



SCK-300S “Low-Speed” Spin Coater Kit

USER MANUAL v2.1 05/11/2022

Dear Customers:

Thank you for using the SCK-300S Low Speed (version 2) spin coater kit designed and produced by **Instras Scientific LLC**. Wrong use and operation may cause personal injuries and damage to equipment due to the fast moving parts of the product. We strongly recommend customers read this manual carefully before using the kit and operate it in strict accordance with the operating procedure outlined below. We assume no responsibility generated by use of this product, including, but not limited to liabilities for damage of incidental losses or indirect losses. Furthermore, we assume no responsibilities generated from the disassembly and/or modification by users themselves and assume no responsibility caused by third party products.

We have the right to alter products including appearance, performance parameters, and operating requirements without advance notice. We make no guarantee, declaration or promise on whether the product is suitable for specific purposes of users.

I. Main Features of the SCK-300S “Low-Speed” Spin Coater Kit

The **SCK-300S** (Stepper) was developed based on customers' request for a version of the SCK-300P which can spin at very **Low Speeds (10 - 5,000 rpm) and Variable Acceleration** for a high degree of control. This allows for casting of relatively thick films, or for other non-traditional spin coater uses. To meet this requirement, the SCK-300S employs a high precision stepper motor, combined with our custom Arduino compatible control board and firmware. The main features are:

- **Low Cost** - The cost of this kit is significantly less than a commercial spin coater unit. This makes it ideal for R&D work where the benefits of a commercial spin coater is yet to be determined.
- **Compact Size** - The small footprint (9” x 6”) of the SCK-300S allows the unit to easily fit in a fume hood, or inside a glove box.
- **Easy to Setup and Use**- Simply plug-in power adapter, turn on the unit, mount substrate, select spin speed, and start the coating process. Moreover, the SCK-300S kits only need a 110V or 220V A/C power source and an optional vacuum system.
- **Wide Speed Range** - Spin rates from **10 - 5,000 rpm** can be achieved with good control.
- **Vacuum Chuck** - The SCK-300S has an innovative vacuum chuck design (patent pending). A SUITABLE VACUUM PUMP SYSTEM IS NOT PROVIDED AND NEEDS TO BE SUPPLIED BY USER.

II. SCK-300S Spin Coater Kit Contents

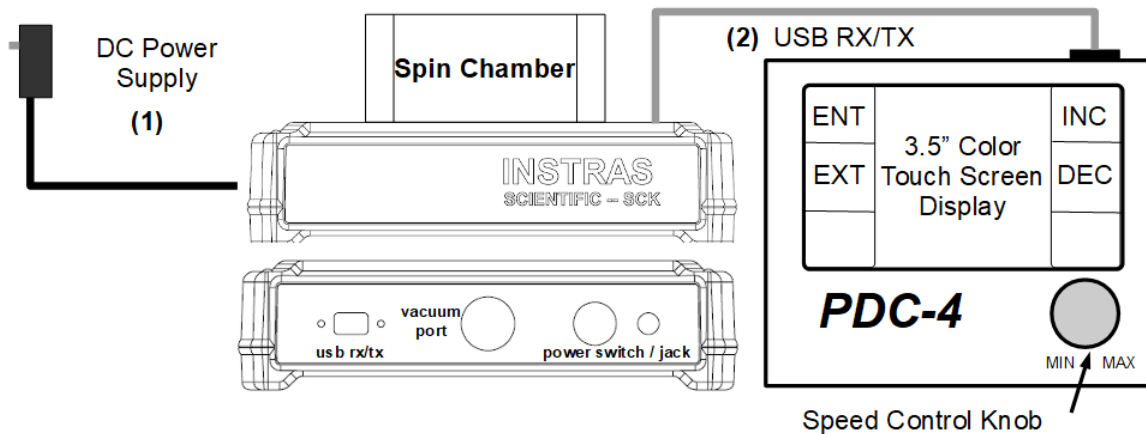
The spin coater kit contains the following items:

1. Spin Coater Base -- Motor/Aluminum 2” Chuck/CD Cakebox/Motor Interface Module
2. TFT35 Touch Screen Precision Digital Control Unit (PDC-4)
3. 36V DC Universal Power Supply
4. Roll of Double Sided Tape

III. Setting up the SCK-300S Spin Coater Kit

The kit requires only connecting the power supply adapter and PDC-4 controller, when using double sided tape for mounting substrates. If using the vacuum chuck, then a suitable vacuum system needs to be connected to the ¼” barb hose adapter on the spin chamber. Please consult our website for setting up a low-cost compatible vacuum system. Once the connections are made, clamp down the Spin Chamber to prevent it from moving during the spin coating process. Also, it is **strongly** recommended that the unit be placed in a fume hood, or glove box to prevent the escape of

any dangerous vapors generated during the spin coating process.



IV. Using the SCK-300S Spin Coater Kit

Warning: **NEVER START THE MOTOR/CHUCK WITHOUT THE SPIN CHAMBER COVER IN PLACE**

Before powering the unit, make sure all connections are properly made. Once the power switch is turned on, the PDC-4 should turn on. If “C_ERR” is displayed on the PDC-4, or it does not turn on, there is a problem with the connection between the PDC-4 and the base. By default, the unit starts in “Analog Control” mode, and is paused (the word “PAUSE” will continually flash on the display). To unpause the unit, simply pressed the ENTER key once.

Basic Spin Coating:

1. If the vacuum chuck of the SCK-300S is being used, place the substrate in the center of the chuck and turn on the vacuum source making sure to verify the substrate is firmly held in place. If using double sided tape, only about 1” piece is all that is necessary, but that depends on the size and weight of the substrate. This tape can be reused as long as it continues to hold the substrate in place.
2. Once the sample is firmly in place, then there are two ways to proceed. [1] Place the coating solution on the substrate, then use the speed control knob to set the desired speed (the unit should be able to attain a stable speed within ~1% of the set value). [2] Set the desired speed then drop the coating solution onto the substrate. Which method works best, depends on the particular application.
3. Depending on what is being coated, the film/substrate should be left spinning from anywhere between 20 to 60 seconds. The amount of spinning time depends primarily on drying time of the coated film.
4. Once the film is dry, press the “EXIT” key to bring the chuck to a stop and enter PAUSE mode. The current speed setting will remain the same (provided the control knob is not turned) until the unit is powered off. **ALWAYS WAIT FOR THE CHUCK TO STOP SPINNING BEFORE REMOVING SPIN CHAMBER COVER.**
5. Remove substrate by either turning off the vacuum source, or if using double sided tape, use a flat/wide tweezer to slowly create a gap between the tape and substrate.

Advance Spin Coating:

With the PDC-4 and new Motor Interface Module / Stepper motor, better control of the spin coating process can now be achieved using “Digital” or “Ramp” control modes.

SELECT MODE: * ANALOG DIGITAL RAMP DIP COATER SETUP	ANALOG CONTROL RPM 660 CLKS 4980 (660) TIME 0000 s	DIGITAL CONTROL RPM 290 CLKS 2400 (290) TIME 0000 s INC: 40 400 2000	RAMP: 1 2 3 MIN 130 15 s MAX 620 30 s RPM 0 CLKS 0	SETUP: *START NONE RAMP BLDC STEPPER RESET ABOUT	BLDC SETUP *MODEL SCK300P SPEED 8000 CALIBRATE PWM:0/RPM:0	STEPPER: *ACTIVE YES DRIVE TIC STEPS 96 SPEED 4500 ACC 600 EXC 4 DIR CW
main menu	analog control	digital control	ramp mode	setup	bldc setup	stepper setup

Digital Control Mode -- In this mode the UP and DOWN keys are used to change and set the speed, rather than the control knob. To access this mode, from the Analog Control:

1. Press the EXIT key twice to go to the main menu.
2. Using the DOWN key, select "Digital Control" and press ENTER. For safety, the motor is paused, and is indicated by the blinking word "PAUSE".
3. Press the ENTER to exit pause, then use the UP and DOWN keys to change the speed. Repeatedly pressing ENTER again will allow the CLKS (i.e speed) increment to be changed between 40, 400, 2000 CLKS.
4. To pause, press the EXIT key once. Pressing the EXIT key a second time will return to the main menu.

Ramp Mode -- In this mode, pre-configured programs, which have two speed steps (MIN and MAX), are used to allow the coating solution to be first evenly spread at a lower speed, before being thinned at a higher speed. The minimum and maximum speeds, along with their respective dwell times (in seconds) are configured through the SETUP menu (see section V below). There are three of these programs. To access this mode, from the Analog Control:

1. Press the EXIT key twice to go to the main menu.
2. Using the DOWN key, select "Ramp" and press ENTER (see image). For safety, the motor is paused, and is indicated by the blinking word "PAUSE", and the continuous beeping.
3. USING either the UP or DOWN key, select one of the three ramp programs to run.
4. Once a program is selected, press ENTER to start the program. At this point the motor speed will be set to the minimum values and MIN text will blink inversely with the countdown of the seconds remaining for that step. Once the MIN step has completed, the MAX step is automatically selected. The MAX text will now intermittently blink with the countdown, and motor speed will be increased to the predefined setting.
5. After the MIN and MAX steps have both completed, the motor will again be paused. The substrate can be removed safely once the chuck has stopped moving.

V. Configuring the PDC-4

The STV3S controller has a number of functions that can be configured by the user, by selecting "SETUP" from the main menu. The UP and DOWN keys are used to select the function to configure. The following functions can be configured:

- **START** -- Specifies the default control mode the unit enters when powered on. Choices are None, Analog, Digital, and Ramp. To change, repeatedly press the ENTER key until the desired mode is displayed, then press the EXIT key to save.
- **RAMP** -- Used to configure the MIN/MAX speeds and corresponding dwell times (in seconds) for the three Ramp programs. To configure those program:
 - Use the UP and DOWN keys to select Ramp program 1, 2, or 3.
 - Press the ENTER key to set the MIN speed value for the selected program. The Control knob is used to change the speed.
 - Press the ENTER key now to modify the dwell time at the MIN speed. Use the UP and DOWN keys to set the dwell time in seconds.
 - Press the ENTER key now to set the MAX speed value. Again, use the Control knob to change the speed.
 - Press the ENTER key now to modify the dwell time at the MAX speed. All parameters for the Ramp program are now set and saved. If a mistake was made, then pressing ENTER at this point will allow all the parameters for the Ramp program to be configured again.
 - Press EXIT to select another Ramp program, or Press EXIT again to return to the Main Setup menu.
- **BLDC** -- Advance functionality for calibrating Spin Coater speed parameters. DO NOT SELECT/MODIFY.
- **STEPPER** -- Advance functionality for calibrating Stepper motor parameters. DO NOT SELECT/MODIFY.
- **RESET** -- Advance functionality to reset default parameters. DO NOT SELECT/MODIFY.
- **ABOUT** -- View information about firmware version and default parameters.

VI. Caring for your Spin Coater Kit

Caring for the spin coater kit primarily involves keeping the spin chamber and the aluminum chuck clean. If the spin chamber becomes too dirty, or damaged, it can be easily replaced with an empty 25 or 30 CD, Cakebox. Pre-drilled CD Cakeboxes can also be purchased from our online store (<http://instras.com/index.php/store/>).

The vacuum bearings of the SCK-300S might also need to be replaced in order to maintain proper vacuum hold on the substrate. A low-cost replacement bearing kit will be provided along with instructions on how to do this task in the near

future.

VII. Limitations

Though fully functional as a Spin Coater, the SCK-300S models do have limitations. Firstly, for best performance, substrate size should be less than 3 inches in diameter. Also, due to the electronic controller/motor employed, the ability to optimize the spinning process (i.e. set the ramp, acceleration, and final spin speed with a high degree of control) is limited. Based on your particular R&D application, this unit can be all you need, and if it is not, then a commercial spin coater can be purchased at little financial loss.

VIII. Handling Common Problems

Problem	Solution(s)
Spin Coater does not turn on	<ol style="list-style-type: none">1. Make sure the A/C adapter is plugged into the wall outlet, and power jack.2. Flip on the power switch. In the ON position, the LED on switch will light up and the PDC-4 is illuminated.3. If the above steps do not work send email to support@instras.com.
The RPM values cannot be set directly	Unlike the motor used in the other SCK-300 units, the SCK-300S uses a high precision Stepper motor which does not have a built-in rpm sensor. Rather, the CLKS (pulses per second) value is set, then the rpm value is calculated based on this number.
Substrate keeps flying off chuck when spinning	Replace double sided tape on chuck or use more tape. If using the vacuum chuck, then verify that there is at least 15 inHg when the substrate is mounted.
The RPM values fluctuate by +/- 5 rpms, how do I know what the real speed of the chuck is?	The resolution of the RPM algorithm is +/- 5 rpm, so this is normal. A laser tachometer can be used to verify the actual speed, which should be within 1% of set speed.
Substrate is not held in place when using vacuum chuck	Verify that the substrate fully covers the o-ring on the chuck, and the vacuum system is functioning correctly with at least -15 inHg with substrate mounted.

IX. Warranty

ALL SALES ARE FINAL. THE SCK-300/300P/300S COME WITH A 90 DAY REPLACEMENT WARRANTY. IF THE UNIT DOESN'T WORK, OR IS DAMAGED WHEN RECEIVED, THEN WE WILL REPLACE OR REPAIR THE UNIT FREE OF CHARGE. THE USER PAYS THE SHIPPING COST TO SEND THE NON FUNCTIONING UNIT BACK TO US, AND WE COVER THE SHIPPING COST BACK TO USER.