BREWER MKIV
SPECTROPHOTOMETER

SERVICE MANUAL

MM-BA-C230/B   REV -, Dec.8, 1999

SCI-TEC Instruments Inc.

1503 Fletcher Road

Saskatoon, Sask. , Canada

S7M 5S5

Phone 306-934-0101

Fax 306-978-2339

Email: info@sci-tec.com

Web site: www.sci-tec.com

REVISION HISTORY				
REV	DESCRIPTION	DCN #	DATE	APPD
-	Initial Release	891	99-12-8	

PREFACE

This document has been developed to aid an operator when a Brewer Spectrophotometer stops operating or when initial operating characteristics have changed since leaving SCI-TEC Instruments Inc. (SCI-TEC). It has been developed from the experience of SCI-TEC and present users of the Brewer. The most likely electronic failures and ones which can be repaired in the field have been documented.

1.0 PURPOSE AND APPLICATION

The purpose of this manual is to help the operator diagnose problems with a Brewer Spectrophotometer to an assembly level. Component level diagnostics will not be covered since the replacement of many components may require instrument realignment or re-calibration.

Potentiometers should not be adjusted nor set screws removed without completely defining the problem area. If the information in this document is not sufficient, it is recommended that the user contact SCI-TEC before dismantling of any assemblies beyond what is called for in this manual.

In several cases the operator will be asked to replace components that are not included in spares kits. In these cases please contact SCI-TEC for information on obtaining the component.

2.0 EQUIPMENT REQUIRED

1) Volt-Ohmmeter, capable of measuring from 1 mV to 2000 volts DC.

2). A clip on or in-line current meter.

3). In place of the above items, a digital Volt-Ohmmeter, such as the one contained in the SCI-TEC UV Stability Kit is adequate except for Voltage readings of greater than 1000V.

4) An oscilloscope may be useful (1 millivolt; 20 megahertz bandwidth).

5) An external UVB lamp may be useful when the internal quartz-halogen lamp appears at fault.

6) If the control computer is suspect, a second computer with Brewer software loaded may be needed.

7) A terminal communications program such as Telix, Procomm, Xtalk or Windows HyperTerminal.

3.0 MAJOR EQUIPMENT FAILURES

A major equipment failure is defined as a condition where there is no communication between the Brewer Spectrophotometer (Brewer) and the external control computer (PC). Symptoms are that no commands go to the Brewer, and no information is received by the PC. This is a "no operation" condition.

3.1 "No Operation" - No Power Indication

1. Reset the Brewer

If any problem is fixed at any point in this trouble shooting procedure attempt to launch the Brewer Software.

When the Brewer Software is launched the Brewer should send the following message to the PC:

```
BREWER OZONE SPECTROPHOTOMETER

            #nnnnn

         AES SCI-TEC

           CANADA

   VERSION 1 Jan 01, 1998
```

If this message is received then communications has been established between the Brewer and the control computer.

If the instrument does not reset (as seen by motors initializing), the problem is probably in the Brewer, but may also be in the communications cable, the PC or the software.

A fresh set of software can be loaded onto the Computer from the origional discs to eliminate it as a potential problem. Ensure that the Brewer configuration files are preserved as they contain important operating information such as the COM: port number. Check the configuration files to ensure that none of the files have been corrupted.

2. Check Power

If the GREEN LED on the Brewer is illuminated, then there is power to the instrument, and the Main Power Supply is producing 5V. If the LED is not illuminated, then the AC power source should be checked at the AC outlet and the end to end continuity of the Power Cable tested. The AC power should then be connected directly to the Brewer, bypassing the Tracker.

If there is still a no-power indication, then the Brewer top cover should be removed and the MAIN power supply checked to see if it feels warmer than ambient.

3. Check Power Switch and Fuses

If the cover is not warm, then perhaps the Power Switch is defective, or a fuse requires replacement. With power disconnected, use an

Ohmmeter to confirm that the Switch is functional, and check the two fuses next to the power supply cover as indicated in the photograph. If a fuse needs changing, ensure that AC power is disconnected, and replace the fuse with the appropriate spare.

To check the fuse inside the power supply, disconnect AC power from the Brewer, remove the Main Power Supply cover (four 6-32 screws) and measure or visually inspect the fuse and replace it if necessary. When re-installing the cover, ensure that the Power Supply connectors remain connected.
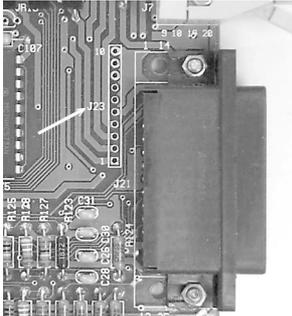
If the power supply appears to be normal, then the LED may be defective, or there may be a faulty connection.

4. Measure Voltages

The main power supply voltages can be checked at the test points on J23 of the Main Electronics board. (Refer to the chart for correct voltages).

Connector J23 Monitor points	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10
	5v	5v	-5v	12v	12v	-12v	24v	2.5v	4.5v	Gnd

3.2 Trouble Shooting Sequence for "No Operation" Condition

It has been established that there is Power, motors reset, but that there is absolutely no communication between the PC and the Brewer.

1. Reset

A software reset should be attempted after the "Brewer Failed to Respond" message appears on the PC monitor, or the PC has tried a number of times to establish contact with the Brewer. The software reset is done by pressing ENTER key on the PC following the error message, or launching the Brewer software from the DOS prompt. If this fails to establish communications, the PC should be given a 'cold' boot (power OFF/ON).

2. Check cables

If there is still no response, the cables should be inspected to ensure that a connector has not been inadvertently removed or pulled out of place. The Communications cable to the Brewer from the PC, as well as the power cable to the Brewer should be checked. All cables involving the linking of peripherals should be checked to ensure that they are plugged in as well. After this has been done another software reset can be tried.

3. Test serial port

Check that the computer serial port is operating correctly by running a serial communications program such as Telix, Procomm, or Windows Hyper Terminal. Make sure the serial communications program is set to 1200 baud, is in full duplex mode, and the correct serial port has been selected. Refer to the communications program documentation for correct operation.

Remove the RS422 adapter from the back of the computer and connect pins 2 and 3 of the computer serial port together. While running the communications program in full Duplex mode, characters typed should be seen echoing to the monitor. Disconnecting the jumper wire should stop the echo-back. This test confirms that the computer serial port is operating correctly. If the computer did not echo the characters change the Brewer's configuration to use another port (see section 3.6 in the Operator's Manual) or have the defective serial port repaired before doing any further tests.

4. Test RS422 adapter

The RS422 adapter at the computer can be tested by removing the communications cable from the adapter, connecting pins 1-3, plugging the adapter into the Computer COM: port, and checking for echo-back as in step 3. Now switch connections to pins 2-4 and test again. The RS422 adapter is operating correctly if characters echo back. If a fault is indicated, then either the adapter or the power module is defective.

The power module output should be approximately +13V DC with no load or +9V with a load (the center pin is positive.) If the voltage is normal, then replace the RS422 adapter and test again.

5. Test communications cable

If the tests have passed to this point, the communications cable between the Brewer and the computer can be tested. Reconnect the cable to the RS422 adapter and connect it back to the computer. Remove the communications cable from the Tracker surge suppressor box and connect a wire jumper to connect pins C-B. Test the cable by sending characters from the computer as in step 3; move the jumper to connect pins I-J and test it again.

Reconnect the communication cable to the tracker and disconnect the communications cable at the Brewer. Short pins C-B and then pins I-J and test as in step 4. If the test passes, reconnect the cable to the Brewer and open the cover of the Brewer. Turn the power off and disconnect the IDC connector (the IDC connector,J7, is the connector attached to the shielded ribbon cable shown in the picture to the left) Use a small wire jumper to connect pins 2-8, and then pins 4-6, using the echo-back test each time. (The IDC pins begin from 1 at the triangle stamped on the side of the connector and increment in odd numbers on the same row - 1, 3, 5, 7, 9 on the first row and 2, 4, 6, 8, 10 on the next row, in the same direction). If the test fails at any point of this cable test procedure the faulty connection should be repaired before proceding to the next test. If all of these procedures have positive results, then the

problem lies in the Brewer Main Electronics Board. Reconnect all the cabling to the instrument and continue to the next test.

As an alternative for testing cables, each line can be tested for continuity by measuring point to point with a ohmmeter, using the appropriate schematic as a guide. The resistance through the surge arrestor is 10 ohms so that a typical resistance should be 12 ohms from the RS422 adapter to the IDC connector at the Brewer Main Electronics board.

6. Line Driver
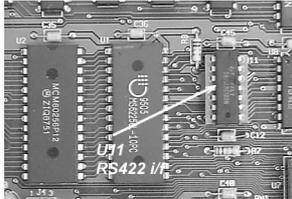
If the reset of the motors is heard and seen, but there is no message sent to the PC, then there may be a problem with the line driver on the Main Electronics board. Ensure that power is turned off and remove the Main Electronics cover plate and replace IC U11 , (on a socket 5cm up and 5cm to the left of the LED). Make sure to use proper grounding precautions before touching the electronics board. Leave the cover plate off and turn on the instrument. The motors should be observed to reset and if the computer was left in the serial communications program, the Brewer reset message will be displayed on the screen. Exit the communications program and launch the Brewer operating program. Normal Brewer commands can be used for checking correct operation.

7. Check Mode of Microprocessor

If there is still no operation, there may be a firmware problem, or a problem on the Main Electronics Board, so the functionality of this board should be tested.

There is a Red status LED located near the bottom left hand side of the board - it should be flashing slowly in 'Cosmac mode' as per the following table. If the Brewer is in some other mode change back to the Cosmac mode (step 10).

LED Mode indication	¼sec	¼sec	¼sec	¼sec	¼sec	¼sec	¼sec	¼sec
Cosmac mode normal operation	**On**	Off	Off	Off	**On**	**On**	**On**	Off
Cosmac mode with configuration missing	**On**	Off	Off	Off	**On**	Off	**On**	Off
Loadmode waiting for code to be downloaded	**On**	Off	**On**	Off	**On**	Off	**On**	Off
Loadmode with bad flash memory	**On**	**On**	**On**	**On**	Off	Off	Off	Off
Loadmode with good flash memory	**On**	**On**	**On**	**On**	**On**	**On**	**On**	Off
Opmode with configuration present	**On**	**On**	Off	Off	**On**	**On**	Off	Off
Opmode without configuration present	**On**	**On**	Off	Off	**On**	Off	**On**	Off
Checking Flash memory	**On**	Off	**On**	Off	Off	Of	Off	Off
Changing from load to cosmac or load mode	**On**	**On**	**On**	**On**	**On**	**On**	**On**	**On**
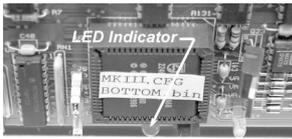
8. Check Voltages

If the LED is not flashing, then the correct voltages should be confirmed for the power supply on the Main Electronics board J23, as per section 3.1.
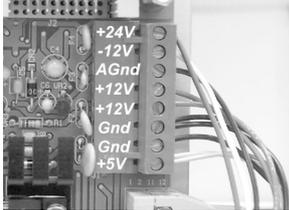
9. Test Main Power Supply

If the power supply values have changed, the power connections should be checked. If they appear normal, and the voltages are still not at proper levels, replacement should be considered. However, there may be a short circuit in one of the assemblies causing the power supply to be loaded. Shut the power off and disconnect the power connector J1 from the Main Electronics board and from the J4 Lamp control board. Repeat the voltage measurements at the connector and see if all the voltages are present. If the voltages are correct then determine which assembly is at fault by installing the connectors one at a time. Replace the main power supply if necessary, and ensure when first turned on that the assemblies are disconnected to allow setup of voltages to correct values. The main 5 volts monitored at the main board should be set to 5.0 volts with the single potentiometer on the main power supply.
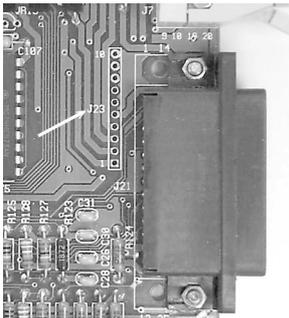
10. Restore Brewer to Cosmac Mode

If the flashing LED on the Main Electronics board indicates that it is not in the cosmac mode, and the software has not been successful in correcting it during the Reset sequence, then the following procedure should be followed:
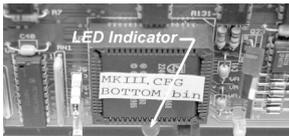
A. Exit the serial communications program and change to the subdirectory c:\bdata\nnn.

B. Type **BREWCMD** [ENTER] , and observe that the instrument has responded and note which mode is indicated. The program should display the same mode as the mode observed on the status LED.

C. If the mode is 'cosmac mode' then type **loadmode** [ENTER] , and the display should return indicating 'loadmode'. Now type **opmode** [ENTER] and within a few seconds the Brewer will be in opmode.

D. Type **readlog** [ENTER] to display past error history, each line displayed will be a possible clue to the problem that caused the failure. If motor failures have occurred, the status will tell you which motor and what the failure is. Usually it is a sensor problem or a wiring problem that prevents the motor from resetting. If no problems are displayed, then the system can be placed back into cosmac mode for further testing.

E. Type **loadmode** [ENTER] and following the return of the prompt, type **cosmacmode** [ENTER] . The motors will reset and within a minute the system will display the status that it is in cosmac mode.

F. Quit the Brewcmd program by typing **quit** [ENTER] .

6

11. Run Brewer Software.

Run the Brewer operating program by typing **BREWER** [ENTER] to check the correct operation of the instrument. Select routines that you are familiar with and ensure that all functions and data appear normal.

12. Replace Main Electronics Board

If no communications return when running Brewcmd then there may be a problem with the Main Electronics Board.

Replace the Main Electronics board with a spare board, ensuring that all cables are reconnected to the original connectors. Normally the spare Main Electronics board is preloaded with the same parameters as those that came with the instrument. Therefore no reprogramming or uploading of the configuration parameters are needed. If the configuration parameters have changed, then refer to the procedure to upload new firmware and configuration data to the board, section 8.

13. Contact SCI-TEC

If you have followed this procedure and not located the problem contact SCI-TEC for further assistance.

Webpage: www.sci-tec.com

Email: info@sci-tec.com

4.0 OPERATING TEST FAILURES

In the Brewer Spectrophotometer, most of the operating tests are done using either the mercury lamp or the quartz-halogen lamp. If any of the other tests fail, the user should proceed immediately to a mercury lamp test (HG) or a standard lamp test (SL).

Mercury lamp test failures and standard lamp test failures are two major problems which can occur. In both cases calibration of the instrument may have been compromised. For the purpose of troubleshooting, these two sections have been separated from the main part of the instrument.

The Light Detection System is made up of the zenith prism, foreoptics, spectrometer, slitmask, PMT, High Voltage Circuitry, High Speed Amplifier, interconnecting harnesses, and the Main Electronics board which houses the photon counting circuits. Without this section being operational, no testing, or measuring, can be done.

There are a few points to remember in the event there is a major failure somewhere in the system, whether it is the Mercury Lamp, Standard Lamp, or Light Detection System.

The error message "`lamp not on test terminated`" is an indication of a failure, either in the lamps or in the Light Detection System.

Changes in dark count may be symptomatic of a number of problems which may occur in the Brewer.

If Dark Count begins to increase or becomes erratic, the slitmask may be at fault. Note that it is normal for Dark Count to increase with temperature.

Dark Count changes may also indicate motor power supply problems, PMT performance problems, or High Speed Amplifier problems.

If the dark count changes, there may be a changing optical condition in the Light Detection System. A higher dark count can also be the result of a poor ground somewhere in the system or high humidity inside the instrument. Grounding connections should be checked, especially between the PMT housing and the Main Electronics.

The desiccant should be changed more frequently in higher humidity locations.

4.1 Mercury Lamp Circuit

The Mercury lamp circuitry (Fig 10-4.2) is a constant current source designed to keep the lamp current constant throughout the temperature range of the instrument. A voltage regulator, connected to a specially selected resistance wire, regulates the lamp current.

4.2 Trouble shooting a Mercury Lamp Test Failure

The Mercury lamp test fails, and software responds with "`lamp not on test terminated`".
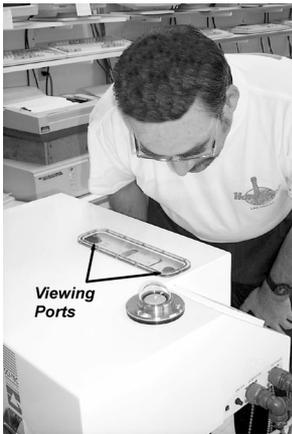
Viewing Ports

1. Check Motor Positions

Retry the test and look through each Viewing Port to see if the lamp turns on. Ensure that the zenith prism and the filter wheels are in the correct position.

2. Check Temperature

Observe the temperature of instrument (TE). If the Brewer temperature is less than 0 degrees Celsius, the lamp may be too cold and may not fire. If this is the case, the Standard Lamp may be turned on for a few minutes to warm the Mercury lamp.

3. Check Lamp Voltage and Current

There is the possibility of a lamp failure. Perform an AP (A/D voltages printout) test. If the Mercury Lamp current is 0.0, and the Mercury Lamp Voltage is near 15 volts, then the lamp is probably bad. Measure the voltage across the lamp, pins 6 and 9 on P111. (Reference Figure 10.6-2.2). It should be approximately 0 volts with the lamp off (B0) and 13 volts with the lamp on (B1).

4. Mercury Lamp Replacement

To replace the bulb, loosen the two thumb screws (item 6, Figure 10.6-2.2) and carefully withdraw the lamp holder. Take care not to touch the new lamp with bare hands. Ensure the lamp is tight in its socket and cleaned with isopropyl alcohol after replacement.

The quartz-halogen lamp should also be checked at this time, as blackening of the glass could reduce the amount of HG light which is passing through it to the foreoptics. Re-assemble the HG lamp by reversing the above steps and test the lamp with B1 and HG commands.

5. Check Micrometer Position

Micrometers

If the lamp is working fine, and light can be seen in the Viewing Ports, then the position of the micrometer should be checked. Remove the "Spectrometer" cover and check to see that the micrometer is in the correct position as indicated in the Final Test Record, and on the Log Sheet taped to the Spectrometer cover. If the Micrometer is not where the Log Sheet indicates, it should be adjusted manually and an HG test attempted again.

6. Attempt a Standard Lamp Test

If the test still fails, the problem could be in a misalignment of a component in the Spectrometer, a problem in the slit mask, or a fault in the PMT or counting circuitry.

Attempt a standard lamp test. The standard lamp has a much higher intensity and does not depend on the position of the micrometer and slitmask as much as the mercury lamp test.

If the standard lamp test operates correctly, the SL printout should be examined carefully to see if any characteristics have changed. If the dark count has increased significantly, this may be an indication that the alignment has changed and may require a mirror adjustment. Check to see if any of the intensities or ratios have changed, which may indicate that the optics have deteriorated, or the PMT performance or counting

has degraded. If the standard lamp test results appear to be normal, then SCI-TEC should be contacted before proceeding.

7. Measure High Voltage

If the standard lamp test is not operational, then it can be assumed that there is an optical failure, or a PMT failure. If the mercury lamp test is normal while the standard lamp has failed, this usually indicates a problem with the lamp or the circuitry that controls the lamp.

The high voltage should be measured using a voltmeter and looking at test point E16 on the Main Electronics board. There should be a voltage between 2.5 volts and 5 volts, which has been factory set (see final test record for the setting), and should not be adjusted. This voltage is equal to the actual high voltage divided by 409 . There may be a variation of a volt or two of the high voltage, but the voltage at testpoint should be very close to the final test record value. If it is significantly different, the high voltage circuit may have failed. This will require a skilled technician for repair or SCI-TEC should be contacted.

8. Check Light Detection System

If the high voltage appears to be normal from the test point reading, then there is a possibility that something has failed in the Light Detection System, reference Section 4.7.

4.3 Standard Lamp Circuit

The standard lamp current regulator is similar to the Mercury lamp circuit except the resistance wire is chosen to regulate the supply current with less variation than the mercury lamp. The circuit maintains the operating current within 3 milliamps over a range of -20 to + 40 degrees C, and is even more stable in the operating range of 10 to 30 degrees.

4.4 Standard Lamp Failure

The quartz-halogen (Standard) lamp is the lamp most frequently used in self diagnostics of the Brewer. With it, calibration can be monitored, and correct operation of many systems can be inferred.

The software for the standard lamp tests has been designed to give an error message in the event of a failure. The message is "Lamp not on test terminated". The message may be somewhat misleading in that there are many conditions which can make it appear that the Lamp is not on. These conditions include PMT performance, filterwheel positioning, Zenith prism position, photon counting electronics, and the I/O electronics used to turn the lamp on and off.

4.5 Trouble-shooting Standard Lamp Test Failure

Error message, "Lamp not on test terminated".

1. Check if Lamp is Burned Out

Retry the test and if the lamp is on, it will be seen through the viewing ports if the Filter Wheels, iris, and the Zenith Prism have moved into the proper position. Perform an AP (A/D voltages printout) test and compare
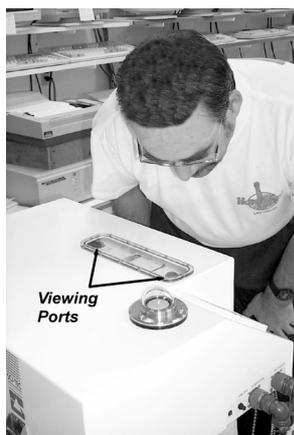
results with previous tests, paying particular attention to standard lamp current and voltage. The current, channel 14, will be approximately zero and the voltage, channel 15, will exceed 14 volts if the lamp is unplugged or burnt out.

2. Attempt HG Test

If the test continues to fail, a mercury lamp test should be attempted. If the mercury lamp test operates correctly, then the Light Detection System is probably operating correctly. If so, a mercury lamp calibration should be done and the Standard Lamp test should be repeated.

3. Observe Slitmask Performance.

If the mercury lamp test is normal, the spectrometer cover should be removed and another standard lamp test done while observing the slitmask. If the standard lamp fails again while the slitmask is operating correctly, SCI-TEC should be consulted.

4. Photon Counting Circuitry

If the mercury lamp test is not normal, there is probably a failure in the photon counting circuitry and section 4.9 of this manual should be consulted.

5. Replace Standard Lamp

Before starting disassembly, it should be confirmed that the lamp filament is open circuit by checking with an ohmmeter across pins 1 and 5 of J111 (lamp connector). Reference fig. 10.6.2-2.

The Standard Lamp is located above the mercury lamp and is attached to a removable plate. Remove the two screws holding the plate. Replace the bulb with a new one, taking care not to touch it with bare fingers- use a tissue or soft cloth and clean the lamp with isopropyl alcohol after installation. If the bulb is blackend, it should be replaced regardless whether or not it is operational.

Replace the connector assembly and test the lamp with the B2 command. Be sure to use B0 to turn the lamp off.

Another standard lamp test should now be tried. If there is no success, there is a possibility of circuit failure on the Lamp Control board, or the Main Electronics board.

6. Check Main Electronics Board

Send the command to turn the Standard Lamp circuit on (B2), and measure the voltage at pin15 of U14 on the Main Electronics Board. The voltage should be +5 volts when the lamp is off and   0 volts when the lamp is on.

If this voltage does not change, the Main Electronics board should be replaced, or SCI-TEC consulted.

7. Check Cable

If there was an indication of a 0 to 5V voltage swing at pin 15 of U14, but still no lamp operation, the cable that connects the Main Electronics board to the Lamp Control board should be checked.
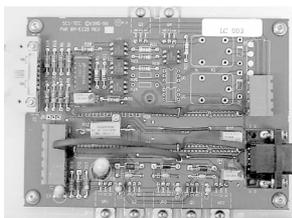
8. Test Lamp Control Board

If the cable it is good , the Lamp Control Board should be tested for correct operation. The lamp control for the standard lamp is very simple - Q1 pin 2 supplies power to the current regulator VR2 (both components are on the bottom edge of the Lamp Control Board). Measure Q1 pin 2, and when the standard lamp is commanded on, it should go to 17 volts. VR2 pin 2 should be 10 volts. If it this point does not go to 10 volts, then the current regulator circuitry is faulty and must be repaired or the complete board must be replaced. Refer to the lamp control board schematic Fig 10.4-2.

9. Test Lamp Cable

If the voltage at VR2 does change on command, then the lamp cable should be tested for continuity.

4.6 Light Detection System Failure

A Light Detection System failure may show up in any or all of the diagnostic or measurement tests of the Brewer. In Lamp diagnostics it will usually be shown on the Computer Display as "Lamp Not On .. test terminated" message. In a measurement (DS for example), the counts may simply go to zero, or some other incorrect number, depending on the nature of the failure. Results of Lamp tests are predictable so an HG and/or SL should be attempted if there is any suspicion of a Light Detection problem.

The Light Detection System is comprised of the foreoptics, spectrometer, micrometer, slit mask, and the PMT (including the high speed amplifier). Adjustments of any of these assemblies should be done with extreme caution, unless they are specified in this manual, as Instrument calibration may be affected.

4.7 Trouble-shooting the Light Detection System

1. Confirm Motor Positions are Correct

If Lamp tests fail and the message "Lamp not on test terminated" is displayed, the SL command should be issued. With the lamp on, the correct positions of the zenith prism, filterwheels, and iris should be confirmed. The correct positions are printed to the screen when the SL command is issued. Light from the lamp should seen in both view tubes.

2. Test Photon Counting Circuit

If the SL test fails the photon counting circuitry should be tested. From the Main Menu enter the Teletype command, TT.

Turn off the power, remove the ribbon cable from the PMT output, and plug it into J22 of the Main Electronics Board. This connector is the output of a 1MHz Pulse Simulator (see picture).

Turn on the Brewer power. At the teletype prompt, enter the command R,0,7,20;O. The display should show 8 numbers, each being
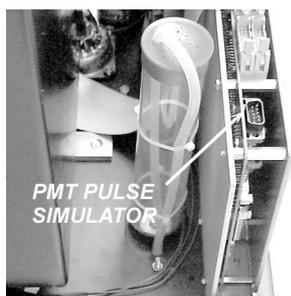
approximately 2,280,140 counts. Exit TT by pressing the Home key, turn off Brewer power, replace the PMT cable, and turn power back on.

If the test is normal, the Counting System is operating correctly.

Now check components in the Spectrometer.

3. Check Micrometer Position

In a low light level and dry room, remove the Brewer cover and the Spectrometer cover. Confirm that the micrometer is in the correct position as indicated on the 'Micrometer Position' log sheet that is taped to the Spectrometer cover.

4. Check Mirror and Grating

Check that the spherical mirror and the grating appear to be in place, and that their mounting assemblies appear normal. ** TAKE CARE NOT TO TOUCH THE SURFACES OF EITHER THE MIRROR OR THE GRATING AS PERMANENT DAMAGE MAY OCCUR **** .

5. Test Slitmask

Slitmask operation can be confirmed by returning to Telytype operation (TT), sending the **R,0,7,20** command, and noting that the slitmask moves back and forth pausing briefly at each of the 8 slitmask positions.

Commands R,X,X,20 (where X =0 to 7) can be sent in sequence. After each command a slot in the slit mask should line up with a slot in the slit plate EXCEPT on command **R,1,1,20**, which is the Dark Count position. If the slitmask does not move, or appears to move incorrectly, then the I/O cable, Motor, or the motor control micro or motor driver IC on the Main Electronics board may be faulty. The Main Electronics board should replaced and another test attempted.

6.Check Dark Count

If the slitmask appears to be functioning correctly note what the count values are when the command **R,0,7,20;O** is isssued in Teletype. There is a very important difference between a count rate of zero and a count rate near zero. A high count rate indicates correct oeration. A low count rate indicates that only dark count (a function of the PMT) is being measured and the light coming through the slit mask is not being measured. A zero count rate indicates a problem with the PMT or the counting electronics.
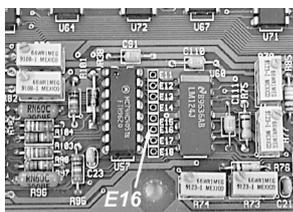
7. Measure High Voltage Test Point

Replace the Spectrometer cover, and remove the cover from the Main Electronics board.

Measure the the high voltage test point E16 on the main electronics board (see picture), if it is not the same as the value given in the Final Test Record, section 5.0, then adjust R4 on the highvolltage control board.

8. Check High Voltage Cable

If the test point voltage cannot be achieved, there may be a short circuit in the high voltage line somewhere between the HV module and the

actual PMT dynode chain. Care should be taken when inspecting this area because there can be as much as 1800 volts at the connection points. Check the high voltage cable for continuity.

9. Measure High Voltage at PMT

The rear cover of the PMT housing can be removed (turn CCW) and the actual high voltage measured on the internal connector. This measurement must be done with a voltmeter rated for 2000 volts or by using a high voltage probe.

If the high voltage is still not as indicated on the Final Test Records, then contact SCI-TEC.

10. Test High Speed Amp Board

If high voltage is correct, there may be a failure in the high speed amp board. TP1 on the high speed amplifier board (inside the PMT housing) should read -10 millivolts (referenced to the HV connector shield) or the value recorded in the Final Test Record, section 4.0. If the value of this test point is incorrect, an adjustment of the on-board potentiometer can be attempted. If this test fails, replace the high speed amplifier board.

If this test point is normal, the photon counter cable should be inspected to ensure that all connections and wires are intact. Finally, an oscilloscope can be used to monitor testpoint TP4 on the high speed amp board, and then pins 1,2,3,4, and 12,13,14, 15 of the IC, SN75114N. There should be clean square waves, the frequency of which should vary with light intensity. If these signals are normal, consult SCI-TEC before proceeding further. If any of the signals are missing or are not clean square waves, replace this board.

11. Contact SCI-TEC

If all of these tests fail, there is a probable fault in the PMT, and SCI-TEC should be contacted before proceeding.

4.8 Stepping motor control

The stepping motor control circuitry provides for the control of each stepping motor through individual motor microprocessors and stepping motor driver integrated circuits. This type of motor control allows the system to move the motors simultaneously, and to monitor the sensors very efficiently. All of the motor microprocessors are controlled by the main processor through a serial "I2C" bus. Each motor is optimized for speed and taylored to each function in the Brewer. The configuration file is included with the control software to allow changes and updates to the system. The configuration file is optimized for each instrument and normally does not require operator modifications unless recommended by SCI-TEC.

4.9 Photon Counter Circuitry

A schematic diagram of the photon counter circuitry is given in figure 10.4-1. The photomultiplier signal which has been amplified and divided by a line driver on the pulse amplifier board is received by a line receiver on the Main Electronics board. This signal is fed to a pair of binary counters. The outputs of the 2 counters are compared and if they differ by more then a set amount the second counter is disabled and a

"PMT counter failure" message is generated in the Firmware Log. The counters are each connected to output ports which are connected to the data bus of the system microprocessor.

The main gate is generated by an electronic circuit that provides a very precise gating signal to enable counting for a specific length of time. The microprocessor decides when the pulse counting circuitry is initiated and the circuitry then triggers the gate to allow counting of the photons.

4.10 High Speed Amp Board

The photomultiplier, and pulse amplifier board are enclosed inside the photomultiplier subassembly. The sub assembly is designed to allow access to the pulse amplifying circuitry without upsetting the alignment of the PMT or the optics.

The photomultiplier is an EMI 9125UVA type. It is enclosed in a magnetic shield at the high voltage potential of the photo cathode. A small area on the shield is open to allow light to fall on the cathode. A high voltage power supply provides stepped voltages to the photomultiplier through a resistor divider circuit at the base of the tube. Since differential thermal expansion between the photomultiplier glass and the teflon base may cause tube breakage under extreme temperature conditions, it is recommended that the photomultiplier housing never be subjected to temperatures of less than -50C or greater than +60C.

The pulse amplifier board is located directly behind the base of the photomultiplier tube. This circuitry accepts the photon pulse signals from the photomultiplier, amplifies them, discriminates the signal level from current leakage, divides the amplified photon pulses by four, and finally outputs the pulses on a line driver. Since the circuitry is extremely sensitive to feedback and RF noise, it is located in close proximity to the photomultiplier.

4.11 Ratemeter

The ratemeter circuit provides a voltage output of the photon count rate. It consists of a two-transistor charge pump on the high speed amp board, and an integrator-amplifier on the Main Electronics board. A transistor is connected as a current pump and driven by one of the outputs of a J-K flip flop on the high speed amplifier board. The pulses from the flip flop are integrated by an RC network, then scaled by an op-amp.

4.12 Temperature monitor

The temperature monitor is a temperature sensitive bridge using YSI linearized thermistors. The bridge output is amplified to produce a suitable scale for the A/D convertor. There are six thermistor circuits available, one of which is located in a hole drilled in the side of the front flange of the PMT housing. The other five are used to measure temperature at points around the instrument as status information. One of the sensors monitors outside temperature.

4.13 High voltage Circuits

The high voltage (600-1600 volts) for the photomultiplier (PMT) is provided by a DC-DC converter / high voltage control circuit board.

4.14 Clock / Calandar

The real time clock/calendar circuit is a battery backed up clock with integral static random access memory. A lithium battery is used to keep the clock operating when there is no power applied to the Brewer. The clock is year 2000 compatible.

4.15 A/D Converter

The A/D converter has a 10 bit conversion resolution and is built into the microprocessor. Analog multiplexers are utilized to select the channel to monitor. The AP routine is the main routine that accesses the data and displays the information on the PC monitor, saves it to a file, or prints it on the printer.

4.16 Breather Desiccant Cartridge

The breather desiccant cartridge allows the Brewer to compensate for normal pressure changes, while preventing the influx of moist air. Breather desiccant is housed in a plastic container with a breathing tube placed at the bottom of the cartridge. The other end of the tube is connected to a port at the bottom on the underside of the Brewer and is exposed to the outside air. As the air is drawn in from the outside, the air is dried as it passes the desiccant. Reference figure 10.8. Note that the breather desiccant does not remove moisure from the Brewer. Extra desiccant is needed to remove moisture from inside the instrument.
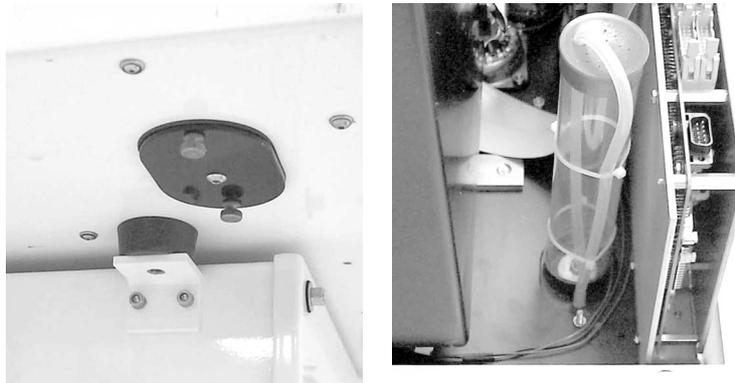
4.17 Humidity Sensor (Optional)

The optional humidity sensor is a monolithic IC sensor that provides a voltage output proportional to relative humidity. The sensor is buffered by an operatioanl amplifier and the output is connected to one of the analog input channels of the A/D converter. A temperature sensor is located near the humidity sensor to provide temperature compensation for the device. The two measured values, relative humidity and temperature allow the absolute moisture to be calculated. The absolute humidity (grams/m^3) value is displayed on the PC screen along with a numerical "moisture index" value. Refer to Figure 10.4-5 for the sensor specifications and Figure 10.4-6 schematic for the humidity sensor assembly.

Filter Wheel #3 (FW#3) - Order Selection Assembly

Following dispersion by the spectrometer, and wavelength selection by the Slit Mask, radiation passes through the "order selection" filters (located in the FW#3 assembly). After order selection the intensity is measured by the photomultiplier and the counting circuitry.

Problems in the FW#3 assembly may result in large changes in lamp intensity, failures of HG and SL tests, errors in the FR test and incorrect observation results.

1. Run FR command

When the FR command is sent the micrometer is reset then FW#3 is reset. FW#3 should be heard as it rotates. Alternately the inspection cover on the top of the filter wheel assembly can be removed and the movement of the wheel can be observed.

If there is no movement the problem may be the electronics board, the interconnecting cable or the motor.

In the O3 mode FW#3 should always be found at step 242, while in N2 mode FW#3 should be found at step 178. If these values are not returned the problem may be in the electronics, interconnecting cables, the FW#3 motor, the reference detector or the filter wheel mechanical assembly.

If the error "reference diode not found" is observed then the filter wheel is stuck and can not turn or the reference circuitry is not functioning. If this message is observed SCI-TEC should be consulted before opening the FW#3 housing.

2. Test cable and motor

Connect the cable from FW#3 to FW#2. When the FR command is sent FW#2 should be observed to move (after the micrometer resets).

If FW#2 does not move the electronics board or the cables are suspect. The cables can be checked by interchanging the cables at the electronics board connectors.

If FW#2 does move then the problem is probably the FW#3 motor.

3. Contact SCI-TEC

If FW#3 motor appears to be trying to move, FW#3 should be inpected to ensure that it rotates freely. With the inspection cover open use a small screwdriver to gently rotate the filter wheel. If any obstruction is detected SCI-TEC should be contacted. If the FW#3 assembly is obstructed the filter wheel housing may need to be opened; opening the housing is not recommended without first consulting SCI-TEC.

If it is determined that the electronics board, interconnecting cable, and motor are functional then the problem is probably in the filter wheel assembly and SCI-TEC should be contacted.

5.0 TEST RESULTS OUT OF SPECIFICATION

Whenever any diagnostic tests are out of specification, (SL, HG,DT,RS,) the following should be done or considered.

1. If the deadtime has increased or decreased significantly, the High Speed Amplifier board may be defective, the slitmask may have become misaligned, or a ground in the instrument wiring may have become resistive. High moisture levels inside the instrument may also cause abnormal deadtime results.

2. A test lamp may have deteriorated to the point where tests are affected, and the lamps may require replacement. They can be inspected as mentioned in the previous sections, and replaced if necessary.

3. The optical surfaces within the zenith prism may have become smudged with a fingerprint or may have become dusty over a period of time. The prism should be cleaned, refering to section 6.2.

4. The micrometer may be "sticking" and not in its exact location after a measurement or a test. It should be inspected and the drive mechanism carefully cleaned with tissue and isopropyl alcohol.

5. Filter wheel #3 may be sticking and stopping in incorrect positions. FR tests will confirm the proper operation of filter wheel #3. For more information see section 4.18.

6. Dark count is a convenient characteristic to monitor as it is printed out in many tests and measurements. Dark count changes may be the result of moisture, changes in the slit mask, PMT, high Voltage, or counting circuitry.

7. When the dark count of an instrument changes, or becomes erratic, a slitmask Run-Stop test should be done to see if there are any changes in the slitmask circuitry. If this does not give any indication of the problem, there may be a ground somewhere which has become resistive, and it should be checked.

8. The High voltage test can be done, and the results compared to those in the Final Test Records.

9. Generally speaking PMT problems are not field repairable.

10. Desiccant should be changed at regular intervals. The frequency of desiccant change depends on the climate. Desiccant will require changing much more frequently in humid environments. Alternately the humidity indicator can be used to indicate that desiccant needs changing – desiccant should be changed if the moisure index provided be the electronic humidity sensor is greater then 10 or if the paper indicator for 40% humidity is no longer blue. Desiccant can be removed and dried overnight at approximately 60 degrees C if necessary.

If these checks fail to locate the problem, SCI-TEC should be consulted as to further investigation.

6.0 OPTICS CARE AND CLEANING

6.1 Optics Care

- Never touch the polished surface of optics.

- Hold an optic only by its edges.

- Reduce the need for cleaning optics as much as possible.

6.2 Optics Cleaning

- Use latex gloves when handling or cleaning optics.

- Do not reuse cleaning materials.

SPECTROMETER MIRROR, ND FILTERS, QUARTZ PRISMS AND LENSES: In the event of dust, blow off with rubber hand pump (avoid using your breath) or use bottled dry nitrogen to remove particles. In the event of grease or fingerprints, dampen a very soft cloth with methyl ethyl alcohol and wipe gently. NOTE: Wipe marks will almost certainly remain. To remove the wipe marks, dampen a soft tissue with a mixture of ether and isopropyl alcohol and wipe gently. The tissue should be dampened to the extent that while wiping, the mixture evaporates one to two millimeters behind the tissue.

QUARTZ DOME AND EXTERIOR QUARTZ WINDOW: Spray with window cleaner and wipe clean with a soft cloth.

LAMPS: Dampen a soft cloth with methyl or ethyl alcohol and wipe gently.

POLARIZING FILTER: Use only a soft, dry cloth or tissue to remove dirt and finger marks. The filter should always be wiped gently to avoid marring the finish.

DIFFRACTION GRATING: Do <u>NOT</u> touch or attempt to clean.

7.0 AzimuthTracker

Problems in the Azimuth Tracker affect the Brewer's ability to track the sun, and thus any measurement that depends on direct solar radiation may be in jeopardy.

Regardless of the problem, it usually manifests itself as frequent failures of the Solar Siting test (SI), or the Steps per Revolution test (SR).

The Main Electronics Board sends motion commands to the Tracker, and receives sensor indications from the Tracker via the Azimuth Tracker connector on the front of the Brewer base.

Indirect problems can affect Brewer power and communications since both of these cables pass through the Tracker housing assembly. Communications is routed through a surge suppressor assembly mounted on the bottom of the Tracker, and Power is supplied to the Brewer via the Tracker enclosure where a set of power line surge suppressors are located.

If the surge suppressors in the communications line are faulty, a no-communications condition can exist. The communication cable from the Computer can be connected to bypass the Tracker as a troubleshooting aid in determining if the surge surpressor assembly is at fault.

Similarly, power can be connected directly to the Power Connector on the Brewer in the event that a "no power" problem exists in the Brewer.

The Power switch on the Tracker will not affect power to the Brewer, but a failure of the fuse in the Tracker will interrupt both Brewer and Tracker power.

Tracker problems can be either mechanical or electrical.

7.1 Brewer Power Problems.

Power for the Brewer passes through the Tracker Case where it is connected to a set of MOV surge suppressors. In the event of large transient voltages on the power cable, one or more of these components may conduct, and subsequently result in an AC power short circuit which will cause the fuse to open circuit and may affect power to both the Brewer and the Tracker. Connecting the AC power directly to the Brewer and observing if operation is restored is a method of troubleshooting this subassembly. An ohmmeter can then be used to determine the specific component at fault. Power connections in the Tracker, including the fuse, can also be checked in the event of power problems in the Brewer.

7.2 Bewer Communications Problems

A failure in the surge suppressor in the communications link can be checked by connecting the communication cable from the Computer directly into the Brewer. If Brewer/Computer communications are restored, the surge suppressor subassembly is likely at fault.

7.3 Tracker Electrical Problems

Electrical problems include AC power, power supply, motor driver board, stepper motor, and sensor/blocker assembly.

7.3.1 Sensor Problems

The tracker is prevented from travelling past the zero (or North) position by a sensor that is attached to the aluminun drive plate. A blocking device which rotates with the Tracker body interupts a light beam in the sensor and the resulting change in sensor voltage output is detected by the electronics.

If it is observed that there is frequent wrapping of the power and communuications cable, or activation of the safety switch, the sensor and its wiring should be tested.

1. With a DC voltmeter, monitor the sensor voltage at U3, pin 13 on the Main Electronics Board.

2. Pass a piece of paper (or other opaque material) through the sensor, and the voltage should go from +5 volts in the blocked state to 0 volts in the non blocked state.

3.   At the Tracker, pin 5 of J201 should go between 0V and 5V as the sensor is unblocked and then blocked.

4. Replace the sensor assembly and cables as necessary.

5. If the above tests shows the sensor and cables are good, then confirm that the blocker passes through the sensor as the Tracked rotates.

6. If all of the tests are good, there could be a problem on the Main Electronics Board sensor detecting circuitry, in which case SCI-TEC should be consulted.

7.3.2 No Tracker operation.

If the Green Power Indicator indicates no Tracker power, but the Brewer functions normally, a problem in the Tracker is indicated.

The Tracker covers should be removed and the AC power to the Power Supply confirmed. If AC is present then the +5 V output of the power supply should be measured. If no +5V is found, then the Power supply is at fault and should be replaced.

If the Power supply is normal, then the safety switch should be inspected to confirm that it has not been tripped by an over-travel condition. The switch should be in the toggle position away from the Tracker center pedistal.

If the Power Supply and safety switch are both normal, and there is still no motor motion, then it should be confirmed that the Brewer is outputting drive pulses to the Tracker.

1. Tracker movement pulses can be found on the cable going to the Tracker Driver Board BA-C99, connector P201, pin 1. Square pulses, 0-5V in amplitude may be observed with an oscilloscope, or an AC reading indication of 2 Volts can be seen with a Voltmeter in the AC measurement mode.

2. Connect an Oscilloscope or Voltmeter to pin 1 of Connector P201 of the Board BA-C99 in the Tracker. (lower left of the BA-C99)

3. From the Brewer Main Menu, go to the TT (TeleType) mode.

4. Send the Command `M,2,1000` and pulses should be observed.

5. If no pulses are seen at the Tracker, then look on pin 4, J17T on the Main Electronics board. This pin is the 2nd from the left on the top row of solder connections just behind J17T when facing the removable plate of the Main Board. .

6. If there are still no pulses, then remove the connector at the BA-C99 end and try again – this will test for a short circuit in the cable

7. If the test fails again, then a fault is indicated in the motor driver circuitry on the Main Electronics Board, and this board should be replaced.

8. If it is confirmed that pulses are going to the Tracker and if the Tracker Power Supply and Safety Switch are both normal, and there is still no motor motion, then the motor Driver board in the Tracker should be replaced.

9. Failure of the motor to move under command at this point indicates a possible motor failure, or a failure of interconnecting cables. All interconnections should be inspected.

7.4 Tracker Mechanical Problems

If the Tracker stepping motor is observed to rotate, but the Tracker does not turn, or turns irratically, this is an indication of a mechanical problem.

The first check should be for cleanliness of the aluminum drive plate, and particles jamming between drive gears.

A rare mechanical problem is the seizing of the main bearings, which can be checked by turning Tracker power off and attempting to rotate the Tracker by hand. If the Tracker does not turn freely, then SCI-TEC should be consulted.

If the Tracker turns freely with no power, and the motor turns when an AZ or SR command is issued, then a mechanical problem exists between the motor and the main drive plate.

Check the small motor gear and confirm that it is turning with the motor, and is not slipping on the gear with which it is meshing. Also check for slippage between the stainless steel drive rod and the large aluminum drive plate.

If the motor gear does not turn with the motor, then check the set screw which holds the gear to the motor shaft. If the motor gear turns, then the spring tensions that provide drive friction between the gears, the drive shaft, and the drive plate may require adjustment. (Ref Figure 7.1 and Section 5.4 of the Operator's Manual).

A spring scale can be used at the top and bottom of the shaft and the the tension adjustments set to 4kg at the top, and 9kg at the bottom tension point.

If the Tracker still does not turn, or gives inconsistant SR results, then SCI-TEC should be contacted for assistance.
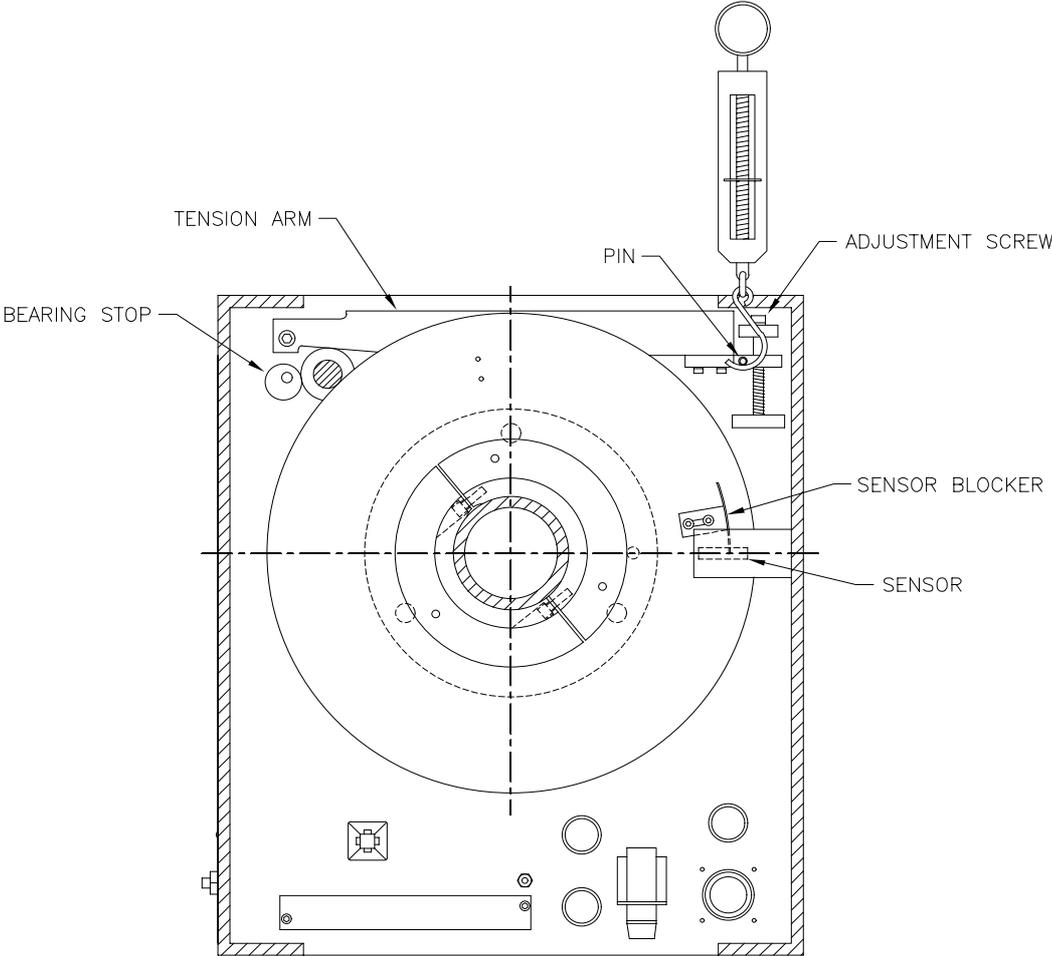

Figure 7-1. Tracker Drive Mechanism

8.0 Main Electronics Firmware / Configuration Loading procedures

This procedure is used to upload new firmware for the BREWER Electronics or to update the configuration files stored in flash memory. The only time this procedure is required is if the firmware has been corrupted due to electrical surges or the memory had been replaced or if the configuration has changed due to some physical changes to the sensor settings or position stops.

8.1 Installation of Brewcmd Software

Before using any of the procedures in this section the Brewcmd software must be installed and properly configured.

Exit out of the BREWER operating program to DOS.

Take the supplied configuration disk and put it into the computer used to reconfigure the BREWER.

Copy the files from the floppy disk **`a:\bdata\nnn`** to the **`c:\bdata\nnn`** subdirectory using the command

`copy a:\bdata\nnn\*.* c:\bdata\nnn` `ENTER`

Edit the file c:\bdata\nnn\brewcmd.ini. Ensure that the com port setting indicated matches the comport setting for your Brewer.

8.2 Restore Back to COSMAC Mode

In certain circumstances where the signal line is placed in a permanent Break signal condition, the BREWER will continually try to reset but eventually it has determined that there is a problem and it will halt trying to reset and go into Loadmode. This fault can happen when the RS422 cable has been incorrectly wired or has shorted together to simulate a break condition. To confirrm that the processor is actually in loadmode, remove the weather proof cover of the BREWER and look down into the Main electronics board between the cover plate and the microprocessor board. You should see a flashing LED light and if it is in loadmode, it will be flashing quickly in 1/4 second intervals. The procedure to restore the system back to the Cosmac mode of operation is as follows:

Change to the directory c:\bdata\nnn by typing the command
`cd \bdata\nnn` `ENTER`

Run the program Brewcmd.exe by typing **`brewcmd`** `ENTER` This program is a utility to allow the user to communicate to the BREWER Microprocessor and change operating modes or upload files.

If all the connections are correct, the display will reply that BREWER responded and at what baud rate it is communicating at. **`[Using load mode at 9600 baud, on com 1; tracing is off]`**

It is expected that it will be in Loadmode but it could be in Opmode as well.

To return it to its normal operating mode, type **`cosmacmode`** `ENTER`

The instrument will reset itself by resetting all of its motors and the display will display the following with other status information.

Motors Initializing.

When the instrument has completed resetting all of the motors, the display will now respond to low level commands.

Exit out of the Brewcmd program by typing **quit** ENTER and the computer will have returned to the dos prompt.

Run the BREWER operating program and then ensure the time and date is correct.

8.3 New Configuration Upload

If hardware changes have been made such as removing the zenith drive gear or adjusting the micrometer drive sensor mask, then correct values for zero offset and other parameters must be uploaded to the instrument for it to operate correctly. The procedure to upload the new configuration file is listed below:

The configuration file that describes the characteristics of the instrument is named BREWnnn.cfg. The nnn will be the instrument number. This file is an ASCII text file that describes all the technical parameters of this particular instrument. This very same file should be uploaded to any replacement BREWER Main Electronics board following the physical installation of the board. A spare BREWER Main Electronics board will normally be sent with the latest configuration file stored at SCI-TEC. If the customer has changed any parameters in the field, it will not be configured into that board and the customer will have to upload the latest file as described below:

Change to the directory c:\bdata\nnn by typing the command **cd \bdata\nnn** ENTER

Run Brewcmd.exe by typing **brewcmd** ENTER

[using cosmac mode at 1200 baud, on com 1: tracing is off] should be displayed

Type **loadmode** ENTER to change modes.

Waiting for the mode change to complete and when complete, the display will display [**using load mode at 1200 baud, on 1: tracing is off]**

Go into Opmode by typing **opmode 9600** ENTER

Trying Operating mode at 9600 baud is displayed until the display will display [**using operating mode at 9600 baud; on port 1; tracing is off]**

Send the configuration file to the microprocessor by typing **putcfg brewnnn.cfg** ENTER (nnn is the instrument number)

Wait approximately one minute to transfer

27

Type `readlog` [ENTER] to clear the log buffer

Type `useconfig` [ENTER] motors should now reset

When complete `readlog` [ENTER] to see if errors were encountered. Contact SCI-TEC if the log displays a problem.

Type `save` [ENTER] a number should appear. This tell you how many configuration writes you have left.

If the number is '`1`' then the next time a configuration is sent, the top firmware must be written to Flash memory and the configuration area is cleared to allow another 4 blocks of configuration files.

Go to Load mode by typing `loadmode`[ENTER]

`Waiting for mode change to complete` and
`Trying load mode at 9600 baud` is displayed until the display will display [`using load mode at 9600 baud, on com 1: tracing is off ]`

Go into Cosmac mode by typing `cosmacmode`[ENTER]

`Reading Cosmac mode reset message`

`Waiting for mode change to complete`

`Trying Cosmac mode at 1200 baud`

`Motors Initializing`

These are some of the messages seen while going into the Cosmac mode.

Motors should reset and it is ready to run the BREWER operating program

type `quit`[ENTER] to get out of Brewcmd

To run the BREWER operating program type `BREWER`[ENTER]

8.4 Uploading new Firmware and configuration files

As SCI-TEC develops new firmware and features, it is now possible for the customer to upgrade the firmware without having to open the cover to the BREWER. The New Electronics has incorporated Flash electrically erasable program memory and the system is capable of being updated from the PC. The procedure below will provide a step by step process to upload the firmware and also upload the configuration file which is erased when the new firmware is loaded.

This disk is supplied with the instrument when first delivered or will be sent out to the customer when firmware updates are done.

Copy the new top.bin or topv#r#.bin firmware file received from SCI-TEC to the `c:\bdata\nnn` subdirectory.

Change to the directory c:\bdata\nnn by typing the command
cd \bdata\nnn ENTER

Run Brewcmd.exe by typing **brewcmd** ENTER

Eventually the following statement is displayed:

[using cosmac mode at 1200 baud, on com 1; tracing is off]should be displayed. If the command **help** ENTER is entered, a list of available commands will be displayed.

Type **loadmode** ENTER to change modes.

Eventually the following statement is displayed:

[using loadmode at 1200 baud, on com 1: tracing is off]

Type **loadmode 4800** ENTER

Eventually the following statement is displayed:

[using loadmode at 4800 baud, on com 1: tracing is off]

Type **load top.bin** or **topv#r#.bin** ENTER
(# will depend on the version number of the firmware.)
Wait until this task is completed (this will take a few minutes).

The display will display some messages below:

Erasing Flash memory

Writing file top.bin to flash ……

The display will show 112 moving dots to show its progress

Turn off the power of the instrument for approximately 10 seconds and turn it back on.

Go into Opmode by typing **opmode 9600** ENTER

Waiting for mode change to complete is displayed and eventually the fan turns on if the heater option is ordered and the display will eventually display **[using operating mode at 9600 baud, on com 1: tracing is off]**

Type **readlog** ENTER to display any errors encountered.

Send the configuration file to the microprocessor by typing
putcfg brewnnn.cfg ENTER

Wait a 1.5 minutes to transfer

Type **readlog** ENTER to clear the log buffer and see if any errors occurred during the configuration installation.

Type **useconfig** ENTER motors should now initialize.

When complete **readlog** ENTER to confirm everything is ok

Type **save** [ENTER] a number should appear. This tell you how many configuration writes you had left when the save command was issued. The number of configuration writes left is one less then the number displayed..

The number is '**4**' should be displayed.

Go to Load mode by typing **loadmode** [ENTER]

The display will eventually display **[using load mode at 9600 baud, on com 1: tracing is off]**

Go into Cosmac mode by typing **cosmacmode** [ENTER]

A number of messages will appear and eventually the motors should initialize and it is ready to run the BREWER operating program and display **[using cosmac mode at 1200 baud, on com 1: tracing is off]**

type **quit** [ENTER] to get out of Brewcmd

To run the BREWER operating program type **BREWER** [ENTER]

9. Warranty

MANUFACTURER'S GUARANTEE / WARRANTY CERTIFICATE
NEW PRODUCT WARRANTY AND LIMITATION OF LIABILITY

SCI-TEC instruments Inc. hereby warrants to its products to be free from defects in material and workmanship for a period of one year from date of purchase.

SCI-TEC's obligation under this warranty is strictly and exclusively limited to repairing or replacing, at SCI-TEC's discretion, any such equipment and / or parts thereof which have failed under normal use and service. Expressly this warranty does not apply to any equipment and / or parts which have been improperly installed, been subject to abuse, neglect and / or accident.

The foregoing warranty is in lieu of any other warranties, expressed or implied, including without limitation, any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations of liabilities whatsoever in any event for payment of any incidental or consequential damages, including, without limitation damages or injury to a person or property.

An authorization must be obtained from SCI-TEC prior to the return of any equipment or parts thereof. Returned material is to be turned to the factory, or other location as may be directed by SCI-TEC, freight prepaid and will be returned freight prepaid. SCI-TEC is not responsible for any transportation, insurance, demurrage, brokerage, duties, or councilor charges, etc.

This warranty is given to the original purchaser and may not be transferred without direct written consent of SCI-TEC.

Should an extended warranty be purchased, then the warranty statements in its entirety is applicable for the entire period of time covered by the extended warranty.

In the absence of another prior agreement, this standard warranty statement will apply.

This page is intentionally left blank

This page is intentionally left blank