

# ENGINEERING THERMODYNAMICS SERIES

This modular product series is designed based on the Engineering Thermodynamics syllabus, combining core theory with practical innovation. It enables students to systematically conduct experiments, understand heat and energy conversion principles, and apply thermodynamic analysis to real-world problems.

Students gain essential skills in temperature, heat, and flow measurement, as well as experiment design and data analysis. The system lays a solid foundation for advanced learning, professional work, and scientific

## ENGINEERING THERMODYNAMICS

### 01 First Law of Thermodynamics

- Basic Energy Equations
- Energy Transfer & Conversion
- Direction of Energy Conversion

► Basic Thermodynamics Module ET100

### 02 Second Law of Thermodynamics

### 03 Properties & Processes of Gases and Steam

- Gas State Equation
- Constant Volume / Pressure / Temperature Processes
- Specific Heat Ratio
- Adiabatic Index
- Properties of Water Vapor
- Gas Flow and Compression – Flow Characteristics in Nozzles

- ET101 Ideal Gas Experimental Module
- ET101 Ideal Gas Experimental Module
- ET104 Air Adiabatic Index
- ET105 Saturated Steam P-T
- ET202 Nozzle Pressure Distribution Unit

### 04 Steam Power Cycles

- Rankine Cycle
- Steam Power System Analysis

► ET201 Rankine Cycle Trainer

### 05 Refrigeration Cycles

- Vapor Compression Refrigeration Cycle
- Heat Pump Cycle
- Other Refrigeration Types

- ET301 Vapor Compression Trainer
- R306 3-Source Heat Pump System
- R216/R108 Absorption/Thermoelectric Refrigeration

### 06 Ideal Gas Mixtures & Moist Air

- Moist Air
- Wet-Bulb Temperature
- Moist Air Processes & Applications
- Specific Heat Measurement

► ET103 Constant Pressure Specific Heat

### ► ET100 Basic Thermodynamics Workbench



This product serves as a fundamental experimental platform designed to support various modules of the Engineering Thermodynamics series by providing data acquisition, display, storage, and power output regulation functions. It can collect parameters such as temperature, pressure, current, voltage, power, and flow rate.

The platform is equipped with a built-in LCD touchscreen and preloaded with multiple Engineering Thermodynamics experiment modules (customization and expansion supported). It displays internal structural diagrams and real-time data from measurement points, as well as dynamic experiment curves. Experimental data can be exported in formats such as video and Excel. In addition to working with Engineering Thermodynamics modules, the platform can also be used independently as a data acquisition tool.



#### ET101-Ideal Gas Law Experiment Module

Designed for theoretical analysis and experimental study of the ideal gas law in engineering thermodynamics.



#### ET103-Constant Pressure Specific Heat Experiment Module

For theoretical analysis and experimental study of the specific heat of gases at constant pressure.



#### ET104-Adiabatic Index of Air Experiment Module

For analysis and experimental study of the adiabatic (isentropic) index of air.



#### ET105-Saturated Steam P-T Experiment Module

Used to study the pressure-temperature relationship of saturated water/steam.



### ► ET201 Rankine Cycle Experimental Setup

This setup includes the main components of the Rankine cycle: steam boiler, high-efficiency turbine generator, condenser, feedwater tank, and feedwater pump.

1. Study the complete Rankine cycle principles
2. Analyze steam boiler energy conversion efficiency
3. Investigate steam P-V diagrams in the cycle
4. Examine effects of condensate reheating and feedwater injection
5. Demonstrate the full operating cycle of a steam power plant
6. Evaluate fuel consumption, boiler efficiency, and condenser heat exchange performance



### ► R260 Air Conditioning Experimental Unit

For studying the refrigeration cycle and air-conditioning process, with temperature and humidity measurement and psychrometric chart analysis.



### ► R903 Multifunctional High-Temperature Heat Pump Experimental System

With two different evaporator configurations (air-cooled and water-cooled), it can produce hot water above 60 °C and can be coupled with thermal storage equipment to provide a heat source.



### ► R262 Innovative Heat and Mass Exchanger Performance Testing System

It can perform air treatment processes such as heating, humidifying, cooling, and dehumidifying, and can measure, display, control, and adjust the air temperature and humidity. This system provides intuitive teaching conditions for students in the HVAC field.



### ► R109 Compressor Performance Test Bench

For testing compressor capacity, power consumption, and efficiency under different operating conditions.



### ► R105 Modular Basic Refrigeration Training System

For basic experiments on refrigeration cycles and system operation.



### ► R108 Thermoelectric Refrigeration Experimental Unit

For studying semiconductor thermoelectric cooling and different power-driven configurations.



### ► R216 Vapor Absorption Refrigeration System

For experiments on absorption refrigeration performance and waste-heat recovery applications.



### ► R306 Air-Water-Ground Triple-Source Heat Pump System

Designed for teaching and experimental research in Engineering Thermodynamics and Heat Pump Technology.



### ► ET301 Vapor Compression Refrigeration Cycle Device

For demonstrating the vapor compression cycle and refrigerant phase change process.

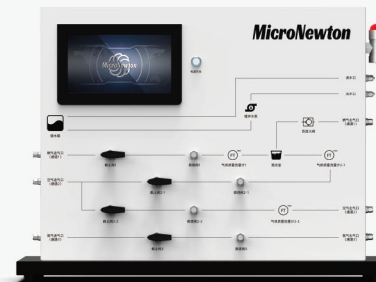


### Refrigeration and Air Conditioning Series

This product series focuses on the study of refrigeration cycles and heat pump systems. It covers multiple refrigeration methods, including vapor absorption, vapor compression, and semiconductor cooling. The series meets teaching needs in industrial refrigeration, commercial cold chains, building air conditioning, and new energy vehicle thermal management.

All units come standard with LCD screens displaying internal operating principles, real-time measurement data, and dynamic experimental curves. Data export in spreadsheet format is supported for easy analysis and processing.

### ► E300 Comprehensive Combustion Experimental System

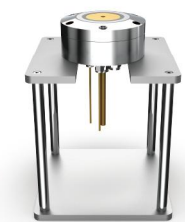


Designed for combustion course teaching and energy engineering applications, this modular system allows flexible switching between gas types, burners, and experimental modules. It supports real-time data acquisition of flow and pressure for calculation and analysis, making it ideal for teaching, training, and research purposes.



### ► E301-Flame Counterflow Experimental Module

Used to study laminar counterflow premixed and diffusion flames, and to measure convective field parameters such as flame stretch rate in response to different flame types.



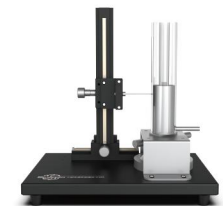
### ► E303-Flat Flame Burner

Enables combustion experiments with various gases or pulverized coal to study different fuel characteristics.



### ► E305-Pulverized Coal Particle Combustion Visualization Experimental Apparatus

Used for in-depth study of coal combustion characteristics and optimization, as well as analysis of the gaseous components generated during combustion.



### ► E302-Flame Propagation Experimental Module

Designed to study laminar premixed and laminar diffusion flames. Enables measurement of premixed flame propagation speed and diffusion flame height.

### FLAME COMBUSTION PHENOMENON



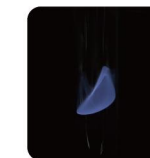
• Planar Counterflow Diffusion Flame



• Premixed Flame in a Variable-Diameter Tube



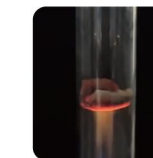
• Planar Counterflow Premixed Flame



• Premixed Flame in a Uniform-Diameter Tube



• Bunsen Burner Premixed Flame



• Oscillating Premixed Flame in a Rijke Tube



### ► ET401 Gas Turbine Experimental System

A miniaturized gas turbine setup including compressor, combustion chamber, high-speed turbine, and control system.

1. Demonstrates a complete gas power cycle
2. Studies energy conversion and efficiency in each stage
3. Analyzes effects of gas flow and temperature on efficiency
4. Explores how flow and temperature impact thrust performance