

Hardware Design Basics - Digital Forensics Labs

Digital Multimeter

It is a test tool used to measure two or more electrical values — principally voltage (volts), current (amps) and resistance (ohms). It is a standard diagnostic tool in the digital forensics and electrical/electronic industries.

Example: Fluke 117, Craftsman 34-82141, Extech EX330, Crenova MS8233D.



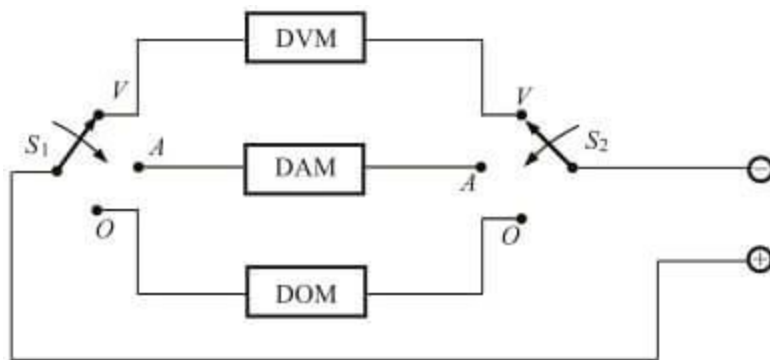
Source: H-11 Digital Forensics

Digital multimeters (DMMs) are widely accepted worldwide as they have better accuracy levels and range from simple 3 ½ to 4 ½ digit handheld DMM to very special system DMM.

Digital Multimeter is mainly divided into three parts that are:

- Display, for viewing the values.
- Selection Dial, to set multimeters to read different electrical parameters such current, voltage, resistance, capacitance etc.
- Ports, for different usage. **COM** port stands for common and is almost connected to the group or considered as a -ve connection of a circuit. **mAVΩ** port allows the measurement of current, voltage and resistance or considered as a +ve connection of a circuit.

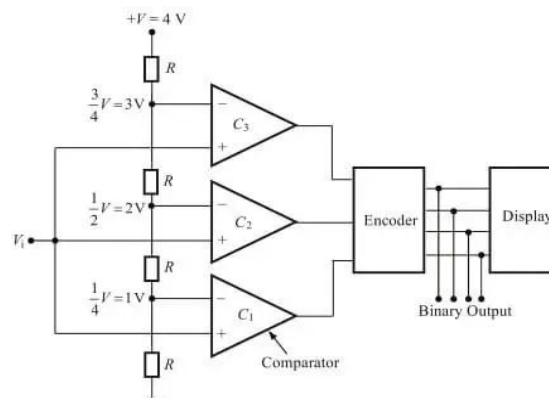
Block Diagram



In a basic DMM, there's a Digital Voltmeter (DVM), Digital Ammeter (DAM), and Digital Ohmmeter (DOM). Other types of the meters could also be incorporated.

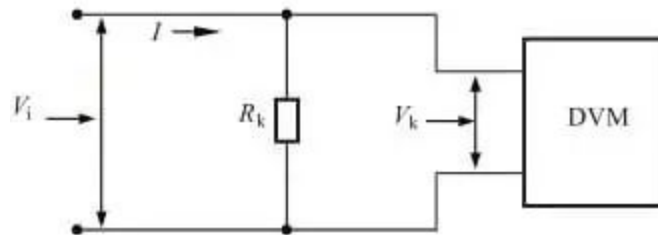
1. Digital Voltmeter (DVM)

It is used for measurement of voltage through the use of Analog to Digital converter. The AD converter (Analog to Digital Converter) comprises comparators, encoders and digital displays. Comparators are driven by a resistor divider network, the encoder converts its inputs to corresponding outputs that drive digital display.



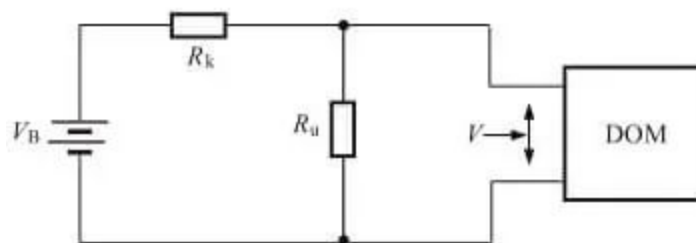
2. Digital Ammeter (DAM)

It uses a shunt resistor (a resistor having a very low value) to produce a calibrated voltage proportional to current flowing. To measure the value we must convert the current into voltage by using known resistance.

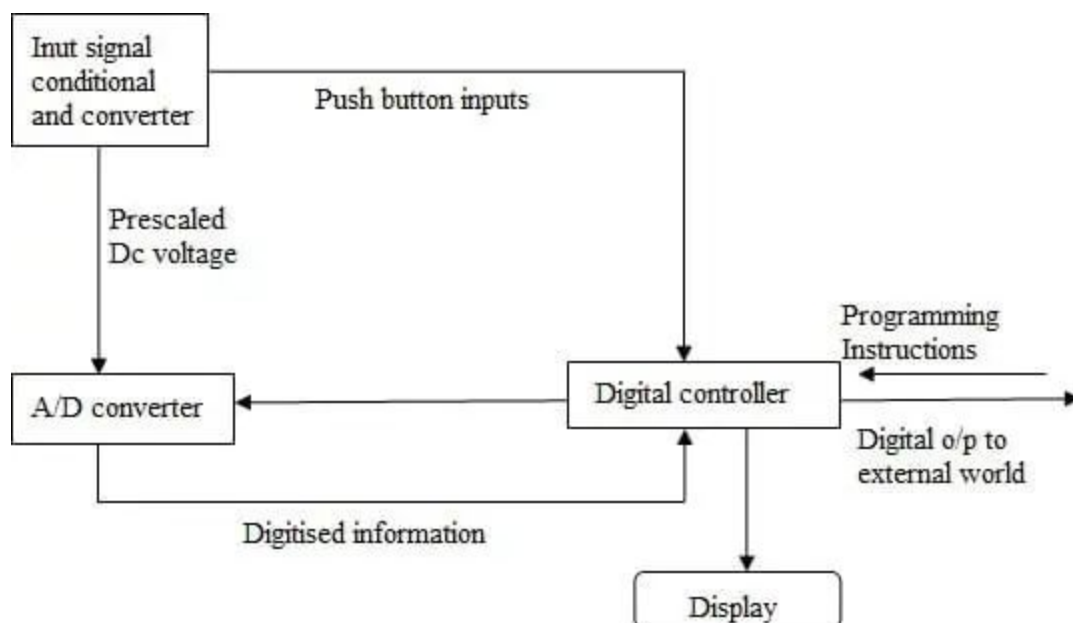


3. Digital Ohmmeter (DOM)

It is used to measure electrical resistance which obstructs the path of the flow of current.



Working



Hard Drive Docking Station

Docking station for hard drives enables us to have quick access to the stored data by using USB or SATA. We can easily recover, transfer or archive data and test multiple hard drives. It combines the function of an external hard drive enclosure with the abilities of partition imaging. And allows us to clone data without connecting to the internet.

Example: Sabrent (EC-DFLT), Inateck FD2002, Storite, Thermaltake BlacX ST0014U-D, ORICO 6619US3-C, etc.



Design

(Top Side)

1. SATA Hard Drive Power button & Activity LED.
2. IDE Hard Drive Power button & Activity LED.
3. SATA Hard Drive slot.
4. IDE Hard Drive slot.
5. SATA Hard Drive eject button.



- ❖ When the drive is **powered on**, the **Blue LED** Power indicator will illuminate. While the **hard drive is being accessed**, the **Red LED** will flash. **Do not remove your drive from the docking station while the Red LED is flashing**, as it could damage to your drive, resulting in data loss.

(Rear Side)

1. IDE Hard Drive Data Port.
2. IDE Hard Drive Power Port.
3. USB 3.0 port.
4. Power adapter port.

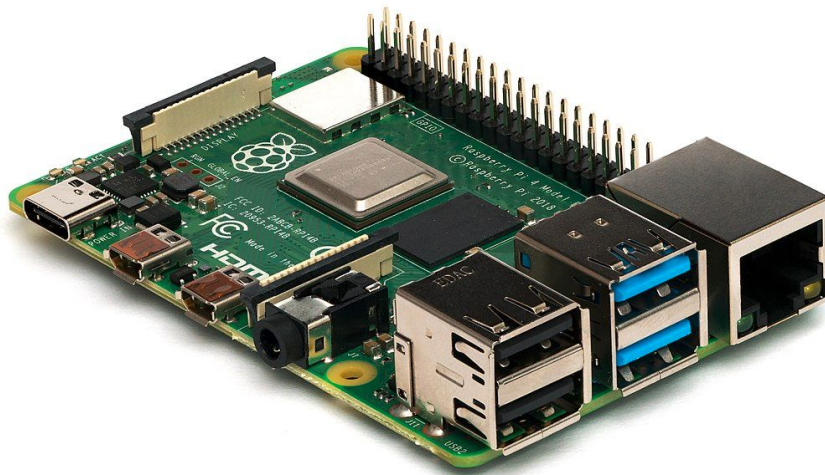


Benefits

- No need to install the drive in a computer case or mount it.
- You can swap the drives easily with top-loading design, push-button drive ejection.
- Optimal performance, professional build, and quality design.
- Increases productivity with USB pass-through hubs and fast charge.
- Convenience, and super speed USB 3.0 technology.

Raspberry Pi Kit

The Raspberry Pi is a series of small single-board computers developed by the Raspberry Pi Foundation to put the power of computing and digital making into the hands of people. It is now widely used even in research projects, such as for weather monitoring because of its low cost and portability. It does not include peripherals. However, some accessories have been included in several official and unofficial bundles.



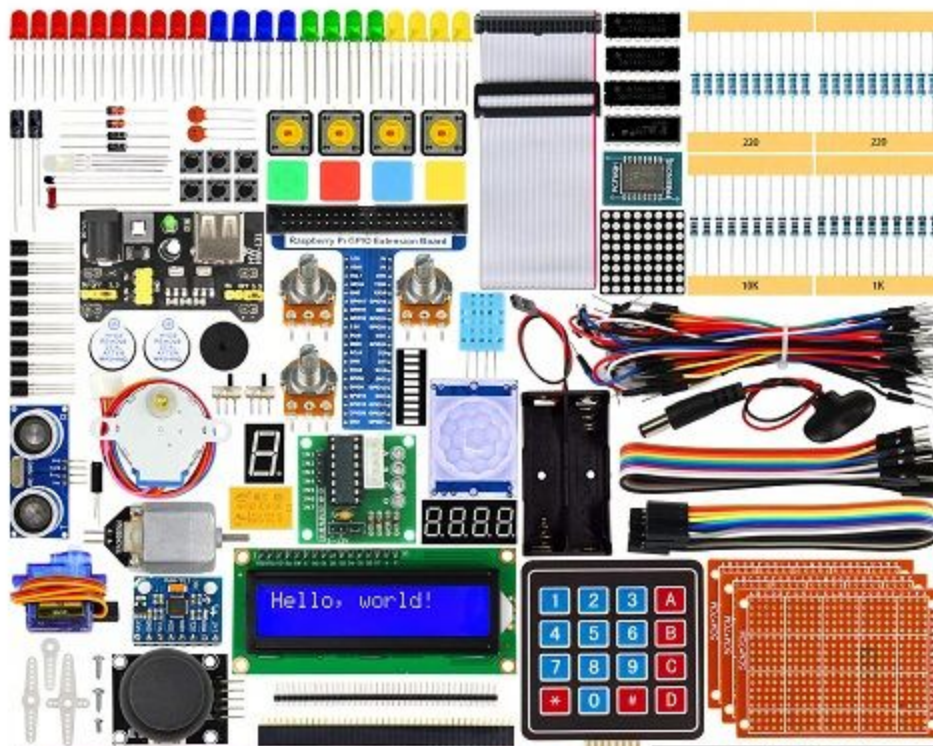
It is widely used in the Internet of Things, Home Automation, Hacking, learning to code. It can also be used as Web server (it can stay ON 24/7 and uses very little power), Laptop (Pi used as a brain), Home theater PC, Wi-Fi extender (wireless capability), Game emulator, Robot car, Alexa Speaker (just Wi-Fi connected Pi with attached speaker and microphone is required), Network-attached storage drive (we can combine Pi with a USB Hard drive), Security Camera (Raspberry

Pi Zero W and official Pi cameras are required), Music streamer with multiroom audio, Minecraft machine, Weather station, Robot Arm.

Raspberry Pi Models: Pi 3 Model B, Pi 2 Model B, Pi Zero W, Pi 1 Model B+/A+.

Basic Kit includes

- Raspberry Pi Model
- Cooling Fan & Heat sinks
- USB 5V 3A Power Supply with ON/OFF Switch
- Micro SD Card and USB-Micro SD Adapter
- Micro HDMI to HDMI Cable
- LCD
- Breadboard
- Keypad
- LEDs
- 2.4 Amps Power Adaptor
- Connecting Wires



Source: Freenove Ultimate Starter Kit for Raspberry Pi 4

In the Soldering Kit, the important hand tool is a soldering iron which is used in soldering (mostly soldering wires for better connection in circuit boards). It supplies heat to melt solder so that it can flow into the joint between two workpieces. A soldering iron is composed of a heated metal tip and an insulated handle.

[illegible]

Basic Kit includes

- Soldering Iron
- Wire Cutter
- Solder Sucker

Its a mechanical vacuum pump which sucks the solder away from the solder joint.



- Solder wick

It is also used for removing the solder which is made up of copper threads that will absorb the solder from the solder joint.



- Tweezers

Used in keeping the components in their place and to avoid burning your fingers when soldering.



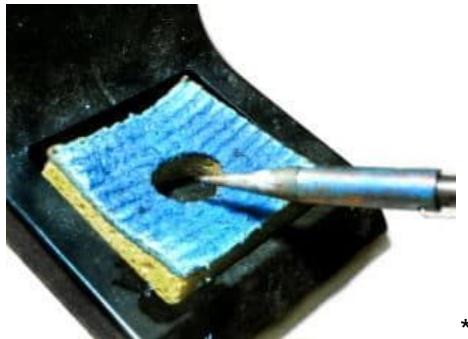
- **USB Microscope**

It is really helpful in debugging situations with fine pitch components. With this we can discover tiny solder joints between pins that are not supposed to be there.



- **Wet Sponge**

It is very useful for cleaning the tip of the soldering iron. As tip is hot which means it will oxidize very fast and get dirty. A clean tip transfers heat faster and makes your soldering easier.



- **Soldering stand**

To place the hot soldering iron in a safe way while soldering.

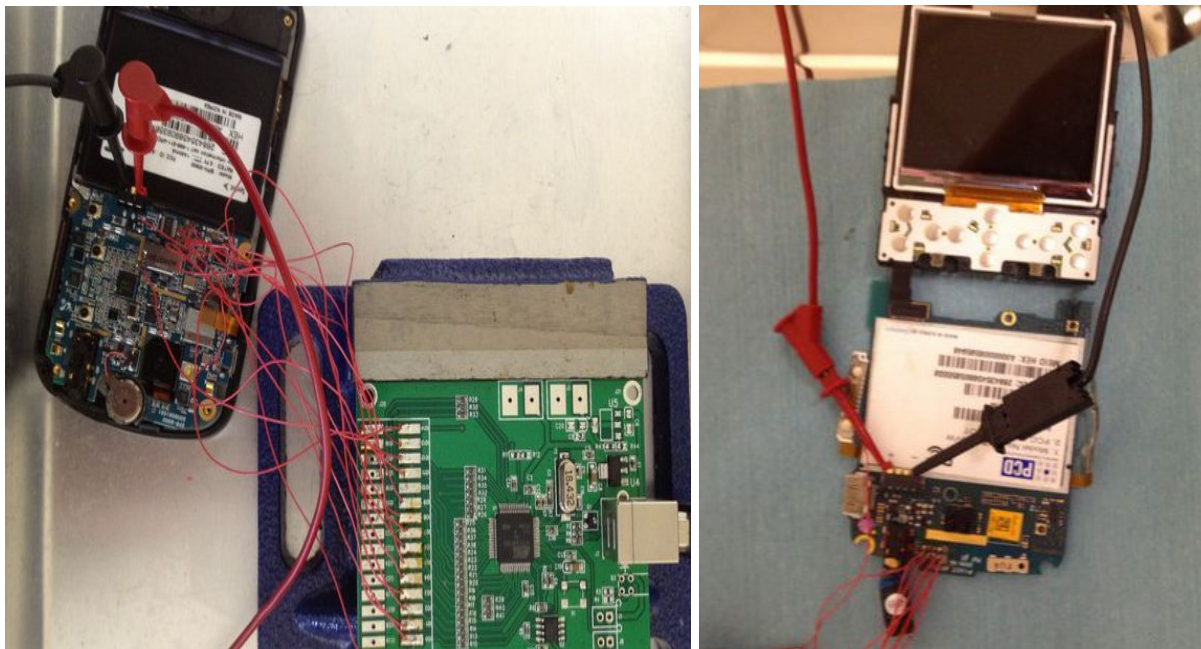


- **Safety glasses**

To prevent the eyes from Lead fumes as lead soldering waste is considered as hazardous.

JTAG Forensics Kit

JTAG (Joint Test Action Group) forensics is an advanced level data acquisition method which involves connecting to Test Access Ports (TAPs) on a device and instructing the processor to transfer the raw data stored on connected memory chips. JTAG is an extremely effective technique which is utilized to extract a full physical image from devices. The majority of our JTAG engagements involve Android phones which are pattern locked and cannot be bypassed by other means.



Source: www.binaryintel.com

Basic Kit includes

- Rework Station (Solder and Hot Air)
- Stereo Microscope
- DC Power & Multimeter
- Preheater and PCB Holder
- Solder Tips and accessories
- Various screwdriver sets and Tweezers
- iPhone Opening Kit

Basic Steps of JTAG

1. Identify the TAPs. When TAPs are unknown, inspect the device PCB for potential TAPs and manually probe to pinpoint appropriate connector pins.
2. Solder the wire to the correct connector pins or utilize a solderless jig.
3. Connect the wire to an appropriate JTAG emulator.
4. Read the flash memory after selecting the appropriate device profile or manually configuring the correct processor/memory settings.
5. Analyze the extracted data using standard forensic tools and custom utilities.