CHEMYX

Nexus Series User Manual

Chemyx Inc.
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Table of Contents

EU Declaration of Conformity (DoC)

We:

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declare that the DoC is issued under the sole responsibility of the manufacturer and belongs to the following product(s):

All Syringe Pump Products, including:
- Fusion 100
- Fusion 200
- Fusion 400
- Nexus 3000
- Nexus 6000
- NanoJet StereoTaxic

The object of the declaration described above is in conformity with the relevant Union harmonization legislation:

- **EMC Directive 2004/108/EC (until April 19, 2016) and Directive 2014/30/EU (from April 20, 2016).**
- **LV Directive 2006/95/EC (until April 19, 2016) and Directive 2014/35/EU (from April 20, 2016).**
- **Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.**

The technical documentation required to demonstrate that the products meet the requirements of the LV and EMC directives has been compiled and is available for inspection by the relevant enforcement authorities.

Signature on behalf of manufacturer: _____
Authority: Jeff Wu, Senior Engineer, Chemyx, Inc.
Date: January 1, 2016

Attention!
The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations to use which must be observed when these products are taken into service to maintain compliance with the above directives.

Details of these special measures and limitations to use are available on request,
and are also contained in the product manuals.

General Information:

This manual covers the basic operational elements and usage of Chemyx syringe pumps. This does not include all aspects of usage or <u>OEM / custom designed systems</u> that are fabricated by Chemyx for other companies. Chemyx does not directly support OEM systems unless otherwise specified.

Limited Warranty:

Chemyx warrants its products against defects in materials and workmanship for a period of one year from the shipment date. Chemyx will repair any product that proves defective during its stated warranty period.

The foregoing warranty will not apply to effects resulting from:

- Improper or inadequate maintenance or operation

- Unauthorized modification or misuse of the product

- Operation outside the electrical specifications for the product

- Operation outside the temperature specifications for the product

- User-induced internal and external contaminations of the instrument

- Failure to use proper surge protection

- Improper product return, packaging, and shipping

- Removing serial number from syringe pump.

You must contact either by e-mail or phone Chemyx Inc. before returning a product. Chemyx will issue a Return Authorization (RA) number to you.

Repairs:

Chemyx can repair any syringe pump without major damage. You must contact either by e-mail or phone Chemyx Inc. before returning a product. Chemyx will issue a Return Authorization (RA) number to you.

Return products to:
Chemyx Inc.
10905 Cash Road
Stafford, TX 77477 USA

Dead Pixel Policy:

During the LCD Monitor manufacturing process, it is not uncommon for one or more pixels to become fixed in an unchanging state. The visible result is a fixed pixel that appears as an extremely tiny dark or bright dot. In almost every case, these fixed pixels are hard to see and do not detract from display quality or usability. A display with 3 to 7 bright or dark dots is considered normal and within industry standards. If your screen has more than 7 dead pixels during the warranty period your system will qualify for warranty replacement. Please see the Limited warranty section for details on how to activate a warranty claim.

Serial Number:

The serial number is located on the back top left corner or center of the pump under a small barcode. Removal of the serial number label voids your warranty.

Calibration:

Chemyx Pumps are pre-calibrated upon arrival to your site. All calibrated parameters are within stated accuracy and precision specifications of the pump. Although the pump might be highly accurate different syringes have much greater error from Glass at 1% to Plastic at 5% error. Chemyx is not responsible for errors generated from syringes.

Operational Safety:

Please read the following safety precautions to ensure personal safety and operational longevity of the Chemyx syringe pump. Chemyx, Inc. is not responsible for the equipment if used in a manner not specified by the manufacturer; warranty coverage provided by the equipment may be dropped as a result.

CHEMYX PRODUCTS ARE NOT FOR USE ON HUMANS

USE PROPER POWER SUPPLY
>Chemyx Inc is not responsible for the use of power supplies outside the stated electrical specifications or failure to switch the power converter from 240V to 120V while in the 240V environment or vice versa.

GROUND PRODUCT
>Proper grounding is required.

DO NOT OPEN THE PUMP
>Warranty coverage will expire if the pump is opened without authorization from Chemyx. Do not touch any electric connectors on the product.

DO NOT OPERATE WITH SUSPECTED FAILURES
>Even though the pump can operate at extremely fast speeds, the user must determine the proper flow rate for any given application. For instance, pumping at 90ml/min using a 20 gauge needle will cause stalls and/or potential bursting of the syringe. Chemyx is not responsible for any damage that might result from examples similar to above.

PINCH HAZARD
>Do not place fingers between the pusher block and end block while the pump is running.

OBSERVE ALL WARNING LABELS ON PRODUCT
>Read all labels on product to ensure proper usage.

CHEMYX IS NOT RESPONSIBLE FOR SYRINGE DAMAGE
>It is the user's responsibility to wet ground glass syringes and set / tighten the safety nut appropriately for microsyringes.

Technical Specifications

Note: The step resolution stated is the minimum step resolution achieved by a pump.

Nexus 3000

No. of syringes	Two (Ten optional)
Syringe size	0.5 µl to 140 ml
Voltage operating range	115 V~240V, 0.25 A, 55-60 Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	0.012 microns
Flow rate range	12 pl/min to 500 ml/min.
Nominal linear force	70 lbs
Dimensions	10.5 x 7.5 x 4.5 inch
Weight	10.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH
RS232 Connector	D9 Sub-connector
TTL Connector	USB-B Receptacle

Nexus 6000

No. of syringes	One
Syringe size	0.5 µl to 300 ml
Voltage operating range	115 V~240V, 0.25 A, 55-60 Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	0.120 microns
Flow rate range	.001 µl/hr to 200 ml/min.
Nominal linear force	450 lbs
Dimensions	9.5 x 6.5 x 5.5 inch
Weight	16.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH
RS232 Connector	D9 Sub-connector
TTL Connector	USB-B Receptacle

**Pump Features:**
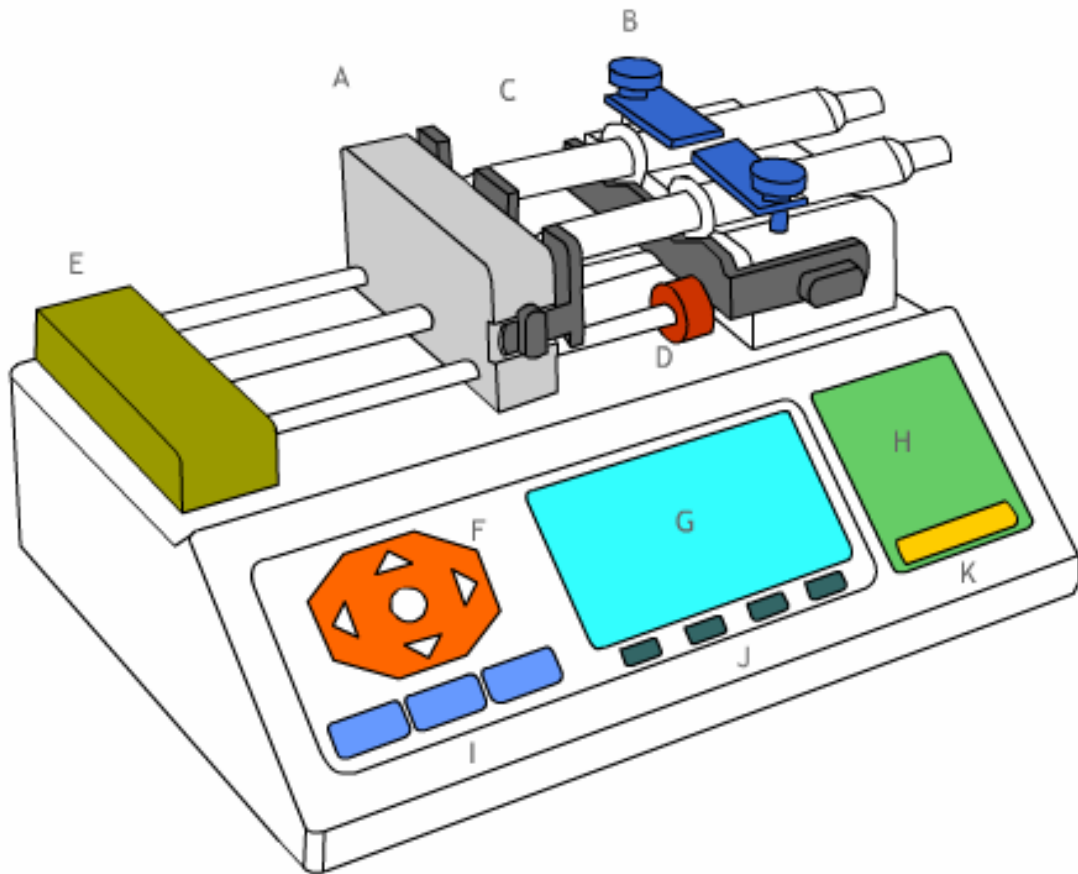
A: Pusher block – locking mechanism varies
B: Spring loaded syringe holder
C: Withdraw holder
D: Safety nut
E: Hex allen wrench
F: Directional keypad
G: LCD Screen
H: Numeric keypad
I: Stop, Start, Pause buttons
J: F1, F2, F3, F4 [Fast forward, Forward, Reverse, Fast Reverse]
K: Numeric Keypad, RS232, Bluetooth selection/active notification

Note: Nexus 6000 systems have one channel syringe holders.

Features continued

Nexus 3000

A

D   E

Active RS232 PC control port

Nexus 6000

A

D   E

Active RS232 PC control port
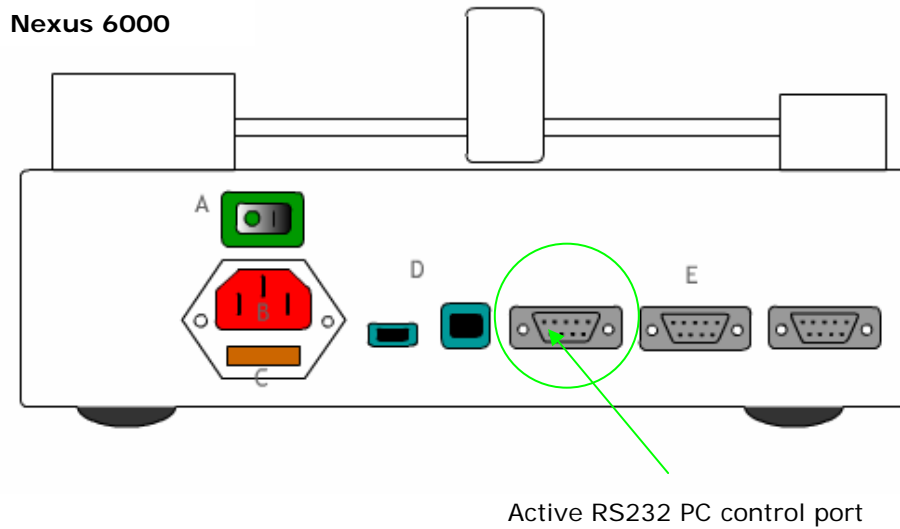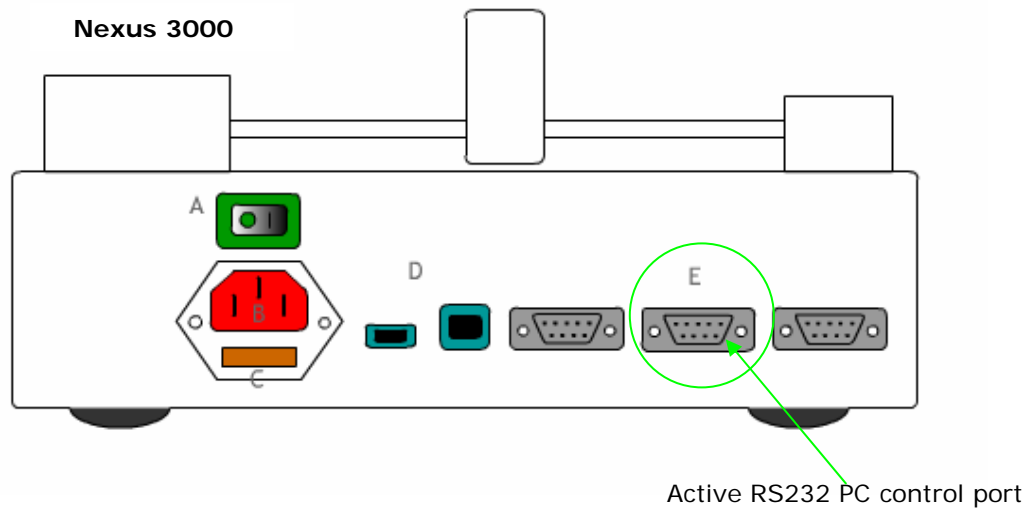
A: Power switch
B: Power plug
C: 2 Amp fuse
D: USB upload/TTL ports
E: D9 RS232 serial ports

RS232 ports (from LEFT to RIGHT- above view)
ACTIVE Nexus 3000 port is the center RS232 Port.
ACTIVE Nexus 6000 port is the far left RS232 port.

* Image may vary due to model

Features continued

Alarms:

Audible Alarms will sound in case of a stall and on power on.

Stall Detection:

Stall detection occurs when an optical detector used in verifying expected movement of the motor detects jamming or excessive pressure.

In the case of severe stalls from corroded guide rods, the mechanical locking nut will decouple and unlock the pusher block

Modes of Operation:

Infuse:
Pump runs continuously ejecting fluids from a syringe until stopped.

Withdraw:
Pump runs in the reverse direction until stopped.

Multi-Step:
Pump operates a specific sequence of infusion steps inputted by the user.

Continual Flow (Only with Nexus 3000):
Pump operates continuously in a push pull mode
*This mode of operation requires Chemyx **part #50006**- Nexus 3000 push/pull rack to activate continuous infuse/withdraw*

Looping (Multi-step Firmware):
Pump operates a specific sequence of steps and repeats the steps a certain number of times determined by the user.

Ramping Rate (Multi-step Firmware):
Pump linearly increases or decreases the rate over a period of time determined by the user.
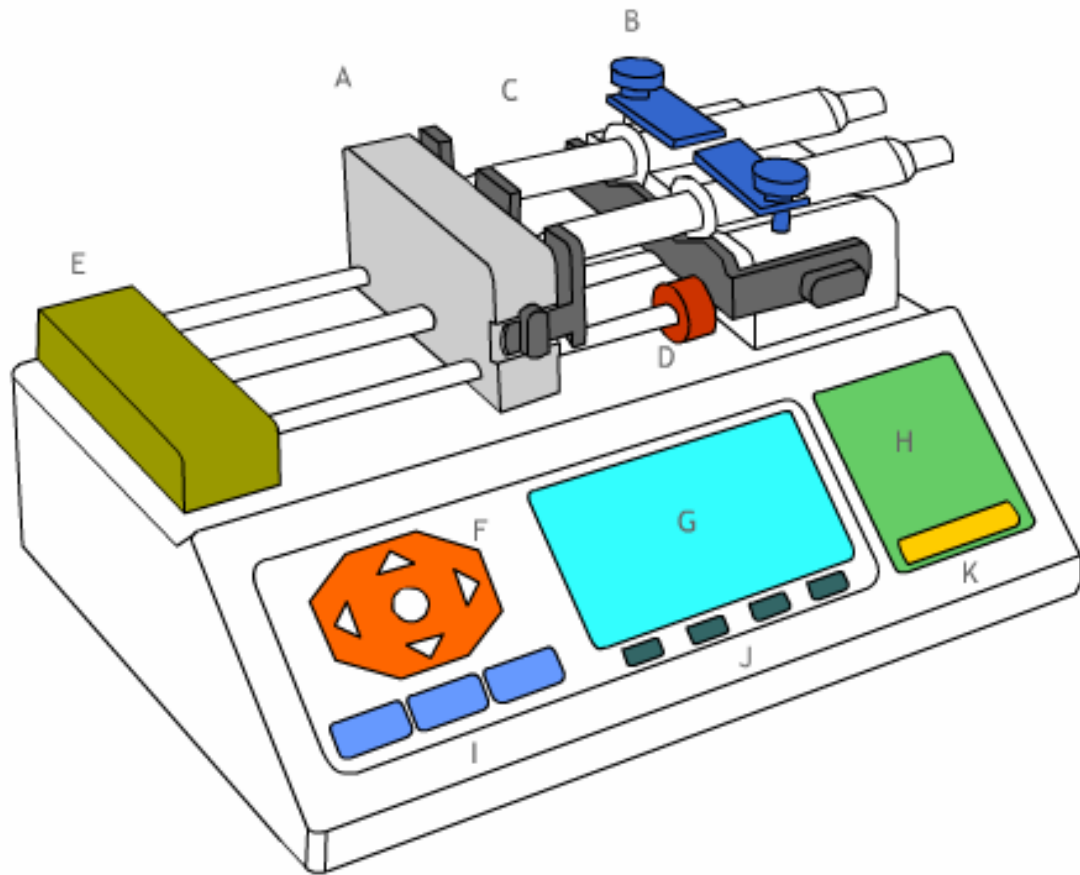
Principle of Operation:

All Chemyx Syringe Pumps are driven via a stepping motor that drives a lead screw and Pusher Block. The resulting action ejects fluid from the barrel of a syringe.
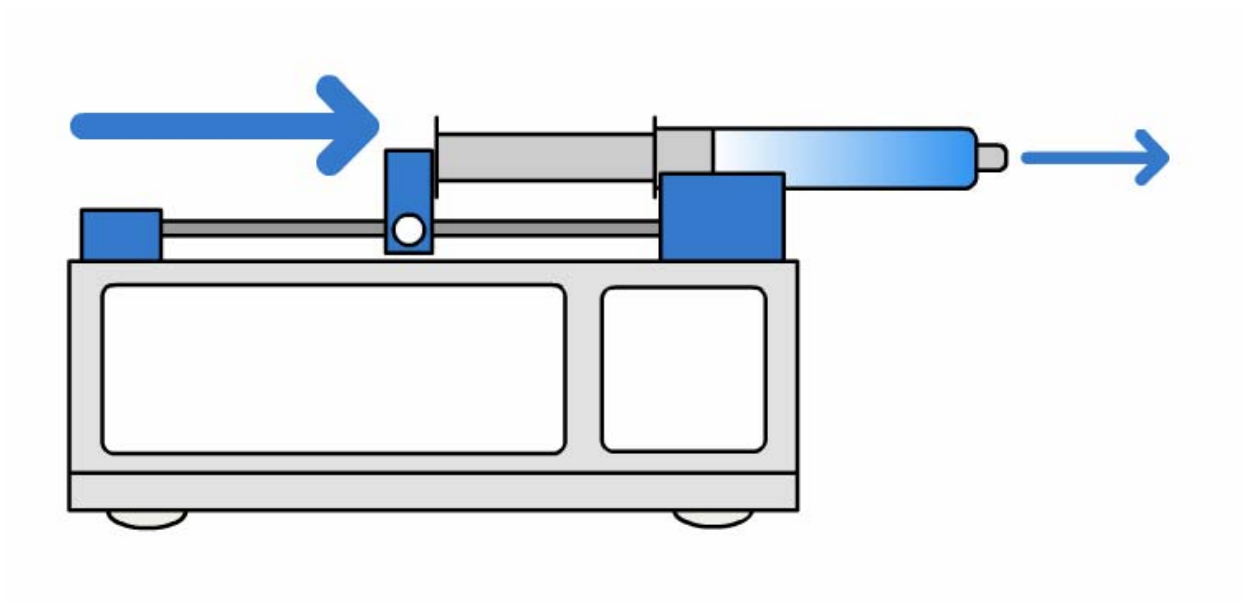
When withdrawing the operation is the same with only the motor reversing direction.

Syringe Loading

Place the syringe into one of the V shaped slots by lifting the spring clamp (part **B**).
Loosen the locking nut to release the pusher block (Part **A**). The pusher block should be pressed firm against the plunger of the syringe before initiating pumping.

Note: The Nexus 6000 has a closed bolt locking system. Refer to F1-F4 controls section on page 14.

F) Navigation controls

The navigation key pad is for tabbing between inputs on the interface. Once the user selects an input, the enter button is used to confirm the input to memory.

I) Pump controls

The pump controls are used for starting pausing and stopping the pump. If any input is out of the pump's range, the pump will not start.

H) Numeric Keypad Controls

The numeric keypad is for entering inputs into the available data entry boxes. The C in the bottom right corner clears an input box if an error has been made in entry.

J) F1-F4 Controls

Fast Forward	**F1**
Forward	**F2**
Reverse	**F3**
Fast Reverse	**F4**

Pressing the buttons F1-F4 moves the pusher block in either direction at different speeds. To move the pusher block, press and hold the appropriate buttons.

The button commands are as follows:

    F1: Fast Forward
    F2: Forward
    F3: Reverse
    F4: Fast Reverse

As you hold the buttons down, a window will appear on the screen with the above commands. When the pusher block reaches either side, a grinding noise will occur and the block may not be moved any further.

Running the Pump Interface:

I.

    When the user powers on the system, you will see a startup screen.

CHEMYX
nEXUX SYRINGE PUMP

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trademarks of Chemyx Inc.
Patent Pending

II.

After the startup screen, the menu screen will appear. On this screen users can choose standard infusion, multi-step infusion, continual flow, or change pump settings.
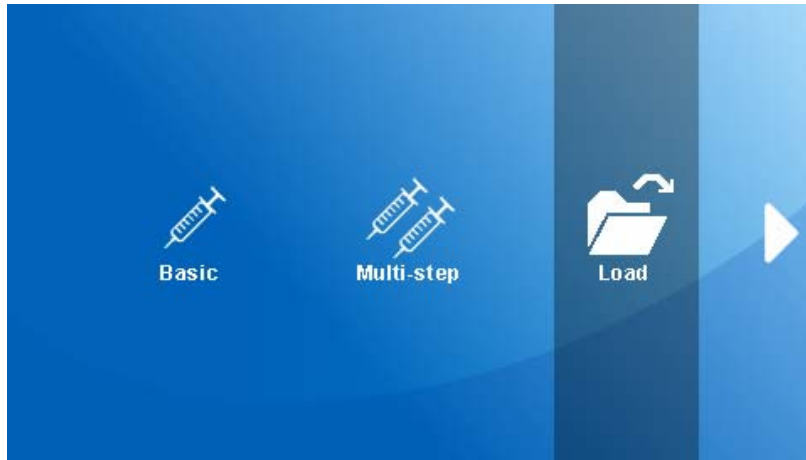
a)

Standard Infusion
In the next screen, enter parameters in the data input screen by using the navigation keys. The selected input box will highlight in light turquoise and a small cursor will appear and blink. You can type in any number on the numeric keypad to enter in your parameter. If the parameter is out of bounds, the pump will blink the max and min inputs at the top of the page. When ready to start the pump, press "start" on the keypad.

b)

        Multi-Step Infusion
        Pump operates a specific sequence of steps. "Multi-step" is like setting up many different individual steps and the internal computer links all the steps together.

In the following screens, input desired parameters into the each of the needed steps. Make sure to designate the last step by selecting "last step" on the appropriate screen. When finished, press "start" on the keypad to begin.

c)

        Continual Flow:
        Pump operates in a continuous push/pull mode.
        *This mode of operation requires Chemyx **part #50006**- Nexus 3000 push/pull rack to activate continuous infuse/withdraw*

d)

        Pump Setup:
        To switch to RS232 or Bluetooth control, return to the main menu screen. Tab to "pump setup" and select the desired method. To return to manual use, unselect. Extended instructions on RS232 use are in "computer control" section on page 20. Bluetooth control- **USA ONLY**

III.

The status page displayed below allows the user to view the elapsed time and infusion time of your syringe. It also allows the user to change the Syringe, Volume and Rate values from within the screen. The user may also press the Start, Pause or Stop button from the status screen.

The screen will display different pump states from: running, paused, stopped, and stalls

Pump Maintenance

Chemyx pumps require limited maintenance that can be performed with minimal downtime and effort. Proper maintenance of your pump will ensure the system's operating life to over 5 years. On a routine basis, the following procedures should be followed:

Oil your system:
1. Apply motor oil or machine oil to the lead screw and guide rod. This should be performed once **every 4 months** to maintain optimal lubrication.
2. Clean contact surfaces and debris. Take care to remove any debris on the lead screw and guide rods.

Consistent oiling of your pump will protect the pump from oxidizing fumes in fume hoods and extend the pumps performance and operating life many years.

Approved Lubricants:

Engine oil or Motor oil – any type or brand
Silicone oil
Machine oil
Tooling oil or "WD-40"

Contact Chemyx if you wish to use other lubricants.

Signs that your system is not adequately lubricated:

1) Grinding sounds coming from the lead screw.
2) Locking nut is decoupling under load before stall.
3) Slow decrease of max pushing force.
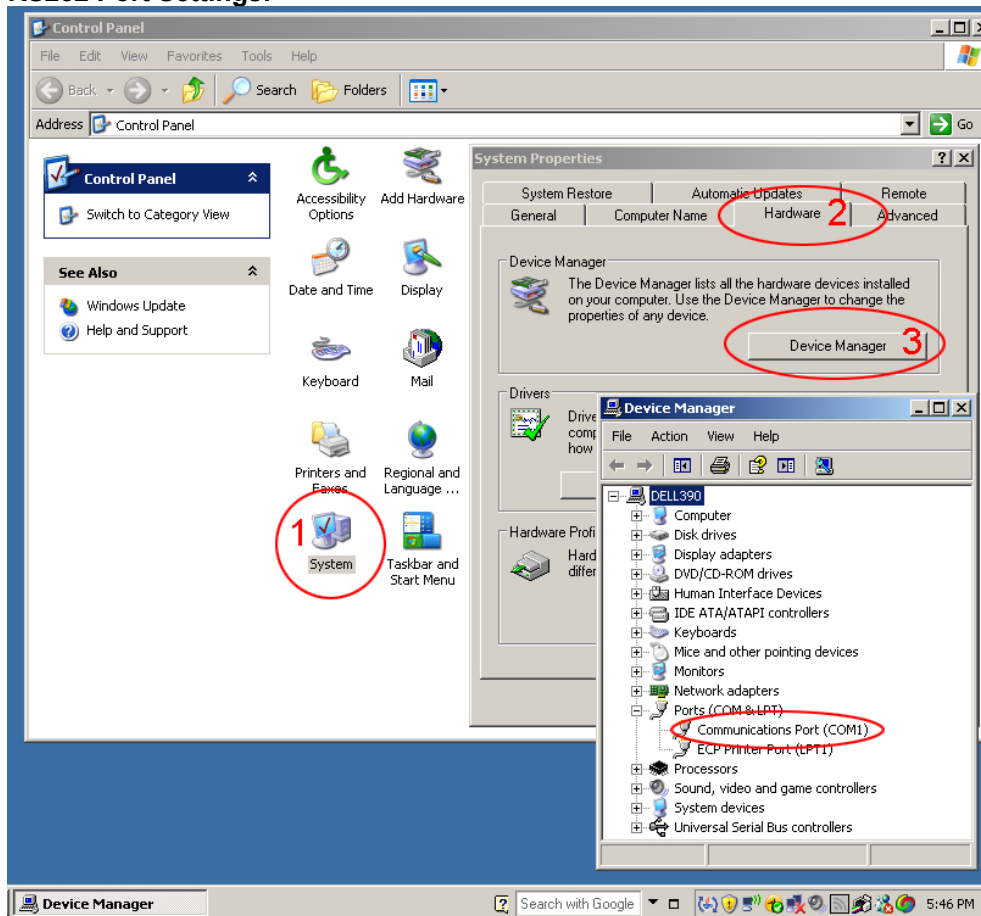
Computer Control (RS232 Operation):

Cable Requirements:
In order to interface to a PC you need the following hardware cable below:

DB9 Serial Cable Male to Female – Straight through configuration. Do not purchase a "Null Modem," "crossover," or "crossed over" cables.

RS232 Port Settings:

Before interfacing with a PC, make sure a RS232 port exists on your PC. RS232 ports will be in parentheses and named "COM1-100" like the one above named COM1

RS232 Port Settings (continued):

Baud Rate - 9600, Data Bits - 8, Parity - none, Stop bits - 1, Flow control – none.

Most programming packages like LabView, LabWindows and Visual Studio will allow you to program comport settings dynamically in program.
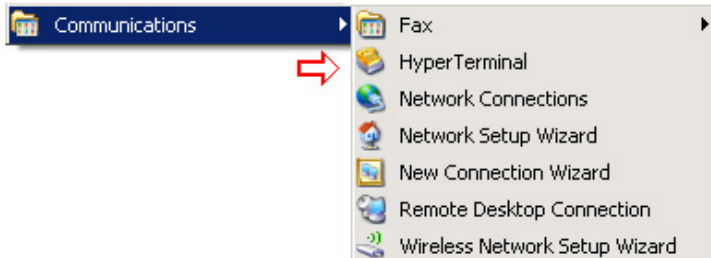
RS232 Communication Protocols:

Protocols:	Resulting Action by Pump
help	- Show help information
stop	- Pump Stop
pause	- Pump Pause
start	- Pump Run
status	- Pump Return Status
set units [xxx]	- Pump Set units
set diameter [x.x]	- Pump Set diameter
set rate [x.x]	- Pump Set rate
set time [xxx]	- Pump Set time@volume
set volume [x.x]	- Pump Set volume
set delay [xxx]	- Pump Set delay@start
save setting	- Pump parameter saved
read limit parameter	- Pump Returns Limit Parameter
view parameter	- Pump parameter settings
restart	- Pump restart

Example: "set volume 1.35" send the command to set the volume to 1.35.

Testing Communication in HyperTerminal:

HyperTerminal is a Microsoft utility where users can manually enter in protocols one by one to get the pump to communicate. All Windows based PCs have the HyperTerminal utility.

Located in START > Programs > Accessories > Communications > HyperTerminal

Click HyperTerminal to start the program. Configure the COM port with the following settings.
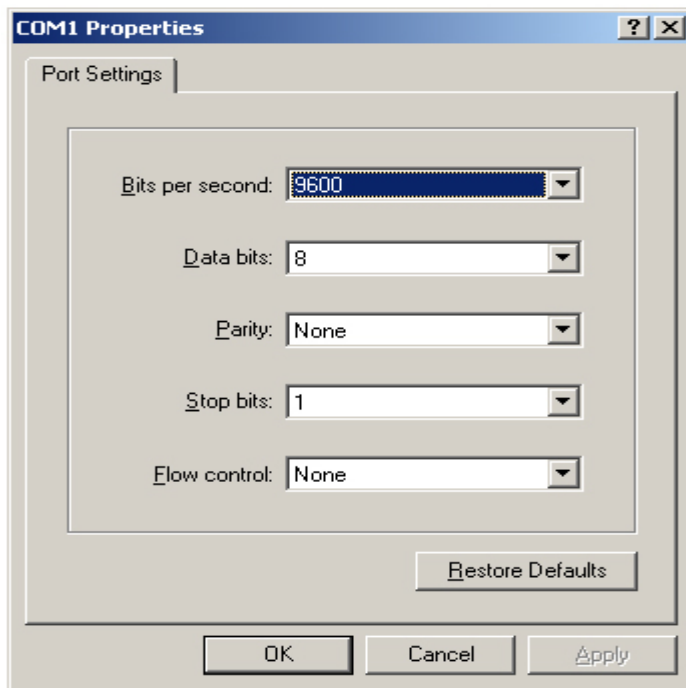
After you press OK you will come to a blank window with a blinking cursor. You can type in protocols here to test communication or to run the pump from a remote computer. Connect the pump to the PC. Type in "help" and then press enter to get a complete list of protocols available to the pump.

USB to RS232 Dongle Converters:

Due to the large numbers of computers made without RS232 ports, USB to RS232 dongles have been popular to "emulate" a RS232 port. Most but not all USB to RS232 dongles work with Chemyx pumps due to driver conflict issues.

How Much Pressure Does the Pump Generate?

The Nexus 3000 can generate up to about 70 pounds of linear force, and the Nexus 6000 series can generate up to about 500 pounds of linear force. Linear force is not the same as PSI (pounds per square inch) which is an area measurement.

Calculating PSI:

For an application where only a syringe is needed, you can use the details below to approximate the psi generated by the force of the pusher block:

- As a first approximation, the pressure is the force pushing on the syringe plunger [lb] divided by the cross-sectional area of the syringe [in2]. Therefore, the smaller the syringe the higher the pressure.
- Pressure units = lb / in2 (psi)
- Force generated by the Nexus 3000 is up to 70 lbs

Nexus with a single syringe: Pressure = force (70 lb) / syringe cross-sectional area (PI*r^2) .

Example: Calculate the pressure for 30 ml syringe where Barrel ID(Inner Diameter) = 30 mm

$$\textbf{Pressure (in}^2\textbf{)} = \frac{70 \text{ lbs}}{3.14 * (30/\,25.4 * 2)^2}$$

Chemyx Inc.   **Parts List**

Part Number	Item Description	Compatible Options
	Pump Systems	
10030	Nexus 3000	▲ ▲ ▲
10060	Nexus 6000	▲
	Options and Accessories	
10002	▲ 10 channel infuse/withdraw holder	
10005	▲ RS232 cable	
10002N	▲ Push/Pull rack	
	Universal Replacement Parts	
50000	Hex-allen wrench for safety nut	
50001	Safety nut screw	
50002	Black insulated foot pad	