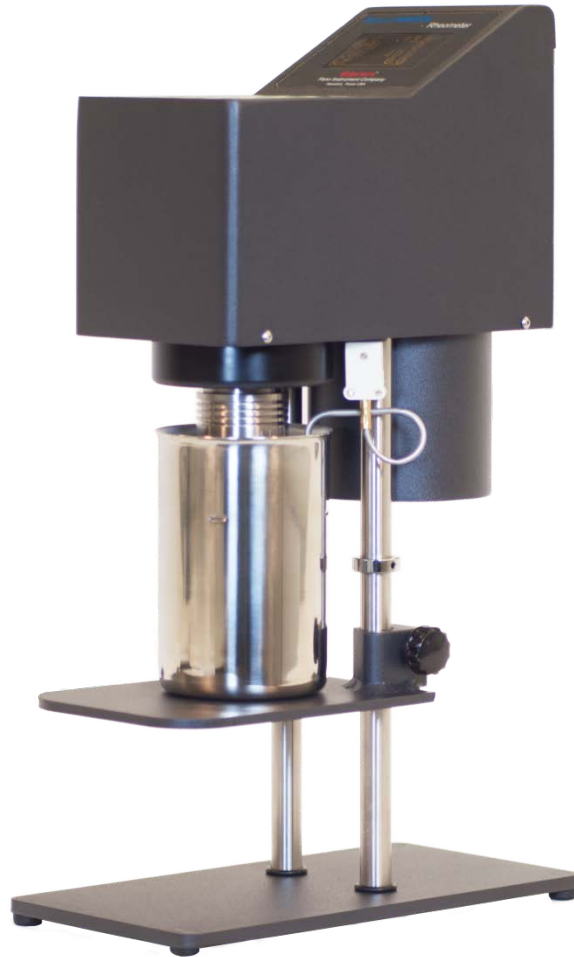


RheoVADR[®] Rheometer

Instruction Manual



Manual No. D00845847, Revision E

Instrument No. 102267855

Software Version 1.5



DNA[™] System Compatible

RheoVADR[®] Rheometer Instruction Manual

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Houston, Texas, USA

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1 Introduction

The RheoVADR[®] Variable Automated Digital Rheometer is the latest addition to the Fann viscometer family. RheoVADR[®] is a direct-reading instrument for evaluating the rheological properties of fluids, Newtonian and non-Newtonian. The advantages of this rheometer are its digital display, pre-programmed API tests, data recording feature, and speed range — 12 preset and variable speeds from 0.01 rpm to 999 rpm.

This design includes a rotor, bob, torsion spring, and a stainless steel sample cup for testing according to American Petroleum Institute Recommended Practice. This instrument is powered by a universal power supply, provided by Fann.



This instruction manual supports software version 1.5.

1.1 Document Conventions

The following icons are used as necessary in this instruction manual.



NOTE. Notes emphasize additional information that may be useful to the reader.



CAUTION. Describes a situation or practice that requires operator awareness or action in order to avoid undesirable consequences.



MANDATORY ACTION. Gives directions that, if not observed, could result in loss of data or in damage to equipment.



WARNING! Describes an unsafe condition or practice that if not corrected, could result in personal injury or threat to health.



ELECTRICITY WARNING! Alerts the operator that there is risk of electric shock.



HOT SURFACE! Alerts the operator that there is a hot surface and that there is risk of getting burned if the surface is touched.



EXPLOSION RISK! Alerts the operator that there is risk of explosion.

2 Safety

Safe laboratory practices and procedures should be observed while operating and maintaining the rheometer. This section lists some precautions to follow.

2.1 Safe Electrical Operation

This instrument is driven by universal power supply provided by Fann (100V to 240V, 50/60 Hz). Heated sample cups and recirculating sample cups (optional) are electrically heated.

Make sure the power and other wiring associated with this rheometer and electrically heated sample cups are in good condition and properly grounded.



Make sure the rheometer's power switch is in the OFF position and unplugged from the source before cleaning, repairing or performing maintenance.

Keep hands, clothes and other objects away from the rotating parts of the machine.

2.2 Heated Sample Cup

See Table 7-1 for heated sample cups available for purchase separately from Fann.



When using the heated sample cups, wear the proper hand protection to avoid getting burned.



When using heated sample cups, do NOT exceed 200°F (93°C).

3 Features and Specifications



This instruction manual supports software version 1.5.

3.1 Rheometer Features

RheoVADR[®] Rheometer features (Figure 3-1) include the following:

- Preprogrammed API tests— API drilling fluid and API cement
- Data recording at 100, 200, 500 milliseconds, and at 1, 5, 10 sec for observing trends and analyzing, sharing, printing, or downloading data
- USB port for connecting a flash drive to save test data (CSV) that can be read in a spreadsheet program
- Resistance Temperature Detector (RTD) for 0.5°F accuracy and repeatability
- Secure fit, left-hand turn for rotor and right-hand turn for bob to help prevent disconnection when measuring high viscosity fluids
- OLED display for high-contrast, making it easier to read
- LED-lighted sample cup for lighting the fluid level
- Pushbutton design for easier operation
- RS485 serial connector for connecting to a computer and instantaneous control software (optional)



DNA[™] System Compatible



The DNA System is a proprietary hardware and software system which adds capabilities to existing Fann instruments by connecting them to a computer using Fann's exclusive Data Acquisition and Control Software. The system combines individual instruments into one integrated system.



Figure 3-1 RheoVADR[®] Rheometer (front and back)

3.2 Rheometer Specifications

Table 3-1 RheoVADR[®] Rheometer Specifications

Category	Specification
Torsion Spring	F1, F2, F0.2
Rotors	R1, R2, R3, R1 Closed End, R2 Closed End
Bobs	B1, B2, B3, B4, B5
Operating Temperature Range	40°F to 125°F (4.44°C to 51.7°C)
Automatic Tests	4 Pre-programmed API tests
Sample Cup Volume	350 mL
Sample Temperature	200°F (93°C)
Temperature Measurements	RTD
Temperature Accuracy	0.5°F
Speed Range	Variable 0.01 to 999.9 rpm 12 Preset: 600, 300, 200, 100, 60, 30, 20, 10, 6, 3, 2, 1
Speed Accuracy	0.001 rpm
Shear Rate	0.01 sec ⁻¹ to 1700 sec ⁻¹
Dial Resolution	0.1
Dial Accuracy	0.5
cP Range (R1, B1, F1)	0.1 to 9M (displays 9999 cP max)
Ports	Power, RS485 Serial, USB
Data Port	USB Flash Drive
Data Recording Speeds (intervals)	100, 200 & 500 ms; 1, 5, & 10 sec
Dimensions	16 x 5 x 9.5 inches 40.6 x 12.7 x 24 centimeters
Weight	15 lb (6.8 kg)
Power Requirement	100V to 250V, AC, 50/60 Hz, 100W*

* Powered by universal power supply (UPS) provided by Fann.

3.3 Rotor and Bob Specifications

Table 3-2 Rotor-Bob Specifications and Constants

ROTOR-BOB	R1 B1	R2 B1	R3 B1	R1 B2	R1 B3	R1 B4	R1B5
Rotor Radius, R_0 (cm)	1.8415	1.7588	2.5866	1.8415	1.8415	1.8415	1.8415
Bob Radius, R_i (cm)	1.7245	1.7245	1.7245	1.2276	0.8622	0.8622	1.59829
Bob Height, L (cm)	3.8	3.8	3.8	3.8	3.8	1.9	3.8
Shear Gap in Annulus (cm)	0.117	0.0343	0.8261	0.6139	0.9793	0.9793	0.2432
Radii Ratio, R_i/R_0	0.9365	0.9805	0.667	0.666	0.468	0.468	0.8679
Maximum Use Temperature (°C)	93	93	93	93	93	93	93
Minimum Use Temperature (°C)	0	0	0	0	0	0	0
Overall Instrument Constant, K Standard F1 Torsion Spring, $\eta = Kf\theta/N$	300	94.18	1355	2672	7620	15,200	703
Shear Rate Constant k_3 (sec^{-1} per rpm)	1.7023	5.4225	0.377	0.377	0.268	0.268	0.8489
Shear Stress Constant for Effective Bob Surface k_2 (cm^{-3})	0.01323	0.01323	0.01323	0.0261	0.0529	0.106	0.01546

3.4 Operating Specifications

Table 3-3 Range of Environmental Conditions

Maximum Altitude	6562 ft (2000 m)
Temperature Range	39°F to 122°F (4°C to 50°C)
Maximum Relative Humidity (RH)	80% RH at 87.8°F (31°C) or less 50% RH at 104°F (40°C)

4 Installation

The rheometer should be placed where there is easy access to the power cord plug for disconnection.

Consideration should be given to the location where samples are prepared and equipment is cleaned when the test is completed. There should be sufficient storage area nearby for commonly used tools, as well as consumables.

5 Operation

To start a test, add 350 mL of sample to the stainless steel sample cup. The sample cup has a line that marks 350 mL. A scribed line on the rotor indicates proper immersion depth.



Damage to the bob shaft bearing may occur if the immersion depth is exceeded.

If other sample holders are used, the space between the bottom of the rotor and the bottom of the sample holder should be one-half inch (1.27cm) or greater.

This instrument is operated through a keypad (Figure 5-1). The keypad functions are summarized in Table 5-1 and described fully in the following sections.

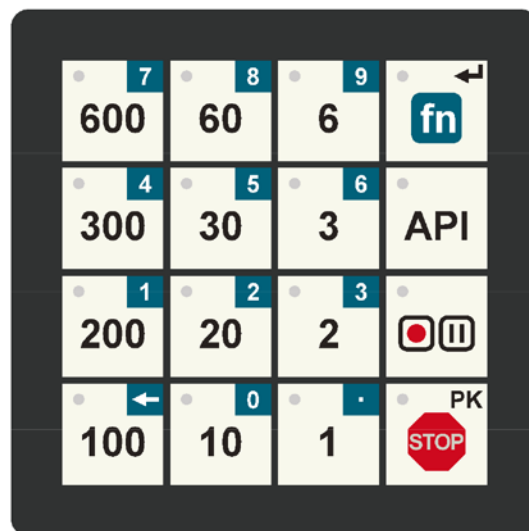


Figure 5-1 RheoVADR[®] Rheometer Keypad

Table 5-1 RheoVADR[®] Keypad Functions

Key name	Use
Preprogrammed Speeds	Press white number keys to activate speeds of 1, 2, 3, 6, 10, 20, 30, 60, 100, 200, 300, or 600 rpm
Function fn	Press to activate blue second function keys
	Use as Enter key ↵
	Press and hold ~ 5 seconds to ZERO the dial reading. See NOTE below.
Blue Second Function	<i>Speed:</i> Press fn key and then press blue number keys to enter speed. Press fn key again as Enter key.
	<i>Backspace</i> ← : When fn key is active, this key acts as backspace to delete last digit entered
	<i>Decimal</i> . : When fn key is active, use decimal key to enter decimal point
API	Press this key to open API menu.
Record/Pause	Press once to record; press again to pause
	Record data at these rates: 100, 200, 500 milliseconds; and 1, 5, 10 seconds
PK	Press and hold STOP for ~ 5 seconds to activate peak mode. The unit displays the peak dial reading (gel strength). To leave peak mode, press STOP again.
STOP	Press to stop the Rheometer or stop a test or recording in progress.
	Press to exit a program or step
	Press to turn on light



Zero the dial reading without fluid and then perform the calibration to obtain the most accurate measurements.

5.1 Instrument Start-up

Plug the power supply into a 100V to 240V, 50/60 Hz power source. Connect the power supply to rear of the rheometer. Turn on the power switch.

The sample cup will illuminate and the following screens will appear (Figure 5-2 and Figure 5-3). The system information shows the current software version, temperature units, communication address, spring, and rotor-bob combination. These settings can be revised in set-up mode (Section 5.4).

The LED light (over the sample cup) will blink 5 times before the screen will change to the operating mode (Figure 5-4).



Figure 5-2 Start Up Message

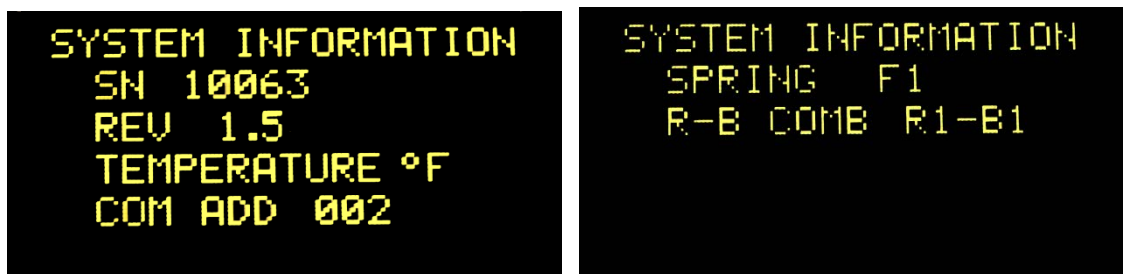


Figure 5-3 System Information

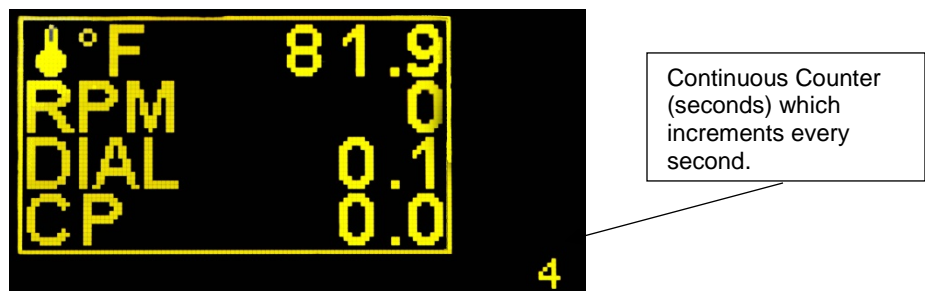


Figure 5-4 Data Display

The data display (Figure 5-4) lists the temperature (°F), speed (RPM), dial reading (DIAL), and the viscosity in centipoise (cP) in real-time. In the lower right corner of the display, a counter (seconds) shows how long a set speed is running.



The temperature units can be set to degrees Fahrenheit or Celsius. See Section 5.4 for instructions.



The counter resets to Zero and starts counting again whenever you press STOP, any speed key, or enter an action.

5.2 Manual Operating Instructions



A flash drive (not provided) must be connected to save data.

5.2.1 Choosing speeds

- Press white number keys to select preset speeds: 600, 300, 200, 100, 60, 30, 20, 10, 6, 3, 2 or 1
- Press **fn** key and blue keys (and decimal key if needed) to enter manual speeds. Then, press **fn** to activate the speed entered.

5.2.2 Recording and Saving data

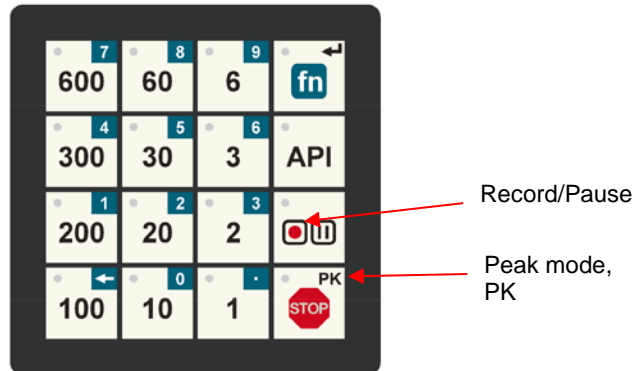
- A flash drive must be connected to save data.
- In API mode, test results are automatically recorded to a flash drive. The last test data from API programs is always available to view.
- Press Record/Pause key once to begin recording.
- Select recording rate by using blue second function keys.
- Press Record/Pause again to pause recording.
- Press Record/Pause again to continue recording.
- While recording, data is saved in the same file.
- To save data in another file (different name), press STOP, and then Record/Pause to record.
- To end recording and not file press STOP.



File name includes the serial number of the RheoVADR.

5.2.3 Measuring Gel Strength

- Press the STOP button and hold it for 5 seconds. This activates the peak mode (PK) dial reading (shown below).
- The instrument displays the peak dial reading for subsequent speed.
- To get out of peak mode, press STOP.



5.2.4 Stopping a test

- Press STOP.

5.2.5 Shutting down the rheometer

- Press STOP.
- Turn the power switch (back of instrument) to OFF position (Figure 3-1).

5.3 API Test Profile

Refer to Figure 5-5 and Table 5-1.



Figure 5-5 API Test Profiles (pages 1 and 2)



This instrument automatically records API test data. Make sure a flash drive (not provided) is connected to the USB port (back of instrument) to save this data.



API Mode only. Last test results are stored in the machine memory. Select 1 to view the data (Figure 5-5, page 1).



API profiles are located in Appendix A API Profiles.

1. Select the API key. The menu will appear (Figure 5-5, left).
2. To start a test, press the corresponding blue function key on the keypad. To see more tests, press fn to go to the next page.
3. Wait for the instrument to complete the test profiles. See Appendix A for tables listing the profile steps.
4. While in progress, the screen displays the current values, file number, test sequence, and current step (Figure 5-6).
5. When the test ends, the results will show in the data display screen (Figure 5-7).

6. Press **fn** to see more results. Press **STOP** to exit.



Figure 5-6 Test in Progress (API Test Mode)



During testing, the temperature, speed, dial reading, and viscosity (cP) will be shown. Also, the total steps (TS), current step (CS), and counter will be displayed.

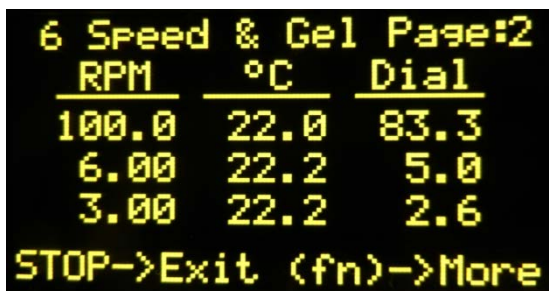


Figure 5-7 Test Results (end of test)

5.3.1 User Profiles

User 1 and User 2 (Figure 5-5) are custom profiles.

See Section 5.4.7 for instructions to load the profiles onto the rheometer.



Fann Instrument Company can create User profiles for loading on your instrument using a USB flash drive. Contact Fann Instrument Company for customizing your User profiles.

5.4 Set-up Mode

This section describes the functions available in **SETUP** mode (shown below).

To enter **SETUP** mode, press and hold **STOP**, and then turn on the power.

Wait for the **SETUP** menu to appear.



Figure 5-8 SETUP Mode (page 1)



Figure 5-9 SETUP Mode (page 2)



From the first **SETUP** menu, you must press **fn** to go to the next page (Figure 5-9).



You can exit **SETUP** mode, by pressing **STOP**.

5.4.1 Changing temperature units

- Press blue key 1 to change units. (Fahrenheit is default temperature unit.)
- Press **STOP** to exit and return to previous menu.

5.4.2 Initiating temperature calibration

- Press blue key 2 to select temperature calibration.
- Follow temperature calibration steps as shown on screen.
- Press STOP to exit and return to previous menu.



Use an RTD calibrator (part no. 102355369, sold separately) for calibrating temperature. Temperature calibration is always performed in Celsius (°C).

5.4.3 Initiating sensor calibration

- Press blue key 3 to begin sensor calibration (Figure 5-8).
- Choose the appropriate standard for the spring (Table 5-2). The instrument will prompt you to use the appropriate fluid.

Table 5-2 Viscosity Standards for Springs

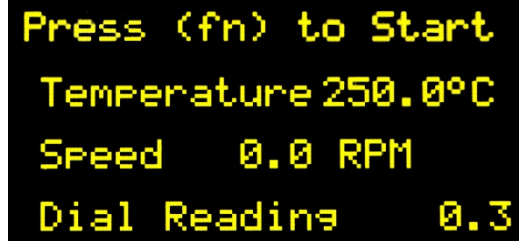
Spring	Viscosity Standard (cp)	Max Calibration Speed (rpm)
F1	200	450
F2	500	360
F3	500	540
F4	1000	360
F5	1000	450
F10	2000	450

- When ready, press **fn** to start (Figure 5-10).



The unit will step through different speeds and compile sensor data. When this process finishes, the user will be prompted to enter the viscosity (cP) of the fluid at the measured temperature. The system uses this reference measurement (cP) to correlate the table it has compiled, and then it calibrates the dial readings to offset for nonlinearities in the measurement system.

- Press STOP to exit and return to previous menu.



```
Press (fn) to Start
Temperature 250.0°C
Speed    0.0 RPM
Dial Reading    0.3
```

Figure 5-10 Fluid Calibration

5.4.4 Choosing address



The device address will be shown (Figure 5-7). Press the blue key 4 to enter the address in the number range 001 to 255.

5.4.5 Choosing Rotor-Bob Combination

Press blue keys to select the rotor-bob combination for your instrument.

Press **fn** to see more options (Figure 5-11).



Figure 5-11 Rotor-Bob Combinations



The selected rotor-bob combination will have an asterisk* next to it. For example, in Figure 5-11, the R1-B1 is selected.



Yield Stress Adapter (YSA) is device that converts a standard oilfield Couette viscometer into an instrument that readily and accurately measures the yield point of various fluids, such as particle-laden fluids, foamed fluids, or emulsions.



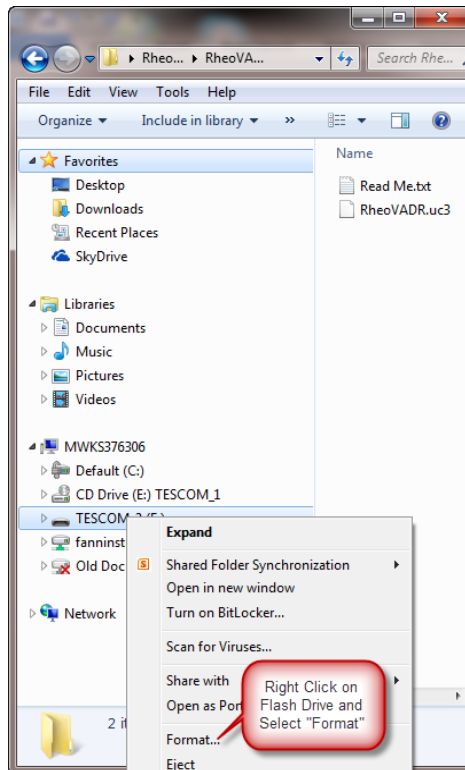
If YSA is selected, the viscosity (cP) value is not useable, only dial readings can be used to calculate yield points using mathematical models.

5.4.6 Applying Firmware Update

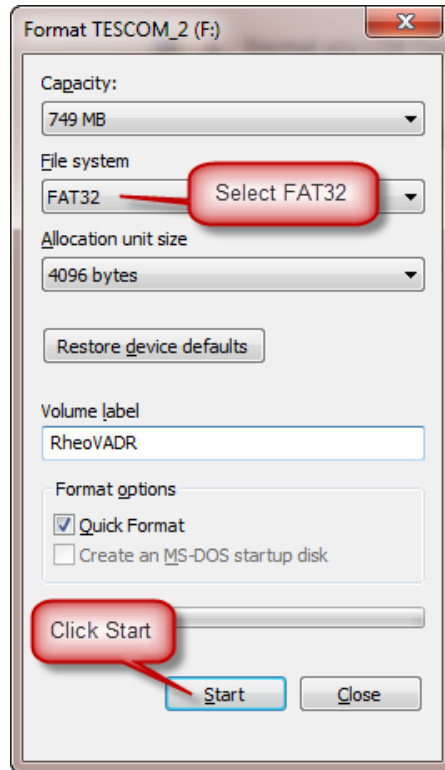


The update process cannot be interrupted after it begins. Ensure that power is not removed during this process.

1. Insert a USB flash drive in the computer USB Port. Navigate to Windows Explorer and select the Format Command as shown below.



2. Format the USB Flash Drive using a Windows Computer. Select FAT32 File System.



3. Download/Unzip the update file “RheoVADR.uc3”. The file name must not be changed.
4. Copy the “RheoVADR.uc3” file to the USB flash drive prepared in Step 2.
5. Safely detach the flash drive from the computer.
6. Turn **OFF** the rheometer to be updated.
7. Insert the USB flash drive into the USB port on the rheometer.
8. Press and hold the **STOP** button, and then turn on power.
9. The **SETUP** screen will display.
10. Press **fn** button to advance to next screen.
11. Select **Option 2 Firmware Update** to start the update.
12. The screen will go blank and after update is completed, the rheometer will restart.
13. On Start up, the System Information screen will display the new Firmware Revision.

5.4.7 Installing User Profiles



Fann Instrument Company can create User profiles for loading on your instrument using a USB flash drive. Contact Fann Instrument Company for customizing your User profiles.

- To load, the custom profile, insert the USB flash drive into rheometer USB port.
- From **SETUP**, press blue keys 3 or 4 (Figure 5-9) to load UP1 or UP2, respectively.

5.5 Rotor Removal and Installation

- To remove the rotor, turn it clockwise (right).
- To install the rotor, turn it counterclockwise (left).

5.6 Bob Removal and Installation

- To remove or install the bob, insert an Allen key wrench (0.050 in.) or similar rod into the hole on the bob shaft as shown in the illustration.
- Turn the bob counterclockwise (left) to remove it and clockwise (right) to install it (right-hand-threads).

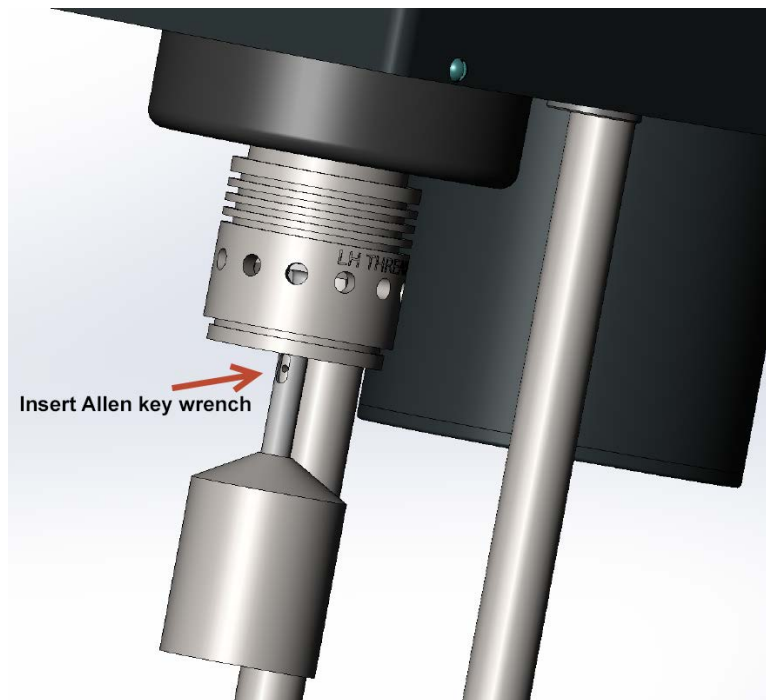


Figure 5-12 Bob and Bob Shaft

6 Troubleshooting and Maintenance

Contact Fann Instrument Company for repair and maintenance.



Make sure the rheometer's power switch is in the OFF position and unplugged from the source before cleaning, repairing or performing maintenance.

7 Accessories

Table 7-1 Accessories for RheoVADR[®] Rheometer

Torsion Springs				
Part No.	F	Constant	Max Shear Stress	Color Code
102406065	F0.2	77.2	307	Green
102267854	F1	386	1533	Blue
102453149	F2	772	3066	Red
Rotors				
102303922	Rotor, R1, RheoVADR Rheometer, Stainless Steel			
102372804	Rotor, R1, RheoVADR Rheometer, Closed End, Stainless Steel			
102372802	Rotor, R2, RheoVADR Rheometer, Stainless Steel			
102372805	Rotor, R2, RheoVADR Rheometer, Closed End, Stainless Steel			
102372803	Rotor, R3, RheoVADR Rheometer, Stainless Steel			
Bobs				
207033	Bob, B1, RheoVADR Rheometer			
102372806	Bob, B2, RheoVADR Rheometer			
102372807	Bob, B3, RheoVADR Rheometer			
102372808	Bob, B4, RheoVADR Rheometer			
102372809	Bob, B5, RheoVADR Rheometer			
Sample Cups				
101558383	Thermocup, 115 Volts, 50/60 Hz, 2 amps, 200°F			
101558384	Thermocup, 230 Volts, 50/60 Hz, 1 amp, 200°F			
207958	Double-Wall Circulating Cup			
207560	Stainless Steel Sample Cup			
Circulators				
208754	Heat-only Circulator, 90°F to 212°F, 4 liters, 115 Volts, 60 Hz, 1,000 Watt			
208755	Cooling /Heating Circulator, -20°C to 150°C, 6 liters, 115 Volts, 60 Hz, Heater Capacity 1,100 Watt			
Calibration				
102355369	Handheld Calibrator/Thermometer Kit			
207026	Fluid Calibration Check Kit			
207124	Calibration Fluid, 10 cP, 16 oz			
207119	Calibration Fluid, 20 cP, 16 oz			
207120	Calibration Fluid, 50 cP, 16 oz			
207121	Calibration Fluid, 100 cP, 16 oz			
207122	Calibration Fluid, 200 cP, 16 oz			
207123	Calibration Fluid, 500 cP, 16 oz			
Miscellaneous				
207952	Cold Water Rheology Kit, 115V			
207953	Cold Water Rheology Kit, 230V			
102448996	Sleeve, Yield Stress Adapter (YSA)			
102448995	Bob, Yield Stress Adapter (YSA)			
102372795	Spares, 1 yr			
102372796	Spares, 2 yr			
102375360	Case			
102357095	Shield			
102469227	Dead Weight Calibration Verification Kit			

8 Parts List

Table 8-1 RheoVADR[®] Rheometer Models

Part No.	Description
102406902	RheoVADR Rheometer with F0.2 Spring
102267855	RheoVADR Rheometer with F1 Spring
102453150	RheoVADR Rheometer with F2 Spring

Table 8-2 RheoVADR[®] Rheometer Parts

Item No.	Part No.	Quantity	Description
1	102260457	1	BASE PLATE
2	102260456	1	HOUSING
3	207949	5	6-32 X 5/8 BHMS STAINLESS STEEL (SS)
4	205690	1	BEARING TOP ROTOR
5	102260459	1	NEOPRENE BELT
6a	102303922	1	ROTOR R1
6b	102372802	1	ROTOR R2
6c	102372803	1	ROTOR R3
6d	102372804	1	ROTOR R1 CLOSED END, SS
6e	102372805	1	ROTOR R2 CLOSED END, SS
7	207099	1	RETAINER RING
8	102333747	2	18-8 SS CUP POINT SET SCREW, 4-40 THREAD, 1/2L
9	102303887	1	STEP MOTOR FRAME SIZE 17 STEP SIZE 1.8 DEG
10	102260454	1	PULLEY MOTOR
11	101255776	4	SCREW, THREADED, CAP, SOCKET HEAD, 18-8 SS
12	102303920	4	WASHER, 18-8 SS, 8mm OD, 1.4mm-2.4mm THICK
13	102303383	1	LED 5MM COOL WHITE CLEAR 15DEG
14	207599	2	ROD SUPPORT
15	207620	2	10-32 X 1/2 SHCS BOPL
16	207871	4	WASHER FLAT 10 SS
17	208704	4	WASHER SPLIT 10 SS
18	207593	1	COLLAR STOP
19	207622	1	6-32 X 1/8 HSSS BOPL
20	102267848	1	STAGE
21	207588	1	KNOB
22	207598	1	SPACER CLAMP
23	207597	1	NUT CLAMP
24	102260460	1	BASE
25	203419	2	10-32 X 5/8 BHMS SS
26a	102406065	1	TORSION SPRING, F0.2

Item No.	Part No.	Quantity	Description
26b	102267854	1	TORSION SPRING, F1
26c	102453149	1	TORSION SPRING, F2
27	207098	1	RETAINER RING INTERNAL 2-3/16
28	102357095	1	SHIELD
29a	207033	1	BOB B1
29b	102372806	1	BOB B2
29c	102372807	1	BOB B3
29d	102372808	1	BOB B4
29e	102372809	1	BOB B5
30	205654	2	O-RING 9/16 X 3/32 NITRILE
31	203495	4	4-40 X 1/2 SHCS SS
32	102267849	1	MOTOR COVER
33	102303919	4	SCREW, 18-8 SS MALE-FEMALE THREADED HEX
34	101652740	6	4-40 x 1/4 SHCS SS
35	102306548	2	SCREW, 18-8 SS FEMALE THREADED HEX
36	102303914	2	SOCKET HEAD CAP SCREW, 16 SS, 4-40 Thread, 7/16 L
37	102346968	1	ELECTRONICS ASSY
38	102267847	1	RTD
39	101443937	1	PANEL THERMOCOUPLE JACK, ROUND HOLE, RMJ
40	102409459	1	OVERLAY KEYPAD ASSEMBLY
41	101729598	4	SCREW, FLAT HEAD, 4-40 UNC, SS, HEX SOCKET
42	207634	8	NUT 4-40 HEX REGULAR SS
43	102333751	2	SCREW, 18-8 SS TRUSS HEAD PHILLIPS
45	102303923	1	OVERLAY LCD
46	102333749	6	SCREW, TRUSS HEAD PHILLIPS, 18-8 SS
47	207560	1	CUP SAMPLE
48	205778	4	FEET RUBBER 1/2in.
49	207487	4	6-32 X 1/4 BHMS SS
50	102267850	1	COVER
51	102267851	1	COVER BACK
N/A	D00845847	1	INSTRUCTION MANUAL, RHEOVADR RHEOMETER

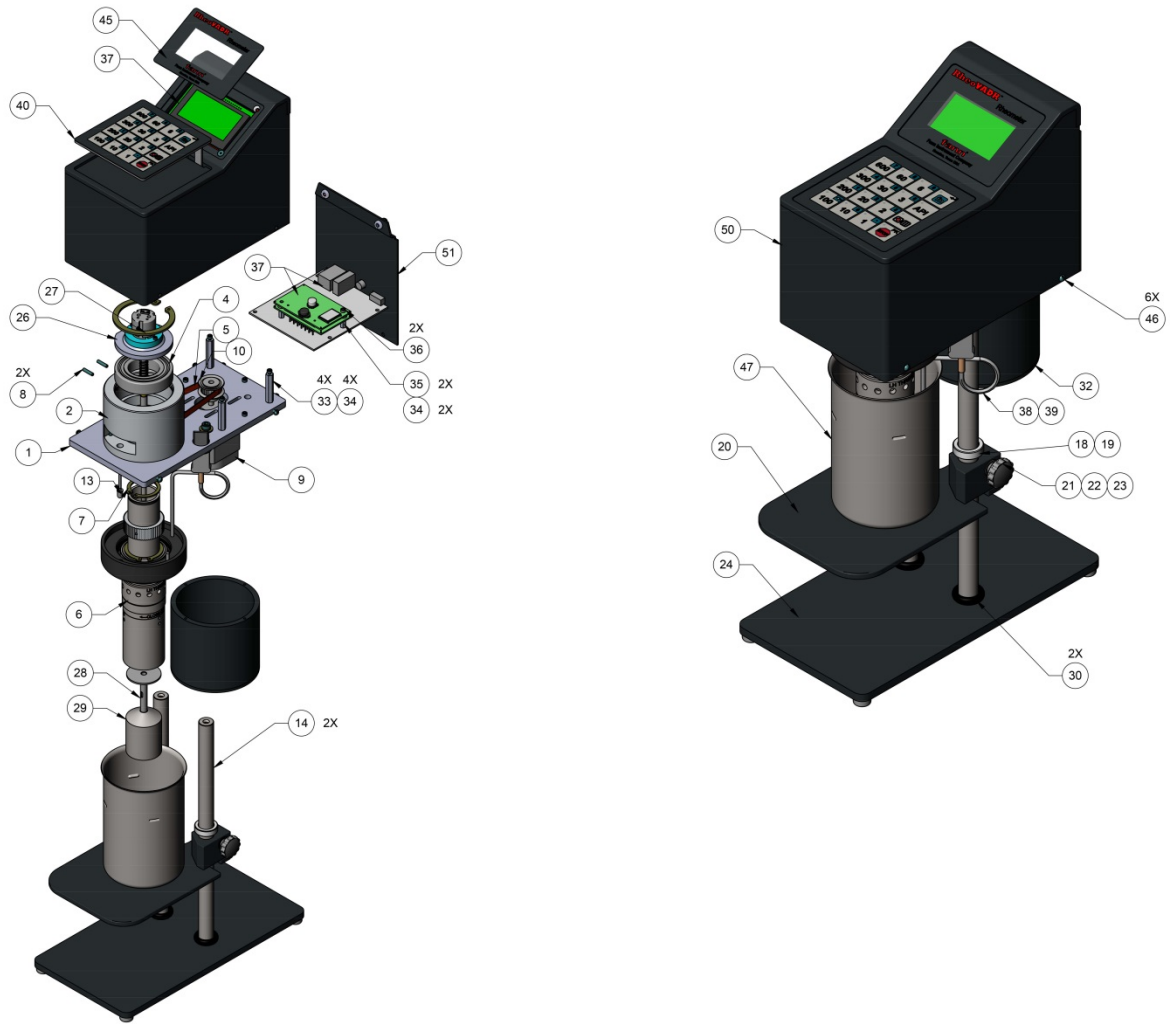


Figure 8-1 RheoVADR[®] Rheometer Assembly, View 1

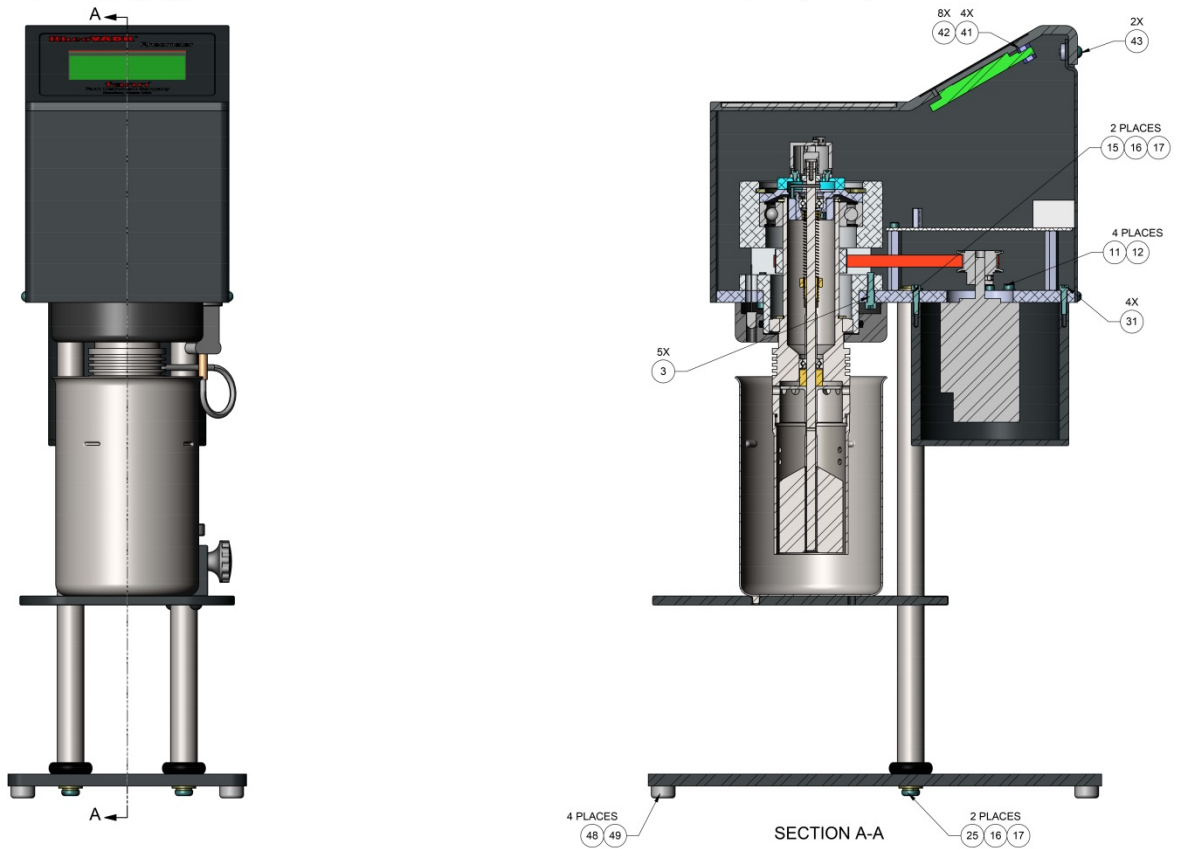


Figure 8-2 RheoVADR[®] Rheometer Assembly, View 2

9 Declaration of Conformity



Declaration of Conformity

Viscometer, RheoVADR

Fann Instrument Company
14851 Milner Road
Houston, Texas 77032

Declares that the following product:

Description:	Couette Rotational Viscometer
Model/Type reference:	RheoVADR
Ratings:	100V to 250V, AC, 50/60 Hz, 100W

Has been evaluated for compliance in accordance with the following standards and the applicable national deviations:

EN 61010-1:2010
UL 61010-1:2012
CSA C22.2 No. 61010-1-12

The requirements enumerated in the summary of testing for this product have been met.

This product fulfils the requirements of EN 61010-1:2010, CAN/CSA C22.2 No. 61010-1-2012 and UL61010-2-030:2012.

This declaration is intended to address the requirements of the European Union Low Voltage Directive (2006/95/EC).



Engineering Manager



Quality Control Manager

HOUSTON TX. USA
Place of Issue

15th October 2015
Date of Issue

Declaration of Conformity RheoVADR.docx

10 Warranty and Returns

10.1 Warranty

Fann Instrument Company warrants only title to the equipment, products and materials supplied and that the same are free from defects in workmanship and materials for one year from date of delivery. **THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED OF MERCHANTABILITY, FITNESS OR OTHERWISE BEYOND THOSE STATED IN THE IMMEDIATELY PRECEDING SENTENCE.** Fann's sole liability and Customer's exclusive remedy in any cause of action (whether in contract, tort, breach of warranty or otherwise) arising out of the sale, lease or use of any equipment, products or materials is expressly limited to the replacement of such on their return to Fann or, at Fann's option, to the allowance to Customer of credit for the cost of such items. In no event shall Fann be liable for special, incidental, indirect, consequential or punitive damages. Notwithstanding any specification or description in its catalogs, literature or brochures of materials used in the manufacture of its products, Fann reserves the right to substitute other materials without notice. Fann does not warrant in any way equipment, products, and material not manufactured by Fann, and such will be sold only with the warranties, if any, that are given by the manufacturer thereof. Fann will only pass through to Customer the warranty granted to it by the manufacturer of such items.

10.2 Returns

For your protection, items being returned must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Fann will not be responsible for damage resulting from careless or insufficient packing.

Before returning items for any reason, authorization must be obtained from Fann Instrument Company. When applying for authorization, please include information regarding the reason the items are to be returned.

Our correspondence address:

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Appendix A API Profiles

Review the following table and notes to better understand the API Profiles.

Mode	Description
Stabilize (S)	The unit will run at specified Speed and Run Time , and then check for stability of readings. The dial is considered stabilized if it does not change more than 0.5 dial reading for 10 seconds. When stability is reached, it will proceed to the next step. However, the unit will continue indefinitely at that step if stability is not achieved.
Peak (P)	The step runs for specified Run Time and the display shows the peak value of dial reading during this run time.
Continuous (C)	The step runs for the specified Run Time and continues to the next step.



In **Stabilize** or **Peak** mode only, if 1 point recording is specified, it will be the stabilized reading or Peak reading. If 2 points are specified, they will be recorded at the start and end of the step. If recording interval is specified, then recording will start immediately when step begins and continue recording at the specified rate at equal intervals. The fastest recording rate is every 0.1 sec.



In **Continuous** mode, if 1 point is specified, it will be recorded just before the end of that step time. If 2 points are specified, they will be recorded at the start and end of the step. If recording interval is specified, then recording will start immediately when step begins and continue recording at the specified rate at equal intervals. The fastest recording rate is every 0.1 sec.

Refer to the preceding table and notes that explain how data is captured and recorded.

Table A-1 API Six Speed & Gel Profile

Step	Speed (rpm)	Run Time (s)	Mode	Number of Points to Record*
1	600	10	S	1
2	300	10	S	1
3	200	10	S	1
4	100	10	S	1
5	6	10	S	1
6	3	10	S	1
7	600	10	C	2
8	0	10	P	2
9	3	10	P	0.1 sec interval
10	600	10	C	2
11	0	10 min	C	2
12	3	10	P	0.1 sec interval

* Also shows recording rate. For example, Step 9, data points are recorded every 0.1 sec.

Table A-2 API PV/YP & Gel Profile

Step	Speed (rpm)	RunTime (s)	Mode	Number of Points to Record*
1	600	10	S	1
2	300	10	S	1
3	600	10	C	2
4	0	10	C	2
5	3	30	P	0.1 sec interval
6	600	10	C	2
7	0	10 min	C	2
8	3	30	P	0.1 sec interval

* Also shows recording rate. For example, Step 5, data points are recorded every 0.1 sec.

Table A-3 API Gel Profile

Step	Speed	Run Time	Mode	Number of Points
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	(rpm)	(s)		to Record*
1	600	10	C	2
2	0	10	C	2
3	3	10	P	0.1 sec interval
4	600	10	C	2
5	0	10 min	C	2
6	3	10	P	0.1 sec interval

* Also shows recording rate. For example, Step 3, data points are recorded every 0.1 sec.

Table A-4 API Cement Profile

Step	Speed (rpm)	Run Time (s)	Mode	Number of Points to Record*
1	3	10	C	1 sec interval
2	6	10	C	1 sec interval
3	30	10	C	1 sec interval
4	60	10	C	1 sec interval
5	100	10	C	1 sec interval
6	200	10	C	1 sec interval
7	300	10	C	1 sec interval
8	200	10	C	1 sec interval
9	100	10	C	1 sec interval
10	60	10	C	1 sec interval
11	30	10	C	1 sec interval
12	6	10	C	1 sec interval
13	3	10	C	1 sec interval
14	300	1 min	C	2
15	0	10	C	2
16	3	30	P	1 sec interval
17	0	10 min	C	2
18	3	30	P	1 sec interval

* Also shows recording rate. For example, Step 1, data points are recorded every 1 sec.

Appendix B Viscosity Calculations

To calculate Newtonian viscosities in centipoise, use the following equation:

$$\eta_N = S \times \theta \times f \times C$$

where,

S is the speed factor, = 300 / Test Speed

θ is the dial reading

f is the spring factor (Refer to Table B-2)

C is the rotor-bob factor (Refer to Table B-1 Rotor-Bob Factor (C))

η_N is the Newtonian viscosity (cP)

Example: Using an R2-B1 combination at a speed of 600 rpm with an F5.0 spring, and a dial deflects to 189, the viscosity is

$$\eta_N = 0.5 \times 189 \times 5 \times 0.315 = 149 \text{ cP}$$

Table B-1 Rotor-Bob Factor (C)

Rotor-Bob Combination	R-B Factor (C)
R1-B1	1.000
R1-B2	8.915
R1-B3	25.392
R1-B4	50.787
R1-B5	2.334
R2-B1	0.315
R2-B2	8.229
R2-B3	24.707
R2-B4	49.412
R2-B5	1.649
R3-B1	4.517
R3-B2	12.431
R3-B3	28.909
R3-B4	57.815
R3-B5	5.849

Table B-2 Torsion Spring Specifications

Torsion Spring Assembly	Torsion Spring Constant* k_1 (dyne/cm/degree deflection)	Torsion Spring Factor f	Maximum Shear Stress with B1 Bob (dyne/cm ²)	Color Code
F0.2	77.2	0.2	307	Green
F0.5	193	0.5	766	Yellow
F1	386	1	1,533	Blue
F2	772	2	3,066	Red
F3	1,158	3	4,600	Purple
F4	1,544	4	6,132	White
F5	1,930	5	7,665	Black
F10	3,860	10	15,330	Orange

*With R1-B1 Combination