# GOVERNMENT ENGINEERING COLLEGE, DAMAN

## DEPARTMENT Of BIOMEDICAL ENGINEERING

## ADVANCED ELECTRONICS LABORATORY

MULTIMETER


### Purpose

Studying a digital multimeter (DMM) can help you learn how to use it to measure and verify electrical quantities. DMM is primarily used to verify one of the three factors of Ohm's Law voltage (volts), current (amps) and resistance (ohms). This simple equation, expressed below, is commonly used by electrical engineers during diagnostic testing.

### Basic Details

| | |
|---|---|
| **DC Voltage** | 200mV/2V/20V/200V/600V |
| **AC Voltage** | 200V/600V |
| **DC Current** | 200uA/20mA/200mA/10A |
| **Resistance** | 0 to 20M Ohm |
| **Continuity** | Continuity Buzzer |
| **Max Display** | 1999 |

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DIGITAL STORAGE OSCILLOSCOPE

### Purpose

A digital storage oscilloscope (DSO) is an electronic instrument that measures and records electrical signals, and is used in a variety of applications. It converts the analog signal into a digital format and stores it in its digital memory, allowing for easy recall and analysis. In biomedical engineering, DSOs are used to measure electrical signals from the human body, such as heartbeats and brainwaves.

### Basic Details

| | |
|---|---|
| **Channel** | 2 |
| **Bandwidth** | 50MHz |
| **Sample Rate** | 500Ms/s |
| **Rise Time** | 7ns |
| **Memory Depth** | 25kpts |
| **Vertical Sensitivity** | 1mV/div~20V/div |
| **Storage** | Setup, Wave, Bitmap |
| **Trigger Modes** | Edge, Pulse, Alternate |

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FUNCTION GENERATOR


### Purpose

A function generator is a piece of electronic test equipment that produces electrical waveforms for a variety of purposes, including testing and troubleshooting. Function Generators are used in laboratories for training and testing purposes due to their ability of generating signals which can be used for testing circuits. DC power supply and even measure the delay margin. Function Generators are also used for research and development purposes. A function generator can simulate various conditions for circuits, which is useful for design, testing, troubleshooting, and education.

### Basic Details

| | |
|---|---|
| **Frequency Range** | 0.5Hz to 5MHz |
| **Waveforms** | Sine, Square, Triangle, DC |
| **Risetime** | 30ns |
| **Distortion Factor** | < 0.5% (upto 100kHz) |
| **Power Supply** | 220 VAC 50/60 Hz |
| **Output** | Trigger Output |

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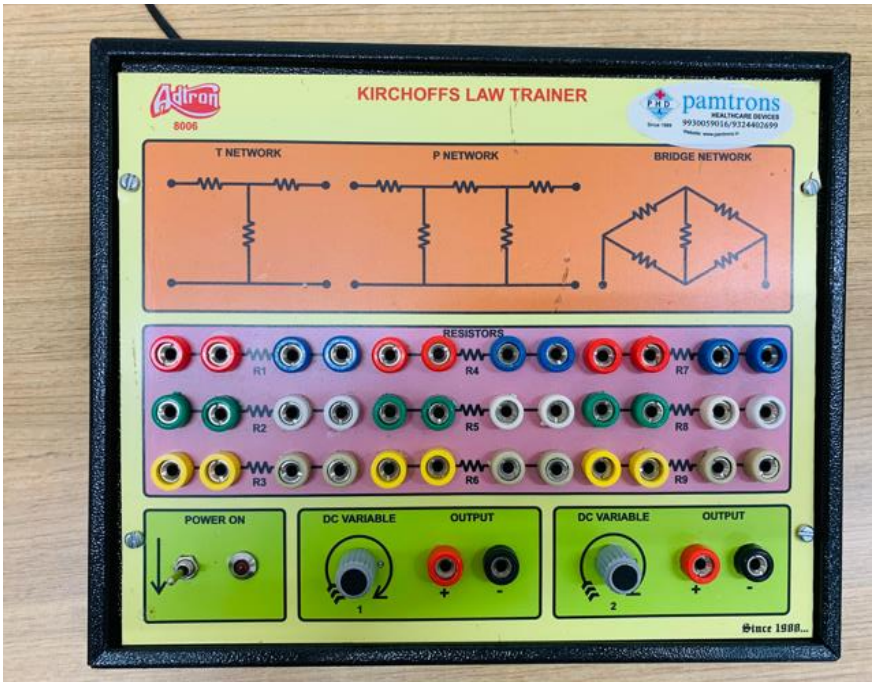
KIRCHOFF'S LAW TRAINER




### Purpose

The experiment aims to investigate Kirchhoff's laws practically using a DC circuit training system. Gain hands-on experience with experiments. Verify Kirchhoff's voltage and current laws.

### Basic Details

| | |
|---|---|
| **Network** | "T" network, "π" network, Bridge "T" network & Ladder network |
| **IC regulated variable** | 1.2Vdc to 20Vdc |
| **Instruments required** | Digital mustimeter |
| **Power Supply** | 230Vac, 50Hz |

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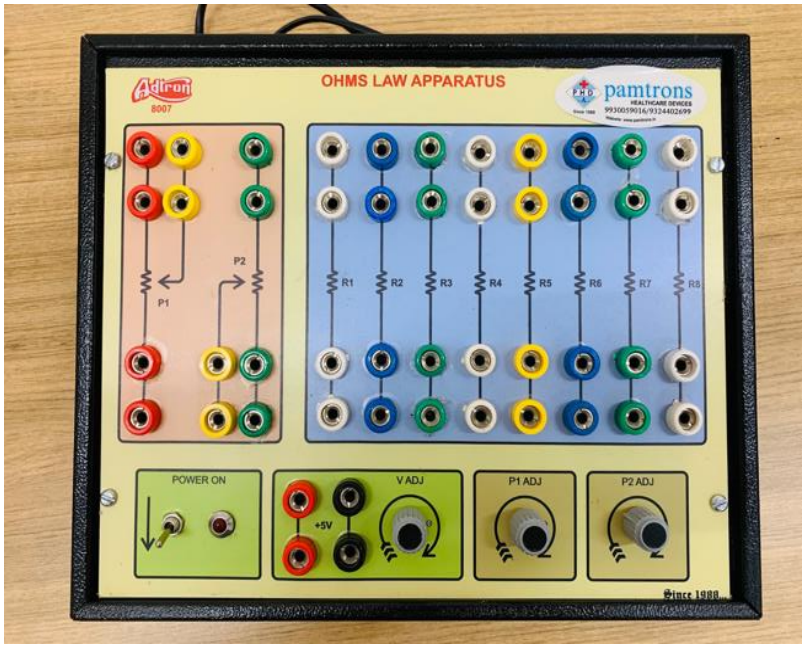
OHM'S LAW APPARATUS




### Purpose

The device is designed to help teach Ohm's Law basics as well as demonstrating common electrical system components and circuit operation.

### Basic Details

| | |
|---|---|
| **Sensitivity Threshold** | ≤20μ V |
| **Paper speed** | 25,50mm/s |
| **Weight** | 5 kg |
| **Dimensions** | 230mm X 310mm X 100mm |
| **Frequency** | 0.05Hz - 150Hz(-3dB) |
| **Power Supply** | DC 14.4V(2000mAh) |

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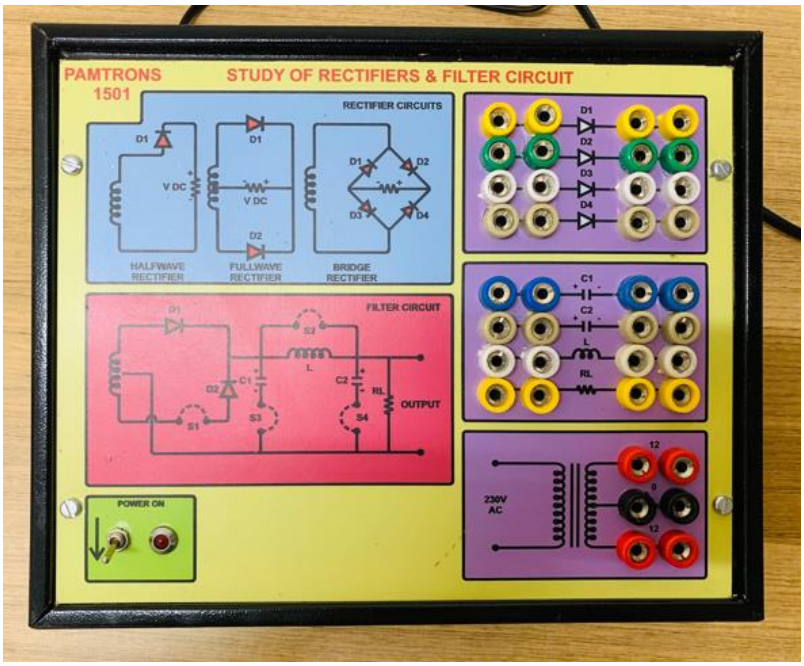
RECTIFIER AND FILTER CIRCUIT




### Purpose

A rectifier and filter circuit kit can help students learn about how to convert alternating current (AC) to direct current (DC) power, and how to smooth out the voltage to produce a stable DC supply:

- **Rectifiers**

Rectifiers convert AC to DC power using diodes. There are two types of rectifiers: half-wave and full-wave. The full-wave rectifier converts both half cycles of an AC current, while the half-wave rectifier only converts one half cycle.

- **Filters**

Filters smooth out the pulsations in the voltage to produce a DC voltage. Filters are widely used in electronics and telecommunication, in radio, television, audio recording, radar, control systems, music synthesis, image processing, computer graphics, and structural dynamics.

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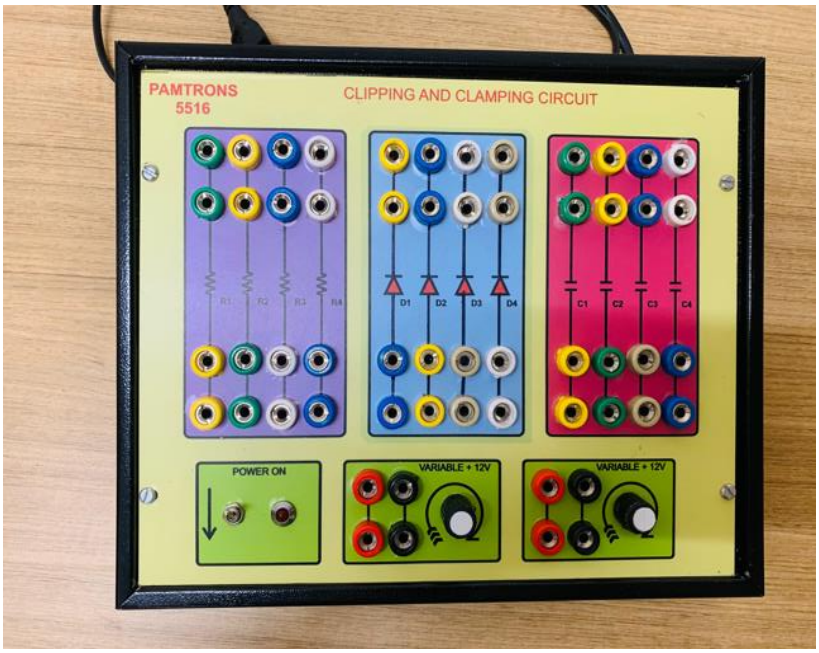
CLIPPING AND CLAMPING CIRCUIT




### Purpose

- The purpose of studying a clipping and clamping circuit kit is to learn how to protect downstream components from voltages that are too high or low.
- Clipping circuits are nonlinear wave shaping circuits. A clipping circuit is useful to cut off the positive or negative portions of an input waveform.
- Clamping circuits change the D.C. level of a signal, but do not change the peak-to-peak value.

### Basic Details

| | |
|---|---|
| **Trainer AC Power Supply** | 6 Vac |
| **Trainer DC Power Supply** | 0 – 5 Vdc |
| **Dimensions** | 250mm X 150mm X 40mm |
| **Frequency** | 50Hz AC mains |
| **Input Power Supply** | 230Vac |

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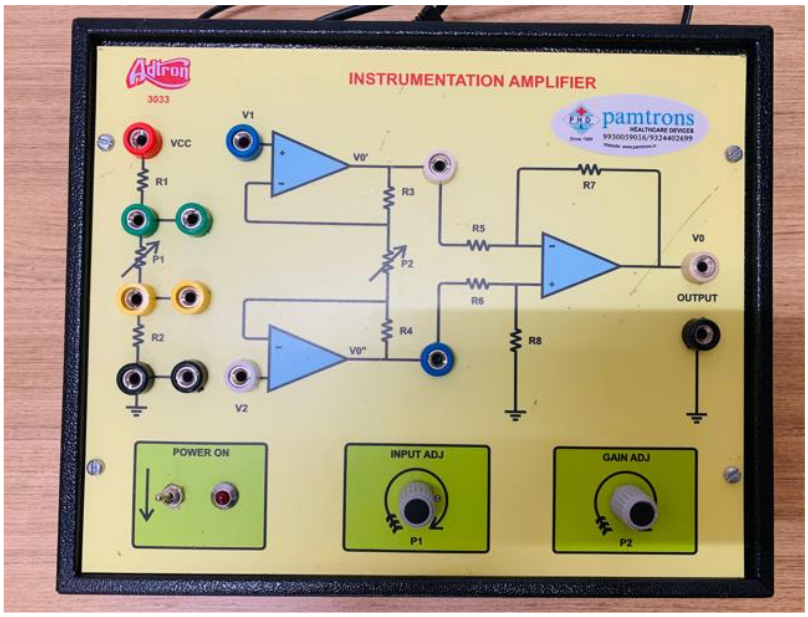
INSTRUMENTATION AMPLIFIER




### Purpose

An instrumentation amplifier (IA) circuit kit can help students learn about the following concepts:

- Amplifying low-level signals

IAs can amplify very low-level signals, even in the presence of high noise levels.

- Common-mode rejection

IAs amplify the difference between two input signals while ignoring any common-mode noise.

- High input impedance

IAs have high input impedance, which is important for circuits that need good gain.

- Adjusting gain

IAs allow engineers to adjust the gain of an amplifier circuit without changing more than one resistor value.

- Extracting small signals

IAs can extract small signals from transducers and other signal sources.

IAs are used in many fields of electronics, and are often used to amplify signals from passive sensors like strain gages.

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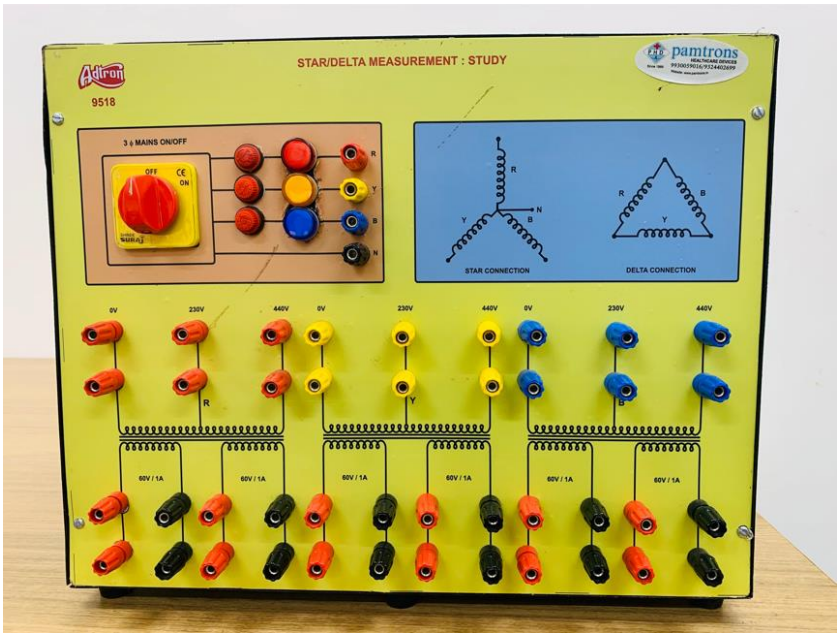
STAR DELTA MEASUREMENT




### Purpose

A star and delta circuit kit can help students learn about the different uses of star and delta connections in electrical systems:

- Star connection

Used in distribution and transmission networks, star connections are preferred for long-distance transmission because they require less insulation and have a neutral to balance the circuit.

- Delta connection

Used in distribution networks, delta connections are preferred for shorter distances because they require more insulation and can have unbalanced currents. Delta connections are also used to transmit high voltage power and control third harmonics.

- Star-delta starter

A star-delta starter starts a motor in a low-voltage, low-current "star" configuration, then switches it to a high-voltage, high-current "delta" configuration once the motor reaches a certain speed. This transition allows for smoother and more controlled acceleration of the motor.

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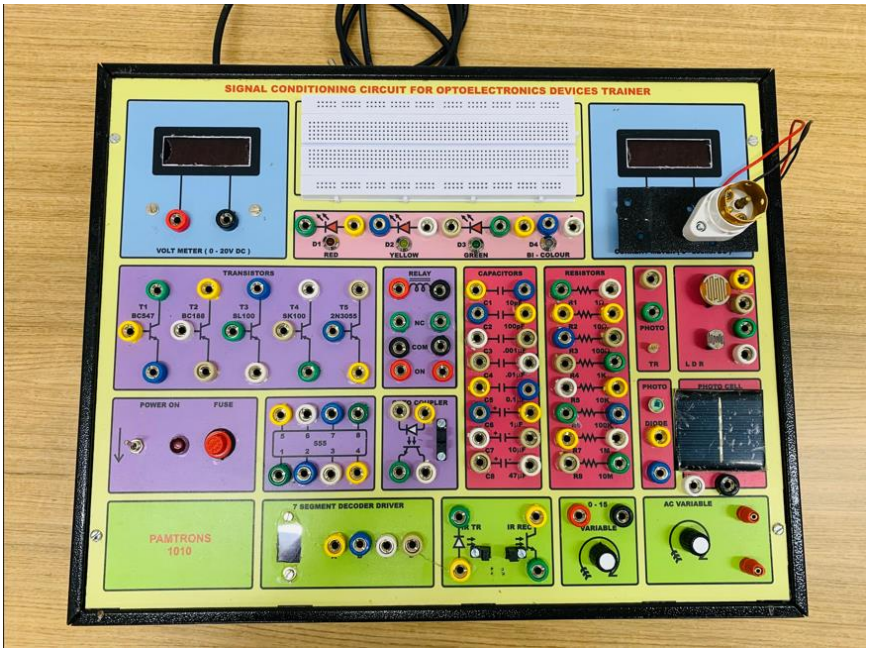
SIGNAL CONDITIONING CIRCUIT




### Purpose

Studying signal conditioning circuits for optoelectronic devices helps to ensure precise measurements and accurate data acquisition:

- Signal conditioning prepares signals for processing
  Signal conditioners convert signals from sensors into a more readable format for data acquisition systems or control equipment.
- Signal conditioning improves weak signals
  Sensors often produce weak signals, such as small voltages, currents, or resistance changes. Signal conditioners amplify and convert these signals into a higher level of electrical signal.
- Signal conditioning protects signals from hostile environments
  Sensors and transducers are often exposed to hostile environments where faults are likely to occur. Signal conditioners provide the circuitry between the sensor and the data acquisition system to protect the signals.
- Signal conditioning performs various functions
  Signal conditioners can perform a number of functions, including amplification, electrical isolation, linearization, and cold junction compensation.

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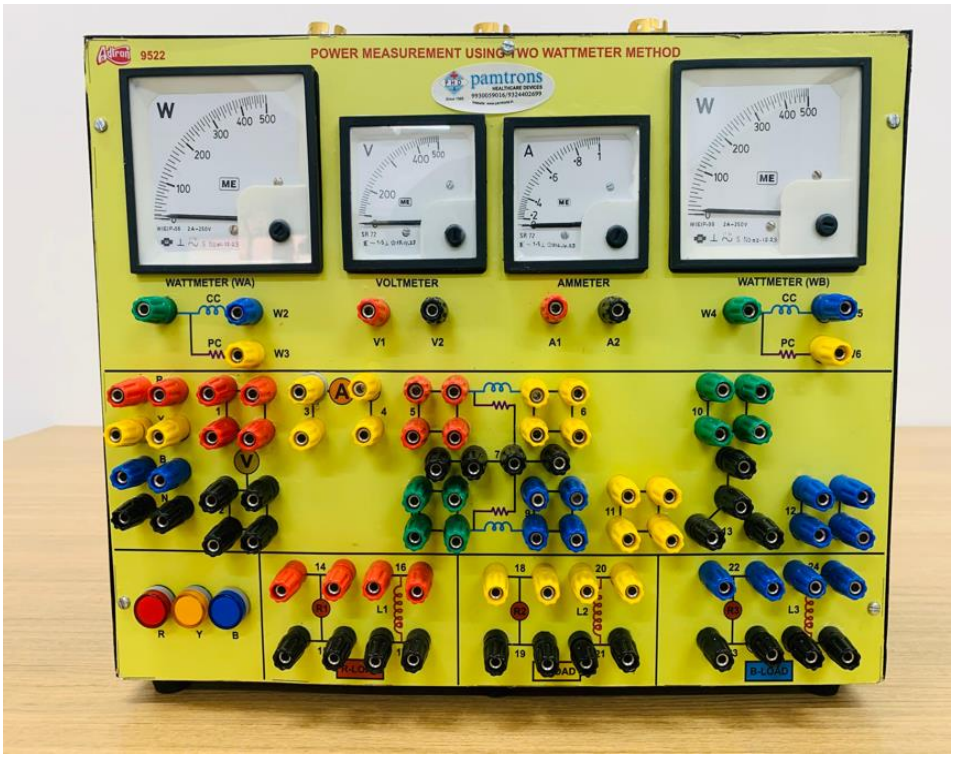
POWER MEASUREMENT




### Purpose

- The purpose of studying power measurements using a two wattmeter trainer kit is to help students learn how to measure power in a three-phase circuit using two wattmeters.
- The kit also helps students understand the power flow in a three-phase system and how to calculate active, reactive, and apparent power.
- The two-wattmeter method is a technique used to calculate the power supplied to a three-phase system. It is known for its accuracy and efficiency, and is often used in industrial and commercial power distribution.
- The method can be used to measure power in balanced or unbalanced loads, and can also be used to calculate the power factor of a circuit.

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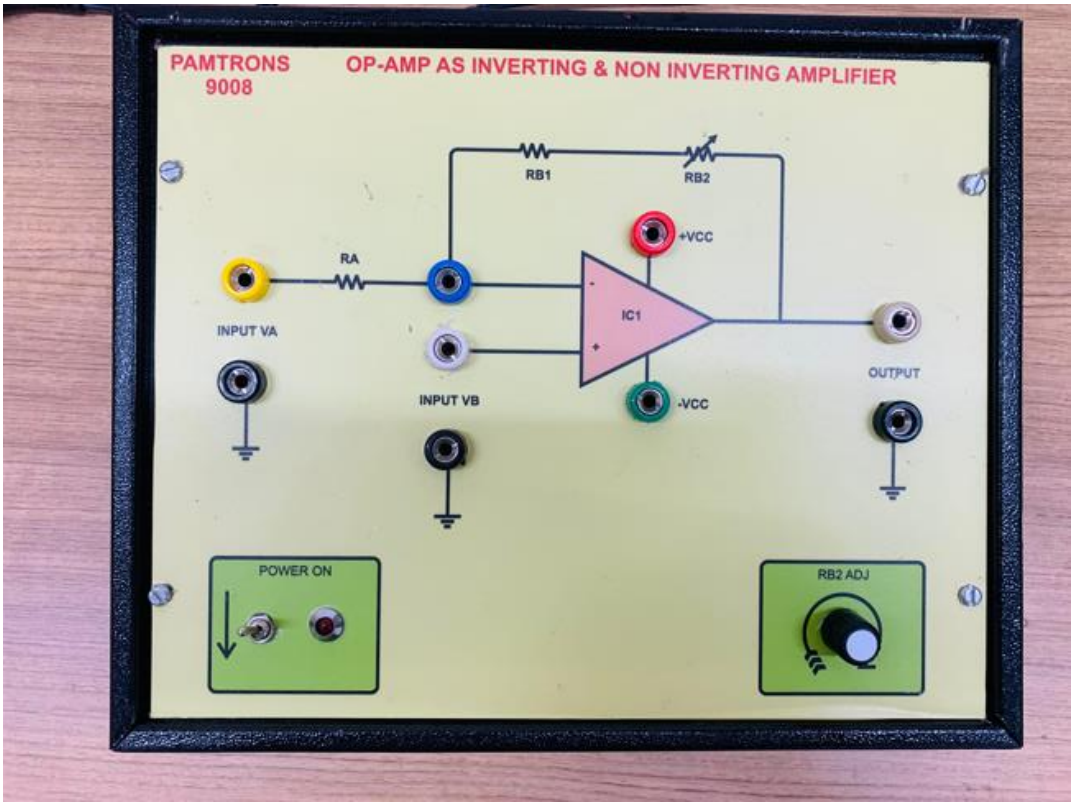
INVERTING & NON-INVERTING AMPLIFIER




### Purpose

- A non-inverting amplifier produces an output signal that is in phase with the input signal, whereas an inverting amplifier's output is out of phase.
- Both the inverting and non-inverting op amps can be constructed from one op amp and two resistors, just in different configurations.
- Some applications for non-inverting op-amps include: voltage followers, buffer amplifiers, and non-inverting amplifier circuits.
- While the applications for inverting op-amps include: radio frequency mixers, mathematical functions, phase shifters etc.

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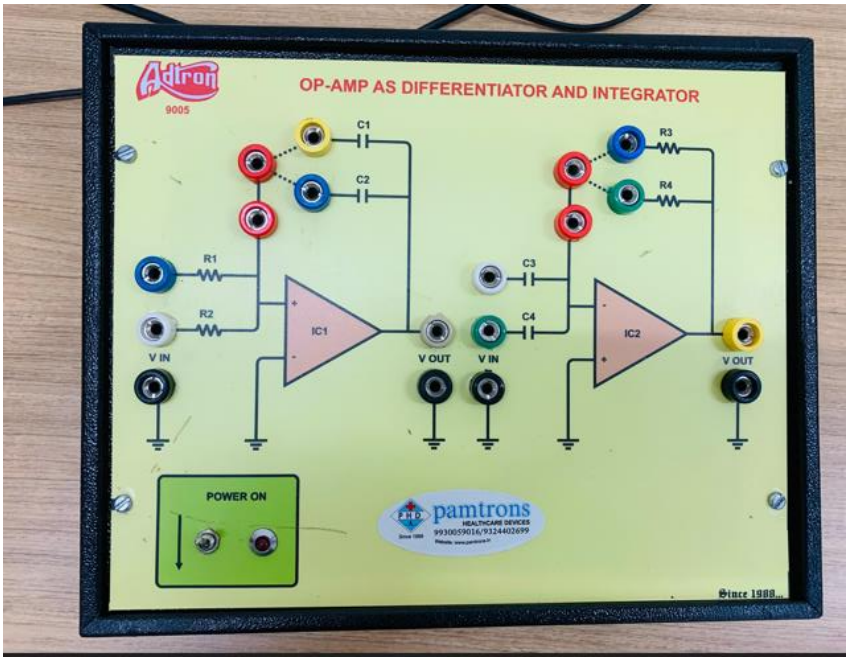
DIFFERENTIATOR & INTEGRATOR AMPLIFIER




### Purpose

- The integrator and differentiator circuit kits help students understand fundamental concepts in electronics, specifically in signal processing.
- The integrator circuit demonstrates how an input signal is mathematically integrated over time, producing a corresponding output that represents the accumulation of the input.
- Conversely, the differentiator circuit shows how an input signal's rate of change is measured, producing an output that reflects the signal's derivative.
- These kits allow students to experiment with and visualize the effects of integration and differentiation on real-world signals, reinforcing theoretical learning and developing practical skills in designing and analyzing circuits for various applications in electronics and communication systems.

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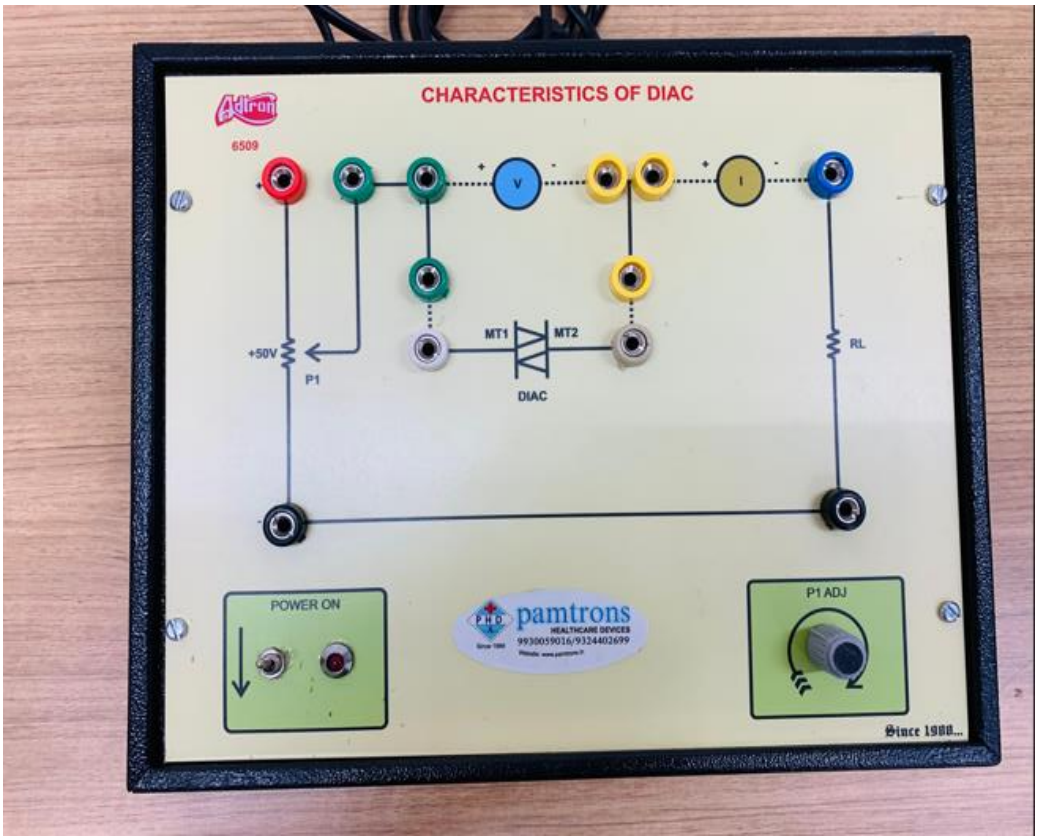
CHARACTERISTICS OF DIAC




### Purpose

- The DIAC circuit kit helps students understand the operation and application of DIACs (Diode for Alternating Current), which are semiconductor devices used for triggering and controlling power in AC circuits.
- By experimenting with this kit, students learn how DIACs function as bidirectional devices, allowing current to flow in both directions once a certain voltage threshold is reached.
- The kit enables students to explore the role of DIACs in triggering TRIACs in applications like light dimmers, motor speed controls, and over-voltage protection.
- This hands-on experience reinforces theoretical concepts and enhances understanding of AC power control and semiconductor devices in real-world applications.

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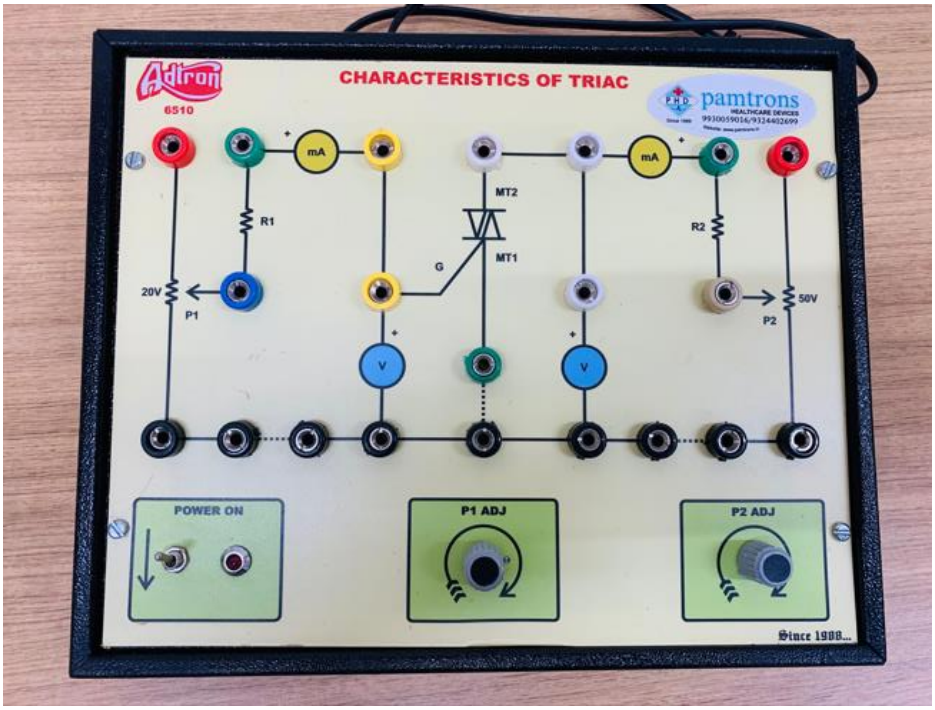
CHARACTERISTICS OF TRIAC




### Purpose

- The TRIAC circuit kit helps students understand the functioning and applications of TRIACs (Triode for Alternating Current), which are semiconductor devices used for controlling power in AC circuits.
- By working with this kit, students learn how TRIACs can switch on or off electrical loads in both directions of an AC waveform, enabling efficient control of power in applications such as light dimmers, fan speed regulators, and motor controllers.
- The kit allows students to explore the operation of TRIACs in triggering and switching circuits, reinforcing theoretical concepts of alternating current, semiconductor behavior, and practical power control in real-world electronic systems.

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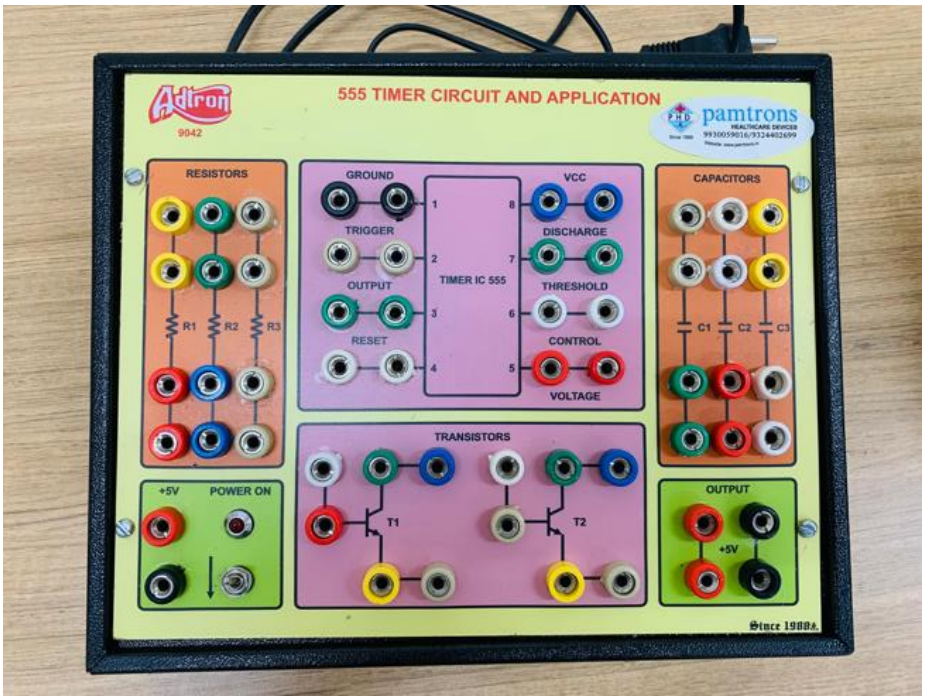
555 TIMER CIRCUIT AND APPLICATION




### Purpose

- The 555 timer circuit kit helps students understand the operation of the versatile 555 timer IC, commonly used in both astable and monostable modes for generating precise timing pulses and oscillations.
- By experimenting with the kit, students learn how the 555 timer can be used in a wide range of applications, such as generating clock pulses, timing delays, frequency modulation, and creating waveform generators.
- This hands-on experience enhances students' understanding of digital circuits, timing principles, and the practical use of ICs in real-world electronics.
- The kit also aids in building essential skills for designing and troubleshooting timing-based circuits.