INSTRUCTION MANUAL

MPS-4

Multichannel Perfusion System

Serial No._____

CONTENTS

ABOUT THIS MANUAL

The following symbols are used in this guide:

🛇 This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.

⚠ This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

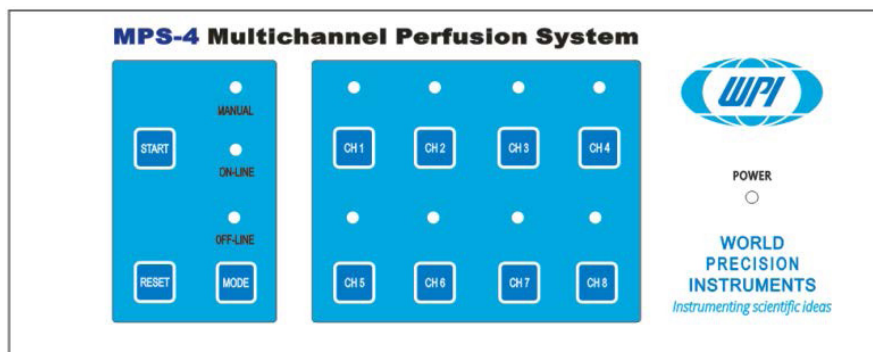NOTES and TIPS contain helpful information.

Fig. 1—The MPS-4 controller operates the eight channels.

INTRODUCTION

The **MPS-4** is a programmable 8-channel perfusion system designed for single channel and whole-cell patch preparations. It offers the best combination of performance and value. The improvement of **MPS-4** over the previous **MPS-2** is the use of a diaphragm type solenoid valve that completely isolates the perfusion solution from the outside to avoid the influence of metal ions in the moving iron of the solenoid valve on the experimental results. Unlike other perfusion systems on the market, which often compromise performance to fit every possible application, the **MPS-4** is the only perfusion system designed and optimized specifically for single-channel and whole-cell patch perfusion applications.

The system can be controlled manually (i.e., via membrane switches on the front panel) or through a PC. Two different manual control modes are offered. One controls each channel independently and the other mode allows sets channel 8 as the master channel that will keep the system flowing when all other channels are switched off. User-friendly timing software is included, and the programmed perfusion sequence can be started by computer, a TTL trigger from an external source such as a patch clamp amplifier or manually by the user. The high level (ON= +3 ~ +5V) and low level (OFF = 0 ~ +1V) control mode that permits independent control of each valve by the external instruments or data acquisition system.

The perfusion fluid flows through specially designed, color-coded, polyurethane ribbon style tubing. The color-coding allows you to easily trace each channel for diagnostic or set up. The ribbon style of the tubing keeps the system neat and clean. Unlike PVC based tubing, polyurethane tubing contains no plasticizer, which can cause contamination.

The most unique feature of the **MPS-4** is its perfusion μ-manifold. Using the latest microfluidic techniques, the injection molded μ-manifold provides the least flow resistance and dead volume of any product on the market. The flow channel inner diameter is approximately 1 mm, except for the last 5 mm before the junction point. This design allows a fast flow rate without using a pressurized system. The maximum flow rates are 1 and 16 μL/s for the 15 mm long 100 μm and 250 μm ID tips, respectively. Small channels and a unique design at the merging point further reduce the chance of cross contamination. Dead volume is less than 100 nL. The injection-molded μ-manifold is also designed as an economical disposable item, eliminating problems of cross-contamination from other experiments.

Notes and Warnings

NOTE: Before starting a formal experiment, perform several preliminary tests, such as the drug interaction range test, to get familiar with this perfusion system.

NOTE: The 100 and 250 μm perfusion manifold tips are made of fine glass capillary, which is subject to breakage and clogging. Handle the tip carefully during the experiment.

CAUTION: Tubing must be removed gently so that the manifold is not damaged.

CAUTION: Any organic solvent, including alcohol, may damage the perfusion manifold.

CAUTION: All the drug solutions should be filtered before use to prevent clogging of the perfusion head.

CAUTION: After the experiment, the tubing system (especially the electromagnetic valve, manifold and perfusion head) should be thoroughly washed with warm, fresh distilled water as soon as possible. Failure to do so may cause damage to the system. See "Cleaning" on page 13.

CAUTION: If the **MPS-4** system does not work properly, stop the experiment immediately. Switch off the power. See "Troubleshooting" on page 13.

Parts List

After unpacking, verify that there is no visible damage to the sensor.
Verify that all items are included:

(1) Stand base and Stainless Steel Post
(1) MPS-4 Controller
(1) Valve Console
(1) Syringe Holder
(1) Power Cord
(1) USB Cable
(2) 1A Fuse
(10) 10mL Syringes
(10) 3-way Stopcock
(10) Luer fitting with barb for 1/16" ID tubing
(5') Color Coded Polyurethane Tubing Ribbon
(1) µ-manifold Holding Rod
(1) µ-manifold with 100µm ID tip
(1) µ-manifold with 250µm ID tip
(1) Installation Software
(1) Instruction Manual

Valve Console

Manifold Holder

Syringe Holder

3-way Stopcock
(#3744-100)

Luer Fitting for 1/16" ID
tubing (#13156-100)

10 mL Syringe
(#3744-100)

µ-Manifold
100µm: #502110
250µm: #502125

Stand, post

Fig. 2—These components are included with the MPS-4 system.

Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 31 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or customerservice@wpiinc.com.

Returns: Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container, if possible. If the original container is not available, use a suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material. For further details, please read the section entitled "Claims and Returns" on page 31 of this manual.

INSTRUMENT DESCRIPTION

Hardware Installation

1. Set the **MPS-4** perfusion stand on a stable platform.
2. Insert the stainless steel post into the base and tighten the screw.
3. Loosen the screw on the back of the valve console and fix it onto the post. Set the distance between the valve console center point and top of the post to the desired height.
4. Fasten the syringe holder onto the post.
5. Connect the valve console to the **MPS-4** instrument with the cable supplied.
6. Pull out of the plungers of the syringes and put the syringes into the syringe holder.
7. Connect the 3-way stopcocks to the syringes.
8. Cut a 20cm long section of the color-coded polyurethane tubing. Split it to 8 individual tubes and put the luer fitting to one end. Connect the luer fitting to the 3-way stopcock.
9. Connect the other ends of the eight tubes to the inputs of the valve console.
10. Split one end of the long color-coded polyurethane tubing for about 15cm. Connect the splited end to the valve output port on the valve console.
11. Carefully connect the other ends of the polyurethane tubing to the μ-manifold.

CAUTION: In this step, the manifold should not be connected to the holding rod. The female luer port may be damaged by the force applied to the manifold when attaching the 8 ends of the tubing.

World Precision Instruments

12. Connect the stainless holder rod to the μ-manifold. The end of the holder rod is a male luer fitting. It can be pressed into the center hole of the μ-manifold for a secure hold. Fix the holder to a micromanipulator.

    TIP: We recommend WPI's **KITE-L** for this purpose. It has sufficient precision for the perfusion tip and an economical price. It has a left hand scale for placing on the left side of the microscope, leaving the right side free for the patch pipette.

13. Connect the **MPS-4** to a computer USB port.

14. Connect a cable with a BNC plug to the socket on the back panel of **MPS-4** controller corresponding to the channel to be controlled. Connect the other end of the cable to the equipment that generates the control signal.
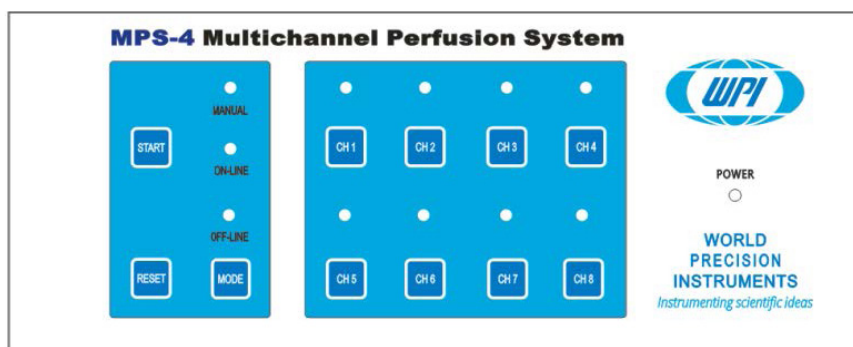
OPERATING INSTRUCTIONS

Fig. 3—The front panel of the MPS-4 has the operational controls.

The left section of the **MPS-4** front panel contains the **Start**, **Reset** and **Mode** buttons, and three functional indicator LEDs.

Start button–The button runs the perfusion process. In the Online mode, it acts as the ▶ button and runs the experiment controlled by the perfusion software. In Offline mode, the **Start** button runs the preset perfusion parameters saved to the RAM of the control box from the computer.

Reset button–This button is the zero button for the micro-controller. It stops any currently running experiment, turns all channels off and resets the mode to Manual. Press the button and hold it for 1 second before lifting it to ensure the system is completely reset.

Mode button–This button toggles the perfusion mode between Manual, Online, Offline and Master Manual. Once a mode is selected, the corresponding LED illuminates. In Master Manual mode, the Manual LED blinks continuously.
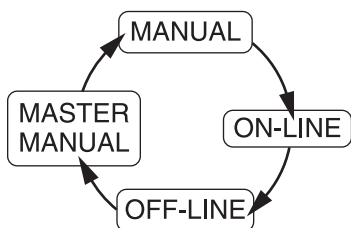
Fig. 4—The Mode button toggles between the four operational modes.

Software Installation

System Requirements: Windows 7, 8, 8.1 or 10 PC, 10 Mb free hard drive space; CD-ROM or DVD-ROM driver.

Installation

NOTE: The installer must have administrative privileges on the computer.

For complete instructions, see:
- "Appendix B: Disable driver signature enforcement (Win10)" on page 15
- "Appendix C: How to install an unsigned driver on Windows 8" on page 19
- "Appendix D: Install the MPS-4 software on Windows 10" on page 22.

Startup

The perfusion software can be found in the Start menu of Windows under C:\Program Files (x86). The software automatically connects to the **MPS-4** on startup. If the **MPS-4** is plugged into the computer after the program has been loaded, press the ⬌ button to establish a connection.

Creating a New Perfusion Experiment

The Experiment menu allows you to open a new or existing perfusion experiment.

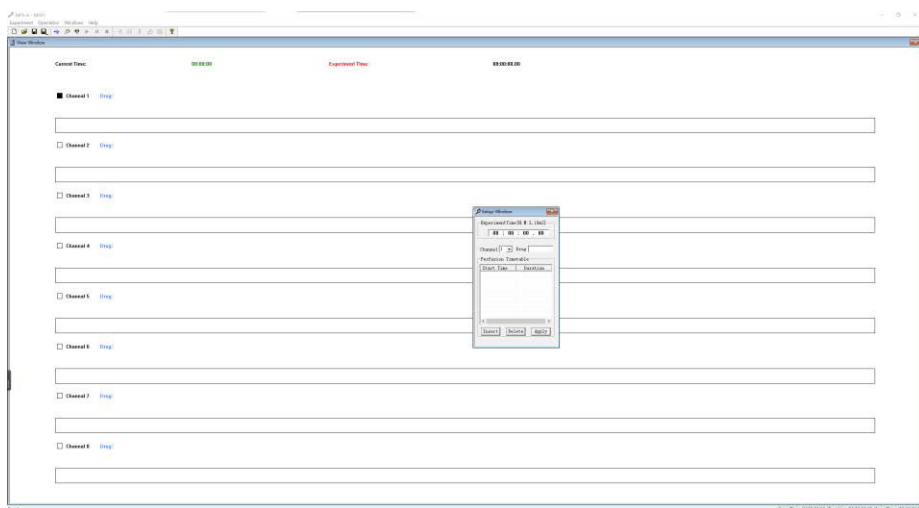After clicking on "New Experiment", two new windows pop up to allow you to set the experimental parameters.
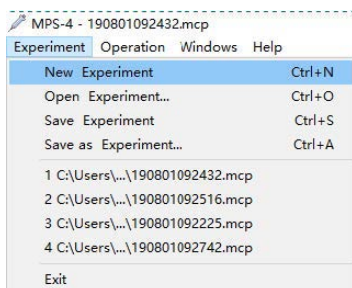
Fig. 5—The View window and the Setup window pop up.

Set the Experiment Time

The first step in creating a new experiment is to set the (Total) Experiment Time.

The format is Hours:Minutes:Seconds:Milliseconds. Hold down the left mouse key over one of these fields to get the a double arrow ($\updownarrow$) cursor. To adjust the value, move the mouse up or down. If you double click on a field, the value can be entered directly with the keyboard. Move to the next field by filling in both digits of the field or by pressing the spacebar. Click **Apply** when all fields are set to the desired values. The perfusion time shown at the right is set for 2 minutes.
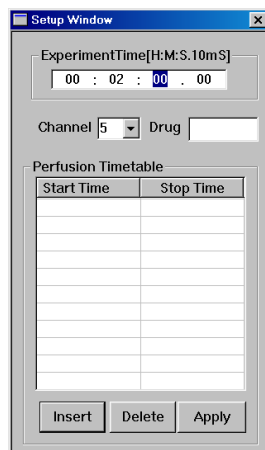
Preset Each Channel's Perfusion Time

1. Choose the desired channel by clicking on the box in front of the channel name in the experiment window, or by clicking on the channel number in the Setup window. In this example, we will be working with the Channel 5.
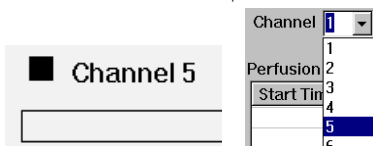

Fig. 6—Click the box in front of the channel name or the channel # in the setup window.

2. Press the **Insert** button on the bottom of the Setup window to add a Start

Time and Stop Time. Click once on a start time or a stop time to select it. Once selected, the values of its fields can be set the same way as the Experiment Time. If the "Time Setup" option in the Mode Setup window (F3) is changed, then "Duration" is displayed instead of "Stop Time".

Perfusion Timetable	
Start Time	Stop Time
00:00:12.00	00 : 01 : 12 . 00

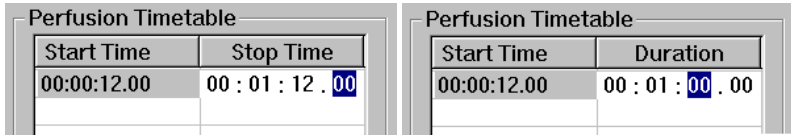| Perfusion Timetable	
Start Time	Duration
00:00:12.00	00 : 01 : 00 . 00

Fig. 7—Set the start and stop times.

4.   Press **Insert** again to add new rows. Once all times are entered for a channel, click **Apply** to verify the changes. Otherwise, the new values will be lost when a different channel is chosen or the Setup window closes.

5.   You can also set the perfusion time by holding the left mouse key, moving to the right position and releasing the key. The precise time at the mouse position is displayed at the right hand side of the status bar at the bottom of the screen.
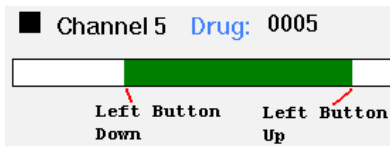

Fig. 8—Set the perfusion time.

6.   After the parameters have been successfully set, the program interface is shown. Follow the same procedure to finish the rest of the channel programming.
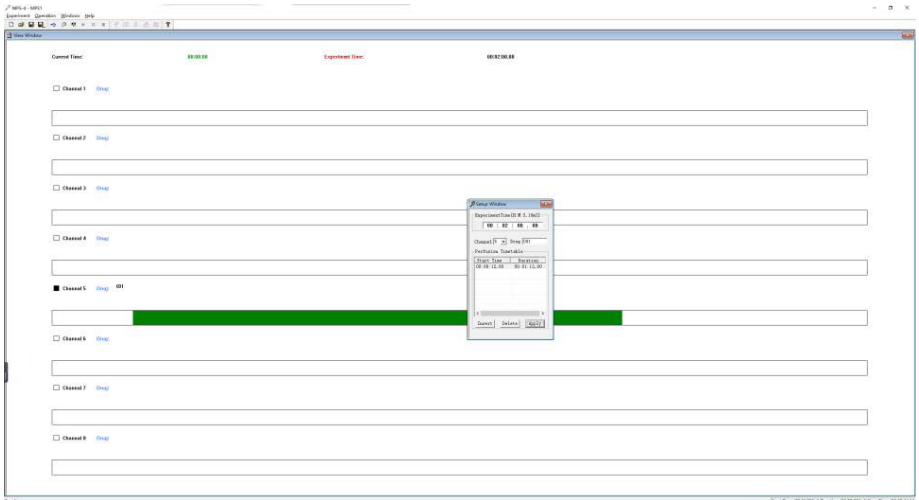

Fig. 9—This View window shows the setup for Channel 5.

Saving Your Experimental Parameters

Select **Save As** from the **Experiment** menu. A second window pops up. Select the file name and folder to save the file. You can also use the system default file name, which is made of 12 digital numbers to indicate the year, month, day, hour, minute and second. In the window below, the file was saved 8/1/2019 18:32:41.
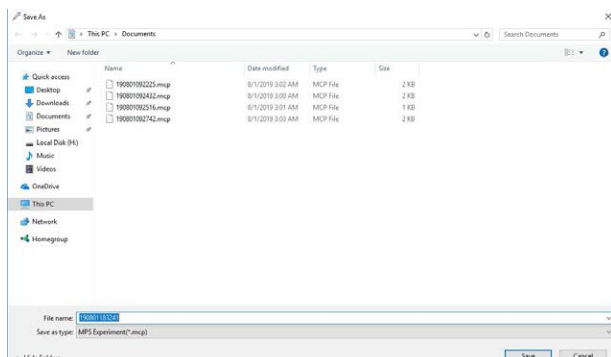

Fig. 10—Enter a file name in the Save As dialog box.

Mode Selection

In order to change the operation mode or choose the serial port, choose **Mode Setup** from the **Operation** menu, press the F3 function key, or click the ![button] button in the Tool Box. The Mode Setup window pops up. Click on the desired mode and press OK to activate it.
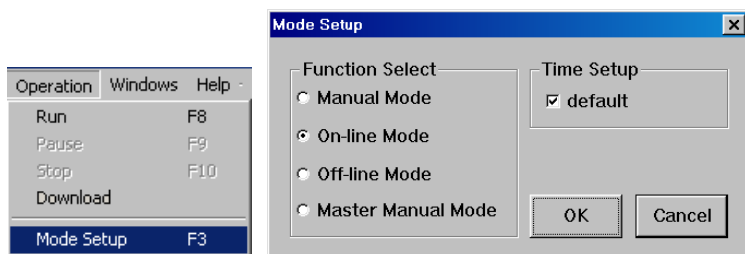

*Fig. 11—Use the Mode Setup window to select a mode.*

Manual mode, Online mode, Offline mode and Master Manual mode are settings for the **MPS-4** electronic unit. When a mode is chosen, the appropriate LED illuminates on its front panel. Master Manual mode makes the Manual LED blink continuously. The Time Setup option toggles the time entry mode of the Setup window from Start Time/End Time to Start Time/Duration.

Manual mode
Online mode
Offline mode
Master manual mode
Download mode
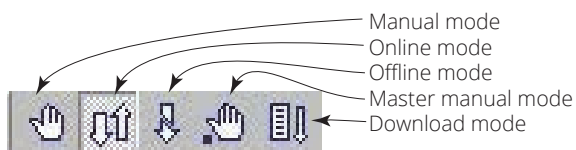
The modes can also be viewed and selected with the following icons located on the toolbar. From left to right, these icons represent Manual mode, Online mode, Offline mode, Master Manual mode and Download mode.

Computer Perfusion Control Modes

Online Mode–In this mode, perfusion is controlled by the computer software in real time. **Run**, **Pause** and **Stop** can be controlled from the Operation menu, the toolbar icons ▶ ❙❙ ■ , or with the function keys (F8, F9 and F10 as shown on the Operation menu).

Data Download Mode–The experimental procedure created with the software is downloaded into the RAM of the **MPS-4** control box when you press the button or select Download from the Operation menu. The Online LED on the **MPS-4** control box blinks while the program is being transferred.

MPS-4 Controller Operation–The left section of the **MPS-4** front panel contains the **Start**, **Reset** and **Mode** buttons, and three functional indicator LEDs:

· **Start** button–The button runs the perfusion process. In the Online mode, it acts as the ▶ button and runs the experiment controlled by the perfusion software. In Offline mode, the **Start** button runs the preset perfusion parameters saved to the RAM of the control box from the computer.

· **Reset** button is the zero button for the micro-controller. It stops any currently running experiment, turns all channels off and reset the mode to Manual.

· **Mode** button toggle the perfusion mode between Manual, Online, Offline and Master Manual. Once a mode is selected, the corresponding LED illuminates. In Master Manual mode, the Manual LED blinks continuously. The operation of each mode is described in the following sections.

Run Perfusion

Normal Mode–In this mode, the 8 channels are independently controlled by pressing the channel buttons. When a channel is on, its LED lights up.

Master Channel Mode–This is just like the normal Manual mode except that only one channel can be on at a time. If all other channels are turned off, channel 8 (the master channel) automatically turns on. When this mode is first selected, it is in the inactive state in which all channels are turned off. Press the channel 8 button to toggle between the active and inactive state.

On-line Perfusion Mode–This is the computer software controlled mode. There are three ways to run the perfusion experiment:
- Click the ▶ (**Run**) button in the software
- Press the **Start** button on the front panel
- Use the external triggered TTL input.

While an experiment is running from the computer, channels can also be turned on and off by pressing the channel buttons on the front panel.

Off-line Perfusion Mode –In this mode, the you can use **Start** button or externally triggered TTL input signal to start the perfusion program and perform the perfusion according to the preset parameters saved in the control unit's RAM from the computer. Note that there is a delay of about 25 ms while the stored sequence is initialized. Perfusion cannot be independently controlled with the channel buttons in this mode.

TTL Control Mode–Each channel is independently controlled by its own input voltage from the BNC socket on the back panel. The **MPS-4** automatically goes into this mode when any one of the control inputs goes high (+3~5 V) and this channel will open. Then it will close when the input voltage of this socket is low (0~+1 V). While this mode remains active, the Offline LED blinks continuously. The **Mode** button is disabled, but **Reset** can still be used to close all open valves and return to Manual mode. Press any of the Channel keys if the experiment has to be manually halted. This will exit out of TTL Control mode and prevent it from going back into that mode until **Reset** is pressed or the instrument is turned off and on.

Hardware Testing Procedure

In order to make sure the perfusion system works perfectly, the connection of the tubing to all of the valves and connectors should be sealed tightly without any leakage of the air pressure. In addition, there should not be any air bubbles present inside the output of the tubes. Since the inner diameter of the tubing is so small, any air bubble inside the tubing can cause the flow of solution to stop due to blockage by air. Therefore, before the experiment, use the following procedure (commonly referred to as priming) to check for air leakage and remove the bubbles in the tubing.

1. Fill all the syringes with the distilled water and open the 3-way stopcock. Check if there is any water leakage. Fix any leakage.
2. Turn on the power.
3. Turn on the first channel switch, until water droplets come out from the μ-manifold tip.
4. During step 3, air bubbles might prevent the water droplets from coming out of the tubing. To clear all air from the system, attach a syringe filled with distilled water to the side port of the stopcock. Turn the stopcock knob so that the syringe on the upper port is disconnected and push the air out with the side port syringe. Repeat steps 3 and 4 for channels 2 to 8.
5. Carefully install the μ-manifold. Turn on and off the channel switches for channel

1 to 8 in sequence, until the water droplets of each channel comes out of the micro perfusion head continuously.

6. Determine the flow velocity at the micro perfusion head from each channel using a stopwatch. Flow velocity for different channels should be about the same. Otherwise, check for air leakage or residual bubbles in the corresponding channel.

Testing Drug Delivery

The drug perfusion area of the **MPS-4** series can cover the whole view field of a 200X microscope (objective 20X, eyepiece 10X). However, in order to perform the experiments in an effective and reliable way, we suggest several preliminary experiments as a control result. The following procedure uses patch clamp as an example.

1. Clean the tubing system with distilled water. "Cleaning" on page 13.

2. Fill channel 1 with 150mM filtered NaCl solution. Fill the other channels with distilled water. Check the system (bubble and flow velocity) as previously described in "Hardware Testing Procedure" on page 11.

3. Fill the culture dish with NaCl solution, and place it on the microscope stage

4. Adjust the position of the perfusion head using the micromanipulator, so that the tip of the micro perfusion head is close to the bottom of the dish. The access angle is about 35-45°.

5. Pull a 1μm micropipette. Fill the pipette with 150mM NaCl solution to make it a microelectrode, and connect it to a patch clamp amplifier. Use the electrode micromanipulator to position the tip of the electrode right in front of the perfusion head at the bottom of the glass dish.

6. Apply a 5–10mV voltage between the microelectrode and reference electrode, and an electric current can be observed passing the electrode. Turning on any of the distilled water filled channels should cause a rapid decrease of electric current to zero. Turning off the distilled water and turning on channel 1 brings the electric current back up to its original level. Test the rest of the channels and the results should be the same.

7. If the electrode current does not reduce to zero, adjust the position and direction of the perfusion head and electrode, and repeat step 6. After several tests, you will get an idea about the right position and direction of the perfusion head, cell and electrode.

8. After the test, clean the entire tubing system.

9. For a formal experiment, the drug perfusion procedures are almost the same as above, except that the NaCl solution is replaced by drug solutions, and only the optimal positions for perfusion head, cell and electrodes are used.

MAINTENANCE

Cleaning

Clean the tubing system before and after each experiment. Although the solution path of the solenoid valve in **MPS-4** does not contact with any metal parts, but the drugs remaining in the solenoid valve will affect the accuracy of subsequent experiments. So at the end of each experiment, the valve needs to be flushed with distilled water. Drain the water out afterwards. The protocols for cleaning are as follows:

1. Remove the perfusion μ-manifold from the holding rod.
2. Carefully remove each of the 8 pieces of tubing from the adaptors on the back of the manifold. It is best to push them from their ends since pulling them off may damage the perfusion manifold. Pressurizing the tubing may facilitate this procedure.
3. Turn on the control switches and discharge the drug solutions from all 8 tubing channels.
4. Keeping the switches open, fill each syringe with warm, distilled water to wash the tubing and valves. Repeat this step 2 to 3 times.
5. After the manifold is removed from the tubing (step 2), press the provided cleaning adaptor onto the manifold from the tip end. Connect it to a syringe filled with filtered water and flush it.

CAUTION: Unfiltered water could clog the manifold and permanently damage it. The manifold is made of PMMA material. It can only be washed with water. Any organic solvent, even alcohol, can permanently damage it. If alcohol must be used, only use ethyl alcohol.

TROUBLESHOOTING

If there is no perfusion, check the following to locate the problem:

1. You can tell if the perfusion controller is running a perfusion sequence by looking at the lights above the numbered manual control buttons. When a valve is being opened, the corresponding light should turn on. If the perfusion controller won't turn on at all, check the power cord and the fuse in the back panel. If there is trouble communicating with the computer in Online mode, make sure the serial cable is tight and try restarting both the instrument and the PC software.
2. The lights above each channel of the valve console turn on when the valve is opened. In addition, there a soft click when a valve is turned on or off. If the valve console is not responding, tighten the cable that connects it to the perfusion controller.
3. Make sure the stopcock is in the correct position. The middle protrusion on the knob should be facing away from the syringe fluid port on the side.
4. Visually check for air bubbles or obstructions in any segments of tubing. Test the μ-manifold by connecting a syringe directly to one of its input passages

with a piece of tubing. If water flows through the μ-manifold and valve console separately, try raising the syringe holder or shortening the manifold output tubing.

5. The **MPS-4** system is designed to work with aqueous solutions. Fluids that are more viscous than water might not flow through the μ-manifold.

NOTE: If you have a problem/issue with that falls outside the definitions of this troubleshooting section, contact the WPI Technical Support team at 941.371.1003 or technicalsupport@wpiinc.com.

SPECIFICATIONS

This unit conforms to the following specifications:

Base .... White plastic over metal
Number of Perfusion Channels 8
I.D. of Micro-perfusion Head Tubing .... MP-1 100 μm; MP-4 250 μm
Dead Volume for Perfusion Head .... <100 nL
TTL Triggering Inputs .... High: +3 ~ 5 V; Low: 0 ~ +1 V
Channels Control Level .... ON: +3 ~ 5 V; OFF: 0 ~ +1 V
Maximum Flow Rates (gravity fed) .... 100 μm ID tip, 8 μL/min. at 50 cm
 .... 250 μm ID tip, 500 μL/min. at 50 cm
Packing Weight .... <8 kg
Packing Volume .... 680x210x170 mm

APPENDIX A: DETERMINING FLOW RATE

Theoretical Calculation

The relationship of flow rate to the height of the liquid column and inner diameter of the capillary tubing can be accurately predicted with the Hagen-Poiseuille equation.

$$F = C (d^4PV/L)$$

F = flow rate in μL/min
P = pressure in mmH_2O
L = length of capillary tubing in mm
V = viscosity of the perfusion media in cps
d = diameter of the capillary tubing in micrometers (μm)
C = constant (1.3765×10^{-8}).

In most biological systems, the fluid has approximately the same density as pure water, so P is equal to the height of the liquid column in mm. The viscosity of most biological perfusion solutions can be considered as one. Since the flow is proportional to the fourth power of the tubing diameter, the restriction of the plastic tubing to the flow can be ignored. We only need to consider the diameters and lengths of the quartz tubing, and the fluid passages leading up to the 8 to 1 junction. A good approximation of the resistance of the junction can be obtained by removing the tubing from one of the 8 manifold inputs, and turning on one of the other channels. Take the calculated flow resistance and divide it by two.

APPENDIX B: DISABLE DRIVER SIGNATURE ENFORCEMENT (WIN10)

Since we are using legacy drivers and have not yet gotten the driver signature for Windows 10, you must disable driver signature enforcement temporarily before installing the 64 bit driver. Please follow those steps below.

1. Since you need to restart the computer multiple times during the operation, you need to save your unfinished work and exit all applications before the disable driver signature enforcement.

2. Click the **Start** in the lower left corner of the Windows10 screen, and click the Settings (gear pattern) in the Start window.

Fig. 12—Click the start button and select the gear icon.

The following window pops up.
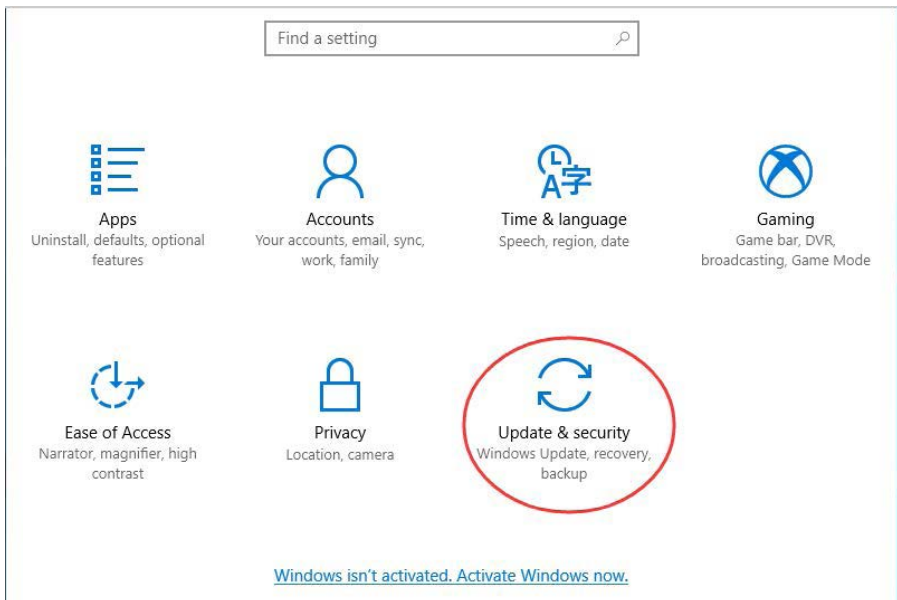
Fig. 13—Click the Update & security icon.

3. Click the option Update & security and a new window appears.
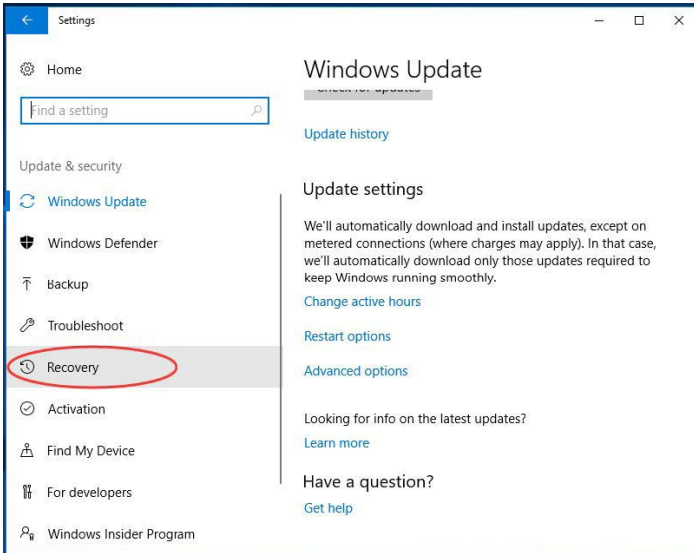
Fig. 14—Select the Recovery tab.

4. After selecting the Recovery tab, the Advanced startup area appears on the right side of the window.
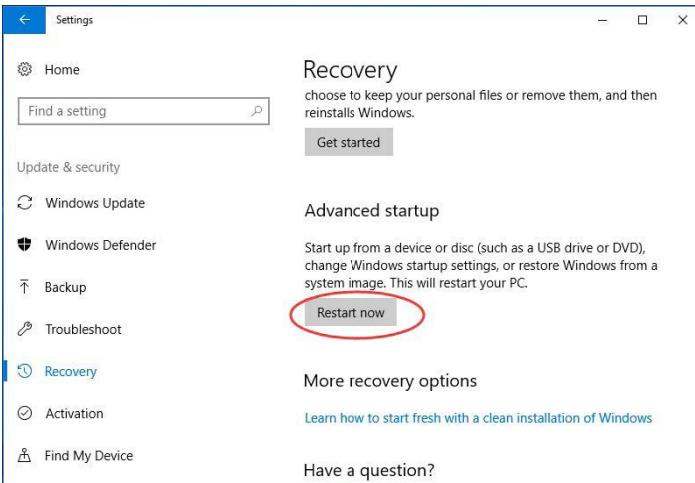
Fig. 15—Click Restart now.

5. Click the Restart now button under the Advanced startup area and the computer will restart.
6. After restart, the Option screen displays.
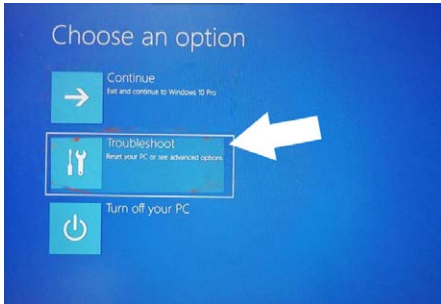
Fig. 16—Click Troubleshoot.

7. After clicking the option Troubleshoot, the Troubleshoot screen appears.

Fig. 17—Click Advanced Options.

8. Click the option Advanced Options, and the screen conversion display as follows to see more recovery options.
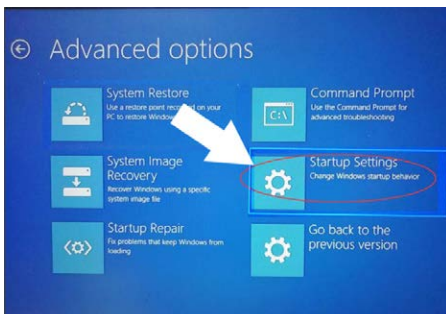
Fig. 18—Choose Startup Settings.

9. Select and click the Startup Settings, and the screen appears as follows.
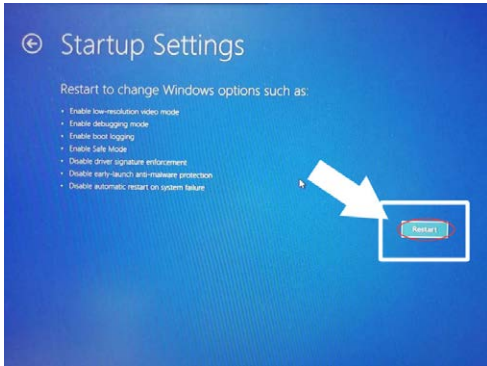
Fig. 19—Click Restart

10. Click the Restart button, and the computer restarts again. The following menu appears on the screen after the restart.
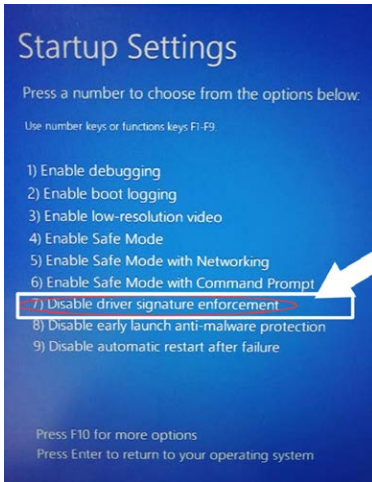
Fig. 20—Press 7 on your keyboard.

11. You can press "7" on your keyboard to choose the Disable driver signing enforcement. The computer will restart automatically. At this point, you can proceed to install the software. For driver installation instructions, see "Appendix D: Install the MPS-4 software on Windows 10" on page 22.

APPENDIX C: HOW TO INSTALL AN UNSIGNED DRIVER ON WINDOWS 8

Windows 8 by default will not let you install unsigned drivers. In order to install an unsigned driver, you can follow the steps shown below to start Windows 8 in "Disable Driver Signature Enforcement" mode.

1. Move the cursor over the top or bottom right corner or the screen and it will show extra options on the right side of the screen (This is the Charm Bar in Windows 8). Choose the Settings option (icon looks like a Gear).

Fig. 21—Click on the gear icon to access the settings.

2. Choose Power option.
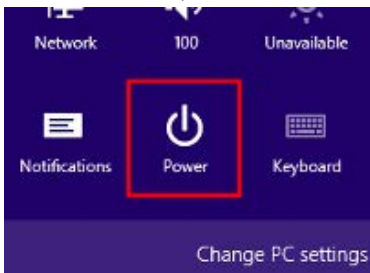
Fig. 22—Click the Power icon.

3. Choose General on the left hand side and then click Restart now button on the right.
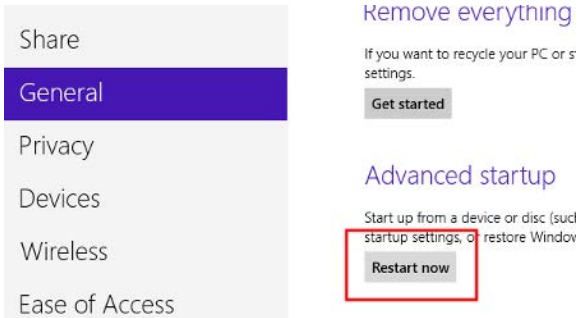
Fig. 23—Select the General tab and click Restart now.

4. After a restart, click Troubleshoot.
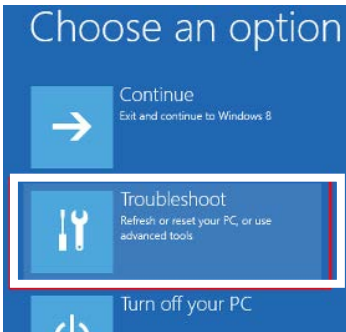
Fig. 24—Select the Troubleshoot option.

5. Click Advanced options.
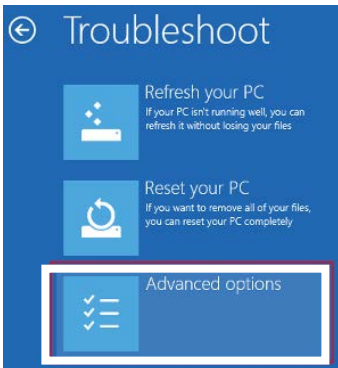
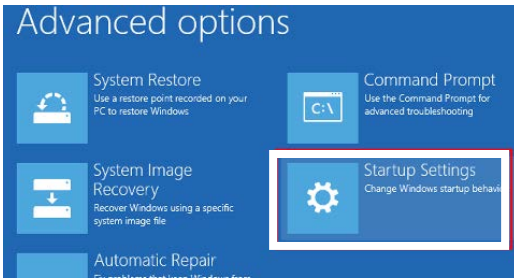*Fig. 25—Choose Advance options.*

6.   Click Startup Settings.

Fig. 26—Press Startup Settings.
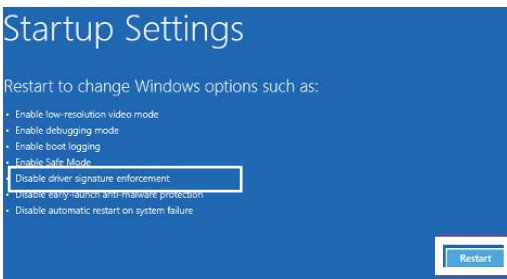
7.   Click the Restart button.

Fig. 27—Press Restart

8.   Choose the Disable Driver Signature Enforcement and hit the Enter key to start Windows
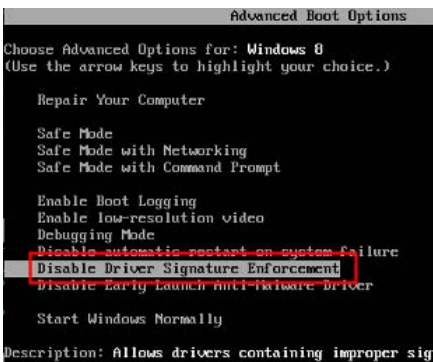
Fig. 28—Select the Disable Driver Signature Enforcement option and press Enter.

9.   You should now be able to install the driver needed. Follow the Windows 10 driver installation instructions, as they are similar.

APPENDIX D: INSTALL THE MPS-4 SOFTWARE ON WINDOWS 10

1. Follow the steps found in "Appendix B: Disable driver signature enforcement (Win10)" on page 15 to <u>temporarily</u> disable driver signature enforcement.

2. Find the program **MPS-4 19.07.exe** in the computer directory or CD and double click on it to begin the installation.

3. Using the provided USB cable, connect the USB port of host computer to the USB port (square) of the **MPS-4** controller, and then turn on the power of the **MPS-4** controller. At this time, the note appears in the lower right corner of the computer display screen.
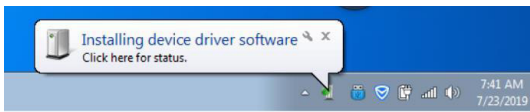
Fig. 29—A note appears when the USB cable is plugged into the computer.

4. Click on the Installing device driver software, and a pop-up window appears. Close the window.
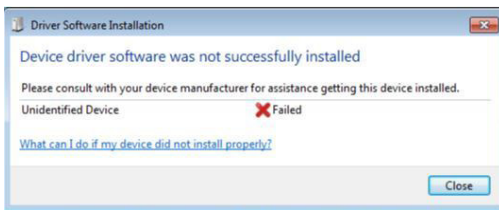

Fig. 30—Click close to acknowledge the message.

5.   The windows shown in this procedure are an example of how to install driver software in the directory. The windows will display differently on your computer depending on what is installed on your computer. When the device manager is opened, the Other devices\Unknown device with yellow background exclamation mark will appear in the directory, as shown in the figure below.
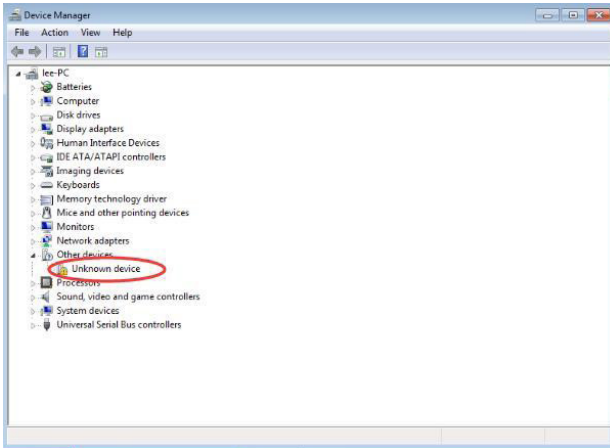

Fig. 31—Select the Unknown device.

6.   Right click Unknown device and open the following window under Properties.
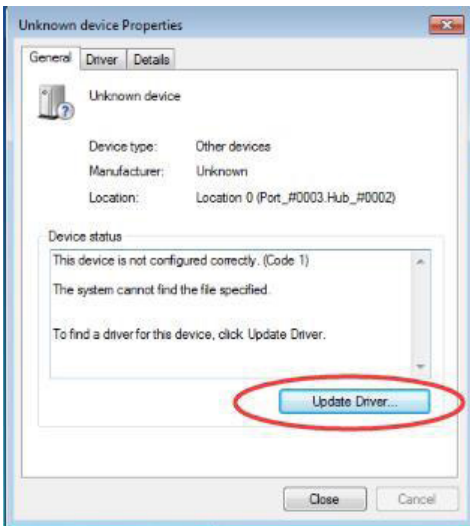

Fig. 32—Click the Update Driver button.

7. Click the Update Driver... button. The following window appears.
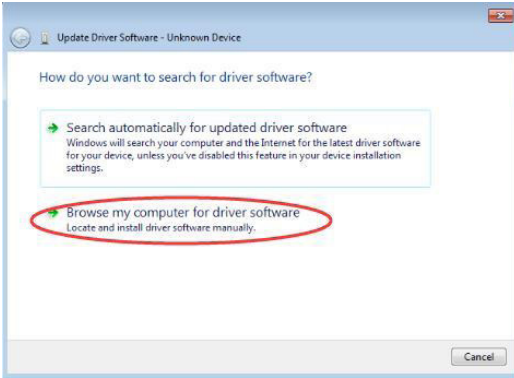

Fig. 33—Select the option to Browse my computer.

8. Select and click Browse my computer for driver software. A similar window appears.

Fig. 34—Click the Browse button.

9. The directory listed for the default driver installation location varies from one computer to the next. So you need to click the Browse button to locate the directory on disk specified from running **MPS-4 19.07.exe** during the installation. For example, on the this computer, the **MPS-4** program was specified to be installed in the following directory location: C:\Program Files(x86)\MPS-4\Driver\x64.
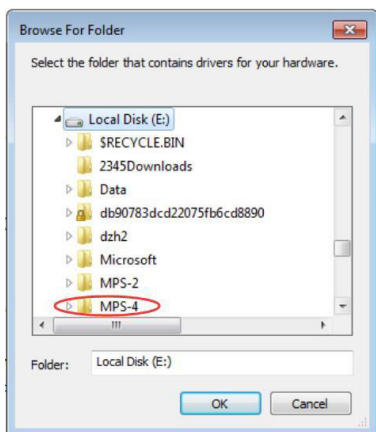

Fig. 35—This is the location for the previous version of the software.

10. Click on the subdirectory of MPS-4, find MPS-4\driver\x64, click on it, then click OK, as shown below:
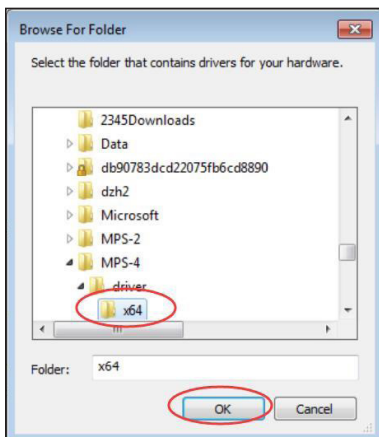

Fig. 36—Select the x64 directory and press OK.

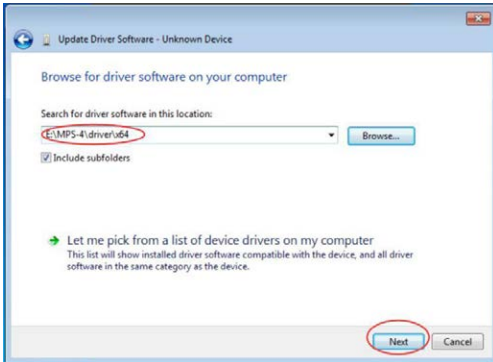11. After clicking OK, the computer displays the following window.

Fig. 37— Click the Next button.

12. This directory should conform to the location where the **MPS-4** driver software was installed from running **MPS-4 19.07.exe** in step 2. Click the Next in the lower right corner, and the following window appears.
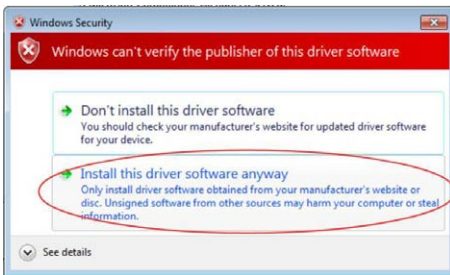

Fig. 38—Click the Install option.

13. Select and click the Install this driver software anyway, and the system will start to install the driver software. A window appears after the completion.

Fig. 39—This note indicates the driver was successfully installed.

14. The Windows system has completed the installation of **MPS-4** driver software. Click Close. Check the device management directory again to see the **MPS-4** in the Universal Serial Bus controllers section and confirm a successful installation of the driver software.
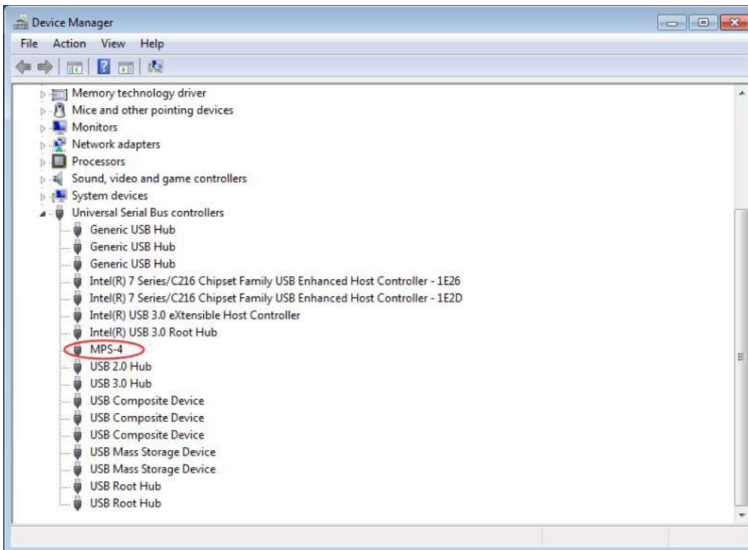
NOTE: After the installation of the **MPS-4** driver software, a system reboot automatically resumes the state of the driver signature enforcement and other installation of driver software for new equipment still requires the driver signature enforcement.

15. After the installation, just click on the icon on the screen to run the **MPS-4** program.

DECLARATION OF CONFORMITY

WORLD PRECISION INSTRUMENTS, LLC.

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Sarasota, FL 34240-9258 USA
Telephone: (941) 371-1003 Fax: (941) 377-5428
E-mail: wpi@wpiinc.com

DECLARATION OF CONFORMITY CE

We: World Precision Instruments
                            175 Sarasota Center Boulevard
                            Sarasota, FL 34240-9258 USA

As the **manufacture/distributor** of the apparatus listed, declare under sole responsibility
that the product(s):
WPI PN: MPS-4

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

Safety:
   EN 61010-1:2010+A1:2019
EMC:
   EN 61326-2-3:2013, EN 61326-1:2013
   EN 61000-3-2:2014, EN 6100-3-3:2013

And therefore conform(s) with the protection requirements of Council Directive
2014/30/EU relating to electromagnetic compatibility and Council Directive 2014/35/EU
relating to safety requirements and Council Directive 2011/65/EU relating to hazardous
substances:

Issued on: **March 24, 2020**

President of WPI

WARRANTY

WPI (World Precision Instruments) 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 ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. 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

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

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