V&P SCIENTIFIC, INC.
Innovators in Liquid Handling, Arraying and Mixing

TECHNICAL NOTE 167C

OPERATION MANUAL FOR THE VP 710SM SERIES SMART MOTOR MAGNETIC TUMBLE STIRRER

US Patent #6,176,609

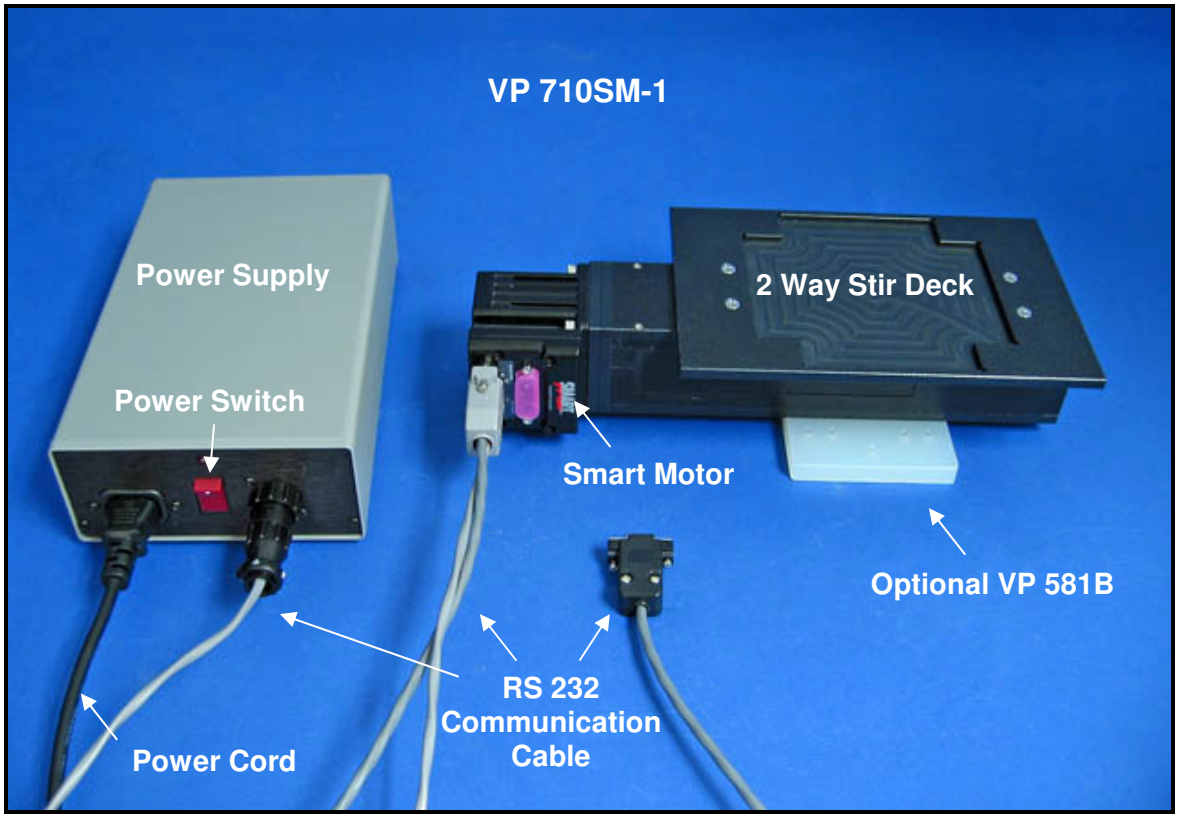

Figure 1. Parts of a VP 710 Series Smart Motor Magnetic Tumble Stirrer, VP 71SM-1, shown with optional 2-Way Stir Deck.

VP 710SM	Magnetic Tumble Stirrer with computer-controlled Smart Motor. A 15cm magnetic stirred area for one microplate footprint In "portrait" or 2 microplates in "landscape".
VP 710SMHT	Magnetic Tumble Stirrer with computer-controlled Smart Motor. A 15cm magnetic stirred area for one microplate footprint in "portrait" or 2 microplates in "landscape". Heat resistant deck for heat block applications, with locking feature.
VP 710SM-1	Magnetic Tumble Stirrer with computer-controlled Smart Motor, low profile (57mm height). A 14cm magnetic stirred area for one microplate footprint in "portrait" or 2 microplates in "landscape".
VP 710SM-1-2	Magnetic Tumble Stirrer with computer-controlled Smart Motor, low profile (57mm height). A 5cm magnetic stirred area for stirring a bubble paddle reservoir. Mounting rivnuts on top and bottom.
VP 710SM3P	Magnetic Tumble Stirrer with computer-controlled Smart Motor. A 30cm magnetic stirred area for 3 microplates in "portrait" orientation.
VP 710SM4PH	Magnetic Tumble Stirrer with computer-controlled Smart Motor. A 30cm magnetic stirred area for 2 VP 741 series heat blocks, MICA heat protection and 150C heat-resistant magnets.

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WARNING!!!!!

- **Be advised that the Magnetic Tumble Stirrer has very strong magnetic fields coming from a 42 or 48 MGO Neodymium Iron Boron drive magnet.**
- **People with pacemakers should not get closer than 24 inches.**
- **Remove all magnetically influenced tools and objects from the immediate area to prevent them from being pulled onto the magnet or from striking anyone as the objects are pulled towards the magnet.**
- **Keep credit cards, watches and other magnetically sensitive items at least 24 inches from the Magnetic Tumble Stirrer's magnetic fields.**
- **Do not operate the Magnetic Tumble Stirrer in close proximity to large pieces of aluminum or ferromagnetic material. For more information see TUMBLE STIRRER INSTALLATION section.**

SET-UP

TUMBLE STIRRER INSTALLATION

Caution: Operating the Tumble Stirrer in close proximity of ferromagnetic and/or aluminum materials is not recommended.

We recommend that the Magnetic Tumble Stirrer be installed as far away from ferromagnetic material as possible. The closer and larger the magnetic material is to the Magnetic Tumble Stirrer, the greater the torque required and the slower the maximum speed.

Placement on a sturdy bench top or table is recommended. Thick aluminum table tops or robot decks, as well as racks or holders, should be avoided. Although aluminum is not magnetic it will cause a drag on the magnetic field due to eddy currents being formed when magnetic flux lines pass through it. A large mass of aluminum will cause significant drag and result in undue strain on the motor, that could cause it to burn out. This type of failure is not covered under V&P Scientific, Inc.'s warranty for this product.

If installation away from these types materials is unavoidable, test before operating instrument without supervision for long time periods. The Smart Motor Tumble Stirrer will turn itself off when the motor temperature exceeds its safety limit. If this happens, turn off power supply and allow motor to cool before re-starting. Modify operating parameters to prevent over-heating. Repeated over-heating could reduce product longevity.

1. Carefully remove internal packing and plastic wrapping material. Keep in mind the magnet warning above.

2. Connect the round 2-pin DC cord of the RS-232 Communication Cable into the Power Supply. Connect the 5-pin, 2-hole plug of the Communication Cable into Smart Motor as shown in Figure 1. Connect the RS-232 plug of the Communication Cable to the computer's serial port and tighten attachment screws. This port is usually "com1" by default.

3. Connect the Power Cord into Power Supply. Connect the Power Supply to a 120 V outlet.

4. Turn on the Power Supply. The motor has a program already programmed into it, so the Tumble Stirrer will immediately begin to stir at a medium speed.

SOFTWARE INSTALLATION

1. Exit all programs on the computer connected to the Smart Motor Tumble Stirrer. Insert the V&P Scientific/Animatics CD into the drive. Installation of the Animatics control program should start automatically. If the program fails to automatically launch, then browse to the CD-ROM drive and double click on Setup.exe. After installation is completed, restart the computer.

2. The HELP FILE in the Animatics software is a valuable resource for customizing a Tumble Stirrer control program. Sample programs are also available in a folder in the Animatics application folder also on the CD.

OPERATION

USING THE ANIMATICS PROGRAM TO CHANGE STIRRING SPEED

Creating Smart Motor Programs

1. Connect the Smart Motor Tumble Stirrer to a computer loaded with the Animatics "Smart Motor Interface" software via the RS 232 cable as described above.

2. Turn the Smart Motor Tumble Stirrer motor on by pressing the red power switch.

3. Run the Animatics program.

4. If the program opens to the following screen, "Smart Motor Playground" " (Figure 2), then click the "Show SMI" button at the bottom (Figure 2 red box) to get to the programming window, "Smart Motor Interface" (Figure 3). The Smart Motor Playground allows for manual, real time operation of the tumble stirrer through the software.

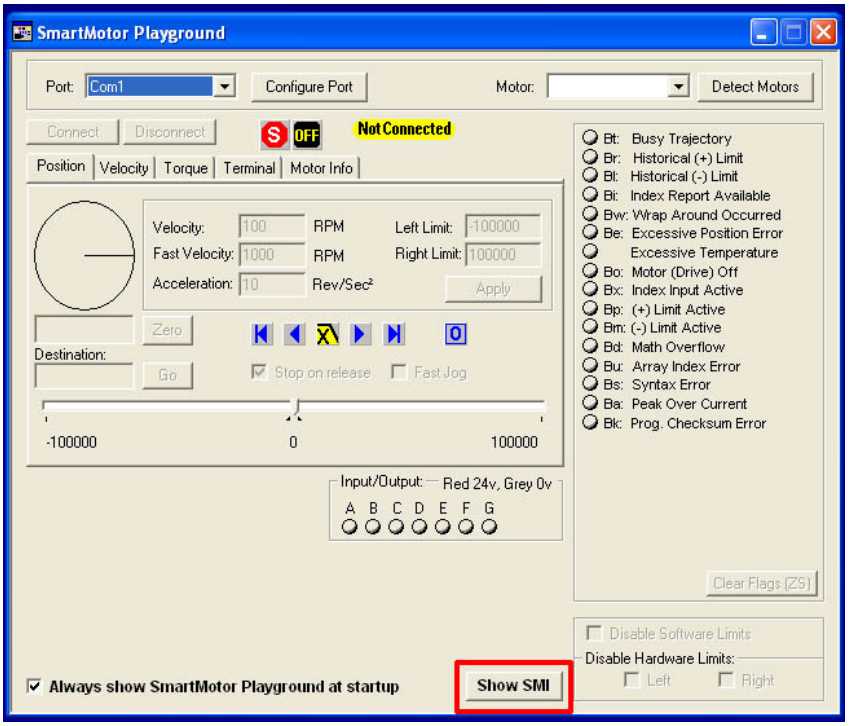

Figure 2. "Smart Motor Playground" window.

5. Once SMI program is open, the motor needs to be detected. To do this, go to the file menu "Communication" and then select "Detect/Address Motors on RS-232 Chain". The detected motor will now be displayed in the window on the left under "Detected Configuration".

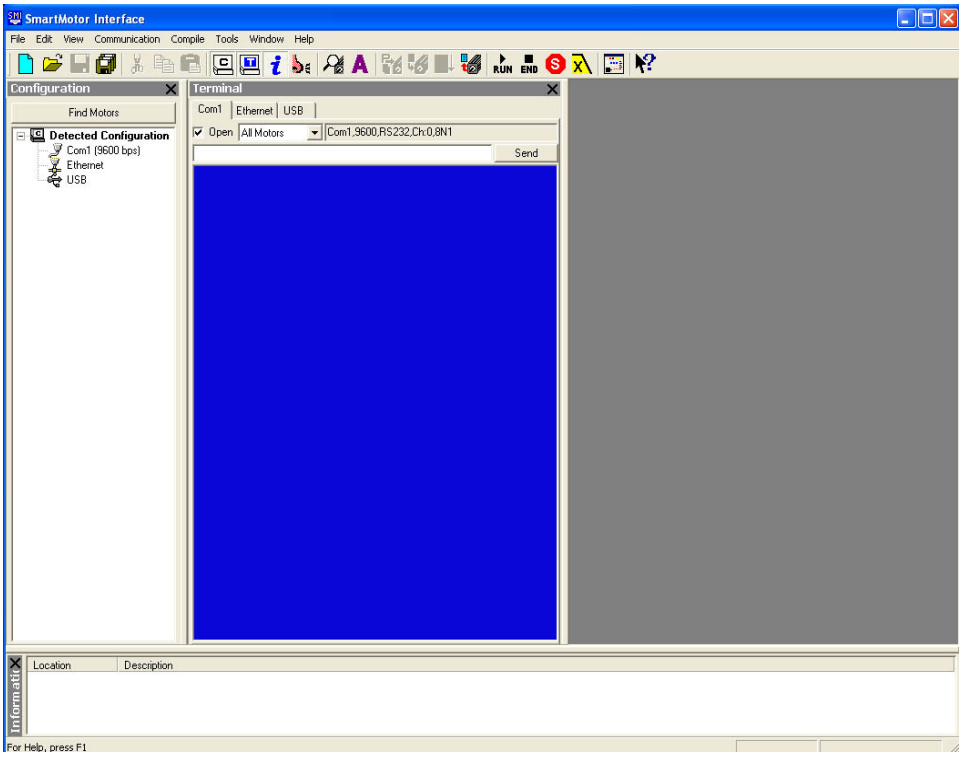

Figure 3. The Smart Motor Interface

6. To modify the program that is on the Smart Motor, go to the file menu "Communication" and select "Upload Program", and select the correct motor. The current program will be opened in the main window of the "Smart Motor Interface" (Figure 3). Table 1 below shows an example of a factory installed program.

TABLE 1. Example Command Lines from a Smart Motor Control Program

Line #	Command
1	MV
2	V= -540000
3	A=20
4	G
5	END

7. To change the speed, simply change the velocity value (V) and download the new program back to the motor. Note that the velocity value is negative and has to be negative for proper function of the Tumble Stirrer. See Table 2 for velocity values for a range of speeds.

TABLE 2. Speed (RPM) Values vs. Velocity Values [for Tumble Stirrer VP 710SM4PH]

RPM	V (velocity)
500	- 537,000
1000	-1,074,000
1500	-1,610,900

8. Once the new velocity value is entered, go to the file menu "Compile" and select "Compile & transmit SMX file". Save the new program under a new name, select the motor, and click the "OK" button. If no errors are found the program will be compiled and sent to the motor. If there are any problems, the software will provide instructions.

9. To test the downloaded program or to begin using the Tumble Stirrer, turn off the power for the Smart Motor using the lighted switch, wait for the red LED on the power supply to go out and then restore the power. The current program in the Smart Motor will always be executed upon power up. The Smart Motor Tumble Stirrer is fully stand-alone and will operate without the computer used to program it.

Additional Smart Motor Programs
Two additional programs are located on the supplied CD within the Smart Motor Programs Directory:

- VP710SM-ONOFF_Operation.sms
- VP710SM-ON_Timer.sms

VP710SM-ONOFF_Operation is a program that allows the user to cycle between turning the motor ON and OFF at desired intervals.

VP710SM-ON_Timer is a program that allows the user to specify how long to have the motor ON.

Instructions on how to edit the program's time parameter is included at the top of each program and can be seen when loaded into the Smart Motor Interface.

Loading Programs To Smart Motor (Quick Instructions)
1. Open Smart Motor Interface software.
2. Go to the menu bar. File -> Open and select one of the smart motor programs.
3. Once opened the program is loaded within the software.
4. Edit the values in the program to the desired values.
5. Make sure smart motor is connected to the computer and is turned on.
6. Detect motor.
7. Go to the menu bar. Compile -> Compile & Transmit SMX file to…
8. In order to compile successfully, the program must be saved on a writable drive, and must be transferred off the CD.
9. Select motor and transfer.
10. If no errors, then turn power off to the motor and back on once the red LED light goes out on the power supply.
11. The program will immediately run upon powering on.

Using V&P Scientific Programming Library
V&P Scientific Programming Library provides an easy way to integrate smart motor stirrers with robotic and custom systems. The library provides a simple way to turn ON and OFF the stirrer and to change the speed. The library is distributed as a windows .NET .DLL. A simple program or script is all that is needed. Library documentation and sample code is provided. Please refer to this for how to use the programming library with your application.

OPERATING THE TUMBLE STIRRER

The optimal operating speed of a Tumble Stirrer is dependent upon the particular application to be used and needs to be empirically determined. Factors to consider in determining optimal stir speed are the fragility of the objects being stirred, size, shape, composition of the test tube, vial, bottle or well (polypropylene or polystyrene), depth of the microplate wells, volume and viscosity of the liquid, and the type of stir disc or bar used.

In general, stirring microbial cultures works best at low speeds. Stirring to resolubilize extracts, or to stir in deep well microplates, requires high speed. The Tumble Stirrer is well suited for either of these types of applications since it can function at minimum as well as at high RPM. Again the speed of stirring needs to be determined empirically for the application.

A typical Tumble Stirrer microplate holder (as provided with VP 710SM or VP 710SMHT) is designed to hold 2 microplates in a "landscape" position or 1 microplate in the "portrait" position. Standard

microplates may be stacked 5 high in the “landscape” position or 6 high in the “portrait” position. The maximum number of plates in a stack will depend on the viscosity of the liquid as well as the type of stir element being used (V&P carrries stir elements made of stainless steel, Alnico, Samarium Cobalt and Neodymium Iron Boron. The microplate holder may be removed and the stirrer attached directly to a robot deck, above or below, keeping in mind the caution statement above regarding aluminum.

Other Smart Motor Series Tumble Stirrers (such as VP 710SM-1-2) are designed to stir only Tumble Bubble Paddle Mixing Reservoirs.

Caution: Operating the Tumble Stirrer for extended periods of time or with challenging loads or both is not recommended for the Tumble Stirrers with the Mini Smart Motor (see product list on page 1). For Tumble Stirrers with the standard Smart Motor longer times or larger loads are possible but should be tested.

During first time use for a given procedure, monitor the temperature of the Tumble Stirrer to make certain that overheating does not occur. If overheating occurs, turn off Tumble Stirrer immediately! Once is has been determined that a set of run parameters (load, speed and duration) does not cause overheating, the unit can be operated without monitoring.

PRODUCT MAINTENANCE

When not in use, turn off the power switch.

In models that do not have heat protective material, the deck of the Tumble Stirrer is made of ABS.

- To clean the deck use a mild detergent followed by a water rinse.
- For chemical compatibility of ABS please see the following link for more information: http://www.coleparmer.com/techinfo/chemcomp.asp
- Do not heat Tumble Stirrer above 60°C.
- Do not place items heated to 60°C or above on deck of Tumble Stirrer.

Modifications of the deck to protect it from heat include the use of Mica, Ultem or both. Clean these materials with a mild detergent followed by a water rinse.

If technical assistance is required, contact:

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WARRANTY

V&P Scientific, Inc. warrants this product to be free from defects in material and workmanship when used under normal laboratory conditions for one year. This warranty begins from the date of delivery by V&P Scientific.

In the event this product fails under normal laboratory conditions within the specified period of time because of a defect in material or workmanship, V&P Scientific will, at its option, repair or replace the product. Damage to the product caused by user negligence is not covered.

Please keep the special shipping carton in case the unit needs to be shipped back to V&P Scientific. Please contact V&P Scientific at the address below for return authorization and shipping instructions.

This warranty is made in lieu of other warranties expressed or implied including the warranties of merchantability and fitness for a particular purpose. V&P Scientific shall not be liable for loss or damages

arising from the use of these products nor for consequential damages of any kind.