

Digital Syringe™

Congratulations! You have purchased the finest quality precision fluid measuring device available today. We combine the highest quality materials with skilled workmanship, ensuring the highest possible performance level of every precision fluid handling device we manufacture. With proper care and handling, the Digital Syringe will provide years of use.

Syringes and needles manufactured by Hamilton Company are intended for scientific research and laboratory use only and are not intended for *in vitro* or human *in vivo* use. Care must be taken to avoid injury from the syringe needle. Follow GLP at all times, particularly when using flammable or biohazardous fluids in the syringe.



The Digital Syringe is a calibrated device composed of a serialized syringe and a serialized digital electronic holder. A certificate of calibration accompanies the unit. A digital readout allows enhanced syringe volume readability, while an adjustable plunger stop assures accurate, reproducible sample injections. The device also reduces the possibility of plunger bending. Suggested uses of the Digital Syringe include standard preparation, sample preparation, GC injection, HPLC partial loop filling, titration, and calibration of gas analyzers.

Hamilton's Digital Syringe is available with 700 series Microliter™, 1700 series Gastight®, and 7000 series Modified Microliter™ syringes. The Digital Syringe is factory calibrated for precision measurements and operates with a standard +3 VDC battery.

Table 1: Technical Specifications

Power Requirements	CR2450 Lithium button cell battery	Dimensions	216 x 29 x 44 mm (8.5 x 1.13 x 1.75 in)
Power Rating	3V, 500/600 mAh	Weight	119 g (4.2 oz)
Accuracy	±0.5% of Syringe Volume at 80% of full stroke ¹	Operating Temperature Range	15 – 30 °C (59 – 86 °F)
Plunger Positioning	Inductive linear encoder	Storage Temperature Range	-20 – 65 °C (-4 – 149 °F)
Display Resolution	0.1% of full scale syringe volume ²	Storage Humidity Range	10 – 90% RH, noncondensing
Syringe Series	700, 1700, 7000	Certifications	CE, CSA
Volume Range	0.5 – 500 µL	Compliance	RoHS, China-RoHS
Fluid Path	Varies (Borosilicate, PTFE, Stainless Steel, Tungsten, FEP)		

Indoor Operation and use only

¹ For 7000 series syringes, accuracy is ±1.0% of Syringe Volume at 80% of full stroke.

² Display resolution is 0.08% for 25 and 250 µL syringes.

Calibration of the Digital Syringe

The syringe model you selected when ordering your Digital Syringe is installed onto the digital electronic holder, and the unit is calibrated at the factory. A Certificate of Calibration, indicating accuracy, is shipped with the Digital Syringe.

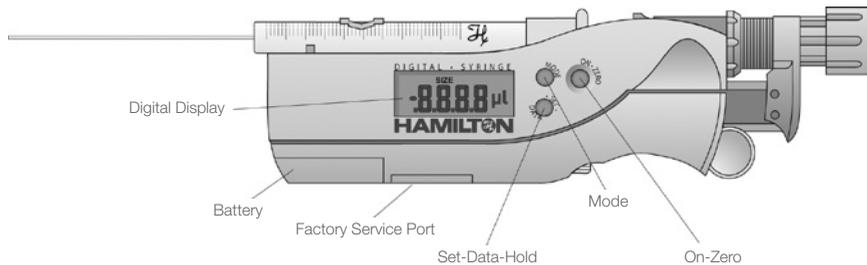
To replace a syringe in a Digital Syringe, order a calibrated syringe using “CAL” in front of the syringe part number.

In addition, the Digital Syringe may be returned to the factory for periodic calibration and syringe replacement.

Features of the Digital Syringe

Digital Display - The digital display consists of an LCD that shows information from the current display mode (see Figure 1). There are seven descriptive parts to the LCD: **SERIES** indicates the syringe series in use; **SIZE** indicates total syringe volume; **CAL** indicates the calibration factor; **HOLD** freezes the current volume display;  indicates that the battery voltage is low and the battery needs to be replaced; **μL** indicates that the displayed information is in units of microliters (μL); and a **negative sign** indicates plunger travel beyond the display zero.

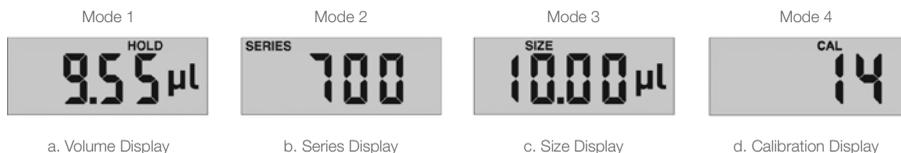
Figure 1: Digital Syringe Diagram



On-Zero Button - Turn on the unit by pressing the On-Zero button (see Figure 1). This will activate the digital display. If the display is already on, pressing the On-Zero button will zero the digital readout, regardless of the position of the plunger. Any subsequent movement of the plunger will result in a changing digital readout. If dispensing starts immediately after pressing the On-Zero button, the display will indicate a negative volume.

Mode Button - Use the Mode button to gain access to four descriptive functions of the digital display. Mode 1 (volume display) is the primary display mode, indicating the current volume dispensed or to be dispensed (Figure 2a). Press the Mode button to view Mode 2 or syringe series (Figure 2b). The syringe series shown should match that marked on the syringe barrel. Press the button again to view Mode 3 or total syringe volume (size) (Figure 2c). Press the Mode button again to view Mode 4 or Calibration Display (Figure 2d). Once entered, Modes 2-4 are saved to memory, even if battery is removed. Change the mode settings using the Set-Data-Hold button described below. When the LCD indicates an error message, the Mode button is not functional.

Figure 2: Digital Syringe Modes



Set-Data-Hold Button - Change mode settings using the Set-Data-Hold button. Press the Mode button until the desired mode appears on the LCD. Then press the Set-Data-Hold button until the desired setting appears on the display. Press this button repeatedly to scroll through available syringe series and syringe volumes. Pressing this button while in Mode 1 freezes the current volumetric display and the word HOLD will appear on the LCD (Figure 1a). As an example, after the syringe is filled to the desired volume, press this button to freeze the display. You may then dispense the sample, and the volume dispensed still appears for recording. Press the button again to release the Hold function.

Set Calibration Factor - The calibration of the unit can be updated when installing a new syringe. First use the Mode button to configure the unit for the series and size of the new syringe. Next enter the Calibration Display screen. Press the Set-Data-Hold button; the calibration code will flash. Slide the plunger clamp along the axis in either direction to adjust the code. The calibration is accepted by pressing the Mode button. Mode 2 or syringe series (Figure 2b). The syringe series shown should match that marked on the syringe barrel. Press the button again to view Mode 3 or total syringe volume (size) (Figure 2c). Press the Mode button again to view Mode 4 or Calibration Display (Figure 2d). Once entered, Modes 2-4 are saved to memory, even if battery is removed. Change the mode settings using the Set-Data-Hold button described below. When the LCD indicates an error message, the Mode button is not functional.

Battery and Battery Access - One +3 VDC battery (P/N 6509006) is supplied with the Digital Syringe. After many hours of operation, the low battery icon  appears in the upper right-hand corner of the digital display. The unit goes into an automatic battery idle mode after five minutes of no operation. The battery is held in place on a slide-out tray located below the left-hand side of the digital display (see Figure 1). Only one battery is required for operation of the Digital Syringe, and it is installed during calibration at the factory.

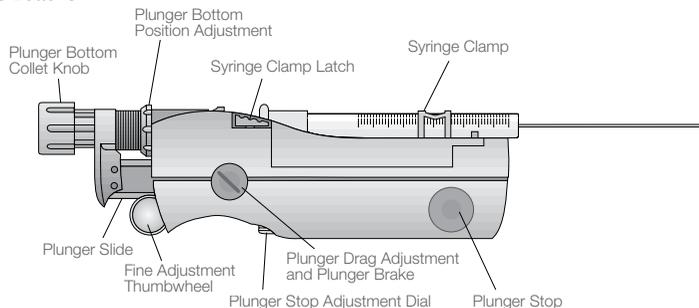
To install the battery, turn the Digital Syringe so that the Hamilton serial number plate faces you. Pull out the battery tray. Place the tray on a flat surface, and place the battery into the tray with the printed side down. Replace the tray with the battery into the Digital Syringe body. Make sure the syringe plunger is bottomed out in the syringe barrel, and turn on the unit by pressing the On-Zero button.

Factory Service Port - This is a maintenance port that is used by Hamilton Service Technicians. This port should not be used for any other purposes.

Fine Adjustment Thumbwheel - Move the plunger in fine increments for a better position or volume control.

Plunger Drag Adjustment and Plunger Brake - Change the force or drag needed to actuate the syringe plunger. Turn the slotted plunger drag adjustment and plunger brake button (see Figure 3) clockwise to increase tension; turn the button counterclockwise to decrease tension. Press the button to activate the plunger brake at any time during the dispense operation.

Figure 3: Digital Syringe Buttons



Plunger Stop and Plunger Stop Adjustment Dial - Repeat exact-volume filling of your syringe by pressing the plunger stop while pulling out the plunger slide until it stops at a preset value. Or if you prefer, repeat exact-volume dispensing by first pulling out the plunger slide to the maximum syringe volume. Then press the plunger stop while advancing the plunger slide. The plunger will stop at the preset value. See “Operation of the Plunger Stop and Plunger Stop Adjustment Dial” on page 4 for more detail.

Syringe Clamp and Syringe Clamp Latch - The syringe clamp firmly holds the syringe barrel in place. Press the syringe clamp latch to remove the syringe for cleaning.

Plunger Bottom Position Adjustment - The plunger bottom position adjustment (Figure 3) allows you to position the plunger so that it will not bottom in the barrel, thereby avoiding potential damage to the syringe.

Plunger Button Collet Knob - Secure the plunger button by tightening the plunger button collet knob (Figure 3). Loosen this knob when removing the syringe from the digital electronic device.

Operation of the Plunger Stop and Plunger Stop Adjustment Dial

The Plunger Stop and Plunger Stop Adjustment Dial are used to set a volume for repeated dispensing, and to increase the precision of the Digital Syringe. To use this feature, choose Method 1 for the most precise results; use Method 2 for larger volumes and only after priming the syringe by aspirating and dispensing several times.

Method 1

1. Determine the volume at which the Plunger Stop is set.
 - a. Pull the plunger beyond maximum volume, and push and hold the Plunger Stop.
 - b. While holding the Plunger Stop, push the Plunger Button Collet Knob until the plunger stops.
 - c. Release the Plunger Stop, and read the digital display.
2. If the Plunger Stop is not at the desired volume, rotate the Plunger Stop Adjustment Dial (+/-) in the desired direction. One increment of turn is about equal to 1% of full syringe scale. Repeat step 1 to determine the new setting. Repeat steps 1 and 2 as many times as necessary to achieve the desired setting.

Note: As you turn the dial, the reading on the digital display will not change. Only when you repeat step 1 will you get a reading for the new setting.

3. Dispense the sample:
 - a. Aspirate a volume of sample greater than that to be used, and push and hold the Plunger Stop.
 - b. While holding the Plunger Stop, push the Plunger Button Collet Knob, dispensing the excess sample, until the plunger stops.
 - c. Release the Plunger Stop, and dispense the remaining volume.

Method 2

1. Determine the volume at which the Plunger Stop is set.
 - a. Push and hold the Plunger Stop.
 - b. While holding the Plunger Stop, pull the Plunger Collet Knob until the plunger stops.
 - c. Release the Plunger Stop, and read the digital display.
2. If the Plunger Stop is not at the desired volume, rotate the Plunger Stop Adjustment Dial (+/-) in the desired direction. One increment of turn is about equal to 1% of full syringe scale. Repeat step 1 to determine the new setting. Repeat steps 1 and 2 as many times as necessary to achieve the desired setting.

Note: As you turn the dial, the reading on the digital display will not change. Only when you repeat step 1 will you get a reading for the new setting.

3. Dispense the sample:
 - a. Push and hold the Plunger Stop.
 - b. While holding the Plunger Stop, aspirate the sample until the plunger stops.
 - c. Release the Plunger Stop, then dispense the syringe contents.

Errors

The message "ERR#" is displayed on the LCD when an error occurs. Errors may be caused by moving the plunger too rapidly, moisture or dirt on the surface of the plunger slide, or incorrect syringe installation.

To correct errors, clean and dry the plunger slide, and press the On-Zero button.

If the unit does not respond, reinstall or replace the battery.

Syringe Removal and Installation

To remove the syringe:

1. Release the plunger button by turning the Plunger Button Collet Knob counterclockwise.
2. Release the Syringe Clamp Latch by pressing down on it until the clamp snaps free. Lift the clamp and remove it if necessary.
3. Pull the plunger slide back to its maximum position and remove the syringe.

To install the syringe:

1. Pull back on the Plunger Button Collet Knob to the maximum plunger slide position.
2. Release the Syringe Clamp and lift.
3. Position the syringe (with plunger fully inserted) over the slot above the LCD so that the syringe scale faces the same direction as the LCD. Push the syringe barrel into the slot making sure the barrel flange is captured between the flange pocket and the flange spring.
4. Press down the Syringe Clamp Latch until it catches.
5. Unscrew the Plunger Button Collet Knob and push down the Plunger Slide so that the collet surrounds the plunger button.
6. Tighten the Plunger Button Collet Knob until it grabs the plunger button snugly. Do not overtighten.
7. Set the Plunger Bottom Position Adjustment so that it comes in contact with the Digital Syringe body just as the plunger bottoms out.

Cleaning and Maintenance of the Digital Syringe

Clean the syringe after each use. Remove it from the Digital Syringe if necessary following the removal instructions provided.

To clean syringes it is best to use solvents known to be effective in dissolving the sample and preferably those that are non-alkaline and non-phosphate based. A biodegradable, non-phosphate, organic Cleaning Solution Concentrate is available from Hamilton (P/N 18311). Rinse the syringe thoroughly with either high quality water or acetone.

To clean the plunger for 700 Series Microliter and 1700 Series Gastight syringes, remove it from the syringe barrel and gently wipe it with a lint-free tissue. Reinsert the plunger. Remember to wet the PTFE plunger tip of a Gastight syringe before inserting the plunger into the barrel.

To clean 7000 Series Modified Microliter syringes, do not remove the plunger assembly. Flush the syringe several times with cleaning solvent and several times with high quality water.

An alternate cleaning method for any of the syringes is Hamilton's Syringe Cleaner. This is a dry method of cleaning that is normally sufficient to vaporize most common liquid samples. You may include a vacuum source, if necessary, to remove suspected residuals.

Whenever needed, wipe the digital electronic device with a soft cloth wetted with water, a dilute bleach solution, or other compatible decontamination solution. Thoroughly dry the device before reinstalling a syringe or operating the unit.

Periodically clean the Plunger Slide by gently wiping it with a soft cloth moistened with water or isopropyl alcohol. Thoroughly dry the plunger slide before operating the unit. Occasionally you may need to lubricate the plunger slide by wiping it with a soft cloth moistened with a light oil. Do not leave excess oil on the slide surface that would tend to accumulate dirt. After applying the lubricant, wipe the surface of the Plunger Slide with a dry cloth, leaving only a very thin film of the oil.

Refer other maintenance questions, concerns, or problems to Hamilton Company.

Digital Syringe Storage

Store the Digital Syringe in a location that is free of vibration. The Digital Syringe goes into an automatic battery idle mode (the digital display is no longer active) after five minutes of no operation. However, low level, high frequency vibrations can cause the device to remain on. This reduces battery life.

If you are in doubt about vibrations in your storage location, check the Digital Syringe after 10 to 15 minutes of no operation to make sure the digital display is no longer active.

Digital Syringe Recalibration

Hamilton Company recommends annual recalibration of the Digital Syringe. However, it can be calibrated as often as your procedures require.

To have your Digital Syringe recalibrated, you may contact Hamilton Customer Service at (888) 525-2123 to obtain a Return Materials Authorization.

Regulatory Information

The Digital Syringe generates and uses radio frequency energy, and may interfere with radio and television reception. The Digital Syringe complies with Class B limits as specified in Subpart J of Part 15 of FCC Rules, which provide reasonable protection against such interference.

In the unlikely event there is interference to radio or television reception, try reorienting the receiving antenna or relocating the Digital Syringe relative to the receiver.

The Digital Syringe complies with: EN61326-1:2013, Radiated: Class B; FCC Part 15, Class B; EN61326-1:2013, Industrial Immunity: Class A Equipment; IEC 61000-4-2: Electrostatic Discharge; IEC 61000-4-3: Radiated Immunity; IEC 61000-4-8: Magnetic Immunity.

Table 2: Label Definition

	EC Declaration of Conformity Signifies the device is certified for sale in the EU.		WEEE (Waste of Electrical and Electronic Equipment) This directive represents recycling, sorting and handling of the device after its lifecycle.
	CSA Product Certification Signifies the device is certified for both the Canadian and U.S. markets to the applicable standards.		China-RoHS EFUP label indicating the product contains less than the maximum concentration value of all six hazardous substances.

Disposal

In the Americas/ Pacific Rim, disposal of the Digital Syringe base unit should be carried out by the customer per local regulations for disposal of electronic devices.

In Europe, electronic device disposal is carried in accordance to the EC directive WEEE. For disposal information, contact Hamilton company at the contact information below.

Warranty Statement

Hamilton Company unconditionally guarantees its products to be free of defects in materials and workmanship. Any product that fails due to such a defect will be repaired or replaced at our discretion without cost, provided the device is returned on a Return Materials Authorization (RMA). It is the responsibility of the purchaser to determine the suitability of application and material compatibility of the product based on the published specifications of the product.

Return of Goods

Hamilton Company's return and repair policy is written to protect its employees from potentially hazardous materials (e.g., serum, radioactive materials, carcinogenic chemicals, etc.) or any substance that may cause them partial or permanent disability during the inspection or repair process. In returning a product, the customer acknowledges that the product is free from any hazardous materials. Furthermore, the customer assumes responsibility should the returned product prove to be hazardous.

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Lit. No. 69191 Rev. J — 08/2016

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