WATSON MARLOW PUMPS

505Di

505di-gb-03.pdf

Declarations

Declaration of conformity CE	***When this pump unit is used as a stand alone pump it complies with: Machinery Directive 98/37/EC EN60204-1, Low Voltage Directive 73/23/EEC EN61010-1, EMC Directive 89/336/EEC EN50081-1/EN50082-1.***

Declaration of Incorporation	***When this pump unit is to be installed into a machine or is to be assembled with other machines for installations, it must not be put into service until the relevant machinery has been declared in conformity with the Machinery Directive 98/37/EC EN60204-1.***

Responsible person: Christopher Gadsden, Managing Director, Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England. Telephone 01326 370370 Fax 01326 376009.

Three year warranty

Watson-Marlow Limited warrants, subject to the conditions below, through either Watson-Marlow Limited, its subsidiaries, or its authorised distributors, to repair or replace free of charge, including labour, any part of this product which fails within three years of delivery of the product to the end user. Such failure must have occurred because of defect in material or workmanship and not as a result of operation of the product other than in accordance with the instructions given in this manual.

Conditions of and specific exceptions to the above warranty are:

- Consumable items such as tubing and rollers are excluded.
- Products must be returned by pre-arrangement carriage paid to Watson-Marlow Limited, its subsidiaries, or its authorised distributor.
- All repairs or modifications must have been made by Watson-Marlow Limited, its subsidiaries, or its authorised distributors or with the express permission of Watson-Marlow Limited, its subsidiaries, or its authorised distributors.
- Products which have been abused, misused, or subjected to malicious or accidental damage or electrical surge are excluded.

Warranties purporting to be on behalf of Watson-Marlow Limited made by any person, including representatives of Watson-Marlow Limited, its subsidiaries, or its distributors, which do not accord with the terms of this warranty shall not be binding upon Watson-Marlow Limited unless expressly approved in writing by a Director or Manager of Watson-Marlow Limited.

Information for returning pumps

Equipment which has been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health must be decontaminated before it is returned to Watson-Marlow or its distributor.

A certificate included at the rear of these operating instructions, or signed statement, must be attached to the outside of the shipping carton.

This certificate is required even if the pump is unused. If the pump has been used, the fluids that have been in contact with the pump and the cleaning procedure must be specified along with a statement that the equipment has been decontaminated.

Safety

In the interests of safety, this pump and the tubing selected should only be used by competent, suitably trained personnel after they have read and understood this manual, and considered any hazard involved.

Any person who is involved in the installation or maintenance of this equipment should be fully competent to carry out the work. In the UK this person should also be familiar with the Health and Safety at Work Act 1974.

	There are dangerous voltages (at mains potential) inside the pump. If access is required, isolate the pump from the mains before removing the cover.

Recommended operating procedures

DO keep delivery and suction lines as short as possible using a minimum number of swept bends.

DO use suction and delivery pipelines with a bore equal to or larger than the bore of the tube fitted in the pumphead. When pumping **viscous** fluids, the losses caused by increased friction can be overcome by using pipe runs with a cross sectional area several times greater than the pumping element.

DO run at a slow speed when pumping viscous fluids. When using the 501RL pumphead, a 4.8 or 6.4mm bore tube with a 1.6mm wall will give best results. Tube diameter smaller than this will generate a high -friction pressure loss, so reducing the flow. Tube with a larger bore will not have sufficient strength to restitute. Flooded suction will enhance pumping performance in all cases, particularly for materials of a viscous nature. Silicone, Marprene and Neoprene tubing is available with a 2.4mm wall thickness for speeds up to 200rpm. (The rotor will require re-setting to a roller/track gap of 3.8mm.)

DO fit an extra length of pump tube in the system to enable tube transfer. This will extend tube life and minimise the downtime of the pumping circuit.

DO keep the track and rollers clean.

The self-priming nature of peristaltic pumps means valves are not required. Any valves fitted must cause no restriction to flow in the pumping circuit.

When using Marprene tubing, after the first 30 minutes of running, re-tension the tube in the pumphead by releasing the tube clamp on the delivery side a little and pulling the tube tight. This is to counteract the normal stretching that occurs with Marprene which can go unnoticed and result in poor tube life.

Tube selection The chemical compatibility list published in the Watson- Marlow catalogue is only a guide. If in doubt about the compatibility of a tube material and the duty fluid, request a tube sample card for immersion trials.

Installation

The 505Di is suitable for single phase mains electricity supplies only.

To ensure correct lubrication of the gearbox the pump should be run only while its feet are standing on a horizontal surface. The pump should be positioned to allow a free flow of air around it.

- Set the voltage selector to either 120V for 100-120V 50/60Hz supplies or 240V for 220-240V 50/60Hz supplies.

A mains cable fitted with a moulded plug is supplied with the pump. The wires are colour coded in accordance with the following code:

- 220-240V: Live- Brown; Neutral - Blue; Earth - Green/Yellow.
- 100-120V: Live - Black; Neutral - White; Earth - Green.

Reduced voltage operation

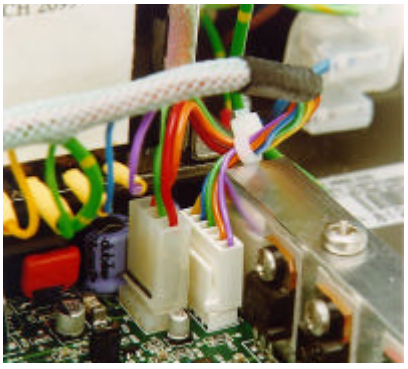
In areas where voltage is below that specified above, modifications can be made to the pump unit to allow operation under the following minimum voltage levels:

- **180V when using the 220-240V setting.**
- **90V when using the 100-120V setting.**

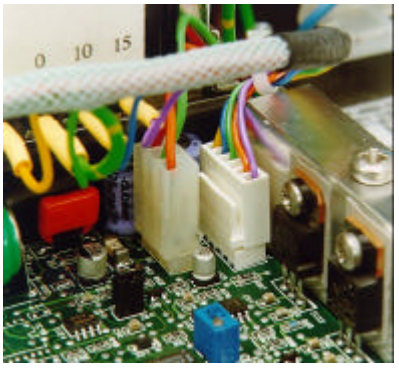
The modification requires the connector J8 on the **Control PCB** to be reversed. To locate the terminal, isolate the mains supply then remove the pump cover. **State A** shows the standard voltage setting, whilst **State B** shows the reduced voltage setting. Any damage caused to the pump in the process of carrying out this modification will not be covered by warranty.

Control PCB

State A



State B



Refer servicing to qualified personnel only.

Troubleshooting

Should the pump fail to operate, make the following checks to determine whether or not servicing is required.

- Check that the power switch is on.
- Check the mains supply is available at the pump.

- Check the voltage selector switch is in the correct position.
- Check the fuse in the mains socket.
- Check that the pump is not stalled by incorrect fitting of tubing.
- Check that the keypad lock is not switched on.

User interfacing

When powering up the pump the user will be taken into the main menu.

Use the ***Step*** key to move between menu options. Use the ***Enter*** key to confirm settings. Use the number keys to enter in settings. Use the ▲ or ▼ key to increase or decrease set values in the pump software i.e. ramp settings, date, rpm etc.

Dose permits the set-up of doses for dispensing. A dose can be initiated by using the Start button or external switching. The pump will allow up to 26 dosing programs to be stored and recalled at any time. A printer can be connected to the pump for recording of dispense runs. Batch and operator codes must be entered when using a printer.

Cal allows the pump to be calibrated for accurate dosing.

Manual allows continuous transfer/fluid metering via keypad control.

Network enables RS232 control

Set-up displays and controls the user and factory settings for the correct operation of the pump.

The speed/volume flow rate of the drive is governed by the pumphead and tubing selected. Factory default is for a 501RL using 8.0mm bore tubing which means the max rpm/volume flow rate of the pump is 300 rpm/3000ml/min.

Dosing procedure

The Dosing program is outlined in the technical data section of the operating instruction in a flow chart format. Each step in the procedure is described to provide full understanding of the procedure.

Print audit routines

If a printer is connected, the completion of a dose run will automatically call the print routine. The first request will be to enter the operator ID.

Up to 16 characters can be entered. Digits and the decimal point are entered directly from the keypad. Alpha characters are entered by pressing ▲ or ▼ which call A to Z and Z to A respectively in circular rotation.

An alpha character is embedded by pressing ***Step***. A numeric character is entered by pressing ***Step*** , any other numeric character, the decimal point or ▲ or ▼.

On pressing ***Enter***, the pump will request the input of a batch number.

Again, up to 16 characters can be entered as for the operator identity. When ***Enter*** is again pressed, the following information is printed out: date, time, dose size, specific gravity, dose interval, number of doses, initial ml/rev, recalibration data, operator identity, batch number and number of doses delivered.

Following the print out a repeat dose option will be given.

Single dose command

Single doses can be dispensed on demand, with a count of the number of doses being kept.

Set the interval time to 0 SECONDS and the number of doses to 1.

To start single dosing, press ***Start*** or use an external start dose switch. The display will indicate the total number of completed doses up to a maximum of 99,999 after which the counter will restart at 0, so that dose 100,001 would be shown as 1.

Calibration procedure

Calibration of the 505Di is based on informing the pump under ***Cal*** of the pumphead and tubing which are to be used. Alternatively a calibration dose can be used. The calibration dose will run for a maximum of 4 minutes, but can be stopped at any time up to 4 minutes. The longer the calibration dose the more accurate the calibration. Entering into the pump the physical volume (ml) or mass (sg) to complete the procedure and will allow the pump to take into account ambient conditions and also the viscosity of the fluid.

Manual operation

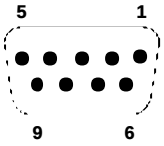
- Switch power on (drive rear panel).
- Change the set speed by pressing the ▲ or ▼ key. The minimum speeds of the 220rpm and 350rpm drives are 1rpm and 2 rpm respectively.

- Change direction by pressing the ***CW/CCW*** key. Indication of direction of rotation is provided via the LCD display.
- Select the maximum speed : press the ⋀ key and the ***Max*** key together. Select the minimum speed: press the ⋁ key and the ***Max*** key together.
- Press ***Start*** to start the pump. Press ***Stop*** to stop the pump.

Network

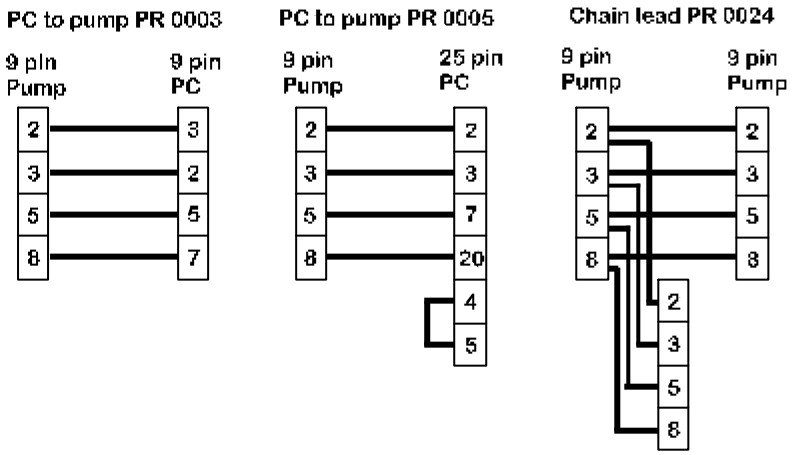
This facility gives full pump functionality under RS232 closed loop control via the 9 pin D connector. Up to 16 pumps can be linked whilst still retaining individual pump control by using lead PR 0024. A network kit is available from Watson-Marlow which includes Pumpnet 2, a DOS compatible control program and leads.

Step to Network in the Main menu and press ***Enter.*** The pump will now be under RS232 control. The keypad ***Stop*** key will act as an emergency stop and disable RS232 settings if pressed.



Connections for RS232 signals (viewed from inside the plug)

RS232 cabling shown for CTR handshake



Use only twin shielded RS232 cables.

RS232 settings

Baud = 9600 ; Stop bits = 2 ; Data bits = 8 ; Parity = None ; Handshake = CTR or None; Auto echo = On

Pin	Function	Pin	Function
1	-	6	-
2	RX (Receive data)	7	RTS (Request to send)
3	TX (Transmit data)	8	CTS (Clear to send)
4	-	9	-
5	GND (Ground)		

The following codes will operate the 505Di under RS232 control. They must be directed to the pump from a computer serial port (or equivalent). Always terminate each command with a RETURN (ASCII CHR13).

nSP*xxx*	Load speed setting *xxx* to pump number n
nSI	Increment speed by 1rpm for pump n
nSD	Decrement speed by 1rpm for pump n
nGO	Start pump number n
nST	Stop pump number n
nRC	Change rotation direction for pump n
nRR	Set clockwise direction for pump n
nRL	Set anti-clockwise direction for pump n
nDOxxxxx,yyy	Set dose for pump number n in tachometer pulses (note 3)
nRS	Show status for pump number n (note 4)

nZY Show status if pump n STARTed **1** or STOPped **0**

nTC Clear tachometer counter

nRT Read tachometer counter

For writing to pump number n display

nCA Clear existing display; followed by:

nCH "Home" cursor; followed by;

nW{text line 1}~{text line 2}@ (@ = terminator)

Notes on control codes

1 n = pump number set in **Set-up**. For the command to operate on all networked pumps simultaneously, use # before the command.

2 There are 800 tacho pulses per pumphead revolution on the 350rpm version, 1280 tacho pulse per revolution on the 220rpm version.

3 nDOxxxxxxxx where xxxxxxxx is any integer and is the target dose in tacho pulses. This can be extended to nDOxxxxxxxx,yyy where yyy is a "kick back" in tacho pulses with a limit of 255 (about 1/5 of a revolution on a 220rpm drive or a 1/3 of a revolution on the 350rpm drive).

4 A show status command will prompt the 505Di to return a text string of the following layout:

[pump type] [ml/rev] [pumphead] [tube size] [speed] [cw/ccw] [P/N] [pump number] [tacho count as a single integer] [stopped/running, 0 /1] [! = delimiter]

e.g. 505Di 0.7 505l 1.6mm 53.5 CW P/N 1 157810 1 !

5 All networked pumps with the same n will respond to the same command.

6 There should be at least 10mS between consecutive commands.

7 When using the # to address all pumps, ensure that it will not generate a *reply*, e.g. nSS, the result will be unpredictable.

This is a typical short program for pump number 2:

```
OPEN "COM1:9600,N,8,2,CDO,CSO,DSO,OP10000" FOR RANDOM AS #1
PRINT #1, "2SP220" + CHR$(13)
DELAY
PRINT #1, "2GO" + CHR$(13)
DELAY 5000
PRINT #1, "2ST" + CHR$(13)
CLOSE #1.
```

RS232 Remote dosing

The following commands enable a remote dose to be requested and repeated.

Note that in accordance with the existing command set, the ‘nn’ field can be either one or two decimal numeric characters in the range 01 to 16. Or the single character ‘#’ for a broadcast command.

All commands are terminated with Carriage Return (0x0D). All characters are ASCII.

Program Dose

The syntax of the command to program a dose into the pump is given below. No response is given. The programmer is advised to check that the command has been correctly received by issuing the ‘nnPD?’ command.

nnPDddddd KRsssSED

where

PD Program Dose Command Characters

ddddd Five character dose size in the range .0001 to 99999 with leading and trailing zeros to form a fixed size field. E.g. 10 is programmed 10.00

K Dose size modifier. This determines the scale of the dose size 'ddddd'. The modifier may only consist of three characters these are:

- l Dose size is in litres
- m Dose size in millilitres
- u Dose size in microlitres

R Direction of rotation. This is a single character:

A Anticlockwise

C Clockwise

ssss Four character speed field in tenths of an rpm in the range of 0001 to 2200 with leading and trailing zeros to form a fixed size field. The maximum speed is dependant upon the type of pumphead used or tubing which is fitted in the pumphead. e.g. 195 rpm is programmed as 1950

S Start ramp value.. Characters '0' to '5' ('0' = none '5' = maximum)

E End ramp value.. Characters '0' to '5' ('0' = none '5' = maximum)

D Drip value.. Characters '0' to '5' ('0' = none '5' = maximum)

Characters outside the range specified in the fields, or omission of any fields or parts thereof cause the whole document to be discarded. An error message is issued on the screen of the pump.

The dose size, ramps and drip values issued by this command overwrite the internal values, normally accessed by the SETUP screen.

The issuing of this command, resets the internal motor overrun value to its nominal setting if the speed changes. Thus typically four doses are required to enable the pump to converge onto the average overrun value, thus increasing the accuracy of the dose.

This command always resets the batch count. See the Report Batch Count command 'nnSC'.

Query dose

The syntax of the command to verify the loading of a dose is:

nnPD?

This elicits the response:

dddddKRssssSED !

where field definitions are given in Program Dose Command.

Note that the dose size after scaling is held internal in millimetres. Thus if a dose size of 0.895m is programmed, the response will be 895.0µ (i.e. 895 microlitres). Dose sizes in excess of 999ml will be reported in litres.

Clear batch count

The syntax of the command to clear the batch count is:

nnCC?

This command does not elicit a response. It clears the batch count without affecting any other pump parameters. See the Report Batch Count command 'nnSC'.

Show batch count

This syntax of the command to view the batch count is:

nnSC

This elicits the response:

ccccc !

where ccccc is a five digit decimal field in the range 00000 to 99999.

This consists of the number of complete doses delivered since the last program dose command. The dose may be initiated with either a Run program 'nnRP' or a footswitch press.

Run program

The syntax of the command to repeat a dose, either in tacho pulses or dose size is:

nnRP

This command does not elicit a response. When the dose has been delivered the batch count is incremented. This is primarily designed for use with the Program Dose command, 'nnPDxxx…xx'.

It will cause a dose specified in tacho pulses ('nnDI*xxx*' or 'nnDO*xxx*' commands) to be repeated.

Please note

The default program dose is 5.0ml, Clockwise, 220.0rpm, Start ramp = 2. No End ramp or Drip value.

Doses specified by the 'nnDI' or 'nnDO' can be repeated using the footswitch or the 'nnRP' command.

Changing, incrementing or decrementing the motor speed using the hnSPxxx', hnSI' or hnSD' commands reset the motor overrun value to its nominal value.

If the motor is dosing, it has no effect until the next dose. Typically four further doses are required to achieve maximum dose accuracy. Then the pump will have converged on the average motor overrun value.

Set-up

***ROM* -** provides user with software identification

***Date/Time* -** Set during manufacture but can be reset to user requirements.

***Beep* -** Audible signal on/off.

***Ramp* -** Rate of acceleration/deceleration of the pump to/from maximum set speed at the beginning/end of a dose. 0 setting signifies no acceleration delay to maximum speed, 5 signifies the longest acceleration delay to maximum speed. The pump default setting is 2.

***Drip* -** Brief reversal of the motor on dose completion ensures no extra drips of fluid are dispensed. 0 means no reverse and 5 means maximum reverse.

***Baud* -** Speed of signal transmission. Default setting 9600, range of setting include 1200, 2400, 4800, 9600.

***Auxiliary* -** Monitor the pump dosing or motor state/direction of rotation using 2 high/low auxiliary signals outputted via the pumps 25D connector. Auxiliary signals can be used, for example, to command a turntable or conveyor to move when a dose has been completed.

Line 1 can be set to change state every time the motor runs, or only when the motor runs to dispense a dose. The signal can be set high or low when the motor runs. **Line 2** changes state when the pump direction is changed. The screens allow the signal to be set high or low when the output shaft rotates clockwise.

***Pump* -** When under RS232 control each individual pump must be identified. Select a number from 1-16.

Default* -** Press ***Enter at Yes to restore factory defaults.

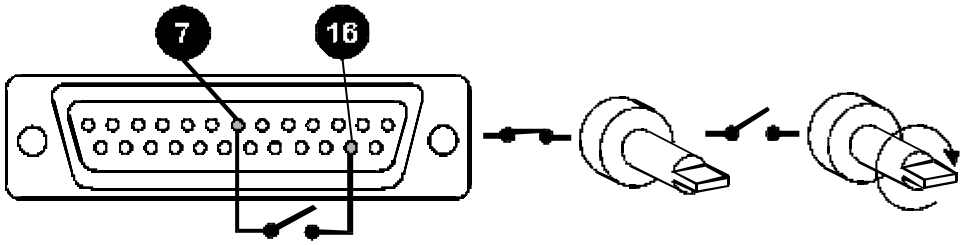
***Autostart* -** If set to **On,** when operating in **Manual** mode only, Autostart will allow the pump to restart pumping automatically after power-up following a mains supply interruption. If set to off the pump will restart and return to the Main Menu.

Remote control

⚠	***Never apply mains voltage across pins on the 25D socket. Up to 5V TTL may be applied to pins 7 and 5, but do not apply voltage across any other pins. Permanent damage not covered by warranty may result.***

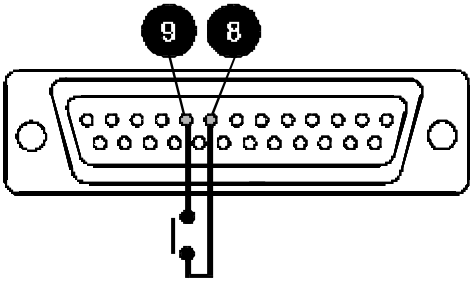
Pause dose/ Remote stop start

This function will pause a dose on for as long as a remote switch remains closed then allows the dose to continue when the switch is opened. Under Manual mode it will also act as a remote stop/start. Connect remote switch as in diagram. Open to run pump, close to pause or stop pump.



Start Dose

A Watson-Marlow footswitch or handswitch can be used to start the dose. If not supplied by Watson-Marlow then select "Other" in the pumps software. Use instantaneous contacts only.



Care and maintenance

The only scheduled maintenance required on the 505Di is to inspect the motor brushes and to replace them before their length is less than 6mm 1/4". The life of the brushes will depend on the duty of the pump, which is expected to be at least 10,000 hours at maximum speed. When the pump needs cleaning, remove the pumphead and use a mild solution of detergent in water. Do not use strong solvents.

If the gearbox is rebuilt you should use 15 ml of the recommended lubricant, which is RD105, this is a SAE 30 mineral oil loaded with molybdenum disulphide to form a soft fluid grease.

Specification

Maximum rotor speeds	220rpm, 350rpm
Voltage/frequency	100-120/220-240V 50/60Hz
Control range	220rpm; 220:1, 350rpm 175:1
Power consumption	100VA
Shaft Torque	2.2Nm
Operating temperature range	5 to 40C
Storage temperature range	-40C to 70C
Weight 505Di/RL	7.5kg
Weight 505Di/L	8.9kg
Noise	<70dBA at 1m
Standards	IEC 335-1, EN60529 (IP31)
	Machinery Directive 98/37/EC EN60204- 1
	Low Voltage Directive 73/23/EEC EN61010- 1
	EMC Directive:89/336/EEC EN50081-1 / EN50082-1

Specific drive performance details such as loaded drive speed variation against mains supply voltage fluctuation and drive stability from a cold start to normal operating temperature are available on request. For further information please contact Watson-Marlow Technical Support Department.

501RL Pumphead

The 501RL pumphead has two spring-loaded working rollers, which automatically compensate for minor variations in tubing wall thickness, giving extended tube life. The 501RL is set during manufacture to accept tubing with wall thicknesses of between 1.6mm and 2.0mm, and internal diameters of up to 8.0mm. It is equipped with a "tool lockable" guard for increased safety. This should be locked shut whilst the pump is in use.

The pumphead can be run clockwise for extended tube life, or anti-clockwise to operate against higher pressures.

Flow rates

Flow rates for the 505Di were obtained using silicone tubing with the pumphead rotating clockwise, pumping water at 20C with zero suction and delivery pressures. For critical applications determine flow rates under operating conditions.

501RL Installation

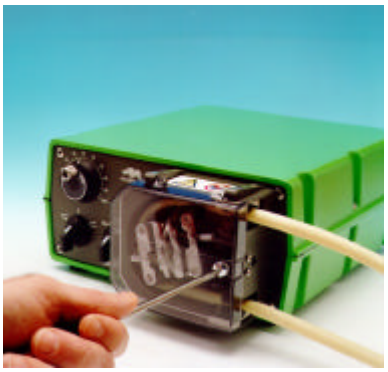
Fit the track in any one of three orientations, over the drive shaft and locating boss. Secure the track with the locating screw. Ensure the drive shaft is degreased before locating the rotor onto the shaft via the split collet. *Rotate the rotor until its guide rollers are alligned flush to the front edge of the track*. Tighten the rotor screw to a torque of 3Nm to prevent the collet slipping during operation.

To reposition the track, swing out the crank handle to expose the rotor retaining screw. Turn the screw anticlockwise one turn to release the collet, and withdraw the rotor from the shaft. Loosen the track locating screw, and pull the track clear. Rotate the track to its new position and tighten the track locating screw. Use this method of removal and fitting in case cleaning is required.

Tube loading

Isolate pump from mains supply. Unlock and open the hinged guard and swing out the rotor crank handle until it locks into position. Select the length of tubing required, noting that approximately 240mm is required for the pumphead.

Fit one end of the tubing into one of the spring loaded clamps, and then, whilst rotating the rotor with the crank handle, feed the tubing between the rollers and the track, aligning it within the rotor tube guides. The tubing must lie naturally against the track and must not be twisted or stretched.



Fit the other end of the tubing into the second spring loaded clamp, ensuring that the tubing is not slack in the pumphead, since this can reduce tube life.

Close the crank handle and shut and lock the guard.

After the pump has been started, open the downstream clamp for a short time, so that the tube can find its natural length.

The 501RL pumphead is fitted with four-position tube clamps, to accommodate various tube diameters, which can be adjusted by pushing in or pulling out the bars at the top of the upper clamp and the bottom of the lower clamp. Set the clamps so that the minimum necessary pressure is applied to the tubing.

Roller adjustment

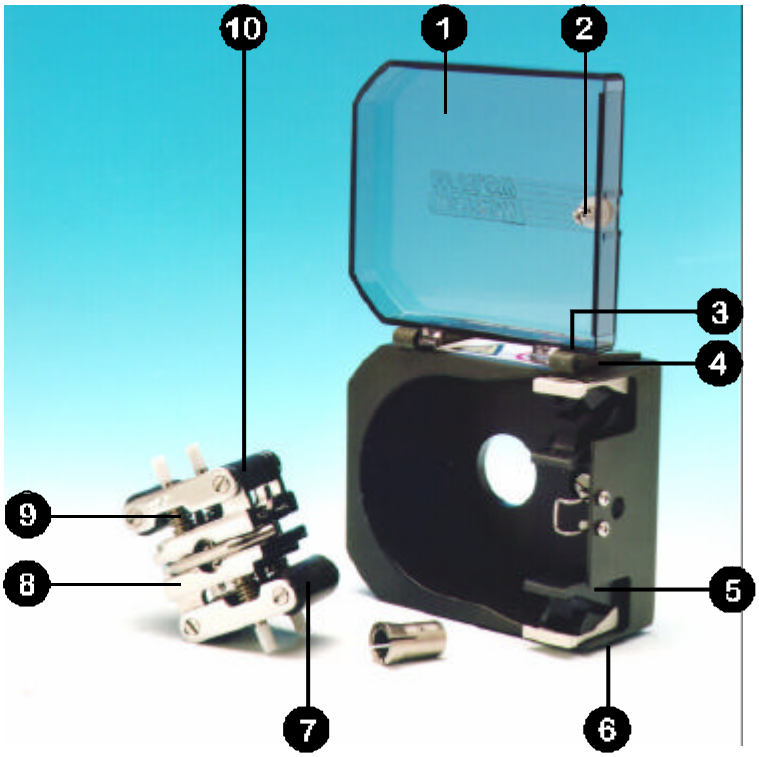
The 501RL has a factory set gap of 2.6mm between the rollers and the track and is suitable for tubing having wall thicknesses of between 1.6 and 2.0mm. Adjustment of the gap will be required if tubing having a wall thickness of less than 1.6mm is required. There is an adjusting screw on each of the two roller arms, and each of these screws will require adjustment. The correct gap is twice the wall thickness less twenty percent. Correct adjustment is important: over occlusion will reduce tube life; under occlusion will reduce pumping efficiency.

To change the gap setting, turn each adjusting screw clockwise to increase the gap, or anticlockwise to decrease the gap. A full turn changes the gap by 0.8mm.

To restore the original settings of 2.6mm, turn the adjusting screws until both rollers are just touching the track, then tighten each screw by three and a quarter turns. The 501RL2 has a factory set gap of 3.8mm between the wall and the track and is suitable for tubing having wall thickness of between 2.1 and 2.5mm.

Check moving parts of the rotor from time to time for freedom of movement. Lubricate pivot points and rollers occasionally with Teflon lubricating oil.

Pumphead spares



Number	Spare	Description
1	MN 1200M	Lockable guard
2	FN 4502	Lock
3	FN 2341	Hinge screw
4	MN 0266M	Hinge grey
5	MNA0623A	Tube clamp assembly
6	FN 2332	Screw
7	MN 0011T	Main roller
8	MNA0143A	501RL Rotor Assembly
9	SG0001/SG0002	Springs standard/hard
10	MN 0012T	Follower roller
	XX 0095	Teflon lubricant

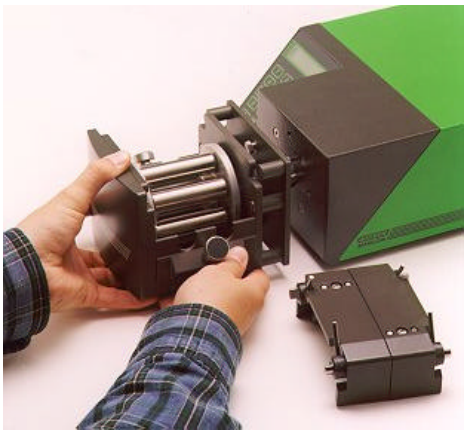
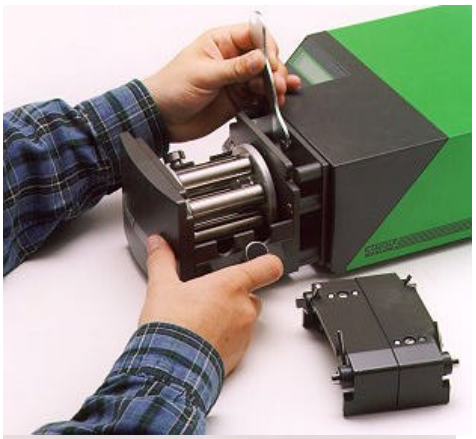
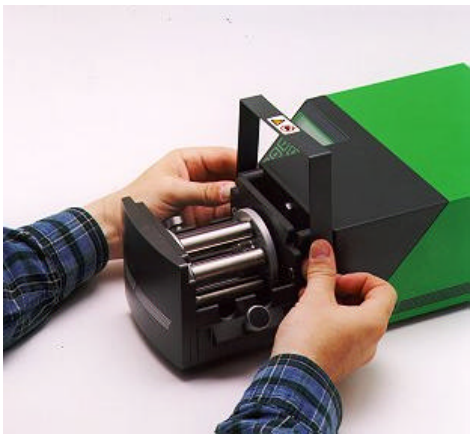
505L pumphead

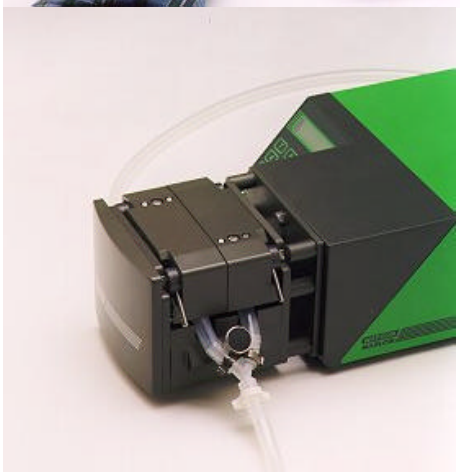
The twin offset track design of the 505L utilises 2.4mm wall double-y tube elements to overcome pulsation for accurate dosing and dispensing. The 505L accepts Silicone and Marprene tubing up to 9.6mm bore giving a potential flow rate of 2400 ml/min per pumphead. (Fit the 505LX for flow rates up to 4800ml/min). Use 2.4mm wall tube for transfer for the highest performance and improved viscous fluid handling.

Alternatively the 505L will run with two separate tubes although some channel to channel variance and minimal pulsation may be experienced. For separate tube fitting or twin tube inlet to single tube outlet fitting tube clamping blocks must be used.

505L Installation

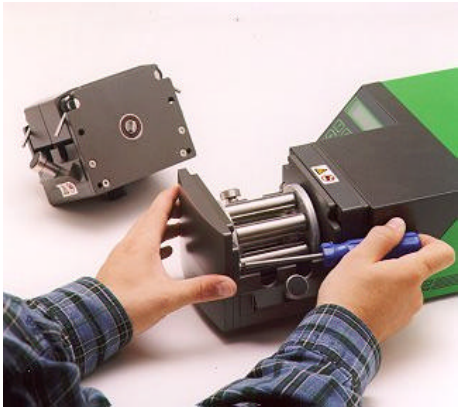
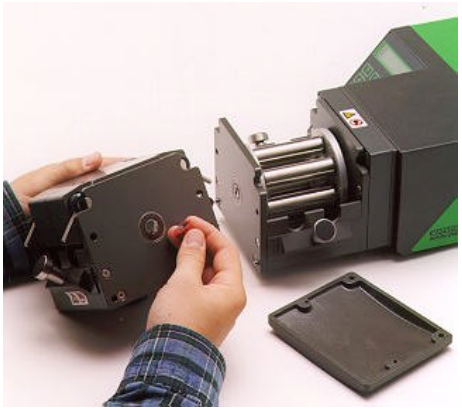
Remove the mounting plate cover from the 505L. Align the drive shaft dog and 505L centre shaft slot and push the pumphead on to drive. Tighten top and bottom mounting plate screws.

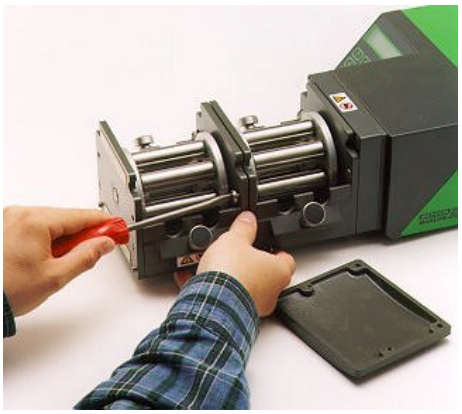
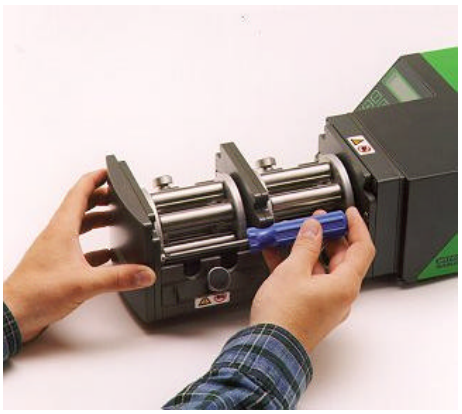
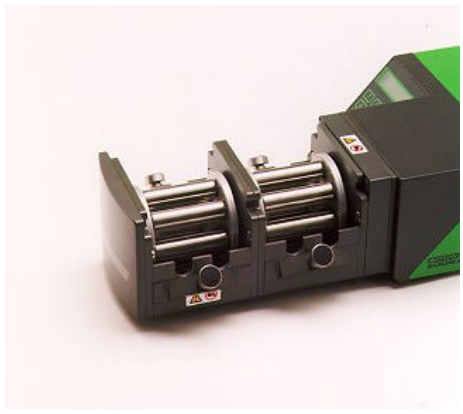






505LX Installation

Remove the 505L bowed front plate by undoing the two retaining screws (inside front face of 505L). Grease drive dog of 505LX. Align 505LX drive dog and 505L slot in centre shaft. Locate 505LX to 505L. Tighten the fixing screws at the mating faces of the 505L and 505LX. Locate the bow front onto the 505LX and fit using the two retaining screws (inside front face of 505LX).

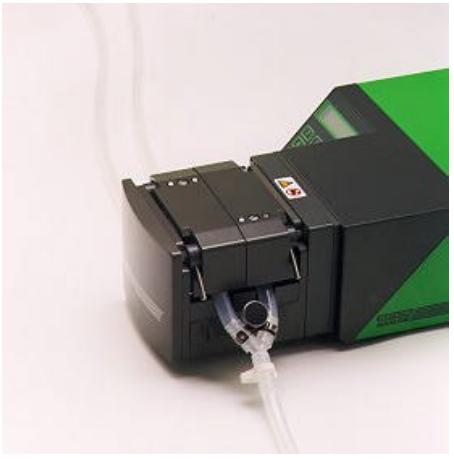
Tube loading

Double-y element

Lift the track locating levers and remove track. Locate one end of double-y element over one of the 505L clamping pegs. Stretch the element over the rotor and locate the other end of the element over the second 505L clamping peg. Replace the track and push down the track locating levers. (See pumphead installation).

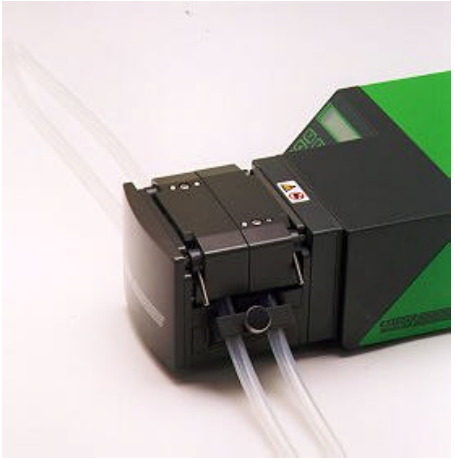
Twin inlet tubes

Lift the track locating levers and remove track. Twist and remove the 505L inlet clamping peg. Connect the twin inlet tubes and outlet tube using the appropriate y piece connector and clamps. Fit the inlet tubes into the correct size clamping block. Locate the clamping block onto the 505L (push down and twist locking fastener to secure). Stretch the tubes over the rotor and locate the y-piece end of the element over the second 505L clamping peg. Replace the track and push down the track locating levers.



Two independent tubes

Lift the track locating levers and remove track. Twist and remove the 505L clamping pegs. Fit the two tube into the correct size clamping blocks. Distance between blocks = 145mm for up to 8.0mm bore; 150mm for 9.6mm bore. Fit the inlet tube clamping block to the 505L. Stretch the tubes over the rotor and fit second tube clamping block to the 505L. Replace the track and push down the track locating levers. When using Marprene it is important to check the distance between the clamping blocks after 30 minutes running time.



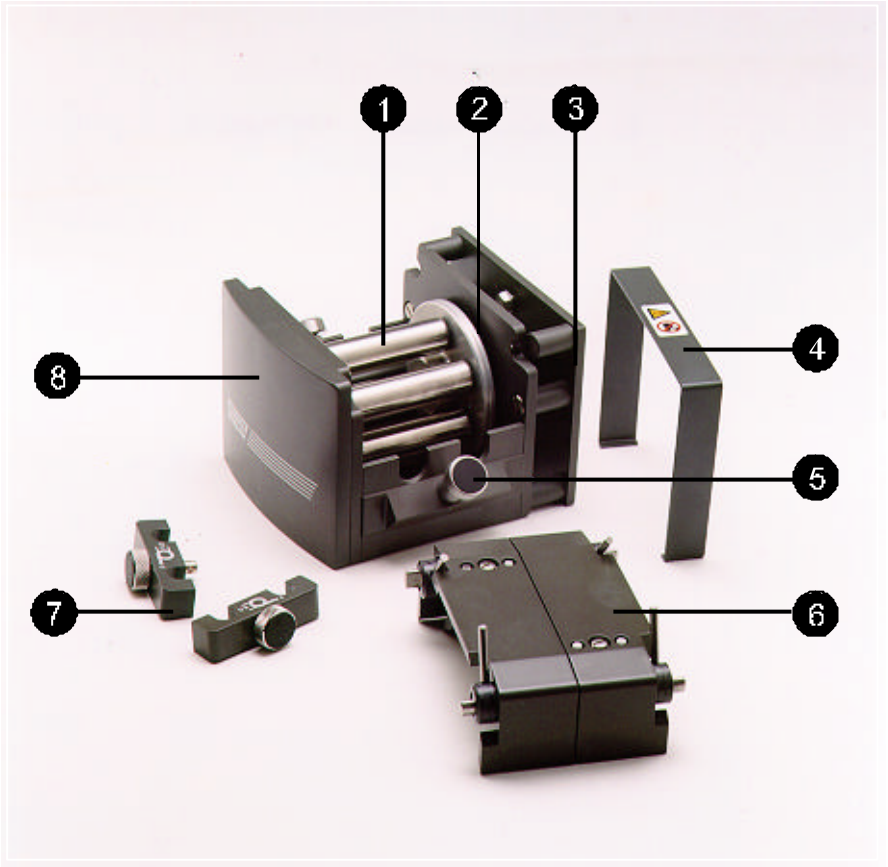
505L Care and maintenance

Check all moving parts for freedom of movement occasionally. If aggressive fluids are split onto the pumphead, remove from drive and clean using a mild detergent only.

505L Track adjustment

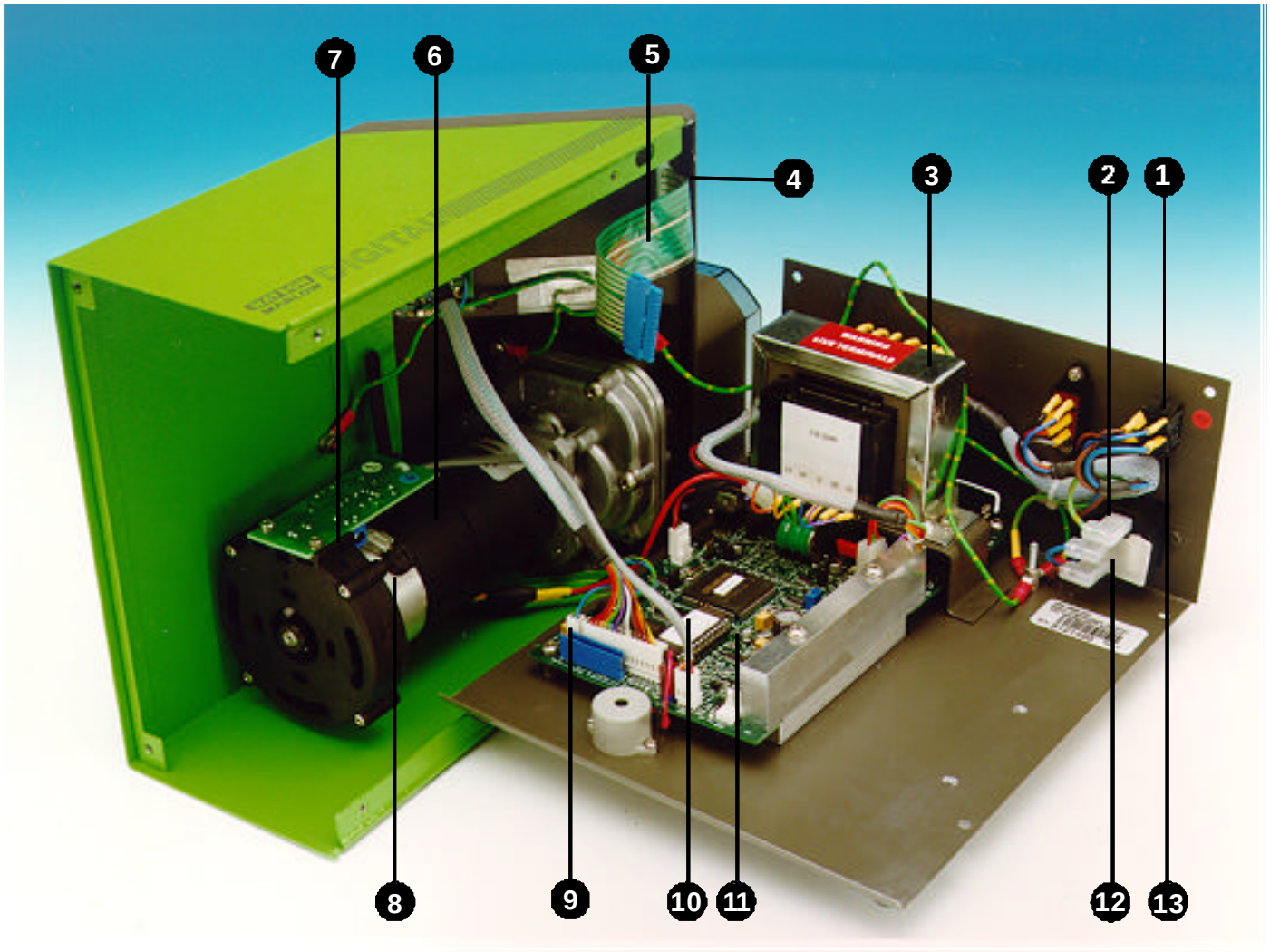
The track is set for 2.4mm wall tubing up to 9.6mm bore. Alteration of this setting using the pan head screws may be necessary to optimise performance if non-standard tubing is used. The factory setting is 14.5mm vertically from the rotor side of the sprung track to the top of the track cover.

505L Pumphead spares



Number	Spare	Description
1	MNA 0371A	Rotor Assembly
2	BB 0014	Drive shaft bearing
3	MNA0338A	Adaptor plate
4	MN 0862S	Cover plate
5	MNA0339A	Locating peg (2 off)
6	MNA0333A	Track assembly
7	059.4001.000	505L tube clamp set. (6 pairs of 2 clamps)
8	MN 1029C	End plate

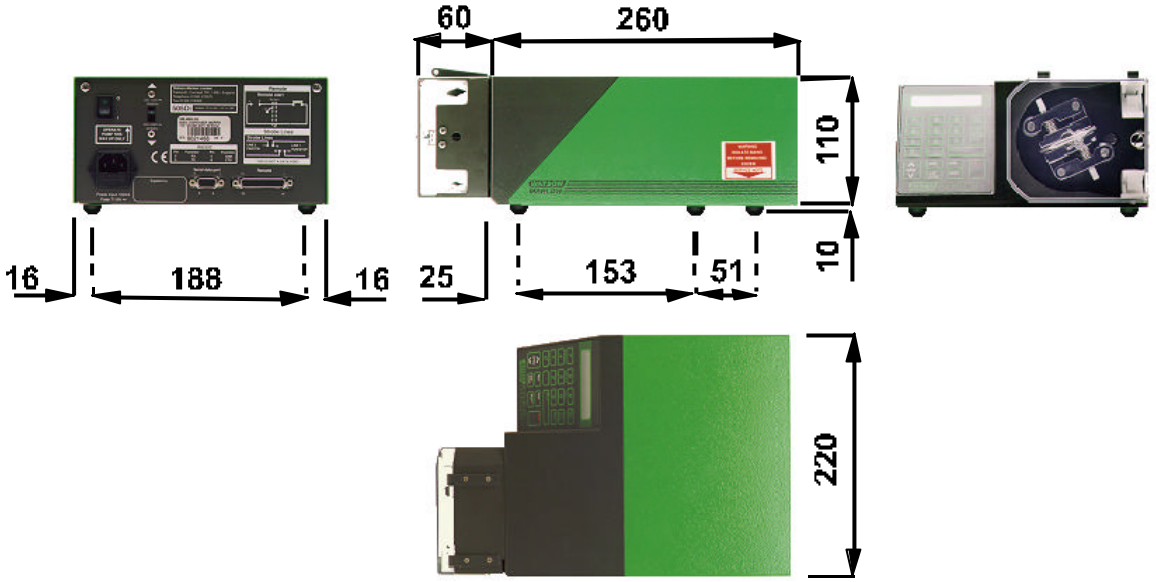
Drive spares



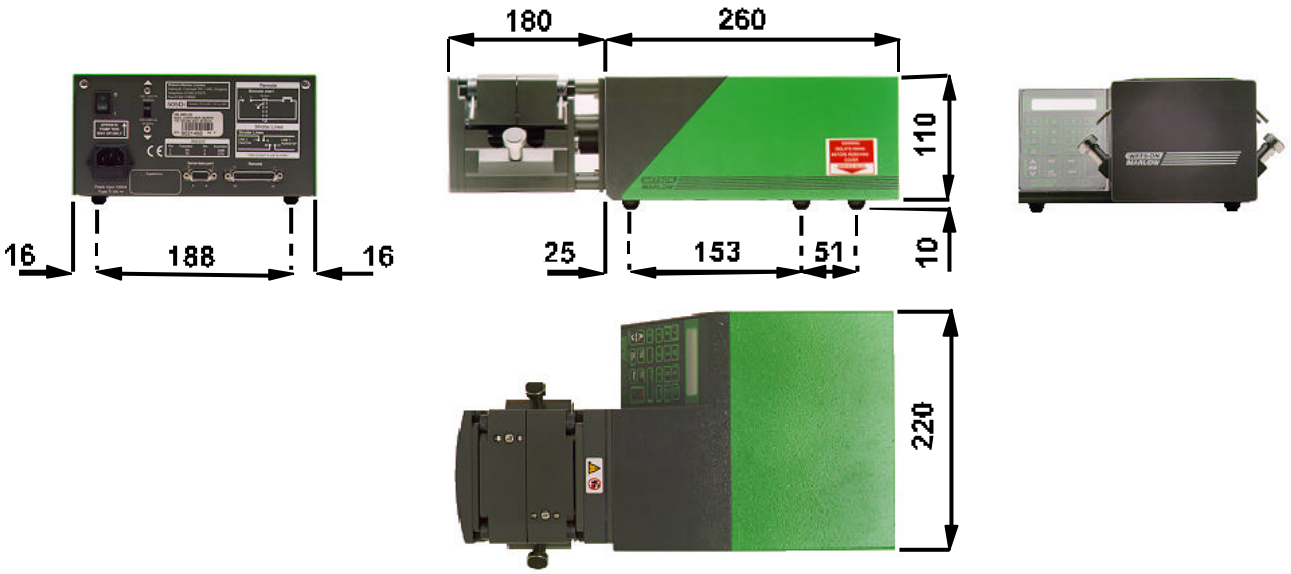
Number	Spare	Description
1	SW 0147	On/off switch
2	FS 0003	Fuse
3	TF0031	Transformer
4	MN0565B	Switch panel membrane
5	MNA0476A	PCB display and harness
6	MNA0377A	Motor 220rpm
6	MNA0525A	Motor 350rpm
7	MNA0500A	PCB tacho and harness
8	BM 0014 (2 off)	Motor brush
9	MNA0346A	Tacho disc assembly
10	MNA 0465A	ROM
11	MNA0651A	Speed control PCB (excluding ROM)
12	US 0045	Mains connector
13	SW 0086	Voltage selector switch

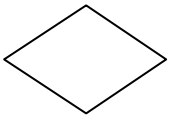
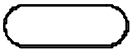
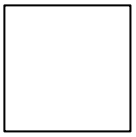
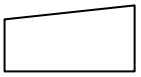
Outline dimensions

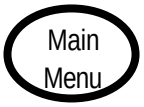
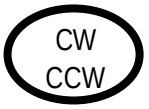
505Di/RL



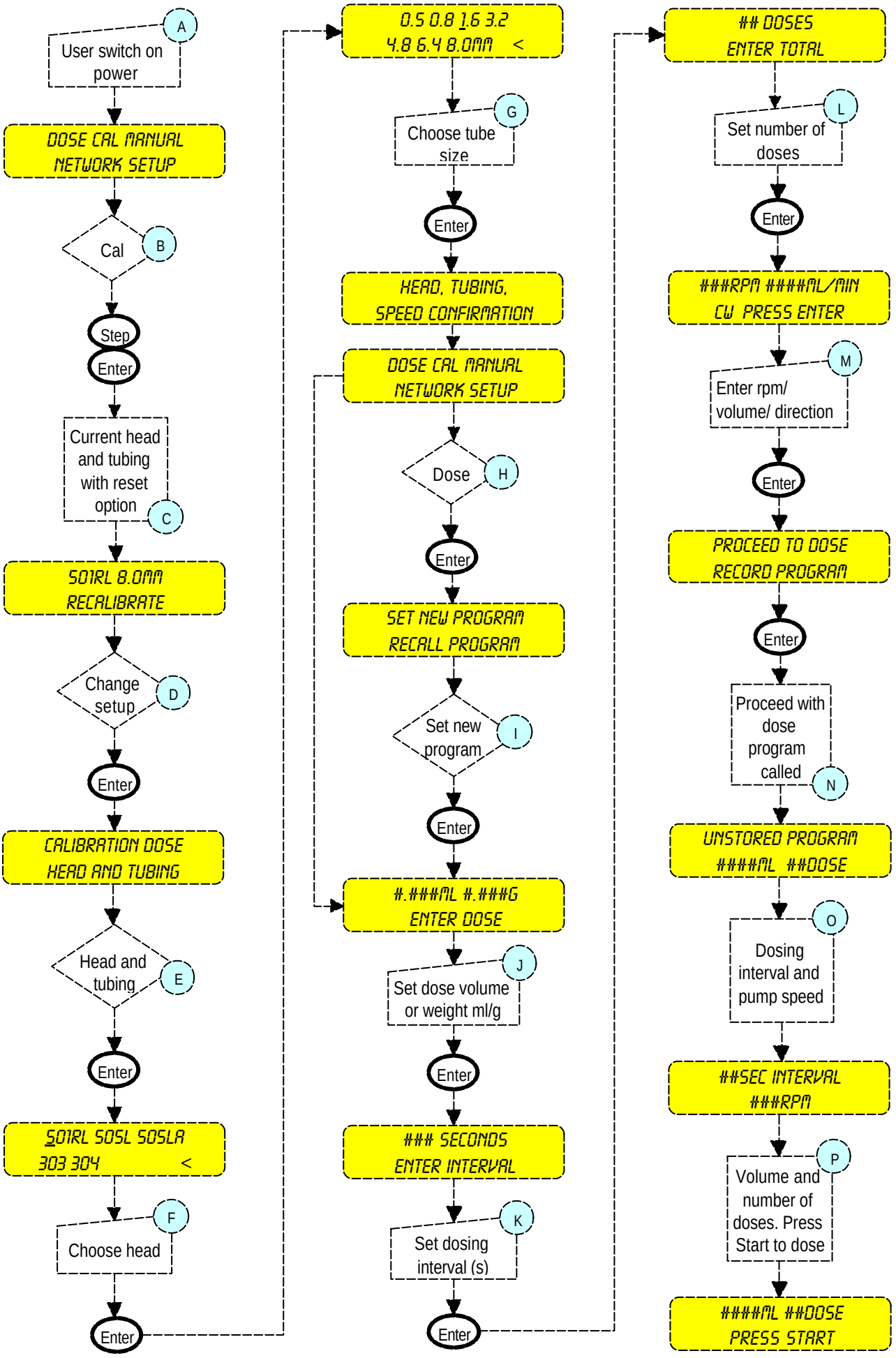
505Di/L



						
English	User decision	Pump screen display	Terminal	Operation	Flow connector	Manual input

							
English	Instruction reference	Keypad function	Keypad function	Keypad function	Keypad function	Keypad function	Keypad function

Quick start up *

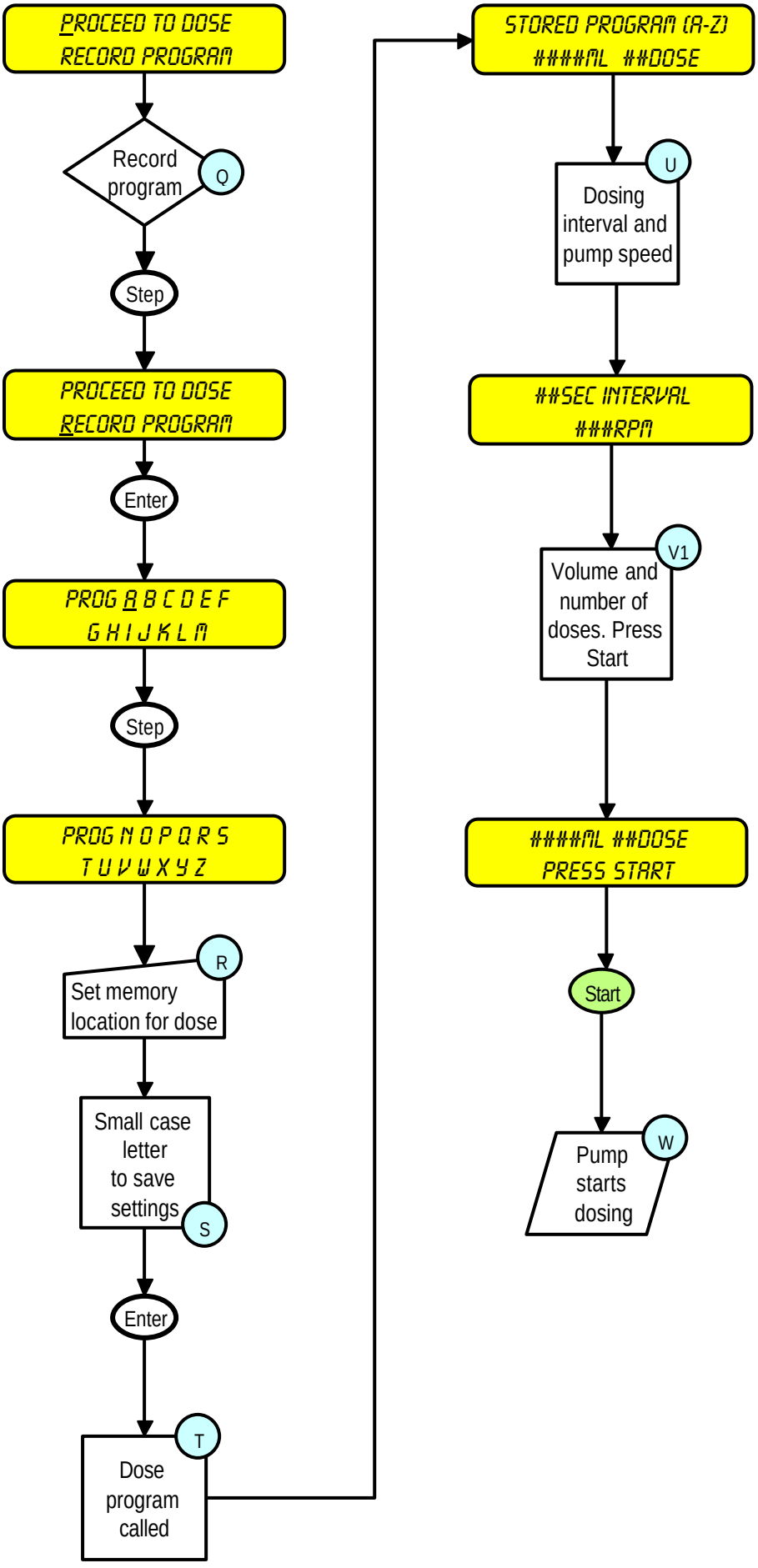


English

* Volume dosing using 501RL, 1.6mm bore tubing. Pumphead/tubing selection screens vary according to selection required.

A. Switch on power to drive
B. User decision to calibrate
C. Indication of head and tubing to which pump is currently calibrated
D. If set-up not correct change existing set-up
E. Select head and tubing
F. Choose the pumphead required
G. Choose the tube size. Selection confirmed
H. Select Dose from Main menu
I. Set a new dose program
J. Set the volume or weight to be dosed
K. Set the time interval between doses
L. Set the number of doses to be dispensed
M. Set the pump speed or volume flow rate
N. Proceed to dose with using set parameters
O. Verification of interval between doses and pump speed
P. Verification of volume and number of doses, press Start

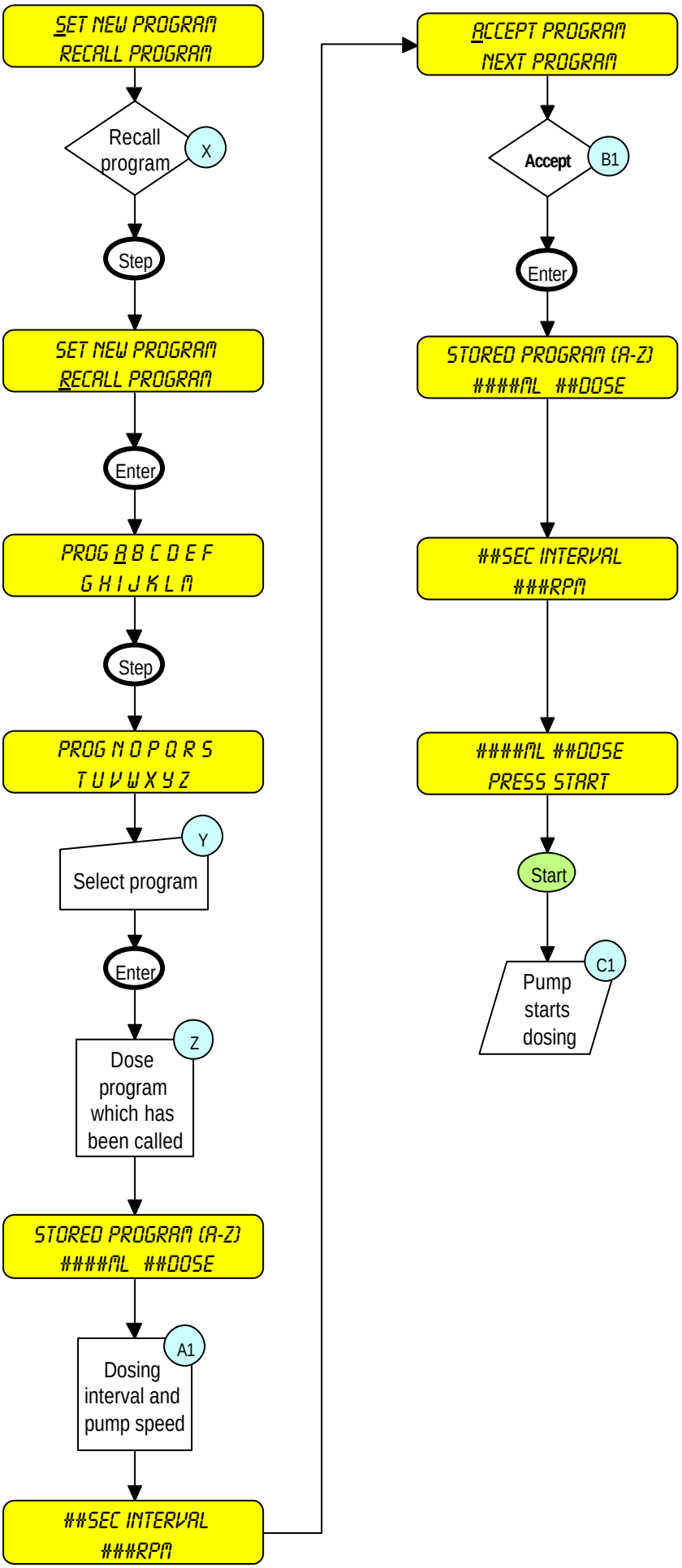
Record Program



English

Q. User decision to record a set of dose program settings
R. Select the memory location. Large letter denotes a previously stored program. Small letter means location is free.
S. Small case letters indicate an empty memory location
T. Verification of saved dose program
U. Verification of time interval between doses and pump speed
V. Verification of volume and number of doses, press Start
W. Pump starts dosing

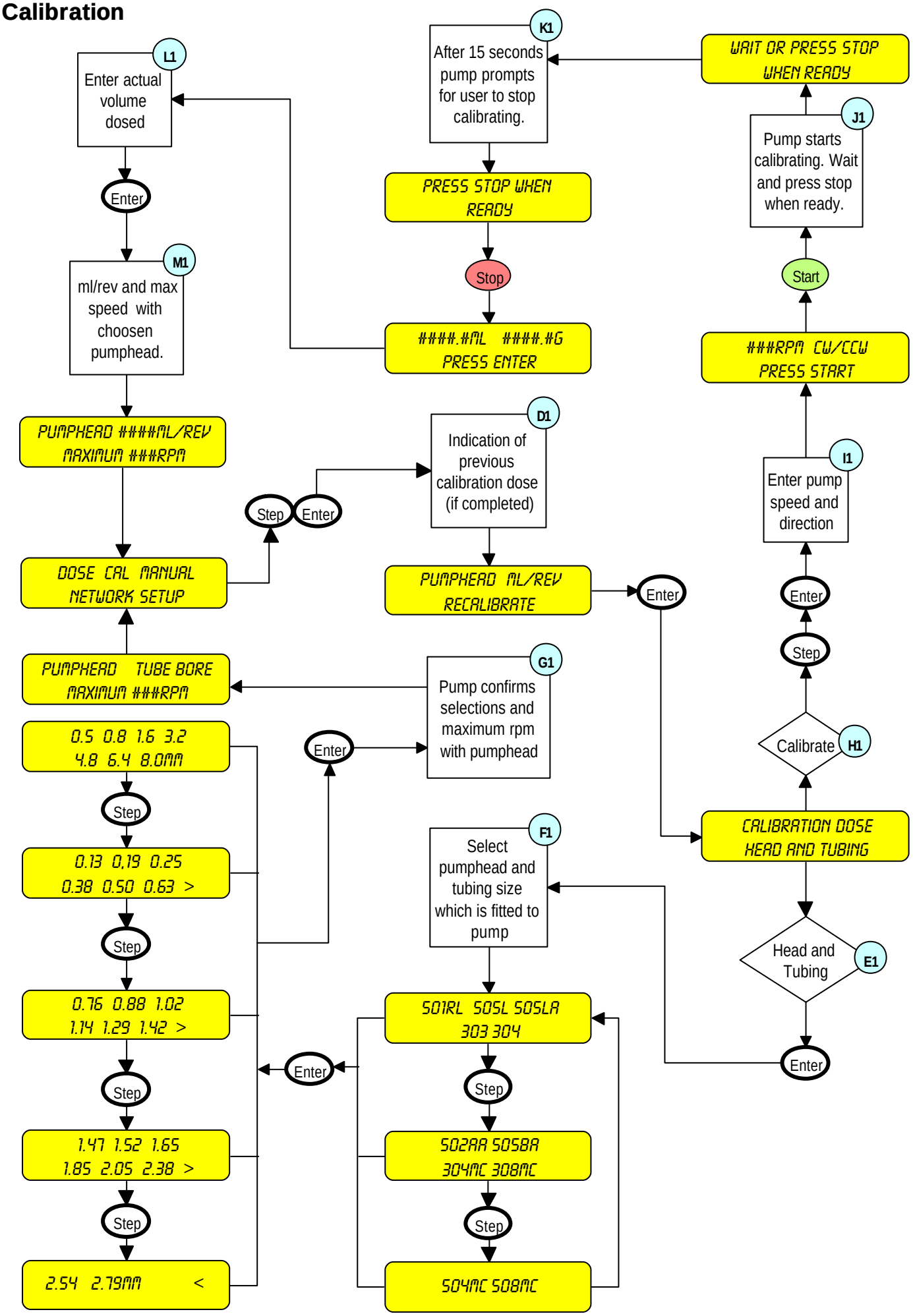
Recall Program



English

X. Recall previously set program from memory
Y. Select required program
Z. Verification of selected dose program
A.1 Verification of interval between doses and pump speed
B.1 User decision to accept chosen program. Repeated verification of dose parameters.
C.1 Pump starts dosing

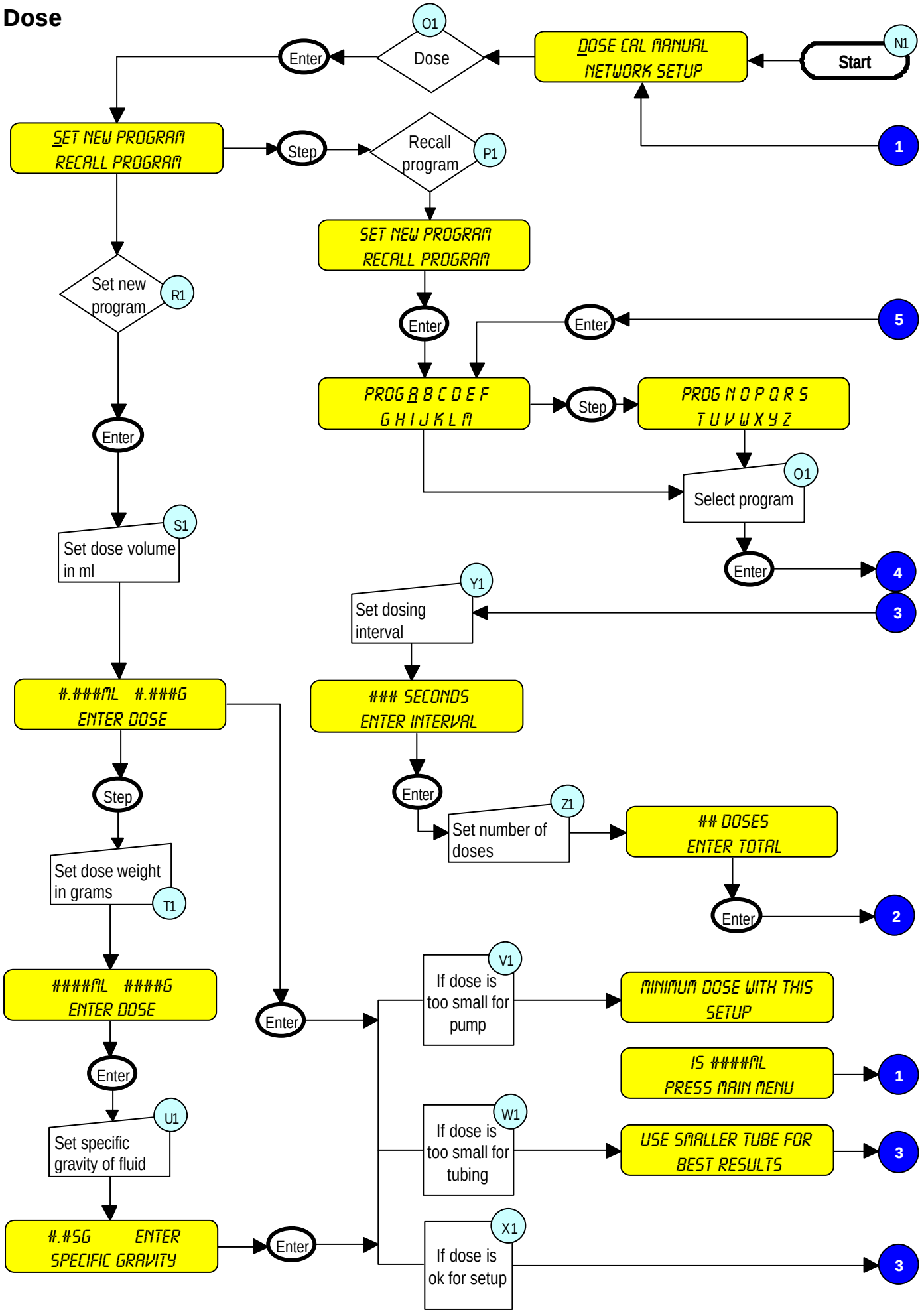
Calibration



D1. Indication of previous calibration (if completed)
E1. Decision to calibrate pump to new pumphead and tubing size
F1. Select the pumphead and tubing which is fitted to pump
G1. Confirmation of user selections. Maximum pump speed is governed by pumphead fitted
H1. Decision to calibrate pump using a calibration dose
I1. Enter calibration speed and direction
J1. Pump starts to calibrate. Press stop when ready
K1. After 15 seconds pump will prompt user to stop calibrating
L1. Measure and then enter the actual volume that has been dosed during calibration
M1. Indication of pumphead, ml/rev and maximum rpm which is governed by the pumphead.

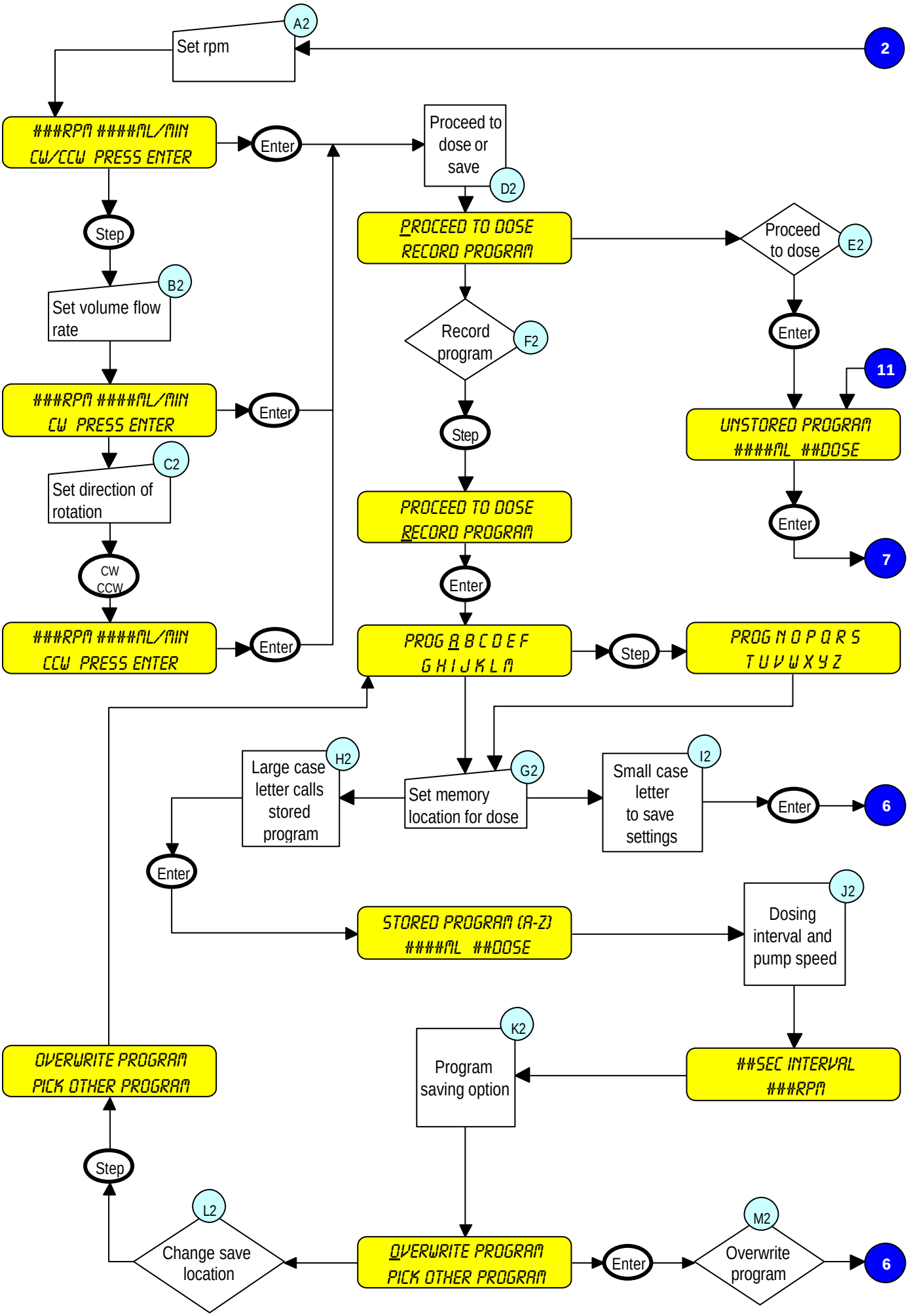
The following section flowcharts the complete Dose procedure of the 505Di. The user can use this chart to map all possible decisions or preferred options within Dose. The map is inter-linked between pages using connecting numbers. Where one section ends at a number, the corresponding section will begin at the same number.

Dose


Start
N1
DOSE CAL MANUAL
NETWORK SETUP
Dose
O1
Enter
SET NEW PROGRAM
RECALL PROGRAM
Step
Recall program
P1
1
SET NEW PROGRAM
RECALL PROGRAM
Set new program
R1
Enter
Enter
5
PROG A B C D E F
G H I J K L M
Step
PROG N O P Q R S
T U V W X Y Z
Enter
Select program
Q1
Enter
4
S1
Set dose volume in ml
Y1
Set dosing interval
3
#.###ML #.###G
ENTER DOSE
SECONDS
ENTER INTERVAL
Step
Enter
Set dose weight in grams
T1
Z1
Set number of doses
DOSES
ENTER TOTAL
Enter
2
####ML ####G
ENTER DOSE
Enter
V1
If dose is too small for pump
MINIMUM DOSE WITH THIS SETUP
IS ####ML
PRESS MAIN MENU
1
Enter
U1
Set specific gravity of fluid
W1
If dose is too small for tubing
USE SMALLER TUBE FOR
BEST RESULTS
3
#.#SG ENTER
SPECIFIC GRAVITY
Enter
X1
If dose is ok for setup
3

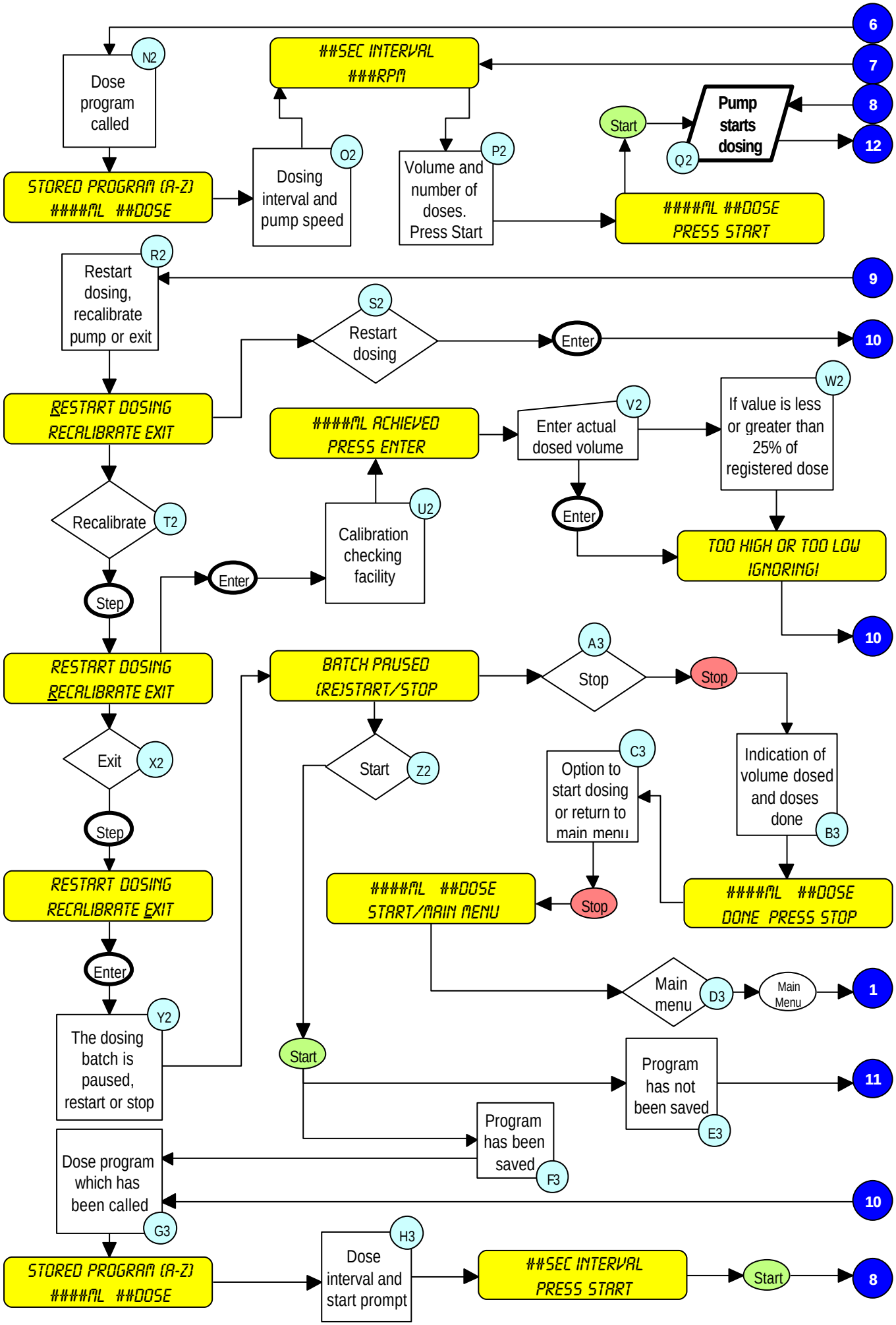
English

N1. Switch on pump and Main menu is called
O1. User chooses dose option
P1. Recall program option available only if program has previously been saved
Q1. User recalls a pre-set program. Large case letters denote a stored program
R1. Decision to set a new dose program
S1. Enter dose volume in ml (0.001ml<Dose<9999ml)
T1. Enter dose weight in grams (0.001g<Dose<9999g)
U1. Set the specific gravity of the fluid (Maximum 5.0)
V1. Dose is too small for pump (Minimum dose set should require 5 rotor revolutions)
W1. Dose is too small for tubing
X1. Dose is OK for set-up
Y1. Set time interval between doses (0.1s<Time<6550s)
Z1. Set total number of doses (up to 9999 doses)


A2
Set rpm
2
###RPM ####ML/MIN
CW/CCW PRESS ENTER
Enter
Proceed to dose or save
D2
Step
PROCEED TO DOSE
RECORD PROGRAM
Proceed to dose
E2
B2
Set volume flow rate
Record program
F2
Enter
11
###RPM ####ML/MIN
CW PRESS ENTER
Enter
Step
UNSTORED PROGRAM
####ML ##DOSE
C2
Set direction of rotation
PROCEED TO DOSE
RECORD PROGRAM
Enter
CW
CCW
Enter
7
###RPM ####ML/MIN
CCW PRESS ENTER
Enter
PROG A B C D E F
G H I J K L M
Step
PROG N O P Q R S
T U V W X Y Z
H2
Large case letter calls stored program
G2
Set memory location for dose
I2
Small case letter to save settings
Enter
6
Enter
STORED PROGRAM (A-Z)
####ML ##DOSE
J2
Dosing interval and pump speed
K2
Program saving option
##SEC INTERVAL
###RPM
OVERWRITE PROGRAM
PICK OTHER PROGRAM
Step
L2
Change save location
OVERWRITE PROGRAM
PICK OTHER PROGRAM
Enter
M2
Overwrite program
6

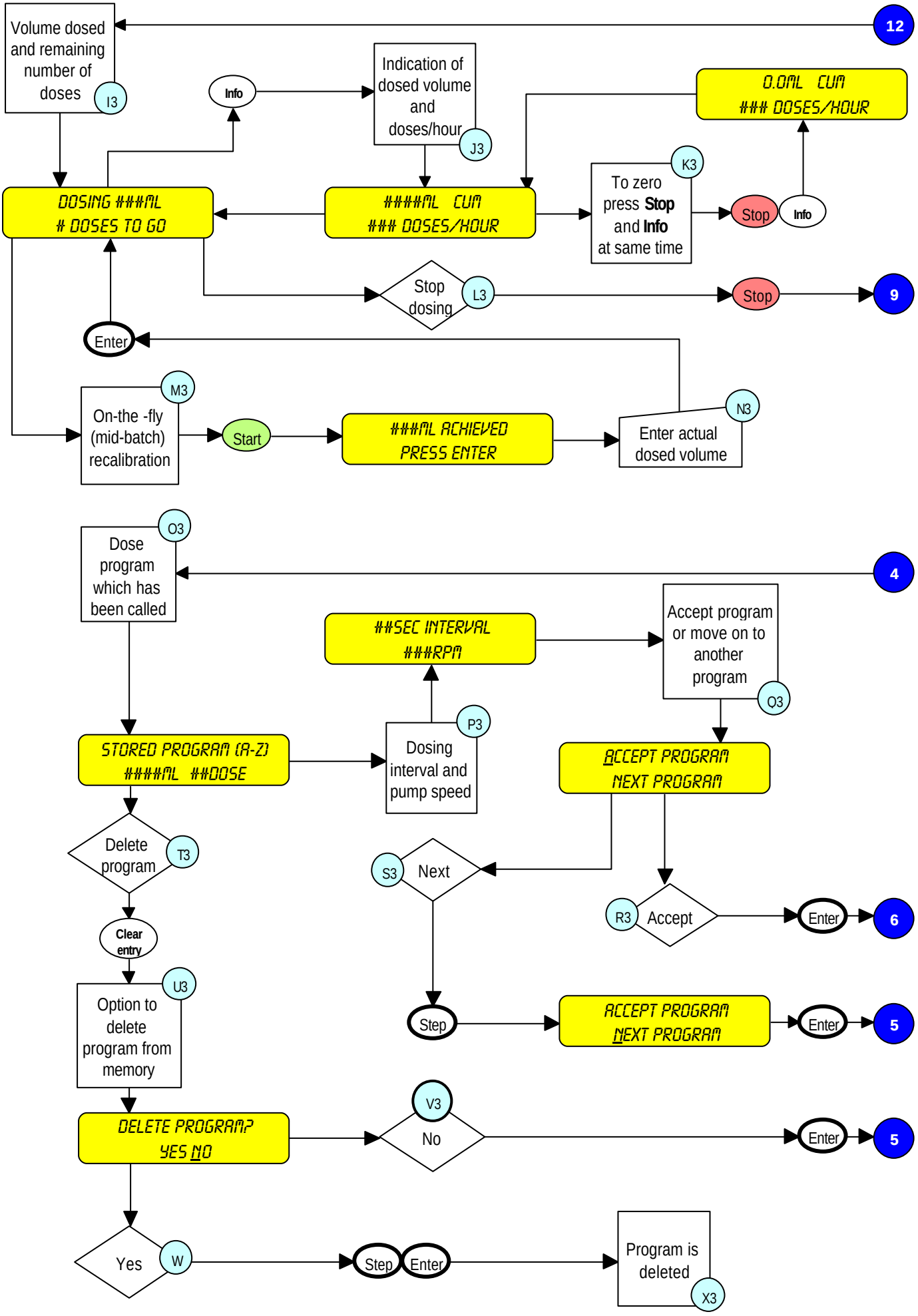
English

A2. Set drive speed (limited by pumphead fitted)
B2. Set volume flow rate
C2. Set direction of rotation of drive
D2. Proceed to dose or save program
E2. Proceed to dose
F2. Record program
G2. Set the memory location for the dose parameters
H2. Choosing a capital letter will call the existing program settings within that memory location
I2. Choosing a small case letter will call the dose settings to be saved
J2. Indication of dosing interval and pump speed
K2. Overwrite existing program or save to different memory location
L2. Decision to choose new memory location
M2. Decision to overwrite existing program
N2. Décision d'écraser le programme existant


N2
Dose program called
STORED PROGRAM (A-Z)
#####ML ##DOSE
O2
Dosing interval and pump speed
##SEC INTERVAL
###RPM
P2
Volume and number of doses. Press Start
#####ML ##DOSE
PRESS START
Start
Q2
Pump starts dosing
6
7
8
12
R2
Restart dosing, recalibrate pump or exit
RESTART DOSING
RECALIBRATE EXIT
S2
Restart dosing
Enter
9
10
Recalibrate
T2
Step
Enter
U2
Calibration checking facility
#####ML ACHIEVED
PRESS ENTER
V2
Enter actual dosed volume
Enter
W2
If value is less or greater than 25% of registered dose
TOO HIGH OR TOO LOW
IGNORING!
10
RESTART DOSING
RECALIBRATE EXIT
Exit
X2
Step
RESTART DOSING
RECALIBRATE EXIT
Enter
Y2
The dosing batch is paused, restart or stop
BATCH PAUSED
(RE)START/STOP
A3
Stop
Stop
Start
Z2
C3
Option to start dosing or return to main menu
Indication of volume dosed and doses done
B3
#####ML ##DOSE
START/MAIN MENU
Stop
#####ML ##DOSE
DONE PRESS STOP
Main menu
D3
Main Menu
1
Start
Program has not been saved
E3
11
Program has been saved
F3
Dose program which has been called
G3
10
STORED PROGRAM (A-Z)
#####ML ##DOSE
H3
Dose interval and start prompt
##SEC INTERVAL
PRESS START
Start
8

English

N2. Dose program called for use
O2. Indication of dosing time interval and pump speed
P2. Volume/weight set and number of doses. Press start
Q2. Pump starts dosing run
R2. Option to restart dosing, re-calibrate pump or exit from dosing
S2. Restart dosing
T2. Decision to re-calibrate pump
U2. Prompt to enter volume which pump is physically dosing during each shot
V2. Measure and then enter manually the actual volume/weight which has been dosed
W2. Default tolerance limit of +/-25% of pre-set dose volume on actual dosing volume entered
X2. Decision to exit from dose program
Y2. The dosing batch is paused. Option to restart or stop
Z2. Decision to re-start dosing
A3. Decision to stop dosing
B3. Indication of volume/weight dosed and number of doses completed
C3. Option to restart dosing or return to Main menu
D3. Return to Main menu
E3. Unsaved dose settings will be called
F3. Saved dose setting will be called
G3. Indication of dose program which has been called
H3. Dosing time interval and start prompt


Volume dosed and remaining number of doses
I3
12
Info
Indication of dosed volume and doses/hour
J3
0.0ML CUM
DOSES/HOUR
DOSING ###ML
DOSES TO GO
#####ML CUM
DOSES/HOUR
K3
To zero press Stop and Info at same time
Stop
Info
Stop dosing
L3
Stop
9
Enter
M3
On-the -fly (mid-batch) recalibration
Start
###ML ACHIEVED
PRESS ENTER
N3
Enter actual dosed volume
O3
Dose program which has been called
4
##SEC INTERVAL
###RPM
Accept program or move on to another program
Q3
STORED PROGRAM (A-Z)
#####ML ##DOSE
P3
Dosing interval and pump speed
ACCEPT PROGRAM
NEXT PROGRAM
Delete program
T3
S3
Next
R3
Accept
Enter
6
Clear entry
U3
Option to delete program from memory
Step
ACCEPT PROGRAM
NEXT PROGRAM
Enter
5
V3
DELETE PROGRAM?
YES NO
No
Enter
5
Yes
W
Step
Enter
Program is deleted
X3

English

I3. Indication of volume/weight dosed and number of doses remaining
J3. Indication of volume/weight dosed and number of doses/hour
K3. Option to zero the cumulative volume register
L3. Decision to stop dosing
M3. On-the-fly (mid batch) re-calibration facility - Pump will continue to dispense
N3. Enter actual volume dosed and pump will re-calibrate itself over 5 doses
O3. Indication of dose volume/weight and number of doses in program called
P3. Verification of time interval between doses and pump speed
Q3. Accept called program for dose or choose another program from memory
R3. Decision to accept program
S3. Move to next program in memory
T3. Decision to delete program from memory
U3. Option to delete program from memory
V3. Decision to not delete program
W3. Decision to delete program
X3. Program is deleted

English

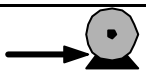
Error Messages

This screen indicates corruption of the RAM or that the EPROM has been changed. In either case pressing Enter will re-initialise the RAM and clear the error.

This screen indicates that the motor has stalled or that a loss of tachometer pulses has been selected. Clear the cause of stalling and power the pump off and on. If the error persists seek qualified assistance.

Symbols

English	Tube number	Tube bore	Double-Y	Maximum cassettes	rpm

					
English	Pressure (+)	Suction	Clockwise (rpm)	Anticlockwise (rpm)	Stop

501RL, 501RL2 (ml/min)

Flow rates								
	#	112	13	14	16	25	17	18
	mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0
	"	1/50	1/32	1/16	1/8	3/16	1/4	5/16
	220	**9.2**	**27**	**94**	**410**	**890**	**1400**	**2200**
	350	**12.5**	**37**	**128**	**560**	**1210**	**1900**	**3000**

505L (ml/min)

Flow rates							
	#	14	16	25	17	18	122
	mm	1.6	3.2	4.8	6.4	8.0	9.6
	"	1/16	1/8	3/16	1/4	5/16	3/8
	220	**155**	**500**	**925**	**1540**	**1980**	**2750**
	350	**245**	**795**	**1470**	**2450**	**3150**	**4375**

505BA (ml/min)

Flow rates									
	mm	0.13	0.19	0.25	0.38	0.50	0.63	0.76	
	"	0.005	0.007	0.01	0.015	0.02	0.025	0.03	
	170	**0.082**	**0.22**	**0.50**	**0.83**	**1.36**	**2.45**	**3.57**	48
	mm	0.88	1.02	1.14	1.29	1.42	1.47	1.52	
	"	0.035	0.04	0.045	0.05	0.055	0.058	0.06	
	170	**4.76**	**6.29**	**7.75**	**9.96**	**11.8**	**12.8**	**13.5**	48
	mm	1.65	1.85	2.05	2.38	2.54	2.79		
	"	0.065	0.07	0.08	0.09	0.1	0.11		
	170	**15.6**	**19.5**	**23.5**	**30.4**	**34.0**	**39.7**		48
⚠ : < 170									

313/314 (ml/min)

Flow rates							
#	112	13	14	16	25	17	18
mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0
"	1/50	1/32	1/16	1/8	3/16	1/4	5/16
313							
220	**6.6**	**15**	**60**	**55**	**121**	**198**	**275**
350	**9.0**	**21**	**81**	**300**	**660**	**1080**	**1500**
314							
220	**6.6**	**13**	**55**	**186**	**418**	**660**	**880**
350	**9.0**	**19**	**75**	**255**	**570**	**900**	**1200**

313

Maximum number of pumpheads															
313/314 Peroxide/ Platinum Silicone															
		(0 = bar = 0.5)							(0.5 = bar = 2.0)						
#		112	13	14	16	25	17	18	112	13	14	16	25	17	18
mm		0.5	0.8	1.6	3.2	4.8	6.4	8.0	0.5	0.8	1.6	3.2	4.8	6.4	8.0
"		1/50	1/32	1/16	1/8	3/16	1/4	5/16	1/50	1/32	1/16	1/8	3/16	1/4	5/16
220		**6**	**6**	**6**	**6**	**6**	**4**	**3**	**6**	**6**	**6**	**6**	**5**	**3**	**3**
350		**6**	**6**	**6**	**5**	**3**	**2**	**2**	**6**	**6**	**6**	**5**	**3**	**2**	**2**
313/314 Marprene, Tygon, Neoprene, Fluorel															
		(0 = bar = 0.5)							(0.5 = bar = 2.0)						
#		112	13	14	16	25	17	18	112	13	14	16	25	17	18
mm		0.5	0.8	1.6	3.2	4.8	6.4	8.0	0.5	0.8	1.6	3.2	4.8	6.4	8.0
"		1/50	1/32	1/16	1/8	3/16	1/4	5/16	1/50	1/32	1/16	1/8	3/16	1/4	5/16
220		**6**	**6**	**6**	**6**	**5**	**3**	**3**	**6**	**6**	**6**	**6**	**4**	**3**	**3**
350		**6**	**6**	**5**	**4**	**3**	**2**	**2**	**6**	**6**	**5**	**4**	**2**	**2**	**1**

308MC, 308MCX, 508MC2 (ml/min)

Flow rates								
"	0.13	0.19	0.25	0.38	0.50	0.63	0.76	
mm	0.005	0.007	0.01	0.015	0.02	0.025	0.03	
110	**0.09**	**0.28**	**0.47**	**0.83**	**1.40**	**2.60**	**3.90**	15
"	0.88	1.02	1.14	1.29	1.42	1.47	1.52	
mm	0.035	0.04	0.045	0.05	0.055	0.058	0.06	
110	**5.30**	**6.60**	**8.80**	**10.0**	**12.0**	**13.0**	**14.0**	15
mm	1.65	1.85	2.05	2.38	2.54	2.79		
"	0.065	0.07	0.08	0.09	0.1	0.11		
110	**17.0**	**20.0**	**24.0**	**29.0**	**33.0**	**36.0**		15
⚠ : < 110								

501RL, 501RLG, 313

Product codes

mm	"	#	Peroxide Silicone	Platinum Silicone	Marprene	Bioprene
0.5	1/50	112	910.0005.016	913.0005.016	902.0005.016	903.0005.016
0.8	1/32	13	910.0008.016	913.0008.016	902.0008.016	903.0008.016
1.6	1/16	14	910.0016.016	913.0016.016	902.0016.016	903.0016.016
3.2	1/8	16	910.0032.016	913.0032.016	902.0032.016	903.0032.016
4.8	3/16	25	910.0048.016	913.0048.016	902.0048.016	903.0048.016
6.4	1/4	17	910.0064.016	913.0064.016	902.0064.016	903.0064.016
8.0	5/16	18	910.0080.016	913.0080.016	902.0080.016	903.0080.016

mm	"	#	STA-PURE*	Gore fluroelastomer*	Neoprene	Tygon
0.8	1/32	13			920.0008.016	
1.6	1/16	14	960.0016.016	965.0016.016	920.0016.016	950.0016.016
3.2	1/8	16	960.0032.016	965.0032.016	920.0032.016	950.0032.016
4.8	3/16	25	960.0048.016	965.0048.016	920.0048.016	950.0048.016
6.4	1/4	17	960.0064.016	965.0064.016	920.0064.016	950.0064.016
8.0	5/16	18	960.0080.016	960.0080.016	920.0080.016	950.0080.016

mm	"	#	Fluorel	Butyl **
1.6	1/16	14	970.0016.016	930.0016.016
3.2	1/8	16	970.0032.016	930.0032.016
4.8	3/16	25	970.0048.016	930.0048.016
6.4	1/4	17	970.0064.016	930.0064.016
8.0	5/16	18	970.0080.016	930.0080.016

*** Use 501RLG**

*** *Not suitable for use with 313 pumpheads**

501RL2, 501RL2G

Product codes

mm	"	Peroxide Silicone	Platinum Silicone	Marprene	Bioprene	STA-PURE*
1.6	1/16	910.0016.024	913.0016.024	902.0016.024	903.0016.024	960.0016.024
3.2	1/8	910.0032.024	913.0032.024	902.0032.024	903.0032.024	960.0032.024
4.8	3/16	910.0048.024	913.0048.024	902.0048.024	903.0048.024	960.0048.024
6.4	¼	910.0064.024	913.0064.024	902.0064.024	903.0064.024	960.0064.024
8.0	5/16	910.0080.024	913.0080.024	902.0080.024	903.0080.024	960.0080.024
9.6	3/8	910.0096.024	913.0096.024	902.0096.024	903.0096.024	

mm	"	Gore fluoroelastomer*
1.6	1/16	965.0016.024
3.2	1/8	965.0032.024
4.8	3/16	965.0048.024
6.4	¼	965.0064.024
8.0	5/16	965.0080.024
9.6	3/8	

*** Use 501RL2G**

505L, 505LG

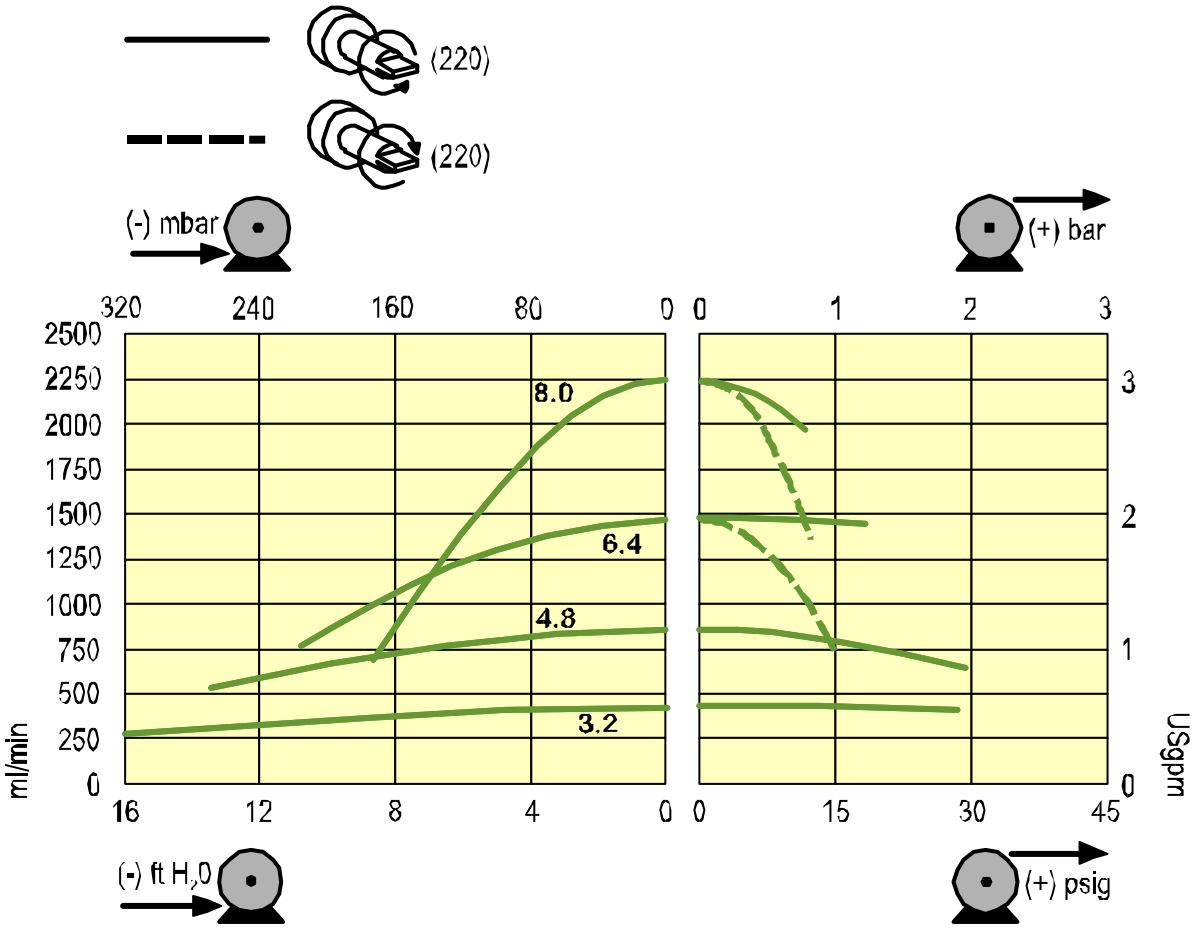
(2.4mm) Product codes

mm	"	#	Peroxide Silicone	Platinum Silicone	Marprene	STA-PURE	Gore fluoroelastomer
1.6	1/16	119	**910.E016.024**	**913.E016.024**	**902.E016.024**	**960.E032.K24**	**965.E032.K24**
3.2	1/8	120	**910.E032.024**	**913.E032.024**	**902.E032.024**	**960.E032.K24**	**965.E032.K24**
4.8	3/16	15	**910.E048.024**	**913.E048.024**	**902.E048.024**	**960.E048.K24**	**965.E048.K24**
6.4	¼	24	**910.E064.024**	**913.E064.024**	**902.E064.024**	**960.E064.K24**	**965.E064.K24**
8.0	5/16	121	**910.E080.024**	**913.E080.024**	**902.E080.024**	**960.E080.K24**	**965.E080.K24**
9.6	3/8	122	**910.E096.024**	**913.E096.024**	**902.E096.024**		
9.6	3/8	122	**910.H096.024 (high flow element)**				

Description		Product code
505AF	**Footswitch**	**059.3001.000**
505AH	**Handswitch**	**059.3011.000**
505AS	**Filling stand**	**059.5001.000**
505AL	**Dispensing lance**	**059.5051.000**
505AV	**Proximity switch**	**059.5071.000**
505AFN	**Filling needle set**	**059.5101.000**
505AN	**Network kit (includes cables and software)**	**059.3101.000**
505AP	**Printer**	**059.3201.000**

501RL

Flow rates



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Warning, These products are not designed for use in, and should not be used for patient connected applications.

The information contained in this document is believed to be correct but Watson-Marlow Limited accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

Product use and decontamination declaration

In compliance with the **UK Health & Safety at Work Act** and the **Control of Substances Hazardous to Health Regulations** you, the user are required to declare the substances which have been in contact with the product(s) you are returning to Watson-Marlow or any of its subsidiaries or distributors. Failure to do so will cause delays in servicing the product. Therefore, please complete this form to ensure that we have the information before receipt of the product(s) being returned. A FURTHER COPY *MUST* BE ATTACHED TO THE OUTSIDE OF THE PACKAGING CONTAINING THE PRODUCT(S). You, the user, are responsible for cleaning and decontaminating the product(s) before returning them.

Please complete a separate Decontamination Certificate for each pump returned. **RGA No:** ……..

1 Company

Address …… ..... Postcode ……

Telephone …… ..... Fax Number ……..

2.1 Serial Number … … … … … … … … … … … … … ..... (a)……

2.2 Has the Product been used? (b)……

YES		NO	

(c)……

(d)……

If yes, please complete all the following Sections. If no, please complete Section 5 only

3 Details of substances pumped

3.1 Chemical names:

(a)……

(b)……

(c)……

(d)……

4 I hereby confirm that the only substances(s) that the equipment specified has pumped or come into contact with are those named, that the information given is correct, and the carrier has been informed if the consignment is of a hazardous nature.

5 Signed ……

Name ……

Position ……

Date ……..

3.2 Precautions to be taken in handling these substances:

(a)…… .....

(b)…… .....

(c) ……

(d)……

3.3 Action to be taken in the event of human contact:

(a)……

(b)……

(c)……

(d)……

3.4 Cleaning fluid to be used if residue of chemical is found:

(a)……

(b)……

(c)……

(d)……

To assist servicing, please describe any fault condition(s) you have witnessed

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