Micro4™

Controller for the Ultra Microsyringe Pump

INSTRUCTION MANUAL

Serial No._____

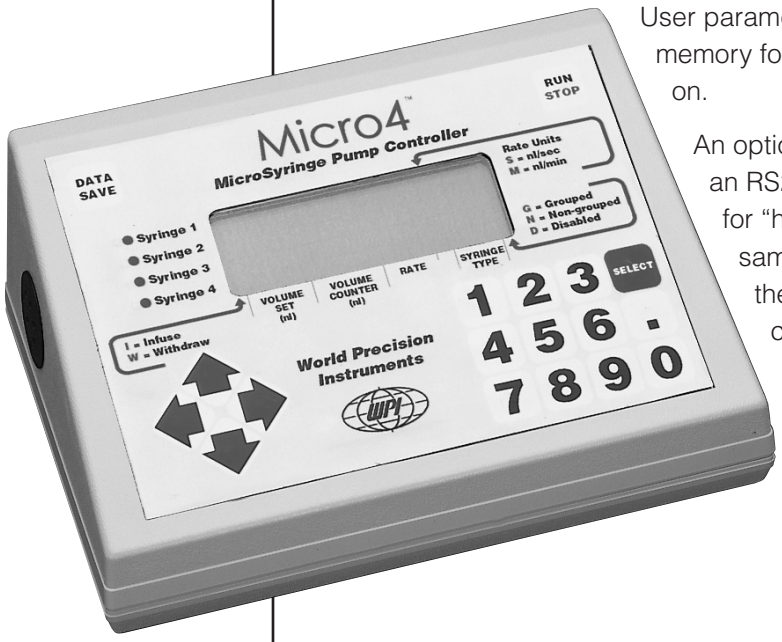
062403

World Precision Instruments, Inc.

Contents

Introduction

A microprocessor-based controller, Micro4™, is available for use with WPI's new Ultra Microsyringe Pump. Operating parameters are set with the membrane keypad and LCD display. The Micro4 can synchronize the starting and stopping of up to four of pumps.



User parameters are stored in "non-volatile" memory for instant recall when the unit is powered on.

An optional footswitch can be plugged into an RS232 port on the rear of the controller for "hands free" start/stop operation. The same port may also be used to connect the controller to a computer for use with computer control software, or to some other device for TTL triggering.

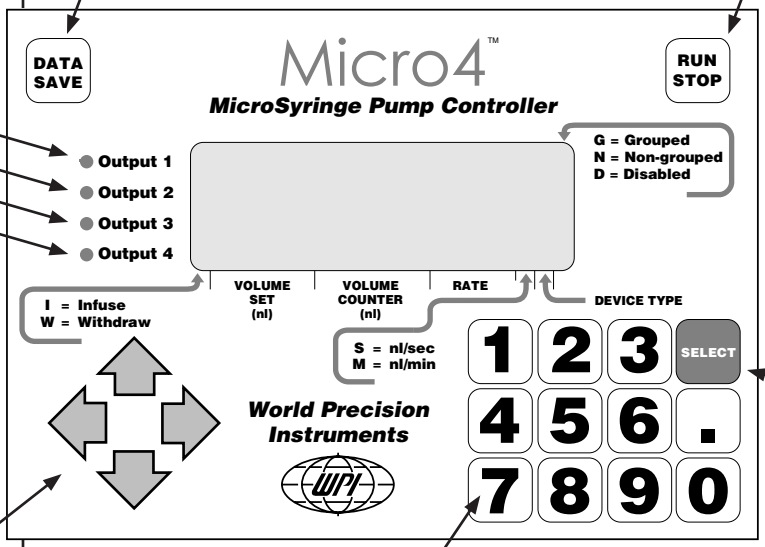
Micro4 Control Panel

Front panel controls and features

Data Save: Saves all parameters on LCD display to memory. Next time the Ultra Microsyringe Pump controller is turned on, the last paramaters saved will be displayed.

Run/Stop: Starts and stops the pump(s).

Lights: When a pump is running, the corresponding light is on. For example, the light next to output 1 will be on when pump one is operating.



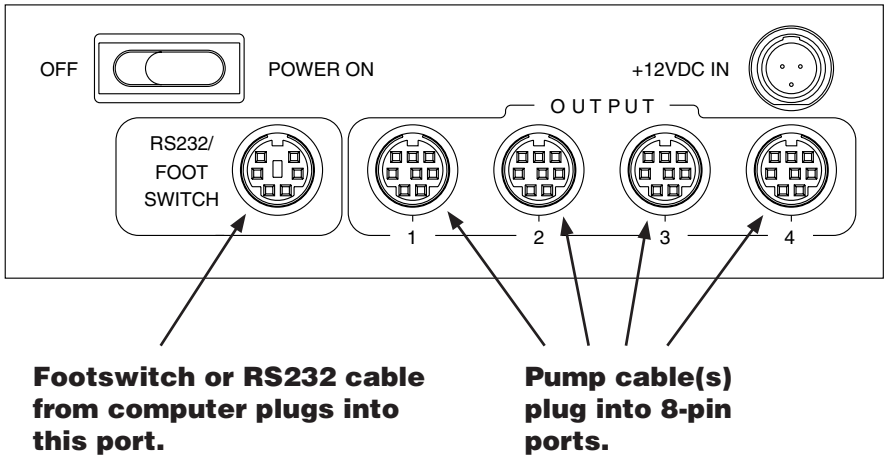
Arrow keys: move the cursor around the display.

Numeric keypad: When the cursor is positioned in the fields for Infuse/Withdraw, Volume Set, Volume counter, and Rate, these keys are used to enter numbers and decimal points.

Select: Toggles the selected parameters: Infuse/Withdraw, Syringe Size, Rate Units, and mode (Grouped, Non-grouped and Disabled).

Rear Panel Connections

Micro4 rear panel



Specifications

Linear displacement per half step..... 3.175 μm (0.000125 in.)

Maximum step rate..... 700/sec (depends on syringe selected)

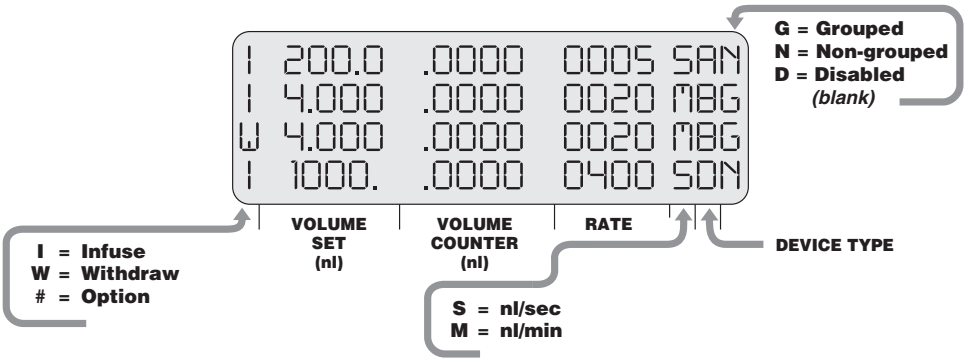
Power Requirements ..... 12 V (1.6 A)

Dimensions..... 12.7 x 15.2 x 8.9 cm (5 x 6 x 3.5 in.)

Setting Parameters

To change a parameter, use the **LEFT** and **RIGHT ARROW** keys to move the cursor to the desired parameter. Use the **UP** and **DOWN ARROW** keys to select the channel. Then use the **NUMBER** keys or the **SELECT** key to change parameters.

Micro4 Display



Infuse/Withdraw: The character displayed in this field indicates the operating mode — "I" for Infuse, "W" for Withdraw. In addition, the options below may be enabled or disabled when the cursor is in this field. To select an option, position the cursor in the Infuse/Withdraw field and press the corresponding option number.

Option 1: Disables audible tone.

Option 2: Enables audible tone.

Option 3: Changes the action of **RUN/STOP** key or footswitch. When this option is enabled the pump will operate as long as the **RUN/STOP** key or footswitch is pressed and stop when the **RUN/STOP** key or footswitch is released.

Option 4: Returns **RUN/STOP** key or footswitch to normal operation.

Option 5: Enables user to define syringe type F (see "Operation Notes").

Volume Set: Defines volume to be infused or withdrawn.

Volume Counter: Real-time display of volume being delivered. When pump is not running, this number may be changed; when pump is restarted, counter will continue from the number entered.

Rate: Selects rate of delivery. If the rate entered is incompatible with the syringe being used, an "E" (Error) will be displayed in this field.

Rate Units: This field selects the rate of infusion or withdrawal — "S" is for nanoliters/sec; "M" is for nanoliters/min.

Device Type: With the cursor in this field, use the **SELECT** key to change the syringe type.

**See "Option 5" on page 4.*

Predefined Syringe Settings

Syringe Type	Syringe Volume	nl/step Rate (nl/sec)	Max.
A	0.5 µL	0.026	20
B	1.0 µL	0.052	40
C	5 µL	0.263	202
D	10 µL	0.528	406
E	25 µL	1.329	1022
F	50 µL	2.646	2035
G	100 µL	5.315	4088
H	250 µL*	13.191	9999
I	500 µL*	26.501	9999
J	1000 µL*	52.995	9999
K	Nanoliter 2000†		884
L	Flexifil	0.220	169
M	User defined—see UMP2 manual.		

**Not recommended for UMP2*

† *WPI's **Nanoliter 2000**, a nanoliter injector for the 2-70 nL range, comes with its own simple controller but may also be driven by the Micro4. For more information, enquire about WPI # **B203XV**.*

Grouped/Non-grouped/Disabled: This field selects three operating modes.

Grouped mode: Syringe channels with "G" in this field are started or stopped when the **RUN/STOP** key is pressed while the cursor is located on any grouped channel.

Non-grouped mode: When the cursor is positioned on a channel that is not grouped, indicated by the letter "N", only that particular channel will start or stop when the **RUN/STOP** key is pressed.

Disabled mode: Selecting "D" in this field disables the channel.

Operation Notes

Fast forward is accomplished by pressing the right arrow key and the **RUN/STOP** key at the same time. **Fast reverse** is accomplished by pressing the left arrow key and the **RUN/STOP** key at the same time. The syringe pump will continue running as long as these two keys are depressed. In fast forward and fast reverse modes the delivery rate is set to maximum.

To define syringe type M, first calculate the Volume per Step using the formula below. Syringe displacement is the distance between 0 and the maximum volume marked on the syringe in inches. Syringe volume is in nanoliters.

$$\text{Volume per Step} = \frac{\text{Syringe Volume}}{\text{Syringe Displacement}} \times 0.000125 \text{ in. } (3.175 \times 10^{-3} \text{ mm})$$

Next, enter this number on the Micro4 output 1 Volume Set. Then use the arrow keys to scroll the cursor to the first position on the LCD display (Infuse/Withdraw) and press "5".

The minimum delivered volume depends on the syringe size and is listed in the syringe type table under Volume per Step. The actual volume delivered is divisible by the volume per step. For example, using a syringe with a Volume per Step of 1 nL, actual delivered volume for the given set volume is listed below.

Volume Set	Actual volume delivered
0-0.9999 nL	0
1 nL-1.999 nL	1 nL
2 nL-2.999 nL	2 nL
and so on...	

Type M Example: 25 µL syringe

Position the cursor over the device type and scroll until type “M” is displayed. From Table 1 below the volume /step is 1.329 nL/step, type this value into the key pad at the volume set location. Back the cursor over the I/W location and press number 5 to program the rate into the controller. Then set the volume you wish to infuse and the rate.

Table 1—Syringe Diameters for UMP, UMP2, SP310

Syringe	Hamilton (mm)	nL/step	SGE (mm)	nL/step	Unim (mm)	nL/step
0.5 µL	0.102	0.026	0.102	0.026	0.102	0.026
1.0 µL	0.145	0.052	0.145	0.052	0.145	0.052
5 µL	0.325	0.263	0.325	0.263	0.325	0.263
10 µL	0.46	0.528	0.46	0.528	0.46	0.528
25 µL	0.73	1.329	0.73	1.329	0.73	1.329
50 µL	1.03	2.646	1.03	2.646	1.03	2.646
100 µL	1.46	5.315	1.46	5.315	1.46	5.315
250 µL*	2.3	13.191	2.3	13.191	2.3	13.191
500 µL*	3.26	26.501	3.26	26.501	3.26	26.501
1000 µL*	4.61	52.995	4.61	52.995	4.61	52.995

**Not recommended for UMP, UMP2, SP310*

Example — 250 µL syringe:

Enter "M" in the Device Type field; enter 13.19 in the Volume Set field; backstep cursor to the "I/W" field and enter "5". The syringe is now programmed into the Micro4. Enter the volume to inject in nanoliters (*e.g.,* 50,000 = 50 µL). The rate can be set up to 4616 nL/sec (4.6 µL sec).

Computer Control

RS232 commands are used to control the Micro4 via the serial port of a PC or Macintosh computer.

RS232 Commands

All commands are case sensitive. The settings for the RS232 port are baud rate 9600, 8 data bits, 1 start bit, 1 stop bit. Numbers and decimal points are indicated below by the "**#**" symbol.

V######; Sets the delivered volume. Number must have a decimal point.
C######; Sets the volume counter. Number must have a decimal point.
R####; Sets the delivery rate. Number must have a decimal point.
I Infuse mode.
W Withdraw mode.
G Go — Starts the syringe pump.
H Halt — Stops the syringe pump.
S Sets the rate units to nanoliters/second.
M Sets the rate units to nanoliters/minute.
L#; Line number — sets the syringe number on display (Micro4 only).
N Not Grouped mode.
P Grouped mode.
D Disabled mode.
Tx Syringe Type. The letter indicating syringe type follows the T. For example, to select syringe type "A" the command is "TA".

Query Commands

All query commands begin with a question mark. Below is a list of the query commands.

- **?V** Returns the set volume.
- **?C** Returns the volume counter
- **?R** Returns the delivery rate
- **?M** Returns a G for grouped mode, N for nongrouped mode, and D for disabled mode.
- **?S** Returns the letter of the syringe type.
- **?D** Returns the syringe pump direction: I=infuse, W=Withdraw.
- **?U** Returns the rate units: S=nL/second, M=nL/minute.
- **?G** Returns a R if pump is running, S if pump is stopped.

Footswitch Connections

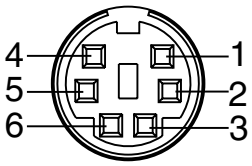
Since the footswitch produces Run and Stop signals by connecting +5 volts (from pin 4) to pin 6, this port may also be used for TTL signals from other sources.

RS232 Cable Pinouts

To control the Micro4 by computer, the RS232 cable must be configured as shown here:

From Micro4 6-pin mini-DIN	To 9-pin mini-DIN connector	To 25-pin mini-DIN connector
pin 1: ground	pin 5: ground	pin 7: ground
pin 2: UMC data in	pin 3: PC data out	pin 2: PC data out
pin 5: UMC data out	pin 2: PC data in	pin 3: PC data in

Mini-DIN connector on rear panel of Micro4 controller



Micro4 cable with 9-pin connector is WPI #**40500**.

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 receipt. 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, 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.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

• Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. In some instances, photographic documentation may be required. Some items are time sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container.

• WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.

• Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.

• Goods returned for repair must be reasonably clean and free of hazardous materials.

• A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.

• Equipment which was built as a special order cannot be returned.

• Always refer to the RMA# when contacting WPI to obtain a status of your returned item.

• For any other issues regarding a claim or return, please contact the RMA department

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

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*

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DECLARATION OF CONFORMITY

We: World Precision Instruments, Inc.
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USA

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

Title: UMC4

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

Safety: EN 61010-1:1993 (IEC 1010-1:1990)

EMC: EN 50081-1:1992
EN 50082-1:1992

and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility and Council Directive 73/23/EEC relating to safety requirements.

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