The Site Operator's Standard Operating Procedure for the Brewer Spectrophotometer

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Contents

I.   <u>Introduction To The Brewer</u>

I.A.   **Standard Operating Procedure (SOP)** - In order to ensure proper operation of the Brewer Spectrophotometers, the following Standard Operating Procedure (SOP) should be followed by the local site operator. Ideally, the instrument should be visited once per day but, realistically, a visit once per week supplemented with daily electronic visits via the Close-Up communication software should be sufficient in most cases to maintain operation. This SOP is organized into detailed sections of procedures that should be followed at each site visit

I.B.   **Logbook** - It is important to log activities that affect data validity. There are four standard forms plus an electronic log to be used for this purpose.

   I.B.1.   Weekly Station Checklist – This form should be filled out during the weekly site visit. The purpose of this form is to provide the operator with a checklist so that standard tasks do not get overlooked or forgotten. An example Weekly Station Checklist is presented in *Figure 1: Example Weekly Station Checklist*.

   I.B.2.   Station Log - The Station Log should be used to log all activities that take place during a site visit. A simple line entry format such as "Aborted schedule, performed 50 Watt lamp scans, checked tracker steps/rev, performed sighting, etc…" is sufficient. See *Figure 2: Example Station Log* for an example of a properly annotated logbook page.

   I.B.3.   50 Watt Lamp Log – This form is used to track the use of the 50 Watt lamps and the results of the QS scans.

I.B.4. Tracker/Sighting Log – This form is used to record the results of the tracker steps per revolution test and the sun sightings as well as the R6 ratio of the Brewer. The R6 values are the ratios of lamp intensities at various wavelengths that allow the detection of spectral response shifts.

I.B.5. Electronic Log – The electronic log should be used to document all site visits. The electronic logbook is accessed using the "CO" command at the Brewer main menu screen. The data processing contractor can download the data and comments via the built-in modem every night.

I.C. Brewer Unit Schematic – The Brewer assembly is comprised of the Brewer Spectrophotometer, the Tracker and the Tripod. Use *Figure 3: Brewer Spectrophotometer Tracker Power Switch and Indicator Locations* to become familiar with the locations of the power LED's, the power switches, the UVB dome, and the quartz window and dome.

I.D. Brewer Monitor Display – Familiarize yourself with *Figure 3: Typical Brewer Computer Screen in Schedule Mode* as you read through the list of displayed parameters below. Due to the variety of tasks the spectrophotometer performs, the monitor will display several different variations of the graphic in *Figure 3*. In general, the monitor screen should display the following information:

- **Month**
- **Day**
- **Year**
- **Julian Day**
- **Internal/External Clock, (I or E)** – "I" indicates the Brewer is using the internal clock or the Brewer clock. "E" indicates the Brewer is using the external clock or the PC clock.
- **Coordinated Universal Time (CUT)** – Previously called Greenwich Mean Time.
- **Brewer Number** – Each Brewer has a serial number that is inscribed on a metal plate on the instrument's cover.
- **Location -** The site should have been named during installation.
- **Schedule Running ("epa96" unless instructed otherwise)** – The schedule is the file that controls the measurement mode and processes and stores the data. The schedule and GWBasic program are stored on the PC hard drive.
- **Mode of Operation (O3 or N2)** – The Brewer spectrophotometer program is made of a series of measurement cycles. Each mode is designed to measure a certain parameter and has multiple settings particular to that parameter.
- **Measurement in Progress (ds, zs, etc…)**
- **Free Disk Memory** – Free memory left on the PC hard drive.
- **Solar Zenith Angle.**
- **RS232 Activity Indicator** – The asterisk flashes when communication is occurring between the Brewer and the PC.
- **Current Brewer Activity Indicator.**
- **Current Data Summary** – In each mode, a particular type of data are collected. This part of the monitor is reserved to display a current data summary.

II. Weekly Site Visit Procedure

II.A. Logbook Entry – Announce your presence at the site by signing in and recording your observations in the Brewer Operator's Logbook. It is important to log activities that

effect data validity.

II.B. **Power On and Brewer Parameter Check -** In the station, the computer, monitor, and printer should be on. Note that the printer can be left off line during normal schedule operation in order to conserve paper, and the monitor can be turned off to preserve the life of the cathode ray tube.

After verifying that the Brewer computer and monitor have power, the next thing to check at each station visit is the parameters that are set to the Brewer computer. The parameters are printed to the monitor screen and have already been introduced in *Section I.D. Brewer Monitor Display*. These parameters are fundamental to correct operation of the Brewer Spectrophotometer. Carefully inspect the monitor screen to be sure that all of the parameters are correct.

II.C. **Correcting Parameters -** If one of the parameters is set incorrectly then it should be corrected immediately. Corrections are made by giving the appropriate command when the monitor displays the Brewer main menu screen; i.e. the Brewer is not in schedule. To interrupt the schedule, press the <HOME> key when "press HOME to stop" appears on the screen. All commands can be entered from the main menu screen, although not all choices are displayed. See Sci-Tec's Brewer MKIV Spectrophotometer Operator's Manual for a complete listing of commands.

II.C.1. **Calendar Date and Julian Day –** In the past, corrections to the calendar date and Julian day were done manually. The new software, UGA2, automatically updates these parameters. No input from the site operator is needed unless otherwise stated by the NUVMC. If the parameters are wrong, simply reboot the computer. If the parameters are not corrected upon reboot, then contact the NUVMC.

II.C.2. **Internal/External Clock and Correct Time –** The internal/external clock was also corrected manually in the past, but UGA2 also automatically updates these parameters. No input from the site operator is needed unless otherwise stated by the NUVMC. If the parameters are wrong, just reboot the computer. If the parameters are not corrected upon reboot, then contact the NUVMC.

II.C.3. **Brewer Number -** The Brewer number is inscribed on a metal plate attached to the spectrophotometer. Corrections to the Brewer number can be made by using the "NO" command, as follows:

Keyboard Action   **Monitor Display**

**Press the <HOME> key. (Wait
several seconds for the Main
Menu to appear).**

Enter "NO" on the command   *Instrument #= 134*
line.   *If correct press return.*
                                                 If incorrect enter the proper
                                                 value.
**Enter the new Brewer Number.
(The program returns to the
Main Menu).**

II.C.4. **Site Location -** Your station location is included on a list presented on the monitor when the "LL" command is entered. Corrections to your station's location can be made by entering the "LL" command, as follows:

Keyboard Action   **Monitor Display**

Press the <HOME> key. (Wait

several seconds for the Main Menu to appear).

Enter "LL" on the command line.	*1 Site Name 1.* *2 Site Name 2.* *3 etc.* *.* *.* *.* *X Site Name X.* *n if not coded above*

Enter the number that corresponds to your site and press <Enter>

II.C.5. Current Schedule - All operations are controlled by individual commands within a program called a schedule. The "SKC" command allows the user to load and enter a schedule via the keyboard. The Brewer will then begin taking measurements and collecting data. The Brewer should be in schedule mode upon entering and leaving the station. The schedule for NPS monitoring is currently "epa96.skd". Set the schedule as follows:

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait Several seconds for the Main Menu to appear).	
Enter "SKC"	*C:\BREWER* *EPA1.SKD................................EPA96.SKD* *XXXXXXXXXXXXX Bytes Free* *Enter schedule name (no extension).*
Enter "epa96"	

"Epa96" will appear in the upper left-hand corner of the window on the monitor to confirm that the schedule is running.

II.C.6. Current Mode of Operation – The Brewer takes measurements in both the Ozone (O3) mode and the Nitrogen Dioxide (N2) mode. Typing O3 or N2 at the Brewer main menu sets the instrument to the respective mode.

II.D.   Clean Optical Inputs – The optical inputs need to be kept free of dirt and debris to insure the quality of the data. Before cleaning the UV dome and the quartz window, make notes in the Brewer Operations Logbook describing their condition, e.g., snow, dust, etc. Use spectroscopic grade methanol on the dome and quartz window and clean gently with a Kimwipe®. Examine the optical surfaces from several different angles watching for debris on the optics, and repeat the cleaning process until satisfactory.

II.E.   Check Humidity Indicator Card - Check the condition of the humidity indicator visible beneath the quartz window. The indicator is a card coated with a moisture-sensitive emulsion that is blue when the desiccant is in good condition, and turns pink when the desiccant has been exhausted.

II.F.   Changing Desiccant Packs - If the indicator is pink, the internal desiccant packs must be replaced. There is a desiccant cartridge supplied by the manufacturer and UGA also keeps four 4 ounce bags of desiccant inside the instrument. In good weather, with no high winds or precipitation, remove the white Brewer cover by turning each of the four latches one-half turn counterclockwise and lifting the cover off. Store the cover, avoiding scuffing the UV dome and quartz

window. The desiccant packs are located throughout the Brewer, usually one near the zenith prism, one on top of the secondary power supply and two under the black spectrometer box. It may be necessary to use a screw driver or some other device to get a hold of the two under the spectrometer box but removing the black spectrophotometer cover should be done only under instructions from the Operations Support Contractor (OSC). **Do not attempt to clean the mirrors and never touch the grating!**

After replacing the desiccant packs in the Brewer, replace the white cover and engage the latches by turning them one-half turn clockwise. The desiccant can be dried again by heating the bag in an oven for at least 24 hours at a temperature of about 150°F with the oven vents open. Seal the reconditioned desiccant in Ziplock® bags until used.

II.G. **Tracker Steps per Revolution Test -** Perform a tracker steps per revolution test, initiated with the "SR" command. Enter a "PNSR" command, which will toggle the printer on-line and begin an "SR" test on the tracker. The tracker moves to the zero azimuth position and then measures the total number of steps in one revolution of the tracker. Upon completion, the computer will display the steps per tracker revolution number and ask you if you want the new value saved. Press "Y" for yes and then press return.

The Main Menu will reappear when the tracker steps per revolution test is complete. Remove the printout and compare the steps/revolution value to the original steps/revolution value in the Final Test Record accompanying your Brewer. The number should be approximately 14660. Record the steps/revolution value in the Brewer Operations Log and the electronic log. If the indicated number and the original value differ by more than ±20 steps, it may indicate the friction wheel is slipping and needs to be cleaned or that the springs need to be tightened. Familiarize yourself with the graphic in *Figure 5: Tracker Friction Wheel Location* before reading further.

II.H. **Clean the Tracker Friction Wheel –** To clean the friction wheel first turn the tracker power off by pressing the tracker power switch located on the side of the tracker. This will allow the tracker to swivel freely, allowing access to the entire friction wheel. Then remove the tracker faceplate by loosening the four hex screws that fix it to the tracker box with a hex key driver supplied with your Brewer. Wipe the edge of the large friction wheel with a Kimwipe® and methanol while rotating it manually. Run "SR" again after cleaning until the same value can be repeated three times, then save the new value when prompted. Record all activities and the new steps/revolution value in the Brewer Operations Logbook.

II.I. **Tracker Level Test -** The tracker level test is performed whenever there is reason to believe that the Brewer platform level has changed or has been compromised. The best sign of mis-leveling is if the solar alignment (SI) tests are consistently off. Perform the level test with the tracker and Brewer power off and the Brewer out of schedule. In this condition the tracker may be manually turned through one revolution.

Remove the Brewer from the tracker by unscrewing the data, power and tracker cables. Then undo the hex screws that connect the Brewer's rubber foot pads to the tracker. *Carefully* remove the tracker and place it on the ground. Place the carpenter's level, which was supplied with the Brewer, on top of the tracker. Note the position of the level bubble. The bubble does not necessarily indicate that the tracker is level, this test challenges only the tracking

mechanism. Observe the bubble as you rotate the Brewer to see if it changes position. If the level bubble changes position during the rotation, it indicates that the Brewer is not leveled properly. Each leg of the tripod can be adjusted up or down. Loosen the bolt on the end of the leg to be leveled using a wrench, and adjust the screw so that the leg is moved either up or down. Maneuver the leg until the bubble is level again. Continue until the bubble does not move when the tracker rotates a full 360 degrees. Note this in the Log Book and the electronic log. Return the Brewer to the original position so that the ground strap does not wrap around the tracker post. Put the Brewer back on the tracker, connect the cables, and replace the hex screws. Turn the Brewer and the Tracker back on.

II.J. **Solar Alignment Test -** Perform a solar alignment test using the "SI" command. This points the azimuth tracker and the zenith prism to the sun based on the current settings for day, time (CUT) and the Brewer's location (latitude and longitude). See *Figure 6: Brewer Viewport Locations* and *Figure 7: Brewer Solar Alignment Adjustment* to become familiar with the expected images and adjustment button locations. The object is to get the image of the slit to split the image of the sun when looking through the Entrance Slit View Port.

Peering through the Iris View Port, use the four buttons located on the front face of the Brewer to adjust both the zenith angle and the azimuthal angle until the image of the sun fills the iris. The CW button rotates the tracker clockwise, and CCW button rotates the tracker counterclockwise. The UP and DOWN buttons move the zenith prism in its respective directions. The adjustment motions are very small; a button may have to be pressed for up to 20 seconds to observe the direction of the correction. There is a 1 to 2 second delay of movement after a button has been depressed and there will be 1 or 2 seconds of movement after the button is released.

Once the rough alignment is made using the Iris View Port, look through the Entrance-Slit View Port and adjust the zenith and azimuthal angles using the buttons until the sun's image is split by the image of the entrance slit. The sky must be reasonably clear for this test. Since the sun's image enters the Brewer through the quartz window take precautions not to block the quartz window with your shoulder as you peer into the view port.

When the image is properly aligned, enter <CTRL> + <END> in the Brewer computer to get out of the sighting mode and press "Y" to save the new setting. Under normal conditions, the azimuth setting doesn't change by more than 10 steps and the zenith setting by more than 4 steps. Record the zenith and azimuth correction steps in the Brewer Operations Logbook and the electronic logbook. The Main Menu is displayed when the test is complete.

II.K. **Re-Start Schedule -** Re-start the schedule, epa96, by typing "SKC" then <ENTER> and then "epa96" (without the extension ".SKD") and <ENTER>. The schedule will appear on the monitor in the "Schedule Running" location.

II.L. **Access via Close-Up -** The status of the Brewer can be ascertained remotely by using the communications software package CLOSE-UP supplied with your Brewer. Follow the instructions that come with the software and install the program on a convenient computer with a modem and a telephone line. Initialize the software with the site's telephone number. Call the site through the program. Once the on-site modem has answered and connection has been established, press <enter> several times until the computer monitor displays the

image of the Brewer computer monitor screen. All commands entered from the keyboard behave similar to those entered on site. Remember to re-start the schedule if necessary.

III. Bi-Monthly Site Visit Procedure (Weekly Procedure Plus 50 Watt Lamp Calibration)

III.A. **Bi-Monthly Procedure -** Every two weeks, in addition to the normal weekly procedure, the Brewer Spectrophotometer should be calibrated using the 50 Watt external lamps. The 50 Watt lamps and the calibration assembly can be found in the black plastic box supplied with your spectrophotometer. Postpone the calibration during wet or windy weather until the next good weather day.

III.B. **External Lamp Kit Contents -** Contents of the external lamp calibration kit include: five individually numbered 50W/12VDC halogen lamps, a multimeter, cabling, and a lamp calibration housing and power supply built into the black box. See the labeled diagram in *Figure 8: 50 Watt Lamp Kit*.

III.C. **Lamp Log Form -** The lamp log form is used to track the performance of the five external calibration lamps. Locate the forms in the back of the Brewer Operations Logbook in preparation for the calibration check. Since weather can affect calibration results, enter the current weather conditions -- such as temperature, winds, and precipitation -- on the Lamp Log Form.

III.D. **Lamp Rotation Schedule -** Choose one lamp as the primary lamp to be used every time the calibration is performed and choose two lamps as secondaries to be burned every other calibration. The Lamp Log Form is useful in establishing a record and a rotation pattern for each lamp. Take a Brewer 50W/12V halogen lamp out of the black case. Take extreme care not to touch the glass envelope of the lamp with your fingers or allow the envelope to come into contact with any wet or dirty materials, as it can reduce the operational lifetime. Enter the three-digit lamp number written on the lamp case on the Lamp Log Form.

III.E. **Clean the UVB Dome -** Ensure that the UVB dome is cleaned with spectroscopic grade methanol and a Kimwipe before performing the scan.

III.F. **Set Up Housing Assembly -** Familiarize yourself with the graphic in *Figure 9: 50 Watt Lamp Housing Assembly and Placement on Brewer*. Place the housing assembly on the top of the Brewer UVB Dome with the two nylon legs firmly against the brewer case. Place the power supply box on the ground to avoid disastrous falls. Plug the lamp cord into the lamp power supply using the nine-pin connector and plug the power cord into the power outlet under the tracker.

III.G. **Align Lamp -** Familiarize yourself with the graphic in *Figure 10: 50 Watt Lamp Filament Alignment* before performing the tasks listed in this section. Carefully remove the two pieces of packing foam from the lamp and store them back in the black case. Check the filament alignment by looking through the side holes of the lamp housing at the filament. The holes should line up with the filament coil as seen in Figure 10. If the misalignment is severe, gently adjust the lamp position by pushing it with a Kimwipe® until the coil is aligned with the sighting holes. If the bulb is accidentally touched, clean it with spectroscopic grade methanol and a Kimwipe®.

CAUTION: These lamps emit UV radiation, which can be harmful to your eyes! Always ensure that the lamp cover is in place before turning the power on. **THE LAMP AND CALIBRATION HOUSING WILL BECOME EXTREMELY HOT.**

III.H. **Insert a 50 Watt Lamp -** Slide the housing cover off the housing by loosening the thumbscrew on the cover. Insert the first lamp firmly into the calibration fixture socket. A pin on the base of the calibration fixture will line up with a keyway in the lamp housing preventing the lamp from being installed upside down. Slide the housing cover on and tighten the thumbscrew on the cover to hold it firmly in place. Turn on the power to the external lamp calibration kit by toggling the switch inside the black case to the "ON" position. Switch on the multimeter to the VDC setting (two clicks clockwise on the selector switch), while holding the yellow button down for two or three seconds. The meter should display a three decimal point output. (If the yellow button is not depressed while turning on the multimeter, it displays a two decimal point output.) Using the voltage adjust knob in the black case, adjust the voltage to 12.000 ±0.005 volts. Let the lamp warm up for approximately 10 minutes and adjust the voltage to 12.000 ±0.005 volts as necessary. Maintain the voltage throughout the calibration. Turn on the multimeter only when checking the voltage to conserve the its 9 Volt battery.

III.I. **Enter the Command String -** After turning on the lamp enter the command string "PNHgQSXLTUPF" on the computer command line. Enter the lamp number and then accept the default distance of 5cm (distance of lamp filament to diffuser) when prompted on the monitor. The command string performs the following separate commands in sequence.

III.I.1. **"PN" - Sends results to the printer.** The printer is toggled on-line to record the results of the calibration.

III.I.2. **"HG" - Mercury Wavelength Calibration.** The mercury lamp calibration re-positions the micrometer using the mercury line spectrum so that the grating disperses the five operational wavelengths onto the appropriate exit slits. There is a 5 minute lamp warm up then the scan takes 2-3 minutes.

III.I.3. **"QS" - Quick Lamp Scan.** The quick scan takes photon counts of the 50 W lamp output in 35 Angstrom increments across a small region of the Brewer's operational spectrum. A five minute delay is built into the scan. If the 50 Watt lamp has already warmed up for a total of ten minutes then press "DEL" to skip the warm-up. Check the lamp voltage before beginning the scan. Make sure that the printer is on for the "quick scan" as the data is saved to the Lamp_???.### (where ??? is the lamp number and ### is the Brewer number) file in a format that makes it inconvenient to read. The "quick scan" printout lists the following:

- Time, CUT in decimal hours. (Example: 14:30:00 in hours:minutes:seconds format is 14.500 in decimal hours format).
- The measurement wavelength, in nanometers.
- Position of the spectrometer micrometer from zero, in number of steps.
- The intensity of the reading.
- The percent change from the stored initial measurement.

III.I.4. **"XL" – Full Spectrum Lamp Scan.** The full spectrum lamp scan takes photon counts of the 50 W lamp output in

five Angstrom increments across the full operational spectrum of the Brewer (2865A-3630A). It takes approximately 20 minutes to complete the scan. Check the digital multimeter a few times during the scan to ensure that a constant voltage of 12.000 ±0.005 VDC is maintained throughout the scan.

III.I.5.   "TU" – Zenith Prism Alignment Test.   This scan uses a 50W lamp to find the step position of the zenith prism for which the light intensity is maximized through slit 1 of the spectrometer. Since the test is performed by the manufacturer and documented in the Brewer's Final Test Record, it allows any changes in the zenith prism alignment to be noted. The scan takes approximately 3 minutes.

III.I.6.   "PF" – Printer Off.   This command toggles the printer off line.

III.J.   Lamp Off/Log Results - Upon completion of all the scans, toggle the power supply off and allow the lamp to cool for a minute before attempting to remove it as it is most fragile while hot. After a minute, remove the lamp from the housing with some finger protection such as a leather glove and slide the second lamp to be burned into the housing. Remove the printout and transcribe the DUV percent change for the lamp (the last line of the QS printout) next to the lamp serial number on the Lamp Log Form. Estimate the "lamp on time" and enter it on the form as well. Enter the results of the QS and TU tests onto the electronic log. Repeat the procedure for the second lamp.

CAUTION: THE LAMP AND CALIBRATION HOUSING WILL BE EXTREMELY HOT FOR SEVERAL MINUTES AFTER THE POWER IS TURNED OFF. WAIT UNTIL THE LAMP IS COOLED BEFORE REMOVING.

III.K.   Finishing Up - After completion of the three lamps (one primary and two secondary lamps) remove the calibration lamp fixture from the UVB dome. If all other Brewer activities for the day are completed, toggle the printer off by giving the "PF" command and then put the Brewer back to its scheduled operation. Enter "SKC" then enter "epa96" on the keyboard (without the ".skd" extension) as shown in the following example:

Keyboard Action	**Monitor Display**
Enter "SKC"	*C:\BREWER*
	EPA1.SKD…………………………EPA96.SKD
	XXXXXXXXXXXX Bytes Free
	Enter schedule name (no
	extension).
Enter "epa96"	

III.L.   **Large DUV Change -** In the event that the percentage difference for one or both of the lamps is greater than 5%, the Brewer response function may have changed. Call the OSC for instructions. Enter all activities in the Brewer Operations Logbook and enter a brief summary of the calibration activities on the electronic log ("CO" command).

IV.   Data Backup Tape Procedure

IV.A. Introduction - Once per quarter, or whenever UGA requests one, the site operator will make a back-up tape of the Brewer data. Blank DAT tapes will be supplied by UGA as consumable supplies. Use the following procedure to make a back up tape.

IV.B. **Insert Tape -** Insert a blank tape into the tape drive located on the front panel of the Brewer computer. The tape should be inserted open side first and so that the metal base is facing down.

IV.C. **Abort Brewer Schedule -** Abort the Brewer schedule by pressing the "Home" key when "Press Home to stop" appears on the screen.

IV.D. **Enter DOS Shell -** Enter "SHELL" to exit the Brewer program to the DOS Shell mode. In the past, exiting the Brewer program by entering "ex" was possible. It is still possible to exit in this fashion, but the new software, UGA2, causes a few complications. Exiting by typing "ex" may sometimes disable the Closeup software, and make it impossible for anyone else to retrieve data on that day via Closeup. To avoid complications, only use the "SHELL" command.

IV.E. **Change to "Tape" Directory -** Change the working file directory to the directory that contains the Colorado Backup software. This directory is called "TAPE". Changing directories in DOS is done by typing "CD\?"at the command prompt where ? stands for the name of the directory that you want to be in. Thus, typing "CD\TAPE" will change to the tape directory.

IV.F. **Start Colorado Backup Software -** Start the Colorado Backup software by typing "TAPE" at the "C:\TAPE" command prompt.

IV.G. **Selecting Functions in Colorado Backup Software -** When the Colorado Backup software starts up, a color menu will appear on the screen. Directions for moving around in Colorado Backup software will be displayed at the bottom of the screen. Pressing "ENTER" will execute a function that is highlighted.

IV.H. **Choose "Backup" -** Select <BACKUP> from the choices on the Colorado Backup main menu to make a back-up tape.

IV.I. **Choose "Selective" -** Select <SELECTIVE> from the Backup menu to avoid making a back-up tape of the entire computer hard drive.

IV.J. **Optional Data Path -** Type "bdata" in the Selective Backup window on the line labeled "optional starting path" to copy the contents of the Bdata directory to the tape. Select <OK> to effect the choice.

IV.K. **Tag Files -** Highlight <Tag/Untag All> to select all of the files within the Bdata directory for back up. There is an arrow next to the files when they are tagged for backup. Select <OK> to effect the choice.

IV.L. **Volume Title -** Write a descriptive volume title. The title typically contains the Julian day and the Brewer number. For example, a typical name could be Br101, 14699.

IV.M. **Choose "Backup Now" -** Select <Backup Now> to begin the back-up process. A window will appear with the choice to optimize the space or time of the backup.

IV.N. **Choose "Space Optimized" -** If the total data byte size is more than half of the capacity of either the tape or the tape drive the data will need to be optimized. Use the arrow keys to select <Space Optimized> from the menu. If the tape and drive are of large enough capacity, select <NONE> from the window.

IV.O. **Label the Tape -** Upon completion of the back-up, remove the tape from the drive and put a paper label on the tape with the date or Julian day of back-up and the Brewer number.

IV.P. **Exit Software -** Exit the Colorado Backup software by selecting <Exit Colorado Backup>.

IV.Q. **Return to Brewer Program -** Return to the Brewer program by typing "exit" at the "C:\BREWER" command prompt.

IV.R. **Restart Schedule -** Restart the Brewer schedule by typing "SKC" at the Brewer main menu screen command line. Then type "EPA96" when prompted for a schedule name.

Figure 1: **Weekly Station Checklist Example**

STATION: Badlands National Park WEEKLY STATION CHECKLIST SECTION B.8.1 SCI-TEC BREWER SPECTROPHOTOMETER MODEL MKIV					
RECORD THE FOLLOWING:	VISIT 1	VISIT 2	VISIT 3	VISIT 4	VISIT 5
SITE OPERATOR	J. Smith				
CALENDAR DATE	10/24/97				
BREWER NUMBER	134				
NOTE WEATHER OBSERVATIONS IN LOGBOOK? (Y/N)	Yes				
BREWER ORIENTED TOWARDS SUN? (Y/N)	Yes				
POWER ON TO SPECTROPHOTOMETER & TRACKER? (Y/N)	Yes				
UV DOME & DIRECTION QUARTZ WINDOW CLEAN? (Y/N)	Yes				
MONITOR FOUND IN SCHEDULE MODE? (Y/N)	Yes				
MONITOR DISPLAYING CORRECT DATE? (Y/N)	Yes				
MONITOR DISPLAYING CORRECT TIME? (Y/N)	Yes				
SCHEDULE CORRECT? (EPA96) (Y/N)	Yes				
WAS THE UV DOME OR QUARTZ WINDOW CLEANED (Y/N)?	No				
HUMIDITY INDICATOR OK (Blue or Pink)?	Blue				
RECORD "SR" TEST RESULT.	14660				
WITHIN LIMITS?* (Y/N)	Yes				
WAS A TRACKER LEVEL TEST PERFORMED? (Y/N)	Yes				
"SI" TEST OK? (Y/N)	Yes				
ALIGNMENT ADJUSTED? (Y/N)	No				
COMMENTS LOGGED ON COMPUTER? (Y/N)?	Yes				
SCHEDULE RE-STARTED (EPA96)? (Y/N)	Yes				
STATION SUPPLY CHECKLIST COMPLETED? (Y/N)	Yes				
* If values are not within acceptable ranges, notify the OSC.					

Figure 2: Station Log Example

Station _Badlands_ Operator _J. Smith_

U.S. National UV Monitoring Station Log

Date	Time	Action	Operator
9/19/97		[ ] Continued from previous page	J.S.
	1945	J. Smith entered the station to perform a weekly Brewer UVB site visit. The Brewer appears to be oriented towards the sun and operating correctly. The UV Dome and quartz window have light dust on them.	
	1957	Clear and cool today, light winds out of the north. The monitor time and date are correct. Computer is in schedule mode.	
	2001	Cleaned the UV Dome and the quartz window and checked the desiccant conditions.	
	2013	Took the computer out of the schedule mode for Brewer performance checks.	
	2035	Performed sr test successfully, results of 14654 compared to a theoretical of 14658. No action necessary.	
	2041	Performed si test. A very small clockwise adjustment was made to the azimuth. Called the monitoring operations support contractor to report the small adjustment. The technician said to call if another adjustment was necessary next week.	
	2102	Left a short message on the computer describing the day's events.	
	2110	Put the computer back in schedule mode.	
	2112	Checked the station supply	

		list. Need more Kimwipes, will call operations support from the office.	
	2120	*Checked to make sure that the Brewer is operational. J. Smith exiting station.*	

Figure 3: Brewer Unit Assembly

UVB Dome

Direct Sun
Quartz Window

Spectrophotometer

Brewer On-Off
Switch

Tracker Unit

Power LED (Green)

Azimuth Tracker
On-Off Switch

Tripod Base

Power LED (Green)
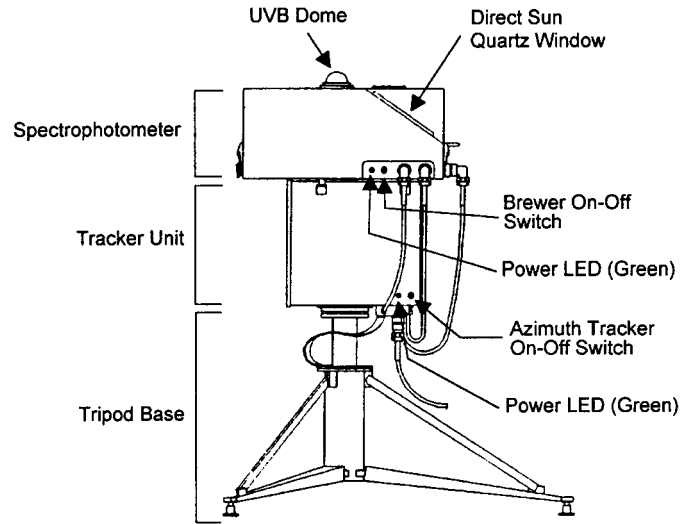
Figure 4: Typical Brewer Computer Screen in Schedule Mode

Month   Day   Year   Julian Day   Operating Mode   Brewer Number   Location   Internal/External Clock   Coordinated Universal Time

may 23/97 day=   o3   #134 * Boulder   C.U.T.   E

ds   1081573376 Bytes   RS232 in: * out:

Solar Zenith

RS232

Current Brewer

Current Data

Measurement in Progress

Schedule

Free Disk

*** taking ds measurement
Press HOME to

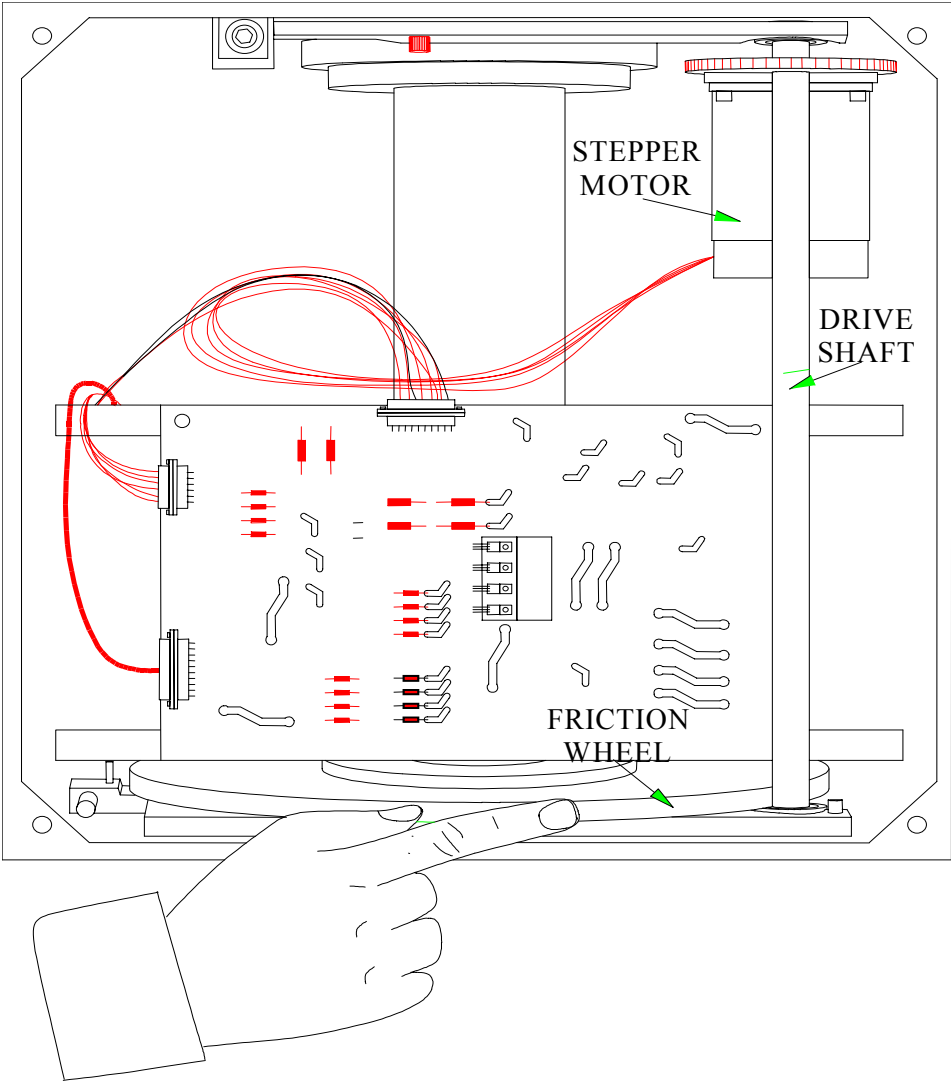| Mean ds O3 | XX.X |
Mean zs O3	XX.X
Mean ds SO2	XX.X
DUV at 14:07:30	XX.X
SLRG at	XX.X
Last HG at	25 C
Current~	25 C
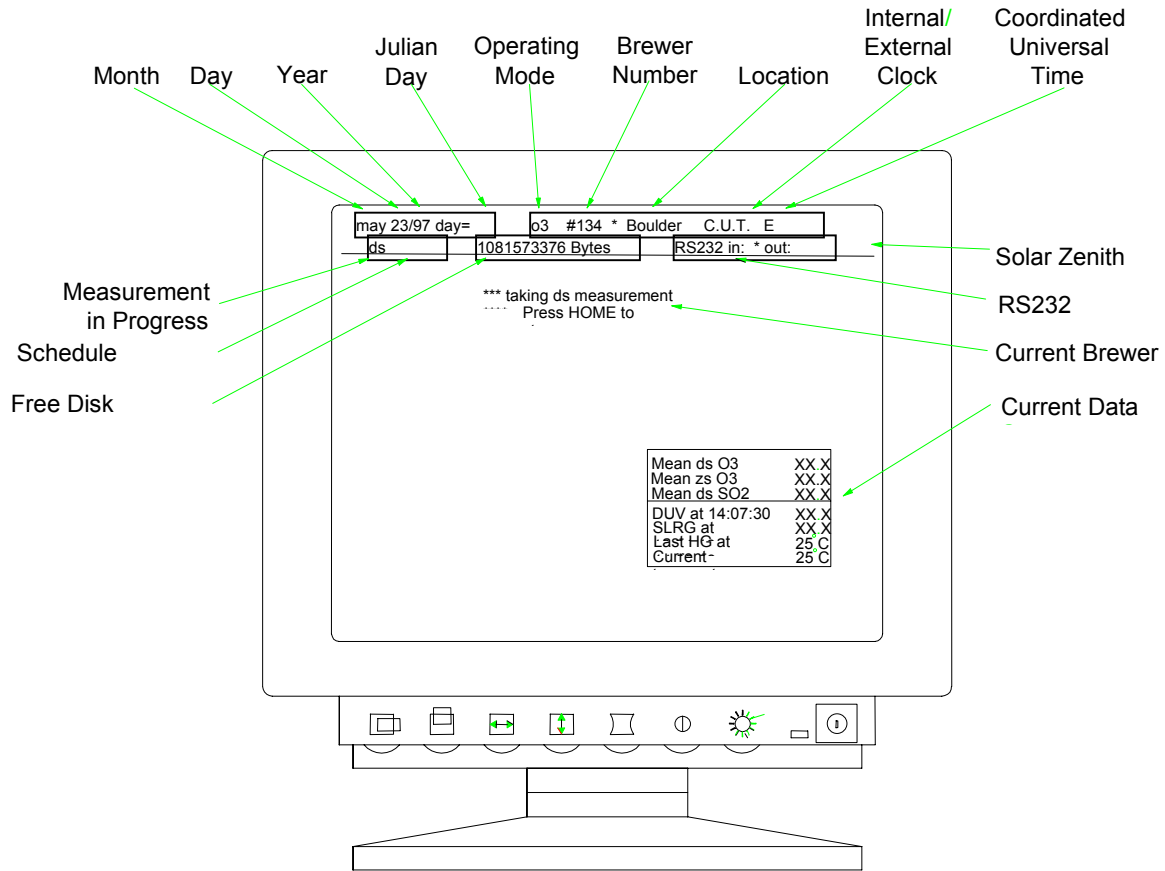
Figure 5: Tracker Friction Wheel Location

Figure 6: Brewer Viewport Locations
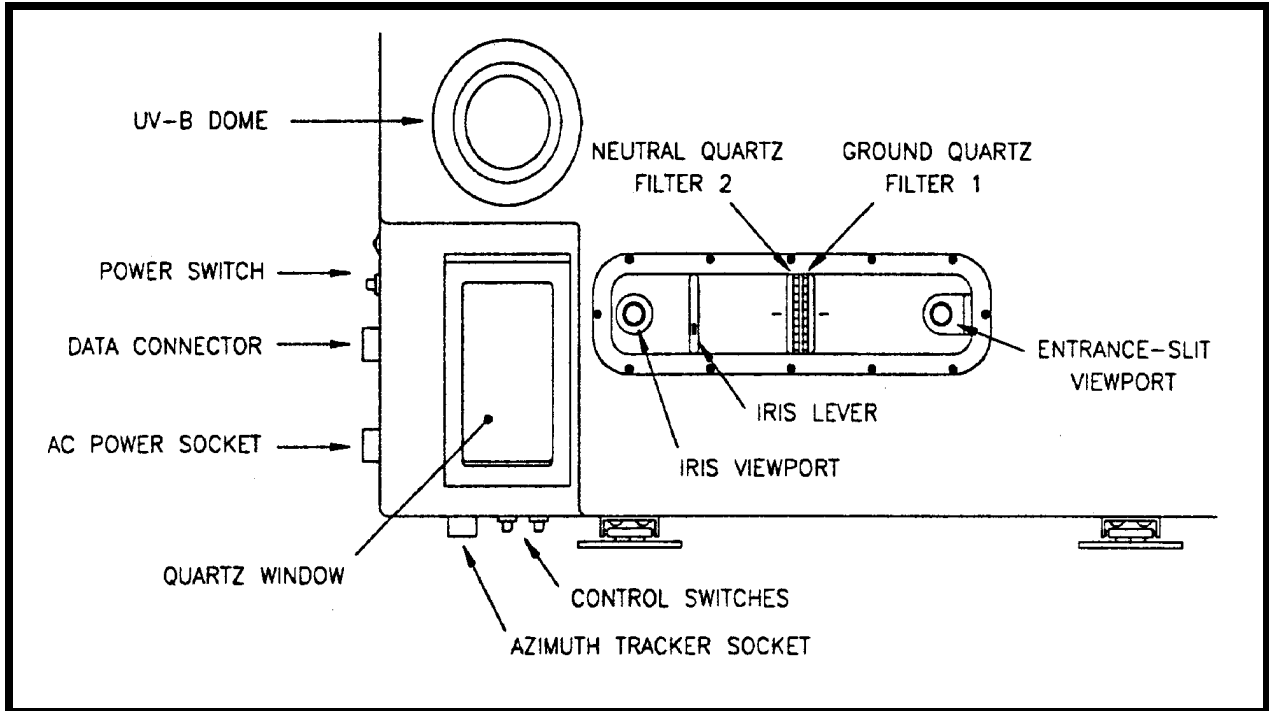
Figure 7: Brewer Solar Alignment Adjustment
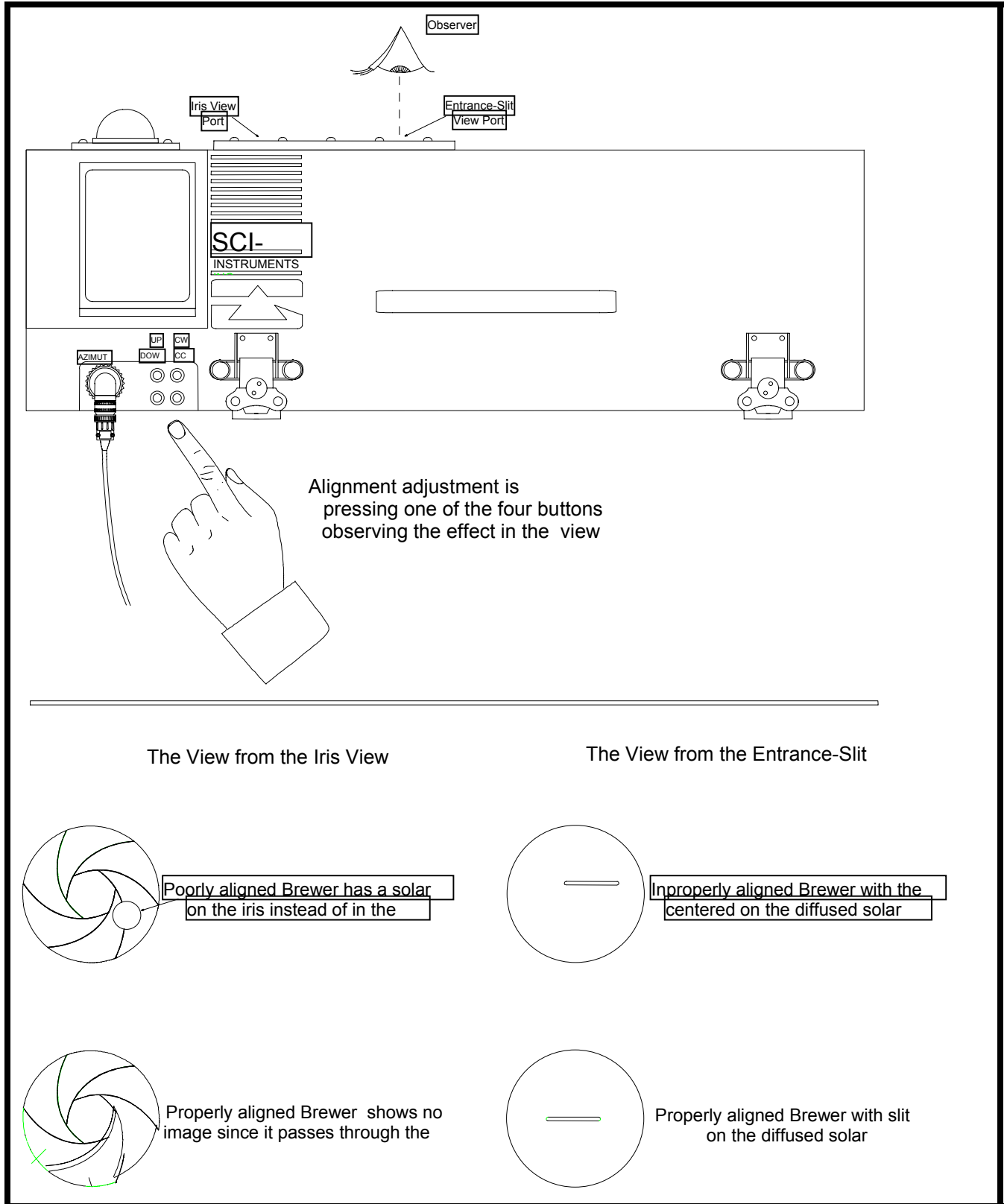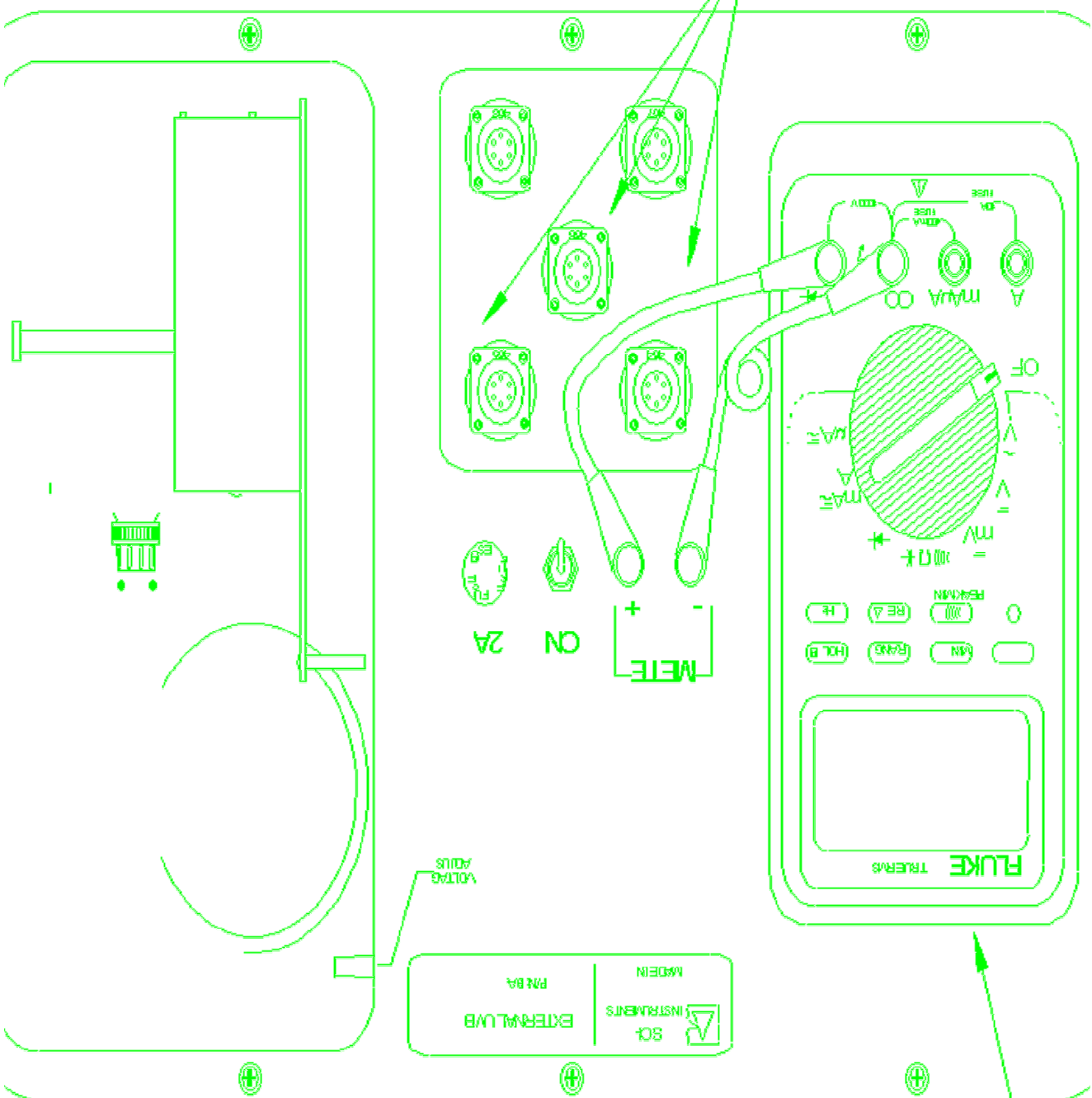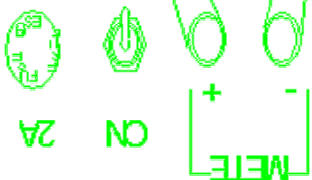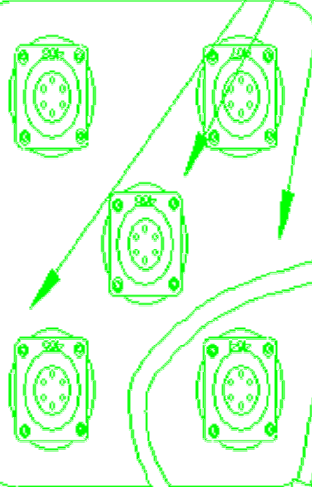
Observer

Iris View Port

Entrance-Slit View Port

SCI-
INSTRUMENTS

UP
DOW

CW
CC

AZIMUT

Alignment adjustment is
  pressing one of the four buttons
  observing the effect in the view

The View from the Iris View

The View from the Entrance-Slit

Poorly aligned Brewer has a solar
on the iris instead of in the

Inproperly aligned Brewer with the
centered on the diffused solar

Properly aligned Brewer shows no
image since it passes through the

Properly aligned Brewer with slit
on the diffused solar

Calibration

Five

Adjus

Multimeter

FLUKE TRUE RMS

METE

+ −

2A   ON

EXTERNAL UV/B   P/N 9A

M/DEIN

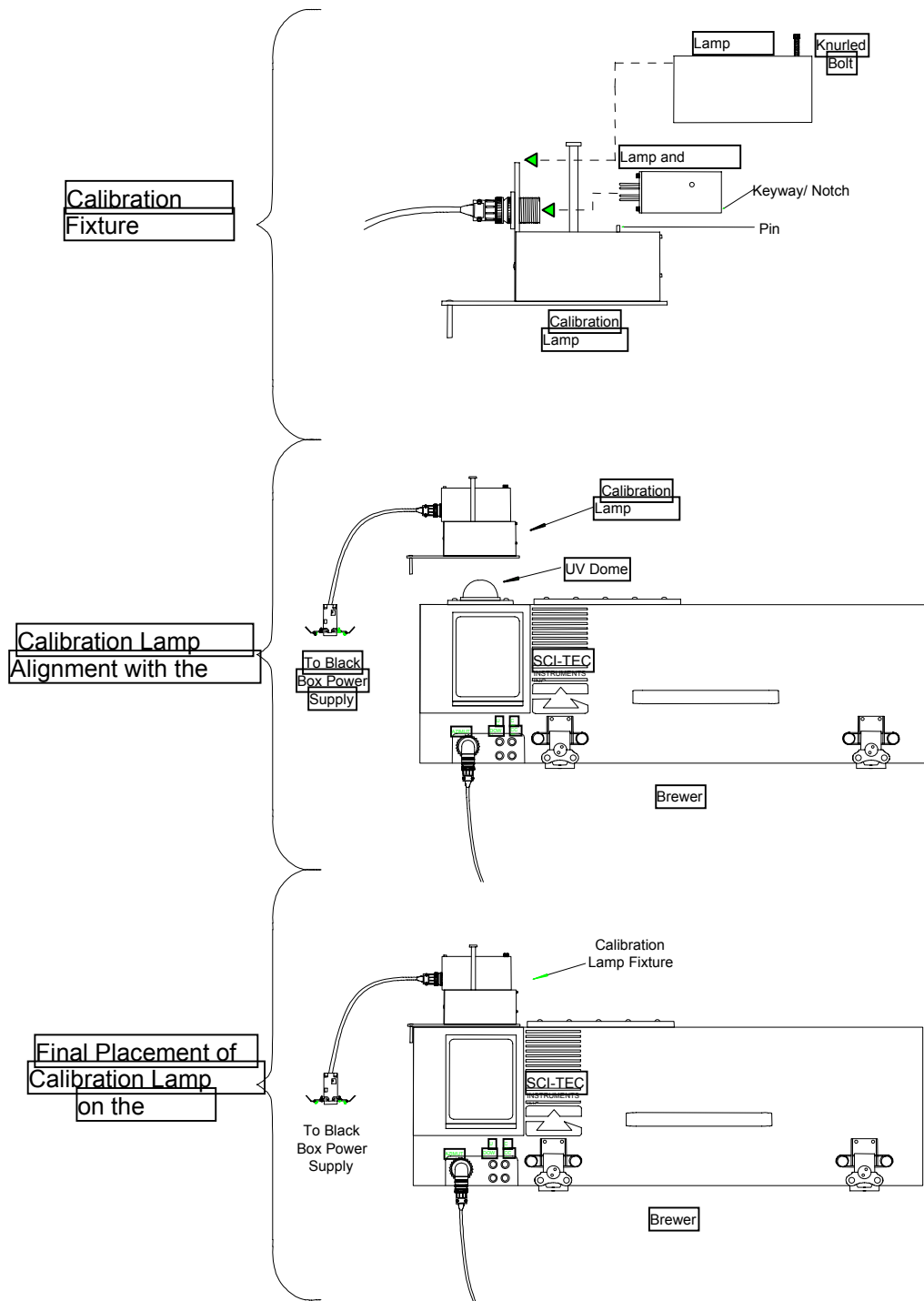SCI INSTRUMENTS

VOLTAG ADJUS

Figure 9: 50 Watt Lamp Housing Assembly and Placement On Brewer

Figure 10: 50 Watt Lamp Filament Alignment

Keyway

Lamp
Housin

Line of
Sight

18

Observe