Faculty Research Labs

(Engineering Lab)

Aiken
UNIVERSITY OF SOUTH CAROLINA

Index

10 IN. (254 MM) DRILL PRESS

Description:

A benchtop drill press designed for precise and controlled drilling operations. It is compact and robust, making it ideal for laboratory and light industrial use.

Details and Capabilities:

- **Motor:** 3.2 A, 120V, 60Hz
- **Speed Settings:** 5-speed settings, 610–2800 RPM
- **Chuck Capacity:** 1/2 inch
- **Tilt Table:** Tilts 45° for angled drilling
- **LED Work Light:** For clear visibility
- **Lockable Switch:** Safety-enhanced operation
- **Self-ejecting** Chuck Key

Applications:

- Wood, metal, and plastic drilling
- Engineering education labs
- Component prototyping

Advantages:

- Precise, stable operation
- Easy speed control and adjustments

GUNT WP 300

UNIVERSAL MATERIAL TESTER

Description:

The GUNT WP 300 is a manual universal testing machine used for tensile, compression, and Brinell hardness tests. It is designed for educational use to demonstrate fundamental material properties and mechanical behavior.

Details and Capabilities:

- **Max Load:** 20 kN
- **Stroke:** 44 mm
- **Test Space:** 165 x 65 mm
- **Force Measurement:** Analog gauge with drag pointer
- **Elongation:** Dial gauge
- **Specimens:** Aluminum, copper, brass, and steel

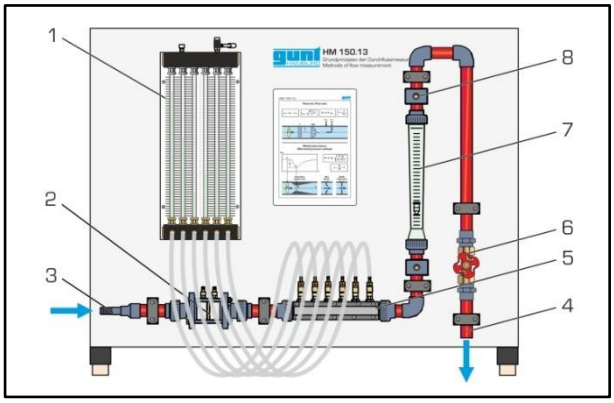
Applications:

- Teaching stress-strain behavior
- Tensile, compressive, and hard testing
- Hands-on material mechanics training

Advantages:

- Simple, compact, and reliable
- Suitable for student use

GUNT HM 150.13 – FLOW MEASUREMENT MODULE



Description:

A module designed for use with the HM 150 base unit, demonstrating classic flow measurement techniques like those using Venturi, Pitot, and Orifice meters.

Details and Capabilities:

- **Includes:** Venturi nozzle, Pitot tube, Orifice plate
- A1 = 338.6 mm²
- A3 = 84.6 mm²
- Displays key flow profiles and pressure drops
- Connects to HM 150 Water Flow System

Applications:

- Fluid mechanics laboratories
- Training on flow rate and pressure relationships
- Calibration of flow measurement devices

Advantages:

- Visualizes real-world applications of Bernoulli's principle
- Compact and easy to use with compatible GUNT base units
- Fast setup and accurate demonstration of fluid flow dynamics

TD1002 — HEAT TRANSFER EXPERIMENTS BASE UNIT

Description:

The TD1002 is the core base unit for a wide range of heat transfer experiments. It supplies the necessary water flow and temperature control to various Armfield accessories used in thermal science education.

Details and Capabilities:

- **Pump:** Integral centrifugal pump
- **Heater:** 2kW electric heater with safety cutouts
- **Flow Control:** Variable flow adjustment
- **Temperature Measurement:** Digital display of inlet and outlet
- **Connections:** Quick-release fittings for accessories

Applications:

- Heat conduction, convection, and radiation studies
- Educational demonstrations in thermodynamics
- Coupling with add-on modules for specific experiments

Advantages:

- Central platform supporting multiple experiments
- Reliable and safe for academic use

TD1007 — HEAT EXCHANGER EXPERIMENT

Description:

This module demonstrates the principles of heat exchange using co-current and counter-current flow arrangements. It connects to the TD1002 base unit.

Details and Capabilities:

- **Heat Exchanger Type:** Shell and tube
- **Flow Patterns:** Co-current & counter-current
- **Temperature Measurement:** Thermocouples at inlets/outlets
- **Flow Measurement:** Visual and quantitative
- **Material:** Corrosion-resistant metal pipes

Applications:

- Teaching heat exchanger efficiency
- Engineering thermodynamics labs
- Comparing different heat transfer rates

Advantages:

- Clear visualization of temperature changes
- Quantitative performance evaluation
- Works seamlessly with base unit TD1002

GUNT TM 1016V

FREE AND FORCED VIBRATIONS

Description:

The TM 1016V demonstrates the behavior of mechanical systems under free and forced vibration. It supports damping and resonance studies.

Details and Capabilities:

- **Components:** Spring-mass systems, Damping devices
- Variable motor speed for forced vibration
- **Data Collection:** Through displacement sensors
- **Drive:** Electromagnetic or crankshaft drive

Applications:

- Mechanical engineering dynamics
- Understanding natural frequency and damping
- Demonstrating resonance effects

Advantages:

- Interactive and visual representation
- Adjustable parameters
- Suitable for advanced lab demonstrations

GUNT WL 202

FREE AND FORCED CONVECTION

Description:

This experiment investigates heat transfer by free and forced convection from a heated cylinder placed in airflow. It includes sensors to measure airspeed and temperatures.

Details and Capabilities:

- **Heat Source:** Electrically heated cylinder
- **Airflow:** Axial fan with speed control
- **Sensors:** Thermocouples and anemometer
- **Data Collection:** Interface-ready for DAQ systems
- **Visual Aid:** Transparent front cover

Applications:

- Exploring convective heat transfer mechanisms
- Calculating heat transfer coefficients
- Comparing free vs. forced convection scenarios

Advantages:

- Allows theoretical and experimental comparison
- Compact and easy-to-use setup

BROOKFIELD VISCOMETER

Description:

The Brookfield Viscometer is a laboratory instrument designed to measure the viscosity of liquids under controlled conditions. It is widely used in fluid mechanics, materials testing, and industrial applications.

Details and Capabilities:

- **Measurement Range:** Wide range depending on spindle and speed
- **Speed Control:** Variable, electronically controlled
- **Readout:** Digital or analog (depending on model)
- **Spindle System:** Multiple spindles available for different viscosities
- **Temperature Compatibility:** Can be paired with water baths
- **Stand Type:** Bench-top, with height-adjustable mount

Applications:

- Measuring viscosity of oils, polymers, and other liquids
- Quality control in manufacturing
- Educational demonstrations of fluid behavior

Advantages:

- Accurate and repeatable results
- Modular spindle system
- Suitable for Newtonian and non-Newtonian fluids

GUNT WL 203 — FUNDAMENTALS OF PRESSURE MEASUREMENT

Description:

The WL 203 is an educational apparatus that illustrates the fundamentals of pressure measurement techniques using traditional and modern methods, including manometers and pressure sensors.

Details and Capabilities:

- **Pressure Devices:** U-tube manometer, Inclined manometer, Bourdon gauge, Electronic pressure sensor
- **Transparent Panels:** For observation of fluid levels
- **Scale Graduations:** High precision for educational use
- **Connections:** Compatible with other GUNT hydraulic systems

Applications:

- Training in pressure measurement techniques
- Fluid mechanics and instrumentation labs
- Comparison of pressure devices

Advantages:

- Clear visual representation of pressure concepts
- Supports both analog and digital methods

BRANSON 250 SONICATOR

Description:

The Branson 250 Sonicator is a high-frequency ultrasonic processor used to disrupt cells, homogenize samples, and break apart particles in solution for scientific research and laboratory use.

Details and Capabilities:

- **Output Power:** Adjustable power levels
- **Frequency:** ~20 kHz
- **Probe Type:** Titanium microtip for localized treatment
- **Control Panel:** Digital timer and amplitude setting
- **Cooling Compatibility:** Can be used with ice baths
- **Safety:** Automatic shutoff and overload protection

Applications:

- Disruption of cell membranes
- Nanoparticle dispersion
- Mixing, emulsification, and sample preparation

Advantages:

- High energy efficiency
- Precise amplitude and time control
- Compact and easy to use in research labs

FREE AND FORCED CONVECTION APPARATUS GUNT

Description:

This apparatus demonstrates the principles of heat transfer by natural (free) and forced convection from a heated element placed in a vertical or horizontal flow.

Details and Capabilities:

- **Heating Element:** Electrically powered rod or plate
- **Airflow Control:** Fan-based for forced convection
- **Sensors:** Thermocouples for temperature distribution
- **Mounting Frame:** Vertical or inclined for configuration flexibility
- **Data Output:** Suitable for manual readings or data logging

Applications:

- Heat transfer laboratory experiments
- Demonstrating convection heat transfer modes
- Comparing theoretical and actual heat transfer coefficients

Advantages:

- Real-time observation of convection effects
- Adjustable airflow for comparative study
- Educationally focused, robust design

GUNT HM 150.02

DEAD WEIGHT PISTON GAUGE

Description:

The HM 150.02 Dead Weight Piston Gauge is a precision device used to calibrate pressure measuring instruments. It generates a known pressure using calibrated weights applied to a piston-cylinder assembly.

Details and Capabilities:

- **Piston-Cylinder Unit:** Precisely machined for minimal friction
- **Weights:** Calibrated masses to generate defined pressure values
- **Operation:** Manual; uses water or oil as fluid medium
- **Reference Gauge:** Included for comparative calibration

Applications:

- Calibration of manometers and pressure sensors
- Verification of fluid system pressure readings
- Educational demonstrations in metrology

Advantages:

- High precision in pressure generation
- Long-term stability with mechanical parts
- No electrical power required

COLE-PARMER S-PA PERISTALTIC PUMP

Description:

The Cole-Parmer S-PA Peristaltic Pump is a compact fluid transfer pump used in labs to deliver liquids without contamination. It operates by compressing flexible tubing to move fluid.

Details and Capabilities:

- **Pump Type:** Peristaltic
- **Flow Rate:** Variable, model-dependent
- **Control:** Manual or digital interface
- **Tubing Compatibility:** Multiple diameters
- **Maintenance:** Tool-free tubing replacement

Applications:

- Chemical and biological fluid handling
- Controlled reagent dosing
- Sterile fluid transfer

Advantages:

- No fluid contact with pump parts (tubing only)
- Ideal for corrosive or sterile applications
- Easy to maintain and operate

VCA OPTIMA ANGLE MEASUREMENT SYSTEM

Description:

The VCA Optima is a high-precision optical contact angle goniometer used for analyzing surface wettability and measuring contact angles of liquid droplets on solid materials.

Details and Capabilities:

- **Measurement:** Static, advancing, and receding contact angles
- **Camera:** High-resolution CCD with droplet shape analysis
- **Software:** Built-in drop analysis for surface energy calculation
- **Lighting:** Backlight LED for crisp droplet imaging

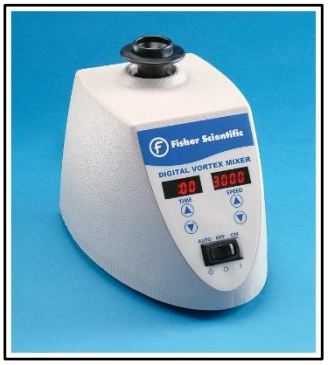
Applications:

- Surface energy and wettability studies
- Coating and adhesion testing
- Quality control in material science

Advantages:

- High image clarity and accuracy
- Real-time droplet tracking
- Suitable for transparent and opaque substrates

FISHER VORTEX MIXERS



Description:

The Fisher Vortex Mixer is a benchtop device designed to quickly mix small volumes of liquid in test tubes and vials using rapid circular motion.

Details and Capabilities:

- **Mixing Motion:** Orbital vortex (approx. 3200 RPM)
- **Control:** Touch mode and continuous operation
- **Construction:** Heavy-duty base for stability
- **Cup Head:** Standard head for tube mixing
- **Speed Control:** Fixed or variable (model dependent)

Applications:

- Laboratory sample mixing
- Suspensions and reagent preparation
- DNA extraction and biochemical experiments

Advantages:

- Fast and efficient mixing with minimal noise
- Compact and durable for daily use
- User-friendly with minimal maintenance

ZETASIZER ULTRA-PRO

Description:

The Zetasizer Ultra-Pro is a high-performance dynamic light scattering (DLS) system used to analyze nanoparticle size, molecular weight, and zeta potential with exceptional sensitivity and precision.

Details and Capabilities:

- **Measurement Parameters:**
  - **Particle size:** 0.3 nm to 10 µm
  - **Zeta potential:** ±200 mV
  - **Molecular weight:** from 342 Da upward
- **Technology:**
  - Non-invasive backscatter (NIBS)
  - Electrophoretic light scattering (ELS)

Applications:

- Nanotechnology research
- Pharmaceutical formulation analysis
- Biophysical characterization of proteins and polymers

Advantages:

- Extremely sensitive for low-concentration samples
- Fast, reproducible, and automated measurements

GUNT HM 150.07

BERNOULLI'S PRINCIPLE

Description:

The HM 150.07 module demonstrates Bernoulli's principle by showing the relationship between pressure, velocity, and cross-sectional area in fluid flow through a transparent duct.

Details and Capabilities:

- **Duct Geometry:** Variable cross-section with measurement ports
- **Pressure Measurement:** Manometers at different sections
- **Flow Control:** Valves for inlet and outlet regulation
- **Compatible Unit:** Requires HM 150 base unit for operation
- **Display:** Transparent duct for visual observation

Applications:

- Teaching fluid dynamics fundamentals
- Verifying Bernoulli's equation
- Demonstrating energy conservation in flow systems

Advantages:

- Hands-on understanding of pressure-velocity relationship
- Simple setup with real-time results
- Clear visualization of theoretical concepts

THERMO SCIENTIFIC

NESLAB RTE SERIES

Description:

The NESLAB RTE Series consists of compact recirculating chillers designed to provide precise temperature control for external laboratory equipment and processes.

Details and Capabilities:

- **Temperature Range:** Typically, from -25°C to +150°C (model dependent)
- **Cooling Capacity:** Varies by model, from 400W to 1000W+
- **Pump:** Pressure and flow-controlled circulating pump
- **Reservoir:** Insulated stainless steel tank
- **Cooling Medium:** Water, glycol-water mixtures

Applications:

- Thermal management for viscometers, spectrometers, reactors
- Biotech, chemical, and physical science labs
- Closed-loop temperature control systems

Advantages:

- Quiet and reliable operation
- Accurate temperature stability
- Compact footprint ideal for lab benches