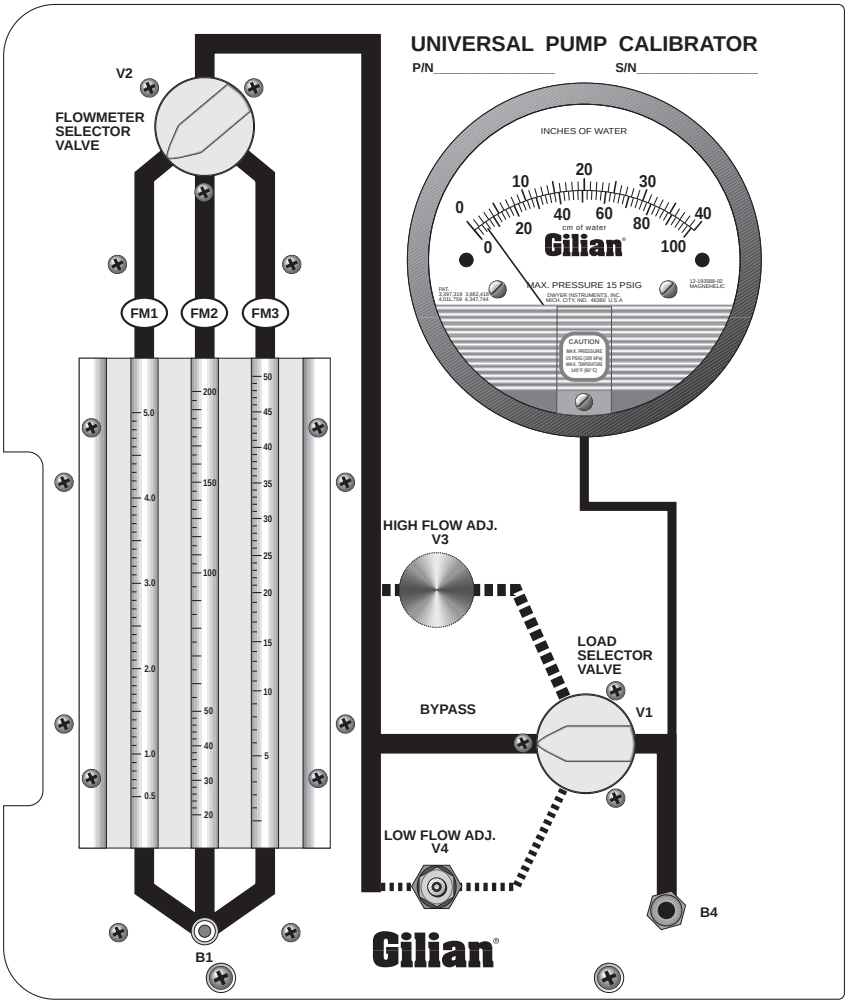
Gilian® LAB & FIELD CALIBRATOR SYSTEM



INSTRUCTION MANUAL

for the following models:

800565-(*)
800573-3
800783-3
800884

SENSIDYNE®

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Revision C • Document No. F-PRO-1260

PACKING LIST

The following items are shipped with the **Gilian Lab & Field Calibrator System** :

- Calibrator Panel (with 3 rotameter flow tubes)
- Carrying Case †
- Sampling Pump †
- Gilibrator-2 Precision Flowmeter †

† Not included with Calibrator Panel only model (PNº 800573-3) or Lab Stand Calibrator (PNº 800873-3)

ALWAYS check to make certain you have received all of the items listed above.

If you have any questions or need assistance, contact your Sensidyne Distributor, or call

(800) 451-9444
or
(727) 530-3602

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⚠ WARNINGS ! ⚠

READ AND UNDERSTAND ALL WARNINGS BEFORE USE

Read and understand ALL warnings before using this product. Failure to read, understand, and comply with ALL warnings could result in property damage, severe personal injury, or death.

Read and understand **ALL** applicable Federal, State, and Local environmental health and safety laws and regulations, including OSHA. Ensure complete compliance with **ALL** applicable laws and regulations before and during use of this product.

UNDER NO CIRCUMSTANCES should this product be used except by qualified, trained, technically competent personnel and not until the warnings, *Operation Manual*, labels, and other literature accompanying this product have been read and understood.

Each user **MUST READ AND UNDERSTAND** the Operation Manual before operating this product in order to ensure proper and safe use and installation of this product and to ensure familiarity with the proper treatment and safety procedures in the event of an accident.

DO NOT remove or alter any label or tag on this product, its accessories, or related products.

DO NOT operate this product should it malfunction or require repair. **DO NOT** attempt to repair or modify the product, except as specified in the *Operation Manual*. Operation of a malfunctioning product, or a product requiring repair may result in serious personal injury or death. If repair is needed, contact Sensidyne Service to arrange for a Returned Material Authorization (RMA).

ONLY use genuine Sensidyne® replacement parts when performing any maintenance procedures provided in this manual. *Failure to do so may seriously impair instrument performance*. Repair or alteration of the product beyond the scope of these maintenance instructions, or by anyone other than authorized Sensidyne® serviceman, *will void the warranty*, and could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

This unit is designed for measuring and monitoring air flow rates and measuring back-pressure for the calibration of air flow instrumentation. The unit should only be operated while it is in a vertical position for optimum performance and accuracy.

SECTION ONE
INTRODUCTION

1.1 OVERVIEW

The Gilian Diagnostic Calibrator provides a fast and accurate method for the testing and calibration of constant flow samplers. The system is available in "Field Case", "Lab Style" or "Panel Only" configurations.

- ***Performance Features***
  - Diagnostic capability for analyzing pump performance.
  - Accurate means of setting flow rates.
  - Rapid verification of sampler flow rates.
  - Pump calibration check.
  - Load simulation and indication of pressure drops associated with those loads.
  - Complete deployment check of air samplers.

The Diagnostic Calibrator is available in two configurations: "single-flowtube" or "triple-flowtube." The single-flowtube model is used for high flow sampling range (particulates) where typical sampling ranges can be 0.5 to 5 LPM.

The triple-flowtube model provides two additional flowtubes and a selector valve. It is ideal for calibration and testing low flow sampling ranges (gas hazards) where flows can be from 20 to 800 cc per minute. Additional flowtubes are available to customize the calibrator flowtube range to meet the users needs.

- ***Specifications***

Flow Rates: (variable in 5 steps)
0.5 - 5000 cc/min
0.4 - 4000 cc/min
50 - 800 cc/min
30 - 300 cc/min
20 - 200 cc/min
10 - 100 cc/min
2 - 50 cc/min

Accuracy: ± 5% Full scale

Pressure Measurements: 0 to 40 inches H_2O

Part No.	Description †
800565-4	LFS, Carrying Case with Panel, 50–800 cc, 20–200 cc, 0.5–50 cc
800565	GilAir, Carrying Case with Panel, 0.4–4 LPM, 20–200 cc, 0.5–50 cc
800565-8	GilAir-5, Carrying Case with Panel, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800565-3	HFS-513, Carrying Case with Panel, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800884	Gilibrator-2, Carrying Case with Panel, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800573-3	Calibrator Panel only, Hi/Lo, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800783-3	Lab Stand Calibrator Hi/Lo, 0.5–5 LPM, 20–200 cc, 0.5–50 cc

† Panel Calibrators come with high and low range flowtubes. A complete range of flowtubes is available for specific requirements

Table 1.1
Available Lab & field Calibrator Models

1.2 THEORY OF OPERATION

The Gilian Lab and Field Calibrator provides a simple means for analyzing pump performance, checking pump calibration, simulating loads, rapid check-out and deployment of samplers, and verification of sampler flow rates to insure that samplers meet performance specifications.

In operation, air passes through a flowtube, as directed by the flowtube selector valve (triple-flowtube model), is applied to a load valve or bypass section which provides a means of instantly loading/unloading the pump flow and is then directed through the internal pressure gauge and into the pump's outlet boss. By monitoring flow and observing the load change conditions, pump performance data can be collected.

In each area of pump diagnostics, the calibrator provides the versatility to meet calibration and flow checking requirements. This also includes directly simulating the load in the loading section or by placing the actual load (i.e., the sampling media) downstream of the flowtube which then gives direct pressure drop readings and flow information about the loading source.

1.3 DIAGNOSTIC PANEL TYPES

1.3.1 Single-Flowtube Configuration

Refer to Figure 1. Air enters the calibrator through boss (B2), passes through flow tube "FM2" and is bypassed or applied to the inlet of valve (V3) and (V4) as determined by the position of the Load Selector Valve (V1). Air leaves the Load Selector Valve, is directed to the pressure gauge and exits the system via boss (B4) which is connected to the pump's air inlet boss.

1.3.2 Triple-Flowtube Configuration:

Refer to Figure 2. In the triple-flowtube configuration, air enters the panel through (B1), (B2) or (B3) and, as directed by "Flow Selector Valve" (V2), passes through "FM1", "FM2" or "FM3". It is then bypassed or applied to the inlet valves (V3) or (V4) as directed by the position of the Load Selector Valve (V1). Air leaves the Load Selector Valve and is directed to the Pressure Gauge and leaves the panel via boss (B4). The panel allows the operator to monitor pressure drops associated with specific sampling media and, in the pump diagnostic mode, allows complete pump performance checkout.

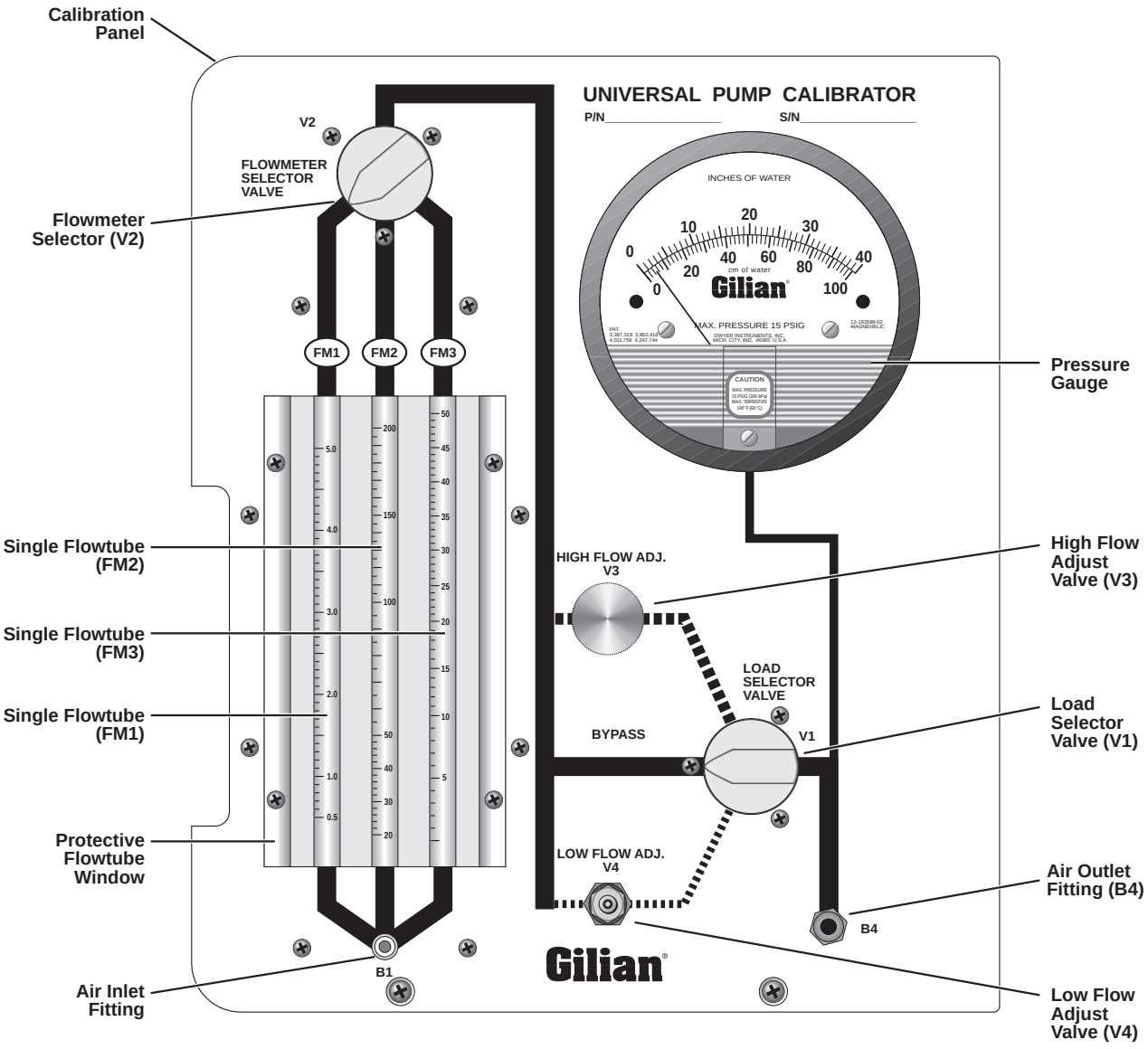

Figure 1.1
Lab & Field Calibrator Panel: Front View

2.1 LEAK TESTING

Before using the Calibration Panel, follow steps below to provide ensure reliable operation and valid data collection.

NOTE

When using the Diagnostic Calibrator Flowtubes, it is important to maintain the panel in a vertical position.

1) Connect a 3-foot length of 1/4" ID tubing to the Pump Suction Fitting (B4).

2) Open valves (V3) and (V4) several turns (counterclockwise).

3) Set the Flowmeter Selector Valve (V2) to the "FM1" position. The position of the Load Selector Valve (V1) is not important at this time.

4) Place finger over the air inlet fitting (B1).

5) Apply mouth suction to one end of the 3-foot length of 1/4" ID tubing to achieve a pressure of approximately 20" H2O, as indicated on the Pressure Gauge, and seal off tubing (pinch or plug the tubing securely).

6) If the pressure reading on the Pressure Gauge decays less than two divisions per minute, the leakage rate is acceptable. If leakage is detected, try selecting a different flowtube "FM2" or "FM3". This will help to isolate the leak. If leakage is detected, set (V2) to "FM2" and repeat the entire procedure. If no leakage is found, it means the total system is intact and that the leakage found in the previous step lies in the tubing and fittings systems from (V2) through flowtube and connector block (V1). If leakage is still present, it indicates there is leakage in the system prior to (V2).

7) If a system leakage is present, repeat the leak test with the Load Selector Valve in each of its remaining positions. Set (V2) to "FM3" and repeat the procedure by applying suction to (B4) with (B3) blocked off. If no leakage is observed, this verifies the system is tight and that the leakage observed was induced by leakage within plumbing systems from the flow path of (V2) to (B1). Fix the leak in the appropriate section such that no leakage is observed. At this point repeat the leakage test with the Load Selector Valve (V1) in all positions. If leakage is observed in any of these positions, refer to the leakage testing procedure in Section 4.1.2.

8) After the "loading" section of the panel has been tested, the leak test should be repeated with the Flowmeter Selector Valve (V2) in positions "FM2" and "FM3". For this part of the test, the Load Selector Valve (V1) may be set in any position.

2.2 FLOWTUBE CALIBRATION

The rotameter flowtubes provided in this kit have been pre-tested for sensitivity and accuracy and are within +5% of full scale. For example, if the flowtube is rated at 4 liters full scale, then the flow accuracy at any reading may have an error of .05 times 4000 cc or 200 cc. Readings of 3000 cc on the scale, which have not been corrected, can have an actual flow of 2800 to 3200 cc. The same is true of a reading at 500 cc, which can have an actual flow as low as 300 cc for the low end or a reading as high as 700 cc.

This illustrates that it is preferable to read these flowtubes in the upper 1/3 of the flow range as the percentage of error is less (5% vs. 40%). Calibrating against primary standards will allow you to rate the desired flow to the rotameter reading within about a 3% accuracy. Good operating and maintenance techniques recommend these flowmeters be checked against a primary standard, buret and stop watch or a Gilian Gilibrator Calibrator, approximately every 4 months.

To perform calibration of the rotameter flow tubes follow the steps below (refer to Figure 1.1). Numbers in brackets correspond to numbers shown in Figure 1.1:

1) Connect the pump to the Air Outlet Fitting (B4) [5] and set the Load Selector Valve (V1) [4] to the "Bypass" position.

2) Set the Flowmeter Selector Valve (V2) [10] to the flowtube being calibrated and connect the suction side of the Gilibrator-2 (or bubble burette) to the Air Inlet Fitting (B1) [7].

3) Set the pump flow rate to 1000 cc/min. by adjusting the pumps flow control.

4) Calculate the observed reading on the flowtube vs. the real value obtained from the precision flowmeter.

5) Repeat Steps 2 and 3 at suitable incremental flow rates (i.e., 1000, 1500, 2000, 2500 & 3000 cc/min.). Additional points may be taken to simulate an actual desired flow value.

6) Using standard graphing techniques, plot the "Observed" reading (horizontal axis) vs. the "Actual" reading (vertical axis).

7) To utilize the plotted curve, select the flow desired from the actual reading, shift horizontally to the curve and then vertically down to the observed reading, which is the value to which the pump should be set.

• *Using the Calibration Plot*

The plots shown in Figure 2.1 are fictitious and are used only as examples. You will generate your own calibration plot following the above steps.

In Figure 2.1, the X-axis has been labeled "Observed Flow" (as seen on the calibrator panel flowtube) and the Y-axis has been labeled "Actual Flow" (as seen on the precision flowmeter).

To determine the "Actual Flow" from an observed reading, do the following:

1) Find the observed value on the X-axis.

2) Follow an imaginary line vertically until it intersects with the calibration plot line.

3) Follow another imaginary line horizontally from the point on the plot until it intersects with the Y-axis. This is the actual flow rate corresponding to the observed flow rate.

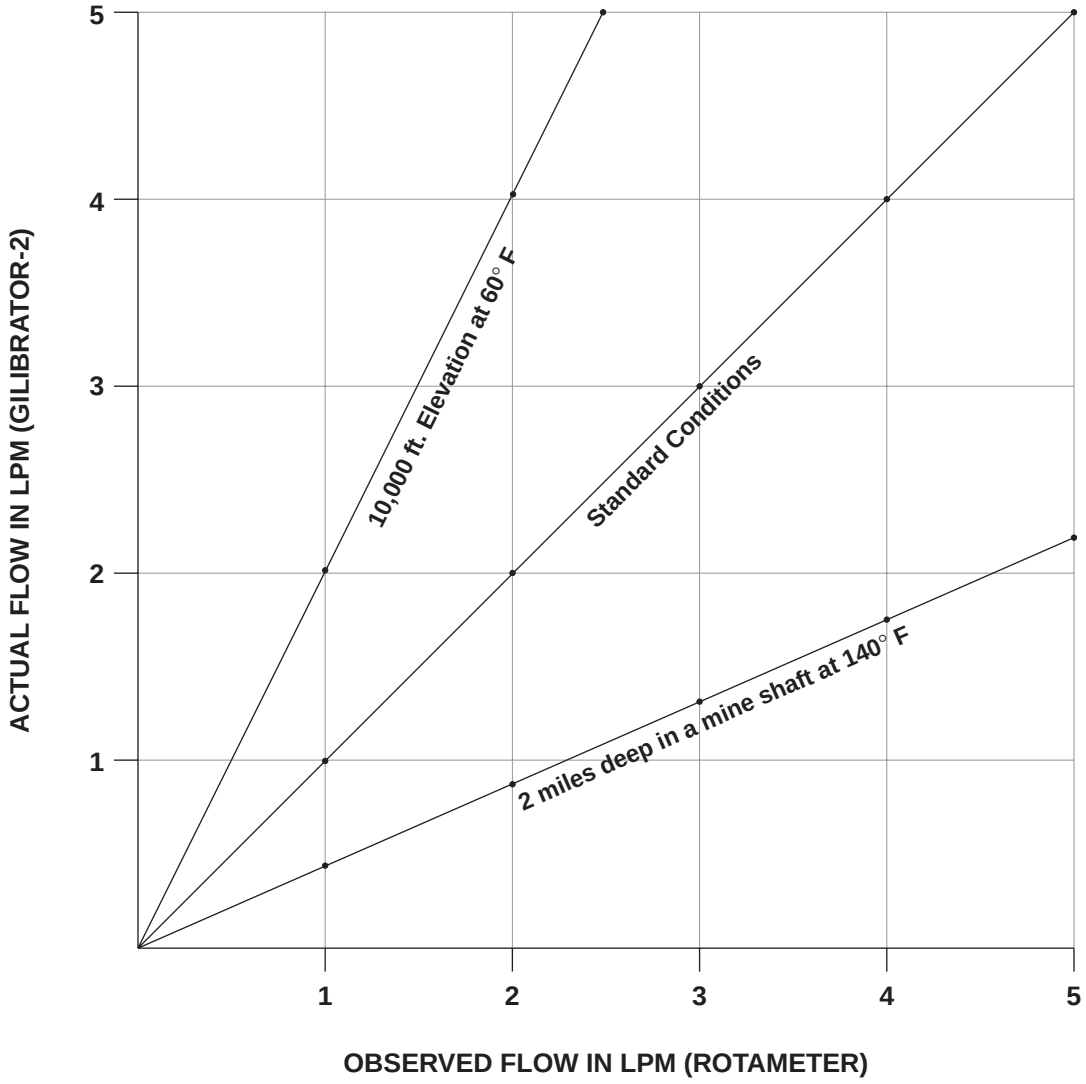

Figure 2.1
Calibration Plot Example

SECTION THREE
PUMP SET-UP & OPERATION

3.1 PUMP PERFORMANCE CHECK

The pump performance check is a test of the pump's constant flow control system.

The following procedure is for a three-flowtube (High/Low Flow) Calibrator Panel. If you have a single-flowtube (High Flow) configuration, the flowtube will normally be found in position marked "FM2" on the panel. This applies to standard Gilian calibrator configurations. If the flowtube is not in that position, simply switch the Flowmeter Selector Valve [10] to the appropriate "FM" position.

Refer to Figure 1.1 for the location of various components. Numbers in brackets correspond to numbers in Figure 1.1.

1) Connect a 3-foot length of 1/4" ID tubing from the Air Outlet Fitting (B4) to the pump's air inlet source.

2) Set the Load Selector Valve (V1) to the "Bypass" position.

3) Set the pump flow rate to 1 LPM through flowtube position "FM1". (For specific pump flow rate setting operations, refer to the manual that comes with your pump).

4) Open the Low Flow Adjust valve (V4) several turns. (Open by turning the valve counterclockwise). Note that this action will have no effect at this time.

5) Switch the Load Selector Valve (V1) to the Low Flow Adjust position (V4).

6) To simulate a 20" H_2O filter loading (back-pressure), set the pressure to 20" H_2O by turning the Low Flow Adjust Valve (V4) clockwise. If the pump is properly calibrated, the reading on the flowtube will change by no more than a +5%.

7) If the change is greater than 5%, refer to the pump calibration procedure in your pump manual.

8) Unload the simulated load from the pump and recheck the set flow rate.

9) Set Load Selector Valve (V1) to "Bypass" and adjust the pump to 3 LPM on "FM1".

10) Open the "High Flow Adjust" valve (V3) several turns. (Open by turning counterclockwise).

11) Set Load Selector Valve (V1) to the High Flow Adjust position (V3).

12) To simulate a 10" H_2O filter loading (back pressure), set the pressure to 10" H_2O by turning the High Flow Adjust Valve (V3) clockwise. If the pump is properly calibrated, the reading on the flowtube will change by no more than a +5%.

13) If the change is greater than 5%, refer to the pump calibration procedure in your pump manual.

14) Unload the back-pressure from the pump and recheck the set flow rate.

This completes the pump performance check. If the pump has passed, you may set the desired flow rate and proceed with sampling.

3.2 PUMP CHECKOUT

This is a test of the pump's fault system, which is designed to activate if the flow rate can not be maintained to +/-5% of set flow.

In this procedure, the pump will be tested prior to field deployment. At this time, the appropriate flowtube range should be selected with the Flowtube Selector Valve (V2), the inlet of the pump is connected to the Air Outlet Fitting (B4) and should be set to the required flow rate.

(The Load Selector Valve (V1) should already be in the "Bypass" position.). Now rotate the Load Selector Valve to the High Flow Adjust position (V3).

Turn the value (V3) clockwise until the required pressure drop is obtained. There will be less than 5% deviation between this flow and the previously set flow. For pumps with an "instant faulting" feature, continue turning the valve (V3) clockwise until the increased load pressure causes the pump's fault light to activate.

Turn the High Flow Adjust Valve (V3) counterclockwise until the pump's fault light to go out. Observe the flowtube reading. This reading should be within 5% of the set point.

Turn the High Flow Adjust Valve (V3) clockwise until the pump's fault light comes on again. Note the time it takes for the fault light to come back on again. This time must with the specification listed in your pump's operation manual.

If your pump does not have an instant fault feature, you must calculate the flow rate deviation manually.

Example:

> You are checking the flow rate at 2000 cc/min. (2.0 LPM). Calculate the deviation by taking 5% of 2000 cc, or 100 cc. Subtract this from 2000 cc to get 1900 cc/min. (1.9 LPM) Continue to increase the back pressure on the pump by turning the High Flow Adjust Valve (V3) clockwise until the flowtube reads 1900 cc/min. Wait 2 minutes.

- If the pump does not fault, increase the pressure to reduce the reading in the flowtube to 1800 cc/min. (10%) Wait another 2 minutes.

- If the pump does not fault during this time, you may use the pump, however, you test the pump again at the end of the sampling period to ensure that the flow rate has not deviated by more than 5%.

- If the pump does fault, then the pump should hold the flow rate constant even at higher back pressures within reason (i.e., 5-7%).

3.2.1 Load Simulation

In this procedure, the load is simulated using either The High Flow Adjust Valve (V3) or the Low Flow Adjust Valve (V4).

Changes in flow rate associated with pressure drops are easily monitored by switching the Load Selector Valve (V1) back and forth between load simulation (at V3 or V4) and "Bypass". Either of these modes will adjust to provide a pressure drop indication on the pressure gauge. Alternating from a "load" position to the "Bypass" allows the constant flow capabilities of the sampler to be monitored.

3.2.2 Pressure Drops & Pressure Loads

In this operating mode, select the appropriate flowtube range for the test (FM1, FM2, or FM3).

Turn on the pump and turn the Flowmeter Selector Valve (V2) to the desired flowtube.

Note the reading on the pressure gauge. This is going to be your tare (baseline) reading.

Connect the sampling device with a piece of tubing to the Air Inlet Fitting (B1). The pressure drop associated with this new load will register on the pressure gauge.

This allows you to check the pressure drop associated with your sampling device both prior to sampling and at the end of sampling period. From this you can determine the load pressure for you pump in order to maintain a constant flow rate.

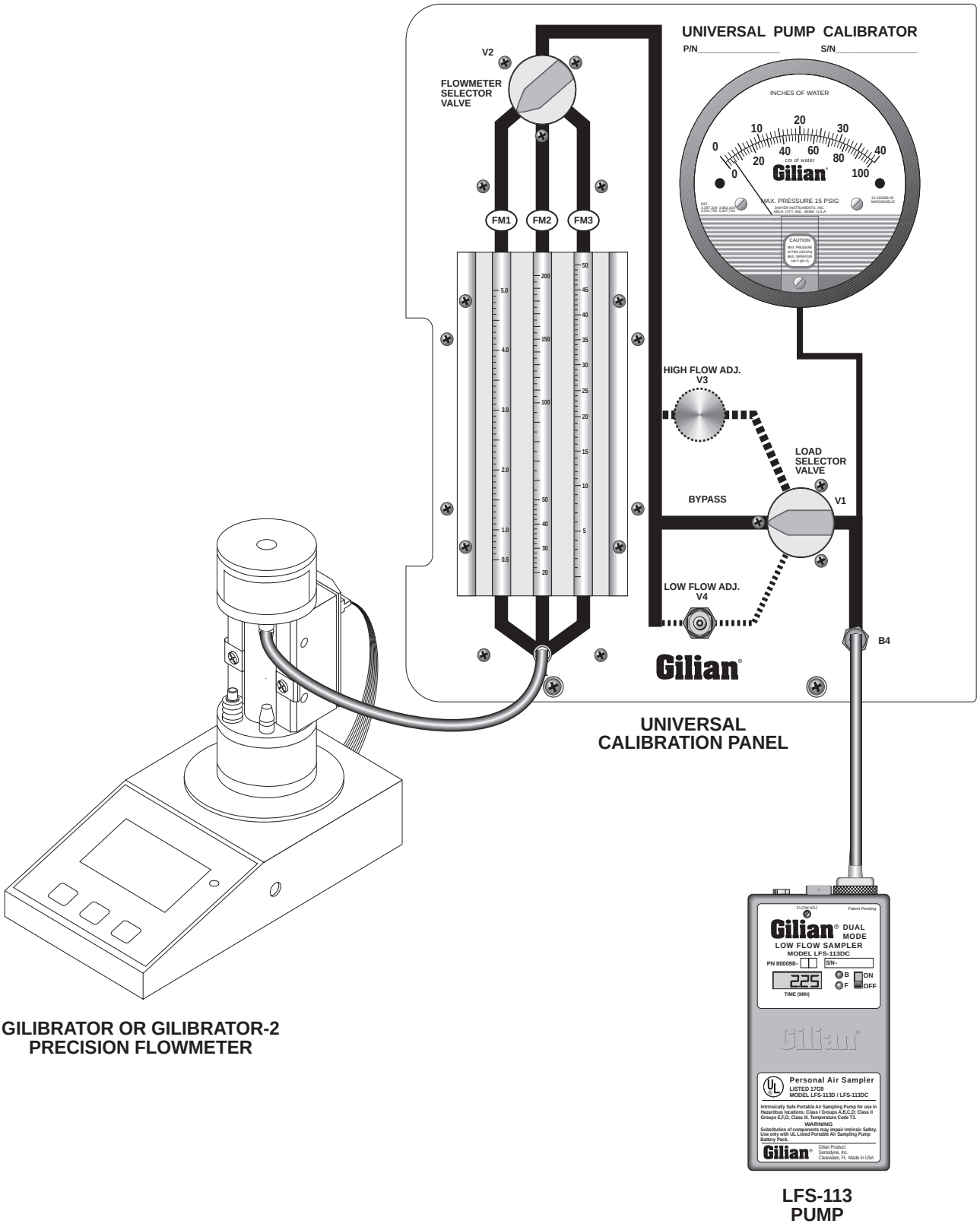

Figure 3.1
Typical Calibration Set-Up

3.3 PUMP CALIBRATIONS FOR MODELS GILAIR-3 & 5 AND HFS-113 & 513

In these Gilian samplers the flow rate control is derived by using the DC motor of the pump as the load sensor which provides a dependable means of providing constant flow. This system requires adjusting the slope and intercept to provide proper linearity for the system. As such, this linearity is provided by the use of two flow calibration points.

3.3.1 High Flow Calibrations

The Diagnostic Calibrator is set up to check electronic calibration over the range 0.5–5.0 liters. For HFS-513, GilAir/GilAir-5 and HFS-113 samplers, please refer to their respective operation manuals for specific calibration ranges and adjustment procedures.

This procedure properly calibrates the electronic flow control system in the pump. Calibrating high flow rates requires adjusting the flow control compensation potentiometers of the Back-pressure Compensation System (BCS) in the pumps.

These potentiometers are adjusted at 2 flow rate points:

- at 1 LPM for HFS-113 & GilAir (1.5 LPM for HFS-513)
- at 3 LPM for HFS-113 & GilAir (4 LPM for HFS-513)

*) In this mode, turn the Flowmeter Selector Valve (V2) to the appropriate flowtube. Connect the pump tubing to the Air Inlet Fitting (B1).

*) Set the Load Selector Valve (V1) to “Bypass” (refer to Figure XX).

*) Turn on the pump and adjust the flow rate to either 1 or 1.5 LPM (depending on your pump model).

*) Turn the Load Selector Valve (V1) to “Low Flow Adjust” (V4) (refer to Figure XX) to simulate the appropriate back pressure on the pressure gauge. Adjust the Low Flow Adjust Valve (V4), as needed, to maintain a constant flow rate when switching between “Bypass” and “Low Flow Adjust” modes.

*) Adjust the pump flow rate to either 3 or 4 LPM (depending on your pump model).

*) Turn the Load Selector Valve (V1) to “High Flow Adjust” (V3) (refer to Figure XX) and adjust until proper back pressure is observed.

*) Note any changes in the flow rate. Adjust the high flow pump compensation potentiometer so as to maintain a constant flow rate when switching between the “Bypass” and “High Flow Adjust” modes.

3.3.2 Low Flow Control System Calibrations

This procedure applies to HFS-113 & HFS-513 samplers with low flow capability and GilAir/GilAir-5 samplers with Multi-Flow Modules in the "On" Position.

The suction/pressure regulator in conjunction with a manifold provides the means for setting low flow

To determine or check these pressures, set sampler flow rate, (between 1–1.5 LPM), blocking the pump inlet and setting a back pressure of 20–21" H_2O for HFS-113 & HFS-513 pumps and 16" H_2O for GilAir/GilAir-5 pumps, indication on the pressure gauge.

In this set up, the pump is connected to inlet (B4) and the Load Selector Valve (V1) is set to "Bypass".

Block the Air Inlet Fitting (B1). The flow rate will drop to zero and the pressure gauge will peg at 20-21" H_2O. This can also be accomplished by closing (clockwise) either the "High Flow Adjust" (V3) or "Low Flow Adjust" (V4) and then positioning the "Load Selector Valve" to either position.

The GilAir with a constant-pressure module can be checked in the same manner except there is no adjustment for the suction/pressure, only verification.

The suction/pressure should be greater than 16" H_2O. To determine the stability of the regulator in all of the above cases, set the Load Selector Valve (V1) to "Bypass", shut the Low Flow Adjust Valve (V4) by turning fully clockwise, then set the Flowmeter Selector Valve (V2) to the High flow range flowtube and connect the sampler to the Air Inlet Fitting (B1).

Turn sampler ON and adjust the flow to 1 LPM HFS-113 & GilAir and 1.5 LPM for the HFS-513.

Turn the load selector valve to the "Low Flow Adjust" position (V4). Be sure valve is shut off.

The regulator should go up to approximately 20-21" H_2O for HFS-113, 24-25" H_2O for HFS-513 and a minimum of 16" H_2O for GilAir. If the pressures are out of specifications, the pump should be leak checked and the "Low Flow Adjust" reset to apply the proper pressure range.

NOTE

It is imperative that flow rates are in the approximate range, and flowtubes must be calibrated to determine this.

3.3.3 Regulator Stability Test

This test determines the stability of the system. Slowly open the Low Flow Adjust (V4) until the flow is approximately 500 cc The pressure should change by no more than 1.5" H_2O.

3.3.4 GilAir (Constant Flow Module)

Connect a GilAir or GilAir-5 sampler to the Air Outlet Fitting (B4).

*) Select the 200 cc flowtube position and set the "Load Selector Valve" to the "Bypass" position. The "Low Flow Adjust" (V4) should be open (counterclockwise).

*) Adjust the flow in the module to 100 cc and carefully note the ball position within the flowtube.

*) Slowly turn the "Load Selector Valve" from "Bypass" to "Low Flow Adjust".

*) Slowly close (V4) to approximately 23" H_2O. The flow rate will remain constant within 5% of the set point and the pumps fault light should not light.

*) Continue closing the valve until the pump fault light actuates. Back-off slightly and check the flow deviation. It will be less than 5%.

*) Continue to close (V4) to approximately 30-35" H_2O or until the "Fault" light stays "On". Once the "Fault" light is "On", do not adjust the valve any further. The pump should stop within one (1) minute after the red light actuates. This test can be run in any flow range setting.

3.3.5 LFS-113 (Constant Flow Mode)

*) Connect an LFS-113 Pump to the Air Outlet Fitting (B4).

*) set the selector valve to "Bypass" and select the 200 cc flow tube.

*) The "Low Flow Adjust" (V4) should be open (counterclockwise).

*) Adjust the flow in the module to 100 cc and carefully note the ball position within the flowtube. Slowly turn the "Load Selector Valve" from "Bypass" to the "Low Flow Adjust" (V4).

*) Slowly close (V4) to approximately 23" H_2O. The flow should remain constant within 5% of the set point and the pump fault light should not light.

*) Continue closing the valve until the pump fault light activates. Back-off slightly and check the flow deviation. It shall be less than 5%.

*) Continue to close (V4) to approximately 30–35" H2O or until the red light stays "On". Once the red light is "On" do not adjust the valve any further. The pump shall stop within 1 minute after the red "Fault" light activates. This test can be run in any flow range setting.

SECTION FOUR
SERVICE & MAINTENANCE

4.1 CALIBRATOR PANEL SERVICE

Refer to Figures 5 and 6. This procedure will guide you in upgrading and testing a one flow meter calibrator panel to a three flowmeter system. The item numbers specified in the assembly instructions can be found in the Calibrator Panel (1 flowtube and 3 flowtube) spare parts.

4.1.1 Reconfiguration Procedure

1) Case model requires removal of four screws to unfasten panel.

2) Remove the following items:
   - "V2" Hole plug (#1)
   - Hole plugs (#2 &3)
   - PVC tubing (#15)
   - Elbow and TYGON¿ tubing (#4 &5)
   - Screws, nuts and lock washers (#6, 7, &8)

3) Assemble two pieces of tubing (#9) onto the flowtube manifold (#10) at back of panel.

4) Carefully insert two (2) flowtubes (#11, 12 or 13) through top holes of the flowtube housing until they engage on the lower manifold tubing.

NOTE

Make sure flow tube graduates are facing front.

5) Slide three (3) pieces of tubing (#9) onto upper manifold (#19) and install onto the flowtubes at top of flowtube housing and secure with two screws (#20).

6) Rotate the selector valve (#17) to its furthest clockwise position and install through rear of panel aligning selector valve to the "FM1" position. Secure with three screws (#15).

7) Install three coupling tubes (#16) from upper manifold to selector valve as shown, and one tubing (#18) from damper (#21) to selector valve.

4.1.2 Leak Test

1) Set "V1" Load Selector Valve (#4) to "Bypass" position and "V2" selector valve (#10) to the "FM1" position on the calibrator panel

2) Plug flow ports "B1", "B2", and "B3" then adjust valves "V3" and "V4" to "OPEN" mode.

3) Connect suction line to "B1" connector port and apply a 20" H20 suction load to the system. Verify load on the panel pressure gauge (#2). Clamp suction line and let system stabilize about 15 seconds. A maximum drop of 1" H20 or one division per minute on the pressure gauge is acceptable. If excessive drop occurs, re-check system for leaks.

4) Repeat Step 3 with "V2" selector valve in "FM2" and "FM3" positions.

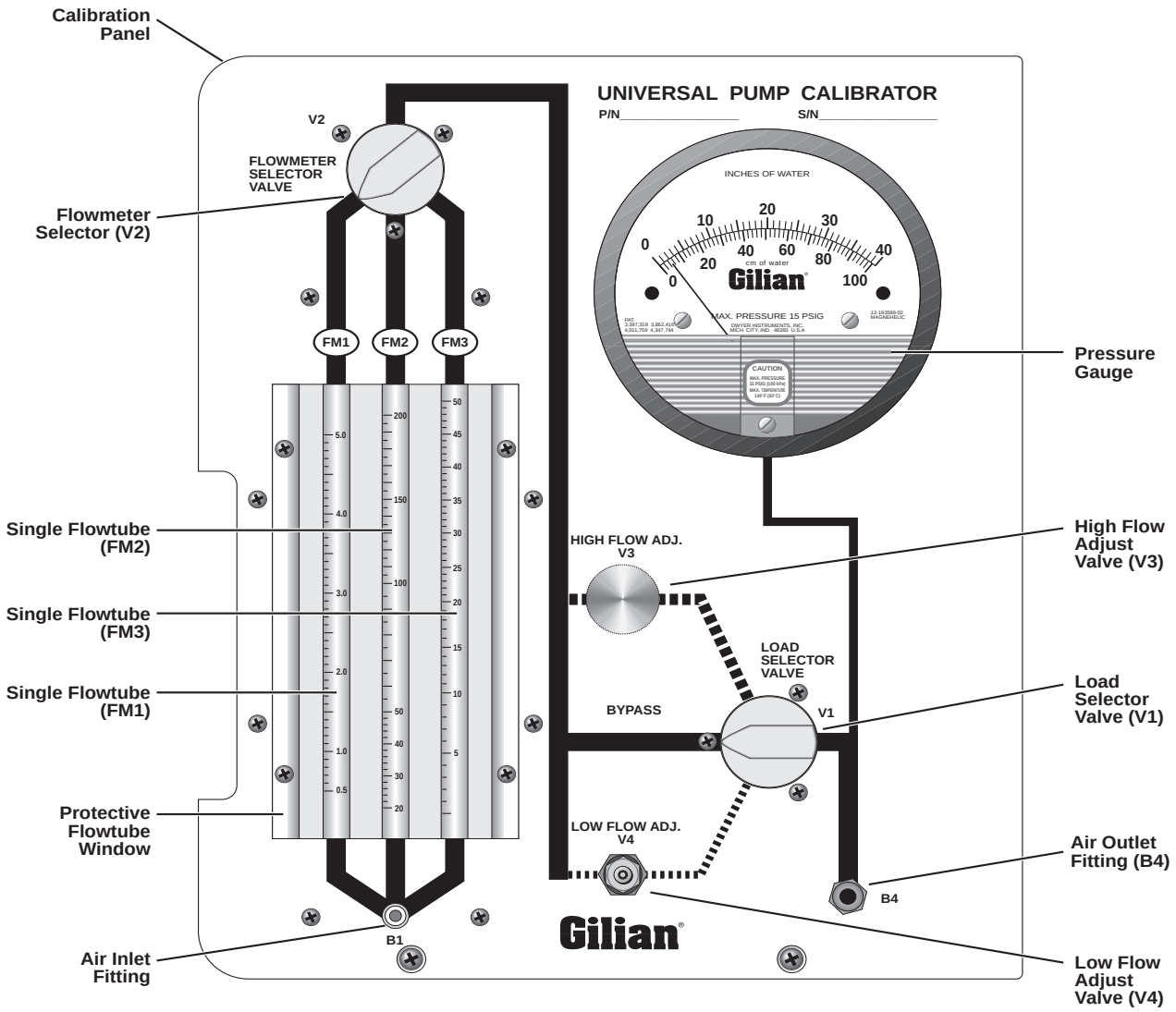

Figure 4.1
Calibrator Panel: Front View

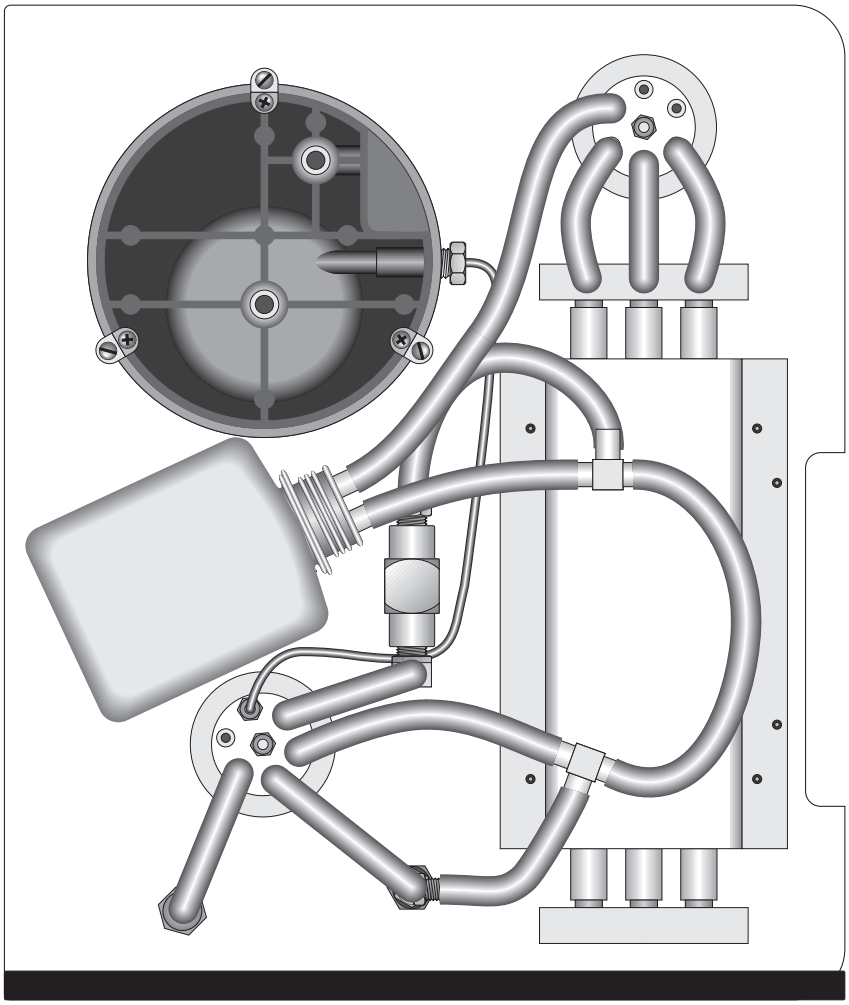

Figure 4.2
Calibrator Panel: Rear View

4.2 FLOWTUBE CLEANING

Refer to Figure 1 & 2. It is advisable every six months to clean the flow meters of any debris which may have accumulated during that usage period. This procedure covers the removal of the flow meters from the panel, cleaning of the individual flow meters and reinstallation of the panel. The procedure which is given is for a three-tube panel.

1) Remove the four sheet metal screws, (#14 & 20), holding the upper/lower manifold blocks.

2) Remove additional four sheet metal screws, (#21), holding the rotameter sheet metal assembly. These are the screws just outside of the clear glass protection window.

3) Remove the three pieces of interconnecting tubing, (#16), from the upper manifold block.

4) Pry the upper manifold block containing the tube coupling, (#19), from the flowtubes.

5) After removing these tubes, all three can be slid down through the sheet metal flowtube housing. Each individual flowtube can then be separated from the lower manifold.

6) Clean the flowtube, using lab grade alcohol in a syringe through the bottom.

7) After cleaning, blow dry with compressed air or air dry.

8) Check the ball for freeness in the bore and flowtube, then adjust the upper and lower flowtube stops to prevent ball sticking in the tube.

9) Clean the upper and lower manifolds using alcohol and blow dry.

10) Re-assemble the manifold as follows. Place the tubular rubber boots, (#23), on to the bore of each flowtube, approximately 1/2" and then insert the bottom of each tube into the lower manifold block, making sure the measurement scale faces forward. The boss of the manifold should also face forward.

11) Re-install all three flowtubes in the housing.

12) Install the three tubes (#11, 12 & 13) onto the top of the flow meter and insert the upper manifold block, bosses facing out from the back of the panel.

13) Re-install the now complete assembly through the panel face and replace all screws.

14) Re-attach the three tube couplings (#16), to the upper manifold. Leakage check the assembly before using.

APPENDIX A
PARTS LIST

Part No.	Description †
800565-4	LFS, Carrying Case with Panel, 50–800 cc, 20–200 cc, 0.5–50 cc
800565	GilAir, Carrying Case with Panel, 0.4–4 LPM, 20–200 cc, 0.5–50 cc
800565-8	GilAir-5, Carrying Case with Panel, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800565-3	HFS-513, Carrying Case with Panel, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800884	Gilibrator-2, Carrying Case with Panel, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800573-3	Calibrator Panel only, Hi/Lo, 0.5–5 LPM, 20–200 cc, 0.5–50 cc
800783-3	Lab Stand Calibrator Hi/Lo, 0.5–5 LPM, 20–200 cc, 0.5–50 cc

† Panel Calibrators come with high and low range flowtubes. A complete range of flowtubes is available for specific requirements

Instrument Cases

800400	LFS, 7” Carrying Case only
400518	LFS, 7” Single Pump Soft Carrier
800511	GilAir/GilAir-5, 7” Carrying Case only
401643	GilAir/GilAir-5, 7” Single Pump Soft Carrier
800339	HFS-513, 9” Carrying Case only
800401	HFS-513, 7” Carrying Case only
400516	HFS-513, 7” Single Pump Soft Carrier
800402	Gilibrator-2, Standard Small Carrying Case only
800843	Gilibrator-2, Deluxe Carrying Case only
400517	Multi-Pimp Soft Carrier
201976-3	Single Pump Plastic Pouch (Water Cover) [3-pack]
400440	Accessory Box, 1 compartment
400439	Accessory Box, divided

Replacement Flow Tubes (Panel or Free-Standing Rotameters)

Part No.	Description
401464	Replacement Flow Tube, 0.5–50 cc
401645	Replacement Flow Tube, 10–100 cc
401247	Replacement Flow Tube, 20–200 cc
401687	Replacement Flow Tube, 30–300 cc
401302	Replacement Flow Tube, 0.4–4 LPM
401249	Replacement Flow Tube, 0.5–5 LPM

Free-Standing Rotameters

Part No.	Description
800717	Rotameter, 0.5–50 cc
800716	Rotameter, 20–200 cc
800718	Rotameter, 50–800 cc
800811	Rotameter, 0.2–2.5 LPM
800810	Rotameter, 0.4–4.0 LPM
800720	Rotameter, 0.5–5.0 LPM
801467	Rotameter, 1–10 LPM
801273	Rotameter, 1–23 LPM
800292	Stand and Bracket
401436	Bracket only

APPENDIX B
RETURNED MATERIAL AUTHORIZATION

Sensidyne maintains an instrument service facility at the factory to provide its customers with both warranty and non-warranty repair service. Sensidyne assumes no liability for service performed by personnel other than Sensidyne personnel. To facilitate the repair process, please contact the Sensidyne Service Department in advance for assistance with a problem which cannot be remedied and/or requires the return of the product to the factory. All returned products require a Returned Material Authorization (RMA) number. Sensidyne Service Department personnel may be reached at:

Sensidyne
1000 112th Circle N, Suite 100
St. Petersburg, FL 33716
(800) 451-9444
(727) 530-3602
FAX (727) 539-0550

All non-warranty repair orders will have a minimum fee whether the repair is authorized or not. This fee includes handling, administration and technical expenses for inspecting the instrument and providing an estimate. However, the estimate fee is waived if the repair is authorized.

If you wish to set a limit to the authorized repair cost, state a "not to exceed" figure on your purchase order. Please indicate if a price quotation is required before authorization of the repair cost, understanding that this invokes extra cost and handling delay. Sensidyne's repair policy is to perform all needed repairs to restore the instrument to its full operating condition.

Repairs are handled on a "first in–first out" basis. Your order may be expedited if you authorize an expediting fee. This will place your order next in line behind orders currently in process.

Pack the instrument and its accessories (preferably in its original packing) and enclose your return address, purchase order, shipping and billing information, RMA#, a description of the problem encountered with your instrument and any special instructions. All prices are subject to change without notice.

If this is the first time you are dealing directly with the factory, you will be asked to prepay or authorize a COD shipment.

Send the instrument, prepaid, to:

Sensidyne
1000 112th CIRCLE N, SUITE 100
ST. PETERSBURG, FL 33716

ATTENTION: Service Department

RMA:_____

SERVICE OPTIONS

The Sensidyne Service Department offers you a variety of service options that will help to increase your user confidence while minimizing costly interruptions and maintenance costs. These options include initial training, on-site technical assistance, and full factory repairs. Sensidyne has developed several programs which will allow you to select just the right options which are best suited to your applications and needs. For further information, contact the Sensidyne Service Department.

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Revision C • Document No. F-PRO-1260