

Gilian®

GILAIR-3 & GILAIR-5

AIR SAMPLING SYSTEMS

OPERATION & SERVICE MANUAL



SENSIDYNE®

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Revision E • Document No. 800880M

PACKING LIST

The items listed below are shipped the **Gilian GilAir-3/GilAir-5 Air Sampling System**:

- GilAir-3 or GilAir-5 Air Sampling Pump
- Tool Kit
- Tubing
- Air Boss
- Restrictor
- *Operation and Service Manual*

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

***If you have any questions or need assistance,
contact your Gilian Sales Representative, or call***

(800) 451-9444

OR

(727) 530-3602

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WARNINGS !

READ AND UNDERSTAND ALL WARNINGS BEFORE USE

WARNING: Do not use the BMS-200 Battery Charger to charge SIRA approved battery packs.

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 and Service Manual*, labels, and other literature accompanying this product have been read and understood.

The *Operation and Service Manual* must be read and understood by each user before operating this product or using its accessories, 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, cover, 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. Operation of a malfunctioning product, or a product requiring repair may result in serious personal injury or death. **DO NOT** attempt to repair or modify the instrument, except as specified in the *Operation and Service Manual*. Contact the Gilian Service Department to arrange for a Returned Material Authorization (RMA).

Use **ONLY** genuine Gilian[®] replacement parts when performing any maintenance procedures described 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 a certified Gilian[®] serviceman, 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.

DO NOT operate in excessive chemical or water vapor atmospheres. Failure to follow instructions may cause permanent damage to the equipment.

The GilAir-3 and GilAir-5 Air Samplers employ rechargeable Nickel-Cadmium batteries. **ALWAYS** fully charge the battery before starting the pump.

DO NOT operate the unit with improperly maintained batteries. This can cause pump failure or faulting.

DO NOT operate the unit with a dirty or blocked inlet filter. This can cause pump failure or faulting.

DO NOT drop, crush, or roughly handle the unit, and **NEVER** submerge the unit in water. This can cause pump failure or faulting.

DO NOT run the pump beyond its recommended specifications.

1.1 OVERVIEW

IMPORTANT

You must read this manual in its entirety to ensure proper operation of your unit.

This manual contains basic operating information for the GilAir-3 and GilAir-5 Air Sampling Systems.

GilAir-3 and GilAir-5 Air Sampling Systems offer both high and low flow sampling capabilities. These capabilities range from 1cc to 3,000cc and 1cc to 5,000cc respectively. Table 1.1 shows the available GilAir-3 and GilAir-5 models and modules. See Sections 3.1 & 3.2 for optional flow modules.

The Clock Timer model offers an elapsed time clock that includes a run/hold function to pause and then resume sampling. The Clock Timer Board includes a liquid crystal display (LCD) and the MODE/HOLD controls (See Figure 2.1).

The Program Timer model offers run/hold and delayed start functions, as well as the capability to program up to six (6) separate sampling programs. The program timer board includes an LCD, and the MODE/HOLD and programming controls (See Figure 2.2).

1.2 GENERAL DESCRIPTION

GilAir-3 and GilAir-5 samplers consist of an electronic control system, a pneumatic system, and a rechargeable battery pack. The GilAir-3 and GilAir-5 Air Samplers share the same electronic control system. The pneumatic system is shown in Table 1.2.

1.2.1 Basic Control Board

All GilAir-3 and GilAir-5 samplers are equipped with a basic control board, which contains the flow control circuitry. The board also contains the On/Off switch, flow control potentiometer, flow fault indicator, and battery charge indicator.

• Flow Control Circuitry

The GilAir-3 and GilAir-5 are designed to maintain flow within $\pm 5\%$ of the initial set point while the pump is subjected to changes in load. Sensing pump load via the motor current, the system compensates for any changes by applying a proportional voltage to the motor, thereby adjusting the pump speed to maintain flow.

Part Number	Product	Model	Standard Flow Rate
800485-111	GilAir-3 R	Basic	850-3000 cc/min [RFI]
800508-111	GilAir-3 RC	Clock	850-3000 cc/min [RFI]
800510-111	GilAir-3 RP	Programmable	850-3000 cc/min [RFI]
800485-111-01	GilAir-3 R [South Africa]	Basic (w/o Battery)	850-3000 cc/min [RFI]
800508-111-01	GilAir-3 RC [South Africa]	Clock (w/o Battery)	850-3000 cc/min [RFI]
800510-111-01	GilAir-3 RP [South Africa]	Programmable (w/o Battery)	850-3000 cc/min [RFI]
800883-111	GilAir-5 R	Basic	850-5000 cc/min [RFI]
800885-111	GilAir-5 RC	Clock	850-5000 cc/min [RFI]
800884-111	GilAir-5 RP	Programmable	850-5000 cc/min [RFI]

**Table 1.1
Available GilAir-3 & GilAir-5 Models**

• **Flow Fault Indicator**

The GilAir-3 and GilAir-5 Flow Fault Indicator lights up if the pump is unable to maintain the flow rate within $\pm 5\%$ of the set point. This can occur if the pump is operated outside its specified performance ranges, or when the battery pack has insufficient charge. After 27–39 seconds of continuous operation under fault conditions, the pump will stop. This delay is provided so that a momentary obstruction of flow will not result in an unnecessary shutdown of the system. For units equipped with the optional timer board, shutdown under fault conditions will preserve the run time in the display. This allows the user to salvage the sample data.

• **Battery Charge Indicator**

The battery charge indicator will illuminate when the sampler is turned on and the battery pack is fully charged. Since the circuit is activated by the slight over-voltage condition common in a fully-charged battery, the indicator will normally turn off after the sampler runs for a short period of time.

1.2.2 Internal/External Vent Control

The internal/external vent control is located on the top of the sampling pump. You may select the venting control as desired, using a screwdriver, provided with the pump. Selecting the open circle position will vent the pump’s discharge external to the sampler’s case (recommended for moist or corrosive sampling environments). Selecting the closed circle will vent the pump’s discharge internally (recommended for dust laden environments).

Description	GilAir-3	GilAir-5
DC motor driven, single piston pump	X	
DC motor driven, dual piston pump		X
Patented pre-loaded valving system	X	X
Integral damper assembly	X	X
See-through filter housing assembly	X	X
Rotameter / Flow indicator (Accuracy: $\pm 20\%$)	X	X
Optional Low Flow Capability: Constant Flow	X	X
Optional Low Flow Capability: Multi-Flow	X	X

**Table 1.2
Pneumatic System**

1.3 DISPLAY ICONS & MESSAGES

Available only on Clock Timer and Program Timer Models.

- **Flashing Battery**

A flashing battery icon indicates that the battery voltage is below its nominal value.

- **Flashing Clock**

A flashing clock icon indicates that the sampler is in the programming mode.

- **Non-Flashing Clock**

A non-flashing clock Icon indicates that the sampler is in the process of executing a sampling run.

- **Display Letters**

“D”	Initial delay interval prior to starting the first sample interval.
“R”	Run Time interval.
“D” + “R”	Pause interval between Run Time intervals.
“C”	Cycles. The number of times that the Run Time interval is performed.
“PC”	Basic program which does the simple Timer mode.
“P1”	User-defined program.
“P2”	User-defined program.
“P3”	User-defined program.
“P4”	User-defined program.
“P5”	User-defined program.
“P6”	User-defined program.
“E”	Programming error.

- **Display Messages**

“LAST”	Flashes alternately with the data and icons of the last sampling run executed.
“Old”	Flashes alternately with the data and icons of the sampling run executed prior to the “LAST” sampling run.
“SHUT”/“OFF”	A reminder message to move the On/Off switch to the Off position to conserve the battery charge. It indicates that 5 minutes have elapsed since: 1) a fault condition has terminated the sampling run, or 2) a programmed sampling run has reach completion (see Section 2.3.8).
“CAL”	Flashes if the air sampler is prepared to run the pump without gathering sampling data. Solid if the pump is running, to enable calibration of the sampler’s air flow rate.

- **Fault Sampling Time**

This number indicates the percentage of sampling time that the pump ran while it was outside the 5% fault tolerance envelope during the run. The number is located on the bottom right portion of the display.

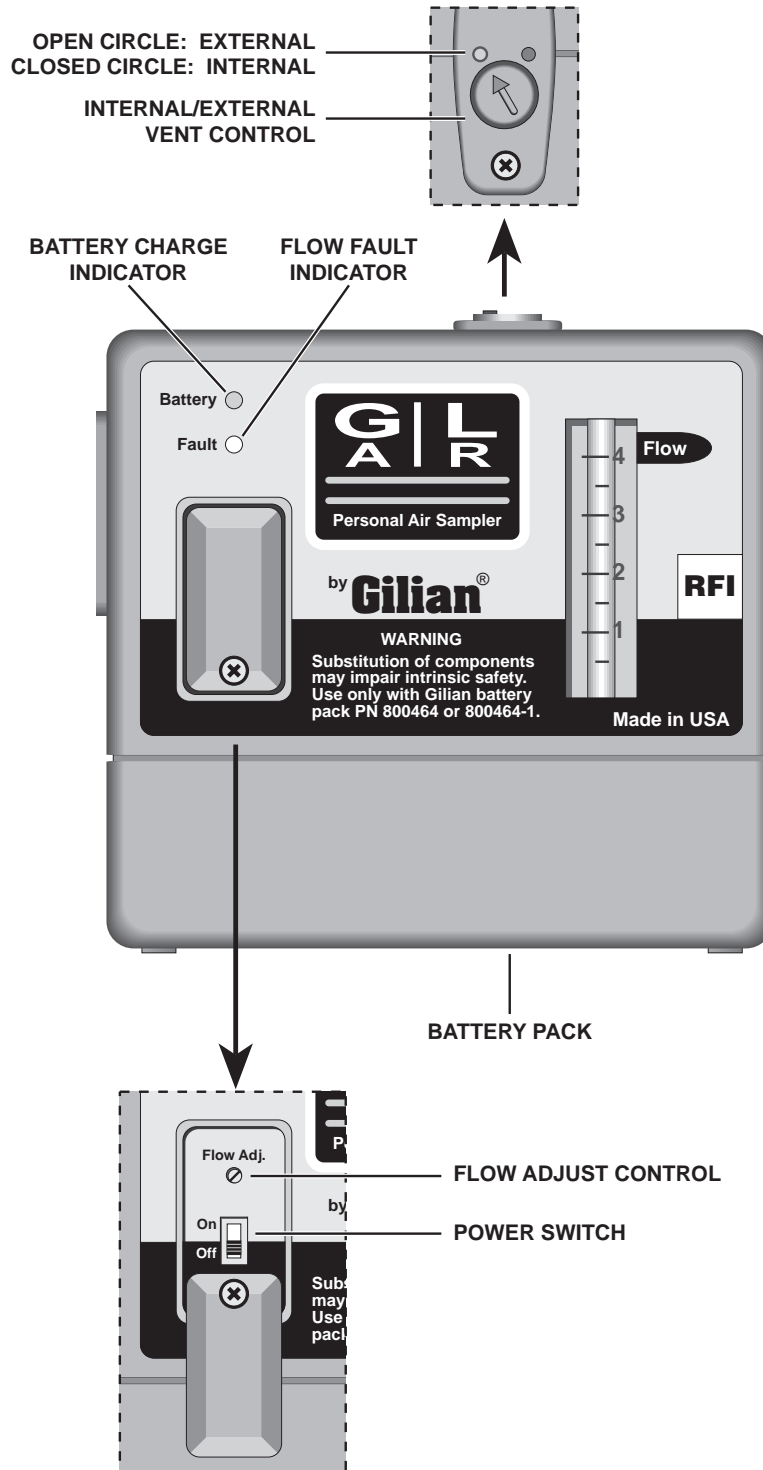


Figure 1.1
GilAir-3 Air Sampler (Front view)

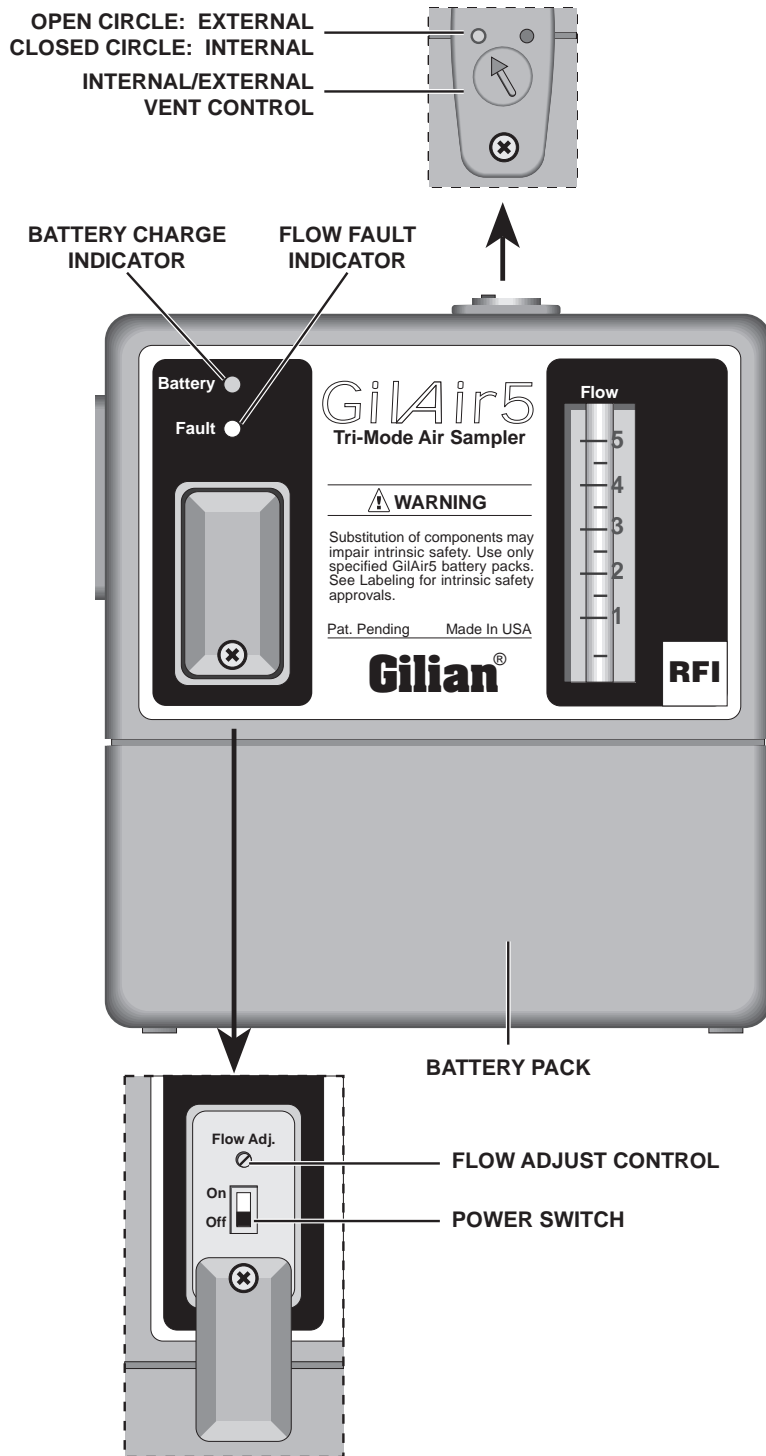


Figure 1.2
GilAir-5 Air Sampler (Front view)

SECTION TWO

OPERATION

2.1 BASIC MODEL

2.1.1 Preparation

1. Charge the battery according to the Battery Maintenance instructions in Section Four.
2. Using a small Phillips screwdriver, back out the holding screw just enough so the anti tamper cover plate can be rotated 180°. This exposes the On/Off switch and the flow adjust screw (See Figure 1.1).

2.1.2 Setting The Pump Flow Rate

1. Move the On/Off switch to the On position.
2. Set the pump flow rate by turning the flow adjust screw. (Clockwise for increased flow and counter-clockwise for decreased flow.
3. Use the built-in rotameter as a flow indicator only. Accurate flow adjustment settings shall be made by using a Gilibrator 2, or equivalent flow calibration device, for calibration measurements.
4. When calibrating the sampler for flow, the sample collection device (cyclone, impinger, filter cassette or sorbent tube) should be in-line.
5. When the desired flow rate has been attained, move the On/Off switch to the Off position. The unit is now ready for sample collection.

2.1.3 Sample Gathering

Begin the sample run by switching the On/Off switch to the On position and secure the front anti-tamper cover. The pump will operate at the flow rate set at the last calibration adjustment. The sampling run is terminated by switching Off the On/Off switch.

2.1.4 Pull Start Operation

Applies only to GilAir-5 (PN^o 800883-3) samplers with a Pull Start Battery Pack (PN^o 800869-7)

The GilAir-5 Pull Start model has a specially designed jack that prevents operation of the unit while charging. This Pull Start Jack may only be used as an ON/OFF switch. Charging must be done through the original charging socket.

2.2 CLOCK TIMER MODEL

2.2.1 Preparation

NOTE

The MODE/HOLD button must be pressed with a pointed instrument, such as a ball-point pen.

1. Charge the battery according to the Battery Maintenance instructions provided in Section Four.
2. Using a small Phillips-head screwdriver, back out the holding screw of the anti-tamper cover plate to expose the On/Off switch and the flow adjust screw. (On the front of the pump.) On the left side of the pump, back out the holding screw of the anti-tamper cover around the display opening to expose the MODE/HOLD button.

NOTE

The pump switches to a low-powered "sleep" mode after five minutes of inactivity whenever the On/Off switch is positioned in the Off position. This conserves the battery charge.

3. If the On/Off switch is moved to the On position at any time, the pump will begin to run and collect data for a new sampling run. **Exception:** If "CAL" is showing on the display the pump is in calibration mode. No data will be collected at this time.

2.2.2 Waking The Pump For "LAST" Run Data Readout

1. With the On/Off switch stiff Off, and using the pointed instrument, press the MODE/HOLD button to wake up the pump from its low-powered "sleep" state.
2. The "LAST" message will appear on the display, followed by a blank screen, and then followed by the presentation of the run time data obtained by the last sampling run. Also on the display in the lower right hand corner is a small digit which indicates the percentage of time in which the last sampling run was made with greater than $\pm 5\%$ (fault) variation in the flow rate, with the maximum presentation of up to 9%. Across the lower portion of the display may be presented one or more icons.

If the “CAL” display appears instead at this time, press the MODE/HOLD button twice more to present the “LAST” run data.

Record the “LAST” run data at this time.

NOTE

If the On/Off switch is set to On at this point, the last run data will be lost as a new sampling run is started.

3. After 5 minutes free of any button depression, the display will blank as the sampler returns to the “sleep” mode. Return to Step 1 to reactivate the unit.

2.2.3 Setting The Pump Flow Rate

1. From the “LAST” presentation, pressing the MODE/HOLD button will change the display to a flashing “CAL” presentation.
2. Switch the On/Off switch to the On position. The “CAL” display will be steady.
3. Set the pump flow rate by turning the flow adjust screw. (Clockwise for increased flow and counter-clockwise for decreased flow.
4. Use the built-in rotameter as a flow indicator only. Accurate flow adjustment settings shall be made by using a Gilibrator 2, or equivalent flow calibration device, for calibration measurements.
5. When calibrating the sampler for flow, the sample collection device (cyclone, impinger, filter cassette or sorbent tube) should be in-line.
6. When the desired flow rate has been attained, switch the On/Off switch to the Off position and replace the left side anti-tamper cover if desired. The unit is now ready for sample collection.

2.2.4 Sample Gathering

Begin the sample run by switching the On/Off switch to the On position and secure the front anti-tamper cover. The display will continuously show the elapsed sampling time for the sampling run, with the error percentage and running icons also shown. The pump will operate at the flow rate set at the last calibration adjustment.

2.2.5 HOLD (Pause) Feature

1. With the left side anti-tamper cover open (see Figure 2.1), the sampling operation may be interrupted for breaks or lunches by pressing the MODE/HOLD button for at least 1 second. The pump will stop and a “Hand” icon will appear flashing in the display window.
2. The sampling run can be resumed by pressing the MODE/HOLD button again. The “Hand” icon will be removed from the display window.

2.2.6 Sampling Run Termination & Recovery

1. When the On/Off switch is moved to the Off position, the sampling run is terminated.
2. The accumulated run time minutes are displayed for 5 more minutes, along with the icon (symbol) data. The unit then goes into “sleep” mode to conserve the battery charge.
3. If you desire to exit the 5 minute run data display to return to a blank display, perform a display self-test (Section 2.2.7). Then, follow the instructions for waking the pump (Section 2.2.2) to perform another action.

2.2.7 Display Self-Test

1. Whenever the On/Off switch is in the Off position and the MODE/HOLD button is pressed continuously for at least three seconds, the sampler display will show the unit’s program date code (e.g., 9644) for as long as the button is pressed.
2. Releasing the MODE/HOLD button will allow the self-test to begin, where all elements of the five digit positions will be individually displayed, followed by all five digits simultaneously counting from 1 through 9, then back down to 1.
3. Each display Icon will be individually displayed from right to left, followed by all the icons flashing twice before the display goes blank, terminating the test.
4. The test runs for about 30 seconds, but can be greatly accelerated by pushing and holding the MODE/HOLD button depressed.

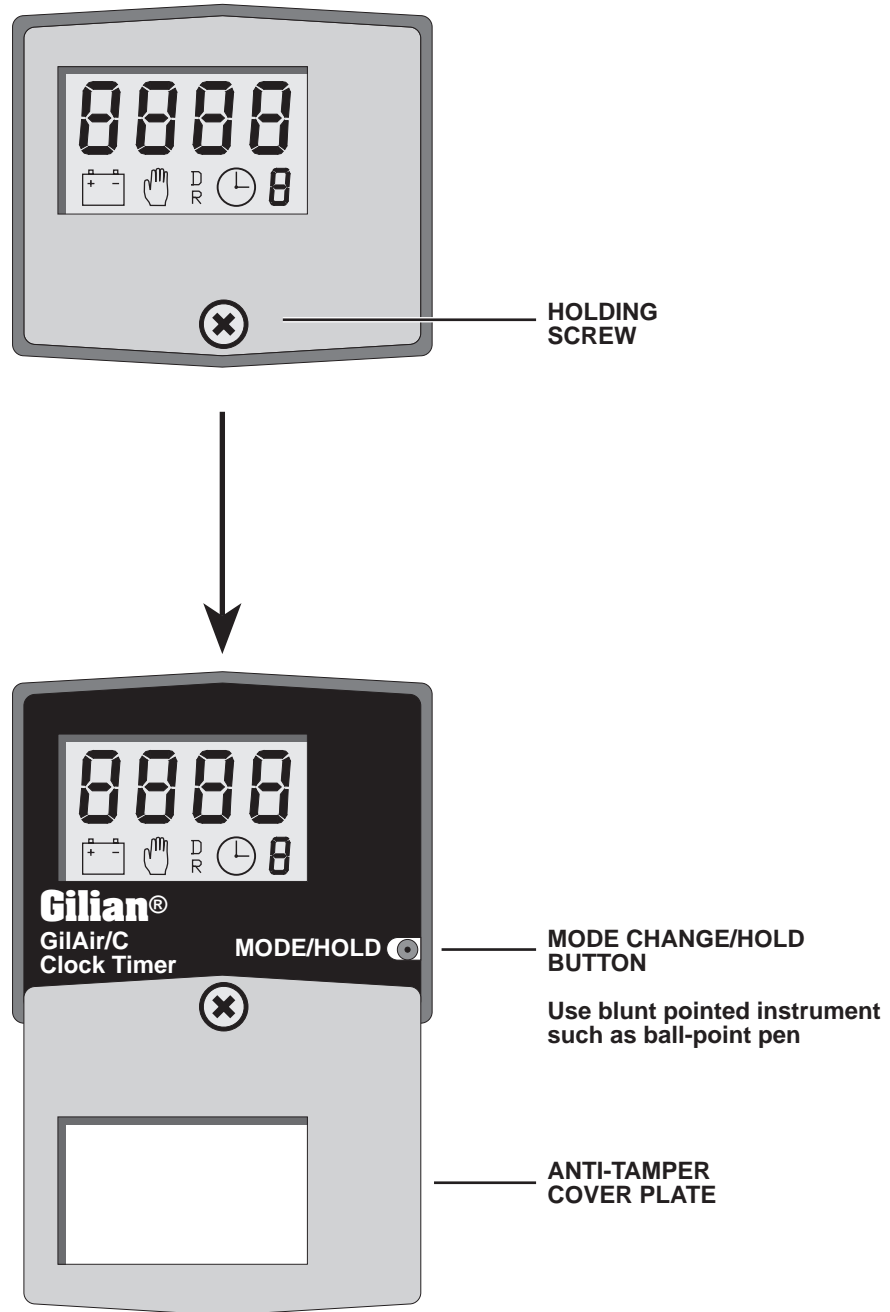


Figure 2.1
Display: Clock Timer Model

2.3 PROGRAM TIMER MODEL

NOTE

The Programming buttons should be pressed with a blunt pointed instrument, such as a ball-point pen.

Button Configuration (refer to Figure 2.2)

▲	Increase
▼	Decrease
PROG	Program Select / Accept Variable Value Shown
MODE/HOLD	Mode Change / Hold Operation

2.3.1 Preparation

1. Charge the battery according to Battery Maintenance Instructions provided in this Manual.
2. Using a small Phillips-head screwdriver, back out the holding screw of the anti-tamper cover plate to expose the On/Off switch and the flow adjust screw. (On the front of the pump.) On the left side of the pump, back out the holding screw of the anti-tamper cover around the display opening to expose the MODE/HOLD, PROG, ▲, and ▼ buttons.

NOTE

The pump switches to an low-powered "sleep" mode after 5 minutes of inactivity whenever the On/Off switch is positioned in the Off position. This conserves the battery charge.

3. If the On/Off switch is moved to the On position at any time, the pump will begin to run and collect data for a new sampling run of the last-selected program (see Section 2.3.8). **Exception:** If "CAL" is showing on the display the pump is in calibration mode and no data will be collected at this time.

2.3.2 Waking The Pump For "LAST" Run Data Readout

1. With the On/Off switch still Off, and using the pointed instrument, press the MODE/HOLD button to wake the pump up from its "sleep" state.
2. The "LAST" message will appear on the display, followed by a program number display, "Px" ("x" may be the letter C or 1 through 6), which is then followed by the presentation of the run time data obtained by the last sampling run. Also on the display in the lower right hand corner is a small digit which indicates the percentage of time in which the last sampling run was made outside of the $\pm 5\%$ (fault) variation in the flow rate, with the maximum presentation of up to 9%. Across the lower portion of the display may be presented one or more icons.

If the "CAL" display appears instead at this time, press the MODE/HOLD button four more times to present the "LAST" run data.

Record the "LAST" run data at this time.

NOTE

If the On/Off switch is set to On at this point to begin a new sampling run, the "LAST" run data will replace the "Old" run data, which will be lost at that time, as the last run data is cleared for the new sampling run data. However, you may retrieve the "Old" run data later by pressing the MODE/HOLD button (with the On/Off switch in the Off position) until the "Old" data are displayed.

3. After 5 minutes free of any button depression, the display will blank as the sampler returns to the "sleep" mode. Return to Step 1 to reactivate the unit.

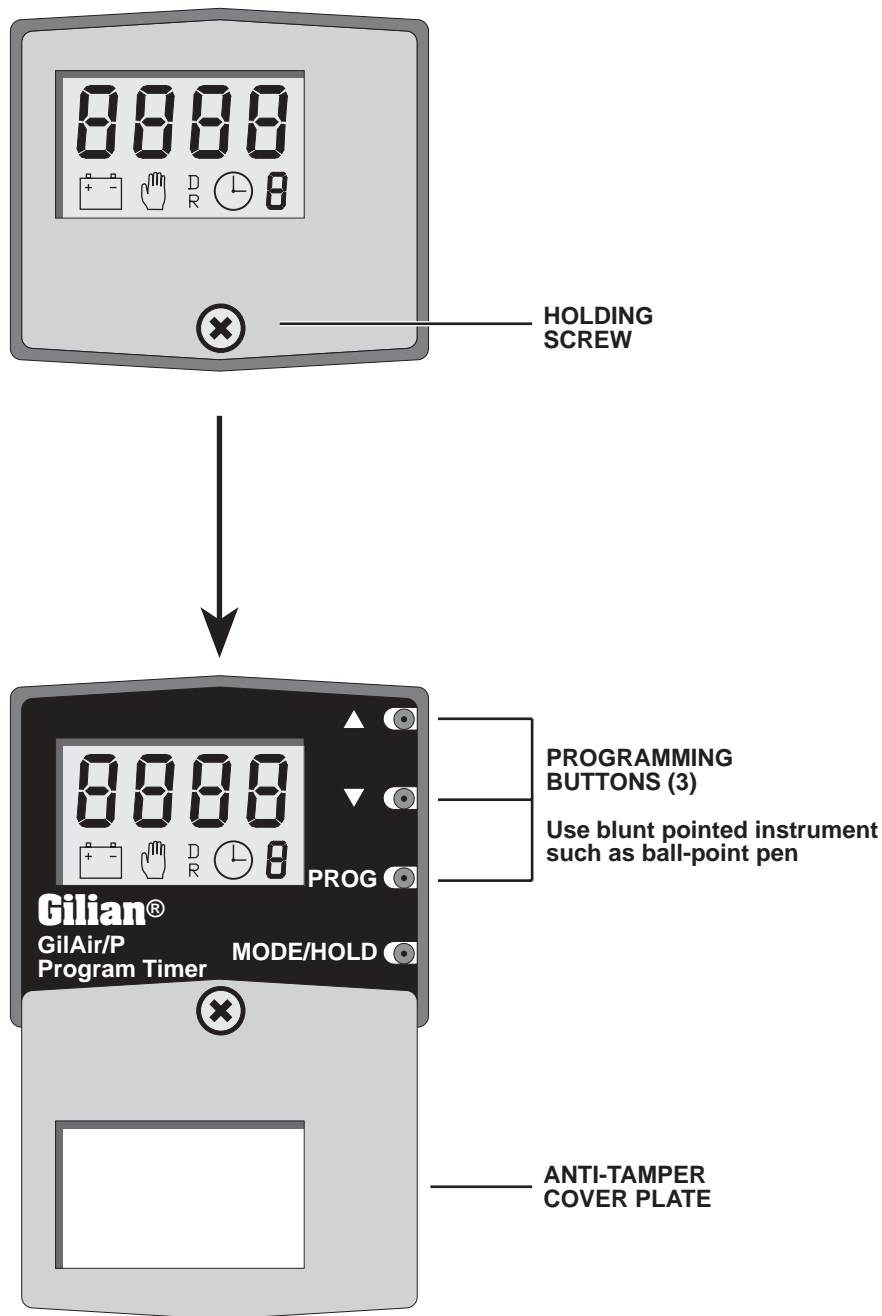


Figure 2.2
Display: Program Timer Model

2.3.3 Setting The Pump Flow Rate

1. From the "LAST" presentation (which follows the blank display), press the MODE/HOLD button to change the display to a flashing "CAL" presentation.
2. Switch the On/Off switch to the On position. The "CAL" display will be steady.
3. Set the pump flow rate by turning the flow adjust screw. (Clockwise for increased flow and counter-clockwise for decreased flow.)
4. Use the built-in rotameter as a flow indicator only. Accurate flow adjustment settings shall be made by using a Gilibrator 2, or equivalent flow calibration device, for calibration measurements.
5. When calibrating the sampler for flow, the sample collection device (cyclone, impinger, filter cassette or sorbent tube) should be in-line.
6. When the desired flow rate has been attained, switch the On/Off switch to the Off position and replace the left side anti-tamper cover if desired. The unit is now ready for sample collection.

2.3.4 Sample Gathering

From any pre-operation mode of the sampler, begin the sampling run by switching the On/Off switch to the On position and secure the front anti-tamper cover if desired. The pump will operate at the flow rate set at the last calibration adjustment. For the first 20 seconds of the sampling run, the program number of the selected program will be shown as PC or P1 through P6. The display will thereafter continuously show the elapsed sampling time for the sampling run or the delay time until the next run time interval, with the error percentage and running icons also shown.

2.3.5 HOLD (Pause) Feature

1. With the left side anti-tamper cover open, the sampling operation may be interrupted for breaks or lunches by pressing the MODE/HOLD button for at least 1 second. The pump will stop and a "Hand" symbol will appear flashing in the display window.
2. The sampling run can be resumed by pressing the MODE/HOLD button again. The "Hand" icon will be removed from the display window.

2.3.6 Sampling Run Termination & Recovery

1. When the On/Off switch is moved to the Off position, the sampling run is manually terminated. A programmed run (P1 through P6) will self-terminate upon completion if the On/Off Switch remains On.
2. The accumulated run time minutes are displayed for 5 more minutes, along with the icon (symbol) data. The unit then goes into the "sleep" mode when the On/Off switch is Off. If the switch is On when a programmed run has been made, the "SHUT"/"OFF" display appears, and remains until the switch is turned Off.
3. If you desire to exit the 5 minute run data display to return to a blank display, perform a display self-test (Section 2.3.7). Then, follow the instructions for waking the pump (Section 2.3.2) to perform another action.

2.3.7 Display Self-Test

1. Whenever the On/Off switch is in the Off position and the MODE/HOLD button is pressed continuously for at least three seconds, the sampler display will show the unit's program date code (e.g., 9644) for as long as the button is pressed.
2. Releasing the MODE/HOLD button will allow the self-test to begin, where all elements of the five digit positions will be individually displayed, followed by all five digits simultaneously counting from 1 through 9, then back down to 1.
3. Each display Icon will be individually displayed from right to left, followed by all the icons flashing twice before the display goes blank, terminating the test.
4. The test runs for about 30 seconds, but can be greatly accelerated by pushing and holding the MODE/HOLD button depressed.

2.3.8 Programming The Pump

1. When the “LAST” display following the blank screen is showing, choose one of the programs, PC or P1 through P6, by pressing ▲ or ▼ to present the selected flashing “Px” in the display window, where “x” may be a C or a number from 1 to 6.
2. Press the PROG button to view the value of the first variable, Delay Time, represented by the “D” icon in the display window. This variable controls the number of minutes from the setting of the On/Off switch to the On position until the occurrence of the first air sampling run time. The “Clock” icon will begin flashing to indicate that the programmed variables are being changed.
3. To change the value of the Delay Time for the selected program, press ▲ or ▼ to increment or decrement the value, respectively, or simply go to Step 4. If either button is held down, the numbers will change at an increasing rate of change after an initial pause.
4. Press the PROG button to accept the displayed Delay Time value and present the value of the second programmed run variable, the Run Time, which is accompanied by the “R” symbol. The Run Time variable is the number of minutes that the sampler will run for data collection before going into the Delayed Run state.
5. To change the value of the Run Time for the selected program, press the ▲ or ▼ to increment or decrement the value, respectively.
6. Press the PROG button to accept the displayed Run Time value and present the value of the third programmed run variable, the Delayed Run Time, which is accompanied by the “D” and “R” symbols. The Delayed Run variable defines the number of minutes between successive Run Time intervals.
7. To change the value of the Delayed Run Time for the selected program, press the ▲ or ▼ to increment or decrement the value, respectively.
8. Press the PROG button to accept the displayed Delayed Run Time value and present the value of the fourth programmed run variable, the Cycle Count, which is accompanied by the letter “C” in the small digit position. The Cycle Count variable defines the number of times that the Run Time intervals are executed.
9. To change the value of the Cycle Count for the selected program, press the ▲ or ▼ to increment or decrement the value, respectively.
10. Press the PROG button to accept the displayed Cycle Count value and return to the flashing “Px” display. This completes the programming operations of the selected program.

NOTE

If the Run Time and Cycle Count variables are large enough to result in a total run time of more than 9,999 minutes, the unit will remain in the Cycle Count programming mode with a flashing “E” in the small digit area, until a value for Cycle Count is acceptable when the PROG button is pressed.

3.1 LOW FLOW OPERATION

3.1.1 Description

The GilAir-3/GilAir-5 Sampling System offers two modes of low-flow sampling Constant Flow and Multi-flow. In each case the appropriate module is fitted to the top of the sampler and communicates with the pump through the opening beneath the top insert plate. Both the Constant Flow and Multi-flow modules are equipped with an On/Off switch control allowing these units to be functionally engaged or disengaged without physical removal from the sampler. The modules incorporate a luer taper port which is used for bag sampling.

3.1.2 Constant Low Flow

The Constant Low Flow Module is suitable for sampling between 5 and 500 cc/min, and will maintain a constant low flow through the sampling head (i.e., tube holder) despite changes in load - the maximum load being 25" H₂O. The device utilizes an internal pressure regulator to maintain a constant pressure drop and hence a constant flow, through an externally adjustable flow control valve discharging to atmosphere. Since the discharge flow is maintained constant and the sampling system is otherwise closed, the inlet flow must remain constant as well. However, the flow constant in this mode is termed "flow stabilized" and will not activate the flow fault function should the flow deviate beyond $\pm 5\%$.

3.1.3 Constant Low Flow Module

NOTE

Installation or removal of any low flow module must be done in a clean environment while the sampler is turned off. Contamination of the air passages between the pump and the low flow module may result in a failure of the system.

Make sure the O-ring seals of the low flow module are properly seated into the top of the pump assembly and that the mating boss clears the case opening prior to securing the mounting screws. Use a flat screwdriver to engage the notch in the module's On/Off control as shown. With the Module in the Off position, turn the sampler On and adjust the flow to between 1.0 and 1.5 LPM using the flow adjust pot. Switch the Module On and using a fine screwdriver, engage the flow control valve through the access hole. Note that the sampler's built-in rotameter will not be useful at flows below 500 cc/min, an external flow measuring device, such as a Gilibrator 2 or calibrator rotameter, must be used. The system's performance should be checked by applying a load of 20-25" H₂O and verifying that the flow recovers to within $\pm 5\%$. Note that at very low flow rates it may take several minutes for the flow to recover. This is normal.

3.1.4 Bag Sampling

The module is provided with an internal luer taper for bag sampling. Bag sampling is accomplished by attaching a piece of tubing from the sampling bag to the boss opposite the luer taper end (luer taper to 1/8" ID tubing). Install the luer taper fitting into the luer taper receptacle on the top of the module. Flow is adjusted by means of the same screw used to set low flow. Flow measurements can be taken via the inlet boss of the pump. The unique feature of this system is that it will automatically shut the flow off when the bag has been filled. The maximum pressure within the bag is approximately 8" of water.

3.2 MULTI-FLOW OPERATION

3.2.1 Multi-Flow Module

The multi-flow module is suitable for multiple tube sampling between 1 and 750 cc/min and can be used in conjunction with the Gilian Universal Tube Holder System to perform multiple tube sampling. The module's internal regulator maintains a constant pressure of approximately 18" H₂O at the sampler's inlet while allowing changes in total flow through the system. With a constant pressure in the tube holder manifold, the flow through each tube can be set independently without affecting the flow(s) through the adjacent tube(s). Total sampling tube combined flows cannot exceed 750 cc/min.

The multi-flow module is installed in the same manner as the Constant Flow Module. Once installed, set the module's On/Off switch to the Off position and adjust the sampler's flow to between 1 and 1.5 LPM. Set the module On/Off control to the On position. Performance should be checked in conjunction with the test set-up. With the load valve closed, the pressure should be 18" ± 3" H₂O. Open the load valve until the flow is approximately 750 cc/min. The pressure should not vary more than ± 3" H₂O.

Once the system's performance has been checked, the Tube Holder System can be connected. Fit each sorbent tube to an appropriately sized Tube Holder and connect the outlet of the Manifold to the inlet of the sample. Set the flow through each tube by adjusting the corresponding flow control valve in the Manifold. The flow through each tube should be measured with a calibrated device connected to the inlet of that tube holder. A Gilibrator 2 or conventional bubble flow meter is preferable since the pressure drop through this type of device is negligible.

3.2.2 Bag Sampling

A unique multi-flow bag sampling capability is available in the latest version of the multi-flow module. Access to the pressure port is by means of an internal luer taper on top of the module. One or more bags may be filled by installing the luer fitting into the luer taper receptacle located on top of the module and connecting a 1/4" tubing from the opposite end of the luer fitting (luer taper from 1/8" ID tubing) to the flow manifold.

Flow is adjusted by means of the flow control valve in the manifold. Connection to the bag is made by screwing the end fittings to the tubing housing such that the O-rings located on the shoulder of the fitting seals against the tube housing. An additional piece of 1/8" ID tubing is secured to the special fitting on the manifold which is then directed to the bag. Flow can be set via a Gilibrator 2 or flow meter by adjusting the screw within the specific tube housing associated with the flow control valve so as to obtain the flow required. Remove the calibration equipment and connect the tubing to the bag to be filled.

SECTION FOUR BATTERY MAINTENANCE

4.1 SERVICE OVERVIEW

Battery packs for Gilian air sampling pumps are rechargeable Nickel Cadmium batteries. They must be fully charged and maintained properly to achieve maximum pump run time. It is incumbent upon the pump user to ensure that the battery has enough charge to complete the intended run time.

Rechargeable Batteries

- GilAir-3: 4.8 Volt, 1.8 Ampere-hours
- GilAir-5: 6.0 Volt, 1.8 Ampere-hours

The battery packs for the GilAir-3 and GilAir-5 are charged through a built-in jack, on the side of the battery pack. The batteries may be charged while in place or while removed from the sampler. Note that the charging plug is polarized to prevent improper insertion. *Do not short the battery terminals or the charging jack. Shorting will result in irreversible damage to the battery pack.*

NOTE

Battery packs for South African versions are customer supplied. These must be rated 4.8V, 1.8 ampere-hours.

4.1.1 Battery Life

Battery life is usually measured in charge/discharge cycles. Gilian battery packs are capable of providing between 300 and 500 charging cycles. Since this is very difficult to track over the life of the battery, the following guide will help you to anticipate how long the battery should last.

The estimated battery life is based on proper battery maintenance. The best way to ensure maximum battery life is to track daily pump usage and only charge the battery pack when necessary.

4.1.2 Memory Effect

Nickel-Cadmium batteries will develop reduced capacity when the user does not maintain the practice of discharging or charging fully during the sampling process. Memory effect takes time to develop and usually can be eliminated with two discharge/charge cycles (Double Evaluation mode on the BMS charger).

4.1.3 Leakage Current

Nickel-Cadmium batteries always have a small internal leakage current. If the battery pack has been removed from the charger for more than two days without use, it will require additional charging to restore it to full capacity. This process can be repeated two or three times without causing signs of memory effect.

Pump Usage	Weekly Use	Est. Battery Life *
High	40–60 hours	1–1.5 years
Medium	20–39 hours	1.5–2.5 years
Low	< 20 hours	over 2.5 years

* extended periods may shorten the life of the nickel-cadmium battery.

Table 4.1
Estimated Battery Life

4.2 CHARGING SYSTEMS

4.2.1 Single-Station Charger

A dual rate charger that can be switched from constant-rate charge to trickle charge.

4.2.2 Universal Multi-Station Charger

A dual rate charger offering five-station timed constant-rate charging that automatically defaults to trickle charge.

4.2.3 BMS Multi-Station Charger

WARNING

Do not use the BMS-200 Battery Charger to charge SIRA approved battery packs.

A five-station charger offering timed charging that defaults to a pulsed charge in either a constant-rate charging mode or two diagnostic modes.

NOTE

The BMS Multi-Station Charger has a single and double discharge mode (Single Evaluation and Double Evaluation). Excessive use of these discharge/charge features will needlessly shorten battery life. We recommend use of the Double Evaluation mode for maintenance only (maximum once monthly).

- **Constant Charging Rate**

This is the charging system normally used for charging Nickel-Cadmium batteries. The charger supplies a fixed constant current to the battery. Overcharging in this mode can cause overheating, which shortens battery life.

- **Pulsed Charge**

This charging feature is used to temporarily maintain full capacity of the battery.

APPENDIX A PARTS LIST

Part No.	Description
800518	GiIAir-3 / GiIAir-5, Low Flow Module, Constant Flow (Blue)
800518-1	GiIAir-3 / GiIAir-5, Low Flow Module, Constant Flow (Black)
800519	GiIAir-3 / GiIAir-5, Low Flow Module, Multi-Flow (Blue)
800519-1	GiIAir-3 / GiIAir-5, Low Flow Module, Multi-Flow (Black)
800320-2	GiIAir-3 / GiIAir-5, Airboss and Restrictor Kit
800112	GiIAir-3 / GiIAir-5, Tool Kit
800880M	GiIAir-3 / GiIAir-5 Operation & Service Manual
800464	GiIAir-3, Battery Pack (Blue)
800464-1	GiIAir-3, Battery Pack (Black)
800464-4	GiIAir-3, Battery Pack (Australia)
800464-5	GiIAir-3, Battery Pack Shell Components (South Africa)
800869	GiIAir-5, Battery Pack (Blue)
800869-1	GiIAir-5, Battery Pack (Black)
800869-7	GiIAir-5, Battery Pack (Pull Start)
400015	Pull Start Jack, 2.5 M
800149	Tube Holder Kit, Single Tube Holder Assy (No Manifold) 6 x 70 mm
800148	Tube Holder Kit, Dual Manifold (Holders/Ends/Tubing) 6 x 70 mm
801407	Tube Holder Kit, Dual Manifold (Holders/Ends/Tubing) 10 x 110 mm
200484	Tubing, 36", 1/4" ID
800159	Tubing, 36", 1/8" ID (with 1/4" ID Adapter)
200505	Tubing, 36", 1/8" ID

* For further information on Gilian spare parts, please contact your Sensidyne Customer Service Representative at 800-451-9444, ext 782.

APPENDIX B SPECIFICATIONS

General Specifications

Controls	Power Switch, Flow Control (all models), plus: MODE/HOLD button (Clock Timer Model) MODE/HOLD, PROG, ▲, & ▼ buttons (Program Timer Model)
Indicators	Display (LCD), Battery (Green) LED, Fault (Red) LED
Display Ranges	0–9999 (Timing), 0–9 (Error Percentage)
Display Messages	LAST, CAL, SHUT/OFF (Clock Timer & Program Timer Models) E, PC, P1–P6, OLD (Program Timer Model)
Dimensions (GilAir-3)	3.6" (H) x 3.9" (W) x 2.0" (D) 90 mm (H) x 100 mm (W) x 51 mm (D)
Dimensions (GilAir-5)	4.1" (H) x 3.9" (W) x 2.0" (D) 103 mm (H) x 100 mm (W) x 51 mm (D)
Weight (GilAir-3)	21 oz. (595 g)
Weight (GilAir-5)	22.5 oz. (638 g)

Power Supply

Battery Pack	GilAir-3: 4.8 volt, 1.8 amp hour GilAir-5: 6 volt, 1.8 amp hour
Battery Type	Rechargeable Nickel-Cadmium
Battery Charge Time	14–18 hours
Expected Battery Life †	300–500 charge/recharge cycles
Estimated Battery Life †	2.5 years (< 20 hours weekly use) 1.5–2.5 years (20–39 hours weekly use) 1–1.5 years (40–60 hours weekly use)

† Inactivity for extended periods may shorten nickel-cadmium battery life.
Battery life estimates are based on proper battery maintenance.

Operating Specifications

Constant High Flow Range	GilAir-3: 850–3000 cc/min GilAir-5: 850–5000 cc/min
Flow Control	External Flow Adjust (\pm 5% of set point)
Constant Flow (Low Flow)	5–500 cc/min to 25" H ₂ O (640 mm Hg)
Multi-Flow (Low Flow)	1–750 cc/min, to 18"+3" H ₂ O (460+80 mm Hg)
Pressure Range	

Pump Flow (LPM)	8 Hr. Run (" H2O)		Min. " H2O before fault	
	GilAir-3	GilAir-5	GilAir-3	GilAir-5
0.85	20	20	25	35
1	25	25	30	35
2	–	26	–	35
2.5	15	–	20	–
3	8	23	10	30
4	–	15	–	15
5	–	8	–	8

APPENDIX C TROUBLESHOOTING GUIDE

<i>Cause</i>	<i>Remedy</i>
<ul style="list-style-type: none">• When On/Off switch is moved to On position, display shows hand icon and "E."	Software problem. Move On/Off switch to Off position and then back to On position.
<ul style="list-style-type: none">• Unusual Display when battery pack is installed.	Battery pack not properly installed. Disconnect battery pack and re-install it properly.

APPENDIX D

RETURNED MATERIAL AUTHORIZATION

Gilian maintains an instrument service facility at the factory to provide its customers with both warranty and non-warranty repair service. Gilian assumes no liability for service performed by personnel other than Gilian personnel. To facilitate the repair process, please contact the Gilian 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. Gilian Service Department personnel may be reached at:

Sensidyne
16333 Bay Vista Drive
Clearwater, FL 33760 USA
727-530-3602
727-539-0550 [FAX]

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. Gilian'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 their original packing) and enclose your return address, purchase order, shipping and billing information, RMA number, 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 to authorize a COD shipment.

Send the instrument, prepaid, to:

SENSIDYNE
16333 BAY VISTA DRIVE
CLEARWATER, FL 33760 USA

ATTENTION: Service Department

RMA #: _____

SERVICE OPTIONS

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



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