Instruction Manual
for the

Gilian®

The Gilibrator™

Primary Standard Airflow Calibrator
with Interchangeable Flow Cell Assemblies

Flow Cell Assembly Ranges
Low : 1 to 250 cc/min.
Standard : 20 cc/min. to 6 LPM
High : 2 to 30 LPM

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Prologue

This Instruction Manual describes the basic principles, installation, operation/controls and maintenance for the Cilibrator, Primary Standard Airflow Calibrator manufactured by Cilian Instrument Corp.

Table of Contents

The Gil ibrator

Section 1
Introduction

The Gilibrator is a high accuracy, electronic bubble flowmeter that provides instantaneous air flow readings and a cumulative averaging of multiple samples. The Gilibrator system provides a large dynamic range through the use of 3 interchangeable flow cell assemblies. A delete function, on the Control Unit, subtracts eroneous readings to insure accurate data. The Control unit also supports a hard copy print out through the use of a printer accessory-.

Section 2
General Description (See fig. la)

The Gilibrator is comprised of the following basic components: Flow Cell Assembly, Control Unit (base), Battery Charger and Soap Solution. Different sized inter-changeable Flow Cell Assemblies are available for use as follows:

Low Flow	: 1 to 250 cc/min.
Standard Flow	: 20 cc/min to 6 LPM
High Flow	: 2 to 30 LPM

In addition to the basic components, an optional Printer Module is available. The printer provides a hard copy record of calibration data, however, identical data is displayed on the LCD of the Cilibrator Control Unit during calibration.

1. Flow Cell Assembly (See fig. lb)

The Flow Cell Assembly consists of a Bubble Generator and Sensor Block. Each Bubble Generator is sized to produce a bubble film stretched across the diameter of the flow cell tube which is carried by airflow from the bottom to top of the tube. As the bubble traverses past two infrared sensors, each sensor transmits a signal to the Control Unit (base) indicating the passage of the film. The Flow Cell Assembly incorporates a manual bubble initiation push button which starts the film on its travel up the tube.

A. Bubble Generator

1) Flow Ranges

Low Flow	: 1 to 250 cc/min.
Standard Flow	: 20 cc/min to 6 LPM
High Flow	: 2 to 30 LPM

2) Pulsation Damper (2) - a built-in damper smoothes out any pulsation' within the airflow and reduces occilation of the bubble film assuring maximum accuracy.

3) Bubble Initiate Button (22) - This pushbutton lowers the Bubble Generator Ring (21) into the soap solution reservoir. Upon releasing the button, the ring lifts out of the soap solution and a film bubble is generated across the opening of the flow tube (24).

4) Bubble Breaker (4) - The Bubble Breaker is a secondary chamber in the upper chamber which provides the soap film a rapid expansion path which is instrumental in breaking the bubble. 'This prevents excessive wall wetting by the soap film and allows it to flow back into the cell.

5) Storage Tubing (25) - This anti-spill tubing connects upper and lower cell chambers and prevents the soap solution from evaporating which may cause the solution concentration to change.'

CAUTION: If transporting by plane, be sure to disconnect this hosing from upper or lower Flow Cell Chamber Bosses (23 & 26) to prevent pressurization and possible rupture within the Bubble Generator.

B. Sensor Block (8)

Surrounding the flow tube (24) and secured between the upper and lower chamber of the bubble generator, is the Sensor Block (8). The blockincorporates lower and upper sensors for time start and time stop. Thesensors consist of an infrared emitter and detector pairs whose sensitivity and accuracy is controlled by a "columnating slot". This block is secured to the Bubble Generator Assembly (1) by means of two Locking Screws ((7) and allows easy removal to facilitate cleaning.

1) Electrical Interface - The Electrical Interface provides power to the sensing system as well as transmits timing information to the Control Unit.

2. The Control Unit (base) (See fig. la)

The Control Unit (14) contains a crystal controlled timing system, a micro processor control system, and an LCD readout for displaying flow and messages. The Control Unit also contains switches for Reset (17), Delete (16) and Auto-Averaging (15) functions as well as an Printer Jack (18) interface port for direct connection to a hard copy printer. LED indicators are provided to note Charging (11) and Run calibration (20) operation.

a) Power (12) - switch turns the Control Units power on and off.

b) Charge Indicator LED (11) - lights when the charger is plugged into the Charging Jack

c) Printer Jack (18) - provides interface for auxillary printer.

d) Reset (17) - push button deletes all current information for the micro processor in order to initiate a new sequence.

e) Delete (16) - push button automatically deletes false information from the average and will reset the average and sample number to the previous reading. When a printer is in line, this will indicate a minus symbol and the average will return to the previous value.

f) Average (15) - push button when pushed and held will display the average of the previous sequence of readings. When released will display the last actual reading and when re-pushed and held, will show the number of samples in the sequence with display information (S=sample #). Releasing the button will automatically bring the display back to the last reading.

g) Sequence Run Indicator LED (20) - indicates bubble sequence by lighting as the bubble passes between the two sensors. The LCD (19) will be blank. The Run signal will also light when turning on the Control Unit and will extinguish after unit has finished it's initial sequence check.

h) Low Battery - will indicate on the LCD display (19) if insufficient battery voltage is available to operate the unit properly. Since power for all Control Unit functions is derived from the rechargeable NiCad battery, the batteries must be fully charged for proper operation. A "Low Battery" indication will also appear initially when turning the Control Unit ON as a sequence check of the unit's electronics.

i) Cable Assembly (5) - mates with the Connecting Jack (6) in the back of the Sensor Block. It provides power for the sensing system, information regarding cell size , and control of the timing information to the micro processor.

j) Timing System - The quartz controlled timing'system controls infra-red sensor activation to assure maximum calculation accuracy.

k) Micro Processor - controls the timing and mathematical data processing to provide optimum flow measurement characteristics. This programmable micro processor can be upgraded as new programs become available.

3. Battery Charger

Standard wall operated 120V charger to charge Gilibrator Control Unit for 14 hours prior to operation. The Charging LED on the Control Unit will be illuminated while charging is in progress.

4. Soap Solution

This specially compounded low residue soap is specifically designed to provide high film strength and compatibility with the materials used within the Flow Cell Assembly.

The Gilibrator

Nomenclature

1. Bubble Generator Assembly
2. Damper Plate
   2a. Pulsation Damper
   2b. "O" Ring
3. Spacer
4. Plate, Bubble Breaker
5. Cable Assembly
6. Sensor Block Connecting Jack
7. Sensor Block Locking Screw
6. Sensor Block
9. Base Plate Assembly

10. Mounting Base
11. Charging Indicator
12. On - Off
13. Charging Jack
14. Control Unit
15. Average & Sample # Switch
16. Delete Switch
17. Reset Switch
16. Printer Jack
19. LCD Display
20. Run Indicator
21. Bubble Generator Ring
22. Bubble Initiate Button
23. Air Inlet Boss
24. Flow Tube
25. Storage Tubing
26. Air Outlet Boss

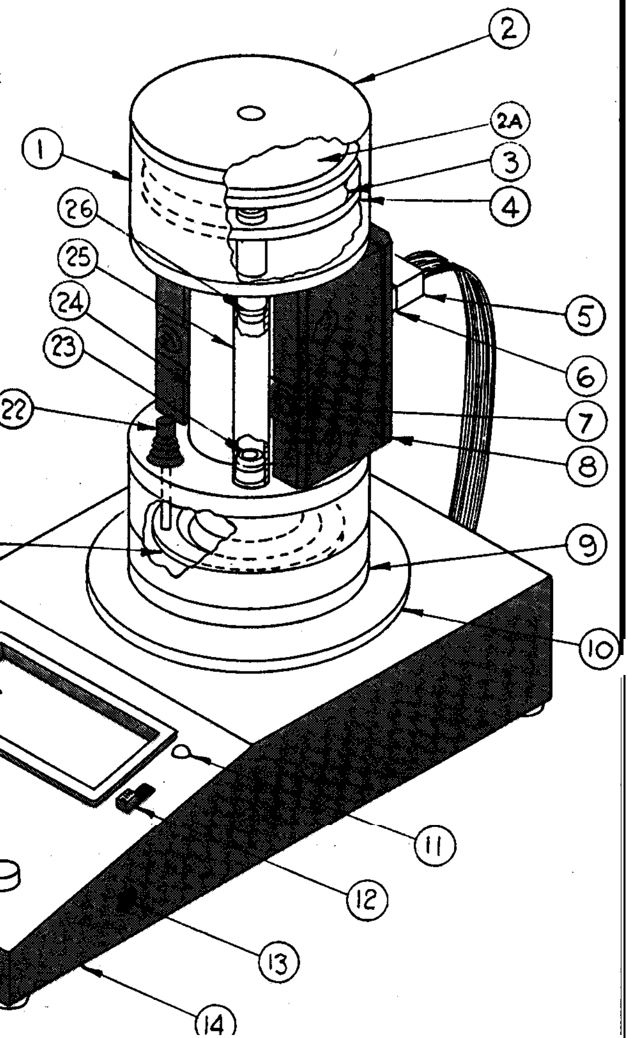
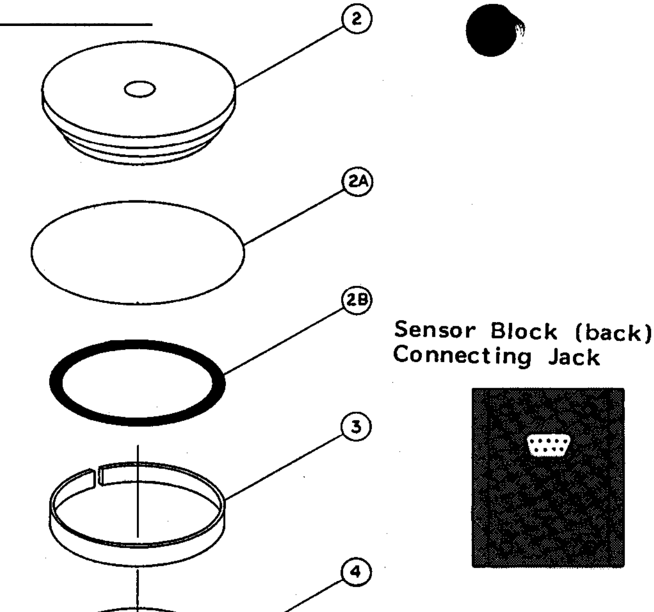


Figure la

The Gilibrator System
The Flow Cell Assembly

Nomenclature

1. Bubble Generator Assembly
2. Damper Plate
   2a. Pulsation Damper
   2b. "O" Ring
3. Spacer
4. Plate, Bubble Breaker
7. Sensor Block Locking Screw
a. Sensor Block
9. Base Plate Assembly
   9a. "O" Ring
21. Bubble Generator Ring
22. Bubble Initiate Button
23. Air Inlet Boss
24. Flow Tube
25. Storage Tubing
26. Air Outlet Boss
27. Safety Tape



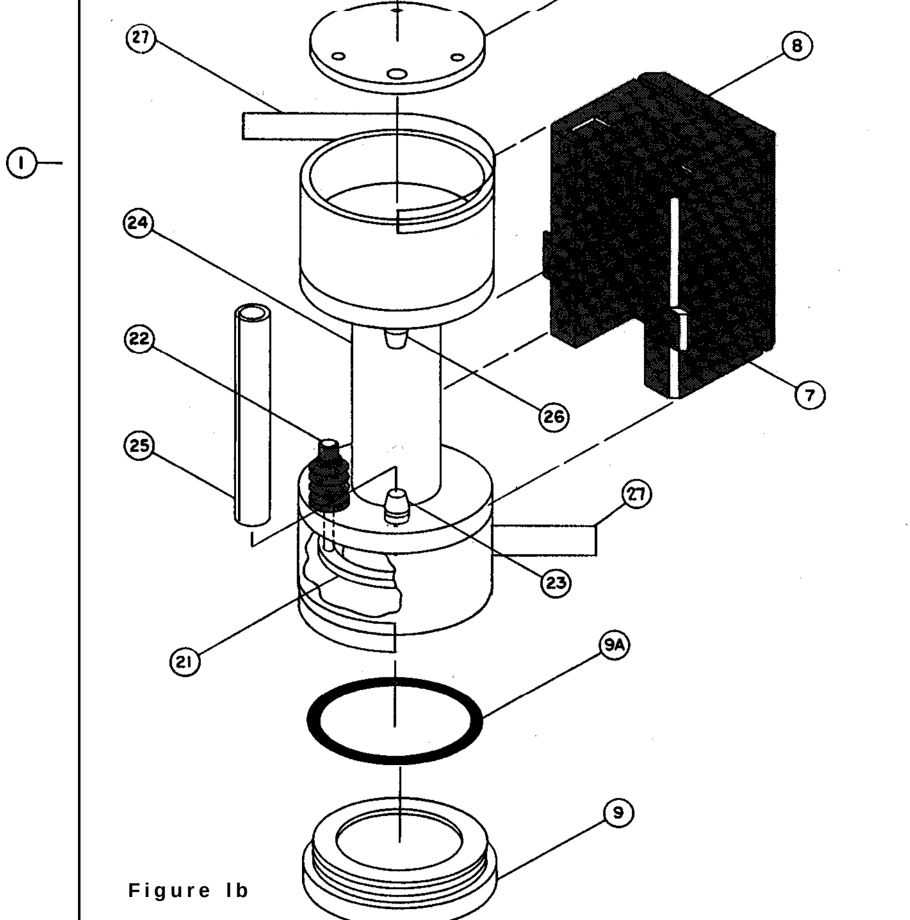


Figure lb

Section 3
Theory of Operation

1. Primary Airflow Standard

To be a primary standard, all values must be absolute and measured as absolute. A primary standard airflow measurement is a volume divided by a time interval as performed by the Control Unit of the Gilibrator. The volume, V, is measured volume of space between two infrared sensors. The time is that interval needed for a soap film bubble to traverse between the two sensors which bound the volume. Therefore, V/t, the volume per unit of time, becomes the airflow and is prime because all measurements are basic... volume and time. In today's technology, time is measured by an electronic clock whose accuracy exceeds that of volume measurements by orders of magnitude, hence, the control accuracy volume resides solely with volume measurements.

2. Bubble Generation and measurement

a) The Gilibrator consists of two elements, the Flow Cell Assembly and the Control Unit (base). The function of the Flow Cell Assembly is to generate a clean consistent bubble which traverses up the flow tube. Measurement of the traverse time is done by infrared sensor pairs which are mounted at the bottom and the top of the Sensor Block. The volume bound by these sensors is specifically adjusted to a volume standard by allowing the upper sensor blocks to move in unison so as to enable this calibration to be set accurately to a primary volume standard, A second function of the sensor block provides the interfacing code to define the cell volume as well as sensitivity adjustments for the optical sensor systems.

b) As the bubble traverses between the sansors, first one and then the second, sensors are tripped thereby providing the time for the bubble traverse. This timing information is sent to the micro processor of the control base which in turn provides the crystal control time base for the system. The timing information along with the volume information are then sent to the micro processor which in turn does the necessary mathematical calculations which allow the flow to be displayed directly on the LCD readout. In order to insure the highest accuracy possible, a Delete and Average function are provided on the Control Unit. The Delete allows for subtracting out an obvious malformed bubble and the average allows the user to obtain average information without pencil or paper. A printer interface allows connection of a Printer Module so that hard copy can be produced.

Section 4
Operating Procedures

1. Initial Set-up

This covers all steps necessary to bring the Gilibrator into operating status. This includes charging, cell mounting, installing soap solution, connecting the printer (optional) and connecting the sampling source.

A) Charging the Gilibrator

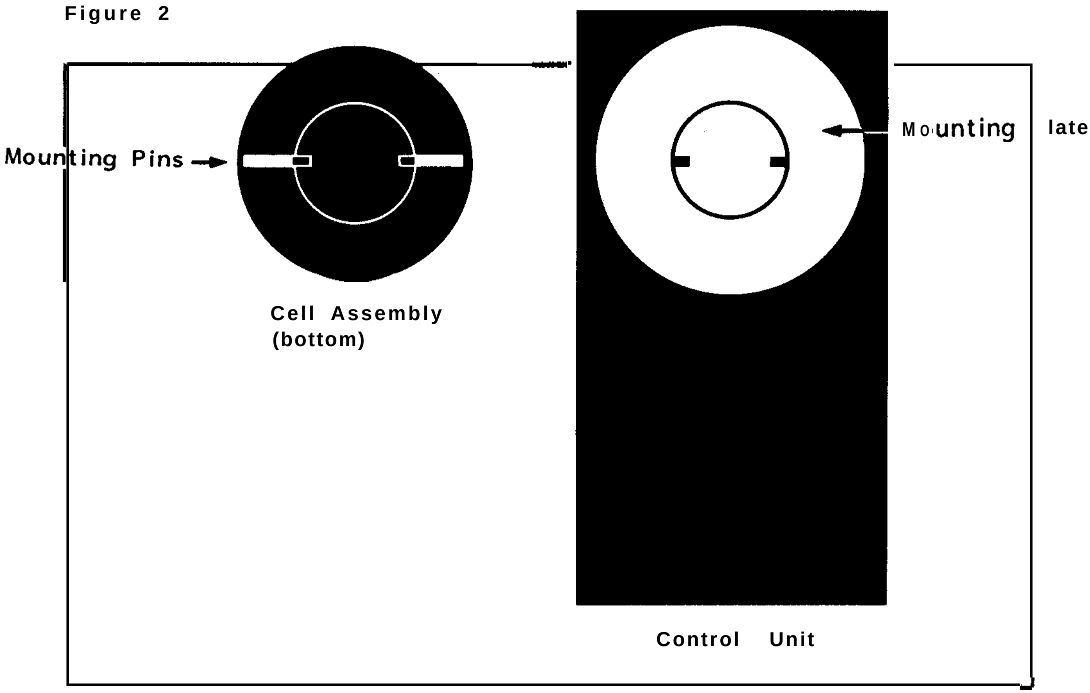
1. Prior to operation, plug the 120V charger into the wall and connect to the Charging Jack (13) on the right side of the Control Unit. The unit's Charging LED (11) will light indicating that the unit is charging properly. Allow the battery system to charge for 14 hours prior to operation.

B) Mounting the Flow Cell Assembly (See fig. 2)

1. Select the Flow Cell Assembly to cover the flow range required.

2. The bottom of the Flow Cell Assembly employs a quick mount feature. The base of the Flow Cell Assembly is positioned onto the mounting plate (10) of the Control Unit (14).

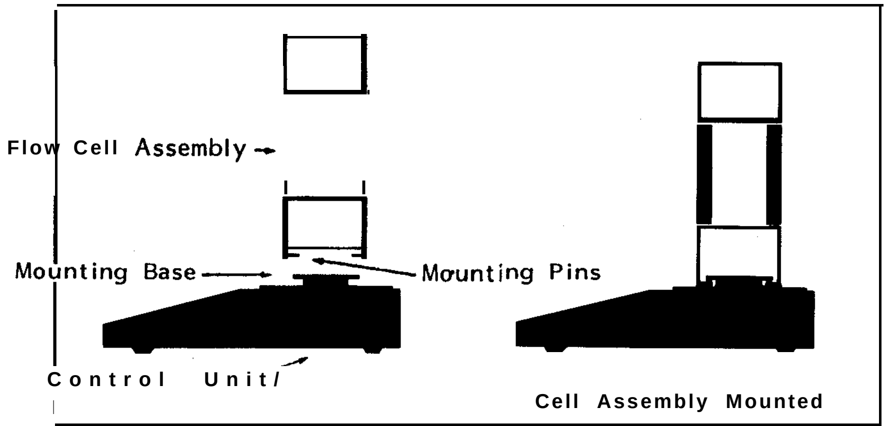
Figure 2



a

3. Engage the pin of the cell assembly base into the mounting plate of the Control Unit. When the Flow Cell Assembly is properly engaged, the base of the cell will be flush to the mounting plate and the cell assembly will face towards either the right or left side. (See fig. 3)

Figure 3



4. Grasp the bottom cell chamber and rotate the cell until it clicks in. CAUTION: Always engage & disengage the cell by grasping and rotating <u>only</u> the bottom cell chamber. The cell assembly will now face forward. (see Fig. 4)

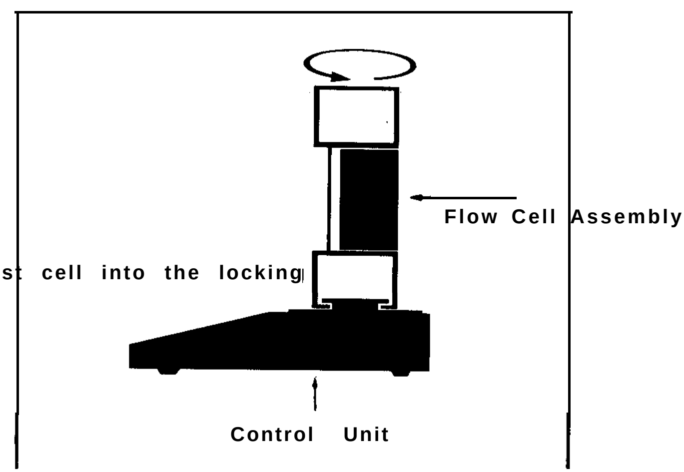
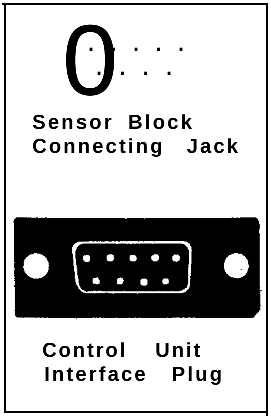


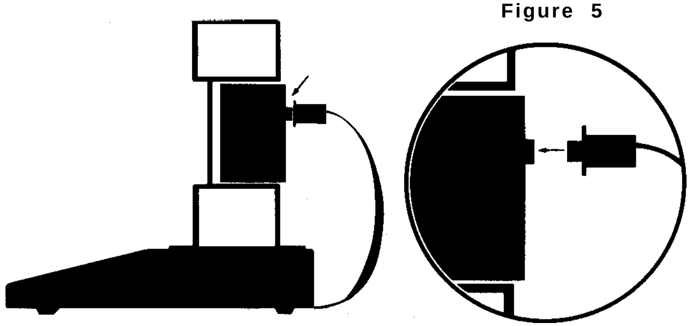
Figure 4

Firmly twist cell into the locking position

5. Insert the Control Unit's Cable Assembly (5) into the Sensor Block Connecting Jack (6) located on the back of the Sensor Block (8). (See fig. 5)

Figure 5





Connecting the Control Unit's Interface Plug to the Sensor Block's Connecting Jack.

C) Adding the Gilibrator Soap Solution

1. Remove the Storage Tubing (25) from the upper Outlet Boss 26) of the upper cell. Fill the dispenser bottle provided with Cilibrator soap solution. Using the rubber Storage Tubing as a funnel, slowly add soap solution from the dispenser.

2. The amount of soap needed is determined by depressing the Bubble Initiate Button (22) and holding it down in the lower position. Continue to add enough soap solution until the angled edge at the bottom of the Bubble Generator Ring (21) is immersed in the solution. Do Not Overfill! (See fig. 6)

3. After filling is completed, the rubber Storage Tubing (25) may be removed completely. Recap the soap dispenser bottle for later use. **NOTE:** If the Flow Cell Assembly is not going to be used for a prolonged period of time, reinstall the rubber Storage Tubing between the inlet and outlet bosses (23 & 26). This will prevent evaporation from occurring which may cause the solution's concentrations to alter.

D) Printer Connection (if applicable)

1. Connect printer cable to Printer Jack connector (18) on the left side of the Control Unit. Be sure to properly match up connectors before engaging.

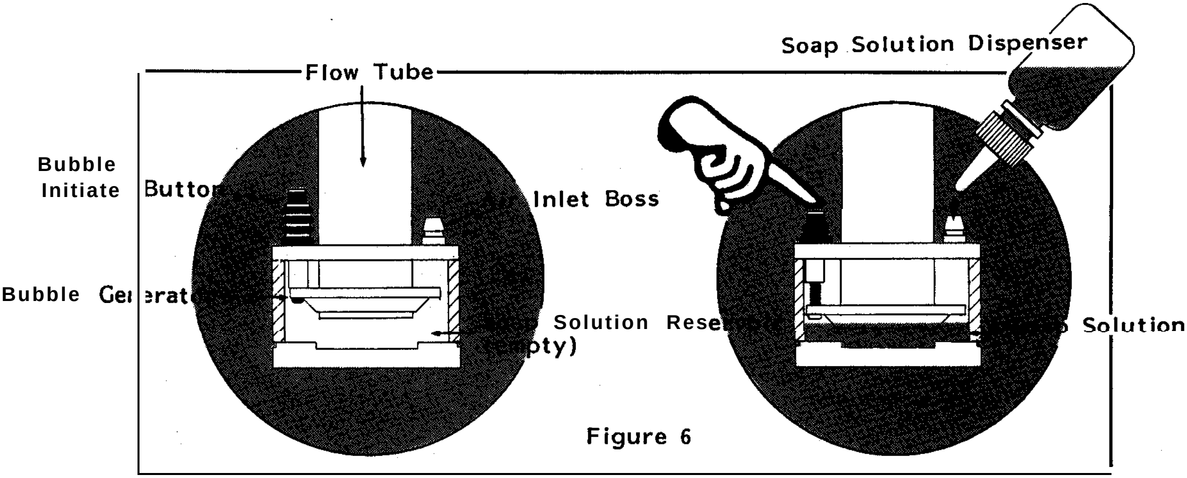


Figure 6

E) Connect the Sampler

1. Connect the air sampler to be calibrated to the Upper Outlet Boss (26) of the Flow Cell Assembly with 1/4" ID tubing. NOTE: An auxillary liquid trap between sampler and flow cell is recommended to prevent moisture carry over into the sampler during continuous calibration periods.

2 . <u>Operation</u>

A) Conditioning the Flow Tube

1. Turn on the sampler. Depress the Bubble Initiate Button (22) several times to wet the inner walls of the flow tube (24). You will not be able to initiate a timing bubble without first "Priming" the flow tube. The operator will develop a feel for bubble generat ion with practice.

B) Power Up

2. After the Flow Tube walls have been "primed", turn on the Power Switch (12) of the Cilibrator Control Unit (base) and the Printer Module if one is being used. Wait approximately 10 seconds while the system runs through it's check sequence. The Run LED (20) will light at this time as well as a Lo Battery indication and a series of five dashes displayed on the LCD Readout (19). Do not operate the Cilibrator until the Run LED signal extinguishes. Ready operation is indicated by a series of 4 <u>dashes</u>.

C) Bubble Generation

1. For optimum bubble generation, depress the Bubble Initiate Button (22) and hold to initiate 1 bubble up the flow tube. Release the button to initiate a second bubble up the flow tube. This will be the standard procedure to making clean, consistent bubbles at High and Medium flow ranges.

2. As the bubble rises up the Flow Tube (24), it will initiate a timing sequence when it passes the lower sensor (Run LED will light) and culminate the timing sequence upon passing the upper sensors (Run LED will extinguish). The timing information is then transmitted to the control unit which will perform all the necessary calculation. A flow reading will instantaneously appear on the LCD display (19).

However, if a bubble breaks before the time sequence is completed, timing will continue until another bubble is generated to trip the second sensors. This will cause an erroneous reading and should be subtracted from the average by hitting the Delete Button (16).

If a Printer Module is used, be sure the printer has completed it's printing sequence before pressing the Delete Button. When the Delete Button is activated, a negative symbol will be displayed on the LCD of the Control Unit and the printer will initiate a line showing this subtraction.

D) Flow Readout

With Printer Option - The printer will print in sequence the flow, average and sample number of each successive bubble reading.

Without Printer Option - The Control Unit will display the actual flow for each sample and will accumulate and average each successive reading.

1. Average (15) - In order to display average and number of samples, depress and hold the Average Button. Releasing the button will display the last flow reading. Repressing the button will display the number of samples accumulated for that averaging sequence and releasing will once again display the last flow reading. Additional pressing and holding will repeat this sequence.

2. Delete (16) - To delete obvious false readings, push the Delete Button which will automatically delete the false information from the average and reset the average and sample number back to the previous reading.

3. Reset (17) - To reinitiate the sequence for additional pumps, hit the Reset Button. This will zero out all sample and average registers within the Control Unit and will cause the printer to index one line and reprint sequence headings. This denotes the start of a new sequence. The Reset Button is also used if a malformed bubble is generated and has not been been subtracted from the average by use of the Delete Function.

Section 5
Storage & Maintenance

1. Storage

A. Take Down

Turn OFF the Control Unit, the sampler and the Printer Module [if applicable).

B. For Daily Use

If Cilibrator is to be used daily, it is recommended that the air sampler be removed and the Storage Tubing be replaced between the upper and lower cell chambers. Plug in the Charger and connect into the Control Unit Charging Jack (13). Recharge overnight for next day usage.

C. Long Term Storage

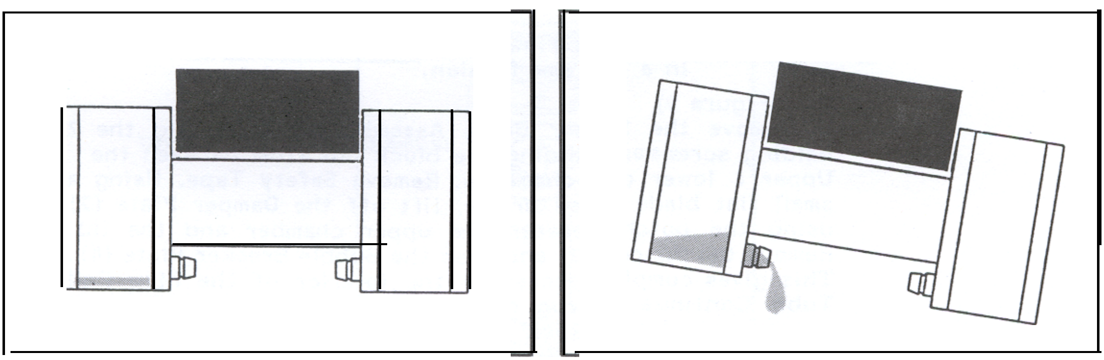
If the Cilibrator is not to be used for long periods of time, the following steps should be taken to keep the unit in proper working order.

1. Disconnect the Cable Assembly from the back of the Sensor Block on the Flow Cell Assembly.

2. Remove the Flow Cell Assembly from the Control Unit (base). Remove the Cell from the base in the reverse order in which it was mounted.

3. Pour soap solution out of the Bubble Generator through the Lower Inlet Boss (23) By holding Bubble Generator horizontally and with the inlet boss facing down, tilt at a 45 degree angle. Continue until all of soap solution has poured out. (See fig. 7)

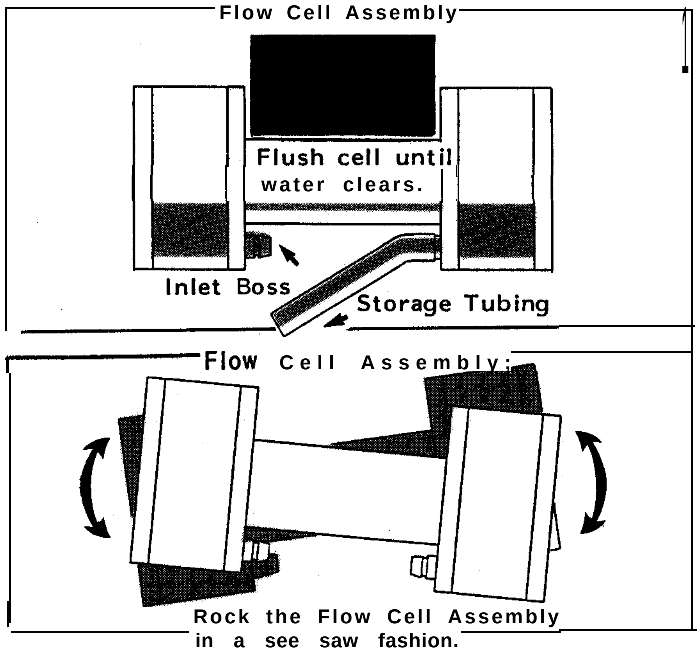
Figure 7



4. Flushing the Bubble Generator Clean - There are 2 methods in which to cleanse the Bubble Generator.

a. The unit may be flushed clean by connecting Storage Tubing to the Upper Outlet Boss and continuously running water through the generator until water runs clear. Maintain a horizontal position with cell bosses facing down and flush for 15 - 30 seconds. Then remove tubing and rock the cell in a see-saw fashion to empty out all excess water. Replace Seal Tubing between the Upper and Lower Cell bosses. (See fig. 8)

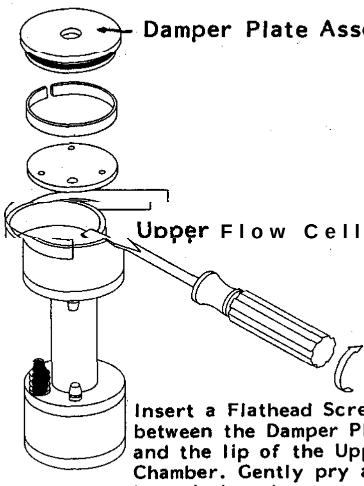
Figure 8

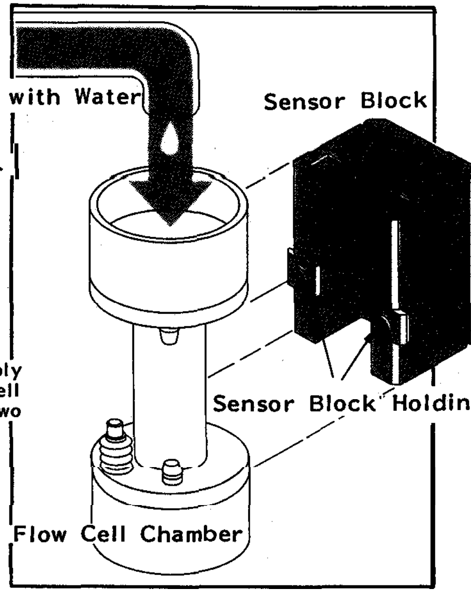


or (see Figure 9)

b. Remove the Sensor Block Assembly by loosening the 2 holding screwsand sliding the block out from between the Upper & lower cell chambers. Remove Safety Tape. Using a small flat blade screw driver, lift off the Damper Plate (2) using the notch between the upper chamber and the lid. Remove the Spacer (3) and then the Bubble Breaker Plate (4). This gives completeaccess to the interior of the Flow Cell Tube. Continue to run clear water through the cell until water runs clear. Rock cell to empty out all excess water. Replace the Bubble Breaker Plate (4) and center the Air Outlet Boss (26) with the plates largest hole. Next insert the spacer. To replace the Damper Plate assembly, moisten the O-ring (2b) with soap solution and then press the Damper Plate into the top of the Upper Cell Chamber.Use fingers and firmly sqeeze plate into upper flow cell chamber.

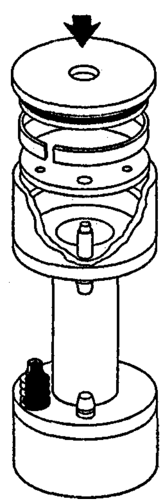
Figure 9





Do Not exert your body weight on the Bubble Generator to press plate into place. Excessive weight on the flow cell may result in breakage.

Replace the Seal Tubing between the Upper and Lower cell bosses for storage.



2. Maintenance

The Cilibrator is designed so that little maintenance is required. The area which may need replacement is the Damper Diaphragm assembly. If the diaphragm becomes ruptured or worn please use the following procedure for its replacement.

a. Removing and Replacing Damper Plate Diaphragm

First, remove flexible Safety Tape (27) from around the lip of the Damper Plate assembly. 1) Using a small flat blade screwdriver, remove the Damper Plate (2) from the Upper Cell Chamber using the notch provided. Remove the large O-ring (2b) and the Pulsation Damper diaphragm (2a). (See fig. 10)

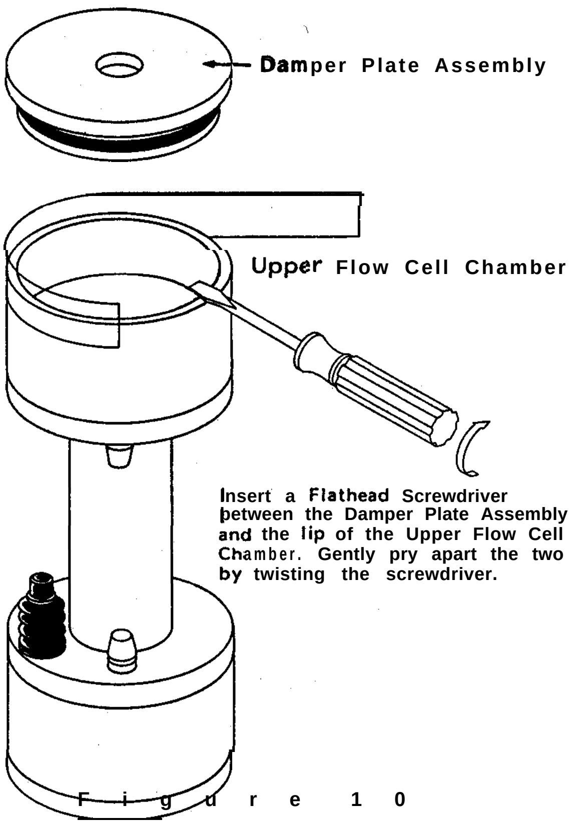
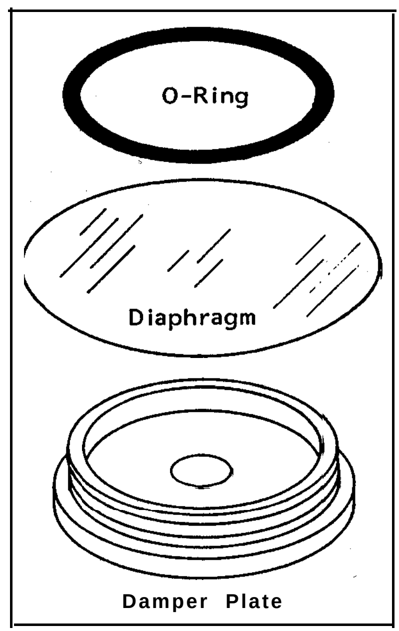


Figure 10

Figure 11



2) To replace, center new diaphragm over Damper Plate aperture and roll O-ring over diaphragm and into the O-ring groove. If wrinkles occur, repeat the procedure to achieve a smooth placement. (See fig. 11)

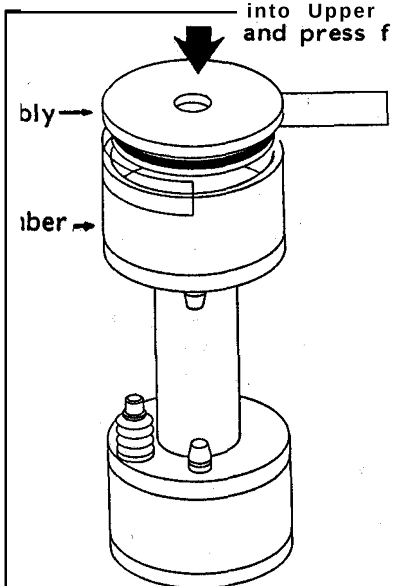


Figure 12

Bubble Generator Assembly

3) Wet "O"-ring of Damper Plate & press into the Upper Cell Chamber firmly. (see Fig. 12)

4) Replace Safety Tape around lip of plate and the upper flow cell chamber.

b. Leakage Check - The system should be leak checked at 6" H20 by connecting a manometer to the outlet boss and evacuate the inlet to 6" H20. No leakage should be observed.

c. Cleaning - To clean the exterior of the Bubble Generator use a mild detergent and warm water. NEVER USE ALCOHOL, ACETONE OR ANY OTHER HARSH CLEANERS TO CLEAN THE BUBBLE GENERATOR.

d. Transportation - When transporting the Gilibrator, especially by air, it is important that one side of the seal tube which connects the inlet and outlet boss, be removed thereby allowing for equalizing internal pressure within the generator. Do Not transport unit with soap solution or storage tubing in place.

CAUTION: Do Not Pressurize the Flow Cell! Excessive pressure may cause cell to rupture resulting in personal injury.

Section 6
Printer Module Operation
Part # C-800274

1. Introduct ion

The Cilibrator Printer provides a hardcopy record of all calibration data, identical to data calculated and displayed on the LCD readout of the Gil ibrator Control Unit (base).

Handling Precautions

a. Do not use where the temperature is extremely hot or cold.
b. Do not leave in direct sunlight or where it is dusty.
c. Do not operate near liquids or beverage.
d. Do not operate without the heat sensitive roll paper loaded.
e. Use only specified Cilian Replacement Roll Paper (A-400681).
f. Do not attempt to disassemble the unit.

NOTE: The printer should <u>only</u> be used with the Cilian Interconnect Cable providedwhich supplies the *power for the printer. Use of this printer with any other cable may cause permanent damage to the printer and to the equipment from which the cable is connected.
The use of a non-shielded interface cable with the printer is prohibit-ed.

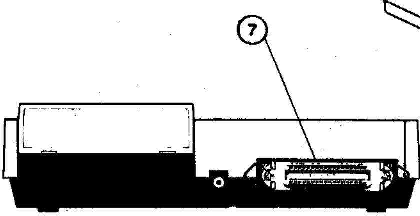
2. General Description (See fig. 13)

The Printer is comprised of the following basic components: The Printer Module (1), Interconnect Cable (2) and the Thermal Roll Paper. A brief description is provided of their use and operation.

The Gil ibrator System
The Printer Module Assembly

Nomenclature

1. Printer Module
2. Printer Interconnect Cable
3. Thermal Paper Cover
4. Paper Cutter
5. Paper Feed
6. Power (On-Off)
7. Parallel Interface Connect0r



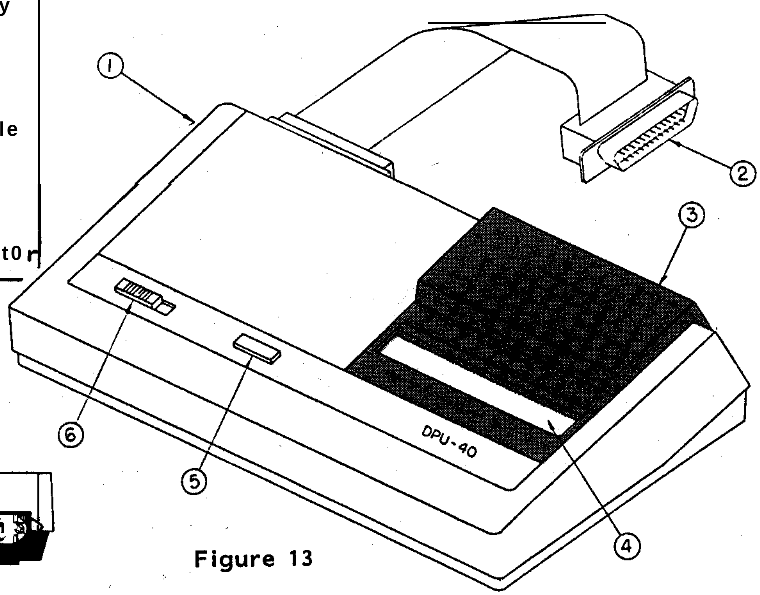


Figure 13

a) Printer Module

1. Power (6) - This switch activates operation of the printer from the Control Unit's power source. The printer will initially print a heading line upon activation.

2. Paper Feed (5) - This switch is used to feed the Thermal Paper continuously. Press it lightly. Note: Use the Paper Feed switch to feed out the paper. If paper is pulled out by hand, always feed it one line with the Paper Feed Switch before starting printing.

3. Paper Cutter (4) - This is used to tear of the paper. Tear off by pulling it in the arrow direction only.

b) Thermal Paper - A specially treated paper which is activated by the printer head.

c) Interconnect Cable (2) - The interconnect cable provides electrical connection between the printer (1) and the Gilibrator Control Unit (14). The printer operates from the same power source as the control unit.

3. Theory of Operation

The Printer Module is powered and interfaced to the Control Unit of the Cilibrator by means of an Interconnect Cable. During a test series, the Control Unit transfers the sum of calculations of a given calibration bubble and provides the flow rate, the sample number and an average of the successive flow rates determined in that calibration series.

The buttons on the Control Unit are used in conjunction with the Printer module during calculation. Delete, Auto Average and Reset buttons are provided to subtract false readings and to initiate new calibration sequences.

Calculations are automatically provided by the Control Unit and transferred to the printer for a hardcopy readout. This is printed onto a thermal sensitive roll paper which advances a single line after printing out each successive reading. These hard copy calculations are retained for calibration records.

4. Operation Procedures

a) Initial set-up

1. Connecting the Printer

a) While the Gilibrator Control Unit is in the OFF mode, connect the large end of the Interconnect Cable (2) to the Printer Modules Parrallel Interface Connector and snap holding clips in place. Connect the smaller end to the Control Unit's Printer connect port. Power is supplied to the printer from the Control Unit's battery system.

2. Turn ON the Control Unit and the Printer Module.

3. Installing the Thermal Paper (See fig. 14)

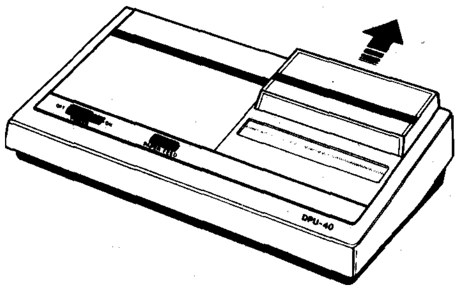
a. Sl ide back and remove the Thermal Paper Cover (3) from the printer section. (see Fig. 14)

b. Use the special Gilian heat sensitive roll paper (A-400681).

c. Cut the end of the paper in a half circle or triangular shape.

d. While inserting the end of the paper, press the Paper Feed Switch (5) until the paper is fed out. Replace protective paper cover. (see Fig. 15)

) Remove the heat sensitive roll paper cover.



2) Cut the end of the heat sensitive paper a shown below.

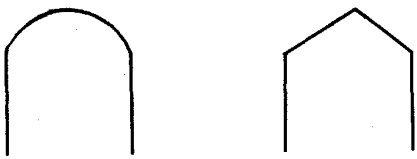


Figure 14

(3) While inserting the end of the heat sensitive roll paper in the direction of the arrow, press and hold the paper feed switch until the paper is fed out. Since the outside of the heat sensitive roll paper is coated with a heat sensitive agent, pay careful attention to the front and back of the paper.

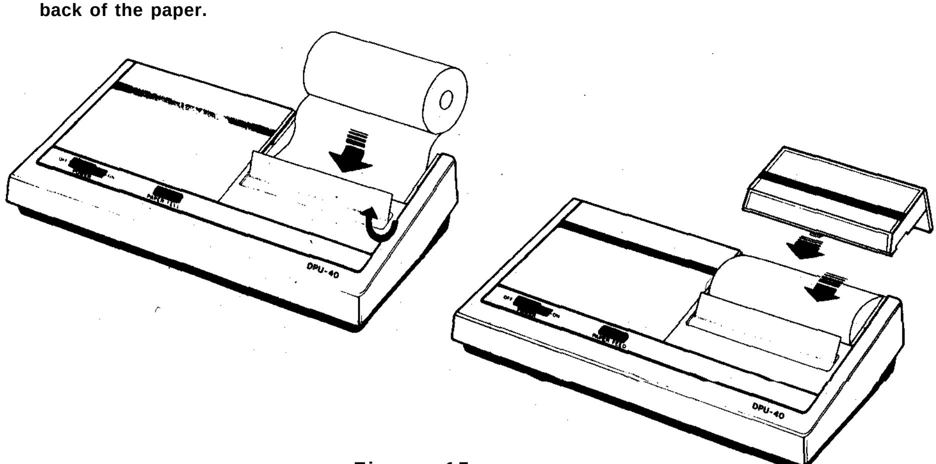


Figure 15

b) Operation

1. Start Sequence

a. Turn the Control Unit ON. The Printer Module will print out an identification heading for the current calibration test. The program version is indicated after the identifica- t ion line for future reference. See sample below.

b. Initiate a bubble up the Flow Tube and observe the reading on the Control unit and also on the Printer Module. The Printer will print in sequence the flow, average and sample number after each successive reading.

NOTE : If you do not need a hard copy printout from the Printer Module, turn it OFF. This will preserve the battery life of the Gilibrator as the printer is powered by same.

2. The Average, Reset and Delete buttons on the Control Unit are used in conjunction with the printer during calibration. They are as follows:

a) Average - In order to display average and number of samples, depress and hold average button. Releasing the button will display the last reading. Repressing will display the number of samples accumulated for that averaging sequence. Releasing the button will once again display the last flow reading. Additional pressing and holding will repeat this sequence.

b. Reset - To reinitiate the sequence for additional pumps,hit the Reset Button. This will zero out sample and average regis- ters within the Control Unit and will cause the printer to index one line and reprint headings. This denotes the start of a new sequence. The Reset Button may also be used if a malformed bubble is generated and has not been been subtracted from the average by use of the Delete Function.

c.Delete - To delete obvious false readings, press the Delete Button and subtract the false reading from the average. This resets the average and sample number back to the previous reading.

5. Storage & Maintenance

a) Storage (Daily Take Down)

1. Turn the Power of the Printer Module OFF. All data stored in the printer cannot be reviewed once this is done.
2. Turn off the Power of the Control Unit.
3. Turn off the Power of the Sampler being calibrated.

b) Storage (Long Term) - If the Printer Module is not to be used for long periods of time, the following steps should be taken to keep the unit in proper working order.

1. Disconnect the interconnect cable from the Control Unit and from the Printer Module.
2. Store in original packaging or carrying case.

c) Cleaning - Use a damp cloth with warm water. Never use ALCOHOL, ACETONE or any other harsh cleaners.

Section 7

Specifications for the Gilibrator System

Flow Cell Assembly Ranges Available

High Flow Cell 2 - 30 LPM
Standard Flow Cell 20 cc/min. - 6 LPM
Low Flow Cell 1 - 250 cc/min.

Operational Features

Direct Flow Readings - The easy to read LCD read-out on the Control Unit (base) instantly displays flow readings.

Auto Averaging - A switch on the Control Unit provides Auto-Averaging of the successive flow readings.

Flow Delete Function - A Flow Delete switch allows the user to delete erroneous flow readings from the Auto-Averaging function. For example, if a double bubble or other obvious malfunction is observed, that reading can be subtracted from the auto-average and will automatically reset the average to it's previous value.

Programmable Update - The micro-processor electronic design allows programmable updates to assure a long useful service life.

Mechanical Features

Pulsation Damper - The pulsation damper removes pulsation from the flow source for higher accuracy sampling as well as eliminating pulsations back into the flow source during bubble generation.

Ring Bubble Generator - The Ring Bubble Generator lifts an even soap film from the soap reservoir and provides consistent bubble generation.

Bubble Breaker - The Bubble Breaker design allows the soap film to be drawn away form the end of the flow tube before bursting. This improves flow measurement accuracy by minimizing film residue within the flow tube.

Programmable Update - The electronics design allows programmable updates to assure a long, useful service life.

Accuracy - Better than 0.5%

Section 7 (cont'd)
Gilibrator Printer Module Specifications

Printing System **Thermal dot matrix**	Character Font **7x5 dot matrix**
Character Spacing **2 dots**	Character Size **2.4 (vertical) x 1.1 (horizontal) mm**
Character Set **159 Alphabetic (upper and lower case), numeric, Kana, symbols**	Paper **Thermal Paper width 80 ± lmm, roll diameter 40mm reorder Gilian Thermal Paper (3 rolls A-400681)**
Printing Direction **Left - right**	Printing Speed **0.6 line/second**
Number of Columns **40 columns/line**	

Section 8
Parts List

		Part #
High Flow Kit(	(2-30 LPM)	D-800270
Standard Flow Kit	(20cc - 6LPM)	D-800271
Low Flow Kit	(l-250 cc/min)	D-800272
Deluxe		D-800275
High Flow Cell Assembly only		D-800265
Standard Flow Cell Assembly 'only		D-800266
Low Flow Cell only,		D-800267
Safety Tape (10 ft.)		B-800331
Control Unit (base)		D-800268
Printer Module		C-800274
Printer paper (3 rolls)		A-400681
Battery Charger (120v)		B-400674
Flow Cell Soap		A-400450
Soap bottle dispenser		A-400667
Tubing		B-800269
Carrying Case		D-800273

Section 9
Warranty

The Seller warrants to the Purchaser that any equipment manufactured by it and bearing its nameplate to be free from defects in material or workmanship, under proper and normal use and service as follows: If, at any time within 90 days from the date of sale, the Purchaser notifies the Seller that in his opinion the equipment is defective, and returns the equipment to the Seller's originating factory prepaid, and the Seller's inspection finds the equipment to be defective in material or workmanship, the Seller will promptly correct it by either, at its option, repairing any defective part or material or replacing it free of charge and returned shipped lowest cost transportation prepaid (if Purchaser requests premium transportation, Purchaser will be billed for difference in transportation costs). If inspection by the Seller does not disclose any defect in material or workmanship, the Seller's regular charges will apply. This warranty shall be effective only if installation and maintenance is in accordance with our instructions and written notice of a defect is given to the seller within such period. This warranty is exclusive and is in lieu of any other warranties, written, oral or implied; specifically , without limitation, there is no warranty of merchantability or fitness for any purpose. The liability of the Seller shall be limited to the repair or replacement of materials or parts as above set forth.

Limitat'ion of Liability

The Seller shall not be liable for any claim for consequential or special loss or damage arising or alleged to have arisen from any delay in delivery or malfunction or failure of the equipment. The Seller's liability for any other loss or damage arising out of or connected with the manufacture, sale or use of the equipment sold, including damage due to negligence, shall not in any event exceed the price of the equipment supplied by us.

Service Policy

For a minimum fee of $95.00, Gilian Instrument Corp. will overhaul, repair and/or replace minor components, and recalibrate one Cilibrator. Gilian reserves the right to proceed with additional repairs up to a maximum cost of $130.00 per Gilibrator without notifying the customer. If major components must be replaced, Gilian will notify the customer before proceeding with repairs.

When the instrument(s) is returned, please include a purchase order marked "Repair Cost not to Exceed $100. Without Customer Authorization". Also include company name, return shipping address, contact name and phone number, serial number(s) of calibrators, date of purchase and description of problem. Return to:

Gilian Instrument Corp.
35 Fairfield Place
W. Caldwell, NJ 07006-6206
Att: Gilibrator Repairs Dept.