CHEMYX

Fusion Series User Manual

Chemyx Inc.
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Stafford, TX 77477 USA

www.chemyx.com

EU Declaration of Conformity (DoC)

We:

Chemyx, Inc.
10905 Cash Road
Stafford, TX 77477
(281) 277-5499
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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.

Table of Contents

Manual Description

This Manual covers the basic operational elements and usage of Chemyx syringe pumps. This does not include all aspects of usage or OEM / custom designed systems 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.

Return products to:

Chemyx Inc.
10905 Cash Road
Stafford, TX 77477 USA

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 Returns
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 be dropped 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 sated is the minimum step resolution achieved by a pump.

Fusion 100

Syringe size	0.5 microliter to 60 milliliter
Voltage operating range	115 V~240V, 0.25 A, 55-60 Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	0.198 microns
Flow rate range	0.001 µl/hr (10µl) to 90 ml/min
Nominal linear force	29 lbs
Dimensions	9.5x 6.5 x 4 inch
Weight	7.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH
RS232 Connector	D9 Sub-connector
TTL Connector	USB-B Receptacle

Fusion 200

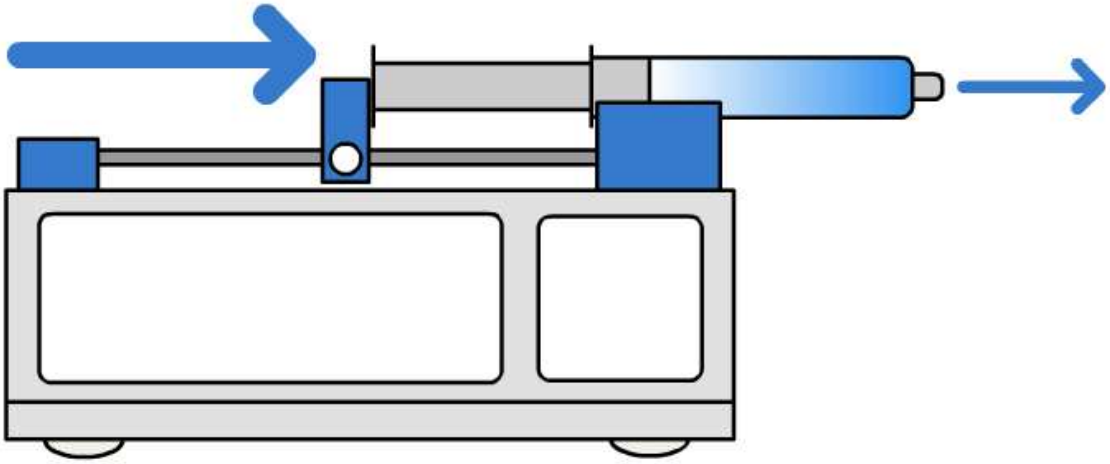
Syringe size	0.5 microliter to 60 milliliter
Voltage operating range	115 V~240V, 0.25 A, 55-60 Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	0.098 microns
Flow rate range	0.001 µl/hr (10µl) to 45 ml/min
Nominal linear force	50 lbs
Dimensions	9.5x 6.5 x 4.5 inch
Weight	7.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH
RS232 Connector	D9 Sub-connector
TTL Connector	USB-B Receptacle

Fusion 400

Syringe size	0.5 microliter to 10 milliliter
Voltage operating range	115 V~240V, 0.25 A, 55-60 Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	0.020 microns
Flow rate range	10pl/min (0.5µl) to 10 ml/min
Nominal linear force	50 lbs
Dimensions	9.5x 6.5 x 5.5 inch
Weight	7.5 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH
RS232 Connector	D9 Sub-connector
USB Connector	USB-B Receptacle

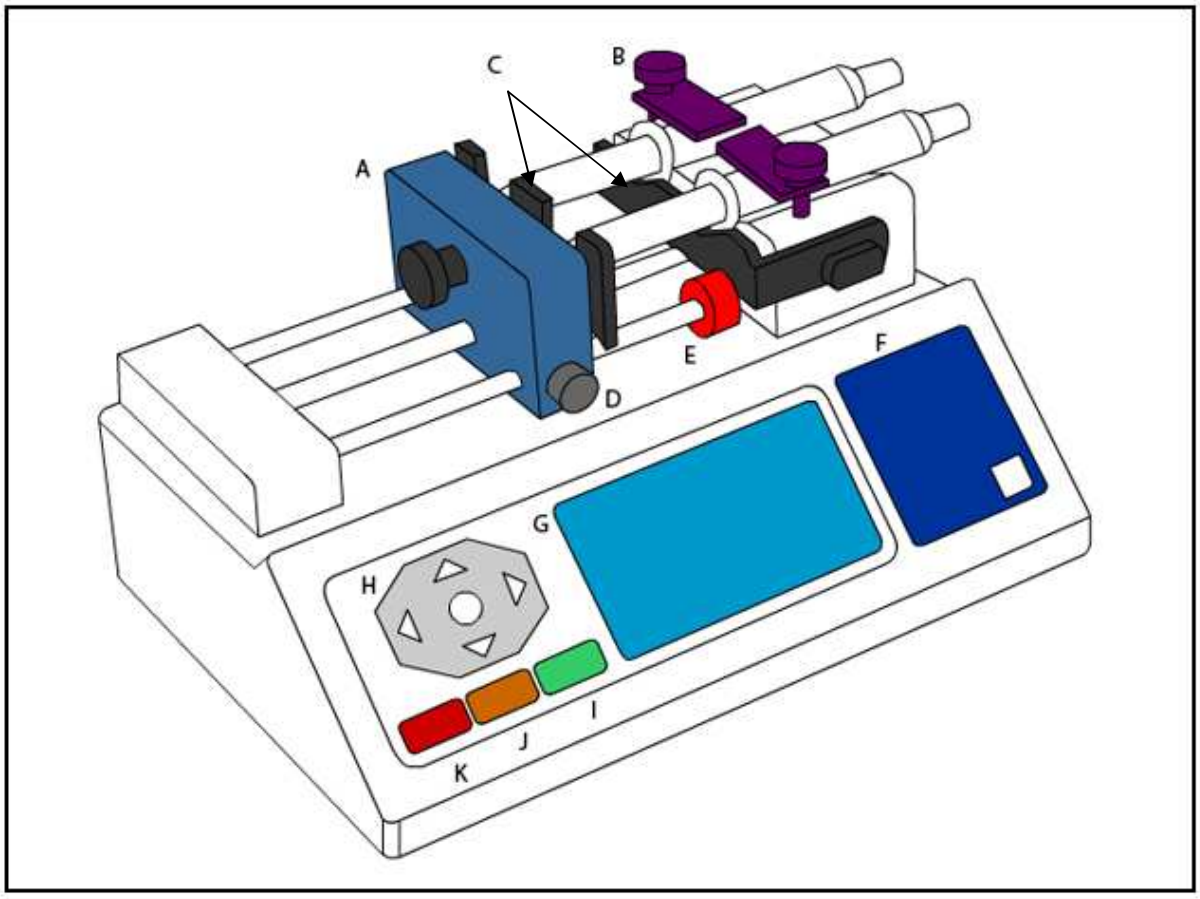
Principle of Operation

All Chemyx Fusion series 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.

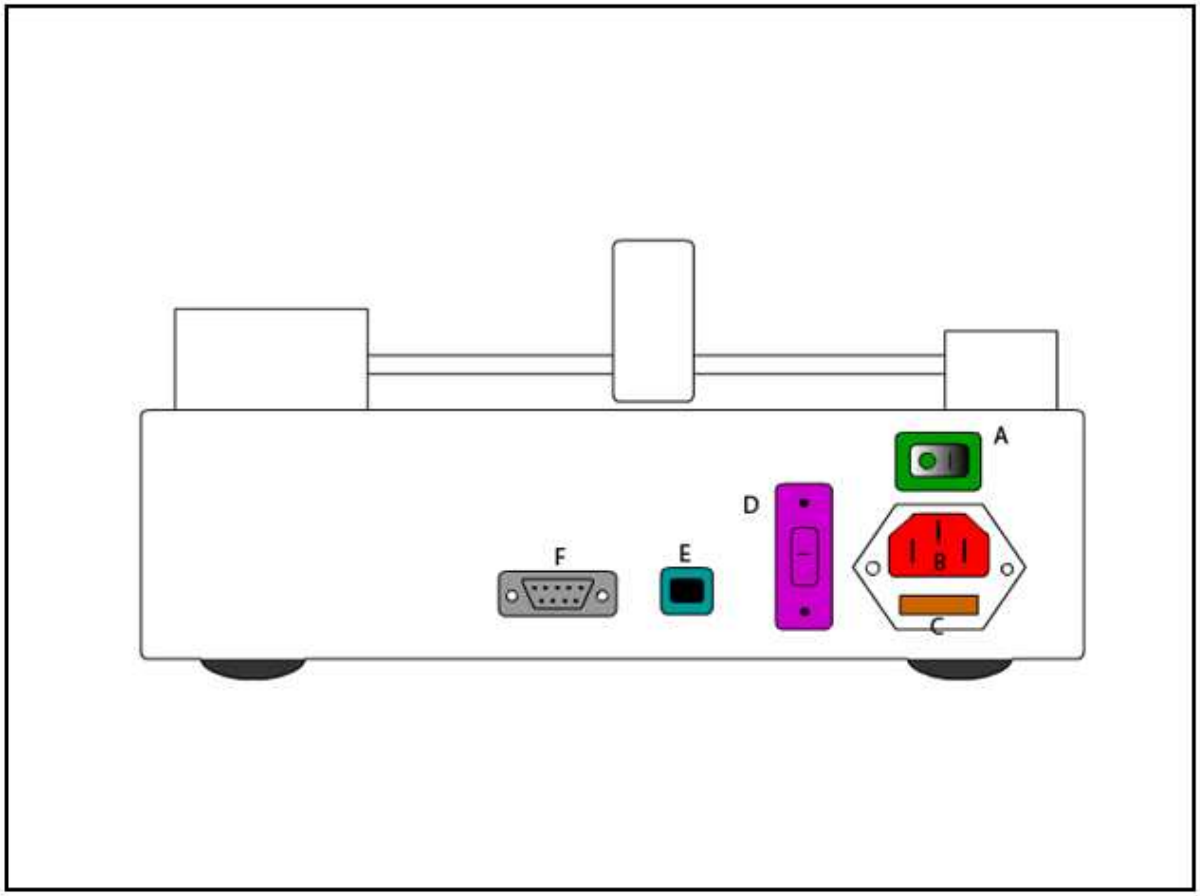
Pump Features



A: Pusher block – locking mechanism varies
B: Spring loaded syringe holder
C: Withdraw holder (Fusion 200 only)
D: Locking nut
E: Safety nut
F: Numeric keypad
G: LCD screen
H: Directional keypad
I: Start button
J: Pause button
K: Stop button

Note: Fusion 400 systems have 4 channel screw clamp holders; as well as a sensor/safety bar mechanism for syringe and stall protection. The Fusion 400 safety/sensor bar is adjusted by a small screw piece located on the top of the F400 pusher block.

Features continued



A: Power switch
B: Power plug
C: 2 Amp fuse
D: Voltage Converter
*E: TTL port USB – B Receptacle *(Only for classic Fusion 100 and Fusion 200)
F: D9 RS232 serial port

*E: USB connector – B Receptacle * Please note: this is only a USB connector for the Fusion 400 system.

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.

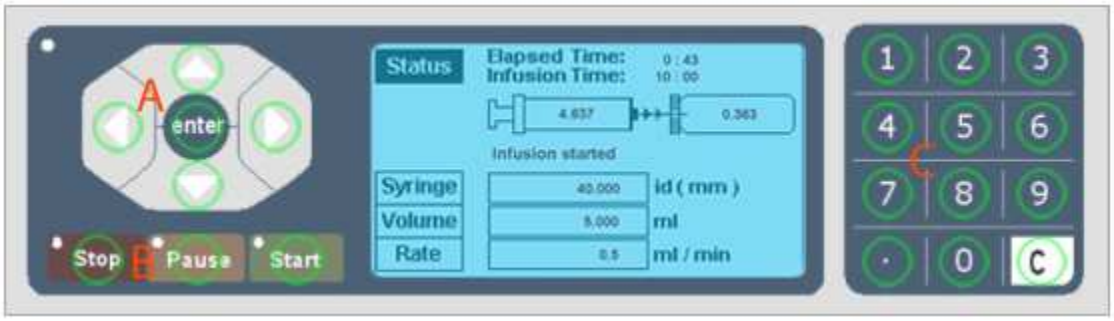
Withdraw (Fusion 200 only):
Pump runs in the reverse direction until stopped.

Multi-Step (Optional Multi-step Firmware Upgrade):
Pump operates a specific sequence of infusion steps inputted by the user.

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

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

Keypad Interface



The green circles represent depressible buttons on the membrane surface.

A) Navigation controls

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

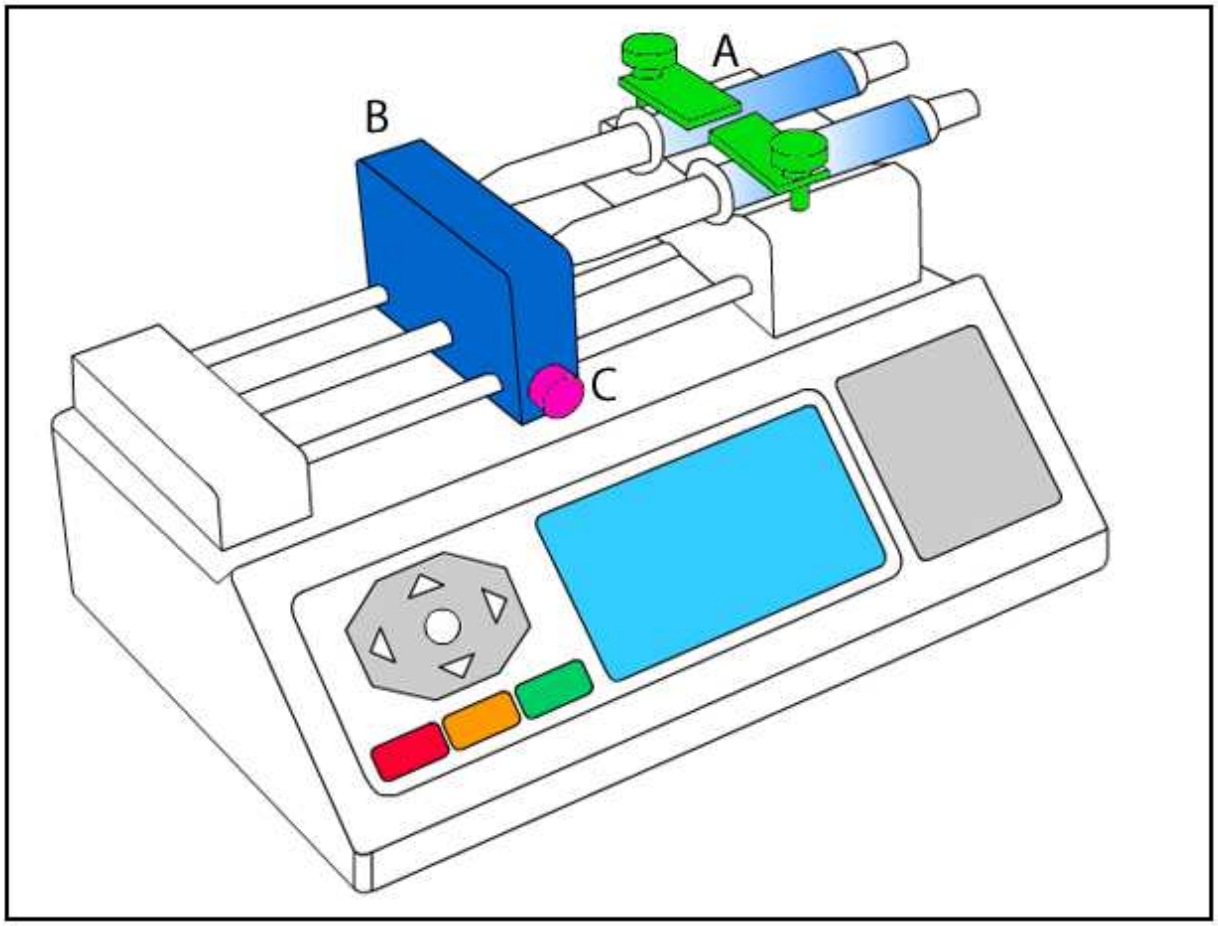
B) Pump controls

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.

C) 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.

Operating Instructions



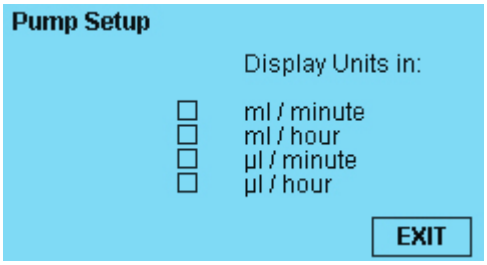
Syringe Loading

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

Running the Pump Interface

1) When you power on the system you will see a startup screen.

2) After the startup screen a unit selection screen will appear. Ml/Min is the default setting for the Fusion 100 and 200 series. ul/min is the default setting for Fusion 400 series pump. Use the arrow keys to tab your selection up and down and press enter to accept your selection. You can come back to this screen later if you are not sure what units to use initially.



3) In the data input screen users can enter any parameter by using the navigation keys to tab to any input. The selected input box will highlight in black 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 you are ready to start the pump, press "start" on the keypad.

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
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:

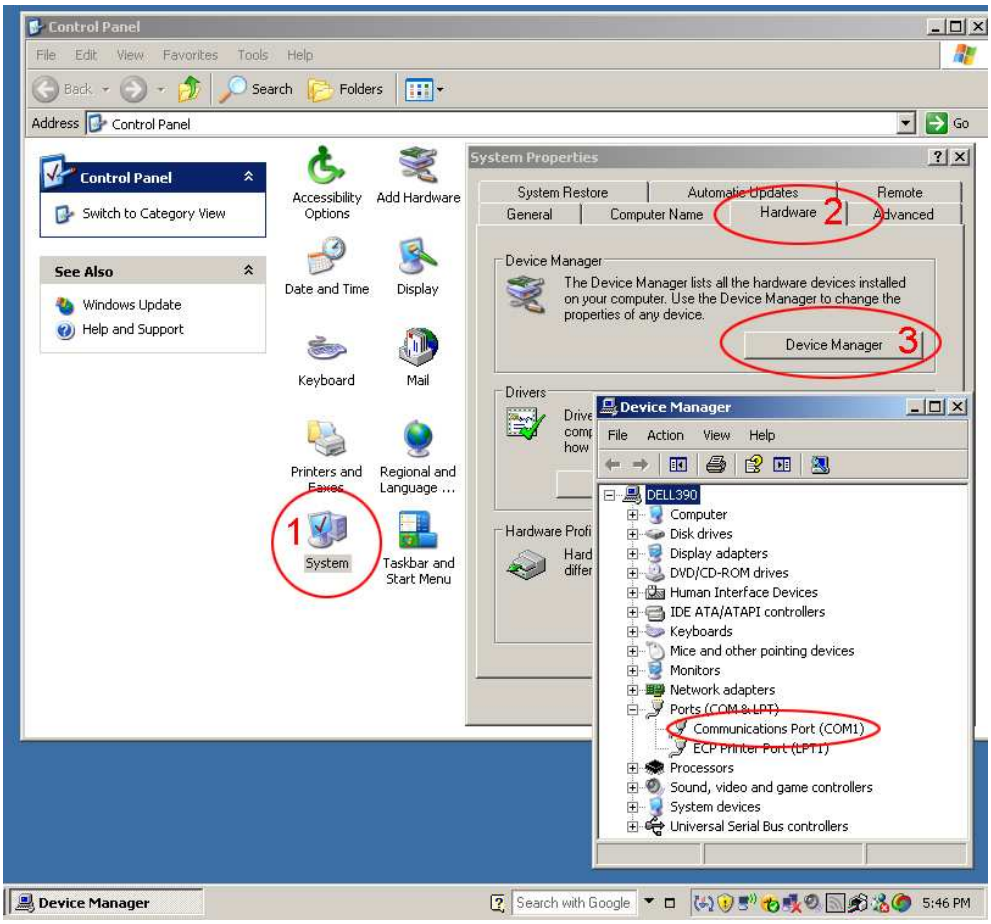
1) Grinding sounds coming from the lead screw.
2) Locking nut is decoupling under load before stall
3) Slow decrease of max pushing force.

Computer Control (RS232 Operation)

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

DB9 Serial Cable Male to Female – Strait though 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

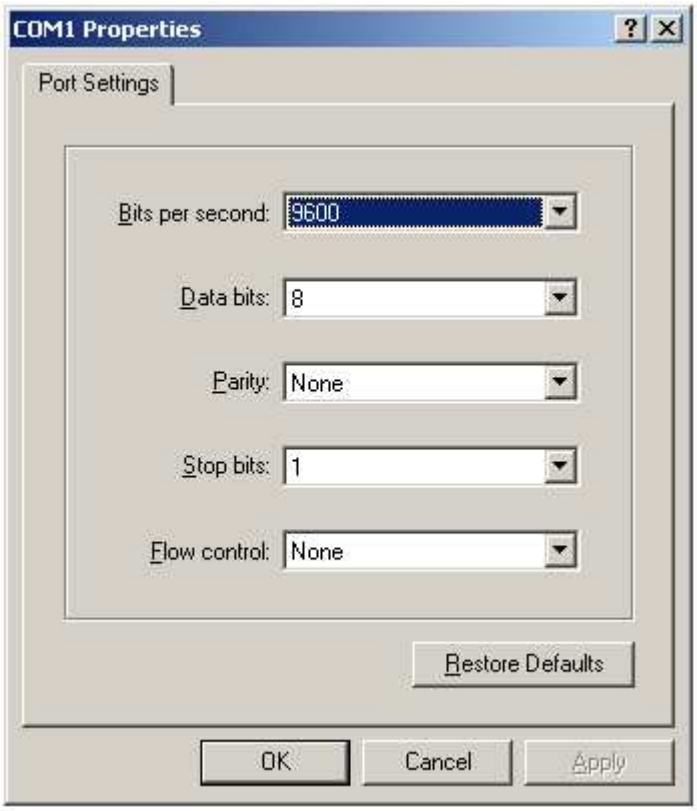
Protocols:	Resulting Action by Pump
help	- Show help information
stop	- Pump Stop
pause	- Pump Pause
start	- Pump Run
status	- Pump Return Status
set units [xxx]	- Pump Set units
set diameter [x.x]	- Pump Set diameter
set rate [x.x]	- Pump Set rate
set time [xxx]	- Pump Set time@volume
set volume [x.x]	- 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.

TTL

TTL is a hold over from classical syringe pumps built in the 1970s before RS232 ports existed. However Chemyx does have a TTL port grandfathered in for triggering starts and stops. The TTL port has a USB-B receiver configuration.

TTL works with Chemyx's foot switch, hand switch or parallel switches.

Other

Multi pump control "Daisy Chaining"

Pumps can be daisy chained via a RS232 Y connector or parallel switches. Please contact chemyx for more details on daisy chaining pumps.

Chemyx Pump Controller Program (Freeware not supported)

Chemyx does not provide technical support for the free pump controller program attached to the manual CD.

This program is freeware to control Chemyx syringe pumps.

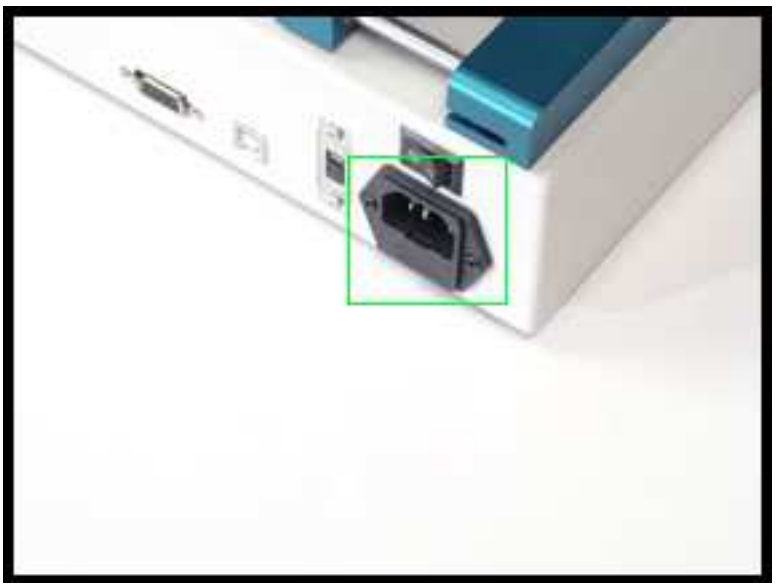
Appendices -A

Replacing The Fuse.

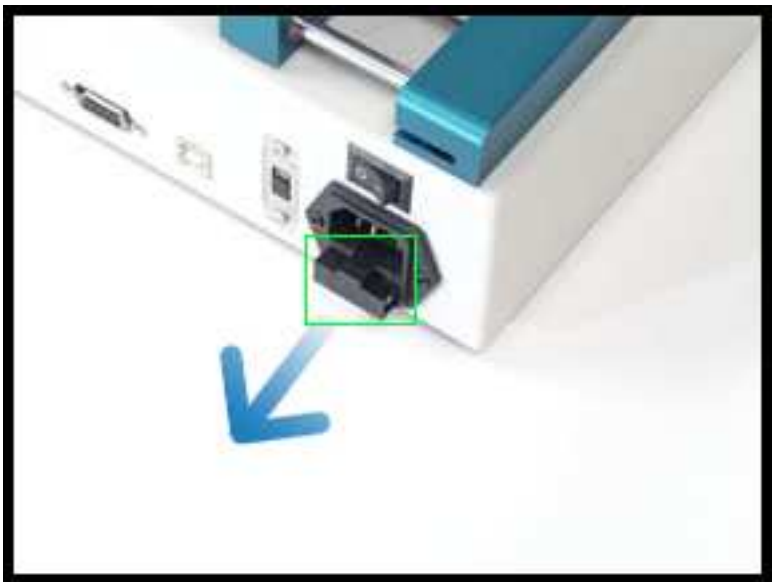
In the event of a power surge resulting from a lightning strike, plugging the pump into an incorrect voltage or other surge event, the fuse in the syringe pump will break. If the fuse breaks, no power will be supplied to the pump.

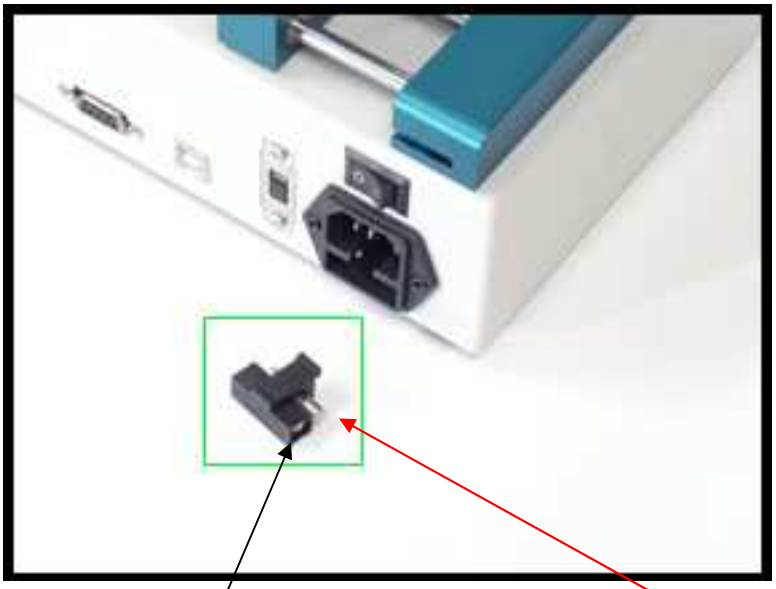
Chemyx syringe pumps come with a complimentary backup fuse inside the pump. Please follow the instructions below on how to access the fuse holder and replace a broken fuse.

Step 1: Locate the power plug on the back of the pump. The Fuse holder is located underneath the 3 prongs of the power plug.



Step 2: Remove the fuse holder from the power plug. There is a small indentation on the bottom edge of the power plug. A small coin or screw driver may be needed to remove the fuse holder from the pump.

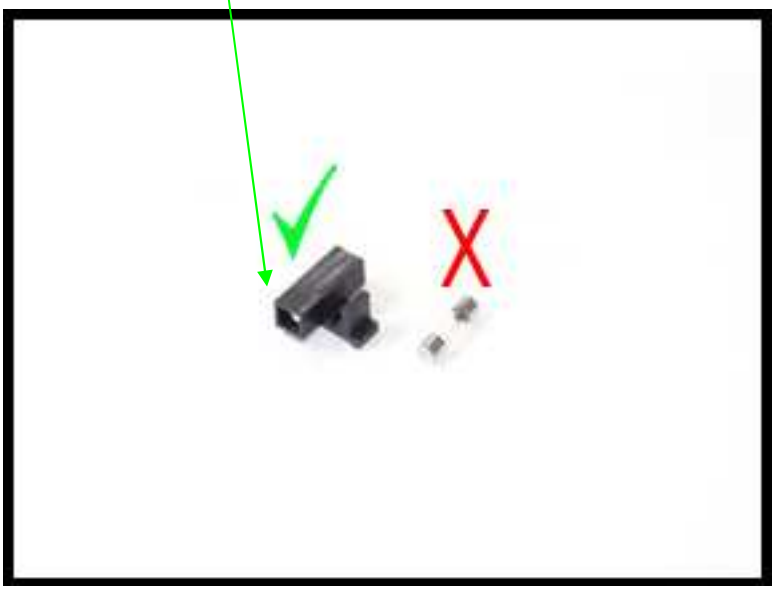




There are 2 fuses in the fuse holder. The exposed fuse in the back is the fuse that is being currently used. In the event of a power surge this fuse will be the broken fuse.

Step 4: Remove the broken fuse from the active slot in the holder. Most of the time and broken fuse will be visible to the naked eye.

Remove the back-up fuse from the plastic casing represented below by the check mark. Place the back-up fuse in the active slot. Insert the fuse holder back into the pump's power plug to reactivate the pump.



Chemyx Inc.	Parts List	www.chemyx.com

Part Number	Item Description	Compatible Options
	Pump systems	
10010	Fusion 100	▲▲▲
10020	Fusion 200	▲▲▲▲▲
10040	Fusion 400	▲▲
10050	NanoJet	▲
	Options and accessories	
10002	▲ 10 channel infuse/withdraw holder	
10003	▲ In-pump multi-step automation program	
10051	▲ Pump head module	
10005	▲ RS232 Cable	
10006	▲ Foot Switch	
	Universal replacement parts	
50000	Hex-allen wrench for safety nut	
50001	Safety nut screw	
50002	Black insulated foot pad	