Ossila
enabling science

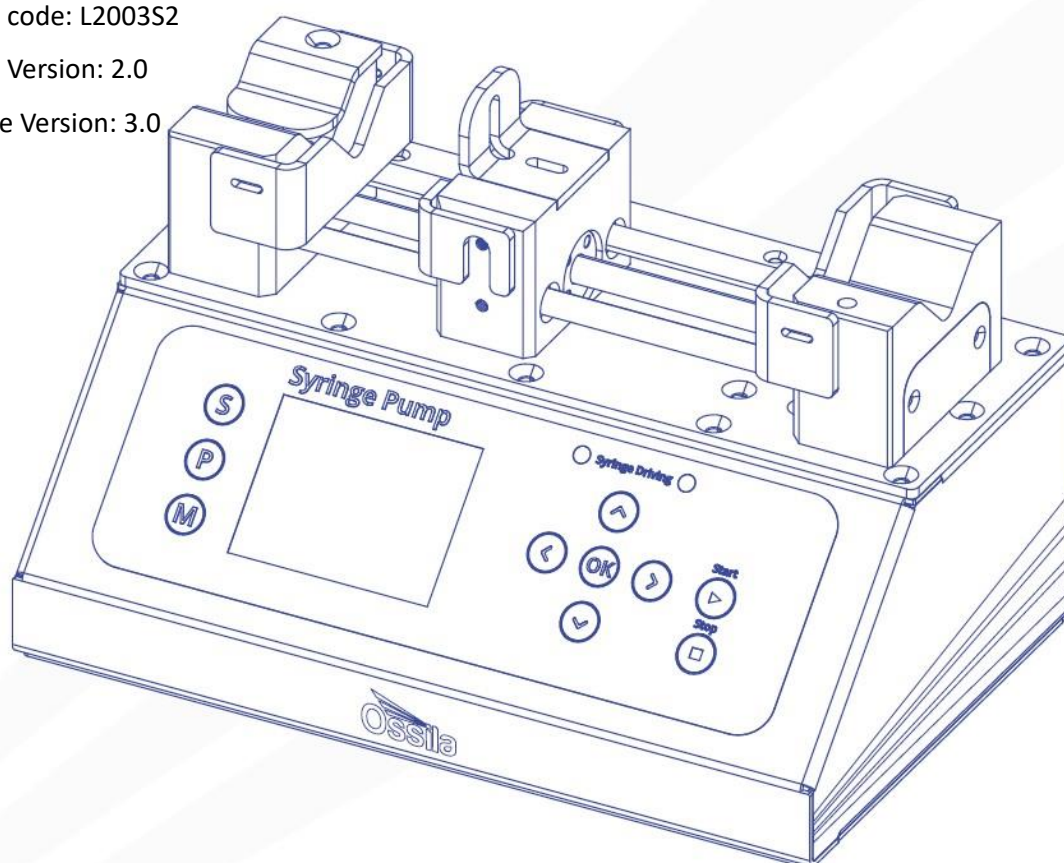# SYRINGE PUMP (SINGLE)
USER MANUAL

Manual Version: 2.0.A

Product code: L2003S2

Product Version: 2.0

Software Version: 3.0

Contents

1. Overview

Syringe pumps are used in the field of scientific research to provide a reliable and repeatable method for moving liquids. Typically, the most common use of a syringe pump is to dispense a liquid at a known rate. This can be for use in processes such as pre-metered coating, automated systems, chemical synthesis, microfluidics, and flow chemistry. Other uses of syringe pumps include the withdrawal of liquids from a system for processes such as automated sample taking, and fluid level adjustment. By combining both infusion and withdrawal from syringes it is possible to use a syringe pump for an even wider array of applications including continuous flow of solutions, solution mixing, and the emulsification of solutions.

A syringe pump works by fixing the barrel of the syringe to the body of the equipment while at the same time fixing the plunger to a moving platform. This movement is achieved via the use of a high accuracy stepper motor where the distance moved by the platform is well known and characterised. By knowing the internal diameter of the syringe being used it is possible to work out the volume displaced when the platform moves. The Ossila Syringe Pump provides you with a simple easily programmable system, where each program can have up to 99 different steps in which the rate, volume, and/or time of infusion/withdrawal can be chosen. By selecting the correct diameter syringe, it is possible to achieve flow rates as low as nanolitres per minute or as high as millilitres per second.

1.1 Applications

- Solution dispensing
- Solution mixing
- Emulsification
- Metered coatings
- Solution quenching
- Electrospinning
- Electrospraying
- Microfluidics
- Flow chemistry

2. EU Declaration of Conformity (DoC)

We

Company Name: Ossila BV

Postal Address: Biopartner 3 building, Galileiweg 8

Postcode: 2333 BD Leiden

Country: The Netherlands

Telephone number: +31 (0)71 3322992

Email Address: info@ossila.com

declare that the DoC is issued under our sole responsibility and belongs to the following product:

Product: Single Syringe Pump (**L2003S2**)

Serial number: L2003S2-xxxx

Object of declaration:

Single Syringe Pump (**L2003S2**)

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

Machinery Directive 2006/42/EC

EMC Directive 2014/30/EU

RoHS Directive 2011/65/EU

The following harmonised standards and technical specifications have been applied:

BS EN ISO 12100:2010 Safety of machinery-General principles for design-Risk assessment and risk reduction.

Signed:

Name: **Dr James Kingsley**
Place: **Leiden**
Date: **18/03/2024**

Декларация   за съответствие на ЕС
Производител: Ossila BV, Biopartner 3 building, Galileiweg 8, 2333 BD Leiden, NL.
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3. Safety

3.1 Warning

> **Pinch points present when in operation, keep hands clear of moving stage.**

3.2 Use of Equipment

⚠️ CAUTION: For research use only. Not for clinical use on patients.

The Ossila Syringe Pump is designed to be used as instructed, it is intended to be used under the following conditions:

- Indoors in a laboratory environment (pollution degree 2)
- Altitudes up to 2000 m
- Temperatures of 5°C to 40°C; maximum relative humidity of 80% up to 31°C.

The Syringe Pump is supplied with a 24V/2A power adapter with a power cord for the country of purchase, in accordance with European Commission regulations and British Standards. Use of any other electrical power cables, adaptors or transformers is not recommended.

3.3 Hazard Icons

The symbols shown in Table 3.1 can be found at points throughout the manual. Note each warning before attempting any associated operations.

Table 3.1 Hazard warning labels used in this manual.

Symbol	Associated Hazard
⚠️	General warning or caution, which accompanying text will explain
⚡	Electrical shock
⚠️	Pinch point, or entanglement hazard

3.4 General Hazards

Before installing or operating the Syringe Pump, there are several health and safety precautions which must be followed and executed to ensure safe installation and operation.

WARNING: Improper handling when operating or servicing this equipment can result in serious injury. Read this manual before operating or servicing this equipment.

CAUTION: During operation, the movement of the plunger clamp and the rotation of the lead screw/coupler could result in a pinch point hazard and/or an entanglement hazard. Caution should be taken whenever the system is in operation.

3.5 Power Cord Safety

Emergency power disconnect options: Use the power cord as a disconnecting method and remove it from the power source. To facilitate disconnect, make sure the power outlet for this cord is readily accessible to the operator.

3.6 Servicing

If servicing is required, please return the unit to Ossila Ltd The warranty will be invalidated if:

- Modification or service has taken place by anyone other than an Ossila engineer.
- The unit has been subjected to chemical damage through improper use.
- The unit has been operated outside the usage parameters stated in the user documentation associated with the unit.
- The unit has been rendered inoperable through accident, misuse, contamination, improper maintenance, modification, or other external causes.

3.7 Health and Safety – Operation

Pinch point and entanglement hazards are present during operation of the syringe pump. As some precaution users should avoid handling or leaning over the equipment during operation in order to avoid possible crushing or entanglement of hair and/or clothing.

3.8 Health and Safety – Servicing

Service or installation work that includes integrating electrical components should be performed by an Ossila engineer only. Never alter the wiring of any purchased equipment. If changes are made, such alterations may damage the equipment, cause injury or death. At the very least, such alterations may void your equipment's warranty.

4. Equipment Purpose

The Ossila Syringe Pump has been designed to provide users with a tool to accurately and repeatedly move volumes of fluids at specified rates. The equipment can be used in a wide variety of experiments where accurate dispense volumes and/or dispense rates are required. In order to achieve this, the system uses a stepper motor to enable movement of specified distances. This is done by securing the body of the syringe to the frame of the syringe pump while at the same time securing the syringe plunger to the moving holder. The internal diameter of the syringe can be used to determine the volume displaced by the movement of the stepper motor and plunger. By choosing the appropriate syringe size, a wide range of dispense rates can be achieved.

The exact syringe types, deposition rates, deposition volumes, and solutions used are up to the user to choose and will vary depending upon the type of experiment being undertaken. For more information on uses please see the operating instructions and guidelines, for more information on the dispensing limits please see the specifications.

5. Unpacking

5.1 Packing List

The standard items included with the Syringe Pump are:

- The Syringe Pump unit
- Universal power adapter

5.2 Damage Inspection

Examine the components for evidence of shipping damage, if damage has occurred, please contact Ossila directly for further action. The shipping packaging will come with a shock indicator to show if there has been any mishandling of the package during transportation.

6. Specifications

The specifications for the syringe pump software are shown in Table 6.1, and the hardware specifications are shown in Table 6.2.

Table 6.1. Ossila Syringe Pump software specifications

Number of Programmes	10
Steps per Programme	99
Syringe Control	Independent Control
Syringe Size Settings	5 pre-sets, 1 customisable diameter
Force Tuning	5% to 100% (5% increments)
Minimum Syringe Size	0.5µl
Memory	Non-Volatile Memory
External Control Interface	USB B

Table 6.2. Ossila Syringe Pump hardware specification

Syringes	1 (L2003S2); 2(L2003D2)
Operation mode	Infusion and withdrawal
Rate accuracy	±0.16%*
Drive motor	1.8° Stepper motor
Max linear force	500N at 100% force
Motor drive controller	Microprocessor with 1/128 micro stepping
Number of microsteps per revolution	25,600
Screw pitch	1mm
Distance per microstep	39nm
Maximum step rate/distance	1000 steps. s^{-1}; 5mm.s^{-1}; 300mm.min^{-1}
Minimum step rate/distance	0.015 steps.s^{-1}; 75nm.s^{-1}; 4.5µm.min^{-1}
Maximum syringe size	50 (60)ml
Safety	Limit switches; crash sensing
Power	24 V DC; 2.0 A
Power supply Input voltage range	100 - 240VAC; 50/60Hz; 50VA
Operating temperature/humidity	5°C to 40°C; Up to 80% RH @ 31°C
Overall dimensions	Width: 240 mm Height: 150 mm Depth: 150 mm

*Rate accuracy is dependent upon not only the pump accuracy but also the accuracy of the dimensions of the syringe used. The value stated only reflects the accuracy of the pump.

7.   System Components

The Syringe Pump (L2003S2/L2003D2) comprises two items:

- Syringe Pump unit (Figure 7.1)
- 24 V mains power supply adapter (Figure 7.2).

Figure 7.1 Syringe Pump
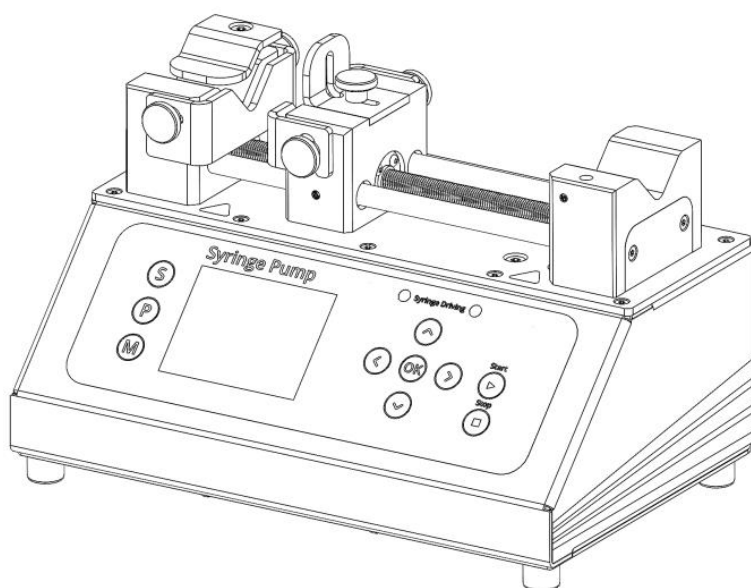
Figure 7.2 24 V mains power supply adapter
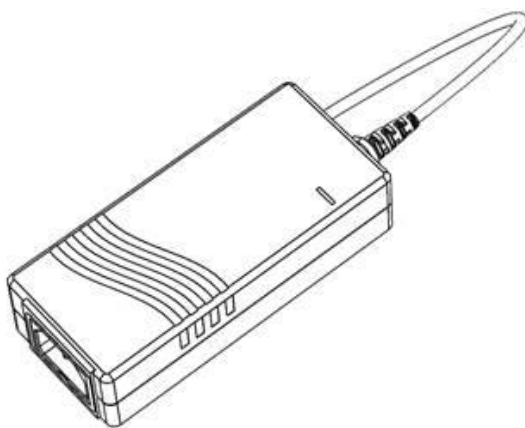
The Syringe Pump unit is powered from a 24 V, 2 A mains power supply adapter. This low voltage supply is convenient and reduces the health and safety risks involved.

8. Installation

1.   Place the unit on a solid, level work surface.

    i.   Ensure the area is free from vibrations, temperature extremes and highly flammable or explosive materials.

2.   Before plugging in the Syringe Pump, ensure the power switch on the unit is switched to the '0' position (off).

3.   Connect the power supply first to the mains outlet and second to the Syringe Pump unit.

    i.   See Figure 8.1 for connecting the Syringe Pump to the power supply cable.

4.   Set the Syringe Pump power switch to the '1' position to turn on.

Figure 8.1 Installation of the Syringe Pump by plugging in the power supply cable.

9.   Operation

9.1 Syringe Pump Schematic

A top-down view of the Syringe Pump is shown in Figure 9.1 with all the relevant components highlighted.

Figure 9.1. Syringe Pump schematic
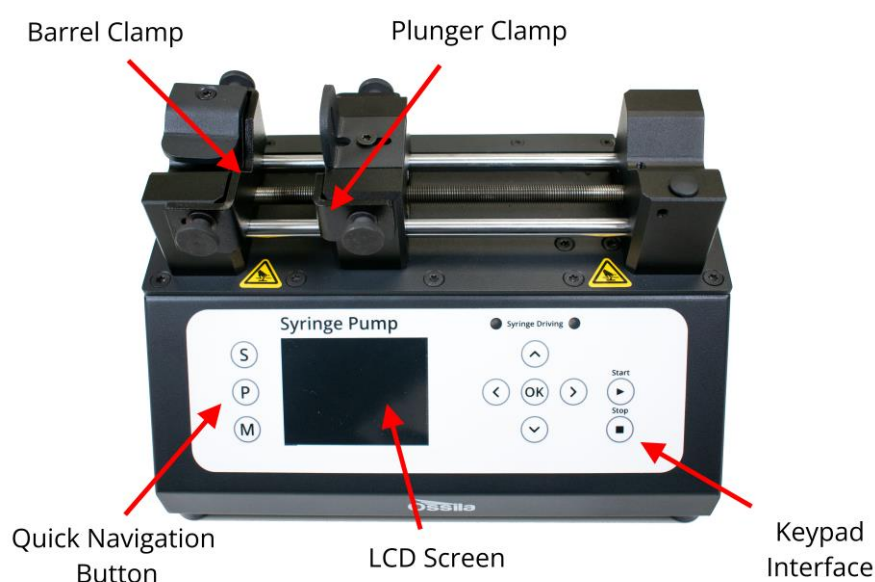
9.2 Attaching a Syringe to the System

When using the Syringe Pump the following procedures should be done while attaching the syringe to the system to achieve the best results.

1. The solution should be preloaded into the syringe; make sure all air bubbles are removed from the syringe before attaching to the system.
2. The syringe barrel should be placed flat into the groove on the syringe holder, and the barrel top should be placed inside the clamping mechanism (see Figure. 9.2). The top clamp should be lifted and rotated onto the top of the syringe, the spring loaded clamp will then hold the barrel down.

Figure 9.2. Placement of the syringe into the groove along with the barrel top placed in the clamping mechanism

Figure 9.3. Placement of the top clamping arm

3. Enter manual mode on the syringe and drive the plunger holder till it rests against the end of the plunger. Slide the end of the plunger into the clamping mechanism and tighten, making sure it is parallel with the barrel of the syringe.

4. Connect any additional tubing or fixtures required for your experiment. Using the manual mode preload the fixtures and tubing with your solution.

9.3 Ossila Syringe Pump User Interface

Figure 9.4. Syringe Pump LCD screen and keypad
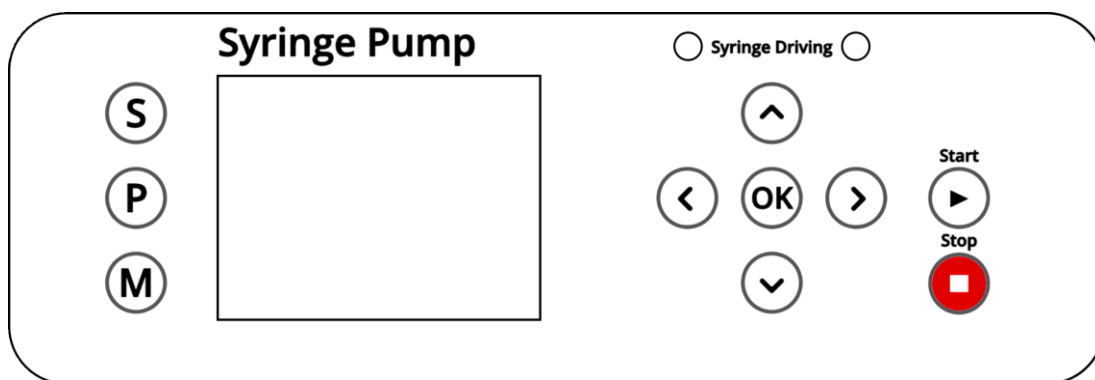
Table 9.1. Operational buttons and their associated functions.

Button	Function
S (SETTINGS)	Enters the Settings menu where syringe diameter, and maximum force can be set
M (MANUAL)	Enters Manual mode where the plunger holder can be moved
P (PROGRAM)	Enters the Program mode where saved programs can be selected and/or edited
(Up arrow)	Navigates 'Up' through menus; increases selected values by 1; increases unit size
(Down arrow)	Navigates 'Down' through menus; decreases selected values by 1; decreases unit size
(Right arrow)	Navigates 'Right' through menus
(Left arrow)	Navigates 'Left' through menus
OK	Press to select, edit, or accept changes
(Stop)	Stop current running program
(Play)	Run currently selected program

9.4 Program Operation

WARNING! Pinch points and entanglement hazards!

The rotation of the lead screw/coupler and the movement of the plunger holder present entanglement and pinch hazards. Care should be taken when the system is running.

1. Turn the Ossila Syringe Pump power switch on (position '1'); the bootup screen will show as below.

2. The system automatically goes to Settings mode screen after the bootup screen. To set the syringe diameter enter the settings menu by pressing the S Button, navigate to syringe selection (as shown in the image below). Press OK to select what diameter of syringe to choose.
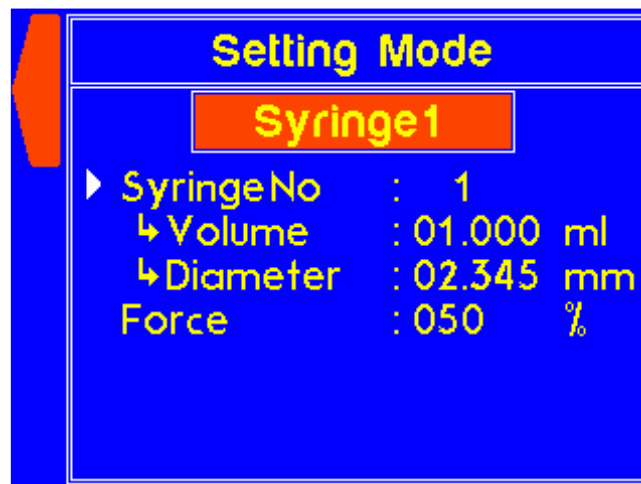
I. For syringes purchased from Ossila there are several pre-set diameters for quick selection, these are 1ml, 2ml, 5ml, 10ml, and 50ml. To change the syringe size setting, Press OK and navigate the syringe number by pressing Left / Right buttons.
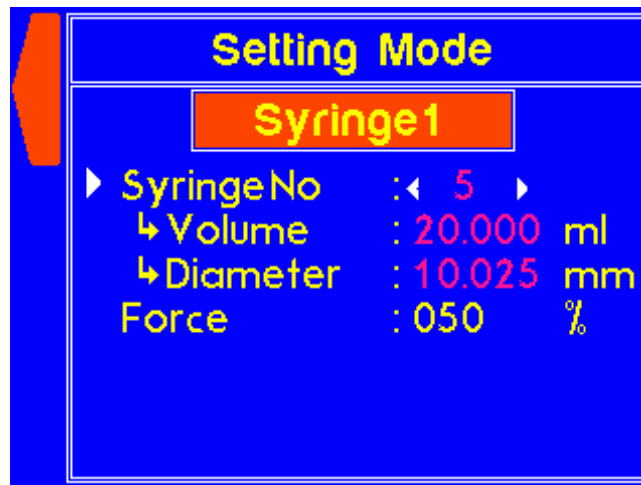
II. For custom diameters navigate to custom and press OK to edit. To edit the diameter, highlight diameter and press OK. Use Up / Down and Left / Right to set the internal diameter and press OK to set the value. Highlight the volume and press OK to edit.
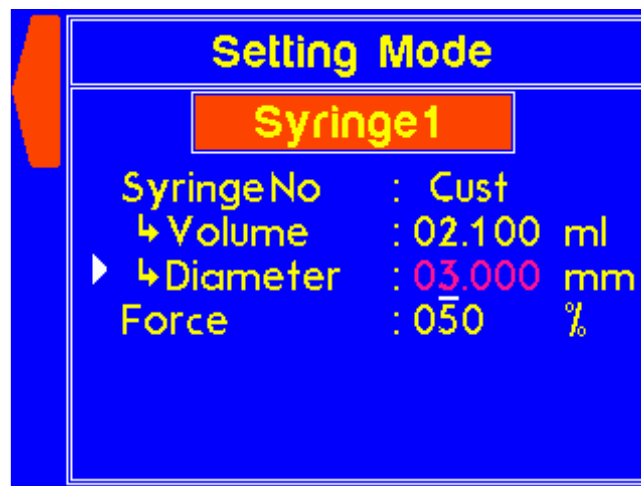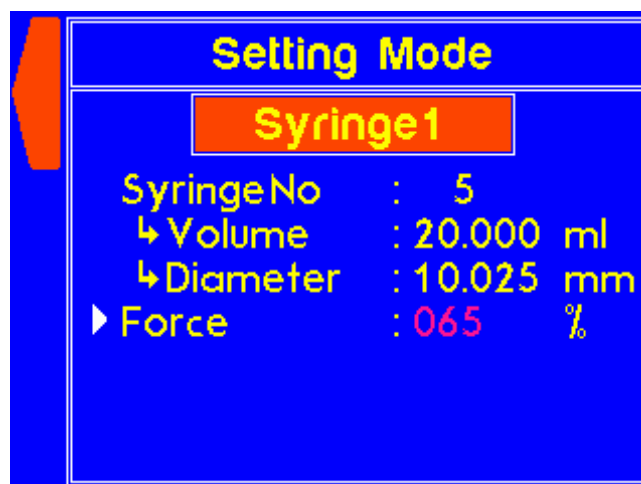

*Note: A warning will appear if the diameter is not set for custom syringe.*

*Note: A warning will appear if the volume is not set for custom syringe.*

III.   To change the force setting value for the syringe, navigate to force and press OK to edit. The change the value, press Up / Down for increment/decrement value of 5.

3. To move the plunger holder without setting a program press the M button, this will take you to Manual mode (as shown in the image below). Press Left / Right to move the plunger holder towards the coupler or towards the syringe clamp. Press OK to cycle through pre-set speeds.
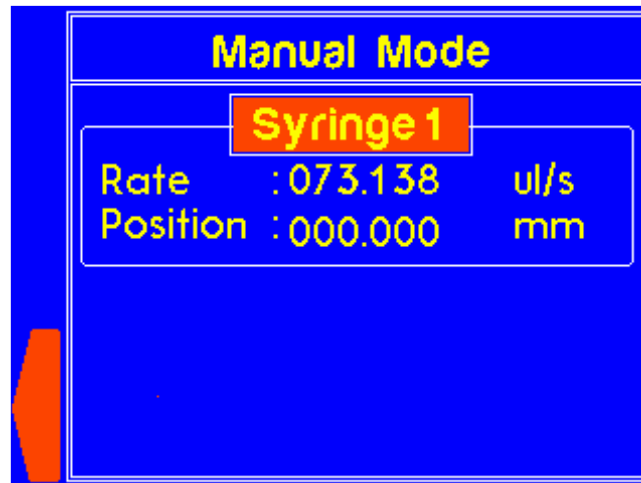
4. To set a program to run automatically go to the program menu by pressing the P button, select the program you wish to edit and run by navigating to the program number (as shown in the image below) and pressing OK. Pressing Up / Down will allow you to switch between pre-saved programs.
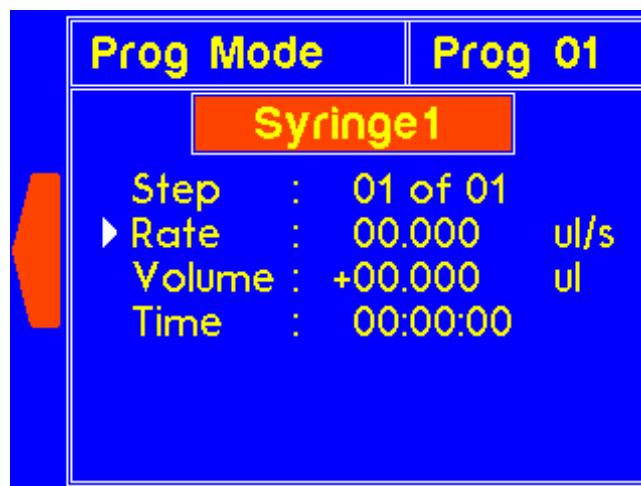
   I. To change the program number, press the Up button until the program number highlighted and press Left / Right to change the program number.

```
Prog Mode        Prog 01

        Syringe1
   Step    :   01 of 01
   Rate    :   12.355     ul/s
   Volume :  -03.000     ml
   Time    :   00:04:02
```

```
Prog Mode        Prog 03

        Syringe1
   Step    :   01 of 01
   Rate    :   00.000     ul/s
   Volume :  +00.000     ul
   Time    :   00:00:00
```

II. To edit the number of steps, navigate to the steps line and press OK to edit and Up / Down to increase or decrease the value. When finished press OK again to save the changes.

```
Prog Mode        Prog 01

        Syringe1
 ▶ Step    :   01 of 03
   Rate    :   00.000     ul/s
   Volume :  +00.000     ul
   Time    :   00:00:00
```

III.	To change the step number, press Left / Right to cycle through the different steps.
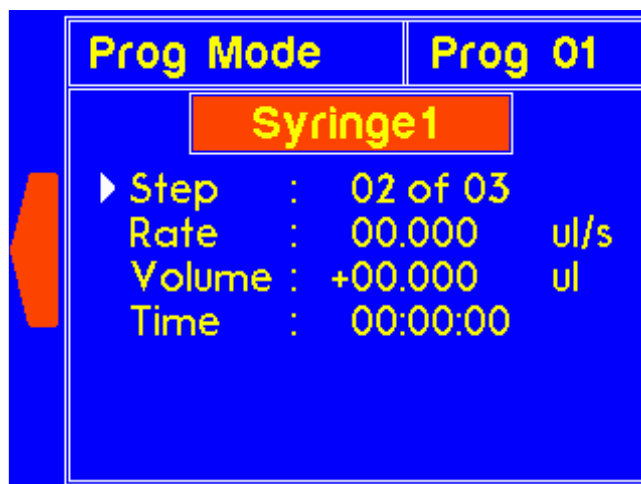
IV.	To edit the dispense rate navigate to the dispense rate line and press OK to begin editing. Use Left / Right to highlight the number you wish to edit and Up / Down to increase or decrease the value. When finished press OK again to save the changes.

Note: The dispense time for the step will automatically update to account for the new rate.

V.	Navigate to the unit to change the dispense rate unit by pressing Up / Down to change from microliter (µl) to millilitre (ml) or vice versa.
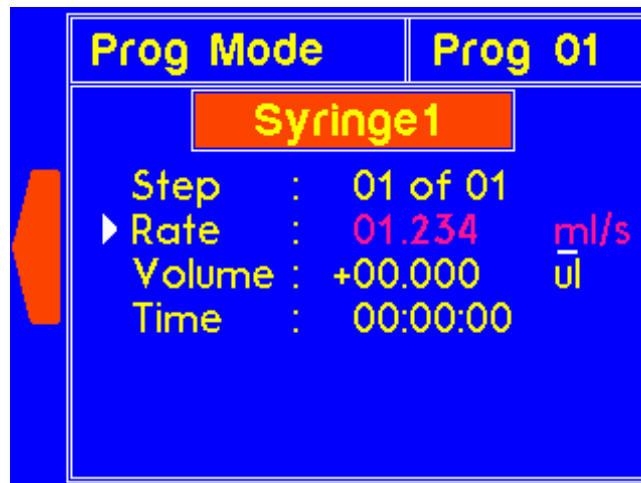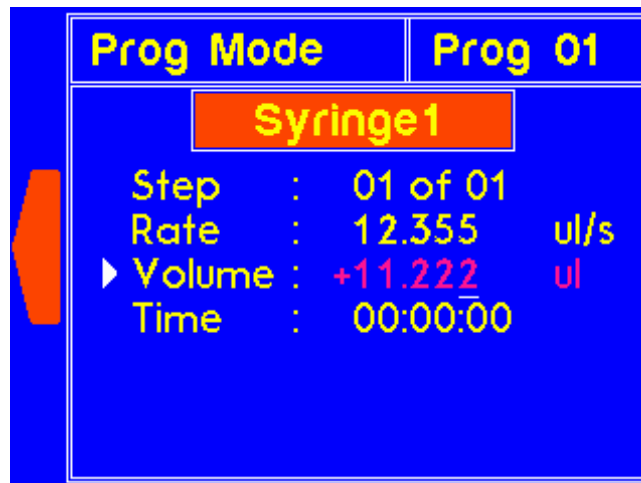
Note: A warning will appear if the set rate higher than allow for the syringe size. The value will be recalculated and set to max rate for the particular syringe.


VI.   To edit the dispense volume navigate to the dispense volume line and press OK to begin editing. Use Left / Right to highlight the number you wish to edit and Up / Down to increase or decrease the value. When finished press OK again to save the changes.

Note: The dispense time for the step will automatically update to account for the new rate.

VII.   Navigate to the unit to change the dispense volume unit by pressing Up / Down to change from microliter (μl) to millilitre (ml) or vice versa.
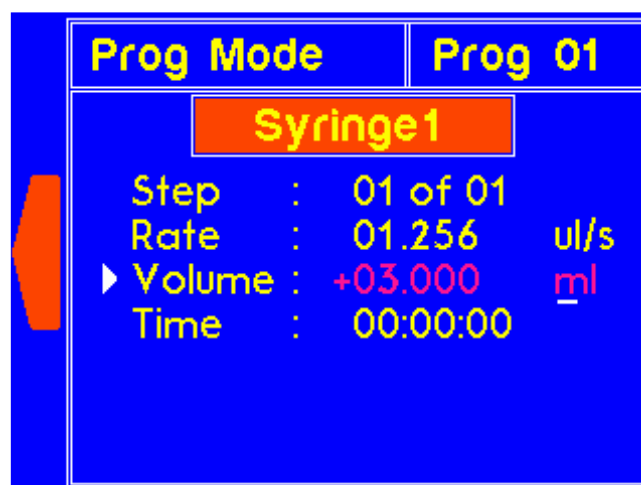
Note: A warning will appear if the set volume higher than allow for the syringe size. The value will be recalculated and set to max volume for the syringe.

The user can either dispense or infuse the solution using Ossila Syringe Pump by navigating to volume sign (+), and press Up / Down button to change the sign.

*Note: '+' sign indicate dispensing and '–' indicate infuse*

VIII. The user can edit the time by navigating to dispense time and pressing OK to edit. The format of time is HH:MM:SS (H – Hour, M – Minute, S – Second).

Note: The dispense volume for the step will automatically update to account for the new dispense time setting.
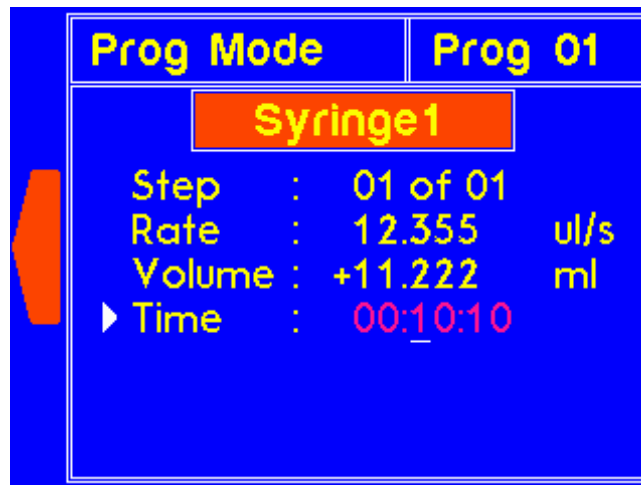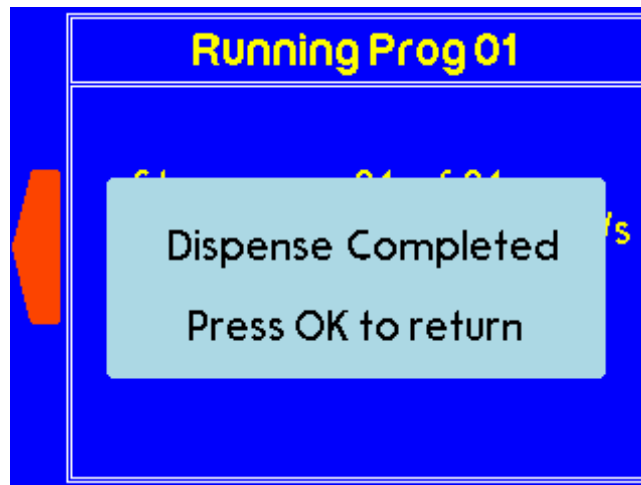
Note: A warning will appear if the volume is larger than allowed for the syringe size. The value will be recalculated to the correct volume for the syringe.
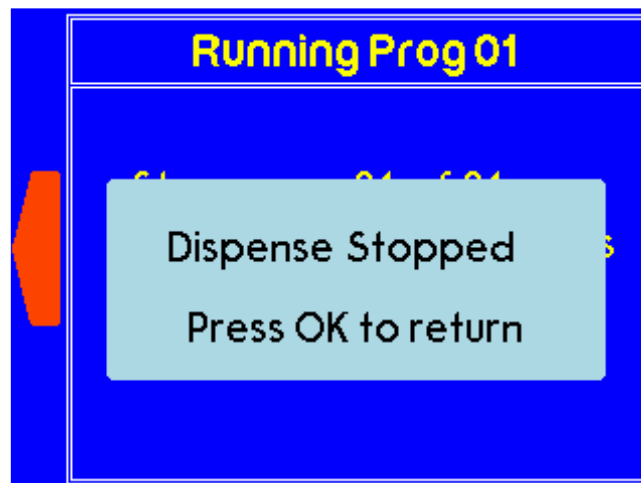
5. The user can run the program by pressing the *Start* button. The running program page will then appear to indicate this.
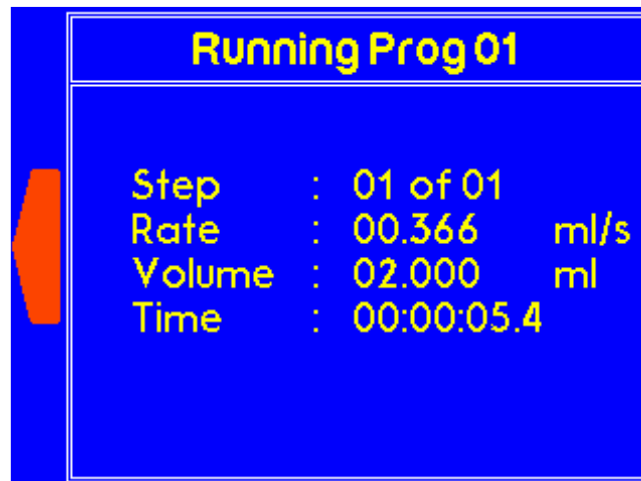
Once the dispensing is complete, a message with pop up to notify the user.

The user can stop the operation by pressing the Stop button and the warning will appear as follows.

10. PC Control

When the syringe pump system is connected to a USB port of a PC and an active serial connection is made the system will read data over the serial line. When the start command is sent via serial the system will then enter PC Mode. In this mode, control via the normal user interface is disabled and control of the system can only be done by sending specific commands via the serial USB.

Programs within the syringe pump are stored as a list of data structures within the memory of the processor. When operating in normal mode the user has access to up to 10 different programs within the list which are saved permanently into memory. In PC mode the systems defaults to a reserved index within the systems memory which is specifically for PC mode programming. The values used within the program are reset to the default values upon restarting the system and so programs uploaded over PC serial are not permanently saved within memory and will need to be set again if the system is restarted.

Programs consists of a set of steps for the syringes used within the system. Each step has the dispense rate for the step, and the time of the step. When setting a program up via PC mode the user can add steps, insert steps, edit steps, or delete steps.

Users can also select specific syringe diameters used within the system a full table of user syringes can be found in the section on syringe indexes. Users have access to an additional syringe index in pc control which can be edited for their use, like the program this value is not saved on reset and must be set anew each time the system is restarted.

10.1 Command List

Below is a full list of commands that can be sent to the syringe pump with the requirements for arguments, expected return values, and associated error messages that can be returned to the user.

Command	Arguments	Return Value	Error Messages	Function
syp set pcmode	none	PC Mode on	Device/command not found	Enters PC mode operation and set the default PC mode syringe size (8).
syp set syringe a b	a : (int) Pump No. (1 or 2) b : (int)Syringe size index (1-8)	Pa Sy Size b Ex. "P1 Sy Size 4"	Pump index out of range No Matching Syringe Size Found	Select one of the pre-defined syringe sizes, default index 8.
syp edit syringe a b c	a : (int) Pump No. (1 or 2) b: (float) volume 'ml/cc' c: (float) diameter 'mm'	Pa Sy Size: [8, *volume*, *diameter*, *area*] Ex. "P1 Sy Size: [8, 20.0, 15.9]"	Pump index out of range	Edit the size of PC mode default syringe index 8. This will change the previous syringe size to 8.
syp get syringes	None	P1 Sy Size: [Sy size index, *volume*, *diameter*, *area*] *Dual system* P1 Sy Size: [Sy size index, *volume*, *diameter*, *area*]	None	Returns the selected syringe parameters for pump 1 (single pump units) or both pump 1 and pump 2 (in dual pump units)

		P2 Sy Size: [Sy size index, *volume*, *diameter*, *area*] Ex. *"P1 Sy Size: [8, 20.0, 15.9]"* *"P2 Sy Size: [8, 20.0, 15.9]"*		
syp get syringe a	a : (int) Pump No. (1 or 2)	Pa Sy Size: [Sy size index, *volume*, *diameter*, *area*] Ex. *"P2 Sy Size: [4, 5.0, 12.45]"*	Pump index out of range	Returns the selected syringe parameters for the selected pump
syp get steps	None	P1 Number of Steps = 2 [[*rate*, *volume*, *time*] [*rate*, *volume*, *time*]] Ex. *"P1 Number of Steps = 3 [[2.4, 12, 5][1, 8, 8][5, 1, 0.2]]"*	No Steps for SyPump 1 No Steps for SyPump 2	Lists all the steps for pump 1 (single pump units) or both pump 1 and pump 2 (in dual pump units)
syp add step a b c	a : (int) Pump No. (1 or 2) b: (float) ± rate c: (int) time	Pa New Step Saved *stepNo*: [*rate*, *time*, *volume*] Ex. *"P2 New Step Saved 7: [4, 12, 3]"*	Pump index out of range Max No Steps Reached! Dispense Rate Exceeds Maximum Value	Add new step after the last step (if the max number of steps has not been reached)

| | | | Dispense volume of step exceeds maximum volume of syringe

Dispense volume of program exceeds maximum volume of syringe | |
| --- | --- | --- | --- | --- |
| syp ins step a b c d | a : (int) Pump No. (1 or 2)

b: step location

c: (float) ± rate

d: (int) time | Pa Step b Inserted Step Saved *StepNo*. [*rate*, *time*, *volume*]

Ex.

"P2 Step 3 Inserted Step Saved 3 [3, 9, 3]" | Pump index out of range

Step number out of range! | Insert a new step at the given location and push the following steps back (if the max number of steps has not been reached)

(no safety checks) |
| syp edit step a b c d | a : (int) Pump No. (1 or 2)

b: step number

c: (float) ± rate

d: (int) time | Pa Step Edited: *stepNo* : [rate,time,volume]

Ex.

"Step Edited : 2 : [4,5,20]" | Pump index out of range

Max No Steps Reached!

Dispense Rate Exceeds Maximum Value | Edit the parameters of the selected step for the selected pump |

			Dispense volume of step exceeds maximum volume of syringe	
			Dispense volume of program exceeds maximum volume of syringe	
syp del step a b	a : (int) Pump No. (1 or 2) b: step number	Pa Step b Deleted Ex. "P2 Step 10 Deleted"	Pump index out of range Step number out of range!	Delete the selected step and shift the following steps (if any) backward
syp clear a	a : (int) Pump No. (1 or 2)	Pa Steps Deleted Ex. "P2 Steps Deleted"	Pump index out of range	Delete all the steps of the selected pump
syp run	None	P1 step x P2 step y P1 Complete P2 Complete Dispense Finished		Run the unit and return the pump No and the step every second. Send "Dispense Finished" at the of program

		Dispense Interrupted		
syp stop a	a : (int) Pump No. (0 to 2) 0 for both pumps	P1 stopped P2 stopped P1 P2 stopped	Pump(s) not Running	Stops the selected pump; pump1 (single pump units) ; pump2 or both pump1 and pump2 (in dual pump units)
syp get version	None	H-V x.x.x ; S-Vx.x.x	Device/command not found	Return the hardware and software version
syp get pcmode	None	Connected Device/command not found	Device/command not found	Check if the system is connected and in PC mode operation
syp end pcmode	None	PC Mode Off	Device/command not found Command not found	Ends PC mode operation and restore the manual mode syringe size.
syp reset	None	System Reset/PC Mode Off in 2-Sec	Command not found	Resets the system, end PC mode operation

10.2 Syringe Index Information

The syringe type contains the information of the syringe diameter and the total volume of the syringe, this information is used to calculate the distance and rate the motor needs to move in order to complete a step and so is critical for correct operation of the syringe pump. The data on the diameter and volume are saved in an indexed list of different syringe types in the system. On starting the PC Mode the syringe type is set to the PC Mode Syringe. Users can edit this syringes diameter and volume or alternatively set the syringe type to a different value using the "syp set syringe" command.

Using the above command, the user can set the syringe to a specified index between 1 and 8. Below is the diameter and volume values that are associated with each index value upon entering PC Mode.

Syringe Index	Diameter (mm)	Volume (ml)
1 (Custom Syringe)	USER SET	USER SET
2 (1 ml Syringe)	4.69	1.0
3 (2 ml Syringe)	9.65	2.0
4 (5 ml Syringe)	12.45	5.0
5 (10 ml Syringe)	15.90	10.0
6 (20 ml Syringe)	20.05	20.0
7 (50 ml Syringe)	29.20	50.0
8 (PC Mode Syringe)	00.00	0.00

So, for example sending the command "syp set 2 4" the second pump syringe will be set to a diameter of 12.45 and a volume of 5 ml.
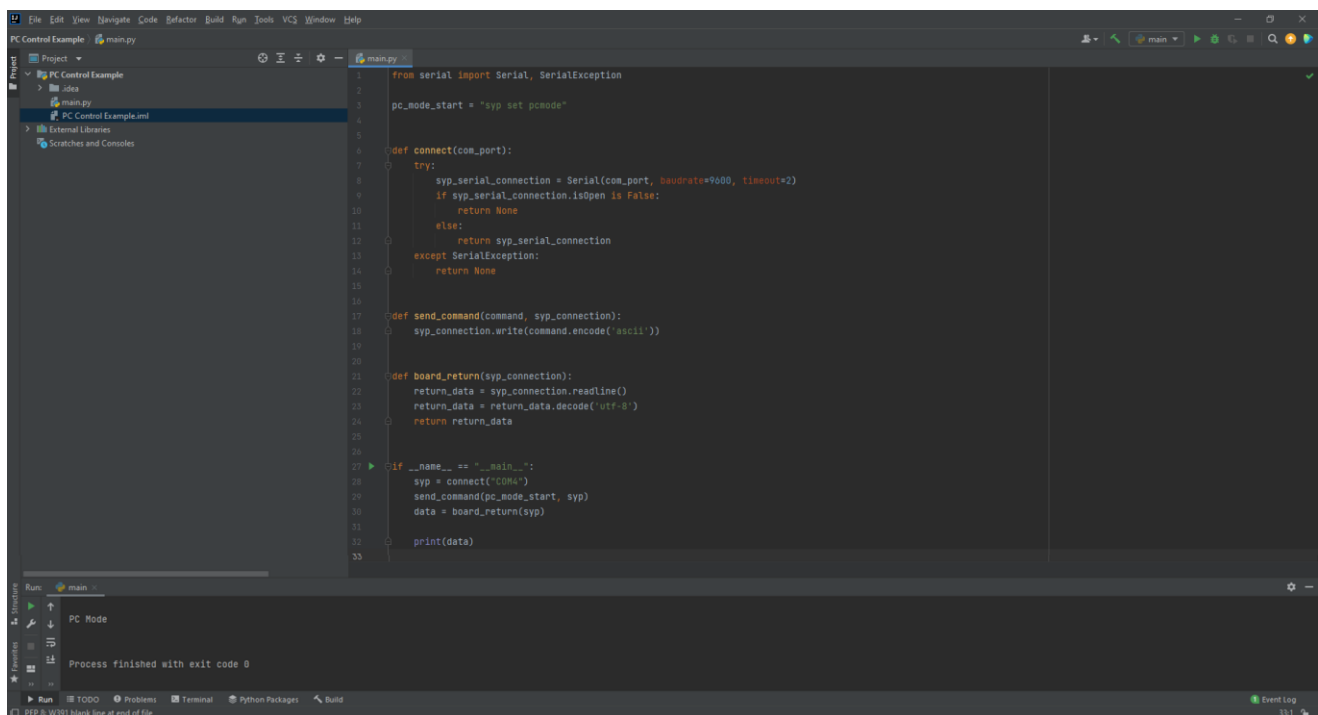
10.3 Program Example

Below a simple python script shows you how to connect to the syringe pump, how to send a command, and how to get data back from the system. Using the serial library, a connection can be made to the board if you know the COM port that the board is connected to. By using the Serial() command a serial object is created and returned to the user. This serial object can then be used to send commands and receive them.

In the example below the send_command() function takes in a string (command) and the serial object (syp_connection). Using the Serial.write() function the command is sent to the board. It should be noted that the string needs to be converted to a ascii format using the

string.encode('ascii') function. In the main function we send a predefined string of "syp set pcmode" to the system to initiate the PC Mode on the equipment.

After sending the command to the board you can read the returned string from the board. Here the function board_return() takes the serial object (syp_connection) and returns a string object. The Serial.readline() function which is used to read data from the serial port returns the data in the ascii format. To make the return easier to read we then convert it back into a utf-8 formatted string before returning.

By printing out the returned data from the board we see that the string "PC Mode" is returned, this is the expected return value from the 'syp set pcmode' command that we have sent.

11. Firmware Updating

Ossila may provide updates to the firmware for the syringe pump to improve the functionality of the system for the users. To update the firmware you will need to install the Ossila Firmware Updater tool and connect the equipment to a PC via the USB port at the rear of the system.

The syringe pumps firmware can be updated via the Ossila Firmware updater tool that can be downloaded from here. (https://www.ossila.com/pages/software-drivers#Firmware-Updater)

The user manual for the firmware updater tool can be found online on the Ossila website here. (https://downloads.ossila.com/manuals/firmware-updater.pdf)

12. Maintenance

The rail guide and the lead screw should be sparingly lubricated periodically; every 200 hrs of usage. The rail guide and the lead screw should be lubricated with super lube synthetic grease provided with the pump.

To clean the exterior surfaces, use a lint-free cloth to remove loose dust. Use care to avoid scratching the clear display window. For more efficient cleaning, use a soft cloth dampened (not soaked) with water, an aqueous solution of 75% isopropyl alcohol, or a mild detergent.

13. Troubleshooting

Problem	Possible cause	Action
No power / display	a.) The power switch on the unit is in the OFF position b.) The power supply may not be connected properly c.) The fuse on the rear panel has blown d.) The power supply adapter has a fault e.) Fault (fuse) on the circuit board	a.) Check the connection and ensure the power is turned ON b.) Ensure the unit is firmly plugged in to the power supply and that the plug is firmly connected to both an adapter and a working power socket c.) Check the fuse on the rear panel. If it has blown replace it with a suitably rated 1A slow blow fuse d.) Contact Ossila for a replacement e.) If all the above has been considered there may be a fault on the board; contact Ossila for more information
Motor stalled	a.) Syringe plunger hitting the bottom / a kink in the tubing (occlusion) / Syringe plunger binding / Low force setting	a.) Increase the force percentage in setting mode

Problem	Possible cause	Action
Crash warning	a.) The secondary safety switch has accidentally been triggered b.) The syringe holder is triggering the secondary safety switch c.) Internal fault in the secondary safety switch	a.) Turn the unit off and on again to see if the warning remains b.) Rotate the lead screw by hand to move the syringe holder closer to the centre of travel c.) If all the above has been considered there may be a fault with the secondary safety switch; contact Ossila for more information