

HERCULES[®]

PROCESS CONTROL VISCOMETER

Model M2

User Guide

HERCULES® HI-SHEAR VISCOMETER, MODEL M2

User Guide

© Kaltec Scientific, Inc.
22425 Heslip Drive ♦ Novi, Michigan 48375
Phone 248.349.8100 ♦ Fax 248.349.8909
www.kaltecsi.com



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Guarantee

All Hercules® Hi-Shear Viscometers are guaranteed against defects in materials and workmanship for one year providing:

1. The unit has been operated within published electrical specifications;
2. The unit has not been damaged by misuse, improper operation, or accident;
3. The unit has not been modified or altered; and
4. All costs of transportation of the unit to Kaltec Scientific, Inc., are prepaid by the original purchaser.

VISCOMETERS MUST BE RETURNED DIRECTLY TO THE FACTORY,
NOT TO THE DISTRIBUTOR OR AGENT FROM WHICH THEY WERE
PURCHASED.

Kaltec Scientific, Inc. limits its obligation under this warrantee solely to the repair or replacement of any unit returned during the period covered by the warranty. No other obligations or liabilities are implied or expressed.

Kaltec Scientific, Inc.

Viscometer Setup

Please read this manual and any other instructions sent with the instrument before assembling.

ICON KEY

 Valuable information

Contents of the Shipping Crate

- 1 M2 Process Control Viscometer
- 4 Leveling Mounts (Feet)
- 2 Bobs (A and Bob of your choice) in a Wooden Bob Box
- 1 Quick Cup
- 1 Splash Guard
- 2 Pinion Levers
- 1 Thermal Printer
- 1 Roll of Thermal Paper, 112mm wide x 48mm diameter
- 1 Power Cord for M2 Viscometer
- 1 Power Cord with Converter for Printer
- 1 Printer Communication Cable
- 5 Spare DC Fuses
- 2 Spare AC Fuses

General Assembly

1. Screw the four rubber Leveling Mounts into the extended feet of the main casting. Adjust the leveling mounts until the unit stands firmly on the table or bench. (Precision leveling is not required.)
2. Screw the Pinion Levers in to the Pinion located on the right side of the Spindle Housing.
3. Connect the Power Cord to the rear of the instrument. Plug the Power Cord into the properly rated and grounded electrical outlet. (Refer to the specification plate affixed to the rear of the unit).
4. Place the printer on the flat area of the viscometer and align the Velcro strips on the bottom of the printer with those on the viscometer.
5. Connect one end of the communication cord to the rear of the printer and the other end to the viscometer.
6. Insert the Cup carefully into the Cup Holder. Align the Cup's keyway with the Cup Holder's locking pin. Carefully lower the Cup to the bottom. Turn the Cup slightly counterclockwise until the Cup locks into place. A fill line has been scribed on the inside wall of the Quick Cup for your convenience. It will provide the proper volume of sample for use with the "A" Bob.  **CAUTION: Viscometer should be turned ON when installing or removing the cup. If the cup is difficult to remove or install, a beeper will warn the operator of excessive force to the torque sensor.**
7. Screw the Bob clockwise no more than finger tight onto the lower, threaded end of the Drive Spindle.  **NOTE: Hold the Drive Spindle only by the flats at the top using the Spindle Wrench provided.**
8. Attach the splash guard after the sample has been added and the bob lowered. The guard is a safety precaution. It also prevents possible splattering of test material. This shield **must be** in place while spindle is rotating.

M2

Viscometer

The Hercules model M2 Process Control Viscometer measures flow properties of materials using the standard Hercules Hi-Shear method of variable shear rates. It has been designed for situations where only one test is needed in determining product acceptability. The model M2 allows an operator to conduct tests easier, quicker, more accurate and reproducible than other models.

The model M2 uses the same torque sensor found in our other advanced viscometers, but its operation has been simplified by using the “quick cup design” (with fill line) and a microprocessor that is built into the viscometer to collect and compute results. A thermal printer produces the conventional Hercules Rheogram along with test rpm, torque, viscosity and date/time group information on a compact report. The operation is simple. Just pour the sample up to the “fill line” inside the cup; lower the bob; install the safety shield; and push the test button. The instrument automatically runs through the test cycle and reports the results on the printer and LED displays.

The model M2 is capable of conducting three separate operations: (1) testing a material using the A bob at 1100 rpm with 100 kilodynes spring settings; (2) testing a material with a bob, speed, and spring setting prescribed by the customer; and (3) calibrating the instrument with a known viscosity standard fluid.

Controls

- **POWER SWITCH** (not labeled). Located in the lower left hand corner of the viscometer base. Push to turn viscometer on or off. A red light will illuminate when the viscometer is on.

- **OPTIONAL TEST SWITCH.** Located directly below the LED display, pressing this switch will complete a test cycle which has been designated by the customer. Options for this test are:
 - ⇒ Bob (A, B, C, D, E, EE, FF, or F2.5)
 - ⇒ RPM (1100, 2200, or 4400)
 - ⇒ Torque Range (50K, 100K, 200K, or 400K)

Each test cycle begins at rest and takes 20.4 seconds to achieve maximum speed. Another 20.4 seconds is taken to reach a full stop.

This test is programmed at the factory and can only be changed by a qualified technician.

- **A BOB, 100K, 1100 SWITCH.** Pressing this switch will activate a test cycle using an A bob, 100,000 dyne-cm torque setting and will achieve a maximum speed of 1100 rpm in 20.4 seconds. When the test reaches maximum speed it will automatically decelerate back to zero in 20.4 seconds. If at any time during the test, torque reaches a maximum of 1800 kilodynes, spindle rotation will stop and test results will be displayed and printed. This test cycle is also used as a calibration check.
- **CALIBRATE SWITCH.** This switch is only used to set torque calibration by a trained operator. It is deliberately covered to avoid accidental recalibration. Please refer to the calibration procedure found in chapter 3.
- **EMERGENCY STOP.** Only use the Emergency Stop if there is an uncontrollable test or an adverse circumstance. When the Emergency Stop button is pressed, the rotation of the spindle shaft is interrupted and the stop button will stay in the “down” position.
 - ⇒ **Activate:** Push down on the button. The drive motor will be disconnected from its power source and test data collected to that point is not retrievable.
 - ⇒ **Deactivate:** Turn the knob clockwise until it releases. The drive motor will be re-connected to its power source and data communication between the printer and viscometer will be back on line.

Test Results

LED Displays

The M2 is equipped with two, four digit displays for torque and speed. They are programmed to record test results at either the programmed maximum speed or

programmed torque limit, whichever occurs first. Speed is indicated in units of rpm and torque is displayed in kilodynes-cm. The data will continue to be displayed until a new test is started.

Printer

Test results are automatically printed at the completion of each cycle. The printer must be on-line to print. Results are shown in both the form of a rheogram of torque vs. rpm and text. Viscosity is calculated at either peak rpm or torque, whichever occurred first. The printer can be stopped by turning off power or by pressing the on-line button.

Viscometer Operation

Since the model M2 has been designed to compliment the process control lab where the same test is repeated daily, we have kept its operation simple.

1. Add a sample to the quick cup until it reaches the fill line.
2. Place the quick cup into the cup holder.
3. Lower the bob into the cup using the pinion handles until it comes to a stop. The proper level of the sample should just cover the top of the bob, but not high enough to come into contact with the shaft.
4. Install the splash shield.
5. Push the test cycle switch.
6. The viscometer shaft will begin its cycle achieving the maximum rpm then slowing to a stop. The printer will then produce its report.
7. Clean the cup and bob and repeat the procedure.

Maintenance

Calibration

The Hercules model M2 Process Control Viscometer operates under standards set by the Technical Association of the Pulp and Paper Industry (TAPPI). The specific test is outlined by TAPPI standard T-648, om-88. This test requires that the test sample temperature is 25°C. A Brookfield Viscosity Standard certified at 100.0 centipoise is used for recalibration. Viscosity standards with values close to 100 cps may be used to check calibration.

CALIBRATION CHECK. We recommend that you perform a calibration check to determine if the instrument requires recalibration. A check should be done every 50 hours of use, or when results appear to be inconsistent.

Procedure to check calibration:

1. Condition “A” bob, cup and sample to exactly 25°C.
2. Fill the cup to the fill line with the Hercules Test Fluid.
3. Install the cup into the cup holder.
4. Lower the bob into the cup until it stops.
5. Install the splash guard.
6. Push the **A Bob, 100K, 1100** switch.
7. Review printout and compare viscosity results to the known value of the Viscosity Standard used.

8. Recalibrate if the deviation exceeds $\pm 2\%$.  **NOTE: Temperature is the most critical factor when checking calibration or recalibrating the instrument. A 1°C change can effect viscosity as much as 2 centipoise.**

RECALIBRATION.

1. Condition “A” bob, cup and sample to exactly 25°C.
2. Fill the cup to the fill line with the only Brookfield Viscosity Standard certified to 100.0 centipoise.
3. Install the cup into the cup holder.
4. Lower the bob into the cup until it stops.
5. Install the splash guard.
6. Lift protective cover and push the **CALIBRATE** switch.
7. The viscometer shaft will begin spinning until it reaches 1100 rpm when it will stop (neither display window will provide data during the calibration phase). The calibration is complete.
8. Confirm new calibration by performing a calibration check.

Lubricating the Viscometer

Bi-Monthly:

Clean and lubricate the four areas of the Dovetail Slide that has contact with the Spindle Housing and the top half of the Drive Spindle that slides through the Drive Pulley. Using a heavy lithium grease, apply the grease in both the raised and lowered positions of the Spindle Housing. Move the Spindle Housing up and down several times to evenly spread the grease.

DO NOT lubricate bearings. All of the bearings are permanently sealed and do not require lubrication. Any lubrication whatsoever will adversely affect measurement accuracy.

Preventive Maintenance

Your Hercules® model M2 Process Control Viscometer has been operated for 50 hours before shipment. Like all fine instruments, however, it is vulnerable to misuse and neglect. Observing the following rules and tips will ensure many years of trouble-free and effective use.

Be especially careful when handling the Cup Holder, and try to protect it from any undue pressures or shocks. **DO NOT** use it as a handle when moving the viscometer. Abuse may result in the Cup Holder shaft becoming bent or the torque sensor strained.

Keep unit clean. Sample spills and other contaminants can permanently damage some components, especially the Cup Holder bearings.

Major problems such as Bob and Cup misalignment, bent shafts, or electronic malfunction should be serviced only by qualified technicians.

Cleaning the Viscometer

Unplug the viscometer from the AC power outlet before cleaning. Clean the viscometer after every test. If the sample spills on to the viscometer, wipe it off before it dries. The sample could damage the Cup Holder bearings or other small components.

When washing, use a damp sponge. Water should not run inside the viscometer. This could create an electronic malfunction and cause a shock hazard. Water or cleaning solution should **NEVER** be poured directly on the viscometer. This could cause more damage to the viscometer. **ONLY** clean the outer surface of the viscometer.

If sample spills during a test, clean it promptly. Coatings and other samples can sometimes get caught between the bottom of the cup holder and torque sensor base. Use a bent paper clip to clear out any foreign matter between these components.

Returning the Viscometer for Service

Call Kaltec's Service Department and receive free unlimited telephone support (outside the United States, please contact your local sales agent). If your viscometer is required to return to Kaltec for service, the Service Representative

will assign an **Return Authorization Number (RA#)**. Please include this number on all correspondence, including the shipping labels.

If you need to ship your viscometer back to Kaltec Scientific, pack it in its original crate. If needed, a shipping crate may be obtained from Kaltec. In-transit damage is not covered by the warranty. We suggest that you always insure shipments.

Include the following items when you return your viscometer for service:

- ◆ All Bobs, Cups
- ◆ Electrical Cords (3)
- ◆ Printer
- ◆ Leveling Mounts (4)
- ◆ Pinion Levers (2)

Include the following documents:

1. A brief description of symptoms.
2. A printout of the test when the problem occurred.
3. Contact name, address, phone number, and viscometer serial number (K_____).
4. Purchase order number, if available.

The customer is responsible for all shipping costs. Kaltec will ship the viscometer back to you “Prepaid” and then add it to the invoice. If any shipments are sent to Kaltec “Collect,” a service charge of \$10.00 plus the amount of the freight bill will be added your bill.

Ship to: **Kaltec Scientific, Inc.**
22425 Heslip Drive
Novi, Michigan 48375-4138
U.S.A.

On your Bill of Lading list the instrument as follows:

Crated Machinery
NMFC Item #133300, Sub 3
Class 85

For international shipments, the schedule B number for the instrument is:

9026.80.0000

After Kaltec has received and inspected your instrument, a representative from Kaltec will call with the cost of repairs. A purchase order number will be required for repairs to be made.

General Troubleshooting

Symptom: Cup resists attachment and detachment from Cup Holder.

Likely Cause: ♦ Dried sample material in and around Cup Holder.

Solution: ♦ Clean thoroughly with steel wool.

Likely Cause: ♦ Cup is bent.

Solution: ♦ Replace with a new cup. Kaltec will check suspected defective cup at no charge.

Symptom: Spindle Housing tracks poorly or is hard to move up/down.

Likely Cause: ♦ Sample material on Slide.

Solution: ♦ Clean thoroughly with stiff brush.

Likely Cause: ♦ A bur has formed on the Slide.

Solution: ♦ Use fine sandpaper or emery cloth to remove bur and lubricate.

Symptom: Bob does not rotate when running a test.

Likely Cause: ♦ DC fuse (located in back of unit) has blown.

Solution: ♦ Replace with AGC 20 fuse only. Spares provided with viscometer.

Symptom: Power switch indicator or LEDs do not light up when the power is turned on (and unit is properly plugged in).

Likely Cause: ♦ AC fuse is blown.

Solution: ♦ Check AC fuses located near power cord receptacle. Spares provided with viscometer.

Symptom: Torque Overload sounder is making continuous beep.

Likely Cause: ♦ Emergency Stop button has been pushed.
Solution: ♦ Deactivate Emergency Stop button (see page 4).

Likely Cause: ♦ Full scale torque has been reached.
Solution: ♦ Switch viscometer off for at least two seconds to reset, then on again. If beep continues, call Kaltec's Service Department.

Symptom: Cannot remove bob from spindle.

Likely Cause: ♦ Burr has formed on spindle shaft diameter.
Solution: ♦ Use a plumber's strap wrench to remove stuck bob. **NEVER grip bob with pliers** on neck or bob surface. Also, applying heat to the bob will cause ID to become larger and make it easier to remove.
♦ To remove burr, check 9/16 diameter of spindle at the leading edge, where the bob pilot hole first makes contact. Locate protruding metal, then file or sand off burr.

Technical Assistance

To contact Kaltec's Service Department

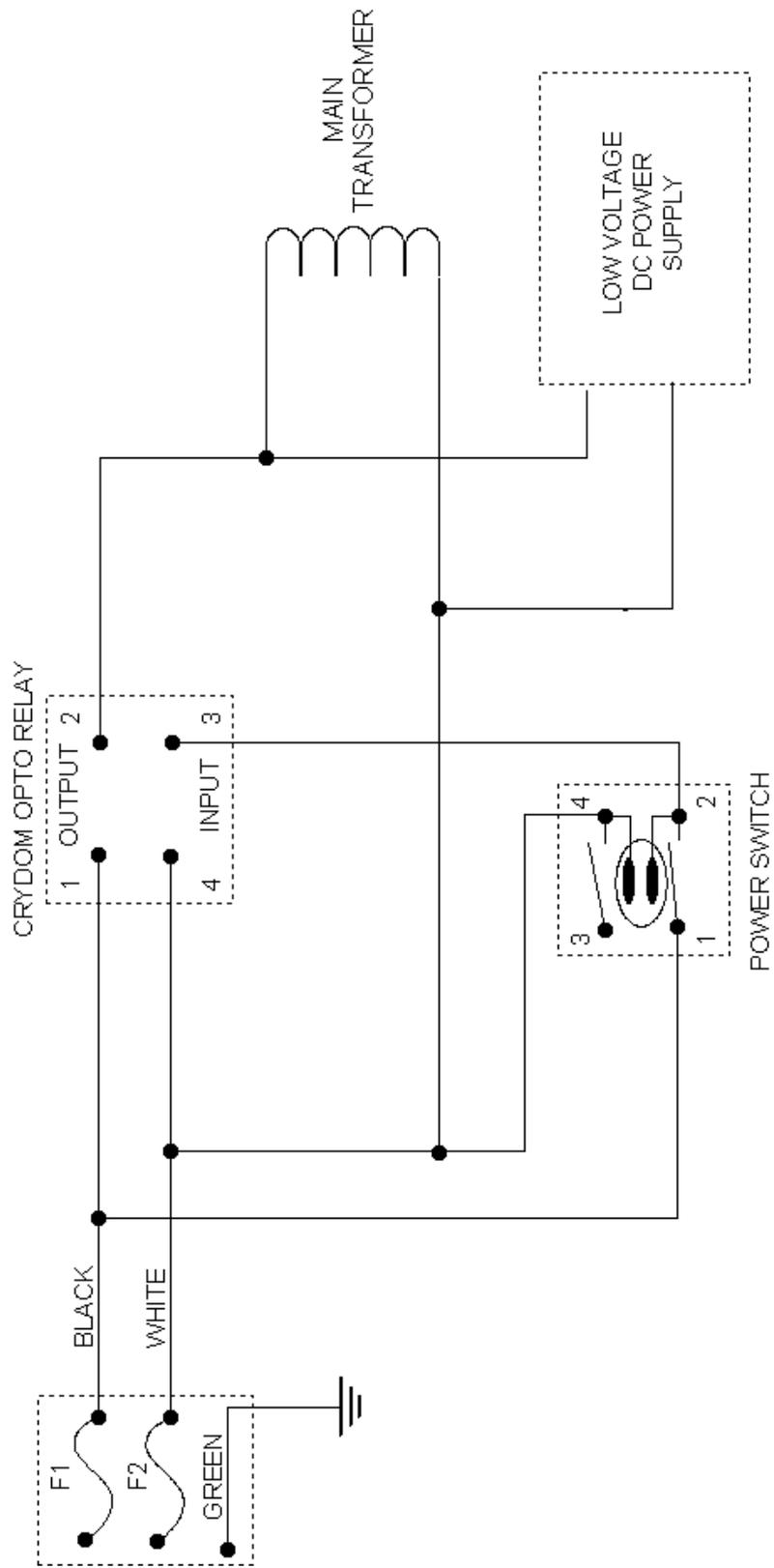
Call: (248) 349-8100

Fax: (248) 349-8909

E-mail: support@kaltecsci.com

Schematics

Please refer to the following schematic for proper AC fuse rating.



VOLTS	F1	F2	DIMENSIONS	PART #
100 - 120	15 A	15 A	.25" X 1.25"	36167
200 - 240	6.3 A	6.3 A	5mm X 20mm	36173