

The **DEETER** Group®

Low Volume Liquid Dispenser



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Introduction

The Liquid Volume Dispenser (LVD) is designed to deliver a measured volume of liquid at the press of a button. In normal use, the operator selects a volume, presses a button and the LVD delivers the required volume without further operator intervention.

The volume is easy to select and is retained in non-volatile memory for repeat operation. Volumes between 0.025 litres and 10.000 litres can be selected in increments of 0.001 litres.

A simple calibration method enables the LVD to repeatedly dispense accurately measure volumes. There are options to allow automatic adjustment of the calibration when dispensing water with varying flow rate (between 0.2L/minute and 2.5L/min) or with changing temperature (0 to 65 Celsius).

Wetted surfaces are nylon, PTFE, Buna and acetal, making the LVD suitable for a wide range of fluids.

The Dispenser can be connected to a PC for remote control and monitoring and is supplied with an easy-to-use software application.

1. Installation

The Dispenser has two John Guest Speedfit[®] push-fit connectors on the bottom side of the case for fluid in and out. The fittings take a tube outside diameter of 8mm and can be used with polyethylene, nylon, polyurethane, brass, copper, or mild steel tubing. (Tube inserts should be used for soft or thin-walled tubing).

The Dispenser is provided with a 12VDC mains adapter that plugs into a socket on the left side of the case. Low voltage operation makes the dispenser safe to use in damp environments or if liquid is spilled.

A USB connector is provided on the right side of the case for connection to a PC. Installation of the PC software supplied with the Dispenser is described in section 6.

2. Volume Accuracy

A calibration method allows fine adjustment of the delivered volume and can considerably reduce the size of any dispense error. One or two measured dispenses (into a measuring vessel or weighed) should be performed to enable calculation of a percentage error. The result is then entered in the Calibration Menu (see section 4.5) with adjustments down to 0.1%.

Repeated accuracy should be better than 99% if the flow-rate and liquid temperature remain constant. Recalibration is recommended from time to time, particularly if flow-rate and temperature are changeable.

The LVD has options to compensate for varying flow-rate and temperature when used for dispensing water - see section 4.6, Compensation Option Menu. The adjustments are a 'best fit' for a typical LVD and will not provide the accuracy that can be achieved at constant flow-rate and temperature, but will reduce any error caused by these variables. With water, the LVD is most consistent at flow-rates from 1.0 to 2.5L/minute and at temperatures above 20C, and accuracy should be within 3% over that range.

3. Operator Controls

A liquid crystal display shows the selected volume and progress during dispensing.


Operator controls consist of three push-button switches, inscribed with the following symbols:


SYMBOL			
DESCRIPTION	UP	DOWN	ENTER

4. Operating States

4.1 Ready


After power-up and between dispensing states, the display shows **READY** on the top line and the selected volume on the bottom line.



Press  to increase the volume. Hold the button to rapidly increase the volume. The maximum setting is 10.000 litres.

Press  to decrease the volume. Hold the button to rapidly decrease the volume. The minimum volume setting is 0.025 litres.

Any change to the volume setting is saved to non-volatile memory when dispensing commences, thus powering off and back on will recover the previous setting.

Press  to start dispensing.

Hold the  button for 3 seconds to select user options (see *Option Setting* and *Calibration*).


Hold the  button and then  to manually deliver a dose (see *Manual Dispensing*).

4.2 Dispensing

Dispensing can be started by pressing  from the Ready state or by computer command.

The display will show the flow rate, the delivered volume and the target volume.

Pressing  will stop delivery with **PAUSED** shown on the display. Pressing  again will resume delivery.



Holding the  button for 3 seconds will cancel delivery and return to Ready state.


If the flow rate falls below 0.2 litres/minute, the word **UNDER** will flash, alternating with the flow rate. At very low flow rates the word **UNDER** will remain constant. A short beep will sound every 5 seconds if the Warning Beep option is enabled.


If the flow rate rises above 2.55 litres/minute, the word **OVER** will flash, alternating with the flow rate. At very high flow rates the word **OVER** will remain constant. A short beep will sound every 5 seconds if the Warning Beep option is enabled.


When the target volume is reached, the LVD will automatically return to Ready state. The buzzer will sound for 1.5 seconds (long beep) if the Finish Beep option is enabled.

4.3 Manual Dispensing

Press and hold the  button and then press  to gain manual control of the dispense valve. This state may be used for adding a 'top-up' after normal dispensing, limited to a maximum of 1.000 litres.


(The press of the  button will temporarily change the volume setting, but the previous setting will be restored immediately Manual Dispensing state is entered.)

Whenever  is pressed the dispense valve will open. The flow rate will be shown on the top line of the display and the additional volume of liquid will be shown on the bottom line.


When  is released, the top line of the display shows the target volume while the bottom line continues to show the added volume.


The LVD will remain in Manual state while  is held. If  is released, the LVD will remain in Manual state while  is pressed, and for 4 seconds after  is released.

4.4 Audio Option Setting

The Audio Option Menu is entered from Ready state by pressing and holding  for 3 seconds.

There are two audio options: **FINISH BEEP** and **WARNING BEEP**.


Pressing  will toggle the **FINISH BEEP** option between **ON** and **OFF**. When **ON** is selected, a long beep will be sounded to indicate the target volume has been reached at the end of Dispense state.


Pressing  will toggle **WARNING BEEP** between **ON** and **OFF**. When **ON** is selected, short beeps will be heard if the flow rate is outside the limits for accurate dispensing.


Both options are saved to non-volatile memory, so are restored to the operator's preference on power-up.


Exit the Audio Option Menu by pressing . This will lead to the Calibration Menu.

4.5 Calibration Menu


The Calibration Menu is entered from the Audio Option Menu by pressing . The display will show the current calibration value between -12.0% and +12.0%. Negative values will reduce the volume delivered and positive numbers will increase the volume.

Pressing  will increment the calibration percentage by 0.1%. Holding the button will rapidly increase the percentage.


Pressing  will decrement the calibration percentage by 0.1%. Holding the button will rapidly decrease the percentage.

Pressing  saves the calibration value to non-volatile memory, exits the Calibration menu and enters the Compensation Option Menu.


4.6 Compensation Option Menu

The Compensation Option Menu is entered from the Calibration Menu by pressing .

There are two compensation options: **FLOW ADJUST** and **TEMP ADJUST**


Pressing  will toggle the **FLOW ADJUST** option between **ON** and **OFF**. When **ON** is selected, the LVD will add a percentage to the dispense volume that changes with

the flow-rate, attempting to compensate for typical affects of flow-rate on dispense accuracy for water over the full flow-rate range of 0.2L/min to 2.5L/min.

Pressing  will toggle **TEMP ADJUST** between **ON** and **OFF**. When **ON** is selected, the LVD will add a percentage to the dispense volume that changes with temperature, attempting to compensate for the typical affects of water temperature on dispense accuracy, between 0C and 65C.

Note that these options compensate for the characteristics of water and may not be appropriate for other liquids. Both compensation options add to the dispense volume, so when first enabled the calibration percentage may need to be reduced or made more negative.

Both options are saved to non-volatile memory and are restored on power-up.

Exit the Compensation Option Menu by pressing  to return to the Ready State.

5. Serial Communications Control

The Dispenser has a serial communication option to enable automated control and monitoring by computer. Communication is via USB and requires a cable (not supplied) with a 'type B' connector (i.e. a typical USB printer cable)

The PC software supplied with the Dispenser replicates the operator controls and makes it easier to access options settings and view progress during dispensing. For those who wish to develop their own PC control and monitoring software, details of serial port settings and the command structure are given in [Appendix A](#).

6. PC Software

The CD Contains:

Liquid Dispenser Help.chm
Deeter_Liquid_Dispenser.pdf
AdobeRdr940_en_US.exe
Install\Setup.exe

html Help File.
The Liquid Dispenser Manual
Adobe Acrobat Reader installer
Folder containing the Liquid Dispenser
Setup and installer.

6.1 Software Installation

After insertion into your CD/DVD drive, the CD should auto-boot. If not, double-click the CD Drive within Explorer to start the CD, or double-click the *autorun.exe* file.

Once running, you will be presented with the following:



Hovering over an item with the mouse will display a message explaining what will happen when that item is selected.

The Liquid Dispenser application software uses Microsoft NET Framework v3.5. The installer will attempt to download and install this software from Microsoft, so you must be connected to the internet when the application is first installed. You must also agree to Microsoft's terms and conditions to use NET Framework. The application has an "unknown publisher" (i.e. Deeter).

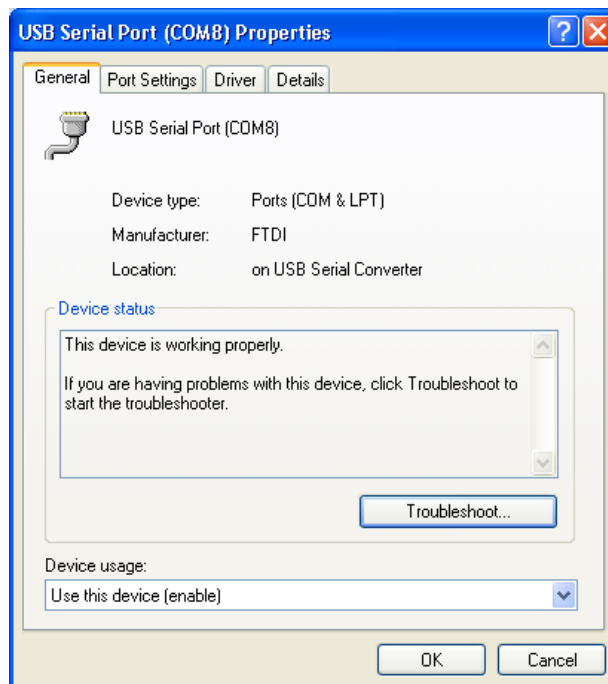
After installation, the application can be run from the Start button:

Start|All Programs| Deeter Electronics Ltd| LiquidVolumeDispenser| Liquid Volume Dispenser

6.2 USB Drivers

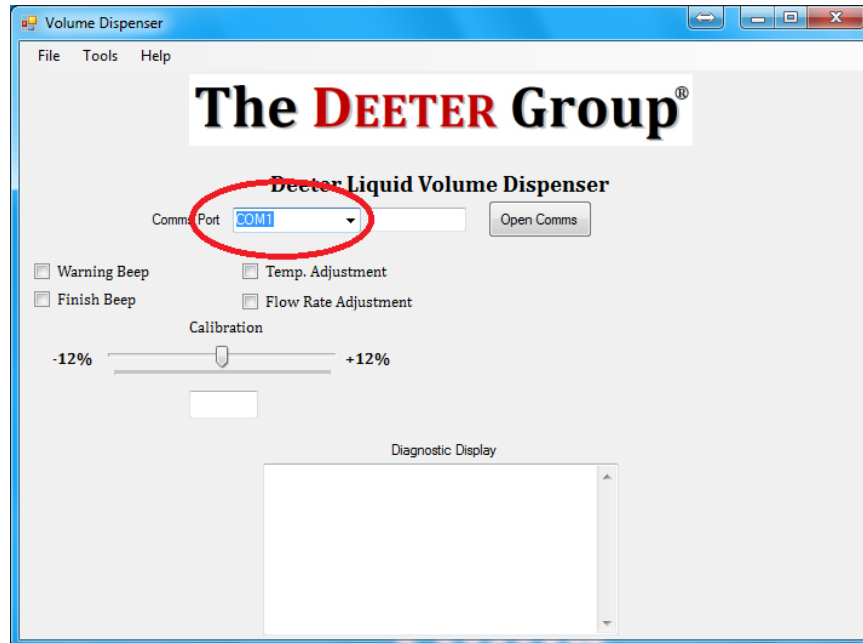
Connect the USB cable and ensure the Dispenser is powered up. The first time this connection is made, the Windows driver for this USB device must be installed, either by plug-and-play (if available) or by downloading the driver.

Drivers for a wide range of operating systems can be downloaded free of charge from www.ftdichip.com. The Virtual COM Port (VCP) driver is required for use with the PC software supplied with the Dispenser and makes the Dispenser appear as a standard RS232 device.

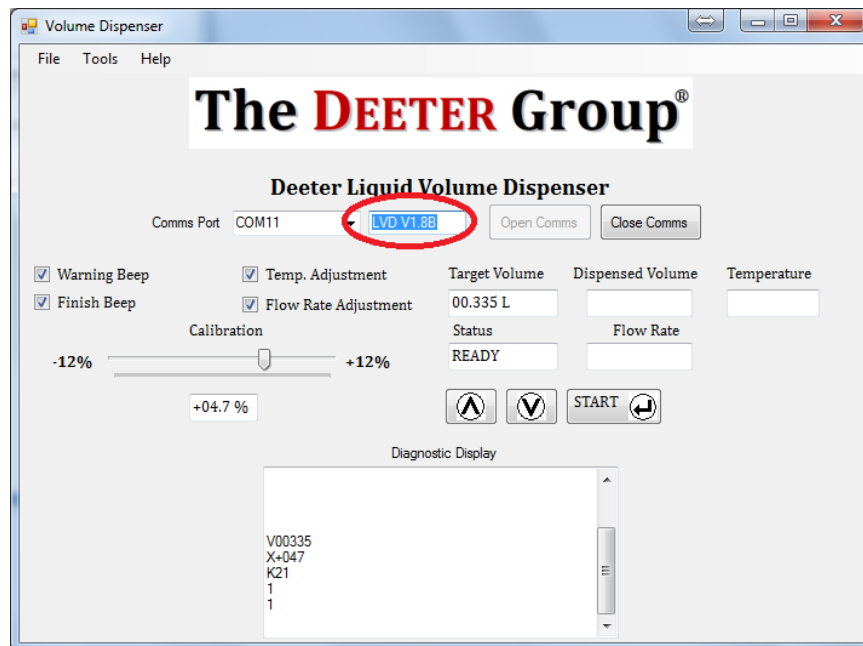


6.3 Using The Software

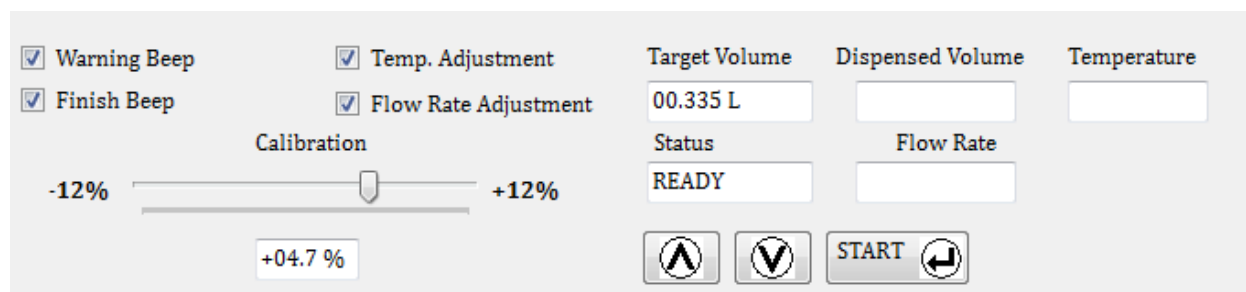
When started, the software will display a drop-down list of the available comms ports. Select the virtual comms port for the USB device.



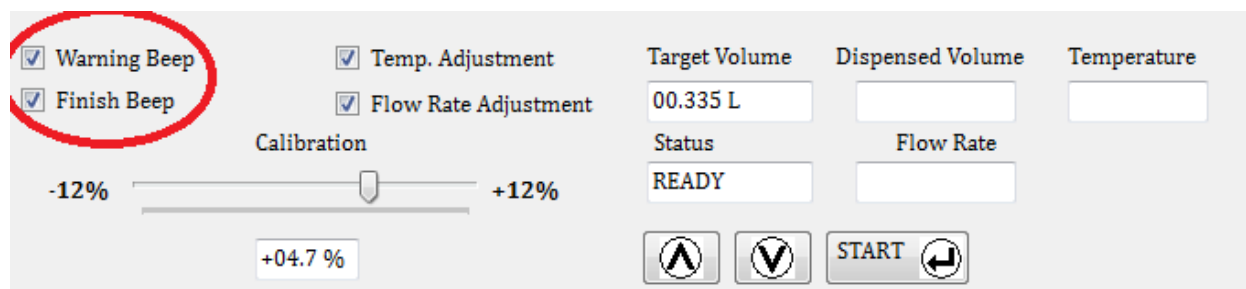
On initial connection, the LVD will fill in the current firmware version and automatically display the current settings for Target Volume etc.



The Status will change to Ready after displaying the current Firmware version.



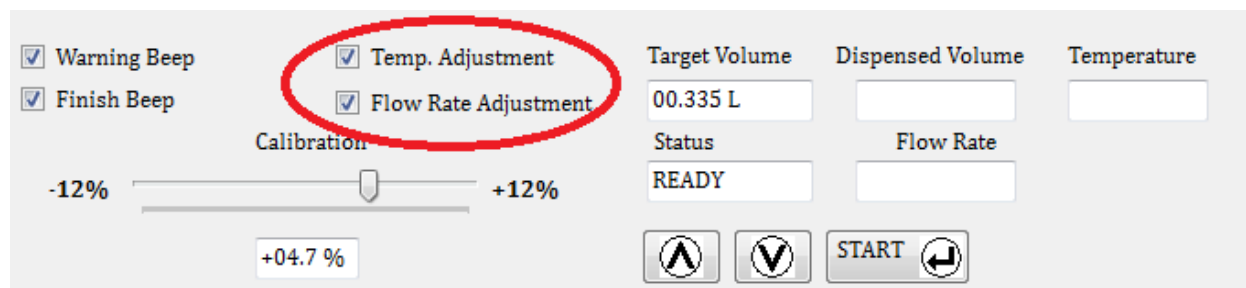
The following options are adjustable.



These two check boxes allow you to Enable and Disable the Finish Beep and Warning Beep from the Liquid Dispenser.

Finish Beep - A simple Beep upon completion of the dispensing of liquid.

Warning Beep - This Beep is only heard when the flow rate goes above or below the limits for accurate dispensing.



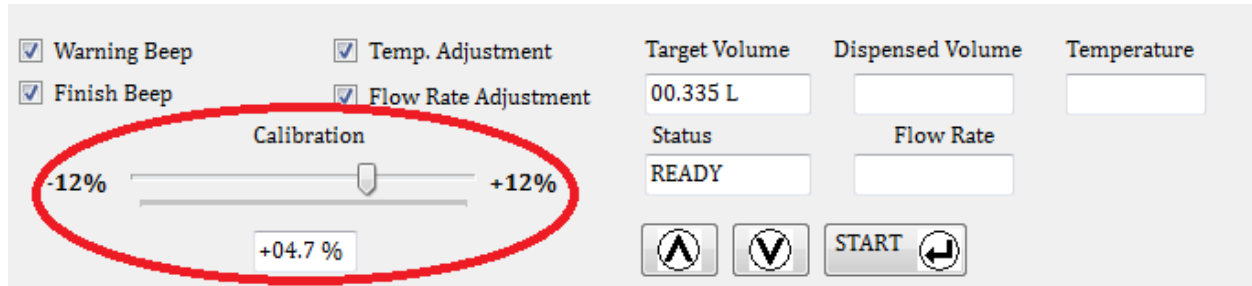
These two check boxes allow you to Enable and Disable the Automatic adjustments for Flow Rate and Temperature. The default state of these options is enabled.

Temp. Adjustment – By default the LVD will add a percentage to the dispense volume in accordance with the temperature, attempting to compensate for the typical affects of water temperature on dispense accuracy, between 0C and 65C.

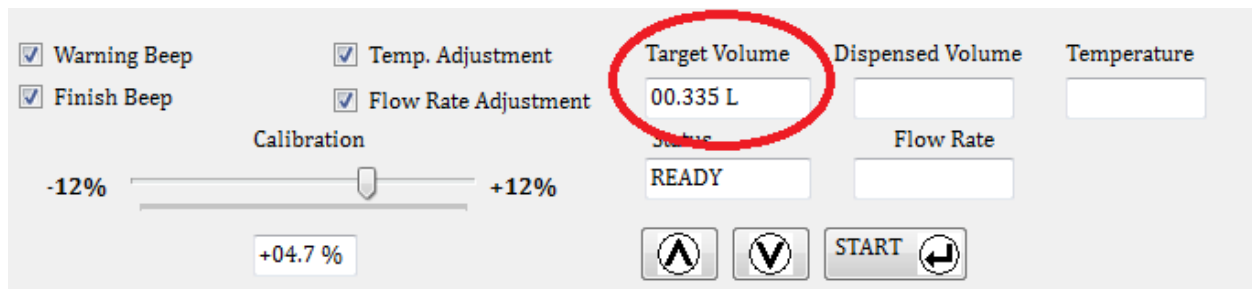
Flow Rate Adjustment – By default the LVD will compensate for the rate of flow.

Note that these options compensate for the characteristics of water and may not be appropriate for other liquids. Both compensation options add to the dispense

volume, so when first enabled the calibration percentage may need to be reduced or made more negative.




The calibration percentage can be set between -12% and +12%, in units of 0.1%. Use the arrow keys to make fine adjustments.



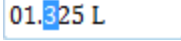
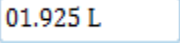
The Target Volume panel shows the volume to be dispensed.

Press  to increase the volume. The maximum setting is 10.000 litres.

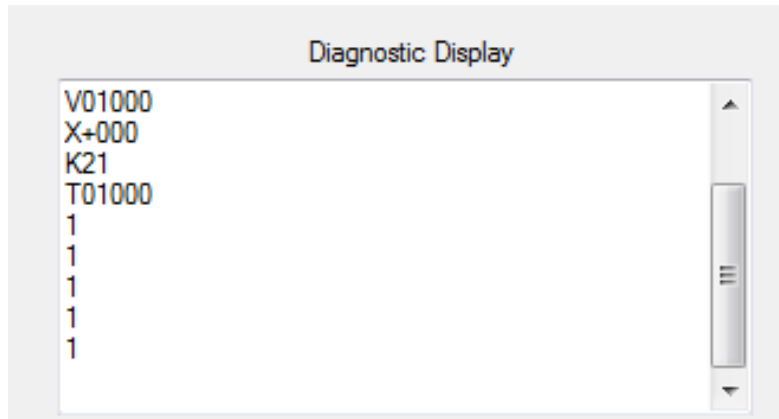
Press  to decrease the volume. The minimum volume setting is 0.025 litres.

The Target Volume can be entered directly into the box clicking on Up or Down. Please note the maximum and minimum volumes are 10.000 and 00.025

Press  to start dispensing.

You can also highlight one or all of the numbers you wish to change, , and simply enter the number you would like, .

6.4 Diagnostic Display



This display shows the commands flowing between the Liquid Dispenser and the PC Software via the serial connection and is there for diagnostic purposes only. Appendix A provides a list of the commands and reports that may be seen.

If you find that you are having any problems with the LVD software, please copy and paste the contents of the Diagnostic Display into an email and sent it to sales@deeter.co.uk along with a description of the problems that you have noticed, this will allow us to see what was happening at the time.

7. Specifications

Dimensions	175mm x 125mm x 78mm	Power supply	10-15VDC @ 500mA 12VDC mains socket adapter supplied
Dispense Volume	0.025 L – 10 L in 0.001 L steps	Flow Rate Range	0.2 – 2.5 litres per minute
Minimum inlet pressure	0.2 Bar	Maximum inlet pressure	at 20 °C up to 10 Bar at 65 °C up to 4 Bar
Dispense Accuracy⁽¹⁾	±1% at constant temperature and flow rate	Fluid Temperature Range⁽¹⁾	0°C to + 65°C
Fluid Connections	8mm OD, push-fit	Suitable Tube Materials⁽²⁾	Polyethylene, nylon, polyurethane, brass, copper, mild steel
USB connection	USB to serial connection (Cable not Supplied)	Software/CD	User Guide Software and Datasheet

⁽¹⁾ Water

⁽²⁾ For soft or thin-walled tubing, tube inserts should be used.

Appendix A – Serial Port Settings and Command Structure

The serial port settings are: 19200 baud, 8 data bits, no parity bit, 1 stop bit.

Commands have the following structure (ignore spaces, inserted for clarity):

S C P1 P2 ... Pn CS

where

S is the sequence start character, 'S'
C is the command character 'A' - 'Z' (case sensitive)
P1 to Pn are parameters in the range '0' - '9', '+', '-', and '?'
CS is a two-byte checksum

The checksum is the 8-bit sum of the command character and the parameter characters. It is the sum of the ASCII characters, not the numbers they represent, and is sent as a hexadecimal number represented by two ASCII characters in the range '0' to '9' and 'A' to 'F'

All valid commands are acknowledged by echoing back the command character followed by the carriage return character, 0Dh. Reports start with the command character and are terminated with carriage return.

Invalid commands, sequences with parameters outside the permitted range, or incorrect checksums will return 'B' and carriage return.

The 'S' character will clear any previous partial command sequence to start a new one.

Command List

Commands (with parameters ranges shown in brackets) are:

A Auto report off/on (0/1), minutes (0-9), seconds (0-59)

If auto-report is enabled, a report of the dispensed volume, flow-rate, temperature, and mode will be sent at regular intervals while dispensing. Reports will stop after the target volume has been reported. Reports are of the form:

A<xxxxx>,<yyyyy>,<zzz>,<m><CR>

where A is the command character 'A', <xxxxx> is the dispensed volume in millilitres (5 bytes), <yyyyy> is the flow-rate in centilitres per minute (5 bytes), <zzz> is the temperature (3 bytes), <m> is the Mode (see the Report Mode command) and <CR> is the carriage return character 0Dh. Each parameter is separated by a colon.

The temperature is in units of 0.5C with a zero at around -21C (see K command). For example, the number 415 would represent 20.5C (41.5 – 21 = 20.5)

C report dispense Completion off/on (0/1)

If enabled, a report will be sent when the target dispense volume has been reached. The report is of the form:

C<x><CR>

where <x> is '0' if the flow rate has been outside limits for accurate dispensing, and '1' if the flow rate has kept within limits.

D report **D**ispense volume

This will return the present dispensed volume in the form:

D<xxxxx><CR>

where <xxxxx> is the dispensed volume in millilitres.

E set **E**nd beep off/on (0/1/?)

A '?' after the command character (E) will return the current status of the End Beep.

F report **F**low rate

This will return the present flow rate in the form:

F<xxxxxx><CR>

where <xxxxxx> is the flow rate in centilitres per minute. Note: the maximum flow rate should be less than 2.5 litres per minute so the first two digits should always be '0'.

G **G**o

This command will start a dispense

H **H**alt

This command will terminate a dispense

I set Temperature Adjustment off/on (0/1/?)

A '?' after the command character (I) will return the current on/off status of the Temperature Adjustment.

J Temperature

This will report the temperature in degrees C to the nearest 0.5C. The temperature is preceded by a '+' or '-' sign and includes a decimal point before the final digit ('0' or '5')

K set thermistor zero-offset temperature (00-99/?)

The default zero offset for the thermistor is -21C. The absolute temperature is not required for error compensation (which uses temperature difference), but absolute temperatures can be displayed by the PC software and this command enables calibration of the displayed temperature.

A '?' after the command character (K) will return the current zero offset in the form:

K<xx><CR>

where <xx> is the offset temperature in C

L set Flow-Rate Adjustment off/on (0/1/?)

A '?' after the command character (L) will return the current on/off status of the Flow-Rate Adjustment.

M report **M**ode

This will return:

M<n><CR>

where M is the command character 'M' and <n> is a number from 1 to 4 to indicate the current status of the dispenser:

- 1 Ready
- 2 Dispensing
- 3 Paused
- 4 The LVD is under operator control from the keypad (e.g. manual dispensing, option setting, etc.)

N report version **N**umber

This will return the firmware version number e.g. 'LVD V1.1'

P **P**ause

This command will pause the current dispense, allowing it to continue later.

R **R**estart

This command will restart a paused dispense

T report **T**arget volume

This command will return the target volume in the form:

T<xxxxxx><CR>

where <xxxxxx> is the volume in millilitres.

V set **V**olume (00010-10000/?)

Sets the target volume in milliliters.

A '?' after the command character (V) will report the target volume (same as the T command but with 'V' prefix)

W set **W**arning beep off/on (0/1/?)

A '?' after the command character (W) will return the current status of the Warning Beep.

X set calibration percentage (-120 to +120/?)

Sets the percentage calibration adjustment in units of 0.1%. The first parameter must be '-' or '+'.
A '?' after the command character (X) will report the calibration (same as the Y command but with 'X' prefix)

Y report calibration

This command will return the present calibration in the form:

Y<s><xxx><CR>

where <s> is the sign character '-' or '+', and <xxx> is the adjustment in 0.1% units.