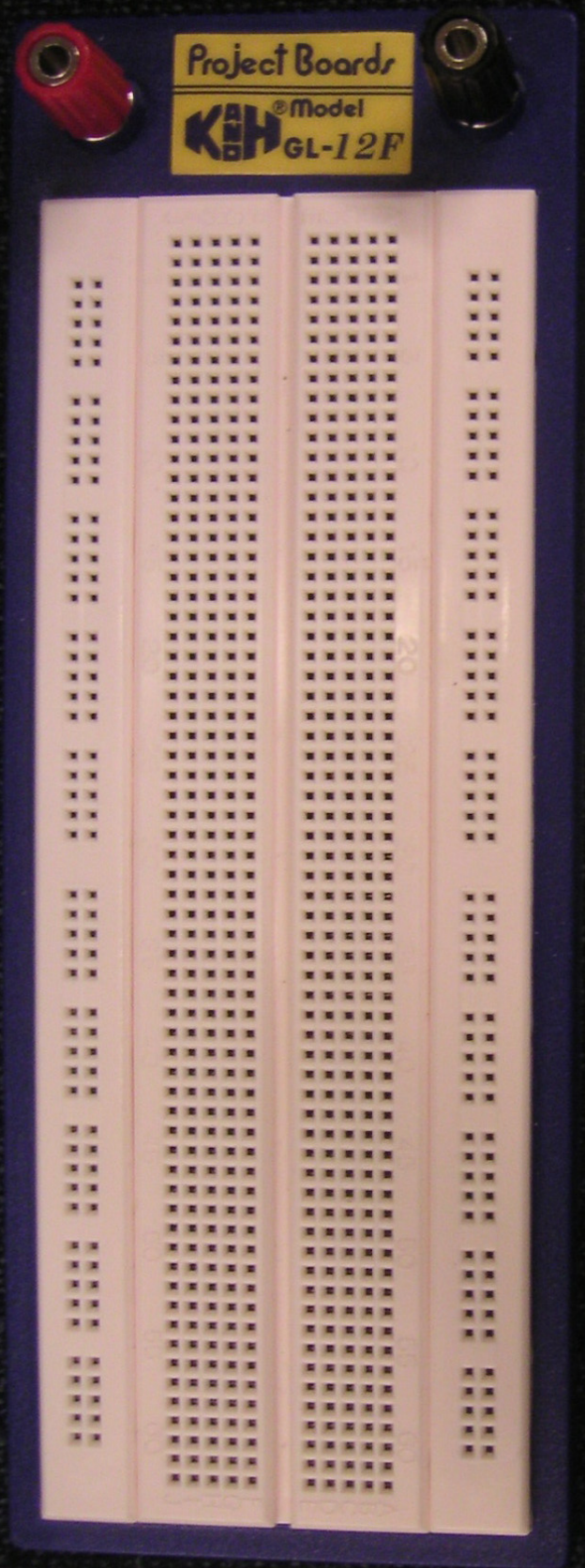
- Breadboard
- Prototype board
- Wire wrapping
- Printed circuit board

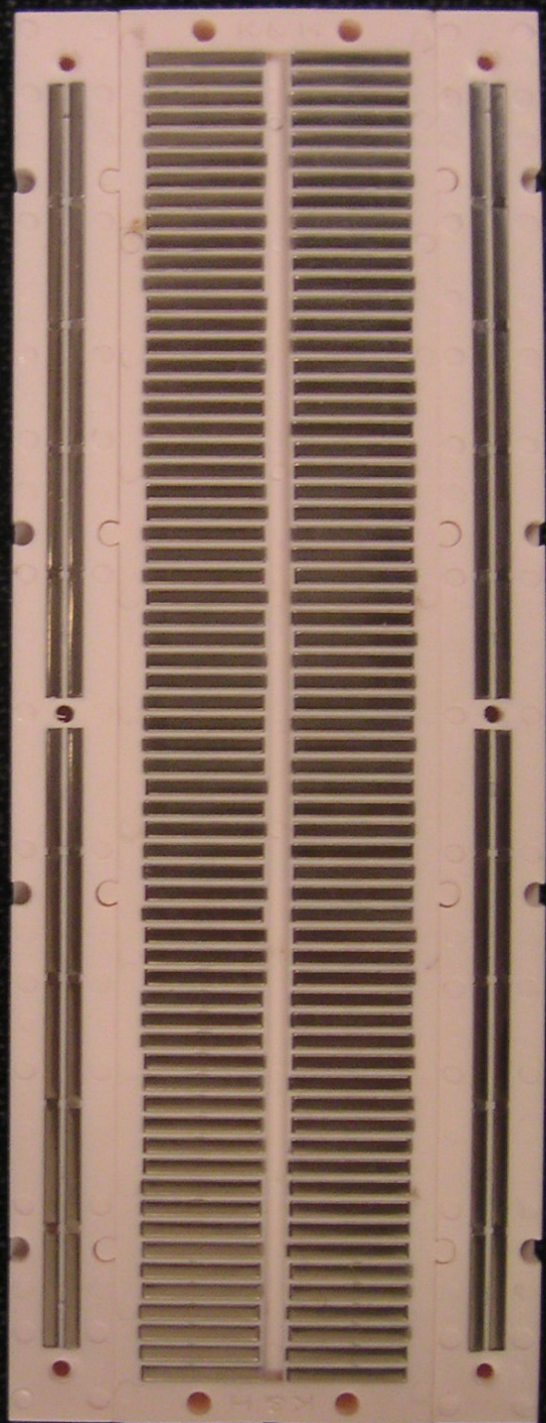


Breadboard

- Push components in
- Certain holes are connected
- Be careful not to short circuit

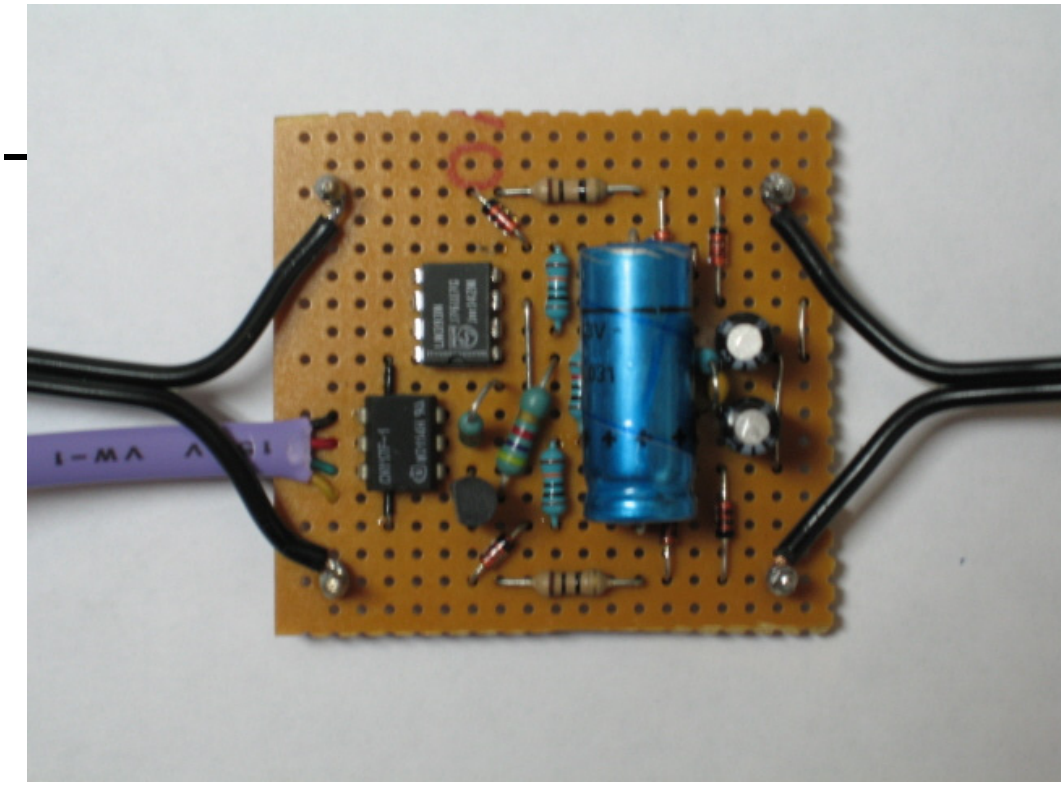



Project Boards
K&H ®Model
GL-12F

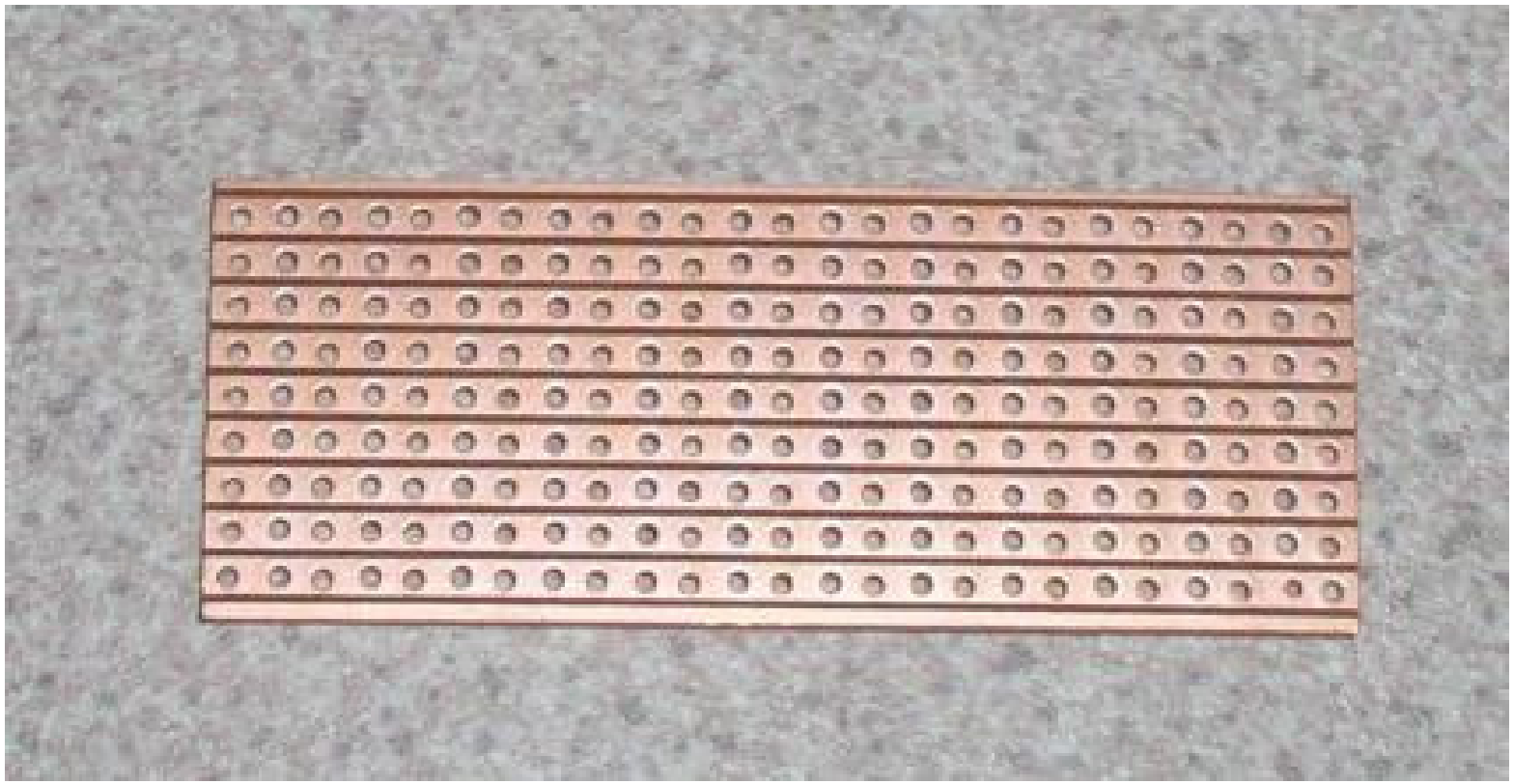


Prototype board

- Also called vero board
- Copper on the back - solder side
- Three different layouts

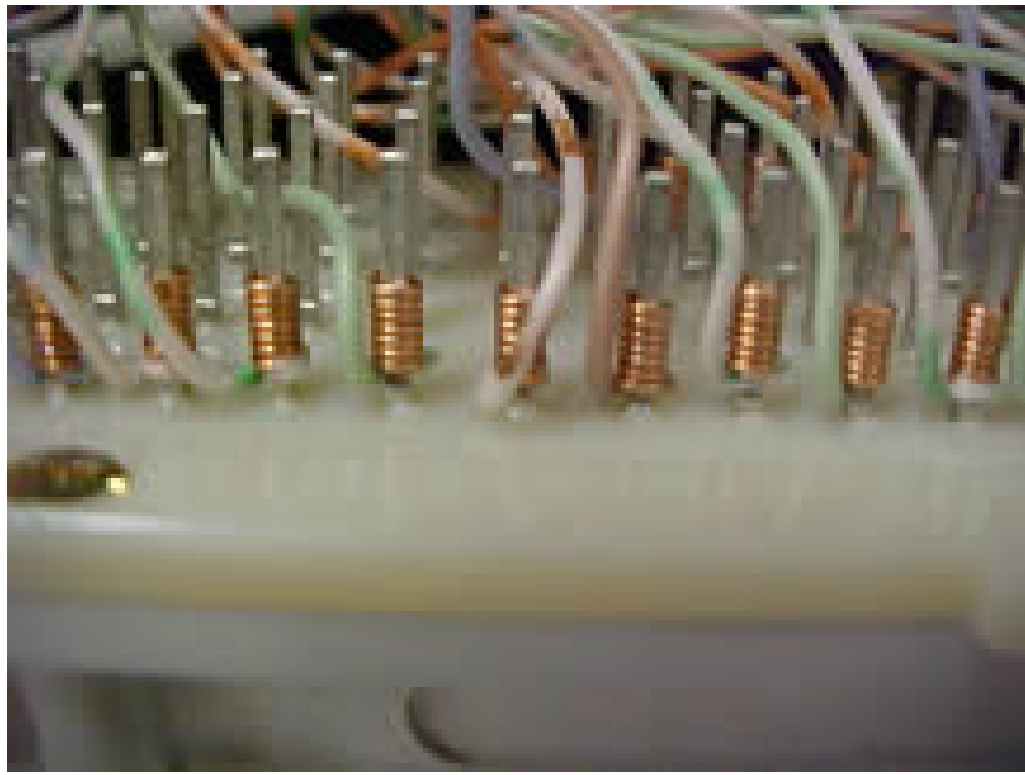


- Strips (shown)
- Groups of three
- Single rings



Wire wrapping

- Quick prototyping
- Risk for rats nests
- Requires special sockets and tools

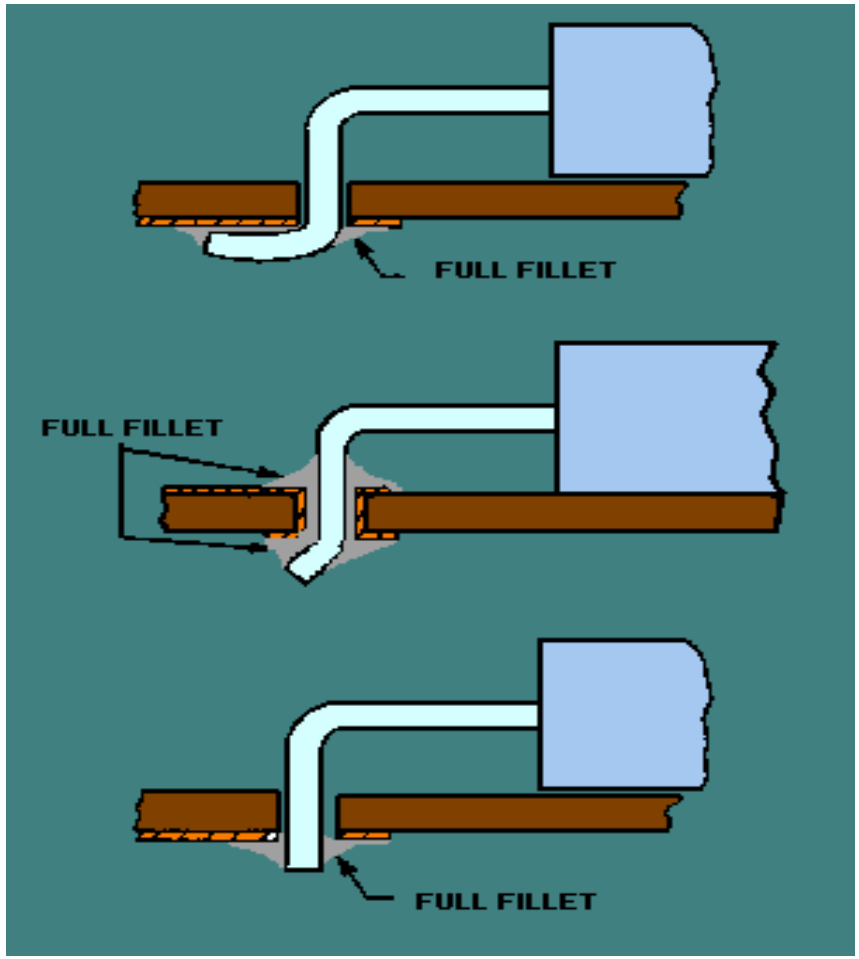


Layout

- Start with the IC:s and work outwards
- Keep wires short
- Make a ground bus and a positive bus
- A neat layout is easy to debug

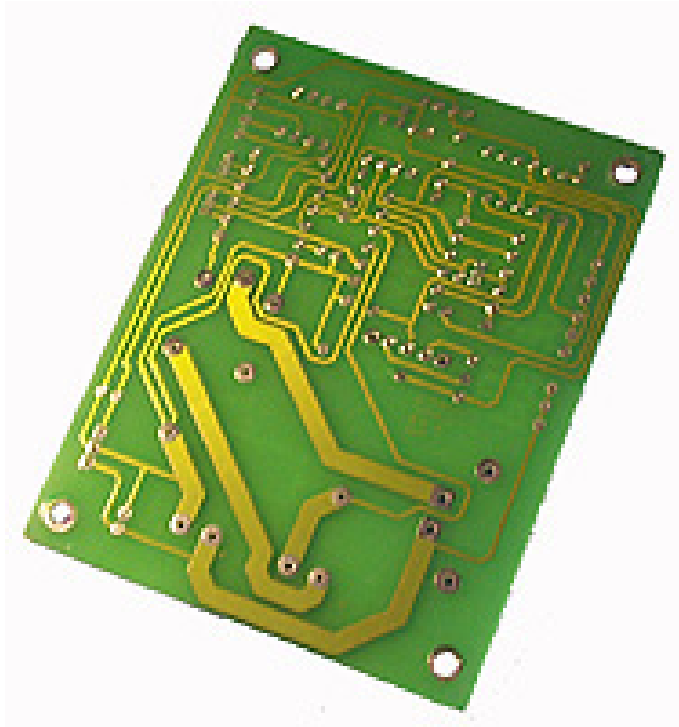
Soldering

- Components as close as possible
- Components resting on the board for stability
- Solder flowing out like a tent



Printed circuit board

- Better layout
- Reproducible
- Long lasting



Debugging

- Use ’beep’ mode on multi meter
- Ceck that there’s one ground everywhere
- Check voltages on all IC:s and other places
- Break problem into small blocks and debug them first
- Use different cable colors

Tomorrow

- Exercise: Chuckles
- Prototyping both on bread board and vero board
- Soldering
- Check webpage