CHEMYX

Fusion One User Manual

Chemyx Inc.
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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.

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Technical Specifications

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

Fusion One Basic

Syringe size	1 milliliter to 60 milliliter
Voltage operating range	120VAC: 50/60Hz, 240VAC 50/60Hz Stepper
Drive mechanism	motor
Step resolution (advance per microstep)	1 micron
Flow rate range	0.1 ml/min (1 ml) to 40 ml/min (60 ml
Nominal linear force	syringe) 15 lbs with variable force selection
Dimensions	3.5 x 6 x 9 inch
Weight	9.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH, Non-condensing
RS232 Connector	Straight-through D9 Female receptacle
TTL Connector	USB-Type B Male Receptacle

Fusion One Advanced

Syringe size	1 milliliter to 60 milliliter
Voltage operating range	120 VAC: 50/60Hz, 240VAC 50/60Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	1 micron
Flow rate range	0.1 ml/min (1 ml) to 40 ml/min (60 ml
Nominal linear force	syringe) 15 lbs with variable force selection
Dimensions	3.5 x 6 x 9 inch
Weight	9.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH, Non-condensing
RS232 Connector	Straight-through D9 Female receptacle
TTL Connector	USB-Type B Male Receptacle

Fusion One GLP

Syringe size	1 milliliter to 60 milliliter
Voltage operating range	120 VAC: 50/60Hz, 240VAC 50/60Hz
Drive mechanism	Stepper motor
Step resolution (advance per microstep)	1 micron
Flow rate range	0.1 ml/min (1 ml) to 40 ml/min (60 ml
Nominal linear force	syringe) 15 lbs with variable force selection
Dimensions	3.5 x 6 x 9 inch
Weight	9.0 lbs
Temperature range	10°C ~ 50°C
Humidity	20% - 80% RH, Non-condensing
RS232 Connector	Straight-through D9 Female receptacle
TTL Connector	USB-Type B Male Receptacle

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

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

Serial Number

The serial number is located on the back top right corner 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 ranging 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.

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.
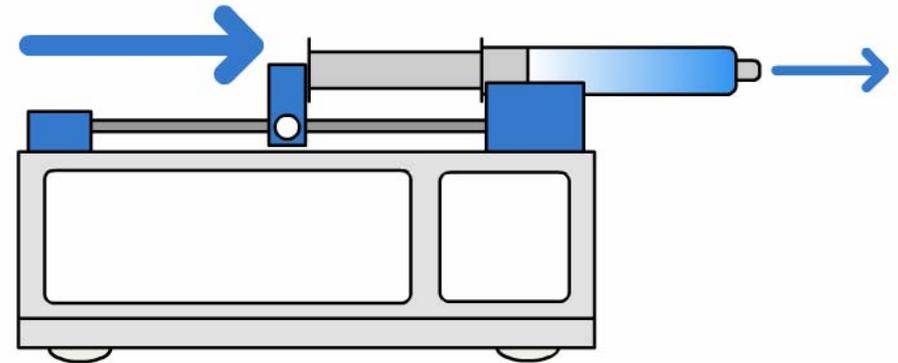
Pump Features

A: Pusher block – locking mechanism varies
B: Spring loaded syringe holder
C: Numeric keypad
D: 4 line Alphanumeric Monochrome Display
E: Directional keypad (Bolus/Reverse)
F: Start button
G: Pause button/Stop button
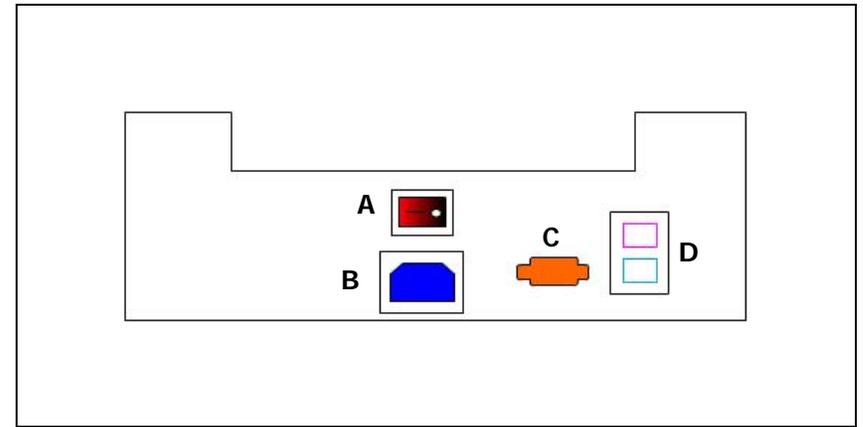
A: Power switch
B: Power plug
C: RS232: Straight-through D9 Female receptacle
D: Input/output signal for multi-pump network

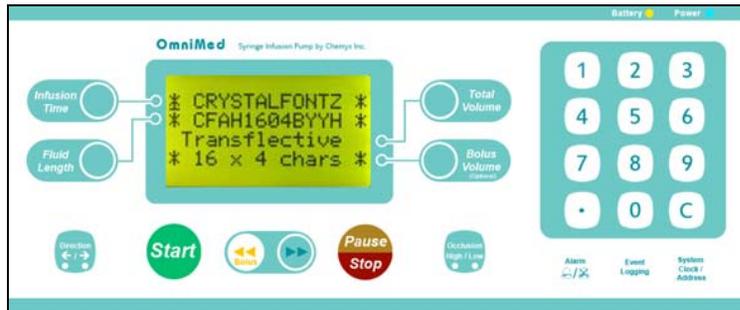*Please note: TTL/USB Ports are located on side of pump box*

Alarms

For on/off sound.

Stall Detection

Stall detection occurs when an optical detector used in verifying expected movement of the motor detects jamming or excessive pressure. "Error: occlusion/stall or End of Travel" will be displayed.

Keypad Interface

A) Navigation control

The depressible **direction** button is for tabbing between movement of the direction of the pusher block (left to right or right to left movement). System must be completely stopped before switching direction of pusher block movement.

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 (Infusion time, fluid length, total volume, bolus volume). If any input is out of the pump's range, the input line will zero out. The **C** in the bottom right corner clears an input box if an error has been made in entry.

D) Optional Keypad Controls
-Occlusion High/Low – Set detection at higher/lower pressures
-Alarm – turn alarm on/off
-Event Logging – Record/recall data from events that occur during pump run
-System Clock/address – reset system clock and assign individual pump address in multi-pump network

How this pump works

This infusion pump contains a micro-stepping motor along with a suite of clinical features including bolus, occlusion and optional event recording functions. Operators do not need to measure the syringe inner diameter for the system to work - especially useful with pre-filled syringes. The system is also syringe make independent meaning there are no restrictions on the brand of syringes that can be used.

Operating Instructions

Syringe Loading

Place the syringe into the V shaped slot by lifting the spring clamp (part **A**).
Use the Directional/Bolus arrow keys (Part **C**) to move the pusher block back and forth for syringe loading (Part **B**). The pusher block should be pressed firm against the plunger of the syringe before initiating pumping.

Running the Pump

When powering on the system user will see a 4 line input screen.

```
Time       =_ _: _ _: _ _
Length     =      _ _: _ _
Total VOL =       _ _: _ _
Bolus VOL =      _ _:  _ _
```

User enters in parameters for run profile using the numeric keypad to enter desired run settings

```
Time       =_ _: _ _: _ _
Length     =      _ _: _ _
Total VOL =       _ _: _ _
Bolus VOL =      _ _:  _ _
```

Time= amount of time for run profile
Length= Fluid length measured by length of syringe
Total Volume= amount of solution being delivered
Bolus volume= Quick dose/shot amount as a function of time

START, STOP, PAUSE, membrane keypad options can be selected as needed to initiate or halt pump run(s)

User must completely STOP pump run to change flow profile parameters as necessary for various applications

Computer Control (RS232 Operation)
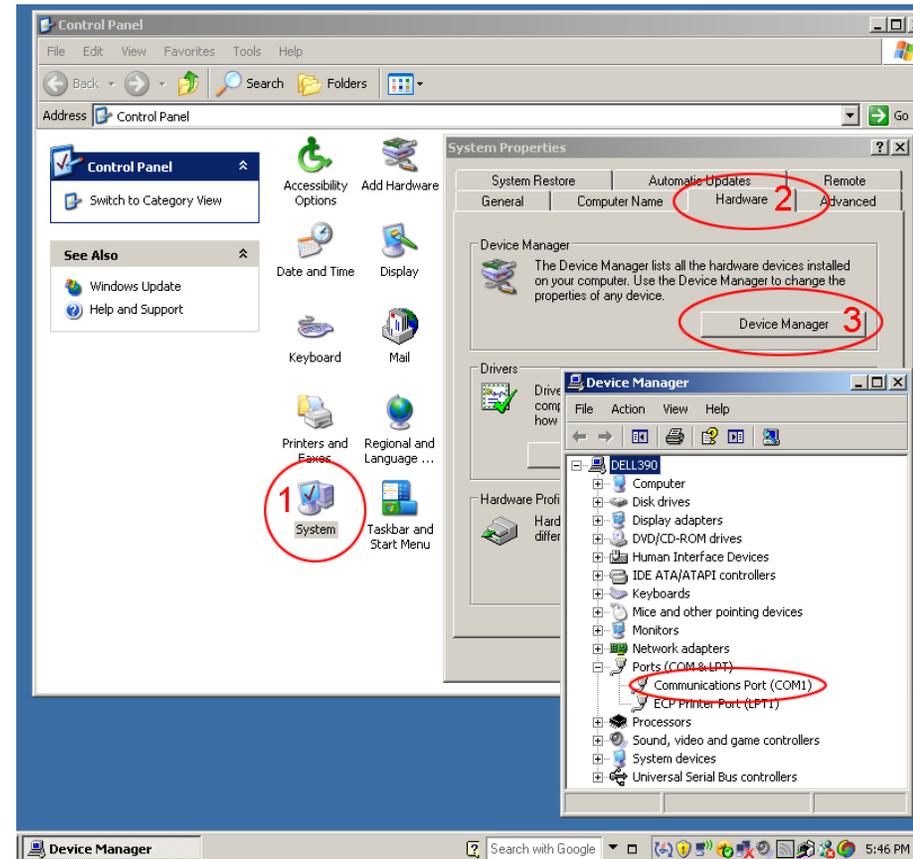
Cable Requirements

In order to interface to a PC you need the following hardware cable

pictured below:

DB9 Serial Cable Male to Female – 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

help   - Show Help Information
Movement Commands

Start   - Pump Start
stop   - Pump Stop
pause   - Pump Pause

Setting Commands

Set time [x:x:x]   - Sets Infusion Time
set length [x.x]   - Sets Fluid Length
set volume [x.x]   - Sets Total Volume (+infuse,-withdraw)
set bolus [x.x]   - Sets Bolus Volume
set bolus rate [x.x] - Sets Bolus Rate 50-100%
set prime rate [x.x] - Sets Prime Rate
set ttl style [pulse/hl] - Sets Pulse or High Low Style
set bolus style [ff/sf] - Sets Fast or Slow then Fast Style
set occlusion [high/low] - Sets Occlusion

Status Commands
----
system status   - Returns Pump Status
dispensed volume   - Returns Dispensed Volume/Length
elapsed time   - Returns Elapsed Time

Logging Commands
----
clock reset   - Resets Clock
log start   - Starts Logging
log stop   - Stops Logging
log reset   - Clears Logs
log recall [x]   - Recalls Logs

Additional Optional Command

setall [time] [length] [+/-volume] [bolus] [occlusion] -Sends All Settings

setall [time] [length] [+/-volume] [bolus] [occlusion] start -Sends All Settings and Starts

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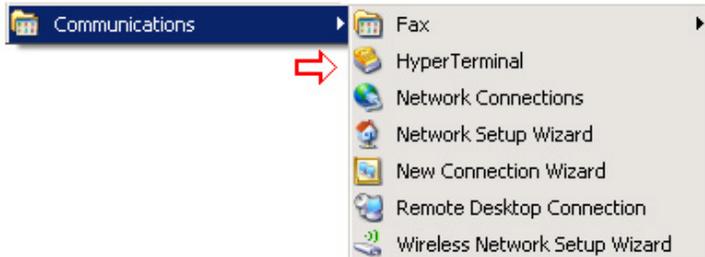
Click HyperTerminal to start the program. Configure the COM port with the following settings.
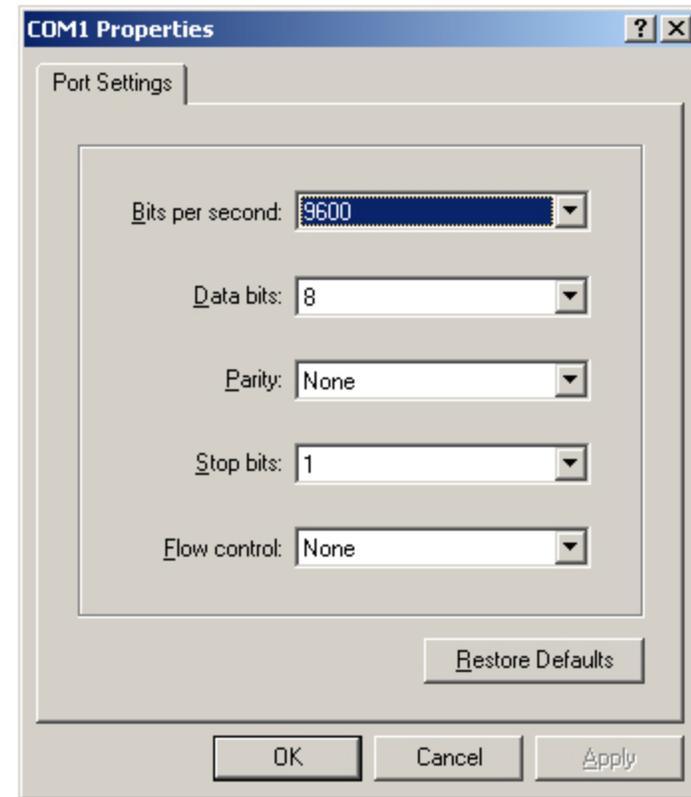
After you press OK you will come to a blank window with a blinking cursor. You can type in protocols here to test communication or to run the pump from a remote computer. Connect the pump to the PC. Type in "help" and then press enter to get a complete list of protocols available to the pump.

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 holdover 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.

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.