



# SP120p-300 Syringe Pump

*Dual syringe pump for simultaneous infusion and withdrawal*

## **INSTRUCTION MANUAL**

Serial No. \_\_\_\_\_

4/00

***World Precision Instruments, Inc.***

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## General Description

This manual applies to infusion pump, model SP120p. Operation of the pump is simplified by using a keypad to select features from a menu displayed on an alphanumeric LCD. All control functions are performed automatically by the pump microcontroller and are based on linear motion of the pusher block, associated with the syringe size (diameter) to deliver a known volume. After entering the syringe diameter, either directly or from a table in memory, all calibration and control functions are performed by the pump automatically.

## Specifications

|                              |  |
|------------------------------|--|
| Syringe Size                 | 10 microliter to 15 milliliter   |
| Voltage Operating Range      | 95-130, 220-260 VAC  |
| Drive Mechanism              | microprocessor controlled stepper motor 1/2 microstepping, driving a leadscrew through a belt and pulley drive mechanism |
| Pusher Advance per Half Step | 0.088 micron   |
| Minimum Stepping Rate        | 1/2-step in 30 seconds   |
| Maximum Stepping Rate        | 400 half-steps/sec   |
| Speed Range                  | 12,000:1   |
| Flow Rate Range              | 0.001 $\mu$ l/min (10 $\mu$ l syringe) to 0.602 ml/min (50 ml syringe)   |
| Linear Force                 | 20 lb min.   |
| Power                        | 115/230 VAC, 50/60 Hz, internal selector switch  |
| Fuse                         | 5x20 mm, 250 V, 0.1 amp  |
| Dimensions                   | 9 x 6 x 5 in. (23 x 15.25 x 13 cm)   |
| Weight                       | 5 lb (2 kg)  |

### Features

The SP120p is an accurate syringe infusion pump designed to hold glass or plastic syringes, of any make, from 10 microliter to 60 milliliter.

Pump setup and operation is extremely simple. A menu, displayed on an alphanumeric LCD “prompts” the operator to make the necessary selections using the keypad for choice of features and numerical entries.

The **internal diameter of the syringe** is used by the control program to calibrate the pump and deliver the volume and flow rate selected. For simplicity, the syringe diameter is also used to set volume and flow rate units.

The syringe diameter can be **entered directly** or the syringe can be identified from a **table of syringes** held in memory. When the syringe is selected from the table the diameter is entered automatically.

Two dispense modes are available:

- a) **dispense volume mode** in which the pump keeps track of the volume dispensed and automatically stops the pump when a set target volume is reached .
- b) **run mode** where the pump runs at the set flow rate until manually stopped .

In the event of a **power interruption** during operation, the pump can be programmed to either resume operation or remain stopped when power is returned.

For convenience, all pump **settings are stored in non-volatile memory** to minimize the number of setting changes required.

### Keypad Functions

- ← This key has two functions:
  - a. Moves the display to the left.
  - b. Causes the numerical entry to **decrease**. To change the displayed number by a single unit press and release the key quickly. If the key is pressed longer the number changes with increasing speed.
- This key has two functions.
  - a. Moves the display to the right.

- b. Causes the numerical entry to **increase**. To change the displayed number by a single unit press and release the key quickly. If the key is pressed longer the number changes with increasing speed.

**select** This key has three functions:

- a. Return to main menu when pressed repeatedly.
- b. Selects the pulsing or “highlighted” feature of the main menu display.
- c. Enter numerical values.

**run/stop** This key has two functions:

- a. Turns the motor on and off.
- b. Acts as a “pause” during a dispense.

## Display

After the pump is programmed an **arrow** on the right side of the display indicates the **direction of operation**. This arrow pulses when the pump is running.

## Operating Instructions

### Power Switch

The power switch is located at the right, rear corner of the pump. When the power is turned on the LCD will display the Volume or Rate setting. Press the **select** key to return to the main menu.

### Main Menu

Pressing **select** repeatedly will always return the display to the main menu. The main menu consists of five variables, three of which are displayed at all times. The center variable pulses to indicate that this option can be reviewed or changed. The menu acts as a continuous loop and the **arrow keys**, ← → are used to move around the loop. The variable to be changed can be selected with the **select** key.

← → **DIA** ← → **TABLE** ← → **RATE** ← → **VOL** ← → **PWR UP** ← →  
direct entry    syr dia.    flow rate    dispense vol    run/stop  
syr dia (mm)    mfr, size    µl or ml/h    µl or ml

### Syringe Diameter Entry

For automatic internal calibration the syringe diameter must be entered. Once entered the diameter is retained in non-volatile memory and need not be entered again unless the syringe used is changed. When a syringe diameter is changed the Volume and Rate settings are set to zero.

There are two methods of diameter entry.

a. **Internal library**

Select TABLE from the main line menu. The table of syringes is organized by manufacturer, then by glass or plastic, and then by size. Use the **arrow** keys to scroll through the table and the **select** key to enter the correct setting.

First, scroll through the manufacturers and select the manufacturer of the syringe used. The menu will next display either material selection or a syringe size. Again, use the arrow keys to move through the table until the correct size is displayed. Press the select key when the correct syringe size is displayed. This automatically enters the internal syringe diameter.

See Table 1 at the end of this manual for the syringe library.

b. **Direct entry**

From the main menu select DIA. The display will read “xx.xx mm”. Use the **arrow** keys to display the measured internal diameter of the syringe in millimeters and enter with the select key.

Changing the diameter clears the Volume and Rate settings, and the display will now prompt for the new Volume setting.

### Volume Entry

The Volume setting mode is selected from the main menu or is displayed automatically after changing the diameter.

Display reads: xx.xx  $\mu$ l (Units  $\mu$ l or ml depend on syringe diameter entered.)

- 1) Use the **arrow** keys to enter the dispense volume required.
- 2) When the correct dispense volume is displayed enter this number with the **select** key.

**note:** If no target dispense volume is required enter volume = 0.0

The pump will run at the set flow rate until stopped manually or a stall occurs.

- 3) After setting a Volume the menu prompts for the flow rate setting.

When the pump runs the actual dispensed volume will be displayed and will increment until the set volume is reached, at which time the pump will stop automatically.

### Flow Rate Entry

RATE can be selected from the main menu or will be displayed automatically after the Volume setting.

The display reads: Rate: X.X µl/h or X.X ml/h

Rate units are µl/h or ml/h, microliter or milliliter/hour and are selected automatically from the syringe diameter.

- 1) Use the arrow keys to display the flow rate required.
- 2) Enter the rate with the **select** key.
- 3) If the rate entered is out of range, a message is displayed:  
"Max Rate XX ml/h"

To continue, enter a lower rate or select a larger syringe.

- note:**
- a. If a dispense volume was set then the display will now change to "Volume : 0.0" , that is, in automatic dispense mode.

When the pump runs, the actual dispensed volume will be displayed and will increment until the set volume is reached, at which time the pump will stop automatically.

- b. If no dispense volume is set, the LCD displays the set flow rate and, when running, the directional indicator arrow will pulse.

### Starting the Pump

- a. Press the **run/stop** key to start the pump. A second press will stop the pump.
- b. If the pump is stopped during a dispense the volume accumulator is not cleared and the dispense is *paused*. Restarting the pump with a second press of the **run/stop** key continues the dispense to the target volume.

### Power Failure Mode

When a dispense volume is set, a power interruption **always** stops the pump and

resets the volume dispense counter to zero. The pump remains stopped when power is returned and displays either the Volume Setting (Pwr Stop mode) or “Power Failed” flashing (Pwr Run mode). The pump can be restarted manually using the run or select keys respectively.

When no dispense volume is selected, the **Power Up run/stop** option allows the pump to either resume the dispense when the power returns or remain stopped but display a message that the dispense was interrupted.

- 1) Move the main menu to the right and select PWR UP.
- 2) The display will read **Power Up Run** (or STOP). Use the **arrow** keys to change display and select the required option.

**RUN** After power is returned the pump resumes normal operation. The display flashes **Power Failed** to acknowledge a power interruption. Press **Select** to display the Rate.

**STOP** Pump does not run when power returns. The LCD displays the rate setting; the directional indicator does not pulse.

### Change or Review Volume Setting While Running

While the pump is running it is possible to look at the volume and flow rate settings without interrupting the operation of the pump. If required the volume and flow rate settings can be changed while the pump continues to run. When the changes are entered the pump immediately changes to the new settings.

- 1) While operating press **select** to return to the main menu.
- 2) Select Volume to display the set dispense volume. If no change is required press **select**.
- 3) For a volume change the arrow keys can be used to change the setting which is entered with the **select** key.
- 4) The display moves to RATE, permitting a change if required. Press **select** if no change is required or use the **arrow** keys to change the setting. Pressing **select** returns the display to the continuing volume dispense and the pump immediately changes to the new flow rate, if changed. The volume continues to increment, uninterrupted to the new dispense setting when it will stop automatically.

**note:** If the VOLUME is changed to a setting **smaller** than the volume already

accumulated then the pump stops when the new, smaller dispense volume is selected.

## Change or Review Rate Setting While Running

- 1) Press **select** to change the volume accumulator display to the main menu.
- 2) Select RATE.
- 3) Make rate changes if required and press **select**.

The pump immediately changes to the new flow rate and the display shows the volume accumulation continuing, uninterrupted at the new rate.

## Loading the Syringe

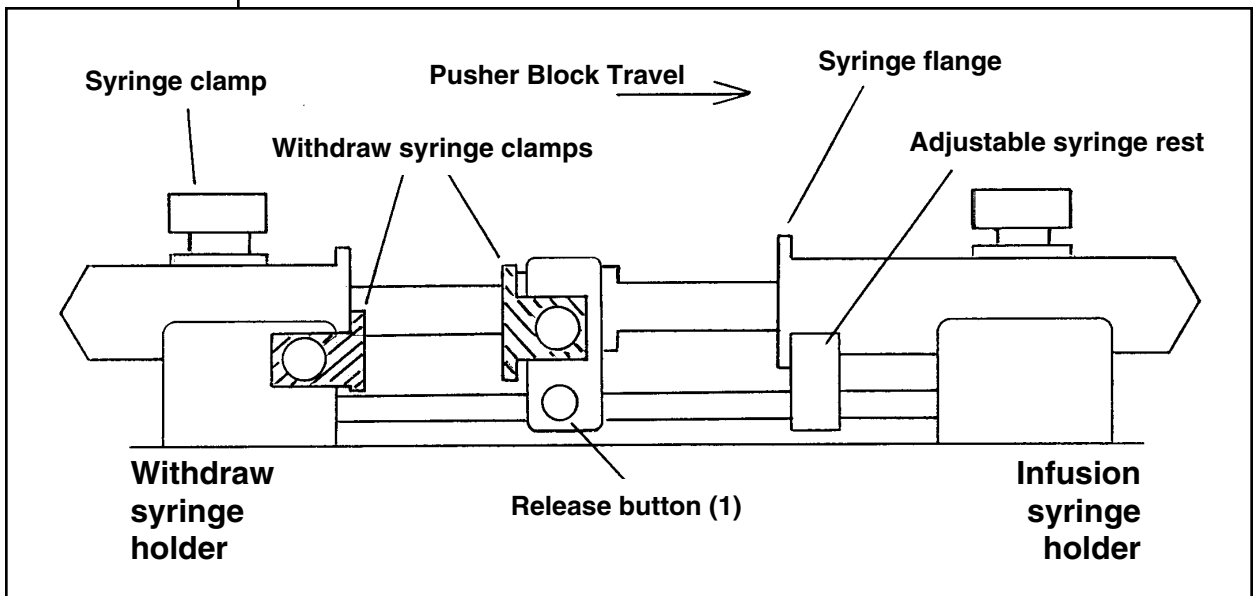


Figure 1

To facilitate loading, the pusher block can be released from the leadscrew by pressing the bronze button (1) and can be manually moved along the guide rods to accommodate the syringes.

First place the withdraw syringe in the withdraw syringe holder, using the spring loaded retaining clamp to retain the syringe barrel in the V of the syringe holder. Make sure the barrel flange is held firmly by the withdraw clamp and that the

adjusting screws on the withdraw clamp are firmly tightened.

While keeping the button (1) pressed firmly “in” slide the block along the guide rods so that the syringe plunger flange can be retained by the clamp on the pusher block. Tighten the locking screws on the adjusted syringe clamp.

Loosen the locking screw on the adjustable syringe rest and position the rest so that the plunger of the loaded syringe is pressed firmly against the pusher block and the syringe barrel flange is pressed up to the syringe rest. The barrel of the loaded infusion syringe should be clamped in the V of the syringe holder with the spring loaded clamp.

Tighten the screw on the syringe rest to lock the rest in place on the guide rod.

### **NV RAM Failure**

If the settings in the non-volatile memory become corrupted the display will read “NV Ram Failure” and the pump will not operate.

To recover from this condition the pump must be powered down and then turned on again. The pump will be re-initialized to the default settings and can now be programmed as normal.

### **Power Selection**

The pump is equipped with an internal voltage selector switch which is set at the factory to the voltage appropriate for the destination country. The voltage setting is indicated on the serial number label found on the rear panel.

FUSE      5x20mm, 250V 0.1A (slow-blow)

### **Maintenance**

Maintenance is required only for the moving mechanical parts which should be kept clean and lubricated. Occasionally, a little light machine oil should be applied to the guide rods and a little grease or oil to the leadscrew.

Surface cleaning may be performed on the pump by using a dampened cloth, taking care that no excess cleaner be allowed to seep into the interior of the pump housing. *Do not use organic solvents.*

**Table 1 TABLE OF SYRINGE DIAMETERS**

**Air-Tite "All Plastic"**

|     |         |
|-----|---------|
| 1cc | 4.70 mm |
| 2.5 | 9.70    |
| 5.0 | 12.48   |
| 10  | 15.89   |
| 20  | 20.00   |
| 30  | 22.50   |
| 50  | 28.90   |

**Ranfac**

|      |         |
|------|---------|
| 2 cc | 9.12 mm |
| 5    | 12.34   |
| 10   | 14.55   |
| 20   | 19.86   |
| 30   | 23.20   |
| 50   | 27.60   |

**Becton Dickinson**  
Interim, WW design, Plastipak

|      |         |
|------|---------|
| 1 cc | 4.70 mm |
| 3    | 8.59    |
| 5    | 11.99   |
| 10   | 14.48   |
| 20   | 19.05   |
| 30   | 21.59   |
| 60   | 26.60   |

**Scientific Glass Engineering**  
**SGE**

|       |         |
|-------|---------|
| 25 µl | 0.73 mm |
| 50    | 1.03    |
| 100   | 1.46    |
| 250   | 2.30    |
| 500   | 3.26    |
| 1ml   | 4.61mm  |
| 2.5   | 7.28    |
| 5     | 10.30   |
| 10    | 14.57   |

**Becton Dickson**  
Glass — all types

|        |         |
|--------|---------|
| 0.5 cc | 4.64 mm |
| 1      | 4.64    |
| 2.5    | 8.66    |
| 5      | 11.86   |
| 10     | 14.34   |
| 20     | 19.13   |
| 30     | 22.70   |
| 60     | 28.60   |

**Sherwood - Monojet Plastic**

|      |         |
|------|---------|
| 1 cc | 4.65 mm |
| 3    | 0.94    |
| 6    | 12.70   |
| 12   | 15.90   |
| 20   | 20.40   |
| 35   | 23.80   |
| 50   | 26.60   |

## SP120p-300 Syringe Pump

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### Hamilton 1000-Series Gastight

|       |         |
|-------|---------|
| 10 µl | 0.46 mm |
| 25    | 0.78    |
| 50    | 1.03    |
| 100   | 1.46    |
| 250   | 2.30    |
| 500   | 3.26    |

|      |         |
|------|---------|
| 1 ml | 4.61 mm |
| 2.5  | 7.28    |
| 5    | 10.30   |
| 10   | 14.57   |
| 25   | 23.03   |
| 50   | 32.57   |

### Popper & Sons, Inc. Perfektum glass

|      |         |
|------|---------|
| 0.25 | 3.45 mm |
| 0.5  | 3.45    |
| 1    | 4.50    |
| 2    | 8.92    |
| 3    | 8.99    |
| 5    | 11.70   |
| 10   | 14.70   |
| 20   | 19.58   |
| 30   | 22.70   |
| 50   | 29.00   |

### Terumo

|      |         |
|------|---------|
| 1 cc | 4.73 mm |
| 3    | 9.00    |
| 5    | 13.04   |
| 10   | 15.79   |
| 20   | 20.18   |
| 30   | 23.36   |
| 60   | 29.45   |

### Unimetrics Series 9000

|       |         |
|-------|---------|
| 10 µl | 0.46 mm |
| 25    | 0.73    |
| 50    | 1.03    |
| 100   | 1.46    |
| 250   | 2.30    |
| 500   | 3.26    |
| 1000  | 4.61    |

**Table 2 FLOW RATES**

| <u>Syringe size</u> | <u>Minimum</u> | <u>Maximum</u> |
|---------------------|----------------|----------------|
| 10 µl               | 0.2 µl/h       | 126 µl/h       |
| 25 µl               | 0.2 µl/h       | 318 µl/h       |
| 50 µl               | 0.4 µl/h       | 625 µl/h       |
| 100 µl              | 2.0 µl/h       | 1274 µl/h      |
| 250 µl              | 2.0 µl/h       | 3164 µl/h      |
| 500 µl              | 4.0 µl/h       | 6359 µl/h      |
| 1 ml                | 0.02 ml/h      | 12.7 ml/h      |
| 2.5 ml              | 0.02 ml/h      | 31.7 ml/h      |
| 3 ml                | 0.03 ml/h      | 44.9 ml/h      |
| 5 ml                | 0.05 ml/h      | 87.0 ml/h      |
| 10 ml               | 0.2 ml/h       | 125 ml/h       |
| 20 ml               | 0.2 ml/h       | 219 ml/h       |
| 30 ml               | 0.2 ml/h       | 282 ml/h       |
| 50/60 ml            | 0.3 ml/h       | 426 ml/h       |

**Note:** Syringes from different manufacturers can have slightly different limits.

### Warranty

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year from the date of shipment. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, transportation, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

The foregoing obligations set forth in this paragraph are in lieu of all obligations and liabilities, including all warranties of merchantability or otherwise, expressed or implied or statutory, and state WPI's entire and exclusive liability and purchaser's exclusive remedy for any claim of damages in connection with the sale or furnishing of all equipment, including design, suitability for use, operation, or installation.

There are no warranties which extend beyond the description of the face hereof. In no event shall WPI be liable for any special or consequential damages.

Warning: This equipment is not designed or intended for use on humans.

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**DECLARATION OF CONFORMITY**

We: World Precision Instruments, Inc.  
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USA

as the distributor of the apparatus listed, declare under sole responsibility that the product(s):

**Title: SP120CE-300 Syringe Pump**

to which this declaration relates is/are in conformity with the following standards or other normative documents:

EN 55011 Class B: 1991 Conducted and radiated emissions  
IEC 801-2: 1984 Electrostatic discharge  
IEC801-3: 1984 Radiated immunity  
IEC801-4: 1988 Elec fast transients/bursts, power leads  
IEC801-5

EN61010-1: 1993

and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility.

**Issued on: April 3, 2000**

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