

# Automatic Kinematic Viscometers

## CANNON® CAV® 2000 Series

**CAV-2200**



**CAV-2100**



**CANNON**  
INSTRUMENT COMPANY®

CANNON®



# CANNON® CAV® 2000 Series Automatic Viscometers

- Modular benchtop unit (small footprint)
- Variable temperature selection from 20°C to 100°C
- Viscosity range of 0.5 to 5000 cSt\*
- ASTM D 445 precision
- Powerful VISCPRO® for Windows® XP® software
- CE marked for safe, reliable performance

\*Special ranges as high as 10,000 cSt are available upon request

The CANNON CAV 2000 Series automatic viscometers are tabletop versions of the original CANNON Automatic Viscometer (CAV), the world's leading automatic viscometer for more than three decades, used by most major companies in the petroleum industry. CAV 2000 Series instruments are now available in two models. The CAV-2100® features a single-bath modular construction with two viscometers per bath. The CAV-2200® features a dual-bath modular construction with a single viscometer in each bath. Most other specifications are identical for both models.

## Capability

Designed for completely unattended operation, each CAV viscometer provides fully automatic kinematic viscosity testing within parameters specified by ASTM D 445. The CAV 2000 Series instruments measure flow rates within  $\pm 0.001$  second by electronically timing the liquid meniscus as it moves between thermistor sensors. Bath temperature is controlled to an accuracy better than  $\pm 0.01^\circ\text{C}$  at any selected temperature between 20°C and 100°C, and an accuracy better than  $\pm 0.03^\circ\text{C}$  between 100°C and 150°C (high-temperature option required above 100°C), exceeding the precision requirements of ASTM D 445. Thermal sensing technology ensures that dark or opaque liquids can be measured with the same precision as transparent liquids.

## Modularity

The CAV modular design offers benefits for both service and growth. Detachable subassemblies are designed for easy access and replacement. The CAV system can grow with your testing needs. A CAV consists of: 1) one to four single- or dual-Bath Units, 2) a Service Unit (regulates vacuum/pressure and solvent flow), and 3) a Solvent Dispensing Unit for use with the customer's pressureless solvent vessel. As many as four single- or dual-Bath Units may be connected to a single Service Unit and Solvent Dispensing Unit, and IBM®-compatible computer. A laboratory may begin operating with a single Bath Unit containing two viscometers, then add additional Bath Units as the work demand increases. The Multi-Unit Interface Kit included with the CAV allows two, three, or four bath units to be connected to a single PC computer.

## Viscometer Tubes

Each CAV Bath Unit contains two viscometer tubes, each with a 100-fold kinematic viscosity range (e.g., 1 to 100 cSt, 6 to 600 cSt, etc.). Fast-run tubes (10-fold range) are also available for time-critical and/or high-throughput applications. A kinematic viscosity range of 0.5 to 5000 cSt can be obtained within a single Bath Unit by selecting two viscometers with complementary viscosity ranges. (see table for available tube sizes).

## Sample-handling

CANNON Instrument Company pioneered fully-automatic sample-handling for multiple-sample kinematic viscosity testing. Our pneumatic system is proven and safe (no complicated gears or electric motors), and so robust that original CAV instruments over two decades old are still in use today. The CANNON quest for more efficient automatic sample-handling capability has generated a host of high performance options including 10-, 13-, 20- and 50-position sample trays, a Solo® Cup test option, plastic and glass sample vials, heated sample trays, and other enhancements. The standard unheated 13-position sample trays allow the operator to load up to 13 samples per viscometer tube for unattended operation. A sample quantity of approximately 12 mL is required for single or double determinations using standard-size sample vials. Throughput for each bath is 8 samples per hour for each standard viscometer tube, and 12-15 samples per hour per tube for optional Fast-Run viscometer tubes. A single instrument can now test up to 100 samples without operator input!



## CAV-2200

- Dual-bath design permits kinematic viscosity testing at two different temperatures simultaneously
- Low to moderate throughput
- One viscometer tube per bath

# CANNON® CAV® 2000 Series Automatic Viscometers



## CAV-2100

- Single-bath design with two viscometer tubes
- Excellent choice when high throughput is desired
- Variable temperature (20 - 150°C)

### VISCPRO® Software

VISCPRO software for Windows® XP® and VISTA® automates multiple sample testing for the CAV. With VISCPRO you can save and restore multiple instrument configurations and/or sample ID information with a few mouse clicks. The VISCPRO software also includes multiple security levels to help protect against inadvertent changes in instrument configuration or sample testing procedures. As VISCPRO controls the CAV, test data is written to a Microsoft® Access® database file. The software provides user-configurable reports which can be used to retrieve selected information from the database. Analyses can be displayed on the computer screen, printed, saved to an ASCII file or transmitted to the user's Laboratory Information Management System (LIMS) or network via a serial connection. VISCPRO is shipped with a companion program, the Database Manager, which provides convenient and powerful functions for managing and archiving database data. User-friendly Help files simplify the operation of VISCPRO.

### Safety

The CAV incorporates many new safety features, including dual over-temperature fault circuits for each bath. A fluid level float built into the bath prevents the heating elements from operating when they are uncovered. All of the bath fluid expansion from cold-fill to max temperature 150°C is contained within the bath (CAV-2200) or an internal expansion vessel (CAV-2100). An electrical/pneumatic interlock on the solvent waste receiver prevents solvent dispensing with the drain disengaged. The confined sample area and integral vent manifold allows for efficient solvent vapor/fumes extraction via the user-supplied ventilation system. A dual-pane exterior window insulates the warm bath and isolates it from the user. Heated drain lines are now standard on all CAV 2000 Series automatic viscometers.

### Required Equipment and Utilities (not provided)

- Computer (contact CANNON for current specifications)
- 115V AC, 20 amp circuit or 230V AC, 10 amp circuit (depending on model number)
- External exhaust fan for solvent vapors (4-inch/100 mm diameter hose connection on instrument)
- External compressed air supply (60 psi, 414 kPa) (low flow)
- Pressureless solvent vessel for use with the Solvent Dispensing Unit

### Optional Equipment and Utilities (not provided by CANNON)

- Nitrogen source for tube drying (if desired)
- External water chiller with built-in circulating pump is strongly recommended for the CAV-2200 if the low temperature bath is below 50°C (40°C for the CAV-2100).

### CAV Specifications

Bath Unit Dimensions:	305 x 727 x 1245 mm, 12 x 35 x 49" (W x D x H)
Service Unit Dimensions:	178 x 508 x 356 mm, 7 x 20 x 14" (W x D x H)
SDU-100 Dimensions:	178 x 508 x 356 mm, 7 x 20 x 14" (W x D x H)
Viscosity Range:	0.5 to 5000 cSt depending on viscometer tubes
Bath Temperature:	Variable from 20°C to 100°C with an accuracy better than ± 0.01°C. High temperature bath option (up to 150°C, ± 0.03°C) available by request.
Drop Time Resolution:	0.01 seconds (timing accuracy to ±0.001 second)
Operating Conditions:	10%-90% RH non-condensing. Installation category II; Pollution degree 2
Compliance:	CE Mark: EMC directive (89/336/EEC); Low voltage directive (73/23/EEC); HI-POT (1900 VDC, 60 sec.)
Preferred Bench Height:	28 to 30 inches
Computer:	Contact CANNON Instrument Company for current specifications and an installation guide detailing space, equipment and utility requirements.

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### CAV Order Information\*

Catalog #	Item Description
9725-A05	CAV-2100, 115 volts AC, 50/60 Hz, 1650W
9725-A07	CAV-2200, 115 volts AC, 50/60 Hz, 1650W
9725-A10	CAV-2100F, 230 volts AC, 50/60 Hz, 1750W
9725-A12	CAV-2200F, 230 volts AC, 50/60 Hz, 1750W
9725-A15	CAV-2100, 100 volts AC, 50/60 Hz, 1750W
9725-A17	CAV-2200, 100 volts AC, 50/60 Hz, 1750W

\* Please specify exact voltage and frequency when ordering



# CANNON® CAV® 2000 Series and Accessories



Two Bath CAV-2100 Configuration on Pedestal Base.

## Pedestal Base

The Pedestal Base permits floor-standing installation of the benchtop CAV at an ideal height for operation. The pedestal will support either one or two CAV bath units along with one service unit. The lightweight aluminum frame is of all-welded construction and is coated with a solvent-resistant epoxy powder-coat finish. The Pedestal Base is supplied with four adjustable leveling feet and all necessary mounting hardware for two bath units. Also included are four 3" (76-mm) diameter locking swivel-type casters that can be installed in place of the standard leveling feet. These casters allow easier movement of the CAV for service and maintenance in tight or otherwise difficult installations.

## Other Options & Accessories

**Dual Solvent Option** - Permits the use of two solvents for cleaning the viscometer tubes.

**High Temperature Bath Options** - Increases the upper operational temperature range of the standard CAV bath unit from 100°C to 150°C.

**Heated Sample Tray Options** - Temperature is variable from ambient to 80°C, adjusted by controls on the front panel of the CAV. Available for both trays or for only one of the two.

**High-Heat Sample Tray Option** - Similar to the Heated Sample Tray option but increases the upper temperature limit to 100°C. Available for both trays or for only one of the two.

**Thermometers for Heated Trays** - Analog and digital thermometers for use in heated or high-heat sample trays.

## Typical CANNON Automatic Viscometer Applications

- Used oil analysis
- Base stock analysis
- Additive analysis
- Fully-formulated oil analysis
- Marine fuel testing
- Crude oil testing
- Hydraulic oil testing
- Light and heavy fuel testing

## Industries Served

- Refinery quality control laboratories
- Refinery satellite laboratories
- Research & development laboratories
- Lube oil blending and packaging facilities
- Oil analysis laboratories
- Engine manufacturers
- Transmission manufacturers
- Railroads
- Marine shipping lines
- Power companies
- Chemical companies
- Distribution terminals
- Grease manufacturers
- Manufacturing companies utilizing hydraulic robotics

## Available CAV Tube Sizes

Standard Tubes	Fast-Run Tubes
Kinematic Viscosity Range*	
.5-50	-
1-100	1-10
2-200	2-20
3-300	3-30
4-400	4-40
5-500	5-50
6-600	6-60
7-700	7-70
8-800	8-80
10-1000	10-100
15-1500	15-150
20-2000	20-200
30-3000	30-300
40-4000	50-500

Other tube sizes available by special order.  
\*mm<sup>2</sup>/s (centistokes)



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